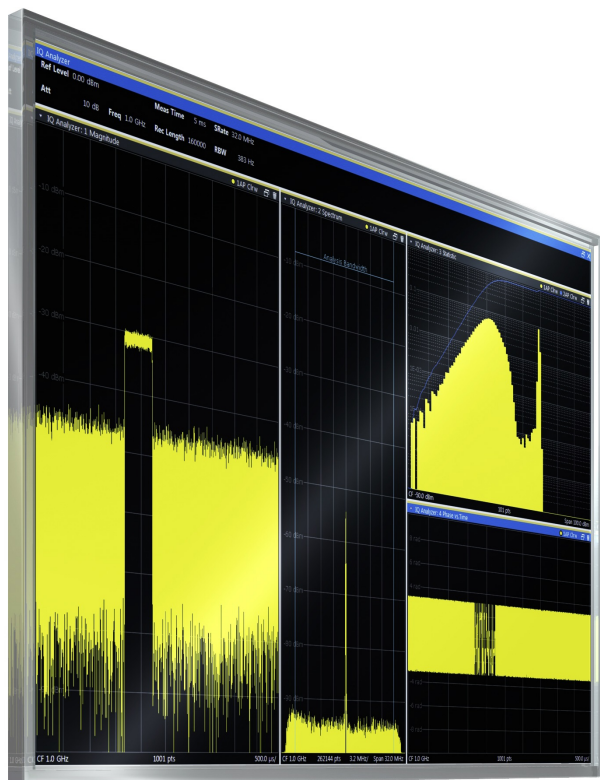


# R&S®VSE

## Vector Signal Explorer Base Software User Manual



1176883902  
Version 19

**ROHDE & SCHWARZ**  
Make ideas real



This manual applies to the following software, version 2.31 and later:

- R&S®VSE Enterprise Edition base software (1345.1105.06)
- R&S®VSE Basic Edition base software (1345.1011.06)
- R&S®VSE License Provider (1310.0002.05/.06)
- R&S®VSESIM-VSS (1345.1511.02)
- R&S®FSW-VSE (1345.2253.xx)
- R&S®FSV3-VSE (1345.2247.xx)
- R&S®CMW-KM150 (1211.5294.xx)
- R&S®VSE-K544 (1309.9580.xx)
- R&S®VSE-KT544 (1309.1728.xx)
- R&S®VSE-PVT (1345.2401.28)
- R&S®CMP-KM150 (1212.3972.28)

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1176.8839.02 | Version 19 | R&S®VSE

Throughout this manual, R&S® is indicated as R&S. R&S VSE refers to both the R&S VSE Enterprise Edition and the R&S VSE Basic Edition software.

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# 1 Documentation Overview

This section provides an overview of the R&S VSE user documentation. Unless specified otherwise, you find the documents at:

[www.rohde-schwarz.com/manual/VSE](http://www.rohde-schwarz.com/manual/VSE)

Further documents are available at:

[www.rohde-schwarz.com/product/VSE](http://www.rohde-schwarz.com/product/VSE)

## 1.1 User Manuals and Help

Separate user manuals are provided for the base software and additional software applications:

- Base software manual  
Contains the description of the graphical user interface, an introduction to remote control, the description of all remote control commands, programming examples, and information on maintenance, software interfaces and error messages.
- Software application manuals  
Contain the description of the specific functions of a software application, including the remote control commands. Basic information on operating the R&S VSE is not included.

The contents of the user manuals are available as help in the R&S VSE. The help offers quick, context-sensitive access to the complete information for the base software and the software applications.

All user manuals are also available for download or for immediate display on the Internet.

## 1.2 Data Sheets and Brochures

The data sheet contains the technical specifications of the R&S VSE. It also lists the firmware applications and their order numbers, and optional accessories.

The brochure provides an overview of the instrument and deals with the specific characteristics.

See [www.rohde-schwarz.com/brochure-datasheet/VSE](http://www.rohde-schwarz.com/brochure-datasheet/VSE)

## 1.3 Release Notes and Open Source Acknowledgment (OSA)

The release notes list new features, improvements and known issues of the current firmware version, and describe the firmware installation.

The software makes use of several valuable open source software packages. An open-source acknowledgment document provides verbatim license texts of the used open source software.

See [www.rohde-schwarz.com/software/VSE](http://www.rohde-schwarz.com/software/VSE)

## 1.4 Application Notes, Application Cards, White Papers, etc.

These documents deal with special applications or background information on particular topics.

See [www.rohde-schwarz.com/application/vse/](http://www.rohde-schwarz.com/application/vse/)

## 1.5 Videos

Find various videos on Rohde & Schwarz products and test and measurement topics on YouTube: <https://www.youtube.com/@RohdeundSchwarz>

## 2 Welcome to the R&S VSE

The R&S VSE is a new high-performance Rohde & Schwarz analysis software for various analysis tasks and input from various instruments.

The R&S VSE features analysis of:

- The same data in various applications simultaneously
- I/Q data files
- Multiple inputs from a single instrument
- Input from different instruments, including:
  - R&S FSW signal and spectrum analyzers (also via external frontend)
  - R&S FSWP phase noise analyzer and VCO tester
  - R&S FPS signal and spectrum analyzers
  - R&S FPL1000 signal and spectrum analyzers
  - R&S FSV signal and spectrum analyzers
  - R&S FSV3000/FSVA3000 signal and spectrum analyzers (also via external frontend)
  - R&S FSL signal and spectrum analyzers
  - R&S ZNL network analyzers (with R&S ZNL3-B1 Spectrum Analyzer Mode option)
  - R&S RTx oscilloscope product family (R&S RTP also via external frontend)
  - R&S CMA radio test sets
  - R&S CMP radio test sets
  - R&S PVT360A performance vector testers
  - R&S NRQ6 power sensors

This user manual contains a description of the basic functionality that the software provides, including remote control operation. The latest version is available for download at the product homepage ([www.rohde-schwarz.com/product/VSE.html](http://www.rohde-schwarz.com/product/VSE.html)).

## 3 Software installation

The R&S VSE software can be installed and executed on any PC or directly on an instrument which will be used as input for signal analysis. See the data sheet for information on which instruments the software can be installed on.



Installation requires administration rights on the PC. If necessary, contact your IT administration for the required access rights.

### 3.1 Installing required components

The following software components must be installed to run the R&S VSE successfully:

- R&S License Server
- VISA (Virtual Instrument Software Architecture)

The R&S License Server is installed automatically during installation of the R&S VSE.

VISA can be installed directly during installation of the R&S VSE, or manually, independently of the R&S VSE installation.

#### Installing VISA

It is also necessary to install VISA (Virtual Instrument Software Architecture) on the PC to access instruments connected via IEEE or LAN bus.

It is recommended that you use the R&S VISA driver. The R&S VISA driver is supplied with the R&S VSE installation file, and can be installed together with the R&S VSE software (see [Chapter 3.2, "Installing and starting the R&S VSE software"](#), on page 16).



Once the R&S VSE software is installed, a status icon in the status bar indicates whether the VISA installation is available, see [Table 6-1](#).

### 3.2 Installing and starting the R&S VSE software

It is recommended that you copy the R&S VSE installation file to your hard disk before you execute it. To install the R&S VSE software directly on an instrument, copy the installation file to a USB storage device and execute it from there.

Installation requires administration rights on the PC. If necessary, contact your IT administration for the required access rights.



### To install the R&S VSE software

1. Download the R&S VSE installation file from [www.rohde-schwarz.com/software/VSE](http://www.rohde-schwarz.com/software/VSE).
2. Double-click the `VSESetup_XXX.exe` file.
3. Select the required options to install.  
Unless you have ensured the required R&S VISA is installed manually before starting the R&S Vector Signal Explorer Base Software installation on a PC, be sure to keep the **"R&S VISA"** option selected.  
To make use of the R&S VSE software in a Cadence®AWR®VSS installation, make sure to enable the **"VSE Cadence VSS Integration"** option. See also [Chapter 3.5, "Using R&S VSE with Cadence®AWR®VSS"](#), on page 21.  
To use the R&S VSE software with a R&S PVT360A or R&S CMP, make sure to enable the **"VSE Alf Manager"** option.
4. Select "Install".

The installer performs the following actions:

- If enabled, installs the "R&S VISA" software on the PC.
- Installs the R&S VSE software including an uninstall tool.
- Creates a shortcut on the desktop.

When the installation is complete, the dialog box turns green and all selected options are indicated as "OK".

### To start the R&S VSE software

- ▶ Start the software via the Windows "Start Menu" entry or the shortcut on the desktop.



#### Demo mode

Without the use of the software license provided by a smart card reader, the software starts in "Demo-Mode". In this case, all (installed) options and remote commands are available. However, the following restrictions apply:

- No instruments can be configured.
- No measurement settings can be loaded or saved.
- Only the demo I/Q files stored in the  
`C:\ProgramData\Rohde-Schwarz\VSE\\user\Demo` directory can be loaded as input.

## 3.3 Using the smart card reader

The R&S VSE software requires a smart card containing the software license to be connected to the PC when you are using the software. The R&S®FSPC license dongle

that contains the software license consists of a smart card and a USB dongle. The smart card can be used in the supplied USB dongle or in a smart card reader. The R&S®FSPC license dongle is available as a separate product and *must be ordered in addition to the software*.

You can connect the smart card in two ways.

- Connect the smart card in SIM format.  
To connect the smart card in SIM format, use the USB smart card reader (dongle) provided with the smart card.
- Connect the smart card in its full format.  
To connect the smart card in full format, an interface compatible to the card format is required.

The following devices are able to read the smart card in full format.

- Smart card reader integrated in a keyboard, notebook, or in a desktop PC (e.g. OMNIKEY)
- Smart card reader connected to the computer via serial bus or USB (e.g. OMNIKEY)
- USB reader connected to a LAN-to-USB converter to distribute the license via the network (e.g. DIGI AnywhereUSB/2)



#### Licensing support

If you have any difficulties with the licensing system, support is only assured if you use the R&S®FSPC license dongle.

#### Using the R&S®FSPC USB smart card reader (dongle)

The R&S®FSPC license dongle consists of a smart card in full format and a USB smart card reader (dongle).



1. Break out the smart card in SIM format.



2. With the label of the USB dongle facing upwards, insert the smart card with the chip facing downwards, and the angled corner facing away from the USB dongle.



3. Insert the smart card as far as possible.

The smart card reader is ready for use with any USB interface.



### Drivers

When you connect the reader to the computer, MS Windows automatically installs the necessary drivers. No manual driver installation is required. For further information, refer to the manufacturer's website at <https://www.hidglobal.com/de/products/omni-key-6121-mobile-smart-card-reader>.

### Problems during login due to smart card reader

When the smart card reader is connected, the operating system can falsely identify the smart card as a medium to perform a login procedure on the PC. In this case, the windows lock screen is displayed instead of a login window.

You can solve this issue by editing the "DisableCAD" ("Disable Ctrl-Alt-Del") registry key in the system registry. This key is located at  
`HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\Windows\CurrentVersion\policies\system.`



### Administration rights

Security policies of your network environment can prevent you from editing the system registry or installing drivers. Contact your IT administration in that case.

### To change the registry key

1. From the Windows "Start Menu", select "Run".
2. In the dialog box, enter `regedit` to open the system registry.

### 3. Search

```
HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\Windows\CurrentVersion\  
policies\system.
```

### 4. Set the value of `DisableCad` to 0.

## 3.4 Using a license server

As an alternative to the R&S®FSPC license dongle, software licenses can now also be provided by an R&S®License Server (for R&S VSE Enterprise Edition only). In this case, all available licenses are stored on a specified server. When you need a particular application, you can obtain a license from the server. When you no longer need the license, you return it to the server and it becomes available to other users again. These licenses are also referred to as *floating licenses*, as opposed to permanently assigned licenses.

The R&S®License Server must be set up as described in the R&S®License Server - Managing Floating Licenses - User Manual.

Two different kinds of floating licenses are available.

### Common floating license

A common floating license enables you to use an option as long as you need it, but requires a permanent connection to the license server.

The license is retrieved from the license server only when you open an application channel. Only one license per option is retrieved, but the option can be used in multiple channels. It is returned shortly after you close the (last) application channel. The license is blocked for other users only while at least one application channel is in use.

If the connection to the license server is lost for longer than approximately 10 minutes, the R&S VSE assumes no license is available and closes the application.

### Occupied license

An occupied license is retrieved once from the license server and stored locally for up to 7 days, depending on the selected time period. During the occupied period, the license is blocked for other users. After this time, the license automatically expires and becomes available on the license server again. During the occupied period, no further access to the license server is required. The license cannot be returned or disabled manually before it expires, but it can be extended.

When the license expires, you must retrieve a new license from the license server. If the connection to the license server is not available or no more licenses are available, the R&S VSE closes the application.

### Setting up floating licenses

To use floating licenses, you must set up one or more floating license servers (see ["Setup Floating License Server"](#) on page 162). The R&S VSE checks the configured servers for available floating licenses when it starts up. Only options for which licenses

are found are available in the R&S VSE. After changing the floating license server configuration, you must restart both the local License Manager service and the R&S VSE software.

When you first start the R&S VSE software after installation, if no license dongle or floating license server is found, the software starts in demo mode.

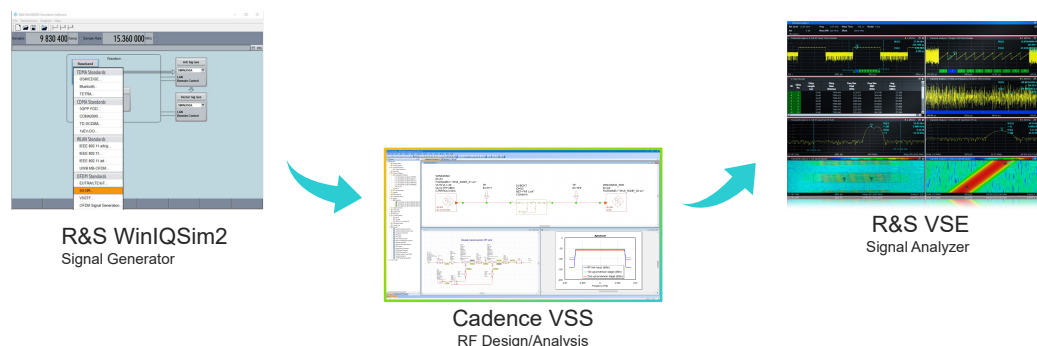
In the software, you can disable, re-enable or occupy licenses from the server for individual applications. Note that all application-specific licenses for a particular application are always enabled or disabled together, you cannot obtain individual sublicenses (such as K100 without K102 for the LTE application).



The currently activated licenses are indicated in the "Versions + Options" dialog box in the "Help" menu, see [Chapter 9.4.1, "Licensing, versions and options"](#), on page 159.

### 3.5 Using R&S VSE with Cadence®AWR®VSS

The Cadence AWR Visual System Simulator (VSS) allows you to simulate RF components in complete communication links. By integrating R&S®VSESIM-VSS into the simulator, you can extend the simulation to baseband signal analysis for various RF components. For example, you can use R&S WinIQSim2 to create encrypted waveform files as input for Cadence®AWR®VSS. Then you can analyze the simulated processed data using the R&S VSE functionality.



**Figure 3-1: Typical integration scenario for R&S VSE and Cadence®AWR®VSS**

#### Scope of functionality and restrictions

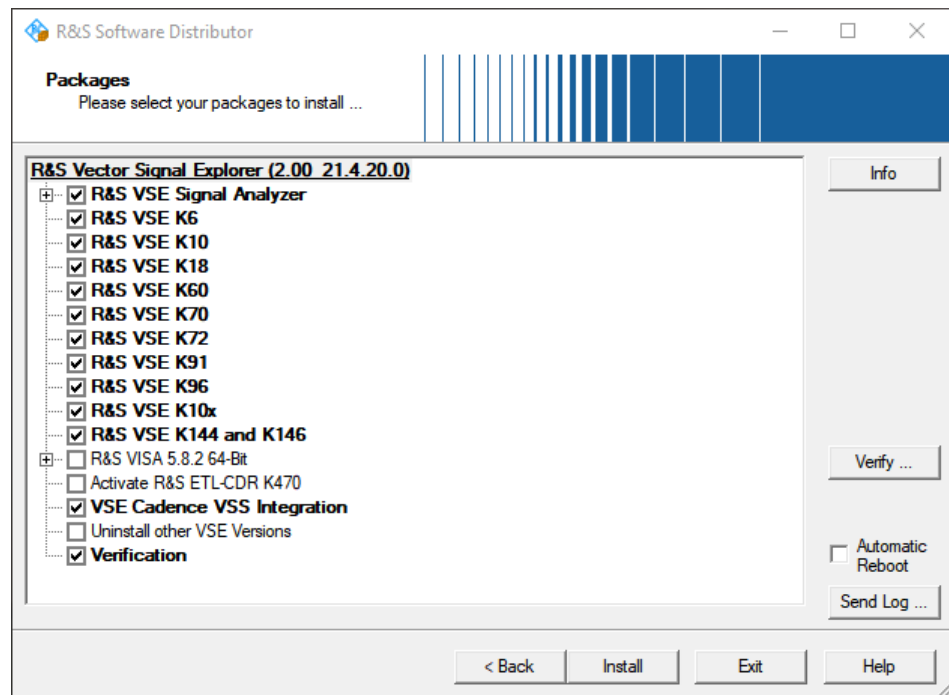
Using the simulator, the R&S VSE can only process input from encrypted waveform files, as provided by the `RS_SNK` block in Cadence®AWR®VSS. It cannot analyze input from an instrument, such as R&S FSW or R&S FSV3000. Otherwise, Cadence®AWR®VSS provides the same analysis functionality as the R&S VSE Basic Edition with all supported applications.

### To integrate R&S VSE in Cadence®AWR®VSS

To integrate R&S VSE in Cadence®AWR®VSS, you must install additional .dll files to Cadence®AWR®VSS via the common R&S VSE installation. Integration is only possible if the Cadence®AWR®VSS software is installed *before* you start the R&S VSE installation. If necessary, repeat the R&S VSE installation for the Cadence®AWR®VSS option after installing the Cadence®AWR®VSS software. The R&S WinIQSim2 software can be installed before or after the R&S VSE software, if required.

Furthermore, an additional licence is required for R&S VSE (R&S®VSESIM-VSS).

1. If necessary, install the Cadence®AWR®VSS software.
2. Install the R&S VSE software as described in ["To install the R&S VSE software"](#) on page 17.
  - a) Make make sure to enable the "VSE Cadence VSS Integration" package.



The two additional .dll files are integrated in the Cadence®AWR®VSS software.

3. Install the Cadence®AWR®VSS license key on the license server, as described in [Chapter 9.4.1.2, "License management"](#), on page 160.

### To create an encrypted waveform file from R&S WinIQSim2 as input

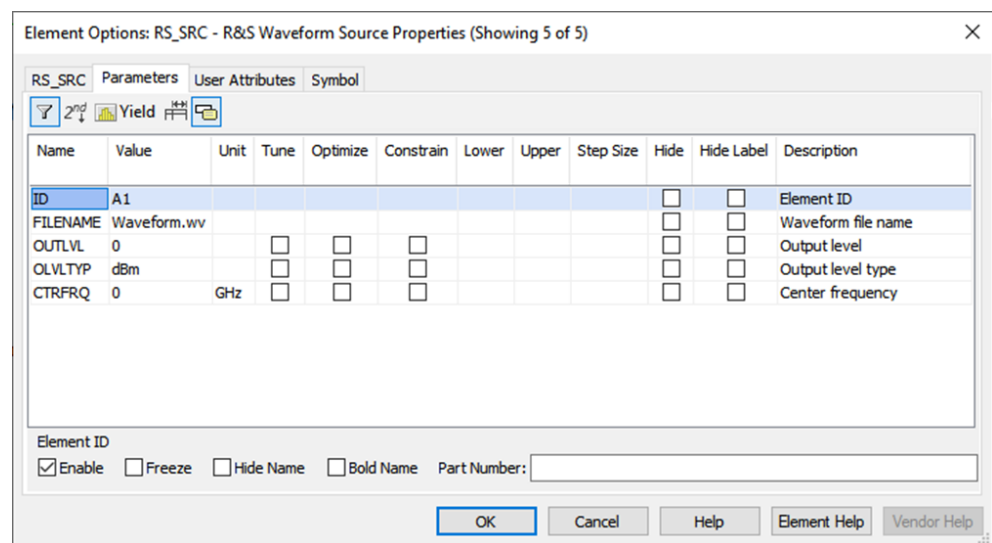
1. Start R&S WinIQSim2.
2. Select a digital baseband standard.
3. Enable the use of the selected standard.
4. From the "Transmission" menu, select "Transmit to:" "File".

5. Enter a file name.
6. Select "Transmit".

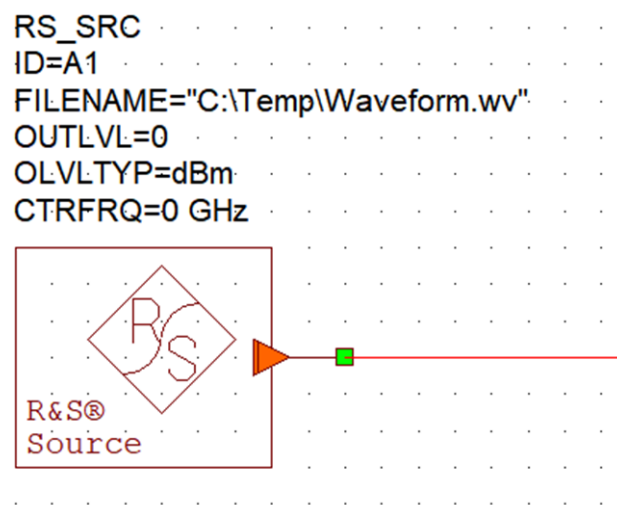
The output waveform file for the used baseband standard is encrypted and stored. It is then ready for Cadence®AWR®VSS to process.

### To configure analysis with R&S VSE from Cadence®AWR®VSS

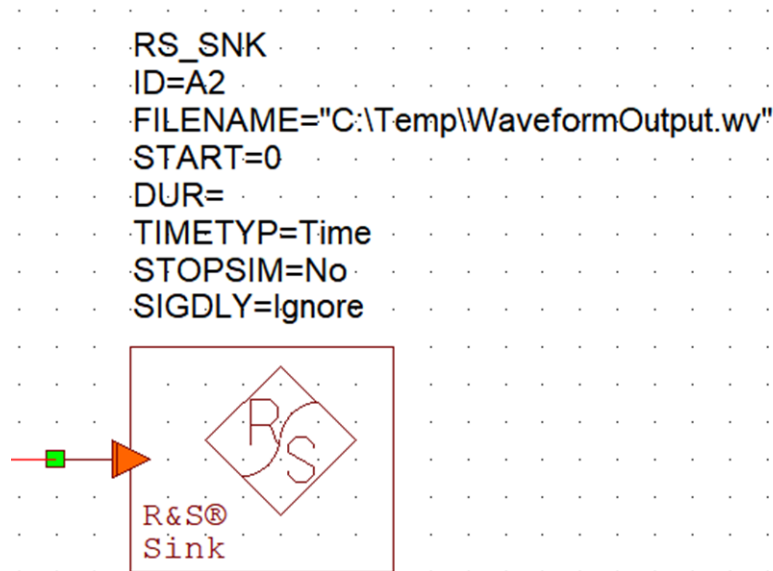
1. Start the Cadence®AWR®VSS software.
2. Create a new project.
3. Add a system block named "RS\_SRC".
4. Double-click the block to display a list of parameters and their description.



5. Configure the "FILENAME" parameter to use as input, e.g. the encrypted waveform file created by R&S WinIQSim2.



6. Add a system block named "RS\_SNK".
7. Connect the "RS\_SNK" block to the "RS\_SRC" block, as required in your Cadence®AWR®VSS project.
8. Configure the "FILENAME" parameter to use as output, that is: the encrypted waveform file to analyze with R&S VSE.



9. Start and stop the simulation.  
After the simulation has finished, the output waveform file is stored to the specified location.
10. Start R&S VSE.
11. Configure a new measurement channel for the generated signal.
12. Select the encrypted .wv file as input for the R&S VSE measurement channel.
13. Perform a measurement in R&S VSE as usual.

#### To analyze signals after initial configuration

After setting up the test system as described in ["To configure analysis with R&S VSE from Cadence®AWR®VSS"](#) on page 23, you can analyze signals in just a few steps.

1. Generate a signal in R&S WinIQSim2.
2. Select "Transmit" in R&S WinIQSim2.
3. Start and stop Cadence®AWR®VSS.
4. After the simulation has finished and the output file has been stored, start the measurement in R&S VSE.



For details on installing and operating Cadence®AWR®VSS, see the Cadence documentation.

## 3.6 Deinstalling R&S VSE

**Access:** "Start" > "All Programs" > "Rohde-Schwarz" > "VSE" > [version\_number] > "Uninstall VSE"

You can uninstall the software itself via the uninstall tool available in the R&S VSE folder. All R&S VSE packages for the selected product version are deinstalled. Other product versions remain untouched.



Uninstalling the software requires administration rights on the PC.

We do not recommend using the standard Windows "Add or Remove Software" function to uninstall the software. In this case, you have to uninstall each package individually.

## 4 Trying out the R&S VSE

This chapter introduces the most important functions and settings of the R&S VSE step by step. The complete and detailed description of the functionality can be found in the subsequent chapters. Basic instrument operation is described in [Chapter 6, "Operating basics"](#), on page 48.

### Prerequisites

- The software is installed and started as described in [Chapter 3, "Software installation"](#), on page 16.

For these first measurements, you can use either a connected instrument in the network or an input file.

- [Capturing and analyzing data from a connected instrument](#).....26
- [Analyzing stored data from a file](#).....35

### 4.1 Capturing and analyzing data from a connected instrument

The following example demonstrates how to perform a very simple measurement on input from a connected instrument using the R&S VSE. Only the default I/Q Analyzer application is required.

Try out the following:

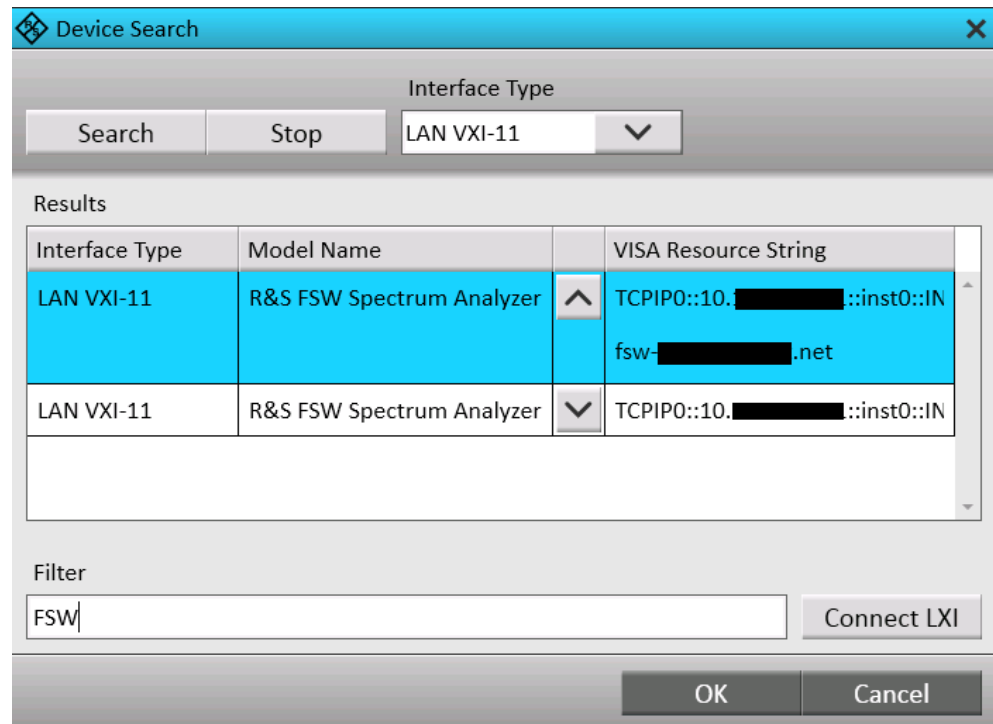
- [Configuring an instrument](#).....26
- [Assigning the instrument to a channel](#).....28
- [Adding additional result displays](#).....29
- [Rearranging windows](#).....31
- [Undocking and resizing the help window](#).....32
- [Adding further measurement channels](#).....32
- [Renaming a measurement channel](#).....34
- [Recording measurement data](#).....35

#### 4.1.1 Configuring an instrument

In the first step, we will search for instruments connected to the same network as the PC running the R&S VSE software, and attempt to connect to one of them.

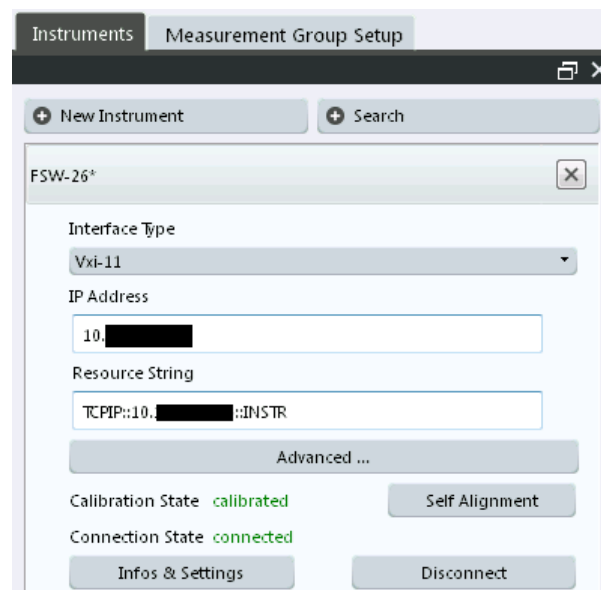
1. Select the "Instruments" tab at the upper left of the R&S VSE window.
2. Select "Search" to search for all instruments in the network.
3. To find instruments using the VXI-11 protocol, in the "Device Search" dialog box, select the interface type "LAN VXI-11" and select "Search".

If there are very many results, try filtering them by the type of instrument, for example, enter *FSW* in the "Filter" field.



- From the result list, select the instrument from which data is to be captured, then select "OK".
- In the "Instruments" window, select "Connect" to establish a connection to the specified instrument.

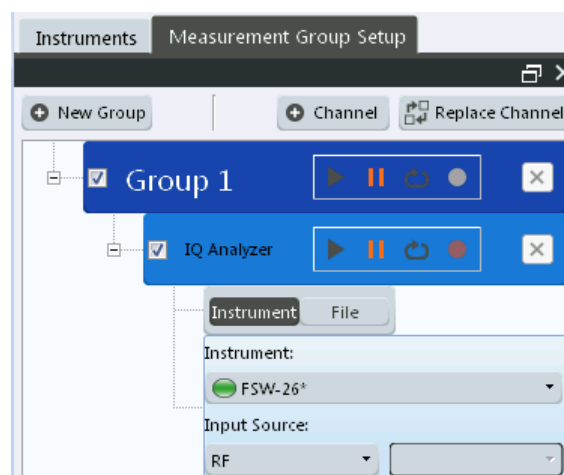
The connection state should turn green and indicate "connected".



### 4.1.2 Assigning the instrument to a channel

Now we must assign the configured and connected instrument as the input source for the default measurement channel.

1. In the "Measurement Group Setup" tool window, for the default group 1, select the "+" icon in front of the default measurement channel "IQ Analyzer".
2. Select "Instrument" as the input type.
3. From the "Instrument" selection list, select the instrument to be used for the measurement.
4. From the "Input Source" selection list, select "RF".




5. Select the ► "Capture" icon for the "IQ Analyzer" measurement channel.  
Since the default measurement mode is continuous, a continuous measurement is started immediately on the connected instrument. The results are displayed in the "IQ Analyzer: Magnitude" and "IQ Analyzer: Spectrum" result displays.



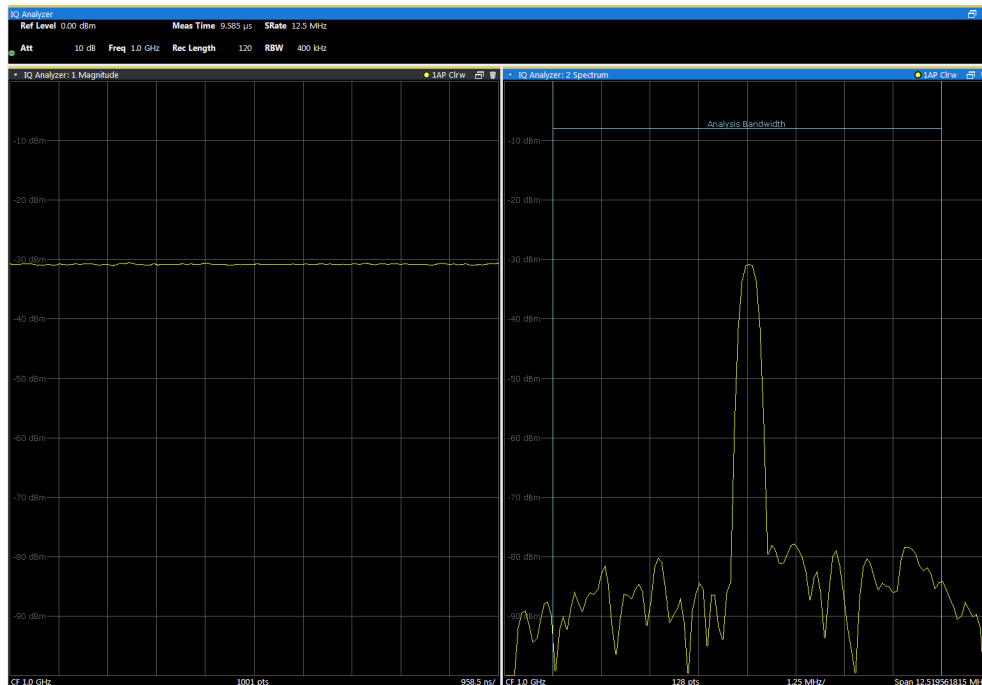
### 4.1.3 Adding additional result displays


For the I/Q Analyzer, up to 6 windows can be displayed for a single channel. We will add Spectrum and Statistics result displays.

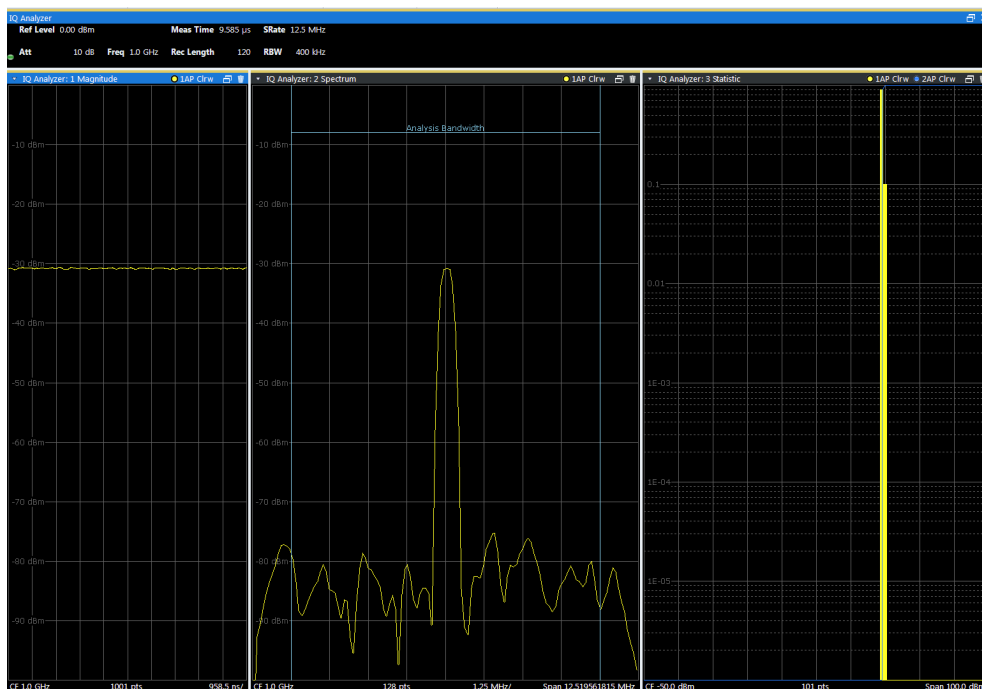
## Capturing and analyzing data from a connected instrument

1. Select the  "Add Window" icon from the toolbar.
2. Select the "Spectrum" result display.

A new window (2) for the "Spectrum" result display is opened.



3. Select the  "Add Window" icon again and select the "Statistics" result display.
- A new window (3) for the "Statistics" result display is opened.



#### 4.1.4 Rearranging windows

The R&S VSE window has now become rather crowded. Let us move the "Statistics" window (3) behind the Spectrum window (2), so both become tabs in the same area.

- ▶ Select the window title bar of the "Statistics" window (3) and drag it over the Spectrum window (2). Possible new positions for the "Statistics" window (3) are indicated by an empty gray space in the R&S VSE window.

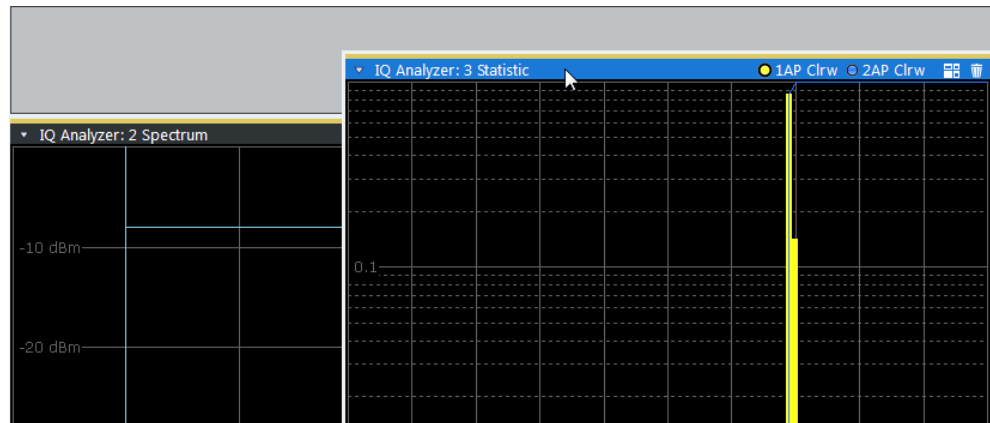


Figure 4-1: Moving the Statistic window over the Spectrum window

As soon as the "Statistics" window (3) is placed over the Spectrum window (2), both windows are shown as tabs.

When you drop the window, the moved window is added as a tab.

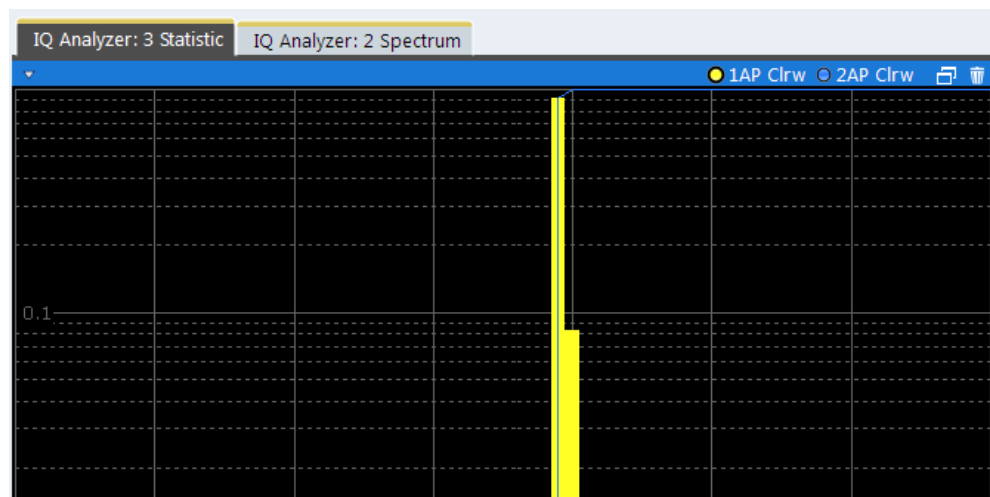




Figure 4-2: Tabbed windows

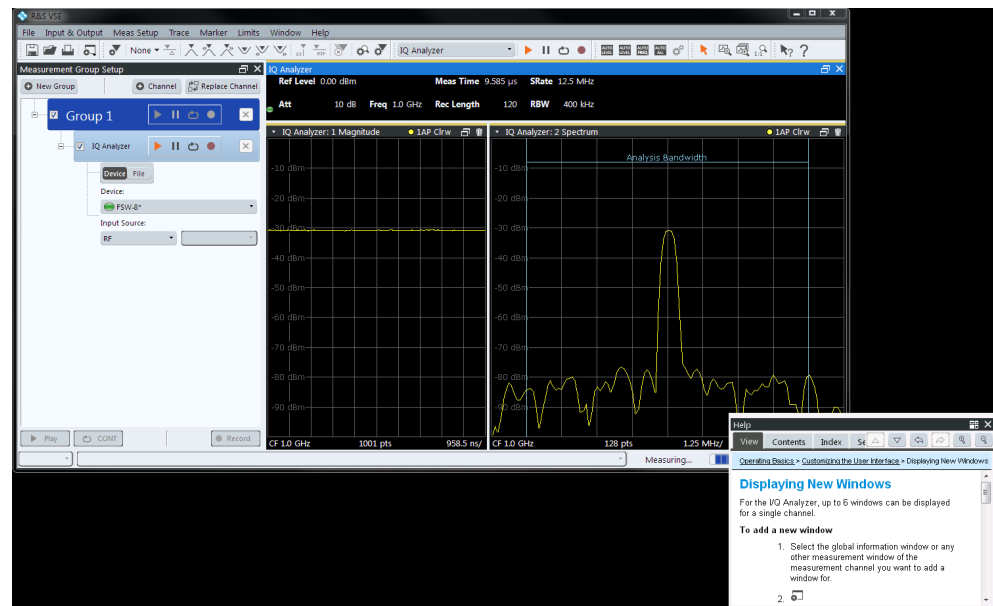
To switch between the two windows, simply select the corresponding tab.

### 4.1.5 Undocking and resizing the help window

Displaying the help window is often useful when you need to know which values to enter in a dialog, for example. However, if many result displays are required, the R&S VSE window might get rather crowded. Thus, we will undock the help window and move it outside the actual R&S VSE window.

1. Select the ?"Help" icon in the window title bar to display the "Help" window.
2. Select the  "Dock" /  "Undock" icon in the "Help" window title bar.

The window is detached and can be moved and resized independently of the R&S VSE window.



3. Move the "Help" window anywhere on the screen, for example next to the R&S VSE window.
4. To resize the "Help" window, select the window frame and drag it to the required size.

### 4.1.6 Adding further measurement channels

In addition to the default I/Q Analyzer measurement channel, we will add a second channel for I/Q Analysis.

1. In the "Measurement Group Setup" tool window, select the "+ Channel" button to add a new measurement channel to the group.
2. Select the "I/Q Analyzer" measurement mode.

The channel bar and the default result displays for the new IQ Analyzer measurement channel are displayed. If necessary, the previously displayed windows are cumulated in tabs to create room on the display.



## Capturing and analyzing data from a connected instrument

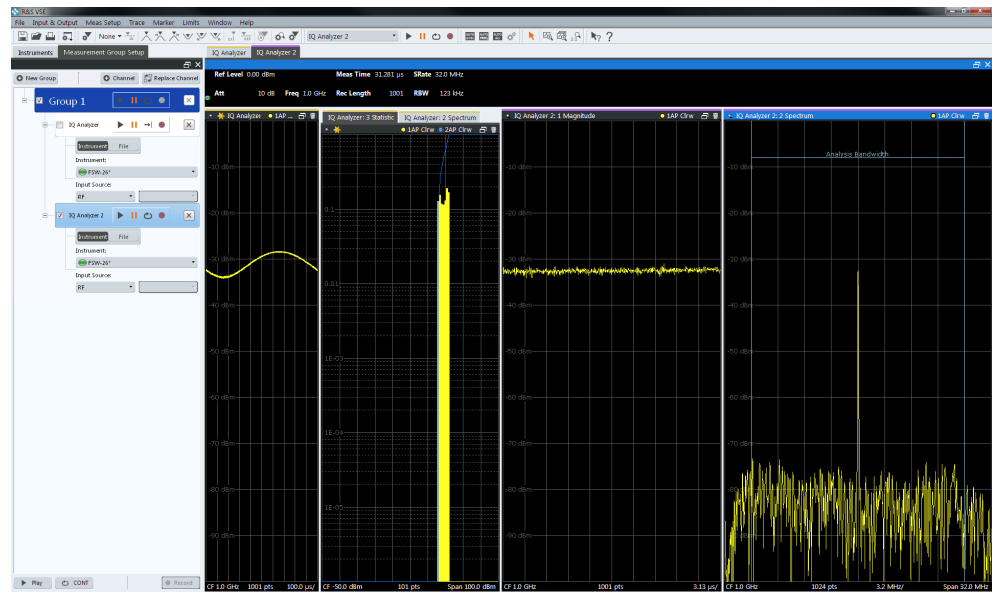
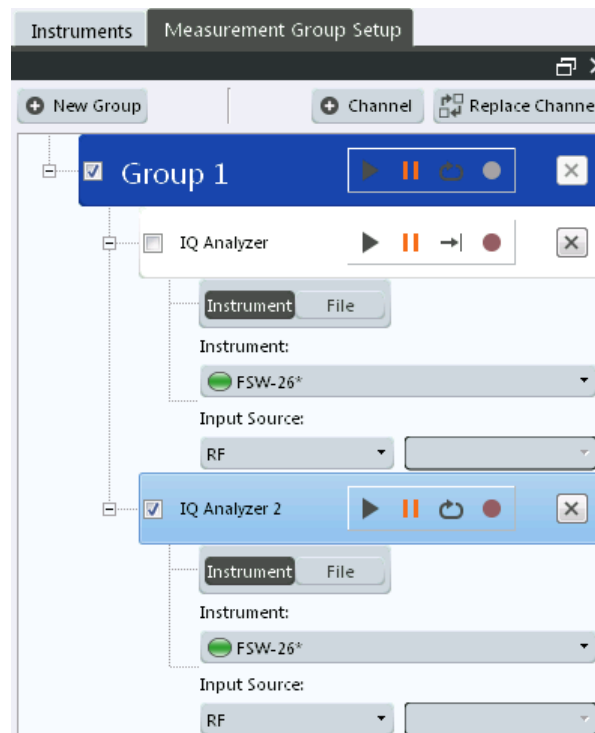






Figure 4-3: Second IQ Analyzer measurement channel ("IQ Analyzer 2")

3. Select the configured instrument as the input type for the new measurement channel.



Notice how the "IQ Analyzer 2" channel is now active, while the "IQ Analyzer" channel is deactivated. This is due to the fact that both channels are based on the same instrument, but each instrument can only perform one measurement at a time. Thus, the channel that was assigned to the instrument previously ("IQ Analyzer") is deactivated when the instrument is assigned to a new channel ("IQ Analyzer 2").

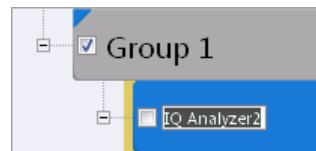
4. Select the "Capture mode" icon to toggle between single  and continuous  measurements for each measurement channel.
5. Select the  "Capture" icon for a measurement channel to perform a measurement on that channel. Only one channel can be started manually at a time. Before you can start another channel, you must stop the previous measurement by selecting the  "Stop" icon for that channel first.

#### 4.1.7 Renaming a measurement channel

The second I/Q Analyzer channel was named "IQ Analyzer 2" by default when it was created. We will change the name to "New I/Q Analyzer".

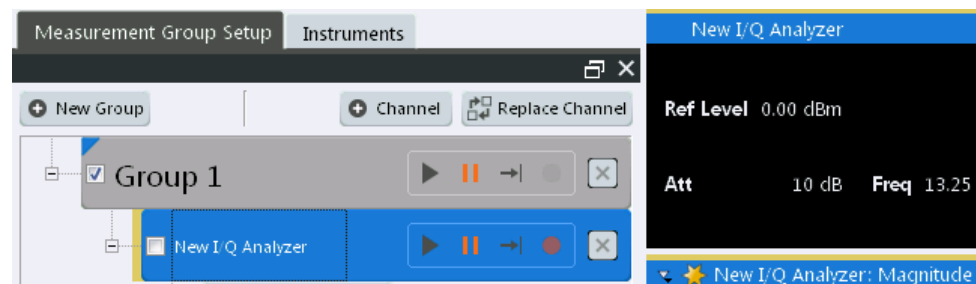
1. In the "Measurement Group Setup" tool window, double-click (slowly) the name of the "IQ Analyzer 2" measurement channel. (Alternatively, select "File" > "Measurement Group" > "Rename Measurement Channel".)

The channel name turns into an input box.



2. Enter *New I/Q Analyzer* and press [ENTER].

The channel name is changed, not only in the "Measurement Group Setup", but also in all channel and window title bars.



### 4.1.8 Recording measurement data

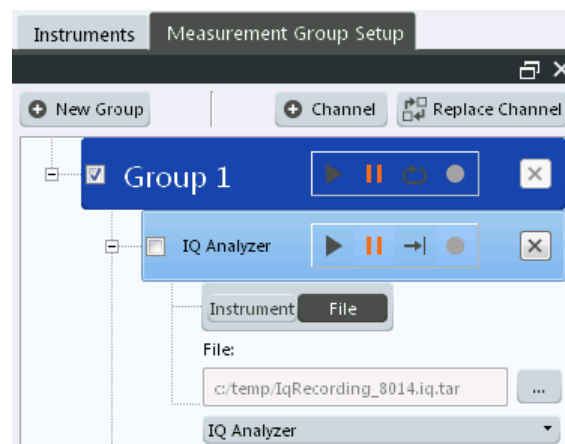
Now we will record the measured I/Q Analyzer data so that we can play it back again later. We want to store all available results, regardless of how many measurements we perform.

1. From the "File" menu, select "Preferences > Recording".
2. For the "Number of Records", select 20.
3. Close the "Preferences" dialog box.
4. Select the ● "Record" function for the "IQ Analyzer" channel in the "Measurement Group Setup" tool window.

The captured I/Q data is recorded.

5. To stop recording measurement results, select the || "Pause" function for the "IQ Analyzer" channel in the "Measurement Group Setup" tool window.

The temporary file is used as input for the "IQ Analyzer" channel, and the first recorded record is displayed immediately in the channel's result displays.



6. From the "File" menu, select "Save IQ Recording" to store the file permanently.
7. Select the storage location and file name for the stored data.
8. Select the "File Type": ".iq.tar".
9. Select "Save".

The captured data is stored to a file. You can now continue with the second part of the Trying Out chapter: analyzing stored data from a file.

## 4.2 Analyzing stored data from a file

If no instrument is available in the network to provide input to the R&S VSE, you can also try out the software using an input file. Several input files are provided with the software for demonstration purposes. Check the

C:\ProgramData\Rohde-Schwarz\VSE\<<version\_no>\user\Demo directory for an appropriate file.

Note that this directory is not displayed in the "Load I/Q File" dialog box, you must enter the path and file name directly in the "File Name" field. (Tip: copy the path and file name from the Windows Explorer window.)

#### 4.2.1 How to import I/Q data for analysis

1. In the "Measurement Group Setup" tool window, select the "+" icon in front of the "IQ Analyzer" measurement channel.
2. Select "File" as the input type.
3. Select the "..." icon to open the "Load I/Q File" dialog box and select the storage location and the file name.
4. Select the ► "Capture" icon for the "IQ Analyzer" measurement channel.

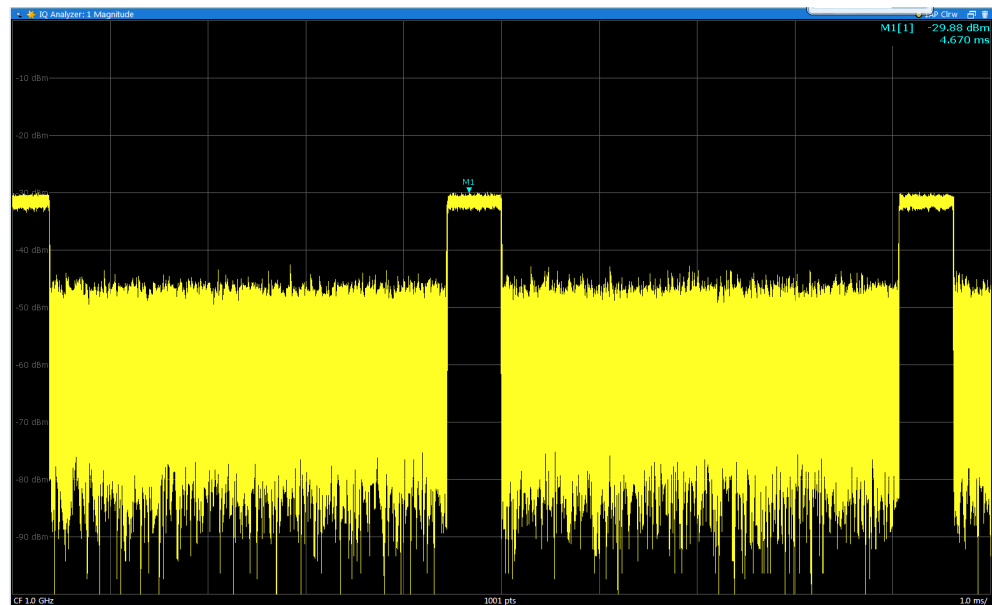
The stored data is loaded from the file and evaluated in the "IQ Analyzer" result displays.

#### 4.2.2 Setting and moving a marker

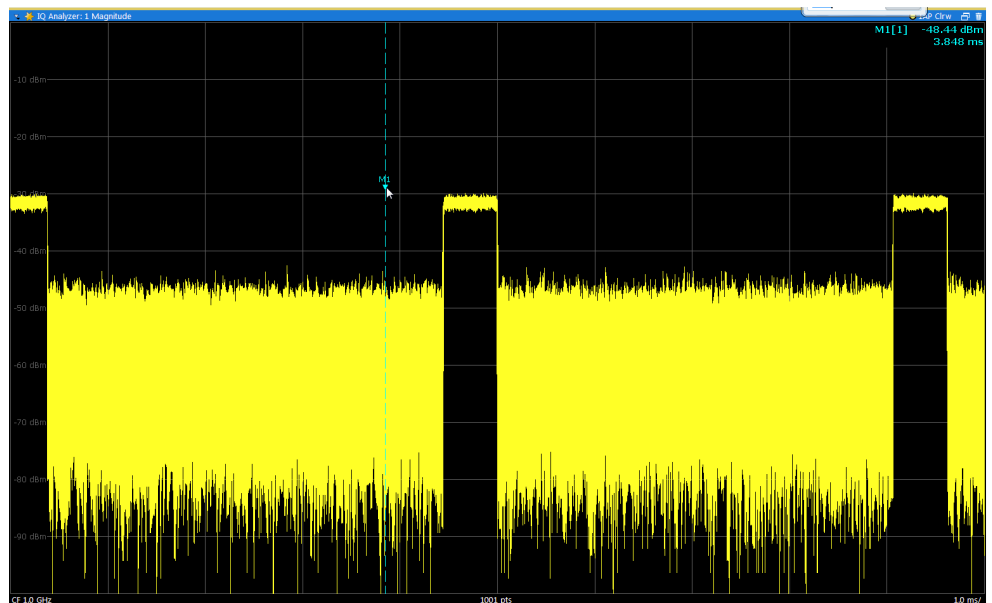
Markers are useful to determine the position of particular effects in the trace. The most common use is to determine a peak, which is the default setting when you activate a marker. We will set a marker on the peak in the Magnitude display of the IQ Analyzer measurement.

1. Tap the Magnitude display to set the focus on that window.
2. Select the 🚩 "New Marker" icon from the toolbar.

Marker 1 is activated and automatically set to the maximum of trace 1. The marker position and value is indicated in the diagram area as M1[1].



3. Now you can move the marker by tapping and dragging it to a different position. The current position is indicated by a dotted blue line. Notice how the position and value change in the marker area of the diagram.



## 5 Measurements and results

The R&S VSE provides several applications for different analysis tasks and different types of signals. The I/Q Analyzer application is included in the basic R&S VSE software. All other applications, such as Analog Demodulation or Vector Signal Analysis (VSA) are optional additions and require special licenses. (See also [Chapter 5.2, "Available applications"](#), on page 44.)

- [Measurement concept](#).....38
- [Available applications](#).....44
- [Starting an application](#).....47

### 5.1 Measurement concept

As a rule, each instrument can only perform a single measurement at any time. However, the R&S VSE allows you to perform multiple measurements on the same instrument sequentially, or to perform multiple measurements on different instruments in parallel. Thus, comprehensive data analysis with a single tool becomes quick and simple.



#### R&S VSE Enterprise Edition vs Basic Edition

The R&S VSE Enterprise Edition and Basic Edition differ in the number of channels, groups, and instruments that can be configured at the same time, see ["R&S VSE Enterprise Edition vs Basic Edition"](#) on page 66. Not all functions described here are supported by the R&S VSE Basic Edition.

#### Basic measurement process

In a basic I/Q measurement, data is imported from a file or captured from an instrument and the measured results are displayed. Multiple applications can be used at the same time in the R&S VSE. However, data acquisition on the same instrument is restricted to a single application at a time.

#### Measurement channels

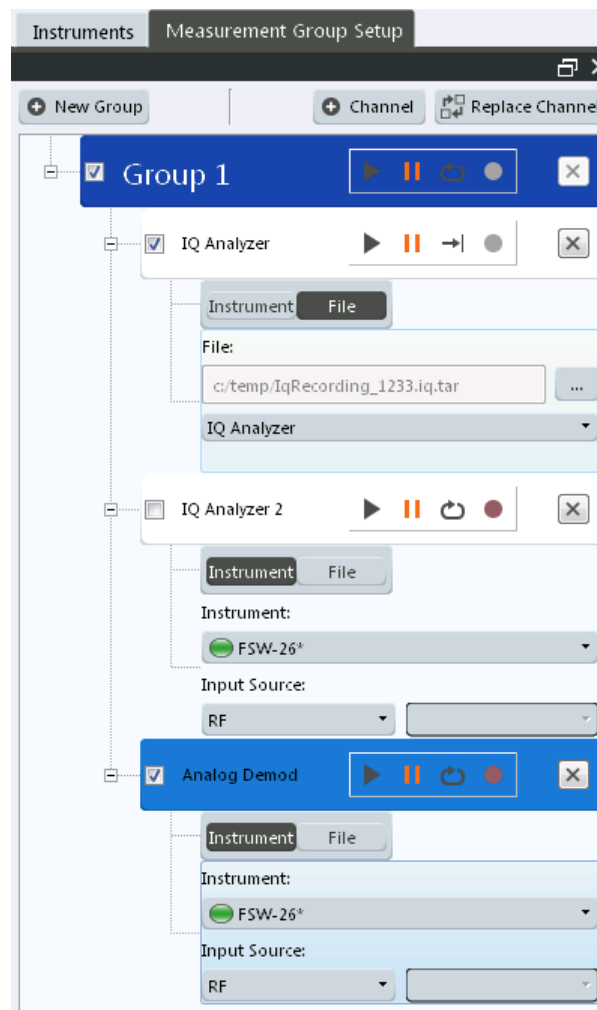
When you activate an application, a new measurement *channel* is created which determines the measurement settings for that application. The same application can be activated with different measurement settings by creating several channels for the same application. Whenever you switch channels, the corresponding measurement settings are restored.

The global information and results for each channel are displayed in separate windows (or tabs) on the screen. The results from various applications can be displayed at the same time. Each application may provide different result displays (see the applications' user manual for details). The measurement windows can be rearranged and configured in the R&S VSE to meet your requirements (see [Chapter 6.3, "Customizing the user interface"](#), on page 56).



The measurement channels are labeled with their default name. If that name already exists, a sequential number is added. However, the name of the measurement channel can be changed. For an overview of default names see [INSTRUMENT:LIST?](#) on page 550.

In the R&S VSE, measurement channels are controlled and initially configured in the "Measurement Group Setup" tool window.



**Figure 5-1: "Measurement Group Setup" tool window**

For each channel, the input type (instrument or file) and the input source type must be configured. Detailed configuration for the measurement can then be performed via the specific configuration "Overview" which is available for each application. (For details see the applications' user manual.)

You can configure up to 30 channels at the same time (for the R&S VSE Basic Edition, up to three channels). However, only one measurement channel can be started manually at any time. Before you can start another channel, you must stop the previous measurement channel first.



The "running" icon in the channel function bar indicates that the channel is currently performing a measurement.

The "error" icon in the channel function bar indicates that an error occurred in the measurement channel. Check the R&S VSE status bar.

### Measurement groups

As opposed to manual channel control, multiple measurements on *different* instruments or files can be performed in parallel if controlled by the software (Enterprise Edition only). All measurement channels that are to be started at the same time must be configured within a *group*. When the group is started, all included (active) measurement channels are started and provide results independently as soon as their measurements are completed. Note, however, that the individual measurements are not synchronized in any way, and the results are totally independent as the input data is different for each channel.



Configure triggers to synchronize the individual measurements.

In the R&S VSE Enterprise Edition, multiple groups of measurement channels can be configured, for example to define individual test scenarios.

Measurement groups are a convenient way to start multiple measurements at the same time.



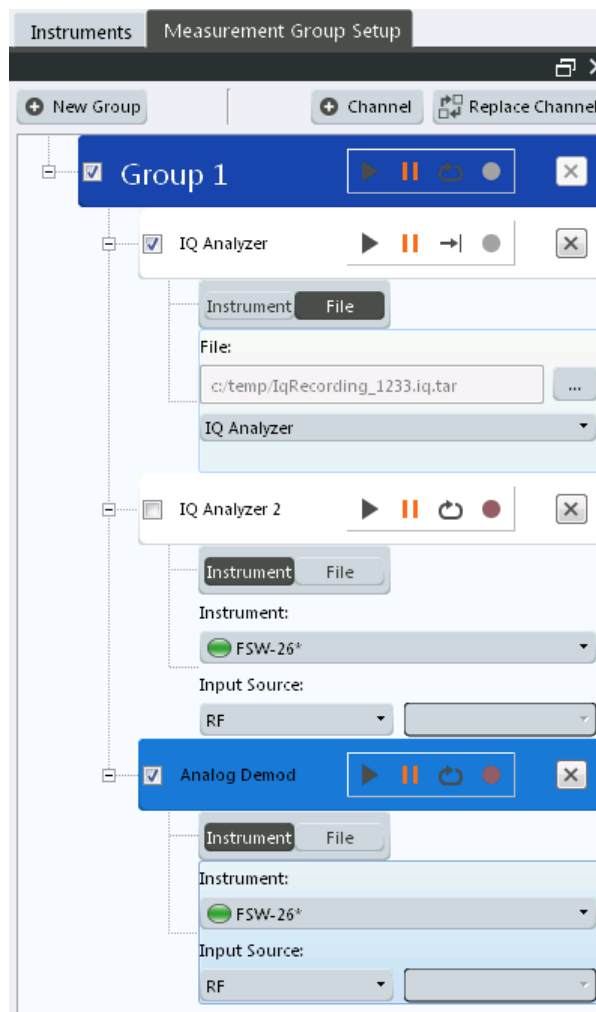
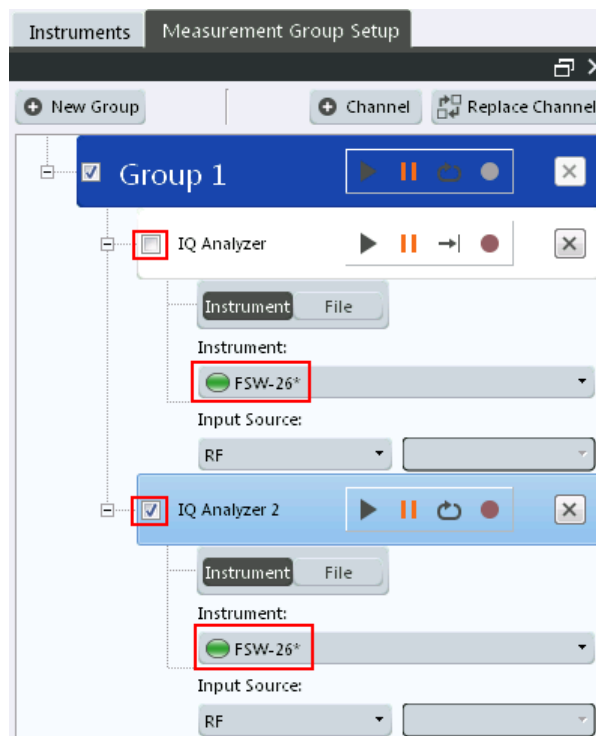


Figure 5-2: Example for a measurement group

### Active vs inactive channels

As mentioned above, only measurements on *different* instruments or on files can be performed in parallel (Enterprise Edition only). If the same instrument is assigned to multiple measurement channels of the same group, those channels cannot be processed simultaneously. Thus, the channel to which the instrument was assigned previously is deactivated. Only active measurements are included in a group measurement.

Active channels are indicated by a checkmark in front of the channel in the "Measurement Group Setup" tool window.



### Measurement groups and sequences

For multiple measurements on the same instrument, without switching between measurement channels manually, the R&S VSE provides a *measurement sequence* (Enterprise Edition only). A single instrument can perform only one measurement at a time; however, a sequence of measurements can be performed very quickly by the software.

A measurement sequence consists of a number of measurement groups, and each group may contain multiple channels. However, only channels with distinct input types can be active within a group during a measurement sequence. The groups themselves can also be activated or deactivated individually. When you start a measurement sequence, the individual groups are processed sequentially, in the order of their definition. The measurements for a single group are started simultaneously, and only when all channels in the group have completed, the next group is processed.

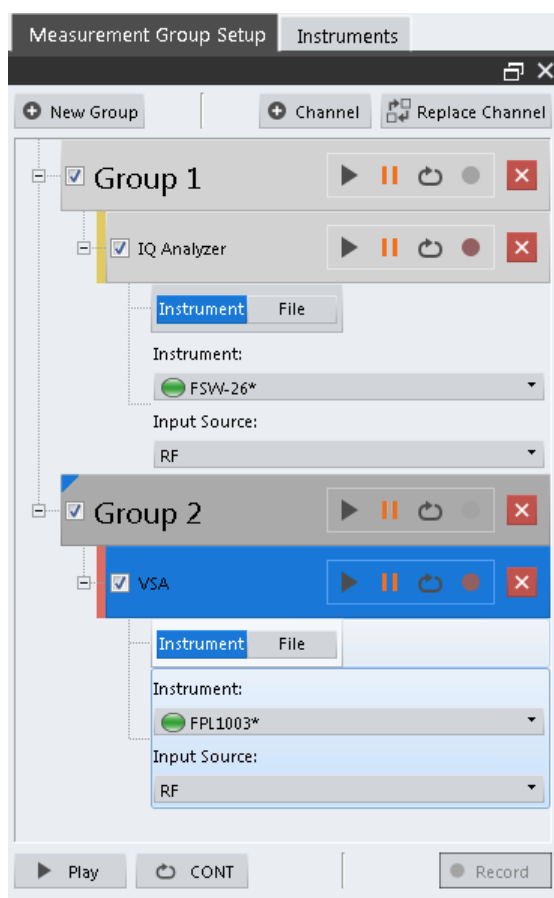



Figure 5-3: Example for a measurement sequence



Active groups are indicated by a checkmark in front of the group in the "Measurement Group Setup" tool window.

A group that is currently performing a measurement is indicated by the "running" icon  next to the group's name in the "Measurement Group Setup" tool window.

A measurement sequence is a convenient way to perform multiple measurements on an input signal in a quick succession, and to obtain results from different applications in a relatively short measurement time without having to switch between applications manually. For stable input data, a measurement sequence can provide results in various applications for almost identical input data.

### Measurement mode

For each measurement you can define whether a defined number of measurements is to be performed, or a continuous measurement. This is referred to as the *measurement mode*. The measurement mode can be defined for an individual measurement channel, a measurement group, or an entire measurement sequence. However, the measurement mode for the channels within a group is always the same as for the entire group, and the mode for the groups is the same as for the sequence. Thus, if you change the mode for a sequence, the mode for the group and the individual chan-

nels is automatically adapted accordingly. Nevertheless, you can change the mode for individual channels for manual measurement control.

### Default measurement

The default measurement in the R&S VSE consists of a single measurement channel (with the I/Q Analyzer application) in a default group and a default measurement sequence in continuous measurement mode. The measured magnitude values are displayed.

## 5.2 Available applications

The I/Q Analyzer application is included in the basic R&S VSE software. All other applications, such as Analog Demodulation or Vector Signal Analysis (VSA) are optional additions and require special licenses.



Optional applications require additional licenses. The application selection in the "Mode" dialog box depends on which licenses are available. If the predefined number of available licenses for a particular option are currently occupied by other users, you cannot open a further instance of the optional application until a license is returned. Per option, you only require a single license for any number of channels.

For more information, see [Chapter 3.4, "Using a license server"](#), on page 20.

3G FDD.....	44
5G NR.....	45
AM/FM/PM Modulation Analysis.....	45
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OFDM Vector Signal Analysis (OFDM VSA).....	46
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Vector Signal Analysis (VSA).....	46
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### 3G FDD

The 3G FDD BTS and 3G FDD UE applications require the 3GPP FDD Measurements option, R&S VSE-K72, to be installed, and an additional license. These applications provide test measurements for W-CDMA uplink and downlink signals (base station signals) according to the test specification.

For details see the R&S VSE-K72 User Manual.

Remote command:

INST:SEL BWCD, see [INSTrument\[:SElect\]](#) on page 552

**5G NR**

The 5G NR application requires an instrument equipped with one of the 5G NR Measurements options.

The R&S VSE-K144 application provides 5G NR measurements on the downlink and uplink.

The R&S VSE-K146 application provides 5G NR MIMO measurements on the downlink.

For details see the R&S VSE-K144 user manuals (one for downlink, and one for uplink).

Remote command:

INST:SEL NR5G, see [INSTrument\[:SElect\]](#) on page 552

**AM/FM/PM Modulation Analysis**

The AM/FM/PM Modulation Analysis application requires an additional license. This application provides measurement functions for demodulating AM, FM, or PM signals.

For details see the R&S VSE-K7 User Manual.

Remote command:

INST:SEL ADEM, see [INSTrument\[:SElect\]](#) on page 552

**Bluetooth**

The Bluetooth application requires an instrument equipped with the Bluetooth Measurements option R&S VSE-K8. This application provides Bluetooth measurements.

For details see the R&S VSE-K8 User Manual.

Remote command:

INST:SEL BTO, see [INSTrument\[:SElect\]](#) on page 552

**GSM**

The GSM application requires the GSM Measurements option R&S VSE-K10, to be installed, and an additional license. This application provides GSM measurements.

For details see the R&S VSE-K10 User Manual.

Remote command:

INST:SEL GSM, see [INSTrument\[:SElect\]](#) on page 552

**I/Q Analyzer**

The I/Q Analyzer is the default application and provides measurement and display functions for I/Q data.

Remote command:

INST:SEL IQ, see [INSTrument\[:SElect\]](#) on page 552

**LTE**

The LTE application requires the LTE Measurements option R&S VSE-K10x, to be installed, and an additional license. This application provides LTE measurements.

For details see the R&S VSE-K10x (LTE Downlink and LTE Uplink) user manuals.

Remote command:

INST:SEL LTE, see [INSTrument\[:SElect\]](#) on page 552

**NB-IoT**

The NB-IoT application requires the NB-IoT Measurements option R&S VSE-K106, to be installed, and an additional license. This application provides NB-IoT measurements.

For details see the R&S VSE-K106 (NB-IoT Downlink and NB-IoT Uplink) user manual.

Remote command:

INST:SEL NIOT, see [INSTrument\[:SElect\]](#) on page 552

**OFDM Vector Signal Analysis (OFDM VSA)**

The OFDM VSA application requires the OFDM Vector Signal Analysis option, R&S VSE-K96, to be installed, and an additional license. This application provides measurements and evaluations for OFDM Vector Signal Analysis.

For details see the R&S VSE-K96 User Manual.

Remote command:

INST:SEL OFDMVSA, see [INSTrument\[:SElect\]](#) on page 552

**Pulse Measurements**

The Pulse application requires the Pulse Measurements option, R&S VSE-K6, to be installed, and an additional license. This application provides measurement functions for pulsed signals.

For details see the R&S VSE-K6 User Manual.

Remote command:

INST:SEL PULSE, see [INSTrument\[:SElect\]](#) on page 552

**Transient Analysis**

The Transient Analysis application requires the Transient Analysis option R&S VSE-K96, to be installed, and an additional license. This application provides measurements and evaluations for Transient Analysis.

For details see the R&S VSE-K60 Transient Analysis User Manual.

Remote command:

INST:SEL TA, see [INSTrument\[:SElect\]](#) on page 552

**Vector Signal Analysis (VSA)**

The VSA application requires the Vector Signal Analysis option, R&S VSE-K70, to be installed, and an additional license. This application provides measurements and evaluations for Vector Signal Analysis.

For details see the R&S VSE-K70 User Manual.

Remote command:

INST:SEL DDEM, see [INSTrument\[:SElect\]](#) on page 552

**WLAN**

The WLAN application requires one of the WLAN options, R&S VSE-K91, to be installed, and an additional license. This application provides measurements and evaluations according to the WLAN IEEE 802.11 standards.

For details see the R&S VSE-K91 User Manual.

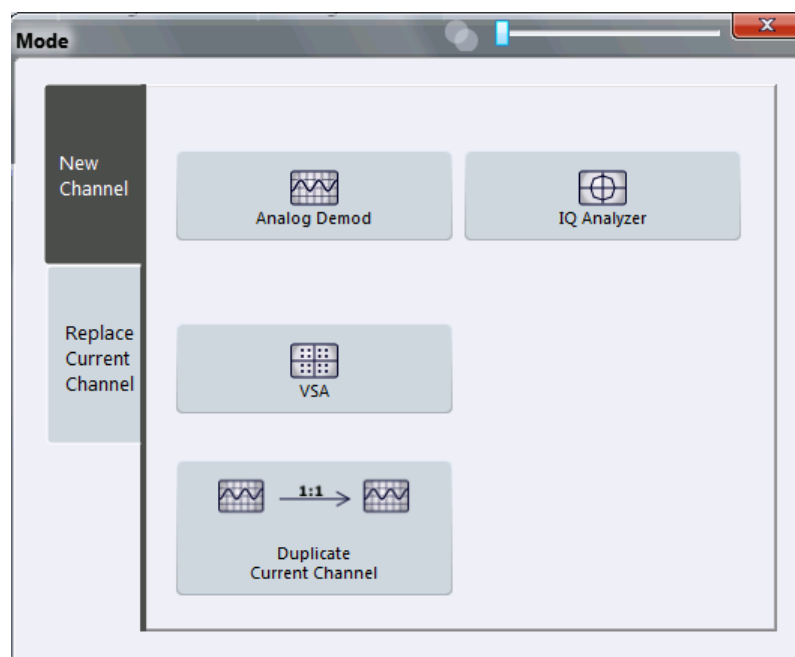
Remote command:

INST:SEL WLAN, see [INSTrument\[:SElect\]](#) on page 552

## 5.3 Starting an application

The default application in the R&S VSE is the I/Q Analyzer.

1. To start a new application, in the "Measurement Group Setup" tool window, select the "New Channel" button.



2. Select the required application.

For more information on working with applications see [Chapter 7, "Controlling instruments and capturing I/Q data"](#), on page 66.

## 6 Operating basics

This chapter provides an overview on how to work with the R&S VSE. It describes what kind of information is displayed in the diagram area, how to operate the R&S VSE via the graphical user interface, and how to use the Online Help. The information described here refers to the basic R&S VSE functionality, and is generally available in all supported applications. For specifics on the individual applications, see the corresponding user manuals.

- [Graphical user interface elements](#)..... 48
- [Understanding the I/Q analyzer display information](#)..... 54
- [Customizing the user interface](#)..... 56
- [Getting help](#)..... 63

### 6.1 Graphical user interface elements

All tasks necessary to operate the connected instrument can be performed using the R&S VSE graphical user interface.

In addition to the measurement results, the display provides status and setting information, allows you to switch between various measurement tasks, and provides access to all measurement functions.

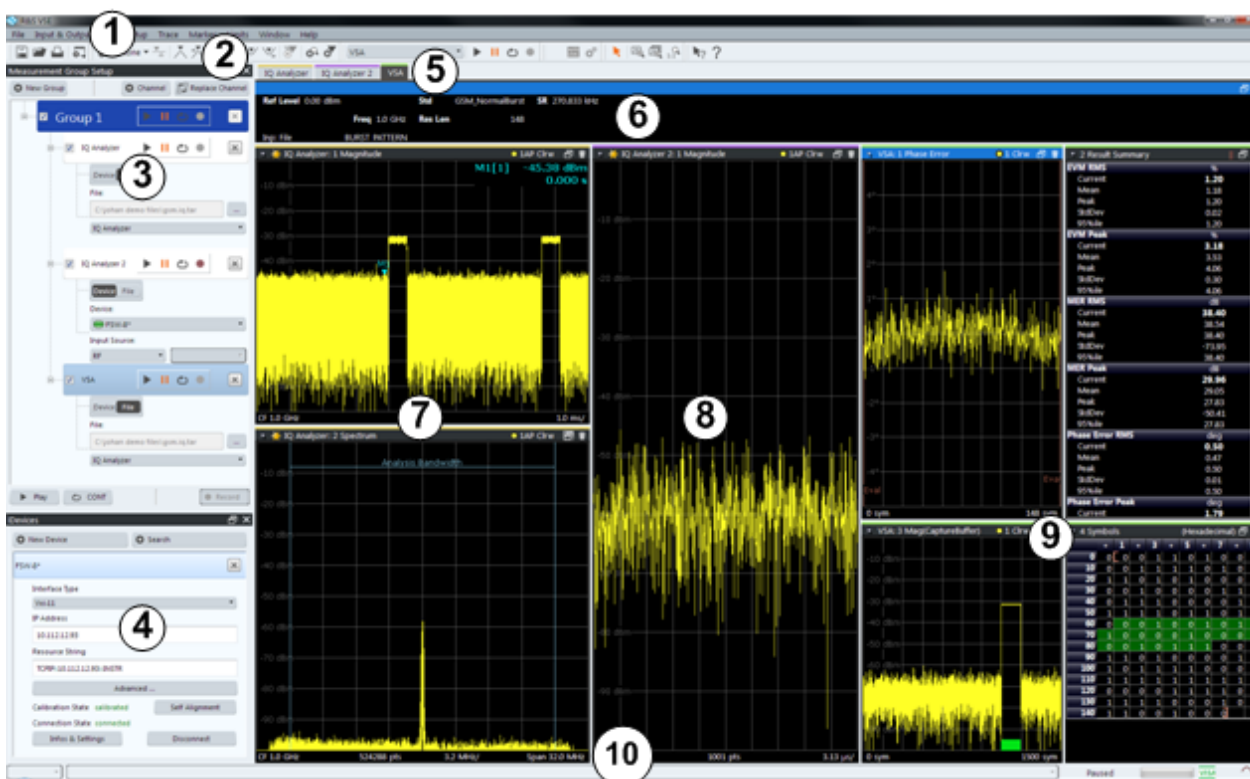


Figure 6-1: Graphical user interface elements



- 1 = Menu bar with general and measurement-specific menus
- 2 = Toolbar with general and measurement-specific tools
- 3 = Tool window for measurement group tool
- 4 = Tool window for instrument configuration
- 5 = Tabs for individual measurement channels
- 6 = Channel bar for active channel settings
- 7 = Result display for first measurement channel (yellow line)
- 8 = Result display for second measurement channel (purple line)
- 9 = Four result displays for third measurement channel (green line)
- 10 = Status bar with error messages, progress bar and instrument status for active channel

### 6.1.1 Menus

Most functions in the R&S VSE are available from the menus at the top of the window.

The following menus provide **basic functions for all applications**:

- "File"
- "Edit"
- "Window"
- "Help"

These functions are described in this manual.

Other menus are **application-specific** and provide different functions depending on the selected measurement channel, for example:

- Input
- Measurement Setup
- Trace
- Marker
- Limits

These menu functions are described in the user manual for the individual application and in [Chapter 10, "I/Q analyzer measurements"](#), on page 166.

### 6.1.2 Toolbars

Standard functions can be performed via the icons in the toolbars.



The toolbars can be docked anywhere alongside the outer edge of the R&S VSE window; that is:

- Beneath the menu bar
- Above the status bar
- On the left or right edges of the window

For details, see [Chapter 6.3, "Customizing the user interface"](#), on page 56.

For information on how to hide or display individual toolbars see [Chapter 6.3.5, "Closing and deactivating windows and bars"](#), on page 63.

Note that some icons are only available for specific applications. Those functions are described in the user manual for the individual application.

### 6.1.3 Status bar

The software status, instrument status, errors and warnings and any irregularities in the connected instrument are indicated in the status bar at the bottom of the R&S VSE window.



#### Hiding the status bar

You can hide the status bar display, e.g. to enlarge the display area for the measurement results ("File > Preferences > Displayed Items").

See [Chapter 9.2.1, "Displayed items"](#), on page 147.

#### Software status

The status bar indicates the state of the VISA installation on the PC running the R&S VSE software. The VISA installation is required to connect the R&S VSE to other instruments.

The following VISA status icons may be displayed:

**Table 6-1: VISA status icons**



	VISA installation is available; network connections to other instruments are possible
	VISA installation is available, but a firewall may be prohibiting a connection to other instruments in the network. Try one of the following to resolve the problem: <ul style="list-style-type: none"> <li>• Check the IP addresses of the instruments configured in the "Instruments" window and make sure you are allowed to connect to those instruments.</li> <li>• Try using HiSLIP protocol instead of VSI-11</li> <li>• Ask your local administrator to loosen the firewall restrictions on your PC.</li> <li>• Restart the instrument you want to connect to.</li> </ul>
	VISA installation is not complete or available; network connections to other instruments are not possible. See <a href="#">"Installing VISA"</a> on page 16 or contact the Rohde & Schwarz Support Center (see <a href="#">Chapter 14.3, "Collecting information for support"</a> , on page 952).



If you place the mouse over the icon, a descriptive message is displayed informing you what to do.

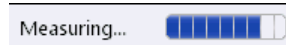
#### Instrument status

The displayed instrument status information depends on the type of instrument that is connected to the R&S VSE. For the supported Rohde & Schwarz Signal and Spectrum Analyzers, the following types of information may be displayed, if applicable.

	The instrument is configured for operation with an external reference.
	The R&S VSE software is resampling the input from the connected instrument to obtain the required sample rate.

**Progress**

The progress of the current software operation is displayed in the status bar.



**Error messages**

If errors or irregularities are detected, a keyword and an error message, if available, are displayed in the status bar. For details, see the user manual for the individual application.

**6.1.4 Windows**

The R&S VSE distinguishes between three types of windows, depending on their use:

- **Tool windows:** provide functionality for specific global tasks, such as configuring instruments or measurement groups; see [Chapter 7, "Controlling instruments and capturing I/Q data"](#), on page 66
- **Channel bar:** provides information on measurement channel settings (one window per active channel)
- **Result displays:** provide the measurement results

The layout of the individual windows is customizable and highly flexible, see [Chapter 6.3, "Customizing the user interface"](#), on page 56.

- [Channel bar](#).....51
- [Result displays / measurement windows](#)..... 52

**6.1.4.1 Channel bar**

For each channel, a separate window with measurement information is displayed. When you select a result display window for a different channel, the channel bar for that channel is also activated. Each channel bar is provided with a colored line in the window title bar which is the same color as the corresponding channel result displays.



Figure 6-2: Example for channel bar (I/Q Analyzer)



In the default configuration, the channel bars for multiple channels are displayed in separate tabs in the same window. Depending on which result display is currently active, the corresponding channel information tab is displayed. However, you can separate the tabs into individual windows. See [Chapter 6.3, "Customizing the user interface"](#), on page 56.

### Channel-specific settings

The channel bar provides information on channel-specific settings for the measurement. A bullet next to the setting indicates that user-defined settings are used, not automatic settings. A green bullet indicates this setting is valid and the measurement is correct. A red bullet indicates an invalid setting that does not provide useful results. Channel information varies depending on the active application. For details, see the individual user manuals.

### Instrument settings

In addition to the channel-specific settings, the channel bar also displays information on general instrument settings. These settings affect the measurement results even though it is not immediately apparent from the display of the measured values. This information is displayed in gray font and only when applicable for the current measurement, as opposed to the channel-specific settings that are always displayed.

The instrument settings depend on the type of instrument that is connected to the R&S VSE. For the supported Rohde & Schwarz Signal and Spectrum Analyzers, the following types of information may be displayed, if applicable.

**Table 6-2: Instrument settings displayed in the channel bar**

"PA"	The preamplifier is activated
"75 Ω"	The input impedance of the instrument is set to 75 Ω
"DC/AC"	An external DC or AC calibration signal is in use.

#### 6.1.4.2 Result displays / measurement windows

Measurement results can be evaluated in many different ways, for example graphically, as summary tables, statistical evaluations, etc. Optional applications add their own specific measurements and result displays. Thus, the result display is highly configurable to suit your specific requirements and optimize analysis.

For each measurement, a separate measurement channel is activated. Each measurement channel can provide multiple result displays. All windows that belong to the same measurement (including the channel bar) are indicated by a colored line at the top of the window title bar.

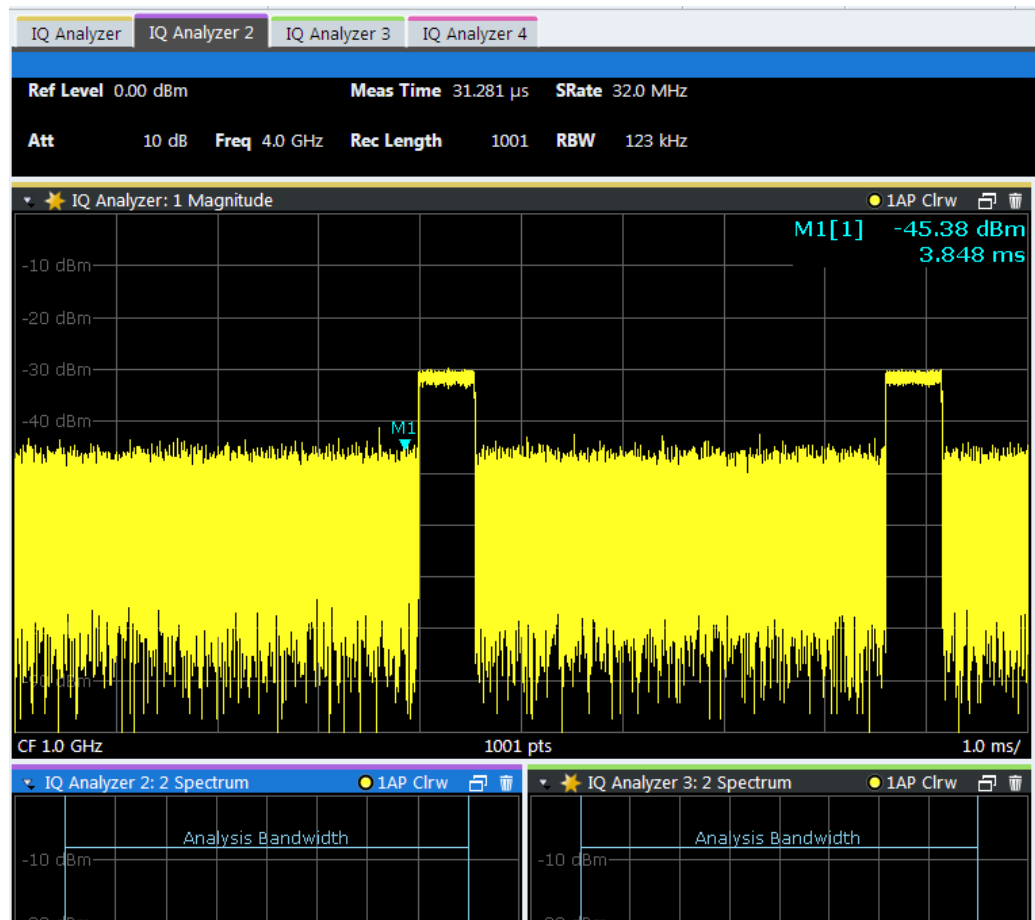




Figure 6-3: Color-coded windows



### Window title bar

The contents of the individual result displays are described in detail in the user manual for the individual application.

The following common functions are available in all window title bars:

Table 6-3: Common functions and icons in the window title bar

	Change result type	Displays a list of possible result types for the active channels to replace the current display.
	Invalid data	Indicates that invalid or inconsistent data is displayed, that is: the trace no longer matches the displayed measurement settings. This may be the case, for example, when you change the measurement bandwidth, but the displayed trace is still based on the old bandwidth. As soon as a new measurement is performed or the display is updated, the icon disappears.  (This icon is sometimes also referred to as a "dirty flag".)

	Dock / Undock window	Docks the window to the main R&S VSE window or separates it from the main window. See "Docked and undocked windows" on page 56
	Delete window	Closes the selected window

## 6.2 Understanding the I/Q analyzer display information

The following figure shows a measurement diagram during I/Q Analyzer operation. All different information areas are labeled. They are explained in more detail in the following sections.

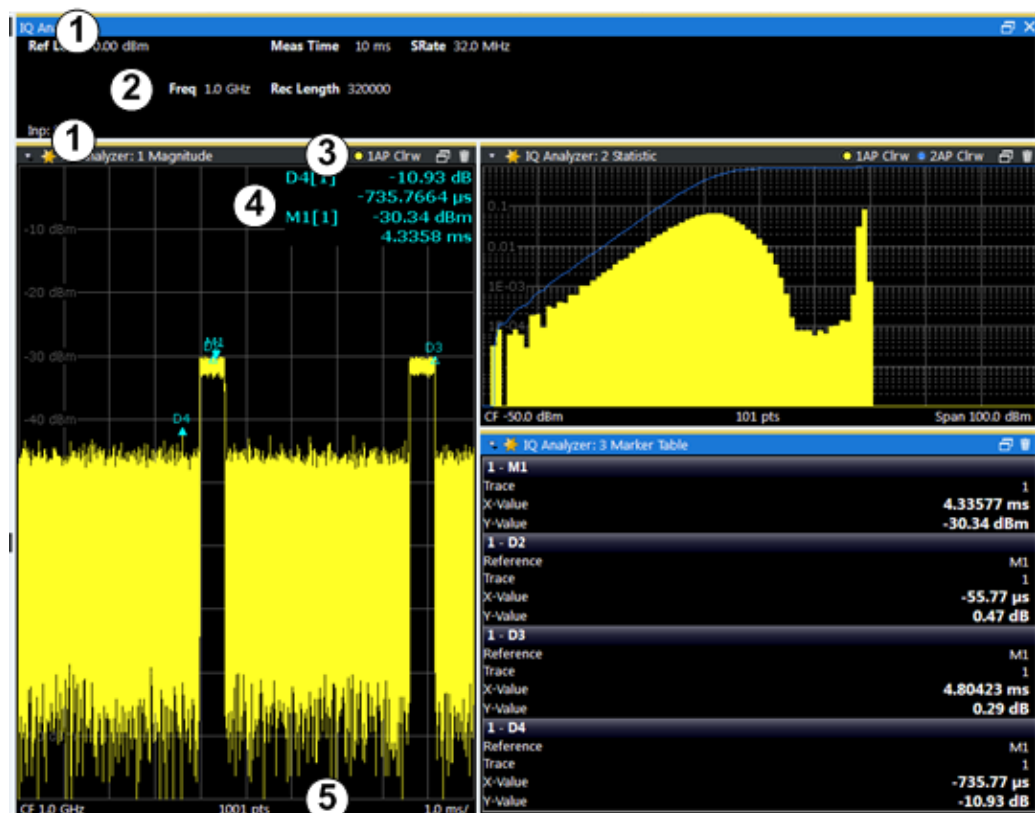


Figure 6-4: Screen elements in the I/Q Analyzer application

- 1 = Color coding for windows of same channel
- 2 = Channel bar with measurement settings
- 3 = Window title bar with diagram-specific (trace) information
- 4 = Diagram area with marker information
- 5 = Diagram footer with diagram-specific information, depending on result display

### Channel bar

The channel bar shows the most important settings for the corresponding application.



Select a setting in the channel bar to open the corresponding configuration dialog box and change the setting quickly and easily.



Right-click a setting to display a context menu for it.

For the I/Q Analyzer application, the channel bar shows the following settings:

**Table 6-4: Information displayed in the channel bar for the I/Q Analyzer application**

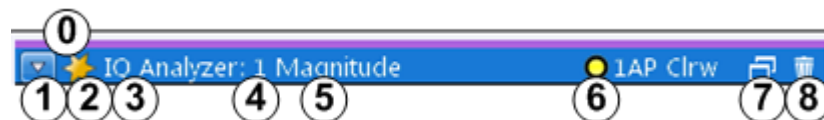
"Ref Level"	Reference level
(m.+el.)"Att"	(Mechanical and electronic) RF attenuation
"Ref Offset"	Reference level offset
"SAN: Att"	Analyzer attenuation when using an (optional) external frontend with the connected instrument
"ExtFE: Att"	External frontend attenuation when measuring external frontend input from the connected instrument.
"Freq"	Center frequency
"Meas Time"	Measurement time
"Rec Length"	Defined record length (number of samples to capture)
"SRate"	Defined sample rate for data acquisition
Inp: Ext Fe <band config mode>	Input captured from external frontend connected to connected instrument; the used band configuration mode is indicated for reference (see " <a href="#">Frequency Band Configuration</a> " on page 214)
"RBW"	(Spectrum evaluation only) Resolution bandwidth calculated from the sample rate and record length

**Table 6-5: Icons in the channel bar**

Icon	Meaning
	Indicates that the channel is currently performing a measurement.
	Indicates that an error occurred in the measurement channel. Check the R&S VSE status bar.

### Window title bar information

For each diagram, the header provides the following information:



**Figure 6-5: Window title bar information in the I/Q Analyzer application**

- 0 = Color coding for windows of same channel
- 1 = Edit result display function
- 2 = Invalid data flag
- 3 = Channel name
- 4 = Window number

- 5 = Window type
- 6 = Trace color, trace number, detector type, trade mode
- 7 = Dock/undock window function
- 8 = Close window function

### Diagram footer information

The diagram footer (beneath the diagram) displays scaling information and depends on the evaluation:

Magnitude and Spectrum diagrams:

- Center frequency
- Number of measurement points
- Range per division (x-axis)
- Span (Spectrum)

I/Q Vector diagram:

- Maximum value on y-axis

## 6.3 Customizing the user interface

The layout of the individual windows in the R&S VSE software is customizable and highly flexible. Apart from a few fixed interface elements (menu bar, status bar), the windows can be positioned almost anywhere on the screen.

• <a href="#">Windows concept</a> .....	56
• <a href="#">Multiview mode</a> .....	60
• <a href="#">Displaying new windows</a> .....	61
• <a href="#">Rearranging windows</a> .....	62
• <a href="#">Closing and deactivating windows and bars</a> .....	63

### 6.3.1 Windows concept

#### Docked and undocked windows

In the default layout, all windows are positioned within the main R&S VSE window. When you change the size of the R&S VSE window, or add new subwindows, the subwindows are adapted or rearranged as necessary. The subwindows are *docked* to the main window.



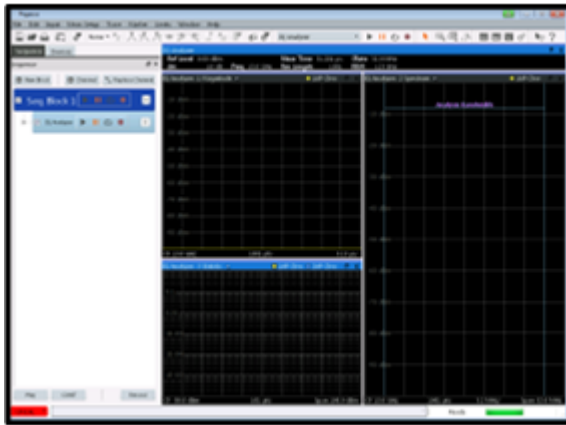


Figure 6-6: Example for docked windows in the R&S VSE window

Optionally, each subwindow can be undocked, that is, detached from the main R&S VSE window. Undocked windows can be placed anywhere on the screen, even outside of the main R&S VSE window. This is useful, for example, if a second monitor is available and you want to take advantage of the additional display area. However, undocked windows "float" on the screen, covering any other displays behind them. They are not adapted or rearranged when you change the size of the R&S VSE window or add new subwindows.

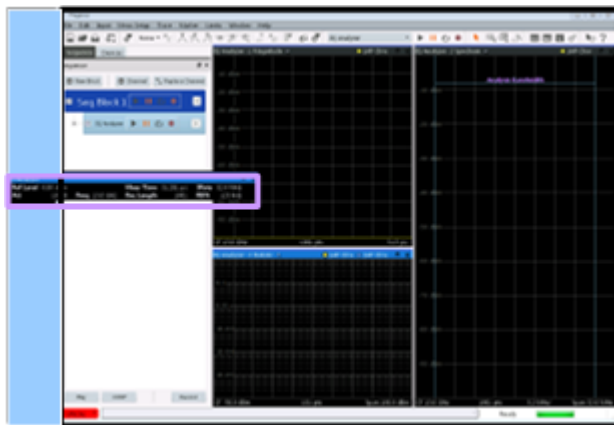


Figure 6-7: Example for undocked window in the R&S VSE window

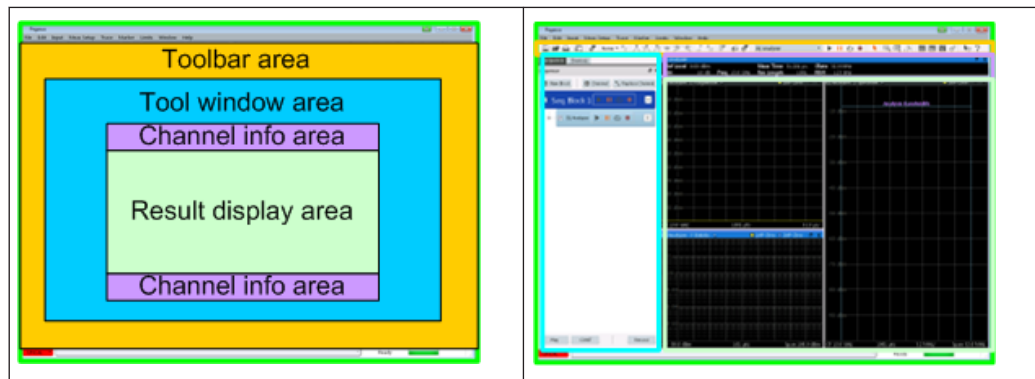
### Docking areas for interface elements

The windows and other interface elements can be docked within predefined areas in the R&S VSE window. (For details on the window types see [Chapter 6.1.4, "Windows"](#), on page 51.)

- The **menu bar and status bar** are fixed elements and are always located at the top and bottom edge of the window, respectively. No windows can be docked above the menu bar or below the status bar.
- **Toolbars** can only be placed along the outer edges of the R&S VSE window, below the menu bar and above the status bar.

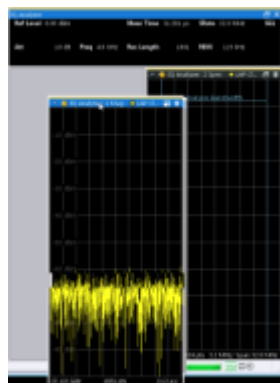
- **Tool windows** can only be placed along the outer edges of the R&S VSE window, below the menu bar and above the status bar, and not outside of any toolbars.
- **Channel bars** can be placed above or below the result displays, at the top or bottom edges of the R&S VSE window, but not outside of any tool windows or toolbars.
- **Result displays** are surrounded by all other window types and bars. They must be placed within a grid structure of columns and rows. The number of result displays in each column or row is restricted only by the available display space and the minimum window size of the individual windows.

**Table 6-6: Docking areas in the R&S VSE window**



### Docking positions

Possible docking positions for the currently selected element are indicated by an empty gray space in the R&S VSE window.



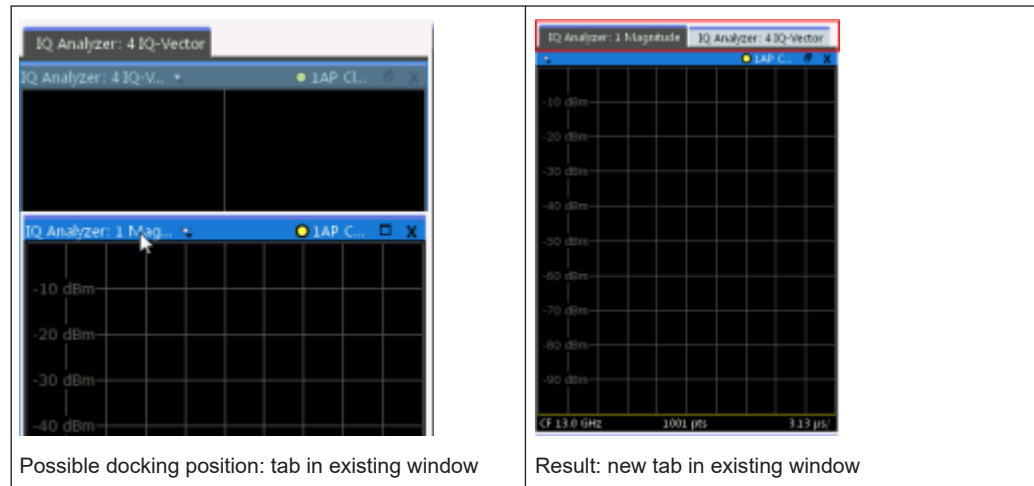
### Window tabs

As mentioned above, each window type requires a minimum amount of space for display. If not enough display space for all active windows is available, windows of the same type are automatically arranged in tabs within one window. To switch between displayed windows, simply select the corresponding tab.

For example, when a new channel is started or a new display is added, the existing windows may be combined into one window using tabs. The new windows are displayed in maximum size.

To save space on the screen and when not all windows are relevant at the same time, you can also arrange windows in tabs manually. Tabs are created when you dock a window on top of an existing window of the same type. The docking position is indicated by showing the existing window with a tab, instead of providing an empty gray space for a new window.

**Table 6-7: Docking windows as tabs**



### Window size

Each window type requires a minimum amount of display space. The maximum size is restricted only by the available display space within the R&S VSE window (for docked windows) or on the entire screen (for undocked windows).

The result displays are placed within a grid structure (see "[Docking areas for interface elements](#)" on page 57). Thus, the minimum width of a window may also be restricted by other result displays in the same column. The minimum height may be restricted by other result displays in the same row.

### Active windows, selected window

When a measurement is performed in a channel, results are determined for all configured result displays. Thus, to analyze result data and possibly store it to a file, you must activate windows for the corresponding result displays. A list of all active windows for all configured measurement channels is available from the "Window" menu.

As soon as you select a window, for example by clicking the mouse in it, any window-specific operations you perform subsequently are applied to that window. For example, you can set a marker or zoom in into the display of the window. Furthermore, when you select a window, you also select the channel the selected window belongs to. The channel bar (see [Chapter 6.1.4.1, "Channel bar"](#), on page 51) for the selected channel is activated, and any channel-specific operations are applied to the selected channel.

### Closing vs deactivating windows

If a large number of channels or result displays are active, the display may become very crowded and confusing. Thus, if you do not require the online visualization of the results, you can *temporarily deactivate* windows in the display. Deactivating a window

simply hides the display, without losing its settings or contents. A deactivated window can easily be restored to the display without having to reconfigure it.

Closing a window permanently deletes the result display and its contents. A new window with the same evaluation method and default settings can be added again, but the previous settings and contents are lost.

### 6.3.2 Multiview mode

By default, all windows for all active measurement channels are displayed at the same time on the screen. This is referred to as the *MultiView mode*, as multiple channels are displayed.



Figure 6-8: MultiView display of several measurement channels

You can disable this mode in order to display only the windows for a single measurement channel at a time. In this case, the windows for each channel are displayed in individual tabs. Only the windows for the currently selected channel are visible. To switch between channels, simply select the corresponding tab. This is particularly useful if the screen gets too confusing.

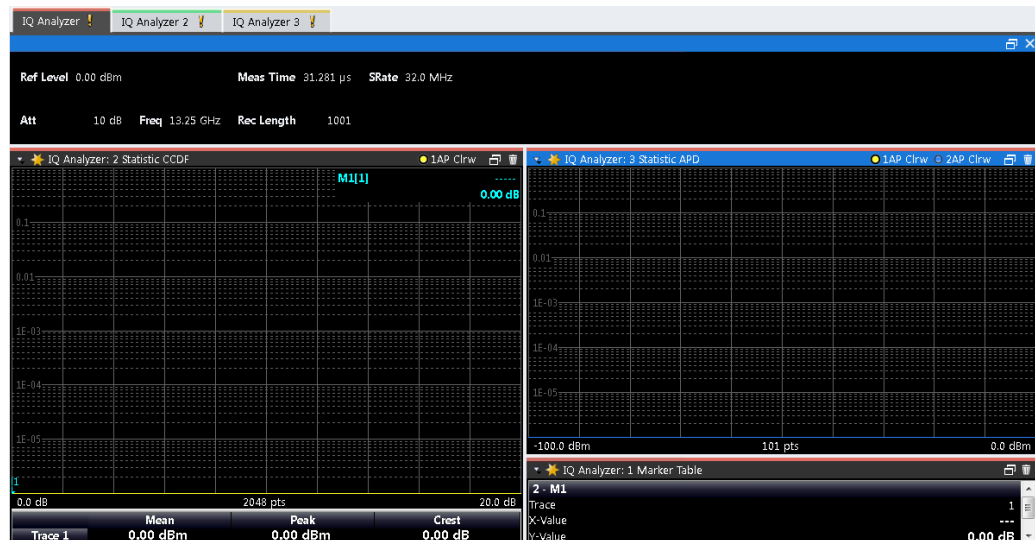


Figure 6-9: MultiView disabled - display of a single measurement channel only

#### To toggle between the two views



- ▶ Select the "Multiview mode" icon in the main toolbar.

#### To change the default behavior

- ▶ Select "File" > "Preferences" > "Displayed Items" > "Multiview mode". "On"/"/"Off".

### 6.3.3 Displaying new windows

For the I/Q Analyzer, up to six windows can be displayed for a single channel.

#### To add a new window

1. Select the global information window or any other measurement window of the measurement channel you want to add a window for.




Select the "Add Window" icon or  
From the "Window" menu, select "New Window".

3. Select the result display you want to add a window for.  
The available result display types depend on the selected application.  
For other applications, see the application-specific documentation.

A new window for the result display is opened.

If not enough display space for all active windows is available, the existing windows are combined into one window using tabs, while the new window is displayed in maximum size.

**To replace the contents of a measurement window**

1. In the window whose contents you want to replace, in the window title bar, select the  "Replace" icon.
2. Select the result display.

The window displays the newly selected result display for the selected measurement channel.

**Remote commands:**

`LAYout:GLOBal:ADD[:WINDow]?` on page 597

`LAYout:GLOBal:REPLace[:WINDow]` on page 602

**6.3.4 Rearranging windows****To dock or undock a window**

- ▶ Select the  "Dock" /  "Undock" icon in the window title bar.

If the window was docked, it is detached and can be moved and resized independently of the R&S VSE window.

If the window was undocked, it is docked to its default position in the R&S VSE window.

(For details see ["Docked and undocked windows"](#) on page 56.)

**To change the position of a window or bar**

- ▶ Select the bar or window title bar and drag it to a new position on the screen. Possible docking positions for the currently selected element are indicated by an empty gray space in the R&S VSE window or by showing the underlying window with a tab.

When you drop the window or bar, it is docked to the selected position.

If you drop the window on top of an existing window of the same type, the moved window is added as a tab.

To switch between displayed windows, simply select the corresponding tab.

**To resize a window**

- ▶ To resize a window, select the window frame and drag it to the required size. Note the restrictions concerning the minimum window size described in ["Window size"](#) on page 59.



To restore the *default* configuration for the measurement channel, use the [Preset > Selected Channel](#) function in the "File" menu.

### 6.3.5 Closing and deactivating windows and bars

Closing a window permanently deletes the result display and its contents, while deactivating a window simply hides the display, without losing its settings or contents. Tool windows and channel bars cannot be closed permanently.

(For details see ["Closing vs deactivating windows"](#) on page 59).

#### To hide or display a toolbar

1. Right-click any toolbar or the menu bar.  
A context menu with a list of all available toolbars is displayed.
2. Select the toolbar you want to hide or display.  
A checkmark indicates that the toolbar is currently displayed.  
The toolbar is toggled on or off.

#### To deactivate or reactivate a tool window or channel bar

- ▶ From the "Window" menu, select the tool window or channel bar.  
The window is toggled on or off.

#### To deactivate or reactivate a result display

1. From the "Window" menu, select "Active Windows".  
Alternatively, right-click the window title bar of a result display that belongs to the same channel.
2. Select the result display you want to deactivate or reactivate.  
A checkmark indicates that the window is currently active.  
The window is toggled on or off.

#### To close a result display



- Select the "Delete" icon in the window title bar.  
The result display is permanently removed.

#### Remote command:

[LAYout:GLOBal:REMove\[:WINDow\]](#) on page 602

## 6.4 Getting help

If any questions or problems concerning the R&S VSE arise, an extensive online help system is provided in the software and can be consulted at any time. The help system is context-sensitive and provides information specifically for the current operation or

setting to be performed. In addition, general topics provide an overview on complete tasks or function groups as well as background information.

### 6.4.1 Calling up help

The online help can be opened at any time by selecting one of the "Help" icons on the toolbar or by selecting the F1 key.

#### Calling context-sensitive help

- ▶ To display the "Help" dialog box for the currently focused screen element, e.g. a softkey or a setting in an opened dialog box, select the "Help" icon on the toolbar.



The "Help" dialog box "View" tab is displayed. A topic containing information about the focused screen element is displayed.

If no context-specific help topic is available, a more general topic or the "Contents" tab is displayed.



For standard Windows dialog boxes (e.g. Print dialog, Device Search, VISA Resource String Builder etc.), no context-sensitive help is available.

- ▶ To display a help topic for a screen element not currently focused:
  - a) Select the "Help pointer" icon on the toolbar.



The pointer changes its shape to a "?" and an arrow.

- b) Select the screen element to change the focus.

A topic containing information about the selected (now focused) screen element is displayed.

### 6.4.2 Using the help window

The Help window contains several tabs:

- "View" - shows the selected help topic
- "Contents" - contains a table of help contents
- "Index" - contains index entries to search for help topics
- "Search" - provides text search



The Help toolbar provides some buttons:

- To browse the topics in the order of the table of contents: up arrow = previous topic, down arrow = next topic



- To browse the topics visited before: left arrow = back, right arrow = forward
- To increase or decrease the font: magnifier with + or - sign, respectively



### To search for a topic in the index

The index is sorted alphabetically. You can browse the list, or search for entries in the list.

1. Switch to the "Index" tab.
2. Select the "Keyboard" icon besides the entry field.
3. Enter the first characters of the keyword you are interested in.  
The entries containing these characters are displayed.
4. Double-click the suitable index entry.  
The "View" tab with the corresponding help topic is displayed.

### To search topics for a text string

1. Switch to the "Search" tab.
2. Select the "Keyboard" icon besides the entry field.
3. Enter the string you want to find.  
If you enter several strings with blanks between, topics containing all words are found (same as AND operator).  
For advanced search, consider the following:
  - To find a defined string of several words, enclose it in quotation marks. For example, a search for *"trigger qualification"* finds all topics with exactly *"trigger qualification"*. A search for *trigger qualification* finds all topics that contain the words *trigger* and *qualification*.
  - Use "Match whole word" and "Match case" to refine the search.
  - Use operators AND, OR, and NOT.

### To close the Help window

- ▶ Select the "Close" icon in the upper right corner of the help window.  
Or: Press the [ESC] key.

## 7 Controlling instruments and capturing I/Q data

A key feature of the R&S VSE is the ability to capture data from various instruments or retrieve data from stored measurement files, and to analyze this data in various applications.

### R&S VSE Enterprise Edition vs Basic Edition

The R&S VSE Enterprise Edition and Basic Edition differ in the number of channels, groups, and instruments that can be configured at the same time.

Supported number of	Enterprise Edition	Basic Edition
Instruments	128	1
Groups	30	1
Channels	30	3

### R&S VSE software installed directly on instruments

Using specific licenses, you can install the R&S VSE software directly on Rohde & Schwarz instruments. Thus, you do not need a separate PC and an additional data connection to analyze measurement data with R&S VSE. No dongle or license server is required. The instrument itself acts as the license server and enables the features accordingly. The R&S VSE software can only be started on the instrument it is installed on. Generally, when installed on an instrument, the R&S VSE software provides the same functionality as the R&S VSE Basic Edition. To use additional options and applications, additional licenses are required on the instrument. However, note the following restrictions:

Installed on the **R&S FSW** (option R&S FSW-VSE) or **R&S FSV/A3000** (option R&S FSV3-VSE):

- Only the instrument itself (localhost) is supported as an input source, in addition to I/Q data files.
- Only options and applications for which licenses are available on the instrument are supported by the R&S VSE software. For example, to analyze EUTRA/LTE FDD uplink signals on an R&S FSW, you require the option R&S FSW-K101.

Installed on Rohde & Schwarz **oscilloscopes** (options R&S VSE-KTx):

- Only the instrument itself (localhost) is supported as an input source, in addition to I/Q data files.
- Only applications for which R&S VSE-KTx licenses are available on the instrument are supported by the R&S VSE software. For example, to analyze EUTRA/LTE FDD uplink signals on an R&S RTO, you require the option R&S VSE-KTx100.

Installed on **R&S CMW** (options - R&S CMW-KM150/-KM152)

- The R&S VSE software can only be started on the same PC the R&S CMW firmware is installed on.

- Only I/Q data files are supported as an input source for the R&S VSE software, no instruments
- Only applications for which R&S CMW-KMx licenses are available on the PC are supported by the R&S VSE software. For example, to perform vector signal analysis on an R&S CMW PC, you require the option R&S CMW-KM152.

### R&S VSE integrated in Cadence®AWR®VSS

Within Cadence®AWR®VSS, the R&S VSE can only process input from encrypted waveform files, not from a device. Otherwise, Cadence®AWR®VSS provides the same functionality as the R&S VSE Basic Edition with all supported applications. For details, see [Chapter 3.5, "Using R&S VSE with Cadence®AWR®VSS"](#), on page 21.

### Using R&S VSE with a R&S PVT360A or R&S CMP

Using specific licenses, you can use the R&S VSE software with a R&S PVT360A or R&S CMP. These licenses only support the R&S VSE Basic Edition.

To use additional options and applications, additional licenses are required on the instrument. However, note the following restrictions:

- Only the instrument connected when you start the software is supported as an input source, in addition to I/Q data files.
- Only applications for which R&S VSE-KPx licenses are available on the instrument are supported by the R&S VSE software. For example, to analyze EUTRA/LTE FDD uplink signals on an R&S PVT360A, you require the option R&S VSE-KP100. For details on which instrument supports which licenses, see the product data sheet.

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## 7.1 Input sources

The input source selects the source of the data to be analyzed. You can either analyze a live signal or a signal that has been recorded previously and whose characteristics have been saved to a file.

### 7.1.1 Connected instrument

Any instruments that are to provide signals to the R&S VSE must be configured in the software. The R&S VSE then manages all connections to the other instruments. If the instrument configured for a particular measurement channel is changed, the R&S VSE

software adapts the measurement settings, if necessary and possible. Thus, the measurement and analysis tasks performed using the R&S VSE software are mostly independent of the underlying instrument.

Currently, the following instruments can be connected to the R&S VSE software to provide signal input:

- R&S FSW signal and spectrum analyzers (also via external frontend)
- R&S FSWP phase noise analyzer and VCO tester
- R&S FPS signal and spectrum analyzers
- R&S FPL1000 signal and spectrum analyzers
- R&S FSV signal and spectrum analyzers
- R&S FSV3000/FSVA3000 signal and spectrum analyzers (also via external frontend)
- R&S FSL signal and spectrum analyzers
- R&S ZNL network analyzers (with R&S ZNL3-B1 Spectrum Analyzer Mode option)
- R&S RTx oscilloscope product family (R&S RTP also via external frontend)
- R&S CMA radio test sets
- R&S CMP radio test sets
- R&S PVT360A performance vector testers
- R&S NRQ6 power sensors



The instrument connected to and controlled by the R&S VSE software is referred to as the connected instrument throughout this documentation.

### Input sources

Depending on the type of instrument and the connectors it provides, the R&S VSE software supports the following source of input:

- **RF**  
Captures and analyzes the data from the RF input of the connected instrument.
- **External frontend**  
If the External Frontend Control option is installed on the connected instrument, you can control measurements with the connected instrument using a connected external frontend.
- **oscilloscope baseband input**  
Captures and analyzes complex oscilloscope baseband input from multiple channels of a connected Rohde & Schwarz oscilloscope. You must specify which channels are used for input. Capturing oscilloscope baseband input requires firmware version 3.0.1.1 or later on the oscilloscope. Not all applications in the R&S VSE software support oscilloscope baseband input.  
For details see [Chapter 10.2.5, "oscilloscope baseband input"](#), on page 184.



### R&S FSW and B2000

The R&S VSE software supports input from a connected R&S FSW with a B2000 option installed. However, the R&S FSW interface to the oscilloscope must be set up and aligned directly on the instrument before the R&S VSE software can start analyzing the input.

Once the B2000 option has been aligned and activated, the R&S VSE applications can process I/Q data with a bandwidth of up to 2 GHz, with a center frequency starting at 8 GHz, up to the maximum frequency supported by the instrument model (the useful range may be restricted, see data sheet). The record length may be restricted by the connected oscilloscope (see its data sheet).

For details on R&S FSW and B2000 see the R&S FSW I/Q Analyzer and I/Q Input Interfaces user manual.



### Oscilloscope input

Input from an R&S oscilloscope with a firmware version 3.0.1.1 or higher can be provided as the original waveform data, or as converted I/Q data. Depending on the measurement requirements and the application, either format may be more suitable.

For details see "[Capture Mode](#)" on page 199.

## 7.1.2 File input

Alternatively to "live" data input from a connected instrument, the R&S VSE software can also analyze measurement data provided "offline" by a stored data file. This allows you to perform a measurement on any instrument and store the results to a file. Then you can analyze the stored data partially or as a whole at any time using the R&S VSE software.

Currently, the R&S VSE software supports the following file formats as signal input:

- .iq.tar (compressed data format)
- .csv
- .mat (matlab)
- .iqw
- .iqx
- .aid
- .wv

For more information, see also [Chapter 8.3.4, "Recalling measurement data from files"](#), on page 132.

## 7.2 Configuring instruments

**Access:** "Window" > "Instruments"

The R&S VSE can capture and analyze data from various instruments. You must configure these instruments before you can perform measurements on them via the R&S VSE. Instruments are configured in the R&S VSE's "Instruments" tool window.



#### R&S VSE Basic Edition

In the R&S VSE Basic Edition, you can configure only one instrument at a time. When installed directly on an instrument, further restrictions can apply, see ["R&S VSE software installed directly on instruments"](#) on page 66.



#### Using R&S VSE with a R&S PVT360A or R&S CMP

When you use the R&S VSE software with a R&S PVT360A or R&S CMP, you must configure the IP address of the PC with the R&S VSE software installed on the instrument in advance. (☰ > "Settings" > "System" tab > "VSE Client") For details, see the instrument documentation.

When you start the R&S VSE software, it automatically detects the connected instrument. These products only support the R&S VSE Basic Edition. Thus, you can use the software only with one single connected instrument. You need not configure any instrument in the R&S VSE software.

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### 7.2.1 Remote control interfaces and protocols

The software supports different interfaces and protocols for remote control. The following table gives an overview.



For a description of the protocols refer to [Remote control via SCPI](#).

Table 7-1: Remote control interfaces and protocols

Inter- face	Protocols, VISA <sup>*)</sup> address string	Port <sup>**)</sup>	Remarks
Local Area Net- work (LAN)	<b>HiSLIP</b> High-Speed LAN Instrument Protocol (IVI-6.1) TCPIP::host address::hislip0[::INSTR]	TCP port: 4880	A LAN connector is located on the rear panel of the instrument.
	<b>VXI-11</b> TCPIP::host address::inst0[::INSTR] Library: VISA	TCP or UDP port: 111 TCP port: well-known ports (600 - 1023) for Linux or registered ports (1024 - 49151) for Windows	
	<b>socket communication</b> (Raw Ethernet, simple Telnet) TCPIP::host address[::LAN device name]::<port>::SOCKET Library: VISA or socket controller	SCPI raw, TCP port: 5025, 5125 SCPI telnet, TCP port: 5024, 5124	
	VNC	via VNC client: 5800/5900 Device web: 5850	
	Device web / web control	80	

<sup>\*)</sup> VISA is a standardized software interface library providing input and output functions to communicate with instruments. A VISA installation on the controller is a prerequisite for remote control using the indicated interfaces.

<sup>\*\*)</sup> By default, R&S VSE use these ports for communication via LAN control interface. If necessary, adapt your firewall to allow for use of these ports.

### 7.2.1.1 LAN interface

To be integrated in a LAN, the instrument is equipped with a LAN interface, consisting of a connector, a network interface card and protocols. The network card can be operated with the following interfaces:

- 10 Mbit/s Ethernet IEEE 802.3
- 100 Mbit/s Ethernet IEEE 802.3u
- 1Gbit/s Ethernet IEEE 802.3ab

For remote control via a network, the PC and the instrument must be connected via the LAN interface to a common network with TCP/IP network protocol. They are connected using a commercial RJ45 cable (shielded or unshielded twisted pair category 5). The TCP/IP network protocol and the associated network services are preconfigured on the instrument. Software for instrument control and the VISA program library must be installed on the controller.

#### IP address

Only the IP address or a valid DNS host name is required to set up the connection. The host address is part of the "VISA resource string" used by the programs to identify and control the instrument.

The VISA resource string has the form:

```
TCPIP::host address[::LAN device name][::INSTR]
```

or

```
TCPIP::host address::port::SOCKET
```

where:

- **TCPIP** designates the network protocol used
- **host address** is the IP address or host name of the device
- **LAN device name** defines the protocol and the instance number of a subinstrument;
  - `inst0` selects the VXI-11 protocol (default)
  - `hislip0` selects the HiSLIP protocol
- **INSTR** indicates the instrument resource class (optional)
- **port** determines the used port number
- **SOCKET** indicates the raw network socket resource class

**Example:**

- Instrument has the IP address *192.1.2.3*; the valid resource string using VXI-11 protocol is:  

```
TCPIP::192.1.2.3::INSTR
```
- The DNS host name is *VSE-123456*; the valid resource string using HiSLIP is:  

```
TCPIP::VSE-123456::hislip0
```
- A raw socket connection can be established using:  

```
TCPIP::192.1.2.3::5025::SOCKET
```



**Identifying instruments in a network**

If several instruments are connected to the network, each instrument has its own IP address and associated resource string. The controller identifies these instruments by the resource string.

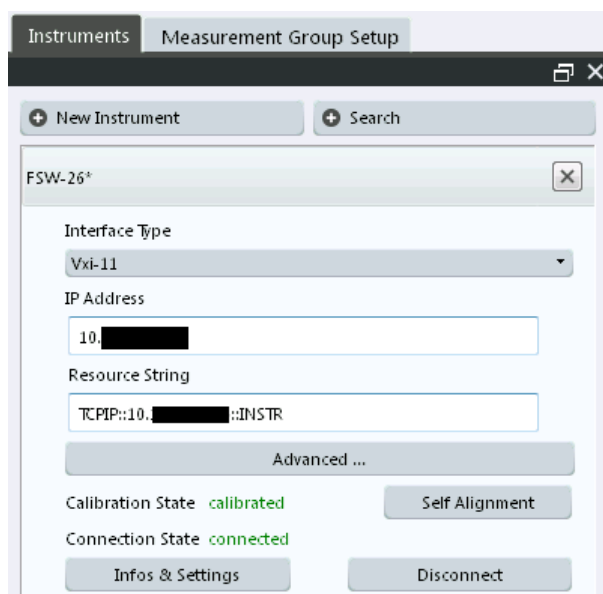
For details on configuring the LAN connection, see [Chapter 12.5, "How to set up a network and remote control"](#), on page 501.

## 7.2.2 Defining the connection information manually

**Access:** "Window" > "Instruments"

If you already know the network connection information of the instrument you want to control using the R&S VSE software, you can enter it directly in the "Instruments" tool window.





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### New Instrument

Displays the configuration dialog for a new instrument. You can also configure instruments that are not connected to the PC running the R&S VSE software.

Note: In the R&S VSE Basic Edition, you can configure only one instrument at a time. When installed directly on an instrument, further restrictions can apply.

See "[R&S VSE software installed directly on instruments](#)" on page 66.

See the R&S VSE base software user manual.

To configure a new instrument quickly while the "Instruments" tool window is closed, select the "File > Instruments > New window" menu item. The "Instruments" tool window is displayed with an entry for a new instrument.

Remote command:

[DEVICE:CREATE](#) on page 513

### Search

Starts a search for all instruments connected to the same network as the PC running the R&S VSE software.

(See [Chapter 7.2.5, "Searching for connected instruments automatically"](#), on page 78).

**Close Instrument**

You can delete an instrument that is no longer available or required by the R&S VSE software. Select the ✕ "Close" icon next to the instrument name in the "Instruments" tool window.

Remote command:

`DEVIce:DELEte` on page 514

**Interface Type**

Specifies the interface protocol used to connect the instrument to the network.

For details on interfaces see [Chapter 7.2.1, "Remote control interfaces and protocols"](#), on page 70

"VXI-11"            Standard TCP/IP-based protocol

"HiSlip"           High performance protocol

Remote command:

`DEVIce:TARGet:TYPE` on page 517

**IP address**

Unique IP address of the connected instrument. The five most recently selected IP addresses are available from the dropdown list.

(To delete this list, select "File > Preset > Reset VSE Layout", see ["Restoring User-Specific Settings \(Reset VSE Layout\)"](#) on page 117.)

The IP address consists of four number groups separated by dots. Each group contains 3 numbers in maximum (e.g. 100.100.100.100), but also one or two numbers are allowed in a group (as an example see the pre-installed address).

For information on how to determine the IP address see the instrument's documentation.

Remote command:

`DEVIce:TARGet` on page 516

**Resource String**

VISA resource string used by the R&S VSE to identify and control the connected instrument. The five most recently selected resource strings are available from the dropdown list.

(To delete this list, select "File > Preset > Reset VSE layout", see ["Restoring User-Specific Settings \(Reset VSE Layout\)"](#) on page 117.)

For details, see [Chapter 7.2.1.1, "LAN interface"](#), on page 71.

Remote command:

`DEVIce:CREate` on page 513

**Advanced Settings**

Opens the "VISA Resource String Builder" which supports you in determining the required resource string, see [Chapter 7.2.4, "Determining the address with software support"](#), on page 76.

**Calibration State/ Self Alignment**

Indicates whether the connected instrument is calibrated. If necessary, a self-alignment can be initiated on the connected instrument (see [Chapter 7.2.9, "Initializing a self-alignment on the connected instrument"](#), on page 82).

**Connection State**

Indicates the current state of the connection to the specified instrument in the network.

Remote command:

`DEVIce:STATe?` on page 516

**Infos & Settings**

Displays additional information on the connected instrument, if available. See [Chapter 7.2.7, "Obtaining information on versions and options on the connected instrument"](#), on page 80.

Remote command:

`DEVIce:INFO:HWInfo?` on page 517

`DEVIce:INFO:OPT?` on page 518

`DEVIce:INFO:IDN?` on page 518

**Connect / Disconnect / Reconnect**

(Re-)Establishes a connection to the specified instrument in the network, or disconnects an existing connection.

Remote command:

`DEVIce:CREate` on page 513

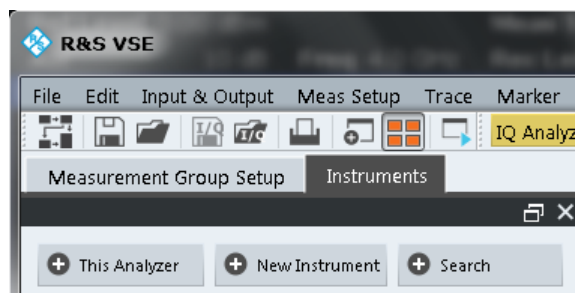
`DEVIce:DISConnect` on page 515

`DEVIce:REConnect` on page 515

**7.2.3 Connecting to the host instrument (localhost)**

**Access:** "Window" > "Instruments" > "This Instrument"

If the R&S VSE software is installed directly on a supported instrument, you can connect the software to that instrument quickly and easily.



- ▶ In the "Instruments" tool window, select "This Instrument".

The software automatically establishes a connection to the instrument. The instrument is displayed in the "Instruments" tool window. You can configure a measurement on that instrument from the R&S VSE software immediately.

## 7.2.4 Determining the address with software support

**Access:** "Window" > "Instruments" > Advanced > "VISA Resource String Builder"

If you do not know the network address of the connected instrument, the R&S VSE software can help you determine the correct connection information using the "VISA Resource String Builder".

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**Alias**

A logical name used to identify the instrument more easily in the network and connection settings in the R&S VSE software.

**Timeout**

Time in which the network connection to the instrument must be established before the attempt is aborted.

**Interface Type**

Specifies the interface protocol used to connect the instrument to the network.

For details on interfaces see [Chapter 7.2.1, "Remote control interfaces and protocols"](#), on page 70

"VXI-11"            Standard TCP/IP-based protocol

"HiSlip"            High performance protocol

Remote command:

[DEVIce:TARGet:TYPE](#) on page 517

**Address (format)**

Defines the format used to specify the instrument's network address

"IPv6"            Internet protocol version 6

"IPv4"            Internet protocol version 4

"Host name"      Computer name of the instrument instead of IP address

**IP address**

Unique IP address of the connected instrument. The five most recently selected IP addresses are available from the dropdown list.

(To delete this list, select "File > Preset > Reset VSE Layout", see ["Restoring User-Specific Settings \(Reset VSE Layout\)"](#) on page 117.)

The IP address consists of four number groups separated by dots. Each group contains 3 numbers in maximum (e.g. 100.100.100.100), but also one or two numbers are allowed in a group (as an example see the pre-installed address).

For information on how to determine the IP address see the instrument's documentation.

Remote command:

[DEVIce:TARGet](#) on page 516

**Host name**

Unique host computer name of the connected instrument (if [Address \(format\)](#) is "Host name").

**Board Number**

Unique board number of the connected instrument.

**LAN device name**

Defines the protocol and the instance number of a sub-instrument;

"inst0"            VXI-11 protocol

"hislip0"        HiSLIP protocol

**VISA Resource String**

The VISA resource string determined from the defined information, to be used by the R&S VSE to identify and control the connected instrument.

For details, see [Chapter 7.2.1.1, "LAN interface"](#), on page 71.

**Status**

Indicates the current state of the connection to the specified instrument in the network after a [Check](#) was performed.

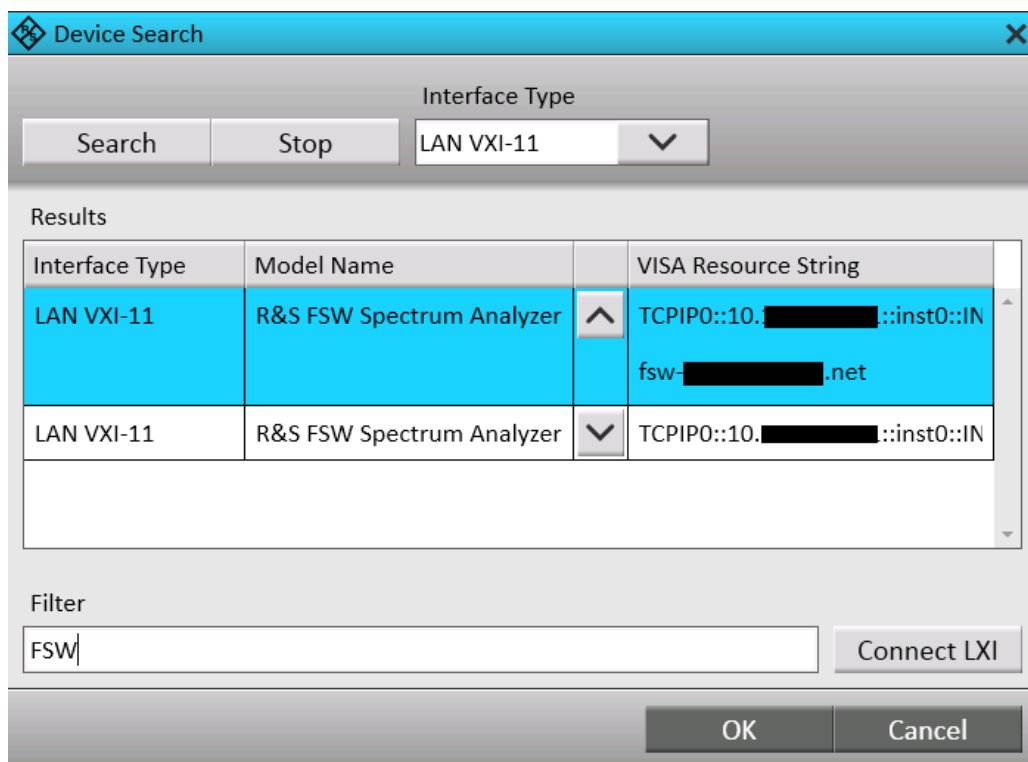
**Check**

Checks the connection state to the instrument specified by the VISA resource string. The result is indicated under [Status](#).

## 7.2.5 Searching for connected instruments automatically

**Access:** "Window" > "Instruments" > "Search"

Alternatively to defining the connection information manually, the R&S VSE can search for all instruments connected to the same network as the PC running the R&S VSE software. You can then select the instrument you want to control with the R&S VSE software from the detected instruments.



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**Search**

Starts a network search for connected instruments using the specified [Interface Type](#). Note that this search can take a while. Results are only displayed when the search is completed.

**Stop**

Stops a search for connected instruments.

**Interface Type**

Specifies the interface protocol used to connect the instrument to the network.

For details on interfaces see [Chapter 7.2.1, "Remote control interfaces and protocols"](#), on page 70

"VXI-11"           Standard TCP/IP-based protocol

"HiSlip"           High performance protocol

Remote command:

[DEVice:TARGet:TYPE](#) on page 517

**Results**

For each instrument detected in the network, the following information is provided:

- [Interface Type](#)
- Instrument model name
- [VISA Resource String](#)  
(The full information is displayed when you select the arrow button for a result entry.)

**Filter**

Applies a filter to the instrument search. Only instruments whose resource string contains the specified characters are displayed.

**Connect LXI**

Opens the LXI configuration home page for the connected instrument. This allows you to configure or operate the instrument directly from a Web browser. For details see the instrument's user documentation.

## 7.2.6 Displaying connection information for the linked instrument

**Access:** "Window" > "Instruments" > "Linked instrument"

When you use the R&S VSE software with a R&S PVT360A or R&S CMP, you must configure the IP address of the PC with the R&S VSE software installed on the instrument in advance. (☰ > "Settings" > "System" tab > "VSE Client") For details, see the instrument documentation.

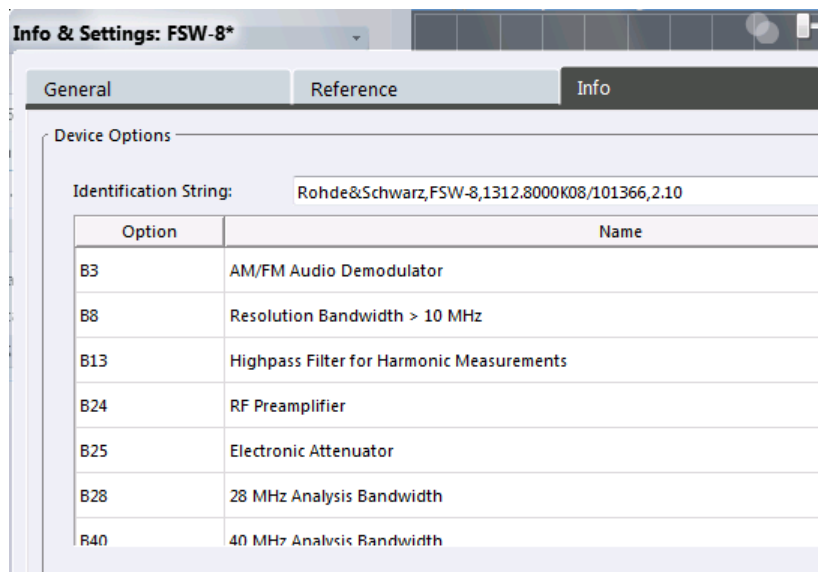
When you start the R&S VSE software, it automatically detects the connected instrument. These products only support the R&S VSE Basic Edition. Thus, you can use the software only with one single connected instrument. You cannot configure or disconnect the instrument in the R&S VSE software. However, you can display the used connection settings.

## 7.2.7 Obtaining information on versions and options on the connected instrument

**Access:** "Window" > "Instruments" > "Info & Settings" > "Info" tab

Information on the firmware version and options installed on the connected instrument is provided.





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### Identification String

Indicates the instrument identification for the selected instrument.

The syntax is:

```
"Rohde&Schwarz,<instrument type>,<part number>/serial
number>,<firmware version>"
```

Remote command:

[DEvice:INFO:IDN?](#) on page 518

### Options

Provides a list of all hardware and software options installed on the instrument.

For details on options, refer to the instrument's documentation.

Remote command:

[DEvice:INFO:HWInfo?](#) on page 517

[DEvice:INFO:OPT?](#) on page 518

## 7.2.8 Deleting all instrument configurations

**Access:** "File" > "Instruments" > "Delete All"

You can delete the connection settings of all defined instruments in one step. Note that after deleting a connection, the instrument is no longer known to the R&S VSE software.

Instrument configurations are also deleted when you use the preset function "File" > "Preset" > "All & Delete Instruments", see ["Restoring All Default Settings and Deleting Instrument Configurations \(Preset All & Delete Instruments\)"](#) on page 116.

**Remote command:**

`DEvice:DELeTe:ALL` on page 514

## 7.2.9 Initializing a self-alignment on the connected instrument

**Access:** "Window" > "Instruments" > "Self Alignment"

Once configured, you can perform a self-alignment on any instrument connected to the R&S VSE software.

When you put the instrument into operation for the first time or when strong temperature changes occur, it may be necessary to align the data to a reference source.



During instrument start, the installed hardware is checked against the current firmware version to ensure the hardware is supported. If not, self-alignment fails until the firmware version is updated.

The correction data and characteristics required for the alignment are determined by comparing the results at different settings with the known characteristics of the instrument's high-precision calibration signal source.

**Remote command:**

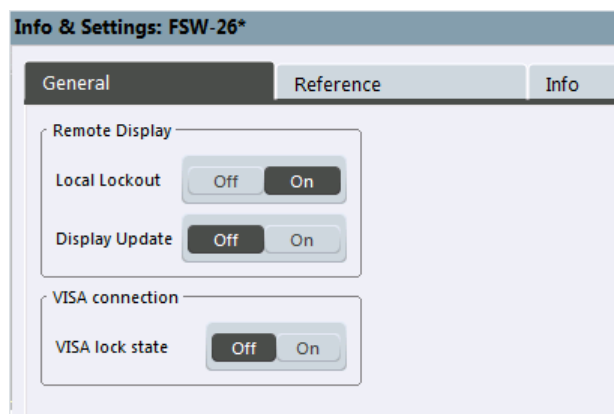
`DEvice:CALibrate[:INIT]` on page 521

`DEvice:CALibrate[:INIT]:ABORT` on page 521

## 7.2.10 Configuring the behavior during remote control

**Access:** "Window" > "Instruments" > "Infos & Settings" > "General" tab

When the R&S VSE software is used to capture and analyze input from a connected instrument, the instrument is operated in remote mode. Some general settings are available to define how the instrument behaves during remote control and whether access by multiple users to the same instrument is allowed.



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### Local Lockout

If enabled, the instrument is set to be controlled remotely (that is, by the R&S VSE software) and the keys or graphical user interface are disabled. See also [Chapter 12.3, "Locking instruments for exclusive remote control"](#), on page 497.

Remote command:

`DEVIce:GENeral:LLO` on page 519

### Display Update

Defines whether the display of the connected instrument is updated while it is being controlled by the R&S VSE software.

Turning off the display update function improves performance.

Tip: you can also turn off the display update function for the R&S VSE software, see ["Remote Display Update"](#) on page 499.

Remote command:

`DEVIce:GENeral:DISPlay` on page 519

### VISA lock state

Locks or unlocks the VISA connection to the selected instrument. If the connection is locked, no other devices can operate the same instrument remotely. If no connection to the instrument has been established yet, any subsequent connection to it is locked immediately (see also [Chapter 12.3, "Locking instruments for exclusive remote control"](#), on page 497).

Tip: you can change the default value for the VISA lock for subsequent connections in the user preferences, see ["Lock new VISA connections"](#) on page 499.

Remote command:

`DEVIce:LOCKing` on page 520

`DEVIce:LOCKing:ALL` on page 520

## 7.2.11 Configuring the use of a power sensor

**Access:** "Window" > "Instruments" > "Infos & Settings" > "General" tab / "Reference" tab

You can connect an R&S NRQ6 power sensor to the R&S VSE software. In this case, some additional general and reference settings are available.



To use power sensors in the R&S VSE software, you must install the "R&S Power Meter device drivers" with the software.

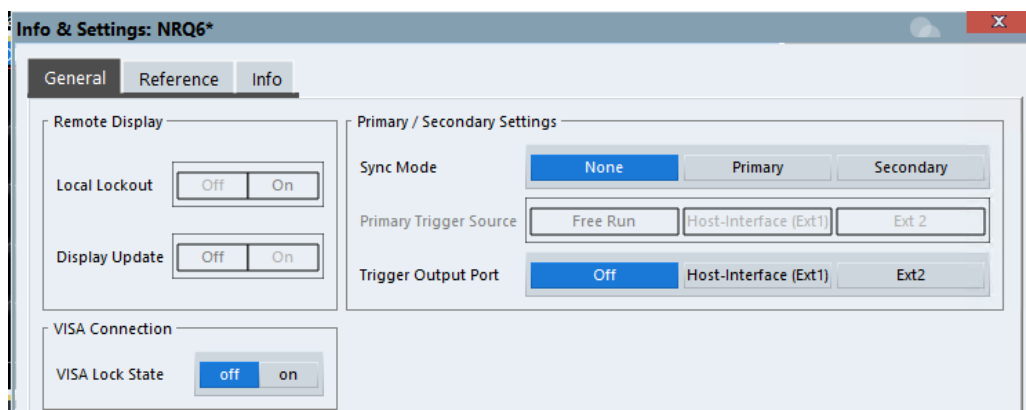


Figure 7-1: Power sensor general settings

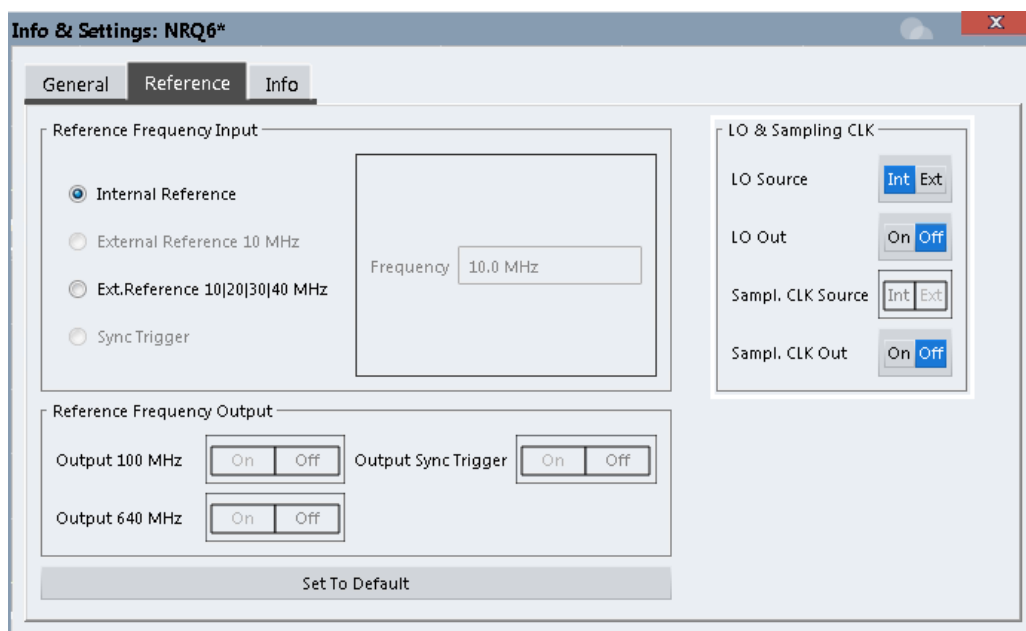


Figure 7-2: Power sensor reference settings

For details see the R&S NRQ6 user manual.



An application sheet describes the use of the R&S NRQ6 as an I/Q data source for the R&S VSE software. It has the title "VSE Feed (I/Q Capturing)" and is available at:

[www.rohde-schwarz.com/manual/NRQ6](http://www.rohde-schwarz.com/manual/NRQ6)

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**Sync Mode**

Requires the R&S NRQ6-K1 and -K3 options.

Defines the synchronization mode for phase-coherent measurements.

"Off"	No synchronization
"Primary"	If the R&S NRQ6 is the primary trigger, the power sensor outputs a digital trigger signal in sync with its own trigger event. The trigger signal is output at the selected port (see <a href="#">"Trigger Output Port"</a> on page 85).
"Secondary"	The R&S NRQ6 is triggered by the primary trigger (the connected instrument).

Remote command:

[\[SENSe:\] TRACe: IQ: SYNC: MODE](#) on page 592

**Primary Trigger Source**

Effective only if the R&S NRQ6 is the primary trigger (see [Sync Mode](#)):

Selects the trigger input for the R&S NRQ6.

"Free Run"	Default: the R&S NRQ6 triggers when a measurement is started in the R&S VSE software.
"Host-Interface (Ext1)"	The R&S NRQ6 "Host Interface" connector provides the trigger signal.
"Ext2"	The R&S NRQ6 "Trigger 2 I/O" connector provides the trigger signal.

Remote command:

[TRIGger: IQ: SENDer: SOURce](#) on page 592

**Trigger Output Port**

Effective only if the R&S NRQ6 is the primary trigger (see [Sync Mode](#)):

Selects the port where the R&S NRQ6 outputs a digital trigger signal.

"Off"	Default: the primary trigger uses its internal trigger source
"Host-Interface (Ext1)"	The R&S NRQ6 "Host Interface" connector is used as external trigger output port.
"Ext2"	The R&S NRQ6 "Trigger 2 I/O" connector is used as external trigger output port.

Remote command:

[TRIGger: SENDer: PORT](#) on page 593

**Local Oscillator (LO) - Source**

Sets the local oscillator source for the power sensor.

"Internal"	Uses the internal LO signal.
"External"	Uses the external LO signal fed into the LO connector. The internal LO generation is disabled.

Remote command:

[\[SENSe:\] FREQuency: CONVersion: MIXer: LO: SOURce](#) on page 590

**LO Out**

Enables or disables the output of the power sensor's local oscillator signal.

"Off" No signal is output. You can use the LO connector as an input.

"On" LO signal is output.

Remote command:

[\[SENSe:\]FREQuency:CONVersion:MIXer:LO:OUTPut:STATe](#) on page 590

**Sampl. CLK Source**

Sets the sampling clock source for the power sensor. By default, the R&S NRQ6 generates its sampling clock internally. Alternatively, you can use external clock sources.

"Internal" Uses the internal sampling clock.

"External" Uses the external sampling clock signal fed into the CLK connector. The internal sampling clock is disabled.

Remote command:

[\[SENSe:\]ROSCillator:PASSthrough](#) on page 591

**Sampl. CLK Out**

Enables or disables the output of the power sensor's sampling clock signal.

"Off" No signal is output. You can use the CLK connector as an input.

"On" Sampling clock signal is output.

Remote command:

[\[SENSe:\]SAMPLing:CLKio:OUTPut](#) on page 591

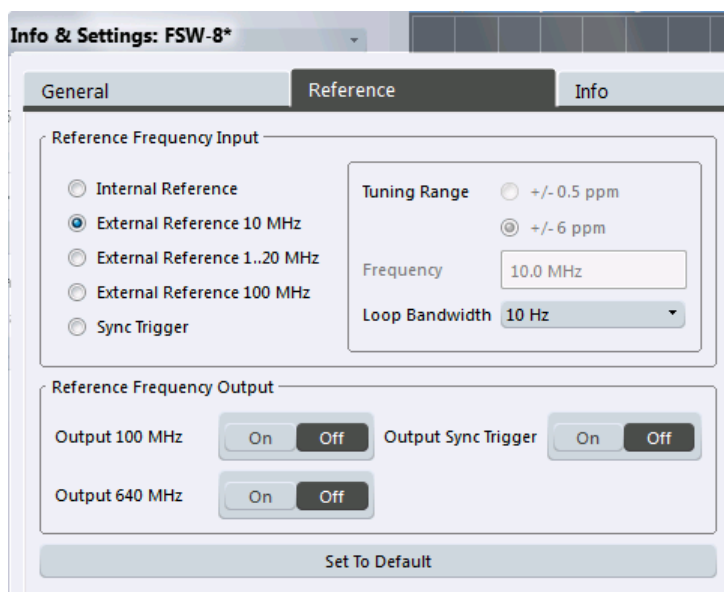
## 7.2.12 Configuring a frequency reference for the connected instrument

**Access:** "Window" > "Instruments" > "Infos & Settings" > "Reference" tab

An connected instrument can use the internal reference source or an external reference source as the frequency standard for all internal oscillators. A crystal oscillator is used as the internal reference source. If an external reference is used, all internal oscillators of the connected instrument are synchronized to the external reference frequency.

External references must be connected to the connected instrument correctly.

For details see the instrument's "Getting Started" manual.



The default setting is the internal reference. When an external reference is used, "EXT REF" is displayed in the status bar.

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### Reference Frequency Input Source

Various sources are available to provide a reference frequency to the connected instrument, depending on the type of instrument. The available reference parameters also depend on the instrument type.

Remote command:

[DEVICE:EXTRef:SOURce](#) on page 523

### Tuning Range

The tuning range is only available for the variable external reference frequency. It determines how far the frequency may deviate from the defined level in parts per million ( $10^{-6}$ ).

Remote command:

[DEVICE:EXTRef:TRANge](#) on page 524

### Frequency

Defines the external reference frequency to be used (for variable connectors only).

Remote command:

[DEVICE:EXTRef:FREQuency](#) on page 521

**Loop Bandwidth**

Defines the speed of internal synchronization with the reference frequency. The setting requires a compromise between performance and increasing phase noise.

Remote command:

`DEVIce:EXTRef:LBWidth` on page 522

**Reference Frequency Output**

The connected instrument can provide a reference frequency to other instruments that are connected to this instrument. If one of the options is activated, the reference signal is output to the corresponding connector.

Remote command:

`DEVIce:EXTRef:O100` on page 522

`DEVIce:EXTRef:O640` on page 522

`DEVIce:EXTRef:OSYNc` on page 523

**Resetting the Default Values**

The values for the "Tuning Range", "Frequency" and "Loop Bandwidth" are stored for each source of "Reference Frequency Input". Thus, when you switch the input source, the previously defined settings are restored. You can restore the default values for all input sources using the "Preset Channel" function.

## 7.3 Controlling measurement channels, groups, and sequences

**Access:** "Window" > "Measurement Group Setup"

Measurement channels, groups, and sequences are configured and controlled in the "Measurement Group Setup" tool window.

- [Sequence functions](#).....88
- [Group functions](#).....90
- [Channel functions](#).....93

### 7.3.1 Sequence functions

A measurement sequence can perform multiple measurements on the same instrument, without switching between measurement channels manually.

A measurement sequence consists of a number of measurement groups, and each group may contain multiple channels.

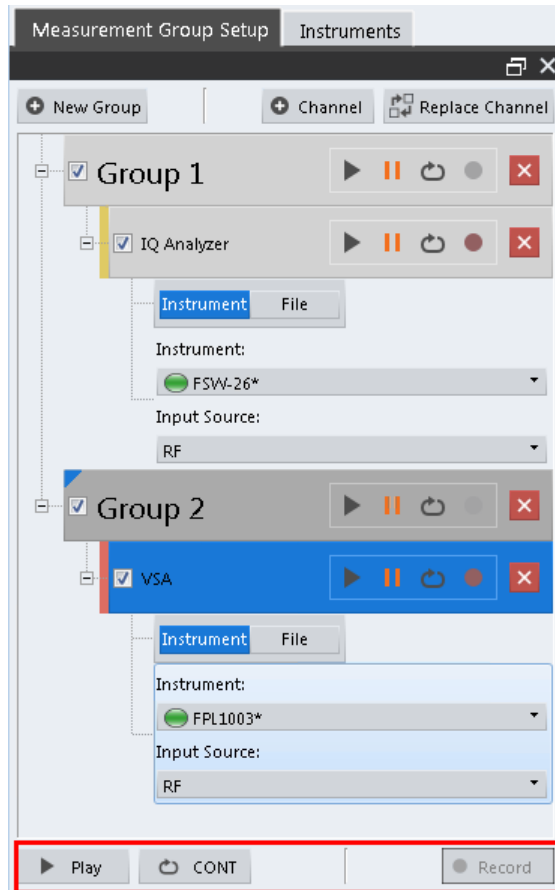


In the R&S VSE Basic Edition, you can configure only one group with up to three channels at a time. In this case, the sequence functions have the same effect as the group functions (see [Chapter 7.3.2, "Group functions"](#), on page 90).



The functions for a measurement sequence are provided above and below the measurement groups in the "Measurement Group Setup" tool window.

For details, see "[Measurement groups and sequences](#)" on page 42.



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- ▶ **Play**  
"Play" starts a new measurement sequence according to the "[Measurement mode \(Single/Continuous\)](#)" on page 90.

Remote command:

[INITiate:SEQuencer:IMMediate](#) on page 568

- **Stop**  
Stops a running measurement sequence.

Remote command:

[INITiate:SEQuencer:ABORT](#) on page 568

→| **Measurement mode (Single/Continuous)**

↻ Defines the measurement mode for the entire measurement sequence and all measurement groups and channels it contains.

For details, see "[Measurement mode](#)" on page 43.

"Single" Each measurement group is started one after the other in the order of definition. All measurement channels in a group are started simultaneously and performed once. After *all* measurements are completed, the next group is started. After the last group, the measurement sequence is finished.

"Continuous" Each measurement group is started one after the other in the order of definition. All measurement channels in a group are started simultaneously and performed once. After *all* measurements are completed, the next group is started. After the last group, the measurement sequence restarts with the first one and continues until it is stopped explicitly (see "[Play](#)" on page 89).

Remote command:

[INITiate:SEQuencer:MODE](#) on page 568

- **Record**  
Currently not available.

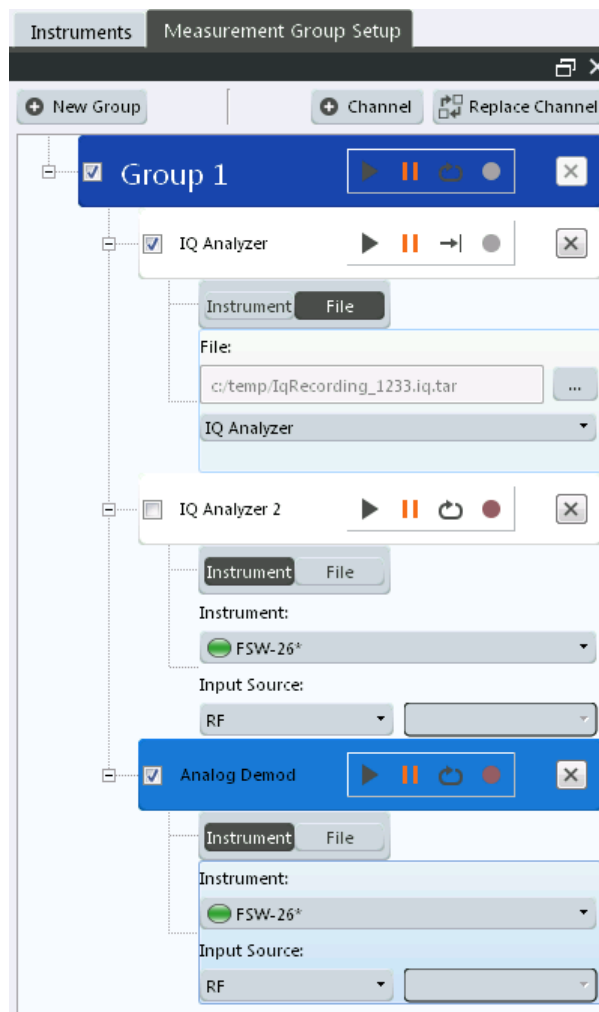
### 7.3.2 Group functions

All measurement channels that are to be started at the same time must be configured within a group.

Multiple groups of measurement channels can be configured (Enterprise Edition only), for example to group measurements for a specific test scenario.

The functions for a measurement group are provided in a function bar with the group name in the "Measurement Group Setup" tool window.

For details, see "[Measurement groups](#)" on page 40.



The "running" icon in the group function bar indicates that the group is currently performing a measurement (within a sequence, see ["Measurement groups and sequences"](#) on page 42).

<a href="#">Activate/Deactivate Group</a> .....	91
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<a href="#">Record</a> .....	92
<a href="#">Close</a> .....	92
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### Activate/Deactivate Group

If activated, the group is included in a measurement sequence.

Remote command:

`INSTrument:BLOCK:USE` on page 567

**New Group**

Inserts a new group in the "Measurement Group Setup" tool window.

Note: In the R&S VSE Basic Edition, you can configure only one group.

Remote command:

`INSTrument:BLOCK:CREate[:NEW]` on page 556

**▶ Capture**

Starts a new measurement (and restarts averaging) for all active measurement channels in the group. Only channels with distinct input types can be active at the same time. The results for each channel are displayed whenever the measurement is completed, independently of the other channels.

Remote command:

`INITiate:BLOCK:IMMediate` on page 554

**|| Pause / Cont**

"Pause" stops a running measurement on the group.

"Cont" continues a measurement group (including any averaging procedures) that was temporarily interrupted.

To restart averaging with the next measurement, use the ▶ ("Capture") function after stopping the last channel.

Remote command:

`INITiate:BLOCK:ABORt` on page 553

`INITiate:BLOCK:CONMeas` on page 553

**→| Measurement mode (Single/Continuous)**

Defines the measurement mode for the group itself and all measurement channels it contains.

For details, see "[Measurement mode](#)" on page 43.

"Single" All measurement channels in the group are started simultaneously and performed once.

"Continuous" All measurement channels in the group are started simultaneously. After *all* measurements are completed, the group restarts all measurements again.

Remote command:

`INITiate:BLOCK:CONT` on page 554

**● Record**

Currently not available.

**× Close**

Removes the group and closes all measurement channels and windows it included.

Note: In the R&S VSE Basic Edition, you cannot delete the group as there is only one.

Remote command:

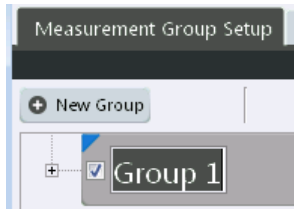
`INSTrument:BLOCK:DELeTe` on page 556

**Rename Group**

**Access:** "File" > "Measurement Group" > "Rename Group"

Or: Double-click (slowly) on group name in the "Measurement Group Setup" tool window

The selected group name turns into an input box so you can enter a user-defined name. Note that you cannot assign an existing group name to another group.



Remote command:

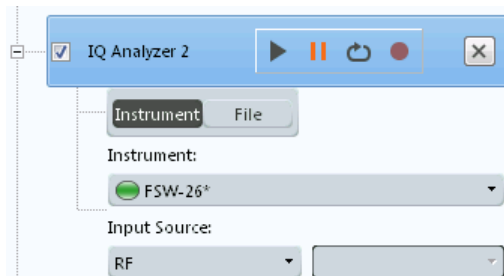
[INSTrument : BLOCk : RENAME](#) on page 567

**7.3.3 Channel functions**

A measurement channel determines the measurement settings for a specific application.

The functions for a measurement channel are provided in a function bar with the channel name in the "Measurement Group Setup" tool window.

For details, see "[Measurement channels](#)" on page 38.



The "running" icon in the channel function bar indicates that a channel is currently performing a measurement.

The "error" icon in the channel function bar indicates that an error occurred in the measurement channel. Check the R&S VSE status bar.

- [Activate/Deactivate Channel](#)..... 94
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Rename Measurement Channel.....	98

### Activate/Deactivate Channel

If activated, the measurement is included in a group measurement.

Note that channels are deactivated automatically if the same instrument is assigned to multiple measurement channels of the same group (Enterprise Edition only). The channel to which the instrument was previously assigned is deactivated (the checkmark is removed).

Remote command:

`INSTrument:BLOCK:CHANnel[:SETTings]:USE` on page 555

### Assigning the Channel Input Source

For each measurement channel, you must configure the input source. The following settings are displayed when you expand the channel settings in the "Measurement Group Setup" tool window (toggle the +/- icon).

#### Input Type (Instrument / File) ← Assigning the Channel Input Source

Selects an instrument or a file as the type of input provided to the channel.

**Note:** External mixers are only available for input from a connected instrument.

**Note:** If the R&S VSE software is installed directly on an instrument, or integrated in Cadence®AWR®VSS, some restrictions apply on the available input type.

See ["R&S VSE software installed directly on instruments"](#) on page 66 and ["R&S VSE integrated in Cadence®AWR®VSS"](#) on page 67.

Remote command:

`INSTrument:BLOCK:CHANnel[:SETTings]:SOURce<si>` on page 543

`INPut:SElect` on page 617

#### Instrument ← Assigning the Channel Input Source

Specifies a configured instrument to be used for input.

Remote command:

`INSTrument:BLOCK:CHANnel[:SETTings]:DEVice<di>` on page 543

#### Input Source ← Instrument ← Assigning the Channel Input Source

Configures the source of input (and channel) on the selected instrument to be used.

**Note:** External mixers are only available for RF input.

Not all input sources are supported by all R&S VSE applications.

"RF"	Radio Frequency ("RF INPUT" connector)
"Channel 1   Channel 2   Channel 3   Channel 4"	Oscilloscope input channel 1, 2, 3, or 4
"Channel 1,2 (I+Q)"	I/Q data provided by oscilloscope input channels 1 and 2 (for oscilloscopes with 2 channels only)
"Channel 1,3 (I+Q)   Channel 2,4 (I+Q)"	I/Q data provided by oscilloscope input channels 1 and 3, or 2 and 4 (for oscilloscopes with 4 channels only)
"Channels 1-4 (diff. I+Q)"	Differential I/Q data provided by oscilloscope input channels (for oscilloscopes with 4 channels only): Channel 1: I (pos.) Channel 2: $\bar{I}$ (neg.) Channel 3: Q (pos.) Channel 4: $\bar{Q}$ (neg.)
"Channels 1,3 (Waveform)"	Waveform data provided by oscilloscope input channels 1 and 3 (for oscilloscopes with 2 channels only)
"Channels 2,4 (Waveform)"	Waveform data provided by oscilloscope input channels 2 and 4 (for oscilloscopes with 2 channels only)
"Channels 1-4 (Waveform)"	Waveform data provided by oscilloscope input channels 1 to 4 (for oscilloscopes with 4 channels only)

Remote command:

[INSTrument:BLOCK:CHANnel\[:SETTings\]:SOURce<si>:TYPE](#) on page 544

[INSTrument:BLOCK:CHANnel\[:SETTings\]:SOURce<si>:CONFig](#) on page 544

### Generator ← Instrument ← Assigning the Channel Input Source

Assigns the selected instrument as the generator input source for the currently selected channel. The generator must have been configured before it can be assigned (see [Chapter 7.2, "Configuring instruments"](#), on page 69).

This setting is only available for channels that support (additional) generator input, e.g. Amplifier measurements (R&S VSE-K18). See the application manuals for details.

Remote command:

[INSTrument:BLOCK:CHANnel\[:SETTings\]:GENErator<di>](#) on page 543

### File ← Assigning the Channel Input Source

Specifies the I/Q data file to be used for input.

Select a file from the list of recently loaded files, or select "." to open the "Recall I/Q Recording" dialog box (see [Chapter 8.3.4.1, "Loading the I/Q data file and essential measurement information"](#), on page 133).

**Note:** The data to be imported must be stored in a specified file format, see [Chapter E, "Reference: supported I/Q file formats"](#), on page 969.

Encrypted .wv files can also be used as input. Note, however, that traces resulting from encrypted file input cannot be exported or stored in a saveset (see [Chapter 8.3, "Recording and recalling captured I/Q data for evaluation"](#), on page 125 and [Chapter 8.5, "Storing graphical results to an ASCII file"](#), on page 144).

**Tip:**

You can load a file simply by selecting it in a file explorer and dragging it to the R&S VSE software. Drop it into the "Measurement Group Setup" window or the channel bar for any channel. The channel is automatically configured for file input, if necessary. If the file contains all essential information, the file input is immediately displayed in the channel. Otherwise, the "Recall I/Q Recording" dialog box is opened for the selected file so you can enter the missing information.

If the file contains data from multiple channels (e.g. from LTE measurements), it can be loaded to individual input sources, if the application supports them.

For more information see ["To import data via drag&drop"](#) on page 463.

Remote command:

`INSTrument:BLOCK:CHANnel[:SETTings]:FILE<fi>:AID` on page 526

`INSTrument:BLOCK:CHANnel[:SETTings]:FILE<fi>:IQTar` on page 530

`INSTrument:BLOCK:CHANnel[:SETTings]:FILE<fi>:CSV` on page 527

`INSTrument:BLOCK:CHANnel[:SETTings]:FILE<fi>:IQW` on page 532

`INSTrument:BLOCK:CHANnel[:SETTings]:FILE<fi>:MAT` on page 534

`INSTrument:BLOCK:CHANnel[:SETTings]:FILE<fi>:REPLace` on page 537

`INSTrument:BLOCK:CHANnel[:SETTings]:FILE<fi>:WV` on page 540

`INSTrument:BLOCK:FILE<fi>:CSV` on page 557

`INSTrument:BLOCK:FILE<fi>:IQTar` on page 559

`INSTrument:BLOCK:FILE<fi>:IQW` on page 560

`INSTrument:BLOCK:FILE<fi>:MAT` on page 563

`INSTrument:BLOCK:FILE<fi>:REPLace` on page 564

`INSTrument:BLOCK:FILE<fi>:WV` on page 565

**Channel ← File ← Assigning the Channel Input Source**

Determines which of the I/Q channels stored in the file is to be restored to the selected measurement channel. This is relevant only for files that contain data from multiple channels.

"Auto" imports all available channels in the file, if supported by the application.

Remote command:

`INSTrument:BLOCK:CHANnel[:SETTings]:FILE<fi>:STReam` on page 540

`INSTrument:BLOCK:CHANnel[:SETTings]:FILE<fi>:STReam:AUTO`  
on page 539

To determine which data channels are available: `INSTrument:BLOCK:CHANnel[:SETTings]:FILE<fi>:STReam:LIST?` on page 540

**Zero Padding ← Assigning the Channel Input Source**

Enables or disables zero padding for input from an I/Q data file that requires resampling. For resampling, a number of samples are required due to filter settling. These samples can either be taken from the provided I/Q data, or the software can add the required number of samples (zeros) at the beginning and end of the file.

If enabled, the required number of samples are inserted as zeros at the beginning and end of the file. The entire input data is analyzed. However, the additional zeros can effect the determined spectrum of the I/Q data. If zero padding is enabled, a status message is displayed.



If disabled (default), no zeros are added. The required samples for filter settling are taken from the provided I/Q data in the file. The start time in the R&S VSE Player is adapted to the actual start (after filter settling).

**Note:** You can activate zero padding directly when you load the file, or afterwards in the "Input Source" settings.

Remote command:

`INPut<ip>:FILE:ZPADing` on page 526

#### **New Channel**

A selection list of available applications is displayed. A new channel for the selected application is created.

For a list of available applications, see [Chapter 5.2, "Available applications"](#), on page 44

Remote command:

`INSTrument:CREate[:NEW]` on page 549

`INSTrument[:SElect]` on page 552

#### **Duplicate Current Channel ← New Channel**

Alternatively to selecting a new application from the selection list of available applications, you can duplicate the currently active channel. In this case, a new measurement channel of the same type and with the identical measurement settings is started. The name of the new channel is the same as the copied channel, extended by a consecutive number (e.g. "Spectrum" -> "Spectrum 2").

Remote command:

`INSTrument:CREate:DUPLicate` on page 549

#### **Replace Current Channel**

A selection list of available applications is displayed. The currently selected channel is replaced by the selected application.

For a list of available applications, see [Chapter 5.2, "Available applications"](#), on page 44

Remote command:

`INSTrument:CREate:REPLace` on page 550

#### **Capture**

Starts a new measurement (and restarts averaging) for the measurement channel.


Remote command:

`INITiate<n>[:IMMediate]` on page 548

#### **Pause / Cont**

"Pause" stops a running measurement.

"Cont" continues a measurement (including any averaging procedures) that was temporarily interrupted.

To restart averaging with the next measurement, use the  ("Capture") function after stopping the last measurement.

Remote command:

[ABORT](#) on page 546

[INITiate<n>:CONMeas](#) on page 547

### → **Measurement mode (Single/Continuous)**

Defines how data is captured during the measurement.



For details, see "[Measurement mode](#)" on page 43.

→ "Single" A single measurement is performed, that is: data is captured for the specified measurement time.  
For the "Input Source": "File", a single record is replayed. To replay subsequent records, continue the measurement using the **||** ("Pause/Continue") function.

↻ "Continuous" A continuous measurement is performed, that is: data is captured continuously until the measurement is stopped manually using the **||** ("Pause/Continue") function.  
For the "Input Source": "File", the data from the I/Q file is replayed continuously until stopped.

Remote command:

[INITiate<n>:CONTinuous](#) on page 547

### ● **Record**

Starts a measurement and stores the measurement data to a temporary file. You can then use the data in the stored file as input for analysis later or using a different application.

For details, see [Chapter 8.3.1, "Recording measurement data"](#), on page 126.

Remote command:

[INSTrument:BLOCK:CHANnel\[:SETTings\]:RECORD](#) on page 549



### **New Measurement Window**

Adds a new window with the selected result display for the measurement channel.



### **Close**

Removes the measurement channel from the group and closes all windows.

### **Select Channel**

Selects a channel from the list of configured channels in the "Control" toolbar.

In the "Measurement Group Setup" window, the selected channel is highlighted. The corresponding channel bar info is displayed and the focus is set on the default window for that channel. The menus are adapted to the selected application.

Remote command:

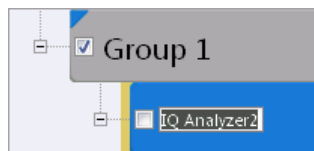
[INSTrument\[:SElect\]](#) on page 552

### **Rename Measurement Channel**

**Access:** "File" > "Measurement Group" > "Rename Measurement Channel"

Or: Double-click (slowly) on channel name in the "Measurement Group Setup" tool window

The selected channel name turns into an input box so you can enter a user-defined name. Note that you cannot assign an existing channel name to another channel.



Remote command:

`INSTrument:REName` on page 551

## 7.4 Configuring measurements in expert mode

**Access:** "Meas Setup" > "Expert mode"

The R&S VSE software provides an expert configuration mode for supported Rohde & Schwarz oscilloscopes. Using this mode, you can configure a connected oscilloscope independently of the R&S VSE software. Thus, you can configure settings that are not accessible directly via the R&S VSE software. You can then perform a measurement on the connected instrument from the R&S VSE software as usual. If any conflicts are to be expected due to the changed settings, a warning is displayed.



We recommend using the expert mode only to configure settings not otherwise supported by the R&S VSE software.

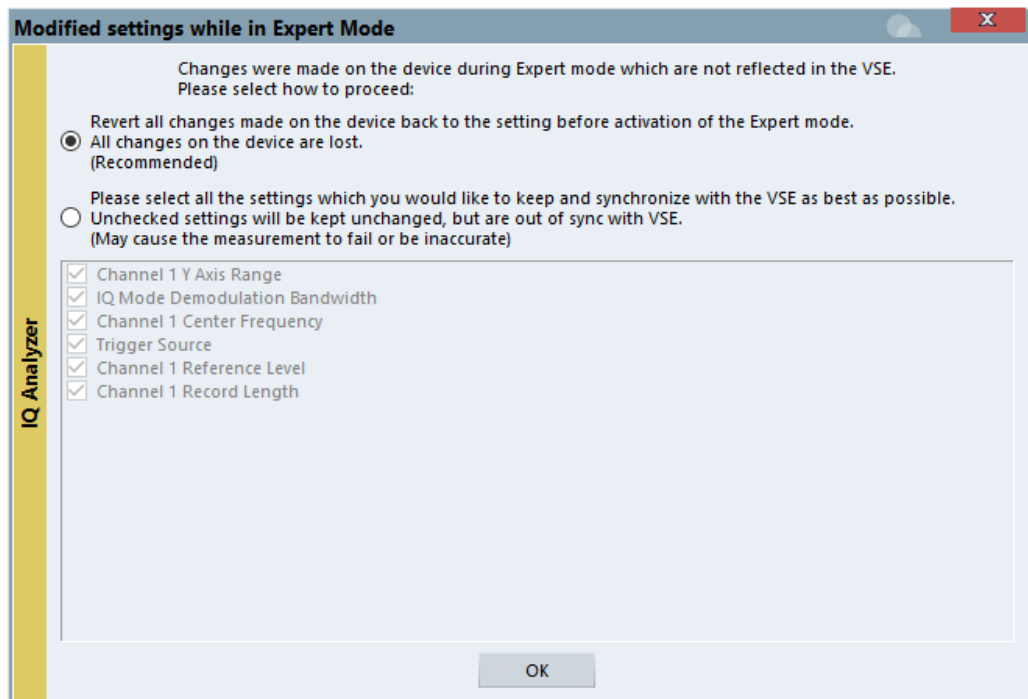
If expert mode is disabled (default behavior) you cannot change settings directly on a connected instrument. The R&S VSE software sets any connected instruments to remote mode automatically. The instrument's display is blocked for local operation. Even if you return to local mode on the instrument manually, the software automatically resets it to remote mode as long as the instrument remains connected in the software.

During expert mode, you cannot configure the connected instrument or the measurement channel in the R&S VSE software. You must manually disable expert mode first.

Expert mode is automatically disabled if you change the assigned instrument or input source (channel) for the measurement channel.

### Modified settings

When you disable expert mode, the R&S VSE software checks whether any settings on the connected instrument are not identical to those in the software. In this case, you have the following possibilities:



#### Revert all changes

The settings on the instrument are reset to those defined in the R&S VSE software before activating expert mode.

#### Synchronize settings

A list of changed settings on the instrument is displayed. Select the settings you want to maintain. The R&S VSE software tries to synchronize the settings, that is: adapt the settings defined in the software accordingly, if possible. Note that interdependent settings can be changed as well, such as the record length for a changed sample rate. Any changed settings that are not selected are maintained on the instrument, but do not correspond to the settings in the software. In this case, the measurement can fail or be inaccurate.

## 7.5 Frequency response correction (R&S VSE-K544)



If the Frequency Response Correction option is installed, the R&S VSE supports frequency response correction using Touchstone (.snp) files or .fres files.

The Frequency Response Correction option requires a separate license, see [Chapter 3.4, "Using a license server"](#), on page 20.

## 7.5.1 Basics on frequency response correction

### Input-specific frequency correction

Frequency response correction can be configured individually for all available input types (RF, oscilloscope baseband channels, file). The settings in the "User-defined Frequency Response Correction" dialog box apply to the currently selected input type. Be sure to select the appropriate input source before you define the correction data (see ["Assigning the Channel Input Source"](#) on page 94). In remote operation, be sure to use the correct command for the required input type (see ["Input-specific frequency correction"](#) on page 570).

Otherwise the correction may seem to fail because it was defined for a different input type than the one being used.



### MIMO measurements

For MIMO measurements, which use multiple input sources, frequency response correction can be configured individually for each source.

### Touchstone (.snp) files

Touchstone (.snp) files contain data to characterize a measurement setup in respect to the gain and phase error over frequency. Such files are generated by network analyzers, for example. The R&S VSE can use such files to compensate for any gain or phase errors between the DUT and the connection from the DUT to the instrument.

Touchstone files can be defined for a varying number of input and output ports. The total number of ports configured in the file is indicated by the file extension; the "n" in .snp is merely a placeholder. Thus, a file for a cable with one input and one output is referred to as an S2P file. A file for a switch with one input and 3 outputs is referred to as an S4P file etc.

### .fres files

Additional frequency response correction files in .fres format allow you to correct effects from components for which no Touchstone files are available.

Files in .fres format correspond to an S1P file. They contain exactly three values for each frequency:

- The frequency
- The magnitude correction value
- The phase correction value

Instead of the magnitude and phase correction values, the I and Q values can be provided.

These values are applied to the input data. If the file contains any other data, it cannot be loaded.

For .fres files, magnitude and phase correction can be activated separately.

### Group delay compensation

The phase correction values can be used to compensate for a group delay. However, to calculate the correction correctly, the distance between two values must not be too large. Thus, the application requires a minimum number of values in the correction file. Define at least enough values so the following equation is true:

$$\text{Group\_delay} * \text{Frequency\_Spacing} * 360 < 180$$

### Combining multiple correction files

Since the measurement setup may consist of several cables, DUTs and other components, multiple Touchstone and frequency response files can be required for full compensation. In this case, the order in which the files are applied is important. The R&S VSE combines all active Touchstone files to a single S2P file, and creates the required filter or correction factors for the measurement.

For MIMO measurements, separate filters are created and used for each input source.



### Correction filters for I/Q data

Filters can only be applied to I/Q data if they are defined for the complete analysis bandwidth. Therefore, if the combined frequency response filter does not cover the complete analysis span, it is invalid and cannot be used for the measurement. See also "[Recognizing frequency response correction in measurement results](#)" on page 102.

### Correcting data in one or more applications

Frequency response correction files can be configured either for the current application only, or for all measurement channels.

Thus, you can configure different files for individual measurement setups with a particular input source and channel setup. For example, you can set up three different I/Q Analyzer channels in parallel and use different Touchstone files for each measurement channel.

### Recognizing frequency response correction in measurement results

If frequency response correction is active for a measurement channel, "FRCORR" is indicated in the channel bar. The status of the correction settings is indicated by the color of this message:

Color	Meaning
Green	Active correction settings valid and in use
Red	Correction settings active, but not in use, e.g. due to invalid settings (see " <a href="#">Correction filters for I/Q data</a> " on page 102)

### Remote command:

`[SENSe:]CORRection:FRESponse<si>:USER:VALid?` on page 589



Since multiple correction settings can be active at the same time, the channel bar merely indicates that frequency response correction is being applied, but not which files are being used. To find out which correction files are being used for the active application, open the "User-Defined Frequency Response Correction" dialog box (see [Chapter 7.5.2, "User-defined frequency response correction settings"](#), on page 103).

### Storing frequency response correction settings

You can store frequency response correction settings to a file (saveset) and load them for future measurements. For details see "[Save Settings](#)" on page 107.



### Storing SaveSets with a loaded Touchstone file

If you store the settings for a measurement using a Touchstone file in a saveset, only the link to the Touchstone file name is actually stored. That means that if you change the settings in the file and recall the saveset for the measurement later, the results will differ from the original measurement.



### Imported I/Q data

Correction factors are also applied to input from I/Q data files. Ensure the frequency range in the correction file corresponds to the frequency settings for the measurement of the input file.

### Restrictions

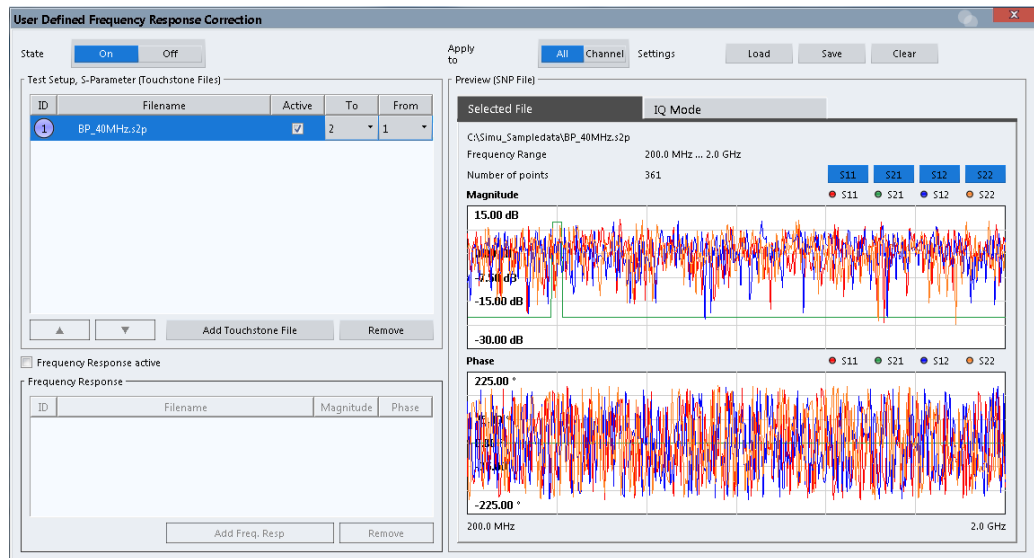
Currently, the R&S VSE has the following restrictions for Touchstone file support:

- Trace data containing corrections from Touchstone files cannot be returned in I/Q block format  
(See [TRACe: IQ: DATA: FORMat](#) on page 871).

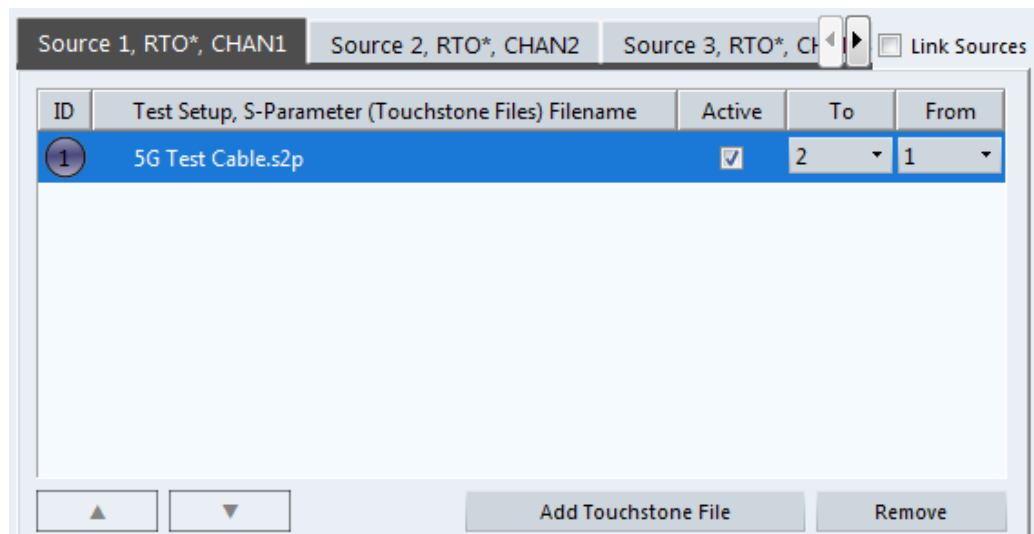
## 7.5.2 User-defined frequency response correction settings

**Access:** "Meas Setup" > "User Correction"

User-defined frequency response correction can be defined in one or more Touchstone files and in one or more frequency response (`.fres`) files, or a combination of them. A configuration of correction files can be stored to and loaded from a file.



Frequency response correction can be configured individually for all available input types (RF, oscilloscope baseband channels, file). The settings in the "User-defined Frequency Response Correction" dialog box apply to the currently selected input type. For MIMO measurements, frequency response correction can be configured individually for each source in separate tabs.



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### State

Enables or disables the general usage of user-defined frequency response correction settings. If activated, the data in the active correction files is combined to create a filter. This filter is applied to the measurement results of subsequent sweeps.

For MIMO measurements, this function enables or disables frequency response correction for *all* sources.

Remote command:

[\[SENSe:\]CORRection:FRESponse<si>:USER:STATe](#) on page 588

Testing the validity of the correction setting:

[\[SENSe:\]CORRection:FRESponse<si>:USER:VALid?](#) on page 589

### Refresh

Retrieves the specified files again and creates a new combined filter. If enabled, the filter is applied immediately.

Remote command:

[\[SENSe:\]CORRection:FRESponse<si>:INPut<ip>:USER:REFresh](#)  
on page 579

### Link sources (MIMO only)

If enabled, the frequency response correction settings for the currently selected input source (tab) are copied to all input sources for the channel. If any settings already exist in other tabs, a message is displayed. If you confirm, the settings are overwritten. As long as this function is enabled, any changes in one tab are automatically applied to all tabs.

This function is only available for MIMO measurements and only for channel-specific configuration ([Apply to](#) = "Channel").

Remote command:

[\[SENSe:\]CORRection:FRESponse<si>:LSources:STATe](#) on page 578

**Adjust Ref Level**

Activates or deactivates the automatic adjustment of the reference level to the active filter calculation configuration. The offset is the mean of the filter calculation. The reference level offset is calculated individually for each channel the frequency response correction settings apply to (see "Apply to" on page 106).

Note the following prerequisites and restrictions concerning the automatic reference level adjustment:

- The reference level offset is only applied if frequency response correction is enabled (see "State" on page 105). If you disable frequency response correction, "Adjust Ref Level" is automatically set to "Manual".
- The reference level offset is only applied if the center frequency is within the currently covered filter frequency range.

"Auto" Activates the automatic adjustment. The original dynamic range of the reference level is shifted by the filter calculation offset.

"Manual" Deactivates the automatic adjustment. Adjust the reference level in the "Amplitude" settings (see "Reference Level" on page 224).

Remote command:

`[SENSe:]CORRection:FRESponse<si>:USER:ADJust:RLEVEL:STATe`  
on page 572

**Apply to**

Determines which channels the correction settings are applied to.

"All Input Src" The frequency response correction settings are applied to **all** active measurement channels with the same input source. A new filter is calculated for each measurement channel as soon as you switch to it, or when a measurement is performed (e.g. by the Sequencer).

"Channel" The frequency response correction settings are applied to the currently selected channel only.

Remote command:

`[SENSe:]CORRection:FRESponse<si>:USER:SCOPE` on page 580

**Load Settings**

Loads a stored saveset for a user-defined frequency response correction scenario. Existing settings in the dialog box are overwritten. The settings apply to the currently selected channel or all channels, depending on the [Apply to](#) setting.

Only `.df1` files can be loaded. The default storage directory for correction files is `C:\ProgramData\Rohde-Schwarz\VSE\<version_no>\user\FResponse`.

For MIMO measurements, the loaded settings are applied to *all* sources.

Remote command:

`[SENSe:]CORRection:FRESponse<si>:USER:LOAD` on page 579

**Save Settings**

Stores a saveset for a user-defined frequency response correction scenario. As for all instrument settings, a .df1 file is created for the correction data. Note that only the settings defined in this dialog box are stored, not the contents of the files themselves. Whether the settings for the currently selected channel only or for all channels are stored depends on the [Apply to](#) setting.

The default storage directory is

C:\ProgramData\Rohde-Schwarz\VSE\\user\FResponse.

Remote command:

[\[SENSe:\]CORRection:FRESponse<si>:USER:STORe](#) on page 588

**Clear Settings**

Clears all current user-defined frequency response correction settings, either for the currently selected channel only or for all channels, depending on the [Apply to](#) setting.

For MIMO measurements, the settings for *all* sources are cleared.

Remote command:

[\[SENSe:\]CORRection:FRESponse<si>:USER:PRESet](#) on page 579

**Touchstone File Information**

Provides information on loaded Touchstone files and the order of their application.

**ID ← Touchstone File Information**

Consecutive number which determines the order in which the correction files are applied to the measurement data. The maximum number of files per configuration is 15.

**Filename ← Touchstone File Information**

Name of a loaded Touchstone file.

**Active ← Touchstone File Information**

Activates or deactivates the selected file for the current configuration. Only active files are included in filter calculation.

Remote command:

[\[SENSe:\]CORRection:FRESponse<si>:USER:SLISt<sli>:STATe](#) on page 587

**To - From ← Touchstone File Information**

Touchstone files can be defined for a varying number of input and output ports.

You must define the ports from the Touchstone file whose data is to be applied.

Remote command:

[\[SENSe:\]CORRection:FRESponse<si>:USER:SLISt<sli>:PORTs:TO](#)  
on page 584

[\[SENSe:\]CORRection:FRESponse<si>:USER:SLISt<sli>:PORTs:FROM](#)  
on page 584

**Add Touchstone File**

Loads a new Touchstone file for the current configuration. The maximum number of files per configuration is 15. The new file is added below the currently selected file. To change the order of the files, use the [Move File Up or Down](#) icons.

The file extension of the Touchstone file must correspond to the number of ports included in the file. For example, a file containing 4 parameters for S11, S22, S12 and S21 must have the extension `.s2p`.

A minimum number of values is required to compensate for a group delay, see "[Group delay compensation](#)" on page 102.

The default directory for Touchstone files is

`C:\ProgramData\Rohde-Schwarz\VSE\\user\Fresponse.`

Remote command:

`[SENSe:]CORRection:FRESponse<si>:USER:SLISt<sli>:INSert`

on page 582

**Remove File**

Removes the selected Touchstone file from the current configuration.

Remote command:

`[SENSe:]CORRection:FRESponse<si>:USER:SLISt<sli>:REMOve`

on page 585

`[SENSe:]CORRection:FRESponse<si>:USER:SLISt<sli>:CLEar` on page 581

**Move File Up or Down**

Moves the selected Touchstone file one position up or down in the list of files, changing the order in which the correction data is applied.

Remote command:

`[SENSe:]CORRection:FRESponse<si>:USER:SLISt<sli>:MOVE` on page 583

**Frequency Response active**

Activates or deactivates the use of additional frequency response (`.fres`) files. The correction data in these files is applied after any correction settings in active Touchstone files. Only active files are included in filter calculation.

Remote command:

`[SENSe:]CORRection:FRESponse<si>:USER:FSTate` on page 577

**Frequency Response File Information**

Provides information on loaded frequency response files and the order of their application.

**ID ← Frequency Response File Information**

Consecutive number which determines the order in which the correction files are applied to the measurement data. The maximum number of files per configuration is 15.

**Filename ← Frequency Response File Information**

Name of a loaded Touchstone file.

**Magnitude ← Frequency Response File Information**

Activates or deactivates the use of the correction data in the selected file for magnitude results.

Remote command:

`[SENSe:]CORRection:FRESponse<si>:USER:FLISt<fli>:MAGNitude[:STATe]` on page 575

**Phase ← Frequency Response File Information**

Activates or deactivates the use of the correction data in the selected file for phase results.

Remote command:

`[SENSe:]CORRection:FRESponse<si>:USER:FLISt<fli>:PHASe[:STATe]` on page 575

**Add Freq Resp File**

Loads a frequency response (.fres) file to the current configuration. The maximum number of files per configuration is 15.

A minimum number of values is required to compensate for a group delay, see "[Group delay compensation](#)" on page 102.

The default directory for .fres files is

`C:\ProgramData\Rohde-Schwarz\VSE\<version_no>\user\Fresponse.`

Remote command:

`[SENSe:]CORRection:FRESponse<si>:USER:FLISt<fli>:INSert` on page 574

**Remove Frequency Response File**

Removes the selected frequency response (.fres) file from the current configuration.

Remote command:

`[SENSe:]CORRection:FRESponse<si>:USER:FLISt<fli>:REMOve` on page 576

`[SENSe:]CORRection:FRESponse<si>:USER:FLISt<fli>:CLEar` on page 573

**Preview**

The preview of the (combined) user correction files shows the correction values.

Remote command:

`[SENSe:]CORRection:FRESponse<si>:USER:PSTATe` on page 585

`[SENSe:]CORRection:FRESponse<si>:USER:SCOVERed?` on page 580

**Selected File ← Preview**

The preview of the selected user correction file shows the correction values for the specified frequency range. The values for individual ports can be activated or deactivated.

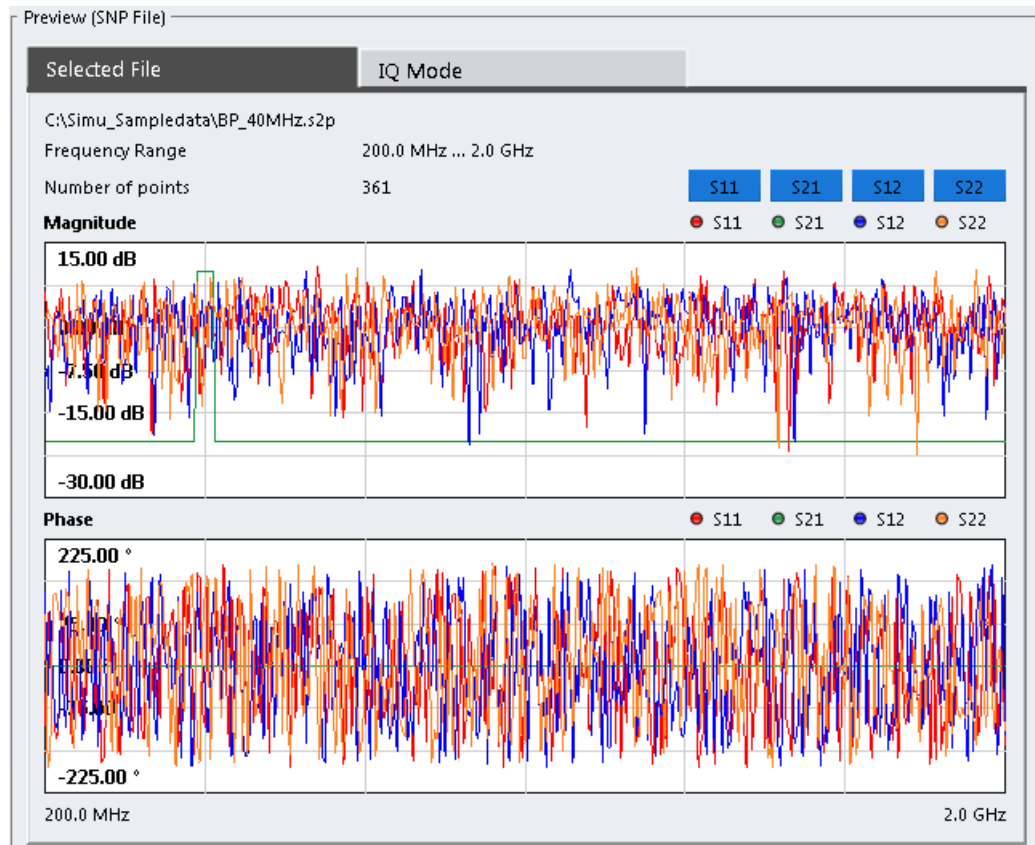


Figure 7-3: Preview of selected user correction file

Remote command:

[SENSe:]CORRection:FRESponse<si>:USER:FLISt<fli>:DATA:FREQuency?  
on page 574

[SENSe:]CORRection:FRESponse<si>:USER:FLISt<fli>:DATA:MAGNitude?  
on page 574

[SENSe:]CORRection:FRESponse<si>:USER:FLISt<fli>:DATA:PHASe?  
on page 574

[SENSe:]CORRection:FRESponse<si>:USER:SLISt<sli>:DATA:  
FREQuency<spi>? on page 581

[SENSe:]CORRection:FRESponse<si>:USER:SLISt<sli>:DATA:  
MAGNitude<spi>? on page 581

[SENSe:]CORRection:FRESponse<si>:USER:SLISt<sli>:DATA:  
PHASe<spi>? on page 581

#### **IQ Mode ← Preview**

The preview in IQ Mode indicates the frequency ranges covered by the individual correction files. The blue bar indicates the valid frequency range for which all files contain values.

The lower part shows the combined correction values for the valid frequency range.

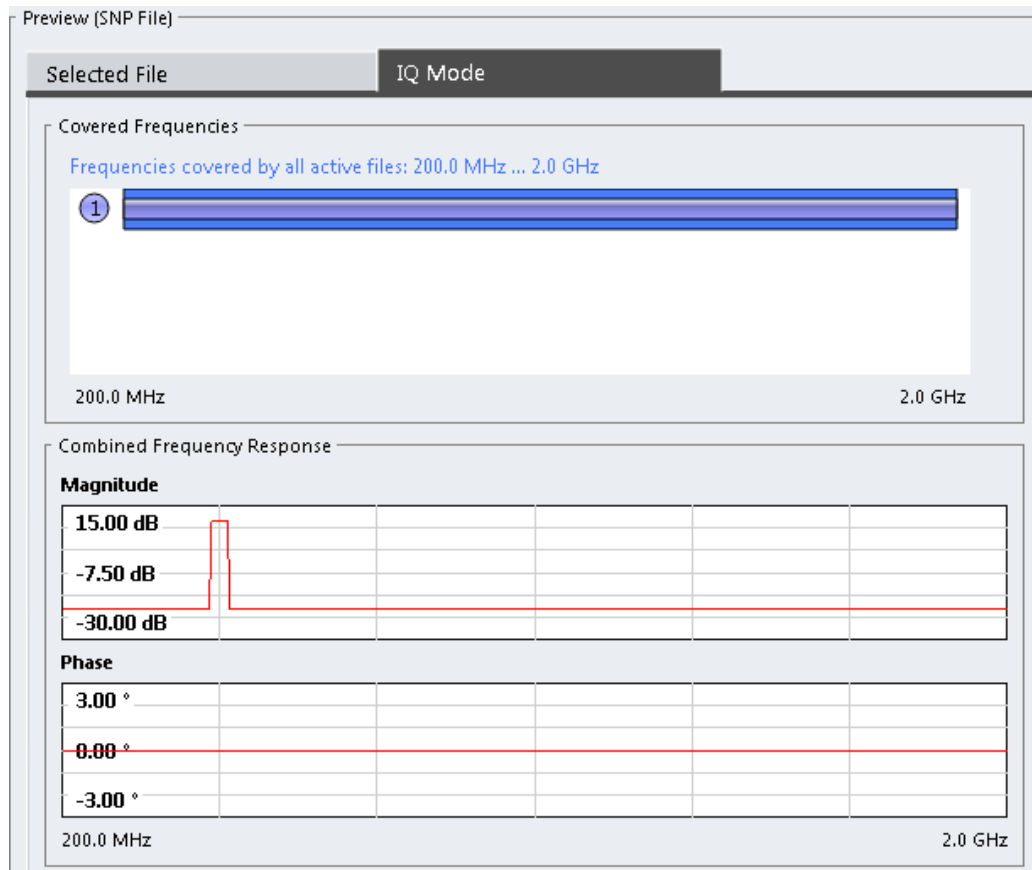


Figure 7-4: IQ Mode preview of user correction files

Remote command:

[\[SENSe:\]CORRection:FRESponse<si>:USER:IQ:DATA:FREQuency?](#)

on page 578

[\[SENSe:\]CORRection:FRESponse<si>:USER:IQ:DATA:MAGNitude?](#)

on page 578

[\[SENSe:\]CORRection:FRESponse<si>:USER:IQ:DATA:PHASe?](#) on page 578

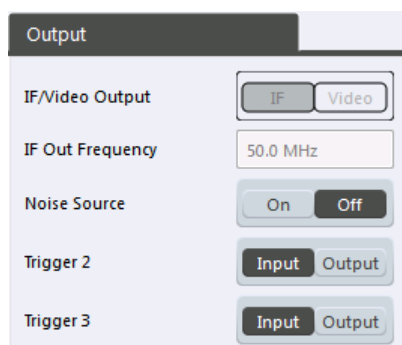
## 7.6 Output settings

**Access:** "Overview" > "Output"

The R&S VSE can control the output provided by the connected instrument to special connectors for other devices.

Which output settings and connectors are available depends on the connected instrument.

For details on the output connectors refer to the instrument's Getting Started manual.



The trigger output settings are described in [Chapter 7.7, "Receiving and providing trigger signals"](#), on page 112.

<a href="#">IF/Video Output, IF Wide Out Frequency</a> .....	112
<a href="#">Noise Source Control</a> .....	112

### IF/Video Output, IF Wide Out Frequency

Not available for the R&S VSE software.

### Noise Source Control

The connected instrument can provide a connector ("NOISE SOURCE CONTROL") with a voltage supply for an external noise source. By switching the supply voltage for an external noise source on or off via the software, you can enable or disable the connected device as required.

External noise sources are useful when you are measuring power levels that fall below the noise floor of the connected instrument itself, for example when measuring the noise level of an amplifier.

In this case, you can first connect an external noise source (whose noise power level is known in advance) to the connected instrument and measure the total noise power. From this value, you can determine the noise power of the connected instrument. Then when you measure the power level of the actual DUT, you can deduct the known noise level from the total power to obtain the power level of the DUT.

Remote command:

[DIAGnostic:SERvice:NSource](#) on page 594

## 7.7 Receiving and providing trigger signals

Using one of the "TRIGGER INPUT / OUTPUT" connectors of the connected instrument, the R&S VSE can use a signal from an external device as a trigger to capture data. Alternatively, the internal trigger signal used by the connected instrument can be output for use by other connected devices. Using the same trigger on several devices is useful to synchronize the transmitted and received signals within a measurement.

For details on the connectors see the R&S VSE "Getting Started" manual.



### External trigger as input

If the trigger signal for the R&S VSE is provided by an external device, the trigger signal source must be connected to the connected instrument and the trigger source must be defined as "External" in the R&S VSE.

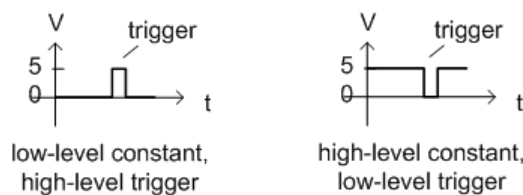
### Trigger output

The connected instrument can provide output to another device either to pass on the internal trigger signal, or to indicate that the connected instrument itself is ready to trigger.

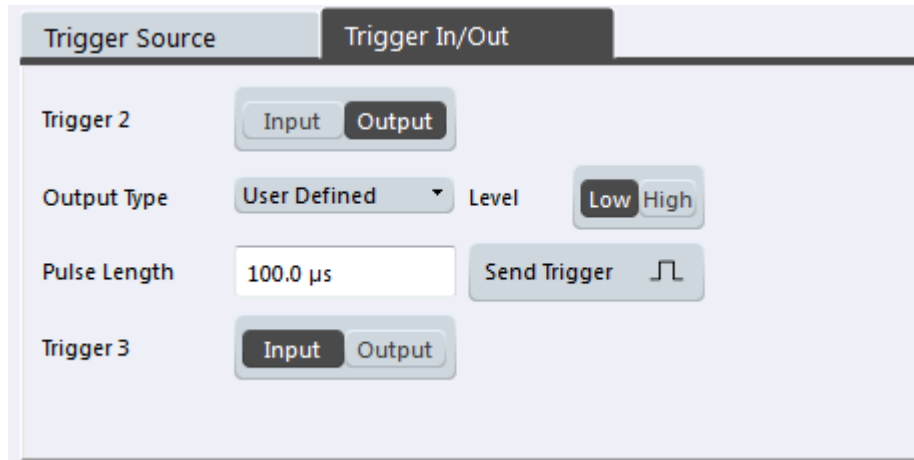
The trigger signal can be output by the connected instrument automatically, or manually by the user. If it is provided automatically, a high signal is output when the connected instrument has triggered due to a measurement start ("Device Triggered" ), or when the connected instrument is ready to receive a trigger signal after a measurement start ("Trigger Armed" ).

### Manual triggering

If the trigger output signal is initiated manually, the length and level (high/low) of the trigger pulse is also user-definable. Note, however, that the trigger pulse level is always opposite to the constant signal level defined by the output "Level" setting, e.g. for "Level" = "High", a constant high signal is output to the connector until "Send Trigger" is selected. Then, a low pulse is provided.



Trigger 1/2/3.....	114
L Output Type .....	114
L Level .....	115
L Pulse Length .....	115
L Send Trigger .....	115

**Trigger 1/2/3**

The trigger input and output functionality depends on how the variable "Trigger Input/Output" connectors are used.

Which output settings are available depends on the type of connected instrument. For details, see the instrument's documentation.

"Trigger 1"	"Trigger 1" is input only.
"Trigger 2"	Defines the usage of the variable "Trigger Input/Output" connector on the front panel
"Trigger 3"	Defines the usage of the variable "Trigger 3 Input/Output" connector on the rear panel
"Input"	The signal at the connector is used as an external trigger source by the connected instrument. Trigger input parameters are available in the "Trigger" dialog box.
"Output"	The connected instrument sends a trigger signal to the output connector to be used by connected devices. Further trigger parameters are available for the connector.

Remote command:

[OUTPut:TRIGger<tp>:DIRection](#) on page 594

**Output Type ← Trigger 1/2/3**

Type of signal to be sent to the output

"Device Triggered" (Default) Sends a trigger when the connected instrument triggers.

- "Trigger Armed" Sends a (high level) trigger when the connected instrument is in "Ready for trigger" state. This state is indicated by a status bit in the `STATUS:OPERation` register (bit 5), as well as by a low-level signal at the "AUX" port (pin 9). For details, see the description of the `STATUS:OPERation` register in the R&S VSE User Manual and the description of the "AUX" port in the R&S VSE Getting Started manual. This state is indicated by a status bit in the `STATUS:OPERation` register (bit 5), as well as by a low-level signal at the "AUX" port (pin 9) of the connected instrument, if available. For details, see "[STATUS:OPERation register](#)" on page 481 and the instrument's documentation.
- "User Defined" Sends a trigger when you select "Send Trigger" . In this case, further parameters are available for the output signal.

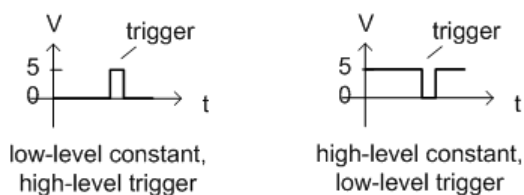
Remote command:

`OUTPut:TRIGger<tp>:OTYPe` on page 595

#### Level ← Output Type ← Trigger 1/2/3

Defines whether a high (1) or low (0) constant signal is sent to the trigger output connector (for "Output Type" : "User Defined" .

The trigger pulse level is always opposite to the constant signal level defined here. For example, for "Level" = "High", a constant high signal is output to the connector until you select the [Send Trigger](#) function. Then, a low pulse is provided.



Remote command:

`OUTPut:TRIGger<tp>:LEVel` on page 595

#### Pulse Length ← Output Type ← Trigger 1/2/3

Defines the duration of the pulse (pulse width) sent as a trigger to the output connector.

Remote command:

`OUTPut:TRIGger<tp>:PULSe:LENGth` on page 596

#### Send Trigger ← Output Type ← Trigger 1/2/3

Sends a user-defined trigger to the output connector immediately.

Note that the trigger pulse level is always opposite to the constant signal level defined by the output [Level](#) setting. For example, for "Level" = "High", a constant high signal is output to the connector until you select the "Send Trigger" function. Then, a low pulse is sent.

Which pulse level is sent is indicated by a graphic on the button.

Remote command:

`OUTPut:TRIGger<tp>:PULSe:IMMediate` on page 596

## 8 Data management

The captured data and measurement results from the R&S VSE can be stored to files. Furthermore, measurement and software settings can be stored.

- [Restoring the default software configuration \(preset\)](#)..... 116
- [Storing and recalling measurement settings](#)..... 117
- [Recording and recalling captured I/Q data for evaluation](#)..... 125
- [Printing current measurement results](#)..... 142
- [Storing graphical results to an ASCII file](#)..... 144
- [Copying graphical results to the clipboard](#)..... 144

### 8.1 Restoring the default software configuration (preset)

**Access:** "File" > "Preset"

When delivered, the R&S VSE has a default configuration. You can restore this defined initial state at any time as a known starting point for measurements. This is often recommendable as a first step in troubleshooting when unusual measurement results arise.

Settings can be restored in different levels:

- [Restoring All Default Settings \(Preset All\)](#)..... 116
- [Restoring All Default Settings and Deleting Instrument Configurations \(Preset All & Delete Instruments\)](#)..... 116
- [Restoring Channel Settings \(Preset Selected Channel\)](#)..... 117
- [Restoring User-Specific Settings \(Reset VSE Layout\)](#)..... 117

#### **Restoring All Default Settings (Preset All)**

Restores the initial software state, that is: **all measurement sequences, groups and channels** are stopped and **all windows** are closed; the default group and I/Q Analyzer measurement channel are restored.

Settings concerning the layout of the R&S VSE window, for example the display and position of toolbars and special tool windows, remain unchanged.

#### **Note:**

The initial software state is also restored if you delete the shutdown file (see ["Deleting the Shutdown File"](#) on page 146).

Remote command:

\*RST on page 511 or `SYSTem:PRESet` on page 880

#### **Restoring All Default Settings and Deleting Instrument Configurations (Preset All & Delete Instruments)**

Restores the initial software state, that is: **all measurement sequences, groups and channels** are stopped and **all windows** are closed; the default group and I/Q Analyzer measurement channel are restored.

In addition, all instrument configurations are deleted (see ).

Settings concerning the layout of the R&S VSE window, for example the display and position of toolbars and special tool windows, remain unchanged.

Remote command:

\*RST on page 511 or SYSTem:PRESet on page 880

+

DEVIce:DELeTe:ALL on page 514

### Restoring Channel Settings (Preset Selected Channel)

Resets the **currently selected measurement channel only** to its default settings.

This function has the same effect as the "Preset Channel" on page 194 function in the Configuration "Overview".

Remote command:

SYSTem:PRESet:CHANnel[:EXEC] on page 880

### Restoring User-Specific Settings (Reset VSE Layout)

Restores user-defined settings, for example the display and position of toolbars and special tool windows or lists of most recently defined input values (e.g. IP addresses of connected instruments).

Measurement channels remain unchanged.

User-defined settings are stored in the file

```
C:\ProgramData\Rohde-Schwarz\VSE\<<version_no>\user\
settings_pcsw_user.xml.
```

## 8.2 Storing and recalling measurement settings

Possibly you would like to restore or repeat a measurement you performed under specific conditions using the R&S VSE. In this case, you can store and recall software and measurement settings, and possibly other related measurement data.

Two different methods are available for managing measurement settings:

- Quick Save/Quick Recall - a defined set of measurement or channel settings are stored or recalled quickly in just one step
- Configurable Save/Recall - a user-defined set of measurement or channel settings are stored to a definable storage location



### Restrictions when recalling measurement settings

When recalling a saved configuration file, the following restrictions apply:

- The connected instrument and the channel application must support the frequency range defined in the configuration file.
- Configuration files created using an instrument with certain options in use will not work using an instrument without these options
- Files created with newer software versions may not work with a previous version
- Files created with the R&S VSE Enterprise Edition may not work in the Basic Edition, for example if more than one instrument, more than one group, or more than three channels are defined
- Depending on the general software setting, instrument configurations are restored, but the connections may have to be established manually (see "[Reconnect saved connections after recall](#)" on page 146).
- Traces resulting from encrypted file input cannot be stored in a saveset.

- [Quick save/quick recall](#)..... 118
- [Configurable storage and recall](#)..... 120

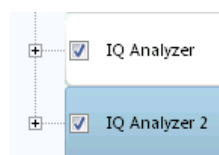
## 8.2.1 Quick save/quick recall

The Quick Save and Quick Recall functions allow you to store channel settings very easily and quickly in one step. Up to ten different sets of settings can be stored to or recalled from "save sets". Each save set is identified by its storage date and contents (all channels or specific channel) in the display. The save sets are stored in the C:\ProgramData\Rohde-Schwarz\VSE\

During recall, save sets of type "All channels" replace the settings of the entire software. All other save sets start a new measurement channel with the stored settings.



A measurement channel with the same name as the channel to be restored may already be active. In this case, the channel name for the new channel is extended by a consecutive number:

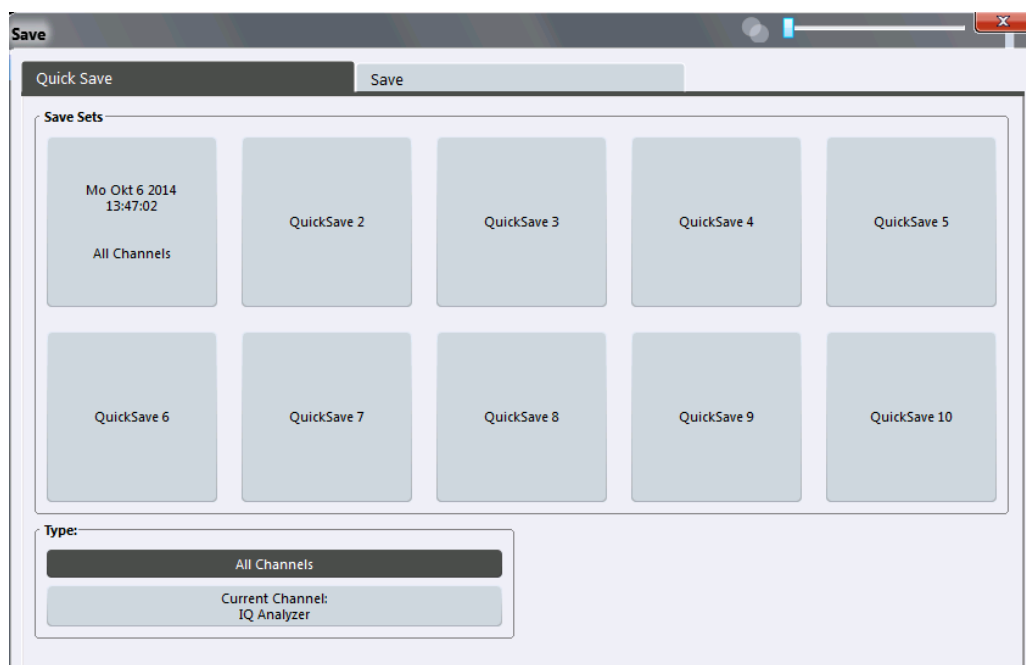


### 8.2.1.1 Quick save / quick recall settings



**Access:** "File" > "Save"/"Recall" > "Quick Save"/ "Quick Recall"

The "Quick Save" and "Quick Recall" dialog boxes are very similar and closely related.



QuickSave 1 / ... / QuickSave 10.....	119
Storage Type (Save only).....	119
Recall.....	119

#### QuickSave 1 / ... / QuickSave 10

Selects one of the save sets to store the current settings in or to be recalled. At the time of storage, the "QuickSave 1 / ... / QuickSave 10" placeholder is replaced by a label indicating the storage date and time and the storage type.

During recall, save sets of type "All channels" replace the measurement settings of the entire software. All other save sets start a new measurement channel with the stored settings.

#### Storage Type (Save only)

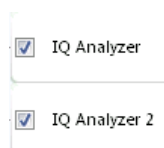
Defines which type of settings are stored in the save set.

- "All channels"    The measurement settings for all currently active channels are stored.
- "Current Chan-    Only the measurement settings for the currently selected measure-  
nel"                    ment channel are stored.

#### Recall

Restores the channel settings as saved in the selected settings file. If the settings file contains settings for a specific channel only a new channel with the stored settings is activated, otherwise the entire measurement settings are loaded.

**Note:** A measurement channel with the same name as the channel to be restored may already be active. In this case, the channel name for the new channel is extended by a consecutive number:



In remote commands, you must append this number to the channel name, as well.

Remote command:

[MMEMoRY:LOAD:STATe](#) on page 890

## 8.2.2 Configurable storage and recall

The more sophisticated storage and recall functions allow you to define which settings are stored, and where the settings file is stored to. Any settings file can be selected for recall.

- [Stored data types](#)..... 120
- [Storage location and file name](#)..... 120
- [Save and recall dialog boxes](#)..... 121
- [Startup recall settings](#)..... 123

### 8.2.2.1 Stored data types

The following types of data can be stored to and loaded from files via the "Save" dialog box on the R&S VSE:

**Table 8-1: Items that can be stored to files**

Item	Description
Current Settings	Current software and measurement settings
All Traces	All active traces; Traces resulting from encrypted file input are not stored.
All Limit Lines	All limit lines (Note: information on which limit lines are active is stored with the "Current Settings") Not available for I/Q Analyzer
Spectrogram	Spectrogram display Only available for I/Q Analyzer and Analog Demod applications

### 8.2.2.2 Storage location and file name

The storage location and file name are selected in a file selection dialog box which is displayed when you perform a storage function.

By default, the name of a settings file consists of a base name followed by an underscore and three numbers, e.g. `limit_lines_005`. In the example, the base name is



limit\_lines. The base name can contain characters, numbers and underscores. The file extension dfl is added automatically. The default folder for settings files is C:\ProgramData\Rohde-Schwarz\VSE\\user.



### Hidden folder

Note that the ProgramData folder is not visible in the Windows Explorer in its default settings. However, if you enter the path with the file name, you can access the files stored there.

Alternatively, enable the "Files and Folders: Hidden files and folders: Show hidden files, folders, and drives" option in the Windows Explorer. (Press the [Alt] key to display the menu bar. Select "Tools > Folder Options" > "View" tab.)

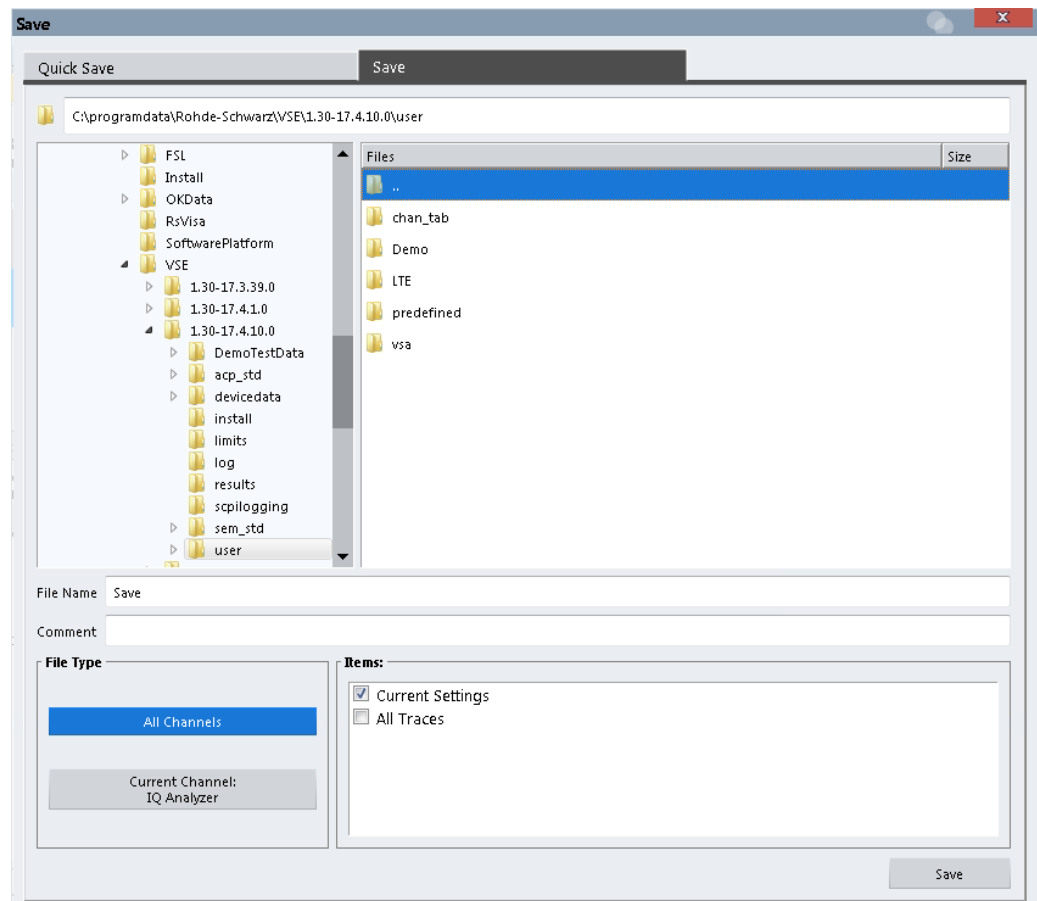
For more information, refer to the Microsoft Windows documentation.

### 8.2.2.3 Save and recall dialog boxes



**Access:** "File" > "Save"/"Recall" > "Save"/"Recall"

The "Save" and "Recall" dialog boxes are very similar and closely related.



Selecting Storage Location - Drive/ Path/ Files.....	122
File Name .....	122
Comment .....	122
File Type.....	122
Items.....	122
Save File.....	123
Recall in New Channel / Recall in Current Channel.....	123

### Selecting Storage Location - Drive/ Path/ Files

Select the storage location of the file on the software or an external drive.

The default storage location for the settings files is:

C:\ProgramData\Rohde-Schwarz\VSE\\Save.

Note that the ProgramData folder is not visible in the Windows Explorer in its default settings. However, if you enter the path with the filename, you can access the files stored there. See also "Hidden folder" on page 121.

The default storage location for the SEM settings files is:

C:\ProgramData\Rohde-Schwarz\VSE\

### File Name

Contains the name of the data file without the path or extension.

File names must be compatible with the Windows conventions for file names. In particular, they must not contain special characters such as ":", "\*", "?".

For details on the filename and location, see [Chapter 8.2.2.2, "Storage location and file name"](#), on page 120.

For details on the filename and location, see [Chapter 8.2.2.2, "Storage location and file name"](#), on page 120.

### Comment

An optional description for the data file. A maximum of 60 characters can be displayed.

Remote command:

[MMEMory:COMMeNt](#) on page 882

### File Type

Determines whether the global software settings with all channels are stored or recalled, or the current channel settings only.

### Items

Defines which data and settings are stored or recalled. Depending on the "File Type", only channel settings or global settings are available. Which items are available also depends on the installed options (see also [Chapter 8.2.2.1, "Stored data types"](#), on page 120).

Remote command:

[MMEMory:SELEct\[:ITEM\]:ALL](#) on page 886

[MMEMory:SELEct\[:ITEM\]:DEFault](#) on page 887

[MMEMory:SELEct\[:ITEM\]:HWSettings](#) on page 887

[MMEMory:SELEct\[:ITEM\]:LINES:ALL](#) on page 887

`MMEMoRY:SELEct[:ITEM]:NONE` on page 888

`MMEMoRY:SELEct[:ITEM]:TRACe<1...3>[:ACTive]` on page 888

### Save File

Saves the settings file with the defined file name.

Remote command:

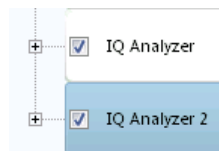
`MMEMoRY:STORe<1|2>:STATe` on page 891

`MMEMoRY:STORe<1|2>:STATe:NEXT` on page 892

### Recall in New Channel / Recall in Current Channel

Restores the measurement settings as saved in the selected settings file. If the settings file contains settings for a specific channel only, select "Recall in New Channel" to activate a new channel with the stored settings. Select "Recall in Current Channel" to replace the current channel settings.

**Note:** A measurement channel with the same name as the channel to be restored may already be active. In this case, the channel name for the new channel is extended by a consecutive number:



In remote commands, you must append this number to the channel name, as well.

**Note:** Files created with the R&S VSE Enterprise Edition cannot be recalled in the Basic Edition if more than one instrument, more than one group, or more than three channels are defined.

Remote command:

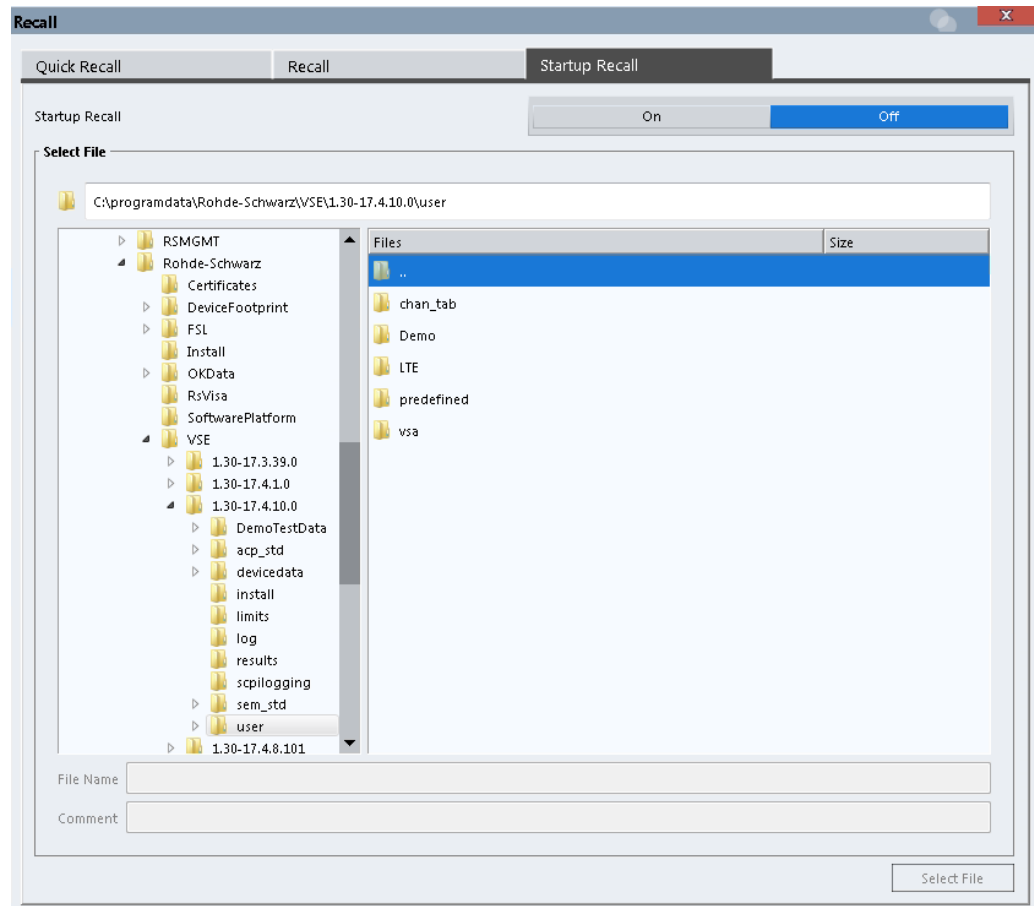
`MMEMoRY:LOAD:STATe` on page 890

#### 8.2.2.4 Startup recall settings



**Access:** "File" > "Recall"> "Startup Recall"

By default, the settings from the shutdown file (see "[Create Shutdown File](#)" on page 146) or the default settings are restored when the R&S VSE software is started. However, you can select a different settings file to be restored.



Startup Recall.....	124
Selecting Storage Location - Drive/ Path/ Files.....	124
File Name .....	125
Comment .....	125

### Startup Recall

Activates or deactivates the startup recall function. If activated, the settings stored in the selected file are loaded each time the software is started or preset. If deactivated, the default settings are loaded.

Note that only *All Channels* settings files can be selected for the startup recall function, not single channel settings files.

**Note:** Settings stored with the R&S VSE Enterprise Edition cannot be recalled in the Basic Edition if more than one instrument, more than one group, or more than three channels are defined.

Remote command:

[MMEMory:LOAD:AUTO](#) on page 889

### Selecting Storage Location - Drive/ Path/ Files

Select the storage location of the file on the software or an external drive.

The default storage location for the settings files is:

C:\ProgramData\Rohde-Schwarz\VSE\<>version\_no<>\Save.

Note that the `ProgramData` folder is not visible in the Windows Explorer in its default settings. However, if you enter the path with the filename, you can access the files stored there. See also ["Hidden folder"](#) on page 121.

The default storage location for the SEM settings files is:

```
C:\ProgramData\Rohde-Schwarz\VSE\<<version>\sem_std.
```

**File Name**

Contains the name of the data file without the path or extension.

File names must be compatible with the Windows conventions for file names. In particular, they must not contain special characters such as ":", "\*", "?".

For details on the filename and location, see [Chapter 8.2.2.2, "Storage location and file name"](#), on page 120.

For details on the filename and location, see [Chapter 8.2.2.2, "Storage location and file name"](#), on page 120.

**Comment**

An optional description for the data file. A maximum of 60 characters can be displayed.

Remote command:

[MMEMory:COMMENT](#) on page 882

## 8.3 Recording and recalling captured I/Q data for evaluation

By default, when data is captured during a measurement, it is stored on the connected instrument. The R&S VSE software accesses this data to analyze and display the results for the channel.

If the captured I/Q data is required for further analysis later or in a different application, possibly using different settings, you can record the captured data. In this case, the I/Q data is stored to a temporary file on the PC running the R&S VSE software. These files can then be exported, that is: stored to a file permanently, at a user-defined storage location. Exported I/Q data can then be recalled and used as input for further measurements and analysis by the R&S VSE software.



### Difference between Save and Export functions

The "Save" function described in [Chapter 8.2, "Storing and recalling measurement settings"](#), on page 117 stores the finished measurement results (and settings), so that the same results can be restored later in the same application.

You can also store the raw I/Q data as it is captured, without further evaluation functions applied, to evaluate it using other functions or in a different application. In this case, use the "Save I/Q Recording" functions described here. Note that to export the raw (resampled) data for a continuous measurement, you must start recording directly at the time of capture. Once the data has been captured without being recorded, it can no longer be exported as raw (resampled) data.

Exception: I/Q data from a single run measurement can be exported for a limited amount of time after the measurement, but only until measurement settings are changed or a new measurement is performed (see ["Data to export"](#) on page 130).



An application note on converting Rohde & Schwarz I/Q data files is available from the Rohde & Schwarz website:

[1EF85: Converting R&S I/Q data files](#)



### Auxiliary tools to convert I/Q files using Matlab®

The R&S VSE installation now also includes some additional tools to convert I/Q files using Matlab®. The tools are stored in the

C:\ProgramData\Rohde-Schwarz\VSE\

The following tools are provided as Matlab® files:

- **load\_iq\_tar\_file.m**: provides functions to convert `.iq.tar` files created or exported by the R&S VSE software to `.mat` files that can be imported by Matlab®.
- **save\_iq\_tar\_file.m**: provides functions to convert I/Q data created in Matlab® to `.iq.tar` files that can be imported by the R&S VSE software
- **write\_matforvse.m**: provides functions to convert I/Q data created in Matlab® to `.mat` files that can be imported by the R&S VSE software

- [Recording measurement data](#)..... 126
- [General recording settings](#)..... 127
- [Exporting captured and recorded I/Q data](#)..... 129
- [Recalling measurement data from files](#)..... 132

## 8.3.1 Recording measurement data

If the captured I/Q data is required for further analysis later or in a different application, you can record the measurement results for a specific channel. In this case, the (resampled) I/Q data is stored to a temporary file on the PC running the R&S VSE software. The record length is defined as:

[<Measurement time> \* <Number of records>] + <Additional settling samples>

Where <Measurement time> is defined in the channel capture settings, and <Number of records> and <Additional settling samples> are general recording settings (see [Chapter 8.3.2, "General recording settings"](#), on page 127).


Alternatively, the measurement time can be set to the maximum provided by the connected instrument automatically.

When the recording is finished, the temporary file is automatically set to be the input source for the selected channel. The measurement results stored in the first record are immediately displayed. The temporary file can then be exported, that is: stored to a file permanently. Recorded I/Q data files are available for export until one of the following actions occur:

- A new measurement is performed. The temporary file is overwritten with each measurement.
- The measurement channel is closed.
- The R&S VSE software is closed.
- The data acquisition settings are changed. In this case, the stored data no longer matches the current settings and the data becomes "invalid". It can no longer be exported.

Note that if a recording is aborted before it has completed, the temporary file is deleted and the captured data is not available for evaluation or display.


#### To start recording measurement data for a channel

- ▶ To record measurement results, select the  "Record" function for the channel in the "Measurement Group Setup" tool window (see also ["Record"](#) on page 98). Alternatively, select the "Record" icon in the toolbar to record the results for the currently active measurement channel.

The captured I/Q data is recorded until the defined number of records have been captured or recording is stopped manually.

The first recorded record is displayed immediately in the channel's result displays. After recording has finished, the I/Q data can be exported to a file permanently, see [Chapter 8.3.3, "Exporting captured and recorded I/Q data"](#), on page 129.

#### To stop data recording

- ▶ To stop recording measurement results, select the  "Pause" function for the channel in the "Measurement Group Setup" tool window.

Note that if a recording is aborted before it has completed, the temporary file is deleted and the captured data is not available for evaluation or display.

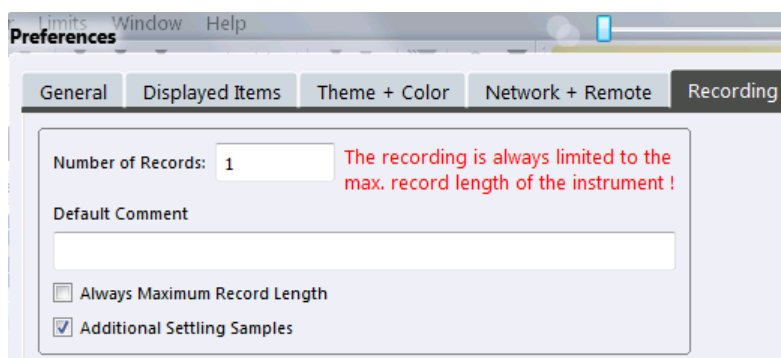
#### Remote command:

`INSTRument:BLOCK:CHANnel[:SETTings]:RECORD` on page 549

## 8.3.2 General recording settings

**Access:** "File" > "Preferences" > "Recording"

Some general settings concerning recording in the R&S VSE are available in the general software settings.



<a href="#">Number of Records</a> .....	128
<a href="#">Default Comment</a> .....	128
<a href="#">Always Maximum Record Length</a> .....	128
<a href="#">Additional Settling Samples</a> .....	128

### Number of Records

Defines the number of records to be stored. One record contains the data captured during the defined measurement time for a single channel. If more measurements are available than the specified number (x) of records, only the most recent (x) measurement results are stored. As a rule, the recording is limited by the maximum record length provided by the instrument.

Alternatively, all available records for a channel can be stored (see "[Always Maximum Record Length](#)" on page 128). In this case, the "Number of Records" are disabled.

Remote command:

[RECORDing:COUNT](#) on page 899

### Default Comment

Defines a default text for the comment to the stored data file. This default comment is displayed in the "Save I/Q Recording" dialog box (see [Comment](#)).

Remote command:

[RECORDing:COMMENT\[:DEFAULT\]](#) on page 898

### Always Maximum Record Length

If enabled, all available records for a channel are stored. The "Number of Records" is ignored (and disabled).

If disabled, only the most recent "[Number of Records](#)" on page 128 are stored.

Remote command:

[RECORDing:MAXimum:RLEN](#) on page 899

### Additional Settling Samples

Stores additional samples (in addition to the specified "Meas Time" ) for the channel to compensate for settling effects.

This setting is required for connected instruments that require resampling. The additional samples compensate for settling effects in the filters used by the resampler.



You can recognize the use of a resampler by the "Resampler active" message in the status bar of the R&S VSE.

Remote command:

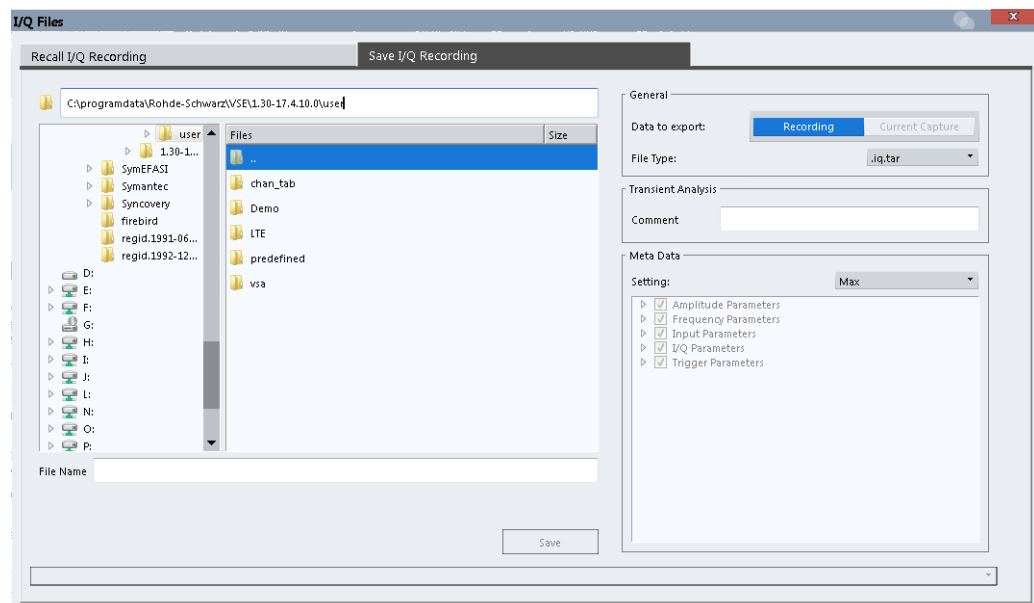
[RECORDing:SETTLing:TIME](#) on page 899

### 8.3.3 Exporting captured and recorded I/Q data



**Access:** "File" > "Save I/Q Recording"

Captured and recorded data from a connected instrument can be stored to a file permanently. You can then use the data in the export file as input for analysis later or using a different application.



Results can only be stored for the currently selected measurement channel and only after measurement data has explicitly been recorded or for a limited amount of time after a single measurement (see [Chapter 8.3.1, "Recording measurement data"](#), on page 126).



#### Exporting MIMO data with multiple I/Q streams

MIMO data that contains multiple streams is recorded in one file for each stream (input channel).

When exporting MIMO data, however, the data from all streams is stored in one file. Within the file, each stream is named `LTE Source <n>`, where `<n>` is a sequential number.

For `.iqw` file format, only one stream can be stored in each file. In this case, one file is created per stream, and each file is extended by a `"_source<n>"` suffix.

Selecting the Storage Location - Drive/ Path/ Files.....	130
File Name.....	130
Data to export.....	130
File Type.....	130
Comment.....	131
Meta Data Settings.....	131
Save.....	132

### Selecting the Storage Location - Drive/ Path/ Files

Select the storage location of the I/Q data file on the PC or an external drive.

Remote command:

`MMEMoRY:CATALog` on page 881

#### File Name

Contains the name of the data file without the path or extension.

For details on the file name and location, see [Chapter 8.2.2.2, "Storage location and file name"](#), on page 120.

