

R&S® VSE-K144 / -K146

3GPP 5G NR Measurement

Application (Downlink)

User Manual



1178909002
Version 09

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-K144 (5G NR R15 Downlink / Uplink Measurements) (1309.9574.02)
- R&S®VSE-K146 (5G NR MIMO Measurements) (1345.1305.02)
- R&S®VSE-K148 (5G NR R16 Downlink / Uplink Measurements) (1345.1392.02)
- R&S®VSE-K171 (5G NR R17 Downlink / Uplink Measurements) (1345.1663.02)
- R&S®VSE-K175 (O-RAN Measurements) (1350.7020.02)
- R&S®VSE-KT144 (5G NR R15 Downlink / Uplink Measurements) (1345.1740.02)
- R&S®VSE-KT146 (5G NR MIMO Measurements) (1345.1734.02)
- R&S®VSE-KT148 (5G NR R16 Downlink / Uplink Measurements) (1345.2099.02)
- R&S®VSE-KT171 (5G NR R17 Downlink / Uplink Measurements) (1345.1992.02)
- R&S®VSE-KT175 (O-RAN Measurements) (1345.2076.02)
- R&S®VSE-KP144 (5G NR R15 Downlink / Uplink Measurements) (1345.2560.02)
- R&S®VSE-KP146 (5G NR MIMO Measurements) (1345.2576.02)
- R&S®VSE-KP148 (5G NR R16 Downlink / Uplink Measurements) (1345.2582.02)
- R&S®VSE-KP171 (5G NR R17 Downlink / Uplink Measurements) (1345.2599.02)
- R&S®VSE-KP175 (O-RAN Measurements) (1345.2601.02)

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Throughout this manual, products from Rohde & Schwarz are indicated without the ® symbol , e.g. R&S®VSE is indicated as R&S VSE.

Contents

1	Documentation Overview.....	9
1.1	User Manuals and Help.....	9
1.2	Data Sheets and Brochures.....	9
1.3	Release Notes and Open Source Acknowledgment (OSA).....	10
1.4	Application Notes, Application Cards, White Papers, etc.....	10
1.5	Videos.....	10
2	Welcome to the 5G NR measurement application.....	11
2.1	Overview of the 5G NR applications.....	11
2.2	Installation.....	14
2.3	5G NR measurement application selection.....	14
2.4	Display information.....	14
3	Measurements and result displays.....	17
3.1	Selecting measurements.....	17
3.2	Selecting result displays.....	19
3.3	Performing measurements.....	19
3.4	Result summary.....	19
3.5	I/Q measurements.....	27
3.6	Time alignment error.....	43
3.7	Transmit on / off power measurement.....	46
3.8	Frequency sweep measurements.....	50
3.9	Reference: custom limits.....	54
3.10	Reference: 3GPP test scenarios.....	55
4	Configuration.....	58
4.1	I/Q measurement.....	58
4.1.1	Configuration overview.....	59
4.1.2	Automatic measurement configuration.....	60
4.1.3	Physical signal description.....	64
4.1.4	Test scenarios.....	66
4.1.5	Component carrier configuration.....	68
4.1.6	MIMO configuration.....	73

4.1.7	Antenna port configuration.....	76
4.1.8	Radio frame configuration.....	78
4.1.9	Synchronization signal configuration.....	82
4.1.10	Bandwidth part configuration.....	88
4.1.11	Slot configuration.....	93
4.1.12	PDSCH and PDCCH configuration.....	105
4.1.13	Advanced settings.....	126
4.1.14	Generator control.....	133
4.1.15	Selecting the input and output source.....	136
4.1.16	Frequency configuration.....	140
4.1.17	Amplitude configuration.....	141
4.1.18	Trigger configuration.....	144
4.1.19	Data capture.....	146
4.1.20	Tracking.....	150
4.1.21	Demodulation.....	152
4.2	Time alignment error configuration.....	156
4.3	Transmit on / off power configuration.....	156
4.4	Frequency sweep measurement configuration.....	157
4.5	Microservice export.....	161
4.6	Time trigger measurement guide.....	161
4.7	Reference: MIMO measurement guide.....	162
4.7.1	Calibration.....	163
4.7.2	Power sensors.....	165
4.7.3	Oscilloscopes.....	168
4.7.4	Combiners.....	169
4.7.5	Signal analyzers.....	171
4.8	O-RAN measurement guide.....	173
4.9	Reference: structure of .allocation files.....	174
5	Analysis.....	184
5.1	General analysis tools.....	184
5.1.1	Data export.....	184
5.1.2	Diagram scale.....	185
5.1.3	Zoom.....	186

5.1.4	Markers.....	186
5.2	Analysis tools for I/Q measurements.....	187
5.2.1	Layout of numerical results.....	187
5.2.2	Result settings.....	187
5.2.3	Table configuration.....	190
5.2.4	Result views.....	192
5.2.5	Evaluation range.....	193
5.2.6	Beamforming selection.....	196
5.3	Analysis tools for frequency sweep measurements.....	197
6	Remote control.....	198
6.1	Common suffixes.....	198
6.2	Introduction.....	199
6.2.1	Conventions used in descriptions.....	200
6.2.2	Long and short form.....	200
6.2.3	Numeric suffixes.....	201
6.2.4	Optional keywords.....	201
6.2.5	Alternative keywords.....	201
6.2.6	SCPI parameters.....	202
6.3	5G NR application selection.....	204
6.4	Screen layout.....	204
6.4.1	General layout.....	204
6.4.2	Layout over all channels.....	205
6.4.3	Layout of a single channel.....	208
6.5	Measurement control.....	214
6.6	Remote commands to retrieve numeric results.....	216
6.6.1	Result summary.....	216
6.6.2	Time alignment error.....	230
6.6.3	Marker table.....	230
6.6.4	CCDF table.....	233
6.7	Limit check results.....	235
6.7.1	EVM limits.....	235
6.7.2	Transmit power on / off limits.....	239
6.7.3	Frequency sweep limits.....	240

6.8 Retrieve trace data.....	248
6.8.1 Using the TRACe[:DATA] command.....	248
6.8.2 Read measurement results.....	266
6.9 Configuration.....	269
6.9.1 General configuration.....	270
6.9.2 Automatic configuration.....	272
6.9.3 Physical settings.....	276
6.9.4 Component carrier configuration.....	281
6.9.5 General radio frame configuration.....	285
6.9.6 Synchronization signal configuration.....	287
6.9.7 Bandwidth part configuration.....	293
6.9.8 Slot configuration.....	297
6.9.9 CSI reference signal configuration.....	304
6.9.10 Positioning reference signal.....	313
6.9.11 CORESET allocation configuration.....	317
6.9.12 PDSCH allocation configuration.....	323
6.9.13 Enhanced CORESET allocation configuration.....	331
6.9.14 Enhanced PDSCH settings: DMRS.....	347
6.9.15 Enhanced PDSCH settings: PTRS.....	357
6.9.16 Enhanced PDSCH settings: scrambling / coding.....	360
6.9.17 Antenna port configuration.....	364
6.9.18 MIMO configuration.....	366
6.9.19 Advanced settings: global.....	367
6.9.20 Advanced settings: reference point A.....	371
6.9.21 Advanced settings: LTE-CRS coexistence.....	375
6.9.22 Generator control.....	377
6.9.23 Inputs configuration.....	383
6.9.24 Frequency configuration.....	388
6.9.25 Amplitude configuration.....	390
6.9.26 Data capture.....	394
6.9.27 Trigger.....	398
6.9.28 Tracking.....	404
6.9.29 Demodulation.....	406

6.9.30	Time alignment measurement.....	409
6.9.31	Transmit on/off power measurements.....	410
6.9.32	Frequency sweep measurements.....	413
6.10	Analysis.....	417
6.10.1	General analysis tools.....	417
6.10.2	Analysis tools for I/Q measurements.....	429
	Annex.....	441
	A Annex: reference.....	441
A.1	Menu reference.....	441
A.1.1	Common R&S VSE menus.....	441
A.1.2	LTE measurement menus.....	443
A.2	Reference of toolbar functions.....	445
	List of commands (5G NR downlink).....	449
	Index.....	460

1 Documentation Overview

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

www.rohde-schwarz.com/manual/VSE

Further documents are available at:

www.rohde-schwarz.com/product/VSE

1.1 User Manuals and Help

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

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

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

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

1.2 Data Sheets and Brochures

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

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

See www.rohde-schwarz.com/brochure-datasheet/VSE

1.3 Release Notes and Open Source Acknowledgment (OSA)

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

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

See www.rohde-schwarz.com/software/VSE

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

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

See www.rohde-schwarz.com/application/vse/

1.5 Videos

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

2 Welcome to the 5G NR measurement application

The R&S VSE-K144 is a firmware application that adds functionality to measure signals according to the 3GPP 5G NR (new radio) standard on the downlink to the R&S VSE.



Bandwidth of 5G NR signals

5G NR signals have a bandwidth between 5 MHz and 400 MHz.

If you measure signals with an instrument, measuring signals greater than 10 MHz requires an instrument with one of the optional bandwidth extensions (28 MHz or more).

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 spectrum application and are described in the R&S VSE user manual. The latest versions of the manuals are available for download at the product homepage.

<https://www.rohde-schwarz.com/manual/vse>.

- [Overview of the 5G NR applications](#)..... 11
- [Installation](#)..... 14
- [5G NR measurement application selection](#)..... 14
- [Display information](#)..... 14

2.1 Overview of the 5G NR applications

You can equip the R&S VSE with one or more NR 5G applications. Each of the applications provides functionality for specific measurement tasks.

R&S VSE-K144

The R&S VSE-K144 is designed to measure NR 5G signals on the downlink and the uplink.

The application supports features up to 3GPP release 15.

- Basic signal characteristics (like multiple component carriers, frequency ranges and channel bandwidths).
- (Automatic) demodulation and configuration of the PDSCH and synchronization signal (SS/PBCH).
- (Automatic) demodulation and configuration of the PUSCH.
- Configuration and analysis of multiple frames and bandwidth parts (multi-numerology).

- Configuration and analysis of special downlink channels and reference signals (like the PDCCH, the CSI-RS or the PT-RS).
- Configuration and analysis of special uplink channels and reference signals (like the PUCCH, the PRACH, the SRS or the PT-RS).
- Configuration and analysis of various demodulation reference signals.
- Mapping of channels to different antenna ports.
- LTE coexistence analysis for downlink signals.
- Synchronization of the configuration with a connected Rohde & Schwarz signal generator.
- Tools to refine and filter the measurement results.
- Various result displays that show the measured signal characteristics in a diagram or a numeric result table.
- Available measurements (downlink): EVM, ACLR, SEM, time alignment and on / off power.
- Available measurements (uplink): EVM, ACLR and SEM.

R&S VSE-K146

The R&S VSE-K146 is designed to measure NR 5G downlink signals in a MIMO system.

Note that this application requires the R&S VSE-K144.

The application supports the following features.

- Analysis of multiple data streams in a MIMO setup.
- Advanced configuration of the antenna port mapping.
- Extended functionality of the EVM result displays, including new result displays to measure, for example, the phase characteristics of the signal.
- Analysis of MIMO streams using multiple signal analyzers, oscilloscopes or power sensors.
- Calibration of the test setup using the R&S VSE-K544 application.

R&S VSE-K148

The R&S VSE-K148 extends the functionality of the base application with features introduced with 3GPP release 16.

Note that this application requires the R&S VSE-K144.

Release 16 features include:

- Configuration of DCI parameters.
- Configuration and analysis of the PRS.
- New operating bands, slot formats (for IAB) and test models introduced with release 16.
- New channel bandwidth introduced with release 16 (70 MHz).
- Increased PDSCH DMRS length.
- Increased number of SS/PBCH blocks to support shared spectrum access.

R&S VSE-K171

The R&S VSE-K171 extends the functionality of the base application with features introduced with 3GPP release 17.

Note that this application requires the R&S VSE-K144 and the R&S VSE-K148.

Release 17 features include:

- New deployment frequency range (FR2-2, up to 71 GHz).
- New channel bandwidths introduced with FR2-2 (800 MHz, 1600 MHz and 2000 MHz).
- New subcarrier spacings for various channels (user allocations, SS/PBCH, PRACH etc.) introduced with FR2-2.
- New channel bandwidths introduced with release 17 (35 MHz and 45 MHz).
- Support of 1024QAM modulation in FR1.
- New operating bands, test models and limits for ACLR and SEM measurements introduced with release 17.

R&S VSE-K175

The R&S VSE-K175 extends the functionality of the base application with features that allow measurements based on the O-RAN standard.

Note that this application requires the R&S VSE-K144.

The application supports the following features.

- Support of O-RAN test cases.
- Extended features in selected result displays that allow evaluation of O-RAN test cases.
- Automatic configuration of the NR 5G application upon selection of an O-RAN test case.

Notes on measurements with the R&S PVT360 and R&S CMP

For measurements with the R&S PVT360 or R&S CMP, some features have limited support.

