R&S®VSE-K6
Pulse Measurement Application
User Manual

1176892202
Version 13

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)

The following firmware options are described:

- R&S VSE-K6 (1320.7516.02)
- R&S VSE-K6A (1345.1286.06)
- R&S VSE-KT6 (1345.1934.02)
- R&S VSE-KT6A (1345.2101.02)

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1176.8922.02 | Version 13 | R&S®VSE-K6

The following abbreviations are used throughout this manual: R&S®VSE is abbreviated as R&S VSE.

Contents

1 Preface

1.1 About this manual

This R&S VSE Pulse User Manual provides all the information **specific to the application**. All general software functions and settings common to all applications and operating modes are described in the R&S VSE Base Software User Manual.

The main focus in this manual is on the measurement results and the tasks required to obtain them. The following topics are included:

- **Welcome to the R&S VSE Pulse application**
  Introduction to and getting familiar with the application
- **Measurements and Result Displays**
  Details on supported measurements and their result types
- **Measurement Basics**
  Background information on basic terms and principles in the context of the measurement
- **Configuration + Analysis**
  A concise description of all functions and settings available to configure measurements and analyze results with their corresponding remote control command
- **Data Export**
  Description of general functions to export measurement data
- **How to Perform Measurements in the R&S VSE Pulse application**
  The basic procedure to perform each measurement and step-by-step instructions for more complex tasks or alternative methods
- **Optimizing and Troubleshooting the Measurement**
  Hints and tips on how to handle errors and optimize the measurement configuration
- **Remote Commands for R&S VSE Pulse application Measurements**
  Remote commands required to configure and perform R&S VSE Pulse application measurements in a remote environment, sorted by tasks
  (Commands required to set up the environment or to perform common tasks in the software are provided in the R&S VSE Base Software User Manual)
  Programming examples demonstrate the use of many commands and can usually be executed directly for test purposes
- **List of remote commands**
  Alphabetical list of all remote commands described in the manual
- **Index**

1.2 Typographical conventions

The following text markers are used throughout this documentation:

Convention	Description
"Graphical user interface elements"	All names of graphical user interface elements on the screen, such as dialog boxes, menus, options, buttons, and softkeys are enclosed by quotation marks.
[Keys]	Key and knob names are enclosed by square brackets.
`Filenames, commands, program code`	Filenames, commands, coding samples and screen output are distinguished by their font.
Input	Input to be entered by the user is displayed in italics.
Links	Links that you can click are displayed in blue font.
"References"	References to other parts of the documentation are enclosed by quotation marks.

2 Welcome to the pulse measurements application

The R&S VSE-K6 is a firmware application that adds functionality to perform measurements on pulsed signals to the R&S VSE.

The R&S VSE Pulse application provides measurement and analysis functions for pulse signals frequently used in radar applications, for example.

The R&S VSE Pulse application features:

- Measurement of basic pulse characteristics
- Analysis of parameter trends over time
- Display of amplitude, frequency and phase measurement traces for individual pulses

The additional option R&S VSE-K6A offers multi-channel analysis. It is based on the premise that a similar pulse is captured on all input channels, with some differences in the pulse parameters according to timing, amplitude, phase, etc. It is also expected that the same number of pulses is captured on each input channel. Therefore, the analysis groups the n-th pulse measured on each input channel into the same "Selected Pulse" result for the different displays. Thus, you can easily compare the pulse amplitude and phase values, for example, across all input channels in the same display.

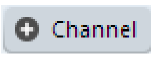
This user manual contains a description of the functionality that the application provides, including remote control operation.

Functions that are not discussed in this manual are the same as in the I/Q Analyzer application and are described in the R&S VSE Base Software User Manual. The latest version is available for download at the product homepage (http://www.rohde-schwarz.com/product/VSE.html).

2.1 Starting the pulse application

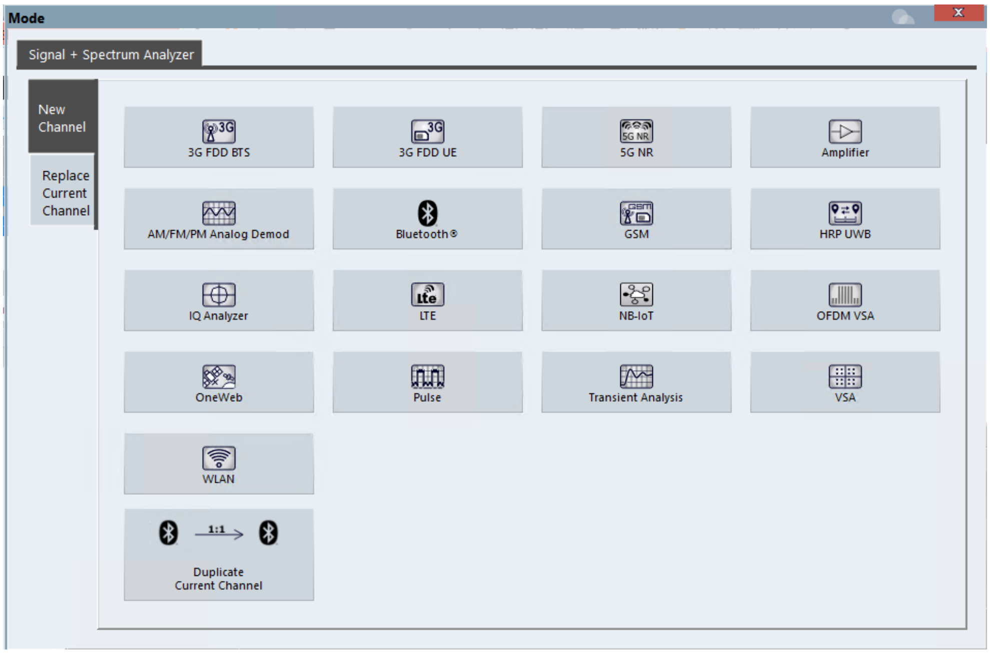
Pulse measurements require a separate application on the R&S VSE. It is activated by creating a new measurement channel in Pulse mode.

To activate the Pulse application

1. 

   Select the "Add Channel" function in the Sequence tool window.

   A dialog box opens that contains all operating modes and applications currently available in your R&S VSE.

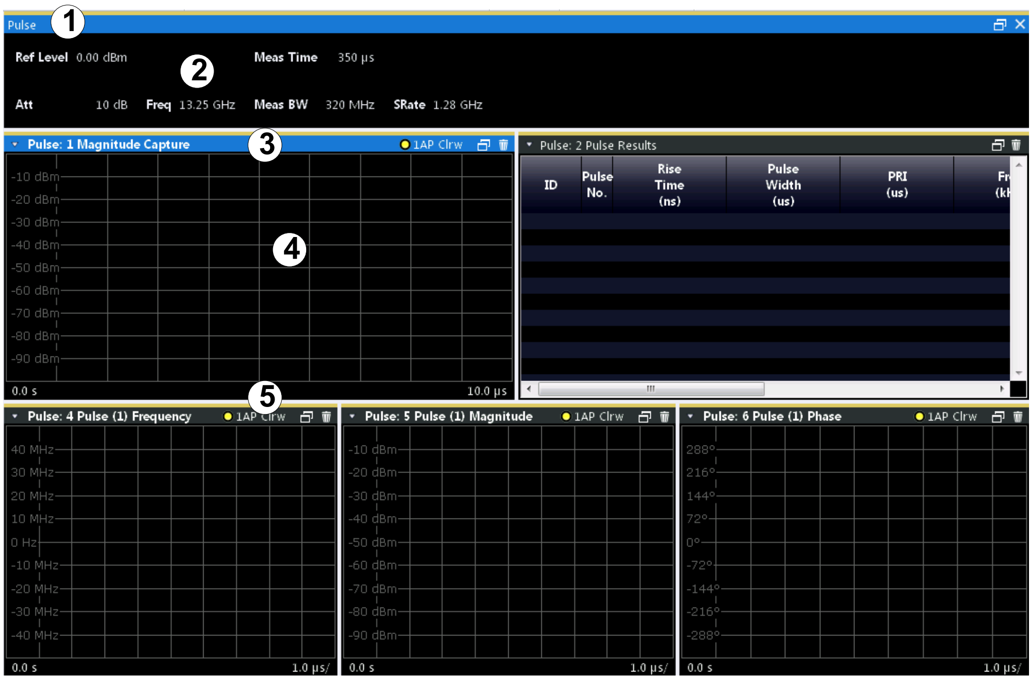


2. Select the "Pulse" item.

The R&S VSE opens a new measurement channel for the R&S VSE Pulse application.

2.2 Understanding the display information

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



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
5 = Diagram footer with diagram-specific information, depending on result display

Channel bar information

In the Pulse application, the R&S VSE shows the following settings:

Table 2-1: Information displayed in the channel bar in the Pulse application

Ref Level	Reference level
Att	Mechanical and electronic RF attenuation (if available)
Freq	Center frequency for the RF signal
Meas Time	Measurement time (data acquisition time)
Meas BW	Measurement bandwidth
SRate	Sample rate

In addition, the channel bar also displays information on instrument settings that affect the measurement results even though this is not immediately apparent from the display of the measured values (e.g. transducer or trigger settings). This information is displayed only when applicable for the current measurement. For details see the R&S VSE Base Software User Manual.

Window title bar information

For each diagram, the header provides the following information:

Figure 2-1: Window title bar information in the Pulse application

0 = Color coding for windows of same channel
1 = Edit result display function
2 = Channel name
3 = Window number
4 = Window type (+ pulse number for pulse-based displays)
5 = Trace color, trace number, trace detector, trace mode
6 = Dock/undock window function
7 = Close window function

Diagram area

The diagram area displays the results according to the selected result displays (see Chapter 3.2, "Evaluation methods for pulse measurements", on page 29).

Diagram footer information

The diagram footer (beneath the diagram) contains the start and stop values for the displayed time range.

Status bar information

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

3 Measurements and result displays

During a pulse measurement, I/Q data from the input signal is captured for a specified time or for a specified record length. Pulses are detected from the signal according to specified thresholds and user-defined criteria. The measured signal is then compared with the ideal signal described by the user and any deviations are recorded. The defined range of measured data is then evaluated to determine characteristic pulse parameters. These parameters can either be displayed as traces, in a table, or be evaluated statistically over a series of measurements.

Measurement range vs. result range vs. detection range

The **measurement range** defines which part of an *individual pulse* is measured (for example for frequency deviation), whereas the **result range** determines which data is **displayed** on the screen in the form of amplitude, frequency or phase vs. time traces.

The **detection range** (if enabled) determines which part of the *capture buffer* is analyzed. The pulse numbers in the result displays are always relative to the current detection range, that is: pulse number 1 is the first pulse within the detection range in the capture buffer. If disabled (default), the entire capture buffer is used as the detection range. See also "Detection range" on page 50.

Result display windows

For each measurement, a separate measurement channel is activated. Each measurement channel can provide multiple result displays, which are displayed in individual windows. The measurement windows can be rearranged and configured in the R&S VSE to meet your requirements. 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.

► To add further result displays for the Pulse channel, select the "Add Window" icon from the toolbar, or select the "Window > New Window" menu item.

  For details on working with channels and windows see the "Operating Basics" chapter in the R&S VSE Base Software User Manual.

3.1 Pulse parameters

The pulse parameters to be measured are based primarily on the IEEE 181 Standard 181-2003. For detailed descriptions refer to the standard documentation ("IEEE Standard on Transitions, Pulses, and Related Waveforms", from the IEEE Instrumentation and Measurement (I&M) Society, 7 July 2003).

The following graphic illustrates the main pulse parameters and characteristic values. (For a definition of the values used to determine the measured pulse parameters see Chapter 4.1, "Parameter definitions", on page 45.)

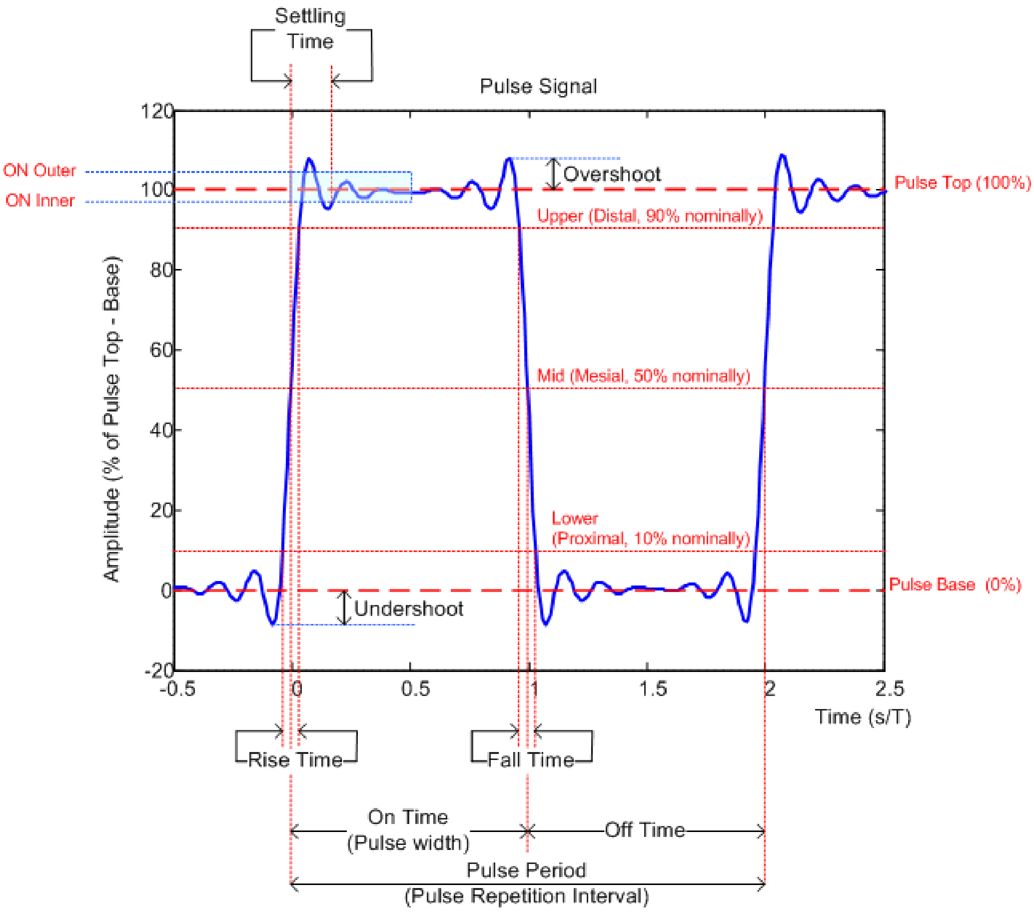


Figure 3-1: Definition of the main pulse parameters and characteristic values

In order to obtain these results, select the corresponding parameter in the result configuration (see Chapter 6.1, "Result configuration", on page 99) or apply the required SCPI parameter to the remote command (see Chapter 8.4.11, "Configuring the results", on page 220 and Chapter 8.6.1, "Retrieving results", on page 302).

3.1.1 Timing parameters

The following timing parameters can be determined by the R&S VSE Pulse application.

Timestamp

The time stamp uniquely identifies each pulse in the capture buffer. It is defined as the time from the capture start point to the beginning of the pulse period of the current pulse. (As opposed to the pulse *number*, which is always relative to the start of the detection range, see also "Detection range" on page 50).

Depending on the user-specified definition of the pulse period, the period begins with the mid-level crossing of the current pulse's rising edge (period: high-to-low) or the mid-level crossing of the previous pulse's falling edge (period low-to-high). See also "Pulse Period" on page 65.

Note: For external triggers, the trigger point within the sample (TPIS) is considered in the timestamp (see `TRACe:IQ:TPISample?` on page 313).

Remote command:
`[SENSe:]PULSe:TIMing:TSTamp?` on page 339
`CALCulate<n>:TABLe:TIMing:TSTamp` on page 276
`[SENSe:]PULSe:TIMing:TSTamp:LIMit?` on page 365

Settling Time

The difference between the time at which the pulse exceeds the mid threshold on the rising edge to the point where the pulse waveform remains within the pulse boundary (ON Inner/ ON Outer)

See Figure 3-1

Remote command:
`[SENSe:]PULSe:TIMing:SETTling?` on page 338
`CALCulate<n>:TABLe:TIMing:SETTling` on page 276
`[SENSe:]PULSe:TIMing:SETTling:LIMit?` on page 365

Rise Time

The time required for the pulse to transition from the base to the top level. This is the difference between the time at which the pulse exceeds the lower and upper thresholds.

See Figure 3-1

Remote command:
`[SENSe:]PULSe:TIMing:RISE?` on page 337
`CALCulate<n>:TABLe:TIMing:RISE` on page 276
`[SENSe:]PULSe:TIMing:RISE:LIMit?` on page 364

Fall Time

The time required for the pulse to transition from the top to the base level. This is the difference between the time at which the pulse drops below the upper and lower thresholds.

See Figure 3-1

Remote command:
[SENSe:]PULSe:TIMing:FALL? on page 333
CALCulate<n>:TABLe:TIMing:FALL on page 275
[SENSe:]PULSe:TIMing:FALL:LIMit? on page 364

Pulse Width (ON Time)
The time that the pulse remains at the top level ("ON"). This is the time between the first positive edge and the subsequent negative edge of the pulse in seconds, where the edges occur at crossings of the mid threshold.

See Figure 3-1

Remote command:
[SENSe:]PULSe:TIMing:PWIDth? on page 337
CALCulate<n>:TABLe:TIMing:PWIDth on page 276
[SENSe:]PULSe:TIMing:PWIDth:LIMit? on page 364

Off Time
The time that the pulse remains at the base level ("OFF"). This is the time between the first negative edge and the subsequent positive edge of the pulse in seconds, where the edges occur at crossings of the mid threshold.

See Figure 3-1

Remote command:
[SENSe:]PULSe:TIMing:OFF? on page 334
CALCulate<n>:TABLe:TIMing:OFF on page 275
[SENSe:]PULSe:TIMing:OFF:LIMit? on page 364

Duty Ratio
The ratio of the "Pulse Width" to "Pulse Repetition Interval" expressed as a value between 0 and 1 (requires at least two measured pulses)

Remote command:
[SENSe:]PULSe:TIMing:DRATio? on page 333
CALCulate<n>:TABLe:TIMing:DRATio on page 274
[SENSe:]PULSe:TIMing:DRATio:LIMit? on page 364

Duty Cycle (%)
The ratio of the "Pulse Width" to "Pulse Repetition Interval" expressed as a percentage (requires at least two measured pulses)

Remote command:
[SENSe:]PULSe:TIMing:DCYCle? on page 332
CALCulate<n>:TABLe:TIMing:DCYCle on page 274
[SENSe:]PULSe:TIMing:DCYCle:LIMit? on page 364

Pulse Repetition Interval
The time between two consecutive edges of the same polarity in seconds (requires at least two measured pulses). The user-specified definition of the pulse period (see"Pulse Period" on page 65) determines whether this value is calculated from consecutive rising or falling edges.

Remote command:
`[SENSe:]PULSe:TIMing:PRI?` on page 336
`CALCulate<n>:TABLe:TIMing:PRI` on page 275
`[SENSe:]PULSe:TIMing:PRI:LIMit?` on page 364

Pulse Repetition Frequency (Hz)
The frequency of occurrence of pulses, i.e. inverse of the "Pulse Repetition Interval" (requires at least two measured pulses)

Remote command:
`[SENSe:]PULSe:TIMing:PRF?` on page 335
`CALCulate<n>:TABLe:TIMing:PRF` on page 275
`[SENSe:]PULSe:TIMing:PRF:LIMit?` on page 364

3.1.2 Power/amplitude parameters

The following power/amplitude parameters can be determined by the R&S VSE Pulse application.

Top Power
The median pulse ON power. The value of this parameter is used as a reference (100%) to determine other parameter values such as the rising / falling thresholds. Various algorithms are provided to determine the top power (see "Measurement Algorithm" on page 93).

Remote command:
`[SENSe:]PULSe:POWer:TOP?` on page 330
`CALCulate<n>:TABLe:POWer:TOP` on page 274
`[SENSe:]PULSe:POWer:TOP:LIMit?` on page 364

Base Power
The median pulse OFF power. The value of this parameter is used as a reference (0%) to determine other parameter values such as the rising / falling thresholds.

Remote command:
[SENSe:]PULSe:POWer:BASE? on page 320
CALCulate<n>:TABLe:POWer:BASE on page 270
[SENSe:]PULSe:POWer:BASE:LIMit? on page 364

Pulse Amplitude

The difference between the "Top Power" and the "Base Power", calculated in linear power units (W). This value determines the 100% power range (amplitude). This value is converted to dBm for the "Pulse Results" table.

Remote command:
[SENSe:]PULSe:POWer:AMPLitude? on page 317
CALCulate<n>:TABLe:POWer:AMPLitude on page 269
[SENSe:]PULSe:POWer:AMPLitude:LIMit? on page 364

In-Phase Amplitude/Quadrature Amplitude

The pulse in-phase or quadrature amplitude as a voltage, measured at the measurement point of the pulse (see Chapter 5.8.2, "Measurement point", on page 94). Values range from -10 mV to +10 mV.

Remote command:
Querying results:
[SENSe:]PULSe:POWer:AMPLitude:I? on page 318
[SENSe:]PULSe:POWer:AMPLitude:Q? on page 319
Including results in result summary table:
CALCulate<n>:TABLe:POWer:AMPLitude:I on page 269
CALCulate<n>:TABLe:POWer:AMPLitude:Q on page 270
Querying limit check results:
[SENSe:]PULSe:POWer:AMPLitude:I:LIMit? on page 364
[SENSe:]PULSe:POWer:AMPLitude:Q:LIMit? on page 364

Average ON Power

The average power during the pulse ON time

Remote command:
[SENSe:]PULSe:POWer:ON? on page 322
CALCulate<n>:TABLe:POWer:ON on page 271
[SENSe:]PULSe:POWer:ON:LIMit? on page 364

Average Tx Power

The average transmission power over the entire pulse ON + OFF time

Remote command:
[SENSe:]PULSe:POWer:AVG? on page 319
CALCulate<n>:TABLe:POWer:AVG on page 270
[SENSe:]PULSe:POWer:AVG:LIMit? on page 364

Minimum Power

The minimum power over the entire pulse ON + OFF time

Remote command:
[SENSe:]PULSe:POWer:MIN? on page 322
CALCulate<n>:TABLe:POWer:MIN on page 271
[SENSe:]PULSe:POWer:MIN:LIMit? on page 364

Peak Power
The maximum power over the entire pulse ON + OFF time

Remote command:
[SENSe:]PULSe:POWer:MAX? on page 321
CALCulate<n>:TABLe:POWer:MAX on page 270
[SENSe:]PULSe:POWer:MAX:LIMit? on page 364

Peak-to-Avg ON Power Ratio
The ratio of maximum to average power over the pulse ON time (also known as **crest factor**)

Remote command:
[SENSe:]PULSe:POWer:PON? on page 327
CALCulate<n>:TABLe:POWer:PON on page 272
[SENSe:]PULSe:POWer:PON:LIMit? on page 364

Peak-to-Average Tx Power Ratio
The ratio of maximum to average power over the entire pulse ON + OFF interval.

Remote command:
[SENSe:]PULSe:POWer:PAVG? on page 325
CALCulate<n>:TABLe:POWer:PAVG on page 272
[SENSe:]PULSe:POWer:PAVG:LIMit? on page 364

Peak-to-Min Power Ratio
The ratio of maximum to minimum power over the entire pulse ON + OFF time

Remote command:
[SENSe:]PULSe:POWer:PMIN? on page 325
CALCulate<n>:TABLe:POWer:PMIN on page 272
[SENSe:]PULSe:POWer:PMIN:LIMit? on page 364

Droop
The rate at which the pulse top level decays, calculated as the difference between the power at the beginning of the pulse ON time and the power at the end of the pulse ON time, divided by the pulse amplitude.

Droop values are only calculated if Pulse Has Droop is set to "On" (default).

For more information see Chapter 4.1.1, "Amplitude droop", on page 46

Note: The percentage ratio values are calculated in %V if the "Measurement Level" is defined in V (see "Reference Level Unit" on page 93), otherwise in %W.

Remote command:
[SENSe:]PULSe:POWer:ADRoop:DB? on page 316
[SENSe:]PULSe:POWer:ADRoop[:PERCent]? on page 316
CALCulate<n>:TABLe:POWer:ADRoop:DB on page 268

CALCulate<n>:TABLe:POWer:ADRoop[:PERCent] on page 269
[SENSe:]PULSe:POWer:ADRoop:DB:LIMit? on page 364
[SENSe:]PULSe:POWer:ADRoop[:PERCent]:LIMit? on page 364

Ripple

The ripple is calculated as the difference between the maximum and minimum deviation from the pulse top reference, within a user specified interval.

For more information see Chapter 4.1.2, "Ripple", on page 46

Note: The percentage ratio values are calculated in %V if the "Measurement Level" is defined in V (see "Reference Level Unit" on page 93), otherwise in %W.

Remote command:

[SENSe:]PULSe:POWer:RIPPle:DB? on page 329
[SENSe:]PULSe:POWer:RIPPle[:PERCent]? on page 329
CALCulate<n>:TABLe:POWer:RIPPle:DB on page 273
CALCulate<n>:TABLe:POWer:RIPPle[:PERCent] on page 273
[SENSe:]PULSe:POWer:RIPPle:DB:LIMit? on page 364
[SENSe:]PULSe:POWer:RIPPle[:PERCent]:LIMit? on page 364

Overshoot

The height of the local maximum after a rising edge, divided by the pulse amplitude.

For more information see Chapter 4.1.3, "Overshoot", on page 48.

Note: The percentage ratio values are calculated in %V if the "Measurement Level" is defined in V (see "Reference Level Unit" on page 93), otherwise in %W.

Remote command:

[SENSe:]PULSe:POWer:OVERshoot:DB? on page 323
[SENSe:]PULSe:POWer:OVERshoot[:PERCent]? on page 324
CALCulate<n>:TABLe:POWer:OVERshoot:DB on page 271
CALCulate<n>:TABLe:POWer:OVERshoot[:PERCent] on page 271
[SENSe:]PULSe:POWer:OVERshoot:DB:LIMit? on page 364
[SENSe:]PULSe:POWer:OVERshoot[:PERCent]:LIMit? on page 364

Power (at Point)

The power measured at the pulse "measurement point" specified by the Measurement Point Reference and the "Offset" on page 96

Remote command:

[SENSe:]PULSe:POWer:POINt? on page 326
CALCulate<n>:TABLe:POWer:POINt on page 272
[SENSe:]PULSe:POWer:POINt:LIMit? on page 364

Pulse-to-Pulse Power Ratio

The ratio of the "Power" values from the first measured pulse to the current pulse.

Remote command:

[SENSe:]PULSe:POWer:PPRatio? on page 328
CALCulate<n>:TABLe:POWer:PPRatio on page 273
[SENSe:]PULSe:POWer:PPRatio:LIMit? on page 364

3.1.3 Frequency parameters

The following frequency parameters can be determined by the R&S VSE Pulse application.

Frequency

Frequency of the pulse measured at the defined Measurement point

Remote command:
`[SENSe:]PULSe:FREQuency:POINt?` on page 343
`CALCulate<n>:TABLe:FREQuency:POINt` on page 266
`[SENSe:]PULSe:FREQuency:POINt:LIMit?` on page 364

Pulse-Pulse Frequency Difference

Difference in frequency between the first measured pulse and the currently measured pulse

Remote command:
`[SENSe:]PULSe:FREQuency:PPFRequency?` on page 343
`CALCulate<n>:TABLe:FREQuency:PPFRequency` on page 266
`[SENSe:]PULSe:FREQuency:PPFRequency:LIMit?` on page 364

Frequency Error (RMS)

The RMS frequency error of the currently measured pulse. The error is calculated relative to the given pulse modulation. It is not calculated at all for modulation type "Arbitrary". The error is calculated over the Measurement range.

Remote command:
`[SENSe:]PULSe:FREQuency:RERRor?` on page 344
`CALCulate<n>:TABLe:FREQuency:RERRor` on page 266
`[SENSe:]PULSe:FREQuency:RERRor:LIMit?` on page 364

Frequency Error (Peak)

The peak frequency error of the currently measured pulse. The error is calculated relative to the given pulse modulation. It is not calculated at all for modulation type "Arbitrary". The error is calculated over the Measurement range.

Remote command:
`[SENSe:]PULSe:FREQuency:PERRor?` on page 342
`CALCulate<n>:TABLe:FREQuency:PERRor` on page 266
`[SENSe:]PULSe:FREQuency:PERRor:LIMit?` on page 364

Frequency Deviation
The frequency deviation of the currently measured pulse. The deviation is calculated as the absolute difference between the maximum and minimum frequency values within the Measurement range.

Remote command:
`[SENSe:]PULSe:FREQuency:DEViation?` on page 341
`CALCulate<n>:TABLe:FREQuency:DEViation` on page 265
`[SENSe:]PULSe:FREQuency:DEViation:LIMit?` on page 364

Chirp Rate
A known frequency chirp rate (per µs) to be used for generating an ideal pulse waveform.

Note: a chirp rate is only available for the Pulse Modulation type "Linear FM".

Remote command:
`[SENSe:]PULSe:FREQuency:CRATe?` on page 340
`CALCulate<n>:TABLe:FREQuency:CRATe` on page 265
`[SENSe:]PULSe:FREQuency:CRATe:LIMit?` on page 364

3.1.4 Phase parameters

The following phase parameters can be determined by the R&S VSE Pulse application.

Phase
Phase of the pulse measured at the defined Measurement point

Remote command:
`[SENSe:]PULSe:PHASe:POINt?` on page 347
`CALCulate<n>:TABLe:PHASe:POINt` on page 267
`[SENSe:]PULSe:PHASe:POINt:LIMit?` on page 364

Pulse-Pulse Phase Difference
Difference in phase between the first measured pulse and the currently measured pulse

Remote command:
`[SENSe:]PULSe:PHASe:PPPHase?` on page 348
`CALCulate<n>:TABLe:PHASe:PPPHase` on page 268
`[SENSe:]PULSe:PHASe:PPPHase:LIMit?` on page 364

Phase Error (RMS)
The RMS phase error of the currently measured pulse. The error is calculated relative to the given pulse modulation. It is not calculated at all for the Pulse Modulation type "Arbitrary". The error is calculated over the Measurement range.

Remote command:
[SENSe:]PULSe:PHASe:RERRor? on page 349
CALCulate<n>:TABLe:PHASe:RERRor on page 268
[SENSe:]PULSe:PHASe:RERRor:LIMit? on page 364

Phase Error (Peak)
The peak phase error of the currently measured pulse. The error is calculated relative to the given pulse modulation. It is not calculated at all for the Pulse Modulation type "Arbitrary". The error is calculated over the Measurement range.

Remote command:
[SENSe:]PULSe:PHASe:PERRor? on page 346
CALCulate<n>:TABLe:PHASe:PERRor on page 267
[SENSe:]PULSe:PHASe:PERRor:LIMit? on page 364

Phase Deviation
The phase deviation of the currently measured pulse. The deviation is calculated as the absolute difference between the maximum and minimum phase values within the Measurement range.

Remote command:
[SENSe:]PULSe:PHASe:DEViation? on page 346
CALCulate<n>:TABLe:PHASe:DEViation on page 267
[SENSe:]PULSe:PHASe:DEViation:LIMit? on page 364

3.1.5 Envelope model (cardinal data points) parameters

The pulse envelope model has the shape of a trapezoid of amplitude (V) versus time (s) values. This model allows for a finite rise and fall time, as well as an amplitude droop across the top of the pulse. During measurement of each pulse, the points of this trapezoidal model are determined as the basis for further measurements. For example, the rise and fall time amplitude thresholds or the "pulse top" duration are determined from the parameters of the envelope model.

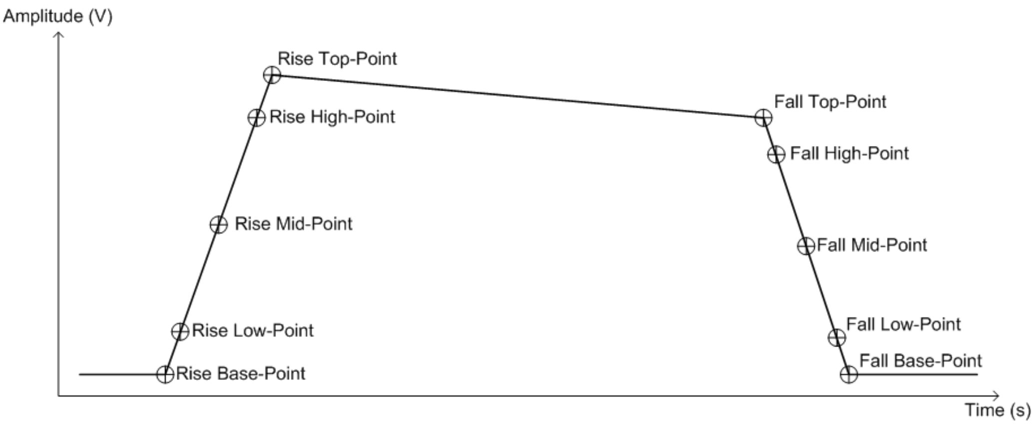


Figure 3-2: Envelope model parameters

Each of these parameters has a time and an amplitude value. The time values are relative to the pulse timestamp and displayed in seconds. The amplitude values are displayed as power in dBm units.

You configure the desired high, mid and low thresholds for the rise and fall slopes relative to the base (0%) and top (100%) levels. See Chapter 5.8.1, "Measurement levels", on page 91.

The power value of the rise base point and the fall base point is assumed to be equal and is defined by the "Base Power" parameter found in the "Amplitude Parameters" group of the table configuration (see "Base Power" on page 19).

Rise Base Point Time

The time the amplitude starts rising above 0 %.

Remote command:

`[SENSe:]PULSe:EMODel:RBPTime?` on page 357

`CALCulate<n>:TABLe:EMODel:RBPTime` on page 262

`[SENSe:]PULSe:EMODel:RBPTime:LIMit?` on page 363

Rise Low Point Time

The time the amplitude reaches the Low (Proximal) Threshold in the rising edge.

Remote command:

`[SENSe:]PULSe:EMODel:RLPTime?` on page 360

`CALCulate<n>:TABLe:EMODel:RLPTime` on page 263

`[SENSe:]PULSe:EMODel:RLPTime:LIMit?` on page 364

Rise Mid Point Time

The time the amplitude reaches the Mid (Mesial) Threshold in the rising edge.

Remote command:
[SENSe:]PULSe:EMODel:RMPTime? on page 361
CALCulate<n>:TABLe:EMODel:RMPTime on page 264
[SENSe:]PULSe:EMODel:RMPTime:LIMit? on page 364

Rise High Point Time
The time the amplitude reaches the High (Distal) Threshold in the rising edge.

Remote command:
[SENSe:]PULSe:EMODel:RHPTime? on page 359
CALCulate<n>:TABLe:EMODel:RHPTime on page 263
[SENSe:]PULSe:EMODel:RHPTime:LIMit? on page 364

Rise Top Point Time
The time the amplitude reaches the 100 % level in the rising edge.

Remote command:
[SENSe:]PULSe:EMODel:RTPTime? on page 363
CALCulate<n>:TABLe:EMODel:RTPTime on page 265
[SENSe:]PULSe:EMODel:RTPTime:LIMit? on page 364

Rise Low Point Level
The amplitude of the Low (Proximal) Threshold in the rising edge.

Remote command:
[SENSe:]PULSe:EMODel:RLPLevel? on page 359
CALCulate<n>:TABLe:EMODel:RLPLevel on page 263
[SENSe:]PULSe:EMODel:RLPLevel:LIMit? on page 364

Rise Mid Point Level
The amplitude of the Mid (Mesial) Threshold in the rising edge.

Remote command:
[SENSe:]PULSe:EMODel:RMPLevel? on page 361
CALCulate<n>:TABLe:EMODel:RMPLevel on page 264
[SENSe:]PULSe:EMODel:RMPLevel:LIMit? on page 364

Rise High Point Level
The amplitude of the High (Distal) Threshold in the rising edge.

Remote command:
[SENSe:]PULSe:EMODel:RHPLevel? on page 358
CALCulate<n>:TABLe:EMODel:RHPLevel on page 263
[SENSe:]PULSe:EMODel:RHPLevel:LIMit? on page 363

Rise Top Point Level
The amplitude at 100 % in the rising edge.

Remote command:
[SENSe:]PULSe:EMODel:RTPLevel? on page 362
CALCulate<n>:TABLe:EMODel:RTPLevel on page 264
[SENSe:]PULSe:EMODel:RTPLevel:LIMit? on page 364

Fall Base Point Time
The time the amplitude reaches 0 % on the falling edge.

Remote command:
`[SENSe:]PULSe:EMODel:FBPTime?` on page 351
`CALCulate<n>:TABLe:EMODel:FBPTime` on page 260
`[SENSe:]PULSe:EMODel:FBPTime:LIMit?` on page 363

Fall Low Point Time
The time the amplitude reaches the Low (Proximal) Threshold in the falling edge.

Remote command:
`[SENSe:]PULSe:EMODel:FLPTime?` on page 354
`CALCulate<n>:TABLe:EMODel:FLPTime` on page 261
`[SENSe:]PULSe:EMODel:FLPTime:LIMit?` on page 363

Fall Mid Point Time
The time the amplitude reaches the Mid (Mesial) Threshold in the falling edge.

Remote command:
`[SENSe:]PULSe:EMODel:FMPTime?` on page 355
`CALCulate<n>:TABLe:EMODel:FMPTime` on page 262
`[SENSe:]PULSe:EMODel:FMPTime:LIMit?` on page 363

Fall High Point Time
The time the amplitude reaches the High (Distal) Threshold in the falling edge.

Remote command:
`[SENSe:]PULSe:EMODel:FHPTime?` on page 353
`CALCulate<n>:TABLe:EMODel:FHPTime` on page 261
`[SENSe:]PULSe:EMODel:FHPTime:LIMit?` on page 363

Fall Top Point Time
The time the amplitude falls below the 100 % level in the falling edge.

Remote command:
`[SENSe:]PULSe:EMODel:FTPTime?` on page 357
`CALCulate<n>:TABLe:EMODel:FTPTime` on page 262
`[SENSe:]PULSe:EMODel:FTPTime:LIMit?` on page 363

Fall Low Point Level
The amplitude of the Low (Proximal) Threshold in the falling edge.

Remote command:
`[SENSe:]PULSe:EMODel:FLPLevel?` on page 353
`CALCulate<n>:TABLe:EMODel:FLPLevel` on page 261
`[SENSe:]PULSe:EMODel:FLPLevel:LIMit?` on page 363

Fall Mid Point Level
The amplitude of the Mid (Mesial) Threshold in the falling edge.

Remote command:
[SENSe:]PULSe:EMODel:FMPLevel? on page 355
CALCulate<n>:TABLe:EMODel:FMPLevel on page 261
[SENSe:]PULSe:EMODel:FMPLevel:LIMit? on page 363

Fall High Point Level
The amplitude of the High (Distal) Threshold in the falling edge.

Remote command:
[SENSe:]PULSe:EMODel:FHPLevel? on page 352
CALCulate<n>:TABLe:EMODel:FHPLevel on page 260
[SENSe:]PULSe:EMODel:FHPLevel:LIMit? on page 363

Fall Top Point Level
The amplitude at 100 % in the falling edge.

Remote command:
[SENSe:]PULSe:EMODel:FTPLevel? on page 356
CALCulate<n>:TABLe:EMODel:FTPLevel on page 262
[SENSe:]PULSe:EMODel:FTPLevel:LIMit? on page 363

3.2 Evaluation methods for pulse measurements

The data that was measured by the R&S VSE Pulse application can be evaluated using various different methods.

By default, the Pulse measurement results are displayed in the following windows:

- "Magnitude Capture"
- "Pulse Results"
- "Pulse Frequency"
- "Pulse Magnitude"
- "Pulse Phase"

The following evaluation methods are available for Pulse measurements:

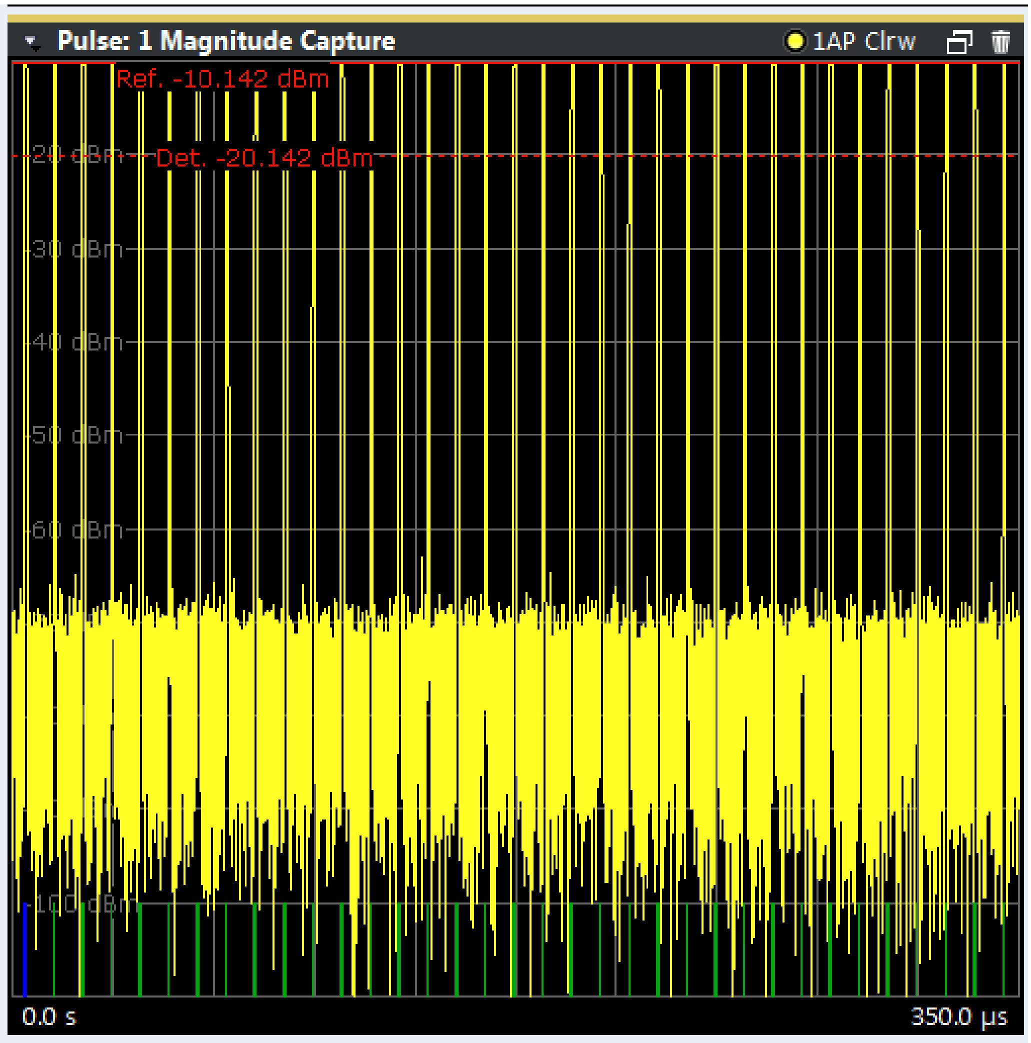
Magnitude Capture

Displays the captured data. Detected pulses are indicated by **green bars** along the x-axis. The currently selected pulse is highlighted in **blue**.

Additionally, the following parameters are indicated by horizontal lines in the diagram:

- **"Ref"**: the pulse detection reference level (see Chapter 5.8.1, "Measurement levels", on page 91)
- **"Det"**: the pulse detection threshold (see "Threshold" on page 90)
- **"100 %"**: a fixed top power level (see "Fixed Value" on page 93)
  You can drag the line in the diagram to change the top power level.

The detection range is indicated by vertical lines (**"DR"**, see "Detection Range" on page 90). You can drag the lines within the capture buffer to change the detection range.



With option R&S VSE-K6A installed, the R&S VSE can display up to four measurement channels simultaneously.

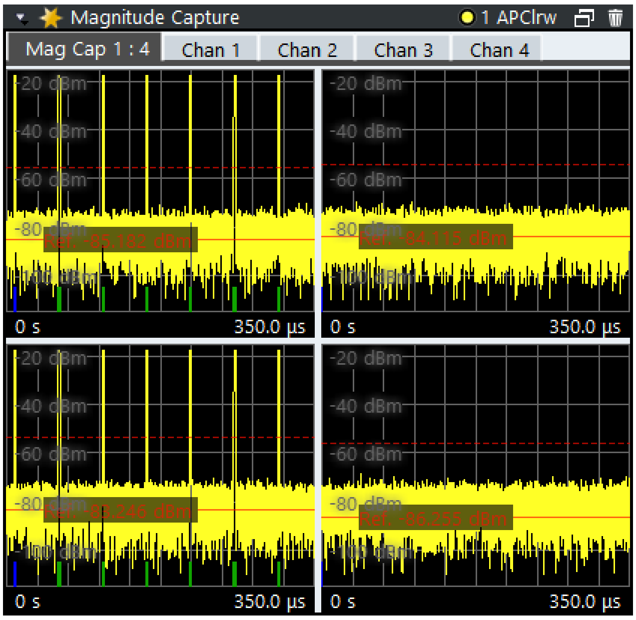


Figure 3-3: Option R&S VSE-K6A

Remote command:
`LAY:ADD:WIND '2',RIGH,MCAP` see `LAYout:ADD[:WINDow]?` on page 213
Results:
`TRACe<n>[:DATA]?` on page 303

Marker Table

Displays a table with the current marker values for the active markers.

This table is displayed automatically if configured accordingly.

3 Marker Table

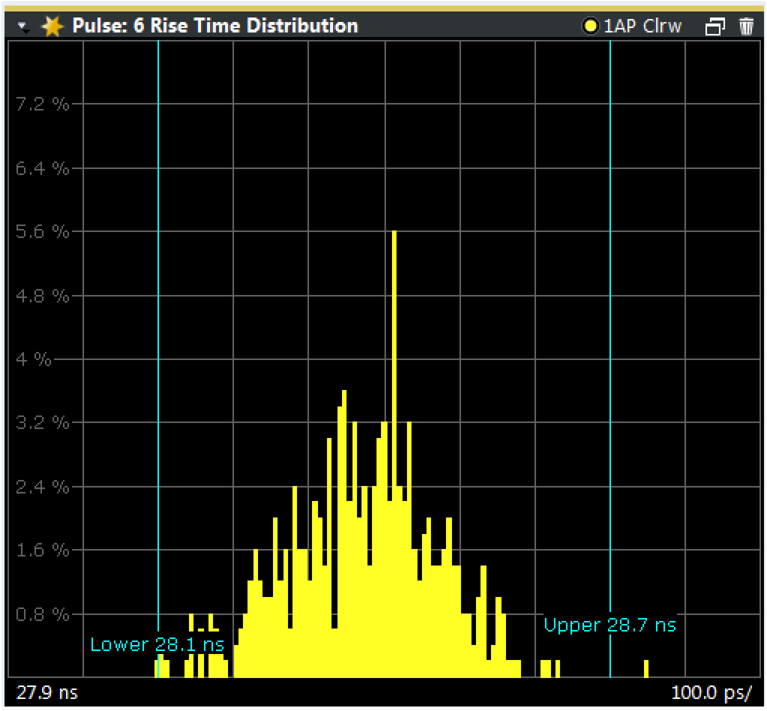
Wnd	Type	Ref	X-Value	Y-Value
1	M1		0.256	0.00 dB
1	D2	M1	415.512	-1.94 dB
1	D3	M1	489.512	-1.95 dB
1	D4	M1	266.512	-2.00 dB

Remote command:
`LAY:ADD? '1',RIGH, MTAB`, see `LAYout:ADD[:WINDow]?` on page 213
Results:
`CALCulate<n>:MARKer<m>:X` on page 292
`CALCulate<n>:MARKer<m>:Y?` on page 370

Parameter Distribution

Plots a histogram of a particular parameter, i.e. all measured parameter values from the current capture vs pulse count or occurrence in %. Thus you can determine how often a particular parameter value occurs. For each "parameter distribution" window you can configure a different parameter to be displayed.

This evaluation method allows you to distinguish transient and stable effects in a specific parameter, such as a spurious frequency deviation or a fluctuation in power over several pulses.



With option R&S VSE-K6A installed, the R&S VSE can display up to four measurement channels simultaneously.

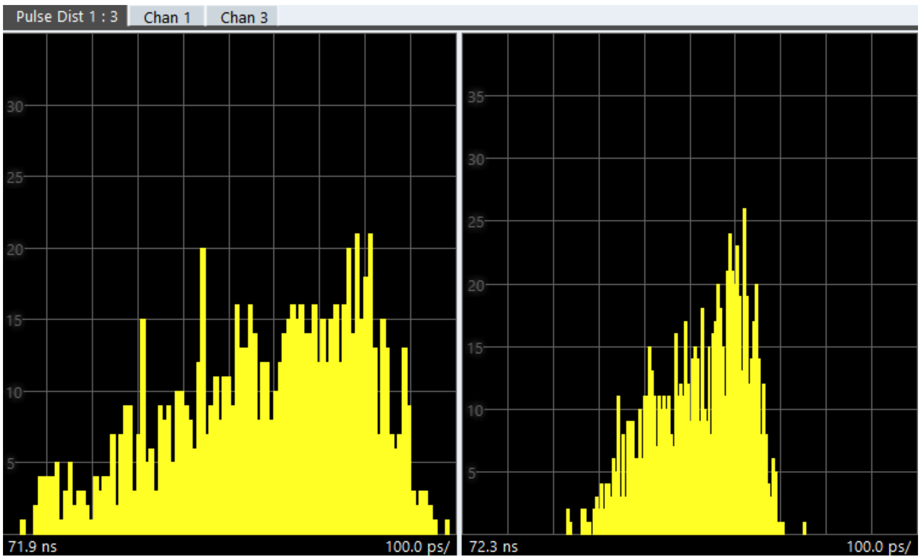


Figure 3-4: Option R&S VSE-K6A

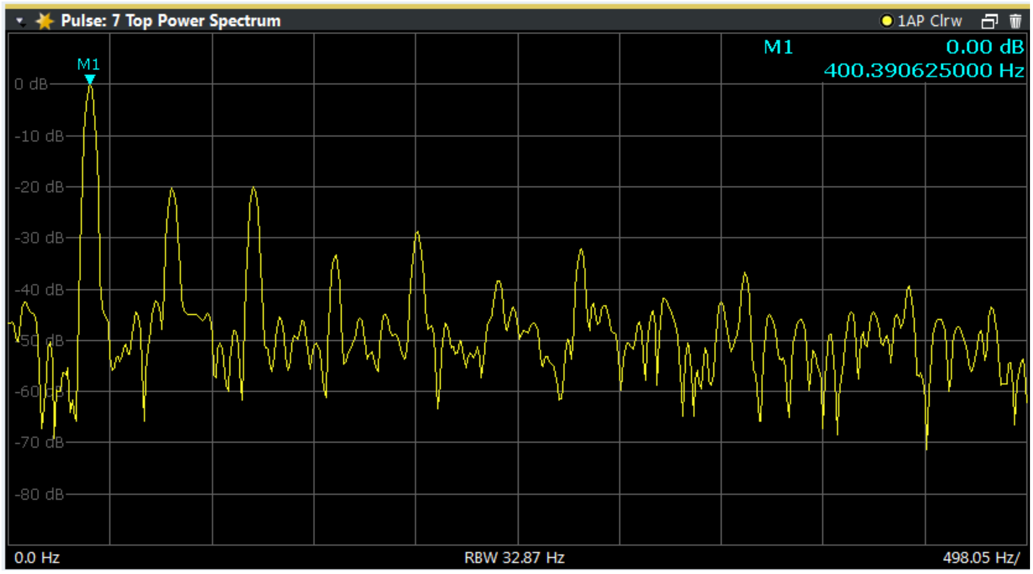
Note that averaging is not possible for "parameter distribution" traces.

Remote command:
`LAY:ADD:WIND '2',RIGH,PDIS` see `LAYout:ADD[:WINDow]?` on page 213
Chapter 8.4.11.3, "Configuring a parameter distribution", on page 222
Results:
`TRACe<n>[:DATA]?` on page 303

Parameter Spectrum

Calculates an FFT for a selected column of the "Pulse Results" table. This "spectrum" allows you to easily determine the frequency of periodicities in the pulse parameters. For example, the "Parameter Spectrum" for "Pulse Top Power" might display a peak at a particular frequency, indicating incidental amplitude modulation of the amplifier output due to the power supply.

The "Parameter Spectrum" is calculated by taking the magnitude of the FFT of the selected parameter and normalizing the result to the largest peak. In order to calculate the frequency axis the average PRI (pulse repetition interval) is taken to be the "sample rate" for the FFT. Note that in cases where the signal has a non-uniform or staggered PRI the frequency axis must therefore be interpreted with caution.



Remote command:
`LAY:ADD:WIND '2',RIGH,PSP` see `LAYout:ADD[:WINDow]?` on page 213
Chapter 8.4.11.4, "Configuring a parameter spectrum", on page 229
Results:
`TRACe<n>[:DATA]?` on page 303

Parameter Trend

Plots all measured parameter values from the current capture buffer (or detection range, if enabled) vs pulse number or pulse timestamp. This is equivalent to plotting a column of the "Pulse Results" table for the rows highlighted green. This evaluation allows you to determine trends in a specific parameter, such as a frequency deviation or a fluctuation in power over several pulses.

The "parameter trend" evaluation can also be used for a more general scatter plot - the parameters from the current capture buffer cannot only be displayed over time, but also versus any other pulse parameter. For example, you can evaluate the rise time vs fall time.

For each "parameter trend" window you can configure a different parameter to be displayed for both the x-axis and the y-axis, making this a very powerful and flexible analysis tool.

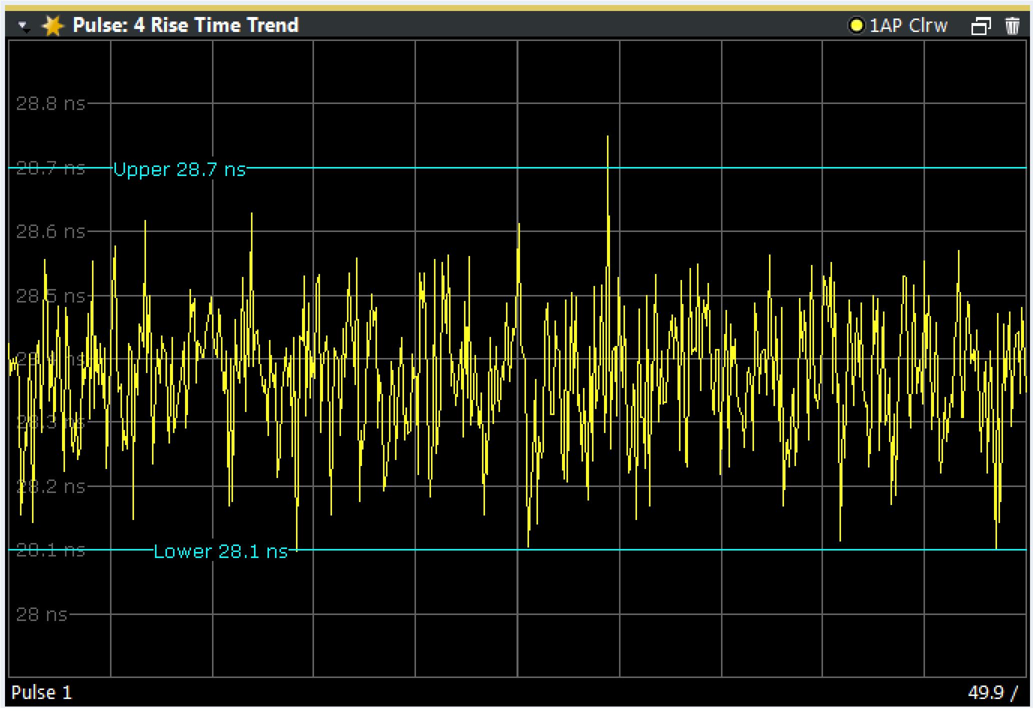


Figure 3-5: Pulse rise time trend display (over pulse numbers)

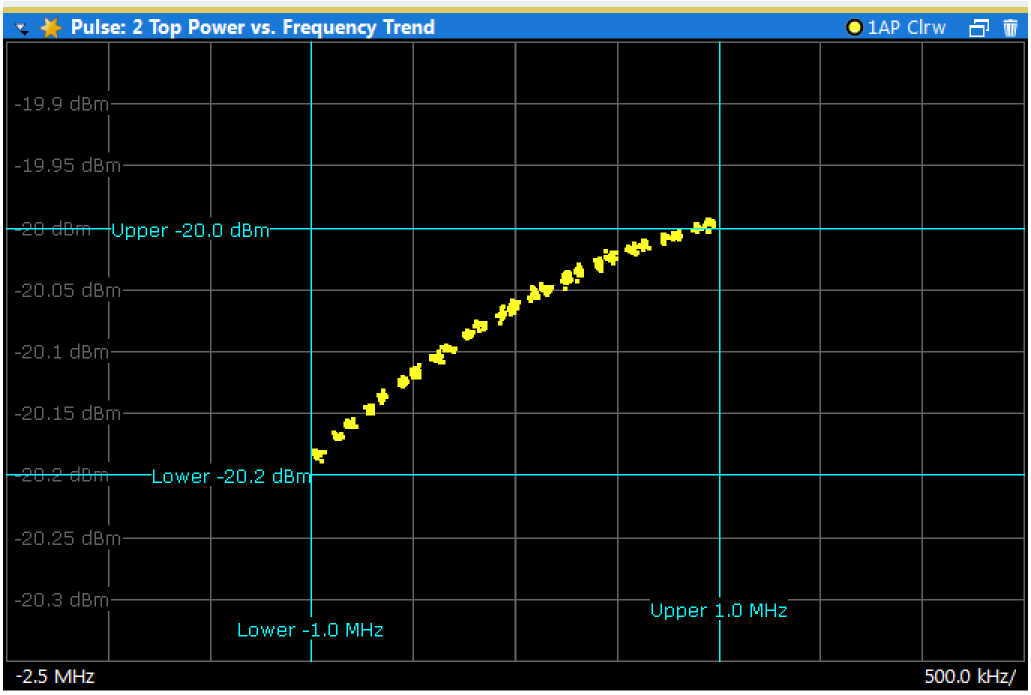


Figure 3-6: Top power vs frequency scatter plot

With option R&S VSE-K6A installed, the R&S VSE can display up to four measurement channels simultaneously. The channels are displayed combined in one result display with different colors for each channel.

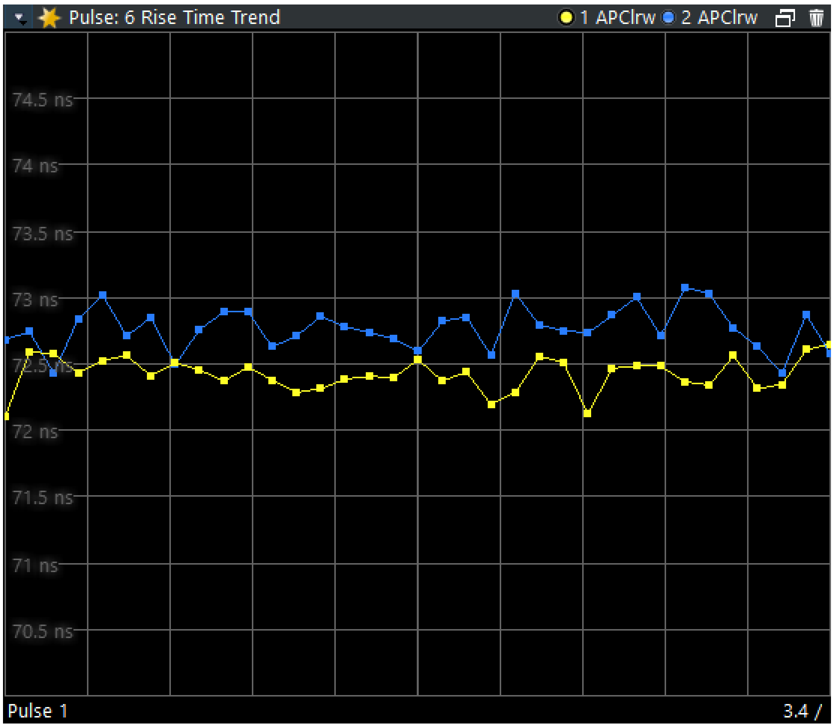


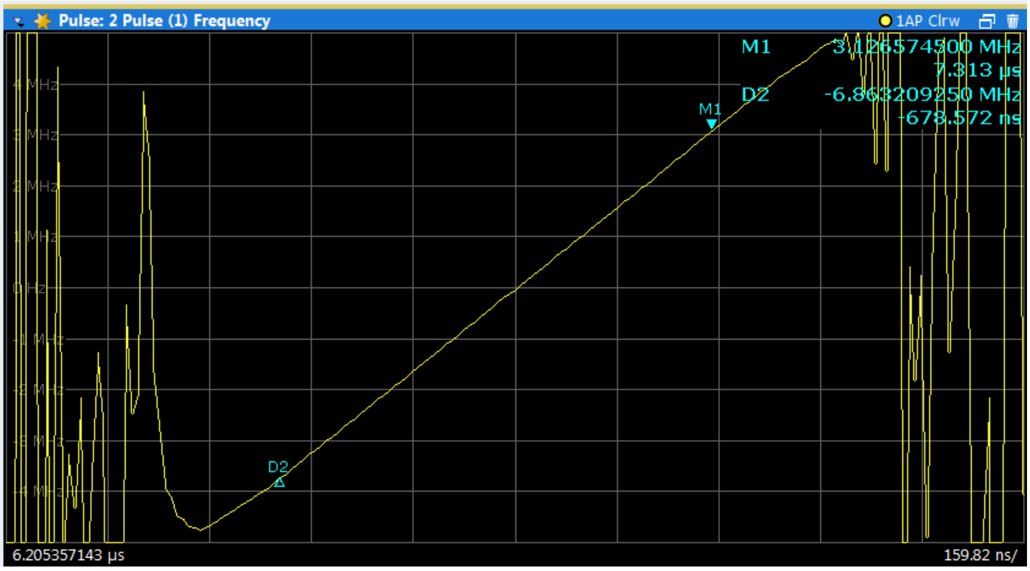
Figure 3-7: Option R&S VSE-K6A

Note that averaging is not possible for "parameter trend" traces.