Remote command:

`INSTRument:BLOCK:CHANnel[:SETTings]:FILE<fi>:IQTar` on page 530

`INSTRument:BLOCK:CHANnel[:SETTings]:FILE<fi>:CSV` on page 527

`INSTRument:BLOCK:CHANnel[:SETTings]:FILE<fi>:IQW` on page 532

`INSTRument:BLOCK:CHANnel[:SETTings]:FILE<fi>:IQX` on page 533

`INSTRument:BLOCK:CHANnel[:SETTings]:FILE<fi>:MAT` on page 534

`INSTRument:BLOCK:CHANnel[:SETTings]:FILE<fi>:REPLace` on page 537

`INSTRument:BLOCK:FILE<fi>:CSV` on page 557

`INSTRument:BLOCK:FILE<fi>:IQTar` on page 559

`INSTRument:BLOCK:FILE<fi>:IQW` on page 560

`INSTRument:BLOCK:FILE<fi>:IQX` on page 561

`INSTRument:BLOCK:FILE<fi>:MAT` on page 563

`INSTRument:BLOCK:FILE<fi>:REPLace` on page 564

#### Data to export

Defines whether the currently captured data in the capture buffer is exported to a file, or the most recently recorded data for the selected measurement channel.

Note that the currently captured data is only available for export directly after a single run measurement was performed, and only until any measurement settings are changed.

See also [Chapter 8.3, "Recording and recalling captured I/Q data for evaluation"](#), on page 125.

Remote command:

`EXPort:IQ:INPut` on page 894

#### File Type

Various file types are supported for I/Q data import and export.

**Note:** For best performance and to ensure comprehensive meta data is available, use the `iq.tar` format. This is a widely used file format for Rohde & Schwarz products.

**Note:** For MIMO measurements, all streams are exported in a single file. Only for `.iqw` format each stream is stored in a single file, whose name is extended by a `"_source<n>"` suffix.

For details on the supported file formats see [Chapter E, "Reference: supported I/Q file formats"](#), on page 969.

"iq.tar"	Compressed file format for an individual measurement channel or several channels with identical capture settings (sample rate, bandwidth)
"csv"	Comma-separated ASCII file format
"iqw"	Binary file format; contains only I/Q data from a single channel, without any meta data
"iqx"	(Import only) Binary file format; contains (large amounts of) I/Q data from a single channel, plus trigger information as markers
"mat"	Matlab file format v.4 or v.7
"aid"	AMMOS intermediate frequency data format
"wv"	(Import only) Proprietary file format used by Rohde & Schwarz signal generators to store waveform data.

Remote command:

Exporting I/Q recording files:

[EXPort:IQ:FORMat](#) on page 893

### Comment

Inserts a descriptive comment to the data file.

Tip: if a default comment is defined in the general recording settings (see ["Default Comment"](#) on page 128), it is provided as a default here.

Remote command:

[MMEMory:STORe<n>:IQ:COMMeNt](#) on page 897

### Meta Data Settings

Defines which meta data is included in the data file. Meta data is required to restore the measurement settings when the data file is recalled as input for the R&S VSE software later.

Note that only the settings used during recording are stored; subsequent changes to the settings are ignored.

For `iqw` file format, no meta data is available.

"Min"	The minimum set of measurement settings required to restore the channel later are stored. In particular, this includes: <ul style="list-style-type: none"> <li>• Reference level</li> <li>• Center frequency</li> <li>• Input path</li> <li>• Analysis bandwidth</li> </ul>
-------	---

"Max" All available meta data from the entire signal processing chain (input path to the output) is stored.

In particular, depending on the type of measurement channel and connected instrument, the meta data can include:

- Amplitude parameters:
  - Reference level
  - Electronic attenuation
  - Mechanical attenuation
  - Preamplifier
  - Input impedance
  - Input coupling
  - Range
- Frequency parameters:
  - Center frequency
- Input parameters:
  - Recording device (instrument providing the data)
  - Calibration state
  - External reference
  - Input path
  - Highpass filter state
  - YIG preselector
- I/Q parameters:
  - Analysis bandwidth
  - Filter settings
- Trigger parameters:
  - Trigger source
  - Trigger position
  - Trigger level
  - Trigger slope
  - Trigger holdoff
  - Trigger hysteresis

"Custom" A user-definable set of meta data (subset of "Full") is stored.

Remote command:

[EXPort: IQ: META: DATA<da>](#) on page 895

[EXPort: IQ: META: DATA<da>: SET](#) on page 895

### Save

Stores the captured data to the specified file.

Remote command:

[EXPort: IQ: FILE](#) on page 893

[MMEMory: STORe<n>: IQ: STATe](#) on page 897

## 8.3.4 Recalling measurement data from files

When measurement (I/Q) data is recorded to a file, not only the result data is stored, but also the essential instrument and measurement settings required to obtain those results. Thus, when you recall a measurement file, the stored settings are restored in

the R&S VSE software, as well. This enables you to repeat the stored measurement under the same conditions - assuming the file was recorded on a compatible instrument and contains the required measurement information.

When you recall measurement data from a file, a measurement channel is activated with the input source "File". You can then "replay" the measurement and the stored results, or even just an extract of the entire measurement.



When measurement results are recorded, the recorded data is immediately used as input for further analysis in the R&S VSE software. Therefore, the input source is switched to "File", rather than "Instrument". However, the instrument settings are maintained so that you can switch back to the instrument as an input source quickly.

To recall measurement results, the I/Q data file and essential measurement information must first be selected. Then the results of the entire measurement, or only a specific extract of it, can be restored.



The data to be imported must be stored in a specified file format, see [Chapter E, "Reference: supported I/Q file formats"](#), on page 969.

- [Loading the I/Q data file and essential measurement information](#)..... 133
- [Restoring the measurement results - R&S VSE player](#)..... 137

#### 8.3.4.1 Loading the I/Q data file and essential measurement information

**Access:** I/Q files are recalled using the "Recall I/Q Recording" dialog box which is displayed when you do one of the following:

- Select the "Recall I/Q Recording" icon from the main toolbar.
- Select the "File > Recall IQ Recording" menu item.
- Select the "Input & Output > Input Source" menu item and switch to the "I/Q File" tab. Select the "Select file" button.
- Select the "Input source": "File" for a measurement channel, then select the "..." button to select the I/Q data file to be loaded.
- In the R&S VSE Player ("Window > Player"), select the "..." button to select the I/Q data file to be loaded.



#### Loading a file via drag&drop

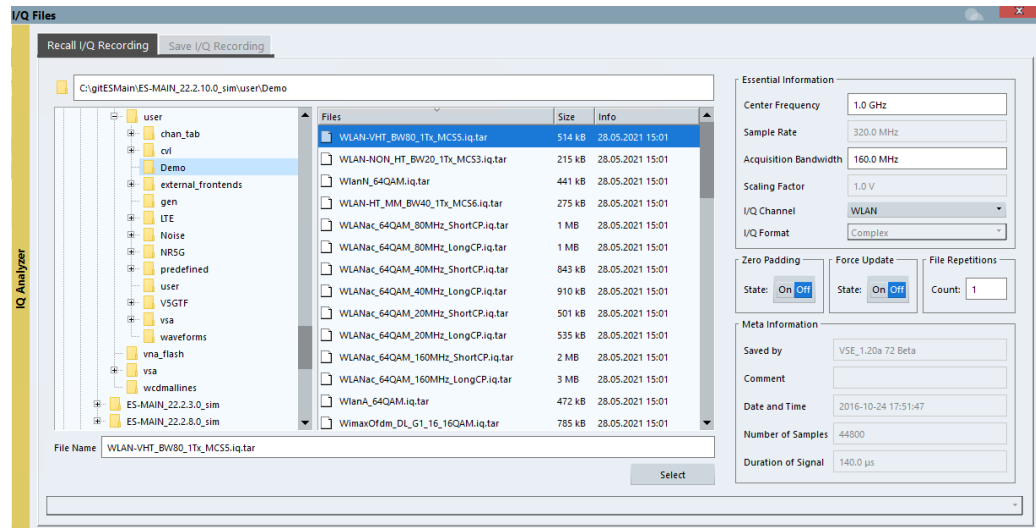
You can load a file simply by selecting it in a file explorer and dragging it to the R&S VSE software. Drop it into the "Measurement Group Setup" window or the channel bar for any channel. The channel is automatically configured for file input, if necessary. If the file contains all essential information, the file input is immediately displayed in the channel. Otherwise, the "Recall I/Q Recording" dialog box is opened for the selected file so you can enter the missing information.

If the file contains data from multiple channels (e.g. from LTE measurements), it can be loaded to individual input sources, if the application supports them.

For more information see ["To import data via drag&drop"](#) on page 463.



The data to be imported must be stored in a specified file format, see [Chapter E, "Reference: supported I/Q file formats"](#), on page 969.



Encrypted `.wv` files can also be imported. Note, however, that traces resulting from encrypted file input cannot be exported or stored in a saveset (see [Chapter 8.3, "Recording and recalling captured I/Q data for evaluation"](#), on page 125 and [Chapter 8.5, "Storing graphical results to an ASCII file"](#), on page 144).

- Selecting the Storage Location - Drive/ Path/ Files..... 134
- File Name..... 134
- Essential Information..... 135
  - Center Frequency..... 135
  - Sample Rate..... 135
  - Acquisition Bandwidth..... 135
  - Scaling Factor..... 136
  - I/Q Channel..... 136
  - I/Q Format..... 136
- Zero Padding..... 137
- Force Update..... 137
- File Repetitions..... 137
- Meta Information..... 137
- Select..... 137

**Selecting the Storage Location - Drive/ Path/ Files**

Select the storage location of the I/Q data file on the PC or an external drive.

Remote command:

`MMEMory:CATalog` on page 881

**File Name**

Contains the name of the data file without the path or extension.

For details on the file name and location, see [Chapter 8.2.2.2, "Storage location and file name"](#), on page 120.

Remote command:

[INSTRument:BLOCK:CHANnel\[:SETTings\]:FILE<fi>:IQTar](#) on page 530

[INSTRument:BLOCK:CHANnel\[:SETTings\]:FILE<fi>:CSV](#) on page 527

[INSTRument:BLOCK:CHANnel\[:SETTings\]:FILE<fi>:IQW](#) on page 532

[INSTRument:BLOCK:CHANnel\[:SETTings\]:FILE<fi>:IQX](#) on page 533

[INSTRument:BLOCK:CHANnel\[:SETTings\]:FILE<fi>:MAT](#) on page 534

[INSTRument:BLOCK:CHANnel\[:SETTings\]:FILE<fi>:REPLace](#) on page 537

[INSTRument:BLOCK:FILE<fi>:CSV](#) on page 557

[INSTRument:BLOCK:FILE<fi>:IQTar](#) on page 559

[INSTRument:BLOCK:FILE<fi>:IQW](#) on page 560

[INSTRument:BLOCK:FILE<fi>:IQX](#) on page 561

[INSTRument:BLOCK:FILE<fi>:MAT](#) on page 563

[INSTRument:BLOCK:FILE<fi>:REPLace](#) on page 564

### Essential Information

Defines the channel-specific information required to re-configure the recorded measurement. If the I/Q data file contains measurement information, it is displayed read-only. For files that do not contain this information, the essential information must be provided manually. In particular, for:

- `iqw` files
- Simple `csv` files
- Simple `mat` files
- Files stored by applications other than R&S VSE

### Center Frequency ← Essential Information

The center frequency of the data that was stored to the file, if available.

Otherwise, it is set to 0 Hz.

Remote command:

[\[SENSe<ip>:\]FREQuency:CENTer](#) on page 661

Default: contained in import file, see ["File"](#) on page 95.

### Sample Rate ← Essential Information

If a stored sample rate is available, it is indicated for reference only and cannot be changed. If not available, the sample rate used to obtain the stored data must be specified manually.

Remote command:

[TRACe:IQ:SRATe](#) on page 681

Default: contained in import file, see ["File"](#) on page 95.

### Acquisition Bandwidth ← Essential Information

The bandwidth of the data that was stored to the file.

If the bandwidth of the stored data is available, it is indicated and cannot be changed.

If the bandwidth was not stored, a default value of  $0.8 * \text{Sample Rate}$  is used. This value can be changed manually.

Remote command:

[TRACe: IQ:BWIDth](#) on page 679

Default: contained in import file, see ["File"](#) on page 95.

### Scaling Factor ← Essential Information

Generally, power values in waveform input files are normalized to a magnitude of 1. The values are interpreted as volts for an impedance of 50 Ω. If necessary, you can define a different scaling factor to obtain correct dBm values.

Values from  $1.0e^{-10}$  to  $1.0e^{10}$  are supported.

### I/Q Channel ← Essential Information

Determines which of the I/Q channels (streams) stored in the file is to be restored to which input source of the selected measurement channel. This is relevant only for files that contain data from multiple channels (for example from MIMO measurements).

You can easily switch between different channels to be used as input from the import file in the "Measurement Group Setup" window.

**Note:** Loading input files with multiple I/Q streams. For MIMO measurements, multiple data streams are required for the multiple input sources. If the streams are stored in individual files, you must load a separate file for each input source. If several streams are stored in one file, the streams are loaded to the input sources in the order they were stored, that is: the first stream is loaded for input source 1, the second stream for input source 2, etc.

See also ["Exporting MIMO data with multiple I/Q streams"](#) on page 129.

Remote command:

[INSTrument:BLOCK:CHANnel\[:SETTings\]:FILE<fi>:STReam](#) on page 540

[INSTrument:BLOCK:CHANnel\[:SETTings\]:FILE<fi>:STReam:AUTO](#)  
on page 539

[INSTrument:BLOCK:CHANnel\[:SETTings\]:FILE<fi>:STReam:LIST?](#)  
on page 540

Default: contained in import file, see ["File"](#) on page 95.

### I/Q Format ← Essential Information

Determines how the stored I/Q data is interpreted. The available formats depend on the file type.

"IIQQ   IQBLoCk"	First all I-values are listed, then the Q-values (I,I,I,I,I,...Q,Q,Q,Q,Q,Q) .iqw format only
"IIQI   IQPair"	One pair of I/Q values after the other is listed (I,Q,I,Q,I,Q...) .iqw format only
"Complex"	.iq.tar format only (cannot be edited)
"Polar"	.iq.tar format only (cannot be edited)



### Zero Padding

Enables or disables zero padding for input from an I/Q data file that requires resampling. For resampling, a number of samples are required due to filter settling. These samples can either be taken from the provided I/Q data, or the software can add the required number of samples (zeros) at the beginning and end of the file.

If enabled, the required number of samples are inserted as zeros at the beginning and end of the file. The entire input data is analyzed. However, the additional zeros can affect the determined spectrum of the I/Q data. If zero padding is enabled, a status message is displayed.

If disabled (default), no zeros are added. The required samples for filter settling are taken from the provided I/Q data in the file. The start time in the R&S VSE Player is adapted to the actual start (after filter settling).

**Note:** You can activate zero padding directly when you load the file, or afterwards in the "Input Source" settings.

Remote command:

`INPut<ip>:FILE:ZPADing` on page 526

### Force Update

Automatically reloads the current I/Q input file for the next data acquisition. Reloading is useful if the file was changed externally since it was last loaded. However, it can decrease performance.

Remote command:

`INPut<ip>:FILE:FUPDate` on page 525

### File Repetitions

Determines how often the data stream is repeatedly copied in the I/Q data memory to create a longer record. If the available memory is not sufficient for the specified number of repetitions, the largest possible number of complete data streams is used.

Remote command:

`INSTrument:BLOCK:CHANnel[:SETTings]:FILE<fi>:REPetition:COUNT`  
on page 537

### Meta Information

Provides additional general information on the data file, if available. This information is provided for reference only and cannot be edited.

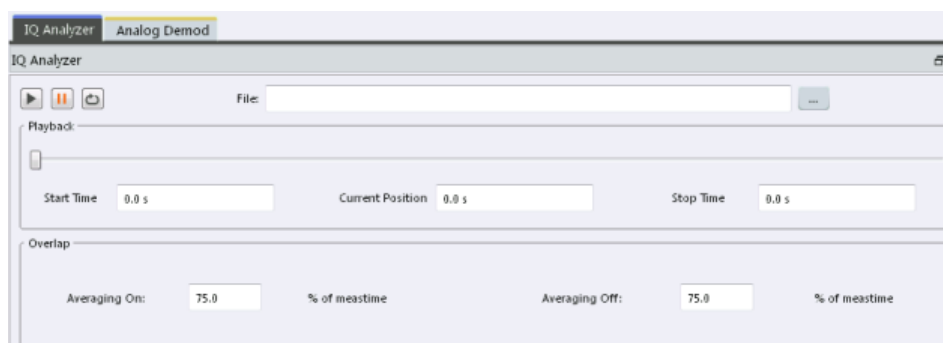
### Select

The selected I/Q data recording is restored and the dialog box is closed.

#### 8.3.4.2 Restoring the measurement results - R&S VSE player

To replay the stored measurements in individual channels, the R&S VSE software provides a special tool: the R&S VSE Player. Using the R&S VSE Player you can play back the entire measurement, or only a specific time span, and you can define how to process multiple records.

The R&S VSE Player is available via the "Window > Player" menu item.



If available, the loaded I/Q file for the selected measurement channel is displayed. You can also load a different I/Q file directly in the R&S VSE Player.



Alternatively to the R&S VSE Player you can use the ► ("Play") function in the "Measurement Group Setup" tool window to replay a channel for which the "Input Source": "File" is selected and a file is loaded.

For details, see "Play" on page 89.

You can also set an option in the general software settings so that the R&S VSE Player is automatically displayed when you select a file as input for a measurement channel (see "Show Player Automatically" on page 148).



### Changing data acquisition settings for a stored measurement

When replaying stored measurement data from a file, you can change the [Data acquisition and bandwidth settings](#), for example:

- **Sample rate / Analysis bandwidth:** The R&S VSE provides an internal resampler, which allows you to change the sample rate, or bandwidth, or both, of the replayed I/Q data
- **Center frequency:** You can shift the center frequency of the current measurement compared to the stored measurement data. The maximum shift depends on the current analysis bandwidth in the channel.  
For details, see "Center Frequency" on page 236.
- **I and Q paths:** Swap the I and Q values for the measurement, for example to compare the data to another measurement in which the instrument ports were swapped.



### Zero padding

You can activate or deactivate zero padding for a loaded input file in the "Input Source" settings. For details, see "Zero Padding" on page 96.

<a href="#">Capture</a> .....	139
<a href="#">Pause / Cont</a> .....	139
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Overlap Settings.....	141

### ▶ Capture

Starts replaying the data from the I/Q file from the beginning for the measurement channel. Any averaging procedures are restarted.

In "Single" **measurement mode**, the first record in the I/Q data file is replayed.

For .iqx files that contain trigger markers, the record is replayed from the selected trigger marker to the next marker. To continue from the next marker, select "Cont".

In "Continuous" **measurement mode**, the entire measurement in the I/Q data file is replayed continuously, starting at the beginning.

Remote command:

`INITiate<n>[:IMMediate]` on page 548

### || Pause / Cont

"Pause" stops replaying data.

"Cont" continues replaying data (including any averaging procedures) at the current position.

In "Single" **measurement mode**, the next record in the I/Q data file is replayed.

For .iqx files that contain trigger markers, the record is replayed from the selected trigger marker to the next marker.

To restart averaging, use the ▶ ("Capture") function after stopping the last measurement.

Remote command:

`ABORt` on page 546

`INITiate<n>:CONMeas` on page 547

### →| Measurement mode (Single/Continuous)

Defines how data is replayed during the measurement.



→|"Single" A single record is replayed. To replay subsequent records, continue the measurement using the || ("Pause/Continue") function.

↻|"Continuous" The data from the I/Q file is replayed continuously until stopped.

Remote command:

`INITiate<n>:CONTinuous` on page 547

### File

Specifies the I/Q data file to be used for input.

Select a file from the list of recently loaded files, or select "." to open the "Recall I/Q Recording" dialog box (see [Chapter 8.3.4.1, "Loading the I/Q data file and essential measurement information"](#), on page 133).

**Note:** The data to be imported must be stored in a specified file format, see [Chapter E, "Reference: supported I/Q file formats"](#), on page 969.

Encrypted `.wv` files can also be used as input. Note, however, that traces resulting from encrypted file input cannot be exported or stored in a saveset (see [Chapter 8.3, "Recording and recalling captured I/Q data for evaluation"](#), on page 125 and [Chapter 8.5, "Storing graphical results to an ASCII file"](#), on page 144).

**Tip:**

You can load a file simply by selecting it in a file explorer and dragging it to the R&S VSE software. Drop it into the "Measurement Group Setup" window or the channel bar for any channel. The channel is automatically configured for file input, if necessary. If the file contains all essential information, the file input is immediately displayed in the channel. Otherwise, the "Recall I/Q Recording" dialog box is opened for the selected file so you can enter the missing information.

If the file contains data from multiple channels (e.g. from LTE measurements), it can be loaded to individual input sources, if the application supports them.

For more information see ["To import data via drag&drop"](#) on page 463.

Remote command:

`INSTRument:BLOCK:CHANnel[:SETTings]:FILE<fi>:AID` on page 526

`INSTRument:BLOCK:CHANnel[:SETTings]:FILE<fi>:IQTar` on page 530

`INSTRument:BLOCK:CHANnel[:SETTings]:FILE<fi>:CSV` on page 527

`INSTRument:BLOCK:CHANnel[:SETTings]:FILE<fi>:IQW` on page 532

`INSTRument:BLOCK:CHANnel[:SETTings]:FILE<fi>:MAT` on page 534

`INSTRument:BLOCK:CHANnel[:SETTings]:FILE<fi>:REPLace` on page 537

`INSTRument:BLOCK:CHANnel[:SETTings]:FILE<fi>:WV` on page 540

`INSTRument:BLOCK:FILE<fi>:CSV` on page 557

`INSTRument:BLOCK:FILE<fi>:IQTar` on page 559

`INSTRument:BLOCK:FILE<fi>:IQW` on page 560

`INSTRument:BLOCK:FILE<fi>:MAT` on page 563

`INSTRument:BLOCK:FILE<fi>:REPLace` on page 564

`INSTRument:BLOCK:FILE<fi>:WV` on page 565

**Channel ← File**

Determines which of the I/Q channels stored in the file is to be restored to the selected measurement channel. This is relevant only for files that contain data from multiple channels.

"Auto" imports all available channels in the file, if supported by the application.

Remote command:

`INSTRument:BLOCK:CHANnel[:SETTings]:FILE<fi>:STReam` on page 540

`INSTRument:BLOCK:CHANnel[:SETTings]:FILE<fi>:STReam:AUTO`

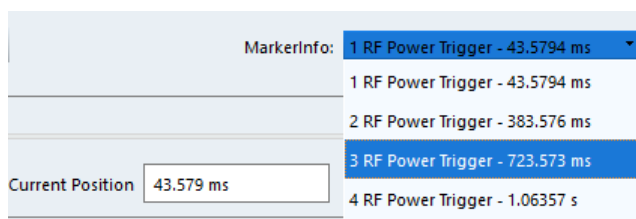
on page 539

To determine which data channels are available: `INSTRument:BLOCK:CHANnel[:SETTings]:FILE<fi>:STReam:LIST?` on page 540

**Marker Info**

(For `.iqx` files only:)

## Recording and recalling captured I/Q data for evaluation



Displays the trigger markers provided by the .iqx file. Select the required marker to start recalling the I/Q data from the trigger position. In Single mode, you can replay the data from one marker to the next using the "Cont" function.

Remote command:

TRIG:SEQ:SOUR MAIT, see [TRIGger\[:SEQuence\]:SOURce](#) on page 668

### Playback Settings

The data to be replayed can be restricted to a specified "Meas Time" within the stored measurement data.

Use the sliders or enter time values to define:

- **Start time:** the measurement time at which replay starts
- **Current Position:** the time in the measurement span that is currently being displayed
- **Stop time:** the measurement time at which replay stops

Remote command:

[INSTrument:BLOCK:CHANnel\[:SETTings\]:FILE<fi>:START:TIME](#)

on page 538

[INSTrument:BLOCK:CHANnel\[:SETTings\]:FILE<fi>:START:SAMPle](#)

on page 537

[INSTrument:BLOCK:CHANnel\[:SETTings\]:FILE<fi>:CURRent:TIME](#)

on page 529

[INSTrument:BLOCK:CHANnel\[:SETTings\]:FILE<fi>:CURRent:SAMPle](#)

on page 528

[INSTrument:BLOCK:CHANnel\[:SETTings\]:FILE<fi>:STOP:TIME](#) on page 539

[INSTrument:BLOCK:CHANnel\[:SETTings\]:FILE<fi>:STOP:SAMPle](#)

on page 538

### Overlap Settings

The overlap settings determine how successive records within one data file are replayed.

After the first record has been replayed, the specified percentage (x) of the next record is displayed together with the remaining data (meas time - x) from the previous record.

The larger the overlap, the slower the display is updated.

The behavior can be defined depending on the used trace mode. Note that the behavior is applied to all windows of the same channel.

"Averaging On:" Applies if any trace in the channel uses average, max hold or average trace mode.

"Averaging Off:" Applies if no averaging trace modes are used in the channel.

Remote command:

`INSTrument:BLOCK:CHANnel[:SETTings]:FILE<fi>:OVERlap:AVG:ON`  
on page 536

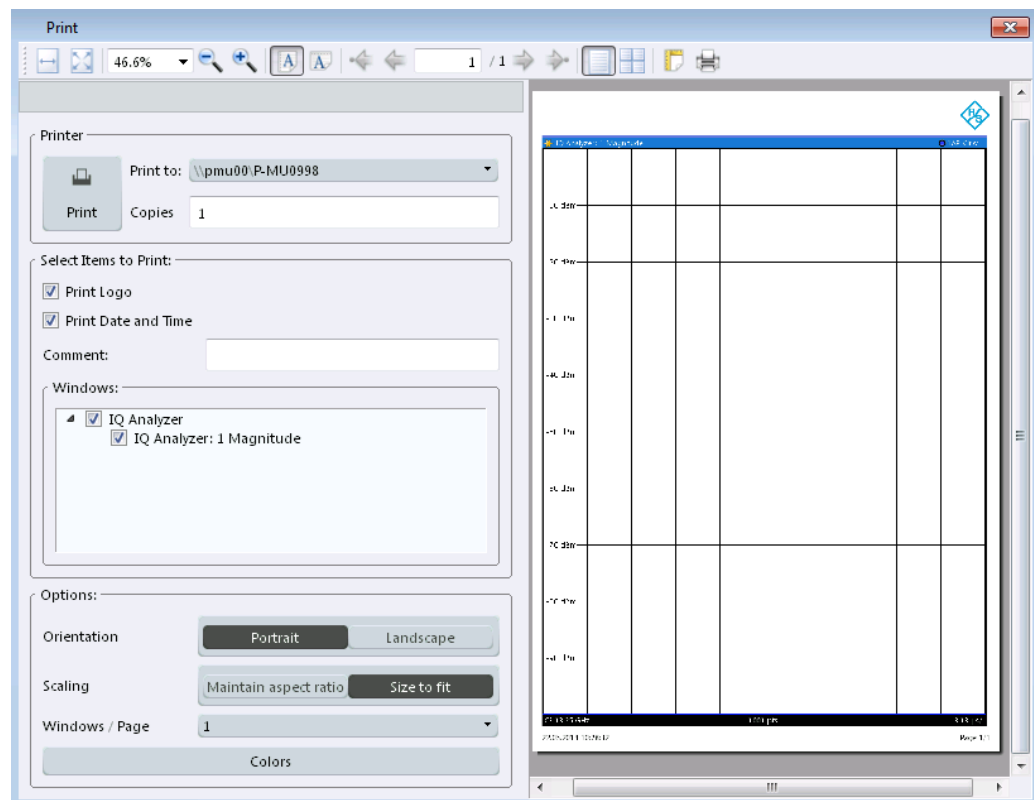
`INSTrument:BLOCK:CHANnel[:SETTings]:FILE<fi>:OVERlap:AVG:OFF`  
on page 535


## 8.4 Printing current measurement results

**Access:** "File" > "Print"

To document the graphical results and the most important settings for the currently performed measurement, you can create a hardcopy or screenshot of the current display.

Remote commands for these settings are described in [Chapter 13.7.6, "Storing or printing screenshots"](#), on page 900.



To print a screenshot of the current display with the current settings immediately, without switching to the "Print" dialog, use the  "Print" icon in the toolbar.

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Print Date and Time.....	143

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### **Print**

Starts printing all measurement results displayed on the screen: diagrams, traces, markers, marker lists, limit lines, etc.. Optionally, comments and the date and time are included at the bottom margin of the printout. All displayed items belonging to the software user interface (e.g. toolbars or dialog boxes) are not printed.

Remote command:

[HCOPY:ITEM:ALL](#) on page 903

[HCOPY:PRINT](#) on page 902

### **Print to**

Specifies a printer configured for the PC the R&S VSE software is installed on.

### **Copies**

Defines the number of copies to be printed.

### **Print Logo**

Activates/deactivates the printout of the Rohde & Schwarz company logo in the upper left corner.

Remote command:

[DISPlay:LOGO](#) on page 900

### **Print Date and Time**

Activates/deactivates the printout of the current date and time at the bottom of the screenshot.

Remote command:

[HCOPY:TDSTamp:STATe](#) on page 903

### **Comment**

Defines an optional comment to be printed with the screenshot of the display. Maximum 120 characters are allowed. 60 characters fit in one line. In the first line, at any point a manual line-feed can be forced by entering "@".

The comment is printed below the diagram area, but not displayed on the screen.

Remote command:

[HCOPY:ITEM:WINDow:TEXT](#) on page 903

### **Windows**

Selects the result display windows to be included in the screenshot. By default, all active windows are included.

### **Orientation**

Selects the page orientation of the printout: portrait or landscape

Remote command:

[HCOPY:PAGE:ORIENTATION](#) on page 903

### Scaling

Selects the scaling of the printout on the paper. A preview using the selected setting is displayed in the dialog box.

"Maintain aspect ratio"      The diagram is scaled only as required to fit the available paper size, while maintaining the original aspect ratio.

"Size to fit"      (Default) Scales the printout to fit the paper size optimally.

### Windows / Page

Defines the number of diagrams to be printed on a single page.

### Colors

Opens the "Print Color" dialog box to configure the colors for printing screenshots. For details, see ["Print Colors "](#) on page 150.

## 8.5 Storing graphical results to an ASCII file

**Access:** "Edit" > "Trace Export"

For some applications, the graphical measurement results can be stored to an ASCII file for evaluation using different software. If available, these functions ("Trace Export") are described in the trace configuration settings for the specific application.

## 8.6 Copying graphical results to the clipboard

**Access:** "Edit" > "Copy to Clipboard"

For some applications, the graphical measurement results in an individual diagram can be copied to the Windows clipboard in ASCII format for further processing. When you select this function, the result data in the currently selected window of the active measurement channel is copied to the clipboard. The data is equivalent to the ASCII data stored to a file using the "Trace Export" functions.



## 9 General software preferences and information

Some basic software settings can be configured independently of the selected operating mode or application. Usually, you will configure most of these settings initially when you set up the software according to your personal preferences or requirements and then only adapt individual settings to special circumstances when necessary. Some special functions are provided for service and basic system configuration.



### Recording, Network and Remote Settings

Recording settings are described in [Chapter 8, "Data management"](#), on page 116.

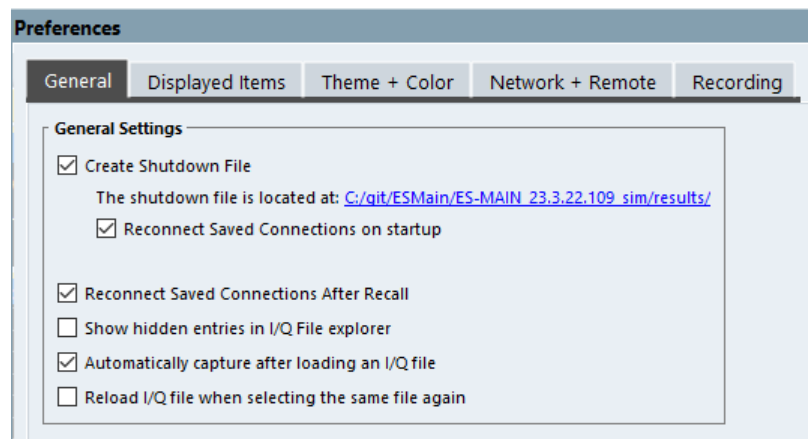
Settings for network and remote operation are described in [Chapter 12.4, "Network and remote control settings"](#), on page 498.

- [General software behavior](#)..... 145
- [Display settings](#)..... 147
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### 9.1 General software behavior

**Access:** "File" > "Preferences" > "General"

You can determine the behavior of the software when it is being shut down and restarted.



- [Create Shutdown File](#)..... 146
- [Reconnect saved connections on startup](#)..... 146
- [Reconnect saved connections after recall](#)..... 146
- [Show hidden entries in I/Q File Explorer](#)..... 146
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### Create Shutdown File

If activated, a shutdown file is created when the R&S VSE software is closed. The shutdown file contains information on the defined connections, as well as measurement sequence and channel configuration, such as which input sources are used for which measurement channels and which result displays are active.

When the R&S VSE software is started again, the previously stored configuration is restored. If you delete the shutdown file (see ["Deleting the Shutdown File"](#) on page 146), the R&S VSE software starts in the default configuration the next time.

The shutdown file is stored located at

```
C:\ProgramData\Rohde-Schwarz\VSE\\results\
Shutdown.dfl.
```

### Reconnect saved connections on startup

If activated, when the R&S VSE software is started, a connection is automatically established to all configured instruments (see [Chapter 8.2, "Storing and recalling measurement settings"](#), on page 117).

If deactivated, the instrument configurations are restored in the "Instruments" window; however, the connections must be established manually (see ["Connect / Disconnect / Reconnect"](#) on page 75).

This function is only available if a shutdown file is available (see ["Create Shutdown File"](#) on page 146).

### Reconnect saved connections after recall

If activated, when stored measurement settings are recalled, a connection is automatically established to all configured instruments (see [Chapter 8.2, "Storing and recalling measurement settings"](#), on page 117).

If deactivated, the instrument configurations are restored in the "Instruments" window; however, the connections must be established manually (see ["Connect / Disconnect / Reconnect"](#) on page 75).

This function is only available if a shutdown file is available (see ["Create Shutdown File"](#) on page 146).

### Show hidden entries in I/Q File Explorer

If enabled, files usually hidden by the Windows File Explorer are displayed in file selection dialog boxes used by the R&S VSE software. This is useful, for example, to access demo files provided by Rohde & Schwarz in the

```
C:\ProgramData\Rohde-Schwarz\VSE\\user\Demo\ directory.
```

If disabled, "hidden" files are not displayed for selection. However, if you enter the full path and file name, you can still access them.

### Deleting the Shutdown File

**Access:** "Start" > "All Programs" > "Rohde-Schwarz" > "VSE" > <version\_number> > "Delete Shutdown File"

In the Windows "Start" menu, an additional function is provided to delete the file that stores the current software configuration during shutdown, if available (see ["Create Shutdown File"](#) on page 146). If you delete the shutdown file, the R&S VSE software starts in the default configuration the next time the R&S VSE software is started again.

Deleting the shutdown file does not affect settings concerning the layout of the basic R&S VSE window. The display and position of toolbars and special tool windows are retained.

Deleting the shutdown file has the same effect as [Restoring All Default Settings \(Pre-set All\)](#) directly after startup.

### Defining a Startup Settings File

You can define a settings file other than the shutdown file to be restored during software startup, see [Chapter 8.2.2.4, "Startup recall settings"](#), on page 123.

### Automatically capture after loading an I/Q file

By default, data acquisition is performed automatically after an input file is loaded. However, sometimes performance issues can arise if you have to adapt the measurement settings for the input data after loading them. In this case, disable this option. Then use the ► "Capture" function to start data acquisition manually after loading the file and adapting the measurement settings.

Remote command:

`SYSTem:FILE:ACAPture` on page 541

### Reload I/Q file when selecting the same file again

By default, data acquisition is skipped if you select the same I/Q file as input data as you already loaded before. However, if you edit the file and do not rename it, you want to reload the meta data and re-evaluate the contents. In this case, enable this setting to perform a data acquisition even if the same file is selected again.

Remote command:

`SYSTem:FILE:SAMEload` on page 542

## 9.2 Display settings

Some general display settings are available regardless of the current application or operating mode.

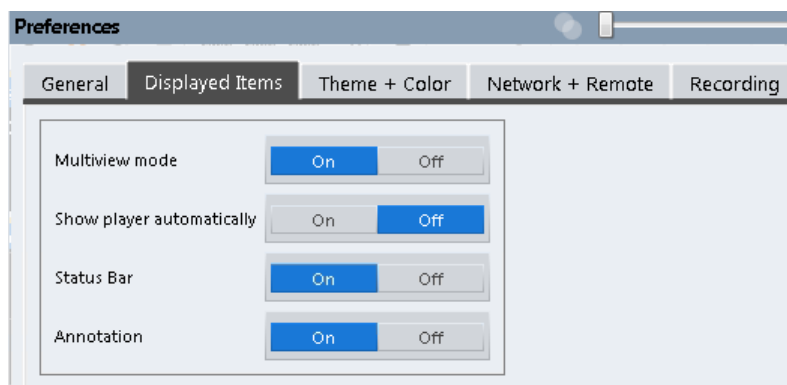
**Access:** "File" > "Preferences"

- [Displayed items](#)..... 147
- [Display theme and colors](#)..... 149
- [How to configure the colors for display and printing](#)..... 153

### 9.2.1 Displayed items

**Access:** "File" > "Preferences" > "Displayed Items"

Several elements on the screen display can be hidden or shown as required, for example to enlarge the display area for the measurement results.



<a href="#">Multiview mode</a> .....	148
<a href="#">Show Player Automatically</a> .....	148
<a href="#">Status Bar</a> .....	148
<a href="#">Diagram Footer (Annotation)</a> .....	148

### Multiview mode

By default, all windows for all active measurement channels are displayed at the same time on the screen (see also [Chapter 6.3.2, "Multiview mode"](#), on page 60).

Disable this option to display only the windows for a single measurement channel at a time. In this case, the windows for each channel are displayed in individual tabs. Only the windows for the currently focused channel are visible. To switch between channels, select the corresponding tab.

Remote command:

[DISPlay:FORMat](#) on page 609

### Show Player Automatically

If enabled, the R&S VSE Player is displayed automatically if a file is selected as the input source of a measurement channel (see ["Assigning the Channel Input Source"](#) on page 94).

### Status Bar

The status bar beneath the diagram indicates the global software settings, the software status and any irregularities during measurement or display.

Some of the information displayed in the status bar can be queried from the status registry via remote commands, see [Chapter 13.10.1, "Using the status register"](#), on page 918.

Remote command:

[DISPlay:SBAR\[:STATe\]](#) on page 908

### Diagram Footer (Annotation)

The diagram footer beneath the diagram contains information on the x-axis of the diagram display, such as the current center frequency and span settings, the displayed span per division and the number of measurement points.

Remote command:

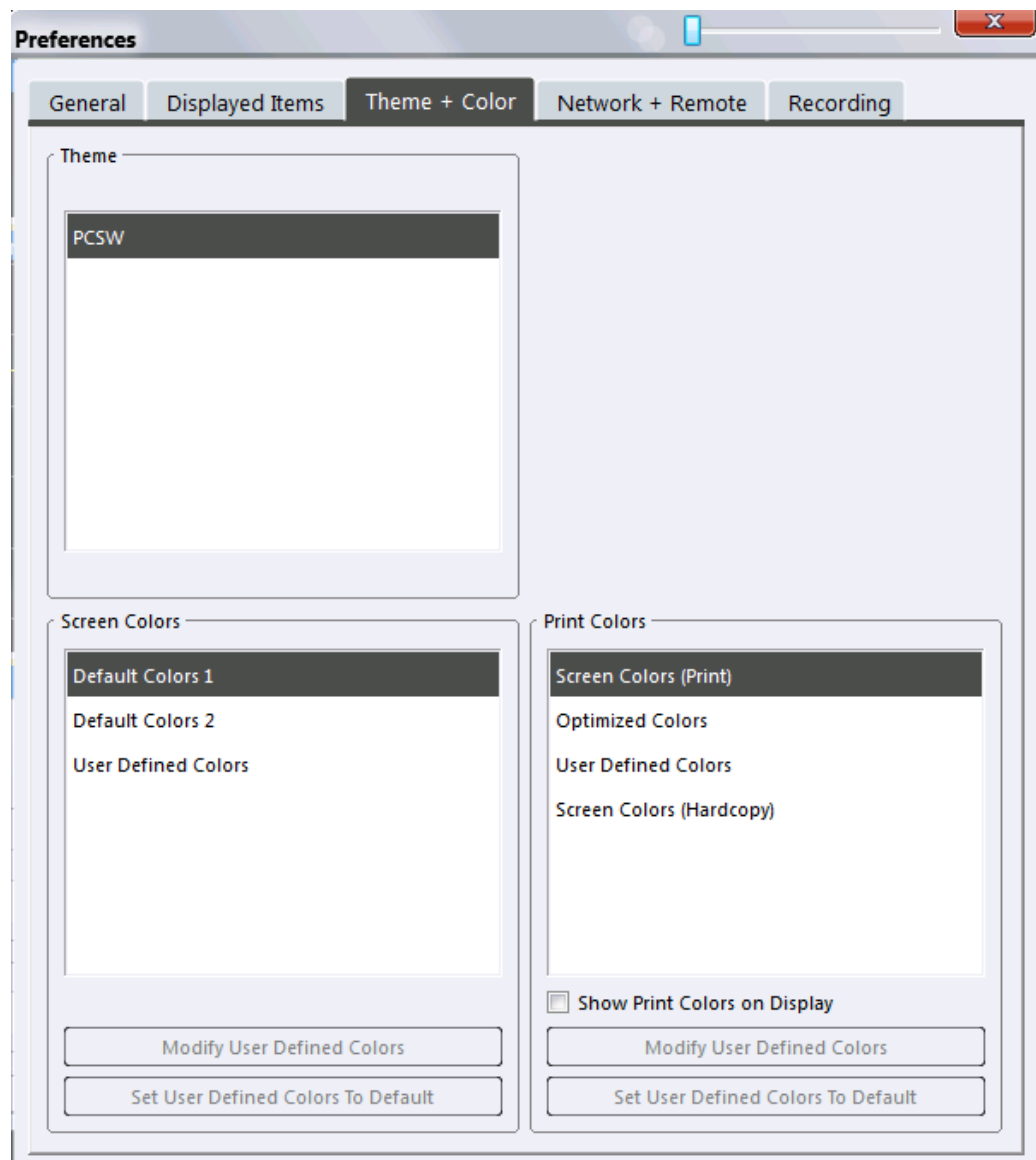
[DISPlay:ANNotation:FREQuency](#) on page 908

## 9.2.2 Display theme and colors

**Access:** "File" > "Preferences" > "Theme + Color" .

You can configure the used colors and styles of display elements on the screen.

For step-by-step instructions see [Chapter 9.2.3, "How to configure the colors for display and printing"](#), on page 153.



<a href="#">Theme</a> .....	150
<a href="#">Screen Colors</a> .....	150
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L Selecting the Object.....	151
L Predefined Colors .....	152
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### Theme

The theme defines the colors and style used to display softkeys and other screen objects.

The default theme is "PCSW" .

Remote command:

`DISPlay:THEMe:SElect` on page 910

### Screen Colors

Two different color sets are provided by the software, a third user-defined set can be configured.

The default color schemes provide optimum visibility of all screen objects when regarding the screen from above or below. Default setting is "Default Colors 1" .

If "User Defined Colors" is selected, a user-defined color set can be defined (see ["Defining User-specific Colors"](#) on page 152).

Remote command:

`DISPlay:CMAP<it>:DEFault<ci>` on page 909

### Print Colors

Defines the color settings used for printout.

In addition to the predefined settings, a user-defined color set can be configured (see ["Defining User-specific Colors"](#) on page 152).

If "Show Print Colors on Display" is activated, the currently selected print colors are displayed as a preview for your selection.

Gui setting	Description	Remote command
"Optimized Colors"	Selects an optimized color setting for the printout to improve the visibility of the colors (default setting). Trace 1 is blue, trace 2 black, trace 3 green, and the markers are turquoise. The background is always printed in white and the grid in black.	<code>HCOP:CMAP:DEF2</code>
"Screen Colors (Print)"	Selects the current screen colors for the printout. The background is always printed in white and the grid in black.	<code>HCOP:CMAP:DEF1</code>
"Screen Colors (Screenshot)"	Selects the current screen colors without any changes for a screenshot.	<code>HCOP:CMAP:DEF4</code>
"User Defined Colors"	Selects the user-defined color setting.	<code>HCOP:CMAP:DEF3</code>

Remote command:

[HCOPY:CMAP<it>:DEFault<ci>](#) on page 901

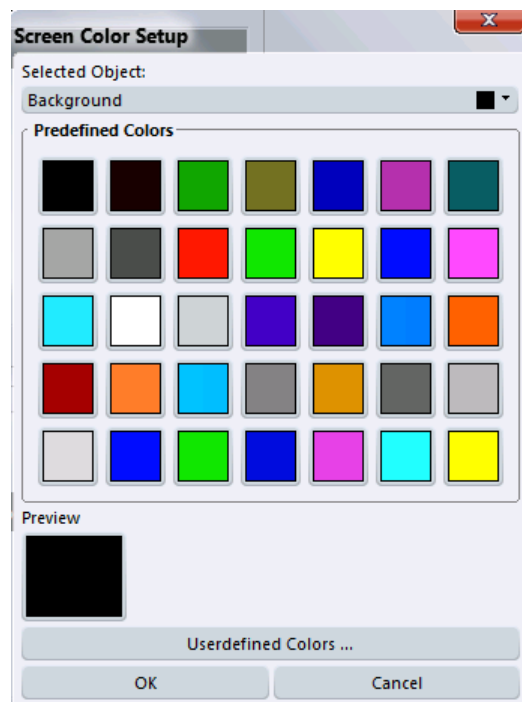
### Showing Print Colors on Display

Temporarily shows the currently selected print colors on the screen display. This function can be used as a preview for printing.

### Modifying User-Defined Color Assignments

You can configure the colors used to display and print individual screen objects according to your specific requirements.

The colors are configured in the (identical) "Screen Color Setup" / "Printer Color Setup" dialog boxes.



### Selecting the Object ← Modifying User-Defined Color Assignments

Selects the object for which the color is to be defined. Colors can be defined for the following objects:

- Background
- Grid
- Individual traces
- Display lines
- Limit lines and check results
- Markers and marker information

Remote command:

Each object is assigned to a specific suffix of the CMAP commands, see [Chapter 13.8.4, "CMAP suffix assignment"](#), on page 910.

**Predefined Colors ← Modifying User-Defined Color Assignments**

Displays the available colors from the predefined color set that can be used for the selected object.

Remote command:

[HCOPY:CMAP<it>:PDEFined](#) on page 902

**Preview ← Modifying User-Defined Color Assignments**

Indicates the currently selected color that will be used for the selected object.

**Defining User-specific Colors**

In addition to the colors in the predefined color set you can configure a user-specific color to be used for the selected object.

When you select "Userdefined Colors..." , the set of predefined colors is replaced by a color palette and color configuration settings.



The color palette allows you to select the color directly. The color settings allow you to define values for tint, saturation and brightness.

Remote command:

[HCOPY:CMAP<it>:HSL](#) on page 901

**Restoring the User Settings to Default Colors**

In addition to the predefined color settings, a user-defined setting can be configured. By default, the same settings as defined in "Default Colors 1" are used. They can then be modified according to user-specific requirements (see "[Modifying User-Defined Color Assignments](#)" on page 151).

The "Set to Default" function restores the original default settings for the user-defined color set. You can select which of the three default settings are restored.



Remote command:

`DISPlay:CMAP<it>:PDEFined` on page 910

### 9.2.3 How to configure the colors for display and printing

You can configure the style and colors with which various screen objects are displayed or printed.

#### To select a color set

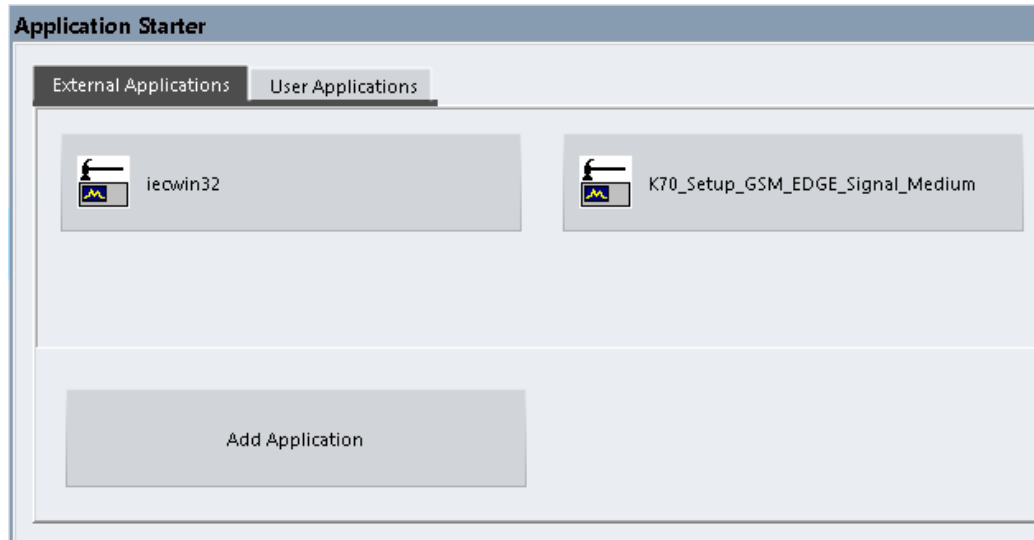
1. Select "File" > "Preferences" > "Theme + Color".
2. In the "Screen Colors" area, select a predefined set of colors to be used for screen display, or select "User Defined Colors" to configure the color set yourself.
3. In the "Print Colors" area, select a predefined set of colors to be used for printing screenshots, or select "User Defined Colors" to configure the color set yourself. Activate the "Show Print Colors on Display" option to see a preview of the print colors.

#### To configure a user-defined color set

1. In the "Theme + Color" tab of the "Preferences" dialog box select "User Defined Colors" either for the screen or the print colors.
2. Select "Modify User Defined Colors".  
The "Screen Color Setup" dialog box is opened.
3. From the "Selected Object" list, select the object to which you want to assign a color.
4. Select a color from the "Predefined Colors" or select the "Userdefined Colors..." button to define a different color.  
The "Preview" area indicates the currently selected color.
5. To assign a user-specific color to the selected object, do one of the following:
  - Select the color from the palette.
  - Enter values for the "Tint", "Saturation", and "Brightness".  
**Note:** In the continuous color spectrum ("Tint") red is represented by 0% and blue by 100%.
  - Enter an "ARGB" value in hexadecimal format.
6. Select the next object to which you want to assign a color from the "Selected Object" list and assign a color as described.  
Repeat these steps until all objects you want to configure have been assigned a color.
7. Select "OK" to close the dialog box and apply the colors to the assigned objects.

## 9.3 Application starter

The "Application Starter" allows you to start any external application directly from the R&S VSE firmware.



This is useful, for example, for the following scenarios:

- Starting analysis software for the measurement data, such as R&S Vector Signal Analysis (VSA) software
- Starting the provided auxiliary tool IECWIN to test a remote command script that was created using the SCPI Recorder, for example
- Start an application to send the measurement results to a connected PC or cloud
- Start any user-defined application script to provide additional functionality to the firmware, such as measurement-specific auto leveling

### 9.3.1 Application starter functions



**Access:** Toolbar

The "Application Starter" dialog box provides different tabs for different types of applications:

- "External Applications": contains applications that are provided with, but are not part of the R&S VSE, such as auxiliary tools
- "User Applications": contains any user-defined applications that can be accessed from the R&S VSE, such as command scripts
- "R&S Applications": contains applications predefined by Rohde & Schwarz to enhance the functionality of your R&S VSE

You can add further applications to the "User Applications" and "External Applications" tabs as you like. They are separated only to improve usability if you have a large number of applications. You cannot edit the "R&S Applications" tab.

The application starter provides the following functions.

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L Working Directory.....	157
L Display Name.....	157
L Choose Icon.....	157
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Add to Toolbar.....	157
Remove from Toolbar.....	157

### Application buttons

Start the selected application directly on the R&S VSE. Any application windows, outputs, or results are displayed on the R&S VSE screen.

Remote command:

`SYSTEM:PLUGin:APPStarter:EXECute` on page 913

### Add Application/ Change Application

Opens the "Add Application"/ "Change Application" dialog box. Both dialog boxes are identical.



This function is not available for applications on the "R&S Applications" tab.

Remote command:

For data security reasons, executable applications cannot be added to the Application Starter remotely.

### Drive/ Path/ File Name ← Add Application/ Change Application

Defines the path and file name of the application.

### File Type ← Add Application/ Change Application

Defines a filter for the type of application, for example an `.exe`, `.inp` (IECWIN script) or other file.

If you select a file type other than `.exe`, the R&S VSE searches for the appropriate application to start your file with.

For `.inp` files, for example, the IECWIN tool provided by Rohde & Schwarz to execute scripts is preselected as the application to start.

### Select ← Add Application/ Change Application

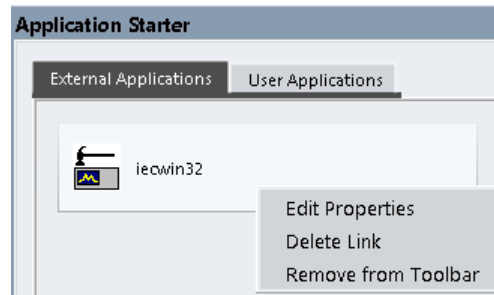
Closes the "Add Application"/ "Change Application" dialog box and opens the "Edit Properties" dialog box.

Remote command:

[SYSTem:PLUGIn:APPStarter:SElect](#) on page 914

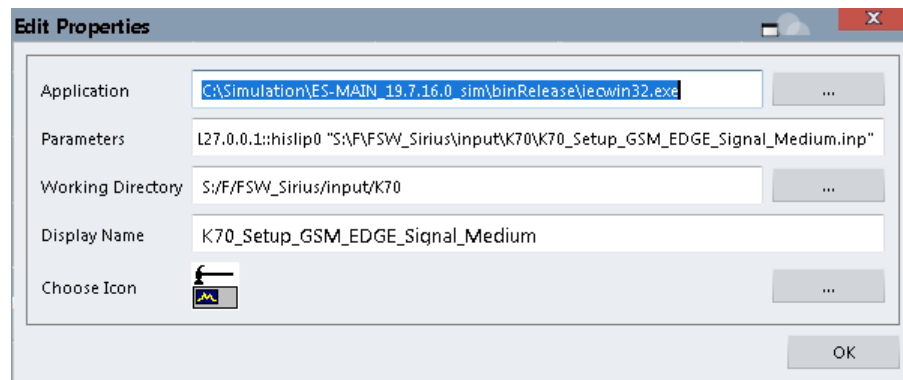
### Edit Properties

**Access:** Application button context menu



Defines the display and behavior of the selected application.

This function is not available for applications on the "R&S Applications" tab.



#### Tip:

For `.inp` files, the IECWIN tool provided by Rohde & Schwarz to execute scripts is preselected as the application to start. The script is defined as the parameter for the application. The file name without the extension is used as the application name. The IECWIN icon is selected as the application icon.

Remote command:

[SYSTem:PLUGIn:APPStarter:SElect](#) on page 914

#### Application ← Edit Properties

Indicates the application selected in the "Add Application" dialog box. Provides access to the [Add Application/ Change Application](#) dialog box to change the application.

Remote command:

[SYSTem:PLUGIn:APPStarter:SElect](#) on page 914

#### Parameters ← Edit Properties

Defines parameters that are provided with the application for execution, for example arguments for a custom script.

Remote command:

[SYSTem:PLUGIn:APPStarter:PARams](#) on page 914

**Working Directory ← Edit Properties**

Defines the working directory used by the selected application.

Remote command:

[SYSTem:PLUGIn:APPStarter:DIRectory](#) on page 913

**Display Name ← Edit Properties**

Defines the name of the application as displayed on the button in the "Application Starter" dialog box.

Remote command:

[SYSTem:PLUGIn:APPStarter:NAME](#) on page 914

**Choose Icon ← Edit Properties**

Defines an icon for the application to be displayed on the button in the "Application Starter" dialog box and optionally in the toolbar.

Remote command:

[SYSTem:PLUGIn:APPStarter:ICON](#) on page 913

**Delete Link**

**Access:** Application button context menu

Removes the application from the "Application Starter" dialog box and the toolbar.

This function is not available for applications on the "R&S Applications" tab.

Remote command:

[SYSTem:PLUGIn:APPStarter:DELeTe](#) on page 912

**Add to Toolbar**

**Access:** Application button context menu

Inserts the specified application icon in the R&S VSE toolbar.

**Remove from Toolbar**

**Access:** Application button context menu

Removes the application icon from the R&S VSE toolbar.

### 9.3.2 How to work with the application starter

**To start an application**

1. Select the Application Starter icon from the toolbar.  
The "Application Starter" dialog box is displayed.
2. Select the required application from the dialog box.  
The application is started and displayed on the R&S VSE screen.

### To return to the R&S VSE



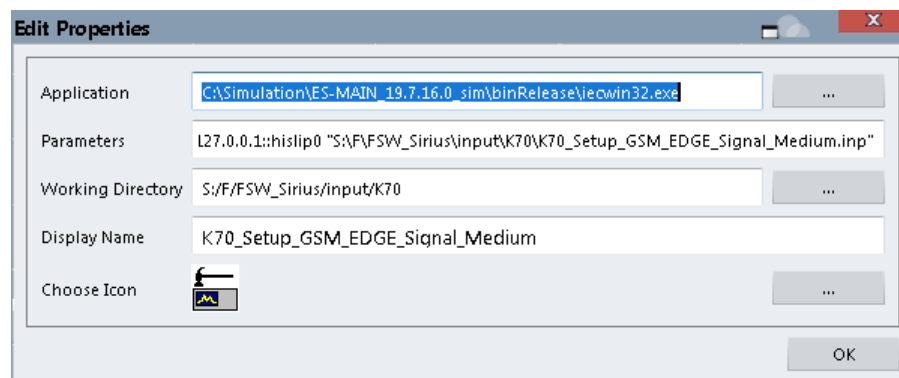
1. If no external keyboard is connected to the instrument, select the online keyboard icon.
2. Press [Alt]+[Tab].

### To add an application to the Application Starter



1. Select the Application Starter icon from the toolbar.  
The "Application Starter" dialog box is displayed.
2. Select "Add Application".
3. Select the file type of the application to filter the file selection in the dialog box.
4. Select or enter the file name of the required application.
5. Select "Select".

The "Edit Properties" dialog box is displayed.



6. Optionally, define parameters to be provided to the application.
7. Define the working directory to be used by the application.
8. Define the name to be displayed on the button in the "Application Starter" dialog box.
9. Select an icon to be displayed on the button in the "Application Starter" dialog box and optionally in the toolbar.
10. Select "OK".  
The application is available in the Application Starter.
11. Optionally, add an icon for the application to the toolbar.

### To add an icon for the application to the toolbar



1. Select the Application Starter icon from the toolbar.  
The "Application Starter" dialog box is displayed.
2. Right-click the application button in the Application Starter.

3. Select "Add to Toolbar".

## 9.4 Software information and support

Some general software functions are available concerning optional functionality, licenses, service functions, or system messages. These settings are available from the "Help" menu.

- [Licensing, versions and options](#)..... 159
- [R&S support information](#)..... 163
- [System messages](#)..... 164

### 9.4.1 Licensing, versions and options

**Access:** "Help" > "License"

Information on the R&S VSE software version and additional licensed options is provided in the "Versions + Options" dialog box. The unique Rohde & Schwarz device ID is also indicated here, as it is required for license and option administration.

Finally, an open source acknowledgment is available at the bottom of the table.



To simply find out the version of the R&S VSE software, select "Help > About".

State	Item	Option	Version	License
	R&S Device ID		1310.0002K02-900014-ff	
	R&S VSE Enterprise Edition		2.00-21.8.5.0 Beta (2021-08-06)	
	Time Control Management			active
	Smart Card Service			installed
	Pulse Measurements	K6		permanent, maintenance until 2026-01-25
...	Pulse Phased Array Measurements	K6A		floating, maintenance until 2026-01-25
	Signal Analyzer Analog	K7		permanent, maintenance until 2026-01-25
	GSM/EDGE/EDGE Evo/VAMOS Measurements	K10		permanent, maintenance until 2026-01-25
...	Amplifier Measurements	K18		floating, maintenance until 2026-01-25
...	Direct DPD for Amplifier Measurements	K18D		floating, maintenance until 2026-01-25
...	Frequency Response Measurements	K18F		floating, maintenance until 2026-01-25
...	Memory Polynomial DPD	K18M		floating, maintenance until 2026-01-25
	Transient Analysis	K60		permanent, maintenance until 2026-01-25
	Transient Chirp Measurements	K60C		permanent, maintenance until 2026-01-25
	Transient Hop Measurements	K60H		permanent, maintenance until 2026-01-25
	Vector Signal Analysis	K70		permanent, maintenance until 2026-01-25

Install Option      Install Option by XML      Setup Floating License Server

**Remote commands:**

[DIAGnostic:SERVICE:VERSInfo?](#) on page 905

- [Obtaining copyright information on used third-party sources](#)..... 160
- [License management](#)..... 160

**9.4.1.1 Obtaining copyright information on used third-party sources****Open Source Acknowledgment: Open**

Displays a PDF file containing information on open source code used by the R&S VSE software.

**9.4.1.2 License management**

After installing optional firmware, you must install or enable its license.

**Expired option licenses**

If a timed option license is about to expire, a message box is displayed to inform you. You can then use the "Install Option" function to enter a new license key or you can enable a new floating license.

If a timed option license has already expired, a message box appears for you to confirm. In this case, the optional functions and applications are unavailable until you enter a new license key or enable a floating license.

<a href="#">Install Option</a> .....	160
<a href="#">Install Option by XML</a> .....	160
<a href="#">License state (.....)</a> .....	161
L <a href="#">Enabling/disabling floating licenses</a> .....	161
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L <a href="#">Open License Server Manager</a> .....	163

**Install Option**

Opens an edit dialog box to enter the license key for the option that you want to install.

Only user accounts with administrator rights are able to install options.

**Install Option by XML**

Opens a file selection dialog box to install an additional (permanently assigned) option license to the R&S VSE using an XML file. Enter or browse for the name of an XML file that contains the option license key and select "Select".

Only user accounts with administrator rights are able to install options.



**License state ( )**

Provides functions to enable or disable a floating license for an installed option. These functions are only available if a floating license server is configured (see "[Setup Floating License Server](#)" on page 162).

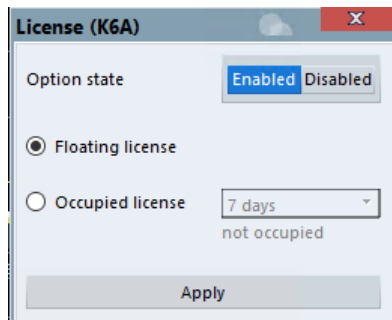
Remote command:

`SYSTem:OPTion:LIcense [:LIST] ?` on page 906

**Enabling/disabling floating licenses ← License state ( )**

If a floating license server is configured (see "[Setup Floating License Server](#)" on page 162), you can enable or disable a license for the selected option in the "License" dialog box. Two different types of licenses are available (see "[Common floating license](#)" on page 20).

You cannot change a license state that is currently in use by an application. The change in license usage becomes effective when you select "Apply". Restarting the firmware is not necessary.



"Enabled"

If enabled, the license is retrieved from the license server when you select the application in the "Mode" dialog box.

Some options are available for multiple applications, such as power sensor support. In this case, the license is retrieved if you select any application that supports the option.

For options with suboptions, e.g. K91 with suboptions K91AC, K91N, all suboptions are automatically activated together with the main option by default.

"Disabled"

If the license is disabled, it is not retrieved from the server when you open the main application. The option is grayed out in the "Versions + Options" dialog box. Disabling licenses is useful for suboptions (e.g. K91N) or options that are available for multiple applications.

"Occupied license" period

Defines the time period an occupied license is stored locally after it is retrieved from the license server. A time period between 1 and 7 days is available. The license cannot be returned or disabled manually before it expires, but it can be extended.

Remote command:

`SYSTem:OPTion:LIcense [:LIST]` on page 906

### Setup Floating License Server

To use floating licenses, you must set up one or more floating license servers. The R&S VSE software checks the configured servers for available floating licenses when it starts up. Only options for which licenses are found are available in the R&S VSE. After adding new options on the floating license server, you must restart the R&S VSE software before using them.

For details on the floating license concept, see [Chapter 3.4, "Using a license server"](#), on page 20.

For details on configuring floating license servers, see the [R&S®License Server - Managing Floating Licenses - user manual](#).

IP / Host name	Port	Description
amu818.rsint.net	9443	Central License Server (added by sim_device.py) (alias: Central License Server 01)
amu819.rsint.net	9443	Central License Server (added by sim_device.py) (alias: Central License Server 02)

Indicates the currently configured floating license servers. All enabled servers are searched for floating licenses when the R&S VSE software starts. Note that changes to the list of servers only take effect after the R&S VSE software and the local License Manager are restarted. To abort any changes, simply close the dialog box.

#### IP / Host name ← Setup Floating License Server

IP address or host name of the server. Ask your administrator for details.

#### Port ← Setup Floating License Server

Port information for the server. The default port is 9443.

Ask your administrator for details.

#### Description ← Setup Floating License Server

Optional description of the configured server.

#### Add Server ← Setup Floating License Server

Opens a dialog to add a floating license server. The server must be connected to the same network as the R&S VSE software, and set up as described in the [R&S®License Server - Managing Floating Licenses - user manual](#).

Configure the [IP / Host name](#) and [Port](#).

The license server automatically restarts. To update the server list and the list of available licenses, you must also restart the R&S VSE software.

**Remove Server ← Setup Floating License Server**

Removes the selected server permanently. To update the server list and the list of available licenses, you must also restart the R&S VSE software.

**Refresh List ← Setup Floating License Server**

Updates the list of floating license servers, for example after someone changes the configuration via the web application instead of the R&S VSE dialog.

**Open License Server Manager ← Setup Floating License Server**

Displays the R&S®License Server Manager window. Press [F1] or select "Help" > "Show Help" in this window to obtain more information on managing floating licenses.

## 9.4.2 R&S support information

**Access:** "Help" > "Support" > "R&S Support"

In case of errors you can store useful information for troubleshooting and send it to your Rohde & Schwarz support center.



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### Create R&S Support Information

Creates a \*.zip file with important support information. The \*.zip file contains the system configuration information ("Device Footprint" ), the current eeprom data and a screenshot of the screen display.

This data is stored to the following directory on the PC the R&S VSE software is installed on:

```
C:\ProgramData\Rohde-Schwarz\VSE\<<version_no>\user.
```

The file name consists of the unique device ID and the current date and time of the file creation.

Example: VSE\_1310.0002K02-900014-if\_20140807\_091003.zip.

If you contact the Rohde & Schwarz support to get help for a certain problem, send these files to the support in order to identify and solve the problem faster.

For more helpful information for support, see also ["To create Windows event log files"](#) on page 952

Remote command:

[DIAGnostic:SERvice:SINFo?](#) on page 904

### Save Device Footprint

Creates an \*.xml file with licensing information on installed software versions.

This data is stored to the following directory on the PC the R&S VSE software is installed on:

```
C:\ProgramData\Rohde-Schwarz\VSE\<<version_no>\devicedata\xml\.
```

It is also included in the `service.zip` file.

The file name consists of the unique device ID and the current date and time of the file creation, e.g.

```
DeviceFootprint_1310.0002K02-900014-if_2014-08-07T06-58-29.xml.
```

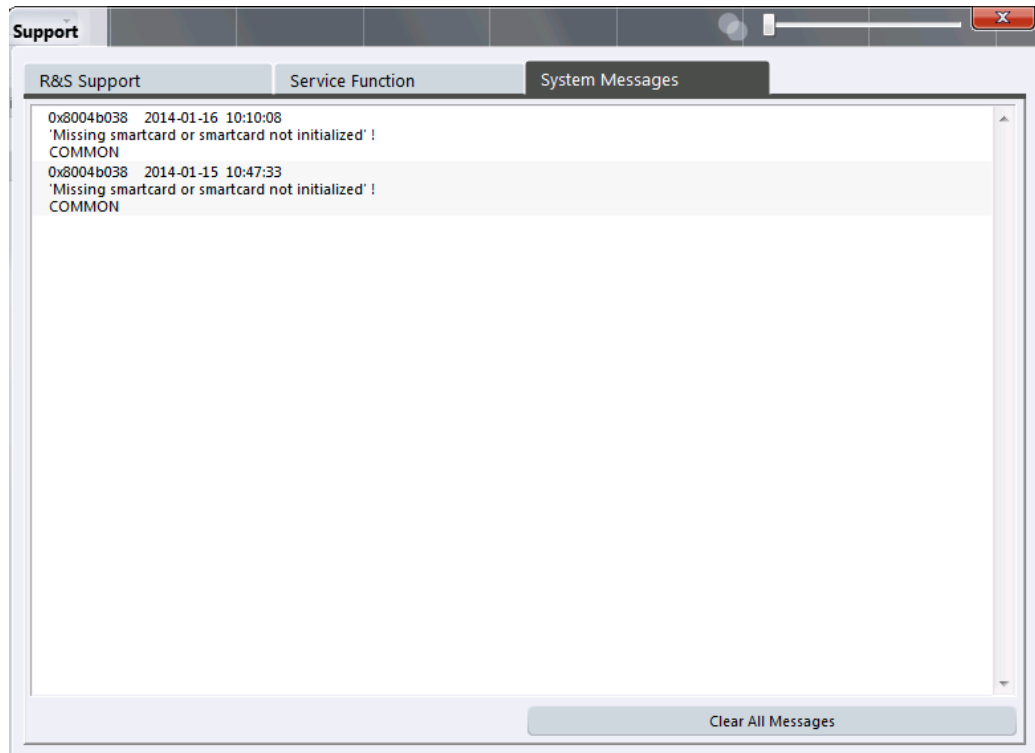
Remote command:

[SYSTEM:DFPrint](#) on page 906

## 9.4.3 System messages

**Access:** "Help" > "Support" > "System Messages"

Any messages that are displayed in the status bar during operation can also be displayed in the "System Messages" tab of the "Support" window. The messages are displayed in the order of their occurrence; the most recent messages are placed at the top of the list. Messages that have occurred since you last visited the system messages tab are marked with an asterisk '\*'.



### Clear All Messages

If the number of error messages exceeds the capacity of the error buffer, "Message buffer overflow" is displayed. To clear the message buffer use the "Clear All Messages" button.

The following information is available:

No	device-specific error code
Date/Time	date and time of the occurrence of the message
Message	brief description of the message
Component	hardware messages: name of the affected module
	software messages: name of the affected application

Remote command:

`SYSTEM:ERRor:CLEar:ALL` on page 921

## 10 I/Q analyzer measurements

### 10.1 Measurements and result displays for the I/Q analyzer

The I/Q Analyzer analyzes the I/Q data that was captured by the connected instrument or imported to the R&S VSE in various different result displays. By default, a basic I/Q measurement is performed on the I and Q components of the data.

Alternatively, the I/Q Analyzer can also perform measurements on the captured I/Q data in the frequency domain. In order to do so, the I/Q Analyzer performs an FFT sweep on the captured I/Q data, providing power vs frequency results. This data is then used for the common frequency or time domain measurements provided by a common spectrum analyzer, such as ACLR or OBW.



#### Maximum span for RF measurements

The maximum span for RF measurements is restricted to the maximum usable I/Q bandwidth of the connected instrument.

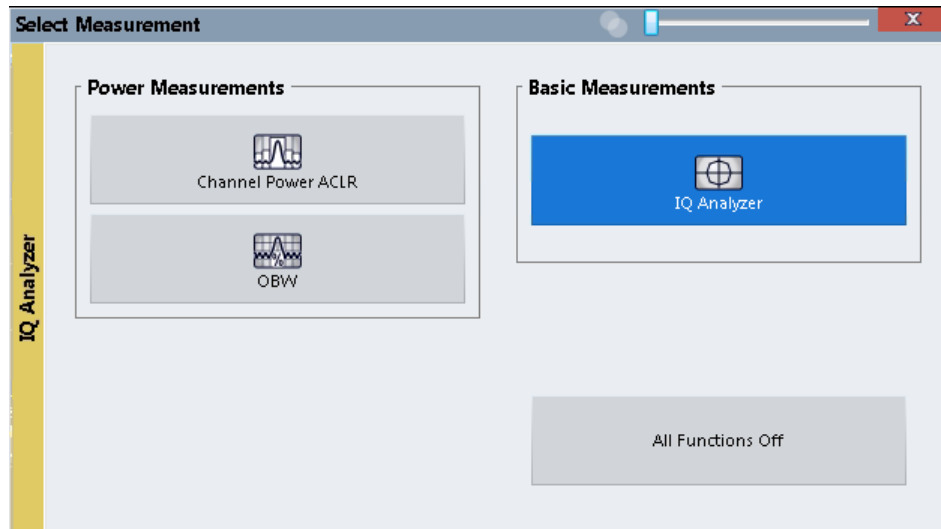
For detailed information on these measurements see:

- [Chapter 10.4.1, "Channel power and adjacent-channel power \(ACLR\) measurement"](#), on page 263
- [Chapter 10.4.2, "Occupied bandwidth measurement \(OBW\)"](#), on page 311
- [Chapter 10.4.3, "Spectrum emission mask \(SEM\) measurement"](#), on page 317
- [Chapter 10.4.4, "Time domain power measurement"](#), on page 360
- [Selecting the measurement](#)..... 166
- [Result displays for basic I/Q measurements](#)..... 167
- [Result displays in the time and frequency domain](#)..... 174

#### 10.1.1 Selecting the measurement

**Access:** "Meas Setup" > "Select Measurement"

Which type of measurement is to be performed - conventional I/Q data analysis or a time or frequency domain measurement - is selected in the "Select Measurement" dialog box.



For details on RF measurements see:

- [Chapter 10.4.1, "Channel power and adjacent-channel power \(ACLR\) measurement"](#), on page 263
- [Chapter 10.4.2, "Occupied bandwidth measurement \(OBW\)"](#), on page 311
- [Chapter 10.4.3, "Spectrum emission mask \(SEM\) measurement"](#), on page 317

#### Remote command:

##### ACLR, OBW:

`CALCulate<n>:MARKer<m>:FUNCTION:POWER<sb>:SElect` on page 725

`CALCulate<n>:MARKer<m>:FUNCTION:POWER<sb>[:STATe]` on page 726

##### SEM:

`[SENSe:]SWEep:MODE` on page 744

`INITiate<n>:ESpectrum` on page 744

##### All Functions Off

Switches off all RF measurement functions and returns to conventional I/Q data analysis.

Remote command:

`CALC:MARK:FUNC:POW:STAT OFF`

## 10.1.2 Result displays for basic I/Q measurements

The following result displays are available for (default) basic I/Q measurements.



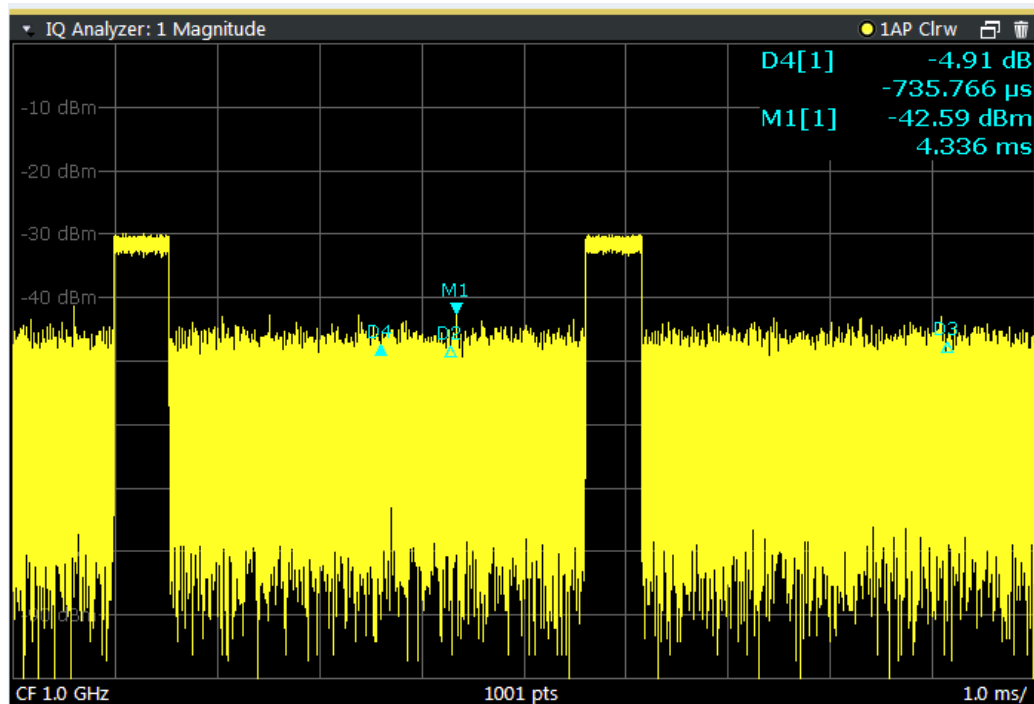
### Spectrograms

Spectrograms are not configured as separate result displays, but as a subwindow of an existing I/Q Analyzer Spectrum or Magnitude window. They are activated and deactivated in the "Spectrogram" tab of the "Traces" settings (see "[Spectrogram settings](#)" on page 399).

Magnitude .....	168
Spectrum .....	168
I/Q-Vector .....	169
Real/Imag (I/Q) .....	170
Statistic APD .....	170
Statistic CCDF .....	171
Phase vs. Time .....	173
Marker Table .....	173

### Magnitude

Shows the level values in time domain.



Remote command:

LAY:ADD:WIND? '1', RIGH, MAGN, see [LAYout:ADD\[:WINDow\]?](#) on page 603

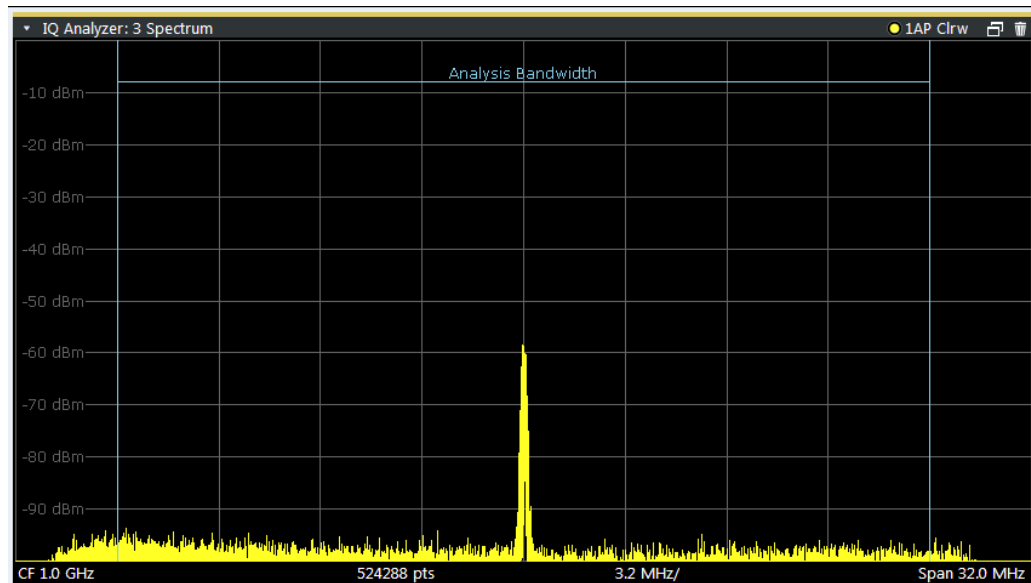
Results:

[TRACe<n>\[:DATA\]?](#) on page 875

### Spectrum

Displays the frequency spectrum of the captured I/Q samples.





**Tip:** You can analyze the levels per frequency over time using a Spectrogram, see ["Working with spectrograms"](#) on page 387.

The specified [Analysis Bandwidth](#) is indicated by vertical blue lines.

Remote command:

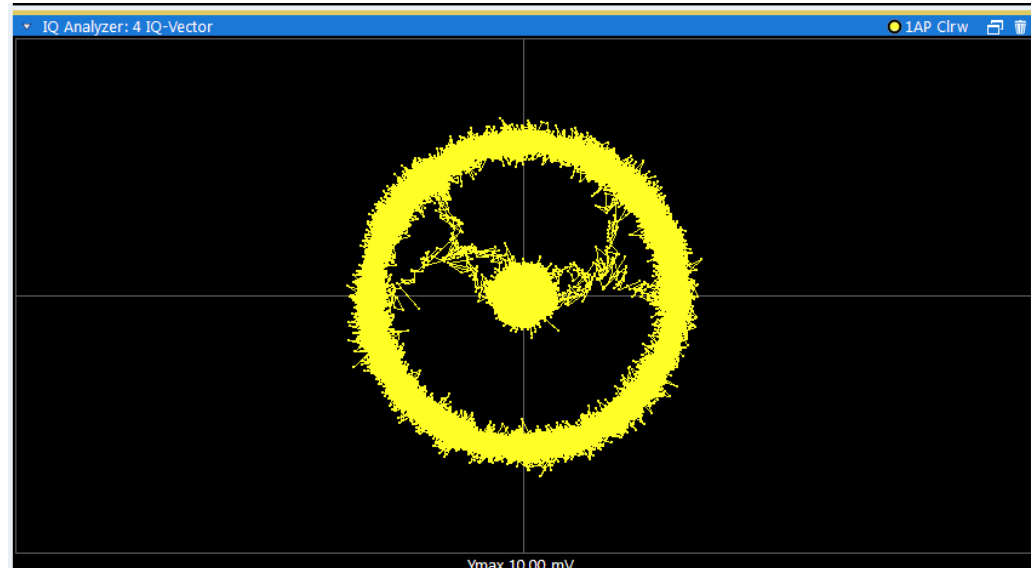
LAY:ADD:WIND? '1', RIGH, FREQ, see [LAYout:ADD\[:WINDow\]?](#) on page 603

Results:

[TRACe<n>\[:DATA\]?](#) on page 875

### I/Q-Vector

Displays the captured samples in an I/Q-plot. The samples are connected by a line.



**Note:** For the I/Q vector result display the number of I/Q samples to record ("Record Length") is automatically set to the number of measurement points. The number of measurement points cannot be changed for this result display.

Remote command:

LAY:ADD:WIND? '1', RIGH, VECT, see [LAYout:ADD\[:WINDow\]?](#) on page 603

Results:

[TRACe<n>\[:DATA\]?](#) on page 875

### Real/Imag (I/Q)

Displays the I and Q values in separate diagrams.



Remote command:

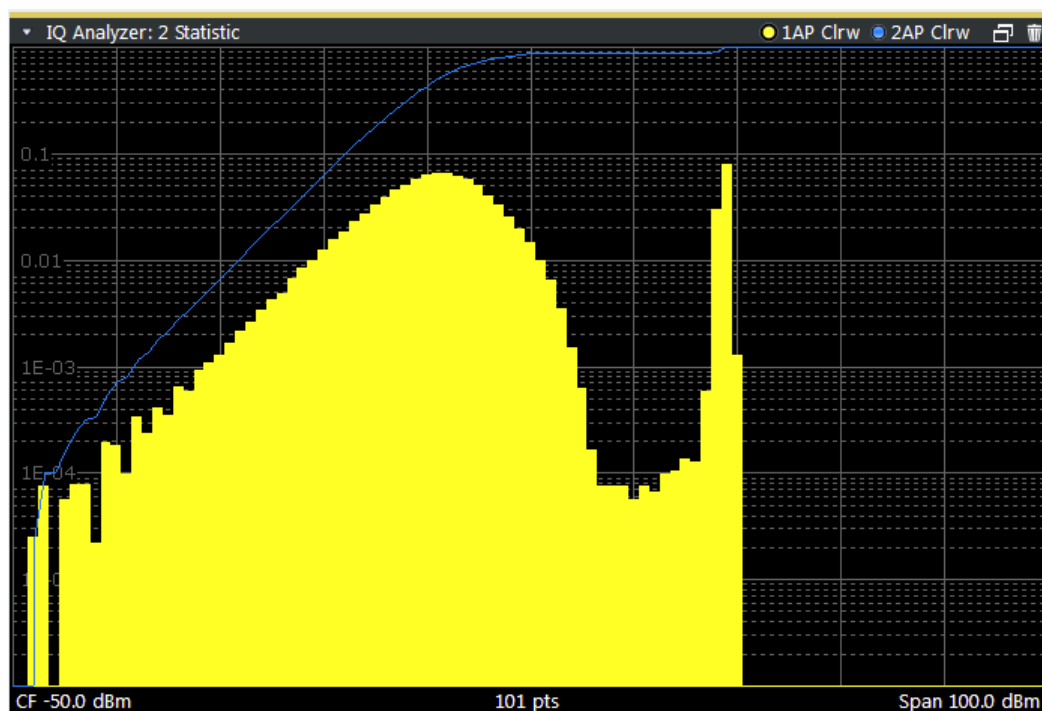
LAY:ADD:WIND? '1', RIGH, RIM, see [LAYout:ADD\[:WINDow\]?](#) on page 603

Results:

[TRACe<n>\[:DATA\]?](#) on page 875

### Statistic APD

Shows a histogram of measured I/Q magnitudes. The number of bins used for the histogram, that is, the number of different measurement values the statistical occurrence is determined for, can be defined.

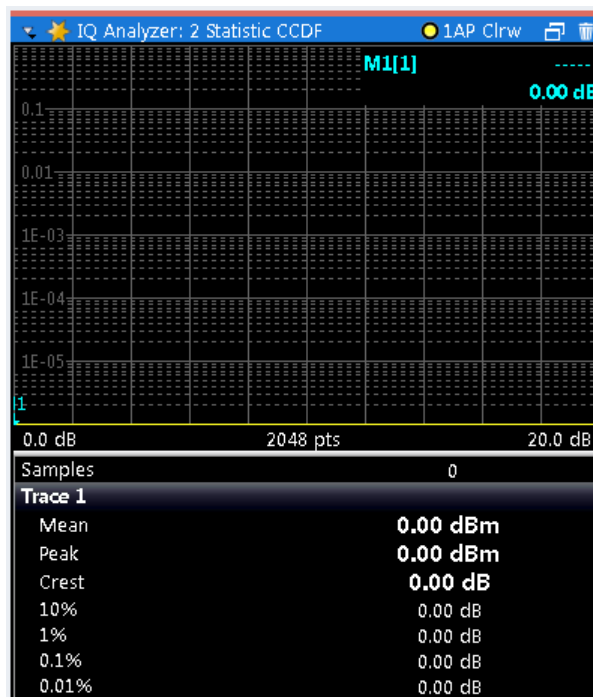


Remote command:

LAY:ADD? '1', RIGH, STAT, see [LAYout:ADD\[:WINDow\]?](#) on page 603

### Statistic CCDF

The Complementary Cumulative Distribution Function (CCDF) shows the probability that the mean signal power amplitude will be exceeded in percent. The level above the mean power is plotted along the x-axis of the graph. The origin of the axis corresponds to the mean power level. The probability that a level will be exceeded is plotted along the y-axis.



A red line indicates the ideal Gaussian distribution for the measured amplitude range. The number of **Quantize Bins** (2048) is indicated in the center of the diagram footer. The displayed amplitude range is indicated as "Mean Pwr" + "<x dB>" in the diagram footer.

The scaling for both the x-axis and y-axis of the statistics diagram can be configured. In particular, you can restrict the range of amplitudes to be evaluated and the probabilities to be displayed (see [Chapter 10.3.3.5, "Scaling for statistics diagrams"](#), on page 232).

In addition to the histogram, a result table is displayed containing the following information:

- Number of samples used for calculation
- For each displayed trace:
  - Mean amplitude
  - Peak amplitude
  - Crest factor  
The crest factor is defined as the peak power to mean power ratio or, logarithmically, as the peak level minus the average level of the signal.
  - Levels for the probability values 10 %, 1 %, 0.1 %, 0.01 %

A special percentage marker is available for CCDF diagrams, which can be set to a probability value (see ["Percent Marker \(CCDF only\)"](#) on page 260). Thus, the power which is exceeded with a given probability can be determined very easily.

**Note:** Make sure the defined **Analysis Bandwidth** is wide enough for the signal bandwidth of the device under test to be fully analyzed (see [Chapter 10.3.6.1, "Data acquisition"](#), on page 252).

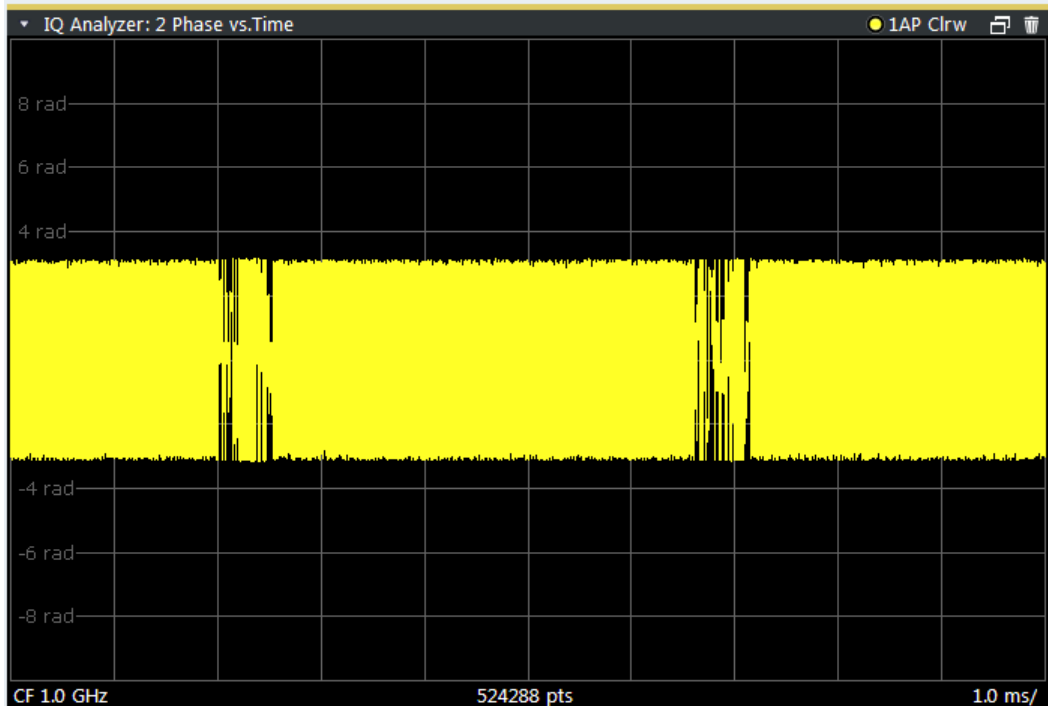
In order to analyze the complete signal, make sure the **"Meas Time"** on page 254 is longer than one period of a bursted signal.

Remote command:

LAY:ADD? '1', RIGH, CCDF, see LAYout:ADD[:WINDow]? on page 603

### Phase vs. Time

Shows the phase values in the time domain.



Remote command:

LAY:ADD? '1', RIGH, PHASe, see LAYout:ADD[:WINDow]? on page 603

### Marker Table

Displays a table with the current marker values for the active markers.

This table is displayed automatically if configured accordingly.

(See "Marker Table Display " on page 421).

Wnd	Type	Ref	X-Value	Y-Value
1	M1		0.256	0.00 dB
1	D2	M1	415.512	-1.94 dB
1	D3	M1	489.512	-1.95 dB
1	D4	M1	266.512	-2.00 dB

Remote command:

LAY:ADD? '1', RIGH, MTAB, see LAYout:ADD[:WINDow]? on page 603

Results:

CALCulate<n>:MARKer<m>:X on page 817

CALCulate<n>:MARKer<m>:Y? on page 877

### 10.1.3 Result displays in the time and frequency domain

The following result displays are available for I/Q measurements in the time and frequency domain.

Diagram .....	174
Marker Table .....	174
Marker Peak List .....	174
Result Summary .....	175

#### Diagram

Displays a basic level vs. frequency or level vs. time diagram of the measured data to evaluate the results graphically. This is the default evaluation method. Which data is displayed in the diagram depends on the "Trace" settings. Scaling for the y-axis can be configured.

See [Chapter 10.5.1, "Trace configuration"](#), on page 378 and [Chapter 10.3.3.4, "Scaling the y-axis"](#), on page 231.

Remote command:

LAY:ADD? '1',RIGH, DIAG, see [LAYout:ADD\[:WINDow\]?](#) on page 603

Results:

[TRACe<n>\[:DATA\]?](#) on page 875

#### Marker Table

Displays a table with the current marker values for the active markers.

This table is displayed automatically if configured accordingly.

(See ["Marker Table Display"](#) on page 421).



Wnd	Type	Ref	X-Value	Y-Value
1	M1		0.256	0.00 dB
1	D2	M1	415.512	-1.94 dB
1	D3	M1	489.512	-1.95 dB
1	D4	M1	266.512	-2.00 dB

Remote command:

LAY:ADD? '1',RIGH, MTAB, see [LAYout:ADD\[:WINDow\]?](#) on page 603

Results:

[CALCulate<n>:MARKer<m>:X](#) on page 817

[CALCulate<n>:MARKer<m>:Y?](#) on page 877

#### Marker Peak List

The marker peak list determines the frequencies and levels of peaks in the spectrum or time domain. How many peaks are displayed can be defined, as well as the sort order. In addition, the detected peaks can be indicated in the diagram. The peak list can also be exported to a file for analysis in an external application.

Marker No	X-Value (GHz)	Y-Value (dBm)
3 - No 1	3.997587	-115.126
3 - No 2	3.997687	-115.442
3 - No 3	3.997777	-121.135
3 - No 4	3.997852	-122.265
3 - No 5	3.997942	-120.539
3 - No 6	3.998082	-114.250
3 - No 7	3.998162	-117.422
3 - No 8	3.998387	-117.170
3 - No 9		

Remote command:

LAY:ADD? '1',RIGH, PEAK, see [LAYout:ADD\[:WINDOW\]?](#) on page 603

Results:

[CALCulate<n>:MARKer<m>:X](#) on page 817

[CALCulate<n>:MARKer<m>:Y?](#) on page 877

### Result Summary

Result summaries provide the results of specific measurement functions in a table for numerical evaluation. The contents of the result summary vary depending on the selected measurement function. See the description of the individual measurement functions for details.

2 Result Summary				
Channel	Bandwidth	Offset	Power	
Tx1 (Ref)	1.229 MHz		<b>-0.86 dBm</b>	
Tx Total			<b>-0.86 dBm</b>	
Channel	Bandwidth	Offset	Lower	Upper
Adj	30.000 kHz	750.000 kHz	<b>-79.59 dB</b>	<b>-80.34 dB</b>
Alt1	30.000 kHz	1.980 MHz	<b>-85.04 dB</b>	<b>-83.85 dB</b>

Remote command:

LAY:ADD? '1',RIGH, RSUM, see [LAYout:ADD\[:WINDOW\]?](#) on page 603

## 10.2 Basics on I/Q data acquisition and processing

Some background knowledge on basic terms and principles used when describing I/Q data processing in the R&S VSE software in general, and in the I/Q Analyzer application in particular, is provided here for a better understanding of the required configuration settings.

Principally, the R&S VSE (and all its applications) analyze data that was captured on a connected instrument, or directly from a file with stored I/Q data. The software itself does not capture data.

The I/Q Analyzer provides various possibilities to acquire the I/Q data to be analyzed:

- Capturing analog I/Q data from the [RF Input] connector of a connected device
- Capturing oscilloscope baseband input from multiple channels of a connected oscilloscope
- Importing I/Q data from a file

Background information for these scenarios and more is provided in the following sections.

• <a href="#">Analyzing I/Q data</a> .....	176
• <a href="#">How much data is measured: capture count and measurement points</a> .....	177
• <a href="#">Basics on FFT</a> .....	178
• <a href="#">Trace smoothing</a> .....	183
• <a href="#">oscilloscope baseband input</a> .....	184
• <a href="#">Basics on external mixers</a> .....	187
• <a href="#">Basics on power sensors</a> .....	191

## 10.2.1 Analyzing I/Q data

In the telephone systems of the past, baseband data was transmitted unchanged as an analog signal. In modern phone systems and in radio communication, however, the baseband data is modulated on a carrier frequency, which is then transmitted and must be demodulated by the receiver. When using modern modulation methods (e.g. QPSK, QAM etc.), the baseband signal becomes complex. Complex data (or: I/Q data) consists of an imaginary (I) and a real (Q) component.

The R&S VSE software can analyze the individual I and Q components of the complex signal.

### 10.2.1.1 Sample rate, record length and analysis bandwidth

#### Definitions

- **Input sample rate (ISR):** the sample rate of the useful data provided by the device connected to the input of the connected instrument
- (User, Output) **Sample rate (SR):** the sample rate that is defined by the user (e.g. in the "Data Acquisition" dialog box in the "I/Q Analyzer" application) and which is used as the basis for analysis or output
- **Usable I/Q (analysis) bandwidth:** the bandwidth range in which the signal remains undistorted in regard to amplitude characteristic and group delay; this range can be used for accurate analysis by the R&S VSE
- **Record length:** the number of I/Q samples the connected instrument captures during the specified measurement time; calculated as the measurement time multiplied by the sample rate. By default, the record length is set to the number of mea-



surement points, and the measurement time and sample rate are adapted accordingly. The maximum record length is 524288, but must not exceed the number of samples provided by the connected instrument.

For the I/Q data acquisition, digital decimation filters are used internally in the connected instrument. The passband of these digital filters determines the *maximum usable I/Q bandwidth*. In consequence, signals within the usable I/Q bandwidth (passband) remain unchanged, while signals outside the usable I/Q bandwidth (passband) are suppressed. Usually, the suppressed signals are noise, artifacts, and the second IF sideband. If frequencies of interest to you are also suppressed, try to increase the output sample rate to increase the maximum usable I/Q bandwidth.

As a rule, the usable I/Q bandwidth is proportional to the output sample rate. However, the bandwidth used by the R&S VSE software is restricted by the bandwidth provided by the connected instrument.

### 10.2.2 How much data is measured: capture count and measurement points

The number of measurements to be performed in single measurement mode is defined by the "Capture Count". Values from 0 to 200000 are allowed. If the values 0 or 1 are set, one measurement is performed. The capture count is applied to all the traces in a diagram.

If the trace configurations "Average", "Max Hold" or "Min Hold" are set, the "Capture Count" also determines the number of averaging or maximum search procedures (see ["Analyzing several traces - trace mode"](#) on page 383).

The number of points configured in the capture settings is not actually the number of points to be captured (that is defined as the [Record Length](#)), but rather the number of points to be evaluated in each trace (also referred to as *measurement points*). Thus, the number of measurement points is window-specific. (However, all time-based displays (except for I/Q Vector) use the same number of measurement points.)

For *I/Q Vector* displays, the number of measurement points is always coupled to the [Record Length](#), which has a maximum of 524288 points.

For *Spectrum* displays and all *time-based* displays (except for the I/Q Vector), the number of measurement points can either be defined manually or automatically.

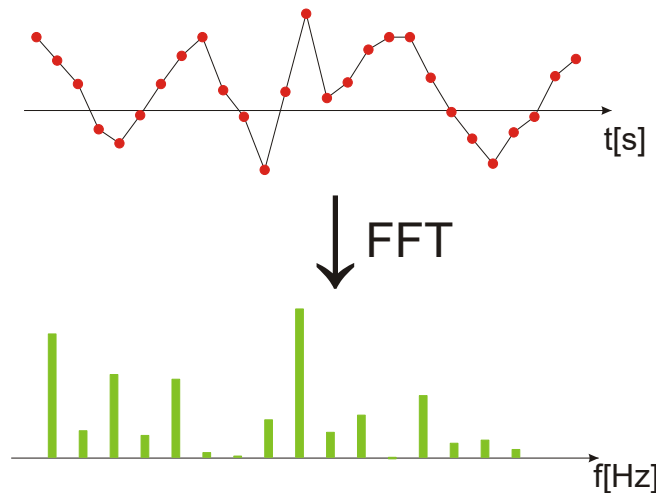
In Auto mode, the number is coupled to the number of frequency points ("[FFT Length](#)" on page 256).

In Manual mode, all values from 51 to 524288 can be set. The default value is 1001 points.

For details on how the number of points and the capture count affect the trace results on the screen, see ["Mapping samples to measurement points with the trace detector"](#) on page 378.

### 10.2.3 Basics on FFT

The I/Q Analyzer measures the power of the signal over time. In order to convert the time domain signal to a frequency spectrum, an FFT (Fast Fourier Transformation) is performed which converts a vector of input values into a discrete spectrum of frequencies.



#### 10.2.3.1 Frequency resolution of FFT results - RBW

The **resolution bandwidth** defines the minimum frequency separation at which the individual components of a spectrum can be distinguished. Small values result in a high precision, as the distance between two distinguishable frequencies is small. Higher values decrease the precision, but increase measurement speed.

The RBW is determined by the following equation:

$$RBW = \text{Normalized Bandwidth} * \frac{\text{Sample Rate}}{\text{Window Length}}$$

*Equation 10-1: Definition of RBW*

(Note: The normalized bandwidth is a fixed value that takes the noise bandwidth of the window function into consideration.)

The maximum RBW is restricted by the [Analysis Bandwidth](#), or by the following equation, whichever is higher:

$$RBW_{max} = \frac{\text{Normalized Bandwidth} * \text{Sample Rate}}{3}$$

If a higher spectral resolution is required, the number of samples must be increased by using a higher sample rate or longer record length.

The minimum achievable RBW depends on the sample rate and record length, according to the following equation:

$$RBW_{\min} = \frac{\text{NormalizedBandwidth} * \text{Sample Rate}}{524288}$$

### RBW and FFT mode

Depending on the selected RBW mode, the resolution bandwidth is either determined automatically or can be defined manually.

#### Auto mode:

This is the default mode in the I/Q Analyzer. The RBW is determined automatically depending on the [Sample Rate](#) and the [Record Length](#).

A single window is used, thus the [Window Length](#) corresponds to the [Record Length](#).

A Flatop window function is used.

(Note: if you enter an RBW value in Auto mode, the mode is automatically switched to Manual.

#### Manual mode:

The RBW can be defined by the user. The required [Sample Rate](#), [Record Length](#) and the "[Meas Time](#)" on page 254 are adapted accordingly.

A single window is used, thus the [Window Length](#) corresponds to the [Record Length](#).

A Flatop window function is used.

#### Advanced FFT mode

The RBW is determined by the [advanced FFT parameters](#). Using advanced FFT mode, multiple overlapping FFT windows can be used with an averaging transformation algorithm (see "[Combining results - trace detector](#)" on page 182).

### 10.2.3.2 FFT calculation methods

FFT calculation can be performed using different methods.

#### Single

In single mode, one FFT is calculated for the entire record length, that means the window length is identical to the FFT length, and both are identical to the record length.



Figure 10-1: FFT parameters for single FFT calculation

## Averaging

In averaging mode, several overlapping FFTs are calculated for each record; the results are combined to determine the final FFT result for the record.

The number of FFTs to be combined is determined by the [Window Overlap](#) and the [Window Length](#).



Figure 10-2: FFT parameters for averaged FFT calculation

## Window functions

In advanced FFT mode, the Fourier transformation is not performed on the entire captured data in one step. In this case, an averaging transformation algorithm is used, which uses only a limited number of samples to calculate an individual result. This process is called windowing.

After sampling in the time domain, each window is multiplied with a specific window function. Windowing helps minimize the discontinuities at the end of the measured signal interval and thus reduces the effect of spectral leakage, increasing the frequency resolution.

Various different window functions are provided in the R&S VSE to suit different input signals. Each of the window functions has specific characteristics, including some advantages and some trade-offs. These characteristics need to be considered carefully to find the optimum solution for the measurement task.



### Ignoring the window function - rectangular window

The rectangular window function is in effect not a function at all, it maintains the original sampled data. This may be useful to minimize the required bandwidth; however, be aware that if the window does not contain exactly one period of your signal, heavy sidelobes may occur, which do not exist in the original signal.

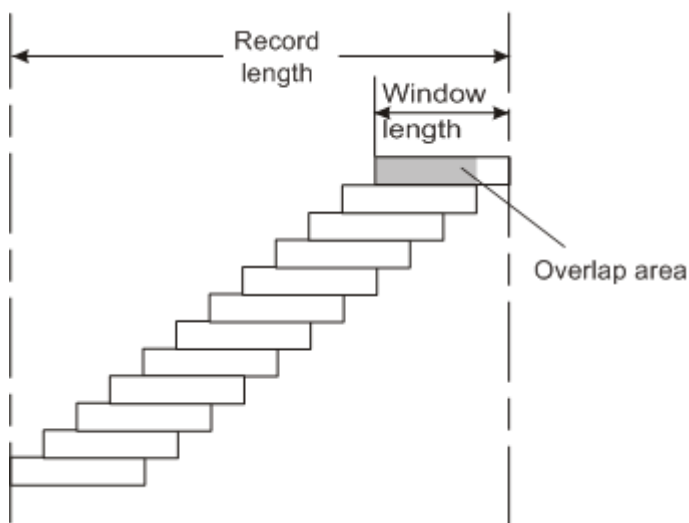
Table 10-1: Characteristics of typical FFT window functions

Window type	Frequency resolution	Magnitude resolution	Sidelobe suppression	Measurement recommendation
Rectangular	Best	Worst	Worst	No function applied. Separation of two tones with almost equal amplitudes and a small frequency distance
Blackman-Harris (default)	Good	Good	Good	Harmonic detection and spurious emission detection
Gauss (Alpha = 0.4)	Good	Good	Good	Weak signals and short duration

Window type	Frequency resolution	Magnitude resolution	Sidelobe suppression	Measurement recommendation
Flattop	Worst	Best	Good	Accurate single tone measurements
5-Term	Good	Good	Best	Measurements with very high dynamic range

### Overlapping

The averaging transformation algorithm in advanced FFT mode calculates multiple FFTs per measurement by dividing one captured record into several windows. Consecutive windows may overlap. Overlapping "reuses" samples that were already used to calculate the preceding FFT result.



In advanced FFT mode with averaging, the overlapping factor can be set freely. The higher the overlap factor, the more windows are used. This leads to more individual results and improves detection of transient signal effects. However, it also extends the duration of the calculation. The size of the window can be defined manually according to the record length, the overlap factor, and the FFT length.

With an overlap of the FFTs of 67%, for example, the second data block the R&S VSE performs the FFT on covers the last 67% of the data of the first FFT with only 33% new data. The third data block still covers 33% of the first data block and 67% of the second data block and so on.

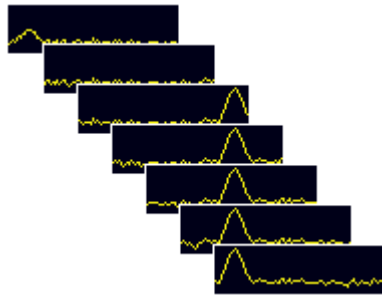


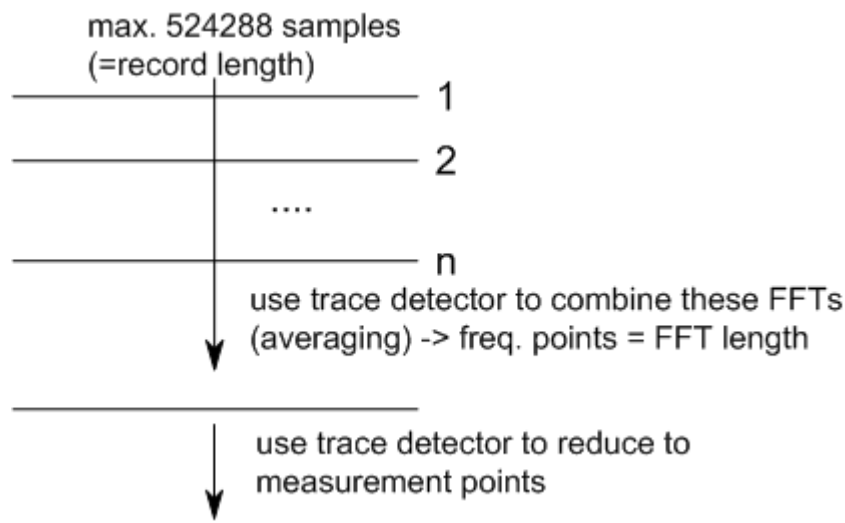
Figure 10-3: Overlapping FFTs

### Combining results - trace detector

Multiple overlapping windows are combined to create the final spectrum using the selected trace detector. If necessary, the trace detector is also used to reduce the number of calculated frequency points (defined by the FFT length) to the defined number of measurement points. By default, the Autopeak trace detector is used.



Due to the fact that the frequency points are reduced to the number of measurement points, using a detector other than Auto Peak may lead to wrong level results if the measurement points are fewer than the number of calculated frequency points (defined by the FFT length) .



### Dependencies between FFT parameters in averaging mode

Advanced FFT analysis in the R&S VSE is highly configurable. Several parameters, including the record length, FFT length, and Window length, can be defined according to the user's requirements. Note, however, that these parameters are correlated and cannot be configured independently of the others.

### Record Length

Defines the number of I/Q samples to capture from the connected instrument. By default, the number of measurement points is used. The record length is calculated as the measurement time multiplied by the sample rate.

The maximum record length is 524288, but may not exceed the connected instrument or the number of samples provided by the input file.

### FFT Length

Defines the number of frequency points determined by each FFT calculation. The more points are used, the higher the resolution in the spectrum becomes, but the longer the calculation takes.

If you use the arrow keys or the mouse wheel to change the FFT length, the value is incremented or decremented by powers of 2. If you enter the value manually, any integer value from 3 to 524288 is available.

If the FFT length is longer than the [Window Length](#) the sample data is filled up with zeros up to the FFT length. The FFT is then performed using interpolated frequency points.

For an FFT length that is not a power of 2, a DFT (discrete Fourier transform) is performed, which requires more time for calculation, but avoids the effects of interpolation.

In order to display all calculated frequency points (defined by the FFT length), the number of measurement points is set to the FFT length automatically in advanced FFT mode.

### Window Length

Defines the number of samples to be included in a single window in averaging mode.

Values from 3 to 524288 are available. However, the window length may not be longer than the [FFT Length](#).

If the window length is shorter than the [FFT Length](#), the sample data is filled up with zeros up to the FFT length.

If the window length is longer than the [Record Length](#) (that is, not enough samples are available), a window length the size of the [Record Length](#) is used for calculation.

The window length and the [Window Overlap](#) determine how many FFT calculations must be performed for each record in averaging mode (see "[Transformation Algorithm](#)" on page 256).

## 10.2.4 Trace smoothing

(Software-based) **smoothing** is a way to remove anomalies visually in the trace that can distort the results. The smoothing process is based on a moving average over the complete measurement range. The number of samples included in the averaging process (the *aperture* size) is variable and is a percentage of all samples that the trace consists of.

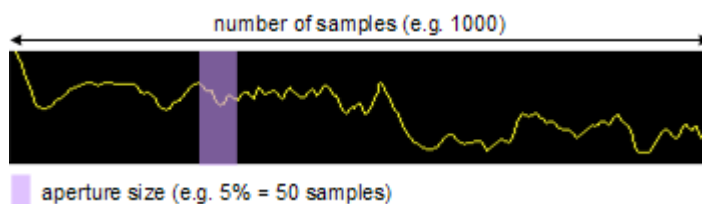


Figure 10-4: Sample size included in trace smoothing

The application smooths the trace only after the measurement has been finished and the data has been analyzed and written to a trace. Thus, smoothing is just an enhancement of the trace display, not of the data itself. This also means that smoothing is always applied after any other trace averagings have been done, as these happen during the measurement itself.

You can turn trace smoothing on and off for all traces individually and compare, for example, the raw and the smooth trace.

## 10.2.5 oscilloscope baseband input

As described above, the R&S VSE software can acquire the power values provided at the RF input of a connected instrument and transform them into complex (I/Q) values. As an alternative, the R&S VSE software can analyze complex baseband (I/Q) input directly. This is useful for measurements in the early stages of signal processing or radio transmission, when the analog baseband signal has not yet been modulated.

### Complex signal input (I+Q)

Complex signal input must be provided to the R&S VSE software by a connected oscilloscope. The I and Q signal components are input in different channels, and transferred to the R&S VSE software in waveform mode.



### Distortion due to different cables

For complex signal input (I+Q), it is recommended that you use two identical cables for the I and Q connectors (same length, same type, same manufacturer). Otherwise, time delay or gain imbalance may occur between the different cables. If necessary, you can define fixed deskew values for individual channels.

The R&S VSE software can process both single-ended (unbalanced) and differential (balanced) input. For single-ended data, you can select any two input channels on the oscilloscope. For differential data, four input channels on the oscilloscope are required. For a detailed channel mapping, see "[Input Source](#)" on page 94.

### Data acquisition

The I and Q data is input using 2 channels of the oscilloscope. Thus, the usable I/Q bandwidth in the R&S VSE software depends on the bandwidth provided by the oscilloscope.

$$\text{max. BW}_{\text{VSE}} = \text{max. BW}_{\text{osci}} (\text{I-channel}) + \text{max. BW}_{\text{osci}} (\text{Q-channel}) = 2 * \text{max. BW}_{\text{osci}}$$



### Applications supporting oscilloscope baseband input

oscilloscope baseband input is captured as waveform data. Currently, only the following applications support waveform input in the R&S VSE software:

- I/Q Analyzer
- Analog Demodulation (K7 option)
- Vector Signal Analysis (VSA, K70 option)
- OFDM Vector Signal Analysis (OFDM VSA, K96 option)

### Voltage levels - full scale level

For RF input, the maximum expected voltage level is defined by the reference level. For oscilloscope baseband input, the maximum expected voltage level *for each component* (I or Q) is defined by the **full scale level**. The full scale level defines the maximum power you can input without clipping the signal.

The full scale level can be defined manually or automatically, such that the power of I and Q does not exceed the reference level.

### Triggering

The following trigger sources are supported for oscilloscope baseband input (see "[Trigger Source](#)" on page 242):

- External
- Time
- Trigger channels 2, 3, 4 - if not used as an input channel

#### 10.2.5.1 I/Q processing modes

The R&S VSE software provides different methods of processing the baseband input, depending on the measurement requirements.

#### Complex baseband mode (I+Q)

In the (default) *complex baseband mode*, the analog input signal is assumed to be a complex baseband signal. There is no need to equalize any IF filter or mix the signal into the complex baseband. The software just has to ensure that the final I/Q data stored in the capture buffer has the correct sample rate for the application. No level compensation is necessary. The resulting data can be processed by the selected application.

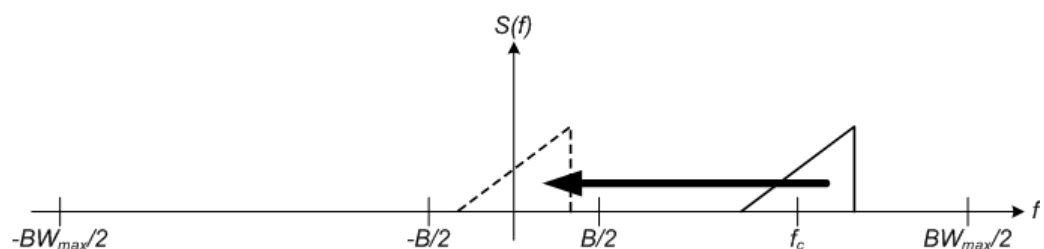


Figure 10-5: Spectrum in complex baseband (I+Q) mode

The complex spectrum of the input signal is displayed. You do not have to move the center frequency, but you can, as long as the selected spectrum remains within the maximum analysis bandwidth (see [Chapter 10.2.5.2, "Sample rates and bandwidths for oscilloscope baseband input"](#), on page 186).

### Low IF mode (I only)

In *low IF mode*, the real signal from the in-phase (I) component is assumed to be a modulated carrier with a specific center frequency. The signal is down-converted to the selected center frequency (= low IF frequency). The center frequency must be higher than 0 Hz so that no part of the negative mirrored spectrum lies within the analysis bandwidth. Select the center frequency such that the displayed spectrum remains within the maximum analysis bandwidth (see [Chapter 10.2.5.2, "Sample rates and bandwidths for oscilloscope baseband input"](#), on page 186).

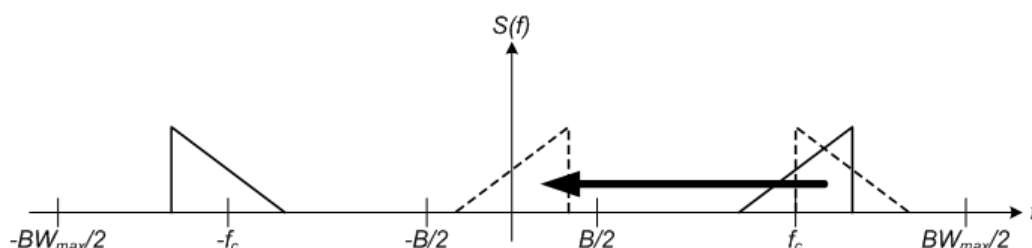


Figure 10-6: Spectrum in low IF mode

Compared to the initial complex baseband signal that was input, the down-converted I component contains only half the spectrum (i.e. one sideband less) after passing the filter. The power is thus reduced by one half (or: -3 dB). This power loss is compensated for by increasing the power of the resulting spectrum by +3 dB.

The digitized data is brought to the desired sample rate using a downsampling filter and fractional resampling.

### 10.2.5.2 Sample rates and bandwidths for oscilloscope baseband input

As described above, the usable I/Q bandwidth in the R&S VSE software depends on the bandwidth provided by the oscilloscope.

$$\mathbf{max. BW_{VSE}} = \mathbf{max. BW_{osci} (I\text{-channel})} + \mathbf{max. BW_{osci} (Q\text{-channel})} = \mathbf{2 * max. BW_{osci}}$$

The usable I/Q bandwidth is the bandwidth range in which the signal remains undistorted in regard to amplitude characteristic and group delay. It is also the range that can be used for accurate analysis by the R&S VSE. The analysis bandwidth and the sample rate are interdependent and are adapted according to the following formula in the I/Q Analyzer:

$$\mathit{Sample\ rate} = \mathit{Analysis\ bandwidth} / 0.8$$

$$\text{(For I only: } \mathit{Sample\ rate} = \mathit{Analysis\ bandwidth} / 0.4\text{)}$$

However, the bandwidth used by the R&S VSE software is restricted by the bandwidth provided by the connected instrument.

Furthermore, the actual sample rate required by the application can be lower, in which case the data is downsampled. Depending on the application used to process the data, the required sample rate is defined by the application itself or by the user.

### Spectrum limits

The analog baseband spectrum to be analyzed depends both on the analysis bandwidth and on the center frequency, which defines the middle of the spectrum. Thus, always select the maximum analysis bandwidth and the position of the center frequency such that the spectrum remains within the available limits. You are not forced by the R&S VSE to do so, but a warning message is displayed if the limits are exceeded.

## 10.2.6 Basics on external mixers

Some background knowledge on basic terms and principles used with external mixers is provided here for a better understanding of the required configuration settings.

- [Frequency ranges](#)..... 187
- [Two-port and three-port mixers](#)..... 188
- [Bias current](#)..... 189
- [Conversion loss tables](#)..... 189

### 10.2.6.1 Frequency ranges

In a common spectrum analyzer, rather than providing one large (and thus inaccurate) filter, or providing several filters to cover the required frequency range of the input signal (at a high cost), a single, very accurate filter is used. Therefore, the input signal must be converted to the frequencies covered by the single accurate filter. This is done by a mixer, which converts and multiplies the frequency of the input signal with the help of the local oscillator (LO). The result is a higher and lower intermediate frequency (IF). The local oscillator can be tuned within the supported frequency range of the input signal.

In order to extend the supported frequency range of the input signal, an external mixer can be used. In this case, the LO frequency is output to the external mixer, where it is mixed with the RF input from the original input signal. In addition, the *harmonics* of the LO are mixed with the input signal, and converted to new intermediate frequencies. Thus, a wider range of frequencies can be obtained. The IF from the external mixer is then returned to the spectrum analyzer.

The frequency of the input signal can be expressed as a function of the LO frequency and the selected harmonic of the first LO as follows:

$$f_{in} = n * f_{LO} + f_{IF}$$

Where:

$f_{in}$ : Frequency of input signal

$n$ : Order of harmonic used for conversion

$f_{IF}$ : Intermediate frequency (variable; defined internally depending on RBW and span)

Thus, depending on the required frequency band, the appropriate order of harmonic must be selected. For commonly required frequency ranges, predefined bands with the appropriate harmonic order setting are provided. By default, the lowest harmonic order is selected that allows conversion of input signals in the whole band.

The frequency ranges for pre-defined bands are described in [Table 13-12](#).



Changes to the band and mixer settings are maintained even after using the [PRESET] function. A "Preset band" function allows you to restore the original band settings.

### Extending predefined ranges

In some cases, the harmonics defined for a specific band allow for an even larger frequency range than the band requires. By default, the pre-defined range is used. However, you can take advantage of the extended frequency range by overriding the defined start and stop frequencies by the maximum possible values ("RF Overrange" option).

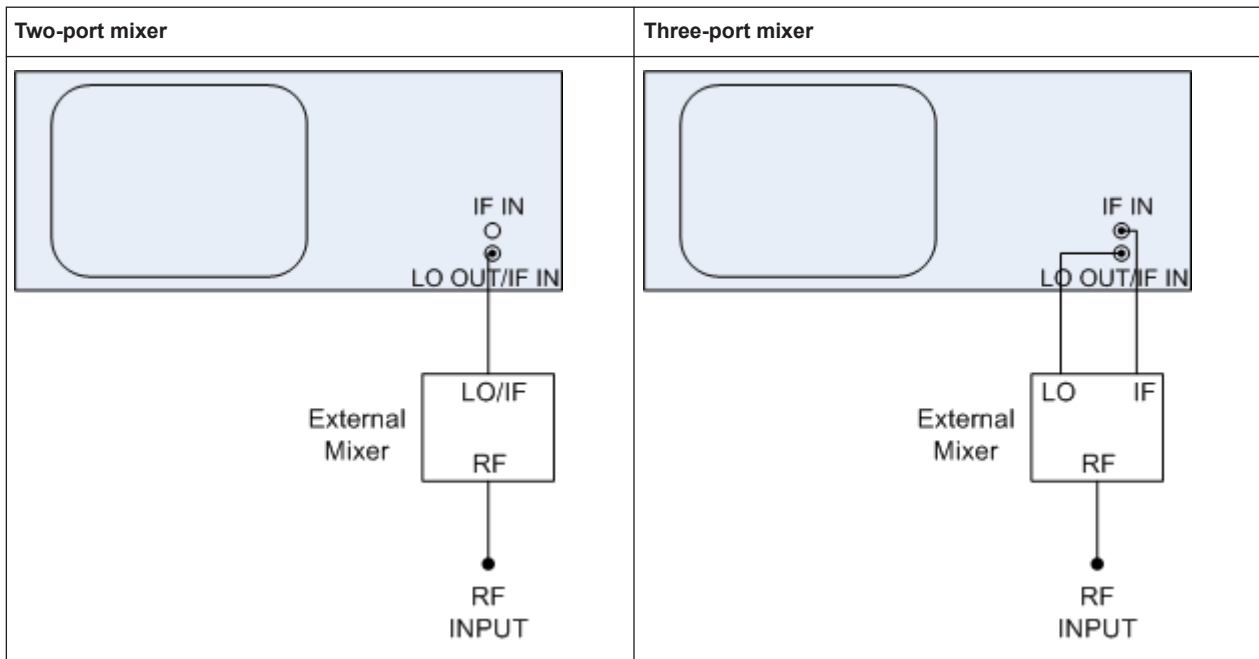
### Additional ranges

If due to the LO frequency the conversion of the input signal is not possible using one harmonic, the band must be split. An adjacent, partially overlapping frequency range can be defined using different harmonics. In this case, the sweep begins using the harmonic defined for the first range, and at a specified frequency in the overlapping range ("handover frequency"), switches to the harmonic for the second range.

## 10.2.6.2 Two-port and three-port mixers

External mixers are connected to the R&S VSE at the LO OUT/IF IN and IF IN connectors.

When using three-port mixers, the LO signal output from the R&S VSE and the IF input from the mixer are transmitted on separate connectors, whereas for two-port mixers, both signals are exchanged via the same connector (LO OUT/IF IN). Because of the diplexer contained in the R&S VSE, the IF signal can be tapped from the line which is used to feed the LO signal to the mixer.



In both cases, the nominal LO level is 15.5 dBm.

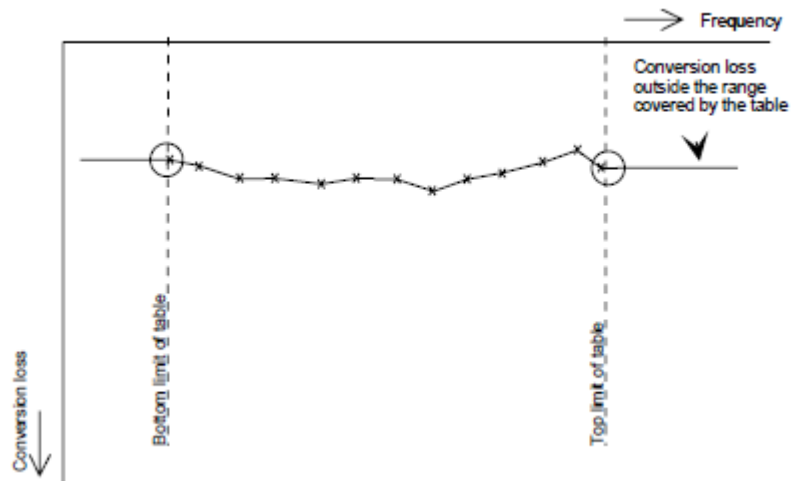
### 10.2.6.3 Bias current

Single-diode mixers generally require a DC voltage which is applied via the LO line. This DC voltage is to be tuned to the minimum conversion loss versus frequency. Such a DC voltage can be set via the "BIAS" function using the D/A converter of the connected instrument. The value to be entered is not the voltage but the short-circuit current. The current is defined in the "Bias Settings" or set to the value of the conversion loss table.

See ["Bias Value"](#) on page 211.

### 10.2.6.4 Conversion loss tables

Conversion loss tables consist of value pairs that describe the correction values for conversion loss at certain frequencies. Correction values for frequencies between the reference values are obtained by interpolation. Linear interpolation is performed if the table contains only two values. If it contains more than two reference values, spline interpolation is carried out. Outside the frequency range covered by the table the conversion loss is assumed to be the same as that for the first and last reference value (see [Figure 10-7](#)).



**Figure 10-7: Conversion loss outside the band's frequency range**

Predefined conversion loss tables are often provided with the external mixer and can be imported to the connected instrument.

### Importing CVL tables

The conversion loss table to be used for a particular measurement range is also defined in the "External Mixer Configuration" dialog box.

The frequency range that the cvl table must cover depends on the used IF, which varies depending on the instrument and installed bandwidth extension options. Thus, external mixers from Rohde & Schwarz provide multiple conversion loss table files.

When you select a storage path containing cvl files, or a particular cvl file from a Rohde & Schwarz mixer for import, all available files are copied to the

C:\ProgramData\Rohde-Schwarz\VSE\\user\cvl\ directory on the connected instrument. Provided .acl files are renamed according to the following syntax:

```
<serial_number>_<harmonic_order>_<IF>.acl,
```

e.g. 12345\_2\_1330M.acl

To select a conversion loss table for use in a measurement, you merely have to select the serial number for the external mixer in use. The R&S VSE automatically selects the correct cvl file for the current IF. As an alternative, you can also select a user-defined conversion loss table (.acl file).



Before copying any files to the

C:\ProgramData\Rohde-Schwarz\VSE\\user\cvl\ directory, the R&S VSE firmware moves any existing user-defined cvl tables to a backup subdirectory. To use a user-defined cvl table later, select the file in the

C:\ProgramData\Rohde-Schwarz\VSE\\user\cvl\backup directory.

A validation check is then performed on the selected table to ensure that it complies with the settings. In particular, the following is checked:

- The assigned band name
- The harmonic order
- The mixer type
- The table must contain at least one frequency that lies within the frequency range for the band

#### Reference level

The maximum possible reference level depends on the maximum used conversion loss value. Thus, the reference level can be adjusted for each range according to the used conversion loss table or average conversion loss value. If a conversion loss value is used which exceeds the maximum reference level, the reference level is adjusted to the maximum value permitted by the firmware.

### 10.2.7 Basics on power sensors

The R&S VSE can also analyze data from a power sensor connected to the PC running the R&S VSE software. Both manual operation and remote control are supported.



For a detailed list of supported sensors, see the instrument's data sheet.



To use power sensors in the R&S VSE software, you must install the "R&S Power Meter device drivers" with the software.

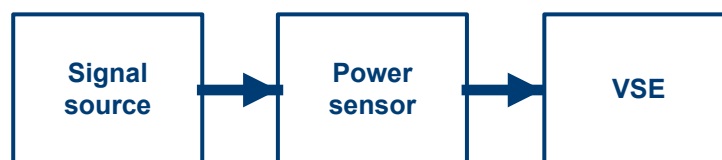


Figure 10-8: Power sensor support – standard test setup

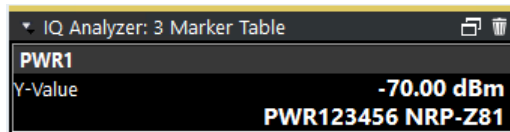


#### Using the power sensor with several applications

The power sensor cannot be used from the R&S VSE software and the R&S Power Viewer Plus simultaneously. The R&S Power Viewer Plus is a virtual power meter to display results of the R&S NRP power sensors.

#### Result display

The results of the power sensor measurements are displayed in the marker table. For each power sensor, a row is inserted. The sensor index is indicated in the "Type" column.



## 10.3 Basic I/Q measurement configuration



**Access:** "Meas Setup" > "Overview"

The easiest way to configure a measurement channel is via the "Overview" dialog box.

Alternatively, you can access the individual dialog boxes from the corresponding menu items, or via tools in the toolbars, if available.

In this documentation, only the most convenient method of accessing the dialog boxes is indicated - usually via the "Overview". For an overview of all available menu items and toolbar icons see [Chapter A, "Menu reference"](#), on page 954 and [Chapter B, "Reference of toolbar functions"](#), on page 962.

The remote commands required to perform these tasks are described in [Chapter 13.6, "Remote commands for the I/Q analyzer"](#), on page 610.

- [Configuration overview](#).....192
- [Data input settings](#)..... 194
- [Amplitude](#).....219
- [Frequency settings](#).....235
- [Trigger and gate configuration](#)..... 237
- [Data acquisition and bandwidth settings](#).....252
- [CCDF \(statistics\) settings](#).....260
- [Adjusting settings automatically](#).....260

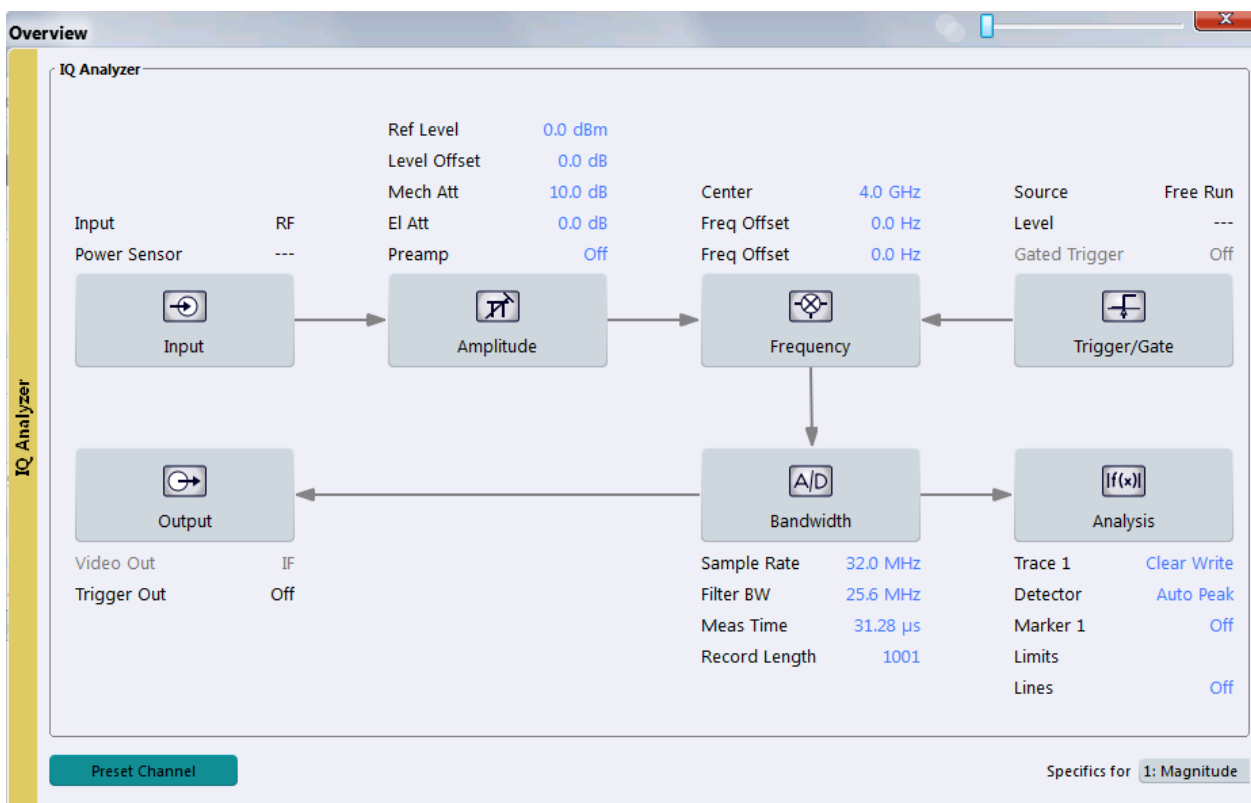
### 10.3.1 Configuration overview



**Access:** "Meas Setup" > "Overview"

The easiest way to configure an I/Q Analysis channel is via the "Overview" dialog box.





**Figure 10-9: Configuration Overview for I/Q Analyzer**

The "Overview" indicates the most important currently defined settings for the measurement channel and provides quick access to the main settings dialog boxes. The individual configuration steps are displayed in the order of the data flow. Thus, you can easily configure an entire measurement channel from input over processing to output and analysis by stepping through the dialog boxes as indicated in the "Overview".



The Overview varies depending on the application; for detailed descriptions see the corresponding application's User Manual.

Furthermore, the overview may vary for measurements in the time and frequency domain. For measurement-specific settings see:

- [Chapter 10.4.1.4, "Channel power configuration"](#), on page 275
- [Chapter 10.4.2.3, "OBW configuration"](#), on page 313
- [Chapter 10.4.3.5, "SEM configuration"](#), on page 331

The "Overview" for the (default) basic I/Q Analyzer measurement provides quick access to the following configuration dialog boxes (listed in the recommended order of processing):

1. Input settings  
See [Chapter 10.3.2, "Data input settings"](#), on page 194
2. Amplitude settings

See [Chapter 10.3.3, "Amplitude"](#), on page 219

3. Frequency settings  
See [Chapter 10.3.4, "Frequency settings"](#), on page 235
4. Optionally, Trigger/Gate settings  
See [Chapter 10.3.5, "Trigger and gate configuration"](#), on page 237
5. Bandwidth (data acquisition and capture) settings  
See [Chapter 10.3.6, "Data acquisition and bandwidth settings"](#), on page 252
6. Optionally, output settings  
See [Chapter 10.3.2, "Data input settings"](#), on page 194
7. Analysis settings and functions  
See [Chapter 10.5, "Analysis"](#), on page 378

#### To configure settings

- ▶ Select any button in the "Overview" or select a setting in the channel's global info bar to open the corresponding dialog box.

For step-by-step instructions on configuring I/Q Analyzer measurements, see [Chapter 11, "How to perform measurements with the R&S VSE"](#), on page 461.

#### Preset Channel

Select the "Preset Channel" button in the lower lefthand corner of the "Overview" to restore all measurement settings **in the current channel** to their default values.

This function has the same effect as the "Preset > Selected Channel" menu item.

Remote command:

`SYSTem:PRESet:CHANnel[:EXEC]` on page 880

#### Specifics for

The channel can contain several windows for different results. Thus, the settings indicated in the "Overview" and configured in the dialog boxes vary depending on the selected window.

Select an active window from the "Specifics for" selection list that is displayed in the "Overview" and in all window-specific configuration dialog boxes.

The "Overview" and dialog boxes are updated to indicate the settings for the selected window.

## 10.3.2 Data input settings

**Access:** "Input & Output"

The R&S VSE can control the input sources and output connectors of the connected instruments.

• Radio frequency input.....	195
• oscilloscope baseband input.....	201
• I/Q file input.....	205
• External mixer settings.....	207
• External frontend settings.....	211
• Power sensor settings.....	216

### 10.3.2.1 Radio frequency input

**Access:** "Overview" > "Input" > "Input Source" > "Radio Frequency"

**Or:** "Input & Output" > "Input Source" > "Radio Frequency"

The default input source for the connected instrument is "Radio Frequency". Depending on the connected instrument, different input parameters are available.

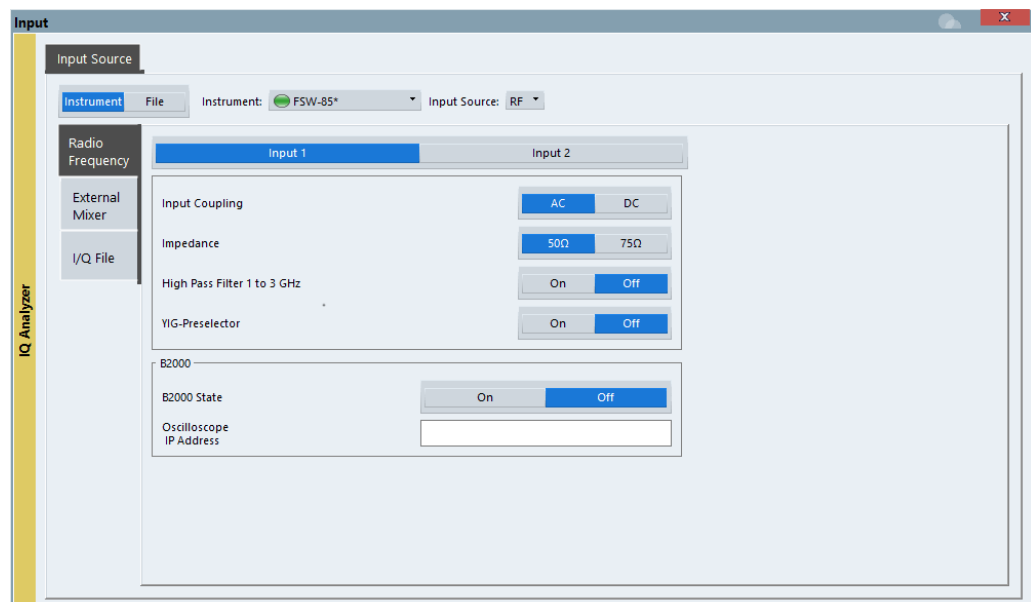


Figure 10-10: RF input source settings for an R&S FSW with B2000 option



If the Frequency Response Correction option (R&S VSE-K544) is installed, the I/Q Analyzer also supports frequency response correction using Touchstone (.snp) files or .fres files.

For details on user-defined frequency response correction, see [Chapter 7.5, "Frequency response correction \(R&S VSE-K544\)"](#), on page 100

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Preselector Mode.....	201
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### Input Type (Instrument / File)

Selects an instrument or a file as the type of input provided to the channel.

**Note:** External mixers are only available for input from a connected instrument.

**Note:** If the R&S VSE software is installed directly on an instrument, or integrated in Cadence®AWR®VSS, some restrictions apply on the available input type.

See "R&S VSE software installed directly on instruments" on page 66 and "R&S VSE integrated in Cadence®AWR®VSS" on page 67.

Remote command:

`INSTRument:BLOCK:CHANnel[:SETTings]:SOURce<si>` on page 543

`INPut:SElect` on page 617

### Instrument

Specifies a configured instrument to be used for input.

### Input 1 / Input 2

For instruments with two input connectors, you must define which input source is used for each measurement channel.

If an external frontend is active, select the connector the external frontend is connected to. You cannot use the other RF input connector simultaneously for the same channel. However, you can configure the use of the other RF input connector for another active channel at the same time.

"Input 1"            R&S FSW85: 1.00 mm RF input connector for frequencies up to 85 GHz (90 GHz with option R&S FSW-B90G)

"Input2"            R&S FSW85: 1.85 mm RF input connector for frequencies up to 67 GHz

Remote command:

`INPut:TYPE` on page 618

### Input Coupling

The RF input of the R&S VSE can be coupled by alternating current (AC) or direct current (DC).

The RF input of the connected instrument can be coupled by alternating current (AC) or direct current (DC).

For an active external frontend, input coupling is always DC.

Not available for input from the optional "Analog Baseband" interface.

AC coupling blocks any DC voltage from the input signal. AC coupling is activated by default to prevent damage to the instrument. Very low frequencies in the input signal can be distorted.

However, some specifications require DC coupling. In this case, you must protect the instrument from damaging DC input voltages manually. For details, refer to the data sheet.

Remote command:

[INPut<ip>:COUPling<ant>](#) on page 612

### Impedance

For some measurements, the reference impedance for the measured levels of the connected instrument can be set to 50  $\Omega$  or 75  $\Omega$ .

For an active external frontend, impedance is always 50  $\Omega$ .

Select 75  $\Omega$  if the 50  $\Omega$  input impedance is transformed to a higher impedance using a 75  $\Omega$  adapter of the RAZ type. (That corresponds to 25 $\Omega$  in series to the input impedance of the instrument.) The correction value in this case is 1.76 dB = 10 log (75 $\Omega$ /50 $\Omega$ ).

This value also affects the unit conversion (see "Reference Level " on page 224).

Not available for input from the optional "Analog Baseband" interface. For analog baseband input, an impedance of 50  $\Omega$  is always used.

Remote command:

[INPut<ip>:IMPedance<ant>](#) on page 614

### Direct Path

Enables or disables the use of the direct path for small frequencies.

In spectrum analyzers, passive analog mixers are used for the first conversion of the input signal. In such mixers, the LO signal is coupled into the IF path due to its limited isolation. The coupled LO signal becomes visible at the RF frequency 0 Hz. This effect is referred to as LO feedthrough.

To avoid the LO feedthrough the spectrum analyzer provides an alternative signal path to the A/D converter, referred to as the *direct path*. By default, the direct path is selected automatically for RF frequencies close to zero. However, this behavior can be disabled. If "Direct Path" is set to "Off" , the spectrum analyzer always uses the analog mixer path.

For an active external frontend, the direct path is always used automatically for frequencies close to zero.

"Auto" (Default) The direct path is used automatically for frequencies close to zero.

"Off" The analog mixer path is always used.

Remote command:

[INPut<ip>:DPATH](#) on page 613

### High Pass Filter 1 to 3 GHz

Activates an additional internal highpass filter for RF input signals from 1 GHz to 3 GHz. This filter is used to remove the harmonics of the analyzer to measure the harmonics for a DUT, for example.

For some connected instruments, this function requires an additional hardware option on the instrument.

**Note:** For RF input signals outside the specified range, the high-pass filter has no effect. For signals with a frequency of approximately 4 GHz upwards, the harmonics are suppressed sufficiently by the YIG-preselector, if available.)

Remote command:

`INPut<ip>:FILTer:HPASs[:STATe]` on page 613

### YIG-Preselector

Enables or disables the YIG-preselector.

This setting requires an additional option on the connected instrument.

An internal YIG-preselector at the input of the connected instrument ensures that image frequencies are rejected. However, image rejection is only possible for a restricted bandwidth. To use the maximum bandwidth for signal analysis you can disable the YIG-preselector at the input of the connected instrument, which can lead to image-frequency display.

**Note:** Note that the YIG-preselector is active only higher frequencies, depending on the connected instrument. Therefore, switching the YIG-preselector on or off has no effect if the frequency is below that value.

To use the optional 90 GHz frequency extension (R&S FSW-B90G), the YIG-preselector must be disabled.

To use the optional 54 GHz frequency extension (R&S FSV3-B54G), the YIG-preselector must be disabled.

#### **Note:**

For the following measurements, the YIG-"Preselector" is off by default (if available).

- I/Q Analyzer
- GSM
- VSA
- OFDM VSA

Remote command:

`INPut<ip>:FILTer:YIG[:STATe]` on page 614

### SAW filter

The R&S VSE hardware contains both a wide and a narrow IF path. Depending on the used analysis bandwidth, the R&S VSE determines which IF path to use automatically. The wide IF path allows for a smoother signal at the center frequency, while the narrow IF path suppresses possibly distorting signals further away from the center frequency. Using this setting, you can affect which IF path is used.

"Auto"                    The R&S VSE determines which IF path to use automatically, depending on the used analysis bandwidth.

"Off"                     The wide IF path is always used.

Remote command:

`INPut<ip>:FILTer:SAW` on page 614

### Capture Mode

Determines how data from an oscilloscope is input to the R&S VSE software.

This function is only available for a connected R&S oscilloscope with a firmware version 3.0.1.1 or higher (for other versions and instruments the input is always I/Q data).

"I/Q"	<p>The measured waveform is converted to I/Q data directly on the R&amp;S oscilloscope (requires option K11), and input to the R&amp;S VSE software as I/Q data.</p> <p>For data imports with small bandwidths, importing data in this format is quicker. However, the maximum record length is restricted by the R&amp;S oscilloscope. (Memory options on the R&amp;S oscilloscope are not available for I/Q data.)</p> <p>This mode is not available for oscilloscope baseband input.</p>
"Waveform"	<p>The data is input in its original waveform format and converted to I/Q data in the R&amp;S VSE software. No additional options are required on the R&amp;S oscilloscope.</p> <p>For oscilloscope baseband input, the capture mode is automatically set to "Waveform". I and Q data is sampled in separate channels in its original waveform format. The separately captured I and Q waveform samples are converted to complex I/Q data in the R&amp;S VSE.</p> <p>For data imports with large bandwidths, this format is more convenient as it allows for longer record lengths if appropriate memory options are available on the R&amp;S oscilloscope.</p>
"Auto"	<p>Uses "I/Q" mode when possible, and "Waveform" only when required by the application (e.g. Pulse measurement, oscilloscope baseband input).</p>

Remote command:

`INPut<ip>:RF:CAPMode` on page 615

### B2000 State

Activates the optional 2 GHz bandwidth extension (R&S FSW-B2000).

**Note:** The R&S VSE software supports input from a connected R&S FSW with a B2000 option installed. However, the R&S FSW interface to the oscilloscope must be set up and aligned directly on the instrument before the R&S VSE software can start analyzing the input.

The analysis bandwidth is defined in the data acquisition settings of the application as usual. Note that the maximum bandwidth cannot be restricted manually as for other bandwidth extension options.

Manual operation on the connected oscilloscope, or remote operation other than by the R&S VSE, is not possible while the B2000 option is active.

Remote command:

`SYSTem:COMMunicate:RDEvice:OSCilloscope[:STATe]` on page 618

### Oscilloscope Sample Rate

Determines the sample rate used by the connected oscilloscope.

This setting is only available if an R&S oscilloscope is used to obtain the input data, either directly or via the R&S FSW.

"10 GHz"	Default for waveform <a href="#">Capture Mode</a> (not available for I/Q <a href="#">Capture Mode</a> ); provides maximum record length
"20 GHz"	Achieves a higher decimation gain, but reduces the record length by half. Only available for R&S oscilloscope models that support a sample rate of 20 GHz (see data sheet). For R&S oscilloscopes with an analysis bandwidth of 4 GHz or larger, a sample rate of 20 GHz is always used in waveform <a href="#">Capture Mode</a>
"40 GHz"	Provides a maximum sample rate. Only available for I/Q <a href="#">Capture Mode</a> , and only for R&S RTP13/RTP16 models that support a sample rate of 40 GHz (see data sheet)

Remote command:

Input source R&S FSW via oscilloscope:

[SYSTem:COMMunicate:RDEvice:OSCilloscope:SRATe](#) on page 619

Input source oscilloscope waveform mode:

[INPut<ip>:RF:CAPMode:WAVeform:SRATe](#) on page 617

Input source oscilloscope I/Q mode:

[INPut<ip>:RF:CAPMode:IQ:SRATe](#) on page 616

### Oscilloscope Splitter Mode

Activates the use of the power splitter inserted between the "IF 2 GHz OUT" connector of the R&S FSW and the "CH1" and "CH3" input connectors of the oscilloscope. Note that this mode requires an additional alignment with the power splitter.

For details see the R&S FSW I/Q Analyzer and I/Q Input user manual.

Remote command:

[SYSTem:COMMunicate:RDEvice:OSCilloscope:PSMode\[:STATe\]](#) on page 619

### Oscilloscope IP Address

When using the optional 2 GHz bandwidth extension (R&S FSW-B2000) with an R&S FSW as the connected instrument, the entire measurement, as well as both instruments, are controlled by the R&S VSE software. Thus, the instruments must be connected via LAN, and the TCPIP address of the oscilloscope must be defined in the R&S VSE software.

For tips on how to determine the computer name or TCPIP address, see the oscilloscope's user documentation.

Remote command:

[SYSTem:COMMunicate:RDEvice:OSCilloscope:TCPIP](#) on page 618

### Preselector State

Turns the preselector on and off.

When you turn on the preselector, you can configure the characteristics of the preselector and add the preamplifier into the signal path.

When you turn off the preselector, the signal bypasses the preselector and the preamplifier, and is fed into the input mixer directly.



Remote command:

[INPut<ip>:PRESelection\[:STATe\]](#) on page 615

### Preselector Mode

Selects the preselection filters to be applied to the measurement.

- |               |   |
|---------------|---|
| "Auto"        | Automatically applies all available bandpass filters in a measurement. Available with the optional preamplifier.  |
| "Auto Wide"   | Automatically applies the wideband filters consecutively: <ul style="list-style-type: none"> <li>• Lowpass 40 MHz</li> <li>• Bandpass 30 MHz to 2250 MHz</li> <li>• Bandpass 2 GHz to 8 GHz</li> <li>• Bandpass 8 GHz to 26.5 GHz</li> </ul> Available with the optional preselector.   |
| "Auto Narrow" | Automatically applies the most suitable narrowband preselection filters in a measurement, depending on the bandwidth you have selected.<br>For measurement frequencies up to 30 MHz, the connected instrument uses combinations of lowpass and highpass filters. For higher frequencies, the connected instrument uses bandpass filters. Available with the optional preselector. |
| "Manual"      | Applies the filter settings you have defined manually.  |

Remote command:

[INPut<ip>:PRESelection:SET](#) on page 615

### 10 dB Minimum Attenuation

Turns the availability of attenuation levels of less than 10 dB on and off.

When you turn on this feature, the attenuation is always at least 10 dB. This minimum attenuation protects the input mixer and avoids accidental setting of 0 dB, especially if you measure EUTs with high RFI voltage.

When you turn it off, you can also select attenuation levels of less than 10 dB.

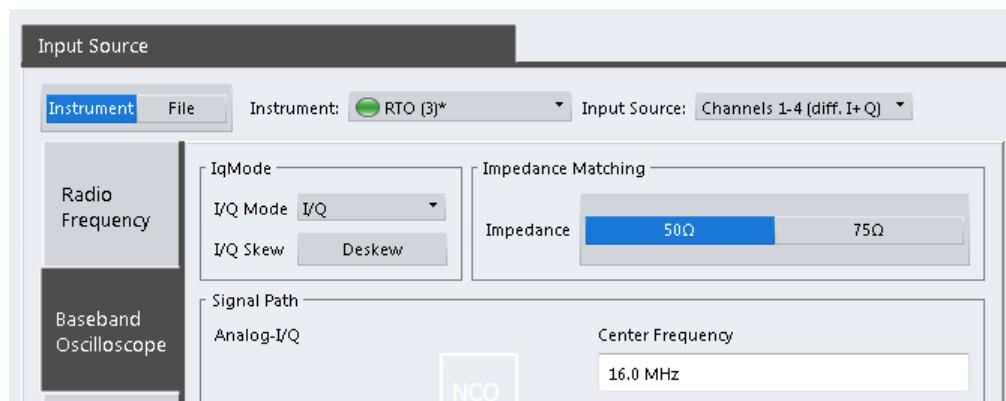
The setting applies to a manual selection of the attenuation as well as the automatic selection of the attenuation.

Remote command:

[INPut:ATTenuation:PROtection:RESet](#) on page 612

#### 10.3.2.2 oscilloscope baseband input

**Access:** "Overview" > "Input" > "Input Source" > "Oscilloscope Baseband"



If the Frequency Response Correction option (R&S VSE-K544) is installed, the I/Q Analyzer also supports frequency response correction using Touchstone (.snp) files or .fres files.

For details on user-defined frequency response correction, see [Chapter 7.5, "Frequency response correction \(R&S VSE-K544\)"](#), on page 100

<a href="#">Input Type (Instrument / File)</a> .....	202
<a href="#">Instrument</a> .....	202
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<a href="#">I/Q Mode</a> .....	203
<a href="#">I/Q Skew</a> .....	203
<a href="#">Impedance</a> .....	204
<a href="#">Center Frequency</a> .....	204
<a href="#">Signal Path</a> .....	204

### Input Type (Instrument / File)

Selects an instrument or a file as the type of input provided to the channel.

**Note:** External mixers are only available for input from a connected instrument.

**Note:** If the R&S VSE software is installed directly on an instrument, or integrated in Cadence®AWR®VSS, some restrictions apply on the available input type.

See ["R&S VSE software installed directly on instruments"](#) on page 66 and ["R&S VSE integrated in Cadence®AWR®VSS"](#) on page 67.

Remote command:

`INSTrument:BLOCK:CHANnel[:SETTings]:SOURce<si>` on page 543

`INPut:SElect` on page 617

### Instrument

Specifies a configured instrument to be used for input.

### Input Source

Configures the source of input (and channel) on the selected instrument to be used.

**Note:** External mixers are only available for RF input.

Not all input sources are supported by all R&S VSE applications.

"RF"                      Radio Frequency ("RF INPUT" connector)

"Channel 1   Channel 2   Channel 3   Channel 4"	Oscilloscope input channel 1, 2, 3, or 4
"Channel 1,2 (I+Q)"	I/Q data provided by oscilloscope input channels 1 and 2 (for oscilloscopes with 2 channels only)
"Channel 1,3 (I+Q)   Channel 2,4 (I+Q)"	I/Q data provided by oscilloscope input channels 1 and 3, or 2 and 4 (for oscilloscopes with 4 channels only)
"Channels 1-4 (diff. I+Q)"	Differential I/Q data provided by oscilloscope input channels (for oscilloscopes with 4 channels only): Channel 1: I (pos.) Channel 2: $\bar{I}$ (neg.) Channel 3: Q (pos.) Channel 4: $\bar{Q}$ (neg.)
"Channels 1,3 (Waveform)"	Waveform data provided by oscilloscope input channels 1 and 3 (for oscilloscopes with 2 channels only)
"Channels 2,4 (Waveform)"	Waveform data provided by oscilloscope input channels 2 and 4 (for oscilloscopes with 2 channels only)
"Channels 1-4 (Waveform)"	Waveform data provided by oscilloscope input channels 1 to 4 (for oscilloscopes with 4 channels only)

Remote command:

[INSTrument:BLOCK:CHANnel\[:SETTings\]:SOURce<si>:TYPE](#) on page 544

[INSTrument:BLOCK:CHANnel\[:SETTings\]:SOURce<si>:CONFig](#) on page 544

### I/Q Mode

Defines the format of the input signal.

For more information, see [Chapter 10.2.5.1, "I/Q processing modes"](#), on page 185.

"I/Q" Both components of the complex input signal (in-phase component, quadrature component) are filtered and resampled to the sample rate of the application.

"I Only / Low IF I"

The input signal at the channel providing I data is filtered and resampled to the sample rate of the application.

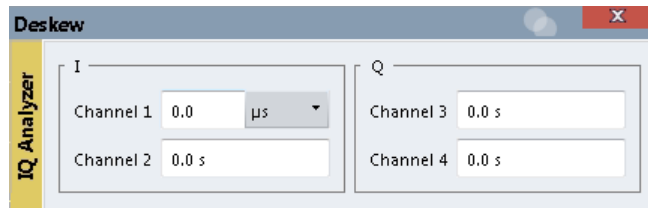
The input signal is down-converted with the center frequency (**Low IF I**).

Remote command:

[INPut<ip>:IQ:OSC:TYPE](#) on page 622

### I/Q Skew

Compensates for skewed I/Q values, e.g. due to different input cables



Define the delay values individually for the I and Q channels. For differential input, changing the positive skew automatically also changes the negative skew (but not vice versa).

Depending on the connected oscilloscope, values between  $\pm 100$  ns are allowed.

Remote command:

`INPut<ip>:IQ:OSC:SKEW:I` on page 621

`INPut<ip>:IQ:OSC:SKEW:I:INVerted` on page 622

`INPut<ip>:IQ:OSC:SKEW:Q` on page 622

`INPut<ip>:IQ:OSC:SKEW:Q:INVerted` on page 622

### Impedance

For some measurements, the reference impedance for the measured levels of the connected instrument can be set to  $50 \Omega$  or  $75 \Omega$ .

For an active external frontend, impedance is always  $50 \Omega$ .

Select  $75 \Omega$  if the  $50 \Omega$  input impedance is transformed to a higher impedance using a  $75 \Omega$  adapter of the RAZ type. (That corresponds to  $25 \Omega$  in series to the input impedance of the instrument.) The correction value in this case is  $1.76 \text{ dB} = 10 \log(75 \Omega / 50 \Omega)$ .

This value also affects the unit conversion (see "Reference Level" on page 224).

Not available for input from the optional "Analog Baseband" interface. For analog baseband input, an impedance of  $50 \Omega$  is always used.

Remote command:

`INPut<ip>:IMPedance<ant>` on page 614

### Center Frequency

Defines the center frequency for oscilloscope baseband input.

**Note:** If the analysis bandwidth to either side of the defined center frequency exceeds the allowed range, an error is displayed. In this case, adjust the center frequency or the analysis bandwidth.

For details on frequency ranges and the analysis bandwidth, see [Chapter 10.2.5.2, "Sample rates and bandwidths for oscilloscope baseband input"](#), on page 186.

Remote command:

`[SENSe<ip>:]FREQuency:CENTer` on page 661

### Signal Path

Illustrates the signal path used for the current baseband input settings.

### 10.3.2.3 I/Q file input

**Access:** "Overview" > "Input" > "Input Source" > "I/Q File"

**Or:** "Input & Output" > "Input Source" > "I/Q File"



#### Loading a file via drag&drop

You can load a file simply by selecting it in a file explorer and dragging it to the R&S VSE software. Drop it into the "Measurement Group Setup" window or the channel bar for any channel. The channel is automatically configured for file input, if necessary. If the file contains all essential information, the file input is immediately displayed in the channel. Otherwise, the "Recall I/Q Recording" dialog box is opened for the selected file so you can enter the missing information.

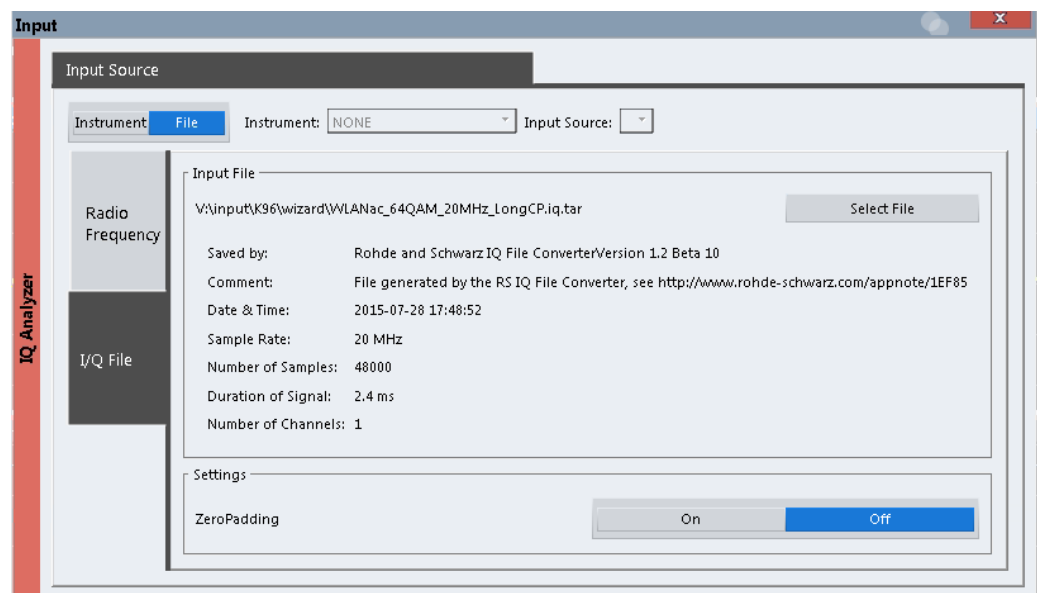
If the file contains data from multiple channels (e.g. from LTE measurements), it can be loaded to individual input sources, if the application supports them.

For more information see ["To import data via drag&drop"](#) on page 463.



The "Input Source" settings defined in the "Input" dialog box are identical to those configured for a specific channel in the "Measurement Group Setup" window.

(See ["Assigning the Channel Input Source"](#) on page 94).



If the Frequency Response Correction option (R&S VSE-K544) is installed, the I/Q Analyzer also supports frequency response correction using Touchstone (.snp) files or .fres files.

For details on user-defined frequency response correction, see [Chapter 7.5, "Frequency response correction \(R&S VSE-K544\)"](#), on page 100



Encrypted `.wv` files can also be imported. Note, however, that traces resulting from encrypted file input cannot be exported or stored in a saveset.

See [Chapter 8.3, "Recording and recalling captured I/Q data for evaluation"](#), on page 125 and [Chapter 8.5, "Storing graphical results to an ASCII file"](#), on page 144.

<a href="#">Input Type (Instrument / File)</a> .....	206
<a href="#">Input File</a> .....	206
<a href="#">Zero Padding</a> .....	206

### Input Type (Instrument / File)

Selects an instrument or a file as the type of input provided to the channel.

**Note:** External mixers are only available for input from a connected instrument.

**Note:** If the R&S VSE software is installed directly on an instrument, or integrated in Cadence®AWR®VSS, some restrictions apply on the available input type.

See ["R&S VSE software installed directly on instruments"](#) on page 66 and ["R&S VSE integrated in Cadence®AWR®VSS"](#) on page 67.

Remote command:

`INSTRument:BLOCK:CHANnel[:SETTings]:SOURce<si>` on page 543

`INPut:SElect` on page 617

### Input File

Specifies the I/Q data file to be used for input.

Select "Select File" to open the "Load I/Q File" dialog box.

(See [Chapter 8.3.4.1, "Loading the I/Q data file and essential measurement information"](#), on page 133).

### Zero Padding

Enables or disables zero padding for input from an I/Q data file that requires resampling. For resampling, a number of samples are required due to filter settling. These samples can either be taken from the provided I/Q data, or the software can add the required number of samples (zeros) at the beginning and end of the file.

If enabled, the required number of samples are inserted as zeros at the beginning and end of the file. The entire input data is analyzed. However, the additional zeros can effect the determined spectrum of the I/Q data. If zero padding is enabled, a status message is displayed.

If disabled (default), no zeros are added. The required samples for filter settling are taken from the provided I/Q data in the file. The start time in the R&S VSE Player is adapted to the actual start (after filter settling).

**Note:** You can activate zero padding directly when you load the file, or afterwards in the "Input Source" settings.

Remote command:

`INPut<ip>:FILE:ZPADing` on page 526

### 10.3.2.4 External mixer settings

**Access:** "Overview" > "Input" > "Input Source" > "Ext. Mixer"

**Or:** "Input & Output" > "Input Source" > "Ext. Mixer"

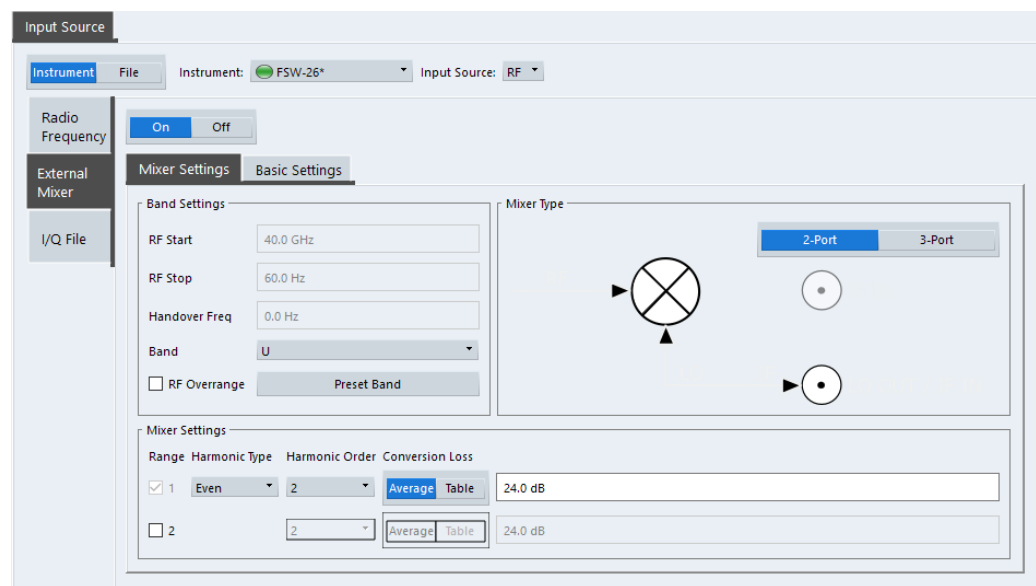
If installed, the optional external mixer can be configured from the R&S VSE software.

- [Mixer settings](#).....207
- [Basic settings](#).....210

#### Mixer settings

**Access:** "Overview" > "Input" > "Input Source" > "Ext. Mixer" > "Mixer Settings"

**Or:** "Input & Output" > "Input Source" > "Ext. Mixer" > "Mixer Settings"



- [External Mixer \(State\)](#)..... 207
- [RF Start / RF Stop](#) .....208
- [Handover Freq](#) ..... 208
- [Band](#) .....208
- [RF Overrange](#) ..... 208
- [Preset Band](#) ..... 209
- [Mixer Type](#) .....209
- [Mixer Settings \(Harmonics Configuration\)](#)..... 209
  - └ [Range 1 /Range 2](#) .....209
  - └ [Harmonic Type](#) .....209
  - └ [Harmonic Order](#) ..... 209
  - └ [Conversion Loss](#) ..... 209

#### External Mixer (State)

Activates or deactivates the external mixer for input. If activated, "ExtMix" is indicated in the channel bar of the application, together with the used band (see "Band " on page 208).

Remote command:

`[SENSe:]MIXer<x>[:STATe]` on page 623

### RF Start / RF Stop

Displays the start and stop frequency of the selected band (read-only).

The frequency range for the user-defined band is defined via the harmonics configuration (see "Range 1 /Range 2 " on page 209).

For details on available frequency ranges, see [table 13-12 on page 627](#).

Remote command:

`[SENSe:]MIXer<x>:FREQuency:START` on page 625

`[SENSe:]MIXer<x>:FREQuency:STOP` on page 626

### Handover Freq

If due to the LO frequency the conversion of the input signal is not possible using one harmonic, the band must be split. An adjacent, partially overlapping frequency range can be defined using different harmonics. In this case, the sweep begins using the harmonic defined for the first range. At the specified "handover frequency" in the overlapping range, it switches to the harmonic for the second range.

The handover frequency can be selected freely within the overlapping frequency range.

Remote command:

`[SENSe:]MIXer<x>:FREQuency:HANDOver` on page 625

### Band

Defines the waveguide frequency band or user-defined frequency band to be used by the mixer.

The start and stop frequencies of the selected band are displayed in the "RF Start" and "RF Stop" fields.

For a definition of the frequency range for the pre-defined bands, see [table 13-12 on page 627](#).

The mixer settings for the user-defined band can be selected freely. The frequency range for the user-defined band is defined via the harmonics configuration (see "Range 1 /Range 2 " on page 209).

Remote command:

`[SENSe:]MIXer<x>:HARMonic:BAND` on page 626

### RF Overrange

Sometimes, the harmonics defined for a specific band allow for an even larger frequency range than the band requires. By default, the pre-defined range is used. However, you can take advantage of the extended frequency range by overriding the defined "RF Start" and "RF Stop" frequencies by the maximum values.

If "RF Overrange" is enabled, the frequency range is not restricted by the band limits ("RF Start" and "RF Stop" ). In this case, the full frequency range that can be reached using the selected harmonics is used.

Remote command:

`[SENSe:]MIXer<x>:RFOVerrange[:STATe]` on page 630



**Preset Band**

Restores the presettings for the selected band.

**Note:** changes to the band and mixer settings are maintained even after using the [PRESET] function. This function allows you to restore the original band settings.

Remote command:

[SENSe:]MIXer<x>:HARMonic:BAND:PRESet on page 626

**Mixer Type**

The External Mixer option supports the following external mixer types:

"2 Port"            LO and IF data use the same port

"3 Port"            LO and IF data use separate ports

Remote command:

[SENSe:]MIXer<x>:PORTs on page 630

**Mixer Settings (Harmonics Configuration)**

The harmonics configuration determines the frequency range for user-defined bands (see "Band " on page 208).

**Range 1 /Range 2 ← Mixer Settings (Harmonics Configuration)**

Enables the use of one or two frequency ranges, where the second range is based on another harmonic frequency of the mixer to cover the band's frequency range.

For each range, you can define which harmonic to use and how the conversion loss is handled.

Remote command:

[SENSe:]MIXer<x>:HARMonic:HIGH:STATe on page 627

**Harmonic Type ← Mixer Settings (Harmonics Configuration)**

Defines if only even, only odd, or even and odd harmonics can be used for conversion. Depending on this selection, the order of harmonic to be used for conversion changes (see "Harmonic Order " on page 209). Which harmonics are supported depends on the mixer type.

Remote command:

[SENSe:]MIXer<x>:HARMonic:TYPE on page 628

**Harmonic Order ← Mixer Settings (Harmonics Configuration)**

Defines which order of the harmonic of the LO frequencies is used to cover the frequency range.

By default, the lowest order of the specified harmonic type is selected that allows conversion of input signals in the whole band. If due to the LO frequency the conversion is not possible using one harmonic, the band is split.

Remote command:

[SENSe:]MIXer<x>:HARMonic[:LOW] on page 628

[SENSe:]MIXer<x>:HARMonic:HIGH[:VALue] on page 627

**Conversion Loss ← Mixer Settings (Harmonics Configuration)**

Defines how the conversion loss is handled. The following methods are available:

"Average" Defines the average conversion loss for the entire frequency range in dB.

"Table" Defines the conversion loss via the table selected from the list. Pre-defined conversion loss tables are often provided with the external mixer and can be stored on the connected instrument.

Remote command:

Average for range 1:

[SENSe:]MIXer<x>:LOSS[:LOW] on page 629

Table for range 1:

[SENSe:]MIXer<x>:LOSS:TABLE[:LOW] on page 629

Average for range 2:

[SENSe:]MIXer<x>:LOSS:HIGH on page 628

Table for range 2:

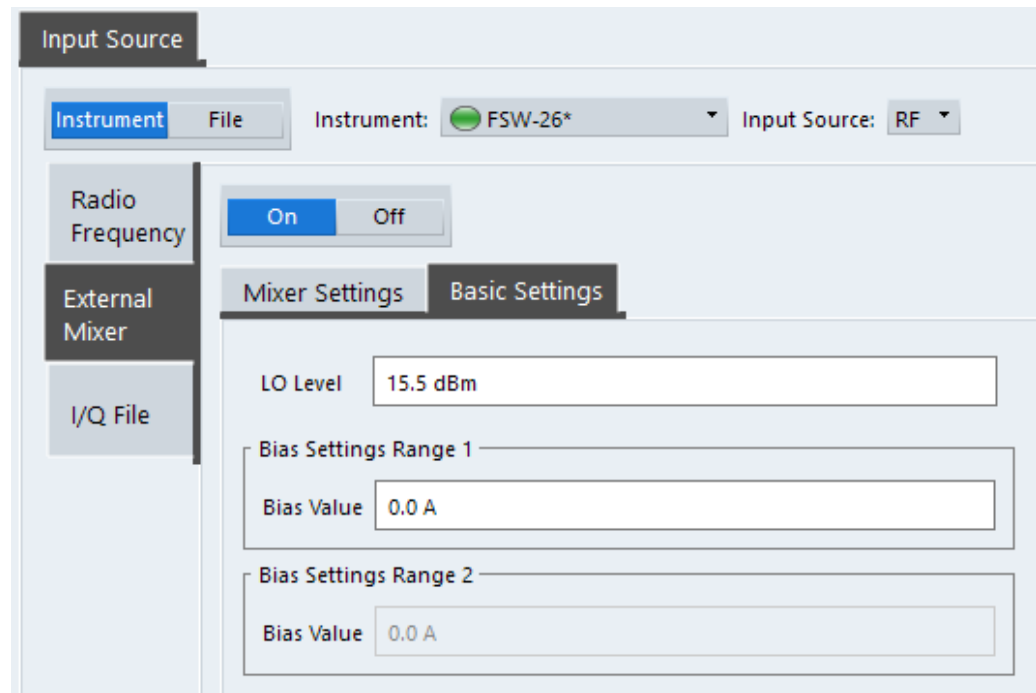
[SENSe:]MIXer<x>:LOSS:TABLE:HIGH on page 629

### Basic settings

**Access:** "Overview" > "Input" > "Input Source" > "Ext. Mixer" > "Basic Settings"

**Or:** "Input & Output" > "Input Source" > "Ext. Mixer" > "Basic Settings"

The basic settings concern general use of an external mixer. They are only available if the [External Mixer \(State\)](#) is "On" .



<a href="#">External Mixer (State)</a> .....	211
<a href="#">LO Level</a> .....	211
<a href="#">Bias Value</a> .....	211

**External Mixer (State)**

Activates or deactivates the external mixer for input. If activated, "ExtMix" is indicated in the channel bar of the application, together with the used band (see "Band " on page 208).

Remote command:

[SENSe:]MIXer<x>[:STATe] on page 623

**LO Level**

Defines the LO level of the external mixer's LO port. Possible values are from 13.0 dBm to 17.0 dBm in 0.1 dB steps. Default value is 15.5 dB.

Remote command:

[SENSe:]MIXer<x>:LOPower on page 624

**Bias Value**

Define the bias current for each range, which is required to set the mixer to its optimum operating point. It corresponds to the short-circuit current. The bias current can range from -10 mA to 10 mA. The actual bias current is lower because of the forward voltage of the mixer diode(s).

**Tip:** The trace in the currently active result display (if applicable) is adapted to the settings immediately so you can check the results.

Remote command:

[SENSe:]MIXer<x>:BIAS[:LOW] on page 624

[SENSe:]MIXer<x>:BIAS:HIGH on page 624

**10.3.2.5 External frontend settings**

**Access:** "Overview" > "Input" > "Input Source Config" > "Input Source" > "External Frontend"

The R&S VSE software supports input from the following instruments with an external frontend connected:

- R&S FSW
- R&S FSV3000/ R&S FSVA3000
- R&S RTP



Note the prerequisites specified by the individual instruments.

Before the R&S VSE software can start analyzing the input, the interface to the external frontend must be set up correctly on the connected instrument. You configure the interface from the instrument to the external frontend directly in the software.

The following settings are only available if the optional external frontend control is installed on the connected instrument. For details, see the documentation for the external frontend or the connected instrument.



For a connected R&S RTP, the R&S VSE software recognizes and uses the interface configuration to the external frontend as defined on the instrument.

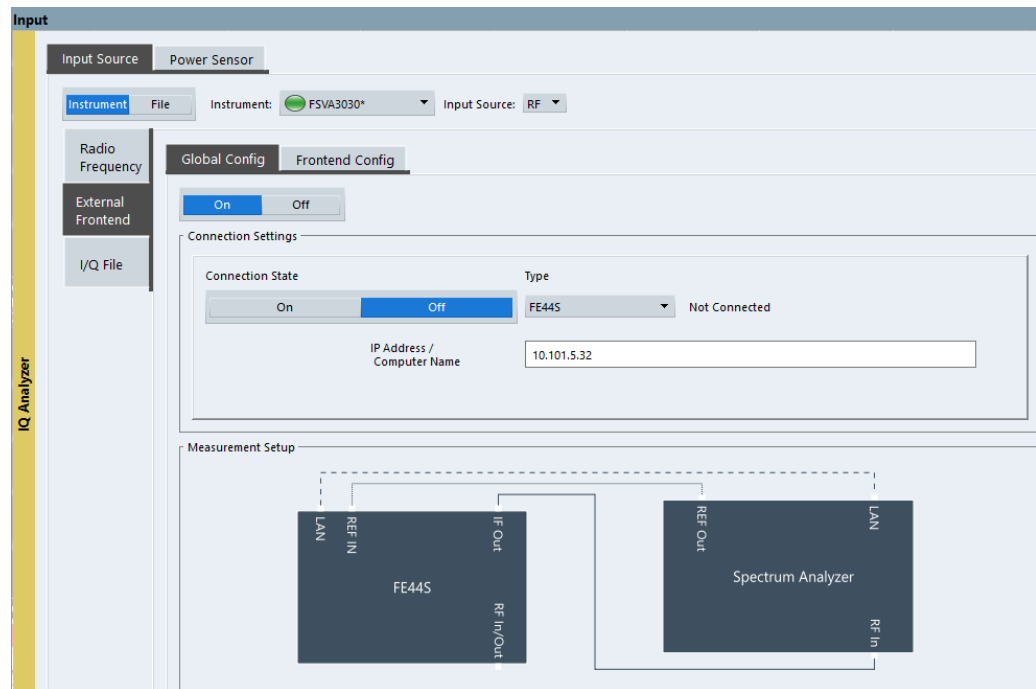
If you configure the interface directly in the R&S VSE software, the settings apply only to the selected "Input Source" channel. For more complex configurations, set up the external frontend directly on the R&S RTP. Then connect the instrument to the software.

- [Global configuration settings](#).....212
- [Frontend configuration settings](#).....213

**Global configuration settings**

**Access:** "Overview" > "Input" > "Input Source Config" > "Input Source" > "External Frontend" > "Global Config"

In the global configuration settings, you define general settings for the connected external frontend.



The required setup is indicated for reference. For details, see the documentation for the external frontend or the connected instrument.

- [Global activation](#).....212
- [External Frontend Connection State](#).....213
- [Frontend Type](#).....213
- [IP Address/ Computer Name](#).....213

**Global activation**

If enabled, the R&S VSE allows you to configure and connect an external frontend. The application adapts the available measurement settings to the connected frontend, for example the available frequency range, reference level and attenuation.

If no frontend is configured yet, the configuration settings become available. The channel bar indicates "Inp: ExtFe".

If disabled, the frontend is disconnected. The application adapts the measurement settings to the common settings supported by the R&S VSE.

Remote command:

[\[SENSe:\]EFRontend\[:STATe\]](#) on page 639

### External Frontend Connection State

Connects or disconnects the configured frontend for use in a measurement. Note that this setting is only available if [Global activation](#) of external frontends is set to "On".

It can take up to 10 seconds to determine that LAN connection failed.

If disabled, the connection to the frontend is deactivated temporarily. A running measurement is aborted, the measurement results are indicated as invalid. The measurement settings for the R&S VSE remain untouched.

Remote command:

[\[SENSe:\]EFRontend:CONNECTION\[:STATe\]](#) on page 633

[\[SENSe:\]EFRontend:CONNECTION:CSTATe?](#) on page 634

### Frontend Type

Defines the type of frontend to be connected.

Currently, the R&S VSE supports the following external frontend types:

- R&S FE44S
- R&S FE50DTR
- R&S FE110SR
- R&S FE170SR

Remote command:

[\[SENSe:\]EFRontend:CONNECTION:CONFIg](#) on page 634

### IP Address/ Computer Name

The IP address or computer name of the frontend connected to the connected instrument via LAN. The IP address and computer name are indicated on the electronic ink display on the side panel of the frontend.

By default, the TCPIP address is expected. To enter the computer name, toggle "123"/"ABC" to "ABC".

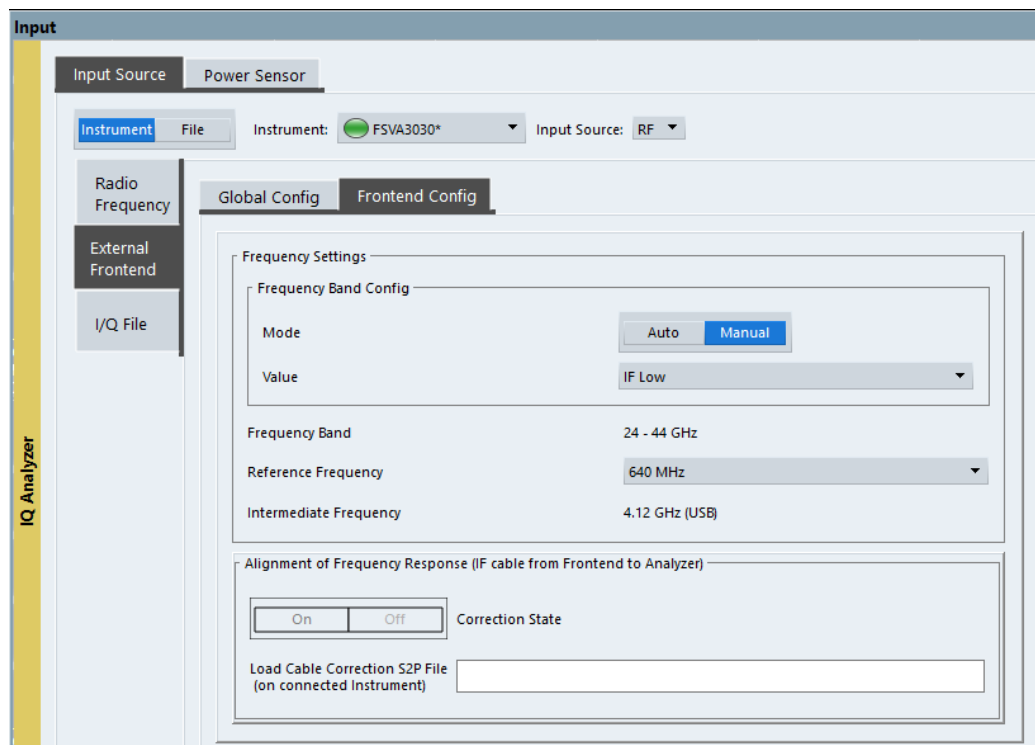
Remote command:

[\[SENSe:\]EFRontend:CONNECTION:CONFIg](#) on page 634

### Frontend configuration settings

**Access:** "Overview" > "Input" > "Input Source Config" > "Input Source" > "External Frontend" > "Frontend Config"

In the frontend configuration tab, frequency information on the connected frontend is provided and you can configure the frequency response for the IF cable.



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Frequency Band.....	215
Reference Frequency.....	215
Intermediate Frequency.....	215
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Load Cable Correction S2P File.....	215

### Frequency Band Configuration

Defines the intermediate frequency (output) range of the external frontend.

The used [Intermediate Frequency](#) and the resulting [Frequency Band](#) sideband that can be analyzed on the connected instrument are indicated for reference.

The selected frequency band configuration is also indicated in the channel bar.

You can select the required IF output range manually, or it can be determined automatically, according to the other frequency settings.

**Note:** For a connected R&S RTP, "IF Low" is always used for all frontends.

In manual mode, select one of the following IF output ranges:

- "IF High" (R&S FE44S/ R&S FE50DTR)  
A higher intermediate frequency is used on the external frontend, resulting in a higher input frequency at the connected instrument.
- "IF Low" (R&S FE44S/ R&S FE50DTR)  
A lower intermediate frequency is used on the external frontend, resulting in a lower input frequency at the connected instrument.
- "Spur Optimized" (R&S FE170SR only)  
The selected IF range avoids unwanted spurious effects.

**"EVM Optimized"**

(R&amp;S FE170SR only)

The selected IF range provides an optimal EVM result.

Remote command:

[\[SENSe:\]EFRontend:FREQuency:BCONfig:AUTO](#) on page 636[\[SENSe:\]EFRontend:FREQuency:BCONfig:LIST?](#) on page 636[\[SENSe:\]EFRontend:FREQuency:BCONfig:SElect](#) on page 637**Frequency Band**

Displays the range of the frequency band supported by the connected frontend (for reference only).

Remote command:

[\[SENSe:\]EFRontend:FREQuency:BAND:COUNT?](#) on page 635[\[SENSe:\]EFRontend:FREQuency:BAND<b>:LOWer?](#) on page 635[\[SENSe:\]EFRontend:FREQuency:BAND<b>:UPPer?](#) on page 635**Reference Frequency**

Sets the reference frequency that is used for frequency conversion on the frontend. Depending on the connected type of frontend, different values are available.

Remote command:

[\[SENSe:\]EFRontend:FREQuency:REFerence](#) on page 638[\[SENSe:\]EFRontend:FREQuency:REFerence:LIST?](#) on page 638**Intermediate Frequency**

Indicates the currently used intermediate frequency (IF) and sideband (upper/lower) for frequency conversion (for reference only).

This value depends on the ["Frequency Band Configuration"](#) on page 214.

For FE50DTR-type frontends that are used by an analyzer and a signal generator simultaneously, make sure that the used intermediate frequency is identical on both instruments.

Make sure the IF frequency required by the external frontend lies within the IF frequency range of the R&amp;S VSE.

**"USB"**            Upper sideband**"LSB"**            Lower sideband

Remote command:

[\[SENSe:\]EFRontend:FREQuency:IFrequency\[:VALue\]?](#) on page 638[\[SENSe:\]EFRontend:FREQuency:IFrequency:SIDeband?](#) on page 637**Correction State**

Activates correction of the IF signal due to cable loss from the frontend to the analyzer.

Remote command:

[\[SENSe:\]EFRontend:ALIGnment<ch>:STATe](#) on page 633**Load Cable Correction S2P File**

Enter the path to a file on the instrument that contains correction data to compensate for signal losses in the cable occurring at different IF signal frequencies.

Frequency response files are usually provided with the IF cable. The calibration data for the IF cable provided with the connected instrument is installed on the instrument at the factory.

The .s2p files are stored on the instrument under

```
C:\R_S\INSTR\USER\external_frontends\\
touchstonefiles\.
```

For example, the files for the IF cable are stored under

```
C:\R_S\Instr\user\external_frontends\FE44S\touchstonefiles\
if_default_cable_1347_7552_00.s2p.
```

Remote command:

[SENSe:] EFRontend:ALIGnment<ch>:FILE on page 632

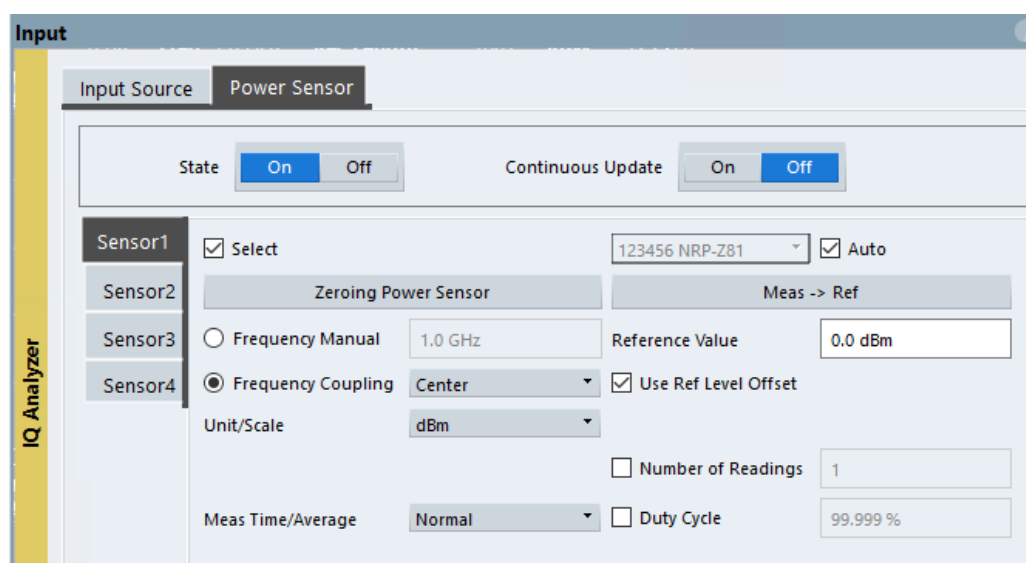
### 10.3.2.6 Power sensor settings

**Access:** "Overview" > "Input" > "Power Sensor" tab



To use power sensors in the R&S VSE software, you must install the "R&S Power Meter device drivers" with the software.

Each sensor is configured on a separate tab.



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### State

Switches the power measurement for all power sensors on or off. Note that in addition to this general setting, each power sensor can be activated or deactivated individually by the **Select** setting on each tab. However, the general setting overrides the individual settings.

### Continuous Value Update

If activated, the power sensor data is updated continuously during a sweep with a long sweep time, and even after a single sweep has completed.

This function cannot be activated for individual sensors.

Remote command:

`[SENSe:] PMETer<p>:UPDate [:STATe]` on page 647

### Select

Selects the individual power sensor for usage if power measurement is generally activated (**State** function).

The detected **serial numbers** of the power sensors connected to the instrument are provided in a selection list. For each of the four available power sensor indexes ("Power Sensor 1" ... "Power Sensor 4" ), which correspond to the tabs in the configuration dialog, one of the detected serial numbers can be assigned. The physical sensor is thus assigned to the configuration setting for the selected power sensor index.

By default, serial numbers not yet assigned are automatically assigned to the next free power sensor index for which "Auto Assignment" is selected.

Alternatively, you can assign the sensors manually by deactivating the "Auto" option and selecting a serial number from the list.

Remote command:

`[SENSe:] PMETer<p>[:STATe]` on page 646

`SYSTem:COMMUnicate:RDEvice:PMETer<p>:DEFine` on page 640

`SYSTem:COMMUnicate:RDEvice:PMETer<p>:CONFIgure:AUTO[:STATe]`  
on page 640

`SYSTem:COMMUnicate:RDEvice:PMETer<p>:COUNT?` on page 640

### Zeroing Power Sensor

Starts zeroing of the power sensor.

Remote command:

`CALibration:PMETer<p>:ZERO:AUTO ONCE` on page 641

### Frequency Manual

Defines the frequency of the signal to be measured. The power sensor has a memory with frequency-dependent correction factors. This allows extreme accuracy for signals of a known frequency.

Remote command:

`[SENSe:] PMETer<p>:FREQuency` on page 644

**Frequency Coupling**

Selects the coupling option. The frequency can be coupled automatically to the center frequency of the instrument or to the frequency of marker 1.

Remote command:

`[SENSe:] PMETer<p>:FREQuency:LINK` on page 644

**Unit/Scale**

Selects the unit with which the measured power is to be displayed. Available units are dBm, dB, W and %.

If dB or % is selected, the display is relative to the reference value that is defined with either the "Meas -> Ref" setting or the "Reference Value" setting.

Remote command:

`UNIT<n>:PMETer<p>:POWer` on page 647

`UNIT<n>:PMETer<p>:POWer:RATio` on page 647

**Meas Time/Average**

Selects the measurement time or switches to manual averaging mode. In general, results are more precise with longer measurement times. The following settings are recommended for different signal types to obtain stable and precise results:

"Short"	Stationary signals with high power (> -40dBm), because they require only a short measurement time and short measurement time provides the highest repetition rates.
"Normal"	Signals with lower power or modulated signals
"Long"	Signals at the lower end of the measurement range (<-50 dBm) or Signals with lower power to minimize the influence of noise
"Manual"	Manual averaging mode. The average count is set with the <a href="#">Average Count (Number of Readings)</a> setting.

Remote command:

`[SENSe:] PMETer<p>:MTIME` on page 645

`[SENSe:] PMETer<p>:MTIME:AVERAge[:STATe]` on page 645

**Setting the Reference Level from the Measurement Meas -> Ref**

Sets the currently measured power as a reference value for the relative display. The reference value can also be set manually via the [Reference Value](#) setting.

Remote command:

`CALCulate<n>:PMETer<p>:RELative[:MAGNitude]:AUTO ONCE` on page 642

**Reference Value**

Defines the reference value in dBm used for relative power meter measurements.

Remote command:

`CALCulate<n>:PMETer<p>:RELative[:MAGNitude]` on page 642

**Use Ref Level Offset**

If activated, takes the reference level offset defined for the analyzer into account for the measured power (see "[Shifting the Display \(Offset\)](#)" on page 224).

If deactivated, takes the [Sensor Level Offset](#) into account.

Remote command:

[SENSe:] PMETer<p>:ROFFset [:STATe] on page 646

### Sensor Level Offset

Takes the specified offset into account for the measured power. Only available if [Use Ref Level Offset](#) is disabled.

Remote command:

[SENSe:] PMETer<p>:SOFFset on page 646

### Average Count (Number of Readings )

Defines the number of readings (averages) to be performed after a single sweep has been started. This setting is only available if manual averaging is selected ([Meas Time/Average](#) setting).

The values for the average count range from 0 to 256 in binary steps (1, 2, 4, 8, ...). For average count = 0 or 1, one reading is performed. The general averaging and sweep count for the trace are independent from this setting.

Results become more stable with extended average, particularly if signals with low power are measured. This setting can be used to minimize the influence of noise in the power sensor measurement.

Remote command:

[SENSe:] PMETer<p>:MTIME:AVERage:COUNT on page 645

### Duty Cycle

Sets the duty cycle to a percent value for the correction of pulse-modulated signals and activates the duty cycle correction. With the correction activated, the sensor calculates the signal pulse power from this value and the mean power.

Remote command:

[SENSe:] PMETer<p>:DCYCLE[:STATe] on page 643

[SENSe:] PMETer<p>:DCYCLE:VALue on page 643

## 10.3.3 Amplitude

**Access:** "Overview" > "Amplitude"

**or:** "Input & Output" > "Amplitude"

Amplitude settings affect the y-axis display in power diagrams.

- [Impact of the vertical axis settings](#)..... 219
- [Amplitude settings](#)..... 222
- [Amplitude settings for oscilloscope baseband input](#)..... 228
- [Scaling the y-axis](#)..... 231
- [Scaling for statistics diagrams](#)..... 232

### 10.3.3.1 Impact of the vertical axis settings

Some background knowledge on the impact of the described settings is provided here for a better understanding of the required configuration.

- [Reference level](#)..... 220
- [RF attenuation](#).....221
- [Scaling](#)..... 221

### Reference level

The reference level value is the maximum value the AD converter can handle without distortion of the measured value. Signal levels above this value will not be measured correctly, which is indicated by the "IF Overload" status display.

Internally, the reference level is also used to determine the optimum hardware settings for the R&S VSE. The defined reference level should correspond with the maximum expected RF input level.



When determining the expected input level, consider that the power from *all* input signals contribute to the total power. The reference level must be higher than the total power from all signals.

The optimum reference level for the current measurement settings can be set automatically by the R&S VSE (see "[Reference Level](#)" on page 224).

In general, the connected instrument measures the signal voltage at the RF input. The level display is calibrated in RMS values of an unmodulated sine wave signal. In the default state, the level is displayed at a power of 1 mW (= dBm). Via the known input impedance, conversion to other units is possible.

See "[Impedance](#)" on page 197.

### Reference level offset

If the signal is attenuated or amplified before it is fed into the R&S VSE, you can define an (arithmetic) offset to the reference level so the application shows correct power results. All displayed power level results are shifted by this value, and the scaling of the y-axis is changed accordingly.

To determine the required offset, consider the external attenuation or gain applied to the input signal. For attenuation, define a positive offset so the R&S VSE increases the displayed power values.

If an external gain is applied, define a negative offset so the R&S VSE decreases the displayed power values.

Note, however, that the *internal* reference level (used to adjust the hardware settings to the expected signal optimally) ignores any "Reference Level Offset". Thus, it is important to keep in mind the actual power level the R&S VSE must handle, and not to rely on the displayed reference level.

internal reference level = displayed reference level - offset

### Example

1. The initial reference level is 2 dBm with no offset.

Both the displayed reference level and the internal reference level are 2 dBm.

2. An offset of 3 dB is defined.
  - The displayed reference level is adjusted to 5 dBm.
  - The internal reference level remains at 2 dBm.
  - $(5 \text{ dBm (displayed ref level)} - 3 \text{ dB (offset)}) = 2 \text{ dBm}$
3. Now the user decreases the reference level to 1 dBm.
  - The displayed reference level is adjusted to 1 dBm.
  - The internal reference level is adjusted to:
    - $1 \text{ dBm (displayed ref level)} - 3 \text{ dB (offset)} = -2 \text{ dBm}$ .

### RF attenuation

The attenuation is meant to protect the input mixer from high RF input levels. The level at the input mixer is determined by the set RF attenuation according to the formula:

$$\text{level}_{\text{mixer}} = \text{level}_{\text{input}} - \text{RF attenuation}$$

The maximum mixer level allowed depends on the connected instrument.

Mixer levels above this value may lead to incorrect measurement results, which is indicated by the "RF Overload" status display. Furthermore, higher input levels may damage the instrument. Therefore, the required RF attenuation is determined automatically according to the reference level by default.

High attenuation levels also avoid intermodulation. On the other hand, attenuation must be compensated for by re-amplifying the signal levels after the mixer. Thus, high attenuation values cause the inherent noise (i.e the noise floor) to rise and the sensitivity of the analyzer decreases.



For ideal sinusoidal signals, the displayed signal level is independent of the RF attenuation.

Depending on the type of measurement you must find a compromise between a low noise floor and high intermodulation levels, and protecting the instrument from high input levels. You achieve this best by letting the connected instrument determine the optimum level automatically (see "[Attenuation Mode / Value](#)" on page 226).

### Scaling

In a linear display, the measurement values are distributed linearly throughout the grid. That means the entire range of measured values is divided by the number of rows in the grid (10) and each row corresponds to 1/10 of the total range. Linear scaling is useful to determine precise levels for a small range of values. However, if large and small values appear in the same display, it is difficult to determine individual values precisely or to distinguish values that are close together.

In a logarithmic display, smaller values are distributed among a much larger area of the display, while large values are condensed to a smaller area. Now it is much easier to distinguish several lower values, as they are spread over a wider area. Logarithmic scaling is useful when large ranges of values must be combined in one display. Logarithmic scaling is best applied to measurement values in logarithmic units (dB, dBm etc.).

In addition to linear or logarithmic scaling, the vertical axis can be set to display either absolute or relative values. Absolute values show the measured levels, while relative values show the difference between the measured level and the defined reference level. Relative values are indicated in percent for linear scaling, and in dB for logarithmic scaling.

### 10.3.3.2 Amplitude settings

**Access:** "Overview" > "Amplitude"

**Or:** "Input & Output" > "Amplitude"

Amplitude settings determine how the connected instrument must process or display the expected input power levels.

Configuring amplitude settings allows you to:

- Adapt the instrument hardware to the expected maximum signal level by setting the [Reference Level](#) to this maximum
- Consider an external attenuator or preamplifier (using the "Offset" ).
- Optimize the SNR of the measurement for low signal levels by configuring the [Reference Level](#) as high as possible without introducing compression, clipping or overload. Use early amplification by the preamplifier and a low attenuation.
- Optimize the SNR for high signal levels and ensure that the instrument hardware is not damaged, using high attenuation and AC coupling (for DC input voltage).
- Adapt the reference impedance for power results when measuring in a 75-Ohm system by connecting an external matching pad to the RF input.



#### Using external frontends

For an active external frontend, the amplitude settings refer to the RF input at the external frontend, not the levels at the RF input of the connected instrument. You can configure the attenuation at the external frontend and the analyzer separately. Electronic attenuation, preamplifier and noise cancellation are not available. Input coupling is always DC. Impedance is always 50  $\Omega$ .

Which amplitude settings are available depends on the connected instrument.

Amplitude settings for input from the optional "Analog Baseband" interface are described in the R&S VSE I/Q Analyzer and I/Q Input User Manual.

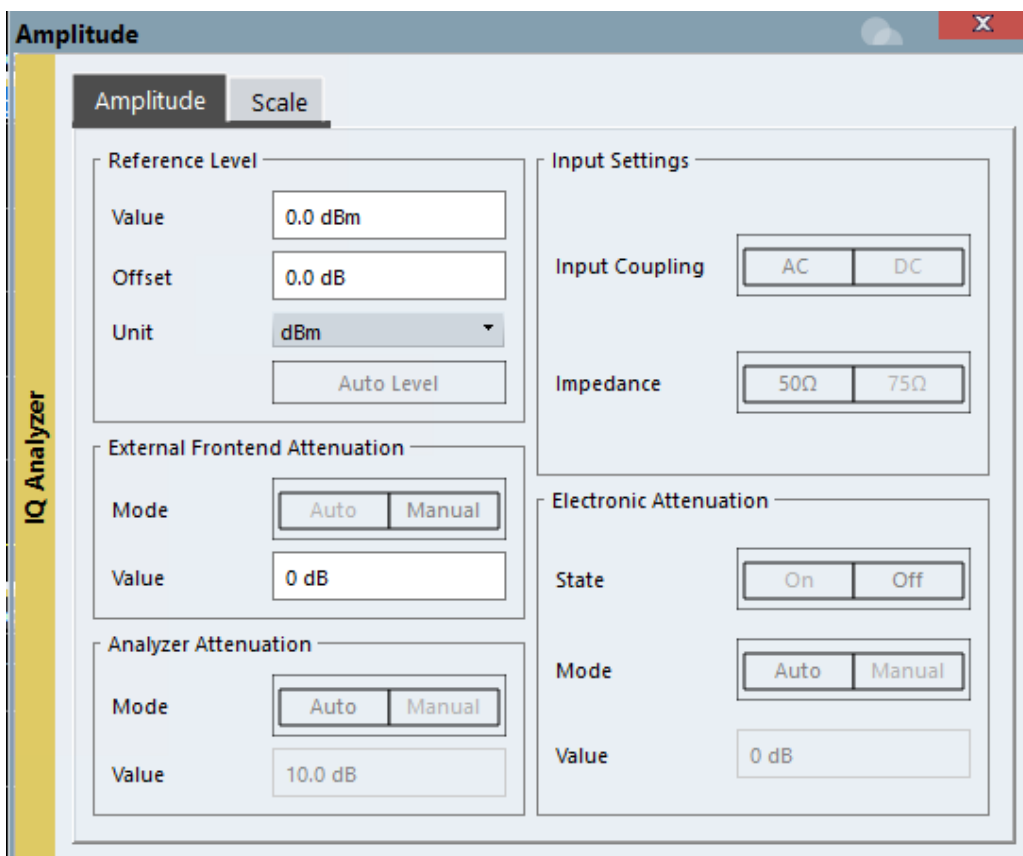
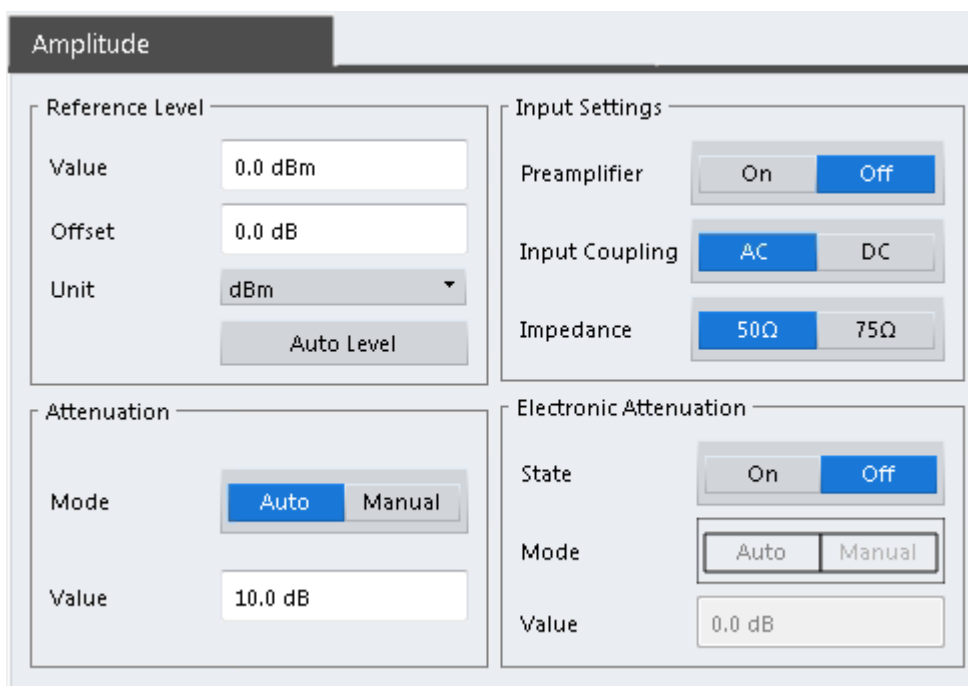



Figure 10-11: Amplitude settings for active external frontend

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Using Electronic Attenuation .....	227
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L Preamplifier .....	227

### Reference Level

Defines the expected maximum input signal level. Signal levels above this value are possibly not measured correctly, which is indicated by the "IF Overload" status display ("OVLD" for baseband input).

Defines the expected maximum reference level. Signal levels above this value are possibly not measured correctly. Signals above the reference level are indicated by an "IF Overload" status display.

The reference level can also be used to scale power diagrams; the reference level is then used for the calculation of the maximum on the y-axis.

Since the hardware of the connected instrument is adapted according to this value, it is recommended that you set the reference level close above the expected maximum signal level. Thus you ensure an optimal measurement (no compression, good signal-to-noise ratio).

Note that for input from the External Mixer (R&S VSE-B21) the maximum reference level also depends on the conversion loss; see the R&S VSE base software user manual for details.

For an active external frontend, the reference level refers to the RF input at the external frontend, not the levels at the RF input of the connected instrument. The hardware is adjusted to the defined reference level optimally for input signals with a crest factor of 10 dB. Thus, the required reference level for an optimal measurement can differ depending on the crest factor of the input signal.

See "[External Frontend Connection State](#)" on page 213.

Remote command:

```
DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:
RLEVel<ant> on page 649
```

### Shifting the Display (Offset) ← Reference Level

Defines an arithmetic level offset. This offset is added to the measured level. In some result displays, the scaling of the y-axis is changed accordingly.

Define an offset if the signal is attenuated or amplified before it is fed into the R&S VSE so the application shows correct power results. All displayed power level results are shifted by this value.

The setting range is  $\pm 200$  dB in 0.01 dB steps.



Note, however, that the *internal* reference level (used to adjust the hardware settings to the expected signal) ignores any "Reference Level Offset" . Thus, it is important to keep in mind the actual power level the R&S VSE must handle. Do not rely on the displayed reference level (internal reference level = displayed reference level - offset).

Remote command:

```
DISPlay[:WINDow<n>] [:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:
RLEVel<ant>:OFFSet on page 649
```

### Unit ← Reference Level

The connected instrument measures the signal voltage at the RF input.

In the default state, the level is displayed at a power level of 1 mW (= dBm). Via the known input impedance (50 Ω or 75 Ω, see "[Impedance](#)" on page 197), conversion to other units is possible.

The following units are available and directly convertible:

- dBm
- dBmV
- dBμV
- dBμA
- dBpW
- Volt
- Ampere
- Watt

Additional units are available only if the R&S VSE-K54 (EMI measurements) option is installed. These additional "dBx/MHz" units are normalized to the pulse bandwidth and intended to be used only for EMI and EMC measurements. As opposed to the common dBm/Hz and dBm/MHz units, they are not suitable to measure power densities in the spectrum application.

- dBmV/MHz (normalized to 1 MHz)
- dBμV/MHz (normalized to 1 MHz)
- dBμV/mMHz (normalized to 1 MHz)  
(only available for active transducers with dBμV/m values)
- dBμA/MHz (normalized to 1 MHz)
- dBμA/mMHz (normalized to 1 MHz)  
(only available for active transducers with dBμA/m values)
- dBpW/MHz (normalized to 1 MHz)

Remote command:

```
INPut<ip>:IMPedance<ant> on page 614
CALCulate<n>:UNIT:POWer on page 648
```

### Setting the Reference Level Automatically (Auto Level) ← Reference Level

The connected instrument automatically determines the optimal reference level for the current input data. At the same time, the internal attenuators and the preamplifier are adjusted so the signal-to-noise ratio is optimized, while signal compression, clipping and overload conditions are minimized. This function is not available on all supported instruments.

You can change the measurement time for the level measurement if necessary (see "[Automatic Measurement Time Mode and Value](#)" on page 262).

Remote command:

[\[SENSe<ip>:\]ADJust:LEVel](#) on page 685

### External Frontend Attenuation

If an external frontend is active, you can configure the attenuation for the external frontend and the analyzer separately.

For more information, see the R&S VSE User Manual.

When using an external frontend, only mechanical attenuation is available.

The RF attenuation can be set automatically as a function of the selected reference level (Auto mode). Automatic attenuation ensures that no overload occurs at the RF Input connector for the current reference level. It is the default setting.

In "Manual" mode, you can set the RF attenuation in 1 dB steps (down to 0 dB). Other entries are rounded to the next integer value. The range is specified in the data sheet. If the defined reference level cannot be set for the defined RF attenuation, the reference level is adjusted accordingly and the warning "limit reached" is displayed.

**NOTICE!** Risk of hardware damage due to high power levels. When decreasing the attenuation manually, ensure that the power level does not exceed the maximum level allowed at the RF input, as an overload can lead to hardware damage.

Remote command:

[INPut<ip>:ATTenuation](#) on page 650

[INPut<ip>:ATTenuation:AUTO](#) on page 651

### Attenuation Mode / Value

Defines the attenuation applied to the RF input of the R&S VSE.

The RF attenuation can be set automatically as a function of the selected reference level (Auto mode). Automatic attenuation ensures that no overload occurs at the RF Input connector for the current reference level. It is the default setting.

**Note:** Using an external frontend. If an external frontend is active, you can configure the attenuation for the external frontend and the analyzer separately. When using an external frontend, only mechanical attenuation is available.

For more information, see the R&S VSE User Manual.

In "Manual" mode, you can set the RF attenuation in 1 dB steps (down to 0 dB). Other entries are rounded to the next integer value. The range is specified in the data sheet. If the defined reference level cannot be set for the defined RF attenuation, the reference level is adjusted accordingly and the warning "limit reached" is displayed.

**NOTICE!** Risk of hardware damage due to high power levels. When decreasing the attenuation manually, ensure that the power level does not exceed the maximum level allowed at the RF input, as an overload can lead to hardware damage.

Remote command:

[INPut<ip>:ATTenuation](#) on page 650

[INPut<ip>:ATTenuation:AUTO](#) on page 651

Defining attenuation for the analyzer when using an external frontend:

[INPut<ip>:SANalyzer:ATTenuation:AUTO](#) on page 653

[INPut<ip>:SANalyzer:ATTenuation](#) on page 653

**Optimization**

Selects the priority for signal processing *after* the RF attenuation has been applied.

This function is only available for specific instrument hardware.

"Low distortion"

(Default:) Optimized for low distortion by avoiding intermodulation

"Low noise"

Optimized for high sensitivity and low noise levels

If this setting is selected, "Low noise" is indicated in the channel information bar.

Remote command:

`INPut<ip>:ATTenuation:AUTO:MODE` on page 651

**Using Electronic Attenuation**

If the (optional) Electronic Attenuation hardware is installed on the connected instrument, you can also activate an electronic attenuator.

In "Auto" mode, the settings are defined automatically; in "Manual" mode, you can define the mechanical and electronic attenuation separately.

For an active external frontend, electronic attenuation is not available.

**Note:** Note that restrictions can apply concerning which frequencies electronic attenuation is available for, depending on which instrument is connected to the R&S VSE software. Check your instrument documentation for details.

In "Auto" mode, RF attenuation is provided by the electronic attenuator as much as possible to reduce the amount of mechanical switching required. Mechanical attenuation can provide a better signal-to-noise ratio, however.

When you switch off electronic attenuation, the RF attenuation is automatically set to the same mode (auto/manual) as the electronic attenuation was set to. Thus, the RF attenuation can be set to automatic mode, and the full attenuation is provided by the mechanical attenuator, if possible.

If the defined reference level cannot be set for the given attenuation, the reference level is adjusted accordingly and the warning "limit reached" is displayed in the status bar.

Remote command:

`INPut:EATT:STATe` on page 652

`INPut:EATT:AUTO` on page 652

`INPut:EATT` on page 651

**Input Settings**

Some input settings affect the measured amplitude of the signal, as well.

The parameters "Input Coupling" and "Impedance" are identical to those in the "Input" settings.

See [Chapter 10.3.2.1, "Radio frequency input"](#), on page 195.

**Preamplifier ← Input Settings**

If the (optional) internal preamplifier hardware is installed on the connected instrument, a preamplifier can be activated for the RF input signal.

You can use a preamplifier to analyze signals from DUTs with low output power.

**Note:** If an optional external preamplifier is activated, the internal preamplifier is automatically disabled, and vice versa.

For an active external frontend, a preamplifier is not available.

"Off" Deactivates the preamplifier.

"15 dB" The RF input signal is amplified by about 15 dB.

"30 dB" The RF input signal is amplified by about 30 dB.

Depending on the connected instrument, different settings are available. See the instrument's documentation for details.

Remote command:

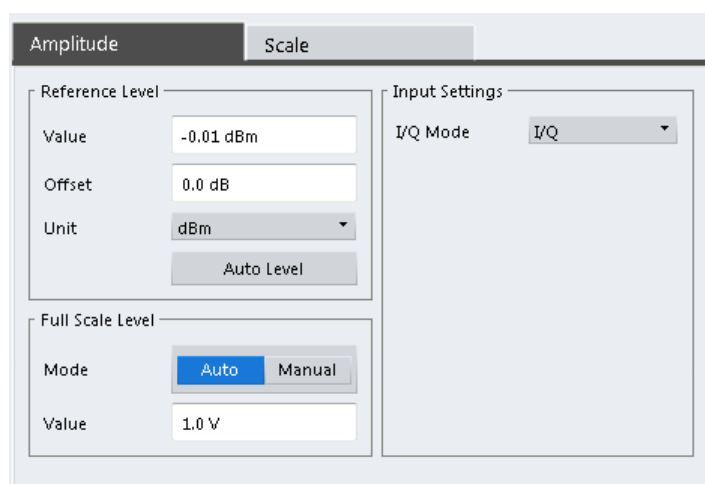
`INPut<ip>:GAIN<ant>:STATe` on page 654

`INPut<ip>:GAIN<ant>[:VALue]` on page 654

### 10.3.3.3 Amplitude settings for oscilloscope baseband input

**Access:** "Overview" > "Amplitude"

The following settings and functions are available to define amplitude settings for oscilloscope baseband input in the applications that support it.



Reference Level .....	228
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#### Reference Level

Defines the expected maximum input signal level. Signal levels above this value are possibly not measured correctly, which is indicated by the "IF Overload" status display ("OVLd" for baseband input).

Defines the expected maximum reference level. Signal levels above this value are possibly not measured correctly. Signals above the reference level are indicated by an "IF Overload" status display.

The reference level can also be used to scale power diagrams; the reference level is then used for the calculation of the maximum on the y-axis.

Since the hardware of the connected instrument is adapted according to this value, it is recommended that you set the reference level close above the expected maximum signal level. Thus you ensure an optimal measurement (no compression, good signal-to-noise ratio).

Note that for input from the External Mixer (R&S VSE-B21) the maximum reference level also depends on the conversion loss; see the R&S VSE base software user manual for details.

For an active external frontend, the reference level refers to the RF input at the external frontend, not the levels at the RF input of the connected instrument. The hardware is adjusted to the defined reference level optimally for input signals with a crest factor of 10 dB. Thus, the required reference level for an optimal measurement can differ depending on the crest factor of the input signal.

See "[External Frontend Connection State](#)" on page 213.

Remote command:

```
DISPlay[:WINDow<n>] [:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:
RLEVel<ant> on page 649
```

#### Shifting the Display (Offset) ← Reference Level

Defines an arithmetic level offset. This offset is added to the measured level. In some result displays, the scaling of the y-axis is changed accordingly.

Define an offset if the signal is attenuated or amplified before it is fed into the R&S VSE so the application shows correct power results. All displayed power level results are shifted by this value.

The setting range is  $\pm 200$  dB in 0.01 dB steps.

Note, however, that the *internal* reference level (used to adjust the hardware settings to the expected signal) ignores any "Reference Level Offset". Thus, it is important to keep in mind the actual power level the R&S VSE must handle. Do not rely on the displayed reference level (internal reference level = displayed reference level - offset).

Remote command:

```
DISPlay[:WINDow<n>] [:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:
RLEVel<ant>:OFFSet on page 649
```

#### Unit ← Reference Level

The connected instrument measures the signal voltage at the RF input.

In the default state, the level is displayed at a power level of 1 mW (= dBm). Via the known input impedance (50  $\Omega$  or 75  $\Omega$ , see "[Impedance](#)" on page 197), conversion to other units is possible.

The following units are available and directly convertible:

- dBm
- dBmV
- dB $\mu$ V
- dB $\mu$ A
- dBpW
- Volt

- Ampere
- Watt

Additional units are available only if the R&S VSE-K54 (EMI measurements) option is installed. These additional "dBx/MHz" units are normalized to the pulse bandwidth and intended to be used only for EMI and EMC measurements. As opposed to the common dBm/Hz and dBm/MHz units, they are not suitable to measure power densities in the spectrum application.

- dBmV/MHz (normalized to 1 MHz)
- dBµV/MHz (normalized to 1 MHz)
- dBµV/mMHz (normalized to 1 MHz)  
(only available for active transducers with dBµV/m values)
- dBµA/MHz (normalized to 1 MHz)
- dBµA/mMHz (normalized to 1 MHz)  
(only available for active transducers with dBµA/m values)
- dBpW/MHz (normalized to 1 MHz)

Remote command:

`INPut<ip>:IMPedance<ant>` on page 614

`CALCulate<n>:UNIT:POWer` on page 648

#### **Setting the Reference Level Automatically (Auto Level) ← Reference Level**

The connected instrument automatically determines the optimal reference level for the current input data. At the same time, the internal attenuators and the preamplifier are adjusted so the signal-to-noise ratio is optimized, while signal compression, clipping and overload conditions are minimized. This function is not available on all supported instruments.

You can change the measurement time for the level measurement if necessary (see "[Automatic Measurement Time Mode and Value](#)" on page 262).

Remote command:

`[SENSe<ip>:]ADJust:LEVel` on page 685

#### **Full Scale Level Mode / Value**

The full scale level defines the maximum power for oscilloscope baseband input possible without clipping the signal.

The full scale level can be defined automatically according to the reference level, or manually.

For manual input, this setting corresponds to the setting on the oscilloscope. Thus, possible scaling values of the oscilloscope are allowed.

Remote command:

`INPut<ip>:IQ:OSC:FULLscale:AUTO` on page 621

`INPut<ip>:IQ:OSC:FULLscale[:LEVel]` on page 621

#### **I/Q Mode**

Defines the format of the input signal.

For more information, see [Chapter 10.2.5.1, "I/Q processing modes"](#), on page 185.

"I/Q" Both components of the complex input signal (in-phase component, quadrature component) are filtered and resampled to the sample rate of the application.

**"I Only / Low IF I"**

The input signal at the channel providing I data is filtered and resampled to the sample rate of the application.

The input signal is down-converted with the center frequency (**Low IF I**).

Remote command:

`INPut<ip>:IQ:OSC:TYPE` on page 622

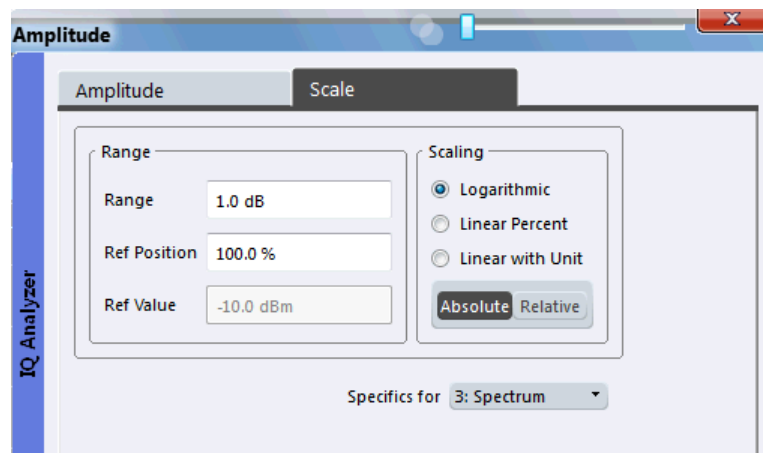
**10.3.3.4 Scaling the y-axis**

The individual scaling settings that affect the vertical axis are described here.

**Access:** "Overview" > "Amplitude" > "Scale" tab

**Or:** "Input & Output" > "Scale"

The settings for statistics results are described in [Chapter 10.3.3.5, "Scaling for statistics diagrams"](#), on page 232.



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Scaling .....	232
Y-Axis Max .....	232

**Range**

Defines the displayed y-axis range in dB.

The default value is 100 dB.

Remote command:

`DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALE]` on page 655

**Ref Level Position**

Defines the reference level position, i.e. the position of the maximum AD converter value on the level axis in %.

0 % corresponds to the lower and 100 % to the upper limit of the diagram.

Values from -120 % to +280 % are available.

Larger values are useful for small scales, such as a power range of 10 dB or 20 dB, and low signal levels, for example 60 dB below the reference level. In this case, large reference level position values allow you to see the trace again.

Remote command:

`DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:RPOSition`  
on page 656

### Ref Value

The reference level value (configured in [Amplitude settings](#)), indicated for reference only.

### Scaling

Defines the scaling method for the y-axis.

"Logarithmic"	Logarithmic scaling (only available for logarithmic units - dB..., and A, V, Watt)
"Linear with Unit"	Linear scaling in the unit of the measured signal
"Linear Percent"	Linear scaling in percentages from 0 to 100
"Absolute"	The labeling of the level lines refers to the absolute value of the reference level (not available for "Linear Percent" )
"Relative"	The scaling is in dB, relative to the reference level (only available for logarithmic units - dB...). The upper line of the grid (reference level) is always at 0 dB.

Remote command:

`DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y:SPACing` on page 657  
`DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:MODE`  
on page 655

### Y-Axis Max

Defines the maximum value of the y-axis in the currently selected diagram in either direction (in Volts). Thus, the y-axis scale starts at  $-<Y\text{-Axis Max}>$  and ends at  $+<Y\text{-Axis Max}>$ .

This command is only available if the evaluation mode for the I/Q Analyzer is set to "I/Q-Vector" or "Real/Imag (I/Q)".

Remote command:

`DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]` on page 655

#### 10.3.3.5 Scaling for statistics diagrams

**Access:** "Overview" > "Amplitude" > "Scale" tab

**Or:** "Input & Output" > "Scale"

For statistics displays, scale settings are available for both the y-axis and the x-axis.



The remote commands required to perform these tasks are described in [Chapter 13.6.2.3, "Configuring the axes for statistical displays"](#), on page 657.

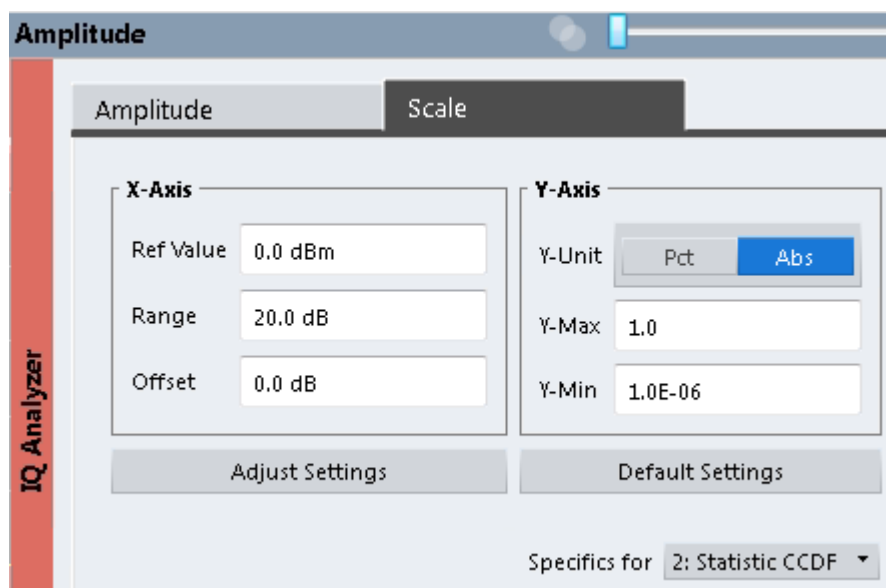


Figure 10-12: Scale settings for CCDF diagram

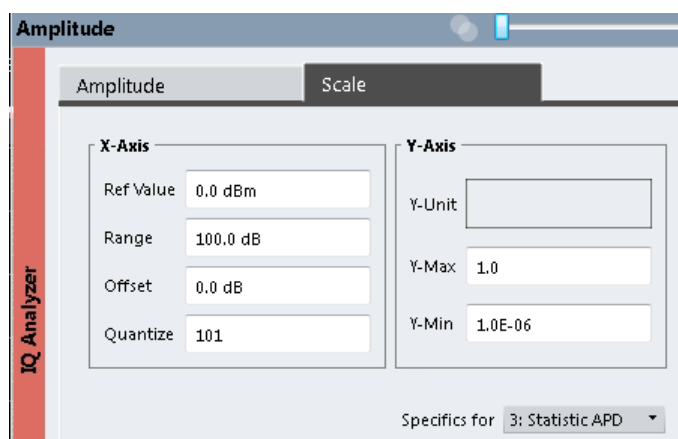


Figure 10-13: Scale settings for APD diagram



In statistical diagrams, the x-axis displays the signal level values (= y-axis in standard display), while the y-axis displays the probability of the values.

X-Axis .....	234
L Ref Level .....	234
L Range .....	234
L Shifting the Display (Offset) .....	234
Quantize Bins .....	234
Y-Axis .....	234
L Y-Unit .....	234

L Y-Max / Y-Min .....	235
Default Settings .....	235
Adjust Settings (CCDF only).....	235

### X-Axis

Defines the scaling settings for signal level values.

#### Ref Level ← X-Axis

Defines the reference level for the signal levels in the currently active unit (dBm, dBμV, etc.).

For the APD function this value corresponds to the right diagram border. For the CCDF function there is no direct representation of this value on the diagram as the x-axis is scaled relatively to the measured mean power.

Remote command:

[CALCulate<n>:STATistics:SCALE:X:RLEVel](#) on page 659

[CALCulate<n>:IQ:STATistic:SCALE:X:RVALue](#) on page 659

#### Range ← X-Axis

Defines the level range in dB to be evaluated by the statistics measurement.

Remote command:

[CALCulate<n>:STATistics:SCALE:X:RANGE](#) on page 658

[CALCulate<n>:IQ:STATistic:SCALE:X:RANGE](#) on page 658

#### Shifting the Display (Offset) ← X-Axis

Defines an arithmetic level offset. This offset is added to the measured level irrespective of the selected unit. The scaling of the x-axis is changed accordingly. The setting range is ±200 dB in 0.1 dB steps.

Remote command:

[DISPlay\[:WINDow<n>\]\[:SUBWindow<w>\]:TRACe<t>:Y\[:SCALE\]:](#)

[RLEVel<ant>:OFFSet](#) on page 649

[CALCulate<n>:IQ:STATistic:SCALE:X:RLEVel:OFFSet](#) on page 658

#### Quantize Bins

For [Statistic APD](#) displays, this value defines the number of **quantize bins** used to create the histogram, that is, the number of different measurement values the statistical occurrence is determined for.

For [Statistic CCDF](#) displays, the number of bins is fixed to 2048.

Remote command:

APD only:

[CALCulate<n>:IQ:STATistics:SCALE:X:QUANTize](#) on page 658

### Y-Axis

Defines the scaling settings for the probability distribution.

#### Y-Unit ← Y-Axis

(CCDF only)

Defines the scaling type of the y-axis as either percentage or absolute. The default value is absolute scaling.

Remote command:

[CALCulate<n>:STATistics:SCALE:Y:UNIT](#) on page 660

#### Y-Max / Y-Min ← Y-Axis

Defines the upper (max) and lower (min) limit of the displayed probability range. Values on the y-axis are normalized which means that the maximum value is 1.0. The minimum value must be in the range:

$1E-9 < Y\text{-Min} < 0.1$

The distance between "Y-Max" and "Y-Min" must be at least one decade.

Remote command:

[CALCulate<n>:STATistics:SCALE:Y:UPPER](#) on page 659

[CALCulate<n>:STATistics:SCALE:Y:LOWER](#) on page 659

[CALCulate<n>:IQ:STATistic:SCALE:Y:UPPER](#) on page 659

[CALCulate<n>:IQ:STATistic:SCALE:Y:LOWER](#) on page 659

#### Default Settings

Resets the x- and y-axis scalings to their preset values.

(CCDF only)

X-axis ref level:	0 dBm
X-axis range CCDF:	20 dB
Y-axis upper limit:	1.0
Y-axis lower limit:	1E-6

Remote command:

[CALCulate<n>:STATistics:PRESet](#) on page 660

#### Adjust Settings (CCDF only)

Adjusts the level settings according to the measured difference between peak and mean power for CCDF measurement in order to obtain maximum power resolution. Adjusts the reference level to the current input signal.

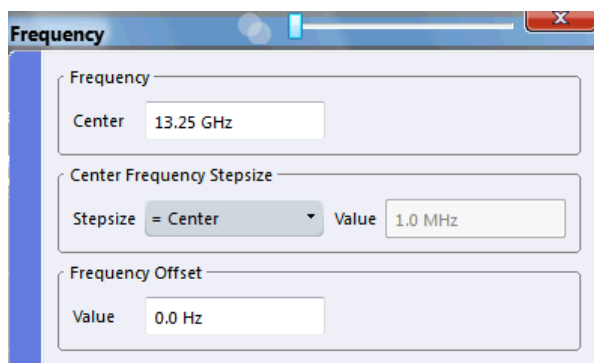
Remote command:

[CALCulate<n>:STATistics:SCALE:AUTO ONCE](#) on page 660

### 10.3.4 Frequency settings

**Access:** "Overview" > "Frequency"

**Or:** "Input & Output" > "Frequency"



Center Frequency .....	236
Center Frequency Stepsize .....	236
Frequency Offset .....	237

### Center Frequency

Defines the center frequency of the signal in Hertz.

$$0 \text{ Hz} \leq f_{\text{center}} \leq f_{\text{max}}$$

$f_{\text{max}}$  and  $\text{span}_{\text{min}}$  depend on the instrument and are specified in the data sheet.

**Note:** For file input, you can shift the center frequency of the current measurement compared to the stored measurement data. The maximum shift depends on the sample rate of the file data.

$$CF_{\text{shiftmax}} = CF_{\text{file}} \pm \frac{SR_{\text{file}}}{2}$$

If the file does not provide the center frequency, it is assumed to be 0 Hz.

To ensure that the input data remains within the valid analysis bandwidth, define the center frequency and the analysis bandwidth for the measurement such that the following applies:

$$CF + \frac{ABW_{\text{channel}}}{2} > CF_{\text{file}} + \frac{ABW_{\text{file}}}{2}$$

$$CF - \frac{ABW_{\text{channel}}}{2} > CF_{\text{file}} - \frac{ABW_{\text{file}}}{2}$$

Remote command:

[SENSe<ip>:]FREQuency:CENTer on page 661

### Center Frequency Stepsize

Defines the step size by which the center frequency is increased or decreased using the arrow keys.

When you use the mouse wheel, the center frequency changes in steps of only 1/10 of the span.

The step size can be coupled to another value or it can be manually set to a fixed value.

"= Center"      Sets the step size to the value of the center frequency. The used value is indicated in the "Value" field.

"Manual" Defines a fixed step size for the center frequency. Enter the step size in the "Value" field.

Remote command:

[SENSe:]FREQuency:CENTer:STEP on page 662

### Frequency Offset

Shifts the displayed frequency range along the x-axis by the defined offset.

This parameter has no effect on the instrument's hardware, on the captured data, or on data processing. It is simply a manipulation of the final results in which absolute frequency values are displayed. Thus, the x-axis of a spectrum display is shifted by a constant offset if it shows absolute frequencies. However, if it shows frequencies relative to the signal's center frequency, it is not shifted.

A frequency offset can be used to correct the display of a signal that is slightly distorted by the measurement setup, for example.

The allowed values range from -1 THz to 1 THz. The default setting is 0 Hz.

Remote command:

[SENSe<ip>:]FREQuency:OFFSet on page 662

## 10.3.5 Trigger and gate configuration

Triggering means to capture the interesting part of the signal. Choosing the right trigger type and configuring all trigger settings correctly allows you to detect various incidents in your signals.

Gating allows you to restrict measurement analysis to the important part or parts of the signal, for example bursts.

- [Triggering](#).....237
- [Gating](#).....248

### 10.3.5.1 Triggering

#### Trigger basics

In a basic measurement with default settings, the measurement is started immediately when you select ►"Capture" . However, sometimes you want the measurement to start only when a specific condition is fulfilled on the connected instrument, for example a signal level is exceeded, or in certain time intervals. For these cases, you can define a trigger for the measurement.

An "Offset" can be defined to delay the measurement after the trigger event, or to include data before the actual trigger event in time domain measurements (pre-trigger offset).

For complex tasks, advanced trigger settings are available:

- Hysteresis to avoid unwanted trigger events caused by noise
- Holdoff to define exactly which trigger event causes the trigger in a jittering signal

• <a href="#">Trigger source</a> .....	238
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• <a href="#">Trigger hysteresis</a> .....	238
• <a href="#">Trigger drop-out time</a> .....	239
• <a href="#">Trigger holdoff</a> .....	240

### Trigger source

The trigger source defines which source must fulfill the condition that triggers the measurement. Basically, the source can be:

- Time: the measurement is repeated in a regular interval
- Power: an input signal is checked for a defined power level  
The trigger signal can be any of the following:
  - The input signal at one of various stages in the signal analysis process - before or after the input mixer, after the video filter etc.
  - A signal from an external device via one of the TRIGGER INPUT / OUTPUT connectors on the instrument
  - A signal from one of the input channels from a connected oscilloscope
- Complex trigger settings defined on a connected R&S RTP: using a manual trigger source, any trigger settings in the R&S VSE software are ignored; only trigger settings defined on the connected instrument are considered. Thus, you can use the more complex trigger settings available on an R&S RTP.

For details on the available trigger sources, see "[Trigger Source](#)" on page 242.

### Trigger offset

An offset can be defined to delay the measurement after the trigger event, or to include data before the actual trigger event in time domain measurements (pre-trigger offset). Pre-trigger offsets are possible because the R&S VSE captures data continuously in the time domain, even before the trigger occurs.

See "[Trigger Offset](#)" on page 245.

### Trigger hysteresis

Setting a hysteresis for the trigger helps avoid unwanted trigger events caused by noise, for example. The hysteresis is a threshold to the trigger level that the signal must fall below on a rising slope or rise above on a falling slope before another trigger event occurs.

**Example:**

In the following example, the signal does not drop below the hysteresis (threshold) before it reaches the trigger level again. Thus, the second possible trigger event on the rising edge is ignored. On the falling edge, however, two trigger events occur. The signal exceeds the hysteresis before it falls to the trigger level the second time.

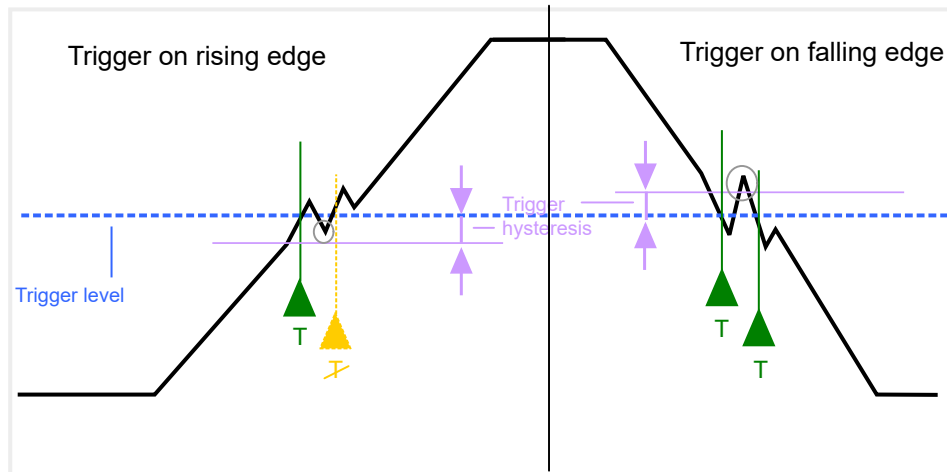


Figure 10-14: Effects of the trigger hysteresis

See "Hysteresis " on page 246

**Trigger drop-out time**

If a modulated signal is instable and produces occasional "drop-outs" during a burst, you can define a minimum duration that the input signal must stay below the trigger level before triggering again. This is called the "drop-out" time. Defining a dropout time helps you stabilize triggering when the analyzer is triggering on undesired events.

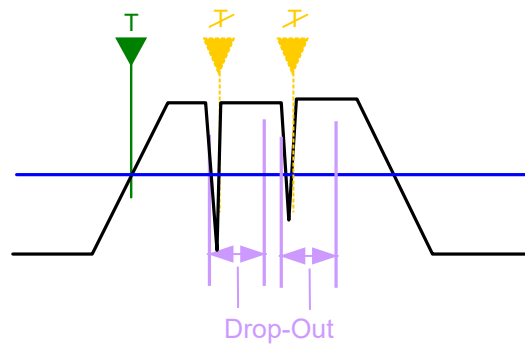


Figure 10-15: Effect of the trigger drop-out time

See "Drop-Out Time " on page 245.



### Drop-out times for falling edge triggers

If a trigger is set to a falling edge ("Slope" = "Falling" , see "Slope " on page 246) the measurement is to start when the power level falls below a certain level. This is useful, for example, to trigger at the end of a burst, similar to triggering on the rising edge for the beginning of a burst.

If a drop-out time is defined, the power level must remain below the trigger level at least for the duration of the drop-out time (as defined above). However, if a drop-out time is defined that is longer than the pulse width, this condition cannot be met before the final pulse. Thus, a trigger event does not occur until the pulsed signal is over.

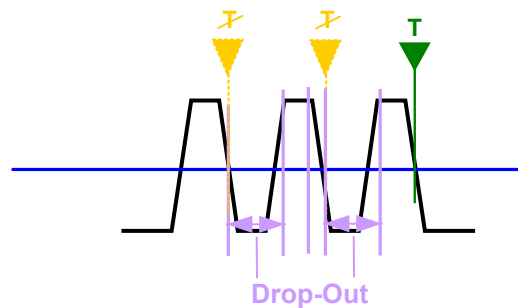


Figure 10-16: Trigger drop-out time for falling edge trigger

### Trigger holdoff

The trigger holdoff defines a waiting period before the next trigger after the current one will be recognized.