- Select and configure the used input connector on the R&S PVT360 and R&S CMP.
- For measurements with high bandwidths (especially in FR2-2), it is possible that the maximum measurement time is smaller than a radio frame.
- For measurements on multiple carriers, it is possible that the maximum measurement time is smaller than a radio frame. We recommend using [single capture mode](#) for such measurements.
- For ACLR and SEM measurements, the measurement time depends on the bandwidth of the carrier. For measurements on carriers with a large bandwidth, it is possible that the measurement does not work.
- For MIMO measurements, R&S VSE applies the same trigger to all inputs.
- [Auto leveling](#) is not supported. Therefore, the auto EVM feature is also not available.
- [Controlling the generator](#) of the R&S PVT360 or R&S CMP is not supported.

- Measuring the on / off power is not supported.

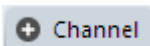
2.2 Installation

Find detailed installation instructions in the getting started or the release notes of the R&S VSE.

2.3 5G NR measurement application selection

The 5G NR measurement application adds a new application to the R&S VSE.

Starting the application

1.  Channel

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 "5G NR" item.

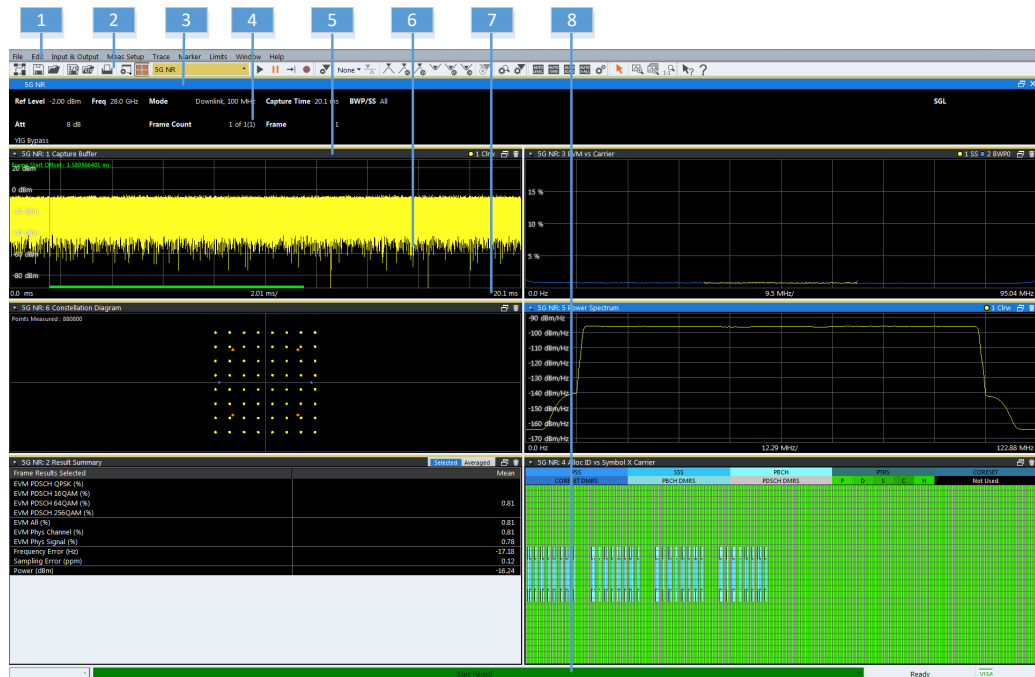


The R&S VSE opens a new measurement channel for the 5G NR application.

The application starts with the default settings. You can configure measurements with the items in the "Meas Setup" menu.

2.4 Display information

The following figure shows a typical display of the 5G NR application. All different information areas are labeled. They are explained in more detail in the following sections.



- 1 = Menu bar
- 2 = Toolbar
- 3 = Channel bar header, incl. color code for windows of the same channel (here: yellow)
- 4 = Channel bar
- 5 = Diagram header, incl. color code for windows of the same channel (here: yellow)
- 6 = Diagram area
- 7 = Diagram footer
- 8 = Status bar

Channel bar information

In the 5G NR measurement application, the R&S VSE shows the following settings:

Table 2-1: Information displayed in the channel bar in the 5G NR measurement application

Ref Level	Reference level
Att	Mechanical and electronic RF attenuation
Freq	Frequency
Mode*	5G NR mode (link direction and channel bandwidth)
Frame Count*	The first number represents the number of frames that have already been captured. The second number represents the total number of frames that will be captured. The third number in brackets represents the number of frames currently in the capture buffer.
Capture Time	Signal length that has been captured
Frame	Frame that is currently analyzed

BWP/SS	Shows the signal part for which results are displayed (evaluation range). SS = synchronization signal BWP = bandwidth part
View<x>	Information about the contents of View 1 and View 2. Select the button for access to the dialog box for view configuration..

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 (for example transducer or trigger settings). This information is displayed only when applicable for the current measurement. For a comprehensive description, refer to the user manual of the R&S VSE.

Diagram header

The information in the diagram header depends on the result display.

- All diagrams show the window number and type of result display.
- Most diagrams contain trace information.
- Some diagrams contain controls to customize the diagram contents. The diagram header of the "Allocation Summary", for example, contains a control to select which columns are displayed.

Status bar information

Global instrument settings, the instrument status and any irregularities are indicated in the status bar beneath the diagram. Furthermore, the progress of the current operation is displayed in the status bar.

Regarding the synchronization state, the application shows the following labels.

- "Sync OK"
The synchronization was successful. The status bar is green.
- "Sync Failed"
The synchronization was not successful. The status bar is red.

3 Measurements and result displays

The 5G NR measurement application measures and analyzes various aspects of a 5G NR signal.

The application provides several measurements and result displays.

- Measurements capture and analyze the signal in a different way.
- Result displays are different representations of the measurement results. They are either diagrams that show the results as a graph or tables that show the results as numbers.

Remote command:

Measurement selection: `CONFigure[:NR5G]:MEASurement` on page 271

Result display selection: `LAYout:ADD[:WINDow]?` on page 208

• Selecting measurements	17
• Selecting result displays	19
• Performing measurements	19
• Result summary	19
• I/Q measurements	27
• Time alignment error	43
• Transmit on / off power measurement	46
• Frequency sweep measurements	50
• Reference: custom limits	54
• Reference: 3GPP test scenarios	55

3.1 Selecting measurements

Access: "Overview" > "Select Measurement"

The "Select Measurement" dialog box contains several buttons. Each button represents a measurement. A measurement in turn is a set of result displays that thematically belong together and that have a particular display configuration. If these predefined display configurations do not suit your requirements, you can add or remove result displays as you like. For more information about selecting result displays, see [Chapter 3.2, "Selecting result displays"](#), on page 19.

Depending on the measurement, the R&S VSE changes the way it captures and processes the raw signal data.

EVM

EVM measurements record, process and demodulate the signal's I/Q data. The result displays available for EVM measurements show various aspects of the 5G NR signal quality.

For EVM measurements, you can combine the result displays in any way.

For more information on the result displays, see [Chapter 3.5, "I/Q measurements"](#), on page 27.

Remote command:

[CONFigure\[:NR5G\]:MEASurement](#) on page 271

Time alignment error

Time alignment error (TAE) measurements record, process and demodulate the signal's I/Q data. The result displays available for TAE measurements indicate how well the antennas in a multi-antenna system are aligned.

For TAE measurements, you can combine the result displays in any way.

For more information on the result displays, see [Chapter 3.6, "Time alignment error"](#), on page 43.

Remote command:

[CONFigure\[:NR5G\]:MEASurement](#) on page 271

Transmit on / off power

Transmit on / off power measurements record and process the signal's I/Q data without demodulating the data. The result displays available for transmit on / off power measurements show various aspects of the transition from on to off power.

For transmit on / off power measurements, you can combine the result displays in any way.

For more information on the result displays, see [Chapter 3.7, "Transmit on / off power measurement"](#), on page 46.

Remote command:

[CONFigure\[:NR5G\]:MEASurement](#) on page 271

Channel power ACLR

ACLR measurements process captured the I/Q data.

The ACLR measurements evaluates the leakage ratio of neighboring channels and evaluates if the signal is within the defined limits. The measurement provides several result displays. You can combine the result displays in any way.

For more information on the result displays, see [Chapter 3.8, "Frequency sweep measurements"](#), on page 50.

Remote command:

[CONFigure\[:NR5G\]:MEASurement](#) on page 271

SEM

SEM measurements process captured the I/Q data.


The SEM measurements tests the signal against a spectrum emission mask and evaluates if the signal is within the defined limits. The measurement provides several result displays. You can combine the result displays in any way.

For more information on the result displays, see [Chapter 3.8, "Frequency sweep measurements"](#), on page 50.

Remote command:

[CONFigure\[:NR5G\]:MEASurement](#) on page 271

3.2 Selecting result displays

Access:  or "Window" > "New Window"

The R&S VSE opens a menu to select result displays. Depending on the number of LTE channels you are currently using, there is a submenu that contains all available result displays for each LTE channel.

In the default state of the application, it shows several conventional result displays.

- Capture Buffer
- EVM vs Carrier
- Power Spectrum
- Result Summary
- Alloc ID vs Symbol x Carrier
- Constellation Diagram

From that predefined state, add and remove result displays to the channels as you like from the "Window" menu.

Remote command: `LAYout:ADD[:WINDow]?` on page 208

3.3 Performing measurements

By default, the application measures the signal continuously. In "Continuous Sweep" mode, the R&S VSE captures and analyzes the data again and again.

- For I/Q measurements, the amount of captured data depends on the [capture time](#).
- For frequency sweep measurement, the amount of captured data depends on the sweep time.

In "Single Sweep" mode, the R&S VSE stops measuring after it has captured the data once. The amount of data again depends on the capture time.

Refreshing captured data

You can also repeat a measurement based on the data that has already been captured with the "Refresh" function. Repeating a measurement with the same data can be useful, for example, if you want to apply different modulation settings to the same I/Q data.

For more information, see the documentation of the R&S VSE.

3.4 Result summary

In addition to various graphical results, the R&S VSE provides a numerical result summary for I/Q measurements. The result summary shows a multitude of results that indicate the signal quality, combined in one table.

The result summary is split into several parts.

- Frame statistics, which evaluate the metrics of the resource elements in a complete frame.
Results are averaged over frames.
- Slot and subframe statistics, which evaluate metrics of the resource elements in a single slot or subframe.
Results are averaged over slots / subframes.

If you are using different [numerologies](#), the R&S VSE first averages all slots with the same numerology, before calculating the overall mean value.

Each row in the table corresponds to a certain metric or result parameter. You can [add](#) or [remove](#) results you want to display as necessary.

By default, the R&S VSE evaluates the results over all captured frames, bandwidth parts, subframes and slots. For most results, the result summary therefore contains a mean (average), maximum and minimum value.

2 Result Summary				
Frame Results Selected	Mean	Limit	Max	Min
EVM PDSCH QPSK (%)	0.00	0.00	0.00	0.00
EVM PDSCH 16QAM (%)	0.00	0.00	0.00	0.00
EVM PDSCH 64QAM (%)	0.00	0.00	0.00	0.00
EVM PDSCH 256QAM (%)	0.00	0.00	0.00	0.00
Results for Selection BWP/SS All, Subframe All, Slot All				
EVM All (%)	0.00		0.00	0.00
EVM Peak (%)	0.00		0.00	0.00
EVM Phys Channel (%)	0.00		0.00	0.00
EVM Phys Signal (%)	0.00		0.00	0.00
Frequency Error (Hz)	0.00		0.00	0.00
Sampling Error (ppm)	0.00		0.00	0.00
I/Q Offset (dB)	0.00		0.00	0.00
I/Q Gain Imbalance (dB)	-		-	-
I/Q Quadrature Error (°)	-		-	-

Limit check

The R&S VSE also tests several results against limits, if 3GPP has defined limits for a result. Limits are only evaluated if the signal complies to the 3GPP specification regarding the [number of analyzed frames](#) and the results are averaged over all frames.

Depending on the limit test, the results are highlighted.

- If one of the results passes the limit, the value is highlighted green.
- If one of the results violates the limit, the value is highlighted red.
- Results that are not evaluated are not highlighted in a color.

For some results you can define custom limits. For more information, see [Chapter 3.9, "Reference: custom limits"](#), on page 54.

You can check if a result supports limit evaluation in the result descriptions below. The result descriptions also indicate special behavior of the limit check.

Evaluation range and multiple frame analysis

The [evaluation range](#) selects the way the results are evaluated and which values are displayed.

For the **frame statistics**, the evaluation range is irrelevant. However, you can select a specific frame that you want to analyze.

- Select "Frame Averaged" in the result summary header to display the average result over all analyzed frames. The average results relate to all frames, not just those in the capture buffer.
The table also shows the minimum and maximum values over the analyzed frames.
- Select "Selected Frame" in the result summary header to display the results for a [single frame](#).
If you analyze a single frame, the mean, minimum and maximum values are the same.



For the **slot statistics** and subframe statistics, the effects of the evaluation range are as follows.