Note: Setting markers in "Parameter Trend" Displays. In "Parameter Trend" displays, especially when the x-axis unit is not pulse number, positioning a marker by defining its x-axis value can be very difficult or ambiguous. Thus, markers can be positioned by defining the corresponding pulse number in the "Marker" edit field for all parameter trend displays, regardless of the displayed x-axis parameter. The "Marker" edit field is displayed when you select one of the "Marker" softkeys.
However, the position displayed in the marker information area or the marker table is shown in the defined x-axis unit.

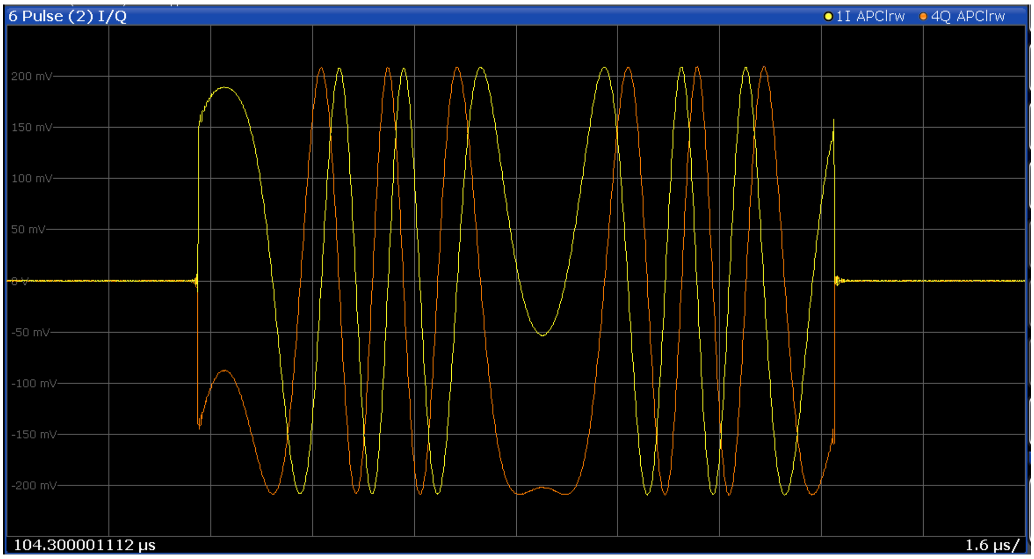
Remote command:
`LAY:ADD:WIND '2',RIGH,PTR` see `LAYout:ADD[:WINDow]?` on page 213
Chapter 8.4.11.6, "Configuring a parameter trend", on page 238

Pulse Frequency
Displays the frequency trace of the selected pulse. The length and alignment of the trace can be configured in the "Result Range" dialog box (see Chapter 6.1.2, "Result range", on page 100).



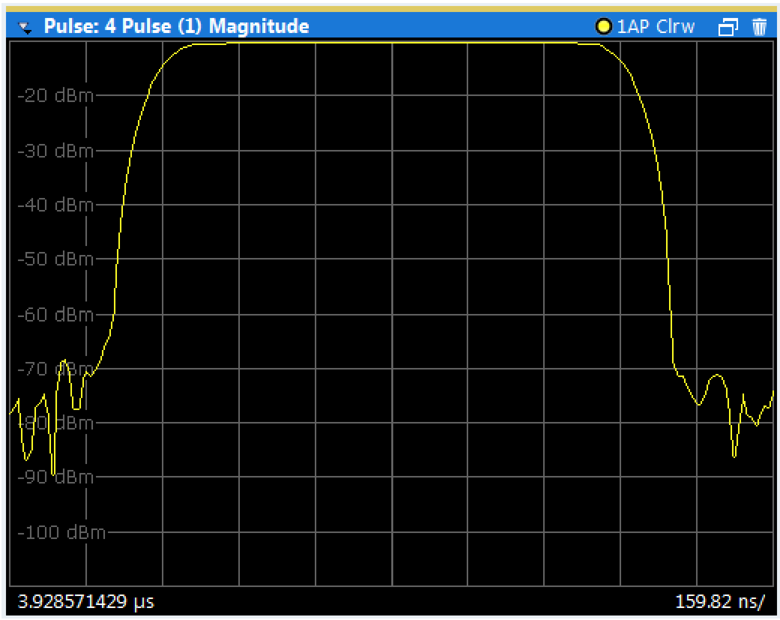
Remote command:
`LAY:ADD:WIND '2',RIGH,PFR` see `LAYout:ADD[:WINDow]?` on page 213
Results:
`TRACe<n>[:DATA]?` on page 303

Pulse I and Q
Displays the magnitude of the I and Q components of the selected pulse versus time as separate traces in one diagram. The length and alignment of the trace can be configured in the "Result Range" dialog box (see Chapter 6.1.2, "Result range", on page 100).



Remote command:
`LAY:ADD:WIND '2',RIGH,PIAQ` see `LAYout:ADD[:WINDow]?` on page 213
Results:
`[SENSe:]PULSe:POWer:AMPLitude:I?` on page 318
`[SENSe:]PULSe:POWer:AMPLitude:Q?` on page 319

Pulse Magnitude
Displays the magnitude vs. time trace of the selected pulse. The length and alignment of the trace can be configured in the "Result Range" dialog box (see Chapter 6.1.2, "Result range", on page 100).



With option R&S VSE-K6A installed, the R&S VSE can display up to four measurement channels simultaneously. The channels are displayed combined in one result display with different colors for each channel.

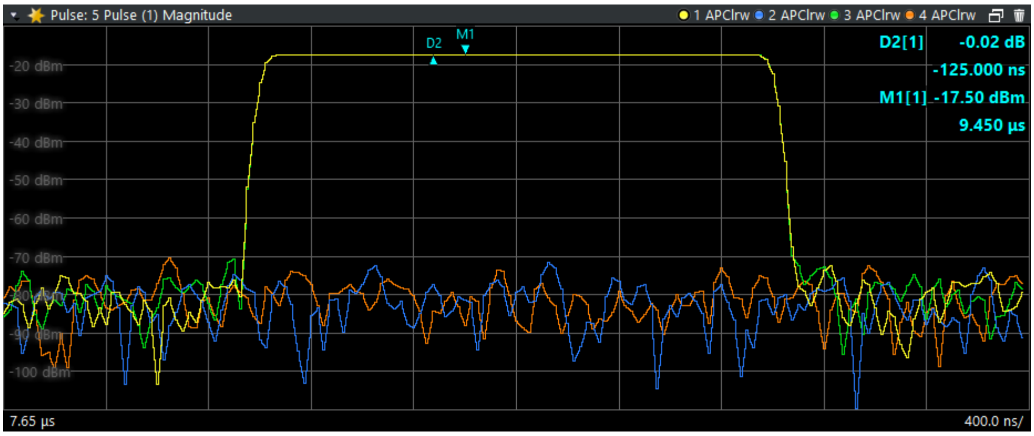
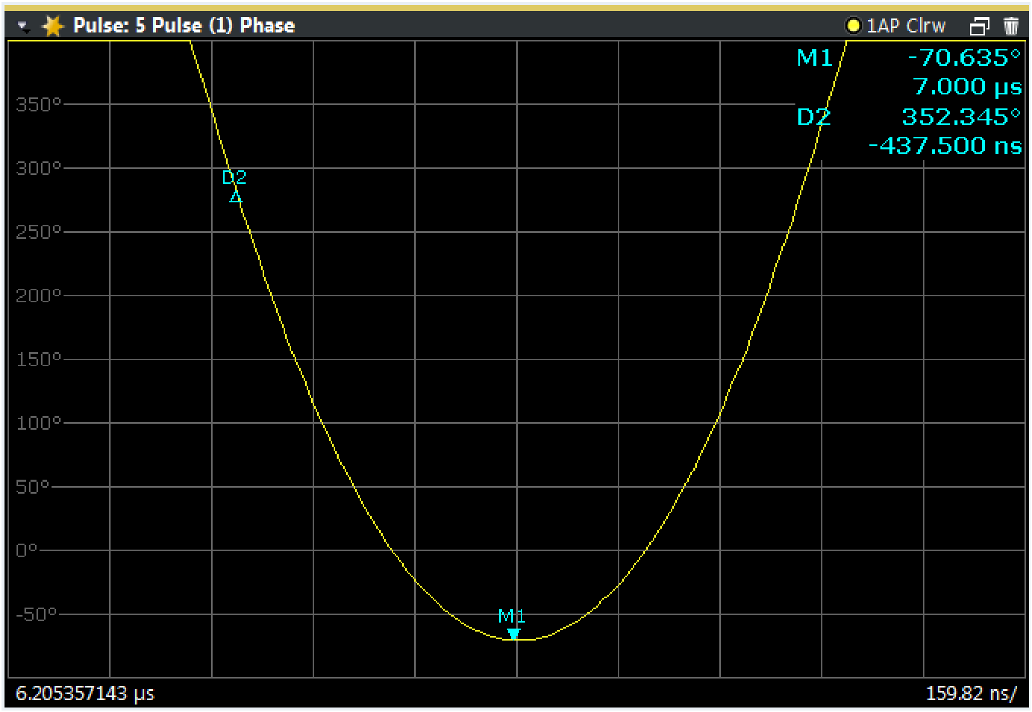


Figure 3-8: Option R&S VSE-K6A

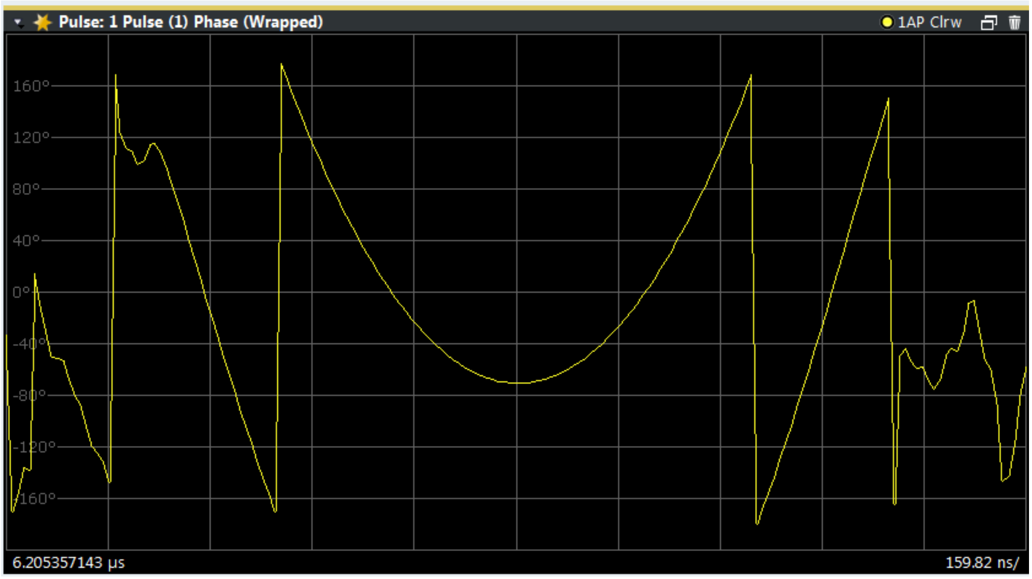
Remote command:
`LAY:ADD:WIND '2',RIGH,PMAG` see `LAYout:ADD[:WINDow]?` on page 213
Results:
`TRACe<n>[:DATA]?` on page 303

Pulse Phase
Displays the phase vs. time trace of the selected pulse. The length and alignment of the trace can be configured in the "Result Range" dialog box (see Chapter 6.1.2, "Result range", on page 100).



Remote command:
`LAY:ADD:WIND '2',RIGH,PPH` see `LAYout:ADD[:WINDow]?` on page 213
Results:
`TRACe<n>[:DATA]?` on page 303

Pulse Phase (Wrapped)
Displays the *wrapped* phase vs. time trace of the selected pulse. The length and alignment of the trace can be configured in the "Result Range" dialog box (see Chapter 6.1.2, "Result range", on page 100).



Remote command:
`LAY:ADD:WIND '2',RIGH,PPW` see `LAYout:ADD[:WINDow]?` on page 213
Results:
`TRACe<n>[:DATA]?` on page 303

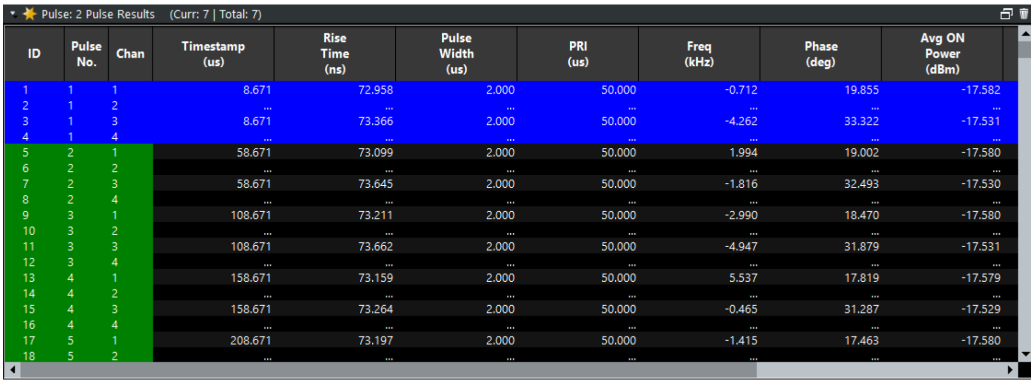
Pulse Results
Displays the measured pulse parameters in a table of results. Which parameters are displayed can be configured in the "Result Configuration" (see Chapter 6.1, "Result configuration", on page 99). The currently selected pulse is highlighted blue. The pulses contained in the current capture buffer (or detection range, if enabled) are highlighted green. The number of detected pulses in the current capture buffer ("Curr") and the entire measurement ("Total") is indicated in the title bar.

For multi-channel analysis with option R&S VSE-K6A , the “point in pulse” at which certain values are measured (see Measurement Point) is defined per pulse and is calculated separately for each channel. This means the time instant used to calculate a “point in pulse” result may be different on each channel, if the pulses have some time offset with each other across the different input channels. If the same time instant on each channel should be used for the measurement of “point in pulse” values, this can be achieved using the segmented capture mode and aligning the measurement point to the trigger instant which is common to all channels (see Measurement Point Reference).

Pulse: 2 Pulse Results

ID	Pulse No.	Rise Time (ns)	Pulse Width (us)	PRI (us)	Freq (kHz)	Phase (deg)	Avg ON Power (dBm)	Avg Tx Power (dBm)
472	20	110.839	0.986	10.000	50.703	-70.708	-10.508	-20.534
473	21	110.572	0.985	10.000	53.878	-70.712	-10.508	-20.534
474	22	110.672	0.985	10.000	52.073	-70.774	-10.509	-20.536
475	23	110.736	0.985	10.000	53.462	-70.734	-10.508	-20.535
476	24	110.776	0.985	10.000	60.349	-70.822	-10.509	-20.535
477	25	110.523	0.985	10.000	56.637	-70.662	-10.508	-20.535
478	26	110.802	0.985	10.000	58.060	-70.762	-10.510	-20.537
479	27	110.653	0.985	10.000	58.756	-70.763	-10.509	-20.535
480	28	110.719	0.985	10.000	54.579	-70.779	-10.508	-20.535
481	29	110.559	0.985	10.000	48.852	-70.771	-10.509	-20.536
482	30	110.496	0.985	10.000	54.130	-70.708	-10.510	-20.536
483	31	110.704	0.985	10.000	55.071	-70.769	-10.509	-20.535
484	32	110.986	0.985	10.000	52.995	-70.730	-10.510	-20.537
485	33	110.736	0.985	10.000	53.463	-70.704	-10.508	-20.535
486	34	110.667	0.985	10.000	59.003	-70.701	-10.509	-20.535
487	35	110.550	0.986	...	60.359	-70.763	-10.509	...
488	1	110.810	0.985	10.000	59.849	-70.599	-10.510	-20.536
489	2	110.862	0.985	10.000	57.452	-70.582	-10.510	-20.536
490	3	110.701	0.985	10.000	50.251	-70.588	-10.509	-20.536
491	4	110.735	0.985	10.000	56.999	-70.647	-10.508	-20.535
492	5	110.726	0.985	10.000	59.952	-70.556	-10.508	-20.535
493	6	110.648	0.985	10.000	51.798	-70.644	-10.508	-20.534
494	7	110.996	0.985	10.000	55.450	-70.561	-10.510	-20.536
495	8	110.564	0.986	10.000	58.288	-70.615	-10.509	-20.535
496	9	110.716	0.985	10.000	62.697	-70.707	-10.509	-20.536
497	10	110.560	0.985	10.000	57.008	-70.613	-10.508	-20.535
498	11	110.720	0.985	10.000	49.939	-70.627	-10.511	-20.537
499	12	110.595	0.986	10.000	44.979	-70.590	-10.509	-20.535
500	13	110.733	0.986	10.000	53.278	-70.542	-10.509	-20.535
501	14	110.570	0.985	10.000	62.036	-70.686	-10.509	-20.536
502	15	110.585	0.985	10.000	47.378	-70.655	-10.509	-20.535
503	16	110.747	0.985	10.000	57.965	-70.663	-10.509	-20.535
504	17	110.741	0.985	10.000	46.735	-70.732	-10.509	-20.536

With option R&S VSE-K6A installed, the R&S VSE can display up to four measurement channels simultaneously. One value for the same pulse is displayed in each channel. If no pulse was detected in a channel, "..." is displayed.



Pulse: 2 Pulse Results (Curr: 7 | Total: 7)

ID	Pulse No.	Chan	Timestamp (us)	Rise Time (ns)	Pulse Width (us)	PRI (us)	Freq (kHz)	Phase (deg)	Avg ON Power (dBm)
1	1	1	8.671	72.958	2.000	50.000	-0.712	19.855	-17.582
2	1	2	...	...	...	...	...	...	...
3	1	3	8.671	73.366	2.000	50.000	-4.262	33.322	-17.531
4	1	4	...	...	...	...	...	...	...
5	2	1	58.671	73.099	2.000	50.000	1.994	19.002	-17.580
6	2	2	...	...	...	...	...	...	...
7	2	3	58.671	73.645	2.000	50.000	-1.816	32.493	-17.530
8	2	4	...	...	...	...	...	...	...
9	3	1	108.671	73.211	2.000	50.000	-2.990	18.470	-17.580
10	3	2	...	...	...	...	...	...	...
11	3	3	108.671	73.662	2.000	50.000	-4.947	31.879	-17.531
12	3	4	...	...	...	...	...	...	...
13	4	1	158.671	73.159	2.000	50.000	5.537	17.819	-17.579
14	4	2	...	...	...	...	...	...	...
15	4	3	158.671	73.264	2.000	50.000	-0.465	31.287	-17.529
16	4	4	...	...	...	...	...	...	...
17	5	1	208.671	73.197	2.000	50.000	-1.415	17.463	-17.580
18	5	2	...	...	...	...	...	...	...

Figure 3-9: Option R&S VSE-K6A

Limit check

Optionally, the measured results can be checked against defined limits (see Chapter 6.1.6.2, "Limit settings for table displays", on page 112). The results of the limit check are indicated in the Pulse Results table as follows:

Table 3-1: Limit check results in the result tables

Display color	Limit check result
White	No limit check active for this parameter
Green	Limit check passed

Display color	Limit check result
Red, asterisk before	Limit check failed; limit exceeds lower limit
Red, asterisk behind	Limit check failed; limit exceeds upper limit


Pulse: 1 Pulse Results

ID	Pulse No.	Rise Time (ns)	Pulse Width (us)	PRI (us)	Freq (kHz)	Phase (deg)	Top Power (dBm)	Avg Tx Power (dBm)
279	279	28.497	2.000	100.000	-185.186	-90.541	-20.080	-37.097
280	280	28.327	2.000	100.000	-336.088	-124.057	-20.098	-37.113
281	281	28.343	2.000	100.000	-500.288	-162.700	-20.118	-37.134
282	282	28.240	2.000	100.000	-645.834	153.910	-20.135	-37.151
283	283	28.353	2.000	100.000	-826.125	105.563	-20.157	-37.174
284	284	28.220	2.000	100.000	-977.370	52.446	-20.180	-37.196
285	285	28.179	2.000	100.000	-869.769	-123.729	-20.167	-37.184
286	286	28.420	2.000	100.000	-707.488	-121.449	-20.146	-37.159
287	287	28.238	2.000	100.000	-568.670	-115.935	-20.127	-37.141
288	288	28.512	2.000	100.000	-393.288	-105.602	-20.105	-37.121
289	289	28.323	2.000	100.000	-224.176	-90.944	-20.088	-37.104
290	290	28.361	2.000	100.000	-70.966	-70.802	-20.077	-37.087
291	291	28.420	2.000	100.000	89.549	-45.366	-20.055	-37.071
292	292	28.516	2.000	100.000	245.758	-13.922	-20.044	-37.059
293	293	28.284	2.000	100.000	412.287	22.111	-20.033	-37.047
294	294	28.341	2.000	100.000	570.037	63.380	-20.017	-37.032
295	295	28.750*	2.000	100.000	730.199	109.231	-20.007	-37.022
296	296	28.259	2.000	100.000	889.857	159.904	-19.999*	-37.014
297	297	28.412	2.000	100.000	945.233	1.503	-19.993*	-37.011
298	298	28.420	2.000	100.000	801.817	2.533	-20.006	-37.020
299	299	28.311	2.000	100.000	628.363	-1.439	-20.013	-37.027
300	300	28.526	2.000	100.000	442.162	-9.355	-20.024	-37.039
301	301	28.407	2.000	100.000	307.592	-21.587	-20.035	-37.050
302	302	28.356	2.000	100.000	126.844	-39.354	-20.050	-37.064
303	303	28.482	2.000	100.000	-23.219	-61.502	-20.062	-37.078
304	304	28.277	2.000	100.000	-148.717	-90.451	-20.077	-37.093
305	305	28.220	2.000	100.000	-331.082	-124.165	-20.099	-37.112
306	306	28.226	2.000	100.000	-475.370	-162.812	-20.116	-37.132
307	307	28.360	2.000	100.000	-649.092	153.619	-20.138	-37.152
308	308	28.346	2.000	100.000	-800.837	105.339	-20.160	-37.175
309	309	28.148	2.000	100.000	-956.082	52.195	-20.181	-37.199
310	310	28.478	2.000	100.000	-882.401	-124.195	-20.170	-37.186

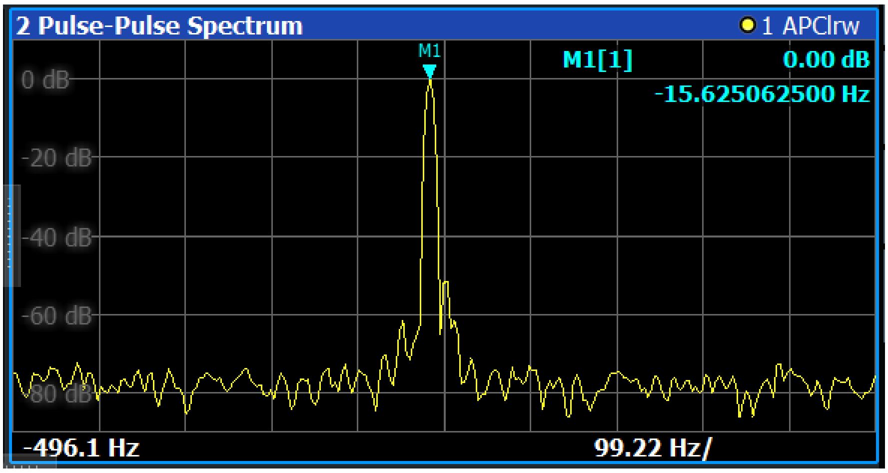
Note: The results of the limit check are for informational purposes only; special events such as stopping the measurement are not available.

Note: Optionally, limit lines can be displayed in the Parameter Distribution and Parameter Trend diagrams. You can drag these lines to a new position in the window. The new position is maintained, the limit check is repeated, and the results of the limit check in any active table displays are adapted.

Remote command:
`LAY:ADD:WIND '2',RIGH,PRES` see `LAYout:ADD[:WINDow]?` on page 213
Chapter 8.4.11.8, "Configuring the statistics and parameter tables", on page 258
Results:
Chapter 8.6.1.3, "Retrieving parameter results", on page 313
Number of pulses: `[SENSe:]PULSe:COUNt?` on page 310
Chapter 8.6.1.4, "Retrieving limit results", on page 363

Pulse-Pulse Spectrum

The pulse-to-pulse spectrum is basically a Parameter Spectrum, based on complex I/Q data. The I and Q values for each pulse (taken at the Measurement Point Reference) are integrated over all pulses to create a spectrum that consists of positive and negative frequencies. You cannot select a parameter for the spectrum. All other settings are identical to the "parameter spectrum".



The pulse-to-pulse spectrum is useful to analyze small frequency shifts which cannot be detected within an individual pulse, for example Doppler effects.

Remote command:
`LAY:ADD? '1',RIGH,PPSP`, see `LAYout:ADD[:WINDow]?` on page 213
Results:
`TRACe<n>[:DATA]?` on page 303

Pulse Statistics
Displays statistical values (minimum, maximum, average, standard deviation) for the measured pulse parameters in a table of results. The number of evaluated pulses is also indicated. Both the current capture buffer data and the cumulated captured data from a series of measurements are evaluated. The statistics calculated only from pulses within the current capture buffer (or detection range, if enabled) are highlighted green. For reference, the measured parameters from the "Selected Pulse" are also shown, highlighted blue. The displayed parameters are the same as in the "Pulse Results" and can be configured in the "Result Configuration" (see Chapter 6.1, "Result configuration", on page 99).

Pulse: 3 Pulse Statistics

Statistic	Rise Time (ns)	Pulse Width (us)	PRI (us)	Freq (kHz)	Phase (deg)	Avg ON Power (dBm)	Avg Tx Power (dBm)
Selected	110.810	0.985	10.000	59.849	-70.599	-10.510	-20.536
Average	110.698	0.985	10.000	55.815	-70.632	-10.509	-20.535
Std. Dev.	0.115657	0.000066	0.000069	5.042152	0.046989	0.000866	0.000889
Maximum	111.002	0.986	10.000	66.979	-70.533	-10.507	-20.533
Minimum	110.549	0.985	10.000	44.979	-70.732	-10.511	-20.537
Average	110.698	0.985	10.000	56.273	-70.985	-10.509	-20.535
Std. Dev.	0.125778	0.000060	0.000060	4.457147	0.206569	0.000881	0.000880
Maximum	111.033	0.986	10.000	68.473	-70.533	-10.506	-20.532
Minimum	110.240	0.985	10.000	40.300	-71.488	-10.511	-20.537

With option R&S VSE-K6A installed, the R&S VSE can display up to four measurement channels simultaneously. In the pulse statistics result display, the values are displayed for each channel seperately.

Pulse: 4 Pulse Statistics | Pulse: 2 Pulse Results

Statistic	Rise Time (ns)	Pulse Width (us)	PRI (us)	Freq (kHz)	Phase (deg)	Avg ON Power (dBm)	Avg Tx Power (dBm)
Ch. 1 Selected	69.852	2.000	50.000	-2.234	148.314	-17.586	-31.553
Ch. 2 Selected	70.100	2.000	50.000	2.643	161.489	-17.504	-31.472
Ch. 1 Average	69.893762	1.999925	49.999998	-1.094169	146.607920	-17.589490	-31.556837
Ch. 2 Average	70.136	2.000	50.000	0.285	159.808	-17.502	-31.470
Ch. 1 Std. Dev.	0.051	0.000	0.000	1.497	1.199	0.002	0.002
Ch. 2 Std. Dev.	0.048	0.000	0.000	1.895	1.190	0.001	0.001
Ch. 1 Maximum	69.974	2.000	50.000	1.381	148.314	-17.586	-31.553
Ch. 2 Maximum	70.195341	1.999885	50.000021	2.796691	161.489304	-17.501214	-31.468658
Ch. 1 Minimum	69.818	2.000	50.000	-2.868	144.965	-17.591	-31.559
Ch. 2 Minimum	70.073	2.000	50.000	-1.656	158.177	-17.504	-31.472
Ch. 1 Count	7	7	6	7	7	7	6
Ch. 2 Count	7	7	6	7	7	7	6
Ch. 1 Average	72.373	2.000	50.000	-0.007	23.198	-17.587	-31.552
Ch. 2 Average	72.913	2.000	50.000	-0.139	36.447	-17.518	-31.483
Ch. 1 Std. Dev.	1.796	0.000	0.000	2.365	104.407	0.006	0.006
Ch. 2 Std. Dev.	1.944	0.000	0.000	2.357	104.365	0.008	0.007
Ch. 1 Maximum	74.493	2.000	50.000	4.449	154.479	-17.575	-31.542
Ch. 2 Maximum	75.119	2.000	50.000	4.668	167.831	-17.501	-31.469
Ch. 1 Minimum	69.474	2.000	50.000	-5.827	-152.094	-17.598	-31.563
Ch. 2 Minimum	70.036	2.000	50.000	-6.843	-138.762	-17.532	-31.495
Ch. 1 Count	69	69	59	69	69	69	59
Ch. 2 Count	69	69	59	69	69	69	59

Figure 3-10: Option R&S VSE-K6A

Note: Limit checks are also available for "Pulse Statistics"; see "Pulse Results" on page 39.

Remote command:
`LAY:ADD:WIND '2',RIGH,PST` see `LAYout:ADD[:WINDow]?` on page 213
Chapter 8.4.11.8, "Configuring the statistics and parameter tables", on page 258
Results:
Chapter 8.6.1.3, "Retrieving parameter results", on page 313
`[SENSe:]PULSe:<ParameterGroup>:<Parameter>:COUNt?` on page 312
Chapter 8.6.1.4, "Retrieving limit results", on page 363

Result Range Spectrum

Calculates a power spectrum from the captured I/Q data, within the time interval defined by the result range (see Chapter 6.1.2, "Result range", on page 100.

The "Result Range Spectrum" is calculated using a *Welch periodogram*, which involves averaging the spectrum calculated by overlapping windows.

With option R&S VSE-K6A installed, the trace data from any selected channel is time aligned to the pulse on the first measurement channel. This means that any timing differences between input channels are visible in the traces shown. It allows the user to see how the pulses align to one another across input channels on a per sample basis.

The shape of the window used for the calculation can be specified. The length of the window is calculated such that a specific resolution bandwidth is obtained.

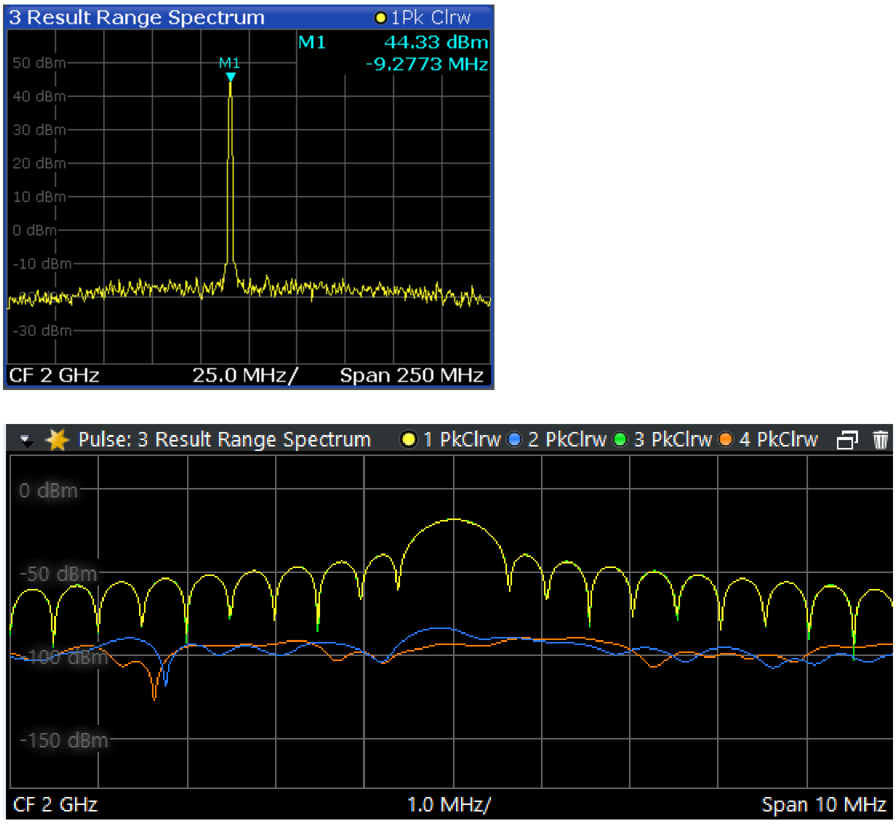


Figure 3-11: Option R&S VSE-K6A

Remote command:
`LAY:ADD:WIND '2',RIGH,RRSP` see `LAYout:ADD[:WINDow]?` on page 213
Results:
`TRACe<n>[:DATA]?` on page 303

4 Measurement basics

Some background knowledge on basic terms and principles used in pulse measurements is provided here for a better understanding of the required configuration settings.

4.1 Parameter definitions

The pulse parameters to be measured are based primarily on the IEEE 181 Standard 181-2003. For detailed descriptions refer to the standard documentation ("IEEE Standard on Transitions, Pulses, and Related Waveforms", from the IEEE Instrumentation and Measurement (I&M) Society, 7 July 2003).

The following definitions are used to determine the measured pulse power parameters:

Value	Description
$L_{0\%}$	The magnitude in V corresponding to the pulse OFF level (base level)
$L_{100\%}$	The magnitude in V corresponding to the pulse ON level (top level)
L_{Ov}	The magnitude in V at the peak level occurring directly after the pulse rising edge (mid-level crossing)
L_{rise}	The magnitude in V of the reference model at the top of the rising edge (beginning of the pulse top)
L_{fall}	The magnitude in V of the reference model at the top of the falling edge (end of the pulse top)
L_{rip+}	The magnitude in V corresponding to the largest level above the reference model which occurs within the ripple portion of the pulse top
L_{top+}	The magnitude in V of the reference model at the point in time where L_{rip+} is measured
L_{rip-}	The magnitude in V corresponding to the lowest measured level below the reference model which occurs within the ripple portion of the pulse top
L_{top-}	The magnitude in V of the reference model at the point in time where L_{rip-} is measured

4.1.1 Amplitude droop

The amplitude droop is calculated as the difference between the power at the beginning of the pulse ON time and the power at the end of the pulse ON time, divided by the pulse amplitude:

$$\text{Droop}\,(\%\text{V}) = \frac{L_{rise} - L_{fall}}{L_{100\%} - L_{0\%}} \times 100$$

$$\text{Droop}\,(\%\text{W}) = \frac{L_{rise}^2 - L_{fall}^2}{L_{100\%}^2 - L_{0\%}^2} \times 100$$

$$\text{Droop}\,(\text{dB}) = 20 \times \log_{10}\left(\frac{L_{rise}}{L_{fall}}\right)$$

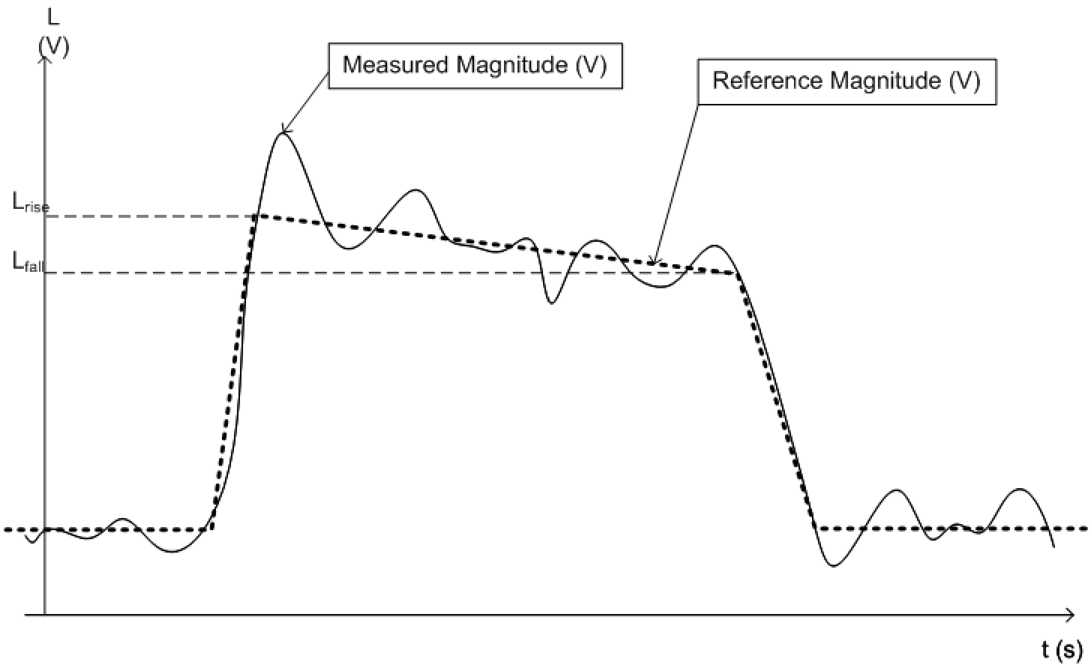


Figure 4-1: Illustration of levels used to define the droop measurement

4.1.2 Ripple

The ripple is calculated as the difference between the maximum and minimum deviation from the pulse top reference, within a user specified interval.

The default behavior compensates for droop in the pulse top using the following formulae:

$$\text{Ripple (\%V)} = \frac{\left|L_{rip+} - L_{top+}\right| + \left|L_{top-} - L_{rip-}\right|}{L_{100\%} - L_{0\%}} \times 100$$

$$\text{Ripple (\%W)} = \frac{\left|L_{rip+}^2 - L_{top+}^2\right| + \left|L_{top-}^2 - L_{rip-}^2\right|}{L_{100\%}^2 - L_{0\%}^2} \times 100$$

$$\text{Ripple (dB)} = 10 \times \log_{10}\left(\frac{L_{100\%}^2 + \left|L_{rip+}^2 - L_{top+}^2\right|}{L_{100\%}^2 - \left|L_{top-}^2 - L_{rip-}^2\right|}\right)$$

However, if Pulse Has Droop is set to "Off" or the 100 % Level Position is set to "Center", then the reference model has a flat pulse top and $L_{top+} = L_{top-} = L_{100\%}$. Thus, the formulae are reduced to:

$$\text{Ripple (\%V)} = \frac{L_{rip+} - L_{rip-}}{L_{100\%} - L_{0\%}} \times 100$$

$$\text{Ripple (\%W)} = \frac{L_{rip+}^2 - L_{rip-}^2}{L_{100\%}^2 - L_{0\%}^2} \times 100$$

$$\text{Ripple (dB)} = 20 \times \log_{10}\left(\frac{L_{rip+}}{L_{rip-}}\right)$$

The following illustration indicates the levels used for calculation.

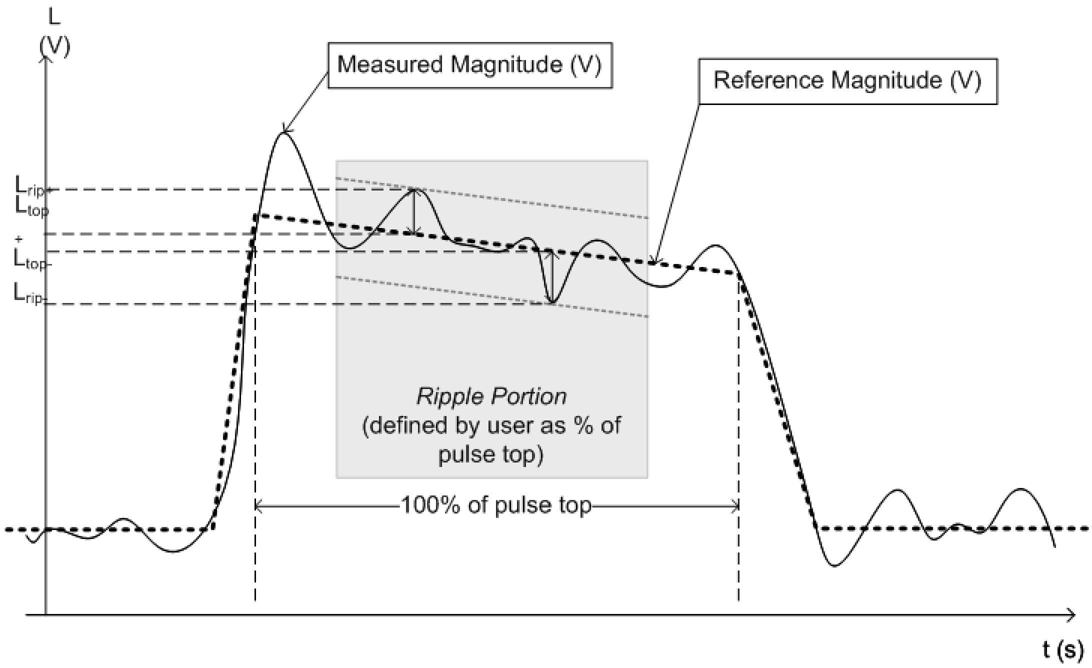


Figure 4-2: Illustration of levels used to define the ripple measurement.

4.1.3 Overshoot

The overshoot is defined as the height of the local maximum after a rising edge, divided by the pulse amplitude:

$$\text{Overshoot }(\%V) = \frac{L_{Ov} - L_{100\%}}{L_{100\%} - L_{0\%}} \times 100$$

$$\text{Overshoot }(\%W) = \frac{L_{Ov}^2 - L_{100\%}^2}{L_{100\%}^2 - L_{0\%}^2} \times 100$$

$$\text{Overshoot }(\text{dB}) = 20 \times \log_{10}\left(\frac{L_{Ov}}{L_{100\%}}\right)$$

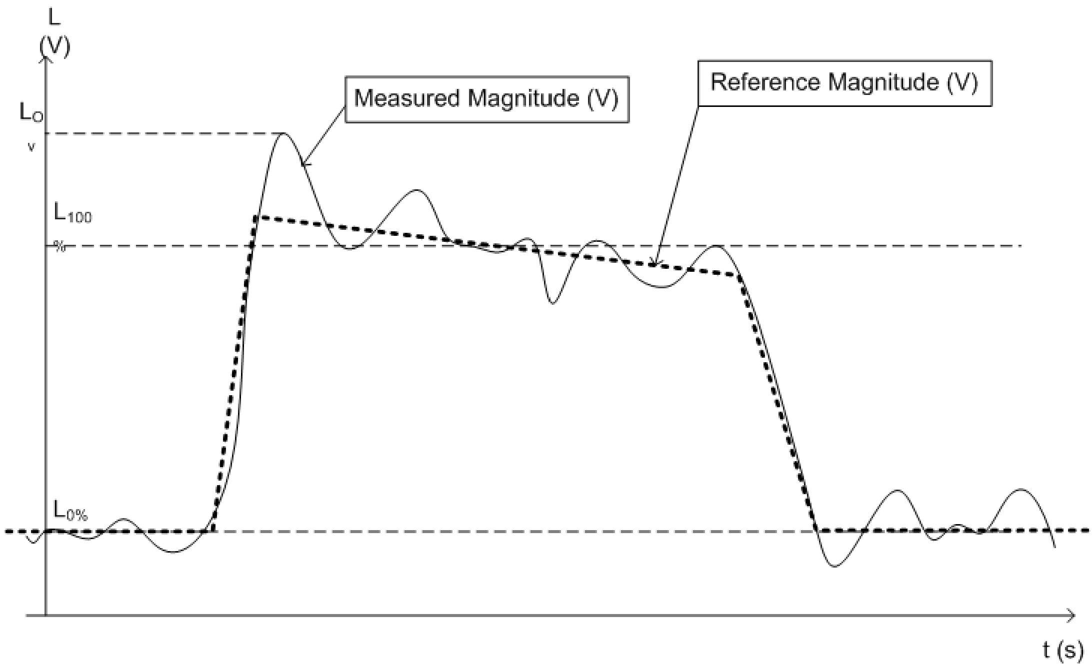
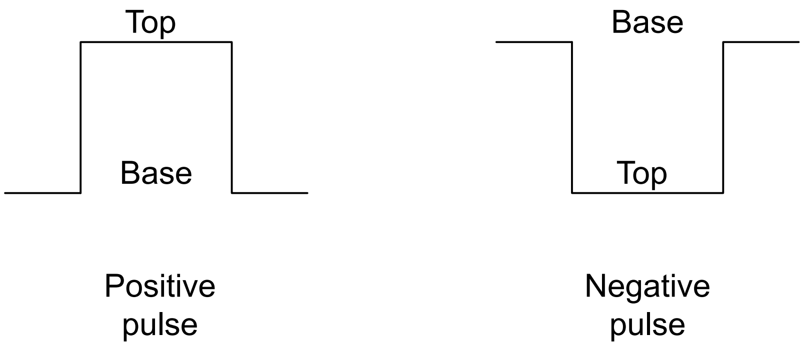


Figure 4-3: Illustration of levels used to define the overshoot measurement

4.2 Pulse detection

A pulsed input signal is a signal whose carrier power is modulated by two states: ON and OFF. Basically, a pulse is detected when the input signal power exceeds a threshold, then falls below that threshold, or vice versa. Pulses that rise to and then remain at a peak (positive) power level for a certain duration, and then fall again are referred to as **positive** pulses. The opposite - falling to and remaining at a minimum (negative) power level, then rising - is referred to as a **negative** pulse. The "**ON**" power level is referred to as the **top** or **100% level**, whereas the "**OFF**" level is referred to as the **base** or **0% level**.



A **hysteresis** can refine the detection process and avoid falsely interpreting unstable signals as additional pulses. Optionally, detection can be restricted to a maximum number of pulses per capture process.

A top power level that is not constant is called an amplitude **droop**. Since the top level is an important reference for several pulse parameters, take a droop into consideration where possible. If a signal is known to have a droop, the reference level is not calculated as an average or median value over the ON time. Instead, it is calculated separately for the rising and falling edges.

The time it takes the signal power to rise from the base level to the top is called the **rise time**.

The duration the signal power remains at the top level is considered the **ON time**, which also defines the **pulse width**.

The time it takes the signal power to fall from the top to the base level is called the **fall time**.

The duration the signal power remains at the base level is called the **OFF time**.

The **pulse repetition interval** (also known as **pulse period**) is defined as the duration of one complete cycle consisting of:

- The rise time
- The ON time
- The fall time
- The OFF time

To avoid taking noise, ripples, or other signal instabilities into consideration, the absolute peak or minimum power values are not used to calculate these characteristic values. Instead, threshold values are defined.

See Chapter 3.1, "Pulse parameters", on page 15 for more precise definitions and an illustration of how these values are calculated.

Detection range

If the capture buffer contains a large number of pulses, it can be tedious to find a particular pulse for analysis. In this case, you can enable the use of a detection range instead of the entire capture buffer for analysis.

A detection range determines which part of the capture buffer is analyzed. It is defined by the Detection Start and the Detection Length. If disabled (default), the entire capture buffer is used as the detection range.

The pulse numbers in the result displays are always relative to the current detection range, that is: pulse number 1 is the first pulse within the detection range. If you change the position of the detection range within the capture buffer, pulse number 1 can be a different pulse. All pulse-based results are automatically updated, if necessary. To navigate to a particular pulse in the capture buffer, use the pulse timestamps, which are relative to the start of the capture buffer.

An active detection range is indicated by vertical lines ("DR") in the "Magnitude Capture" Buffer display. You can also change the detection range graphically by dragging the vertical lines in the window.

4.3 Parameter spectrum calculation

When a signal is measured over time, it is possible to calculate the frequency spectrum for the measured signal by performing an FFT on the measured data. Similarly, it is possible to calculate a "spectrum" for a particular pulse parameter by performing an FFT. This "spectrum" allows you to determine the frequency of periodicities in the pulse parameters easily. For example, the "Parameter Spectrum" for "Pulse Top Power" can display a peak at a particular frequency, indicating incidental amplitude modulation of the amplifier output due to the power supply.

Basically, the "parameter spectrum" is calculated by taking the magnitude of the FFT of the selected parameter and normalizing the result to the largest peak.

Frequency axis

When calculating a spectrum from a measured signal, the sample rate ensures a regular distance between two frequencies. To calculate the frequency axis for a "parameter spectrum", the average PRI (pulse repetition interval) is taken to be the "sample rate" for the FFT.

Interpolation

However, in cases where the signal has a non-uniform or staggered PRI the frequency axis must be interpreted with caution. In cases where the pulses only occur in non-contiguous intervals, using the PRI no longer provides useful results. A good solution to create equidistant samples for calculation is to "fill up" the intervals between pulses with interpolated values. Based on the measured and interpolated values, the frequency axis can then be created.

The number of possible interpolation values is restricted to 100,000 by the R&S VSE Pulse application . Thus, the resulting spectrum is limited. By default, the frequency span for the resulting spectrum is determined automatically. However, to improve the accuracy (and performance) of the interpolation, the maximum required frequency span can be restricted further manually.

Non-contiguous pulses - sections vs gaps

For the non-contiguous pulse measurements described above, interpolation in the long intervals where no pulses occur distort the result. Therefore, time intervals without pulses are identified, referred to as gaps. The time intervals that contain pulses are also identified, referred to as *sections*. Interpolation is then performed only on the sections, whereas the gaps are ignored for the spectrum calculation.

A *gap threshold* ensures that pulses with large intervals are not split into multiple sections. A *section threshold* ensures that singular pulses within a long gap are not included in calculation.

Example: Non-contiguous pulse measurement

A typical measurement setup that results in non-contiguous pulses is a rotating radar antenna scanning the air. For most of the time required for a single rotation, no pulses are received. However, when an object comes within the scan area, several pulses are detected within a short duration in time (identified as a section). When the object leaves the scan area again, the pulses will stop, defining a gap until the next object is detected.

Blocks

Spectrum calculation is then performed for the individual sections only. However, the Fourier transformation is not performed on the entire section in one step. Each section is split into blocks, which can overlap. An FFT is performed on each block to calculate an individual result. The smaller the block size, the more individual results are calculated, and the more precise the final result. Thus, the block size determines the resolution bandwidth in the final spectrum. Note that while the block size can be defined manually, the RBW cannot.

Window functions

Each block with its measured and interpolated values 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 Pulse application. Each of the window functions has specific characteristics, including some advantages and some trade-offs. Consider these characteristics carefully to find the optimum solution for the measurement task.

Table 4-1: FFT window functions

Window type	Function
Rectangular	The rectangular window function is in effect not a function at all, it maintains the original sampled data. This can be useful to minimize the required bandwidth; however, heavy sidelobes can occur, which do not exist in the original signal.
Hamming	$w_{hamming}(n) = 0.54 - 0.46(\frac{2\pi n}{length - 1})$
Hann	$w_{hann}(n) = 0.5 - 0.5(\frac{2\pi n}{length - 1})$
Blackman (default)	$w_{blackman}(n) = \frac{alpha + 1}{2} - 0.5\cos\left(\frac{2\pi n}{length - 1}\right) - \frac{alpha}{2}\cos\left(\frac{4\pi n}{length - 1}\right)$ $alpha = \frac{0.5}{1 + \cos\frac{2\pi}{length - 1}}$
Bartlett	$w_{bartlett}(n) = 0.54 - 0.46(\frac{2\pi n}{length - 1})$

Averaging and final spectrum

After windowing, an FFT is performed on each block, and the individual spectrum results are then combined to a total result by averaging the traces. The complete process to calculate a "parameter spectrum" is shown in Figure 4-4.

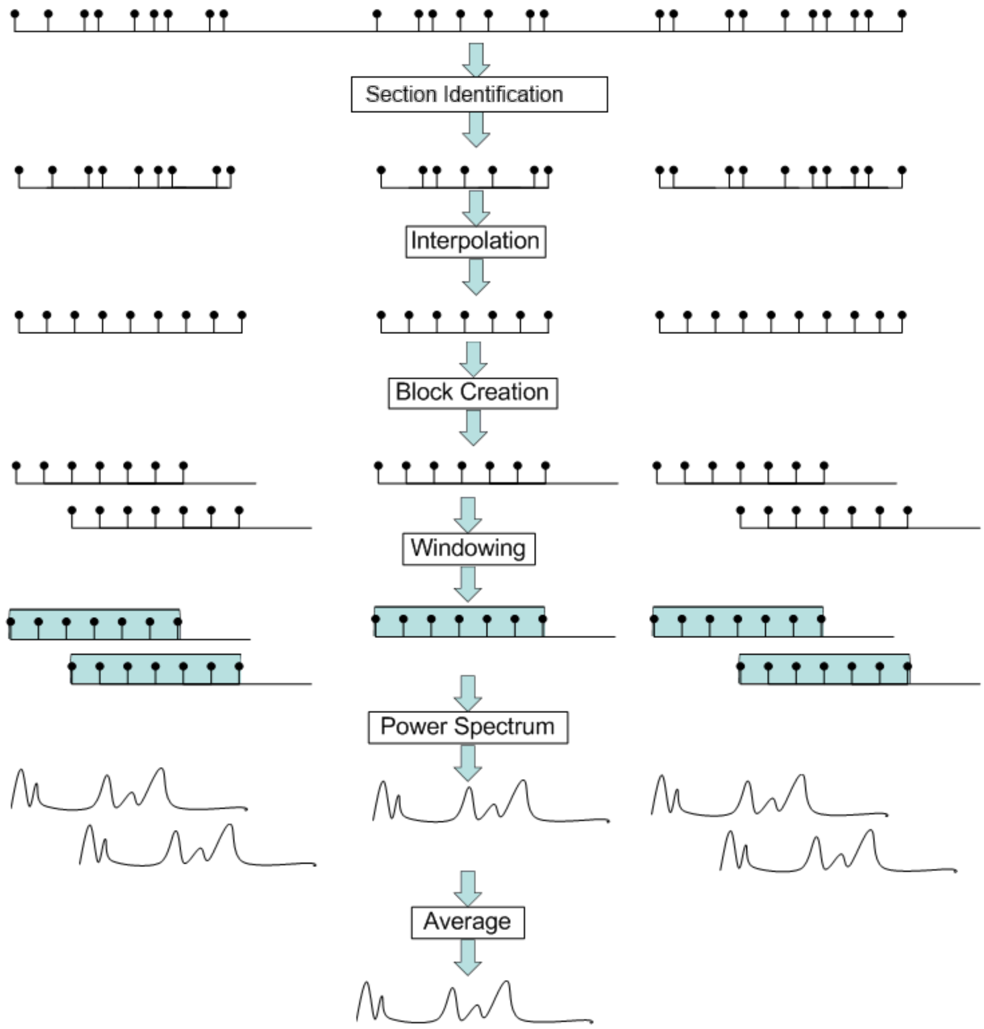


Figure 4-4: Calculating a parameter spectrum for non-contiguous pulses

4.4 Segmented data capturing

As described above, measuring pulses with a varying repetition interval is a common task in the R&S VSE Pulse application. Pulses to be measured can have a relatively short duration compared to the repetition interval (low duty cycle). Performing a measurement over a long time period can lead to large volumes of data with only minor parts of it being relevant. Thus, a new *segmented data capturing* function has been introduced. Using this function, the input signal is measured for the entire time span, which can be very long; however, only user-defined segments of the data are actually stored on the R&S VSE. Thus, much less data, and only *relevant* data, needs to be analyzed. Analyzing pulses becomes much quicker and more efficient.

Although segmented data capturing is similar to the common gated trigger method for data acquisition, there is a significant difference: absolute timing information is provided for the entire acquisition, in addition to the samples within the gating intervals. Furthermore, pretrigger information for the pulses within a segment is available, as opposed to gates that are triggered by a rising or falling edge, and do not provide pretrigger data.

Trigger and trigger offset

A precondition for segmented data capturing is a trigger, as the segment definition is based on the trigger event. A specified trigger *offset* is applied to each segment, thus allowing for pretrigger data to be included in the segment. Furthermore, the length of each segment (that is: the measurement time for an individual segment) must be defined such that the longest expected pulse can be captured in one segment. Finally, the number of trigger events for which data is to be captured can be defined.

Measurement time

If segmented capturing is active, the total measurement time is defined by the number of trigger events and the segment length. Thus, the Measurement Time setting in the "Data Acquisition" dialog box is not available.

A process indicator in the status bar shows the progress of the measurement if segmented capturing is used.

Alignment based on trigger event

Since segment definition is based on the trigger event, this event can also be used as a reference point for the measurement point and result range definition (see Chapter 5.8.2, "Measurement point", on page 94 and "Alignment" on page 101).

To align the measurement point to a trigger event on a per-pulse basis, the R&S VSE Pulse application needs to associate one trigger event with each measured pulse. The following rule applies to both power and external trigger sources:

- Trigger source - rising slope: The pulse whose rising edge is closest to the trigger event is associated
- Trigger source - falling slope: The pulse whose falling edge is closest to the trigger event is associated

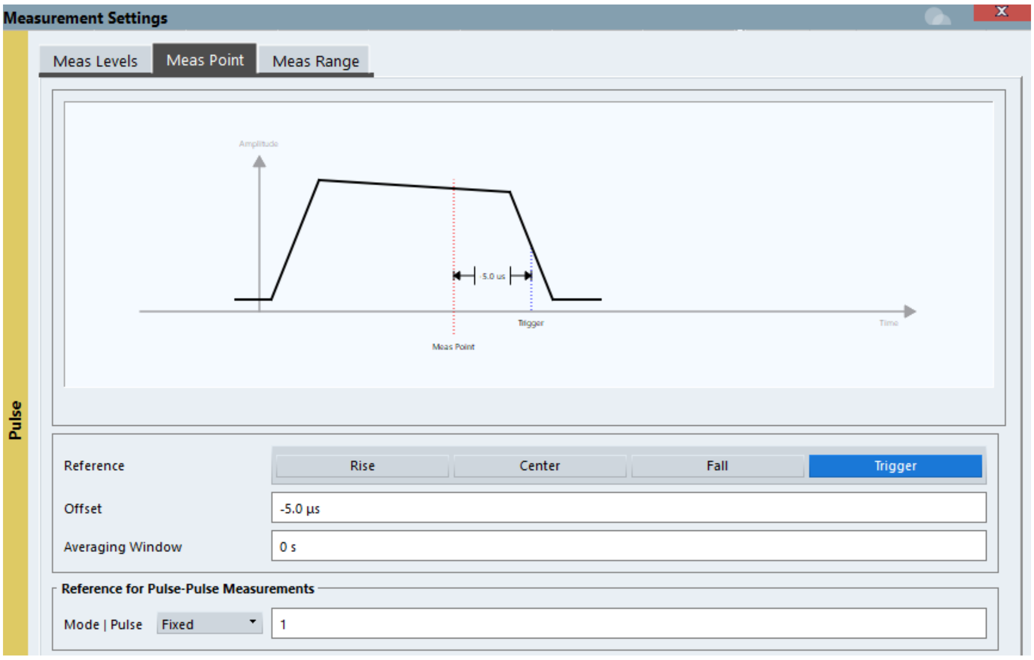


Figure 4-5: Measurement point aligned to trigger on falling edge

Number of events vs number of segments

Generally, the number of trigger events corresponds to the number of captured segments. However, sometimes, multiple trigger events can occur within a time interval shorter than the specified segment length. Thus, the segments for the individual trigger events overlap. In this case, the overlapping segments are merged together and the number of segments is lower than the number of trigger events.

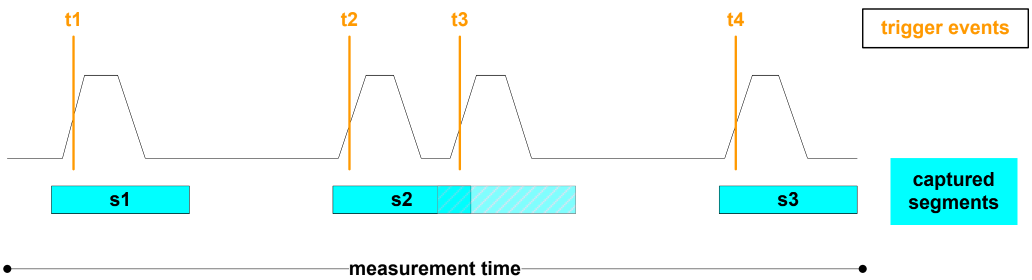
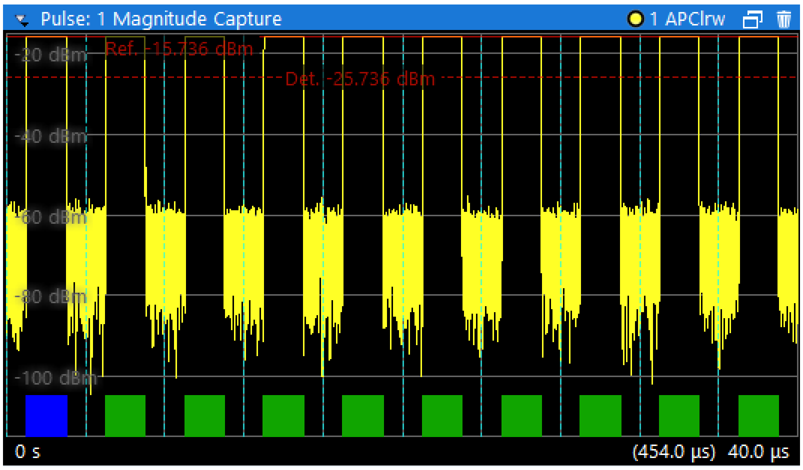


Figure 4-6: Number of segments vs. number of trigger events

Result displays for segmented data

The **"Magnitude Capture"** display provides an overview of the entire measurement. However, for segmented data, the time span can be very long, whereas the relevant signal segments can be relatively short. Thus, to improve clarity, the display is compressed to eliminate the gaps between the captured segments. The segment ranges are indicated by vertical lines. Between two segments, the gap can be compressed in the display. The time span indicated for the x-axis in the diagram footer is only up-to-date when the measurement is completed. (See also "Magnitude Capture" on page 30.)



Markers "jump" over the gaps, but indicate the correct absolute time within the segments.