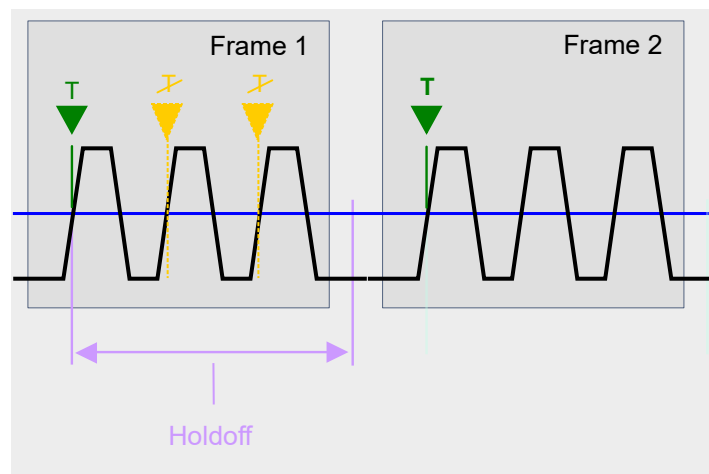


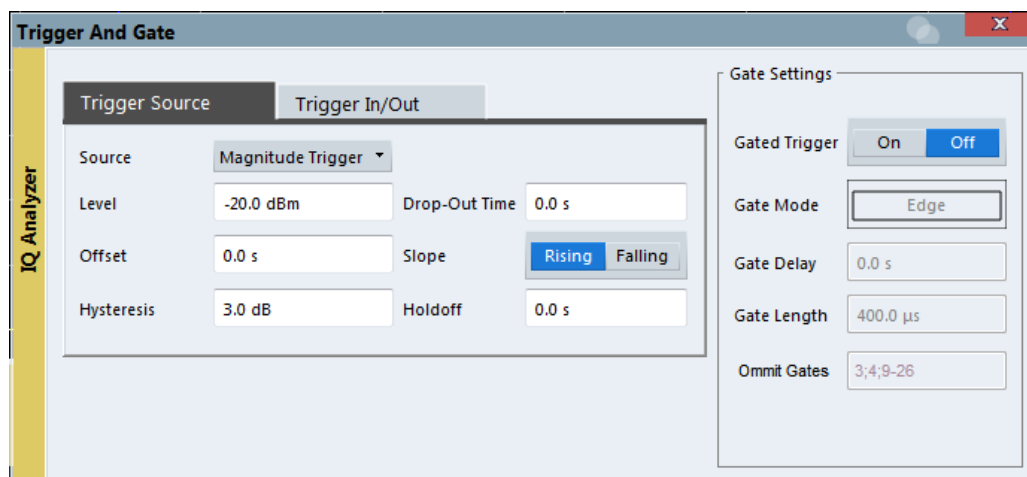
Figure 10-17: Effect of the trigger holdoff

See "Trigger Holdoff " on page 246.

### Trigger settings

Access: "Overview" > "Trigger/Gate"





Trigger output is described in the R&S VSE base software user manual.

External triggers from one of the TRIGGER INPUT / OUTPUT connectors on the R&S VSE are configured in a separate tab of the dialog box.

See [Chapter 7.7, "Receiving and providing trigger signals"](#), on page 112.

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### Preview

The preview mode allows you to try out trigger and gate settings before actually applying them to the current measurement.

The preview diagram displays a zero span measurement at the center frequency with the defined RBW and sweep time. This is useful when analyzing bursts, for example, to determine the required gate settings.

The trigger and gate settings are applied to the measurement when the dialog box is closed.

**Note:** The zero span settings refer only to the preview diagram. The main diagram remains unchanged.

If preview mode is switched off, any changes to the settings in this dialog box are applied to the measurement diagram directly. In this case, the zero span settings for the preview diagram are not displayed.

#### **Frequency ← Preview**

Defines the center frequency for the preview diagram.

Remote command:

[\[SENSe<ip>:\]FREQuency:CENTer](#) on page 661

#### **RBW ← Preview**

Defines the resolution bandwidth for the preview diagram. The available resolution bandwidths are specified in the data sheet. Numeric input is always rounded to the nearest possible bandwidth.

Remote command:

[\[SENSe:\]BANDwidth\[:RESolution\]](#) on page 789

#### **Sweep Time ← Preview**

Defines the sweep time for the preview diagram. Allowed values depend on the ratio of span to RBW and RBW to VBW. For details refer to the data sheet. Numeric input is always rounded to the nearest possible sweep time.

Remote command:

[\[SENSe:\]SWEep:TIME](#) on page 678

#### **Trigger Source**

Selects the trigger source. If a trigger source other than "Free Run" is set, "TRG" is displayed in the channel bar and the trigger source is indicated.

Note that the availability of trigger sources depends on the connected instrument.

For an active external frontend, only external triggers, I/Q power triggers and (periodic) time triggers are supported as trigger sources. See ["External Frontend Connection State"](#) on page 213.

Remote command:

[TRIGger\[:SEQuence\]:SOURce](#) on page 668

#### **Free Run ← Trigger Source**

No trigger source is considered. Data acquisition is started manually or automatically and continues until stopped explicitly.

Remote command:

[TRIG:SOUR IMM](#), see [TRIGger\[:SEQuence\]:SOURce](#) on page 668

#### **External Trigger / Trigger Channel X ← Trigger Source**

Data acquisition starts when the signal fed into the specified input connector or input channel of the connected instrument meets or exceeds the specified trigger level.

**Note:** Which input and output connectors are available depends on the connected instrument. For details, see the instrument's documentation.

For a connected R&S oscilloscope, the following signals are used as trigger input:

- "External Trigger": EXT TRIGGER INPUT connector on rear panel of instrument
- "Trigger Channel 2"/"Trigger Channel 3"/"Trigger Channel 4": Input at channel connectors CH 2/3/4 on front panel of instrument - if not used as an input source

Remote command:

TRIG:SOUR EXT, TRIG:SOUR EXT2, TRIG:SOUR EXT3, TRIG:SOUR EXT4

See [TRIGger\[:SEquence\]:SOURce](#) on page 668

### External Channel 3 ← Trigger Source

Data acquisition starts when the signal fed into the "Ch3" input connector on the oscilloscope meets or exceeds the specified trigger level.

**Note:** In previous firmware versions, the external trigger was connected to the "Ch2" input on the oscilloscope. As of firmware version R&S VSE 2.30, the "Ch3" input on the oscilloscope must be used!

**Note:** Since the external trigger uses a second channel on the oscilloscope, the maximum memory size, and thus record length, available for the input channel 1 may be reduced by half. For details, see the oscilloscope's data sheet and documentation.

Remote command:

TRIG:SOUR EXT, see [TRIGger\[:SEquence\]:SOURce](#) on page 668

### External Analog ← Trigger Source

Data acquisition starts when the signal fed into the EXT TRIGGER INPUT connector on the oscilloscope meets or exceeds the specified trigger level.

This trigger source is only available if the optional 2 GHz bandwidth extension (R&S FSW-B2000) is active in power splitter mode (see "[Oscilloscope Splitter Mode](#)" on page 200).

Remote command:

TRIG:SOUR EXT, see [TRIGger\[:SEquence\]:SOURce](#) on page 668

### IF Power ← Trigger Source

The R&S VSE starts capturing data as soon as the trigger level is exceeded around the third intermediate frequency.

(The third IF represents the center frequency.)

This trigger source is only available for RF input.

The available trigger levels depend on the RF attenuation and preamplification. A reference level offset, if defined, is also considered.

When using the optional 2 GHz bandwidth extension (R&S FSW-B2000) with an IF power trigger, the IF power trigger corresponds to a "width" trigger on the oscilloscope, with a negative polarity and the range "longer". Thus, data acquisition starts when both of the following conditions apply to the signal fed into the CH1 input connector on the oscilloscope:

- The power level has remained below the specified trigger level for a duration longer than the drop-out time.
- The power level then rises above the specified trigger level.

For details on available trigger levels and trigger bandwidths, see the data sheet.

Remote command:

TRIG:SOUR IFP, see [TRIGger\[:SEquence\]:SOURce](#) on page 668

#### **I/Q Power ← Trigger Source**

This trigger source is only available in the I/Q Analyzer application and in applications that process I/Q data.

Triggers the measurement when the magnitude of the sampled I/Q data exceeds the trigger threshold.

The trigger bandwidth corresponds to the bandwidth setting for I/Q data acquisition.

(See ["Analysis Bandwidth"](#) on page 253.)

Remote command:

TRIG:SOUR IQP, see [TRIGger\[:SEquence\]:SOURce](#) on page 668

#### **RF Power ← Trigger Source**

Defines triggering of the measurement via signals which are outside the displayed measurement range.

For this purpose, the software uses a level detector at the first intermediate frequency.

The resulting trigger level at the RF input depends on the RF attenuation and preamplification. For details on available trigger levels, see the instrument's data sheet.

**Note:** If the input signal contains frequencies outside of this range (e.g. for fullspan measurements), the measurement can be aborted. A message indicating the allowed input frequencies is displayed in the status bar.

A "Trigger Offset", "Trigger Polarity" and "Trigger Holdoff" (to improve the trigger stability) can be defined for the RF trigger, but no "Hysteresis".

Not available for input from the optional "Analog Baseband" interface.

If the trigger source "RF Power" is selected and you enable baseband input, the trigger source is automatically switched to "Free Run".

Remote command:

TRIG:SOUR RFP, see [TRIGger\[:SEquence\]:SOURce](#) on page 668

#### **Time ← Trigger Source**

Triggers in a specified repetition interval.

See ["Repetition Interval"](#) on page 245.

For file input, data is taken from the file in the specified time interval. Overlap settings for the R&S VSE Player are ignored.

(See [Chapter 8.3.4.2, "Restoring the measurement results - R&S VSE player"](#), on page 137).

Remote command:

TRIG:SOUR TIME, see [TRIGger\[:SEquence\]:SOURce](#) on page 668

#### **Magnitude (Offline) ← Trigger Source**

For (offline) input from a file, rather than an instrument. Triggers on a specified signal level.

Remote command:

TRIG:SOUR MAGN, see [TRIGger\[:SEquence\]:SOURce](#) on page 668

### Manual ← Trigger Source

Only available for a connected R&S RTP:

Any trigger settings in the R&S VSE software are ignored; only trigger settings defined on the connected instrument are considered. Thus, you can make use of the more complex trigger settings available on an R&S RTP.

Remote command:

TRIG:SOUR MAN, see [TRIGger\[:SEquence\]:SOURce](#) on page 668

### Trigger Level

Defines the trigger level for the specified trigger source.

For details on supported trigger levels, see the instrument data sheet.

For time triggers, the repetition interval is defined. See "[Repetition Interval](#)" on page 245.

Remote command:

[TRIGger\[:SEquence\]:LEVel:IFPower](#) on page 666

[TRIGger\[:SEquence\]:LEVel:IQPower](#) on page 666

[TRIGger\[:SEquence\]:LEVel\[:EXternal<port>\]](#) on page 665

[TRIGger\[:SEquence\]:LEVel:RFPower](#) on page 667

For baseband input only:

[TRIGger\[:SEquence\]:LEVel:BBPower](#) on page 665

[TRIGger\[:SEquence\]:LEVel:MAPower](#) on page 666

### Repetition Interval

Defines the repetition interval for a time trigger.

The shortest interval is 2 ms.

Set the repetition interval to the exact pulse period, burst length, frame length or other repetitive signal characteristic. If the required interval cannot be set with the available granularity, configure a multiple of the interval that can be set. Thus, the trigger remains synchronized to the signal.

Remote command:

[TRIGger\[:SEquence\]:TIME:RINTerval](#) on page 670

### Drop-Out Time

Defines the time that the input signal must stay below the trigger level before triggering again.

**Note:** For input from the optional "Analog Baseband" interface using the baseband power trigger (BBP), the default drop out time is set to 100 ns. This avoids unintentional trigger events (as no hysteresis can be configured in this case).

Remote command:

[TRIGger\[:SEquence\]:DTIME](#) on page 664

### Trigger Offset

Defines the time offset between the trigger event and the start of the measurement.

Offset > 0:	Start of the measurement is delayed
Offset < 0:	Measurement starts earlier (pretrigger) Only possible for zero span (e.g. I/Q Analyzer application) and gated trigger switched off Maximum allowed range limited by the measurement time: $\text{Pretrigger}_{\text{max}} = \text{measurement time}_{\text{max}}$

**Tip:** To determine the trigger point in the sample (for "External" or "IF Power" trigger source), use the `TRACe:IQ:TPISample?` command.

(If supported by the connected instrument.)

For the "Time" trigger source, this function is not available.

Remote command:

`TRIGger[:SEquence]:HOLDoff[:TIME]` on page 664

### Hysteresis

Defines the distance in dB to the trigger level that the trigger source must exceed before a trigger event occurs. Setting a hysteresis avoids unwanted trigger events caused by noise oscillation around the trigger level.

When using the optional 2 GHz bandwidth extension (R&S FSW-B2000) with an IF power trigger, the hysteresis refers to the robust width trigger.

This setting is only available for "IF Power" or "Magnitude (Offline)" trigger sources.

The range of the value depends on the connected instrument.

Remote command:

`TRIGger[:SEquence]:IFPower:HYSteresis` on page 665

`TRIGger[:SEquence]:MAPower:HYSteresis` on page 667

### Trigger Holdoff

Defines the minimum time (in seconds) that must pass between two trigger events. Trigger events that occur during the holdoff time are ignored.

Remote command:

`TRIGger[:SEquence]:IFPower:HOLDoff` on page 664

`TRIGger[:SEquence]:MAPower:HOLDoff` on page 667

### Slope

For all trigger sources except time, you can define whether triggering occurs when the signal rises to the trigger level or falls down to it.

For gated measurements in "Edge" mode, the slope also defines whether the gate starts on a falling or rising edge.

When using the optional 2 GHz bandwidth extension (R&S FSW-B2000) with an IF power trigger, only rising slopes can be detected.

Remote command:

`TRIGger[:SEquence]:SLOPe` on page 668

### How to determine the required trigger/gate parameters

1. In the "Trigger And Gate" dialog box, switch on "Show Preview" .  
A zero span measurement for the currently defined center frequency is displayed.
2. Set the "Frequency" , "RBW" and "Meas Time" such that the relevant part of the signal is displayed, for example a complete burst.
3. Determine the parameters you want to use to define the trigger and gate conditions from the preview diagram, for example:
  - the length of a burst or slot
  - the upper or lower power level of a pulse
  - the maximum noise level
  - the power level or time at which a certain incident occurs
4. Try out different trigger and gate settings as described in [How to configure a triggered measurement](#) and [How to configure a gated measurement](#), then select "Update Main Diagram" to see the effect of the current settings on the main measurement in the background.
5. If the results are as expected, close the dialog box to keep the changes permanently. Otherwise, correct the settings as necessary.

### How to configure a triggered measurement

#### To define an external trigger:

1. Connect an external device that will provide the trigger signal to one of the TRIGGER INPUT / OUTPUT connectors on the R&S VSE.  
For details see the R&S VSE "Getting Started" manual.
2. In the "Trigger And Gate" dialog box, define the "Trigger Source" = "External" .
3. Configure the external trigger as described for the other power triggers.

#### To define a power trigger:

1. In the "Trigger And Gate" dialog box, define the "Trigger Source" = "IF Power" .
2. Define the "Trigger Level" : the power level at which the measurement will start.
3. Define whether the signal must cross the trigger level on a falling or on a rising edge ("Slope" ) to trigger the measurement.
4. To start the measurement with a time delay, define a "Trigger Offset" .
5. To reject triggers due to noise or jittering in the signal, define a "Hysteresis" that is larger than the expected noise or jittering. After the previous trigger, the signal must exceed this threshold before the next level crossing triggers a new measurement.

6. To skip multiple triggers in a burst, define a "Holdoff" time that must pass between two triggers. The holdoff time should be slightly larger than the burst.

### 10.3.5.2 Gating

- [Gated measurements](#).....248
- [Gate settings](#).....248
- [Continuous gate settings](#).....250
- [How to configure a gated measurement](#).....251

#### Gated measurements

Like a gate provides an opening in a fence, a gated measurement lets data from the input signal pass in defined areas only. The *gate* controls exactly when data is included in the measurement results and when not. The gate is opened by the trigger source, which is also the gate source.



#### Conditions

The R&S VSE I/Q Analyzer supports gating under the following conditions:

- File input
- "Edge" mode
- Using a time or magnitude (offline) trigger
- For RF measurements such as SEM, OBW, ACLR

The gate opens and the measurement starts when a defined level in the gate source is exceeded or the time is reached, and stops when the defined "Gate Length" is reached.

Additionally, a delay time can be defined so that the first few measurement points after the gate opening are ignored.

Gated sweep operation is also possible for zero span measurements. This allows you to display level variations of individual slots, for instance in burst signals, versus time.

To indicate that a gate is used for the sweep, "GAT" and the gate source is displayed in the channel bar.

#### Gate settings

**Access:** "Overview" > "Trigger" > "Trigger / Gate Config." > "Gate Settings"

Gate settings define one or more extracts of the signal to be measured.



Gated Trigger .....	249
Gate Mode .....	249
Gate Delay .....	249
Gate Length .....	249
Skip Gates.....	250

### Gated Trigger

Switches gated triggering on or off.

If the gate is switched on, an (offline) magnitude or a time trigger controls the gates for the measurement.

Remote command:

[\[SENSe:\] SWEEp:EGATe](#) on page 671

### Gate Mode

Sets the gate mode.

The R&S VSE I/Q Analyzer supports gating in edge mode only. After the gate signal has been detected, the gate remains open until the gate length is over.

### Gate Delay

Defines the delay time between the gate signal and the continuation of the measurement.

Remote command:

[\[SENSe:\] SWEEp:EGATe:HOLDoff](#) on page 672

### Gate Length

Defines how long the gate is open when it is triggered.

**Note:** The gate length must be larger than or equal to the FFT [Window Length](#) to determine the correct spectrum. If necessary, increase the [RBW](#) or decrease the [Window Length](#) in the I/Q data acquisition settings to obtain the required relation to the selected gate length.

Remote command:

[\[SENSe:\] SWEEp:EGATe:LENGth](#) on page 672

**Skip Gates**

Ignores the specified gates in a continuous gate measurement. This setting is only available for magnitude (offline) triggered measurements.

Enter a comma-separated list of gate numbers or gate ranges.

**Example:**

1,5-9 ignores gates 1,5,6,7,8,9

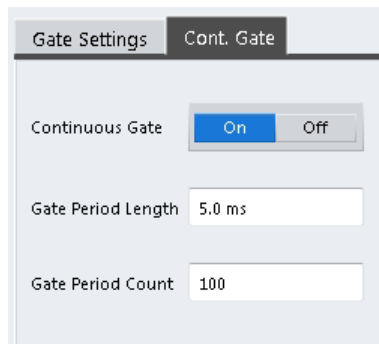
Remote command:

[SENSe:] SWEEp:EGATe:SKIP on page 673

**Continuous gate settings**

**Access:** "Overview" > "Trigger" > "Trigger / Gate Config." > "Cont. Gate" tab

Continuous gating allows you to perform a continuous gated sweep after a single magnitude (offline) trigger is received.



Continuous Gate.....	250
Gate Period Length.....	250
Gate Period Count.....	251

**Continuous Gate**

Activates or deactivates continuous gating.

This setting is only available if **Gated Trigger** is "On".

It is only available for magnitude (offline) triggers.

Remote command:

[SENSe:] SWEEp:EGATe:CONTinuous[:STATe] on page 672

**Gate Period Length**

Defines the length in seconds of a single gate period in continuous gating. The length is determined from the beginning of one gate measurement to the beginning of the next one.

Remote command:

[SENSe:] SWEEp:EGATe:CONTinuous:PLENgtH on page 672

### Gate Period Count

Defines the number of gate periods to be measured after a single trigger event in continuous gating.

Remote command:

[\[SENSe:\]SWEep:EGATe:CONTinuous:PCOunt](#) on page 671

### How to configure a gated measurement

A gated measurement records data only while the gate conditions are fulfilled. These step-by-step instructions demonstrate how to configure a gated measurement manually.

#### To configure a common gated measurement

1. Determine the required parameters as described in ["How to determine the required trigger/gate parameters"](#) on page 247.
2. The gate is opened by a trigger event. Define the trigger as described in ["How to configure a triggered measurement"](#) on page 247. As the "Trigger Source" , use "Magnitude (offline)".
3. Define how long the gate is to remain open:  
Define the time to measure for each gate: "Gate Length" .
4. To open the gate with a time delay, for example to ignore an overshoot, define a "Gate Delay" .
5. Select "Gated Trigger" = "On" .

#### To configure a continuous gated measurement

A continuous gated measurement is based on a common gated measurement. However, after a single magnitude (offline) trigger event, multiple further gate measurements are performed.

1. The gate is opened by a trigger event. Define the trigger as described in ["How to configure a triggered measurement"](#) on page 247. As the "Trigger Source" , use "Magnitude (offline)".
2. In the "Gate Settings" of the "Trigger and Gate" dialog box, select "Gated Trigger": "On".
3. Define the gate settings as described in ["To configure a common gated measurement"](#) on page 251.
4. Select the "Cont. Gate" tab next to the "Gate Settings".
5. Set "Continuous Gate" to "On".
6. Define the length in seconds from the beginning of one gate measurement to the beginning of the next one ("Gate Period Length").
7. Define how many gate measurements are to be performed after a single trigger event ("Gate Period Count").

8. Run a measurement and wait for the magnitude (offline) trigger event to occur.

### 10.3.6 Data acquisition and bandwidth settings

**Access:** "Overview" > "Bandwidth"

**or:** "Meas Setup" > "Data Acquisition"

The signal bandwidth to be captured and analyzed is configurable.

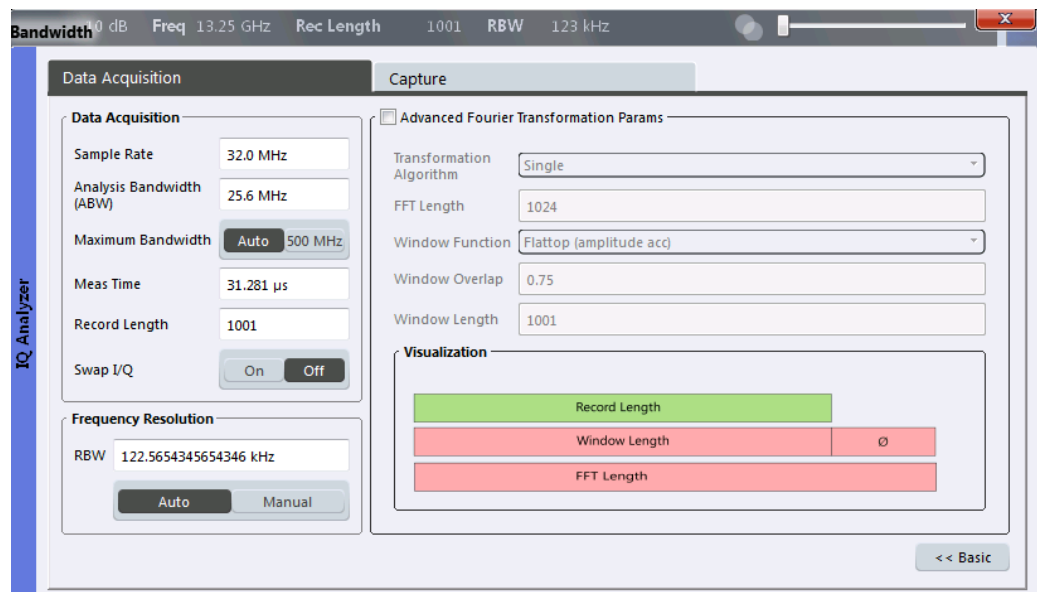
- [Data acquisition](#).....252
- [Capture settings](#).....257

#### 10.3.6.1 Data acquisition

**Access:** "Overview" > "Bandwidth" > "Data Acquisition"

**or:** "Meas Setup" > "Data Acquisition"

The data acquisition settings define which parts of the input signal are captured for further evaluation in the applications.



**Figure 10-18:** Data acquisition settings with advanced FFT parameters

The remote commands required to perform these tasks are described in [Chapter 13.6.2.6, "Configuring data acquisition"](#), on page 674.

- [Sample Rate](#)..... 253
- [Analysis Bandwidth](#)..... 253
- [Maximum Bandwidth](#)..... 253
- [200 MHz Filter](#)..... 253
- [Meas Time](#) ..... 254
- [Record Length](#) ..... 254
- [Swap I/Q](#) ..... 254

RBW .....	255
Advanced FFT mode / Basic Settings .....	255
L Transformation Algorithm .....	256
L FFT Length .....	256
L Window Function .....	256
L Window Overlap .....	256
L Window Length .....	256

### Sample Rate

Defines the I/Q data sample rate of the R&S VSE. This value is dependent on the [Analysis Bandwidth](#) and the signal source.

$$\text{sample rate} = \text{analysis bandwidth} / 0.8$$

For details on the dependencies see [Chapter 10.2.1.1, "Sample rate, record length and analysis bandwidth"](#), on page 176.

Remote command:

[TRACe: IQ:SRATe](#) on page 681

### Analysis Bandwidth

Defines the flat, usable bandwidth of the final I/Q data. This value is dependent on the defined [Sample Rate](#) and the defined signal source.

$$\text{analysis bandwidth} = 0.8 * \text{sample rate}$$

However, the analysis bandwidth used by the R&S VSE software may be restricted by the bandwidth provided by the connected instrument.

For a connected R&S FSW using an external mixer, the bandwidth is restricted to 512 MHz, regardless of any installed larger bandwidth extension options.

Remote command:

[TRACe: IQ:BWIDth](#) on page 679

### Maximum Bandwidth

Depending on the connected instrument, the maximum bandwidth to be used by the R&S VSE for I/Q data acquisition can be restricted. This setting is only available if a bandwidth extension option is installed on the connected instrument. Otherwise the maximum bandwidth is determined automatically.

The available values depend on the instrument and the installed bandwidth extension options. For details see the instrument's documentation.

Remote command:

[TRACe: IQ:WBANd\[:STATe\]](#) on page 682

[TRACe: IQ:WBANd:MBWidth](#) on page 682

### 200 MHz Filter

Activates a 200 MHz filter before the A/D converter, thus restricting the processed bandwidth to 200 MHz while using the wideband processing path in the connected instrument.

This is useful for signals that have a bandwidth of approximately 200 MHz (for example Docsis 3.1). In this case, the connected instrument can optimize signal processing for the relevant signal and filter out unwanted signal parts from adjacent channels, while taking advantage of a higher sample rate.

If you simply reduce the specified [Analysis Bandwidth](#), the sample rate, which is coupled, is also reduced.

If the filter is active, "200 MHz" is indicated in the channel information bar.

Remote command:

[TRACe: IQ:WFILter](#) on page 682

### Meas Time

Defines the I/Q acquisition time. By default, the measurement time is calculated as the number of I/Q samples ("Record Length" ) divided by the sample rate. If you change the measurement time, the [Record Length](#) is automatically changed, as well.

For details on the maximum number of samples see also [Chapter 10.2.1.1, "Sample rate, record length and analysis bandwidth"](#), on page 176. Note that the measurement time used by the R&S VSE software may be restricted by the measurement time available on the connected instrument.

Remote command:

[\[SENSe:\] SWEep: TIME](#) on page 678

### Record Length

Defines the number of I/Q samples to record. By default, the number of measurement points is used. The record length is calculated as the measurement time multiplied by the sample rate. If you change the record length, the [Meas Time](#) is automatically changed, as well.

**Note:** For the I/Q vector result display, the number of I/Q samples to record ("Record Length" ) must be identical to the number of trace points to be displayed ("Capture Points"). Thus, the measurement points are not editable for this result display. If the "Record Length" is edited, the measurement points are adapted automatically.

For record lengths outside the valid range of measurement points (see ["Points"](#) on page 258) the diagram does not show valid results.

**Note:** If the optional 2 GHz bandwidth extension (R&S FSW-B2000) or the optional oscilloscope baseband input is used, the record length may be restricted by the connected oscilloscope (see its data sheet).

Remote command:

[TRACe: IQ: RLENgth](#) on page 679

[TRACe: IQ: SET](#) on page 679

### Swap I/Q

Activates or deactivates the inverted I/Q modulation. If the I and Q parts of the signal from the DUT are interchanged, the R&S VSE can do the same to compensate for it.

On	I and Q signals are interchanged Inverted sideband, $Q+j*I$
Off	I and Q signals are not interchanged Normal sideband, $I+j*Q$

Remote command:

[\[SENSe:\]SWAPiQ](#) on page 677

### RBW

Defines the resolution bandwidth for Spectrum results. The available RBW values depend on the sample rate and record length.

Depending on the selected RBW mode, the value is either determined automatically or can be defined manually. As soon as you enter a value in the input field, the RBW mode is changed to "Manual" .

If the "Advanced Fourier Transformation Params" option is enabled, advanced FFT mode is selected and the RBW cannot be defined directly.

Note that the RBW is correlated with the [Sample Rate](#) and [Record Length](#) (and possibly the [Window Function](#) and [Window Length](#) ). Changing any one of these parameters may cause a change to one or more of the other parameters. For more information see [Chapter 10.2.3.1, "Frequency resolution of FFT results - RBW"](#), on page 178.

"Auto mode" (Default) The RBW is determined automatically depending on the [Sample Rate](#) and [Record Length](#) . A single window function is used (window length = record length). The number of measurement points is automatically adapted to the FFT length.

"Manual mode" The RBW can be defined by the user.  
The user-defined RBW is used and the [Window Length](#) (and possibly [Sample Rate](#)) are adapted accordingly. A single window function is used (window length = record length)

"Advanced FFT mode" This mode is used if the "Advanced Fourier Transformation Params" option is enabled.  
The RBW is determined by the [advanced FFT parameters](#).  
An averaging window function can be used (window length  $\leq$  record length).

Remote command:

[\[SENSe<ip>:\]IQ:BWIDth:MODE](#) on page 674

[\[SENSe<ip>:\]IQ:BWIDth:RESolution](#) on page 675

### Advanced FFT mode / Basic Settings

Shows or hides the "Advanced Fourier Transformation" parameters in the "Data Acquisition" dialog box.

These parameters are required for Spectrum results and are thus only available if a Spectrum window is active.

Note that if the advanced FFT mode is used, the [RBW](#) settings are not available.

For more information see [Chapter 10.2.3.2, "FFT calculation methods"](#), on page 179.

**Transformation Algorithm ← Advanced FFT mode / Basic Settings**

Defines the FFT calculation method.

- |             |   |
|-------------|---|
| "Single"    | One FFT is calculated for the entire record length; if the <a href="#">FFT Length</a> is larger than the record length, zeros are appended to the captured data.  |
| "Averaging" | Several overlapping FFTs are calculated for each record; the results are combined to determine the final FFT result for the record. The number of FFTs to be averaged is determined by the <a href="#">Window Overlap</a> and the <a href="#">Window Length</a> . |

Remote command:

[\[SENSe<ip>:\] IQ:FFT:ALGORITHM](#) on page 675

**FFT Length ← Advanced FFT mode / Basic Settings**

Defines the number of frequency points determined by each FFT calculation. The more points are used, the higher the resolution in the spectrum becomes, but the longer the calculation takes.

For Spectrum displays, the number of measurement points is set to the FFT length automatically.

**Note:** If you use the arrow keys or the mouse wheel to change the FFT length, the value is incremented or decremented by powers of 2.

If you enter the value manually, any integer value from 3 to 524288 is available.

Remote command:

[\[SENSe<ip>:\] IQ:FFT:LENGTH](#) on page 676

**Window Function ← Advanced FFT mode / Basic Settings**

In the I/Q analyzer you can select one of several FFT window types.

The following window types are available:

- Blackman-Harris
- Flattop
- Gauss
- Rectangular
- 5-Term

Remote command:

[\[SENSe<ip>:\] IQ:FFT:WINDOW:TYPE](#) on page 677

**Window Overlap ← Advanced FFT mode / Basic Settings**

Defines the part of a single FFT window that is re-calculated by the next FFT calculation when using multiple FFT windows.

Remote command:

[\[SENSe<ip>:\] IQ:FFT:WINDOW:OVERLAP](#) on page 676

**Window Length ← Advanced FFT mode / Basic Settings**

Defines the number of samples to be included in a single FFT window in averaging mode. (In single mode, the window length corresponds to the ["Record Length "](#) on page 254.)

In manual or advanced FFT mode, values from 3 to 524288 are available. (In Auto mode, averaging is not used.)



However, the window length may not be longer than the [FFT Length](#) .

Remote command:

[\[SENSe:\] IQ:FFT:WINDow:LENGth](#) on page 676

### 10.3.6.2 Capture settings

**Access:** "Overview" > "Bandwidth" > "Capture"

or: "Meas Setup" > "Capture"

Spectrogram settings are only available if a spectrogram is active for the selected window (see ["State"](#) on page 400).

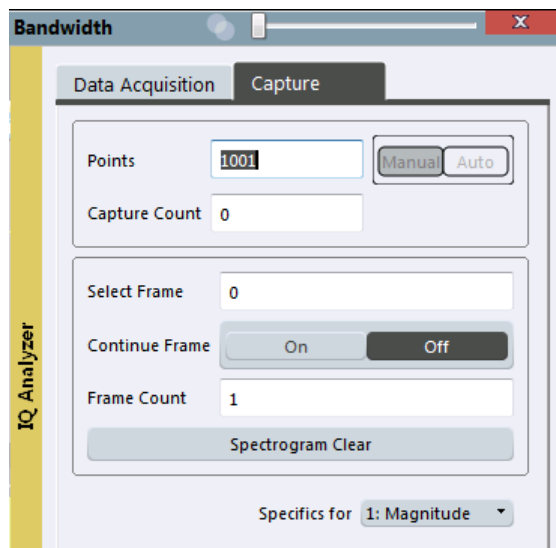


Figure 10-19: Capture settings with active spectrogram

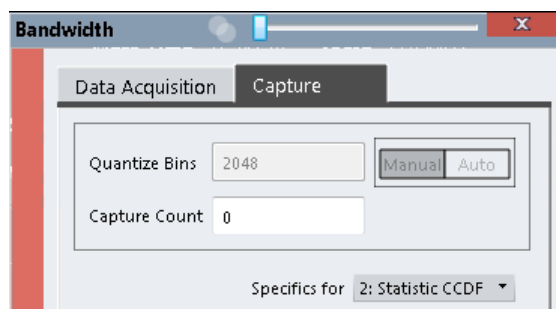


Figure 10-20: Capture settings for statistical results

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<a href="#">Quantize Bins</a> .....	258
<a href="#">Capture Count</a> .....	258
<a href="#">Select Frame</a> .....	259
<a href="#">Continue Frame</a> .....	259
<a href="#">Frame Count</a> .....	259
<a href="#">Clear Spectrogram</a> .....	259

**Points**

This value defines the number of measurement points that are evaluated and displayed in the result diagrams.

In "Auto" mode, the number of capture points is coupled with the [FFT Length](#) .

In "Manual" mode or Advanced FFT mode, the number is user-definable.

**Note:** The capture settings are window-specific. For some result displays, the points may not be editable as they are determined automatically, or restrictions may apply. For the I/Q vector result display, the number of I/Q samples to record ("Record Length") must be identical to the number of trace points to be displayed ("Points"). Thus, the points are not editable for this result display. If the "Record Length" is edited, the points are adapted automatically. For record lengths outside the valid range of points, i.e. fewer than 51 points or more than 524288 points, the diagram does not show valid results.

Using fewer points than the [FFT Length](#) with a detector other than Auto Peak may lead to wrong level results. For details see "[Combining results - trace detector](#)" on page 182.

Remote command:

`[SENSe:]SWEep[:WINDow<n>]:POINTs` on page 678

**Quantize Bins**

For [Statistic APD](#) displays, this value defines the number of **quantize bins** used to create the histogram, that is, the number of different measurement values the statistical occurrence is determined for.

For [Statistic CCDF](#) displays, the number of bins is fixed to 2048.

Remote command:

APD only:

`CALCulate<n>:IQ:STATistics:SCALE:X:QUANTize` on page 658

**Capture Count**

Defines the number of times data is captured in single measurement mode. Values from 0 to 200000 are allowed. If the values 0 or 1 are set, one measurement is performed.

The capture count is applied to all the traces in all diagrams.

If the trace modes "Average", "Max Hold" or "Min Hold" are set, this value also determines the number of averaging or maximum search procedures.

In continuous measurement mode, if capture count = 0 (default), averaging is performed over 10 measurement. For capture count =1, no averaging, maxhold or minhold operations are performed.

For more information see [Chapter 10.2.2, "How much data is measured: capture count and measurement points"](#), on page 177.

For spectrogram displays, the capture count determines how many captures are combined in one frame in the spectrogram, i.e. how many captures the R&S VSE performs to plot one trace in the spectrogram result display. For more details see "[Time frames](#)" on page 389.

Remote command:

`[SENSe:]AVERage<n>:COUNT` on page 800

**Select Frame**

Selects a specific frame, loads the corresponding trace from the memory, and displays it in the Spectrum window.

Note that activating a marker or changing the position of the active marker automatically selects the frame that belongs to that marker.

This function is only available in single sweep mode or if the sweep is stopped, and only if a spectrogram is selected.

The most recent frame is number 0, all previous frames have a negative number.

For more details, see "[Time frames](#)" on page 389.

Remote command:

[CALCulate<n>:SPECTrogram:FRAMe:SElect](#) on page 806

[CALCulate<n>:SPECTrogram:FRAMe:SElect](#) on page 806

**Continue Frame**

Determines whether the results of the previous sweeps are included in the analysis of the next sweeps for trace modes "Max Hold", "Min Hold", and "Average".

This function is available in single sweep mode only.

- **On**  
When the average or peak values are determined for the new sweep, the results of the previous sweeps in the spectrogram are also considered.
- **Off**  
The average or peak values are determined from the results of the newly swept frames only.

Remote command:

[CALCulate<n>:SPECTrogram:CONTinuous](#) on page 805

**Frame Count**

Determines how many frames are plotted during a single capture (as opposed to a continuous capture). The maximum number of possible frames depends on the history depth (see "[History Depth](#)" on page 401).

For more details, see "[Time frames](#)" on page 389.

Remote command:

[CALCulate<n>:SPECTrogram:FRAMe:COUNt](#) on page 806

**Clear Spectrogram**

Resets the spectrogram result display and clears the history buffer.

This function is only available if a spectrogram is selected.

Remote command:

[CALCulate<n>:SPECTrogram:CLEar\[:IMMediate\]](#) on page 805

### 10.3.7 CCDF (statistics) settings

The following settings are only available for CCDF statistics results (see ["Statistic CCDF"](#) on page 171).

<a href="#">Percent Marker (CCDF only)</a> .....	260
<a href="#">Adjust Settings (CCDF only)</a> .....	260

#### Percent Marker (CCDF only)



Defines a probability value. Thus, the power which is exceeded with a given probability can be determined very easily. If marker 1 is deactivated, it is switched on automatically.

Remote command:

`CALCulate<n>:MARKer<m>:Y:PERCent` on page 878

#### Adjust Settings (CCDF only)

Adjusts the level settings according to the measured difference between peak and mean power for CCDF measurement in order to obtain maximum power resolution. Adjusts the reference level to the current input signal.

Remote command:

`CALCulate<n>:STATistics:SCALE:AUTO ONCE` on page 660

### 10.3.8 Adjusting settings automatically

**Access:** "Auto Set" toolbar

Depending on the connected instrument, some settings can be adjusted by the instrument automatically according to the current measurement settings. In order to do so, a measurement is performed. The duration of this measurement can be defined automatically or manually.

To activate the automatic adjustment of a setting from the R&S VSE, select the corresponding function in the "Auto Set" toolbar or in the configuration dialog box for the setting, where available.

For an active external frontend, automatic settings are not available.

See ["External Frontend Connection State"](#) on page 213.




### Adjusting settings automatically during triggered measurements

When you select an auto adjust function a measurement is performed to determine the optimal settings. If you select an auto adjust function for a triggered measurement, you are asked how the connected instrument should behave:

- (default:) The measurement for adjustment waits for the next trigger
- The measurement for adjustment is performed without waiting for a trigger. The trigger source is temporarily set to "Free Run". After the measurement is completed, the original trigger source is restored. The trigger level is adjusted as follows for IF Power and RF Power triggers:  
Trigger Level = Reference Level - 15 dB

#### Remote command:

[SENSe<ip>:]ADJust:CONFigure:TRIGger on page 685

Adjusting all Determinable Settings Automatically (Auto All )	261
Adjusting the Center Frequency Automatically (Auto Frequency )	261
 Setting the Reference Level Automatically (Auto Level )	261
Auto Settings Configuration	262
L Automatic Measurement Time Mode and Value	262
L Upper Level Hysteresis	262
L Lower Level Hysteresis	262

### Adjusting all Determinable Settings Automatically (Auto All )

Activates all automatic adjustment functions for the current measurement settings, including:

- [Auto Frequency](#)
- " [Setting the Reference Level Automatically \(Auto Level \)](#)" on page 225

#### Remote command:

[SENSe<ip>:]ADJust:ALL on page 683

### Adjusting the Center Frequency Automatically (Auto Frequency )

The connected instrument adjusts the center frequency automatically.

The optimum center frequency is the frequency with the highest S/N ratio in the frequency span. As this function uses the signal counter, it is intended for use with sinusoidal signals.

#### Remote command:

[SENSe<ip>:]ADJust:FREQuency on page 685

### Setting the Reference Level Automatically (Auto Level )

The connected instrument automatically determines the optimal reference level for the current input data. At the same time, the internal attenuators and the preamplifier are adjusted so the signal-to-noise ratio is optimized, while signal compression, clipping and overload conditions are minimized. This function is not available on all supported instruments.

You can change the measurement time for the level measurement if necessary (see "[Automatic Measurement Time Mode and Value](#)" on page 262).

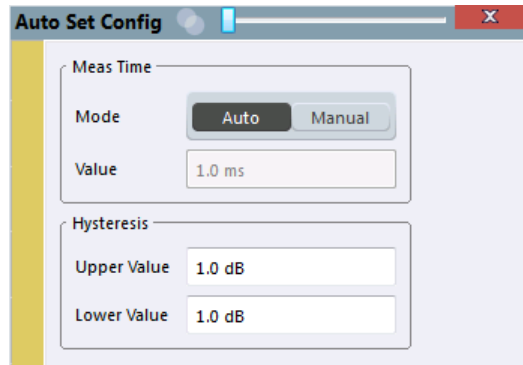
Remote command:

[\[SENSe<ip>:\]ADJust:LEVel](#) on page 685



### Auto Settings Configuration

For some automatic settings, additional parameters can be configured. The "Auto Set Config" dialog box is available when you select the icon from the "Auto Set" toolbar.



#### Automatic Measurement Time Mode and Value ← Auto Settings Configuration

To determine the optimal reference level automatically, a level measurement is performed on the connected instrument. You can define whether the duration of this measurement is determined automatically or manually.

To define the duration manually, enter a value in seconds.

Remote command:

[\[SENSe<ip>:\]ADJust:CONFigure:LEVel:DURation:MODE](#) on page 683

[\[SENSe<ip>:\]ADJust:CONFigure:LEVel:DURation](#) on page 683

#### Upper Level Hysteresis ← Auto Settings Configuration

When the reference level is adjusted automatically using the [Auto Level](#) function, the internal attenuators and the preamplifier (if available) of the connected instrument are also adjusted. To avoid frequent adaptation due to small changes in the input signal, you can define a hysteresis. This setting defines an upper threshold that the signal must exceed (compared to the last measurement) before the reference level is adapted automatically.

Remote command:

[\[SENSe<ip>:\]ADJust:CONFigure:HYSTeresis:UPPer](#) on page 684

#### Lower Level Hysteresis ← Auto Settings Configuration

When the reference level is adjusted automatically using the [Auto Level](#) function, the internal attenuators and the preamplifier (if available) of the connected instrument are also adjusted. To avoid frequent adaptation due to small changes in the input signal, you can define a hysteresis. This setting defines a lower threshold that the signal must fall below (compared to the last measurement) before the reference level is adapted automatically.

Remote command:

[\[SENSe<ip>:\]ADJust:CONFigure:HYSTeresis:LOWer](#) on page 684

## 10.4 RF measurement configuration



**Access:** "Meas Setup" > "Select Measurement"

"Meas Setup" > "Overview"

For RF measurements, the configuration steps described in the overview are slightly different. The available settings are described here.

The remote commands required to perform these tasks are described in [Chapter 13.6.3, "Configuring RF measurements"](#), on page 686.

- [Channel power and adjacent-channel power \(ACLR\) measurement](#).....263
- [Occupied bandwidth measurement \(OBW\)](#).....311
- [Spectrum emission mask \(SEM\) measurement](#).....317
- [Time domain power measurement](#).....360
- [Frequency and span settings](#).....364
- [Bandwidth, filter and capture configuration](#).....367

### 10.4.1 Channel power and adjacent-channel power (ACLR) measurement

Measuring the power in channels adjacent to the carrier or transmission channel is useful to detect interference. The results are displayed as a bar chart for the individual channels.

- [About channel power measurements](#).....263
- [Channel power results](#).....264
- [Channel power basics](#).....266
- [Channel power configuration](#).....275
- [MSR ACLR configuration](#).....285
- [How to perform channel power measurements](#).....299
- [Measurement examples](#).....303
- [Optimizing and troubleshooting the measurement](#).....308
- [Reference: predefined CP/ACLR standards](#).....308
- [Reference: predefined ACLR user standard XML files](#).....310

#### 10.4.1.1 About channel power measurements

Measuring channel power and adjacent channel power is one of the most important tasks during signal analysis with the necessary test routines in the field of digital transmission. Theoretically, a power meter could be used to measure channel power at highest accuracy. However, its low selectivity means that it is not suitable for measuring adjacent channel power as an absolute value or relative to the transmit channel power. Only a selective power meter can measure the power in the adjacent channels.

A signal analyzer cannot be classified as a true power meter, because it displays the IF envelope voltage. However, it is calibrated such as to display the power of a pure sine wave signal correctly, irrespective of the selected detector. This calibration cannot be applied for non-sinusoidal signals. Assuming that the digitally modulated signal has a Gaussian amplitude distribution, the signal power within the selected resolution bandwidth can be obtained using correction factors. The internal power measurement rou-

tines in a signal analyzer normally use these correction factors to determine the signal power from IF envelope measurements. These factors apply if and only if the assumption of a Gaussian amplitude distribution is correct.

Apart from this common method, the connected instrument also has a true power detector, i.e. an RMS detector. It displays the power of the test signal within the selected resolution bandwidth correctly, irrespective of the amplitude distribution, without additional correction factors being required.

The R&S VSE software allows you to perform ACLR measurements on input containing multiple signals for different communication standards. A measurement standard is provided that allows you to define multiple discontinuous transmit channels at specified frequencies, independent from the selected center frequency. The ACLR measurement determines the power levels of the individual transmit, adjacent, and gap channels, as well as the total power for each sub block of transmit channels.

A detailed measurement example is provided in [Chapter 10.4.1.7, "Measurement examples"](#), on page 303.

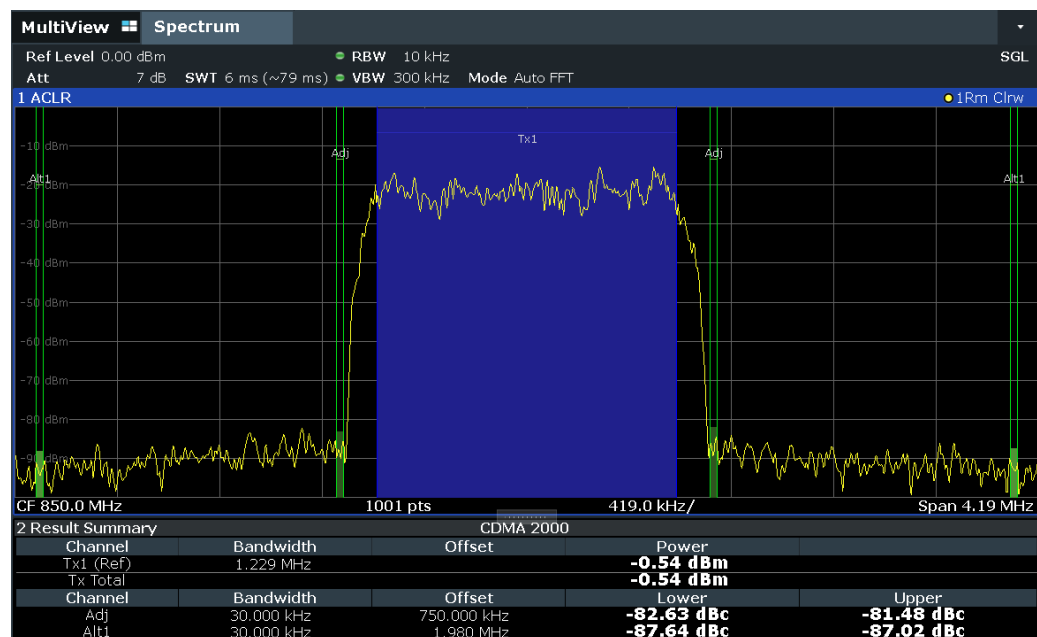
#### 10.4.1.2 Channel power results

For channel or adjacent-channel power measurements, the individual channels are indicated by different colored bars in the diagram. The height of each bar corresponds to the measured power of that channel. In addition, the name of the channel ("Adj", "Alt %1", "Tx %1", etc., or a user-defined name) is indicated above the bar (separated by a line which has no further meaning).



#### Multi-standard radio (MSR) channel power results

The channel power results for MSR signals are described in ["Measurement on multi-standard radio \(MSR\) signals"](#) on page 270.





Results are provided for the TX channel and the number of defined adjacent channels *above and below* the TX channel. If more than one TX channel is defined, you must specify the channel to which the relative adjacent-channel power values refer. By default, it is the TX channel with the maximum power.

**Table 10-2: Measurements performed depending on the number of adjacent channels**

Number of adj. chan.	Measurement results
0	Channel powers
1	<ul style="list-style-type: none"> <li>Channel powers</li> <li>Power of the upper and lower adjacent channel</li> </ul>
2	<ul style="list-style-type: none"> <li>Channel powers</li> <li>Power of the upper and lower adjacent channel</li> <li>Power of the next higher and lower channel (alternate channel 1)</li> </ul>
3	<ul style="list-style-type: none"> <li>Channel powers</li> <li>Power of the upper and lower adjacent channel</li> <li>Power of the next higher and lower channel (alternate channel 1)</li> <li>Power of the second next higher and lower adjacent channel (alternate channel 2)</li> </ul>
...	...
12	<ul style="list-style-type: none"> <li>Channel powers</li> <li>Power of the upper and lower adjacent channel</li> <li>Power of all the higher and lower channels (alternate channels 1 to 11)</li> </ul>



In the R&S VSE display, only the first neighboring channel of the carrier (TX) channel is labeled "Adj" (adjacent) channel; all others are labeled "Alt" (alternate) channels. In this manual, "Adjacent" refers to both adjacent and alternate channels.

The measured power values for the TX and adjacent channels are also output as a table in the Result Summary window. Which powers are measured depends on the number of configured channels.

For each channel, the following values are displayed:

Label	Description
Channel	Channel name as specified in the "Channel Settings" (see " <a href="#">Channel Names</a> " on page 285).
Bandwidth	Configured channel bandwidth (see " <a href="#">Channel Bandwidth</a> " on page 281)
Offset	Offset of the channel to the TX channel (configured channel spacing, see " <a href="#">Channel Bandwidth</a> " on page 281)
Power (Lower/Upper)	The measured power values for the TX and lower and upper adjacent channels. The powers of the transmission channels are output in dBm or dBm/Hz, or in dBc, relative to the specified reference TX channel.

### Retrieving Results via Remote Control

All or specific channel power measurement results can be retrieved using the `CALC:MARK:FUNC:POW:RES?` command from a remote computer (see [CALCulate<n>:MARKer<m>:FUNCTION:POWER<sb>:RESULT?](#) on page 724). Alter-

natively, the results can be output as channel power density, i.e. in reference to the measurement bandwidth.

Furthermore, the measured power values of the displayed trace can be retrieved as usual using the `TRAC:DATA?` commands (see `TRACe<n>[:DATA]` on page 730). In this case, the measured power value for each sweep point (by default 1001) is returned.

For a full list of remote commands for ACLR measurements, see "[Retrieving and analyzing measurement results](#)" on page 726.

### 10.4.1.3 Channel power basics

Some background knowledge on basic terms and principles used in channel power measurements is provided here for a better understanding of the required configuration settings.

- [Measurement method](#)..... 266
- [Recommended common measurement parameters](#).....266
- [Measurement on multi-standard radio \(MSR\) signals](#).....270

#### Measurement method

The channel power is defined as the integration of the power across the channel bandwidth.

The **Adjacent Channel Leakage Power Ratio (ACLR)** is also known as the **Adjacent Channel Power Ratio (ACPR)**. It is defined as the ratio between the total power of the adjacent channel to the power of the carrier channel. An ACLR measurement with several carrier channels (also known as transmission or TX channels) is also possible and is referred to as a *multicarrier ACLR measurement*.

The R&S VSE software captures data once for the span defined by the I/Q bandwidth of the connected instrument. Then it calculates multiple FFTs based on the selected RBW.

#### Recommended common measurement parameters

The following sections provide recommendations on the most important measurement parameters for channel power measurements.



All instrument settings for the selected channel setup (channel bandwidth, channel spacing) can be optimized automatically using the "Adjust Settings" function (see "[Optimized Settings \(Adjust Settings\)](#)" on page 280).

- [Meas Time](#) ..... 267
- [Frequency span](#)..... 267
- [Resolution bandwidth \(RBW\)](#).....268
- [Video bandwidth \(VBW\)](#).....268
- [Detector](#).....269
- [Trace averaging](#)..... 269
- [Reference level](#)..... 269

### Meas Time

The "Meas Time" is selected depending on the desired reproducibility of results. Reproducibility increases with "Meas Time" since power measurement is then performed over a longer time period. As a general approach, approximately 500 non-correlated measured values are required for a reproducibility of 0.5 dB. (That means: 95 % of the measurements are within 0.5 dB of the true measured value). Approximately 5000 measured values are required for a reproducibility of 0.1 dB (99 %). These values are valid for white noise. The measured values are considered as non-correlated if their time interval corresponds to the reciprocal of the measured bandwidth.

The number of A/D converter values, N, used to calculate the power, is defined by the "Meas Time" . The time per trace pixel for power measurements is directly proportional to the selected "Meas Time" .

If the sample detector is used, it is best to select the smallest "Meas Time" possible for a given span and resolution bandwidth. The minimum time is obtained if the setting is coupled, that is: the time per measurement is minimal. Extending the measurement time does not have any advantages. The number of samples for calculating the power is defined by the number of trace points in the channel.

If the RMS detector is used, the selection of "Meas Time" s can affect the repeatability of the measurement results. Repeatability is increased at longer "Meas Time" s.

If the RMS detector is used, the number of samples can be estimated as follows:

Since only uncorrelated samples contribute to the RMS value, the number of samples can be calculated from the "Meas Time" and the resolution bandwidth.

Samples can be assumed to be uncorrelated if sampling is performed at intervals of 1/ RBW. The number of uncorrelated samples is calculated as follows:

$$N_{\text{decorr}} = \text{SWT} * \text{RBW}$$

( $N_{\text{decorr}}$  means uncorrelated samples)

The number of uncorrelated samples per trace pixel is obtained by dividing  $N_{\text{decorr}}$  by 1001 (= pixels per trace).

### Frequency span

The frequency span must cover at least the channels to be measured plus a measurement margin of approximately 10 %.

If the frequency span is large in comparison to the channel bandwidth (or the adjacent-channel bandwidths) being analyzed, only a few points on the trace are available per channel. The calculated waveform for the used channel filter is less accurate, which has a negative effect on the measurement accuracy. It is therefore strongly recommended that you consider the described formulas when you select the frequency span.

The frequency span for the defined channel settings can be optimized. Use the "Adjust Settings" function in the "Ch Power" menu or the "General Settings" tab of the "ACLR Setup" dialog box (see ["Optimized Settings \(Adjust Settings\)"](#) on page 280). You can set the frequency span manually in the "Frequency" configuration dialog box.

For channel power measurements the "Adjust Settings" function sets the frequency span as follows:

*(No. of transmission channels – 1) x transmission channel spacing + 2 x transmission channel bandwidth + measurement margin*

For adjacent-channel power measurements, the "Adjust Settings" function sets the frequency span as a function of the following parameters:

- Number of transmission channels
- Transmission channel spacing
- Adjacent-channel spacing
- Bandwidth of one of adjacent-channels ADJ, ALT1 or ALT2, whichever is furthest away from the transmission channels

*(No. of transmission channels – 1) \* (transmission channel spacing + 2) \* (adjacent-channel spacing + adjacent-channel bandwidth) + measurement margin*

The measurement margin is approximately 10 % of the value obtained by adding the channel spacing and the channel bandwidth.

### Resolution bandwidth (RBW)

It is important to suppress spectral components outside the channel to be measured, especially of the adjacent channels. At the same time, you expect an acceptable measurement speed. To fulfill both these requirements, the appropriate resolution bandwidth is essential. As a general approach, set the resolution bandwidth to values between 1 % and 4 % of the channel bandwidth.

If the spectrum within the channel to be measured and the spectrum around the channel has a flat characteristic, you can select a larger resolution bandwidth. In the standard setting, e.g. for standard IS95A REV at an adjacent channel bandwidth of 30 kHz, a resolution bandwidth of 30 kHz is used. This yields correct results since the spectrum near the adjacent channels normally has a constant level.

You can optimize the resolution bandwidth for the defined channel settings. Use the "Adjust Settings" function in the "Ch Power" menu or the "General Settings" tab of the "ACLR Setup" dialog box (see ["Optimized Settings \(Adjust Settings\)"](#) on page 280). You can set the RBW manually in the "Bandwidth" configuration dialog box, see ["RBW"](#) on page 373.

Except for the IS95 CDMA standards, the "Adjust Settings" function sets the resolution bandwidth (RBW) as a function of the channel bandwidth:

"RBW" ≤ 1/40 of "Channel Bandwidth"

The maximum resolution bandwidth (concerning the requirement RBW ≤ 1/40) resulting from the available RBW steps (1, 3) is selected.

### Video bandwidth (VBW)

For a correct power measurement, the video signal must not be limited in bandwidth. A restricted bandwidth of the logarithmic video signal causes signal averaging and thus results in a too low indication of the power (-2.51 dB at very low video bandwidths). Thus, select the video bandwidth at least three times the resolution bandwidth:

VBW ≥ 3 \* RBW

For FFT sweeps, instead of increasing the VBW, you can also select the trace average mode "Power" to ensure correct power measurements (see ["Average Mode "](#) on page 396). Note that in power measurements this setting affects the VBW regardless of whether or not a trace is actually averaged.

The video bandwidth for the defined channel settings can be optimized. Use the "Adjust Settings" function in the "Ch Power" menu or the "General Settings" tab of the "ACLR Setup" dialog box (see ["Optimized Settings \(Adjust Settings \)"](#) on page 280). You can set the VBW manually in the "Bandwidth" configuration dialog box, see ["VBW "](#) on page 374.

The video bandwidth (VBW) is set as a function of the channel bandwidth (see formula above) and the smallest possible VBW with regard to the available step size is selected.

### Detector

The RMS detector correctly indicates the power irrespective of the characteristics of the signal to be measured.

In principle, the sample detector is also possible. However, due to the limited number of measurement points used to calculate the power in the channel, the sample detector yields less stable results.

You can set the RMS detector for the defined channel settings automatically. Use the "Adjust Settings" function in the "Ch Power" menu or the "General Settings" tab of the "ACLR Setup" dialog box (see ["Optimized Settings \(Adjust Settings \)"](#) on page 280).

You can set the detector manually in the "Traces" configuration dialog box, see ["Detector "](#) on page 395.

### Trace averaging

Avoid averaging, which is often performed to stabilize the measurement results but leads to a level indication that is too low. The reduction in the displayed power depends on the number of averages and the signal characteristics in the channel to be measured.

The "Adjust Settings" function switches off trace averaging. You can deactivate the trace averaging manually in the "Traces" configuration dialog box, see ["Average Mode "](#) on page 396.

### Reference level

To achieve an optimum dynamic range, set the reference level so that the signal is as close to the reference level as possible without forcing an overload message. However, if the signal-to-noise ratio becomes too small, the dynamic range is also limited. The measurement bandwidth for channel power measurements is significantly smaller than the signal bandwidth. Thus, the signal path can be overloaded although the trace is still significantly below the reference level.



Selecting a predefined standard or automatically adjusting settings does not affect the reference level. The reference level can be set automatically using the "Auto Level" function in the [Auto Set] menu, or manually in the "Amplitude" menu.

### Measurement on multi-standard radio (MSR) signals

Modern base stations can contain multiple signals for different communication standards. A new measurement standard is provided for the R&S VSE ACLR measurement that allows you to measure such MSR signals, including non-contiguous setups. Multiple (also non-) contiguous transmit channels can be specified at absolute frequencies, independent from the common center frequency selected for display.

### Signal structure

Up to 18 transmit channels can be grouped in a maximum of 5 sub blocks. Between two sub blocks, two gaps are defined: a *lower gap* and an *upper gap*. Each gap in turn contains two channels (*gap channels*). The channels in the upper gap are identical to those in the lower gap, but inverted. To either side of the outermost transmit channels, lower and upper adjacent channels can be defined as in common ACLR measurement setups.

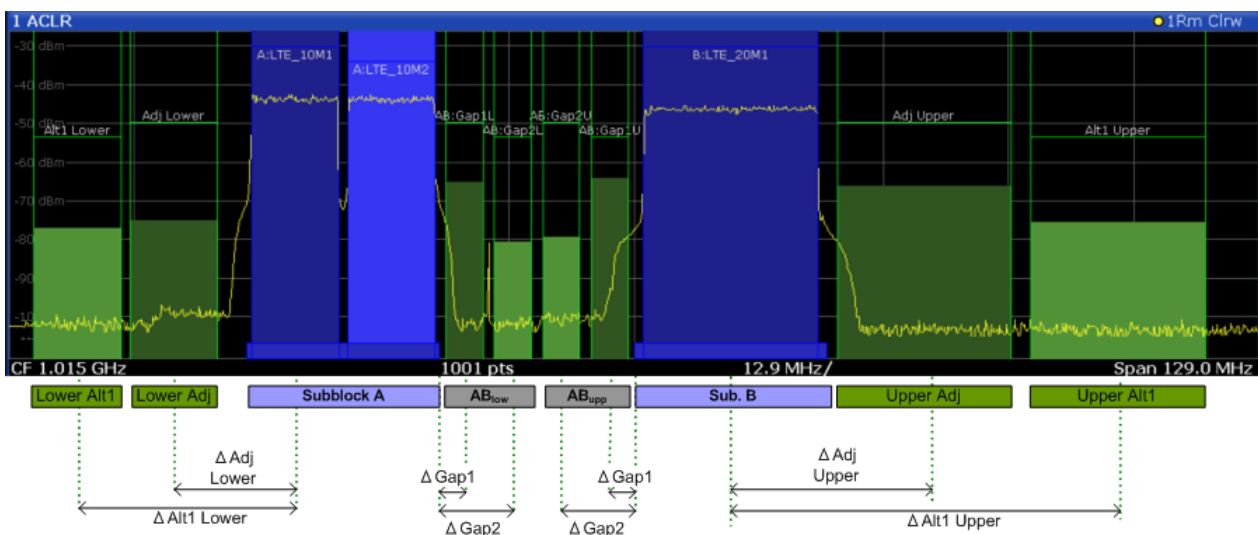


Figure 10-21: MSR signal structure

### Asymmetrical gap channels

Gap channels between sub blocks can now also be asymmetrical, that is: channels in the lower and upper gaps are not identical. For example, in Figure 10-22, the gap between sub blocks A and B contains one lower channel (AB:Gap1L), but two upper channels (AB:Gap1U, AB:Gap2U). Furthermore, the gaps between different sub blocks need not be identical. For example, the gap between sub blocks A and B contains 3 gap channels, while the gap between sub blocks B and C contains only two gap channels (BC:Gap1L, BC:Gap2L, which are not identical to the lower gap channels in gap AB).

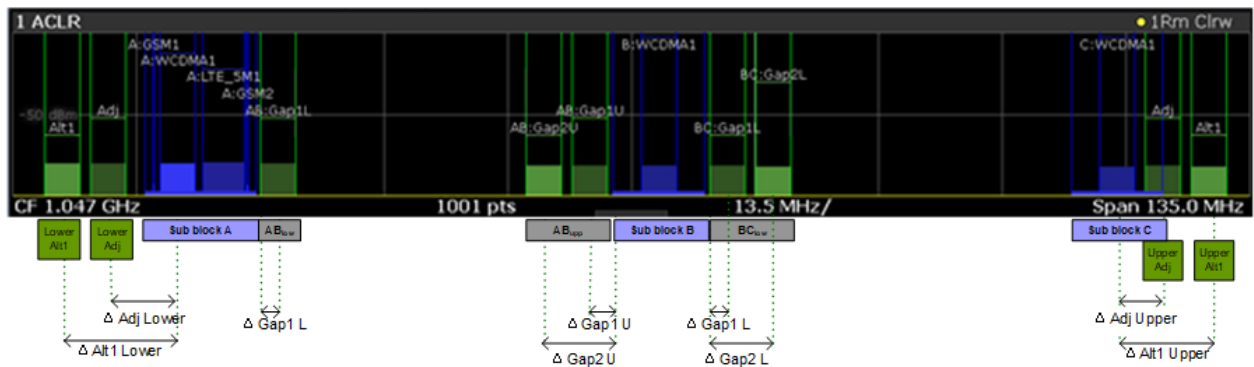


Figure 10-22: Asymmetrical MSR signal structure

### Sub block and channel definition

The sub blocks are defined by a specified center frequency, RF bandwidth, and number of transmit channels.

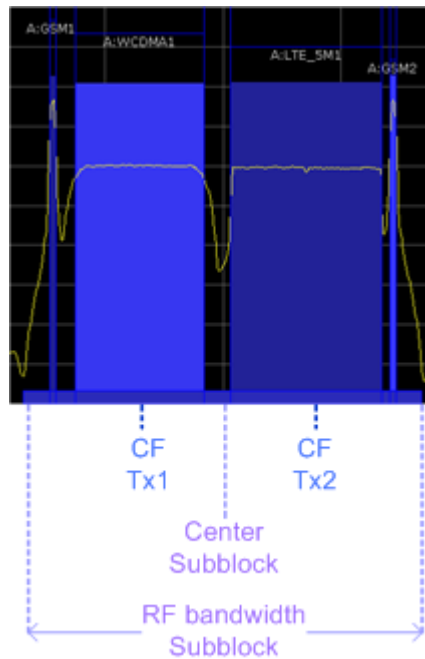


Figure 10-23: Sub block definition

As opposed to common ACLR channel definitions, the TX channels are defined at absolute frequencies, rather than by a spacing relative to the (common) center frequency. Each transmit channel can be assigned a different technology, used to predefine the required bandwidth.

### Gap channels and CA CLR

If two or more sub blocks are defined, the power in the gaps between the sub blocks must also be measured. Gap channels are defined using bandwidths and spacings, relative to the outer edges of the surrounding sub blocks.

If the upper and lower gap channels are symmetrical, only two gap channels must be configured. The required spacing can be determined according to the following formula (indicated for lower channels):

$$\text{Spacing} = [\text{CF of gap channel}] - [\text{left sub block CF}] + ([\text{RF bandwidth of left sub block}] / 2)$$

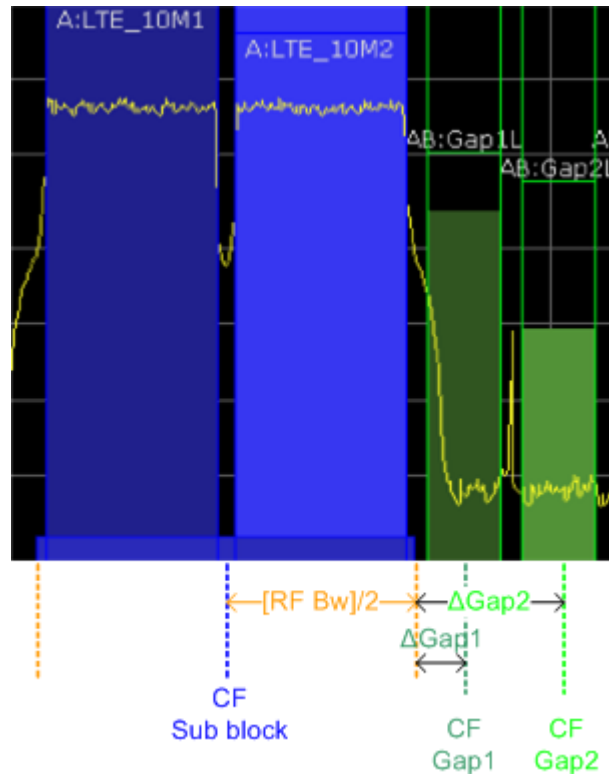


Figure 10-24: Gap channel definition for lower gap

If the gap channels are not symmetrical, you must configure up to four channels individually. The formula indicated above applies for the lower channels. For the upper channels, the spacing is defined as:

$$\text{Spacing} = [\text{right sub block CF}] - [\text{CF of gap channel}] - ([\text{RF bandwidth of right sub block}] / 2)$$

According to the MSR standard, the **Cumulative Adjacent Channel Leakage Ratio (CACLR)** power must be determined for the gap channels. The CACLR power is measured in the two gap channels for the upper and lower gap. The power in the gap channels is then set in relation to the power of the two closest transmission channels to either side of the gap. The CACLR power for the gap channels is indicated in the Result Summary.

In addition, the ACLR power for the individual gap channels is indicated in the Result Summary. The ACLR power of the lower gap channels refers to the TX channel to the left of the gap. The ACLR power of the upper gap channels refers to the TX channel to the right of the gap. A separate relative limit value can be defined for the ACLR power.



### Adjacent channels

Adjacent channels are defined as in common ACLR measurements using bandwidths and spacings, relative to the uppermost or lowermost transmit channels in the sub blocks (see also [Figure 10-21](#)):

- The spacing of the lower adjacent channels refers to the CF of the first TX channel in the first sub block.
- The spacing of the upper adjacent channels refers to the CF of the last TX channel in the last sub block.



The upper and lower adjacent channels can also be defined asymmetrically (see "[Symmetrical Adjacent Setup](#)" on page 289). This is particularly useful if the lowest TX channel and highest TX channel use different standards and thus require different bandwidths for adjacent channel power measurement.

### Channel display for MSR signals

As in common ACLR measurements, the individual channels are indicated by different colored bars in the diagram. The height of each bar corresponds to the measured power of that channel. In addition, the name of the channel is indicated above the bar. Sub blocks are named A,B,C,D,E and are also indicated by a slim blue bar along the frequency axis.

TX channel names correspond to the specified technology (for LTE including the bandwidth), followed by a consecutive number. (If the channel is too narrow to display the channel name, "..." is displayed instead.) The assigned sub block is indicated with the channel name, e.g. "B: LTE\_5M1" for the first TX channel in sub block B that uses the LTE 5 MHz bandwidth technology.

Adjacent and alternate channels are displayed as in common ACLR measurements.

Gap channels are indicated using the following syntax:

- The names of the surrounding sub blocks (e.g. "AB" for the gap between sub blocks A and B),
- The channel name ("Gap1" or "Gap2" )
- "L" (for lower) or "U" (for upper)

For example: "ABGap1L" indicates the first lower gap channel between sub blocks A and B.

Both the lower and upper gap channels are displayed.



For symmetrical configuration, gap channels can be hidden if they do not reach a minimum size.

For asymmetrical configuration, you can define the number of upper or lower gap channels to be displayed.

In both cases, you can deactivate all gap channels. This enhances the result display, as fewer lines and bars are displayed. If gap channels are deactivated, the power results are not calculated and thus are not shown in the Result Summary table.

Furthermore, channel names for all TX, adjacent, and alternate channels are user-definable (not gap channels).

### Channel power results

The Result Summary for MSR signal measurements is similar to the table for common signals (see [Chapter 10.4.1.2, "Channel power results"](#), on page 264). However, the TX channel results are grouped by sub blocks, and sub block totals are provided instead of a total TX channel power. Instead of the individual channel frequency offsets, the absolute center frequencies are indicated for the transmit channels.

The CACLR and ACLR power results for each gap channel are appended at the end of the table. The CACLR results are calculated as the power in the gap channel divided by the power sum of the two closest transmission channels to either side of it.

2 Result Summary		USER(MSR_ACLR_Example)		
Channel	Bandwidth	Frequency	Power	
A:GSM1	200.000 kHz	994.900 MHz	<b>-92.97 dBm</b>	
A:WCDMA1	3.840 MHz	997.500 MHz	<b>-80.45 dBm</b>	
A:LTE_SM1 (Ref)	4.515 MHz	1.000 GHz	<b>-79.65 dBm</b>	
A:GSM2	200.000 kHz	1.005 GHz	<b>-93.46 dBm</b>	
Sub Block A Total			<b>-76.82 dBm</b>	
Channel	Bandwidth	Frequency	Power	
B:WCDMA1	3.840 MHz	1.050 GHz	<b>-81.98 dBm</b>	
Sub Block B Total			<b>-81.98 dBm</b>	
Channel	Bandwidth	Frequency	Power	
C:WCDMA1	3.840 MHz	1.100 GHz	<b>-82.10 dBm</b>	
Sub Block C Total			<b>-82.10 dBm</b>	
Adj Channels	Bandwidth	Offset	ACLR Lower	ACLR Upper
Adj	3.840 MHz	5.000 MHz	<b>-0.74 dBc</b>	<b>-2.33 dBc</b>
Alt1	3.840 MHz	10.000 MHz	<b>-0.83 dBc</b>	<b>-2.44 dBc</b>
Gap Channels ACLR	Bandwidth	Offset	ACLR Lower	ACLR Upper
AB:Gap1	3.840 MHz	2.500 MHz	<b>13.19 dBc</b>	<b>0.04 dBc</b>
AB:Gap2	3.840 MHz	7.500 MHz	<b>13.29 dBc</b>	<b>0.05 dBc</b>
BC:Gap1	3.840 MHz	2.500 MHz	<b>-0.02 dBc</b>	<b>-0.02 dBc</b>
BC:Gap2	3.840 MHz	7.500 MHz	<b>-0.11 dBc</b>	<b>0.08 dBc</b>
Gap Channels CACLR	Bandwidth	Offset	CACLR Lower	CACLR Upper
AB:Gap1	3.840 MHz	2.500 MHz	<b>1.41 dBc</b>	<b>-0.26 dBc</b>
AB:Gap2	3.840 MHz	7.500 MHz	<b>1.52 dBc</b>	<b>-0.25 dBc</b>
BC:Gap1	3.840 MHz	2.500 MHz	<b>-2.97 dBc</b>	<b>-3.10 dBc</b>
BC:Gap2	3.840 MHz	7.500 MHz	<b>-3.06 dBc</b>	<b>-2.99 dBc</b>

Figure 10-25: Result summary for symmetrical channel definition

2 Result Summary		USER(MSR_ACLR_Example)		
Channel	Bandwidth	Frequency	Power	
A:GSM1	200.000 kHz	994.900 MHz	<b>-92.92 dBm</b>	
A:WCDMA1	3.840 MHz	997.500 MHz	<b>-80.41 dBm</b>	
A:LTE_SM1 (Ref)	4.515 MHz	1.000 GHz	<b>-79.61 dBm</b>	
A:GSM2	200.000 kHz	1.005 GHz	<b>-93.37 dBm</b>	
Sub Block A Total			<b>-76.78 dBm</b>	
Channel	Bandwidth	Frequency	Power	
B:WCDMA1	3.840 MHz	1.050 GHz	<b>-82.01 dBm</b>	
Sub Block B Total			<b>-82.01 dBm</b>	
Channel	Bandwidth	Frequency	Power	
C:WCDMA1	3.840 MHz	1.100 GHz	<b>-82.10 dBm</b>	
Sub Block C Total			<b>-82.10 dBm</b>	
Adj Channels	Bandwidth	Offset	ACLR Lower	ACLR Upper
Adj	3.840 MHz	5.000 MHz	<b>-0.77 dBc</b>	<b>-2.35 dBc</b>
Alt1	3.840 MHz	10.000 MHz	<b>-0.89 dBc</b>	<b>-2.42 dBc</b>
Gap Channels	Bandwidth	Offset	ACLR Power	CACLR Power
AB:Gap1L	3.840 MHz	2.500 MHz	<b>13.08 dBc</b>	<b>1.41 dBc</b>
AB:Gap1U	3.840 MHz	2.500 MHz	<b>0.09 dBc</b>	<b>-0.22 dBc</b>
AB:Gap2U	3.840 MHz	7.500 MHz	<b>0.09 dBc</b>	<b>-0.22 dBc</b>
BC:Gap1L	3.840 MHz	2.500 MHz	<b>0.01 dBc</b>	<b>-2.95 dBc</b>
BC:Gap2L	3.840 MHz	7.500 MHz	<b>-0.03 dBc</b>	<b>-3.00 dBc</b>

Figure 10-26: Result summary for asymmetrical channel definition

**Remote command:**

CALCulate:MARKer:FUNction:POWer<sb>:RESult? GACLR or  
CALCulate:MARKer:FUNction:POWer<sb>:RESult? MACM, see  
[CALCulate<n>:MARKer<m>:FUNction:POWer<sb>:RESult?](#) on page 724

**Restrictions and dependencies**

As the signal structure in multi-standard radio signals can vary considerably, you can define the channels very flexibly for the ACLR measurement with the R&S VSE. No checks or limitations are implemented concerning the channel definitions, apart from the maximum number of channels to be defined. Thus, you are not notified if transmit channels for a specific sub block lie outside the defined frequency range for the sub block, or if transmit and gap channels overlap.

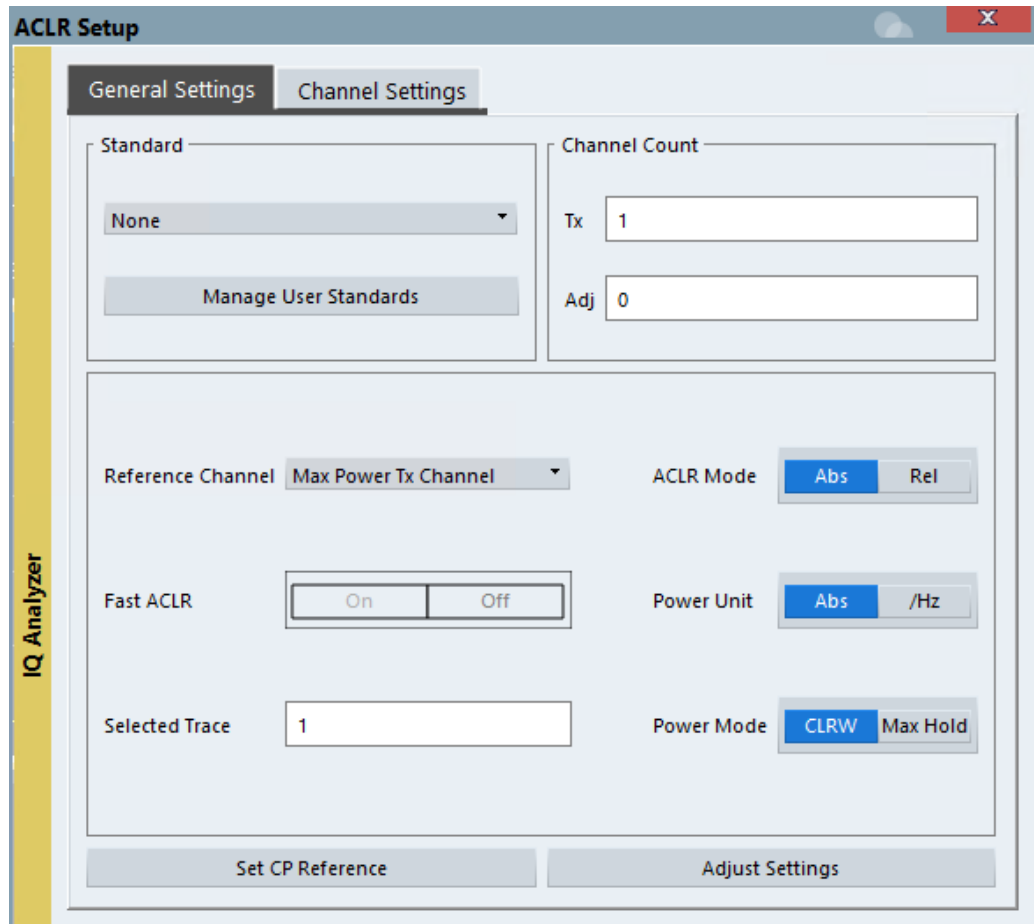
**10.4.1.4 Channel power configuration**

**Access:** "Overview" > "Select Measurement" > "Channel Power ACLR" > "CP / ACLR Config"

Both Channel Power (CP) and Adjacent-Channel Power (ACLR) measurements are available.



If the "Multi-Standard Radio" standard is selected (see ["Standard "](#) on page 277), the "ACLR Setup" dialog box is replaced by the "MSR ACLR Setup" dialog box. See [Chapter 10.4.1.5, "MSR ACLR configuration"](#), on page 285 for a description of these settings.



The remote commands required to perform these tasks are described in [Chapter 13.6.3.1, "Measuring the channel power and ACLR"](#), on page 686.

- [General CP/ACLR measurement settings](#)..... 276
- [Channel setup](#)..... 280

**General CP/ACLR measurement settings**

General measurement settings are defined in the "ACLR Setup" dialog, in the "General Settings" tab.

[Standard](#) .....277

- L [Predefined Standards](#) ..... 277
- L [User Standards](#) ..... 277

[Number of channels: Tx , Adj](#) .....278

[Reference Channel](#) ..... 278

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Setting a fixed reference for Channel Power measurements (Set CP Reference )....	280
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### Standard

The main measurement settings can be stored as a standard file. When such a standard is loaded, the required channel and general measurement settings are automatically set on the R&S VSE. However, the settings can be changed. Predefined standards are available for standard measurements, but standard files with user-defined configurations can also be created.

### Predefined Standards ← Standard

Predefined standards contain the main measurement settings for standard measurements. When such a standard is loaded, the required channel settings are automatically set on the R&S VSE. However, you can change the settings.

The predefined standards contain the following settings:

- Channel bandwidths
- Channel spacings
- Detector
- Trace Average setting
- Resolution Bandwidth (RBW)
- Weighting Filter

For details on the available standards, see [Chapter 10.4.1.9, "Reference: predefined CP/ACLR standards"](#), on page 308.

Remote command:

`CALCulate<n>:MARKer<m>:FUNCTION:POWer<sb>:PRESet` on page 686

### User Standards ← Standard

**Access:** "CP / ACLR Config" > "General Settings" tab > "Manage User Standards"

In addition to the predefined standards, you can save your own standards with your specific measurement settings in an XML file so you can use them again later. User-defined standards are stored on the instrument in the

`C:\ProgramData\Rohde-Schwarz\VSE\<version>\acp_std` directory.

**Note:** User standards created on an analyzer of the R&S FSP family are compatible to the R&S VSE. User standards created on an R&S VSE, however, are not necessarily compatible to the analyzers of the R&S FSP family and may not work there.

The following parameter definitions are saved in a user-defined standard:

- Number of adjacent channels
- Channel bandwidth of transmission (Tx), adjacent (Adj) and alternate (Alt) channels
- Channel spacings
- Weighting filters
- Resolution bandwidth
- Video bandwidth
- Detector
- ACLR limits and their state
- "Meas Time" and "Meas Time" coupling
- Trace and power mode

- (MSR only: sub block and gap channel definition)

Save the current measurement settings as a user-defined standard, load a stored measurement configuration, or delete an existing configuration file.

For details see ["How to manage user-defined configurations"](#) on page 302.

Remote command:

To query all available standards:

`CALCulate<n>:MARKer<m>:FUNCTION:POWER<sb>:STANdard:CATalog?`  
on page 687

To load a standard:

`CALCulate<n>:MARKer<m>:FUNCTION:POWER<sb>:PRESet` on page 686

To save a standard:

`CALCulate<n>:MARKer<m>:FUNCTION:POWER<sb>:STANdard:SAVE`  
on page 688

To delete a standard:

`CALCulate<n>:MARKer<m>:FUNCTION:POWER<sb>:STANdard:DELeTe`  
on page 687

### Number of channels: Tx , Adj

Up to 18 carrier channels and up to 12 adjacent channels can be defined.

Results are provided for the Tx channel and the number of defined adjacent channels *above and below* the Tx channel. If more than one Tx channel is defined, the carrier channel to which the relative adjacent-channel power values should be referenced must be defined (see ["Reference Channel "](#) on page 278).

**Note:** If several carriers (Tx channels) are activated for the measurement, the number of sweep points is increased to ensure that adjacent-channel powers are measured with adequate accuracy.

For more information on how the number of channels affects the measured powers, see [Chapter 10.4.1.2, "Channel power results"](#), on page 264.

Remote command:

Number of Tx channels:

`[SENSe:] POWER:ACHannel:TXChannel:COUNT` on page 692

Number of Adjacent channels:

`[SENSe:] POWER:ACHannel:ACPairs` on page 688

### Reference Channel

The measured power values in the adjacent channels can be displayed relative to the transmission channel. If more than one Tx channel is defined, define which one is used as a reference channel.

Tx Channel 1	Transmission channel 1 is used. (Not available for MSR ACLR)
Min Power Tx Channel	The transmission channel with the lowest power is used as a reference channel.
Max Power Tx Channel	The transmission channel with the highest power is used as a reference channel (Default).
Lowest & Highest Channel	The outer left-hand transmission channel is the reference channel for the lower adjacent channels, the outer right-hand transmission channel that for the upper adjacent channels.

Remote command:

[\[SENSe:\] POWER:ACHannel:REFERENCE:TXChannel:MANual](#) on page 695

[\[SENSe:\] POWER:ACHannel:REFERENCE:TXChannel:AUTO](#) on page 695

### Fast ACLR

Not available for the R&S VSE software.

### Selected Trace

The CP/ACLR measurement can be performed on any active trace.

Remote command:

[\[SENSe:\] POWER:TRACe](#) on page 708

### Absolute and Relative Values (ACLR Mode)

The powers of the adjacent channels are output in dBm or dBm/Hz (absolute values), or in dBc, relative to the specified reference Tx channel.

"Abs"                    The absolute power in the adjacent channels is displayed in the unit of the y-axis, e.g. in dBm, dBμV.

"Rel"                    The level of the adjacent channels is displayed relative to the level of the transmission channel in dBc.

Remote command:

[\[SENSe:\] POWER:ACHannel:MODE](#) on page 729

### Channel power level and density (Power Unit )

By default, the channel power is displayed in absolute values. If "/Hz" or "/MHz" is activated, the channel power density is displayed instead. Thus, the absolute unit of the channel power is switched from dBm to dBm/Hz or dBm/MHz.

**Note:** The channel power density in dBm/Hz corresponds to the power inside a bandwidth of 1 Hz and is calculated as follows:

"channel power density = channel power – log<sub>10</sub>(channel bandwidth)"

Thus you can measure the signal/noise power density, for example, or use the additional functions [Absolute and Relative Values \(ACLR Mode\)](#) and [Reference Channel](#) to obtain the signal to noise ratio.

Remote command:

[CALCulate<n>:MARKer<m>:FUNCTION:POWER<sb>:RESult:PHZ](#) on page 728

[CALCulate<n>:MARKer<m>:FUNCTION:POWER<sb>:RESult:UNIT](#) on page 729

### Power Mode

The measured power values can be displayed directly for each trace ("Clear/ Write" ), or only the maximum values over a series of measurements can be displayed ("Max Hold" ). In the latter case, the power values are calculated from the current trace and compared with the previous power value using a maximum algorithm. The higher value is retained. If "Max Hold" mode is activated, "Pwr Max" is indicated in the table header. Note that the *trace* mode remains unaffected by this setting.

Remote command:

[CALCulate<n>:MARKer<m>:FUNCTION:POWER<sb>:MODE](#) on page 709

**Setting a fixed reference for Channel Power measurements (Set CP Reference )**

If only one TX channel and no adjacent channels are defined, the currently measured channel power can be used as a fixed reference value for subsequent channel power measurements.

When you select this button, the channel power currently measured on the TX channel is stored as a fixed reference power. In the following channel power measurements, the power is indicated relative to the fixed reference power. The reference value is displayed in the "Reference" field (in relative ACLR mode); the default value is 0 dBm.

**Note:** In adjacent-channel power measurement, the power is always referenced to a transmission channel (see "Reference Channel " on page 278), thus, this function is not available.

Remote command:

[SENSe:]POWer:ACHannel:REference:AUTO ONCE on page 694

**Optimized Settings (Adjust Settings )**

All instrument settings for the selected channel setup (channel bandwidth, channel spacing) can be optimized automatically.

The adjustment is carried out only once. If necessary, the instrument settings can be changed later.

The following settings are optimized by "Adjust Settings" :

- "Frequency span" on page 267
- "Resolution bandwidth (RBW)" on page 268
- "Video bandwidth (VBW)" on page 268
- "Detector" on page 269
- "Trace averaging" on page 269

**Note:** The reference level is not affected by this function. To adjust the reference level automatically, use the "Amplitude" > Reference Level function.

Remote command:

[SENSe:]POWer:ACHannel:PRESet on page 708

**Meas Time**

With the RMS detector, a longer "Meas Time" increases the stability of the measurement results. For recommendations on setting this parameter, see "Meas Time " on page 267.

The "Meas Time" can be set via the "Meas Setup" > "Meas Time" menu item and is identical to the general setting in the "Bandwidth" dialog box.

Remote command:

[SENSe:]SWEep:TIME on page 678

**Channel setup**

The "Channel Settings" tab in the "ACLR Setup" dialog box provides all the channel settings to configure the channel power or ACLR measurement. You can define the channel settings for all channels, independent of the defined number of *used* TX or adjacent channels (see "Number of channels: Tx , Adj " on page 278).

For details on setting up channels, see "How to set up the channels" on page 299.





In addition to the specific channel settings, the general settings "Standard" on page 277 and "Number of channels: Tx , Adj" on page 278 are also available in this tab.

The following settings are available in individual subtabs of the "Channel Settings" tab.

Channel Bandwidth .....	281
Channel Spacings .....	282
Limit Check .....	283
Total Limit Pass Mode.....	283
Weighting Filters .....	284
Channel Names .....	285

### Channel Bandwidth

The screenshot shows the 'ACLR Setup' dialog box with the 'Channel Settings' tab selected. Under 'Standard', a dropdown menu is set to 'EUTRA/LTE Square' with a 'Manage User Standards' button below it. To the right, 'Channel Count' is set with 'Tx' at 1 and 'Adj' at 2. Below these are sub-tabs for 'Bandwidths', 'Spacing', 'Limits', 'Weighting Filters', and 'Names'. The 'Bandwidths' sub-tab is active, displaying two columns of input fields: 'Tx Channels' (Tx 1 to Tx 11) and 'Adjacent Channels' (Adj, Alt 1 to Alt 10). All fields in both columns are set to '9.015 MHz'. A vertical label 'IQ Analyzer' is visible on the left side of the dialog.

The Tx channel bandwidth is normally defined by the transmission standard.

The correct bandwidth is set automatically for the selected standard. The bandwidth for each channel is indicated by a colored bar in the display.

The value entered for any Tx channel is automatically also defined for all subsequent Tx channels. Thus, only enter one value if all Tx channels have the same bandwidth.

The value entered for any ADJ or ALT channel is automatically also defined for all alternate (ALT) channels. Thus, only enter one value if all adjacent channels have the same bandwidth.

Remote command:

[\[SENSe:\] POWER:ACHannel:BANDwidth\[:CHANnel<ch>\]](#) on page 689

[\[SENSe:\] POWER:ACHannel:BANDwidth:ACHannel](#) on page 689

[\[SENSe:\] POWER:ACHannel:BANDwidth:ALternate<ch>](#) on page 689

### Channel Spacings

Channel spacings are normally defined by the transmission standard but can be changed.

If the spacings are not equal, the channel distribution in relation to the center frequency is as follows:

Odd number of Tx channels	The middle Tx channel is centered to center frequency.
Even number of Tx channels	The two Tx channels in the middle are used to calculate the frequency between those two channels. This frequency is aligned to the center frequency.

The spacings between all Tx channels can be defined individually. When you change the spacing for one channel, the value is automatically also defined for all subsequent Tx channels. This allows you to set up a system with equal Tx channel spacing quickly. For different spacings, set up the channels from top to bottom.

Tx1-2	Spacing between the first and the second carrier
Tx2-3	Spacing between the second and the third carrier
...	...

If you change the adjacent-channel spacing (ADJ), all higher adjacent channel spacings (ALT1, ALT2, ...) are multiplied by the same factor (new spacing value/old spacing value). Again, only enter one value for equal channel spacing. For different spacing, configure the spacings from top to bottom.

For details, see ["How to set up the channels"](#) on page 299

Remote command:

[\[SENSe:\] POWER:ACHannel:SPACing:CHANnel<ch>](#) on page 691

[\[SENSe:\] POWER:ACHannel:SPACing\[:ACHannel\]](#) on page 690

[\[SENSe:\] POWER:ACHannel:SPACing:ALternate<ch>](#) on page 691

### Limit Check

During an ACLR measurement, the power values can be checked whether they exceed user-defined or standard-defined limits. A relative or absolute limit can be defined, or both. Both limit types are considered, regardless whether the measured levels are absolute or relative values. The check of both limit values can be activated independently. If any active limit value is exceeded, the measured value is displayed in red and marked by a preceding asterisk in the result table.

2 Result Summary		Tx Power 30.54 dBm		Tx Bandwidth 3.840 MHz		W-CDMA 3GPP DL	
Range Low	Range Up	RBW	Frequency	Power Abs	Power Rel	ΔLimit	
-12.750 MHz	-8.000 MHz	1.000 MHz	2.09053 GHz	-40.68 dBm	-71.22 dB	-17.18 dB	
-8.000 MHz	-4.000 MHz	1.000 MHz	2.09268 GHz	-40.13 dBm	-70.67 dB	-20.63 dB	
-4.000 MHz	-3.515 MHz	30.000 kHz	2.09647 GHz	-52.60 dBm	-83.14 dB	-20.10 dB	
-3.515 MHz	-2.715 MHz	30.000 kHz	2.09652 GHz	-54.30 dBm	-84.84 dB	-22.38 dB	
-2.715 MHz	-2.515 MHz	30.000 kHz	2.09728 GHz	-51.51 dBm	-82.05 dB	-31.01 dB	
-2.515 MHz	2.715 MHz	30.000 kHz	2.10270 GHz	-54.13 dBm	-84.67 dB	-33.63 dB	
2.715 MHz	3.515 MHz	30.000 kHz	2.10299 GHz*	-47.29 dBm*	-67.83 dB*	-7.27 dB*	
3.515 MHz	4.000 MHz	30.000 kHz	2.10355 GHz	-51.94 dBm	-82.48 dB	-19.44 dB	
4.000 MHz	8.000 MHz	1.000 MHz	2.10725 GHz	-40.01 dBm	-70.55 dB	-20.51 dB	
8.000 MHz	12.750 MHz	1.000 MHz	2.10911 GHz	-40.28 dBm	-70.82 dB	-16.78 dB	

The results of the power limit checks are also indicated in the `STAT:QUES:ACPL` status registry (see "[STATus:QUESTIONable:ACPLimit register](#)" on page 482).

Remote command:

`CALCulate<n>:LIMit<li>:ACPowe[r]:STATe` on page 702

`CALCulate<n>:LIMit<li>:ACPowe[r]:ACHannel:ABSolute:STATe` on page 696

`CALCulate<n>:LIMit<li>:ACPowe[r]:ACHannel:ABSolute` on page 696

`CALCulate<n>:LIMit<li>:ACPowe[r]:ACHannel[:RELative]:STATe`

on page 698

`CALCulate<n>:LIMit<li>:ACPowe[r]:ACHannel[:RELative]` on page 697

`CALCulate<n>:LIMit<li>:ACPowe[r]:ALternate<ch>:ABSolute:STATe`

on page 699

`CALCulate<n>:LIMit<li>:ACPowe[r]:ALternate<ch>:ABSolute` on page 698

`CALCulate<n>:LIMit<li>:ACPowe[r]:ALternate<ch>[:RELative]:STATe`

on page 701

`CALCulate<n>:LIMit<li>:ACPowe[r]:ALternate<ch>[:RELative]`

on page 700

`CALCulate<n>:LIMit<li>:ACPowe[r]:ACHannel:RESult?` on page 697

### Total Limit Pass Mode

Supported only by the 5G application.

**Access** (ACLR measurement): "Meas Config" > "CP / ACLR Config" > "Channel Settings" > "Limits"

**Access** (multi-carrier ACLR measurement): "Meas Config" > "CP / ACLR Config" > "MSR General Settings"

The "Total Limit Pass Mode" selects the logic the ACLR limits are evaluated with if you define both absolute limits and relative limits.

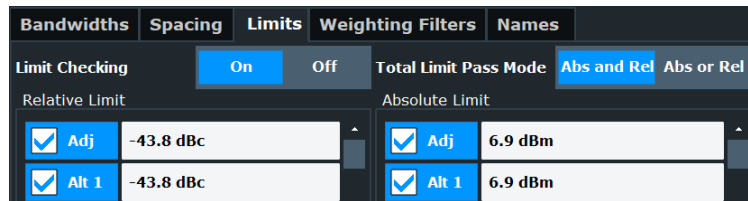


Figure 10-27: Evaluate both absolute and relative limits

If you define only relative or absolute limits, the R&S VSE only evaluates the corresponding limits.

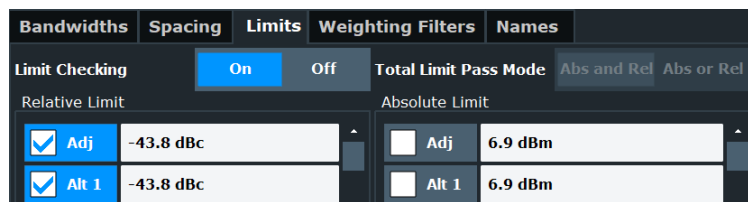


Figure 10-28: Evaluate only relative limits

If you change the limit evaluation method after the measurement, you have to refresh the measurement.

The selected method adjusts the contents of the following result displays.

- ACLR result summary

The default value is according to 3GPP 38.141-1/2.

"Absolute"	Checks the absolute limits defined for the ACLR. The limit check passes when the signal level is within the absolute limits.
"Relative"	Checks the relative limits defined for the ACLR. The limit check passes when the signal level is within the relative limits.
"Absolute and Relative"	The limit check for both, the absolute and the relative limits, must pass to get an overall pass.
"Absolute or Relative"	The limit check for either the absolute or the relative limits must pass to get an overall pass.

Remote command:

`CALCulate<n>:LIMit<li>:ACPoweR:PMODE` on page 701

### Weighting Filters

Weighting filters allow you to determine the influence of individual channels on the total measurement result. For each channel you can activate or deactivate the use of the weighting filter and define an individual weighting factor ("Alpha:" value).

Weighting filters are not available for all supported standards and cannot always be defined manually where they are available.

Remote command:

Activating/Deactivating:

`[SENSe:] POWer:ACHannel:FILTer[:STATe]:CHANnel<ch>` on page 694

`[SENSe:] POWer:ACHannel:FILTer[:STATe]:ACHannel` on page 693

`[SENSe:] POWer:ACHannel:FILTer[:STATe]:ALternate<ch>` on page 694

Alpha value:

[SENSe:] POWer:ACHannel:FILTer:ALPHa:CHANnel<ch> on page 693

[SENSe:] POWer:ACHannel:FILTer:ALPHa:ACHannel on page 692

[SENSe:] POWer:ACHannel:FILTer:ALPHa:ALTername<ch> on page 692

### Channel Names

In the R&S VSE's display, carrier channels are labeled "Tx" by default; the first neighboring channel is labeled "Adj" (adjacent) channel; all others are labeled "Alt" (alternate) channels. You can define user-specific channel names for each channel which are displayed in the result diagram and result table.

Remote command:

[SENSe:] POWer:ACHannel:NAME:ACHannel on page 689

[SENSe:] POWer:ACHannel:NAME:ALTername<ch> on page 690

[SENSe:] POWer:ACHannel:NAME:CHANnel<ch> on page 690

#### 10.4.1.5 MSR ACLR configuration

**Access:** "Overview" > "Select Measurement" > "Channel Power ACLR" > "CP / ACLR Standard" > "Standard" : "Multi-Standard Radio" > "CP / ACLR Config"

ACLR measurements can also be performed on input containing multiple signals for different communication standards. A new measurement standard is provided that allows you to define multiple discontinuous transmit channels at specified frequencies, independent from the selected center frequency. If the "Multi-Standard Radio" standard is selected (see "Standard" on page 277), the "ACLR Setup" dialog box is replaced by the "MSR ACLR Setup" dialog box.

For more information, see "Measurement on multi-standard radio (MSR) signals" on page 270.

The remote commands required to perform these tasks are described in Chapter 13.6.3.1, "Measuring the channel power and ACLR", on page 686.

- [General MSR ACLR measurement settings](#)..... 285
- [MSR sub block and TX channel definition](#)..... 290
- [MSR adjacent channel setup](#)..... 292
- [MSR gap channel setup](#)..... 295
- [MSR channel names](#)..... 298

### General MSR ACLR measurement settings

**Access:** "Overview" > "Select Measurement" > "Channel Power ACLR" > "CP / ACLR Standard" > "Standard" : "Multi-Standard Radio" > "CP / ACLR Config" > "MSR General Settings" tab

Standard .....	286
L Predefined Standards .....	286
L User Standards .....	287
Number of Sub Blocks .....	288
Reference Channel .....	288
Selected Trace .....	288
Absolute and Relative Values (ACLR Mode) .....	288
Channel power level and density (Power Unit) .....	288
Power Mode .....	289
Optimized Settings (Adjust Settings) .....	289
Symmetrical Adjacent Setup .....	289
Limit Checking .....	289

## Standard

The main measurement settings can be stored as a standard file. When such a standard is loaded, the required channel and general measurement settings are automatically set on the R&S VSE. However, the settings can be changed. Predefined standards are available for standard measurements, but standard files with user-defined configurations can also be created.

### Predefined Standards ← Standard

Predefined standards contain the main measurement settings for standard measurements. When such a standard is loaded, the required channel settings are automatically set on the R&S VSE. However, you can change the settings.

The predefined standards contain the following settings:

- Channel bandwidths

- Channel spacings
- Detector
- Trace Average setting
- Resolution Bandwidth (RBW)
- Weighting Filter

For details on the available standards, see [Chapter 10.4.1.9, "Reference: predefined CP/ACLR standards"](#), on page 308.

Remote command:

`CALCulate<n>:MARKer<m>:FUNCTION:POWER<sb>:PRESet` on page 686

### User Standards ← Standard

**Access:** "CP / ACLR Config" > "General Settings" tab > "Manage User Standards"

In addition to the predefined standards, you can save your own standards with your specific measurement settings in an XML file so you can use them again later. User-defined standards are stored on the instrument in the

`C:\ProgramData\Rohde-Schwarz\VSE\<version>\acp_std` directory.

**Note:** User standards created on an analyzer of the R&S FSP family are compatible to the R&S VSE. User standards created on an R&S VSE, however, are not necessarily compatible to the analyzers of the R&S FSP family and may not work there.

The following parameter definitions are saved in a user-defined standard:

- Number of adjacent channels
- Channel bandwidth of transmission (Tx), adjacent (Adj) and alternate (Alt) channels
- Channel spacings
- Weighting filters
- Resolution bandwidth
- Video bandwidth
- Detector
- ACLR limits and their state
- "Meas Time" and "Meas Time" coupling
- Trace and power mode
- (MSR only: sub block and gap channel definition)

Save the current measurement settings as a user-defined standard, load a stored measurement configuration, or delete an existing configuration file.

For details see ["How to manage user-defined configurations"](#) on page 302.

Remote command:

To query all available standards:

`CALCulate<n>:MARKer<m>:FUNCTION:POWER<sb>:STANdard:CATalog?`  
on page 687

To load a standard:

`CALCulate<n>:MARKer<m>:FUNCTION:POWER<sb>:PRESet` on page 686

To save a standard:

`CALCulate<n>:MARKer<m>:FUNCTION:POWER<sb>:STANdard:SAVE`  
on page 688

To delete a standard:

`CALCulate<n>:MARKer<m>:FUNCTION:POWER<sb>:STANdard:DELeTe`  
on page 687

**Number of Sub Blocks**

Defines the number of sub blocks, i.e. groups of transmission channels in an MSR signal.

For more information, see ["Measurement on multi-standard radio \(MSR\) signals"](#) on page 270.

Remote command:

[\[SENSe:\] POWER:ACHannel:SBCount](#) on page 711

**Reference Channel**

The measured power values in the adjacent channels can be displayed relative to the transmission channel. If more than one Tx channel is defined, define which one is used as a reference channel.

Tx Channel 1	Transmission channel 1 is used. (Not available for MSR ACLR)
Min Power Tx Channel	The transmission channel with the lowest power is used as a reference channel.
Max Power Tx Channel	The transmission channel with the highest power is used as a reference channel (Default).
Lowest & Highest Channel	The outer left-hand transmission channel is the reference channel for the lower adjacent channels, the outer right-hand transmission channel that for the upper adjacent channels.

Remote command:

[\[SENSe:\] POWER:ACHannel:REFERENCE:TXChannel:MANual](#) on page 695

[\[SENSe:\] POWER:ACHannel:REFERENCE:TXChannel:AUTO](#) on page 695

**Selected Trace**

The CP/ACLR measurement can be performed on any active trace.

Remote command:

[\[SENSe:\] POWER:TRACe](#) on page 708

**Absolute and Relative Values (ACLR Mode)**

The powers of the adjacent channels are output in dBm or dBm/Hz (absolute values), or in dBc, relative to the specified reference Tx channel.

"Abs"                    The absolute power in the adjacent channels is displayed in the unit of the y-axis, e.g. in dBm, dBμV.

"Rel"                    The level of the adjacent channels is displayed relative to the level of the transmission channel in dBc.

Remote command:

[\[SENSe:\] POWER:ACHannel:MODE](#) on page 729

**Channel power level and density (Power Unit)**

By default, the channel power is displayed in absolute values. If "/Hz" or "/MHz" is activated, the channel power density is displayed instead. Thus, the absolute unit of the channel power is switched from dBm to dBm/Hz or dBm/MHz.

**Note:** The channel power density in dBm/Hz corresponds to the power inside a bandwidth of 1 Hz and is calculated as follows:



"channel power density = channel power –  $\log_{10}$ (channel bandwidth)"

Thus you can measure the signal/noise power density, for example, or use the additional functions [Absolute and Relative Values \(ACLR Mode\)](#) and [Reference Channel](#) to obtain the signal to noise ratio.

Remote command:

[CALCulate<n>:MARKer<m>:FUNCTION:POWER<sb>:RESULT:PHZ](#) on page 728

[CALCulate<n>:MARKer<m>:FUNCTION:POWER<sb>:RESULT:UNIT](#) on page 729

### Power Mode

The measured power values can be displayed directly for each trace ("Clear/ Write" ), or only the maximum values over a series of measurements can be displayed ("Max Hold" ). In the latter case, the power values are calculated from the current trace and compared with the previous power value using a maximum algorithm. The higher value is retained. If "Max Hold" mode is activated, "Pwr Max" is indicated in the table header. Note that the *trace* mode remains unaffected by this setting.

Remote command:

[CALCulate<n>:MARKer<m>:FUNCTION:POWER<sb>:MODE](#) on page 709

### Optimized Settings (Adjust Settings )

All instrument settings for the selected channel setup (channel bandwidth, channel spacing) can be optimized automatically.

The adjustment is carried out only once. If necessary, the instrument settings can be changed later.

The following settings are optimized by "Adjust Settings" :

- ["Frequency span"](#) on page 267
- ["Resolution bandwidth \(RBW\)"](#) on page 268
- ["Video bandwidth \(VBW\)"](#) on page 268
- ["Detector"](#) on page 269
- ["Trace averaging"](#) on page 269

**Note:** The reference level is not affected by this function. To adjust the reference level automatically, use the "Amplitude" > [Reference Level](#) function.

Remote command:

[\[SENSe:\] POWER:ACHannel:PRESet](#) on page 708

### Symmetrical Adjacent Setup

If enabled, the upper and lower adjacent and alternate channels are defined symmetrically. This is the default behavior.

If disabled, the upper and lower channels can be configured differently. This is particularly useful if the lowest TX channel and highest TX channel use different standards and thus require different bandwidths for adjacent channel power measurement.

Remote command:

[\[SENSe:\] POWER:ACHannel:SSETup](#) on page 715

### Limit Checking

Activates or deactivates limit checks globally for all adjacent and gap channels. In addition to this setting, limits must be defined and activated individually for each channel.

The results of the power limit checks are also indicated in the `STAT:QUES:ACPL` status registry (see "[STATus:QUESTIONable:ACPLimit register](#)" on page 482).

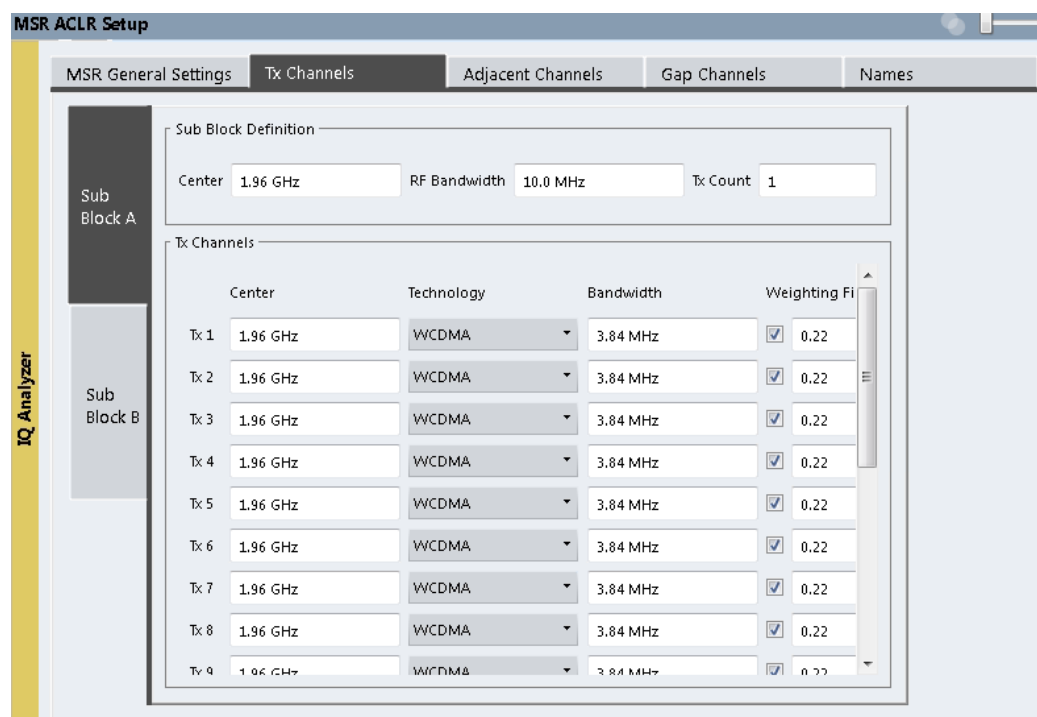
Remote command:

`CALCulate<n>:LIMit<li>:ACPower[:STATe]` on page 702

### MSR sub block and TX channel definition

**Access:** "Overview" > "Select Measurement" > "Channel Power ACLR" > "CP / ACLR Standard" > "Standard" : "Multi-Standard Radio" > "CP / ACLR Config" > "Tx Channels" tab

The "Tx Channels" tab provides all the channel settings to configure sub blocks and TX channels in MSR ACLR measurements.



For details on MSR signals, see "[Measurement on multi-standard radio \(MSR\) signals](#)" on page 270.

For details on setting up channels, see "[How to configure an MSR ACLR measurement](#)" on page 301.

The TX channel settings for the individual sub blocks are configured in individual sub-tabs of the "Tx Channel Settings" tab.

Sub Block Definition .....	291
L Sub Block / Center Freq .....	291
L RF Bandwidth .....	291
L Number of Tx Channels (Tx Count) .....	291
Tx Channel Definition .....	291
L Tx Center Frequency .....	291

L Technology Used for Transmission .....	292
L Tx Channel Bandwidth .....	292
L Weighting Filters .....	292

### Sub Block Definition

Sub blocks are groups of transmit channels in an MSR signal. Up to 5 sub blocks can be defined. They are defined as an RF bandwidth around a center frequency with a specific number of transmit channels (max. 18).

Sub blocks are named A,B,C,D,E and are indicated by a slim blue bar along the frequency axis.

### Sub Block / Center Freq ← Sub Block Definition

Defines the center of an MSR sub block. Note that the position of the sub block also affects the position of the adjacent gap channels.

Remote command:

`[SENSe:] POWER:ACHannel:SBLOCK<sb>:FREQUENCY:CENTer` on page 712

### RF Bandwidth ← Sub Block Definition

Defines the bandwidth of the individual MSR sub block. Note that sub block ranges also affect the position of the adjacent gap channels.

Remote command:

`[SENSe:] POWER:ACHannel:SBLOCK<sb>:RFBWidth` on page 713

### Number of Tx Channels (Tx Count ) ← Sub Block Definition

Defines the number of transmit channels the specific sub block contains. The maximum is 18 TX channels.

Remote command:

`[SENSe:] POWER:ACHannel:SBLOCK<sb>:TXCHANNEL:COUNT` on page 714

### Tx Channel Definition

As opposed to common ACLR channel definitions, the TX channels are defined at absolute frequencies, rather than by a spacing relative to the (common) center frequency. Each transmit channel can be assigned a different technology, used to predefine the required bandwidth.

The TX channel settings for the individual sub blocks are configured in individual sub-tabs of the "Tx Channel Settings" tab.

For details on configuring MSR TX channels, see "[How to configure an MSR ACLR measurement](#)" on page 301.

Remote command:

`[SENSe:] POWER:ACHannel:SBLOCK<sb>:NAME[:CHANNEL<ch>]` on page 723

### Tx Center Frequency ← Tx Channel Definition

Defines the (absolute) center frequency of an MSR TX channel. Each TX channel is defined independently of the others; automatic spacing as in common ACLR measurements is not performed.

Note that the position of the adjacent channels is also affected by:

- The position of the first TX channel in the first sub block

- The position of last TX channel in the last sub block

Remote command:

`[SENSe:] POWER:ACHannel:SBLOCK<sb>:CENTer[:CHANnel<ch>]` on page 711

### Technology Used for Transmission ← Tx Channel Definition

The technology used for transmission by the individual channel can be defined for each channel. The required channel bandwidth and use of a weighting filter are pre-configured automatically according to the selected technology standard.

"GSM"	Transmission according to GSM standard
"W-CDMA"	Transmission according to W-CDMA standard
"LTE_xxx"	Transmission according to LTE standard for different channel bandwidths
"USER"	User-defined transmission; no automatic preconfiguration possible

Remote command:

`[SENSe:] POWER:ACHannel:SBLOCK<sb>:TECHnology[:CHANnel<ch>]`  
on page 713

### Tx Channel Bandwidth ← Tx Channel Definition

The TX channel bandwidth is normally defined by the transmission technology standard. The correct bandwidth is predefined automatically for the selected technology. Each TX channel is defined independently of the others; automatic bandwidth configuration for subsequent channels as in common ACLR measurements is not performed.

The bandwidth for each channel is indicated by a colored bar in the display.

Remote command:

`[SENSe:] POWER:ACHannel:SBLOCK<sb>:BANDwidth[:CHANnel<ch>]`  
on page 711

### Weighting Filters ← Tx Channel Definition

Weighting filters allow you to determine the influence of individual channels on the total measurement result. For each channel, you can activate or deactivate the use of the weighting filter and define an individual weighting factor ("Alpha:" value).

Remote command:

Activating/Deactivating:

`[SENSe:] POWER:ACHannel:FILTer[:STATe]:SBLOCK<sb>:CHANnel<ch>`  
on page 710

Alpha value:

`[SENSe:] POWER:ACHannel:FILTer:ALPHa:SBLOCK<sb>:CHANnel<ch>`  
on page 710

### MSR adjacent channel setup

**Access:** "Overview" > "Select Measurement" > "Channel Power ACLR" > "CP / ACLR Standard" > "Standard" : "Multi-Standard Radio" > "CP / ACLR Config" > "Adjacent Channels" tab

The "Adjacent Channels" tab provides all the channel settings to configure adjacent and gap channels in MSR ACLR measurements.



For symmetrical channel definition (see "Symmetrical Adjacent Setup" on page 289), the dialog box is reduced as the upper and lower channels are identical.

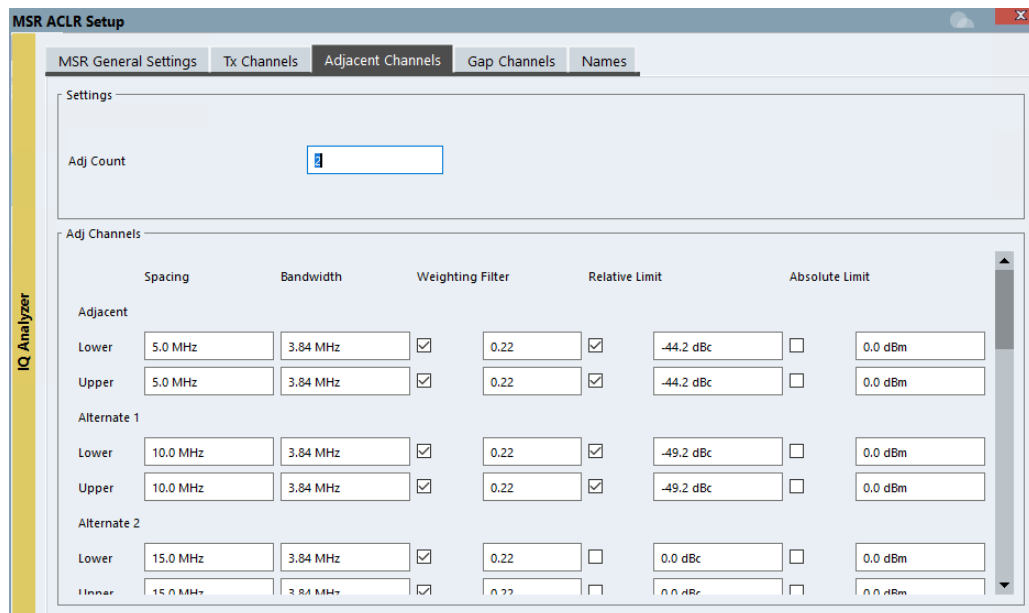


Figure 10-29: Asymmetrical adjacent channel definition

For details on setting up channels, see "How to configure an MSR ACLR measurement" on page 301.

- Number of Adjacent Channels (Adj Count) ..... 293
- Adjacent Channel Definition ..... 293
  - └ Adjacent Channel Spacings ..... 294
  - └ Adjacent Channel Bandwidths ..... 294
  - └ Weighting Filters ..... 294
  - └ Limit Checking ..... 295

**Number of Adjacent Channels (Adj Count)**

Defines the number of adjacent channels *above and below* the TX channel block in an MSR signal. You must define the carrier channel to which the relative adjacent-channel power values refer (see "Reference Channel" on page 278).

Remote command:

[SENSe:]POWER:ACHannel:ACPairs on page 688

**Adjacent Channel Definition**

Defines the channels adjacent to the transmission channel block in MSR signals. A maximum of 12 adjacent channels can be defined.

For MSR signals, adjacent channels are defined in relation to the center frequency of the first and last transmission channel in the entire block, i.e.:

- The lower adjacent channels are defined in relation to the CF of the first TX channel in the first sub block.

- The upper adjacent channels are defined in relation to the CF of the last TX channel in the last sub block.

Adjacent channels are named "Adj" and "Alt1" to "Alt11" by default; the names can be changed manually (see ["MSR channel names"](#) on page 298).

In all other respects, channel definition is identical to common ACLR measurements.

### Adjacent Channel Spacings ← Adjacent Channel Definition

Channel spacings are normally predefined by the selected technology but can be changed.

For MSR signals, adjacent channels are defined in relation to the center frequency of the first and last transmission channel in the entire block, i.e.:

- The spacing of the lower adjacent channels refers to the CF of the first TX channel in the first sub block.
- The spacing of the upper adjacent channels refers to the CF of the last TX channel in the last sub block.

For details, see ["How to configure an MSR ACLR measurement"](#) on page 301

Remote command:

[\[SENSe:\] POWER:ACHannel:SPACing\[:ACHannel\]](#) on page 690

[\[SENSe:\] POWER:ACHannel:SPACing:ALternate<ch>](#) on page 691

[\[SENSe:\] POWER:ACHannel:SPACing:UACHannel](#) on page 714

[\[SENSe:\] POWER:ACHannel:SPACing:UALternate<ch>](#) on page 714

### Adjacent Channel Bandwidths ← Adjacent Channel Definition

The adjacent channel bandwidth is normally predefined by the transmission technology standard. The correct bandwidth is set automatically for the selected technology. The bandwidth for each channel is indicated by a colored bar in the display.

Remote command:

[\[SENSe:\] POWER:ACHannel:BANDwidth:ACHannel](#) on page 689

[\[SENSe:\] POWER:ACHannel:BANDwidth:ALternate<ch>](#) on page 689

[\[SENSe:\] POWER:ACHannel:BANDwidth:UACHannel](#) on page 715

[\[SENSe:\] POWER:ACHannel:BANDwidth:UALternate<ch>](#) on page 715

### Weighting Filters ← Adjacent Channel Definition

Weighting filters allow you to determine the influence of individual channels on the total measurement result. For each channel, you can activate or deactivate the use of the weighting filter and define an individual weighting factor ("Alpha:" value).

Remote command:

Activating/Deactivating:

[\[SENSe:\] POWER:ACHannel:FILTer\[:STATe\]:ACHannel](#) on page 693

[\[SENSe:\] POWER:ACHannel:FILTer\[:STATe\]:ALternate<ch>](#) on page 694

[\[SENSe:\] POWER:ACHannel:FILTer\[:STATe\]:UACHannel](#) on page 716

[\[SENSe:\] POWER:ACHannel:FILTer\[:STATe\]:UALternate<ch>](#) on page 716

Alpha value:

[\[SENSe:\] POWER:ACHannel:FILTer:ALPHa:ACHannel](#) on page 692

[\[SENSe:\] POWER:ACHannel:FILTer:ALPHa:ALternate<ch>](#) on page 692

[\[SENSe:\] POWER:ACHannel:FILTer:ALPHa:UACHannel](#) on page 716

[\[SENSe:\] POWER:ACHannel:FILTer:ALPHa:UALternate<ch>](#) on page 716

### Limit Checking ← Adjacent Channel Definition

During an ACLR measurement, the power values can be checked whether they exceed user-defined or standard-defined limits. A relative or absolute limit can be defined, or both, for each individual adjacent channel. Both limit types are considered, regardless whether the measured levels are absolute or relative values. The check of both limit values can be activated independently. If any active limit value is exceeded, the measured value is displayed in red and marked by a preceding asterisk in the result table.

Note that in addition to activating limit checking for individual channels, limit checking must also be activated globally for the MSR ACLR measurement (see "Limit Checking" on page 289).

2 Result Summary		Multi-Standard Radio		
Channel	Bandwidth	Frequency	Power	
B: GSM2	200.000 kHz	1.020 GHz	<b>-80.44 dBm</b>	
Sub Block B Total				
Channel	Bandwidth	Offset	Lower	Upper
Adj*	3.840 MHz	5.000 MHz	<b>-33.27 dB *</b>	<b>-32.63 dB *</b>
Alt1	3.840 MHz	10.000 MHz	<b>-49.76 dB</b>	<b>-50.37 dB</b>

Remote command:

`CALCulate<n>:LIMit<li>:ACPowe[r]:STATe` on page 702

`CALCulate<n>:LIMit<li>:ACPowe[r]:ACHannel:ABSolute:STATe` on page 696

`CALCulate<n>:LIMit<li>:ACPowe[r]:ACHannel:ABSolute` on page 696

`CALCulate<n>:LIMit<li>:ACPowe[r]:ACHannel[:RELative]:STATe`  
on page 698

`CALCulate<n>:LIMit<li>:ACPowe[r]:ACHannel[:RELative]` on page 697

`CALCulate<n>:LIMit<li>:ACPowe[r]:ALternate<ch>:ABSolute:STATe`  
on page 699

`CALCulate<n>:LIMit<li>:ACPowe[r]:ALternate<ch>:ABSolute` on page 698

`CALCulate<n>:LIMit<li>:ACPowe[r]:ALternate<ch>[:RELative]:STATe`  
on page 701

`CALCulate<n>:LIMit<li>:ACPowe[r]:ALternate<ch>[:RELative]`  
on page 700

`CALCulate<n>:LIMit<li>:ACPowe[r]:ACHannel:RESult?` on page 697

### MSR gap channel setup

**Access:** "Overview" > "Select Measurement" > "Channel Power ACLR" > "CP / ACLR Standard" > "Standard" : "Multi-Standard Radio" > "CP / ACLR Config" > "Gap Channels" tab

The "Gap Channels" tab provides all the channel settings to configure gap channels in MSR ACLR measurements.

For details on MSR signals, see "Measurement on multi-standard radio (MSR) signals" on page 270.

For details on setting up channels, see "How to configure an MSR ACLR measurement" on page 301.

Activate Gaps .....	296
Gap Channel Definition .....	296
L Minimum gap size to show Gap 1 / Minimum gap size to show Gap 2 .....	296
L Gap Channel Spacing .....	296

L	Gap Channel Bandwidths .....	297
L	Weighting Filters .....	297
L	Limit Checking .....	298

### Activate Gaps

If enabled, the gap channels are displayed and channel power results are calculated and displayed in the Result Summary.

Remote command:

`[SENSe:]POWer:ACHannel:AGChannels` on page 717

### Gap Channel Definition

Between two sub blocks in an MSR signal, two gaps are defined: a *lower gap* and an *upper gap*. Each gap in turn can contain two channels, the *gap channels*.

Gap channels are indicated using the following syntax:

- The names of the surrounding sub blocks (e.g. "AB" for the gap between sub blocks A and B)
- The channel name ("Gap1" or "Gap2" )
- "L" (for lower) or "U" (for upper)

### Minimum gap size to show Gap 1 / Minimum gap size to show Gap 2 ← Gap Channel Definition

If the gap between the sub blocks does not exceed the specified bandwidth, the gap channels are not displayed in the diagram. The gap channel results are not calculated in the result summary.

Remote command:

`[SENSe:]POWer:ACHannel:GAP<gap>[:AUTO]:MSIZE` on page 721

### Gap Channel Spacing ← Gap Channel Definition

Gap channel spacings are normally predefined by the MSR standard but can be changed.

Gap channels are defined using bandwidths and spacings, relative to the outer edges of the surrounding sub blocks.

The required spacing can be determined according to the following formula (indicated for lower channels):

$$\text{Spacing} = [\text{CF of gap channel}] - [\text{left sub block CF}] + ([\text{RF bandwidth of left sub block}] / 2)$$



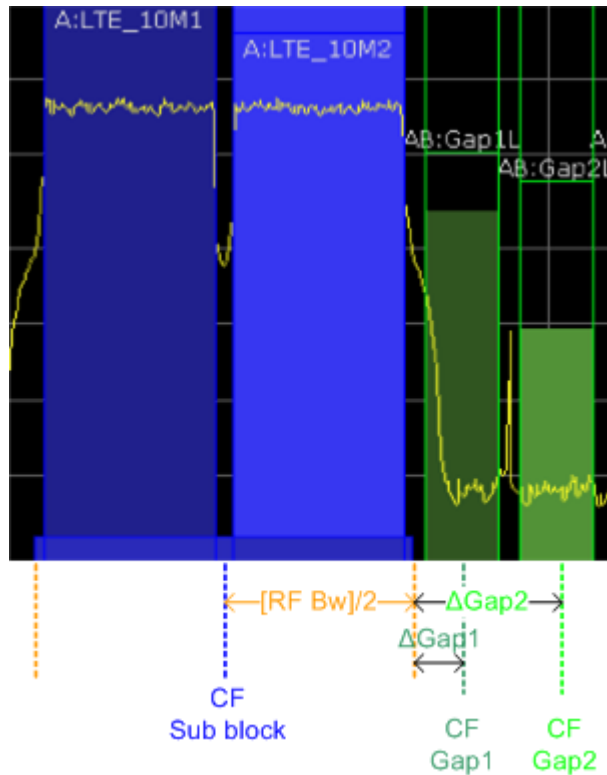


Figure 10-30: Gap channel definition for lower gap

For details, see ["How to configure an MSR ACLR measurement"](#) on page 301.

Remote command:

`[SENSe:] POWER:ACHannel:SPACing:GAP<gap> [:AUTO]` on page 722

#### Gap Channel Bandwidths ← Gap Channel Definition

The gap channel bandwidth is normally predefined by the transmission technology standard. The correct bandwidth is set automatically for the selected technology. The bandwidth for each channel is indicated by a colored bar in the display (if the gap is not too narrow, see ["Channel display for MSR signals"](#) on page 273).

Remote command:

`[SENSe:] POWER:ACHannel:BANDwidth:GAP<gap> [:AUTO]` on page 720

#### Weighting Filters ← Gap Channel Definition

Weighting filters allow you to determine the influence of individual channels on the total measurement result. For each channel, you can activate or deactivate the use of the weighting filter and define an individual weighting factor ("Alpha:" value).

Remote command:

`[SENSe:] POWER:ACHannel:FILTer [:STATe]:GAP<gap> [:AUTO]` on page 721

`[SENSe:] POWER:ACHannel:FILTer:ALPHA:GAP<gap> [:AUTO]` on page 721

### Limit Checking ← Gap Channel Definition

During an ACLR measurement, the power values can be checked whether they exceed user-defined or standard-defined limits. A relative or absolute limit can be defined, or both, for each individual gap channel. Both limit types are considered, regardless whether the measured levels are absolute or relative values. The check of both limit values can be activated independently. Furthermore, relative limits can be defined and activated individually for ACLR or CACLR power levels.

If any active limit value is exceeded, the measured value is displayed in red and marked by a preceding asterisk in the result table.

Note that in addition to activating limit checking for individual channels, limit checking must also be activated globally for the MSR ACLR measurement (see "Limit Checking" on page 289).

Remote command:

"Automatic (symmetrical) configuration" on page 717

### MSR channel names

**Access:** "Overview" > "Select Measurement" > "Channel Power ACLR" > "CP / ACLR Standard" > "Standard" : "Multi-Standard Radio" > "CP / ACLR Config" > "Names" tab

Channel names for all TX, adjacent, and alternate channels are user-definable.

In the "Names" tab, you can define a customized name for each channel in each sub block. Note that the names are not checked for uniqueness.

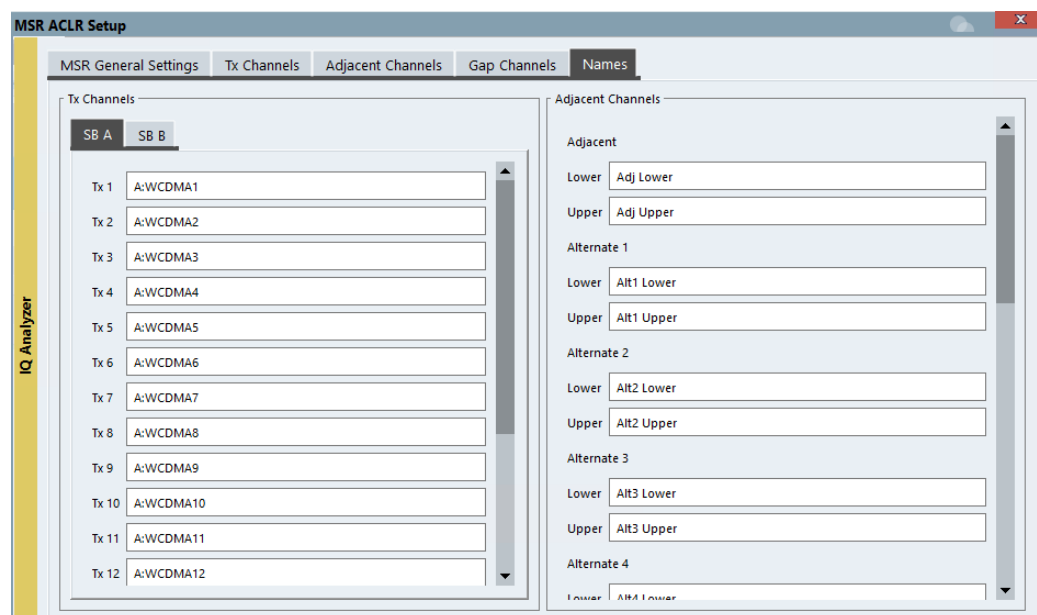


Figure 10-31: Channel name definition for asymmetric adjacent channels

Remote command:

[SENSe:] POWER:ACHannel:SBLock<sb>:NAME[:CHANnel<ch>] on page 723

[SENSe:] POWER:ACHannel:NAME:ACHannel on page 689

[\[SENSe:\] POWER:ACHannel:NAME:ALternate<ch>](#) on page 690

[\[SENSe:\] POWER:ACHannel:NAME:UACHannel](#) on page 723

[\[SENSe:\] POWER:ACHannel:NAME:UALternate<ch>](#) on page 723

#### 10.4.1.6 How to perform channel power measurements

The following step-by-step instructions demonstrate the most common tasks when performing channel power measurements.



For remote operation, see ["Programming examples for channel power measurements"](#) on page 731.

- [How to perform a standard channel power measurement](#).....299
- [How to set up the channels](#).....299
- [How to configure an MSR ACLR measurement](#).....301
- [How to manage user-defined configurations](#).....302
- [How to compare the TX channel power in successive measurements](#).....303

#### How to perform a standard channel power measurement

Performing a channel power or ACLR measurement according to common standards is a very easy and straightforward task with the R&S VSE.

1. Select "Meas Setup" > "Select Measurement" .
2. Select "Channel Power ACLR" .  
The measurement is started immediately with the default settings.
3. Select "Meas Setup" > "CP / ACLR Standard" .
4. Select a standard from the list.  
The measurement is restarted with the predefined settings for the selected standard.
5. If necessary, edit the settings for your specific measurement as described in ["How to set up the channels"](#) on page 299, or load a user-defined configuration (see ["To load a user-defined configuration"](#) on page 302).

#### How to set up the channels

Channel definition is the basis for measuring power levels in certain frequency ranges. Usually, the power levels in one or more carrier (TX) channels and possibly the adjacent channels are of interest. Up to 18 carrier channels and up to 12 adjacent channels can be defined.

When a measurement standard is selected, all settings including the channel bandwidths and channel spacings are set according to the selected standard. Select a standard in the "Ch Power" menu or the "ACLR Setup" dialog box. You can adjust the settings afterwards.

Channel setup consists of the following settings:

- The number of transmission (TX) and adjacent channels
- The bandwidth of each channel
- For multicarrier ACLR measurements: which TX channel is used as a reference
- The spacing between the individual channels
- Optionally: the names of the channels displayed in the diagram and result table
- Optionally: the influence of individual channels on the total measurement result ("Weighting Filter" )
- Optionally: limits for a limit check on the measured power levels



Changes to an existing standard can be stored as a user-defined standard, see ["How to manage user-defined configurations"](#) on page 302.

- ▶ To configure the channels in the "Ch Power" dialog box, select "Ch Power" > "CP / ACLR Config" > "Channel Settings" tab.



In the "Channel Setup" dialog box, you can define the channel settings for all channels, independent of the defined number of *used* TX or adjacent channels.

### To define channel spacings

Channel spacings are normally defined by the selected standard but can be changed.

- ▶ In the "Channel Settings" tab of the "ACLR Setup" dialog box, select the "Spacing" subtab.  
The value entered for any TX channel is automatically also defined for all subsequent TX channels. Thus, only enter one value if all TX channels have the same spacing.  
If the channel spacing for the adjacent or an alternate channel is changed, all higher alternate channel spacings are multiplied by the same factor (new spacing value/old spacing value). The lower adjacent-channel spacings remain unchanged.  
Only enter one value for equal channel spacing.

### Example: Defining channel spacing

In the default setting, the adjacent channels have the following spacing: 20 kHz ("ADJ"), 40 kHz ("ALT1"), 60 kHz ("ALT2"), 80 kHz ("ALT3"), 100 kHz ("ALT4"), ...

Set the spacing of the first adjacent channel ("ADJ") to *40 kHz*. For all other adjacent channels, the spacing is multiplied by factor 2: 80 kHz ("ALT1"), 120 kHz ("ALT2"), 160 kHz ("ALT3"), ...

Starting from the default setting, set the spacing of the fifth adjacent channel ("ALT4") to *150 kHz*. For all higher adjacent channels, the spacing is multiplied by factor 1.5: 180 kHz ("ALT5"), 210 kHz ("ALT6"), 240 kHz ("ALT7"), ...

### How to configure an MSR ACLR measurement

You configure ACLR measurements on MSR signals in a special configuration dialog box on the R&S VSE.

1. Select "Meas Setup" > "Select Measurement" .
2. Select "Channel Power ACLR" .  
The measurement is started immediately with the default settings.
3. Select "CP / ACLR Standard" .
4. Select the "Multi-Standard Radio" standard from the list.
5. Select "CP / ACLR Config" to configure general MSR settings, including the number of sub blocks (up to 5).  
To configure asymmetric adjacent channels, deactivate the "Symmetrical" option in the general MSR settings.
6. Select the "Tx Channels" tab to configure the sub blocks and transmission channels.  
For each sub block:
  - a) Define the (center frequency) position and bandwidth of the sub block, as well as the number of transmission channels it contains.
  - b) For each transmission channel in the sub block:
    - Define the center frequency.
    - Select the technology used for transmission.
    - Check the bandwidth.
    - If necessary, define the use of a weighting filter for the channel.
7. Select the "Adjacent Channels" tab to configure the adjacent channels.
8. Define the number of adjacent channels and the settings for each channel:
  - The spacing, defined as the distance of the center frequency from the center frequency of the first transmission channel in the first sub block.  
For asymmetrical channels, define the upper adjacent channel spacing as the distance from the center frequency of the last transmission channel in the last sub block.
  - The bandwidth
  - If necessary, a weighting filter
  - Optionally, define *and activate* relative or absolute limits, or both, against which the power levels of the channel are to be checked.
9. Select the "Gap Channels" tab to configure the gap channels.
10. Define the following settings for the two (upper or lower) gap channels. Since the upper and lower channels are identical, it is only necessary to configure two channels.

- The spacing, defined as the distance of the center frequency from the outer edge of the sub block to the left or right of the gap. You can determine the required spacing as follows:  
Spacing = [CF of the gap channel] - [left sub block center] + ([RF bandwidth of left sub block] / 2)
  - The bandwidth
  - If necessary, a weighting filter
  - Optionally, define *and activate* relative or absolute limits, or both, against which the power levels of the channel are to be checked.
11. If power limits are defined and activated, activate global limit checking for the measurement on the "MSR General Settings" tab.
  12. Optionally, store the settings for the MSR ACLR measurement as a user-defined standard as described in "[To store a user-defined configuration](#)" on page 302. Otherwise the configuration is lost when you select a different measurement standard.

### How to manage user-defined configurations

You can define measurement configurations independently of a predefined standard and save the current ACLR configuration as a "user standard" in an XML file. You can then load the file and thus the settings again later.

User-defined standards are not supported for multicarrier ACLR measurements.



### Compatibility to R&S FSP

User standards created on an analyzer of the R&S FSP family are compatible to the R&S VSE. User standards created on an R&S VSE, however, are not necessarily compatible to the analyzers of the R&S FSP family and may not work there.

### To store a user-defined configuration

1. In the "Ch Power" menu, select "CP / ACLR Config" to display the "ACLR Setup" dialog box.
2. Configure the measurement as required (see also "[How to set up the channels](#)" on page 299).
3. In the "General Settings" tab, select "Manage User Standards" to display the "Manage" dialog box.
4. Define a filename and storage location for the user standard.  
By default, the XML file is stored in  
C:\Program Files\Rohde-Schwarz\VSE\- 5. Select "Save".

### To load a user-defined configuration

1. In the "General Settings" tab of the "ACLR Setup" dialog box, select "Manage User Standards" to display the "Manage" dialog box.

2. Select the user standard file.
3. Select "Load" .

The stored settings are automatically set on the R&S VSE and the measurement is restarted with the new parameters.

### How to compare the TX channel power in successive measurements

For power measurements with only one TX channel and no adjacent channels, you can define a fixed reference power and compare subsequent measurement results to the stored reference power.

1. Configure a measurement with only one TX channel and no adjacent channels (see also ["How to set up the channels"](#) on page 299).

2. In the "ACLR Setup" dialog box, select "Set CP Reference" .

The channel power currently measured on the TX channel is stored as a fixed reference power. The reference value is displayed in the "Reference" field of the result table (in relative ACLR mode).

3. Start a new measurement.

The resulting power is indicated relative to the fixed reference power.

4. Repeat this for any number of measurements.

5. To start a new measurement without the fixed reference, temporarily define a second channel or preset the instrument.

#### 10.4.1.7 Measurement examples

The R&S VSE has test routines for simple channel and adjacent channel power measurements. These routines give quick results without any complex or tedious setting procedures.

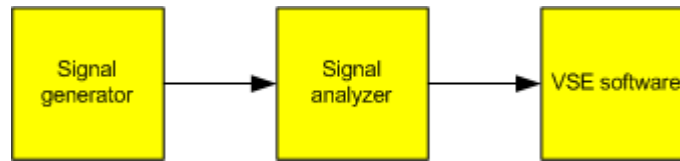


A programming example demonstrating an ACLR measurement in a remote environment is provided in ["Programming examples for channel power measurements"](#) on page 731.

- [Measurement example 1 – ACPR measurement on a CDMA2000 signal](#)..... 304
- [Measurement example 2 – measuring adjacent channel power of a W-CDMA uplink signal](#)..... 305
- [Measurement example 3 – measuring the intrinsic noise of the connected instrument with the channel power function](#).....306

### Measurement example 1 – ACPR measurement on a CDMA2000 signal

#### Test setup:



#### Signal generator settings (e.g. R&S SMW):

Frequency:	850 MHz
Level:	0 dBm
Modulation:	CDMA2000

#### Procedure:

1. Set up a basic measurement with instrument input in the R&S VSE as described in [Chapter 11.1, "How to perform a basic measurement with instrument input"](#), on page 461.
2. Set the center frequency to *850 MHz*.
3. Set the span to *4 MHz*.
4. Set the reference level to *+10 dBm*.
5. Select "Meas Setup" > "Select Measurement" .
6. Select the "Channel Power ACLR" measurement function.
7. Set the "CDMA2000 1X" standard for adjacent channel power measurement in the "ACLR Setup" dialog box.

The R&S VSE sets the channel configuration according to the 2000 standard with two adjacent channels above and 2 below the transmit channel. The spectrum is displayed in the upper part of the screen, the numeric values of the results and the channel configuration in the lower part of the screen. The various channels are represented by vertical lines on the graph.

The frequency span, resolution bandwidth, video bandwidth and detector are selected automatically to give correct results. To obtain stable results – especially in the adjacent channels (30 kHz bandwidth) which are narrow in comparison with the transmission channel bandwidth (1.23 MHz) – the RMS detector is used.

8. Set the optimal reference level and RF attenuation for the applied signal level using the "Auto Level" function in the [Auto Set] menu.

The R&S VSE sets the optimal RF attenuation and the reference level based on the transmission channel power to obtain the maximum dynamic range.

The [Figure 10-32](#) shows the result of the measurement.



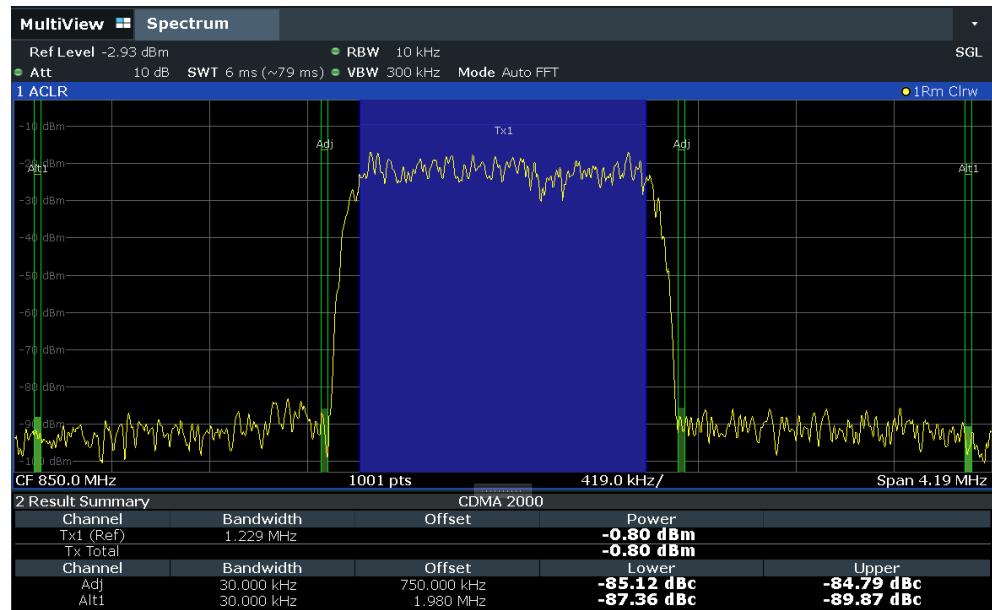
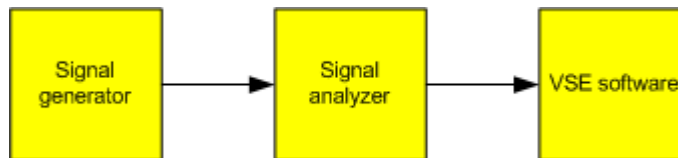


Figure 10-32: Adjacent channel power measurement on a CDMA2000 signal

## Measurement example 2 – measuring adjacent channel power of a W-CDMA uplink signal

### Test setup:



### Signal generator settings (e.g. R&S SMW):

Frequency:	1950 MHz
Level:	4 dBm
Modulation:	3GPP W-CDMA Reverse Link

### Procedure:

1. Enter the Spectrum application via [MODE].
2. Set up a basic measurement with instrument input in the R&S VSE as described in [Chapter 11.1, "How to perform a basic measurement with instrument input"](#), on page 461.
3. Set the center frequency to *1950 MHz*.
4. Select the "Channel Power ACLR" measurement function from the "Select Measurement" dialog box.

- Set the "W-CDMA 3GPP REV" standard for adjacent channel power measurement in the "ACLR Setup" dialog box.

The R&S VSE sets the channel configuration to the W-CDMA standard for mobiles with two adjacent channels above and below the transmit channel. The frequency span, the resolution and video bandwidth and the detector are automatically set to the correct values. The spectrum is displayed in the upper window and the channel power, the level ratios of the adjacent channel powers and the channel configuration in the lower window. The individual channels are displayed as bars in the graph.

- Set the optimal reference level and RF attenuation for the applied signal level using the "Auto Level" function.

The R&S VSE sets the optimum RF attenuation and the reference level for the power in the transmission channel to obtain the maximum dynamic range. The following figure shows the result of the measurement.

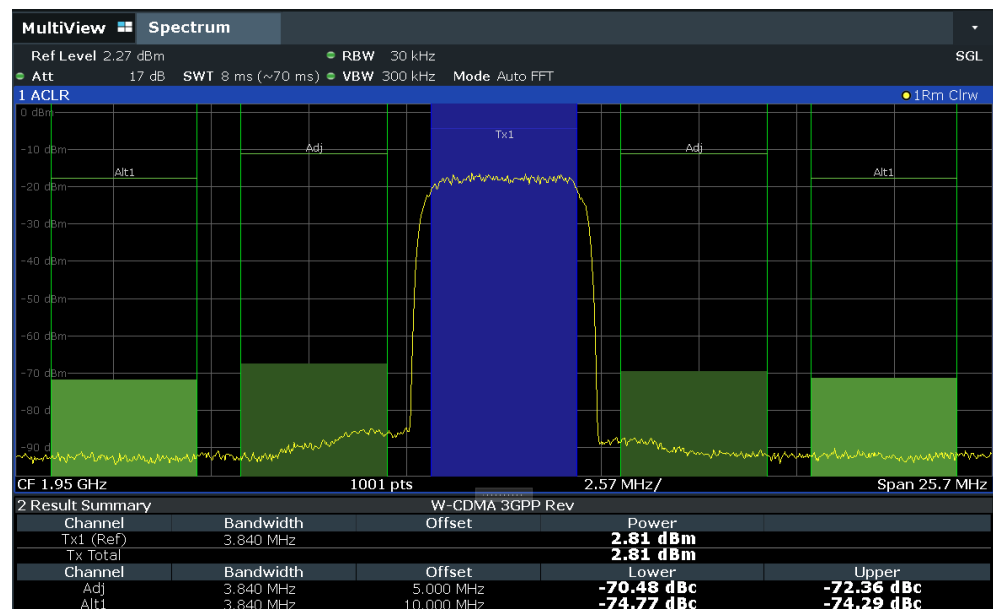


Figure 10-33: Measuring the relative adjacent channel power on a W-CDMA uplink signal

The R&S VSE measures the power of the individual channels. A root raised cosine filter with the parameters  $\alpha = 0.22$  and chip rate 3.84 Mcps (= receive filter for W-CDMA) is used as channel filter.

### Measurement example 3 – measuring the intrinsic noise of the connected instrument with the channel power function

Noise in any bandwidth can be measured with the channel power measurement functions. Thus the noise power in a communication channel can be determined, for example.

**Test setup:**

- ▶ Leave the RF input of the connected instrument open-circuited or terminate it with 50  $\Omega$ .

**Procedure:**

1. Set up a basic measurement with instrument input in the R&S VSE as described in [Chapter 11.1, "How to perform a basic measurement with instrument input"](#), on page 461.
2. Set the center frequency to 1 GHz and the span to 1 MHz.
3. To obtain maximum sensitivity, set RF attenuation to 0 dB and the reference level to -40 dBm.
4. Select the "Channel Power ACLR" measurement function from the "Select Measurement" dialog box.
5. In the "ACLR Setup" dialog box, set up a single TX channel with the channel bandwidth 1.23 MHz.
6. Select "Adjust Settings" .  
The settings for the frequency span, the bandwidth (RBW and VBW) and the detector are automatically set to the optimum values required for the measurement.
7. Stabilize the measurement result by increasing the "Meas Time" .  
Set the "Meas Time" to 1 s.  
(If the connected instrument allows, otherwise the maximum "Meas Time" .)  
The trace becomes much smoother because of the RMS detector and the channel power measurement display is much more stable.

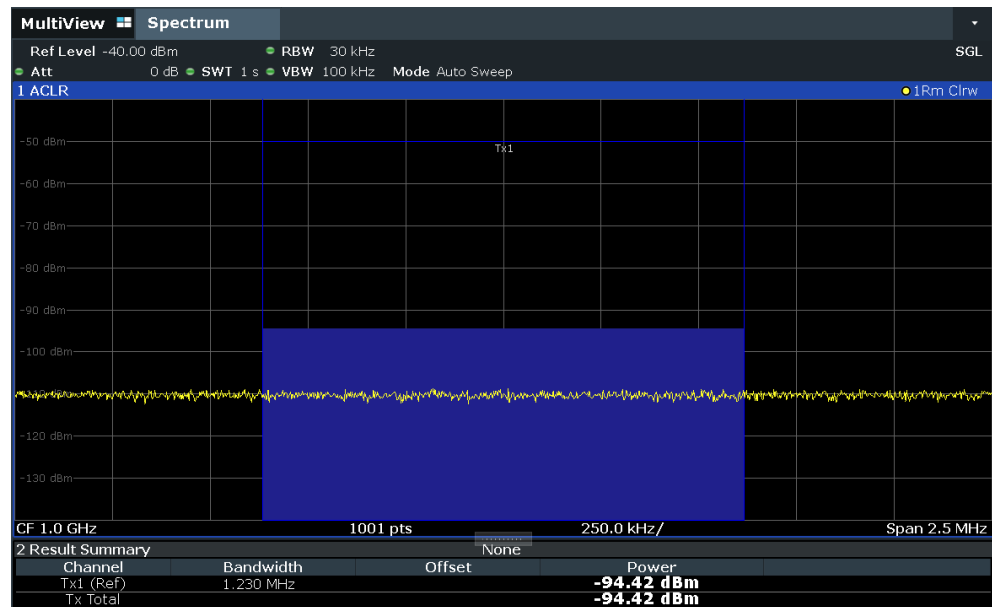


Figure 10-34: Measurement of the R&S VSE's intrinsic noise power in a 1.23 MHz channel bandwidth.

#### 10.4.1.8 Optimizing and troubleshooting the measurement

If the results do not meet your expectations, or if you want to minimize the measurement duration, try the following methods to optimize the measurement:

- Only activate as many **adjacent channels** as necessary to minimize the required span and thus the required measurement time for the measurement.
- Increase the **RBW** to minimize the measurement time; however, consider the requirements of the standard if you need to measure according to standard! The automatic settings are always according to standard.
- Reduce the **"Meas Time"** and thus the amount of data to be captured and calculated; however, consider the requirements regarding the standard deviation.
- To improve the **stability of the measured results**, increase the "Meas Time" , which also leads to more averaging steps.
- Instead of **trace averaging**, use an RMS detector with a higher "Meas Time" to obtain better average power results in less time.

#### 10.4.1.9 Reference: predefined CP/ACLR standards

When using predefined standards for ACLR measurement, the test parameters for the channel and adjacent-channel measurements are configured automatically.

You can select a predefined standard via "CP / ACLR Standard" in the "Ch Power" menu or the selection list in the "General Settings" tab of the "ACLR Setup" dialog box (see "Standard " on page 277).

**Table 10-3: Predefined CP / ACLR standards with remote command parameters**

Standard	Remote parameter
None	NONE
Multi-Standard Radio	MSR
EUTRA/LTE Square	EUTRa
EUTRA/LTE Square/RRC	REUTra
5G NR DL FR1 20MHz	F1D20nr5g
5G NR DL FR1 100MHz	F1D100nr5g
5G NR UL FR1 20MHz	F1U20nr5g
5G NR UL FR1 100MHz	F1U100nr5g
5G NR DL FR2 100MHz	F2D100nr5g
5G NR DL FR2 200MHz	F2D200nr5g
5G NR UL FR2 100MHz	F2U100nr5g
5G NR UL FR2 200MHz	F2U200nr5g
W-CDMA 3GPP FWD	FW3Gppcdma
W-CDMA 3GPP REV	RW3Gppcdma
CDMA IS95A FWD	F8CDma
CDMA IS95A REV	R8CDma
CDMA IS95C Class 0 FWD*)	FIS95c0
CDMA IS95C Class 0 REV*)	RIS95c0
CDMA J-STD008 FWD	F19Cdma
CDMA J-STD008 REV	R19Cdma
CDMA IS95C Class 1 FWD*)	FIS95c1
CDMA IS95C Class 1 REV*)	RIS95c1
CDMA2000	S2CDma
TD-SCDMA FWD	FTCDma
TD-SCDMA REV	TRCDma
WLAN 802.11A	AWLAN
WLAN 802.11B	BWLAN
WIMAX	WIMax
WIBRO	WIBRo
RFID 14443	RFID14443
TETRA	TETRa
PDC	PDC
PHS	PHS

Standard	Remote parameter
CDPD	CDPD
APCO-25 P2	PAPCo25
User Standard	USER
Customized Standard	<string>



For the R&S VSE, the channel spacing is defined as the distance between the center frequency of the adjacent channel and the center frequency of the transmission channel. The definition of the adjacent-channel spacing in standards IS95C and CDMA 2000 is different. These standards define the adjacent-channel spacing from the center of the transmission channel to the closest border of the adjacent channel. This definition is also used by the R&S VSE for the standards marked with an asterisk \*).

#### 10.4.1.10 Reference: predefined ACLR user standard XML files

In addition to the predefined standards, some user standards with specific measurement settings for common ACLR measurements are provided in XML files on the instrument in the

C:\Program Files\Rohde-Schwarz\VSE\<>version>\acp\_std directory.

Furthermore, the following XML files are provided:

##### 5GNR\DL

- 5GNR\DL\5GNR\_DL\_FR1\_20MHz
- 5GNR\DL\5GNR\_DL\_FR1\_100MHz
- 5GNR\DL\5GNR\_DL\_FR2\_100MHz
- 5GNR\DL\5GNR\_DL\_FR2\_200MHz

##### 5GNR\UL

- 5GNR\UL\5GNR\_UL\_FR1\_20MHz
- 5GNR\UL\5GNR\_UL\_FR1\_100MHz
- 5GNR\UL\5GNR\_UL\_FR2\_100MHz
- 5GNR\UL\5GNR\_UL\_FR2\_200MHz

##### LTE\DL

- LTE\DL\LTE\_DL\_5MHZ.XML
- LTE\DL\LTE\_DL\_10MHZ.XML
- LTE\DL\LTE\_DL\_15MHZ.XML
- LTE\DL\LTE\_DL\_20MHZ.XML

##### LTE\UL

- LTE\UL\LTE\_UL\_5MHZ.XML
- LTE\UL\LTE\_UL\_10MHZ.XML
- LTE\UL\LTE\_UL\_15MHZ.XML
- LTE\UL\LTE\_UL\_20MHZ.XML

**WLAN**

- WLAN\802\_11ac\802\_11ac\_20MHZ.XML
- WLAN\802\_11ac\802\_11ac\_40MHZ.XML
- WLAN\802\_11ac\802\_11ac\_80MHZ.XML
- WLAN\802\_11ac\802\_11ac\_160MHZ.XML



To load a stored measurement configuration, in the "General Settings" tab of the "ACLR Setup" dialog box, select "Manage User Standards" to display the "Manage" dialog box. Select the user standard file, then "Load" .

The stored settings are automatically set on the R&S VSE and the measurement is restarted with the new parameters.

For details, see "[How to manage user-defined configurations](#)" on page 302.

**10.4.2 Occupied bandwidth measurement (OBW)**

An important characteristic of a modulated signal is its occupied bandwidth, that is: the bandwidth which must contain a defined percentage of the power. In a radio communications system, for instance, the occupied bandwidth must be limited to enable distortion-free transmission in adjacent channels.

- [About the measurement](#).....311
- [OBW results](#).....313
- [OBW configuration](#).....313
- [How to determine the occupied bandwidth](#).....315
- [Measurement example](#).....316

**10.4.2.1 About the measurement**

The occupied bandwidth is defined as the bandwidth containing a defined percentage of the total transmitted power. A percentage between 10 % and 99.9 % can be set.

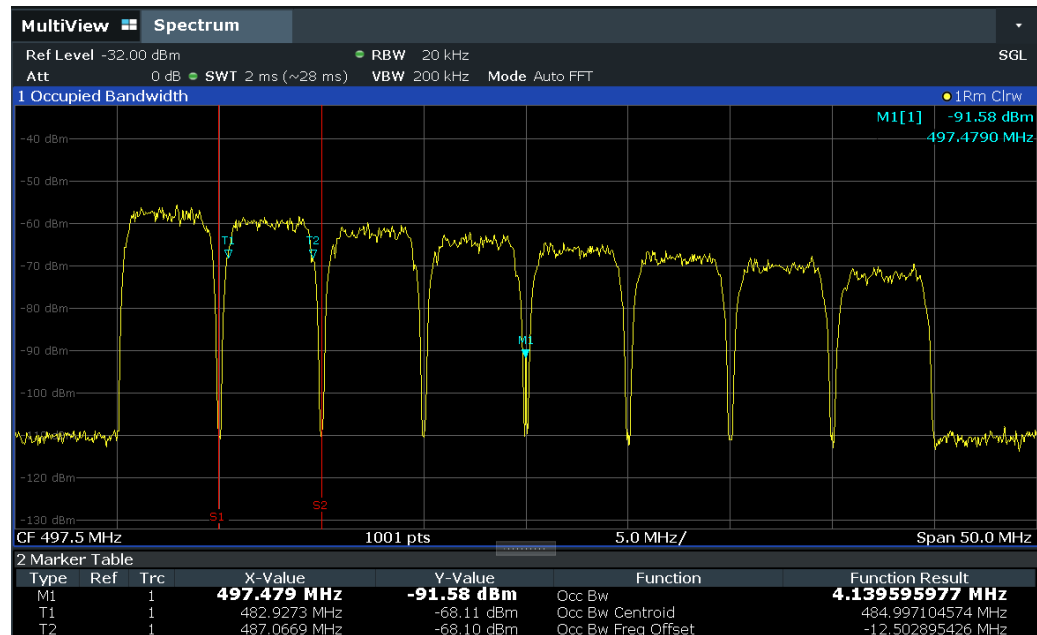
**Measurement principle**

The bandwidth containing 99% of the signal power is to be determined, for example. The algorithm first calculates the total power of all displayed points of the trace. In the next step, the points from the right edge of the trace are summed up until 0.5 % of the total power is reached. Auxiliary marker 1 is positioned at the corresponding frequency. Then the points from the left edge of the trace are summed up until 0.5 % of the power is reached. Auxiliary marker 2 is positioned at this point. 99 % of the power is now between the two markers. The distance between the two frequency markers is the occupied bandwidth which is displayed in the marker field.



### OBW within defined search limits - multicarrier OBW measurement in one sweep

The occupied bandwidth of the signal can also be determined within defined search limits instead of for the entire signal. Thus, only a single sweep is required to determine the OBW for a multicarrier signal. To do so, search limits are defined for an individual carrier and the OBW measurement is restricted to the frequency range contained within those limits. Then the search limits are adapted for the next carrier and the OBW is automatically recalculated for the new range.



For step-by-step instructions, see ["How to determine the OBW for a multicarrier signal using search limits"](#) on page 316.

### Prerequisites

To ensure correct power measurement, especially for noise signals, and to obtain the correct occupied bandwidth, the following prerequisites and settings are necessary:

- Only the signal to be measured is displayed in the window, or search limits are defined to include only one (carrier) signal. An additional signal would falsify the measurement.
- $RBW \ll$  occupied bandwidth (approx. 1/20 of occupied bandwidth, for voice communication type: 300 Hz or 1 kHz)
- $VBW \geq 3 \times RBW$
- RMS detector
- $Span \geq 2$  to  $3 \times$  occupied bandwidth

Some of the measurement specifications (e.g. PDC, RCR STD-27B) require measurement of the occupied bandwidth using a peak detector. The detector setting of the R&S VSE has to be changed accordingly then.



### 10.4.2.2 OBW results

As a result of the OBW measurement the occupied bandwidth ("Occ Bw" ) is indicated in the marker results. Furthermore, the marker at the center frequency and the temporary markers are indicated.

The measurement is performed on the trace with marker 1. In order to evaluate another trace, marker 1 must be placed on another trace (see [Assigning the Marker to a Trace](#) ).



The OBW calculation is repeated if the [Search Limits](#) are changed, without performing a new sweep. Thus, the OBW for a multicarrier signal can be determined using only one sweep.

#### Centroid frequency

The centroid frequency is defined as the point in the center of the occupied bandwidth, calculated using the temporary OBW markers T1 and T2. This frequency is indicated as a function result ("Occ Bw Centroid" ) in the marker table.

#### Frequency offset

The offset of the calculated centroid frequency to the defined center frequency of the R&S VSE is indicated as a function result ("Occ Bw Freq Offset" ) in the marker table.

#### Remote command:

The determined occupied bandwidth can also be queried using the remote command `CALC:MARK:FUNC:POW:RES? OBW` or `CALC:MARK:FUNC:POW:RES? AOBW`. While the `OBW` parameter returns only the occupied bandwidth, the `AOBW` parameter also returns the position and level of the temporary markers T1 and T2 used to calculate the occupied bandwidth.

`CALC:MARK:FUNC:POW:SEL OBW`, see [CALCulate<n>:MARKer<m>:FUNCTION:POWer<sb>:SElect](#) on page 725

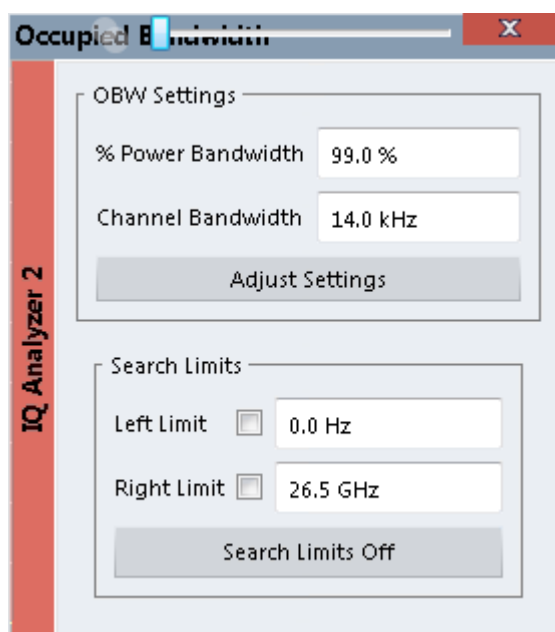
[CALCulate<n>:MARKer<m>:FUNCTION:POWer<sb>\[:STATe\]](#) on page 726

`CALC:MARK:FUNC:POW:RES? OBW`, see [CALCulate<n>:MARKer<m>:FUNCTION:POWer<sb>:RESult?](#) on page 724

`CALC:MARK:FUNC:POW:RES? COBW`, see [CALCulate<n>:MARKer<m>:FUNCTION:POWer<sb>:RESult?](#) on page 724

### 10.4.2.3 OBW configuration

**Access:** "Overview" > "Select Measurement" > "OBW" > "OBW Config"



This measurement is not available in zero span.



### Configuring search limits for OBW measurement

The OBW measurement uses the same search limits as defined for marker search (see "Search Limits" on page 424). However, only the left and right limits are considered.

The remote commands required to perform these tasks are described in [Chapter 13.6.3.2, "Measuring the occupied bandwidth"](#), on page 740.

<a href="#">% Power Bandwidth</a> .....	314
<a href="#">Channel Bandwidth</a> .....	314
<a href="#">Adjust Settings</a> .....	315
<a href="#">Search Limits (Left / Right)</a> .....	315
<a href="#">Deactivating All Search Limits</a> .....	315

#### % Power Bandwidth

Defines the percentage of total power in the displayed frequency range which defines the occupied bandwidth. Values from 10 % to 99.9 % are allowed.

Remote command:

`[SENSe:]POWer:BANDwidth` on page 740

#### Channel Bandwidth

Defines the channel bandwidth for the transmission channel in single-carrier measurements. This bandwidth is used to optimize the test parameters (for details see "[Adjust Settings](#)" on page 315). The default setting is 14 kHz.

For measurements according to a specific transmission standard, define the bandwidth specified by the standard for the transmission channel.

For multicarrier measurements, this setting is irrelevant.

Remote command:

[\[SENSe:\] POWER:ACHannel:BANDwidth\[:CHANnel<ch>\]](#) on page 689

### Adjust Settings

Optimizes the instrument settings for the measurement of the occupied bandwidth according to the specified channel bandwidth.

This function is only useful for single carrier measurements.

All instrument settings relevant for power measurement within a specific frequency range are optimized:

- Frequency span:  $3 \times$  channel bandwidth
- RBW  $\leq 1/40$  of channel bandwidth
- VBW  $\geq 3 \times$  RBW
- Detector: RMS

The reference level is not affected by "Adjust Settings". For an optimum dynamic range, select the reference level such that the signal maximum is close to the reference level.

See "Amplitude" > [Reference Level](#).

The adjustment is carried out only once. If necessary, the instrument settings can be changed later.

Remote command:

[\[SENSe:\] POWER:ACHannel:PRESet](#) on page 708

### Search Limits (Left / Right)

If activated, limit lines are defined and displayed for the search. Only results within the limited search range are considered.

Remote command:

[CALCulate<n>:MARKer<m>:X:SLIMits\[:STATe\]](#) on page 829

[CALCulate<n>:MARKer<m>:X:SLIMits:LEFT](#) on page 829

[CALCulate<n>:MARKer<m>:X:SLIMits:RIGHT](#) on page 830

### Deactivating All Search Limits

Deactivates the search range limits.

Remote command:

[CALCulate<n>:MARKer<m>:X:SLIMits\[:STATe\]](#) on page 829

[CALCulate<n>:THReshold:STATe](#) on page 831

#### 10.4.2.4 How to determine the occupied bandwidth

The following step-by-step instructions demonstrate how to determine the occupied bandwidth.



For remote operation, see "[Programming example: OBW measurement](#)" on page 741.

### How to determine the OBW for a single signal

1. Select "Meas Setup" > "Select Measurement" .
2. Select the "OBW" measurement function.  
The measurement is started immediately with the default settings.
3. Select "Meas Setup" > "OBW Config" .  
The "Occupied Bandwidth" configuration dialog box is displayed.
4. Define the percentage of power ("% Power Bandwidth" ) that defines the bandwidth to be determined.
5. If necessary, change the channel bandwidth for the transmission channel.
6. To optimize the settings for the selected channel configuration, select "Adjust Settings" .
7. Start a sweep.  
The result is displayed as OBW in the marker results.

### How to determine the OBW for a multicarrier signal using search limits

1. Select "Meas Setup" > "Select Measurement" .
2. Select the "OBW" measurement function.
3. Select "Meas Setup" > "OBW Config" .
4. Define the percentage of power ("% Power Bandwidth" ) that defines the bandwidth to be determined.
5. Define search limits so the search area contains only the first carrier signal:
  - a) Enter values for the left or right limits, or both.
  - b) Enable the use of the required limits.
6. Start a sweep.  
The result for the first carrier is displayed as OBW in the marker results.
7. Change the search limits so the search area contains the next carrier signal as described in [step 5](#).  
The OBW is recalculated and the result for the next carrier is displayed. A new sweep is not necessary!
8. Continue in this way until all carriers have been measured.

#### 10.4.2.5 Measurement example

In the following example, the bandwidth that occupies 99 % of the total power of a PDC signal at 800 MHz, level 0 dBm is measured.



A programming example demonstrating an OBW measurement in a remote environment is provided in ["Programming example: OBW measurement"](#) on page 741.

1. Set up a basic measurement with instrument input in the R&S VSE as described in ["Programming example: OBW measurement"](#) on page 741.
2. Set the "Center Frequency" to *800 MHz*.
3. Set the "Reference Level" to *-10 dBm*.
4. Select "Meas Setup" > "Select Measurement" .
5. Select the "OBW" measurement function.
6. Select "Meas Setup" > "OBW Config" .
7. Set the "% Power Bandwidth" to *99 %*.
8. Set the "Channel Bandwidth" to *21 kHz* as specified by the PDC standard.
9. Optimize the settings for the selected channel configuration by selecting "Adjust Settings" .
10. Adjust the reference level to the measured total power by selecting "Auto Level" in the toolbar.
11. The PDC standard requires the peak detector for OBW measurement. In the "Traces" configuration dialog, set the trace detector to "PositivePeak" .
12. Start a sweep.

The result is displayed as OBW in the marker results.

### 10.4.3 Spectrum emission mask (SEM) measurement

Spectrum Emission Mask (SEM) measurements monitor compliance with a spectral mask.

- [About the measurement](#).....317
- [Typical applications](#).....318
- [SEM results](#).....318
- [SEM basics](#).....321
- [SEM configuration](#).....331
- [How to perform a spectrum emission mask measurement](#).....346
- [Measurement example: Multi-SEM measurement](#).....351
- [Reference: SEM file descriptions](#).....353

#### 10.4.3.1 About the measurement

The Spectrum Emission Mask (SEM) measurement defines a measurement that monitors compliance with a spectral mask. The mask is defined with reference to the input signal power. The R&S VSE allows for a flexible definition of all parameters in the SEM

measurement. The R&S VSE software performs a measurement on the connected instrument, then calculates an FFT sweep from the captured data.

Spectrum emissions can be measured for multiple sub blocks of channels, where the sub blocks can include gaps or overlap, and define separate masks. Radio signals using multiple standards can also be analyzed.

SEM measurement configurations can be saved to an XML file which can then be exported to another application or loaded on the R&S VSE again later. Some predefined XML files are provided that contain ranges and parameters according to the selected standard.

To improve the performance of the R&S VSE for spectrum emission mask measurements, a "Fast SEM" mode is available.

A special limit check for SEM measurements allows for monitoring compliance of the spectrum.

#### 10.4.3.2 Typical applications

Spectrum Emission Mask measurements are typically performed to ensure that modulated signals remain within the valid signal level ranges. These ranges are defined by a particular transmission standard, both in the transmission channel and neighboring channels. Any violations of the mask can interfere with other transmissions.

The 3GPP TS 34.122 standard, for example, defines a mask for emissions outside the transmission channel. This mask is defined relative to the input signal power. Three frequency ranges to each side of the transmission channel are defined.

#### 10.4.3.3 SEM results

As a result of the Spectrum Emission Mask measurement, the following results are displayed in a diagram (see also "[Limit lines in SEM measurements](#)" on page 324):

- The measured signal levels
- The result of the limit check (mask monitoring)
- The defined limit lines
- TX channel power "P"
- The used power class



#### Multi-SEM measurements

Multi-SEM measurements are SEM measurements with more than one sub block. In these measurements, each sub block has its own power class definitions. In this case, the power class is not indicated in the graphical result displays.

#### Example:

For example, in [Figure 10-35](#), " $31 < P < 39$ " is indicated as the used power class is defined from 31 to 39.

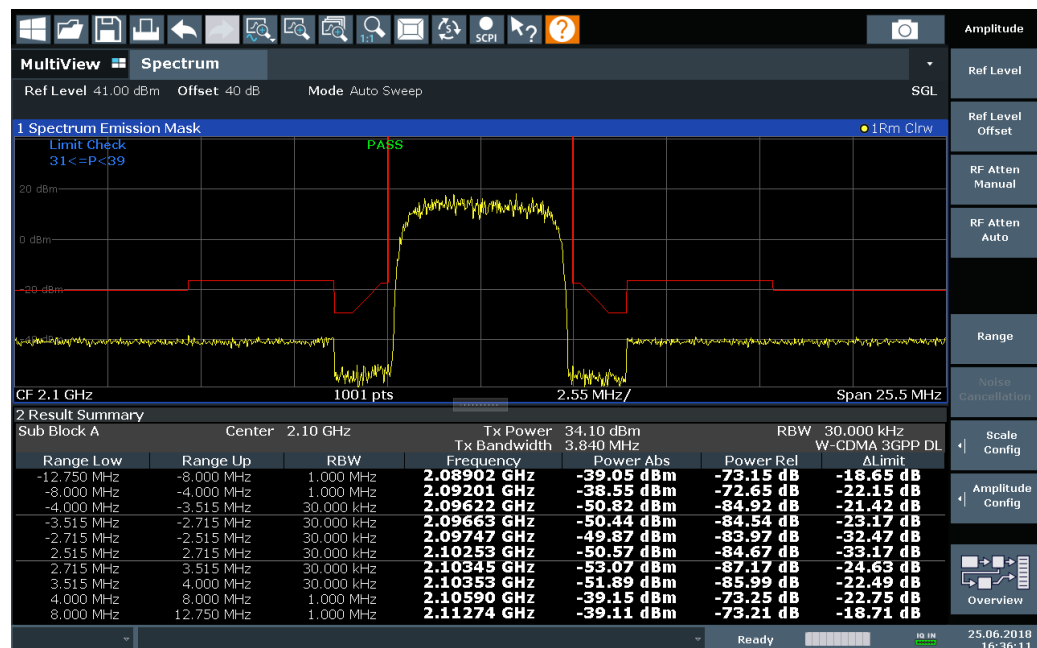


Figure 10-35: Spectrum Emission Mask result displays

In addition to the graphical results of the SEM measurement displayed in the diagram, a result summary is displayed to evaluate the limit check results (see also "[Limit lines in SEM measurements](#)" on page 324).

The following information is provided in the result summary:

Label	Description
<b>General information</b>	
"Standard"	Loaded standard settings
"Tx Power"	Power of the reference range
"Tx Bandwidth"	Tx bandwidth used by the reference range
"RBW"	RBW used by the reference range
<b>Range results</b>	
"Range Low"	Start of the frequency range the peak value was found in
"Range Up"	Frequency range end the peak value was found in
"RBW"	RBW of the range
"Frequency"	Frequency of the peak power level
"Power Abs"	Absolute peak power level within the range
"Power Rel"	Peak power level within the range, relative to the "Tx Power"
"ΔLimit"	Deviation of the peak power level from the limit line

You can define in which detail the data is displayed in the result summary in the "List Evaluation" settings (see "[List evaluation \(results configuration\)](#)" on page 345). By

default, one peak per range is displayed. However, you can change the settings to display only peaks that exceed a threshold ("Margin" ).

Detected peaks are not only listed in the Result Summary, they are also indicated by colored squares in the diagram (optionally, see [Show Peaks](#) in the "List Evaluation" settings).

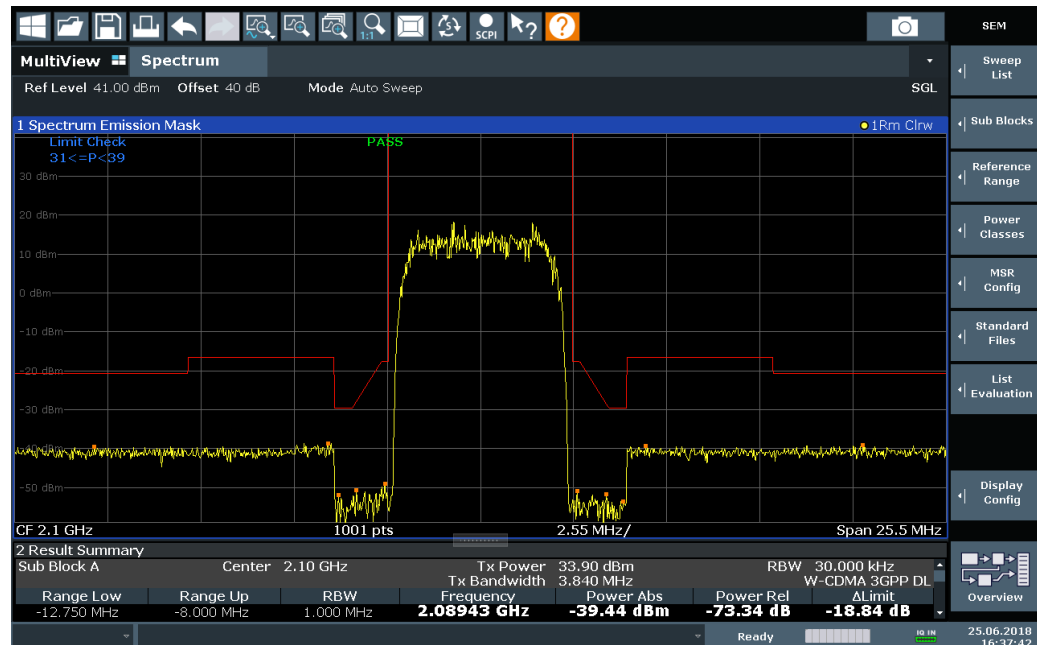


Figure 10-36: Detected peak display in SEM measurement

Furthermore, you can export the results of the result summary to a file which can be exported to another application for further analysis.

### Results for SEM with multiple sub blocks

In the Spectrum application only, spectrum emissions can be measured for multiple sub blocks of channels (see "[SEM with multiple sub blocks \("Multi-SEM"\)](#)" on page 328 for details). Up to 3 sub blocks (with 2 gaps) can be defined. For each sub block and each gap, the results described above are provided individually in the result summary.



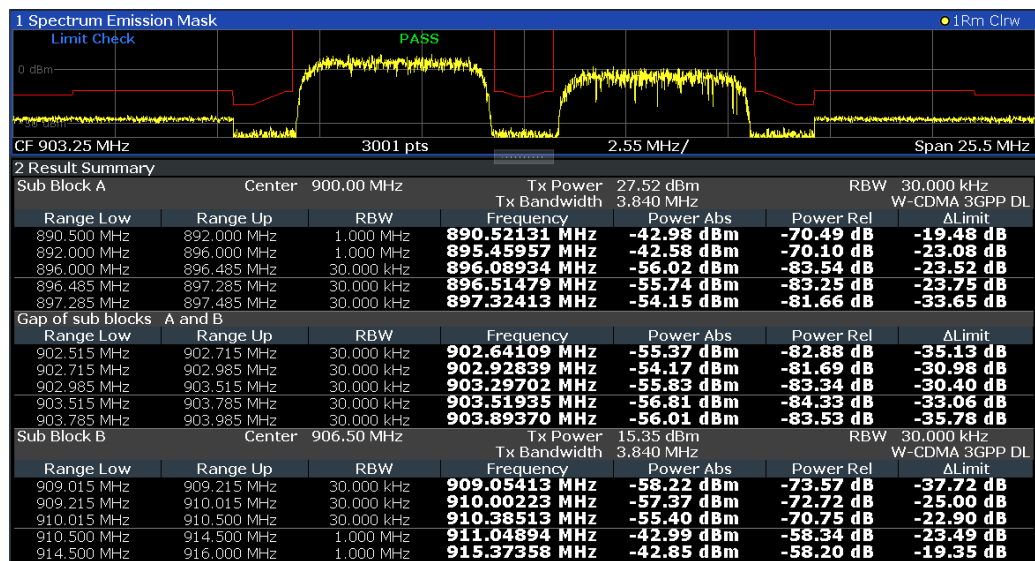


Figure 10-37: SEM results for multiple sub blocks

### Retrieving results via remote control

The measurement results of the spectrum emission mask *test* can be retrieved using the `CALC:LIM:FAIL?` command from a remote computer; see `CALCulate<n>`:  
`LIMit<li>:FAIL?` on page 867 for a detailed description.

The *power* result for the reference range can be queried using  
`CALC:MARK:FUNC:POW:RES? CPOW`;

The *peak* power for the reference range can be queried using  
`CALC:MARK:FUNC:POW:RES? PPOW`, see `CALCulate<n>:MARKer<m>:FUNCTION:`  
`POWer<sb>:RESult?` on page 724.

The measured *power trace* can be queried using `TRAC:DATA?` and `TRAC:DATA:X?`,  
see `TRACe<n>[:DATA]` on page 730 and `TRACe<n>[:DATA]:X?` on page 876:

The measured *peak power list* can be queried using `TRAC:DATA? LIST`, see  
`TRACe<n>[:DATA]` on page 730.

#### 10.4.3.4 SEM basics

Some background knowledge on basic terms and principles used in SEM measurements is provided here for a better understanding of the required configuration settings.

- [Ranges and range settings](#)..... 322
- [Limit lines in SEM measurements](#)..... 324
- [Fast SEM measurements](#)..... 326
- [Multi-standard radio \(MSR\) SEM measurements](#)..... 327
- [SEM with multiple sub blocks \("Multi-SEM"\)](#)..... 328

### Ranges and range settings

In the Spectrum Emission Mask measurements, a range defines a segment for which you can define the following parameters separately:

- Start and stop frequency
- RBW
- VBW
- "Meas Time"
- "Capture Points"
- Limit values

Via the capture list, you define the ranges and their settings. For details on settings, refer to "[Sweep List](#)" on page 332.

For details on defining the limits (masks), see "[Limit lines in SEM measurements](#)" on page 324.

### Range definition

After a preset, the capture list contains a set of default ranges and parameters. For each range, you can change the parameters listed above. You can insert or delete ranges.

The changes of the capture list are only kept until you load another parameter set (by pressing [PRESET] or by loading an XML file). If you want a parameter set to be available permanently, create an XML file for this configuration (for details refer to "[How to save a user-defined SEM settings file](#)" on page 350).

If you load one of the provided XML files, the capture list contains ranges and parameters according to the selected standard.

### Reference range

The range containing the center frequency is defined as the reference range for all other ranges in the capture list. All range limits are defined in relation to the reference range. The TX power used as a reference for all power level results in the result summary is also calculated for this reference range. You can define whether the power used for reference is the peak power level or the integrated power of the reference range. In the "Sweep List", the reference range is highlighted in blue and cannot be deleted.

### Rules

The following rules apply to ranges:

- The minimum span of a range is 20 Hz.
- The individual ranges must not overlap (but can have gaps).
- The maximum number of ranges is 30.
- The minimum number of ranges is 3.
- The reference range cannot be deleted.
- Center the reference range on the center frequency.

- The current "Tx Bandwidth" defines the minimum span of the reference range (see ["Channel Power Settings "](#) on page 338).
- Define frequency values for each range relative to the center frequency.

To change the start frequency of the first range or the stop frequency of the last range, select the appropriate span with [SPAN]. You can define a span that is smaller than the combined span of all ranges. In this case, the measurement includes only the ranges that lie within the defined span and have a minimum span of 20 Hz. The first and last ranges are adapted to the given span as long as the minimum span of 20 Hz is not violated.



#### **Changing the frequency range of the measurement using external mixers**

If you change the used frequency range of the measurement by activating or deactivating an external mixer, the R&S VSE automatically adapts the span to full span. Thus, the ranges for the SEM measurement can change, as well.



#### **Changing the frequency range of the measurement**

If you change the used frequency range of the measurement, for example by changing the input file or instrument providing the data, the R&S VSE maintains the configured span. Only if the span is larger than the available frequency range, the span is reduced. In this case, the ranges for the SEM measurement can change, as well.

#### **Capture points**

You can define a minimum number of capture points for each range. The total number of available capture points is then distributed among the ranges in consideration of the minimum values. If the total number of capture points is not enough to satisfy the minimum capture point requirements in all ranges, the R&S VSE adjusts the global number of [Capture Points](#) accordingly. By default, each range has a minimum of one capture point.

This allows you to increase the resolution within a specific range for detailed analysis. You do not have to increase the overall number of capture points and thus the measurement time for the SEM measurement.

#### **Symmetrical ranges**

You can easily define a capture list with symmetrical range settings, i.e. the ranges to the left and right of the reference range are defined symmetrically. When symmetrical setup is activated, the current capture list configuration is changed to define a symmetrical setup regarding the reference range. The number of ranges to the left of the reference range is reflected to the right, i.e. any missing ranges on the right are inserted, while superfluous ranges are removed. The values in the ranges to the right of the reference range are adapted symmetrically to those in the left ranges.

Symmetrical ranges fulfill the conditions required for "Fast SEM" mode (see ["Fast SEM measurements"](#) on page 326).

### Power classes

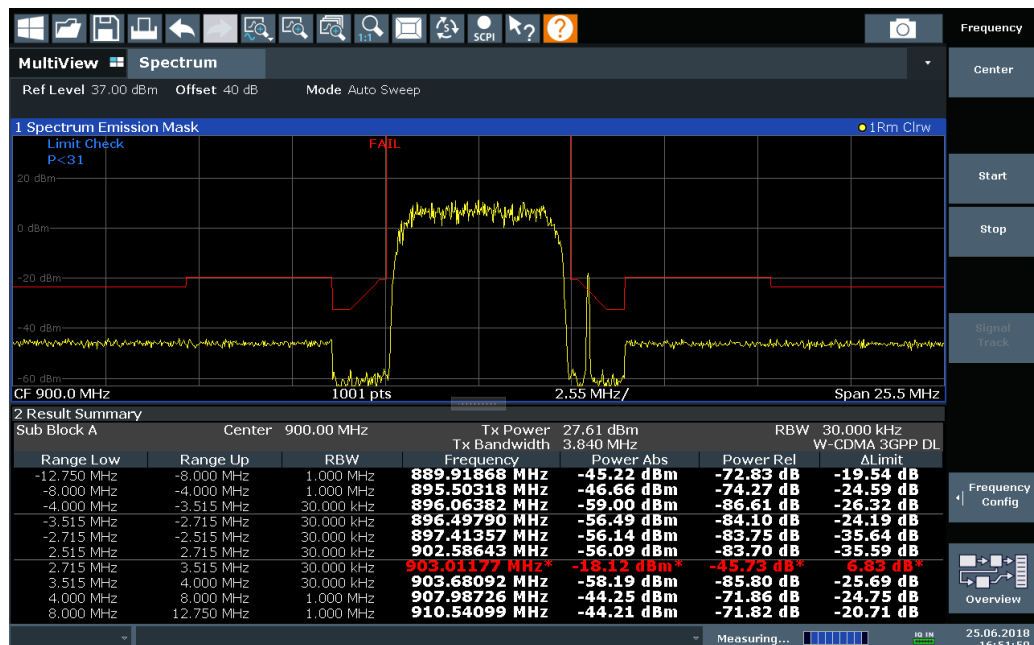
If the signal power level to be monitored varies and the limits vary accordingly, you can define power classes, which can then be assigned to the frequency ranges. Thus, the limits for the signal levels can be defined differently for varying input levels. For instance, for higher input levels a transmission standard can allow for higher power levels in adjacent channels, whereas for lower input levels the allowed deviation can be stricter. Up to four different power classes can be defined.

### Limit lines in SEM measurements

For the R&S VSE, the spectrum emission mask is defined using limit lines. Limit lines allow you to check the measured data (that is, the trace results) against specified limit values. Generally, it is possible to define limit lines for any measurement in the I/Q Analyzer application using the [Lines] function. For SEM measurements, however, special limit lines are available via the "Sweep List", and it is strongly recommended that you use only these limit line definitions.

In the "Sweep List", you can define a limit line for each power class that varies its level according to the specified frequency ranges. Special limit lines are automatically defined for each power class according to the current "Sweep List" settings every time the settings change. These limit lines are labeled "\_SEM\_LINE\_<xxx>\_ABS<0...3>" and "\_SEM\_LINE\_<xxx>\_REL<0...3>", where <xxx> is an index to distinguish limit lines between different channels.

The limit line defined for the currently used power class is indicated by a red line in the display. The result of the limit check is indicated at the top of the diagram. Note that only "Pass" or "Fail" is indicated; a "Margin" function as for general limit lines is not available.



The indicated limit line depends on the settings in the "Sweep List". Several types of limit checks are possible:

Table 10-4: Limit check types

Limit check type	Pass/fail criteria	Limit line definition
"Absolute"	Absolute power levels must not exceed limit line	Defined by the "Abs Limit Start" / "Abs Limit Stop" values for each range
"Relative"	Power deviations relative to the TX channel power must not exceed limit line	Defined by the "Rel Limit Start" / "Rel Limit Stop" values (relative to the TX channel power), fixed for each range.
"Relative with function f(x)"	If the power exceeds <b>both</b> the absolute <b>and</b> the relative limits, the check fails (see <a href="#">Relative limit line functions</a> below)	Defined by the maximum of the absolute or relative start and stop limit values for each range. Thus, the start or stop point of the limit range, or both, are variable (since the maximum can vary).
"Abs and Rel"	If the power exceeds <b>both</b> the absolute <b>and</b> the relative limits, the check fails.	The less strict (higher) limit line is displayed for each range.  If you use a function to define the relative limit start or stop value, the signal is checked against an additional condition: the power must exceed the absolute limit, as well as the absolute and relative function values.
"Abs or Rel"	If the power exceeds <b>either</b> the absolute <b>or</b> the relative limits, the check fails.	The stricter (lower) limit line is displayed for each range.  If you use a function to define the relative limit start or stop value, the signal is checked against an additional condition: if the power exceeds the absolute limit, or the higher of the absolute and relative function values, the check fails.

### Relative limit line functions

A new function allows you to define limit lines whose start or end points (or both) are variable, depending on the carrier power. Thus, the resulting limit line can change its slope within the range, depending on the carrier power. Common relative limit lines are calculated once for the defined start and end points and maintain a constant slope.

If the relative limit value function is used in combination with the "Abs and Rel" or "Abs or Rel" limit check types, an additional condition is considered for the limit check (see [Table 10-4](#)).

### Limit check results in the result summary

For each range, the peak measured value and the deviation of these values from the limit line are displayed in the result summary. If the limit check is passed for the range, the deviation represents the closest value to the limit line. If the limit check is failed for the range, the deviation represents the maximum violation against the limit line. Furthermore, the absolute power levels and the relative deviation of the peaks from the TX channel power are displayed. Values that exceed the limit are indicated in red and by an asterisk (\*).

A2 Spectrum Emission Mask				W-CDMA 3GPP (31,39)dBm DL		
Tx Power -28.10 dBm		Tx Bandwidth 3.840 MHz		RBW 1.000 MHz		
Range Low	Range Up	RBW	Frequency	Power Abs	Power Rel	ΔLimit
-12.750 MHz	-8.000 MHz	1.000 MHz	13.24173 GHz*	-47.08 dBm*	-18.98 dB*	35.52 dB*
-8.000 MHz	-4.000 MHz	1.000 MHz	13.24364 GHz*	-25.01 dBm*	3.09 dB*	53.59 dB*
-4.000 MHz	-3.515 MHz	30.000 kHz	13.24619 GHz	-100.18 dBm	-72.08 dB	-8.58 dB
-3.515 MHz	-2.715 MHz	30.000 kHz	13.24668 GHz	-105.92 dBm	-77.83 dB	-17.23 dB



Although a margin functionality is not available for the limit check, a margin (threshold) for the peak values to be displayed in the Result Summary can be defined. (In the "List Evaluation" settings, see ["List evaluation \(results configuration\)"](#) on page 345).

### Fast SEM measurements

To improve the performance of the R&S VSE for spectrum emission mask measurements, a "Fast SEM" mode is available. If this mode is activated, several consecutive ranges with identical capture settings are combined to one capture internally, which makes the measurement considerably faster. The displayed results remain unchanged and still consist of several ranges. Thus, measurement settings that apply only to the results, such as limits, can nevertheless be defined individually for each range.

### Prerequisites

"Fast SEM" mode is available if the following criteria apply:

- The frequency ranges are consecutive, without frequency gaps
- The following capture settings are identical (for details see ["Sweep List "](#) on page 332):
  - "Filter Type"
  - "RBW"
  - "VBW"
  - "Sweep Time Mode"

### Activating Fast SEM mode

"Fast SEM" mode is activated in the capture list (see ["Sweep List "](#) on page 332) or using a remote command. Activating the mode for one range automatically activates it for all ranges in the capture list.

### Remote command:

[SENSe:] ESpectrum<sb>: HSPeed on page 746



### Fast SEM not supported for multiple sub blocks

For SEM with multiple sub blocks, fast SEM is not available. If more than one sub block is defined and a standard is loaded which contains an active fast SEM setting, this setting is disabled.

For more information on multi-SEM measurements, see ["SEM with multiple sub blocks \("Multi-SEM"\)"](#) on page 328.

### Consequences

When the "Fast SEM" mode is activated, the ranges for which these criteria apply are displayed as one single range. The capture time is defined as the sum of the individual capture times, initially, but can be changed.



If "Symmetrical Setup" mode is active when "Fast SEM" mode is activated, not all capture list settings can be configured symmetrically automatically (see also "Symmetrical Setup" on page 336).

Any other changes to the capture settings of the combined range are applied to each included range and remain changed even after deactivating "Fast SEM" mode.

### Example

Sub Block A	Range 1	Range 2	Range 3	Range 4	Range 5
Range Start	-12.75 MHz	-2.515 MHz	-2.51498 MHz	2.515 MHz	2.51502 MHz
Range Stop	-2.515 MHz	-2.51498 MHz	2.51498 MHz	2.51502 MHz	12.75 MHz
Fast SEM	On	On	On	On	On
Filter Type	Normal(3dB)			Normal(3dB)	
RBW	30 kHz	1		30 kHz	2
VBW	3 MHz			3 MHz	
Sweep Time	419 µs			279 µs	
Ref Level	0 dBm			0 dBm	
RF Att Mode	Auto			Auto	
RF Attenuation	10 dB			10 dB	
Transducer	None	None	Baseband Input I to RF	None	None
Multi Limit Calc	SUM	SUM	NONE	SUM	SUM
Min Sweep Points	1	1	1	1	1

Figure 10-38: Capture list using Fast SEM mode

In Figure 10-38, a capture list is shown for which Fast SEM is activated. The formerly five separately defined ranges are combined to two capture ranges internally.

### Multi-standard radio (MSR) SEM measurements

Multi-standard radio (MSR) measurements allow you to perform SEM tests on signals with multiple carriers using different digital standards. MSR measurements are described in the specification 3GPP TS 37.141. Various typical combinations of standards for base station tests are described, e.g. LTE FDD and W-CDMA carriers. By performing an MSR SEM measurement you can determine if or how the different carriers affect each other, i.e. if unwanted emissions occur. On the R&S VSE, the MSR SEM measurement is a standard measurement as for single carriers. The MSR settings merely

provide a convenient way of configuring the capture list for all required ranges according to the specification quickly.

Refined settings allow the R&S VSE to calculate the SEM limits according to standard 3GPP 37.141 V12.2.0, which distinguishes between base station configurations and power values.

### SEM with multiple sub blocks ("Multi-SEM")

In the I/Q Analyzer application only, spectrum emissions can be measured for multiple sub blocks of channels (also referred to as a "Multi-SEM" measurement). Sub blocks are a set of multiple ranges around a defined center frequency (carrier). Multiple sub blocks can include gaps or overlap, and each sub block defines a separate mask. In the overlapping masks, multi-limit lines are calculated. Up to 3 sub blocks (with 2 gaps) can be defined. For each sub block, the familiar configuration settings concerning ranges, limit lines etc. can be defined individually.

### Comparison to "traditional" SEM measurement

The default SEM measurement is simply a special case of "*Multi-SEM*" - consisting of one single block. Only if the number of sub blocks in the basic SEM configuration is larger than 1, multiple sub blocks are inserted in the configuration settings and result tables.

### Particular features of configuring multiple sub blocks

The sub blocks are independent of the global start, stop, center and span frequencies for the complete SEM measurement. Thus, there can be gaps that can even include other carrier ranges, but are not configured for the SEM measurement.

For each sub block, you define:

- The center frequency of the reference range of the sub block; center frequencies must be defined in ascending order for sub blocks A,B,C
- The reference range; note that although individual ranges of different sub blocks can overlap, reference ranges for different sub blocks *cannot*; they must define distinct frequency ranges
- The capture list, including the limit lines
- Optionally: a standard file or MSR settings to be used for measurement (if one is selected, the other is disabled)



### Fast SEM not supported for multiple sub blocks

For SEM with multiple sub blocks, fast SEM is not available. If more than one sub block is defined and a standard is loaded which contains an active fast SEM setting, this setting is disabled.

### Absolute vs relative frequencies

In the default configuration with only one sub block, frequencies are defined relative to the center frequency; this is the familiar configuration.



For setups with more than one sub block, frequencies are defined relative to the center frequency of the reference ranges for the individual sub blocks. However, in the result summary, frequencies are indicated as absolute values. Relative frequencies that refer to different reference ranges would be inconvenient and difficult to analyze.

### Limit check behavior for overlapping masks

Since spectrum emission masks are defined individually for each sub block, and sub blocks can overlap, the question arises what happens during the limit check in the overlapping regions? To answer this question, we must distinguish the following cases:

- For the reference range, no limit checking is performed, as the reference range contains the carrier
- For other ranges, only the limit lines defined for ranges between the carriers, that is the reference ranges to either side, are significant. In other words: if a limit line definition covers the frequency area of several carriers, only the limit lines for ranges between the corresponding reference range and the next closest reference range are significant.

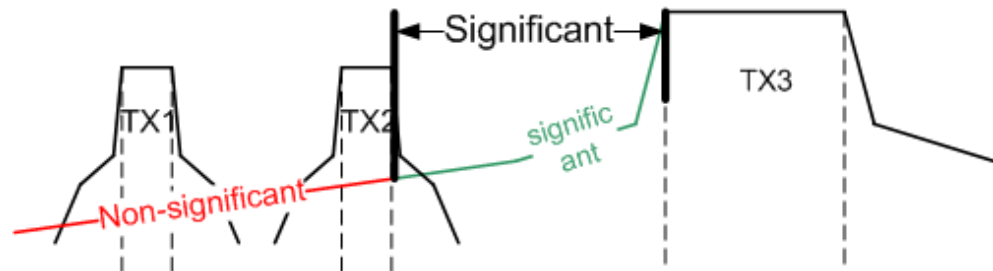


Figure 10-39: Behavior for overlapping masks

- For the ranges in which multiple limit lines are significant, a range-specific function determines the behavior of the limit check

### Limit calculation for individual ranges

For each range a function can be defined that determines the behavior of the limit check if there are multiple limit lines:

- **"NONE"** : In reference ranges no limit check is performed; Reference ranges always use the function "NONE" . For other ranges, see the combinations for overlapping ranges below.
- **"SUM"** : sum of the two limit lines (calculated for linear powers) is used
- **"MAX"** : maximum of the two limit lines is used

This leads to the following **combinations for overlapping ranges**:

- **"MAX" + "MAX"** : maximum of the two limit lines is used
- **"MAX" + "SUM"** : maximum of the two limit lines is used
- **"SUM" + "SUM"** : sum of the two limit lines (calculated for linear powers) is used
- **"NONE" + "MAX" / "NONE" + "SUM"** : limit line (and parameters) of the "NONE" range are ignored
- **"NONE" + "NONE"** : depends on the position of the overlapping ranges in relation to the mid-frequency between the two neighboring sub blocks:

- Overlap is completely *below* the mid-frequency: limits and parameters of the left sub block are used
- Overlap is completely *above* the mid-frequency: limits and parameters of the right sub block are used
- Overlap crosses the mid-frequency: new subranges are created: one to the left of the mid-frequency, one to the right of the mid-frequency. The left subrange uses the limits and parameters of the left sub block, the right subrange uses the limits and parameters of the right sub block.



### Different RBWs in overlapping ranges

If different RBWs are defined for the overlapping ranges, the following parameters from the range with the smaller RBW are considered for both ranges:

- RBW
- Filter type
- (proportional) capture time

In the range with the higher RBW, the following offset is applied to the limit line:

$$-10 \cdot \log(RBW_{large} / RBW_{small})$$

Table 10-5: Limit lines in overlapping ranges crossing the mid-frequency

<p>Mid-frequency SB1-SB2</p> <p>Sub block 1</p> <p>Sub block 2</p> <p>TX1</p> <p>TX2</p> <p>Range 3</p> <p>Range 6</p> <p>Range 4 "None"</p> <p>Range 5 "None"</p>	<p>Mid-frequency SB1-SB2</p> <p>Sub block 2</p> <p>TX1</p> <p>TX2</p> <p>Range 3</p> <p>Range 6</p> <p>Subrange 4a: Range 3 applies</p> <p>Subrange 5a: Range 6 applies</p>
<p><b>Initial situation:</b> overlapping ranges</p> <p>Range 4 ("None") + Range 5 ("None") overlap and cross the mid-frequency between sub blocks 1 and 2</p>	<p><b>Result:</b> Subranges 4a and 5a are created left and right of the mid-frequency;</p> <p>For subrange 4a: limit line and parameters of range 4 apply</p> <p>For subrange 5a: limit line and parameters of range 5 apply</p>

### Global SEM limit check

For the complete SEM measurement, which can consist of multiple sub blocks, only one single limit check is performed. A single limit line is calculated according to the individual range limit lines and the defined functions for overlapping ranges. The mea-

sured values are then compared with this single limit line. If the limit is exceeded in any range, the result of the limit check is "failed!"

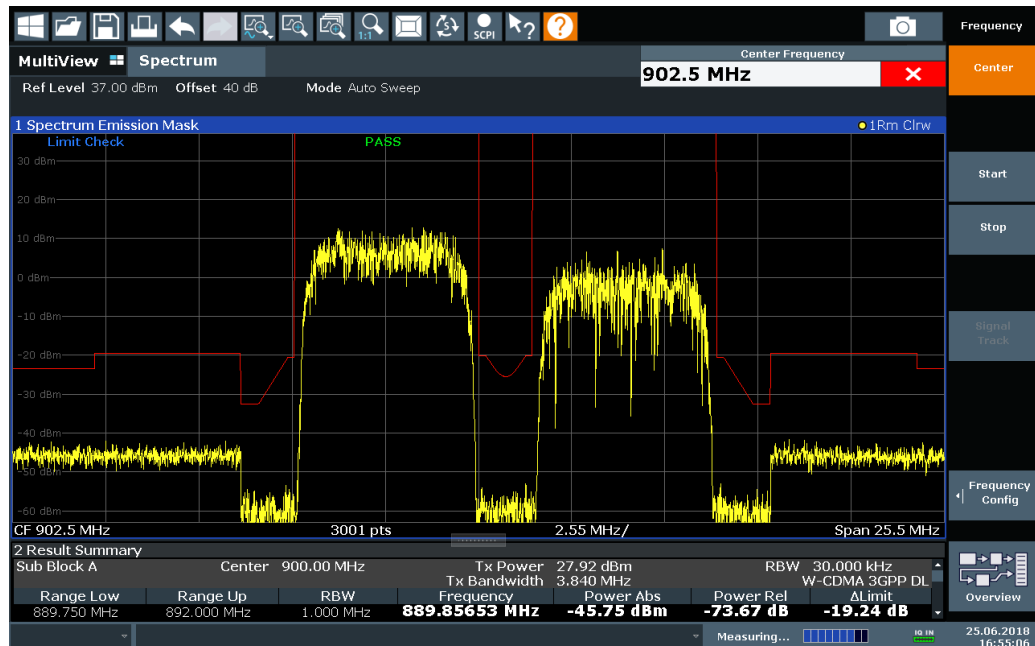


Figure 10-40: Summarized limit line for multiple sub blocks

#### 10.4.3.5 SEM configuration

**Access:** "Overview" > "Select Measurement" > "Spectrum Emission Mask"

The SEM measurement is started immediately with the default settings.

The remote commands required to perform these tasks are described in [Chapter 13.6.3.3, "Measuring the spectrum emission mask"](#), on page 742.



##### Global span settings

The span of the signal to be monitored is configured in the general span settings (see [Chapter 10.4.5, "Frequency and span settings"](#), on page 364). Only ranges within this global span are considered for the SEM measurement.



##### Multi-SEM configuration

In the I/Q Analyzer application only, spectrum emissions can be measured for multiple sub blocks of channels (see ["SEM with multiple sub blocks \("Multi-SEM\)"](#) on page 328). Up to 3 sub blocks (with 2 gaps) can be defined. For each sub block, the familiar configuration settings concerning ranges, limit lines etc. can be defined in individual tabs. In addition, settings on the sub blocks themselves must be configured in the "Sub Block" tab of the "Spectrum Emission Mask" configuration dialog box (see ["Multi-SEM \(sub block\) settings"](#) on page 336).

The following settings are available in individual tabs of the "Spectrum Emission Mask" configuration dialog box.

- [Sweep List](#) ..... 332
- [Multi-SEM \(sub block\) settings](#)..... 336
- [Reference range](#)..... 338
- [Power classes](#)..... 339
- [MSR settings](#)..... 340
- [Standard files](#)..... 343
- [List evaluation \(results configuration\)](#)..... 345

**Sweep List**

**Access:** "Overview" > "Select Measurement" > "Spectrum Emission Mask" > "Sweep List"

For SEM measurements, the R&S VSE software captures data from the connected instrument once, then performs FFTs sweeps and calculates the SEM for each range individually.



If you edit the capture list, always follow the rules and consider the limitations described in "[Ranges and range settings](#)" on page 322.

Sub Block A	Range 1	Range 2	Range 3
Range Start	-12.75 MHz	-2.515 MHz	2.515 MHz
Range Stop	-2.515 MHz	2.515 MHz	12.75 MHz
Fast SEM	Off	Off	Off
Filter Type	Normal(3dB)	Normal(3dB)	Normal(3dB)
RBW	30 kHz	30 kHz	30 kHz
VBW	3 MHz	3 MHz	3 MHz
Sweep Time Mode	Auto	Auto	Auto
Sweep Time	140 µs	140 µs	140 µs
Ref Level	0 dBm	0 dBm	0 dBm
RF Att Mode	Auto	Auto	Auto
RF Attenuation	10 dB	10 dB	10 dB
Preamp	Off	Off	Off
Transducer	None	None	None
Multi Limit Calc	SUM	NONE	SUM
Min Sweep Points	1	1	1
Limit Check 1	Relative	Relative	Relative
Rel Limit Start 1	-50 dBc	300 dBc	-50 dBc

- [Range Start / Range Stop](#) ..... 333
- [Fast SEM](#) ..... 333
- [Filter Type](#) ..... 333
- [RBW](#) ..... 333
- [VBW](#) ..... 334
- [Sweep Time Mode](#) ..... 334

Meas Time .....	334
Limit Check <n> .....	334
Abs Limit Start / Stop <n> .....	334
Rel Limit Start / Stop <n> .....	334
Multi-Limit Calc <n> .....	335
Min Sweep Points .....	335
Insert before Range / Insert after Range .....	336
Delete Range .....	336
Symmetrical Setup .....	336

### Range Start / Range Stop

Sets the start frequency/stop frequency of the selected range.

To change the start/stop frequency of the first or last range, respectively, select the appropriate span in the [SPAN] configuration dialog. You can set a span that is smaller than the overall span of the ranges. In this case, the measurement includes only the ranges that lie within the defined span and have a minimum span of 20 Hz. The first and last ranges are adapted to the given span as long as the minimum span of 20 Hz is not violated.

Define frequency values for each range relative to the center frequency. Center the reference range on the center frequency. The current "Tx Bandwidth" defines the minimum span of the reference range (see "[Channel Power Settings](#)" on page 338).

Remote command:

`[SENSe:]ESpectrum<sb>:RANGe<ri>[:FREQuency]:START` on page 748

`[SENSe:]ESpectrum<sb>:RANGe<ri>[:FREQuency]:STOP` on page 749

### Fast SEM

Activates "Fast SEM" mode for all ranges in the capture list. For details, see "[Fast SEM measurements](#)" on page 326.

**Note:** If you deactivate "Fast SEM" mode while "Symmetrical Setup" mode is on, "Symmetrical Setup" mode is automatically also deactivated.

If you activate "Fast SEM" mode while "Symmetrical Setup" mode is on, not all range settings can be configured symmetrically automatically.

Remote command:

`[SENSe:]ESpectrum<sb>:HSPeed` on page 746

### Filter Type

Sets the filter type for this range.

For details on filter types, see "[Which data may pass: filter types](#)" on page 371.

Remote command:

`[SENSe:]ESpectrum<sb>:RANGe<ri>:FILTer:TYPE` on page 748

### RBW

Sets the resolution bandwidth for this range.

For details on the RBW, see "[Separating signals by selecting an appropriate resolution bandwidth](#)" on page 367.

Remote command:

`[SENSe:]ESpectrum<sb>:RANGe<ri>:BANDwidth:RESolution` on page 746

**VBW**

Sets the video bandwidth for this range.

For details on the VBW, see ["Smoothing the trace using the video bandwidth"](#) on page 368.

Remote command:

`[SENSe:]ESpectrum<sb>:RANGe<ri>:BANDwidth:VIDeo` on page 747

**Sweep Time Mode**

Activates or deactivates the auto mode for the capture time.

For details on the capture time mode, see ["How long the data is measured: Meas Time"](#) on page 371

Remote command:

`[SENSe:]ESpectrum<sb>:RANGe<ri>:SWEep:TIME:AUTO` on page 758

**Meas Time**

Sets the capture time value for the range.

For details on the capture time, see ["How long the data is measured: Meas Time"](#) on page 371

Remote command:

`[SENSe:]ESpectrum<sb>:RANGe<ri>:SWEep:TIME` on page 758

**Limit Check <n>**

Sets the type of limit check for the n-th power class in the range. Up to four limits are possible.

For details on limit checks, see ["Limit lines in SEM measurements"](#) on page 324.

The limit state affects the availability of all limit settings.

Remote command:

`[SENSe:]ESpectrum<sb>:RANGe<ri>:LIMit<li>:STATe` on page 756

`CALCulate<n>:LIMit<li>:FAIL?` on page 867

**Abs Limit Start / Stop <n>**

Sets an absolute limit value for the n-th power class at the start or stop frequency of the range [dBm].

Remote command:

`[SENSe:]ESpectrum<sb>:RANGe<ri>:LIMit<li>:ABSolute:START`

on page 751

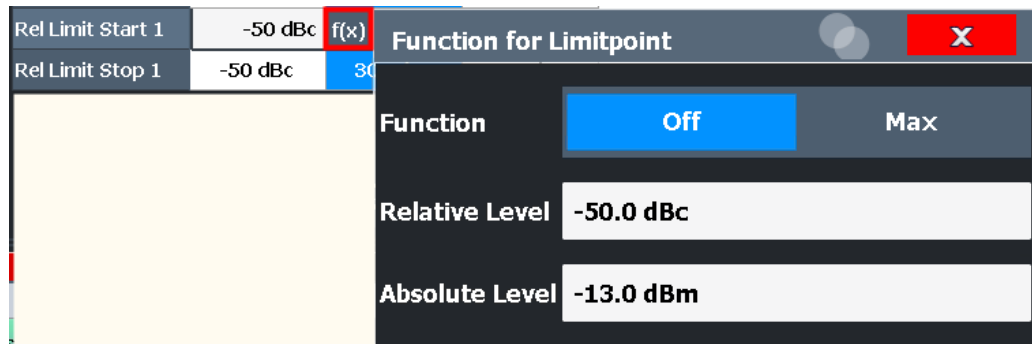
`[SENSe:]ESpectrum<sb>:RANGe<ri>:LIMit<li>:ABSolute:STOP`

on page 752

**Rel Limit Start / Stop <n>**

Sets a relative limit value for the n-th power class at the start or stop frequency of the range [dBc].

By default, this value is a fixed relative limit, i.e. no function is defined. To define a function for the relative limit, select the input field for "Rel Limit Start" or "Rel Limit Stop" and then the "f(x)" icon that appears.



If the function is set to "Max", you can define a relative *and* an absolute limit level. In this case, the maximum of the two values is used as the limit level.

For more information, see "[Relative limit line functions](#)" on page 325.

Remote command:

`[SENSe:]ESpectrum<sb>:RANGe<ri>:LIMit<li>:RELative:START`  
on page 752

`[SENSe:]ESpectrum<sb>:RANGe<ri>:LIMit<li>:RELative:STOP`  
on page 754

`[SENSe:]ESpectrum<sb>:RANGe<ri>:LIMit<li>:RELative:START:FUNCTION`  
on page 753

`[SENSe:]ESpectrum<sb>:RANGe<ri>:LIMit<li>:RELative:STOP:FUNCTION`  
on page 755

`[SENSe:]ESpectrum<sb>:RANGe<ri>:LIMit<li>:RELative:START:ABS`  
on page 753

`[SENSe:]ESpectrum<sb>:RANGe<ri>:LIMit<li>:RELative:STOP:ABS`  
on page 755

### Multi-Limit Calc <n>

Defines the function used to calculate the limit line for the n-th power class for overlapping ranges in Multi-SEM measurements. For details, see "[Limit calculation for individual ranges](#)" on page 329.

"NONE" (reference ranges only:) the limit of the reference range is used

"SUM" Sum of the two limit lines (calculated for linear powers) is used

"MAX" Maximum of the two limit lines is used

Remote command:

`[SENSe:]ESpectrum<sb>:RANGe<ri>:MLCalc` on page 757

### Min Sweep Points

Defines the minimum number of capture points for the range.

If necessary to fulfill all minimum capture point requirements in all ranges, the global [Capture Points](#) setting is increased. By default, each range is supplied with a minimum of one capture point.

For details, see "[Capture points](#)" on page 323

Remote command:

`[SENSe:]ESpectrum<sb>:RANGe<ri>:POINTs:MINimum[:VALue]` on page 757

### Insert before Range / Insert after Range

Inserts a new range to the left (before) or to the right (after) of the range in which the cursor is currently displayed. The range numbers of the currently focused range and all higher ranges are increased accordingly. The maximum number of ranges is 30.

Remote command:

`[SENSe:]ESpectrum<sb>:RANGe<ri>:INSert` on page 751

### Delete Range

Deletes the currently focused range, if possible. (The reference range cannot be deleted. A minimum of three ranges is required.) The range numbers are updated accordingly.

Remote command:

`[SENSe:]ESpectrum<sb>:RANGe<ri>:DELete` on page 748

### Symmetrical Setup

Any changes to the range settings in active "Symmetrical Setup" mode lead to symmetrical changes in the other ranges (where possible). In particular, this means:

- Inserting ranges: a symmetrical range is inserted on the other side of the reference range
- Deleting ranges: the symmetrical range on the other side of the reference range is also deleted
- Editing range settings: the settings in the symmetrical range are adapted accordingly

**Note:** If "Fast SEM" mode is deactivated while "Symmetrical Setup" mode is on, "Sym Setup" mode is automatically also deactivated.

If "Fast SEM" mode is activated while "Symmetrical Setup" mode is on, not all range settings can be set automatically.

Remote command:

`[SENSe:]ESpectrum<sb>:SSETup` on page 759

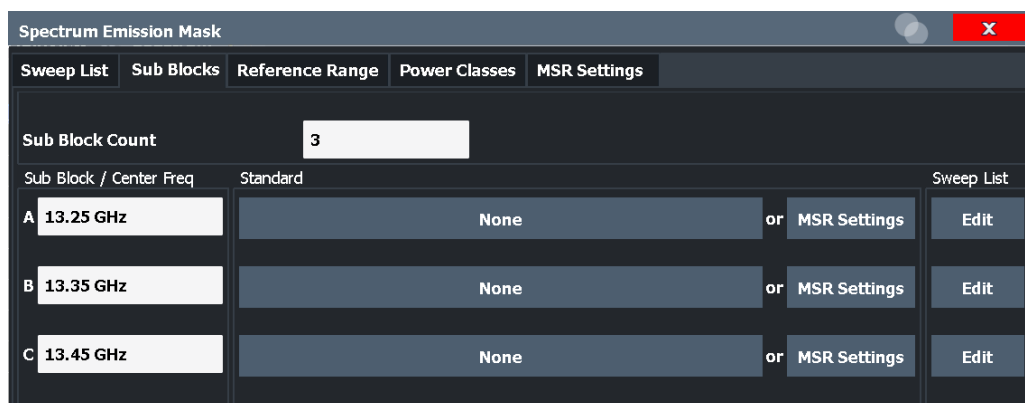
### Multi-SEM (sub block) settings

**Access:** "Overview" > "Select Measurement" > "Spectrum Emission Mask" > "Sub Blocks"

In the I/Q Analyzer application only, spectrum emissions can be measured for multiple sub blocks of channels (see "[SEM with multiple sub blocks \("Multi-SEM"\)](#)" on page 328). Sub blocks are a set of multiple ranges around a defined center frequency (carrier).

By default, a single sub block is assumed. If more than one sub blocks are defined, additional tabs are inserted for each sub block in the individual tabs of the "Spectrum Emission Mask" configuration dialog box.





Sub Block Count .....	337
Sub Block / Center Freq .....	337
Standard / MSR Settings .....	337
Edit Sweep List .....	337

### Sub Block Count

Defines the number of sub blocks. By default, the familiar SEM measurement with just one single block of ranges is configured.

Remote command:

[\[SENSe:\]ESpectrum<sb>:SCount](#) on page 745

### Sub Block / Center Freq

Defines the center frequency for an individual sub block. The center frequency determines the reference range used for each block.

For measurements with only one sub block, this setting corresponds to the global setting in the "Frequency" settings (see [Center Frequency](#) ).

Remote command:

[\[SENSe:\]ESpectrum<sb>:SCENTER](#) on page 745

### Standard / MSR Settings

Defines the use of a standard settings file or a multi-standard radio configuration for a particular sub block. For details, see "[Standard files](#)" on page 343 and "[MSR settings](#)" on page 340.

Note that *either* a standard *or* an MSR setting can be selected; if one is selected, the other is disabled.

Remote command:

[\[SENSe:\]ESpectrum<sb>:PRESet\[:STANdard\]](#) on page 743

["Configuring a multi-sem measurement"](#) on page 744

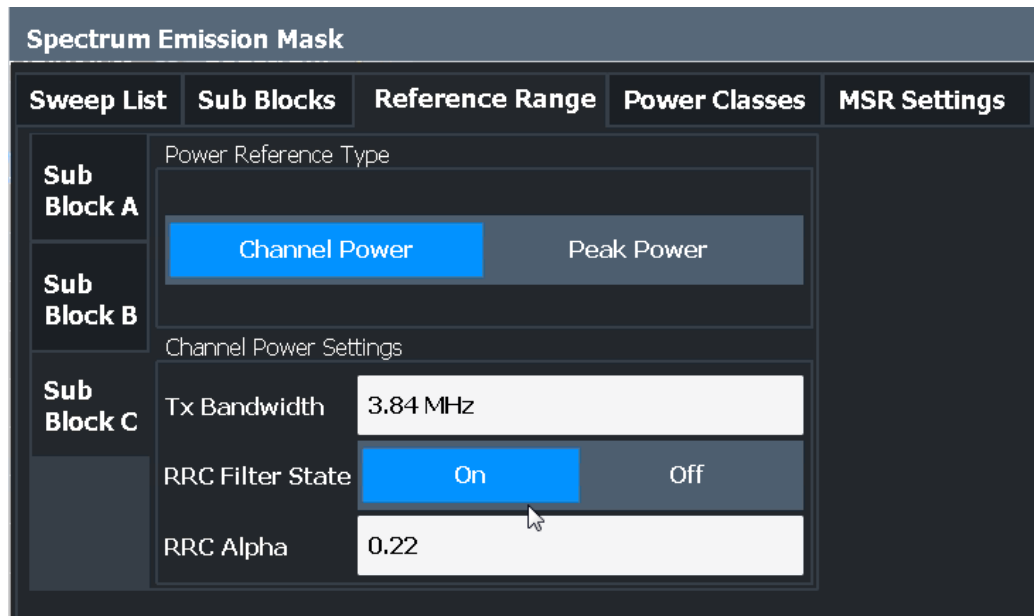
### Edit Sweep List

Switches to the "Sweep List" tab of the "Spectrum Emission Mask" dialog box to configure the individual frequency ranges and mask limits for the corresponding sub block. See "[Sweep List](#)" on page 332.

## Reference range

**Access:** "Overview" > "Select Measurement" > "Spectrum Emission Mask" > "Reference Range"

The range around the center frequency is defined as the reference range for all other ranges in the capture list.



Power Reference Type .....	338
Channel Power Settings .....	338
L Tx Bandwidth .....	338
L RRC Filter State .....	339
L Alpha: .....	339

### Power Reference Type

Defines how the reference power is calculated.

"Channel Power"

Measures the channel power within the reference range using the integration bandwidth method. Additional settings can be configured for this method.

"Peak Power"

Determines the peak power within the reference range.

Remote command:

[SENSe:]ESpectrum<sb>:RTYPE on page 761

### Channel Power Settings

If the "Power Reference Type:" "Channel Power" was selected, additional parameters can be configured.

#### Tx Bandwidth ← Channel Power Settings

Defines the bandwidth used for measuring the channel power, with:

Minimum span ≤ "Tx Bandwidth" ≤ of reference range

Remote command:

[SENSe:]ESpectrum<sb>:BWID on page 760

**RRC Filter State ← Channel Power Settings**

Activates or deactivates the use of an RRC filter.

Remote command:

[SENSe:]ESpectrum<sb>:FILTer[:RRC][:STATe] on page 760

**Alpha: ← Channel Power Settings**

Sets the alpha value of the RRC filter (if activated).

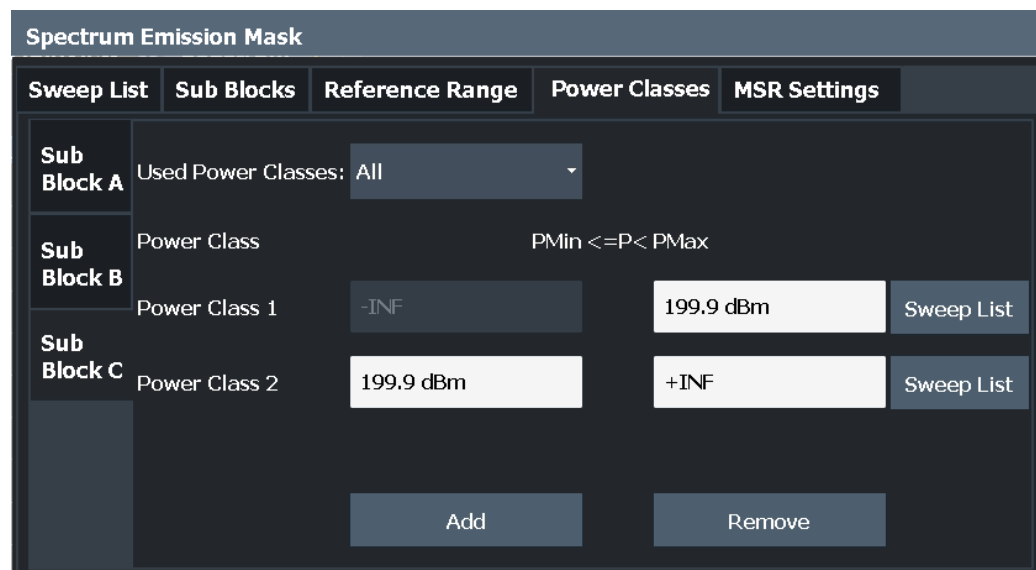
Remote command:

[SENSe:]ESpectrum<sb>:FILTer[:RRC]:ALPHa on page 760

**Power classes**

**Access:** "Overview" > "Select Measurement" > "Spectrum Emission Mask" > "Power Classes"

You can configure power classes which you can then assign to capture list ranges. For details, see "Power classes" on page 324.



Used Power Classes: ..... 339  
 PMin / PMax ..... 340  
 Sweep List ..... 340  
 Adding or Removing a Power Class ..... 340

**Used Power Classes:**

Defines which power classes are considered for the SEM measurement. Limits can be defined only for used power classes. It is only possible to select either one specific power class or all the defined power classes.

If "All" is selected, the power class that corresponds to the currently measured power in the reference range is used for monitoring. The limits assigned to that power class are applied (see ["Abs Limit Start / Stop <n>"](#) on page 334 and ["Rel Limit Start / Stop <n>"](#) on page 334).

Remote command:

```
CALCulate<n>:LIMit<li>:ESpectrum<sb>:PCLass<pc>[:EXCLusive]
```

on page 764

To define all limits in one step:

```
CALCulate<n>:LIMit<li>:ESpectrum<sb>:PCLass<pc>:LIMit[:STATe]
```

on page 765

### PMin / PMax

Defines the power limits for each power class. The first range always starts at -200 dBm (-INF) and the last range always stops at 200 dBm (+INF). These fields cannot be modified. If more than one power class is defined, the value of "PMin" must be equal to the value of "PMax" of the previous power class and vice versa.

Note that the power level can be equal to the lower limit(s), but must be lower than the upper limit(s):

$$P_{\min} \leq P < P_{\max}$$

Otherwise the ranges are corrected automatically.

Remote command:

```
CALCulate<n>:LIMit<li>:ESpectrum<sb>:PCLass<pc>:MINimum
```

on page 766

```
CALCulate<n>:LIMit<li>:ESpectrum<sb>:PCLass<pc>:MAXimum
```

on page 765

### Sweep List

Switches to the "Sweep List" tab of the "Spectrum Emission Mask" dialog box and focuses the "Limit Check" setting for the corresponding power class (1-4) in the reference range (see ["Limit Check <n>"](#) on page 334).

### Adding or Removing a Power Class

Adds a new power class at the end of the list or removes the last power class. After adding or removing, the last power class is adapted to end at "+INF". Note that a maximum of four power classes are available.

Remote command:

```
CALCulate<n>:LIMit<li>:ESpectrum<sb>:PCLass<pc>:COUNT on page 764
```

### MSR settings

**Access:** "Overview" > "Select Measurement" > "Spectrum Emission Mask" > "MSR Settings"

Multi-standard radio (MSR) measurements allow you to perform SEM tests on multiple carriers using different digital standards.

For details, see ["Multi-standard radio \(MSR\) SEM measurements"](#) on page 327.

Spectrum Emission Mask				
Sweep List	Sub Blocks	Reference Range	Power Classes	MSR Settings
	Common Settings			
Sub Block A	Band Category	BC2		
Sub Block B	Base Station Class	Wide Area		
	BS Max Output Power	39.0 dBm		
Sub Block C	Bands	<input type="checkbox"/> <= 3 GHz <input type="checkbox"/> > 3 GHz		
	Base Station RF Bandwidth	10.0 MHz		
	Carrier Adjacent to RF Bandwidth Edge			
		<input type="checkbox"/> GSM/Edge Present		
	Power Gsm Carrier	39.0 dBm		
		<input type="checkbox"/> LTE FDD 1.4MHz/3MHz Present		
	Apply to SEM			

Band Category .....	341
Base Station Class .....	341
Base Station Maximum Output Power .....	342
Bands .....	342
Base Station RF Bandwidth .....	342
Carrier Adjacent to RF Bandwidth Edge .....	342
Power Gsm Carrier .....	342
Apply to SEM .....	343

### Band Category

Defines the band category for MSR measurements, i.e. the combination of available carriers to measure.

"BC1"	LTE FDD and W-CDMA
"BC2"	LTE FDD, W-CDMA and GSM/EDGE
"BC3"	LTE TDD and TD-SCDMA

Remote command:

[SENSe:]ESpectrum<sb>:MSR:BCATegory on page 768

### Base Station Class

Defines the class of the base station according to its sending range.

This setting is required to calculate the SEM limits according to standard 3GPP 37.141 V12.2.0.

Remote command:

[SENSe:]ESpectrum<sb>:MSR:CLASs on page 769

### Base Station Maximum Output Power

Defines the maximum output power of the base station. Possible values are from 0 dBm to 100 dBm in 1 dB steps.

This setting is only available for base stations with a medium range [Base Station Class](#).

This value is required to calculate the SEM limits according to standard 3GPP 37.141 V12.2.0.

Remote command:

[SENSe:]ESpectrum<sb>:MSR:MPOWer on page 771

### Bands

Defines the frequency range of the bands used by the base station.

This setting is only available for [Band Category](#) 1 or 3.

This setting is required to calculate the SEM limits according to standard 3GPP 37.141 V12.2.0.

Remote command:

[SENSe:]ESpectrum<sb>:MSR:BAND on page 767

### Base Station RF Bandwidth

Defines the relevant RF bandwidth (span) required to measure all available carriers in MSR SEM measurements.

Remote command:

[SENSe:]ESpectrum<sb>:MSR:RFBWidth on page 772

### Carrier Adjacent to RF Bandwidth Edge

For particular measurement setups, the specification demands specific limits for the SEM ranges.

These settings are only available for [Band Category](#) 2.

"GSM/Edge Present"

A GSM/EDGE carrier is located at the edge of the RF band.

In this case, the power of the GSM carrier must be specified (see "[Power Gsm Carrier](#)" on page 342).

"LTE FDD 1.4MHz/3MHz Present"

An LTE FDD 1.4 MHz or 3 MHz carrier is located at the edge of the RF band.

Remote command:

[SENSe:]ESpectrum<sb>:MSR:GSM:CPResent on page 770

[SENSe:]ESpectrum<sb>:MSR:LTE:CPResent on page 771

### Power Gsm Carrier

Defines the power of the GSM carrier (if available, see "[Carrier Adjacent to RF Bandwidth Edge](#)" on page 342). Possible values are from 0 dBm to 100 dBm in 1 dB steps.

This setting is only available for [Band Category](#) 2.

This setting is required to calculate the SEM limits according to standard 3GPP 37.141 V12.2.0.

Remote command:

[SENSe:]ESpectrum<sb>:MSR:GSM:CARRier on page 769

### Apply to SEM

Configures the SEM capture list according to the specified MSR settings.

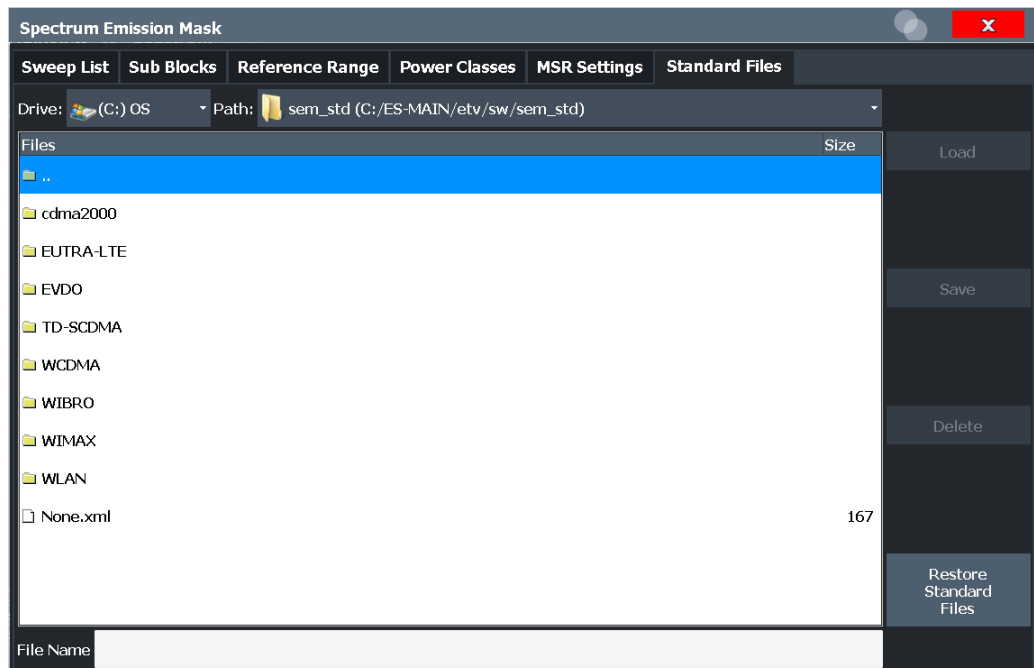
Remote command:

[SENSe:]ESpectrum<sb>:MSR:APPLY on page 767

### Standard files

**Access:** "Overview" > "Select Measurement" > "Spectrum Emission Mask" > "Standard Files"

You can save the current measurement settings as a user-defined standard (XML file), or load stored measurement settings. Furthermore, you can delete an existing settings file.



For details, see "How to manage SEM settings files" on page 349.



### Standard files for sub blocks (Multi-SEM measurements)

If more than one sub blocks are defined, the "Standard Files" tab and softkey are not available. To load a standard file for an individual sub block, use the [Standard / MSR Settings](#) setting in the "Sub Blocks" tab.

<a href="#">Selecting Storage Location - Drive/ Path/ Files</a> .....	344
<a href="#">File Name</a> .....	344
<a href="#">Load Standard</a> .....	344

File Explorer.....	344
Save Standard .....	344
Delete Standard .....	344
Restore Standard Files .....	345

### Selecting Storage Location - Drive/ Path/ Files

Select the storage location of the file on the software or an external drive.

The default storage location for the settings files is:

C:\ProgramData\Rohde-Schwarz\VSE\\Save.

Note that the `ProgramData` folder is not visible in the Windows Explorer in its default settings. However, if you enter the path with the filename, you can access the files stored there. See also "[Hidden folder](#)" on page 121.

The default storage location for the SEM settings files is:

C:\ProgramData\Rohde-Schwarz\VSE\

### File Name

Contains the name of the data file without the path or extension.

File names must be compatible with the Windows conventions for file names. In particular, they must not contain special characters such as ":", "\*", "?".

For details on the filename and location, see [Chapter 8.2.2.2, "Storage location and file name"](#), on page 120.

For details on the filename and location, see [Chapter 8.2.2.2, "Storage location and file name"](#), on page 120.

### Load Standard

Loads the selected measurement settings file.

Remote command:

`[SENSe:]ESpectrum<sb>:PRESet[:STANdard]` on page 743

### File Explorer

Opens the Microsoft Windows File Explorer.

Remote command:

not supported

### Save Standard

Saves the current measurement settings for a specific standard as a file with the defined name.

Remote command:

`[SENSe:]ESpectrum<sb>:PRESet:STORe` on page 743

### Delete Standard

Deletes the selected standard. Standards predefined by Rohde & Schwarz can also be deleted. A confirmation query is displayed to avoid unintentional deletion of the standard.



**Note:** Restoring predefined standard files. The standards predefined by Rohde & Schwarz available at the time of delivery can be restored using the "Restore Standard Files" function (see "Restore Standard Files" on page 345).

### Restore Standard Files

Restores the standards predefined by Rohde & Schwarz available at the time of delivery.

The XML files from the

C:\Program Files\Rohde-Schwarz\VSE\

Note that this function overwrites customized standards that have the same name as predefined standards.

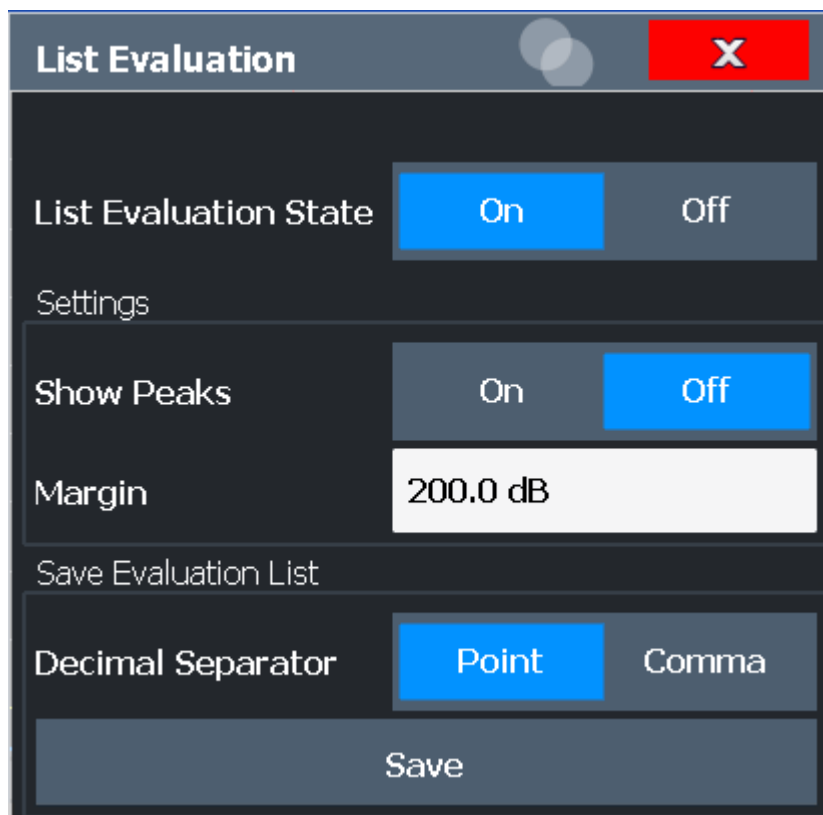
Remote command:

[SENSe:]ESpectrum<sb>:PRESet:REStore on page 743

### List evaluation (results configuration)

**Access:** "Overview" > "Select Measurement" > "Spectrum Emission Mask" > "List Evaluation"

In the "List Evaluation" dialog box, you configure the contents and display of the SEM results.



List Evaluation State (result summary).....	346
Show Peaks .....	346
Margin .....	346
Saving the Result Summary (Evaluation List) to a File .....	346

### List Evaluation State (result summary)

Activates or deactivates the Result Summary.

Remote command:

`CALCulate<n>:ESpectrum:PEAKsearch:AUTO` on page 773

`TRACe<n>[:DATA]` on page 730

### Show Peaks

If activated, all peaks that have been detected during an active SEM measurement are marked with blue squares in the Spectrum diagram.

Remote command:

`CALCulate<n>:ESpectrum:PEAKsearch:PSHow` on page 774

### Margin

Although a margin functionality is not available for the limit check, you can define a margin (or: *threshold*) for the peak values to be displayed in the result summary. Only peaks that exceed the margin value are displayed (also in the diagram, if activated).