- Select "Frame Averaged" in the result summary header to display the average results over all analyzed slots in all analyzed frames. The average results relate to all frames, not just those in the capture buffer. The table also shows the minimum and maximum values found in the analyzed frames.
When you select a specific BWP, subframe or slot while in "Frame Averaged" mode, the R&S VSE automatically selects "Selected Frame" mode.
- Select "Selected Frame" in the result summary header to display the results over all analyzed slots in a single frame. The analyzed frame depends on the frame you have selected. In this case, you can filter the evaluation range as you like.

Examples:

- If you select a specific BWP: the R&S VSE takes the average over all slots in the selected BWP.
- If you select a specific subframe: the R&S VSE takes the average over all slots in the selected subframe.
- If you select a specific slot: the R&S VSE shows the result for that slot.
Note that selecting a specific slot for the subframe results (frequency and sampling error) will not make a difference, because those results are always calculated over a complete subframe.

The current evaluation range is indicated in the header row of the slot statistics.

Multiple carrier analysis

For measurements on [multiple carriers](#), the contents of the result summary depend on your configuration, especially the [CC result](#) setting.

- Select "CC Result" = "All" to display information about all component carriers, regardless of the number of component carriers.
 - The "All" tab shows the average results for all component carriers. Each column in the table corresponds to one component carrier.

- The "View <x>" tabs show the detailed results for the component carriers assigned to the two [views](#).
- Select "CC Result" = "Viewed" to display information about the component carriers assigned to the two views.
 - The "All" tab shows the average results for the two selected component carriers. Depending on your selection in the result summary header, the results are either averaged over all frames, or relate to a single frame.
 - The "View <x>" tabs show the detailed results for the component carriers assigned to the two views. Depending on your selection in the result summary header, the results are either averaged over all frames, or relate to a single, selected frame.

If you analyze only one frame, the results are the same in both cases.

Note that analyzing all component carriers is slower compared analyzing the viewed component carriers, because of the post-processing that occurs during the analysis. Thus, if time is an issue, you can select two component carriers to analyze, and, if you are later interested in the characteristics of another component carrier, analyze that component carrier later (the data of the other carriers is available, just not analyzed).

Units

Most of the units of the results are fixed.

The unit of the EVM results depends on the selected [EVM unit](#).

Remote queries	22
EVM PDSCCH	23
BLER (%)	23
TPUT (%)	24
Frame Start Offset	24
EVM All	24
EVM Peak	24
EVM Phys Channel	24
EVM Phys Signal	25
Frequency Error	25
Sampling Error	25
Power	25
I/Q Offset	25
I/Q Gain Imbalance	25
I/Q Quadrature Error	26
Crest Factor	26
OSTP	26
RSTP	26
RSRP	26

Remote queries

The remote commands to query individual results and limit check results are indicated in the description of the respective result.

Alternatively, you can query all results or limit check results at the same time using a single command.

Remote command:

Results: `FETCh[:CC<cc>][:ISRC<ant>][:FRAME<fr>]:SUMMARY:ALL?`
on page 218

Limit check: `CALCulate<n>:LIMit[:CC<cc>][:ISRC<ant>][:FRAME<fr>]:SUMMARY:ALL:RESult?` on page 235

EVM PDSCH

Shows the EVM for all PDSCH resource elements with a certain modulation in the analyzed frame (QPSK, 16QAM, 64QAM, 256QAM).

3GPP release 17 adds 1024QAM modulation.

[Limit](#) evaluation supported.

Remote command:

QPSK: `FETCh[:CC<cc>][:ISRC<ant>][:FRAME<fr>]:SUMMARY:EVM:DSQP[:AVERAGE]?` on page 221

16QAM: `FETCh[:CC<cc>][:ISRC<ant>][:FRAME<fr>]:SUMMARY:EVM:DSST[:AVERAGE]?` on page 222

64QAM: `FETCh[:CC<cc>][:ISRC<ant>][:FRAME<fr>]:SUMMARY:EVM:DSSF[:AVERAGE]?` on page 221

256QAM: `FETCh[:CC<cc>][:ISRC<ant>][:FRAME<fr>]:SUMMARY:EVM:DSTS[:AVERAGE]?` on page 222

1024QAM: `FETCh[:CC<cc>][:ISRC<ant>][:FRAME<fr>]:SUMMARY:EVM:DS1K[:AVERAGE]?` on page 220

Limit check QPSK: `CALCulate<n>:LIMit[:CC<cc>][:ISRC<ant>][:FRAME<fr>]:SUMMARY:EVM:DSQP[:AVERAGE]:RESult?` on page 236

Limit check 16QAM: `CALCulate<n>:LIMit[:CC<cc>][:ISRC<ant>][:FRAME<fr>]:SUMMARY:EVM:DSST[:AVERAGE]:RESult?` on page 238

Limit check 64QAM: `CALCulate<n>:LIMit[:CC<cc>][:ISRC<ant>][:FRAME<fr>]:SUMMARY:EVM:DSSF[:AVERAGE]:RESult?` on page 237

Limit check 256QAM: `CALCulate<n>:LIMit[:CC<cc>][:ISRC<ant>][:FRAME<fr>]:SUMMARY:EVM:DSTS[:AVERAGE]:RESult?` on page 238

Limit check 1024QAM: `CALCulate<n>:LIMit[:CC<cc>][:ISRC<ant>][:FRAME<fr>]:SUMMARY:EVM:DS1K[:AVERAGE]:RESult?` on page 236

BLER (%)

Shows the block error rate (BLER) for all code blocks used by the PDSCH as a percentage. The BLER is the ratio of the number of erroneously transmitted code blocks to all code blocks in the analyzed frame.

Note that the result is only calculated if the number of bits per code block is identical for all allocations.

To see the BLER results, you have to turn on the [throughput measurement](#).

Remote command:

`FETCh[:CC<cc>][:ISRC<ant>][:FRAME<fr>]:SUMMARY:BLER[:AVERAGE]?`
on page 219

TPUT (%)

Shows the throughput for all code blocks used by the PDSCH. The BLER is the ratio of the number of successfully transmitted code blocks to all code blocks in the analyzed frame.

Note that the result is only calculated if the number of bits per code block is identical for all allocations.

To see the throughput results, you have to turn on the [throughput measurement](#).

Remote command:

`FETCh[:CC<cc>][:ISRC<ant>][:FRAME<fr>]:SUMMARY:TPUT[:AVERAGE]?`
on page 229

Frame Start Offset

Shows the start of the frame relative to the start of the capture buffer.

Unavailable for "Frame Averaged" results, otherwise refers to the selected frame.

Remote command:

`FETCh[:CC<cc>][:ISRC<ant>]:SUMMARY:TFrame?` on page 229

EVM All

Shows the EVM for all resource elements in the selected evaluation range.

The result is a weighted average over all resource elements (PDSCH, DMRS etc.). The number of occupied resource blocks and the number of used symbols of each allocation is taken into account in the calculation of the mean EVM. Therefore, a fully loaded PDSCH across multiple symbols gets a much higher weight than a single symbol DMRS.

Remote command:

`FETCh[:CC<cc>][:ISRC<ant>][:FRAME<fr>]:SUMMARY:EVM[:ALL][:AVERAGE]?` on page 219

EVM Peak

Shows the EVM of the resource element with the highest EVM value in the selected evaluation range.

Remote command:

`FETCh[:CC<cc>][:ISRC<ant>][:FRAME<fr>]:SUMMARY:EVM:PEAK[:AVERAGE]?` on page 223

EVM Phys Channel

Shows the EVM for all physical channel resource elements in the selected evaluation range.

A physical channel corresponds to a set of resource elements carrying information from higher layers. PDSCH, PUSCH, PBCH or PDCCH, for example, are physical channels.

Remote command:

`FETCh[:CC<cc>][:ISRC<ant>][:FRAME<fr>]:SUMMARY:EVM:PChannel[:AVERAGE]?` on page 223

EVM Phys Signal

Shows the EVM for all physical signal resource elements in the selected evaluation range.

The reference signal is a physical signal, for example.

Frequency Error

Shows the difference in the measured center frequency and the reference center frequency.

The frequency error is calculated over a subframe.

[Limits](#) are evaluated if you [turn on the limit check](#).

The R&S VSE checks the measured frequency error against the limits defined by 3GPP. The values are highlighted green (pass) or red (fail) respectively. The color of the mean value indicates the overall limit check passes or fails. Note that if you evaluate a single subframe only, the minimum, maximum and mean values are the same.

The limit values depend on the [base station category](#).

Remote command:

Result: `FETCh[:CC<cc>][:ISRC<ant>][:FRAME<fr>]:SUMMARY:FERRor[:AVERAge]?` on page 224

Limit check: `CALCulate<n>:LIMit[:CC<cc>][:ISRC<ant>][:FRAME<fr>]:SUMMARY:EVM:FERRor[:AVERAge]:RESult?` on page 239

Sampling Error

Shows the difference in measured symbol clock and reference symbol clock relative to the system sampling rate.

The sampling error is calculated over a subframe.

Remote command:

`FETCh[:CC<cc>][:ISRC<ant>][:FRAME<fr>]:SUMMARY:SERRor[:AVERAge]?` on page 228

Power

Shows the average time domain power for all resource elements in the selected evaluation range.

Remote command:

`FETCh[:CC<cc>][:ISRC<ant>][:FRAME<fr>]:SUMMARY:POWer[:AVERAge]?` on page 226

I/Q Offset

Shows the power at spectral line 0 normalized to the total transmitted power.

Not available for multiple BWPs.

Remote command:

`FETCh[:CC<cc>][:ISRC<ant>][:FRAME<fr>]:SUMMARY:IQOFFset[:AVERAge]?` on page 225

I/Q Gain Imbalance

Shows the logarithm of the gain ratio between the Q-channel and the I-channel.

Not available for multiple BWPs and only calculated if you [turn on the calculation](#).

Remote command:

`FETCh[:CC<cc>][:ISRC<ant>][:FRAME<fr>]:SUMMARY:GIMBalance[:AVERage]?` on page 225

I/Q Quadrature Error

Shows the measure of the phase angle between Q-channel and I-channel deviating from the ideal 90 degrees.

Not available for multiple BWPs and only calculated if you [turn on the calculation](#).

Crest Factor

Shows the peak-to-average power ratio of the captured signal.

The peak power is determined over multiple frames.

Remote command:

`FETCh[:CC<cc>][:ISRC<ant>]:SUMMARY:CRESt[:AVERage]?` on page 219

OSTP

Shows the OFDM symbol transmit power.

The result is the average power of all OFDM symbols that carry PDSCH and not containing PDCCH, RS or SSB within a slot.

Not available for multiple BWPs.

Remote command:

`FETCh[:CC<cc>][:ISRC<ant>][:FRAME<fr>]:SUMMARY:OSTP[:AVERage]?` on page 226

RSTP

Shows the reference signal transmit power.

The result is an average over all PDSCH DMRS within a frame. For the calculation, the R&S VSE first averages all DMRS in each slot, and then averages this value over all slots in a frame.

Not available for multiple BWPs.

Remote command:

`FETCh[:CC<cc>][:ISRC<ant>][:FRAME<fr>]:SUMMARY:RSTP[:AVERage]?` on page 228

RSRP

Shows the reference signal receive power for the CSI reference signal (CSI-RSRP) and the second synchronization reference signal (SS-RSRP) as defined in 3GPP 38.215.

It is an average power over all resource elements that carry the CSI or SS reference signal.

Not available for multiple BWPs.

Remote command:

CSI-RSRP: `FETCh[:CC<cc>][:ISRC<ant>][:FRAME<fr>]:SUMMARY:RSRP:CSI[:AVERage]?` on page 227

SS-RSRP: `FETCh[:CC<cc>][:ISRC<ant>][:FRAME<fr>]:SUMMARY:RSRP:SS[:AVERage]?` on page 227

3.5 I/Q measurements

Access: [MEAS] > "EVM/Frequency Err/Power"

For I/Q measurements, the R&S VSE captures and then analyzes the demodulated I/Q data. I/Q measurements provide various result displays that show different aspects and characteristics of the captured signal.

You can select the result displays from the evaluation bar and arrange them as you like with the SmartGrid functionality.

Remote command:

Measurement selection: `CONFigure[:NR5G]:MEASurement` on page 271

Result display selection: `LAYout:ADD[:WINDow]?` on page 208

Capture Buffer.....	27
EVM vs Carrier.....	28
EVM vs Symbol.....	29
EVM vs RB.....	30
Frequency Error vs Symbol.....	30
Frequency Error vs Subframe.....	31
Power Spectrum.....	32
Flatness.....	32
CCDF.....	33
Constellation Diagram.....	34
Allocation Summary.....	34
Channel Decoder Results.....	35
Bitstream.....	36
EVM vs Symbol x Carrier.....	38
Power vs Symbol x Carrier.....	38
Allocation ID vs Symbol x Carrier.....	38
RS Magnitude.....	39
RS Phase.....	40
RS Phase Difference.....	41
Beamforming Summary.....	41
Marker Table.....	42

Capture Buffer

The "Capture Buffer" shows the complete range of captured data for the last data capture.