This compressed time-axis display is also used for the **pulse-based results**.

The result **tables** are identical for segmented or full data capture.

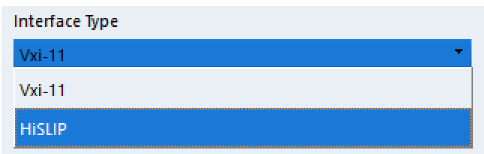
Timestamps vs. sample number

As mentioned above, timing information is available for the entire measurement span, not only for the captured data segments. Thus, the absolute time that each segment starts at is available as a timestamp. On the other hand, only the data samples within the specified segments are actually stored. The samples are indexed. Thus, in addition to the timestamps, the start of a segment can also be referenced by the index number of the first sample in the segment. This is useful, for example, when retrieving the captured segment data in remote operation. (See also `TRACe<n>:IQ:SCAPture:BOUNdary?` on page 194.)

Interface type for segmented capture

Using a "HiSLIP" interface type for the device connection is recommended when performing a segmented capture measurement, as it can improve the overall measurement speed.

For more information on how to select the interface type, see the R&S VSE Base Software User Manual.



4.5 Trace evaluation

Traces in graphical result displays based on the defined result range (see Chapter 6.1.2, "Result range", on page 100) can be configured. For example, you can perform statistical evaluations over a defined number of measurements, pulses, or samples.

You can configure up to 6 individual traces for the following result displays (see Chapter 6.1.2, "Result range", on page 100):

- "Pulse Frequency" on page 36
- "Pulse Magnitude" on page 37
- "Pulse Phase" on page 38
- "Pulse Phase (Wrapped)" on page 39

4.5.1 Trace statistics

Each trace represents an analysis of the data measured in one result range. Statistical evaluations can be performed over several traces, that is, result ranges. Which ranges and how many are evaluated depends on the configuration settings.

Selected pulse vs all pulses

The "Capture Count" determines how many measurements are evaluated.

For each measurement, in turn, either the selected pulse only (that is: one result range), or all detected pulses (that is: possibly several result ranges) can be included in the statistical evaluation.

Thus, the overall number of averaging steps depends on the "Capture Count" and the statistical evaluation mode.

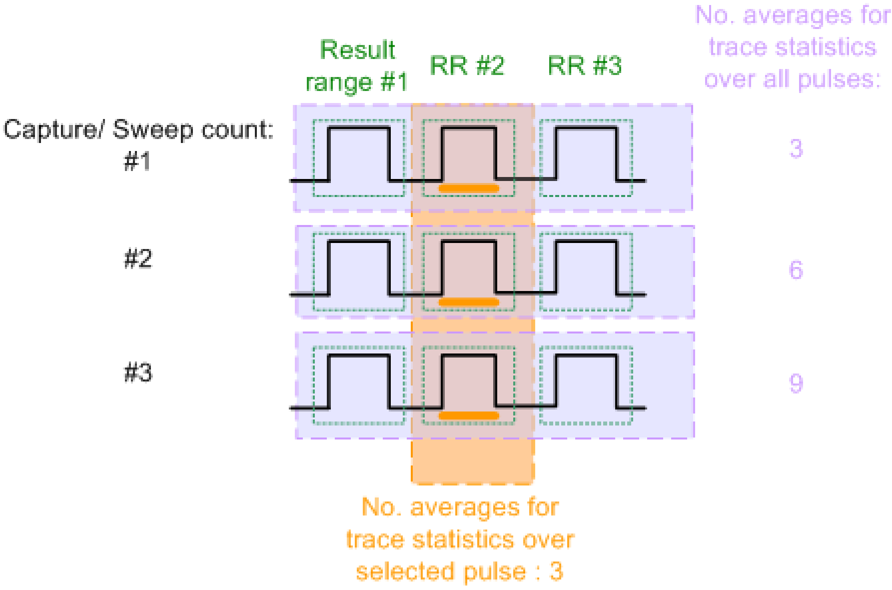


Figure 4-7: Trace statistics - number of averaging steps

4.5.2 Normalizing traces

For pulse results based on an individual pulse, sometimes, the absolute value is not of interest. Instead, the relative offset of each point in the trace from a specific measurement point within the pulse, or from a reference pulse, is of interest.

Normalization based on a measurement point

In a standard trace for a pulse result display, the measured frequency, magnitude, or phase value for each measurement point in the result range is displayed. If only the relative deviations within that pulse are of interest, you can subtract a fixed value from each trace point. The fixed value is the value measured at a specified point in the pulse. Thus, the trace value at the specified measurement point is always 0. This happens when a trace is normalized based on the measured pulse.

The measurement point used for normalization is the same point used to determine the pulse parameter results, see Chapter 5.8.2, "Measurement point", on page 94.

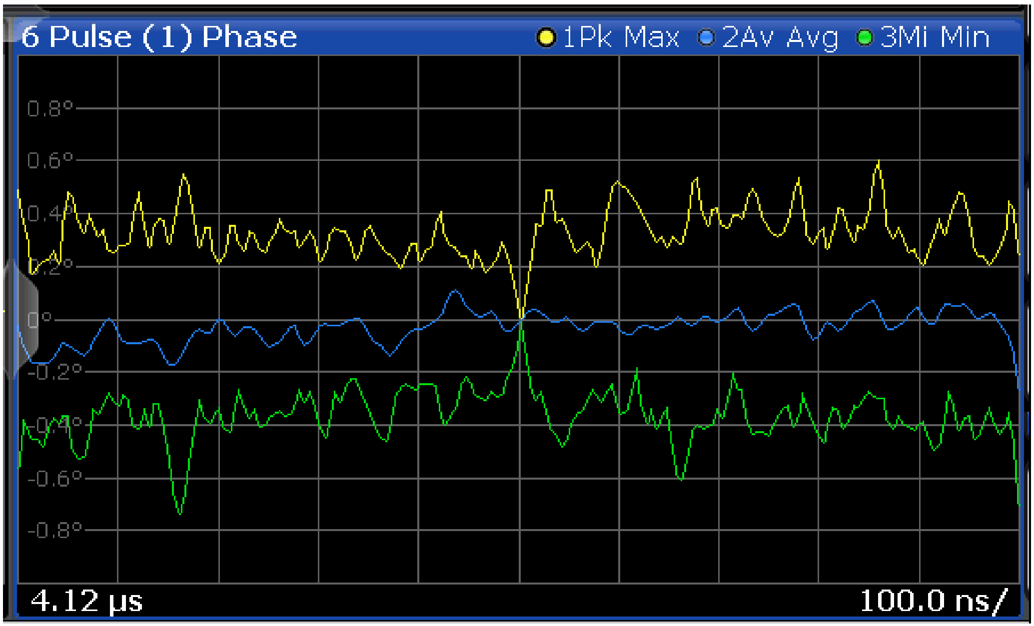


Figure 4-8: Normalization of the Pulse Phase trace based on the measured pulse

By default, the measurement point is the center of the pulse. However, this position can be moved arbitrarily within the pulse by defining an offset.

If the measurement point is defined with an offset in time, the trace value does not pass 0 at the measurement point. It passes 0 at the time of the measurement point + the offset value.

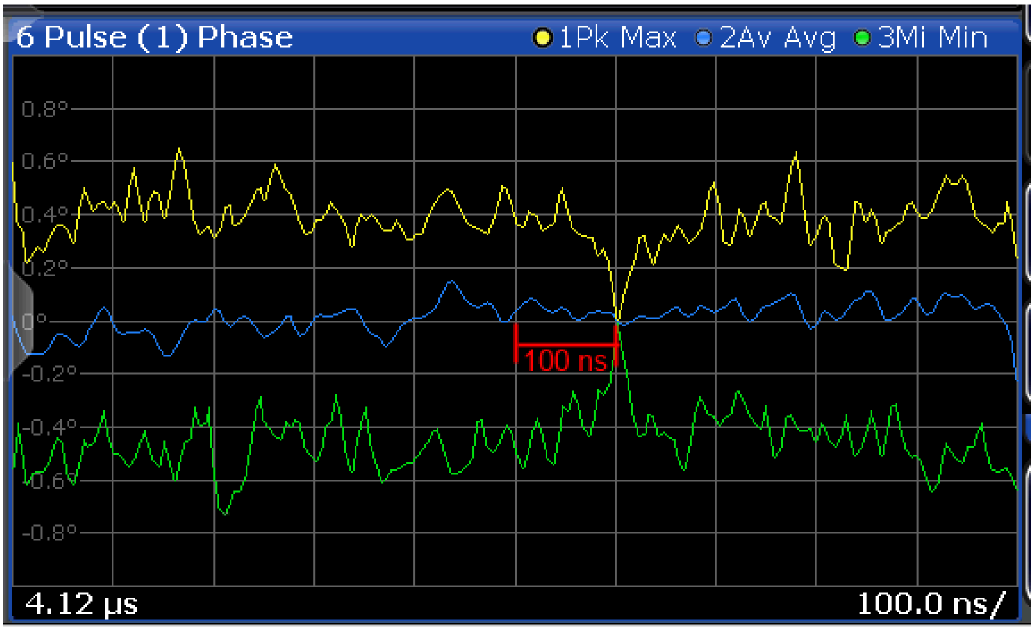


Figure 4-9: Normalization of the Pulse Phase trace based on the measured pulse + 100 ns offset

Normalization + averaging window

Together with an Averaging Window for the measurement point, normalization based on the measured pulse can provide for a very stable pulse trace. However, the calculated average value does not always coincide with the measured trace point value. So in this case, the maxhold, minhold or average traces do not necessarily pass 0 at the measurement point.

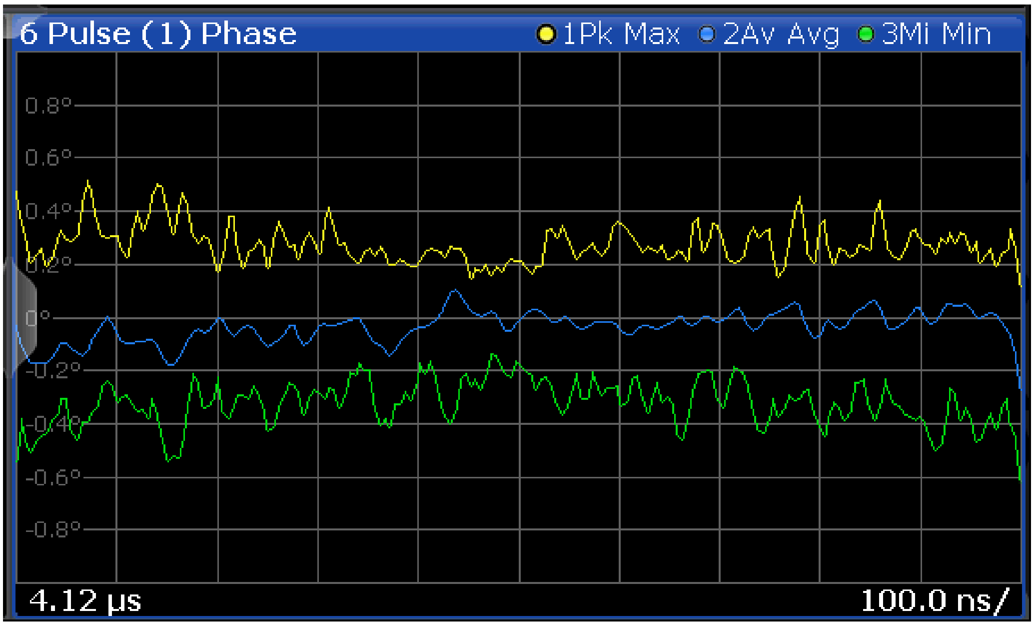


Figure 4-10: Normalization based on the measured pulse with an average window

Normalization based on a reference pulse

Sometimes you are not interested in the deviations of the pulse results within a single pulse, but rather in the deviations to a reference pulse. Then you can also base normalization on the measurement point of a specified reference pulse. In this case, the trace value for the measurement point in the reference pulse is deducted from all trace values in the measured pulse.

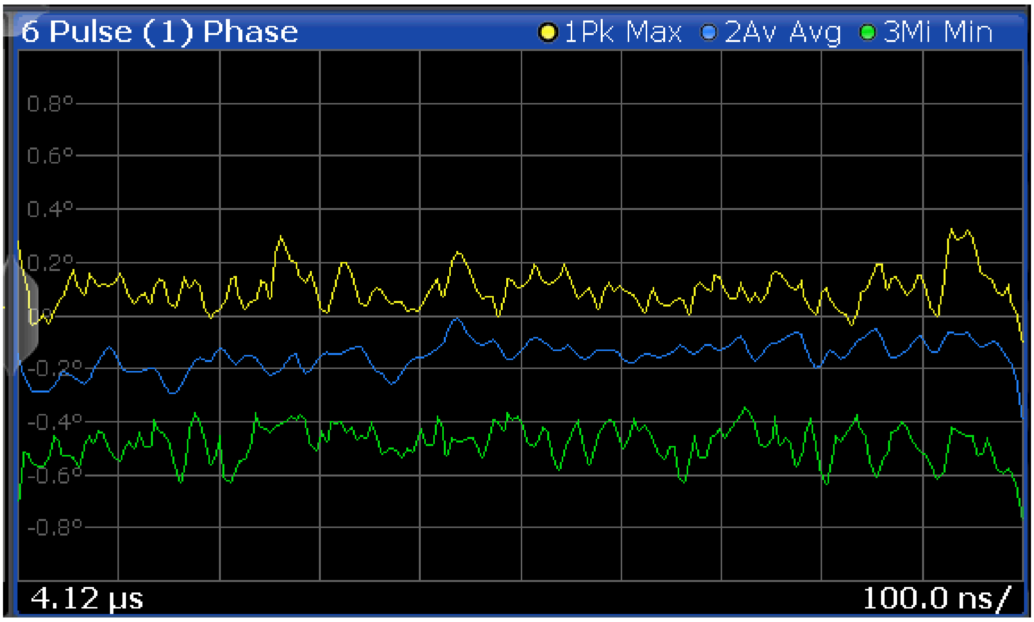


Figure 4-11: Normalization based on a reference pulse

Note that in this case, the value at the measurement point used to determine pulse parameter results is also normalized. Thus, normalization based on a reference pulse modifies the results in the Pulse Results and "Pulse Statistics" on page 42 tables! The pulse parameter values in the pulse tables for the (normalized) reference pulse are always 0.

However, as opposed to normalization based on a measured pulse, the pulse-to-pulse deviations are maintained when normalized to a reference pulse.

The reference pulse can be defined as one of the following:

- A fixed pulse number
- The currently selected pulse
- A previous (-n) or subsequent (+n) pulse, relative to the currently evaluated pulse

Normalization of pulse phase traces

Phase traces for an individual pulse can be normalized just like magnitude and frequency traces, as described above. However, you can also define a phase offset. In this case, the pulses are not normalized to 0, but to the phase offset value. The phase measured at a specified point in the reference or measured pulse, *plus the phase offset*, is subtracted from each trace point.

The phase offset for normalization is defined in the "Units" settings (see "Phase Normalization" on page 116).

5 Configuration

Pulse measurements require a special application on the R&S VSE.

Multiple access paths to functionality

The easiest way to configure a measurement channel is via the "Overview" dialog box, which is displayed when you select the "Overview" icon from the main toolbar or the "Meas Setup" > "Overview" menu item.

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 377.

General R&S VSE functions

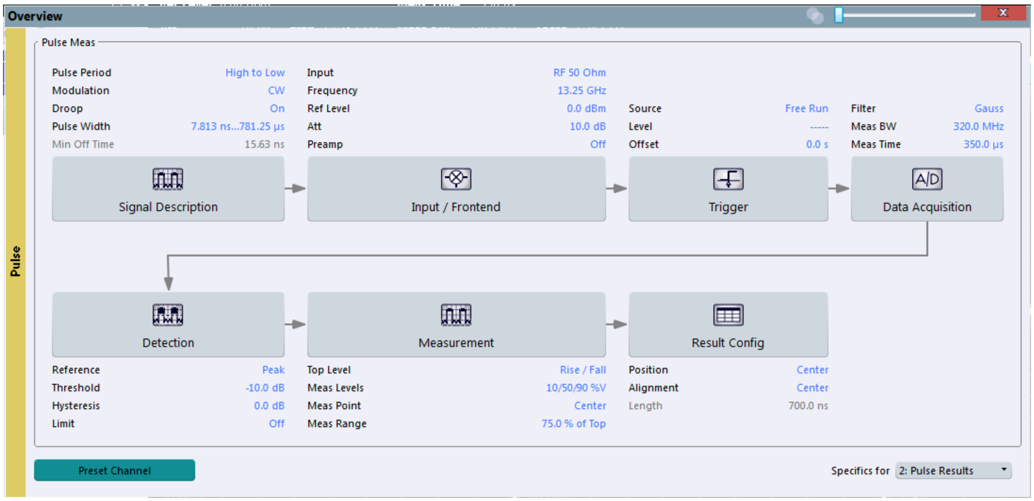
The application-independent functions for general tasks on the R&S VSE are also available for Pulse measurements and are described in the R&S VSE Base Software User Manual. In particular, this comprises the following functionality:

- Controlling Instruments and Capturing I/Q Data
- Data Management
- General Software Preferences and Information

5.1 Configuration overview

Access: "Meas Setup" > "Overview"

Throughout the measurement configuration, an overview of the most important currently defined settings is provided in the "Overview".



In addition to the main measurement settings, the "Overview" provides quick access to the main settings dialog boxes. Thus, you can easily configure an entire measurement channel from input over processing to output and evaluation by stepping through the dialog boxes as indicated in the "Overview".

In particular, the "Overview" provides quick access to the following configuration dialog boxes (listed in the recommended order of processing):

1. Signal Description
   See Chapter 5.2, "Signal description", on page 64
2. Input and Frontend Settings
   See Chapter 5.3.1, "Radio frequency input", on page 67 and Chapter 5.4, "Frontend settings", on page 75
3. (Optionally:) Trigger/Gate
   See Chapter 5.5, "Trigger settings", on page 81
4. Data Acquisition
   See Chapter 5.6, "Data acquisition", on page 86
5. Pulse Detection
   See Chapter 5.7, "Pulse detection", on page 88
6. Pulse Measurement
   See Chapter 5.8, "Pulse measurement settings", on page 91
7. Result Configuration
   See Chapter 6.1, "Result configuration", on page 99

To configure settings

► Select any button in the "Overview" to open the corresponding dialog box.

Select a setting in the channel bar (at the top of the measurement channel tab) to change a specific setting.

Preset Channel

Select "Preset Channel" in the lower left-hand corner of the "Overview" to restore all measurement settings *in the current channel* to their default values.

Remote command:

`SYSTem:PRESet:CHANnel[:EXEC]` on page 141

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.

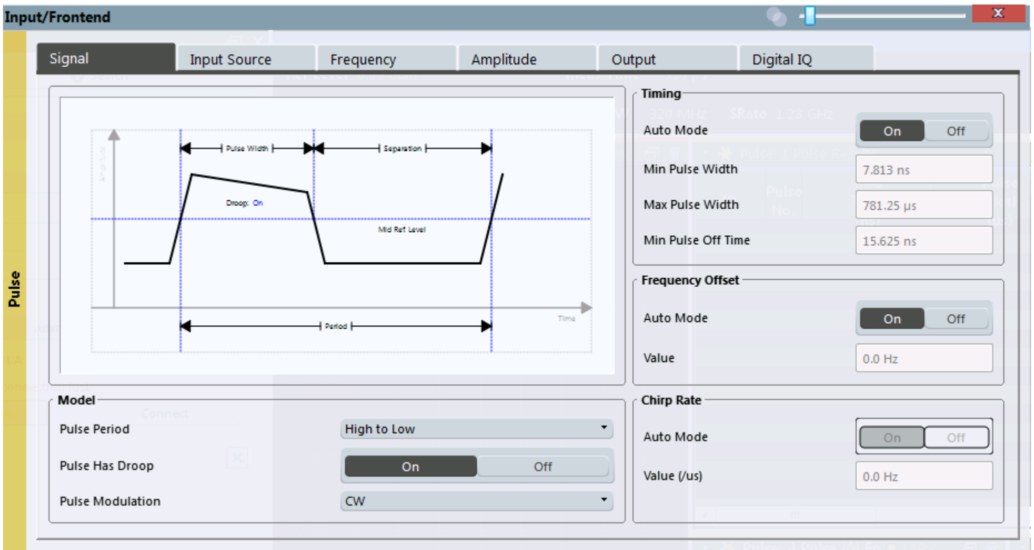
The "Overview" and dialog boxes are updated to indicate the settings for the selected window.

5.2 Signal description

Access: "Overview" > "Signal Description"

Or: "Meas Setup" > "Signal Description"

The signal description provides information on the expected input signal, which optimizes pulse detection and measurement.



Pulse Period

Defines how a pulse is detected.

"High to Low" The pulse period begins with the falling edge of the preceding pulse and ends with the falling edge of the current pulse.

"Low to High" The pulse period begins with the rising edge of the current pulse and end with the rising edge of the succeeding pulse.

Remote command:
`SENSe:TRACe:MEASurement:DEFine:PULSe:PERiod` on page 144

Pulse Has Droop

If enabled, a pulse can be modeled as having amplitude droop, i.e. the pulse top may not be flat.

Remote command:
`SENSe:TRACe:MEASurement:DEFine:PULSe:ADRoop` on page 144

Pulse Modulation

Defines the expected pulse modulation:

"Arbitrary" Modulation not considered (no phase error/frequency error results available)

"CW" Continuous wave modulation, i.e. only the carrier power is modulated (On/Off)
For CW modulation, additional parameters are available to define the frequency offset.

"Linear FM" Linear frequency modulation (FM) (The frequency changes linearly over time within each pulse)
For linear pulse modulation, additional parameters are available to define the chirp rate.

Remote command:
`SENSe:TRACe:MEASurement:DEFine:PULSe:MODulation` on page 144

Timing Auto Mode

If enabled, the timing parameters (minimum pulse width, maximum pulse width, minimum pulse off time) are determined automatically from the current capture settings.

Remote command:
`SENSe:TRACe:MEASurement:DEFine:DURation:AUTO` on page 142

Minimum Pulse Width

Defines a minimum pulse width; pulses outside this range are not detected. The available value range is restricted by the sample rate.

Remote command:
`SENSe:TRACe:MEASurement:DEFine:DURation:MIN` on page 142

Maximum Pulse Width

Defines a maximum pulse width; pulses outside this range are not detected. The available value range is restricted by the sample rate.

The analysis of a single pulse is limited to 1 million samples.

Table 5-1: Measurement example for 10 MHz and 1 GHz Meas BW, default oversampling factor for Gauss filter is 4 and 1.25 for flat filter.

Meas BW	Filter	R&S VSE
10 MHz	Gauss	25 ms
	Flat	80 ms
1 GHz	Gauss	250 µs
	Flat	800 µs

Remote command:
`SENSe:TRACe:MEASurement:DEFine:DURation:MAX` on page 142

Min Pulse Off Time

The minimum time the pulse is "off", i.e. the time between successive pulses. This value is used to determine noise statistics and to reject short drops in amplitude during pulse "on" time. The available value range is 50ns to 100s, but may be restricted further by the sample rate.

Remote command:
`SENSe:TRACe:MEASurement:DEFine:DURation:OFF` on page 142

Frequency Offset Auto Mode

If enabled, the frequency offset is considered when calculating the pulse frequency and phase error on a pulse-by-pulse basis. A different value can be determined for each pulse. Note that compensation for a frequency offset is reflected in the pulse frequency/phase error results, but does not alter the original I/Q data or the pulse frequency/phase trace displays.

Remote command:
`SENSe:TRACe:MEASurement:DEFine:FREQuency:OFFSet:AUTO` on page 143

Frequency Offset Value

If Frequency Offset Auto Mode is disabled, this value is used when calculating pulse frequency and phase error on a pulse-by-pulse basis. The same value is used for all pulses. Note that compensation for a frequency offset is reflected in the pulse frequency/phase error results, but does not alter the original I/Q data or the pulse frequency/phase trace displays.

Remote command:
`SENSe:TRACe:MEASurement:DEFine:FREQuency:OFFSet` on page 143

Chirp Rate Auto Mode
If enabled, the chirp rate is estimated automatically for each individual pulse.

Remote command:
SENSe:TRACe:MEASurement:DEFine:FREQuency:RATE:AUTO on page 143

Chirp Rate
Defines a known frequency chirp rate (in Hz/µs) to be used to generate an ideal pulse waveform for computing frequency and phase error parameters. This value is assumed constant for all measured pulses.

Remote command:
SENSe:TRACe:MEASurement:DEFine:FREQuency:RATE on page 143

5.3 Input source settings

Access: "Overview" > "Input/Frontend" > "Input Source"

Or: "Input & Output" > "Input Source"

The R&S VSE can control the input sources of the connected instruments.

With option R&S VSE-K6A installed, measurements on up to four channels of the same input source can be executed simultaneously.

5.3.1 Radio frequency input

Access: "Overview" > "Input/Frontend" > "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.

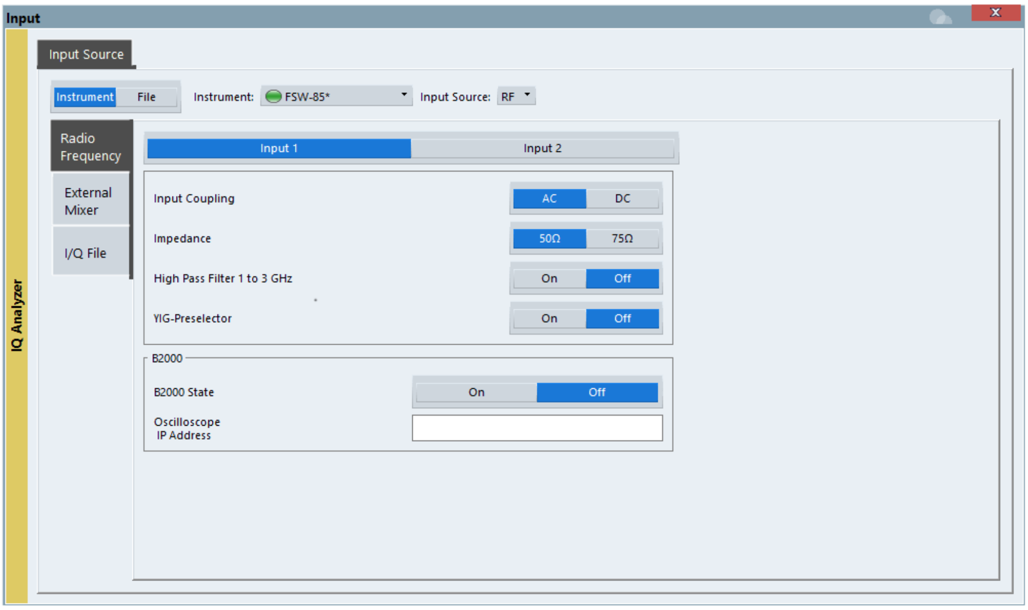


Figure 5-1: RF input source settings for an R&S FSW with B2000 option

If the Frequency Response Correction option (R&S VSE-K544) is installed, the R&S VSE Pulse application also supports frequency response correction using Touchstone (`.snp`) files or `.fres` files.

If option R&S VSE-K6A is installed, the R&S VSE Pulse application also supports individual frequency response correction for each measurement channel.

For details on user-defined frequency response correction, see the R&S VSE Base Software User Manual.

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.

Remote command:
`INSTrument:BLOCk:CHANnel[:SETTings]:SOURce<si>` on page 152
`INPut:SELect` on page 151

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 151

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).

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 146

Impedance
For some measurements, the reference impedance for the measured levels of the connected instrument can be set to 50 Ω or 75 Ω.

Select 75 Ω if the 50 Ω input impedance is transformed to a higher impedance using a 75 Ω adapter of the RAZ type. (That corresponds to 25Ω in series to the input impedance of the instrument.) The correction value in this case is 1.76 dB = 10 log (75Ω/50Ω).

Not available for input from the optional "Analog Baseband" interface. For analog baseband input, an impedance of 50 Ω is always used.

Remote command:
`INPut<ip>:IMPedance<ant>` on page 148

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.

"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 147

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 147

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.

Remote command:
`INPut<ip>:FILTer:YIG[:STATe]` on page 148

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).

With option R&S VSE-K6A installed and a multichannel measurement running, only "Waveform" capture mode is supported.

"I/Q"	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. For data imports with small bandwidths, importing data in this format is quicker. However, the maximum record length is restricted by the R&S oscilloscope. (Memory options on the R&S oscilloscope are not available for 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. 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&S oscilloscope.
"Auto"	Uses "I/Q" mode when possible, and "Waveform" only when required by the application (e.g. Pulse measurement, oscilloscope baseband input).

Remote command:
`INPut<ip>:RF:CAPMode` on page 149

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 153

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 Capture Mode (not available for I/Q Capture Mode); 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 Capture Mode
"40 GHz"	Provides a maximum sample rate. Only available for I/Q Capture Mode, 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 154
Input source oscilloscope waveform mode:
`INPut<ip>:RF:CAPMode:WAVeform:SRATe` on page 150
Input source oscilloscope I/Q mode:
`INPut<ip>:RF:CAPMode:IQ:SRATe` on page 150

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 154

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 153

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 149

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:

- Lowpass 40 MHz
- Bandpass 30 MHz to 2250 MHz
- Bandpass 2 GHz to 8 GHz
- Bandpass 8 GHz to 26.5 GHz

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.
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 149

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 146

5.3.2 I/Q file input

Access: "Overview" > "Input/Frontend" > "Input Source" > "I/Q File"

Or: "Input & Output" > "Input Source" > "I/Q File"

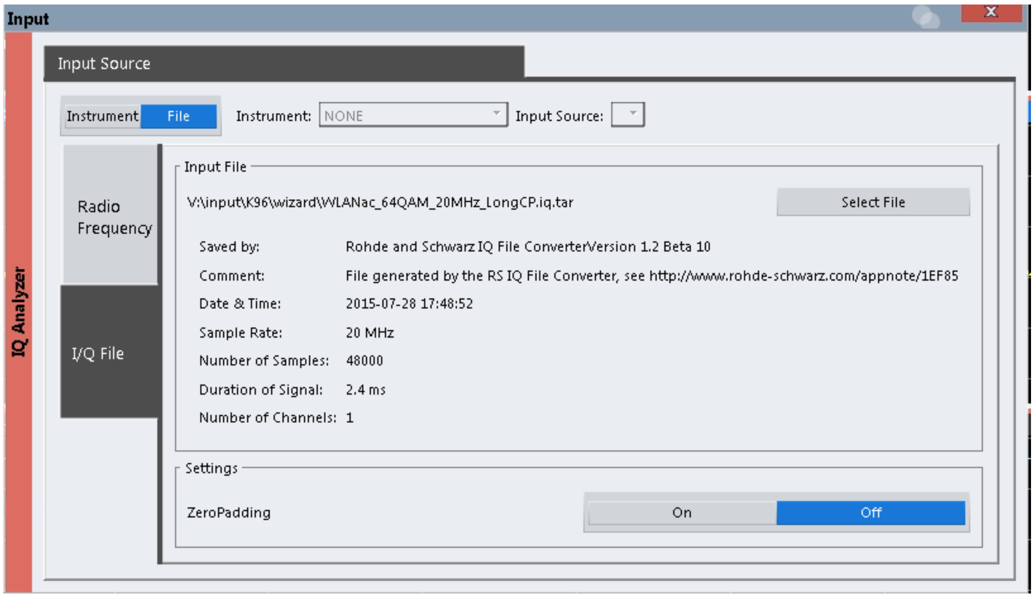
Loading a file via drag&drop

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 details see the R&S VSE Base Software User Manual.

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.



If the Frequency Response Correction option (R&S VSE-K544) is installed, the R&S VSE Pulse application also supports frequency response correction using Touchstone (`.snp`) files or `.fres` files.

If option R&S VSE-K6A is installed, the R&S VSE Pulse application also supports individual frequency response correction for each measurement channel.

For details on user-defined frequency response correction, see the R&S VSE Base Software User Manual.

Encrypted `.wv` files can also be imported. Note, however, that traces resulting from encrypted file input cannot be exported or stored in a saveset.

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.

Remote command:
`INSTrument:BLOCk:CHANnel[:SETTings]:SOURce<si>` on page 152
`INPut:SELect` on page 151

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.

With option R&S VSE-K6A installed and option "Auto" selected in the input file dialog box, all available measurement channels of the I/Q file are displayed simultaneously.

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 147

5.4 Frontend settings

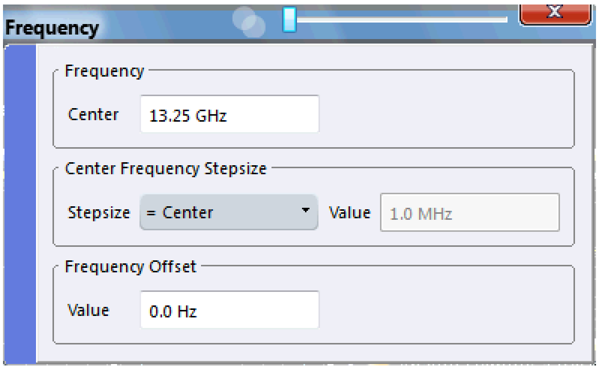
Access: "Overview" > "Input/Frontend"

The frequency and amplitude settings represent the "frontend" of the measurement setup.

5.4.1 Frequency settings

Access: "Overview" > "Input/Frontend" > "Frequency"

Or: "Input & Output" > "Frequency"



Center Frequency

Defines the center frequency of the signal in Hertz.

0 Hz ≤ f_{center} ≤ f_{max}

f_{max} and $span_{min}$ 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.

$$CF_{shift_{max}} = CF_{file} \pm \frac{SR_{file}}{2}$$

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 179

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 179

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.

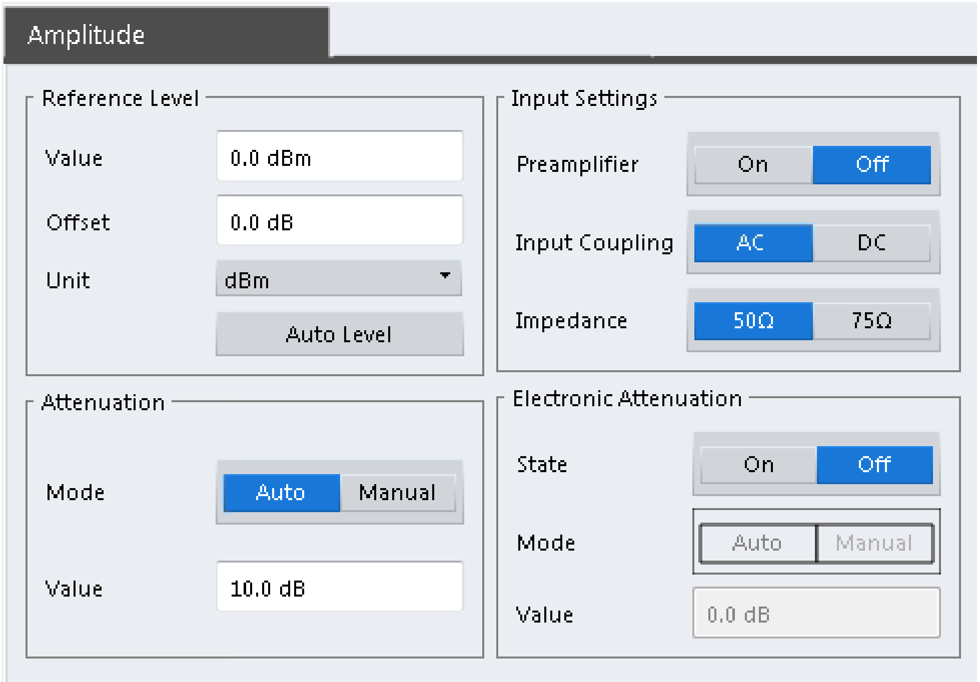
Remote command:
`[SENSe<ip>:]FREQuency:OFFSet` on page 180

5.4.2 Amplitude settings

Access: "Overview" > "Input/Frontend" > "Amplitude"

Or: "Input & Output" > "Amplitude"

Amplitude settings affect the y-axis values.



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 input signal level. Signal levels above this value are possibly not measured correctly, which is indicated by the "IF Overload" status display.

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).

Remote command:
`DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:RLEVel<ant>` on page 180

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 ±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 181

RF Attenuation
Defines the mechanical attenuation for RF input.

Attenuation Mode / Value ← RF Attenuation
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.

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 182
`INPut<ip>:ATTenuation:AUTO` on page 183

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.

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 184
`INPut:EATT:AUTO` on page 184
`INPut:EATT` on page 183

Input Settings
Some input settings affect the measured amplitude of the signal, as well.

For details see Chapter 5.3.1, "Radio frequency input", on page 67.

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.

"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 181
`INPut<ip>:GAIN<ant>[:VALue]` on page 182

Input Coupling ← Input Settings
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).

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 146

Impedance ← Input Settings
For some measurements, the reference impedance for the measured levels of the connected instrument can be set to 50 Ω or 75 Ω.

Select 75 Ω if the 50 Ω input impedance is transformed to a higher impedance using a 75 Ω adapter of the RAZ type. (That corresponds to 25Ω in series to the input impedance of the instrument.) The correction value in this case is 1.76 dB = 10 log (75Ω/ 50Ω).

Not available for input from the optional "Analog Baseband" interface. For analog baseband input, an impedance of 50 Ω is always used.

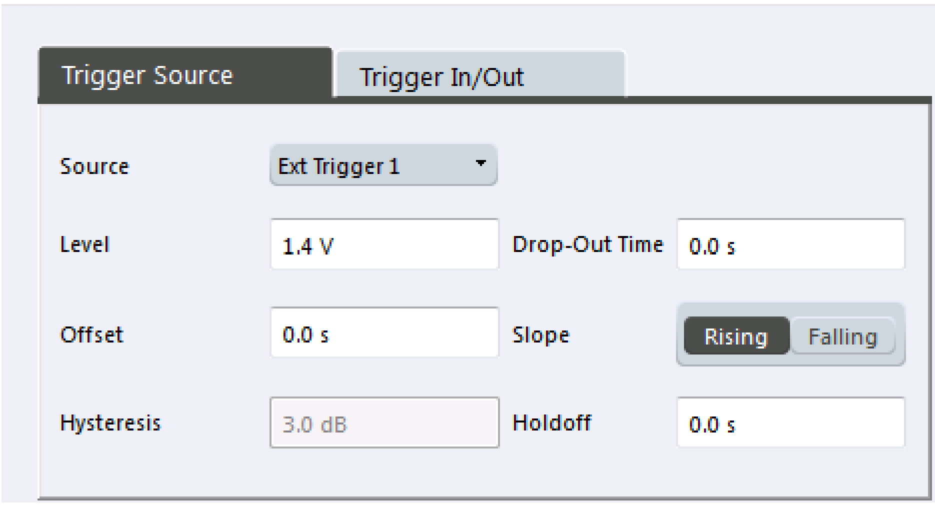
Remote command:
INPut<ip>:IMPedance<ant> on page 148

5.5 Trigger settings

Access: "Overview" > "Trigger" > "Trigger Source"

Or: "Input & Output" > "Trigger"

Trigger settings determine when the input signal is measured.



External triggers from one of the [TRIGGER INPUT/OUTPUT] connectors on the connected instrument are also available.

See the R&S VSE Base Software User Manual.

Trigger Source

Defines 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: When triggering is activated, the squelch function is automatically disabled.

Remote command:

`TRIGger[:SEQuence]:SOURce` on page 189

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 189

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 189

I/Q Power ← Trigger Source

Triggers the measurement when the magnitude of the sampled I/Q data exceeds the trigger threshold.

Remote command:
`TRIG:SOUR IQP`, see `TRIGger[:SEQuence]:SOURce` on page 189

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.

Note: Be aware that in auto sweep type mode, due to a possible change in sweep types, the trigger bandwidth can vary considerably for the same RBW setting.

Remote command:
`TRIG:SOUR IFP`, see `TRIGger[:SEQuence]:SOURce` on page 189

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 189

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.

If you enable manual triggering, segmented data capture is automatically enabled. See Chapter 4.4, "Segmented data capturing", on page 53. If you disable the manual trigger, segmented data capture is also disabled.

Remote command:
`TRIG:SOUR MAN`, see `TRIGger[:SEQuence]:SOURce` on page 189

Trigger Level
Defines the trigger level for the specified trigger source.

For details on supported trigger levels, see the instrument data sheet.

Remote command:
`TRIGger[:SEQuence]:LEVel:IFPower` on page 187
`TRIGger[:SEQuence]:LEVel:IQPower` on page 187
`TRIGger[:SEQuence]:LEVel[:EXTernal<port>]` on page 187
`TRIGger[:SEQuence]:LEVel:RFPower` on page 188
For baseband input only:
`TRIGger[:SEQuence]:LEVel:BBPower` on page 186

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 185

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: Pretrigger_{max} = $\text{measurement time}_{max}$

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.)

Remote command:
`TRIGger[:SEQuence]:HOLDoff[:TIME]` on page 185

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.

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 189

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.

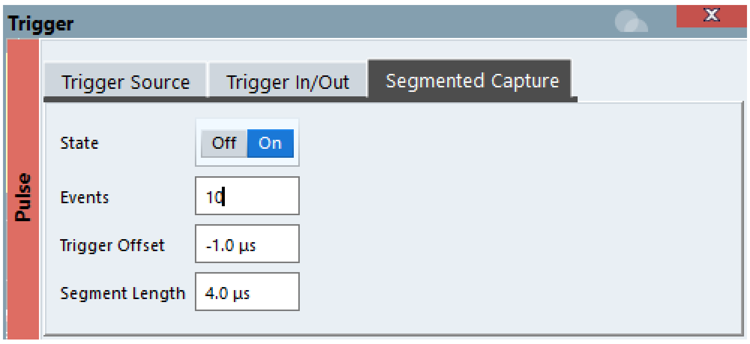
Remote command:
`TRIGger[:SEQuence]:IFPower:HYSTeresis` on page 186
`TRIGger[:SEQuence]:MAPower:HYSTeresis` on page 188

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 186
`TRIGger[:SEQuence]:MAPower:HOLDoff` on page 188

Segmented Capture
Access: "Overview" > "Trigger" > "Segmented Capture"

Configures data capturing with a gating function, that is non-continuous data acquisition.



Segmented capture is only possible if an R&S RTO, R&S RTP or R&S FSW device is connected, an external trigger or trigger channel <n> is used as trigger source and "Waveform" capture mode is selected.

For details on segmented data capture and recommended settings see Chapter 4.4, "Segmented data capturing", on page 53.

Activating/de-activating segmented data capturing ← Segmented Capture
If activated, data is captured for the specified duration before and after each trigger event, for the specified number of trigger events. The signal data between these capture times is not stored in the capture buffer.

Remote command:
`[SENSe:]SWEep:SCAPture[:STATe]` on page 194

Events ← Segmented Capture
Specifies the number of trigger events for which data segments are to be captured. If multiple events occur within one segment length, the segment is extended (see "Number of events vs number of segments" on page 55).

Remote command:
`[SENSe:]SWEep:SCAPture:EVENts` on page 193

Trigger Offset ← Segmented Capture
Defines an offset to the trigger event at which data capturing starts. For a negative offset, data capturing starts before the actual trigger event.

Remote command:
`[SENSe:]SWEep:SCAPture:OFFSet[:TIME]` on page 193
`TRACe<n>:IQ:SCAPture:TSTamp:SSTart?` on page 195
`TRACe<n>:IQ:SCAPture:TSTamp:TRIGger?` on page 197

Segment Length ← Segmented Capture
Defines a time period starting from the Trigger Offset in which data is captured. If multiple events occur within one segment length, the segment is extended (see "Number of events vs number of segments" on page 55).

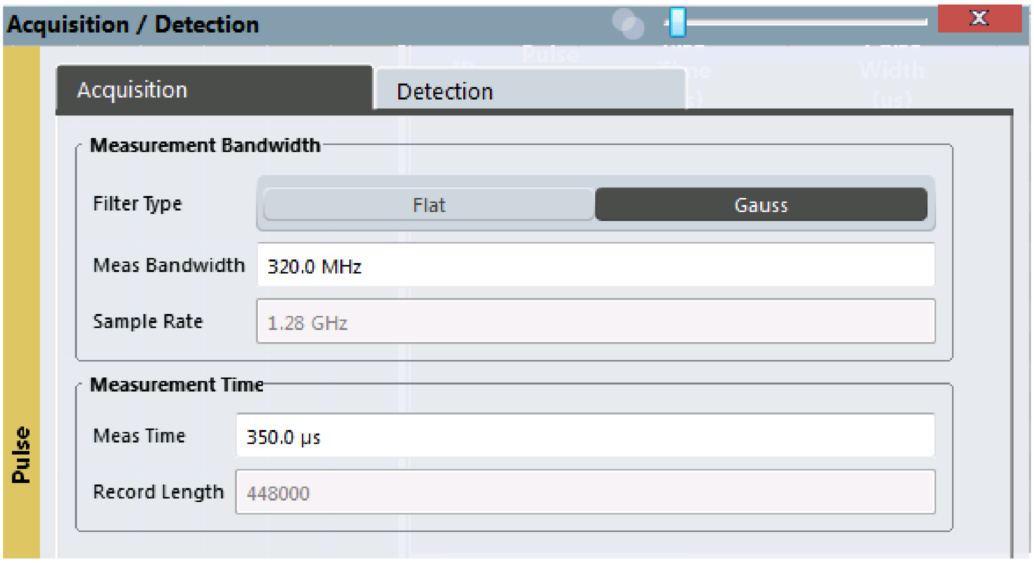
Remote command:
`[SENSe:]SWEep:SCAPture:LENGth[:TIME]` on page 193

5.6 Data acquisition

Access: "Overview" > "Data Acquisition" > "Acquisition"

Or: "Meas Setup" > "Data Acquisition" > "Acquisition" tab

You must define how much and how data is captured from the input signal.



Filter type

Defines the filter to be used for demodulation.

"Flat" Standard flat demodulation filter

"Gauss" Filter with optimized settling behavior (default)

Note: For Gaussian filters whose -3dB bandwidth is large compared to the maximum I/Q bandwidth, the ideal Gaussian filter shape would exceed the maximum I/Q bandwidth at its outer edges. Thus, the actual filter only follows the ideal Gaussian filter shape in the inner range of the set I/Q bandwidth. At a certain frequency offset it must deviate from the ideal Gauss filter and drop off faster.
For details see Chapter D, "Effects of large gauss filters", on page 388.

Remote command:
`[SENSe:]BWIDth:DEMod:TYPE` on page 198

Measurement Bandwidth

The measurement bandwidth is defined by the used filter and the sample rate. Either a flat or a Gauss filter are available. For information on supported sample rates and filter bandwidths see the data sheet.

Remote command:
`[SENSe:]BANDwidth:DEMod` on page 197

Sample rate
The sample rate for I/Q data acquisition is indicated for reference only. It is calculated from the defined measurement bandwidth and measurement time, or taken from the I/Q data input file.

Measurement Time
Defines how long data is captured for analysis ("Meas Time"), or how many samples are captured in each record ("Record Length").

The maximum measurement time in the R&S VSE Pulse application is limited only by the available memory ("memory limit reached" message is shown in status bar). Note, however, that increasing the measurement time (and thus reducing the available memory space) may restrict the number of measurement channels that can be activated simultaneously on the R&S VSE.

Remote command:
`[SENSe:]SWEep:TIME` on page 199

Record length
The record length for I/Q data acquisition is indicated for reference only. It is calculated from the defined measurement bandwidth and measurement time, or taken from the I/Q data input file.

Remote command:
`[SENSe:]RLENgth?` on page 199

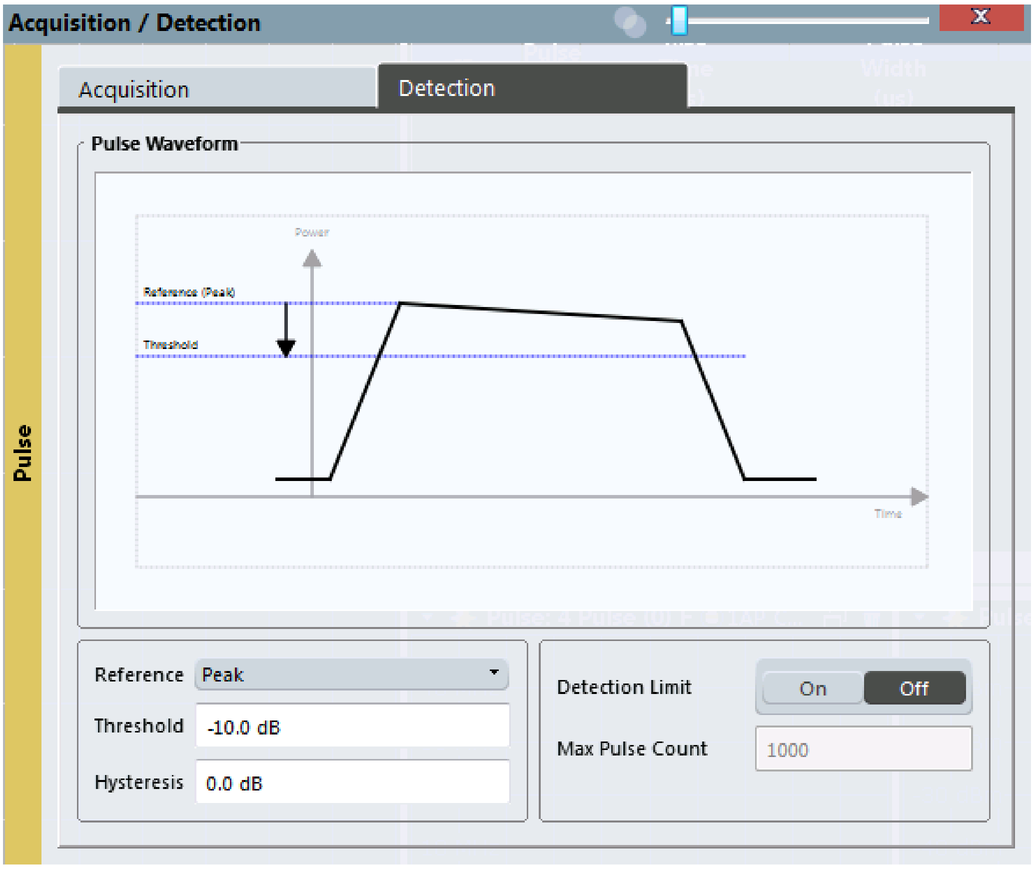
5.7 Pulse detection

Access: "Overview" > "Detection"

Or: "Meas Setup" > "Detection"

The pulse detection settings define the conditions under which a pulse is detected within the input signal.

For multi-channel measurements using option R&S VSE-K6A the pulse detection is initially performed separately on each channel. However, the same number of pulses on each input channel is expected. Therefore the total number of pulses analyzed is set to the number of pulses detected on the first acquired channel. If more pulses are found on channels other than the first, these are not included in the analysis. If fewer pulses are found on other channels than the first, then no results ("…" in the table or blank trace data) are shown for these channels, at positions where no pulse was detected.



Reference Source

Defines the level to be used as a reference for the pulse detection threshold.

"Reference" Current reference level

"Peak" Peak level as measured over the entire capture data interval

"Noise" Noise level determined from the current capture data according to the Min Pulse Off Time parameter set in Signal description.

"Absolute" Absolute level defined by the Threshold

Remote command:

`[SENSe:]DETect:REFerence` on page 202

Threshold
The threshold determines whether a pulse is detected or not. The top of a pulse must exceed the threshold in order to be detected. The threshold is defined in dB in relation to the defined reference, or as an absolute threshold in dBm.

Remote command:
`[SENSe:]DETect:THReshold` on page 202

Hysteresis
Defines a hysteresis for pulse detection in dB in relation to the defined threshold. As long as the signal does not exceed the hysteresis, the next threshold crossing is ignored.

Remote command:
`[SENSe:]DETect:HYSTeresis` on page 201

Detection Limit
Restricts the number of pulses to be detected. When the maximum number is exceeded, measurement is stopped for the current capture buffer. This limitation can be used to speed up the measurement if only a small number of pulses is of interest.

Remote command:
`[SENSe:]DETect:LIMit` on page 200

Maximum Pulse Count
Defines the maximum number of pulses to be detected.

This limit is ignored if Detection Limit is disabled.

Remote command:
`[SENSe:]DETect:LIMit:COUNt` on page 200

Detection Range
Enables or disables the use of a detection range instead of the entire capture buffer for analysis.

A detection range determines which part of the capture buffer is analyzed. It is defined by the Detection Start and the Detection Length. An active detection range is indicated in the "Magnitude Capture" Buffer display by vertical lines ("DR").

See also "Detection range" on page 50.

Remote command:
`[SENSe:]DETect:RANGe` on page 201

Detection Start
Defines the beginning of the detection range as the time in seconds from the capture buffer start. You can also change the detection start graphically by dragging the left vertical line ("DR") in the "Magnitude Capture" Buffer.

The pulse numbers in the result displays are always relative to the current detection range, that is: pulse number 1 is the first pulse within the detection range in the capture buffer. (Timestamps are in relation to the capture buffer start.)

Remote command:
`[SENSe:]DETect:RANGe:STARt` on page 202

Detection Length
Defines the length of the detection range as a time in seconds. You can also change the detection length graphically by dragging one of the vertical lines ("DR") in the "Magnitude Capture" Buffer.

Remote command:
`[SENSe:]DETect:RANGe:LENGth` on page 201

5.8 Pulse measurement settings

Access: "Overview" > "Measurement"

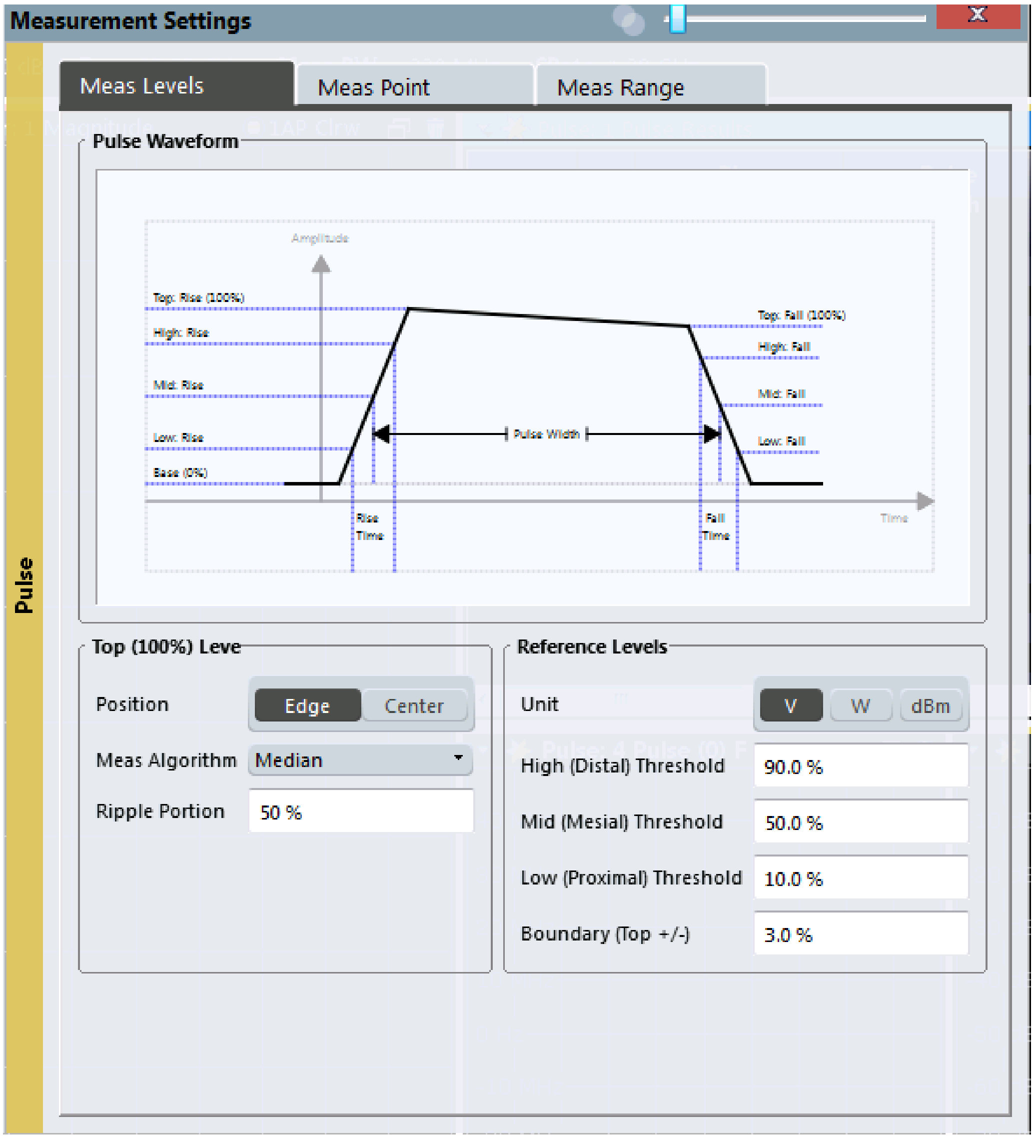
The pulse measurement settings determine how much data is measured for each pulse, in relation to defined levels, points, or ranges. Which definition is actually used during measurement depends on the selected evaluation method.

5.8.1 Measurement levels

Access: "Overview" > "Measurement" > "Meas Levels" tab

Or: "Meas Setup" > "Pulse Meas" > "Meas Levels"tab

Some measurements are performed depending on defined levels.



Position

Determines where the 100% value (from base to top) for the rise and fall time measurements is calculated.

This allows you to consider a "droop" in the pulse top during the pulse measurements. If a droop is to be considered, the 100% value must be calculated separately for the rising and falling edges.

"Edge" The 100% value is measured separately for the rising and falling edges.

"Center" The 100% value is measured at the pulse center and used for all measurements.

Remote command:
`SENSe:TRACe:MEASurement:DEFine:COMPensate:ADRoop` on page 204

Measurement Algorithm

Defines the algorithm used to detect the pulse top level.

"Mean" The arithmetic average of the measured values

"Median" The level for which half the values lie above, the other half below in the histogram

"Fixed" A Fixed Value is used.
Useful if some pulses do not reach the top level, but you want to measure them nevertheless, while maintaining a specified top level.

"Peak Power" The peak power is used to detect the pulse top level.

Remote command:
`SENSe:TRACe:MEASurement:ALGorithm` on page 203

Fixed Value

Defines the value (in dBm) to be used by the "Fixed" measurement algorithm.

Note that if the fixed value is much higher than the actual pulse top level, pulse parameters cannot be measured ("---" indicated in the table results). In this case, reduce the fixed power level or the High (Distal) Threshold used for rise/fall time measurements.

You can also change the fixed top power level graphically, by moving the "100 %" horizontal line in the "Magnitude Capture" Buffer display.

Remote command:
`SENSe:TRACe:MEASurement:DEFine:TOP:FIXed` on page 205

Ripple Portion

Defines the portion of the pulse top which is used to measure the ripple.

Remote command:
`SENSe:TRACe:MEASurement:DEFine:RIPPle` on page 204

Reference Level Unit

Defines the unit of the pulse amplitude values, i.e. whether magnitude (V) or power (W, dBm) values are used to determine the threshold levels for fall and rise times.

Remote command:
`SENSe:TRACe:MEASurement:DEFine:AMPLitude:UNIT` on page 203

High (Distal) Threshold

The upper threshold in percent of the pulse amplitude used to signify the end of a rising or beginning of a falling signal level.

Remote command:
`SENSe:TRACe:MEASurement:DEFine:TRANsition:HREFerence` on page 205

Mid (Mesial) Threshold
The middle threshold in percent of the pulse amplitude used to signify the mid-transition level between pulse states.

Remote command:
`SENSe:TRACe:MEASurement:DEFine:TRANsition:REFerence` on page 205

Low (Proximal) Threshold
The lower threshold in percent of the pulse amplitude used to signify the end of a falling or beginning of a rising signal level.

Remote command:
`SENSe:TRACe:MEASurement:DEFine:TRANsition:LREFerence` on page 205

Boundary
The boundary in percent of the pulse amplitude to either side of the pulse top (ON state). Used to determine the settling time, for example. Once the signal remains within the boundary, it is assumed to have settled.

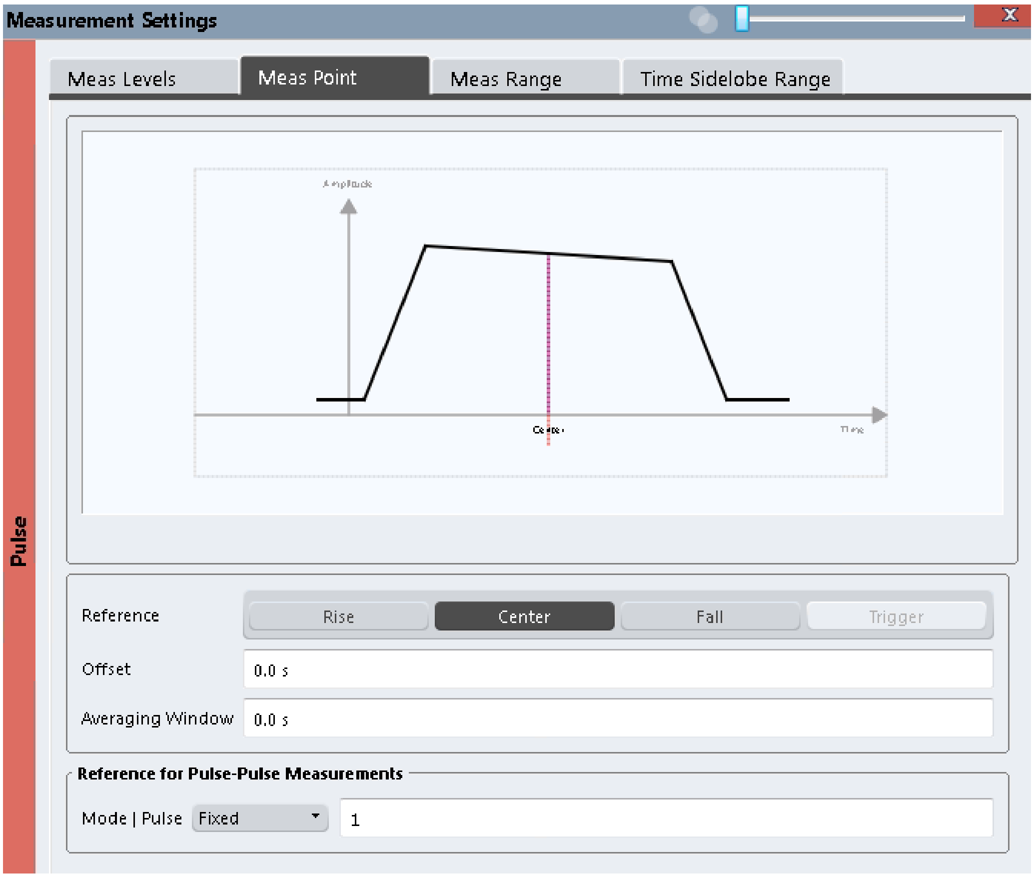
Remote command:
`SENSe:TRACe:MEASurement:DEFine:BOUNdary:TOP` on page 204

5.8.2 Measurement point

Access: "Overview" > "Measurement" > "Meas Point" tab

Or: "Meas Setup" > "Pulse Meas" > "Meas Point" tab

Some specific pulse parameters, e.g. the phase or the frequency, are determined at a specific time instant (measurement point) within the pulse. You can configure this point based on a reference and offset value.