Remote command:

`CALCulate<n>:ESpectrum:PEAKsearch:MARGin` on page 773

### Saving the Result Summary (Evaluation List) to a File

Exports the Result Summary of the SEM measurement to an ASCII file for evaluation in an external application. If necessary, change the decimal separator for evaluation in other languages.

Define the filename and storage location in the file selection dialog box that is displayed when you select the "Save" function.

For details, see "[ASCII file export format \(spectrum emission mask\)](#)" on page 358.

Remote command:

`MMEMory:STORe<n>:LIST` on page 897

`FORMat:DEXPort:DSEParator` on page 874

#### 10.4.3.6 How to perform a spectrum emission mask measurement

SEM measurements can be performed according to a specific standard or freely configured. Configuration for signals with a regular channel definition can be configured quickly and easily. Selecting the SEM measurement is a prerequisite for all other tasks.

For signals with multiple carriers, also in non-contiguous ranges, an SEM measurement with multiple sub blocks can be configured.

For multi-standard radio SEM measurements, configuration for specified scenarios can be done automatically.

The following tasks are described:

- ["To select an SEM measurement"](#) on page 347
- ["To perform an SEM measurement according to a standard"](#) on page 347
- ["To configure a user-defined SEM measurement"](#) on page 347
- ["To perform an MSR SEM measurement"](#) on page 348
- ["To perform a Multi-SEM measurement"](#) on page 349



For remote operation, see ["Example: SEM measurement"](#) on page 774.

#### To select an SEM measurement

- ▶ Select "Meas Setup" > "Select Measurement" , then select the "Spectrum Emission Mask" measurement.

#### To perform an SEM measurement according to a standard

- ▶ Load the settings file as described in ["How to load an SEM settings file"](#) on page 350 and start a measurement.

#### To configure a user-defined SEM measurement

1. Define the span of the signal you want to monitor in the general span settings.
2. Split the frequency span of the measurement into ranges for signal parts with similar characteristics.  
Starting from the center frequency, determine which sections of the signal to the left and right can be swept and monitored using the same parameters. Criteria for such a range definition may be, for example:

- The signal power level
- The required resolution bandwidth or capture time
- Transducer factors
- Permitted deviation from the defined signal level, i.e. the required limit values for monitoring

If the signal consists of a transmission channel and adjacent channels, the channel ranges can usually be used for the range definition.

3. If the signal power level to be monitored varies and the limits vary, define power classes. For each range of levels that can be monitored in the same way, define a power class.
  - a) Select "Overview" .
  - b) Select "SEM Setup" .
  - c) Switch to the "Power Classes" tab.
  - d) To add a power class, select "Add" .
  - e) Enter the start and stop power levels to define the class.

- f) Select the power classes to be used for the current measurement:
  - a specific class
  - all classes, to have the required class selected automatically according to the input level measured in the reference range
4. Select the "Sweep List" tab of the "Spectrum Emission Mask" dialog box.
5. Insert the required ranges using "Insert before Range" and "Insert after Range" , which refer to the currently selected range (the reference range by default). If the signal trace is symmetric to the center frequency, activate the "Sym Setup" option to make setup easier and quicker.
6. Define the measurement parameters for each range as required. If symmetrical setup is activated, you only have to configure the ranges to one side of the center range.

In particular, define the limits for each range of the signal, i.e. the area in which the signal level can deviate without failing the limit check. If several power classes were defined (see [step 3](#)), define limits for each power class.

  - a) Define the type of limit check, i.e. whether absolute values or relative values are checked, or both. The type of limit check is identical for all power classes.
  - b) Define the limit start and stop values.
7. If the capture list settings - other than the limit and transducer values - are identical for several adjacent ranges, activate "Fast SEM" mode to speed up the measurement. You only have to activate the mode for one range, the others are adapted automatically.
8. If necessary, change the settings for the reference power to which all SEM results refer in the "Reference Range" tab.
9. To indicate the determined peaks in the display during an SEM measurement, select "Overview" > "Analysis" > "Show Peaks" .
10. To save the current SEM measurement settings to a file to re-use them later, save a settings file as described in ["How to save a user-defined SEM settings file"](#) on page 350.
11. Start a capture.

The determined powers and limit deviations for each range are indicated in the Result Summary. If activated, the peak power levels for each range are also indicated in the Spectrum diagram.
12. To save the Result Summary, export the results to a file as described in ["How to save SEM result files"](#) on page 350.

#### To perform an MSR SEM measurement

1. Select "Meas Setup" > "MSR Config" .
2. Select the band category that determines the digital standards used in the measurement setup (see ["Band Category "](#) on page 341).

3. Define the bandwidth that contains all relevant carrier signals to be measured.
4. For measurements with GSM/EDGE, LTE FDD and W-CDMA carriers (BC2), define whether a GSM/EDGE or an LTE FDD carrier, or both, are located at the edge of the bandwidth.
5. Select "Apply to SEM" .  
The capture list is configured according to the MSR specification, with the required number of ranges and defined limits.
6. Start a capture.  
The determined powers and limit deviations for each range are indicated in the Result Summary. If activated, the peak power levels for each range are also indicated in the Spectrum diagram.
7. To save the Result Summary, export the results to a file as described in ["How to save SEM result files"](#) on page 350.

#### To perform a Multi-SEM measurement

1. Define the span of the signal to be monitored in the general span settings.
2. Select "Meas Setup" > "Multi-SEM Config" .
3. Define the number of sub blocks (up to 3) that contain the relevant carriers.
4. For each sub block, define the center frequency, that is, the frequency of the TX carrier or a frequency in the dedicated reference range.
5. For each sub block, do one of the following:
  - Select a standard settings file to be used.
  - Select "MSR Settings" and define the MSR configuration as described in ["To perform an MSR SEM measurement"](#) on page 348.
  - Select "Edit" and configure the capture list manually as defined in ["To configure a user-defined SEM measurement"](#) on page 347. Be sure to select the correct vertical tab for the corresponding sub block within each subtab of the "Spectrum Emission Mask" configuration dialog.  
Define a function to be used for overlapping ranges in the "Multi-Limit Calc" field of the capture list.
6. Start a capture.  
The determined powers and limit deviations for each sub block, each gap, and each range are indicated in the Result Summary. If activated, the peak power levels for each range are also indicated in the Spectrum diagram.
7. To save the Result Summary, export the results to a file as described in ["How to save SEM result files"](#) on page 350.

#### How to manage SEM settings files

SEM measurement settings can be saved to an XML file which can then be exported to another application or loaded on the R&S VSE again later. Some predefined XML files

are provided that contain ranges and parameters according to the selected standard. All XML files are stored under

C:\Program Files\Rohde-Schwarz\VSE\

For details on the file format of the SEM settings file, see ["Format description of SEM XML files"](#) on page 353.

SEM settings or standard files are managed in the "Standard" tab of the "Spectrum Emission Mask" dialog box. To display this dialog box, select "Overview" and then "SEM Setup" .

#### How to load an SEM settings file

1. From the file selection dialog box, select the settings file (with a .xml extension).
2. Select "Load" .

The settings from the selected file are restored to the R&S VSE and you can repeat the SEM measurement with the stored settings.

#### How to save a user-defined SEM settings file

1. Configure the SEM measurement as required (see [Chapter 10.4.3.6, "How to perform a spectrum emission mask measurement"](#), on page 346).
2. In the "Standard Files" tab of the "Spectrum Emission Mask" dialog box, define a filename and storage location for the settings file.
3. Select "Save" .

The settings are stored to a file with the extension .xml as specified.

#### How to delete an SEM settings file

1. In the "Standard Files" tab of the "Spectrum Emission Mask" dialog box, select the file you want to delete.
2. Select "Delete" .
3. Confirm the message.

The settings file is removed from the R&S VSE.

#### How to restore default SEM settings files

The R&S VSE is delivered with predefined settings files which can be edited and overwritten. However, you can restore the original files.

- ▶ In the "Standard Files" tab of the "Spectrum Emission Mask" dialog box, select "Restore Standard Files" .

The original predefined settings files are available for selection on the R&S VSE.

#### How to save SEM result files

The Result Summary from an SEM measurement can be saved to a file, which can be exported to another application for further analysis, for example.

For details on the file format of the SEM export file, see ["ASCII file export format \(spectrum emission mask\)"](#) on page 358.

1. Configure and perform an SEM measurement as described in [Chapter 10.4.3.6, "How to perform a spectrum emission mask measurement"](#), on page 346.
2. In the "Overview" , select "Analysis" .
3. If necessary, change the "Decimal Separator" to "COMMA" for evaluation in other languages.
4. Select "Save" .
5. In the file selection dialog box, select a storage location and filename for the result file.
6. Select "Save" .

The file with the specified name and the extension `.dat` is stored in the defined storage location.

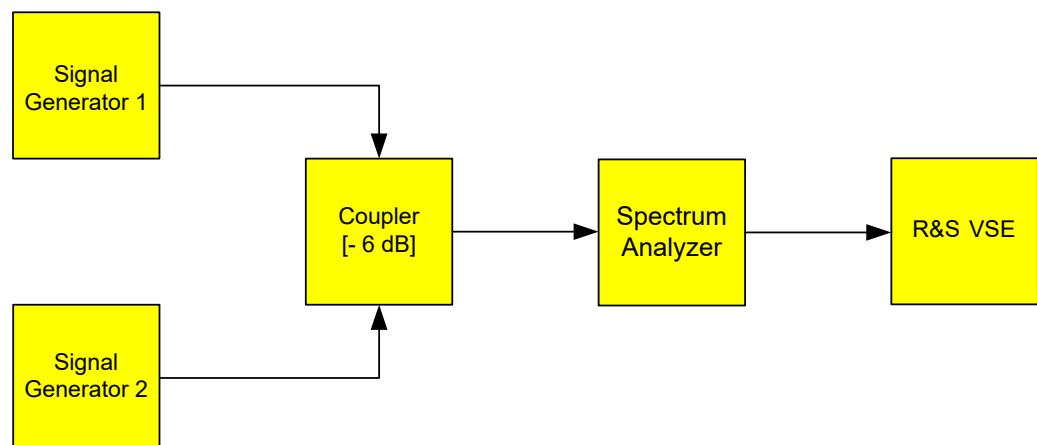
#### 10.4.3.7 Measurement example: Multi-SEM measurement

The following measurement example demonstrates an SEM measurement for a signal with multiple sub blocks.



A programming example demonstrating a SEM measurement in a remote environment is provided in ["Example: SEM measurement"](#) on page 774.

##### Test setup:



##### Signal generator settings (e.g. R&S VSE SMW):

Device	Standard	Center frequency	Level	Test model
SigGen 1	3GPP/FDD	900 MHz	0 dBm	1-16
SigGen 2	EUTRA/LTE	906.5 MHz	0 dBm	1_1_5MHz

### Setting up the measurement

1. Set up a basic measurement with instrument input in the R&S VSE as described in [Chapter 11.1, "How to perform a basic measurement with instrument input"](#), on page 461.
2. Set the center frequency to *903.25 MHz*.
3. Set the reference level to *10 dBm* with an offset of to *30 dB*.
4. Select "Meas Setup" > "Select Measurement" .
5. Select the "SEM" measurement function.
6. Select "Sub Blocks" and enter "Sub Block Count" of 2.
7. For "Sub Block A" , define the settings for the 3GPP/FDD signal:
  - Set the "Center Frequency" to *900 MHz*
  - Select "MSR Settings" .
  - Set the "Base Station RF Bandwidth" to *5 MHz*.
  - Select "Apply to SEM" .
8. For "Sub Block B" , define the settings for the EUTRA/LTE signal:
  - Set the "Center Frequency" to *906.5 MHz*
  - Select "MSR Settings" .
  - Set the "Base Station RF Bandwidth" to *5 MHz*.
  - Select "Apply to SEM" .
9. Select [RUN SINGLE] to perform a measurement with the new settings.

The results of the measurement for each sub block are displayed in the Result Summary. The summarized limit line is indicated in the Spectrum graph.



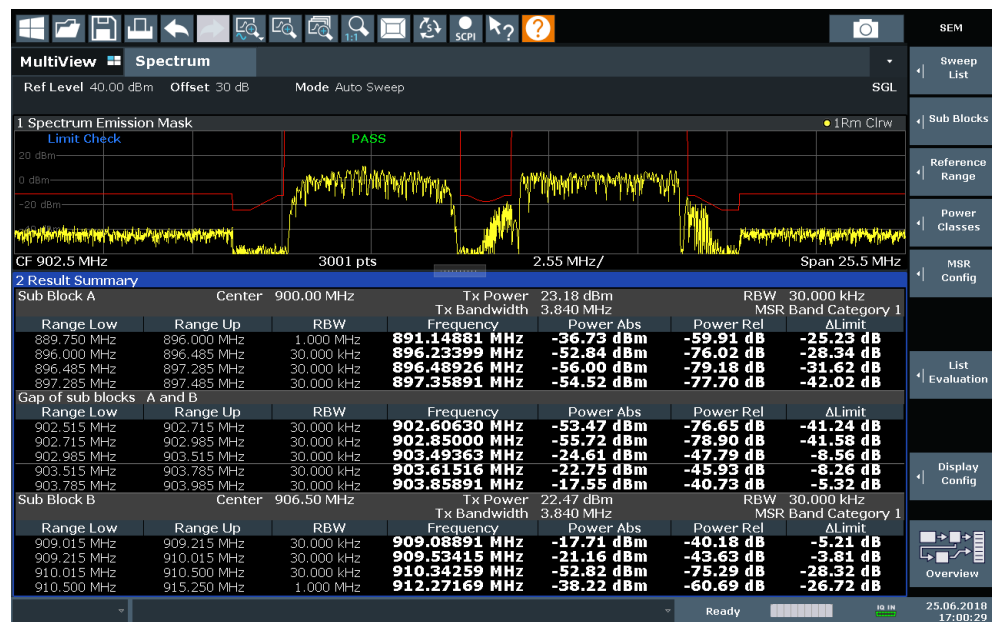


Figure 10-41: Multi-SEM measurement: results of the measurement for each sub block

#### 10.4.3.8 Reference: SEM file descriptions

This reference provides details on the format of the SEM settings and result files.

- [Format description of SEM XML files](#)..... 353
- [ASCII file export format \(spectrum emission mask\)](#)..... 358

#### Format description of SEM XML files

The SEM XML files offer a quick way to change the measurement settings. A set of predefined XML files for different standards is already provided. You can also create and use your own XML files. Alternatively, edit the settings directly in the "Spectrum Emission Mask" dialog box and save the XML file afterwards. This way, you do not have to modify the XML file itself.

In addition to saving the current settings to a file, settings files can also be created independently of the R&S VSE, in an external application. When creating your own XML files, be sure to comply with the following conventions because the R&S VSE can only interpret XML files of a known structure. For sample files, see the C:\Program Files\Rohde-Schwarz\VSE\\sem\_std directory of the R&S VSE.

To load a settings file, use the "Load" function in the "Standard Files" tab of the "Spectrum Emission Mask" dialog box (see [How to load an SEM settings file](#) on page 350). All XML files are stored under

C:\Program Files\Rohde-Schwarz\VSE\\sem\_std.

The files for importing range settings obey the rules of the XML standard. The child nodes, attributes, and structure defined for the data import are described here.



Be sure to follow the structure exactly as shown below or else the R&S VSE is not able to interpret the XML file and error messages are shown on the screen. It is recommended that you make a copy of an existing file and edit the copy of the file.

Basically, the file consists of three elements that can be defined:

- The `BaseFormat` element
- The `PowerClass` element
- The `Range` element

### The "BaseFormat" element

It carries information about basic settings. In this element, only the `ReferencePower` child node has any effects on the measurement itself. The other attributes and child nodes are used to display information about the Spectrum Emission Mask standard on the measurement screen. The child nodes and attributes of this element are shown in [Table 10-6](#).

#### Example:

In the sample file `PowerClass_39_43.xml` under

`C:\Program Files\Rohde-Schwarz\VSE\<version>\sem_std\WCDMA\3GPP`, these attributes are defined as follows:

- `Standard="W-CDMA 3GPP"`
- `LinkDirection="DL"`
- `PowerClass="(39,43)dBm"`

### The "PowerClass" element

It is embedded in the `BaseFormat` element and contains settings information about the power classes. Up to four different power classes can be defined. For details, refer to "[Power classes](#)" on page 339. The child nodes and attributes of this element are shown in [Table 10-7](#).

### The "Range" element

This element is embedded in the `PowerClass` element. It contains the settings information of the range. There have to be at least three defined ranges: one reference range and at least one range to either side of the reference range. The maximum number of ranges is 30. Note that the R&S VSE uses the same ranges in each power class. Therefore, the contents of the ranges of each defined power class have to be identical to the first power class. The `Start` and `Stop` values of the two `Limit` nodes that are used to determine the power class are an exception. Note also that you must define two limit nodes: one that defines the limit in absolute values and one in relative values. Make sure units for the `Start` and `Stop` nodes are identical for each `Limit` node.

For details, refer to "[Sweep List](#)" on page 332. The child nodes and attributes of this element are shown in [Table 10-8](#).

The following tables show the child nodes and attributes of each element and show if a child node or attribute is mandatory for the R&S VSE to interpret the file or not. The hierarchy of the XML cannot be seen in the tables. View one of the predefined files already stored on the R&S VSE in the "C:\Program Files\Rohde-Schwarz\VSE\*<version>*\sem\_std" directory, or check the structure as shown below.

Below, a basic example of the structure of the file is shown, containing all mandatory attributes and child nodes. Note that the `PowerClass` element and the `Range` element are themselves elements of the `BaseFormat` element. They must be inserted where noted. They are separated here simply to provide a better overview. Also, no example values are given here to allow a quick reference to the tables above. Italic font shows the placeholders for the values.

- The `BaseFormat` element is structured as follows:
  - `<RS_SEM_ACP_FileFormat Version="1.0.0.0">`  
`<Name>"Standard"</Name>`  
`<Instrument>`  
`<Type>"Instrument Type"</Type>`  
`<Application>"Application"</Application>`  
`</Instrument>`  
`<LinkDirection Name="Name">`  
`<ReferencePower>`  
`<Method>"Method"</Method>`  
`</ReferencePower>`  
`<PowerClass Index="n">`  
`<!-- For contents of the PowerClass node, see Table 10-7 -->`  
`<!-- Define up to four PowerClass nodes -->`  
`</PowerClass>`  
`</LinkDirection>`  
`</RS_SEM_ACP_File>`
- The "PowerClass" element is structured as follows:
  - `<PowerClass Index="n">`  
`<StartPower Unit="dBm" InclusiveFlag="true" Value="StartPowerValue"/>`  
`<StopPower Unit="dBm" InclusiveFlag="false" Value="StopPowerValue"/>`  
`<DefaultLimitFailMode>"Limit Fail Mode"</DefaultLimitFailMode>`  
`<Range Index="n">`  
`<!-- For contents of the Range node, see Table 10-8 -->`  
`<!-- Define up to twenty Range nodes -->`  
`</Range>`  
`...`  
`</PowerClass>`
- The "Range" element is structured as follows:
  - `<Range Index="n">`  
`<Name="Name">`  
`<ChannelType>"Channel Type"</Channel Type>`  
`<WeightingFilter>`  
`<Type>"FilterType"</Type>`  
`<RollOffFactor>"Factor"</RollOffFactor>`

```

<Bandwidth>"Bandwidth"</Bandwidth>
</WeightingFilter>
<FrequencyRange>
<Start>"RangeStart"</Start>
<Stop>"RangeStop"</Stop>
</FrequencyRange>
<Limit>
<Start Unit="Unit" Value="Value"/>
<Stop Unit="Unit" Value="Value"/>
</Limit>
<Limit>
<Start Unit="Unit" Value="Value"/>
<Stop Unit="Unit" Value="Value"/>
</Limit>
<RBW Bandwidth="Bandwidth" Type="FilterType"/>
<VBW Bandwidth="Bandwidth"/>
<Detector>"Detector"</Detector>
<Sweep Mode="SweepMode" Time="SweepTime"/>
<Amplitude>
<ReferenceLevel Unit="dBm" Value="Value"/>
<RFAttenuation Mode="Auto" Unit="dB" Value="Value"/>
<Preamplifier State="State"/>
</Amplitude>
<MeasPointsMin>1</MeasPointsMin>
<CalcRuleMulti>Sum</CalcRuleMulti>
</Range>

```

**Table 10-6: Attributes and child nodes of the BaseFormat element**

Child Node	Attribute	Value	Parameter Description	Mand.
	FileFormatVersion	1.0.0.0		Yes
	Date	YYYY-MM-DD HH:MM:SS	Date in ISO 8601 format	No
Name		<string>	Name of the standard	Yes
Instrument	Type	FSL	Name of the instrument	No
	Application	SA   K72   K82	Name of the application	No
LinkDirection	Name	Downlink   Uplink   None		Yes
	ShortName	DL   UL		No
Reference- Power				Yes
Method	TX Channel Power   TX Channel Peak Power			Yes
Reference- Channel	<string>			No

**Table 10-7: Attributes and child nodes of the PowerClass element**

Child Node	Attribute	Value	Parameter description	Mand.
StartPower	Value	<power in dBm>	The start power must be equal to the stop power of the previous power class. The StartPower value of the first range is -200	Yes
	Unit	dBm		Yes
	InclusiveFlag	true		Yes
StopPower	Value	<power in dBm>	The stop power must be equal to the start power of the next power class. The StopPower value of the last range is 200	Yes
	Unit	dBm		
	InclusiveFlag	false		Yes
DefaultLimitFailMode		Absolute   Relative   Absolute and Relative   Absolute or Relative		Yes

**Table 10-8: Attributes and child nodes of the Range element (normal ranges)**

Child node	Attribute	Value	Parameter description	Mand.
	Index	0...19	Indices are continuous and have to start with 0	Yes
	Name	<string>	Name of the range	Only if ReferenceChannel contains a name and the range is the reference range
	Short-Name	<string>	Short name of the range	No
ChannelType		TX   Adjacent		Yes
WeightingFilter				Only if ReferencePower method is TX Channel Power and the range is the reference range
Type		RRC   CFilter	Type of the weighting filter	Yes
Roll Off Factor		0...1	Excess bandwidth of the filter	Only if the filter type is RRC
Bandwidth		<bandwidth in Hz>	Filter bandwidth	Only if the filter type is RRC
FrequencyRange				Yes
Start		<frequency in Hz>	Start value of the range	Yes
Stop		<frequency in Hz>	Stop value of the range	Yes

Child node	Attribute	Value	Parameter description	Mand.
Limit		dBm/Hz   dBm   dBc   dBr   dB	A Range must contain exactly two limit nodes; one of the limit nodes has to have a relative unit (e.g. dBc), the other one must have an absolute unit (e.g. dBm)	Yes
Start	Value	<numeric_value>	Power limit at start frequency	Yes
	Unit	dBm/Hz   dBm   dBc   dBr   dB	Sets the unit of the start value	
Stop	Value	<numeric_value>	Power limit at stop frequency	
	Unit	dBm/Hz   dBm   dBc   dBr   dB	Sets the unit of the stop value	
LimitFailMode		Absolute   Relative   Absolute and Relative   Absolute or Relative	If used, it has to be identical to DefaultLimitFailMode	No
RBW	Bandwidth	<bandwidth in Hz>	"RBW " on page 333	Yes
	Type	NORM   PULS   CFIL		No
VBW	Bandwidth	<bandwidth in Hz>	"VBW " on page 334	Yes
Detector		NEG   POS   SAMP   RMS   AVER   QUAS	If used, it has to be identical in all ranges.	No
Sweep	Mode	Manual   Auto	"Sweep Time Mode " on page 334	Yes
	Time	<time in sec>	"Meas Time " on page 334	No
Amplitude				No

### ASCII file export format (spectrum emission mask)

When trace data from an SEM measurement is exported, the data is stored in ASCII format as described below. The first part of the file lists information about the signal analyzer and the general setup.

File contents	Explanation
<b>File header</b>	
	Model
Version;1.00;	Firmware version
Date;31.Mar 17;	Storage date of data set
Mode;ANALYZER;SEM;	Operating mode and measurement function
Center Freq;1325000000.000000;Hz	X-axis settings

File contents	Explanation
Freq Offset;0.000000;Hz	
Span;25500000.000000;Hz	
x-Axis;LIN;	
Start;13237250000.000000;Hz	
Stop;13262750000.000000;Hz	
Level Offset;0.000000;dB	Y-axis settings
Ref Position;100.000000;%	
y-Axis;LOG;	
Level Range;100.000000;dB	
<b>Trace settings</b>	
Trace Mode;CLR/WRITE;	
Detector;RMS;	
Sweep Count;0;	
Trace 1.;	
x-Unit;Hz;	
y-Unit;dBm;	
<b>List evaluation settings</b>	
Margin;200;	Peak List margin
<b>Reference range settings</b>	
RefType; CPOWER;	Reference power type
TxBandwidth;3840000.;;Hz	Channel power settings
Filter State; ON;	
Alpha;0.22;	
PeaksPerRange;1;	Max. number of peaks per range to be detected
Values;2;	Number of detected peaks
<b>File data section</b>	

File contents	Explanation
0;-12750000;-2515000;30000;13242367500;-43.844 722747802734;-0.33028793334960938;49.6697120 66650391;FAIL;	Measured peak values: <range number>; <start frequency>; <stop frequency>; <resolution bandwidth of range>; <frequency of peak>; <absolute power in dBm of peak>; <relative power in dBc of peak>; (related to the channel power) <distance to the limit line in dB>; (positive value means above the limit) <limit fail (pass = 0, fail =1)>;
2;2515000;12750000;30000;13257632500;-43.8447 22747802734;-0.33028793334960938;49.66971206 66650391;FAIL;	

## 10.4.4 Time domain power measurement

The Time Domain Power measurement determines the power of a signal in the time domain.

A time domain power measurement is only possible for zero span.

- [About the measurement](#)..... 360
- [Time domain power results](#)..... 360
- [Time domain power basics - range definition using limit lines](#)..... 361
- [Time domain power configuration](#)..... 362
- [How to measure powers in the time domain](#)..... 363

### 10.4.4.1 About the measurement

Using the Time Domain Power measurement function, the R&S VSE determines the power of the signal in zero span by summing up the power at the individual measurement points and dividing the result by the number of measurement points. Thus it is possible to measure the power of TDMA signals during transmission, for example, or during the muting phase. Both the mean power and the RMS power can be measured.

For this measurement, the sample detector is recommended. The sample detector is activated automatically if the detector is in auto mode.

### 10.4.4.2 Time domain power results

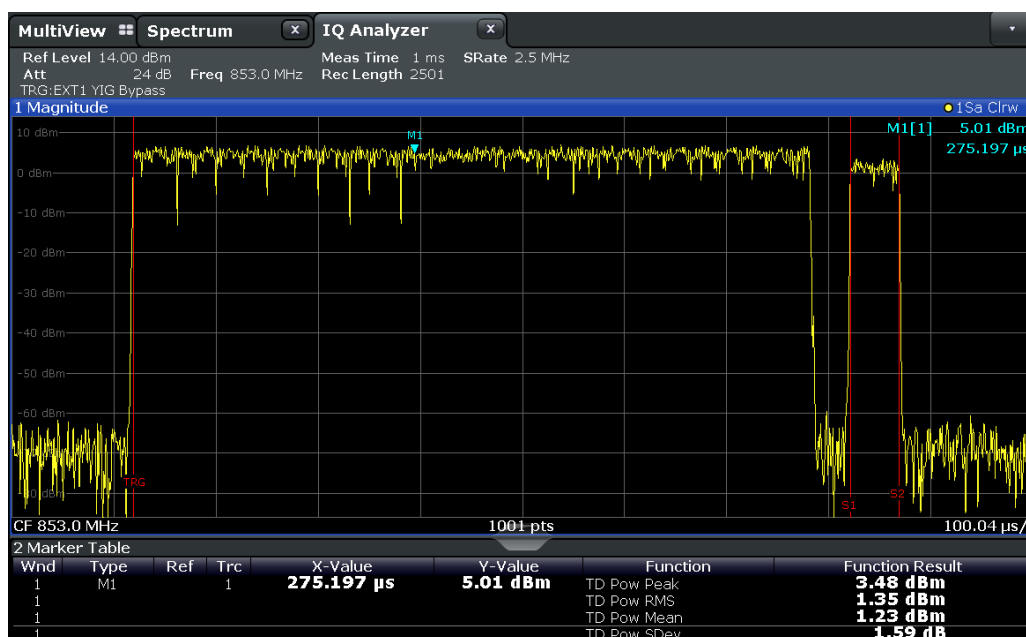
Several different power results can be determined simultaneously:

Mode	Description
Peak	Peak value from the points of the displayed trace or a segment thereof.
RMS	RMS value from the points of the displayed trace or a segment thereof.



Mode	Description
Mean	Mean value from the points of the displayed trace or a segment thereof. The linear mean value of the equivalent voltages is calculated.  For example to measure the mean power during a GSM burst
Std Dev	The standard deviation of the measurement points from the mean value.

The result is displayed in the marker results, indicated by "Power" and the selected power mode, e.g. "RMS" . The measured values are updated after each sweep or averaged over a user-defined number of sweeps (trace averaging).



The results can also be queried using the remote commands described in [Chapter 13.6.3.4, "Measuring the time domain power"](#), on page 778.

#### 10.4.4.3 Time domain power basics - range definition using limit lines

The range of the measured signal to be evaluated for the power measurement can be restricted using limit lines. The left and right limit lines (S1, S2) define the evaluation range and are indicated by vertical red lines in the diagram. If activated, the power results are only calculated from the levels within the limit lines.

For example, if both the on and off phase of a burst signal are displayed, the measurement range can be limited to the transmission or to the muting phase. The ratio between signal and noise power of a TDMA signal for instance can be measured by using a measurement as a reference value and then varying the measurement range.



In order to get stable measurement results for a limited evaluation range, usually a trigger is required.

#### 10.4.4.4 Time domain power configuration

**Time Domain Power**
X

Results

Peak	On	Off
RMS	On	Off
Mean	On	Off
Std Dev	On	Off

Limits

State	On	Off
Left	-----	
Right	-----	

The remote commands required to perform these tasks are described in [Chapter 13.6.3.4, "Measuring the time domain power"](#), on page 778.

Results .....	362
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Left Limit / Right Limit .....	363

#### Results

Activates the power results to be evaluated from the displayed trace or a limited area of the trace.

"Peak"	Peak power over several measurements (uses trace averaging, Max Hold)
"RMS"	RMS value from the points of the displayed trace or a segment thereof.

"Mean"	Mean value from the points of the displayed trace or a segment thereof. The linear mean value of the equivalent voltages is calculated.
"Std Dev"	The standard deviation of the measurement points from the mean value. The measurement of the mean power is automatically switched on at the same time.

Remote command:

[CALCulate<n>:MARKer<m>:FUNCTION:SUMMARY:PPEak\[:STATE\]](#) on page 780

[CALCulate<n>:MARKer<m>:FUNCTION:SUMMARY:PPEak:RESULT?](#) on page 783

[CALCulate<n>:MARKer<m>:FUNCTION:SUMMARY:RMS\[:STATE\]](#) on page 780

[CALCulate<n>:MARKer<m>:FUNCTION:SUMMARY:RMS:RESULT?](#) on page 784

[CALCulate<n>:MARKer<m>:FUNCTION:SUMMARY:MEAN\[:STATE\]](#) on page 780

[CALCulate<n>:MARKer<m>:FUNCTION:SUMMARY:MEAN:RESULT?](#) on page 782

### Limit State

Switches the limitation of the evaluation range on or off. Default setting is off.

If deactivated, the entire sweep time is evaluated. If switched on, the evaluation range is defined by the left and right limit. If only one limit is set, it corresponds to the left limit and the right limit is defined by the stop frequency. If the second limit is also set, it defines the right limit.

Remote command:

[CALCulate<n>:MARKer<m>:X:SLIMITS\[:STATE\]](#) on page 829

### Left Limit / Right Limit

Defines a power level limit for line S1 (left) or S2 (right).

Remote command:

[CALCulate<n>:MARKer<m>:X:SLIMITS:LEFT](#) on page 829

[CALCulate<n>:MARKer<m>:X:SLIMITS:RIGHT](#) on page 830

## 10.4.4.5 How to measure powers in the time domain

The step-by-step procedure to measure powers in the time domain is described here in detail.

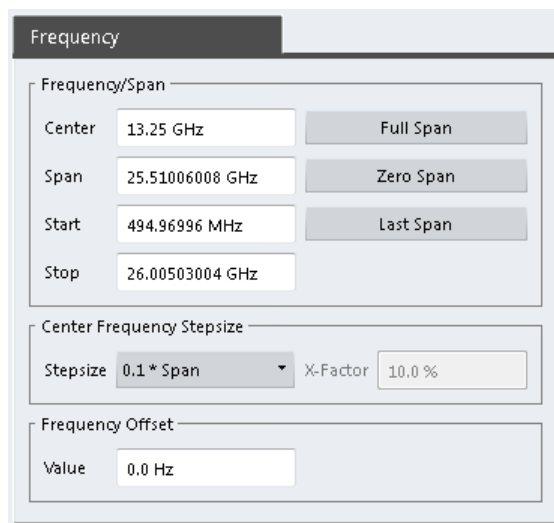
### To measure the power in the time domain

1. Select a result window in the time domain, for example a "Magnitude" window.
2. Select [MARK FUNC].
3. From the "Select Marker Function" dialog box, select the "Time Domain Power" function.
4. Select the type of power measurement results to be determined by selecting the corresponding softkeys.
5. To restrict the power evaluation range, define limits:

- a) Select "Time Dom Power Config" to display the "Time Domain Power" configuration dialog box.
  - b) Switch on the limits by setting the "Limit State" to "On" .  
The limit lines S1 and S2 are displayed.
  - c) Define the left limit (limit line S1), the right limit (S2), or both.
6. Start a sweep.  
The measured powers are displayed in the marker results.

### 10.4.5 Frequency and span settings

Access: "Overview" > "Frequency"



Center Frequency ..... 364

Span ..... 365

Start / Stop ..... 365

Full Span ..... 365

Zero Span ..... 365

Last Span ..... 365

Center Frequency Stepsize ..... 366

Frequency Offset ..... 366

#### Center Frequency

Defines the center frequency of the signal in Hertz.

$$0 \text{ Hz} \leq f_{\text{center}} \leq f_{\text{max}}$$

$f_{\text{max}}$  and  $\text{span}_{\text{min}}$  depend on the instrument and are specified in the data sheet.

**Note:** For file input, you can shift the center frequency of the current measurement compared to the stored measurement data. The maximum shift depends on the sample rate of the file data.

$$CF_{\text{shiftmax}} = CF_{\text{file}} \pm \frac{SR_{\text{file}}}{2}$$

If the file does not provide the center frequency, it is assumed to be 0 Hz.

To ensure that the input data remains within the valid analysis bandwidth, define the center frequency and the analysis bandwidth for the measurement such that the following applies:

$$CF + \frac{ABW_{channel}}{2} > CF_{file} + \frac{ABW_{file}}{2}$$

$$CF - \frac{ABW_{channel}}{2} > CF_{file} - \frac{ABW_{file}}{2}$$

Remote command:

[\[SENSe<ip>:\]FREQuency:CENTer](#) on page 661

### Span

Defines the frequency span. The center frequency is kept constant. The following range is allowed:

span = 0: 0 Hz

span >0:

$$\text{span}_{\min} \leq f_{\text{span}} \leq f_{\max}$$

$f_{\max}$  and  $\text{span}_{\min}$  are specified in the data sheet.

Remote command:

[\[SENSe:\]FREQuency:SPAN](#) on page 788

### Start / Stop

Defines the start and stop frequencies.

Remote command:

[\[SENSe<ip>:\]FREQuency:START](#) on page 788

[\[SENSe<ip>:\]FREQuency:STOP](#) on page 789

### Full Span

Sets the span to the full frequency range of the R&S VSE specified in the data sheet. This setting is useful for overview measurements.

Remote command:

[\[SENSe<ip>:\]FREQuency:SPAN:FULL](#) on page 788

### Zero Span

Sets the span to 0 Hz (zero span). The x-axis becomes the time axis with the grid lines corresponding to 1/10 of the current sweep time ("SWT").

Remote command:

FREQ:SPAN 0Hz, see [\[SENSe:\]FREQuency:SPAN](#) on page 788

### Last Span

Sets the span to the previous value. With this function you can switch between an overview measurement and a detailed measurement quickly.

Remote command:

[\[SENSe:\]FREQuency:SPAN](#) on page 788

### Center Frequency Stepsize

Defines the step size by which the center frequency is increased or decreased when the arrow keys are pressed. When you use the rotary knob the center frequency changes in much smaller steps (1/10 the size as for the arrow keys).

The step size can be coupled to the span (span > 0) or the resolution bandwidth (span = 0), or it can be manually set to a fixed value.

"0.1 \* Span" /  
"0.1 \* RBW"      Sets the step size for the center frequency to 10 % of the span / RBW.

This is the default setting.

"0.5 \* Span" /  
"0.5 \* RBW"      Sets the step size for the center frequency to 50 % of the span / RBW.

"x \* Span" /  
"x \* RBW"      Sets the step size for the center frequency to a manually defined factor of the span / RBW. The "X-Factor" defines the percentage of the span / RBW.

Values between 1 and 100 % in steps of 1 % are allowed. The default setting is 10 %.

"= Center"      Sets the step size to the value of the center frequency and removes the coupling of the step size to span or resolution bandwidth. The used value is indicated in the "Value" field.

"= Marker"      This setting is only available if a marker is active.  
Sets the step size to the value of the current marker and removes the coupling of the step size to span or resolution bandwidth. The used value is indicated in the "Value" field.

"Manual"      Defines a fixed step size for the center frequency. Enter the step size in the "Value" field.

Remote command:

[\[SENSe:\] FREQuency:CENTer:STEP:LINK](#) on page 787

[\[SENSe:\] FREQuency:CENTer:STEP:LINK:FACTor](#) on page 787

[\[SENSe:\] FREQuency:CENTer:STEP](#) on page 662

### Frequency Offset

Shifts the displayed frequency range along the x-axis by the defined offset.

This parameter has no effect on the instrument's hardware, on the captured data, or on data processing. It is simply a manipulation of the final results in which absolute frequency values are displayed. Thus, the x-axis of a spectrum display is shifted by a constant offset if it shows absolute frequencies. However, if it shows frequencies relative to the signal's center frequency, it is not shifted.

A frequency offset can be used to correct the display of a signal that is slightly distorted by the measurement setup, for example.

The allowed values range from -1 THz to 1 THz. The default setting is 0 Hz.

Remote command:

[\[SENSe<ip>:\] FREQuency:OFFSet](#) on page 662

## 10.4.6 Bandwidth, filter and capture configuration

The basic bandwidth, filter and capture settings that apply to most measurements are described here. These parameters define how the data is measured: how much data is collected internally and which filters are used.

- [Impact of the bandwidth, filter and capture settings](#).....367
- [Bandwidth, filter and capture settings](#)..... 372

### 10.4.6.1 Impact of the bandwidth, filter and capture settings

The bandwidth, filter and capture settings are closely related and interdependent. The values available for resolution bandwidth and video bandwidth depend on the selected filter type. In addition, these settings have an impact on other measurement parameters. The following equation shows the interdependency of these settings:

$$T_{\text{MIN}} = K \cdot \text{Span} / \text{RBW}^2$$

where K = Filter constant

By default, a Gaussian filter is used. The resolution bandwidth, the video bandwidth and the "Meas Time" are set automatically according to the set span, and default coupling is used. Thus, the following settings are applied:

$$\text{RBW} = \text{Span} / 100$$

$$\text{VBW} = \text{RBW}$$

$$\text{"Meas Time"} = T_{\text{min}} \text{ for set Span, RBW, VBW}$$

When defining the bandwidth and filter settings, consider the impact of the individual settings on the other settings and the measurement result, as described in more detail in the following sections.

- [Separating signals by selecting an appropriate resolution bandwidth](#)..... 367
- [Smoothing the trace using the video bandwidth](#)..... 368
- [Coupling VBW and RBW](#)..... 369
- [Coupling span and RBW](#).....369
- [How data is measured: the capture type](#).....369
- [Which data may pass: filter types](#)..... 371
- [How long the data is measured: Meas Time](#) .....371
- [How much data is measured: capture points and capture count](#)..... 371
- [How often data is measured: capture mode](#)..... 372

#### Separating signals by selecting an appropriate resolution bandwidth

The resolution bandwidth defines the 3 dB bandwidth of the resolution filter to be used. An RF sinusoidal signal is displayed according to the passband characteristic of the resolution filter (RBW), i.e. the signal display reflects the shape of the filter.

A basic feature of a signal analyzer is being able to separate the spectral components of a mixture of signals. The resolution at which the individual components can be separated is determined by the resolution bandwidth. Selecting a resolution bandwidth that is too large may make it impossible to distinguish between spectral components, i.e.

they are displayed as a single component. Smaller resolution bandwidths, however, increase the required "Meas Time" .

Two signals with the same amplitude can be resolved if the resolution bandwidth is smaller than or equal to the frequency spacing of the signal. If the resolution bandwidth is equal to the frequency spacing, the spectrum display screen shows a level drop of 3 dB precisely in the center of the two signals. Decreasing the resolution bandwidth makes the level drop larger, which thus makes the individual signals clearer.

The highest sensitivity is obtained at the smallest bandwidth (1 Hz). If the bandwidth is increased, the reduction in sensitivity is proportional to the change in bandwidth. Increasing the bandwidth by a factor of 3 increases the displayed noise by approx. 5 dB (4.77 dB precisely). If the bandwidth is increased by a factor of 10, the displayed noise increases by a factor of 10, i.e. 10 dB.

If there are large level differences between signals, the resolution is determined by selectivity as well as by the resolution bandwidth that has been selected. The measure of selectivity used for signal analyzers is the ratio of the 60 dB bandwidth to the 3 dB bandwidth (= shape factor).

For the R&S VSE, the shape factor for bandwidths is < 5, i.e. the 60 dB bandwidth of the 30 kHz filter is <150 kHz.

The higher spectral resolution with smaller bandwidths is won by longer sweep times for the same span. The sweep time has to allow the resolution filters to settle during a capture at all signal levels and frequencies to be displayed.

If the RBW is too large, signal parts that are very far away (e.g. from a different signal) are considered in the measurement and distort the results. The noise increases.

If the RBW is too small, parts of the signal are lost. As the displayed signal always reflects the shape of the filter, select a bandwidth large enough so the displayed signal reflects the entire shape of the filter.

### Smoothing the trace using the video bandwidth

The video filters are responsible for smoothing the displayed trace. Using video bandwidths that are small compared to the resolution bandwidth, only the signal average is displayed and noise peaks and pulsed signals are repressed. If pulsed signals are to be measured, it is advisable to use a video bandwidth that is large compared to the resolution bandwidth ( $VBW = 10 \times RBW$ ) for the amplitudes of pulses to be measured correctly.

The level of a sine wave signal is not influenced by the video bandwidth. A sine wave signal can therefore be freed from noise by using a video bandwidth that is small compared with the resolution bandwidth, and thus be measured more accurately.





### RMS/Average detector and VBW

If an RMS detector is used, the video bandwidth in the hardware is bypassed. Thus, duplicate trace averaging with small VBWs and RMS or average detector no longer occurs. However, the VBW is still considered when calculating the "Meas Time". This leads to a longer "Meas Time" for small VBW values. Thus, you can reduce the VBW value to achieve more stable trace curves even when using an RMS detector. Normally, if the RMS detector is used, the "Meas Time" should be increased to get more stable traces.

If an average detector is used, the video bandwidth in the hardware is only bypassed if the video filter is set to "Auto" mode. Use this mode to avoid duplicate trace averaging with small VBWs.

### Coupling VBW and RBW

The video bandwidth can be coupled to the resolution bandwidth automatically. In this case, if the resolution bandwidth is changed, the video bandwidth is automatically adjusted.

Coupling is recommended if a minimum "Meas Time" is required for a selected resolution bandwidth. Narrow video bandwidths require longer "Meas Time" s due to the longer settling time. Wide bandwidths reduce the signal/noise ratio.

**Table 10-9: Overview of RBW/VBW ratios and recommendations for use**

Ratio RBW/VBW	Recommendation for use
1/1	Recommended for sinusoidal signals This is the default setting for automatic coupling.
0.1	Recommended when the amplitudes of pulsed signals are to be measured correctly. The IF filter is exclusively responsible for the pulse shape. No additional evaluation is performed by the video filter.
10	Recommended to suppress noise and pulsed signals in the video domain.
Manually set (0.001 to 1000)	Recommended for other measurement requirements

### Coupling span and RBW

The resolution bandwidth can be coupled to the span setting, either by a manually defined factor or automatically. If the span is changed, the resolution bandwidth is automatically adjusted. The automatic coupling adapts the resolution bandwidth to the currently set frequency span/100.

With a span/RBW ratio of 100 and a screen resolution of 1000 pixels, each frequency in the spectrum is displayed by 10 pixels. A span/RBW ratio of 1000 provides the highest resolution.

### How data is measured: the capture type

In a standard analog **frequency sweep**, the local oscillator of the analyzer sweeps the applied signal quasi analog from the start to the stop frequency to determine the frequency spectrum.

Alternatively, the analyzer can sample signal levels over time at a defined frequency and transform the data to a spectrum by Fast Fourier Transformation (**FFT**). Although this measurement method requires additional calculations, it can provide results much faster than the frequency sweep, in particular for small RBWs.

Which sweep mode is appropriate for the current measurement depends on the span, RBW, VBW and "Meas Time" settings. By default ("Auto" capture type), the R&S VSE automatically uses the capture type with the highest capture rate depending on these measurement settings.

### Optimization

In FFT mode, FFT analysis is performed to determine a spectrum of frequencies. Several analysis steps are required to cover the entire span. The subspan which is covered by one FFT analysis depends on the RBW. The subspan cannot be defined directly, but it can be optimized according to measurement requirements.

Narrow subspans provide a higher dynamic range, and also allow you to perform measurements near a carrier with a reduced reference level. With a wide subspan, the carrier and the useful signal are likely to be measured at the same time, in which case the powers of both signals are summarized, so the reference level must be high enough to consider this factor. With a narrow subspan, this is less likely to happen, so the reference level can be reduced.

On the other hand, the narrower the subspan, the more steps are required to cover the entire span, thus increasing analysis and calculation time. To **optimize the capture rate**, the widest possible subspan (depending on the RBW) is used.



For an optimal capture rate, it is recommended that you set the "Meas Time" to "Auto" , as well.

For general purpose measurements, an "Auto" mode is available, which provides a **compromise between a large dynamic range and a fast capture**. In this case, a medium-sized subspan is used.



### FFT mode and external mixers (R&S VSE-B21)

The subspan optimization modes "Dynamic" and "Auto" include automatic suppression of unwanted mixing products. Thus, when using external mixers (R&S VSE-B21), use the "Speed" mode to obtain similar results in FFT mode as in normal sweep mode.

### Optimization for zero span sweeps

For normal sweeps in the time domain (zero span), the optimization mode determines the selection of the A/D converter prefilter, which depends on the RBW.

In "**Dynamic**" mode, the narrowest possible prefilter is used.

In "**Speed**" mode, the widest possible prefilter is used.

In "**Auto**" mode, a medium-sized prefilter is used.

### Which data may pass: filter types

While the filter is irrelevant when measuring individual narrowband signals (as long as the signal remains within the RBW), the measurement result for broadband signals is very dependant on the selected filter type and its shape. If the filter is too narrow, the signal is distorted by the filter. If the filter is too wide, multiple signals can no longer be distinguished. Generally, the smaller the filter width and the steeper its edges, the longer the settling time and thus the longer the "Meas Time" must be.

All resolution bandwidths are realized with digital filters. Normal (3dB) Gaussian filters are set by default. Some communication standards require different filters.

For a list of available filter types, see the data sheet.

### Normal (3 dB) Gaussian filters

Gaussian filters provide a good compromise between steep edges and a short settling time. This filter is suitable for most measurement tasks and is used by default.

The available Gaussian (3 dB) filters are listed in the R&S VSE data sheet.

### Channel filters

Channel filters are fairly steep but require a long settling time; they are useful for pulse measurements in the time domain.

### How long the data is measured: Meas Time

Each filter has a settling time that must be awaited in order to obtain correct results. Since the resolution bandwidth and video bandwidth define the filter, the smaller of the two determines the minimum "Meas Time" required for the measurement. Allowed values depend on the ratio of span to RBW and RBW to VBW.

If the selected "Meas Time" is too short for the selected bandwidth and span, level measurement errors will occur. In this case, the R&S VSE displays the error message "Sweep time too low" and marks the indicated "Meas Time" with a red bullet. Furthermore, a status bit indicates an error.

(For more information see "[STATus:QUESTIONable:TIME register](#)" on page 486.)

The "Meas Time" can be coupled to the span (not zero span), video bandwidth (VBW) and resolution bandwidth (RBW) automatically. If the span, resolution bandwidth or video bandwidth is changed, the "Meas Time" is automatically adjusted.



Note that the "Meas Time" only indicates how long data is captured; the time required to process the captured data may be considerably longer, in particular for FFT mode. For FFT mode, an estimated duration is indicated behind the "Meas Time" in the channel bar (for RF measurements only).

### How much data is measured: capture points and capture count

By default, 1001 data points are determined in a single capture. During the next capture, 1001 new data points are collected, and so on. The number of **capture points** defines how much of the entire span is covered by a single data point. By increasing the number of capture points you can increase the reliability of the individual data

points and thus the accuracy of the analyzed results. However, these data points are all stored on the instrument, occupying a large amount of memory, and each capture point increases the overall measurement time.

The number of captures to be performed in single capture mode is defined by the "Capture Count". Values from 0 to 200000 are allowed. If the values 0 or 1 are set, one capture is performed. The capture count is applied to all the traces in a diagram.

If the trace configurations "Average", "Max Hold" or "Min Hold" are set, the "Capture Count" also determines the number of averaging or maximum search procedures (see ["Analyzing several traces - trace mode"](#) on page 383).

For details on how the number of capture points and the capture count affect the trace results on the screen, see ["Mapping samples to measurement points with the trace detector"](#) on page 378.

#### **How often data is measured: capture mode**

How often the spectrum is swept depends on the capture mode. Either a certain number of captures can be defined ("Capture Count") which are performed in "Single Sweep" mode, or the capture is repeated continuously ("Continuous Sweep" mode).

By default, the data is collected for the specified number of captures and the corresponding trace is displayed. When the next capture is started, the previous trace is deleted.

However, the data from a single capture run can also be retained and displayed together with the new data ("Continue Single Sweep" mode). This is particularly of interest when using the trace configurations "Average" or "Max Hold" to take previously recorded measurements into account for averaging/maximum search (see ["Analyzing several traces - trace mode"](#) on page 383).

#### **10.4.6.2 Bandwidth, filter and capture settings**

**Access:** "Overview" > "Bandwidth"

The remote commands required to define these settings are described in [Chapter 13.6.3.6, "Configuring bandwidth and sweep settings"](#), on page 789.

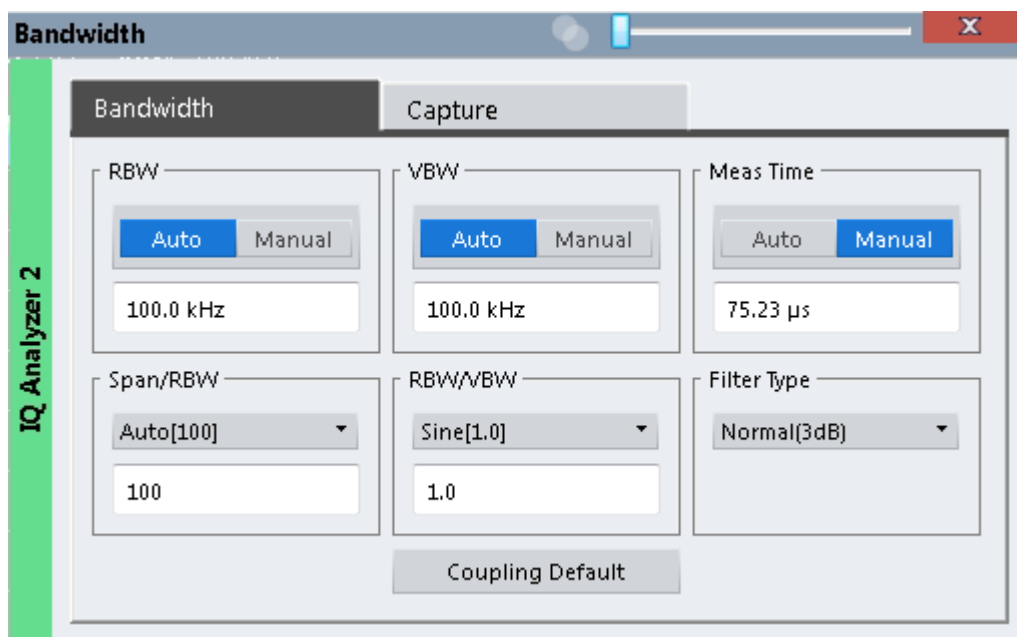


Figure 10-42: Bandwidth dialog box for RF measurements

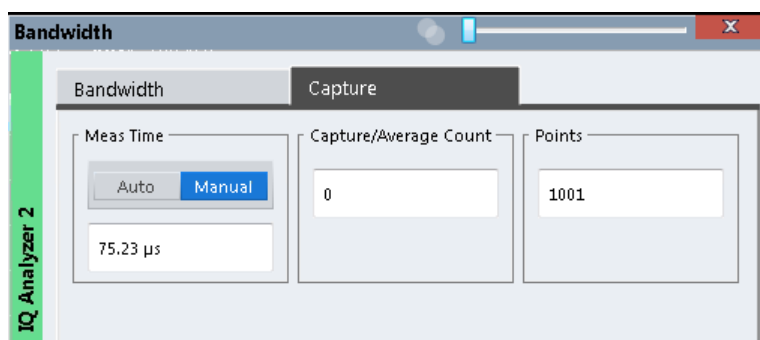


Figure 10-43: Capture dialog box for RF measurements

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**RBW**

Defines the resolution bandwidth. The available resolution bandwidths are specified in the data sheet. Numeric input is always rounded to the nearest possible bandwidth.

If "Auto" is selected, the resolution bandwidth is coupled to the selected span (for span > 0). If the span is changed, the resolution bandwidth is automatically adjusted.

If the resolution bandwidth is defined manually, a green bullet is displayed next to the "RBW" display in the channel bar.

For a list of supported filters, see the data sheet.

For more information see ["Separating signals by selecting an appropriate resolution bandwidth"](#) on page 367.

Remote command:

`[SENSe:]BANDwidth[:RESolution]` on page 789

`[SENSe<ip>:]BANDwidth[:RESolution]:AUTO` on page 790

### VBW

Defines the video bandwidth automatically or manually.

For more information see ["Smoothing the trace using the video bandwidth"](#) on page 368.

"Auto" The video bandwidth is coupled to the resolution bandwidth. If the resolution bandwidth is changed, the video bandwidth is automatically adjusted.

"Manual" For manual mode, define the bandwidth value. The available video bandwidths are specified in the data sheet. Numeric input is always rounded to the nearest possible bandwidth. If the video bandwidth is defined manually, a green bullet is displayed next to the "VBW" display in the channel bar.

Remote command:

`[SENSe<ip>:]BANDwidth:VIDeo:AUTO` on page 791

`[SENSe<ip>:]BANDwidth:VIDeo` on page 791

`[SENSe<ip>:]BANDwidth:VIDeo:TYPE` on page 792

### Meas Time

Defines the duration of a single capture, during which the defined number of capture points are measured. The "Meas Time" can be defined automatically or manually.

The allowed "Meas Time" depends on the device model; refer to the data sheet.

For more information see ["How long the data is measured: Meas Time"](#) on page 371.

**Note:** The "Meas Time" only indicates how long data is captured; the time required to process the captured data may be considerably longer, in particular for FFT mode. For FFT mode, an estimated duration is indicated behind the "Meas Time" in the channel bar (for RF measurements only).

"Auto" The "Meas Time" is coupled to the span (not zero span), video bandwidth (VBW) and resolution bandwidth (RBW). If the span, resolution bandwidth or video bandwidth is changed, the "Meas Time" is automatically adjusted.

"Manual" For manual mode, define the "Meas Time". Allowed values depend on the ratio of span to RBW and RBW to VBW. For details refer to the data sheet. Numeric input is always rounded to the nearest possible "Meas Time".

Remote command:

[SENSe:] SWEep:TIME:AUTO on page 794

[SENSe:] SWEep:TIME on page 678

[SENSe:] SWEep:DURation? on page 792

### Span/RBW

Sets the coupling ratio if **RBW** is set to auto mode.

For more information see "[Coupling span and RBW](#)" on page 369.

"Auto[100]"	"Resolution Bandwidth" = "Span/100" This coupling ratio is the default setting of the R&S VSE.
"Manual"	The coupling ratio is defined manually. The span/resolution bandwidth ratio can be set in the range from 1 to 10000.

Remote command:

[SENSe:] BANDwidth[:RESolution]:RATio on page 790

### RBW/VBW

Sets the coupling ratio between the resolution bandwidth and the video bandwidth.

This setting is only effective if **VBW** is set to auto mode.

For more information see "[Coupling VBW and RBW](#)" on page 369.

"Sine[1/1]"	"Video Bandwidth" = "Resolution Bandwidth" This is the default setting for the coupling ratio RBW/VBW and is recommended if sinusoidal signals are to be measured.
"Pulse[0.1]"	"Video Bandwidth" = 10 x "Resolution Bandwidth" or "Video Bandwidth" = "10 MHz" (= max. VBW) Recommended for pulse signals
"Noise[10]"	"Video Bandwidth" = "Resolution Bandwidth/10" Recommended for noise measurements
"Manual"	The coupling ratio is defined manually. The RBW/VBW ratio can be set in the range of 0.001 to 1000.

Remote command:

[SENSe<ip>:] BANDwidth:VIDeo:AUTO on page 791

[SENSe<ip>:] BANDwidth:VIDeo:RATio on page 791

### Filter Type

Defines the filter type.

The following filter types are available:

- Normal (3dB)
- Channel
- RRC (not available for capture type "FFT" )
- 5-Pole (not available for capture type "FFT" )

For more information, see "[Which data may pass: filter types](#)" on page 371.

Remote command:

[SENSe:] BANDwidth[:RESolution]:TYPE on page 790

### Default Coupling

Sets all coupled functions to the default state ("Auto" ). In addition, the ratio "RBW/VBW" is set to "Sine[1/1]" and the ratio "Span/RBW" to 100.

For more information see ["Coupling VBW and RBW"](#) on page 369.

Remote command:

[\[SENSe<ip>:\]BANDwidth\[:RESolution\]:AUTO](#) on page 790

[\[SENSe<ip>:\]BANDwidth:VIDeo:AUTO](#) on page 791

[\[SENSe:\]SWEep:TIME:AUTO](#) on page 794

### Capture Count

Defines the number of measurements to be performed in the single capture mode. Values from 0 to 200000 are allowed. If the values 0 or 1 are set, one measurement is performed.

The capture count is applied to all the traces in all diagrams.

If the trace modes "Average" , "Max Hold" or "Min Hold" are set, this value also determines the number of averaging or maximum search procedures.

In continuous capture mode, if "Capture Count" = 0 (default), averaging is performed over 10 measurements. For "Capture Count" =1, no averaging, maxhold or minhold operations are performed.

For more information, see ["How much data is measured: capture points and capture count"](#) on page 371.

Remote command:

[\[SENSe:\]SWEep:COUNT](#) on page 678

[\[SENSe:\]AVERage<n>:COUNT](#) on page 800

### Capture Points

Defines the number of measured values to be collected during one capture.

For details see ["How much data is measured: capture points and capture count"](#) on page 371.

Remote command:

[\[SENSe:\]SWEep\[:WINDow<n>\]:POINTs](#) on page 678

### Optimization

In FFT mode, several FFT analysis steps are required to cover the entire measurement span. The span which is covered by one FFT analysis step is called *subspan*. The sub-span cannot be defined directly, but it can be optimized according to measurement requirements.



**Table 10-10: Optimization parameters in FFT mode**

Optimization mode	Description
"Dynamic"	Optimizes the dynamic range by using the narrowest possible subspan (depending on the RBW).
"Speed"	Optimizes the capture rate by using the widest possible subspan (depending on the RBW). It is recommended that you set the <a href="#">Meas Time</a> to "Auto" to optimize the capture rate.
"Auto"	Uses a medium-sized subspan to obtain a compromise between a large dynamic range and a fast capture rate.

**Note: FFT mode and external mixers (R&S VSE-B21)**

The subspan optimization modes "Dynamic" and "Auto" include automatic suppression of unwanted mixing products. Thus, when using external mixers (R&S VSE-B21), use the "Speed" mode to obtain similar results in FFT mode as in frequency sweep mode.

**Zero span mode**

For zero span measurements, the optimization mode defines the selection of the A/D converter prefilter.

**Table 10-11: Optimization parameters in zero span mode**

Optimization mode	Description
Dynamic	The narrowest filter possible (depending on the RBW) is used.
Speed	The widest filter possible (depending on the RBW) is used.
Auto	A medium-sized prefilter is used.

Remote command:

[\[SENSe:\]SWEep:OPTimize](#) on page 793

**Single Sweep / Run Single**

After triggering, starts the number of sweeps set in "Capture Count". The measurement stops after the defined number of sweeps has been performed.

While the measurement is running, "Single Sweep" and [RUN SINGLE] are highlighted. The running measurement can be aborted by selecting the highlighted softkey or key again.

Remote command:

[INITiate<n>\[:IMMediate\]](#) on page 548

**Continuous Sweep / Run Cont**

After triggering, starts the sweep and repeats it continuously until stopped. This is the default setting.

While the measurement is running, "Continuous Sweep" and [RUN CONT] are highlighted. The running measurement can be aborted by selecting the highlighted softkey or key again. The results are not deleted until a new measurement is started.

Remote command:

[INITiate<n>:CONTinuous](#) on page 547

## 10.5 Analysis

General result analysis settings concerning the trace, markers, lines etc..

- [Trace configuration](#)..... 378
- [Marker usage](#)..... 411
- [Zoomed displays](#)..... 443
- [Display and limit lines](#)..... 449

### 10.5.1 Trace configuration

A trace is a collection of measured data points. The trace settings determine how the measured data is analyzed and displayed on the screen.

- [Basics on setting up traces](#)..... 378
- [Trace configuration](#)..... 393
- [Trace / data export configuration](#)..... 403
- [How to configure traces](#)..... 406

#### 10.5.1.1 Basics on setting up traces

Some background knowledge on traces is provided here for a better understanding of the required configuration settings.

- [Mapping samples to measurement points with the trace detector](#)..... 378
- [Analyzing several traces - trace mode](#)..... 383
- [How many traces are averaged - capture count + Measurement mode](#)..... 384
- [X-value of the measurement point](#)..... 385
- [How trace data is averaged - the averaging mode](#)..... 386
- [Working with spectrograms](#)..... 387

#### **Mapping samples to measurement points with the trace detector**

A trace displays the values measured at the measurement points (also known as sweep points in some applications). However, the number of samples taken during a measurement can be much larger than the number of measurement points that are displayed in the measurement trace.

**Example:**

Assume the following measurement parameters:

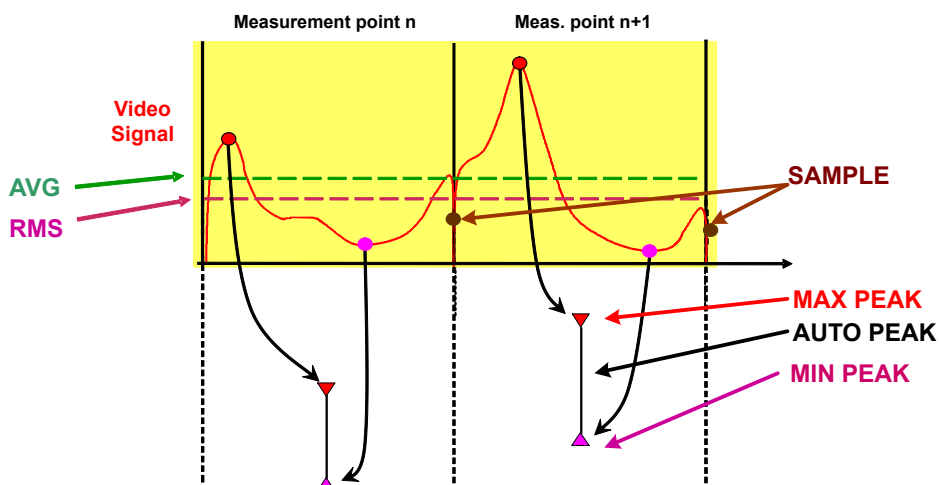
- Sample rate: 32 MSamples / s
- Measurement points: 1000
- Measurement time: 100 ms
- Span: 5 GHz

During a single measurement,  $3.2 \cdot 10^6$  samples are collected and distributed to 1000 measurement points, i.e. 3200 samples are collected per measurement point. For each measurement point, the measured data for a frequency span of 5 MHz ( $\text{span}/\langle \text{measurement points} \rangle$ ) is analyzed.

Note that if you increase the number of measurement points, the frequency span analyzed for each point in the trace decreases, making the trace more reliable. The analyzed results become more accurate. On the other hand, for detectors that average the samples within the span, the trace becomes less stable because fewer samples are averaged.

Obviously, the data must be reduced to determine which of the samples are displayed for each measurement point. This is the trace detector's task. The trace detector can analyze the measured data using various methods.

The result obtained from the selected detector for a measurement point is displayed as the value at this frequency point in the trace.



You can define the trace detector to be used for the individual traces manually, or the R&S VSE can select the appropriate detector automatically.

The detectors of the R&S VSE are implemented as pure digital devices. All detectors work in parallel in the background, which means that the measurement speed is independent of the detector combination used for different traces.

However, you should select a measurement time that is sufficient for the detector that requires the longest measurement time.

### Auto detector

If the R&S VSE is set to define the appropriate detector automatically, the detector is set depending on the selected trace mode and average mode:

Trace mode	Detector
"Clear Write"	Auto peak
"Max Hold"	Positive peak
"Min Hold"	Negative peak
"Average"	Sample peak (for average mode "Power": RMS)
"View"	–
"Blank"	–



The detector activated for the specific trace is indicated in the corresponding trace information by an abbreviation. Not all detector types are supported by all applications available for the R&S VSE.

**Table 10-12: Detector types**

Detector	Abbrev.
Positive peak	"Pk"
Negative peak	"Mi"
Auto peak	"Ap"
RMS	"Rm"
Average	"Av"

### Measurement time

The measurement time defines how long the R&S VSE measures the signal at the individual frequencies. Each detector needs a different period of time to fully charge and discharge; the individual requirements on the measurement time are described for each detector.

- [Positive peak \(max peak\) and negative peak \(min peak\) detector](#)..... 380
- [Auto peak detector](#)..... 381
- [RMS detector](#)..... 381
- [Average detector](#)..... 382
- [Sample detector](#)..... 383

### Positive peak (max peak) and negative peak (min peak) detector

The positive (maximum) detector determines the largest of all positive peak values measured at the individual measurement points which are combined in one sample point.

The negative (minimum) peak detector determines the smallest of all negative peak values measured at the individual measurement points which are combined in one sample point.

Tips regarding measurement time:

- For unmodulated signals, you can use the shortest possible measurement time.
- For pulsed signals, measurement time must be longer than the expected pulse length, that is: it must cover at least one pulse.

### Auto peak detector

The auto peak detector combines the "Positive peak (max peak) and negative peak (min peak) detector" on page 380. The maximum and the minimum values determined for each sample point are displayed.

Available in the spectrum application, but not for the Spectrum Emission Mask measurement.

### RMS detector

The RMS detector calculates the root mean square of all samples combined in a measurement point. The whole IF envelope is used to calculate the power for each measurement point. The IF envelope is digitized using a sample rate which is at least five times the selected resolution bandwidth. Based on the sample values, the power is calculated for each measurement point using the following formula:

$$P_{RMS} = \frac{U_{RMS}^2}{R} = \frac{\left( \sqrt{\frac{1}{N} * \sum_{i=1}^N s_i} \right)^2}{R} = \frac{1}{N * R} * \sum_{i=1}^N s_i^2$$

Where:

- $P_{RMS}$  = power represented by a measurement point
- $N$  = number of A/D converter values (samples) per measurement point
- $R$  = electrical impedance
- $s_i$  = linear digitized video voltage at the output of the A/D converter

For logarithmic scaling, after the power has been calculated, the power units are converted into decibels and the value is displayed as a measurement point.

$$P(dBm) = 30dBm + 10 \cdot \log_{10} \cdot P_{RMS} = 30dBm + 10 \cdot \log_{10} \left( \frac{1}{N * R} * \sum_{i=1}^N s_i^2 \right)$$

Where:

- $P$  (dB) = logarithmic power represented by a measurement point

Each measurement point thus corresponds to the root mean square of the measured values combined in the measurement point.

The RMS detector supplies the power of the signal irrespective of the waveform (CW carrier, modulated carrier, white noise or impulsive signal). Correction factors as nee-

ded for other detectors to measure the power of the different signal classes are not required.

Tips regarding measurement time:

- For unmodulated signals, you can use the shortest possible measurement time.
- For modulated signals, the measurement time must be long enough to make sure the averaging considers all variations due to the modulation characteristics of the signal.
- For pulsed signals, the measurement time must be long enough to capture a sufficient number of pulses. For averaging, a sufficient number of pulses is greater than 10.

### Average detector

The average detector calculates the linear average of all samples combined in a measurement point.

For average detection, the video voltage (envelope of IF signal) is averaged over the measurement time. Averaging is digital, i.e. the digitized values of the video voltage are summed up and divided by the number of samples at the end of the measurement time. This corresponds to a filtering with a rectangular window in the time domain and a filtering with sin x/x characteristic in the frequency domain.

To this effect, R&S VSE uses the linear voltage after envelope detection. The sampled linear values are summed up and the sum is divided by the number of samples (= linear average value). For linear display, the average value is displayed.

$$P_{Avg} = \frac{U_{Avg}^2}{R} = \frac{1}{R} * \left( \frac{1}{N} * \sum_{i=1}^N s_i \right)^2$$

Where:

- $P_{AVG}$  = power represented by a measurement point
- $N$  = number of A/D converter values per measurement point
- $R$  = electrical impedance
- $s_i$  = linear digitized video voltage at the output of the A/D converter

For logarithmic scaling, after the power has been calculated, the power units are converted into decibels, and the value is displayed as a measurement point.

$$P(dBm) = 30dBm + 10 \cdot \log_{10} \cdot P_{Avg} = 30dBm + 10 \cdot \log_{10} \left( \frac{1}{R} * \left( \frac{1}{N} * \sum_{i=1}^N s_i \right)^2 \right)$$

Where:

- $P$  (dBm) = logarithmic power represented by a measurement point

Each measurement point thus corresponds to the average of the measured values combined in the measurement point.

The average detector supplies the average value of the signal irrespective of the waveform (CW carrier, modulated carrier, white noise or impulsive signal).

Tips regarding measurement time:

- For unmodulated signals, you can use the shortest possible measurement time.
- For modulated signals, the measurement time must be long enough to make sure the averaging considers all variations due to the modulation characteristics of the signal.
- For pulsed signals, the measurement time must be long enough to capture a sufficient number of pulses. For averaging, a sufficient number of pulses is greater than 10.

### Sample detector

The sample detector selects and displays a single sample (always the first or always the last) from all samples that are combined in the measurement point. All other measured values for the sample point are ignored.

### Analyzing several traces - trace mode

If several measurements are performed one after the other, or continuous measurements are performed, the trace mode determines how the data for subsequent traces is processed. After each measurement, the trace mode determines whether:

- The data is frozen ("View")
- The data is hidden ("Blank")
- The data is replaced by new values ("Clear Write")
- The data is replaced selectively ("Max Hold", "Min Hold", "Average")



Each time you change the trace mode, the selected trace memory is cleared.

The trace mode also determines the detector type if the detector is set automatically, see ["Mapping samples to measurement points with the trace detector"](#) on page 378.

The R&S VSE supports the following trace modes:

**Table 10-13: Overview of available trace modes**

Trace Mode	Description
Blank	Hides the selected trace.
Clear Write	Overwrite mode: the trace is overwritten by each measurement. This is the default setting. All available detectors can be selected.
Max Hold	The maximum value is determined over several measurements and displayed. The R&S VSE saves the measurement result in the trace memory only if the new value is greater than the previous one. This mode is especially useful with modulated or pulsed signals. The signal spectrum is filled up upon each measurement until all signal components are detected in a kind of envelope. This mode is not available for statistics measurements.

Trace Mode	Description
Min Hold	The minimum value is determined from several measurements and displayed. The R&S VSE saves the measurement result in the trace memory only if the new value is lower than the previous one.  This mode is useful for example for making an unmodulated carrier in a composite signal visible. Noise, interference signals or modulated signals are suppressed, whereas a CW signal is recognized by its constant level.  This mode is not available for statistics measurements.
Average	The average is formed over several measurements and displayed.  The <a href="#">Capture Count</a> determines the number of averaging procedures.  This mode is not available for statistics measurements.
View	The current contents of the trace memory are frozen and displayed.



If a trace is frozen ("View" mode), you can change the measurement settings, apart from scaling settings, without impact on the displayed trace. The fact that the displayed trace no longer matches the current measurement settings is indicated by a yellow asterisk \* on the tab label.

If you change any parameters that affect the scaling of the diagram axes, the R&S VSE automatically adapts the trace data to the changed display range. Thus, you can zoom into the diagram after the measurement to show details of the trace.

### How many traces are averaged - capture count + Measurement mode

In "Average" trace mode, the capture count and measurement mode determine how many traces are averaged. The more traces are averaged, the smoother the trace is likely to become.

The algorithm for averaging traces depends on the measurement mode and capture count.

- **capture count = 0** (default)
  - In "**Continuous**" measurement mode, a continuous average is calculated for 10 measurements, according to the following formula:

$$Trace = \frac{9 * Trace_{old} + MeasValue}{10}$$

Figure 10-44: Equation 1

Due to the weighting between the current trace and the average trace, past values have practically no influence on the displayed trace after about ten measurements. With this setting, signal noise is effectively reduced without need for restarting the averaging process after a change of the signal.

- In "**Single**" measurement mode, the current trace is averaged with the previously stored averaged trace. No averaging is carried out for the first measurement but the measured value is stored in the trace memory. The next time a measurement is performed, the trace average is calculated according to the following formula:



$$Trace = \frac{Trace_{old} + MeasValue}{2}$$

The averaged trace is then stored in the trace memory.

- **capture count = 1**  
The currently measured trace is displayed and stored in the trace memory. No averaging is performed.
- **capture count > 1**  
For both **"Single"** measurement mode and **"Continuous"** measurement mode, averaging takes place over the selected number of measurements. In this case the displayed trace is determined during averaging according to the following formula:

$$Trace_n = \frac{1}{n} \cdot \left[ \sum_{i=1}^{n-1} (T_i) + MeasValue_n \right]$$

Figure 10-45: Equation 2

Where n is the number of the current measurement (n = 2 ... capture count).

No averaging is carried out for the first measurement but the measured value is stored in the trace memory. With increasing n, the displayed trace is increasingly smoothed since there are more individual measurements for averaging.

After the selected number of measurements, the average trace is saved in the trace memory. Until this number of measurements is reached, a preliminary average is displayed. When the averaging length defined by the "Capture Count" is attained, averaging is continued in continuous measurement mode or for "Continue Single Sweep" according to the following formula:

$$Trace = \frac{(N-1) * Trace_{old} + MeasValue}{N}$$

Where N is the capture count

### X-value of the measurement point

As described in ["Mapping samples to measurement points with the trace detector"](#) on page 378, the number of samples taken during a measurement can be much larger than the number of measurement points that are displayed in the measurement trace.

To determine the x-value of the measurement point, two different methods are available:

- Start/stop
- Bin-centered

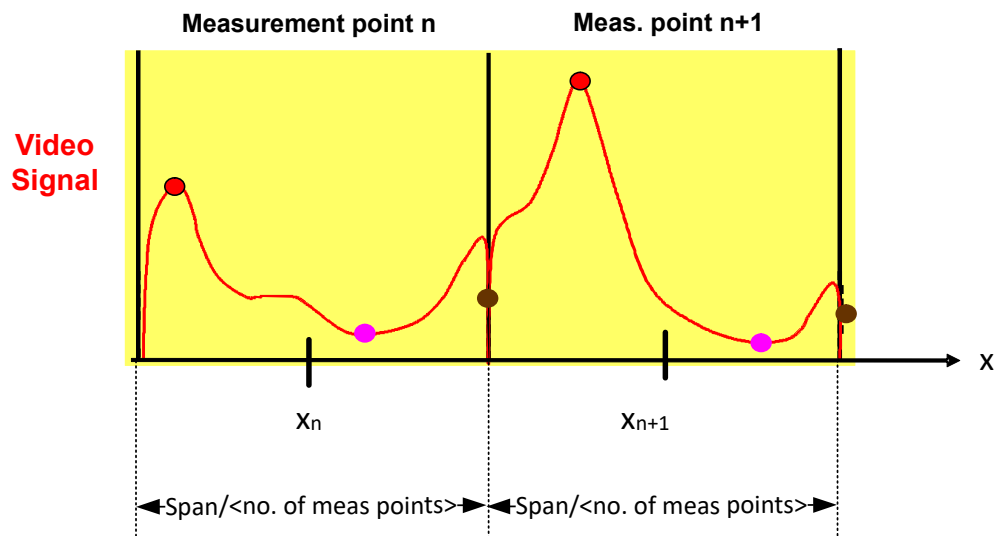
#### Start/stop

This is the default (legacy) method for trace values in the frequency domain. The x-value of the first measurement point corresponds to the starting point of the full measurement span. The x-value of the last measurement point corresponds to the end point of the full measurement span. All other measurement points are divided evenly

between the first and last points. The distance between two measurement points is  $\text{span}/(\text{no\_measurement\_points} - 1)$ .

### Bin-centered

This is the default method for all marker values. The full measurement span is divided by the number of measurement points. The result is the span that is evaluated for an individual measurement point, also referred to as a *bin*. The x-value of the measurement point is then defined as the x-value at the center of the bin ( $\text{bin}/2$ ).



Using the bin-centered method, the first and last x-values of the trace are not identical to the exact starting and end point of the measurement span. The distance between two measurement points corresponds to the width of the bin, or  $\text{span}/(\text{no\_measurement\_points})$ .

Marker values are always determined using the bin-centered method. Markers placed on the first and last x-values of the measured span indicate the same results as the first and last trace point.

For trace values in the frequency domain, you can select which method is used to determine the x-values in the frequency domain, that is:

- In the result displays
- When exporting traces
- For the `TRACe<n>[:DATA]:X?` command

Note the possible minor discrepancy between marker values and trace values using the start/stop method.

### How trace data is averaged - the averaging mode

When the trace is averaged over several sweeps (Trace mode: "Average" ), different methods are available to determine the trace average.

With logarithmic averaging, the dB values of the display voltage are averaged or subtracted from each other with trace mathematical functions.

With linear averaging, the level values in dB are converted into linear voltages or powers before averaging. Voltage or power values are averaged or offset against each other and reconverted into level values.

For stationary signals, the two methods yield the same result.

Logarithmic averaging is recommended if sinewave signals are to be clearly visible against noise since with this type of averaging noise suppression is improved while the sinewave signals remain unchanged.

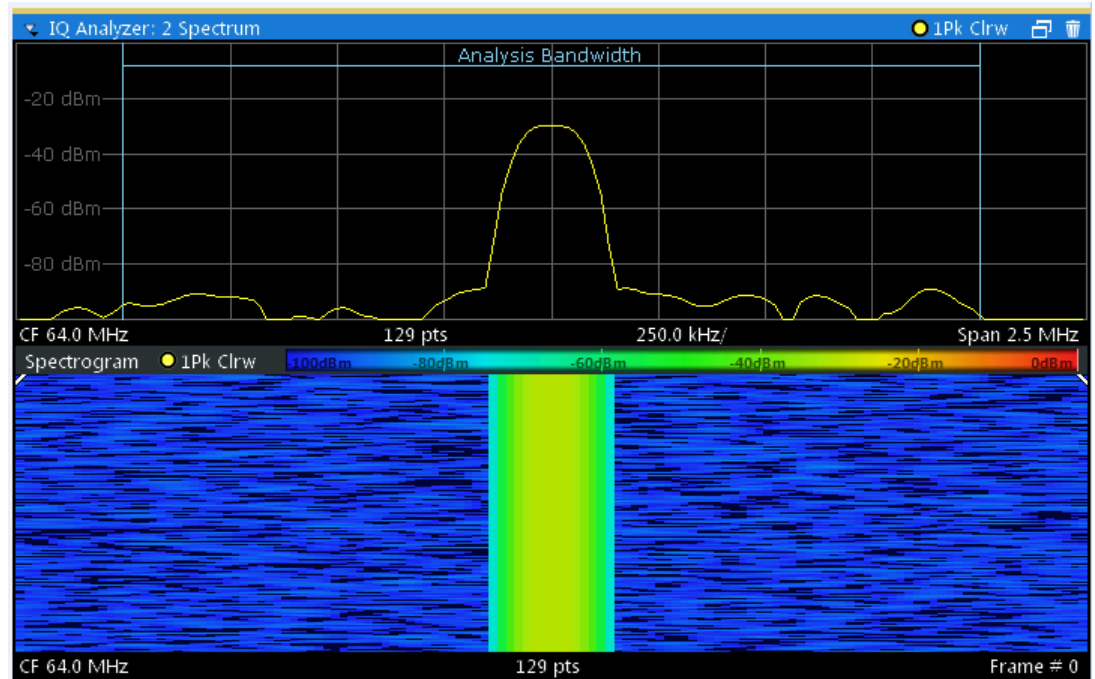
For noise or pseudo-noise signals, the positive peak amplitudes are decreased in logarithmic averaging due to the characteristic involved. The negative peak values are increased relative to the average value. If the distorted amplitude distribution is averaged, a value is obtained that is smaller than the actual average value. The difference is -2.5 dB.

This low average value is usually corrected in noise power measurements by a 2.5 dB factor. Therefore the R&S VSE offers the selection of linear averaging. The trace data is linearized before averaging, then averaged and logarithmized again for display on the screen. The average value is always displayed correctly irrespective of the signal characteristic.

### **Working with spectrograms**

In addition to the standard "level versus frequency" or "level versus time" traces, the I/Q Analyzer also provides a spectrogram display of the measured data. A special feature of the R&S VSE software is that it provides spectrograms for applications based on I/Q data, such as the I/Q Analyzer and the Analog Modulation Analysis application.

A spectrogram shows how the spectral density of a signal varies over time. The x-axis shows the frequency, the y-axis shows the time. A third dimension, the power level, is indicated by different colors. Thus you can see how the strength of the signal varies over time for different frequencies.

**Example:**

In this example, you see the spectrogram for the calibration signal of an R&S FSW, compared to the standard spectrum display. Since the signal does not change over time, the color of the frequency levels does not change over time, i.e. vertically. The legend above the spectrogram display describes the power levels the colors represent.

**Spectrogram based on specific trace**

The R&S VSE software allows you to define which trace of a particular result display the Spectrogram is calculated from, if multiple traces are available. For example, assume a Spectrum is displayed with a Maxhold, a Minhold and an Average trace. Then you can activate a Spectrogram that displays the maximum, minimum, or average power levels over time and frequency.

**Result display**

The spectrogram result can consist of the following elements:

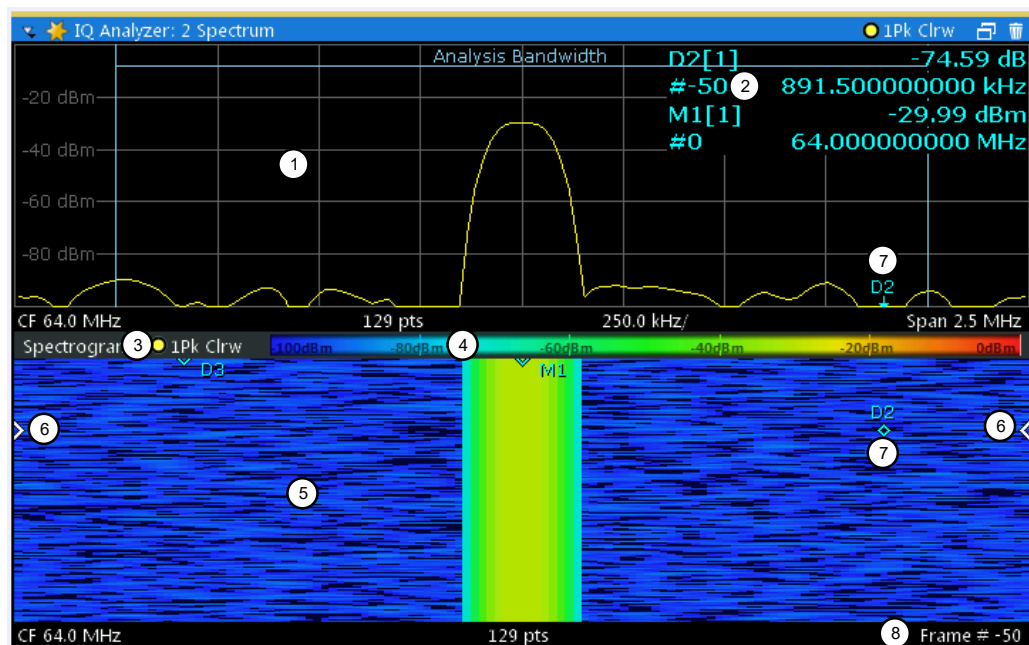


Figure 10-46: Display elements for a result display with a spectrogram subwindow

- 1 = Main result display (in this case: Spectrum)
- 2 = Marker info with frame number
- 3 = Spectrogram subwindow title with trace information
- 4 = Color map
- 5 = Spectrogram subwindow
- 6 = Current frame indicators
- 7 = Delta marker in Spectrogram and Spectrum displays
- 8 = Current frame number

For more information about spectrogram configuration, see "[Spectrogram settings](#)" on page 399.

#### Remote commands:

Activating and configuring spectrograms:

[Chapter 13.6.4.4, "Configuring spectrograms"](#), on page 804

Storing results:

[MMEMory:STORe<n>:SPECTrogram](#) on page 898

- [Time frames](#)..... 389
- [Color maps](#)..... 390

#### Time frames

The time information in the spectrogram is displayed vertically, along the y-axis. Each line (or trace) of the y-axis represents one or more captured measurement and is called a **time frame** or simply "frame". As with standard spectrum traces, several measured values are combined in one measurement point using the selected detector.

(See "[Mapping samples to measurement points with the trace detector](#)" on page 378).

Frames are sorted in chronological order, beginning with the most recently recorded frame at the top of the diagram (frame number 0). With the next measurement, the previous frame is moved further down in the diagram, until the maximum number of captured frames is reached. The display is updated continuously during the measurement, and the measured trace data is stored. Spectrogram displays are continued even after single measurements unless they are cleared manually.

The maximum number of frames that you can capture depends on the number of measurement points that are analyzed during the measurement.



The scaling of the time axis (y-axis) is not configurable. However, you can enlarge the spectrogram display to the full window size using the **State**: "Full" .

### Displaying individual frames

The spectrogram diagram contains all stored frames since it was last cleared. Arrows on the left and right border of the spectrogram indicate the currently selected frame. The spectrum diagram always displays the spectrum for the currently selected frame.

The current frame number is indicated in the diagram footer. The current frame, displayed at the top of the diagram, is frame number 0. Older frames further down in the diagram are indicated by a negative index, e.g. "-10" . You can display the spectrum diagram of a previous frame by changing the current frame number.

### Color maps

The color display is highly configurable to adapt the spectrograms to your needs. You can define:

- Which colors to use (Color scheme)
- Which value range to apply the color scheme to
- How the colors are distributed within the value range, i.e where the focus of the visualization lies (shape of the color curve)

The individual colors are assigned to the power levels automatically by the R&S VSE.

### The Color Scheme

- **Hot**



Uses a color range from blue to red. Blue colors indicate low levels, red colors indicate high ones.

- **Cold**



Uses a color range from red to blue. Red colors indicate low levels, blue colors indicate high ones.

The "Cold" color scheme is the inverse "Hot" color scheme.

- **Radar**



Uses a color range from black over green to light turquoise with shades of green in between. Dark colors indicate low levels, light colors indicate high ones.

- **Grayscale**



Shows the results in shades of gray. Dark gray indicates low levels, light gray indicates high ones.

### The value range of the color map

If the measured values only cover a small area in the spectrogram, you can optimize the displayed value range. Then it becomes easier to distinguish between values that are close together. Display only parts of interest.

### The shape and focus of the color curve

The color-mapping function assigns a specified color to a specified power level in the spectrogram display. By default, colors on the color map are distributed evenly. However, to visualize a certain area of the value range in greater detail than the rest, you can set the focus of the color mapping to that area. Changing the focus is performed by changing the shape of the color curve.

The color curve is a tool to shift the focus of the color distribution on the color map. By default, the color curve is linear. If you shift the curve to the left or right, the distribution becomes non-linear. The slope of the color curve increases or decreases. One end of the color palette then covers a large range of results, while the other end distributes several colors over a relatively small result range.

You can use this feature to put the focus on a particular region in the diagram and to be able to detect small variations of the signal.

**Example:**

In the color map based on the linear color curve, the range from -100 dBm to -60 dBm is covered by blue and a few shades of green only. The range from -60 dBm to -20 dBm is covered by red, yellow and a few shades of green.

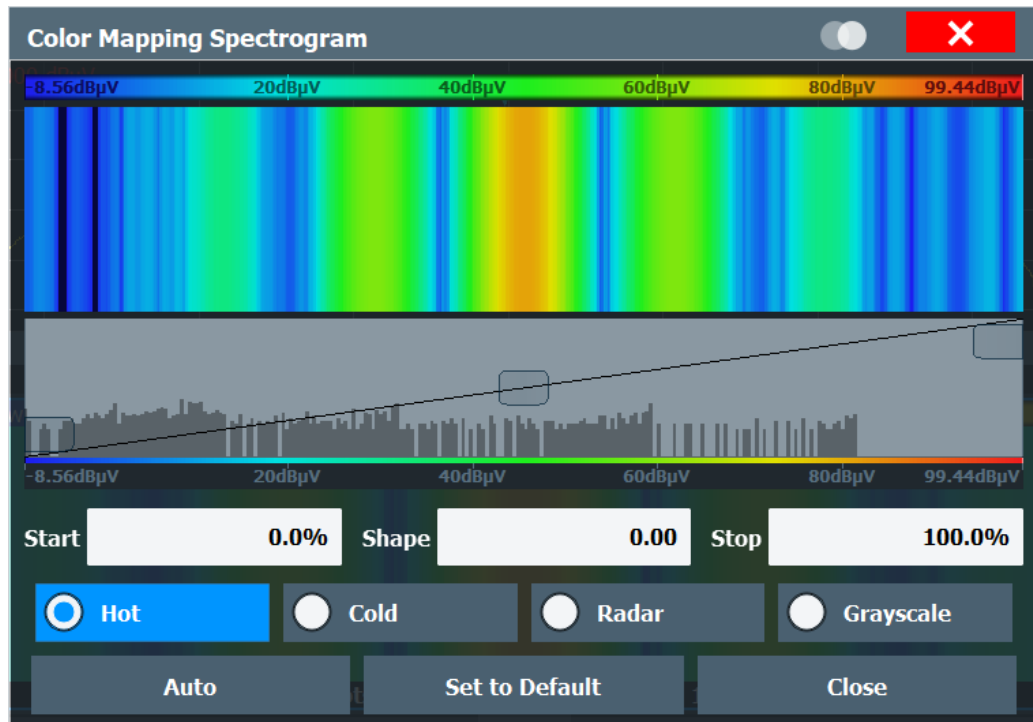


Figure 10-47: Spectrogram with (default) linear color curve shape = 0

The sample spectrogram is dominated by blue and green colors. After shifting the color curve to the left (negative value), more colors cover the range from -100 dBm to -60 dBm (blue, green and yellow). This range occurs more often in the example. The range from -60 dBm to -20 dBm, on the other hand, is dominated by various shades of red only.



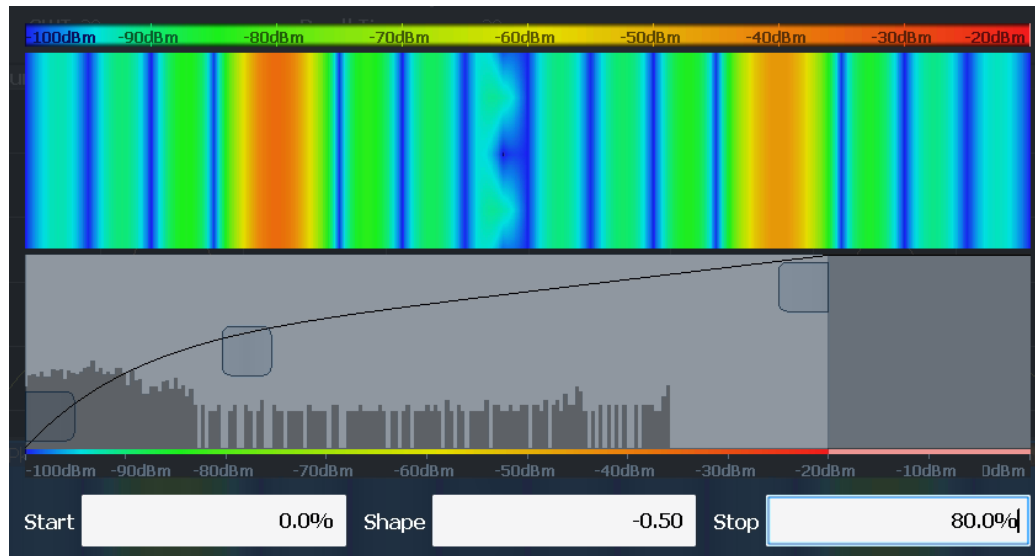


Figure 10-48: Spectrogram with non-linear color curve (shape = -0.5)

### 10.5.1.2 Trace configuration

or: "Trace"

Trace configuration includes the following settings and functions:

- [Trace settings](#).....393
- [Trace math](#).....397
- [Spectrogram settings](#).....399

#### Trace settings

**Access:** "Overview" > "Analysis" > "Traces"

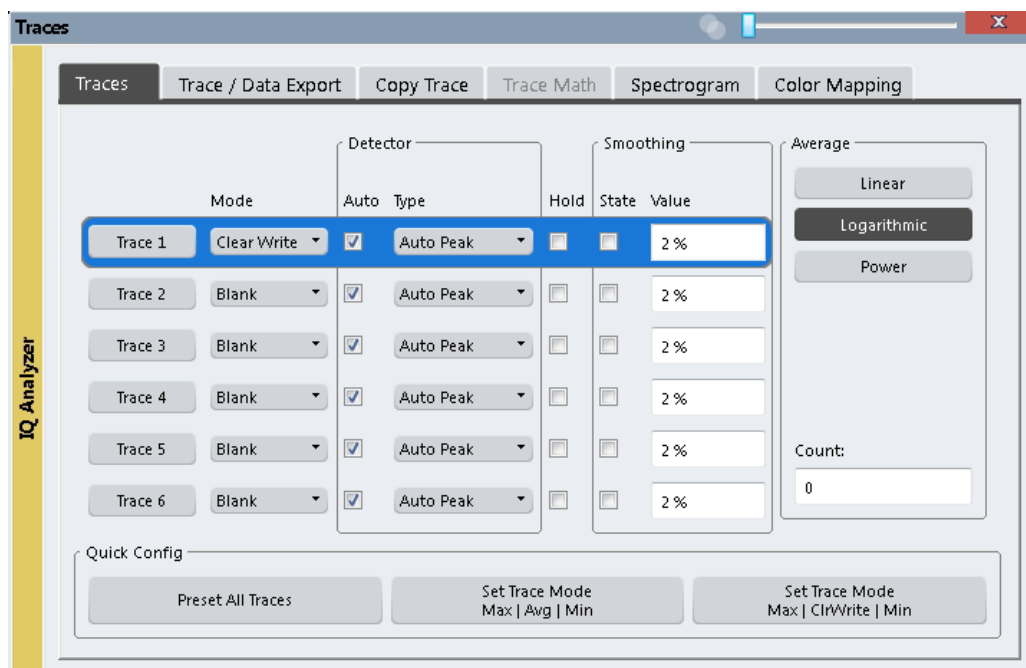
**Or:** "Trace" > "Trace"

You can configure the settings for up to 6 individual traces in the same result display. Each trace is displayed in a different color, indicated in the window title bar and the trace settings.



Trace data can also be exported to an ASCII file for further analysis. For details see [Chapter 10.5.1.3, "Trace / data export configuration"](#), on page 403.

For I/Q Vector evaluation mode, only 1 trace is available and the detector is not editable.



Trace 1 /Trace 2 /Trace 3 /Trace 4 /Trace 5 /Trace 6 ..... 394

Trace Mode ..... 394

Detector ..... 395

Hold ..... 396

Smoothing ..... 396

Average Mode ..... 396

Predefined Trace Settings - Quick Config ..... 397

Copy Trace ..... 397

**Trace 1 /Trace 2 /Trace 3 /Trace 4 /Trace 5 /Trace 6**

Selects the corresponding trace for configuration. The currently selected trace is highlighted.

"How to configure a standard trace" on page 406

Remote command:

Selected via numeric suffix of:TRACe<1 . . . 6> commands

DISPlay[:WINDow<n>] [:SUBWindow<w>]:TRACe<t>[:STATe] on page 797

**Trace Mode**

Defines the update mode for subsequent traces.

- "Clear/ Write" Overwrite mode (default): the trace is overwritten by each measurement.  
All available detectors can be selected.

"Max Hold"	<p>The maximum value is determined over several measurements and displayed. The R&amp;S VSE saves the measurement result in the trace memory only if the new value is greater than the previous one. This mode is especially useful with modulated or pulsed signals. The signal spectrum is filled up upon each measurement until all signal components are detected in a kind of envelope. This mode is not available for statistics measurements.</p>
"Min Hold"	<p>The minimum value is determined from several measurements and displayed. The R&amp;S VSE saves the measurement result in the trace memory only if the new value is lower than the previous one. This mode is useful for example for making an unmodulated carrier in a composite signal visible. Noise, interference signals or modulated signals are suppressed, whereas a CW signal is recognized by its constant level. This mode is not available for statistics measurements.</p>
"Average"	<p>The average is formed over several measurements. The <b>Capture Count</b> determines the number of averaging procedures. This mode is not available for statistics measurements.</p>
"View"	<p>The current contents of the trace memory are frozen and displayed.</p> <p><b>Note:</b> If a trace is frozen, you can change the measurement settings, apart from scaling settings, without impact on the displayed trace. The fact that the displayed trace no longer matches the current measurement settings is indicated by a yellow asterisk * on the tab label. If you change any parameters that affect the scaling of the diagram axes, the R&amp;S VSE automatically adapts the trace data to the changed display range. Thus, you can zoom into the diagram after the measurement to show details of the trace.</p>
"Blank"	Removes the selected trace from the display.

Remote command:

`DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:MODE` on page 795

### Detector

Defines the trace detector to be used for trace analysis.

The trace detector is used to combine multiple FFT window results to create the final spectrum. (Note: in previous versions of the R&S VSE, the I/Q Analyzer always used the linear average detector.) If necessary, the trace detector is also used to reduce the number of calculated frequency points (defined by the FFT length) to the defined number of measurement points. By default, the Autopeak trace detector is used.

"Auto" (default:) Selects the optimum detector for the selected trace and filter mode

"Type" Defines the selected detector type.

Remote command:

`[SENSe:] [WINDow<n>:] DETector<t>[:FUNCTION]` on page 799

`[SENSe:] [WINDow<n>:] DETector<t>[:FUNCTION]:AUTO` on page 799

**Hold**

If activated, traces in "Min Hold" , "Max Hold" and "Average" mode are not reset after specific parameter changes have been made.

Normally, the measurement is started again after parameter changes, before the measurement results are analyzed (e.g. using a marker). In all cases that require a new measurement after parameter changes, the trace is reset automatically to avoid false results (e.g. with span changes). For applications that require no reset after parameter changes, the automatic reset can be switched off.

The default setting is off.

Remote command:

`DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:MODE:HCONTinuous`  
on page 796

**Smoothing**

If enabled, the trace is smoothed by the specified value (between 1 % and 50 %). The smoothing value is defined as a percentage of the display width. The larger the smoothing value, the greater the smoothing effect.

For more information, see the R&S VSE User Manual.

Remote command:

`DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:SMOothing[:STATe]`  
on page 798

`DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:SMOothing:APERture`  
on page 797

**Average Mode**

Defines the mode with which the trace is averaged over several measurements.

This setting is generally applicable if trace mode "Average" is selected.

For FFT sweeps, the setting also affects the VBW (regardless of whether the trace is averaged).

(See the chapter on ACLR power measurements in the R&S VSE User Manual.)

The **Capture Count** determines the number of averaging procedures.

"Linear"	The power level values are converted into linear units before averaging. After the averaging, the data is converted back into its original unit.
"Logarithmic"	For logarithmic scaling, the values are averaged in dBm. For linear scaling, the behavior is the same as with linear averaging.
"Power"	Activates linear power averaging. The power level values are converted into unit Watt before averaging. After the averaging, the data is converted back into its original unit. Use this mode to average power values in Volts or Amperes correctly. In particular, for small VBW values (smaller than the RBW), use power averaging mode for correct power measurements in FFT sweep mode.

Remote command:

`[SENSe:]AVERAge<n>:TYPE` on page 798

### Predefined Trace Settings - Quick Config

Commonly required trace settings have been predefined and can be applied very quickly by selecting the appropriate button.

Function	Trace Settings	
Preset All Traces	Trace 1:	Clear Write
	Traces 2-6:	Blank
Set Trace Mode Max   Avg   Min	Trace 1:	Max Hold
	Trace 2:	Average
	Trace 3:	Min Hold
	Traces 4-6:	Blank
Set Trace Mode Max   ClrWrite   Min	Trace 1:	Max Hold
	Trace 2:	Clear Write
	Trace 3:	Min Hold
	Traces 4-6:	Blank

### Copy Trace

**Access:** "Overview" > "Analysis" > "Traces" > "Copy Trace"

**Or:** "Trace" > "Copy Trace"

Copies trace data to another trace.

The first group of buttons (labeled "Trace 1" to "Trace 6" ) selects the source trace. The second group of buttons (labeled "Copy to Trace 1" to "Copy to Trace 6" ) selects the destination.

Remote command:

`TRACe<n>:COPY` on page 800

### Trace math

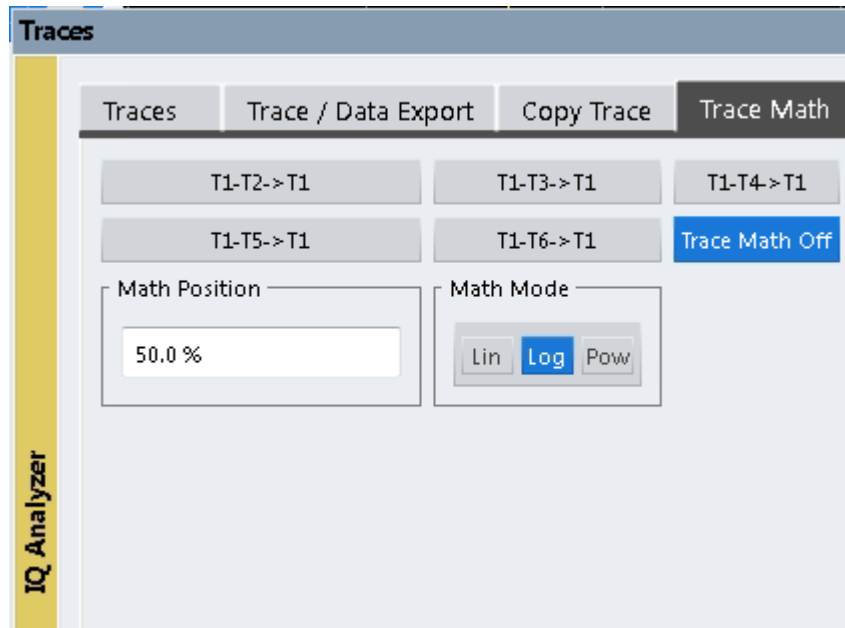
**Access:** [TRACE] > "Trace Math"

**Or:** "Overview" > "Analysis" > "Traces" > "Trace Math"

If you have several traces with different modes, for example an average trace and a maximum trace, it may be of interest to compare the results of both traces. In this example, you could analyze the maximum difference between the average and maximum values. To analyze the span of result values, you could subtract the minimum trace from the maximum trace. For such tasks, the results from several traces can be combined using mathematical functions.



Trace math functions are only available for RF measurements, see [Chapter 10.1.3, "Result displays in the time and frequency domain"](#), on page 174.



<a href="#">Trace Math Function</a> .....	398
<a href="#">Trace Math Off</a> .....	398
<a href="#">Trace Math Position</a> .....	399
<a href="#">Trace Math Mode</a> .....	399

### Trace Math Function

You can select one of several different math operations.

Each operation subtracts one trace from another as indicated on the corresponding button and writes the result to one of the traces. "T1 - T3 > T1", for example, subtracts trace 3 from trace 1 and writes the result to trace 1. You can apply one operation at a time.

The result refers to the zero point defined with the [Trace Math Position](#) setting. The following subtractions can be performed:

"T1-T2->T1"	Subtracts trace 2 from trace 1.
"T1-T3->T1"	Subtracts trace 3 from trace 1
"T1-T4->T1"	Subtracts trace 4 from trace 1
"T1-T5->T1"	Subtracts trace 5 from trace 1
"T1-T6->T1"	Subtracts trace 6 from trace 1

To switch off the trace math, use the [Trace Math Off](#) button.

Remote command:

[CALCulate<n>:MATH<t>\[:EXPRession\] \[:DEFine\]](#) on page 802

[CALCulate<n>:MATH<t>:STATe](#) on page 804

### Trace Math Off

Deactivates any previously selected trace math functions.

Remote command:

CALC:MATH:STAT OFF, see [CALCulate<n>:MATH<t>:STATe](#) on page 804

### Trace Math Position

Defines the zero point on the y-axis of the resulting trace in % of the diagram height. The range of values extends from -100 % to +200 %.

Remote command:

[CALCulate<n>:MATH<t>:POSition](#) on page 803

### Trace Math Mode

Defines the mode for the trace math calculations.

"Lin"	<p>Activates linear subtraction, which means that the power level values are converted into linear units prior to subtraction. After the subtraction, the data is converted back into its original unit.</p> <p>This setting takes effect if the grid is set to a linear scale. In this case, subtraction is done in two ways (depending on the set unit):</p> <ul style="list-style-type: none"> <li>• The unit is set to either W or dBm: the data is converted into W prior to subtraction, i.e. averaging is done in W.</li> <li>• The unit is set to either V, A, dBmV, dBμV, dBμA or dBpW: the data is converted into V prior to subtraction, i.e. subtraction is done in V.</li> </ul>
"Log"	<p>Activates logarithmic subtraction.</p> <p>This subtraction method only takes effect if the grid is set to a logarithmic scale, i.e. the unit of the data is dBm. In this case the values are subtracted in dBm. Otherwise (i.e. with linear scaling) the behavior is the same as with linear subtraction.</p>
"Power"	<p>Activates linear power subtraction.</p> <p>The power level values are converted into unit Watt prior to subtraction. After the subtraction, the data is converted back into its original unit.</p> <p>Unlike the linear mode, the subtraction is always done in W.</p>

Remote command:

[CALCulate<n>:MATH<t>:MODE](#) on page 803

### Spectrogram settings

**Access:** "Overview" > "Analysis" > "Traces" > "Spectrogram"

or: "Trace" > Spectrogram

The individual settings available for spectrogram display are described here. For settings on color mapping, see ["Color map settings"](#) on page 401.

Settings concerning the frames and how they are handled during a measurement are provided as additional capture settings for spectrogram display, see [Chapter 10.3.6.2, "Capture settings"](#), on page 257.

For background information see also ["Working with spectrograms"](#) on page 387.

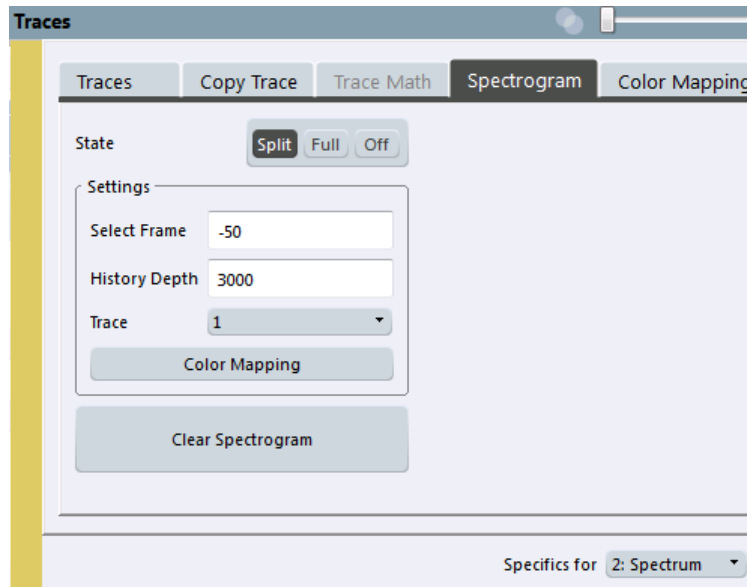
- [General spectrogram settings](#)..... 400
- [Color map settings](#)..... 401

## General spectrogram settings

**Access:** "Overview" > "Analysis" > "Traces" > "Spectrogram"

**or:** "Trace" > "Spectrogram"

This section describes general settings for spectrogram display.



State.....	400
Select Frame.....	400
History Depth .....	401
Color Mapping .....	401
Clear Spectrogram .....	401

### State

Activates and deactivates a Spectrogram subwindow.

- "Split"            Displays the Spectrogram as a subwindow in the original result display.
- "Full"            Displays the Spectrogram in a subwindow in the full size of the original result display.
- "Off"             Closes the Spectrogram subwindow.

Remote command:

[CALCulate<n>:SPECTrogram:LAYout](#) on page 807

### Select Frame

Selects a specific frame, loads the corresponding trace from the memory, and displays it in the Spectrum window.

Note that activating a marker or changing the position of the active marker automatically selects the frame that belongs to that marker.

This function is only available in single sweep mode or if the sweep is stopped, and only if a spectrogram is selected.



The most recent frame is number 0, all previous frames have a negative number.

For more details, see ["Time frames"](#) on page 389.

Remote command:

[CALCulate<n>:SPECTrogram:FRAMe:SElect](#) on page 806

[CALCulate<n>:SPECTrogram:FRAMe:SElect](#) on page 806

### History Depth

Sets the number of frames that the R&S VSE stores in its memory.

The maximum number of frames depends on the [Points](#).

For an overview of the maximum number of frames depending on the number of sweep points, see the R&S VSE User Manual.

If the memory is full, the R&S VSE deletes the oldest frames stored in the memory and replaces them with the new data.

Remote command:

[CALCulate<n>:SPECTrogram:HDEPth](#) on page 807

### Color Mapping

Opens the "Color Mapping" dialog.

For details see ["Color maps"](#) on page 390.

### Clear Spectrogram

Resets the spectrogram result display and clears the history buffer.

This function is only available if a spectrogram is selected.

Remote command:

[CALCulate<n>:SPECTrogram:CLEAr\[:IMMediate\]](#) on page 805

### Color map settings

**Access:** "Overview" > "Analysis" > "Traces" > "Color Mapping"

**or:** "Trace" > "Spectrogram" > "Color Mapping"

For more information on color maps, see ["Color maps"](#) on page 390. For details on changing color-mapping settings, see ["How to configure the color mapping"](#) on page 409.

In addition to the available color settings, the dialog box displays the current color map and provides a preview of the display with the current settings.

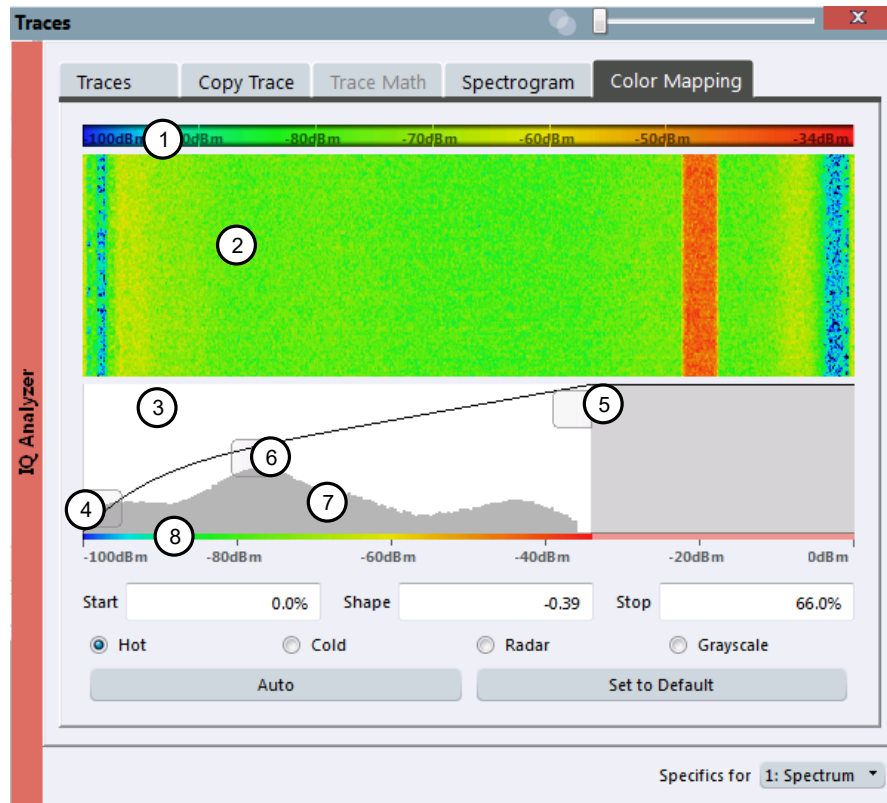


Figure 10-49: Color Mapping dialog box

- 1 = Color map: shows the current color distribution
- 2 = Preview pane: shows a preview of the spectrogram with any changes that you make to the color scheme
- 3 = Color curve pane: graphical representation of all settings available to customize the color scheme
- 4/5 = Color range start and stop sliders: define the range of the color map or amplitudes for the spectrogram
- 6 = Color curve slider: adjusts the focus of the color curve
- 7 = Histogram: shows the distribution of measured values
- 8 = Scale of the horizontal axis (value range)

Start / Stop .....	402
Shape .....	402
Hot /Cold /Radar /Grayscale .....	403
Auto .....	403
Set to Default .....	403
Close.....	403

**Start / Stop**

Defines the lower and upper boundaries of the value range of the spectrogram.

Remote command:

`DISPlay[:WINDow<n>]:SPECTrogram:COLor:LOWer` on page 809

`DISPlay[:WINDow<n>]:SPECTrogram:COLor:UPPer` on page 809

**Shape**

Defines the shape and focus of the color curve for the spectrogram result display.

"-1 to <0"      More colors are distributed among the lower values

"0" Colors are distributed linearly among the values  
 ">0 to 1" More colors are distributed among the higher values

Remote command:

`DISPlay[:WINDow<n>]:SPECTrogram:COLor:SHApe` on page 809

#### Hot /Cold /Radar /Grayscale

Sets the color scheme for the spectrogram.

Remote command:

`DISPlay[:WINDow<n>]:SPECTrogram:COLor[:STYLE]` on page 810

#### Auto

Defines the color range automatically according to the existing measured values for optimized display.

#### Set to Default

Sets the color mapping to the default settings.

Remote command:

`DISPlay[:WINDow<n>]:SPECTrogram:COLor:DEFault` on page 808

#### Close

Saves the changes and closes the dialog box.

### 10.5.1.3 Trace / data export configuration

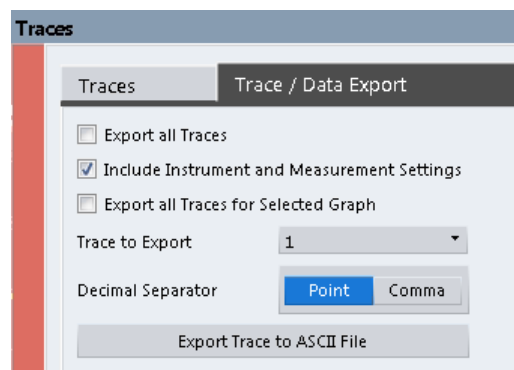
**Access:** "Overview" > "Analysis" > "Traces" > "Trace / Data Export"

The R&S VSE provides various evaluation methods for the results of the performed measurements. However, if you want to evaluate the data with other, external applications, you can export the measurement data to an ASCII file.

Traces resulting from encrypted file input cannot be exported.



The standard data management functions that are available for all R&S VSE applications are not described here, e.g. saving or loading instrument settings, or exporting the I/Q data in other formats.



Export all Traces and all Table Results .....	404
Include Instrument & Measurement Settings .....	404
Trace to Export .....	404
Decimal Separator .....	404
Export Trace to ASCII File .....	404
L File Type .....	405
L Decimal Separator .....	405
L File Explorer.....	405
Export Spectrogram to ASCII File .....	405

### Export all Traces and all Table Results

Selects all displayed traces and result tables (e.g. "Result Summary", marker table etc.) in the current application for export to an ASCII file.

Alternatively, you can select one specific trace only for export (see [Trace to Export](#) ).

The results are output in the same order as they are displayed on the screen: window by window, trace by trace, and table row by table row.

Remote command:

`FORMat:DEXPort:TRACes` on page 802

### Include Instrument & Measurement Settings

Includes additional instrument and measurement settings in the header of the export file for result data.

Remote command:

`FORMat:DEXPort:HEADer` on page 801

### Trace to Export

Defines an individual trace to be exported to a file.

This setting is not available if [Export all Traces and all Table Results](#) is selected.

"All"                    All traces in all diagrams are exported, but no table results.

### Decimal Separator

Defines the decimal separator for floating-point numerals for the data export/import files. Evaluation programs require different separators in different languages.

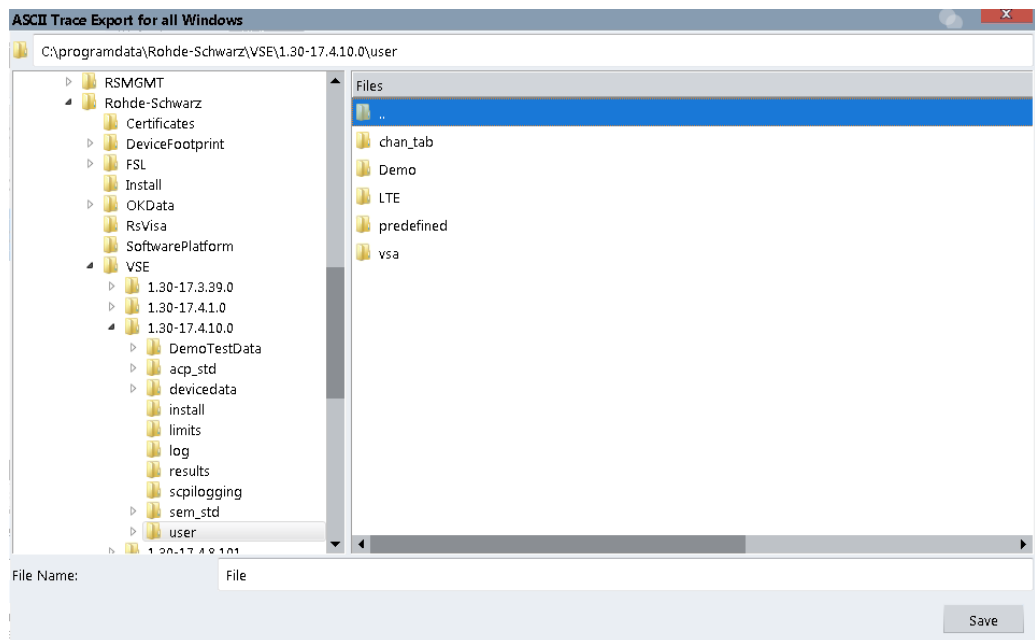
Remote command:

`FORMat:DEXPort:DSEParator` on page 874

### Export Trace to ASCII File

Saves the selected trace or all traces in the currently active result display to the specified file and directory in the selected ASCII format.

"File Explorer": Instead of using the file manager of the R&S VSE firmware, you can also use the Microsoft Windows File Explorer to manage files.



**Note:** Traces resulting from encrypted file input cannot be exported.

Remote command:

[MMEMory:STORe<n>:TRACe](#) on page 898

#### **File Type** ← **Export Trace to ASCII File**

Determines the format of the ASCII file to be imported or exported.

Depending on the external program in which the data file was created or is evaluated, a comma-separated list (CSV) or a plain data format (DAT) file is required.

Remote command:

[FORMat:DEXPort:FORMat](#) on page 801

#### **Decimal Separator** ← **Export Trace to ASCII File**

Defines the decimal separator for floating-point numerals for the data export/import files. Evaluation programs require different separators in different languages.

Remote command:

[FORMat:DEXPort:DSEParator](#) on page 874

#### **File Explorer** ← **Export Trace to ASCII File**

Opens the Microsoft Windows File Explorer.

Remote command:

not supported

#### **Export Spectrogram to ASCII File**

Opens a file selection dialog box and saves the selected spectrogram in ASCII format (.dat) to the specified file and directory.

If the spectrogram display is selected when you perform this function, the entire histogram buffer with all frames is exported to a file. The data corresponding to a particular frame begins with information about the frame number and the time that frame was recorded. For large history buffers the export operation can take some time.

For details on the file format, see [Chapter F, "Reference: ASCII file export format"](#), on page 1002.

For details on the file format, see the R&S VSE base software user manual.

Remote command:

`MMEMory:STORe<n>:SPEctrogram` on page 898

#### 10.5.1.4 How to configure traces

The following step-by-step procedures describe the following tasks:

- [How to configure a standard trace](#)..... 406
- [How to display and configure a spectrogram](#).....407
- [How to copy traces](#).....411

##### How to configure a standard trace

Step-by-step instructions on configuring the trace settings are provided here. For details on individual functions and settings see ["Trace settings"](#) on page 393.

Trace settings are configured in the "Traces" dialog box.

To display the "Traces" dialog box, do one of the following:

- Select "Analysis" from the "Overview", then select the "Traces" tab.
- Select the "Trace > Trace" menu item.

1. For each trace, select the "Trace Mode" and "Trace Detector". Traces with the trace mode "Blank" are not displayed.
2. To configure several traces to predefined display modes in one step, press the button for the required function:
  - "Preset All Traces"
  - "Set Trace Mode Avg | Max | Min"
  - "Set Trace Mode Max | ClrWrite | Min"

For details see ["Trace settings"](#) on page 393.

3. For "Average" trace mode, define the number of measurements to be averaged in the "Count" field.
4. If linear scaling is used, select the "Average Mode: Linear".
5. To improve the trace stability, increase the number of "Measurement Points" or the "Measurement Time" (in the "Capture" settings).

All configured traces (not set to "Blank") are displayed after the next measurement.

### How to Copy Traces

1. A trace copy function is provided in a separate tab of the "Traces" dialog box. To display this tab do one of the following:
  - Select "Analysis" from the "Overview", then select the "Trace Copy" tab.
  - Select the "Trace > Copy Trace" menu item.
2. Select the "Source" trace to be copied.
3. Select the "Copy to trace..." button for the trace to which the settings are to be applied.

The settings from the source trace are applied to the destination trace. The newly configured trace (if not set to "Blank") is displayed after the next measurement.

### How to display and configure a spectrogram

Step-by-step instructions on how to display and configure a spectrogram are provided here.

For details on individual functions and settings see ["Spectrogram settings"](#) on page 399. The remote commands required to perform these tasks are described in [Chapter 13.6.4.4, "Configuring spectrograms"](#), on page 804.

The following tasks are described here:

- ["To display a spectrogram"](#) on page 407
- ["To remove the spectrogram display"](#) on page 408
- ["To set a marker in the spectrogram"](#) on page 408
- ["To configure a spectrogram"](#) on page 408
- ["To select a color scheme"](#) on page 409
- ["To set the value range graphically using the color range sliders"](#) on page 409
- ["To set the value range of the color map numerically"](#) on page 410
- ["To set the color curve shape graphically using the slider"](#) on page 411
- ["To set the color curve shape numerically"](#) on page 411

### To display a spectrogram

1. Select a Magnitude or Spectrum result display.
2. From the "Trace" menu, select "Spectrogram".

The Spectrogram is automatically displayed as a subwindow of the selected result display, where each subwindow is the same size.
3. To enlarge the Spectrogram to the full window size, select "State: Full".
4. To clear an existing spectrogram display, select "Clear Spectrogram".
5. Close the dialog box.

The spectrogram is updated continuously with each new capture.

**To display the Spectrum or Magnitude diagram for a specific time frame:**


1. Stop the continuous measurement or wait until the single capture is completed.
2. Select the frame number in the diagram footer of the Spectrogram.
3. Enter the required frame number in the edit dialog box.  
Note that the most recent sweep is frame number 0, all previous frames have negative numbers.

**To remove the spectrogram display**

1. Select the result display that contains the Spectrogram subwindow.
2. From the "Trace" menu, select "Spectrogram".
3. Select "State: Off"

The Spectrogram subwindow is closed, and the original result display is restored in full window size.

**To set a marker in the spectrogram**

1. While a spectrogram is displayed, select the  "Place Next Marker" icon in the "Marker" toolbar.
2. Select a "Marker" softkey.
3. Enter the frequency or time (x-value) of the marker or delta marker.
4. Enter the frame number for which the marker is to be set, for example 0 for the current frame, or -2 for the second to last frame. Note that the frame number is always 0 or a negative value!

The marker is only visible in the spectrum diagram if it is defined for the currently selected frame. In the spectrogram result display all markers are visible that are positioned on a visible frame.

**To configure a spectrogram**

1. Configure the spectrogram frames:
  - a) From the Meas Setup menu, select "Capture".
  - b) In the "Capture Count" field, define how many captures are to be analyzed to create a single frame.
  - c) In the "Frame Count" field, define how many frames are to be plotted during a single measurement.
  - d) To include frames from previous measurements in the analysis of the new frame (for "Max Hold", "Min Hold" and "Average" trace modes only), select "Continue Frame" = "ON".
2. Define how many frames are to be stored in total:
  - a) From the "Trace" menu, select "Spectrogram".
  - b) In the "History Depth" field, enter the maximum number of frames to store.



- If necessary, adapt the color mapping for the spectrogram to a different value range or color scheme as described in ["How to configure the color mapping"](#) on page 409.

### How to configure the color mapping

The color display is highly configurable to adapt the spectrogram to your needs.

The settings for color mapping are defined in the "Color Mapping" dialog box. To display this dialog box, do one of the following:

- Select the color map in the window title bar of the "Spectrogram" result display.
- From the "Trace" menu, select "Spectrogram" , then select "Color Mapping" , or switch to the "Color Mapping" tab directly.

### To select a color scheme

You can select which colors are assigned to the measured values.

- ▶ In the "Color Mapping" dialog box, select the option for the color scheme to be used.

### Editing the value range of the color map

The distribution of the measured values is displayed as a histogram in the "Color Mapping" dialog box. To cover the entire measurement value range, make sure the first and last bar of the histogram are included.

To ignore noise in a spectrogram, for example, exclude the lower power levels from the histogram.

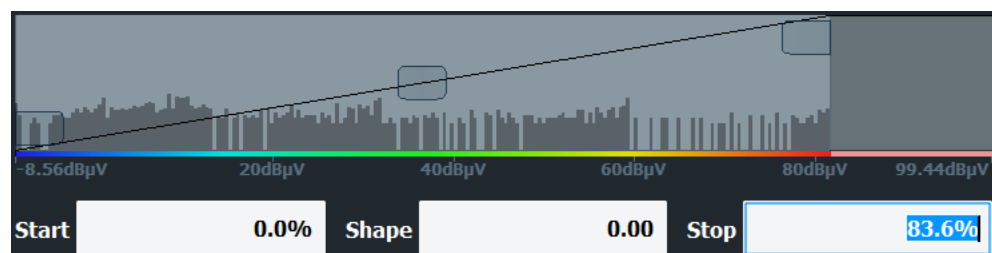


The value range of the color map must cover at least 10% of the value range on the horizontal axis of the diagram, that means, the difference between the start and stop values must be at least 10%.

The value range of the color map can be set numerically or graphically.

### To set the value range graphically using the color range sliders

- Select and drag the bottom color curve slider (indicated by a gray box at the left of the color curve pane) to the lowest value you want to include in the color mapping.
- Select and drag the top color curve slider (indicated by a gray box at the right of the color curve pane) to the highest value you want to include in the color mapping.



**To set the value range of the color map numerically**

1. In the "Start" field, enter the percentage from the left border of the histogram that marks the beginning of the value range.
2. In the "Stop" field, enter the percentage from the right border of the histogram that marks the end of the value range.

**Example:**

The color map starts at -110 dBm and ends at -10 dBm (that is: a range of 100 dB). In order to suppress the noise, you only want the color map to start at -90 dBm. Thus, you enter 10% in the "Start" field. The R&S VSE shifts the start point 10% to the right, to -90 dBm.

**Adjusting the reference level and level range**

Since the color map is configured using percentages of the total value range, changing the reference level and level range of the measurement (and thus the power value range) also affects the color mapping in the spectrogram.

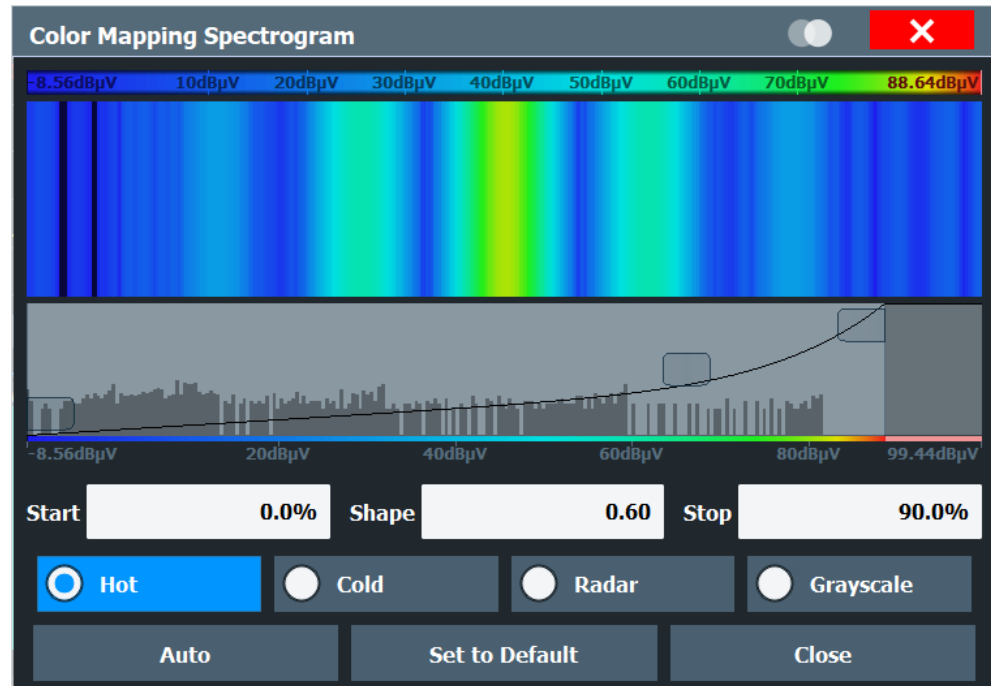
**Editing the shape of the color curve**

The color curve is a tool to shift the focus of the color distribution on the color map. By default, the color curve is linear, i.e. the colors on the color map are distributed evenly. If you shift the curve to the left or right, the distribution becomes non-linear. The slope of the color curve increases or decreases. One end of the color palette then covers a large number of results, while the other end distributes several colors over a relatively small result range.

The color curve shape can be set numerically or graphically.

### To set the color curve shape graphically using the slider

- ▶ Select and drag the color curve shape slider (indicated by a gray box in the middle of the color curve) to the left or right. The area beneath the slider is focused, i.e. more colors are distributed there.



### To set the color curve shape numerically

- ▶ In the "Shape" field, enter a value to change the shape of the curve:
  - A negative value (-1 to <0) focuses the lower values
  - 0 defines a linear distribution
  - A positive value (>0 to 1) focuses the higher values

### How to copy traces

You can copy the trace settings from one trace to another in the "Copy Trace" tab of the "Traces" dialog box.

- ▶ Select the "Source" trace and then the button for the "Copy to" trace.

### Remote command:

`TRACe<n>:COPY` on page 800

## 10.5.2 Marker usage

The following marker settings and functions are available in the I/Q Analyzer application.

Marker settings are window-specific.



For "I/Q Vector" displays markers are not available.



In the I/Q Analyzer application, the resolution with which the frequency can be measured with a marker depends on the filter bandwidth, which is derived from the defined sample rate, as well as the number of measurement points and the used detector (see [Chapter 10.2.3.1, "Frequency resolution of FFT results - RBW"](#), on page 178).

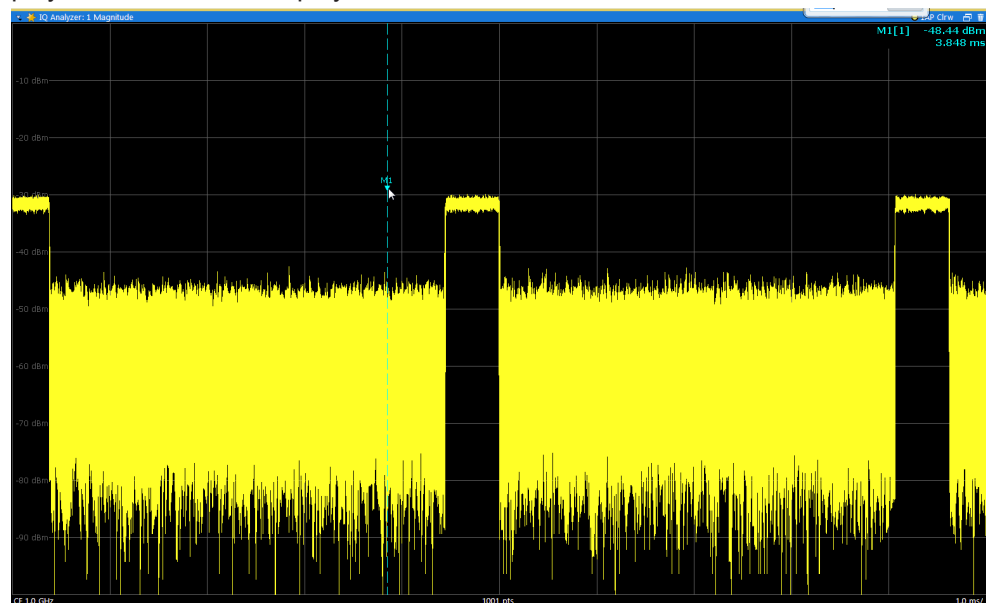
- [Basics on markers and marker functions](#).....412
- [Marker settings](#).....416
- [Marker search settings and positioning functions](#).....422
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### 10.5.2.1 Basics on markers and marker functions


Some background knowledge on marker settings and functions is provided here for a better understanding of the required configuration settings.

Markers are used to mark points on traces, to read out measurement results and to select a display section quickly. R&S VSE provides 16 markers per display window.

- The easiest way to work with markers is using a mouse. Simply drag the marker and drop it at the required position. When you select the marker label in the display, a vertical line is displayed which indicates the marker's current x-value.



- You can also set an active marker to a new position by defining its x-position numerically. When you select a marker from the list in the "Marker" toolbar or from the "Marker" menu, an edit dialog box is displayed.
- To select or set individual markers very quickly, use the functions in the "Marker" menu or in the "Marker" toolbar.

- To set up several markers at once, use the "Marker" dialog box (select  or "Marker > Marker").
- To determine more sophisticated marker results, use the special functions in the "Marker Function" dialog box (select "Marker > Marker Function").
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- [Activating markers](#).....413
- [Marker results](#)..... 413
- [Searching for signal peaks](#).....414
- [Markers in the spectrogram](#)..... 416

### Marker types

All markers can be used either as normal markers or delta markers. A normal marker indicates the absolute signal value at the defined position in the diagram. A delta marker indicates the value of the marker relative to the specified reference marker (by default marker 1).

In addition, special functions can be assigned to the individual markers. The availability of special marker functions depends on whether the measurement is performed in the frequency or time domain, and on the type of measurement.

Temporary markers are used in addition to the markers and delta markers to analyze the measurement results for special marker functions. They disappear when the associated function is deactivated.

### Activating markers

Only active markers are displayed in the diagram and in the marker table.

Active markers are indicated by a checkmark in the marker selection lists.

By default, marker 1 is active and positioned on the maximum value (peak) of trace 1 as a normal marker. If several traces are displayed, the marker is set to the maximum value of the trace which has the lowest number and is not frozen (View mode). The next marker to be activated is set to the frequency of the next lower level (next peak) as a delta marker; its value is indicated as an offset to marker 1.

A marker can only be activated when at least one trace in the corresponding window is visible. If a trace is switched off, the corresponding markers and marker functions are also deactivated. If the trace is switched on again, the markers along with coupled functions are restored to their original positions, provided the markers have not been used on another trace.

### Marker results

Normal markers point to a trace point on the x-axis and display the associated numeric value for that trace point. Delta markers indicate an offset between the level at the delta marker position and the level at the position of the assigned reference marker, in dB.

The results can be displayed directly within the diagram area or in a separate table. By default, the first two active markers are displayed in the diagram area. If more markers are activated, the results are displayed in a marker table.

### Marker information in diagram area

By default, the results of the last two markers or delta markers that were activated are displayed in the diagram area.

D2[1]	-21.90 dB
	-3.9180 GHz
M1[1]	-25.87 dBm
	13.1970 GHz

The following information is displayed there:

- The marker type (M for normal, D for delta, or special function name)
- The marker number
- The assigned trace number in square brackets [ ]
- The marker value on the y-axis, or the result of the marker function
- The marker position on the x-axis

### Marker information in marker table

In addition to the marker information displayed within the diagram area, a separate marker table may be displayed beneath the diagram. This table provides the following information for all active markers:

**Table 10-14: Contents of the marker table in the I/Q Analyzer application**

<b>Wnd</b>	Window within the application
<b>Type</b>	Marker type: N (normal), D (delta), T (temporary, internal) and number
<b>Ref</b>	Reference marker for delta markers
<b>Trc</b>	Trace to which the marker is assigned
<b>Frame</b>	Spectrogram frame the marker is positioned in. Displayed only when the Spectrogram is displayed.
<b>X-value</b>	X-value of the marker
<b>Y-value</b>	Y-value of the marker
<b>Function</b>	Activated marker or measurement function
<b>Function Result</b>	Result of the active marker or measurement function

### Searching for signal peaks

A common measurement task is to determine peak values, i.e. maximum or minimum signal levels. The R&S VSE provides various peak search functions and applications:

- Setting a marker to a peak value once (Peak Search)
- Searching for a peak value within a restricted search area (Search Limits)

### Peak search limits

The peak search can be restricted to a search area. The search area is defined by limit lines which are also indicated in the diagram. In addition, a minimum value (threshold) can be defined as a further search condition.

### When is a peak a peak? - Peak excursion

During a peak search, for example when a marker peak table is displayed, noise values may be detected as a peak if the signal is very flat or does not contain many peaks. Therefore, you can define a relative threshold ("Peak excursion"). The signal level must increase by the threshold value before falling again before a peak is detected. To avoid identifying noise peaks as maxima or minima, enter a peak excursion value that is higher than the difference between the highest and the lowest value measured for the displayed inherent noise.

### Effect of peak excursion settings (example)

The following figure shows a trace to be analyzed.

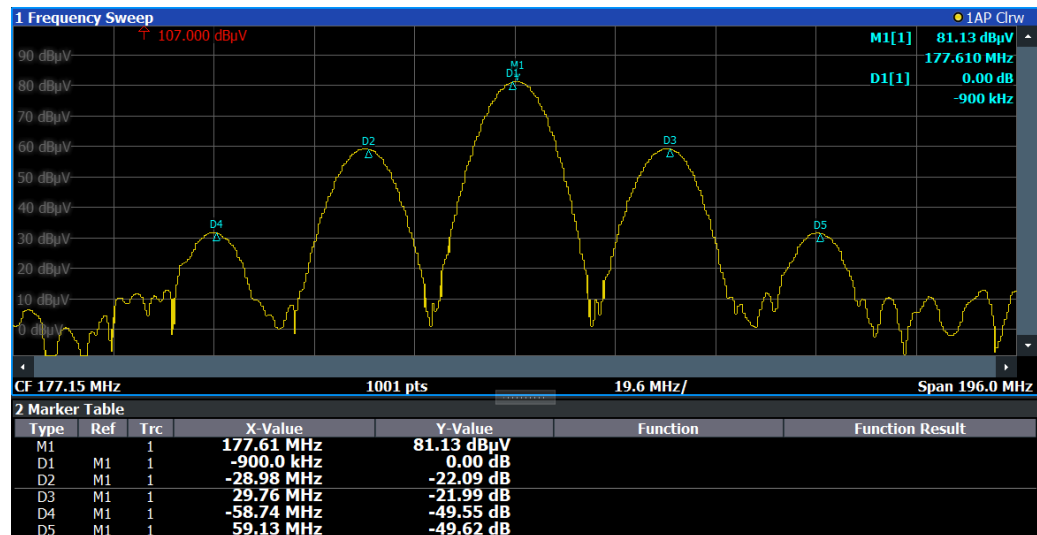


Figure 10-50: Trace example

The following table lists the peaks as indicated by the marker numbers in the diagram above, as well as the minimum decrease in amplitude to either side of the peak:

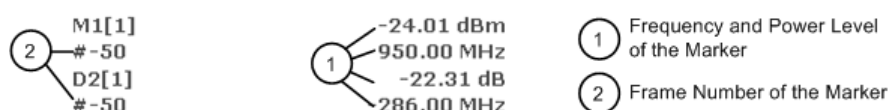
Marker #	Min. amplitude decrease to either side of the signal
1	30 dB
2	29.85 dB
3	20 dB
4	10 dB
5	18 dB

In order to eliminate the smaller peaks M3, M4 and M5 in the example above, a peak excursion of at least 20 dB is required. In this case, the amplitude must rise at least 20 dB before falling again before a peak is detected.

### Markers in the spectrogram

Markers and delta markers are shaped like diamonds in the spectrogram. They are only displayed in the spectrogram if the marker position is inside the visible area of the spectrogram. If more than two markers are active, the marker values are displayed in a separate marker table.

In the spectrum result display, the markers and their frequency and level values (1) are displayed as usual. Additionally, the frame number is displayed to indicate the position of the marker in time (2).



In the spectrogram result display, you can activate up to 16 markers or delta markers at the same time. Each marker can be assigned to a different frame. Therefore, in addition to the frequency you also define the frame number when activating a new marker. If no frame number is specified, the marker is positioned on the currently selected frame. All markers are visible that are positioned on a visible frame. Special search functions are provided for spectrogram markers.

In the spectrum result display, only the markers positioned on the currently selected frame are visible. In "Continuous Sweep" mode this means that only markers positioned on frame 0 are visible. To view markers that are positioned on a frame other than frame 0 in the spectrum result display, you must stop the measurement and select the corresponding frame.

#### 10.5.2.2 Marker settings

Or: "Marker" > "Marker"

The remote commands required to define these settings are described in "[Setting up individual markers](#)" on page 810.



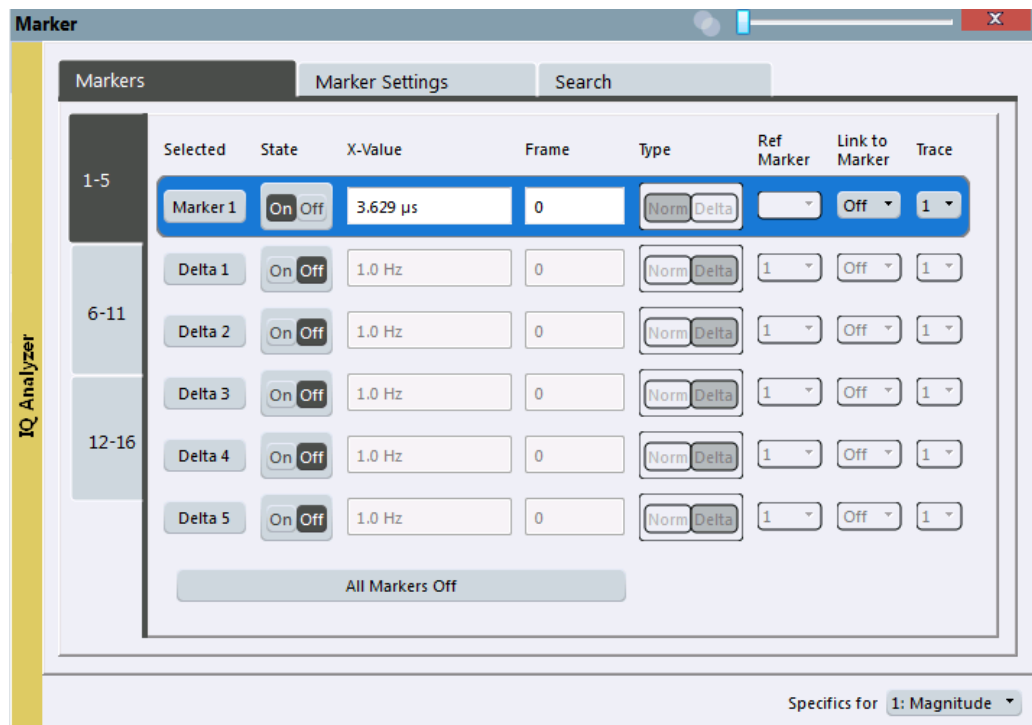
The [Percent Marker \(CCDF only\)](#) is only available for CCDF results and is described in [Chapter 10.3.7, "CCDF \(statistics\) settings"](#), on page 260.

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#### Individual marker setup

Up to 17 markers or delta markers can be activated for each window simultaneously. Initial marker setup is performed using the "Marker" dialog box.





The markers are distributed among 3 tabs for a better overview. By default, the first marker is defined as a normal marker, whereas all others are defined as delta markers with reference to the first marker. All markers are assigned to trace 1, but only the first marker is active.

▼ Place New Marker .....	417
ML  Marker 1 / Delta Marker 1 / Delta Marker 2 / Delta Marker 16 .....	417
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#### ▼ Place New Marker

Activates the next currently unused marker and sets it to the peak value of the current trace in the current window.

If a spectrogram is active, an edit field is displayed for the frame number ( $\leq 0$ ) in which the marker is to be placed.

#### ML Marker 1 / Delta Marker 1 / Delta Marker 2 / Delta Marker 16

To activate a marker, select the arrow on the marker selection list in the toolbar, or select a marker from the "Marker" > "Select Marker" menu. Enter the marker position ("X-value" ) in the edit dialog box.

If a spectrogram is active, the frame number ( $\leq 0$ ) in which the marker is to be placed can also be defined.

To deactivate a marker, select the marker name in the marker selection list in the toolbar (not the arrow) to display the "Select Marker" dialog box. Change the "State" to "Off" .

Marker 1 is always the default reference marker for relative measurements. If activated, markers 2 to 16 are delta markers that refer to marker 1. These markers can be converted into markers with absolute value display using the "Marker Type" function.

Several markers can be configured very easily using the "Marker" dialog box, see [Chapter 10.5.2.2, "Marker settings"](#), on page 416.

Remote command:

[CALCulate<n>:MARKer<m>\[:STATe\]](#) on page 816

[CALCulate<n>:MARKer<m>:X](#) on page 817

[CALCulate<n>:MARKer<m>:Y?](#) on page 877

[CALCulate<n>:DELTamarker<m>\[:STATe\]](#) on page 813

[CALCulate<n>:DELTamarker<m>:X](#) on page 814

[CALCulate<n>:DELTamarker<m>:X:RELative?](#) on page 877

[CALCulate<n>:DELTamarker<m>:Y?](#) on page 877

For spectrogram display:

[CALCulate<n>:DELTamarker<m>:SPECTrogram:FRAME](#) on page 824

[CALCulate<n>:MARKer<m>:SPECTrogram:FRAME](#) on page 820

### Selected Marker

Marker name. The marker which is currently selected for editing is highlighted orange.

Remote command:

Marker selected via suffix <m> in remote commands.

### Marker State

Activates or deactivates the marker in the diagram.

Remote command:

[CALCulate<n>:MARKer<m>\[:STATe\]](#) on page 816

[CALCulate<n>:DELTamarker<m>\[:STATe\]](#) on page 813

### Marker Position X-value

Defines the position (x-value) of the marker in the diagram. For normal markers, the absolute position is indicated. For delta markers, the position relative to the reference marker is provided.

Remote command:

[CALCulate<n>:MARKer<m>:X](#) on page 817

[CALCulate<n>:DELTamarker<m>:X](#) on page 814

### Frame (Spectrogram only)

Spectrogram frame the marker is assigned to.

Remote command:

[CALCulate<n>:MARKer<m>:SPECTrogram:FRAME](#) on page 820

[CALCulate<n>:DELTamarker<m>:SPECTrogram:FRAME](#) on page 824

## Marker Type



Toggles the marker type.

The type for marker 1 is always "Normal" , the type for delta marker 1 is always "Delta" . These types cannot be changed.

**Note:** If normal marker 1 is the active marker, switching the "Mkr Type" activates an additional delta marker 1. For any other marker, switching the marker type does not activate an additional marker, it only switches the type of the selected marker.

"Normal"            A normal marker indicates the absolute value at the defined position in the diagram.

"Delta"            A delta marker defines the value of the marker relative to the specified reference marker (marker 1 by default).

Remote command:

[CALCulate<n>:MARKer<m>\[:STATe\]](#) on page 816

[CALCulate<n>:DELTAmarker<m>\[:STATe\]](#) on page 813

## Reference Marker

Defines a marker as the reference marker which is used to determine relative analysis results (delta marker values).

If the reference marker is deactivated, the delta marker referring to it is also deactivated.

Remote command:

[CALCulate<n>:DELTAmarker<m>:MREference](#) on page 813

## Linking to Another Marker

Links the current marker to the marker selected from the list of active markers. If the x-axis value of the initial marker is changed, the linked marker follows to the same position on the x-axis. Linking is off by default.

Using this function you can set two markers on different traces to measure the difference (e.g. between a max hold trace and a min hold trace or between a measurement and a reference trace).

Remote command:

[CALCulate<n>:MARKer<ms>:LINK:TO:MARKer<md>](#) on page 815

[CALCulate<n>:DELTAmarker<ms>:LINK:TO:MARKer<md>](#) on page 812

[CALCulate<n>:DELTAmarker<m>:LINK](#) on page 811

## Assigning the Marker to a Trace

The "Trace" setting assigns the selected marker to an active trace. The trace determines which value the marker shows at the marker position. If the marker was previously assigned to a different trace, the marker remains on the previous frequency or time, but indicates the value of the new trace.

The marker can also be assigned to the currently active trace using the "Marker" > "Marker To Trace" menu item.

If a trace is turned off, the assigned markers and marker functions are also deactivated.

Remote command:

[CALCulate<n>:MARKer<m>:TRACe](#) on page 816

### Select Marker

ML

The "Select Marker" function opens a dialog box to select and activate or deactivate one or more markers quickly.



Remote command:

[CALCulate<n>:MARKer<m>\[:STATe\]](#) on page 816

[CALCulate<n>:DELTAmarker<m>\[:STATe\]](#) on page 813

### All Markers Off

ML

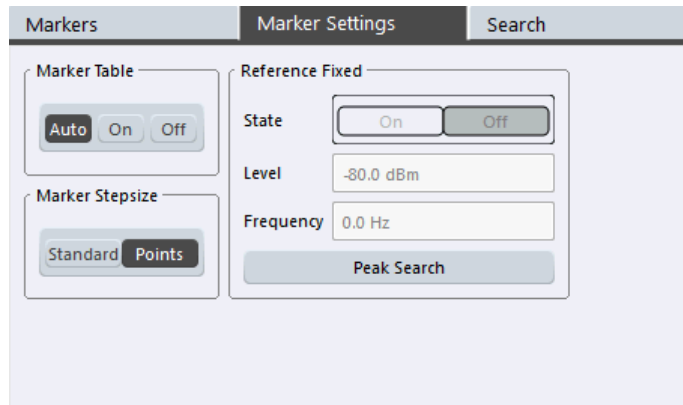
Deactivates all markers in one step.

Remote command:

[CALCulate<n>:MARKer<m>:AOFF](#) on page 815

### General marker settings

Some general marker settings allow you to influence the marker behavior for all markers.



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### Marker Table Display

Defines how the marker information is displayed.

"On"	Displays the marker information in a table in a separate area beneath the diagram.
"Off"	No separate marker table is displayed. If <a href="#">Marker Info</a> is active, the marker information is displayed within the diagram area.
"Auto"	(Default) If more than two markers are active, the marker table is displayed automatically. If <a href="#">Marker Info</a> is active, the marker information for up to two markers is displayed in the diagram area.

Remote command:

`DISPlay[:WINDow<n>]:MTABLE` on page 817

### Marker Info

Turns the marker information displayed in the diagram on and off.

1AP Clrw	
M1[1]	81.13 dBµV 177.610 MHz
D2[1]	-22.18 dB -28.980 MHz

Remote command:

`DISPlay[:WINDow<n>]:MINFo[:STATe]` on page 818

### Marker Stepsize

Defines the size of the steps that the marker position is moved using the mouse wheel.

- "Standard" The marker position is moved in steps of (Span/1000), which corresponds approximately to the number of pixels for the default display of 1001 measurement points. This setting is most suitable to move the marker over a larger distance.
- "Points" The marker position is moved from one measurement point to the next. This setting is required for a very precise positioning if more measurement points are collected than the number of pixels that can be displayed on the screen. It is the default mode.

Remote command:

[CALCulate<n>:MARKer<m>:X:SSIZE](#) on page 818

### Defining a Fixed Reference

Instead of using a reference marker whose position can vary depending on the measurement results, you can define a fixed reference marker for trace analysis.

Note that this function is not available in all result displays.

For "State" = "On" , a vertical and a horizontal red display line are displayed, marked as "FXD" . The normal marker 1 is activated and set to the peak value of the trace assigned to marker 1, and a delta marker to the next peak. The fixed reference marker is set to the position of marker 1 at the peak value. The delta marker refers to the fixed reference marker.

The "Level" and "Frequency" or "Time" settings define the position and value of the reference marker. To move the fixed reference, move the red display lines marked "FXD" in the diagram, or change the position settings in the "Marker Settings" tab of the "Marker" dialog box.

**Peak Search** sets the fixed reference marker to the current maximum value of the trace assigned to marker 1.

If activated, the fixed reference marker ("FXD" ) can also be selected as a [Reference Marker](#) instead of another marker.

Remote command:

[CALCulate<n>:DELTAmarker<m>:FUNCTION:FIXed\[:STATe\]](#) on page 843

[CALCulate<n>:DELTAmarker<m>:FUNCTION:FIXed:RPOint:Y](#) on page 842

[CALCulate<n>:DELTAmarker<m>:FUNCTION:FIXed:RPOint:X](#) on page 842

[CALCulate<n>:DELTAmarker<m>:FUNCTION:FIXed:RPOint:MAXimum\[:PEAK\]](#) on page 842

### 10.5.2.3 Marker search settings and positioning functions

**Access:** "Overview" > "Analysis" > "Marker" > "Search"

**or:** "Marker" > "Search"

Several functions are available to set the marker to a specific position very quickly and easily, or to use the current marker position to define another characteristic value. In order to determine the required marker position, searches may be performed. The search results can be influenced by special settings.



In I/Q Analyzer mode, the search settings for "Real/Imag (I/Q)" evaluation include an additional parameter, see "Branch for Peaksearch " on page 425.

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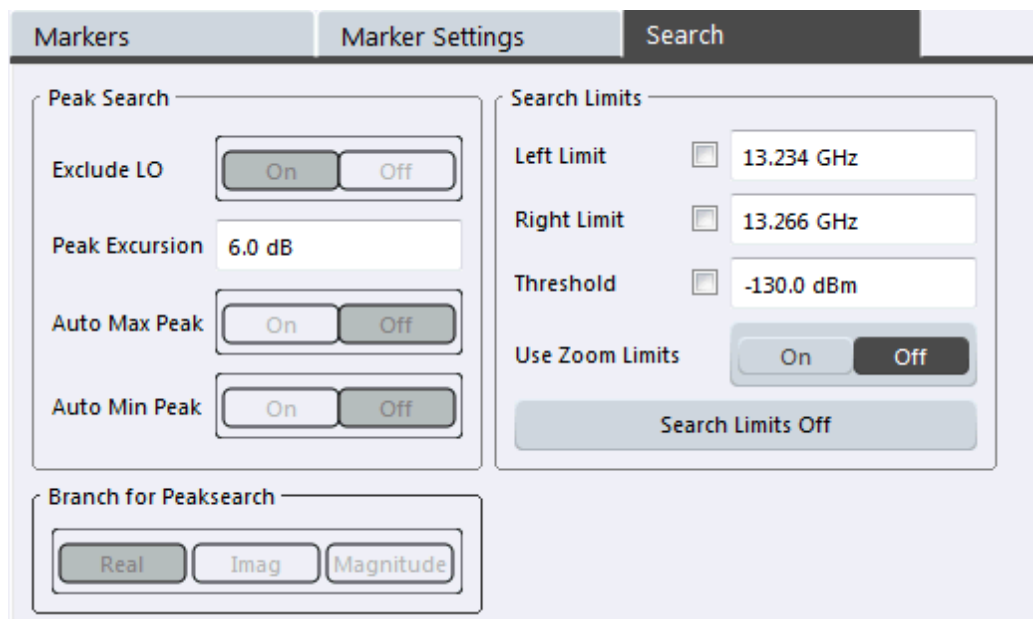
**Marker search settings**

or: "Marker" > "Search"

Markers are commonly used to determine peak values, i.e. maximum or minimum values, in the measured signal. Configuration settings allow you to influence the peak search results.



For Spectrograms, special marker settings are available, see "Marker search settings for spectrograms" on page 425.



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- [Exclude LO](#) .....424
- [Peak Excursion](#) ..... 424
- [Auto Max Peak Search / Auto Min Peak Search](#) .....424
- [Search Limits](#) ..... 424
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  - └ [Deactivating All Search Limits](#) ..... 425
- [Branch for Peaksearch](#) .....425

**Search Mode for Next Peak**

Selects the search mode for the next peak search.

"Left"	Determines the next maximum/minimum to the left of the current peak.
"Absolute"	Determines the next maximum/minimum to either side of the current peak.
"Right"	Determines the next maximum/minimum to the right of the current peak.

Remote command:

["Positioning the marker"](#) on page 832

**Exclude LO**

If activated, restricts the frequency range for the marker search functions.

"On"	The minimum frequency included in the peak search range is $\geq 5 \times$ resolution bandwidth (RBW). Due to the interference by the first local oscillator to the first intermediate frequency at the input mixer, the LO is represented as a signal at 0 Hz. To avoid the peak marker jumping to the LO signal at 0 Hz, this frequency is excluded from the peak search.
"Off"	No restriction to the search range. The frequency 0 Hz is included in the marker search functions.

Remote command:

[CALCulate<n>:MARKer<m>:LOEXclude](#) on page 828

**Peak Excursion**

Defines the minimum level value by which a signal must rise or fall so that it is identified as a maximum or a minimum by the search functions.

Entries from 0 dB to 80 dB are allowed; the resolution is 0.1 dB. The default setting for the peak excursion is 6 dB.

For Analog Modulation Analysis, the unit and value range depend on the selected result display type.

Remote command:

[CALCulate<n>:MARKer<m>:PEXCursion](#) on page 828

**Auto Max Peak Search / Auto Min Peak Search**

If activated, a maximum or minimum peak search is performed automatically for marker 1 after each measurement.

Remote command:

[CALCulate<n>:MARKer<m>:MAXimum:AUTO](#) on page 832

[CALCulate<n>:MARKer<m>:MINimum:AUTO](#) on page 834

**Search Limits**

The search results can be restricted by limiting the search area or adding search conditions.



**Search Limits (Left / Right) ← Search Limits**

If activated, limit lines are defined and displayed for the search. Only results within the limited search range are considered.

Remote command:

[CALCulate<n>:MARKer<m>:X:SLIMits\[:STATe\]](#) on page 829

[CALCulate<n>:MARKer<m>:X:SLIMits:LEFT](#) on page 829

[CALCulate<n>:MARKer<m>:X:SLIMits:RIGHT](#) on page 830

**Search Threshold ← Search Limits**

Defines an absolute threshold as an additional condition for the peak search. If enabled, only peaks that exceed the threshold are detected.

Remote command:

[CALCulate<n>:THReshold:STATe](#) on page 831

[CALCulate<n>:THReshold](#) on page 831

**Use Zoom Limits ← Search Limits**

If activated, the peak search is restricted to the active zoom area defined for a single zoom.

Remote command:

[CALCulate<n>:MARKer<m>:X:SLIMits:ZOOM\[:STATe\]](#) on page 830

**Deactivating All Search Limits ← Search Limits**

Deactivates the search range limits.

Remote command:

[CALCulate<n>:MARKer<m>:X:SLIMits\[:STATe\]](#) on page 829

[CALCulate<n>:THReshold:STATe](#) on page 831

**Branch for Peaksearch**

Defines which data is used for marker search functions in I/Q data.

This function is only available for the display configuration "Real/Imag (I/Q)" (see "[Real/Imag \(I/Q\)](#)" on page 170).

**Note:** The search settings apply to all markers, not only the currently selected one.

"Real"

Marker search functions are performed on the real trace of the I/Q measurement.

"Imag"

Marker search functions are performed on the imaginary trace of the I/Q measurement.

"Magnitude"

Marker search functions are performed on the magnitude of the I and Q data.

Remote command:

[CALCulate<n>:MARKer<m>:SEARch](#) on page 828

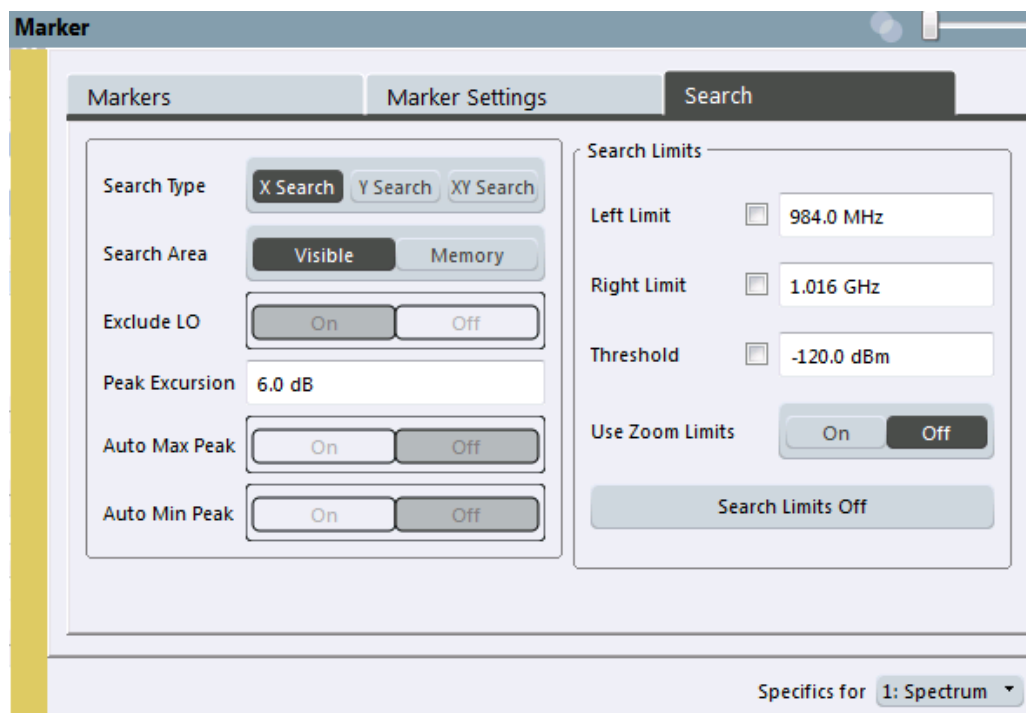
**Marker search settings for spectrograms**

**Access:** "Overview" > "Analysis" > "Markers" > "Search"

or: "Marker" > "Search"

Spectrograms show not only the current sweep results, but also the sweep history. Thus, when searching for peaks, you must define the search settings within a single time frame (x-direction) and within several time frames (y-direction).

These settings are only available for spectrogram displays.



Marker Search Type .....	426
Marker Search Area .....	426
Peak Excursion .....	427
Search Limits .....	427
L Search Limits (Left / Right) .....	427
L Search Threshold .....	427
L Use Zoom Limits .....	427
L Deactivating All Search Limits .....	427

### Marker Search Type

Defines the type of search to be performed in the spectrogram.

"X-Search"      Searches only within the currently selected frame.

"Y-Search"      Searches within all frames but only at the current frequency position.

"XY-Search"     Searches in all frames at all positions.

Remote command:

Defined by the search function, see "[Marker search \(spectrograms\)](#)" on page 819

### Marker Search Area

Defines which frames the search is performed in.

"Visible"        Only the visible frames are searched.

"Memory" All frames stored in the memory are searched.

Remote command:

[CALCulate<n>:MARKer<m>:SPECTrogram:SARea](#) on page 820

[CALCulate<n>:DELTAmarker<m>:SPECTrogram:SARea](#) on page 825

### Peak Excursion

Defines the minimum level value by which a signal must rise or fall so that it is identified as a maximum or a minimum by the search functions.

Entries from 0 dB to 80 dB are allowed; the resolution is 0.1 dB. The default setting for the peak excursion is 6 dB.

For Analog Modulation Analysis, the unit and value range depend on the selected result display type.

Remote command:

[CALCulate<n>:MARKer<m>:PEXCursion](#) on page 828

### Search Limits

The search results can be restricted by limiting the search area or adding search conditions.

#### Search Limits (Left / Right) ← Search Limits

If activated, limit lines are defined and displayed for the search. Only results within the limited search range are considered.

Remote command:

[CALCulate<n>:MARKer<m>:X:SLIMits\[:STATe\]](#) on page 829

[CALCulate<n>:MARKer<m>:X:SLIMits:LEFT](#) on page 829

[CALCulate<n>:MARKer<m>:X:SLIMits:RIGHT](#) on page 830

#### Search Threshold ← Search Limits

Defines an absolute threshold as an additional condition for the peak search. If enabled, only peaks that exceed the threshold are detected.

Remote command:

[CALCulate<n>:THReshold:STATe](#) on page 831

[CALCulate<n>:THReshold](#) on page 831

#### Use Zoom Limits ← Search Limits

If activated, the peak search is restricted to the active zoom area defined for a single zoom.

Remote command:

[CALCulate<n>:MARKer<m>:X:SLIMits:ZOOM\[:STATe\]](#) on page 830

#### Deactivating All Search Limits ← Search Limits

Deactivates the search range limits.

Remote command:

[CALCulate<n>:MARKer<m>:X:SLIMits\[:STATe\]](#) on page 829

[CALCulate<n>:THReshold:STATe](#) on page 831

## Positioning functions

**Access:** "Marker" toolbar

The following functions set the currently selected marker to the result of a peak search or set other characteristic values to the current marker value.

Peak Search .....	428
Search Next Peak .....	428
Search Minimum .....	428
Search Next Minimum .....	428
Center Frequency = Marker Frequency .....	429
Reference Level = Marker Level .....	429

### Peak Search



Sets the selected marker/delta marker to the maximum of the trace. If no marker is active, marker 1 is activated.

Remote command:

[CALCulate<n>:MARKer<m>:MAXimum\[:PEAK\]](#) on page 833

[CALCulate<n>:DELTamarker<m>:MAXimum\[:PEAK\]](#) on page 836

### Search Next Peak

Sets the selected marker/delta marker to the next (lower) maximum of the assigned trace. If no marker is active, marker 1 is activated.



For the Next Peak Up/Down functions, the search is automatically performed in all frames above or below the currently selected frame, respectively.

Remote command:

[CALCulate<n>:MARKer<m>:MAXimum:NEXT](#) on page 833

[CALCulate<n>:MARKer<m>:MAXimum:RIGHT](#) on page 833

[CALCulate<n>:MARKer<m>:MAXimum:LEFT](#) on page 833

[CALCulate<n>:DELTamarker<m>:MAXimum:NEXT](#) on page 836

[CALCulate<n>:DELTamarker<m>:MAXimum:RIGHT](#) on page 836

[CALCulate<n>:DELTamarker<m>:MAXimum:LEFT](#) on page 836

### Search Minimum



Sets the selected marker/delta marker to the minimum of the trace. If no marker is active, marker 1 is activated.

Remote command:

[CALCulate<n>:MARKer<m>:MINimum\[:PEAK\]](#) on page 835

[CALCulate<n>:DELTamarker<m>:MINimum\[:PEAK\]](#) on page 837

### Search Next Minimum

Sets the selected marker/delta marker to the next (higher) minimum of the selected trace. If no marker is active, marker 1 is activated.



For spectrogram displays, define which frame the next minimum is to be searched in.

For the Next Min Up/Down functions, the search is automatically performed in all frames above or below the currently selected frame, respectively.

Remote command:

[CALCulate<n>:MARKer<m>:MINimum:NEXT](#) on page 834  
[CALCulate<n>:MARKer<m>:MINimum:LEFT](#) on page 834  
[CALCulate<n>:MARKer<m>:MINimum:RIGHT](#) on page 835  
[CALCulate<n>:DELTamarker<m>:MINimum:NEXT](#) on page 837  
[CALCulate<n>:DELTamarker<m>:MINimum:LEFT](#) on page 837  
[CALCulate<n>:DELTamarker<m>:MINimum:RIGHT](#) on page 838

### Center Frequency = Marker Frequency



Sets the center frequency to the selected marker or delta marker frequency. A peak can thus be set as center frequency, for example to analyze it in detail with a smaller span.

Remote command:

[CALCulate<n>:MARKer<m>:FUNCTION:CENTer](#) on page 661

### Reference Level = Marker Level



Sets the reference level to the selected marker level.

Remote command:

[CALCulate<n>:MARKer<m>:FUNCTION:REFerence](#) on page 648

## 10.5.2.4 Marker functions

Some special marker functions are available in the I/Q Analyzer.

- [Measuring the power in a channel \(band power marker\)](#).....429
- [Time domain power measurement](#).....432
- [Marker peak list](#).....436
- [Measuring noise density \(noise meas marker\)](#)..... 439
- [Fixed reference marker](#).....442
- [Deactivating all marker functions](#)..... 443

### Measuring the power in a channel (band power marker)

**Access:** "Overview" > "Analysis" > "Marker Functions" > "Band Power" > "Band Power Config"

**or:** "Marker" > "Marker Function" > "Band Power"

To determine the noise power in a transmission channel, you can use a noise marker and multiply the result with the channel bandwidth. However, the results are only accurate for flat noise.

Band power markers allow you to measure the integrated power for a defined span (band) around a marker (similar to ACP measurements). By default, 5 % of the current span is used. The span is indicated by limit lines in the diagram. You can easily change

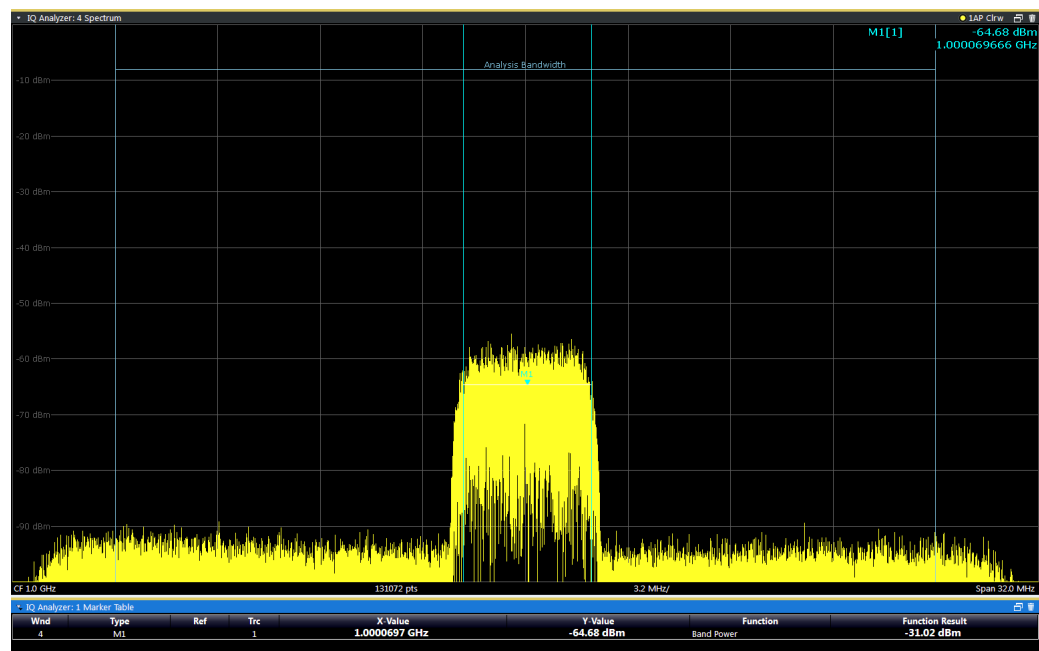
the span by moving the limit lines in the diagram. They are automatically aligned symmetrically to the marker frequency. They are also moved automatically if you move the marker on the screen.

The results can be displayed either as a power (dBm) or density (dBm/Hz) value and are indicated in the "marker table" for each band power marker.



Band power markers are only available for result displays in the frequency domain.

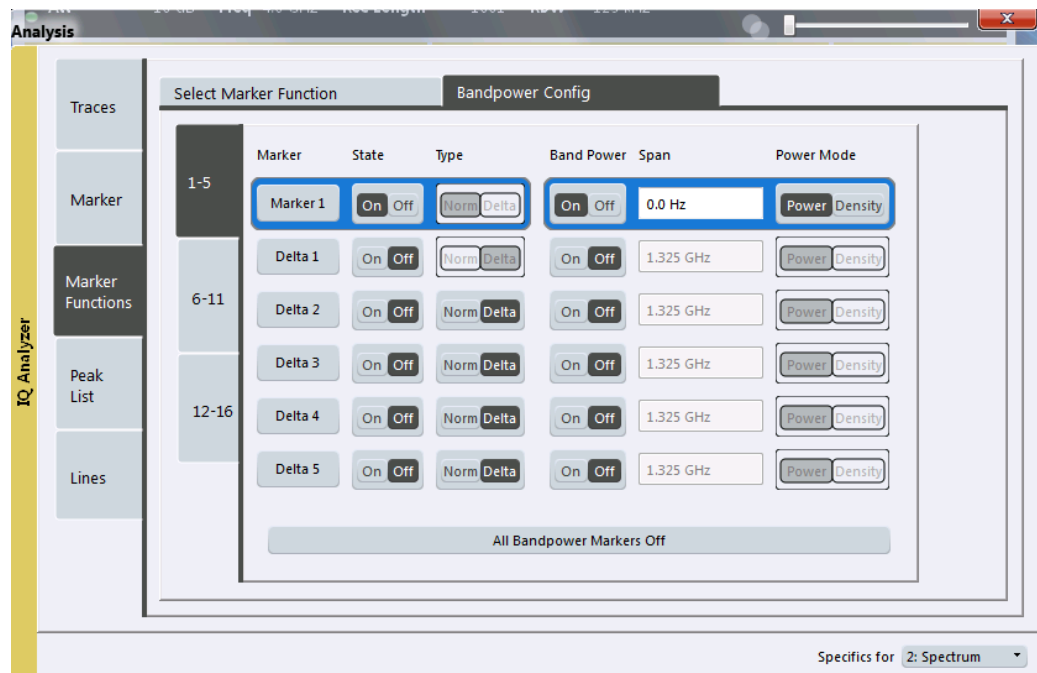
The entire band must lie within the display. If it is moved out of the display, the result cannot be calculated (indicated by "- -" as the "Function Result" ). However, the width of the band is maintained so that the band power can be calculated again when it returns to the display.



All markers can be defined as band power markers, each with a different span. When a band power marker is activated, if no marker is active yet, marker 1 is activated. Otherwise, the currently active marker is used as a band power marker (all other marker functions for this marker are deactivated).

If the detector mode for the marker trace is set to "Auto", the RMS detector is used.

The individual marker settings correspond to those defined in the "Marker" dialog box (see "[Individual marker setup](#)" on page 416). Any settings to the marker state or type changed in the "Marker Function" dialog box are also changed in the "Marker" dialog box and vice versa.



### Remote commands:

[CALCulate<n>:MARKer<m>:FUNCTION:BPOWER\[:STATE\]](#) on page 840

[CALCulate<n>:MARKer<m>:FUNCTION:BPOWER:RESULT?](#) on page 839

<a href="#">Band Power Measurement State</a> .....	431
<a href="#">Span</a> .....	431
<a href="#">Power Mode</a> .....	432
<a href="#">Switching All Band Power Measurements Off</a> .....	432

### Band Power Measurement State

Activates or deactivates band power measurement for the marker in the diagram.

Band power markers are only available for standard frequency measurements (not zero span) in the Spectrum application.

If activated, the markers display the power or density measured in the band around the current marker position.

For details see "[Measuring the power in a channel \(band power marker\)](#)" on page 429.

Remote command:

[CALCulate<n>:MARKer<m>:FUNCTION:BPOWER\[:STATE\]](#) on page 840

[CALCulate<n>:DELTAmarker<m>:FUNCTION:BPOWER\[:STATE\]](#) on page 841

### Span

Defines the span (band) around the marker for which the power is measured.

The span is indicated by lines in the diagram. You can easily change the span by moving the limit lines in the diagram. They are automatically aligned symmetrically to the marker frequency. They are also moved automatically if you move the marker on the screen.

Remote command:

[CALCulate<n>:MARKer<m>:FUNCTION:BPOWER:SPAN](#) on page 839

[CALCulate<n>:DELTAmarker<m>:FUNCTION:BPOWER:SPAN](#) on page 841

### Power Mode

Defines the mode of the power measurement result.

For Analog Modulation Analysis, the power mode is not editable for AM, FM, or PM spectrum results. In this case, the marker function does not determine a power value, but rather the deviation within the specified span.

"Power"            The result is an absolute power level.  
The power unit depends on the [Unit](#) setting.

"Density"           The result is a power level in relation to the bandwidth, displayed in dBm/Hz.

Remote command:

[CALCulate<n>:MARKer<m>:FUNCTION:BPOWER:MODE](#) on page 838

[CALCulate<n>:DELTAmarker<m>:FUNCTION:BPOWER:MODE](#) on page 840

### Switching All Band Power Measurements Off

Deactivates band power measurement for all markers.

Remote command:

[CALCulate<n>:MARKer<m>:FUNCTION:BPOWER\[:STATe\]](#) on page 840

[CALCulate<n>:DELTAmarker<m>:FUNCTION:BPOWER\[:STATe\]](#) on page 841

### Time domain power measurement

The Time Domain Power measurement determines the power of a signal in the time domain.

A time domain power measurement is only possible for zero span.

- [About the measurement](#).....432
- [Time domain power results](#).....432
- [Time domain power basics - range definition using limit lines](#).....433
- [Time domain power configuration](#).....434
- [How to measure powers in the time domain](#).....435

#### About the measurement

Using the Time Domain Power measurement function, the R&S VSE determines the power of the signal in zero span by summing up the power at the individual measurement points and dividing the result by the number of measurement points. Thus it is possible to measure the power of TDMA signals during transmission, for example, or during the muting phase. Both the mean power and the RMS power can be measured.

For this measurement, the sample detector is recommended. The sample detector is activated automatically if the detector is in auto mode.

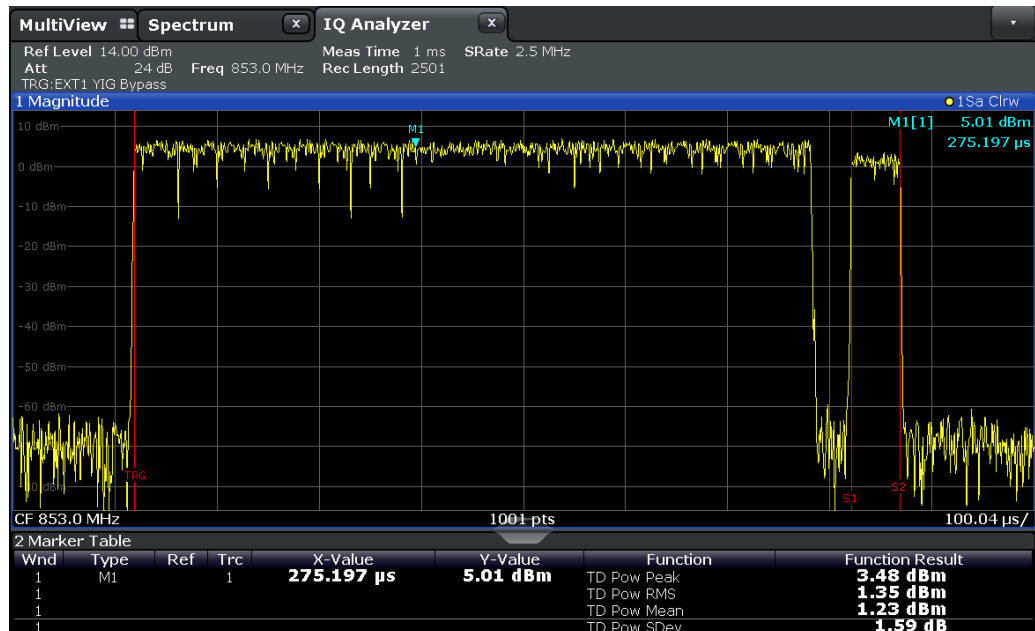
#### Time domain power results

Several different power results can be determined simultaneously:



Mode	Description
Peak	Peak value from the points of the displayed trace or a segment thereof.
RMS	RMS value from the points of the displayed trace or a segment thereof.
Mean	Mean value from the points of the displayed trace or a segment thereof. The linear mean value of the equivalent voltages is calculated. For example to measure the mean power during a GSM burst
Std Dev	The standard deviation of the measurement points from the mean value.

The result is displayed in the marker results, indicated by "Power" and the selected power mode, e.g. "RMS". The measured values are updated after each sweep or averaged over a user-defined number of sweeps (trace averaging).



The results can also be queried using the remote commands described in [Chapter 13.6.3.4, "Measuring the time domain power"](#), on page 778.

### Time domain power basics - range definition using limit lines

The range of the measured signal to be evaluated for the power measurement can be restricted using limit lines. The left and right limit lines (S1, S2) define the evaluation range and are indicated by vertical red lines in the diagram. If activated, the power results are only calculated from the levels within the limit lines.

For example, if both the on and off phase of a burst signal are displayed, the measurement range can be limited to the transmission or to the muting phase. The ratio between signal and noise power of a TDMA signal for instance can be measured by using a measurement as a reference value and then varying the measurement range.



In order to get stable measurement results for a limited evaluation range, usually a trigger is required.

### Time domain power configuration

**Time Domain Power**
X

Results

Peak	On	Off
RMS	On	Off
Mean	On	Off
Std Dev	On	Off

Limits

State	On	Off
Left	-----	
Right	-----	

The remote commands required to perform these tasks are described in [Chapter 13.6.3.4, "Measuring the time domain power"](#), on page 778.

Results .....	434
Limit State .....	435
Left Limit / Right Limit .....	435

#### Results

Activates the power results to be evaluated from the displayed trace or a limited area of the trace.

"Peak"	Peak power over several measurements (uses trace averaging, Max Hold)
"RMS"	RMS value from the points of the displayed trace or a segment thereof.

"Mean"	Mean value from the points of the displayed trace or a segment thereof. The linear mean value of the equivalent voltages is calculated.
"Std Dev"	The standard deviation of the measurement points from the mean value. The measurement of the mean power is automatically switched on at the same time.

Remote command:

[CALCulate<n>:MARKer<m>:FUNCTION:SUMMARY:PPEak\[:STATE\]](#) on page 780

[CALCulate<n>:MARKer<m>:FUNCTION:SUMMARY:PPEak:RESult?](#) on page 783

[CALCulate<n>:MARKer<m>:FUNCTION:SUMMARY:RMS\[:STATE\]](#) on page 780

[CALCulate<n>:MARKer<m>:FUNCTION:SUMMARY:RMS:RESult?](#) on page 784

[CALCulate<n>:MARKer<m>:FUNCTION:SUMMARY:MEAN\[:STATE\]](#) on page 780

[CALCulate<n>:MARKer<m>:FUNCTION:SUMMARY:MEAN:RESult?](#) on page 782

### Limit State

Switches the limitation of the evaluation range on or off. Default setting is off.

If deactivated, the entire sweep time is evaluated. If switched on, the evaluation range is defined by the left and right limit. If only one limit is set, it corresponds to the left limit and the right limit is defined by the stop frequency. If the second limit is also set, it defines the right limit.

Remote command:

[CALCulate<n>:MARKer<m>:X:SLIMits\[:STATE\]](#) on page 829

### Left Limit / Right Limit

Defines a power level limit for line S1 (left) or S2 (right).

Remote command:

[CALCulate<n>:MARKer<m>:X:SLIMits:LEFT](#) on page 829

[CALCulate<n>:MARKer<m>:X:SLIMits:RIGHT](#) on page 830

### How to measure powers in the time domain

The step-by-step procedure to measure powers in the time domain is described here in detail.

#### To measure the power in the time domain

1. Select a result window in the time domain, for example a "Magnitude" window.
2. Select [MARK FUNC].
3. From the "Select Marker Function" dialog box, select the "Time Domain Power" function.
4. Select the type of power measurement results to be determined by selecting the corresponding softkeys.
5. To restrict the power evaluation range, define limits:
  - a) Select "Time Dom Power Config" to display the "Time Domain Power" configuration dialog box.

- b) Switch on the limits by setting the "Limit State" to "On" .  
The limit lines S1 and S2 are displayed.
  - c) Define the left limit (limit line S1), the right limit (S2), or both.
6. Start a sweep.  
The measured powers are displayed in the marker results.

### Marker peak list

**Access:** "Overview" > "Analysis" > "Marker Functions" > "Marker Peak List"

A common measurement task is to determine peak values, i.e. maximum or minimum signal levels. The R&S VSE provides various peak search functions and applications:

- Setting a marker to a peak value once (Peak Search)
- Searching for a peak value within a restricted search area (Search Limits)

### Peak search limits

The peak search can be restricted to a search area. The search area is defined by limit lines which are also indicated in the diagram. In addition, a minimum value (threshold) can be defined as a further search condition.

### When is a peak a peak? - Peak excursion

During a peak search, noise values are detected as a peak if the signal is very flat or does not contain many peaks. Therefore, you can define a relative threshold ("Peak Excursion" ). The signal level must increase by the threshold value before falling again before a peak is detected. To avoid identifying noise peaks as maxima or minima, enter a peak excursion value that is higher than the difference between the highest and the lowest value measured for the displayed inherent noise.

### Effect of peak excursion settings (example)

The following figure shows a trace to be analyzed.

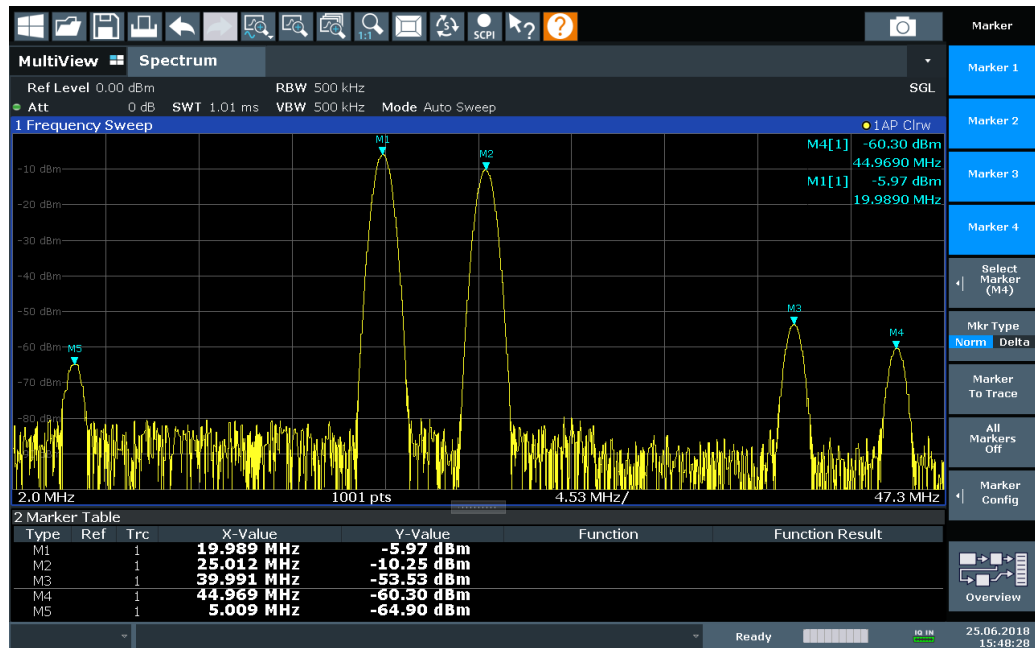


Figure 10-51: Trace example

The following table lists the peaks as indicated by the marker numbers in the diagram above, as well as the minimum decrease in amplitude to either side of the peak:

Marker #	Min. amplitude decrease to either side of the signal
1	80 dB
2	80 dB
3	55 dB
4	39 dB
5	32 dB

To eliminate the smaller peaks M3, M4 and M5 in the example above, a peak excursion of at least 60 dB is required. In this case, the amplitude must rise at least 60 dB before falling again before a peak is detected.

The screenshot shows the 'Peak List' settings panel in the I/Q analyzer software. On the left, a vertical sidebar contains buttons for 'Traces', 'Marker', 'Marker Functions', and 'Peak List'. The main panel is titled 'Peak List' and contains the following controls:

- State:** A toggle switch set to 'On'.
- Settings:**
  - Sort Mode:** Two buttons, 'X Value' (selected) and 'Y Value'.
  - Maximum Number of Peaks:** A text input field containing '50'.
  - Peak Excursion:** A text input field containing '5.0' and a dropdown menu set to 'dB'.
  - Display Marker Numbers:** A toggle switch set to 'On'.
- Search Limits:**
  - Left Limit:** A checkbox (unchecked) and a text input field containing '0.0 Hz'.
  - Right Limit:** A checkbox (unchecked) and a text input field containing '160.0 MHz'.
  - Threshold:** A checkbox (unchecked) and a text input field containing '-28.58 dB'.
  - Use Zoom Limits:** Two toggle switches, 'On' (selected) and 'Off'.
  - A 'Search Limits Off' button is located below these fields.
- Export:**
  - An 'Export Peak List' button.
  - Decimal Separator:** Two buttons, 'Point' (selected) and 'Comma'.

**Remote commands:**

[CALCulate<n>:MARKer<m>:FUNCTION:FPEaks:STATE](#) on page 846

TRAC? LIST,

See [TRACe<n>\[:DATA\]?](#) on page 875

<a href="#">Peak List State</a> .....	438
<a href="#">Sort Mode</a> .....	438
<a href="#">Maximum Number of Peaks</a> .....	438
<a href="#">Peak Excursion</a> .....	439
<a href="#">Display Marker Numbers</a> .....	439
<a href="#">Export Peak List</a> .....	439

**Peak List State**

Activates/deactivates the marker peak list. If activated, the peak list is displayed and the peaks are indicated in the trace display.

For each listed peak, the frequency/time ("X-value" ) and level ("Y-Value" ) values are given.

Remote command:

[CALCulate<n>:MARKer<m>:FUNCTION:FPEaks:STATE](#) on page 846

**Sort Mode**

Defines whether the peak list is sorted according to the x-values or y-values. In either case, the values are sorted in ascending order.

Remote command:

[CALCulate<n>:MARKer<m>:FUNCTION:FPEaks:SORT](#) on page 846

**Maximum Number of Peaks**

Defines the maximum number of peaks to be determined and displayed.

Remote command:

[CALCulate<n>:MARKer<m>:FUNCTION:FPEaks:LIST:SIZE](#) on page 845

**Peak Excursion**

Defines the minimum level value by which a signal must rise or fall so that it is identified as a maximum or a minimum by the search functions.

Entries from 0 dB to 80 dB are allowed; the resolution is 0.1 dB. The default setting for the peak excursion is 6 dB.

For Analog Modulation Analysis, the unit and value range depend on the selected result display type.

Remote command:

`CALCulate<n>:MARKer<m>:PEXCursion` on page 828

**Display Marker Numbers**

By default, the marker numbers are indicated in the diagram so you can find the peaks from the list. However, for large numbers of peaks, the marker numbers can decrease readability; in this case, deactivate the marker number display.

Remote command:

`CALCulate<n>:MARKer<m>:FUNCTION:FPEaks:ANNOtation:LABel[:STATe]` on page 844

**Export Peak List**

The peak list can be exported to an ASCII file (.DAT) for analysis in an external application.

Remote command:

`MMEMory:STORe<n>:PEAK` on page 847

`FORMat:DEXPort:DSEParator` on page 874

**Measuring noise density (noise meas marker)**

**Access:** "Overview" > "Analysis" > "Marker Functions" > "Select Marker Function" > "Noise Measurement" > "Noise Meas Config"



This marker function is only available for measurements in the time and frequency domain (see [Chapter 10.1, "Measurements and result displays for the I/Q analyzer"](#), on page 166).

Using the noise measurement marker function, the noise power density is measured at the position of the marker. In the time domain mode, all points of the trace are used to determine the noise power density. When measurements are performed in the frequency domain, eight points to the right and left of the marker (if available) are used for the measurement to obtain a stable result.

**Result display**

Noise density is the noise referred to a bandwidth of 1 Hz. With logarithmic amplitude units (dBm, dBmV, dBm $\mu$ V, dB $\mu$ A), the noise power density is output in dBm/Hz, i.e. as the level in 1 Hz bandwidth with reference to 1 mW. With linear amplitude units (V, A, W), the noise voltage density is analyzed in  $\mu$ V/ $\sqrt$ Hz; the noise current density in  $\mu$ A/ $\sqrt$ Hz; the noise power density in  $\mu$ W/ $\sqrt$ Hz.

The result is indicated as the **function result in the Marker Table**.

### Prerequisite settings

The following settings are required to obtain correct values:

- Detector: Sample or RMS
- Video bandwidth:
  - ≤ 0.1 resolution bandwidth with sample detector
  - ≥ 3 x resolution bandwidth with RMS detector
- Trace averaging:

In the default setting, the R&S VSE uses the sample detector for the noise function. With the sample detector, you can set the trace to "Average" mode to stabilize the measured values. When the RMS detector is used, trace averaging produces noise levels that are too low and cannot be corrected. Instead, increase the sweep time to obtain stable measurement results.

### Correction factors

The R&S VSE uses the following correction factors to analyze the noise density from the marker level:

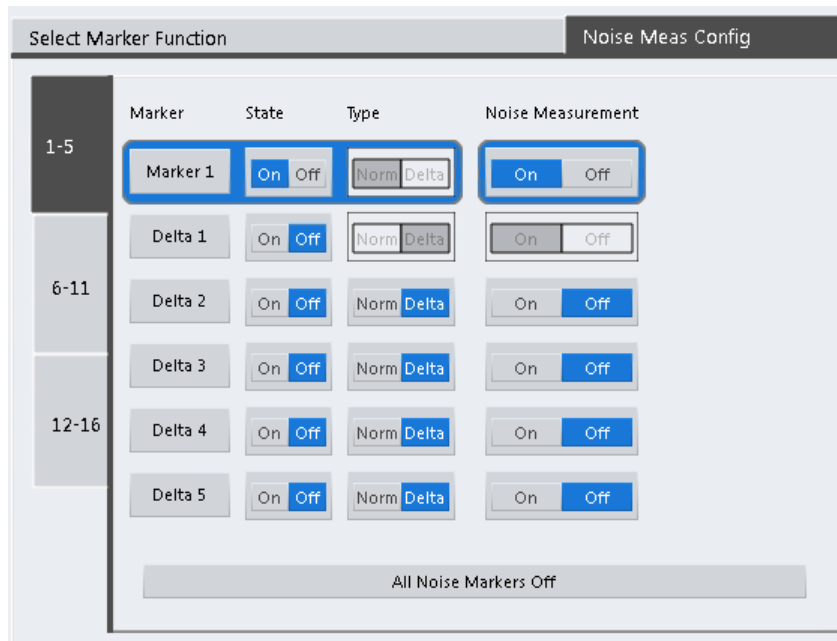
- Since the noise power is indicated with reference to 1 Hz bandwidth, the bandwidth correction value is deducted from the marker level. It is  $10 \times \lg(1 \text{ Hz}/\text{BWNoise})$ , where BWNoise is the noise or power bandwidth of the set resolution filter (RBW).
- RMS detector: With the exception of bandwidth correction, no further corrections are required since this detector already indicates the power for each point of the trace.
- Sample detector: As a result of video filter averaging and trace averaging, 1.05 dB is added to the marker level. This is the difference between the average value and the RMS value of white noise. With a logarithmic level axis, 1.45 dB is added additionally. Logarithmic averaging is thus fully taken into account, which yields a value that is 1.45 dB lower than that of linear averaging.
- To allow for a more stable noise display, eight trace points on each side of the measurement frequency are averaged.
- For span > 0, the measured values are averaged versus time (after a sweep).



The R&S VSE noise figure can be calculated from the measured power density level. It is calculated by deducting the set RF attenuation (RF Att) from the displayed noise level and adding 174 to the result.

The individual marker settings correspond to those defined in the "Marker" dialog box (see "[Individual marker setup](#)" on page 416). Any settings to the marker state or type changed in the "Marker Function" dialog box are also changed in the "Marker" dialog box and vice versa.





**Remote commands:**

[CALCulate<n>:MARKer<m>:FUNCTION:NOISE\[:STATe\]](#) on page 848

[CALCulate<n>:MARKer<m>:FUNCTION:NOISE:RESult?](#) on page 848

[Marker State](#) .....441

[Marker Type](#) ..... 441

[Noise Measurement State](#) .....442

[Switching All Noise Measurement Off](#) .....442

**Marker State**

Activates or deactivates the marker in the diagram.

Remote command:

[CALCulate<n>:MARKer<m>\[:STATe\]](#) on page 816

[CALCulate<n>:DELTAmarker<m>\[:STATe\]](#) on page 813

**Marker Type**



Toggles the marker type.

The type for marker 1 is always "Normal" , the type for delta marker 1 is always "Delta" . These types cannot be changed.

**Note:** If normal marker 1 is the active marker, switching the "Mkr Type" activates an additional delta marker 1. For any other marker, switching the marker type does not activate an additional marker, it only switches the type of the selected marker.

"Normal"            A normal marker indicates the absolute value at the defined position in the diagram.

"Delta"             A delta marker defines the value of the marker relative to the specified reference marker (marker 1 by default).

Remote command:

`CALCulate<n>:MARKer<m>[:STATe]` on page 816

`CALCulate<n>:DELTAmarker<m>[:STATe]` on page 813

### Noise Measurement State

Activates or deactivates noise measurement for the marker in the diagram.

This function is only available for normal markers.

If activated, the marker displays the noise power density measured at the position of the marker.

For details see "[Measuring noise density \(noise meas marker\)](#)" on page 439.

Remote command:

`CALCulate<n>:MARKer<m>:FUNCTION:NOISE[:STATe]` on page 848

`CALCulate<n>:MARKer<m>:FUNCTION:NOISE:RESult?` on page 848

### Switching All Noise Measurement Off

Deactivates noise measurement for all markers.

Remote command:

`CALCulate<n>:MARKer<m>:FUNCTION:NOISE[:STATe]` on page 848

### Fixed reference marker

**Access:** "Overview" > "Analysis" > "Marker Functions" > "Reference Fixed"

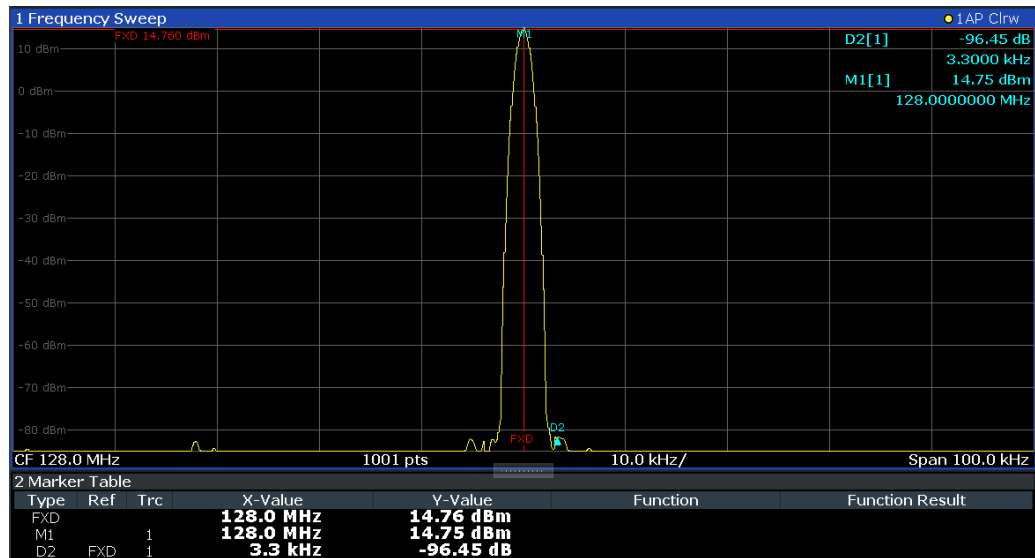
**Or:** "Marker" > "Marker Function" > "Reference Fixed"



This marker function is only available for measurements in the time and frequency domain (see [Chapter 10.1, "Measurements and result displays for the I/Q analyzer"](#), on page 166).

Instead of using a reference marker that may vary its position depending on the measurement results, a fixed reference marker can be defined for trace analysis. Once positioned, the reference marker does not move during subsequent sweeps unless you explicitly move it manually.

When you select this marker function, a vertical and a horizontal red display line are displayed, marked as "FXD". A normal marker is activated and set to the peak value and a delta marker to the next peak. The fixed reference marker is set to the position of the normal marker at the peak value. The delta marker refers to the fixed reference marker.



You can move the position of the fixed reference marker graphically by dragging the display lines, or numerically by entering values for the marker position and level.

#### Remote commands:

`CALCulate<n>:DELTamarker<m>:FUNction:FIXed[:STATe]` on page 843

`CALCulate<n>:DELTamarker<m>:FUNction:FIXed:RPOint:X` on page 842

`CALCulate<n>:DELTamarker<m>:FUNction:FIXed:RPOint:Y` on page 842

#### Deactivating all marker functions

**Access:** "Overview" > "Analysis" > "Marker Functions" > "All Functions Off"

**Or:** "Marker" > "All Marker Off"

All special marker functions can be deactivated in one step.

**Remote command:**

### 10.5.3 Zoomed displays

You can zoom into the diagram to visualize the measurement results in greater detail. Using a mouse pointer you can easily define the area to be enlarged.



#### Zoom and the number of trace points

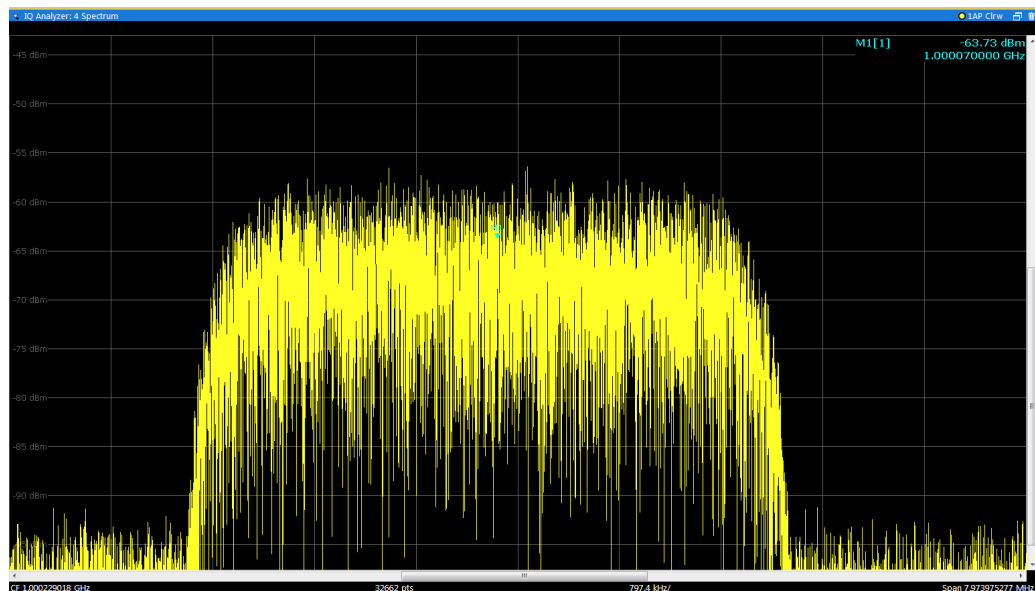
Note that zooming is merely a visual tool, it does not change any measurement settings, such as the number of trace points!

You should increase the number of trace points before zooming, as otherwise the function has no real effect (see [Chapter 10.2.2, "How much data is measured: capture count and measurement points"](#), on page 177).

- [Single zoom versus multiple zoom](#).....444
- [Zoom functions](#).....445
- [How to zoom into a diagram](#)..... 447

### 10.5.3.1 Single zoom versus multiple zoom

Two different (graphical) zoom modes are available: single zoom and multiple zoom. A single zoom replaces the current diagram by a new diagram which displays an enlarged extract of the trace. This function can be used repetitively until the required details are visible. In multiple zoom mode, you can enlarge up to four different areas of the trace simultaneously. An overview window indicates the zoom areas in the original trace, while the zoomed trace areas are displayed in individual windows. The zoom areas can be moved and resized any time. The zoom area that corresponds to the individual zoom display is indicated in the lower right corner, between the scrollbars.



**Figure 10-52: Single zoom**

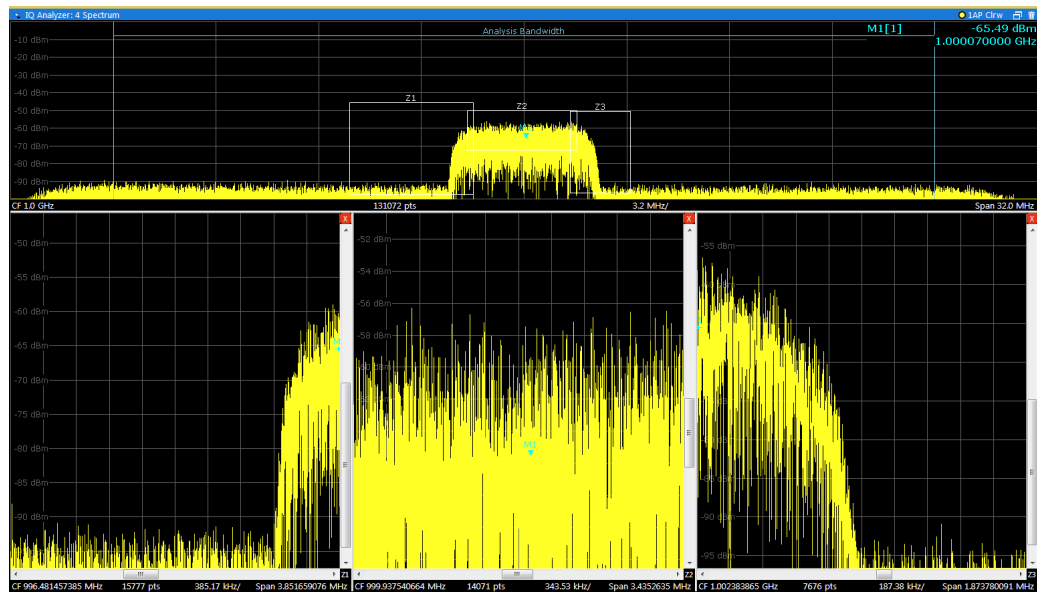


Figure 10-53: Multiple zoom



### Using the zoom area to restrict a peak search

The selected zoom area can be used to restrict the search range for a peak search, but only in single zoom mode (see "Use Zoom Limits " on page 425).

## 10.5.3.2 Zoom functions

**Access:** "Zoom" icons in toolbar

Single Zoom .....	445
Multi-Zoom .....	445
Restore Original Display .....	446
Data shift (Pan) .....	446
Data Zoom .....	446

### Single Zoom



A single zoom replaces the current diagram by a new diagram which displays an enlarged extract of the trace. This function can be used repetitively until the required details are visible.

Remote command:

`DISPlay[:WINDow<n>][:SUBWindow<w>]:ZOOM[:STATE]` on page 850

`DISPlay[:WINDow<n>][:SUBWindow<w>]:ZOOM:AREA` on page 849

### Multi-Zoom



In multiple zoom mode, you can enlarge several different areas of the trace simultaneously. An overview window indicates the zoom areas in the original trace, while the zoomed trace areas are displayed in individual windows. The zoom area that corresponds to the individual zoom display is indicated in the lower right corner, between the scrollbars.

Remote command:

`DISPlay[:WINDow<n>][:SUBWindow<w>]:ZOOM:MULTiple<zn>[:STATe]`  
on page 852

`DISPlay[:WINDow<n>][:SUBWindow<w>]:ZOOM:MULTiple<zn>:AREA`  
on page 851

### Restore Original Display



Restores the original display, that is, the originally calculated displays for the entire capture buffer, and closes all zoom windows.

**Note:** This function only restores graphically zoomed displays. Measurement zooms, for which measurement settings were adapted, are recalculated based on the adapted measurement settings. In this case, the zoomed display is maintained.

Remote command:

Single zoom:

`DISPlay[:WINDow<n>][:SUBWindow<w>]:ZOOM[:STATe]` on page 850

Multiple zoom:

`DISPlay[:WINDow<n>][:SUBWindow<w>]:ZOOM:MULTiple<zn>[:STATe]`  
on page 852 (for each multiple zoom window)

### Data shift (Pan)

Shifts the data to be evaluated in the result display (analysis region or hop/chirp) and re-evaluates the new data. *ALL* result displays based on the same data (analysis region or hop/chirp) are updated.

Currently, this function is only available in the Transient Analysis application.

**Tip:** Result tables are also re-evaluated for each data shift, which can take some time. Close the result tables during a data shift/zoom to improve the screen update speed.

### Data Zoom

Decreases the amount of data to be evaluated in the result display (analysis region or hop/chirp) and re-evaluates the new data, thus enlarging the display of the remaining data.

*ALL* result displays based on the same data (analysis region or hop/chirp) are updated.

Currently, this function is only available in the Transient Analysis application.

**Tip:** result tables are also re-evaluated for each data zoom, which can take some time. Close the result tables during a data shift/zoom to improve the screen update speed.

### 10.5.3.3 How to zoom into a diagram

The remote commands required to zoom into a display are described in [Chapter 13.6.4.6, "Zooming into the display"](#), on page 849.

The following tasks are described here:

- ["To zoom into the diagram at one position"](#) on page 447
- ["To return to original display"](#) on page 448
- ["To zoom into multiple positions in the diagram"](#) on page 448
- ["To maintain a zoomed display permanently"](#) on page 448

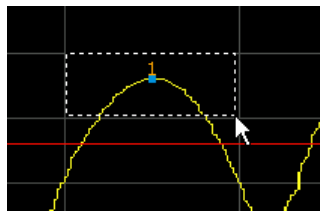
#### To zoom into the diagram at one position

1. 

Click on the "Single Zoom" icon in the toolbar.

Zoom mode is activated.

2. Select the area in the diagram to be enlarged using the mouse pointer. The selected area is indicated by a dotted rectangle.



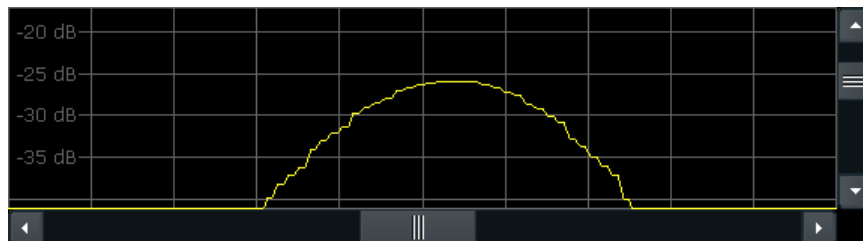
When you drop the mouse pointer, the diagram is replaced by the zoomed trace area.

3. Repeat these steps, if necessary, to enlarge the diagram further.



#### Scrolling in the zoomed display

You can scroll the diagram area to display the entire diagram using the scrollbars at the right and at the bottom of the diagram.



### To return to original display



Click on the "Zoom Off" icon in the toolbar.

The original trace display is restored. Zoom mode remains active, however.

### To zoom into multiple positions in the diagram



1.

Click on the "Multi-Zoom" icon in the toolbar.

Multiple zoom mode is activated.

2. Select the first area in the diagram to be enlarged as described in ["To zoom into the diagram at one position"](#) on page 447. The selected area is indicated by a dotted rectangle.

When you have completed your selection, the original trace is shown in an overview diagram with the selected area indicated by a dotted rectangle. The zoomed trace area is displayed in a separate window (see [Figure 10-53](#)).



3.

Click on the "Multi-Zoom" icon in the toolbar again.

4. In the overview diagram, select the next area to be enlarged.

The second zoom area is indicated in the overview diagram, and a second zoom window is displayed.

5. Repeat these steps, if necessary, to zoom into further trace areas (up to four).

### To move or change zoom areas

In multiple zoom mode, you can change the size or position of the individual zoom areas easily at any time.

- ▶ To resize a zoom area, set the mouse pointer directly **on** the corresponding frame in the overview window and drag the line to change the size of the frame.  
To move a zoom area, set the mouse pointer **inside** the corresponding frame in the overview window and drag the frame to the new position.

The contents of the zoom windows are adapted accordingly.

### To maintain a zoomed display permanently

Graphical zooming only changes the resolution of the displayed trace points temporarily. In order to change the display permanently, you must change the corresponding measurement settings.



(Note: Performing a measurement zoom automatically adapts the measurement settings to reflect a graphically zoomed display, see ["To perform a measurement zoom"](#) on page 449).

1. Perform a graphical zoom as described in the previous procedures.
2. Select the "Measurement Zoom" icon from the toolbar.
3. Select "Adapt Measurement to Zoom (selected diagram)".



The measurement settings are adapted as required to obtain the zoomed result display.

#### To perform a measurement zoom

Performing a measurement zoom automatically adapts the measurement settings to reflect a graphically zoomed display.



1. Select the "Measurement Zoom" icon from the toolbar.
2. Do one of the following to define the zoom area:
  - Stretch two fingers in the diagram to enlarge the area between them.
  - Tap and drag one finger in the diagram to select the area to be enlarged. The selected area is indicated by a dotted rectangle.

The measurement settings are adapted as required to obtain the zoomed result display.

### 10.5.4 Display and limit lines

Display and limit lines help you analyze a measurement trace.

**Access:** "Overview" > "Analysis" > "Lines"

For remote operation, see [Chapter 13.6.4.7, "Configuring display lines"](#), on page 852.

- [Display lines](#)..... 449
- [Limit lines](#)..... 451

#### 10.5.4.1 Display lines

##### Basics on display lines

Display lines help you analyze a trace – as do markers. The function of a display line is comparable to that of a ruler that can be shifted on the trace in order to mark absolute values. They are used exclusively to visually mark relevant frequencies or points in time (zero span), as well as constant level values. It is not possible to check automatically whether the points are below or above the marked level values - use limit lines for that task (see ["Basics on limit lines"](#) on page 451).

Two different types of display lines are provided:

- Two horizontal lines: "Horizontal Line 1" and "Horizontal Line 2".  
These lines are continuous horizontal lines across the entire width of a diagram and can be shifted up and down.
- Four vertical lines: "Vertical Line 1" to "Vertical Line 4"  
These lines are continuous vertical lines across the entire height of the diagram and can be shifted left and right.

### Lables

Each line is identified by one of the following abbreviations in the diagrams:

- H1: "Horizontal Line 1"
- H2: "Horizontal Line 2"
- V1: "Vertical Line 1"
- V2: "Vertical Line 2"
- V3: "Vertical Line 3"
- V4: "Vertical Line 4"

### Display line settings

**Access:** "Overview" > "Analysis" > "Lines" > "Display Lines"

Four vertical and two horizontal lines can be defined in the display.

Limit Lines	Display Lines
Vertical Line 1 <input checked="" type="checkbox"/>	13.249979 GHz
Vertical Line 2 <input checked="" type="checkbox"/>	13.250021 GHz
Horizontal Line 1 <input checked="" type="checkbox"/>	0.0 dBm
Horizontal Line 2 <input checked="" type="checkbox"/>	-100.0 dBm

<a href="#">Vertical Line &lt;x&gt;</a> .....	450
<a href="#">Horizontal Line 1 / Horizontal Line 2</a> .....	450

#### Vertical Line <x>

Activates a vertical display line in the diagram at the specified point of the x-axis, depending on the scale of the axis.

Remote command:

[CALCulate<n>:FLINe<dl>](#) on page 853

[CALCulate<n>:TLINe<dl>](#) on page 854

#### Horizontal Line 1 / Horizontal Line 2

Activates a horizontal display line (H1 or H2) in the diagram at the specified point of the y-axis.

Remote command:

[CALCulate<n>:DLINe<dl>](#) on page 853

[CALCulate<n>:DLINe<dl>](#) on page 853

### Defining display lines

1. Display lines are configured in the "Lines Config" dialog box. To display this dialog box, press [Lines] and then "Lines Config".
2. Select the "Display Lines" tab.
3. To define a vertical line:
  - a) Select "Vertical Line 1", 2, 3, or 4.
  - b) Enter the x-value at which the line is to be displayed.
4. To define a horizontal line:
  - a) Select "Horizontal Line 1" or 2.
  - b) Enter the y-value at which the line is to be displayed.

#### 10.5.4.2 Limit lines

Limit lines allow you to check automatically whether the measured points are below or above specified values.

In the I/Q Analyzer application, lines are only available for measurements in the frequency domain.

- [Basics on limit lines](#).....451
- [Limit line settings and functions](#)..... 454
- [How to define limit lines](#)..... 458

#### Basics on limit lines

Limit lines are used to define amplitude curves or spectral distribution boundaries in the result diagram which are not to be exceeded. They indicate, for example, the upper limits for interference radiation or spurious waves which are allowed from a device under test (DUT). When transmitting information in TDMA systems (e.g. GSM), the amplitude of the bursts in a time slot must adhere to a curve that falls within a specified tolerance band. The lower and upper limits may each be specified by a limit line. Then, the amplitude curve can be controlled either visually or automatically for any violations of the upper or lower limits (GO/NOGO test).

The R&S VSE supports limit lines with a maximum of 200 data points. Eight of the limit lines stored in the instrument can be activated simultaneously. The number of limit lines stored in the software is only limited by the capacity of the storage device used.

Limit line data can also be exported to a file in ASCII (CSV) format for further evaluation in other applications. Limit lines stored in the specified ASCII (CSV) format can also be imported to the R&S VSE for other measurements.

#### Compatibility

Limit lines are compatible with the current measurement settings, if the following applies:

- The x unit of the limit line has to be identical to the current setting.

- The y unit of the limit line has to be identical to the current setting with the exception of dB based units; all dB based units are compatible with each other.

### Validity

Only limit lines that fulfill the following conditions can be activated:

- Each limit line must consist of a minimum of 2 and a maximum of 200 data points.
- The frequencies/times for each data point must be defined in ascending order; however, for any single frequency or time, two data points may be entered (to define a vertical segment of a limit line).
- Gaps in frequency or time are not allowed. If gaps are desired, two separate limit lines must be defined and then both enabled.
- The entered frequencies or times need not necessarily be selectable in R&S VSE. A limit line may also exceed the specified frequency or time range. The minimum frequency for a data point is -200 GHz, the maximum frequency is 200 GHz. For the time range representation, negative times may also be entered. The allowed range is -1000 s to +1000 s.

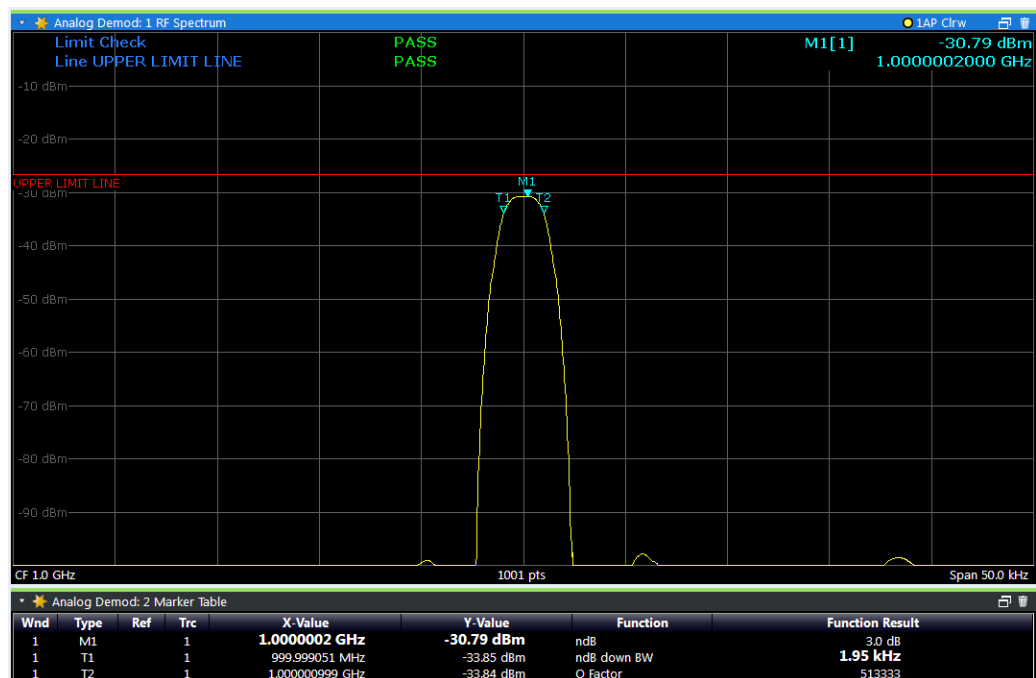
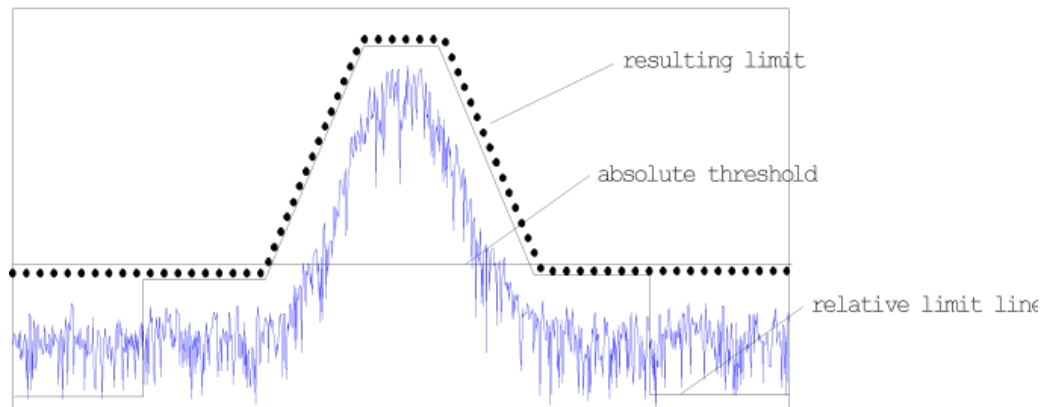


Figure 10-54: Example for an upper limit line

### Thresholds

If the y-axis for the limit line data points uses relative scaling, an additional absolute **threshold** can be defined for the limit check. In this case, both the threshold value and the relative limit line must be exceeded before a violation occurs.



### Offsets and Shifting

A configured limit line can easily be moved vertically or horizontally. Two different methods to do so are available:

- An **offset** moves the entire line in the diagram without editing the configured values or positions of the individual data points. This option is only available if relative scaling is used.  
Thus, a new limit line can be easily generated based upon an existing limit line which has been shifted horizontally or vertically.
- Defining a **shift** width for the values or position of the individual data points changes the line configuration, thus changing the position of the line in the diagram.

### Limit Check Results

A limit check is automatically performed as soon as any of the limit lines is activated ("Visibility" setting). Only the specified "Traces to be Checked" are compared with the active limit lines. The status of the limit check for each limit line is indicated in the diagram. If a violation occurs, the limit check status is set to "MARG" for a margin violation, or to "Fail" for a limit violation.

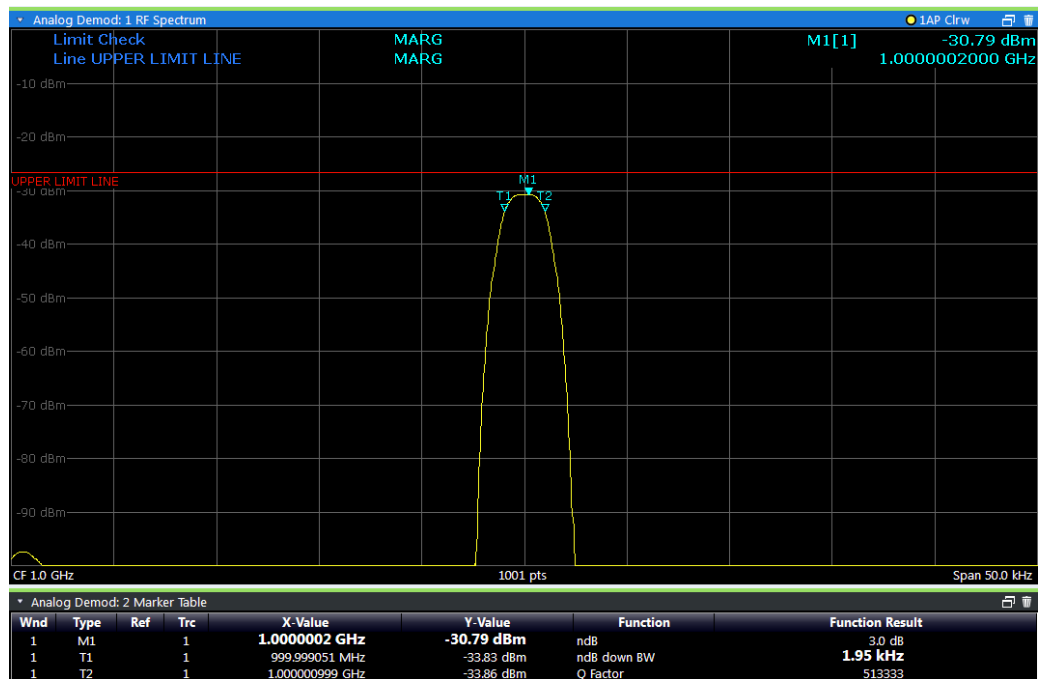


Figure 10-55: Margin violation for limit check

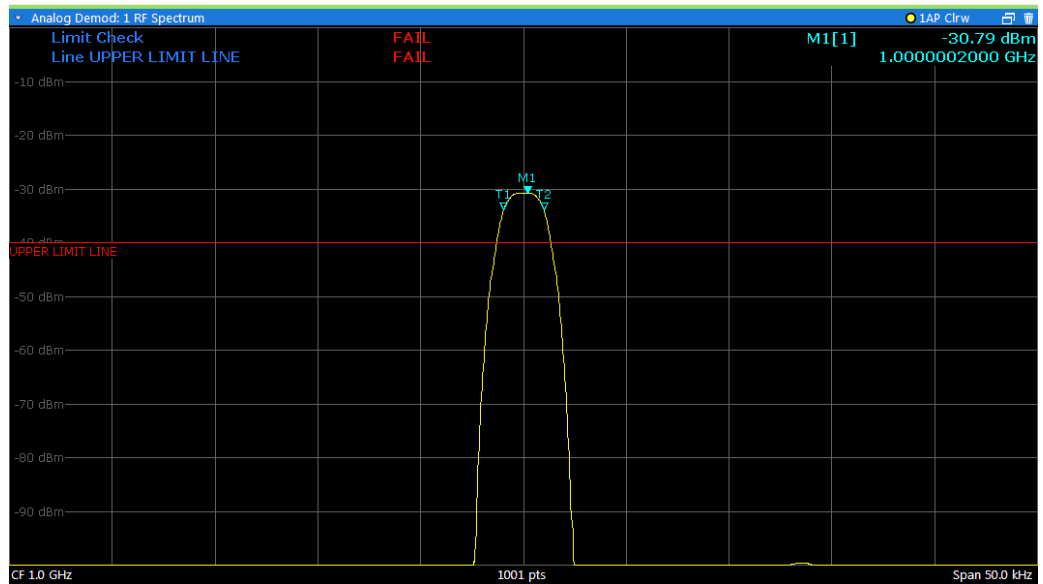


Figure 10-56: Limit violation for limit check

**Limit line settings and functions**

or: "Limits" > "Line"

- [Limit line management](#).....455
- [Limit line details](#).....456

## Limit line management

**Access:** "Overview" > "Analysis" > "Lines" > "Limit Lines"

**or:** "Limits" > "Line" > "Limit Lines"

For the limit line overview, the R&S VSE searches for all stored limit lines with the file extension `.LIN` in the `limits` subfolder of the main installation folder. The overview allows you to determine which limit lines are available and can be used for the current measurement.

For details on settings for individual lines see ["Limit line details"](#) on page 456.

Name .....	455
Unit .....	455
Compatibility .....	455
Visibility .....	455
Traces to be Checked .....	455
Comment .....	456
X-Offset .....	456
Y-Offset .....	456
Create New Line .....	456
Edit Line .....	456
Copy Line .....	456
Delete Line .....	456
Disable All Lines .....	456

### Name

The name of the stored limit line.

### Unit

The unit in which the y-values of the data points of the limit line are defined.

### Compatibility

Indicates whether the limit line definition is compatible with the current measurement settings.

### Visibility

Displays or hides the limit line in the diagram. Up to 8 limit lines can be visible at the same time. Inactive limit lines can also be displayed in the diagram.

Remote command:

[CALCulate<n>:LIMit<li>:LOWer:STATe](#) on page 860

[CALCulate<n>:LIMit<li>:UPPer:STATe](#) on page 863

[CALCulate<n>:LIMit<li>:ACTive?](#) on page 864

### Traces to be Checked

Defines which traces are automatically checked for conformance with the limit lines. As soon as a trace to be checked is defined, the assigned limit line is active. One limit line can be activated for several traces simultaneously. If any of the "Traces to be Checked" violate any of the active limit lines, a message is indicated in the diagram.

Remote command:

[CALCulate<n>:LIMit<li>:TRACe<t>:CHECK](#) on page 866

### Comment

An optional description of the limit line.

### X-Offset

Shifts a limit line that has been specified for relative frequencies or times (x-axis) horizontally.

This setting does not have any effect on limit lines that are defined by absolute values for the x-axis.

Remote command:

[CALCulate<n>:LIMit<li>:CONTRol:OFFSet](#) on page 857

### Y-Offset

Shifts a limit line that has relative values for the y-axis (levels or linear units such as volt) vertically.

This setting does not have any effect on limit lines that are defined by absolute values for the y-axis.

Remote command:

[CALCulate<n>:LIMit<li>:LOWer:OFFSet](#) on page 859

[CALCulate<n>:LIMit<li>:UPPer:OFFSet](#) on page 862

### Create New Line

Creates a new limit line.

### Edit Line

Edit an existing limit line configuration.

### Copy Line

Copy the selected limit line configuration to create a new line.

Remote command:

[CALCulate<n>:LIMit<li>:COPY](#) on page 865

### Delete Line

Delete the selected limit line configuration.

Remote command:

[CALCulate<n>:LIMit<li>:DELete](#) on page 865

### Disable All Lines

Disable all limit lines in one step.

Remote command:

[CALCulate<n>:LIMit<li>:STATe](#) on page 865

### Limit line details

**Access:** "Overview" > "Analysis" > "Lines" > "Limit Lines" > "New" / "Edit" / "Copy To"



or: "Limits" > "Line" > "Limit Lines" > "New" / "Edit" / "Copy To"

Name .....	457
Comment .....	457
Threshold .....	457
Data Points .....	457
Insert Value .....	457
Delete Value .....	457
Shift x .....	457
Shift y .....	458
Save .....	458

### Name

Defines the limit line name. All names must be compatible with Windows conventions for file names. The limit line data is stored under this name (with a `.LIN` extension).

Remote command:

`CALCulate<n>:LIMit<li>:NAME` on page 861

### Comment

Defines an optional comment for the limit line.

Remote command:

`CALCulate<n>:LIMit<li>:COMMENT` on page 856

### Threshold

Defines an absolute threshold value (only for relative scaling of the y-axis).

Remote command:

`CALCulate<n>:LIMit<li>:LOWer:THReshold` on page 860

`CALCulate<n>:LIMit<li>:UPPer:THReshold` on page 864

### Data Points

Each limit line is defined by a minimum of 2 and a maximum of 200 data points. Each data point is defined by its position (x-axis) and value (y-value). Data points must be defined in ascending order. The same position can have two different values.

Remote command:

`CALCulate<n>:LIMit<li>:CONTrol[:DATA]` on page 856

`CALCulate<n>:LIMit<li>:LOWer[:DATA]` on page 858

`CALCulate<n>:LIMit<li>:UPPer[:DATA]` on page 861

### Insert Value

Inserts a data point in the limit line above the selected one in the "Edit Limit Line" dialog box.

### Delete Value

Deletes the selected data point in the "Edit Limit Line" dialog box.

### Shift x

Shifts the x-value of each data point horizontally by the defined shift width (as opposed to an additive offset defined for the entire limit line, see "[X-Offset](#)" on page 456).

Remote command:

[CALCulate<n>:LIMit<li>:CONTrol:SHIFt](#) on page 857

### Shift y

Shifts the y-value of each data point vertically by the defined shift width (as opposed to an additive offset defined for the entire limit line, see "[Y-Offset](#)" on page 456).

Remote command:

[CALCulate<n>:LIMit<li>:LOWer:SHIFt](#) on page 859

[CALCulate<n>:LIMit<li>:UPPer:SHIFt](#) on page 863

### Save

Saves the currently edited limit line under the name defined in the "Name" field.

### How to define limit lines

**Access:** "Overview" > "Analysis" > "Lines" > "Limit Lines"

**or:** "Limits" > "Line" > "Limit Lines"

The following tasks are described here:

- "[How to find compatible limit lines](#)" on page 458
- "[How to activate and deactivate a limit check](#)" on page 458
- "[How to edit existing limit lines](#)" on page 459
- "[How to copy an existing limit line](#)" on page 459
- "[How to delete an existing limit line](#)" on page 459
- "[How to configure a new limit line](#)" on page 459
- "[How to move the limit line vertically or horizontally](#)" on page 460

### How to find compatible limit lines

- ▶ In the "Line Config" dialog box, select the "View Filter" option: "Show Compatible" .  
All stored limit lines with the file extension `.LIN` in the `limits` subfolder of the main installation folder of the instrument that are compatible to the current measurement settings are displayed in the overview.

### How to activate and deactivate a limit check

A limit check is automatically performed as soon as any of the limit lines is activated.

1. To activate a limit check:  
Select the "Check Traces" setting for a limit line in the overview and select the trace numbers to be included in the limit check. One limit line can be assigned to several traces.  
  
The specified traces to be checked are compared with the active limit lines. The status of the limit check is indicated in the diagram.
2. To deactivate a limit line, deactivate all "Traces to be Checked" for it.  
To deactivate all limit lines at once, select "Disable All Lines" .

The limit checks for the deactivated limit lines are stopped and the results are removed from the display.

### How to edit existing limit lines

Existing limit line configurations can be edited.

1. In the "Line Config" dialog box, select the limit line.
2. Select "Edit" .
3. Edit the line configuration as described in ["How to configure a new limit line"](#) on page 459.
4. Save the new configuration by selecting "Save" .

If the limit line is active, the edited limit line is displayed in the diagram.

### How to copy an existing limit line

1. In the dialog box, select the limit line.
2. Select "Line Config" "Copy To" .
3. Define a new name to create a new limit with the same configuration as the source line.
4. Edit the line configuration as described in ["How to configure a new limit line"](#) on page 459.
5. Save the new configuration by selecting "Save" .

The new limit line is displayed in the overview and can be activated.

### How to delete an existing limit line

1. In the "Line Config" dialog box, select the limit line.
2. Select "Delete" .
3. Confirm the message.

The limit line and the results of the limit check are deleted.

### How to configure a new limit line

1. In the "Line Config" dialog box, select "New" .

The "Edit Limit Line" dialog box is displayed. The current line configuration is displayed in the preview area of the dialog box. The preview is updated after each change to the configuration.

2. Define a "Name" and, optionally, a "Comment" for the new limit line.
3. Define the x-axis configuration:
  - Time domain or frequency domain
  - Absolute or relative limits
  - Linear or logarithmic scaling

4. Define the y-axis configuration:
  - Level unit
  - Absolute or relative limits
  - Upper or lower limit line
5. Define the data points: minimum 2, maximum 200:
  - a) Select "Insert Value" .
  - b) Define the x-value ("Position" ) and y-value ("Value" ) of the first data point.
  - c) Select "Insert Value" again and define the second data point.
  - d) Repeat this to insert all other data points.
    - To insert a data point before an existing one, select the data point and then "Insert Value" .
    - To insert a new data point at the end of the list, move the focus to the line after the last entry and then select "Insert Value" .
    - To delete a data point, select the entry and then "Delete Value" .
6. Check the current line configuration in the preview area of the dialog box. If necessary, correct individual data points or add or delete some.  
If necessary, shift the entire line vertically or horizontally by selecting "Shift x" or "Shift y" and defining the shift width.
7. Optionally, define a "Margin" at a fixed distance to the limit line.  
The margin must be within the valid value range and is not displayed in the diagram or preview area.
8. Optionally, if the y-axis uses relative scaling, define an absolute "Threshold" as an additional criteria for a violation.
9. Save the new configuration by selecting "Save" .  
The new limit line is displayed in the overview and can be activated.

#### **How to move the limit line vertically or horizontally**

A configured limit line can easily be moved vertically or horizontally. Thus, a new limit line can be easily generated based upon an existing limit line which has been shifted horizontally.

1. In the "Line Config" dialog box, select the limit line.
2. To shift the complete limit line parallel in the horizontal direction, select "X-Offset" and enter an offset value.  
To shift the complete limit line parallel in the vertical direction, select "Y-Offset" and enter an offset value.
3. To shift the individual data points of a limit line by a fixed value (all at once):
  - a) Select "Edit" .
  - b) In the "Edit Limit Line" dialog box, select "Shift x" or "Shift y" and define the shift width.
  - c) Save the shifted data points by selecting "Save" .

If activated, the limit line is shifted in the diagram.