The x-axis represents time. The maximum value of the x-axis is equal to the [Capture Time](#).

The y-axis represents the amplitude of the captured I/Q data in dBm (for RF input).

The capture buffer uses the auto peak detector to evaluate the measurement data. The auto peak detector determines the maximum and the minimum value of the measured levels for each measurement point and combines both values in one sample point.

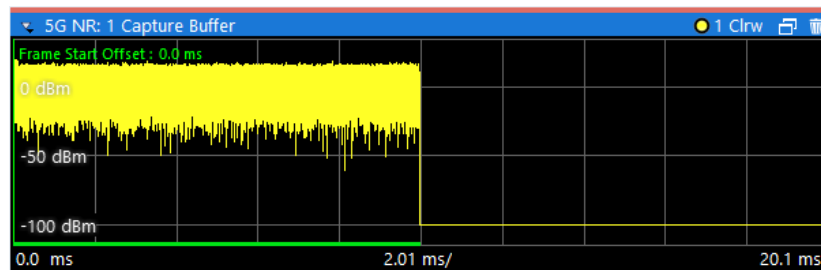


Figure 3-1: Capture buffer without zoom

A green bar at the bottom of the diagram represents the frame that is currently analyzed.

A green vertical line at the beginning of the green bar in the capture buffer represents the frame start. The diagram also contains the "Start Offset" value. This value is the time difference between the frame start and capture buffer start.

The header of the "Capture Buffer" result display contains an "I/Q Export" button that allows you to export I/Q data easily.

Remote command:

Selection: `LAY:ADD ? '1',LEFT,CBUF`

Query (y-axis): `TRACe:DATA?`

Query (x-axis): `TRACe<n>[:DATA]:X?` on page 269

Frame start offset: `FETCh[:CC<cc>][:ISRC<ant>]:SUMMARY:TFrame?` on page 229

EVM vs Carrier

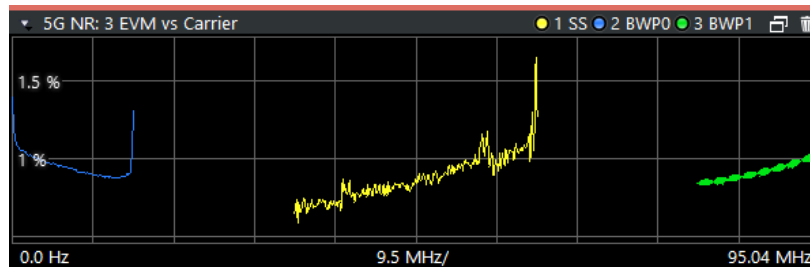
The "EVM vs Carrier" result display shows the error vector magnitude (EVM) of the subcarriers. With the help of a marker, you can use it as a debugging technique to identify any subcarriers whose EVM is too high.

The results are based on an average EVM that is calculated over the resource elements for each subcarrier. This average subcarrier EVM is determined for each analyzed slot in the capture buffer.

The contents of the result display depend on the [evaluation range](#).

- If you analyze all synchronization signals (SS) and bandwidth parts (BWP), the result display contains one trace for the [synchronization signal](#) and a variable number of traces that represent the [bandwidth parts](#). The traces show the average EVM of the corresponding signal part. The diagram header contains a legend that shows the information that each trace carries.
- If you analyze only the synchronization signal, one specific bandwidth part, or a single subframe, the diagram contains three traces. The traces show the following information.
 - The average subcarrier EVM over all slots in the selected signal part.
 - The lowest subcarrier EVM over all slots in the selected signal part.
 - The highest subcarrier EVM over all slots in the selected signal part.
- If you analyze only a single slot, the diagram contains one trace. That trace shows the subcarrier EVM for that slot only. Average, minimum and maximum values in that case are the same.

The x-axis represents the center frequencies of the subcarriers. The y-axis shows the EVM in % or in dB, depending on the [EVM Unit](#).



Remote command:

Selection `LAY:ADD ? '1',LEFT,EVCA`

Query (y-axis): `TRACe:DATA?`

Query (x-axis): `TRACe<n>[:DATA]:X?` on page 269

EVM vs Symbol

The "EVM vs Symbol" result display shows the error vector magnitude (EVM) of the OFDM symbols. You can use it as a debugging technique to identify any symbols whose EVM is too high.

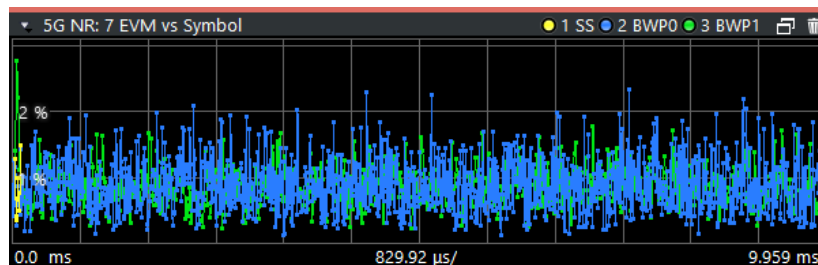
The results are based on an average EVM that is calculated over the resource elements for each subcarrier. This average subcarrier EVM is determined for each analyzed slot in the capture buffer.

The contents of the result display depend on the [evaluation range](#).

- If you analyze all synchronization signals (SS) and bandwidth parts (BWP), the result display contains one trace for the [synchronization signal](#) and a variable number of traces that represent the [bandwidth parts](#). The diagram header contains a legend that shows the information that each trace carries.
- If you analyze only the synchronization signal, one specific bandwidth part, a single subframe or a single slot, the diagram contains one trace. That trace shows the average EVM of the symbols in the selected signal part.

The x-axis represents the OFDM symbols, with each symbol represented by a dot on the line. Any missing connections from one dot to another mean that the R&S VSE could not determine the EVM for that symbol.

On the y-axis, the EVM is plotted either in % or in dB, depending on the [EVM Unit](#).



Remote command:

Selection: `LAY:ADD ? '1',LEFT,EVSY`

Query (y-axis): `TRACe:DATA?`

Query (x-axis): `TRACe<n>[:DATA]:X?` on page 269

EVM vs RB

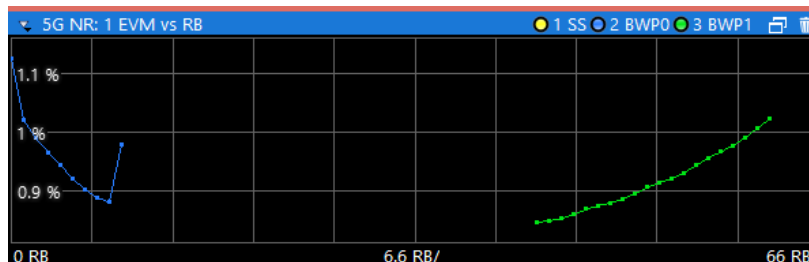
The "EVM vs RB" result display shows the Error Vector Magnitude (EVM) for all resource blocks that can be occupied by the PDSCH.

The contents of the result display depend on the [evaluation range](#).

- If you analyze all synchronization signals (SS) and bandwidth parts (BWP), the result display contains one trace for the [synchronization signal](#) and a variable number of traces that represent the [bandwidth parts](#). The traces show the average EVM of the corresponding signal part. The diagram header contains a legend that shows the information that each trace carries.
- If you analyze only the synchronization signal, one specific bandwidth part, or a single subframe, the diagram contains three traces. The traces show the following information.
 - The average subcarrier EVM over all slots in the selected signal part.
 - The lowest subcarrier EVM over all slots in the selected signal part.
 - The highest subcarrier EVM over all slots in the selected signal part.
- If you analyze only a single slot, the diagram contains one trace. That trace shows the subcarrier EVM for that slot only. Average, minimum and maximum values in that case are the same.

If you select and analyze one subframe only, the result display contains one trace that shows the resource block EVM for that subframe only. Average, minimum and maximum values in that case are the same. For more information, see "[Subframe Selection](#)" on page 194.

The x-axis represents the PDSCH resource blocks. On the y-axis, the EVM is plotted either in % or in dB, depending on the [EVM Unit](#).



Remote command:

Selection: `LAY:ADD ? '1', LEFT, EVRB`

Query (y-axis): `TRACe:DATA?`

Query (x-axis): `TRACe<n> [:DATA] :X?` on page 269

Frequency Error vs Symbol

The "Frequency Error vs Symbol" result display shows the frequency error of each symbol. You can use it as a debugging technique to identify any frequency errors within symbols.

The result is an average over all subcarriers in the symbol.

The contents of the result display depend on the [evaluation range](#).

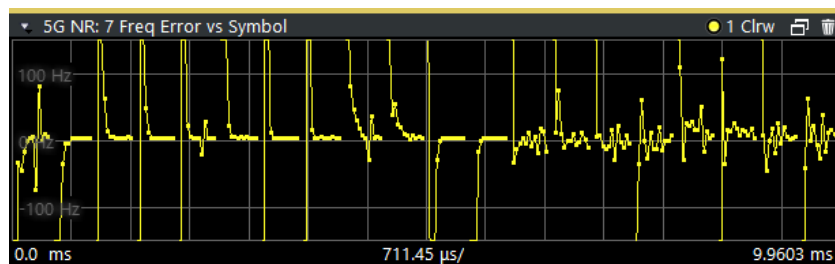
- If you analyze all synchronization signals (SS) and bandwidth parts (BWP), the result display contains one trace for the [synchronization signal](#) and a variable number of traces that represent the [bandwidth parts](#). The diagram header contains a legend that shows the information that each trace carries.

- If you analyze only the synchronization signal, one specific bandwidth part, a single subframe or a single slot, the diagram contains one trace. That trace shows the average frequency error of the symbols in the selected signal part.

The x-axis represents the OFDM symbols, with each symbol represented by a dot on the line. The number of displayed symbols depends on the [subframe selection](#). Any missing connections from one dot to another mean that the R&S VSE could not determine the frequency error for that symbol.

On the y-axis, the frequency error is plotted in Hz.

Note that the variance of the measurement results in this result display can be much higher compared to the frequency error display in the numerical result summary, depending on the PDSCH and control channel configuration. The potential difference is caused by the number of available resource elements for the measurement on symbol level.



Remote command:

Selection: `LAY:ADD ? '1',LEFT,FEVS`

Query (y-axis): `TRACe:DATA?`

Query (x-axis): `TRACe<n> [:DATA] :X?` on page 269

Frequency Error vs Subframe

The "Frequency Error vs Subframe" result display shows the frequency error of each subframe. You can use it as a debugging technique to identify any frequency errors among subframes.

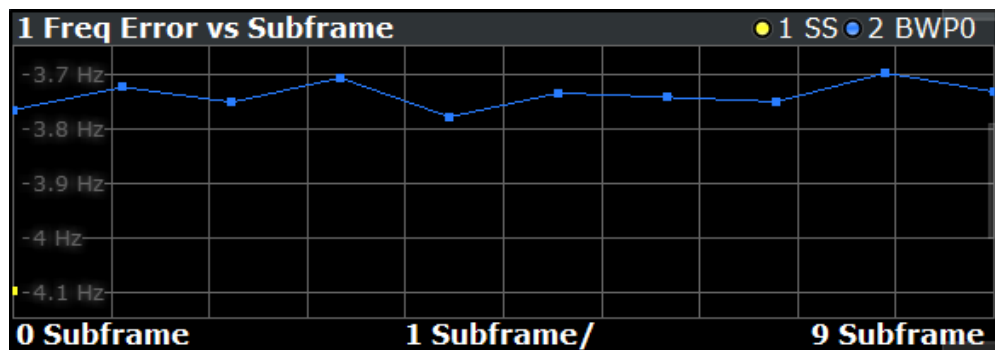
The result is an average over all subcarriers and symbols of each subframe.

The contents of the result display depend on the [evaluation range](#).

- If you analyze all synchronization signals (SS) and bandwidth parts (BWP), the result display contains one trace for the [synchronization signal](#) and a variable number of traces that represent the [bandwidth parts](#). The diagram header contains a legend that shows the information that each trace carries.
- If you analyze only the synchronization signal or one specific bandwidth part, the diagram contains one trace. That trace shows the average frequency error of the subframes in the selected signal part. Selecting a specific subframe or slot from the evaluation range has no effects on the contents of the diagram.

The x-axis represents the subframes, with each of the nine subframes represented by a dot on the line.

On the y-axis, the frequency error is plotted in Hz.