Measurement Point Reference

Defines the reference which the Offset refers to.

With option R&S VSE-K6A installed, the measurement point is positioned individually for each measurement channel according to the selected reference and not absolutely time synchronous for all channels.

"Rise" The measurement point is defined in reference to the rising edge (mid-level crossing).

"Center" The measurement point is defined in reference to the center of the pulse (equal distance from the rising and falling mid-level crossings).

"Fall" The measurement point is defined in reference to the falling edge (mid-level crossing).

"Trigger" The measurement point is defined in reference to the trigger event. This setting is only available for segmented capture. Configure a trigger and activate segmented capture mode (see "Trigger Source" on page 82 and "Activating/de-activating segmented data capturing" on page 86).
For details see "Alignment based on trigger event" on page 54.

Remote command:
`SENSe:TRACe:MEASurement:DEFine:PULSe:INSTant:REFerence` on page 206

Offset
The time offset of the measurement point in reference to the pulse center or an edge, depending on the Measurement Point Reference setting.

The "Offset" is indicated in the dialog box.

Remote command:
`SENSe:TRACe:MEASurement:DEFine:PULSe:INSTant` on page 206

Averaging Window
Measurement point results are averaged over a window centered at the measurement point. The length of the averaging window in seconds can be defined. A minimum length of 1 sample is enforced internally.

Remote command:
`SENSe:TRACe:MEASurement:DEFine:PULSe:INSTant:AWINdow` on page 206

Reference for Pulse-Pulse Measurements
Reference pulse on which relative pulse results are based (e.g. for traces normalized to reference pulse, see Chapter 4.5.2, "Normalizing traces", on page 58).

"Fixed"	A fixed pulse number Relative results for the specified pulse number itself are not valid and are indicated as "...".
"Selected"	The currently selected pulse (see Chapter 6.1.1, "Pulse selection", on page 99) Relative results for the selected pulse itself are not valid and are indicated as "...". If you change the value for the reference pulse here, the Chapter 6.1.1, "Pulse selection", on page 99 value is adapted accordingly, and vice versa.
"Before Pulse"	The nth pulse before the currently evaluated pulse, where n is the specified number No values are available for the first n pulses, as no valid reference pulse is available. These results are indicated as "...". For example, a value of 2 will use row 1 as the reference row for Pulse-Pulse results for pulse number 3. In this case, pulse numbers 1 and 2 will not have a valid reference row and the Pulse-Pulse results will be invalid for these rows.
"After Pulse"	The nth pulse after the currently evaluated pulse, where n is the specified number No values are available for the last n pulses, as no valid reference pulse is available. These results are indicated as "...". For example, a value of 2 will use row 5 as the reference row for Pulse-Pulse results for pulse number 3. In this case, the last two pulse rows will not have a valid reference row and the Pulse-Pulse results will be invalid for these rows.

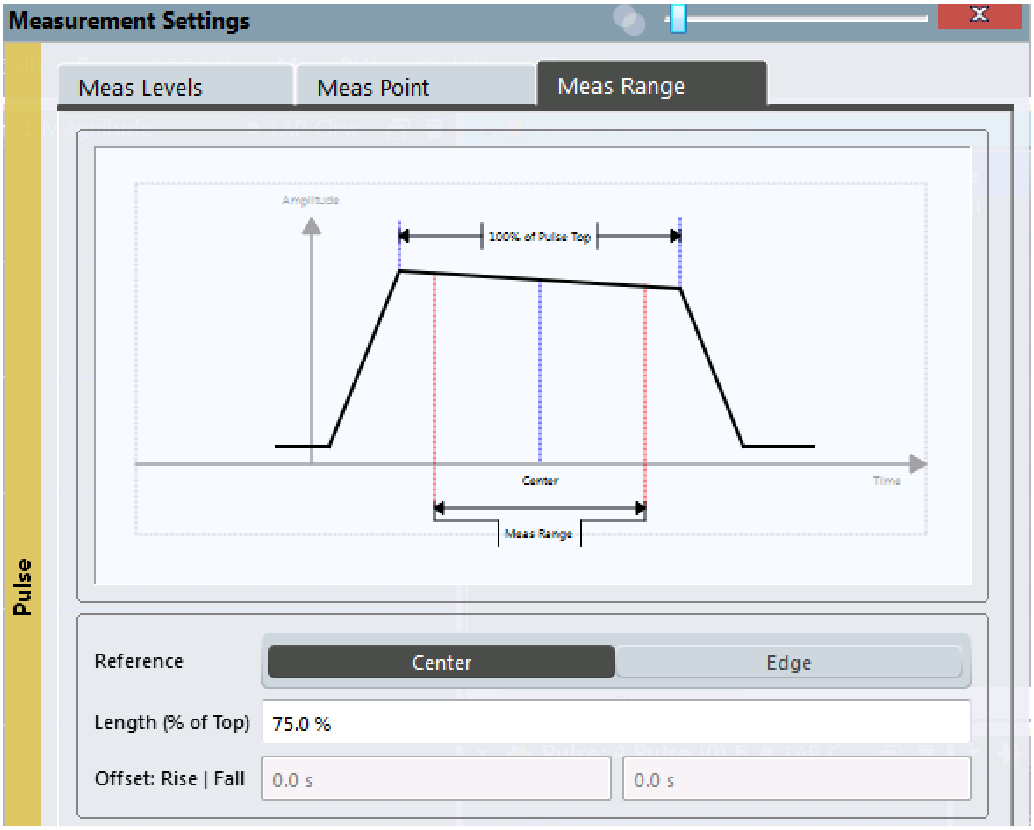
Remote command:
SENSe:TRACe:MEASurement:DEFine:PULSe:REFerence:POSition on page 207
SENSe:TRACe:MEASurement:DEFine:PULSe:REFerence on page 207

5.8.3 Measurement range

Access: "Overview" > "Measurement" > "Meas Range" tab

Or: "Meas Setup" > "Pulse Meas" > "Meas Range"tab

Some measurements are performed over a range within the pulse, for example the phase or frequency deviation. The measurement range is specified either by start and end points relative to the rising and falling edges, or as a proportion of the pulse top.



Reference, Length, Offset
Defines the reference for the measurement range definition. Depending on the selected reference type, an additional setting is available to define the range.

"Center" Defines a relative range around the center of the pulse. The range is defined by its **length** in percent of the pulse top.

"Edge" Defines the start and stop of the measurement range with respect to the pulse edges. The range is defined by a time **offset** from the middle of the **rising edge** and a time offset from the middle of the **falling edge**.

Remote command:
SENSe:TRACe:MEASurement:DEFine:PULSe:ESTimation:REFerence
on page 209
Relative range (Center):
SENSe:TRACe:MEASurement:DEFine:PULSe:ESTimation:LENGth on page 208
Absolute range (Edge):
SENSe:TRACe:MEASurement:DEFine:PULSe:ESTimation:OFFSet:LEFT
on page 208
SENSe:TRACe:MEASurement:DEFine:PULSe:ESTimation:OFFSet:RIGHt
on page 208

5.9 Automatic settings

Access: "Auto Set" toolbar

Some settings can be adjusted by the R&S VSE automatically according to the current measurement settings.

Auto Scale Continuous (All)
Automatically determines the optimal result range and reference level position for *each new measurement* in all displayed diagrams (for graphical or pulse-based result displays only).

Remote command:
SENS:TRAC:MEAS:DEF:RRAN:AUTO ON, see SENSe:TRACe:MEASurement:DEFine:RRANge:AUTO on page 221
DISP:TRAC:Y:SCAL:AUTO ON, see DISPlay[:WINDow<n>][:SUBWindow<n>]:TRACe<t>:Y[:SCALe]:AUTO on page 282

Auto Scale Once (All)
Automatically determines the optimal result range and reference level position *once* for the *current* measurement settings in all displayed diagrams and pulse-based result displays. All automatic scaling functions are then switched off.

Remote command:
SENS:TRAC:MEAS:DEF:RRAN:AUTO ONCE, see SENSe:TRACe:MEASurement:DEFine:RRANge:AUTO on page 221
DISP:TRAC:Y:SCAL:AUTO ONCE, see DISPlay[:WINDow<n>][:SUBWindow<n>]:TRACe<t>:Y[:SCALe]:AUTO on page 282

6 Analysis

After a Pulse measurement has been performed, you can analyze the results in various ways.

6.1 Result configuration

Access: "Overview" > "Result Configuration"

Or: "Meas Setup" > "Result"

Some evaluation methods require or allow for additional settings to configure the result display. Note that the available settings depend on the selected window (see "Specifics for " on page 64).

6.1.1 Pulse selection

Access: "Meas Setup" > "Selected Pulse"

The pulse traces (frequency, magnitude and pulse vs. time) always display the trace for one specific pulse, namely the currently selected pulse. The currently selected pulse is highlighted blue in the "Pulse Results" and "Pulse Statistics" displays.

As soon as a new pulse is selected, all pulse-specific displays are automatically updated.

You can also select a pulse simply by clicking on it in the Pulse Results display.

The selected pulse (number) is relative to the currently defined detection range, if enabled (see "Detection Range" on page 90). If you change the detection range within the capture buffer, the selected pulse is adapted automatically, and all pulse-based results are updated, if necessary.

Remote command:

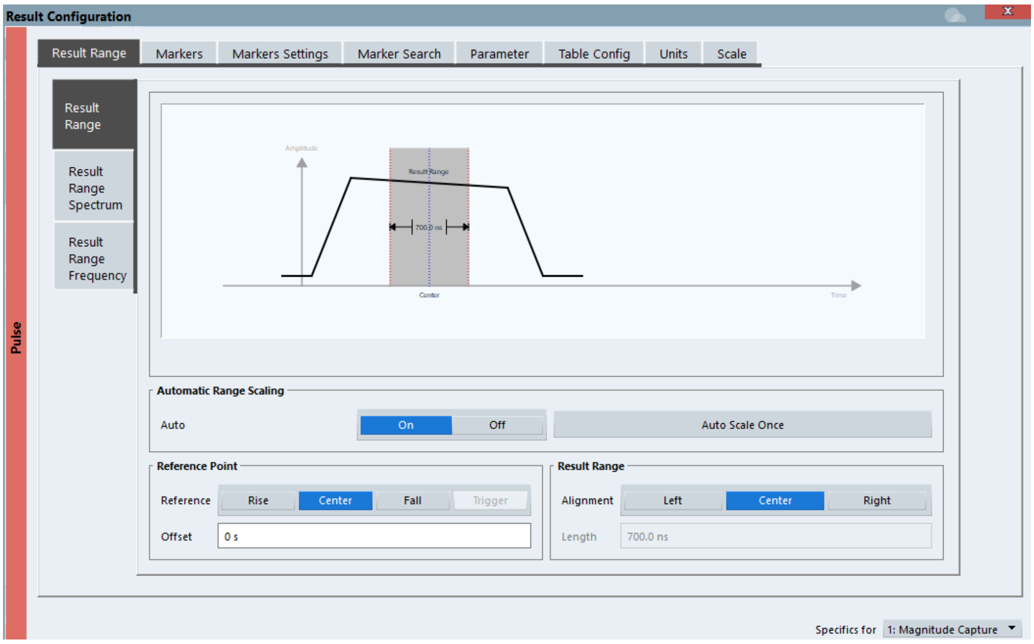
SENSe:TRACe:MEASurement:DEFine:PULSe:SELected on page 220

6.1.2 Result range

Access: "Overview" > "Result Configuration" > "Result Range" tab

Or: "Meas Setup" > "Result" > "Result Range" tab

The result range determines which data is displayed on the screen (see also "Measurement range vs. result range vs. detection range" on page 15). This range applies to the "pulse magnitude", frequency and phase vs time displays.



The range is defined by a reference point, alignment and the range length.

Automatic Range Scaling

Defines whether the result range length is determined automatically according to the width of the selected pulse (see Chapter 6.1.1, "Pulse selection", on page 99).

Note: The result range is applied to all pulse-based result displays.

"OFF" Switches automatic range scaling off

"ON" Switches automatic range scaling on

"ONCE" Executes automatic range scaling once and then switches it off

Remote command:
`SENSe:TRACe:MEASurement:DEFine:RRANge:AUTO` on page 221

Result Range Reference Point
Defines the reference point for positioning the result range. The Offset is given with respect to this value.

"Rise"	The result range is defined in reference to the rising edge.
"Center"	The result range is defined in reference to the center of the pulse top.
"Fall"	The result range is defined in reference to the falling edge.
"Trigger"	The result range is defined in reference to the trigger event. This setting is only available for segmented capture. Configure a trigger and activate segmented capture mode (see "Segmented Capture" on page 85).

Remote command:
`SENSe:TRACe:MEASurement:DEFine:RRANge:REFerence` on page 222

Offset
The offset in seconds from the pulse edge or center at which the result range reference point occurs.

Remote command:
`SENSe:TRACe:MEASurement:DEFine:RRANge:OFFSet` on page 222

Alignment
Defines the alignment of the result range in relation to the selected Result Range Reference Point.

With option R&S VSE-K6A installed, the R&S VSE always uses the first measurement channel as a reference for the alignment. The same time window is cut out in every channel and the same starting time is applied onto all channels.

"Left"	The result range starts at the pulse center or selected edge.
"Center"	The result range is centered around the pulse center or selected edge.
"Right"	The result range ends at the pulse center or selected edge.

Remote command:
`SENSe:TRACe:MEASurement:DEFine:RRANge:ALIGnment` on page 221

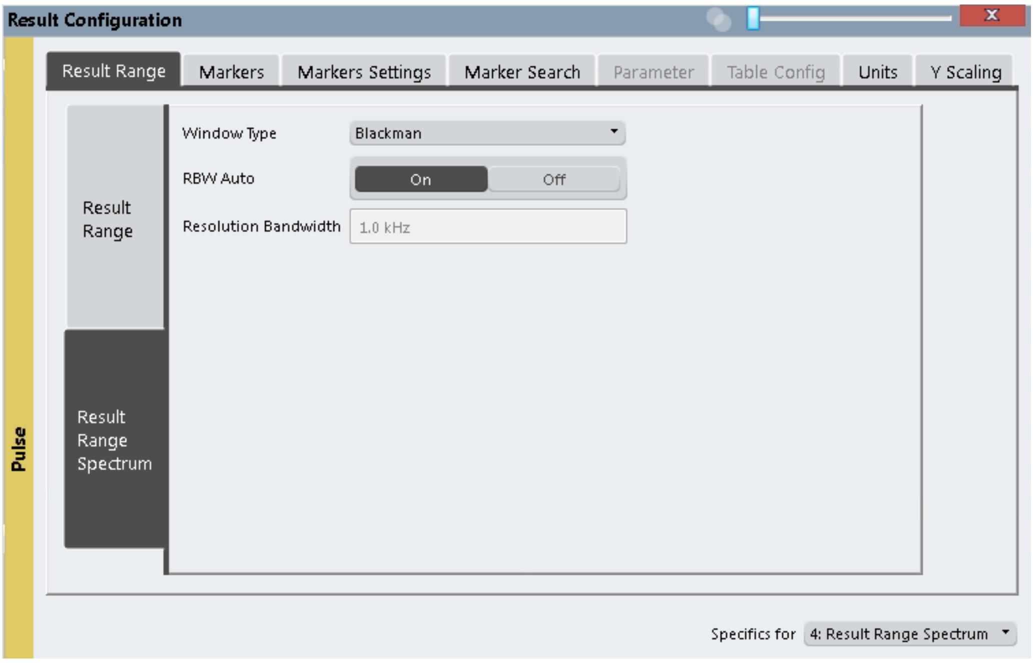
Length
Defines the length or duration of the result range.

Remote command:
`SENSe:TRACe:MEASurement:DEFine:RRANge:LENGth` on page 222

6.1.3 Result range spectrum configuration

Access: "Overview" > "Result Configuration" > "Result Range" tab > "Result Range Spectrum" tab

For the "Result Range Spectrum" display additional settings are available for the FFT.



Window Type

Used FFT window type for "Result Range Spectrum". The same window types are available as for "Parameter Spectrum" displays (see "Window functions" on page 51).

Remote command:
`CALCulate<n>:RRSPectrum:WINDow` on page 257

ResBW Manual

Defines the resolution bandwidth for the "Result Range Spectrum".

The resolution bandwidth defines the minimum frequency separation at which the individual components of a spectrum can be distinguished. Small values lead to high precision results, as the distance between two distinguishable frequencies is small, but require a larger measurement interval (that is: longer Result Range length) for the calculation. Higher values decrease the precision, but can increase measurement speed.

Remote command:
`CALCulate<n>:RRSPectrum:RBW` on page 258

RBW Auto

If activated, a resolution bandwidth is selected automatically which provides a good balance between fast measurement speed and high spectral resolution.

Remote command:
`CALCulate<n>:RRSPectrum:AUTO` on page 258

6.1.4 Result range frequency configuration

FM Video Bandwidth
Additional filters applied after demodulation help filter out unwanted signals, or correct pre-emphasized input signals.

- Relative low pass filters:
  Relative filters (3 dB) can be selected in % of the analysis (demodulation) bandwidth. The filters are designed as 5th-order Butterworth filters (30 dB/octave) and active for all demodulation bandwidths.
- "None" deactivates the FM video bandwidth (default).

Remote command:
`[SENSe:]DEMod:FMVF:TYPE` on page 198

6.1.5 Parameter configuration for result displays

Access: "Overview" > "Result Configuration" > "Parameter" tab

Or: "Meas Setup" > "Result" > "Parameter" tab

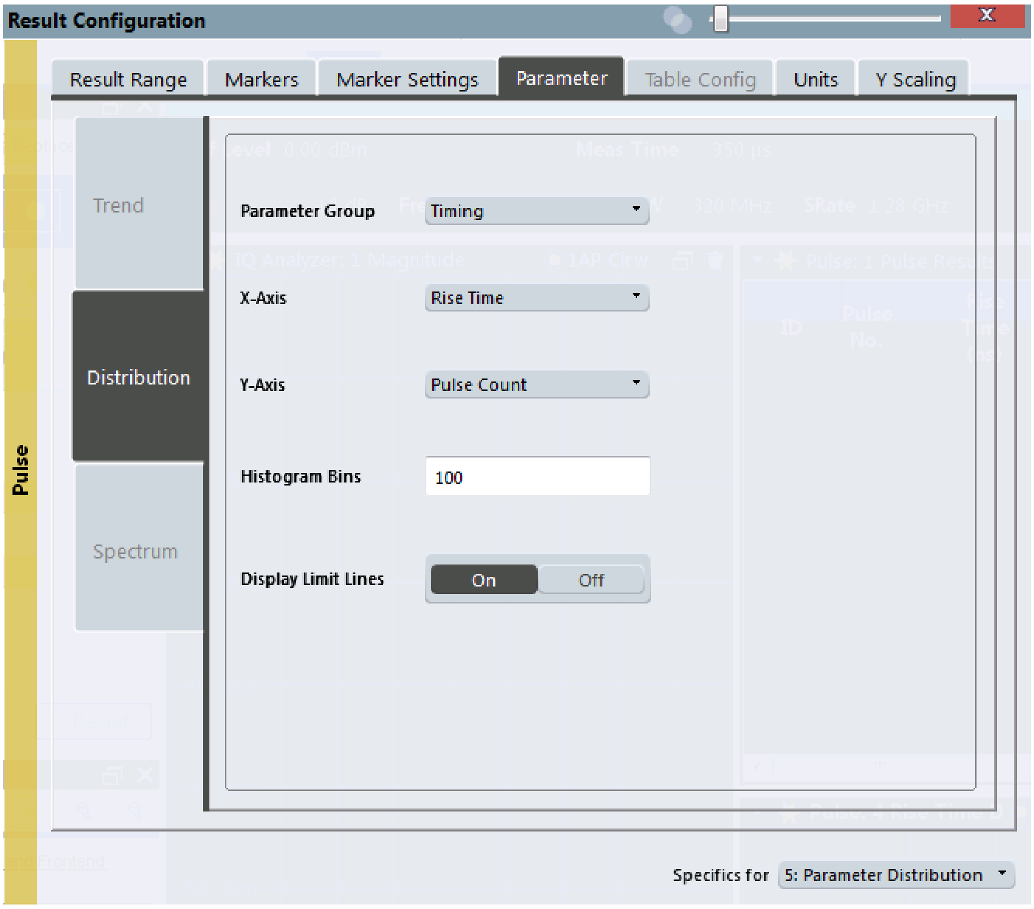
For "parameter trend", spectrum, or distribution displays you can define which parameters are to be evaluated in each window.

6.1.5.1 Parameter distribution configuration

Access: "Overview" > "Result Configuration" > "Parameter" > "Distribution"

Or: "Meas Setup" > "Result" > "Parameter" tab > "Distribution" tab

The "parameter distribution" evaluations allow you to visualize the number of occurrences for a specific parameter value within the current capture buffer. For each "parameter distribution" window you can configure which measured parameter is to be displayed.



This tab is only available for windows with a Parameter Distribution evaluation.

Parameter Group

Defines the group of parameters from which one can be selected to display the distribution of the measured values on the y-axis. For a description of the parameters see Chapter 3.1, "Pulse parameters", on page 15.

X-Axis

Defines the parameter for which the values are displayed on the x-axis. The available parameters depend on the selected Parameter Group.

Remote command:

CALCulate<n>:DIStribution:<GroupName> <X-Axis>,<Y-Axis>, see e.g. CALCulate<n>:DIStribution:FREQuency on page 224

Y-Axis

Defines the scaling of the y-axis.

"Pulse count" Number of pulses in which the value occurred.

"Occurrence" Number of occurrences in percent of all measured values.

Histogram Bins

Number of columns on the x-axis, i.e. the number of measurement value ranges for which the occurrences are determined.

Remote command:
`CALCulate<n>:DISTribution:NBINs` on page 225

Display Limit Lines

Hides or shows the limit lines in the selected Parameter Trend or Parameter Distribution result display. You can drag these lines to a new position in the window. The new position is maintained, the limit check is repeated, and the results of the limit check in any active table displays are adapted.

Note that this function only has an effect on the visibility of the lines in the graphical displays, it does not affect the limit check in general or the display of the limit check results in the table displays.

Remote command:
`CALCulate<n>:DISTribution:LLINes[:STATe]` on page 225
`CALCulate<n>:TRENd:LLINes[:STATe]` on page 246

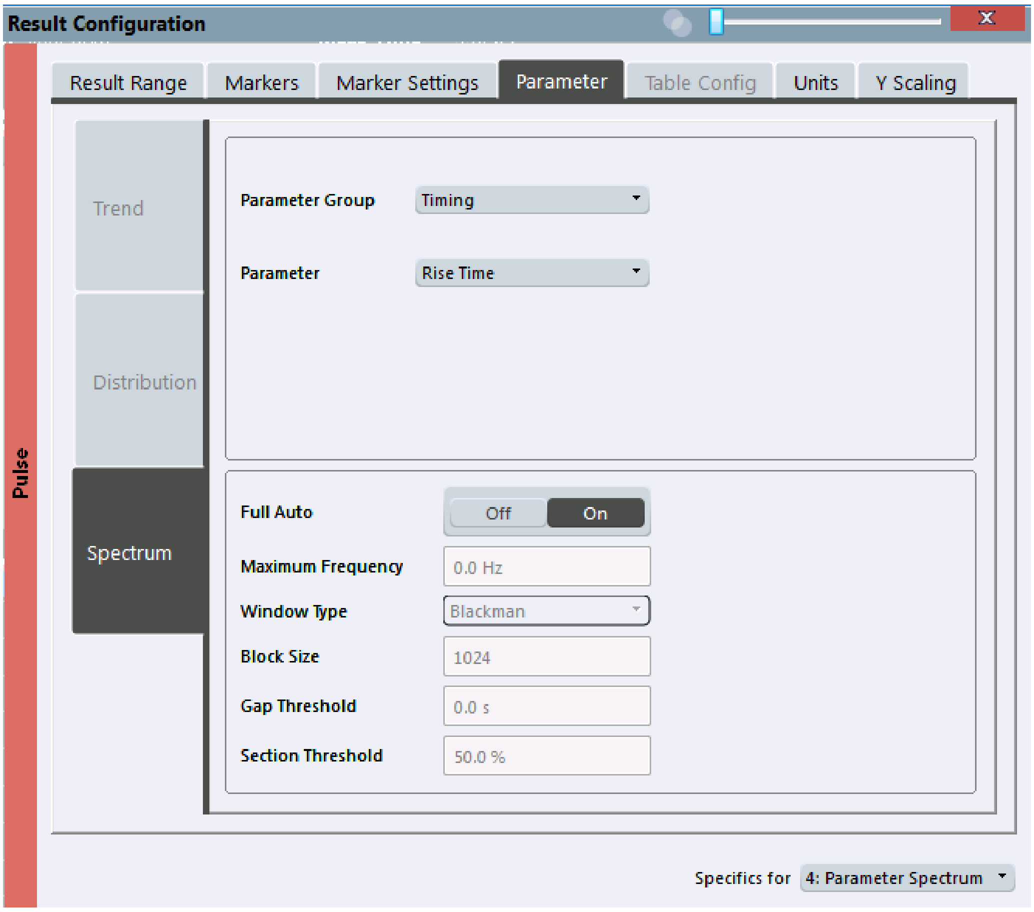
6.1.5.2 Parameter spectrum configuration

Access: "Overview" > "Result Configuration" > "Parameter" > "Spectrum"

A "parameter spectrum" displays the results of an FFT for a selected column of the "Pulse Results" table. This "spectrum" allows you to easily determine the frequency of periodicities in the pulse parameters.

For each "Parameter Spectrum" window you can configure which measured parameter is to be displayed and how the spectrum is determined.

The pulse-to-pulse spectrum is basically a "parameter spectrum" based on complex I/Q data. You cannot select a parameter for the spectrum. All other settings are identical to the "parameter spectrum".



This tab is only available for windows with a "Parameter Spectrum" evaluation.

For more information on how the "parameter spectrum" is calculated see Chapter 4.3, "Parameter spectrum calculation", on page 50.

Parameter Group

Defines the group of parameters from which one can be selected to display the FFT of the measured values. For a description of the parameters see Chapter 3.1, "Pulse parameters", on page 15.

Parameter
Defines the parameter for which the FFT is calculated and displayed. The available parameters depend on the selected Parameter Group.

Remote command:
`CALCulate<n>:PSPectrum:<GroupName> <X-Axis>`, see e.g. `CALCulate<n>:PSPectrum:FREQuency` on page 231

Full Auto
Determines the "Parameter Spectrum" settings automatically. For most measurement cases, automatic configuration should be suitable.

If enabled, the individual settings are not available.

Remote command:
`CALCulate<n>:PSPectrum:AUTO` on page 229

Maximum Frequency
Defines the maximum frequency span for which the Spectrum is calculated. Internally, the span is limited by the number of possible interpolation samples (100 000). Limiting the span to the actually required frequencies decreases the calculation time and can improve the obtained RBW.

Remote command:
`CALCulate<n>:PSPectrum:MAXFrequency` on page 232

Window Type
Used FFT window type

Remote command:
`CALCulate<n>:PSPectrum:WINDow` on page 235

Block Size
Size of block used in spectrum calculation. Windowing and averaging are used to combine blocks. The block size also determines the resulting RBW of the spectrum.

Remote command:
`CALCulate<n>:PSPectrum:BLOCksize` on page 230

Gap Threshold
Minimum time that must pass before a gap is detected as such.

Remote command:
`CALCulate<n>:PSPectrum:GTHReshold` on page 232

Section Threshold
Minimum section size as a percentage of the block size. Sections that are smaller than the threshold are ignored and considered to be in the detected gap.

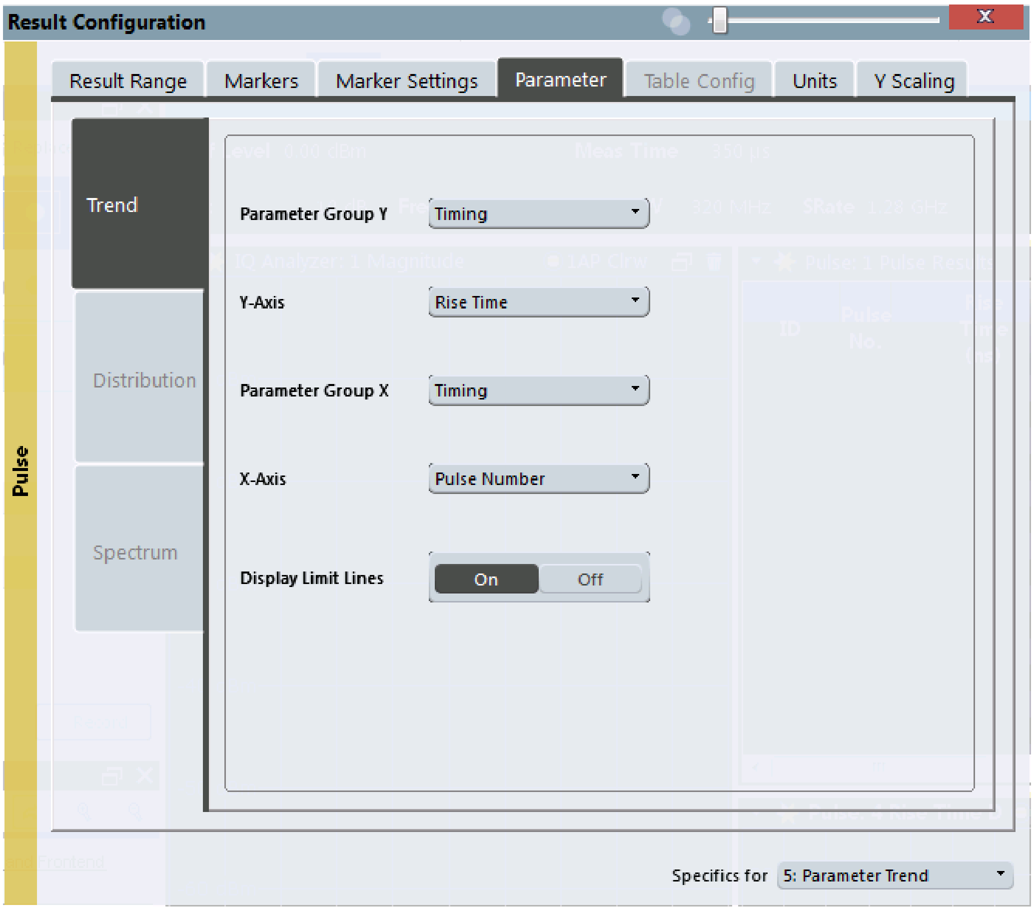
Remote command:
`CALCulate<n>:PSPectrum:STHReshold` on page 234

6.1.5.3 Parameter trend configuration

Access: "Overview" > "Result Configuration" > "Parameter" tab > "Trend" tab

Or: "Meas Setup" > "Result" > "Parameter" tab > "Trend" tab

The parameter trend result displays allow you to visualize changes in a specific parameter for all measured pulses within the current capture buffer. For each parameter trend window you can configure which measured parameter is to be displayed on the x-axis and which on the y-axis.



This tab is only available for windows with a Parameter Trend result display.

Parameter Group Y

Defines the group of parameters from which one can be selected to display the trend on the y-axis. For a description of the parameters see Chapter 3.1, "Pulse parameters", on page 15.

Y-Axis

Defines the parameter for which the trend is displayed on the y-axis. The available parameters depend on the selected "Parameter Group Y" on page 109.

Remote command:

`CALCulate<n>:TRENd:<GroupName>:Y`, see e.g. `CALCulate<n>:TRENd:FREQuency:Y` on page 245

`CALCulate<n>:TRENd:<GroupName> Y,X`, see e.g. `CALCulate<n>:TRENd:FREQuency` on page 243

Parameter Group X

Defines the group of parameters from which one can be selected to display the trend on the x-axis. For a description of the parameters see Chapter 3.1, "Pulse parameters", on page 15.

X-Axis

Defines the parameter for which the trend is displayed on the y-axis. The available parameters depend on the selected Parameter Group X.

Remote command:

`CALCulate<n>:TRENd:<GroupName>:X`, see e.g. `CALCulate<n>:TRENd:FREQuency:X` on page 244

`CALCulate<n>:TRENd:<GroupName> Y,X`, see e.g. `CALCulate<n>:TRENd:FREQuency` on page 243

Display Limit Lines

Hides or shows the limit lines in the selected Parameter Trend or Parameter Distribution result display. You can drag these lines to a new position in the window. The new position is maintained, the limit check is repeated, and the results of the limit check in any active table displays are adapted.

Note that this function only has an effect on the visibility of the lines in the graphical displays, it does not affect the limit check in general or the display of the limit check results in the table displays.

Remote command:

`CALCulate<n>:DISTribution:LLINes[:STATe]` on page 225

`CALCulate<n>:TRENd:LLINes[:STATe]` on page 246

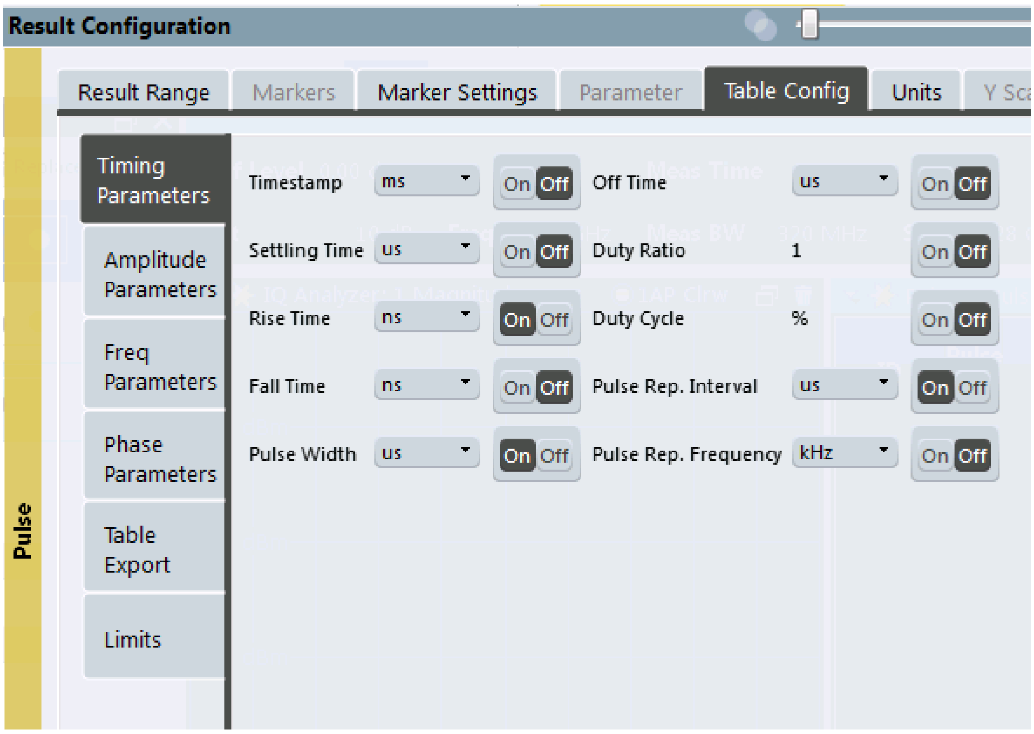
6.1.6 Table configuration

Access: "Overview" > "Result Configuration" > "Table Config"

Or: "Meas Setup" > "Result" > "Table Config" tab

During each measurement, a large number of statistical and characteristic values are determined. The "Pulse Statistics" and "Pulse Results" result displays provide an overview of the parameters selected here.

Note that the "Result Configuration" dialog box is window-specific; table configuration settings are only available if a table display is selected. However, the table configuration applies to *all* tables, regardless of which table is selected.



Select the parameters to be included in the tables, and the required unit scaling, if available. For a description of the individual parameters see Chapter 3.1, "Pulse parameters", on page 15.

Remote command:

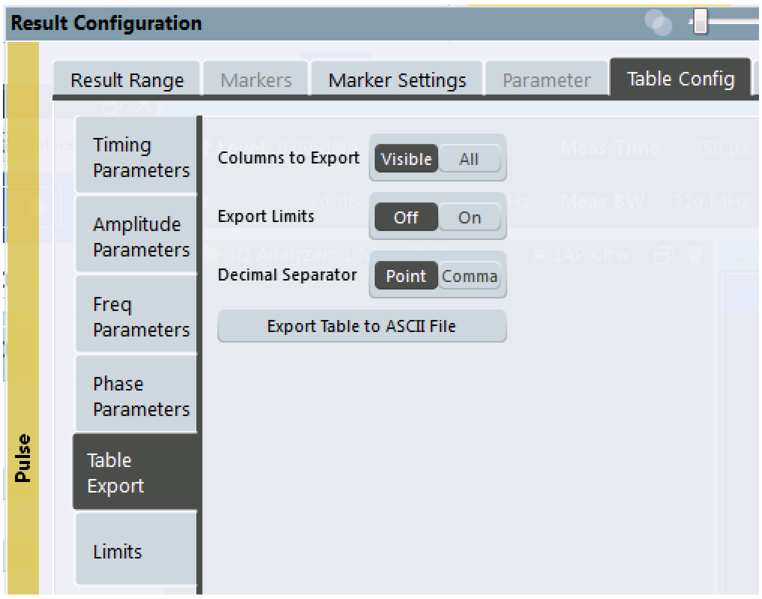
`CALCulate<n>:TABLe:<GroupName>:<ParamName>`, see Chapter 8.4.11.8, "Configuring the statistics and parameter tables", on page 258

6.1.6.1 Table export configuration

Access: "Overview" > "Result Configuration" > "Table Config" > "Table Export"

Table results can be exported to an ASCII file for further evaluation in other (external) applications.

The settings are window-specific and only available for result tables.



The result tables can be exported either directly in the settings dialog box or via the "Export" function in the "Save/Recall" menu (via the toolbar).

Columns to Export

Defines which of the result table columns are to be included in the export file.

"Visible" Only the currently visible columns in the result display are exported.

"All" All columns, including currently hidden ones, for the result display are exported.

Remote command:
`MMEMory:STORe<n>:TABLe` on page 367

Export Limits

If activated, any limits defined for the table will be included in the export file.

Remote command:
`MMEMory:STORe<n>:TABLe:LIMit` on page 368

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 366

Export table to ASCII File

Opens a file selection dialog box and saves the selected result table in ASCII format (`.DAT`) to the specified file and directory.

For details on the file format, see Chapter C, "Reference: ASCII file export format", on page 386.

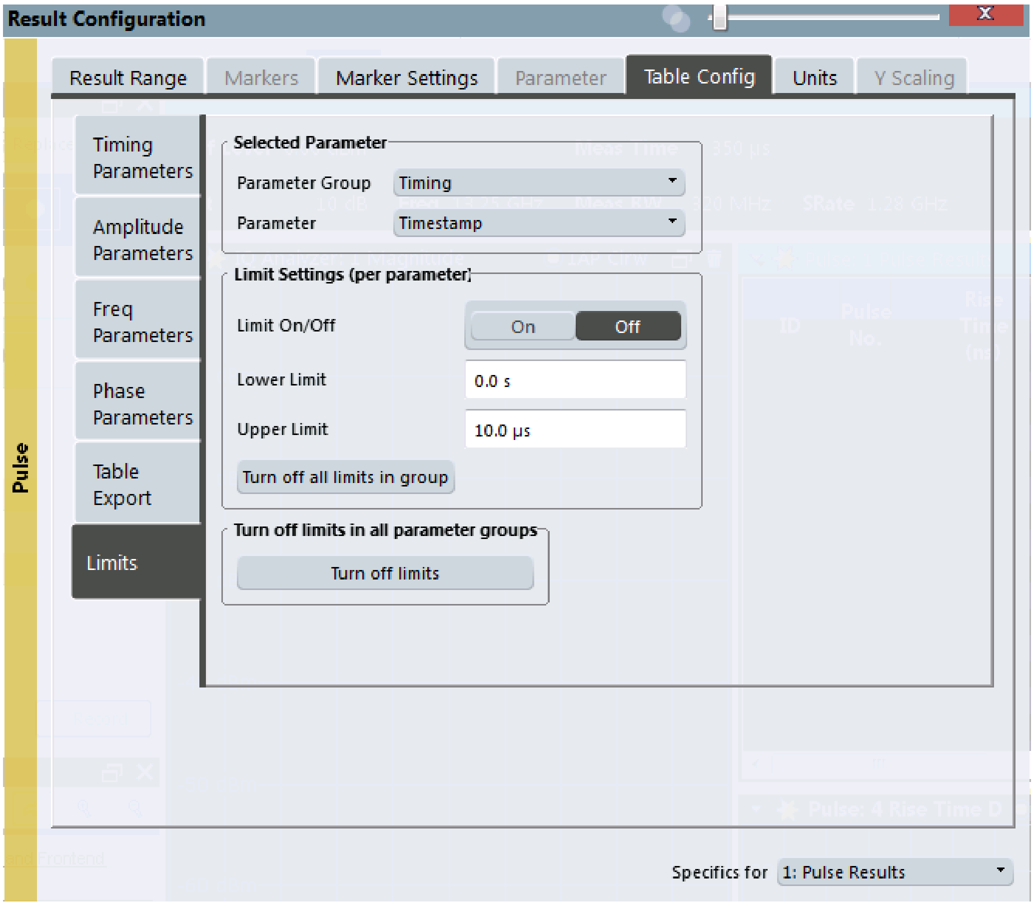
Remote command:
`MMEMory:STORe<n>:TABLe` on page 367

6.1.6.2 Limit settings for table displays

Access: "Overview" > "Result Configuration" > "Table Config" > "Limits"

Measurement results can be checked against defined limits and the results of the limit check can then be indicated in the Result Table.

For details on limits see "Pulse Results" on page 39.



The settings are window-specific and only available for result tables.

Optionally, limit lines can be displayed in the Parameter Distribution and Parameter Trend diagrams. You can drag these lines to a new position in the window. The new position is maintained, the limit check is repeated, and the results of the limit check in any active table displays are adapted.

Parameter Group
Defines the group of parameters from which one can be selected to define limits. For a description of the parameters see Chapter 3.1, "Pulse parameters", on page 15.

Parameter
Defines the parameter for which the limits are to be defined. The available parameters depend on the selected Parameter Group.

Activating a limit check for a parameter
To activate a limit check for the selected parameter, set "Limit On/Off" to "ON".

Remote command:
`CALCulate<n>:TABLe:<ParameterGroup>:<Parameter>:LIMit:STATe` on page 277

Defining lower and upper limits for a parameter
The "Lower Limit" and "Upper Limit" define the valid value range for the limit check for the selected parameter.

Remote command:
`CALCulate<n>:TABLe:<ParameterGroup>:<Parameter>:LIMit` on page 279

Deactivating a limit check for an entire parameter group
To deactivate all limits for an entire parameter group at once, select "Turn off all limits in group". This function is identical to setting "Limit On/Off" to "OFF" for each parameter in the group.

Remote command:
`CALCulate<n>:TABLe:<ParameterGroup>:ALL:LIMit:STATe` on page 278

Deactivating all limit checks for all parameter groups
To deactivate all limits for all parameter groups at once, select "Turn off limits". This function is identical to setting "Limit On/Off" to "OFF" for each parameter in each group.

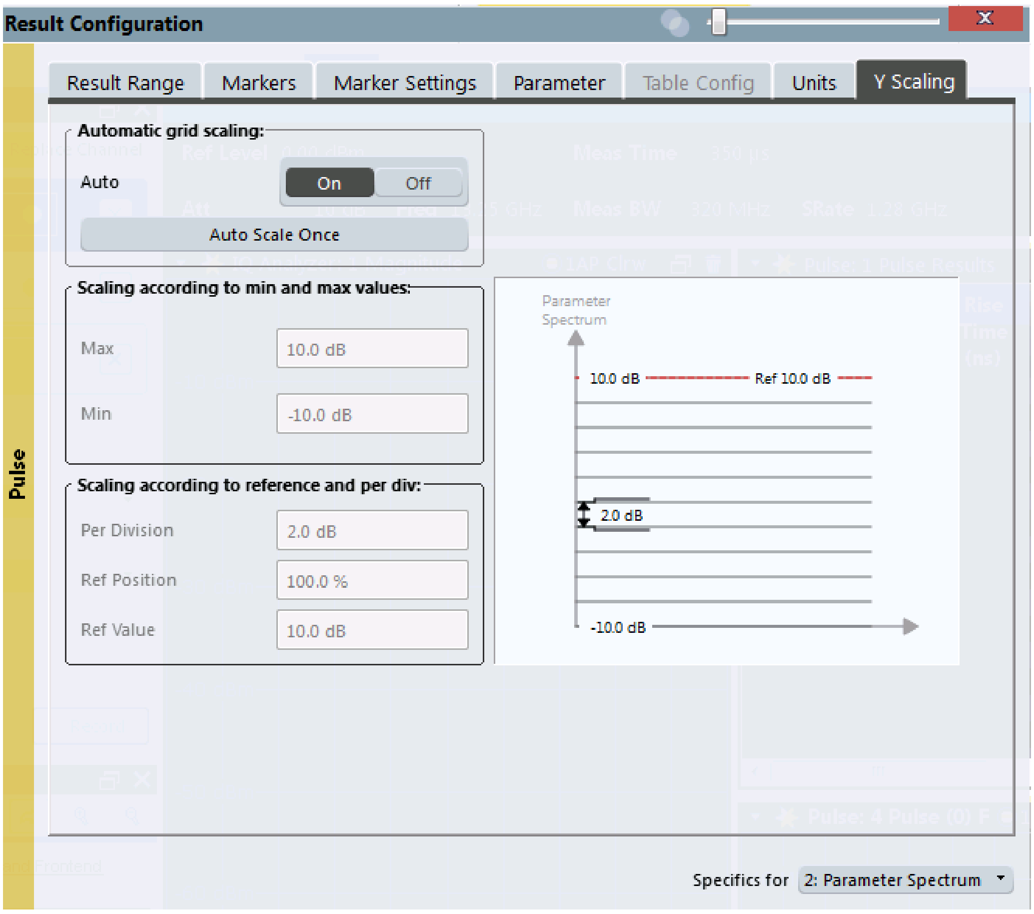
Remote command:
`CALCulate<n>:TABLe:ALL:LIMit:STATe` on page 279

6.1.7 Y-Scaling

Access: "Overview" > "Result Configuration" > "Y Scaling"

Or: "Meas Setup" > "Result" > "Y Scaling" tab

The scaling for the vertical axis is highly configurable, using either absolute or relative values.



Automatic Grid Scaling

The y-axis is scaled automatically according to the current measurement settings and results (continuously).

Note: If a limit is defined for a parameter that is displayed in a Parameter Trend diagram (see "Activating a limit check for a parameter" on page 113), autoscaling is not available for the axis this parameter is displayed on.

Note: Tip: To update the scaling automatically *once* when this setting for continuous scaling is off, use the "Auto Scale Once " on page 115 button or the softkey in the [AUTO SET] menu.

Remote command:

`DISPlay[:WINDow<n>][:SUBWindow<n>]:TRACe<t>:Y[:SCALe]:AUTO`

on page 282

Auto Scale Once
Automatically determines the optimal range and reference level position to be displayed for the current measurement settings.

The display is only set once; it is not adapted further if the measurement settings are changed again.

This function is only available for RF measurements.

Remote command:
`DISPlay[:WINDow<n>][:SUBWindow<n>]:TRACe<t>:Y[:SCALe]:AUTO`
on page 282

Absolute Scaling (Min/Max Values)
Define the scaling using absolute minimum and maximum values.

Remote command:
`DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:MAXimum` on page 282
`DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:MINimum` on page 282

Relative Scaling (Reference/ per Division)
Define the scaling relative to a reference value, with a specified value range per division.

Per Division ← Relative Scaling (Reference/ per Division)
Defines the value range to be displayed per division of the diagram (1/10 of total range).

Note: The value defined per division refers to the default display of 10 divisions on the y-axis. If fewer divisions are displayed (e.g. because the window is reduced in height), the range per division is increased in order to display the same result range in the smaller window. In this case, the per division value does not correspond to the actual display.

Remote command:
`DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:PDIVision`
on page 283

Ref Position ← Relative Scaling (Reference/ per Division)
Defines the position of the reference value in percent of the total y-axis range.

Remote command:
`DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:RPOSition`
on page 283

Ref Value ← Relative Scaling (Reference/ per Division)
Defines the reference value to be displayed at the specified reference position.

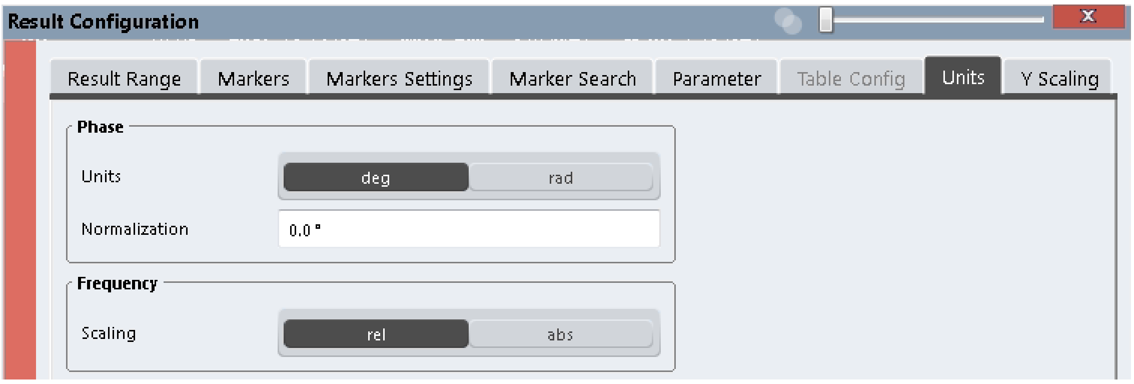
Remote command:
`DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:RVALue` on page 284

6.1.8 Units

Access: "Overview" > "Result Configuration" > "Units"

Or: "Meas Setup" > "Result" > "Units" tab

The unit for phase display is configurable.



Phase Unit

Defines the unit in which phases are displayed (degree or rad).

Remote command:
`UNIT:ANGLe` on page 284

Phase Normalization

Normalizes "pulse phase" traces to a specific phase value. For details see "Normalization of pulse phase traces" on page 61.

This function is only available for "Pulse Phase" and "Pulse Phase (Wrapped)" result displays.

Remote command:
`DISPlay[:WINDow<n>]:TRACe<t>:NORMalize:PHASe` on page 287

Frequency Scaling

Switches between relative (default) and absolute frequency values. This setting applies to "Pulse Frequency", Result Range Spectrum, "Parameter Distribution" and "Parameter Trend" result displays.

Remote command:
`CALCulate<n>:UNIT:FREQuency` on page 281

6.2 Markers

Access: "Overview" > "Result Configuration" > "Markers"

Or: "Marker"

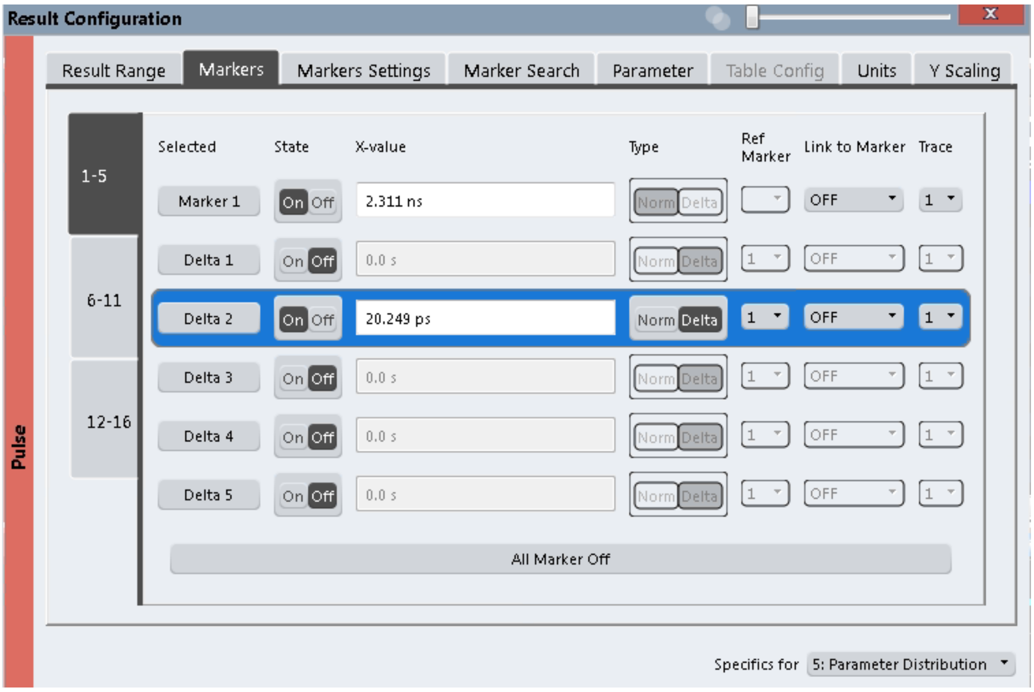
Markers help you analyze your measurement results by determining particular values in the diagram. Thus you can extract numeric values from a graphical display.

6.2.1 Individual marker settings

Access: "Overview" > "Result Configuration" > "Markers"

Or: "Marker" > "Marker"

Up to 17 markers or delta markers can be activated for each window simultaneously.



Marker 1 / Marker 2 / Marker 3 / Marker 4

"Marker X" activates the corresponding marker and opens an edit dialog box to enter the marker position ("X-value"). Pressing the softkey again deactivates the selected marker.

Marker 1 is always the default reference marker for relative measurements. If activated, markers 2 to 4 are delta markers that refer to marker 1. These markers can be converted into markers with absolute value display using the "Marker Type" function.

If normal marker 1 is the active marker, pressing "Mkr Type" switches on an additional delta marker 1.

Note: Setting markers in "Parameter Trend" Displays. In "Parameter Trend" displays, positioning a marker by defining its x-axis value can be very difficult or unambiguous. It is especially difficult when the x-axis unit is not the pulse number. Thus, markers are positioned by defining the corresponding pulse number in the "Marker" edit field for all parameter trend displays, regardless of the displayed x-axis parameter. However, the position displayed in the marker information area or the marker table is shown in the defined x-axis unit.

Remote command:
`CALCulate<n>:MARKer<m>[:STATe]` on page 292
`CALCulate<n>:MARKer<m>:X` on page 292
`CALCulate<n>:MARKer<m>:Y?` on page 370
`CALCulate<n>:DELTamarker<m>[:STATe]` on page 294
`CALCulate<n>:DELTamarker<m>:X` on page 295
`CALCulate<n>:DELTamarker<m>:Y?` on page 369

Place New Marker

Activates the next currently unused marker and sets it to the peak value of the current trace in the current window.

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.

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.

Remote command:
`CALCulate<n>:MARKer<m>[:STATe]` on page 292
`CALCulate<n>:MARKer<m>:X` on page 292
`CALCulate<n>:MARKer<m>:Y?` on page 370
`CALCulate<n>:DELTamarker<m>[:STATe]` on page 294
`CALCulate<n>:DELTamarker<m>:X` on page 295
`CALCulate<n>:DELTamarker<m>:X:RELative?` on page 369
`CALCulate<n>:DELTamarker<m>:Y?` on page 369

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 292
`CALCulate<n>:DELTamarker<m>[:STATe]` on page 294

X-value

Defines the position of the marker on the x-axis.

Note: Setting markers in "Parameter Trend" Displays. In "Parameter Trend" displays, especially when the x-axis unit is not pulse number, positioning a marker by defining its x-axis value can be very difficult or unambiguous. Thus, markers can be positioned by defining the corresponding pulse number in the "Marker" edit field for all parameter trend displays, regardless of the displayed x-axis parameter. The "Marker" edit field is displayed when you select one of the "Marker" softkeys.

Remote command:
`CALCulate<n>:DELTamarker<m>:X` on page 295
`CALCulate<n>:MARKer<m>:X` on page 292

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 292
`CALCulate<n>:DELTamarker<m>[:STATe]` on page 294

Reference Marker

Defines a marker as the reference marker which is used to determine relative analysis results (delta marker values).

Remote command:
`CALCulate<n>:DELTamarker<m>:MREFerence` on page 294

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 291
`CALCulate<n>:DELTamarker<ms>:LINK:TO:MARKer<md>` on page 294
`CALCulate<n>:DELTamarker<m>:LINK` on page 293

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.

If a trace is turned off, the assigned markers and marker functions are also deactivated.

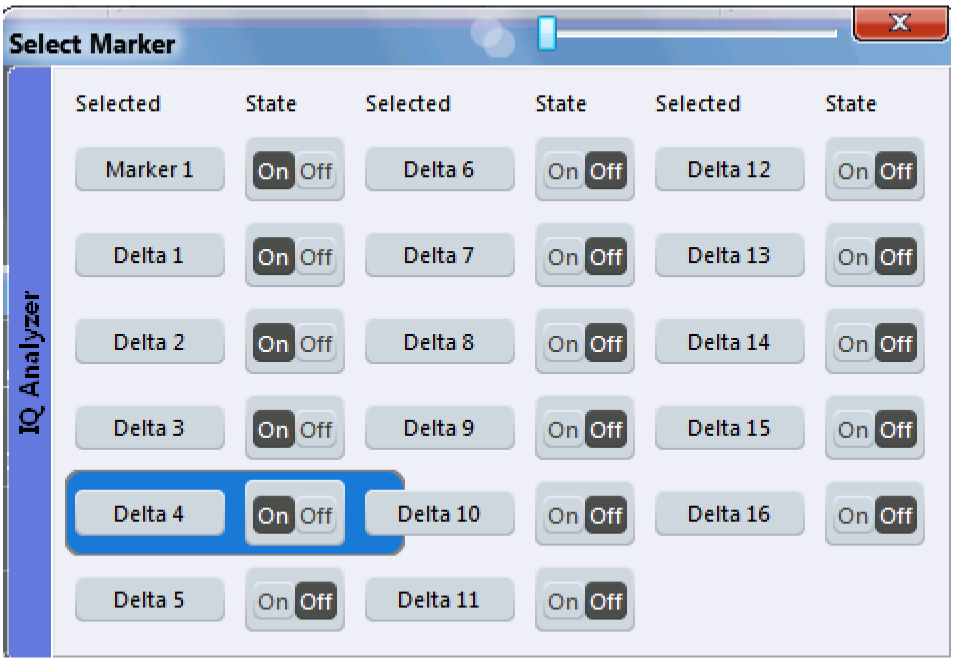
Remote command:

`CALCulate<n>:MARKer<m>:TRACe` on page 292

Select Marker

M1

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 292
`CALCulate<n>:DELTamarker<m>[:STATe]` on page 294

All Markers Off

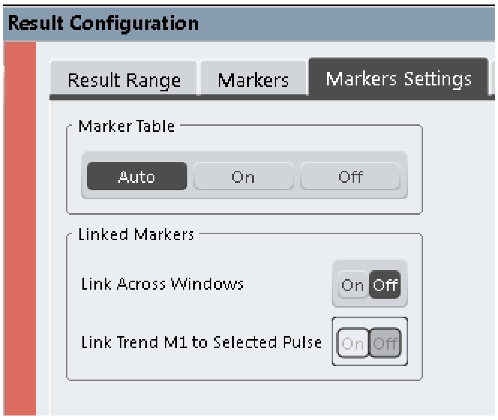
Deactivates all markers in one step.

Remote command:
`CALCulate<n>:MARKer<m>:AOFF` on page 291

6.2.2 General marker settings

Access: "Overview" > "Result Configuration" > "Marker Settings"

Or: "Marker" > "Marker" > "Marker Settings" tab



Marker Table Display
Defines how the marker information is displayed.

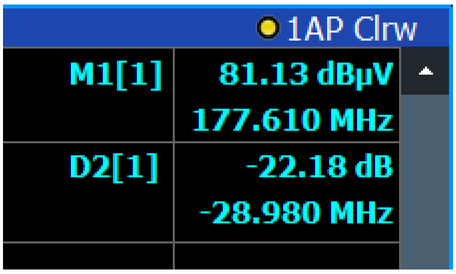
"On" Displays the marker information in a table in a separate area beneath the diagram.

"Off" No separate marker table is displayed.
If Marker Info 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 Marker Info is active, the marker information for up to two markers is displayed in the diagram area.

Remote command:
`DISPlay[:WINDow<n>]:MTABle` on page 298

Marker Info
Turns the marker information displayed in the diagram on and off.



Remote command:
DISPlay[:WINDow<n>]:MINFo[:STATe] on page 297

Linked Markers Across Windows
If enabled, the markers in all diagrams with the same x-axis are linked, i.e. when you move a marker in one window, the markers in all other windows are moved to the same x-value.

In particular, markers in all pulse measurement displays (such as "Pulse Magnitude", "Pulse Phase" etc.) are linked, if enabled. Similarly, markers in all "Parameter Trend" displays can be linked.

Remote command:
CALCulate<n>:MARKer<m>:LINK on page 296

Link Trend M1 to Selected Pulse
If enabled, marker M1 in "Parameter Trend" displays is linked to the pulse selection. Thus, if you move the marker M1 to a different pulse, the Pulse selection is set to the same pulse, and vice versa.