# 11 How to perform measurements with the R&S VSE

The following step-by-step instructions demonstrate:




- How to load and store I/Q data
- How to perform basic measurements with the R&S VSE in general
- How to configure data acquisition and analyze data in the I/Q Analyzer application
- [How to perform a basic measurement with instrument input](#)..... 461
- [How to import I/Q data for analysis](#)..... 463
- [How to work with a power sensor](#)..... 465
- [How to perform measurements on multiple files and instruments](#)..... 467
- [How to perform a sequence of measurements on a single file or instrument](#)..... 468
- [How to save and load measurement settings](#)..... 469
- [How to export I/Q data](#)..... 470
- [How to capture baseband \(I/Q\) data in the I/Q analyzer](#)..... 471
- [How to analyze data in the I/Q analyzer](#)..... 472

## 11.1 How to perform a basic measurement with instrument input




The following step-by-step instructions demonstrate how to perform a simple measurement on input from a connected instrument using the R&S VSE.


1. Configure an instrument from you want to capture data from:
  - a) In the "Instruments" tool window, select "New Instrument".
  - b) Select "Search" to search for all instruments in the network and select the instrument from which data is to be captured.  
Alternatively, enter the connection information for the new instrument manually.
  - c) Select "Connect" to establish a connection to the specified instrument.
  - d) If necessary, select "Self Alignment" to calibrate the instrument.
  - e) Optionally, select "Infos & Settings" to do one of the following:
    - Configure the use of an external reference on the instrument
    - Control the display of the remote controlled instrument
    - Obtain information on the options installed on the connected instrument
2. Assign the configured instrument to the default measurement channel:
  - a) In the "Measurement Group Setup" tool window, for the default group 1, select the "+" icon in front of the default measurement channel "IQ Analyzer".
  - b) Select "Instrument" as the input type.
  - c) If several instruments are configured, select the instrument to be used for the measurement from the "Instrument" selection list.

## How to perform a basic measurement with instrument input

- d) If optional interfaces for data input to the instrument are available, select the input source to be used for the measurement from the "Input Source" selection list.
3. Configure further input source settings as required for the selected signal source (see [Chapter 11.8, "How to capture baseband \(I/Q\) data in the I/Q analyzer"](#), on page 471).
4. Select the "Capture mode" icon for the "IQ Analyzer" measurement channel to toggle between single  and continuous  measurements.  
In single capture mode, a fixed number of measurements is performed (defined by the measurement settings).  
In continuous capture mode, measurements are performed continuously until you stop them manually.
5. Select the  "Capture" icon for the "IQ Analyzer" measurement channel.  
One or more measurements are performed on the input data from the connected instrument and the results are displayed in the "IQ Analyzer: Magnitude" result display.  
  
Analyze the captured data as described in [Chapter 11.9, "How to analyze data in the I/Q analyzer"](#), on page 472, or add further measurement channels to analyze the input data in other applications as described in [Chapter 11.4, "How to perform measurements on multiple files and instruments"](#), on page 467.

**To add further measurement channels**

1. In the "Measurement Group Setup" tool window, select the "+ Channel" button to add a new measurement channel to the group.
2. Select the measurement mode or a copy of the currently selected measurement channel ("Duplicate Current Channel").  
The channel bar and the default result displays for the new measurement channel are displayed. If necessary, the previously displayed windows are cumulated in tabs to create room on the display.
3. Select the input type for the new measurement channel.
4. Assign a configured instrument (see [Chapter 11.1, "How to perform a basic measurement with instrument input"](#), on page 461), or import a file (see [Chapter 11.2, "How to import I/Q data for analysis"](#), on page 463).
5. Configure further input source or measurement settings as required for the individual channels (see the applications' user manual for details).
6. Repeat these steps to add further measurement channels to the group.
7. Select the "Capture mode" icon to toggle between single  and continuous  measurements for each measurement channel.
8. Select the  "Capture" icon for a measurement channel to perform a measurement on that channel.

You can only start one channel manually at a time. Before you can start another channel, you must stop the previous measurement by selecting the  "Stop" icon for that channel first.



To start multiple measurements (on different input types) at the same time, perform a measurement on the entire group; see [Chapter 11.4, "How to perform measurements on multiple files and instruments"](#), on page 467.

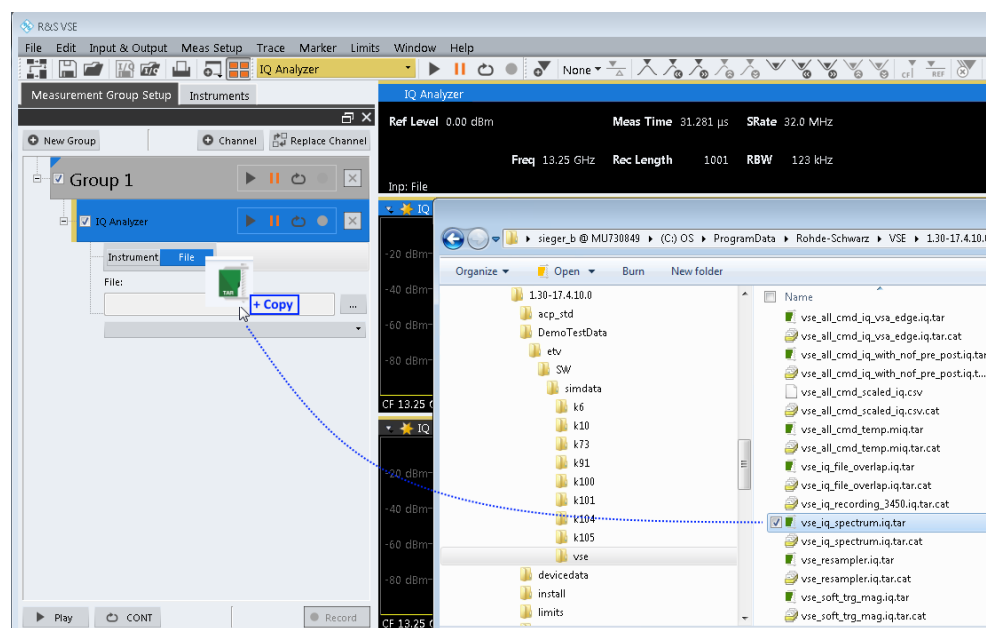
To perform several measurements on the same instrument sequentially, configure a measurement sequence; see [Chapter 11.5, "How to perform a sequence of measurements on a single file or instrument"](#), on page 468.

## 11.2 How to import I/Q data for analysis

### To import data via drag&drop

As of R&S VSE software version 1.30, you can load a file simply by selecting it in a file explorer and dragging it to the R&S VSE software.

1. In a file explorer, select the file that contains the I/Q data.
2. Drag the selected file from the file explorer to the R&S VSE software.
3. Drop the file at one of the following positions:
  - In the channel bar of a channel
  - In the "Measurement Group Setup" tool window, over the channel configuration
  - In the "Measurement Group Setup" tool window, for a channel with multiple input sources, over one of the input sources(Tip: If you drag the file and hold it over the channel configuration for a second, the input sources are expanded automatically so you can drop the file on an individual source.)



The channel is automatically configured for file input, if necessary.

The data from the file is used as input for the selected channel.

If the file contains data from multiple channels (e.g. from LTE measurements), the first channel is used as the first input source, the second channel is used for the second input source (if available), and so on.

If the measurement channel contains multiple input sources, but the input file only contains one data channel, the data is used for the input source the file was dropped on. If the file was dropped on the channel bar, the data is used for the first input source.

4. If essential data is not included in the data file, enter the missing data in the displayed "Recall I/Q Recording" dialog box.
5. Select the ► "Capture" icon for the measurement channel.

The stored data is loaded from the file and evaluated in the selected application.

#### To import data via the "Measurement Group Setup" window

1. In the "Measurement Group Setup" tool window, select the "+" icon in front of the measurement channel.
2. Select "File" as the input type.
3. Select the "..." icon to open a file selection dialog box and select the storage location and the file name.  
Alternatively, select a file from the selection list of recently imported files.
4. Select the ► "Capture" icon for the measurement channel.

The stored data is loaded from the file and evaluated in the selected application.



### To import data via the "Input" dialog box

Alternatively to the procedure described above, starting in the "Measurement Group Setup" tool window, you can also import data via the "Input" dialog box.

1. From the "Input & Output" menu, select "Input Source".
2. Select "I/Q File" as the input source.
3. Select "Select File" to open a file selection dialog box and select the storage location and the file name.
4. Set the state of the I/Q file input source to "On".
5. Close the "Input" dialog box.
6. Select the ► "Capture" icon for the measurement channel.

The stored data is loaded from the file and evaluated in the selected application.

## 11.3 How to work with a power sensor

The following step-by-step instructions demonstrate how to set up a power sensor. For details on individual functions and settings see [Chapter 10.3.2.6, "Power sensor settings"](#), on page 216.

The remote commands required to perform these tasks are described in ["Working with power sensors"](#) on page 639.

### 11.3.1 How to set up a power sensor

Up to 4 external power sensors can be configured separately and used for precise power measurement. All power sensors can be activated and deactivated individually.

The following procedure describes in detail how to configure and activate power sensors.

1. Select "Input & Output" > "Input Source" > "Power Sensor".
2. Select the tab for the power sensor index you want to configure, e.g. "Sensor 1".
3. Enable "Select" to analyze the power sensor data according to the current configuration when power measurement is activated.
4. From the selection list with serial numbers of connected power sensors, select the sensor you want to configure.  
To have newly connected power sensors assigned to a tab automatically (default), select "Auto" .
5. Define the frequency of the signal whose power you want to measure.
  - To define the frequency manually, select "Frequency Manual" and enter a frequency.

- To determine the frequency automatically, select "Frequency Coupling" .  
Then select:
  - "Center" , to use the center frequency.
  - "Marker" , to use the frequency defined by marker 1.
- 6. Select the unit for the power result display.
- 7. Select the averaging mode:
  - The measurement time for which the average is calculated ("Short", "Normal", "Long").
  - The number of readings to average ("Manual" + "Number of Readings" ).
- 8. To activate the duty cycle correction, select "DutyCycle" and enter a percentage as the correction value.
- 9. If you selected "dB" or "%" as units (relative display), define a reference value:
  - To set the currently measured power as a reference value, select "Meas -> Ref" .
  - Enter a value manually in the "Reference Value" field.
  - a) Optionally, to consider the reference level offset defined for the analyzer for the measured power, enable "Use Ref Level Offset" .
- 10. If necessary, repeat the procedure for another power sensor.
- 11. Set the "Power Sensor State" at the top of the "Power Sensor" tab to "On" to activate power measurement for the selected power sensors.  
  
The results of the power measurement are displayed in the marker table (Function: "Sensor <1...4>" ).

### 11.3.2 How to zero the power sensor

1. Select "Input & Output" > "Input Source" > "Power Sensor".
2. Select the tab for the power sensor you want to zero.
3. Select "Zeroing Power Sensor" .  
A dialog box is displayed that prompts you to disconnect all signals from the input of the power sensor.
4. Disconnect all signals sending input to the power sensor and select "Continue".
5. Wait until zeroing is complete.  
A corresponding message is displayed.

## 11.4 How to perform measurements on multiple files and instruments


Multiple measurements on different instruments or files can be performed quasi in parallel. All measurements are started at the same time, and provide results independently as they are completed in each measurement channel.

1. In the "Instruments" tool window, configure all instruments on which measurements are to be performed (see also [Chapter 11.1, "How to perform a basic measurement with instrument input"](#), on page 461).
2. In the "Measurement Group Setup" tool window, select the "+ Channel" button to add a new measurement channel to the group.
3. Select the measurement mode or a copy of the currently selected measurement channel ("Duplicate Current Channel").

The channel bar and the default result displays for the new measurement channel are displayed. If necessary, the previously displayed windows are cumulated in tabs to create room on the display.


4. Select the input type for the new measurement channel.
5. Assign a configured instrument (see [Chapter 11.1, "How to perform a basic measurement with instrument input"](#), on page 461), or import a file (see [Chapter 11.2, "How to import I/Q data for analysis"](#), on page 463).


If the same instrument is assigned to multiple measurement channels of the same group, the channel to which the instrument was assigned last is deactivated. The checkmark for the channel in the "Measurement Group Setup" tool window is removed.


6. Configure further input source or measurement settings as required for the individual channels (see the applications' user manual for details).
7. Repeat these steps to add further measurement channels to the group.
8. Select the "Capture mode" icon () for the group to toggle between single and continuous measurements.

In single capture mode, each measurement channel is processed a single time, In continuous capture mode, the measurements are performed continuously until you stop the group measurement manually.

Note that the capture mode of the group automatically defines the capture mode of the individual channels as the same mode.

9. Select the  "Capture" icon for the group to start all active measurement channels. One or more measurements are performed on the input data for each active measurement channel at the same time. The results are displayed in the channels' result displays when available.



**Note:** You can perform a measurement for a single channel by selecting the  "Capture" icon for that measurement channel. However, you can only start one

channel manually at a time. Before you can start another channel, you must stop the previous measurement by selecting the  "Pause" icon for that channel first.

Analyze the captured data as described in [Chapter 11.9, "How to analyze data in the I/Q analyzer"](#), on page 472.

## 11.5 How to perform a sequence of measurements on a single file or instrument

A single instrument can perform only one measurement at a time; however, a sequence of measurements can be performed in just one step.

1. In the "Instruments" tool window, configure the instrument on which the measurements are to be performed (see also [Chapter 11.1, "How to perform a basic measurement with instrument input"](#), on page 461).
2. In the "Measurement Group Setup" tool window, select the "+ New Group" button to add a measurement group, that is: a measurement channel for the same instrument or file.
3. Select the input type for the new measurement channel.
4. Assign the same configured instrument (see [Chapter 11.1, "How to perform a basic measurement with instrument input"](#), on page 461), or import the same file (see [Chapter 11.2, "How to import I/Q data for analysis"](#), on page 463) as for the other groups.
5. Optionally, you can add further measurement channels *on different instruments/files* to a group (see [Chapter 11.4, "How to perform measurements on multiple files and instruments"](#), on page 467).
6. Repeat these steps to add further groups.
7. Toggle the  "CONT" /  "SGL" button at the bottom of the "Measurement Group Setup" tool window to toggle between single and continuous measurements for the entire measurement sequence.  
In single capture mode, each group is processed a single time in the defined sequence.  
In continuous capture mode, the groups are performed in the defined sequence continuously until you stop the measurement manually.  
Note that the capture mode of the entire measurement sequence automatically defines the capture mode of the individual groups and channels as the same mode.
8. Select the "Capture" button at the bottom of the "Measurement Group Setup" tool window to start the active groups in the defined order.


The measurements for a single group are performed and the results are displayed in the channels' result displays. When that group has completed its measurements, the next group in the sequence is started.

Analyze the captured data as described in [Chapter 11.9, "How to analyze data in the I/Q analyzer"](#), on page 472.

## 11.6 How to save and load measurement settings


Measurement settings can be saved to a file and loaded again later, so that you can repeat the measurement with the same settings.

### To save configurable measurement settings

1. Select the  "Save" icon from the toolbar.
2. In the "Save" dialog box, switch to the "Save" tab.
3. In the file selection dialog box, select a file name and storage location for the settings file.
4. Optionally, define a comment to describe the stored settings.
5. Select which measurement settings to store:
  - For **all** channels
  - Only for the **current** channel
6. Select the items to be saved with the settings.
  - The settings for the currently selected channel only
  - The settings for all channels
  - Other items such as lines or traces (see [Chapter 8.2.2.1, "Stored data types"](#), on page 120)
7. Select "Save".

A file with the defined name and path and the extension `.df1` is created.

### To recall configurable measurement settings

1. Select the  "Open" icon from the toolbar.
2. In the "Recall" dialog box, switch to the "Recall" tab.
3. In the file selection dialog box, select the file name and storage location of the settings file.

**Note:** The "File Type" indicates whether the file contains instrument settings for **all** channels, or only those for the current channel.
4. If several items were saved, select which items are to be restored.
5. If channel settings were saved, select whether:
  - The settings will replace the settings in the current channel

- A new channel with the saved settings will be opened
6. Select "Recall".

The settings and selected items from the saved measurement are restored and you can repeat the measurement with the same settings.

## 11.7 How to export I/Q data

Note that in order to export the raw data, you must start recording directly at the time of capture. Once the data has been captured without being recorded, it can no longer be exported as raw data.

To save results of data that has been captured, but not recorded, use the "Save settings" functions (see [Chapter 11.6, "How to save and load measurement settings"](#), on page 469).

### To record I/Q data

- ▶ Configure the measurement as required (see also [Chapter 11.8, "How to capture baseband \(I/Q\) data in the I/Q analyzer"](#), on page 471), but use the ● "Record" function to start the measurement (instead of the ▶ "Capture" function).

### To export the I/Q data recording

1. Select "File > Save I/Q Recording".
2. Select the storage location for the I/Q data file.
3. Select the file type (format).
4. Select which set of meta data is to be stored with the I/Q data.
5. Select "Save".

To import the stored data file to the R&S VSE again as input, see [Chapter 11.2, "How to import I/Q data for analysis"](#), on page 463.

### Previewing the I/Q data from an iq-tar file in a web browser

The `iq-tar` file format allows you to preview the exported I/Q data in a web browser.

1. Use an archive tool (e.g. WinZip® or PowerArchiver®) to unpack the `iq-tar` file into a folder.
2. Locate the folder using Windows Explorer.
3. Open your web browser.

4. Drag the I/Q parameter XML file, e.g. `example.xml`, into your web browser.

**xzy.xml (of .iq.tar file)**

Description	
Saved by	FSV IQ Analyzer
Comment	Here is a comment
Date & Time	2011-03-03 14:33:05
Sample rate	6.5 MHz
Number of samples	65000
Duration of signal	10 ms
Data format	complex, float32
Data filename	xzy.complex.1ch.float32
Scaling factor	1 V

**Channel 1**

Comment	Channel 1 of 1
<b>Power vs time</b> y-axis: 10 dB /div x-axis: 1 ms /div	
<b>Spectrum</b> y-axis: 20 dB /div x-axis: 500 kHz /div	

E-mail: [info@rohde-schwarz.com](mailto:info@rohde-schwarz.com)  
 Internet: <http://www.rohde-schwarz.com>  
 Fileformat version: 1

## 11.8 How to capture baseband (I/Q) data in the I/Q analyzer

By default, the I/Q Analyzer assumes the captured data is modulated on a carrier frequency and consists of two components (I/Q).

Make sure the I/Q Analyzer measurement channel is currently active before you attempt to change its configuration, for example by selecting one of its windows or the application in the toolbar selection list.

1. From the "Meas Setup" menu, select "Overview" to display the configuration "Overview" that guides you through the configuration steps.
2. Select "Input" to configure the "RF Input" signal source.
3. Select "Amplitude" to define the attenuation, reference level or other settings that affect the input signal's amplitude and scaling.
4. Select "Frequency" to define the input signal's center frequency.
5. Optionally, select "Trigger" to define a trigger for data acquisition, for example an I/Q Power trigger to start capturing data only when a specific power is exceeded.
6. Select "Bandwidth" and define the bandwidth parameters for data acquisition:
  - "Sample rate" or "Analysis Bandwidth:" the span of the input signal to be captured for analysis, or the rate at which samples are captured (both values are correlated)
  - Optionally, if a bandwidth extension for 160 MHz or 320 MHz is installed on the instrument, the "Maximum Bandwidth", depending on whether you require a larger bandwidth or not.
  - "Measurement Time:" how long the data is to be captured
  - "Record Length": the number of samples to be captured (also defined by sample rate and measurement time)
7. Switch to the "Capture" tab of the "Data Acquisition" dialog box and define the number of measurements to be performed ("Capture Count"). The setting "Capture Count = 0" is only useful for continuous capture mode.
8. From the "Window" menu, select "New Window" and then the result displays that are of interest to you.  
Arrange the windows on the display to suit your preferences by moving them around or changing their size (see also [Chapter 6.3, "Customizing the user interface"](#), on page 56).
9. Perform a measurement with the defined settings as described in [Chapter 11.1, "How to perform a basic measurement with instrument input"](#), on page 461.

## 11.9 How to analyze data in the I/Q analyzer

1. Select the "I/Q Analyzer" measurement channel.
2. Select the "Meas Setup > Overview" menu item to display the configuration "Overview".



3. Select the "Analysis" button to make use of the advanced analysis functions in the displays.

For example:

- Configure a trace to display the average over a series of measurements (on the "Trace" tab; if necessary, increase the "Average Count").
- Configure markers and delta markers to determine deviations and offsets within the signal (on the "Marker" tab).

## 12 Network and remote operation

The R&S VSE software can capture and analyze data from a connected instrument in a network. In this case, the R&S VSE software controls the connected instrument remotely. The R&S VSE software, in turn, can be controlled remotely from another PC in the network. Various methods for remote control are supported:

- Connecting the host PC with the R&S VSE software installed and the connected instrument to a network to capture data directly from the instrument.  
This is the basic operating scenario for the R&S VSE software and is described in detail in [Chapter 7, "Controlling instruments and capturing I/Q data"](#), on page 66
- Using the Windows Remote Desktop application in a LAN network to work with the R&S VSE software interactively
- Connecting a controller PC to the network to operate both the R&S VSE software and the connected instrument remotely from the same PC.

How to configure the remote control interfaces is described in [Chapter 12.5, "How to set up a network and remote control"](#), on page 501.



For additional information on remote control of spectrum analyzers see the following application notes available from the Rohde & Schwarz website:

[1EF62: Hints and Tricks for Remote Control of Spectrum and Network Analyzers](#)

[1MA171: How to use Rohde & Schwarz Instruments in MATLAB](#)

[1MA208: Fast Remote Instrument Control with HiSLIP](#)

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• <a href="#">Network and remote control settings</a> .....	498
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### 12.1 Remote control basics

Basic information on operating the connected instrument via remote control is provided here. This information applies to all applications and operating modes on the connected instrument.



For additional information on remote control of spectrum analyzers see the following documents available from the Rohde & Schwarz website:

- [Remote control via SCPI](#)
- [1EF62: Hints and Tricks for Remote Control of Spectrum and Network Analyzers](#)
- [1MA171: How to use Rohde & Schwarz Instruments in MATLAB](#)
- [1MA208: Fast Remote Instrument Control with HiSLIP](#)

- [Remote control interfaces and protocols](#).....475
- [Status reporting system](#)..... 477

### 12.1.1 Remote control interfaces and protocols

The software supports different interfaces and protocols for remote control. The following table gives an overview.



For a description of the protocols refer to [Remote control via SCPI](#).

**Table 12-1: Remote control interfaces and protocols**

Inter- face	Protocols, VISA <sup>*)</sup> address string	Port <sup>**)</sup>	Remarks
Local Area Net- work (LAN)	<b>HiSLIP</b> High-Speed LAN Instrument Protocol (IVI-6.1) TCP/IP::host address::hislip0[::INSTR]	TCP port: 4880	A LAN connector is located on the rear panel of the instrument.
	<b>VXI-11</b> TCP/IP::host address::inst0[::INSTR] Library: VISA	TCP or UDP port: 111 TCP port: well-known ports (600 - 1023) for Linux or registered ports (1024 - 49151) for Windows	
	<b>socket communication</b> (Raw Ethernet, simple Telnet) TCP/IP::host address[::LAN device name]::<port>::SOCKET Library: VISA or socket controller	SCPI raw, TCP port: 5025, 5125 SCPI telnet, TCP port: 5024, 5124	
	VNC	via VNC client: 5800/5900 Device web: 5850	
	Device web / web control	80	

<sup>\*)</sup> VISA is a standardized software interface library providing input and output functions to communicate with instruments. A VISA installation on the controller is a prerequisite for remote control using the indicated interfaces.

<sup>\*\*)</sup> By default, R&S VSE use these ports for communication via LAN control interface. If necessary, adapt your firewall to allow for use of these ports.

### 12.1.1.1 LAN interface

To be integrated in a LAN, the instrument is equipped with a LAN interface, consisting of a connector, a network interface card and protocols. The network card can be operated with the following interfaces:

- 10 Mbit/s Ethernet IEEE 802.3
- 100 Mbit/s Ethernet IEEE 802.3u
- 1Gbit/s Ethernet IEEE 802.3ab

For remote control via a network, the PC and the instrument must be connected via the LAN interface to a common network with TCP/IP network protocol. They are connected using a commercial RJ45 cable (shielded or unshielded twisted pair category 5). The TCP/IP network protocol and the associated network services are preconfigured on the instrument. Software for instrument control and the VISA program library must be installed on the controller.

#### IP address

Only the IP address or a valid DNS host name is required to set up the connection. The host address is part of the "VISA resource string" used by the programs to identify and control the instrument.

The VISA resource string has the form:

```
TCPIP::host address[::LAN device name][::INSTR]
```

or

```
TCPIP::host address::port::SOCKET
```

where:

- **TCPIP** designates the network protocol used
- **host address** is the IP address or host name of the device
- **LAN device name** defines the protocol and the instance number of a subinstrument;
  - `inst0` selects the VXI-11 protocol (default)
  - `hislip0` selects the HiSLIP protocol
- **INSTR** indicates the instrument resource class (optional)
- **port** determines the used port number
- **SOCKET** indicates the raw network socket resource class

**Example:**

- Instrument has the IP address *192.1.2.3*; the valid resource string using VXI-11 protocol is:  
TCPIP::192.1.2.3::INSTR
- The DNS host name is *VSE-123456*; the valid resource string using HiSLIP is:  
TCPIP::VSE-123456::hislip0
- A raw socket connection can be established using:  
TCPIP::192.1.2.3::5025::SOCKET

**Identifying instruments in a network**

If several instruments are connected to the network, each instrument has its own IP address and associated resource string. The controller identifies these instruments by the resource string.

For details on configuring the LAN connection, see [Chapter 12.5, "How to set up a network and remote control"](#), on page 501.

**12.1.2 Status reporting system**

The status reporting system stores all information on the current operating state of the instrument, and on errors which have occurred. This information is stored in the status registers and in the error queue. Both can be queried via GPIB bus or LAN interface using the `STATus...` commands.

(See [Chapter 13.10.1, "Using the status register"](#), on page 918).

For details on the status reporting system, see [Remote control via SCPI](#).

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**12.1.2.1 Hierarchy of status registers**

As shown in the following figure, the status information is of hierarchical structure.

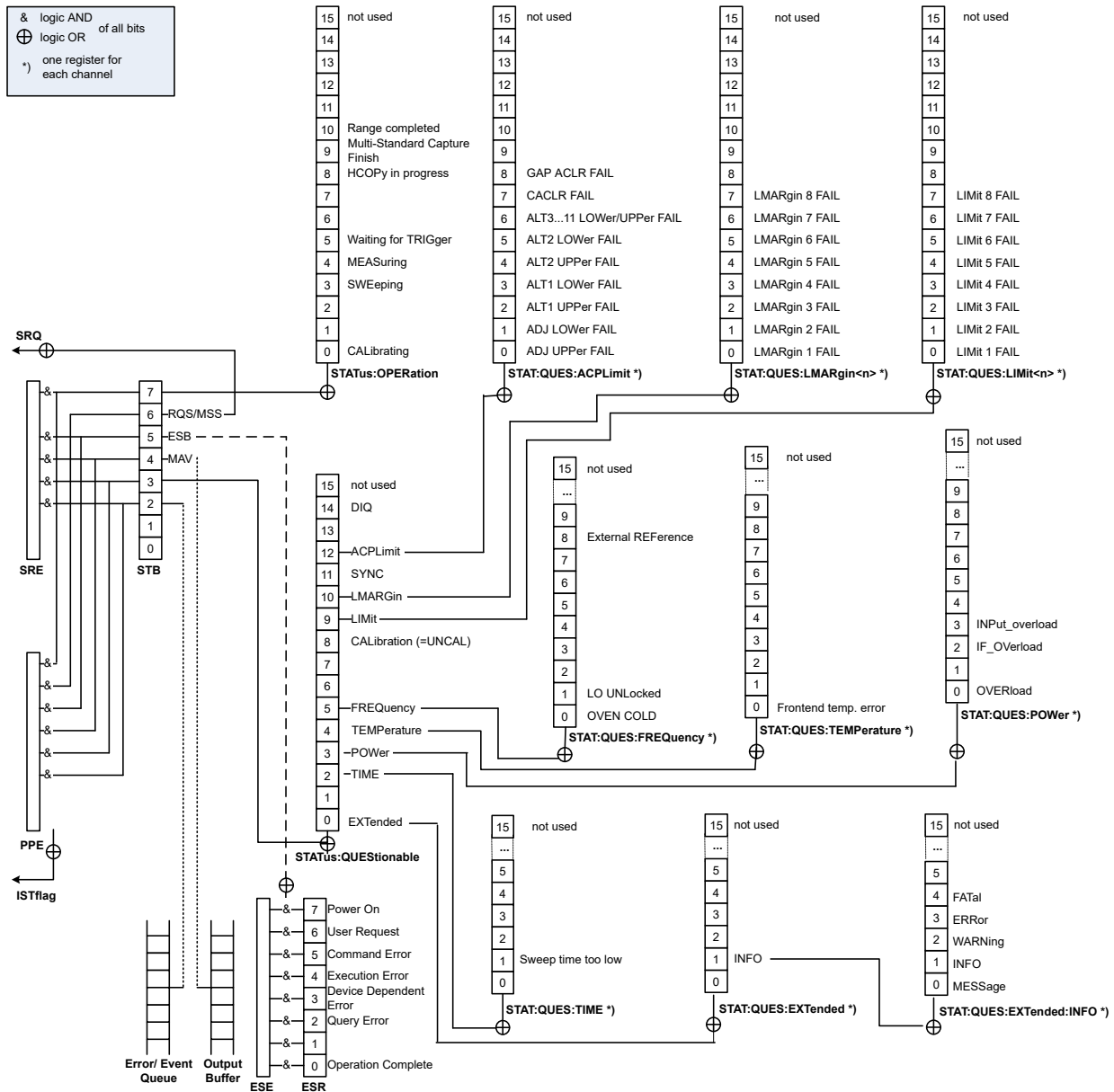


Figure 12-1: Graphical overview of the R&S VSE status registers hierarchy

All status registers have the same internal structure.

### 12.1.2.2 Contents of the status registers

In the following sections, the contents of the status registers are described in more detail.

- Status byte (STB) and service request enable register (SRE).....479
- IST flag and parallel poll enable register (PPE)..... 480
- Event status register (ESR) and event status enable register (ESE).....480
- STATUS:OPERation register.....481
- STATUS:QUESTIONable register.....481

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•	<a href="#">STATUS:QUESTIONable:EXTended register</a> .....	483
•	<a href="#">STATUS:QUESTIONable:EXTended:INFO register</a> .....	483
•	<a href="#">STATUS:QUESTIONable:FREQUENCY register</a> .....	484
•	<a href="#">STATUS:QUESTIONable:LIMit register</a> .....	484
•	<a href="#">STATUS:QUESTIONable:LMARgin register</a> .....	485
•	<a href="#">STATUS:QUESTIONable:POWer register</a> .....	486
•	<a href="#">STATUS:QUESTIONable:TIME register</a> .....	486

### Status byte (STB) and service request enable register (SRE)

The `STATUS Byte` (STB) is already defined in IEEE 488.2. It provides a rough overview of the instrument status by collecting the pieces of information of the lower registers. A special feature is that bit 6 acts as the sum bit of the remaining bits of the status byte.

The STB can thus be compared with the `CONDITION` part of an SCPI register and assumes the highest level within the SCPI hierarchy.

The STB is read using the command `*STB?` or a serial poll.

The `STATUS Byte` (STB) is linked to the `Service Request Enable` (SRE) register. Each bit of the STB is assigned a bit in the SRE. Bit 6 of the SRE is ignored. If a bit is set in the SRE and the associated bit in the STB changes from 0 to 1, a service request (SRQ) is generated. The SRE can be set using the command `*SRE` and read using the command `*SRE?`.

**Table 12-2: Meaning of the bits used in the status byte**

Bit No.	Meaning
0...1	Not used
2	Error Queue not empty The bit is set when an entry is made in the error queue. If this bit is enabled by the SRE, each entry of the error queue generates a service request. Thus an error can be recognized and specified in greater detail by polling the error queue. The poll provides an informative error message. This procedure is to be recommended since it considerably reduces the problems involved with remote control.
3	QUESTIONable status register summary bit The bit is set if an <code>EVENT</code> bit is set in the <code>QUESTIONable</code> status register and the associated <code>ENABLE</code> bit is set to 1. A set bit indicates a questionable instrument status, which can be specified in greater detail by querying the <code>STATUS:QUESTIONable</code> status register.
4	MAV bit (message available) The bit is set if a message is available in the output queue which can be read. This bit can be used to enable data to be automatically read from the instrument to the controller.
5	ESB bit Sum bit of the event status register. It is set if one of the bits in the event status register is set and enabled in the event status enable register. Setting of this bit indicates a serious error which can be specified in greater detail by polling the event status register.

Bit No.	Meaning
6	MSS bit (main status summary bit) The bit is set if the instrument triggers a service request. This is the case if one of the other bits of this registers is set together with its mask bit in the service request enable register SRE.
7	STATUS:OPERation status register summary bit The bit is set if an EVENT bit is set in the OPERATION status register and the associated ENABLE bit is set to 1. A set bit indicates that the instrument is just performing an action. The type of action can be determined by querying the STATUS:OPERation status register.

### IST flag and parallel poll enable register (PPE)

As with the SRQ, the IST flag combines the entire status information in a single bit. It can be read by means of a parallel poll or using the command `*IST?`.

The parallel poll enable register (PPE) determines which bits of the STB contribute to the IST flag. The bits of the STB are "ANDed" with the corresponding bits of the PPE, with bit 6 being used as well in contrast to the SRE. The IST flag results from the "ORing" of all results. The PPE can be set using commands `*PRE` and read using command `*PRE?`.

### Event status register (ESR) and event status enable register (ESE)

The ESR is defined in IEEE 488.2. It can be compared with the EVENT part of a SCPI register. The event status register can be read out using command `*ESR?`.

The ESE corresponds to the ENABLE part of a SCPI register. If a bit is set in the ESE and the associated bit in the ESR changes from 0 to 1, the ESB bit in the STB is set. The ESE register can be set using the command `*ESE` and read using the command `*ESE?`.

**Table 12-3: Meaning of the bits used in the event status register**

Bit No.	Meaning
0	Operation Complete This bit is set on receipt of the command <code>*OPC</code> exactly when all previous commands have been executed.
1	Not used
2	Query Error This bit is set if either the controller wants to read data from the instrument without having sent a query, or if it does not fetch requested data and sends new instructions to the instrument instead. The cause is often a query which is faulty and hence cannot be executed.
3	Device-dependent Error This bit is set if a device-dependent error occurs. An error message with a number between -300 and -399 or a positive error number, which denotes the error in greater detail, is entered into the error queue.
4	Execution Error This bit is set if a received command is syntactically correct but cannot be performed for other reasons. An error message with a number between -200 and -300, which denotes the error in greater detail, is entered into the error queue.



Bit No.	Meaning
5	Command Error This bit is set if a command is received, which is undefined or syntactically incorrect. An error message with a number between -100 and -200, which denotes the error in greater detail, is entered into the error queue.
6	User Request This bit is set when the instrument is switched over to manual control.
7	Power On (supply voltage on) This bit is set on switching on the instrument.

### STATus:OPERation register

The `STATus:OPERation` register contains information on current activities of the connected instrument. It also contains information on activities that have been executed since the last read out.

You can read out the register with `STATus:OPERation:CONDition?` or `STATus:OPERation[:EVENT]?`.

**Table 12-4: Meaning of the bits used in the `STATus:OPERation` register**

Bit No.	Meaning
0	<code>CALibrating</code> This bit is set as long as the instrument is performing a self-alignment.
1-2	Not used
3	<code>SWEeping</code> Sweep is being performed in base unit (applications are not considered); identical to bit 4 In applications, this bit is not used.
4	<code>MEASuring</code> Measurement is being performed in base unit (applications are not considered); identical to bit 3 In applications, this bit is not used.
5	<code>Waiting for TRigger</code> Instrument is ready to trigger and waiting for trigger signal.
6-7	Not used
8	<code>HardCOpy in progress</code> This bit is set while the instrument is printing a hardcopy.
9	
10-14	Not used
15	This bit is always 0.

### STATus:QUESTionable register

The `STATus:QUESTionable` register contains information on instrument states that do not meet the specifications.



The `STAT:QUES:SYNC` register is used by the applications and is thus described in the individual applications' User Manuals.

You can read out the register with `STAT:QUES:COND` or `STAT:QUES:EVEN`.



The `STATUS:QUESTIONABLE` register "sums up" the information from all subregisters (e.g. bit 2 sums up the information for all `STATUS:QUESTIONABLE:TIME` registers). For some subregisters, there may be separate registers for each active channel. Thus, if a status bit in the `STATUS:QUESTIONABLE` register indicates an error, the error may have occurred in any of the channel-specific subregisters. In this case, you must check the subregister of each channel to determine which channel caused the error. By default, querying the status of a subregister always returns the result for the currently selected channel.

### **STATUS:QUESTIONABLE:ACPLimit register**

The `STATUS:QUESTIONABLE:ACPLimit` register contains information about the results of a limit check during ACLR measurements. A separate `ACPLimit` register exists for each active channel.

You can read out the register with `STATUS:QUESTIONABLE:ACPLimit:CONDITION?` or `STATUS:QUESTIONABLE:ACPLimit[:EVENT]?`

**Table 12-5: Meaning of the bits used in the STATUS:QUESTIONABLE:ACPLimit register**

Bit No.	Meaning
0	ADJ UPPER FAIL This bit is set if the limit is exceeded in the <b>upper adjacent</b> channel
1	ADJ LOWER FAIL This bit is set if the limit is exceeded in the <b>lower adjacent</b> channel.
2	ALT1 UPPER FAIL This bit is set if the limit is exceeded in the <b>upper 1st alternate</b> channel.
3	ALT1 LOWER FAIL This bit is set if the limit is exceeded in the <b>lower 1st alternate</b> channel.
4	ALT2 UPPER FAIL This bit is set if the limit is exceeded in the <b>upper 2nd alternate</b> channel.
5	ALT2 LOWER FAIL This bit is set if the limit is exceeded in the <b>lower 2nd alternate</b> channel.
6	ALT3 ... 11 LOWER/UPPER FAIL This bit is set if the limit is exceeded in one of the lower or upper alternate channels 3 ... 11.
7	CACLR FAIL This bit is set if the CACLR limit is exceeded in one of the gap channels.
8	GAP ACLR FAIL This bit is set if the ACLR limit is exceeded in one of the gap channels.

Bit No.	Meaning
9 to 14	Unused
15	This bit is always 0.

### STATUS:QUESTIONABLE:EXTENDED register

The `STATUS:QUESTIONABLE:EXTENDED` register contains further status information not covered by the other status registers of the connected instrument. A separate `EXTENDED` register exists for each active channel.

You can read out the register with `STATUS:QUESTIONABLE:EXTENDED:CONDITION?` or `STATUS:QUESTIONABLE:EXTENDED[:EVENT]?`

**Table 12-6: Meaning of the bits used in the STATUS:QUESTIONABLE:EXTENDED register**

Bit No.	Meaning
0	not used
1	INFO This bit is set if a status message is available for the application. Which type of message occurred is indicated in the <code>STATUS:QUESTIONABLE:EXTENDED:INFO</code> register.
2 to 14	Unused
15	This bit is always 0.

### STATUS:QUESTIONABLE:EXTENDED:INFO register

The `STATUS:QUESTIONABLE:EXTENDED:INFO` register contains information on the type of messages that occur during operation of the connected instrument. A separate `INFO` register exists for each active channel.

You can read out the register with `STATUS:QUESTIONABLE:EXTENDED:INFO:CONDITION?` or `STATUS:QUESTIONABLE:EXTENDED:INFO[:EVENT]?`. You can query all messages that occur for a specific channel using the command `SYSTEM:ERROR:EXTENDED?` on page 922.

**Table 12-7: Meaning of the bits used in the STATUS:QUESTIONABLE:EXTENDED:INFO register**

Bit No.	Meaning
0	MESSAge This bit is set if event or state has occurred that may lead to an error during further operation.
1	INFO This bit is set if an informational status message is available for the application.
2	WARNIng This bit is set if an irregular situation occurs during measurement, e.g. the settings no longer match the displayed results, or the connection to an external device was interrupted temporarily.
3	ERRor This bit is set if an error occurs during a measurement, e.g. due to missing data or wrong settings, so that the measurement cannot be completed correctly.

Bit No.	Meaning
4	FATal This bit is set if a serious error occurs in the application and regular operation is no longer possible.
5 to 14	Unused
15	This bit is always 0.

### STATUS:QUESTIONABLE:FREQUENCY register

The STATUS:QUESTIONABLE:FREQUENCY register contains information about the condition of the local oscillator and the reference frequency. A separate frequency register exists for each active channel.

You can read out the register with `STATUS:QUESTIONABLE:FREQUENCY:CONDITION?` or `STATUS:QUESTIONABLE:FREQUENCY[:EVENT]?`.

**Table 12-8: Meaning of the bits used in the STATUS:QUESTIONABLE:FREQUENCY register**

Bit No.	Meaning
0	OVEN COLD This bit is set if the reference oscillator has not yet attained its operating temperature. "OCXO" is displayed.
1	LO UNLocked This bit is set if the local oscillator no longer locks. "LOUNL" is displayed.
2 to 7	Not used
8	EXTernalREFerence This bit is set if you have selected an external reference oscillator but did not connect a useable external reference source. In that case the synthesizer can not lock. The frequency in all probability is not accurate.
9 to 14	Not used
15	This bit is always 0.

### STATUS:QUESTIONABLE:LIMIT register

The STATUS:QUESTIONABLE:LIMIT register contains information about the results of a limit check when you are working with limit lines.

A separate LIMIT register exists for each active channel and for each window.

You can read out the register with `STATUS:QUESTIONABLE:LIMIT<n>:CONDITION?` or `STATUS:QUESTIONABLE:LIMIT<n>[:EVENT]?`.

**Table 12-9: Meaning of the bits used in the STATUS:QUESTIONABLE:LIMIT register**

Bit No.	Meaning
0	LIMIT 1 FAIL This bit is set if limit line 1 is violated.
1	LIMIT 2 FAIL This bit is set if limit line 2 is violated.

Bit No.	Meaning
2	LIMit 3 FAIL This bit is set if limit line 3 is violated.
3	LIMit 4 FAIL This bit is set if limit line 4 is violated.
4	LIMit 5 FAIL This bit is set if limit line 5 is violated.
5	LIMit 6 FAIL This bit is set if limit line 6 is violated.
6	LIMit 7 FAIL This bit is set if limit line 7 is violated.
7	LIMit 8 FAIL This bit is set if limit line 8 is violated.
8 to 14	Unused
15	This bit is always 0.

#### STATus:QUESTionable:LMARgin register

This register contains information about the observance of limit margins.

A separate LMARgin register exists for each active channel and for each window.

It can be read using the commands

STATus:QUESTionable:LMARgin:CONDition? and  
STATus:QUESTionable:LMARgin[:EVENT]?.

**Table 12-10: Meaning of the bits used in the STATus:QUESTionable:LMARgin register**

Bit No.	Meaning
0	LMARgin 1 FAIL This bit is set if limit margin 1 is violated.
1	LMARgin 2 FAIL This bit is set if limit margin 2 is violated.
2	LMARgin 3 FAIL This bit is set if limit margin 3 is violated.
3	LMARgin 4 FAIL This bit is set if limit margin 4 is violated.
4	LMARgin 5 FAIL This bit is set if limit margin 5 is violated.
5	LMARgin 6 FAIL This bit is set if limit margin 6 is violated.
6	LMARgin 7 FAIL This bit is set if limit margin 7 is violated.

Bit No.	Meaning
7	LMARgin 8 FAIL This bit is set if limit margin 8 is violated.
8 to 14	Not used
15	This bit is always 0.

### STATus:QUEStionable:POWer register

The `STATus:QUEStionable:POWer` register contains information about possible overload situations that may occur during operation of the connected instrument. A separate power register exists for each active channel.

You can read out the register with `STATus:QUEStionable:POWer:CONDition?` or `STATus:QUEStionable:POWer[:EVENT]?`

### STATus:QUEStionable:TIME register

The `STATus:QUEStionable:TIME` register contains information about possible time errors that may occur during operation of the connected instrument. A separate time register exists for each active channel.

You can read out the register with `STATus:QUEStionable:TIME:CONDition?` or `STATus:QUEStionable:TIME[:EVENT]?`

*Table 12-11: Meaning of the bits used in the STATus:QUEStionable:TIME register*

Bit No.	Meaning
0	not used
1	Sweep time too low This bit is set if the sweep time is too low.
2 to 14	Unused
15	This bit is always 0.

#### 12.1.2.3 Reset values of the status reporting system

The following table contains the different commands and events causing the status reporting system to be reset. None of the commands, except `*RST` and `SYSTem:PRESet`, influence the functional instrument settings. In particular, `DCL` does not change the instrument settings.

Table 12-12: Resetting the status reporting system

Event	Switching on supply voltage		DCL, SDC (Device Clear, Selected Device Clear)	*RST or SYS-Tem:PRE Set	STA-Tus:PRE-Set	*CLS
	Power-On-Status-Clear					
Effect	0	1				
Clear STB, ESR	-	yes	-	-	-	yes
Clear SRE, ESE	-	yes	-	-	-	-
Clear PPE	-	yes	-	-	-	-
Clear EVENT parts of the registers	-	yes	-	-	-	yes
Clear ENABLE parts of all OPERATION and QUESTIONABLE registers; Fill ENABLE parts of all other registers with "1".	-	yes	-	-	yes	-
Fill PTRansition parts with "1"; Clear NTRansition parts	-	yes	-	-	yes	-
Clear error queue	yes	yes	-	-	-	yes
Clear output buffer	yes	yes	yes	1)	1)	1)
Clear command processing and input buffer	yes	yes	yes	-	-	-

1) The first command in a command line that immediately follows a <PROGRAM MESSAGE TERMINATOR> clears the output buffer.

## 12.2 Status reporting system

The status reporting system stores all information on the current operating state of the instrument, and on errors which have occurred. This information is stored in the status registers and in the error queue. Both can be queried via GPIB bus or LAN interface using the `STATus...` commands.

(See [Chapter 13.10.1, "Using the status register"](#), on page 918).

For details on the status reporting system, see [Remote control via SCPI](#).

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### 12.2.1 Hierarchy of status registers

As shown in the following figure, the status information is of hierarchical structure.

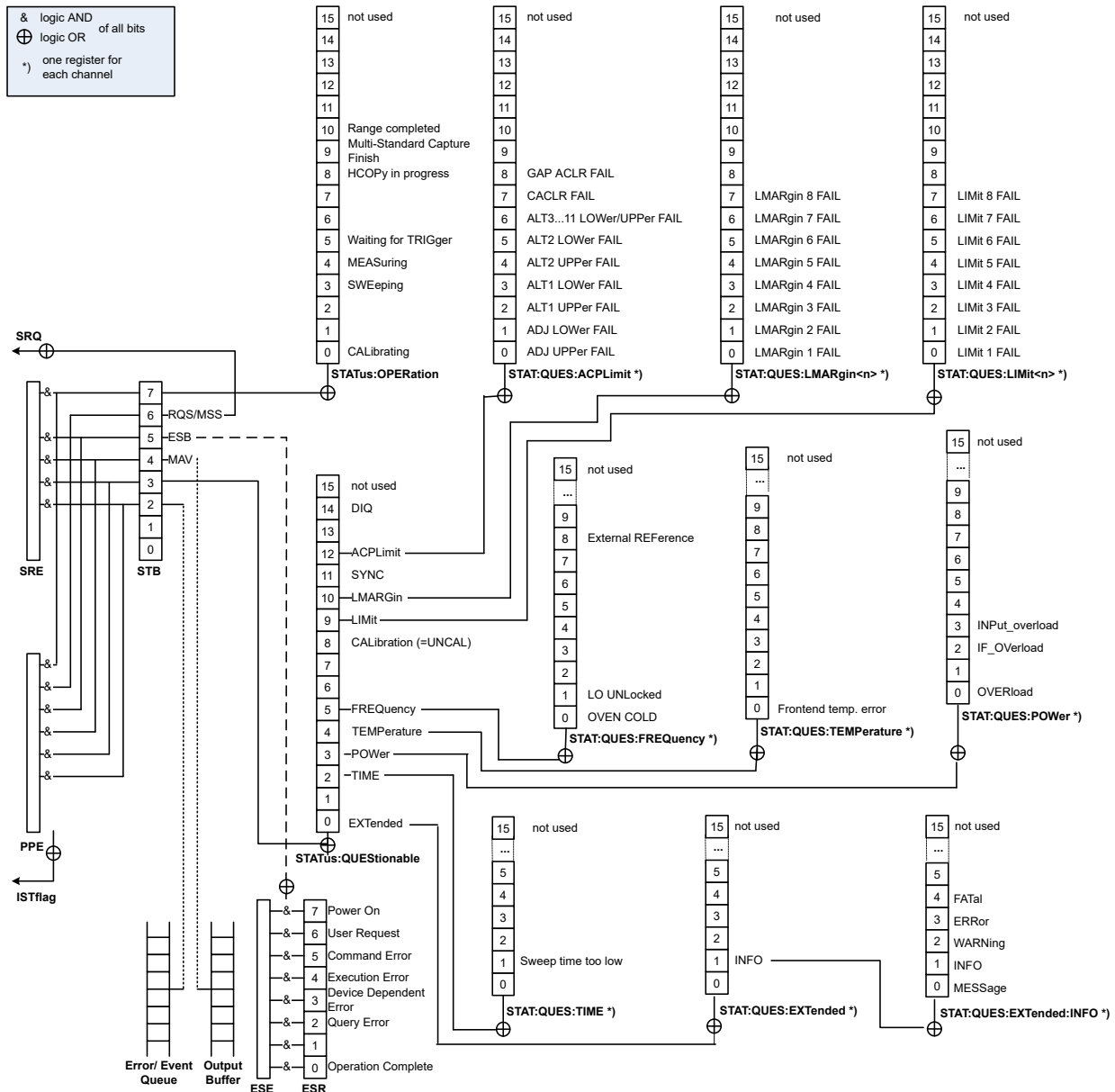


Figure 12-2: Graphical overview of the R&S VSE status registers hierarchy

All status registers have the same internal structure.

### 12.2.2 Contents of the status registers

In the following sections, the contents of the status registers are described in more detail.

- [Status byte \(STB\) and service request enable register \(SRE\)](#).....489
- [IST flag and parallel poll enable register \(PPE\)](#).....490
- [Event status register \(ESR\) and event status enable register \(ESE\)](#).....490
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- [STATUS:QUESTIONable register](#)..... 492
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### 12.2.2.1 Status byte (STB) and service request enable register (SRE)

The `STATUS Byte` (STB) is already defined in IEEE 488.2. It provides a rough overview of the instrument status by collecting the pieces of information of the lower registers. A special feature is that bit 6 acts as the sum bit of the remaining bits of the status byte.

The STB can thus be compared with the `CONDition` part of an SCPI register and assumes the highest level within the SCPI hierarchy.

The STB is read using the command `*STB?` or a serial poll.

The `STATUS Byte` (STB) is linked to the `Service Request Enable` (SRE) register. Each bit of the STB is assigned a bit in the SRE. Bit 6 of the SRE is ignored. If a bit is set in the SRE and the associated bit in the STB changes from 0 to 1, a service request (SRQ) is generated. The SRE can be set using the command `*SRE` and read using the command `*SRE?`.

**Table 12-13: Meaning of the bits used in the status byte**

Bit No.	Meaning
0...1	Not used
2	Error Queue not empty The bit is set when an entry is made in the error queue. If this bit is enabled by the SRE, each entry of the error queue generates a service request. Thus an error can be recognized and specified in greater detail by polling the error queue. The poll provides an informative error message. This procedure is to be recommended since it considerably reduces the problems involved with remote control.
3	QUESTIONable status register summary bit The bit is set if an <code>EVENT</code> bit is set in the <code>QUESTIONable</code> status register and the associated <code>ENABLE</code> bit is set to 1. A set bit indicates a questionable instrument status, which can be specified in greater detail by querying the <code>STATUS:QUESTIONable</code> status register.
4	MAV bit (message available) The bit is set if a message is available in the output queue which can be read. This bit can be used to enable data to be automatically read from the instrument to the controller.
5	ESB bit Sum bit of the event status register. It is set if one of the bits in the event status register is set and enabled in the event status enable register. Setting of this bit indicates a serious error which can be specified in greater detail by polling the event status register.

Bit No.	Meaning
6	MSS bit (main status summary bit) The bit is set if the instrument triggers a service request. This is the case if one of the other bits of this registers is set together with its mask bit in the service request enable register SRE.
7	STATUS:OPERation status register summary bit The bit is set if an EVENT bit is set in the OPERATION status register and the associated ENABLE bit is set to 1. A set bit indicates that the instrument is just performing an action. The type of action can be determined by querying the STATUS:OPERation status register.

### 12.2.2.2 IST flag and parallel poll enable register (PPE)

As with the SRQ, the IST flag combines the entire status information in a single bit. It can be read by means of a parallel poll or using the command `*IST?`.

The parallel poll enable register (PPE) determines which bits of the STB contribute to the IST flag. The bits of the STB are "ANDed" with the corresponding bits of the PPE, with bit 6 being used as well in contrast to the SRE. The IST flag results from the "ORing" of all results. The PPE can be set using commands `*PRE` and read using command `*PRE?`.

### 12.2.2.3 Event status register (ESR) and event status enable register (ESE)

The ESR is defined in IEEE 488.2. It can be compared with the EVENT part of a SCPI register. The event status register can be read out using command `*ESR?`.

The ESE corresponds to the ENABLE part of a SCPI register. If a bit is set in the ESE and the associated bit in the ESR changes from 0 to 1, the ESB bit in the STB is set. The ESE register can be set using the command `*ESE` and read using the command `*ESE?`.

**Table 12-14: Meaning of the bits used in the event status register**

Bit No.	Meaning
0	Operation Complete This bit is set on receipt of the command <code>*OPC</code> exactly when all previous commands have been executed.
1	Not used
2	Query Error This bit is set if either the controller wants to read data from the instrument without having sent a query, or if it does not fetch requested data and sends new instructions to the instrument instead. The cause is often a query which is faulty and hence cannot be executed.
3	Device-dependent Error This bit is set if a device-dependent error occurs. An error message with a number between -300 and -399 or a positive error number, which denotes the error in greater detail, is entered into the error queue.

Bit No.	Meaning
4	<p>Execution Error</p> <p>This bit is set if a received command is syntactically correct but cannot be performed for other reasons. An error message with a number between -200 and -300, which denotes the error in greater detail, is entered into the error queue.</p>
5	<p>Command Error</p> <p>This bit is set if a command is received, which is undefined or syntactically incorrect. An error message with a number between -100 and -200, which denotes the error in greater detail, is entered into the error queue.</p>
6	<p>User Request</p> <p>This bit is set when the instrument is switched over to manual control.</p>
7	<p>Power On (supply voltage on)</p> <p>This bit is set on switching on the instrument.</p>

#### 12.2.2.4 STATUS:OPERation register

The `STATUS:OPERation` register contains information on current activities of the connected instrument. It also contains information on activities that have been executed since the last read out.

You can read out the register with `STATUS:OPERation:CONDition?` or `STATUS:OPERation[:EVENT]?`.

**Table 12-15: Meaning of the bits used in the STATUS:OPERation register**

Bit No.	Meaning
0	<p>CALibrating</p> <p>This bit is set as long as the instrument is performing a self-alignment.</p>
1-2	Not used
3	<p>SWEeping</p> <p>Sweep is being performed in base unit (applications are not considered); identical to bit 4 In applications, this bit is not used.</p>
4	<p>MEASuring</p> <p>Measurement is being performed in base unit (applications are not considered); identical to bit 3 In applications, this bit is not used.</p>
5	<p>Waiting for TRigger</p> <p>Instrument is ready to trigger and waiting for trigger signal.</p>
6-7	Not used
8	<p>HardCOpy in progress</p> <p>This bit is set while the instrument is printing a hardcopy.</p>
9	
10-14	Not used
15	This bit is always 0.

### 12.2.2.5 STATus:QUEStionable register

The STATus:QUEStionable register contains information on instrument states that do not meet the specifications.



The STAT:QUES:SYNC register is used by the applications and is thus described in the individual applications' User Manuals.

You can read out the register with STAT:QUES:COND or STAT:QUES:EVEN.



The STATus:QUEStionable register "sums up" the information from all subregisters (e.g. bit 2 sums up the information for all STATus:QUEStionable:TIME registers). For some subregisters, there may be separate registers for each active channel. Thus, if a status bit in the STATus:QUEStionable register indicates an error, the error may have occurred in any of the channel-specific subregisters. In this case, you must check the subregister of each channel to determine which channel caused the error. By default, querying the status of a subregister always returns the result for the currently selected channel.

### 12.2.2.6 STATus:QUEStionable:ACPLimit register

The STATus:QUEStionable:ACPLimit register contains information about the results of a limit check during ACLR measurements. A separate ACPLimit register exists for each active channel.

You can read out the register with STATus:QUEStionable:ACPLimit:CONDition? or STATus:QUEStionable:ACPLimit[:EVENT]?

**Table 12-16: Meaning of the bits used in the STATus:QUEStionable:ACPLimit register**

Bit No.	Meaning
0	ADJ UPPer FAIL This bit is set if the limit is exceeded in the <b>upper adjacent</b> channel
1	ADJ LOWer FAIL This bit is set if the limit is exceeded in the <b>lower adjacent</b> channel.
2	ALT1 UPPer FAIL This bit is set if the limit is exceeded in the <b>upper 1st alternate</b> channel.
3	ALT1 LOWer FAIL This bit is set if the limit is exceeded in the <b>lower 1st alternate</b> channel.
4	ALT2 UPPer FAIL This bit is set if the limit is exceeded in the <b>upper 2nd alternate</b> channel.
5	ALT2 LOWer FAIL This bit is set if the limit is exceeded in the <b>lower 2nd alternate</b> channel.
6	ALT3 ... 11 LOWer/UPPer FAIL This bit is set if the limit is exceeded in one of the lower or upper alternate channels 3 ... 11.

Bit No.	Meaning
7	CACLR FAIL This bit is set if the CACLR limit is exceeded in one of the gap channels.
8	GAP ACLR FAIL This bit is set if the ACLR limit is exceeded in one of the gap channels.
9 to 14	Unused
15	This bit is always 0.

### 12.2.2.7 STATUS:QUESTIONABLE:EXTENDED register

The STATUS:QUESTIONABLE:EXTENDED register contains further status information not covered by the other status registers of the connected instrument. A separate EXTENDED register exists for each active channel.

You can read out the register with STATUS:QUESTIONABLE:EXTENDED:CONDITION? or STATUS:QUESTIONABLE:EXTENDED[:EVENT]?

**Table 12-17: Meaning of the bits used in the STATUS:QUESTIONABLE:EXTENDED register**

Bit No.	Meaning
0	not used
1	INFO This bit is set if a status message is available for the application. Which type of message occurred is indicated in the STATUS:QUESTIONABLE:EXTENDED:INFO register.
2 to 14	Unused
15	This bit is always 0.

### 12.2.2.8 STATUS:QUESTIONABLE:EXTENDED:INFO register

The STATUS:QUESTIONABLE:EXTENDED:INFO register contains information on the type of messages that occur during operation of the connected instrument. A separate INFO register exists for each active channel.

You can read out the register with STATUS:QUESTIONABLE:EXTENDED:INFO:CONDITION? or STATUS:QUESTIONABLE:EXTENDED:INFO[:EVENT]?. You can query all messages that occur for a specific channel using the command SYSTEM:ERROR:EXTENDED? on page 922.

**Table 12-18: Meaning of the bits used in the STATUS:QUESTIONABLE:EXTENDED:INFO register**

Bit No.	Meaning
0	MESSAge This bit is set if event or state has occurred that may lead to an error during further operation.
1	INFO This bit is set if an informational status message is available for the application.

Bit No.	Meaning
2	WARNing This bit is set if an irregular situation occurs during measurement, e.g. the settings no longer match the displayed results, or the connection to an external device was interrupted temporarily.
3	ERRor This bit is set if an error occurs during a measurement, e.g. due to missing data or wrong settings, so that the measurement cannot be completed correctly.
4	FATal This bit is set if a serious error occurs in the application and regular operation is no longer possible.
5 to 14	Unused
15	This bit is always 0.

### 12.2.2.9 STATUS:QUESTIONable:FREQUENCY register

The STATUS:QUESTIONable:FREQUENCY register contains information about the condition of the local oscillator and the reference frequency. A separate frequency register exists for each active channel.

You can read out the register with `STATUS:QUESTIONable:FREQUENCY:CONDition?` or `STATUS:QUESTIONable:FREQUENCY[:EVENT]?`.

*Table 12-19: Meaning of the bits used in the STATUS:QUESTIONable:FREQUENCY register*

Bit No.	Meaning
0	OVEN COLD This bit is set if the reference oscillator has not yet attained its operating temperature. "OCXO" is displayed.
1	LO UNLocked This bit is set if the local oscillator no longer locks. "LOUNL" is displayed.
2 to 7	Not used
8	EXTernalREFerence This bit is set if you have selected an external reference oscillator but did not connect a useable external reference source. In that case the synthesizer can not lock. The frequency in all probability is not accurate.
9 to 14	Not used
15	This bit is always 0.

### 12.2.2.10 STATUS:QUESTIONable:LIMit register

The STATUS:QUESTIONable:LIMit register contains information about the results of a limit check when you are working with limit lines.

A separate LIMit register exists for each active channel and for each window.

You can read out the register with `STATUS:QUESTIONABLE:LIMit<n>:CONDition?` or `STATUS:QUESTIONABLE:LIMit<n>[:EVENT]?`.

**Table 12-20: Meaning of the bits used in the STATUS:QUESTIONABLE:LIMit register**

Bit No.	Meaning
0	LIMit 1 FAIL This bit is set if limit line 1 is violated.
1	LIMit 2 FAIL This bit is set if limit line 2 is violated.
2	LIMit 3 FAIL This bit is set if limit line 3 is violated.
3	LIMit 4 FAIL This bit is set if limit line 4 is violated.
4	LIMit 5 FAIL This bit is set if limit line 5 is violated.
5	LIMit 6 FAIL This bit is set if limit line 6 is violated.
6	LIMit 7 FAIL This bit is set if limit line 7 is violated.
7	LIMit 8 FAIL This bit is set if limit line 8 is violated.
8 to 14	Unused
15	This bit is always 0.

#### 12.2.2.11 STATUS:QUESTIONABLE:LMARgin register

This register contains information about the observance of limit margins.

A separate LMARgin register exists for each active channel and for each window.

It can be read using the commands

`STATUS:QUESTIONABLE:LMARgin:CONDition?` and  
`STATUS:QUESTIONABLE:LMARgin[:EVENT]?`.

**Table 12-21: Meaning of the bits used in the STATUS:QUESTIONABLE:LMARgin register**

Bit No.	Meaning
0	LMARgin 1 FAIL This bit is set if limit margin 1 is violated.
1	LMARgin 2 FAIL This bit is set if limit margin 2 is violated.
2	LMARgin 3 FAIL This bit is set if limit margin 3 is violated.

Bit No.	Meaning
3	LMARgin 4 FAIL This bit is set if limit margin 4 is violated.
4	LMARgin 5 FAIL This bit is set if limit margin 5 is violated.
5	LMARgin 6 FAIL This bit is set if limit margin 6 is violated.
6	LMARgin 7 FAIL This bit is set if limit margin 7 is violated.
7	LMARgin 8 FAIL This bit is set if limit margin 8 is violated.
8 to 14	Not used
15	This bit is always 0.

#### 12.2.2.12 STATUS:QUESTIONable:POWer register

The `STATUS:QUESTIONable:POWer` register contains information about possible overload situations that may occur during operation of the connected instrument. A separate power register exists for each active channel.

You can read out the register with `STATUS:QUESTIONable:POWer:CONDition?` or `STATUS:QUESTIONable:POWer[:EVENT]?`

#### 12.2.2.13 STATUS:QUESTIONable:TIME register

The `STATUS:QUESTIONable:TIME` register contains information about possible time errors that may occur during operation of the connected instrument. A separate time register exists for each active channel.

You can read out the register with `STATUS:QUESTIONable:TIME:CONDition?` or `STATUS:QUESTIONable:TIME[:EVENT]?`

**Table 12-22: Meaning of the bits used in the STATUS:QUESTIONable:TIME register**

Bit No.	Meaning
0	not used
1	Sweep time too low This bit is set if the sweep time is too low.
2 to 14	Unused
15	This bit is always 0.



### 12.2.3 Reset values of the status reporting system

The following table contains the different commands and events causing the status reporting system to be reset. None of the commands, except \*RST and SYSTem:PRESet, influence the functional instrument settings. In particular, DCL does not change the instrument settings.

**Table 12-23: Resetting the status reporting system**

Event	Switching on supply voltage Power-On-Status-Clear		DCL, SDC (Device Clear, Selected Device Clear)	*RST or SYS- Tem:PRE Set	STA- Tus:PRE- Set	*CLS
	0	1				
Effect						
Clear STB, ESR	-	yes	-	-	-	yes
Clear SRE, ESE	-	yes	-	-	-	-
Clear PPE	-	yes	-	-	-	-
Clear EVENT parts of the registers	-	yes	-	-	-	yes
Clear ENABLE parts of all OPERation and QUEStionable registers; Fill ENABle parts of all other registers with "1".	-	yes	-	-	yes	-
Fill PTRansition parts with "1"; Clear NTRansition parts	-	yes	-	-	yes	-
Clear error queue	yes	yes	-	-	-	yes
Clear output buffer	yes	yes	yes	1)	1)	1)
Clear command processing and input buffer	yes	yes	yes	-	-	-

1) The first command in a command line that immediately follows a <PROGRAM MESSAGE TERMINATOR> clears the output buffer.

## 12.3 Locking instruments for exclusive remote control

In order to keep full control of the instrument while performing a specific task, it is important to prevent access by other users or devices during remote control.

While in remote mode, you can prevent manual operation using the [Local Lockout](#) function. If enabled, the connected instrument can no longer be operated by the keys on the front panel or using the touchscreen. A remote command is required to enable manual operation again.

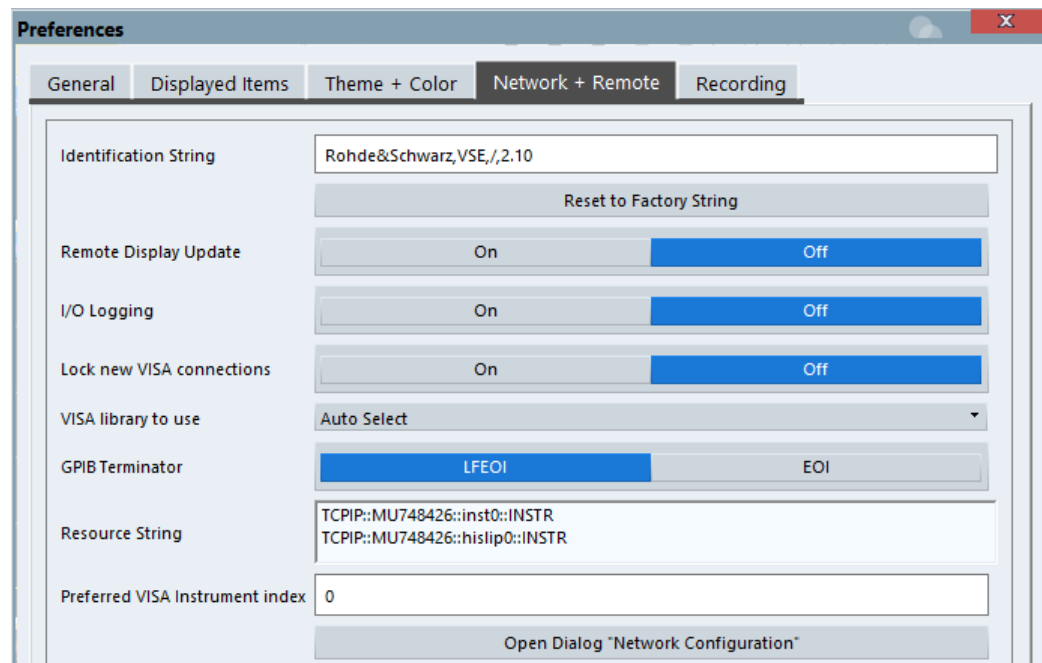
Similarly, remote control by any other device can be prevented using the VISA lock (see [Chapter 7.2.10, "Configuring the behavior during remote control"](#), on page 82). If

enabled, the connection to the connected instrument is locked by the first device to establish a connection, so that no other devices can access the instrument. The R&S VSE software can be configured to lock all connections by default (see ["Lock new VISA connections"](#) on page 499), or individual connections can be locked.

Note, however, that if you exclude manual operation and use the VISA lock, then if the remote connection from the control PC to the connected instrument is interrupted, regaining control of the connected instrument may cause problems (see ["To regain control over a blocked remote channel"](#) on page 949).

## 12.4 Network and remote control settings

**Access:** "File" > "Preferences" > "Network + Remote"



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Lock new VISA connections.....	499
VISA library to use.....	500
GPIB Terminator.....	500
Resource string.....	500
Preferred VISA instrument index.....	500
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### Identification String

Defines the identification string for the R&S VSE which is provided as a response to the \*IDN? query. Maximum 36 characters are allowed.

Remote command:

[SYSTem:IDENtify\[:STRing\]](#) on page 917

### Reset to Factory String

Restores the default identification string. Each R&S VSE has a unique ID according to the following syntax:

Rohde&Schwarz,<device>,<Unique number>,1.00

Remote command:

[SYSTem:IDENtify:FACTory](#) on page 917

### Remote Display Update

Defines whether the display of the R&S VSE is updated when changing from manual operation to remote control.

Turning off the display update function improves performance during remote control.

**Note:** Usually, this function remains available on the display during remote operation. However, it can be disabled remotely. In this case, the display is not updated during remote operation, and cannot be turned on again locally until local operation is resumed.

Tip: you can also turn off the display update function on the connected instrument when it is being controlled by the R&S VSE software, see ["Display Update"](#) on page 83.

Remote command:

[SYSTem:DISPlay:UPDate](#) on page 917

### I/O Logging

Activates or deactivates the SCPI error log function. All remote control commands received by the R&S VSE are recorded in a log file. The files are named according to the following syntax:

```
C:\ProgramData\Rohde-Schwarz\VSE\<<version_no>\ScpiLogging\ScpiLog.<no.>
```

where <no.> is a sequential number

A new log file is started each time logging was stopped and is restarted.

Logging the commands may be extremely useful for debug purposes, e.g. in order to find misspelled keywords in control programs.

Remote command:

[SYSTem:CLOGging](#) on page 916

### Lock new VISA connections

Defines the default setting for the VISA connection lock for all subsequent instrument connections (see ["VISA lock state"](#) on page 83). If the connection is locked, no other devices can operate the same instrument remotely.

Tip: In order to lock existing connections, use the [VISA lock state](#) function (see [Chapter 7.2.10, "Configuring the behavior during remote control"](#), on page 82).

Remote command:

[DEVice:LOCKing:DEFault](#) on page 915

**VISA library to use**

Defines the VISA library to be used for subsequent instrument connections. Only VISA libraries that were detected in the network when the software was started are listed. However, you can select further libraries from the network manually.

If you change the VISA library to use and confirm the message, all currently established connections are closed and the VISA library is deactivated. Then the new VISA library is activated and the defined connections are re-established.

If the selected VISA library is not available at the time of connection, an error message is displayed.

"<VISA Library>"	Selects one of the VISA libraries detected in the network
"..."	Opens a file selection dialog box to select a .dll file containing a VISA library manually.
"Auto Select"	Automatically selects the first available VISA library in the list to be used

Remote command:  
not available

**GPIB Terminator**

Changes the GPIB receive terminator.

"LFEOI"	According to the standard, the terminator in ASCII is <LF> and/or <EOI>.
"EOI"	For binary data transfers (e.g. trace data) from the control computer to the instrument, the binary code used for <LF> might be included in the binary data block, and therefore should not be interpreted as a terminator in this particular case. This can be avoided by using only the receive terminator EOI.

Remote command:  
[SYSTem:COMMunicate:GPIB\[:SELF\]:RTERminator](#) on page 916

**Resource string**

Indicates the VISA resource strings you can use to connect to the R&S VSE software, e.g.

TCPIP::MYINST::inst0::INSTR

TCPIP::MYINST::hislip0::INSTR

This information is read-only. To change the instrument index, specify the [Preferred VISA instrument index](#).

**Preferred VISA instrument index**

Defines the index to be used to connect to the R&S VSE software.

By default, the R&S VSE uses 0, e.g. `inst0` for VXI-11 protocol, or `hislip0` for HiSLIP protocol. If the R&S VSE detects other instruments or software in the network when it starts, it uses the next available higher index. If conflicts still occur, you can define an index for the R&S VSE software manually. The change only becomes effective after you restart the software. Then the newly assigned index is indicated in the [Resource string](#) field of the "Network and Remote" settings. Use the new index to identify the R&S VSE software from other instruments via VISA.

**Note:** Due to technical restrictions of the VXI-11 protocol, if no other software in the system is using VISA, the index 0 is always used, regardless of the specified preferred index.

See also [Chapter 7.2.1.1, "LAN interface"](#), on page 71.

Remote command:  
not available

### Network Configuration

Opens the standard Windows "Network Configuration" dialog box for further configuration.

## 12.5 How to set up a network and remote control

Remote operation of the R&S VSE software is possible using SCPI commands.

### 12.5.1 How to configure a network

In order to operate the R&S Vector Signal Explorer Base Software remotely, the PC running the R&S VSE software as well as the connected instrument must be connected to a LAN network.

How to configure the R&S VSE software is described here. For details on configuring the connected instrument see the instrument's documentation.



#### Windows Firewall Settings

A firewall protects an instrument by preventing unauthorized users from gaining access to it through a network. Rohde & Schwarz highly recommends the use of the firewall on your instrument. Rohde & Schwarz instruments are shipped with the Windows firewall enabled and preconfigured in such a way that all ports and connections for remote control are enabled.

For more details on firewall configuration, see the Rohde & Schwarz White Paper [1DC01: Malware Protection](#).

### 12.5.1.1 How to assign the IP address

Depending on the network capacities, the TCP/IP address information for the instrument can be obtained in different ways.

- If the network supports dynamic TCP/IP configuration using the Dynamic Host Configuration Protocol (DHCP), all address information can be assigned automatically.
- If the network does not support DHCP, or if the instrument is set to use alternate TCP/IP configuration, the addresses must be set manually.

By default, most connected instrument are configured to use dynamic TCP/IP configuration and obtain all address information automatically. This means that it is safe to establish a physical connection to the LAN without any previous instrument configuration.



When a DHCP server is used, a new IP address may be assigned each time the PC is restarted. This address must first be determined on the PC itself. Thus, when using a DHCP server, it is recommended that you use the permanent computer name, which determines the address via the DNS server (see ["Using a DNS server to determine the IP address"](#) on page 503).

---

#### **NOTICE**

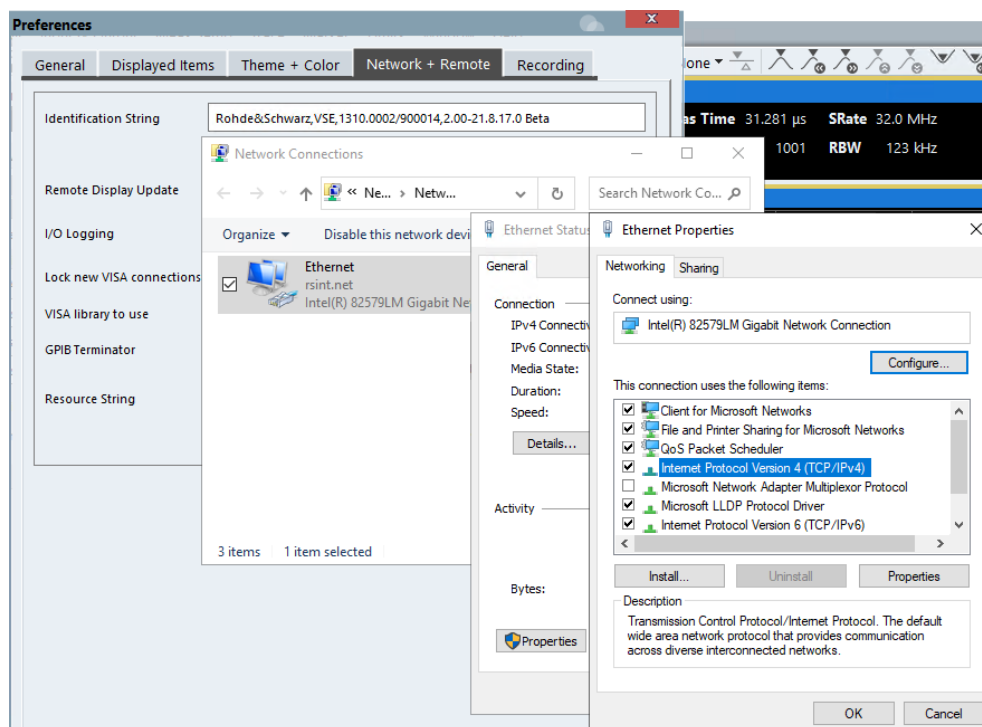
##### **Risk of network errors**

Connection errors can affect the entire network. If your network does not support DHCP, or if you choose to disable dynamic TCP/IP configuration, you must assign valid address information before connecting the instrument to the LAN. Contact your network administrator to obtain a valid IP address.

---

##### **Assigning the IP address on the PC running the R&S VSE software**

1. Select "File > Preferences > Network + Remote".
2. Select "Open Network Configuration".
3. Double-click the "Ethernet" icon.
4. In the "Ethernet" dialog box, select the "Properties" button.  
The items used by the Ethernet connection are displayed.
5. Click the entry named "Internet Protocol Version 4 (TCP/IPv4)" to highlight it.



6. Select the "Properties" button.
7. In the "General" tab, select "Use the following IP address" .
8. Enter the "IP Address", for example *10.0.0.10*. The IP address consists of four number blocks separated by dots. Every block contains 3 numbers in maximum.
9. Enter the "Subnet Mask", for example *255.255.255.0*. The subnet mask consists of four number blocks separated by dots. Every block contains 3 numbers in maximum.
10. Close the dialog box.  
If you have entered an invalid IP address or subnet mask, the message "out of range" is displayed in the status line. If the settings are correct, the configuration is saved, and you are prompted to restart the PC.
11. Confirm the displayed message ("Yes" button) to restart the PC.

### Using a DNS server to determine the IP address

If a DNS server is configured on the PC running the R&S VSE software, the server can determine the current IP address for the connection using the permanent computer name.

1. For the connected instrument:
  - a) Obtain the name of your DNS domain and the IP addresses of the DNS and WINS servers on your network.
  - b) Press the [Setup] key and then the "Network + Remote" softkey.
  - c) In the "Network" tab, select the "Open Dialog 'Network Connections'" button.

2. For the PC running the R&S VSE software:
  - a) Select "File > Preferences > Network + Remote".
  - b) Select "Open Network Configuration".
3. Select the "Local Area Network" icon.
4. In the "Local Area Connection Status" dialog box, select the "Properties" button.  
The items used by the LAN connection are displayed.
5. Select the entry named "Internet Protocol Version 4 (TCP/IPv4)" to highlight it.
6. Select the "Properties" button.
7. On the "General" tab, select "Use the following DNS server addresses" and enter your own DNS addresses.

For more information refer to the Windows 7 operating system Help.

## 12.5.2 How to log on to the network

Windows requires that users identify themselves by entering a user name and password in a login window. You can set up two types of user accounts, either an administrator account with unrestricted access to the computer/domain or a standard user account with limited access. Most instruments provide an auto-login function for the administrator account, i.e. login with unrestricted access is carried out automatically in the background. By default, the user name for the administrator account is "Instrument", and the user name for the standard user account is "NormalUser". In both cases the initial password is "894129". You can change the password in Windows 7 for any user at any time. Some administrative tasks require administrator rights (e.g. changing the computer name or the configuration of a LAN network).

At the same time you log on to the operating system, you are automatically logged on to the network. As a prerequisite, the user name and the password must be identical on the instrument and on the network.

### 12.5.2.1 How to change the user password

After the new user has been created on the instrument, the password must be adapted to the network password. This is also done using the "User Accounts" dialog box.

1. 

Select the "Windows" icon in the toolbar to access the operating system.

2. Press [Ctrl + Alt + Delete], then select "Change a password".
3. Enter the user account name.
4. Enter the old password.
5. Enter the new password in the upper text line and repeat it in the following line.



6. Press [Enter].  
The new password is now active.

### 12.5.3 How to start a remote control session from a PC

#### To start remote control

1. Send an addressed command (`GTR` - Go to Remote) from a controller to the instrument.  
  
The instrument is switched to remote control ("remote" state). Operation via the front panel is disabled. Only the "Local" softkey is displayed to return to manual operation. The instrument remains in the remote state until it is reset to the manual state via the instrument or via remote control interfaces. Switching from manual operation to remote control and vice versa does not affect the other instrument settings.
2. To obtain optimum performance during remote control, send the `SYST:DISPlay:UPDate OFF` command to deactivate the display of results on the connected instrument.
3. Send the `DEV:GEN:DISP:UPD ON` command to activate the display of results in the R&S VSE software (see `DEVIce:GENeral:DISPlay` on page 519).  
  
The changes in the device settings and the recorded measurement values are displayed in the software window.
4. To prevent other users from taking remote control of the connected instrument, lock the connection using the `DEVIce:LOCKing` or `DEVIce:LOCKing:ALL` commands.
5. To prevent other users from taking manual control of the connected instrument, disable the keys of the instrument and the "Local" function using the command `DEV:GEN:LLO ON`.  
  
Switching to manual mode is only possible via remote control then.
6. To enable the keys of the connected instrument again use `DEV:GEN:LLO OFF`, or switch the instrument to local mode (`GTL` - Go to Local), i.e. deactivate the `REN` line of the remote control interface.

### 12.5.4 How to return to manual operation on the instrument

Before you switch the instrument back to manual operation, all remote command processing must be completed. Otherwise, the instrument will switch back to remote control immediately.

1. If necessary, enable the keys of the instrument and the "Local" function using the command `DEV:GEN:LLO OFF`.

2. On the instrument, if available, select the "Local" softkey or the [PRESET] key. Alternatively, send the @LOC command to the connected instrument.

## 13 Remote commands

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### 13.1 Conventions used in SCPI command descriptions

The following conventions are used in the remote command descriptions:

- **Command usage**  
If not specified otherwise, commands can be used both for setting and for querying parameters.  
If a command can be used for setting or querying only, or if it initiates an event, the usage is stated explicitly.
- **Parameter usage**  
If not specified otherwise, a parameter can be used to set a value and it is the result of a query.  
Parameters required only for setting are indicated as **Setting parameters**.  
Parameters required only to refine a query are indicated as **Query parameters**.  
Parameters that are only returned as the result of a query are indicated as **Return values**.
- **Conformity**  
Commands that are taken from the SCPI standard are indicated as **SCPI confirmed**. All commands used by the R&S VSE follow the SCPI syntax rules.
- **Asynchronous commands**  
A command which does not automatically finish executing before the next command starts executing (overlapping command) is indicated as an **Asynchronous command**.
- **Reset values (\*RST)**  
Default parameter values that are used directly after resetting the instrument (\*RST command) are indicated as **\*RST** values, if available.
- **Default unit**  
The default unit is used for numeric values if no other unit is provided with the parameter.
- **Manual operation**

If the result of a remote command can also be achieved in manual operation, a link to the description is inserted.

## 13.2 Common suffixes

In the I/Q Analyzer, the following common suffixes are used in remote commands:

*Table 13-1: Common suffixes used in remote commands in the I/Q Analyzer*

Suffix	Value range	Description
<m>	1 to 16	Marker
<n>	1 to x	Window (in the currently selected channel)
<t>	1 to 6	Trace
<li>	1 to 8	Limit line

## 13.3 Common commands

Common commands are described in the IEEE 488.2 (IEC 625-2) standard. These commands have the same effect and are employed in the same way on different devices. The headers of these commands consist of "\*" followed by three letters. Many common commands are related to the Status Reporting System.

Available common commands:

*CAL?	508
*CLS	509
*ESE	509
*ESR?	509
*IDN?	509
*IST?	510
*OPC	510
*OPT?	510
*PCB	510
*PRE	510
*PSC	511
*RST	511
*SRE	511
*STB?	511
*TRG	512
*TST?	512
*WAI	512

---

### \*CAL?

Calibration query

Initiates a calibration of the instrument and then queries the calibration status. Responses > 0 indicate errors.

**Note:** If you start a self-alignment remotely, then select the "Local" softkey while the alignment is still running, the instrument only returns to the manual operation state after the alignment is completed.

**Usage:** Query only

---

### \*CLS

Clear status

Sets the status byte (STB), the standard event register (ESR) and the `EVENT` part of the `QUESTIONABLE` and the `OPERATION` registers to zero. The command does not alter the mask and transition parts of the registers. It clears the output buffer.

**Usage:** Setting only

---

### \*ESE <Value>

Event status enable

Sets the event status enable register to the specified value. The query returns the contents of the event status enable register in decimal form.

**Parameters:**

<Value> Range: 0 to 255

---

### \*ESR?

Event status read

Returns the contents of the event status register in decimal form and then sets the register to zero.

**Return values:**

<Contents> Range: 0 to 255

**Usage:** Query only

---

### \*IDN?

Identification

Returns the instrument identification.

**Return values:**

<ID> "Rohde&Schwarz,<device type>,<part number>/<serial number>,<firmware version>"

**Example:** Rohde&Schwarz,VSE,1310.0002K02/900014,1.20

**Usage:** Query only

---

**\*IST?**

Individual status query

Returns the contents of the IST flag in decimal form. The IST flag is the status bit which is sent during a parallel poll.

**Return values:**

<ISTflag>            0 | 1

**Usage:**                Query only

---

**\*OPC**

Operation complete

Sets bit 0 in the event status register when all preceding commands have been executed. This bit can be used to initiate a service request. The query writes a "1" into the output buffer when all preceding commands have been executed, which is useful for command synchronization.

---

**\*OPT?**

Option identification query

Queries the options included in the instrument. For a list of all available options and their description, refer to the data sheet.

**Return values:**

<Options>            The query returns a list of all installed and activated options, separated by commas, where:  
B<number> describes hardware options.  
K<number> describes software options.

**Usage:**                Query only

---

**\*PCB <Address>**

Pass control back

Indicates the controller address to which remote control is returned after termination of the triggered action.

**Setting parameters:**

<Address>            Range:     0 to 30

**Usage:**                Setting only

---

**\*PRE <Value>**

Parallel poll register enable

Sets parallel poll enable register to the indicated value. The query returns the contents of the parallel poll enable register in decimal form.

**Parameters:**

<Value>                      Range:     0 to 255

**\*PSC <Action>**

Power on status clear

Determines whether the contents of the `ENABLE` registers are preserved or reset when the instrument is switched on. Thus a service request can be triggered when the instrument is switched on, if the status registers ESE and SRE are suitably configured. The query reads out the contents of the "power-on-status-clear" flag.

**Parameters:**

<Action>                      0 | 1

**0**

The contents of the status registers are preserved.

**1**

Resets the status registers.

**\*RST**

Reset

Sets the instrument to a defined default status. The default settings are indicated in the description of commands.

The command is equivalent to `SYSTEM:PRESet`.

**Usage:**                      Setting only

**Manual operation:**    See ["Restoring All Default Settings \(Preset All\)"](#) on page 116  
 See ["Restoring All Default Settings and Deleting Instrument Configurations \(Preset All & Delete Instruments\)"](#) on page 116

**\*SRE <Contents>**

Service request enable

Sets the service request enable register to the indicated value. This command determines under which conditions a service request is triggered.

**Parameters:**

<Contents>                      Contents of the service request enable register in decimal form.  
 Bit 6 (MSS mask bit) is always 0.

Range:     0 to 255

**\*STB?**

Status byte query

Reads the contents of the status byte in decimal form.

**Usage:** Query only

---

### \*TRG

Trigger

Triggers all actions waiting for a trigger event. In particular, \*TRG generates a manual trigger signal. This common command complements the commands of the TRIGger subsystem.

\*TRG corresponds to the INITiate:IMMediate command.

(See INITiate<n>[:IMMediate] on page 548.)

**Usage:** Event

---

### \*TST?

Self-test query

Initiates self-tests of the instrument and returns an error code.

**Note:** If you start a self-test remotely, then select the "Local" softkey while the test is still running, the instrument only returns to the manual operation state after the test is completed. In this case, the self-test cannot be aborted.

**Return values:**

<ErrorCode>	<b>integer &gt; 0 (in decimal format)</b> An error occurred. (For details, see the Service Manual supplied with the instrument).
	<b>0</b> No errors occurred.

**Usage:** Query only

---

### \*WAI

Wait to continue

Prevents servicing of the subsequent commands until all preceding commands have been executed and all signals have settled (see also command synchronization and \*OPC).

**Usage:** Event

## 13.4 Controlling instruments and capturing data

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### 13.4.1 Configuring instruments

The R&S VSE can capture and analyze data from various instruments. These instruments must be configured before measurements can be performed on them via the R&S VSE.

How to configure instruments in manual mode is described in [Chapter 7.2, "Configuring instruments"](#), on page 69.

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#### 13.4.1.1 Configuring the basic connection data

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---

**DEvice:CREate** <DevName>,<Address>[,<Protocol>]

Defines a new connection to a instrument to be controlled by the R&S VSE software.

**Setting parameters:**

<DevName>	string
	Name of the instrument to be used for subsequent reference

<Address>	string Network address of the instrument, for example IP address Alternatively, the VISA resource string can be specified.
<Protocol>	(Optional) Interface protocol used to connect the specified instrument to the network; if no parameter is specified, the VXI11 protocol is assumed. <b>VXI11</b> Standard TCP/IP-based protocol <b>HiSlip</b> High performance protocol
<b>Example:</b>	DEV:CRE 'SpecAnalyzer', '100.100.100.100', VXI11
<b>Example:</b>	DEV:CRE 'SpecAnalyzer', 'TCPIP:: 100.100.100.100::INSTR'
<b>Usage:</b>	Setting only
<b>Manual operation:</b>	See " <a href="#">New Instrument</a> " on page 73 See " <a href="#">Resource String</a> " on page 74 See " <a href="#">Connect / Disconnect / Reconnect</a> " on page 75

---

**DEVIce:DELeTe** <DevName>

Deletes the connection settings of the specified instrument. Note that after deleting a connection, the instrument is no longer known to the R&S VSE software.

**Setting parameters:**

<DevName>	string Name of a configured instrument (see <a href="#">DEVIce:CREate</a> on page 513)
-----------	---

**Example:** DEV:CRE 'SpecAnalyzer', '100.100.100.100',  
'VXI11'  
DEV:DEL 'SpecAnalyzer'

**Usage:** Setting only

**Manual operation:** See "[Close Instrument](#)" on page 74

---

**DEVIce:DELeTe:ALL**

Deletes the connection settings of all defined instruments. Note that after deleting a connection, the instrument is no longer known to the R&S VSE software.

**Usage:** Event

**Manual operation:** See "[Restoring All Default Settings and Deleting Instrument Configurations \(Preset All & Delete Instruments\)](#)" on page 116

---

**DEVIce:DISConnect** <DevName>

Disconnects the specified instrument from the R&S VSE software.

**Setting parameters:**

<DevName>            string  
Name of the instrument (as defined when the connection was created)

**Example:**            DEV:DISC 'SpecAnalyzer'

**Usage:**              Setting only  
Asynchronous command

**Manual operation:** See "[Connect / Disconnect / Reconnect](#)" on page 75

---

**DEVIce:LIST?**

Queries the names of all defined instruments, whether they are currently connected or not. Defined instruments with no (valid) IP address are also included. The names are returned as a comma-separated list in the order of their definition.

**Return values:**

<InstName>           string  
Name of the instrument

**Example:**            DEV:LIST?  
Result:  
'FSW-8\*', 'New Instrument\*', 'New Instrument  
(2) \*'

**Usage:**              Query only

---

**DEVIce:REConnect** <DevName>

Reconnects the specified instrument to the R&S VSE software after a previous connection was interrupted.

**Setting parameters:**

<DevName>            string  
Name of the instrument (as defined when the connection was created)

**Example:**            DEV:CRE 'SpecAnalyzer', '100.100.100.100', VXI11

**Example:**            DEV:DISC 'SpecAnalyzer'

**Example:**            DEV:REC 'SpecAnalyzer'

**Usage:**              Setting only  
Asynchronous command

**Manual operation:** See "[Connect / Disconnect / Reconnect](#)" on page 75

---

**DEVice:STATe?** <DevName>

Queries the connection status of the specified instrument.

**Query parameters:**

<DevName>            string  
Name of a configured instrument (see [DEVice:CREate](#) on page 513)

**Return values:**

<State>            ON | OFF | 0 | 1  
**OFF | 0**  
Switches the function off  
**ON | 1**  
Switches the function on

**Example:**            DEV:STAT? 'SpecAnalyzer'

**Usage:**            Query only

**Manual operation:** See "[Connection State](#)" on page 75

**DEVice:TARGet** <DevName>, <Address>[, <Protocol>]

Changes the connection configuration to the specified instrument.

The query returns the address information for the specified instrument.

**Parameters:**

<Address>            string  
Network address of the instrument, for example IP address  
Alternatively, the VISA resource string can be specified.

**Setting parameters:**

<DevName>            string  
Name of the instrument

<Protocol>            (Optional) Interface protocol used to connect the specified instrument to the network; if no parameter is specified, the VXI11 protocol is assumed.

**VXI11**  
Standard TCP/IP-based protocol

**HiSlip**  
High performance protocol

**Example:**            DEV:CRE 'SpecAnalyzer', '100.100.100.100', VXI11

**Example:**            DEV:TARG 'SpecAnalyzer', 'TCPIP::  
100.100.100.100::INSTR'

**Example:**            DEV:TARG? 'SpecAnalyzer'  
//Result: 'TCPIP::100.100.100.100::INSTR'

**Manual operation:** See "[IP address](#)" on page 74

---

**DEvice:TARGet:TYPE** <DevName>,<Protocol>

**DEvice:TARGet:TYPE?** <DevName>

Defines or queries the interface protocol used to connect the specified instrument to the network.

For details on interfaces see [Chapter 7.2.1, "Remote control interfaces and protocols"](#), on page 70

**Parameters:**

<DevName>                    string  
                                   Name of a configured instrument (see [DEvice:CREate](#)  
                                   on page 513)

**Setting parameters:**

<Protocol>                    Interface protocol used to connect the specified instrument to  
                                   the network

**VXI11**

Standard TCP/IP-based protocol

**HiSlip**

High performance protocol

**Example:**                    DEV:TARG:TYPE 'SpecAnalyzer','VXI11'

**Manual operation:**        See "[Interface Type](#)" on page 74

### 13.4.1.2 Obtaining information on connected instruments

The following commands are required to query information on the firmware version and options installed on the connected instrument.

For details on options refer to the instrument's documentation.

<a href="#">DEvice:INFO:HWInfo?</a> .....	517
<a href="#">DEvice:INFO:IDN?</a> .....	518
<a href="#">DEvice:INFO:OPT?</a> .....	518

---

**DEvice:INFO:HWInfo?** <DevName>

This command queries hardware information for the connected instrument.

**Query parameters:**

<DevName>                    string  
                                   Name of a configured instrument (see [DEvice:CREate](#)  
                                   on page 513)

**Return values:**

<Info>                         String containing the following information for every hardware  
                                   component.  
                                   <component>: name of the hardware component  
                                   <serial#>: serial number of the component  
                                   <order#>: order number of the component  
                                   <model>: model of the component

`<code>`: code of the component  
`<revision>`: revision of the component

**Example:** `DEV:INFO:HWIN? 'SpecAnalyzer'`  
 Queries the hardware information for the instrument named 'SpecAnalyzer'.  
`"FRONTEND|100001/003|1300.3009|03|01|00|00",`  
`"MOTHERBOARD|123456/002|1300.3080|02|00|00|00",`  
`...`

**Usage:** Query only

**Manual operation:** See ["Infos & Settings"](#) on page 75  
 See ["Options"](#) on page 81

**DEVIce:INFO:IDN? <DevName>**

Returns the instrument identification for the specified instrument.

**Query parameters:**

`<DevName>` string  
 Name of a configured instrument (see [DEVIce:CREate](#) on page 513)

**Return values:**

`<ID>` "Rohde&Schwarz,<device type>,<part number>/serial number,<firmware version>"

**Example:** `DEV:INFO:IDN? 'SpecAnalyzer'`  
`Rohde&Schwarz,FSW-26,1312.8000K26/100005,1.30`

**Usage:** Query only

**Manual operation:** See ["Infos & Settings"](#) on page 75  
 See ["Identification String"](#) on page 81

**DEVIce:INFO:OPT? <DevName>**

Queries the options included in the specified instrument. For a list of all available options and their description refer to the data sheet.

**Query parameters:**

`<DevName>` string  
 Name of a configured instrument (see [DEVIce:CREate](#) on page 513)

**Return values:**

`<Options>` The query returns a list of all installed and activated options, separated by commas, where:  
 B<number> describes hardware options  
 K<number> describes software options

**Example:** `DEV:INFO:OPT? 'SpecAnalyzer'`  
`B4,B5,B6,B7,B8,B10,B22,B30,B31,K7,K70`

<b>Usage:</b>	Query only
<b>Manual operation:</b>	See " <a href="#">Infos &amp; Settings</a> " on page 75 See " <a href="#">Options</a> " on page 81

### 13.4.1.3 General instrument setup

The following commands are required to configure initial instrument settings relevant for control by the software.

<a href="#">DEVIce:GENeral:DISPlay</a> .....	519
<a href="#">DEVIce:GENeral:LLO</a> .....	519
<a href="#">DEVIce:LOCKing</a> .....	520
<a href="#">DEVIce:LOCKing:ALL</a> .....	520

---

#### **DEVIce:GENeral:DISPlay** <DevName>

Activates or deactivates the display update function on the specified instrument.

##### **Parameters:**

<DevName>	string Name of a configured instrument (see <a href="#">DEVIce:CREate</a> on page 513)
<State>	ON   OFF   0   1 <b>OFF   0</b> Switches the function off <b>ON   1</b> Switches the function on

**Example:**           DEV:GEN:DISP 'SpecAnalyzer', ON

**Manual operation:** See "[Display Update](#)" on page 83

---

#### **DEVIce:GENeral:LLO** <DevName>

Activates or deactivates the local lockout function on the specified instrument.

##### **Parameters:**

<State>	ON   OFF   0   1 <b>OFF   0</b> Switches the function off <b>ON   1</b> Switches the function on
---------	--

##### **Query parameters:**

<DevName>

**Example:**           DEV:GEN:LLO 'SpecAnalyzer', ON

**Manual operation:** See "[Local Lockout](#)" on page 83

---

**DEVIce:LOCKing** <DevName>,<STATe>

**DEVIce:LOCKing?** <DevName>

Locks or unlocks the VISA connection to the selected instrument. If the connection is locked, no other devices can operate the same instrument remotely. If no connection to the instrument has been established yet, any subsequent connection to it is locked immediately.

This command is similar to the [DEVIce:GENeral:LLO](#) command, but for remote operation.

**Parameters:**

<DevName>	string Name of a configured instrument (see <a href="#">DEVIce:CREate</a> on page 513)
<State>	ON   OFF   0   1 <b>OFF   0</b> Switches the function off <b>ON   1</b> Switches the function on

**Example:** `DEV:LOCK 'SpecAnalyzer', ON`

**Manual operation:** See "[VISA lock state](#)" on page 83

---

**DEVIce:LOCKing:ALL** <STATe>

Locks or unlocks the VISA connection for *all* currently connected instruments. (The command has the same effect as the [DEVIce:LOCKing](#) command for all currently connected instruments.)

**Setting parameters:**

<State>	ON   OFF   0   1 <b>OFF   0</b> Switches the function off <b>ON   1</b> Switches the function on
---------	--

**Example:** `DEV:LOCK:ALL ON`

**Usage:** Setting only

**Manual operation:** See "[VISA lock state](#)" on page 83

---

#### 13.4.1.4 Performing a self-alignment on the instrument

The following commands are required to perform or abort a self-alignment on a connected instrument.

<a href="#">DEVIce:CALibrate[:INIT]</a> .....	521
<a href="#">DEVIce:CALibrate[:INIT]:ABORT</a> .....	521



---

**DEvice:CALibrate[:INIT]** <DevName>

Performs a self-alignment on the specified instrument.

**Setting parameters:**

<DevName>

**Usage:**                    Setting only

---

**DEvice:CALibrate[:INIT]:ABORt** <DevName>

Stops a running self-alignment on the specified instrument.

**Setting parameters:**

<DevName>

**Usage:**                    Setting only

### 13.4.1.5 Configuring an external reference on the instrument

The following commands are required to configure the use of an external reference on the connected instrument.

For manual operation see [Chapter 7.2.12, "Configuring a frequency reference for the connected instrument"](#), on page 86.

For power sensor reference settings, see [Chapter 13.4.8, "Commands for power sensor usage"](#), on page 590.

<a href="#">DEvice:EXTRef:FREquency</a> .....	521
<a href="#">DEvice:EXTRef:LBWidth</a> .....	522
<a href="#">DEvice:EXTRef:O100</a> .....	522
<a href="#">DEvice:EXTRef:O640</a> .....	522
<a href="#">DEvice:EXTRef:OSYNc</a> .....	523
<a href="#">DEvice:EXTRef:SOURce</a> .....	523
<a href="#">DEvice:EXTRef:TRANge</a> .....	524

---

**DEvice:EXTRef:FREquency** <DevName>,<Frequency>

**DEvice:EXTRef:FREquency?** <DevName>

This command defines the frequency of the external reference oscillator of the connected instrument.

The reference signal must be connected to the rear panel of the instrument.

**Parameters:**

<DevName>	string
	Name of a configured instrument (see <a href="#">DEvice:CREate</a> on page 513)
<Frequency>	Range:     1 MHz to 20 MHz
	Default unit: HZ

**Example:** `DEV:EXTR:FREQ 'SpecAnalyzer',13MHZ`  
Sets the frequency for the 'SpecAnalyzer' instrument to 13 MHz.

**Example:** `DEV:EXTR:FREQ? 'SpecAnalyzer'`  
Queries the external reference frequency for the 'SpecAnalyzer' instrument.  
Result: 13MHZ

**Manual operation:** See "[Frequency](#)" on page 87

**DEVice:EXTRef:LBWidth** <DevName>,<Bandwidth>

**DEVice:EXTRef:LBWidth?** <DevName>

Defines the loop bandwidth, that is, the speed of internal synchronization with the reference frequency on the connected instrument. The setting requires a compromise between performance and increasing phase noise.

For a variable external reference frequency with a narrow tuning range (+/- 0.5 ppm), the loop bandwidth is fixed to 0.1 Hz and cannot be changed.

**Parameters:**

<DevName> string  
Name of a configured instrument (see [DEVice:CREate](#) on page 513)

<Bandwidth> 0.1 Hz | 1 Hz | 3 Hz | 10 Hz | 30 Hz | 100 Hz | 300 Hz  
The possible values depend on the reference source and tuning range (see instrument documentation).  
Default unit: Hz

**Example:** `DEV:EXTR::LBW 3`

**Manual operation:** See "[Loop Bandwidth](#)" on page 88

**DEVice:EXTRef:O100** <DevName>,<State>

**DEVice:EXTRef:O100?** <DevName>

**DEVice:EXTRef:O640** <DevName>,<State>

**DEVice:EXTRef:O640?** <DevName>

If enabled, a 640 MHz reference signal is provided to the [REF OUTPUT 640 MHz] connector of the connected instrument.

**Parameters:**

<State> ON | OFF | 0 | 1  
**OFF | 0**  
Switches the function off  
**ON | 1**  
Switches the function on

**Parameters for setting and query:**

<DevName> string  
Name of a configured instrument (see [DEvice:CREate](#) on page 513)

**Example:** DEV:EXTR:0640 ON

**Manual operation:** See "[Reference Frequency Output](#)" on page 88

**DEvice:EXTRef:OSYNc** <DevName>,<State>

**DEvice:EXTRef:OSYNc?** <DevName>

If enabled, a 100 MHz reference signal is provided to the [SYNC TRIGGER OUTPUT] connector of the connected instrument.

**Parameters:**

<DevName> string  
Name of a configured instrument (see [DEvice:CREate](#) on page 513)

<State> ON | OFF | 0 | 1  
**OFF | 0**  
Switches the function off  
**ON | 1**  
Switches the function on

**Example:** DEV:EXTR:OSYN ON

**Manual operation:** See "[Reference Frequency Output](#)" on page 88

**DEvice:EXTRef:SOURce** <DevName>,<Source>

**DEvice:EXTRef:SOURce?** <DevName>

This command selects the reference oscillator for the connected instrument.

The external reference must be connected to the connected instrument.

Note that depending on the type of instrument connected to the R&S VSE software, not all options may be available.

**Parameters:**

<Source> **INTernal**  
the internal reference is used (10 MHz)  
**EXTernal**  
the external reference from the [REF INPUT 1..20 MHz] connector is used with a variable frequency; if none is available, an error flag is displayed in the status bar  
**E10**  
the external reference from [REF INPUT 1..20 MHz] connector is used with a fixed 10 MHz frequency; if none is available, an error flag is displayed in the status bar

**E100**

the external reference from [REF INPUT 100 MHZ] connector is used; if none is available, an error flag is displayed in the status bar

**EAUTO**

the external reference is used as long as it is available, then the instrument switches to the internal reference

**SYNC**

the external reference is used; if none is available, an error flag is displayed in the status bar

**Parameters for setting and query:**

<DevName> string  
Name of a configured instrument (see [DEVIce:CREate](#) on page 513)

**Example:** `DEV:EXTR:SOUR 'FSW-8*',EXT`

**Manual operation:** See "[Reference Frequency Input Source](#)" on page 87

**DEVIce:EXTRef:TRANge** <DevName>,<Range>

**DEVIce:EXTRef:TRANge?** <DevName>

Defines the tuning range of the external reference for the connected instrument. The tuning range is only available for the variable external reference frequency ([DEVIce:EXTR:SOUR EXT](#)). It determines how far the frequency may deviate from the defined level in parts per million ( $10^{-6}$ ).

**Parameters:**

<DevName> string  
Name of a configured instrument (see [DEVIce:CREate](#) on page 513)

<Range> The possible values depend on the reference source (see instrument documentation).

**SMALI**

With this smaller deviation (+/- 0.5 ppm) a very narrow fixed loop bandwidth of 0.1 Hz is realized. With this setting the instrument can synchronize to an external reference signal with a very precise frequency. Due to the very narrow loop bandwidth, unwanted noise or spurious components on the external reference input signal are strongly attenuated. Furthermore, the loop requires about 30 seconds to reach a locked state. During this locking process, "NO REF" is displayed in the status bar.

**WIDE**

The larger deviation (+/- 6 ppm) allows the instrument to synchronize to less precise external reference input signals.

**Example:** `DEV:EXTR:TRAN WIDE`

**Manual operation:** See "[Tuning Range](#)" on page 87

## 13.4.2 Loading input files

The following commands are required to load measurement data from files to be used as input. (See also [Chapter 8.3.4, "Recalling measurement data from files"](#), on page 132).

Useful commands for using input files described elsewhere:

- `INSTRument[:SElect]` on page 552
- [Chapter 13.4.5, "Controlling measurement groups"](#), on page 553
- `EXPort:IQ:METa:DATA<da>:VALue` on page 896

### Remote commands exclusive to loading input files:

<code>INPut&lt;ip&gt;:FILE:FUPDate</code> .....	525
<code>INPut&lt;ip&gt;:FILE:ZPADing</code> .....	526
<code>INSTRument:BLOCK:CHANnel[:SETTings]:FILE&lt;fi&gt;:AID</code> .....	526
<code>INSTRument:BLOCK:CHANnel[:SETTings]:FILE&lt;fi&gt;:CSV</code> .....	527
<code>INSTRument:BLOCK:CHANnel[:SETTings]:FILE&lt;fi&gt;:CURRENT:SAMPLE</code> .....	528
<code>INSTRument:BLOCK:CHANnel[:SETTings]:FILE&lt;fi&gt;:CURRENT:TIME</code> .....	529
<code>INSTRument:BLOCK:CHANnel[:SETTings]:FILE&lt;fi&gt;</code> .....	529
<code>INSTRument:BLOCK:CHANnel[:SETTings]:FILE&lt;fi&gt;:IQTar</code> .....	530
<code>INSTRument:BLOCK:CHANnel[:SETTings]:FILE&lt;fi&gt;:IQW</code> .....	532
<code>INSTRument:BLOCK:CHANnel[:SETTings]:FILE&lt;fi&gt;:IQX</code> .....	533
<code>INSTRument:BLOCK:CHANnel[:SETTings]:FILE&lt;fi&gt;:MAT</code> .....	534
<code>INSTRument:BLOCK:CHANnel[:SETTings]:FILE&lt;fi&gt;:OVERlap:AVG:OFF</code> .....	535
<code>INSTRument:BLOCK:CHANnel[:SETTings]:FILE&lt;fi&gt;:OVERlap:AVG:ON</code> .....	536
<code>INSTRument:BLOCK:CHANnel[:SETTings]:FILE&lt;fi&gt;:REPetition:COUNT</code> .....	537
<code>INSTRument:BLOCK:CHANnel[:SETTings]:FILE&lt;fi&gt;:REPLace</code> .....	537
<code>INSTRument:BLOCK:CHANnel[:SETTings]:FILE&lt;fi&gt;:START:SAMPLE</code> .....	537
<code>INSTRument:BLOCK:CHANnel[:SETTings]:FILE&lt;fi&gt;:START:TIME</code> .....	538
<code>INSTRument:BLOCK:CHANnel[:SETTings]:FILE&lt;fi&gt;:STOP:SAMPLE</code> .....	538
<code>INSTRument:BLOCK:CHANnel[:SETTings]:FILE&lt;fi&gt;:STOP:TIME</code> .....	539
<code>INSTRument:BLOCK:CHANnel[:SETTings]:FILE&lt;fi&gt;:STReam:AUTO</code> .....	539
<code>INSTRument:BLOCK:CHANnel[:SETTings]:FILE&lt;fi&gt;:STReam:LIST?</code> .....	540
<code>INSTRument:BLOCK:CHANnel[:SETTings]:FILE&lt;fi&gt;:STReam</code> .....	540
<code>INSTRument:BLOCK:CHANnel[:SETTings]:FILE&lt;fi&gt;:WV</code> .....	540
<code>SYSTem:FILE:ACAPture</code> .....	541
<code>SYSTem:FILE:SAMeload</code> .....	542

---

### `INPut<ip>:FILE:FUPDate <State>`

Automatically reloads the currently loaded I/Q input file for the next data acquisition.

#### Suffix:

<ip> 1..n

#### Parameters:

<State> ON | OFF | 0 | 1

**OFF | 0**

Switches the function off

**ON | 1**

Switches the function on

**\*RST: 0****Manual operation:** See "[Force Update](#)" on page 137**INPut<ip>:FILE:ZPADing <State>**

Enables or disables zeropadding for input from an I/Q data file that requires resampling. For resampling, a number of samples are required due to filter settling. These samples can either be taken from the provided I/Q data, or the software can add the required number of samples (zeros) at the beginning and end of the file.

**Suffix:**

&lt;ip&gt; 1..n

**Parameters:**

&lt;State&gt; ON | OFF | 0 | 1

**OFF | 0**

Switches the function off

**ON | 1**

Switches the function on

**\*RST: 0****Example:** INP:FILE:ZPAD ON**Manual operation:** See "[Zero Padding](#)" on page 96**INSTrument:BLOCK:CHANnel[:SETTings]:FILE<fi>:AID <FileName>[, <ABW>, <IQChannel>, <ZeroPadding>]**

Assigns the specified .aid file as the input source for the currently selected channel. The file is automatically loaded to the R&S VSE software and assigned the sequential number provided by the FILE suffix. Subsequent commands concerning file input from this file must use the same suffix.

Note that the input source must be specified as file input before you can load a file (see [INSTrument:BLOCK:CHANnel\[:SETTings\]:SOURce<si>](#) on page 543).

**Suffix:**

&lt;fi&gt; 1..n

**Parameters:**

&lt;FileName&gt; string

String containing the path and file name of the file to be loaded.

<b>&lt;ABW&gt;</b>	<p>numeric value</p> <p>The analysis bandwidth to be used by the measurement. The bandwidth must be smaller than or equal to the bandwidth of the data that was stored in the file.</p> <p>Tip: If the file was stored using the R&amp;S VSE software, the ABW is included in the meta data information in the file (see "<a href="#">Meta Data Settings</a>" on page 131).</p> <p>Default unit: HZ</p>
<b>&lt;IQChannel&gt;</b>	<p>string</p> <p>ID of the I/Q channel in the stored file which is to be restored to the measurement channels.</p> <p>If this parameter is omitted, the first channel found is restored.</p> <p>Tip: If the file was stored using the R&amp;S VSE software, the I/Q channel is included in the meta data information in the file (see "<a href="#">Meta Data Settings</a>" on page 131).</p>
<b>&lt;ZeroPadding&gt;</b>	<p>ON   OFF</p> <p>Enables or disables zero padding for input from an I/Q data file that requires resampling.</p> <p>For details see "<a href="#">Zero Padding</a>" on page 96.</p>

**Example:**

```
// Select the channel to be used
INST:SEL 'IQ Analyzer'
// Change input source to file
INST:BLOC:CHAN:SOUR FILE
// Load the I/Q file to be analyzed
INST:BLOC:CHAN:FILE:AID 'C:\Users\ImportFile.aid',,10MHZ,
'Channel1';*OPC?
```

The data from the channel named 'Channel1' in the file is used as input for the measurement channel 'IQ Analyzer'. The displayed bandwidth is restricted to 10 MHz.

**Manual operation:** See "[File](#)" on page 95

---

**INSTrument:BLOCK:CHANnel[:SETTings]:FILE<fi>:CSV** <FileName>[, <ABW>, <SampleRate>, <IQChannel>, <ZeroPadding>]

Assigns the specified .csv file as the input source for the currently selected channel. The file is automatically loaded to the R&S VSE software and assigned the sequential number provided by the FILE suffix. Subsequent commands concerning file input from this file must use the same suffix.

Note that the input source must be specified as file input before you can load a file (see [INSTrument:BLOCK:CHANnel\[:SETTings\]:SOURce<si>](#) on page 543).

**Suffix:**

<fi>                    1 to 99  
Sequential number of the source

**Parameters:**

<FileName>	string String containing the path and file name of the file to be loaded.
<ABW>	numeric value The analysis bandwidth to be used by the measurement. The bandwidth must be smaller than or equal to the bandwidth of the data that was stored in the file. Tip: If the file was stored using the R&S VSE software, the ABW is included in the meta data information in the file (see " <a href="#">Meta Data Settings</a> " on page 131). Default unit: HZ
<SampleRate>	numeric value Default unit: HZ
<IQChannel>	string ID of the I/Q channel in the stored file which is to be restored to the measurement channels. If this parameter is omitted, the first channel found is restored. Tip: If the file was stored using the R&S VSE software, the I/Q channel is included in the meta data information in the file (see " <a href="#">Meta Data Settings</a> " on page 131).
<ZeroPadding>	ON   OFF Enables or disables zero padding for input from an I/Q data file that requires resampling. For details see " <a href="#">Zero Padding</a> " on page 96.

**Example:**

```
// Select the channel to be used
INST:SEL 'IQ Analyzer'
// Change input source to file
INST:BLOC:CHAN:SOUR FILE
// Load the I/Q file to be analyzed
INST:BLOC:CHAN:FILE:CSV 'C:\Users\ImportFile.csv',,10MHZ,
'Channel1';*OPC?
```

The data from the channel named 'Channel1' in the file is used as input for the measurement channel 'IQ Analyzer'. The displayed bandwidth is restricted to 10 MHz.

**Manual operation:** See "[File](#)" on page 95  
See "[File Name](#)" on page 130

---

**INSTrument:BLOCK:CHANnel[:SETTINGS]:FILE<fi>:CURRent:SAMPle <Sample>**

This command starts a sweep and displays the defined sample within the input file <i>. Note that the subsequent command must be synchronized to the end of this command, for example using the \*OPC? command.

For details on synchronization, see [Remote control via SCPI](#).



**Suffix:**  
 <fi> 1..99  
 Sequential number of a configured input file (required only if multiple files are loaded for a single channel)

**Parameters:**  
 <Sample> numeric value  
 Range: 0 to record length of stored data

**Example:**  
 INST:BLOC:CHAN:FILE:STAR:SAMP 10  
 INST:BLOC:CHAN:FILE:STOP:SAMP 1000  
 INST:BLOC:CHAN:FILE:CURR:SAMP 120; \*OPC?  
 Data from the input file is replayed starting with sample number 10 and ending with sample number 1000. The current display is at sample 120.

**Manual operation:** See "[Playback Settings](#)" on page 141

#### INSTrument:BLOCK:CHANnel[:SETTings]:FILE<fi>:CURRent:TIME <Time>

This command starts a sweep and displays the defined (absolute) time within the input file <i>. Note that the subsequent command must be synchronized to the end of this command, for example using the \*OPC? command.

For details on synchronization, see [Remote control via SCPI](#).

**Suffix:**  
 <fi> 1..99  
 Sequential number of a configured input file (required only if multiple files are loaded for a single channel)

**Parameters:**  
 <Time> double value  
 Absolute time  
 Range: 0 to meas time of stored data  
 Default unit: s

**Example:**  
 INST:BLOC:CHAN:FILE:STAR:TIME 0.32s  
 INST:BLOC:CHAN:FILE:STOP:TIME 0.64s  
 INST:BLOC:CHAN:FILE:CURR:TIME 0.40s; \*OPC?  
 Data from the input file is replayed starting at 0.32 s and ending at 0.64 s of the captured data. The current display is at 0.40 s.

**Manual operation:** See "[Playback Settings](#)" on page 141

#### INSTrument:BLOCK:CHANnel[:SETTings]:FILE<fi> <Source>[, <arg1>[, <IQChannel>[, <ZeroPadding>]]

Assigns the specified file as the input source for the currently selected channel. The file is automatically loaded to the R&S VSE software and assigned the sequential number provided as the FILE<fi> suffix. Subsequent commands concerning file input from this file must use the same suffix.

Note that the input source must be specified as file input before you can load a file (see [INSTrument:BLOCK:CHANnel\[:SETTings\]:SOURce<si>](#) on page 543).

To query the values of the stored meta data after loading the file, see [EXPort:IQ:METa:DATA<da>:VALue](#) on page 896.

**Suffix:**

<fi> 1..n  
Sequential number of the source

**Parameters:**

<Source> String containing the path and file name of the file to be loaded.

<arg1> numeric value  
The analysis bandwidth to be used by the measurement. The bandwidth must be smaller than or equal to the bandwidth of the data that was stored in the file.  
Tip: If the file was stored using the R&S VSE software, the ABW is included in the meta data information in the file (see ["Meta Data Settings"](#) on page 131).  
Default unit: HZ

<IQChannel> string  
ID of the I/Q channel in the stored file which is to be restored to the selected measurement channel.  
If this parameter is omitted, the first channel found is restored.  
Tip: If the file was stored using the R&S VSE software, the I/Q channel is included in the meta data information in the file (see ["Meta Data Settings"](#) on page 131).

<ZeroPadding> ON | OFF

**Example:**

```
// Select the channel to be used
INST:SEL 'IQ Analyzer'
// Change input source to file
INST:BLOC:CHAN:SOUR FILE
// Load the I/Q file to be analyzed
INST:BLOC:CHAN:FILE:CSV 'C:\Users\ImportFile.csv',,10MHZ,
'Channel1';*OPC?
```

The data from the channel named 'Channel1' in the file is used as input for the measurement channel 'IQ Analyzer'. The displayed bandwidth is restricted to 10 MHz.

---

**INSTrument:BLOCK:CHANnel[:SETTings]:FILE<fi>:IQTar <FileName>[, <ABW>, <IQChannel>, <ZeroPadding>]**

Assigns the specified `.iq.tar` file as the input source for the currently selected channel. The file is automatically loaded to the R&S VSE software and assigned the sequential number provided by the `FILE` suffix. Subsequent commands concerning file input from this file must use the same suffix.

Note that the input source must be specified as file input before you can load a file (see `INSTrument:BLOCk:CHANnel[:SETTings]:SOURce<si>` on page 543).

To query the values of the stored meta data after loading the file, see `EXPort:IQ:METa:DATA<da>:VALue` on page 896.

**Suffix:**

<fi> 1 to 99  
Sequential number of the source

**Parameters:**

<FileName> string  
String containing the path and file name of the file to be loaded.

<ABW> numeric value  
The analysis bandwidth to be used by the measurement. The bandwidth must be smaller than or equal to the bandwidth of the data that was stored in the file.  
Tip: If the file was stored using the R&S VSE software, the ABW is included in the meta data information in the file (see "[Meta Data Settings](#)" on page 131).  
Default unit: HZ

<IQChannel> string  
ID of the I/Q channel in the stored file which is to be restored to the measurement channels.  
If this parameter is omitted, the first channel found is restored.  
Tip: If the file was stored using the R&S VSE software, the I/Q channel is included in the meta data information in the file (see "[Meta Data Settings](#)" on page 131).

<ZeroPadding> ON | OFF  
Enables or disables zero padding for input from an I/Q data file that requires resampling.  
For details see "[Zero Padding](#)" on page 96.

**Example:**

```
// Select the channel to be used
INST:SEL 'IQ Analyzer'

// Change input source to file
INST:BLOC:CHAN:SOUR FILE

// Load the I/Q file to be analyzed
INST:BLOC:CHAN:FILE:IQT 'C:\MyIQFile.iq.tar',1MHz,'Channel1';*OPC?
```

The data from the channel named 'Channel1' in the file is used as input for the current measurement channel 'IQ Analyzer'. The displayed bandwidth is restricted to 1 MHz.

**Manual operation:** See "[File](#)" on page 95  
See "[File Name](#)" on page 130

---

**INSTrument:BLOCK:CHANnel[:SETTings]:FILE<fi>:IQW** <FileName>, <ABW>, <SampleRate>[, <Format>, <ZeroPadding>, <CenterFrequency>]

Assigns the specified .iqw file as the input source for the currently selected channel. The file is automatically loaded to the R&S VSE software and assigned the sequential number provided by the FILE suffix. Subsequent commands concerning file input from this file must use the same suffix.

Note that the input source must be specified as file input before you can load a file (see [INSTrument:BLOCK:CHANnel\[:SETTings\]:SOURce<si>](#) on page 543).

**Suffix:**

<fi> 1 to 99  
Sequential number of the source

**Parameters:**

<FileName> string  
String containing the path and file name of the file to be loaded.

<ABW> numeric value  
The analysis bandwidth to be used by the measurement. The bandwidth must be smaller than or equal to the bandwidth of the data that was stored in the file.  
Tip: If the file was stored using the R&S VSE software, the ABW is included in the meta data information in the file (see ["Meta Data Settings"](#) on page 131).  
Default unit: HZ

<SampleRate> numeric value  
The sample rate used to obtain the stored data.  
Tip: If the file was stored using the R&S VSE software, the sample rate is included in the meta data information in the file (see ["Meta Data Settings"](#) on page 131).  
Default unit: HZ

<Format> IQPair | IQBLock | IQIQ | IIQQ  
The format in which the I/Q data is provided  
**IIQQ | IQBLock**  
First all I-values are listed, then the Q-values (I,I,I,I,I,...Q,Q,Q,Q,Q,Q)  
**IQIQ | IQPair**  
One pair of I/Q values after the other is listed (I,Q,I,Q,I,Q...).  
\*RST: IQPair

<ZeroPadding> ON | OFF  
Enables or disables zero padding for input from an I/Q data file that requires resampling.  
For details see ["Zero Padding"](#) on page 96.

<CenterFrequency> numeric value  
 Default unit: HZ

**Example:**

```
// Select the channel to be used
INST:SEL 'IQ Analyzer'
```

```
// Change input source to file
INST:BLOC:CHAN:SOUR FILE
```

```
// Load the I/Q file to be analyzed
```

```
INST:BLOC:CHAN:FILE:IQW 'C:\Users\ImportFile.iqw',10MHZ,32MHz,IIQQ,'Chan
```

The data from the channel named 'Channel1' in the file is used as input for the measurement channel 'IQ Analyzer'. The displayed bandwidth is restricted to 10 MHz. A sample rate of 32 MHz is applied. The data is interpreted in the format "IIQQ".

**Manual operation:** See "File" on page 95  
 See "File Name" on page 130

**INSTrument:BLOCK:CHANnel[:SETTings]:FILE<fi>:IQX <FileName>[, <ABW>,  
 <IQChannel>, <ZeroPadding>]**

Assigns the specified .iqx file as the input source for the currently selected channel. The file is automatically loaded to the R&S VSE software and assigned the sequential number provided by the FILE suffix. Subsequent commands concerning file input from this file must use the same suffix.

Note that the input source must be specified as file input before you can load a file (see [INSTrument:BLOCK:CHANnel\[:SETTings\]:SOURce<si>](#) on page 543).

**Suffix:**

<fi> 1 to 99  
 Sequential number of the source

**Parameters:**

<FileName> string  
 String containing the path and file name of the file to be loaded.

<ABW> numeric value  
 The analysis bandwidth to be used by the measurement. The bandwidth must be smaller than or equal to the bandwidth of the data that was stored in the file.  
 Tip: If the file was stored using the R&S VSE software, the ABW is included in the meta data information in the file (see ["Meta Data Settings"](#) on page 131).  
 Default unit: HZ

**<IQChannel>** string  
 (Optional:) ID of the I/Q channel in the stored file which is to be restored to the measurement channels.  
 If this parameter is omitted, the first channel found is restored.  
 Tip: If the file was stored using the R&S VSE software, the I/Q channel is included in the meta data information in the file (see ["Meta Data Settings"](#) on page 131).

**<ZeroPadding>** ON | OFF  
 (Optional:) Enables or disables zero padding for input from an I/Q data file that requires resampling.  
 For details see ["Zero Padding"](#) on page 96.

**Example:**

```
// Select the channel to be used
INST:SEL 'LTE MIMO'

// Change input source to file
INST:BLOC:CHAN:SOUR FILE

// Load the I/Q file to be analyzed
INST:BLOC:CHAN:FILE:IQW 'C:\Users\ImportFile.iqX',10MHZ,'Channel1',0;*OPC
```

The data from the channel named 'Channel1' in the file is used as input for the measurement channel 'LTE MIMO'. The displayed bandwidth is restricted to 10 MHz.

**Manual operation:** See ["File Name"](#) on page 130

---

**INSTrument:BLOCK:CHANnel[:SETTings]:FILE<fi>:MAT** <FileName>[, <ABW>,  
 <SampleRate>, <IQChannel>, <ZeroPadding>]

Assigns the specified .mat file as the input source for the currently selected channel. The file is automatically loaded to the R&S VSE software and assigned the sequential number provided by the FILE suffix. Subsequent commands concerning file input from this file must use the same suffix.

Note that the input source must be specified as file input before you can load a file (see [INSTrument:BLOCK:CHANnel\[:SETTings\]:SOURce<si>](#) on page 543).

**Suffix:**

**<fi>** 1 to 99  
 Sequential number of the source

**Parameters:**

**<FileName>** string  
 String containing the path and file name of the file to be loaded.

<ABW>	numeric value The analysis bandwidth to be used by the measurement. The bandwidth must be smaller than or equal to the bandwidth of the data that was stored in the file. Tip: If the file was stored using the R&S VSE software, the ABW is included in the meta data information in the file (see " <a href="#">Meta Data Settings</a> " on page 131). Default unit: HZ
<SampleRate>	numeric value Default unit: HZ
<IQChannel>	string ID of the I/Q channel in the stored file which is to be restored to the measurement channels. If this parameter is omitted, the first channel found is restored. Tip: If the file was stored using the R&S VSE software, the I/Q channel is included in the meta data information in the file (see " <a href="#">Meta Data Settings</a> " on page 131).
<ZeroPadding>	ON   OFF Enables or disables zero padding for input from an I/Q data file that requires resampling. For details see " <a href="#">Zero Padding</a> " on page 96.

**Example:**

```
// Select the channel to be used
INST:SEL 'IQ Analyzer'

// Change input source to file
INST:BLOC:CHAN:SOUR FILE

// Load the I/Q file to be analyzed
INST:BLOC:CHAN:FILE:MAT 'C:\Users\ImportFile.mat',,10MHZ,'Channel1';*OPC?
```

The data from the channel named 'Channel1' in the file is used as input for the measurement channel 'IQ Analyzer'. The displayed bandwidth is restricted to 10 MHz.

**Manual operation:** See "[File](#)" on page 95  
See "[File Name](#)" on page 130

---

**INSTrument:BLOCK:CHANnel[:SETTINGS]:FILE<fi>:OVERlap:AVG:OFF**  
<Percentage>

The overlap settings determine how successive records within one data file are replayed.

This command defines the behavior if a non-averaging trace detector is used.

After the first record has been replayed, the specified percentage (x) of the next record is displayed together with the remaining data (meas time - x) from the previous record. This leads to a smoother trace update; whereas without any overlap, the trace appears to "jump" after each record.

**Suffix:**

<fi> 1..99  
Sequential number of a configured input file (required only if multiple files are loaded for a single channel)

**Parameters:**

<Percentage> numeric value  
Range: 0 to 100  
\*RST: 90

**Example:**

INST:BLOC:CHAN:FILE1:OVER:AVG:OFF 75

For normal clear/write traces, after each update, the display shows 25% of the previous record and 75% of the next record.

**Manual operation:** See "[Overlap Settings](#)" on page 141

**INSTrument:BLOCK:CHANnel[:SETTings]:FILE<fi>:OVERlap:AVG:ON**  
<Percentage>

The overlap settings determine how successive records within one data file are replayed.

This command defines the behavior if an averaging trace detector is used.

After the first record has been replayed, the specified percentage (x) of the next record is displayed together with the remaining data (meas time - x) from the previous record. This leads to a smoother trace update; whereas without any overlap, the trace appears to "jump" after each record.

On the other hand, if an overlap is applied, the overlapping data is included in multiple averaging calculations, thus distorting the overall average.

**Suffix:**

<fi> 1..99  
Sequential number of a configured input file (required only if multiple files are loaded for a single channel)

**Parameters:**

<Percentage> numeric value  
Range: 0 to 100  
\*RST: 0

**Example:**

INST:BLOC:CHAN:FILE1:OVER:AVG:ON 99

For averaged traces, after each update, the display shows 1% of the previous record and 99% of the next record. Thus, 1% of each record is included in multiple averaging calculations.

**Manual operation:** See "[Overlap Settings](#)" on page 141



---

**INSTrument:BLOCK:CHANnel[:SETTings]:FILE<fi>:REPetition:COUNT**  
 <RepetitionCount>

Determines how often the data stream is repeatedly stored in the I/Q data memory. If the available memory is not sufficient for the specified number of repetitions, the largest possible number of complete data streams is used.

**Suffix:**

<fi> 1..n

**Parameters:**

<RepetitionCount> integer

**Example:**

INST:BLOC:CHAN:SETT:FILE:REP:COUN 3

**Manual operation:** See ["File Repetitions"](#) on page 137

---

**INSTrument:BLOCK:CHANnel[:SETTings]:FILE<fi>:REPLace <Source>**

Assigns the specified file as the input source for the currently selected channel. The file is automatically loaded to the R&S VSE software and assigned the sequential number provided as the FILE<fi> suffix. Subsequent commands concerning file input from this file must use the same suffix.

This command is only available for R&S VSEEnterprise Edition.

**Suffix:**

<fi> 1 to 99  
Sequential number of the source

**Setting parameters:**

<Source> String containing the path and file name of the file to be loaded. Since this command provides only the file name, you must ensure that the file type and all essential file information such as the analysis bandwidth, sample rate etc. correspond to the file you are replacing.

**Example:**

```
INST:SEL 'IQ Analyzer'
INST:BLOC:CHAN:FILE:REPL 'C:
\Users\ImportFile.iqtar'
```

The data from the I/Q channel stored in the file is used as input for the current measurement channel 'IQ Analyzer'.

**Usage:**

Setting only

**Manual operation:**

See ["File"](#) on page 95  
See ["File Name"](#) on page 130

---

**INSTrument:BLOCK:CHANnel[:SETTings]:FILE<fi>:START:SAMPle <Sample>**

This command defines the sample within the input file <fi> at which replay starts.

**Suffix:**  
 <fi> 1..99  
 Sequential number of a configured input file (required only if multiple files are loaded for a single channel)

**Parameters:**  
 <Sample> numeric value  
 Range: 0 to record length of stored data

**Example:**  
 INST:BLOC:CHAN:FILE:START:SAMP 10  
 Data from the input file is replayed starting with sample number 10.

**Manual operation:** See ["Playback Settings"](#) on page 141

**INSTrument:BLOCK:CHANnel[:SETTings]:FILE<fi>:STARt:TIME <Time>**

This command defines the start time within the input file <fi> at which replay starts.

**Suffix:**  
 <fi> 1..99  
 Sequential number of a configured input file (required only if multiple files are loaded for a single channel)

**Parameters:**  
 <Time> double value  
 Absolute start time  
 Range: 0 to meas time of stored data  
 Default unit: s

**Example:**  
 INST:BLOC:CHAN:FILE:START:TIME 0.32s  
 Data from the input file is replayed starting at 0.32 s of the captured data.

**Manual operation:** See ["Playback Settings"](#) on page 141

**INSTrument:BLOCK:CHANnel[:SETTings]:FILE<fi>:STOP:SAMPle <Sample>**

This command defines the sample within the input file <fi> at which replay stops.

**Suffix:**  
 <fi> 1..99  
 Sequential number of a configured input file (required only if multiple files are loaded for a single channel)

**Parameters:**  
 <Sample> numeric value  
 Range: 0 to record length of stored data

**Example:**  
 INST:BLOC:CHAN:FILE:STAR:SAMP 10  
 INST:BLOC:CHAN:FILE:STOP:SAMP 1000  
 Data from the input file is replayed starting with sample number 10 and ending with sample number 1000.

**Manual operation:** See "[Playback Settings](#)" on page 141

---

### **INSTrument:BLOCK:CHANnel[:SETTings]:FILE<fi>:STOP:TIME <Time>**

This command defines the (absolute) time within the input file <i> at which replay stops.

**Suffix:**

<fi> 1..99  
Sequential number of a configured input file (required only if multiple files are loaded for a single channel)

**Parameters:**

<Time> double value  
Absolute stop time (not duration)  
Range: 0 to meas time of stored data  
Default unit: s

**Example:**

```
INST:BLOC:CHAN:FILE:START:TIME 0.32s
INST:BLOC:CHAN:FILE:STOP:TIME 0.64s
```

Data from the input file is replayed starting at 0.32 s and ending at 0.64 s of the captured data.

**Manual operation:** See "[Playback Settings](#)" on page 141

---

### **INSTrument:BLOCK:CHANnel[:SETTings]:FILE<fi>:STReam:AUTO <State>**

Only available for files that contain more than one data stream from multiple channels: automatically defines which data stream in the file is used as input for the channel.

**Suffix:**

<fi> 1..99  
Sequential number of a configured input file (required only if multiple files are loaded for a single channel)

**Parameters:**

<State> ON | OFF | 0 | 1  
**OFF | 0**  
The data stream specified by `INSTrument:BLOCK:CHANnel[:SETTings]:FILE<fi>:STReam` is used as input for the channel.  
**ON | 1**  
All data streams in the file are used as input for the channel. If the input source only supports a single data channel, the first data stream in the file is used.  
\*RST: 1

**Example:**

```
INST:BLOC:CHAN:SETT:FILE:STR:AUTO OFF
```

**Manual operation:** See "[Channel](#)" on page 96  
See "[I/Q Channel](#)" on page 136

**INSTrument:BLOCK:CHANnel[:SETTings]:FILE<fi>:STReam:LIST?**

Returns the available channels in the currently loaded input file.

**Suffix:**

<fi> 1..99  
Sequential number of a configured input file (required only if multiple files are loaded for a single channel)

**Example:**

```
INST:BLOC:CHAN:SETT:FILE:STR:LIST?
//Result: 'Channel1', 'Channel2'
```

**Usage:**

Query only

**Manual operation:**

See "Channel" on page 96  
See "I/Q Channel" on page 136

**INSTrument:BLOCK:CHANnel[:SETTings]:FILE<fi>:STReam <IQChannel>**

Defines the I/Q channel in the stored file which is to be restored to the selected measurement channel. This command can be used to change the I/Q channel only for an existing file input definition.

**Suffix:**

<fi> 1..99  
Sequential number of a configured input file (required only if multiple files are loaded for a single channel)

**Parameters:**

<IQChannel> ID of the I/Q channel in the stored file which is to be restored to the selected measurement channel.

**Example:**

```
INST:BLOC:CHAN:SETT:FILE:STR 'IQAnalyzer'
```

**Manual operation:**

See "Channel" on page 96  
See "I/Q Channel" on page 136

**INSTrument:BLOCK:CHANnel[:SETTings]:FILE<fi>:WV <FileName>[, <ABW>, <IQChannel>, <ZeroPadding>]**

Assigns the specified .wv file as the input source for for the currently selected channel. The file is automatically loaded to the R&S VSE software and assigned the sequential number provided by the FILE suffix. Subsequent commands concerning file input from this file must use the same suffix.

Note that the input source must be specified as file input before you can load a file (see [INSTrument:BLOCK:CHANnel\[:SETTings\]:SOURce<si>](#) on page 543).

Both basic and encrypted .wv files are supported. Note, however, that traces resulting from encrypted file input cannot be exported or stored in a saveset (see [Chapter 8.3, "Recording and recalling captured I/Q data for evaluation"](#), on page 125 and [Chapter 8.5, "Storing graphical results to an ASCII file"](#), on page 144).

To query the values of the stored meta data after loading the file, see [EXPort:IQ:METa:DATA<da>:VALue](#) on page 896.

**Suffix:**

<fi> 1 to 99  
Sequential number of the source

**Parameters:**

<FileName> string  
String containing the path and file name of the file to be loaded.

<ABW> numeric value  
The analysis bandwidth to be used by the measurement. The bandwidth must be smaller than or equal to the bandwidth of the data that was stored in the file.  
Default unit: HZ

<IQChannel> string  
ID of the I/Q channel in the stored file which is to be restored to the measurement channels.  
If this parameter is omitted, the first channel found is restored.

<ZeroPadding> ON | OFF  
(Optional:) Enables or disables zero padding for input from an I/Q data file that requires resampling.  
For details see ["Zero Padding"](#) on page 96.

**Example:**

```
// Select the channel to be used
INST:SEL 'IQ Analyzer'

// Change input source to file
INST:BLOC:CHAN:SOUR FILE

// Load the I/Q file to be analyzed
INST:BLOC:CHAN:FILE:WV 'C:\MyIQFile.wv',1MHz,'Channel1';*OPC?
```

The data from the channel named 'Channel1' in the file is used as input for the current measurement channel 'IQ Analyzer'. The displayed bandwidth is restricted to 1 MHz.

**Manual operation:** See ["File"](#) on page 95

**SYSTem:FILE:ACAPture <State>**

By default, data acquisition is performed automatically after an input file is loaded. However, sometimes performance issues can arise if you have to adapt the measurement settings for the input data after loading them. In this case, disable this option. Then use the [INITiate<n>\[:IMMEDIATE\]](#) command to start data acquisition after loading the file and adapting the measurement settings.

**Parameters:**

<State> ON | OFF | 0 | 1

**OFF | 0**

Switches the function off

**ON | 1**

Switches the function on

\*RST: 1

**Manual operation:** See ["Automatically capture after loading an I/Q file"](#) on page 147**SYSTem:FILE:SAMeload <State>**

Defines whether a data acquisition is performed if the same file is loaded as input again.

**Parameters:**

&lt;State&gt; ON | OFF | 0 | 1

**OFF | 0**

No data acquisition is performed.

**ON | 1**

A data acquisition is performed.

\*RST: 0

**Example:**

SYST:FILE:SAM ON

A data acquisition is performed each time the file is loaded, even if it has already been loaded before.

**Manual operation:** See ["Reload I/Q file when selecting the same file again"](#) on page 147

### 13.4.3 Configuring channel input sources

The following commands define which type of input is used for a measurement channel.

The commands for input from a file are described in [Chapter 13.4.2, "Loading input files"](#), on page 525.

Useful commands for configuring channel input described elsewhere:

- [INSTrument\[:SElect\]](#) on page 552

**Remote commands exclusive to configuring channel input:**

<a href="#">INSTrument:BLOCK:CHANnel[:SETTings]:DEVice&lt;di&gt;</a> .....	543
<a href="#">INSTrument:BLOCK:CHANnel[:SETTings]:GENErator&lt;di&gt;</a> .....	543
<a href="#">INSTrument:BLOCK:CHANnel[:SETTings]:SOURce&lt;si&gt;</a> .....	543
<a href="#">INSTrument:BLOCK:CHANnel[:SETTings]:SOURce&lt;si&gt;:CONFig</a> .....	544
<a href="#">INSTrument:BLOCK:CHANnel[:SETTings]:SOURce&lt;si&gt;:TYPE</a> .....	544

**INSTrument:BLOCK:CHANnel[:SETTings]:DEVice<di>** <DevName>

Assigns the specified instrument as the input source for the currently selected channel. The instrument must have been configured before it can be assigned (see [Chapter 13.4.1, "Configuring instruments"](#), on page 513).

**Suffix:**

&lt;di&gt;

**Parameters:**

&lt;DevName&gt;

string

Name of a configured instrument.

**'NONE'**

No instrument or file is defined as the input source.

**Example:**

INST:BLOCK:CHAN:DEV 'MyFSW'

**Manual operation:** See ["Instrument"](#) on page 94**INSTrument:BLOCK:CHANnel[:SETTings]:GENerator<di>** <DevName>

Assigns the specified instrument as the generator input source for the currently selected channel. The instrument must have been configured before it can be assigned (see [Chapter 13.4.1, "Configuring instruments"](#), on page 513).

This command is only available for channels that support (additional) generator input, e.g. Amplifier measurements (R&S VSE-K18). See the application manuals for details.

**Suffix:**

&lt;di&gt;

1..n

**Parameters:**

&lt;DevName&gt;

string

Name of a configured generator.

**'NONE'**

No generator is defined as an input source.

**Example:**

```
DEVice:CREate 'MyGenerator', '192.168.1.2';*OPC
INST:SEL AMPL;*OPC
INST:BLOC:CHAN:GEN 'MyGenerator';*OPC
```

**Manual operation:** See ["Generator"](#) on page 95**INSTrument:BLOCK:CHANnel[:SETTings]:SOURce<si>** <Type>

Selects an instrument or a file as the source of input provided to the channel.

**Suffix:**

&lt;si&gt;

1 to 99

LTE-MIMO only: input source number

**Parameters:**

&lt;Type&gt;

FILE | DEVice | NONE

**FILE**

A loaded file is used for input.

(See [Chapter 13.4.2, "Loading input files"](#), on page 525.)

**DEvice**

A configured device provides input for the measurement

(See [Chapter 13.4.1, "Configuring instruments"](#), on page 513.)

**NONE**

No input source defined.

**Manual operation:** See ["Input Type \(Instrument / File\)"](#) on page 94

**INSTrument:BLOCK:CHANnel[:SETTings]:SOURce<si>:CONFig <Port>**

Configures the port to be used for input on the selected instrument.

Is only available if an oscilloscope is connected.

**Suffix:**

<si> 1 to 99  
LTE-MIMO only: input source number

**Parameters:**

<Port>

**Manual operation:** See ["Input Source"](#) on page 94

**INSTrument:BLOCK:CHANnel[:SETTings]:SOURce<si>:TYPE <Source>**

Configures the source of input to be used from the selected instrument.

Not all input sources are supported by all R&S VSE applications.

**Suffix:**

<si> 1 to 99  
LTE-MIMO only: input source number

**Parameters:**

<Source>

**RF**

Radio Frequency ("RF INPUT" connector)

**'Channel 1' | 'Channel 2' | 'Channel 3' | 'Channel 4'**

Oscilloscope input channel 1, 2, 3, or 4

**'Channel 1,2 (I+Q)'**

I/Q data provided by oscilloscope input channels 1 and 2 (for oscilloscopes with 2 channels only)

**'Channel 1,3 (I+Q)' | 'Channel 2,4 (I+Q)'**

I/Q data provided by oscilloscope input channels 1 and 3, or 2 and 4 (for oscilloscopes with 4 channels only)



**'Channels 1-4 (diff. I+Q)'**

Differential I/Q data provided by oscilloscope input channels (for oscilloscopes with 4 channels only):

Channel 1: I (pos.)

Channel 2:  $\bar{I}$  (neg.)

Channel 3: Q (pos.)

Channel 4:  $\bar{Q}$  (neg.)

**'Channels 1,3 (Waveform)'**

Waveform data provided by oscilloscope input channels 1 and 3 (for oscilloscopes with 2 channels only)

**'Channels 2,4 (Waveform)'**

Waveform data provided by oscilloscope input channels 2 and 4 (for oscilloscopes with 2 channels only)

**'Channels 1-4 (Waveform)'**

Waveform data provided by oscilloscope input channels 1 to 4 (for oscilloscopes with 4 channels only)

\*RST: RF

**Example:** INST:BLOC:CHAN:SOUR:TYPE 'Channel 2,4 (I+Q)  
I/Q data is provided by oscilloscope input channels 2 and 4

**Manual operation:** See ["Input Source"](#) on page 94

### 13.4.4 Configuring measurement channels

The following commands are required to configure a measurement channel and select the application in a remote environment. The tasks for manual operation are described in [Chapter 7.3, "Controlling measurement channels, groups, and sequences"](#), on page 88.

Useful commands for configuring measurement channels described elsewhere:

- `INSTrument[:SElect]` on page 552
- [Chapter 13.4.5, "Controlling measurement groups"](#), on page 553
- [Chapter 13.4.3, "Configuring channel input sources"](#), on page 542
- [Chapter 13.4.2, "Loading input files"](#), on page 525
- `SYSTem:PRESet:CHANnel[:EXEC]` on page 880

#### Remote commands exclusive to configuring measurement channels:

<code>ABORT</code> .....	546
<code>INITiate&lt;n&gt;:CONMeas</code> .....	547
<code>INITiate&lt;n&gt;:CONTinuous</code> .....	547
<code>INITiate&lt;n&gt;[:IMMediate]</code> .....	548
<code>INSTrument:BLOCK:CHANnel[:SETTings]:RECORD</code> .....	549
<code>INSTrument:CREate:DUPLicate</code> .....	549
<code>INSTrument:CREate[:NEW]</code> .....	549
<code>INSTrument:CREate:REPLace</code> .....	550
<code>INSTrument:DELeTe</code> .....	550

INSTrument:LIST?.....	550
INSTrument:REName.....	551
INSTrument[:SElect].....	552

---

## ABORt

Aborts the measurement in the current channel and resets the trigger system.

To prevent overlapping execution of the subsequent command before the measurement has been aborted successfully, use the \*OPC? or \*WAI command after ABOR and before the next command.

For details on overlapping execution see [Remote control via SCPI](#).

To abort an entire group of measurements, use the INITiate:BLOCK:ABORt command.

To abort the entire sequence of measurements, use the INITiate:SEQuencer:ABORt command.

### Note on blocked remote control programs:

If a sequential command cannot be completed, for example because a triggered sweep never receives a trigger, the remote control program will never finish and the remote channel to the connected instrument is blocked for further commands. In this case, you must interrupt processing on the remote channel first in order to abort the measurement.

To do so, send a "Device Clear" command from the control instrument to the connected instrument on a parallel channel to clear all currently active remote channels. Depending on the used interface and protocol, send the following commands:

- **Visa:** viClear()
- **GPIB:** ibclr()
- **RSIB:** RSDLLibclr()

Now you can send the ABORt command on the remote channel performing the measurement.

**Example:**                    ABOR; :INIT:IMM  
Aborts the current measurement and immediately starts a new one.

**Example:**                    ABOR; \*WAI  
                                  INIT:IMM  
Aborts the current measurement and starts a new one once abortion has been completed.

**Usage:**                     Event

**Manual operation:**    See "[Pause / Cont](#)" on page 97  
                              See "[Pause / Cont](#)" on page 139

**INITiate<n>:CONMeas**

Restarts a (single) measurement that has been stopped (using `ABORT`) or finished in single measurement mode.

The measurement is restarted at the beginning, not where the previous measurement was stopped.

As opposed to `INITiate<n>[:IMMediate]`, this command does not reset traces in maxhold, minhold or average mode. Therefore it can be used to continue measurements using maxhold or averaging functions.

Tip: To continue all measurements in a group, use the `INITiate:BLOCK:CONMeas` command.

**Suffix:**

<n> irrelevant

**Example:**

```
INIT:CONT OFF
```

Switches to single measurement mode.

```
DISP:WIND:TRAC:MODE AVER
```

Switches on trace averaging.

```
SWE:COUN 20
```

Setting the measurement counter to 20 measurements.

```
INIT;*WAI
```

Starts the measurement and waits for the end of the 20 measurements.

```
INIT:CONM;*WAI
```

Continues the measurement (next 20 measurements) and waits for the end.

Result: Averaging is performed over 40 measurements.

**Usage:**

Asynchronous command

**Manual operation:**

See "Pause / Cont" on page 97

See "Pause / Cont" on page 139

**INITiate<n>:CONTInuous <State>**

Controls the measurement mode for an individual channel.

Note that in single measurement mode, you can synchronize to the end of the measurement with `*OPC`, `*OPC?` or `*WAI`. In continuous measurement mode, synchronization to the end of the measurement is not possible. Thus, it is not recommended that you use continuous measurement mode in remote control, as results like trace data or markers are only valid after a single measurement end synchronization.

For details on synchronization see [Remote control via SCPI](#).

If the measurement mode is changed for a channel while a measurement sequence is active (see `INITiate:SEQuencer:IMMediate` on page 568), the mode is only considered the next time the group containing the channel is started.

Tip: To change the measurement mode for an entire group, use the `INITiate:BLOCK:CONT` command.

**Suffix:**

<n> irrelevant

**Parameters:**

<State> ON | OFF | 0 | 1  
**ON | 1**  
 Continuous measurement  
**OFF | 0**  
 Single measurement  
 \*RST: 1 (some applications can differ)

**Example:**

```
INIT:CONT OFF
Switches the measurement mode to single measurement.
INIT:CONT ON
Switches the measurement mode to continuous measurement.
```

**Manual operation:**

See "[Measurement mode \(Single/Continuous\)](#)" on page 98  
 See "[Measurement mode \(Single/Continuous\)](#)" on page 139  
 See "[Continuous Sweep / Run Cont](#)" on page 377

**INITiate<n>[:IMMediate]**

Starts a (single) new measurement.

With measurement count or average count > 0, this means a restart of the corresponding number of measurements. With trace mode MAXHold, MINHold and AVERage, the previous results are reset on restarting the measurement.

You can synchronize to the end of the measurement with \*OPC, \*OPC? or \*WAI.

For details on synchronization see [Remote control via SCPI](#).

**Suffix:**

<n> irrelevant

**Example:**

```
INIT:CONT OFF
Switches to single measurement mode.
DISP:WIND:TRAC:MODE AVER
Switches on trace averaging.
SWE:COUN 20
Sets the measurement counter to 20 measurements.
INIT;*WAI
Starts the measurement and waits for the end of the 20 measurements.
```

**Usage:**

Asynchronous command

**Manual operation:**

See "[Capture](#)" on page 97  
 See "[Capture](#)" on page 139  
 See "[Single Sweep / Run Single](#)" on page 377

**INSTrument:BLOCK:CHANnel[:SETTings]:RECord**

Starts a measurement for the currently selected channel and stores the measurement data to a temporary file.

You can store the file permanently using [EXPort:IQ:FILE](#).

For details see [Chapter 8.3.1, "Recording measurement data"](#), on page 126.

**Usage:** Asynchronous command

**Manual operation:** See ["Record"](#) on page 98

**INSTrument:CREate:DUPLicate**

Duplicates the currently selected channel, i.e. creates a new channel of the same type and with the identical measurement settings. The name of the new channel is the same as the copied channel, extended by a consecutive number (e.g. "IQAnalyzer" -> "IQAnalyzer 2").

The channel to be duplicated must be selected first using the `INST:SEL` command.

The new channel is inserted in the currently selected group of the measurement sequence (see [INSTrument:BLOCK:SElect](#) on page 567).

**Example:**

```
INST:SEL 'IQAnalyzer'
```

```
INST:CRE:DUPL
```

Duplicates the channel named 'IQAnalyzer' and creates a new channel named 'IQAnalyzer2'.

**Usage:** Event

**Manual operation:** See ["Duplicate Current Channel"](#) on page 97

**INSTrument:CREate[:NEW] <ChannelType>, <ChannelName>**

Adds a measurement channel. You can configure up to 10 measurement channels at the same time (depending on available memory).

See also

- [INSTrument\[:SElect\]](#) on page 552
- [INSTrument:DElete](#) on page 550

**Parameters:**

<ChannelType> Channel type of the new channel.  
For a list of available channel types, see [INSTrument:LIST?](#) on page 550.

<ChannelName> String containing the name of the channel.  
Note that you cannot assign an existing channel name to a new channel. If you do, an error occurs.

**Example:**

```
INST:CRE SAN, 'Spectrum 2'
```

Adds a spectrum display named "Spectrum 2".

**Manual operation:** See "[Channel New Channel](#)" on page 97

---

**INSTRument:CREate:REPLace** <ChannelName1>, <ChannelType>, <ChannelName2>

Replaces a channel with another one.

**Setting parameters:**

<ChannelName1> String containing the name of the channel you want to replace.

<ChannelType> Channel type of the new channel.  
For a list of available channel types, see [INSTRument:LIST?](#) on page 550.

<ChannelName2> String containing the name of the new channel.  
**Note:** If the specified name for a new channel already exists, the default name, extended by a sequential number, is used for the new channel (see [INSTRument:LIST?](#) on page 550). Channel names can have a maximum of 31 characters, and must be compatible with the Windows conventions for file names. In particular, they must not contain special characters such as ":", "\*", "?".

**Example:** `INST:CRE:REPL 'IQAnalyzer2', IQ, 'IQAnalyzer'`  
Replaces the channel named "IQAnalyzer2" by a new channel of type "IQ Analyzer" named "IQAnalyzer".

**Usage:** Setting only

**Manual operation:** See "[Replace Current Channel](#)" on page 97

---

**INSTRument:DELeTe** <ChannelName>

Deletes a channel.

The last channel cannot be deleted; at least one channel must always be defined.

Tip: To remove a channel without deleting it permanently, deactivate it using [INSTRument:BLOCK:CHANnel\[:SETTings\]:USE](#) on page 555.

**Setting parameters:**

<ChannelName> String containing the name of the channel you want to delete.  
A channel must exist to delete it.

**Example:** `INST:DEL 'IQAnalyzer4'`  
Deletes the channel with the name 'IQAnalyzer4'.

**Usage:** Setting only

---

**INSTRument:LIST?**

Queries all active channels. The query is useful to obtain the names of the existing channels, which are required to replace or delete the channels.

**Return values:**

<ChannelType>  
<ChannelName>

For each channel, the command returns the channel type and channel name (see tables below).

Tip: to change the channel name, use the [INSTrument:REName](#) command.

**Example:**

```
INST:LIST?
```

Result for 3 channels:

```
'ADEM', 'Analog Demod', 'IQ', 'IQ  
Analyzer', 'IQ', 'IQ Analyzer2'
```

**Usage:**

Query only

**Table 13-2: Available channel types and default channel names**

Application	<ChannelType> Parameter	Default Channel Name*)
3GPP FDD BTS (R&S VSE-K72)	BWCD	3G FDD BTS
3GPP FDD UE (R&S VSE-K72)	MWCD	3G FDD UE
AM/FM/PM Modulation Analysis	ADEM	Analog Demod
Bluetooth (R&S VSE-K8)	BTO	Bluetooth
GSM (R&S VSE-K10)	GSM	GSM
I/Q Analyzer	IQ	IQ Analyzer
LTE (R&S VSE-K10x)	LTE	LTE
LTE NB-IoT (R&S VSE-K106)	NIOT	LTE NB-IoT
OFDM VSA (R&S VSE-K96)	OFDMVSA	OFDM VSA
Pulse (R&S VSE-K6)	PULSE	Pulse
Transient Analysis (R&S VSE-K60)	TA	Transient Analysis
VSA (R&S VSE-K70)	DDEM	VSA
WLAN (R&S VSE-K91)	WLAN	WLAN

Note: the default channel name is also listed in the table. If the specified name for a new channel already exists, the default name, extended by a sequential number, is used for the new channel.

**INSTrument:REName** <ChannelName1>, <ChannelName2>

Renames a channel.

**Setting parameters:**

<ChannelName1> String containing the name of the channel you want to rename.

<ChannelName2> String containing the new channel name.  
 Note that you cannot assign an existing channel name to a new channel. If you do, an error occurs.  
 Channel names can have a maximum of 31 characters, and must be compatible with the Windows conventions for file names. In particular, they must not contain special characters such as ":", "\*", "?".

**Example:** `INST:REN 'IQAnalyzer2','IQAnalyzer3'`  
 Renames the channel with the name 'IQAnalyzer2' to 'IQAnalyzer3'.

**Usage:** Setting only

**Manual operation:** See ["Rename Measurement Channel"](#) on page 98

**INSTrument[:SElect]** <ChannelType> | <ChannelName>

Activates a new channel with the defined channel type, or selects an existing channel with the specified name.

Also see

- [INSTrument:CREate\[:NEW\]](#) on page 549

**Parameters:**

<ChannelType> Channel type of the new channel.  
 For a list of available channel types see [INSTrument:LIST?](#) on page 550.

<ChannelName> String containing the name of the channel.

**Example:** `INST IQ`  
 Activates a channel for the I/Q Analyzer application.  
`INST 'MyIQSpectrum'`  
 Selects the channel named 'MyIQSpectrum' (for example before executing further commands for that channel).

**Manual operation:** See ["3G FDD"](#) on page 44  
 See ["5G NR"](#) on page 45  
 See ["AM/FM/PM Modulation Analysis"](#) on page 45  
 See ["Bluetooth"](#) on page 45  
 See ["GSM"](#) on page 45  
 See ["I/Q Analyzer"](#) on page 45  
 See ["LTE"](#) on page 45  
 See ["NB-IoT"](#) on page 46  
 See ["OFDM Vector Signal Analysis \(OFDM VSA\)"](#) on page 46  
 See ["Pulse Measurements"](#) on page 46  
 See ["Transient Analysis"](#) on page 46  
 See ["Vector Signal Analysis \(VSA\)"](#) on page 46  
 See ["WLAN"](#) on page 46  
 See ["Channel New Channel"](#) on page 97  
 See ["Select Channel"](#) on page 98



### 13.4.5 Controlling measurement groups

The following commands are required to control measurement sequences in a remote environment. The functions for manual operation are described in [Chapter 7.3.1, "Sequence functions"](#), on page 88 and [Chapter 7.3.2, "Group functions"](#), on page 90.

<a href="#">INITiate:BLOCK:ABORT</a> .....	553
<a href="#">INITiate:BLOCK:CONMeas</a> .....	553
<a href="#">INITiate:BLOCK:CONT</a> .....	554
<a href="#">INITiate:BLOCK:IMMediate</a> .....	554
<a href="#">INSTrument:BLOCK:CHANnel:MOVE</a> .....	555
<a href="#">INSTrument:BLOCK:CHANnel[:SETTings]:USE</a> .....	555
<a href="#">INSTrument:BLOCK:CREate[:NEW]</a> .....	556
<a href="#">INSTrument:BLOCK:DELeTe</a> .....	556
<a href="#">INSTrument:BLOCK:FILE&lt;fi&gt;</a> .....	556
<a href="#">INSTrument:BLOCK:FILE&lt;fi&gt;:CSV</a> .....	557
<a href="#">INSTrument:BLOCK:FILE&lt;fi&gt;:IQTar</a> .....	559
<a href="#">INSTrument:BLOCK:FILE&lt;fi&gt;:IQW</a> .....	560
<a href="#">INSTrument:BLOCK:FILE&lt;fi&gt;:IQX</a> .....	561
<a href="#">INSTrument:BLOCK:FILE&lt;fi&gt;:MAT</a> .....	563
<a href="#">INSTrument:BLOCK:FILE&lt;fi&gt;:REPLace</a> .....	564
<a href="#">INSTrument:BLOCK:FILE&lt;fi&gt;:WV</a> .....	565
<a href="#">INSTrument:BLOCK:LIST?</a> .....	566
<a href="#">INSTrument:BLOCK:MOVE</a> .....	567
<a href="#">INSTrument:BLOCK:REName</a> .....	567
<a href="#">INSTrument:BLOCK:SElect</a> .....	567
<a href="#">INSTrument:BLOCK:USE</a> .....	567

---

#### **INITiate:BLOCK:ABORT**

This command stops the currently active measurement group.

To continue the measurement for the group, use [INITiate:BLOCK:CONMeas](#) on page 553.

To start a new measurement for the group, use [INITiate:SEQuencer:IMMediate](#) on page 568 .

To abort the entire measurement sequence, use [INITiate:SEQuencer:ABORT](#) on page 568.

**Manual operation:** See ["Pause / Cont"](#) on page 92

---

#### **INITiate:BLOCK:CONMeas** [<GroupName>]

This command restarts a measurement that has been stopped in single capture mode.

The measurement is restarted from the beginning.

As opposed to [INITiate:BLOCK:IMMediate](#), this command does not reset traces in maxhold, minhold or average mode. Therefore it can be used to continue measurements using max hold or averaging functions.

**Parameters:**

<GroupName> String containing the name of the group for which the measurement is continued. If no group parameter is provided, the currently selected group is continued (see [INSTRUMENT:BLOCK:SElect](#) on page 567).

**Manual operation:** See "[Pause / Cont](#)" on page 92

**INITiate:BLOCK:CONT** <State> [,<GroupName>]

Defines the capture mode for the measurement group and channels it contains.

For details see "[Measurement mode](#)" on page 43.

To change the capture mode for an individual channel, use the [INITiate<n>:CONTinuous](#) command.

**Note:** In order to synchronize to the end of a measurement sequence using \*OPC, \*OPC? or \*WAI you must use [SINGLE](#) capture mode.

If the capture mode is changed for a measurement channel while a measurement sequence is active (see [INITiate:SEQuencer:IMMediate](#) on page 568) the mode is only considered the next time the measurement in that channel is activated by the Sequencer.

**Parameters:**

<State> ON | OFF | 0 | 1

**OFF | 0**

Switches the function off

**ON | 1**

Switches the function on

<GroupName>

String containing the name of the group for which the capture mode is defined.

If no group parameter is provided, the currently selected group is configured (see [INSTRUMENT:BLOCK:SElect](#) on page 567).

**Example:**

```
INITiate:BLOCK:CONT OFF, 'Group 2'
```

**Manual operation:** See "[Measurement mode \(Single/Continuous\)](#)" on page 92

**INITiate:BLOCK:IMMediate** [<GroupName>]

This command starts a new measurement for all active channels in the selected or specified group. Depending on the capture mode, a single or continuous measurements are performed (see [INITiate:BLOCK:CONT](#) on page 554).

**Setting parameters:**

<GroupName> String containing the name of the group for which a measurement is started. If no group parameter is provided, the currently selected group is started (see [INSTRUMENT:BLOCK:SElect](#) on page 567).

**Manual operation:** See ["Capture"](#) on page 92

---

**INSTrument:BLOCK:CHANnel:MOVE** <GroupName>, <Predecessor>, <ChannelName>

This command moves the specified channel to a different group. This command is useful to change the order in which the measurements are performed within a sequence (within a single group, all measurements are performed synchronously).

To move an entire group within a sequence, see [INSTrument:BLOCK:MOVE](#) on page 567.

**Setting parameters:**

<GroupName> String containing the name of the group in which the channel is to be included.  
For a list of available groups see [INSTrument:SEQuencer:LIST](#) on page 569.

<Predecessor> String containing the name of an existing channel in the specified group after which the specified channel will be inserted. Use an empty string to move the channel to the first position in the group.

<ChannelName> String containing the name of the channel to be moved.

**Example:** `INST:BLOC:CHAN:MOVE 'Group 1','IQ Analyzer','IQ Analyzer2'`  
Moves the measurement channel named `IQ Analyzer2` to the group 1, after the `IQ Analyzer` measurement channel.

**Usage:** Setting only

---

**INSTrument:BLOCK:CHANnel[:SETTings]:USE** <State>,<ChannelName>

If activated, the specified measurement channel is included in the currently selected group measurement.

**Parameters:**

<State> ON | OFF | 0 | 1  
**OFF | 0**  
Switches the function off  
**ON | 1**  
Switches the function on

<ChannelName> String containing the name of the channel.

**Example:** `INST:BLOC:CHAN:USE 1,'IQAnalyzer'`

**Manual operation:** See ["Activate/Deactivate Channel"](#) on page 94

**INSTrument:BLOCK:CREate[:NEW]** [<GroupName>, <Predecessor>]

This command inserts a new group in the measurement sequence. The new group is automatically selected for further group operations.

Tip: To insert a measurement channel in the group see [INSTrument:CREate\[:NEW\]](#) on page 549.

**Setting parameters:**

<GroupName> String containing the name of the group you want to create.

<Predecessor> String containing the name of an existing group after which the new group will be inserted.  
Use an empty string to create the new group at the first position.

**Example:** `INST:BLOC:CRE 'AdemodGroup', 'Group 1'`  
Adds an additional group named "AdemodGroup2" after the existing group named "Group 1".

**Manual operation:** See ["New Group"](#) on page 92

**INSTrument:BLOCK:DELeTe** [<GroupName>]

This command deletes a measurement group. At least one group with one measurement channel must remain in the sequence.

Tip: To delete an individual measurement channel use [INSTrument:DELeTe](#) on page 550

. To remove a group from the measurement sequence without deleting it permanently, deactivate it using [INSTrument:BLOCK:USE](#) on page 567.

**Setting parameters:**

<GroupName> String containing the name of the group you want to delete. The last existing group in a sequence cannot be deleted.

**Example:** `INST:BLOC:DEL 'Group 1'`

**Manual operation:** See ["Close"](#) on page 92

**INSTrument:BLOCK:FILE<fi>** <Source>[, <arg1>, <IQChannel>, <ZeroPadding>]

Assigns the specified file as the input source for all *active* channels with file input in the currently selected block (if possible). The file is automatically loaded to the R&S VSE software and assigned the sequential number provided by the `FILE` suffix. Subsequent commands concerning file input from this file must use the same suffix.

Note that the file is only loaded to channels for which the input source is specified as file input (see [INSTrument:BLOCK:CHANnel\[:SETTings\]:SOURce<si>](#) on page 543).

**Suffix:**

<fi> 1 to 99  
Sequential number of the source

**Parameters:**

<Source>	string String containing the path and file name of the file to be loaded.
<arg1>	numeric value (Optional:) The sample rate used to obtain the stored data. Tip: If the file was stored using the R&S VSE software, the sample rate is included in the meta data information in the file (see <a href="#">"Meta Data Settings"</a> on page 131). Default unit: HZ
<IQChannel>	string (Optional:) ID of the I/Q channel in the stored file which is to be restored to the measurement channels. If this parameter is omitted, the first channel found is restored. Tip: If the file was stored using the R&S VSE software, the I/Q channel is included in the meta data information in the file (see <a href="#">"Meta Data Settings"</a> on page 131).
<ZeroPadding>	ON   OFF (Optional:) Enables or disables zero padding for input from an I/Q data file that requires resampling. For details see <a href="#">"Zero Padding"</a> on page 96.

**Example:**

```
// Select the group
INST:BLOC:SEL 'Group 1'
// Change input source for channel 'IQ Analyzer' to file
INST:SEL 'IQ Analyzer'
INST:BLOC:CHAN:SOUR FILE
// Load the I/Q file to be analyzed
INST:BLOC:FILE 'C:\Users\ImportFile.csv',, 'Channel1';*OPC?
```

The data from the channel named 'Channel1' in the file is used as input for all active measurement channels that use file input in the group 'Group 1'. In particular, the channel named 'IQ Analyzer' will use the data as input.

---

**INSTrument:BLOCK:FILE<fi>:CSV** <FileName>[, <ABW>, <IQChannel>, <ZeroPadding>]

Assigns the specified .csv file as the input source for all *active* channels with file input in the currently selected block (if possible). The file is automatically loaded to the R&S VSE software and assigned the sequential number provided by the FILE suffix. Subsequent commands concerning file input from this file must use the same suffix.

Note that the file is only loaded to channels for which the input source is specified as file input (see [INSTrument:BLOCK:CHANnel\[:SETTings\]:SOURce<si>](#) on page 543).

<b>Suffix:</b>	
<fi>	1 to 99 Sequential number of the source
<b>Parameters:</b>	
<FileName>	string String containing the path and file name of the file to be loaded.
<ABW>	numeric value (Optional:) The analysis bandwidth to be used by the measurement. The bandwidth must be smaller than or equal to the bandwidth of the data that was stored in the file. Tip: If the file was stored using the R&S VSE software, the ABW is included in the meta data information in the file (see " <a href="#">Meta Data Settings</a> " on page 131). Default unit: HZ
<IQChannel>	string (Optional:) ID of the I/Q channel in the stored file which is to be restored to the measurement channels. If this parameter is omitted, the first channel found is restored. Tip: If the file was stored using the R&S VSE software, the I/Q channel is included in the meta data information in the file (see " <a href="#">Meta Data Settings</a> " on page 131).
<ZeroPadding>	ON   OFF (Optional:) Enables or disables zero padding for input from an I/Q data file that requires resampling. For details see " <a href="#">Zero Padding</a> " on page 96.
<b>Example:</b>	<pre>// Select the group INST:BLOC:SEL 'Group 1' // Change input source for channel 'IQ Analyzer' to file INST:SEL 'IQ Analyzer' INST:BLOC:CHAN:SOUR FILE // Load the I/Q file to be analyzed INST:BLOC:FILE:CSV 'C:\Users\ImportFile.csv',10MHZ,, 'Channel1';*OPC?</pre> <p>The data from the channel named 'Channel1' in the file is used as input for all active measurement channels that use file input in the group 'Group 1'. In particular, the channel named 'IQ Analyzer' will use the data as input. The displayed bandwidth is restricted to 10 MHz.</p>
<b>Manual operation:</b>	See " <a href="#">File</a> " on page 95 See " <a href="#">File Name</a> " on page 130

---

**INSTrument:BLOCK:FILE<fi>:IQTar** <FileName>[, <ABW>, <IQChannel>,  
<ZeroPadding>]

Assigns the specified `.iq.tar` file as the input source for all *active* channels with file input in the currently selected block (if possible). The file is automatically loaded to the R&S VSE software and assigned the sequential number provided by the `FILE` suffix. Subsequent commands concerning file input from this file must use the same suffix.

Note that the file is only loaded to channels for which the input source is specified as file input (see `INSTrument:BLOCK:CHANnel[:SETTings]:SOURce<si>` on page 543).

To query the values of the stored meta data after loading the file, see `EXPort:IQ:METa:DATA<da>:VALue` on page 896.

**Suffix:**

<fi> 1 to 99  
Sequential number of the source

**Parameters:**

<FileName> string  
String containing the path and file name of the file to be loaded.

<ABW> numeric value  
The analysis bandwidth to be used by the measurement. The bandwidth must be smaller than or equal to the bandwidth of the data that was stored in the file.  
Tip: If the file was stored using the R&S VSE software, the ABW is included in the meta data information in the file (see "[Meta Data Settings](#)" on page 131).  
Default unit: HZ

<IQChannel> string  
ID of the I/Q channel in the stored file which is to be restored to the measurement channels.  
If this parameter is omitted, the first channel found is restored.  
Tip: If the file was stored using the R&S VSE software, the I/Q channel is included in the meta data information in the file (see "[Meta Data Settings](#)" on page 131).

<ZeroPadding> ON | OFF  
Enables or disables zero padding for input from an I/Q data file that requires resampling.  
For details see "[Zero Padding](#)" on page 96.

**Example:**

```
// Select the group
INST:BLOC:SEL 'Group 1'
// Change input source for channel 'IQ Analyzer' to file
INST:SEL 'IQ Analyzer'
INST:BLOC:CHAN:SOUR FILE
// Load the I/Q file to be analyzed
INST:BLOC:FILE:CSV 'C:\Users\ImportFile.iq.tar',10MHZ,'Channel1';*OPC?
```

The data from the channel named 'Channel1' in the file is used as input for all measurement channels that use file input in the group 'Group 1'. In particular, the channel named 'IQ Analyzer' will use the data as input. The displayed bandwidth is restricted to 10 MHz.

**Manual operation:** See ["File"](#) on page 95  
See ["File Name"](#) on page 130

---

**INSTrument:BLOCK:FILE<fi>:IQW <FileName>, <ABW>, <SampleRate>[, <Format>, <ZeroPadding>]**

Assigns the specified .iqw file as the input source for all *active* channels with file input in the currently selected block (if possible). The file is automatically loaded to the R&S VSE software and assigned the sequential number provided by the FILE suffix. Subsequent commands concerning file input from this file must use the same suffix.

Note that the file is only loaded to channels for which the input source is specified as file input (see [INSTrument:BLOCK:CHANnel\[:SETTings\]:SOURce<si>](#) on page 543).

**Suffix:**

<fi> 1 to 99  
Sequential number of the source

**Parameters:**

<FileName> string  
String containing the path and file name of the file to be loaded.

<ABW> numeric value  
The analysis bandwidth to be used by the measurement. The bandwidth must be smaller than or equal to the bandwidth of the data that was stored in the file.  
Tip: If the file was stored using the R&S VSE software, the ABW is included in the meta data information in the file (see ["Meta Data Settings"](#) on page 131).  
Default unit: HZ



<SampleRate>	numeric value The sample rate used to obtain the stored data. Tip: If the file was stored using the R&S VSE software, the sample rate is included in the meta data information in the file (see <a href="#">"Meta Data Settings"</a> on page 131). Default unit: HZ
<Format>	IQPair   IQBLock   IQIQ   IIQQ (Optional:) The format in which the I/Q data is provided <b>IIQQ   IQBBlock</b> First all I-values are listed, then the Q-values (I,I,I,I,I,...Q,Q,Q,Q,Q,Q) <b>IQIQ   IQPair</b> One pair of I/Q values after the other is listed (I,Q,I,Q,I,Q...). *RST:       IQPair
<ZeroPadding>	ON   OFF (Optional:) Enables or disables zero padding for input from an I/Q data file that requires resampling. For details see <a href="#">"Zero Padding"</a> on page 96.

**Example:**

```
// Select the group to be used
INST:BLOC:SEL 'IQ Analysis'
// Change input source for channel 'IQ Analyzer' to file
INST:SEL 'IQ Analyzer'
INST:BLOC:CHAN:SOUR FILE
// Load the I/Q file to be analyzed
INST:BLOC:CHAN:FILE:IQW 'C:\Users\ImportFile.iqw',10MHZ,32MHZ,IIQQ;*OPC?
```

The data from the channel stored in the file is used as input for all measurement channels that use file input in the group 'Group 1'. In particular, the channel named 'IQ Analyzer' will use the data as input. The displayed bandwidth is restricted to 10 MHz. A sample rate of 32 MHz is applied. The data is interpreted in the format "IIQQ".

**Manual operation:** See ["File"](#) on page 95  
See ["File Name"](#) on page 130

---

**INSTrument:BLOCK:FILE<fi>:IQX** <FileName>[, <ABW>, <IQChannel>,  
<ZeroPadding>]

Assigns the specified .iqx file as the input source for all *active* channels with file input in the currently selected block (if possible). The file is automatically loaded to the R&S VSE software and assigned the sequential number provided by the FILE suffix. Subsequent commands concerning file input from this file must use the same suffix.

Note that the file is only loaded to channels for which the input source is specified as file input (see `INST:BLOCK:CHANNEL[:SETTINGS]:SOURCE<si>` on page 543).

**Suffix:**

<fi> 1 to 99  
Sequential number of the source

**Parameters:**

<FileName> string  
String containing the path and file name of the file to be loaded.

<ABW> numeric value  
The analysis bandwidth to be used by the measurement. The bandwidth must be smaller than or equal to the bandwidth of the data that was stored in the file.  
Tip: If the file was stored using the R&S VSE software, the ABW is included in the meta data information in the file (see "[Meta Data Settings](#)" on page 131).  
Default unit: HZ

<IQChannel> string  
(Optional:) ID of the I/Q channel in the stored file which is to be restored to the measurement channels.  
If this parameter is omitted, the first channel found is restored.  
Tip: If the file was stored using the R&S VSE software, the I/Q channel is included in the meta data information in the file (see "[Meta Data Settings](#)" on page 131).

<ZeroPadding> ON | OFF  
(Optional:) Enables or disables zero padding for input from an I/Q data file that requires resampling.  
For details see "[Zero Padding](#)" on page 96.

**Example:**

```
// Select the group
INST:BLOC:SEL 'Group 1'
// Change input source for channel 'IQ Analyzer' to file
INST:SEL 'LTE MIMO'
INST:BLOC:CHAN:SOUR FILE
// Load the I/Q file to be analyzed
INST:BLOC:FILE:IQX 'C:\Users\ImportFile.IQX',10MHZ,'Channel1',0;*OPC?
```

The data from the channel named 'Channel1' in the file is used as input for all active measurement channels that use file input in the group 'Group 1'. In particular, the channel named 'LTE MIMO' will use the data as input. The displayed bandwidth is restricted to 10 MHz.

**Manual operation:** See "[File Name](#)" on page 130

---

**INSTRument:BLOCK:FILE<fi>:MAT** <FileName>[, <ABW>, <IQChannel>, <ZeroPadding>]

Assigns the specified `.mat` file as the input source for all *active* channels with file input in the currently selected block (if possible). The file is automatically loaded to the R&S VSE software and assigned the sequential number provided by the `FILE` suffix. Subsequent commands concerning file input from this file must use the same suffix.

Note that the file is only loaded to channels for which the input source is specified as file input (see `INSTRument:BLOCK:CHANNEL[:SETTINGS]:SOURCE<si>` on page 543).

**Suffix:**

<fi> 1 to 99  
Sequential number of the source

**Parameters:**

<FileName> string  
String containing the path and file name of the file to be loaded.

<ABW> numeric value  
(Optional:) The analysis bandwidth to be used by the measurement. The bandwidth must be smaller than or equal to the bandwidth of the data that was stored in the file.  
Tip: If the file was stored using the R&S VSE software, the ABW is included in the meta data information in the file (see "[Meta Data Settings](#)" on page 131).  
Default unit: HZ

<IQChannel> string  
(Optional:) ID of the I/Q channel in the stored file which is to be restored to the measurement channels.  
If this parameter is omitted, the first channel found is restored.  
Tip: If the file was stored using the R&S VSE software, the I/Q channel is included in the meta data information in the file (see "[Meta Data Settings](#)" on page 131).

<ZeroPadding> ON | OFF  
(Optional:) Enables or disables zero padding for input from an I/Q data file that requires resampling.  
For details see "[Zero Padding](#)" on page 96.

**Example:**

```
// Select the group
INST:BLOC:SEL 'Group 1'
// Change input source for channel 'IQ Analyzer' to file
INST:SEL 'IQ Analyzer'
INST:BLOC:CHAN:SOUR FILE
// Load the I/Q file to be analyzed
INST:BLOC:FILE:MAT 'C:\Users\ImportFile.mat',,10MHZ,'Channel1';*OPC?
```

The data from the channel named 'Channel1' in the file is used as input for all active measurement channels that use file input in the group 'Group 1'. In particular, the channel named 'IQ Analyzer' will use the data as input. The displayed bandwidth is restricted to 10 MHz. The data is interpreted in the format "IIQQ".

**Manual operation:** See ["File"](#) on page 95  
See ["File Name"](#) on page 130

---

#### **INSTrument:BLOCK:FILE<fi>:REPLace <Source>**

Assigns the specified file as the input source for all *active* channels with file input in the currently selected block (if possible). The file is automatically loaded to the R&S VSE software and assigned the sequential number provided as the FILE<fi> suffix. Subsequent commands concerning file input from this file must use the same suffix.

Note that the file is only loaded to channels for which the input source is specified as file input (see [INSTrument:BLOCK:CHANnel\[:SETTings\]:SOURce<si>](#) on page 543).

This command is only available for R&S VSEEnterprise Edition.

#### **Suffix:**

<fi> 1 to 99  
Sequential number of the source

#### **Setting parameters:**

<Source> String containing the path and file name of the file to be loaded. Since this command provides only the file name, you must ensure that the file type and all essential file information such as the analysis bandwidth, sample rate etc. correspond to the file you are replacing.

**Example:**

```
// Select the group
INST:BLOC:SEL 'Group 1'
// Change input source for channel 'IQ Analyzer' to file
INST:SEL 'IQ Analyzer'
INST:BLOC:CHAN:SOUR FILE
// Define the I/Q file to replace the previously used one
INST:BLOC:FILE:REPL 'C:\Users\ImportFile.iq.tar'
```

The data from the I/Q channel stored in the file is used as input for all active measurement channels that use file input in the group 'Group 1'. In particular, the channel named 'IQ Analyzer' will use the data as input.

**Usage:** Setting only

**Manual operation:** See ["File"](#) on page 95  
See ["File Name"](#) on page 130

**INSTrument:BLOCK:FILE<fi>:WV** <FileName>[, <ABW>, <IQChannel>,  
<ZeroPadding>]

Assigns the specified `.wv` file as the input source for all *active* channels with file input in the currently selected block (if possible). The file is automatically loaded to the R&S VSE software and assigned the sequential number provided by the `FILE` suffix. Subsequent commands concerning file input from this file must use the same suffix.

Note that the file is only loaded to channels for which the input source is specified as file input (see [INSTrument:BLOCK:CHANnel\[:SETTings\]:SOURce<si>](#) on page 543).

Both basic and encrypted `.wv` files are supported. Note, however, that traces resulting from encrypted file input cannot be exported or stored in a saveset (see [Chapter 8.3, "Recording and recalling captured I/Q data for evaluation"](#), on page 125 and [Chapter 8.5, "Storing graphical results to an ASCII file"](#), on page 144).

To query the values of the stored meta data after loading the file, see [EXPort:IQ:METa:DATA<da>:VALue](#) on page 896.

**Suffix:**

<fi> 1 to 99  
Sequential number of the source

**Parameters:**

<FileName> string  
String containing the path and file name of the file to be loaded.

<ABW>	<p>numeric value</p> <p>The analysis bandwidth to be used by the measurement. The bandwidth must be smaller than or equal to the bandwidth of the data that was stored in the file.</p> <p>Tip: If the file was stored using the R&amp;S VSE software, the ABW is included in the meta data information in the file (see "<a href="#">Meta Data Settings</a>" on page 131).</p> <p>Default unit: HZ</p>
<IQChannel>	<p>string</p> <p>ID of the I/Q channel in the stored file which is to be restored to the measurement channels.</p> <p>If this parameter is omitted, the first channel found is restored.</p> <p>Tip: If the file was stored using the R&amp;S VSE software, the I/Q channel is included in the meta data information in the file (see "<a href="#">Meta Data Settings</a>" on page 131).</p>
<ZeroPadding>	<p>ON   OFF</p> <p>Enables or disables zero padding for input from an I/Q data file that requires resampling.</p> <p>For details see "<a href="#">Zero Padding</a>" on page 96.</p>

**Example:**

```
// Select the group to be used
INST:BLOC:SEL 'IQ Analysis'
// Change input source for channel 'IQ Analyzer' to file
INST:SEL 'IQ Analyzer'
INST:BLOC:CHAN:SOUR FILE
// Load the I/Q file to be analyzed
INST:BLOC:CHAN:FILE:WV 'C:\Users\ImportFile.wv',10MHZ,'Channel1';*OPC?
```

The data from the channel named 'Channel1' stored in the file is used as input for all measurement channels that use file input in the group 'Group 1'. In particular, the channel named 'IQ Analyzer' will use the data as input. The displayed bandwidth is restricted to 10 MHz.

**Manual operation:** See "[File](#)" on page 95

**INSTrument:BLOCK:LIST?** [<GroupName>]

This command queries all active measurement channels in the currently selected or specified group. This is useful in order to obtain the names of the existing measurement channels, which are required in order to replace or delete the channels.

For a list of available channel types and names see [INSTrument:LIST?](#) on page 550.

**Query parameters:**

<GroupName>	<p>string</p> <p>Defines the group for which the measurement channels are returned. If this parameter is omitted, the currently selected group is evaluated.</p>
-------------	--

**Return values:**

<ChannelName> Comma-separated list of strings containing the name of an active channel in the group

**Example:**

```
INST:BLOC:LIST?
```

Result for 3 measurement channels:

```
'Analog Demod', 'IQ Analyzer', 'IQ Analyzer 2'
```

**Example:**

```
INST:BLOC:LIST? 'Group1'
```

```
//Result for group named 'Group1':
```

```
'Analog Demod', 'IQ Analyzer', 'IQ Analyzer 2'
```

**Usage:**

Query only

**INSTrument:BLOCK:MOVE <Predecessor>****Setting parameters:**

<Predecessor>

**Usage:**

Setting only

**INSTrument:BLOCK:REName <GroupName1>[, <GroupName2>]**

Replaces the selected group name by a user-defined name. Note that you cannot assign an existing group name to another group.

**Setting parameters:**

<GroupName1> String containing the original name of the group.

<GroupName2> String containing the new name of the group.

**Example:**

```
INSTrument:BLOCK:REName 'Group 2', 'Group 3'
```

**Usage:**

Setting only

**Manual operation:** See "[Rename Group](#)" on page 93

**INSTrument:BLOCK:SElect <GroupName>**

This command selects a measurement group for further operations, for example channel functions.

**Parameters:**

<GroupName> String containing the name of the group.

**Example:**

```
INST:BLOC:SEL 'RF MEAS'
```

**INSTrument:BLOCK:USE <State>,<GroupName>**

If activated, the specified group is included in the measurement sequence.

**Parameters:**

<State> ON | OFF | 0 | 1

**OFF | 0**

Switches the function off

**ON | 1**

Switches the function on

**Setting parameters:**

&lt;GroupName&gt; String containing the name of the group.

**Example:** INST:BLOC:USE 1, 'Group 1'**Manual operation:** See "[Activate/Deactivate Group](#)" on page 91

### 13.4.6 Controlling measurement sequences

The following commands are required to control measurement sequences in a remote environment. The functions for manual operation are described in [Chapter 7.3.1, "Sequence functions"](#), on page 88 and [Chapter 7.3.2, "Group functions"](#), on page 90.

INITiate:SEQuencer:ABORt.....	568
INITiate:SEQuencer:IMMediate.....	568
INITiate:SEQuencer:MODE.....	568
INSTrument:SEQuencer:LIST.....	569

---

**INITiate:SEQuencer:ABORt**

Stops the currently active sequence of measurements.

You can start a new sequence any time using `INITiate:SEQuencer:IMMediate` on page 568.

Tip: To stop the currently active group only - and continue the measurement sequence with that group later - use the `INITiate:BLOCK:ABORt` and `INITiate:BLOCK:CONMeas` commands.

**Usage:** Event**Manual operation:** See "[Stop](#)" on page 89

---

**INITiate:SEQuencer:IMMediate**

This command starts a new measurement sequence according to the capture mode specified using `INITiate:SEQuencer:MODE` on page 568.

**Manual operation:** See "[Play](#)" on page 89

---

**INITiate:SEQuencer:MODE <Mode>**

Defines the capture mode for the entire measurement sequence and all measurement groups and channels it contains.

For details see "[Measurement mode](#)" on page 43.



**Note:** To synchronize to the end of a measurement sequence using \*OPC, \*OPC? or \*WAI, use `SINGLE` Sequencer mode.

**Parameters:**

<Mode>

**SINGLE**

Each measurement group is started one after the other in the order of definition. All measurement channels in a group are started simultaneously and performed once. After *all* measurements are completed, the next group is started. After the last group, the measurement sequence is finished.

**CONTInuous**

Each measurement group is started one after the other in the order of definition. All measurement channels in a group are started simultaneously and performed once. After *all* measurements are completed, the next group is started. After the last group, the measurement sequence restarts with the first one and continues until it is stopped explicitly.

(see "Play" on page 89)

\*RST:       CONTInuous

**Manual operation:** See "[Measurement mode \(Single/Continuous\)](#)" on page 89

**INSTrument:SEQuencer:LIST**

This command queries all active groups in a measurement sequence. This is useful in order to obtain the names of the existing groups, which are required in order to replace or delete the groups.

**Return values:**

<Groups>

<list>

Comma-separated list of strings containing the name of an active group.

**Example:**

INST:SEQ:LIST?

Result for 2 groups:

'Group 1','Group 2'

### 13.4.7 Compensating for frequency response using touchstone files (R&S VSE-K544)

If the Frequency Response Correction option (R&S VSE-K544) is installed, the R&S VSE supports the use of Touchstone (.SnP) files, as well as additional frequency response correction files in .fres format.

For details, see the R&S VSE User Manual.

- [Remote commands for frequency response correction](#)..... 570
- [Programming example: using touchstone files](#)..... 589

### 13.4.7.1 Remote commands for frequency response correction

The following commands are only available if the Frequency Response Correction option (R&S VSE-K544) is installed.



#### Input-specific frequency correction

Frequency response correction can be configured for all inputs, or for particular input types only. Be sure to use the correct command for the required setting.

- [SENSe:]CORRection:FRESponse:INPut<ip>:USER: commands are applied to RF input only
- [SENSe:]CORRection:FRESponse:BASEband:USER: commands are applied to baseband input only
- [SENSe:]CORRection:FRESponse:FILE:USER: commands are applied to file input only
- [SENSe:]CORRection:FRESponse:USER: commands are applied to all input types; queries refer to the currently active input source
- The suffix <si> in the [SENSe:]CORRection:FRESponse: commands refers to the MIMO source.

[SENSe:]CORRection:FRESponse<si>:BASEband:USER:ADJust:RLEVel:STATe.....	572
[SENSe:]CORRection:FRESponse<si>:FILE:USER:ADJust:RLEVel:STATe.....	572
[SENSe:]CORRection:FRESponse<si>:INPut<ip>:USER:ADJust:RLEVel:STATe.....	572
[SENSe:]CORRection:FRESponse<si>:USER:ADJust:RLEVel:STATe.....	572
[SENSe:]CORRection:FRESponse<si>:BASEband:USER:FLISt<fli>:CATalog?.....	573
[SENSe:]CORRection:FRESponse<si>:FILE:USER:FLISt<fli>:CATalog?.....	573
[SENSe:]CORRection:FRESponse<si>:INPut<ip>:USER:FLISt<fli>:CATalog?.....	573
[SENSe:]CORRection:FRESponse<si>:USER:FLISt<fli>:CATalog?.....	573
[SENSe:]CORRection:FRESponse<si>:BASEband:USER:FLISt<fli>:CLEar.....	573
[SENSe:]CORRection:FRESponse<si>:FILE:USER:FLISt<fli>:CLEar.....	573
[SENSe:]CORRection:FRESponse<si>:INPut<ip>:USER:FLISt<fli>:CLEar.....	573
[SENSe:]CORRection:FRESponse<si>:USER:FLISt<fli>:CLEar.....	573
[SENSe:]CORRection:FRESponse<si>:USER:FLISt<fli>:DATA:FREQuency?.....	574
[SENSe:]CORRection:FRESponse<si>:USER:FLISt<fli>:DATA:MAGNitude?.....	574
[SENSe:]CORRection:FRESponse<si>:USER:FLISt<fli>:DATA:PHASe?.....	574
[SENSe:]CORRection:FRESponse<si>:BASEband:USER:FLISt<fli>:INSert.....	574
[SENSe:]CORRection:FRESponse<si>:FILE:USER:FLISt<fli>:INSert.....	574
[SENSe:]CORRection:FRESponse<si>:INPut<ip>:USER:FLISt<fli>:INSert.....	574
[SENSe:]CORRection:FRESponse<si>:USER:FLISt<fli>:INSert.....	574
[SENSe:]CORRection:FRESponse<si>:BASEband:USER:FLISt<fli>:MAGNitude[:STATe].....	575
[SENSe:]CORRection:FRESponse<si>:FILE:USER:FLISt<fli>:MAGNitude[:STATe].....	575
[SENSe:]CORRection:FRESponse<si>:INPut<ip>:USER:FLISt<fli>:MAGNitude[:STATe].....	575
[SENSe:]CORRection:FRESponse<si>:USER:FLISt<fli>:MAGNitude[:STATe].....	575
[SENSe:]CORRection:FRESponse<si>:BASEband:USER:FLISt<fli>:PHASe[:STATe].....	575
[SENSe:]CORRection:FRESponse<si>:FILE:USER:FLISt<fli>:PHASe[:STATe].....	575
[SENSe:]CORRection:FRESponse<si>:INPut<ip>:USER:FLISt<fli>:PHASe[:STATe].....	575
[SENSe:]CORRection:FRESponse<si>:USER:FLISt<fli>:PHASe[:STATe].....	575
[SENSe:]CORRection:FRESponse<si>:BASEband:USER:FLISt<fli>:REMOve.....	576

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[SENSe:]CORRection:FRESponse<si>:INPut<ip>:USER:FLISt<fli>:REMove.....	576
[SENSe:]CORRection:FRESponse<si>:USER:FLISt<fli>:REMove.....	576
[SENSe:]CORRection:FRESponse<si>:BASeband:USER:FLISt<fli>:SELEct.....	576
[SENSe:]CORRection:FRESponse<si>:FILE:USER:FLISt<fli>:SELEct.....	576
[SENSe:]CORRection:FRESponse<si>:INPut<ip>:USER:FLISt<fli>:SELEct.....	576
[SENSe:]CORRection:FRESponse<si>:USER:FLISt<fli>:SELEct.....	576
[SENSe:]CORRection:FRESponse<si>:BASeband:USER:FLISt<fli>:SIZE?.....	577
[SENSe:]CORRection:FRESponse<si>:FILE:USER:FLISt<fli>:SIZE?.....	577
[SENSe:]CORRection:FRESponse<si>:INPut<ip>:USER:FLISt<fli>:SIZE?.....	577
[SENSe:]CORRection:FRESponse<si>:USER:FLISt<fli>:SIZE?.....	577
[SENSe:]CORRection:FRESponse<si>:USER:FSTate.....	577
[SENSe:]CORRection:FRESponse<si>:USER:IQ:DATA:FREQUency?.....	578
[SENSe:]CORRection:FRESponse<si>:USER:IQ:DATA:MAGNitude?.....	578
[SENSe:]CORRection:FRESponse<si>:USER:IQ:DATA:PHASe?.....	578
[SENSe:]CORRection:FRESponse<si>:LSources:STATe.....	578
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[SENSe:]CORRection:FRESponse<si>:FILE:USER:LOAD.....	578
[SENSe:]CORRection:FRESponse<si>:INPut<ip>:USER:LOAD.....	579
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[SENSe:]CORRection:FRESponse<si>:BASeband:USER:PRESet.....	579
[SENSe:]CORRection:FRESponse<si>:FILE:USER:PRESet.....	579
[SENSe:]CORRection:FRESponse<si>:INPut<ip>:USER:PRESet.....	579
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[SENSe:]CORRection:FRESponse<si>:USER:SCOVERed?.....	580
[SENSe:]CORRection:FRESponse<si>:BASeband:USER:SLISt<sli>:CATalog?.....	580
[SENSe:]CORRection:FRESponse<si>:FILE:USER:SLISt<sli>:CATalog?.....	580
[SENSe:]CORRection:FRESponse<si>:INPut<ip>:USER:SLISt<sli>:CATalog?.....	581
[SENSe:]CORRection:FRESponse<si>:USER:SLISt<sli>:CATalog?.....	581
[SENSe:]CORRection:FRESponse<si>:BASeband:USER:SLISt<sli>:CLEar.....	581
[SENSe:]CORRection:FRESponse<si>:FILE:USER:SLISt<sli>:CLEar.....	581
[SENSe:]CORRection:FRESponse<si>:INPut<ip>:USER:SLISt<sli>:CLEar.....	581
[SENSe:]CORRection:FRESponse<si>:USER:SLISt<sli>:CLEar.....	581
[SENSe:]CORRection:FRESponse<si>:USER:SLISt<sli>:DATA:FREQUency<spi>?.....	581
[SENSe:]CORRection:FRESponse<si>:USER:SLISt<sli>:DATA:MAGNitude<spi>?.....	581
[SENSe:]CORRection:FRESponse<si>:USER:SLISt<sli>:DATA:PHASe<spi>?.....	581
[SENSe:]CORRection:FRESponse<si>:BASeband:USER:SLISt<sli>:INSert.....	582
[SENSe:]CORRection:FRESponse<si>:FILE:USER:SLISt<sli>:INSert.....	582
[SENSe:]CORRection:FRESponse<si>:INPut<ip>:USER:SLISt<sli>:INSert.....	582
[SENSe:]CORRection:FRESponse<si>:USER:SLISt<sli>:INSert.....	582
[SENSe:]CORRection:FRESponse<si>:BASeband:USER:SLISt<sli>:MOVE.....	583
[SENSe:]CORRection:FRESponse<si>:FILE:USER:SLISt<sli>:MOVE.....	583
[SENSe:]CORRection:FRESponse<si>:INPut<ip>:USER:SLISt<sli>:MOVE.....	583
[SENSe:]CORRection:FRESponse<si>:USER:SLISt<sli>:MOVE.....	583
[SENSe:]CORRection:FRESponse<si>:BASeband:USER:SLISt<sli>:PORTs:FROM.....	583
[SENSe:]CORRection:FRESponse<si>:FILE:USER:SLISt<sli>:PORTs:FROM.....	583

[SENSe:]CORRection:FRESponse<si>:INPut<ip>:USER:SLISt<sli>:PORTs:FROM.....	584
[SENSe:]CORRection:FRESponse<si>:USER:SLISt<sli>:PORTs:FROM.....	584
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[SENSe:]CORRection:FRESponse<si>:INPut<ip>:USER:SLISt<sli>:REMOve.....	585
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[SENSe:]CORRection:FRESponse<si>:FILE:USER:SLISt<sli>:SELEct.....	585
[SENSe:]CORRection:FRESponse<si>:INPut<ip>:USER:SLISt<sli>:SELEct.....	586
[SENSe:]CORRection:FRESponse<si>:USER:SLISt<sli>:SELEct.....	586
[SENSe:]CORRection:FRESponse<si>:BASEband:USER:SLISt<sli>:SIZE?.....	586
[SENSe:]CORRection:FRESponse<si>:FILE:USER:SLISt<sli>:SIZE?.....	586
[SENSe:]CORRection:FRESponse<si>:INPut<ip>:USER:SLISt<sli>:SIZE?.....	586
[SENSe:]CORRection:FRESponse<si>:USER:SLISt<sli>:SIZE?.....	586
[SENSe:]CORRection:FRESponse<si>:BASEband:USER:SLISt<sli>:STATe.....	587
[SENSe:]CORRection:FRESponse<si>:FILE:USER:SLISt<sli>:STATe.....	587
[SENSe:]CORRection:FRESponse<si>:INPut<ip>:USER:SLISt<sli>:STATe.....	587
[SENSe:]CORRection:FRESponse<si>:USER:SLISt<sli>:STATe.....	587
[SENSe:]CORRection:FRESponse<si>:USER:SPEctrum:DATA:FREQUency?.....	587
[SENSe:]CORRection:FRESponse<si>:USER:SPEctrum:DATA:MAGNitude?.....	587
[SENSe:]CORRection:FRESponse<si>:USER:SPEctrum:DATA:PHASe?.....	587
[SENSe:]CORRection:FRESponse<si>:BASEband:USER:STATe.....	588
[SENSe:]CORRection:FRESponse<si>:FILE:USER:STATe.....	588
[SENSe:]CORRection:FRESponse<si>:INPut<ip>:USER:STATe.....	588
[SENSe:]CORRection:FRESponse<si>:USER:STATe.....	588
[SENSe:]CORRection:FRESponse<si>:BASEband:USER:STORe.....	588
[SENSe:]CORRection:FRESponse<si>:FILE:USER:STORe.....	588
[SENSe:]CORRection:FRESponse<si>:INPut<ip>:USER:STORe.....	588
[SENSe:]CORRection:FRESponse<si>:USER:STORe.....	588
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---

**[SENSe:]CORRection:FRESponse<si>:BASEband:USER:ADJust:RLEVel:STATe <State>**

**[SENSe:]CORRection:FRESponse<si>:FILE:USER:ADJust:RLEVel:STATe <State>**

**[SENSe:]CORRection:FRESponse<si>:INPut<ip>:USER:ADJust:RLEVel:STATe <State>**

**[SENSe:]CORRection:FRESponse<si>:USER:ADJust:RLEVel:STATe <State>**

Activates or deactivates the automatic adjustment of the reference level to the active filter calculation configuration. The offset is the mean of the filter calculation.

For details and restrictions see "[Adjust Ref Level](#)" on page 106.

**Suffix:**

<si> 1..n  
source index for MIMO measurements

**Parameters:**

<State> ON | OFF | 0 | 1  
**OFF | 0**  
Switches the function off  
**ON | 1**  
Switches the function on  
\*RST: 0

**Manual operation:** See "[Adjust Ref Level](#)" on page 106

```
[SENSe:]CORRection:FRESponse<si>:BASEband:USER:FLISt<fli>:CATalog?
[SENSe:]CORRection:FRESponse<si>:FILE:USER:FLISt<fli>:CATalog?
[SENSe:]CORRection:FRESponse<si>:INPut<ip>:USER:FLISt<fli>:CATalog?
[SENSe:]CORRection:FRESponse<si>:USER:FLISt<fli>:CATalog?
```

Returns a list of currently available `.fres` files in the directory.

**Suffix:**

<si> 1..n  
source index for MIMO measurements

<fli> 1..n  
irrelevant

**Return values:**

<List>

**Example:** SENS:CORR:FRES:USER:FLIS:CAT?

**Usage:** Query only

```
[SENSe:]CORRection:FRESponse<si>:BASEband:USER:FLISt<fli>:CLEar
[SENSe:]CORRection:FRESponse<si>:FILE:USER:FLISt<fli>:CLEar
[SENSe:]CORRection:FRESponse<si>:INPut<ip>:USER:FLISt<fli>:CLEar
[SENSe:]CORRection:FRESponse<si>:USER:FLISt<fli>:CLEar
```

Removes **all** frequency response (`.fres`) files in the current configuration for the selected or all input types.

**Suffix:**

<si> 1..n  
source index for MIMO measurements

<fli> 1..n  
irrelevant

**Example:** SENS:CORR:FRES:USER:FLIS:CLE

**Usage:** Event

**Manual operation:** See "Remove Frequency Response File" on page 109

---

```
[SENSe:]CORRection:FRESponse<si>:USER:FLISt<fli>:DATA:FREQuency?
[SENSe:]CORRection:FRESponse<si>:USER:FLISt<fli>:DATA:MAGNitude?
[SENSe:]CORRection:FRESponse<si>:USER:FLISt<fli>:DATA:PHASe?
```

Queries the trace values for the selected `.fres` file.

**Suffix:**

<si>	1..n source index for MIMO measurements
<fli>	1..n Index in frequency response file list Use <code>[SENSe:]CORRection:FRESponse&lt;si&gt;:BASEband:USER:FLISt&lt;fli&gt;:SIZE?</code> to determine the maximum index number.

**Example:** `SENS:CORR:FRES:USER:FLIS2:DATA:PHAS?`

**Usage:** Query only

**Manual operation:** See "Selected File" on page 109

---

```
[SENSe:]CORRection:FRESponse<si>:BASEband:USER:FLISt<fli>:INSert
<FilePath>
[SENSe:]CORRection:FRESponse<si>:FILE:USER:FLISt<fli>:INSert <FilePath>
[SENSe:]CORRection:FRESponse<si>:INPut<ip>:USER:FLISt<fli>:INSert
<FilePath>
[SENSe:]CORRection:FRESponse<si>:USER:FLISt<fli>:INSert <FilePath>
```

Loads a frequency response (`.fres`) file to the current configuration. The maximum number of files per configuration is 15. The new file is added below the entry specified by the `<fli>` index. All other entries with a higher suffix are moved down by one position.

**Suffix:**

<si>	1..n source index for MIMO measurements
<fli>	1..n Index in frequency response file list Use <code>[SENSe:]CORRection:FRESponse&lt;si&gt;:BASEband:USER:FLISt&lt;fli&gt;:SIZE?</code> to determine the maximum index number.

**Parameters:**

<FilePath>	string Path and file name The default directory for <code>.fres</code> files is <code>C:\ProgramData\Rohde-Schwarz\VSE\&lt;version_no&gt;\user\Fresponse.</code>
------------	--

**Example:** `SENS:CORR:FRES:USER:FLIS2:INS 'C:\FRes.fres'`

**Manual operation:** See ["Add Freq Resp File"](#) on page 109

---

```
[SENSe:]CORRection:FRESponse<si>:BASEband:USER:FLISt<fli>:MAGNitude[:
  STATE] <State>
[SENSe:]CORRection:FRESponse<si>:FILE:USER:FLISt<fli>:MAGNitude[:STATe]
  <State>
[SENSe:]CORRection:FRESponse<si>:INPut<ip>:USER:FLISt<fli>:MAGNitude[:
  STATE] <State>
[SENSe:]CORRection:FRESponse<si>:USER:FLISt<fli>:MAGNitude[:STATe]
  <State>
```

Activates or deactivates the use of the correction data in the selected file for magnitude results.

**Suffix:**

<si> 1..n  
source index for MIMO measurements

<fli> 1..n  
Index in frequency response file list  
Use [\[SENSe:\]CORRection:FRESponse<si>:BASEband:USER:FLISt<fli>:SIZE?](#) to determine the maximum index number.

**Parameters:**

<State> ON | OFF | 0 | 1  
**OFF | 0**  
Applies the data for magnitude results.  
**ON | 1**  
Does not apply the data for magnitude results.  
\*RST: 1

**Example:** SENS:CORR:FRES:USER:FLIS2:MAGN:STAT ON

**Manual operation:** See ["Magnitude"](#) on page 109

---

```
[SENSe:]CORRection:FRESponse<si>:BASEband:USER:FLISt<fli>:PHASe[:
  STATE] <State>
[SENSe:]CORRection:FRESponse<si>:FILE:USER:FLISt<fli>:PHASe[:STATe]
  <State>
[SENSe:]CORRection:FRESponse<si>:INPut<ip>:USER:FLISt<fli>:PHASe[:
  STATE] <State>
[SENSe:]CORRection:FRESponse<si>:USER:FLISt<fli>:PHASe[:STATe] <State>
```

Activates or deactivates the use of the correction data in the selected file for magnitude results.

**Suffix:**

<si> 1..n  
source index for MIMO measurements

<fli> 1..n  
Index in frequency response file list  
Use [SENSe:]CORRection:FRESponse<si>:BASEband:USER:FLISt<fli>:SIZE? to determine the maximum index number.

**Parameters:**

<State> ON | OFF | 0 | 1  
**OFF | 0**  
Applies the data for magnitude results.  
**ON | 1**  
Does not apply the data for magnitude results.  
\*RST: 1

**Example:** SENS:CORR:FRES:USER:FLIS2:PHAS:STAT ON

**Manual operation:** See "Phase" on page 109

```
[SENSe:]CORRection:FRESponse<si>:BASEband:USER:FLISt<fli>:REMOve
[SENSe:]CORRection:FRESponse<si>:FILE:USER:FLISt<fli>:REMOve
[SENSe:]CORRection:FRESponse<si>:INPut<ip>:USER:FLISt<fli>:REMOve
[SENSe:]CORRection:FRESponse<si>:USER:FLISt<fli>:REMOve
```

Removes the selected frequency response (.fres) file from the current configuration.

**Suffix:**

<si> 1..n  
source index for MIMO measurements

<fli> 1..n  
Index in frequency response file list  
Use [SENSe:]CORRection:FRESponse<si>:BASEband:USER:FLISt<fli>:SIZE? to determine the maximum index number.

**Example:** SENS:CORR:FRES:USER:FLIS2:REM

**Usage:** Event

**Manual operation:** See "Remove Frequency Response File" on page 109

```
[SENSe:]CORRection:FRESponse<si>:BASEband:USER:FLISt<fli>:SELEct
<FilePath>
[SENSe:]CORRection:FRESponse<si>:FILE:USER:FLISt<fli>:SELEct <FilePath>
[SENSe:]CORRection:FRESponse<si>:INPut<ip>:USER:FLISt<fli>:SELEct
<FilePath>
[SENSe:]CORRection:FRESponse<si>:USER:FLISt<fli>:SELEct <FilePath>
```

Loads an additional frequency response (.fres) file to the current configuration.

**Suffix:**

<si> 1..n  
source index for MIMO measurements



<fli> 1..n  
Index in frequency response file list  
Use `[SENSe:]CORRection:FRESponse<si>:BASEband:USER:FLISt<fli>:SIZE?` to determine the maximum index number.

**Parameters:**

<FilePath> string  
Path and file name  
The default directory for `.fres` files is `C:\ProgramData\Rohde-Schwarz\VSE\<version_no>\user\Fresponse`.

**Example:** `SENS:CORR:FRES:USER:FLIS2:SEL 'C:\FRes.fres'`

`[SENSe:]CORRection:FRESponse<si>:BASEband:USER:FLISt<fli>:SIZE?`  
`[SENSe:]CORRection:FRESponse<si>:FILE:USER:FLISt<fli>:SIZE?`  
`[SENSe:]CORRection:FRESponse<si>:INPut<ip>:USER:FLISt<fli>:SIZE?`  
`[SENSe:]CORRection:FRESponse<si>:USER:FLISt<fli>:SIZE?`

Queries the number of entries in the list of `.fres` files for the current configuration.

**Suffix:**

<si> 1..n  
source index for MIMO measurements

<fli> 1..n  
irrelevant

**Return values:**

<Size> integer  
Range: 1 to 15  
\*RST: 1

**Example:** `SENS:CORR:FRES:BASE:USER:FLIS:SIZE?`

**Usage:** Query only

`[SENSe:]CORRection:FRESponse<si>:USER:FState <State>`

Activates or deactivates the use of additional frequency response (`.fres`) files. The correction data in these files is applied after any correction settings in active touchstone files.

For details, see the R&S VSE User Manual.

**Suffix:**

<si> 1..n  
source index for MIMO measurements

**Parameters:**

<State> ON | OFF | 0 | 1  
**OFF | 0**  
Activates the files.

**ON | 1**

Deactivates the files.

\*RST: 1

**Example:** SENS:CORR:FRES:USER:FST ON**Manual operation:** See "[Frequency Response active](#)" on page 108**[SENSe:]CORRection:FRESponse<si>:USER:IQ:DATA:FREQuency?****[SENSe:]CORRection:FRESponse<si>:USER:IQ:DATA:MAGNitude?****[SENSe:]CORRection:FRESponse<si>:USER:IQ:DATA:PHASe?**

Queries the trace values for the combined user correction files (.snp+.fres) in IQ mode.

**Suffix:**<si> 1..n  
source index for MIMO measurements**Example:** SENS:CORR:FRES:USER:IQ:DATA:PHAS?**Usage:** Query only**Manual operation:** See "[IQ Mode](#)" on page 110**[SENSe:]CORRection:FRESponse<si>:LSources:STATe <State>**

If enabled, the frequency response correction settings for the currently selected input source (tab) are copied to all input sources for the channel. If any settings already exist in other tabs, a message is displayed. If you confirm, the settings are overwritten. As long as this function is enabled, any changes in one tab are automatically applied to all tabs.

This function is only available for MIMO measurements and only for channel-specific configuration ([SENSe:]CORRection:FRESponse&lt;si&gt;:USER:SCOPECHAN).

**Suffix:**<si> 1..n  
source index for MIMO measurements**Parameters:**<State> ON | OFF | 0 | 1  
**OFF | 0**  
Switches the function off  
**ON | 1**  
Switches the function on  
\*RST: 0**Manual operation:** See "[Link sources \(MIMO only\)](#)" on page 105**[SENSe:]CORRection:FRESponse<si>:BASEband:USER:LOAD <FilePath>****[SENSe:]CORRection:FRESponse<si>:FILE:USER:LOAD <FilePath>**

**[SENSe:]CORRection:FRESponse<si>:INPut<ip>:USER:LOAD <FilePath>**

**[SENSe:]CORRection:FRESponse<si>:USER:LOAD <FilePath>**

Loads a stored user-defined frequency response correction scenario.

**Suffix:**

<si> 1..n  
source index for MIMO measurements

**Setting parameters:**

<FilePath> string

**Example:** SENS:CORR:FRES:USER:LOAD 'Fres1'

**Usage:** Setting only

**Manual operation:** See "[Load Settings](#)" on page 106

**[SENSe:]CORRection:FRESponse<si>:BASEband:USER:PRESet**

**[SENSe:]CORRection:FRESponse<si>:FILE:USER:PRESet**

**[SENSe:]CORRection:FRESponse<si>:INPut<ip>:USER:PRESet**

**[SENSe:]CORRection:FRESponse<si>:USER:PRESet**

Restores the default frequency response correction settings (containing only files specific to the R&S VSE itself). Frequency response correction using .fres files is deactivated.

**Suffix:**

<si> 1..n  
source index for MIMO measurements

**Example:** SENS:CORR:FRES:USER:PRESet

**Usage:** Event

**Manual operation:** See "[Clear Settings](#)" on page 107

**[SENSe:]CORRection:FRESponse<si>:BASEband:USER:REFResh**

**[SENSe:]CORRection:FRESponse<si>:FILE:USER:REFResh**

**[SENSe:]CORRection:FRESponse<si>:INPut<ip>:USER:REFResh**

Recalculates the input source correction filter.

**Suffix:**

<si> 1..n  
source index for MIMO measurements

<ip> 1..n

**Example:** SENSe:CORRection:FRESponse:Input1:USER:REFResh

**Usage:** Event

**Manual operation:** See "[Refresh](#)" on page 105

**[SENSe:]CORRection:FRESponse<si>:USER:SCOPE <Frames>**

Determines whether the frequency response correction settings are applied to all active measurement channels, or only the currently selected channel.

**Suffix:**

<si> 1..n  
source index for MIMO measurements

**Parameters:**

<Frames> CHANnel | ALL

**CHANnel**

The frequency response correction settings are applied to the currently selected channel only.

To select a channel, use `INSTrument[:SElect]`.

For a list of available channels, use `INSTrument:LIST?`.

**ALL**

The frequency response correction settings are applied to all active measurement channels.

**Example:**

```
INST:SEL 'MyIQSpectrum'
```

```
SENS:CORR:FRES:USER:SCOPE CHAN
```

The filter is applied only to the channel named 'MyIQSpectrum'.

**Manual operation:** See "[Apply to](#)" on page 106

**[SENSe:]CORRection:FRESponse<si>:USER:SCOVERed?**

Indicates whether the frequency correction file covers the full measurement span.

**Suffix:**

<si> 1..n  
source index for MIMO measurements

**Return values:**

<Covered> 0 | 1  
**0**  
Span not fully covered  
**1**  
Full measurement span is covered

**Example:**

```
SENSe1:CORRection:FRESponse:USER:SCOVERed?
```

**Usage:**

Query only

**Manual operation:** See "[Preview](#)" on page 109

**[SENSe:]CORRection:FRESponse<si>:BASEband:USER:SLIST<sli>:CATalog?**  
**[SENSe:]CORRection:FRESponse<si>:FILE:USER:SLIST<sli>:CATalog?**

**[SENSe:]CORRection:FRESponse<si>:INPut<ip>:USER:SLISt<sli>:CATalog?**  
**[SENSe:]CORRection:FRESponse<si>:USER:SLISt<sli>:CATalog?**

Returns a list of currently configured touchstone format files.

Tip: to determine the currently *selected* file, use the `[SENSe:]CORRection:FRESponse<si>:xxx:SLISt<sli>:SElect?` query.

**Suffix:**

<si> 1..n  
source index for MIMO measurements

<sli> 1..n  
irrelevant

**Return values:**

<List> path and file name of all currently configured touchstone format files.

**Example:**

```
SENS:CORR:FRES:USER:SLIS:CAT?
C:
\ProgramData\Rohde-Schwarz\VSE\\user\MyS7p.s7p
\ProgramData\Rohde-Schwarz\VSE\\user\MyS2p.s2p
```

**Usage:** Query only

**[SENSe:]CORRection:FRESponse<si>:BASEband:USER:SLISt<sli>:CLEar**  
**[SENSe:]CORRection:FRESponse<si>:FILE:USER:SLISt<sli>:CLEar**  
**[SENSe:]CORRection:FRESponse<si>:INPut<ip>:USER:SLISt<sli>:CLEar**  
**[SENSe:]CORRection:FRESponse<si>:USER:SLISt<sli>:CLEar**

Removes **all** touchstone files from the current configuration for the selected or all input types.

**Suffix:**

<si> 1..n  
source index for MIMO measurements

<sli> irrelevant

**Example:**

```
SENS:CORR:FRES:USER:SLIS:CLE
```

**Usage:** Event

**Manual operation:** See "[Remove File](#)" on page 108

**[SENSe:]CORRection:FRESponse<si>:USER:SLISt<sli>:DATA:FREQuency<spi>?**  
**[SENSe:]CORRection:FRESponse<si>:USER:SLISt<sli>:DATA:MAGNitude<spi>?**  
**[SENSe:]CORRection:FRESponse<si>:USER:SLISt<sli>:DATA:PHASe<spi>?**

Queries the trace values for the specified .snp file and ports.

**Suffix:**

<si> 1..n  
source index for MIMO measurements

<sl> 1..n  
Index in Touchstone file list  
Use [SENSe:]CORRection:FRESponse<si>:USER:SLISt<sl>:SIZE? to determine the maximum index number.

<spi> 1..4  
S-port pair index, where:  
1 = From port - from port  
2 = To port - from port  
3 = From port - to port  
4 = To port - to port

**Example:** SENS:CORR:FRES:USER:SLIS2:SEL 'FRes21.s2p'  
SENS:CORR:FRES:USER:SLIS2:PORT:TO 2  
SENS:CORR:FRES:USER:SLIS2:PORT:FROM 1  
SENS:CORR:FRES:USER:SLIS2:DATA:PHAS3?  
The correction data from port 1 to port 2 is returned.

**Usage:** Query only

**Manual operation:** See "Selected File" on page 109

---

[SENSe:]CORRection:FRESponse<si>:BASEband:USER:SLISt<sl>:INSert  
<FilePath>

[SENSe:]CORRection:FRESponse<si>:FILE:USER:SLISt<sl>:INSert <FilePath>

[SENSe:]CORRection:FRESponse<si>:INPut<ip>:USER:SLISt<sl>:INSert  
<FilePath>

[SENSe:]CORRection:FRESponse<si>:USER:SLISt<sl>:INSert <FilePath>

Loads a new Touchstone file for the current configuration. The maximum number of files per configuration is 15. The new file is added below the entry specified by the <sl> index. All other entries with a higher suffix are moved down by one position.

To change the order of the files, use the [SENSe:]CORRection:FRESponse<si>:USER:SLISt<sl>:MOVE command.

To determine which files are available, use [SENSe:]CORRection:FRESponse<si>:USER:SLISt<sl>:CATalog? on page 581.

**Suffix:**

<si> 1..n  
source index for MIMO measurements

<sl> 1..n  
Index in Touchstone file list  
Use [SENSe:]CORRection:FRESponse<si>:USER:SLISt<sl>:SIZE? to determine the maximum index number.

**Parameters:**

<FilePath> string  
 Path and file name  
 The file extension of the Touchstone file must correspond to the number of ports included in the file. For example, a file containing 4 parameters for S11, S22, S12 and S21 must have the extension .s2p.  
 The default directory for Touchstone files is  
 C:\ProgramData\Rohde-Schwarz\VSE\<>version\_no>\user\Fresponse.

**Manual operation:** See ["Add Touchstone File"](#) on page 108

**[SENSe:]CORRection:FRESponse<si>:BASEband:USER:SLISt<sli>:MOVE**  
 <Direction>

**[SENSe:]CORRection:FRESponse<si>:FILE:USER:SLISt<sli>:MOVE** <Direction>

**[SENSe:]CORRection:FRESponse<si>:INPut<ip>:USER:SLISt<sli>:MOVE**  
 <Direction>

**[SENSe:]CORRection:FRESponse<si>:USER:SLISt<sli>:MOVE** <Direction>

Moves the selected Touchstone file one position up or down in the list of files, changing the order in which the correction data is applied.

**Suffix:**

<si> 1..n  
 source index for MIMO measurements

<sli> 1..n  
 Index in Touchstone file list  
 Use [\[SENSe:\]CORRection:FRESponse<si>:USER:SLISt<sli>:SIZE?](#) to determine the maximum index number.  
 If an index outside the available range is specified, an error occurs.

**Setting parameters:**

<Direction> UP | DOWN

**Example:** SENS:CORR:FRES:USER:SLIS:MOVE UP

**Usage:** Setting only

**Manual operation:** See ["Move File Up or Down"](#) on page 108

**[SENSe:]CORRection:FRESponse<si>:BASEband:USER:SLISt<sli>:PORTs:**  
 FROM <PortFrom>

**[SENSe:]CORRection:FRESponse<si>:FILE:USER:SLISt<sli>:PORTs:FROM**  
 <PortFrom>

**[SENSe:]CORRection:FRESponse<si>:INPut<ip>:USER:SLIS<sli>:PORTs:FROM**  
 <PortFrom>

**[SENSe:]CORRection:FRESponse<si>:USER:SLIS<sli>:PORTs:FROM**  
 <PortFrom>

SnP files can be defined for a varying number of input and output ports.

You must define the ports from the touchstone file whose data is to be applied.

**Suffix:**

<si> 1..n  
 source index for MIMO measurements

<sli> 1..n  
 Index in Touchstone file list  
 Use [SENSe:]CORRection:FRESponse<si>:USER:SLIS<sli>:SIZE? to determine the maximum index number.

**Parameters:**

<PortFrom> \*RST: 1

**Example:**

```
SENS:CORR:FRES:USER:SLIS:SEL 'FRes21.s2p'
SENS:CORR:FRES:USER:SLIS:PORT:TO 2
SENS:CORR:FRES:USER:SLIS:PORT:FROM 1
The correction data from port 1 to port 2 is included in the filter.
```

**Manual operation:** See "To - From" on page 107

**[SENSe:]CORRection:FRESponse<si>:BASEband:USER:SLIS<sli>:PORTs:TO**  
 <PortTo>

**[SENSe:]CORRection:FRESponse<si>:FILE:USER:SLIS<sli>:PORTs:TO** <PortTo>

**[SENSe:]CORRection:FRESponse<si>:INPut<ip>:USER:SLIS<sli>:PORTs:TO**  
 <PortTo>

**[SENSe:]CORRection:FRESponse<si>:USER:SLIS<sli>:PORTs:TO** <PortTo>

SnP files can be defined for a varying number of input and output ports.

You must define the ports from the touchstone file whose data is to be applied.

**Suffix:**

<si> 1..n  
 source index for MIMO measurements

<sli> 1..n  
 Index in Touchstone file list  
 Use [SENSe:]CORRection:FRESponse<si>:USER:SLIS<sli>:SIZE? to determine the maximum index number.

**Parameters:**

<PortTo> \*RST: 1

**Example:**

```
SENS:CORR:FRES:USER:SLIS:SEL 'FRes21.s2p'
SENS:CORR:FRES:USER:SLIS:PORT:TO 2
SENS:CORR:FRES:USER:SLIS:PORT:FROM 1
The correction data from port 1 to port 2 is included in the filter.
```



**Manual operation:** See ["To - From"](#) on page 107

---

```
[SENSe:]CORRection:FRESponse<si>:BASEband:USER:SLISt<sli>:REMove
[SENSe:]CORRection:FRESponse<si>:FILE:USER:SLISt<sli>:REMove
[SENSe:]CORRection:FRESponse<si>:INPut<ip>:USER:SLISt<sli>:REMove
[SENSe:]CORRection:FRESponse<si>:USER:SLISt<sli>:REMove
```

Removes the specified touchstone file from the list.

**Suffix:**

<si> 1..n  
source index for MIMO measurements

<sli> 1..n  
Index in Touchstone file list  
Use [\[SENSe:\]CORRection:FRESponse<si>:USER:SLISt<sli>:SIZE?](#) to determine the maximum index number.

**Example:** SENS:CORR:FRES:USER:SLIS2:REM

**Usage:** Event

**Manual operation:** See ["Remove File"](#) on page 108

---

```
[SENSe:]CORRection:FRESponse<si>:USER:PState <State>
```

Activates or deactivates the preview of the user correction files for all input types.

Note that this function is only available for remote operation. The preview cannot be switched back on in manual operation.

**Suffix:**

<si> 1..n  
source index for MIMO measurements

**Parameters:**

<State> ON | OFF | 0 | 1  
**OFF | 0**  
Switches the function off  
**ON | 1**  
Switches the function on  
\*RST: 1

**Example:** SENS:CORR:FRES:USER:PST ON

**Manual operation:** See ["Preview"](#) on page 109

---

```
[SENSe:]CORRection:FRESponse<si>:BASEband:USER:SLISt<sli>:SElect
<FilePath>
[SENSe:]CORRection:FRESponse<si>:FILE:USER:SLISt<sli>:SElect <FilePath>
```

**[SENSe:]CORRection:FRESponse<si>:INPut<ip>:USER:SLISt<sli>:SElect**  
<FilePath>

**[SENSe:]CORRection:FRESponse<si>:USER:SLISt<sli>:SElect** <FilePath>

Selects a Touchstone format file from the specified directory to be loaded to the current configuration for the specified input type. If no input type is specified, the currently active input source is assumed.

You can provide channel-specific correction values for different input sources in MIMO setups.

The query returns the currently selected file.

To determine which files are available, use [\[SENSe:\]CORRection:FRESponse<si>:USER:SLISt<sli>:CATalog?](#) on page 581.

**Suffix:**

<si> 1..n  
source index for MIMO measurements

<sli> 1..n  
Index in Touchstone file list  
Use [\[SENSe:\]CORRection:FRESponse<si>:USER:SLISt<sli>:SIZE?](#) to determine the maximum index number.  
To replace an existing file in the configuration, specify its index.  
To add a new file, use the next available index.  
If an index outside the available range is specified, an error occurs.

**Parameters:**

<FilePath> string  
Path and file name of the selected file.  
The default directory for Touchstone files is  
C:\ProgramData\Rohde-Schwarz\VSE\<>version\_no>\user\Fresponse.

**Example:** SENS:CORR:FRES:USER:SLIS:SEL 'C:\FRes21.s2p'

**Example:** Example for multi-channel (MIMO) input:

```
INST:SEL PULSE
SENSe1:CORRection:FRESponse:USER:SCOPE CHAN
INST:BLOC:CHAN:FILE:IQT 'k6a_2channel_1_3.iq.tar'
SENSe:CORRection:FRESponse1:USER:SLISt1:SElect 'bs_frequency_response_bp
SENSe:CORRection:FRESponse2:USER:SLISt1:SElect 'bs_frequency_response_bp
SENS:CORR:FRES:USER:STAT ON
```

---

**[SENSe:]CORRection:FRESponse<si>:BASEband:USER:SLISt<sli>:SIZE?**

**[SENSe:]CORRection:FRESponse<si>:FILE:USER:SLISt<sli>:SIZE?**

**[SENSe:]CORRection:FRESponse<si>:INPut<ip>:USER:SLISt<sli>:SIZE?**

**[SENSe:]CORRection:FRESponse<si>:USER:SLISt<sli>:SIZE?**

Queries the number of entries in the list of touchstone files for the current configuration.

**Suffix:**

<si> 1..n  
source index for MIMO measurements

<slj> irrelevant

**Return values:**

<Size> integer  
Range: 1 to 15  
\*RST: 1

**Example:** SENS:CORR:FRES:USER:SLIS:SIZE?

**Usage:** Query only

[SENSe:]CORRection:FRESponse<si>:BASEband:USER:SLIS<slj>:STATe  
<State>

[SENSe:]CORRection:FRESponse<si>:FILE:USER:SLIS<slj>:STATe <State>

[SENSe:]CORRection:FRESponse<si>:INPut<ip>:USER:SLIS<slj>:STATe <State>

[SENSe:]CORRection:FRESponse<si>:USER:SLIS<slj>:STATe <State>

Activates or deactivates the loaded file for the current configuration. Only active files are included in filter calculation.

For queries with no input type specified, the currently active input type is queried.

**Suffix:**

<si> 1..n  
source index for MIMO measurements

<slj> 1..n  
Index in Touchstone file list  
Use [SENSe:]CORRection:FRESponse<si>:USER:SLIS<slj>:SIZE? to determine the maximum index number.

**Parameters:**

<State> ON | OFF | 0 | 1  
**OFF | 0**  
Activates the file.  
**ON | 1**  
Deactivates the file.  
\*RST: 1

**Example:** SENS:CORR:FRES:USER:SLIS2:STAT ON

**Manual operation:** See "Active" on page 107

[SENSe:]CORRection:FRESponse<si>:USER:SPECtrum:DATA:FREQUency?

[SENSe:]CORRection:FRESponse<si>:USER:SPECtrum:DATA:MAGNitude?

[SENSe:]CORRection:FRESponse<si>:USER:SPECtrum:DATA:PHASe?

Queries the trace values for the combined user correction files (.snp+.fres) in Spectrum mode.

**Suffix:**  
 <si> 1..n  
 source index for MIMO measurements

**Usage:** Query only

[SENSe:]CORRection:FRESponse<si>:BASEband:USER:STATe <State>  
 [SENSe:]CORRection:FRESponse<si>:FILE:USER:STATe <State>  
 [SENSe:]CORRection:FRESponse<si>:INPut<ip>:USER:STATe <State>  
 [SENSe:]CORRection:FRESponse<si>:USER:STATe <State>

Activates or deactivates the general usage of user-defined frequency response correction settings.

Only if activated, the filter is calculated and applied to the results.

For details, see the R&S VSE User Manual.

**Suffix:**  
 <si> 1..n  
 source index for MIMO measurements

**Parameters:**  
 <State> ON | OFF | 0 | 1  
**OFF | 0**  
 Switches the function off  
**ON | 1**  
 Switches the function on  
 \*RST: 0

**Example:** SENS:CORR:FRES:USER:STAT

**Manual operation:** See "State" on page 105

[SENSe:]CORRection:FRESponse<si>:BASEband:USER:STORE <FilePath>  
 [SENSe:]CORRection:FRESponse<si>:FILE:USER:STORE <FilePath>  
 [SENSe:]CORRection:FRESponse<si>:INPut<ip>:USER:STORE <FilePath>  
 [SENSe:]CORRection:FRESponse<si>:USER:STORE <FilePath>

Stores a saveset for a user-defined frequency response correction scenario. By default, the saveset is stored in the  
 C:\ProgramData\Rohde-Schwarz\VSE\<version\_no>\user\FResponse directory.

**Suffix:**  
 <si> 1..n  
 source index for MIMO measurements

**Setting parameters:**  
 <FilePath> string

- Example:**                   SENS:CORR:FRES:USER:STOR 'FRes1'  
Stores the current frequency response correction configuration to a file named  
C:\ProgramData\Rohde-Schwarz\VSE\<<version\_no>\user\FResponse\FRes1.dfl.
- Usage:**                    Setting only
- Manual operation:**    See "[Save Settings](#)" on page 107

#### [SENSe:]CORRection:FRESponse<si>:USER:VALid?

This command queries the validity of the user-defined correction settings.

**Suffix:**

<si>                            1..n  
source index for MIMO measurements

**Return values:**

<Validity>                    0 | 1  
**1**  
The setting is valid.  
**0**  
The setting is not valid.

- Example:**                   SENS:CORR:FRES:USER:VAL?
- Usage:**                    Query only
- Manual operation:**    See "[State](#)" on page 105

#### 13.4.7.2 Programming example: using touchstone files

This example demonstrates how to use Touchstone files in a basic I/Q Analyzer measurement setup in a remote environment.

```
-----Configuring the measurement -----
*RST; *WAI
SYST:DISP:UPD ON
TRACel:IQ ON
TRACe:IQ:EVAL ON
LAY:REPL:WIND "1",FREQ
INIT:CONT OFF

// Use calibration signal as input data
DIAG:SERV:INP CAL
DIAG:SERV:INP:RF:SPEC BRO
DIAG:SERV:INP:PULS:CFR 1MHz

// Set SR/Bandwidth and CF
TRAC:IQ:SRAT 100 MHz
FREQ:CENT 500MHz
```

```
// Activate S2P file
SENSe:CORRection:FRESponse:Input1:USER:PRESet
SENSe:CORRection:FRESponse:Input1:USER:SLIST1:SElect 'c:\BP_40MHz.s2p'
SENSe:CORRection:FRESponse:Input1:USER:STATE ON

INIT:IMM; *WAI
SYST:COMM:INT:REM OFF
```

### 13.4.8 Commands for power sensor usage

These commands are required to configure a connected R&S NRQ6 power sensor.

[SENSe:]FREQuency:CONVersion:MIXer:LO:OUTPut:STATe.....	590
[SENSe:]FREQuency:CONVersion:MIXer:LO:SOURce.....	590
[SENSe:]ROSCillator:PASSthrough.....	591
[SENSe:]SAMPLing:CLKio:OUTPut.....	591
[SENSe:]TRACe:IQ:SYNC:MODE.....	592
TRIGger:IQ:SENDER:SOURce.....	592
TRIGger:SENDER:PORT.....	593

---

**[SENSe:]FREQuency:CONVersion:MIXer:LO:OUTPut:STATe <DevName>, <arg1>**

Enables or disables the output of the power sensor's local oscillator signal.

Only available for a connected R&S NRQ6.

**Setting parameters:**

<DevName>	string Name of a configured instrument (see <a href="#">DEVIce:CREate</a> on page 513)
<arg1>	ON   OFF   0   1 <b>OFF   0</b> Switches the function off <b>ON   1</b> Switches the function on <b>*RST: 0</b>

**Example:**           FREQ:CONV:MIX:LO:OUTP:STAT NRQ1,ON

**Manual operation:** See "[LO Out](#)" on page 86

---

**[SENSe:]FREQuency:CONVersion:MIXer:LO:SOURce <DevName>, <LOSource>**

Sets the local oscillator source for the power sensor.

Only available for a connected R&S NRQ6.

**Setting parameters:**

<DevName>	string Name of a configured instrument (see <a href="#">DEVIce:CREate</a> on page 513)
<LOSource>	INT   EXT <b>INT</b> Uses the internal LO signal. <b>EXT</b> Uses the external LO signal fed into the LO connector. The internal LO generation is disabled. *RST: INT

**Example:** `FREQ:CONV:MIX:LO:SOUR NRQ1,EXT`

**Manual operation:** See "[Local Oscillator \(LO\) - Source](#)" on page 85

**[SENSe:]ROSCillator:PASSthrough <DevName>, <arg1>**

Enables or disables the use of an external sampling clock for the power sensor.  
Only available for a connected R&S NRQ6.

**Setting parameters:**

<DevName>	string Name of a configured instrument (see <a href="#">DEVIce:CREate</a> on page 513)
<arg1>	ON   OFF   0   1 <b>OFF   0</b> Switches the function off <b>ON   1</b> Switches the function on *RST: 0

**Example:** `ROSC:PASS NRQ1,ON`

**Manual operation:** See "[Sampl. CLK Source](#)" on page 86

**[SENSe:]SAMPLing:CLKio:OUTPut <DevName>, <arg1>**

Enables or disables the output of the power sensor's sampling clock signal.  
Only available for a connected R&S NRQ6.

**Parameters:**

<arg1>	ON   OFF   0   1 <b>OFF   0</b> Switches the function off <b>ON   1</b> Switches the function on
--------	--

\*RST: 0

**Setting parameters:**

<DevName> string  
Name of a configured instrument (see [DEVIce:CREate](#) on page 513)

**Example:** SAMP:CLK:OUTP NRQ1, ON

**Manual operation:** See "[Sampl. CLK Out](#)" on page 86

**[SENSe:]TRACe:IQ:SYNC:MODE** <DevName>, <MSSyncMode>

Defines the synchronization mode for phase-coherent measurements.

Only available for a connected R&S NRQ6. Requires the R&S NRQ6-K1 and -K3 options.

**Parameters:**

<MSSyncMode> **NONE**  
No synchronization

**PRIMary | MASTer**  
If the R&S NRQ6 is the primary trigger, the power sensor outputs a digital trigger signal in sync with its own trigger event. The trigger signal is output at the selected port (see [\[SENSe:\] TRACe:IQ:SYNC:MODE](#) on page 592).

**SECOndary | SLAVE**  
The R&S NRQ6 is triggered by the primary (the connected instrument).

\*RST: NONE

**Setting parameters:**

<DevName> string  
Name of a configured instrument (see [DEVIce:CREate](#) on page 513)

**Example:** TRAC:IQ:SYNC:MODE NRQ1, PRIM  
TRIG:MAST:PORT NRQ1, EXT1

The power sensor outputs a digital trigger signal at its "Host Interface" connector.

**Manual operation:** See "[Sync Mode](#)" on page 85

**TRIGger:IQ:SENDER:SOURce** <DevName>, <TriggerIQSource>

Selects the trigger input for the R&S NRQ6.

Effective only if the R&S NRQ6 is primary trigger (see [\[SENSe:\] TRACe:IQ:SYNC:MODE](#) on page 592):



Only available for a connected R&S NRQ6.

**Parameters:**

<TriggerIQSource> OFF | HOST | EXT1 | EXT2

**IMMediate**

Default: the R&S NRQ6 triggers when a measurement is started in the R&S VSE software (see [TRIGger\[:SEquence\]:SOURce](#) on page 668).

**EXT1**

The R&S NRQ6 "Host Interface" connector provides the trigger signal.

**EXT2**

The R&S NRQ6 "Trigger 2 I/O" connector provides the trigger signal.

\*RST: IMM

**Setting parameters:**

<DevName> string

Name of a configured instrument (see [DEVIce:CREate](#) on page 513)

**Example:**

```
TRAC:IQ:SYNC:MODE NRQ1, PRIM
TRIG:IQ:SEND:SOUR NRQ1, EXT2
TRIG:SEND:PORT NRQ1, EXT1
```

The power sensor receives a digital trigger signal from its "Trigger 2 I/O" connector, and outputs it at the "Host Interface" connector.

**Manual operation:** See "[Primary Trigger Source](#)" on page 85

**TRIGger:SENDER:PORT** <DevName>, <Port>

Selects the port where the R&S NRQ6 outputs a digital trigger signal.

Effective only if the R&S NRQ6 is primary trigger (see [\[SENSe:\]TRACe:IQ:SYNC:MODE](#) on page 592):

Only available for a connected R&S NRQ6.

**Parameters:**

<Port> OFF | HOST | EXT1 | EXT2

**OFF**

Default: the primary trigger uses its internal trigger source

**EXT1**

The R&S NRQ6 "Host Interface" connector is used as external trigger output port.

**EXT2**

The R&S NRQ6 "Trigger 2 I/O" connector is used as external trigger output port.

\*RST: OFF

**Setting parameters:**

<DevName> string  
Name of a configured instrument (see [DEVIce:CREate](#) on page 513)

**Example:**

```
TRAC:IQ:SYNC:MODE NRQ1, PRIM
TRIG:SEND:PORT NRQ1, EXT1
```

The power sensor outputs a digital trigger signal at its "Host Interface" connector.

**Manual operation:** See ["Trigger Output Port"](#) on page 85

### 13.4.9 Configuring the outputs

The following commands are required to provide output from the connected instrument to other connected devices.