Remote command:

Selection: `LAY:ADD ? '1',LEFT,FEVS`

Query (y-axis): `TRACe:DATA?`

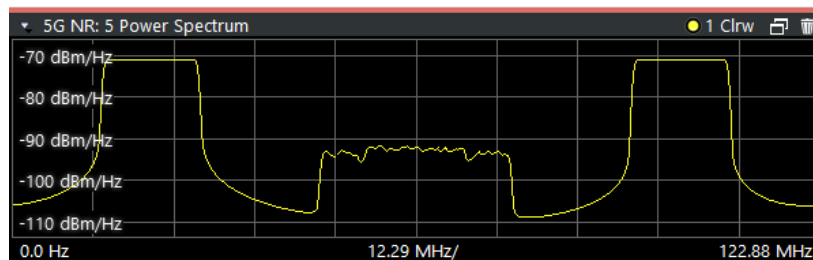
Query (x-axis): `TRACe<n>[:DATA]:X?` on page 269

Power Spectrum

The "Power Spectrum" shows the power density of the complete capture buffer in dBm/Hz.

The displayed bandwidth depends on the [channel bandwidth](#).

The x-axis represents the frequency. On the y-axis, the power level is plotted.



Remote command:

Selection: `LAY:ADD ? '1',LEFT,PSPE`

Query (y-axis): `TRACe:DATA?`

Query (x-axis): `TRACe<n>[:DATA]:X?` on page 269

Flatness

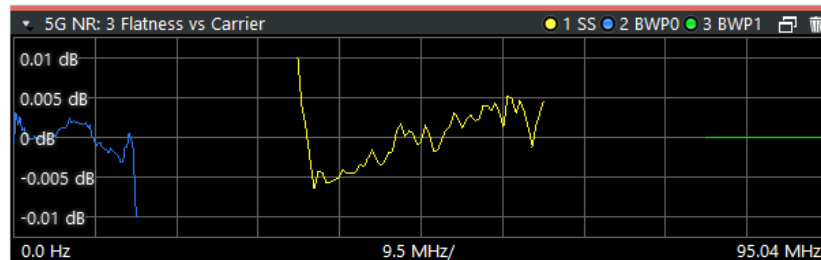
The "Channel Flatness" result shows the relative power offset caused by the transmit channel for each subcarrier.

The contents of the result display depend on the [evaluation range](#).

- If you analyze all synchronization signals (SS) and bandwidth parts (BWP), the result display contains one trace for the [synchronization signal](#) and a variable number of traces that represent the [bandwidth parts](#). The traces show the average flatness of the corresponding signal part. The diagram header contains a legend that shows the information that each trace carries.
- If you analyze only the synchronization signal, one specific bandwidth part, a specific frame or a single subframe, the diagram contains three traces. The traces show the following information.
 - The average subcarrier flatness over all slots in the selected signal part.
 - The lowest subcarrier flatness over all slots in the selected signal part.

- The highest subcarrier flatness over all slots in the selected signal part.
- If you analyze only a single slot, the diagram contains one trace. That trace shows the subcarrier flatness for that slot only. Average, minimum and maximum values in that case are the same.

The x-axis represents the frequency. On the y-axis, the channel flatness is plotted in dB.



Remote command:

Selecting the result display: `LAY:ADD ? '1',LEFT,FLAT`

Querying results:

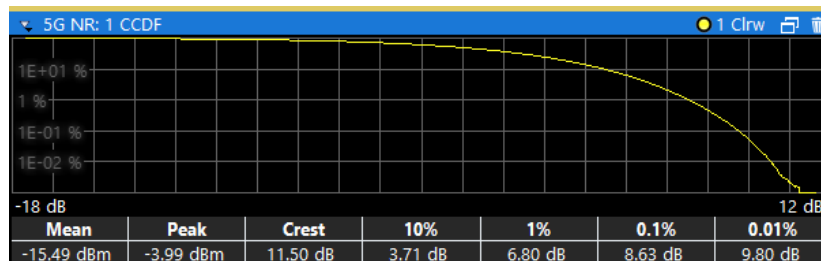
`TRACe:DATA?`

`TRACe<n>[:DATA]:X?` on page 269

CCDF

The "Complementary Cumulative Distribution Function (CCDF)" shows the probability of an amplitude exceeding the mean power. For the measurement, the complete capture buffer is used.

The x-axis represents the power relative to the measured mean power. On the y-axis, the probability is plotted in %.



In addition to the diagram, the results for the CCDF measurement are summarized in the CCDF table.

Mean	Mean power
Peak	Peak power
Crest	Crest factor (peak power – mean power)
10 %	10 % probability that the level exceeds mean power + [x] dB
1 %	1 % probability that the level exceeds mean power + [x] dB
0.1 %	0.1 % probability that the level exceeds mean power + [x] dB
0.01 %	0.01 % probability that the level exceeds mean power + [x] dB

Remote command:

Selection: `LAY:ADD ? '1',LEFT,CCDF`

Query (y-axis): `TRACe:DATA?`

Numerical results: `CALCulate<n>:STATistics:CCDF:X<t>?` on page 233

Numerical results: `CALCulate<n>:STATistics:RESult<res>?` on page 234

Constellation Diagram

The "Constellation Diagram" shows the in-phase and quadrature phase results and is an indicator of the quality of the modulation of the signal.

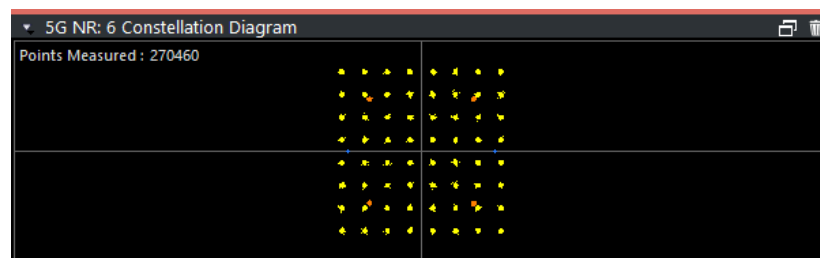
In the default state, the result display evaluates the full range of the measured input data.

If you apply a boosting factor to resources as required by 3GPP for certain test models, the constellation diagram excludes that boosting factor to display the constellation diagram points by default. To consider the boosting factor for the calculation of the constellation points, turn on the [corresponding parameter](#).

The color represent either the modulation type or the allocation type, depending on your selection. The color mapping for modulation is as follows. The color mapping for allocations is the same as in the [allocation ID vs symbol vs carrier](#) result display.

- RBPSK
- QPSK
- 16QAM
- 64QAM
- 256QAM
- 1024QAM

You can filter the results by changing the [evaluation range](#).



The constellation diagram shows the number of points that are displayed in the diagram.

Remote command:

Selection: `LAY:ADD ? '1',LEFT,CONS`

Query: `TRACe:DATA?`

Allocation Summary

The "Allocation Summary" shows various parameters of the measured allocations in a table.

Each row in the allocation table corresponds to an allocation. A set of several allocations make up a slot. A horizontal line indicates the beginning of a new slot. Special allocations summarize the characteristics of all allocations in a bandwidth part ("BWP ALL") and the radio frame ("TOTAL ALL").

The "BWP ALL" and "TOTAL ALL" values are an average of all EVM values in the table. For example: (EVM PDSCH 1 + EVM PDSCH 2 + EVM PDSCH 3 + EVM DMRS) / 4. Each value has the same weight. Therefore, a fully loaded PDSCH across multiple symbols has the same weight as a single symbol DMRS.

BWP/SF/Slot	Allocation ID	RBs	Rel Pow[dB]	Mod	Pow per RE[dBm]	EVM [%]
SS / 0 / 0	PSS		0.000	RBPSK	-17.092	1.023
	SSS		0.000	RBPSK	-17.089	0.492
	PBCH DMRS		0.000	QPSK	-17.092	0.907
	PBCH		0.000	QPSK	-17.095	0.931
	BWP ALL	66				0.839
0 / 0 / 0	PDSCH 0	10	0.000	QPSK	-17.092	0.816
	PDSCH DMRS 0		0.000	QPSK	-17.092	1.279
0 / 0 / 1	PDSCH 0	10	0.000	QPSK	-17.094	0.841
	PDSCH DMRS 0		0.000	QPSK	-17.092	0.836

The columns of the table show the following properties for each allocation.

- The location of the allocation (slot, subframe, bandwidth part number).
- The ID of the allocation (channel type).
- Number of resource blocks used by the allocation.
- The relative power of the allocation in dB.
- The modulation of the allocation.
- The power of each resource element in the allocation in dBm.
- The EVM of the allocation.

The unit depends on the [EVM unit](#)

Select "TableConfig" to open a dialog box that allows you to add and remove columns.

Remote command:

Selection: `LAY:ADD ? '1', LEFT, ASUM`

Query: `TRACe:DATA?`

Channel Decoder Results

The "Channel Decoder" result display shows the characteristics of various channels in a specific subframe.

The size of the table thus depends on the number of subframes and the number of channels that were decoded.

The R&S VSE can decode the following channels, if they are present.

- Protocol information of the PBCH.

SF / SSB	Allocation ID	Data					
SF 0 / SSB 0	PBCH	SSBIndexExplicitFR2	1				
		HalfFrameIndex	secondHalf	systemFrameNumber	922	subCarrierSpacingCommon	120 Khz
		sub-carrierOffset	8	dmrs-TypeA-Position	pos3	pdcc-ConfigSIB1	19
		cellBarred	not barred	intraFreqReselection	not allowed	spare	1
SF 0 / SSB 1	PBCH	SSBIndexExplicitFR2	0				
		HalfFrameIndex	secondHalf	systemFrameNumber	403	subCarrierSpacingCommon	120 Khz
		sub-carrierOffset	6	dmrs-TypeA-Position	pos3	pdcc-ConfigSIB1	180
		cellBarred	barred	intraFreqReselection	allowed	spare	0

For each channel type, the table contains a different set of values.

- PBCH

Information as defined in 3GPP 38.331, for example:

- The half frame index
- The system frame number
- The [subcarrier spacing](#)
- The [subcarrier offset](#)
- The [DMRS Type A position](#)

If the CRC is not valid, the R&S VSE shows a corresponding message instead of the results.

- PDCCH

Information about the [DCI fields](#) in the signal as defined by 3GPP. This includes the field name and transmitted field values.

To decode the PDCCH, you have to demodulate the [decoded payload data](#).

Remote command:

Selecting the result display: `LAY:ADD ? '1',LEFT,CDEC`

Querying results: `TRACe:DATA?`

Bitstream

The "Bitstream" shows the demodulated data stream for the data allocations.

Each row in the table corresponds to an allocation (PDSCH or CORESET). A set of several allocations make up a slot.

At the end of the table is a summary of the bitstream for certain configurations.

- Total number of bits or symbols
- Total number of coded bits
- Total number of bit errors
- Bit error rate (BER) in percent
- Bits per second (= coded bits - bit errors)

The totals are calculated over all PDSCH allocations that contribute to the bitstream. If the crc fails for one of the allocations, the R&S VSE returns NAN for the total numbers.

The bitstream summary is displayed under the following conditions.

- Select an ORAN test case.
The PDSCH [reference data](#) must be "ORAN PN23".
- Outside of ORAN test cases:
Select PDSCH [reference data](#) = "All 0" or "PN23" or [demodulation data](#) = "Decoded Payload Data".

Depending on the [bitstream format](#), the numbers represent either bits (bit order) or symbols (symbol order).

- For the bit format, each number represents one raw bit.
- For the symbol format, the bits that belong to one symbol are shown as hexadecimal numbers with two digits.

(1024QAM: hexadecimal number with three digits)

Resource elements that do not contain data or are not part of the transmission are represented by a "-".

BWP/Sf/Slot	Allocation ID	Code-word	Mod	# Symb	Bitstream [Com]
0 / 0 / 0	CORESET 0	1/1	QPSK	2430	— 02 00 02 00 01 00 00 02 00
0 / 0 / 0	PDSCH 0	1/1	QPSK	40131	02 00 00 01 00 00 03 01 01 02
0 / 0 / 1	CORESET 0	1/1	QPSK	2430	— 02 00 02 03 00 00 02 00 00

The table contains the following information:

- BWP / Sf / Slot**
 Number of the bandwidth part, subframe and slot the bits belong to.
- Allocation ID**
 Channel the bits belong to.
 This is either a PDSCH, PDCCH or PBCH allocation.
 If you [bundle PDSCH allocations](#), a row combines the information for all allocations with the same user ID.
- Codeword**
 Code word of the allocation.
- Modulation**
 Modulation type of the channels.
- # Symbols / # Bits**
 Number of symbols in the allocation.
- Bit Stream**
 The actual bit stream.
 The table only shows the first few bits for each slot. If you want to see the complete bitstream, you have to select a certain bandwidth part, subframe and slot from the [evaluation range](#). When you have done that, you can select "Extended" bitstream from the header row.

# Symbols	Bitstream Extended [Compact]
3756	00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 ...

Symbol Index	Bitstream [Extended] Compact
0	00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
16	00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
32	00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
48	00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
64	00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 03
80	00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
96	00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00

Figure 3-2: Compact vs extended bitstream (symbol format for coded data)

In the extended display, the "# Symbols" / "# Bits" column turns into the "Bit Index" or "Symbol Index" column, which indicates the position of the table row's first bit or symbol within the complete stream.