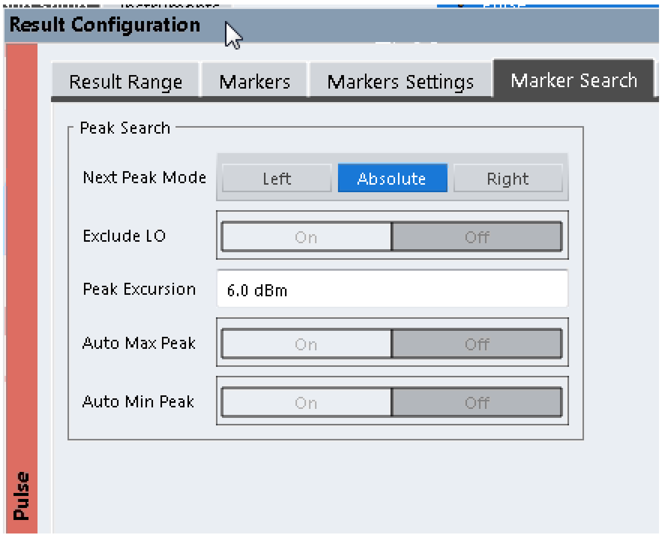
Note that this function is only available if Linked Markers Across Windows is also enabled.

Remote command:
CALCulate<n>:MARKer<m>:LINK:TRENd on page 296

6.2.3 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.



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:
Chapter 8.5.2.3, "Positioning the marker", on page 298

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.

Remote command:
`CALCulate<n>:MARKer<m>:PEXCursion` on page 297

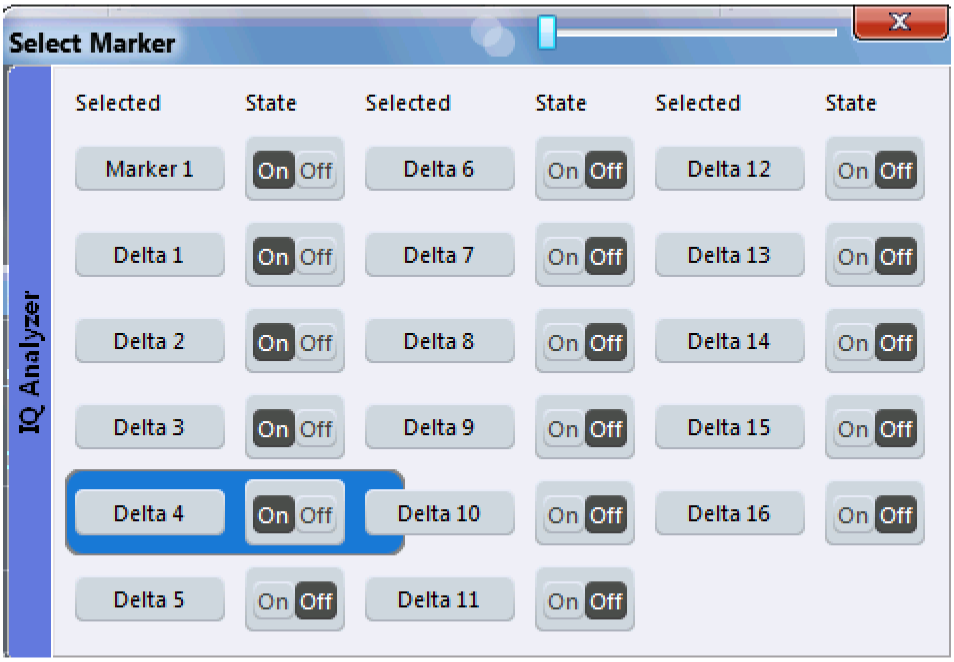
6.2.4 Marker positioning functions

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.

Select Marker

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 292
`CALCulate<n>:DELTamarker<m>[:STATe]` on page 294

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 299
`CALCulate<n>:DELTamarker<m>:MAXimum[:PEAK]` on page 301

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.

Remote command:
`CALCulate<n>:MARKer<m>:MAXimum:NEXT` on page 299
`CALCulate<n>:DELTamarker<m>:MAXimum:NEXT` on page 301

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 300
`CALCulate<n>:DELTamarker<m>:MINimum[:PEAK]` on page 302

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.

Remote command:
`CALCulate<n>:MARKer<m>:MINimum:NEXT` on page 299
`CALCulate<n>:DELTamarker<m>:MINimum:NEXT` on page 301

6.3 Trace configuration

Access: "Trace > Trace..."

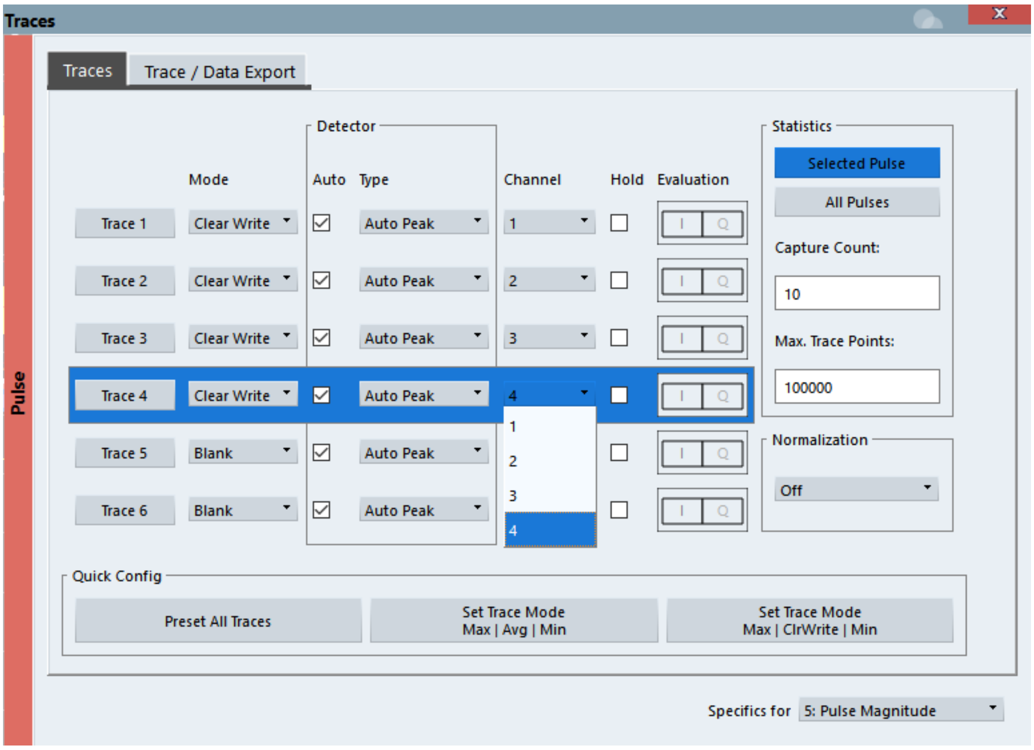
Traces in graphical result displays based on the defined result range (see Chapter 6.1.2, "Result range", on page 100) can be configured, for example to perform statistical evaluations over a defined number of measurements, pulses, or samples.

For details on trace evaluation see Chapter 4.5, "Trace evaluation", on page 57.

Trace data can also be exported to an ASCII file for further analysis. For details see Chapter 6.4, "Trace / data export configuration", on page 129.

You can configure up to 6 individual traces for the following result displays (see Chapter 6.1.2, "Result range", on page 100):

- "Pulse Frequency" on page 36
- "Pulse Magnitude" on page 37
- "Pulse Phase" on page 38
- "Pulse Phase (Wrapped)" on page 39



Trace 1/Trace 2/Trace 3/Trace 4/Trace 5/Trace 6

Selects the corresponding trace for configuration. The currently selected trace is highlighted orange.

For the Magnitude Capture result display, only one trace is available, which cannot be configured.

Remote command:

`DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>[:STATe]` on page 288

Selected via numeric suffix of `TRACe<t>` commands

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"	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.
"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.
"Average"	The average is formed over several measurements. (See also Chapter 4.5.1, "Trace statistics", on page 57.)
"View"	The current contents of the trace memory are frozen and displayed. **Note:** 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&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.
"Blank"	Removes the selected trace from the display.

Remote command:
`DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:MODE` on page 285

Detector

Defines the trace detector to be used for trace analysis.

"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 289
`[SENSe:][WINDow<n>:]DETector<t>[:FUNCtion]:AUTO` on page 289

Channel

The channel selection is only available with option R&S VSE-K6A installed. It provides funtionality to assign a trace to a specified measurement channel.

Remote command:
`CALCulate<n>:TRACe<t>[:VALue]:CHANnel` on page 307

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 286

Evaluation
Defines which signal component (I/Q) is evaluated in which trace for the Pulse I and Q result display. This setting is not available for any other result displays. By default, the I component is displayed by trace 1, while the Q component is displayed by trace 4.

Remote command:
`CALCulate<n>:TRACe<t>[:VALue]` on page 307

Statistical Evaluation
If the trace modes "Average", "Max Hold" or "Min Hold" are set, you can define how many pulses, measurements and measurement samples are included in the statistical evaluation.

For details see Chapter 4.5.1, "Trace statistics", on page 57.

Selected Pulse vs All Pulses ← Statistical Evaluation
Defines which pulses are included in the statistical evaluation.

"Selected pulse"	Only the selected pulse from each measurement is included in the statistical evaluation.
"All Pulses"	All measured pulses from each measurement are included in the statistical evaluation.

Remote command:
`[SENSe:]STATistic<n>:TYPE` on page 290

Capture Count ← Statistical Evaluation
Defines the number of measurements to be performed in the single capture mode.

Maximum number of trace points ← Statistical Evaluation
If the number of samples within the result range (see Chapter 6.1.2, "Result range", on page 100) is larger than this value, the trace data is reduced to the defined maximum number of trace points using the selected detector.

Restricting this value can improve performance during statistical evaluation of large result range lengths.

Remote command:
`[SENSe:]SWEep:POINts` on page 290

Normalization
Enables or disables normalization of the trace in reference to the measured pulse or a reference pulse. For details see Chapter 4.5.2, "Normalizing traces", on page 58.

"Off"	Traces are not normalized
"Measured Pulse"	The value in the measurement point (that is: the value in the "Pulse Results" table) for each pulse in phase, amplitude or frequency is subtracted from the respective trace to normalize each trace to 0. An additional phase offset may be defined, see "Phase Normalization" on page 116.
"Reference Pulse"	The value in the measurement point (that is: the value in the "Pulse Results" table) for the *Reference Pulse* is subtracted from the respective trace to normalize the traces. The reference pulse is defined in the "Measurement Point" settings, see "Reference for Pulse-Pulse Measurements" on page 96. An additional phase offset may be defined, see "Phase Normalization" on page 116.

Remote command:
`DISPlay[:WINDow<n>]:TRACe<t>:NORMalize:MODE` on page 286

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
		Blank
Set Trace Mode Max | Avg | Min	Trace 1:	Max Hold
	Trace 2:	Average
	Trace 3:	Min Hold
		Blank
Set Trace Mode Max | ClrWrite | Min	Trace 1:	Max Hold
	Trace 2:	Clear Write
	Trace 3:	Min Hold
		Blank

Trace 1 / Trace 2 / Trace 3 / Trace 4 (Softkeys)
Displays the "Traces" settings and focuses the "Mode" list for the selected trace.

Remote command:
`DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>[:STATe]` on page 288

6.4 Trace / data export configuration

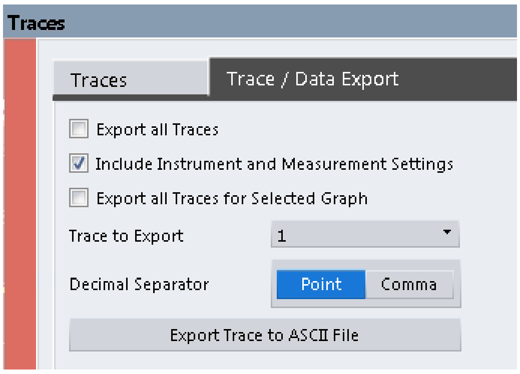
Access: "Trace" > "Trace" > "Trace / Data Export"

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.

See the R&S VSE base software user manual for a description of the standard functions.



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 367

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 366

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.

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 366

Export Trace to ASCII File
Opens a file selection dialog box and saves the selected trace in ASCII format (**.dat**) to the specified file and directory.

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.

Note: Traces resulting from encrypted file input cannot be exported.

Remote command:
`MMEMory:STORe<n>:TRACe` on page 308

7 How to perform measurements in the pulse application

The following step-by-step instructions demonstrate how to perform a Pulse measurement with the R&S VSE Pulse application.

7.1 How to perform a standard pulse measurement

To perform a standard pulse measurement

1. Open a new channel or replace an existing one and select the "Pulse" application.
2. Configure the input source to be used as described in the R&S VSE Base Software User Manual.
3. Select the "Meas Setup > Overview" menu item to display the "Overview" for a Pulse measurement.
4. Select the "Signal Description" button and configure the expected pulse characteristics.
5. Select the "Input/Frontend" button to define the input signal's center frequency, amplitude and other basic settings.
6. Optionally, select the "Trigger" button and define a trigger for data acquisition, for example an external trigger to start capturing data only when a useful signal is transmitted.
7. Select the "Data Acquisition" button and define the bandwidth parameters for the input signal:
   - "Measurement Bandwidth": the amount of signal bandwidth to be captured
   - "Measurement Time": how long the input signal is to be captured
8. Select the "Pulse Detection" button and define the criteria to detect the individual pulses within the input signal.
9. Select the "Measurement" button and define the general measurement settings concerning:
   - the measurement levels
   - the measurement point
   - the measurement range
10. Select the "Add Window" icon from the toolbar to add further result displays for the Pulse channel.

11. Select "Meas Setup > Overview" to display the "Overview".
12. Select the "Result Config" button in the "Overview" to configure which data is displayed in the individual result displays, and other settings for specific evaluation methods. These settings can be configured individually for each window, so select the window first and then configure the settings.
    - Define the "Result Range", which determines the extent of measured data displayed in pulse magnitude, frequency and phase vs time traces.
    - Configure specific settings for the selected evaluation method(s).
    - Configure a limit check (see Chapter 7.2, "How to configure a limit check for a pulse measurement", on page 133)
    - Configure markers and delta markers to determine deviations and offsets within the results, e.g. when comparing errors or peaks.
    - Adapt the diagram scaling to the displayed data.
    - Optionally, configure the trace to display the average over a series of measurements. If necessary, increase the "Capture/Average Count" in the "Capture" dialog box.
13. In the "Control" toolbar, or in the "Sequence" tool window, select ➝| "Single" capture mode, then select the ▶ "Capture" function to stop the continuous measurement mode and start a defined number of measurements.
14. Select "Meas Setup > Selected Pulse" and select a specific pulse to be evaluated.

    The result displays are updated to show the results for the selected pulse.

7.2 How to configure a limit check for a pulse measurement

To configure a limit check for a pulse measurement

Measurement results can be checked against defined limits and the results of the limit check can then be indicated in the Result Table. This procedure assumes a standard pulse measurement has been defined (as described in Chapter 7.1, "How to perform a standard pulse measurement", on page 132) and a Result Table display is active.

1. Select the "Result Config" button in the "Overview".
2. If necessary, select the Result Table from the "Specifics for" list of windows.
3. Switch to the "Table Config" tab, then select the "Limits" tab.
4. Select the parameter for which you want to perform a limit check.
   For details on available parameters and parameter groups see Chapter 3.1, "Pulse parameters", on page 15.
5. Toggle the "Limit On/Off" setting to "On".
6. Define the lower or upper limit value, or both.

7. Repeat step 5 to step 6 for each parameter you want to perform a limit check on.

   The measured values and all newly measured values for the specified parameter are compared to the defined limit values.
   If the measured value remains above the lower limit and below the upper limit, it is displayed in green in the Result Table.
   If the measured value exceeds either limit value, it it displayed in red in the Result Table.

Changing the limit values graphically

Limit lines can also be displayed in Parameter Trend or Parameter Distribution result displays ("Meas Setup > Result Config" > "Parameter" tab > "Display Limit Lines").

You can drag these limit lines to a new position in the window. The new position is maintained, the limit check is repeated, and the results of the limit check in any active table displays are adapted.

To deactivate a limit check

1. Select the "Result Config" button in the "Overview".
2. If necessary, select the Result Table from the "Specifics for" list of windows.
3. Switch to the "Table Config" tab, then select the "Limits" tab.
4. - To deactivate the limit check for a single parameter, select the parameter and toggle the "Limit On/Off" setting to "Off".
   - To deactivate the limit check for an entire parameter group, select "Turn off all limits in group".
   - To deactivate the limit check for all parameters in all parameter groups, select "Turn off limits".

8 Remote commands for pulse measurements

The following commands are required to perform measurements in the R&S VSE Pulse application in a remote environment.

It is assumed that the R&S VSE has already been set up for remote control in a network as described in the R&S VSE Base Software User Manual.

General R&S VSE Remote Commands

The application-independent remote commands for general tasks on the R&S VSE are also available for Pulse measurements and are described in the R&S VSE Base Software User Manual. In particular, this comprises the following functionality:

- Controlling instruments and capturing data
- Managing Settings and Results
- Setting Up the Instrument
- Using the Status Register

Channel-specific commands

Apart from a few general commands on the R&S VSE, most commands refer to the currently active channel. Thus, always remember to activate a Pulsechannel before starting a remote program for a Pulsemeasurement.

After a short introduction, the tasks specific to the Pulse application are described here:

8.1 Introduction

Commands are program messages that a controller (e.g. a PC) sends to the instrument or software. They operate its functions ('setting commands' or 'events') and request information ('query commands'). Some commands can only be used in one way, others work in two ways (setting and query). If not indicated otherwise, the commands can be used for settings and queries.

The syntax of a SCPI command consists of a header and, usually, one or more parameters. To use a command as a query, you have to append a question mark after the last header element, even if the command contains a parameter.

A header contains one or more keywords, separated by a colon. Header and parameters are separated by a "white space" (ASCII code 0 to 9, 11 to 32 decimal, e.g. blank). If there is more than one parameter for a command, they are separated by a comma from one another.

Only the most important characteristics that you need to know when working with SCPI commands are described here. For a more complete description, refer to the user manual of the R&S VSE.

Remote command examples

Note that some remote command examples mentioned in this general introduction are possibly not supported by this particular application.

8.1.1 Conventions used in 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.

8.1.2 Long and short form

The keywords have a long and a short form. You can use either the long or the short form, but no other abbreviations of the keywords.

The short form is emphasized in uppercase letters. Note however, that this emphasis only serves the purpose to distinguish the short from the long form in the manual. For the instrument, the case does not matter.

Example:

`SENSe:FREQuency:CENTer` is the same as `SENS:FREQ:CENT`.

8.1.3 Numeric suffixes

Some keywords have a numeric suffix if the command can be applied to multiple instances of an object. In that case, the suffix selects a particular instance (e.g. a measurement window).

Numeric suffixes are indicated by angular brackets (<n>) next to the keyword.

If you do not quote a suffix for keywords that support one, a 1 is assumed.

Example:

`DISPlay[:WINDow<1...4>]:ZOOM:STATe` enables the zoom in a particular measurement window, selected by the suffix at `WINDow`.

`DISPlay:WINDow4:ZOOM:STATe ON` refers to window 4.

8.1.4 Optional keywords

Some keywords are optional and are only part of the syntax because of SCPI compliance. You can include them in the header or not.

If an optional keyword has a numeric suffix and you need to use the suffix, you have to include the optional keyword. Otherwise, the suffix of the missing keyword is assumed to be the value 1.

Optional keywords are emphasized with square brackets.

Example:

Without a numeric suffix in the optional keyword:

`[SENSe:]FREQuency:CENTer` is the same as `FREQuency:CENTer`

With a numeric suffix in the optional keyword:

`DISPlay[:WINDow<1...4>]:ZOOM:STATe`

`DISPlay:ZOOM:STATe ON` enables the zoom in window 1 (no suffix).

`DISPlay:WINDow4:ZOOM:STATe ON` enables the zoom in window 4.

8.1.5 Alternative keywords

A vertical stroke indicates alternatives for a specific keyword. You can use both keywords to the same effect.

Example:

`[SENSe:]BANDwidth|BWIDth[:RESolution]`

In the short form without optional keywords, `BAND 1MHZ` would have the same effect as `BWID 1MHZ`.

8.1.6 SCPI parameters

Many commands feature one or more parameters.

If a command supports more than one parameter, they are separated by a comma.

Example:

`LAYout:ADD:WINDow Spectrum,LEFT,MTABle`

Parameters can have different forms of values.

8.1.6.1 Numeric values

Numeric values can be entered in any form, i.e. with sign, decimal point or exponent. For physical quantities, you can also add the unit. If the unit is missing, the command uses the basic unit.

Example:

With unit: `SENSe:FREQuency:CENTer 1GHZ`

Without unit: `SENSe:FREQuency:CENTer 1E9` would also set a frequency of 1 GHz.

Values exceeding the resolution of the instrument are rounded up or down.

If the number you have entered is not supported (e.g. for discrete steps), the command returns an error.

Instead of a number, you can also set numeric values with a text parameter in special cases.

- MIN/MAX
  Defines the minimum or maximum numeric value that is supported.
- DEF
  Defines the default value.

- UP/DOWN
  Increases or decreases the numeric value by one step. The step size depends on the setting. Sometimes, you can customize the step size with a corresponding command.

Querying numeric values

When you query numeric values, the system returns a number. For physical quantities, it applies the basic unit (e.g. Hz for frequencies). The number of digits after the decimal point depends on the type of numeric value.

Example:

Setting: `SENSe:FREQuency:CENTer 1GHZ`

Query: `SENSe:FREQuency:CENTer?` would return `1E9`

Sometimes, numeric values are returned as text.

- INF/NINF
  Infinity or negative infinity. Represents the numeric values 9.9E37 or -9.9E37.
- NAN
  Not a number. Represents the numeric value 9.91E37. NAN is returned if errors occur.

8.1.6.2 Boolean

Boolean parameters represent two states. The "on" state (logically true) is represented by "`ON`" or the numeric value 1. The "off" state (logically untrue) is represented by "`OFF`" or the numeric value 0.

Querying Boolean parameters

When you query Boolean parameters, the system returns either the value 1 ("`ON`") or the value 0 ("`OFF`").

Example:

Setting: `DISPlay:WINDow:ZOOM:STATe ON`

Query: `DISPlay:WINDow:ZOOM:STATe?` would return `1`

8.1.6.3 Character data

Character data follows the syntactic rules of keywords. You can enter text using a short or a long form. For more information, see Chapter 8.1.2, "Long and short form", on page 137.

Querying text parameters

When you query text parameters, the system returns its short form.

Example:

Setting: `SENSe:BANDwidth:RESolution:TYPE NORMal`

Query: `SENSe:BANDwidth:RESolution:TYPE?` would return `NORM`

8.1.6.4 Character strings

Strings are alphanumeric characters. They have to be in straight quotation marks. You can use a single quotation mark (') or a double quotation mark (").

Example:

`INSTRument:DELete 'Spectrum'`

8.1.6.5 Block data

Block data is a format which is suitable for the transmission of large amounts of data.

The ASCII character # introduces the data block. The next number indicates how many of the following digits describe the length of the data block. The data bytes follow. During the transmission of these data bytes, all end or other control signs are ignored until all bytes are transmitted. #0 specifies a data block of indefinite length. The use of the indefinite format requires an `NL^END` message to terminate the data block. This format is useful when the length of the transmission is not known or if speed or other considerations prevent segmentation of the data into blocks of definite length.

8.2 Common suffixes

In the R&S VSE Pulse application, the following common suffixes are used in remote commands:

Table 8-1: Common suffixes used in remote commands in the R&S VSE Pulse application

Suffix	Value range	Description
<m>	1 to 16	Marker
<n>	1 to x	Window (**in the currently selected channel**)
<t>	1	Trace
	1 to 8	Limit line

8.3 Activating Pulse measurements

Pulse measurements require a special application in the R&S VSE. The common commands for configuring and controlling measurement channels, as well as blocks and sequences, are also used in the R&S VSE Pulse application.

They are described in the R&S VSE base software user manual.

8.4 Configuring the measurement

The following remote commands are required to configure a Pulse measurement.

8.4.1 Restoring the default configuration (Preset)

SYSTem:PRESet:CHANnel[:EXEC]

Restores the default software settings in the current channel.

Use `INST:SEL` to select the channel.

Example: `INST:SEL 'Spectrum2'`
Selects the channel for "Spectrum2".
`SYST:PRES:CHAN:EXEC`
Restores the factory default settings to the "Spectrum2" channel.

Usage: Event

Manual operation: See "Preset Channel" on page 64

8.4.2 Signal description

The signal description provides information on the expected input signal, which optimizes pulse detection.

SENSe:TRACe:MEASurement:DEFine:DURation:AUTO <State>

If this flag is set to ON, the pulse timing parameters (min/max width, min off time) are determined automatically from the current capture settings.

Parameters:

<State> ON | OFF | 0 | 1

*RST: 1

Manual operation: See "Timing Auto Mode" on page 65

SENSe:TRACe:MEASurement:DEFine:DURation:MAX <PulseMaxWidth>

Defines a maximum pulse width; pulses outside this range are not detected. The available value range may be restricted by the sample rate.

Parameters:

<PulseMaxWidth> Range: 50ns to 100s
*RST: 5 ms
Default unit: S

Manual operation: See "Maximum Pulse Width" on page 66

SENSe:TRACe:MEASurement:DEFine:DURation:MIN <PulseMinWidth>

Defines a minimum pulse width; pulses outside this range are not detected. The available value range may be restricted by the sample rate.

Parameters:

<PulseMinWidth> Range: 50ns to 100s
*RST: 50 ns
Default unit: S

Manual operation: See "Minimum Pulse Width" on page 66

SENSe:TRACe:MEASurement:DEFine:DURation:OFF <PulseMinOff>

The minimum time the pulse is "off", i.e. the time between successive pulses. This value is used to determine noise statistics and to reject short drops in amplitude during pulse "ON" time. The available value range may be restricted by the sample rate.

Parameters:

<PulseMinOff> Range: 50ns to 100s
*RST: 1 us
Default unit: S

Manual operation: See "Min Pulse Off Time" on page 66

SENSe:TRACe:MEASurement:DEFine:FREQuency:OFFSet <Offset>

For `SENSe:TRACe:MEASurement:DEFine:FREQuency:OFFSet:AUTO` `OFF`, this command defines the value to use when calculating pulse frequency and phase error on a pulse-by-pulse basis. The same value is used for all pulses. Note that compensation for a frequency offset is reflected in the pulse frequency/phase error results, but does not alter the original I/Q data or the pulse frequency/phase trace displays.

Parameters:

<Offset> *RST: 0
Default unit: HZ

Manual operation: See "Frequency Offset Value" on page 66

SENSe:TRACe:MEASurement:DEFine:FREQuency:OFFSet:AUTO <State>

If enabled, the frequency offset is considered when calculating the pulse frequency and phase error on a pulse-by-pulse basis. A different value can be determined for each pulse. Note that compensation for a frequency offset is reflected in the pulse frequency/phase error results, but does not alter the original I/Q data or the pulse frequency/phase trace displays.

Parameters:

<State> ON | OFF | 0 | 1
*RST: 1

Manual operation: See "Frequency Offset Auto Mode" on page 66

SENSe:TRACe:MEASurement:DEFine:FREQuency:RATE <PulseChirpRate>

Defines a known frequency chirp rate (in Hz/µs) to be used to generate an ideal pulse waveform for computing frequency and phase error parameters. This value is assumed constant for all measured pulses.

Use the `SENSe:TRACe:MEASurement:DEFine:FREQuency:RATE:AUTO` to define the chirp rate automatically.

Parameters:

<PulseChirpRate> *RST: 0
Default unit: Hz/µs

Manual operation: See "Chirp Rate" on page 67

SENSe:TRACe:MEASurement:DEFine:FREQuency:RATE:AUTO <State>

If enabled, the chirp rate is estimated automatically for each individual pulse.

Parameters:

<State> ON | OFF | 0 | 1
*RST: 1

Manual operation: See "Chirp Rate Auto Mode" on page 67

SENSe:TRACe:MEASurement:DEFine:PULSe:ADRoop <State>

Parameters:

<State> ON | OFF | 0 | 1

*RST: 1

Manual operation: See "Pulse Has Droop" on page 65

SENSe:TRACe:MEASurement:DEFine:PULSe:MODulation <Modulation>

The type of pulse modulation which is expected.

Parameters:

<Modulation> ARB | CW | LFM | RIQ

ARB
Arbitrary

CW
Continuous wave

LFM
Linear FM (fixed value)

*RST: CW

Manual operation: See "Pulse Modulation" on page 65

SENSe:TRACe:MEASurement:DEFine:PULSe:PERiod <PulsePeriod>

Defines how a pulse is detected.

Parameters:

<PulsePeriod> HL | LH

HL
The pulse period begins with the falling edge of the preceding pulse and ends with the falling edge of the current pulse.

LH
The pulse period begins with the rising edge of the current pulse and end with the rising edge of the succeeding pulse.

*RST: HL

Manual operation: See "Pulse Period" on page 65

8.4.3 Configuring data input

The following commands are required to configure data input.

Data output is described in the R&S VSE Base Software User Manual.

8.4.3.1 RF input

Remote commands exclusive to configuring RF input:

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.

(For details on the status register see the R&S VSE base software user manual).

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 73

INPut<ip>:COUPling<ant> <CouplingType>

Selects the coupling type of the RF input.

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 69

INPut<ip>:DPATh <DirectPath>

Enables or disables the use of the direct path for frequencies close to 0 Hz.

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 70

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:

<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:FILE:ZPAD ON`

Manual operation: See "Zero Padding" on page 75

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 70

INPut<ip>:FILTer:YIG[:STATe] <State>

Enables or disables the YIG filter.

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 70

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:
<Impedance> 50 | 75

*RST: 50 Ω
Default unit: OHM

Example: `INP:IMP 75`

Manual operation: See "Impedance " on page 69

INPut<ip>:PRESelection:SET <Mode>

Selects the preselector mode.

The command is available with the optional preselector.

Suffix:

<ip>	1..n

Parameters:

<Mode>

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 73

INPut<ip>:PRESelection[:STATe] <State>

Turns the preselector on and off.

Suffix:

<ip>	1 | 2 irrelevant

Manual operation: See "Preselector State" on page 72

INPut<ip>:RF:CAPMode <CAPMode>

Determines how data from an oscilloscope is input to the R&S VSE software.

Is only available for connected oscilloscopes.

Suffix:

<ip>	1..n

Parameters:

<CAPMode> 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 71

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 149).

This setting is only available if an R&S oscilloscope is used to obtain the input data.

Suffix:

<ip> 1..n

Parameters:

<SamplingRate> 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 72

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 149).

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 72

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.

Parameters:

<Source>

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 68

INPut:TYPE <Input>

The command selects the input path for R&S FSW85 models.

Parameters:

<Input>

INPUT1
Selects RF input 1.

INPUT2
Selects RF input 2.

*RST: INPUT1

Example:
//Select input path
```
INP:TYPE INPUT1
```

Manual operation: See "Input 1 / Input 2" on page 69

INSTrument:BLOCk:CHANnel[:SETTings]:SOURce<si> <Type>

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

Suffix:

<si> 1 to 99
LTE-MIMO only: input source number

Parameters:

<Type> FILE | DEVice | NONE

FILE
A loaded file is used for input.

DEVice
A configured device provides input for the measurement

NONE
No input source defined.

Manual operation: See "Input Type (Instrument / File)" on page 68

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>

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: Ī (neg.)
Channel 3: Q (pos.)
Channel 4: Q̄ (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

SYSTem:COMMunicate:RDEVice:OSCilloscope[:STATe] <State>

Activates the optional 2 GHz bandwidth extension (R&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

OFF | 0
Switches the function off

ON | 1
Switches the function on

Example: `SYST:COMM:RDEV:OSC ON`

Manual operation: See "B2000 State" on page 71

SYSTem:COMMunicate:RDEVice:OSCilloscope:TCPip <Address>

Defines the TCPIP address or computer name of the oscilloscope connected to the R&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 72

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 72

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 72

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

8.4.3.2 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

The basic settings concern general usage of an external mixer.

[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`

[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 156).

Suffix:
<x> 1..n
irrelevant

Parameters:
<BiasSetting> *RST: 0.0 A
Default unit: A

[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 156).

Suffix:
<x> 1..n
irrelevant

Parameters:
<BiasSetting> *RST: 0.0 A
Default unit: A

[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`

Mixer settings

The following commands are required to configure the band and specific mixer settings.

[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 156).

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.

[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.

[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.

[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:PRES`
Presets the selected waveguide band.

[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 156).

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.

Table 8-2: 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`

[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
```

[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`

[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`

[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 162.

Usage: Query only

[SENSe:]MIXer<x>:LOSS:HIGH <Average>

Defines the average conversion loss to be used for the entire high (second) range.

Suffix:

<x>	1..n

Parameters:

<Average>	Range: 0 to 100 *RST: 24.0 dB Default unit: dB

Example: `MIX:LOSS:HIGH 20dB`

[SENSe:]MIXer<x>:LOSS:TABLe:HIGH <FileName>

Defines the conversion loss table to be used for the high (second) range.

Suffix:

<x>	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 (`.acl` file).

[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:

<x>	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 (`.acl` file).

Example:

```
MIX:LOSS:TABL '101567'
MIX:LOSS:TABL?
//Result:
'101567_MAG_6_B5000_3G5.B5G'
```

[SENSe:]MIXer<x>:LOSS[:LOW] <Average>

Defines the average conversion loss to be used for the entire low (first) range.

Suffix:

<x>	1..n

Parameters:

<Average>	Range: 0 to 100 *RST: 24.0 dB Default unit: dB

Example:

```
MIX:LOSS 20dB
```

[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`

[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

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.

```
//--------------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: 47480000000 (47.48 GHz)
```

```
SENS:MIX:FREQ:STOP?
//Result: 138020000000 (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
```

8.4.3.3 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 151
- [SENSe<ip>:]FREQuency:CENTer on page 179
- DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:RLEVel<ant> on page 180
- INPut<ip>:ATTenuation:AUTO on page 183
- INPut<ip>:ATTenuation on page 182

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.

[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:

<ch> 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"`

[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 164.

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

[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 166.

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
```

[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
```

[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

[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

[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 166 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

[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 166 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

[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 168.

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"
```

[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

[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"
```

[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

[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

[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 169.

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
```

[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

[SENSe:]EFRontend:IDN?

Queries the device identifcation 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.

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
```

8.4.3.4 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

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`

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

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".

Configuring power sensor measurements

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

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.

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

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`

[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%.

[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.

[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

[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.

[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.

[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.

[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.

[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`

[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.

[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.

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`

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`

8.4.4 Frontend configuration

The following commands are required to configure frequency and amplitude settings, which represent the "frontend" of the measurement setup.

8.4.4.1 Frequency

[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: fmax/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 76

[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 179.

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 76

[SENSe:]FREQuency:CENTer:STEP:AUTO <State>

This command couples or decouples the center frequency step size to the span.

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 77.

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 77

8.4.4.2 Amplitude settings

The following commands are required to configure the amplitude settings in a remote environment.

Useful commands for amplitude settings described elsewhere:

- `INPut<ip>:COUPling<ant>` on page 146
- `INPut<ip>:IMPedance<ant>` on page 148
- `DISPlay[:WINDow<n>][:SUBWindow<n>]:TRACe<t>:Y[:SCALe]:AUTO` on page 282

Remote commands exclusive to amplitude settings:

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 78

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 79

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.

Depending on the connected instrument, the preamplification is defined by `INPut<ip>:GAIN<ant>[:VALue]`.

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 80

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 181).

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 80

8.4.4.3 Configuring the attenuation

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 184).

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.

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 "Attenuation Mode / Value " on page 79

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.

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 "Attenuation Mode / Value " on page 79

INPut:EATT <Attenuation>

Defines an electronic attenuation manually. Automatic mode must be switched off (`INP:EATT:AUTO OFF`, see `INPut:EATT:AUTO` on page 184).

If the current reference level is not compatible with an attenuation that has been set manually, the command also adjusts the reference level.

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 79

INPut:EATT:AUTO <State>

Turns automatic selection of the electronic attenuation on and off.

If on, electronic attenuation reduces the mechanical attenuation whenever possible.

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 79

INPut:EATT:STATe <State>

Turns the electronic attenuator on and off.

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 79

8.4.5 Triggering measurements

Useful commands for triggering described elsewhere:

- `[SENSe<ip>:]FREQuency:CENTer` on page 179

Remote commands exclusive to triggering:

8.4.5.1 Configuring the triggering conditions

The following commands are required to configure triggered measurements.

Note that the availability of trigger settings depends on the connected instrument.

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 84

TRIGger[:SEQuence]:HOLDoff[:TIME] <Offset>

Defines the time offset between the trigger event and the start of the measurement.

A negative offset is possible for time domain measurements.

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 84

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).

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 85

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 85

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 84

TRIGger[:SEQuence]:LEVel[:EXTernal<port>] <TriggerLevel>

Defines the level the external signal must exceed to cause a trigger event.

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 84

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 84

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 84

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`

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 85

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 85

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 84

TRIGger[:SEQuence]:RFPower:HOLDoff <Time>

Parameters:

<Time> Default unit: S

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 85

TRIGger[:SEQuence]:SOURce <Source>

Selects the trigger source.

Note that the availability of trigger sources depends on the connected instrument.

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.

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.

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.

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.

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 "Trigger Source" on page 82
See "Free Run " on page 82
See "External Trigger / Trigger Channel X" on page 82
See "I/Q Power " on page 82
See "IF Power " on page 83
See "RF Power " on page 83
See "Manual" on page 83

8.4.5.2 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 <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

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`

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

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.

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`

8.4.6 Segmented data capturing

Configures data capturing with a gating function, that is non-continuous data acquisition.

Segmented capture is only possible if an R&S RTO or R&S RTP device is connected and an external trigger or trigger channel <n> is used (see "Trigger Source" on page 82).

[SENSe:]SWEep:SCAPture:EVENts <Count>

Specifies the number of trigger events for which data segments are to be captured.

Parameters:
<Count> numeric value
*RST: 2

Manual operation: See "Events" on page 86

[SENSe:]SWEep:SCAPture:LENGth[:TIME] <Time>

Defines a time period (starting from the trigger offset) in which data is captured. If multiple events occur within one segment length, the segment is extended (see "Number of events vs number of segments" on page 55).

Parameters:
<Time> *RST: 0
Default unit: s

Manual operation: See "Segment Length" on page 86

[SENSe:]SWEep:SCAPture:OFFSet[:TIME] <Time>

Defines an offset to the trigger event at which data capturing starts. For a negative offset, data capturing starts before the actual trigger event.

Parameters:

<Time> *RST: 0
Default unit: s

Manual operation: See "Trigger Offset" on page 86

[SENSe:]SWEep:SCAPture[:STATe] <State>

If activated, data is captured for the specified duration before and after each trigger event, for the specified number of trigger events. The signal data between these capture times is not stored in the capture buffer.

Parameters:

<State> ON | OFF | 0 | 1

OFF | 0
Switches the function off

ON | 1
Switches the function on

*RST: 0

Example:

```
//Configure a power trigger at -20dBm
TRIG:SOUR RFP
TRIG:LEV:RFP -20dBm
//Activate segmented capture
SENS:SWE:SCAP ON
//Define a pretrigger offset of 5 us
SENS:SWE:SCAP:OFFS -5 us
//Capture data for 20us for 20 trigger events
SENS:SWE:SCAP:EVEN 20
SENS:SWE:SCAP:LENG 20 us

//Select single sweep mode.
INIT:CONT OFF
//Initiate a new measurement and wait until the sweep
//has finished.
INIT;*WAI

//Query the timestamps at which segments were captured
TRAC:IQ:SCAP:TST:SST?
//Query the timestamps at which trigger events occured
TRAC:IQ:SCAP:TST:TRIG?
```

Manual operation: See "Activating/de-activating segmented data capturing" on page 86

TRACe<n>:IQ:SCAPture:BOUNdary?

This remote control command returns an array of sample indices for the start of each captured data segment. The length of the array depends on the number of trigger events specified by `[SENSe:]SWEep:SCAPture:EVENts` on page 193.

Suffix:
<n> 1..n
Window

Return values:
<Data>

Example: See TRACe<n>:IQ:SCAPture:TSTamp:SSTart? on page 195.

Usage: Query only

TRACe<n>:IQ:SCAPture:TSTamp:SSTart?

This remote control command returns an array of timestamps for each segment start in the captured data. The length of the array depends on the number of trigger events specified by [SENSe:]SWEep:SCAPture:EVENts on page 193. For details see "Timestamps vs. sample number" on page 56.

Suffix:
<n> 1..n
Window

Return values:
<Data>

Example:

```
//Configure a power trigger at -20dBm
TRIG:SOUR RFP
TRIG:LEV:RFP -20dBm
//Activate segmented capture
SENS:SWE:SCAP ON
//Define a pretrigger offset of 5 us
SENS:SWE:SCAP:OFFS -5 us
//Capture data for 25us for 10 trigger events
SENS:SWE:SCAP:EVEN 10
SENS:SWE:SCAP:LENG 25 us
//Query the sample rate
SRATE?
//Result: 200 MHz
//Measurement time = 10 Events * Segment Len (25 us) = 250 us
//Record length = Sample Rate(200 MHz)*Meas Time(250us)=50000

//Select single sweep mode.
INIT:CONT OFF
//Initiate a new measurement and wait until the sweep
//has finished.
INIT;*WAI

//Query the sample indices at which segments start
TRAC:IQ:SCAP:BOUN?
//Result:
//0,5000,10000,15000,20000,25000,30000,35000,40000,45000

//Query the timestamps at which segments were captured
TRAC:IQ:SCAP:TST:SST?
//Result:
//-4.999999874E-006,+7.450049743E-004,+1.494999975E-003,
//+2.245004987E-003,+2.994999988E-003,+3.745000111E-003,
//+4.495000001E-003,+5.245004781E-003,+5.994999781E-003,
//+6.745005026E-003

//Query the timestamps at which trigger events occured
TRAC:IQ:SCAP:TST:TRIG?
//Result:
//+0.000000000,+7.500050124E-004,+1.500000013E-003,
//+2.250005025E-003,+3.000000026E-003,+3.749999916E-003,
//+4.499999806E-003,+5.250005051E-003,+6.000000052E-003,
//+6.750004832E-003
```

Usage: Query only

Manual operation: See "Trigger Offset" on page 86

TRACe<n>:IQ:SCAPture:TSTamp:TRIGger?

This remote control command returns an array of trigger event time stamps for the captured data segments. The length of the array depends on the number of trigger events specified by `[SENSe:]SWEep:SCAPture:EVENts` on page 193.

Suffix:

<n> 1..n
Window

Return values:

<Data>

Usage: Query only

Manual operation: See "Trigger Offset" on page 86

8.4.7 Data acquisition

The following commands are required to configure how much and how data is captured from the input signal.

[SENSe:]BANDwidth:DEMod <Bandwidth>
[SENSe:]BWIDth:DEMod <Bandwidth>

Sets/queries the measurement bandwidth in Hz.

The measurement bandwidth is defined by the used filter and the sample rate. For information on supported sample rates and filter bandwidths see the data sheet.

Parameters:

<Bandwidth> *RST: 80.0 MHz
Default unit: HZ

[SENSe:]FREQuency:SPAN <Span>

Defines the frequency span.

Parameters:

<Span> Range: 80 Hz to depends on options installed
*RST: maximum allowed
Default unit: Hz

[SENSe:]BANDwidth:DEMod:TYPE <FilterType>
[SENSe:]BWIDth:DEMod:TYPE <FilterType>

Defines the type of demodulation filter to be used. For information on supported filter bandwidths see the data sheet.

Parameters:

<FilterType> FLAT | GAUSs

FLAT
Standard flat demodulation filter

GAUSs
Gaussian filter for optimized settling behavior
For Gaussian filters with a large 3dB bandwidth (> 40 MHz, only available with the bandwidth extension option) the actual filter shape deviates strongly from the ideal Gauss filter outside a range of approximately ±80 MHz. For this range the flat filter is more accurate.
For details see Chapter D, "Effects of large gauss filters", on page 388.

*RST: GAUS

Manual operation: See "Filter type" on page 87

[SENSe:]DEMod:FMVF:TYPE <Filter>

Activates or deactivates additional filters applied after demodulation to filter out unwanted signals, or correct pre-emphasized input signals.

Parameters:

<Filter> NONE | LP01 | LP1 | LP5 | LP10 | LP25

NONE
No video filter applied

LP01
Low pass filter 0.1 % bandwidth

LP1
Low pass filter1 % bandwidth

LP5
Low pass filter 5 % bandwidth

LP10
Low pass filter 10 % bandwidth

LP25
Low pass filter 25 % bandwidth

Example:
```
SENS:DEM:FMVF:TYPE LP01
```

Manual operation: See "FM Video Bandwidth" on page 103

[SENSe:]RLENgth?

Returns the record length in samples set up for current measurement settings.

Usage: Query only

Manual operation: See "Record length" on page 88

[SENSe:]SRATe?

Returns the sample rate set up for current measurement settings.

Return values:

<SampleRate> Current sample rate used by the application.

Usage: Query only

[SENSe:]SWEep:TIME <Time>

Defines the measurement time. It automatically decouples the time from any other settings.

The maximum measurement time in the R&S VSE Pulse application is limited only by the available memory ("memory limit reached" message is shown in status bar). Note, however, that increasing the measurement time (and thus reducing the available memory space) may restrict the number of measurement channels that can be activated simultaneously on the R&S VSE.

Parameters:

<Time> refer to data sheet

*RST: depends on current settings (determined automatically)

Default unit: S

Manual operation: See "Measurement Time" on page 88

TRACe:IQ:LCAPture <State>

The long capture buffer provides functionality to use the full I/Q memory depth of the R&S VSE for data acquisition.

Parameters:

<State> AUTO | ON | OFF

AUTO
The long capture buffer is activated in case that the record length exceeds the amount of data which can be acquired within the standard memory capacity of the R&S VSE. If the record length decreases again, the long capture buffer is deactivated automatically.

ON
The long capture buffer is activated permanently. A data capture in a different measurement channel will overwrite and invalidate the acquired I/Q data. A red "IQ" icon in the channel tab indicates that the results for the channel no longer match the data currently in the capture buffer.

OFF
This is the default setting. Only the standard I/Q memory capacity of the R&S VSE is used. The available I/Q memory capacity is shared by all measurement channels.

8.4.8 Pulse detection

The pulse detection settings define the conditions under which a pulse is detected within the input signal.

[SENSe:]DETect:LIMit <State>

If enabled, the number of pulses to be detected is restricted. When the maximum number is exceeded, measurement is stopped for the current capture buffer. This limitation can be used to speed up the measurement if only a small number of pulses is of interest.

The maximum number of pulses to be detected is defined using the `[SENSe:]DETect:LIMit:COUNt` command.

Parameters:

<State> ON | OFF | 0 | 1

OFF | 0
Switches the function off

ON | 1
Switches the function on

*RST: 0

Manual operation: See "Detection Limit" on page 90

[SENSe:]DETect:LIMit:COUNt <MaxPulseCount>

Defines the maximum number of pulses to be detected.

This limit is only considered if `[SENSe:]DETect:LIMit` is enabled.

Parameters:

<MaxPulseCount> integer

Range: 0 to see data sheet
*RST: 1000

Manual operation: See "Maximum Pulse Count" on page 90

[SENSe:]DETect:HYSTeresis <Hysteresis>

Defines a hysteresis for pulse detection in dB in relation to the defined threshold (see `[SENSe:]DETect:THReshold` on page 202). As long as the signal does not exceed the hysteresis, the next threshold crossing is ignored.

Parameters:

<Hysteresis> *RST: 0
Default unit: DB

Manual operation: See "Hysteresis" on page 90

[SENSe:]DETect:RANGe <State>

Enables or disables the use of a detection range instead of the entire capture buffer for analysis.

Parameters:

<State> ON | OFF | 0 | 1

OFF | 0
The entire capture buffer is analyzed.

ON | 1
The range defined by `[SENSe:]DETect:RANGe:STARt` and `[SENSe:]DETect:RANGe:LENGth` is analyzed.

*RST: 0

Example:

```
SENS:DET:RANG ON
SENS:DET:RANG:STAR 10ms
SENS:DET:RANG:LENG 100ms
```

Manual operation: See "Detection Range" on page 90

[SENSe:]DETect:RANGe:LENGth <DetectionStart>

Defines the length of the detection range as a time in seconds.

Is only available for `[SENSe:]DETect:RANGe ON`.

Parameters:

<DetectionStart> Default unit: S

Example:

```
SENS:DET:RANG ON
SENS:DET:RANG:STAR 10ms
SENS:DET:RANG:LENG 100ms
```

Manual operation: See "Detection Length" on page 91

[SENSe:]DETect:RANGe:STARt <DetectionStart>

Defines the beginning of the detection range as the time in seconds from the capture buffer start.

Is only available for `[SENSe:]DETect:RANGe ON`.

Parameters:

<DetectionStart> Time from the capture buffer start

Default unit: S

Example:

```
SENS:DET:RANG ON
SENS:DET:RANG:STAR 10ms
SENS:DET:RANG:LENG 100ms
```

Manual operation: See "Detection Start" on page 90

[SENSe:]DETect:REFerence <Reference>

The reference level to be used for setting the pulse detection threshold.

Parameters:

<Reference> REFLevel | PEAK | NOISe | ABSolute

REFLevel
Current reference level

PEAK
Peak level as measured over the entire capture data interval

NOISe
Noise level determined from the current capture data according to `SENSe:TRACe:MEASurement:DEFine:DURation:MIN` on page 142.

ABSolute
Absolute level defined by `[SENSe:]DETect:THReshold` on page 202.

*RST: PEAK

Manual operation: See "Reference Source" on page 89

[SENSe:]DETect:THReshold <Level>

The threshold determines whether a pulse is detected or not. The top of a pulse must exceed the threshold in order to be detected. The threshold is defined in relation to the reference defined by `[SENSe:]DETect:REFerence`.

Parameters:

<Level> numeric value in dB or dBm, depending on reference type

*RST: -10.0

Manual operation: See "Threshold" on page 90

8.4.9 Configuring the pulse measurement

The following commands determine how much data is measured for each pulse, in relation to defined levels, points, or ranges.

8.4.9.1 Measurement levels

SENSe:TRACe:MEASurement:ALGorithm <Algorithm>

The measurement algorithm used for finding the pulse top and base levels.

Parameters:

<Algorithm>

MEAN
The arithmetic average of the measured values

MEDian
The level for which half the values lie above, the other half below in the histogram

PEAKpower
The peak power is used to detect the pulse top level.

FIXed
A fixed pulse top level value is used

*RST: MEDian

Example: `SENS:TRAC:MEAS:ALG PEAK`

Manual operation: See "Measurement Algorithm" on page 93

SENSe:TRACe:MEASurement:DEFine:AMPLitude:UNIT <Unit>

Defines the unit of the pulse amplitude values, i.e. whether magnitude (V) or power (W, dBm) values are used to determine the threshold levels for fall and rise times.

Parameters:

<Unit> V | W | DBM

*RST: V

Manual operation: See "Reference Level Unit" on page 93

SENSe:TRACe:MEASurement:DEFine:BOUNdary:TOP <PulseInstant>

The boundary in percent of the pulse amplitude to either side of the pulse top (ON state). Used to determine the settling time, for example. Once the signal remains within the boundary, it is assumed to have settled.

Parameters:

<PulseInstant> percentage

Range: 1 to 20

*RST: 3

Manual operation: See "Boundary" on page 94

SENSe:TRACe:MEASurement:DEFine:COMPensate:ADRoop <State>

Determines whether the 100% value (from base to top) for the rise and fall time measurements is calculated from the Edges.

This allows you to consider a "droop" in the pulse top during the pulse measurements. If a droop is to be considered, the 100% value must be calculated separately for the rising and falling edges.

Parameters:

<State>

ON | 1

The 100% value is measured separately for the rising and falling edges.

OFF | 0

The 100% value is measured at the pulse center and used for all measurements.

*RST: 1

Manual operation: See "Position" on page 92

SENSe:TRACe:MEASurement:DEFine:RIPPle <Portion>

Determines portion of the pulse top which is used to measure the ripple.

Parameters:

<Portion> percentage

Range: 0 to 100

*RST: 50

Manual operation: See "Ripple Portion" on page 93

SENSe:TRACe:MEASurement:DEFine:TOP:FIXed <TopFixed>

Defines the top power level value to be used by the pulse measurement algorithm.

Is only available for `SENSe:TRACe:MEASurement:ALGorithmFIXed`

Parameters:

<TopFixed> numeric value

Default unit: dBm

Example:

```
SENS:TRAC:MEAS:ALG FIXED
SENS:TRAC:MEAS:DEF:TOP:FIX -10
```

Manual operation: See "Fixed Value" on page 93

SENSe:TRACe:MEASurement:DEFine:TRANsition:HREFerence <Threshold>

The upper threshold in percent of the pulse amplitude used to signify the end of a rising or beginning of a falling signal level.

Parameters:

<Threshold> percentage

Range: 0 to 100
*RST: 90

Manual operation: See "High (Distal) Threshold" on page 93

SENSe:TRACe:MEASurement:DEFine:TRANsition:LREFerence <Threshold>

The lower threshold in percent of the pulse amplitude used to signify the end of a falling or beginning of a rising signal level.

Parameters:

<Threshold> percentage

Range: 0 to 100
*RST: 10

Manual operation: See "Low (Proximal) Threshold" on page 94

SENSe:TRACe:MEASurement:DEFine:TRANsition:REFerence <Threshold>

The threshold in percent of the pulse amplitude used to signify the mid-transition level between pulse states.

Parameters:

<Threshold> percentage

Range: 0 to 100
*RST: 50

Manual operation: See "Mid (Mesial) Threshold" on page 94

8.4.9.2 Measurement point

SENSe:TRACe:MEASurement:DEFine:PULSe:INSTant <PulseInstant>

The time instant used for in-pulse measurements e.g. power, phase or frequency.

Parameters:

<PulseInstant> *RST: 0
Default unit: S

Manual operation: See "Offset" on page 96

SENSe:TRACe:MEASurement:DEFine:PULSe:INSTant:AWINdow <Length>

The length of an averaging window centered on the Measurement Point.

Parameters:

<Length> Size of the window around the measurement point used for averaging

Range: 0 to 10000
*RST: 0.0
Default unit: s

Manual operation: See "Averaging Window" on page 96

SENSe:TRACe:MEASurement:DEFine:PULSe:INSTant:REFerence <Reference>

The reference point used for specifying the pulse time instant.

Parameters:

<Reference>

RISE
The measurement point is defined in reference to the rising edge (mid-level crossing).

CENTer
The measurement point is defined in reference to the center of the pulse (equal distance from the rising and falling mid-level crossings).

FALL
The measurement point is defined in reference to the falling edge (mid-level crossing).

*RST: CENTer

Manual operation: See "Measurement Point Reference" on page 95

SENSe:TRACe:MEASurement:DEFine:PULSe:REFerence <RefPulseNumber>

Selects a particular pulse to be used as a reference for relative pulse parameters (see `SENSe:TRACe:MEASurement:DEFine:PULSe:REFerence:POSition` on page 207).

The number of the current or all detected pulses can be queried using `[SENSe:]PULSe:NUMBer?` on page 312 or `[SENSe:]PULSe:ID?` on page 312.

Parameters:

<RefPulseNumber>	Range:	0 to number of detected pulses
	*RST:	0

Manual operation: See "Reference for Pulse-Pulse Measurements" on page 96

SENSe:TRACe:MEASurement:DEFine:PULSe:REFerence:POSition <Mode>

Defines the eference pulse on which relative pulse results are based (e.g. for traces normalized to reference pulse, see Chapter 4.5.2, "Normalizing traces", on page 58).

Parameters:

<Mode> FIXed | SELected | BPULse | APULse

FIXed
A fixed pulse number; the pulse number is specified by `SENSe:TRACe:MEASurement:DEFine:PULSe:REFerence` on page 207

SELected
The currently selected pulse (see `SENSe:TRACe:MEASurement:DEFine:PULSe:SELected` on page 220)

BPULse
The nth pulse *before* the currently evaluated pulse, where n is the number specified by `SENSe:TRACe:MEASurement:DEFine:PULSe:REFerence` on page 207.
No values are available for the first n pulses.

APULse
The nth pulse *after* the currently evaluated pulse, where n is the number specified by `SENSe:TRACe:MEASurement:DEFine:PULSe:REFerence` on page 207.
No values are available for the last n pulses.

Example:

```
SENS:TRAC:MEAS:DEF:PULS:REF:POS FIX
SENS:TRAC:MEAS:DEF:PULS:REF 1
```

All relative pulse results are based on pulse number 1.

Example:

```
SENS:TRAC:MEAS:DEF:PULS:SEL 2
SENS:TRAC:MEAS:DEF:PULS:REF:POS SEL
```

All relative pulse results are based on the currently selected pulse number 2.

Example:
`SENS:TRAC:MEAS:DEF:PULS:REF:POS BPUL`
`SENS:TRAC:MEAS:DEF:PULS:REF 1`
For each pulse evaluation, the previous pulse is used as a reference. The first pulse has no results.

Example:
`SENS:TRAC:MEAS:DEF:PULS:REF:POS APUL`
`SENS:TRAC:MEAS:DEF:PULS:REF 2`
For each pulse evaluation, the second-next pulse is used as a reference. The last 2 pulses have no results.

Manual operation: See "Reference for Pulse-Pulse Measurements" on page 96

8.4.9.3 Measurement range

SENSe:TRACe:MEASurement:DEFine:PULSe:ESTimation:LENGth <Length>

Parameters:
<Length> percentage
Range: 1 to 100
*RST: 75

Manual operation: See "Reference, Length, Offset" on page 97

SENSe:TRACe:MEASurement:DEFine:PULSe:ESTimation:OFFSet:LEFT <OffsetLeft>

The offset in seconds from the pulse rising edge at which the estimation range begins.

Parameters:
<OffsetLeft> *RST: 0
Default unit: S

Manual operation: See "Reference, Length, Offset" on page 97

SENSe:TRACe:MEASurement:DEFine:PULSe:ESTimation:OFFSet:RIGHt <OffsetRight>

The offset in seconds from the pulse falling edge at which the estimation range ends.

Parameters:
<OffsetRight> *RST: 0
Default unit: S

Manual operation: See "Reference, Length, Offset" on page 97

SENSe:TRACe:MEASurement:DEFine:PULSe:ESTimation:REFerence <Reference>

Defines the reference for the measurement range definition. Depending on the selected reference type, an additional setting is available to define the range.

Parameters:

<Reference> CENTer | EDGE

CENTer
Defines a relative range around the center of the pulse. The range is defined by its **length** in percent of the pulse top.

EDGE
Defines the start and stop of the measurement range with respect to the pulse edges. The range is defined by a time **offset** from the middle of the **rising edge** and a time offset from the middle of the **falling edge**.

*RST: CENTer

Manual operation: See "Reference, Length, Offset" on page 97

8.4.10 Configuring the result display

The commands required to configure the screen display in a remote environment are described here.

8.4.10.1 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 8.4.10.2, "Working with windows in the display", on page 213 are also supported. Note, however, that the commands described there only allow you to configure the layout within the *active* measurement channel.

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 `LAYout:GLOBal:IDENtify[:WINDow]?` query.

<Direction> LEFT | RIGHt | ABOVe | BELow | TAB
Direction the new window is added relative to the existing window.
TAB
The new window is added as a new tab in the specified existing window.

<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 8-3: <WindowType> parameter values for Pulse application

Parameter value	Window type
MCAPture	Magnitude Capture Buffer
MTABle	Marker Table
PDIStribution	Parameter Distribution
PFRequency	Pulse Frequency

Parameter value	Window type
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

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

8.4.10.2 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*.

To configure the layout of windows across channels, use the Chapter 8.4.10.1, "Global layout commands", on page 209.

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 `LAYout:CATalog[:WINDow]?` 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 `LAYout:GLOBal:REPLace[: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: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 Capture" on page 30
See "Marker Table " on page 31
See "Parameter Distribution" on page 31
See "Parameter Spectrum" on page 33
See "Parameter Trend" on page 33
See "Pulse Frequency" on page 36
See "Pulse I and Q" on page 36
See "Pulse Magnitude" on page 37
See "Pulse Phase" on page 38
See "Pulse Phase (Wrapped)" on page 39
See "Pulse Results" on page 39
See "Pulse-Pulse Spectrum" on page 41
See "Pulse Statistics" on page 42
See "Result Range Spectrum" on page 43

For a detailed example, see Chapter 8.7, "Programming example: pulse measurement", on page 370.

Table 8-4: <WindowType> parameter values for Pulse application

Parameter value	Window type
MCAPture	"Magnitude Capture Buffer"
MTABle	"Marker Table"
PDIStribution	"Parameter Distribution"
PFRequency	"Pulse Frequency"
PIAQ	"Pulse I and Q"
PMAGnitude	"Pulse Magnitude"
PPHase	"Pulse Phase"
PPSPectrum	"Pulse-Pulse Spectrum"
PPWrapped	"Pulse phase, wrapped"
PRESults	"Pulse Results"
PSPectrum	"Parameter Spectrum"
PSTatistics	"Pulse Statistics"
PTRend	"Parameter Trend"
RRSPectrum	"Result Range Spectrum"

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 `LAYout:CATalog[:WINDow]?` 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 `LAYout:CATalog[:WINDow]?` 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 `LAYout:CATalog[:WINDow]?` query.

<WindowType>	Type of result display you want to use in the existing window. See `LAYout:ADD[:WINDow]?` on page 213 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 213 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 213 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 213.

Note that this command is not available in all applications and measurements.

Suffix:
<n> 1..n
Window

Parameters:
<WindowType>

Example: `LAY:WIND2:TYPE?`

8.4.10.3 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*.

DISPlay:FORMat <Format>

Determines which tab is displayed.

Parameters:
<Format>
SPLit
Displays the MultiView tab with an overview of all active channels
SINGle
Displays the measurement channel that was previously focused.
*RST: SING

Example: `DISP:FORM SPL`

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`

8.4.11 Configuring the results

Some evaluation methods require or allow for additional settings to configure the result display.

8.4.11.1 Selecting the pulse

The pulse traces (frequency, magnitude and pulse vs. time) always display the trace for one specific pulse, namely the currently selected pulse. To select a pulse, use the following command:

SENSe:TRACe:MEASurement:DEFine:PULSe:SELected <PulseNumber>

Selects a particular pulse for which the traces, parameters and results are displayed, or queries the number of the selected pulse.

The pulse number is always relative to the current detection range, that is: pulse number 1 is the first pulse within the detection range in the capture buffer.

Query the number of the current or all detected pulses using `[SENSe:]PULSe:NUMBer?` on page 312 or `[SENSe:]PULSe:ID?` on page 312.

Note that this command causes an error if no measurement results are available.

Parameters:

<PulseNumber> Range: 0 to number of detected pulses
*RST: 0

Example: `SENS:TRAC:MEAS:DEF:PULS:SEL 2`

8.4.11.2 Defining the result range

The result range determines which data is displayed on the screen (see also "Measurement range vs. result range vs. detection range" on page 15). This range applies to the pulse magnitude, frequency and phase vs time displays.

SENSe:TRACe:MEASurement:DEFine:RRANge:ALIGnment <Alignment>

Specifies the alignment with respect to the reference point used to define the result range.

Parameters:

<Alignment> LEFT | CENTer | RIGHt

LEFT
The result range starts at the pulse center or selected edge.

CENTer
The result range is centered around the pulse center or selected edge.

RIGHt
The result range ends at the pulse center or selected edge.

*RST: CENTer

Manual operation: See "Alignment" on page 101

SENSe:TRACe:MEASurement:DEFine:RRANge:AUTO <State>

If enabled, the result range length is determined automatically according to the width of the selected pulse (see `SENSe:TRACe:MEASurement:DEFine:PULSe:SELected` on page 220).

Parameters:

<State>

OFF
Switch the function off

ON
Switch the function on

ONCE
Execute the function once and then switch it off

*RST: ON

Manual operation: See "Auto Scale Continuous (All)" on page 98
See "Auto Scale Once (All)" on page 98
See "Automatic Range Scaling" on page 100

SENSe:TRACe:MEASurement:DEFine:RRANge:LENGth <Length>

Parameters:

<Length> *RST: 30 us
Default unit: S

Manual operation: See "Length" on page 101

SENSe:TRACe:MEASurement:DEFine:RRANge:OFFSet <Offset>

The offset (in seconds) from the reference point at which the pulse result range is aligned.

Parameters:

<Offset> *RST: 0
Default unit: S

Manual operation: See "Offset" on page 101

SENSe:TRACe:MEASurement:DEFine:RRANge:REFerence <Reference>

Specifies the reference point used to define the result range.

Parameters:

<Reference>

RISE
The result range is defined in reference to the rising edge.

CENTer
The result range is defined in reference to the center of the pulse top.

FALL
The result range is defined in reference to the falling edge.

*RST: CENTer

Manual operation: See "Result Range Reference Point" on page 101

8.4.11.3 Configuring a parameter distribution

The parameter distribution evaluations allow you to visualize the number of occurrences for a specific parameter value within the current capture buffer. For each parameter distribution window you can configure which measured parameter is to be displayed.

Useful commands for configuring a parameter distribution described elsewhere:

- `LAYout:ADD[:WINDow]?` on page 213

Remote commands exclusive to configuring a parameter distribution:

CALCulate<n>:DISTribution:EMODel <XAxis>, <YAxis>

Configures the Parameter Distribution result display.

Suffix:

<n> 1..n
Window

Setting parameters:

<XAxis> RBPTime | RLPTime | RMPTime | RHPTime | RTPTime | RLPLevel | RMPLevel | RHPLevel | RTPLevel | FBPTime | FLPTime | FMPTime | FHPTime | FTPTime | FLPLevel | FMPLevel | FHPLevel | FTPLevel

RBPTime
Rise Base Point Time

RLPTime
Rise Low Point Time

RMPTime
Rise Mid Point Time

RHPTime
Rise High Point Time

RTPTime
Rise Top Point Time

RLPLevel
Rise Low Point Level

RMPLevel
Rise Mid Point Level

RHPLevel
Rise High Point Level

RTPLevel
Rise Top Point Level

FBPTime
Fall Base Point Time

FLPTime
Fall Low Point Time

FMPTime
Fall Mid Point Time

FHPTime
Fall High Point Time

FTPTime
Fall Top Point Time

FLPLevel
Fall Low Point Level

FMPLevel
Fall Mid Point Level

FHPLevel
Fall High Point Level

FTPLevel
Fall Top Point Level

<YAxis> COUNt | OCCurrence

Parameter to be displayed on the y-axis.

COUNt
Number of pulses in which the parameter value occurred.

OCCurrence
Percentage of all measured pulses in which the parameter value occurred.

*RST: COUNt

Usage: Setting only

CALCulate<n>:DISTribution:FREQuency <XAxis>, <YAxis>

Configures the Parameter Distribution result display.

Suffix:

<n> 1..n
Window

Setting parameters:

<XAxis> POINt | PPFRequency | RERRor | PERRor | DEViation | CRATe

Pulse parameter to be displayed on the x-axis. For a description of the available parameters see Chapter 3.1.3, "Frequency parameters", on page 23.

POINt
Frequency at measurement point

PPFRequency
Pulse-Pulse Frequency Difference

RERRor
Frequency Error (RMS)

PERRor
Frequency Error (Peak)

DEViation
Frequency Deviation

CRATe
Chirp Rate

*RST: POINt

<YAxis> COUNt | OCCurrence

Parameter to be displayed on the y-axis.

COUNt
Number of pulses in which the parameter value occurred.

OCCurence
Percentage of all measured pulses in which the parameter value occurred.

*RST: COUNt

Usage: Setting only

Manual operation: See "X-Axis" on page 104

CALCulate<n>:DISTribution:LLINes[:STATe] <State>

Hides or shows the limit lines in the selected Parameter Trend or Parameter Distribution result display.

Note that this function only has an effect on the visibility of the lines in the graphical displays, it does not affect the limit check in general or the display of the limit check results in the table displays.

Suffix:
<n> 1..n
Window

Parameters:
<State> ON | OFF | 1 | 0

*RST: 1

Example: `CALC:DIST:LLIN ON`

Manual operation: See "Display Limit Lines" on page 105

CALCulate<n>:DISTribution:NBINs <# bins>

Sets the number of bins used to calculate the historgram

Suffix:
<n> 1..n
Window

Parameters:
<# bins> Range: 1 to 1000
*RST: 100

Manual operation: See "Histogram Bins" on page 105

CALCulate<n>:DISTribution:PHASe <XAxis>, <YAxis>

Configures the Parameter Distribution result display.

Suffix:
<n> 1..n
Window

Setting parameters:
<XAxis> POINt | PPPHase | RERRor | PERRor | DEViation

Pulse parameter to be displayed on the x-axis. For a description of the available parameters see Chapter 3.1.4, "Phase parameters", on page 24.

POINt
Pulse phase at measurement point

PPPHase
Pulse-Pulse Phase Difference

RERRor
Phase Error (RMS)

PERRor
Phase Error (Peak)

DEViation
Phase Deviation

*RST: POINt

<YAxis> COUNt | OCCurrence

Parameter to be displayed on the y-axis.

COUNt
Number of pulses in which the parameter value occurred.

OCCurrence
Percentage of all measured pulses in which the parameter value occurred.

*RST: COUNt

Usage: Setting only

CALCulate<n>:DISTribution:POWer <XAxis>, <YAxis>

Configures the Parameter Distribution result display.

Suffix:
<n> 1..n
Window

Setting parameters:
<XAxis> TOP | BASE | AMPLitude | ON | AVG | MIN | MAX | PON | PAVG | PMIN | ADPercent | ADDB | RPERcent | RDB | OPERcent | ODB | POINt | PPRatio | I | Q

Pulse parameter to be displayed on the x-axis. For a description of the available parameters see Chapter 3.1.4, "Phase parameters", on page 24.

TOP
Top Power

BASE
Base Power

AMPLitude
Pulse Amplitude

ON
Average ON Power

AVG
Average Tx Power

MIN
Minimum Power

MAX
Peak Power

PON
Peak-to-Avg ON Power Ratio

PAVG
Peak-to-Average Tx Power Ratio

PMIN
Peak-to-Min Power Ratio

ADPercent
Droop in %

ADDB
Droop in dB

RPERcent
Ripple in %

RDB
Ripple in dB

OPERcent
Overshoot in %

ODB
Overshoot in dB

POINt
Pulse power measured at measurement point

PPRatio
Pulse-to-Pulse Power Difference

*RST: TOP

<YAxis> COUNt | OCCurence

Parameter to be displayed on the y-axis.

COUNt
Number of pulses in which the parameter value occurred.

OCCurrence
Percentage of all measured pulses in which the parameter value occurred.

*RST: COUNt

Usage: Setting only

CALCulate<n>:DISTribution:TIMing <XAxis>, <YAxis>

Configures the Parameter Distribution result display.

Suffix:

<n> 1..n
Window

Setting parameters:

<XAxis> TSTamp | SETTling | RISE | FALL | PWIDth | OFF | DRATio | DCYCle | PRI | PRF

Pulse parameter to be displayed on the x-axis. For a description of the available parameters see Chapter 3.1.1, "Timing parameters", on page 16.

TSTamp
Timestamp

SETTling
Settling Time

RISE
Rise Time

FALL
Fall Time

PWIDth
Pulse Width (ON Time)

OFF
Off Time

DRATio
Duty Ratio

DCYCle
Duty Cycle (%)

PRI
Pulse Repetition Interval

PRF
Pulse Repetition Frequency (Hz)

*RST: RISE

<YAxis> COUNt | OCCurrence

Parameter to be displayed on the y-axis.

COUNt
Number of pulses in which the parameter value occurred.

OCCurrence
Percentage of all measured pulses in which the parameter value occurred.

*RST: COUNt

Usage: Setting only

8.4.11.4 Configuring a parameter spectrum

The parameter spectrum evaluations allow you to visualize the spectrum of results for a specific parameter for all measured pulses within the current capture buffer. For each parameter spectrum window you can configure which measured parameter is to be displayed.

Useful commands for configuring a parameter spectrum described elsewhere:

- `LAYout:ADD[:WINDow]?` on page 213

Remote commands exclusive to configuring a parameter spectrum:

CALCulate<n>:PSPectrum:AUTO <State>

Enables or disables automatic configuration for Parameter Spectrum displays. If enabled, the commands for individual settings are not available.

Suffix:
<n> 1..n
Window

Parameters:
<State> ON | OFF | 1 | 0

*RST: 1

Manual operation: See "Full Auto" on page 107

CALCulate<n>:PSPectrum:BLOCksize <BlockSize>

Defines the size of blocks used in Pulse-to-Pulse Spectrum calculation. The block size also determines the resulting RBW of the Pulse-to-Pulse Spectrum (see `CALCulate<n>:PSPectrum:RBW?` on page 234).

Suffix:
<n> 1..n
Window

Parameters:
<BlockSize> Range: 8 to 100k
*RST: 1024

Manual operation: See "Block Size" on page 107

CALCulate<n>:PSPectrum:EMODel <Param>

Suffix:
<n> 1..n
Window

Setting parameters:
<Param> RBPTime | RLPTime | RMPTime | RHPTime | RTPTime | RLPLevel | RMPLevel | RHPLevel | RTPLevel | FBPTime | FLPTime | FMPTime | FHPTime | FTPTime | FLPLevel | FMPLevel | FHPLevel | FTPLevel

RBPTime
Rise Base Point Time

RLPTime
Rise Low Point Time

RMPTime
Rise Mid Point Time

RHPTime
Rise High Point Time

RTPTime
Rise Top Point Time

RLPLevel
Rise Low Point Level

RMPLevel
Rise Mid Point Level

RHPLevel
Rise High Point Level

RTPLevel
Rise Top Point Level

FBPTime
Fall Base Point Time

FLPTime
Fall Low Point Time

FMPTime
Fall Mid Point Time

FHPTime
Fall High Point Time

FTPTime
Fall Top Point Time

FLPLevel
Fall Low Point Level

FMPLevel
Fall Mid Point Level

FHPLevel
Fall High Point Level

FTPLevel
Fall Top Point Level

CALCulate<n>:PSPectrum:FREQuency <Param>

Configures the Parameter Spectrum result display.

Suffix:

<n> 1..n
Window

Setting parameters:

<Param> POINt | PPFRequency | RERRor | PERRor | DEViation | CRATe

Pulse parameter to be displayed on the x-axis. For a description of the available parameters see Chapter 3.1.3, "Frequency parameters", on page 23.

POINt
Frequency at measurement point

PPFRequency
Pulse-Pulse Frequency Difference

RERRor
Frequency Error (RMS)

PERRor
Frequency Error (Peak)

DEViation
Frequency Deviation

CRATe
Chirp Rate

*RST: POINt

Manual operation: See "Parameter" on page 107

CALCulate<n>:PSPectrum:GTHReshold <GapThreshold>

Defines the minimum time that must pass before a gap is detected as such for Pulse-to-Pulse Spectrum displays.

Suffix:

<n> 1..n
Window

Parameters:

<GapThreshold> Range: minimum spacing between pulses to meas time
Default unit: S

Manual operation: See "Gap Threshold" on page 107

CALCulate<n>:PSPectrum:MAXFrequency <MaxFrequncy>

Defines the maximum frequency span for which the Pulse-to-Pulse Spectrum is calculated. Internally, the span is limited by the number of possible interpolation samples (100 000).

Suffix:

<n> 1..n
Window

Parameters:

<MaxFrequncy> Range: >0 to 1/10 of sample rate
Default unit: HZ

Manual operation: See "Maximum Frequency" on page 107

CALCulate<n>:PSPectrum:PHASe <Param>

Configures the Parameter Spectrum result display.

Suffix:

<n> 1..n
Window

Setting parameters:

<Param> POINt | PPPHase | RERRor | PERRor | DEViation

Pulse parameter to be displayed on the x-axis. For a description of the available parameters see Chapter 3.1.4, "Phase parameters", on page 24.

POINt
Pulse phase at measurement point

PPPHase
Pulse-Pulse Phase Difference

RERRor
Phase Error (RMS)

PERRor
Phase Error (Peak)

DEViation
Phase Deviation

*RST: POINt

CALCulate<n>:PSPectrum:POWer <Param>

Configures the Parameter Spectrum result display.

Suffix:

<n> 1..n
Window

Setting parameters:

<Param> TOP | BASE | AMPLitude | ON | AVG | MIN | MAX | PON | PAVG | PMIN | ADPercent | ADDB | RPERcent | RDB | OPERcent | ODB | POINt | PPRatio | I | Q

Pulse parameter to be displayed on the x-axis. For a description of the available parameters see Chapter 3.1.4, "Phase parameters", on page 24.

TOP
Top Power

BASE
Base Power

AMPLitude
Pulse Amplitude

ON
Average ON Power

AVG
Average Tx Power

MIN
Minimum Power

MAX
Peak Power

PON
Peak-to-Avg ON Power Ratio

PAVG
Peak-to-Average Tx Power Ratio

PMIN
Peak-to-Min Power Ratio

ADPercent
Droop in %

ADDB
Droop in dB

RPERcent
Ripple in %

RDB
Ripple in dB

OPERcent
Overshoot in %

ODB
Overshoot in dB

POINt
Pulse power measured at measurement point

PPRatio
Pulse-to-Pulse Power Difference

*RST: TOP

CALCulate<n>:PSPectrum:RBW?

Queries the resulting resolution bandwidth for the spectrum. Depends on the block size (see `CALCulate<n>:PSPectrum:BLOCksize` on page 230).

Suffix:
<n> 1..n
Window

Return values:
<RBW> Default unit: Hz

Usage: Query only

CALCulate<n>:PSPectrum:STHReshold <Threshold>

Defines the minimum section size for Pulse-to-Pulse Spectrum displays. Sections that are smaller than the threshold are ignored and considered to be part of the detected gap.

Suffix:
<n> 1..n
Window

Parameters:
<Threshold> Minimum section size as a percentage of the block size (see `CALCulate<n>:PSPectrum:BLOCksize` on page 230)

Range: 0 to 100
*RST: 50

Manual operation: See "Section Threshold" on page 107

CALCulate<n>:PSPectrum:TIMing <Param>

Configures the Parameter Spectrum result display.

Suffix:
<n> 1..n
Window

Setting parameters:
<Param> TSTamp | SETTling | RISE | FALL | PWIDth | OFF | DRATio | DCYCle | PRI | PRF

Pulse parameter to be displayed on the x-axis. For a description of the available parameters see Chapter 3.1.1, "Timing parameters", on page 16.

TSTamp
Timestamp

SETTling
Settling Time

RISE
Rise Time

FALL
Fall Time

PWIDth
Pulse Width (ON Time)

OFF
Off Time

DRATio
Duty Ratio

DCYCle
Duty Cycle (%)

PRI
Pulse Repetition Interval

PRF
Pulse Repetition Frequency (Hz)

*RST: RISE

CALCulate<n>:PSPectrum:WINDow <WindowType>

Defines the used FFT window type for Pulse-to-Pulse Spectrum displays

Suffix:
<n> 1..n
Window

Setting parameters:
<WindowType> RECTangle | BARTlett | HAMMing | HANNing | BLACkman

*RST: BLACkman

Manual operation: See "Window Type" on page 107

8.4.11.5 Configuring a pulse-pulse spectrum

The pulse-to-pulse spectrum evaluation allows you to visualize the spectrum of I and Q-based results for all measured pulses within the current capture buffer.

Useful commands for configuring a pulse-to-pulse spectrum distribution described elsewhere:

- `LAYout:ADD[:WINDow]?` on page 213

Remote commands exclusive to configuring a pulse-to-pulse spectrum:

CALCulate<n>:PPSPectrum:AUTO <State>

Enables or disables automatic configuration for Pulse-to-Pulse Spectrum displays. If enabled, the commands for individual settings are not available.

Suffix:

<n> 1..n
Window

Parameters:

<State> ON | OFF | 0 | 1

OFF | 0
Switches the function off

ON | 1
Switches the function on

*RST: 0

Example: `CALC:PPSP:AUTO OFF`

CALCulate<n>:PPSPectrum:GTHReshold <GapThreshold>

Defines the minimum time that must pass before a gap is detected as such.

Suffix:

<n> 1..n
Window

Parameters:

<GapThreshold> Range: minimum spacing between pulses to meas time
Default unit: S

Example: `CALC:PPSP:GTHR 100us`

CALCulate<n>:PPSPectrum:MAXFrequency <MaxFrequncy>

Defines the maximum frequency span for which the Spectrum is calculated. Internally, the span is limited by the number of possible interpolation samples (100 000).

Suffix:

<n> 1..n
Window

Parameters:

<MaxFrequncy> Range: >0 to 1/10 of sample rate
Default unit: HZ

Example: `CALC:PPSP:MAXF 10000Hz`

CALCulate<n>:PPSPectrum:RBW?

Queries the resulting resolution bandwidth for the spectrum. Depends on the block size (see `CALCulate<n>:PSPectrum:BLOCksize` on page 230).

Suffix:

<n> 1..n
Window

Return values:

<RBW>

Example: `CALC:PPSP:RBW?`

Usage: Query only

CALCulate<n>:PPSPectrum:STHReshold <Threshold>

Defines the minimum section size. Sections that are smaller than the threshold are ignored and considered to be part of the detected gap.

Suffix:

<n> 1..n
Window

Parameters:

<Threshold> Minimum section size as a percentage of the block size (see `CALCulate<n>:PSPectrum:BLOCksize` on page 230)

Range: 0 to 100
*RST: 50

Example: `CALC:PSPS:STHR 0.1`

CALCulate<n>:PPSPectrum:WINDow <WindowType>

Defines the used FFT window type for pulse-to-pulse spectrum displays.

Suffix:

<n> 1..n
Window

Setting parameters:

<WindowType> RECTangle | BARTlett | HAMMing | HANNing | BLACkman
*RST: BLACkman

Example: `CALC:PPSP:WIND BART`

8.4.11.6 Configuring a parameter trend

The parameter trend evaluations allow you to visualize changes in a specific parameter for all measured pulses within the current capture buffer. For each parameter trend window you can configure which measured parameter is to be displayed.

Useful commands for configuring a parameter trend described elsewhere:

- `LAYout:ADD[:WINDow]?` on page 213

Remote commands exclusive to configuring a parameter trend:

CALCulate<n>:TRENd:DSTYle <Type>

Suffix:

<n> 1..n
Window

Parameters:

<Type> AUTO | DOTS | LINes | DLINes

CALCulate<n>:TRENd:EMODel <YAxis>, <XAxis>

Configures the Parameter Trend result display for envelope model trends. This command defines both x-axis and y-axis parameters in one step. It is equivalent to the two subsequent commands:

`CALCulate<n>:TRENd:EMODel:X TSTamp | PNUMber` (see `CALCulate<n>:TRENd:EMODel:X` on page 241)

`CALCulate<n>:TRENd:EMODel:Y <YAxis>` (see `CALCulate<n>:TRENd:EMODel:Y` on page 242)

Suffix:

<n> 1..n
Window

Setting parameters:

<YAxis> RBPTime | RLPTime | RMPTime | RHPTime | RTPTime | RLPLevel | RMPLevel | RHPLevel | RTPLevel | FBPTime | FLPTime | FMPTime | FHPTime | FTPTime | FLPLevel | FMPLevel | FHPLevel | FTPLevel

RBPTime
Rise Base Point Time

RLPTime
Rise Low Point Time

RMPTime
Rise Mid Point Time

RHPTime
Rise High Point Time

RTPTime
Rise Top Point Time

RLPLevel
Rise Low Point Level

RMPLevel
Rise Mid Point Level

RHPLevel
Rise High Point Level

RTPLevel
Rise Top Point Level

FBPTime
Fall Base Point Time

FLPTime
Fall Low Point Time

FMPTime
Fall Mid Point Time

FHPTime
Fall High Point Time

FTPTime
Fall Top Point Time

FLPLevel
Fall Low Point Level

FMPLevel
Fall Mid Point Level

FHPLevel
Fall High Point Level

FTPLevel
Fall Top Point Level

<XAxis> PNUMber | TSTamp | SETTling | RISE | FALL | PWIDth | OFF | DRATio | DCYCle | PRI | PRF

Pulse parameter to be displayed on the x-axis. For a description of the available parameters see Chapter 3.1.1, "Timing parameters", on page 16.

TSTamp
Timestamp

PNUMber
The pulse numbers are represented on the x-axis (available numbers can be queried using `[SENSe:]PULSe:NUMBer?` on page 312). Intervals without pulses are not displayed.

SETTling
Settling Time

RISE
Rise Time

FALL
Fall Time

PWIDth
Pulse Width (ON Time)

OFF
Off Time

DRATio
Duty Ratio

DCYCle
Duty Cycle (%)

PRI
Pulse Repetition Interval

PRF
Pulse Repetition Frequency (Hz)

*RST: PNUMber

Usage: Setting only

CALCulate<n>:TRENd:EMODel:X <XAxis>

Configures the x-axis of the Parameter Trend result display.

The y-axis is configured using the `CALCulate<n>:TRENd:<GroupName>:Y` commands.

Suffix:

<n> 1..n
Window

Setting parameters:

<XAxis> RBPTime | RLPTime | RMPTime | RHPTime | RTPTime | RLPLevel | RMPLevel | RHPLevel | RTPLevel | FBPTime | FLPTime | FMPTime | FHPTime | FTPTime | FLPLevel | FMPLevel | FHPLevel | FTPLevel

RBPTime
Rise Base Point Time

RLPTime
Rise Low Point Time

RMPTime
Rise Mid Point Time

RHPTime
Rise High Point Time

RTPTime
Rise Top Point Time

RLPLevel
Rise Low Point Level

RMPLevel
Rise Mid Point Level

RHPLevel
Rise High Point Level

RTPLevel
Rise Top Point Level

FBPTime
Fall Base Point Time

FLPTime
Fall Low Point Time

FMPTime
Fall Mid Point Time

FHPTime
Fall High Point Time

FTPTime
Fall Top Point Time

FLPLevel
Fall Low Point Level

FMPLevel
Fall Mid Point Level

FHPLevel
Fall High Point Level

FTPLevel
Fall Top Point Level

Usage: Setting only

CALCulate<n>:TRENd:EMODel:Y <YAxis>

Configures the y-axis of the Parameter Trend result display.

The x-axis is configured using the `CALCulate<n>:TRENd:<GroupName>:X` commands.

Suffix:

<n> 1..n
Window

Setting parameters:

<YAxis> RBPTime | RLPTime | RMPTime | RHPTime | RTPTime | RLPLevel | RMPLevel | RHPLevel | RTPLevel | FBPTime | FLPTime | FMPTime | FHPTime | FTPTime | FLPLevel | FMPLevel | FHPLevel | FTPLevel

RBPTime
Rise Base Point Time

RLPTime
Rise Low Point Time

RMPTime
Rise Mid Point Time

RHPTime
Rise High Point Time

RTPTime
Rise Top Point Time

RLPLevel
Rise Low Point Level

RMPLevel
Rise Mid Point Level

RHPLevel
Rise High Point Level

RTPLevel
Rise Top Point Level

FBPTime
Fall Base Point Time

FLPTime
Fall Low Point Time

FMPTime
Fall Mid Point Time

FHPTime
Fall High Point Time

FTPTime
Fall Top Point Time

FLPLevel
Fall Low Point Level

FMPLevel
Fall Mid Point Level

FHPLevel
Fall High Point Level

FTPLevel
Fall Top Point Level

Usage: Setting only

CALCulate<n>:TRENd:FREQuency <YAxis>, <XAxis>

Configures the Parameter Trend result display for time trends. This command defines both x-axis and y-axis parameters in one step. It is equivalent to the two subsequent commands:

`CALCulate<n>:TRENd:TIMing:X TSTamp | PNUMber` (see `CALCulate<n>:TRENd:TIMing:X` on page 255)

`CALCulate<n>:TRENd:FREQuency:Y <YAxis>` (see `CALCulate<n>:TRENd:FREQuency:Y` on page 245)

Suffix:

<n> 1..n
Window

Setting parameters:

<YAxis> POINt | PPFRequency | RERRor | PERRor | DEViation | CRATe

Pulse parameter to be displayed on the y-axis. For a description of the available parameters see Chapter 3.1.3, "Frequency parameters", on page 23.

POINt
Frequency at measurement point

PPFRequency
Pulse-Pulse Frequency Difference

RERRor
Frequency Error (RMS)

PERRor
Frequency Error (Peak)

DEViation
Frequency Deviation

CRATe
Chirp Rate

*RST: POINt

<XAxis> PNUMber | TSTamp | SETTling | RISE | FALL | PWIDth | OFF | DRATio | DCYCle | PRI | PRF

Pulse parameter to be displayed on the x-axis. For a description of the available parameters see Chapter 3.1.1, "Timing parameters", on page 16.

TSTamp
Timestamp

PNUMber
The pulse numbers are represented on the x-axis (available numbers can be queried using `[SENSe:]PULSe:NUMBer?` on page 312). Intervals without pulses are not displayed.

SETTling
Settling Time

RISE
Rise Time

FALL
Fall Time

PWIDth
Pulse Width (ON Time)

OFF
Off Time

DRATio
Duty Ratio

DCYCle
Duty Cycle (%)

PRI
Pulse Repetition Interval

PRF
Pulse Repetition Frequency (Hz)

*RST: PNUMber

Usage: Setting only

Manual operation: See "Y-Axis" on page 109
See "X-Axis" on page 109

CALCulate<n>:TRENd:FREQuency:X <XAxis>

Configures the x-axis of the Parameter Trend result display.

The y-axis is configured using the `CALCulate<n>:TRENd:<GroupName>:Y` commands.

Suffix:
<n> 1..n
Window

Setting parameters:
<XAxis> POINt | PPFRequency | RERRor | PERRor | DEViation | CRATe

Pulse parameter to be displayed on the x-axis. For a description of the available parameters see Chapter 3.1.3, "Frequency parameters", on page 23.

POINt
Frequency at measurement point

PPFRequency
Pulse-Pulse Frequency Difference

RERRor
Frequency Error (RMS)

PERRor
Frequency Error (Peak)

DEViation
Frequency Deviation

CRATe
Chirp Rate

*RST: POINt

Example: `CALC2:TREN:FREQ:X PERR`

Usage: Setting only

Manual operation: See "X-Axis" on page 109

CALCulate<n>:TRENd:FREQuency:Y <YAxis>

Configures the y-axis of the Parameter Trend result display.

The x-axis is configured using the `CALCulate<n>:TRENd:<GroupName>:X` commands.

Suffix:
<n> 1..n
Window

Setting parameters:
<YAxis> POINt | PPFRequency | RERRor | PERRor | DEViation | CRATe

Pulse parameter to be displayed on the y-axis. For a description of the available parameters see Chapter 3.1.3, "Frequency parameters", on page 23.

POINt
Frequency at measurement point

PPFRequency
Pulse-Pulse Frequency Difference

RERRor
Frequency Error (RMS)

PERRor
Frequency Error (Peak)

DEViation
Frequency Deviation

CRATe
Chirp Rate

*RST: POINt

Usage: Setting only

Manual operation: See "Y-Axis" on page 109

CALCulate<n>:TRENd:LLINes[:STATe] <State>

Hides or shows the limit lines in the selected Parameter Trend or Parameter Distribution result display.

Note that this function only has an effect on the visibility of the lines in the graphical displays, it does not affect the limit check in general or the display of the limit check results in the table displays.

Suffix:
<n> Window

Parameters:
<State> ON | OFF | 0 | 1

OFF | 0
Switches the function off

ON | 1
Switches the function on

*RST: 1

Manual operation: See "Display Limit Lines" on page 105

CALCulate<n>:TRENd:PHASe <YAxis>, <XAxis>

Configures the Parameter Trend result display for time trends. This command defines both x-axis and y-axis parameters in one step. It is equivalent to the two subsequent commands:

`CALCulate<n>:TRENd:TIMing:X TSTamp | PNUMber` (see `CALCulate<n>:TRENd:TIMing:X` on page 255)

`CALCulate<n>:TRENd:PHASe:Y <YAxis>` (see `CALCulate<n>:TRENd:PHASe:Y` on page 248)

Suffix:
<n> 1..n
Window

Setting parameters:
<YAxis> POINt | PPPHase | RERRor | PERRor | DEViation

Pulse parameter to be displayed on the y-axis. For a description of the available parameters see Chapter 3.1.4, "Phase parameters", on page 24.

POINt
Pulse phase at measurement point

PPPHase
Pulse-Pulse Phase Difference

RERRor
Phase Error (RMS)

PERRor
Phase Error (Peak)

DEViation
Phase Deviation

*RST: POINt

<XAxis> PNUMber | TSTamp | SETTling | RISE | FALL | PWIDth | OFF | DRATio | DCYCle | PRI | PRF

Pulse parameter to be displayed on the x-axis. For a description of the available parameters see Chapter 3.1.1, "Timing parameters", on page 16.

TSTamp
Timestamp

PNUMber
The pulse numbers are represented on the x-axis (available numbers can be queried using `[SENSe:]PULSe:NUMBer?` on page 312). Intervals without pulses are not displayed.

SETTling
Settling Time

RISE
Rise Time

FALL
Fall Time

PWIDth
Pulse Width (ON Time)

OFF
Off Time

DRATio
Duty Ratio

DCYCle
Duty Cycle (%)

PRI
Pulse Repetition Interval

PRF
Pulse Repetition Frequency (Hz)

*RST: PNUMber

Usage: Setting only

CALCulate<n>:TRENd:PHASe:X <XAxis>

Configures the x-axis of the Parameter Trend result display.

The y-axis is configured using the `CALCulate<n>:TRENd:<GroupName>:Y` commands.

Suffix:
<n> 1..n
Window

Setting parameters:
<XAxis> POINt | PPPHase | RERRor | PERRor | DEViation

Pulse parameter to be displayed on the x-axis. For a description of the available parameters see Chapter 3.1.4, "Phase parameters", on page 24.

POINt
Pulse phase at measurement point

PPPHase
Pulse-Pulse Phase Difference

RERRor
Phase Error (RMS)

PERRor
Phase Error (Peak)

DEViation
Phase Deviation

*RST: POINt

Example: `CALC2:TREN:PHAS:X PERR`

Usage: Setting only

CALCulate<n>:TRENd:PHASe:Y <YAxis>

Configures the y-axis of the Parameter Trend result display.

The x-axis is configured using the `CALCulate<n>:TRENd:<GroupName>:X` commands.

Suffix:

<n> 1..n
Window

Setting parameters:

<YAxis> POINt | PPPHase | RERRor | PERRor | DEViation

Pulse parameter to be displayed on the y-axis. For a description of the available parameters see Chapter 3.1.4, "Phase parameters", on page 24.

POINt
Pulse phase at measurement point

PPPHase
Pulse-Pulse Phase Difference

RERRor
Phase Error (RMS)

PERRor
Phase Error (Peak)

DEViation
Phase Deviation

*RST: POINt

Usage: Setting only

CALCulate<n>:TRENd:POWer <YAxis>, <XAxis>

Configures the Parameter Trend result display for time trends. This command defines both x-axis and y-axis parameters in one step. It is equivalent to the two subsequent commands:

`CALCulate<n>:TRENd:TIMing:X TSTamp | PNUMber` (see CALCulate<n>:TRENd:TIMing:X on page 255)

`CALCulate<n>:TRENd:POWer:Y <YAxis>` (see CALCulate<n>:TRENd:POWer:Y on page 252)

Suffix:

<n> 1..n
Window

Setting parameters:

<YAxis> TOP | BASE | AMPLitude | ON | AVG | MIN | MAX | PON | PAVG | PMIN | ADPercent | ADDB | RPERcent | RDB | OPERcent | ODB | POINt | PPRatio | I | Q

Pulse parameter to be displayed on the y-axis. For a description of the available parameters see Chapter 3.1.2, "Power/amplitude parameters", on page 19.

TOP
Top Power

BASE
Base Power

AMPLitude
Pulse Amplitude

ON
Average ON Power

AVG
Average Tx Power

MIN
Minimum Power

MAX
Peak Power

PON
Peak-to-Avg ON Power Ratio

PAVG
Peak-to-Average Tx Power Ratio

PMIN
Peak-to-Min Power Ratio

ADPercent
Droop in %

ADDB
Droop in dB

RPERcent
Ripple in %

RDB
Ripple in dB

OPERcent
Overshoot in %

ODB
Overshoot in dB

POINt
Pulse power measured at measurement point

PPRatio
Pulse-to-Pulse Power Difference

*RST: TOP

<XAxis> PNUMber | TSTamp | SETTling | RISE | FALL | PWIDth | OFF | DRATio | DCYCle | PRI | PRF

Pulse parameter to be displayed on the x-axis. For a description of the available parameters see Chapter 3.1.1, "Timing parameters", on page 16.

TSTamp
Timestamp

PNUMber
The pulse numbers are represented on the x-axis (available numbers can be queried using `[SENSe:]PULSe:NUMBer?` on page 312). Intervals without pulses are not displayed.

SETTling
Settling Time

RISE
Rise Time

FALL
Fall Time

PWIDth
Pulse Width (ON Time)

OFF
Off Time

DRATio
Duty Ratio

DCYCle
Duty Cycle (%)

PRI
Pulse Repetition Interval

PRF
Pulse Repetition Frequency (Hz)

*RST: PNUMber

Usage: Setting only

CALCulate<n>:TRENd:POWer:X <XAxis>

Configures the x-axis of the Parameter Trend result display.

The y-axis is configured using the `CALCulate<n>:TRENd:<GroupName>:Y` commands.

Suffix:

<n> 1..n
Window

Setting parameters:

<XAxis> TOP | BASE | AMPLitude | ON | AVG | MIN | MAX | PON | PAVG | PMIN | ADPercent | ADDB | RPERcent | RDB | OPERcent | ODB | POINt | PPRatio | I | Q

Pulse parameter to be displayed on the x-axis. For a description of the available parameters see Chapter 3.1.2, "Power/amplitude parameters", on page 19.

TOP
Top Power

BASE
Base Power

AMPLitude
Pulse Amplitude

ON
Average ON Power

AVG
Average Tx Power

MIN
Minimum Power

MAX
Peak Power

PON
Peak-to-Avg ON Power Ratio

PAVG
Peak-to-Average Tx Power Ratio

PMIN
Peak-to-Min Power Ratio

ADPercent
Droop in %

ADDB
Droop in dB

RPERcent
Ripple in %

RDB
Ripple in dB

OPERcent
Overshoot in %

ODB
Overshoot in dB

POINt
Pulse power measured at measurement point

PPRatio
Pulse-to-Pulse Power Difference

*RST: TOP

Example: `CALC2:TREN:POW:X ODB`

Usage: Setting only

CALCulate<n>:TRENd:POWer:Y <YAxis>

Configures the y-axis of the Parameter Trend result display.

The x-axis is configured using the `CALCulate<n>:TRENd:<GroupName>:X` commands.

Suffix:

<n> 1..n
Window

Setting parameters:

<YAxis> TOP | BASE | AMPLitude | ON | AVG | MIN | MAX | PON | PAVG | PMIN | ADPercent | ADDB | RPERcent | RDB | OPERcent | ODB | POINt | PPRatio | I | Q

Pulse parameter to be displayed on the y-axis. For a description of the available parameters see Chapter 3.1.2, "Power/amplitude parameters", on page 19.

TOP
Top Power

BASE
Base Power

AMPLitude
Pulse Amplitude

ON
Average ON Power

AVG
Average Tx Power

MIN
Minimum Power

MAX
Peak Power

PON
Peak-to-Avg ON Power Ratio

PAVG
Peak-to-Average Tx Power Ratio

PMIN
Peak-to-Min Power Ratio

ADPercent
Droop in %

ADDB
Droop in dB

RPERcent
Ripple in %

RDB
Ripple in dB

OPERcent
Overshoot in %

ODB
Overshoot in dB

POINt
Pulse power measured at measurement point

PPRatio
Pulse-to-Pulse Power Difference

*RST: TOP

Usage: Setting only

CALCulate<n>:TRENd:TIMing <YAxis>, <XAxis>

Configures the Parameter Trend result display for time trends. This command defines both x-axis and y-axis parameters in one step. It is equivalent to the two subsequent commands:

`CALCulate<n>:TRENd:TIMing:X TSTamp | PNUMber` (see `CALCulate<n>:TRENd:TIMing:X` on page 255)

`CALCulate<n>:TRENd:TIMing:Y <YAxis>` (see `CALCulate<n>:TRENd:TIMing:Y` on page 256)

Suffix:

<n> 1..n
Window

Setting parameters:

<YAxis> TSTamp | SETTling | RISE | FALL | PWIDth | OFF | DRATio | DCYCle | PRI | PRF

Pulse parameter to be displayed on the y-axis. For a description of the available parameters see Chapter 3.1.1, "Timing parameters", on page 16.

TSTamp
Timestamp

SETTling
Settling Time

RISE
Rise Time

FALL
Fall Time

PWIDth
Pulse Width (ON Time)

OFF
Off Time

DRATio
Duty Ratio

DCYCle
Duty Cycle (%)

PRI
Pulse Repetition Interval

PRF
Pulse Repetition Frequency (Hz)

	*RST: RISE
<XAxis>	PNUMber | TSTamp | SETTling | RISE | FALL | PWIDth | OFF | DRATio | DCYCle | PRI | PRF

Pulse parameter to be displayed on the x-axis. For a description of the available parameters see Chapter 3.1.1, "Timing parameters", on page 16.

TSTamp
Timestamp

PNUMber
The pulse numbers are represented on the x-axis (available numbers can be queried using `[SENSe:]PULSe:NUMBer?` on page 312). Intervals without pulses are not displayed.

SETTling
Settling Time

RISE
Rise Time

FALL
Fall Time

PWIDth
Pulse Width (ON Time)

OFF
Off Time

DRATio
Duty Ratio

DCYCle
Duty Cycle (%)

PRI
Pulse Repetition Interval

PRF
Pulse Repetition Frequency (Hz)

*RST: PNUMber

Usage: Setting only

CALCulate<n>:TRENd:TIMing:X <XAxis>

Configures the x-axis of the Parameter Trend result display.

The y-axis is configured using the `CALCulate<n>:TRENd:<GroupName>:Y` commands.

Suffix:
<n> Window

Setting parameters:
<XAxis> PNUMber | TSTamp | SETTling | RISE | FALL | PWIDth | OFF | DRATio | DCYCle | PRI | PRF

Pulse parameter to be displayed on the x-axis. For a description of the available parameters see Chapter 3.1.1, "Timing parameters", on page 16.

TSTamp
Timestamp

PNUMber
The pulse numbers are represented on the x-axis (available numbers can be queried using `[SENSe:]PULSe:NUMBer?` on page 312). Intervals without pulses are not displayed.

SETTling
Settling Time

RISE
Rise Time

FALL
Fall Time

PWIDth
Pulse Width (ON Time)

OFF
Off Time

DRATio
Duty Ratio

DCYCle
Duty Cycle (%)

PRI
Pulse Repetition Interval

PRF
Pulse Repetition Frequency (Hz)

*RST: PNUMber

Example: `CALC2:TREN:TIM:X DCYCle`

Usage: Setting only

CALCulate<n>:TRENd:TIMing:Y <YAxis>

Configures the y-axis of the Parameter Trend result display.

The x-axis is configured using the `CALCulate<n>:TRENd:<GroupName>:X` commands.

Suffix:
<n> Window

Setting parameters:
<YAxis> TSTamp | SETTling | RISE | FALL | PWIDth | OFF | DRATio | DCYCle | PRI | PRF

Pulse parameter to be displayed on the y-axis. For a description of the available parameters see Chapter 3.1.1, "Timing parameters", on page 16.

TSTamp
Timestamp

SETTling
Settling Time

RISE
Rise Time

FALL
Fall Time

PWIDth
Pulse Width (ON Time)

OFF
Off Time

DRATio
Duty Ratio

DCYCle
Duty Cycle (%)

PRI
Pulse Repetition Interval

PRF
Pulse Repetition Frequency (Hz)

*RST: RISE

Example: `CALC2:TREN:TIM:Y DCYCle`

Usage: Setting only

8.4.11.7 Configuring a result range spectrum

The following commands determine the FFT parameters for spectrum calculation.

CALCulate<n>:RRSPectrum:WINDow <WindowType>

Defines the RBW for the Result Range Spectrum.

The same window types are available as for Parameter Spectrum displays (see "Window functions" on page 51).

Suffix:
<n> 1..n
Window

Setting parameters:
<WindowType> RECTangle | BARTlett | HAMMing | HANNing | BLACkman

Manual operation: See "Window Type" on page 102

CALCulate<n>:RRSPectrum:AUTO <State>

If activated, the optimal RBW for the Result Range Spectrum is selected automatically.

Suffix:

<n> 1..n
Window

Parameters:

<State> ON | OFF | 0 | 1

OFF | 0
Switches the function off

ON | 1
Switches the function on

*RST: 0

Manual operation: See "RBW Auto" on page 102

CALCulate<n>:RRSPectrum:RBW <RBW>

Defines the resolution bandwidth for the Result Range Spectrum.

Suffix:

<n> 1..n
Window

Parameters:

<RBW> *RST: 1000
Default unit: Hz

Manual operation: See "ResBW Manual" on page 102

8.4.11.8 Configuring the statistics and parameter tables

The following commands select which parameters are displayed in the Pulse Statistics and Pulse Results evaluation.

For details on the individual parameters see Chapter 3.1, "Pulse parameters", on page 15.

CALCulate<n>:TABLe:EMODel:ALL[:STATe] <State>

If enabled, all envelope model parameters are included in the result tables.

Suffix:

<n>	1..n Window

Setting parameters:

<State>	ON | OFF | 0 | 1 **OFF | 0** Switches the function off **ON | 1** Switches the function on *RST: 0
Usage:	Setting only

CALCulate<n>:TABLe:EMODel:FBPTime <State>

If enabled, the Fall Base Point Time is included in the result tables.

Suffix:

<n>	1..n Window

Parameters:

<State>	ON | OFF | 1 | 0 *RST: 0
Manual operation:	See "Fall Base Point Time" on page 28

CALCulate<n>:TABLe:EMODel:FHPLevel <State>

If enabled, the Fall High Point Level is included in the result tables.

Suffix:

<n>	1..n Window

Parameters:

<State>	ON | OFF | 1 | 0 *RST: 0
Manual operation:	See "Fall High Point Level" on page 29

CALCulate<n>:TABLe:EMODel:FHPTime <State>

If enabled, the Fall High Point Time is included in the result tables.

Suffix:
<n> 1..n
Window

Parameters:
<State> ON | OFF | 1 | 0
*RST: 0

Manual operation: See "Fall High Point Time" on page 28

CALCulate<n>:TABLe:EMODel:FLPLevel <State>

If enabled, the Fall Low Point Level is included in the result tables.

Suffix:
<n> 1..n
Window

Parameters:
<State> ON | OFF | 1 | 0
*RST: 0

Manual operation: See "Fall Low Point Level" on page 28

CALCulate<n>:TABLe:EMODel:FLPTime <State>

If enabled, the Fall Low Point Time is included in the result tables.

Suffix:
<n> 1..n
Window

Parameters:
<State> ON | OFF | 1 | 0
*RST: 0

Manual operation: See "Fall Low Point Time" on page 28

CALCulate<n>:TABLe:EMODel:FMPLevel <State>

If enabled, the Fall Mid Point Level is included in the result tables.

Suffix:
<n> 1..n
Window

Parameters:
<State> ON | OFF | 1 | 0
*RST: 0

Manual operation: See "Fall Mid Point Level" on page 28

CALCulate<n>:TABLe:EMODel:FMPTime <State>

If enabled, the Fall Mid Point Time is included in the result tables.

Suffix:

<n>	1..n Window

Parameters:

<State>	ON | OFF | 1 | 0 *RST: 0

Manual operation: See "Fall Mid Point Time" on page 28

CALCulate<n>:TABLe:EMODel:FTPLevel <State>

If enabled, the Fall Top Point Level is included in the result tables.

Suffix:

<n>	1..n Window

Parameters:

<State>	ON | OFF | 1 | 0 *RST: 0

Manual operation: See "Fall Top Point Level" on page 29

CALCulate<n>:TABLe:EMODel:FTPTime <State>

If enabled, the Fall Top Point Time is included in the result tables.

Suffix:

<n>	1..n Window

Parameters:

<State>	ON | OFF | 1 | 0 *RST: 0

Manual operation: See "Fall Top Point Time" on page 28

CALCulate<n>:TABLe:EMODel:RBPTime <State>

If enabled, the Rise Base Point Time is included in the result tables.

Suffix:

<n>	1..n Window

Parameters:
<State> ON | OFF | 1 | 0
*RST: 0

Manual operation: See "Rise Base Point Time" on page 26

CALCulate<n>:TABLe:EMODel:RHPLevel <State>

If enabled, the Rise High Point Level is included in the result tables.

Suffix:
<n> 1..n
Window

Parameters:
<State> ON | OFF | 1 | 0
*RST: 0

Manual operation: See "Rise High Point Level" on page 27

CALCulate<n>:TABLe:EMODel:RHPTime <State>

If enabled, the Rise High Point Time is included in the result tables.

Suffix:
<n> 1..n
Window

Parameters:
<State> ON | OFF | 1 | 0
*RST: 0

Manual operation: See "Rise High Point Time" on page 27

CALCulate<n>:TABLe:EMODel:RLPLevel <State>

If enabled, the Rise Low Point Level is included in the result tables.

Suffix:
<n> 1..n
Window

Parameters:
<State> ON | OFF | 1 | 0
*RST: 0

Manual operation: See "Rise Low Point Level" on page 27

CALCulate<n>:TABLe:EMODel:RLPTime <State>

If enabled, the Rise Low Point Time is included in the result tables.

Suffix:
<n> 1..n
Window

Parameters:
<State> ON | OFF | 1 | 0
*RST: 0

Manual operation: See "Rise Low Point Time" on page 26

CALCulate<n>:TABLe:EMODel:RMPLevel <State>

If enabled, the Rise Mid Point Level is included in the result tables.

Suffix:
<n> 1..n
Window

Parameters:
<State> ON | OFF | 1 | 0
*RST: 0

Manual operation: See "Rise Mid Point Level" on page 27

CALCulate<n>:TABLe:EMODel:RMPTime <State>

If enabled, the Rise Mid Point Time is included in the result tables.

Suffix:
<n> 1..n
Window

Parameters:
<State> ON | OFF | 1 | 0
*RST: 0

Manual operation: See "Rise Mid Point Time" on page 26

CALCulate<n>:TABLe:EMODel:RTPLevel <State>

If enabled, the Rise Top Point Level is included in the result tables.

Suffix:
<n> 1..n
Window

Parameters:
<State> ON | OFF | 1 | 0
*RST: 0

Manual operation: See "Rise Top Point Level" on page 27

CALCulate<n>:TABLe:EMODel:RTPTime <State>

If enabled, the Rise Top Point Time is included in the result tables.

Suffix:
<n> 1..n
Window

Parameters:
<State> ON | OFF | 1 | 0
*RST: 0

Manual operation: See "Rise Top Point Time" on page 27

CALCulate<n>:TABLe:FREQuency:ALL[:STATe] <State>

If enabled, all frequency parameters are included in the result tables.

Suffix:
<n> 1..n
Window

Setting parameters:
<State> ON | OFF | 1 | 0
*RST: 0

Usage: Setting only

CALCulate<n>:TABLe:FREQuency:CRATe <State>

If enabled, the chirp rate (per µs) is included in the result tables.

Suffix:
<n> 1..n
Window

Parameters:
<State> ON | OFF | 1 | 0
*RST: 0

Manual operation: See "Chirp Rate" on page 24

CALCulate<n>:TABLe:FREQuency:DEViation <State>

If enabled, the frequency deviation is included in the result tables.

Suffix:
<n> 1..n
Window

Parameters:
<State> ON | OFF | 1 | 0
*RST: 0

Manual operation: See "Frequency Deviation" on page 24

CALCulate<n>:TABLe:FREQuency:PERRor <State>

If enabled, the peak frequency error is included in the result tables.

Suffix:

<n> 1..n
Window

Parameters:

<State> ON | OFF | 1 | 0
*RST: 0

Manual operation: See "Frequency Error (Peak)" on page 23

CALCulate<n>:TABLe:FREQuency:POINt <State>

If enabled, the frequency at the measurement point is included in the result tables.

Suffix:

<n> 1..n
Window

Parameters:

<State> ON | OFF | 1 | 0
*RST: 1

Manual operation: See "Frequency" on page 23

CALCulate<n>:TABLe:FREQuency:PPFRequency <State>

If enabled, the Pulse-Pulse Frequency Difference is included in the result tables.

Suffix:

<n> 1..n
Window

Parameters:

<State> ON | OFF | 1 | 0
*RST: 0

Manual operation: See "Pulse-Pulse Frequency Difference" on page 23

CALCulate<n>:TABLe:FREQuency:RERRor <State>

If enabled, the RMS frequency error is included in the result tables.

Suffix:

<n> 1..n
Window

Parameters:

<State>	ON | OFF | 1 | 0 *RST: 0

Manual operation: See "Frequency Error (RMS)" on page 23

CALCulate<n>:TABLe:PHASe:ALL[:STATe] <State>

If enabled, all phase parameters are included in the result tables.

Suffix:

<n>	1..n Window

Setting parameters:

<State>	ON | OFF | 1 | 0 *RST: 0

Usage: Setting only

CALCulate<n>:TABLe:PHASe:DEViation <State>

If enabled, the Phase Deviation is included in the result tables.

Suffix:

<n>	1..n Window

Parameters:

<State>	ON | OFF | 1 | 0 *RST: 0

Manual operation: See "Phase Deviation" on page 25

CALCulate<n>:TABLe:PHASe:PERRor <State>

If enabled, the Phase Error (Peak) is included in the result tables.

Suffix:

<n>	1..n Window

Parameters:

<State>	ON | OFF | 1 | 0 *RST: 0

Manual operation: See "Phase Error (Peak)" on page 25

CALCulate<n>:TABLe:PHASe:POINt <State>

If enabled, the phase at the measurement point is included in the result tables.

Suffix:
<n> 1..n
Window

Parameters:
<State> ON | OFF | 1 | 0
*RST: 1

Manual operation: See "Phase" on page 24

CALCulate<n>:TABLe:PHASe:PPPHase <State>

If enabled, the Pulse-Pulse Phase Difference is included in the result tables.

Suffix:
<n> 1..n
Window

Parameters:
<State> ON | OFF | 1 | 0
*RST: 0

Manual operation: See "Pulse-Pulse Phase Difference" on page 24

CALCulate<n>:TABLe:PHASe:RERRor <State>

If enabled, the Phase Error (RMS) is included in the result tables.

Suffix:
<n> 1..n
Window

Parameters:
<State> ON | OFF | 1 | 0
*RST: 0

Manual operation: See "Phase Error (RMS)" on page 24

CALCulate<n>:TABLe:POWer:ADRoop:DB <State>

If enabled, the Droop in dB is included in the result tables.

Suffix:
<n> 1..n
Window

Parameters:
<State> ON | OFF | 1 | 0
*RST: 0

Manual operation: See "Droop" on page 21

CALCulate<n>:TABLe:POWer:ADRoop[:PERCent] <State>

If enabled, the droop in percent is included in the result tables.

Suffix:
<n> 1..n
Window

Parameters:
<State> ON | OFF | 1 | 0
*RST: 0

Manual operation: See "Droop" on page 21

CALCulate<n>:TABLe:POWer:ALL[:STATe] <State>

If enabled, all power parameters are included in the result tables.

Suffix:
<n> 1..n

Setting parameters:
<State> ON | OFF | 1 | 0
*RST: 0

Usage: Setting only

CALCulate<n>:TABLe:POWer:AMPLitude <State>

If enabled, the pulse amplitude is included in the result tables.

Suffix:
<n> 1..n
Window

Parameters:
<State> ON | OFF | 1 | 0
*RST: 0

Manual operation: See "Pulse Amplitude" on page 20

CALCulate<n>:TABLe:POWer:AMPLitude:I <State>

If enabled, the in-phase amplitude is included in the result tables.

Suffix:
<n> 1..n
Window

Parameters:
<State> ON | OFF | 1 | 0
*RST: 0

Manual operation: See "In-Phase Amplitude/Quadrature Amplitude" on page 20

CALCulate<n>:TABLe:POWer:AMPLitude:Q <State>

If enabled, the quadrature amplitude is included in the result tables.

Suffix:
<n> 1..n
Window

Parameters:
<State> ON | OFF | 1 | 0
*RST: 0

Manual operation: See "In-Phase Amplitude/Quadrature Amplitude" on page 20

CALCulate<n>:TABLe:POWer:AVG <State>

If enabled, the average Tx power is included in the result tables.

Suffix:
<n> 1..n
Window

Parameters:
<State> ON | OFF | 1 | 0
*RST: 1

Manual operation: See "Average Tx Power" on page 20

CALCulate<n>:TABLe:POWer:BASE <State>

If enabled, the base power is included in the result tables.

Suffix:
<n> 1..n
Window

Parameters:
<State> ON | OFF | 1 | 0
*RST: 0

Manual operation: See "Base Power" on page 19

CALCulate<n>:TABLe:POWer:MAX <State>

If enabled, the maximum Tx power is included in the result tables.

Suffix:
<n> 1..n
Window

Parameters:
<State> ON | OFF | 1 | 0
*RST: 0

Manual operation: See "Peak Power" on page 21

CALCulate<n>:TABLe:POWer:MIN <State>

If enabled, the minimum Tx power is included in the result tables.

Suffix:
<n> 1..n
Window

Parameters:
<State> ON | OFF | 1 | 0
*RST: 0

Manual operation: See "Minimum Power" on page 20

CALCulate<n>:TABLe:POWer:ON <State>

If enabled, the average ON power is included in the result tables.

Suffix:
<n> 1..n
Window

Parameters:
<State> ON | OFF | 1 | 0
*RST: 1

Manual operation: See "Average ON Power" on page 20

CALCulate<n>:TABLe:POWer:OVERshoot:DB <State>

If enabled, the overshoot in dB is included in the result tables.

Suffix:
<n> 1..n
Window

Parameters:
<State> ON | OFF | 1 | 0
*RST: 0

Manual operation: See "Overshoot" on page 22

CALCulate<n>:TABLe:POWer:OVERshoot[:PERCent] <State>

If enabled, the overshoot in percent is included in the result tables.

Suffix:
<n> 1..n
Window

Parameters:
<State> ON | OFF | 1 | 0
*RST: 0

Manual operation: See "Overshoot" on page 22

CALCulate<n>:TABLe:POWer:PAVG <State>

If enabled, the Peak-to-Average Tx Power Ratio is included in the result tables.

Suffix:
<n> 1..n
Window

Parameters:
<State> ON | OFF | 1 | 0
*RST: 0

Manual operation: See "Peak-to-Average Tx Power Ratio" on page 21

CALCulate<n>:TABLe:POWer:PMIN <State>

If enabled, the Peak-to-Min Power Ratio is included in the result tables.

Suffix:
<n> 1..n
Window

Parameters:
<State> ON | OFF | 1 | 0
*RST: 0

Manual operation: See "Peak-to-Min Power Ratio" on page 21

CALCulate<n>:TABLe:POWer:POINt <State>

If enabled, the power at the measurement point is included in the result tables.

Suffix:
<n> 1..n
Window

Parameters:
<State> ON | OFF | 1 | 0
*RST: 0

Manual operation: See "Power (at Point)" on page 22

CALCulate<n>:TABLe:POWer:PON <State>

If enabled, the Peak-to-Avg ON Power Ratio is included in the result tables.

Suffix:
<n> 1..n
Window

Parameters:
<State> ON | OFF | 1 | 0
*RST: 0

Manual operation: See "Peak-to-Avg ON Power Ratio" on page 21

CALCulate<n>:TABLe:POWer:PPRatio <State>

If enabled, the Pulse-to-Pulse Power Difference

is included in the result tables.

Suffix:
<n> 1..n
Window

Parameters:
<State> ON | OFF | 1 | 0
*RST: 0

Manual operation: See "Pulse-to-Pulse Power Ratio" on page 22

CALCulate<n>:TABLe:POWer:RIPPle:DB <State>

If enabled, the ripple in dB is included in the result tables.

Suffix:
<n> 1..n
Window

Parameters:
<State> ON | OFF | 1 | 0
*RST: 0

Manual operation: See "Ripple" on page 22

CALCulate<n>:TABLe:POWer:RIPPle[:PERCent] <State>

If enabled, the ripple in percent is included in the result tables.

Suffix:
<n> 1..n
Window

Parameters:
<State> ON | OFF | 1 | 0
*RST: 0

Manual operation: See "Ripple" on page 22

CALCulate<n>:TABLe:POWer:TOP <State>

If enabled, the Top power is included in the result tables.

Suffix:
<n> 1..n
Window

Parameters:
<State> ON | OFF | 1 | 0
*RST: 0

Manual operation: See "Top Power" on page 19

CALCulate<n>:TABLe:TIMing:ALL[:STATe] <State>

If enabled, all timing parameters are included in the result tables.

Suffix:
<n> 1..n
Window

Setting parameters:
<State> ON | OFF | 1 | 0
*RST: 0

Usage: Setting only

CALCulate<n>:TABLe:TIMing:DCYCle <State>

If enabled, the duty cycle (in %) is included in the result tables.

Suffix:
<n> 1..n
Window

Parameters:
<State> ON | OFF | 1 | 0
*RST: 1

Manual operation: See "Duty Cycle (%)" on page 18

CALCulate<n>:TABLe:TIMing:DRATio <State>

If enabled, the duty ratio (in dB) is included in the result tables.

Suffix:
<n> 1..n
Window

Parameters:
<State> ON | OFF | 1 | 0
*RST: 0

Manual operation: See "Duty Ratio" on page 18

CALCulate<n>:TABLe:TIMing:FALL <State>

If enabled, the fall time is included in the result tables.

Suffix:

<n> 1..n
Window

Parameters:

<State> ON | OFF | 1 | 0
*RST: 0

Manual operation: See "Fall Time" on page 17

CALCulate<n>:TABLe:TIMing:OFF <State>

If enabled, the "OFF" time is included in the result tables.

Suffix:

<n> 1..n
Window

Parameters:

<State> ON | OFF | 1 | 0
*RST: 0

Manual operation: See "Off Time" on page 18

CALCulate<n>:TABLe:TIMing:PRF <State>

If enabled, the pulse repetition frequency is included in the result tables.

Suffix:

<n> 1..n
Window

Parameters:

<State> ON | OFF | 1 | 0
*RST: 0

Manual operation: See "Pulse Repetition Frequency (Hz)" on page 19

CALCulate<n>:TABLe:TIMing:PRI <State>

If enabled, the pulse repetition interval is included in the result tables.

Suffix:

<n> 1..n
Window

Parameters:

<State> ON | OFF | 1 | 0

*RST: 1

Manual operation: See "Pulse Repetition Interval" on page 18

CALCulate<n>:TABLe:TIMing:PWIDth <State>

If enabled, the pulse width is included in the result tables.

Suffix:

<n> 1..n

Window

Parameters:

<State> ON | OFF | 1 | 0

*RST: 1

Manual operation: See "Pulse Width (ON Time)" on page 18

CALCulate<n>:TABLe:TIMing:RISE <State>

If enabled, the rise time is included in the result tables.

Suffix:

<n> 1..n

Window

Parameters:

<State> ON | OFF | 1 | 0

*RST: 1

Manual operation: See "Rise Time" on page 17

CALCulate<n>:TABLe:TIMing:SETTling <State>

If enabled, the settling time is included in the result tables.

Suffix:

<n> 1..n

Window

Parameters:

<State> ON | OFF | 1 | 0

*RST: 0

Manual operation: See "Settling Time" on page 17

CALCulate<n>:TABLe:TIMing:TSTamp <State>

If enabled, the timestamp is included in the result tables.

Suffix:
<n> 1..n
Window

Parameters:
<State> ON | OFF | 1 | 0
*RST: 0

Manual operation: See "Timestamp" on page 17

8.4.11.9 Configuring limit checks

For each parameter in the result tables you can activate a limit check and define the valid value ranges. For details see "Pulse Results" on page 39.

Useful commands for configuring limit checks described elsewhere:

- `CALCulate<n>:DISTribution:LLINes[:STATe]` on page 225
- `CALCulate<n>:TRENd:LLINes[:STATe]` on page 246

For commands required to retrieve the results of the limit check for individual parameters see Chapter 8.6.1.4, "Retrieving limit results", on page 363.

Remote commands exclusive to configuring limit checks:

CALCulate<n>:TABLe:<ParameterGroup>:<Parameter>:LIMit:STATe <State>
CALCulate<n>:TABLe:EMODel:FBPTime:LIMit:STATe <State>
CALCulate<n>:TABLe:EMODel:FHPLevel:LIMit:STATe <State>
CALCulate<n>:TABLe:EMODel:FHPTime:LIMit:STATe <State>
CALCulate<n>:TABLe:EMODel:FLPLevel:LIMit:STATe <State>
CALCulate<n>:TABLe:EMODel:FLPTime:LIMit:STATe <State>
CALCulate<n>:TABLe:EMODel:FMPLevel:LIMit:STATe <State>
CALCulate<n>:TABLe:EMODel:FMPTime:LIMit:STATe <State>
CALCulate<n>:TABLe:EMODel:FTPLevel:LIMit:STATe <State>
CALCulate<n>:TABLe:EMODel:FTPTime:LIMit:STATe <State>
CALCulate<n>:TABLe:EMODel:RBPTime:LIMit:STATe <State>
CALCulate<n>:TABLe:EMODel:RHPLevel:LIMit:STATe <State>
CALCulate<n>:TABLe:EMODel:RHPTime:LIMit:STATe <State>
CALCulate<n>:TABLe:EMODel:RLPLevel:LIMit:STATe <State>
CALCulate<n>:TABLe:EMODel:RLPTime:LIMit:STATe <State>
CALCulate<n>:TABLe:EMODel:RMPLevel:LIMit:STATe <State>
CALCulate<n>:TABLe:EMODel:RMPTime:LIMit:STATe <State>
CALCulate<n>:TABLe:EMODel:RTPLevel:LIMit:STATe <State>
CALCulate<n>:TABLe:EMODel:RTPTime:LIMit:STATe <State>
CALCulate<n>:TABLe:FREQuency:CRATe:LIMit:STATe <State>
CALCulate<n>:TABLe:FREQuency:DEViation:LIMit:STATe <State>
CALCulate<n>:TABLe:FREQuency:PERRor:LIMit:STATe <State>
CALCulate<n>:TABLe:FREQuency:POINt:LIMit:STATe <State>
CALCulate<n>:TABLe:FREQuency:PPFRequency:LIMit:STATe <State>
CALCulate<n>:TABLe:FREQuency:RERRor:LIMit:STATe <State>
CALCulate<n>:TABLe:PHASe:DEViation:LIMit:STATe <State>

CALCulate<n>:TABLe:PHASe:PERRor:LIMit:STATe <State>
CALCulate<n>:TABLe:PHASe:POINt:LIMit:STATe <State>
CALCulate<n>:TABLe:PHASe:PPPHase:LIMit:STATe <State>
CALCulate<n>:TABLe:PHASe:RERRor:LIMit:STATe <State>
CALCulate<n>:TABLe:POWer:ADRoop:DB:LIMit:STATe <State>
CALCulate<n>:TABLe:POWer:ADRoop[:PERCent]:LIMit:STATe <State>
CALCulate<n>:TABLe:POWer:AMPLitude:LIMit:STATe <State>
CALCulate<n>:TABLe:POWer:AMPLitude:I:LIMit:STATe <State>
CALCulate<n>:TABLe:POWer:AMPLitude:Q:LIMit:STATe <State>
CALCulate<n>:TABLe:POWer:AVG:LIMit:STATe <State>
CALCulate<n>:TABLe:POWer:BASE:LIMit:STATe <State>
CALCulate<n>:TABLe:POWer:MAX:LIMit:STATe <State>
CALCulate<n>:TABLe:POWer:MIN:LIMit:STATe <State>
CALCulate<n>:TABLe:POWer:ON:LIMit:STATe <State>
CALCulate<n>:TABLe:POWer:OVERshoot:DB:LIMit:STATe <State>
CALCulate<n>:TABLe:POWer:OVERshoot[:PERCent]:LIMit:STATe <State>
CALCulate<n>:TABLe:POWer:PAVG:LIMit:STATe <State>
CALCulate<n>:TABLe:POWer:PMIN:LIMit:STATe <State>
CALCulate<n>:TABLe:POWer:POINt:LIMit:STATe <State>
CALCulate<n>:TABLe:POWer:PON:LIMit:STATe <State>
CALCulate<n>:TABLe:POWer:PPRatio:LIMit:STATe <State>
CALCulate<n>:TABLe:POWer:RIPPle:DB:LIMit:STATe <State>
CALCulate<n>:TABLe:POWer:RIPPle[:PERCent]:LIMit:STATe <State>
CALCulate<n>:TABLe:POWer:TOP:LIMit:STATe <State>
CALCulate<n>:TABLe:TIMing:DCYCle:LIMit:STATe <State>
CALCulate<n>:TABLe:TIMing:DRATio:LIMit:STATe <State>
CALCulate<n>:TABLe:TIMing:FALL:LIMit:STATe <State>
CALCulate<n>:TABLe:TIMing:OFF:LIMit:STATe <State>
CALCulate<n>:TABLe:TIMing:PRF:LIMit:STATe <State>
CALCulate<n>:TABLe:TIMing:PRI:LIMit:STATe <State>
CALCulate<n>:TABLe:TIMing:PWIDth:LIMit:STATe <State>
CALCulate<n>:TABLe:TIMing:RISE:LIMit:STATe <State>
CALCulate<n>:TABLe:TIMing:SETTling:LIMit:STATe <State>
CALCulate<n>:TABLe:TIMing:TSTamp:LIMit:STATe <State>

Activates or deactivates a limit check for the selected parameter. The limits are defined using `CALCulate<n>:TABLe:<ParameterGroup>:<Parameter>:LIMit` on page 279.

Suffix:

<n>	1..n

Parameters:

<State>	ON | OFF | 1 | 0
	*RST: 0

CALCulate<n>:TABLe:<ParameterGroup>:ALL:LIMit:STATe <State>
CALCulate<n>:TABLe:EMODel:ALL:LIMit:STATe <State>
CALCulate<n>:TABLe:FREQuency:ALL:LIMit:STATe <State>
CALCulate<n>:TABLe:PHASe:ALL:LIMit:STATe <State>

CALCulate<n>:TABLe:POWer:ALL:LIMit:STATe <State>
CALCulate<n>:TABLe:TIMing:ALL:LIMit:STATe <State>

Activates or deactivates a limit check for all parameters in the selected parameter group.

Suffix:
<n> 1..n

Setting parameters:
<State> ON | OFF | 1 | 0
*RST: 0

Usage: Setting only

CALCulate<n>:TABLe:ALL:LIMit:STATe <State>

Activates or deactivates a limit check for all parameters in all parameter groups.

Suffix:
<n> 1..n
Window

Setting parameters:
<State> ON | OFF | 1 | 0
*RST: 0

Usage: Setting only

Manual operation: See "Deactivating all limit checks for all parameter groups" on page 113

CALCulate<n>:TABLe:<ParameterGroup>:<Parameter>:LIMit <LowLimit>, <UppLimit>
CALCulate<n>:TABLe:EMODel:FBPTime:LIMit <LowerLimit>, <UpperLimit>
CALCulate<n>:TABLe:EMODel:FHPLevel:LIMit <LowerLimit>, <UpperLimit>
CALCulate<n>:TABLe:EMODel:FHPTime:LIMit <LowerLimit>, <UpperLimit>
CALCulate<n>:TABLe:EMODel:FLPLevel:LIMit <LowerLimit>, <UpperLimit>
CALCulate<n>:TABLe:EMODel:FLPTime:LIMit <LowerLimit>, <UpperLimit>
CALCulate<n>:TABLe:EMODel:FMPLevel:LIMit <LowerLimit>, <UpperLimit>
CALCulate<n>:TABLe:EMODel:FMPTime:LIMit <LowerLimit>, <UpperLimit>
CALCulate<n>:TABLe:EMODel:FTPLevel:LIMit <LowerLimit>, <UpperLimit>
CALCulate<n>:TABLe:EMODel:FTPTime:LIMit <LowerLimit>, <UpperLimit>
CALCulate<n>:TABLe:EMODel:RBPTime:LIMit <LowerLimit>, <UpperLimit>
CALCulate<n>:TABLe:EMODel:RHPLevel:LIMit <LowerLimit>, <UpperLimit>
CALCulate<n>:TABLe:EMODel:RHPTime:LIMit <LowerLimit>, <UpperLimit>
CALCulate<n>:TABLe:EMODel:RLPLevel:LIMit <LowerLimit>, <UpperLimit>
CALCulate<n>:TABLe:EMODel:RLPTime:LIMit <LowerLimit>, <UpperLimit>
CALCulate<n>:TABLe:EMODel:RMPLevel:LIMit <LowerLimit>, <UpperLimit>
CALCulate<n>:TABLe:EMODel:RMPTime:LIMit <LowerLimit>, <UpperLimit>
CALCulate<n>:TABLe:EMODel:RTPLevel:LIMit <LowerLimit>, <UpperLimit>
CALCulate<n>:TABLe:EMODel:RTPTime:LIMit <LowerLimit>, <UpperLimit>

CALCulate<n>:TABLe:FREQuency:CRATe:LIMit <LowerLimit>, <UpperLimit>
CALCulate<n>:TABLe:FREQuency:DEViation:LIMit <LowerLimit>, <UpperLimit>
CALCulate<n>:TABLe:FREQuency:PERRor:LIMit <LowerLimit>, <UpperLimit>
CALCulate<n>:TABLe:FREQuency:POINt:LIMit <LowerLimit>, <UpperLimit>
CALCulate<n>:TABLe:FREQuency:PPFRequency:LIMit <LowerLimit>, <UpperLimit>
CALCulate<n>:TABLe:FREQuency:RERRor:LIMit <LowerLimit>, <UpperLimit>
CALCulate<n>:TABLe:PHASe:DEViation:LIMit <LowerLimit>, <UpperLimit>
CALCulate<n>:TABLe:PHASe:PERRor:LIMit <LowerLimit>, <UpperLimit>
CALCulate<n>:TABLe:PHASe:POINt:LIMit <LowerLimit>, <UpperLimit>
CALCulate<n>:TABLe:PHASe:PPPHase:LIMit <LowerLimit>, <UpperLimit>
CALCulate<n>:TABLe:PHASe:RERRor:LIMit <LowerLimit>, <UpperLimit>
CALCulate<n>:TABLe:POWer:ADRoop:DB:LIMit <LowerLimit>, <UpperLimit>
CALCulate<n>:TABLe:POWer:ADRoop[:PERCent]:LIMit <LowerLimit>, <UpperLimit>
CALCulate<n>:TABLe:POWer:AMPLitude:LIMit <LowerLimit>, <UpperLimit>
CALCulate<n>:TABLe:POWer:AMPLitude:I:LIMit <LowerLimit>, <UpperLimit>
CALCulate<n>:TABLe:POWer:AMPLitude:Q:LIMit <LowerLimit>, <UpperLimit>
CALCulate<n>:TABLe:POWer:AVG:LIMit <LowerLimit>, <UpperLimit>
CALCulate<n>:TABLe:POWer:BASE:LIMit <LowerLimit>, <UpperLimit>
CALCulate<n>:TABLe:POWer:MAX:LIMit <LowerLimit>, <UpperLimit>
CALCulate<n>:TABLe:POWer:MIN:LIMit <LowerLimit>, <UpperLimit>
CALCulate<n>:TABLe:POWer:ON:LIMit <LowerLimit>, <UpperLimit>
CALCulate<n>:TABLe:POWer:OVERshoot:DB:LIMit <LowerLimit>, <UpperLimit>
CALCulate<n>:TABLe:POWer:OVERshoot[:PERCent]:LIMit <LowerLimit>, <UpperLimit>
CALCulate<n>:TABLe:POWer:PAVG:LIMit <LowerLimit>, <UpperLimit>
CALCulate<n>:TABLe:POWer:PMIN:LIMit <LowerLimit>, <UpperLimit>
CALCulate<n>:TABLe:POWer:POINt:LIMit <LowerLimit>, <UpperLimit>
CALCulate<n>:TABLe:POWer:PON:LIMit <LowerLimit>, <UpperLimit>
CALCulate<n>:TABLe:POWer:PPRatio:LIMit <LowerLimit>, <UpperLimit>
CALCulate<n>:TABLe:POWer:RIPPle:DB:LIMit <LowerLimit>, <UpperLimit>
CALCulate<n>:TABLe:POWer:RIPPle[:PERCent]:LIMit <LowerLimit>, <UpperLimit>
CALCulate<n>:TABLe:POWer:TOP:LIMit <LowerLimit>, <UpperLimit>
CALCulate<n>:TABLe:TIMing:DCYCle:LIMit <LowerLimit>, <UpperLimit>
CALCulate<n>:TABLe:TIMing:DRATio:LIMit <LowerLimit>, <UpperLimit>
CALCulate<n>:TABLe:TIMing:FALL:LIMit <LowerLimit>, <UpperLimit>
CALCulate<n>:TABLe:TIMing:OFF:LIMit <LowerLimit>, <UpperLimit>
CALCulate<n>:TABLe:TIMing:PRF:LIMit <LowerLimit>, <UpperLimit>
CALCulate<n>:TABLe:TIMing:PRI:LIMit <LowerLimit>, <UpperLimit>
CALCulate<n>:TABLe:TIMing:PWIDth:LIMit <LowerLimit>, <UpperLimit>
CALCulate<n>:TABLe:TIMing:RISE:LIMit <LowerLimit>, <UpperLimit>
CALCulate<n>:TABLe:TIMing:SETTling:LIMit <LowerLimit>, <UpperLimit>
CALCulate<n>:TABLe:TIMing:TSTamp:LIMit <LowerLimit>, <UpperLimit>

Defines the valid value range for the limit check for the selected parameter if limit check is active (`CALCulate<n>:TABLe:<ParameterGroup>:<Parameter>:LIMit:STATe` `ON`).

For details on the individual parameters see Chapter 3.1, "Pulse parameters", on page 15.

Suffix:
<n> 1..n

Parameters:
<LowerLimit> Lower limit of the valid value range.
Default unit: S

<UpperLimit> Upper limit of the valid value range.
Default unit: S

8.4.11.10 Configuring the Y-Axis scaling and units

The scaling for the vertical axis is highly configurable, using either absolute or relative values. These commands are described here.

Useful commands for configuring scaling described elsewhere:

- `DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:RLEVel<ant>` on page 180

Remote commands exclusive to scaling the y-axis

CALCulate<n>:UNIT:FREQuency <Unit>

Switches between relative (default) and absolute frequency values. This setting applies to Pulse Frequency, Result Range Spectrum, Parameter Distribution and Parameter Trend result displays.

Suffix:
<n> 1..n
Window

Parameters:
<Unit> REL | ABS

Manual operation: See "Frequency Scaling" on page 116

DISPlay[:WINDow<n>]:TRACe<t>:X[:SCALe]:UNIT?

This command reads the unit type currently configured for the X-axis

Suffix:

<n>	1..n Window
<t>	1..n Trace

Usage: Query only

DISPlay[:WINDow<n>][:SUBWindow<n>]:TRACe<t>:Y[:SCALe]:AUTO <State>

If enabled, the Y-axis is scaled automatically according to the current measurement.

Suffix:

<n>	Window
<w>	subwindow Not supported by all applications
<t>	irrelevant

Parameters for setting and query:

<State>

OFF
Switch the function off

ON
Switch the function on

ONCE
Execute the function once

*RST: ON

Manual operation: See "Auto Scale Continuous (All)" on page 98
See "Auto Scale Once (All)" on page 98
See "Automatic Grid Scaling" on page 114
See "Auto Scale Once " on page 115

DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:MAXimum <Value>

Defines the maximum value on the y-axis in the specified window.

Suffix:

<n>	Window
<t>	irrelevant

Parameters:

<Max> numeric value

Example: `DISP:WIND2:TRAC:Y:SCAL:MAX 10`

Manual operation: See "Absolute Scaling (Min/Max Values)" on page 115

DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:MINimum <Value>

Defines the minimum value on the y-axis in the specified window.

Suffix:

<n> Window

<t> irrelevant

Parameters:

<Min> numeric value

Example: `DISP:WIND2:TRAC:Y:SCAL:MIN -90`

Manual operation: See "Absolute Scaling (Min/Max Values)" on page 115

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

Manual operation: See "Per Division" on page 115

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 Position" on page 115

DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:RVALue <Value>

This command defines the reference value assigned to the reference position in the specified window. Separate reference values are maintained for the various displays.

Suffix:

<n> Window

<t> irrelevant

Parameters:

<Value> numeric value WITHOUT UNIT

Default unit: dBm

Manual operation: See "Ref Value" on page 115

DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:UNIT?

This command reads the unit type currently configured for the Y-axis

Suffix:

<n> 1..n
Window

<t> 1..n
Trace

Usage: Query only

CALCulate<n>:UNIT:ANGLe <Unit>
UNIT:ANGLe <Unit>

Parameters:

<Unit> DEG | RAD

Manual operation: See "Phase Unit" on page 116

8.5 Analyzing results

The following remote commands are required to configure general result analysis settings concerning the trace, markers, etc. in a remote environment.

More details are described for manual operation in Chapter 6, "Analysis", on page 99.

8.5.1 Configuring standard traces

The following commands are required to configure traces in the R&S VSE Pulse application.

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
<t>	Trace

Parameters:

<Mode>

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 126

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:

<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:
`DISP:WIND:TRAC3:MODE:HCON ON`
Switches off the reset function.

Manual operation: See "Hold " on page 127

DISPlay[:WINDow<n>]:TRACe<t>:NORMalize:MODE <Mode>

Enables or disables normalization of the traces in reference to the measured pulse or a reference pulse. For details see Chapter 4.5.2, "Normalizing traces", on page 58.

Is valid only for Magnitude Time, Frequency Time, Phase Time and Phase Time Wrapped result displays.

Suffix:

<n> 1..n

<t> 1..n

Parameters:

<Mode>

OFF
Traces are not normalized

MEASured
The value in the measurement point (that is: the value in the Pulse Results table) for each pulse in phase, amplitude or frequency is subtracted from the respective trace to normalize each trace to 0.

REFerence
The value in the measurement point (that is: the value in the Pulse Results table) for the *Reference Pulse* is subtracted from the respective trace to normalize the traces.
The reference pulse is defined using `SENSe:TRACe:MEASurement:DEFine:PULSe:REFerence:POSition` on page 207 and `SENSe:TRACe:MEASurement:DEFine:PULSe:REFerence` on page 207.

*RST: OFF

Example: `DISP:WIND2:TRAC:NORM:MODE MEAS`

Manual operation: See "Normalization" on page 128

DISPlay[:WINDow<n>]:TRACe<t>:NORMalize:PHASe <Phase>

Normalizes pulse phase traces to a specific phase value. For details see "Normalization of pulse phase traces" on page 61.

Is valid only for Phase Time and Phase Time Wrapped result displays.

Suffix:

<n> 1..n
Window

<t> 1..n
irrelevant

Parameters:

<Phase> floating point value

Phase offset in degrees or radians

*RST: 0
Default unit: DEG

Example: `DISP:WIND2:TRAC:NORM:PHAS 45`

Manual operation: See "Phase Normalization" on page 116

[SENSe:]SWEep:COUNt <SweepCount>

Defines the number of measurements that the application uses to average traces.

See also Chapter 4.5.1, "Trace statistics", on page 57.

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.

Parameters:

<SweepCount> When you set a capture count of 0 or 1, the R&S VSE performs one single measurement in single measurement mode.
In continuous measurement mode, if the capture count is set to 0, a moving average over 10 measurements is performed.

Range: 0 to 200000
*RST: 0

<SweepCount> If you set a sweep count of 0 or 1, the application performs one single sweep in single sweep mode.
In continuous sweep mode, if the average count is set to 0, a moving average over 10 sweeps is performed.

Range: 0 to 100000
*RST: 0

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.

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 126
See "Trace 1 / Trace 2 / Trace 3 / Trace 4 (Softkeys)" on page 129

[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

AVERage
Average

*RST: APEak

Example: `DET POS`
Sets the detector to "positive peak".

Manual operation: See "Detector " on page 127

[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 127

[SENSe:]STATistic<n>:TYPE <TraceStatistic>

Suffix:

<n> 1..n
Window

Parameters:

<TraceStatistic> SEL | ALL

SEL
Only the selected pulse from each capture is included in the statistical evaluation of trace results. The pulse is selected using `SENSe:TRACe:MEASurement:DEFine:PULSe:SELected` on page 220.

ALL