[DIAGnostic:SERVice:NSource](#)..... 594

---

**DIAGnostic:SERVice:NSource** <State>

Turns the 28 V supply of the BNC connector labeled [noise source control] on the connected instrument on and off.

**Parameters:**

<State> ON | OFF | 0 | 1  
**OFF | 0**  
Switches the function off  
**ON | 1**  
Switches the function on

**Example:** `DIAG:SERV:NSO ON`

**Manual operation:** See ["Noise Source Control"](#) on page 112

### 13.4.10 Configuring the trigger output

The following commands are required to send the trigger signal to one of the variable "TRIGGER INPUT/OUTPUT" connectors on the connected instrument.

[OUTPut:TRIGger<tp>:DIRection](#)..... 594  
[OUTPut:TRIGger<tp>:LEVel](#)..... 595  
[OUTPut:TRIGger<tp>:OTYPe](#)..... 595  
[OUTPut:TRIGger<tp>:PULSe:IMMediate](#)..... 596  
[OUTPut:TRIGger<tp>:PULSe:LENGth](#)..... 596

---

**OUTPut:TRIGger<tp>:DIRection** <Direction>

Selects the trigger direction for trigger ports that serve as an input as well as an output.

**Suffix:**

<Undefp> irrelevant

<tp>

**Parameters:**

<Direction> INPut | OUTPut

**INPut**

Port works as an input.

**OUTPut**

Port works as an output.

\*RST: INPut

**Manual operation:** See "[Trigger 1/2/3](#)" on page 114

**OUTPut:TRIGger<tp>:LEVel <Level>**

Defines the level of the (TTL compatible) signal generated at the trigger output.

Works only if you have selected a user-defined output with [OUTPut:TRIGger<tp>:OTYPe](#).

**Suffix:**

<tp> 1..n

Selects the trigger port to which the output is sent.

**Parameters:**

<Level> **HIGH**

5 V

**LOW**

0 V

\*RST: LOW

**Example:** `OUTP:TRIG2:LEV HIGH`

**Manual operation:** See "[Level](#)" on page 115

**OUTPut:TRIGger<tp>:OTYPe <OutputType>**

Selects the type of signal generated at the trigger output.

**Suffix:**

<tp> 1..n

Selects the trigger port to which the output is sent.

**Parameters:**

<OutputType> **DEVice**

Sends a trigger signal when the R&S VSE has triggered internally.

**TARMed**

Sends a trigger signal when the trigger is armed and ready for an external trigger event.

**UDEFined**

Sends a user-defined trigger signal. For more information, see [OUTPut:TRIGger<tp>:LEVel](#).

\*RST: DEVIce

**Manual operation:** See "[Output Type](#)" on page 114

**OUTPut:TRIGger<tp>:PULSe:IMMEDIATE**

Generates a pulse at the trigger output.

**Suffix:**

<tp> 1..n  
Selects the trigger port to which the output is sent.

**Manual operation:** See "[Send Trigger](#)" on page 115

**OUTPut:TRIGger<tp>:PULSe:LENGth <Length>**

Defines the length of the pulse generated at the trigger output.

**Suffix:**

<tp> Selects the trigger port to which the output is sent.

**Parameters:**

<Length> Pulse length in seconds.  
Default unit: S

**Example:** `OUTP:TRIG2:PULS:LENG 0.02`

**Manual operation:** See "[Pulse Length](#)" on page 115

## 13.5 Configuring the result display

The commands required to configure the screen display in a remote environment are described here.

The tasks for manual operation are described in [Chapter 6, "Operating basics"](#), on page 48.

- [Global layout commands](#).....596
- [Working with windows in the display](#).....603
- [General window commands](#).....609

### 13.5.1 Global layout commands

The following commands are required to change the evaluation type and rearrange the screen layout across measurement channels as you do in manual operation.



For compatibility with other Rohde & Schwarz Signal and Spectrum Analyzers, the layout commands described in [Chapter 13.5.2, "Working with windows in the display"](#), on page 603 are also supported. Note, however, that the commands described there only allow you to configure the layout within the *active* measurement channel.

<a href="#">LAYout:GLOBal:ADD[:WINDow]?</a> .....	597
<a href="#">LAYout:GLOBal:CATalog[:WINDow]?</a> .....	601
<a href="#">LAYout:GLOBal:IDENtify[:WINDow]?</a> .....	602
<a href="#">LAYout:GLOBal:REMOve[:WINDow]</a> .....	602
<a href="#">LAYout:GLOBal:REPLace[:WINDow]</a> .....	602

---

### **LAYout:GLOBal:ADD[:WINDow]?**

<ExChanName>,<ExWinName>,<Direction>,<NewChanName>,<NewWinType>

Adds a window to the display next to an existing window. The new window may belong to a different channel than the existing window.

To replace an existing window, use the [LAYout:GLOBal:REPLace\[:WINDow\]](#) command.

#### **Parameters:**

<ExChanName>	string Name of an existing channel
<ExWinName>	string Name of the existing window within the <ExChanName> channel the new window is inserted next to. By default, the name of a window is the same as its index. To determine the name and index of all active windows use the <a href="#">LAYout:GLOBal:IDENtify[:WINDow]?</a> query.
<Direction>	LEFT   RIGHT   ABOVE   BELOW   TAB Direction the new window is added relative to the existing window. <b>TAB</b> The new window is added as a new tab in the specified existing window. (See also <a href="#">"Window tabs"</a> on page 58).
<NewChanName>	string Name of the channel for which a new window is to be added.
<NewWinType>	string Type of result display (evaluation method) you want to add. See the table below for available parameter values.

#### **Return values:**

<NewWindowName> When adding a new window, the command returns its name (by default the same as its number) as a result.

**Example:** `LAYout:GLOBal:ADD:WINDow? 'IQ Analyzer', '1', RIGH, 'IQ Analyzer2', 'FREQ'`  
 Adds a new window named 'Spectrum' with a Spectrum display to the right of window 1 in the channel 'IQ Analyzer'.

**Usage:** Query only

**Table 13-3: <WindowType> parameter values for IQ Analyzer application**

Parameter value	Window type
'FREQ'	Spectrum
'MAGN'	Magnitude
'MTABLE'	Marker table
'PEAKlist'	Marker peak list
'RIMAG'	Real/Imag (I/Q)
'VECT'	I/Q Vector

**Table 13-4: <WindowType> parameter values for Pulse application**

Parameter value	Window type
MCAPture	Magnitude Capture Buffer
MTABLE	Marker Table
PDIStribution	Parameter Distribution
PFRequency	Pulse Frequency
PMAGnitude	Pulse Magnitude
PPHase	Pulse Phase
PPWrapped	Pulse phase, wrapped
PREsults	Pulse Results
PSPectrum	Parameter Spectrum
PStatistics	Pulse Statistics
PTREnd	Parameter Trend
RRSPectrum	Result Range Spectrum

**Table 13-5: <WindowType> parameter values for AnalogDemod application**

Parameter value	Window type
MTABLE	Marker table
PEAKlist	Marker peak list
RSUMmary	Result summary
'XTIM:AM'	RF Time Domain (= RF power)
'XTIM:AM:RELative'	AM Time Domain

Parameter value	Window type
'XTIM:AM:RELative:AFSPec-trum'	AM Spectrum
'XTIM:FM'	FM Time Domain
'XTIM:FM:AFSPpectrum'	FM Spectrum
'XTIM:PM'	PM Time Domain
'XTIM:PM:AFSPpectrum'	PM Spectrum
'XTIM:SPECTrum'	RF Spectrum

**Table 13-6: <WindowType> parameter values for GSM application**

Parameter value	Window type
CONStell	Constellation
ETIMe	EVM vs Time
MCAPture	Magnitude Capture
MERRor	Magnitude Error vs Time
MTABle	Marker Table
MACCuracy	Modulation Accuracy
MSFDomain	Modulation Spectrum Graph (Frequency domain)
MSTable	Modulation Spectrum Table
PERRor	Phase Error vs Time
PSTable	Power vs Slot
PTFull	PvT Full Burst
TGSGraph	Trigger to Sync Graph
TGSTable	Trigger to Sync Table
TSFDomain	Transient Spectrum Graph (Frequency domain)
TSTable	Transient Spectrum Table

**Table 13-7: <WindowType> parameter values for VSA application**

Parameter value	Data source (+default result display)
CBUFFer	Capture buffer (Magnitude absolute)
MEAS	Meas & Ref (Magnitude relative)
REF	
EQUalizer	Equalizer
EVEctor	Error vector (EVM)
MACCuracy	Modulation Accuracy (Result Summary)

Parameter value	Data source (+default result display)
MERRor	Modulation Errors (Magnitude error)
SYMB	Symbols (Hexadecimal)

**Table 13-8: <WindowType> parameter values for 3GPP FDD application**

Parameter value	Window type
BITStream	Bitstream
CCONst	Composite Constellation
CDPower	Code Domain Power
CDEPower	Code Domain Error Power
CEVM	Composite EVM
CTABLE	Channel Table
EVMChip	EVM vs Chip
FESLot	Frequency Error vs Slot
MECHip	Magnitude Error vs Chip
MTABLE	Marker table
PCDerror	Peak Code Domain Error
PDSLot	Phase Discontinuity vs Slot
PECHip	Phase Error vs Chip
PSLot	Power vs Slot
PSYMBOL	Power vs Symbol
RSUMmary	Result Summary
SCONst	Symbol Constellation
SEVM	Symbol EVM
SMERror	Symbol Magnitude Error
SPERror	Symbol Phase Error

**Table 13-9: <WindowType> parameter values for WLAN application**

Parameter value	Window type
BITStream	Bitstream
CMEMory	Magnitude Capture
CONStellation	Constellation
CVCarrier	Constellation vs Carrier (IEEE 802.11a, ac, g (OFDM), n only)
EVCARRIER	EVM vs Carrier (IEEE 802.11a, ac, g (OFDM), n only)
EVCHip	EVM vs Chip (IEEE 802.11b and g (DSSS) only)



Parameter value	Window type
EVSYmbol	EVM vs Symbol (IEEE 802.11a, ac, g (OFDM), n only)
FSPpectrum	FFT Spectrum
GDElay	Group Delay (IEEE 802.11a, ac, g (OFDM), n only)
PFPPdu	PvT Full PDU
RSDetailed	Result Summary Detailed (IEEE 802.11a, ac, g (OFDM), n only)
RSGlobal	Result Summary Global
SFfield	Signal Field (IEEE 802.11a, ac, g (OFDM), n) PLCP Header (IEEE 802.11b and g (DSSS))
SFLatness	Spectrum Flatness (IEEE 802.11a, ac, g (OFDM), n only)

### LAYout:GLOBal:CATalog[:WINDow]?

Queries the name and index of all active windows from top left to bottom right for each active channel. The result is a comma-separated list of values for each window, with the syntax:

<ChannelName\_1>: <WindowName\_1>,<WindowIndex\_1>..<WindowName\_n>,<WindowIndex\_n>

..

<ChannelName\_m>: <WindowName\_1>,<WindowIndex\_1>..<WindowName\_n>,<WindowIndex\_n>

#### Return values:

<ChannelName> String containing the name of the channel. The channel name is displayed as the tab label for the measurement channel.

<WindowName> string  
Name of the window.  
In the default state, the name of the window is its index.

<WindowIndex> **numeric value**  
Index of the window.

#### Example:

LAY:GLOB:CAT?

Result:

IQ Analyzer: '1',1,'2',2

Analog Demod: '1',1,'4',4

For the I/Q Analyzer channel, two windows are displayed, named '2' (at the top or left), and '1' (at the bottom or right).  
For the Analog Demodulation channel, two windows are displayed, named '1' (at the top or left), and '4' (at the bottom or right).

**Usage:** Query only

---

**LAYout:GLOBal:IDENtify[:WINDow]?** <ChannelName>,<WindowName>

Queries the **index** of a particular display window in the specified channel.

**Note:** to query the **name** of a particular window, use the `LAYout:WINDow<n>:IDENtify?` query.

**Parameters:**

<ChannelName> String containing the name of the channel. The channel name is displayed as the tab label for the measurement channel.

**Query parameters:**

<WindowName> String containing the name of a window.

**Return values:**

<WindowIndex> Index number of the window.

**Example:**

```
LAYout:GLOBal:ADD:WINDow? IQ, '1', RIGH,
'Spectrum', FREQ
```

Adds a new window named 'Spectrum' with a Spectrum display to the right of window 1.

**Example:**

```
LAYout:GLOBal:IDENtify? 'IQ Analyzer',
'Spectrum'
```

Result:

2

Window index is: 2.

**Usage:** Query only

---

**LAYout:GLOBal:REMOve[:WINDow]** <ChannelName>, <WindowName>

**Setting parameters:**

<ChannelName>

<WindowName>

**Usage:** Setting only

---

**LAYout:GLOBal:REPLace[:WINDow]** <ExChannelName>, <WindowName>, <NewChannelName>, <WindowType>

**Setting parameters:**

<ExChannelName>

<WindowName>

<NewChannelName>

<WindowType>

**Usage:** Setting only

## 13.5.2 Working with windows in the display

Note that the suffix <n> always refers to the window *in the currently selected channel*.

The following commands are required to change the evaluation type and rearrange the screen layout for a channel as you do in manual operation. Since the available evaluation types depend on the selected application, some parameters for the following commands also depend on the selected channel.

Note that the suffix <n> always refers to the window *in the currently selected channel*.

(See `INSTrument[:SElect]` on page 552).

To configure the layout of windows across channels, use the [Chapter 13.5.1, "Global layout commands"](#), on page 596.

<code>LAYout:ADD[:WINDow]?</code> .....	603
<code>LAYout:CATalog[:WINDow]?</code> .....	605
<code>LAYout:IDENtify[:WINDow]?</code> .....	605
<code>LAYout:MOVE[:WINDow]</code> .....	606
<code>LAYout:REMOve[:WINDow]</code> .....	606
<code>LAYout:REPLace[:WINDow]</code> .....	606
<code>LAYout:WINDow&lt;n&gt;:ADD?</code> .....	607
<code>LAYout:WINDow&lt;n&gt;:IDENtify?</code> .....	607
<code>LAYout:WINDow&lt;n&gt;:REMOve</code> .....	608
<code>LAYout:WINDow&lt;n&gt;:REPLace</code> .....	608
<code>LAYout:WINDow&lt;n&gt;:TYPE</code> .....	609

---

**`LAYout:ADD[:WINDow]?` <WindowName>, <Direction>, <WindowType>**

Adds a window to the display in the active channel.

Is always used as a query so that you immediately obtain the name of the new window as a result.

To replace an existing window, use the `LAYout:REPLace[:WINDow]` command.

### Query parameters:

<WindowName>	String containing the name of the existing window the new window is inserted next to. By default, the name of a window is the same as its index. To determine the name and index of all active windows, use the <code>LAYout:CATalog[:WINDow]?</code> query.
<Direction>	LEFT   RIGHT   ABOVE   BELOW Direction the new window is added relative to the existing window.
<WindowType>	text value Type of result display (evaluation method) you want to add. See the table below for available parameter values. Note that the window type must be valid for the active channel. To create a window for a different channel, use the <code>LAYout:GLOBal:REPLace[:WINDow]</code> command.

**Return values:**

<NewWindowName> When adding a new window, the command returns its name (by default the same as its number) as a result.

**Example:**

```
LAY:ADD? '1', LEFT, MTAB
```

Result:

```
'2'
```

Adds a new window named '2' with a marker table to the left of window 1.

**Usage:**

Query only

**Manual operation:**

See "[Magnitude](#)" on page 168

See "[Spectrum](#)" on page 168

See "[I/Q-Vector](#)" on page 169

See "[Real/Imag \(I/Q\)](#)" on page 170

See "[Statistic APD](#)" on page 170

See "[Statistic CCDF](#)" on page 171

See "[Phase vs. Time](#)" on page 173

See "[Marker Table](#)" on page 173

See "[Diagram](#)" on page 174

See "[Marker Peak List](#)" on page 174

See "[Result Summary](#)" on page 175

**Table 13-10: <WindowType> parameter values for IQ Analyzer application**

Parameter value	Window type
Basic I/Q measurement:	
FREQ	"Spectrum"
MAGN	"Magnitude"
MTABle	"Marker table"
PEAKlist	"Marker peak list"
PHASe	"Phase vs. time"
RIMAG	"Real/Imag (I/Q)"
STATistic	"Statistic APD"
"CCDF"	"Statistic CCDF"
VECT	"I/Q Vector"
Frequency and time domain measurements:	
DIAGram	"Diagram"
MTABle	"Marker table"
PEAKlist	"Marker peak list"
RSUMmary	"Result summary"

**LAYout:CATalog[:WINDow]?**

Queries the name and index of all active windows in the active channel from top left to bottom right. The result is a comma-separated list of values for each window, with the syntax:

```
<WindowName_1>,<WindowIndex_1>..<WindowName_n>,<WindowIndex_n>
```

To query the name and index of all windows in all channels, use the `LAYout:GLOBal:CATalog[:WINDow]?` command.

**Return values:**

**<WindowName>** string  
Name of the window.  
In the default state, the name of the window is its index.

**<WindowIndex>** **numeric value**  
Index of the window.

**Example:**

```
LAY:CAT?
```

Result:

```
'2',2,'1',1
```

Two windows are displayed, named '2' (at the top or left), and '1' (at the bottom or right).

**Usage:** Query only

**LAYout:IDENtify[:WINDow]? <WindowName>**

Queries the **index** of a particular display window in the active channel.

**Note:** to query the **name** of a particular window, use the `LAYout:WINDow<n>:IDENtify?` query.

To query the index of a window in a different channel, use the `LAYout:GLOBal:IDENtify[:WINDow]?` command.

**Query parameters:**

**<WindowName>** String containing the name of a window.

**Return values:**

**<WindowIndex>** Index number of the window.

**Example:**

```
LAY:IDEN:WIND? '2'
```

Queries the index of the result display named '2'.

Response:

```
2
```

**Usage:** Query only

---

**LAYout:MOVE[:WINDow]** <WindowName>, <WindowName>, <Direction>

**Setting parameters:**

<WindowName>	String containing the name of an existing window that is to be moved. By default, the name of a window is the same as its index. To determine the name and index of all active windows in the active channel, use the <a href="#">LAYout:CATalog[:WINDow] ?</a> query.
<WindowName>	String containing the name of an existing window the selected window is placed next to or replaces. By default, the name of a window is the same as its index. To determine the name and index of all active windows in the active channel, use the <a href="#">LAYout:CATalog[:WINDow] ?</a> query.
<Direction>	LEFT   RIGHT   ABOVE   BELOW   REPLACE Destination the selected window is moved to, relative to the reference window.

**Example:** `LAY:MOVE '4', '1', LEFT`  
Moves the window named '4' to the left of window 1.

**Example:** `LAY:MOVE '1', '3', REPL`  
Replaces the window named '3' by window 1. Window 3 is deleted.

**Usage:** Setting only

---

**LAYout:REMOve[:WINDow]** <WindowName>

Removes a window from the display in the active channel.

**Setting parameters:**

<WindowName>	String containing the name of the window. In the default state, the name of the window is its index.
--------------	--

**Example:** `LAY:REM '2'`  
Removes the result display in the window named '2'.

**Usage:** Setting only

---

**LAYout:REPLace[:WINDow]** <WindowName>, <WindowType>

Replaces the window type (for example from "Diagram" to "Result Summary") of an already existing window in the active channel while keeping its position, index and window name.

To add a new window, use the [LAYout:ADD\[:WINDow\] ?](#) command.

**Setting parameters:**

<WindowName>	String containing the name of the existing window. By default, the name of a window is the same as its index. To determine the name and index of all active windows in the active channel, use the <a href="#">LAYout:CATalog[:WINDow] ?</a> query.
--------------	--

**<WindowType>** Type of result display you want to use in the existing window. See [LAYout:ADD\[:WINDow\]?](#) on page 603 for a list of available window types. Note that the window type must be valid for the active channel. To create a window for a different channel, use the [LAYout:GLOBal:REPLace\[:WINDow\]](#) command.

**Example:** `LAY:REPL:WIND '1',MTAB`  
Replaces the result display in window 1 with a marker table.

**Usage:** Setting only

### **LAYout:WINDow<n>:ADD? <Direction>,<WindowType>**

Adds a measurement window to the display. Note that with this command, the suffix <n> determines the existing window next to which the new window is added. Unlike [LAYout:ADD\[:WINDow\]?](#), for which the existing window is defined by a parameter.

To replace an existing window, use the [LAYout:WINDow<n>:REPLace](#) command.

Is always used as a query so that you immediately obtain the name of the new window as a result.

**Suffix:**

<n> [Window](#)

**Query parameters:**

<Direction> LEFT | RIGHT | ABOVE | BELOW

**<WindowType>** Type of measurement window you want to add. See [LAYout:ADD\[:WINDow\]?](#) on page 603 for a list of available window types. Note that the window type must be valid for the active channel. To create a window for a different channel, use the [LAYout:GLOBal:ADD\[:WINDow\]?](#) command.

**Return values:**

**<NewWindowName>** When adding a new window, the command returns its name (by default the same as its number) as a result.

**Example:** `LAY:WIND1:ADD? LEFT,MTAB`  
Result:  
`'2'`  
Adds a new window named '2' with a marker table to the left of window 1.

**Usage:** Query only

### **LAYout:WINDow<n>:IDENTify?**

Queries the **name** of a particular display window (indicated by the <n> suffix) in the active channel.

**Note:** to query the **index** of a particular window, use the `LAYout:IDENtify[:WINDow]?` command.

**Suffix:**

<n> [Window](#)

**Return values:**

<WindowName> String containing the name of a window.  
In the default state, the name of the window is its index.

**Example:**

```
LAY:WIND2:IDEN?
Queries the name of the result display in window 2.
Response:
'2'
```

**Usage:**

Query only

**LAYout:WINDow<n>:REMOve**

Removes the window specified by the suffix <n> from the display in the active channel.

The result of this command is identical to the `LAYout:REMOve[:WINDow]` command.

To remove a window in a different channel, use the `LAYout:GLOBal:REMOve[:WINDow]` command.

**Suffix:**

<n> [Window](#)

**Example:**

```
LAY:WIND2:REM
Removes the result display in window 2.
```

**Usage:**

Event

**LAYout:WINDow<n>:REPLace <WindowType>**

Changes the window type of an existing window (specified by the suffix <n>) in the active channel.

The effect of this command is identical to the `LAYout:REPLace[:WINDow]` command.

To add a new window, use the `LAYout:WINDow<n>:ADD?` command.

**Suffix:**

<n> [Window](#)

**Setting parameters:**

<WindowType> Type of measurement window you want to replace another one with.  
See `LAYout:ADD[:WINDow]?` on page 603 for a list of available window types.  
Note that the window type must be valid for the active channel.  
To create a window for a different channel, use the `LAYout:GLOBal:REPLace[:WINDow]` command.



**Example:** `LAY:WIND2:REPL MTAB`  
Replaces the result display in window 2 with a marker table.

**Usage:** Setting only

#### **LAYout:WINDow<n>:TYPE <WindowType>**

Queries or defines the window type of the window specified by the index <n>. The window type determines which results are displayed. For a list of possible window types, see [LAYout:ADD\[:WINDow\]?](#) on page 603.

Note that this command is not available in all applications and measurements.

**Suffix:**

<n> 1..n  
[Window](#)

**Parameters:**

<WindowType>

**Example:** `LAY:WIND2:TYPE?`

### 13.5.3 General window commands

The following commands are required to work with windows, independently of the application.

Note that the suffix <n> always refers to the window *in the currently selected measurement channel*.

(See [INSTrument\[:SElect\]](#) on page 552).

[DISPlay:FORMat](#)..... 609  
[DISPlay\[:WINDow<n>\]\[:SUBWindow<w>\]:SElect](#)..... 610

#### **DISPlay:FORMat <Format>**

Determines which tab is displayed.

**Parameters:**

<Format> **SPLit**  
Displays the MultiView tab with an overview of all active channels  
See [Chapter 6.3.2, "Multiview mode"](#), on page 60.  
**SINGle**  
Displays the measurement channel that was previously focused.  
**\*RST: SING**

**Example:** `DISP:FORM SPL`

**Manual operation:** See ["Multiview mode"](#) on page 148

**DISPlay[:WINDow<n>][:SUBWindow<w>]:SElect**

Sets the focus on the selected result display window.

This window is then the active window.

For measurements with multiple results in subwindows, the command also selects the subwindow. Use this command to select the (sub)window before querying trace data.

**Suffix:**

<n>	Window
<w>	subwindow Not supported by all applications

**Example:** //Put the focus on window 1  
DISP:WIND1:SEL

**Example:** //Put the focus on subwindow 2 in window 1  
DISP:WIND1:SUBW2:SEL

## 13.6 Remote commands for the I/Q analyzer

- [Common suffixes](#)..... 610
- [Configuring I/Q analyzer measurements](#).....610
- [Configuring RF measurements](#)..... 686
- [I/Q analysis](#)..... 795
- [Retrieving results](#)..... 870

### 13.6.1 Common suffixes

In the I/Q Analyzer, the following common suffixes are used in remote commands:

*Table 13-11: Common suffixes used in remote commands in the I/Q Analyzer*

Suffix	Value range	Description
<m>	1 to 16	Marker
<n>	1 to x	Window ( <b>in the currently selected channel</b> )
<t>	1 to 6	Trace
<li>	1 to 8	Limit line

### 13.6.2 Configuring I/Q analyzer measurements

The following commands configure the I/Q Analyzer measurements.

- [Configuring data input](#)..... 611
- [Configuring the vertical axis \(amplitude, scaling\)](#).....648
- [Configuring the axes for statistical displays](#)..... 657
- [Frequency](#)..... 661

- [Configuring triggered and gated measurements](#).....663
- [Configuring data acquisition](#).....674
- [Adjusting settings automatically](#).....682

### 13.6.2.1 Configuring data input

The following commands are required to configure data input.

- [RF input](#).....611
- [Configuring oscilloscope baseband input](#).....620
- [Using external mixers](#).....623
- [Remote commands for external frontend control](#).....632
- [Working with power sensors](#).....639

#### RF input

Useful commands for configuring RF input described elsewhere:

- `INSTRument:BLOCK:CHANnel[:SETTings]:SOURce<si>` on page 543

#### Remote commands exclusive to configuring RF input:

<code>INPut&lt;ip&gt;:ATTenuation:PROTection[:STATe]</code> .....	611
<code>INPut:ATTenuation:PROTection:RESet</code> .....	612
<code>INPut&lt;ip&gt;:COUPling&lt;ant&gt;</code> .....	612
<code>INPut&lt;ip&gt;:DPATH</code> .....	613
<code>INPut&lt;ip&gt;:FILTer:HPASs[:STATe]</code> .....	613
<code>INPut&lt;ip&gt;:FILTer:SAW</code> .....	614
<code>INPut&lt;ip&gt;:FILTer:YIG[:STATe]</code> .....	614
<code>INPut&lt;ip&gt;:IMPedance&lt;ant&gt;</code> .....	614
<code>INPut&lt;ip&gt;:PRESelection:SET</code> .....	615
<code>INPut&lt;ip&gt;:PRESelection[:STATe]</code> .....	615
<code>INPut&lt;ip&gt;:RF:CAPMode</code> .....	615
<code>INPut&lt;ip&gt;:RF:CAPMode:IQ:SRATe</code> .....	616
<code>INPut&lt;ip&gt;:RF:CAPMode:WAVeform:SRATe</code> .....	617
<code>INPut:SELEct</code> .....	617
<code>INPut:TYPE</code> .....	618
<code>SYSTem:COMMunicate:RDEVice:OSCilloscope[:STATe]</code> .....	618
<code>SYSTem:COMMunicate:RDEVice:OSCilloscope:TCPip</code> .....	618
<code>SYSTem:COMMunicate:RDEVice:OSCilloscope:PSMMode[:STATe]</code> .....	619
<code>SYSTem:COMMunicate:RDEVice:OSCilloscope:SRATe</code> .....	619
<code>SYSTem:COMMunicate:RDEVice:OSCilloscope:VDEVice?</code> .....	620
<code>SYSTem:COMMunicate:RDEVice:OSCilloscope:VFIRmware?</code> .....	620

---

#### `INPut<ip>:ATTenuation:PROTection[:STATe] <State>`

Turns the availability of attenuation levels of 10 dB or less on and off.

##### Suffix:

<ip>                    1..n

##### Parameters:

<State>                ON | OFF | 1 | 0

**ON | 1**

Attenuation levels of 10 dB or less are not allowed to protect the RF input connector of the connected instrument.

**OFF | 0**

Attenuation levels of 10 dB or less are not blocked. Provide appropriate protection for the RF input connector of the connected instrument yourself.

\*RST: 1

**Example:**

```
INP:ATT:PROT ON
Turns on the input protection.
```

**INPut:ATTenuation:PROTection:RESet [<DeviceName>]**

Resets the attenuator and reconnects the RF input with the input mixer for the connected instrument after an overload condition occurred and the protection mechanism intervened. The error status bit (bit 3 in the `STAT:QUES:POW` status register) and the `INPUT OVLD` message in the status bar are cleared.

The command works only if the overload condition has been eliminated first.

For details on the protection mechanism, see the instrument's documentation.

**Setting parameters:**

<DeviceName> string  
Name of the instrument for which the RF input protection is to be reset.

**Example:**

```
INP:ATT:PROT:RES 'MyDevice'
```

**Manual operation:** See "[10 dB Minimum Attenuation](#)" on page 201

**INPut<ip>:COUPling<ant> <CouplingType>**

Selects the coupling type of the RF input.

If an external frontend is active, the coupling is automatically set to `AC`.

**Suffix:**

<ip> 1 | 2  
irrelevant

<ant> [Input source](#) (for MIMO measurements only)

**Parameters:**

<CouplingType> AC | DC  
**AC**  
AC coupling  
**DC**  
DC coupling  
\*RST: AC

**Example:**

```
INP:COUP DC
```

**Manual operation:** See ["Input Coupling "](#) on page 196

---

### INPut<ip>:DPATH <DirectPath>

Enables or disables the use of the direct path for frequencies close to 0 Hz.

If an external frontend is active, the direct path is always used.

**Suffix:**

<ip> 1..n

**Parameters:**

<DirectPath> AUTO | OFF

**AUTO | 1**

(Default) the direct path is used automatically for frequencies close to 0 Hz.

**OFF | 0**

The analog mixer path is always used.

**Example:** INP:DPAT OFF

**Manual operation:** See ["Direct Path "](#) on page 197

---

### INPut<ip>:FILTer:HPASs[:STATE] <State>

Activates an additional internal high-pass filter for RF input signals from 1 GHz to 3 GHz. This filter is used to remove the harmonics of the connected instrument to measure the harmonics for a DUT, for example.

Requires an additional high-pass filter hardware option.

(Note: for RF input signals outside the specified range, the high-pass filter has no effect. For signals with a frequency of approximately 4 GHz upwards, the harmonics are suppressed sufficiently by the YIG-preselector, if available.)

**Suffix:**

<ip> 1..n

**Parameters:**

<State> ON | OFF | 0 | 1

**OFF | 0**

Switches the function off

**ON | 1**

Switches the function on

\*RST: 0

**Example:** INP:FILT:HPAS ON

Turns on the filter.

**Manual operation:** See ["High Pass Filter 1 to 3 GHz "](#) on page 198

---

**INPut<ip>:FILTer:SAW <State>**

Determines which IF path the R&S VSE hardware uses.

**Suffix:**

<ip> 1..n

**Parameters:**

<State> AUTO | OFF

**AUTO**

The R&S VSE determines which IF path to use automatically, depending on the used analysis bandwidth.

**OFF**

The wide IF path is always used.

\*RST: I/Q Analyzer: AUTO; VSA: OFF

**Example:** INP:FILT:SAW AUTO

**Manual operation:** See "[SAW filter](#)" on page 198

---

**INPut<ip>:FILTer:YIG[:STATe] <State>**

Enables or disables the YIG filter.

For details and restrictions, see "[YIG-Preselector](#)" on page 198

**Suffix:**

<ip> 1 | 2  
irrelevant

**Parameters:**

<State> ON | OFF | 0 | 1

**Example:** INP:FILT:YIG OFF  
Deactivates the YIG-preselector.

**Manual operation:** See "[YIG-Preselector](#)" on page 198

---

**INPut<ip>:IMPedance<ant> <Impedance>**

Selects the nominal input impedance of the RF input. In some applications, only 50 Ω are supported.

**Suffix:**

<ip> 1 | 2  
irrelevant

<ant> [Input source](#) (for MIMO measurements only)

**Parameters:**

&lt;Impedance&gt; 50 | 75

**numeric value**

User-defined impedance from 50 Ohm to 100000000 Ohm (=100 MOhm)

User-defined values are only available for the Spectrum application, the I/Q Analyzer, and some optional applications.

\*RST: 50 Ω

Default unit: OHM

**Example:**

INP:IMP 75

**Manual operation:** See "[Impedance](#)" on page 197See "[Unit](#)" on page 225**INPut<ip>:PRESelection:SET <Mode>**

Selects the preselector mode.

The command is available with the optional preselector.

**Suffix:**

&lt;ip&gt; 1..n

**Parameters:**

&lt;Mode&gt;

**NARROW**

Performs a measurement by automatically applying all available combinations of low and high pass filters consecutively. These combinations all have a narrow bandwidth.

**WIDE**

Performs a measurement by automatically applying all available bandpass filters consecutively. The bandpass filters have a wide bandwidth.

**Manual operation:** See "[Preselector Mode](#)" on page 201**INPut<ip>:PRESelection[:STATE] <State>**

Turns the preselector on and off.

**Suffix:**<ip> 1 | 2  
irrelevant**Manual operation:** See "[Preselector State](#)" on page 200**INPut<ip>:RF:CAPMode <CAPMode>**

Determines how data from an oscilloscope is input to the R&amp;S VSE software.

Is only available for connected oscilloscopes.

**Suffix:**

&lt;ip&gt; 1..n

**Parameters:**

&lt;CAPMode&gt; AUTO | IQ | WAVeform

**IQ**

The measured waveform is converted to I/Q data directly on the R&S oscilloscope (requires option K11), and input to the R&S VSE software as I/Q data.

**WAVeform**

The data is input in its original waveform format and converted to I/Q data in the R&S VSE software. No additional options are required on the R&S oscilloscope.

**AUTO**

Uses "I/Q" mode when possible, and "Waveform" only when required by the application (e.g. Pulse measurement).

\*RST: IQ

**Example:**

INP:RF:CAPM WAV

**Manual operation:** See "[Capture Mode](#)" on page 199**INPut<ip>:RF:CAPMode:IQ:SRATe <SamplingRate>**

Determines the sample rate used by the connected oscilloscope for I/Q capture mode (see [INPut<ip>:RF:CAPMode](#) on page 615).

This setting is only available if an R&S oscilloscope is used to obtain the input data.

**Suffix:**

&lt;ip&gt; 1..n

**Parameters:**

&lt;SamplingRate&gt; 20 GHz | 40 GHz

No other sample rate values are allowed.

**20 GHz**

Achieves a higher decimation gain, but reduces the record length by half.

Only available for R&S oscilloscope models that support a sample rate of 20 GHz (see data sheet).

**40 GHz**

Provides a maximum sample rate.

Only available for R&S RTP13/RTP16 models that support a sample rate of 40 GHz (see data sheet).

\*RST: 20 GHz

Default unit: HZ

**Example:**

INP:RF:CAPM IQ

INP:RF:CAPM:IQ:SRAT 40 GHz

**Manual operation:** See "[Oscilloscope Sample Rate](#)" on page 199



**INPut<ip>:RF:CAPMode:WAVEform:SRATe <SamplingRate>**

Determines the sample rate used by the connected oscilloscope for waveform capture mode (see [INPut<ip>:RF:CAPMode](#) on page 615).

This setting is only available if an R&S oscilloscope is used to obtain the input data, either directly or via the R&S FSW.

**Suffix:**

<ip> 1..n

**Parameters:**

<SamplingRate> 10 GHz | 20 GHz

No other sample rate values are allowed.

**10 GHz**

Default ; provides maximum record length

**20 GHz**

Achieves a higher decimation gain, but reduces the record length by half.

Only available for R&S oscilloscope models that support a sample rate of 20 GHz (see data sheet).

For R&S oscilloscopes with an analysis bandwidth of 4 GHz or larger, a sample rate of 20 GHz is always used.

\*RST: 10 GHz

Default unit: HZ

**Example:**

```
INP:RF:CAPM WAV
```

```
INP:RF:CAPM:WAVE:SRAT 10000000
```

**Manual operation:** See "[Oscilloscope Sample Rate](#)" on page 199

**INPut:SElect <Source>**

Selects the signal source for measurements, i.e. it defines which connector is used to input data to the R&S VSE.

If no additional input options are installed, only RF input or file input is supported.

Is identical to [INSTrument:BLOCK:CHANnel\[:SETTings\]:SOURce<si>](#) on page 543, applied to the currently selected channel and block.

**Parameters:**

<Source>

**ABB**

Analog Baseband signal for R&S FSWP

**OBB**

Oscilloscope Baseband signal

For details on oscilloscope baseband input see [Chapter 10.2.5, "oscilloscope baseband input"](#), on page 184.

**RF**

Radio Frequency ("RF INPUT" connector)

**FIQ**

I/Q data file

**AIQ**

Analog Baseband signal (only available with optional "Analog Baseband" interface)

\*RST: RF

**Manual operation:** See ["Input Type \(Instrument / File\)"](#) on page 94**INPut:TYPE** <Input>

The command selects the input path for R&amp;S FSW85 models.

**Parameters:**

<Input>	<b>INPUT1</b> Selects RF input 1.
	<b>INPUT2</b> Selects RF input 2.
	*RST: INPUT1

**Example:** //Select input path  
INP:TYPE INPUT1

**Manual operation:** See ["Input 1 / Input 2"](#) on page 196**SYSTem:COMMunicate:RDEvice:OSCilloscope[:STATE]** <State>

Activates the optional 2 GHz bandwidth extension (R&amp;S FSW-B2000).

**Note:** Manual operation on the connected oscilloscope, or remote operation other than by the R&S VSE, is not possible while the B2000 option is active.**Parameters:**

<State>	ON   OFF   0   1
	<b>OFF   0</b> Switches the function off
	<b>ON   1</b> Switches the function on

**Example:** SYST:COMM:RDEV:OSC ON

**Manual operation:** See ["B2000 State"](#) on page 199**SYSTem:COMMunicate:RDEvice:OSCilloscope:TCPip** <Address>

Defines the TCPIP address or computer name of the oscilloscope connected to the R&amp;S VSE via LAN.

**Note:** The IP address is maintained after a [PRESET], and is transferred between applications.

**Parameters:**

<Address> computer name or IP address

**Example:** SYST:COMM:RDEV:OSC:TCP '192.0.2.0'

**Example:** SYST:COMM:RDEV:OSC:TCP 'FSW43-12345'

**Manual operation:** See "[Oscilloscope IP Address](#)" on page 200

**SYSTem:COMMunicate:RDEVice:OSCilloscope:PSMode[:STATe] <State>**

Activates the use of the power splitter inserted between the "IF 2 GHZ OUT" connector of the R&S VSE and the "CH1" and "CH3" input connectors of the oscilloscope. Note that this mode requires an additional alignment with the power splitter.

For details see the R&S FSW I/Q Analyzer and I/Q Input User Manual

**Parameters:**

<State> ON | OFF | 0 | 1

**OFF | 0**

Switches the function off

**ON | 1**

Switches the function on

**Example:** SYST:COMM:RDEV:OSC:PSM ON

**Manual operation:** See "[Oscilloscope Splitter Mode](#)" on page 200

**SYSTem:COMMunicate:RDEVice:OSCilloscope:SRATe <Rate>**

Determines whether the 10 GHz mode (default) or 20 GHz mode of the connected oscilloscope is used. The 20 GHz mode achieves a higher decimation gain, but reduces the record length by half.

**Parameters:**

<Rate> 10 GHz | 20 GHz

No other sample rate values are allowed.

\*RST: 10 GHz

Default unit: HZ

**Example:**

```
TRAC:IQ:SRAT?
//Result: 100000000
TRAC:IQ:RLEN?
//Result: 3128
SYST:COMM:RDEV:OSC:SRAT 20GHZ
TRAC:IQ:SRAT?
//Result: 200000000
TRAC:IQ:RLEN?
//Result: 1564
```

**Manual operation:** See "[Oscilloscope Sample Rate](#)" on page 199

**SYSTem:COMMunicate:RDEvice:OSCilloscope:VDEvice?**

Queries whether the connected instrument is supported by the 2 GHz bandwidth extension option(B2000).

**Return values:**

<State>                    ON | OFF | 0 | 1  
                               **OFF | 0**  
                               Switches the function off  
                               **ON | 1**  
                               Switches the function on

**Example:**                    SYST:COMM:RDEV:OSC:VDEV?

**Usage:**                      Query only

**SYSTem:COMMunicate:RDEvice:OSCilloscope:VFIRmware?**

Queries whether the firmware on the connected oscilloscope is supported by the 2 GHz bandwidth extension (B2000) option.

**Return values:**

<State>                    ON | OFF | 0 | 1  
                               **OFF | 0**  
                               Switches the function off  
                               **ON | 1**  
                               Switches the function on

**Example:**                    SYST:COMM:RDEV:OSC:VFIR?

**Usage:**                      Query only

**Configuring oscilloscope baseband input**

The following commands define settings for oscilloscope baseband input.



The commands for oscilloscope baseband input from an oscilloscope to the R&S VSE software are similar, but *not identical* to those used by an R&S FSW.

Useful commands for oscilloscope baseband input described elsewhere:

- [INSTrument:BLOCK:CHANnel\[:SETTings\]:SOURce<si>:TYPE](#) on page 544

**Remote commands exclusive to oscilloscope baseband input:**

<a href="#">INPut&lt;ip&gt;:IQ:OSC:FULLscale[:LEVel]</a> .....	621
<a href="#">INPut&lt;ip&gt;:IQ:OSC:FULLscale:AUTO</a> .....	621
<a href="#">INPut&lt;ip&gt;:IQ:OSC:SKEW:I</a> .....	621
<a href="#">INPut&lt;ip&gt;:IQ:OSC:SKEW:I:INVerted</a> .....	622
<a href="#">INPut&lt;ip&gt;:IQ:OSC:SKEW:Q</a> .....	622
<a href="#">INPut&lt;ip&gt;:IQ:OSC:SKEW:Q:INVerted</a> .....	622
<a href="#">INPut&lt;ip&gt;:IQ:OSC:TYPE</a> .....	622

**INPut<ip>:IQ:OSC:FULLscale[:LEVel] <Level>**

The full scale level defines the maximum power for baseband input possible without clipping the signal.

For manual input, this setting corresponds to the setting on the oscilloscope. Thus, possible scaling values of the oscilloscope are allowed.

**Suffix:**

<ip> 1..n

**Parameters:**

<Level> Default unit: V

**Example:** INP:IQ:OSC:FULL:AUTO OFF

**Example:** INP:IQ:OSC:FULL:LEV 1.0

**Manual operation:** See "[Full Scale Level Mode / Value](#)" on page 230

**INPut<ip>:IQ:OSC:FULLscale:AUTO <State>**

If enabled, the full scale level is defined automatically according to the reference level.

For manual mode, define the level using [INPut<ip>:IQ:OSC:FULLscale\[:LEVel\]](#) on page 621.

**Suffix:**

<ip> 1..n

**Parameters:**

<State> ON | OFF | 0 | 1

**OFF | 0**

Switches the function off

**ON | 1**

Switches the function on

\*RST: 0

**Example:** INP:IQ:OSC:FULL:AUTO OFF

**Manual operation:** See "[Full Scale Level Mode / Value](#)" on page 230

**INPut<ip>:IQ:OSC:SKEW:I <Value>**

Compensates for skewed values in the positive I path, e.g. due to different input cables.

**Suffix:**

<ip> 1..n

**Parameters:**

<Value> Default unit: S

**Example:** INP:IQ:OSC:SKEW:I 0.2

**Manual operation:** See "[I/Q Skew](#)" on page 203

---

**INPut<ip>:IQ:OSC:SKEW:I:INVerted <Value>**

Compensates for skewed values in the negative I path, e.g. due to different input cables.

**Suffix:**

<ip> 1..n

**Parameters:**

<Value> Default unit: S

**Example:**

INP:IQ:OSC:SKEW:I:INV 0.2

**Manual operation:** See "[I/Q Skew](#)" on page 203

---

**INPut<ip>:IQ:OSC:SKEW:Q <Value>**

Compensates for skewed values in the positive Q path, e.g. due to different input cables.

**Suffix:**

<ip> 1..n

**Parameters:**

<Value> Default unit: S

**Example:**

INP:IQ:OSC:SKEW:Q 0.2

**Manual operation:** See "[I/Q Skew](#)" on page 203

---

**INPut<ip>:IQ:OSC:SKEW:Q:INVerted <Value>**

Compensates for skewed values in the negative Q path, e.g. due to different input cables.

**Suffix:**

<ip> 1..n

**Parameters:**

<Value> Default unit: S

**Example:**

INP:IQ:OSC:SKEW:Q:INV 0.2

**Manual operation:** See "[I/Q Skew](#)" on page 203

---

**INPut<ip>:IQ:OSC:TYPE <Type>**

Defines the format of the input signal.

**Suffix:**

<ip> 1..n

**Parameters:**

<Type> IQ | I

**IQ**

Both components of the complex input signal (in-phase component, quadrature component) are filtered and resampled to the sample rate of the application.

The input signal is down-converted with the center frequency (**Low IF I**).

**I**

The input signal at the channel providing I data is resampled to the sample rate of the application.

The input signal is down-converted with the center frequency (**Low IF I**).

**Example:** `INP:IQ:OSC:TYPE I`

**Manual operation:** See "[I/Q Mode](#)" on page 203

**Using external mixers**

The commands required to work with external mixers in a remote environment are described here. Note that these commands require the connected instrument to have an external mixer option installed and an external mixer to be connected to the connected instrument.

- [Basic settings](#).....623
- [Mixer settings](#).....625
- [Programming example: working with an external mixer](#).....630

**Basic settings**

The basic settings concern general usage of an external mixer.

<a href="#">[SENSe:]MIXer&lt;x&gt;[:STATe]</a> .....	623
<a href="#">[SENSe:]MIXer&lt;x&gt;:BIAS:HIGH</a> .....	624
<a href="#">[SENSe:]MIXer&lt;x&gt;:BIAS[:LOW]</a> .....	624
<a href="#">[SENSe:]MIXer&lt;x&gt;:LOPower</a> .....	624

**[SENSe:]MIXer<x>[:STATe] <State>**

Activates or deactivates the use of a connected external mixer as input for the measurement. This command is only available if the optional External Mixer is installed and an external mixer is connected.

**Suffix:**

<x>	1..n
	irrelevant

**Parameters:**

<State>	ON   OFF   1   0
*RST:	0

**Example:** `MIX ON`

**Manual operation:** See "[External Mixer \(State\)](#)" on page 207

---

**[SENSe:]MIXer<x>:BIAS:HIGH <BiasSetting>**

Defines the bias current for the high (last) range.

Is only available if the external mixer is active (see [SENSe:]MIXer<x>[:STATe] on page 623).

**Suffix:**

<x>                    1..n  
                         irrelevant

**Parameters:**

<BiasSetting>        \*RST:        0.0 A  
                         Default unit: A

**Manual operation:** See "Bias Value " on page 211

---

**[SENSe:]MIXer<x>:BIAS[:LOW] <BiasSetting>**

Defines the bias current for the low (first) range.

Is only available if the external mixer is active (see [SENSe:]MIXer<x>[:STATe] on page 623).

**Suffix:**

<x>                    1..n  
                         irrelevant

**Parameters:**

<BiasSetting>        \*RST:        0.0 A  
                         Default unit: A

**Manual operation:** See "Bias Value " on page 211

---

**[SENSe:]MIXer<x>:LOPower <Level>**

Specifies the LO level of the external mixer's LO port.

**Suffix:**

<x>                    1..n  
                         irrelevant

**Parameters:**

<Level>                Range:        13.0 dBm to 17.0 dBm  
                         Increment:    0.1 dB  
                         \*RST:        15.5 dBm  
                         Default unit: DBM

**Example:**            MIX:LOP 16.0dBm

**Manual operation:** See "LO Level " on page 211

---



## Mixer settings

The following commands are required to configure the band and specific mixer settings.

[SENSe:]MIXer<x>:FREQUency:HANdOver.....	625
[SENSe:]MIXer<x>:FREQUency:STARt.....	625
[SENSe:]MIXer<x>:FREQUency:STOP.....	626
[SENSe:]MIXer<x>:HARMonic:BAND:PRESet.....	626
[SENSe:]MIXer<x>:HARMonic:BAND.....	626
[SENSe:]MIXer<x>:HARMonic:HIGH:STATe.....	627
[SENSe:]MIXer<x>:HARMonic:HIGH[:VALue].....	627
[SENSe:]MIXer<x>:HARMonic:TYPE.....	628
[SENSe:]MIXer<x>:HARMonic[:LOW].....	628
[SENSe:]MIXer<x>:IF?.....	628
[SENSe:]MIXer<x>:LOSS:HIGH.....	628
[SENSe:]MIXer<x>:LOSS:TABLE:HIGH.....	629
[SENSe:]MIXer<x>:LOSS:TABLE[:LOW].....	629
[SENSe:]MIXer<x>:LOSS[:LOW].....	629
[SENSe:]MIXer<x>:PORTs.....	630
[SENSe:]MIXer<x>:RFOVerrange[:STATe].....	630

---

### [SENSe:]MIXer<x>:FREQUency:HANdOver <Frequency>

Defines the frequency at which the mixer switches from one range to the next (if two different ranges are selected). The handover frequency for each band can be selected freely within the overlapping frequency range.

Is only available if the external mixer is active (see [SENSe:]MIXer<x>[:STATe] on page 623).

#### Suffix:

<x>	1..n
	irrelevant

#### Parameters:

<Frequency>	Default unit: HZ
-------------	------------------

#### Example:

```
MIX ON
Activates the external mixer.
MIX:FREQ:HAND 78.0299GHz
Sets the handover frequency to 78.0299 GHz.
```

**Manual operation:** See "Handover Freq" on page 208

---

### [SENSe:]MIXer<x>:FREQUency:STARt

Sets or queries the frequency at which the external mixer band starts.

#### Suffix:

<x>	1..n
	irrelevant

**Example:** `MIX:FREQ:STAR?`  
Queries the start frequency of the band.

**Manual operation:** See "[RF Start / RF Stop](#)" on page 208

#### **[SENSe:]MIXer<x>:FREQuency:STOP**

Sets or queries the frequency at which the external mixer band stops.

**Suffix:**

<x> 1..n  
irrelevant

**Example:** `MIX:FREQ:STOP?`  
Queries the stop frequency of the band.

**Manual operation:** See "[RF Start / RF Stop](#)" on page 208

#### **[SENSe:]MIXer<x>:HARMonic:BAND:PRESet**

Restores the preset frequency ranges for the selected standard waveguide band.

**Note:** Changes to the band and mixer settings are maintained even after using the [PRESET] function. Use this command to restore the predefined band ranges.

**Suffix:**

<x> 1..n  
irrelevant

**Example:** `MIX:HARM:BAND:PRESet`  
Preset the selected waveguide band.

**Manual operation:** See "[Preset Band](#)" on page 209

#### **[SENSe:]MIXer<x>:HARMonic:BAND <Band>**

Selects the external mixer band. The query returns the currently selected band.

Is only available if the external mixer is active (see [\[SENSe:\]MIXer<x>\[:STATe\]](#) on page 623).

**Suffix:**

<x> 1..n  
irrelevant

**Parameters:**

<Band> KA|Q|U|V|E|W|F|D|G|Y|J|USER  
Standard waveguide band or user-defined band.

**Manual operation:** See "[Band](#)" on page 208

Table 13-12: Frequency ranges for pre-defined bands

Band	Frequency start [GHz]	Frequency stop [GHz]
KA (A) *)	26.5	40.0
Q	33.0	50.0
U	40.0	60.0
V	50.0	75.0
E	60.0	90.0
W	75.0	110.0
F	90.0	140.0
D	110.0	170.0
G	140.0	220.0
J	220.0	325.0
Y	325.0	500.0
USER	32.18 (default)	68.22 (default)

\*) The band formerly referred to as "A" is now named "KA".

**[SENSe:]MIXer<x>:HARMonic:HIGH:STATe <State>**

Specifies whether a second (high) harmonic is to be used to cover the band's frequency range.

**Suffix:**

<x> 1..n

**Parameters:**

<State> ON | OFF  
\*RST: ON

**Example:** MIX:HARM:HIGH:STAT ON

**Manual operation:** See "Range 1 /Range 2 " on page 209

**[SENSe:]MIXer<x>:HARMonic:HIGH[:VALue] <HarmOrder>**

Specifies the harmonic order to be used for the high (second) range.

**Suffix:**

<x> 1..n  
irrelevant

**Parameters:**

<HarmOrder> Range: 2 to 128 (USER band); for other bands: see band definition

**Example:**           MIX:HARM:HIGH:STAT ON  
                  MIX:HARM:HIGH 3

**Manual operation:** See "[Harmonic Order](#)" on page 209

**[SENSe:]MIXer<x>:HARMonic:TYPE <OddEven>**

Specifies whether the harmonic order to be used should be odd, even, or both.

Which harmonics are supported depends on the mixer type.

**Suffix:**

<x>                   1..n  
                      irrelevant

**Parameters:**

<OddEven>           ODD | EVEN | EODD  
                      **ODD | EVEN | EODD**  
                      \*RST:     EVEN

**Example:**           MIX:HARM:TYPE ODD

**Manual operation:** See "[Harmonic Type](#)" on page 209

**[SENSe:]MIXer<x>:HARMonic[:LOW] <HarmOrder>**

Specifies the harmonic order to be used for the low (first) range.

**Suffix:**

<x>                   1..n  
                      irrelevant

**Example:**           MIX:HARM 3

**Manual operation:** See "[Harmonic Order](#)" on page 209

**[SENSe:]MIXer<x>:IF?**

Queries the intermediate frequency currently used by the external mixer.

**Suffix:**

<x>                   1..n  
                      irrelevant

**Example:**           MIX:IF?

**Example:**           See "[Programming example: working with an external mixer](#)"  
                      on page 630.

**Usage:**             Query only

**[SENSe:]MIXer<x>:LOSS:HIGH <Average>**

Defines the average conversion loss to be used for the entire high (second) range.

**Suffix:**

&lt;x&gt; 1..n

**Parameters:**

<Average> Range: 0 to 100  
 \*RST: 24.0 dB  
 Default unit: dB

**Example:** MIX:LOSS:HIGH 20dB**Manual operation:** See "[Conversion Loss](#)" on page 209**[SENSe:]MIXer<x>:LOSS:TABLE:HIGH <FileName>**

Defines the conversion loss table to be used for the high (second) range.

**Suffix:**

&lt;x&gt; 1..n

**Parameters:**

<FileName> String containing the path and name of the file, or the serial number of the external mixer whose file is required. The R&S VSE automatically selects the correct cvl file for the current IF. As an alternative, you can also select a user-defined conversion loss table (.ac1 file).

**Manual operation:** See "[Conversion Loss](#)" on page 209**[SENSe:]MIXer<x>:LOSS:TABLE[:LOW] <FileName>**

Defines the file name of the conversion loss table to be used for the low (first) range.

**Suffix:**

&lt;x&gt; 1..n

**Parameters:**

<FileName> String containing the path and name of the file, or the serial number of the external mixer whose file is required. The R&S VSE automatically selects the correct cvl file for the current IF. As an alternative, you can also select a user-defined conversion loss table (.ac1 file).

**Example:** MIX:LOSS:TABL '101567'  
 MIX:LOSS:TABL?  
 //Result:  
 '101567\_MAG\_6\_B5000\_3G5.B5G'

**Manual operation:** See "[Conversion Loss](#)" on page 209**[SENSe:]MIXer<x>:LOSS[:LOW] <Average>**

Defines the average conversion loss to be used for the entire low (first) range.

**Suffix:**

&lt;x&gt; 1..n

**Parameters:**

<Average> Range: 0 to 100  
 \*RST: 24.0 dB  
 Default unit: dB

**Example:** MIX:LOSS 20dB**Manual operation:** See "[Conversion Loss](#)" on page 209**[SENSe:]MIXer<x>:PORTs <PortType>**

Selects the mixer type.

**Suffix:**<x> 1..n  
irrelevant**Parameters:**

<PortType> **2 | 3**  
**2**  
 Two-port mixer.  
**3**  
 Three-port mixer.  
 \*RST: 2

**Example:** MIX:PORT 3**Manual operation:** See "[Mixer Type](#)" on page 209**[SENSe:]MIXer<x>:RFOVerrange[:STATe] <State>**

If enabled, the band limits are extended beyond "RF Start" and "RF Stop" due to the capabilities of the used harmonics.

**Suffix:**<x> 1..n  
irrelevant**Parameters:**

<State> ON | OFF | 1 | 0  
 \*RST: 0

**Manual operation:** See "[RF Overrange](#)" on page 208**Programming example: working with an external mixer**

This example demonstrates how to work with an external mixer in a remote environment. It is performed in the Spectrum application in the default layout configuration. Note that without a real input signal and connected mixer, this measurement will not return useful results.

## Remote commands for the I/Q analyzer

```

//-----Preparing the instrument -----
//Reset the instrument
*RST
//Activate the use of the connected external mixer.
SENS:MIX ON
//----- Configuring basic mixer behavior -----
//Set the LO level of the mixer's LO port to 15 dBm.
SENS:MIX:LOP 15dBm
//Set the bias current to -1 mA .
SENS:MIX:BIAS:LOW -1mA
//----- Configuring the mixer and band settings -----
//Use band "V" to full possible range extent for assigned harmonic (6).
SENS:MIX:HARM:BAND V
SENS:MIX:RFOV ON
//Query the possible range
SENS:MIX:FREQ:STAR?
//Result: 4748000000 (47.48 GHz)
SENS:MIX:FREQ:STOP?
//Result: 13802000000 (138.02 GHz)
//Use a 3-port mixer type
SENS:MIX:PORT 3
//Split the frequency range into two ranges;
//range 1 covers 47.48 GHz GHz to 80 GHz; harmonic 6, average conv. loss of 20 dB
//range 2 covers 80 GHz to 138.02 GHz; harmonic 8, average conv.loss of 30 dB
SENS:MIX:HARM:TYPE EVEN
SENS:MIX:HARM:HIGH:STAT ON
SENS:MIX:FREQ:HAND 80GHz
SENS:MIX:HARM:LOW 6
SENS:MIX:LOSS:LOW 20dB
SENS:MIX:HARM:HIGH 8
SENS:MIX:LOSS:HIGH 30dB
//----- Activating automatic signal identification functions -----
//Activate both automatic signal identification functions.
SENS:MIX:SIGN ALL
//Use auto ID threshold of 8 dB.
SENS:MIX:THR 8dB

//-----Performing the Measurement-----
//Select single sweep mode.
INIT:CONT OFF
//Initiate a basic frequency sweep and wait until the sweep has finished.
INIT;*WAI
//-----Retrieving Results-----
//Return the trace data for the input signal without distortions
//(default screen configuration)
TRAC:DATA? TRACE3

```

### Remote commands for external frontend control

The following commands are available and required only if the optional external frontend control is installed on the connected instrument.

Further commands for external frontend control described elsewhere:

- `INPut:SElect RF`; see `INPut:SElect` on page 617
- `[SENSe<ip>:]FREQuency:CENTer` on page 661
- `DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:RLEVel<ant>` on page 649
- `INPut<ip>:ATTenuation:AUTO` on page 651
- `INPut<ip>:ATTenuation` on page 650
- [Commands for initial configuration](#).....632

### Commands for initial configuration

The following commands are required when you initially set up a measurement with an external frontend on the connected instrument. Note that some commands are not available for all connected instruments, or only as queries.

<code>[SENSe:]EFRontend:ALIGnment&lt;ch&gt;:FILE</code> .....	632
<code>[SENSe:]EFRontend:ALIGnment&lt;ch&gt;:STATe</code> .....	633
<code>[SENSe:]EFRontend:CONNection[:STATe]</code> .....	633
<code>[SENSe:]EFRontend:CONNection:CONFig</code> .....	634
<code>[SENSe:]EFRontend:CONNection:CSTate?</code> .....	634
<code>[SENSe:]EFRontend:FREQuency:BAND:COUNT?</code> .....	635
<code>[SENSe:]EFRontend:FREQuency:BAND&lt;b&gt;:LOWer?</code> .....	635
<code>[SENSe:]EFRontend:FREQuency:BAND&lt;b&gt;:UPPer?</code> .....	635
<code>[SENSe:]EFRontend:FREQuency:BCONfig:AUTO</code> .....	636
<code>[SENSe:]EFRontend:FREQuency:BCONfig:LIST?</code> .....	636
<code>[SENSe:]EFRontend:FREQuency:BCONfig:SElect</code> .....	637
<code>[SENSe:]EFRontend:FREQuency:IFRequency:SIDeband?</code> .....	637
<code>[SENSe:]EFRontend:FREQuency:IFRequency[:VALue]?</code> .....	638
<code>[SENSe:]EFRontend:FREQuency:REFerence</code> .....	638
<code>[SENSe:]EFRontend:FREQuency:REFerence:LIST?</code> .....	638
<code>[SENSe:]EFRontend:IDN?</code> .....	639
<code>[SENSe:]EFRontend[:STATe]</code> .....	639

---

#### `[SENSe:]EFRontend:ALIGnment<ch>:FILE <File>`

Selects or queries the touchstone file that contains correction data to compensate for signal losses in the cable occurring at different IF signal frequencies.

#### Suffix:

<code>&lt;ch&gt;</code>	1..n
	Currently irrelevant



**Parameters:**

<File> string in double quotes  
 Path and file name of the correction data file. The file must be in s2p format.  
 If the specified file is not found or does not have the correct format, an error message is returned (-256, "File name not found", -150, "String data error").

**Example:**

```
EFR:ALIG:FILE "FE44S.s2p"
```

**Manual operation:** See "[Load Cable Correction S2P File](#)" on page 215

**[SENSe:]EFRontend:ALIGnment<ch>:STATe <State>**

Activates correction of the IF signal due to cable loss from the frontend to the analyzer. Specify the file with correction data using [\[SENSe:\]EFRontend:ALIGnment<ch>:FILE](#) on page 632.

**Suffix:**

<ch> 1..n  
 Currently irrelevant

**Parameters:**

<State> ON | OFF | 0 | 1  
**OFF | 0**  
 Switches the function off  
**ON | 1**  
 Switches the function on  
 \*RST: 0

**Manual operation:** See "[Correction State](#)" on page 215

**[SENSe:]EFRontend:CONNection[:STATe] <State>**

Queries the external frontend connection state in the firmware.

Note: to query the physical connection state of the external frontend, use [\[SENSe:\]EFRontend:CONNection:CSTate?](#) on page 634.

**Parameters:**

<State> ON | OFF | 0 | 1  
**OFF | 0**  
 The connection to the frontend is deactivated temporarily. The frontend is thus available for use elsewhere, for example by a signal generator. The measurement settings on the R&S VSE remain untouched.  
**ON | 1**  
 Frontend connection enabled.  
 The frontend is reserved for exclusive use by the R&S VSE.  
 \*RST: 0

**Example:**

```
//Global activation of external frontend
EFR ON
//Configure frontend
EFR:CONN:CONF "FE44S", "123.456.789"
//Activate exclusive use of frontend by
R&S VSE.
EFR:CONN ON
```

**Manual operation:** See ["External Frontend Connection State"](#) on page 213

**[SENSe:]EFRontend:CONNECTION:CONFIg <Type>, <IPAddress>[, <DeviceID>, <SymbolicName>]**

Configures the connection to the external frontend.

**Parameters:**

<Type> String in double quotes containing the type of frontend to be connected.

<IPAddress> string in double quotes  
The IP address or computer name of the frontend connected to the R&S VSE via LAN. The IP address and computer name are indicated on the electronic ink display on the side panel of the frontend.

<DeviceID> string in double quotes  
Unique device ID consisting of <type>-<serialnumber>  
Not required or relevant for the R&S VSE.

<SymbolicName> string in double quotes  
Symbolic name of the external frontend.  
Not required or relevant for the R&S VSE.

**Example:**

```
//Global activation of external frontend
EFR ON
//Configure frontend
EFR:CONN:CONF "FE44S", "123.456.789"
//Activate exclusive use of frontend by
R&S VSE.
EFR:CONN ON
```

**Manual operation:** See ["Frontend Type"](#) on page 213  
See ["IP Address/ Computer Name"](#) on page 213

**[SENSe:]EFRontend:CONNECTION:CState?**

Queries the status of the physical connection to the external frontend.

**Return values:**

<State> ON | OFF | 0 | 1  
**OFF | 0**  
Frontend not connected; connection error

**ON | 1**

Frontend connected

**Usage:** Query only**Manual operation:** See "[External Frontend Connection State](#)" on page 213**[SENSe:]EFRontend:FREQuency:BAND:COUNT?**

Queries the number of frequency bands provided by the selected frontend.

**Return values:**

<NoBands> integer  
 Number of frequency bands

**Example:** `//Query number of frequency bands  
 EFR:FREQ:BAND:COUN?  
 //Result: 2`

**Usage:** Query only**Manual operation:** See "[Frequency Band](#)" on page 215**[SENSe:]EFRontend:FREQuency:BAND<b>:LOWer?**

Queries the start of the frequency range supported by the selected frontend frequency band.

**Suffix:**

<b> 1..n  
 Band for multi-band frontends  
 Use [\[SENSe:\]EFRontend:FREQuency:BAND:COUNT?](#)  
 on page 635 to determine the number of available bands.

**Return values:**

<StartFreq> Start frequency of the specified band

**Example:** `//Query start frequency of second band  
 EFR:FREQ:BAND2:LOW?  
 //Result: 24000000000`

**Usage:** Query only**Manual operation:** See "[Frequency Band](#)" on page 215**[SENSe:]EFRontend:FREQuency:BAND<b>:UPPer?**

Queries the end of the frequency range supported by the selected frontend frequency band.

**Suffix:**

<b> 1..n  
 Band for multi-band frontends  
 Use `[SENSe:]EFRontend:FREQUENCY:BAND:COUNT?`  
 on page 635 to determine the number of available bands.

**Return values:**

<StopFreq> End frequency of the specified band

**Example:**

```
//Query end frequency of second band
EFR:FREQ:BAND2:UPP?
//Result: 44000000000
```

**Usage:**

Query only

**Manual operation:** See ["Frequency Band"](#) on page 215

**[SENSe:]EFRontend:FREQUENCY:BCONfig:AUTO <State>**

Determines whether the frequency band of the external frontend is configured automatically or manually.

**Parameters:**

<State> ON | OFF | 0 | 1

**OFF | 0**

Uses the frequency band configured by `[SENSe:]EFRontend:FREQUENCY:BCONfig:SElect` on page 637.

**ON | 1**

Configures the frequency band automatically

\*RST: 1

**Example:**

```
//Configures the use of the IF high band manually.
EFR:FREQ:BCON:AUTO 0
EFR:FREQ:BCON:SEL "IF HIGH"
```

**Manual operation:** See ["Frequency Band Configuration"](#) on page 214

**[SENSe:]EFRontend:FREQUENCY:BCONfig:LIST?**

Returns the intermediate frequency (output) range of the external frontend.

**Return values:**

<BandConfigs> string

**"IF LOW"**

A higher intermediate frequency is used on the external frontend, resulting in a higher input frequency at the R&S VSE.

**"IF HIGH"**

A lower intermediate frequency is used on the external frontend, resulting in a lower input frequency at the R&S VSE.

**Example:**           EFR:FREQ:BCON:LIST?  
                   //Result: "IF HIGH", "IF LOW"  
                   EFR:FREQ:BCON:SEL "IF HIGH"

**Usage:**            Query only

**Manual operation:** See ["Frequency Band Configuration"](#) on page 214

**[SENSe:]EFRontend:FREQuency:BCONfig:SElect <BandConfig>**

Defines the intermediate frequency (output) range of the external frontend.

**Parameters:**

<BandConfig>

**"IF HIGH"**

(R&S FE44S/ R&S FE50DTR)

A higher intermediate frequency is used on the external frontend, resulting in a higher input frequency at the connected instrument.

**"IF LOW"**

(R&S FE44S/ R&S FE50DTR)

A lower intermediate frequency is used on the external frontend, resulting in a lower input frequency at the connected instrument.

**"Spur Optimized"**

(R&S FE170SR/R&S FE110SR only)

The selected IF range avoids unwanted spurious effects.

**"EVM Optimized"**

(R&S FE170SR/R&S FE110SR only)

The selected IF range provides an optimal EVM result.

**"Shared LO"**

(R&S FE170SR/R&S FE110SR only)

Ensures that multiple external frontends (R&S FE170SR/ R&S FE170ST or R&S FE110SR/R&S FE110ST) use the same LO frequencies for upconversion and downconversion.

**Example:**           EFR:FREQ:BCON:LIST?  
                   //Result: "IF HIGH", "IF LOW"  
                   EFR:FREQ:BCON:SEL "IF HIGH"

**Manual operation:** See ["Frequency Band Configuration"](#) on page 214

**[SENSe:]EFRontend:FREQuency:IFRequency:SIDeband?**

Queries the currently used sideband for frequency conversion.

**Return values:**

<Sideband>

"USB" | "LSB"

**"USB"**

Upper sideband

**"LSB"**

Lower sideband

**Example:** EFR:FREQ:IFR?  
EFR:FREQ:IFR:SID?

**Usage:** Query only

**Manual operation:** See "[Intermediate Frequency](#)" on page 215

**[SENSe:]EFRontend:FREQuency:IFRequency[:VALue]?**

Queries the currently used intermediate frequency (IF) for frequency conversion.

**Return values:**  
<IFFrequency> numeric

**Example:** EFR:FREQ:IFR?

**Usage:** Query only

**Manual operation:** See "[Intermediate Frequency](#)" on page 215

**[SENSe:]EFRontend:FREQuency:REFerence <Frequency>**

Sets the reference frequency that is used for frequency conversion on the frontend. Depending on the connected type of frontend, different values are available. To determine which reference levels are available, use [\[SENSe:\]EFRontend:FREQuency:REFerence:LIST?](#) on page 638.

**Parameters:**  
<Frequency> Default unit: HZ

**Example:** //Query the available reference levels  
EFR:FREQ:REF:LIST?  
//Result: 10000000,640000000,1000000000  
//Use 640 MHz reference  
EFR:FREQ:REF 640000000

**Manual operation:** See "[Reference Frequency](#)" on page 215

**[SENSe:]EFRontend:FREQuency:REFerence:LIST?**

Queries the available reference signals for the connected frontend type.

**Return values:**  
<References> 10000000 | 640000000 | 1000000000

**Example:** //Query the available reference levels  
EFR:FREQ:REF:LIST?  
//Result: 10000000,640000000,1000000000  
//Use 640 MHz reference  
EFR:FREQ:REF 640000000

**Usage:** Query only

**Manual operation:** See "[Reference Frequency](#)" on page 215

**[SENSe:]EFRontend:IDN?**

Queries the device identification information (\*IDN?) of the frontend.

**Return values:**

<DevInfo> string without quotes  
 Rohde&Schwarz,<device type>,<part number>/<serial number>,<firmware version>

**Example:**

```
EFR:IDN?
//Result: Rohde&Schwarz,FE44S,
1234.5678K00/123456,0.8.0
```

**Usage:** Query only

**[SENSe:]EFRontend[:STATe] <State>**

Enables or disables the general use of an external frontend for the application.

For details, see ["Global activation"](#) on page 212.

**Parameters:**

<State> ON | OFF | 0 | 1  
**OFF | 0**  
 The frontend is disconnected. The application adapts the measurement settings to the common settings supported by the R&S VSE.  
**ON | 1**  
 The R&S VSE allows you to configure and connect an external frontend for the application. The application adapts the available measurement settings to the connected frontend. The channel bar indicates "Inp: ExtFe".  
 \*RST: 0

**Example:** EFR ON

**Manual operation:** See ["Global activation"](#) on page 212

**Working with power sensors**

The following commands describe how to work with power sensors.

These commands require the use of a Rohde & Schwarz power sensor. For a list of supported sensors, see the data sheet.

- [Configuring power sensors](#)..... 639
- [Configuring power sensor measurements](#)..... 641

**Configuring power sensors**

[SYSTem:COMMunicate:RDEvice:PMETer<p>:CONFigure:AUTO\[:STATe\]](#)..... 640  
[SYSTem:COMMunicate:RDEvice:PMETer<p>:COUNT?](#)..... 640  
[SYSTem:COMMunicate:RDEvice:PMETer<p>:DEFine](#)..... 640

**SYSTem:COMMunicate:RDEvice:PMETer<p>:CONFigure:AUTO[:STATe] <State>**

Turns automatic assignment of a power sensor to the power sensor index on and off.

**Suffix:**

<p> Power sensor index

**Parameters:**

<State> ON | OFF | 0 | 1  
\*RST: 1

**Example:** SYST:COMM:RDEV:PMET:CONF:AUTO OFF

**Manual operation:** See "Select" on page 217

**SYSTem:COMMunicate:RDEvice:PMETer<p>:COUNT?**

Queries the number of power sensors currently connected to the R&S VSE.

**Suffix:**

<p> Power sensor index

**Return values:**

<NumberSensors> Number of connected power sensors.

**Example:** SYST:COMM:RDEV:PMET:COUN?

**Usage:** Query only

**Manual operation:** See "Select" on page 217

**SYSTem:COMMunicate:RDEvice:PMETer<p>:DEFine <Placeholder>, <Type>, <Interface>, <SerialNo>**

Assigns the power sensor with the specified serial number to the selected power sensor index (configuration).

The query returns the power sensor type and serial number of the sensor assigned to the specified index.

**Suffix:**

<p> Power sensor index

**Parameters:**

<Placeholder> Currently not used

<Type> Detected power sensor type, e.g. "NRP-Z81".

<Interface> Interface the power sensor is connected to; always "USB"

<SerialNo> Serial number of the power sensor assigned to the specified index



**Example:** `SYST:COMM:RDEV:PMET2:DEF '', 'NRP-Z81', '', '123456'`  
 Assigns the power sensor with the serial number '123456' to the configuration "Power Sensor 2".  
`SYST:COMM:RDEV:PMET2:DEF?`  
 Queries the sensor assigned to "Power Sensor 2".  
**Result:**  
`'' , 'NRP-Z81', 'USB', '123456'`  
 The NRP-Z81 power sensor with the serial number '123456' is assigned to the "Power Sensor 2".

**Manual operation:** See "[Select](#)" on page 217

### Configuring power sensor measurements

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<a href="#">CALCulate&lt;n&gt;:PMETer&lt;p&gt;:RELative[:MAGNitude]:AUTO ONCE</a> .....	642
<a href="#">CALCulate&lt;n&gt;:PMETer&lt;p&gt;:RELative:STATe</a> .....	642
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---

### **CALibration:PMETer<p>:ZERO:AUTO ONCE**

Zeroes the power sensor.

Note that you have to disconnect the signals from the power sensor input before you start to zero the power sensor. Otherwise, results are invalid.

**Suffix:**

<p> Power sensor index

**Example:** `CAL:PMET2:ZERO:AUTO ONCE;*WAI`  
 Starts zeroing the power sensor 2 and delays the execution of further commands until zeroing is concluded.

**Usage:** Event

**Manual operation:** See "[Zeroing Power Sensor](#)" on page 217

**CALCulate<n>:PMETer<p>:RELative[:MAGNitude] <RefValue>**

Defines the reference value for relative measurements.

**Suffix:**

<n> [Window](#)

<p> Power sensor index

**Parameters:**

<RefValue> Range: -200 dBm to 200 dBm  
\*RST: 0  
Default unit: DBM

**Example:**

CALC:PMET2:REL -30

Sets the reference value for relative measurements to -30 dBm for power sensor 2.

**Manual operation:** See ["Reference Value "](#) on page 218

**CALCulate<n>:PMETer<p>:RELative[:MAGNitude]:AUTO ONCE**

Sets the current measurement result as the reference level for relative measurements.

**Suffix:**

<n> [Window](#)

<p> Power sensor index

**Example:**

CALC:PMET2:REL:AUTO ONCE

Takes the current measurement value as reference value for relative measurements for power sensor 2.

**Usage:**

Event

**Manual operation:** See ["Setting the Reference Level from the Measurement Measurements -> Ref "](#) on page 218

**CALCulate<n>:PMETer<p>:RELative:STATe <State>**

Turns relative power sensor measurements on and off.

**Suffix:**

<n> [Window](#)

<p> Power sensor index

**Parameters:**

<State> ON | OFF | 0 | 1  
**OFF | 0**  
Switches the function off  
**ON | 1**  
Switches the function on

**Example:** `CALC:PMET2:REL:STAT ON`  
 Activates the relative display of the measured value for power sensor 2.

---

#### **FETCH:PMETer<p>?**

Queries the results of power sensor measurements.

**Suffix:**  
 <p> Power sensor index

**Usage:** Query only

---

#### **READ:PMETer<p>?**

Initiates a power sensor measurement and queries the results.

**Suffix:**  
 <p> Power sensor index

**Usage:** Query only

---

#### **[SENSe:]PMETer<p>:DCYClE[:STATe] <State>**

Turns the duty cycle correction on and off.

**Suffix:**  
 <p> Power sensor index

**Parameters:**  
 <State> **ON | OFF | 0 | 1**  
**OFF | 0**  
 Switches the function off  
**ON | 1**  
 Switches the function on

**Example:** `PMET2:DCYC:STAT ON`

**Manual operation:** See "[Duty Cycle](#)" on page 219

---

#### **[SENSe:]PMETer<p>:DCYClE:VALue <Percentage>**

Defines the duty cycle for the correction of pulse signals.

The power sensor uses the duty cycle in combination with the mean power to calculate the power of the pulse.

**Suffix:**  
 <p> Power sensor

**Parameters:**

<Percentage>      Range:      0.001 to 99.999  
                          \*RST:      99.999  
                          Default unit: %

**Example:**

PMET2:DCYC:STAT ON  
 Activates the duty cycle correction.  
 PMET2:DCYC:VAL 0.5  
 Sets the correction value to 0.5%.

**Manual operation:** See "[Duty Cycle](#)" on page 219

**[SENSe:]PMETer<p>:FREQUency <Frequency>**

Defines the frequency of the power sensor.

**Suffix:**

<p>                      Power sensor index

**Parameters:**

<Frequency>      The available value range is specified in the data sheet of the power sensor in use.

\*RST:      50 MHz  
 Default unit: HZ

**Example:**

PMET2:FREQ 1GHZ  
 Sets the frequency of the power sensor to 1 GHz.

**Manual operation:** See "[Frequency Manual](#)" on page 217

**[SENSe:]PMETer<p>:FREQUency:LINK <Coupling>**

Selects the frequency coupling for power sensor measurements.

**Suffix:**

<p>                      Power sensor index

**Parameters:**

<Coupling>

**CENTER**

Couples the frequency to the center frequency of the analyzer

**MARKer1**

Couples the frequency to the position of marker 1

**OFF**

Switches the frequency coupling off

\*RST:      CENTER

**Example:**

PMET2:FREQ:LINK CENT  
 Couples the frequency to the center frequency of the analyzer

**Manual operation:** See "[Frequency Coupling](#)" on page 218

**[SENSe:]PMETer<p>:MTIME <Duration>**

Selects the duration of power sensor measurements.

**Suffix:**

<p> Power sensor index

**Parameters:**

<Duration> SHORT | NORMAl | LONG  
\*RST: NORMAl

**Example:**

PMET2:MTIM SHOR

Sets a short measurement duration for measurements of stationary high power signals for the selected power sensor.

**Manual operation:** See "[Meas Time/Average](#)" on page 218

**[SENSe:]PMETer<p>:MTIME:AVERAge:COUNT <NumberReadings>**

Sets the number of power readings included in the averaging process of power sensor measurements.

Extended averaging yields more stable results for power sensor measurements, especially for measurements on signals with a low power, because it minimizes the effects of noise.

**Suffix:**

<p> Power sensor index

**Parameters:**

<NumberReadings> An average count of 0 or 1 performs one power reading.  
Range: 0 to 256  
Increment: binary steps (1, 2, 4, 8, ...)

**Example:**

PMET2:MTIM:AVER ON

Activates manual averaging.

PMET2:MTIM:AVER:COUN 8

Sets the number of readings to 8.

**Manual operation:** See "[Average Count \(Number of Readings\)](#)" on page 219

**[SENSe:]PMETer<p>:MTIME:AVERAge[:STATe] <State>**

Turns averaging for power sensor measurements on and off.

**Suffix:**

<p> Power sensor index

**Parameters:**

<State> ON | OFF | 0 | 1  
**OFF | 0**  
Switches the function off

**ON | 1**

Switches the function on

**Example:** `PMET2:MTIM:AVER ON`  
Activates manual averaging.

**Manual operation:** See "[Meas Time/Average](#)" on page 218

**[SENSe:]PMETer<p>:ROFFset[:STATe] <State>**

Includes or excludes the reference level offset of the analyzer for power sensor measurements.

**Suffix:**

<p> Power sensor index

**Parameters:**

<State> ON | OFF | 0 | 1

**OFF | 0**

Switches the function off

**ON | 1**

Switches the function on

**Example:** `PMET2:ROFF OFF`  
Takes no offset into account for the measured power.

**Manual operation:** See "[Use Ref Level Offset](#)" on page 218

**[SENSe:]PMETer<p>:SOFFset <SensorOffset>**

Takes the specified offset into account for the measured power. Only available if [\[SENSe:\]PMETer<p>:ROFFset\[:STATe\]](#) is disabled.

**Suffix:**

<p> Power sensor index

**Parameters:**

<SensorOffset> Default unit: DB

**Example:** `PMET2:SOFF 0.001`

**Manual operation:** See "[Sensor Level Offset](#)" on page 219

**[SENSe:]PMETer<p>[:STATe] <State>**

Turns a power sensor on and off.

**Suffix:**

<p> Power sensor index

**Parameters:**

<State> ON | OFF | 0 | 1

**OFF | 0**

Switches the function off

**ON | 1**

Switches the function on

**Example:** `PMET1 ON`  
Switches the power sensor measurements on.

**Manual operation:** See "[Select](#)" on page 217

**[SENSe:]PMETer<p>:UPDate[:STATe] <State>**

Turns continuous update of power sensor measurements on and off.

If on, the results are updated even if a single sweep is complete.

**Suffix:**

<p> Power sensor index

**Parameters:**

<State> ON | OFF | 0 | 1

**OFF | 0**

Switches the function off

**ON | 1**

Switches the function on

**Example:** `PMET1:UPD ON`  
The data from power sensor 1 is updated continuously.

**Manual operation:** See "[Continuous Value Update](#)" on page 217

**UNIT<n>:PMETer<p>:POWer <Unit>**

Selects the unit for absolute power sensor measurements.

**Suffix:**

<n> irrelevant

<p> Power sensor index

**Parameters:**

<Unit> DBM | WATT | W | DB | PCT

\*RST: DBM

**Example:** `UNIT:PMET:POW DBM`

**Manual operation:** See "[Unit/Scale](#)" on page 218

**UNIT<n>:PMETer<p>:POWer:RATio <Unit>**

Selects the unit for relative power sensor measurements.

**Suffix:**

<n> irrelevant

<p> Power sensor index

**Parameters:**

<Unit> DB | PCT  
 \*RST: DB

**Example:** UNIT:PMET:POW:RAT DB

**Manual operation:** See "Unit/Scale " on page 218

**13.6.2.2 Configuring the vertical axis (amplitude, scaling)**

The following commands are required to configure the amplitude and vertical axis settings in a remote environment.

- [Amplitude settings](#).....648
- [Configuring the attenuation](#).....650
- [Configuring a preamplifier](#).....654
- [Scaling the Y-axis](#).....655

**Amplitude settings**

- [\[SENSe<ip>:\]ADJust:LEVel](#) on page 685

**Remote commands exclusive to amplitude configuration:**

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<a href="#">UNIT&lt;n&gt;:POWer</a> .....	648
<a href="#">CALCulate&lt;n&gt;:UNIT:POWer</a> .....	648
<a href="#">DISPlay[:WINDow&lt;n&gt;][:SUBWindow&lt;w&gt;]:TRACe&lt;t&gt;:Y[:SCALe]:RLEVel&lt;ant&gt;</a> .....	649
<a href="#">DISPlay[:WINDow&lt;n&gt;][:SUBWindow&lt;w&gt;]:TRACe&lt;t&gt;:Y[:SCALe]:RLEVel&lt;ant&gt;:OFFSet</a> .....	649

**CALCulate<n>:MARKer<m>:FUNction:REFerence**

Matches the reference level to the power level of a marker.

If you use the command in combination with a delta marker, that delta marker is turned into a normal marker.

**Suffix:**

<n> [Window](#)

<m> [Marker](#)

**Example:** CALC:MARK2:FUNC:REF  
 Sets the reference level to the level of marker 2.

**Manual operation:** See "Reference Level = Marker Level " on page 429

**UNIT<n>:POWer <Unit>**  
**CALCulate<n>:UNIT:POWer <Unit>**

Selects the unit of the y-axis.

The unit applies to all power-based measurement windows with absolute values.



**Suffix:**

<n> irrelevant

**Parameters:**

<Unit> DBM | V | A | W | DBPW | WATT | DBUV | DBMV | VOLT |  
DBUA | AMPere

\*RST: dBm

**Example:**

CALC:UNIT:POW DBM

Sets the power unit to dBm.

**Manual operation:** See "Unit " on page 225

**DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:RLEVel<ant>**  
**<ReferenceLevel>**

Defines the reference level (for all traces in all windows).

With a reference level offset ≠ 0, the value range of the reference level is modified by the offset.

**Suffix:**

<n> irrelevant

<w> subwindow  
Not supported by all applications

<t> irrelevant

<ant> [Input source](#) (for MIMO measurements only)

**Parameters:**

<ReferenceLevel> The unit is variable.

Range: see datasheet

\*RST: 0 dBm

Default unit: DBM

**Example:**

DISP:TRAC:Y:RLEV -60dBm

**Manual operation:** See "Reference Level " on page 224

**DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:RLEVel<ant>:**  
**OFFSet <Offset>**

Defines a reference level offset (for all traces in all windows).

**Suffix:**

<n> irrelevant

<w> subwindow  
Not supported by all applications

<t> irrelevant

<ant> [Input source](#) (for MIMO measurements only)

**Parameters:**

<Offset>                   Range:       -200 dB to 200 dB  
                               \*RST:        0dB  
                               Default unit: DB

**Example:**

DISP:TRAC:Y:RLEV:OFFS -10dB

**Manual operation:** See "Shifting the Display (Offset )" on page 224  
 See "Shifting the Display (Offset )" on page 234

**Configuring the attenuation**

INPut<ip>:ATTenuation.....	650
INPut<ip>:ATTenuation:AUTO.....	651
INPut<ip>:ATTenuation:AUTO:MODE.....	651
INPut:EATT.....	651
INPut:EATT:AUTO.....	652
INPut:EATT:STATe.....	652
INPut<ip>:SANalyzer:ATTenuation.....	653
INPut<ip>:SANalyzer:ATTenuation:AUTO.....	653

**INPut<ip>:ATTenuation <Attenuation>**

Defines the total attenuation for RF input.

If an electronic attenuator is available and active, the command defines a mechanical attenuation (see [INPut:EATT:STATe](#) on page 652).

If you set the attenuation manually, it is no longer coupled to the reference level, but the reference level is coupled to the attenuation. Thus, if the current reference level is not compatible with an attenuation that has been set manually, the command also adjusts the reference level.

If an external frontend is active (see [\[SENSe:\]EFRontend\[:STATe\]](#) on page 639), you can configure the attenuation of the external frontend and the analyzer separately. See also [INPut<ip>:SANalyzer:ATTenuation:AUTO](#) on page 653 and [INPut<ip>:SANalyzer:ATTenuation](#) on page 653.

Is not available if the optional "Digital Baseband" interface is active.

**Suffix:**

<ip>                        1..n

**Parameters:**

<Attenuation>           Range:       see data sheet  
                               Increment:  5 dB (with optional electr. attenuator: 1 dB)  
                               \*RST:       10 dB (AUTO is set to ON)  
                               Default unit: DB

**Example:**

INP:ATT 30dB

Defines a 30 dB attenuation and decouples the attenuation from the reference level.

**Manual operation:** See "External Frontend Attenuation" on page 226  
 See "Attenuation Mode / Value " on page 226

**INPut<ip>:ATTenuation:AUTO <State>**

Couples or decouples the attenuation to the reference level. Thus, when the reference level is changed, the R&S VSE determines the signal level for optimal internal data processing and sets the required attenuation accordingly.

If an external frontend is active (see [SENSe:]EFRontend[:STATe] on page 639), you can configure the attenuation of the external frontend and the analyzer separately. See also INPut<ip>:SANalyzer:ATTenuation:AUTO on page 653 and INPut<ip>:SANalyzer:ATTenuation on page 653.

**Suffix:**

<ip> 1..n

**Parameters:**

<State> ON | OFF | 0 | 1  
\*RST: 1

**Example:**

INP:ATT:AUTO ON  
Couples the attenuation to the reference level.

**Manual operation:** See "[External Frontend Attenuation](#)" on page 226  
See "[Attenuation Mode / Value](#)" on page 226

**INPut<ip>:ATTenuation:AUTO:MODE <OptMode>**

Selects the priority for signal processing *after* the RF attenuation has been applied.

**Suffix:**

<ip> 1..n

**Parameters:**

<OptMode> LNOise | LDISTortion

**LNOise**

Optimized for high sensitivity and low noise levels

**LDISTortion**

Optimized for low distortion by avoiding intermodulation

\*RST: LDISTortion (WLAN application: LNOise)

**Example:**

INP:ATT:AUTO:MODE LNO

**Manual operation:** See "[Optimization](#)" on page 227

**INPut:EATT <Attenuation>**

Defines an electronic attenuation manually. Automatic mode must be switched off (INP:EATT:AUTO OFF, see INPut:EATT:AUTO on page 652).

If the current reference level is not compatible with an attenuation that has been set manually, the command also adjusts the reference level.

Requires the electronic attenuation hardware option.

**Parameters:**

<Attenuation>           attenuation in dB  
 Range:            see data sheet  
 Increment:        1 dB  
 \*RST:            0 dB (OFF)  
 Default unit:     DB

**Example:**

```
INP:EATT:AUTO OFF
INP:EATT 10 dB
```

**Manual operation:** See ["Using Electronic Attenuation "](#) on page 227

**INPut:EATT:AUTO <State>**

Turns automatic selection of the electronic attenuation on and off.

If on, electronic attenuation reduces the mechanical attenuation whenever possible.

Requires the electronic attenuation hardware option.

**Parameters:**

<State>                ON | OFF | 0 | 1  
**OFF | 0**  
 Switches the function off  
**ON | 1**  
 Switches the function on  
 \*RST:                1

**Example:**

```
INP:EATT:AUTO OFF
```

**Manual operation:** See ["Using Electronic Attenuation "](#) on page 227

**INPut:EATT:STATe <State>**

Turns the electronic attenuator on and off.

Requires the electronic attenuation hardware option.

**Parameters:**

<State>                ON | OFF | 0 | 1  
**OFF | 0**  
 Switches the function off  
**ON | 1**  
 Switches the function on  
 \*RST:                0

**Example:**

```
INP:EATT:STAT ON
```

Switches the electronic attenuator into the signal path.

**Manual operation:** See ["Using Electronic Attenuation "](#) on page 227

**INPut<ip>:SANalyzer:ATTenuation <Attenuation>**

Configures attenuation at the analyzer input for an active external frontend manually.

**Suffix:**

<ip> 1..n

**Parameters:**

<Attenuation> Range: see data sheet  
Increment: 1 dB  
Default unit: DB

**Manual operation:** See "[Attenuation Mode / Value](#)" on page 226

**INPut<ip>:SANalyzer:ATTenuation:AUTO <State>**

Enables or disables automatic configuration of attenuation at the analyzer input for an active external frontend.

By default, the attenuation settings are applied at the input of the external frontend, see [INPut<ip>:ATTenuation:AUTO](#) on page 651 and [INPut<ip>:ATTenuation](#) on page 650.

**Suffix:**

<ip> 1..n

**Parameters:**

<State> ON | OFF | 0 | 1

**OFF | 0**

Auto mode for analyzer attenuation is disabled. Allows you to configure attenuation at the analyzer using [INPut<ip>:SANalyzer:ATTenuation](#) on page 653.

**ON | 1**

Auto mode for analyzer attenuation is enabled. No attenuation is configured at the analyzer.

\*RST: 0

**Example:**

```
//Enable external frontend
EFR ON

//Query the currently configured RF attenuation
INP:ATT?
//Result: 10 dB

//Disable auto mode for analyzer attenuation
INP:SAN:ATT:AUTO OFF

//Configure 10 dB attenuation at the analyzer
INP:SAN:ATT 10

//Query the currently configured RF attenuation at the ext. FE
INP:ATT?
//Result: 0 dB
```

**Manual operation:** See "[Attenuation Mode / Value](#)" on page 226

### Configuring a preamplifier

<a href="#">INPut&lt;ip&gt;:GAIN&lt;ant&gt;:STATe</a> .....	654
<a href="#">INPut&lt;ip&gt;:GAIN&lt;ant&gt;[:VALue]</a> .....	654

---

#### INPut<ip>:GAIN<ant>:STATe <State>

Turns the internal preamplifier on the connected instrument on and off. It requires the additional preamplifier hardware option on the connected instrument.

##### Suffix:

<ip>                    1 | 2  
                          irrelevant

<ant>                    [Input source](#) (for MIMO measurements only)

##### Parameters:

<State>                ON | OFF | 0 | 1  
                          **OFF | 0**  
                          Switches the function off  
                          **ON | 1**  
                          Switches the function on  
                          \*RST:        0

**Example:**            INP:GAIN:STAT ON  
                          INP:GAIN:VAL 15  
                          Switches on 15 dB preamplification.

**Manual operation:** See "[Preamplifier](#)" on page 227

---

#### INPut<ip>:GAIN<ant>[:VALue] <Gain>

Selects the "gain" if the preamplifier is activated (INP:GAIN:STAT ON, see [INPut<ip>:GAIN<ant>:STATe](#) on page 654).

The command requires the additional preamplifier hardware option.

##### Suffix:

<ip>                    1 | 2  
                          irrelevant

<ant>                    [Input source](#) (for MIMO measurements only)

##### Parameters:

<Gain>                15 dB and 30 dB  
                          All other values are rounded to the nearest of these two.  
                          30 dB  
                          Default unit: DB

**Example:**            INP:GAIN:STAT ON  
                          INP:GAIN:VAL 30  
                          Switches on 30 dB preamplification.

**Manual operation:** See "[Preamplifier](#)" on page 227

### Scaling the Y-axis

DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe].....	655
DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:AUTO ONCE.....	655
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DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:PDIVision.....	656
DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:RPOSition.....	656
DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y:SPACing.....	657

---

#### DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe] <Range>

Defines the display range of the y-axis (for all traces).

Note that the command works only for a logarithmic scaling. You can select the scaling with `DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y:SPACing`.

#### Suffix:

<n>	Window
<w>	subwindow Not supported by all applications
<t>	irrelevant

#### Parameters:

<Range>	Range: 1 dB to 200 dB
	*RST: 100 dB
	Default unit: HZ

**Example:** `DISP:TRAC:Y 110dB`

**Manual operation:** See "Range " on page 231  
See "Y-Axis Max " on page 232

---

#### DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:AUTO ONCE

Automatic scaling of the y-axis is performed once, then switched off again (for all traces).

#### Suffix:

<n>	Window
<t>	irrelevant

---

#### DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:MODE <Mode>

Selects the type of scaling of the y-axis (for all traces).

When the display update during remote control is off, this command has no immediate effect.

#### Suffix:

<n>	Window
<w>	subwindow

<t> irrelevant

**Parameters:**

<Mode>           **ABSolute**  
absolute scaling of the y-axis

**RELative**  
relative scaling of the y-axis

\*RST:           ABSolute

**Example:**           DISP:TRAC:Y:MODE REL

**Manual operation:** See "Scaling " on page 232

**DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:PDIVision**  
<Value>

This remote command determines the grid spacing on the Y-axis for all diagrams, where possible.

In spectrum displays, for example, this command is not available.

**Suffix:**

<n>                   Window

<w>                   subwindow  
Not supported by all applications

<t>                   irrelevant

**Parameters:**

<Value>           numeric value WITHOUT UNIT (unit according to the result display)  
Defines the range per division (total range = 10\*<Value>)

\*RST:           depends on the result display  
Default unit: DBM

**Example:**           DISP:TRAC:Y:PDIV 10  
Sets the grid spacing to 10 units (e.g. dB) per division

**DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:RPOSition**  
<Position>

Defines the vertical position of the reference level on the display grid (for all traces).

The R&S VSE adjusts the scaling of the y-axis accordingly.

**Suffix:**

<n>                   Window

<w>                   subwindow  
Not supported by all applications

<t>                   irrelevant



**Parameters:**

<Position> 0 PCT corresponds to the lower display border, 100% corresponds to the upper display border.  
 \*RST: 100 PCT = frequency display; 50 PCT = time display  
 Default unit: PCT

**Example:**

DISP:TRAC:Y:RPOS 50PCT

**Manual operation:** See "Ref Level Position " on page 231

**DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y:SPACing <ScalingType>**

Selects the scaling of the y-axis (for all traces, <t> is irrelevant).

**Suffix:**

<n> [Window](#)  
 <w> subwindow  
 <t> [Trace](#)

**Parameters:**

<ScalingType> **LOGarithmic**  
 Logarithmic scaling.  
**LINear**  
 Linear scaling in %.  
**LDB**  
 Linear scaling in the specified unit.  
**PERCent**  
 Linear scaling in %.  
 \*RST: LOGarithmic

**Example:**

DISP:TRAC:Y:SPAC LIN  
 Selects linear scaling in %.

**Manual operation:** See "Scaling " on page 232

### 13.6.2.3 Configuring the axes for statistical displays

For statistical displays, the scaling can be configured for both the x-axis and the y-axis.

<a href="#">CALCulate&lt;n&gt;:IQ:STATistics:SCALe:X:QUANtize</a> .....	658
<a href="#">CALCulate&lt;n&gt;:STATistics:SCALe:X:RANGe</a> .....	658
<a href="#">CALCulate&lt;n&gt;:IQ:STATistic:SCALe:X:RANGe</a> .....	658
<a href="#">CALCulate&lt;n&gt;:IQ:STATistic:SCALe:X:RLEVel:OFFSet</a> .....	658
<a href="#">CALCulate&lt;n&gt;:STATistics:SCALe:X:RLEVel</a> .....	659
<a href="#">CALCulate&lt;n&gt;:IQ:STATistic:SCALe:X:RVALue</a> .....	659
<a href="#">CALCulate&lt;n&gt;:STATistics:SCALe:Y:LOWer</a> .....	659
<a href="#">CALCulate&lt;n&gt;:IQ:STATistic:SCALe:Y:LOWer</a> .....	659
<a href="#">CALCulate&lt;n&gt;:STATistics:SCALe:Y:UPPer</a> .....	659
<a href="#">CALCulate&lt;n&gt;:IQ:STATistic:SCALe:Y:UPPer</a> .....	659

CALCulate<n>:STATistics:PRESet.....	660
CALCulate<n>:STATistics:SCALE:AUTO ONCE.....	660
CALCulate<n>:STATistics:SCALE:Y:UNIT.....	660

---

### CALCulate<n>:IQ:STATistics:SCALE:X:QUANTize <StatNofColumns>

This command defines the number of columns for the statistical distribution (APD diagram only).

#### Setting parameters:

<StatNofColumns>    numeric value  
                          Range:        2 to 1024  
                          \*RST:        101  
                          Default unit: NONE

**Example:**                CALC:IQ:STAT:SCALE:X:QUAN 10

**Manual operation:**    See "[Quantize Bins](#)" on page 234

---

### CALCulate<n>:STATistics:SCALE:X:RANGE <Range>

### CALCulate<n>:IQ:STATistic:SCALE:X:RANGE <Range>

This command defines the display range of the x-axis for statistical measurements.

The effects are identical to [DISPlay\[:WINDow<n>\]\[:SUBWindow<w>\]:TRACe<t>:Y\[:SCALE\]](#).

#### Suffix:

<n>

#### Parameters:

<Range>                Range:        1 dB to 200 dB  
                          \*RST:        100 dB  
                          Default unit: DBM

**Example:**                CALC:IQ:STAT:SCALE:X:RANG 20dB

**Manual operation:**    See "[Range](#)" on page 234

---

### CALCulate<n>:IQ:STATistic:SCALE:X:RLEVEL:OFFSet <Level>

This command defines an arithmetic level offset. This offset is added to the measured level irrespective of the selected unit. The scaling of the x-axis is changed accordingly.

#### Suffix:

<n>

#### Parameters:

<Level>                The unit is variable.  
                          Default unit: DB

**Example:**                CALC:IQ:STAT:SCALE:X:RLEV:OFFS -10dBm

**Manual operation:**    See "[Shifting the Display \(Offset\)](#)" on page 234

---

**CALCulate<n>:STATistics:SCALE:X:RLEVel <RefLevel>**

**CALCulate<n>:IQ:STATistic:SCALE:X:RVALue <RefLevel>**

This command sets the reference level for statistical measurements. The effects are identical to `DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALE]:RLEVel<ant>`.

Note that in case of statistical measurements the reference level applies to the x-axis.

**Suffix:**

<n>

**Parameters:**

<RefLevel>

The unit is variable.

If a reference level offset is included, the range is adjusted by that offset.

Range: -130 dBm to 30 dBm

\*RST: 0 dBm

Default unit: DBM

**Example:**

`CALC:IQ:STAT:SCALE:X:RVAL -60dBm`

**Manual operation:** See "Ref Level" on page 234

---

**CALCulate<n>:STATistics:SCALE:Y:LOWer <Magnitude>**

**CALCulate<n>:IQ:STATistic:SCALE:Y:LOWer <Magnitude>**

This command defines the lower vertical limit of the diagram.

**Suffix:**

<n>

**Parameters:**

<Magnitude>

The number is a statistical value and therefore dimensionless.

Range: 1E-9 to 0.1

\*RST: 1E-6

**Example:**

`CALC:IQ:STAT:SCALE:Y:LOW 0.001`

**Manual operation:** See "Y-Max / Y-Min" on page 235

---

**CALCulate<n>:STATistics:SCALE:Y:UPPer <Magnitude>**

**CALCulate<n>:IQ:STATistic:SCALE:Y:UPPer <Magnitude>**

This command defines the upper vertical limit of the diagram.

**Suffix:**

<n>

**Parameters:**

<Magnitude>

The number is a statistical value and therefore dimensionless.

Range: 1E-5 to 1.0

\*RST: 1.0

**Example:**

`CALC:IQ:STAT:SCALE:Y:UPP 0.01`

**Manual operation:** See "[Y-Max / Y-Min](#)" on page 235

---

### CALCulate<n>:STATistics:PRESet

Resets the scale of the diagram (x- and y-axis).

- Reference level (x-axis)  
0.0 dBm
- Display range (x-axis) for APD measurements  
100 dB
- Display range (x-axis) for CCDF measurements  
20 dB
- Upper limit of the y-axis  
1.0
- Lower limit of the y-axis  
1E-6

**Suffix:**

<n> [Window](#)

**Example:**

CALC:STAT:PRES

Resets the scaling for statistical functions

**Manual operation:** See "[Default Settings](#)" on page 235

---

### CALCulate<n>:STATistics:SCALE:AUTO ONCE

Initiates an automatic scaling of the diagram (x- and y-axis).

To obtain maximum resolution, the level range is set as a function of the measured spacing between peak power and the minimum power for the APD measurement and of the spacing between peak power and mean power for the CCDF measurement. In addition, the probability scale for the number of test points is adapted.

To get valid results, you have to perform a complete sweep with synchronization to the end of the auto range process. This is only possible in single sweep mode.

Note this command is not available when using an external frontend.

**Suffix:**

<n> [Window](#)

**Manual operation:** See "[Adjust Settings \(CCDF only\)](#)" on page 235

---

### CALCulate<n>:STATistics:SCALE:Y:UNIT <Unit>

Selects the unit of the y-axis.

**Suffix:**

<n> [Window](#)

**Parameters:**

<Unit> PCT | ABS  
 \*RST: ABS

**Example:**

CALC:STAT:SCAL:Y:UNIT PCT  
 Sets the percentage scale.

**Manual operation:** See "[Y-Unit](#)" on page 234

**13.6.2.4 Frequency**

CALCulate<n>:MARKer<m>:FUNCTION:CENTer.....	661
[SENSe<ip>:]FREQUENCY:CENTer.....	661
[SENSe:]FREQUENCY:CENTer:STEP.....	662
[SENSe:]FREQUENCY:CENTer:STEP:AUTO.....	662
[SENSe<ip>:]FREQUENCY:OFFSet.....	662

**CALCulate<n>:MARKer<m>:FUNCTION:CENTer**

Matches the center frequency to the frequency of a marker.

If you use the command in combination with a delta marker, that delta marker is turned into a normal marker.

**Suffix:**

<n> Window  
 <m> Marker

**Example:**

CALC:MARK2:FUNC:CENT  
 Sets the center frequency to the frequency of marker 2.

**Manual operation:** See "[Center Frequency = Marker Frequency](#)" on page 429

**[SENSe<ip>:]FREQUENCY:CENTer <Frequency>**

Defines the center frequency.

**Suffix:**

<ip> 1..n

**Parameters:**

<Frequency> The allowed range and  $f_{\max}$  is specified in the data sheet.  
 \*RST:  $f_{\max}/2$   
 Default unit: Hz

**Example:**

FREQ:CENT 100 MHz  
 FREQ:CENT:STEP 10 MHz  
 FREQ:CENT UP  
 Sets the center frequency to 110 MHz.

**Manual operation:** See ["Center Frequency"](#) on page 135  
 See ["Center Frequency"](#) on page 204  
 See ["Center Frequency"](#) on page 236  
 See ["Frequency"](#) on page 242

### [SENSe:]FREQuency:CENTer:STEP <StepSize>

Defines the center frequency step size.

You can increase or decrease the center frequency quickly in fixed steps using the SENS:FREQ UP AND SENS:FREQ DOWN commands, see [\[SENSe<ip>:\]FREQuency:CENTer](#) on page 661.

#### Parameters:

<StepSize>  $f_{\max}$  is specified in the data sheet.  
 Range: 1 to fMAX  
 \*RST: 0.1 x span  
 Default unit: Hz

**Example:** //Set the center frequency to 110 MHz.  
 FREQ:CENT 100 MHz  
 FREQ:CENT:STEP 10 MHz  
 FREQ:CENT UP

**Manual operation:** See ["Center Frequency Stepsize"](#) on page 236  
 See ["Center Frequency Stepsize"](#) on page 366

### [SENSe:]FREQuency:CENTer:STEP:AUTO <State>

Couples or decouples the center frequency step size to the span.

In time domain (zero span) measurements, the center frequency is coupled to the RBW.

#### Parameters:

<State> ON | OFF | 0 | 1  
 \*RST: 1

**Example:** FREQ:CENT:STEP:AUTO ON  
 Activates the coupling of the step size to the span.

### [SENSe<ip>:]FREQuency:OFFSet <Offset>

Defines a frequency offset.

If this value is not 0 Hz, the application assumes that the input signal was frequency shifted outside the application. All results of type "frequency" will be corrected for this shift numerically by the application.

See also ["Frequency Offset"](#) on page 237.

#### Suffix:

<ip> 1..n

**Parameters:**

<Offset>                    Range:     -1 THz to 1 THz  
                                  \*RST:     0 Hz  
                                  Default unit: HZ

**Example:**                 `FREQ:OFFS 1GHZ`

**Manual operation:**    See "[Frequency Offset](#)" on page 237

### 13.6.2.5 Configuring triggered and gated measurements

The commands required to configure a triggered or gated measurement in a remote environment are described here.

More details are described for manual operation in [Chapter 10.3.5, "Trigger and gate configuration"](#), on page 237.

The commands required for trigger input or output are described in [Chapter 13.4.10, "Configuring the trigger output"](#), on page 594.

Note that the availability of trigger settings depends on the connected instrument.



\*OPC should be used after requesting data. This will hold off any subsequent changes to the selected trigger source, until after the sweep is completed and the data is returned.

- [Configuring the triggering conditions](#).....663
- [Configuring gated measurements](#).....671
- [Programming example: continuous gating](#).....673

#### Configuring the triggering conditions

The following commands are required to configure a triggered measurement.

Note that the availability of trigger sources depends on the connected instrument.

#### Remote commands exclusive to configuring triggers:

<code>TRIGger[:SEQuence]:DTIME</code> .....	664
<code>TRIGger[:SEQuence]:HOLDoff[:TIME]</code> .....	664
<code>TRIGger[:SEQuence]:IFPower:HOLDoff</code> .....	664
<code>TRIGger[:SEQuence]:IFPower:HYSTeresis</code> .....	665
<code>TRIGger[:SEQuence]:LEVel:BBPower</code> .....	665
<code>TRIGger[:SEQuence]:LEVel[:EXTernal&lt;port&gt;]</code> .....	665
<code>TRIGger[:SEQuence]:LEVel:IFPower</code> .....	666
<code>TRIGger[:SEQuence]:LEVel:IQPower</code> .....	666
<code>TRIGger[:SEQuence]:LEVel:MAPower</code> .....	666
<code>TRIGger[:SEQuence]:LEVel:RFPower</code> .....	667
<code>TRIGger[:SEQuence]:MAPower:HOLDoff</code> .....	667
<code>TRIGger[:SEQuence]:MAPower:HYSTeresis</code> .....	667
<code>TRIGger[:SEQuence]:OSCilloscope:COUPling</code> .....	668

TRIGger[:SEquence]:SLOPe.....	668
TRIGger[:SEquence]:SOURce.....	668
TRIGger[:SEquence]:TIME:RINTerval.....	670

---

### TRIGger[:SEquence]:DTIME <DropoutTime>

Defines the time the input signal must stay below the trigger level before a trigger is detected again.

For input from the "Analog Baseband" interface using the baseband power trigger (BBP), the default drop out time is set to 100 ns to avoid unintentional trigger events (as no hysteresis can be configured in this case).

#### Parameters:

<DropoutTime> Dropout time of the trigger.  
 Range: 0 s to 10.0 s  
 \*RST: 0 s  
 Default unit: S

**Manual operation:** See "[Drop-Out Time](#)" on page 245

---

### TRIGger[:SEquence]:HOLDoff[:TIME] <Offset>

Defines the time offset between the trigger event and the start of the measurement.

#### Parameters:

<Offset> For measurements in the frequency domain, the range is 0 s to 30 s.  
 For measurements in the time domain, the range is the negative measurement time to 30 s.  
 \*RST: 0 s  
 Default unit: S

**Example:** TRIG:HOLD 500us

**Manual operation:** See "[Trigger Offset](#)" on page 245

---

### TRIGger[:SEquence]:IFPower:HOLDoff <Period>

Defines the holding time before the next trigger event.

Note that this command can be used for **any trigger source**, not just IF Power (despite the legacy keyword).

For (offline) input from a file, this command does not apply. In this case, use [TRIGger\[:SEquence\]:MAPower:HOLDoff](#) on page 667.

#### Parameters:

<Period> Range: 0 s to 10 s  
 \*RST: 0 s  
 Default unit: S



**Example:**           TRIG:SOUR EXT  
Sets an external trigger source.  
TRIG:IFP:HOLD 200 ns  
Sets the holding time to 200 ns.

**Manual operation:** See "[Trigger Holdoff](#)" on page 246

#### TRIGger[:SEQuence]:IFPower:HYSteresis <Hysteresis>

Defines the trigger hysteresis, which is only available for "IF Power" trigger sources.

**Parameters:**

<Hysteresis>           Range:       3 dB to 50 dB  
                          \*RST:        3 dB  
                          Default unit: DB

**Example:**           TRIG:SOUR IFP  
Sets the IF power trigger source.  
TRIG:IFP:HYST 10DB  
Sets the hysteresis limit value.

**Manual operation:** See "[Hysteresis](#)" on page 246

#### TRIGger[:SEQuence]:LEVel:BBPower <Level>

Sets the level of the baseband power trigger.

Is available for the optional "Analog Baseband" interface.

**Parameters:**

<Level>                Range:       -50 dBm to +20 dBm  
                          \*RST:        -20 dBm  
                          Default unit: DBM

**Example:**           TRIG:LEV:BBP -30DBM

**Manual operation:** See "[Trigger Level](#)" on page 245

#### TRIGger[:SEQuence]:LEVel[:EXTernal<port>] <TriggerLevel>

Defines the level the external signal must exceed to cause a trigger event.

In the I/Q Analyzer, only EXTERNAL1 is supported.

**Suffix:**

<port>                 Selects the trigger port.  
                          1 = trigger port 1 (TRIGGER INPUT connector on front panel)  
                          2 = trigger port 2 (TRIGGER INPUT/OUTPUT connector on front panel)  
                          3 = trigger port 3 (TRIGGER3 INPUT/OUTPUT connector on rear panel)

**Parameters:**

<TriggerLevel>      Range:      0.5 V to 3.5 V  
                          \*RST:      1.4 V  
                          Default unit: V

**Example:**            TRIG:LEV 2V

**Manual operation:** See ["Trigger Level "](#) on page 245

**TRIGger[:SEQuence]:LEVel:IFPower** <TriggerLevel>

Defines the power level at the third intermediate frequency that must be exceeded to cause a trigger event.

Note that any RF attenuation or preamplification is considered when the trigger level is analyzed. If defined, a reference level offset is also considered.

For compatibility reasons, this command is also available for the "Baseband Power" trigger source when using the "Analog Baseband" interface.

**Parameters:**

<TriggerLevel>      For details on available trigger levels and trigger bandwidths, see the data sheet.  
                          \*RST:      -20 dBm  
                          Default unit: DBM

**Example:**            TRIG:LEV:IFP -30DBM

**Manual operation:** See ["Trigger Level "](#) on page 245

**TRIGger[:SEQuence]:LEVel:IQPower** <TriggerLevel>

Defines the magnitude the I/Q data must exceed to cause a trigger event.

Note that any RF attenuation or preamplification is considered when the trigger level is analyzed. If defined, a reference level offset is also considered.

**Parameters:**

<TriggerLevel>      Range:      -130 dBm to 30 dBm  
                          \*RST:      -20 dBm  
                          Default unit: DBM

**Example:**            TRIG:LEV:IQP -30DBM

**Manual operation:** See ["Trigger Level "](#) on page 245

**TRIGger[:SEQuence]:LEVel:MAPower** <TriggerLevel>

Defines the power level that must be exceeded to cause a trigger event for (offline) input from a file.

**Parameters:**

<TriggerLevel> For details on available trigger levels and trigger bandwidths, see the data sheet.

Default unit: DBM

**Example:**

TRIG:LEV:MAP -30DBM

**Manual operation:** See "[Trigger Level](#)" on page 245

**TRIGger[:SEQuence]:LEVel:RFPower** <TriggerLevel>

Defines the power level the RF input must exceed to cause a trigger event. Note that any RF attenuation or preamplification is considered when the trigger level is analyzed. If defined, a reference level offset is also considered.

The input signal must be between 500 MHz and 8 GHz.

**Parameters:**

<TriggerLevel> For details on available trigger levels and trigger bandwidths, see the data sheet.

\*RST: -20 dBm

Default unit: DBM

**Example:**

TRIG:LEV:RFP -30dBm

**Manual operation:** See "[Trigger Level](#)" on page 245

**TRIGger[:SEQuence]:MAPower:HOLDoff** <Period>

Defines the holding time before the next trigger event for (offline) input from a file.

**Parameters:**

<Period> Range: 0 s to 10 s

\*RST: 0 s

Default unit: S

**Example:**

TRIG:SOUR MAGN

Sets an offline magnitude trigger source.

TRIG:MAP:HOLD 200 ns

Sets the holding time to 200 ns.

**Manual operation:** See "[Trigger Holdoff](#)" on page 246

**TRIGger[:SEQuence]:MAPower:HYSteresis** <Hysteresis>

Defines the trigger hysteresis for the (offline) magnitude trigger source (used for input from a file).

**Parameters:**

<Hysteresis> Range: 3 dB to 50 dB

\*RST: 3 dB

Default unit: DB

**Example:** TRIG:SOUR MAP  
Sets the (offline) magnitude trigger source.  
TRIG:MAP:HYST 10DB  
Sets the hysteresis limit value.

**Manual operation:** See "[Hysteresis](#)" on page 246

### TRIGger[:SEquence]:OSCilloscope:COUPling <CoupType>

Configures the coupling of the external trigger to the oscilloscope.

**Parameters:**

<CoupType> Coupling type

**DC**  
Direct connection with 50 Ω termination, passes both DC and AC components of the trigger signal.

**CDLimit**  
Direct connection with 1 MΩ termination, passes both DC and AC components of the trigger signal.

**AC**  
Connection through capacitor, removes unwanted DC and very low-frequency components.

\*RST: DC

### TRIGger[:SEquence]:SLOPe <Type>

**Parameters:**

<Type> POSitive | NEGative

**POSitive**  
Triggers when the signal rises to the trigger level (rising edge).

**NEGative**  
Triggers when the signal drops to the trigger level (falling edge).

\*RST: POSitive

**Example:** TRIG:SLOP NEG

**Manual operation:** See "[Slope](#)" on page 246

### TRIGger[:SEquence]:SOURce <Source>

Selects the trigger source.

Note that the availability of trigger sources depends on the connected instrument.

For details on trigger sources, see "[Trigger Source](#)" on page 242.

**Note on external triggers:**

If a measurement is configured to wait for an external trigger signal in a remote control program, remote control is blocked until the trigger is received and the program can continue. Make sure that this situation is avoided in your remote control programs.

For troubleshooting tips, see ["Incompleted sequential commands - blocked remote channels"](#) on page 949.

**Parameters:**

<Source>

**IMMediate**

Free Run

**EXTernal**

Trigger signal from the "Trigger Input" connector.

If the optional 2 GHz bandwidth extension (B2000) is installed and active, this parameter activates the "Ch3" input connector on the oscilloscope. Then the R&S VSE triggers when the signal fed into the "Ch3" input connector on the oscilloscope meets or exceeds the specified trigger level.

**Note:** In previous firmware versions, the external trigger was connected to the "Ch2" input on the oscilloscope. As of firmware version R&S VSE 2.30, the **"Ch3"** input on the oscilloscope must be used!

If power splitter mode is active, this parameter activates the "EXT TRIGGER INPUT" connector on the oscilloscope. Then the R&S VSE triggers when the signal fed into the "EXT TRIGGER INPUT" connector on the oscilloscope meets or exceeds the specified trigger level.

**EXT | EXT2 | EXT3 | EXT4**

Trigger signal from the corresponding "TRIGGER INPUT/ OUTPUT" connector on the connected instrument, or the oscilloscope's corresponding input channel (if not used as an input source).

For details on the connectors see the instrument's Getting Started manual.

**RFPower**

First intermediate frequency

(Frequency and time domain measurements only.)

Not available for input from the optional "Analog Baseband" interface.

**IFPower**

Second intermediate frequency

For input from the optional "Analog Baseband" interface, this parameter is interpreted as `BBPower` for compatibility reasons.

**IQPower**

Magnitude of sampled I/Q data

For applications that process I/Q data, such as the I/Q Analyzer or optional applications.

**TIME**

Time interval

**VIDeo**

Video mode is available in the time domain and only in the Spectrum application.

**BBPower**

Baseband power

For input from the optional "Analog Baseband" interface.

**MAGNitude**

For (offline) input from a file, rather than an instrument.

The trigger level is specified by `TRIGger[:SEquence]:`

`LEVel:MAPower`.

**MAIT**

For trigger information stored as markers in an `.iqx` file.

See [Chapter E.4, "IQX file format"](#), on page 987.

**MANual**

Only available for a connected R&S RTP:

Any trigger settings in the R&S VSE software are ignored; only trigger settings defined on the connected instrument are considered. Thus, you can use the more complex trigger settings available on an R&S RTP.

\*RST: IMMEDIATE

**Example:**

`TRIG:SOUR EXT`

Selects the external trigger input as source of the trigger signal

**Manual operation:**

See ["Marker Info"](#) on page 140

See ["Trigger Source"](#) on page 242

See ["Free Run"](#) on page 242

See ["External Trigger / Trigger Channel X"](#) on page 242

See ["External Channel 3"](#) on page 243

See ["External Analog"](#) on page 243

See ["IF Power"](#) on page 243

See ["I/Q Power"](#) on page 244

See ["RF Power"](#) on page 244

See ["Time"](#) on page 244

See ["Magnitude \(Offline\)"](#) on page 244

See ["Manual"](#) on page 245

**TRIGger[:SEquence]:TIME:RINTerval <Interval>**

Defines the repetition interval for the time trigger.

**Parameters:**

<Interval>

numeric value

Range: 2 ms to 5000 s

\*RST: 1.0 s

Default unit: S

**Example:**

`TRIG:SOUR TIME`

Selects the time trigger input for triggering.

`TRIG:TIME:RINT 5`

The measurement starts every 5 s.

**Manual operation:**

See ["Repetition Interval"](#) on page 245

## Configuring gated measurements

[SENSe:]SWEep:EGATe.....	671
[SENSe:]SWEep:EGATe:CONTInuous:PCOunt.....	671
[SENSe:]SWEep:EGATe:CONTInuous:PLENght.....	672
[SENSe:]SWEep:EGATe:CONTInuous[:STATe].....	672
[SENSe:]SWEep:EGATe:HOLDoff.....	672
[SENSe:]SWEep:EGATe:LENGth.....	672
[SENSe:]SWEep:EGATe:SKIP.....	673

---

### [SENSe:]SWEep:EGATe <State>

Turns gated measurements on and off.

For measurements with an magnitude (offline) trigger gate, the measured values are recorded as long as the gate is opened. During a measurement the gate can be opened and closed several times. The synchronization mechanisms with \*OPC, \*OPC? and \*WAI remain completely unaffected.

#### Parameters:

<State>            ON | OFF | 0 | 1  
**OFF | 0**  
 Switches the function off  
**ON | 1**  
 Switches the function on

#### Example:

```
SWE:EGAT ON
Switches on the gate mode.
SWE:EGAT:TYPE EDGE
Switches on the edge-triggered mode.
SWE:EGAT:HOLD 100US
Sets the gate delay to 100 µs.
SWE:EGAT:LEN 500US
Sets the gate opening time to 500 µs.
INIT;*WAI
Starts a sweep and waits for its end.
```

**Manual operation:** See "[Gated Trigger](#)" on page 249

---

### [SENSe:]SWEep:EGATe:CONTInuous:PCOunt <Amount>

Defines the number of gate periods to be measured after a single trigger event.

#### Parameters:

<Amount>            integer  
 Range:            1 to <file\_length> / <cont.\_period\_length>  
 Increment:        1  
 \*RST:            100

**Example:**            SWE:EGAT:CONT:PCO 50

**Manual operation:** See "[Gate Period Count](#)" on page 251

**[SENSe:]SWEep:EGATe:CONTInuous:PLENgtH <Time>**

Defines the length in seconds of a single gate period in continuous gating. The length is determined from the beginning of one gate measurement to the beginning of the next one.

**Parameters:**

<Time>                    Range:        1 / <file\_sample\_rate> to <file\_length>  
                              \*RST:        5 ms  
                              Default unit: S

**Example:**                SWE:EGAT:CONT:PLEN 10

**Manual operation:**    See "[Gate Period Length](#)" on page 250

**[SENSe:]SWEep:EGATe:CONTInuous[:STATe] <State>**

Activates or deactivates continuous gating.

This setting is only available if [SENSe:]SWEep:EGATe is "On".

**Parameters:**

<State>                    ON | OFF | 0 | 1  
                              **OFF | 0**  
                              Switches the function off  
                              **ON | 1**  
                              Switches the function on  
                              \*RST:        0

**Example:**                SWE:EGAT ON  
                              Activate gating  
                              SWE:EGAT:CONT:STAT ON  
                              Activate continuous gating

**Manual operation:**    See "[Continuous Gate](#)" on page 250

**[SENSe:]SWEep:EGATe:HOLDoff <DelayTime>**

Defines the delay time between the gate signal and the continuation of the measurement.

**Parameters:**

<DelayTime>               Range:        0 s to 30 s  
                              \*RST:        0 s  
                              Default unit: S

**Example:**                SWE:EGAT:HOLD 100us

**Manual operation:**    See "[Gate Delay](#)" on page 249

**[SENSe:]SWEep:EGATe:LENGth <GateLength>**

Defines the gate length.



**Parameters:**

<GateLength>      Range:      125 ns to 30 s  
                          \*RST:      400µs  
                          Default unit: S

**Example:**                SWE:EGAT:LENG 10ms

**Manual operation:**    See "[Gate Length](#)" on page 249

**[SENSe:]SWEep:EGATe:SKIP <Comment>**

Ignores the specified gates in a continuous gate measurement. This setting is only available for magnitude (offline) triggered measurements.

**Parameters:**

<Comment>                String containing a comma-separated list of gate numbers to be ignored during a measurement.

**Example:**                SENS:SWEE:EGAT:SKIP '1,4-5'

**Manual operation:**    See "[Skip Gates](#)" on page 250

**Programming example: continuous gating**

This example demonstrates how to perform a measurement with continuous gating in a remote environment.

```
//-----Configuring the measurement -----
*RST

//ACLR LTE TDD with 51 MHz Span
CALC:MARK:FUNC:POW:PRES EUTra
FREQ:CENT 1GHZ
SWE:EGAT ON
SWE:EGAT:SOUR EXT
SWE:EGAT:TYPE EDGE
SWE:EGAT:HOLD 9.25MS
SWE:EGAT:LENG 1.25MS
SWE:EGAT:CONTinuous:STAT?
//0
SWE:EGAT:CONTinuous:STAT ON
SWE:EGAT:CONTinuous:STAT?
//1
SWE:EGAT:CONTinuous:PLENght?
//0.005
SWE:EGAT:CONTinuous:PLENght 4MS
SWE:EGAT:CONTinuous:PLENght?
//0.004
SWE:EGAT:CONTinuous:PCOunt?
//100
SWE:EGAT:CONTinuous:PCOunt 80
SWE:EGAT:CONTinuous:PCOunt?
```

```
//80

//-----Performing the Measurement-----
INIT:CONT OFF
INIT
// Sweep duration is less than 1 second
```

### 13.6.2.6 Configuring data acquisition

The following commands are required to capture data in the I/Q Analyzer.

#### Remote commands exclusive to I/Q data acquisition

[SENSe<ip>:]IQ:BWIDth:MODE.....	674
[SENSe<ip>:]IQ:BWIDth:RESolution.....	675
[SENSe<ip>:]IQ:FFT:ALGorithm.....	675
[SENSe<ip>:]IQ:FFT:LENGth.....	676
[SENSe:]IQ:FFT:WINDow:LENGth.....	676
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TRACe:IQ:TPISamplE?.....	681
TRACe:IQ:WBANd[:STATe].....	682
TRACe:IQ:WBANd:MBWidth.....	682
TRACe:IQ:WFILter.....	682

---

#### [SENSe<ip>:]IQ:BWIDth:MODE <Mode>

Defines how the resolution bandwidth is determined.

##### Suffix:

<ip> 1..n

##### Parameters:

<Mode> AUTO | MANual | FFT

##### **AUTO**

(Default) The RBW is determined automatically depending on the sample rate and record length.

##### **MANual**

The user-defined RBW is used and the (FFT) window length (and possibly the sample rate) are adapted accordingly. The RBW is defined using the [SENSe<ip>:]IQ:BWIDth:RESolution command.

**FFT**

The RBW is determined by the FFT parameters.

\*RST: AUTO

**Example:**

```
IQ:BAND:MODE MAN
Switches to manual RBW mode.
IQ:BAND:RES 120000
Sets the RBW to 120 kHz.
```

**Manual operation:** See "RBW " on page 255

**[SENSe<ip>:]IQ:BWIDth:RESolution <Bandwidth>**

Defines the resolution bandwidth manually if [SENSe<ip>:]IQ:BWIDth:MODE is set to MAN.

Defines the resolution bandwidth. The available RBW values depend on the sample rate and record length.

For details see [Chapter 10.2.3.1, "Frequency resolution of FFT results - RBW"](#), on page 178.

**Suffix:**

<ip> 1..n

**Parameters:**

<Bandwidth> refer to data sheet  
 \*RST: RBW: AUTO mode is used  
 Default unit: HZ

**Example:**

```
IQ:BAND:MODE MAN
Switches to manual RBW mode.
IQ:BAND:RES 120000
Sets the RBW to 120 kHz.
```

**Manual operation:** See "RBW " on page 255

**[SENSe<ip>:]IQ:FFT:ALGORITHM <Method>**

Defines the FFT calculation method.

**Suffix:**

<ip> 1..n

**Parameters:**

<Method> **SINGLE**  
 One FFT is calculated for the entire record length; if the FFT length is larger than the record length (see [SENSe<ip>:]IQ:FFT:LENGth and TRACe:IQ:RLENGth), zeros are appended to the captured data.

**AVERage**

Several overlapping FFTs are calculated for each record; the results are averaged to determine the final FFT result for the record.

The user-defined window length and window overlap are used. See [SENSe:] IQ:FFT:WINDow:LENGth and [SENSe<ip>:] IQ:FFT:WINDow:OVERlap.

\*RST: AVER

**Example:** IQ:FFT:ALG SING

**Manual operation:** See "[Transformation Algorithm](#)" on page 256

**[SENSe<ip>:]IQ:FFT:LENGth <NoOfBins>**

Defines the number of frequency points determined by each FFT calculation. The more points are used, the higher the resolution in the spectrum becomes, but the longer the calculation takes.

**Suffix:**

<ip> 1..n

**Parameters:**

<NoOfBins> integer value  
 Range: 3 to 524288  
 \*RST: 4096

**Example:** IQ:FFT:LENG 2048

**Manual operation:** See "[FFT Length](#)" on page 256

**[SENSe:]IQ:FFT:WINDow:LENGth <NoOfFFT>**

Defines the number of samples to be included in a single FFT window when multiple FFT windows are used.

**Parameters:**

<NoOfFFT> integer value  
 Range: 3 to 524288  
 \*RST: record length

**Example:** IQ:FFT:WIND:LENG 500

**Manual operation:** See "[Window Length](#)" on page 256

**[SENSe<ip>:]IQ:FFT:WINDow:OVERlap <Rate>**

Defines the part of a single FFT window that is re-calculated by the next FFT calculation.

**Suffix:**

<ip> 1..n

**Parameters:**

<Rate> double value  
 Percentage rate  
 Range: 0 to 1  
 \*RST: 0.75

**Example:**

`IQ:FFT:WIND:OVER 0.5`  
 Half of each window overlaps the previous window in FFT calculation.

**Manual operation:** See "[Window Overlap](#)" on page 256

**[SENSe<ip>:]IQ:FFT:WINDow:TYPE <Function>**

In the I/Q Analyzer you can select one of several FFT window types.

**Suffix:**

<ip> 1..n

**Parameters:**

<Function> **BLACKharris**  
 Blackman-Harris  
**FLATtop**  
 Flattop  
**GAUSSian**  
 Gauss  
**RECTangular**  
 Rectangular  
**P5**  
 5-Term  
 \*RST: FLAT

**Example:**

`IQ:FFT:WIND:TYPE GAUS`

**Manual operation:** See "[Window Function](#)" on page 256

**[SENSe:]SWAPiq <State>**

Defines whether or not the recorded I/Q pairs should be swapped (I<->Q) before being processed. Swapping I and Q inverts the sideband.

This is useful if the DUT interchanged the I and Q parts of the signal; then the R&S VSE can do the same to compensate for it.

**Parameters:**

<State> **ON | 1**  
 I and Q signals are interchanged  
 Inverted sideband,  $Q+jI$   
**OFF | 0**  
 I and Q signals are not interchanged  
 Normal sideband,  $I+jQ$

\*RST: 0

**Manual operation:** See "[Swap I/Q](#)" on page 254

**[SENSe:]SWEep:COUNT** <SweepCount>

Defines the number of measurements that the application uses to average traces.

In continuous measurement mode, the application calculates the moving average over the average count.

In single measurement mode, the application stops the measurement and calculates the average after the average count has been reached.

**Example:**

```
SWE:COUN 64
Sets the number of measurements to 64.
INIT:CONT OFF
Switches to single measurement mode.
INIT;*WAI
Starts a measurement and waits for its end.
```

**Manual operation:** See "[Capture Count](#)" on page 376

**[SENSe:]SWEep[:WINDow<n>]:POINTs** <MeasPoints>

This command defines the number of measurement points to analyze after a measurement.

**Suffix:**  
<n>

**Parameters:**

```
<MeasPoints> Range: 51 to 524288
*RST: 1001
```

**Example:** SWE:POIN 251

**Manual operation:** See "[Points](#)" on page 258  
See "[Capture Points](#)" on page 376

**[SENSe:]SWEep:TIME** <Time>

Defines the measurement time. It automatically decouples the time from any other settings.

**Parameters:**

```
<Time> refer to data sheet
*RST: depends on current settings (determined automatically)
Default unit: S
```

**Manual operation:** See ["Sweep Time"](#) on page 242  
 See ["Meas Time "](#) on page 254  
 See ["Meas Time "](#) on page 280  
 See ["Meas Time "](#) on page 374

---

### TRACe:IQ:BWIDth

Defines or queries the bandwidth of the resampling filter.

The bandwidth of the resampling filter depends on the sample rate.

**Parameters:**

<Bandwidth> For details on the maximum bandwidth see [Chapter 10.2.1.1, "Sample rate, record length and analysis bandwidth"](#), on page 176.  
 Default unit: HZ

**Manual operation:** See ["Acquisition Bandwidth"](#) on page 135  
 See ["Analysis Bandwidth"](#) on page 253

---

### TRACe:IQ:RLENgth <NoOfSamples>

Sets the record length for the acquired I/Q data.

Increasing the record length also increases the measurement time.

**Note:** Alternatively, you can define the measurement time using the `SENS:SWE:TIME` command.

**Parameters:**

<NoOfSamples> Number of samples to record.  
 See [Chapter 10.2.1.1, "Sample rate, record length and analysis bandwidth"](#), on page 176  
 \*RST: 1001

**Example:** `TRAC:IQ:RLEN 256`

**Manual operation:** See ["Record Length "](#) on page 254

---

### TRACe:IQ:SET <NORM>, <0>, <SampleRate>, <TriggerMode>, <TriggerSlope>, <PretriggerSamp>, <NumberSamples>

Sets up the R&S VSE for I/Q measurements.

If you do not use this command to set up I/Q measurements, the R&S VSE will use its current settings for I/Q measurements.

If the I/Q Analyzer has not been turned on previously, the command also switches to the I/Q Analyzer.

**Note:** If you use the default settings with `TRACe:IQ:DATA??`, the following minimum buffer sizes for the response data are recommended:

ASCII format: 10 kBytes

Binary format: 2 kBytes

**Parameters:**

<NORM>	This value is always <code>NORM</code> .
<0>	Default unit: HZ This value is always 0.
<SampleRate>	Sample rate for the data acquisition. Range: 100 Hz to 20 GHz, continuously adjustable *RST: 32000000 Default unit: HZ
<TriggerMode>	Selection of the trigger source used for the measurement. <b>IMMEDIATE   EXTERNAL   EXT2   EXT3   IFPOWER</b> For IMM mode, gating is automatically deactivated. *RST: IMM
<TriggerSlope>	Used trigger slope. <b>POSITIVE   NEGATIVE</b> *RST: POS
<PretriggerSamp>	Defines the trigger offset in terms of pretrigger samples. Negative values correspond to a trigger delay. This value also defines the interval between the trigger signal and the gate edge in samples. Range: -1399999999 to 1399999999 *RST: 0
<NumberSamples>	Number of measurement values to record (including the pretrigger samples). See <a href="#">Chapter 10.2.1.1, "Sample rate, record length and analysis bandwidth"</a> , on page 176. *RST: 1001

**Example:**

```
TRAC:IQ:SET NORM,0,32MHz,EXT,POS,0,2048
```

Reads 2048 I/Q-values starting at the trigger point.  
sample rate = 32 MHz  
trigger = External  
slope = Positive

```
TRAC:IQ:SET NORM,0,4 MHz,EXT,POS,1024,512
```

Reads 512 I/Q-values from 1024 measurement points before the trigger point.  
filter type = NORMAL  
sample rate = 4 MHz  
trigger = External  
slope = Positive

**Manual operation:** See "[Record Length](#)" on page 254



**TRACe:IQ:SRATe** <SampleRate>

Sets the final user sample rate for the acquired I/Q data. Thus, the user sample rate can be modified without affecting the actual data capturing settings on the R&S VSE.

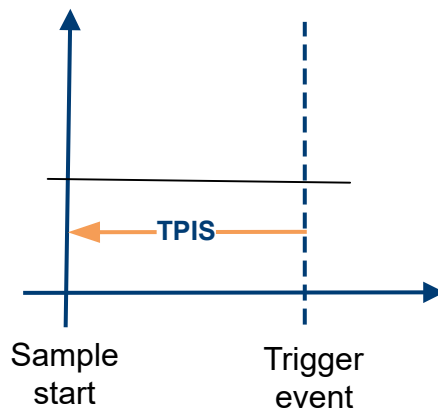
**Parameters:**

<SampleRate> The valid sample rates depend on the connected instrument. Refer to the instrument's documentation.  
 \*RST: 32 MHz  
 Default unit: HZ

**Manual operation:** See "Sample Rate" on page 135  
 See "Sample Rate" on page 253

**TRACe:IQ:TPISample?**

Queries the time offset from the sample start to the trigger event (trigger point in sample = TPIS). Since the R&S VSE usually samples with a much higher sample rate than the specific application actually requires, the trigger point determined internally is much more precise than the one determined from the (downsampled) data in the application. Thus, the TPIS indicates the offset from the sample start to the actual trigger event.



This value can only be determined in triggered measurements using external or IFPower triggers, otherwise the value is 0.

**Return values:**

<TPIS> numeric value  
 Default unit: s

**Example:**

TRAC:IQ:TPIS?

Result for a sample rate of 1 MHz: between 0 and 1/1 MHz, i.e. between 0 and 1  $\mu$ s (the duration of 1 sample).

**Usage:** Query only

**TRACe:IQ:WBANd[:STATe]** <State>

Determines whether the wideband provided by bandwidth extension options is used or not (if installed).

**Parameters:**

<State>                    ON | OFF | 0 | 1  
                               **OFF | 0**  
                               Switches the function off  
                               **ON | 1**  
                               Switches the function on

**Manual operation:** See "[Maximum Bandwidth](#)" on page 253

**TRACe:IQ:WBANd:MBWidth** <Limit>

Defines the maximum analysis bandwidth. Any value can be specified; the next higher fixed bandwidth is used.

The available fixed values depend on the connected instrument and the installed bandwidth extension options.

(See [Chapter 10.2.1.1, "Sample rate, record length and analysis bandwidth"](#), on page 176).

**Manual operation:** See "[Maximum Bandwidth](#)" on page 253

**TRACe:IQ:WFILter** <State>

Activates a 200 MHz filter before the A/D converter, thus restricting the processed bandwidth to 200 MHz while using the wideband processing path in the R&S VSE. For prerequisites see manual operation.

**Parameters:**

<State>                    ON | OFF | 0 | 1  
                               **OFF | 0**  
                               Switches the function off  
                               **ON | 1**  
                               Switches the function on  
                               \*RST:            0

**Manual operation:** See "[200 MHz Filter](#)" on page 253

**13.6.2.7 Adjusting settings automatically**

The commands required to adjust settings automatically in a remote environment are described here.

<a href="#">[SENSe&lt;ip&gt;:]ADJust:ALL</a> .....	683
<a href="#">[SENSe&lt;ip&gt;:]ADJust:CONFigure:LEVel:DURation</a> .....	683
<a href="#">[SENSe&lt;ip&gt;:]ADJust:CONFigure:LEVel:DURation:MODE</a> .....	683

[SENSe<ip>:]ADJust:CONFigure:HYSTeresis:LOWer.....	684
[SENSe<ip>:]ADJust:CONFigure:HYSTeresis:UPPer.....	684
[SENSe<ip>:]ADJust:CONFigure:TRIGger.....	685
[SENSe<ip>:]ADJust:FREQuency.....	685
[SENSe<ip>:]ADJust:LEVel.....	685

---

### [SENSe<ip>:]ADJust:ALL

Initiates a measurement to determine and set the ideal settings for the current task automatically (only once for the current measurement).

This includes:

- Center frequency
- Reference level

#### Suffix:

<ip> 1..n

#### Example:

ADJ:ALL

**Manual operation:** See ["Adjusting all Determinable Settings Automatically \(Auto All\)"](#) on page 261

---

### [SENSe<ip>:]ADJust:CONFigure:LEVel:DURation <Duration>

To determine the ideal reference level, the R&S VSE performs a measurement on the current input data. This command defines the length of the measurement if `[SENSe<ip>:]ADJust:CONFigure:LEVel:DURation:MODE` is set to `MANual`.

#### Suffix:

<ip> 1..n

#### Parameters:

<Duration> Numeric value in seconds  
 Range: 0.001 to 16000.0  
 \*RST: 0.001  
 Default unit: s

#### Example:

ADJ:CONF:DUR:MODE MAN  
 Selects manual definition of the measurement length.  
 ADJ:CONF:LEV:DUR 5ms  
 Length of the measurement is 5 ms.

**Manual operation:** See ["Automatic Measurement Time Mode and Value"](#) on page 262

---

### [SENSe<ip>:]ADJust:CONFigure:LEVel:DURation:MODE <Mode>

To determine the ideal reference level, the R&S VSE performs a measurement on the current input data. This command selects the way the R&S VSE determines the length of the measurement .

**Suffix:**

&lt;ip&gt; 1..n

**Parameters:**

&lt;Mode&gt;

**AUTO**

The R&S VSE determines the measurement length automatically according to the current input data.

**MANual**

The R&S VSE uses the measurement length defined by `[SENSe<ip>:]ADJust:CONFigure:LEVel:DURation` on page 683.

\*RST: AUTO

**Manual operation:** See "[Automatic Measurement Time Mode and Value](#)" on page 262

`[SENSe<ip>:]ADJust:CONFigure:HYSTeresis:LOWer <Threshold>`

**Suffix:**

&lt;ip&gt; 1..n

**Parameters:**

&lt;Threshold&gt;

Range: 0 dB to 200 dB

\*RST: +1 dB

Default unit: dB

**Example:**

SENS:ADJ:CONF:HYST:LOW 2

For an input signal level of currently 20 dBm, the reference level is only adjusted when the signal level falls below 18 dBm.

**Manual operation:** See "[Lower Level Hysteresis](#)" on page 262

`[SENSe<ip>:]ADJust:CONFigure:HYSTeresis:UPPer <Threshold>`

**Suffix:**

&lt;ip&gt; 1..n

**Parameters:**

&lt;Threshold&gt;

Range: 0 dB to 200 dB

\*RST: +1 dB

Default unit: dB

**Example:**

SENS:ADJ:CONF:HYST:UPP 2

**Example:**

For an input signal level of currently 20 dBm, the reference level is only adjusted when the signal level rises above 22 dBm.

**Manual operation:** See "[Upper Level Hysteresis](#)" on page 262

**[SENSe<ip>:]ADJust:CONFigure:TRIGger <State>**

Defines the behavior of a triggered measurement when adjusting a setting automatically (using `SENS:ADJ:LEV ON`, for example).

**Suffix:**

<ip> 1..n

**Parameters:**

<State> ON | OFF | 0 | 1

**OFF | 0**

(default:) The measurement for adjustment waits for the next trigger.

To abort the measurement, use [ABORt](#) on page 546.

**ON | 1**

The measurement for adjustment is performed without waiting for a trigger (corresponds to "Continue" in manual operation).

\*RST: 0

**Example:**

```
//Use default ref level at 0.00 dBm.
//Define an RF power trigger at -20 dBm
:TRIG:SEQ:SOUR RFP
:TRIG:SEQ:LEV:RFP -20
//Perform adjustment measurement without waiting for trigger
SENS:ADJ:CONF:TRIG ON
//Perform auto level adjustment
:SENS:ADJ:LEV;*WAI
```

**[SENSe<ip>:]ADJust:FREQuency**

Sets the center frequency to the frequency with the highest signal level in the current frequency range.

**Suffix:**

<ip> 1..n

**Example:**

ADJ:FREQ

**Manual operation:** See ["Adjusting the Center Frequency Automatically \(Auto Frequency\)"](#) on page 261

**[SENSe<ip>:]ADJust:LEVel**

Initiates a single (internal) measurement that evaluates and sets the ideal reference level for the current input data and measurement settings. Thus, the settings of the RF attenuation and the reference level are optimized for the signal level. The R&S VSE is not overloaded and the dynamic range is not limited by an S/N ratio that is too small.

**Suffix:**

<ip> 1..n

**Example:**

ADJ:LEV

**Manual operation:** See  [Setting the Reference Level Automatically \(Auto Level \)](#) on page 225

### 13.6.3 Configuring RF measurements

The following commands configure RF measurements in the I/Q Analyzer.

Only the commands specific to RF measurements are described here. See also [Chapter 13.6.2, "Configuring I/Q analyzer measurements"](#), on page 610 for general I/Q Analyzer commands.

- [Measuring the channel power and ACLR](#)..... 686
- [Measuring the occupied bandwidth](#).....740
- [Measuring the spectrum emission mask](#).....742
- [Measuring the time domain power](#).....778
- [Defining the frequency range](#).....786
- [Configuring bandwidth and sweep settings](#).....789

#### 13.6.3.1 Measuring the channel power and ACLR

All remote control commands specific to channel power or ACLR measurements are described here.

- [Managing measurement configurations](#).....686
- [Configuring the channels](#).....688
- [Defining weighting filters](#).....692
- [Selecting the reference channel](#).....694
- [Checking limits](#).....695
- [Checking limits \(total limit pass mode\)](#).....702
- [General ACLR measurement settings](#).....707
- [Configuring MSR ACLR measurements](#).....709
- [Performing an ACLR measurement](#).....724
- [Retrieving and analyzing measurement results](#).....726
- [Programming examples for channel power measurements](#).....731

#### Managing measurement configurations

The following commands control measurement configurations for ACLR measurements.

- [CALCulate<n>:MARKer<m>:FUNCTION:POWER<sb>:PRESet](#).....686
- [CALCulate<n>:MARKer<m>:FUNCTION:POWER<sb>:STANdard:CATalog?](#).....687
- [CALCulate<n>:MARKer<m>:FUNCTION:POWER<sb>:STANdard:DELeTe](#).....687
- [CALCulate<n>:MARKer<m>:FUNCTION:POWER<sb>:STANdard:SAVE](#).....688

---

**CALCulate<n>:MARKer<m>:FUNCTION:POWER<sb>:PRESet <Standard>**

Loads a measurement configuration.

The measurement configuration for power measurements consists of weighting filter, channel bandwidth and spacing, resolution and video bandwidth, detector and sweep time.

If the "Multi-Standard Radio" standard is selected (see "[Standard](#)" on page 277), different commands are required to configure ACLR measurements (see "[Configuring MSR ACLR measurements](#)" on page 709).

**Suffix:**

<n>	<a href="#">Window</a>
<m>	<a href="#">Marker</a>
<sb>	irrelevant

**Parameters:**

<Standard>	For more information see <a href="#">Chapter 10.4.1.9, "Reference: predefined CP/ACLR standards"</a> , on page 308. If you want to load a customized configuration, the parameter is a string containing the file name.
------------	--

**Manual operation:** See "[Predefined Standards](#)" on page 277  
See "[User Standards](#)" on page 277

**CALCulate<n>:MARKer<m>:FUNction:POWer<sb>:STANdard:CATalog?**

Queries all xml files containing ACLR standards in the C:\Program Files\Rohde-Schwarz\VSE\<version>\acp\_std directory. Note that subdirectories are not searched.

**Suffix:**

<n>	<a href="#">Window</a>
<m>	<a href="#">Marker</a>
<sb>	Sub block in a Multi-standard radio measurement; MSR ACLR: 1 to 5 Multi-SEM: 1 to 3 for all other measurements: irrelevant

**Return values:**

<Standards>	List of standard files.
-------------	-------------------------

**Usage:** Query only

**Manual operation:** See "[User Standards](#)" on page 277

**CALCulate<n>:MARKer<m>:FUNction:POWer<sb>:STANdard:DELeTe  
<Standard>**

Deletes a file containing an ACLR standard.

**Suffix:**

<n>	<a href="#">Window</a>
<m>	<a href="#">Marker</a>

<sb> irrelevant

**Parameters:**

<Standard> String containing the file name of the standard.

**Manual operation:** See "[User Standards](#)" on page 277

**CALCulate<n>:MARKer<m>:FUNCTION:POWer<sb>:STANdard:SAVE <Standard>**

Saves the current ACLR measurement configuration as a new ACLR standard.

The measurement configuration for power measurements consists of weighting filter, channel bandwidth and spacing, resolution and video bandwidth, detector and sweep time.

**Suffix:**

<n> [Window](#)

<m> [Marker](#)

<sb> irrelevant

**Parameters:**

<Standard> String containing the file name. The file format is xml.

**Manual operation:** See "[User Standards](#)" on page 277

**Configuring the channels**

The following commands configure channels for channel power and ACLR measurements.

[SENSe:]POWer:ACHannel:ACPairs.....	688
[SENSe:]POWer:ACHannel:BWIDth:ACHannel.....	689
[SENSe:]POWer:ACHannel:BANDwidth:ACHannel.....	689
[SENSe:]POWer:ACHannel:BWIDth:ALternate<ch>.....	689
[SENSe:]POWer:ACHannel:BANDwidth:ALternate<ch>.....	689
[SENSe:]POWer:ACHannel:BWIDth[:CHANnel<ch>].....	689
[SENSe:]POWer:ACHannel:BANDwidth[:CHANnel<ch>].....	689
[SENSe:]POWer:ACHannel:NAME:ACHannel.....	689
[SENSe:]POWer:ACHannel:NAME:ALternate<ch>.....	690
[SENSe:]POWer:ACHannel:NAME:CHANnel<ch>.....	690
[SENSe:]POWer:ACHannel:SPACing[:ACHannel].....	690
[SENSe:]POWer:ACHannel:SPACing:ALternate<ch>.....	691
[SENSe:]POWer:ACHannel:SPACing:CHANnel<ch>.....	691
[SENSe:]POWer:ACHannel:TXCHannel:COUNT.....	692

**[SENSe:]POWer:ACHannel:ACPairs <ChannelPairs>**

Defines the number of pairs of adjacent and alternate channels.

**Parameters:**

<ChannelPairs> Range: 0 to 12  
\*RST: 1



**Manual operation:** See ["Number of channels: Tx , Adj "](#) on page 278  
 See ["Number of Adjacent Channels \(Adj Count \)"](#) on page 293

---

**[SENSe:]POWer:ACHannel:BWIDth:ACHannel** <Bandwidth>  
**[SENSe:]POWer:ACHannel:BANDwidth:ACHannel** <Bandwidth>

Defines the channel bandwidth of the adjacent channels.

**Parameters:**

<Bandwidth>            Range:        100 Hz to 1000 MHz  
                              \*RST:        14 kHz  
                              Default unit: Hz

**Manual operation:** See ["Channel Bandwidth "](#) on page 281  
 See ["Adjacent Channel Bandwidths "](#) on page 294

---

**[SENSe:]POWer:ACHannel:BWIDth:ALternate<ch>** <Bandwidth>  
**[SENSe:]POWer:ACHannel:BANDwidth:ALternate<ch>** <Bandwidth>

Defines the channel bandwidth of the alternate channels.

**Suffix:**

<ch>                        1..n  
                                  Alternate channel number

**Parameters:**

<Bandwidth>            Range:        100 Hz to 1000 MHz  
                              \*RST:        14 kHz  
                              Default unit: Hz

**Manual operation:** See ["Channel Bandwidth "](#) on page 281  
 See ["Adjacent Channel Bandwidths "](#) on page 294

---

**[SENSe:]POWer:ACHannel:BWIDth[:CHANnel<ch>]** <Bandwidth>  
**[SENSe:]POWer:ACHannel:BANDwidth[:CHANnel<ch>]** <Bandwidth>

Defines the channel bandwidth of the transmission channels.

**Suffix:**

<ch>                        1..n  
                                  Tx channel number

**Parameters:**

<Bandwidth>            Range:        100 Hz to 1000 MHz  
                              \*RST:        14 kHz  
                              Default unit: Hz

**Manual operation:** See ["Channel Bandwidth "](#) on page 281  
 See ["Channel Bandwidth "](#) on page 314

---

**[SENSe:]POWer:ACHannel:NAME:ACHannel** <Name>

Defines a name for the adjacent channel.

For MSR ACLR measurements, this command defines the name for the lower adjacent channel in asymmetric channel definitions. To define the name for the upper adjacent channel use the `[SENSe:]POWer:ACHannel:NAME:UACHannel` command.

**Parameters:**

<Name> String containing the name of the channel  
 \*RST: ADJ

**Manual operation:** See "[Channel Names](#)" on page 285

**[SENSe:]POWer:ACHannel:NAME:ALternate<ch> <Name>**

Defines a name for an alternate channel.

For MSR ACLR measurements, this command defines the name for the lower alternate channel in asymmetric channel definitions. To define the name for the upper alternate channels use the `[SENSe:]POWer:ACHannel:NAME:UALternate<ch>` command.

**Suffix:**

<ch> 1..n  
 Alternate channel number

**Parameters:**

<Name> String containing the name of the channel  
 \*RST: ALT<1...11>

**Manual operation:** See "[Channel Names](#)" on page 285

**[SENSe:]POWer:ACHannel:NAME:CHANnel<ch> <Name>**

Defines a name for a transmission channel.

**Suffix:**

<ch> 1..n  
 Tx channel number

**Parameters:**

<Name> String containing the name of the channel  
 \*RST: TX<1...12>

**Manual operation:** See "[Channel Names](#)" on page 285

**[SENSe:]POWer:ACHannel:SPACing[:ACHannel] <Spacing>**

Defines the distance from transmission channel to adjacent channel.

For MSR signals, this command defines the distance from the CF of the first Tx channel in the first sub block to the lower adjacent channel. To configure the spacing for the upper adjacent channel in asymmetrical configurations, use the `[SENSe:]POWer:ACHannel:SPACing:UACHannel` command.

A change of the adjacent channel spacing causes a change in the spacing of all alternate channels below the adjacent channel (not for MSR signals).

**Parameters:**

<Spacing>            Range:      100 Hz to 2000 MHz  
                          \*RST:      14 kHz  
                          Default unit: Hz

**Manual operation:** See "[Channel Spacings](#)" on page 282  
 See "[Adjacent Channel Spacings](#)" on page 294

**[SENSe:]POWer:ACHannel:SPACing:ALternate<ch>** <Spacing>

Defines the distance from transmission channel to alternate channels.

For MSR signals, this command defines the distance from the CF of the first Tx channel in the first sub block to the lower alternate channel. To configure the spacing for the upper alternate channel in asymmetrical configurations, use the [\[SENSe:\]POWer:ACHannel:SPACing:UALternate<ch>](#) command.

If you set the channel spacing for the first alternate channel, the R&S VSE adjusts the spacing of alternate channels of a lower order, but not the other way round (not for MSR signals). The command works hierarchically: to set a distance from the transmission channel to the 2nd and 3rd alternate channel, you have to define a spacing for the 2nd alternate channel first.

**Suffix:**

<ch>                    1..n  
                          Alternate channel number

**Parameters:**

<Spacing>            Range:      100 Hz to 2000 MHz  
                          \*RST:      40 kHz (ALT1), 60 kHz (ALT2), 80 kHz (ALT3), ...  
                          Default unit: Hz

**Manual operation:** See "[Channel Spacings](#)" on page 282  
 See "[Adjacent Channel Spacings](#)" on page 294

**[SENSe:]POWer:ACHannel:SPACing:CHANnel<ch>** <Spacing>

Defines the distance between transmission channels.

If you set the channel spacing for a transmission channel, the R&S VSE sets the spacing of the lower transmission channels to the same value, but not the other way round. The command works hierarchically: to set a distance between the 2nd and 3rd and 3rd and 4th channel, you have to set the spacing between the 2nd and 3rd channel first.

**Suffix:**

<ch>                    1..n  
                          Tx channel number

**Parameters:**

<Spacing>            Range:      14 kHz to 2000 MHz  
                          \*RST:      20 kHz  
                          Default unit: Hz

**Manual operation:** See "[Channel Spacings](#)" on page 282

**[SENSe:]POWer:ACHannel:TXChannel:COUNT <Number>**

Defines the number of transmission channels.

The command works for measurements in the frequency domain.

**Parameters:**

<Number>	Range:	1 to 18
	*RST:	1

**Manual operation:** See ["Number of channels: Tx , Adj "](#) on page 278

**Defining weighting filters**

The following commands define weighting filters for ACLR measurements.

<a href="#">[SENSe:]POWer:ACHannel:FILTer:ALPHa:ACHannel</a> .....	692
<a href="#">[SENSe:]POWer:ACHannel:FILTer:ALPHa[:ALL]</a> .....	692
<a href="#">[SENSe:]POWer:ACHannel:FILTer:ALPHa:ALternate&lt;ch&gt;</a> .....	692
<a href="#">[SENSe:]POWer:ACHannel:FILTer:ALPHa:CHANnel&lt;ch&gt;</a> .....	693
<a href="#">[SENSe:]POWer:ACHannel:FILTer[:STATe]:ACHannel</a> .....	693
<a href="#">[SENSe:]POWer:ACHannel:FILTer[:STATe][:ALL]</a> .....	693
<a href="#">[SENSe:]POWer:ACHannel:FILTer[:STATe]:ALternate&lt;ch&gt;</a> .....	694
<a href="#">[SENSe:]POWer:ACHannel:FILTer[:STATe]:CHANnel&lt;ch&gt;</a> .....	694

**[SENSe:]POWer:ACHannel:FILTer:ALPHa:ACHannel <Alpha>**

Defines the roll-off factor for the adjacent channel weighting filter.

For asymmetrical MSR signals, this command defines the roll-off factor for the lower adjacent channel. To configure the factor for the upper adjacent channel, use the [\[SENSe:\]POWer:ACHannel:FILTer:ALPHa:UACHannel](#) command.

**Parameters:**

<Alpha>	Roll-off factor
	Range: 0 to 1
	*RST: 0.22

**Manual operation:** See ["Weighting Filters "](#) on page 284  
See ["Weighting Filters "](#) on page 294

**[SENSe:]POWer:ACHannel:FILTer:ALPHa[:ALL] <Value>**

Defines the alpha value for the weighting filter for all channels.

**Parameters:**

<Value>	*RST: 0.22
---------	------------

**Example:** POW:ACH:FILT:ALPH:ALL 0.35

**[SENSe:]POWer:ACHannel:FILTer:ALPHa:ALternate<ch> <Alpha>**

Defines the roll-off factor for the alternate channel weighting filter.

For asymmetrical MSR signals, this command defines the roll-off factor for the lower alternate channels. To configure the factor for the upper alterante channels, use the `[SENSe:]POWer:ACHannel:FILTer:ALPHa:UALTernate<ch>` command.

**Suffix:**

<ch> 1..n  
Alternate channel number

**Parameters:**

<Alpha> Roll-off factor  
Range: 0 to 1  
\*RST: 0.22

**Manual operation:** See "Weighting Filters " on page 284  
See "Weighting Filters " on page 294

`[SENSe:]POWer:ACHannel:FILTer:ALPHa:CHANnel<ch>` <Alpha>

Defines the roll-off factor for the transmission channel weighting filter.

**Suffix:**

<ch> 1..n  
Tx channel number

**Parameters:**

<Alpha> Roll-off factor  
Range: 0 to 1  
\*RST: 0.22

**Manual operation:** See "Weighting Filters " on page 284

`[SENSe:]POWer:ACHannel:FILTer[:STATe]:ACHannel` <State>

Turns the weighting filter for the adjacent channel on and off.

For asymmetrical MSR signals, this command turns the weighting filter for the lower adjacent channel on and off. To configure the filter state for the upper adjacent channel, use the `[SENSe:]POWer:ACHannel:FILTer[:STATe]:UACHannel` command.

**Parameters:**

<State> ON | OFF | 1 | 0  
\*RST: 0

**Manual operation:** See "Weighting Filters " on page 284  
See "Weighting Filters " on page 294

`[SENSe:]POWer:ACHannel:FILTer[:STATe][:ALL]` <State>

Turns the weighting filters for all channels on and off.

**Parameters:**

<State> ON | OFF | 1 | 0  
 \*RST: 0

---

**[SENSe:]POWer:ACHannel:FiLTer[:STATe]:ALternate<ch> <State>**

Turns the weighting filter for an alternate channel on and off.

For asymmetrical MSR signals, this command turns the weighting filter for the lower alternate channels on and off. To configure the filter state for the upper alternate channels, use the `[SENSe:]POWer:ACHannel:FiLTer[:STATe]:UALternate<ch>` command.

**Suffix:**

<ch> 1..n  
 Alternate channel number

**Parameters:**

<State> ON | OFF | 1 | 0  
 \*RST: 0

**Manual operation:** See ["Weighting Filters"](#) on page 284  
 See ["Weighting Filters"](#) on page 294

---

**[SENSe:]POWer:ACHannel:FiLTer[:STATe]:CHANnel<ch> <State>**

Turns the weighting filter for a transmission channel on and off.

**Suffix:**

<ch> 1..n  
 Tx channel number

**Parameters:**

<State> ON | OFF | 1 | 0  
 \*RST: 0

**Manual operation:** See ["Weighting Filters"](#) on page 284

**Selecting the reference channel**

The following commands define the reference channel for relative ACLR measurements.

[\[SENSe:\]POWer:ACHannel:REFeRence:AUTO ONCE](#)..... 694  
[\[SENSe:\]POWer:ACHannel:REFeRence:TXCHannel:AUTO](#)..... 695  
[\[SENSe:\]POWer:ACHannel:REFeRence:TXCHannel:MANual](#)..... 695

---

**[SENSe:]POWer:ACHannel:REFeRence:AUTO ONCE**

This command sets the channel power as the reference for relative ACLR measurements.

**Example:** POW:ACH:REF:AUTO ONCE

**Usage:** Event

**Manual operation:** See ["Setting a fixed reference for Channel Power measurements \(Set CP Reference\)"](#) on page 280

**[SENSe:]POWer:ACHannel:REFerence:TXCHannel:AUTO** <RefChannel>

Selects the reference channel for relative measurements.

You need at least one channel for the command to work.

**Parameters:**

<RefChannel> MINimum | MAXimum | LHIGhest

**MINimum**

Transmission channel with the lowest power

**MAXimum**

Transmission channel with the highest power

**LHIGhest**

Lowest transmission channel for lower adjacent channels and highest transmission channel for upper adjacent channels

**Example:**

POW:ACH:REF:TXCH:AUTO MAX

Selects the channel with the peak power as reference channel.

**Manual operation:** See ["Reference Channel"](#) on page 278

**[SENSe:]POWer:ACHannel:REFerence:TXCHannel:MANual** <ChannelNumber>

Defines a reference channel for relative ACLR measurements.

You need at least one channel for the command to work.

**Parameters:**

<ChannelNumber> Range: 1 to 18  
\*RST: 1

**Manual operation:** See ["Reference Channel"](#) on page 278

### Checking limits

The following commands configure and query limit checks for channel power and ACLR measurements.



The results of the power limit checks are also indicated in the `STAT:QUES:ACPL` status registry (see ["STATus:QUESTIONable:ACPLimit register"](#) on page 482).

<a href="#">CALCulate&lt;n&gt;:LIMit&lt;li&gt;:ACPower:ACHannel:ABSolute</a> .....	696
<a href="#">CALCulate&lt;n&gt;:LIMit&lt;li&gt;:ACPower:ACHannel:ABSolute:STATe</a> .....	696
<a href="#">CALCulate&lt;n&gt;:LIMit&lt;li&gt;:ACPower:ACHannel[:RELative]</a> .....	697
<a href="#">CALCulate&lt;n&gt;:LIMit&lt;li&gt;:ACPower:ACHannel:RESult?</a> .....	697
<a href="#">CALCulate&lt;n&gt;:LIMit&lt;li&gt;:ACPower:ACHannel[:RELative]:STATe</a> .....	698

CALCulate<n>:LIMit<li>:ACPoweR:ALTErnate<ch>:ABSolute.....	698
CALCulate<n>:LIMit<li>:ACPoweR:ALTErnate<ch>:ABSolute:STATe.....	699
CALCulate<n>:LIMit<li>:ACPoweR:ALTErnate<ch>[:RELative].....	700
CALCulate<n>:LIMit<li>:ACPoweR:ALTErnate<ch>:RESult?.....	700
CALCulate<n>:LIMit<li>:ACPoweR:ALTErnate<ch>[:RELative]:STATe.....	701
CALCulate<n>:LIMit<li>:ACPoweR:PMODE.....	701
CALCulate<n>:LIMit<li>:ACPoweR[:STATe].....	702

---

**CALCulate<n>:LIMit<li>:ACPoweR:ACHannel:ABSolute** <LowerLimit>[, <UpperLimit>]

Defines the absolute limit of the adjacent channels.

If you have defined an absolute limit as well as a relative limit, the R&S VSE uses the lower value for the limit check.

**Suffix:**

<n>                    irrelevant

<li>                   irrelevant

**Parameters:**

<LowerLimit>        The limit of the lower adjacent channel.  
 Range:                -200 dBm to 200 dBm  
 \*RST:                -200 dBm  
 Default unit: dBm

<UpperLimit>        The limit of the upper adjacent channel.  
 Range:                -200 dBm to 200 dBm  
 \*RST:                -200 dBm  
 Default unit: dBm

**Manual operation:** See "Limit Check " on page 283  
 See "Limit Checking " on page 295

---

**CALCulate<n>:LIMit<li>:ACPoweR:ACHannel:ABSolute:STATe** <State>[, <State>]

This command turns the absolute limit check for the adjacent channels on and off.

You have to activate the general ACLR limit check before using this command with [CALCulate<n>:LIMit<li>:ACPoweR\[:STATe\]](#).

**Suffix:**

<n>                    irrelevant

<li>                   irrelevant

**Parameters:**

<State>                ON | OFF | 1 | 0  
 Absolute limit check for lower adjacent channel  
 \*RST:                0



<State> ON | OFF | 1 | 0  
 Absolute limit check for upper adjacent channel  
 \*RST: 0

**Manual operation:** See "[Limit Check](#)" on page 283  
 See "[Limit Checking](#)" on page 295

**CALCulate<n>:LIMit<li>:ACPpower:ACHannel[:RELative]** <LowerLimit>[,  
 <UpperLimit>]

Defines the relative limit of the adjacent channels. The reference value for the relative limit is the measured channel power.

If you have defined an absolute limit as well as a relative limit, the R&S VSE uses the lower value for the limit check.

**Suffix:**

<n> irrelevant

<li> irrelevant

**Parameters:**

<LowerLimit> The limit of the lower adjacent channel.  
 Range: 0 dB to 100 dB  
 \*RST: 0 dB  
 Default unit: dB

<UpperLimit> The limit of the upper adjacent channel.  
 Range: 0 dB to 100 dB  
 \*RST: 0 dB  
 Default unit: dB

**Manual operation:** See "[Limit Check](#)" on page 283  
 See "[Limit Checking](#)" on page 295

**CALCulate<n>:LIMit<li>:ACPpower:ACHannel:RESult?**

Queries the state of the limit check for the adjacent channels in an ACLR measurement.

To get a valid result, you have to perform a complete measurement with synchronization to the end of the measurement before reading out the result. This is only possible for single measurement mode.

See also [INITiate<n>:CONTinuous](#) on page 547.

**Suffix:**

<n> irrelevant

<li> irrelevant

**Return values:**

<LowerACH> text value  
 The state of the limit check for the lower adjacent channels.

**PASSED**

Limit check has passed.

**FAIL**

Limit check has failed.

&lt;UpperACH&gt;

text value

The state of the limit check for the upper adjacent channels.

**PASSED**

Limit check has passed.

**FAIL**

Limit check has failed.

**Example:**

```
INIT:IMM;*WAI;
CALC:LIM:ACP:ACH:RES?
PASSED,PASSED
```

**Usage:**

Query only

**Manual operation:**See "[Limit Check](#)" on page 283See "[Limit Checking](#)" on page 295

**CALCulate<n>:LIMit<li>:ACPpower:ACHannel[:RELative]:STATe <State>[, <State>]**

This command turns the relative limit check for the adjacent channels on and off.

You have to activate the general ACLR limit check before using this command with

[CALCulate<n>:LIMit<li>:ACPpower\[:STATe\]](#).

**Suffix:**

<n> irrelevant

<li> irrelevant

**Parameters:**

<State> ON | OFF | 1 | 0

Relative limit check for lower adjacent channel

\*RST: 0

<State> ON | OFF | 1 | 0

Relative limit check for upper adjacent channel

\*RST: 0

**Manual operation:**See "[Limit Check](#)" on page 283See "[Limit Checking](#)" on page 295

**CALCulate<n>:LIMit<li>:ACPpower:ALTErnate<ch>:ABSolute <LowerLimit>[, <UpperLimit>]**

Defines the absolute limit of the alternate channels.

If you have defined an absolute limit as well as a relative limit, the R&S VSE uses the lower value for the limit check.

**Suffix:**

<n>	irrelevant
<li>	irrelevant
<ch>	1..n Alternate channel number

**Parameters:**

<LowerLimit>	The limit of the lower adjacent channel. Range: -200 dBm to 200 dBm *RST: -200 dBm Default unit: dBm
<UpperLimit>	The limit of the upper adjacent channel. Range: -200 dBm to 200 dBm *RST: -200 dBm Default unit: dBm

**Manual operation:** See "[Limit Check](#)" on page 283  
See "[Limit Checking](#)" on page 295

**CALCulate**<n>:**LIMit**<li>:**ACP**ower:**AL**Ternate<ch>:**ABS**olute:**STA**Te <State>[, <State>]

This command turns the absolute limit check for the alternate channels on and off.

You have to activate the general ACLR limit check before using this command with [CALCulate](#)<n>:[LIMit](#)<li>:[ACP](#)ower[:[STA](#)Te].

**Suffix:**

<n>	irrelevant
<li>	irrelevant
<ch>	1..n Alternate channel number

**Parameters:**

<State>	ON   OFF   1   0 Absolute limit check for lower alternate channel *RST: 0
<State>	ON   OFF   1   0 Absolute limit check for upper alternate channel *RST: 0

**Manual operation:** See "[Limit Check](#)" on page 283  
See "[Limit Checking](#)" on page 295

---

**CALCulate**<n>:LIMit<li>:ACPpower:ALternate<ch>[:RELative] <LowerLimit>[, <UpperLimit>]

Defines the relative limit of the alternate channels. The reference value for the relative limit is the measured channel power.

If you have defined an absolute limit as well as a relative limit, the R&S VSE uses the lower value for the limit check.

**Suffix:**

<n>	irrelevant
<li>	irrelevant
<ch>	1..n Alternate channel number

**Parameters:**

<LowerLimit>	The limit of the lower alternate channel. Range: 0 dB to 100 dB *RST: 0 dB Default unit: dB
<UpperLimit>	The limit of the upper alternate channel. Range: 0 dB to 100 dB *RST: 0 dB Default unit: dB

**Manual operation:** See "[Limit Check](#)" on page 283  
See "[Limit Checking](#)" on page 295

---

**CALCulate**<n>:LIMit<li>:ACPpower:ALternate<ch>:RESult?

Queries the state of the limit check for the adjacent or alternate channels in an ACLR measurement.

To get a valid result, you have to perform a complete measurement with synchronization to the end of the measurement before reading out the result. This is only possible for single measurement mode.

See also [INITiate](#)<n>:CONTinuous on page 547.

**Suffix:**

<n>	irrelevant
<li>	irrelevant
<ch>	Alternate channel number

**Return values:**

<LowerChan>	text value The state of the limit check for the lower alternate or adjacent channels. <b>PASSED</b> Limit check has passed.
-------------	--

	<b>FAIL</b> Limit check has failed.
<UpperChan>	text value  The state of the limit check for the upper alternate or adjacent channels.
	<b>PASSED</b> Limit check has passed.
	<b>FAIL</b> Limit check has failed.
<b>Example:</b>	INIT:IMM;*WAI; CALC:LIM:ACP:ACH:RES? PASSED,PASSED
<b>Usage:</b>	Query only

---

**CALCulate<n>:LIMit<li>:ACPpower:ALternate<ch>[:RELative]:STATe <State>[, <State>]**

This command turns the relative limit check for the alternate channels on and off.

You have to activate the general ACLR limit check before using this command with [CALCulate<n>:LIMit<li>:ACPpower\[:STATe\]](#).

**Suffix:**

<n>	irrelevant
<li>	irrelevant
<ch>	1..n Alternate channel number

**Parameters:**

<State>	ON   OFF   1   0 Relative limit check for lower alternate channel *RST: 0
<State>	ON   OFF   1   0 Relative limit check for upper alternate channel *RST: 0

**Manual operation:** See "[Limit Check](#)" on page 283  
See "[Limit Checking](#)" on page 295

---

**CALCulate<n>:LIMit<li>:ACPpower:PMODE <Mode>**

Selects the limit evaluation mode for ACLR measurements.

Supported for ACLR measurements in the 5G application.

**Suffix:**

<n>	irrelevant
-----	------------

<li> irrelevant

**Parameters:**

<Mode>

**AND**

Overall limit check passes if both absolute and relative limit checks pass.

**OR**

Overall limit check passes if either absolute or relative limit checks pass.

\*RST: AND

**Example:**

```
//Select evaluation mode
CALC:LIM:ACP:PMOD AND
```

**Manual operation:** See "[Total Limit Pass Mode](#)" on page 283

**CALCulate<n>:LIMit<li>:ACPower[:STATe] <State>**

Turns the limit check for ACLR measurements on and off.

In addition, limits must be defined and activated individually for each channel (see [CALCulate<n>:LIMit<li>:ACPower:ACHannel\[:RELative\]:STATe](#), [CALCulate<n>:LIMit<li>:ACPower:ALternate<ch>\[:RELative\]:STATe](#), [CALCulate<n>:LIMit<li>:ACPower:GAP<gap>\[:AUTO\]:ABSolute:STATe](#), [CALCulate<n>:LIMit<li>:ACPower:GAP<gap>\[:AUTO\]:ACLR\[:RELative\]:STATe](#) and [CALCulate<n>:LIMit<li>:ACPower:GAP<gap>\[:AUTO\]\[:CACLR\]\[:RELative\]:STATe](#)).

**Suffix:**

<n> irrelevant

<li> irrelevant

**Parameters:**

<State> ON | OFF | 1 | 0

\*RST: 0

**Manual operation:** See "[Limit Check](#)" on page 283  
See "[Limit Checking](#)" on page 289  
See "[Limit Checking](#)" on page 295

**Checking limits (total limit pass mode)**

The following commands are only available in the ACLR measurements of the 5G application.

Depending on the syntax, the commands return the limit check results for:

- adjacent channels
- alternate channels
- gap channels in multi carrier ACLR measurements (LTE and 5G downlink only)

- gap channels in cumulative ACLR measurement (LTE downlink and 5G downlink only)

CALCulate<n>:LIMit<li>:ACPpower:ACHannel:RESult:ABSolute.....	703
CALCulate<n>:LIMit<li>:ACPpower:ACHannel:RESult:RELative.....	703
CALCulate<n>:LIMit<li>:ACPpower:ALternate<ch>:RESult:ABSolute.....	704
CALCulate<n>:LIMit<li>:ACPpower:ALternate<ch>:RESult:RELative.....	704
CALCulate<n>:LIMit<li>:ACPpower:GAP<gap>:ACLR:RESult:ABSolute?.....	705
CALCulate<n>:LIMit<li>:ACPpower:GAP<gap>:ACLR:RESult:RELative?.....	705
CALCulate<n>:LIMit<li>:ACPpower:GAP<gap>[:CACLR]:RESult:ABSolute?.....	706
CALCulate<n>:LIMit<li>:ACPpower:GAP<gap>[:CACLR]:RESult:RELative?.....	706

---

### CALCulate<n>:LIMit<li>:ACPpower:ACHannel:RESult:ABSolute

Queries the absolute limit check results for adjacent channels (ACLR measurements).

Prerequisites for this command

- Select absolute limit check mode  
evaluation mode  
ACLR: CALCulate<n>:LIMit<li>:ACPpower:PMODE.

#### Suffix:

<n> irrelevant

<li> irrelevant

#### Return values:

<LimitCheck> Returns two values, one for the upper and one for the lower adjacent channel.

#### **PASSED**

Limit check has passed.

#### **FAILED**

Limit check has failed.

**Example:** //Query results of the adjacent channel limit check  
CALC:LIM:ACP:ACH:RES:ABS?

---

### CALCulate<n>:LIMit<li>:ACPpower:ACHannel:RESult:RELative

Queries the relative limit check results for the adjacent channels (ACLR measurements).

Prerequisites for this command

- Select relative limit check mode  
ACLR: CALCulate<n>:LIMit<li>:ACPpower:PMODE.

#### Suffix:

<n> irrelevant

<lj> irrelevant

**Return values:**

<LimitCheck> Returns two values, one for the upper and one for the lower adjacent channel.

**PASSED**

Limit check has passed.

**FAILED**

Limit check has failed.

**Example:**

```
//Query results of the adjacent channel limit check
CALC:LIM:ACP:ACH:RES:REL?
```

**CALCulate<n>:LIMit<li>:ACPpower:ALternate<ch>:RESult:ABSolute**

Queries the absolute limit check results for the alternate channels (MC ACLR measurements).

Prerequisites for this command

- Select absolute limit check mode  
ACLR: `CALCulate<n>:LIMit<li>:ACPpower:PMODE.`

**Suffix:**

<n> irrelevant

<lj> irrelevant

<ch> irrelevant

**Return values:**

<LimitCheck> Returns two values, one for the upper and one for the lower adjacent channel.

**PASSED**

Limit check has passed.

**FAILED**

Limit check has failed.

**Example:**

```
//Query results of the alternate channel limit check
CALC:LIM:ACP:ALT:RES:ABS?
```

**CALCulate<n>:LIMit<li>:ACPpower:ALternate<ch>:RESult:RELative**

Queries the relative limit check results for the alternate channels (MC ACLR measurements).

Prerequisites for this command

- Select relative limit check mode  
ACLR: `CALCulate<n>:LIMit<li>:ACPpower:PMODE.`

**Suffix:**

<n> irrelevant

<lj> irrelevant



<ch> irrelevant

**Return values:**

<LimitCheck> Returns two values, one for the upper and one for the lower adjacent channel.

**PASSED**

Limit check has passed.

**FAILED**

Limit check has failed.

**Example:**

```
//Query results of the alternate channel limit check
CALC:LIM:ACP:ALT:RES:REL?
```

**CALCulate<n>:LIMit<li>:ACPower:GAP<gap>:ACLR:RESult:ABSolute?**

Queries the absolute power limit check results for the gap channels (MC ACLR measurements).

Prerequisites for this command

- Select absolute limit check mode evaluation mode

ACLR: [CALCulate<n>:LIMit<li>:ACPower:PMODE.](#)

**Suffix:**

<n> irrelevant

<li> irrelevant

<gap> irrelevant

**Return values:**

<LimitCheck> Returns two values, one for the upper and one for the lower adjacent channel.

**PASSED**

Limit check has passed.

**FAILED**

Limit check has failed.

**Example:**

```
//Query results of the gap channel limit check
CALC:LIM:ACP:GAP:ACLR:RES:ABS?
```

**Usage:**

Query only

**CALCulate<n>:LIMit<li>:ACPower:GAP<gap>:ACLR:RESult:RELative?**

Queries the relative power limit check results for the gap channels (MC ACLR measurements).

Prerequisites for this command

- Select relative limit check mode evaluation mode

ACLR: [CALCulate<n>:LIMit<li>:ACPower:PMODE.](#)

<b>Suffix:</b>	
<n>	irrelevant
<li>	irrelevant
<gap>	irrelevant
<b>Return values:</b>	
<LimitCheck>	Returns two values, one for the upper and one for the lower adjacent channel. <b>PASSED</b> Limit check has passed. <b>FAILED</b> Limit check has failed.
<b>Example:</b>	//Query results of the gap channel limit check CALC:LIM:ACP:GAP:ACLR:RES:REL?
<b>Usage:</b>	Query only

#### **CALCulate<n>:LIMit<li>:ACPpower:GAP<gap>[:CACLR]:RESult:ABSolute?**

Queries the absolute limit check results for the gap channels (MC ACLR measurements).

Prerequisites for this command

- Select absolute limit check mode evaluation mode  
ACLR: `CALCulate<n>:LIMit<li>:ACPpower:PMODE.`

<b>Suffix:</b>	
<n>	irrelevant
<li>	irrelevant
<gap>	irrelevant
<b>Return values:</b>	
<LimitCheck>	Returns two values, one for the upper and one for the lower adjacent channel. <b>PASSED</b> Limit check has passed. <b>FAILED</b> Limit check has failed.
<b>Example:</b>	//Query results of the gap channel limit check CALC:LIM:ACP:GAP:RES:ABS?
<b>Usage:</b>	Query only

#### **CALCulate<n>:LIMit<li>:ACPpower:GAP<gap>[:CACLR]:RESult:RELative?**

Queries the relative limit check results for the gap channels (MC ACLR measurements).

Prerequisites for this command

- Select relative limit check mode evaluation mode  
ACLR: `CALCulate<n>:LIMit<li>:ACPower:PMODE.`

**Suffix:**

<n>	irrelevant
<li>	irrelevant
<gap>	irrelevant

**Return values:**

<LimitCheck> Returns two values, one for the upper and one for the lower adjacent channel.

**PASSED**

Limit check has passed.

**FAILED**

Limit check has failed.

**Example:** //Query results of the gap channel limit check  
`CALC:LIM:ACP:GAP:RES:REL?`

**Usage:** Query only

### General ACLR measurement settings

The following commands control the measurement algorithm.

<code>[SENSe:]POWer:HSPeed</code> .....	707
<code>[SENSe:]POWer:ACHannel:PRESet</code> .....	708
<code>[SENSe:]POWer:ACHannel:PRESet:RLEVel</code> .....	708
<code>[SENSe:]POWer:TRACe</code> .....	708
<code>CALCulate&lt;n&gt;:MARKer&lt;m&gt;:FUNCTion:POWer&lt;sb&gt;:MODE</code> .....	709

---

#### `[SENSe:]POWer:HSPeed <State>`

Turns high speed ACLR and channel power measurements on and off.

If on, the R&S VSE performs a measurement on each channel in the time domain. It returns to the frequency domain when the measurement is done.

In some telecommunications standards, high speed measurements use weighting filters with characteristic or steep-edged channel filters for band limitation.

**Parameters:**

<State> ON | OFF | 1 | 0  
\*RST: 0

**Example:** `POW:HSP ON`

---

**[SENSe:]POWer:ACHannel:PRESet <Measurement>**

Determines the ideal span, bandwidths and detector for the current power measurement.

To get a valid result, you have to perform a complete measurement with synchronization to the end of the measurement before reading out the result. This is only possible for single measurement mode.

See also [INITiate<n>:CONTinuous](#) on page 547.

**Parameters:**

<Measurement>	<b>ACPower   MCACpower</b> ACLR measurement
	<b>CPOWer</b> channel power measurement
	<b>OBANdwidth   OBWidth</b> Occupied bandwidth measurement

**Manual operation:** See "[Optimized Settings \(Adjust Settings \)](#)" on page 280  
See "[Adjust Settings](#)" on page 315

---

**[SENSe:]POWer:ACHannel:PRESet:RLEVel**

This command determines the ideal reference level for the current measurement.

This automatic routine makes sure that the that the signal power level does not overload the R&S VSE or limit the dynamic range by too small a S/N ratio.

To determine the best reference level, the R&S VSE aborts current measurements and performs a series of test sweeps. After it has finished the test, it continues with the actual measurement.

To get a valid result, you have to perform a complete sweep with synchronization to the sweep end. This is only possible in single sweep mode.

---

**[SENSe:]POWer:TRACe <TraceNumber>**

Selects the trace channel power measurements are performed on.

For the measurement to work, the corresponding trace has to be active.

**Parameters:**

<TraceNumber>	Range: 1 to 6
	*RST: 1

**Example:** POW:TRAC 2  
Assigns the measurement to trace 2.

**Manual operation:** See "[Selected Trace](#)" on page 279

**CALCulate<n>:MARKer<m>:FUNction:POWer<sb>:MODE <Mode>**

Selects the trace display mode for power measurements.

**Suffix:**

<n>	Window
<m>	Marker
<sb>	irrelevant

**Parameters:**

<Mode>      WRITe | MAXHold

**WRITe**

The power is calculated from the current trace.

**MAXHold**

The power is calculated from the current trace and compared with the previous power value using a maximum algorithm.

**Manual operation:** See "Power Mode " on page 279

**Configuring MSR ACLR measurements**

If the "Multi-Standard Radio" standard is selected (see [CALCulate<n>:MARKer<m>:FUNction:POWer<sb>:PRESet](#) on page 686), the channels for the ACLR measurement are configured differently. (For more information see "[Measurement on multi-standard radio \(MSR\) signals](#)" on page 270.)

In this case, use the following commands.

- [General MSR ACLR measurement settings](#)..... 709
- [MSR sub block and Tx channel setup](#)..... 710
- [MSR adjacent channel setup](#)..... 712
- [General gap channel setup](#)..... 717
- [Automatic \(symmetrical\) configuration](#)..... 717
- [MSR channel names](#)..... 722

**General MSR ACLR measurement settings**

Useful commands for configuring general MSR ACLR settings described elsewhere:

- [CALCulate<n>:MARKer<m>:FUNction:POWer<sb>:PRESet](#) on page 686
- [CALCulate<n>:MARKer<m>:FUNction:POWer<sb>:RESult?](#) on page 724
- [CALCulate<n>:MARKer<m>:FUNction:POWer<sb>:RESult:PHZ](#) on page 728
- [CALCulate<n>:MARKer<m>:FUNction:POWer<sb>:MODE](#) on page 709
- [CALCulate<n>:LIMit<li>:ACPower\[:STATe\]](#) on page 702
- [\[SENSe:\] POWER:ACHannel:REFerence:TXCHannel:AUTO](#) on page 695
- [\[SENSe:\] POWER:TRACe](#) on page 708
- [\[SENSe:\] POWER:ACHannel:MODE](#) on page 729
- [\[SENSe:\] POWER:ACHannel:PRESet](#) on page 708

- [\[SENSe:\]POWer:ACHannel:SSEtup](#) on page 715

### MSR sub block and Tx channel setup

The functions for manual operation are described in "[MSR sub block and TX channel definition](#)" on page 290.

Useful commands for configuring Tx channels described elsewhere:

- [\[SENSe:\]POWer:ACHannel:SBLOCK<sb>:NAME\[:CHANnel<ch>\]](#) on page 723

### Remote commands exclusive to configuring sub blocks and Tx channels

<a href="#">[SENSe:]POWer:ACHannel:FILTer:ALPHA:SBLOCK&lt;sb&gt;:CHANnel&lt;ch&gt;</a> .....	710
<a href="#">[SENSe:]POWer:ACHannel:FILTer[:STATe]:SBLOCK&lt;sb&gt;:CHANnel&lt;ch&gt;</a> .....	710
<a href="#">[SENSe:]POWer:ACHannel:SBCount</a> .....	711
<a href="#">[SENSe:]POWer:ACHannel:SBLOCK&lt;sb&gt;:BWIth[:CHANnel&lt;ch&gt;]</a> .....	711
<a href="#">[SENSe:]POWer:ACHannel:SBLOCK&lt;sb&gt;:BANDwidth[:CHANnel&lt;ch&gt;]</a> .....	711
<a href="#">[SENSe:]POWer:ACHannel:SBLOCK&lt;sb&gt;:CENTer[:CHANnel&lt;ch&gt;]</a> .....	711
<a href="#">[SENSe:]POWer:ACHannel:SBLOCK&lt;sb&gt;:FREQuency:CENTer</a> .....	712

---

#### **[SENSe:]POWer:ACHannel:FILTer:ALPHA:SBLOCK<sb>:CHANnel<ch>** <Alpha>

Defines the roll-off factor for the specified transmission channel's weighting filter.

##### Suffix:

<sb>	1 to 5 sub block number
<ch>	1..n Tx channel number

##### Parameters:

<Alpha>	Roll-off factor
	Range: 0 to 1
	*RST: 0.22

**Manual operation:** See "[Weighting Filters](#)" on page 292

---

#### **[SENSe:]POWer:ACHannel:FILTer[:STATe]:SBLOCK<sb>:CHANnel<ch>** <State>

Turns the weighting filter for the specified transmission channel on and off.

##### Suffix:

<sb>	1 to 5 sub block number
<ch>	1..n Tx channel number

##### Parameters:

<State>	ON   OFF   1   0
	*RST: W-CDMA: 1, other technologies: 0

**Manual operation:** See ["Weighting Filters"](#) on page 292

---

**[SENSe:]POWer:ACHannel:SBCount** <Number>

Defines the number of sub blocks, i.e. groups of transmission channels in an MSR signal.

For more information see ["Measurement on multi-standard radio \(MSR\) signals"](#) on page 270.

**Parameters:**

<Number>                    Range:        1 to 5  
                                   \*RST:        1

**Manual operation:** See ["Number of Sub Blocks"](#) on page 288

---

**[SENSe:]POWer:ACHannel:SBLock<sb>:BWIDth[:CHANnel<ch>]** <Bandwidth>  
**[SENSe:]POWer:ACHannel:SBLock<sb>:BANDwidth[:CHANnel<ch>]**  
                                   <Bandwidth>

Defines the bandwidth of the specified MSR Tx channel.

Is for MSR signals only (see [CALCulate<n>:MARKer<m>:FUNction:POWer<sb>:PRESet](#) on page 686).

**Suffix:**

<sb>                            1 to 5  
                                   sub block number

<ch>                            1..n  
                                   Tx channel number

**Parameters:**

<Bandwidth>                Bandwidth in Hz  
                                   Default unit: Hz

**Manual operation:** See ["Tx Channel Bandwidth"](#) on page 292

---

**[SENSe:]POWer:ACHannel:SBLock<sb>:CENTer[:CHANnel<ch>]** <Frequency>

Defines the (absolute) center frequency of the specified MSR Tx channel.

Note that the position of the first Tx channel in the first sub block and the last Tx channel in the last sub block also affect the position of the adjacent channels.

Is for MSR signals only (see [CALCulate<n>:MARKer<m>:FUNction:POWer<sb>:PRESet](#) on page 686).

**Suffix:**

<sb>                            1 to 5  
                                   sub block number

<ch>                            1..n  
                                   Tx channel number

**Parameters:**

<Frequency> absolute frequency in Hz  
 Default unit: Hz

**Manual operation:** See ["Tx Center Frequency"](#) on page 291

**[SENSe:]POWer:ACHannel:SBLock<sb>:FREQuency:CENTer** <Frequency>

Defines the center of the specified MSR sub block. Note that the position of the sub block also affects the position of the adjacent gap (CACLR) channels.

Is for MSR signals only (see [CALCulate<n>:MARKer<m>:FUNction:POWer<sb>:PRESet](#) on page 686).

**Suffix:**

<sb> 1 to 5  
 sub block number

**Parameters:**

<Frequency> absolute frequency in Hz  
 Default unit: Hz

**Manual operation:** See ["Sub Block / Center Freq"](#) on page 291

**MSR adjacent channel setup**

The functions for manual operation are described in [Chapter 10.4.1.5, "MSR ACLR configuration"](#), on page 285.

Useful commands for MSR adjacent channel setup described elsewhere:

- ["Checking limits"](#) on page 695
- ["MSR channel names"](#) on page 722

**Remote commands exclusive to MSR adjacent channel setup:**

<a href="#">[SENSe:]POWer:ACHannel:SBLock&lt;sb&gt;:RFBWidth</a> .....	713
<a href="#">[SENSe:]POWer:ACHannel:SBLock&lt;sb&gt;:TECHnology[:CHANnel&lt;ch&gt;]</a> .....	713
<a href="#">[SENSe:]POWer:ACHannel:SBLock&lt;sb&gt;:TXCHannel:COUNT</a> .....	714
<a href="#">[SENSe:]POWer:ACHannel:SPACing:UACHannel</a> .....	714
<a href="#">[SENSe:]POWer:ACHannel:SPACing:UALTernate&lt;ch&gt;</a> .....	714
<a href="#">[SENSe:]POWer:ACHannel:SSETup</a> .....	715
<a href="#">[SENSe:]POWer:ACHannel:BWIDth:UACHannel</a> .....	715
<a href="#">[SENSe:]POWer:ACHannel:BANDwidth:UACHannel</a> .....	715
<a href="#">[SENSe:]POWer:ACHannel:BANDwidth:UALTernate&lt;ch&gt;</a> .....	715
<a href="#">[SENSe:]POWer:ACHannel:BANDwidth:UALTernate&lt;ch&gt;</a> .....	715
<a href="#">[SENSe:]POWer:ACHannel:FILTer:ALPHa:UACHannel</a> .....	716
<a href="#">[SENSe:]POWer:ACHannel:FILTer:ALPHa:UALTernate&lt;ch&gt;</a> .....	716
<a href="#">[SENSe:]POWer:ACHannel:FILTer[:STATE]:UACHannel</a> .....	716
<a href="#">[SENSe:]POWer:ACHannel:FILTer[:STATE]:UALTernate&lt;ch&gt;</a> .....	716



**[SENSe:]POWer:ACHannel:SBLock<sb>:RFBWidth <Bandwidth>**

Defines the bandwidth of the individual MSR sub block. Note that sub block ranges also affect the position of the adjacent gap channels (CACLR).

Is for MSR signals only (see [CALCulate<n>:MARKer<m>:FUNction:POWer<sb>:PRESet](#) on page 686).

**Suffix:**

<sb> 1 to 5  
sub block number

**Parameters:**

<Bandwidth> Bandwidth in Hz  
Default unit: Hz

**Manual operation:** See "[RF Bandwidth](#)" on page 291

**[SENSe:]POWer:ACHannel:SBLock<sb>:TECHnology[:CHANnel<ch>]  
<Standard>**

Defines the technology used for transmission by the specified MSR Tx channel.

Is for MSR signals only (see [CALCulate<n>:MARKer<m>:FUNction:POWer<sb>:PRESet](#) on page 686).

**Suffix:**

<sb> 1 to 5  
sub block number

<ch> 1..n  
Tx channel number

**Parameters:**

<Standard> Technology used for transmission

**GSM**

Transmission according to GSM standard

**WCDMa**

Transmission according to W-CDMA standard

**LTE\_1\_40 | LTE\_3\_00 | LTE\_5\_00 | LTE\_10\_00 | LTE\_15\_00 |  
LTE\_20\_00**

Transmission according to LTE standard for different channel bandwidths

**NR5G\_fr1\_5 | NR5G\_fr1\_10 | NR5G\_fr1\_15 | NR5G\_fr1\_20 |  
NR5G\_fr1\_25 | NR5G\_fr1\_30 | NR5G\_fr1\_40 | NR5G\_fr1\_50 |  
NR5G\_fr1\_60 | NR5G\_fr1\_70 | NR5G\_fr1\_80 | NR5G\_fr1\_90 |  
NR5G\_fr1\_100 | NR5G\_fr2\_50 | NR5G\_fr2\_100 |  
NR5G\_fr2\_200 | NR5G\_fr2\_400**

Transmission according to new radio 5G standard

**USER**

User-defined transmission; no automatic preconfiguration possible

**Manual operation:** See ["Technology Used for Transmission "](#) on page 292

---

**[SENSe:]POWer:ACHannel:SBLock<sb>:TXCHannel:COUnT <Number>**

Defines the number of transmission channels the specific sub block contains.

Is for MSR signals only (see [CALCulate<n>:MARKer<m>:FUNction:POWer<sb>:PRESet](#) on page 686).

**Suffix:**

<sb>                    1 to 5  
                              sub block number

**Parameters:**

<Number>                Range:     1 to 18  
                              \*RST:      1

**Manual operation:** See ["Number of Tx Channels \(Tx Count \)"](#) on page 291

---

**[SENSe:]POWer:ACHannel:SPACing:UACHannel <Spacing>**

Defines the distance from the transmission channel to the upper adjacent channel.

For MSR signals, this command defines the distance from the CF of the last Tx channel in the last sub block to the upper adjacent channel in asymmetrical configurations. To configure the spacing for the lower adjacent channel use the [\[SENSe:\]POWer:ACHannel:SPACing\[:ACHannel\]](#) command.

**Parameters:**

<Spacing>                Range:     100 Hz to 2000 MHz  
                              \*RST:     14 kHz  
                              Default unit: Hz

**Manual operation:** See ["Adjacent Channel Spacings "](#) on page 294

---

**[SENSe:]POWer:ACHannel:SPACing:UALTernate<ch> <Spacing>**

Defines the distance from transmission channel to the upper alternate channels.

For MSR signals, this command defines the distance from the CF of the last Tx channel in the last sub block to the upper alternate channel in asymmetrical configurations. To configure the spacing for the lower alternate channel, use the [\[SENSe:\]POWer:ACHannel:SPACing:ALTernate<ch>](#) command.

**Suffix:**

<ch>                      1..n  
                              Alternate channel number

**Parameters:**

<Spacing>                Range:     100 Hz to 2000 MHz  
                              \*RST:     40 kHz (ALT1), 60 kHz (ALT2), 80 kHz (ALT3), ...  
                              Default unit: Hz

**Manual operation:** See ["Adjacent Channel Spacings "](#) on page 294

---

**[SENSe:]POWer:ACHannel:SSEtUp <State>**

Defines whether adjacent channels are defined symmetrically or not.

For more information see ["Measurement on multi-standard radio \(MSR\) signals"](#) on page 270.

**Parameters:**

<State> ON | OFF | 1 | 0

**ON | 1**

The upper and lower adjacent and alternate channels are defined symmetrically. This is the default behaviour and corresponds to the behavior in firmware versions before 2.10.

**OFF | 0**

The upper and lower channels can be configured differently.

\*RST: 1

**Manual operation:** See ["Symmetrical Adjacent Setup "](#) on page 289

---

**[SENSe:]POWer:ACHannel:BWIDth:UACHannel <Bandwidth>**

**[SENSe:]POWer:ACHannel:BANDwidth:UACHannel <Bandwidth>**

Defines the channel bandwidth of the upper adjacent channel in asymmetrical configurations.

The adjacent channel is the first pair of channels next to the transmission channels. To configure the bandwidth for the lower adjacent channel, use the [\[SENSe:\]POWer:ACHannel:BANDwidth:ACHannel](#) command.

**Parameters:**

<Bandwidth> Range: 100 Hz to 1000 MHz  
\*RST: 14 kHz  
Default unit: Hz

**Manual operation:** See ["Adjacent Channel Bandwidths "](#) on page 294

---

**[SENSe:]POWer:ACHannel:BWIDth:UALTernate<ch> <Bandwidth>**

**[SENSe:]POWer:ACHannel:BANDwidth:UALTernate<ch> <Bandwidth>**

Defines the channel bandwidth of the upper alternate channels in asymmetrical configurations. To configure the bandwidth for the lower alternate channel, use the [\[SENSe:\]POWer:ACHannel:BANDwidth:ALTernate<ch>](#) command.

**Suffix:**

<ch> 1..n  
Alternate channel number

**Parameters:**

<Bandwidth> Range: 100 Hz to 1000 MHz  
\*RST: 14 kHz  
Default unit: Hz

**Manual operation:** See ["Adjacent Channel Bandwidths "](#) on page 294

---

**[SENSe:]POWer:ACHannel:FILTer:ALPHa:UACHannel <Alpha>**

Defines the roll-off factor for the upper adjacent channel weighting filter for asymmetrical MSR signals. To configure the factor for the upper adjacent channel, use the [\[SENSe:\]POWer:ACHannel:FILTer:ALPHa:ACHannel](#) command.

**Parameters:**

<Alpha>                      Roll-off factor  
                                     Range:     0 to 1  
                                     \*RST:     0.22

**Manual operation:**    See "[Weighting Filters](#) " on page 294

---

**[SENSe:]POWer:ACHannel:FILTer:ALPHa:UALTernate<ch> <Alpha>**

Defines the roll-off factor for the upper alternate channels' weighting filter for asymmetrical MSR signals. To configure the factor for the upper alternate channels, use the [\[SENSe:\]POWer:ACHannel:FILTer:ALPHa:ALTernate<ch>](#) command.

**Suffix:**

<ch>                            1..n  
                                     Alternate channel number

**Parameters:**

<Alpha>                      Roll-off factor  
                                     Range:     0 to 1  
                                     \*RST:     0.22

**Manual operation:**    See "[Weighting Filters](#) " on page 294

---

**[SENSe:]POWer:ACHannel:FILTer[:STATe]:UACHannel <State>**

Turns the weighting filter for the upper adjacent channel on and off for asymmetrical MSR signals. To configure the factor for the lower adjacent channel, use the [\[SENSe:\]POWer:ACHannel:FILTer\[:STATe\]:ACHannel](#) command.

**Parameters:**

<State>                      ON | OFF | 1 | 0  
                                     \*RST:     0

**Manual operation:**    See "[Weighting Filters](#) " on page 294

---

**[SENSe:]POWer:ACHannel:FILTer[:STATe]:UALTernate<ch> <State>**

Turns the weighting filter for the upper alternate channels on and off for asymmetrical MSR signals. To configure the factor for the lower alternate channels, use the [\[SENSe:\]POWer:ACHannel:FILTer\[:STATe\]:ALTernate<ch>](#) command.

**Suffix:**

<ch>                            1..n  
                                     Alternate channel number

**Parameters:**

<State> ON | OFF | 1 | 0  
 \*RST: 0

**Manual operation:** See "[Weighting Filters](#)" on page 294

**General gap channel setup**

[SENSe:]POWer:ACHannel:AGCHannels..... 717

**[SENSe:]POWer:ACHannel:AGCHannels <State>**

Activates or deactivates gap channels in an MSR signal.

For more information see "[Measurement on multi-standard radio \(MSR\) signals](#)" on page 270.

**Parameters:**

<State> ON | OFF | 1 | 0

**ON | 1**

The gap channels are displayed and channel power results are calculated and displayed in the Result Summary.

**OFF | 0**

The gap channels are not displayed in the diagram and channel power results are not calculated nor displayed in the Result Summary.

\*RST: 1

**Manual operation:** See "[Activate Gaps](#)" on page 296

**Automatic (symmetrical) configuration**

The following commands are available to configure gap channels.

CALCulate<n>:LIMit<li>:ACPower:GAP<gap>[:AUTO]:ABSolute..... 717  
 CALCulate<n>:LIMit<li>:ACPower:GAP<gap>[:AUTO]:ABSolute:STATe..... 718  
 CALCulate<n>:LIMit<li>:ACPower:GAP<gap>[:AUTO]:ACLR[:RELative]..... 718  
 CALCulate<n>:LIMit<li>:ACPower:GAP<gap>[:AUTO]:ACLR[:RELative]:STATe..... 719  
 CALCulate<n>:LIMit<li>:ACPower:GAP<gap>[:AUTO][:CACLR][:RELative]..... 719  
 CALCulate<n>:LIMit<li>:ACPower:GAP<gap>[:AUTO][:CACLR][:RELative]:STATe..... 720  
 [SENSe:]POWer:ACHannel:BWIDth:GAP<gap>[:AUTO]..... 720  
 [SENSe:]POWer:ACHannel:BANDwidth:GAP<gap>[:AUTO]..... 720  
 [SENSe:]POWer:ACHannel:FILTer:ALPHa:GAP<gap>[:AUTO]..... 721  
 [SENSe:]POWer:ACHannel:FILTer[:STATe]:GAP<gap>[:AUTO]..... 721  
 [SENSe:]POWer:ACHannel:GAP<gap>[:AUTO]:MSIZE..... 721  
 [SENSe:]POWer:ACHannel:SPACing:GAP<gap>[:AUTO]..... 722

**CALCulate<n>:LIMit<li>:ACPower:GAP<gap>[:AUTO]:ABSolute <Limit>[, <Reserved>]**

Defines the absolute limit of the specified gap (CACLR) channel.

If you define both an absolute limit and a relative limit, the R&S VSE uses the lower value for the limit check.

**Suffix:**

<n>	irrelevant
<li>	irrelevant
<gap>	1   2 Gap (CACLR) channel number

**Parameters:**

<Limit>	Defines the absolute limit of the specified gap channel. Default unit: dBm
<Reserved>	Ignored.

**Example:** `CALC:LIM:ACP:GAP2:ABS 44.2dBm`

**CALCulate<n>:LIMit<li>:ACPpower:GAP<gap>[:AUTO]:ABSolute:STATe <State>**

Turns the absolute limit check for the specified gap (CACLR) channel on and off.

You have to activate the general ACLR limit check before using this command with `CALCulate<n>:LIMit<li>:ACPpower[:STATe]`.

**Suffix:**

<n>	irrelevant
<li>	irrelevant
<gap>	1   2 Gap (CACLR) channel number

**Parameters:**

<State>	ON   OFF   1   0
*RST:	0

**Example:** `CALC:LIM:ACP:GAP1:ABS:STAT ON`

**CALCulate<n>:LIMit<li>:ACPpower:GAP<gap>[:AUTO]:ACLR[:RELative] <Limit>[, <UpperLimit>]**

Defines the relative limit for the ACLR power in the specified gap channel. The reference value for the relative limit is the measured channel power.

If you define both an absolute limit and a relative limit, the R&S VSE uses the lower value for the limit check.

**Suffix:**

<n>	irrelevant
<li>	irrelevant
<gap>	1   2 Gap (CACLR) channel number

**Parameters:**

<Limit>	Defines the relative limit for the ACLR power in the specified gap channel in dB. Default unit: DB
<UpperLimit>	Ignored. Default unit: DB

**Example:** `CALC:LIM:ACP:GAP1:ACLR:REL 3dB`

**CALCulate<n>:LIMit<li>:ACPpower:GAP<gap>[:AUTO]:ACLR[:RELative]:STATe**  
<State>

Turns the relative limit check for the specified gap (CACLR) channel on and off.

You have to activate the general ACLR limit check before using this command with `CALCulate<n>:LIMit<li>:ACPpower[:STATe]`.

**Suffix:**

<n>	irrelevant
<li>	irrelevant
<gap>	1   2 Gap (CACLR) channel number

**Parameters:**

<State>	ON   OFF   1   0 *RST: 0
---------	-----------------------------

**Example:** `CALC:LIM:ACP:GAP1:ACLR:REL:STAT ON`

**CALCulate<n>:LIMit<li>:ACPpower:GAP<gap>[:AUTO][:CACLR][:RELative]**  
<Limit>, <UpperLimit>

Defines the relative limit of the specified gap (CACLR) channel. The reference value for the relative limit is the measured channel power.

If you define both an absolute limit and a relative limit, the R&S VSE uses the lower value for the limit check.

**Suffix:**

<n>	irrelevant
<li>	irrelevant
<gap>	1   2 Gap (CACLR) channel number

**Parameters:**

<Limit>	Defines the relative limit of the specified gap channel in dB. Default unit: DB
---------	--

<UpperLimit> Optional: Defines the relative upper limit of the specified gap channel.  
Default unit: dB

**Example:** `CALC:LIM:ACP:GAP1:REL 3dB,0`

**CALCulate<n>:LIMit<li>:ACPower:GAP<gap>[:AUTO][:CACLR][:RELative]:STATe**  
<State>

Turns the relative limit check for the specified gap (CACLR) channel on and off.

You have to activate the general ACLR limit check before using this command with `CALCulate<n>:LIMit<li>:ACPower[:STATe]`.

**Suffix:**

<n> irrelevant  
<li> irrelevant  
<gap> 1 | 2  
Gap (CACLR) channel number

**Parameters:**

<State> ON | OFF | 0 | 1  
**OFF | 0**  
Switches the function off  
**ON | 1**  
Switches the function on

**Example:** `CALC:LIM:ACP:GAP1:REL:STAT ON`

**[SENSe:]POWER:ACHannel:BWIDth:GAP<gap>[:AUTO] <Bandwidth>**  
**[SENSe:]POWER:ACHannel:BANDwidth:GAP<gap>[:AUTO] <Bandwidth>**

Defines the bandwidth of the MSR gap (CACLR) channel in all sub block gaps.

Is for MSR signals only (see `CALCulate<n>:MARKer<m>:FUNction:POWer<sb>:PRESet` on page 686).

**Suffix:**

<gap> 1 | 2  
Gap (CACLR) channel number

**Parameters:**

<Bandwidth> numeric value in Hz  
\*RST: 3.84 MHz  
Default unit: Hz

**Example:** `SENS:POW:ACH:BAND:GAP2 5MHZ`

**Manual operation:** See "Gap Channel Bandwidths" on page 297



**[SENSe:]POWer:ACHannel:FiLTer:ALPHa:GAP<gap>[:AUTO] <Alpha>**

Defines the roll-off factor for the specified gap (CACLR) channel's weighting filter in all sub block gaps.

**Suffix:**

<gap> 1 | 2  
Gap (CACLR) channel number

**Parameters:**

<Alpha> Roll-off factor  
Range: 0 to 1  
\*RST: 0.22

**Example:** SENS:POW:ACH:FILT:ALPH:GAP2 0.2

**Manual operation:** See "[Weighting Filters](#)" on page 297

**[SENSe:]POWer:ACHannel:FiLTer[:STATe]:GAP<gap>[:AUTO] <State>**

Turns the weighting filter for the specified gap (CACLR) channel in all sub block gaps on and off.

**Suffix:**

<gap> 1 | 2  
Gap (CACLR) channel number

**Parameters:**

<State> ON | OFF | 1 | 0  
\*RST: 0

**Example:** SENS:POW:ACH:FILT:GAP2 ON

**Manual operation:** See "[Weighting Filters](#)" on page 297

**[SENSe:]POWer:ACHannel:GAP<gap>[:AUTO]:MSIZe <Bandwidth>**

If the gap between the sub blocks does not exceed the specified bandwidth, the gap channels are not displayed in the diagram, and the gap channel results are not calculated in the result summary.

**Suffix:**

<gap> 1 | 2  
Gap channel number

**Parameters:**

<Bandwidth> numeric value in Hz  
\*RST: gap1: 5 MHz; gap2: 10 MHz  
Default unit: Hz

**Example:**

POW:ACH:GAP2:MSIZ 5 MHz

Gap channel 2 is only evaluated if the gap is wider than 5 MHz.

**Manual operation:** See "[Minimum gap size to show Gap 1 / Minimum gap size to show Gap 2](#)" on page 296

---

**[SENSe:]POWer:ACHannel:SPACing:GAP<gap>[:AUTO] <Spacing>**

Defines the distance from sub block to the specified gap channel.

In "Auto" gap mode, channels in the upper gap are identical to those in the lower gap. Thus, only 2 gap channels are configured.

The spacing for gap channels is defined in relation to the outer edges of the surrounding sub blocks, i.e.

Spacing = [CF of the gap channel] - [left sub block center] + ([RF bandwidth of left sub block] / 2)

(See also [Figure 10-21](#) and [Figure 10-23](#).)

**Suffix:**

<gap>                    1 | 2  
                                  Gap channel number

**Parameters:**

<Spacing>                numeric value in Hz  
                                  \*RST:        2.5 MHz  
                                  Default unit: HZ

**Example:**                SENS:POW:ACH:SPAC:GAP2 5MHZ

**Manual operation:** See "[Gap Channel Spacing](#)" on page 296

**MSR channel names**

The functions for manual operation are described in "[MSR channel names](#)" on page 298.

<a href="#">[SENSe:]POWer:ACHannel:NAME:GAP&lt;gap&gt;</a> .....	722
<a href="#">[SENSe:]POWer:ACHannel:NAME:UACHannel</a> .....	723
<a href="#">[SENSe:]POWer:ACHannel:NAME:UALTernate&lt;ch&gt;</a> .....	723
<a href="#">[SENSe:]POWer:ACHannel:SBLock&lt;sb&gt;:NAME[:CHANnel&lt;ch&gt;]</a> .....	723

---

**[SENSe:]POWer:ACHannel:NAME:GAP<gap> <Name>**

This command queries the name of the GAP channel.

**Suffix:**

<gap>                    1 | 2  
                                  Gap (CACLR) channel number

**Parameters:**

<Name>                    String containing the name of the channel  
                                  \*RST:        'Gap1', 'Gap2'

**[SENSe:]POWer:ACHannel:NAME:UACHannel <Name>**

Defines the name for the upper adjacent channel in asymmetrical MSR channel definitions. To define the name for the lower adjacent channel use the [\[SENSe:\]POWer:ACHannel:NAME:ACHannel](#) command.

**Parameters:**

<Name> String containing the name of the channel  
\*RST: ADJ

**[SENSe:]POWer:ACHannel:NAME:UALTernate<ch> <Name>**

Defines the name for the specified upper alternate channel in asymmetrical MSR channel definitions. To define the name for the lower adjacent channels use the [\[SENSe:\]POWer:ACHannel:NAME:ALTernate<ch>](#) command.

**Suffix:**

<ch> 1..n  
Alternate channel number

**Parameters:**

<Name> String containing the name of the channel  
\*RST: ALT<1...11>

**[SENSe:]POWer:ACHannel:SBLock<sb>:NAME[:CHANnel<ch>] <Name>**

Defines the name of the specified MSR Tx channel.

Is for MSR signals only.

In MSR ACLR measurements, the default TX channel names correspond to the specified technology, followed by a consecutive number. The assigned sub block (A,B,C,D,E,F,G,H) is indicated as a prefix (e.g. A: WCDMA1).

Is for MSR signals only (see [CALCulate<n>:MARKer<m>:FUNCTION:POWer<sb>:PRESet](#) on page 686).

**Suffix:**

<sb> 1 to 5  
sub block number  
  
<ch> 1 to 18  
Tx channel number

**Parameters:**

<Name> String containing the name of the channel

**Example:**

POW:ACH:SBL2:NAME:CHAN2?  
Result:  
'B:WCDMA'

**Manual operation:** See "[Tx Channel Definition](#)" on page 291

## Performing an ACLR measurement

The following commands are required to perform an ACLR measurement:

<code>CALCulate&lt;n&gt;:MARKer&lt;m&gt;:FUNction:POWer&lt;sb&gt;:RESult?</code> .....	724
<code>CALCulate&lt;n&gt;:MARKer&lt;m&gt;:FUNction:POWer&lt;sb&gt;:SELect</code> .....	725
<code>CALCulate&lt;n&gt;:MARKer&lt;m&gt;:FUNction:POWer&lt;sb&gt;[:STATe]</code> .....	726

---

### `CALCulate<n>:MARKer<m>:FUNction:POWer<sb>:RESult? <Measurement>`

Queries the results of power measurements.

To get a valid result, you have to perform a complete measurement with synchronization to the end of the measurement before reading out the result. This is only possible for single measurement mode.

See also `INITiate<n>:CONTinuous` on page 547.

#### Suffix:

<code>&lt;n&gt;</code>	irrelevant
<code>&lt;m&gt;</code>	irrelevant
<code>&lt;sb&gt;</code>	Sub block in a Multi-standard radio measurement; MSR ACLR: 1 to 5 Multi-SEM: 1 to 3 for all other measurements: irrelevant

#### Parameters:

`<Measurement>`

#### **ACPower | MCACpower**

ACLR measurements (also known as adjacent channel power or multicarrier adjacent channel measurements).

Returns the power for every active transmission and adjacent channel. The order is:

- power of the transmission channels
- power of adjacent channel (lower,upper)
- power of alternate channels (lower,upper)

#### **MSR ACLR results:**

For MSR ACLR measurements, the order of the returned results is slightly different:

- power of the transmission channels
- total power of the transmission channels for each sub block
- power of adjacent channels (lower, upper)
- power of alternate channels (lower, upper)
- power of gap channels (lower1, upper1, lower2, upper2)

The unit of the return values depends on the scaling of the y-axis:

- logarithmic scaling returns the power in the current unit
- linear scaling returns the power in W

#### **GACLR**

For MSR ACLR measurements only: returns a list of ACLR values for each gap channel (lower1, upper1, lower2, upper2)

**MACM**

For MSR ACLR measurements only: returns a list of CACLR values for each gap channel (lower1, upper1, lower2, upper2)

**CPOWer**

Channel power measurements.

Returns the channel power. The unit of the return values depends on the scaling of the y-axis:

- logarithmic scaling returns the power in the current unit
- linear scaling returns the power in W

For SEM measurements, the return value is the channel power of the reference range (in the specified sub block).

**PPOWer**

Peak power measurements.

Returns the peak power. The unit of the return values depends on the scaling of the y-axis:

- logarithmic scaling returns the power in the current unit
- linear scaling returns the power in W

For SEM measurements, the return value is the peak power of the reference range (in the specified sub block).

Note that this result is only available if the power reference type is set to peak power (see [\[SENSe:\]ESpectrum<sb>:RTYPE](#) on page 761).

**OBANdwidth | OBWidth**

Occupied bandwidth.

Returns the occupied bandwidth in Hz.

**COBandwidth | COBWidth**

<Centroid frequency>,<Frequency offset>

See [Chapter 10.4.2.2, "OBW results"](#), on page 313

**CALCulate<n>:MARKer<m>:FUNction:POWer<sb>:SElect <MeasType>**

Selects a power measurement and turns the measurement on.

**Suffix:**

<n>	<a href="#">Window</a>
<m>	<a href="#">Marker</a>
<sb>	irrelevant

**Parameters:**

<MeasType>

**ACPower | MCACpower**

Adjacent channel leakage ratio (ACLR), also known as adjacent channel power or multicarrier adjacent channel.

The R&S VSE performs the measurement on the trace selected with [\[SENSe:\]POWer:TRACe](#).

**CPOWer**

Channel power measurement with a single carrier.

The R&S VSE performs the measurement on the trace selected with [\[SENSe:\]POWer:TRACe](#).

**OBANdwidth | OBWidth**

Occupied bandwidth measurement.

The R&S VSE performs the measurement on the trace that marker 1 is positioned on.

**CALCulate<n>:MARKer<m>:FUNctioN:POWer<sb>[:STATe] <State>**

Turns a power measurement off. To switch on the power measurement again, use [CALCulate<n>:MARKer<m>:FUNctioN:POWer<sb>:SElect](#) on page 725.

A standard frequency sweep is activated.

**Suffix:**

<n>	irrelevant
<m>	irrelevant
<sb>	irrelevant

**Parameters:**

<State>	OFF
---------	-----

**Manual operation:** See ["All Functions Off"](#) on page 167

**Retrieving and analyzing measurement results**

The following commands retrieve and analyze measurement results for ACLR measurements.

**Useful commands for channel power measurements described elsewhere**

- [CALCulate<n>:MARKer<m>:FUNctioN:POWer<sb>:RESult?](#) on page 724
- [CALCulate<n>:LIMit<li>:ACPower:ACHannel:RESult?](#) on page 697
- [CALCulate<n>:LIMit<li>:ACPower:ALternate<ch>:RESult?](#) on page 700

**Remote commands exclusive to channel power measurements**

<a href="#">CALCulate&lt;n&gt;:LIMit&lt;li&gt;:ACPower:GAP&lt;gap&gt;:ACLR:RESult?</a> .....	726
<a href="#">CALCulate&lt;n&gt;:LIMit&lt;li&gt;:ACPower:GAP&lt;gap&gt;[:CACLR]:RESult?</a> .....	727
<a href="#">CALCulate&lt;n&gt;:MARKer&lt;m&gt;:FUNctioN:POWer&lt;sb&gt;:RESult:PHZ</a> .....	728
<a href="#">CALCulate&lt;n&gt;:MARKer&lt;m&gt;:FUNctioN:POWer&lt;sb&gt;:RESult:UNIT</a> .....	729
<a href="#">[SENSe:]POWer:ACHannel:MODE</a> .....	729
<a href="#">TRACe&lt;n&gt;[:DATA]</a> .....	730

**CALCulate<n>:LIMit<li>:ACPower:GAP<gap>:ACLR:RESult?**

The command returns the ACLR power limit check results for the selected gap channel in an MSR ACLR measurement.

To get a valid result, you have to perform a complete measurement with synchronization to the end of the measurement before reading out the result. This is only possible for single measurement mode.

See also [INITiate<n>:CONTinuous](#) on page 547.

The results of the power limit checks are also indicated in the `STAT:QUES:ACPL` status registry (see "[STATus:QUESTionable:ACPLimit register](#)" on page 482).

**Suffix:**

<n>	1..n
<lj>	1..n irrelevant
<gap>	1   2 Gap (CACLR) channel number

**Return values:**

<LowerGap\_AB>  
 <UpperGap\_AB>  
 <LowerGap\_BC>  
 <UpperGap\_BC>  
 <LowerGap\_CD>  
 <UpperGap\_CD>  
 <LowerGap\_DE>  
 <UpperGap\_DE>

**Example:**

```
INIT:IMM;*WAI;
CALC:LIM:ACP:GAP2:ACLR:RES?
PASSED,PASSED
```

**Usage:** Query only

---

**CALCulate<n>:LIMit<lj>:ACPpower:GAP<gap>[:CACLR]:RESult?**

The command returns the limit check results for the upper and lower gap (CACLR) channels for the selected gap in an MSR ACLR measurement.

To get a valid result, you have to perform a complete measurement with synchronization to the end of the measurement before reading out the result. This is only possible for single measurement mode.

See also [INITiate<n>:CONTinuous](#) on page 547.

The results of the power limit checks are also indicated in the `STAT:QUES:ACPL` status registry (see "[STATus:QUESTionable:ACPLimit register](#)" on page 482).

**Suffix:**

<n>	irrelevant
<lj>	irrelevant

<gap> 1 | 2  
Gap (CACLR) channel number

**Return values:**

<LowerGap\_AB>, <UpperGap\_AB>  
[,<LowerGap\_BC>, <UpperGap\_BC>,  
<LowerGap\_CD>, <UpperGap\_CD>,  
<LowerGap\_DE>, <UpperGap\_DE>,  
<LowerGap\_EF>, <UpperGap\_EF>,  
<LowerGap\_FG>, <UpperGap\_FG>,  
<LowerGap\_GH>, <UpperGap\_GH>]

Limit check results for the CACLR power in the upper and lower gap channels for the selected gap. Results are only returned for the available sub blocks.

**PASSED**

Limit check has passed.

**FAIL**

Limit check has failed.

**NONE**

No results available, e.g. because limit checking was deactivated

**Example:**

```
INIT:IMM;*WAI;
CALC:LIM:ACP:GAP2:RES?
PASSED,PASSED
```

**Usage:** Query only

**CALCulate<n>:MARKer<m>:FUNCtion:POWer<sb>:RESult:PHZ <State>**

Selects the unit the R&S VSE returns results for power measurements.

You can query results with `CALCulate<n>:MARKer<m>:FUNCtion:POWer<sb>:RESult?`.

For LTE and 5G applications, use the command `CALCulate<n>:MARKer<m>:FUNCtion:POWer<sb>:RESult:UNIT`.

**Suffix:**

<n> [Window](#)  
<m> [Marker](#)  
<sb> irrelevant

**Parameters:**

<State> ON | OFF | 1 | 0  
**ON | 1**  
Channel power density in dBm/Hz  
**OFF | 0**  
Channel power in dBm  
\*RST: 0

**Example:**

```
CALC:MARK:FUNC:POW:RES:PHZ ON
Output of results referred to the channel bandwidth.
```



**Manual operation:** See ["Channel power level and density \(Power Unit\)"](#) on page 279

---

**CALCulate<n>:MARKer<m>:FUNction:POWer<sb>:RESult:UNIT <Measurement>**

LTE and 5G applications only.

Selects the unit the R&S VSE returns results for power measurements.

You can query results with [CALCulate<n>:MARKer<m>:FUNction:POWer<sb>:RESult?](#).

**Suffix:**

<n> [Window](#)

<m> irrelevant

<sb> irrelevant

**Parameters:**

<Measurement> **ABS**  
Channel power in dBm

**PHZ**  
Channel power density in dBm/Hz

**MPHZ**  
Channel power density in dBm/MHz

\*RST: ABS

**Example:** //Select unit for power measurements  
CALC:MARK:FUNC:POW:RES:UNIT PHZ

**Manual operation:** See ["Channel power level and density \(Power Unit\)"](#) on page 279

---

**[SENSe:]POWer:ACHannel:MODE <Mode>**

Selects the way the R&S VSE displays the power of adjacent channels.

You need at least one adjacent channel for the command to work.

**Parameters:**

<Mode> ABSolute | RELative

**ABSolute**  
Shows the absolute power of all channels

**RELative**  
Shows the power of adjacent and alternate channels in relation to the transmission channel

\*RST: RELative

**Manual operation:** See ["Absolute and Relative Values \(ACLR Mode\)"](#) on page 279

**TRACe<n>[:DATA]** <Trace>,<Data>  
**TRACe<n>[:DATA]?** <ResultType>

This command queries current trace data and measurement results.

In the Spectrum application only, you can use it as a setting command to transfer trace data from an external source to the R&S VSE.

The data format depends on [FORMat \[:DATA\]](#) on page 873.

**Suffix:**

<n> [Window](#)

**Parameters:**

<Trace> **TRACE1 | TRACE2 | TRACE3 | TRACE4 | TRACE5 | TRACE6**  
 Selects the trace to write the data to (Spectrum application only).

<Data> Contains the data to transfer (Spectrum application only).

**Query parameters:**

<ResultType> Selects the type of result to be returned. See [Table 13-13](#).  
 Note that not all result types are available for all applications.  
 See the application-specific documentation for details.

**Example:** (Spectrum application only:)  
 TRAC TRACE1,-30,-20,-10  
 Transfers trace data (-30,-20,-10) to trace 1.

**Example:** TRAC? TRACE3  
 Queries the data of trace 3.

**Manual operation:** See "[List Evaluation State \(result summary\)](#)" on page 346

**Table 13-13: Return values for result type parameters**

Parameter	Result display / measurement	Results
TRACE1   ...   TRACE6	Returns the trace data for the corresponding trace.  The trace data consists of a list of measured power levels. The number of power levels in the list depends on the currently selected number of sweep points. The unit depends on the measurement and on the configured unit.  For the auto peak detector, the command returns positive peak values only. (To retrieve negative peak values, define a second trace with a negative peak detector.)  For SEM or Spurious Emission measurement results, query the x-values as well, as they are not equidistant (see <a href="#">TRACe&lt;n&gt;[:DATA]:X?</a> on page 876).	
LIST	SEM measurements	Peak list evaluation, one peak per range is returned.

Parameter	Result display / measurement	Results
	Spurious emission measurements	Peak list evaluation; For each peak, the command returns 11 values in the following order: <ul style="list-style-type: none"> <li>• &lt;No&gt;: range number</li> <li>• &lt;StartFreq&gt;,&lt;StopFreq&gt;: start and stop frequency of the range</li> <li>• &lt;RBW&gt;: resolution bandwidth</li> <li>• &lt;PeakFreq&gt;: frequency of the peak in a range</li> <li>• &lt;PowerAbs&gt;: absolute power of the peak in dBm</li> <li>• &lt;PowerRel&gt;: power of the peak in relation to the channel power in dBc</li> <li>• &lt;PowerDelta&gt;: distance from the peak to the limit line in dB, positive values indicate a failed limit check</li> <li>• &lt;LimitCheck&gt;: state of the limit check (0 = PASS, 1 = FAIL)</li> <li>• &lt;Unused1&gt;,&lt;Unused2&gt;: reserved (0.0)</li> </ul>
SPURious		Peak list evaluation of Spurious Emission measurements.
SPECTrogram   SGRam		For every frame in the spectrogram, the command returns the power levels that have been measured, one for each sweep point. The number of frames depends on the size of the history depth. The power level depends on the configured unit. Only REAL, 32 format is supported.

### Programming examples for channel power measurements

The following programming examples are meant to demonstrate the most important commands to perform channel power measurements in a remote environment.

- [Example: configuring and performing an ACLR measurement](#).....731
- [Example: configuring and performing an MSR ACLR measurement](#).....734
- [Example: configuring and performing an asymmetrical MSR ACLR measurement](#).....736

#### Example: configuring and performing an ACLR measurement

In this example we will configure and perform an adjacent-channel power measurement. Note that this example is primarily meant to demonstrate the remote control commands, it does not necessarily reflect a useful measurement task. For most common measurement standards, the R&S VSE performs the measurement optimally with the predefined settings, without further configuration.

```
//-----Preparing the measurement -----
//Reset the instrument
*RST

DEvice:DElete:ALL

//*****
//***** Configure instrument connections *****
//*****
//Configure connection to MyAnalyzer at 123.456.789.100 using VSI11 protocol
DEV:CRE 'MyAnalyzer','123.456.789.100',VXI11;*WAI
//Query the network address of MyAnalyzer
```

## Remote commands for the I/Q analyzer

```

DEV:TARG? 'MyAnalyzer'
//Result: '123.456.789.100'
//Query connection state to MyAnalyzer
DEV:STAT? 'MyAnalyzer'
//Result: 1 (connection established)
//Query information on MyAnalyzer
//Instrument ID?
DEV:INFO:IDN? 'MyAnalyzer'
//Define the use of an external reference on MyAnalyzer
DEV:EXTR:SOUR 'MyAnalyzer',EXT
//Assign MyAnalyzer as input source for default channel 1
INST:BLOC:CHAN:SETT:SOUR DEV
INST:BLOC:CHAN:SETT:DEV 'MyAnalyzer'

//-----Preparing the measurement-----

//Activate adjacent-channel power measurement.
CALC:MARK:FUNC:POW:SEL ACP
//Select the user standard "GSM"
CALC:MARK:FUNC:POW:PRES GSM

//-----Setting Up Channels-----
//Create one transmission channel.
POW:ACH:TXCH:COUN 1
//Name the first transmission channel 'TX Channel'.
POW:ACH:NAME:CHAN1 'TX Channel'
//Create two adjacent channels - one adjacent channel and one alternate channel.
POW:ACH:ACP 2
//Name the adjacent channel 'ABC'
POW:ACH:NAME:ACH 'ABC'
//Name the first alternate channel 'XYZ'.
POW:ACH:NAME:ALT1 'XYZ'
//Define a bandwidth of 30 kHz for the transmission channel.
POW:ACH:BWID:CHAN1 30kHz
//Define a bandwidth of 30 kHz for the adjacent channel.
POW:ACH:BWID:ACH 30kHz
//Define a bandwidth of 30 kHz for the first alternate channel.
POW:ACH:BWID:ALT1 30kHz
//Define a distance of 33 kHz from the center of the transmission channel to the
//center of the adjacent channel.
//Also adjust the distance to the alternate channels (66 kHz).
POW:ACH:SPAC 33kHz
//Define a distance of 100 kHz from the center of the transmission channel to the
//center of the first alternate channel.
POW:ACH:SPAC:ALT1 100kHz

//-----Selecting a Reference Channel--
//Select relative display of the channel power.
POW:ACH:MODE REL
//Define transmission channel 1 as the reference channel.

```

## Remote commands for the I/Q analyzer

```

POW:ACH:REF:TXCH:MAN 1

//-----Saving the settings as a user standard-----
//Save the user standard with the name "my_aclr_standard".
//Weighting filters can only be defined for user-defined standards.
CALC:MARK:FUNC:POW:STAN:SAVE 'my_aclr_standard'

//-----Defining Weighting Filters-----
//Define a roll-off factor of 0.35 for the weighting filter of the first
//transmission channel.
POW:ACH:FILT:ALPH:CHAN1 0.35
//Turn the weighting filter for the first transmission channel on.
POW:ACH:FILT:CHAN1 ON
//Define a roll-off factor of 0.35 for the weighting filter of the adjacent
//channel.
POW:ACH:FILT:ALPH:ACH 0.35
//Turn the weighting filter for the adjacent channel on.
POW:ACH:FILT:ACH ON
//Define a roll-off factor of 0.35 for the weighting filter of the first
//alternate channel.
POW:ACH:FILT:ALPH:ALT1 0.35
//Turn the weighting filter for the first alternate channel on.
POW:ACH:FILT:ALT1 ON

//-----Working with Limits-----
//Define a relative limit of 30 dB below the power of the reference channel
//for both adjacent channels.
CALC:LIM:ACP:ACH 30DB,30DB
//Define a relative limit of 25 dB below the power of the reference channel
//for the first alternate channels.
CALC:LIM:ACP:ALT1 25DB,25DB
//Define an absolute limit of -35 dBm for both adjacent channels.
CALC:LIM:ACP:ACH:ABS -35DBM,-35DBM
//Turn the ACLR limit check on.
CALC:LIM:ACP ON
//Turn the relative limit check for adjacent channels on.
CALC:LIM:ACP:ACH:STAT ON
//Turn the absolute limit check for adjacent channels on.
CALC:LIM:ACP:ACH:ABS:STAT ON
//Turn the absolute limit check for the first alternate channel on.
CALC:LIM:ACP:ALT1:ABS:STAT ON

//-----Performing the Measurement-----
//Determine the ideal ACLR measurement configuration.
POW:ACH:PRES ACP;*WAI
//Determine the ideal reference level for the measurement.
POW:ACH:PRES:RLEV;*WAI
//Initiate a new measurement and waits until the sweep has finished.
INIT;*WAI

```

```
//-----Limit Check-----
//Query the results of the limit check for the adjacent channels.
CALC:LIM:ACP:ACH:RES?
//Query the results of the limit check for the first alternate channels.
CALC:LIM:ACP:ALT1:RES?

//-----Retrieving Results-----
//Query the results for the ACLR measurement.
CALC:MARK:FUNC:POW:RES? ACP
```

### Example: configuring and performing an MSR ACLR measurement

This example demonstrates how to configure and perform an ACLR measurement on a multi-standard radio signal in a remote environment.

Note that this example assumes the instrument 'MyAnalyzer' is configured as described in ["Example: configuring and performing an ACLR measurement"](#) on page 731.

```
//-----Preparing the measurement -----
//Reset the instrument
*RST

//Assign MyAnalyzer as input source for default channel 1
INST:BLOC:CHAN:SETT:SOUR DEV
INST:BLOC:CHAN:SETT:DEV 'MyAnalyzer'

// Select ACLR measurement
:CALCulate:MARKer:FUNCTion:POWer:SElect ACPower

// Select MSR Standard :CALCulate:MARKer:FUNCTion:POWer:PRESet MSR

//Configure general measurement settings
:SENSe:FREQuency:CENTer 1.25GHz
:SENSe:FREQuency:SPAN 62.0MHz
:SENSe:POWer:ACHannel:SBCount 3

//----- Configuring Sub block A

:SENSe:POWer:ACHannel:SBLock1:TXChannel:COUNt 3
:SENSe:POWer:ACHannel:SBLock1:FREQuency:CENTer 1.230GHZ
:SENSe:POWer:ACHannel:SBLock1:RFBWidth 12MHZ

:SENSe:POWer:ACHannel:SBLock1:CENTer:CHANnel1 1.226GHZ
:SENSe:POWer:ACHannel:SBLock1:CENTer:CHANnel2 1.230GHZ
:SENSe:POWer:ACHannel:SBLock1:CENTer:CHANnel3 1.234GHZ

:SENSe:POWer:ACHannel:SBLock1:TECHnology:CHANnel1 WCDMA
:SENSe:POWer:ACHannel:SBLock1:TECHnology:CHANnel2 WCDMA
:SENSe:POWer:ACHannel:SBLock1:TECHnology:CHANnel3 GSM
```

## Remote commands for the I/Q analyzer

```
:SENSe:POWer:ACHannel:SBLOCK1:BANDwidth:CHANnel1 2.5MHZ
:SENSe:POWer:ACHannel:SBLOCK1:BANDwidth:CHANnel2 2.5MHZ
:SENSe:POWer:ACHannel:SBLOCK1:BANDwidth:CHANnel3 2.5MHZ

//----- Configuring Sub block B

:SENSe:POWer:ACHannel:SBLOCK2:TXChannel:COUNT 1
:SENSe:POWer:ACHannel:SBLOCK2:FREQuency:CENTer 1.255GHZ
:SENSe:POWer:ACHannel:SBLOCK2:RFBWidth 4MHZ

:SENSe:POWer:ACHannel:SBLOCK2:CENTer:CHANnel1 1.255GHZ

:SENSe:POWer:ACHannel:SBLOCK2:TECHnology:CHANnel1 LTE_1_40

:SENSe:POWer:ACHannel:SBLOCK2:BANDwidth:CHANnel1 3.25MHZ

//----- Configuring Sub block C

:SENSe:POWer:ACHannel:SBLOCK3:TXChannel:COUNT 2
:SENSe:POWer:ACHannel:SBLOCK3:FREQuency:CENTer 1.268GHZ
:SENSe:POWer:ACHannel:SBLOCK3:RFBWidth 8MHZ

:SENSe:POWer:ACHannel:SBLOCK3:CENTer:CHANnel1 1.266GHZ
:SENSe:POWer:ACHannel:SBLOCK3:CENTer:CHANnel2 1.270GHZ

:SENSe:POWer:ACHannel:SBLOCK3:BANDwidth:CHANnel1 2.75MHZ
:SENSe:POWer:ACHannel:SBLOCK3:BANDwidth:CHANnel2 2.75MHZ

//----- Configuring ADJ channels

:SENSe:POWer:ACHannel:BANDwidth:ACHannel 1.60MHZ
:SENSe:POWer:ACHannel:BANDwidth:ALternate1 1.60MHZ

:SENSe:POWer:ACHannel:SPACing:ACHannel 3MHZ
:SENSe:POWer:ACHannel:SPACing:ALternate1 5MHZ

//----- Configuring gap (CACLR) channels

:SENSe:POWer:ACHannel:SPACing:GAP1 2.0MHZ
:SENSe:POWer:ACHannel:SPACing:GAP2 5.0MHZ

:SENSe:POWer:ACHannel:BANDwidth:GAP1 2.0MHZ
:SENSe:POWer:ACHannel:BANDwidth:GAP2 2.0MHZ

//-----Performing the Measurement-----

//Select single sweep mode.
INIT:CONT OFF
```

```
//Initiate a new measurement and wait until the sweep has finished.
INIT;*WAI

//-----Retrieving Results-----

//Return the results for the ACLR measurement.
CALC:MARK:FUNC:POW:RES? MCAC
//Results:
//Transmission channels in sub block A
//-13.2346727385,-13.2346723793,-13.2390131759,
//Transmission channels in sub block B
//-17.0863336597,
//Transmission channels in sub block C
//-13.2390127767,-13.2390134744,
//Totals for each sub block
//-8.4649064021,-17.0863336597,-10.2287131689,
//Adjacent channels
//-67.9740721019,-67.9740728014,-0.00434041734,-0.00434041734,
//CACLR channels
//-0.52933512766,-64.9990115835,-64.5012521492,-0.33507330922,
//-64.4924159646,-0.52932552499,-0.52932552495,-64.4934163414
```

### Example: configuring and performing an asymmetrical MSR ACLR measurement

This example demonstrates how to configure and perform an ACLR measurement on an asymmetrical multi-standard radio signal in a remote environment.