If you decode the payload data, the R&S VSE shows the number of coded bits (# symbols * Number of bits per symbol) and the number of bit errors at the end of the bitstream. The number of info bits transmitted by the PDCCH is displayed in a dedicated column ("# Bits").

Remote command:

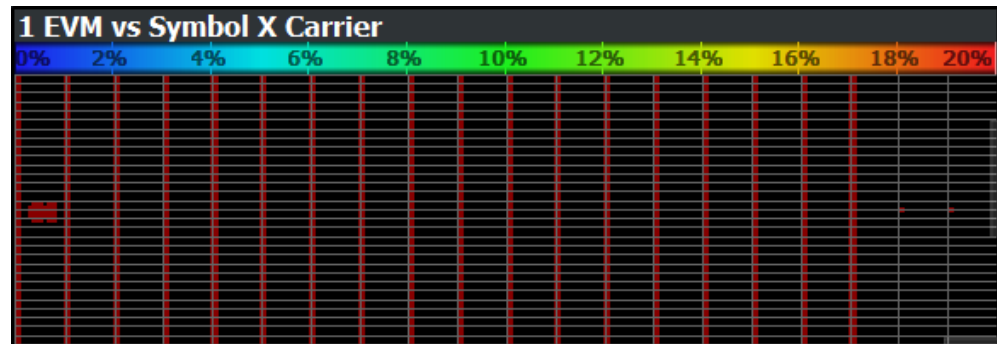
Selection: `LAY:ADD ? '1', LEFT, BSTR`

Query: `TRACe:DATA?`

EVM vs Symbol x Carrier

The "EVM vs Symbol x Carrier" result display shows the EVM for each carrier in each symbol.

The x-axis represents the symbols. The y-axis represents the subcarriers. Different colors in the diagram area represent the EVM. A color map in the diagram header indicates the corresponding power levels.



Remote command:

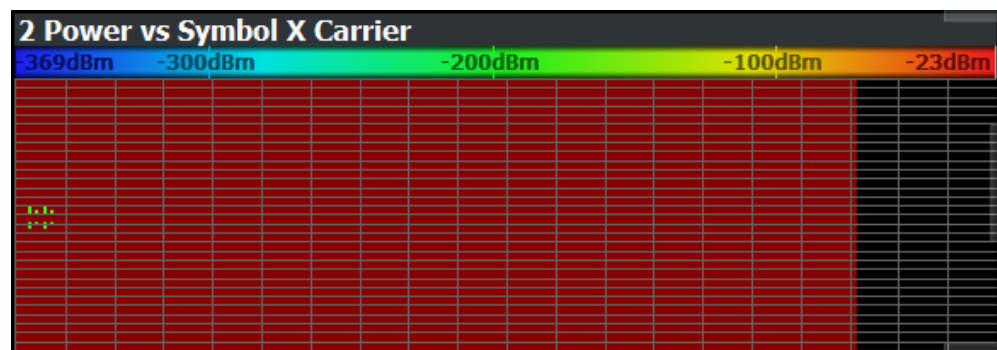
Selection: `LAY:ADD ? '1',LEFT,EVSC`

Query: `TRACe:DATA?`

Power vs Symbol x Carrier

The "Power vs Symbol x Carrier" result display shows the power for each carrier in each symbol.

The x-axis represents the symbols. The y-axis represents the subcarriers. Different colors in the diagram area represent the power. A color map in the diagram header indicates the corresponding power levels.



Remote command:

Selection: `LAY:ADD ? '1',LEFT,PVSC`

Query: `TRACe:DATA?`







Allocation ID vs Symbol x Carrier

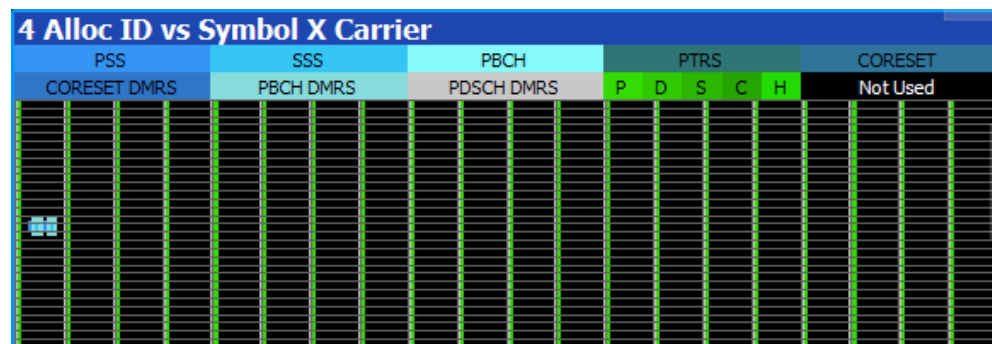
The "Allocation ID vs Symbol x Carrier" result display is a graphical representation of the structure of the analyzed frame. It shows the allocation type of each subcarrier in each symbol of the received signal.

The x-axis represents the OFDM symbols. The y-axis represents the subcarriers.

Each type of allocation is represented by a different color. The legend above the diagram indicates the colors used for each allocation. You can also use a marker to get more information about the type of allocation.

The color mapping is as follows.

- : PDSCH allocations
- : CORESET allocations
- : DMRS allocations (PBCH, CORESET, PDSCH)
- : PTRS allocations
- : CSI-RS and PRS allocations
- : Synchronization signal allocations (PSS, SSS, PBCH)



Remote command:

Selection: `LAY:ADD ? '1',LEFT,AISC`

Query: `TRACe:DATA?`

RS Magnitude

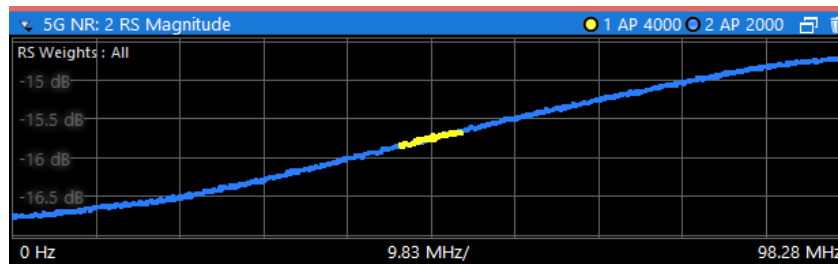
The "RS Magnitude" result display shows the magnitude of the carriers occupied by various reference signals (PDSCH, PDCCH etc.) on different antenna ports (AP).

The contents of the result display depend on the [evaluation range](#).

- If you analyze all antenna ports, the result display contains one trace for each antenna port. The traces show the average magnitude of the corresponding antenna port. The diagram header contains a legend that shows the information that each trace carries.
- If you analyze a specific antenna port, the diagram contains three traces.
 - The average magnitude over all slots on the selected antenna port.
 - The lowest magnitude over all slots on the selected antenna port.
 - The highest magnitude over all slots on the selected antenna port.
- If you analyze only a single slot, the diagram contains one trace. That trace shows the magnitude for that slot only. Average, minimum and maximum values in that case are the same.

The x-axis represents the frequency, with the unit depending on your [selection](#). The y-axis shows the magnitude of each antenna port in dB.

Because the beamforming configuration can change between the slots of one frame, the contents of this result display for [Slot Selection](#) = 'All' might be invalid. Thus, it is recommended to select the precise slot to be evaluated in order to get valid results.



Remote command:

Selection: `LAY:ADD ? '1',LEFT,RSMA`

Query: `TRACe:DATA?`

RS Phase

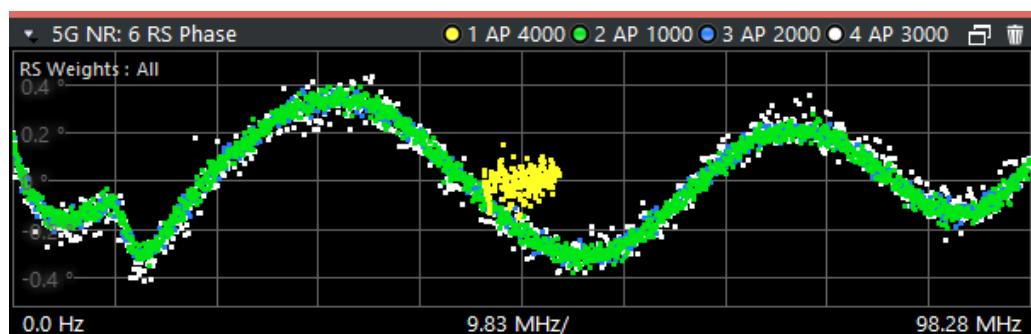
The "RS Phase" result display shows the phase of the carriers occupied by various reference signals (PDSCH, PDCCH etc.) on different antenna ports (AP).

The contents of the result display depend on the [evaluation range](#).

- If you analyze all antenna ports, the result display contains one trace for each antenna port. The traces show the average phase of the corresponding antenna port. The diagram header contains a legend that shows the information that each trace carries.
- If you analyze a specific antenna port, the diagram contains three traces.
 - The average phase over all slots on the selected antenna port.
 - The lowest phase over all slots on the selected antenna port.
 - The highest phase over all slots on the selected antenna port.
- If you analyze only a single slot, the diagram contains one trace. That trace shows the phase for that slot only. Average, minimum and maximum values in that case are the same.

The x-axis represents the frequency, with the unit depending on your [selection](#). The y-axis shows the phase of each antenna port in degrees.

Because the beamforming configuration can change between the slots of one frame, the contents of this result display for [Slot Selection](#) = 'All' might be invalid. Thus, it is recommended to select the precise slot to be evaluated in order to get valid results.



Remote command:

Selection: `LAY:ADD ? '1',LEFT,RSWP`

Query: `TRACe:DATA?`

RS Phase Difference

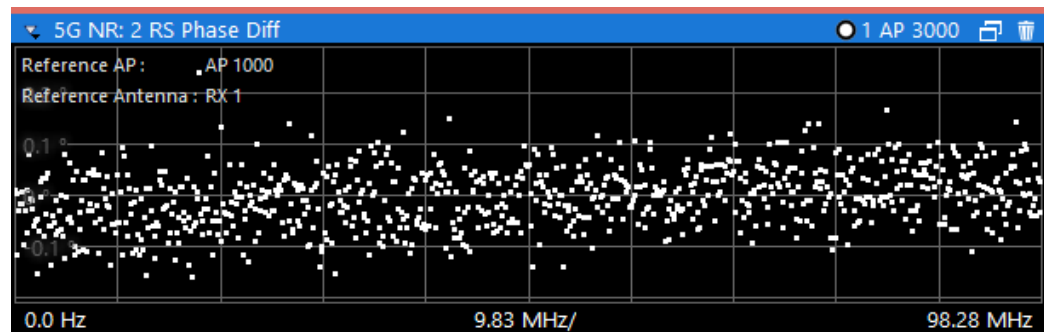
The "RS Phase Difference" result display shows the phase difference of different antenna ports (AP) relative to a [reference antenna port](#).

The contents of the result display depend on the [evaluation range](#).

- If you analyze all antenna ports, the result display contains one trace for each antenna port (but not the reference antenna port). The traces show the average phase deviation of the corresponding antenna port to the reference antenna port. The diagram header contains a legend that shows the information that each trace carries.
- If you analyze a specific antenna port, the diagram contains three traces.
 - The average phase deviation over all slots on the selected antenna port.
 - The lowest phase deviation over all slots on the selected antenna port.
 - The highest phase deviation over all slots on the selected antenna port.
- If you analyze only a single slot, the diagram contains one trace. That trace shows the phase deviation for that slot only. Average, minimum and maximum values in that case are the same.

The x-axis represents the frequency, with the unit depending on your [selection](#). The y-axis shows the phase deviation of each evaluated antenna port in degrees.

Because the beamforming configuration can change between the slots of one frame, the contents of this result display for [Slot Selection](#) = 'All' might be invalid. Thus, it is recommended to select the precise slot to be evaluated in order to get valid results.



Remote command:

Selection: `LAY:ADD ? '1', LEFT, RSWP`

Query: `TRACe:DATA?`

Beamforming Summary

The "Beamforming Summary" shows the phase characteristics for each allocation used by the UE-specific reference signals (PDSCH, CORESET, CSI-RS etc.) in numerical form.

5G NR: 3 Beamforming Summary				
BWP/Sf/Slot	Allocation Type	Ant Port	Phase [°]	Phase Diff [°]
SS / 0 / 0	PBCH	AP 4000	0.000	
SS / 0 / 1	PBCH	AP 4000	-0.000	
0 / 0 / 0	PDSCH	AP 1000	0.000	
	CORESET	AP 2000	-0.003	-0.003
	CSI-RS	AP 3000	-0.009	-0.009

The rows in the table represent the allocation types. A set of allocations forms a slot. The slots are separated by a line. The columns of the table contain the following information:

- **BWP / SF / Slot**
Shows the location of the allocation (bandwidth part - subframe - slot).
- **Allocation Type**
Shows the type of the allocation.
- **Antenna Port**
Shows the antenna port used by the allocation.
- **Phase**
Shows the phase of the allocation in degrees.
- **Phase Diff(ference)**
Shows the phase difference of the allocation relative to the [reference antenna port](#).
- **Average RS Weights**
Shows the average [magnitude](#) of the weighted reference signal carriers in dB.
- **Rel Power**
Shows the power of each antenna port relative to the [reference AP](#) defined for the corresponding slot.
The relative power in combination with the phase difference allows you to calculate the beamforming.