All measured pulses from each capture are included in the statistical evaluation of trace results.

Manual operation: See "Selected Pulse vs All Pulses" on page 128

[SENSe:]SWEep:POINts <SweepPoints>

Sets/queries the number of trace points to be displayed and used for statistical evaluation.

Parameters:

<SweepPoints>

Manual operation: See "Maximum number of trace points" on page 128

DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:CHANnel <Channel>

Sets and queries the trace channel for a given window. The channel availability depends on the selected channel mode.

Suffix:

<n> Window

<w> irrelevant

<t> Trace

Parameters:

<Channel>

Example: `DISP:WIND:SUBW:TRAC:CHAN 4`

8.5.2 Working with markers

8.5.2.1 Individual marker settings

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 121

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> 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:MARK2 ON`
Links marker 4 to marker 2.

Manual operation: See "Linking to Another Marker " on page 120

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> Window

<m> Marker

Parameters:

<State> ON | OFF | 0 | 1

OFF | 0
Switches the function off

ON | 1
Switches the function on

Example: `CALC:MARK3 ON`
Switches on marker 3.

Manual operation: See "Marker 1 / Marker 2 / Marker 3 / Marker 4" on page 118
See "Marker 1 / Delta Marker 1 / Delta Marker 2 / Delta Marker 16 " on page 118
See "Marker State " on page 119
See "Marker Type " on page 119
See "Select Marker " on page 120

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:

<Trace>

Example: //Assign marker to trace 1
`CALC:MARK3:TRAC 2`

Manual operation: See "Assigning the Marker to a Trace " on page 120

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 31
See "Marker 1 / Marker 2 / Marker 3 / Marker 4" on page 118
See "Marker 1 / Delta Marker 1 / Delta Marker 2 / Delta Marker 16 " on page 118
See "X-value" on page 119

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.

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 120

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).

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:DELT4:LINK:TO:MARK2 ON`
Links the delta marker 4 to the marker 2.

Manual operation: See "Linking to Another Marker " on page 120

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.

D1
Selects the deltamarker 1 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 119

CALCulate<n>:DELTamarker<m>[:STATe] <State>

Turns delta markers on and off.

If necessary, the command activates the delta marker first.

No suffix at DELTamarker 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 / Marker 2 / Marker 3 / Marker 4" on page 118
See "Marker 1 / Delta Marker 1 / Delta Marker 2 / Delta Marker 16 " on page 118
See "Marker State " on page 119
See "Marker Type " on page 119
See "Select Marker " on page 120

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 / Marker 2 / Marker 3 / Marker 4" on page 118
See "Marker 1 / Delta Marker 1 / Delta Marker 2 / Delta Marker 16 " on page 118
See "X-value" on page 119

8.5.2.2 General marker settings

CALCulate<n>:MARKer<m>:LINK <State>

Defines whether the markers in all diagrams with the same x-axis are linked. If enabled, and you move one marker along the x-axis, all other markers are moved to the same x-axis position.

Note that if the `CALCulate<n>:MARKer<m>:LINK:TRENd` is enabled, this command is automatically also enabled, if necessary.

Suffix:

<m> irrelevant

<n> irrelevant

Parameters:

<State> ON | OFF | 1 | 0

*RST: 0

Example: `CALC2:MARK:LINK ON`
Links all markers across all diagrams. The window selection `2` is irrelevant.

Manual operation: See "Linked Markers Across Windows" on page 122

CALCulate<n>:MARKer<m>:LINK:TRENd <State>

If enabled, marker M1 in Parameter Trend displays is linked to the pulse selection. Thus, if you move the marker M1 to a different pulse, the Pulse selection is set to the same pulse, and vice versa.

Requires the markers to be linked across all windows (`CALCulate<n>:MARKer<m>:LINK ON`). If the `CALCulate<n>:MARKer<m>:LINK:TRENd` command is enabled, the `CALCulate<n>:MARKer<m>:LINK` command is automatically also enabled, if necessary.

Suffix:
<n>, <m> irrelevant

Parameters:
<State> ON | OFF | 1 | 0
*RST: 0

Example:
```
CALC:MARK:LINK ON
CALC:MARK:LINK:TREN ON
```

Manual operation: See "Link Trend M1 to Selected Pulse" on page 122

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.

Suffix:
<n> irrelevant

<m> irrelevant

Manual operation: See "Peak Excursion " on page 123

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 121

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 121

8.5.2.3 Positioning the marker

This chapter contains remote commands necessary to position the marker on a trace.

Positioning normal markers

The following commands position markers on the trace.

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.

Suffix:

<n> Window

<m> Marker

CALCulate<n>:MARKer<m>:MAXimum:NEXT

Moves a marker to the next positive peak.

Suffix:

<n>	Window
<m>	Marker

Manual operation: See "Search Next Peak" on page 124

CALCulate<n>:MARKer<m>:MAXimum[:PEAK]

Moves a marker to the highest level.

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 124

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.

Suffix:

<n>	Window
<m>	Marker

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.

Suffix:

<n>	Window
<m>	Marker

CALCulate<n>:MARKer<m>:MINimum:NEXT

Moves a marker to the next minimum peak value.

Suffix:

<n>	Window
<m>	Marker

Manual operation: See "Search Next Minimum" on page 125

CALCulate<n>:MARKer<m>:MINimum[:PEAK]

Moves a marker to the minimum level.

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 124

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.

Suffix:

<n> Window

<m> Marker

Positioning delta markers

The following commands position delta markers on the trace.

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.

Suffix:

<n> Window

<m> Marker

CALCulate<n>:DELTamarker<m>:MAXimum:NEXT

Moves a marker to the next positive peak value.

Suffix:

<n>	1..n Window
<m>	1..n Marker

Manual operation: See "Search Next Peak" on page 124

CALCulate<n>:DELTamarker<m>:MAXimum[:PEAK]

Moves a delta marker to the highest level.

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 124

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.

Suffix:

<n>	Window
<m>	Marker

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.

Suffix:

<n>	Window
<m>	Marker

CALCulate<n>:DELTamarker<m>:MINimum:NEXT

Moves a marker to the next minimum peak value.

Suffix:

<n> Window

<m> Marker

Manual operation: See "Search Next Minimum" on page 125

CALCulate<n>:DELTamarker<m>:MINimum[:PEAK]

Moves a delta marker to the minimum level.

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 124

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.

Suffix:

<n> Window

<m> Marker

8.6 Retrieving results

The following remote commands are required to retrieve the results from a Pulse measurement in a remote environment.

8.6.1 Retrieving results

The following commands are required to retrieve the calculated pulse parameters.

Note that for each pulse result query you can specify for which pulse(s) you require results:

- **ALL**: for all pulses detected in the entire measurement
- **CURRent**: for all pulses in the current capture buffer
- **SELected**: only for the currently selected pulse

For each pulse result, you can query either the current value (default) or the following statistical values for the pulses detected in the capture buffer or the entire measurement:

- **AVER:** average of the results
- **MIN:** minimum of the results
- **MAX:** maximum of the results
- **SDEV:** standard deviation of the results

To determine how many pulses were considered for statistical evaluation, see [SENSe:]PULSe:<ParameterGroup>:<Parameter>:COUNt? on page 312.

8.6.1.1 Retrieving and storing trace data

In order to retrieve the trace results in a remote environment, use the following command:

TRACe<n>[:DATA]? <Trace>

This command queries the y-values in the selected result display. It is only available for graphical displays.

For each trace point, the measured or calculated value is returned. For the Magnitude Capture display, the maximum y-value for each trace point is returned.

The unit depends on the display and on the unit you have currently set.

Suffix:

<n> Window

Query parameters:

<Trace> TRACE1 | TRACE2 | TRACE3 | TRACE4 | TRACE5 | TRACE6

The trace number whose values are to be returned.

Example: R&S RTO/RTP selection in option R&S VSE-K6A: "CHAN2_CHAN4_WV"

`TRACe1:DATA? TRACE1` returns trace data for R&S RTO/RTP channel 2.

`TRACe1:DATA? TRACE2` returns trace data for R&S RTO/RTP channel 4.

Usage: Query only

Manual operation: See "Magnitude Capture" on page 30
See "Parameter Distribution" on page 31
See "Parameter Spectrum" on page 33
See "Pulse Frequency" on page 36
See "Pulse Magnitude" on page 37
See "Pulse Phase" on page 38
See "Pulse Phase (Wrapped)" on page 39
See "Pulse-Pulse Spectrum" on page 41
See "Result Range Spectrum" on page 43

TRACe<n>[:DATA]:X? <Trace>

This remote control command returns the X values only for the trace in the selected result display. Depending on the type of result display and the scaling of the x-axis, this can be either the pulse number or a timestamp for each detected pulse in the capture buffer.

Is only available for graphical displays, except for the Magnitude Capture display.

Suffix:
<n> 1..n
Window

Query parameters:
<Trace> TRACe1 | TRACe2 | TRACe3 | TRACe4 | TRACe5 | TRACe6
The trace number whose values are to be returned.

Return values:
<Data> <char_data>

Example: See Chapter 8.7, "Programming example: pulse measurement", on page 370.

Usage: Query only

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.

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.
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: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:

<SampleRate> * <CaptureTime>

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 <# of samples> – 1, with <# of samples> 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 <# of samples> - <offset samples> with <# of samples> maximum number of captured values
*RST: <# of samples>

Return values:

<IQData>
: Measured value pair (I,Q) for each sample that has been recorded.
The first half of the list contains the I values, the second half the Q values.
The data format of the individual values depends on `FORMat[:DATA]` on page 365.
Default unit: V

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

TRACe<n>:IQ[:INPut<i>]:DATA:MEMory? [<Start>, <Stop>]

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.

Suffix:

<n>
: 1..n
Window

<i>
: 1..n
Selects the input channel for R&S VSE-K6A multi-channel measurements.

Query parameters:

<Start>
: 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 <# of samples> – 1, with <# of samples> being the maximum number of captured values
*RST: 0

<Stop>
: 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 <# of samples> - <offset samples> with <# of samples> maximum number of captured values
*RST: <# of samples>

Example:
Example for input source: Channels 1,3 (Waveform)
Retrieve channel 1 data: `TRAC:IQ:INP1:DATA:MEM?`
Retrieve channel 3 data: `TRAC:IQ:INP2:DATA:MEM?`

Usage: Query only

CALCulate<n>:TRACe<t>[:VALue] <Detector>

Defines which signal component (I/Q) is evaluated in which trace for the Pulse I and Q result display. This setting is not available for any other result displays. By default, the I component is displayed by trace 1, while the Q component is displayed by trace 4.

Suffix:

<n> Window

<t> Trace

Parameters:

<Detector> ITIMe | QTIMe

ITIMe
The I component is evaluated by the selected trace.

QTIMe
The Q component is evaluated by the selected trace.

Example: `CALC2:TRAC2 QTIM`
Trace 2 in window 2 evaluates the Q component of the signal.

Manual operation: See "Evaluation" on page 128

CALCulate<n>:TRACe<t>[:VALue]:CHANnel <Channel>

With option R&S VSE-K6A installed, this command selects the trace channel for pulse result displays.

Suffix:

<n> Window

<t> Trace

Parameters:

<Channel> CHANnel1 | CHANnel2 | CHANnel3 | CHANnel4

Example: `CALC4:TRAC2:VAL:CHAN CHANnel3`

Manual operation: See "Channel" on page 127

TRACe:IQ:DATA:RRANge?

This command queries the I/Q data currently stored in the memory of the R&S VSE for the defined result range (seeChapter 8.4.11.2, "Defining the result range", on page 221).

Return values:

<IQData> Measured value pair (I,Q) for each sample that has been recorded.
The data format depends on `FORMat[:DATA]`.

Default unit: V

Example: `TRAC:IQ:DATA:RRAN?`

Usage: Query only

MMEMory:STORe<n>:TRACe <Trace>, <FileName>

Exports trace data from the specified window to an ASCII file.

You cannot query trace data resulting from encrypted file input.

For details on the file format, see Chapter C, "Reference: ASCII file export format", on page 386.

Suffix:
<n> Window

Parameters:
<Trace> Number of the trace to be stored

<FileName> String containing the path and name of the target file.

Example: `MMEM:STOR1:TRAC 1,'C:\TEST.ASC'`
Stores trace 1 from window 1 in the file `TEST.ASC`.

Example: See Chapter 8.7, "Programming example: pulse measurement", on page 370.

Manual operation: See "Export Trace to ASCII File " on page 131

8.6.1.2 Retrieving information on detected pulses

The following commands return general information on the currently selected or all detected pulses.

[SENSe:]PULSe:COUNt? <QueryRange>

Queries the number of detected pulses in the current capture buffer or the entire measurement.

Query parameters:

<QueryRange> CURRent | ALL

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Example: `PULS:COUN?`

Usage: Query only

Manual operation: See "Pulse Results" on page 39

[SENSe:]PULSe:EMODel:FBPTime:COUNt? <QueryRange>
[SENSe:]PULSe:EMODel:FHPLevel:COUNt? <QueryRange>
[SENSe:]PULSe:EMODel:FHPTime:COUNt? <QueryRange>
[SENSe:]PULSe:EMODel:FLPLevel:COUNt? <QueryRange>
[SENSe:]PULSe:EMODel:FLPTime:COUNt? <QueryRange>
[SENSe:]PULSe:EMODel:FMPLevel:COUNt? <QueryRange>
[SENSe:]PULSe:EMODel:FMPTime:COUNt? <QueryRange>
[SENSe:]PULSe:EMODel:FTPLevel:COUNt? <QueryRange>
[SENSe:]PULSe:EMODel:FTPTime:COUNt? <QueryRange>
[SENSe:]PULSe:EMODel:RBPTime:COUNt? <QueryRange>
[SENSe:]PULSe:EMODel:RHPLevel:COUNt? <QueryRange>
[SENSe:]PULSe:EMODel:RHPTime:COUNt? <QueryRange>
[SENSe:]PULSe:EMODel:RLPLevel:COUNt? <QueryRange>
[SENSe:]PULSe:EMODel:RLPTime:COUNt? <QueryRange>
[SENSe:]PULSe:EMODel:RMPLevel:COUNt? <QueryRange>
[SENSe:]PULSe:EMODel:RMPTime:COUNt? <QueryRange>
[SENSe:]PULSe:EMODel:RTPLevel:COUNt? <QueryRange>
[SENSe:]PULSe:EMODel:RTPTime:COUNt? <QueryRange>
[SENSe:]PULSe:FREQuency:CRATe:COUNt? <QueryRange>
[SENSe:]PULSe:FREQuency:DEViation:COUNt? <QueryRange>
[SENSe:]PULSe:FREQuency:PERRor:COUNt? <QueryRange>
[SENSe:]PULSe:FREQuency:POINt:COUNt? <QueryRange>
[SENSe:]PULSe:FREQuency:PPFRequency:COUNt? <QueryRange>
[SENSe:]PULSe:FREQuency:RERRor:COUNt? <QueryRange>
[SENSe:]PULSe:PHASe:DEViation:COUNt? <QueryRange>
[SENSe:]PULSe:PHASe:PERRor:COUNt? <QueryRange>

[SENSe:]PULSe:PHASe:POINt:COUNt? <QueryRange>
[SENSe:]PULSe:PHASe:PPPHase:COUNt? <QueryRange>
[SENSe:]PULSe:PHASe:RERRor:COUNt? <QueryRange>
[SENSe:]PULSe:POWer:ADRoop:DB:COUNt? <QueryRange>
[SENSe:]PULSe:POWer:ADRoop[:PERCent]:COUNt? <QueryRange>
[SENSe:]PULSe:POWer:AMPL:I:COUNt? <QueryRange>
[SENSe:]PULSe:POWer:AMPL:Q:COUNt? <QueryRange>
[SENSe:]PULSe:POWer:AMPLitude:COUNt? <QueryRange>
[SENSe:]PULSe:POWer:AVG:COUNt? <QueryRange>
[SENSe:]PULSe:POWer:BASE:COUNt? <QueryRange>
[SENSe:]PULSe:POWer:MAX:COUNt? <QueryRange>
[SENSe:]PULSe:POWer:MIN:COUNt? <QueryRange>
[SENSe:]PULSe:POWer:ON:COUNt? <QueryRange>
[SENSe:]PULSe:POWer:OVERshoot:DB:COUNt? <QueryRange>
[SENSe:]PULSe:POWer:OVERshoot[:PERCent]:COUNt? <QueryRange>
[SENSe:]PULSe:POWer:PAVG:COUNt? <QueryRange>
[SENSe:]PULSe:POWer:PMIN:COUNt? <QueryRange>
[SENSe:]PULSe:POWer:POINt:COUNt? <QueryRange>
[SENSe:]PULSe:POWer:PON:COUNt? <QueryRange>
[SENSe:]PULSe:POWer:PPRatio:COUNt? <QueryRange>
[SENSe:]PULSe:POWer:RIPPle:DB:COUNt? <QueryRange>
[SENSe:]PULSe:POWer:RIPPle[:PERCent]:COUNt? <QueryRange>
[SENSe:]PULSe:POWer:TOP:COUNt? <QueryRange>
[SENSe:]PULSe:STABility:AMPLitude:COUNt? <QueryRange>
[SENSe:]PULSe:STABility:BURSt:COUNt? <QueryRange>
[SENSe:]PULSe:STABility:PHASe:COUNt? <QueryRange>
[SENSe:]PULSe:STABility:PIBurst:COUNt? <QueryRange>
[SENSe:]PULSe:STABility:TOTal:COUNt? <QueryRange>
[SENSe:]PULSe:TIMing:DCYCle:COUNt? <QueryRange>
[SENSe:]PULSe:TIMing:DRATio:COUNt? <QueryRange>
[SENSe:]PULSe:TIMing:FALL:COUNt? <QueryRange>
[SENSe:]PULSe:TIMing:OFF:COUNt? <QueryRange>
[SENSe:]PULSe:TIMing:PRF:COUNt? <QueryRange>
[SENSe:]PULSe:TIMing:PRI:COUNt? <QueryRange>
[SENSe:]PULSe:TIMing:PWIDth:COUNt? <QueryRange>
[SENSe:]PULSe:TIMing:RISE:COUNt? <QueryRange>
[SENSe:]PULSe:TIMing:SETTling:COUNt? <QueryRange>
[SENSe:]PULSe:TIMing:TSTamp:COUNt? <QueryRange>
[SENSe:]PULSe:TSIDelobe:AMPower:COUNt? <QueryRange>
[SENSe:]PULSe:TSIDelobe:CRATio:COUNt? <QueryRange>
[SENSe:]PULSe:TSIDelobe:IMPower:COUNt? <QueryRange>
[SENSe:]PULSe:TSIDelobe:ISLevel:COUNt? <QueryRange>
[SENSe:]PULSe:TSIDelobe:MFRequency:COUNt? <QueryRange>
[SENSe:]PULSe:TSIDelobe:MPHase:COUNt? <QueryRange>
[SENSe:]PULSe:TSIDelobe:MWIDth:COUNt? <QueryRange>
[SENSe:]PULSe:TSIDelobe:PCORrelation:COUNt? <QueryRange>
[SENSe:]PULSe:TSIDelobe:PSLevel:COUNt? <QueryRange>

[SENSe:]PULSe:TSIDelobe:SDELay:COUNt? <QueryRange>
[SENSe:]PULSe:<ParameterGroup>:<Parameter>:COUNt? <QueryRange>

Returns the number of pulses considered for statistical evaluation of the specified result.

Query parameters:

<QueryRange> CURRent | ALL

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Return values:

<Result> integer

Number of pulses

Example: `PULS:POW:ADR:DB:COUN? CURR`
Returns the number of pulses used to determine the statistical values for amplitude droop in dB in the current capture buffer.

Usage: Query only

Manual operation: See "Pulse Statistics" on page 42

[SENSe:]PULSe:ID? <QueryRange>

Queries the ids of the detected pulses, i.e the unique index within the entire measurement (as opposed to `[SENSe:]PULSe:NUMBer?`).

Query parameters:

<QueryRange> CURRent | ALL

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Usage: Query only

[SENSe:]PULSe:NUMBer? <QueryRange>

Queries the detected pulse numbers, i.e. the index within the capture buffer (as opposed to `[SENSe:]PULSe:ID?`).

Query parameters:

<QueryRange> CURRent | ALL

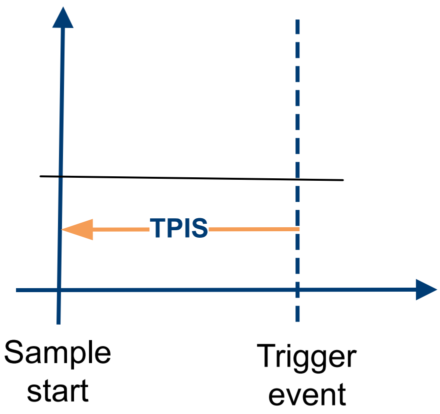
CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Usage: Query only

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 μs (the duration of 1 sample).
Usage:	Query only

8.6.1.3 Retrieving parameter results

The following commands return the calculated pulse parameters.

For details on the individual parameters see Chapter 3.1.2, "Power/amplitude parameters", on page 19.

To determine how many pulses were considered for statistical evaluation, see `[SENSe:]PULSe:<ParameterGroup>:<Parameter>:COUNt?` on page 312.

Retrieving power / amplitude parameters

The following commands return the calculated pulse parameters.

For details on the individual parameters see Chapter 3.1.2, "Power/amplitude parameters", on page 19.

[SENSe:]PULSe:POWer:ADRoop:DB? <QueryRange>

Returns the amplitude droop in dB for the specified pulse(s).

Query parameters:

<QueryRange> SELected | CURRent | ALL

SELected
Currently selected pulse

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Return values:

<Result> <char_data>

Usage: Query only

Manual operation: See "Droop" on page 21

[SENSe:]PULSe:POWer:ADRoop:DB:AVERage? <QueryRange>
[SENSe:]PULSe:POWer:ADRoop:DB:MAXimum? <QueryRange>
[SENSe:]PULSe:POWer:ADRoop:DB:MINimum? <QueryRange>
[SENSe:]PULSe:POWer:ADRoop:DB:SDEViation? <QueryRange>

Returns the statistical value for the amplitude droop in dB over the specified pulses.

Query parameters:

<QueryRange> CURRent | ALL

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Return values:

<Result> <char_data>

Usage: Query only

[SENSe:]PULSe:POWer:ADRoop[:PERCent]? <QueryRange>

Returns the amplitude droop in percent for the specified pulse(s).

Query parameters:

<QueryRange> SELected | CURRent | ALL

SELected
Currently selected pulse

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Return values:
<Result> <char_data>

Usage: Query only

Manual operation: See "Droop" on page 21

[SENSe:]PULSe:POWer:ADRoop[:PERCent]:AVERage? <QueryRange>
[SENSe:]PULSe:POWer:ADRoop[:PERCent]:MAXimum? <QueryRange>
[SENSe:]PULSe:POWer:ADRoop[:PERCent]:MINimum? <QueryRange>
[SENSe:]PULSe:POWer:ADRoop[:PERCent]:SDEViation? <QueryRange>

Returns the statistical value for the amplitude droop in percent over the specified pulses.

Query parameters:
<QueryRange> CURRent | ALL

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Return values:
<Result> <char_data>

Usage: Query only

[SENSe:]PULSe:POWer:AMPLitude? <QueryRange>

Returns the pulse amplitude for the specified pulse(s).

Query parameters:
<QueryRange> SELected | CURRent | ALL

SELected
Currently selected pulse

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Return values:
<Result> <char_data>

Usage: Query only

Manual operation: See "Pulse Amplitude" on page 20

[SENSe:]PULSe:POWer:AMPLitude:AVERage? <QueryRange>
[SENSe:]PULSe:POWer:AMPLitude:MAXimum? <QueryRange>
[SENSe:]PULSe:POWer:AMPLitude:MINimum? <QueryRange>
[SENSe:]PULSe:POWer:AMPLitude:SDEViation? <QueryRange>

Returns the statistical value for the pulse amplitude over the specified pulses.

Query parameters:

<QueryRange> CURRent | ALL

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Return values:

<Result> <char_data>

Usage: Query only

[SENSe:]PULSe:POWer:AMPLitude:I? <QueryRange>

Returns the in-phase amplitude for the specified pulse(s).

Query parameters:

<QueryRange> SELected | CURRent | ALL

SELected
Currently selected pulse

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Usage: Query only

Manual operation: See "In-Phase Amplitude/Quadrature Amplitude" on page 20
See "Pulse I and Q" on page 36

[SENSe:]PULSe:POWer:AMPLitude:I:AVERage? <QueryRange>
[SENSe:]PULSe:POWer:AMPLitude:I:MAXimum? <QueryRange>
[SENSe:]PULSe:POWer:AMPLitude:I:MINimum? <QueryRange>
[SENSe:]PULSe:POWer:AMPLitude:I:SDEViation? <QueryRange>

Returns the statistical value for the in-phase amplitude over the specified pulses.

Query parameters:

<QueryRange> CURRent | ALL

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Usage: Query only

[SENSe:]PULSe:POWer:AMPLitude:Q? <QueryRange>

Returns the quadrature amplitude for the specified pulse(s).

Query parameters:
<QueryRange> SELected | CURRent | ALL

SELected
Currently selected pulse

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Usage: Query only

Manual operation: See "In-Phase Amplitude/Quadrature Amplitude" on page 20
See "Pulse I and Q" on page 36

[SENSe:]PULSe:POWer:AMPLitude:Q:AVERage? <QueryRange>
[SENSe:]PULSe:POWer:AMPLitude:Q:MAXimum? <QueryRange>
[SENSe:]PULSe:POWer:AMPLitude:Q:MINimum? <QueryRange>
[SENSe:]PULSe:POWer:AMPLitude:Q:SDEViation? <QueryRange>

Returns the statistical value for the quadrature amplitude over the specified pulses.

Query parameters:
<QueryRange> CURRent | ALL

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Usage: Query only

[SENSe:]PULSe:POWer:AVG? <QueryRange>

Returns the average transmission power for the specified pulse(s).

Query parameters:
<QueryRange> SELected | CURRent | ALL

SELected
Currently selected pulse

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Return values:
<Result> <char_data>

Usage: Query only

Manual operation: See "Average Tx Power" on page 20

[SENSe:]PULSe:POWer:AVG:AVERage? <QueryRange>
[SENSe:]PULSe:POWer:AVG:MAXimum? <QueryRange>
[SENSe:]PULSe:POWer:AVG:MINimum? <QueryRange>
[SENSe:]PULSe:POWer:AVG:SDEViation? <QueryRange>

Returns the statistical value for the average transmission power over the specified pulses.

Query parameters:
<QueryRange> CURRent | ALL

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Return values:
<Result> <char_data>

Usage: Query only

[SENSe:]PULSe:POWer:BASE? <QueryRange>

Returns the base power for the specified pulse(s).

Query parameters:
<QueryRange> SELected | CURRent | ALL

SELected
Currently selected pulse

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Return values:
<Result> <char_data>

Usage: Query only

Manual operation: See "Base Power" on page 19

[SENSe:]PULSe:POWer:BASE:AVERage? <QueryRange>
[SENSe:]PULSe:POWer:BASE:MAXimum? <QueryRange>

[SENSe:]PULSe:POWer:BASE:MINimum? <QueryRange>
[SENSe:]PULSe:POWer:BASE:SDEViation? <QueryRange>

Returns the statistical value for the base power over the specified pulses.

Query parameters:

<QueryRange> CURRent | ALL

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Return values:

<Result> <char_data>

Usage: Query only

[SENSe:]PULSe:POWer:MAX? <QueryRange>

Returns the maximum transmission power for the specified pulse(s).

Query parameters:

<QueryRange> SELected | CURRent | ALL

SELected
Currently selected pulse

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Return values:

<Result> <char_data>

Usage: Query only

Manual operation: See "Peak Power" on page 21

[SENSe:]PULSe:POWer:MAX:AVERage? <QueryRange>
[SENSe:]PULSe:POWer:MAX:MAXimum? <QueryRange>
[SENSe:]PULSe:POWer:MAX:MINimum? <QueryRange>
[SENSe:]PULSe:POWer:MAX:SDEViation? <QueryRange>

Returns the statistical value for the maximum transmission power over the specified pulses.

Query parameters:

<QueryRange> CURRent | ALL

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Return values:
<Result> <char_data>

Usage: Query only

[SENSe:]PULSe:POWer:MIN? <QueryRange>

Returns the minimum transmission power for the specified pulse(s).

Query parameters:
<QueryRange> SELected | CURRent | ALL

SELected
Currently selected pulse

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Return values:
<Result> <char_data>

Usage: Query only

Manual operation: See "Minimum Power" on page 20

[SENSe:]PULSe:POWer:MIN:AVERage? <QueryRange>
[SENSe:]PULSe:POWer:MIN:MAXimum? <QueryRange>
[SENSe:]PULSe:POWer:MIN:MINimum? <QueryRange>
[SENSe:]PULSe:POWer:MIN:SDEViation? <QueryRange>

Returns the statistical value for the minimum transmission power over the specified pulses.

Query parameters:
<QueryRange> CURRent | ALL

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Return values:
<Result> <char_data>

Usage: Query only

[SENSe:]PULSe:POWer:ON? <QueryRange>

Returns the average ON power for the specified pulse(s).

Query parameters:
<QueryRange> SELected | CURRent | ALL

SELected
Currently selected pulse

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Return values:
<Result> <char_data>

Usage: Query only

Manual operation: See "Average ON Power" on page 20

[SENSe:]PULSe:POWer:ON:AVERage? <QueryRange>
[SENSe:]PULSe:POWer:ON:MAXimum? <QueryRange>
[SENSe:]PULSe:POWer:ON:MINimum? <QueryRange>
[SENSe:]PULSe:POWer:ON:SDEViation? <QueryRange>

Returns the statistical value for the average ON power over the specified pulses.

Query parameters:
<QueryRange> CURRent | ALL

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Return values:
<Result> <char_data>

Usage: Query only

[SENSe:]PULSe:POWer:OVERshoot:DB? <QueryRange>

Returns the overshoot in dB for the specified pulse(s).

Query parameters:
<QueryRange> SELected | CURRent | ALL

SELected
Currently selected pulse

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Return values:
<Result> <char_data>

Usage: Query only

Manual operation: See "Overshoot" on page 22

[SENSe:]PULSe:POWer:OVERshoot:DB:AVERage? <QueryRange>
[SENSe:]PULSe:POWer:OVERshoot:DB:MAXimum? <QueryRange>
[SENSe:]PULSe:POWer:OVERshoot:DB:MINimum? <QueryRange>
[SENSe:]PULSe:POWer:OVERshoot:DB:SDEViation? <QueryRange>

Returns the statistical value for the overshoot in dB over the specified pulses.

Query parameters:

<QueryRange> CURRent | ALL

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Return values:

<Result> <char_data>

Usage: Query only

[SENSe:]PULSe:POWer:OVERshoot[:PERCent]? <QueryRange>

Returns the overshoot in percent for the specified pulse(s).

Query parameters:

<QueryRange> SELected | CURRent | ALL

SELected
Currently selected pulse

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Return values:

<Result> <char_data>

Usage: Query only

Manual operation: See "Overshoot" on page 22

[SENSe:]PULSe:POWer:OVERshoot[:PERCent]:AVERage? <QueryRange>
[SENSe:]PULSe:POWer:OVERshoot[:PERCent]:MAXimum? <QueryRange>
[SENSe:]PULSe:POWer:OVERshoot[:PERCent]:MINimum? <QueryRange>
[SENSe:]PULSe:POWer:OVERshoot[:PERCent]:SDEViation? <QueryRange>

Returns the statistical value for the overshoot in percent over the specified pulses.

Query parameters:

<QueryRange> CURRent | ALL

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Return values:
<Result> <char_data>

Usage: Query only

[SENSe:]PULSe:POWer:PAVG? <QueryRange>

Returns the Peak-to-Average Tx Power Ratio for the specified pulse(s).

Query parameters:
<QueryRange> SELected | CURRent | ALL

SELected
Currently selected pulse

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Return values:
<Result> <char_data>

Usage: Query only

Manual operation: See "Peak-to-Average Tx Power Ratio" on page 21

[SENSe:]PULSe:POWer:PAVG:AVERage? <QueryRange>
[SENSe:]PULSe:POWer:PAVG:MAXimum? <QueryRange>
[SENSe:]PULSe:POWer:PAVG:MINimum? <QueryRange>
[SENSe:]PULSe:POWer:PAVG:SDEViation? <QueryRange>

Returns the statistical value for the Peak-to-Average Tx Power Ratio over the specified pulses.

Query parameters:
<QueryRange> CURRent | ALL

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Return values:
<Result> <char_data>

Usage: Query only

[SENSe:]PULSe:POWer:PMIN? <QueryRange>

Returns the Peak-to-Min Power Ratio for the specified pulse(s).

Query parameters:
<QueryRange> SELected | CURRent | ALL

SELected
Currently selected pulse

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Return values:
<Result> <char_data>

Usage: Query only

Manual operation: See "Peak-to-Min Power Ratio" on page 21

[SENSe:]PULSe:POWer:PMIN:AVERage? <QueryRange>
[SENSe:]PULSe:POWer:PMIN:MAXimum? <QueryRange>
[SENSe:]PULSe:POWer:PMIN:MINimum? <QueryRange>
[SENSe:]PULSe:POWer:PMIN:SDEViation? <QueryRange>

Returns the statistical value for the Peak-to-Min Power Ratio over the specified pulses.

Query parameters:
<QueryRange> CURRent | ALL

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Return values:
<Result> <char_data>

Usage: Query only

[SENSe:]PULSe:POWer:POINt? <QueryRange>

Returns the power in the measurement point for the specified pulse(s).

Query parameters:
<QueryRange> SELected | CURRent | ALL

SELected
Currently selected pulse

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Return values:
<Result> <char_data>

Usage: Query only

Manual operation: See "Power (at Point)" on page 22

[SENSe:]PULSe:POWer:POINt:AVERage? <QueryRange>
[SENSe:]PULSe:POWer:POINt:MAXimum? <QueryRange>
[SENSe:]PULSe:POWer:POINt:MINimum? <QueryRange>
[SENSe:]PULSe:POWer:POINt:SDEViation? <QueryRange>

Returns the statistical value for the power in the measurement point over the specified pulses.

Query parameters:

<QueryRange> CURRent | ALL

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Return values:

<Result> <char_data>

Usage: Query only

[SENSe:]PULSe:POWer:PON? <QueryRange>

Returns the Peak-to-Avg ON Power Ratio for the specified pulse(s).

Query parameters:

<QueryRange> SELected | CURRent | ALL

SELected
Currently selected pulse

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Return values:

<Result> <char_data>

Usage: Query only

Manual operation: See "Peak-to-Avg ON Power Ratio" on page 21

[SENSe:]PULSe:POWer:PON:AVERage? <QueryRange>
[SENSe:]PULSe:POWer:PON:MAXimum? <QueryRange>
[SENSe:]PULSe:POWer:PON:MINimum? <QueryRange>
[SENSe:]PULSe:POWer:PON:SDEViation? <QueryRange>

Returns the statistical value for the Peak-to-Avg ON Power Ratio over the specified pulses.

Query parameters:

<QueryRange> CURRent | ALL

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Return values:
<Result> <char_data>

Usage: Query only

[SENSe:]PULSe:POWer:PPRatio? <QueryRange>

Returns the Pulse-to-Pulse Power Difference for the specified pulse(s).

Query parameters:
<QueryRange> SELected | CURRent | ALL

SELected
Currently selected pulse

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Return values:
<Result> <char_data>

Usage: Query only

Manual operation: See "Pulse-to-Pulse Power Ratio" on page 22

[SENSe:]PULSe:POWer:PPRatio:AVERage? <QueryRange>
[SENSe:]PULSe:POWer:PPRatio:MAXimum? <QueryRange>
[SENSe:]PULSe:POWer:PPRatio:MINimum? <QueryRange>
[SENSe:]PULSe:POWer:PPRatio:SDEViation? <QueryRange>

Returns the statistical value for the Pulse-to-Pulse Power Difference over the specified pulses.

Query parameters:
<QueryRange> CURRent | ALL

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Return values:
<Result> <char_data>

Usage: Query only

[SENSe:]PULSe:POWer:RIPPle:DB? <QueryRange>

Returns the ripple in dB for the specified pulse(s).

Query parameters:

<QueryRange> SELected | CURRent | ALL

SELected
Currently selected pulse

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Usage: Query only

Manual operation: See "Ripple" on page 22

[SENSe:]PULSe:POWer:RIPPle:DB:AVERage? <QueryRange>
[SENSe:]PULSe:POWer:RIPPle:DB:MAXimum? <QueryRange>
[SENSe:]PULSe:POWer:RIPPle:DB:MINimum? <QueryRange>
[SENSe:]PULSe:POWer:RIPPle:DB:SDEViation? <QueryRange>

Returns the statistical value for the ripple in dB over the specified pulses.

Query parameters:

<QueryRange> CURRent | ALL

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Return values:

<Result> <char_data>

Usage: Query only

[SENSe:]PULSe:POWer:RIPPle[:PERCent]? <QueryRange>

Returns the ripple in percent for the specified pulse(s).

Query parameters:

<QueryRange> SELected | CURRent | ALL

SELected
Currently selected pulse

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Return values:

<Result> <char_data>

Usage: Query only

Manual operation: See "Ripple" on page 22

[SENSe:]PULSe:POWer:RIPPle[:PERCent]:AVERage? <QueryRange>
[SENSe:]PULSe:POWer:RIPPle[:PERCent]:MAXimum? <QueryRange>
[SENSe:]PULSe:POWer:RIPPle[:PERCent]:MINimum? <QueryRange>
[SENSe:]PULSe:POWer:RIPPle[:PERCent]:SDEViation? <QueryRange>

Returns the statistical value for the ripple in percent over the specified pulses.

Query parameters:

<QueryRange> CURRent | ALL

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Return values:

<Result> <char_data>

Usage: Query only

[SENSe:]PULSe:POWer:TOP? <QueryRange>

Returns the Top power for the specified pulse(s).

Query parameters:

<QueryRange> SELected | CURRent | ALL

SELected
Currently selected pulse

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Return values:

<Result> <char_data>

Usage: Query only

Manual operation: See "Top Power" on page 19

[SENSe:]PULSe:POWer:TOP:AVERage? <QueryRange>
[SENSe:]PULSe:POWer:TOP:MAXimum? <QueryRange>
[SENSe:]PULSe:POWer:TOP:MINimum? <QueryRange>
[SENSe:]PULSe:POWer:TOP:SDEViation? <QueryRange>

Returns the statistical value for the Top power over the specified pulses.

Query parameters:

<QueryRange> CURRent | ALL

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Return values:
<Result> <char_data>

Usage: Query only

Retrieving timing parameters

The following commands return the calculated pulse parameters.

For details on the individual parameters see Chapter 3.1.1, "Timing parameters", on page 16.

[SENSe:]PULSe:TIMing:DCYCle? <QueryRange>

Returns the duty cycle (in %) for the specified pulse(s).

Query parameters:

<QueryRange> SELected | CURRent | ALL

SELected
Currently selected pulse

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Return values:

<Result> <char_data>

Usage: Query only

Manual operation: See "Duty Cycle (%)" on page 18

[SENSe:]PULSe:TIMing:DCYCle:AVERage? <QueryRange>
[SENSe:]PULSe:TIMing:DCYCle:MAXimum? <QueryRange>
[SENSe:]PULSe:TIMing:DCYCle:MINimum? <QueryRange>
[SENSe:]PULSe:TIMing:DCYCle:SDEViation? <QueryRange>

Returns the statistical value for the duty cycle (in %) over the specified pulses.

Query parameters:

<QueryRange> CURRent | ALL

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Return values:

<Result> <char_data>

Usage: Query only

[SENSe:]PULSe:TIMing:DRATio? <QueryRange>

Returns the duty ratio for the specified pulse(s).

Query parameters:

<QueryRange> SELected | CURRent | ALL

SELected
Currently selected pulse

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Return values:

<Result> <char_data>

Usage: Query only

Manual operation: See "Duty Ratio" on page 18

[SENSe:]PULSe:TIMing:DRATio:AVERage? <QueryRange>
[SENSe:]PULSe:TIMing:DRATio:MAXimum? <QueryRange>
[SENSe:]PULSe:TIMing:DRATio:MINimum? <QueryRange>
[SENSe:]PULSe:TIMing:DRATio:SDEViation? <QueryRange>

Returns the statistical value for the duty ratio over the specified pulses.

Query parameters:

<QueryRange> CURRent | ALL

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Return values:

<Result> <char_data>

Usage: Query only

[SENSe:]PULSe:TIMing:FALL? <QueryRange>

Returns the fall time for the specified pulse(s).

Query parameters:

<QueryRange> SELected | CURRent | ALL

SELected
Currently selected pulse

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Return values:
<Result> <char_data>

Usage: Query only

Manual operation: See "Fall Time" on page 17

[SENSe:]PULSe:TIMing:FALL:AVERage? <QueryRange>
[SENSe:]PULSe:TIMing:FALL:MAXimum? <QueryRange>
[SENSe:]PULSe:TIMing:FALL:MINimum? <QueryRange>
[SENSe:]PULSe:TIMing:FALL:SDEViation? <QueryRange>

Returns the statistical value for the fall time over the specified pulses.

Query parameters:
<QueryRange> CURRent | ALL

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Return values:
<Result> <char_data>

Usage: Query only

[SENSe:]PULSe:TIMing:OFF? <QueryRange>

Returns the Off time for the specified pulse(s).

Query parameters:
<QueryRange> SELected | CURRent | ALL

SELected
Currently selected pulse

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Return values:
<Result> <char_data>

Usage: Query only

Manual operation: See "Off Time" on page 18

[SENSe:]PULSe:TIMing:OFF:AVERage? <QueryRange>
[SENSe:]PULSe:TIMing:OFF:MAXimum? <QueryRange>
[SENSe:]PULSe:TIMing:OFF:MINimum? <QueryRange>
[SENSe:]PULSe:TIMing:OFF:SDEViation? <QueryRange>

Returns the statistical value for the Off time over the specified pulses.

Query parameters:

<QueryRange> CURRent | ALL

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Return values:

<Result> <char_data>

Usage: Query only

[SENSe:]PULSe:TIMing:PRF? <QueryRange>

Returns the Pulse Repetition Frequency (Hz) for the specified pulse(s).

Query parameters:

<QueryRange> SELected | CURRent | ALL

SELected
Currently selected pulse

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Return values:

<Result> <char_data>

Usage: Query only

Manual operation: See "Pulse Repetition Frequency (Hz)" on page 19

[SENSe:]PULSe:TIMing:PRF:AVERage? <QueryRange>
[SENSe:]PULSe:TIMing:PRF:MAXimum? <QueryRange>
[SENSe:]PULSe:TIMing:PRF:MINimum? <QueryRange>
[SENSe:]PULSe:TIMing:PRF:SDEViation? <QueryRange>

Returns the statistical value for the Pulse Repetition Frequency (Hz) over the specified pulses.

Query parameters:

<QueryRange> CURRent | ALL

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Return values:
<Result> <char_data>

Usage: Query only

[SENSe:]PULSe:TIMing:PRI? <QueryRange>

Returns the Pulse Repetition Interval for the specified pulse(s).

Query parameters:
<QueryRange> SELected | CURRent | ALL

SELected
Currently selected pulse

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Return values:
<Result> <char_data>

Usage: Query only

Manual operation: See "Pulse Repetition Interval" on page 18

[SENSe:]PULSe:TIMing:PRI:AVERage? <QueryRange>
[SENSe:]PULSe:TIMing:PRI:MAXimum? <QueryRange>
[SENSe:]PULSe:TIMing:PRI:MINimum? <QueryRange>
[SENSe:]PULSe:TIMing:PRI:SDEViation? <QueryRange>

Returns the statistical value for the Pulse Repetition Interval over the specified pulses.

Query parameters:
<QueryRange> CURRent | ALL

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Return values:
<Result> <char_data>

Usage: Query only

[SENSe:]PULSe:TIMing:PWIDth? <QueryRange>

Returns the pulse width for the specified pulse(s).

Query parameters:

<QueryRange> SELected | CURRent | ALL

SELected
Currently selected pulse

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Return values:

<Result> <char_data>

Usage: Query only

Manual operation: See "Pulse Width (ON Time)" on page 18

[SENSe:]PULSe:TIMing:PWIDth:AVERage? <QueryRange>
[SENSe:]PULSe:TIMing:PWIDth:MAXimum? <QueryRange>
[SENSe:]PULSe:TIMing:PWIDth:MINimum? <QueryRange>
[SENSe:]PULSe:TIMing:PWIDth:SDEViation? <QueryRange>

Returns the pulse width for the phase deviation over the specified pulses.

Query parameters:

<QueryRange> CURRent | ALL

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Return values:

<Result> <char_data>

Usage: Query only

[SENSe:]PULSe:TIMing:RISE? <QueryRange>

Returns the rise time for the specified pulse(s).

Query parameters:

<QueryRange> SELected | CURRent | ALL

SELected
Currently selected pulse

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Return values:
<Result> <char_data>

Usage: Query only

Manual operation: See "Rise Time" on page 17

[SENSe:]PULSe:TIMing:RISE:AVERage? <QueryRange>
[SENSe:]PULSe:TIMing:RISE:MAXimum? <QueryRange>
[SENSe:]PULSe:TIMing:RISE:MINimum? <QueryRange>
[SENSe:]PULSe:TIMing:RISE:SDEViation? <QueryRange>

Returns the statistical value for the rise time over the specified pulses.

Query parameters:
<QueryRange> CURRent | ALL

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Return values:
<Result> <char_data>

Usage: Query only

[SENSe:]PULSe:TIMing:SETTling? <QueryRange>

Returns the settling time for the specified pulse(s).

Query parameters:
<QueryRange> SELected | CURRent | ALL

SELected
Currently selected pulse

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Return values:
<Result> <char_data>

Usage: Query only

Manual operation: See "Settling Time" on page 17

[SENSe:]PULSe:TIMing:SETTling:AVERage? <QueryRange>
[SENSe:]PULSe:TIMing:SETTling:MAXimum? <QueryRange>

[SENSe:]PULSe:TIMing:SETTling:MINimum? <QueryRange>
[SENSe:]PULSe:TIMing:SETTling:SDEViation? <QueryRange>

Returns the statistical value for the settling time over the specified pulses.

Query parameters:

<QueryRange> CURRent | ALL

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Return values:

<Result> <char_data>

Usage: Query only

[SENSe:]PULSe:TIMing:TSTamp? <QueryRange>

Returns the timestamp for the specified pulse(s).

Query parameters:

<QueryRange> SELected | CURRent | ALL

SELected
Currently selected pulse

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Return values:

<Result> <char_data>

Usage: Query only

Manual operation: See "Timestamp" on page 17

[SENSe:]PULSe:TIMing:TSTamp:AVERage? <QueryRange>
[SENSe:]PULSe:TIMing:TSTamp:MAXimum? <QueryRange>
[SENSe:]PULSe:TIMing:TSTamp:MINimum? <QueryRange>
[SENSe:]PULSe:TIMing:TSTamp:SDEViation? <QueryRange>

Returns the timestamp for the phase deviation over the specified pulses.

Query parameters:

<QueryRange> CURRent | ALL

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Return values:

<Result> <char_data>

Usage: Query only

Retrieving frequency parameters

The following commands return the calculated pulse parameters.

For details on the individual parameters see Chapter 3.1.3, "Frequency parameters", on page 23.

[SENSe:]PULSe:FREQuency:CRATe? <QueryRange>

Returns the chirp rate (per µs) for the specified pulse(s).

Query parameters:

<QueryRange> SELected | CURRent | ALL

SELected
Currently selected pulse

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Return values:
<Result> <char_data>

Usage: Query only

Manual operation: See "Chirp Rate" on page 24

[SENSe:]PULSe:FREQuency:CRATe:AVERage? <QueryRange>
[SENSe:]PULSe:FREQuency:CRATe:MAXimum? <QueryRange>
[SENSe:]PULSe:FREQuency:CRATe:MINimum? <QueryRange>
[SENSe:]PULSe:FREQuency:CRATe:SDEViation? <QueryRange>

Returns the statistical value for the chirp rate (per µs) over the specified pulses.

Query parameters:
<QueryRange> CURRent | ALL

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Return values:
<Result> <char_data>

Usage: Query only

[SENSe:]PULSe:FREQuency:DEViation? <QueryRange>

Returns the frequency at the measurement point for the specified pulse(s).

Query parameters:
<QueryRange> SELected | CURRent | ALL

SELected
Currently selected pulse

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Return values:
<Result> <char_data>

Usage: Query only

Manual operation: See "Frequency Deviation" on page 24

[SENSe:]PULSe:FREQuency:DEViation:AVERage? <QueryRange>
[SENSe:]PULSe:FREQuency:DEViation:MAXimum? <QueryRange>

[SENSe:]PULSe:FREQuency:DEViation:MINimum? <QueryRange>
[SENSe:]PULSe:FREQuency:DEViation:SDEViation? <QueryRange>

Returns the statistical value for the chirp rate (per µs) over the specified pulses.

Query parameters:

<QueryRange> CURRent | ALL

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Return values:

<Result> <char_data>

Usage: Query only

[SENSe:]PULSe:FREQuency:PERRor? <QueryRange>

Returns the peak frequency error for the specified pulse(s).

Query parameters:

<QueryRange> SELected | CURRent | ALL

SELected
Currently selected pulse

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Return values:

<Result> <char_data>

Usage: Query only

Manual operation: See "Frequency Error (Peak)" on page 23

[SENSe:]PULSe:FREQuency:PERRor:AVERage? <QueryRange>
[SENSe:]PULSe:FREQuency:PERRor:MAXimum? <QueryRange>
[SENSe:]PULSe:FREQuency:PERRor:MINimum? <QueryRange>
[SENSe:]PULSe:FREQuency:PERRor:SDEViation? <QueryRange>

Returns the statistical value for the peak frequency error over the specified pulses.

Query parameters:

<QueryRange> CURRent | ALL

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Return values:

<Result> <char_data>

Usage: Query only

[SENSe:]PULSe:FREQuency:POINt? <QueryRange>

Returns the frequency at the measurement point for the specified pulse(s).

Query parameters:

<QueryRange> SELected | CURRent | ALL

SELected
Currently selected pulse

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Return values:

<Result> <char_data>

Usage: Query only

Manual operation: See "Frequency" on page 23

[SENSe:]PULSe:FREQuency:POINt:AVERage? <QueryRange>
[SENSe:]PULSe:FREQuency:POINt:MAXimum? <QueryRange>
[SENSe:]PULSe:FREQuency:POINt:MINimum? <QueryRange>
[SENSe:]PULSe:FREQuency:POINt:SDEViation? <QueryRange>

Returns the statistical value for the phase deviation over the specified pulses.

Query parameters:

<QueryRange> CURRent | ALL

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Return values:

<Result> <char_data>

Usage: Query only

[SENSe:]PULSe:FREQuency:PPFRequency? <QueryRange>

Returns the Pulse-Pulse Frequency Difference for the specified pulse(s).

Query parameters:

<QueryRange> SELected | CURRent | ALL

SELected
Currently selected pulse

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Return values:
<Result> <char_data>

Usage: Query only

Manual operation: See "Pulse-Pulse Frequency Difference" on page 23

[SENSe:]PULSe:FREQuency:PPFRequency:AVERage? <QueryRange>
[SENSe:]PULSe:FREQuency:PPFRequency:MAXimum? <QueryRange>
[SENSe:]PULSe:FREQuency:PPFRequency:MINimum? <QueryRange>
[SENSe:]PULSe:FREQuency:PPFRequency:SDEViation? <QueryRange>

Returns the statistical value for the Pulse-Pulse Frequency Difference over the specified pulses.

Query parameters:
<QueryRange> CURRent | ALL

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Return values:
<Result> <char_data>

Usage: Query only

[SENSe:]PULSe:FREQuency:RERRor? <QueryRange>

Returns the Frequency Error (RMS) for the specified pulse(s).

Query parameters:
<QueryRange> SELected | CURRent | ALL

SELected
Currently selected pulse

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Return values:
<Result> <char_data>

Usage: Query only

Manual operation: See "Frequency Error (RMS)" on page 23

[SENSe:]PULSe:FREQuency:RERRor:AVERage? <QueryRange>
[SENSe:]PULSe:FREQuency:RERRor:MAXimum? <QueryRange>

[SENSe:]PULSe:FREQuency:RERRor:MINimum? <QueryRange>
[SENSe:]PULSe:FREQuency:RERRor:SDEViation? <QueryRange>

Returns the statistical value for the Frequency Error (RMS) over the specified pulses.

Query parameters:

<QueryRange> CURRent | ALL

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Return values:

<Result> <char_data>

Usage: Query only

Retrieving phase parameters

The following commands return the calculated pulse parameters.

For details on the individual parameters see Chapter 3.1.4, "Phase parameters", on page 24.

[SENSe:]PULSe:PHASe:DEViation? <QueryRange>

Returns the phase deviation for the specified pulse(s).

Query parameters:

<QueryRange> SELected | CURRent | ALL

SELected
Currently selected pulse

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Return values:

<Result> <char_data>

Usage: Query only

Manual operation: See "Phase Deviation" on page 25

[SENSe:]PULSe:PHASe:DEViation:AVERage? <QueryRange>
[SENSe:]PULSe:PHASe:DEViation:MAXimum? <QueryRange>
[SENSe:]PULSe:PHASe:DEViation:MINimum? <QueryRange>
[SENSe:]PULSe:PHASe:DEViation:SDEViation? <QueryRange>

Returns the statistical value for the phase deviation over the specified pulses.

Query parameters:

<QueryRange> CURRent | ALL

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Return values:

<Result> <char_data>

Usage: Query only

[SENSe:]PULSe:PHASe:PERRor? <QueryRange>

Returns the peak phase error for the specified pulse(s).

Query parameters:

<QueryRange> SELected | CURRent | ALL

SELected
Currently selected pulse

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Return values:

<Result> <char_data>

Usage: Query only

Manual operation: See "Phase Error (Peak)" on page 25

[SENSe:]PULSe:PHASe:PERRor:AVERage? <QueryRange>
[SENSe:]PULSe:PHASe:PERRor:MAXimum? <QueryRange>
[SENSe:]PULSe:PHASe:PERRor:MINimum? <QueryRange>
[SENSe:]PULSe:PHASe:PERRor:SDEViation? <QueryRange>

Returns the statistical value for the peak phase error over the specified pulses.

Query parameters:

<QueryRange> CURRent | ALL

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Return values:

<Result> <char_data>

Usage: Query only

[SENSe:]PULSe:PHASe:POINt? <QueryRange>

Returns the phase at the measurement point for the specified pulse(s).

Query parameters:

<QueryRange> SELected | CURRent | ALL

SELected
Currently selected pulse

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Return values:

<Result> <char_data>

Usage: Query only

Manual operation: See "Phase" on page 24

[SENSe:]PULSe:PHASe:POINt:AVERage? <QueryRange>
[SENSe:]PULSe:PHASe:POINt:MAXimum? <QueryRange>

[SENSe:]PULSe:PHASe:POINt:MINimum? <QueryRange>
[SENSe:]PULSe:PHASe:POINt:SDEViation? <QueryRange>

Returns the statistical value for the phase at the measurement point over the specified pulses.

Query parameters:

<QueryRange> CURRent | ALL

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Return values:

<Result> <char_data>

Usage: Query only

[SENSe:]PULSe:PHASe:PPPHase? <QueryRange>

Returns the Pulse-Pulse Phase Difference for the specified pulse(s).

Query parameters:

<QueryRange> SELected | CURRent | ALL

SELected
Currently selected pulse

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Return values:

<Result> <char_data>

Usage: Query only

Manual operation: See "Pulse-Pulse Phase Difference" on page 24

[SENSe:]PULSe:PHASe:PPPHase:AVERage? <QueryRange>
[SENSe:]PULSe:PHASe:PPPHase:MAXimum? <QueryRange>
[SENSe:]PULSe:PHASe:PPPHase:MINimum? <QueryRange>
[SENSe:]PULSe:PHASe:PPPHase:SDEViation? <QueryRange>

Returns the statistical value for the Pulse-Pulse Phase Difference over the specified pulses.

Query parameters:

<QueryRange> CURRent | ALL

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Return values:
<Result> <char_data>

Usage: Query only

[SENSe:]PULSe:PHASe:RERRor? <QueryRange>

Returns the phase error (RMS) for the specified pulse(s).

Query parameters:
<QueryRange> SELected | CURRent | ALL

SELected
Currently selected pulse

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Return values:
<Result> <char_data>

Usage: Query only

Manual operation: See "Phase Error (RMS)" on page 24

[SENSe:]PULSe:PHASe:RERRor:AVERage? <QueryRange>
[SENSe:]PULSe:PHASe:RERRor:MAXimum? <QueryRange>
[SENSe:]PULSe:PHASe:RERRor:MINimum? <QueryRange>
[SENSe:]PULSe:PHASe:RERRor:SDEViation? <QueryRange>

Returns the statistical value for the phase error (RMS) over the specified pulses.

Query parameters:
<QueryRange> CURRent | ALL

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Return values:
<Result> <char_data>

Usage: Query only

Retrieving envelope model parameters

The following commands return the calculated pulse parameters.

For details on the individual parameters see Chapter 3.1.5, "Envelope model (cardinal data points) parameters", on page 25.

[SENSe:]PULSe:EMODel:FBPTime? <QueryRange>

Returns the Fall Base Point Time for the specified pulse(s).

Query parameters:

<QueryRange> SELected | CURRent | ALL

SELected
Currently selected pulse

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Usage: Query only

Manual operation: See "Fall Base Point Time" on page 28

[SENSe:]PULSe:EMODel:FBPTime:AVERage? <QueryRange>
[SENSe:]PULSe:EMODel:FBPTime:MAXimum? <QueryRange>
[SENSe:]PULSe:EMODel:FBPTime:MINimum? <QueryRange>
[SENSe:]PULSe:EMODel:FBPTime:SDEViation? <QueryRange>

Returns the statistical value for the Fall Base Point Time over the specified pulses.

Query parameters:

<QueryRange> CURRent | ALL

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Usage: Query only

[SENSe:]PULSe:EMODel:FHPLevel? <QueryRange>

Returns the Fall High Point Level for the specified pulse(s).

Query parameters:

<QueryRange> SELected | CURRent | ALL

SELected
Currently selected pulse

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Usage: Query only

Manual operation: See "Fall High Point Level" on page 29

[SENSe:]PULSe:EMODel:FHPLevel:AVERage? <QueryRange>
[SENSe:]PULSe:EMODel:FHPLevel:MAXimum? <QueryRange>
[SENSe:]PULSe:EMODel:FHPLevel:MINimum? <QueryRange>
[SENSe:]PULSe:EMODel:FHPLevel:SDEViation? <QueryRange>

Returns the statistical value for the Fall High Point Level over the specified pulses.

Query parameters:

<QueryRange> CURRent | ALL

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Usage: Query only

[SENSe:]PULSe:EMODel:FHPTime? <QueryRange>

Returns the Fall High Point Time for the specified pulse(s).

Query parameters:

<QueryRange> SELected | CURRent | ALL

SELected
Currently selected pulse

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Usage: Query only

Manual operation: See "Fall High Point Time" on page 28

[SENSe:]PULSe:EMODel:FHPTime:AVERage? <QueryRange>
[SENSe:]PULSe:EMODel:FHPTime:MAXimum? <QueryRange>
[SENSe:]PULSe:EMODel:FHPTime:MINimum? <QueryRange>
[SENSe:]PULSe:EMODel:FHPTime:SDEViation? <QueryRange>

Returns the statistical value for the Fall High Point Time over the specified pulses.

Query parameters:

<QueryRange> CURRent | ALL

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Usage: Query only

[SENSe:]PULSe:EMODel:FLPLevel? <QueryRange>

Returns the Fall Low Point Level for the specified pulse(s).

Query parameters:

<QueryRange> SELected | CURRent | ALL

SELected
Currently selected pulse

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Usage: Query only

Manual operation: See "Fall Low Point Level" on page 28

[SENSe:]PULSe:EMODel:FLPLevel:AVERage? <QueryRange>
[SENSe:]PULSe:EMODel:FLPLevel:MAXimum? <QueryRange>
[SENSe:]PULSe:EMODel:FLPLevel:MINimum? <QueryRange>
[SENSe:]PULSe:EMODel:FLPLevel:SDEViation? <QueryRange>

Returns the statistical value for the Fall Low Point Level over the specified pulses.

Query parameters:

<QueryRange> CURRent | ALL

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Usage: Query only

[SENSe:]PULSe:EMODel:FLPTime? <QueryRange>

Returns the Fall Low Point Time for the specified pulse(s).

Query parameters:

<QueryRange> SELected | CURRent | ALL

SELected
Currently selected pulse

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Usage: Query only

Manual operation: See "Fall Low Point Time" on page 28

[SENSe:]PULSe:EMODel:FLPTime:AVERage? <QueryRange>
[SENSe:]PULSe:EMODel:FLPTime:MAXimum? <QueryRange>
[SENSe:]PULSe:EMODel:FLPTime:MINimum? <QueryRange>
[SENSe:]PULSe:EMODel:FLPTime:SDEViation? <QueryRange>

Returns the statistical value for the Fall Low Point Time over the specified pulses.

Query parameters:

<QueryRange> CURRent | ALL

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Usage: Query only

[SENSe:]PULSe:EMODel:FMPLevel? <QueryRange>

Returns the Fall Mid Point Level for the specified pulse(s).

Query parameters:

<QueryRange> SELected | CURRent | ALL

SELected
Currently selected pulse

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Usage: Query only

Manual operation: See "Fall Mid Point Level" on page 28

[SENSe:]PULSe:EMODel:FMPLevel:AVERage? <QueryRange>
[SENSe:]PULSe:EMODel:FMPLevel:MAXimum? <QueryRange>
[SENSe:]PULSe:EMODel:FMPLevel:MINimum? <QueryRange>
[SENSe:]PULSe:EMODel:FMPLevel:SDEViation? <QueryRange>

Returns the statistical value for the Fall Mid Point Level over the specified pulses.

Query parameters:

<QueryRange> CURRent | ALL

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Usage: Query only

[SENSe:]PULSe:EMODel:FMPTime? <QueryRange>

Returns the Fall Mid Point Time for the specified pulse(s).

Query parameters:

<QueryRange> SELected | CURRent | ALL

SELected
Currently selected pulse

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Usage: Query only

Manual operation: See "Fall Mid Point Time" on page 28

[SENSe:]PULSe:EMODel:FMPTime:AVERage? <QueryRange>
[SENSe:]PULSe:EMODel:FMPTime:MAXimum? <QueryRange>
[SENSe:]PULSe:EMODel:FMPTime:MINimum? <QueryRange>
[SENSe:]PULSe:EMODel:FMPTime:SDEViation? <QueryRange>

Returns the statistical value for the Fall Mid Point Time over the specified pulses.

Query parameters:

<QueryRange> CURRent | ALL

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Usage: Query only

[SENSe:]PULSe:EMODel:FTPLevel? <QueryRange>

Returns the Fall Top Point Level for the specified pulse(s).

Query parameters:

<QueryRange> SELected | CURRent | ALL

SELected
Currently selected pulse

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Usage: Query only

Manual operation: See "Fall Top Point Level" on page 29

[SENSe:]PULSe:EMODel:FTPLevel:AVERage? <QueryRange>
[SENSe:]PULSe:EMODel:FTPLevel:MAXimum? <QueryRange>
[SENSe:]PULSe:EMODel:FTPLevel:MINimum? <QueryRange>
[SENSe:]PULSe:EMODel:FTPLevel:SDEViation? <QueryRange>

Returns the statistical value for the Fall Top Point Level over the specified pulses.

Query parameters:

<QueryRange> CURRent | ALL

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Usage: Query only

[SENSe:]PULSe:EMODel:FTPTime? <QueryRange>

Returns the Fall Top Point Time for the specified pulse(s).

Query parameters:

<QueryRange> SELected | CURRent | ALL

SELected
Currently selected pulse

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Usage: Query only

Manual operation: See "Fall Top Point Time" on page 28

[SENSe:]PULSe:EMODel:FTPTime:AVERage? <QueryRange>
[SENSe:]PULSe:EMODel:FTPTime:MAXimum? <QueryRange>
[SENSe:]PULSe:EMODel:FTPTime:MINimum? <QueryRange>
[SENSe:]PULSe:EMODel:FTPTime:SDEViation? <QueryRange>

Returns the statistical value for the Fall Top Point Time over the specified pulses.

Query parameters:

<QueryRange> CURRent | ALL

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Usage: Query only

[SENSe:]PULSe:EMODel:RBPTime? <QueryRange>

Returns the Rise Base Point Time for the specified pulse(s).

Query parameters:

<QueryRange> SELected | CURRent | ALL

SELected
Currently selected pulse

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Usage: Query only

Manual operation: See "Rise Base Point Time" on page 26

[SENSe:]PULSe:EMODel:RBPTime:AVERage? <QueryRange>
[SENSe:]PULSe:EMODel:RBPTime:MAXimum? <QueryRange>
[SENSe:]PULSe:EMODel:RBPTime:MINimum? <QueryRange>
[SENSe:]PULSe:EMODel:RBPTime:SDEViation? <QueryRange>

Returns the statistical value for the Rise Base Point Time over the specified pulses.

Query parameters:

<QueryRange> CURRent | ALL

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Usage: Query only

[SENSe:]PULSe:EMODel:RHPLevel? <QueryRange>

Returns the Rise High Point Level for the specified pulse(s).

Query parameters:

<QueryRange> SELected | CURRent | ALL

SELected
Currently selected pulse

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Usage: Query only

Manual operation: See "Rise High Point Level" on page 27

[SENSe:]PULSe:EMODel:RHPLevel:AVERage? <QueryRange>
[SENSe:]PULSe:EMODel:RHPLevel:MAXimum? <QueryRange>
[SENSe:]PULSe:EMODel:RHPLevel:MINimum? <QueryRange>
[SENSe:]PULSe:EMODel:RHPLevel:SDEViation? <QueryRange>

Returns the statistical value for the Rise High Point Level over the specified pulses.

Query parameters:

<QueryRange> CURRent | ALL

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Usage: Query only

[SENSe:]PULSe:EMODel:RHPTime? <QueryRange>

Returns the Rise High Point Time for the specified pulse(s).

Query parameters:

<QueryRange> SELected | CURRent | ALL

SELected
Currently selected pulse

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Usage: Query only

Manual operation: See "Rise High Point Time" on page 27

[SENSe:]PULSe:EMODel:RHPTime:AVERage? <QueryRange>
[SENSe:]PULSe:EMODel:RHPTime:MAXimum? <QueryRange>
[SENSe:]PULSe:EMODel:RHPTime:MINimum? <QueryRange>
[SENSe:]PULSe:EMODel:RHPTime:SDEViation? <QueryRange>

Returns the statistical value for the Rise High Point Time over the specified pulses.

Query parameters:

<QueryRange> CURRent | ALL

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Usage: Query only

[SENSe:]PULSe:EMODel:RLPLevel? <QueryRange>

Returns the Rise Low Point Level for the specified pulse(s).

Query parameters:

<QueryRange> SELected | CURRent | ALL

SELected
Currently selected pulse

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Usage: Query only

Manual operation: See "Rise Low Point Level" on page 27

[SENSe:]PULSe:EMODel:RLPLevel:AVERage? <QueryRange>
[SENSe:]PULSe:EMODel:RLPLevel:MAXimum? <QueryRange>
[SENSe:]PULSe:EMODel:RLPLevel:MINimum? <QueryRange>
[SENSe:]PULSe:EMODel:RLPLevel:SDEViation? <QueryRange>

Returns the statistical value for the Rise Low Point Level over the specified pulses.

Query parameters:

<QueryRange> CURRent | ALL

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Usage: Query only

[SENSe:]PULSe:EMODel:RLPTime? <QueryRange>

Returns the Rise Low Point Time for the specified pulse(s).

Query parameters:

<QueryRange> SELected | CURRent | ALL

SELected
Currently selected pulse

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Usage: Query only

Manual operation: See "Rise Low Point Time" on page 26

[SENSe:]PULSe:EMODel:RLPTime:AVERage? <QueryRange>
[SENSe:]PULSe:EMODel:RLPTime:MAXimum? <QueryRange>
[SENSe:]PULSe:EMODel:RLPTime:MINimum? <QueryRange>
[SENSe:]PULSe:EMODel:RLPTime:SDEViation? <QueryRange>

Returns the statistical value for the Rise Low Point Time over the specified pulses.

Query parameters:

<QueryRange> CURRent | ALL

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Usage: Query only

[SENSe:]PULSe:EMODel:RMPLevel? <QueryRange>

Returns the Rise Mid Point Level for the specified pulse(s).

Query parameters:

<QueryRange> SELected | CURRent | ALL

SELected
Currently selected pulse

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Usage: Query only

Manual operation: See "Rise Mid Point Level" on page 27

[SENSe:]PULSe:EMODel:RMPLevel:AVERage? <QueryRange>
[SENSe:]PULSe:EMODel:RMPLevel:MAXimum? <QueryRange>
[SENSe:]PULSe:EMODel:RMPLevel:MINimum? <QueryRange>
[SENSe:]PULSe:EMODel:RMPLevel:SDEViation? <QueryRange>

Returns the statistical value for the Rise Mid Point Level over the specified pulses.

Query parameters:

<QueryRange> CURRent | ALL

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Usage: Query only

[SENSe:]PULSe:EMODel:RMPTime? <QueryRange>

Returns the Rise Mid Point Time for the specified pulse(s).

Query parameters:

<QueryRange> SELected | CURRent | ALL

SELected
Currently selected pulse

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Usage: Query only

Manual operation: See "Rise Mid Point Time" on page 26

[SENSe:]PULSe:EMODel:RMPTime:AVERage? <QueryRange>
[SENSe:]PULSe:EMODel:RMPTime:MAXimum? <QueryRange>
[SENSe:]PULSe:EMODel:RMPTime:MINimum? <QueryRange>
[SENSe:]PULSe:EMODel:RMPTime:SDEViation? <QueryRange>

Returns the statistical value for the Rise Mid Point Time over the specified pulses.

Query parameters:

<QueryRange> CURRent | ALL

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Usage: Query only

[SENSe:]PULSe:EMODel:RTPLevel? <QueryRange>

Returns the Rise Top Point Level for the specified pulse(s).

Query parameters:

<QueryRange> SELected | CURRent | ALL

SELected
Currently selected pulse

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Usage: Query only

Manual operation: See "Rise Top Point Level" on page 27

[SENSe:]PULSe:EMODel:RTPLevel:AVERage? <QueryRange>
[SENSe:]PULSe:EMODel:RTPLevel:MAXimum? <QueryRange>
[SENSe:]PULSe:EMODel:RTPLevel:MINimum? <QueryRange>
[SENSe:]PULSe:EMODel:RTPLevel:SDEViation? <QueryRange>

Returns the statistical value for the Rise Top Point Level over the specified pulses.

Query parameters:

<QueryRange> CURRent | ALL

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Usage: Query only

[SENSe:]PULSe:EMODel:RTPTime? <QueryRange>

Returns the Rise Top Point Time for the specified pulse(s).

Query parameters:

<QueryRange> SELected | CURRent | ALL

SELected
Currently selected pulse

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Usage: Query only

Manual operation: See "Rise Top Point Time" on page 27

[SENSe:]PULSe:EMODel:RTPTime:AVERage? <QueryRange>
[SENSe:]PULSe:EMODel:RTPTime:MAXimum? <QueryRange>
[SENSe:]PULSe:EMODel:RTPTime:MINimum? <QueryRange>
[SENSe:]PULSe:EMODel:RTPTime:SDEViation? <QueryRange>

Returns the statistical value for the Rise Top Point Time over the specified pulses.

Query parameters:

<QueryRange> CURRent | ALL

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Usage: Query only

8.6.1.4 Retrieving limit results

The following commands retrieve the results of the limit check for individual parameters.

[SENSe:]PULSe:<Parametertype>:<Parameter>:LIMit? <QueryRange>
[SENSe:]PULSe:EMODel:FBPTime:LIMit? <QueryRange>
[SENSe:]PULSe:EMODel:FHPLevel:LIMit? <QueryRange>
[SENSe:]PULSe:EMODel:FHPTime:LIMit? <QueryRange>
[SENSe:]PULSe:EMODel:FLPLevel:LIMit? <QueryRange>
[SENSe:]PULSe:EMODel:FLPTime:LIMit? <QueryRange>
[SENSe:]PULSe:EMODel:FMPLevel:LIMit? <QueryRange>
[SENSe:]PULSe:EMODel:FMPTime:LIMit? <QueryRange>
[SENSe:]PULSe:EMODel:FTPLevel:LIMit? <QueryRange>
[SENSe:]PULSe:EMODel:FTPTime:LIMit? <QueryRange>
[SENSe:]PULSe:EMODel:RBPTime:LIMit? <QueryRange>
[SENSe:]PULSe:EMODel:RHPLevel:LIMit? <QueryRange>

[SENSe:]PULSe:EMODel:RHPTime:LIMit? <QueryRange>
[SENSe:]PULSe:EMODel:RLPLevel:LIMit? <QueryRange>
[SENSe:]PULSe:EMODel:RLPTime:LIMit? <QueryRange>
[SENSe:]PULSe:EMODel:RMPLevel:LIMit? <QueryRange>
[SENSe:]PULSe:EMODel:RMPTime:LIMit? <QueryRange>
[SENSe:]PULSe:EMODel:RTPLevel:LIMit? <QueryRange>
[SENSe:]PULSe:EMODel:RTPTime:LIMit? <QueryRange>
[SENSe:]PULSe:FREQuency:CRATe:LIMit? <QueryRange>
[SENSe:]PULSe:FREQuency:DEViation:LIMit? <QueryRange>
[SENSe:]PULSe:FREQuency:PERRor:LIMit? <QueryRange>
[SENSe:]PULSe:FREQuency:POINt:LIMit? <QueryRange>
[SENSe:]PULSe:FREQuency:PPFRequency:LIMit? <QueryRange>
[SENSe:]PULSe:FREQuency:RERRor:LIMit? <QueryRange>
[SENSe:]PULSe:PHASe:DEViation:LIMit? <QueryRange>
[SENSe:]PULSe:PHASe:PERRor:LIMit? <QueryRange>
[SENSe:]PULSe:PHASe:POINt:LIMit? <QueryRange>
[SENSe:]PULSe:PHASe:PPPHase:LIMit? <QueryRange>
[SENSe:]PULSe:PHASe:RERRor:LIMit? <QueryRange>
[SENSe:]PULSe:POWer:ADRoop:DB:LIMit? <QueryRange>
[SENSe:]PULSe:POWer:ADRoop[:PERCent]:LIMit? <QueryRange>
[SENSe:]PULSe:POWer:AMPLitude:LIMit? <QueryRange>
[SENSe:]PULSe:POWer:AMPLitude:I:LIMit? <QueryRange>
[SENSe:]PULSe:POWer:AMPLitude:Q:LIMit? <QueryRange>
[SENSe:]PULSe:POWer:AVG:LIMit? <QueryRange>
[SENSe:]PULSe:POWer:BASE:LIMit? <QueryRange>
[SENSe:]PULSe:POWer:MAX:LIMit? <QueryRange>
[SENSe:]PULSe:POWer:MIN:LIMit? <QueryRange>
[SENSe:]PULSe:POWer:ON:LIMit? <QueryRange>
[SENSe:]PULSe:POWer:OVERshoot:DB:LIMit? <QueryRange>
[SENSe:]PULSe:POWer:OVERshoot[:PERCent]:LIMit? <QueryRange>
[SENSe:]PULSe:POWer:PAVG:LIMit? <QueryRange>
[SENSe:]PULSe:POWer:PMIN:LIMit? <QueryRange>
[SENSe:]PULSe:POWer:POINt:LIMit? <QueryRange>
[SENSe:]PULSe:POWer:PON:LIMit? <QueryRange>
[SENSe:]PULSe:POWer:PPRatio:LIMit? <QueryRange>
[SENSe:]PULSe:POWer:RIPPle:DB:LIMit? <QueryRange>
[SENSe:]PULSe:POWer:RIPPle[:PERCent]:LIMit? <QueryRange>
[SENSe:]PULSe:POWer:TOP:LIMit? <QueryRange>
[SENSe:]PULSe:TIMing:DCYCle:LIMit? <QueryRange>
[SENSe:]PULSe:TIMing:DRATio:LIMit? <QueryRange>
[SENSe:]PULSe:TIMing:FALL:LIMit? <QueryRange>
[SENSe:]PULSe:TIMing:OFF:LIMit? <QueryRange>
[SENSe:]PULSe:TIMing:PRF:LIMit? <QueryRange>
[SENSe:]PULSe:TIMing:PRI:LIMit? <QueryRange>
[SENSe:]PULSe:TIMing:PWIDth:LIMit? <QueryRange>
[SENSe:]PULSe:TIMing:RISE:LIMit? <QueryRange>

[SENSe:]PULSe:TIMing:SETTling:LIMit? <QueryRange>
[SENSe:]PULSe:TIMing:TSTamp:LIMit? <QueryRange>

Returns the limit value for the specified parameter. For details on available parameters see Chapter 3.1, "Pulse parameters", on page 15.

Query parameters:

<QueryRange> SELected | CURRent | ALL

SELected
Currently selected pulse

CURRent
Detected pulses in the current capture buffer

ALL
All detected pulses in the entire measurement.

Return values:

<CheckResult> <char_data>

Example: `SENS:PULS:POW:ON:LIM? CURR`

Usage: Query only

Manual operation: See "Timestamp" on page 17

8.6.1.5 Exporting trace results to an ASCII file

Trace results can be exported to an ASCII file for further evaluation in other (external) applications.

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:

<Format> **ASCii**
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.

REAL
Floating-point numbers (according to IEEE 754) in the "definite length block format".

<BitLength> Length in bits for floating-point results

16
16-bit floating-point numbers.
Compared to `REAL,32` format, half as many numbers are returned.

32
32-bit floating-point numbers
For I/Q data, 8 bytes per sample are returned for this format setting.

64
64-bit floating-point numbers
Compared to `REAL,32` format, twice as many numbers are returned.

Example: `FORM REAL,32`

FORMat:DEXPort:DSEParator <Separator>

Selects the decimal separator for data exported in ASCII format.

Parameters:

<Separator> POINt | COMMa

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: `FORM:DEXP:DSEP POIN`
Sets the decimal point as separator.

Manual operation: See "Decimal Separator " on page 111

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 130

FORMat:DEXPort:TRACes <Selection>

Selects the data to be included in a data export file (see `MMEMory:STORe<n>:TRACe` on page 308).

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 130

FORMat:DEXPort:TSTamp <State>

Turns on display of absolute time stamp for table export.

Parameters:

<State> ON | OFF

*RST: OFF

Example: `FORMat:DEXPort:TSTamp ON`

8.6.1.6 Exporting table results to an ASCII file

Table results can be exported to an ASCII file for further evaluation in other (external) applications.

Useful commands for exporting table results described elsewhere:

- `FORMat:DEXPort:DSEParator` on page 366
- Chapter 8.4.11.8, "Configuring the statistics and parameter tables", on page 258

Remote commands exclusive to exporting table results

MMEMory:STORe<n>:TABLe <Columns>, <FileName>

Exports result table data from the specified window to an ASCii file (`.DAT`).

For details on the file format see Chapter C, "Reference: ASCII file export format", on page 386.

Suffix:
<n> Window

Setting parameters:
<Columns> Columns to be stored in file

SELected
Export only the selected (visible) table columns

ALL
Export all table columns (all possible measured parameters)

*RST: SEL

<FileName> String containing the path and name of the target file.

Example: `MMEM:STOR1:TABL SEL,'TEST.DAT'`
Stores the selected columns from the result table in window 1 in the file `TEST.DAT`.

Example: See Chapter 8.7, "Programming example: pulse measurement", on page 370.

Usage: Setting only

Manual operation: See "Columns to Export" on page 111
See "Export table to ASCII File " on page 111

MMEMory:STORe<n>:TABLe:LIMit <Columns>, <Filename>

Stores the table columns (all or selected), along with limit check results in a file with ASCII format. The decimal separator (decimal point or comma) for floating-point numerals contained in the file is defined with the `FORMat:DEXPort:DSEParator` command.

Suffix:
<n> 1..n
Window

Setting parameters:
<Columns> SELected | ALL

SELected
Only the currently visible columns in the result display are exported.

ALL
All columns, including currently hidden ones, for the result display are exported.

<Filename> String containing the path and name of the file.

Usage: Setting only

Manual operation: See "Export Limits" on page 111

8.6.2 Retrieving marker results

The following commands are required to retrieve marker results.

Useful commands for retrieving marker results described elsewhere:

- `CALCulate<n>:DELTamarker<m>:X` on page 295
- `CALCulate<n>:MARKer<m>:X` on page 292

Remote commands exclusive to retrieving marker results:

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 118

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 / Marker 2 / Marker 3 / Marker 4" on page 118
See "Marker 1 / Delta Marker 1 / Delta Marker 2 / Delta Marker 16 " on page 118

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 31
See "Marker 1 / Marker 2 / Marker 3 / Marker 4" on page 118
See "Marker 1 / Delta Marker 1 / Delta Marker 2 / Delta Marker 16 " on page 118

8.7 Programming example: pulse measurement

This example demonstrates how to perform a pulse measurement in a remote environment.

Note that some of the used commands may not be necessary as they define default values, but are included to demonstrate their use.