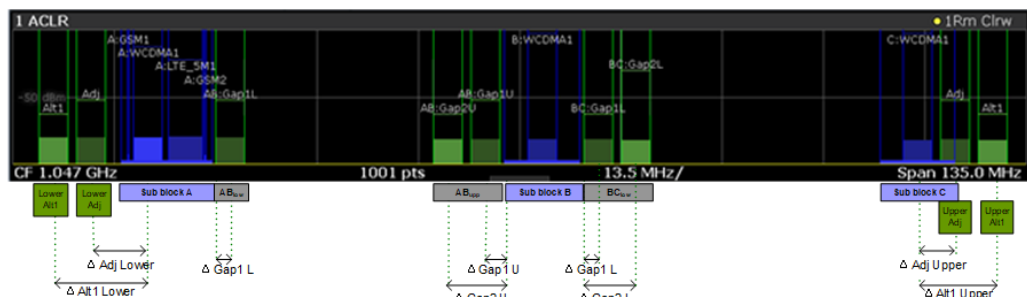


Figure 13-1: Asymmetrical MSR signal structure

Note that this example assumes the instrument 'MyAnalyzer' is configured as described in "Example: configuring and performing an ACLR measurement" on page 731.

```
//-----Preparing the measurement -----
//Reset the instrument
*RST

//Assign MyAnalyzer as input source for default channel 1
INST:BLOC:CHAN:SETT:SOUR DEV
INST:BLOC:CHAN:SETT:DEV 'MyAnalyzer'

// Select ACLR measurement
```



## Remote commands for the I/Q analyzer

```
:CALCulate:MARKer:FUNCTION:POWER:SElect ACPower

// Select MSR Standard
:CALCulate:MARKer:FUNCTION:POWER:PRESet MSR

//Configure general measurement settings
:SENSe:FREQuency:CENTer 1.25GHz
:SENSe:FREQuency:SPAN 62.0MHz
:SENSe:POWer:ACHannel:SBCount 3

//----- Configuring Sub block A

:SENSe:POWer:ACHannel:SBLOCK1:TXChannel:COUNT 3
:SENSe:POWer:ACHannel:SBLOCK1:FREQuency:CENTer 1.230GHZ
:SENSe:POWer:ACHannel:SBLOCK1:RFBWidth 12MHZ

:SENSe:POWer:ACHannel:SBLOCK1:CENTer:CHANnel1 1.226GHZ
:SENSe:POWer:ACHannel:SBLOCK1:CENTer:CHANnel2 1.230GHZ
:SENSe:POWer:ACHannel:SBLOCK1:CENTer:CHANnel3 1.234GHZ

:SENSe:POWer:ACHannel:SBLOCK1:TECHnology:CHANnel1 WCDMA
:SENSe:POWer:ACHannel:SBLOCK1:TECHnology:CHANnel2 WCDMA
:SENSe:POWer:ACHannel:SBLOCK1:TECHnology:CHANnel3 GSM

:SENSe:POWer:ACHannel:SBLOCK1:BANDwidth:CHANnel1 2.5MHZ
:SENSe:POWer:ACHannel:SBLOCK1:BANDwidth:CHANnel2 2.5MHZ
:SENSe:POWer:ACHannel:SBLOCK1:BANDwidth:CHANnel3 2.5MHZ

//----- Configuring Sub block B

:SENSe:POWer:ACHannel:SBLOCK2:TXChannel:COUNT 1
:SENSe:POWer:ACHannel:SBLOCK2:FREQuency:CENTer 1.255GHZ
:SENSe:POWer:ACHannel:SBLOCK2:RFBWidth 4MHZ

:SENSe:POWer:ACHannel:SBLOCK2:CENTer:CHANnel1 1.255GHZ

:SENSe:POWer:ACHannel:SBLOCK2:TECHnology:CHANnel1 LTE_1_40

:SENSe:POWer:ACHannel:SBLOCK2:BANDwidth:CHANnel1 3.25MHZ

//----- Configuring Sub block C

:SENSe:POWer:ACHannel:SBLOCK3:TXChannel:COUNT 2
:SENSe:POWer:ACHannel:SBLOCK3:FREQuency:CENTer 1.268GHZ
:SENSe:POWer:ACHannel:SBLOCK3:RFBWidth 8MHZ

:SENSe:POWer:ACHannel:SBLOCK3:CENTer:CHANnel1 1.266GHZ
:SENSe:POWer:ACHannel:SBLOCK3:CENTer:CHANnel2 1.270GHZ
```

## Remote commands for the I/Q analyzer

```

:SENSe:POWer:ACHannel:SBLOCK3:BANDwidth:CHANnel1 2.75MHZ
:SENSe:POWer:ACHannel:SBLOCK3:BANDwidth:CHANnel2 2.75MHZ

//----- Configuring ADJ channels

:SENSe:POWer:ACHannel:BANDwidth:ACHannel 1.60MHZ
:SENSe:POWer:ACHannel:BANDwidth:ALternate1 1.60MHZ

:SENSe:POWer:ACHannel:SPACing:ACHannel 3MHZ
:SENSe:POWer:ACHannel:SPACing:ALternate1 5MHZ

//----- Configuring gap channels manually
:SENSe:POWer:ACHannel:AGCHannels ON
:SENSe:POWer:ACHannel:GAP:MODE MAN

//----- Configuring AB gap channels
// 1 lower, 2 upper

:SENSe:POWer:ACHannel:GCH:GAP1:MAN:LOW AB, ON
:SENSe:POWer:ACHannel:GCH:GAP1:MAN:UPP AB, ON
:SENSe:POWer:ACHannel:GCH:GAP2:MAN:UPP AB, ON

:SENSe:POWer:ACHannel:SPACing:GAP1:MAN:LOW AB,2.0MHZ
:SENSe:POWer:ACHannel:SPACing:GAP1:MAN:UPP AB,2.0MHZ
:SENSe:POWer:ACHannel:SPACing:GAP2:MAN:UPP AB,4.2MHZ

:SENSe:POWer:ACHannel:BANDwidth:GAP1:MAN:LOW AB,2.0MHZ
:SENSe:POWer:ACHannel:BANDwidth:GAP1:MAN:UPP AB,2.0MHZ
:SENSe:POWer:ACHannel:BANDwidth:GAP2:MAN:UPP AB,2.0MHZ

:SENSe:POWer:ACHannel:FILTer:STATe:GAP1:MAN:LOW AB,ON
:SENSe:POWer:ACHannel:FILTer:STATe:GAP1:MAN:UPP AB,ON
:SENSe:POWer:ACHannel:FILTer:STATe:GAP2:MAN:UPP AB,ON

:SENSe:POWer:ACHannel:FILTer:ALPHa:GAP1:MAN:LOW AB,0.25
:SENSe:POWer:ACHannel:FILTer:ALPHa:GAP1:MAN:UPP AB,0.25
:SENSe:POWer:ACHannel:FILTer:ALPHa:GAP2:MAN:UPP AB,0.25

//Limit check
:CALC:LIM:ACP ON
:CALC:LIM:ACP:GAP1:MAN:UPP:ABS:STAT AB,ON
:CALC:LIM:ACP:GAP1:MAN:UPP:ABS AB,3DBM
:CALC:LIM:ACP:GAP2:MAN:UPP:ABS:STAT AB,ON
:CALC:LIM:ACP:GAP2:MAN:UPP:ABS AB,3DBM

//----- Configuring BC gap channels
// 2 lower, 0 upper

:SENSe:POWer:ACHannel:GCH:GAP1:MAN:LOW AB, ON

```

## Remote commands for the I/Q analyzer

```

:SENSe:POWer:ACHannel:GCH:GAP2:MAN:LOW AB, ON

:SENSe:POWer:ACHannel:SPACing:GAP1:MAN:LOW BC,2.0MHZ
:SENSe:POWer:ACHannel:SPACing:GAP2:MAN:LOW BC,4.2MHZ

:SENSe:POWer:ACHannel:BANDwidth:GAP1:MAN:LOW BC,2.0MHZ
:SENSe:POWer:ACHannel:BANDwidth:GAP2:MAN:LOW BC,2.0MHZ

//Limit check
:CALC:LIM:ACP ON
:CALC:LIM:ACP:GAP1:MAN:LOW:ABS:STAT BC,ON
:CALC:LIM:ACP:GAP1:MAN:LOW:ABS BC,3DBM
:CALC:LIM:ACP:GAP1:MAN:LOW:CACL:REL:STAT BC,ON
:CALC:LIM:ACP:GAP1:MAN:LOW:CACL:REL BC,-3DB

:CALC:LIM:ACP:GAP2:MAN:LOW:ACLR:REL:STAT BC,ON
:CALC:LIM:ACP:GAP2:MAN:LOW:ACLR:REL BC,-3DB

//-----Performing the Measurement-----

//Select single sweep mode.
INIT:CONT OFF
//Initiate a new measurement and wait until the sweep has finished.
INIT;*WAI

//-----Retrieving Results-----

//Return the results for the ACLR measurement.
CALC:MARK:FUNC:POW:RES? MCAC
//Results:
//Transmission channels in sub block A
//-13.2346727385,-13.2346723793,-13.2390131759,
//Transmission channels in sub block B
//-17.0863336597,
//Transmission channels in sub block C
//-13.2390127767,-13.2390134744,
//Totals for each sub block
//-8.4649064021,-17.0863336597,-10.2287131689,
//Adjacent channels
//-67.9740721019,-67.9740728014,-0.00434041734,-0.00434041734,
//CACL channels (AB2L, BC1U, BC2U invalid)
//-0.52933512766,-64.9990115835 9.91e37,-0.33507330922,
//-64.4924159646, 9.91e37,-0.52932552495, 9.91e37

//Limit check
CALC:LIM:ACP:GAP1:ACLR:RES?
//Result for gap 1 channels: ABGap1L,ABGap1U,BCGap1L, ( BCGap1U invalid )
//PASSED, PASSED, PASSED, NONE
CALC:LIM:ACP:GAP2:ACLR:RES?

```

```
//Result for gap 2 channels: (ABGap2L invalid ),ABGap2U,BCGap2L, ( BCGap2U invalid )
//NONE, PASSED, PASSED, NONE
```

### 13.6.3.2 Measuring the occupied bandwidth

All remote control commands specific to occupied bandwidth measurements are described here.

- [Configuring the measurement](#).....740
- [Programming example: OBW measurement](#)..... 741

#### Configuring the measurement

The following commands configure measurements of the occupied bandwidth.

#### Useful commands for occupied bandwidth measurements described elsewhere

Configuring the channel:

- `[SENSe:]POWer:ACHannel:BANDwidth[:CHANnel<ch>]`
- `[SENSe:]POWer:ACHannel:PRESet`
- `[SENSe:]POWer:ACHannel:PRESet:RLEVel`

Defining search limits:

- `CALCulate<n>:MARKer<m>:X:SLIMits[:STATe]` on page 829
- `CALCulate<n>:MARKer<m>:X:SLIMits:LEFT` on page 829
- `CALCulate<n>:MARKer<m>:X:SLIMits:RIGHT` on page 830

Performing the measurement:

- `CALCulate<n>:MARKer<m>:FUNction:POWer<sb>:SElect` on page 725
- `CALCulate<n>:MARKer<m>:FUNction:POWer<sb>[:STATe]` on page 726

Retrieving results:

- `CALCulate<n>:MARKer<m>:FUNction:POWer<sb>:RESult?` on page 724

#### Remote commands exclusive to occupied bandwidth measurements:

`[SENSe:]POWer:BWIDth`..... 740  
`[SENSe:]POWer:BANDwidth`..... 740

---

`[SENSe:]POWer:BWIDth <Percentage>`  
`[SENSe:]POWer:BANDwidth <Percentage>`

Selects the percentage of the total power that defines the occupied bandwidth.

#### Parameters:

<Percentage>            Range:      10 PCT to 99.9 PCT  
                              \*RST:      99 PCT  
                              Default unit: PCT

**Example:**              POW:BAND 95PCT

**Manual operation:**    See "[% Power Bandwidth](#) " on page 314

### Programming example: OBW measurement

This programming example demonstrates the measurement example described in [Chapter 10.4.2.5, "Measurement example"](#), on page 316 in a remote environment.

```
//-----Preparing the measurement -----
//Reset the instrument
*RST

DEvice:DElete:ALL

//*****
//***** Configure instrument connections *****
//*****
//Configure connection to MyFSW at 123.456.789.100 using VSI11 protocol
DEV:CRE 'MyFSW','123.456.789.100',VXI11;*WAI
//Query the network address of MyFSW
DEV:TARG? 'MyFSW'
//Result: '123.456.789.100'
//Query connection state to MyFSW
DEV:STAT? 'MyFSW'
//Result: 1 (connection established)
//Query information on MyFSW
//Instrument ID?
DEV:INFO:IDN? 'MyFSW'
//Define the use of an external reference on MyFSW
DEV:EXTR:SOUR 'MyFSW',EXT
DEV:EXTR:FREQ 'MyFSW',13MHZ
//Assign MyFSW as input source for default channel 1
INST:BLOC:CHAN:SETT:SOUR DEV
INST:BLOC:CHAN:SETT:DEV 'MyFSW'

//-----Configuring the Measurement-----
//Set the center frequency to 800 MHz.
FREQ:CENT 800MHz
//Set the reference level to -10 dBm.
DISP:TRAC:Y:RLEV -10dBm
//Activate occupied bandwidth measurement.
CALC:MARK:FUNC:POW:SEL OBW
//Set the percentage of power to 99%.
POW:BWID 99PCT
//Set the channel bandwidth to 21 kHz.
POW:ACH:BAND 21kHz
//Optimize the instrument settings according to the channel bandwidth.
POW:ACH:PRES OBW
//Determine the ideal reference level for the measurement.
POW:ACH:PRES:RLEV
//Set the trace detector to positive peak.
DET APE

//-----Performing the Measurement-----
```

```
//Select single sweep mode.INIT:CONT OFF

//Initiate a new measurement and waits until the sweep has finished.
INIT;*WAI

//-----Retrieving Results-----
//Return the occupied bandwidth.
CALC:MARK:FUNC:POW:RES? OBW
```

### 13.6.3.3 Measuring the spectrum emission mask

All remote control commands specific to spectrum emission mask measurements are described here.

#### Remote commands exclusive to spectrum emission mask measurements:

• <a href="#">Managing measurement configurations</a> .....	742
• <a href="#">Controlling the measurement</a> .....	744
• <a href="#">Configuring a multi-sem measurement</a> .....	744
• <a href="#">Configuring a sweep list</a> .....	745
• <a href="#">Configuring the reference range</a> .....	759
• <a href="#">Configuring the power classes</a> .....	761
• <a href="#">Configuring MSR SEM measurements</a> .....	766
• <a href="#">Configuring the list evaluation</a> .....	772
• <a href="#">Performing an SEM measurement</a> .....	774
• <a href="#">Retrieving results</a> .....	774
• <a href="#">Example: SEM measurement</a> .....	774

#### Managing measurement configurations

The following commands control measurement configurations for SEM measurements.

<a href="#">CALCulate&lt;n&gt;:LIMit&lt;li&gt;:ESPectrum&lt;sb&gt;:RESTore</a> .....	742
<a href="#">[SENSe:]ESPectrum&lt;sb&gt;:PRESet[:STANdard]</a> .....	743
<a href="#">[SENSe:]ESPectrum&lt;sb&gt;:PRESet:RESTore</a> .....	743
<a href="#">[SENSe:]ESPectrum&lt;sb&gt;:PRESet:STORe</a> .....	743

---

#### **CALCulate<n>:LIMit<li>:ESPectrum<sb>:RESTore**

Restores the predefined limit lines for the selected Spectrum Emission Mask standard.

All modifications made to the predefined limit lines are lost and the factory-set values are restored.

#### Suffix:

<n>	irrelevant
<li>	irrelevant
<sb>	1 to 3 Subblock in a multi-SEM measurement

**Example:**            `CALC:LIM:ESP:REST`  
 Resets the limit lines for the current Spectrum Emission Mask standard to the default setting.

---

**[SENSe:]ESpectrum<sb>:PRESet[:STANdard] <Standard>**

Loads a measurement configuration.

Standard definitions are stored in an xml file. The default directory for SEM standards is `C:\ProgramData\Rohde-Schwarz\VSE\<version_no>\sem_std.`

**Suffix:**

<sb>                    1 to 3  
 Subblock in a multi-SEM measurement

**Parameters:**

<Standard>            String containing the file name.  
 If you have stored the file in a subdirectory of the directory mentioned above, you have to include the relative path to the file.

**Manual operation:**   See "[Standard / MSR Settings](#) " on page 337  
 See "[Load Standard](#) " on page 344

---

**[SENSe:]ESpectrum<sb>:PRESet:RESTore**

Restores the default configurations of predefined SEM standards.

Note that the command will overwrite customized standards that have the same name as predefined standards.

**Suffix:**

<sb>                    1 to 3  
 Subblock in a multi-SEM measurement

**Manual operation:**   See "[Restore Standard Files](#) " on page 345

---

**[SENSe:]ESpectrum<sb>:PRESet:STORe <Standard>**

Saves the current SEM measurement configuration.

Standard definitions are stored in an xml file. The default directory for SEM standards is `C:\ProgramData\Rohde-Schwarz\VSE\<version_no>\sem_std.`

**Suffix:**

<sb>                    1 to 3  
 Subblock in a multi-SEM measurement

**Parameters:**

<Standard>            String containing the file name.  
 You can save the file in a subdirectory of the directory mentioned above. In that case, you have to include the relative path to the file.

**Manual operation:**   See "[Save Standard](#) " on page 344

## Controlling the measurement

The following commands control the measurement itself.

<a href="#">INITiate&lt;n&gt;:ESpectrum</a> .....	744
<a href="#">[SENSe:]SWEep:MODE</a> .....	744

---

### INITiate<n>:ESpectrum

Initiates a Spectrum Emission Mask measurement.

#### Suffix:

<n>                      irrelevant

**Usage:**                      Asynchronous command

---

### [SENSe:]SWEep:MODE <Mode>

Selects the spurious emission and spectrum emission mask measurements.

You can select other measurements with

- [CALCulate<n>:MARKer<m>:FUNCTION:POWER<sb>\[:STATE\]](#)

#### Parameters:

<Mode>                      LIST | AUTO | ESpectrum

#### **AUTO**

Turns on basic spectrum measurements.

#### **ESpectrum**

Turns on spectrum emission mask measurements.

\*RST:                      AUTO

**Example:**                      SWE:MODE ESP

## Configuring a multi-sem measurement

In the Spectrum application only, spectrum emissions can be measured for multiple sub blocks of channels (see "[SEM with multiple sub blocks \("Multi-SEM"\)](#)" on page 328). Up to 8 sub blocks (with 7 gaps) can be defined. For each sub block, the familiar configuration settings concerning ranges, limit lines etc. can be defined in individual tabs (select the sub block using the <sb> suffix in the corresponding commands). In addition, settings on the sub blocks themselves must be configured.

Useful commands for multi-SEM measurements described elsewhere:

- [\[SENSe:\]ESpectrum<sb>:RANGe<ri>:MLCalc](#) on page 757

### Remote commands exclusive to multi-SEM measurements

<a href="#">[SENSe:]ESpectrum&lt;sb&gt;:SCENter</a> .....	745
<a href="#">[SENSe:]ESpectrum&lt;sb&gt;:SCOunt</a> .....	745



**[SENSe:]ESpectrum<sb>:SCENter <Frequency>**

Defines the center frequency of the selected sub block in a Multi-SEM measurement.

**Suffix:**

<sb> 1 to 3  
Subblock in a multi-SEM measurement

**Parameters:**

<Frequency> Frequency within the currently defined global span (see [\[SENSe:\]FREQUENCY:SPAN](#) on page 788 and [\[SENSe<ip>:\]FREQUENCY:CENTer](#) on page 661).

Range: 1 to 3

\*RST: 1

Default unit: Hz

**Example:** ESP1:SCEN 1GHZ

**Manual operation:** See "[Sub Block / Center Freq](#)" on page 337

**[SENSe:]ESpectrum<sb>:SCOUNt <Subblocks>**

Defines the number of sub blocks in the SEM measurement.

**Suffix:**

<sb> 1 to 3  
Subblock in a multi-SEM measurement

**Parameters:**

<Subblocks> Number of sub blocks in the SEM measurement.

Range: 1 to 3

\*RST: 1

**Example:** ESP:SCO 2

**Manual operation:** See "[Sub Block Count](#)" on page 337

**Configuring a sweep list**

The following commands define a sweep list for SEM measurements.



The sweep list cannot be configured using remote commands during an on-going sweep operation.

See also:

- [CALCulate<n>:LIMit<li>:ESpectrum<sb>:PCLass<pc>:LIMit\[:STATe\]](#) on page 765

[\[SENSe:\]ESpectrum<sb>:HSPeed](#)..... 746

[\[SENSe:\]ESpectrum<sb>:RANGe<ri>:BANDwidth:RESolution](#)..... 746

[\[SENSe:\]ESpectrum<sb>:RANGe<ri>:BANDwidth:VIDeo](#)..... 747

[\[SENSe:\]ESpectrum<sb>:RANGe<ri>:COUNt?](#).....747

[SENSe:]ESpectrum<sb>:RANGe<ri>:DELete.....	748
[SENSe:]ESpectrum<sb>:RANGe<ri>:FILTer:TYPE.....	748
[SENSe:]ESpectrum<sb>:RANGe<ri>[:FREQuency]:STARt.....	748
[SENSe:]ESpectrum<sb>:RANGe<ri>[:FREQuency]:STOP.....	749
[SENSe:]ESpectrum<sb>:RANGe<ri>:INPut:ATTenuation.....	749
[SENSe:]ESpectrum<sb>:RANGe<ri>:INPut:ATTenuation:AUTO.....	750
[SENSe:]ESpectrum<sb>:RANGe<ri>:INPut:GAIN[:VALue].....	750
[SENSe:]ESpectrum<sb>:RANGe<ri>:INPut:GAIN:STATe.....	750
[SENSe:]ESpectrum<sb>:RANGe<ri>:INSErt.....	751
[SENSe:]ESpectrum<sb>:RANGe<ri>:LIMit<li>:ABSolute:STARt.....	751
[SENSe:]ESpectrum<sb>:RANGe<ri>:LIMit<li>:ABSolute:STOP.....	752
[SENSe:]ESpectrum<sb>:RANGe<ri>:LIMit<li>:RELative:STARt.....	752
[SENSe:]ESpectrum<sb>:RANGe<ri>:LIMit<li>:RELative:STARt:ABS.....	753
[SENSe:]ESpectrum<sb>:RANGe<ri>:LIMit<li>:RELative:STARt:FUNCTion.....	753
[SENSe:]ESpectrum<sb>:RANGe<ri>:LIMit<li>:RELative:STOP.....	754
[SENSe:]ESpectrum<sb>:RANGe<ri>:LIMit<li>:RELative:STOP:ABS.....	755
[SENSe:]ESpectrum<sb>:RANGe<ri>:LIMit<li>:RELative:STOP:FUNCTion.....	755
[SENSe:]ESpectrum<sb>:RANGe<ri>:LIMit<li>:STATe.....	756
[SENSe:]ESpectrum<sb>:RANGe<ri>:POINts:MINimum[:VALue].....	757
[SENSe:]ESpectrum<sb>:RANGe<ri>:MLCalc.....	757
[SENSe:]ESpectrum<sb>:RANGe<ri>:RLEVel.....	757
[SENSe:]ESpectrum<sb>:RANGe<ri>:SWEep:TIME.....	758
[SENSe:]ESpectrum<sb>:RANGe<ri>:SWEep:TIME:AUTO.....	758
[SENSe:]ESpectrum<sb>:RANGe<ri>:TRANSDucer.....	759
[SENSe:]ESpectrum<sb>:SSETup.....	759

---

### [SENSe:]ESpectrum<sb>:HSPeed <State>

Turns high speed mode for SEM measurements on and off.

For more information including restrictions see "[Fast SEM measurements](#)" on page 326.

#### Suffix:

<sb>                                    1 to 3  
     Subblock in a multi-SEM measurement

#### Parameters:

<State>                                ON | OFF | 0 | 1  
     **OFF | 0**  
     Switches the function off  
     **ON | 1**  
     Switches the function on

**Example:**                            ESP:HSP ON

**Manual operation:**    See "[Fast SEM](#)" on page 333

---

### [SENSe:]ESpectrum<sb>:RANGe<ri>:BANDwidth:RESolution <RBW>

Defines the resolution bandwidth for a SEM range.

In case of high speed measurements, the resolution bandwidth has to be identical for all ranges.

**Suffix:**

<sb> 1 to 3  
Subblock in a multi-SEM measurement

<ri> 1..n  
Selects the measurement range.

**Parameters:**

<RBW> Resolution bandwidth.  
Refer to the data sheet for available resolution bandwidths.

\*RST: 30.0 kHz  
Default unit: Hz

**Manual operation:** See "[RBW](#)" on page 333

**[SENSe:]ESpectrum<sb>:RANGe<ri>:BANDwidth:VIDeo <VBW>**

Defines the video bandwidth for a SEM range.

In case of high speed measurements, the video bandwidth has to be identical for all ranges.

**Suffix:**

<sb> 1 to 3  
Subblock in a multi-SEM measurement

<ri> 1..n  
Selects the measurement range.

**Parameters:**

<VBW> Video bandwidth.  
Refer to the data sheet for available video bandwidths.

\*RST: 10.0 MHz  
Default unit: Hz

**Manual operation:** See "[VBW](#)" on page 334

**[SENSe:]ESpectrum<sb>:RANGe<ri>:COUNT?**

Queries the number of ranges in the sweep list.

**Suffix:**

<sb> 1 to 3  
Subblock in a multi-SEM measurement

<ri> irrelevant

**Return values:**

<Ranges> Number of ranges in the sweep list.

**Usage:** Query only

**[SENSe:]ESpectrum<sb>:RANGe<ri>:DELete**

Removes a range from the sweep list.

Note that

- you cannot delete the reference range
- a minimum of three ranges is mandatory.

**Suffix:**

<sb>                    1 to 3  
                              Subblock in a multi-SEM measurement

<ri>                      Selects the measurement range.

**Manual operation:** See "[Delete Range](#)" on page 336

**[SENSe:]ESpectrum<sb>:RANGe<ri>:FILTer:TYPE <FilterType>**

This command selects the filter type for an SEM range.

In case of high speed measurements, the filter has to be identical for all ranges.

**Suffix:**

<sb>                    1 to 3  
                              Subblock in a multi-SEM measurement

<ri>                      1...30  
                              Selects the measurement range.

**Parameters:**

<FilterType>            **NORMAL**  
                              Gaussian filters

**CFILter**  
                              channel filters

                              \*RST:        NORM  
                              Refer to the datasheet for available filter bandwidths.

**Manual operation:** See "[Filter Type](#)" on page 333

**[SENSe:]ESpectrum<sb>:RANGe<ri>[:FREQUENCY]:STARt <Frequency>**

Defines the start frequency of a SEM range.

Make sure to set an appropriate span. If you set a span that is

- smaller than the span the SEM sweep list covers, the R&S VSE will not measure the ranges that are outside the span - results may be invalid.
- greater than the span the SEM sweep list covers, the R&S VSE will adjust the start frequency of the first SEM range and the stop frequency of the last SEM range to the span

For more information see "[Ranges and range settings](#)" on page 322.

**Suffix:**

<sb>	1 to 3 Subblock in a multi-SEM measurement
<ri>	1..n Selects the measurement range.

**Parameters:**

<Frequency>	Numeric value. Note that the minimum frequency range of a SEM range is 20 Hz.
*RST:	-12.75 MHz (range 1), -2.515 MHz (range 2), 2.515 MHz (range 3)
	Default unit: Hz

**Manual operation:** See "[Range Start / Range Stop](#)" on page 333

**[SENSe:]ESpectrum<sb>:RANGe<ri>[:FREQUENCY]:STOP <Frequency>**

Defines the stop frequency of a SEM range.

Make sure to set an appropriate span. If you set a span that is

- smaller than the span the SEM sweep list covers, the R&S VSE will not measure the ranges that are outside the span - results may be invalid.
- greater than the span the SEM sweep list covers, the R&S VSE will adjust the start frequency of the first SEM range and the stop frequency of the last SEM range to the span

For more information see "[Ranges and range settings](#)" on page 322.

**Suffix:**

<sb>	1 to 3 Subblock in a multi-SEM measurement
<ri>	1..n Selects the measurement range.

**Parameters:**

<Frequency>	Numeric value.
*RST:	-2.52 MHz (range 1), 2.52 MHz (range 2), 250.0 MHz (range 3)
	Default unit: Hz

**Manual operation:** See "[Range Start / Range Stop](#)" on page 333

**[SENSe:]ESpectrum<sb>:RANGe<ri>:INPut:ATTenuation <Attenuation>**

Defines the input attenuation for a SEM range.

In case of high speed measurements, the input attenuation has to be identical for all ranges.

**Suffix:**

<sb> 1 to 3  
Subblock in a multi-SEM measurement

<ri> 1..n  
Selects the measurement range.

**Parameters:**

<Attenuation> Numeric value.  
Refer to the data sheet for the attenuation range.  
\*RST: 10 dB  
Default unit: dB

**[SENSe:]ESPectrum<sb>:RANGe<ri>:INPut:ATTenuation:AUTO <State>**

Turns automatic selection of the input attenuation for a SEM range on and off.

In case of high speed measurements, the input attenuation has to be identical for all ranges.

**Suffix:**

<sb> 1 to 3  
Subblock in a multi-SEM measurement

<ri> 1..n  
Selects the measurement range.

**Parameters:**

<State> ON | OFF | 0 | 1  
\*RST: 1

**Example:**

ESP:RANG2:INP:ATT:AUTO OFF  
Deactivates the RF attenuation auto mode for range 2.

**[SENSe:]ESPectrum<sb>:RANGe<ri>:INPut:GAIN[:VALue] <Gain>**

This command selects the gain for a SEM range.

In case of high speed measurements, the level of the preamplifier has to be identical for all ranges.

**Suffix:**

<sb> 1 to 3  
Subblock in a multi-SEM measurement

<ri> 1..30  
Selects the measurement range.

**[SENSe:]ESPectrum<sb>:RANGe<ri>:INPut:GAIN:STATE <State>**

Turns the preamplifier for a SEM range on and off.

In case of high speed measurements, the state of the preamplifier has to be identical for all ranges.

**Suffix:**

<sb> 1 to 3  
Subblock in a multi-SEM measurement

<ri> 1..n  
Selects the measurement range.

**Parameters:**

<State> ON | OFF | 1 | 0  
\*RST: 0

**[SENSe:]ESpectrum<sb>:RANGe<ri>:INSert <Mode>**

Inserts a new SEM range and updates the range numbers accordingly.

**Suffix:**

<sb> 1 to 3  
Subblock in a multi-SEM measurement

<ri> 1..n  
Selects the SEM range.

**Parameters:**

<Mode> AFTer | BEFore

**AFTer**  
Inserts a range after the selected range.

**BEFore**  
Inserts a range before the selected range.

**Manual operation:** See "[Insert before Range / Insert after Range](#)" on page 336

**[SENSe:]ESpectrum<sb>:RANGe<ri>:LIMit<li>:ABSolute:STARt <Level>**

Defines an absolute limit for a SEM range.

Unlike manual operation, you can define an absolute limit anytime and regardless of the limit check mode.

**Suffix:**

<sb> 1 to 3  
Subblock in a multi-SEM measurement

<ri> 1..n  
Selects the measurement range.

<li> 1..n  
Power class for which the limit is defined.

**Parameters:**

<Level> Absolute limit at the start frequency of a SEM range.  
 Range: -400 to 400  
 \*RST: -13  
 Default unit: dBm

**Example:**

SENSe:ESpectrum:RANGe:LIMit:ABSolute:START -10  
 For a detailed example see ["Example: SEM measurement"](#) on page 774.

**Manual operation:** See ["Abs Limit Start / Stop <n> "](#) on page 334

**[SENSe:]ESpectrum<sb>:RANGe<ri>:LIMit<li>:ABSolute:STOP <Level>**

Defines an absolute limit for a SEM range.

Unlike manual operation, you can define an absolute limit anytime and regardless of the limit check mode.

**Suffix:**

<sb> 1 to 3  
 Subblock in a multi-SEM measurement

<ri> 1..n  
 Selects the measurement range.

<li> 1..n  
 Power class for which the limit is defined.

**Parameters:**

<Level> Absolute limit at the stop frequency of a SEM range.  
 Range: -400 to 400  
 \*RST: -13  
 Default unit: dBm

**Example:**

SENSe:ESpectrum:RANGe:LIMit:ABSolute:STOP -15  
 For a detailed example see ["Example: SEM measurement"](#) on page 774.

**Manual operation:** See ["Abs Limit Start / Stop <n> "](#) on page 334

**[SENSe:]ESpectrum<sb>:RANGe<ri>:LIMit<li>:RELative:START <Level>**

Defines a relative limit for a SEM range.

Unlike manual operation, you can define a relative limit regardless of the limit check mode.

**Suffix:**

<sb> 1 to 3  
 Subblock in a multi-SEM measurement

<ri> 1..n  
 Selects the SEM range.



<li> 1..n  
Power class for which the limit is defined.

**Parameters:**

<Level> Relative limit at the start frequency of a SEM range.  
Range: -400 to 400  
\*RST: -50  
Default unit: dBc

**Example:** SENSE:ESP:RANG:LIM:REL:STAR -10

**Manual operation:** See "[Rel Limit Start / Stop <n>](#)" on page 334

**[SENSe:]ESpectrum<sb>:RANGe<ri>:LIMit<li>:RELative:STARt:ABS <Level>**

Defines an absolute limit for the MAX function of the relative limit for a SEM range.

For more information see "[Relative limit line functions](#)" on page 325.

**Suffix:**

<sb> 1 to 3  
Subblock in a multi-SEM measurement

<ri> 1..n  
Selects the SEM range.

<li> 1..n  
Power class for which the limit is defined.

**Parameters:**

<Level> Absolute limit at the start frequency of a SEM range to be used in addition to the relative limit if the MAX function is enabled (see [\[SENSe:\]ESpectrum<sb>:RANGe<ri>:LIMit<li>:RELative:STARt:FUNCTION](#) on page 753).  
Range: -400 to 400  
\*RST: -13  
Default unit: dBm

**Example:** SENSE:ESpectrum:RANGe:LIMit:RELative:STARt:ABSolute -10

For a detailed example see "[Example: SEM measurement](#)" on page 774.

**Manual operation:** See "[Rel Limit Start / Stop <n>](#)" on page 334

**[SENSe:]ESpectrum<sb>:RANGe<ri>:LIMit<li>:RELative:STARt:FUNCTION <Function>**

**Suffix:**

<sb> 1 to 3  
Subblock in a multi-SEM measurement

<ri> 1..n  
Selects the SEM range.

<li>	1..n Power class for which the limit is defined.
<b>Parameters:</b>	
<Function>	OFF   MAX Defines the function to be used to determine the relative limit line start value <b>MAX</b> The maximum of the relative <i>and</i> the absolute level is used as the limit start value. Use the [SENSe:]ESpectrum<sb>:RANGe<ri>:LIMit<li>:RELative:START and [SENSe:]ESpectrum<sb>:RANGe<ri>:LIMit<li>:RELative:START:ABS commands to define these values. <b>OFF</b> No function is used, the relative limit line is defined by a fixed relative start value. Use the [SENSe:]ESpectrum<sb>:RANGe<ri>:LIMit<li>:RELative:START command to define this value. *RST: OFF
<b>Example:</b>	SENSe:ESpectrum:RANGe:LIMit:RELative:START:FUNCTION MAX For a detailed example see " <a href="#">Example: SEM measurement</a> " on page 774.
<b>Manual operation:</b>	See " <a href="#">Rel Limit Start / Stop &lt;n&gt;</a> " on page 334

---

**[SENSe:]ESpectrum<sb>:RANGe<ri>:LIMit<li>:RELative:STOP <Level>**

Defines a relative limit for a SEM range.

Unlike manual operation, you can define a relative limit anytime and regardless of the limit check mode.

**Suffix:**

<sb>	1 to 3 Subblock in a multi-SEM measurement
<ri>	1..n Selects the SEM range.
<li>	1..n Power class for which the limit is defined.

**Parameters:**

<Level>	Relative limit at the stop frequency of a SEM range. Range: -400 to 400 *RST: -50 Default unit: dBc
---------	--

**Example:** `SENSe:ESpectrum:RANGe:LIMit:RELative:STOP -15`  
 For a detailed example see ["Example: SEM measurement"](#) on page 774.

**Manual operation:** See ["Rel Limit Start / Stop <n> "](#) on page 334

**[SENSe:]ESpectrum<sb>:RANGe<ri>:LIMit<li>:RELative:STOP:ABS <Level>**

Defines an absolute limit for the MAX function of the relative limit for a SEM range.

For more information see ["Relative limit line functions"](#) on page 325.

**Suffix:**

<sb> 1 to 3  
 Subblock in a multi-SEM measurement

<ri> 1..n  
 Selects the SEM range.

<li> 1..n  
 Power class for which the limit is defined.

**Parameters:**

<Level> Absolute limit at the stop frequency of a SEM range to be used in addition to the relative limit if the MAX function is enabled (see [\[SENSe:\]ESpectrum<sb>:RANGe<ri>:LIMit<li>:RELative:STOP:FUNCTION](#) on page 755).

Range: -400 to 400  
 \*RST: -13  
 Default unit: dBm

**Example:** `SENSe:ESpectrum:RANGe:LIMit:RELative:STOP:ABSolute -15`  
 For a detailed example see ["Example: SEM measurement"](#) on page 774.

**Manual operation:** See ["Rel Limit Start / Stop <n> "](#) on page 334

**[SENSe:]ESpectrum<sb>:RANGe<ri>:LIMit<li>:RELative:STOP:FUNCTION <Function>**

Enables the use of a function when defining the relative limit for a SEM range.

**Suffix:**

<sb> 1 to 3  
 Subblock in a multi-SEM measurement

<ri> 1..n  
 Selects the SEM range.

<li> 1..n  
 Power class for which the limit is defined.

**Parameters:**

<Function> OFF | MAX

Defines the function to be used to determine the relative limit line stop value

#### MAX

The maximum of the relative *and* the absolute level is used as the limit stop value. Use the `[SENSe:]ESpectrum<sb>:RANGe<ri>:LIMit<li>:RELative:STOP` and `[SENSe:]ESpectrum<sb>:RANGe<ri>:LIMit<li>:RELative:STOP:ABS` commands to define these values.

#### OFF

No function is used, the relative limit line is defined by a fixed relative stop value. Use the `[SENSe:]ESpectrum<sb>:RANGe<ri>:LIMit<li>:RELative:STOP` command to define this value.

\*RST: OFF

#### Example:

```
SENSe:ESpectrum:RANGe:LIMit:RELative:STOP:
FUNction MAX
```

For a detailed example see ["Example: SEM measurement"](#) on page 774.

**Manual operation:** See ["Rel Limit Start / Stop <n> "](#) on page 334

**[SENSe:]ESpectrum<sb>:RANGe<ri>:LIMit<li>:STATe <State>**

Selects the limit check mode for *all* SEM ranges (<range> is irrelevant).

#### Suffix:

<sb>	1 to 3 Subblock in a multi-SEM measurement
<ri>	1..n Selects the SEM range.
<li>	1..n Power class for which the limit is defined.

#### Parameters:

<State> ABSolute | RELative | AND | OR

#### ABSolute

Checks only the absolute limits defined.

#### RELative

Checks only the relative limits. Relative limits are defined as relative to the measured power in the reference range.

#### AND

Combines the absolute and relative limit. The limit check fails when both limits are violated.

#### OR

Combines the absolute and relative limit. The limit check fails when one of the limits is violated.

\*RST: RELative

**Manual operation:** See "[Limit Check <n>](#)" on page 334

---

**[SENSe:]ESpectrum<sb>:RANGe<ri>:POINTs:MINimum[:VALue] <SweepPoint>**

Defines the minimum number of sweep points for the range.

**Suffix:**

<sb> 1 to 3  
Subblock in a multi-SEM measurement

<ri> Selects the measurement range.

**Parameters:**

<SweepPoint> Minimum number of sweep points per range  
Range: 1 to 32001  
\*RST: 1

**Example:** SENSe1:ESpectrum:RANGe3:POINTs:MIN:VALue 400

**Manual operation:** See "[Min Sweep Points](#)" on page 335

---

**[SENSe:]ESpectrum<sb>:RANGe<ri>:MLCalc <Function>**

Defines the function used to calculate the limit line for the n-th power class for overlapping ranges in Multi-SEM measurements. For details see "[Limit calculation for individual ranges](#)" on page 329.

**Suffix:**

<sb> 1 to 3  
Subblock in a multi-SEM measurement

<ri> 1..n  
Selects the measurement range.

**Parameters:**

<Function> NONE | MAX | SUM

**NONE**  
(reference ranges only:) the limit of the reference range is used; Reference ranges always use the function "NONE".

**SUM**  
sum of the two limit lines (calculated for linear powers) is used

**MAX**  
maximum of the two limit lines is used

\*RST: SUM (reference range: NONE)

**Manual operation:** See "[Multi-Limit Calc <n>](#)" on page 335

---

**[SENSe:]ESpectrum<sb>:RANGe<ri>:RLEVel <RefLevel>**

Defines the reference level for a SEM range.

In case of high speed measurements, the reference level has to be identical for all ranges.

**Suffix:**

<sb> 1 to 3  
Subblock in a multi-SEM measurement

<ri> 1..n  
Selects the measurement range.

**Parameters:**

<RefLevel> Reference level.  
Refer to the data sheet for the reference level range.

\*RST: 0 dBm  
Default unit: dBm

**[SENSe:]ESpectrum<sb>:RANGe<ri>:SWEep:TIME <SweepTime>**

Defines the sweep time for a SEM range.

In case of high speed measurements, the sweep time has to be identical for all ranges.

**Suffix:**

<sb> 1 to 3  
Subblock in a multi-SEM measurement

<ri> 1..n  
Selects the measurement range.

**Parameters:**

<SweepTime> Sweep time.  
The range depends on the ratios of the span to the RBW and the RBW to the VBW. Refer to the data sheet for more information.  
Default unit: s

**Manual operation:** See "[Meas Time](#)" on page 334

**[SENSe:]ESpectrum<sb>:RANGe<ri>:SWEep:TIME:AUTO <State>**

Turns automatic selection of the sweep time for a SEM range on and off.

In case of high speed measurements, the sweep time has to be identical for all ranges.

**Suffix:**

<sb> 1 to 3  
Subblock in a multi-SEM measurement

<ri> 1..n  
Selects the measurement range.

**Parameters:**

<State> ON | OFF | 0 | 1  
\*RST: 1

**Example:** `ESP:RANG3:SWE:TIME:AUTO OFF`  
Deactivates the sweep time auto mode for range 3.

**Manual operation:** See "[Sweep Time Mode](#)" on page 334

**[SENSe:]ESpectrum<sb>:RANGe<ri>:TRANsducer <Transducer>**

Selects a transducer factor for a SEM range.

Note that

- the transducer must cover at least the span of the range
- the x-axis has to be linear
- the unit has to be dB

**Suffix:**

<sb> 1 to 3  
Subblock in a multi-SEM measurement

<ri> 1..n  
Selects the measurement range.

**Parameters:**

<Transducer> String containing the transducer file name, including the path information.

**[SENSe:]ESpectrum<sb>:SSETup <State>**

Enables or disables symmetrical configuration of the range settings.

See "[Ranges and range settings](#)" on page 322.

**Suffix:**

<sb> 1 to 3  
Subblock in a multi-SEM measurement

**Parameters:**

<State> ON | OFF | 0 | 1  
**OFF | 0**  
Switches the function off  
**ON | 1**  
Switches the function on  
\*RST: 0

**Manual operation:** See "[Symmetrical Setup](#)" on page 336

### Configuring the reference range

The following commands define the reference range for the SEM sweep list.

[SENSe:]ESpectrum<sb>:BWID.....	760
[SENSe:]ESpectrum<sb>:FILTer[:RRC]:ALPHA.....	760
[SENSe:]ESpectrum<sb>:FILTer[:RRC][:STATe].....	760
[SENSe:]ESpectrum<sb>:RRANge?.....	761
[SENSe:]ESpectrum<sb>:RTYPe.....	761

---

### [SENSe:]ESpectrum<sb>:BWID <Bandwidth>

Defines the channel bandwidth of the reference range.

The bandwidth is available if the power reference is the channel power.

#### Suffix:

<sb>                      1 to 3  
Subblock in a multi-SEM measurement

#### Parameters:

<Bandwidth>            minimum span ≤ value ≤ span of reference range  
\*RST:                    3.84 MHz  
Default unit: Hz

**Manual operation:** See "[Tx Bandwidth](#)" on page 338

---

### [SENSe:]ESpectrum<sb>:FILTer[:RRC]:ALPHA <Alpha>

Defines the roll-off factor for the RRC filter.

The RRC filter is available if the power reference is the channel power.

#### Suffix:

<sb>                      1 to 3  
Subblock in a multi-SEM measurement

#### Parameters:

<Alpha>                   Range:        0 to 1  
\*RST:                    0.22

**Manual operation:** See "[Alpha:](#)" on page 339

---

### [SENSe:]ESpectrum<sb>:FILTer[:RRC][:STATe] <State>

Turns the RRC filter in the reference range on and off.

The RRC filter is available if the power reference is the channel power.

#### Suffix:

<sb>                      1 to 3  
Subblock in a multi-SEM measurement

#### Parameters:

<State>                    ON | OFF | 0 | 1  
\*RST:                    1

**Manual operation:** See "[RRC Filter State](#)" on page 339



**[SENSe:]ESpectrum<sb>:RRANge?**

Queries the reference range.

**Suffix:**

<sb>                    1 to 3  
Subblock in a multi-SEM measurement

**Return values:**

<RefRange>            Number of the current reference range.  
Range:                1 to 30

**Usage:**                Query only

**[SENSe:]ESpectrum<sb>:RTYPe <Type>**

Defines the type of the power reference.

**Suffix:**

<sb>                    1 to 3  
Subblock in a multi-SEM measurement

**Parameters:**

<Type>                 PEAK | CPOWer

**PEAK**

Measures the highest peak within the reference range.

**CPOWer**

Measures the channel power within the reference range (integral bandwidth method).

\*RST:                 CPOWer

**Manual operation:** See "[Power Reference Type](#)" on page 338

**Configuring the power classes**

The following commands define the power classes for SEM measurements.

<a href="#">CALCulate&lt;n&gt;:LIMit&lt;li&gt;:ESpectrum&lt;sb&gt;:LIMits</a> .....	761
<a href="#">CALCulate&lt;n&gt;:LIMit&lt;li&gt;:ESpectrum&lt;sb&gt;:MODE</a> .....	762
<a href="#">CALCulate&lt;n&gt;:LIMit&lt;li&gt;:ESpectrum&lt;sb&gt;:VALue</a> .....	763
<a href="#">CALCulate&lt;n&gt;:LIMit&lt;li&gt;:ESpectrum&lt;sb&gt;:PCLass&lt;pc&gt;:COUNT</a> .....	764
<a href="#">CALCulate&lt;n&gt;:LIMit&lt;li&gt;:ESpectrum&lt;sb&gt;:PCLass&lt;pc&gt;[:EXCLUSIVE]</a> .....	764
<a href="#">CALCulate&lt;n&gt;:LIMit&lt;li&gt;:ESpectrum&lt;sb&gt;:PCLass&lt;pc&gt;:LIMit[:STATE]</a> .....	765
<a href="#">CALCulate&lt;n&gt;:LIMit&lt;li&gt;:ESpectrum&lt;sb&gt;:PCLass&lt;pc&gt;:MAXimum</a> .....	765
<a href="#">CALCulate&lt;n&gt;:LIMit&lt;li&gt;:ESpectrum&lt;sb&gt;:PCLass&lt;pc&gt;:MINimum</a> .....	766

**CALCulate<n>:LIMit<li>:ESpectrum<sb>:LIMits <Max1>,<Max2>,<Max3>**

This command sets or queries up to 4 power classes in one step. You can only define values for the number of power classes defined by [CALCulate<n>:LIMit<li>:ESpectrum<sb>:PCLass<pc>:COUNT](#) on page 764.

**Suffix:**

<n>	irrelevant
<li>	irrelevant
<sb>	1 to 3 Subblock in a multi-SEM measurement

**Setting parameters:**

<Max1>	<p>Defines the value range for power class 1 as -200 to &lt;Max1&gt;.</p> <p>Only available for <code>CALC:LIM:ESP:PCL:COUNT &gt;=2</code></p> <p>If only 2 power classes are defined, the value range for power class 2 is defined as &lt;Max1&gt; to 200.</p> <p>Range: -199 to + 199</p> <p>Default unit: DBM</p>
<Max2>	<p>Defines the value range for power class 2 as &lt;Max1&gt; to &lt;Max2&gt;.</p> <p>Only available for <code>CALC:LIM:ESP:PCL:COUNT &gt;=3</code></p> <p>If only 3 power classes are defined, the value range for power class 3 is defined as &lt;Max2&gt; to 200.</p> <p>Range: -199 to + 199, &lt;Max2&gt; must be higher than &lt;Max1&gt;</p>
<Max3>	<p>Defines the value range for power class 3 as &lt;Max2&gt; to &lt;Max3&gt;.</p> <p>The value range for power class 4 is defined as &lt;Max3&gt; to 200.</p> <p>Only available for <code>CALC:LIM:ESP:PCL:COUNT = 4</code></p> <p>Range: -199 to + 199, &lt;Max3&gt; must be higher than &lt;Max2&gt;</p>

**Example:**

```

CALC:LIM:ESP:LIM -50,50,70
Defines the following power classes:
<-200, -50>
<-50, 50>
<50, 70>
<70, 200>
Query:
CALC:LIM:ESP:LIM?
Response:
-200,-50,50,70,200

```

**CALCulate<n>:LIMit<li>:ESPectrum<sb>:MODE <Mode>**

Which limit line is to be used for an SEM measurement depends on the power class the input signal power belongs to. This command defines whether the power class is determined automatically or manually.

**Suffix:**

<n>	irrelevant
<li>	irrelevant
<sb>	1 to 3 Subblock in a multi-SEM measurement

**Parameters:**

<Mode>	<b>AUTO</b> The power class (and thus the limit line) is assigned dynamically according to the currently measured channel power.
	<b>MANUAL</b> One of the specified power classes is selected manually for the entire measurement. The selection is made with the <code>CALCulate&lt;n&gt;:LIMit&lt;li&gt;:ESpectrum&lt;sb&gt;:PCLass&lt;pc&gt;[:EXCLUSIVE]</code> command.
*RST:	AUTO

**Example:**

```
CALC:LIM:ESP:MODE AUTO
```

Activates automatic selection of the limit line.

**CALCulate<n>:LIMit<li>:ESpectrum<sb>:VALue <Power>**

Activates the manual limit line selection as and specifies the expected power as a value. Depending on the entered value, the associated predefined limit lines is selected.

Has the same effect as a combination of the `CALC:LIM:ESP:MODE MAN` and the `CALCulate<n>:LIMit<li>:ESpectrum<sb>:PCLass<pc>[:EXCLUSIVE]` commands; however, the power class to be used is not defined directly, but via the expected power. As opposed to `CALC:LIM:ESP:MODE AUTO`, the power class is not re-assigned to the input signal power dynamically, but only once when the command is executed.

**Suffix:**

<n>	irrelevant
<li>	irrelevant
<sb>	1 to 3 Subblock in a multi-SEM measurement

**Parameters:**

<Power>	integer
Range:	-200 to 199
*RST:	0

**Example:**

```
CALC:LIM:ESP:VAL 33
```

Activates manual selection of the limit line and selects the limit line for P = 33.

**CALCulate<n>:LIMit<li>:ESPectrum<sb>:PCLass<pc>:COUNT <NoPowerClasses>**

Sets the number of power classes to be defined.

Must be executed before any new power class values can be defined using [CALCulate<n>:LIMit<li>:ESPectrum<sb>:PCLass<pc>:MAXimum](#) and [CALCulate<n>:LIMit<li>:ESPectrum<sb>:PCLass<pc>:MINimum](#).

**Suffix:**

<n>	irrelevant
<li>	irrelevant
<sb>	1 to 3 Subblock in a multi-SEM measurement
<pc>	irrelevant

**Parameters:**

<NoPowerClasses>	1 to 4
*RST:	1

**Example:**

CALC:LIM:ESP:PCL:COUN 2  
Two power classes can be defined.

**Manual operation:** See ["Adding or Removing a Power Class "](#) on page 340

**CALCulate<n>:LIMit<li>:ESPectrum<sb>:PCLass<pc>[:EXCLusive] <State>**

Selects the power class used by the measurement if [CALCulate<n>:LIMit<li>:ESPectrum<sb>:MODE](#) is set to manual.

Note that:

- You can only use power classes for which limits are defined.

**Suffix:**

<n>	irrelevant
<li>	irrelevant
<sb>	1 to 3 Subblock in a multi-SEM measurement
<pc>	1..n power class

**Parameters:**

<State>	ON   OFF   1   0
*RST:	0

**Example:**

CALC:LIM:ESP:PCL1 ON  
Activates the first defined power class.

**Manual operation:** See ["Used Power Classes: "](#) on page 339

**CALCulate<n>:LIMit<li>:ESPectrum<sb>:PCLass<pc>:LIMit[:STATe] <State>**

Selects the limit check mode for each power class.

**Suffix:**

<n>	irrelevant
<li>	irrelevant
<sb>	1 to 3 Subblock in a multi-SEM measurement
<pc>	1..n power class

**Parameters:**

<State> ABSolute | RELative | AND | OR

**ABSolute**

Evaluates only limit lines with absolute power values

**RELative**

Evaluates only limit lines with relative power values

**AND**

Evaluates limit lines with relative and absolute power values. A negative result is returned if both limits fail.

**OR**

Evaluates limit lines with relative and absolute power values. A negative result is returned if at least one limit failed.

\*RST: REL

**Example:** CALC:LIM:ESP:PCL:LIM ABS

**Manual operation:** See "[Used Power Classes:](#)" on page 339

**CALCulate<n>:LIMit<li>:ESPectrum<sb>:PCLass<pc>:MAXimum <Level>**

Defines the upper limit of a particular power class.

Note:

- The last power class always has an upper limit of 200 dBm.
- The upper limit of a power class must always be the same as the lower limit of the subsequent power class.
- The power class must already exist (see [CALCulate<n>:LIMit<li>:ESPectrum<sb>:PCLass<pc>:COUNT](#) on page 764).

**Suffix:**

<n>	irrelevant
<li>	irrelevant
<sb>	1 to 3 Subblock in a multi-SEM measurement

<pc> 1..n  
power class

**Parameters:**

<Level> Range: -199.9 dBm to 200 dBm  
Default unit: dBm

**Example:**

CALC:LIM:ESP:PCL1:MAX -40 dBm  
Sets the maximum power value of the first power class to -40 dBm.

**Manual operation:** See "PMin / PMax " on page 340

**CALCulate<n>:LIMit<li>:ESPectrum<sb>:PCLass<pc>:MINimum <Level>**

Defines the lower limit of a particular power class.

**Note:**

- The first power class always has a lower limit of -200 dBm.
- The lower limit of a power class must always be the same as the upper limit of the previous power class.
- The power class must already exist (see [CALCulate<n>:LIMit<li>:ESPectrum<sb>:PCLass<pc>:COUNT](#) on page 764).

**Suffix:**

<n> irrelevant  
<li> irrelevant  
<sb> 1 to 3  
Subblock in a multi-SEM measurement  
<pc> 1..n  
power class

**Parameters:**

<Level> Range: -200 dBm to 199.9 dBm  
Default unit: dBm

**Example:**

CALC:LIM:ESP:PCL2:MIN -40 dBm  
Sets the minimum power value of the second power class to -40 dBm.

**Manual operation:** See "PMin / PMax " on page 340

**Configuring MSR SEM measurements**

The following commands configure MSR SEM measurements. For details see "[Multi-standard radio \(MSR\) SEM measurements](#)" on page 327.

For manual operation see "[MSR settings](#)" on page 340.

[SENSe:]ESPectrum<sb>:MSR:APPLY.....	767
[SENSe:]ESPectrum<sb>:MSR:BAND.....	767
[SENSe:]ESPectrum<sb>:MSR:BCATegory.....	768

[SENSe:]ESpectrum<sb>:MSR:CLASs.....	769
[SENSe:]ESpectrum<sb>:MSR:GSM:CARRier.....	769
[SENSe:]ESpectrum<sb>:MSR:GSM:CPResent.....	770
[SENSe:]ESpectrum<sb>:MSR:LTE:CPResent.....	771
[SENSe:]ESpectrum<sb>:MSR:MPOWer.....	771
[SENSe:]ESpectrum<sb>:MSR:RFBWidth.....	772

---

### [SENSe:]ESpectrum<sb>:MSR:APPLy

Configures the SEM sweep list according to the MSR settings defined by previous commands.

#### Suffix:

<sb>                    1 to 3  
Subblock in a multi-SEM measurement

#### Example:

```
//Select the band category 1
ESP2:MSR:BCAT 1
//Set the base station class to medium range
ESP2:MSR:CLAS MED
//Set the maximum output power to 10 dBm.
ESP2:MSR:MPOW 10
//Set the frequency range of the base station to > 3 GHz
ESP2:MSR:BAND:HIGH
//Set the base station RF bandwidth to 20 MHz
ESP2:MSR:RFBW 20MHZ
//Calculate limits for MSR SEM
ESP2:MSR:APPL
```

**Manual operation:** See "[Apply to SEM](#)" on page 343

---

### [SENSe:]ESpectrum<sb>:MSR:BAND <Range>

Defines the frequency range of the bands used by the base station.

#### Suffix:

<sb>                    1 to 3  
Subblock in a multi-SEM measurement

#### Parameters:

<Range>                LOW | HIGH  
**LOW**  
≤ 3 GHz  
**HIGH**  
> 3 GHz  
\*RST:                LOW

**Example:**

```
//Select the band category 1
ESP2:MSR:BCAT 1
//Set the base station class to medium range
ESP2:MSR:CLAS MED
//Set the maximum output power to 10 dBm.
ESP2:MSR:MPOW 10
//Set the frequency range of the base station to > 3 GHz
ESP2:MSR:BAND:HIGH
//Set the base station RF bandwidth to 20 MHz
ESP2:MSR:RFBW 20MHZ
//Calculate limits for MSR SEM
ESP2:MSR:APPL
```

**Manual operation:** See "[Bands](#)" on page 342

### [SENSe:]ESpectrum<sb>:MSR:BCATegory <Category>

Defines the band category for MSR measurements, i.e. the combination of available carriers to measure.

#### Suffix:

<sb>                    1 to 3  
Subblock in a multi-SEM measurement

#### Parameters:

<Category>            1 | 2 | 3  
**1**  
2 carriers: LTE FDD and W-CDMA  
**2**  
3 carriers: LTE FDD, W-CDMA and GSM/EDGE  
**3**  
2 carriers: LTE TDD and TD-SCDMA  
\*RST:                1

**Example:**

```
//Select the band category 1
ESP2:MSR:BCAT 1
//Set the base station class to medium range
ESP2:MSR:CLAS MED
//Set the maximum output power to 10 dBm.
ESP2:MSR:MPOW 10
//Set the frequency range of the base station to > 3 GHz
ESP2:MSR:BAND:HIGH
//Set the base station RF bandwidth to 20 MHz
ESP2:MSR:RFBW 20MHZ
//Calculate limits for MSR SEM
ESP2:MSR:APPL
```

**Manual operation:** See "[Band Category](#)" on page 341



**[SENSe:]ESpectrum<sb>:MSR:CLASs <Class>**

Defines the class of the base station according to its sending range.

**Suffix:**

<sb>                    1 to 3  
Subblock in a multi-SEM measurement

**Parameters:**

<Class>                WIDE | MEDium | LOCal

**WIDE**

Wide Area

**MEDium**

Medium Range

**LOCal**

Local Area

\*RST:                WIDE

**Example:**

```
//Select the band category 1
ESP2:MSR:BCAT 1
//Set the base station class to medium range
ESP2:MSR:CLAS MED
//Set the maximum output power to 10 dBm.
ESP2:MSR:MPOW 10
//Set the frequency range of the base station to > 3 GHz
ESP2:MSR:BAND:HIGH
//Set the base station RF bandwidth to 20 MHz
ESP2:MSR:RFBW 20MHZ
//Calculate limits for MSR SEM
ESP2:MSR:APPL
```

**Manual operation:** See "[Base Station Class](#)" on page 341

**[SENSe:]ESpectrum<sb>:MSR:GSM:CARRier <Power>**

Defines the power of the GSM carrier (if available, see [\[SENSe:\]ESpectrum<sb>:MSR:GSM:CPResent](#) on page 770).

Is only available for band category 2 (see [\[SENSe:\]ESpectrum<sb>:MSR:BCATegory](#) on page 768).

**Suffix:**

<sb>                    1 to 3  
Subblock in a multi-SEM measurement

**Parameters:**

<Power>                Range:        0 dBm to 100 dBm  
\*RST:                39.0 dBm  
Default unit: dBm

**Example:**

```
//Select the band category 2
ESP2:MSR:BCAT BC2
//Set the base station class to medium range
ESP2:MSR:CLAS MED
//Set the maximum output power to 10 dBm.
ESP2:MSR:MPOW 10
//Set the base station RF bandwidth to 20 MHz
ESP2:MSR:RFBW 20MHZ
//GSM/Edge present
ESP2:MSR:GSM:CPR ON
//Power of the GSM carrier is 20dBm
ESP2:MSR:GSM:CARR 20
//Calculate limits for MSR SEM
ESP2:MSR:APPL
```

**Manual operation:** See "[Power GSM Carrier](#)" on page 342

---

### [SENSe:]ESpectrum<sb>:MSR:GSM:CPResent <State>

Defines whether a GSM/Edge carrier is located at the edge of the specified RF bandwidth. In this case, the specification demands specific limits for the SEM ranges.

Is only available for band category 2 (see [\[SENSe:\]ESpectrum<sb>:MSR:BCATegory](#) on page 768).

#### Suffix:

<sb> 1 to 3  
Subblock in a multi-SEM measurement

#### Parameters:

<State> ON | OFF | 1 | 0  
\*RST: 0

**Example:**

```
//Select the band category 2
ESP2:MSR:BCAT BC2
//Set the base station class to medium range
ESP2:MSR:CLAS MED
//Set the maximum output power to 10 dBm.
ESP2:MSR:MPOW 10
//Set the base station RF bandwidth to 20 MHz
ESP2:MSR:RFBW 20MHZ
//GSM/Edge present
ESP2:MSR:GSM:CPR ON
//Power of the GSM carrier is 20dBm
ESP2:MSR:GSM:CARR 20
```

**Manual operation:** See "[Carrier Adjacent to RF Bandwidth Edge](#)" on page 342

**[SENSe:]ESpectrum<sb>:MSR:LTE:CPResent <State>**

Defines whether an LTE FDD 1.4 MHz or 3 MHz carrier is located at the edge of the specified RF bandwidth. In this case, the specification demands specific limits for the SEM ranges.

Is only available for band category 2 (see [\[SENSe:\]ESpectrum<sb>:MSR:BCATegory](#) on page 768).

**Suffix:**

<sb> 1 to 3  
Subblock in a multi-SEM measurement

**Parameters:**

<State> ON | OFF | 1 | 0  
\*RST: 0

**Example:**

```
//Select the band category 2
ESP2:MSR:BCAT BC2
//Set the base station class to medium range
ESP2:MSR:CLAS MED
//Set the maximum output power to 10 dBm.
ESP2:MSR:MPOW 10
//Set the base station RF bandwidth to 20 MHz
ESP2:MSR:RFBW 20MHZ
//LTE present
ESP2:MSR:LTE:CPR ON
//Calculate limits for MSR SEM
ESP2:MSR:APPL
```

**Manual operation:** See "[Carrier Adjacent to RF Bandwidth Edge](#)" on page 342

**[SENSe:]ESpectrum<sb>:MSR:MPOWER <Power>**

Defines the maximum output power of the base station.

This setting is only available for base stations with a medium range base station class (see [\[SENSe:\]ESpectrum<sb>:MSR:CLASSs](#) on page 769).

**Suffix:**

<sb> 1 to 3  
Subblock in a multi-SEM measurement

**Parameters:**

<Power> Range: 0 dBm to 100 dBm  
Increment: 1 dB  
Default unit: dBm

**Example:**

```
//Select the band category 1
ESP2:MSR:BCAT 1
//Set the base station class to medium range
ESP2:MSR:CLAS MED
//Set the maximum output power to 10 dBm.
ESP2:MSR:MPOW 10
//Set the frequency range of the base station to > 3 GHz
ESP2:MSR:BAND:HIGH
//Set the base station RF bandwidth to 20 MHz
ESP2:MSR:RFBW 20MHZ
```

**Manual operation:** See "[Base Station Maximum Output Power](#)" on page 342

---

**[SENSe:]ESpectrum<sb>:MSR:RFBWidth <Bandwidth>**

Defines the RF bandwidth of the base station for MSR measurements.

**Suffix:**

<sb>                    1 to 3  
Subblock in a multi-SEM measurement

**Parameters:**

<Bandwidth>            Bandwidth in Hz  
\*RST:                    10.0 MHz  
Default unit: Hz

**Example:**

```
//Select the band category 1
ESP2:MSR:BCAT 1
//Set the base station class to medium range
ESP2:MSR:CLAS MED
//Set the maximum output power to 10 dBm.
ESP2:MSR:MPOW 10
//Set the frequency range of the base station to > 3 GHz
ESP2:MSR:BAND:HIGH
//Set the base station RF bandwidth to 20 MHz
ESP2:MSR:RFBW 20MHZ
//Calculate limits for MSR SEM
ESP2:MSR:APPL
```

**Manual operation:** See "[Base Station RF Bandwidth](#)" on page 342

### Configuring the list evaluation

The following commands configure the list evaluation.

#### Useful commands for SEM measurements described elsewhere

- [MMEMoRY:STORe<n>:LIST](#) on page 897

**Remote commands exclusive to SEM measurements**

CALCulate<n>:ESpectrum:PSEarch:AUTO.....	773
CALCulate<n>:ESpectrum:PEAKsearch:AUTO.....	773
CALCulate<n>:ESpectrum:PSEarch[:IMMEDIATE].....	773
CALCulate<n>:ESpectrum:PEAKsearch[:IMMEDIATE].....	773
CALCulate<n>:ESpectrum:PSEarch:MARGIN.....	773
CALCulate<n>:ESpectrum:PEAKsearch:MARGIN.....	773
CALCulate<n>:ESpectrum:PSEarch:PSHOW.....	774
CALCulate<n>:ESpectrum:PEAKsearch:PSHOW.....	774

---

**CALCulate<n>:ESpectrum:PSEarch:AUTO <State>**

**CALCulate<n>:ESpectrum:PEAKsearch:AUTO <State>**

Turns the list evaluation on and off.

**Suffix:**

<n> [Window](#)

**Parameters:**

<State> ON | OFF | 0 | 1

\*RST: 1

**Example:**

CALC:ESP:PSE:AUTO OFF

Deactivates the list evaluation.

**Manual operation:** See "[List Evaluation State \(result summary\)](#)" on page 346

---

**CALCulate<n>:ESpectrum:PSEarch[:IMMEDIATE]**

**CALCulate<n>:ESpectrum:PEAKsearch[:IMMEDIATE]**

Initiates a list evaluation.

**Suffix:**

<n> [Window](#)

---

**CALCulate<n>:ESpectrum:PSEarch:MARGIN <Threshold>**

**CALCulate<n>:ESpectrum:PEAKsearch:MARGIN <Margin>**

Defines the threshold of the list evaluation.

**Suffix:**

<n> [Window](#)

**Parameters:**

<Margin> Range: -200 to 200

\*RST: 200

Default unit: dB

**Example:**

CALC:ESP:PSE:MARG 100

Sets the margin to 100 dB.

**Manual operation:** See "[Margin](#)" on page 346

**CALCulate<n>:ESPectrum:PSEarch:PSHow <State>**

**CALCulate<n>:ESPectrum:PEAKsearch:PSHow <State>**

Turns the peak labels in the diagram on and off.

Peak labels are blue squares.

**Suffix:**

<n> [Window](#)

**Parameters:**

<State> ON | OFF | 1 | 0

\*RST: 0

**Example:**

CALC:ESP:PSE:PSH ON

Marks all peaks with blue squares.

**Manual operation:** See ["Show Peaks"](#) on page 346

### Performing an SEM measurement

The following commands are required to perform an SEM measurement:

- [SENS:SWE:MODE ESP](#), see [\[SENSe:\]SWEep:MODE](#) on page 744
- [INITiate<n>\[:IMMediate\]](#) on page 548

### Retrieving results

The following commands analyze and retrieve measurement results for SEM measurements.

- [CALCulate<n>:LIMit<li>:FAIL?](#) on page 867
- [TRACe<n>\[:DATA\]](#) on page 730
- [TRACe<n>\[:DATA\]:MEMory?](#) on page 875
- [TRACe<n>\[:DATA\]:X?](#) on page 876
- [CALCulate<n>:MARKer<m>:FUNction:POWer<sb>:RESult?](#) on page 724

### Example: SEM measurement

In this example we will configure and perform an SEM measurement. Note that this example is primarily meant to demonstrate the remote control commands, it does not necessarily reflect a useful measurement task. For most common measurement standards, the R&S VSE performs the measurement optimally with the predefined settings, without further configuration.

```
//-----Preparing the measurement -----
//Reset the instrument
*RST

DEvice:DElete:ALL

//*****
//***** Configure instrument connections *****
```

## Remote commands for the I/Q analyzer

```

//*****
//Configure connection to MyFSW at 123.456.789.100 using VSI11 protocol
DEV:CRE 'MyFSW','123.456.789.100',VXI11;*WAI
//Query the network address of MyFSW
DEV:TARG? 'MyFSW'
//Result: '123.456.789.100'
//Query connection state to MyFSW
DEV:STAT? 'MyFSW'
//Result: 1 (connection established)
//Query information on MyFSW
//Instrument ID?
DEV:INFO:IDN? 'MyFSW'
//Define the use of an external reference on MyFSW
DEV:EXTR:SOUR 'MyFSW',EXT
DEV:EXTR:FREQ 'MyFSW',13MHZ
//Assign MyFSW as input source for default channel 1
INST:BLOC:CHAN:SETT:SOUR DEV
INST:BLOC:CHAN:SETT:DEV 'MyFSW'

//----- Preparing the measurement-----
//Activate SEM Measurement
SWE:MODE ESP

//Selects single sweep mode.
//SEM has to be in single sweep mode to be configured and no sweep operation
//may be running!
// If required, a sweep stop can be ensured by INIT:IMM;*WAI
INIT:CONT OFF

//----- Managing Measurement Configurations-----
//Load the 3GPP configuration stored in the file '3GPP_UL.xml'
ESP:PRES 'WCDMA\3GPP\UL\3GPP_UL.xml'

//----- Defining the Reference Range-----
//Query the current reference range.
ESP:RRAN?
//Select the channel power as the power reference.
ESP:RTYP CPOW
//Define a channel bandwidth of 4 MHz for the power reference.
ESP:BWID 4 MHZ
//Use an RRC filter with a roll-off factor of 0.5 when measuring
//the reference power.
ESP:FILT:RRC ON
ESP:FILT:ALPH 0.5

//----- Configuring Power Classes-----
//Define 3 power classes.
CALC:LIM:ESP:PCL:COUN 3
//Define the value ranges of the three power classes as [dBm]:

```

```

//power class 1: -200 to -100
//power class 2: -100 to 0
//power class 3: 0 to 200
CALC:LIM:ESP:LIM -100,0
//Define an absolute limit check for class 1.
CALC:LIM:ESP:PCL1:LIM ABS
//Define a relative limit check for class 2.
CALC:LIM:ESP:PCL2:LIM REL
//Define a manual selection of the power class.
CALC:LIM:ESP:MODE MAN
//Activate the use of the second power class for the entire measurement.
CALC:LIM:ESP:PCL2 ON

//----- Configuring a Sweep List-----
//Insert a range after range 2.
ESP:RANG2:INS AFT
//Insert a range before range 1.
ESP:RANG1:INS BEF
//Query the number of measurement ranges in the sweep list (currently 11).
ESP:RANG:COUNT?
//Delete the 11th range.
ESP:RANG5:DEL

//Define a stop frequency of -9 MHz for range 1.
ESP:RANG1:STOP -10000000

//Define a start frequency of -10 MHz for range 2.
ESP:RANG2:STAR -9000000

//Switch off Fast SEM mode so the ranges can be configured individually.
ESP:HSP OFF

//Define a resolution bandwidth of 1 MHz for range 2.
ESP:RANG2:BAND:RES 1000000

//Define a video bandwidth of 5 MHz for range 2.
ESP:RANG2:BAND:VID 5000000
//Define a sweep time of 1 second for range 2.
ESP:RANG2:SWE:TIME 1
//Define a reference level of 0 dBm for range 2.
ESP:RANG2:RLEV 0
//Define an input attenuation of 10 dB for range 2.
ESP:RANG2:INP:ATT 10

// Create a transducer that can be used.
// It has to cover the corresponding frequency range

SENSE1:CORREction:TRANSDUCER:SElect 'Transducer'
SENSE1:CORREction:TRANSDUCER:UNIT 'DB'

```



## Remote commands for the I/Q analyzer

```

SENSE1:CORREction:TRANsdUCer:COMMeNt 'Test Transducer'
// Frequency Span 0 MHz bis 20 Ghz
SENSE1:CORREction:TRANsdUCer:DATA 0e6,5, 20e9,3

//Include a transducer called 'transducer' for range 2.
ESP:RANG2:TRAN 'Transducer'

//----- Configuring the limit check-----

//Check the absolute and relative limits for all ranges in power class 1 and
//fails if both limits are violated. Since power class 2 is set to be used for
//the entire measurement, values for Limit Check 1 are irrelevant. They are
//defined here to demonstrate the use of the MAX function for relative limits.
ESP:RANG:LIM1:STAT AND
//Enable the use of maximum function for relative limit start. If the value
//exceeds the larger of the absolute (-13 dBm) and relative (-10 dBc) start
//values, the check fails.
ESP:RANG2:LIM1:REL:STAR:FUNC MAX
ESP:RANG2:LIM1:REL:STAR -10
ESP:RANG2:LIM1:REL:STAR:ABS -13
ESP:RANG2:LIM1:REL:STOP:FUNC MAX
ESP:RANG2:LIM1:REL:STOP -10
ESP:RANG2:LIM1:REL:STOP:ABS -13

//Check the absolute and relative limits for all ranges in power class 2 and
//fails if either limit is violated. Since power class 2 is set to be used for
//the entire measurement, values for Limit Check 1 are irrelevant.
ESP:RANG:LIM2:STAT OR
//Define an absolute limit of 10 dBm for the entire range 2 for power class 2.
ESP:RANG2:LIM2:ABS:STAR 10
ESP:RANG2:LIM2:ABS:STOP 10
//Define a relative limit of -20 dBc for the entire range 2 for power class 2.
ESP:RANG2:LIM2:REL:STAR -20
ESP:RANG2:LIM2:REL:STOP -20

//----- Configuring List Evaluation-----
//Activate list evaluation, i.e. the peak is determined for each range
//after each sweep.
CALC:ESP:PSE:AUTO ON
//Define a peak threshold of 10 dB.
CALC:ESP:PSE:MARG 10dB

//----- Managing Measurement Configurations-----

//Save the current configuration in a new file named '3GPP_UL_User'
//in the same directory so the standard is not overwritten.
ESP:PRES:STOR 'WCDMA\3GPP\UL\3GPP_UL_User.xml'

//----- Performing the measurement-----

```

```
//One sweep
INIT:ESP

//----- Checking the Results-----
//Query the result of the limit check for all ranges.
CALC:LIM:FAIL?
//Query the peak for each range of the SEM measurement as a list.
TRAC:DATA? LIST
```

### 13.6.3.4 Measuring the time domain power

All remote control commands specific to time domain power measurements are described here.

- [Configuring the measurement](#)..... 778
- [Performing a time domain power measurement](#)..... 781
- [Retrieving measurement results](#)..... 781

#### Configuring the measurement

The following remote commands measure the time domain power.

#### Useful commands for time domain power measurements described elsewhere

- `CALCulate<n>:MARKer<m>:X:SLIMits:LEFT`
- `CALCulate<n>:MARKer<m>:X:SLIMits:RIGHT`
- `CALCulate<n>:MARKer<m>:X:SLIMits[:STATe]`

#### Remote commands exclusive to time domain power measurements

<code>CALCulate&lt;n&gt;:MARKer&lt;m&gt;:FUNCTION:SUMMARY:AOFF</code> .....	778
<code>CALCulate&lt;n&gt;:MARKer&lt;m&gt;:FUNCTION:SUMMARY:AVERAGE</code> .....	779
<code>CALCulate&lt;n&gt;:MARKer&lt;m&gt;:FUNCTION:SUMMARY:PHOLD</code> .....	779
<code>CALCulate&lt;n&gt;:MARKer&lt;m&gt;:FUNCTION:SUMMARY[:STATe]</code> .....	779
<code>CALCulate&lt;n&gt;:MARKer&lt;m&gt;:FUNCTION:SUMMARY:MEAN[:STATe]</code> .....	780
<code>CALCulate&lt;n&gt;:MARKer&lt;m&gt;:FUNCTION:SUMMARY:PPEAK[:STATe]</code> .....	780
<code>CALCulate&lt;n&gt;:MARKer&lt;m&gt;:FUNCTION:SUMMARY:RMS[:STATe]</code> .....	780
<code>CALCulate&lt;n&gt;:MARKer&lt;m&gt;:FUNCTION:SUMMARY:SDEVIAtion[:STATe]</code> .....	781

---

#### `CALCulate<n>:MARKer<m>:FUNCTION:SUMMARY:AOFF`

Turns all time domain power evaluation modes off.

#### Suffix:

<n>	Window
<m>	Marker

**CALCulate<n>:MARKer<m>:FUNCTION:SUMMARY:AVERage <State>**

Switches on or off averaging for the active power measurement in zero span in the window specified by the suffix <n>. If activated, a time domain value is calculated from the trace after each sweep; in the end, all values are averaged to calculate the final result.

The number of results required for the calculation of average is defined with [\[SENSe: \]AVERage<n>:COUNT](#) .

Averaging is reset by switching it off and on again.

Synchronization to the end of averaging is only possible in single sweep mode.

**Suffix:**

<n> [Window](#)

<m> [Marker](#)

**Parameters:**

<State> ON | OFF | 1 | 0

\*RST: 0

**Example:**

```
INIT:CONT OFF
```

Switches to single sweep mode.

```
CALC:MARK:FUNC:SUMM:AVER ON
```

Switches on the calculation of average.

```
AVER:COUN 200
```

Sets the measurement counter to 200.

```
INIT;*WAI
```

Starts a sweep and waits for the end.

**CALCulate<n>:MARKer<m>:FUNCTION:SUMMARY:PHOLD <State>**

Switches on or off the peak-hold function for the active power measurement in zero span in the window specified by the suffix <n>. If activated, the peak for each sweep is compared to the previously stored peak; the maximum of the two is stored as the current peak.

The peak-hold function is reset by switching it off and on again.

**Suffix:**

<n> [Window](#)

<m> [Marker](#)

**Parameters:**

<State> ON | OFF | 1 | 0

\*RST: 0

**CALCulate<n>:MARKer<m>:FUNCTION:SUMMARY[:STATe] <State>**

Turns time domain power measurements on and off. This measurement is only available in zero span.

When you turn the measurement on, the R&S VSE activates a marker and positions it on the peak power level in the marker search range.

**Suffix:**

<n> [Window](#)

<m> [Marker](#)

**Parameters:**

<State> ON | OFF | 1 | 0

\*RST: 0

**CALCulate<n>:MARKer<m>:FUNCTION:SUMMARY:MEAN[:STATE] <State>**

Turns the evaluation to determine the mean time domain power on and off.

The R&S VSE performs the measurement on the trace marker 1 is positioned on.

**Suffix:**

<n> [Window](#)

<m> [Marker](#)

**Parameters:**

<State> ON | OFF | 1 | 0

\*RST: 0

**Manual operation:** See ["Results "](#) on page 362

**CALCulate<n>:MARKer<m>:FUNCTION:SUMMARY:PPEak[:STATE] <State>**

Turns the evaluation to determine the positive peak time domain power on and off.

The R&S VSE performs the measurement on the trace marker 1 is positioned on.

**Suffix:**

<n> [Window](#)

<m> [Marker](#)

**Parameters:**

<State> ON | OFF | 1 | 0

\*RST: 0

**Manual operation:** See ["Results "](#) on page 362

**CALCulate<n>:MARKer<m>:FUNCTION:SUMMARY:RMS[:STATE] <State>**

Turns the evaluation to determine the RMS time domain power on and off.

The R&S VSE performs the measurement on the trace marker 1 is positioned on.

**Suffix:**

<n> [Window](#)

<m> [Marker](#)

**Parameters:**

<State> ON | OFF | 1 | 0  
 \*RST: 0

**Manual operation:** See "Results " on page 362

**CALCulate<n>:MARKer<m>:FUNcTion:SUMMary:SDEVIation[:STATe] <State>**

Turns the evaluation to determine the standard deviation of the time domain power on and off.

The R&S VSE performs the measurement on the trace marker 1 is positioned on.

**Suffix:**

<n> Window  
 <m> Marker

**Parameters:**

<State> ON | OFF | 1 | 0  
 \*RST: 0

**Performing a time domain power measurement**

The following commands are required to perform a Time Domain Power measurement:

[INITiate<n>\[:IMMediate\]](#) on page 548

**Retrieving measurement results**

The following commands query the results for time domain measurements.

**Measuring the mean power**

[CALCulate<n>:MARKer<m>:FUNcTion:SUMMary:MEAN:AVERage:RESult?](#)..... 781  
[CALCulate<n>:MARKer<m>:FUNcTion:SUMMary:MEAN:PHOLd:RESult?](#)..... 782  
[CALCulate<n>:MARKer<m>:FUNcTion:SUMMary:MEAN:RESult?](#)..... 782

**CALCulate<n>:MARKer<m>:FUNcTion:SUMMary:MEAN:AVERage:RESult?**

Queries the average mean time domain power. The query is only possible if averaging has been activated previously using [CALCulate<n>:MARKer<m>:FUNcTion:SUMMary:AVERage](#) on page 779.

To get a valid result, you have to perform a complete measurement with synchronization to the end of the measurement before reading out the result. This is only possible for single measurement mode.

See also [INITiate<n>:CONTinuous](#) on page 547.

**Suffix:**

<n> Window  
 <m> Marker

**Return values:**

<MeanPower> Mean power of the signal during the measurement time.

**Usage:** Query only

**CALCulate<n>:MARKer<m>:FUNCTION:SUMMARY:MEAN:PHOLD:RESULT?**

Queries the maximum mean time domain power. The query is only possible if the peak hold function has been activated previously using [CALCulate<n>:MARKer<m>:FUNCTION:SUMMARY:PHOLD](#).

To get a valid result, you have to perform a complete measurement with synchronization to the end of the measurement before reading out the result. This is only possible for single measurement mode.

See also [INITiate<n>:CONTinuous](#) on page 547.

**Suffix:**

<n> [Window](#)

<m> [Marker](#)

**Return values:**

<MeanPower> Mean power of the signal during the measurement time.

**Usage:** Query only

**CALCulate<n>:MARKer<m>:FUNCTION:SUMMARY:MEAN:RESULT?**

Queries the mean time domain power.

To get a valid result, you have to perform a complete measurement with synchronization to the end of the measurement before reading out the result. This is only possible for single measurement mode.

See also [INITiate<n>:CONTinuous](#) on page 547.

**Suffix:**

<n> [Window](#)

<m> [Marker](#)

**Return values:**

<MeanPower> Mean power of the signal during the measurement time.

**Usage:** Query only

**Manual operation:** See "[Results](#)" on page 362

**Measuring the peak power****CALCulate<n>:MARKer<m>:FUNCTION:SUMMARY:PPEAK:AVERAGE:RESULT?**

Queries the average positive peak time domain power. The query is only possible if averaging has been activated previously using [CALCulate<n>:MARKer<m>:FUNCTION:SUMMARY:AVERAGE](#) on page 779.

To get a valid result, you have to perform a complete measurement with synchronization to the end of the measurement before reading out the result. This is only possible for single measurement mode.

See also [INITiate<n>:CONTInuous](#) on page 547.

**Suffix:**

<n> [Window](#)

<m> [Marker](#)

**Return values:**

<PeakPower> Peak power of the signal during the measurement time.

**Usage:** Query only

**CALCulate<n>:MARKer<m>:FUNction:SUMMary:PPEak:PHOLd:RESult?**

Queries the maximum positive peak time domain power. The query is only possible if the peak hold function has been activated previously using [CALCulate<n>:MARKer<m>:FUNction:SUMMary:PHOLd](#).

To get a valid result, you have to perform a complete measurement with synchronization to the end of the measurement before reading out the result. This is only possible for single measurement mode.

See also [INITiate<n>:CONTInuous](#) on page 547.

**Suffix:**

<n> [Window](#)

<m> [Marker](#)

**Return values:**

<PeakPower> Peak power of the signal during the measurement time.

**Usage:** Query only

**CALCulate<n>:MARKer<m>:FUNction:SUMMary:PPEak:RESult?**

Queries the positive peak time domain power.

To get a valid result, you have to perform a complete measurement with synchronization to the end of the measurement before reading out the result. This is only possible for single measurement mode.

See also [INITiate<n>:CONTInuous](#) on page 547.

**Suffix:**

<n> [Window](#)

<m> [Marker](#)

**Return values:**

<PeakPower> Peak power of the signal during the measurement time.

**Usage:** Query only

**Manual operation:** See "Results " on page 362

### Measuring the RMS power

---

#### CALCulate<n>:MARKer<m>:FUNction:SUMMary:RMS:AVERage:RESult?

Queries the average RMS of the time domain power. The query is only possible if averaging has been activated previously using [CALCulate<n>:MARKer<m>:FUNction:SUMMary:AVERage](#) on page 779.

To get a valid result, you have to perform a complete measurement with synchronization to the end of the measurement before reading out the result. This is only possible for single measurement mode.

See also [INITiate<n>:CONTinuous](#) on page 547.

**Suffix:**

<n> [Window](#)

<m> [Marker](#)

**Return values:**

<RMSPower> RMS power of the signal during the measurement time.

**Usage:** Query only

---

#### CALCulate<n>:MARKer<m>:FUNction:SUMMary:RMS:PHOLd:RESult?

Queries the maximum RMS of the time domain power. The query is only possible if the peak hold function has been activated previously using [CALCulate<n>:MARKer<m>:FUNction:SUMMary:PHOLd](#).

To get a valid result, you have to perform a complete measurement with synchronization to the end of the measurement before reading out the result. This is only possible for single measurement mode.

See also [INITiate<n>:CONTinuous](#) on page 547.

**Suffix:**

<n> [Window](#)

<m> [Marker](#)

**Return values:**

<RMSPower> RMS power of the signal during the measurement time.

**Usage:** Query only

---

#### CALCulate<n>:MARKer<m>:FUNction:SUMMary:RMS:RESult?

Queries the RMS of the time domain power.

To get a valid result, you have to perform a complete measurement with synchronization to the end of the measurement before reading out the result. This is only possible for single measurement mode.



See also [INITiate<n>:CONTinuous](#) on page 547.

**Suffix:**

<n> [Window](#)

<m> [Marker](#)

**Return values:**

<RMSPower> RMS power of the signal during the measurement time.

**Usage:** Query only

**Manual operation:** See "[Results](#)" on page 362

### Measuring the standard deviation

---

#### **CALCulate<n>:MARKer<m>:FUNction:SUMMary:SDEViation:AVERage:RESult?**

Queries the average standard deviation of the time domain power. The query is only possible if averaging has been activated previously using [CALCulate<n>:MARKer<m>:FUNction:SUMMary:AVERage](#) on page 779.

To get a valid result, you have to perform a complete measurement with synchronization to the end of the measurement before reading out the result. This is only possible for single measurement mode.

See also [INITiate<n>:CONTinuous](#) on page 547.

**Suffix:**

<n> [Window](#)

<m> [Marker](#)

**Return values:**

<StandardDeviation> Standard deviation of the signal during the measurement time.

**Usage:** Query only

---

#### **CALCulate<n>:MARKer<m>:FUNction:SUMMary:SDEViation:PHOLd:RESult?**

Queries the maximum standard deviation of the time domain power. The query is only possible if the peak hold function has been activated previously using [CALCulate<n>:MARKer<m>:FUNction:SUMMary:PHOLd](#).

To get a valid result, you have to perform a complete measurement with synchronization to the end of the measurement before reading out the result. This is only possible for single measurement mode.

See also [INITiate<n>:CONTinuous](#) on page 547.

**Suffix:**

<n> [Window](#)

<m> [Marker](#)

**Return values:**

<StandardDeviation> Standard deviation of the signal during the measurement time.

**Usage:** Query only

---

### **CALCulate<n>:MARKer<m>:FUNction:SUMMary:SDEVIation:RESult?**

Queries the standard deviation of the time domain power.

To get a valid result, you have to perform a complete measurement with synchronization to the end of the measurement before reading out the result. This is only possible for single measurement mode.

See also [INITiate<n>:CONTinuous](#) on page 547.

**Suffix:**

<n> [Window](#)

<m> [Marker](#)

**Return values:**

<StandardDeviation> Standard deviation of the signal during the measurement time.

**Usage:** Query only

### 13.6.3.5 Defining the frequency range

The following commands are required to define the frequency range.

Useful commands for defining the frequency range described elsewhere:

- [\[SENSe<ip>:\]FREQuency:CENTer](#) on page 661
- [\[SENSe:\]FREQuency:CENTer:STEP](#) on page 662
- [\[SENSe:\]FREQuency:CENTer:STEP:AUTO](#) on page 662
- [\[SENSe<ip>:\]FREQuency:OFFSet](#) on page 662
- [CALCulate<n>:MARKer<m>:FUNction:CENTer](#) on page 661

**Remote commands exclusive to defining the frequency range:**

<a href="#">CALCulate&lt;n&gt;:MARKer&lt;m&gt;:FUNction:CSTep</a> .....	786
<a href="#">DISPlay[:WINDow&lt;n&gt;][:SUBWindow&lt;w&gt;]:TRACe&lt;t&gt;:X:SPACing</a> .....	787
<a href="#">[SENSe:]FREQuency:CENTer:STEP:LINK</a> .....	787
<a href="#">[SENSe:]FREQuency:CENTer:STEP:LINK:FACTor</a> .....	787
<a href="#">[SENSe:]FREQuency:SPAN</a> .....	788
<a href="#">[SENSe&lt;ip&gt;:]FREQuency:SPAN:FULL</a> .....	788
<a href="#">[SENSe&lt;ip&gt;:]FREQuency:START</a> .....	788
<a href="#">[SENSe&lt;ip&gt;:]FREQuency:STOP</a> .....	789

---

### **CALCulate<n>:MARKer<m>:FUNction:CSTep**

Matches the center frequency step size to the current marker frequency.

The command turns delta markers into normal markers.

**Suffix:**

<n> [Window](#)

<m> [Marker](#)

---

### DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:X:SPACing <Scale>

Selects the scaling of the x-axis.

#### Suffix:

<n> [Window](#)

<w> subwindow

<t>

#### Parameters:

<Scale> **LOGarithmic**  
Logarithmic scaling.

**LINear**  
Linear scaling.

\*RST: LINear

**Example:** DISP:TRAC:X:SPAC LOG

---

### [SENSe:]FREQuency:CENTer:STEP:LINK <CouplingType>

Couples and decouples the center frequency step size to the span or the resolution bandwidth.

#### Parameters:

<CouplingType> SPAN | RBW | OFF

**SPAN**  
Couples the step size to the span. Available for measurements in the frequency domain.

**RBW**  
Couples the step size to the resolution bandwidth. Available for measurements in the time domain.

**OFF**  
Decouples the step size.

\*RST: SPAN

**Example:** //Couple step size to span  
FREQ:CENT:STEP:LINK SPAN

**Manual operation:** See "[Center Frequency Stepsize](#)" on page 366

---

### [SENSe:]FREQuency:CENTer:STEP:LINK:FACTor <Factor>

Defines a step size factor if the center frequency step size is coupled to the span or the resolution bandwidth.

**Parameters:**

<Factor> 1 to 100 PCT  
 \*RST: 10  
 Default unit: PCT

**Example:**

```
//Couple frequency step size to span and define a step size factor
FREQ:CENT:STEP:LINK SPAN
FREQ:CENT:STEP:LINK:FACT 20PCT
```

**Manual operation:** See "[Center Frequency Stepsize](#)" on page 366

**[SENSe:]FREQUENCY:SPAN <Span>**

Defines the frequency span.

If you set a span of 0 Hz in the Spectrum application, the R&S VSE starts a measurement in the time domain.

**Parameters:**

<Span> The minimum span for measurements in the frequency domain is 10 Hz.  
 Range: 0 Hz to fmax  
 \*RST: Full span  
 Default unit: Hz

**Manual operation:** See "[Span](#)" on page 365  
 See "[Zero Span](#)" on page 365  
 See "[Last Span](#)" on page 365

**[SENSe<ip>:]FREQUENCY:SPAN:FULL**

Restores the full span.

**Suffix:**

<ip> 1..n

**Manual operation:** See "[Full Span](#)" on page 365

**[SENSe<ip>:]FREQUENCY:STARt <Frequency>****Suffix:**

<ip> 1..n

**Parameters:**

<Frequency> 0 to (fmax - min span)  
 \*RST: 0  
 Default unit: HZ

**Example:**

```
FREQ:STAR 20MHz
```

**Manual operation:** See "[Start / Stop](#)" on page 365

---

**[SENSe<ip>:]FREQUENCY:STOP <Frequency>**

**Suffix:**

<ip> 1..n

**Parameters:**

<Frequency> min span to fmax  
 \*RST: fmax  
 Default unit: HZ

**Example:**           FREQ:STOP 2000 MHz

**Manual operation:** See "Start / Stop " on page 365

### 13.6.3.6 Configuring bandwidth and sweep settings

The commands required to configure the bandwidth, sweep and filter settings in a remote environment are described here. The tasks for manual operation are described in [Chapter 10.4.6, "Bandwidth, filter and capture configuration"](#), on page 367.

- [Configuring the bandwidth and filter](#).....789
- [Configuring the sweep](#)..... 792

#### Configuring the bandwidth and filter

[SENSe<ip>:]BWIDTh[:RESolution]	789
[SENSe:]BANDwidth[:RESolution]	789
[SENSe<ip>:]BWIDTh[:RESolution]:AUTO	790
[SENSe<ip>:]BANDwidth[:RESolution]:AUTO	790
[SENSe<ip>:]BWIDTh[:RESolution]:RATio	790
[SENSe:]BANDwidth[:RESolution]:RATio	790
[SENSe<ip>:]BWIDTh[:RESolution]:TYPE	790
[SENSe:]BANDwidth[:RESolution]:TYPE	790
[SENSe<ip>:]BWIDTh:VIDeo	791
[SENSe<ip>:]BANDwidth:VIDeo	791
[SENSe<ip>:]BWIDTh:VIDeo:AUTO	791
[SENSe<ip>:]BANDwidth:VIDeo:AUTO	791
[SENSe<ip>:]BWIDTh:VIDeo:RATio	791
[SENSe<ip>:]BANDwidth:VIDeo:RATio	791
[SENSe<ip>:]BWIDTh:VIDeo:TYPE	792
[SENSe<ip>:]BANDwidth:VIDeo:TYPE	792

---

**[SENSe<ip>:]BWIDTh[:RESolution] <Bandwidth>**

**[SENSe:]BANDwidth[:RESolution] <Bandwidth>**

Defines the resolution bandwidth and decouples the resolution bandwidth from the span.

For statistics measurements, this command defines the **demodulation** bandwidth.

**Parameters:**

<Bandwidth> refer to data sheet  
 \*RST: RBW: AUTO is set to ON; DBW: 3MHz  
 Default unit: Hz

**Example:**

BAND 1 MHz  
 Sets the resolution bandwidth to 1 MHz

**Manual operation:**

See "RBW " on page 242  
 See "RBW " on page 373

[SENSe<ip>:]BWIDTH[:RESolution]:AUTO <State>

[SENSe<ip>:]BANDwidth[:RESolution]:AUTO <State>

Couples and decouples the resolution bandwidth to the span.

**Suffix:**

<ip> 1..n

**Parameters:**

<State> ON | OFF | 0 | 1

\*RST: 1

**Example:**

BAND:AUTO OFF  
 Switches off the coupling of the resolution bandwidth to the span.

**Manual operation:**

See "RBW " on page 373  
 See "Default Coupling " on page 376

[SENSe<ip>:]BWIDTH[:RESolution]:RATio <Ratio>

[SENSe:]BANDwidth[:RESolution]:RATio <Ratio>

Defines the ratio between the resolution bandwidth (Hz) and the span (Hz).

Note that the ratio defined with this remote command (RBW/span) is reciprocal to that of the coupling ratio (span/RBW).

**Parameters:**

<Ratio> Range: 0.0001 to 1

\*RST: 0.01

**Example:**

BAND:RAT 0.1

**Manual operation:**

See "Span/RBW " on page 375

[SENSe<ip>:]BWIDTH[:RESolution]:TYPE <FilterType>

[SENSe:]BANDwidth[:RESolution]:TYPE <FilterType>

This command selects the resolution filter type.

When you change the filter type, the command selects the next larger filter bandwidth if the same bandwidth is unavailable for that filter.

**Example:**

BAND:TYPE NORM

**Manual operation:** See "[Filter Type](#)" on page 375

---

**[SENSe<ip>:]BWIDth:VIDeo <Bandwidth>**  
**[SENSe<ip>:]BANDwidth:VIDeo <Bandwidth>**

Defines the video bandwidth.

The command decouples the video bandwidth from the resolution bandwidths.

**Suffix:**

<ip> 1..n

**Parameters:**

<Bandwidth> refer to data sheet  
 \*RST: AUTO is set to ON  
 Default unit: HZ

**Example:** BAND:VID 10 kHz

**Manual operation:** See "[VBW](#)" on page 374

---

**[SENSe<ip>:]BWIDth:VIDeo:AUTO <State>**  
**[SENSe<ip>:]BANDwidth:VIDeo:AUTO <State>**

Couples and decouples the video bandwidth to the resolution bandwidth.

**Suffix:**

<ip> 1..n

**Parameters:**

<State> ON | OFF | 0 | 1  
 \*RST: 1

**Example:** BAND:VID:AUTO OFF

**Manual operation:** See "[VBW](#)" on page 374  
 See "[RBW/VBW](#)" on page 375  
 See "[Default Coupling](#)" on page 376

---

**[SENSe<ip>:]BWIDth:VIDeo:RATio <Ratio>**  
**[SENSe<ip>:]BANDwidth:VIDeo:RATio <Ratio>**

Defines the coupling ratio of the video bandwidth to the resolution bandwidth (VBW/RBW).

**Suffix:**

<ip> 1..n

**Parameters:**

<Ratio> Range: 0,001 to 1000  
 \*RST: 1

**Example:** BAND:VID:RAT 3  
 Sets the video bandwidth to 3\*resolution bandwidth.

**Manual operation:** See "RBW/VBW " on page 375

---

**[SENSe<ip>:]BWIDTH:VIDeo:TYPE <Mode>**

**[SENSe<ip>:]BANDwidth:VIDeo:TYPE <Mode>**

Enables or disables the logarithmic amplifier in front of the video filter in the signal path.

**Suffix:**

<ip> 1..n

**Parameters:**

<Mode>

**LINear**

The logarithmic amplifier in front of the video filter is bypassed to process linear detector samples.

**LOGarithmic**

The logarithmic amplifier in front of the video filter is enabled to process logarithmic detector samples.

\*RST: LOGarithmic

**Example:**

BAND:VID:TYPE LIN

Logarithmic amplifier in front of the video filter is disabled.

**Manual operation:** See "VBW " on page 374

### Configuring the sweep

Useful commands for configuring sweeps described elsewhere:

- [SENSe:]AVERAge<n>:COUNT on page 800
- [SENSe:]AVERAge<n>[:STATe<t>] on page 800
- [SENSe:]AVERAge<n>:TYPE on page 798
- [SENSe:]SWEep:COUNT on page 678
- [SENSe:]SWEep:TIME on page 678
- [SENSe:]SWEep[:WINDow<n>]:POINTs on page 678

### Remote commands exclusive to configuring sweeps:

[SENSe:]SWEep:DURation?	792
[SENSe:]SWEep:OPTimize	793
[SENSe:]SWEep:TIME:AUTO	794
[SENSe<ip>:]BWIDTH[:RESolution]:FFT	794
[SENSe<ip>:]BANDwidth[:RESolution]:FFT	794

---

**[SENSe:]SWEep:DURation? <Time>**

Provides an estimation of the total time required to capture the data and process it. This time span may be considerably longer than the actual sweep time (see [SENSe:]SWEep:TIME on page 678).



**Tip:** To determine the necessary timeout for data capturing in a remote control program, double the estimated time and add 1 second.

**Return values:**

<Time>

**Example:**           SWE:TIME 1s  
                   SWE:DUR?  
**Reply:**  
 27.9734842578

**Usage:**            Query only

**Manual operation:** See "[Meas Time](#)" on page 374

---

**[SENSe:]SWEep:OPTimize <Mode>**

In FFT mode, several FFT analysis steps are required to cover the entire measurement span. The span which is covered by one FFT analysis step is called *subspan*. The subspan cannot be defined directly, but it can be optimized according to measurement requirements.

**Table 13-14: Optimization parameters in FFT mode**

Optimization mode	Description
DYNamic	Optimizes the dynamic range by using the narrowest possible subspan (depending on the RBW).
SPEed	Optimizes the sweep rate by using the widest possible subspan (depending on the RBW). It is recommended that you set the <a href="#">Meas Time</a> to "Auto" to optimize the sweep rate.
AUTO	Uses a medium-sized subspan to obtain a compromise between a large dynamic range and a fast sweep rate.

**Note: FFT mode and external mixers (R&S VSE-B21)**

The subspan optimization modes "Dynamic" and "Auto" include automatic suppression of unwanted mixing products. Thus, when using external mixers (R&S VSE-B21), use the "Speed" mode to obtain similar results in FFT mode as in frequency sweep mode.

**Zero span mode**

For zero span measurements, the optimization mode defines the selection of the A/D converter prefilter.

**Table 13-15: Optimization parameters in zero span mode**

Optimization mode	Description
DYNamic	The narrowest filter possible (depending on the RBW) is used.
SPEed	The widest filter possible (depending on the RBW) is used.
AUTO	A medium-sized prefilter is used.

**Parameters:**

<Mode>                \*RST:        AUTO

**Example:** `SWE:OPT DYN`  
Selects optimization for dynamic range.

**Manual operation:** See "[Optimization](#)" on page 376

**[SENSe:]SWEep:TIME:AUTO <State>**

Couples and decouples the sweep time to the span and the resolution and video bandwidths.

**Parameters:**

<State> ON | OFF | 0 | 1  
\*RST: 1

**Example:** `SWE:TIME:AUTO ON`  
Activates automatic sweep time.

**Manual operation:** See "[Meas Time](#)" on page 374  
See "[Default Coupling](#)" on page 376

**[SENSe<ip>:]BWIDth[:RESolution]:FFT <FilterMode>**

**[SENSe<ip>:]BANDwidth[:RESolution]:FFT <FilterMode>**

Defines the filter mode to be used for FFT filters by defining the subspan size. The subspan is the span which is covered by one FFT analysis.

Is only available when using the sweep type "FFT".

**Suffix:**

<ip> 1..n

**Parameters:**

<FilterMode> WIDE | AUTO | NARRow

**AUTO**

Automatically applies the sweep optimization mode that is best for the current measurement.

**NARRow**

Optimizes the sweep mode for a large dynamic range.

**WIDE**

Optimizes the sweep mode for high performance.

\*RST: AUTO

**Example:** `BAND:TYPE FFT`  
Select FFT filter.

**Example:** `BAND:FFT NARR`  
Select narrow subspan for FFT filter.

## 13.6.4 I/Q analysis

General result analysis settings concerning the trace, markers, etc. can be configured using the following commands. They are identical to the analysis functions in the Spectrum application except for the special marker functions.

• <a href="#">Configuring standard traces</a> .....	795
• <a href="#">Exporting trace results</a> .....	801
• <a href="#">Using trace mathematics</a> .....	802
• <a href="#">Configuring spectrograms</a> .....	804
• <a href="#">Using markers</a> .....	810
• <a href="#">Zooming into the display</a> .....	849
• <a href="#">Configuring display lines</a> .....	852
• <a href="#">Defining limit checks</a> .....	855

### 13.6.4.1 Configuring standard traces

#### Useful commands for trace configuration described elsewhere

- `DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y:SPACing`  
on page 657
- `DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]`  
on page 655

#### Remote commands exclusive to trace configuration

<code>DISPlay[:WINDow&lt;n&gt;][:SUBWindow&lt;w&gt;]:TRACe&lt;t&gt;:MODE</code> .....	795
<code>DISPlay[:WINDow&lt;n&gt;][:SUBWindow&lt;w&gt;]:TRACe&lt;t&gt;:MODE:HCONTinuous</code> .....	796
<code>DISPlay[:WINDow&lt;n&gt;][:SUBWindow&lt;w&gt;]:TRACe&lt;t&gt;[:STATe]</code> .....	797
<code>DISPlay[:WINDow&lt;n&gt;][:SUBWindow&lt;w&gt;]:TRACe&lt;t&gt;:SMOothing:APERture</code> .....	797
<code>DISPlay[:WINDow&lt;n&gt;][:SUBWindow&lt;w&gt;]:TRACe&lt;t&gt;:SMOothing[:STATe]</code> .....	798
<code>[SENSe:]AVERAge&lt;n&gt;:TYPE</code> .....	798
<code>[SENSe:][WINDow&lt;n&gt;:]DETEctor&lt;t&gt;[:FUNCTion]</code> .....	799
<code>[SENSe:][WINDow&lt;n&gt;:]DETEctor&lt;t&gt;[:FUNCTion]:AUTO</code> .....	799
<code>TRACe&lt;n&gt;:COPY</code> .....	800
<code>[SENSe:]AVERAge&lt;n&gt;:COUNT</code> .....	800
<code>TRACe:IQ:AVERAge:COUNT</code> .....	800
<code>[SENSe:]AVERAge&lt;n&gt;[:STATe&lt;t&gt;]</code> .....	800
<code>TRACe:IQ:AVERAge[:STATe]</code> .....	800

---

**DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:MODE <Mode>**

Selects the trace mode. If necessary, the selected trace is also activated.

#### Suffix:

<n>	Window
<w>	subwindow
	Not supported by all applications

&lt;t&gt;

[Trace](#)**Parameters:**

&lt;Mode&gt;

**WRITe**

(default:) Overwrite mode: the trace is overwritten by each sweep.

**AVERAge**

The average is formed over several sweeps. The "Sweep/Average Count" determines the number of averaging procedures.

**MAXHold**

The maximum value is determined over several sweeps and displayed. The R&S VSE saves the sweep result in the trace memory only if the new value is greater than the previous one.

**MINHold**

The minimum value is determined from several measurements and displayed. The R&S VSE saves the sweep result in the trace memory only if the new value is lower than the previous one.

**VIEW**

The current contents of the trace memory are frozen and displayed.

**BLANK**

Hides the selected trace.

\*RST: Trace 1: WRITe, Trace 2-6: BLANK

**Example:**

```
INIT:CONT OFF
```

Switching to single sweep mode.

```
SWE:COUN 16
```

Sets the number of measurements to 16.

```
DISP:TRAC3:MODE WRIT
```

Selects clear/write mode for trace 3.

```
INIT;*WAI
```

Starts the measurement and waits for the end of the measurement.

**Manual operation:** See "[Trace Mode](#)" on page 394

---

**DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:MODE:HCONtinuous**  
<State>

Turns an automatic reset of a trace on and off after a parameter has changed.

The reset works for trace modes min hold, max hold and average.

Note that the command has no effect if critical parameters like the span have been changed to avoid invalid measurement results

**Suffix:**

&lt;n&gt;

[Window](#)

&lt;w&gt;

subwindow

<t> [Trace](#)

**Parameters:**

<State> ON | OFF | 0 | 1  
**OFF | 0**  
 Switches the function off  
**ON | 1**  
 Switches the function on

**Example:** DISP:WIND:TRAC3:MODE:HCON ON  
 Switches off the reset function.

**Manual operation:** See "[Hold](#) " on page 396

**DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>[:STATe] <State>**

Turns a trace on and off.

The measurement continues in the background.

**Suffix:**

<n> [Window](#)  
 <w> subwindow  
 Not supported by all applications  
 <t> [Trace](#)

**Parameters:**

<State> ON | OFF | 0 | 1  
**OFF | 0**  
 Switches the function off  
**ON | 1**  
 Switches the function on

**Example:** DISP:TRAC3 ON

**Manual operation:** See "[Trace 1 /Trace 2 /Trace 3 /Trace 4 /Trace 5 /Trace 6](#) " on page 394

**DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:SMOothing:APERture <Aperture>**

Defines the degree (aperture) of the trace smoothing, if [DISPlay\[:WINDow<n>\]\[:SUBWindow<w>\]:TRACe<t>:SMOothing\[:STATe\]](#) TRUE.

**Suffix:**

<n> [Window](#)  
 <w> subwindow  
 <t> [Trace](#)

**Parameters:**

<Aperture>            Range:     1 to 50  
                          \*RST:     2  
                          Default unit: PCT

**Example:**

DISP3:TRAC2:SMO:APER 5  
 Defines an aperture of 5% for trace 2 in window 3

**Manual operation:** See "[Smoothing](#)" on page 396

**DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:SMOothing[:STATe] <State>**

Turns trace smoothing for a particular trace on and off.

If enabled, the trace is smoothed by the value specified using [DISPlay\[:WINDow<n>\]\[:SUBWindow<w>\]:TRACe<t>:SMOothing:APERture](#) on page 797.

For more information see the R&S VSE User Manual.

**Suffix:**

<n>                    [Window](#)  
 <w>                    subwindow  
 <t>                    [Trace](#)

**Parameters:**

<State>              ON | OFF | 0 | 1  
                          **OFF | 0**  
                          Switches the function off  
                          **ON | 1**  
                          Switches the function on

**Example:**

DISP3:TRAC2:SMO ON  
 Turns on trace smoothing for trace 2 in window 3

**Manual operation:** See "[Smoothing](#)" on page 396

**[SENSe:]AVERAge<n>:TYPE <Mode>**

Selects the trace averaging mode.

**Suffix:**

<n>                    1..n  
                          [Window](#)

**Parameters:**

<Mode>                **LOGarithmic**  
                          The logarithmic power values are averaged.  
                          **LINear**  
                          The power values are averaged before they are converted to logarithmic values.

**POWER**

The power level values are converted into unit Watt prior to averaging. After the averaging, the data is converted back into its original unit.

**Example:** `AVER:TYPE LIN`  
Switches to linear average calculation.

**Manual operation:** See "[Average Mode](#)" on page 396

**[SENSe:][WINDow<n>:]DETEctor<t>[:FUNCTion] <Detector>**

Defines the trace detector to be used for trace analysis.

**Suffix:**

<n> [Window](#)

<t> [Trace](#)

**Parameters:**

<Detector> **APEak**  
Autopeak

**NEGative**  
Negative peak

**POSitive**  
Positive peak

**SAMPLE**  
First value detected per trace point

**RMS**  
RMS value

**AVERage**  
Average

\*RST: `APEak`

**Example:** `DET POS`  
Sets the detector to "positive peak".

**Manual operation:** See "[Detector](#)" on page 395

**[SENSe:][WINDow<n>:]DETEctor<t>[:FUNCTion]:AUTO <State>**

Couples and decouples the detector to the trace mode.

**Suffix:**

<n> [Window](#)

<t> [Trace](#)

**Parameters:**

<State> `ON | OFF | 0 | 1`

\*RST: `1`

**Example:** `DET:AUTO OFF`  
The selection of the detector is not coupled to the trace mode.

**Manual operation:** See "[Detector](#)" on page 395

**TRACe<n>:COPY** <TraceNumber>, <TraceNumber>

Copies data from one trace to another.

**Suffix:**

<n> [Window](#)

**Parameters:**

<TraceNumber> **TRACE1 | TRACE2 | TRACE3 | TRACE4 | TRACE5 | TRACE6**  
The first parameter is the destination trace, the second parameter is the source.  
(Note the 'e' in the parameter is required!)

**Example:** `TRAC:COPY TRACE1,TRACE2`  
Copies the data from trace 2 to trace 1.

**Manual operation:** See "[Copy Trace](#)" on page 397

**[SENSe:]AVERAge<n>:COUNT** <AverageCount>

**TRACe:IQ:AVERAge:COUNT** <NumberSets>

This command defines the number of I/Q data sets that the averaging is based on.

**Parameters:**

<NumberSets> Range: 0 to 32767  
\*RST: 0

**Example:** `TRAC:IQ ON`  
Switches on acquisition of I/Q data.  
`TRAC:IQ:AVER ON`  
Enables averaging of the I/Q measurement data  
`TRAC:IQ:AVER:COUN 10`  
Selects averaging over 10 data sets  
`TRAC:IQ:DATA?`  
Starts the measurement and reads out the averaged data.

**[SENSe:]AVERAge<n>[:STATe<t>]** <State>

**TRACe:IQ:AVERAge[:STATe]** <State>

This command turns averaging of the I/Q data on and off.

If averaging is on, the maximum amount of I/Q data that can be recorded is 512kS (524288 samples).

**Parameters:**

<State> ON | OFF | 0 | 1  
**OFF | 0**  
Switches the function off



**ON | 1**

Switches the function on

**Example:**

TRAC:IQ ON

Switches on acquisition of I/Q data.

TRAC:IQ:AVER ON

Enables averaging of the I/Q measurement data.

TRAC:IQ:AVER:COUN 10

Selects averaging over 10 data sets.

TRAC:IQ:DATA?

Starts the measurement and reads out the averaged data.

**13.6.4.2 Exporting trace results**

Trace results can be exported to a file.

Useful commands for exporting trace results described elsewhere:

- [MMEMoRY:STORe<n>:TRACe](#) on page 898
- [MMEMoRY:STORe<n>:SPECTrogram](#) on page 898
- [FORMat:DEXPort:DSEParator](#) on page 874

**Remote commands exclusive to exporting traces:**

<a href="#">FORMat:DEXPort:FORMat</a> .....	801
<a href="#">FORMat:DEXPort:HEADer</a> .....	801
<a href="#">FORMat:DEXPort:TRACes</a> .....	802

**FORMat:DEXPort:FORMat <FileFormat>**

Determines the format of the ASCII file to be imported or exported. Depending on the external program that creates the data file or evaluates it, a comma-separated list (CSV) or a plain data format (DAT) file is required.

**Parameters:**

<FileFormat>            CSV | DAT  
 \*RST:                    DAT

**Example:**              FORM:DEXP:FORM CSV

**Manual operation:**    See "[File Type](#)" on page 405

**FORMat:DEXPort:HEADer <State>**

If enabled, additional instrument and measurement settings are included in the header of the export file for result data. If disabled, only the pure result data from the selected traces and tables is exported.

Trace data resulting from encrypted file input cannot be queried.

**Parameters:**

<State> ON | OFF | 0 | 1  
 \*RST: 1

**Manual operation:** See ["Include Instrument & Measurement Settings "](#) on page 404

**FORMat:DEXPort:TRACes** <Selection>

Selects the data to be included in a data export file (see [MMEMory:STORe<n>:TRACe](#) on page 898).

Trace data resulting from encrypted file input cannot be queried.

**Parameters:**

<Selection> SINGLE | ALL

**SINGLE**

Only a single trace is selected for export, namely the one specified by the [MMEMory:STORe<n>:TRACe](#) command.

**ALL**

Selects all active traces and result tables (e.g. "Result Summary", marker peak list etc.) in the current application for export to an ASCII file.

The <trace> parameter for the [MMEMory:STORe<n>:TRACe](#) command is ignored.

\*RST: SINGLE

**Manual operation:** See ["Export all Traces and all Table Results "](#) on page 404

**13.6.4.3 Using trace mathematics**

The following commands control trace mathematics.



Trace math functions are only available for RF measurements, see [Chapter 10.1.3, "Result displays in the time and frequency domain"](#), on page 174.

<a href="#">CALCulate&lt;n&gt;:MATH&lt;t&gt;[:EXPRession][:DEFine]</a> .....	802
<a href="#">CALCulate&lt;n&gt;:MATH&lt;t&gt;:MODE</a> .....	803
<a href="#">CALCulate&lt;n&gt;:MATH&lt;t&gt;:POSition</a> .....	803
<a href="#">CALCulate&lt;n&gt;:MATH&lt;t&gt;:STATe</a> .....	804

**CALCulate<n>:MATH<t>[:EXPRession][:DEFine]** <Expression>

Selects the mathematical expression for trace mathematics.

Before you can use the command, you have to turn trace mathematics on.

**Suffix:**

<n> [Window](#)

<t> irrelevant

**Parameters:**

<Expression> **(TRACE1-TRACE2)**  
Subtracts trace 2 from trace 1.  
**(TRACE1-TRACE3)**  
Subtracts trace 3 from trace 1.  
**(TRACE1-TRACE4)**  
Subtracts trace 4 from trace 1.  
**(TRACE1-TRACE5)**  
Subtracts trace 5 from trace 1.  
**(TRACE1-TRACE6)**  
Subtracts trace 6 from trace 1.

**Example:**

CALC:MATH:STAT ON  
Turns trace mathematics on.  
CALC:MATH:EXPR:DEF (TRACE1-TRACE3)  
Subtracts trace 3 from trace 1.

**Manual operation:** See "[Trace Math Function](#)" on page 398

**CALCulate<n>:MATH<t>:MODE <Mode>**

Selects the way the R&S VSE calculates trace mathematics.

**Suffix:**

<n> [Window](#)

<t> irrelevant

**Parameters:**

<Mode> For more information on the way each mode works see [Trace Math Mode](#).

**LINear**

Linear calculation.

**LOGarithmic**

Logarithmic calculation.

**POWER**

Linear power calculation.

\*RST: LOGarithmic

**Example:**

CALC:MATH:MODE LIN  
Selects linear calculation.

**Manual operation:** See "[Trace Math Mode](#)" on page 399

**CALCulate<n>:MATH<t>:POSition <Position>**

Defines the position of the trace resulting from the mathematical operation.

**Suffix:**<n> [Window](#)

&lt;t&gt; irrelevant

**Parameters:**

&lt;Position&gt; Vertical position of the trace in % of the height of the diagram area.

100 PCT corresponds to the upper diagram border.

Range: -100 to 200

\*RST: 50

Default unit: PCT

**Example:**

CALC:MATH:POS 100

Moves the trace to the top of the diagram area.

**Manual operation:** See "[Trace Math Position](#)" on page 399**CALCulate<n>:MATH<t>:STATe <State>**

Turns the trace mathematics on and off.

**Suffix:**<n> [Window](#)

&lt;t&gt; irrelevant

**Parameters:**

&lt;State&gt; ON | OFF | 0 | 1

**OFF | 0**

Switches the function off

**ON | 1**

Switches the function on

**Example:**

CALC:MATH:STAT ON

Turns on trace mathematics.

**Manual operation:** See "[Trace Math Function](#)" on page 398  
See "[Trace Math Off](#)" on page 398

#### 13.6.4.4 Configuring spectrograms

In addition to the standard "level versus frequency" or "level versus time" spectrum traces, the R&S VSE also provides a spectrogram display of the measured data. A spectrogram shows how the spectral density of a signal varies over time. The x-axis shows the frequency, the y-axis shows the time. The commands required to configure spectrograms in a remote environment are described here. For details and manual operation see "[Spectrogram settings](#)" on page 399.

For commands to set markers in spectrograms, see "[Marker search \(spectrograms\)](#)" on page 819.

Configuring a spectrogram measurement.....	805
Configuring the color map.....	808

### Configuring a spectrogram measurement

<a href="#">CALCulate&lt;n&gt;:SGRam:CLEar[:IMMediate]</a> .....	805
<a href="#">CALCulate&lt;n&gt;:SPECtrogram:CLEar[:IMMediate]</a> .....	805
<a href="#">CALCulate&lt;n&gt;:SGRam:CONT</a> .....	805
<a href="#">CALCulate&lt;n&gt;:SPECtrogram:CONTinuous</a> .....	805
<a href="#">CALCulate&lt;n&gt;:SGRam:FRAMe:COUNT</a> .....	806
<a href="#">CALCulate&lt;n&gt;:SPECtrogram:FRAMe:COUNT</a> .....	806
<a href="#">CALCulate&lt;n&gt;:SGRam:FRAMe:SElect</a> .....	806
<a href="#">CALCulate&lt;n&gt;:SPECtrogram:FRAMe:SElect</a> .....	806
<a href="#">CALCulate&lt;n&gt;:SGRam:HDEPth</a> .....	807
<a href="#">CALCulate&lt;n&gt;:SPECtrogram:HDEPth</a> .....	807
<a href="#">CALCulate&lt;n&gt;:SGRam:LAYout</a> .....	807
<a href="#">CALCulate&lt;n&gt;:SPECtrogram:LAYout</a> .....	807
<a href="#">CALCulate&lt;n&gt;:SGRam[:STATe]</a> .....	808
<a href="#">CALCulate&lt;n&gt;:SPECtrogram[:STATe]</a> .....	808
<a href="#">CALCulate&lt;n&gt;:SGRam:TRACe</a> .....	808
<a href="#">CALCulate&lt;n&gt;:SPECtrogram:TRACe</a> .....	808

---

#### **CALCulate<n>:SGRam:CLEar[:IMMediate]**

#### **CALCulate<n>:SPECtrogram:CLEar[:IMMediate]**

Resets the spectrogram and clears the history buffer.

#### **Suffix:**

<n>                      [Window](#)

#### **Example:**

```
//Reset the result display and clear the memory
CALC:SGR:CLE
```

**Manual operation:** See "[Clear Spectrogram](#)" on page 259

---

#### **CALCulate<n>:SGRam:CONT <State>**

#### **CALCulate<n>:SPECtrogram:CONTinuous <State>**

Determines whether the results of the last measurement are deleted before starting a new measurement in single sweep mode.

This setting applies to all spectrograms in the channel.

#### **Suffix:**

<n>                      [Window](#)

#### **Parameters:**

<State>                      ON | OFF | 0 | 1

**OFF | 0**

Switches the function off

**ON | 1**

Switches the function on

**Example:**

```
INIT:CONT OFF
```

Selects single sweep mode.

```
INIT; *WAI
```

Starts the sweep and waits for the end of the sweep.

```
CALC:SGR:CONT ON
```

Repeats the single sweep measurement without deleting the results of the last measurement.

**Manual operation:** See "[Continue Frame](#)" on page 259

**CALCulate<n>:SGRam:FRAMe:COUNT <Frames>**

**CALCulate<n>:SPECTrogram:FRAMe:COUNT <Frames>**

Defines the number of frames to be recorded in a single capture.

This value applies to all spectrograms in the channel.

**Suffix:**

<n> [Window](#)

**Parameters:**

<Frames> The maximum number of frames depends on the history depth.

Range: 1 to history depth

Increment: 1

\*RST: 1

**Example:**

```
//Select single capture mode
```

```
INIT:CONT OFF
```

```
//Set the number of frames to 200
```

```
CALC:SGR:FRAM:COUNT 200
```

**Manual operation:** See "[Frame Count](#)" on page 259

**CALCulate<n>:SGRam:FRAMe:SELEct <Frame> | <Time>**

**CALCulate<n>:SPECTrogram:FRAMe:SELEct <Frame> | <Time>**

Selects a specific frame for further analysis.

The command is available if no measurement is running or after a single sweep has ended.

**Suffix:**

<n> [Window](#)

**Parameters:**

<Frame> Selects a frame directly by the frame number. Valid if the time stamp is off.

The range depends on the history depth.

Default unit: S

<Time> Selects a frame via its time stamp. Valid if the time stamp is on. The number is the distance to frame 0 in seconds. The range depends on the history depth.

**Example:** INIT:CONT OFF  
Stop the continuous sweep.  
CALC:SGR:FRAM:SEL -25  
Selects frame number -25.

**Manual operation:** See "[Select Frame](#)" on page 259

**CALCulate<n>:SGRam:HDEPth <History>**  
**CALCulate<n>:SPECtrogram:HDEPth <History>**

Defines the number of frames to be stored in the R&S VSE memory.

**Suffix:**

<n> [Window](#)

**Parameters:**

<History> The maximum number of frames depends on the number of sweep points.

Range: 781 to 20000

Increment: 1

\*RST: 3000

**Example:** //Set the history depth to 1500  
CALC:SGR:SPEC 1500

**Manual operation:** See "[History Depth](#)" on page 401

**CALCulate<n>:SGRam:LAYout <State>**  
**CALCulate<n>:SPECtrogram:LAYout <State>**

This command selects the state and size of spectrograms.

The command is available for result displays that support spectrograms.

**Suffix:**

<n> [Window](#)

**Parameters:**

<State> **FULL**  
Only the spectrogram is displayed, the trace diagram is not.

**SPLIT**  
Spectrogram and trace diagram share a window.

**OFF**  
Only the trace diagram is displayed, the spectrogram is not.

\*RST: OFF

**Example:** CALC4:SPEC:LAY FULL  
Shows the spectrogram in window 4. The corresponding trace diagram is hidden.

**Manual operation:** See "State" on page 400

---

**CALCulate<n>:SGRam[:STATe] <State>**  
**CALCulate<n>:SPECtrogram[:STATe] <State>**

Turns the spectrogram on and off.

**Parameters:**

<State>                    ON | OFF | 0 | 1  
**OFF | 0**  
 Switches the function off  
**ON | 1**  
 Switches the function on

**Example:**                CALC:SGR ON  
 Activates the Spectrogram result display.

---

**CALCulate<n>:SGRam:TRACe <Trace>**  
**CALCulate<n>:SPECtrogram:TRACe <Trace>**

This command determines the trace in the result display the Spectrogram is based on.

**Suffix:**

<n>                         Window

**Parameters:**

<Trace>                    TRACE1 | TRACE2 | TRACE3 | TRACE4 | TRACE5 | TRACE6  
 How many traces are available depends on the selected result display.

**Example:**                CALC2:SPEC:TRAC TRACE3

**Configuring the color map**

DISPlay[:WINDow<n>]:SGRam:COLor:DEFault.....	808
DISPlay[:WINDow<n>]:SPECtrogram:COLor:DEFault.....	808
DISPlay[:WINDow<n>]:SGRam:COLor:LOWer.....	809
DISPlay[:WINDow<n>]:SPECtrogram:COLor:LOWer.....	809
DISPlay[:WINDow<n>]:SGRam:COLor:SHAPE.....	809
DISPlay[:WINDow<n>]:SPECtrogram:COLor:SHAPE.....	809
DISPlay[:WINDow<n>]:SGRam:COLor:UPPer.....	809
DISPlay[:WINDow<n>]:SPECtrogram:COLor:UPPer.....	809
DISPlay[:WINDow<n>]:SGRam:COLor[:STYLe].....	810
DISPlay[:WINDow<n>]:SPECtrogram:COLor[:STYLe].....	810

---

**DISPlay[:WINDow<n>]:SGRam:COLor:DEFault**  
**DISPlay[:WINDow<n>]:SPECtrogram:COLor:DEFault**

Restores the original color map.

**Suffix:**

<n>                         Window



**Manual operation:** See ["Set to Default "](#) on page 403

---

**DISPlay[:WINDow<n>]:SGRam:COLor:LOWer** <Percentage>  
**DISPlay[:WINDow<n>]:SPECTrogram:COLor:LOWer** <Percentage>

Defines the starting point of the color map.

**Suffix:**

<n> [Window](#)

**Parameters:**

<Percentage> Statistical frequency percentage.  
 Range: 0 to 66  
 \*RST: 0  
 Default unit: %

**Example:** `DISP:WIND:SGR:COL:LOW 10`  
 Sets the start of the color map to 10%.

**Manual operation:** See ["Start / Stop "](#) on page 402

---

**DISPlay[:WINDow<n>]:SGRam:COLor:SHAPE** <Shape>  
**DISPlay[:WINDow<n>]:SPECTrogram:COLor:SHAPE** <Shape>

Defines the shape and focus of the color curve for the spectrogram result display.

**Suffix:**

<n> [Window](#)

**Parameters:**

<Shape> Shape of the color curve.  
 Range: -1 to 1  
 \*RST: 0

**Manual operation:** See ["Shape "](#) on page 402

---

**DISPlay[:WINDow<n>]:SGRam:COLor:UPPer** <Percentage>  
**DISPlay[:WINDow<n>]:SPECTrogram:COLor:UPPer** <Percentage>

Defines the end point of the color map.

**Suffix:**

<n> [Window](#)

**Parameters:**

<Percentage> Statistical frequency percentage.  
 Range: 0 to 66  
 \*RST: 0  
 Default unit: %

**Example:** `DISP:WIND:SGR:COL:UPP 95`  
 Sets the start of the color map to 95%.

**Manual operation:** See ["Start / Stop "](#) on page 402

**DISPlay[:WINDow<n>]:SGRam:COLor[:STYLE] <ColorScheme>**  
**DISPlay[:WINDow<n>]:SPEctrogram:COLor[:STYLE] <ColorScheme>**

Selects the color scheme.

**Parameters:**

<ColorScheme>

**HOT**

Uses a color range from blue to red. Blue colors indicate low levels, red colors indicate high ones.

**COLD**

Uses a color range from red to blue. Red colors indicate low levels, blue colors indicate high ones.

**RADar**

Uses a color range from black over green to light turquoise with shades of green in between.

**GRAYscale**

Shows the results in shades of gray.

\*RST: HOT

**Example:**

DISP:WIND:SPEC:COL GRAY

Changes the color scheme of the spectrogram to black and white.

**Manual operation:** See "[Hot /Cold /Radar /Grayscale](#)" on page 403

### 13.6.4.5 Using markers

The following commands are available for marker settings and functions in the I/Q Analyzer application.



For "I/Q Vector" displays markers are not available.

- [Setting up individual markers](#)..... 810
- [General marker settings](#)..... 817
- [Marker search \(spectrograms\)](#)..... 819
- [Configuring and performing a marker search](#)..... 827
- [Positioning the marker](#)..... 832
- [Band power marker](#)..... 838
- [Fixed reference marker settings](#)..... 841
- [Marker peak lists](#)..... 844
- [Noise measurement marker](#)..... 847

#### Setting up individual markers

The following commands define the position of markers in the diagram.

- [CALCulate<n>:DELTa<m>:AOff](#)..... 811
- [CALCulate<n>:DELTa<m>:LINK](#)..... 811
- [CALCulate<n>:DELTa<ms>:LINK:TO:DELTA<md>](#)..... 812

CALCulate<n>:DELTamarker<ms>:LINK:TO:MARKer<md>.....	812
CALCulate<n>:DELTamarker<m>:MODE.....	813
CALCulate<n>:DELTamarker<m>:MREFerence.....	813
CALCulate<n>:DELTamarker<m>[:STATe].....	813
CALCulate<n>:DELTamarker<m>:TRACe.....	814
CALCulate<n>:DELTamarker<m>:X.....	814
CALCulate<n>:MARKer<m>:AOFF.....	815
CALCulate<n>:MARKer<ms>:LINK:TO:DELTa<md>.....	815
CALCulate<n>:MARKer<ms>:LINK:TO:MARKer<md>.....	815
CALCulate<n>:MARKer<m>[:STATe].....	816
CALCulate<n>:MARKer<m>:TRACe.....	816
CALCulate<n>:MARKer<m>:X.....	817

---

### CALCulate<n>:DELTamarker<m>:AOFF

Turns off *all* delta markers.

#### Suffix:

<n> [Window](#)

<m> irrelevant

#### Example:

CALC:DELT:AOFF

Turns off all delta markers.

---

### CALCulate<n>:DELTamarker<m>:LINK <State>

Links delta marker <m> to marker 1.

If you change the horizontal position (x-value) of marker 1, delta marker <m> changes its horizontal position to the same value.

**Tip:** to link any marker to a different marker than marker 1, use the [CALCulate<n>:DELTamarker<ms>:LINK:TO:MARKer<md>](#) or [CALCulate<n>:MARKer<ms>:LINK:TO:MARKer<md>](#) commands.

#### Suffix:

<n> [Window](#)

<m> [Marker](#)

#### Parameters:

<State> ON | OFF | 0 | 1

**OFF | 0**

Switches the function off

**ON | 1**

Switches the function on

#### Example:

CALC:DELT2:LINK ON

**Manual operation:** See "[Linking to Another Marker](#)" on page 419

**CALCulate<n>:DELTamarker<ms>:LINK:TO:DELTA<md> <State>**

Links the delta source marker <ms> to any active destination delta marker <md>.

If you change the horizontal position of marker <md>, marker <ms> changes its horizontal position to the same value.

**Suffix:**

<n>	<a href="#">Window</a>
<ms>	source marker, see <a href="#">Marker</a>
<md>	destination marker, see <a href="#">Marker</a>

**Parameters:**

<State>	ON   OFF   0   1
	<b>OFF   0</b>
	Switches the function off
	<b>ON   1</b>
	Switches the function on

**Example:**

```
CALC:DELT2:LINK:TO:DELT3 ON
Links D2 and D3.
```

**CALCulate<n>:DELTamarker<ms>:LINK:TO:MARKer<md> <State>**

Links the delta source marker <ms> to any active destination marker <md> (normal or delta marker).

In I/Q Analyzer mode, if <md> is the reference marker for the delta marker <ms>, the relative distance (delta) between the two markers is maintained when you move the normal marker.

In other applications, the delta marker is set to the same horizontal position as the marker <md>, and if <md> is moved along the x-axis, <ms> follows to the same horizontal position.

**Suffix:**

<n>	<a href="#">Window</a>
<ms>	source marker, see <a href="#">Marker</a>
<md>	destination marker, see <a href="#">Marker</a>

**Parameters:**

<State>	ON   OFF   0   1
	<b>OFF   0</b>
	Switches the function off
	<b>ON   1</b>
	Switches the function on

**Example:**

```
CALC:DELT4:LINK:TO:MARK2 ON
Links the delta marker 4 to the marker 2.
```

**Manual operation:** See "[Linking to Another Marker](#)" on page 419

**CALCulate<n>:DELTamarker<m>:MODE <Mode>**

Defines whether the position of a delta marker is provided as an absolute value or relative to a reference marker. Note that this setting applies to *all* windows.

Note that when the position of a delta marker is *queried*, the result is always an absolute value (see [CALCulate<n>:DELTamarker<m>:X](#) on page 814)!

**Suffix:**

<n> irrelevant

<m> irrelevant

**Parameters:**

<Mode>

**ABSolute**

Delta marker position in absolute terms.

**RELative**

Delta marker position in relation to a reference marker.

\*RST: RELative

**Example:**

CALC:DELT:MODE ABS

Absolute delta marker position.

**CALCulate<n>:DELTamarker<m>:MREFerence <Reference>**

Selects a reference marker for a delta marker other than marker 1.

**Suffix:**

<n> [Window](#)

<m> [Marker](#)

**Parameters:**

<Reference>

**1 to 16**

Selects markers 1 to 16 as the reference.

**Example:**

CALC:DELT3:MREF 2

Specifies that the values of delta marker 3 are relative to marker 2.

**Manual operation:** See "[Reference Marker](#)" on page 419

**CALCulate<n>:DELTamarker<m>[:STATe] <State>**

Turns delta markers on and off.

If necessary, the command activates the delta marker first.

No suffix at DELTmarker turns on delta marker 1.

**Suffix:**

<n> [Window](#)

<m> [Marker](#)

**Parameters:**

<State> ON | OFF | 0 | 1  
**OFF | 0**  
 Switches the function off  
**ON | 1**  
 Switches the function on

**Example:** CALC:DELT2 ON  
 Turns on delta marker 2.

**Manual operation:** See "[Marker 1 / Delta Marker 1 / Delta Marker 2 / Delta Marker 16](#)" on page 417  
 See "[Marker State](#)" on page 418  
 See "[Marker Type](#)" on page 419  
 See "[Select Marker](#)" on page 420

**CALCulate<n>:DELTamarker<m>:TRACe <Trace>**

Selects the trace a delta marker is positioned on.

Note that the corresponding trace must have a trace mode other than "Blank".

If necessary, the command activates the marker first.

**Suffix:**

<n> [Window](#)

<m> [Marker](#)

**Parameters:**

<Trace> Trace number the marker is assigned to.

**Example:** CALC:DELT2:TRAC 2  
 Positions delta marker 2 on trace 2.

**CALCulate<n>:DELTamarker<m>:X <Position>**

Moves a delta marker to a particular coordinate on the x-axis.

If necessary, the command activates the delta marker and positions a reference marker to the peak power.

**Suffix:**

<n> [Window](#)

<m> [Marker](#)

**Parameters:**

<Position> Numeric value that defines the marker position on the x-axis.  
 Range: The value range and unit depend on the measurement and scale of the x-axis.

**Example:** `CALC:DELT:X?`  
Outputs the absolute x-value of delta marker 1.

**Manual operation:** See "[Marker 1 / Delta Marker 1 / Delta Marker 2 / Delta Marker 16](#)" on page 417  
See "[Marker Position X-value](#)" on page 418

### **CALCulate<n>:MARKer<m>:AOFF**

Turns off all markers.

**Suffix:**

<n> [Window](#)

<m> [Marker](#)

**Example:** `CALC:MARK:AOFF`  
Switches off all markers.

**Manual operation:** See "[All Markers Off](#)" on page 420

### **CALCulate<n>:MARKer<ms>:LINK:TO:DELTA<md> <State>**

Links the normal source marker <ms> to any active delta destination marker <md>.

If you change the horizontal position of marker <md>, marker <ms> changes its horizontal position to the same value.

**Suffix:**

<n> [Window](#)

<ms> source marker, see [Marker](#)

<md> destination marker, see [Marker](#)

**Parameters:**

<State> ON | OFF | 0 | 1

**OFF | 0**

Switches the function off

**ON | 1**

Switches the function on

**Example:** `CALC:MARK4:LINK:TO:DELTA2 ON`  
Links marker 4 to delta marker 2.

### **CALCulate<n>:MARKer<ms>:LINK:TO:MARKer<md> <State>**

Links the normal source marker <ms> to any active destination marker <md> (normal or delta marker).

If you change the horizontal position of marker <md>, marker <ms> changes its horizontal position to the same value.

**Suffix:**

<n>	<a href="#">Window</a>
<ms>	source marker, see <a href="#">Marker</a>
<md>	destination marker, see <a href="#">Marker</a>

**Parameters:**

<State>	ON   OFF   0   1
	<b>OFF   0</b>
	Switches the function off
	<b>ON   1</b>
	Switches the function on

**Example:** `CALC:MARK4:LINK:TO:MARK2 ON`  
Links marker 4 to marker 2.

**Manual operation:** See "[Linking to Another Marker](#)" on page 419

**CALCulate<n>:MARKer<m>[:STATe] <State>**

Turns markers on and off. If the corresponding marker number is currently active as a delta marker, it is turned into a normal marker.

**Suffix:**

<n>	<a href="#">Window</a>
<m>	<a href="#">Marker</a>

**Parameters:**

<State>	ON   OFF   0   1
	<b>OFF   0</b>
	Switches the function off
	<b>ON   1</b>
	Switches the function on

**Example:** `CALC:MARK3 ON`  
Switches on marker 3.

**Manual operation:** See "[Marker 1 / Delta Marker 1 / Delta Marker 2 / Delta Marker 16](#)" on page 417  
See "[Marker State](#)" on page 418  
See "[Marker Type](#)" on page 419  
See "[Select Marker](#)" on page 420

**CALCulate<n>:MARKer<m>:TRACe <Trace>**

Selects the trace the marker is positioned on.

Note that the corresponding trace must have a trace mode other than "Blank".

If necessary, the command activates the marker first.



**Suffix:**<n> [Window](#)<m> [Marker](#)**Parameters:**

&lt;Trace&gt;

**Example:** //Assign marker to trace 1  
 CALC:MARK3:TRAC 2

**Manual operation:** See "[Assigning the Marker to a Trace](#)" on page 419

**CALCulate<n>:MARKer<m>:X <Position>**

Moves a marker to a specific coordinate on the x-axis.

If necessary, the command activates the marker.

If the marker has been used as a delta marker, the command turns it into a normal marker.

**Suffix:**<n> [Window](#)<m> [Marker](#)**Parameters:**

<Position> Numeric value that defines the marker position on the x-axis.  
 The unit depends on the result display.  
 Range: The range depends on the current x-axis range.  
 Default unit: Hz

**Example:** CALC:MARK2:X 1.7MHz  
 Positions marker 2 to frequency 1.7 MHz.

**Manual operation:** See "[Marker Table](#)" on page 173  
 See "[Marker Peak List](#)" on page 174  
 See "[Marker 1 / Delta Marker 1 / Delta Marker 2 / Delta Marker 16](#)" on page 417  
 See "[Marker Position X-value](#)" on page 418

**General marker settings**

The following commands control general marker functionality.

**Remote commands exclusive to general marker functionality**

<a href="#">DISPlay[:WINDow&lt;n&gt;]:MTABLE</a> .....	817
<a href="#">DISPlay[:WINDow&lt;n&gt;]:MINFo[:STATe]</a> .....	818
<a href="#">CALCulate&lt;n&gt;:MARKer&lt;m&gt;:X:SSize</a> .....	818

**DISPlay[:WINDow<n>]:MTABLE <DisplayMode>**

Turns the marker table on and off.

**Suffix:**

<n> irrelevant

**Parameters:**

<DisplayMode> **ON | 1**  
Turns on the marker table.

**OFF | 0**  
Turns off the marker table.

**AUTO**  
Turns on the marker table if 3 or more markers are active.

\*RST: AUTO

**Example:**

DISP:MTAB ON  
Activates the marker table.

**Manual operation:** See "[Marker Table Display](#)" on page 421

**DISPlay[:WINDow<n>]:MINFo[:STATE] <State>**

Turns the marker information in all diagrams on and off.

**Suffix:**

<n> irrelevant

**Parameters:**

<State> **ON | 1**  
Displays the marker information in the diagrams.

**OFF | 0**  
Hides the marker information in the diagrams.

\*RST: 1

**Example:**

DISP:MINF OFF  
Hides the marker information.

**Manual operation:** See "[Marker Info](#)" on page 421

**CALCulate<n>:MARKer<m>:X:SSIZE <StepSize>**

Selects the marker step size mode for *all* markers in *all* windows.

The step size defines the distance the marker moves when you move it with the mouse wheel.

It therefore takes effect in manual operation only.

**Suffix:**

<n> irrelevant

<m> irrelevant

**Parameters:**

<StepSize> **STANdard**  
the marker moves from one pixel to the next

**POINTs**

the marker moves from one sweep point to the next

\*RST: POINTs

**Example:**

CALC:MARK:X:SSIZ STAN

Sets the marker step size to one pixel.

**Manual operation:** See "[Marker Stepsize](#) " on page 421

**Marker search (spectrograms)**

The following commands automatically define the marker and delta marker position in the spectrogram.

**Using markers**

The following commands control spectrogram markers.

**Useful commands for spectrogram markers described elsewhere**

The following commands define the horizontal position of the markers.

- [CALCulate<n>:MARKer<m>:MAXimum:LEFT](#) on page 833
- [CALCulate<n>:MARKer<m>:MAXimum:NEXT](#) on page 833
- [CALCulate<n>:MARKer<m>:MAXimum\[:PEAK\]](#) on page 833
- [CALCulate<n>:MARKer<m>:MAXimum:RIGHT](#) on page 833
- [CALCulate<n>:MARKer<m>:MINimum:LEFT](#) on page 834
- [CALCulate<n>:MARKer<m>:MINimum:NEXT](#) on page 834
- [CALCulate<n>:MARKer<m>:MINimum\[:PEAK\]](#) on page 835
- [CALCulate<n>:MARKer<m>:MINimum:RIGHT](#) on page 835

**Remote commands exclusive to spectrogram markers**

<a href="#">CALCulate&lt;n&gt;:MARKer&lt;m&gt;:SGRam:FRAME</a> .....	820
<a href="#">CALCulate&lt;n&gt;:MARKer&lt;m&gt;:SPEctrogram:FRAME</a> .....	820
<a href="#">CALCulate&lt;n&gt;:MARKer&lt;m&gt;:SGRam:SARea</a> .....	820
<a href="#">CALCulate&lt;n&gt;:MARKer&lt;m&gt;:SPEctrogram:SARea</a> .....	820
<a href="#">CALCulate&lt;n&gt;:MARKer&lt;m&gt;:SGRam:XY:MAXimum[:PEAK]</a> .....	821
<a href="#">CALCulate&lt;n&gt;:MARKer&lt;m&gt;:SPEctrogram:XY:MAXimum[:PEAK]</a> .....	821
<a href="#">CALCulate&lt;n&gt;:MARKer&lt;m&gt;:SGRam:XY:MINimum[:PEAK]</a> .....	821
<a href="#">CALCulate&lt;n&gt;:MARKer&lt;m&gt;:SPEctrogram:XY:MINimum[:PEAK]</a> .....	821
<a href="#">CALCulate&lt;n&gt;:MARKer&lt;m&gt;:SGRam:Y:MAXimum:ABOVe</a> .....	821
<a href="#">CALCulate&lt;n&gt;:MARKer&lt;m&gt;:SPEctrogram:Y:MAXimum:ABOVe</a> .....	821
<a href="#">CALCulate&lt;n&gt;:MARKer&lt;m&gt;:SGRam:Y:MAXimum:BELOW</a> .....	821
<a href="#">CALCulate&lt;n&gt;:MARKer&lt;m&gt;:SPEctrogram:Y:MAXimum:BELOW</a> .....	821
<a href="#">CALCulate&lt;n&gt;:MARKer&lt;m&gt;:SGRam:Y:MAXimum:NEXT</a> .....	821
<a href="#">CALCulate&lt;n&gt;:MARKer&lt;m&gt;:SPEctrogram:Y:MAXimum:NEXT</a> .....	821
<a href="#">CALCulate&lt;n&gt;:MARKer&lt;m&gt;:SGRam:Y:MAXimum[:PEAK]</a> .....	822
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<a href="#">CALCulate&lt;n&gt;:MARKer&lt;m&gt;:SGRam:Y:MINimum:ABOVe</a> .....	822

CALCulate<n>:MARKer<m>:SPECTrogram:Y:MINimum:ABOVe.....	822
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CALCulate<n>:MARKer<m>:SPECTrogram:Y:MINimum:BELOW.....	822
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CALCulate<n>:MARKer<m>:SPECTrogram:Y:MINimum:NEXT.....	822
CALCulate<n>:MARKer<m>:SGRam:Y:MINimum[:PEAK].....	823
CALCulate<n>:MARKer<m>:SPECTrogram:Y:MINimum[:PEAK].....	823

---

**CALCulate<n>:MARKer<m>:SGRam:FRAME <Frame>**

**CALCulate<n>:MARKer<m>:SPECTrogram:FRAME <Frame> | <Time>**

Positions a marker on a particular frame.

**Suffix:**

<n>                      [Window](#)

<m>                      [Marker](#)

**Parameters:**

<Frame>                      Selects a frame directly by the frame number. Valid if the time stamp is off.

The range depends on the history depth.

Default unit: S

<Time>                      Selects a frame via its time stamp. Valid if the time stamp is on.

The number is the (negative) distance to frame 0 in seconds.

The range depends on the history depth.

**Example:**

`CALC:MARK:SGR:FRAM -20`

Sets the marker on the 20th frame before the present.

`CALC:MARK2:SGR:FRAM -2s`

Sets second marker on the frame 2 seconds ago.

**Manual operation:** See "[Marker 1 / Delta Marker 1 / Delta Marker 2 / Delta Marker 16](#)" on page 417

See "[Frame \(Spectrogram only\)](#)" on page 418

---

**CALCulate<n>:MARKer<m>:SGRam:SAREa <SearchArea>**

**CALCulate<n>:MARKer<m>:SPECTrogram:SAREa <SearchArea>**

Defines the marker search area for all spectrogram markers in the channel.

**Parameters:**

<SearchArea>                      **VISible**

Performs a search within the visible frames.

Note that the command does not work if the spectrogram is not visible for any reason (e.g. if the display update is off).

**MEMory**

Performs a search within all frames in the memory.

\*RST:                      VISible

**Manual operation:** See "[Marker Search Area](#)" on page 426

---

**CALCulate<n>:MARKer<m>:SGRam:XY:MAXimum[:PEAK]**  
**CALCulate<n>:MARKer<m>:SPECTrogram:XY:MAXimum[:PEAK]**

Moves a marker to the highest level of the spectrogram.

**Suffix:**

<n> [Window](#)

<m> [Marker](#)

---

**CALCulate<n>:MARKer<m>:SGRam:XY:MINimum[:PEAK]**  
**CALCulate<n>:MARKer<m>:SPECTrogram:XY:MINimum[:PEAK]**

Moves a marker to the minimum level of the spectrogram.

**Suffix:**

<n> [Window](#)

<m> [Marker](#)

---

**CALCulate<n>:MARKer<m>:SGRam:Y:MAXimum:ABOVE**  
**CALCulate<n>:MARKer<m>:SPECTrogram:Y:MAXimum:ABOVE**

Moves a marker vertically to the next lower peak level for the current frequency.

The search includes only frames above the current marker position. It does not change the horizontal position of the marker.

**Suffix:**

<n> [Window](#)

<m> [Marker](#)

---

**CALCulate<n>:MARKer<m>:SGRam:Y:MAXimum:BELOW**  
**CALCulate<n>:MARKer<m>:SPECTrogram:Y:MAXimum:BELOW**

Moves a marker vertically to the next lower peak level for the current frequency.

The search includes only frames below the current marker position. It does not change the horizontal position of the marker.

**Suffix:**

<n> [Window](#)

<m> [Marker](#)

---

**CALCulate<n>:MARKer<m>:SGRam:Y:MAXimum:NEXT**  
**CALCulate<n>:MARKer<m>:SPECTrogram:Y:MAXimum:NEXT**

Moves a marker vertically to the next lower peak level for the current frequency.

The search includes all frames. It does not change the horizontal position of the marker.

**Suffix:**

&lt;n&gt;                   Window

&lt;m&gt;                   Marker

**CALCulate<n>:MARKer<m>:SGRam:Y:MAXimum[:PEAK]****CALCulate<n>:MARKer<m>:SPECTrogram:Y:MAXimum[:PEAK]**

Moves a marker vertically to the highest level for the current frequency.

The search includes all frames. It does not change the horizontal position of the marker.

If the marker hasn't been active yet, the command looks for the peak level in the whole spectrogram.

**Suffix:**

&lt;n&gt;                   Window

&lt;m&gt;                   Marker

**CALCulate<n>:MARKer<m>:SGRam:Y:MINimum:ABOVE****CALCulate<n>:MARKer<m>:SPECTrogram:Y:MINimum:ABOVE**

Moves a marker vertically to the next higher minimum level for the current frequency.

The search includes only frames above the current marker position. It does not change the horizontal position of the marker.

**Suffix:**

&lt;n&gt;                   Window

&lt;m&gt;                   Marker

**CALCulate<n>:MARKer<m>:SGRam:Y:MINimum:BELOW****CALCulate<n>:MARKer<m>:SPECTrogram:Y:MINimum:BELOW**

Moves a marker vertically to the next higher minimum level for the current frequency.

The search includes only frames below the current marker position. It does not change the horizontal position of the marker.

**Suffix:**

&lt;n&gt;                   Window

&lt;m&gt;                   Marker

**CALCulate<n>:MARKer<m>:SGRam:Y:MINimum:NEXT****CALCulate<n>:MARKer<m>:SPECTrogram:Y:MINimum:NEXT**

Moves a marker vertically to the next higher minimum level for the current frequency.

The search includes all frames. It does not change the horizontal position of the marker.

**Suffix:**<n> [Window](#)<m> [Marker](#)**CALCulate<n>:MARKer<m>:SGRam:Y:MINimum[:PEAK]****CALCulate<n>:MARKer<m>:SPECTrogram:Y:MINimum[:PEAK]**

Moves a marker vertically to the minimum level for the current frequency.

The search includes all frames. It does not change the horizontal position of the marker.

If the marker hasn't been active yet, the command first looks for the peak level for all frequencies and moves the marker vertically to the minimum level.

**Suffix:**<n> [Window](#)<m> [Marker](#)**Using delta markers**

The following commands control spectrogram delta markers.

**Useful commands for spectrogram markers described elsewhere**

The following commands define the horizontal position of the delta markers.

- [CALCulate<n>:DELTaMarker<m>:MAXimum:LEFT](#) on page 836
- [CALCulate<n>:DELTaMarker<m>:MAXimum:NEXT](#) on page 836
- [CALCulate<n>:DELTaMarker<m>:MAXimum\[:PEAK\]](#) on page 836
- [CALCulate<n>:DELTaMarker<m>:MAXimum:RIGHT](#) on page 836
- [CALCulate<n>:DELTaMarker<m>:MINimum:LEFT](#) on page 837
- [CALCulate<n>:DELTaMarker<m>:MINimum:NEXT](#) on page 837
- [CALCulate<n>:DELTaMarker<m>:MINimum\[:PEAK\]](#) on page 837
- [CALCulate<n>:DELTaMarker<m>:MINimum:RIGHT](#) on page 838

**Remote commands exclusive to spectrogram markers**

<a href="#">CALCulate&lt;n&gt;:DELTaMarker&lt;m&gt;:SGRam:FRAME</a> .....	824
<a href="#">CALCulate&lt;n&gt;:DELTaMarker&lt;m&gt;:SPECTrogram:FRAME</a> .....	824
<a href="#">CALCulate&lt;n&gt;:DELTaMarker&lt;m&gt;:SGRam:SARea</a> .....	825
<a href="#">CALCulate&lt;n&gt;:DELTaMarker&lt;m&gt;:SPECTrogram:SARea</a> .....	825
<a href="#">CALCulate&lt;n&gt;:DELTaMarker&lt;m&gt;:SGRam:XY:MAXimum[:PEAK]</a> .....	825
<a href="#">CALCulate&lt;n&gt;:DELTaMarker&lt;m&gt;:SPECTrogram:XY:MAXimum[:PEAK]</a> .....	825
<a href="#">CALCulate&lt;n&gt;:DELTaMarker&lt;m&gt;:SGRam:XY:MINimum[:PEAK]</a> .....	825
<a href="#">CALCulate&lt;n&gt;:DELTaMarker&lt;m&gt;:SPECTrogram:XY:MINimum[:PEAK]</a> .....	825
<a href="#">CALCulate&lt;n&gt;:DELTaMarker&lt;m&gt;:SGRam:Y:MAXimum:ABOVE</a> .....	825
<a href="#">CALCulate&lt;n&gt;:DELTaMarker&lt;m&gt;:SPECTrogram:Y:MAXimum:ABOVE</a> .....	825
<a href="#">CALCulate&lt;n&gt;:DELTaMarker&lt;m&gt;:SGRam:Y:MAXimum:BELOW</a> .....	825

CALCulate<n>:DELTamarker<m>:SPECTrogram:Y:MAXimum:BELOW.....	825
CALCulate<n>:DELTamarker<m>:SGRam:Y:MAXimum:NEXT.....	826
CALCulate<n>:DELTamarker<m>:SPECTrogram:Y:MAXimum:NEXT.....	826
CALCulate<n>:DELTamarker<m>:SGRam:Y:MAXimum[:PEAK].....	826
CALCulate<n>:DELTamarker<m>:SPECTrogram:Y:MAXimum[:PEAK].....	826
CALCulate<n>:DELTamarker<m>:SGRam:Y:MINimum:ABOVE.....	826
CALCulate<n>:DELTamarker<m>:SPECTrogram:Y:MINimum:ABOVE.....	826
CALCulate<n>:DELTamarker<m>:SGRam:Y:MINimum:BELOW.....	826
CALCulate<n>:DELTamarker<m>:SPECTrogram:Y:MINimum:BELOW.....	826
CALCulate<n>:DELTamarker<m>:SGRam:Y:MINimum:NEXT.....	827
CALCulate<n>:DELTamarker<m>:SPECTrogram:Y:MINimum:NEXT.....	827
CALCulate<n>:DELTamarker<m>:SGRam:Y:MINimum[:PEAK].....	827
CALCulate<n>:DELTamarker<m>:SPECTrogram:Y:MINimum[:PEAK].....	827

---

**CALCulate<n>:DELTamarker<m>:SGRam:FRAME <Frame>**

**CALCulate<n>:DELTamarker<m>:SPECTrogram:FRAME <Frame>**

Positions a delta marker on a particular frame. The frame is relative to the position of marker 1.

The command is available for the spectrogram.

**Suffix:**

<n>                      [Window](#)

<m>                      [Marker](#)

**Parameters:**

<Frame>                      Selects a frame either by its frame number or time stamp. The frame number is available if the time stamp is off. The range depends on the history depth. The time stamp is available if the time stamp is on. The number is the distance to frame 0 in seconds. The range depends on the history depth. Default unit: S

**Example:**

CALC:DELT4:SGR:FRAM -20

Sets fourth deltamarker 20 frames below marker 1.

CALC:DELT4:SGR:FRAM 2 s

Sets fourth deltamarker 2 seconds above the position of marker 1.

**Manual operation:** See "[Marker 1 / Delta Marker 1 / Delta Marker 2 / Delta Marker 16](#)" on page 417  
See "[Frame \(Spectrogram only\)](#)" on page 418



---

**CALCulate**<n>:DELTa**marker**<m>:SG**Ram**:SA**Rea** <SearchArea>

**CALCulate**<n>:DELTa**marker**<m>:SPE**Ctrogram**:SA**Rea** <SearchArea>

Defines the marker search area for *all* spectrogram markers in the channel.

**Parameters:**

<SearchArea>

**VISible**

Performs a search within the visible frames.

Note that the command does not work if the spectrogram is not visible for any reason (e.g. if the display update is off).

**MEMory**

Performs a search within all frames in the memory.

\*RST:       VISible

**Manual operation:** See "[Marker Search Area](#)" on page 426

---

**CALCulate**<n>:DELTa**marker**<m>:SG**Ram**:XY:MA**Ximum**[:PEAK]

**CALCulate**<n>:DELTa**marker**<m>:SPE**Ctrogram**:XY:MA**Ximum**[:PEAK]

Moves a marker to the highest level of the spectrogram over all frequencies.

**Suffix:**

<n>                    [Window](#)

<m>                    [Marker](#)

---

**CALCulate**<n>:DELTa**marker**<m>:SG**Ram**:XY:MI**Nimum**[:PEAK]

**CALCulate**<n>:DELTa**marker**<m>:SPE**Ctrogram**:XY:MI**Nimum**[:PEAK]

Moves a delta marker to the minimum level of the spectrogram over all frequencies.

**Suffix:**

<n>                    [Window](#)

<m>                    [Marker](#)

---

**CALCulate**<n>:DELTa**marker**<m>:SG**Ram**:Y:MA**Ximum**:ABO**Ve**

**CALCulate**<n>:DELTa**marker**<m>:SPE**Ctrogram**:Y:MA**Ximum**:ABO**Ve**

Moves a marker vertically to the next higher level for the current frequency.

The search includes only frames above the current marker position. It does not change the horizontal position of the marker.

**Suffix:**

<n>                    [Window](#)

<m>                    [Marker](#)

---

**CALCulate**<n>:DELTa**marker**<m>:SG**Ram**:Y:MA**Ximum**:BE**Low**

**CALCulate**<n>:DELTa**marker**<m>:SPE**Ctrogram**:Y:MA**Ximum**:BE**Low**

Moves a marker vertically to the next higher level for the current frequency.

The search includes only frames below the current marker position. It does not change the horizontal position of the marker.

**Suffix:**

<n> [Window](#)

<m> [Marker](#)

**CALCulate<n>:DELTamarker<m>:SGRam:Y:MAXimum:NEXT**

**CALCulate<n>:DELTamarker<m>:SPECTrogram:Y:MAXimum:NEXT**

Moves a delta marker vertically to the next higher level for the current frequency.

The search includes all frames. It does not change the horizontal position of the marker.

**Suffix:**

<n> [Window](#)

<m> [Marker](#)

**CALCulate<n>:DELTamarker<m>:SGRam:Y:MAXimum[:PEAK]**

**CALCulate<n>:DELTamarker<m>:SPECTrogram:Y:MAXimum[:PEAK]**

Moves a delta marker vertically to the highest level for the current frequency.

The search includes all frames. It does not change the horizontal position of the marker.

If the marker hasn't been active yet, the command looks for the peak level in the whole spectrogram.

**Suffix:**

<n> [Window](#)

<m> [Marker](#)

**CALCulate<n>:DELTamarker<m>:SGRam:Y:MINimum:ABOVE**

**CALCulate<n>:DELTamarker<m>:SPECTrogram:Y:MINimum:ABOVE**

Moves a delta marker vertically to the next minimum level for the current frequency.

The search includes only frames above the current marker position. It does not change the horizontal position of the marker.

**Suffix:**

<n> [Window](#)

<m> [Marker](#)

**CALCulate<n>:DELTamarker<m>:SGRam:Y:MINimum:BELOW**

**CALCulate<n>:DELTamarker<m>:SPECTrogram:Y:MINimum:BELOW**

Moves a delta marker vertically to the next minimum level for the current frequency.

The search includes only frames below the current marker position. It does not change the horizontal position of the marker.

**Suffix:**

<n> [Window](#)

<m> [Marker](#)

**CALCulate<n>:DELTaMarker<m>:SGRam:Y:MINimum:NEXT**

**CALCulate<n>:DELTaMarker<m>:SPECTrogram:Y:MINimum:NEXT**

Moves a delta marker vertically to the next minimum level for the current frequency.

The search includes all frames. It does not change the horizontal position of the marker.

**Suffix:**

<n> [Window](#)

<m> [Marker](#)

**CALCulate<n>:DELTaMarker<m>:SGRam:Y:MINimum[:PEAK]**

**CALCulate<n>:DELTaMarker<m>:SPECTrogram:Y:MINimum[:PEAK]**

Moves a delta marker vertically to the minimum level for the current frequency.

The search includes all frames. It does not change the horizontal position of the marker.

If the marker hasn't been active yet, the command first looks for the peak level in the whole spectrogram and moves the marker vertically to the minimum level.

**Suffix:**

<n> [Window](#)

<m> [Marker](#)

**Configuring and performing a marker search**

The following commands control the marker search.

<a href="#">CALCulate&lt;n&gt;:MARKer&lt;m&gt;:LOEXclude</a> .....	828
<a href="#">CALCulate&lt;n&gt;:MARKer&lt;m&gt;:PEXCursion</a> .....	828
<a href="#">CALCulate&lt;n&gt;:MARKer&lt;m&gt;:SEARch</a> .....	828
<a href="#">CALCulate&lt;n&gt;:MARKer&lt;m&gt;:X:SLIMits[:STATe]</a> .....	829
<a href="#">CALCulate&lt;n&gt;:MARKer&lt;m&gt;:X:SLIMits:LEFT</a> .....	829
<a href="#">CALCulate&lt;n&gt;:MARKer&lt;m&gt;:X:SLIMits:RIGHT</a> .....	830
<a href="#">CALCulate&lt;n&gt;:MARKer&lt;m&gt;:X:SLIMits:ZOOM[:STATe]</a> .....	830
<a href="#">CALCulate&lt;n&gt;:THReshold</a> .....	831
<a href="#">CALCulate&lt;n&gt;:THReshold:STATe</a> .....	831

**CALCulate<n>:MARKer<m>:LOEXclude <State>**

Turns the suppression of the local oscillator during automatic marker positioning on and off (for *all* markers in *all* windows).

**Suffix:**

<n> irrelevant

<m> irrelevant

**Parameters:**

<State> ON | OFF | 0 | 1

\*RST: 1

**Example:** CALC:MARK:LOEX ON

**Manual operation:** See "[Exclude LO](#)" on page 424

**CALCulate<n>:MARKer<m>:PEXCursion <Excursion>**

Defines the peak excursion (for *all* markers in *all* windows).

The peak excursion sets the requirements for a peak to be detected during a peak search.

The unit depends on the measurement.

Application/Result display	Unit
Spectrum	dB

**Suffix:**

<n> irrelevant

<m> irrelevant

**Example:** CALC:MARK:PEXC 10dB  
Defines peak excursion as 10 dB.

**Manual operation:** See "[Peak Excursion](#)" on page 424

**CALCulate<n>:MARKer<m>:SEARch <MarkReallmag>**

Selects the trace type a marker search is performed on.

**Suffix:**

<n> irrelevant

<m> irrelevant

**Parameters:**

<MarkReallmag>

**REAL**

Marker search functions are performed on the real trace of the "I/Q" measurement.

**IMAG**

Marker search functions are performed on the imaginary trace of the "I/Q" measurement.

**MAGN**

Marker search functions are performed on the magnitude of the I and Q data.

\*RST: REAL

**Example:** CALC4:MARK:SEAR IMAG

**Manual operation:** See "[Branch for Peaksearch](#)" on page 425

**CALCulate<n>:MARKer<m>:X:SLIMits[:STATE] <State>**

Turns marker search limits on and off for *all* markers in *all* windows.

If you perform a measurement in the time domain, this command limits the range of the trace to be analyzed.

**Suffix:**

<n> irrelevant

<m> irrelevant

**Parameters:**

<State> ON | OFF | 0 | 1

**OFF | 0**

Switches the function off

**ON | 1**

Switches the function on

**Example:** CALC:MARK:X:SLIM ON  
Switches on search limitation.

**Manual operation:** See "[Search Limits \(Left / Right \)](#)" on page 315  
See "[Deactivating All Search Limits](#)" on page 315  
See "[Limit State](#)" on page 363  
See "[Search Limits \(Left / Right \)](#)" on page 425  
See "[Deactivating All Search Limits](#)" on page 425

**CALCulate<n>:MARKer<m>:X:SLIMits:LEFT <SearchLimit>**

Defines the left limit of the marker search range for *all* markers in *all* windows.

If you perform a measurement in the time domain, this command limits the range of the trace to be analyzed.

**Suffix:**

<n> irrelevant

<m> irrelevant

**Parameters:**

<SearchLimit> The value range depends on the frequency range or measurement time.  
The unit is Hz for frequency domain measurements and s for time domain measurements.  
\*RST: left diagram border  
Default unit: HZ

**Example:**

```
CALC:MARK:X:SLIM ON
Switches the search limit function on.
CALC:MARK:X:SLIM:LEFT 10MHz
Sets the left limit of the search range to 10 MHz.
```

**Manual operation:**

See "[Search Limits \(Left / Right \)](#)" on page 315  
See "[Left Limit / Right Limit](#) " on page 363  
See "[Search Limits \(Left / Right \)](#)" on page 425

**CALCulate<n>:MARKer<m>:X:SLIMits:RIGHT <SearchLimit>**

Defines the right limit of the marker search range for *all* markers in *all* windows.

If you perform a measurement in the time domain, this command limits the range of the trace to be analyzed.

**Suffix:**

<n> irrelevant  
<m> irrelevant

**Parameters:**

<Limit> The value range depends on the frequency range or measurement time.  
The unit is Hz for frequency domain measurements and s for time domain measurements.  
\*RST: right diagram border  
Default unit: HZ

**Example:**

```
CALC:MARK:X:SLIM ON
Switches the search limit function on.
CALC:MARK:X:SLIM:RIGH 20MHz
Sets the right limit of the search range to 20 MHz.
```

**Manual operation:**

See "[Search Limits \(Left / Right \)](#)" on page 315  
See "[Left Limit / Right Limit](#) " on page 363  
See "[Search Limits \(Left / Right \)](#)" on page 425

**CALCulate<n>:MARKer<m>:X:SLIMits:ZOOM[:STATe] <State>**

Adjusts the marker search range to the zoom area for *all* markers in *all* windows.

**Suffix:**

<n> irrelevant

<m> irrelevant

**Parameters:**

<State> ON | OFF | 0 | 1  
**OFF | 0**  
 Switches the function off  
**ON | 1**  
 Switches the function on

**Example:**

CALC:MARK:X:SLIM:ZOOM ON  
 Switches the search limit function on.  
 CALC:MARK:X:SLIM:RIGH 20MHz  
 Sets the right limit of the search range to 20 MHz.

**Manual operation:** See "[Use Zoom Limits](#)" on page 425

**CALCulate<n>:THReshold <Level>**

Defines a threshold level for the marker peak search (for *all* markers in *all* windows).

Note that you must enable the use of the threshold using [CALCulate<n>:THReshold:STATe](#) on page 831.

**Suffix:**

<n> irrelevant

**Parameters:**

<Level> Numeric value. The value range and unit are variable.  
 \*RST: -120 dBm  
 Default unit: DBM

**Example:**

CALC:THR:STAT ON

**Example:**

CALC:THR -82DBM  
 Enables the search threshold and sets the threshold value to -82 dBm.

**Manual operation:** See "[Search Threshold](#)" on page 425

**CALCulate<n>:THReshold:STATe <State>**

Turns a threshold for the marker peak search on and off (for *all* markers in *all* windows).

**Suffix:**

<n> irrelevant

**Parameters:**

<State> ON | OFF | 0 | 1  
**OFF | 0**  
 Switches the function off  
**ON | 1**  
 Switches the function on

**Example:** `CALC:THR:STAT ON`  
Switches on the threshold line.

**Manual operation:** See "Deactivating All Search Limits " on page 315  
See "Search Threshold " on page 425  
See "Deactivating All Search Limits " on page 425

### Positioning the marker

This chapter contains remote commands necessary to position the marker on a trace.

- [Positioning normal markers](#).....832
- [Positioning delta markers](#).....835

### Positioning normal markers

The following commands position markers on the trace.

<code>CALCulate&lt;n&gt;:MARKer&lt;m&gt;:MAXimum:AUTO</code> .....	832
<code>CALCulate&lt;n&gt;:MARKer&lt;m&gt;:MAXimum:LEFT</code> .....	833
<code>CALCulate&lt;n&gt;:MARKer&lt;m&gt;:MAXimum:NEXT</code> .....	833
<code>CALCulate&lt;n&gt;:MARKer&lt;m&gt;:MAXimum[:PEAK]</code> .....	833
<code>CALCulate&lt;n&gt;:MARKer&lt;m&gt;:MAXimum:RIGHT</code> .....	833
<code>CALCulate&lt;n&gt;:MARKer&lt;m&gt;:MINimum:AUTO</code> .....	834
<code>CALCulate&lt;n&gt;:MARKer&lt;m&gt;:MINimum:LEFT</code> .....	834
<code>CALCulate&lt;n&gt;:MARKer&lt;m&gt;:MINimum:NEXT</code> .....	834
<code>CALCulate&lt;n&gt;:MARKer&lt;m&gt;:MINimum[:PEAK]</code> .....	835
<code>CALCulate&lt;n&gt;:MARKer&lt;m&gt;:MINimum:RIGHT</code> .....	835

---

### `CALCulate<n>:MARKer<m>:MAXimum:AUTO <State>`

Turns an automatic marker peak search for a trace maximum on and off (using marker 1). The R&S VSE performs the peak search after each sweep.

#### Suffix:

`<n>` [Window](#)  
`<m>` irrelevant

#### Parameters:

`<State>` `ON | OFF | 0 | 1`  
**OFF | 0**  
Switches the function off  
**ON | 1**  
Switches the function on

**Example:** `CALC:MARK:MAX:AUTO ON`  
Activates the automatic peak search function for marker 1 at the end of each particular sweep.

**Manual operation:** See "Auto Max Peak Search / Auto Min Peak Search " on page 424



---

**CALCulate<n>:MARKer<m>:MAXimum:LEFT**

Moves a marker to the next positive peak.

The search includes only measurement values to the left of the current marker position.

In the spectrogram, the command moves a marker horizontally to the maximum level in the currently selected frame. The vertical marker position remains the same.

**Suffix:**

<n> [Window](#)

<m> [Marker](#)

**Manual operation:** See "[Search Next Peak](#)" on page 428

---

**CALCulate<n>:MARKer<m>:MAXimum:NEXT**

Moves a marker to the next positive peak.

In the spectrogram, the command moves a marker horizontally to the maximum level in the currently selected frame. The vertical marker position remains the same.

**Suffix:**

<n> [Window](#)

<m> [Marker](#)

**Manual operation:** See "[Search Next Peak](#)" on page 428

---

**CALCulate<n>:MARKer<m>:MAXimum[:PEAK]**

Moves a marker to the highest level.

In the spectrogram, the command moves a marker horizontally to the maximum level in the currently selected frame. The vertical marker position remains the same.

If the marker is not yet active, the command first activates the marker.

**Suffix:**

<n> [Window](#)

<m> [Marker](#)

**Manual operation:** See "[Peak Search](#)" on page 428

---

**CALCulate<n>:MARKer<m>:MAXimum:RIGHT**

Moves a marker to the next positive peak.

The search includes only measurement values to the right of the current marker position.

In the spectrogram, the command moves a marker horizontally to the maximum level in the currently selected frame. The vertical marker position remains the same.

**Suffix:**<n> [Window](#)<m> [Marker](#)**Manual operation:** See "[Search Next Peak](#)" on page 428**CALCulate<n>:MARKer<m>:MINimum:AUTO <State>**

Turns an automatic marker peak search for a trace minimum on and off (using marker 1). The R&S VSE performs the peak search after each sweep.

**Suffix:**<n> [Window](#)

&lt;m&gt; irrelevant

**Parameters:**

&lt;State&gt; ON | OFF | 0 | 1

**OFF | 0**

Switches the function off

**ON | 1**

Switches the function on

**Example:**

CALC:MARK:MIN:AUTO ON

Activates the automatic minimum value search function for marker 1 at the end of each particular sweep.

**Manual operation:** See "[Auto Max Peak Search / Auto Min Peak Search](#)" on page 424**CALCulate<n>:MARKer<m>:MINimum:LEFT**

Moves a marker to the next minimum peak value.

The search includes only measurement values to the right of the current marker position.

In the spectrogram, the command moves a marker horizontally to the minimum level in the currently selected frame. The vertical marker position remains the same.

**Suffix:**<n> [Window](#)<m> [Marker](#)**Manual operation:** See "[Search Next Minimum](#)" on page 428**CALCulate<n>:MARKer<m>:MINimum:NEXT**

Moves a marker to the next minimum peak value.

In the spectrogram, the command moves a marker horizontally to the minimum level in the currently selected frame. The vertical marker position remains the same.

**Suffix:**<n> [Window](#)<m> [Marker](#)**Manual operation:** See "[Search Next Minimum](#)" on page 428**CALCulate<n>:MARKer<m>:MINimum[:PEAK]**

Moves a marker to the minimum level.

In the spectrogram, the command moves a marker horizontally to the minimum level in the currently selected frame. The vertical marker position remains the same.

If the marker is not yet active, the command first activates the marker.

**Suffix:**<n> [Window](#)<m> [Marker](#)**Manual operation:** See "[Search Minimum](#)" on page 428**CALCulate<n>:MARKer<m>:MINimum:RIGHT**

Moves a marker to the next minimum peak value.

The search includes only measurement values to the right of the current marker position.

In the spectrogram, the command moves a marker horizontally to the minimum level in the currently selected frame. The vertical marker position remains the same.

**Suffix:**<n> [Window](#)<m> [Marker](#)**Manual operation:** See "[Search Next Minimum](#)" on page 428**Positioning delta markers**

The following commands position delta markers on the trace.

<a href="#">CALCulate&lt;n&gt;:DELTamarker&lt;m&gt;:MAXimum:LEFT</a> .....	836
<a href="#">CALCulate&lt;n&gt;:DELTamarker&lt;m&gt;:MAXimum:NEXT</a> .....	836
<a href="#">CALCulate&lt;n&gt;:DELTamarker&lt;m&gt;:MAXimum[:PEAK]</a> .....	836
<a href="#">CALCulate&lt;n&gt;:DELTamarker&lt;m&gt;:MAXimum:RIGHT</a> .....	836
<a href="#">CALCulate&lt;n&gt;:DELTamarker&lt;m&gt;:MINimum:LEFT</a> .....	837
<a href="#">CALCulate&lt;n&gt;:DELTamarker&lt;m&gt;:MINimum:NEXT</a> .....	837
<a href="#">CALCulate&lt;n&gt;:DELTamarker&lt;m&gt;:MINimum[:PEAK]</a> .....	837
<a href="#">CALCulate&lt;n&gt;:DELTamarker&lt;m&gt;:MINimum:RIGHT</a> .....	838

---

**CALCulate<n>:DELTamarker<m>:MAXimum:LEFT**

Moves a delta marker to the next positive peak value.

The search includes only measurement values to the left of the current marker position.

In the spectrogram, the command moves a marker horizontally to the maximum level in the currently selected frame. The vertical marker position remains the same.

**Suffix:**

<n> [Window](#)

<m> [Marker](#)

**Manual operation:** See "[Search Next Peak](#)" on page 428

---

**CALCulate<n>:DELTamarker<m>:MAXimum:NEXT**

Moves a marker to the next positive peak value.

In the spectrogram, the command moves a marker horizontally to the maximum level in the currently selected frame. The vertical marker position remains the same.

**Suffix:**

<n> 1..n  
[Window](#)

<m> 1..n  
[Marker](#)

**Manual operation:** See "[Search Next Peak](#)" on page 428

---

**CALCulate<n>:DELTamarker<m>:MAXimum[:PEAK]**

Moves a delta marker to the highest level.

In the spectrogram, the command moves a marker horizontally to the maximum level in the currently selected frame. The vertical marker position remains the same.

If the marker is not yet active, the command first activates the marker.

**Suffix:**

<n> [Window](#)

<m> [Marker](#)

**Manual operation:** See "[Peak Search](#)" on page 428

---

**CALCulate<n>:DELTamarker<m>:MAXimum:RIGHT**

Moves a delta marker to the next positive peak value on the trace.

The search includes only measurement values to the right of the current marker position.

In the spectrogram, the command moves a marker horizontally to the maximum level in the currently selected frame. The vertical marker position remains the same.

**Suffix:**

<n> [Window](#)

<m> [Marker](#)

**Manual operation:** See "[Search Next Peak](#)" on page 428

**CALCulate<n>:DELTamarker<m>:MINimum:LEFT**

Moves a delta marker to the next minimum peak value.

The search includes only measurement values to the right of the current marker position.

In the spectrogram, the command moves a marker horizontally to the minimum level in the currently selected frame. The vertical marker position remains the same.

**Suffix:**

<n> [Window](#)

<m> [Marker](#)

**Manual operation:** See "[Search Next Minimum](#)" on page 428

**CALCulate<n>:DELTamarker<m>:MINimum:NEXT**

Moves a marker to the next minimum peak value.

In the spectrogram, the command moves a marker horizontally to the minimum level in the currently selected frame. The vertical marker position remains the same.

**Suffix:**

<n> [Window](#)

<m> [Marker](#)

**Manual operation:** See "[Search Next Minimum](#)" on page 428

**CALCulate<n>:DELTamarker<m>:MINimum[:PEAK]**

Moves a delta marker to the minimum level.

In the spectrogram, the command moves a marker horizontally to the minimum level in the currently selected frame. The vertical marker position remains the same.

If the marker is not yet active, the command first activates the marker.

**Suffix:**

<n> [Window](#)

<m> [Marker](#)

**Manual operation:** See "[Search Minimum](#)" on page 428

**CALCulate<n>:DELTaMarker<m>:MINimum:RIGHT**

Moves a delta marker to the next minimum peak value.

The search includes only measurement values to the right of the current marker position.

In the spectrogram, the command moves a marker horizontally to the minimum level in the currently selected frame. The vertical marker position remains the same.

**Suffix:**

<n> [Window](#)

<m> [Marker](#)

**Manual operation:** See "[Search Next Minimum](#)" on page 428

**Band power marker**

The following commands control the marker for band power measurements.

**Using markers**

<a href="#">CALCulate&lt;n&gt;:MARKer&lt;m&gt;:FUNCTION:BPOWER:AOFF</a> .....	838
<a href="#">CALCulate&lt;n&gt;:MARKer&lt;m&gt;:FUNCTION:BPOWER:MODE</a> .....	838
<a href="#">CALCulate&lt;n&gt;:MARKer&lt;m&gt;:FUNCTION:BPOWER:RESult?</a> .....	839
<a href="#">CALCulate&lt;n&gt;:MARKer&lt;m&gt;:FUNCTION:BPOWER:SPAN</a> .....	839
<a href="#">CALCulate&lt;n&gt;:MARKer&lt;m&gt;:FUNCTION:BPOWER[:STATe]</a> .....	840

**CALCulate<n>:MARKer<m>:FUNCTION:BPOWER:AOFF**

Removes all band power markers in the specified window.

**Suffix:**

<n> [Window](#)

<m> irrelevant

**Example:** `CALC:MARK:FUNC:BPOW:AOFF`

**CALCulate<n>:MARKer<m>:FUNCTION:BPOWER:MODE <Mode>**

Selects the way the results for a band power marker are displayed.

(Note: relative power results are only available for delta markers, see [.CALCulate<n>:DELTaMarker<m>:FUNCTION:BPOWER:MODE](#) on page 840)

**Suffix:**

<n> [Window](#)

<m> [Marker](#)

**Parameters:**

<Mode> **POWER**

Result is displayed as an absolute power. The power unit depends on the [CALCulate<n>:UNIT:POWER](#) setting.

**DENSity**

Result is displayed as a density in dBm/Hz.

\*RST:       POWER

**Example:**

```
CALC:MARK4:FUNC:BPOW:MODE DENS
```

Configures marker 4 to show the measurement results in dBm/Hz.

**Manual operation:** See "[Power Mode](#)" on page 432

**CALCulate<n>:MARKer<m>:FUNCtion:BPOWER:RESult?**

Queries the results of the band power measurement.

**Suffix:**

<n>               [Window](#)

<m>               [Marker](#)

**Return values:**

<Power>         Signal power over the marker bandwidth.

**Example:**

Activate the band power marker:

```
CALC:MARK:FUNC:BPOW:STAT ON
```

Select the density mode for the result:

```
CALC:MARK:FUNC:BPOW:MODE DENS
```

Query the result:

```
CALC:MARK:FUNC:BPOW:RES?
```

Response:

```
20dBm/Hz
```

**Usage:**               Query only

**CALCulate<n>:MARKer<m>:FUNCtion:BPOWER:SPAN <Span>**

Defines the bandwidth around the marker position.

**Suffix:**

<n>               [Window](#)

<m>               [Marker](#)

**Parameters:**

<Span>            Frequency. The maximum span depends on the marker position and R&S VSE model.

\*RST:       5% of current span

Default unit: Hz

**Example:**

```
CALC:MARK:FUNC:BPOW:SPAN 2MHz
```

Measures the band power over 2 MHz around the marker.

**Manual operation:** See "[Span](#)" on page 431

**CALCulate<n>:MARKer<m>:FUNCTION:BPOWER[:STATe] <State>**

Turns markers for band power measurements on and off.

**Suffix:**

<n> [Window](#)

<m> [Marker](#)

**Parameters:**

<State> ON | OFF | 0 | 1

**OFF | 0**

Switches the function off

**ON | 1**

Switches the function on

**Example:**

CALC:MARK4:FUNC:BPOW:STAT ON

Activates or turns marker 4 into a band power marker.

**Manual operation:** See ["Band Power Measurement State"](#) on page 431  
See ["Switching All Band Power Measurements Off"](#)  
on page 432

**Using delta markers**

<a href="#">CALCulate&lt;n&gt;:DELTamarker&lt;m&gt;:FUNCTION:BPOWER:MODE.....</a>	840
<a href="#">CALCulate&lt;n&gt;:DELTamarker&lt;m&gt;:FUNCTION:BPOWER:RESult?.....</a>	840
<a href="#">CALCulate&lt;n&gt;:DELTamarker&lt;m&gt;:FUNCTION:BPOWER:SPAN.....</a>	841
<a href="#">CALCulate&lt;n&gt;:DELTamarker&lt;m&gt;:FUNCTION:BPOWER[:STATe].....</a>	841

**CALCulate<n>:DELTamarker<m>:FUNCTION:BPOWER:MODE <Mode>**

Selects the way the results for a band power delta marker are displayed.

**Suffix:**

<n> [Window](#)

<m> [Marker](#)

**Parameters:**

<Mode>

**POWER**

Result is displayed as an absolute power. The power unit depends on the [CALCulate<n>:UNIT:POWER](#) setting.

**DENSITY**

Result is displayed as a density in dBm/Hz.

\*RST: POWER

**Manual operation:** See ["Power Mode"](#) on page 432

**CALCulate<n>:DELTamarker<m>:FUNCTION:BPOWER:RESult?**

Queries the results of the band power measurement.



**Suffix:**<n> [Window](#)<m> [Marker](#)**Return values:**

&lt;Power&gt; Signal power over the delta marker bandwidth.

**Usage:** Query only**CALCulate<n>:DELTamarker<m>:FUNction:BPOWer:SPAN <Span>**

Defines the bandwidth around the delta marker position.

**Suffix:**<n> [Window](#)<m> [Marker](#)**Parameters:**

&lt;Span&gt; Frequency. The maximum span depends on the marker position and R&amp;S VSE model.

\*RST: 5% of current span

Default unit: Hz

**Manual operation:** See "[Span](#)" on page 431**CALCulate<n>:DELTamarker<m>:FUNction:BPOWer[:STATe] <State>**

Turns delta markers for band power measurements on and off.

If necessary, the command also turns on a reference marker.

**Suffix:**<n> [Window](#)<m> [Marker](#)**Parameters:**

&lt;State&gt; ON | OFF | 0 | 1

**OFF | 0**

Switches the function off

**ON | 1**

Switches the function on

**Manual operation:** See "[Band Power Measurement State](#)" on page 431  
See "[Switching All Band Power Measurements Off](#)" on page 432**Fixed reference marker settings**

The following commands configure a fixed reference marker.

CALCulate<n>:DELTaMarker<m>:FUNction:FIXed:RPOint:MAXimum[:PEAK].....	842
CALCulate<n>:DELTaMarker<m>:FUNction:FIXed:RPOint:X.....	842
CALCulate<n>:DELTaMarker<m>:FUNction:FIXed:RPOint:Y.....	842
CALCulate<n>:DELTaMarker<m>:FUNction:FIXed:RPOint:Y:OFFSet.....	843
CALCulate<n>:DELTaMarker<m>:FUNction:FIXed[:STATe].....	843

---

### CALCulate<n>:DELTaMarker<m>:FUNction:FIXed:RPOint:MAXimum[:PEAK]

Moves the fixed reference marker to the peak power.

#### Suffix:

<n>                      Window

<m>                      Marker

#### Example:

CALC:DELT:FUNC:FIX:RPO:MAX

Sets the reference point level for delta markers to the peak of the selected trace.

**Manual operation:** See ["Defining a Fixed Reference"](#) on page 422

---

### CALCulate<n>:DELTaMarker<m>:FUNction:FIXed:RPOint:X <RefPoint>

Defines the horizontal position of the fixed delta marker reference point. The coordinates of the reference may be anywhere in the diagram.

#### Suffix:

<n>                      Window

<m>                      Marker

#### Parameters:

<RefPoint>            Numeric value that defines the horizontal position of the reference.  
 For frequency domain measurements, it is a frequency in Hz.  
 For time domain measurements, it is a point in time in s.  
 \*RST:                Fixed Reference: OFF  
 Default unit: HZ

#### Example:

CALC:DELT:FUNC:FIX:RPO:X 128 MHz

Sets the frequency reference to 128 MHz.

**Manual operation:** See ["Defining a Fixed Reference"](#) on page 422

---

### CALCulate<n>:DELTaMarker<m>:FUNction:FIXed:RPOint:Y <RefPointLevel>

Defines the vertical position of the fixed delta marker reference point. The coordinates of the reference may be anywhere in the diagram.

#### Suffix:

<n>                      Window

<m>                      Marker

**Parameters:**

<RefPoint> Numeric value that defines the vertical position of the reference.  
The unit and value range is variable.

\*RST: Fixed Reference: OFF  
Default unit: DBM

**Example:**

CALC:DELT:FUNC:FIX:RPO:Y -10dBm  
Sets the reference point level for delta markers to -10 dBm.

**Manual operation:** See ["Defining a Fixed Reference"](#) on page 422

**CALCulate<n>:DELTaMarker<m>:FUNCTION:FIXed:RPOint:Y:OFFSet <Offset>**

Defines a level offset for the fixed delta marker reference point.

**Suffix:**

<n> [Window](#)

<m> [Marker](#)

**Parameters:**

<Offset> Numeric value  
\*RST: 0  
Default unit: dB

**CALCulate<n>:DELTaMarker<m>:FUNCTION:FIXed[:STATe] <State>**

Activates or deactivates a marker that defines a fixed reference point for relative marker analysis.

If necessary, the command activates a marker and positions it on the peak power.

Subsequently, you can change the coordinates of the fixed reference independent of the marker. The fixed reference is independent of the trace and is applied to all active delta markers.

**Suffix:**

<n> [Window](#)

<m> [Marker](#)

**Parameters:**

<State> ON | OFF | 0 | 1  
**OFF | 0**  
Switches the function off  
**ON | 1**  
Switches the function on

**Example:**            `CALC:DELT:FUNC:FIX ON`  
 Switches on the measurement with fixed reference value for all delta markers.  
`CALC:DELT:FUNC:FIX:RPO:X 128 MHZ`  
 Sets the frequency reference to 128 MHz.  
`CALC:DELT:FUNC:FIX:RPO:Y 30 DBM`  
 Sets the reference level to +30 dBm.

**Manual operation:** See ["Defining a Fixed Reference"](#) on page 422

## Marker peak lists

### Useful commands for peak lists described elsewhere

- [CALCulate<n>:MARKer<m>:PEXCursion](#) on page 828
- [MMEMory:STORe<n>:PEAK](#) on page 847

### Remote commands exclusive to peak lists

<a href="#">CALCulate&lt;n&gt;:MARKer&lt;m&gt;:FUNCTION:FPEaks:ANNOtation:LABel[:STATe]</a> .....	844
<a href="#">CALCulate&lt;n&gt;:MARKer&lt;m&gt;:FUNCTION:FPEaks:COUNT?</a> .....	845
<a href="#">CALCulate&lt;n&gt;:MARKer&lt;m&gt;:FUNCTION:FPEaks[:IMMEDIATE]</a> .....	845
<a href="#">CALCulate&lt;n&gt;:MARKer&lt;m&gt;:FUNCTION:FPEaks:LIST:SIZE</a> .....	845
<a href="#">CALCulate&lt;n&gt;:MARKer&lt;m&gt;:FUNCTION:FPEaks:SORT</a> .....	846
<a href="#">CALCulate&lt;n&gt;:MARKer&lt;m&gt;:FUNCTION:FPEaks:STATe</a> .....	846
<a href="#">CALCulate&lt;n&gt;:MARKer&lt;m&gt;:FUNCTION:FPEaks:X?</a> .....	847
<a href="#">CALCulate&lt;n&gt;:MARKer&lt;m&gt;:FUNCTION:FPEaks:Y?</a> .....	847
<a href="#">MMEMory:STORe&lt;n&gt;:PEAK</a> .....	847

---

### **CALCulate<n>:MARKer<m>:FUNCTION:FPEaks:ANNOtation:LABel[:STATe]** <State>

Turns labels for peaks found during a peak search on and off.

The labels correspond to the marker number in the marker peak list.

#### **Suffix:**

<n>                    [Window](#)

<m>                    [Marker](#)

#### **Parameters:**

<State>              ON | OFF | 0 | 1

\*RST:                1

**Example:**            `CALC:MARK:FUNC:FPE:ANN:LAB:STAT OFF`  
 Removes the peak labels from the diagram

**Manual operation:** See ["Display Marker Numbers "](#) on page 439

**CALCulate<n>:MARKer<m>:FUNCTION:FPEaks:COUNT?**

Queries the number of peaks that have been found during a peak search.

The actual number of peaks that have been found may differ from the number of peaks you have set to be found because of the peak excursion.

**Suffix:**

<n> irrelevant

<m> irrelevant

**Return values:**

<NumberOfPeaks>

**Example:**

```
CALC:MARK:FUNC:FPE:COUN?
Queries the number of peaks.
```

**Usage:**

Query only

**CALCulate<n>:MARKer<m>:FUNCTION:FPEaks[:IMMEDIATE] <Peaks>**

Initiates a peak search.

**Suffix:**

<n> [Window](#)

<m> [Marker](#)

**Parameters:**

<Peaks> This parameter defines the number of peaks to find during the search.

Note that the actual number of peaks found during the search also depends on the peak excursion you have set with [CALCulate<n>:MARKer<m>:PEXCursion](#).

Range: 1 to 200

**Example:**

```
CALC:MARK:PEXC 5
```

Defines a peak excursion of 5 dB, i.e. peaks must be at least 5 dB apart to be detected as a peak.

```
CALC:MARK:FUNC:FPE 10
```

Initiates a search for 10 peaks on the current trace.

**CALCulate<n>:MARKer<m>:FUNCTION:FPEaks:LIST:SIZE <MaxNoPeaks>**

Defines the maximum number of peaks that the R&S VSE looks for during a peak search.

**Suffix:**

<n> [Window](#)

<m> [Marker](#)

**Parameters:**

<MaxNoPeaks> Maximum number of peaks to be determined.

Range: 1 to 500

\*RST: 50

**Example:**

CALC:MARK:FUNC:FPE:LIST:SIZE 10

The marker peak list will contain a maximum of 10 peaks.

**Manual operation:** See "[Maximum Number of Peaks](#)" on page 438

**CALCulate<n>:MARKer<m>:FUNCTion:FPEaks:SORT <SortMode>**

Selects the order in which the results of a peak search are returned.

**Suffix:**

<n> [Window](#)

<m> [Marker](#)

**Parameters:**

<SortMode> **X**

Sorts the peaks according to increasing position on the x-axis.

**Y**

Sorts the peaks according to decreasing position on the y-axis.

\*RST: X

**Example:**

CALC:MARK:FUNC:FPE:SORT Y

Sets the sort mode to decreasing y values

**Manual operation:** See "[Sort Mode](#)" on page 438

**CALCulate<n>:MARKer<m>:FUNCTion:FPEaks:STATe <State>**

Turns a peak search on and off.

**Suffix:**

<n> [Window](#)

<m> [Marker](#)

**Parameters:**

<State> ON | OFF | 0 | 1

**OFF | 0**

Switches the function off

**ON | 1**

Switches the function on

**Example:**

CALC:MARK:FUNC:FPE:STAT ON

Activates marker peak search

**Manual operation:** See "[Peak List State](#)" on page 438

---

**CALCulate<n>:MARKer<m>:FUNction:FPEaks:X?**

Queries the position of the peaks on the x-axis.

The order depends on the sort order that has been set with [CALCulate<n>:MARKer<m>:FUNction:FPEaks:SORT](#).

**Suffix:**

<n> irrelevant

<m> irrelevant

**Return values:**

<PeakPosition> Position of the peaks on the x-axis. The unit depends on the measurement.

**Usage:** Query only

---

**CALCulate<n>:MARKer<m>:FUNction:FPEaks:Y?**

Queries the position of the peaks on the y-axis.

The order depends on the sort order that has been set with [CALCulate<n>:MARKer<m>:FUNction:FPEaks:SORT](#).

**Suffix:**

<n> irrelevant

<m> irrelevant

**Return values:**

<PeakPosition> Position of the peaks on the y-axis. The unit depends on the measurement.

**Usage:** Query only

---

**MMEMory:STORe<n>:PEAK <FileName>**

Exports the marker peak list to a file.

**Suffix:**

<n> [Window](#)

**Parameters:**

<FileName> String containing the path,name and extension of the target file.

**Example:**

```
MMEM:STOR:PEAK 'test.dat'
```

Saves the current marker peak list in the file `test.dat`.

**Manual operation:** See "[Export Peak List](#)" on page 439

---

**Noise measurement marker**

The following commands control the noise measurement marker function.

CALCulate<n>:MARKer<m>:FUNCTION:NOISe:AOff.....	848
CALCulate<n>:MARKer<m>:FUNCTION:NOISe:RESult?.....	848
CALCulate<n>:MARKer<m>:FUNCTION:NOISe[:STATe].....	848

---

### CALCulate<n>:MARKer<m>:FUNCTION:NOISe:AOff

Removes all noise markers in the specified window.

#### Suffix:

<n>                      [Window](#)

<m>                      irrelevant

**Example:**                      CALC:MARK:FUNC:NOIS:AOff

---

### CALCulate<n>:MARKer<m>:FUNCTION:NOISe:RESult?

Queries the result of the noise measurement.

To get a valid result, you have to perform a complete measurement with synchronization to the end of the measurement before reading out the result. This is only possible for single measurement mode.

See also [INITiate<n>:CONTinuous](#) on page 547.

#### Suffix:

<n>                      [Window](#)

<m>                      [Marker](#)

#### Return values:

<NoiseLevel>                      Current noise level. The unit is the one currently active.

#### Example:

```
INIT:CONT OFF
```

Switches to single sweep mode.

```
CALC:MARK2 ON
```

Switches on marker 2.

```
CALC:MARK2:FUNC:NOIS ON
```

Switches on noise measurement for marker 2.

```
INIT;*WAI
```

Starts a sweep and waits for the end.

```
CALC:MARK2:FUNC:NOIS:RES?
```

Outputs the noise result of marker 2.

**Usage:**                      Query only

**Manual operation:**    See "[Noise Measurement State](#)" on page 442

---

### CALCulate<n>:MARKer<m>:FUNCTION:NOISe[:STATe] <State>

Turns the noise measurement at the marker position on and off.

#### Suffix:

<n>                      [Window](#)



<m> [Marker](#)

**Parameters:**

<State> ON | OFF | 0 | 1  
**OFF | 0**  
 Switches the function off  
**ON | 1**  
 Switches the function on

**Example:** CALC:MARK:FUNC:NOIS ON  
 Switches on the noise measurement.

**Manual operation:** See ["Noise Measurement State"](#) on page 442  
 See ["Switching All Noise Measurement Off"](#) on page 442

### 13.6.4.6 Zooming into the display

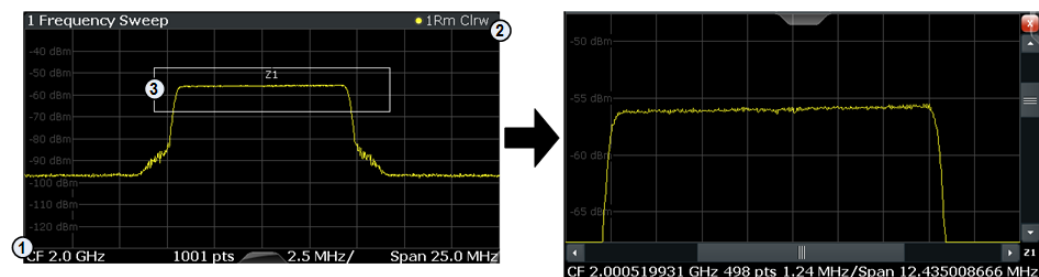
#### Using the single zoom

DISPlay[:WINDow<n>][:SUBWindow<w>]:ZOOM:AREA..... 849  
 DISPlay[:WINDow<n>][:SUBWindow<w>]:ZOOM[:STATe]..... 850

**DISPlay[:WINDow<n>][:SUBWindow<w>]:ZOOM:AREA <x1>,<y1>,<x2>,<y2>**

Defines the zoom area.

To define a zoom area, you first have to turn the zoom on.



1 = origin of coordinate system (x1 = 0, y1 = 0)  
 2 = end point of system (x2 = 100, y2 = 100)  
 3 = zoom area (e.g. x1 = 60, y1 = 30, x2 = 80, y2 = 75)

**Suffix:**

<n> [Window](#)  
 <w> subwindow  
 Not supported by all applications

**Parameters:**

<x1>	Diagram coordinates in % of the complete diagram that define the zoom area. The lower left corner is the origin of coordinate system. The upper right corner is the end point of the system. Range: 0 to 100 Default unit: PCT
<y1>	Diagram coordinates in % of the complete diagram that define the zoom area. The lower left corner is the origin of coordinate system. The upper right corner is the end point of the system. Range: 0 to 100 Default unit: PCT
<x2>	Diagram coordinates in % of the complete diagram that define the zoom area. The lower left corner is the origin of coordinate system. The upper right corner is the end point of the system. Range: 0 to 100 Default unit: PCT
<y2>	Diagram coordinates in % of the complete diagram that define the zoom area. The lower left corner is the origin of coordinate system. The upper right corner is the end point of the system. Range: 0 to 100 Default unit: PCT

**Manual operation:** See "[Single Zoom](#)" on page 445

---

**DISPlay[:WINDow<n>][:SUBWindow<w>]:ZOOM[:STATe] <State>**

Turns the zoom on and off.

**Suffix:**

<n>	<a href="#">Window</a>
<w>	subwindow Not supported by all applications

**Parameters:**

<State>	ON   OFF   0   1 <b>OFF   0</b> Switches the function off <b>ON   1</b> Switches the function on
---------	--

**Example:**

DISP:ZOOM ON  
Activates the zoom mode.

**Manual operation:** See "Single Zoom " on page 445  
See "Restore Original Display " on page 446

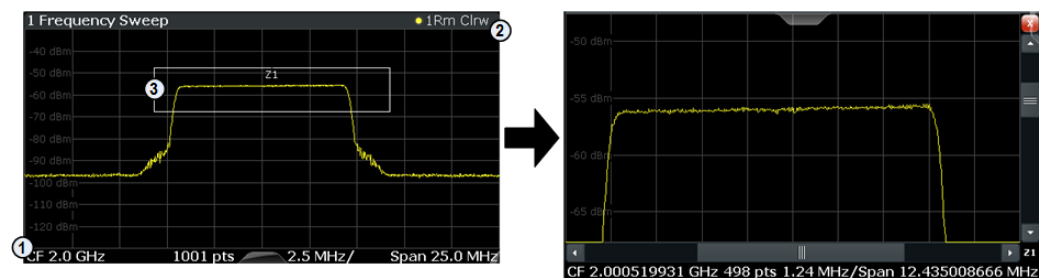
### Using the multiple zoom

DISPlay[:WINDow<n>][:SUBWindow<w>]:ZOOM:MULTiple<zn>:AREA.....851  
DISPlay[:WINDow<n>][:SUBWindow<w>]:ZOOM:MULTiple<zn>[:STATE]..... 852

**DISPlay[:WINDow<n>][:SUBWindow<w>]:ZOOM:MULTiple<zn>:AREA**  
<x1>,<y1>,<x2>,<y2>

Defines the zoom area for a multiple zoom.

To define a zoom area, you first have to turn the zoom on.



- 1 = origin of coordinate system (x1 = 0, y1 = 0)
- 2 = end point of system (x2 = 100, y2 = 100)
- 3 = zoom area (e.g. x1 = 60, y1 = 30, x2 = 80, y2 = 75)

#### Suffix:

- <n> [Window](#)
- <w> subwindow  
Not supported by all applications
- <zn> Selects the zoom window.

#### Parameters:

- <x1> Diagram coordinates in % of the complete diagram that define the zoom area.  
The lower left corner is the origin of coordinate system. The upper right corner is the end point of the system.  
Range: 0 to 100  
Default unit: PCT
- <y1> Diagram coordinates in % of the complete diagram that define the zoom area.  
The lower left corner is the origin of coordinate system. The upper right corner is the end point of the system.  
Range: 0 to 100  
Default unit: PCT

<code>&lt;x2&gt;</code>	Diagram coordinates in % of the complete diagram that define the zoom area. The lower left corner is the origin of coordinate system. The upper right corner is the end point of the system. Range: 0 to 100 Default unit: PCT
<code>&lt;y2&gt;</code>	Diagram coordinates in % of the complete diagram that define the zoom area. The lower left corner is the origin of coordinate system. The upper right corner is the end point of the system. Range: 0 to 100 Default unit: PCT

**Manual operation:** See "[Multi-Zoom](#)" on page 445

#### **DISPlay[:WINDow<n>][:SUBWindow<w>]:ZOOM:MULTiple<zn>[:STATe] <State>**

Turns the multiple zoom on and off.

##### **Suffix:**

<code>&lt;n&gt;</code>	<a href="#">Window</a>
<code>&lt;w&gt;</code>	subwindow Not supported by all applications
<code>&lt;zn&gt;</code>	Selects the zoom window. If you turn off one of the zoom windows, all subsequent zoom windows move up one position.

##### **Parameters:**

<code>&lt;State&gt;</code>	ON   OFF   0   1 <b>OFF   0</b> Switches the function off <b>ON   1</b> Switches the function on
----------------------------	--

**Manual operation:** See "[Multi-Zoom](#)" on page 445  
See "[Restore Original Display](#)" on page 446

### 13.6.4.7 Configuring display lines

The commands required to configure display lines in a remote environment are described here.

<a href="#">CALCulate&lt;n&gt;:DLINe&lt;dl&gt;</a> .....	853
<a href="#">CALCulate&lt;n&gt;:DLINe&lt;dl&gt;:STATe</a> .....	853
<a href="#">CALCulate&lt;n&gt;:FLINe&lt;dl&gt;</a> .....	853
<a href="#">CALCulate&lt;n&gt;:FLINe&lt;dl&gt;:STATe</a> .....	854
<a href="#">CALCulate&lt;n&gt;:TLINe&lt;dl&gt;</a> .....	854
<a href="#">CALCulate&lt;n&gt;:TLINe&lt;dl&gt;:STATe</a> .....	855

**CALCulate<n>:DLINe<dl>** <Position>

Defines the (horizontal) position of a display line.

**Suffix:**

<n> [Window](#)

<dl> 1 | 2

**Parameters:**

<Position> The value range is variable.  
You can use any unit you want, the R&S VSE then converts the unit to the currently selected unit. If you omit a unit, the R&S VSE uses the currently selected unit.

\*RST: (state is OFF)

Default unit: DBM

**Example:**

CALC:DLIN2 -20dBm

Positions the second display line at -20 dBm.

**Manual operation:** See "[Horizontal Line 1 / Horizontal Line 2](#)" on page 450

**CALCulate<n>:DLINe<dl>:STATe** <State>

Turns a display line on and off

**Suffix:**

<n> [Window](#)

<dl> 1 | 2

**Parameters:**

<State> ON | OFF | 0 | 1

**OFF | 0**

Switches the function off

**ON | 1**

Switches the function on

**Example:**

CALC:DLIN2:STAT ON

Turns on display line 2.

**CALCulate<n>:FLINe<dl>** <Frequency>

Defines the position of a frequency line.

**Suffix:**

<n> [Window](#)

**Parameters:**

&lt;Frequency&gt;

Note that you can not set a frequency line to a position that is outside the current span.

Range: 0 Hz to Fmax

\*RST: (STATe to OFF)

Default unit: HZ

**Example:**

```
CALC:FLIN2 120MHz
```

Sets frequency line 2 to a frequency of 120 MHz.

**Manual operation:** See "[Vertical Line <x>](#)" on page 450

**CALCulate<n>:FLINe<dl>:STATe <State>**

Turns a frequency line on and off

**Suffix:**

<n> [Window](#)

<dl> 1 | 2  
frequency line

**Parameters:**

<State> ON | OFF | 0 | 1

**OFF | 0**

Switches the function off

**ON | 1**

Switches the function on

**Example:**

```
CALC:FLIN2:STAT ON
```

Turns frequency line 2 on.

**CALCulate<n>:TLINe<dl> <Time>**

Defines the position of a time line.

**Suffix:**

<n> [Window](#)

**Parameters:**

&lt;Time&gt;

Note that you can not set a time line to a position that is higher than the current sweep time.

Range: 0 s to 1600 s

\*RST: (STATe to OFF)

Default unit: S

**Example:**

```
CALC:TLIN 10ms
```

Sets the first time line to 10 ms.

**Manual operation:** See "[Vertical Line <x>](#)" on page 450

**CALCulate<n>:TLINe<dl>:STATe <State>**

Turns a time line on and off

**Suffix:**

<n> [Window](#)  
 <dl> 1 | 2  
 time line

**Parameters:**

<State> ON | OFF | 0 | 1  
**OFF | 0**  
 Switches the function off  
**ON | 1**  
 Switches the function on

**Example:**

CALC:TLIN:STAT ON  
 Turns the first time line on.

**13.6.4.8 Defining limit checks**

Note that in remote control, upper and lower limit lines are configured using separate commands. Thus, you must decide in advance which you want to configure. The x-values for both upper and lower limit lines are defined as a common control line. This control line is the reference for the y-values for both upper and lower limit lines.

- [Configuring limit lines](#)..... 855
- [Managing limit lines](#)..... 864
- [Checking the results of a limit check](#)..... 866
- [Programming example: using limit lines](#)..... 867

**Configuring limit lines**

<a href="#">CALCulate&lt;n&gt;:LIMit&lt;li&gt;:COMMeNt</a> .....	856
<a href="#">CALCulate&lt;n&gt;:LIMit&lt;li&gt;:CONTRol[:DATA]</a> .....	856
<a href="#">CALCulate&lt;n&gt;:LIMit&lt;li&gt;:CONTRol:DOMain</a> .....	856
<a href="#">CALCulate&lt;n&gt;:LIMit&lt;li&gt;:CONTRol:MODE</a> .....	857
<a href="#">CALCulate&lt;n&gt;:LIMit&lt;li&gt;:CONTRol:OFFSet</a> .....	857
<a href="#">CALCulate&lt;n&gt;:LIMit&lt;li&gt;:CONTRol:SHIFt</a> .....	857
<a href="#">CALCulate&lt;n&gt;:LIMit&lt;li&gt;:CONTRol:SPACing</a> .....	858
<a href="#">CALCulate&lt;n&gt;:LIMit&lt;li&gt;:LOWer[:DATA]</a> .....	858
<a href="#">CALCulate&lt;n&gt;:LIMit&lt;li&gt;:LOWer:MARGin</a> .....	858
<a href="#">CALCulate&lt;n&gt;:LIMit&lt;li&gt;:LOWer:MODE</a> .....	859
<a href="#">CALCulate&lt;n&gt;:LIMit&lt;li&gt;:LOWer:OFFSet</a> .....	859
<a href="#">CALCulate&lt;n&gt;:LIMit&lt;li&gt;:LOWer:SHIFt</a> .....	859
<a href="#">CALCulate&lt;n&gt;:LIMit&lt;li&gt;:LOWer:SPACing</a> .....	860
<a href="#">CALCulate&lt;n&gt;:LIMit&lt;li&gt;:LOWer:STATe</a> .....	860
<a href="#">CALCulate&lt;n&gt;:LIMit&lt;li&gt;:LOWer:THReshold</a> .....	860
<a href="#">CALCulate&lt;n&gt;:LIMit&lt;li&gt;:NAME</a> .....	861
<a href="#">CALCulate&lt;n&gt;:LIMit&lt;li&gt;:UNIT</a> .....	861
<a href="#">CALCulate&lt;n&gt;:LIMit&lt;li&gt;:UPPer[:DATA]</a> .....	861

CALCulate<n>:LIMit<li>:UPPer:MARGin.....	862
CALCulate<n>:LIMit<li>:UPPer:MODE.....	862
CALCulate<n>:LIMit<li>:UPPer:OFFSet.....	862
CALCulate<n>:LIMit<li>:UPPer:SHIFt.....	863
CALCulate<n>:LIMit<li>:UPPer:SPACing.....	863
CALCulate<n>:LIMit<li>:UPPer:STATe.....	863
CALCulate<n>:LIMit<li>:UPPer:THReshold.....	864

---

### CALCulate<n>:LIMit<li>:COMMeNt <Comment>

Defines a comment for a limit line.

#### Suffix:

<n>	irrelevant
<li>	Limit line

#### Parameters:

<Comment> String containing the description of the limit line.

**Manual operation:** See "[Comment](#)" on page 457

---

### CALCulate<n>:LIMit<li>:CONTRol[:DATA] <LimitLinePoints>...

Defines the horizontal definition points of a limit line.

#### Suffix:

<n>	irrelevant
<li>	Limit line

#### Parameters:

<LimitLinePoints> Variable number of x-axis values.  
 Note that the number of horizontal values has to be the same as the number of vertical values set with [CALCulate<n>:LIMit<li>:LOWer\[:DATA\]](#) or [CALCulate<n>:LIMit<li>:UPPer\[:DATA\]](#). If not, the R&S VSE either adds missing values or ignores surplus values.

\*RST: -  
 Default unit: HZ

**Manual operation:** See "[Data Points](#)" on page 457

---

### CALCulate<n>:LIMit<li>:CONTRol:DOMain <SpanSetting>

Selects the domain of the limit line.

#### Suffix:

<n>	irrelevant
<li>	Limit line

#### Parameters:

<SpanSetting> FREQUency | TIME



**FREQuency**

For limit lines that apply to a range of frequencies.

**TIME**

For limit lines that apply to a period of time.

\*RST:       FREQuency

**Example:**

CALC:LIM:CONT:DOM FREQ

Select a limit line in the frequency domain.

**CALCulate<n>:LIMit<li>:CONTrol:MODE <Mode>**

Selects the horizontal limit line scaling.

**Suffix:**

<n>               irrelevant

<li>              [Limit line](#)

**Parameters:**

<Mode>

**ABSolute**

Limit line is defined by absolute physical values (Hz or s).

**RELative**

Limit line is defined by relative values related to the center frequency (frequency domain) or the left diagram border (time domain).

\*RST:       ABSolute

**CALCulate<n>:LIMit<li>:CONTrol:OFFSet <Offset>**

Defines an offset for a complete limit line.

Compared to shifting the limit line, an offset does not actually change the limit line definition points.

**Suffix:**

<n>               irrelevant

<li>              [Limit line](#)

**Parameters:**

<Offset>

Numeric value.

The unit depends on the scale of the x-axis.

\*RST:       0

Default unit: HZ

**Manual operation:** See "[X-Offset](#) " on page 456

**CALCulate<n>:LIMit<li>:CONTrol:SHIFt <Distance>**

Moves a complete limit line horizontally.

Compared to defining an offset, this command actually changes the limit line definition points by the value you define.

**Suffix:**

<n> irrelevant

<li> [Limit line](#)

**Parameters:**

<Distance> Numeric value.  
The unit depends on the scale of the x-axis.  
Default unit: HZ

**Manual operation:** See "[Shift x](#)" on page 457

**CALCulate<n>:LIMit<li>:CONTrol:SPACing <InterpolMode>**

Selects linear or logarithmic interpolation for the calculation of limit lines from one horizontal point to the next.

**Suffix:**

<n> [Window](#)

<li> [Limit line](#)

**Parameters:**

<InterpolMode> LINear | LOGarithmic  
\*RST: LIN

**Example:** CALC:LIM:CONT:SPAC LIN

**CALCulate<n>:LIMit<li>:LOWer[:DATA] <LimitLinePoints>...**

Defines the vertical definition points of a lower limit line.

**Suffix:**

<n> irrelevant

<li> [Limit line](#)

**Parameters:**

<LimitLinePoints> Variable number of level values.  
Note that the number of vertical values has to be the same as the number of horizontal values set with [CALCulate<n>:LIMit<li>:CONTrol\[:DATA\]](#). If not, the R&S VSE either adds missing values or ignores surplus values.  
\*RST: Limit line state is OFF  
Default unit: DBM

**Manual operation:** See "[Data Points](#)" on page 457

**CALCulate<n>:LIMit<li>:LOWer:MARGin <Margin>**

Defines an area around a lower limit line where limit check violations are still tolerated.

**Suffix:**

<n> irrelevant

<li> [Limit line](#)

**Parameters:**

<Margin> **numeric value**

\*RST: 0

Default unit: dB

**CALCulate<n>:LIMit<li>:LOWer:MODE <Mode>**

Selects the vertical limit line scaling.

**Suffix:**

<n> [Window](#)

<li> [Limit line](#)

**Parameters:**

<Mode> **ABSolute**

Limit line is defined by absolute physical values.

The unit is variable.

**RELative**

Limit line is defined by relative values related to the reference level (dB).

\*RST: ABSolute

**CALCulate<n>:LIMit<li>:LOWer:OFFSet <Offset>**

Defines an offset for a complete lower limit line.

Compared to shifting the limit line, an offset does not actually change the limit line definition points.

**Suffix:**

<n> [Window](#)

<li> [Limit line](#)

**Parameters:**

<Offset> Numeric value.

\*RST: 0

Default unit: dB

**Manual operation:** See "[Y-Offset](#)" on page 456

**CALCulate<n>:LIMit<li>:LOWer:SHIFt <Distance>**

Moves a complete lower limit line vertically.

Compared to defining an offset, this command actually changes the limit line definition points by the value you define.

**Suffix:**<n> [Window](#)<li> [Limit line](#)**Parameters:**<Distance> Defines the distance that the limit line moves.  
Default unit: DB**Manual operation:** See "[Shift y](#)" on page 458**CALCulate<n>:LIMit<li>:LOWer:SPACing <InterpolType>**

Selects linear or logarithmic interpolation for the calculation of a lower limit line from one horizontal point to the next.

**Suffix:**<n> [Window](#)<li> [Limit line](#)**Parameters:**<InterpolType> LINear | LOGarithmic  
\*RST: LIN**CALCulate<n>:LIMit<li>:LOWer:STATe <State>**

Turns a lower limit line on and off.

Before you can use the command, you have to select a limit line with [CALCulate<n>:LIMit<li>:NAME](#) on page 861.**Suffix:**

&lt;n&gt; irrelevant

<li> [Limit line](#)**Parameters:**<State> ON | OFF | 0 | 1  
**OFF | 0**  
Switches the function off  
**ON | 1**  
Switches the function on**Manual operation:** See "[Visibility](#)" on page 455**CALCulate<n>:LIMit<li>:LOWer:THReshold <Threshold>**

Defines a threshold for relative limit lines.

The R&amp;S VSE uses the threshold for the limit check, if the limit line violates the threshold.

**Suffix:**

<n> irrelevant

<li> [Limit line](#)

**Parameters:**

<Threshold> Numeric value.  
The unit depends on [CALCulate<n>:LIMit<li>:UNIT](#) on page 861.

\*RST: -200 dBm

Default unit: DBM

**Manual operation:** See "[Threshold](#)" on page 457

**CALCulate<n>:LIMit<li>:NAME <Name>**

Selects a limit line that already exists or defines a name for a new limit line.

**Suffix:**

<n> [Window](#)

<li> [Limit line](#)

**Parameters:**

<Name> String containing the limit line name.

\*RST: REM1 to REM8 for lines 1 to 8

**Manual operation:** See "[Name](#)" on page 457

**CALCulate<n>:LIMit<li>:UNIT <Unit>**

Defines the unit of a limit line.

**Suffix:**

<n> irrelevant

<li> [Limit line](#)

**Parameters:**

<Unit> DBM | DBPW | WATT | DBUV | DBMV | VOLT | DBUA | AMPere | DB | DBUV\_M | DBUA\_M | DEG | RAD | S | HZ | PCT | (unitless)

If you select a dB-based unit for the limit line, the command automatically turns the limit line into a relative limit line.

\*RST: DBM

**CALCulate<n>:LIMit<li>:UPPer[:DATA] <LimitLinePoints>...**

Defines the vertical definition points of an upper limit line.

**Suffix:**

<n> irrelevant

<li> [Limit line](#)

**Parameters:**

<LimitLinePoints> Variable number of level values.  
 Note that the number of vertical values has to be the same as the number of horizontal values set with [CALCulate<n>:LIMit<li>:CONTRol\[:DATA\]](#). If not, the R&S VSE either adds missing values or ignores surplus values.  
 \*RST: Limit line state is OFF  
 Default unit: DBM

**Manual operation:** See "[Data Points](#)" on page 457

**CALCulate<n>:LIMit<li>:UPPer:MARGIn <Margin>**

Defines an area around an upper limit line where limit check violations are still tolerated.

**Suffix:**

<n> irrelevant

<li> [Limit line](#)

**Parameters:**

<Margin> **numeric value**  
 \*RST: 0  
 Default unit: dB

**CALCulate<n>:LIMit<li>:UPPer:MODE <Mode>**

Selects the vertical limit line scaling.

**Suffix:**

<n> [Window](#)

<li> [Limit line](#)

**Parameters:**

<Mode> **ABSolute**  
 Limit line is defined by absolute physical values.  
 The unit is variable.  
**RELative**  
 Limit line is defined by relative values related to the reference level (dB).  
 \*RST: ABSolute

**CALCulate<n>:LIMit<li>:UPPer:OFFSet <Offset>**

Defines an offset for a complete upper limit line.

Compared to shifting the limit line, an offset does not actually change the limit line definition points.

**Suffix:**

<n> irrelevant

<li> [Limit line](#)

**Parameters:**

<Offset> Numeric value.

\*RST: 0

Default unit: dB

**Manual operation:** See "[Y-Offset](#)" on page 456

**CALCulate<n>:LIMit<li>:UPPer:SHIFt <Distance>**

Moves a complete upper limit line vertically.

Compared to defining an offset, this command actually changes the limit line definition points by the value you define.

**Suffix:**

<n> irrelevant

<li> [Limit line](#)

**Parameters:**

<Distance> Defines the distance that the limit line moves.

**Manual operation:** See "[Shift y](#)" on page 458

**CALCulate<n>:LIMit<li>:UPPer:SPACing <InterpolType>**

Selects linear or logarithmic interpolation for the calculation of an upper limit line from one horizontal point to the next.

**Suffix:**

<n> [Window](#)

<li> [Limit line](#)

**Parameters:**

<InterpolType> LINear | LOGarithmic

\*RST: LIN

**CALCulate<n>:LIMit<li>:UPPer:STATe <State>**

Turns an upper limit line on and off.

Before you can use the command, you have to select a limit line with [CALCulate<n>:LIMit<li>:NAME](#) on page 861.

**Suffix:**

<n> irrelevant

<li> [Limit line](#)

**Parameters:**

<State> ON | OFF | 0 | 1  
**OFF | 0**  
 Switches the function off  
**ON | 1**  
 Switches the function on

**Manual operation:** See "[Visibility](#)" on page 455

**CALCulate<n>:LIMit<li>:UPPer:THReshold <Limit>**

Defines an absolute limit for limit lines with a relative scale.

The R&S VSE uses the threshold for the limit check, if the limit line violates the threshold.

**Suffix:**

<n> irrelevant

<li> [Limit line](#)

**Parameters:**

<Limit> Numeric value.  
 The unit depends on [CALCulate<n>:LIMit<li>:UNIT](#) on page 861.  
 \*RST: -200  
 Default unit: dBm

**Manual operation:** See "[Threshold](#)" on page 457

**Managing limit lines**

Useful commands for managing limit lines described in the R&S VSE User Manual:

- `M MEM:SEL [ : ITEM ] :LIN:ALL`
- `M MEM:STOR:TYPE`
- `M MEM:LOAD:TYPE`

**Remote commands exclusive to managing limit lines:**

<a href="#">CALCulate&lt;n&gt;:LIMit&lt;li&gt;:ACTive?</a> .....	864
<a href="#">CALCulate&lt;n&gt;:LIMit&lt;li&gt;:COPY</a> .....	865
<a href="#">CALCulate&lt;n&gt;:LIMit&lt;li&gt;:DELeTe</a> .....	865
<a href="#">CALCulate&lt;n&gt;:LIMit&lt;li&gt;:STATe</a> .....	865
<a href="#">CALCulate&lt;n&gt;:LIMit&lt;li&gt;:TRACe&lt;t&gt;:CHECK</a> .....	866

**CALCulate<n>:LIMit<li>:ACTive?**

Queries the names of *all* active limit lines.



**Suffix:**

<n> irrelevant

<li> irrelevant

**Return values:**

<LimitLines> String containing the names of all active limit lines in alphabetical order.

**Example:**

```
CALC:LIM:ACT?
```

Queries the names of all active limit lines.

**Usage:**

Query only

**Manual operation:** See "[Visibility](#)" on page 455

**CALCulate<n>:LIMit<li>:COPY <Line>**

Copies a limit line.

**Suffix:**

<n> [Window](#)

<li> [Limit line](#)

**Parameters:**

<Line> **1 to 8**  
number of the new limit line

**<name>**

String containing the name of the limit line.

**Example:**

```
CALC:LIM1:COPY 2
```

Copies limit line 1 to line 2.

```
CALC:LIM1:COPY 'FM2'
```

Copies limit line 1 to a new line named FM2.

**Manual operation:** See "[Copy Line](#)" on page 456

**CALCulate<n>:LIMit<li>:DELete**

Deletes a limit line.

**Suffix:**

<n> [Window](#)

<li> [Limit line](#)

**Manual operation:** See "[Delete Line](#)" on page 456

**CALCulate<n>:LIMit<li>:STATe <State>**

Turns the limit check for a specific limit line on and off.

To query the limit check result, use [CALCulate<n>:LIMit<li>:FAIL?](#).

Note that a new command exists to activate the limit check and define the trace to be checked in one step (see `CALCulate<n>:LIMit<li>:TRACe<t>:CHECK` on page 866).

**Suffix:**

<n> irrelevant

<li> [Limit line](#)

**Parameters:**

<State> ON | OFF | 0 | 1  
**OFF | 0**  
 Switches the function off  
**ON | 1**  
 Switches the function on

**Example:**

`CALC:LIM:STAT ON`  
 Switches on the limit check for limit line 1.

**Manual operation:** See "[Disable All Lines](#)" on page 456

**CALCulate<n>:LIMit<li>:TRACe<t>:CHECK <State>**

Turns the limit check for a specific trace on and off.

To query the limit check result, use `CALCulate<n>:LIMit<li>:FAIL?`.

**Suffix:**

<n> [Window](#)

<li> [Limit line](#)

<t> [Trace](#)

**Parameters:**

<State> ON | OFF | 0 | 1  
**OFF | 0**  
 Switches the function off  
**ON | 1**  
 Switches the function on

**Example:**

`CALC:LIM3:TRAC2:CHEC ON`  
 Switches on the limit check for limit line 3 on trace 2.

**Manual operation:** See "[Traces to be Checked](#)" on page 455

**Checking the results of a limit check**

`CALCulate<n>:LIMit<li>:CLEAr[:IMMEDIATE]`..... 866  
`CALCulate<n>:LIMit<li>:FAIL?`..... 867

**CALCulate<n>:LIMit<li>:CLEAr[:IMMEDIATE]**

Deletes the result of the current limit check.

The command works on *all* limit lines in *all* measurement windows at the same time.

**Suffix:**

<n> [Window](#)

<li> irrelevant

**Example:**

CALC:LIM:CLE

Deletes the result of the limit check.

**CALCulate<n>:LIMit<li>:FAIL?**

Queries the result of a limit check in the specified window.

To get a valid result, you have to perform a complete measurement with synchronization to the end of the measurement before reading out the result. This is only possible for single measurement mode.

See also [INITiate<n>:CONTinuous](#) on page 547.

**Suffix:**

<n> [Window](#)

<li> [Limit line](#)

**Return values:**

<Result>      **0**  
                  PASS  
                  **1**  
                  FAIL

**Example:**

INIT;\*WAI

Starts a new sweep and waits for its end.

CALC2:LIM3:FAIL?

Queries the result of the check for limit line 3 in window 2.

**Usage:**

Query only

**Manual operation:** See "[Limit Check <n>](#)" on page 334

**Programming example: using limit lines**

The following examples demonstrate how to work with limit lines in a remote environment.

- [Example: configuring limit lines](#).....867
- [Example: performing a limit check](#).....869

**Example: configuring limit lines**

This example demonstrates how to configure 2 limit lines - an upper and a lower limit - for a measurement in a remote environment.

```
//----- Configuring the limit lines -----
CALC:LIM1:NAME 'FM1'
//Names limit line 1 'FM1'.
```

## Remote commands for the I/Q analyzer

```

CALC:LIM1:CONT:MODE ABS
//Selects absolute scaling for the horizontal axis.
CALC:LIM1:CONT 1 MHz,50MHz,100 MHz,150MHz,200MHz
//Defines 5 horizontal definition points for limit line 1.
CALC:LIM1:UPP:MODE ABS
//Selects an absolute vertical scale for limit line 1.
CALC:LIM1:UNIT DBM
//Selects the unit dBm for limit line 1.
CALC:LIM1:UPP -10,-5,0,-5,-10
//Defines 5 definition points for limit line 1.

CALC:LIM1:UPP:MARG 5dB
//Defines an area of 5 dB around limit line 1 where limit check violations
//are still tolerated.

CALC:LIM1:UPP:SHIF -10DB
//Shifts the limit line 1 by -10 dB.
CALC:LIM1:UPP:OFFS -3dB
//Defines an additional -3 dB offset for limit line 1.

CALC:LIM3:NAME 'FM3'
//Names limit line 3 'FM3'.

CALC:LIM3:LOW:MODE REL
//Selects a relative vertical scale for limit line 3.
CALC:LIM3:UNIT DB

CALC:LIM3:CONT 1 MHz,50MHz,100 MHz,150MHz,200MHz
//Defines 5 horizontal definition points for limit line 3.
CALC:LIM3:LOW -90,-60,-40,-60,-90
//Defines 5 definition points relative to the reference level for limit line 3.

CALC:LIM3:LOW:SHIF 2
//Shifts the limit line 3 by 2dB.
CALC:LIM3:LOW:OFFS 3
//Defines an additional 3 dB offset for limit line 3.

CALC:LIM3:LOW:THR -200DBM
//Defines a power threshold of -200dBm that must be exceeded for limit to be checked

CALC:LIM3:LOW:MARG 5dB
//Defines an area of 5dB around limit line 3 where limit check violations
//are still tolerated.

//----- Storing the limit lines -----
MMEM:SEL:CHAN:LIN:ALL ON
MMEM:STOR:TYPE CHAN
MMEM:STOR:STAT 1,'LimitLines_FM1_FM3'

```

**Example: performing a limit check**

This example demonstrates how to perform a limit check during a basic frequency sweep measurement in a remote environment. The limit lines configured in ["Example: configuring limit lines"](#) on page 867 are assumed to exist and be active.

```
//-----Preparing the instrument -----
*RST
//Resets the instrument
INIT:CONT OFF
//Selects single sweep mode.

//-----Configuring the measurement -----
FREQ:CENT 100MHz
//Defines the center frequency
FREQ:SPAN 200MHz
//Sets the span to 100 MHz on either side of the center frequency.
SENS:SWE:COUN 10
//Defines 10 sweeps to be performed in each measurement.
DISP:TRAC1:Y:RLEV 0dBm
//Sets the reference level to 0 dBm.
TRIG:SOUR IFP
TRIG:LEV:IFP -10dBm
//Defines triggering when the second intermediate frequency rises to a level
//of -10 dBm.

//-----Configuring the Trace-----
DISP:TRAC2 ON
DISP:TRAC2:MODE AVER
DISP:TRAC3 ON
DISP:TRAC3:MODE MAXH
//Configures 3 traces: 1 (default): clear/write; 2: average; 3: max hold

//----- Configuring the limit check -----
MMEM:LOAD:TYPE REPL
MMEM:LOAD:STAT 1,'LimitLines_FM1_FM3'
//Loads the limit lines stored in 'LimitLines_FM1_FM3'
CALC:LIM1:NAME 'FM1'
CALC:LIM1:UPP:STAT ON
//Activates upper limit FM1 as line 1.
CALC:LIM3:NAME 'FM3'
CALC:LIM3:LOW:STAT ON
//Activates lower limit line FM3 as line 3.
CALC:LIM:ACT?
//Queries the names of all active limit lines
//Result: 'FM1,FM3'
CALC:LIM1:TRAC3:CHEC ON
//Activates the upper limit to be checked against trace3 (maxhold trace)
CALC:LIM3:TRAC2:CHEC ON
//Activates the upper limit to be checked against trace2 (average trace)
CALC:LIM:CLE
```

```
//Clears the previous limit check results

//----- Performing the measurement-----
INIT;*WAI
//Initiates a new measurement and waits until the last sweep has finished.

//----- Retrieving limit check results-----

CALC:LIM1:FAIL?
//Queries the result of the upper limit line check
CALC:LIM3:FAIL?
//Queries the result of the lower limit line check
```

### 13.6.5 Retrieving results

The following commands can be used to retrieve the results of the I/Q Analyzer measurement.

- [Retrieving captured I/Q data](#)..... 870
- [Retrieving I/Q trace data](#)..... 873
- [Retrieving marker results](#)..... 876
- [Retrieving statistical results](#)..... 878

#### 13.6.5.1 Retrieving captured I/Q data

The captured I/Q data is output in the form of a list, three different formats can be selected for this list (see [TRACe:IQ:DATA:FORMat](#) on page 871).

For details on formats refer to [Chapter D, "Reference: format description for I/Q data files"](#), on page 967.

<a href="#">TRACe:IQ:DATA?</a> .....	870
<a href="#">TRACe:IQ:DATA:FORMat</a> .....	871
<a href="#">TRACe:IQ:DATA:MEMory?</a> .....	871

---

#### TRACe:IQ:DATA?

Initiates a measurement with the current settings and returns the captured data from I/Q measurements.

Corresponds to:

```
INIT:IMM;*WAI;:TRACe:IQ:DATA:MEMory?
```

However, the [TRACe:IQ:DATA?](#) command is quicker in comparison.

**Note:** Using the command with the \*RST values for the [TRACe:IQ:SET](#) command, the following minimum buffer sizes for the response data are recommended: ASCII format 10 kBytes, binary format: 2 kBytes

Trace data resulting from encrypted file input cannot be queried.

**Return values:**

<Results> Measured voltage for I and Q component for each sample that has been captured during the measurement.  
 The number of samples depends on [TRACe:IQ:SET](#). In ASCII format, the number of results is 2\* the number of samples.  
 The data format depends on [TRACe:IQ:DATA:FORMat](#) on page 871.  
 Default unit: V

**Example:**

```
TRAC:IQ:STAT ON
Enables acquisition of I/Q data
TRAC:IQ:SET NORM,10MHz,32MHz,EXT,POS,0,4096
Measurement configuration:
Sample Rate = 32 MHz
Trigger Source = External
Trigger Slope = Positive
Pretrigger Samples = 0
Number of Samples = 4096
FORMat REAL,32
Selects format of response data
TRAC:IQ:DATA?
Starts measurement and reads results
```

**Usage:**

Query only

**TRACe:IQ:DATA:FORMat <Format>**

Selects the order of the I/Q data.

For details see [Chapter D, "Reference: format description for I/Q data files"](#), on page 967.

**Parameters:**

<Format> COMPatible | IQBLock | IQPair

**COMPatible**

I and Q values are separated and collected in blocks: A block (512k) of I values is followed by a block (512k) of Q values, followed by a block of I values, followed by a block of Q values etc.  
 (I,I,I,I,Q,Q,Q,Q,I,I,I,I,Q,Q,Q,Q...)

**IQBLock**

First all I-values are listed, then the Q-values  
 (I,I,I,I,I,...Q,Q,Q,Q,Q)

**IQPair**

One pair of I/Q values after the other is listed  
 (I,Q,I,Q,I,Q...).

\*RST: IQBL

**TRACe:IQ:DATA:MEMory? [<OffsetSamples>,<NoOfSamples>]**

Queries the I/Q data currently stored in the capture buffer of the R&S VSE.

By default, the command returns all I/Q data in the memory. You can, however, narrow down the amount of data that the command returns using the optional parameters.

If no parameters are specified with the command, the entire trace data is retrieved.

In this case, the command returns the same results as [TRACe:IQ:DATA?](#). (Note, however, that the [TRAC:IQ:DATA?](#) command initiates a new measurement before returning the captured values, rather than returning the existing data in the memory.)

Trace data resulting from encrypted file input cannot be queried.

The command returns a comma-separated list of the measured values in floating point format (comma-separated values = CSV). The number of values returned is 2 \* the number of complex samples.

The total number of complex samples is displayed in the channel bar in manual operation and can be calculated as:

$\langle \text{SampleRate} \rangle * \langle \text{CaptureTime} \rangle$

(See [TRACe:IQ:SET](#), [TRACe:IQ:SRATe](#) on page 681 and [\[SENSE:\]SWEep:TIME](#) on page 678)

#### Query parameters:

**<OffsetSamples>** Selects an offset at which the output of data should start in relation to the first data. If omitted, all captured samples are output, starting with the first sample.

Range: 0 to  $\langle \# \text{ of samples} \rangle - 1$ , with  $\langle \# \text{ of samples} \rangle$  being the maximum number of captured values

\*RST: 0

**<NoOfSamples>** Number of samples you want to query, beginning at the offset you have defined. If omitted, all captured samples (starting at offset) are output.

Range: 1 to  $\langle \# \text{ of samples} \rangle - \langle \text{offset samples} \rangle$  with  $\langle \# \text{ of samples} \rangle$  maximum number of captured values

\*RST:  $\langle \# \text{ of samples} \rangle$

#### Return values:

**<IQData>** Measured value pair (I,Q) for each sample that has been recorded.

By default, the first half of the list contains the I values, the second half the Q values. The order can be configured using [TRACe:IQ:DATA:FORMat](#).

The data format of the individual values depends on [FORMat\[:DATA\]](#) on page 873.

Default unit: V



**Example:**

```
TRAC:IQ:STAT ON
```

Enables acquisition of I/Q data

```
TRAC:IQ:SET NORM,10MHz,32MHz,EXT,POS,100,4096
```

**Measurement configuration:**

Sample Rate = 32 MHz

Trigger Source = External

Trigger Slope = Positive

Pretrigger Samples = 100

Number of Samples = 4096

```
INIT;*WAI
```

Starts measurement and wait for sync

```
FORMat REAL,32
```

Determines output format

**To read the results:**

```
TRAC:IQ:DATA:MEM?
```

Reads all 4096 I/Q data

```
TRAC:IQ:DATA:MEM? 0,2048
```

Reads 2048 I/Q data starting at the beginning of data acquisition

```
TRAC:IQ:DATA:MEM? 2048,1024
```

Reads 1024 I/Q data from half of the recorded data

```
TRAC:IQ:DATA:MEM? 100,512
```

Reads 512 I/Q data starting at the trigger point (<Pretrigger Samples> was 100)

**Example:**

```
// Perform a single I/Q capture.
```

```
INIT;*WAI
```

```
// Determine output format (binary float32)
```

```
FORMat REAL,32
```

```
// Read 1024 I/Q samples starting at sample 2048.
```

```
TRAC:IQ:DATA:MEM? 2048,1024
```

**Usage:**

Query only

**13.6.5.2 Retrieving I/Q trace data**

In addition to the raw captured I/Q data, the results from I/Q analysis as shown in the result displays can also be retrieved.

FORMat[:DATA].....	873
FORMat:DEXPort:DSEPARATOR.....	874
TRACe<n>[:DATA]?.....	875
TRACe<n>[:DATA]:MEMory?.....	875
TRACe<n>[:DATA]:X?.....	876

**FORMat[:DATA] <Format>[, <BitLength>]**

Selects the data format that is used for transmission of trace data from the R&S VSE to the controlling computer.

Note that the command has no effect for data that you send to the R&S VSE. The R&S VSE automatically recognizes the data it receives, regardless of the format.

**Parameters:**

<b>&lt;Format&gt;</b>	<p><b>ASCIi</b> ASCII format, separated by commas. This format is almost always suitable, regardless of the actual data format. However, the data is not as compact as other formats can be.</p> <p><b>REAL</b> Floating-point numbers (according to IEEE 754) in the "definite length block format".</p>
<b>&lt;BitLength&gt;</b>	<p>Length in bits for floating-point results</p> <p><b>16</b> 16-bit floating-point numbers. Compared to <code>REAL, 32</code> format, half as many numbers are returned.</p> <p><b>32</b> 32-bit floating-point numbers For I/Q data, 8 bytes per sample are returned for this format setting.</p> <p><b>64</b> 64-bit floating-point numbers Compared to <code>REAL, 32</code> format, twice as many numbers are returned.</p>

**Example:**            `FORM REAL, 32`

**FORMat:DEXPort:DSEParator <Separator>**

Selects the decimal separator for data exported in ASCII format.