Remote command:

Selection: `LAY:ADD ? '1',LEFT,BSUM`

Query: `TRACe:DATA?`

Marker Table

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

This table is displayed automatically if configured accordingly.

Wnd	Shows the window the marker is in.
Type	Shows the marker type and number ("M" for a normal marker, "D" for a delta marker).
Trc	Shows the trace that the marker is positioned on.
Ref	Shows the reference marker that a delta marker refers to.

X- / Y-Value	Shows the marker coordinates (usually frequency and level).
Z-EVM	Shows the "EVM", power and allocation type at the marker position.
Z-Power	Only in 3D result displays (for example "EVM vs Symbol x Carrier").
Z-Alloc ID	

Wind	Type	Trc	Ref	X-value	Y-value	Z-type	Z-value
1	M1	1		-82.500 kHz	7.82 dB		
1	D1	1	M1	135.000 kHz	-8.00 dB		
3	M1	1		Symbol 72	Carrier 3	EVM Power Alloc ID	NaN -14.96 dBm Not Used
5	M1	1		320.300 µs	-3.84 dBm		
5	D2	1	M1	10.000 ms	-0.00 dB		
5	D3	1	M1	9.709 ms	-1.51 dB		

Remote command:

LAY:ADD? '1', RIGH, MTAB, see [LAYout:ADD\[:WINDow\]?](#) on page 208

Results:

[CALCulate<n>:MARKer<m>:X](#) on page 231

[CALCulate<n>:MARKer<m>:Y](#) on page 232

[CALCulate<n>:MARKer<m>:Z?](#) on page 232

[CALCulate<n>:MARKer<m>:Z:ALL?](#) on page 233

3.6 Time alignment error

Access: [MEAS] > "Time Alignment Error"

The time alignment error measurement captures the signal from different antenna ports and calculates the time offset between a reference antenna port and another antenna port(s).

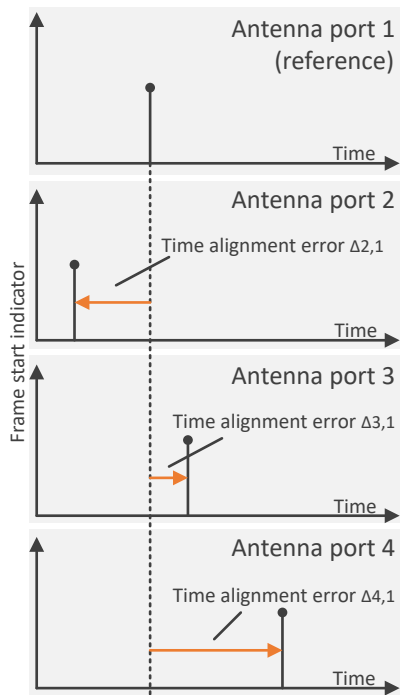


Figure 3-3: Time alignment error measurement (4 antenna ports)

Note that the measurement only works if you are analyzing [multiple layers](#) (antenna ports). Therefore, you have to mix the signals into one cable that you can connect to the R&S VSE.

Test setup

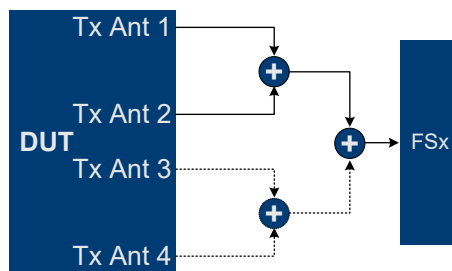


Figure 3-4: Hardware setup

The dashed lines are optional connections, and only necessary if you measure more than two antenna ports. For most accurate measurement results, we recommend to use cables of the same length and identical combiners as adders.

In addition to the result displays mentioned in this section, the time alignment error measurement also supports the following result displays described elsewhere.

- ["Capture Buffer"](#) on page 27
- ["Power Spectrum"](#) on page 32
- ["Marker Table"](#) on page 42

In the default layout, the application shows the "Time Alignment Error", "Capture Buffer" and "Power Spectrum" result displays.

The remote commands required to configure the time alignment error measurement are described in [Chapter 6.9.30, "Time alignment measurement"](#), on page 409.

Remote command:

Measurement selection: `CONFigure[:NR5G]:MEASurement` on page 271

Result display selection: `LAYout:ADD[:WINDow]?` on page 208

[Time Alignment Error](#)..... 45

Time Alignment Error

The time alignment is an indicator of how well the transmission antennas or antenna ports in a MIMO system and between component carriers are synchronized. The time alignment error is the time delay between a reference antenna port and another antenna port. The reference is [antenna port 1000](#). For measurements on multiple carriers, the reference is antenna port 1000 of the first component carrier.

As AP1000 is the reference antenna port, it must be sent. Otherwise result are invalid.

The application shows the results in a table.

- For single carrier MIMO measurements, each row in the table represents one antenna port.
- For multi carrier measurements, each row in the table represents one antenna port for each carrier.

The number of rows therefore depends on the [number of carriers](#) and the [PDSCH antenna port configuration](#).

The reference antenna port is not shown in the table (all results would be "0").

For each antenna, the maximum, minimum and average time delay that has been measured is shown. The minimum and maximum results are calculated only if the measurement covers more than one frame.

In any case, results are only displayed if the transmission power of both antennas ports is within 15 dB of each other. Likewise, if only one antenna transmits a signal, results will not be displayed (for example if the cabling on one antenna is faulty).

The "Limit" value shown in the result display is the maximum time delay that may occur for each antenna (only displayed for systems without carrier aggregation).

You can define a custom limit for the time alignment error. For more information, see [Chapter 3.9, "Reference: custom limits"](#), on page 54.

Remote command:

Measurement selection: `LAY:ADD ? '1',LEFT,TAL`

Result query: `FETCh:TAERror[:CC<cc>]:AP<ap>[:AVERage]?` on page 230

3.7 Transmit on / off power measurement

The technical specification in 3GPP 38.141-1 / -2 describes the measurement of the transmitter "off" power and the transmitter transient period of a base transceiver station (BTS) transmitting a TDD signal and operating at its rated output power.

This measurement requires a special hardware setup. During the "off" periods (the interesting parts of the signal for this measurement), the signal power is very low - measuring such low powers requires a low attenuation at the RF input. On the other hand, the signal power is very high during the transmitter "on" periods - in fact the signal power is usually higher than the maximum allowed RF input level. Measuring high signal levels requires an appropriate test setup as described below.

NOTICE

Risk of instrument damage

The signal power during the "on" periods in this test scenario is usually higher than the maximum power allowed at the RF input of a spectrum analyzer.

Make sure to set up the measurement appropriately. Not doing so can cause severe damage to the spectrum analyzer.

Test setup

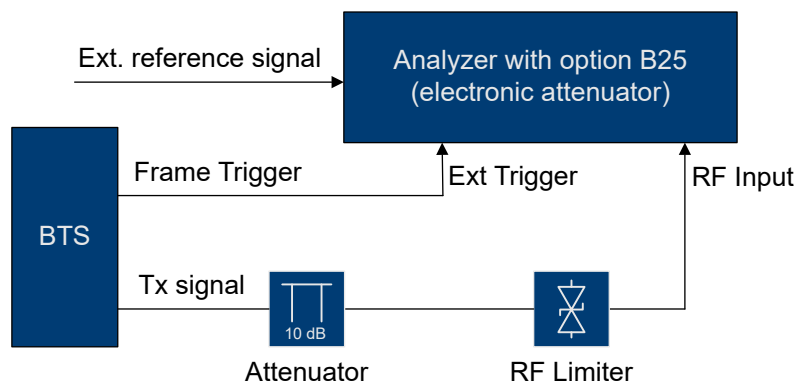


Figure 3-5: Test setup for transmit on / off power measurement

- Connect an RF limiter to the RF input to protect the RF input from damage. [Table 3-1](#) shows the specifications that the limiter has to fulfill.
- Insert an additional 10 dB attenuator in front of the RF limiter to absorb possible reflected waves (because of the high VSWR of the limiter). The maximum allowed CW input power of the attenuator must be higher than the maximum output power of the BTS.

Table 3-1: Specifications of the RF limiter in the test setup

Min. acceptable CW input power	BTS output power minus 10 dB
Min. acceptable peak input power	BTS peak output power minus 10 dB
Max. output leakage	20 dBm

Max. response time	1 µs
Max. recovery time	1 µs

Measuring the on / off power

If you are using an external trigger, you have to [adjust the timing](#) before you can start the actual measurement.

The status message in the diagram header shows if timing adjustment is required or not. After timing was successfully adjusted, you can start the measurement. Note that relevant changes of settings might require another timing adjustment.

If timing adjustment fails for any reason, the application shows a corresponding message in the diagram header. To find out what causes the synchronization failure, we recommend to perform a regular [EVM measurement](#). Then you can use all the measurement results like "EVM vs Carrier" to get more detailed information about the failure. The timing adjustment will succeed if the synchronization state in the header is OK.

Select "Run Single" to start the measurement. The number of measurements that trace averaging is based on depends on the [number of frames](#) you have defined. When all measurements are done, the R&S VSE indicates if the measurement has failed or passed.

The remote commands required to measure the transmit on / off power are described in [Chapter 6.9.31, "Transmit on/off power measurements"](#), on page 410.

Remote command:

Measurement selection: `CONFigure[:NR5G]:MEASurement` on page 271

Result display selection: `LAYout:ADD[:WINDow]?` on page 208

Transmit On / Off Power	47
L Numerical results	48
L Transmit power on / off diagram	49
L Transition diagram	49
L Adjust Timing	50
L Noise Cancellation	50

Transmit On / Off Power

The transmit on / off power measurement analyzes the transition from transmission ("on" periods) to reception ("off" periods) of an 5G NR TDD signal over time. Because this transition must happen very fast to use resources efficiently, it can be an issue in TDD systems.

During the transmit power on / off measurement, the R&S VSE verifies if the "off" periods (= no signal transmission) comply to the limits defined by 3GPP. Note that you have to apply a signal to the RF input for this measurement, because the R&S VSE has to capture new I/Q data instead of using the data other I/Q measurements are based on.

The results for the transmit on / off power measurement are available in the following displays.

- ["Numerical results"](#) on page 48

- ["Transmit power on / off diagram"](#) on page 49
- ["Transition diagram"](#) on page 49

Remote command:

Selection: [CONFigure\[:NR5G\]:MEASurement](#) on page 271

Selection (transition period): [DISPlay\[:WINDow<n>\]:TPOO:PERiod:SElect](#) on page 412

Query: [TRACe:DATA?](#)

Numerical results ← Transmit On / Off Power

The result summary shows the measurement results in a table. Each line in the table corresponds to one "off" period.

The result summary shows the following information for each "off" period.

- "Start Off Period Limit"
Shows the beginning of the "off" period relative to the frame start (0 seconds).
- "Stop Off Period Limit"
Shows the end of the "off" period relative to the frame start (0 seconds).
The time from the start to the stop of the "off" period is the period over which the limits are checked. It corresponds to the yellow trace in the diagram.
- "Time at Δ to Limit"
Shows the trace point at which the lowest distance between trace and limit line has been detected. The result is a time relative to the frame start.
- "OFF Power"
Shows the absolute power of the signal at the trace point with the lowest distance to the limit line.
- "OFF Power Δ to Limit"
Shows the distance between the trace and the limit line of the trace point with the lowest distance to the limit line in dB.
- "Falling Transition Period"
Shows the length of the falling transient.
- "Rising Transition Period"
Shows the length of the rising transient.

Results that comply with the limits are displayed in green. Any results that violate the limits defined by 3GPP are displayed in red.

Note that the beginning and end of a transition period is determined based on the "Off Power Density Limit". This limit is defined in 3GPP 38.141-1 / -2 as the maximum allowed mean power spectral density. The length of the transient from "on" to "off" period is, for example, the distance from the detected end of the subframe to the last time that the signal power is above the measured mean power spectral density.

You can define a custom limit for the off power density. For more information, see [Chapter 3.9, "Reference: custom limits"](#), on page 54.