```
//----------- Preparing the measurement ------------
//Reset the instrument
*RST
//Activate the pulse measurement application
INST:SEL 'PULSE'

//-----------Configuring the measurement ------------
//Set the center frequency
FREQ:CENT 1GHz

// Set the filter, bandwidth, and implicitly the sample rate
SENS:BWID:DEM:TYPE GAUSS
SENS:BWID:DEM 80MHZ
SENS:SRAT?

//Configure the expected pulse:
//width between 1ms and 1.5ms, off time at least 0.5ms
SENS:TRAC:MEAS:DEF:DUR:AUTO OFF
SENS:TRAC:MEAS:DEF:DUR:MIN 1ms
SENS:TRAC:MEAS:DEF:DUR:MAX 1.5ms
```

```
SENS:TRAC:MEAS:DEF:DUR:OFF 0.5ms

//Assume amplitude droop
SENS:TRAC:MEAS:DEF:PULS:ADR ON
//Assume Linear FM modulation
SENS:TRAC:MEAS:DEF:PULS:MOD LFM
//Pulse starts with rising edge
SENS:TRAC:MEAS:DEF:PULS:PER LH
//Determine freq offset and chirp rate for each pulse automatically
SENS:TRAC:MEAS:DEF:FREQ:OFFS:AUTO ON
SENS:TRAC:MEAS:DEF:FREQ:RATE:AUTO ON

//Input from RF input connector
INP:SEL RF
//Alternatively: Input from I/Q data file
//INP:SEL FIQ
//INP:FILE:PATH 'C:\R_S\Instr\user\data.iq.tar'

//Configure a power trigger at -20dBm (pulse level - 10dB default attenuation)
TRIG:SOUR RFP
TRIG:LEV:RFP -20dBm
//Avoid triggering on overshoot:
//level must remain below trigger level at least 0.5ms
TRIG:DTIM 0.5ms

//Configure the conditions for pulse detection:
//max. 10 pulses, min. -30dB power level, 2dB hysteresis
DET:LIM ON
DET:LIM:COUN 10
DET:REF ABS
DET:THR -30dB
DET:HYST 2dB

//Configure how and which levels are used for pulse detection:
//mean level for top, power values in dBm, consider droop
//ripple calculated in first 5% of pulse top
SENS:TRAC:MEAS:ALG MEAN
SENS:TRAC:MEAS:DEF:AMPL:UNIT DBM
SENS:TRAC:MEAS:DEF:COMP:ADR ON
SENS:TRAC:MEAS:DEF:RIPP 5

// meas levels at 15,50,85% power
//in dB: -1.41, -6.02, -26.02
SENS:TRAC:MEAS:DEF:TRAN:HREF -1.41
SENS:TRAC:MEAS:DEF:TRAN:REF  -6.02
SENS:TRAC:MEAS:DEF:TRAN:LREF -26.02

//boundary calculated in top 5% = 0.26dB
SENS:TRAC:MEAS:DEF:BOUN:TOP 0.26
```

```
//Configure which point is used to determine pulse characteristics:
//0.1ms from top center, window 1ms
SENS:TRAC:MEAS:DEF:PULS:INST:REF CENT
SENS:TRAC:MEAS:DEF:PULS:INST 0.1ms
SENS:TRAC:MEAS:DEF:PULS:INST:AWIN 1ms

//Configure the range used for estimation: 0.1ms from either edge
SENS:TRAC:MEAS:DEF:PULS:EST:REF EDGE
SENS:TRAC:MEAS:DEF:PULS:EST:OFFS:LEFT 0.1ms
SENS:TRAC:MEAS:DEF:PULS:EST:OFFS:RIGH 0.1ms

//Configure the range for which individual pulse results are displayed:
//300us starting from left edge of pulse top
SENS:TRAC:MEAS:DEF:RRAN:REF RISE
SENS:TRAC:MEAS:DEF:RRAN:ALIG LEFT
SENS:TRAC:MEAS:DEF:RRAN:LENG 300us

//Configure data acquisition for 10ms
SWE:TIME 10ms

//------------- Configuring the results -------------------------------
//Result displays:
//upper row: (1)MagCapt (2)Pulse results (3)Pulse statistics
//bottom row: (4)Pulse magnitude (5)Pulse power dist vs occurance
//(6)Pulse power spectrum
LAY:REPL '1',MCAP
LAY:REPL '2',PRES
LAY:ADD:WIND? '2',RIGH,PST
LAY:REPL '4',PMAG
LAY:REPL '5',PDIS
CALC5:DIST:POW POIN,OCC
LAY:REPL '6',PSP
CALC6:PSP:POW POIN

//Configure magnitude capture: automatic scaling
DISP:WIND1:TRAC:Y:SCAL:AUTO ON

//Configure parameters in pulse results table:
//Freq.: freq. at meas point, pulse-pulse difference, freq.dev., freq. err peak
CALC2:TABL:FREQ:POIN ON
CALC2:TABL:FREQ:PPFR ON
CALC2:TABL:FREQ:DEV ON
CALC2:TABL:FREQ:PERR ON

//Phase: phase deviation
CALC2:TABL:PHAS:DEV ON

//Power: average ON, droop, pulse-pulse difference, amplitude
CALC2:TABL:POW:ON ON
CALC2:TABL:POW:ADR ON
```

```
CALC2:TABL:POW:PPR ON
CALC2:TABL:POW:AMPL ON
//Limit check for average ON power: lower limit -10 dBm, upper: 1 dBm
CALC2:TABL:POW:ON:LIM:STAT ON
CALC2:TABL:POW:ON:LIM -10DBM,1DBM

//Timing: settling time, pulse width
CALC2:TABL:TIM:SETT ON
CALC2:TABL:TIM:PWID ON

//Configure pulse statistics table - same par. as results table
CALC3:TABL:FREQ:POIN ON
CALC3:TABL:FREQ:PPFR ON
CALC3:TABL:FREQ:DEV ON
CALC3:TABL:FREQ:PERR ON
CALC3:TABL:PHAS:DEV ON
CALC3:TABL:POW:ON ON
CALC3:TABL:POW:ADR ON
CALC3:TABL:POW:PPR ON
CALC3:TABL:POW:AMPL ON
CALC3:TABL:TIM:SETT ON
CALC3:TABL:TIM:PWID ON


//Configure pulse magnitude:
//scaling is 25 dBm above and below pulse mid level
DISP:WIND4:TRAC:Y:SCAL:AUTO OFF
DISP:WIND4:TRAC:Y:SCAL:RPOS 50
DISP:WIND4:TRAC:Y:SCAL:RVAL 0
DISP:WIND4:TRAC:Y:SCAL:PDIV 2


//--------------Performing the Measurement-----
INIT:CONT OFF
//Selects single sweep mode.
INIT;*WAI
//Initiates a new measurement and waits until the sweep has finished.


//---------------Retrieving Results-------------
//Select pulse for individual pulse results: pulse 1
SENS:TRAC:MEAS:DEF:PULS:SEL 1
//    Determine pulse numbers in entire meas
SENS:PULS:NUMB? ALL
//    Determine pulse numbers in current capture buffer
SENS:PULS:NUMB? CURR

//Retrieve parameter results from results table (pulse 1)
SENS:PULS:FREQ:POIN? SEL
SENS:PULS:FREQ:PPFR? SEL
```

```
SENS:PULS:FREQ:DEV? SEL
SENS:PULS:FREQ:PERR? SEL
SENS:PULS:PHAS:DEV? SEL
SENS:PULS:POW:ON? SEL
SENS:PULS:POW:ADR? SEL
SENS:PULS:POW:PPR? SEL
SENS:PULS:POW:AMPL? SEL
SENS:PULS:TIM:SETT? SEL
SENS:PULS:TIM:PWID? SEL

//Retrieve limit check result for average ON power in pulses in current meas
SENS:PULS:POW:ON:LIM? CURR

//Retrieve pulse statistics (aver., min., max) for all pulses in entire meas
SENS:PULS:FREQ:POIN:AVER? ALL
SENS:PULS:FREQ:POIN:MIN? ALL
SENS:PULS:FREQ:POIN:MAX? ALL

SENS:PULS:FREQ:PPFR:AVER? ALL
SENS:PULS:FREQ:PPFR:MIN? ALL
SENS:PULS:FREQ:PPFR:MAX? ALL

SENS:PULS:FREQ:DEV:AVER? ALL
SENS:PULS:FREQ:DEV:MIN? ALL
SENS:PULS:FREQ:DEV:MAX? ALL

SENS:PULS:FREQ:PERR:AVER? ALL
SENS:PULS:FREQ:PERR:MIN? ALL
SENS:PULS:FREQ:PERR:MAX? ALL

SENS:PULS:PHAS:DEV:AVER? ALL
SENS:PULS:PHAS:DEV:MIN? ALL
SENS:PULS:PHAS:DEV:MAX? ALL

SENS:PULS:POW:ON:AVER? ALL
SENS:PULS:POW:ON:MIN? ALL
SENS:PULS:POW:ON:MAX? ALL

SENS:PULS:POW:ADR:AVER? ALL
SENS:PULS:POW:ADR:MIN? ALL
SENS:PULS:POW:ADR:MAX? ALL

SENS:PULS:POW:PPR:AVER? ALL
SENS:PULS:POW:PPR:MIN? ALL
SENS:PULS:POW:PPR:MAX? ALL

SENS:PULS:POW:AMPL:AVER? ALL
SENS:PULS:POW:AMPL:MIN? ALL
SENS:PULS:POW:AMPL:MAX? ALL
```

```
SENS:PULS:TIM:SETT:AVER? ALL
SENS:PULS:TIM:SETT:MIN? ALL
SENS:PULS:TIM:SETT:MAX? ALL

SENS:PULS:TIM:PWID:AVER? ALL
SENS:PULS:TIM:PWID:MIN? ALL
SENS:PULS:TIM:PWID:MAX? ALL

//Retrieve trace data for pulse magnitude (pulse 1)
//TRAC4:DATA? TRACe1
//TRAC4:DATA:X? TRACe1

//Export entire result table (all params) to an ASCII file
//MMEM:STOR2:TABL ALL,'C:\R_S\Instr\user\AllResults.dat'

//Store I/Q data for result range to an iq-tar file
//MMEM:STOR:IQ:COMM 'I/Q data for result range'
//MMEM:STOR:IQ:RANG RRAN
//MMEM:STOR:IQ:STAT 1,'C:\R_S\Instr\user\RRTestdata.iq.tar'
```

Annex

A Menu reference

Most functions in the R&S VSE are available from the menus.

A.1 Common R&S VSE menus

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

A.1.1 File menu

The "File" menu includes all functionality directly related to any file operations, printing or setting up general parameters.

For a description of these functions see the "Data Management" chapter in the R&S VSE base software user manual.

Menu item	Correspond-ing icon in toolbar	Description
Save		Saves the current software configuration to a file
Recall		Recalls a saved software configuration from a file
Save IQ Recording	-	Saves the recorded I/Q data from a measurement channel to a file With option R&S VSE-K6A installed, all available measurement channels are included in the I/Q file.
Recall IQ Recording	-	Loads the recorded I/Q data from a file
Measurement Group >	-	Configures measurement channels and groups
> New Group	-	Inserts a new group in the measurement sequence
> Rename Group	-	Changes the name of the selected group
> New Measurement Channel	-	Inserts a new channel in the selected group
> Replace Measure-ment Channel	-	Replaces the currently selected channel by the selected applica-tion.
> Rename Measure-ment Channel	-	Changes the name of the selected channel.

Menu item	Correspond-ing icon in toolbar	Description
> Delete Current Mea-surement Channel	-	Deletes the currently selected channel.
> Measurement Group Setup	-	Displays the "Measurement Group Setup" tool window.
Instruments >	-	Configures instruments to be used for input to the R&S VSE soft-ware
> New	-	Creates a new instrument configuration
> Search	-	Searches for connected instruments in the network
> Delete All	-	Deletes all current instrument configurations
> Setup	-	Hides or displays the "Instrument" tool window
Preset >	-	Restores stored settings
> Selected Channel	-	Restores the default software configuration for an individual channel
> All	-	Restores the default software configuration globally for the entire software
> All & Delete Instru-ments		Restores the default software configuration globally for the entire software and deletes all instrument configurations
> Reset VSE Layout	-	Restores the default layout of windows, toolbars etc. in the R&S VSE
Preferences >	-	Configures global software settings
> General	-	
> Displayed Items	-	Hides or shows individual screen elements
> Theme & Color	-	Configures the style of individual screen elements
> Network & Remote	-	Configures the network settings and remote access to or from other devices
> Recording	-	Configures general recording parameters
Print	-	Opens "Print" dialog to print selected measurement results
Exit	-	Closes the R&S VSE

A.1.2 Window menu

The "Window" menu allows you to hide or show individual windows.

For a description of these functions see the "Controlling Instruments and Capturing Data" chapter in the R&S VSE base software user manual.

Menu item	Correspond-ing icon in toolbar	Description
Player	-	Displays the "Player" tool window to recall I/Q data recordings
Instruments	-	Displays the "Instruments" window to configure input instruments
Measurement Group Setup	-	Displays the "Measurement Group Setup" window to configure a measurement sequence
New Window >		Inserts a new result display window for the selected measurement channel
Channel Information >	-	Displays the channel bar with global channel information for the selected measurement channel
Active Windows >	-	Selects a result display as the active window; the corresponding channel is also activated

A.1.3 Help menu

The "Help" menu provides access to help, support and licensing functions.

For a description of these functions see the "Basic Operations" and "General Software Settings" chapters in the R&S VSE base software user manual.

Menu item	Correspond-ing icon in toolbar	Description
Help	?	Opens the Online help window
License	-	Licensing, version and options information
Support	-	Support functions
Register VSE	-	Opens the Rohde & Schwarz support page (http://www.rohde-schwarz.com/support) in a browser for registration.
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 Pulse Measurements Menus

The following menus are only available if an Pulse measurement channel is selected.

A.2.1 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 Pulse Measurements

Menu item	Description
Amplitude	Chapter 5.4.2, "Amplitude settings", on page 77
Scale	Chapter 6.1.7, "Y-Scaling", on page 113
Frequency	Chapter 5.4.1, "Frequency settings", on page 76
Trigger	Chapter 5.5, "Trigger settings", on page 81
Input Source	Chapter 5.3.1, "Radio frequency input", on page 67
Output	R&S VSE Base Software User Manual

A.2.2 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.

Table A-2: "Meas Setup" menu items for Pulse Measurements

Menu item	Description
Signal Description	Chapter 5.2, "Signal description", on page 64
Input/Frontend	Chapter 5.3, "Input source settings", on page 67 Chapter 5.4, "Frontend settings", on page 75
Data Acquisition	Chapter 5.6, "Data acquisition", on page 86
Pulse Detection	Chapter 5.7, "Pulse detection", on page 88
Pulse Meas	Chapter 5.8, "Pulse measurement settings", on page 91
Result	Chapter 6.1, "Result configuration", on page 99
Selected Pulse	Chapter 6.1.1, "Pulse selection", on page 99
Expert mode	For Rohde & Schwarz oscilloscopes only: Configuration directly on the instrument, see the R&S VSE Base Software User Manual.
User Correction	User-defined frequency response correction, see the R&S VSE Base Software User Manual.
Overview	Chapter 5.1, "Configuration overview", on page 62

A.2.3 Trace Menu

The "Trace" menu provides access to trace-specific functions.

See Chapter 6.3, "Trace configuration", on page 125

This menu is application-specific.

Table A-3: "Trace" menu items for Pulse Measurements

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
Trace ...	Opens the "Traces" configuration dialog box

A.2.4 Marker Menu

The "Marker" menu provides access to marker-specific functions.

This menu is application-specific.

Table A-4: "Marker" menu items for Pulse Measurements

Menu item	Correspond-ing icon in toolbar	Description
Select marker <x>		"Select Marker " on page 120
Marker Type		"Marker Type " on page 119
Marker to Trace	-	"Assigning the Marker to a Trace " on page 120
All Markers Off		"All Markers Off " on page 121
Marker...		Chapter 6.2, "Markers", on page 116

A.2.5 Limits Menu

The "Limits" menu does not contain any functions for Pulse measurements.

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 the R&S VSE base software user manual.

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 the R&S VSE base software user manual.

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 the R&S VSE base software user manual.

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 the R&S VSE base software user manual.

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 level
AUTO FREQ	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	Auto all
	Configure auto settings

C Reference: ASCII file export format

Trace data can be exported to a file in ASCII format for further evaluation in other applications

The file consists of the header containing important scaling parameters and a data section containing the trace data.

Generally, the format of this ASCII file can be processed by spreadsheet calculation programs, e.g. MS-Excel. Different language versions of evaluation programs may require a different handling of the decimal point. Thus you can define the decimal separator to be used (decimal point or comma, see "Decimal Separator " on page 111).

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 two lines containing the measured parameter names and units, followed by the measured data in multiple columns (depending on measurement) which are also separated by a semicolon.

Table C-1: ASCII file format for table export

File contents	Description
Header data	
Type;R&S VSE;	Instrument model
Version;5.00;	Firmware version
Date;01.Oct 2006;	Date of data set storage
Mode;PULSE;	Application
Center Freq;55000;Hz	Center frequency
Freq Offset;0;Hz	Frequency offset
Meas BW;10000000,Hz	Measurement Bandwidth
Filter Type;GAUS;	Measurement filter type can be Gaussian (GAUS) or flat (FLAT)
Ref Level;-30;dBm	Reference level
Level Offset;0;dB	Level offset
Rf Att;20;dB	Input attenuation
El Att;2.0;dB	Electrical attenuation
SWT;0.005;s	Sweep time (measurement time)
Sweep Count;20;	Number of sweeps set
Preamplifier;OFF	Preamplifier status
Top Pos.;CENT;	Top (100%) level position can be Edge (EDGE) or Center (CENT)
Top Alg.;MEDI	Top level measurement algorithm can be Median (MEDI) or Mean (MEAN)
Ripple Portion;50;%	Portion of pulse top where ripple is measured

File contents	Description
High Level;90;%V	High (distal) threshold level
Mid Level;50;%V	Mid (mesial) threshold level
Low Level;10;%V	Low (proximal) threshold level
Boundary;3;%V	The (top +/-) boundary level
Point Ref;CENT;	Measurement point reference can be Rise (RISE), Center (CENT) or Fall (FALL)
Point Offset;0;s	Measurement point offset
Range Ref;CENT;	Measurement range reference can be Center (CENT) or Edge (EDGE)
Range Length;75;%	Measurement range length (only valid for “Range Ref:;CENT”)
Range Offset Rise;0;s	Measurement range offset from rising edge (only valid for “Range Ref:;EDGE”)
Range Offset Fall;0;s	Measurement range offset from falling edge (only valid for “Range Ref:;EDGE”)
Data section	
Values; 1001;	Number of rows of measured values in the table
ID:;Pulse No.:;Rise Time:;…	Pulse parameter names
Unit;;s;…	Unit of pulse parameters
1;1;10.0e-9;… 2;2;10.1e-9;… 1;3;9.9e-9;… …;…;…;…	Measured values: <ID>, <Pulse No.>, <Param 1>, … , <Param N>

D Effects of large gauss filters

As an alternative to the nearly rectangular "flat" measurement filters, the R&S VSE also provides Gaussian filters. Gaussian filters have an optimized settling behavior, which avoids overshoot distortions in time domain data.

However, for Gaussian filters whose -3dB bandwidth is large compared to the maximum I/Q bandwidth, the ideal Gaussian filter shape would exceed the maximum I/Q bandwidth at its outer edges. Thus, the actual filter only follows the ideal Gaussian filter shape in the inner range of the set I/Q bandwidth. At a certain frequency offset it must deviate from the ideal Gauss filter and drop off faster.

Gaussian filters with large -3dB bandwidths (<10 MHz)

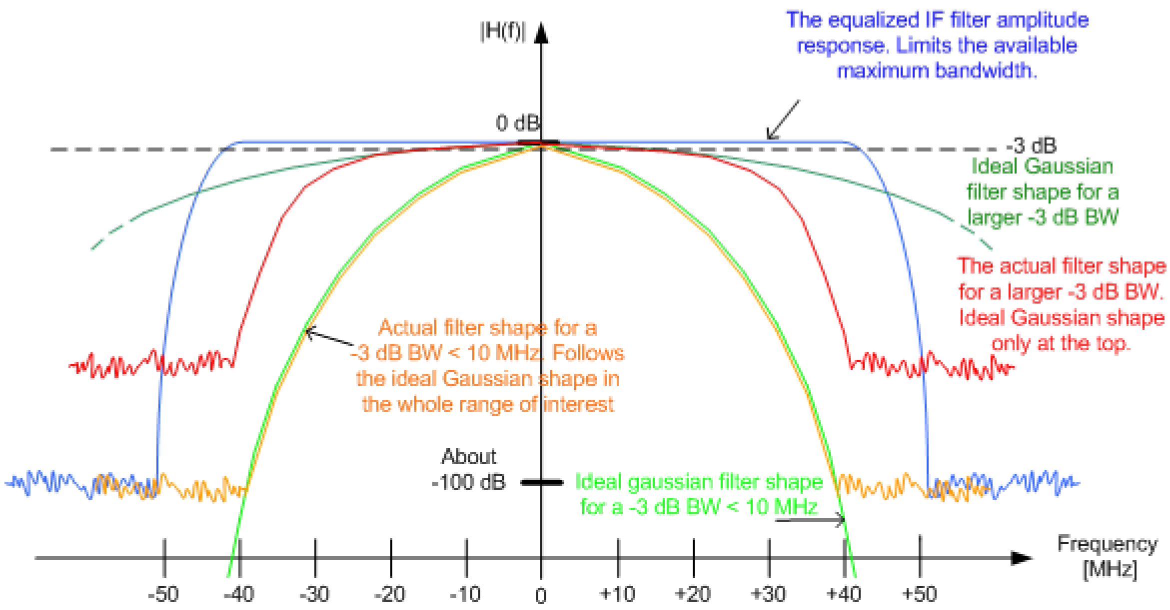


Table D-1: Gauss filters with large -3 dB bandwidths

-3 dB BW	Max. freq. with Gaussian shape	Attenuation at max. freq.	Attenuation at I/Q range edge (±40 MHz)
40 MHz	+/-24 MHz	4 dB	> 60 dB
28 MHz	+/-22 MHz	7 dB	> 65 dB
18 MHz	+/-28 MHz	29 dB	> 100 dB
10 MHz	+/-25 MHz	75 dB	> 100 dB

List of Remote Commands (Pulse)

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