**Parameters:**

<b>&lt;Separator&gt;</b>	<p>POINT   COMMa</p> <p><b>COMMa</b> Uses a comma as decimal separator, e.g. <code>4,05</code>.</p> <p><b>POINT</b> Uses a point as decimal separator, e.g. <code>4.05</code>.</p> <p>*RST:            *RST has no effect on the decimal separator. Default is POINT.</p>
--------------------------	---

**Example:**            `FORM:DEXP:DSEP POIN`  
Sets the decimal point as separator.

**Manual operation:** See ["Saving the Result Summary \(Evaluation List\) to a File "](#) on page 346  
See ["Decimal Separator "](#) on page 404  
See ["Export Peak List "](#) on page 439

**TRACe<n>[:DATA]? <ResultType>**

This command queries current trace data and measurement results.

The data format depends on [FORMat \[:DATA\]](#) on page 873.

**Suffix:**

<n> [Window](#)

**Query parameters:**

<ResultType> Selects the type of result to be returned.  
See [Table 13-16](#).

**Example:**

TRAC? TRACE3  
Queries the data of trace 3.

**Manual operation:**

See ["Magnitude "](#) on page 168  
See ["Spectrum "](#) on page 168  
See ["I/Q-Vector "](#) on page 169  
See ["Real/Imag \(I/Q\) "](#) on page 170  
See ["Diagram "](#) on page 174

**Table 13-16: Return values for result type parameters**

Parameter	Result display / measurement	Results
TRACE1   ...   TRACE6		Returns the sweep point values as shown in the result display. For the auto peak detector, the command returns positive peak values only. (To retrieve negative peak values, define a second trace with a negative peak detector.)
	"Magnitude" "Spectrum"	Magnitude of the I and Q values (I+jQ) for each sweep point (=1001 values)
	"Real/Imag (I/Q)"	First the real parts for each trace point, then the imaginary parts (I <sub>1</sub> ,...,I <sub>1001</sub> , Q <sub>1</sub> ,...,Q <sub>1001</sub> ).
	"I/Q Vector"	The I and Q values for each trace point are returned (1001 pairs of I and Q values).
LIST	SEM measurements	Peak list evaluation, one peak per range is returned.
SPECTrogram   SGRam		For every frame in the spectrogram, the command returns the power levels that have been measured, one for each sweep point. The number of frames depends on the size of the history depth. The power level depends on the configured unit. Only REAL, 32 format is supported.

**TRACe<n>[:DATA]:MEMory? <Trace>,<OffsSwPoint>,<NoOfSwPoints>**

Queries the previously captured trace data for the specified trace from the memory. As an offset and number of sweep points to be retrieved can be specified, the trace data can be retrieved in smaller portions, making the command faster than the TRAC:DATA? command. This is useful if only specific parts of the trace data are of interest.

If no parameters are specified with the command, the entire trace data is retrieved; in this case, the command returns the same results as TRAC:DATA? TRACE1.

<b>Suffix:</b>	
<n>	Window
<b>Query parameters:</b>	
<Trace>	TRACE1   TRACE2   TRACE3   TRACE4   TRACE5   TRACE6
<OffsSwPoint>	The offset in sweep points related to the start of the measurement at which data retrieval is to start.
<NoOfSwPoints>	Number of sweep points to be retrieved from the trace.
<b>Return values:</b>	
<SweepPointValues>	
<b>Example:</b>	TRAC:DATA:MEM? TRACE1,25,100 Retrieves 100 sweep points from trace 1, starting at sweep point 25.
<b>Usage:</b>	Query only

---

#### TRACe<n>[:DATA]:X? <TraceNumber>

Queries the horizontal trace data for each sweep point in the specified window, for example the frequency in frequency domain or the time in time domain measurements.

This is especially useful for traces with non-equidistant x-values.

<b>Suffix:</b>	
<n>	Window
<b>Query parameters:</b>	
<TraceNumber>	Trace number. TRACE1   TRACE2   TRACE3   TRACE4   TRACE5   TRACE6
<b>Return values:</b>	
<X-Values>	
<b>Example:</b>	TRAC3:X? TRACE1 Returns the x-values for trace 1 in window 3.
<b>Usage:</b>	Query only

### 13.6.5.3 Retrieving marker results

The following commands are required to retrieve the results of markers.

Useful commands for retrieving marker results described elsewhere:

- [CALCulate<n>:DELTaMarker<m>:X](#) on page 814
- [CALCulate<n>:MARKer<m>:X](#) on page 817

#### Remote commands exclusive to retrieving marker results:

<a href="#">CALCulate&lt;n&gt;:DELTaMarker&lt;m&gt;:X:RELative?</a> .....	877
<a href="#">CALCulate&lt;n&gt;:DELTaMarker&lt;m&gt;:Y?</a> .....	877
<a href="#">CALCulate&lt;n&gt;:MARKer&lt;m&gt;:Y?</a> .....	877

**CALCulate<n>:DELTaMarker<m>:X:RELative?**

Queries the relative position of a delta marker on the x-axis.

If necessary, the command activates the delta marker first.

**Suffix:**

<n> [Window](#)

<m> [Marker](#)

**Return values:**

<Position> Position of the delta marker in relation to the reference marker.

**Example:**

CALC:DELT3:X:REL?

Outputs the frequency of delta marker 3 relative to marker 1 or relative to the reference position.

**Usage:** Query only

**Manual operation:** See "[Marker 1 / Delta Marker 1 / Delta Marker 2 / Delta Marker 16](#)" on page 417

**CALCulate<n>:DELTaMarker<m>:Y?**

Queries the result at the position of the specified delta marker.

**Suffix:**

<n> 1..n

<m> 1..n

**Return values:**

<Result> Result at the position of the delta marker.  
The unit is variable and depends on the one you have currently set.

Default unit: DBM

**Usage:** Query only

**Manual operation:** See "[Marker 1 / Delta Marker 1 / Delta Marker 2 / Delta Marker 16](#)" on page 417

**CALCulate<n>:MARKer<m>:Y?**

Queries the result at the position of the specified marker.

**Suffix:**


<n> 1..n

<m> 1..n

**Return values:**

<Result> Default unit: DBM

**Usage:** Query only

**Manual operation:** See "Marker Table " on page 173  
 See "Marker Peak List " on page 174  
 See "Marker 1 / Delta Marker 1 / Delta Marker 2 / Delta Marker 16 " on page 417

#### 13.6.5.4 Retrieving statistical results

The following commands are required to retrieve results from statistical calculations (see "Statistic APD" on page 170 and "Statistic CCDF" on page 171).

CALCulate<n>:MARKer<m>:Y:PERCent.....	878
CALCulate<n>:STATistics:CCDF:X<t>?.....	878
CALCulate<n>:STATistics:RESult<res>?.....	879

---

#### CALCulate<n>:MARKer<m>:Y:PERCent <Probability>

Sets a marker to a particular probability value. You can query the corresponding level with `CALCulate<n>:MARKer<m>:X`.

Using the command turns delta markers into normal markers.

##### Suffix:

<n>	Window
<m>	Marker

##### Parameters:

<Probability>	Range: 0 % to 100 % Default unit: %
---------------	--

##### Example:

`CALC1:MARK:Y:PERC 95PCT`  
 Positions marker 1 to a probability of 95 %.

**Manual operation:** See "Percent Marker (CCDF only)" on page 260

---

#### CALCulate<n>:STATistics:CCDF:X<t>? <Probability>

Queries the results of the CCDF.

##### Suffix:

<n>	Window
<t>	Trace

##### Query parameters:

<Probability>	<b>P0_01</b> Level value for 0.01 % probability
	<b>P0_1</b> Level value for 0.1 % probability
	<b>P1</b> P1: Level value for 1 % probability
	<b>P10</b> Level value for 10 % probability

**Return values:**

&lt;CCDF Result&gt;

**Example:**

CALC:STAT:CCDF:X1? P10

Returns the level values that are over 10 % above the mean value.

**Usage:**

Query only

**CALCulate<n>:STATistics:RESult<res>? <ResultType>**

Queries the results of a measurement for a specific trace.

**Suffix:**<n> [Window](#)<res> [Trace](#)**Query parameters:**

&lt;ResultType&gt;

**MEAN**

Average (=RMS) power in dBm measured during the measurement time.

**PEAK**

Peak power in dBm measured during the measurement time.

**CFACTOR**

Determined crest factor (= ratio of peak power to average power) in dB.

**ALL**

Results of all three measurements mentioned before, separated by commas: &lt;mean power&gt;,&lt;peak power&gt;,&lt;crest factor&gt;

**Example:**

CALC:STAT:RES2? ALL

Reads out the three measurement results of trace 2. Example of answer string: 5.56,19.25,13.69 i.e. mean power: 5.56 dBm, peak power 19.25 dBm, crest factor 13.69 dB

**Usage:**

Query only

## 13.7 Managing settings and results

The commands required to store and load software settings and import and export measurement results in a remote environment are described here.

The tasks for manual operation are described in [Chapter 8, "Data management"](#), on page 116.

### Addressing drives

The various drives can be addressed via the "mass storage instrument specifier" <msis> using the conventional Windows syntax. The internal hard disk is addressed by "C:".

For details on storage locations refer to [Chapter 8.2.2.2, "Storage location and file name"](#), on page 120.

The file names (<FileName> parameter) are given as string parameters enclosed in quotation marks. They also comply with Windows conventions. Windows file names do not distinguish between uppercase and lowercase notation.

### Wildcards

The two characters "\*" and "?" can be used as "wildcards", i.e., they are variables for a selection of several files. The question mark "?" replaces exactly one character, the asterisk replaces any of the remaining characters in the file name. "\*.\*" thus means all files in a directory.

### Path names

Storage locations can be specified either as absolute (including the entire path) or relative paths (including only subfolders of the current folder). Use the `MMEM:CDIR?` query to determine the current folder.

- [Restoring the default configuration \(preset\)](#)..... 880
- [General data storage and loading commands](#)..... 881
- [Selecting the items to store](#)..... 886
- [Storing and loading measurement settings](#)..... 889
- [Exporting captured and recorded I/Q data](#)..... 892
- [Storing or printing screenshots](#)..... 900

## 13.7.1 Restoring the default configuration (preset)

<a href="#">SYSTem:PRESet</a> .....	880
<a href="#">SYSTem:PRESet:CHANnel[:EXEC]</a> .....	880

---

### SYSTem:PRESet

This command presets the R&S VSE. It is identical to `*RST`.

**Example:**                `SYST:PRES`

**Usage:**                 Event

**Manual operation:**    See ["Restoring All Default Settings \(Preset All\)"](#) on page 116  
                               See ["Restoring All Default Settings and Deleting Instrument Configurations \(Preset All & Delete Instruments\)"](#) on page 116

---

### SYSTem:PRESet:CHANnel[:EXEC]

Restores the default software settings in the current channel.

Use `INST:SEL` to select the channel.



<b>Example:</b>	<pre>INST:SEL 'Spectrum2'</pre> <p>Selects the channel for "Spectrum2".</p> <pre>SYST:PRES:CHAN:EXEC</pre> <p>Restores the factory default settings to the "Spectrum2" channel.</p>
<b>Usage:</b>	Event
<b>Manual operation:</b>	<p>See <a href="#">"Restoring Channel Settings (Preset Selected Channel)"</a> on page 117</p> <p>See <a href="#">"Preset Channel"</a> on page 194</p>

### 13.7.2 General data storage and loading commands

See also:

- [FORMat \[:DATA\]](#) on page 873

<a href="#">MMEMory:CATalog</a> .....	881
<a href="#">MMEMory:CATalog:LONG</a> .....	882
<a href="#">MMEMory:CDIRectory</a> .....	882
<a href="#">MMEMory:COMMeNt</a> .....	882
<a href="#">MMEMory:COpy</a> .....	883
<a href="#">MMEMory:DATA</a> .....	883
<a href="#">MMEMory:DELeTe:IMMeDiate</a> .....	884
<a href="#">MMEMory:MDIRectory</a> .....	884
<a href="#">MMEMory:MOVe</a> .....	884
<a href="#">MMEMory:MSIS</a> .....	884
<a href="#">MMEMory:NAME</a> .....	884
<a href="#">MMEMory:NETWork:DISConnect</a> .....	885
<a href="#">MMEMory:NETWork:MAP</a> .....	885
<a href="#">MMEMory:NETWork:UNUSeddrives</a> .....	885
<a href="#">MMEMory:NETWork:USEDdrives</a> .....	886
<a href="#">MMEMory:RDIRectory</a> .....	886

---

#### **MMEMory:CATalog** <FileName>

This command returns the contents of a particular directory.

#### **Parameters:**

<FileName>	<p>String containing the path and directory</p> <p>If you leave out the path, the command returns the contents of the directory selected with <a href="#">MMEMory:CDIRectory</a> on page 882.</p> <p>The path may be relative or absolute. Using wildcards ("*") is possible to query a certain type of files only.</p> <p>If you use a specific file as a parameter, the command returns the name of the file if the file is found in the specified directory, or an error if the file is not found ("-256, "File name not found").</p>
------------	--

- Example:** `MMEM:CAT? 'C:\Data\SPOOL?.PNG'`  
Returns all files in C:\Data\ whose names start with SPOOL, have 6 characters and the extension .PNG, e.g.:  
SPOOL1.PNG, SPOOL2.PNG, SPOOL3.PNG
- Example:** `MMEM:CAT? 'C:\Data\SPOOL6.PNG'`  
Query whether the file 'SPOOL6.PNG' also exists in the directory;  
Result:  
-256,"File name not found;:MMEMory:CATalog?  
'C:\Data\SPOOL6.PNG'
- Manual operation:** See ["Selecting the Storage Location - Drive/ Path/ Files"](#) on page 130

**MMEMory:CATalog:LONG** <Directory>

This command returns the contents of a particular directory with additional information about the files.

**Parameters:**

- <Directory> String containing the path and directory.  
If you leave out the path, the command returns the contents of the directory selected with [MMEMory:CDIRectory](#) on page 882.  
The path may be relative or absolute. Using wildcards (\*) is possible to query a certain type of files only.

**MMEMory:CDIRectory** <Directory>

This command changes the current directory.

**Parameters:**

- <Directory> String containing the path to another directory.  
The path may be relative or absolute.

**MMEMory:COMMent** <Comment>

Defines a comment for the stored settings.

**Parameters:**

- <Comment> String containing the comment.

**Example:**

```
MMEMory:COMMent "ACP measurement with Standard
Tetra from 23.05."
MMEMory::MMEMory:STORel:STATe 1, "ACP_T"
As a result, in the selection list for recall settings, the comment
"ACP measurement with Standard Tetra from
23.05." is added to the ACP entry.
```

- Manual operation:** See ["Comment "](#) on page 122

**MMEMory:COPY** <FileName>, <FileName>

This command copies one or more files to another directory.

**Parameters:**

<FileName>	String containing the path and file name of the source file. Special behavior if optional external mixer is active and the destination is C:\ProgramData\Rohde-Schwarz\VSE\<>version_no>\user\cv1\ : the contents of the entire folder are copied. For details, see <a href="#">Chapter 10.2.6.4, "Conversion loss tables"</a> , on page 189.
<FileName>	String containing the path and name of the target file. The path may be relative or absolute.

**MMEMory:DATA** <FileName>[, <Data>]**MMEMory:DATA?** <FileName>

This command writes block data into a file. The delimiter must be set to EOI to obtain error-free data transfer.

When you query the contents of a file, you can save them in a file on the remote control computer.

The command is useful for reading stored settings files or trace data from the software or for transferring them to the software

**Parameters:**

<Data>	<block_data> Data block with the following structure. <b>#</b> Hash sign. <b>&lt;number&gt;</b> Length of the length information. <b>&lt;number&gt;</b> Length information of the binary data (number of bytes). <b>&lt;data&gt;</b> Binary data with the indicated <number> of bytes.
--------	---

**Parameters for setting and query:**

<FileName>

**Example:**

```
MMEM:NAME '\Public\User\Testfile.txt'
```

Creates a new file called 'testfile.txt'.

```
MMEM:DATA 'Testfile.txt',#220
```

Contents of the file

The parameter means:

#2: hash sign and length of the length information (20 bytes = 2 digits)

20: indicates the number of subsequent binary data bytes.

Contents of the file: store 20 binary bytes (characters) to the file.

```
MMEM:DATA? 'Testfile.txt'
```

Returns the contents of the file.

---

**MMEMory:DELeTe:IMMediate** <FileName>

This command deletes a file.

**Parameters:**

<FileName> String containing the path and file name of the file to delete.  
The path may be relative or absolute.

---

**MMEMory:MDIRectory** <Directory>

This command creates a new directory.

**Parameters:**

<Directory> String containing the path and new directory name  
The path may be relative or absolute.

---

**MMEMory:MOVE** <FileName>, <FileName>

This command moves a file to another directory.

The command also renames the file if you define a new name in the target directory.

If you do not include a path for <NewFileName>, the command just renames the file.

**Parameters:**

<FileName> String containing the path and file name of the source file.

<FileName> String containing the path and name of the target file.

**Example:**

```
MMEM:MOVE 'C:\TEST01.CFG', 'SETUP.CFG'  
Renames TEST01.CFG in SETUP.CFG in directory C:\.
```

---

**MMEMory:MSIS** <Drive>

This command selects the default storage device used by all MMEMory commands.

**Parameters:**

<Drive> 'A:' | 'C:' | ... | 'Z:'  
String containing the device drive name  
\*RST: n.a.

---

**MMEMory:NAME** <FileName>

This command has several purposes, depending on the context it is used in.

- It creates a new and empty file.
- It defines the file name for screenshots taken with `HCOPY:PRINT`. Note that you have to route the printer output to a file.

**Parameters:**

<FileName> String containing the path and name of the target file.

**Example:** MMEM:NAME 'C:\Data\PRINT1.BMP'  
Selects the file name.

---

### MMEMory:NETWork:DISConnect <Drive>[, <State>]

This command disconnects a network drive.

**Parameters:**

<Drive> String containing the drive name.

<State> 1 | 0 | ON | OFF  
Optional: determines whether disconnection is forced or not

**1 | ON**  
Disconnection is forced.

**0 | OFF**  
Disconnect only if not in use.

\*RST: 0

---

### MMEMory:NETWork:MAP <FilePath>, <IP>[, <UserName>, <Password>, <State>]

This command maps a drive to a server or server directory of the network.

Note that you have to allow sharing for a server or folder in Microsoft networks first.

**Parameters:**

<FilePath> String containing the drive name or path of the directory you want to map.

<IP> String containing the host name of the computer or the IP address and the share name of the drive.  
'<host name or IP address\share name>'

<UserName> String containing a user name in the network.  
The user name is optional.

<Password> String containing the password corresponding to the <User-Name>.  
The password is optional.

<State> ON | OFF | 1 | 0  
**ON | 1**  
Reconnects at logon with the same user name.  
**OFF | 0**  
Does not reconnect at logon.

---

### MMEMory:NETWork:UNUSeddrives

This command returns a list of unused network drives.

**MMEMory:NETWork:USEDdrives [<State>]**

This command returns a list of all network drives in use.

**Parameters:**

&lt;State&gt;

You do not have to use the parameter. If you do not include the parameter, the command returns a list of all drives in use. This is the same behavior as if you were using the parameter OFF.

**ON | 1**

Returns a list of all drives in use including the folder information.

**OFF | 0**

Returns a list of all drives in use.

**MMEMory:RDIRECTory <Directory>**

This command deletes the indicated directory.

**Parameters:**

&lt;Directory&gt;

String containing the path of the directory to delete.

Note that the directory you want to remove must be empty.

### 13.7.3 Selecting the items to store

The following commands select the items to be included in the configuration file.

Depending on the used command, either the items from the entire software (MMEMory:SElect[:ITEM] . . .), or only those from the currently selected channel (MMEM:SElect:CHANnel[:ITEM] . . .) are stored.

MMEMory:SElect:CHANnel[:ITEM]:ALL.....	886
MMEMory:SElect[:ITEM]:ALL.....	886
MMEMory:SElect:CHANnel[:ITEM]:DEFault.....	887
MMEMory:SElect[:ITEM]:DEFault.....	887
MMEMory:SElect:CHANnel[:ITEM]:HWSettings.....	887
MMEMory:SElect[:ITEM]:HWSettings.....	887
MMEMory:SElect:CHANnel[:ITEM]:LINes:ALL.....	887
MMEMory:SElect[:ITEM]:LINes:ALL.....	887
MMEMory:SElect:CHANnel[:ITEM]:NONE.....	888
MMEMory:SElect[:ITEM]:NONE.....	888
MMEMory:SElect:CHANnel[:ITEM]:SGRam.....	888
MMEMory:SElect[:ITEM]:SGRam.....	888
MMEMory:SElect:CHANnel[:ITEM]:TRACe[:ACTIve].....	888
MMEMory:SElect[:ITEM]:TRACe<1...3>[:ACTIve].....	888

**MMEMory:SElect:CHANnel[:ITEM]:ALL****MMEMory:SElect[:ITEM]:ALL**

This command includes all items when storing or loading a configuration file.

The items are:

- Limit lines: `MMEMoRY:SElect[:ITEM]:LiNeS:ALL` on page 887
- Spectrogram data: `MMEMoRY:SElect[:ITEM]:SGRam` on page 888
- Trace data: `MMEMoRY:SElect[:ITEM]:TRACe<1...3>[:ACTive]` on page 888

**Example:** `MMEM:SEL:ALL`

**Manual operation:** See "[Items](#)" on page 122

### **MMEMoRY:SElect:CHANnel[:ITEM]:DEFault** **MMEMoRY:SElect[:ITEM]:DEFault**

This command selects the current settings as the only item to store to and load from a configuration file.

**Manual operation:** See "[Items](#)" on page 122

### **MMEMoRY:SElect:CHANnel[:ITEM]:HWSettings <State>** **MMEMoRY:SElect[:ITEM]:HWSettings <State>**

This command includes or excludes measurement (hardware) settings when storing or loading a configuration file.

Measurement settings include:

- general channel configuration
- measurement hardware configuration including markers
- limit lines  
Note that a configuration may include no more than 8 limit lines. This number includes active limit lines as well as inactive limit lines that were used last. Therefore the combination of inactivate limit lines depends on the sequence of use with `MMEMoRY:LOAD:STATe` on page 890.
- color settings

Depending on the used command, either the items for all channels (`MMEMoRY:SElect[:ITEM] . . .`), or only those from the currently selected channel (`MMEM:SElect:CHANnel[:ITEM] . . .`) are stored or loaded.

#### **Parameters:**

<State>                   ON | OFF | 0 | 1  
\*RST:                    1

**Example:** `MMEM:SEL:HWS ON`

**Manual operation:** See "[Items](#)" on page 122

### **MMEMoRY:SElect:CHANnel[:ITEM]:LiNeS:ALL <State>** **MMEMoRY:SElect[:ITEM]:LiNeS:ALL <State>**

This command includes or excludes all limit lines (active and inactive) when storing or loading a configuration file.

**Parameters:**

<State> ON | OFF | 1 | 0  
 \*RST: 0

**Example:**

MMEM:SEL:LIN:ALL ON

**Manual operation:** See "Items" on page 122

**MMEMemory:SElect:CHANnel[:ITEM]:NONE****MMEMemory:SElect[:ITEM]:NONE**

This command does not include any of the following items when storing or loading a configuration file.

- Hardware configuration: [MMEMemory:SElect\[:ITEM\]:HWSettings](#) on page 887
- Limit lines: [MMEMemory:SElect\[:ITEM\]:LINES:ALL](#) on page 887
- Spectrogram data: [MMEMemory:SElect\[:ITEM\]:SGRam](#) on page 888
- Trace data: [MMEMemory:SElect\[:ITEM\]:TRACe<1...3>\[:ACTIVE\]](#) on page 888

**Example:**

MMEM:SEL:NONE

**Manual operation:** See "Items" on page 122

**MMEMemory:SElect:CHANnel[:ITEM]:SGRam <State>****MMEMemory:SElect[:ITEM]:SGRam <State>**

This command includes or excludes spectrogram data when storing or loading a configuration file.

**Parameters:**

<State> ON | OFF | 1 | 0  
 \*RST: 0

**Example:**

MMEM:SEL:SGR ON

Adds the spectrogram data to the list of data subsets.

**MMEMemory:SElect:CHANnel[:ITEM]:TRACe[:ACTIVE] <State>****MMEMemory:SElect[:ITEM]:TRACe<1...3>[:ACTIVE] <State>**

This command includes or excludes trace data when storing or loading a configuration file.

**Suffix:**

<1...3> irrelevant

**Parameters:**

<State> ON | OFF | 1 | 0  
 \*RST: 0, i.e. no traces are stored

**Example:**

MMEM:SEL:TRAC ON

**Manual operation:** See "Items" on page 122



### 13.7.4 Storing and loading measurement settings

See also:

- `INSTRUMENT[:SELECT]` on page 552 to select the channel.

<code>MMEMory:CLEar:ALL</code> .....	889
<code>MMEMory:CLEar:STATe</code> .....	889
<code>MMEMory:LOAD:AUTO</code> .....	889
<code>MMEMory:LOAD:STATe</code> .....	890
<code>MMEMory:LOAD:TYPE</code> .....	891
<code>MMEMory:STORe&lt;1 2&gt;:STATe</code> .....	891
<code>MMEMory:STORe&lt;1 2&gt;:STATe:NEXT</code> .....	892
<code>MMEMory:STORe&lt;1 2&gt;:TYPE</code> .....	892

---

#### **MMEMory:CLEar:ALL**

This command deletes all software configuration files in the current directory.

You can select the directory with `MMEMory:CDIRectory` on page 882.

**Example:** `MMEM:CLE:ALL`

---

#### **MMEMory:CLEar:STATe <1>, <FileName>**

This command deletes an instrument configuration file.

**Parameters:**

<1>

<FileName> String containing the path and name of the file to delete.  
The string may or may not contain the file's extension.

**Example:** `MMEM:CLE:STAT 1, 'TEST'`

---

#### **MMEMory:LOAD:AUTO <1>, <FileName>**

This command restores an software configuration and defines that configuration as the default state.

The default state is restored after a preset (`*RST`) or after you turn on the R&S VSE.

**Parameters:**

<1>

<FileName> **'Factory'**  
Restores the factory settings as the default state.  
**'<file\_name>**  
String containing the path and name of the configuration file.  
Note that only *All channel* files can be selected for the startup recall function; single channel files cause an error.

**Example:** `MMEM:LOAD:AUTO 1, 'C:\ProgramData\Rohde-Schwarz\VSE\<version_no>\user\TEST'`

**Manual operation:** See "[Startup Recall](#)" on page 124

---

### **MMEMory:LOAD:STATe** <1>, <FileName>

This command restores and activates the software configuration stored in a \*.dfl file.

Note that files with other formats cannot be loaded with this command.

The contents that are reloaded from the file are defined by the last selection made either in the "Save/Recall" dialogs (manual operation) or through the `MMEMory:SELEct[:ITEM]` commands (remote operation; the settings are identical in both cases).

By default, the selection is limited to the user settings ("User Settings" selection in the dialogs, `HWSettings` in SCPI). The selection is not reset by `[Preset]` or `*RST`.

As a consequence, the results of a SCPI script using the `MMEMory:LOAD:STATe` command without a previous `MMEMory:SELEct[:ITEM]` command may vary, depending on previous actions in the GUI or in previous scripts, even if the script starts with the `*RST` command.

It is therefore recommended that you use the appropriate `MMEMory:SELEct[:ITEM]` command before using `MMEMory:LOAD:STATe`.

#### **Parameters:**

<1>

<FileName> String containing the path and name of the file to load.  
The string may or may not include the file's extension.

#### **Example:**

```
MMEM:SEL:ALL
//Save all items (User Settings, All Traces, All Limit Lines) from
the R&S VSE.
MMEM:LOAD:STAT 1, 'C:
\ProgramData\Rohde-Schwarz\VSE\<version_no>\user\TEST01'
//Reloads all items
In the "Recall" dialog, select only "User Settings" and "All Limit
Lines".
MMEM:LOAD:STAT 1, 'C:
\ProgramData\Rohde-Schwarz\VSE\<version_no>\user\TEST01'
//Reloads user settings and all limit lines.
*RST
//Reset software.
MMEM:LOAD:STAT 1, 'C:
\ProgramData\Rohde-Schwarz\VSE\<version_no>\user\TEST01'
//Selected items are retained. Reloads user settings and all limit
lines.
Restart the software.
MMEM:LOAD:STAT 1, 'C:
\ProgramData\Rohde-Schwarz\VSE\<version_no>\user\TEST01'
// Selected items are set to default. Reloads only the user set-
tings.
```

**Manual operation:** See ["Recall"](#) on page 119  
See ["Recall in New Channel / Recall in Current Channel"](#)  
on page 123

---

### MMEMory:LOAD:TYPE <Type>

This command defines whether the channels that will be loaded with the subsequent `MMEM:LOAD:STAT` command will replace the current channel or activate a new channel.

**Parameters:**

<Type>                      NEW | REPLace

**NEW**  
The loaded settings will be activated in a new channel.

**REPLace**  
The loaded settings will replace the currently active channel.

\*RST:                      NEW

**Example:**

```
INST:SEL 'SPECTRUM2'
//Selects channel 'SPECTRUM2'.
MMEM:STOR:TYP CHAN
//Specifies that channel data is to be stored.
MMEM:STOR:STAT 1, 'C:\Analyzer\Spectrum'
//Stores the settings from channel
//'SPECTRUM2' to the file 'C:\Analyzer\Spectrum'.
MMEM:LOAD:TYPE NEW
//Specifies that channels are to be loaded
//in a new channel.
MMEM:LOAD:STAT 1, 'C:\Analyzer\Spectrum'
//Loads the channel from the file
//'C:\Analyzer\Spectrum' to the new channel
//'SPECTRUM2*'.

```

---

### MMEMory:STORe<1|2>:STATe <1>, <FileName>

This command saves the current software configuration in a \*.df1 file.

**Suffix:**

<1|2>                      irrelevant

**Parameters:**

<1>

<FileName>                      String containing the path and name of the target file.  
The file extension is .df1.

**Example:**

```
MMEM:STOR:STAT 1, 'Save'
Saves the current software settings in the file Save.dfl.

```

**Manual operation:** See ["Save File"](#) on page 123

**MMEMory:STORe<1|2>:STATe:NEXt**

This command saves the current software configuration in a \*.df1 file.

The file name depends on the one you have set with `MMEMory:STORe<1|2>:STATe` on page 891. This command adds a consecutive number to the file name.

**Suffix:**

<1|2> irrelevant

**Example:**

```
MMEM:STOR:STAT 1, 'Save'
```

Saves the current software settings in the file `Save.dfl`.

```
MMEM:STOR:STAT:NEXT
```

Saves the current software settings in the file `Save_001.dfl`

```
MMEM:STOR:STAT:NEXT
```

Saves the current software settings in the file `Save_002.dfl`

**Manual operation:** See "[Save File](#)" on page 123

**MMEMory:STORe<1|2>:TYPE <Type>**

This command defines whether the data from the entire software or only from the current channel is stored with the subsequent `MMEM:STOR...` command.

**Suffix:**

<1|2> irrelevant

**Parameters:**

<Type> INSTRument | CHANnel

**INSTRument**

Stores data from the entire software.

**CHANnel**

Stores data from an individual channel.

```
*RST: INST
```

**Example:**

```
INST:SEL 'SPECTRUM2'
```

Selects channel 'SPECTRUM2'.

```
MMEM:STOR:TYPE CHAN
```

Specifies that channel data is to be stored.

### 13.7.5 Exporting captured and recorded I/Q data

The following commands are required to export I/Q data files

Useful commands for exporting recorded data described elsewhere:

- `INSTRument:BLOCK:CHANnel[:SETTings]:RECORD` on page 549

**Remote commands exclusive to exporting recorded data:**

<a href="#">EXPort:IQ:FILE</a> .....	893
<a href="#">EXPort:IQ:FORMat</a> .....	893
<a href="#">EXPort:IQ:FORMat:CSV:DSEParator</a> .....	894
<a href="#">EXPort:IQ:INPut</a> .....	894
<a href="#">EXPort:IQ:META:DATA&lt;da&gt;</a> .....	895
<a href="#">EXPort:IQ:META:DATA&lt;da&gt;:SET</a> .....	895
<a href="#">EXPort:IQ:META:DATA&lt;da&gt;:VALue</a> .....	896
<a href="#">MMEMory:LOAD:IQ:STATe</a> .....	896
<a href="#">MMEMory:STORe&lt;n&gt;:IQ:COMMeNt</a> .....	897
<a href="#">MMEMory:STORe&lt;n&gt;:IQ:STATe</a> .....	897
<a href="#">MMEMory:STORe&lt;n&gt;:LIST</a> .....	897
<a href="#">MMEMory:STORe&lt;n&gt;:SGRam</a> .....	898
<a href="#">MMEMory:STORe&lt;n&gt;:SPECTrogram</a> .....	898
<a href="#">MMEMory:STORe&lt;n&gt;:TRACe</a> .....	898
<a href="#">RECording:COMMeNt[:DEFault]</a> .....	898
<a href="#">RECording:COUNT</a> .....	899
<a href="#">RECording:MAXimum:RLEN</a> .....	899
<a href="#">RECording:SETTling:TIME</a> .....	899

**EXPort:IQ:FILE** <FileName>

This command writes the captured I/Q data to a file.

The file type is defined using [EXPort:IQ:FORMat](#) on page 893.

**Parameters:**

<FileName> String containing the path and name of the target file.

**Example:**

```
EXP:IQ:FORM IQTAR
EXP:IQ:FILE 'C:
\ProgramData\Rohde-Schwarz\VSE\<version_no>\user\data.iq.t
Stores the captured I/Q data to the specified file.
```

**Usage:**

Asynchronous command

**Manual operation:** See "[Save](#)" on page 132

**EXPort:IQ:FORMat** <FileType>

Defines the file type used to store the I/Q data.

For details on file formats see [Chapter E, "Reference: supported I/Q file formats"](#), on page 969.

**Parameters:**

<FileType>

**IQTAR**

Compressed file format for an individual measurement channel

**CSV**

Comma-separated ASCII file format

**IQW**

Binary file format; contains only I/Q data from a single channel, without any meta data

**MAT**

Matlab v4 file format

**MAT7**

Matlab v7 file format

**AID**

AMMOS intermediate frequency data format

**Manual operation:** See "[File Type](#)" on page 130

**EXPort:IQ:FORMat:CSV:DSEParator** <Separator>

This command selects the decimal separator for exported I/Q data.

**Parameters:**

<Separator>

**COMMa**

Uses a comma as decimal separator, e.g. *4,05*.

**POINT**

Uses a point as decimal separator, e.g. *4.05*.

\*RST:        \*RST has no effect on the decimal separator.  
Default is POINT.

**Example:**

```
EXP:IQ:FORM:CSV:DSEP POIN
Sets the decimal point as separator.
```

**EXPort:IQ:INPut** <DataType>

Defines which data is exported to a file.

**Parameters:**

<DataType>

**RECORDing**

The most recently recorded data for the selected measurement channel is exported.

**CAPTure**

The currently captured data in the capture buffer for the selected measurement channel is exported.

**Example:**

```
INST:SEL 'My IQ Analyzer'
INST:BLOC:CHAN:REC;*WAI
EXP:IQ:INP REC
EXP:IQ:FILE 'C:
\R_S\Instr\user\MyIQAnalyzerData.iq.tar'
```

**Example:**

```
INST:SEL 'My IQ Analyzer'
INIT:IMM;*WAI
EXP:IQ:INP CAPT
EXP:IQ:FILE 'C:
\R_S\Instr\user\MyIQAnalyzerData.iq.tar'
```

**Manual operation:** See ["Data to export"](#) on page 130

---

**EXPort:IQ:META:DATA<da>** <DataType>, <State>

Defines which meta data is included in the data file if a user-defined set is specified (see [EXPort:IQ:META:DATA<da>:SET](#) on page 895).

Note that only the settings used during recording are stored; subsequent changes to the settings are ignored.

To query the values of the stored meta data after loading the file, see [EXPort:IQ:META:DATA<da>:VALue](#) on page 896.

**Suffix:**

<da>

**Parameters:**

<DataType> 'AttenElecState' | 'AttenElecValue[dB]' | 'AttenMech[dB]' | 'CalibrationState' | 'DeviceHwInfo' | 'DeviceId' | 'DeviceOptions' | 'FilterSettings' | 'HighPassFilterState' | 'Impedance[Ohm]' | 'InputCoupling' | 'InputPath' | 'MeasBandwidth[Hz]' | 'NumberOfPreSamples' | 'NumberOfPostSamples' | 'PreampGain[dB]' | 'PreampState' | 'RefLevel[dBm]' | 'RefLevelOffset[dB]' | 'RefOscillatorInput' | 'RefOscillatorFreq[Hz]' | 'TrgDropOut[s]' | 'TrgHoldoff[s]' | 'TrgHysteresis[dB]' | 'TrgLevel[dBm]' | 'TrgOffset[s]' | 'TrgSlope' | 'TrgSource' | 'YigPreSelectorState' |

Individual meta data type

<State> ON | OFF | 0 | 1

**OFF | 0**

Switches the function off

**ON | 1**

Switches the function on

**Example:** EXP:IQ:META:DATA MIN

Includes minimum set of meta data.

**Example:** EXP:IQ:META:DATA MIN

EXP:IQ:META:DATA 'InputPath',ON

EXP:IQ:META:DATA 'AttenMech[dB]',ON

EXP:IQ:META:DATA 'PreampState',ON

EXP:IQ:META:DATA 'Impedance[Ohm]',ON

Includes minimum set of data except for input path, plus mechanical attenuation, preamplifier, input impedance

**Manual operation:** See ["Meta Data Settings"](#) on page 131

---

**EXPort:IQ:META:DATA<da>:SET** <Set>

Defines which meta data is included in the data file. Either a fixed set of data can be specified, or a user-defined set of data types can be included.

Note that only the settings used during recording are stored; subsequent changes to the settings are ignored.

For `iqw` file format, no meta data is available.

To query the values of the stored meta data after loading the file, see `EXPort:IQ:METa:DATA<da>:VALue` on page 896.

**Suffix:**

<da> irrelevant

**Parameters:**

<Set> Defines a fixed set of meta data. For a detailed description of these sets see "[Meta Data Settings](#)" on page 131.

**MINimum**

The minimum set of measurement settings required to restore the channel later are stored.

**MAXimum**

All available meta data from the entire signal processing chain (input path to the output) is stored.

**CUSTom**

A user-defined set of individual data types is included. The data types are defined using `EXPort:IQ:METa:DATA<da>` on page 895.

**Example:**

`EXP:IQ:METa:DATA:SET MIN`

Includes minimum set of meta data.

**Manual operation:** See "[Meta Data Settings](#)" on page 131

**EXPort:IQ:METa:DATA<da>:VALue** <DataType>

**Suffix:**

<da> 1..n

**Parameters:**

<DataType>

**MMEMory:LOAD:IQ:STATe** 1, <FileName>

Restores I/Q data from a file.

The file extension is \*.iq.tar.

Note: This command is maintained for compatibility with various Rohde & Schwarz signal and spectrum analyzers only. For new R&S VSE remote control programs, use the `INSTrument:BLOCK:CHANnel[:SETTings]:FILE<fi>:IQTar` command.

**Setting parameters:**

<FileName> string

String containing the path and name of the source file.



**Example:** `MMEM:LOAD:IQ:STAT 1, 'C:\R_S\Instr\user\data.iq.tar'`  
Loads IQ data from the specified file.

**Usage:** Setting only

#### **MMEMory:STORe<n>:IQ:COMMeNt <Comment>**

Adds a comment to a file that contains I/Q data.

**Suffix:**  
<n> irrelevant

**Parameters:**  
<Comment> String containing the comment.

**Example:** `MMEM:STOR:IQ:COMM 'Device test 1b'`  
Creates a description for the export file.  
`MMEM:STOR:IQ:STAT 1, 'C:\R_S\Instr\user\data.iq.tar'`  
Stores I/Q data and the comment to the specified file.

**Manual operation:** See "[Comment](#)" on page 131

#### **MMEMory:STORe<n>:IQ:STATe <1>, <FileName>**

Writes the captured I/Q data to a file.

The file extension is \*.iq.tar. By default, the contents of the file are in 32-bit floating point format.

**Suffix:**  
<n> 1..n

**Parameters:**  
<1>  
<FileName> String containing the path and name of the target file.

**Example:** `MMEM:STOR:IQ:STAT 1, 'C:\R_S\Instr\user\data.iq.tar'`  
Stores the captured I/Q data to the specified file.

**Usage:** Asynchronous command

**Manual operation:** See "[Save](#)" on page 132

#### **MMEMory:STORe<n>:LIST <FileName>**

Exports the SEM and spurious emission list evaluation to a file.

The file format is \*.dat.

**Suffix:**  
<n> [Window](#)

**Parameters:**

<FileName> String containing the path and name of the target file.

**Example:**

```
MME:STOR:LIST 'test'
```

Stores the current list evaluation results in the `test.dat` file.

**Manual operation:**

See ["Saving the Result Summary \(Evaluation List\) to a File "](#) on page 346

**MME:STOR:n:SGR** <FileName>

**MME:STOR:n:SPECT**rogram <FileName>

Exports spectrogram data to an ASCII file.

The file contains the data for every frame in the history buffer. The data corresponding to a particular frame begins with information about the frame number and the time that frame was recorded.

Note that, depending on the size of the history buffer, the process of exporting the data can take a while.

**Suffix:**

<n> [Window](#)

**Parameters:**

<FileName> String containing the path and name of the target file.

**Example:**

```
MME:STOR:SGR 'Spectrogram'
```

Copies the spectrogram data to a file.

**Manual operation:**

See ["Export Spectrogram to ASCII File "](#) on page 405

**MME:STOR:n:TRAC**e <Trace>, <FileName>

Exports trace data from the specified window to an ASCII file.

You cannot query trace data resulting from encrypted file input.

**Suffix:**

<n> [Window](#)

**Parameters:**

<Trace> Number of the trace to be stored

<FileName> String containing the path and name of the target file.

**Example:**

```
MME:STOR1:TRAC 1, 'C:\TEST.ASC'
```

Stores trace 1 from window 1 in the file `TEST.ASC`.

**Manual operation:**

See ["Export Trace to ASCII File "](#) on page 404

**REC:COMM[:DEF]** <Comment>

Defines a default text for the comment to the stored data file. This default comment is displayed in the "Save I/Q Recording" dialog box (see [Comment](#)).

**Parameters:**

<Comment>            string

**Manual operation:**    See ["Default Comment"](#) on page 128

**RECORDing:COUNT** <NoRecords>

Defines the number of records to be stored. One record contains the data captured during the defined measurement time for a single channel. If more measurements are available than the specified number (x) of records, only the most recent (x) measurement results are stored.

As a rule, the recording is limited by the maximum record length provided by the instrument.

This setting is ignored for `RECORDing:MAXimum:RLEN` ON.

**Parameters:**

<NoRecords>            numeric value

\*RST:            1

**Manual operation:**    See ["Number of Records"](#) on page 128

**RECORDing:MAXimum:RLEN** <State>

Defines how many records are stored.

**Parameters:**

<State>            ON | OFF | 0 | 1

**OFF | 0**

Switches the function off

**ON | 1**

Switches the function on

**Manual operation:**    See ["Always Maximum Record Length"](#) on page 128

**RECORDing:SETTling:TIME** <State>

If enabled, additional samples (in addition to the specified capture time) are stored for the channel to compensate for settling effects.

This setting is required for connected instruments that do not support the standard bandwidth-to-sample-rate-ratio of 0.8 and thus require an upsampler. The additional samples compensate for settling effects in the filters used by the upsampler.

**Parameters:**

<State>            ON | OFF | 0 | 1

**OFF | 0**

Switches the function off

**ON | 1**

Switches the function on

**Manual operation:** See ["Additional Settling Samples"](#) on page 128

## 13.7.6 Storing or printing screenshots

**Useful commands to configure screenshots described elsewhere**

- [MMEMory:NAME](#) on page 884

**Remote commands exclusive to configure screenshots**

<a href="#">DISPlay:LOGO</a> .....	900
<a href="#">HCOPy:ABORt</a> .....	900
<a href="#">HCOPy:CMAP&lt;it&gt;:DEFault&lt;ci&gt;</a> .....	901
<a href="#">HCOPy:CMAP&lt;it&gt;:HSL</a> .....	901
<a href="#">HCOPy:CMAP&lt;it&gt;:PDEFined</a> .....	902
<a href="#">HCOPy:DEVice:COLor</a> .....	902
<a href="#">HCOPy:PRINt</a> .....	902
<a href="#">HCOPy:ITEM:ALL</a> .....	903
<a href="#">HCOPy:ITEM:WINDow:TEXT</a> .....	903
<a href="#">HCOPy:PAGE:ORientation</a> .....	903
<a href="#">HCOPy:TDSamp:STATe</a> .....	903
<a href="#">SYSTem:COMMunicate:PRINter:ENUMerate:FIRSt</a> .....	903
<a href="#">SYSTem:COMMunicate:PRINter:ENUMerate[:NEXT]</a> .....	904

---

### **DISPlay:LOGO** <State>

Activates/deactivates the printout of the Rohde & Schwarz company logo at the top of each page.

**Parameters:**

<State>            1 | 0 | ON | OFF  
                       **1 | ON**  
                       Logo is printed.  
                       **0 | OFF**  
                       Logo is not printed.  
                       \*RST:        1

**Example:**            DISP:LOGO OFF

**Manual operation:** See ["Print Logo"](#) on page 143

---

### **HCOPy:ABORt**

This command aborts a running hardcopy output.

**Example:**            HCOP:ABOR

**HCOPY:CMAP<it>:DEFault<ci>**

This command defines the color scheme for print jobs.

For details see "[Print Colors](#)" on page 150.

**Suffix:**

<it> Irrelevant.

<ci> See table below

**Example:**

HCOPY:CMAP:DEF2

Selects the optimized color set for the color settings of a print-out.

**Manual operation:** See "[Print Colors](#)" on page 150

Gui setting	Description	Remote command
"Screen Colors (Print)"	Selects the current screen colors for the printout. The background is always printed in white and the grid in black.	HCOPY:CMAP:DEF1
"Optimized Colors"	Selects an optimized color setting for the printout to improve the visibility of the colors (default setting). Trace 1 is blue, trace 2 black, trace 3 green, and the markers are turquoise. The background is always printed in white and the grid in black.	HCOPY:CMAP:DEF2
"User Defined Colors"	Selects the user-defined color setting.	HCOPY:CMAP:DEF3
	currently not used	HCOPY:CMAP:DEF3
"Screen Colors (Screenshot)"	Selects the current screen colors without any changes for a screenshot.	HCOPY:CMAP:DEF4

**HCOPY:CMAP<it>:HSL <hue>, <sat>, <lum>**

This command selects the color for various screen elements in print jobs.

**Suffix:**

<it> Selects the item for which the color scheme is to be defined.  
For more information see [Chapter 13.8.4, "CMAP suffix assignment"](#), on page 910.

**Parameters:**

<hue> **hue**  
tint  
Range: 0 to 1

<sat> **sat**  
saturation  
Range: 0 to 1

**<lum>**                    **lum**  
 brightness  
 Range:     0 to 1

**Example:**                `HCOP:CMAP2:HSL 0.3,0.8,1.0`  
 Changes the grid color

**Manual operation:**    See "[Defining User-specific Colors](#)" on page 152

### **HCOPy:CMAP<it>:PDEFined <Color>**

This command selects a predefined color for various screen elements in print jobs.

**Suffix:**

**<it>**                      1..n  
 Selects the item for which the color scheme is to be defined.  
 For more information see [Chapter 13.8.4, "CMAP suffix assignment"](#), on page 910.

**Parameters:**

**<Color>**                BLACK | BLUE | BROWn | GREen | CYAN | RED | MAGenta |  
 YELLow | WHITe | DGRay | LGRay | LBLue | LGRreen | LCYan |  
 LRED | LMAGenta

**Example:**                `HCOP:CMAP2:PDEF GRE`

**Manual operation:**    See "[Predefined Colors](#)" on page 152

### **HCOPy:DEVice:COLor <State>**

This command turns color printing on and off.

**Parameters:**

**<State>**                ON | OFF | 0 | 1  
**ON | 1**  
 Color printing  
**OFF | 0**  
 Black and white printing  
**\*RST:                1**

**Example:**                `HCOP:DEV:COL ON`

### **HCOPy:PRINT**

This command initiates a print job.

If you are printing to a file, the file name depends on [MMEMoRY:NAME](#) on page 884.

**Example:**                `HCOP:PRIN`

**Manual operation:**    See "[Print](#)" on page 143

---

**HCOPy:ITEM:ALL**

This command is maintained for compatibility reasons only. It has no effect.

**Manual operation:** See ["Print"](#) on page 143

---

**HCOPy:ITEM:WINDow:TEXT <Comment>**

This command defines a comment to be added to the printout.

**Parameters:**

<Comment> String containing the comment.

**Manual operation:** See ["Comment"](#) on page 143

---

**HCOPy:PAGE:ORientation <Orientation>**

The command selects the page orientation of the printout.

The command is only available if the output device is a printer or a PDF file.

**Parameters:**

<Orientation> LANDscape | PORTrait

\*RST: PORTrait

**Example:**

```
HCOP:DEV:LANG1 PDF
```

```
HCOP:PAGE:ORI2 LAND
```

**Manual operation:** See ["Orientation"](#) on page 143

---

**HCOPy:TDSTamp:STATe <State>**

This command includes or excludes the time and date in the printout.

**Parameters:**

<State> 1 | 0 | ON | OFF

**1 | ON**

The time and date are printed.

**0 | OFF**

The time and date are not printed.

\*RST: 1

**Manual operation:** See ["Print Date and Time"](#) on page 143

---

**SYSTem:COMMunicate:PRINter:ENUMerate:FIRSt**

This command queries the name of the first available printer.

To query the name of other installed printers, use [SYSTem:COMMunicate:PRINter:ENUMerate\[:NEXT\]](#) on page 904.

**SYSTem:COMMunicate:PRINter:ENUMerate[:NEXT]**

This command queries the name of available printers.

You have to use `SYSTem:COMMunicate:PRINter:ENUMerate:FIRSt` on page 903 for this command to work properly.

## 13.8 Configuring the software

- [Software support and information](#)..... 904
- [General display](#)..... 907
- [Colors and themes](#)..... 908
- [CMAP suffix assignment](#)..... 910
- [Configuring the application starter](#)..... 912
- [Programming example: Working with the application starter](#)..... 914

### 13.8.1 Software support and information

The following commands are required to obtain information concerning optional functionality, licenses, service functions, or system messages.

<a href="#">DIAGnostic:SERVice:SINFo?</a> .....	904
<a href="#">DIAGnostic:SERVice:VERSinfo?</a> .....	905
<a href="#">SYSTem:DFPRint</a> .....	906
<a href="#">SYSTem:OPTion:LICense[:LIST]</a> .....	906
<a href="#">SYSTem:OPTion:LICense[:LIST]?</a> .....	906

**DIAGnostic:SERVice:SINFo?**

This command creates a \*.zip file with important support information. The \*.zip file contains the system configuration information ("device footprint"), the current eeprom data and a screenshot of the screen display (if available).

This data is stored to the following directory on the PC the R&S VSE software is installed on:

```
C:\ProgramData\Rohde-Schwarz\VSE\\user.
```

As a result of this command, the created file name (including the drive and path) is returned.

You can use the resulting file name information as a parameter for the `MMEM:COPI` command to store the file on the controller PC.

(See [MMEMory:COPI](#) on page 883)



If you contact the Rohde & Schwarz support to get help for a certain problem, send this file to the support in order to identify and solve the problem faster.

**Return values:**

**<FileName>** C:\ProgramData\Rohde-Schwarz\VSE\<>version\_no>\user\  
\<>R&S Device ID>\_<CurrentDate>\_<CurrentTime>  
String containing the drive, path and file name of the created support file, where the file name consists of the following elements:  
**<R&S Device ID>**: The unique R&S device ID indicated in the "Versions + Options" information (See [Chapter 9.4.1, "Licensing, versions and options"](#), on page 159)  
**<CurrentDate>**: The date on which the file is created (<YYYYMMDD>)  
**<CurrentTime>**: The time at which the file is created (<HHMMSS>)

**Usage:** Query only

**Manual operation:** See "[Create R&S Support Information](#)" on page 164

**Example:**

DIAG:SERV:SINF?

**Result:**

"C:\Program  
Files\Rohde-Schwarz\VSE\<>version>\user\FSW-26\_1312.8000K26-100005-xx\_201504

**DIAGnostic:SERVice:VERSinfo?**

This command queries information about the hardware and software components.

**Return values:**

**<Information>** String containing the version of hardware and software components including the types of licenses for installed options.

**Example:**

DIAG:SERV:VERS?

Queries the version information.

**Response:**

R&S VSE |0.80a 51 Beta,  
Time Control Management ||active,  
Analog Modulation Analysis K7|0.70|permanent,  
maintenance until 2018-09-30,  
Software Maintenance || Expires on 2018-09-30

**Usage:** Query only

**SYSTem:DFPRint**

Creates an \*.xml file with information on installed hardware, software, image and FPGA versions. The \*.xml file is stored under

C:\ProgramData\Rohde-Schwarz\VSE\\devicedata\xml\  
DeviceFootprint\_\* on the instrument. It is also output to the remote interface as binary data.

**Return values:**

<xxx> Contents of the xml file in binary format.

**Example:** SYST:DFPR?

**Manual operation:** See ["Save Device Footprint"](#) on page 164

**SYSTem:OPTion:LiCense[:LIST] <Option>, <State>, <Days>**

Defines the availability of floating licenses for the R&S VSE.

**Parameters:**

<Option> string value

Name of an option whose license is set.

<State> ON | OFF | OCCupy

State of the license

**ON**

Floating license enabled

**OFF**

Floating license disabled

**OCCupy**

Occupied license

<Days> The time period that an occupied license is stored locally after it is retrieved from the license server.

Range: 1 to 7

Default unit: days

**Example:** Disable floating license for K102:

SYST:OPT:LiC 'K102',OFF

**Example:** Configure occupied license for K100 for 5 days:

SYST:OPT:LiC 'K100',OCC,5

**Usage:** Setting only

**Manual operation:** See ["Enabling/disabling floating licenses"](#) on page 161

**SYSTem:OPTion:LiCense[:LIST]? [<Option>]**

Queries the availability of floating licenses on all license servers configured on the R&S VSE.

**Query parameters:**

<Option> string value  
Optional: Name of an option whose license is queried.

**Return values:**

<Option> string values  
Comma-separated list of strings for available options with a floating license.

<State> ON | OFF | OCCupy  
State of the license  
**ON**  
Floating license enabled  
**OFF**  
Floating license disabled  
**OCCupy**  
Occupied license

<Days> The remaining time period that an occupied license is available.  
Range: 1 to 7  
Default unit: days

**Example:** Query which type of license is available for K100:

```
SYST:OPT:LIC? 'K100'
//Result: K100 floating
//K100,ON
```

**Example:** Query which licenses are available for the R&S VSE:

```
SYST:OPT:LIC?
//Result:
B4,ON,B5,ON,B21,ON,B114,ON,K10,OFF,K91,ON,
K91AC,ON,K91N,OFF,K100,OCC,
2,K101,ON,K102,ON,K103,ON,K104,ON,K105,ON,K106,
ON
```

**Usage:** Query only

**Manual operation:** See "[License state \( \)](#)" on page 161

## 13.8.2 General display

<a href="#">DISPlay:ANNotation:CBAR</a> .....	907
<a href="#">DISPlay:ANNotation:FREQuency</a> .....	908
<a href="#">DISPlay:SBAR[:STATe]</a> .....	908

**DISPlay:ANNotation:CBAR <State>**

This command hides or displays the channel bar information.

**Parameters:**

<State> ON | OFF | 0 | 1  
 \*RST: 1

**Example:**

DISP:ANN:CBAR OFF

**DISPlay:ANNotation:FREQuency** <State>

This command turns the label of the x-axis on and off.

**Parameters:**

<State> ON | OFF | 0 | 1  
 \*RST: 1

**Example:**

DISP:ANN:FREQ OFF

**Manual operation:** See "[Diagram Footer \(Annotation\)](#)" on page 148

**DISPlay:SBAR[:STATe]** <State>

This command turns the status bar on and off.

**Parameters:**

<State> ON | OFF | 0 | 1  
 \*RST: 1

**Example:**

DISP:SBAR:OFF

**Manual operation:** See "[Status Bar](#)" on page 148

### 13.8.3 Colors and themes

#### Useful commands to customize display colors described elsewhere

The HCO<sub>Py</sub> commands define the print colors and thus only take effect on the display colors, if the display shows the printing colors.

- [HCO<sub>Py</sub>:CMAP<it>:DEFault<ci>](#) on page 901
- [HCO<sub>Py</sub>:CMAP<it>:HSL](#) on page 901
- [HCO<sub>Py</sub>:CMAP<it>:PDEFined](#) on page 902

#### Remote commands exclusive to customize the display colors and themes

<a href="#">DISPlay:CMAP&lt;it&gt;:DEFault&lt;ci&gt;</a> .....	909
<a href="#">DISPlay:CMAP&lt;it&gt;:HSL</a> .....	909
<a href="#">DISPlay:CMAP&lt;it&gt;:PDEFined</a> .....	910
<a href="#">DISPlay:THEMe:CATalog?</a> .....	910
<a href="#">DISPlay:THEMe:SElect</a> .....	910

**DISPlay:CMAP<it>:DEFault<ci>**

This command selects the color scheme for the display. The query returns the default color scheme.

**Suffix:**

<it>	Irrelevant.
<ci>	1 Default color set 1 with a black background and white grid. 2 Default color set 2 with a white background and a black grid. 3 User-defined colors. Suffix irrelevant for query

**Return values:**

<DefScheme>	1   2   3 The default color scheme used for the screen, as specified by the <ci> suffix.
-------------	---

**Example:**

```
DISP:CMAP:DEF2
Selects default setting 2 (white background and a black grid) for
screen colors.
DISP:CMAP:DEF?
//Result: 2
```

**Manual operation:** See "[Screen Colors](#)" on page 150

**DISPlay:CMAP<it>:HSL <hue>, <sat>, <lum>**

This command selects the color for various screen elements in the display.

**Suffix:**

<it>	1..n Selects the item for which the color scheme is to be defined. For more information see <a href="#">Chapter 13.8.4, "CMAP suffix assignment"</a> , on page 910.
------	---

**Parameters:**

<hue>	tint Range: 0 to 1
<sat>	saturation Range: 0 to 1
<lum>	brightness Range: 0 to 1

**Example:**

```
DISP:CMAP2:HSL 0.3,0.8,1.0
Changes the grid color.
```

**DISPlay:CMAP<it>:PDEFined <Color>**

This command selects a predefined color for various screen elements.

**Suffix:**

<it> 1..n  
Selects the item for which the color scheme is to be defined.  
For more information see [Chapter 13.8.4, "CMAP suffix assignment"](#), on page 910.

**Parameters:**

<Color> BLACK | BLUE | BROWN | GREEN | CYAN | RED | MAGenta |  
YELLOW | WHITE | DGRAY | LGRAY | LBLue | LGREEN | LCYan |  
LRED | LMAGenta

**Example:** DISP:CMAP2:PDEF GRE

**Manual operation:** See ["Restoring the User Settings to Default Colors"](#) on page 152

**DISPlay:THEMe:CATalog?**

This command queries all available display themes.

**Return values:**

<Themes> String containing all available display themes.

**Example:** DISP:THEMe:CAT?

**Usage:** Query only

**DISPlay:THEMe:SElect <Theme>**

This command selects the display theme.

**Parameters:**

<Theme> String containing the name of the theme.  
\*RST: SPL

**Example:** DISP:THEM:SEL "BlueOcean"

**Manual operation:** See ["Theme "](#) on page 150

### 13.8.4 CMAP suffix assignment

Several commands to change the color settings of individual items of the display or printout are available. Which item is to be configured is defined using a <CMAP> suffix. The following assignment applies:

Suffix	Description
CMAP1	Background
CMAP2	Grid

Suffix	Description
CMAP3 *)	Common Text
CMAP4 *)	Check Status OK
CMAP5 *)	Check Status Error
CMAP6 *)	Text Special 1
CMAP7 *)	Text Special 2
CMAP8	Trace 1
CMAP9	Trace 2
CMAP10	Trace 3
CMAP11	Marker Info Text
CMAP12	Limit Lines
CMAP13	Limit and Margin Check – "Pass"
CMAP14	Limit and Margin Check – "Fail"
CMAP15 *)	Softkey Text
CMAP16 *)	Softkey Background
CMAP17 *)	Selected Field Text
CMAP18 *)	Selected Field Background
CMAP19 *)	Softkey 3D Bright Part
CMAP20 *)	Softkey 3D Dark Part
CMAP21 *)	Softkey State "On"
CMAP22 *)	Softkey State "Dialog open"
CMAP23 *)	Softkey Text Disabled
CMAP24	Logo
CMAP25	Trace 4
CMAP26	Grid – Minorlines
CMAP27	Marker
CMAP28	Display Lines
CMAP29 *)	Sweepcount – Text
CMAP30	Limit and Margin Check – Text
CMAP31	Limit and Margin Check – "\"Margin\""
CMAP32 *)	Table Overall – Title Text
CMAP33 *)	Table Overall – Title Background
CMAP34 *)	Table Overall – Text
CMAP35 *)	Table Overall – Background

Suffix	Description
CMAP36 *)	Table Value – Title Text
CMAP37 *)	Table Value – Title Background
CMAP38 *)	Table Value – Text
CMAP39 *)	Table Value – Background
CMAP40	Trace 5
CMAP41	Trace 6

\*) these settings can only be defined via the theme (`DISPlay:THEMe:SElect`) and are thus ignored in the SCPI command

### 13.8.5 Configuring the application starter

The Application Starter allows you to start any external application directly from the R&S VSE firmware, if it was added to the firmware manually in advance.

The commands for manual operation are described in [Chapter 9.3, "Application starter"](#), on page 154

<code>SYSTem:PLUGin:APPStarter:DELeTe</code> .....	912
<code>SYSTem:PLUGin:APPStarter:DIRectory</code> .....	913
<code>SYSTem:PLUGin:APPStarter:EXECute</code> .....	913
<code>SYSTem:PLUGin:APPStarter:ICON</code> .....	913
<code>SYSTem:PLUGin:APPStarter:NAME</code> .....	914
<code>SYSTem:PLUGin:APPStarter:PARams</code> .....	914
<code>SYSTem:PLUGin:APPStarter:SElect</code> .....	914

---

**`SYSTem:PLUGin:APPStarter:DELeTe`** <ApplicationGroup>, <DisplayName>

Removes the specified application from the Application Starter dialog box.

**Setting parameters:**

<ApplicationGroup> 'External' | 'User'

The group (tab) of applications in the Application Starter that the application belongs to.

**'External'**

External Applications

**'User'**

User Applications

<DisplayName> Name of the application in the Application Starter

**Example:** `SYSTem:PLUGin:APPStarter:DELeTe 'External', 'Notepad++'`

**Usage:** Setting only

**Manual operation:** See ["Delete Link"](#) on page 157



---

**SYSTem:PLUGIn:APPStarter:DIRectory** <WorkingDir>

Defines the working directory used by the selected application.

**Parameters:**

<WorkingDir>

**Example:** SYSTem:PLUGIn:APPStarter:DIRectory 'C:\TEMP'

**Manual operation:** See "[Working Directory](#)" on page 157

---

**SYSTem:PLUGIn:APPStarter:EXECute** <ApplicationGroup>, <DisplayName>

Starts the specified application directly on the R&S VSE.

Note that for data security reasons, executable applications cannot be added to the Application Starter remotely. Only applications added to the firmware manually in advance can be executed remotely.

**Setting parameters:**

<ApplicationGroup> 'External' | 'User'

The group (tab) of applications in the Application Starter that the application belongs to.

**'External'**

External Applications

**'User'**

User Applications

<DisplayName> Name of the application in the Application Starter

**Example:** SYSTem:PLUGIn:APPStarter:EXECute 'External',  
'Notepad++'

**Usage:** Setting only

**Manual operation:** See "[Application buttons](#)" on page 155

---

**SYSTem:PLUGIn:APPStarter:ICON** <IconPath>, <IconIndex>

Defines an icon for the selected application to be displayed in the "Application Starter" dialog box.

**Parameters:**

<IconPath> Path and file name for icon

<IconIndex> Position of the icon as an ordered number within the dialog box.

**Example:** SYSTem:PLUGIn:APPStarter:ICON 'C:\Program Files  
(x86)\Inkscape\inkscape.exe', '0'

**Manual operation:** See "[Choose Icon](#)" on page 157

---

---

**SYSTem:PLUGIn:APPStarter:NAME** <DisplayName>

Defines the name of the application as displayed in the "Application Starter" dialog box.

**Parameters:**

<DisplayName>

**Example:**               SYSTem:PLUGIn:APPStarter:NAME 'MyEditor'

**Manual operation:**   See "[Display Name](#)" on page 157

---

**SYSTem:PLUGIn:APPStarter:PARams** <Params>

Defines parameters that are provided with the application for execution, for example arguments for a custom script.

**Parameters:**

<Params>

**Example:**               SYSTem:PLUGIn:APPStarter:PARams 'D:  
                              \Scripts\freqsweep.inp'

**Manual operation:**   See "[Parameters](#)" on page 156

---

**SYSTem:PLUGIn:APPStarter:SElect** <ApplicationGroup>, <DisplayName>

Selects the application to be executed in subsequent commands.

The query returns the currently selected application.

**Parameters:**

<ApplicationGroup> 'External' | 'User'

The group (tab) of applications in the Application Starter that the application belongs to.

**'External'**

External Applications

**'User'**

User Applications

<DisplayName>       Name of the application in the Application Starter

**Example:**               SYSTem:PLUGIn:APPStarter:SElect 'External',  
                              'Notepad++'

**Manual operation:**   See "[Select](#)" on page 155  
                          See "[Edit Properties](#)" on page 156  
                          See "[Application](#)" on page 156

---

### 13.8.6 Programming example: Working with the application starter

The following programming example demonstrates how to use the remote commands for the application starter.

## Commands for remote instrument operation

```
//Add the notepad application to the "External" tab of the application starter manually
//via the graphical user interface of the instrument

//Select the notepad application for further configuration
SYSTem:PLUGIn:APPStarter:SElect 'External','Notepad++'
//Change the displayed name of the notepad application
SYSTem:PLUGIn:APPStarter:NAME 'MyEditor'
//Add an icon to display in the dialog box
SYSTem:PLUGIn:APPStarter:ICON 'C:\temp\script_icon.png','0'
//Define the working directory for the application
SYSTem:PLUGIn:APPStarter:DIRectory 'C:\Scripts\'
//Define the file to open in the editor
SYSTem:PLUGIn:APPStarter:PARAmS 'freqsweep.inp'
//Execute the application
SYSTem:PLUGIn:APPStarter:EXECute 'External','MyEditor'

//*****
//Configure the default IECWIN application to execute a predefined script.
//Add the IECWIN application to the "External" tab of the application starter manually
//via the graphical user interface of the instrument
SYSTem:PLUGIn:APPStarter:SElect 'External','IECWIN'
//Define the working directory for the application
SYSTem:PLUGIn:APPStarter:DIRectory 'C:\Scripts\'
//Define the script to perform in the IECWIN application
SYSTem:PLUGIn:APPStarter:PARAmS 'freqsweep.inp'
//Execute the script
SYSTem:PLUGIn:APPStarter:EXECute 'External','IECWIN'
```

## 13.9 Commands for remote instrument operation

The following commands are required to shutdown or reboot the R&S VSE from a remote PC.

<a href="#">DEVIce:LOCKing:DEFault</a> .....	915
<a href="#">SYSTem:CLOGging</a> .....	916
<a href="#">SYSTem:COMMunicate:GPIB[:SELF]:RTERminator</a> .....	916
<a href="#">SYSTem:DISPlay:LOCK</a> .....	917
<a href="#">SYSTem:DISPlay:UPDate</a> .....	917
<a href="#">SYSTem:IDENtify:FACTory</a> .....	917
<a href="#">SYSTem:IDENtify[:STRing]</a> .....	917

---

### DEVIce:LOCKing:DEFault <STATe>

Defines the default setting for the VISA connection lock for all subsequent instrument connections (see [DEVIce:LOCKing](#) on page 520).

#### Parameters:

<State>                    ON | OFF | 0 | 1

**OFF | 0**

Switches the function off

**ON | 1**

Switches the function on

**Example:** `DEV:LOCK:DEF ON`**Manual operation:** See "[Lock new VISA connections](#)" on page 499**SYSTem:CLOGging <State>**

This command turns logging of remote commands on and off.

**Parameters:**

&lt;State&gt; ON | OFF | 1 | 0

**ON | 1**

Writes all remote commands that have been sent to a file.

The destination is C :

\ProgramData\Rohde-Schwarz\VSE\ScpiLog.<no.>.

where &lt;no.&gt; is a sequential number

A new log file is started each time logging was stopped and is restarted.

**OFF | 0**

\*RST: 0

**Manual operation:** See "[I/O Logging](#)" on page 499**SYSTem:COMMunicate:GPIB[:SELF]:RTERminator <Terminator>**

This command selects the GPIB receive terminator.

Output of binary data from the instrument to the control computer does not require such a terminator change.

**Parameters:**

&lt;Terminator&gt; LFEOI | EOI

**LFEOI**

According to the standard, the terminator in ASCII is &lt;LF&gt; and/or &lt;EOI&gt;.

**EOI**

For binary data transfers (e.g. trace data) from the control computer to the instrument, the binary code used for &lt;LF&gt; might be included in the binary data block, and therefore should not be interpreted as a terminator in this particular case. This can be avoided by using only the receive terminator EOI.

\*RST: LFEOI

**Example:** `SYST:COMM:GPIB:RTER EOI`**Manual operation:** See "[GPIB Terminator](#)" on page 500

**SYSTem:DISPlay:LOCK** <State>

Defines whether the "Display Update" function remains available in remote operation or not.

**Parameters:**

<State> ON | OFF | 0 | 1

**OFF | 0**

The function remains available.

**ON | 1**

The function is not available and the display is not updated during remote operation.

\*RST: 0

**SYSTem:DISPlay:UPDate** <State>

This command turns the display during remote operation on and off.

If on, the R&S VSE updates the diagrams, traces and display fields only.

The best performance is obtained if the display is off during remote control operation.

**Parameters:**

<State> ON | OFF | 1 | 0

\*RST: 0

**Example:** SYST:DISP:UPD ON

**Manual operation:** See "[Remote Display Update](#)" on page 499

**SYSTem:IDENtify:FACTory**

This command resets the query to \*IDN? to its default value.

**Usage:** Event

**Manual operation:** See "[Reset to Factory String](#)" on page 499

**SYSTem:IDENtify[:STRing]** <String>

This command defines the response to \*IDN?.

**Parameters:**

<String> String containing the description of the instrument.

**Manual operation:** See "[Identification String](#)" on page 498

## 13.10 Working with status registers

- [Using the status register](#)..... 918

### 13.10.1 Using the status register

For more information on the contents of the status registers see:

- [Remote control via SCPI](#)
- ["STATus:OPERation register" on page 481](#)
- ["STATus:QUESTionable:EXTended register" on page 483](#)
- ["STATus:QUESTionable:FREQuency register" on page 484](#)
- ["STATus:QUESTionable:LIMit register" on page 484](#)
- ["STATus:QUESTionable:LMARgin register" on page 485](#)
- ["STATus:QUESTionable:POWer register" on page 486](#)
- ["STATus:QUESTionable:TIME register" on page 486](#)
- [General status register commands..... 918](#)
- [Reading out the CONDition part..... 919](#)
- [Reading out the EVENT part..... 919](#)
- [Controlling the ENABle part..... 920](#)
- [Controlling the negative transition part..... 920](#)
- [Controlling the positive transition part..... 921](#)

#### 13.10.1.1 General status register commands

<a href="#">STATus:PRESet.....</a>	<a href="#">918</a>
<a href="#">STATus:QUEue[:NEXT]?.....</a>	<a href="#">918</a>

---

#### STATus:PRESet

Resets the edge detectors and `ENABle` parts of all registers to a defined value. All `PTRansition` parts are set to `FFFFh`, i.e. all transitions from 0 to 1 are detected. All `NTRansition` parts are set to 0, i.e. a transition from 1 to 0 in a `CONDition` bit is not detected. The `ENABle` part of the `STATus:OPERation` and `STATus:QUESTionable` registers are set to 0, i.e. all events in these registers are not passed on.

**Usage:**                      Event

---

#### STATus:QUEue[:NEXT]?

Queries the most recent error queue entry and deletes it.

Positive error numbers indicate device-specific errors, negative error numbers are error messages defined by SCPI. If the error queue is empty, the error number 0, "No error", is returned.

Is identical to the `SYSTem:ERRor[:NEXT]?` command.

**Usage:**                      Query only

### 13.10.1.2 Reading out the CONDition part

---

**STATus:OPERation:CONDition?**  
**STATus:QUESTionable:CONDition?**  
**STATus:QUESTionable:ACPLimit:CONDition?** <ChannelName>  
**STATus:QUESTionable:EXTended:CONDition?** <ChannelName>  
**STATus:QUESTionable:EXTended:INFO:CONDition?** <ChannelName>  
**STATus:QUESTionable:FREQuency:CONDition?** <ChannelName>  
**STATus:QUESTionable:LIMit<n>:CONDition?** <ChannelName>  
**STATus:QUESTionable:LMARgin<n>:CONDition?** <ChannelName>  
**STATus:QUESTionable:POWer:CONDition?** <ChannelName>  
**STATus:QUESTionable:TIME:CONDition?** <ChannelName>

These commands read out the CONDition section of the status register.

The commands do not delete the contents of the CONDition section.

**Suffix:**

<n> [Window](#)

**Query parameters:**

<ChannelName> String containing the name of the channel.  
 The parameter is optional. If you omit it, the command works for the currently active channel.

**Usage:** Query only

### 13.10.1.3 Reading out the EVENT part

---

**STATus:OPERation[:EVENT]?**  
**STATus:QUESTionable[:EVENT]?**  
**STATus:QUESTionable:ACPLimit[:EVENT]?** <ChannelName>  
**STATus:QUESTionable:EXTended[:EVENT]?** <ChannelName>  
**STATus:QUESTionable:EXTended:INFO[:EVENT]?** <ChannelName>  
**STATus:QUESTionable:FREQuency[:EVENT]?** <ChannelName>  
**STATus:QUESTionable:LIMit<n>[:EVENT]?** <ChannelName>  
**STATus:QUESTionable:LMARgin<n>[:EVENT]?** <ChannelName>  
**STATus:QUESTionable:POWer[:EVENT]?** <ChannelName>  
**STATus:QUESTionable:TIME[:EVENT]?** <ChannelName>

These commands read out the EVENT section of the status register.

At the same time, the commands delete the contents of the EVENT section.

**Suffix:**

<n> [Window](#)

**Query parameters:**

<ChannelName> String containing the name of the channel.  
 The parameter is optional. If you omit it, the command works for the currently active channel.

**Usage:** Query only

#### 13.10.1.4 Controlling the ENABLE part

---

```

STATus:OPERation:ENABLE <SumBit>
STATus:QUESTionable:ENABLE <SumBit>
STATus:QUESTionable:ACPLimit:ENABLE <SumBit>,<ChannelName>
STATus:QUESTionable:EXTended:ENABLE <SumBit>,<ChannelName>
STATus:QUESTionable:EXTended:INFO:ENABLE <SumBit>,<ChannelName>
STATus:QUESTionable:FREQuency:ENABLE <SumBit>,<ChannelName>
STATus:QUESTionable:LIMit<n>:ENABLE <SumBit>,<ChannelName>
STATus:QUESTionable:LMARgin<n>:ENABLE <SumBit>,<ChannelName>
STATus:QUESTionable:POWER:ENABLE <SumBit>,<ChannelName>
STATus:QUESTionable:TIME:ENABLE <SumBit>,<ChannelName>

```

These commands control the ENABLE part of a register.

The ENABLE part allows true conditions in the EVENT part of the status register to be reported in the summary bit. If a bit is 1 in the enable register and its associated event bit transitions to true, a positive transition will occur in the summary bit reported to the next higher level.

**Suffix:**

<n> [Window](#)

**Parameters:**

<SumBit> Range: 0 to 65535

<ChannelName> String containing the name of the channel.  
The parameter is optional. If you omit it, the command works for the currently active channel.

#### 13.10.1.5 Controlling the negative transition part

---

```

STATus:OPERation:NTRansition <SumBit>
STATus:QUESTionable:NTRansition <SumBit>
STATus:QUESTionable:ACPLimit:NTRansition <SumBit>,<ChannelName>
STATus:QUESTionable:EXTended:NTRansition <SumBit>,<ChannelName>
STATus:QUESTionable:EXTended:INFO:NTRansition <SumBit>,<ChannelName>
STATus:QUESTionable:FREQuency:NTRansition <SumBit>,<ChannelName>
STATus:QUESTionable:LIMit<n>:NTRansition <SumBit>,<ChannelName>
STATus:QUESTionable:LMARgin<n>:NTRansition <SumBit>,<ChannelName>
STATus:QUESTionable:POWER:NTRansition <SumBit>,<ChannelName>
STATus:QUESTionable:TIME:NTRansition <SumBit>,<ChannelName>

```

These commands control the Negative TRansition part of a register.

Setting a bit causes a 1 to 0 transition in the corresponding bit of the associated register. The transition also writes a 1 into the associated bit of the corresponding EVENT register.

**Suffix:**

<n> [Window](#)



**Parameters:**

<SumBit>	Range: 0 to 65535
<ChannelName>	String containing the name of the channel. The parameter is optional. If you omit it, the command works for the currently active channel.

**13.10.1.6 Controlling the positive transition part**


---

**STATus:OPERation:PTRansition** <SumBit>  
**STATus:QUESTionable:PTRansition** <SumBit>  
**STATus:QUESTionable:ACPLimit:PTRansition** <SumBit>,<ChannelName>  
**STATus:QUESTionable:EXTended:PTRansition** <SumBit>,<ChannelName>  
**STATus:QUESTionable:EXTended:INFO:PTRansition** <SumBit>,<ChannelName>  
**STATus:QUESTionable:FREQuency:PTRansition** <SumBit>,<ChannelName>  
**STATus:QUESTionable:LIMit<n>:PTRansition** <SumBit>,<ChannelName>  
**STATus:QUESTionable:LMARgin<n>:PTRansition** <SumBit>,<ChannelName>  
**STATus:QUESTionable:POWEr:PTRansition** <SumBit>,<ChannelName>  
**STATus:QUESTionable:TIME:PTRansition** <SumBit>,<ChannelName>

These commands control the Positive TRansition part of a register.

Setting a bit causes a 0 to 1 transition in the corresponding bit of the associated register. The transition also writes a 1 into the associated bit of the corresponding EVENT register.

**Suffix:**

<n> [Window](#)

**Parameters:**

<SumBit>	Range: 0 to 65535
<ChannelName>	String containing the name of the channel. The parameter is optional. If you omit it, the command works for the currently active channel.

**13.11 Retrieving error messages**

<a href="#">SYSTem:ERRor:CLEar:ALL</a> .....	921
<a href="#">SYSTem:ERRor:EXTended?</a> .....	922
<a href="#">SYSTem:ERRor:LIST?</a> .....	922
<a href="#">SYSTem:ERRor[:NEXT]?</a> .....	923

---

**SYSTem:ERRor:CLEar:ALL**

This command deletes all contents of the "System Messages" table.

**Example:** SYST:ERR:CLE:ALL

**Manual operation:** See ["Clear All Messages"](#) on page 165

**SYSTem:ERRor:EXTended?** <MessageType>[, <ChannelName>]

This command queries all system messages, or all messages of a defined type, displayed in the status bar for a specific channel (application).

**Note:** This command queries the strings displayed for manual operation. For remote programs, do not define processing steps depending on these results. Instead, query the results of the `STATUS:QUESTIONABLE:EXTENDED:INFO` status register, which indicates whether messages of a certain type have occurred (see "[STATUS:QUESTIONABLE:EXTENDED:INFO register](#)" on page 483).

**Parameters:**

<MessageType> ALL | INFO | WARNING | FATAL | ERROR | MESSAGE  
 <ChannelName> String containing the name of the channel.  
 The parameter is optional. If you omit it, the command works for the currently active channel.

**Return values:**

<Messages> String containing all messages of the selected type for the specified channel. Each message is separated by a comma and inserted in parentheses. If no messages are available, empty parentheses are returned.

**Example:**

```
SYST:ERR:EXT? ALL
```

Returns all messages for the currently active application, e.g. "Message 1", "Message 2".

**Example:**

```
SYST:ERR:EXT? FAT, 'Spectrum2'
```

Queries fatal errors in the 'Spectrum2' application. If none have occurred, the result is: " ".

**Usage:**

Query only

**SYSTem:ERRor:LIST?** [<MessType>]

This command queries the error messages that occur during R&S VSE operation.

**Query parameters:**

<MessType> SMSG | REMote

**SMSG**

(default) Queries the system messages which occurred during manual operation.

**REMOte**

Queries the error messages that occurred during remote operation.

Note: The remote error list is automatically cleared when the R&S VSE is shut down.

**Return values:**

<SystemMessages> String containing all messages in the "System Messages" table.

<RemoteErrors> <Error\_no> | <Description> | <Command> | <Date> | <Time>

Comma-separated list of errors from the "Remote Errors" table, where:

<Error\_no>: device-specific error code

<Description>: brief description of the error

<Command>: remote command causing the error

<Date>|<Time>: date and time the error occurred

**Usage:** Query only

### SYSTem:ERRor[:NEXT]?

This command queries the most recent error queue entry and deletes it.

Positive error numbers indicate device-specific errors, negative error numbers are error messages defined by SCPI. If the error queue is empty, the error number 0, "No error", is returned.

For details on error queues see [Chapter 12.1.2, "Status reporting system"](#), on page 477.

**Usage:** Query only

## 13.12 Programming examples

The following programming examples demonstrate how to capture I/Q data and perform basic I/Q data analysis using the I/Q Analyzer in a remote environment.

- [Configuring file input](#)..... 923
- [Configuring input from an instrument](#)..... 924
- [Performing a sequence of measurements](#)..... 925
- [Basic I/Q analysis](#)..... 927
- [Recording I/Q data](#)..... 930
- [Saving and loading measurement settings](#)..... 931
- [Programming example: complete sequential measurement with data export](#)..... 932
- [Programming examples for channel power measurements](#)..... 938
- [Programming example: OBW measurement](#)..... 947

### 13.12.1 Configuring file input

This example demonstrates how to configure input from a file for a measurement in a remote environment.

```
//***** Prepare software, start in default configuration *****
*RST
DEvice:DElete:ALL

//Assign the file as input source for the default channel 1 in VSE *****
INST:BLOC:CHAN:SETT:SOUR FILE
```

```
//Define file to load
INST:BLOC:CHAN:SETT:FILE 'c:\ProgramData\Rohde-Schwarz\VSE\1.15_SP1\user\Demo\VSA-GSM_8PSK.iq

//Load 5ms of measurement time, starting at 1ms; current display at 2.5ms from start
INST:BLOC:CHAN:SETT:FILE:STAR:TIME 0.001
INST:BLOC:CHAN:SETT:FILE:STOP:TIME 0.005
INST:BLOC:CHAN:SETT:FILE:CURR:TIME 0.0025

//Start playing the data from the current position in single measurement mode
INIT:CONT OFF
INIT:IMM;*WAI
```

### 13.12.2 Configuring input from an instrument

This example demonstrates how to configure two different connected instruments for a measurement in a remote environment. Only one instrument is used for input in this example. For a more complex example see [Chapter 13.12.3, "Performing a sequence of measurements"](#), on page 925.

```
//Prepare software
*RST
//Configure connection to MyFSW at 123.456.789.100 using VSI11 protocol
DEV:CRE 'MyFSW','123.456.789.100',VXI11;*WAI
//Query the network address of MyFSW
DEV:TARG? 'MyFSW'
//Result: '123.456.789.100'
//Query connection state to MyFSW
DEV:STAT? 'MyFSW'
//Result: 1 (connection established)

//Query information on MyFSW
//Installed hardware?
DEV:INFO:HWIN? 'MyFSW'
//Instrument ID?
DEV:INFO:IDN? 'MyFSW'
//Installed options?
DEV:INFO:OPT? 'MyFSW'

//Define the use of an external reference on MyFSW
DEV:EXTR:SOUR 'MyFSW',EXT
DEV:EXTR:FREQ 'MyFSW',13MHZ

//Assign MyFSW as input source for default channel 1 in VSE
INST:BLOC:CHAN:SETT:SOUR DEV
INST:BLOC:CHAN:SETT:DEV 'MyFSW'

//Configure connection to YourFSW at 100.100.100.99 using HiSlip protocol
DEV:CRE 'YourFSW','100.100.100.99',HiSlip; *WAI
```

```

DEV:STAT? 'YourFSW'
//Result: 1
DEV:TARG? 'YourFSW'
//Result: '100.100.100.99'

//Start capturing data from MyFSW
//Select default channel 1
INST 'IQ Analyzer'
//Start measurement on channel 1
INIT:IMM;*WAI

```

### 13.12.3 Performing a sequence of measurements

This example demonstrates how to configure and perform a sequence of measurements in a remote environment. It assumes the instruments 'MyFSW' and 'YourFSW' have been configured, as described in [Chapter 13.12.2, "Configuring input from an instrument"](#), on page 924.

```

//***** Prepare software *****
*RST

//***** Configure four channels *****
//1) (default): IQ Analyzer: I/Q Analyzer for instrument input from 'MyFSW',
//2) AnalogDemodFSW: AnalogDemod for instrument input from 'MyFSW',
//3) Your IQ Analyzer: I/Q Analyzer for instrument input from 'YourFSW'
//4) AnalogDemodFile: AnalogDemod for file input

//Create channel 2
INST:CRE:NEW ADEM, 'AnalogDemodFSW'
//Duplicate default channel 1 to create channel 3
INST:SEL 'IQ Analyzer'
INST:CRE:DUPL
//Result: 'IQ Analyzer 2'
INST:REN 'IQ Analyzer 2', 'Your IQ Analyzer'
//Create channel 4
INST:CRE:NEW ADEM, 'AnalogDemodFile'
//Query list of channels
INST:LIST?
//Result: 'IQ', 'IQ Analyzer', 'ADEM', 'AnalogDemodFSW', 'IQ', 'Your IQ Analyzer',
//'ADEM', 'AnalogDemodFile'

//Configure input sources for each channel
INST:SEL 'IQ Analyzer'
INST:BLOC:CHAN:SETT:SOUR DEV
INST:BLOC:CHAN:SETT:DEV 'MyFSW'

INST:SEL 'AnalogDemodFSW'
INST:BLOC:CHAN:SETT:SOUR DEV
INST:BLOC:CHAN:SETT:DEV 'MyFSW'

```

```

INST:SEL 'Your IQ Analyzer'
INST:BLOC:CHAN:SETT:SOUR DEV
INST:BLOC:CHAN:SETT:DEV 'YourFSW'

INST:SEL 'AnalogDemodFile'
INST:BLOC:CHAN:SETT:SOUR FILE
INST:BLOC:CHAN:FILE 'c:\ProgramData\Rohde-Schwarz\VSE\1.15_SP1\user\Demo\VSA-GSM_8PSK.iq.tar'

//***** Configure two groups *****
//Measurements on one instrument cannot be performed simultaneously
//-> Separate channels using same instrument as input into different groups:
//Group 1: (default)'Group 1': channels 1,3
//Group 2: 'AdemodGroup': channels 2,4

//Create new group 2:
INST:BLOC:CRE 'AdemodGroup', 'Group 1'
//Move channels 2+4 to new group:
INST:BLOC:CHAN:MOVE 'AdemodGroup','', 'AnalogDemodFSW'
INST:BLOC:CHAN:MOVE 'AdemodGroup','AnalogDemodFSW','AnalogDemodFile'

//Query list of channels in group 2:
INST:BLOC:LIST?
//Result: 'AnalogDemodFSW','AnalogDemodFile'
//Query list of channels in group 1:
INST:BLOC:SEL 'Group 1'
INST:BLOC:LIST?
//Result: 'IQ Analyzer','Your IQ Analyzer'

//***** Activate all channels and groups for measurement *****
INST:BLOC:CHAN:USE 1,'IQ Analyzer'
INST:BLOC:CHAN:USE 1,'AnalogDemodFSW'
INST:BLOC:CHAN:USE 1,'Your IQ Analyzer'
INST:BLOC:CHAN:USE 1,'AnalogDemodFile'
INST:BLOC:USE 1, 'Group 1'
INST:BLOC:USE 1, 'AdemodGroup'

//***** Perform a single measurement on all groups *****
//Measurements 1+3 are started simultaneously;
//When I/Q Analyzer measurements on both instruments are finished,
//measurements 2+4 are started;
INIT:SEQ:MODE SING
INIT:SEQ:IMM;*WAI

//***** Retrieve results for I/Q Analyzer channel *****
INST:SEL 'IQ Analyzer'
TRAC:DATA? TRACE1
//Returns the magnitude for each trace point

```

### 13.12.4 Basic I/Q analysis

This example demonstrates how to configure and perform a basic I/Q data acquisition and analyze the data using the I/Q Analyzer in a remote environment.

```
//-----Activate the I/Q Analyzer application -----
//Reset the software
*RST
//Default channel is I/Q Analyzer with Magnitude result display
//For demonstration purposes, create a new channel for I/Q Analyzer
INST:CRE:NEW IQ,'My IQ Analyzer'
INST:BLOC:CHAN:SETT:SOUR DEV
INST:BLOC:CHAN:SETT:DEV 'MyFSW'

//-----Configure data acquisition-----
//Define the sample rate
TRAC:IQ:SRAT 32MHZ
//Set the record length (number of samples to capture) to 1000 samples
TRAC:IQ:RLEN 1000
//Query the bandwidth of the resampling filter, determined by the sample rate
TRAC:IQ:BWID?

//-----Configure the trace-----
//Define averaging for the I/Q trace
TRAC:IQ:AVER ON
//Define an average over 10 measurements
TRAC:IQ:AVER:COUN 10

//Add traces with different trace modes
DISP:TRAC1:MODE WRIT
DISP:TRAC2:MODE MAXH
DISP:TRAC3:MODE MINH

//-----Perform the measurement-----
//Initiate a new measurement and wait until the measurement has finished
INIT:CONT OFF
INIT;*WAI

//-----Retrieve results-----
//Format the data as 32-byte real values
INST:SEL 'My IQ Analyzer'
//Use real 32-bit format for data
FORM:DATA REAL,32
//List all I values first, then all Q values in the trace results
TRAC:IQ:DATA:FORM IQP

//Query the magnitude for each trace point
TRAC:DATA? TRACE1
```

```

TRAC:DATA? TRACE2
TRAC:DATA? TRACE3

//Change the result display to Real/Imag (I/Q)
LAY:REPL:WIND '1',RIMAG

//Configure searches to search both I and Q branches
CALC:MARK:SEAR MAGN
//Query the result of the peak search on both branches
CALC:MARK:Y?

//Query the first 500 samples of the stored I/Q data for the measurement
TRAC:IQ:DATA:MEM? 0,500
//For each sample, first the I-value, then the Q-value is listed.

//Query the second half of the 1000 captured sample values
TRAC:IQ:DATA:MEM? 500,500

```

#### 13.12.4.1 Programming example: configuring a spectrogram

This example demonstrates how to configure a spectrogram for a basic I/Q measurement in a remote environment. The spectrogram is displayed in a subwindow of the Spectrum display. In addition, the usage of special spectrogram markers is demonstrated (see ["Marker search \(spectrograms\)"](#) on page 819).

```

//-----Preparing the Measurement -----
//Reset the I/Q Analyzer channel settings, but not the instrument assignment
INST:SEL 'My IQ Analyzer'
SYST:PRES:CHAN
//Add a Spectrum result display
LAY:ADD:WIND? '1',RIGH,FREQ
//Result is window name: '2'
//Display a Spectrogram
CALC2:SPEC:STAT ON
//The spectrogram is updated with each new measurement.

//-----Configuring the Spectrogram-----
//Clear the displayed spectrogram to start a new one
CALC2:SGR:CLE
//Configure a continuous spectrogram for a series of measurements.
//The display is not cleared when a new measurement is started.
CALC2:SGR:CONT ON
//Set the number of frames to be recorded per measurement to 100.
CALC2:SGR:FRAM:COUN 100
//Set the number of frames to be stored to 1000 (=10 measurements)
CALC2:SGR:HDEP 1000

//-----Configuring the Color Map-----
//Define a gray-scaled coloring: low values light gray, high values dark gray

```



```

DISP:WIND2:SGR:COL GRAY
//Define a color map for a range that comprises 40% of the measurement range,
//excluding 30% at each end. The colors are not scaled linearly; the light gray
//colors are stretched to distinguish low values better.
DISP:WIND2:SGR:COL:LOW 30
DISP:WIND2:SGR:COL:UPP 70
DISP:WIND2:SGR:COL:SHAP 0.8

//-----Performing the Measurement-----
//Select single capture mode.
INIT:CONT OFF
//Define 10 captures to be performed per measurement
SENS:AVER:COUN 10
//Initiate a new measurement and wait until the captures have finished
INIT;*WAI
//The spectrogram is updated with each new capture

//-----Positioning Markers-----
//Includes all frames in the memory in the search area
CALC2:MARK:SGR:SAR MEM
//Set marker 1 to the frame 1 second after measurement begin. (Note the
//negative value!
CALC2:MARK1:SGR:FRAM -1s
//Set marker 1 to the minimum level in this frame
CALC2:MARK1:MIN
//Set marker 1 to the minimum level for the same frequency the marker is
//currently positioned at in all frames.
CALC2:MARK1:SGR:Y:MIN
//Set marker 2 to the maximum level in the entire spectrogram.
CALC2:MARK2:SGR:XY:MAX
//Set the deltamarker 1 to the frame number -3. By default
//it is set to the peak of that frame and displays the level difference to marker 1.
//Note the negative value!
CALC2:DELT1:SGR:FRAM -3
//Set deltamarker 1 to the minimum level in this frame.
CALC2:DELT1:MIN
//Set deltamarker 3 to the maximum level in the entire spectrogram. By default
//its value is the difference to marker 1. We will change it to refer to marker 2.
CALC2:DELT3:SGR:XY:MAX
CALC2:DELT3:MREF 2
//Deltamarker 3 now refers to marker 2, both are positioned on the maximum of the
//spectrogram. Thus, D3=0.

//-----Retrieving Results-----
//Query the frequency (x), level (y) and frame values of marker 1.
CALC2:MARK1:X?
CALC2:MARK1:Y?
CALC2:MARK1:SGR:FRAM?

```

```

//Query the frequency (x), level (y) and frame values of marker 2.
CALC2:MARK2:X?
CALC2:MARK2:Y?
CALC2:MARK2:SGR:FRAM?

//Query the frequency (x), level (y) and frame values of deltamarker 1.
CALC2:DELT1:X?
CALC2:DELT1:Y?
CALC2:DELT1:SGR:FRAM?

//Query the frequency (x), level (y) and frame values of deltamarker 3.
CALC2:DELT3:X?
CALC2:DELT3:Y?
CALC2:DELT3:SGR:FRAM?

//Select the frame that was captured 1 second after measurement start (Note the
//negative value!). This frame is displayed in the Spectrum window.
CALC2:SGR:FRAM:SEL -1
//Retrieve the Spectrum trace data for the selected frame only.
TRAC2:DATA? TRACE1

```

#### 13.12.4.2 Programming example: marker search in spectrograms

This example demonstrates how to search for peak values in spectrograms in a remote environment. It assumes a spectrogram is already available (see [Chapter 13.12.4.1, "Programming example: configuring a spectrogram"](#), on page 928) and thus does not begin by presetting the instrument.

```

//----- Analyzing the results using markers -----
//Set marker1 on the peak power in the most recent spectrum and query
//its position
CALC2:SPEC:FRAM:SEL 0
CALC2:MARK1 ON
CALC2:MARK1:X?
CALC2:MARK1:Y?

//Set marker3 on peak power level in the entire spectrogram in memory and
//query its position
CALC2:MARK3 ON
CALC2:MARK:SPEC:SAR MEM
CALC2:MARK3:SPEC:XY:MAX
CALC2:MARK3:X?
CALC2:MARK3:Y?

```

#### 13.12.5 Recording I/Q data

This example demonstrates how to record I/Q data in a remote environment. It assumes a measurement has been configured as described in [Chapter 13.12.4, "Basic I/Q analysis"](#), on page 927.



How to recall recorded I/Q data in a remote environment is described in [Chapter 13.12.1, "Configuring file input"](#), on page 923.

```
//***** Configure recording *****
//Store most recent 10 measurements (10 * 1000 records)
REC:COUN 10
REC:MAX:RLEN OFF
//Configure default comment to be 'FSW_data_'
REC:COMM 'FSW_data_'
//Store additional samples for settling time (for demonstration purposes only)
REC:SETT:TIME ON

//***** Perform the measurement *****
INST:SEL 'My IQ Analyzer'
INST:BLOC:CHAN:REC;*WAI

//***** Export the recorded data *****
//Include minimum set of meta data except for input path, plus
//preamplifier, input impedance
EXP:IQ:META:DATA:SET MIN
EXP:IQ:META:DATA:SET CUST
EXP:IQ:META:DATA 'InputCoupling',OFF
EXP:IQ:META:DATA 'PreampState',ON

//Store the recorded data to an iq.tar file
EXP:IQ:FORM IQTAR;*WAI;
EXP:IQ:INP REC
EXP:IQ:FILE 'C:\ProgramData\Rohde-Schwarz\VSE\1.0_11\user\
MyFSW_IQanalyzer_results.iq.tar'
```

### 13.12.6 Saving and loading measurement settings

This example demonstrates how to save and load measurement settings in a remote environment. It assumes a measurement has been configured as described in [Chapter 13.12.4, "Basic I/Q analysis"](#), on page 927.

```
//***** Store the channel settings *****

//Select the channel whose settings are to be saved
INST:SEL 'My IQ Analyzer'
//Specify that channel-specific data is to be stored.
MMEM:STOR:TYPE CHAN
//Store the channel settings from the 'My IQ Analyzer' channel
// to the file 'MyFSW_IQanalyzer.dfl'.
MMEM:STOR:STAT 1, 'C:\temp\MyFSW_IQanalyzer.dfl'

//***** Load the channel settings *****

//Specify that settings will be loaded to a new channel besides the existing
```

```
//'My IQ Analyzer' channel.
MMEM:LOAD:TYPE NEW
//Select all settings and results to be loaded.
MMEM:SEL:CHAN:ALL
//Load the channel-specific settings from the file 'MyFSW_IQanalyzer.dfl'
//to a new channel. The new channel is named 'My IQ Analyzer 2' by default
MMEM:LOAD:STAT 1, 'C:\temp\MyFSW_IQanalyzer.dfl'
//Rename the loaded channel to 'MyFSW_IQanalyzer_FromFile'.
INST:REN 'My IQ Analyzer 2','MyFSW_IQanalyzer_FromFile'
```

### 13.12.7 Programming example: complete sequential measurement with data export

The following example comprises many of the tasks described above to provide a complete measurement example in one script.

For this measurement, two instruments (R&S FSW) are configured for input. The measurement consists of four measurement channels:

- 1) IQ Analyzer: I/Q Analyzer for instrument input from 'MyFSW',
- 2) AnalogDemodFSW: AnalogDemod for instrument input from 'MyFSW',
- 3) Your IQ Analyzer: I/Q Analyzer for instrument input from 'YourFSW'
- 4) AnalogDemodFile: AnalogDemod for file input

The individual measurements are configured, then performed and the captured data is recorded. Finally, the recorded data and the measurement results are stored to a file.

```
//*****
//***** Prepare software *****
//*****
*RST
DEvice:DElete:ALL

//*****
//***** Configure instrument connections *****
//*****

//Configure connection to MyFSW at 123.456.789.100 using VSI11 protocol
DEV:CRE 'MyFSW','123.456.789.100',VXI11
//Query the network address of MyFSW
DEV:TARG? 'MyFSW'
//Result: '123.456.789.100'
//Query connection state to MyFSW
DEV:STAT? 'MyFSW'
//Result: 1 (connection established)

//Query information on MyFSW
//Installed hardware?
```

```

DEV:INFO:HWIN? 'MyFSW'
//Instrument ID?
DEV:INFO:IDN? 'MyFSW'
//Installed options?
DEV:INFO:OPT? 'MyFSW'

//Define the use of an external reference on MyFSW
DEV:EXTR:SOUR 'MyFSW',EXT
DEV:EXTR:FREQ 'MyFSW',13MHZ

//Assign MyFSW as input source for default channel 1
INST:BLOC:CHAN:SETT:SOUR DEV
INST:BLOC:CHAN:SETT:DEV 'MyFSW'

//Configure connection to YourFSW at 100.100.100.99 using HiSlip protocol
DEV:CRE 'YourFSW','100.100.100.99',HiSlip; *WAI
DEV:STAT? 'YourFSW'
//Result: 1
DEV:TARG? 'YourFSW'
//Result: '100.100.100.99'

//*****
//***** Configure four channels *****
//*****

//1) (default): IQ Analyzer: I/Q Analyzer for instrument input from 'MyFSW',
//2) AnalogDemodFSW: AnalogDemod for instrument input from 'MyFSW',
//3) Your IQ Analyzer: I/Q Analyzer for instrument input from 'YourFSW'
//4) AnalogDemodFile: AnalogDemod for file input

//Create channel 2
INST:CRE:NEW ADEM,'AnalogDemodFSW'
//Duplicate default channel 1 to create channel 3
INST:SEL 'IQ Analyzer'
INST:CRE:DUPL
//Result: 'IQ Analyzer 2'
INST:REN 'IQ Analyzer 2','Your IQ Analyzer'
//Create channel 4
INST:CRE:NEW ADEM,'AnalogDemodFile'
//Query list of channels
INST:LIST?
//Result: 'IQ','IQ Analyzer', 'ADEM','AnalogDemodFSW', 'IQ','Your IQ Analyzer',
//'ADEM','AnalogDemodFile'

//Configure input sources for each channel
INST:SEL 'IQ Analyzer'
INST:BLOC:CHAN:SETT:SOUR DEV
INST:BLOC:CHAN:SETT:DEV 'MyFSW'

INST:SEL 'AnalogDemodFSW'

```

```

INST:BLOC:CHAN:SETT:SOUR DEV
INST:BLOC:CHAN:SETT:DEV 'MyFSW'

INST:SEL 'Your IQ Analyzer'
INST:BLOC:CHAN:SETT:SOUR DEV
INST:BLOC:CHAN:SETT:DEV 'YourFSW'

INST:SEL 'AnalogDemodFile'
INST:BLOC:CHAN:SETT:SOUR FILE
INST:BLOC:CHAN:FILE 'c:\ProgramData\Rohde-
Schwarz\VSE\1.15_SP1\user\Demo\VSA-GSM_8PSK.iq.tar',866KHZ
//Load 10ms of measurement time, starting at 1ms; current display at 2.5ms from start
INST:BLOC:CHAN:SETT:FILE:STAR:TIME 0.001
INST:BLOC:CHAN:SETT:FILE:STOP:TIME 0.005
INST:BLOC:CHAN:SETT:FILE:CURR:TIME 0.0025

//*****
//***** Configure two groups *****
//*****

//Measurements on one instrument cannot be performed simultaneously
//-> Separate channels using same instrument as input into different groups:
//Group 1: (default)'Group 1': channels 1,3
//Group 2: 'AdemodGroup': channels 2,4

//Create new group 2:
INST:BLOC:CRE 'AdemodGroup', 'Group 1'
//Move channels 2+4 to new group:
INST:BLOC:CHAN:MOVE 'AdemodGroup','', 'AnalogDemodFSW'
INST:BLOC:CHAN:MOVE 'AdemodGroup', 'AnalogDemodFSW', 'AnalogDemodFile'

//Query list of channels in group 2:
INST:BLOC:LIST?
//Result: 'AnalogDemodFSW','AnalogDemodFile'
//Query list of channels in group 1:
INST:BLOC:SEL 'Group 1'
INST:BLOC:LIST?
//Result: 'IQ Analyzer','Your IQ Analyzer'

//Activate all channels and groups for measurement
INST:BLOC:CHAN:USE 1, 'IQ Analyzer'
INST:BLOC:CHAN:USE 1, 'AnalogDemodFSW'
INST:BLOC:CHAN:USE 1, 'Your IQ Analyzer'
INST:BLOC:CHAN:USE 1, 'AnalogDemodFile'
INST:BLOC:USE 1, 'Group 1'
INST:BLOC:USE 1, 'AdemodGroup'

//*****
//***** Configure the I/Q Analyzer application *****
//*****

```

```

//Select the channel
INST:SEL 'IQ Analyzer'

//***** Configure data acquisition *****
//Define the sample rate.
TRAC:IQ:SRAT 32MHZ
//Set the record length (number of samples to capture) to 1000 samples.
TRAC:IQ:RLEN 1000
//Query the bandwidth of the resampling filter, determined by the sample rate
TRAC:IQ:BWID?
//Format the data as 32-byte real values.
FORM:DATA REAL,32
//List all I values first, then all Q values in the trace results.
TRAC:IQ:DATA:FORM IQP

//***** Configure the trace *****
//Define averaging for the I/Q trace.
TRAC:IQ:AVER ON
//Define an average over 10 captures.
TRAC:IQ:AVER:COUN 10

//Change the trace modes.
DISP:TRAC1:MODE WRIT
DISP:TRAC2:MODE MAXH
DISP:TRAC3:MODE MINH

//*****
//***** Configure the Analog Demod measurement channel *****
//*****

//Select Analog Demod channel
INST:SEL 'AnalogDemodFSW'

//Set the center frequency to 500 MHz
FREQ:CENT 500 MHz
//Set the reference level to 0 dBm
DISP:TRAC:Y:SCAL:RLEV 0

//***** Configure data acquisition *****

//Set the measurement time to 1 ms (=10 periods)
ADEM:MTIM 1ms
//Optimize the scaling of the y-axis for the current measurement (continuously)
SENS:ADJ:SCAL:Y:AUTO ON
//Set the demodulation bandwidth to 400 kHz
BAND:DEM 400 kHz
//Use IQ Power trigger
TRIG:SOUR IQP
//Trigger when magnitude of I/Q data reaches -50dBm

```

```

TRIG:LEV:IQP -50

//***** Configure the result display *****

//Add an FM Spectrum result display below FM Time Domain
LAY:ADD:WIND? '1',BEL,'XTIM:FM:AFSP'
//Define two traces in the FM Spectrum: 1: Clear/write, 2: average
ADEM:FM:AFSP WRIT,AVER,OFF,OFF,OFF,OFF
//Define two traces in the FM Time domain: 1: Clear/write, 2: average
ADEM:FM:TDOM WRIT,AVER,OFF,OFF,OFF,OFF
//Set analog demodulator to execute 30 captures with 32000 samples each
//at a sample rate of 8 MHz; use IQP trigger, trigger on positive slope
//with a pretrigger offset of 500 samples
ADEM:SET 8MHz,32000,IQP,POS,-500,30

//*****
//***** Perform a single measurement on all groups *****
//*****

//Measurements 1+3 are started simultaneously;
//When I/Q Analyzer measurements on both instruments are finished,
//measurements 2+4 are started;
INIT:SEQ:MODE SING
INIT:SEQ:IMM;*WAI

//*****
//***** Retrieve results for I/Q Analyzer*****
//*****

//Return the magnitude for each trace point
INST:SEL 'IQ Analyzer'
TRAC:DATA? TRACE1
TRAC:DATA? TRACE2
TRAC:DATA? TRACE3

//Change the result display to Real/Imag (I/Q)
LAY:REPL:WIND '1',RIMAG

//Configure searches to search both I and Q branches.
CALC:MARK:SEAR MAGN
//Query the result of the peak search on both branches.
CALC:MARK:Y?

//Return the first 500 samples of the stored I/Q data for the measurement.
//For each sample, first the I-value, then the Q-value is listed.
TRAC:IQ:DATA:MEM? 0,500

//Return the second half of the 1000 captured sample values.
TRAC:IQ:DATA:MEM? 500,500

```



```

//*****
//***** Retrieve Results for Analog Demodulation *****
//*****

INST:SEL 'AnalogDemodFSW'

//Query the carrier power
CALC:MARK:FUNC:ADEM:CARR?
//Result: -10.37 [dBm]
//Retrieve the trace data of the most recent measurement (trace 1)
TRAC:DATA? TRACE1
//Result: -1.201362252,-1.173495054,-1.187217355,-1.186594367,-1.171583891,
//-1.188250422,-1.204138160,-1.181404829,-1.186317205,-1.197872400, [...]
//Retrieve the averaged trace data for all 30 measurements (trace 2)
TRAC:DATA? TRACE2
//Result: -1.201362252,-1.173495054,-1.187217355,-1.186594367,-1.171583891,
//-1.188250422,-1.204138160,-1.181404829,-1.186317205,-1.197872400, [...]

//*****
//***** Configure recording *****
//*****

//Store most recent 10 measurements (10 * 1000 records)
REC:COUN 10
REC:MAX:RLEN OFF
//Configure default comment to be 'FSW_data_'
REC:COMM 'FSW_data_'
//Store additional samples for settling time (for demonstration purposes only)
REC:SETT:TIME ON

//Perform the measurement
INST:SEL 'IQ Analyzer'
INST:BLOC:CHAN:REC

//Export the recorded data
//Include minimum set of meta data except for input path, plus
//preamplifier, input impedance
EXP:IQ:META:DATA:SET MIN
EXP:IQ:META:DATA:SET CUST
EXP:IQ:META:DATA 'InputCoupling',OFF
EXP:IQ:META:DATA 'PreampState',ON

//Store the data to an iq.tar file
EXP:IQ:FORM IQTAR;*WAI
EXP:IQ:FILE 'C:\temp\MyFSW_IQanalyzer_results.iq.tar'

//*****
//***** Store the channel settings *****
//*****

```

```

//Select the channel whose settings are to be saved
INST:SEL 'IQ Analyzer'
//Specify that channel-specific data is to be stored.
MMEM:STOR:TYPE CHAN
//Store the channel settings from the 'IQ Analyzer' channel
// to the file 'MyFSW_IQanalyzer.dfl'.
MMEM:STOR:STAT 1, 'C:\temp\MyFSW_IQanalyzer.dfl'

//*****
//***** Load the channel settings *****
//*****

//Specify that settings will be loaded to a new channel besides the existing
//'IQ Analyzer' channel.
MMEM:LOAD:TYPE NEW
//Select all settings and results to be loaded.
MMEM:SEL:CHAN:ALL
//Load the channel-specific settings from the file 'MyFSW_IQanalyzer.dfl'
//to a new channel. The new channel is named 'IQ Analyzer 2' by default
MMEM:LOAD:STAT 1, 'C:\temp\MyFSW_IQanalyzer.dfl'
//Rename the loaded channel to 'MyFSW_IQanalyzer_FromFile'.
INST:REN 'IQ Analyzer 2','MyFSW_IQanalyzer_FromFile'

```

## 13.12.8 Programming examples for channel power measurements

The following programming examples are meant to demonstrate the most important commands to perform channel power measurements in a remote environment.

- [Example: configuring and performing an ACLR measurement](#).....938
- [Example: configuring and performing an MSR ACLR measurement](#).....941
- [Example: configuring and performing an asymmetrical MSR ACLR measurement](#)  
..... 943

### 13.12.8.1 Example: configuring and performing an ACLR measurement

In this example we will configure and perform an adjacent-channel power measurement. Note that this example is primarily meant to demonstrate the remote control commands, it does not necessarily reflect a useful measurement task. For most common measurement standards, the R&S VSE performs the measurement optimally with the predefined settings, without further configuration.

```

//-----Preparing the measurement -----
//Reset the instrument
*RST

DEvice:DElete:ALL

//*****

```

```

//***** Configure instrument connections *****
//*****
//Configure connection to MyAnalyzer at 123.456.789.100 using VSI11 protocol
DEV:CRE 'MyAnalyzer','123.456.789.100',VXI11;*WAI
//Query the network address of MyAnalyzer
DEV:TARG? 'MyAnalyzer'
//Result: '123.456.789.100'
//Query connection state to MyAnalyzer
DEV:STAT? 'MyAnalyzer'
//Result: 1 (connection established)
//Query information on MyAnalyzer
//Instrument ID?
DEV:INFO:IDN? 'MyAnalyzer'
//Define the use of an external reference on MyAnalyzer
DEV:EXTR:SOUR 'MyAnalyzer',EXT
//Assign MyAnalyzer as input source for default channel 1
INST:BLOC:CHAN:SETT:SOUR DEV
INST:BLOC:CHAN:SETT:DEV 'MyAnalyzer'

//-----Preparing the measurement-----

//Activate adjacent-channel power measurement.
CALC:MARK:FUNC:POW:SEL ACP
//Select the user standard "GSM"
CALC:MARK:FUNC:POW:PRES GSM

//-----Setting Up Channels-----
//Create one transmission channel.
POW:ACH:TXCH:COUN 1
//Name the first transmission channel 'TX Channel'.
POW:ACH:NAME:CHAN1 'TX Channel'
//Create two adjacent channels - one adjacent channel and one alternate channel.
POW:ACH:ACP 2
//Name the adjacent channel 'ABC'
POW:ACH:NAME:ACH 'ABC'
//Name the first alternate channel 'XYZ'.
POW:ACH:NAME:ALT1 'XYZ'
//Define a bandwidth of 30 kHz for the transmission channel.
POW:ACH:BWID:CHAN1 30kHz
//Define a bandwidth of 30 kHz for the adjacent channel.
POW:ACH:BWID:ACH 30kHz
//Define a bandwidth of 30 kHz for the first alternate channel.
POW:ACH:BWID:ALT1 30kHz
//Define a distance of 33 kHz from the center of the transmission channel to the
//center of the adjacent channel.
//Also adjust the distance to the alternate channels (66 kHz).
POW:ACH:SPAC 33kHz
//Define a distance of 100 kHz from the center of the transmission channel to the
//center of the first alternate channel.
POW:ACH:SPAC:ALT1 100kHz

```

```

//-----Selecting a Reference Channel--
//Select relative display of the channel power.
POW:ACH:MODE REL
//Define transmission channel 1 as the reference channel.
POW:ACH:REF:TXCH:MAN 1

//-----Saving the settings as a user standard-----
//Save the user standard with the name "my_aclr_standard".
//Weighting filters can only be defined for user-defined standards.
CALC:MARK:FUNC:POW:STAN:SAVE 'my_aclr_standard'

//-----Defining Weighting Filters-----
//Define a roll-off factor of 0.35 for the weighting filter of the first
//transmission channel.
POW:ACH:FILT:ALPH:CHAN1 0.35
//Turn the weighting filter for the first transmission channel on.
POW:ACH:FILT:CHAN1 ON
//Define a roll-off factor of 0.35 for the weighting filter of the adjacent
//channel.
POW:ACH:FILT:ALPH:ACH 0.35
//Turn the weighting filter for the adjacent channel on.
POW:ACH:FILT:ACH ON
//Define a roll-off factor of 0.35 for the weighting filter of the first
//alternate channel.
POW:ACH:FILT:ALPH:ALT1 0.35
//Turn the weighting filter for the first alternate channel on.
POW:ACH:FILT:ALT1 ON

//-----Working with Limits-----
//Define a relative limit of 30 dB below the power of the reference channel
//for both adjacent channels.
CALC:LIM:ACP:ACH 30DB,30DB
//Define a relative limit of 25 dB below the power of the reference channel
//for the first alternate channels.
CALC:LIM:ACP:ALT1 25DB,25DB
//Define an absolute limit of -35 dBm for both adjacent channels.
CALC:LIM:ACP:ACH:ABS -35DBM,-35DBM
//Turn the ACLR limit check on.
CALC:LIM:ACP ON
//Turn the relative limit check for adjacent channels on.
CALC:LIM:ACP:ACH:STAT ON
//Turn the absolute limit check for adjacent channels on.
CALC:LIM:ACP:ACH:ABS:STAT ON
//Turn the absolute limit check for the first alternate channel on.
CALC:LIM:ACP:ALT1:ABS:STAT ON

//-----Performing the Measurement-----
//Determine the ideal ACLR measurement configuration.
POW:ACH:PRES ACP;*WAI

```

```

//Determine the ideal reference level for the measurement.
POW:ACH:PRES:RLEV;*WAI
//Initiate a new measurement and waits until the sweep has finished.
INIT;*WAI

//-----Limit Check-----
//Query the results of the limit check for the adjacent channels.
CALC:LIM:ACP:ACH:RES?
//Query the results of the limit check for the first alternate channels.
CALC:LIM:ACP:ALT1:RES?

//-----Retrieving Results-----
//Query the results for the ACLR measurement.
CALC:MARK:FUNC:POW:RES? ACP

```

### 13.12.8.2 Example: configuring and performing an MSR ACLR measurement

This example demonstrates how to configure and perform an ACLR measurement on a multi-standard radio signal in a remote environment.

Note that this example assumes the instrument 'MyAnalyzer' is configured as described in ["Example: configuring and performing an ACLR measurement"](#) on page 731.

```

//-----Preparing the measurement -----
//Reset the instrument
*RST

//Assign MyAnalyzer as input source for default channel 1
INST:BLOC:CHAN:SETT:SOUR DEV
INST:BLOC:CHAN:SETT:DEV 'MyAnalyzer'

// Select ACLR measurement
:CALCulate:MARKer:FUNCTion:POWer:SElect ACPower

// Select MSR Standard :CALCulate:MARKer:FUNCTion:POWer:PRESet MSR

//Configure general measurement settings
:SENSe:FREQuency:CENTer 1.25GHz
:SENSe:FREQuency:SPAN 62.0MHz
:SENSe:POWer:ACHannel:SBCount 3

//----- Configuring Sub block A

:SENSe:POWer:ACHannel:SBLock1:TXChannel:COUNT 3
:SENSe:POWer:ACHannel:SBLock1:FREQuency:CENTer 1.230GHZ
:SENSe:POWer:ACHannel:SBLock1:RFBWidth 12MHZ

:SENSe:POWer:ACHannel:SBLock1:CENTer:CHANnel1 1.226GHZ
:SENSe:POWer:ACHannel:SBLock1:CENTer:CHANnel2 1.230GHZ

```

```

:SENSe:POWer:ACHannel:SBLOCK1:CENTer:CHANnel3 1.234GHZ

:SENSe:POWer:ACHannel:SBLOCK1:TECHnology:CHANnel1 WCDMA
:SENSe:POWer:ACHannel:SBLOCK1:TECHnology:CHANnel2 WCDMA
:SENSe:POWer:ACHannel:SBLOCK1:TECHnology:CHANnel3 GSM

:SENSe:POWer:ACHannel:SBLOCK1:BANDwidth:CHANnel1 2.5MHZ
:SENSe:POWer:ACHannel:SBLOCK1:BANDwidth:CHANnel2 2.5MHZ
:SENSe:POWer:ACHannel:SBLOCK1:BANDwidth:CHANnel3 2.5MHZ

//----- Configuring Sub block B

:SENSe:POWer:ACHannel:SBLOCK2:TXCHannel:COUNT 1
:SENSe:POWer:ACHannel:SBLOCK2:FREQuency:CENTer 1.255GHZ
:SENSe:POWer:ACHannel:SBLOCK2:RFBWidth 4MHZ

:SENSe:POWer:ACHannel:SBLOCK2:CENTer:CHANnel1 1.255GHZ

:SENSe:POWer:ACHannel:SBLOCK2:TECHnology:CHANnel1 LTE_1_40

:SENSe:POWer:ACHannel:SBLOCK2:BANDwidth:CHANnel1 3.25MHZ

//----- Configuring Sub block C

:SENSe:POWer:ACHannel:SBLOCK3:TXCHannel:COUNT 2
:SENSe:POWer:ACHannel:SBLOCK3:FREQuency:CENTer 1.268GHZ
:SENSe:POWer:ACHannel:SBLOCK3:RFBWidth 8MHZ

:SENSe:POWer:ACHannel:SBLOCK3:CENTer:CHANnel1 1.266GHZ
:SENSe:POWer:ACHannel:SBLOCK3:CENTer:CHANnel2 1.270GHZ

:SENSe:POWer:ACHannel:SBLOCK3:BANDwidth:CHANnel1 2.75MHZ
:SENSe:POWer:ACHannel:SBLOCK3:BANDwidth:CHANnel2 2.75MHZ

//----- Configuring ADJ channels

:SENSe:POWer:ACHannel:BANDwidth:ACHannel 1.60MHZ
:SENSe:POWer:ACHannel:BANDwidth:ALternate1 1.60MHZ

:SENSe:POWer:ACHannel:SPACing:ACHannel 3MHZ
:SENSe:POWer:ACHannel:SPACing:ALternate1 5MHZ

//----- Configuring gap (CACLR) channels

:SENSe:POWer:ACHannel:SPACing:GAP1 2.0MHZ
:SENSe:POWer:ACHannel:SPACing:GAP2 5.0MHZ

:SENSe:POWer:ACHannel:BANDwidth:GAP1 2.0MHZ

```

```

:SENSe:POWer:ACHannel:BANDwidth:GAP2 2.0MHZ

//-----Performing the Measurement-----

//Select single sweep mode.
INIT:CONT OFF
//Initiate a new measurement and wait until the sweep has finished.
INIT;*WAI

//-----Retrieving Results-----

//Return the results for the ACLR measurement.
CALC:MARK:FUNC:POW:RES? MCAC
//Results:
//Transmission channels in sub block A
//-13.2346727385,-13.2346723793,-13.2390131759,
//Transmission channels in sub block B
//-17.0863336597,
//Transmission channels in sub block C
//-13.2390127767,-13.2390134744,
//Totals for each sub block
//-8.4649064021,-17.0863336597,-10.2287131689,
//Adjacent channels
//-67.9740721019,-67.9740728014,-0.00434041734,-0.00434041734,
//CACLR channels
//-0.52933512766,-64.9990115835,-64.5012521492,-0.33507330922,
//-64.4924159646,-0.52932552499,-0.52932552495,-64.4934163414

```

### 13.12.8.3 Example: configuring and performing an asymmetrical MSR ACLR measurement

This example demonstrates how to configure and perform an ACLR measurement on an asymmetrical multi-standard radio signal in a remote environment.

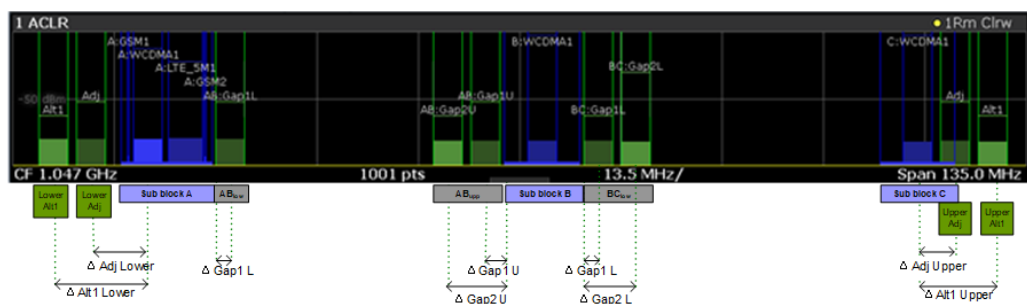


Figure 13-2: Asymmetrical MSR signal structure

Note that this example assumes the instrument 'MyAnalyzer' is configured as described in "Example: configuring and performing an ACLR measurement" on page 731.

```

//-----Preparing the measurement -----
//Reset the instrument
*RST

```

```
//Assign MyAnalyzer as input source for default channel 1
INST:BLOC:CHAN:SETT:SOUR DEV
INST:BLOC:CHAN:SETT:DEV 'MyAnalyzer'

// Select ACLR measurement
:CALCulate:MARKer:FUNction:POWer:SElect ACPower

// Select MSR Standard
:CALCulate:MARKer:FUNction:POWer:PRESet MSR

//Configure general measurement settings
:SENSe:FREQuency:CENTer 1.25GHz
:SENSe:FREQuency:SPAN 62.0MHz
:SENSe:POWer:ACHannel:SBCount 3

//----- Configuring Sub block A

:SENSe:POWer:ACHannel:SBLOCK1:TXChannel:COUNT 3
:SENSe:POWer:ACHannel:SBLOCK1:FREQuency:CENTer 1.230GHZ
:SENSe:POWer:ACHannel:SBLOCK1:RFBWidth 12MHZ

:SENSe:POWer:ACHannel:SBLOCK1:CENTer:CHANnel1 1.226GHZ
:SENSe:POWer:ACHannel:SBLOCK1:CENTer:CHANnel2 1.230GHZ
:SENSe:POWer:ACHannel:SBLOCK1:CENTer:CHANnel3 1.234GHZ

:SENSe:POWer:ACHannel:SBLOCK1:TECHnology:CHANnel1 WCDMA
:SENSe:POWer:ACHannel:SBLOCK1:TECHnology:CHANnel2 WCDMA
:SENSe:POWer:ACHannel:SBLOCK1:TECHnology:CHANnel3 GSM

:SENSe:POWer:ACHannel:SBLOCK1:BANDwidth:CHANnel1 2.5MHZ
:SENSe:POWer:ACHannel:SBLOCK1:BANDwidth:CHANnel2 2.5MHZ
:SENSe:POWer:ACHannel:SBLOCK1:BANDwidth:CHANnel3 2.5MHZ

//----- Configuring Sub block B

:SENSe:POWer:ACHannel:SBLOCK2:TXChannel:COUNT 1
:SENSe:POWer:ACHannel:SBLOCK2:FREQuency:CENTer 1.255GHZ
:SENSe:POWer:ACHannel:SBLOCK2:RFBWidth 4MHZ

:SENSe:POWer:ACHannel:SBLOCK2:CENTer:CHANnel1 1.255GHZ

:SENSe:POWer:ACHannel:SBLOCK2:TECHnology:CHANnel1 LTE_1_40

:SENSe:POWer:ACHannel:SBLOCK2:BANDwidth:CHANnel1 3.25MHZ

//----- Configuring Sub block C
```



```

:SENSe:POWer:ACHannel:SBLOCK3:TXChannel:COUNT 2
:SENSe:POWer:ACHannel:SBLOCK3:FREQuency:CENTer 1.268GHZ
:SENSe:POWer:ACHannel:SBLOCK3:RFBWidth 8MHZ

:SENSe:POWer:ACHannel:SBLOCK3:CENTer:CHANnel1 1.266GHZ
:SENSe:POWer:ACHannel:SBLOCK3:CENTer:CHANnel2 1.270GHZ

:SENSe:POWer:ACHannel:SBLOCK3:BANDwidth:CHANnel1 2.75MHZ
:SENSe:POWer:ACHannel:SBLOCK3:BANDwidth:CHANnel2 2.75MHZ

//----- Configuring ADJ channels

:SENSe:POWer:ACHannel:BANDwidth:ACHannel 1.60MHZ
:SENSe:POWer:ACHannel:BANDwidth:ALternate1 1.60MHZ

:SENSe:POWer:ACHannel:SPACing:ACHannel 3MHZ
:SENSe:POWer:ACHannel:SPACing:ALternate1 5MHZ

//----- Configuring gap channels manually
:SENSe:POWer:ACHannel:AGCHannels ON
:SENSe:POWer:ACHannel:GAP:MODE MAN

//----- Configuring AB gap channels
// 1 lower, 2 upper

:SENSe:POWer:ACHannel:GCH:GAP1:MAN:LOW AB, ON
:SENSe:POWer:ACHannel:GCH:GAP1:MAN:UPP AB, ON
:SENSe:POWer:ACHannel:GCH:GAP2:MAN:UPP AB, ON

:SENSe:POWer:ACHannel:SPACing:GAP1:MAN:LOW AB,2.0MHZ
:SENSe:POWer:ACHannel:SPACing:GAP1:MAN:UPP AB,2.0MHZ
:SENSe:POWer:ACHannel:SPACing:GAP2:MAN:UPP AB,4.2MHZ

:SENSe:POWer:ACHannel:BANDwidth:GAP1:MAN:LOW AB,2.0MHZ
:SENSe:POWer:ACHannel:BANDwidth:GAP1:MAN:UPP AB,2.0MHZ
:SENSe:POWer:ACHannel:BANDwidth:GAP2:MAN:UPP AB,2.0MHZ

:SENSe:POWer:ACHannel:FILTer:STATe:GAP1:MAN:LOW AB,ON
:SENSe:POWer:ACHannel:FILTer:STATe:GAP1:MAN:UPP AB,ON
:SENSe:POWer:ACHannel:FILTer:STATe:GAP2:MAN:UPP AB,ON

:SENSe:POWer:ACHannel:FILTer:ALPha:GAP1:MAN:LOW AB,0.25
:SENSe:POWer:ACHannel:FILTer:ALPha:GAP1:MAN:UPP AB,0.25
:SENSe:POWer:ACHannel:FILTer:ALPha:GAP2:MAN:UPP AB,0.25

//Limit check
:CALC:LIM:ACP ON
:CALC:LIM:ACP:GAP1:MAN:UPP:ABS:STAT AB,ON
:CALC:LIM:ACP:GAP1:MAN:UPP:ABS AB,3DBM

```

```

:CALC:LIM:ACP:GAP2:MAN:UPP:ABS:STAT AB,ON
:CALC:LIM:ACP:GAP2:MAN:UPP:ABS AB,3DBM

//----- Configuring BC gap channels
// 2 lower, 0 upper

:SENSe:POWer:ACHannel:GCH:GAP1:MAN:LOW AB, ON
:SENSe:POWer:ACHannel:GCH:GAP2:MAN:LOW AB, ON

:SENSe:POWer:ACHannel:SPACing:GAP1:MAN:LOW BC,2.0MHZ
:SENSe:POWer:ACHannel:SPACing:GAP2:MAN:LOW BC,4.2MHZ

:SENSe:POWer:ACHannel:BANDwidth:GAP1:MAN:LOW BC,2.0MHZ
:SENSe:POWer:ACHannel:BANDwidth:GAP2:MAN:LOW BC,2.0MHZ

//Limit check
:CALC:LIM:ACP ON
:CALC:LIM:ACP:GAP1:MAN:LOW:ABS:STAT BC,ON
:CALC:LIM:ACP:GAP1:MAN:LOW:ABS BC,3DBM
:CALC:LIM:ACP:GAP1:MAN:LOW:CACL:REL:STAT BC,ON
:CALC:LIM:ACP:GAP1:MAN:LOW:CACL:REL BC,-3DB

:CALC:LIM:ACP:GAP2:MAN:LOW:ACLR:REL:STAT BC,ON
:CALC:LIM:ACP:GAP2:MAN:LOW:ACLR:REL BC,-3DB

//-----Performing the Measurement-----

//Select single sweep mode.
INIT:CONT OFF
//Initiate a new measurement and wait until the sweep has finished.
INIT;*WAI

//-----Retrieving Results-----

//Return the results for the ACLR measurement.
CALC:MARK:FUNC:POW:RES? MCAC
//Results:
//Transmission channels in sub block A
//-13.2346727385,-13.2346723793,-13.2390131759,
//Transmission channels in sub block B
//-17.0863336597,
//Transmission channels in sub block C
//-13.2390127767,-13.2390134744,
//Totals for each sub block
//-8.4649064021,-17.0863336597,-10.2287131689,
//Adjacent channels
//-67.9740721019,-67.9740728014,-0.00434041734,-0.00434041734,
//CACL channels (AB2L, BC1U, BC2U invalid)
//-0.52933512766,-64.9990115835 9.91e37,-0.33507330922,
//-64.4924159646, 9.91e37,-0.52932552495, 9.91e37

```

```
//Limit check
CALC:LIM:ACP:GAP1:ACLR:RES?
//Result for gap 1 channels: ABGap1L,ABGap1U,BCGap1L, ( BCGap1U invalid )
//PASSED,PASSED,PASSED,NONE
CALC:LIM:ACP:GAP2:ACLR:RES?
//Result for gap 2 channels: (ABGap2L invalid ),ABGap2U,BCGap2L, ( BCGap2U invalid )
//NONE,PASSED,PASSED,NONE
```

### 13.12.9 Programming example: OBW measurement

This programming example demonstrates the measurement example described in [Chapter 10.4.2.5, "Measurement example"](#), on page 316 in a remote environment.

```
//-----Preparing the measurement -----
//Reset the instrument
*RST

DEVIce:DELeTe:ALL

//*****
//***** Configure instrument connections *****
//*****
//Configure connection to MyFSW at 123.456.789.100 using VSI11 protocol
DEV:CRE 'MyFSW','123.456.789.100',VXI11;*WAI
//Query the network address of MyFSW
DEV:TARG? 'MyFSW'
//Result: '123.456.789.100'
//Query connection state to MyFSW
DEV:STAT? 'MyFSW'
//Result: 1 (connection established)
//Query information on MyFSW
//Instrument ID?
DEV:INFO:IDN? 'MyFSW'
//Define the use of an external reference on MyFSW
DEV:EXTR:SOUR 'MyFSW',EXT
DEV:EXTR:FREQ 'MyFSW',13MHZ
//Assign MyFSW as input source for default channel 1
INST:BLOC:CHAN:SETT:SOUR DEV
INST:BLOC:CHAN:SETT:DEV 'MyFSW'

//-----Configuring the Measurement-----
//Set the center frequency to 800 MHz.
FREQ:CENT 800MHz
//Set the reference level to -10 dBm.
DISP:TRAC:Y:RLEV -10dBm
//Activate occupied bandwidth measurement.
CALC:MARK:FUNC:POW:SEL OBW
//Set the percentage of power to 99%.
```

```
POW:BWID 99PCT
//Set the channel bandwidth to 21 kHz.
POW:ACH:BAND 21kHz
//Optimize the instrument settings according to the channel bandwidth.
POW:ACH:PRES OBW
//Determine the ideal reference level for the measurement.
POW:ACH:PRES:RLEV
//Set the trace detector to positive peak.
DET APE

//-----Performing the Measurement-----
//Select single sweep mode.INIT:CONT OFF

//Initiate a new measurement and waits until the sweep has finished.
INIT;*WAI

//-----Retrieving Results-----
//Return the occupied bandwidth.
CALC:MARK:FUNC:POW:RES? OBW
```

# 14 Troubleshooting

If the results do not meet your expectations, or problems occur, the following information may help you solve your problem.

- [Troubleshooting remote operation](#)..... 949
- [Error messages in remote control mode](#)..... 951
- [Collecting information for support](#)..... 952

## 14.1 Troubleshooting remote operation

If problems arise during measurement in remote operation, try the following methods to solve them.

### Incompleted sequential commands - blocked remote channels

If a sequential command cannot be completed, for example because a triggered sweep never receives a trigger, the remote control program will never finish and the remote channel to the R&S VSE is blocked for further commands. In this case, you must interrupt processing on the remote channel in order to abort the measurement.

### To regain control over a blocked remote channel

Usually, if you wait a minute for the VISA connection to detect the lost connection and clear the control channel by itself, you can then re-establish the connection again. If this fails, try the following:

1. Press "Local" on the front panel of the connected instrument to return to manual operation (if not disabled). Then re-establish the connection.
2. Send a "Device Clear" command from the control instrument to the R&S VSE to clear all currently active remote channels. Depending on the used interface and protocol, send the following commands:
  - **Visa:** `viClear()`

The remote channel currently processing the incompleted command is then ready to receive further commands again.
3. On the remote channel performing the measurement, send the SCPI command `ABORT` to abort the current measurement and reset the trigger system.
4. If the connected instrument still does not react to the remote commands, switch it off and back on.

### Ignored commands

When a remote command attempts to define incompatible settings, the command is ignored and the instrument status remains unchanged, i.e. other settings are not automatically adapted. Therefore, control programs should always define an initial instrument status (e.g. using the `*RST` command) and then implement the required settings.

### Detecting false commands - log file

If a remote program does not provide the expected results and you are using a GPIB connection, you can log the commands and any errors that may occur. To activate the SCPI error log function, in the "Network + Remote" dialog box, in the "GPIB" tab, select "I/O Logging" .

All remote control commands received by the R&S VSE are recorded in log files with the following syntax:

```
C:\ProgramData\Rohde-Schwarz\VSE\<<version_no>\ScpiLogging\ScpiLog.<xx>
```

where <xx> is a consecutive number, starting with 00;

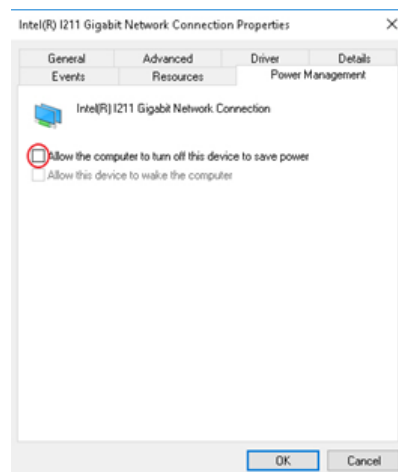
A new file is created each time you stop and restart the logging function. The lowest available number is used for the <xx> extension.

Logging the commands may be extremely useful for debug purposes, e.g. in order to find misspelled keywords in control programs. However, remember to turn off the logging function after debugging to avoid unnecessary access to the hard drive and use of storage space.

### Interrupted VISA connection to R&S VSE

Sometimes, in combination with a certain LAN-switch (SMC Switch 210), the VISA remote connection to the R&S VSE is interrupted. In this case, disable the power save mode for the network controller on the R&S VSE.

1. On the R&S VSE, open the Windows "Start" menu.
2. Search for the network connection properties.
3. On the "Power Management" tab, disable the power save option.



## 14.2 Error messages in remote control mode

In remote control mode error messages are entered in the error/event queue of the status reporting system and can be queried with the command `SYSTem:ERRor?`. The answer format of R&S VSE to the command is as follows:

```
<error code>, "<error text with queue query>; <remote control command concerned>"
```

The indication of the remote control command with prefixed semicolon is optional.

### Example:

The command `TEST:COMMAND` generates the following answer to the query `SYSTem:ERRor?`

```
-113, "Undefined header;TEST:COMMAND"
```

There are two types of error messages:

- Error messages defined by SCPI are marked by negative error codes. These messages are defined and described in the SCPI standard and not listed here.
- Device-specific error messages use positive error codes. These messages are described below.

**Table 14-1: Device-specific error messages**

Error code	Error text in the case of queue poll Error explanation
1052	<b>Frontend LO is Unlocked</b> This message is displayed when the phase regulation of the local oscillator fails in the RF front-end.
1060	<b>Trigger-Block Gate Delay Error- gate length &lt; Gate Delay</b> This message is displayed when the gate signal length is not sufficient for the pull-in delay with a predefined gate delay.
1064	<b>Tracking LO is Unlocked</b> This message is displayed when the phase regulation of the local oscillator fails on the external generator module.
2028	<b>Hardcopy not possible during measurement sequence</b> This message is displayed when a printout is started during scan sequences that cannot be interrupted. Such sequences are for example: <ul style="list-style-type: none"> <li>• Recording the system error correction data (alignment)</li> <li>• Instrument self-test</li> </ul> In such cases synchronization to the end of the scan sequence should be performed prior to starting the printout.
2033	<b>Printer Not Available</b> This message is displayed when the selected printer is not included in the list of available output devices. A possible cause is that the required printer driver is missing or incorrectly installed.
2034	<b>CPU Temperature is too high</b> This message is displayed when the temperature of the processor exceeds 70 °C.

## 14.3 Collecting information for support

If problems occur, the software generates error messages which in most cases will be sufficient for you to detect the cause of an error and find a remedy.

Error messages are described in [Chapter 14, "Troubleshooting"](#), on page 949.

In addition, our customer support centers are there to assist you in solving any problems that you may encounter with your R&S VSE. We will find solutions more quickly and efficiently if you provide us with the information listed below.

- **Windows Event Log Files**

Windows records important actions of applications and the operating system in event logs. You can create event log files to summarize and save the existing event logs (see ["To create Windows event log files"](#) on page 952).

- **Error Log:** The log file

(C:\Program Files\Rohde-Schwarz\VSE\

- **Support file:** a \*.zip file with important support information can be created automatically. The \*.zip file contains the system configuration information, the current software data and a screenshot of the screen display.

See also [Chapter 9.4.2, "R&S support information"](#), on page 163.

### To collect the support information

- ▶ Select "Help > Support" and then "Create R&S Support Information".

This data is stored to the following directory on the PC the R&S VSE software is installed on:

```
C:\ProgramData\Rohde-Schwarz\VSE\\user.
```

### To create Windows event log files



1. Select the "Windows Start Button" in the bottom left corner.
2. Type in *Event Viewer* and select "Enter".
3. Select and expand "Windows Logs" in the "Console Tree".
4. Right-click on each subsection and select "Save All Events As...".



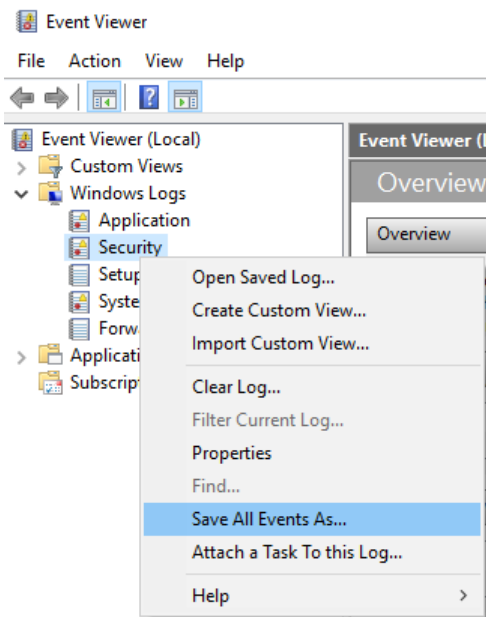


Figure 14-1: Event Viewer

5. Enter a file name and select "Save"

Attach the files to an e-mail in which you describe the problem and send it to the Rohde & Schwarz customer support.

### 14.3.1 Contacting customer support

#### Technical support – where and when you need it

For quick, expert help with any Rohde & Schwarz product, contact our customer support center. A team of highly qualified engineers provides support and works with you to find a solution to your query on any aspect of the operation, programming or applications of Rohde & Schwarz products.

#### Contact information

Contact our customer support center at [www.rohde-schwarz.com/support](http://www.rohde-schwarz.com/support), or follow this QR code:



Figure 14-2: QR code to the Rohde & Schwarz support page

# Annex

## A Menu reference

Most functions in the R&S VSE are available from the menus.

- [Common R&S VSE menus](#)..... 954
- [I/Q analyzer menus](#).....958



### A.1 Common R&S VSE menus

The following menus provide **basic functions for all applications**:

- [File menu](#)..... 954
- [Window menu](#)..... 956
- [Help menu](#).....957

#### A.1.1 File menu

The "File" menu includes all functionality directly related to any file operations, printing or setting up general parameters.

Menu item	Corresponding icon in toolbar	Description
Save		Saves the current software configuration to a file See <a href="#">Chapter 8.2, "Storing and recalling measurement settings"</a> , on page 117
Recall		Recalls a saved software configuration from a file See <a href="#">Chapter 8.2, "Storing and recalling measurement settings"</a> , on page 117
Save IQ Recording	-	Saves the recorded I/Q data from a measurement channel to a file See <a href="#">Chapter 8.3.3, "Exporting captured and recorded I/Q data"</a> , on page 129
Recall IQ Recording	-	Loads the recorded I/Q data from a file See <a href="#">Chapter 8.3.4, "Recalling measurement data from files"</a> , on page 132
Measurement Group >	-	Configures measurement channels and groups See <a href="#">Chapter 7.3, "Controlling measurement channels, groups, and sequences"</a> , on page 88
> New Group	-	Inserts a new group in the measurement sequence See <a href="#">"New Group"</a> on page 92

## Common R&amp;S VSE menus


Menu item	Corresponding icon in toolbar	Description
> Rename Group	-	Changes the name of the selected group See <a href="#">"Rename Group"</a> on page 93
> New Measurement Channel	-	Inserts a new channel in the selected group See <a href="#">"Channel New Channel"</a> on page 97
> Replace Measurement Channel	-	Replaces the currently selected channel by the selected application. See <a href="#">"Replace Current Channel"</a> on page 97
> Rename Measurement Channel	-	Changes the name of the selected channel. See <a href="#">"Rename Measurement Channel"</a> on page 98
> Delete Current Measurement Channel	-	Deletes the currently selected channel. See <a href="#">"Close"</a> on page 98
> Measurement Group Setup	-	Displays the "Measurement Group Setup" tool window. See <a href="#">Chapter 7.3, "Controlling measurement channels, groups, and sequences"</a> , on page 88
Instruments >	-	Configures instruments to be used for input to the R&S VSE software See <a href="#">Chapter 7.2, "Configuring instruments"</a> , on page 69
> New	-	Creates a new instrument configuration See <a href="#">Chapter 7.2.2, "Defining the connection information manually"</a> , on page 72
> Search	-	Searches for connected instruments in the network See <a href="#">Chapter 7.2.5, "Searching for connected instruments automatically"</a> , on page 78
> Delete All	-	Deletes all current instrument configurations See <a href="#">Chapter 7.2.8, "Deleting all instrument configurations"</a> , on page 81
> Setup	-	Hides or displays the "Instrument" tool window See <a href="#">Chapter 7.2, "Configuring instruments"</a> , on page 69
Preset >	-	Restores stored settings See <a href="#">Chapter 8.1, "Restoring the default software configuration (preset)"</a> , on page 116
> Selected Channel	-	Restores the default software configuration for an individual channel See <a href="#">"Restoring Channel Settings (Preset Selected Channel)"</a> on page 117
> All	-	Restores the default software configuration globally for the entire software See <a href="#">"Restoring All Default Settings (Preset All)"</a> on page 116

## Common R&amp;S VSE menus

Menu item	Corresponding icon in toolbar	Description
> All & Delete Instruments		Restores the default software configuration globally for the entire software and deletes all instrument configurations See <a href="#">"Restoring All Default Settings and Deleting Instrument Configurations (Preset All &amp; Delete Instruments)"</a> on page 116
> Reset VSE Layout	-	Restores the default layout of windows, toolbars etc. in the R&S VSE See <a href="#">"Restoring User-Specific Settings (Reset VSE Layout)"</a> on page 117
> Predefined Display	-	VSA application only: Sets up a predefined set of windows optimized for typical measurement scenarios.
> Restore VSA Factory Settings	-	VSA application only: Restores the VSA application's default settings and standards predefined by Rohde & Schwarz available at the time of delivery. Note that this function will overwrite customized standards that have the same name as predefined standards.
Preferences >	-	Configures global software settings See <a href="#">Chapter 9.1, "General software behavior"</a> , on page 145
> General	-	See <a href="#">Chapter 9.1, "General software behavior"</a> , on page 145
> Displayed Items	-	Hides or shows individual screen elements See <a href="#">Chapter 9.2.1, "Displayed items"</a> , on page 147
> Theme & Color	-	Configures the style of individual screen elements See <a href="#">Chapter 9.2.2, "Display theme and colors"</a> , on page 149
> Network & Remote	-	Configures the network settings and remote access to or from other devices See <a href="#">Chapter 12.4, "Network and remote control settings"</a> , on page 498
> Recording	-	Configures general recording parameters See <a href="#">Chapter 8.3.2, "General recording settings"</a> , on page 127
Print	-	Opens "Print" dialog to print selected measurement results See <a href="#">Chapter 8.4, "Printing current measurement results"</a> , on page 142
Exit	-	Closes the R&S VSE


## A.1.2 Window menu

The "Window" menu allows you to hide or show individual windows.

Menu item	Corresponding icon in toolbar	Description
Player	-	Displays the "Player" tool window to recall I/Q data recordings See <a href="#">Chapter 8.3.4.2, "Restoring the measurement results - R&amp;S VSE player"</a> , on page 137
Instruments	-	Displays the "Instruments" window to configure input instruments See <a href="#">Chapter 7.2, "Configuring instruments"</a> , on page 69
Measurement Group Setup	-	Displays the "Measurement Group Setup" window to configure a measurement sequence See <a href="#">Chapter 7.3, "Controlling measurement channels, groups, and sequences"</a> , on page 88
New Window >		Inserts a new result display window for the selected measurement channel See <a href="#">"New Measurement Window"</a> on page 98
Channel Information >	-	Displays the channel bar with global channel information for the selected measurement channel See <a href="#">"Channel bar"</a> on page 54
Active Windows >	-	Selects a result display as the active window; the corresponding channel is also activated See <a href="#">"Active windows, selected window"</a> on page 59
Configure Selected Result Window	-	Displays the "Window Configuration" dialog box to configure result-specific settings VSA application only

### A.1.3 Help menu

The "Help" menu provides access to help, support and licensing functions.

Menu item	Corresponding icon in toolbar	Description
Help		Opens the Online help window See <a href="#">Chapter 6.4, "Getting help"</a> , on page 63
License	-	Licensing, version and options information See <a href="#">Chapter 9.4.1, "Licensing, versions and options"</a> , on page 159
Support	-	Support functions See <a href="#">Chapter 9.4.2, "R&amp;S support information"</a> , on page 163
Register VSE	-	Opens the Rohde & Schwarz support page ( <a href="http://www.rohde-schwarz.com/support">http://www.rohde-schwarz.com/support</a> ) in a browser for registration.

Menu item	Corresponding icon in toolbar	Description
Online Support	-	Opens the default web browser and attempts to establish an Internet connection to the Rohde & Schwarz product site.
About	-	Software version information

## A.2 I/Q analyzer menus

The following menus are only available if an I/Q Analyzer measurement channel is selected.

• <a href="#">Edit menu</a> .....	958
• <a href="#">Input &amp; output menu</a> .....	958
• <a href="#">Meas setup menu</a> .....	959
• <a href="#">Trace menu</a> .....	960
• <a href="#">Marker menu</a> .....	960

### A.2.1 Edit menu

The "Edit" menu contains functions for processing the temporarily stored current measurement results.

Menu item	Description
Trace Export	Exports the selected traces and table results to an ASCII file See <a href="#">Chapter 10.5.1.3, "Trace / data export configuration"</a> , on page 403
Copy to Clipboard	Copies the selected graphical measurement results (as ASCII data) to the Windows clipboard for further processing. See <a href="#">Chapter 8.6, "Copying graphical results to the clipboard"</a> , on page 144

### A.2.2 Input & output menu

The "Input & Output" menu provides functions to configure the input source, frontend parameters and output settings for the measurement.

This menu is application-specific.

**Table A-1: "Input" menu items for the basic I/Q Analyzer**

Menu item	Description
Amplitude	<a href="#">Chapter 10.3.3, "Amplitude"</a> , on page 219
Scale	<a href="#">Chapter 10.3.3.4, "Scaling the y-axis"</a> , on page 231
Frequency	<a href="#">Chapter 10.3.4, "Frequency settings"</a> , on page 235
Trigger	<a href="#">Chapter 10.3.5, "Trigger and gate configuration"</a> , on page 237

Menu item	Description
Input Source	<a href="#">Chapter 10.3.2.1, "Radio frequency input"</a> , on page 195
Output	<a href="#">"Trigger 1/2/3"</a> on page 114

### A.2.3 Meas setup menu

The "Meas Setup" menu provides access to most measurement-specific settings, as well as bandwidth, sweep and auto configuration settings, and the configuration "Overview" window.

This menu is application-specific and measurement-specific.

**Table A-2: "Meas Setup" menu items for the basic I/Q Analyzer measurement**

Menu item	Description
Select Measurement	<a href="#">Chapter 10.1.1, "Selecting the measurement"</a> , on page 166
Data acquisition	<a href="#">Chapter 10.3.6.1, "Data acquisition"</a> , on page 252
Capture	<a href="#">Chapter 10.3.6.2, "Capture settings"</a> , on page 257
CCDF	Only for <a href="#">Statistic CCDF</a> measurement: <a href="#">Chapter 10.3.7, "CCDF (statistics) settings"</a> , on page 260
Overview	<a href="#">Chapter 10.3.1, "Configuration overview"</a> , on page 192
Expert mode	For Rohde & Schwarz oscilloscopes only: <a href="#">Chapter 7.4, "Configuring measurements in expert mode"</a> , on page 99

**Table A-3: "Meas Setup" menu items for the for the I/Q Analyzer CP ACLR measurement**

Menu item	Description
Select Measurement	<a href="#">Chapter 10.1.1, "Selecting the measurement"</a> , on page 166
Data acquisition	<a href="#">Chapter 10.3.6.1, "Data acquisition"</a> , on page 252
Capture	<a href="#">Chapter 10.3.6.2, "Capture settings"</a> , on page 257
CP/ACLR Standard	<a href="#">"Standard "</a> on page 277
ACLR Mode	<a href="#">"Absolute and Relative Values (ACLR Mode) "</a> on page 279
Set CP Reference	<a href="#">"Reference Channel "</a> on page 278
Meas Time	<a href="#">"Meas Time "</a> on page 280
Adjust Settings	<a href="#">"Optimized Settings (Adjust Settings )"</a> on page 280
CP/ACLR	<a href="#">"General CP/ACLR measurement settings"</a> on page 276
User Correction	<a href="#">Chapter 7.5, "Frequency response correction (R&amp;S VSE-K544)"</a> , on page 100
Overview	<a href="#">Chapter 10.4.1.4, "Channel power configuration"</a> , on page 275

**Table A-4: "Meas Setup" menu items for the I/Q Analyzer OBW measurement**

Menu item	Description
Select Measurement	<a href="#">Chapter 10.1.1, "Selecting the measurement"</a> , on page 166
Data acquisition	<a href="#">Chapter 10.3.6.1, "Data acquisition"</a> , on page 252
Capture	<a href="#">Chapter 10.3.6.2, "Capture settings"</a> , on page 257
% Power Bandwidth	<a href="#">"% Power Bandwidth "</a> on page 314
Channel Bandwidth	<a href="#">"Channel Bandwidth "</a> on page 314
Adjust Settings	<a href="#">"Adjust Settings "</a> on page 315
OBW	<a href="#">Chapter 10.4.2.3, "OBW configuration"</a> , on page 313
Overview	<a href="#">Chapter 10.4.2.3, "OBW configuration"</a> , on page 313

## A.2.4 Trace menu

The "Trace" menu provides access to trace-specific functions.

See [Chapter 10.5.1, "Trace configuration"](#), on page 378

This menu is application-specific.

**Table A-5: "Trace" menu items for the I/Q Analyzer**




Menu item	Description
Trace <x>	Selects the corresponding trace for configuration. The currently selected trace is highlighted blue
Copy Trace	Copies trace data to another trace
Spectrogram	Displays the "Spectrogram" configuration settings
Trace	Opens the "Traces" configuration dialog box

## A.2.5 Marker menu




The "Marker" menu provides access to marker-specific functions.

This menu is application-specific.

**Table A-6: "Marker" menu items for the I/Q Analyzer**

Menu item	Corresponding icon in toolbar	Description
Place New Marker		<a href="#">"Place New Marker "</a> on page 417
Percent Marker		<a href="#">"Percent Marker (CCDF only)"</a> on page 260
Select marker <x>		<a href="#">"Select Marker "</a> on page 420



Menu item	Corresponding icon in toolbar	Description
Marker to Trace	-	<a href="#">"Assigning the Marker to a Trace "</a> on page 419
All Markers Off		<a href="#">"All Markers Off "</a> on page 420
Marker...		<a href="#">"Individual marker setup"</a> on page 416
Search...		<a href="#">"Marker search settings"</a> on page 423
Marker Function...	-	<a href="#">Chapter 10.5.2.4, "Marker functions"</a> , on page 429

## B Reference of toolbar functions

Common functions can be performed via the icons in the toolbars.



Individual toolbars can be hidden or displayed.

### Hiding and displaying a toolbar

1. Right-click any toolbar or the menu bar.  
A context menu with a list of all available toolbars is displayed.
2. Select the toolbar you want to hide or display.  
A checkmark indicates that the toolbar is currently displayed.  
The toolbar is toggled on or off.

Note that some icons are only available for specific applications. Those functions are described in the individual application's User Manual.

### General toolbars

The following functions are generally available for all applications:

#### "Main" toolbar

For a description of these functions see [Chapter 8, "Data management"](#), on page 116.

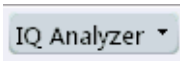






**Table B-1: Functions in the "Main" toolbar**

Icon	Description
	Overview: Displays the configuration overview for the current measurement channel
	Save: Saves the current software configuration to a file
	Recall: Recalls a saved software configuration from a file
	Save I/Q recording: Stores the recorded I/Q data to a file
	Recall I/Q recording: Loads recorded I/Q data from a file
	Print immediately: prints the current display (screenshot) as configured
	Add Window: Inserts a new result display window for the selected measurement channel
	MultiView mode: displays windows for all active measurement channels (disabled: only windows for currently selected channel are displayed)

### "Control" toolbar

For a description of these functions see [Chapter 7, "Controlling instruments and capturing I/Q data"](#), on page 66.



**Table B-2: Functions in the "Control" toolbar**

Icon	Description
	Selects the currently active channel
	Capture: performs the selected measurement
	Pause: temporarily stops the current measurement
	Continuous: toggles to continuous measurement mode for next capture
	Single: toggles to single measurement mode for next capture
	Record: performs the selected measurement and records the captured data and results
	Refresh: Repeats the evaluation of the data currently in the capture buffer without capturing new data (VSA application only).

### "Help" toolbar

For a description of these functions see [Chapter 6.4, "Getting help"](#), on page 63.

**Table B-3: Functions in the "Help" toolbar**

Icon	Description
	Help (+ Select): allows you to select an object for which context-specific help is displayed (not available in standard Windows dialog boxes or measurement result windows)
	Help: displays context-sensitive help topic for currently selected element



### Application-specific toolbars

The following toolbars are application-specific; not all functions shown here may be available in each application:

#### "Zoom" toolbar

For a description of these functions see [Chapter 10.5.3, "Zoomed displays"](#), on page 443.

**Table B-4: Functions in the "Zoom" toolbar**

Icon	Description
	Normal mouse mode: the cursor can be used to select (and move) markers in a zoomed display
	Zoom mode: displays a dotted rectangle in the diagram that can be expanded to define the zoom area

























Icon	Description
	Multiple zoom mode: multiple zoom areas can be defined for the same diagram
	Zoom off: displays the diagram in its original size

Table B-5: Functions in the "Marker" toolbar

Icon	Description
	Place new marker
	Percent Marker (CCDF only)
	Select marker
	Marker type "normal"
	Marker type "delta"
	Global peak
	Absolute peak (Currently only for GSM application)
	Next peak to the left
	Next peak to the right
	Next peak up (for spectrograms only: search in more recent frames)
	Next peak down (for spectrograms only: search in previous frames)
	Global minimum
	Next minimum left
	Next minimum right
	Next min up (for spectrograms only: search in more recent frames)
	Next min down (for spectrograms only: search in previous frames)
	Set marker value to center frequency
	Set reference level to marker value
	All markers off

Icon	Description
	Marker search configuration
	Marker configuration

**Table B-6: Functions in the "AutoSet" toolbar**

Icon	Description
	Refresh measurement results (R&S VSE VSA and OFDM VSA applications only)
	Auto level
	Auto frequency
	Auto trigger (R&S VSE GSM application only)
	Auto frame (R&S VSE GSM application only)
	Auto search (R&S VSE 3GPP FDD application only)
	Auto scale (R&S VSE 3GPP FDD + Pulse applications only)
	Auto scale all (R&S VSE 3GPP FDD + Pulse applications only)
	Auto all
	Configure auto settings

## C Formats for returned values: ASCII format and binary format

When trace data is retrieved using the `TRAC:DATA` or `TRAC:IQ:DATA` command, the data is returned in the format defined using the `FORMat[:DATA]` on page 873. The possible formats are described here.

- **ASCII Format (FORMat ASCII):**  
The data is stored as a list of comma-separated values (CSV) of the measured values in floating point format.
- **Binary Format (FORMat REAL,16/32/64):**  
The data is stored as binary data (definite length block data according to IEEE 488.2), each measurement value being formatted in 16-bit/32-bit/64-bit IEEE 754 floating-point-format.  
The schema of the result string is as follows:  
`#<Length of length><Length of data><value1><value2>...<value n>`  
with:

<Length of length>	Number of digits of the following number of data bytes
<Length of data>	Number of following data bytes
<Value>	2-byte/4-byte/8-byte floating point value

**Example:** `#41024<Data>...` contains 1024 data bytes

### Data blocks larger than 999,999,999 bytes

According to SCPI, the header of the block data format allows for a maximum of 9 characters to describe the data length. Thus, the maximum REAL 32 data that can be represented is 999,999,999 bytes. However, the R&S VSE is able to send larger data blocks. In this case, the length of the data block is placed in brackets, e.g.  
`#(1234567890)<value1><value2>...`



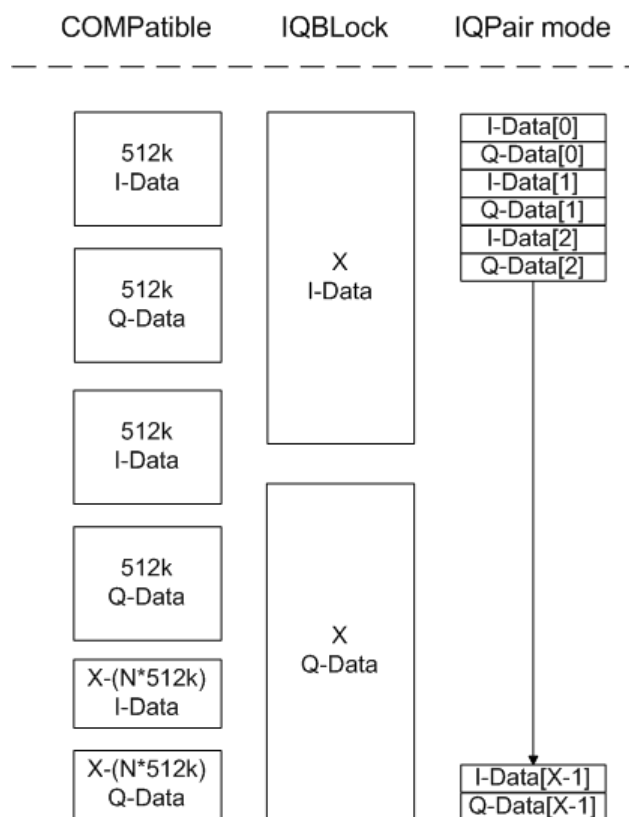
Reading out data in binary format is quicker than in ASCII format. Thus, binary format is recommended for large amounts of data.

## D Reference: format description for I/Q data files

This section describes how I/Q data is transferred to the memory during remote control (see `TRACe: IQ: DATA: FORMat` command).

For details on the format of the individual values, see [Chapter C, "Formats for returned values: ASCII format and binary format"](#), on page 966.

For details on the format of I/Q export files (using the "I/Q Export" function), see [Chapter E, "Reference: supported I/Q file formats"](#), on page 969 .



**Figure D-1: I/Q data formats**

**Note:** 512k corresponds to 524288 samples

For maximum performance, the formats "Compatible" or "IQPair" should be used. Furthermore, for large amounts of data, the data should be in binary format to improve performance.

In binary format, the number of I- and Q-data can be calculated as follows:

$$\# \text{ of I-Data} = \# \text{ of Q-Data} = \frac{\# \text{ of DataBytes}}{8}$$

For the format "QBLock", the offset of Q-data in the output buffer can be calculated as follows:

$$Q - Data - Offset = \frac{(\# \text{ of } DataBytes)}{2} + LengthIndicatorDigits$$

with "LengthIndicatorDigits" being the number of digits of the length indicator including the #. In the example above (#41024...), this results in a value of 6 for "LengthIndicatorDigits" and the offset for the Q-data results in  $512 + 6 = 518$ .



## E Reference: supported I/Q file formats

Various file types are supported for I/Q data import and export. The most important characteristics for each format are described here.

(See [Chapter 8.3, "Recording and recalling captured I/Q data for evaluation"](#), on page 125)



For best performance and to ensure comprehensive meta data is available, use the `iq.tar` format. This is a widely used file format for Rohde & Schwarz products.

**Table E-1: Characteristics of data file formats**

File format	File extension	Comment
IQ.tar	<code>.iq.tar</code>	<p>An <code>IQ.tar</code> file contains I/Q data in binary format together with meta information that describes the nature and the source of data, e.g. the sample rate. The objective of the <code>IQ.tar</code> file format is to separate I/Q data from the meta information while still having both inside one file. In addition, the file format allows a preview of the I/Q data in a web browser, and inclusion of user-specific data.</p> <p>Several streams of data can be provided in one file.</p> <p><b>Limitations:</b></p> <p>Recorded files &gt; 2 GB do not contain an xml-preview of the I/Q data.</p>
IQX	<code>.iqx</code>	<p>A file that contains 16-bit integer data in a binary format (values are stored interleaved starting with the first I value, IQIQIQ). The file contains additional measurement information as a header, e.g. the sample rate or marker information.</p> <p>Several streams of data can be provided in one file.</p> <p>The R&amp;S®IQW I/Q data recorder generates <code>IQX</code> files.</p>
IQW	<code>.iqw</code>	<p>A binary file format containing one channel of complex IQ data.</p> <p>The file contains float32 data in a binary format (interleaved IQIQ or in blocks, IIIQQQ). The file does not contain any additional information as a header.</p> <p>This format requires setting the sample rate and measurement time or record length manually.</p>
CSV	<code>.csv</code>	<p>A file containing I/Q data as comma-separated values (CSV). Additional metadata can be included.</p>
Simple CSV	<code>.csv</code>	<p>Simple CSV contains I/Q data only, without any header or meta data. That is, the file contains only (I,Q) data pairs, separated by commas. Several streams of data can be provided in one file.</p> <p>This format requires setting the sample rate and measurement time or record length manually.</p>
Matlab® v4	<code>.mat</code>	<p>A file containing I/Q data in Matlab® file format v4. Channel-related information is stored in matlab variables with names starting with 'ChX_'. 'X' represents the number of the channel with a lower bound of 1, e.g. the variable <code>Ch1_ChannelName</code> contains the name of the first channel. The corresponding data is contained in <code>ChX_Data</code>. Optional user data can be saved to variables named <code>UserDataX</code>, where 'X' starts at 0. The variable <code>UserData_Count</code> contains the number of <code>UserData</code> variables. For compatibility reasons user data needs to be saved as a 2xN char array, where the first row contains the key of the user data and the second row the actual value. Both rows must have the same column count and are therefore right-padded with white spaces. Variables can be written to the <code>*.mat</code> files in arbitrary order.</p> <p><b>Limitations:</b></p> <p>In general, the file format is limited to a maximum of 2 GB. A maximum of 10000000 values can be stored in a single variable, e.g. 50000000 complex data samples.</p>

File format	File extension	Comment
Matlab® v7.3	.mat	A file containing I/Q data in Matlab® file format v7.3.
Simple Matlab®	.mat	Simple Matlab® format contains I/Q data only, without any meta data. That is, the file contains only variables (double, double) for the corresponding channel data. This format requires setting the sample rate and measurement time or record length manually.
AMMOS intermediate frequency data format	.aid	Format used to transmit real or complex baseband signals. The IF signal is sent along with information that characterizes the datastream and datastream source. All datastreams have a frame-based structure, consisting of a global frame header coupled with a data-type specific frame body (i.e. the frame payload).
wv	.wv	(Import only) Proprietary file format used by Rohde & Schwarz signal generators to store waveform data. A waveform file contains a header and raw I/Q samples.

• I/Q data file format (iq-tar).....	970
• CSV file format.....	983
• IQW file format.....	986
• IQX file format.....	987
• Matlab® v. 4 / v. 7.3 file format.....	988
• AID format.....	991
• WV format.....	1001

## E.1 I/Q data file format (iq-tar)

I/Q data is packed in a file with the extension `.iq.tar`. An `iq-tar` file contains I/Q data in binary format together with meta information that describes the nature and the source of data, e.g. the sample rate. The objective of the `iq-tar` file format is to separate I/Q data from the meta information while still having both inside one file. In addition, the file format allows you to include user-specific data and to preview the I/Q data in a web browser (not supported by all web browsers).

The `iq-tar` container packs several files into a single `.tar` archive file. Files in `.tar` format can be unpacked using standard archive tools (see [http://en.wikipedia.org/wiki/Comparison\\_of\\_file\\_archivers](http://en.wikipedia.org/wiki/Comparison_of_file_archivers)) available for most operating systems. The advantage of `.tar` files is that the archived files inside the `.tar` file are not changed (not compressed) and thus it is possible to read the I/Q data directly within the archive without the need to unpack (untar) the `.tar` file first.



### Sample iq-tar files

Some sample `iq-tar` files are provided in the `C:\ProgramData\Rohde-Schwarz\VSE\<version_no>\user\Demo\` directory on the R&S VSE.

These files are also available in the demo mode of the R&S VSE software.



An application note on converting Rohde & Schwarz I/Q data files is available from the Rohde & Schwarz website:

[1EF85: Converting R&S I/Q data files](#)

### Contained files

An iq-tar file must contain the following files:

- **I/Q parameter XML file**, e.g. xyz.xml  
Contains meta information about the I/Q data (e.g. sample rate). The filename can be defined freely, but there must be only one single I/Q parameter XML file inside an iq-tar file.
- **I/Q data binary file**, e.g. xyz.complex.float32  
Contains the binary I/Q data of all channels. There must be only one single I/Q data binary file inside an iq-tar file.

Optionally, an iq-tar file can contain the following file:

- **I/Q preview XSLT file**, e.g. open\_IqTar\_xml\_file\_in\_web\_browser.xslt  
Contains a stylesheet to display the I/Q parameter XML file and a preview of the I/Q data in a web browser (not supported by all web browsers).  
A sample stylesheet is available at [http://www.rohde-schwarz.com/file/open\\_IqTar\\_xml\\_file\\_in\\_web\\_browser.xslt](http://www.rohde-schwarz.com/file/open_IqTar_xml_file_in_web_browser.xslt).
- [I/Q parameter XML file specification](#)..... 971
- [I/Q data binary file](#)..... 981

## E.1.1 I/Q parameter XML file specification



The content of the I/Q parameter XML file must comply with the XML schema RsIqTar.xsd available at: <http://www.rohde-schwarz.com/file/RsIqTar.xsd>.

In particular, the order of the XML elements must be respected, i.e. iq-tar uses an "ordered XML schema". For your own implementation of the iq-tar file format make sure to validate your XML file against the given schema.

The following example shows an I/Q parameter XML file. The XML elements and attributes are explained in the following sections.

### Sample I/Q parameter XML file: xyz.xml

```
<?xml version="1.0" encoding="UTF-8"?>
<?xml-stylesheet type="text/xsl"
href="open_IqTar_xml_file_in_web_browser.xslt"?>
<RS_IQ_TAR_FileFormat fileFormatVersion="1"
xsi:noNamespaceSchemaLocation="RsIqTar.xsd"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
  <Name>R&S VSE</Name>
  <Comment>Here is a comment</Comment>
  <DateTime>2011-01-24T14:02:49</DateTime>
```

```

<Samples>68751</Samples>
<Clock unit="Hz">6.5e+006</Clock>
<Format>complex</Format>
<DataType>float32</DataType>
<ScalingFactor unit="V">1</ScalingFactor>
<NumberOfChannels>1</NumberOfChannels>
<DataFilename>xyz.complex.float32</DataFilename>
<UserData>
  <UserDefinedElement>Example</UserDefinedElement>
</UserData>
  <PreviewData>...</PreviewData>
</RS_IQ_TAR_FileFormat>

```

### E.1.1.1 Minimum data elements

The following data elements are the minimum required for a valid *iq-tar* file. They are always provided by an *iq-tar* file export from a Rohde & Schwarz product. If not specified otherwise, it must be available in all *iq-tar* files used to import data to a Rohde & Schwarz product.

Element	Possible Values	Description
<RS_IQ_TAR_FileFormat>	-	The root element of the XML file. It must contain the attribute <code>fileFormatVersion</code> that contains the number of the file format definition.
<Name>	string	Optional: describes the device or application that created the file.
<Comment>	string	Optional: contains text that further describes the contents of the file.
<DateTime>	yyyy-mm-ddThh:mm:ss	Contains the date and time of the creation of the file. Its type is <code>xs:dateTime</code> (see <code>RsIqTar.xsd</code> ).
<Samples>	integer	Contains the number of samples of the I/Q data. For multi-channel signals all channels have the same number of samples. One sample can be: <ul style="list-style-type: none"> <li>• A complex number represented as a pair of I and Q values</li> <li>• A complex number represented as a pair of magnitude and phase values</li> <li>• A real number represented as a single real value</li> </ul> See also <Format> element.
<Clock>	double	Contains the clock frequency in Hz, i.e. the sample rate of the I/Q data. A signal generator typically outputs the I/Q data at a rate that equals the clock frequency. If the I/Q data was captured with a signal analyzer, the signal analyzer used the clock frequency as the sample rate. The attribute <code>unit</code> must be set to "Hz".

Element	Possible Values	Description
<Format>	complex   real   polar	Specifies how the binary data is saved in the I/Q data binary file (see <DataFilename> element). Every sample must be in the same format. The format can be one of the following: <ul style="list-style-type: none"> <li>• <code>complex</code>: Complex number in cartesian format, i.e. I and Q values interleaved. I and Q are unitless</li> <li>• <code>real</code>: Real number (unitless)</li> <li>• <code>polar</code>: Complex number in polar format, i.e. magnitude (unitless) and phase (rad) values interleaved. Requires <code>DataType = float32 or float64</code></li> </ul>
<DataType>	int8   int16   int32   float32   float64	Specifies the binary format used for samples in the I/Q data binary file (see <DataFilename> element and <a href="#">Chapter E.1.2, "I/Q data binary file"</a> , on page 981). The following data types are allowed: <ul style="list-style-type: none"> <li>• <code>int8</code>: 8 bit signed integer data</li> <li>• <code>int16</code>: 16 bit signed integer data</li> <li>• <code>int32</code>: 32 bit signed integer data</li> <li>• <code>float32</code>: 32 bit floating point data (IEEE 754)</li> <li>• <code>float64</code>: 64 bit floating point data (IEEE 754)</li> </ul>
<ScalingFactor>	double	Optional: describes how the binary data can be transformed into values in the unit Volt. The binary I/Q data itself has no unit. To get an I/Q sample in the unit Volt the saved samples have to be multiplied by the value of the <ScalingFactor>. For polar data only the magnitude value has to be multiplied. For multi-channel signals the <ScalingFactor> must be applied to all channels. The attribute <code>unit</code> must be set to "v". The <ScalingFactor> must be > 0. If the <ScalingFactor> element is not defined, a value of 1 V is assumed.
<NumberOfChannels>	integer	Optional: specifies the number of channels, e.g. of a MIMO signal, contained in the I/Q data binary file. For multi-channels, the I/Q samples of the channels are expected to be interleaved within the I/Q data file (see <a href="#">Chapter E.1.2, "I/Q data binary file"</a> , on page 981). If the <NumberOfChannels> element is not defined, one channel is assumed.
<DataFilename>		Contains the filename of the I/Q data binary file that is part of the <code>iq-tar</code> file. It is recommended that the filename uses the following convention: <xyz>.<Format>.<Channels>ch.<Type> <ul style="list-style-type: none"> <li>• &lt;xyz&gt; = a valid Windows file name</li> <li>• &lt;Format&gt; = complex, polar or real (see <code>Format</code> element)</li> <li>• &lt;Channels&gt; = Number of channels (see <code>NumberOfChannels</code> element)</li> <li>• &lt;Type&gt; = float32, float64, int8, int16, int32 or int64 (see <code>DataType</code> element)</li> </ul> Examples: <ul style="list-style-type: none"> <li>• <code>xyz.complex.1ch.float32</code></li> <li>• <code>xyz.polar.1ch.float64</code></li> <li>• <code>xyz.real.1ch.int16</code></li> <li>• <code>xyz.complex.16ch.int8</code></li> </ul>

Element	Possible Values	Description
<UserData>	xml	Optional: contains user, application or device-specific XML data which is not part of the <code>iq-tar</code> specification. This element can be used to store additional information, e.g. the hardware configuration. User data must be valid XML content.
<PreviewData>	xml	Optional: contains further XML elements that provide a preview of the I/Q data. The preview data is determined by the routine that saves an <code>iq-tar</code> file (e.g. R&S VSE). For the definition of this element refer to the <code>RsIqTar.xsd</code> schema. Note that the preview can be only displayed by current web browsers that have JavaScript enabled and if the XSLT stylesheet <code>open_IqTar_xml_file_in_web_browser.xslt</code> is available.

### E.1.1.2 User-defined data elements

You can insert additional user, application or device-specific XML data that is not part of the `iq-tar` specification in the `<UserData>` element. User data must be valid XML content.

Rohde & Schwarz products use this element to import and export application-specific data. While some elements are mandatory in order to import the `iq-tar` file to the product, others are optional.

The subelements within the `<UserData>` element provided by the Rohde & Schwarz products are `<DataImportExport_MandatoryData>` and `<DataImportExport_OptionalData>`. To import an `iq-tar` file to the R&S VSE software, either both of these elements or none of them must be provided.

#### Mandatory data elements

The following information is always provided by an `iq-tar` file export from Rohde & Schwarz products. It is contained in the `<DataImportExport_MandatoryData>` element. It must be available in all `iq-tar` files used to import data to the R&S VSE software if optional data is included (see "[Optional data elements](#)" on page 975).

**Table E-2: Subelements of `<DataImportExport_MandatoryData>`**

Element Name	Possible Values	Description
<ChannelNames>	<ChannelName>	Mapping of channels in <code>iq-tar</code> file to channel names in R&S VSE software. CH_1 = first <ChannelName> CH_2 = second <ChannelName> ... CH_n = last <ChannelName>
<ChannelName>	String	Channel name in R&S VSE software
<CenterFrequency>	Double	Center frequency of captured I/Q data

### Optional data elements

Optionally, the following information can be provided in `iq-tar` files used to import data to Rohde & Schwarz products. This information can also be provided by an `iq-tar` file export from the R&S VSE software, if selected. Note that the available information during data export depends on the connected instrument.

Optional information is contained in the `<DataImportExport_OptionalData>` element. If this element is included in the `<UserData>` element, the `<DataImportExport_MandatoryData>` element must also be included (see ["Mandatory data elements"](#) on page 974).

Optional data is included in `<Key>` subelements with a specific name attribute. Keys for an individual channel are provided together, i.e. first all keys for CH\_1, then all keys for CH\_2 etc. The channel index is provided as a prefix for the key name attribute and corresponds to the mapping defined in the `<ChannelNames>` in `<DataImportExport_MandatoryData>` (see ["Mandatory data elements"](#) on page 974).

**Table E-3: Possible information in `<DataImportExport_OptionalData>`**

<code>&lt;Key&gt;</code> element name attribute	Possible Values
Ch<n>_RefLevel[dBm]	Double
Ch<n>_RefLevelOffset[dB]	Double
Ch<n>_AttenuMech[dB]	Integer
Ch<n>_AttenuElecState	ON   OFF
Ch<n>_AttenuElecValue[dB]	Integer
Ch<n>_PreampState	ON   OFF
Ch<n>_PreampGain[dB]	Integer
Ch<n>_PreSelectorState	ON   OFF (R&S FSWT only)
Ch<n>_PreSelectorType	NARROW   WIDE (R&S FSWT only)
Ch<n>_Impedance[Ohm]	50   75
Ch<n>_InputCoupling	AC   DC
Ch<n>_DeviceId	String
Ch<n>_DeviceOptions	String
Ch<n>_DeviceHwInfo	String
Ch<n>_DeviceVersions	String
Ch<n>_CalibrationState	ON   OFF
Ch<n>_RefOscillatorInput	OFF   ON
Ch<n>_RefOscillatorFreq[Hz]	Double
Ch<n>_InputPath	RF

<b>&lt;Key&gt; element name attribute</b>	<b>Possible Values</b>
Ch<n>_InputSelection	INPUT1   INPUT2 (R&S FSWT only)
Ch<n>_HighPassFilterState	ON   OFF
Ch<n>_YigPreSelectorState	ON   OFF
Ch<n>_ExtMixerState	ON   OFF
Ch<n>_MeasBandwidth[Hz]	Double
Ch<n>_FilterSettings	FLAT   GAUSS   OFF
Ch<n>_TrgSource	Extern <1 ..4>   I/Q Power   IF Power   RF Power   Power Sensor   Time
Ch<n>_TrgLevel[dB]	Double
Ch<n>_TrgHysteresis[dB]	Double
Ch<n>_TrgTpis[s]	Double
Ch<n>_TrgOffset[s]	Double
Ch<n>_TrgSlope	Rising   Falling   Rising/Falling
Ch<n>_TrgHoldoff[s]	Double
Ch<n>_TrgDropOut[s]	Double
Ch<n>_NumberOfPostSamples	Integer
Ch<n>_NumberOfPreSamples	Integer



**Example: Example for <DataImportExport\_OptionalData>**

```

<DataImportExport_OptionalData>
<Key name="Ch1_AttenElecState">OFF</Key>
<Key name="Ch1_AttenElecValue[dB]">0</Key>
<Key name="Ch1_AttenMech[dB]">0</Key>
<Key name="Ch1_CalibrationState">ON</Key>
<Key name="Ch1_DeviceHwInfo"></Key>
<Key name="Ch1_DeviceId">Rohde-Schwarz,RTP,1320.5007k08/101011,4.15.1.0</Key>
<Key name="Ch1_DeviceOptions">B4,B10,B110</Key>
<Key name="Ch1_FilterSettings">FLAT</Key>
<Key name="Ch1_HighPassFilterState">OFF</Key>
<Key name="Ch1_Impedance[Ohm]">50</Key>
<Key name="Ch1_InputCoupling">AC</Key>
<Key name="Ch1_InputPath">RF</Key>
<Key name="Ch1_MeasBandwidth[Hz]">1000000000</Key>
<Key name="Ch1_NumberOfPostSamples">0</Key>
<Key name="Ch1_NumberOfPreSamples">0</Key>
<Key name="Ch1_PreamplifierGain[dB]">0</Key>
<Key name="Ch1_PreamplifierState">OFF</Key>
<Key name="Ch1_RefLevelOffset[dB]">0</Key>
<Key name="Ch1_RefLevel[dBm]">-15.0362</Key>
<Key name="Ch1_RefOscillatorInput">OFF</Key>
<Key name="Ch1_SelectedIqInputSource">CHAN1_CHAN3_WV</Key>
<Key name="Ch1_TriggerSource">FREE RUN</Key>
<Key name="Ch1_YigPreSelectorState">OFF</Key>
<Key name="Ch2_AttenElecState">OFF</Key>
<Key name="Ch2_AttenElecValue[dB]">0</Key>
<Key name="Ch2_AttenMech[dB]">0</Key>
<Key name="Ch2_CalibrationState">ON</Key>
<Key name="Ch2_DeviceHwInfo"></Key>
<Key name="Ch2_DeviceId">Rohde-Schwarz,RTP,1320.5007k08/101011,4.15.1.0</Key>
<Key name="Ch2_DeviceOptions">B4,B10,B110</Key>
<Key name="Ch2_FilterSettings">FLAT</Key>
<Key name="Ch2_HighPassFilterState">OFF</Key>
<Key name="Ch2_Impedance[Ohm]">50</Key>
<Key name="Ch2_InputCoupling">AC</Key>
<Key name="Ch2_InputPath">RF</Key>
<Key name="Ch2_MeasBandwidth[Hz]">1000000000</Key>
<Key name="Ch2_NumberOfPostSamples">0</Key>
<Key name="Ch2_NumberOfPreSamples">0</Key>
<Key name="Ch2_PreamplifierGain[dB]">0</Key>
<Key name="Ch2_PreamplifierState">OFF</Key>
<Key name="Ch2_RefLevelOffset[dB]">0</Key>
<Key name="Ch2_RefLevel[dBm]">-15.0362</Key>
<Key name="Ch2_RefOscillatorInput">OFF</Key>
<Key name="Ch2_SelectedIqInputSource">CHAN1_CHAN3_WV</Key>
<Key name="Ch2_TriggerSource">FREE RUN</Key>
<Key name="Ch2_YigPreSelectorState">OFF</Key>

```

```
<Key name="FirmwareVersion">1.80-20.5.16.0 Beta</Key>
</DataImportExport_OptionalData>
```

### Example: userdata for I/Q recordings by R&S VSE software

```
<UserData>
  <RohdeSchwarz>
    <DataImportExport_MandatoryData>
      <CenterFrequency unit="Hz">1e+09</CenterFrequency>
    </DataImportExport_MandatoryData>

    <DataImportExport_OptionalData>
      <Key name="Ch1_RefLevel[dBm]">11.3</Key>
      <Key name="Ch1_RefLevelOffset[dB]">15.375</Key>
      <Key name="Ch1_AttenuMech[dB]">20</Key>
      <Key name="Ch1_AttenuElecState">ON | OFF</Key>
      <Key name="Ch1_AttenuElecValue[dB]">3</Key>
      <Key name="Ch1_PreamplifierState">ON</Key>
      <Key name="Ch1_PreamplifierGain[dB]">15</Key>
      <Key name="Ch1_PreamplifierGain[dB]">15</Key>

      <Key name="Ch1_Impedance[Ohm]">50</Key>
      <Key name="Ch1_InputCoupling">AC</Key>
      <Key name="Ch1_PreamplifierGain[dB]">15</Key>
      <Key name="Ch1_PreamplifierGain[dB]">15</Key>

      <Key name="Ch1_DeviceId">string</Key>
      <Key name="Ch1_DeviceOptions">string</Key>
      <Key name="Ch1_DeviceHwInfo">string</Key>
      <Key name="Ch1_DeviceVersions">string</Key>
      <Key name="Ch1_DeviceHwInfo">string</Key>

      <Key name="Ch1_CalibrationState">ON | OFF</Key>

      <Key name="Ch1_RefOscillatorInput">enum</Key>
      <Key name="Ch1_RefOscillatorFreq[Hz]">15</Key>
      <Key name="Ch1_InputPath">RF | AIQ | FIQ | DIQ</Key>
      <Key name="Ch1_HighPassFilterState">ON | OFF</Key>
      <Key name="Ch1_YigPreSelectorState">ON | OFF</Key>
      <Key name="Ch1_ExtMixerState">ON | OFF</Key>

      <Key name="Ch1_MeasBandwidth[Hz]">8e+06</Key>
      <Key name="Ch1_FilterSettings">FLAT | GAUSS | OFF</Key>

      <Key name="Ch1_TriggerSource">enum</Key>
      <Key name="Ch1_TriggerLevel[dB]">15</Key>
      <Key name="Ch1_TriggerHysteresis[dB]">15</Key>
      <Key name="Ch1_TriggerTpis[s]">15</Key>
      <Key name="Ch1_TriggerOffset[s]">15</Key>
```

```

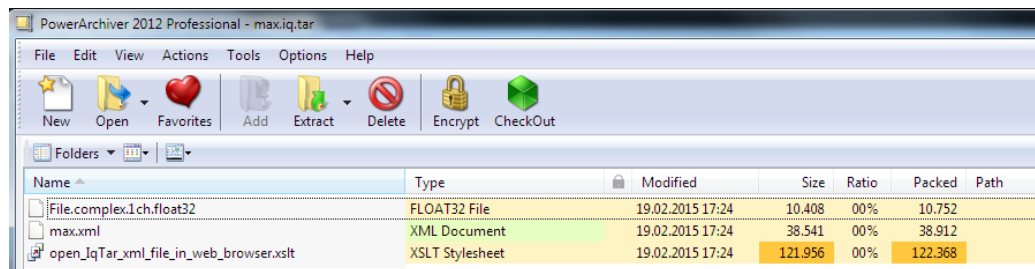
<Key name="Ch1_TrgSlope">Rising | Falling</Key>
<Key name="Ch1_TrgHoldoff[s]">15</Key>
<Key name="Ch1_TrgDropOut[s]">15</Key>

<Key name=" Ch1_NumberOfPreSamples">300</Key>
<Key name=" Ch1_NumberOfPostSamples">300</Key>
</DataImportExport_OptionalData>
</RohdeSchwarz>
</UserData>

```

### E.1.1.3 Example

The following example demonstrates the XML description inside the `iq-tar` file. Note that this preview is not supported by all web browsers.



Name	Type	Modified	Size	Ratio	Packed	Path
File.complex.1ch.float32	FLOAT32 File	19.02.2015 17:24	10.408	00%	10.752	
max.xml	XML Document	19.02.2015 17:24	38.541	00%	38.912	
open_iqTar_xml_file_in_web_browser.xslt	XSLT Stylesheet	19.02.2015 17:24	121.956	00%	122.368	

Open the xml file in a web browser. If the stylesheet `open_iqTar_xml_file_in_web_browser.xslt` is in the same directory, the web browser displays the xml file in a readable format.

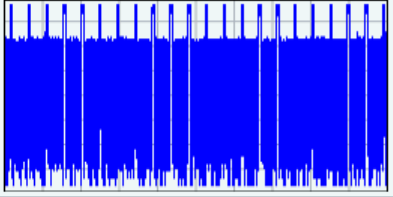
← → C:\temp\max.xml max.xml

## max.xml (of .iq.tar file)

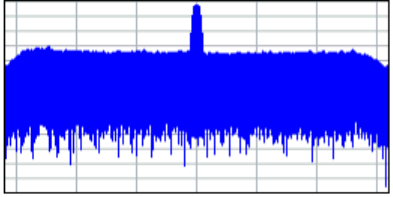
Description	
Saved by	VSE_1.10
Date & Time	2014-11-24 14:34:06
Sample rate	32 MHz
Number of samples	3200300
Duration of signal	100.009 ms
Data format	complex, float32
Data filename	File.complex.1ch.float32
Scaling factor	1 V

### IQ Analyzer

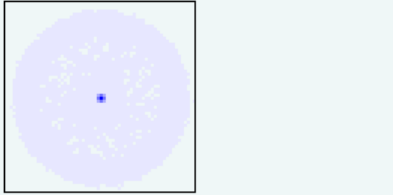
**Power vs time**  
y-axis: 10 dB /div  
x-axis: 10 ms /div



**Spectrum**  
y-axis: 10 dB /div  
x-axis: 5 MHz /div



**I/Q**



```
<?xml version="1.0" encoding="UTF-8"?>
<?xml-stylesheet type="text/xsl" href="open_IqTar_xml_file_in_web_browser.xslt"?>
<RS_IQ_TAR_FileFormat fileFormatVersion="1" xsi:noNamespaceSchemaLocation=
"http://www.rohde-schwarz.com/file/RsIqTar.xsd" xmlns:xsi=
"http://www.w3.org/2001/XMLSchema-instance">
  <Name>VSE_1.10a 29 Beta</Name>
  <Comment></Comment>
  <DateTime>2015-02-19T15:24:58</DateTime>
  <Samples>1301</Samples>
  <Clock unit="Hz">32000000</Clock>
  <Format>complex</Format>
  <DataType>float32</DataType>
```

```

<ScalingFactor unit="V">1</ScalingFactor>
<NumberOfChannels>1</NumberOfChannels>
<DataFilename>File.complex.1ch.float32</DataFilename>

<UserData>
  <RohdeSchwarz>
    <DataImportExport_MandatoryData>
      <ChannelNames>
        <ChannelName>IQ Analyzer</ChannelName>
      </ChannelNames>
      <CenterFrequency unit="Hz">0</CenterFrequency>
    </DataImportExport_MandatoryData>
    <DataImportExport_OptionalData>
      <Key name="Ch1_NumberOfPostSamples">150</Key>
      <Key name="Ch1_NumberOfPreSamples">150</Key>
    </DataImportExport_OptionalData>
  </RohdeSchwarz>
</UserData>

</RS_IQ_TAR_FileFormat>

```

**Example: ScalingFactor**

Data stored as int16 and a desired full scale voltage of 1 V

ScalingFactor = 1 V / maximum int16 value = 1 V / 2<sup>15</sup> = 3.0517578125e-5 V

Scaling Factor	Numerical value	Numerical value x ScalingFactor
Minimum (negative) int16 value	- 2 <sup>15</sup> = - 32768	-1 V
Maximum (positive) int16 value	2 <sup>15</sup> -1= 32767	0.999969482421875 V

**E.1.2 I/Q data binary file**

The I/Q data is saved in binary format according to the format and data type specified in the XML file (see <Format> element and <DataType> element). To allow reading and writing of streamed I/Q data, all data is interleaved, i.e. complex values are interleaved pairs of I and Q values and multi-channel signals contain interleaved (complex) samples for channel 0, channel 1, channel 2 etc. If the <NumberOfChannels> element is not defined, one channel is presumed.

**Example: Element order for real data (1 channel)**

```

I[0],           // Real sample 0
I[1],           // Real sample 1
I[2],           // Real sample 2
...

```

**Example: Element order for complex cartesian data (1 channel)**

```
I[0], Q[0],           // Real and imaginary part of complex sample 0
I[1], Q[1],           // Real and imaginary part of complex sample 1
I[2], Q[2],           // Real and imaginary part of complex sample 2
...
```

**Example: Element order for complex polar data (1 channel)**

```
Mag[0], Phi[0],       // Magnitude and phase part of complex sample 0
Mag[1], Phi[1],       // Magnitude and phase part of complex sample 1
Mag[2], Phi[2],       // Magnitude and phase part of complex sample 2
...
```

**Example: Element order for complex cartesian data (3 channels)**

Complex data: I[channel no][time index], Q[channel no][time index]

```
I[0][0], Q[0][0],     // Channel 0, Complex sample 0
I[1][0], Q[1][0],     // Channel 1, Complex sample 0
I[2][0], Q[2][0],     // Channel 2, Complex sample 0

I[0][1], Q[0][1],     // Channel 0, Complex sample 1
I[1][1], Q[1][1],     // Channel 1, Complex sample 1
I[2][1], Q[2][1],     // Channel 2, Complex sample 1

I[0][2], Q[0][2],     // Channel 0, Complex sample 2
I[1][2], Q[1][2],     // Channel 1, Complex sample 2
I[2][2], Q[2][2],     // Channel 2, Complex sample 2
...
```

**Example: Element order for complex cartesian data (1 channel)**

This example demonstrates how to store complex cartesian data in float32 format using MATLAB®.

```
% Save vector of complex cartesian I/Q data, i.e. iqiqliq...
N = 100
iq = randn(1,N)+1j*randn(1,N)
fid = fopen('xyz.complex.float32','w');
for k=1:length(iq)
    fwrite(fid, single(real(iq(k))), 'float32');
    fwrite(fid, single(imag(iq(k))), 'float32');
end
fclose(fid)
```

**Example: PreviewData in XML**

```
<PreviewData>
  <ArrayOfChannel length="1">
    <Channel>
      <PowerVsTime>
        <Min>
```

```

        <ArrayOfFloat length="256">
            <float>-134</float>
            <float>-142</float>
            ...
            <float>-140</float>
        </ArrayOfFloat>
    </Min>
    <Max>
        <ArrayOfFloat length="256">
            <float>-70</float>
            <float>-71</float>
            ...
            <float>-69</float>
        </ArrayOfFloat>
    </Max>
</PowerVsTime>
<Spectrum>
    <Min>
        <ArrayOfFloat length="256">
            <float>-133</float>
            <float>-111</float>
            ...
            <float>-111</float>
        </ArrayOfFloat>
    </Min>
    <Max>
        <ArrayOfFloat length="256">
            <float>-67</float>
            <float>-69</float>
            ...
            <float>-70</float>
            <float>-69</float>
        </ArrayOfFloat>
    </Max>
</Spectrum>
<IQ>
    <Histogram width="64" height="64">0123456789...0</Histogram>
</IQ>
</Channel>
</ArrayOfChannel>
</PreviewData>

```

## E.2 CSV file format

CSV files contain I/Q data as comma-separated values. Additional metadata can be saved.

- [Mandatory data elements](#).....984
- [Optional data elements](#)..... 984
- [Example](#)..... 985
- [Simple CSV format](#).....986

## E.2.1 Mandatory data elements

Parameter Name	Possible Values
Name	String
Comment	String
DateTime	Year-Month-DayTHour:Min:Sec
Format	complex
DataType	float32
NumberOfChannels	Integer
Ch<n>_ChannelName	String
Ch<n>_Samples	Integer
Ch<n>_Clock[Hz]	double
Ch<n>_CenterFrequency[Hz]	Double
IQ Data Header	<Channel Name>_I; <Channel Name>_Q (IQ data value)
-----	Double ; Double (IQ data I/Q pairs)

## E.2.2 Optional data elements

Parameter name	Possible Values
Ch<n>_AttenuElecState	ON   OFF
Ch<n>_AttenuElecValue[dB]	Integer
Ch<n>_AttenuMech[dB]	Integer
Ch<n>_CalibrationState	ON   OFF
Ch<n>_DeviceHwInfo	String
Ch<n>_DeviceId	String
Ch<n>_DeviceOptions	String
Ch<n>_DeviceVersions	String
Ch<n>_FilterSettings	FLAT   GAUSS   OFF
Ch<n>_HighPassFilterState	ON   OFF



Parameter name	Possible Values
Ch<n>_Impedance[Ohm]	50   75
Ch<n>_InputCoupling	AC   DC
Ch<n>_InputPath	RF
Ch<n>_MeasBandwidth[Hz]	double
Ch<n>_NumberOfPostSamples	Integer
Ch<n>_NumberOfPreSamples	Integer
Ch<n>_PreampGain[dB]	Integer
Ch<n>_PreampState	ON   OFF
Ch<n>_RefLevelOffset[dB]	Double
Ch<n>_RefLevel[dBm]	Double
Ch<n>_RefOscillatorInput	OFF   ON
Ch<n>_RefOscillatorFreq[Hz]	Double
Ch<n>_TrgSource	Extern <1..4>   I/Q Power   IF Power   RF Power   Power Sensor   Time
Ch<n>_TrgLevel[dB]	Double
Ch<n>_TrgHysteresis[dB]	Double
Ch<n>_TrgTpis[s]	Double
Ch<n>_TrgOffset[s]	Double
Ch<n>_TrgSlope	Rising   Falling   Rising/Falling
Ch<n>_TrgHoldoff[s]	Double
Ch<n>_TrgDropOut[s]	Double
Ch<n>_YigPreSelectorState	ON   OFF

### E.2.3 Example

```

DataImportExport_MandatoryData;
Name;ExampleFile
Comment;Example Comment
DateTime;2015-02-19T15:26:33
Format;complex
DataType;float32
NumberOfChannels;1
Ch1_ChannelName;Example_Channel
Ch1_Samples;10
Ch1_Clock[Hz];3,2000000E+007
Ch1_CenterFrequency[Hz];100,0000000E+007
DataImportExport_EndHeaderSection;
Example_Channel_I;Example_Channel_Q

```

```
-5,9390777E-006;-3,4644620E-006
9,8984629E-007;-8,4631858E-005
-5,9885701E-005;4,1078620E-005
2,0786772E-005;7,8692778E-005
-4,9492314E-006;-1,5095156E-004
1,6332464E-005;1,8312156E-005
-5,4936470E-005;4,5532928E-005
-4,8997390E-005;9,7004937E-005
-1,1383232E-005;4,5532928E-005
-8,2157239E-005;3,2170003E-005
```

### E.2.4 Simple CSV format

The simple .CSV format contains I/Q data only, without any header or meta data. That is, the file contains only (I,Q) data pairs, separated by commas. Several streams of data can be provided in one file, one after the other.

**Example:**

```
7.0663854e-003,1.7059683e-005,
7.0817876e-003,7.5836733e-006,
7.0711789e-003,-1.2189972e-005,
```



When you load a simple CSV file, you must define the used sample rate, and optionally, analysis bandwidth and number of streams, manually.

See [Chapter 8.3.4.1, "Loading the I/Q data file and essential measurement information"](#), on page 133.

## E.3 IQW file format

IQW is a binary file format containing one channel of complex IQ data.

Format description details:

- IQDataFormat: Complex
- IQDataType: Float32
- Byte order: Intel
- Data order: IQIQIQ (I/Q paired or interleaved) or IIIQQQ (I/Q blocks, default)  
Currently, the R&S VSE software saves I/Q data in interleaved order for IQW file format.

**Mandatory Data Elements**

Only the binary I/Q data.

**Optional Data Elements**

None.

## E.4 IQX file format

IQX is a binary file format containing one or more streams of complex IQ data. IQW files can contain very large amounts of data for long measurements.

The file contains a header section, including not only the sample rate, but also information regarding markers which have been registered during the recording. After loading an IQX file in the R&S VSE software, you can make use of the "Marker Info" option in the R&S VSE Player. Currently, IQX is the only format supported by the R&S VSE software which allows for this feature.

The R&S®IQW I/Q data recorder generates IQX files.

Format description details:

- IQDataFormat: IQIQ
- IQDataType: Int16  
Wenn imported to the R&S VSE software, the data is converted to float32 type values.
- Byte order: Intel

### Mandatory Data Elements

Only the binary I/Q data.

### Optional Data Elements

Markerinfo - Trigger list. Markers are included in the file to indicate trigger events. Different trigger types are indicated by different marker codes:

**Table E-4: Trigger type coding in IQX files**

Code	Trigger Type	Trigger Type (remote parameter)
0x01	Time Domain Trigger 0	TDT0
0x02	Time Domain Trigger 1	TDT1
0x03	Heartbeat Trigger	HBT
0x04	External Trigger 0	EXT0
0x05	Software Trigger	SWT
0x06	Frequency Mask Trigger	FMT
0x07	Probability Mask Trigger	PMT
0x08	Correlation Trigger	CFT
0x09	RF Power Trigger	RFPT
0x0A	IF Power Trigger	IFPT
0x0B	IQ Power Trigger	IQPT
0x0C	Modulation Trigger	MODT

Code	Trigger Type	Trigger Type (remote parameter)
0x0D	External Trigger 1	EXT1
0x0E	External Trigger 2	EXT2
0x0F	External Trigger 3	EXT3

## E.5 Matlab® v. 4 / v. 7.3 file format

In Matlab® files, channel-related information is stored in Matlab® variables with names starting with 'ChX\_'. 'X' represents the number of the channel with a lower bound of 1, e.g. the variable `Ch1_ChannelName` contains the name of the first channel. The corresponding data is contained in `ChX_Data`.

Optional user data can be saved to variables named `UserDataX`, where 'x' starts at 0. The variable `UserData_Count` contains the number of `UserData` variables. For compatibility reasons user data needs to be saved as a 2xN char array, where the first row contains the key of the user data and the second row the actual value. Both rows must have the same column count and are therefore right-padded with white spaces.

Variables can be written to the \*.mat files in arbitrary order.



The Matlab® v7.3. file format requires the Matlab® Compiler Runtime (MCR) to be installed on the system and registered in the `PATH` environment variable.



### Auxiliary tools to convert I/Q files using Matlab®

The R&S VSE installation now also includes some additional tools to convert I/Q files using Matlab®. The tools are stored in the `C:\ProgramData\Rohde-Schwarz\VSE\<version_no>\user\tools` directory.

For details see [Chapter 8.3, "Recording and recalling captured I/Q data for evaluation"](#), on page 125.

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### E.5.1 Mandatory data elements

Variable name	Class	Format / possible values
Name	char	
Comment	char	

Variable name	Class	Format / possible values
DateTime	char	Year-Month-DayTHour:Min:Sec
Format	char	complex
DataType	char	float32
NumberOfChannels	Double	
Ch<n>_ChannelName	char	
Ch<n>_Samples	double	
Ch<n>_Clock_Hz	double	
Ch<n>_CFrequency_Hz	Double	
Ch<n>_Data	Double, Double	I,Q
UserData_Count	Double	(Number of optional user data variables)

## E.5.2 Optional data elements

Optional user data can be saved to variables named `UserDataX`, where 'x' starts at 0. The variable `UserData_Count` contains the number of `UserData` variables. For compatibility reasons user data needs to be saved as a 2xN char array, where the first row contains the key of the user data and the second row the actual value. Both rows must have the same column count and are therefore right-padded with white spaces.

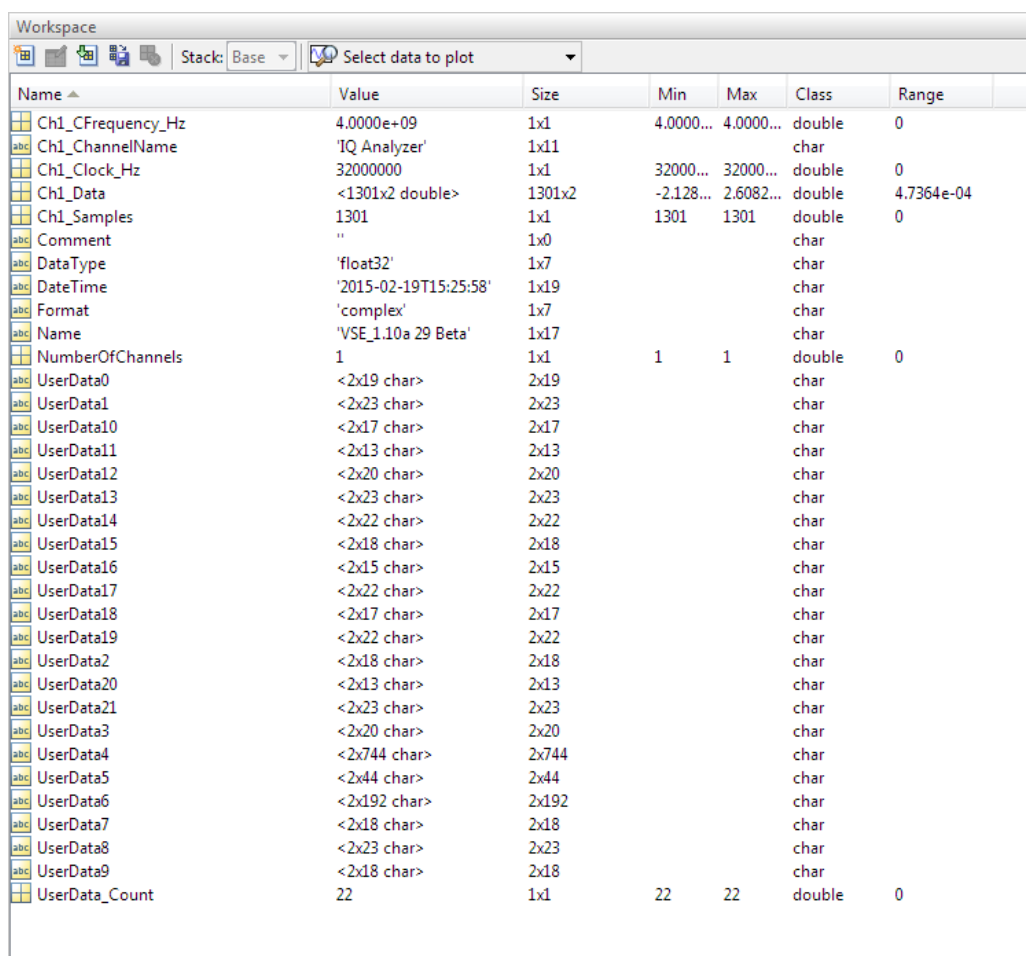
Variable name	Class	Format
UserData<n>	char	Optional Data Parameter name, Value

**Table E-5: Optional parameter names to be defined in `UserData<n>` variables**

Parameter name	Possible Values
Ch<n>_AttenuElecState	ON   OFF
Ch<n>_AttenuElecValue_dB	Integer
Ch<n>_AttenuMech_dB	Integer
Ch<n>_CalibrationState	ON   OFF
Ch<n>_DeviceHwInfo	String
Ch<n>_DeviceId	String
Ch<n>_DeviceOptions	String
Ch<n>_DeviceVersions	String
Ch<n>_FilterSettings	FLAT   GAUSS   OFF
Ch<n>_HighPassFilterState	ON   OFF
Ch<n>_Impedance_Ohm	50   75
Ch<n>_InputCoupling	AC   DC

Parameter name	Possible Values
Ch<n>_InputPath	RF
Ch<n>_MeasBandwidth_Hz	double
Ch<n>_NumberOfPostSamples	Integer
Ch<n>_NumberOfPreSamples	Integer
Ch<n>_PreampGain_dB	Integer
Ch<n>_PreampState	ON   OFF
Ch<n>_RefLevelOffset_dB	Double
Ch<n>_RefLevel_dBm	Double
Ch<n>_RefOscillatorInput	OFF   ON
Ch<n>_RefOscillatorFreq_Hz	Double
Ch<n>_TrgSource	Extern <1 ..4>   I/Q Power   IF Power   RF Power   Power Sensor   Time
Ch<n>_TrgLevel_dB	Double
Ch<n>_TrgHysteresis_dB	Double
Ch<n>_TrgTpis_s	Double
Ch<n>_TrgOffset_s	Double
Ch<n>_TrgSlope	Rising   Falling   Rising/Falling
Ch<n>_TrgHoldoff_s	Double
Ch<n>_TrgDropOut_s	Double
Ch<n>_YigPreSelectorState	ON   OFF

### E.5.3 Example



Name	Value	Size	Min	Max	Class	Range
Ch1_CFrequency_Hz	4.0000e+09	1x1	4.0000...	4.0000...	double	0
Ch1_ChannelName	'IQ Analyzer'	1x11			char	
Ch1_Clock_Hz	32000000	1x1	32000...	32000...	double	0
Ch1_Data	<1301x2 double>	1301x2	-2.128...	2.6082...	double	4.7364e-04
Ch1_Samples	1301	1x1	1301	1301	double	0
Comment	''	1x0			char	
DataType	'float32'	1x7			char	
DateTime	'2015-02-19T15:25:58'	1x19			char	
Format	'complex'	1x7			char	
Name	'VSE_1.10a 29 Beta'	1x17			char	
NumberOfChannels	1	1x1	1	1	double	0
UserData0	<2x19 char>	2x19			char	
UserData1	<2x23 char>	2x23			char	
UserData10	<2x17 char>	2x17			char	
UserData11	<2x13 char>	2x13			char	
UserData12	<2x20 char>	2x20			char	
UserData13	<2x23 char>	2x23			char	
UserData14	<2x22 char>	2x22			char	
UserData15	<2x18 char>	2x18			char	
UserData16	<2x15 char>	2x15			char	
UserData17	<2x22 char>	2x22			char	
UserData18	<2x17 char>	2x17			char	
UserData19	<2x22 char>	2x22			char	
UserData2	<2x18 char>	2x18			char	
UserData20	<2x13 char>	2x13			char	
UserData21	<2x23 char>	2x23			char	
UserData3	<2x20 char>	2x20			char	
UserData4	<2x744 char>	2x744			char	
UserData5	<2x44 char>	2x44			char	
UserData6	<2x192 char>	2x192			char	
UserData7	<2x18 char>	2x18			char	
UserData8	<2x23 char>	2x23			char	
UserData9	<2x18 char>	2x18			char	
UserData_Count	22	1x1	22	22	double	0

### E.5.4 Simple matlab® format

As of R&S VSE software version 1.50, a simple `.mat` format is supported. This format contains I/Q data only, without any meta data. That is, the file contains only variables (double, double) for the corresponding channel data.



When you load a simple Matlab® file, you must define the used sample rate (and optionally analysis bandwidth) manually.

See [Chapter 8.3.4.1, "Loading the I/Q data file and essential measurement information"](#), on page 133.

## E.6 AID format

AID is a format used to transmit real or complex baseband signals. The IF signal is sent along with information that characterizes the datastream and datastream source.

All datastreams have a frame based structure using the same format, consisting of a global *Frame header* coupled with a data-type specific *Frame body* (i.e. the frame payload).

The header and the body of the frame consist of a number of 32-bit words. The *Frame header* has a predefined structure and size. The size and structure of the *Frame body* depends on the payload type. This is an important factor in the choice of the frame size.

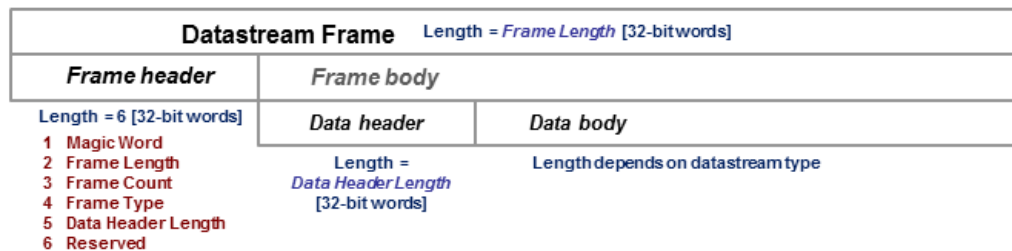


Figure E-1: Generic Datastream Frame structure

### Global Frame header

The *Frame header* contains information used for frame synchronization, frame sequencing, payload identification and frame sizing. It consist of six 32-bit words as depicted in the following figure and is defined in

`rs_gx40x_global_frame_header_if_defs.h`

Table E-6: Global Frame header (structure name: `typFRH_FRAMEHEADER`)

Word position in frame	Member name Member type	Description
1	<code>uintMagicWord</code> <code>ptypUINT</code>	<b>Magic Word</b> - 32-bit word, always identical ( <code>0xFB746572</code> ), defines the start of the <i>Frame header</i> and is used for frame synchronization. The <i>Magic Word</i> and the <i>Frame Length</i> are used to identify the beginning of each frame.
2	<code>uintFrameLength</code> <code>ptypUINT</code>	<b>Frame Length</b> - gives the length of the frame including both <i>Frame header</i> and <i>Frame body</i> . The length is expressed in 32-bit words. The minimum length is six in case the <i>Frame body</i> is empty and the maximum length is limited to the value: <ul style="list-style-type: none"> <li><code>kFRH_FRAME_LENGTH_MAX = 0x100000</code> (<math>1048576 = 2^{20}</math>) in case of normal frames</li> <li><code>kFRH_FRAME_LENGTH_MAX_EX = 0x400000</code> (<math>64 * 1048576 = 2^{26}</math>) in case of extended frames (an extended frame is marked by Bit#0 of the Reserved word of the frame header). Only some datastream types allow the extended frame size, see the definitions in the <code>rs_gx40x_global_frame_types_if_defs.h</code>.</li> </ul> The next <i>Magic Word</i> which denotes the next frame in this data stream will occur <code>uintFrameLength</code> [32-bit words] after the <i>Magic Word</i> in this frame.
3	<code>uintFrameCount</code> <code>ptypUINT</code>	<b>Frame Count</b> - sequence counter modulo $2^{32}$ . Determines the position of this frame in the datastream and is used for sequencing and lost frame detection.



Word position in frame	Member name Member type	Description
4	<b>uintFrameType</b> ptypUINT	<b>Frame Type</b> - identifies the data type contained in this frame and gives the specific structure of the frame payload. The complete list of frame types (i.e. datastream types) can be found in the following header file: <code>rs_gx40x_global_frame_types_if_defs.h</code>
5	<b>uintDataHeaderLength</b> ptypUINT	<b>Data Header Length</b> - gives the length of the <i>data header</i> positioned at the beginning of the <i>Frame body</i> . The length is expressed in 32-bit words (0 means no data header). This information can be used by the software to recognize the version of the datastream format and thus its compatibility to read and correctly interpret the datastream. It enables forward-compatibility with future datastream versions. This value will not vary for a continuous data stream.
6	<b>uintReserved</b> ptypUINT	<ul style="list-style-type: none"> <li>• Bits #31 to #1 - Reserved (not yet used, must be 0)</li> <li>• Bit #0 - Marks the frame with extended size (up to <code>kFRH_FRAME_LENGTH_MAX_EX</code> 32-bit words).</li> </ul>



The *Data Header Length* information is very important for the correct addressing of the data samples. This information gives the exact position in the frame where the *Data body* begins independent of the version of the *data header* (different versions consist of different number of parameters). From the frame beginning (indicated by the *Magic Word*), the first six 32-bit words represent the *Frame header* and the next *Data Header Length* 32-bit words represent the *data header*. After  $6 + \text{uintDataHeaderLength}$  32-bit words starts the *Data body*, i.e. the first data sample.

### Frame body

The *Frame body* contains the payload of the frame and its structure depends on the datastream type, as defined by the *Frame Type* element in the *Frame header*.

The *Frame body* is structured into a *data header* followed by the *Data body*. The *data header* contains datastream specific information of the payload.



### Bit numbering

Throughout this format description it is assumed that bit #0 is the bit of least numeric significance.

## E.6.1 Data body

The IF Data format is valid for the following datastream types:

Table E-7: IF Datastream types

Datastream type ID	Description	Sample data type
ekFRH_DATASTREAM__IFDATA_32RE_32IM_FIX ekFRH_DATASTREAM__IFDATA_32RE_32IM_FIX_RESCALED	Complex IF Data samples, 32-bit real-part and 32-bit imaginary-part, fixed point	typIFD_SAMPLE_32RE_32IM_FIX
ekFRH_DATASTREAM__IFDATA_16RE_16IM_FIX	Complex IF Data samples, 16-bit real-part and 16-bit imaginary-part, fixed point	typIFD_SAMPLE_16RE_16IM_FIX
ekFRH_DATASTREAM__IFDATA_16RE_16RE_FIX	Real IF Data samples, 16-bit real-part, two samples in each 32-bit word, fixed point	typIFD_SAMPLE_16RE_16RE_FIX
ekFRH_DATASTREAM__IFDATA_32RE_32IM_FLOAT_RESCALED	Complex IF Data samples, 32-bit real-part und 32-bit imaginary-part, floating point	typIFD_SAMPLE_32RE_32IM_FLOAT

For the datastream types defined in Table E-7, the same frame body structure is used, the only difference is the carried sample data type.

### IF Data Frame Structure

The structure of the IF Datastream is defined in the `rs_gx40x_global_ifdata_header_if_defs.h` header file.

The Data Frame consists of the global *frame header* of type `typFRH_FRAMEHEADER`, as described in "Global Frame header" on page 992, followed by the datastream-specific *Frame body*.

The corresponding "Frame Type" value from the *frame header* for this datastream type can be found in the global frame types header file:

`rs_gx40x_global_frame_types_if_defs.h`.

The *frame body* consists of: the *data header* which describes the datastream payload and the *data body* which contains the actual datastream payload.

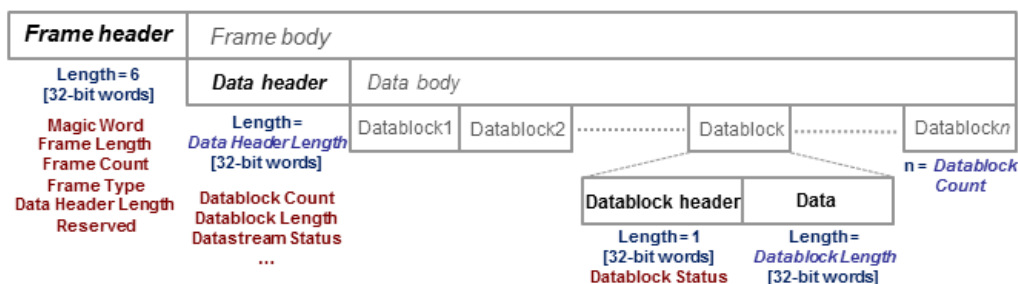


Figure E-2: IF Data frame format

### IF data header

The data header describes the datastream payload (such as number of data samples contained in this frame), and contains common properties of the data samples.

The **basic** data header contains several fields that are always sent.

The **extended** data header contains extra information fields sent after the fields of the basic structure.

The length of the data header, as specified by the `uintDataHeaderLength` parameter from the frame header. This parameter provides information about which data header type is used - i.e. the basic header or the extended header.

The IF data header structure, of type `typIFD_IFDATAHEADER`, is described in the following table (data header length = 14 [32-bit words]).

**Table E-8: IF DATA header (typIFD\_IFDATAHEADER)**

Word position in frame	Member name Member type	Description
7	<b>uintDatablockCount</b> ptypUINT	<b>Datablock Count</b> - represents the number of IF signal data blocks in the IF data frame.
8	<b>uintDatablockLength</b> ptypUINT	<b>Datablock Length</b> - The number 32-bit words in each IF signal data block excluding the data block header (has to be of the form $2^N$ with $N \geq 2$ ). This may not be the same as the number of IF signal data samples, as the size of a sample may be 16, 32 or 64 bits.
9 10	<b>bigtimeTimeStamp</b> ptypBIGTIME	64-bit <b>Timestamp</b> [μs] - Absolute time of the first IF signal data sample, in the first data block of IF signal data in this frame.
11	<b>uintStatusword</b> ptypUINT	<b>Status Word</b> - extra information that help the receiver react by parameter changes. <ul style="list-style-type: none"> <li>• Bit #31 - Reserved</li> <li>• Bit #30 - <b>dBFS flag</b> <ul style="list-style-type: none"> <li>– 1 indicates that all samples in this frame are considered to be dBFS (dB full scale).</li> <li>– 0 indicates that the values <i>Antenna Voltage Reference</i> and <i>Reciprocal gain correction</i> (see the <i>Status Word</i> description of the datablock header) can be used to calculate the corresponding level for each sample.</li> </ul> </li> <li>• Bits #29 to #8 - Reserved (not yet used, must be 0)</li> <li>• Bits #7 to #0 - User flags for special signaling between IF Data processing components.</li> </ul>
12	<b>uintSignalSourceID</b> ptypUINT	<b>Signal Source Identifier</b> or antenna identifier (value 0x0 if not used)

Word position in frame	Member name Member type	Description
13	<b>uintSignalSourceState</b> ptypUINT	<p>Current <b>Signal Source State</b> (value 0×0 if not used)</p> <ul style="list-style-type: none"> <li>gives the <i>Configuration Set Identifier</i> of the Task Data Set (in GX400) currently being applied by the IF signal source OR</li> <li>the current <i>Scan Step Number</i> in the case of scan operation In the case of memory scanning, the scan step number starts at 0 for the scan channel (memory location) configured with the lowest frequency, and increments (+1) for every channel configured for scanning in the memory scan list. In the case of frequency scanning, the scan step number starts at 0 for the scan step at the lowest frequency, and increments (+1) for every step taken within the configured frequency scan range.</li> </ul>
14 15	<b>uintTunerFrequency_Low</b> <b>uintTunerFrequency_High</b> ptypUINT	64-bit <b>Tuner Center Frequency</b> [Hz] - least significant 32 bits (uintTunerFrequency_Low) followed by most significant 32 bits (uintTunerFrequency_High)
16	<b>uintBandwidth</b> ptypUINT	IF signal 3dB <b>Bandwidth</b> [Hz]
17	<b>uintSamplerate</b> ptypUINT	<b>Sample Rate</b> of the AD Converter [samples / second] - due to digital filtering within the source, the resulting sample rate of the samples within this frame is: Sample Rate × Interpolation / Decimation
18	<b>uintInterpolation</b> ptypUINT	<b>Interpolation Factor</b> referred to the ADC signal sample rate. The value 0×1 indicates no interpolation

Word position in frame	Member name Member type	Description
19	<b>uintDecimation</b> ptypUINT	<b>Decimation Factor</b> referred to the ADC signal sample rate. The value 0x1 indicates no decimation
20	<b>intAntennaVoltageRef</b> ptypINT	<b>Antenna Voltage Reference (Ant-VoltRef)</b> is the device specific correction value for the tuner front-end Rx attenuation (expresses anything from antenna input connector to ADC) and is expressed in [0.1 dB $\mu$ V]. This is the level which, while the AGC amplification is at maximum attenuation, is required at the antenna input to produce the full scale value at the ADC. Using this value together with the Recip-Gain (Reciprocal Gain) value, one can calculate the true signal level at the antenna input connector (see "Data samples" on page 999). The RecipGain value is given in the Status Word of the IF Datablock header <a href="#">Table E-7</a>

The extended IF data header structure, of type `typIFD_IFDATAHEADER_EX`, is described in the following table (total data header length = 19 [32-bit words]).

**Table E-9: Extended IF data header (typIFD\_IFDATAHEADER\_EX) - extra fields only**

Word position in frame	Member name Member type	Description
21 22	<b>bigtimeStartTimeStamp</b> ptypBIGTIME_NS	64-bit <b>Timestamp</b> [ns] - Absolute time of the first sample of the datastream since starting the datastream ("Sample Counter" == 0). This value remains constant until the datastream is stopped and started again or until the tuner performs an internal synchronization.
23 24	<b>uintSampleCounter_Low</b> <b>uintSampleCounter_High</b> ptypUINT	<b>Sample Count</b> - 64-bit counter from the first sample of the first datablock in this frame. Note that this value can be reset when the datastream is stopped and started again or when the tuner performs an internal synchronization. The Sample Count of the next IF frame can be deduced from Datablock Count, Datablock Length and the number of 32-bit words per sample. In this way the number of sample Dropouts can be estimated (that can be replaced with Null values). The exact time is given by $t = Start\ Time + Sample\ Count * Decimation / (Sample\ rate * Interpolation)$ .
25	<b>intKFactor</b> ptypINT	<b>kFactor</b> - Correction factor of the current antenna, given in 0.1dB/m. Used to determine the field strength (in dB $\mu$ V/m) at the antenna from the voltage level at the antenna input of the receiver. Contains antenna gain, cable attenuation, antenna switch matrix attenuation and anything else from air to antenna input. (the value 0x80000000 is used if no kFactor is defined).



The values contained in the data header fields represent the status at the beginning of the frame. A modification happening during the transmission of a frame will only be noted in the data header of the next frame.

### IF Data Body

The IF data body contains zero or more IF Data samples arranged as an array of `typIFD_DATABLOCK` data blocks (the actual IF signal datastream payload). The number of datablocks is specified by the `Datablock Count` parameter from the data header.

Each datablock (`typIFD_DATABLOCK`) has its own datablock header: `datablockheaderDatablockHeader` (of type `typIFD_DATABLOCKHEADER`) and a datablock body that contains the actual data sample.

**Table E-10: IF Datablock header (`typIFD_DATABLOCKHEADER`)**

Member name Member type	Description
<code>uintStatusword</code> <code>ptypUINT</code>	Status of the Datablock <ul style="list-style-type: none"> <li>Bits #31 to #16 - <b>RecipGain</b> - Automatic Gain Control (AGC) <b>Reciprocal Gain Correction</b> value that was applied when generating the following IF Data samples. The RecipGain is represented as 16-bit unsigned decimal value (the 16-bit unsigned decimal has to be divided by <math>2^{16} = 65535</math> to obtain the unsigned fractional between 0 and 1). For example a correction value of <math>-17.5\text{dB}</math> gives a value for RecipGain of <math>0.1333</math> which will be represented as <code>0x2220</code>. Using this value together with the value for the antenna voltage reference, one can calculate the true signal level at the antenna input connector (see "<a href="#">Data samples</a>" on page 999).</li> <li>Bits #15 to #8 - Reserved (must be 0).</li> <li>Bits #7 to #2 - User flags for special signaling between IF Data processing components. Set to 0 if not used.</li> <li>Bit #1 - <b>Blanking flag</b> - this flag is set (1) to indicate that the data in this block may have been falsified by some external event.</li> <li>Bit #0 - <b>Invalidity flag</b> - this flag is set (1) to indicate that the data within this block may be corrupt (e.g. the input signal exceeded the range of the AD converter, or the analog signal input from which the data was converted was overloaded), OR any one of the fields in the IF datastream header does not represent the data in this block correctly.</li> </ul>

The datablock body is defined as an array of size `uintDatablockLength` with `uintData` elements interpreted using the corresponding sample type format ("`typIFD_SAMPLE....`" as described in the following table). The actual IF data samples have to be extracted from the array. Their structure and size is given by the IF datastream format ([Table E-7](#)). The possible IF data sample formats are described in the table below:

**Table E-11: IF data sample format**

Sample type	Sample format	Most significant bits	Least significant bits	Data type
<code>typIFD_SAMPLE_32RE_32IM_FIX</code>	64-bit I/Q format	First 32-bit Real component		<code>ptypINT</code> or <code>ptyp-FLOAT_SP</code>
<code>typIFD_SAMPLE_32RE_32IM_FLOAT</code>		Second 32-bit Imaginary component		<code>ptypINT</code> or <code>ptyp-FLOAT_SP</code>

Sample type	Sample format	Most significant bits	Least significant bits	Data type
typIFD_SAMPLE_16RE_16IM_FIX	32-bit I/Q format	16-bit Imaginary component	16-bit Real component	ptypINT
typIFD_SAMPLE_16RE_16RE_FIX	16-bit Real format	16-bit sample number I+1	16-bit sample number I	ptypINT

The term 'fix' ('fixed' point) indicates signed (2s-complement) fixed point fractional numbers.

### Data samples

The absolute signal level in [dBμV] may be calculated as follows:

$$\text{Level [dB}\mu\text{V]} = 10 \cdot \log(I_{\text{rel}}^2 + Q_{\text{rel}}^2) \text{ [dB]} + 20 \cdot \log(\text{RecipGain} / 2^{16}) \text{ [dB]} + 0.1 \cdot \text{AntVoltRef [dB}\mu\text{V]}$$

where I and Q are the real and imaginary parts of each signal sample.

The absolute signal level in [μV] may be calculated as follows:

$$I \text{ [}\mu\text{V]} = I_{\text{rel}} \cdot (\text{RecipGain} / 2^{16}) \cdot \text{AntVoltLin}$$

$$Q \text{ [}\mu\text{V]} = Q_{\text{rel}} \cdot (\text{RecipGain} / 2^{16}) \cdot \text{AntVoltLin}$$

$$\text{where AntVoltLin [}\mu\text{V]} = 10^{(0.1 \cdot \text{AntVoltRef}) / 20}$$

Depending on the sample format, as presented in [Table E-11](#), I and Q values can be represented as signed integers on 32-bits ( $I_{\text{int32}}$ ) or 16-bits ( $I_{\text{int16}}$ ) or as 32-bit float values ( $I_{\text{float}}$ ). The relative values of I and Q can be calculated with the following formulas (same applies for  $Q_{\text{rel}}$ ):

- $I_{\text{rel}} = I_{\text{int32}} / (2^{31} - 1)$  where  $I_{\text{int32}}$  is a signed integer, the most significant bit gives the sign (0 is positive, 1 is negative)
- $I_{\text{rel}} = I_{\text{int16}} / (2^{15} - 1)$  where  $I_{\text{int16}}$  is a signed integer, the most significant bit gives the sign (0 is positive, 1 is negative)
- $I_{\text{rel}} = I_{\text{float}}$

In the first two cases  $I_{\text{rel}}$  and  $Q_{\text{rel}}$  represent relative signal level values between -1 and 1. The absolute signal levels are retrieved through the parameter AntVoltRef as presented above. In the third case,  $I_{\text{rel}}$  and  $Q_{\text{rel}}$  can represent directly the absolute signal levels - in this case the RecipGain and AntVoltRef are not used (and are set to RecipGain=1, AntVoltRef=0).

### Example

Word position in frame	Frame component name	Hex value	Description
1	uintMagicWord	FB746572	Frame synchronisation
2	uintFrameLength	0000001E	Entire frame length = 30 (in 32-bit units)

Word position in frame	Frame component name	Hex value	Description
3	<b>uintFrameCount</b>	000000FE	Running frame number = 254
4	<b>uintFrameType</b>	00000004	The type of data contained in this frame
5	<b>uintDataHeaderLength</b>	0000000E	data header length = 14 (in 32-bit units)
6	<b>uintReserved</b>	00000000	Reserved field
7	<b>uintDatablockCount</b>	00000002	Number of data blocks in this frame = 2
8	<b>uintDatablockLength</b>	00000004	The data block length (in 32-bit units) excluding the data block header = 4. Every data block in this frame will have the same length.
9 10	<b>bigtimeTimeStamp</b>	00035CED 1D63F4D0	Absolute time [ $\mu$ s] of the first IF signal data sample in this frame
11	<b>uintStatusword</b>	00000000	No status change indications.
12	<b>uintSignalSourceID</b>	00000003	Antenna ID = 3
13	<b>uintSignalSourceState</b>	00000A73	Tuner scan status = position 2675
14	<b>uintTunerFrequency_Low</b>	42E9EC0	Tuner center frequency = 1,123 GHz
15	<b>uintTunerFrequency_High</b>	00000000	
16	<b>uintBandwidth</b>	01312d00	The IF Data bandwidth = 20 MHz
17	<b>uintSamplerate</b>	0493E000	ADC sample rate = 76,8 Msample/s
18	<b>uintInterpolation</b>	00000001	Interpolation factor = none
19	<b>uintDecimation</b>	00000003	Decimation factor referred to the ADC sample rate = 3
20	<b>intAntennaVoltageRef</b>	0000001E	Antenna reference voltage = 3dB $\mu$ V
21	<b>uintStatusword</b>	22200000	Beginning of the first Datablock. Statusword contains AGC correction factor = 0.1333 and no flags indications.
22	<b>uintData</b>	23873454	Real part of first sample
23	<b>uintData</b>	34234523	Imaginary part of first sample
24	<b>uintData</b>	56567543	Real part of second sample
25	<b>uintData</b>	34563456	Imaginary part of second sample
26	<b>uintStatusword</b>	41000004	Beginning of the second Datablock. Statusword contains AGC correction factor = 0.2539 and one user flag indication.
27	<b>uintData</b>	45345222	Real part of third sample
28	<b>uintData</b>	546672ab	Imaginary part of third sample
29	<b>uintData</b>	5BB25346	Real part of fourth sample
30	<b>uintData</b>	BBF7673e	Imaginary part of fourth sample



## E.7 WV format

WV is a format used by Rohde & Schwarz signal generators to store waveforms. A waveform file contains a header and raw I/Q samples.

### E.7.1 Mandatory elements

Each waveform file must begin with the TYPE tag. The sequence of the remaining tags is arbitrary.

Element	Description
TYPE	Designates the file type and source of creation (instrument type). Also includes an ASCII-coded checksum of the data part of the WAVEFORM tag, used to detect transmission errors.
CLOCK	The clock frequency (sample rate), in Hz
EMPTYTAG-Length	Length is an ASCII integer value that specifies the number of bytes in the EMPTYTAG, i.e. defines the number of bytes from the colon : to the end bracket }
WAVEFORM-Length	<p>The actual waveform data (I/Q stream)</p> <p>Length specifies the number of bytes in a WAVEFORM tag and is calculated as follows:</p> <p>Length = Number of I/Q pairs * 4 (2 bytes per I and 2 bytes per Q value) + 1 byte (the length of the #)</p> <p>The binary data is represented by 16-bit signed integer in 2's complement notation. It contains the I and Q component alternately, starting with the I component. Each component consists of 2 bytes in Little endian format representation, i.e. least significant byte (LSB) first. The values of the 2 bytes in an I component and a Q component are in the range 0x0 to 0xFFFF (-32767 to +32767).</p>

### E.7.2 Optional elements

The following elements are optional in a .wv file.

Element	Description
DATE	Date and time at which the file was created Syntax: yyyy-mm-dd;hh:mm:ss
LEVEL OFFS	Offset of RMS and peak level relative to the 16-bit full scale modulation (-32767 to + 32767) = 0 dB.
SAMPLES	Number of I/Q samples in the waveform in ASCII format

## F Reference: ASCII file export format

Trace data can be exported to a file in ASCII format for further evaluation in other applications. This reference describes in detail the format of the export files for result data.

The file consists of the header containing important scaling parameters and a data section containing the trace data. Optionally, the header can be excluded from the file (see ["Include Instrument & Measurement Settings"](#) on page 404).

The data of the file header consist of three columns, each separated by a semicolon: parameter name; numeric value; basic unit. The data section starts with the keyword "Trace <n>" (<n> = number of stored trace). The measured data follows in one or several columns (depending on the measurement), which are also separated by a semicolon.

The results are output in the same order as they are displayed on the screen: window by window, trace by trace, and table row by table row.

Generally, the format of this ASCII file can be processed by spreadsheet calculation programs, e.g. MS-Excel. Different language versions of evaluation programs can require a different handling of the decimal point. Thus, you can define the decimal separator to use (decimal point or comma, see ["Decimal Separator"](#) on page 404).

**Table F-1: ASCII file format for trace export in the I/Q Analyzer application**

File contents	Description
<b>Header data</b>	
Type;VSE;	Measurement software
Version;1.15;	Software version
Date;08.Jan 2016;	Date of data set storage
Mode;ANALYZER;	Operating mode
Preamplifier;OFF;	Preamplifier status
Transducer;OFF;	Transducer status
Center Freq;13250000000.000000;Hz	Center frequency
Freq Offset;0.000000;Hz	Frequency offset
Start;13250000000.000000;Hz	Start/stop of the display range. Unit: Hz for span > 0, s for span = 0, dBm/dB for statistics measurements
Stop;13250000000.000000;Hz	Frequency range (0 Hz in zero span and statistics measurements)
Ref Level;0.000000;dBm	Reference level
Level Offset;0.000000;dB	Level offset
Rf Att;10.000000;dB	Input attenuation
EI Att;0.000000;dB	Electrical attenuation
RBW;122565.434565;Hz	Resolution bandwidth

File contents	Description
VBW;0.000000;Hz	Video bandwidth
SWT;0.010000;s	Sweep time
Sweep Count;0;	Number of sweeps set
<b>Data section for individual window</b>	
Window;2;Spectrum	Window number and name
Ref Position;100.000000;%	Display range in y direction. Unit: dB with x-axis LOG, % with x-axis LIN
Level Range;100.000000;dB	Scaling of x-axis linear (LIN) or logarithmic (LOG)
x-Axis;LIN;	Scaling of y-axis linear (LIN) or logarithmic (LOG)
y-Axis;LOG;	Unit of x values: Hz with span > 0; s with span = 0; dBm/dB with statistics measurements
x-Unit;Hz;	Unit of y values: dB*/V/A/W depending on the selected unit with y-axis LOG or % with y-axis LIN
y-Unit;dBm;	
Trace 1;;	Selected trace
Trace Mode;AVERAGE;	Display mode of trace: CLR/WRITE,AVERAGE,MAXHOLD,MINHOLD
Detector;AUTOPEAK;	Detector set: AUTOPEAK,MAXPEAK,MINPEAK,AVERAGE,RMS,SAMPLE,QUASPEAK
Values; 1001;	Number of measurement points
10000;-10.3;-15.7 10130;-11.5;-16.9 10360;-12.0;-17.4 ...;...;	Measured values: <x value>, <y1>, <y2>; <y2> being available only with detector AUTOPEAK and containing in this case the smallest of the two measured values for a measurement point.
<b>Data section for individual trace</b>	
Trace 2;;	Next trace in same window
...	
<b>Data section for individual window</b>	
Window;2 ..;	Name of next window
<b>Data section for individual trace</b>	
Trace 1;;	First trace
...	

## List of remote commands (basic software)

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[SENSe:]WINDow<n>:DETEctor<t>[:FUNction]:AUTO.....	799
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[SENSe:]AVERAge<n>[:STATe<t>].....	800
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[SENSe:]BANDwidth[:RESolution]:RATio.....	790
[SENSe:]BANDwidth[:RESolution]:TYPE.....	790
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[SENSe:]CORRection:FRESponse<si>:BASeband:USER:PRESet.....	579
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[SENSe:]CORRection:FRESponse<si>:BASeband:USER:SLISt<sli>:CATalog?.....	580
[SENSe:]CORRection:FRESponse<si>:BASeband:USER:SLISt<sli>:CLEar.....	581
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[SENSe:]CORRection:FRESponse<si>:BASeband:USER:SLISt<sli>:SIZE?.....	586
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[SENSe:]CORRection:FRESponse<si>:FILE:USER:FLISt<fli>:CLEar.....	573
[SENSe:]CORRection:FRESponse<si>:FILE:USER:FLISt<fli>:INSert.....	574
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[SENSe:]CORRection:FRESponse<si>:FILE:USER:SLISt<sli>:INSert.....	582

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