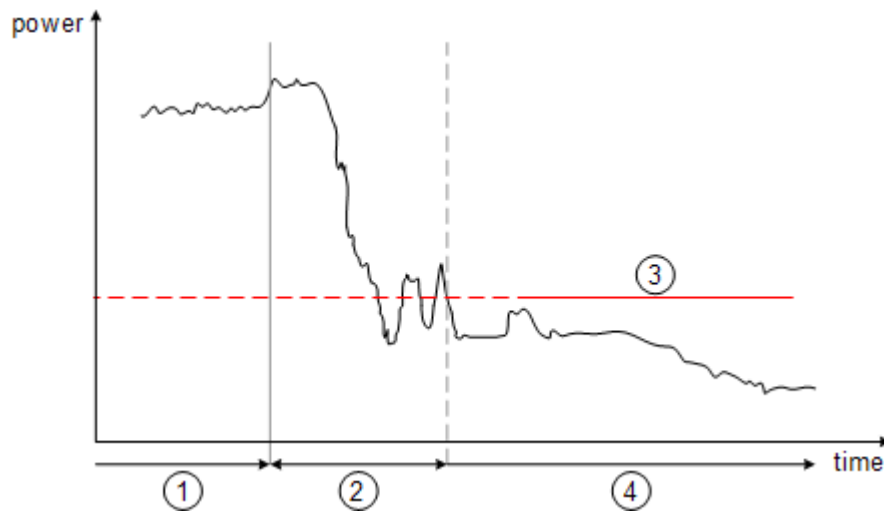


Figure 3-6: Power profile of a TD-LTE On-to-Off transition. The transition lasts from the end of the ON period until the signal is completely below the off power density limit.

- 1 = subframe ("on" power period)
- 2 = transient (transition length)
- 3 = "off" power density limit
- 4 = "off" power period

Transmit power on / off diagram ← Transmit On / Off Power

The diagram shows all TDD frames that were captured and analyzed and contains several elements.

- Yellow trace
The yellow trace represents the signal power during the "off" periods. The calculation of the trace also accounts for filtering as defined in 3GPP 38.141-1 / -2.
- Blue trace
The blue trace represents the transition periods (falling and rising).
- Blue rectangles
The blue rectangles represent the "on" periods. Because of the overload during the "on" periods, the actual signal power is only hinted at, not shown.
- Red lines
Limits as defined by 3GPP.
- Other information
In addition to these elements, the diagram also shows the overall limit check, the average count and the limit for the mean power spectral density ("Off Power Density Limit").
The overall limit check only passes if all "off" periods (including the transients) comply with the limits.

Transition diagram ← Transmit On / Off Power

The transition diagrams show the rising and falling periods for each TDD frame in more detail.

The maximum number of transitions you can display depends on the slot configuration. When you add a "Falling Period" or "Rising Period" to the diagram area, you can select the period you want to analyze from a dropdown menu in the header of the result display. By default, the R&S VSE shows two periods.

Alternatively, you can configure these diagrams via the "Evaluation Range" dialog box.

The diagrams contain the following elements.

- Blue trace
The blue trace represents the transition periods (falling and rising).
- Red lines
Limits as defined by 3GPP.

Adjust Timing ← Transmit On / Off Power

Access: [Sweep] > "Adjust Timing"

If you are using an external trigger for the on / off power measurement, you have to determine the offset of the trigger time to the time the 5G NR frame starts. You can do this with the "Adjust Timing" function. When the application has determined the offset, it corrects the results of the on / off power measurement accordingly.

Adjust timing also captures data with a reference level optimized for the "on" period to increase the probability for successful synchronization.

Remote command:

[\[SENSe:\]NR5G:OOPower:ATIMing](#) on page 412

Noise Cancellation ← Transmit On / Off Power

Access: [Meas Config] > "Noise Cancellation"

Noise cancellation corrects the results by removing the inherent noise of the analyzer, which increases the dynamic range. To do this, the R&S VSE measures its inherent noise and subtracts the measured noise power from the power in the channel that is being analyzed.

Noise cancellation is valid for the current measurement configuration. If you change the measurement configuration in any way, you have to repeat noise cancellation.

Remote command:

[\[SENSe:\]NR5G:OOPower:NCORrection](#) on page 412

3.8 Frequency sweep measurements

Access (ACLR): [MEAS] > "Channel Power ACLR"

Access (MC ACLR): [MEAS] > "Multi Carrier ACLR"

Access (Cumulative ACLR): [MEAS] > "Cumulative ACLR"

Access (SEM): [MEAS] > "Spectrum Emission Mask"

Access (Multi Carrier SEM): [MEAS] > "Multi Carrier SEM"

The 5G NR application supports the following frequency sweep measurements.

- Adjacent channel leakage ratio (ACLR)
- Spectrum emission mask (SEM)

Frequency sweep measurements also capture and process I/Q data to analyze a signal.

Make sure to have sufficient bandwidth to be able to capture the whole signal, including neighboring channels.

Features of the frequency sweep measurements:

- SEM measurements use the FFT sweep type by default. For more information, see the R&S VSE user manual.
- Gated trigger is possible by using I/Q files for the ACLR and SEM.

In addition to the specific diagrams and table (see description below), frequency sweep measurements support the following result displays.

- "Marker Table" on page 42
 - Marker peak list
- Both result displays have the same contents as the spectrum application.

Remote command:

Measurement selection: `CONFigure[:NR5G]:MEASurement` on page 271

Result display selection: `LAYout:ADD[:WINDow]?` on page 208

Adjacent Channel Leakage Ratio (ACLR).....	51
L Result diagram.....	51
L Result summary.....	52
Spectrum Emission Mask (SEM).....	52
L Result diagram.....	53
L Result summary.....	53
Marker Peak List.....	53

Adjacent Channel Leakage Ratio (ACLR)

The adjacent channel leakage ratio (ACLR) measurement is designed to analyze signals that contain multiple signals for different radio standards. Using the ACLR measurement, you can determine the power of the transmit (Tx) channel and the power of the neighboring (adjacent) channels to the left and right of the Tx channel. Thus, the ACLR measurement provides information about the power in the adjacent channels as well as the leakage into these adjacent channels.

When you measure the ACLR in the 5G NR application, the R&S VSE automatically selects appropriate ACLR settings based on the selected channel bandwidth.

For a comprehensive description of the ACLR measurement, refer to the user manual of the R&S VSE.

Remote command:

Selection: `CONFigure[:NR5G]:MEASurement` on page 271

Result diagram ← Adjacent Channel Leakage Ratio (ACLR)

The result diagram is a graphic representation of the signals with a trace that shows the measured signal. Individual channels (Tx and adjacent channels) are indicated by vertical lines and corresponding labels.

In addition, the R&S VSE highlights the channels (blue: Tx channel, green: adjacent channels).

The x-axis represents the frequency with a frequency span that relates to the specified 5G NR channel and adjacent channel bandwidths. On the y-axis, the power is plotted in dBm.

The power for the Tx channel is an absolute value in dBm. The power of the adjacent channels is relative to the power of the Tx channel.

In addition, the R&S VSE tests the ACLR measurement results against the limits defined by 3GPP.

Remote command:

Result query: [TRACe:DATA?](#)

Result summary ← Adjacent Channel Leakage Ratio (ACLR)

The result summary shows the signal characteristics in numerical form. Each row in the table corresponds to a certain channel type (Tx, adjacent channel). The columns contain the channel characteristics.

- **Channel**
Shows the channel type (Tx, adjacent or alternate channel).
- **Bandwidth**
Shows the channel bandwidth.
- **Offset**
Shows the channel spacing.
- **Power**
Shows the power of the Tx channel.
- **Lower / Upper**
Shows the relative power of the lower and upper adjacent and alternate channels. The values turn red if the power violates the limits. Depending on the [evaluation logic](#), the R&S VSE shows either the absolute power in dBm, the relative power in dBc or both power values. The overall limit check passes or fails depending on your selected evaluation logic. The end result of the limit check is displayed in the table header.

Remote command:

Result query: [CALCulate<n>:MARKer<m>:FUNCTION:POWER<sb>:RESULT\[:CURRENT\]?](#)

Limit check: [CALCulate<n>:LIMIT:FAIL?](#) on page 247

Limit check absolute: [CALCulate<n>:LIMIT:ACPower:ACHannel:RESULT:ABSolute](#) on page 241

Limit check relative: [CALCulate<n>:LIMIT:ACPower:ACHannel:RESULT:RELative](#) on page 242

Spectrum Emission Mask (SEM)

The "Spectrum Emission Mask" (SEM) measurement shows the quality of the measured signal by comparing the power values in the frequency range near the carrier against a spectral mask that is defined by the 3GPP specifications. In this way, you can test the performance of the DUT and identify the emissions and their distance to the limit.

For a comprehensive description of the SEM measurement, refer to the user manual of the R&S VSE.

Remote command:

Selection: [CONFigure\[:NR5G\]:MEASurement](#) on page 271

Result diagram ← Spectrum Emission Mask (SEM)

The result diagram is a graphic representation of the signal with a trace that shows the measured signal. The SEM is represented by a red line.

If any measured power levels are above that limit line, the test fails. If all power levels are inside the specified limits, the test passes. The application labels the limit line to indicate whether the limit check has passed or failed.

The x-axis represents the frequency with a frequency span that relates to the specified 5G NR channel bandwidths. The y-axis shows the signal power in dBm.

Remote command:

Result query: [TRACe:DATA?](#)

Result summary ← Spectrum Emission Mask (SEM)

The result summary shows the signal characteristics in numerical form. Each row in the table corresponds to a certain SEM range. The columns contain the range characteristics. If a limit fails, the range characteristics turn red.

- **Start / Stop Freq Rel**
Shows the start and stop frequency of each section of the spectrum emission mask relative to the center frequency.
- **RBW**
Shows the resolution bandwidth of each section of the spectrum emission mask.
- **Freq at Δ to Limit**
Shows the absolute frequency whose power measurement being closest to the limit line for the corresponding frequency segment.
- **Power Abs**
Shows the absolute measured power of the frequency whose power is closest to the limit. The application evaluates this value for each frequency segment.
- **Power Rel**
Shows the distance from the measured power to the limit line at the frequency whose power is closest to the limit. The application evaluates this value for each frequency segment.
- **Δ to Limit**
Shows the minimal distance of the tolerance limit to the SEM trace for the corresponding frequency segment. Negative distances indicate that the trace is below the tolerance limit, positive distances indicate that the trace is above the tolerance limit.

Marker Peak List

The marker peak list determines the frequencies and levels of peaks in the spectrum or time domain. How many peaks are displayed can be defined, as well as the sort order. In addition, the detected peaks can be indicated in the diagram. The peak list can also be exported to a file for analysis in an external application.

Remote command:

[LAY:ADD? '1',RIGH, PEAK](#), see [LAYout:ADD\[:WINDow\]?](#) on page 208

Results:

[CALCulate<n>:MARKer<m>:X](#) on page 231

[CALCulate<n>:MARKer<m>:Y](#) on page 232

3.9 Reference: custom limits

The R&S VSE checks various results against the limits defined by 3GPP. For some of those limits, you can define custom limits.

I/Q measurement [result summary](#)

- EVM PDSCH QPSK / 16QAM / 64QAM / 256QAM
- EVM PUSCH PI/2 BPSK / QPSK / 16QAM / 64QAM
- EVM PUSCH DMRS PI/2 BPSK / QPSK / 16QAM / 64QAM
- EVM PUCCH

[Time alignment error measurements](#)

- Time alignment error

Limit values are stored in an xml file that combines the limits for downlink and uplink. The file name must be `Default.nr5G_limits` and is located in the following directory:

```
C:\R_S\instr\user\NR5G\
```

The R&S VSE automatically applies the custom limits after you have copied the file and restarted the R&S VSE

The structure of the file is as follows. You can omit any xml elements you do not want to define, either by making no entry or by deleting the corresponding element.

```
<Limits>
  <DL>
    <EVM>
      <PDSCHQPSK Mean="0.185"></PDSCHQPSK>
      <!--Unit: linear (1 = 0 dB, 0.1 = -20 dB)-->
      <PDSCH16QAM Mean="0.135"></PDSCH16QAM>
      <!--Unit: linear (1 = 0 dB, 0.1 = -20 dB)-->
      <PDSCH64QAM Mean="0.09"></PDSCH64QAM>
      <!--Unit: linear (1 = 0 dB, 0.1 = -20 dB)-->
      <PDSCH256QAM Mean="0.045"></PDSCH256QAM>
      <!--Unit: linear (1 = 0 dB, 0.1 = -20 dB)-->
    </EVM>
    <TimeAlignmentError Limit="90"></TimeAlignmentError>
    <!--Unit [ns]-->
    <OffPowSpectralDensity Limit="-82.5"></OffPowSpectralDensity>
    <!--Unit: [dBm/MHz]-->
  </DL>
  <UL>
    <EVM>
      <PUSCHPI_2BPSK Max="0.3"></PUSCHPI_2BPSK>
      <!--Unit: linear (1 = 0 dB, 0.1 = -20 dB)-->
```

```

<PUSCHQPSK Max="0.175"></PUSCHQPSK>
<!--Unit: linear (1 = 0 dB, 0.1 = -20 dB)-->
<PUSCH16QAM Max="0.125"></PUSCH16QAM>
<!--Unit: linear (1 = 0 dB, 0.1 = -20 dB)-->
<PUSCH64QAM Max="0.08"></PUSCH64QAM>
<!--Unit: linear (1 = 0 dB, 0.1 = -20 dB)-->
<DMRSPUSCHPI_2BPSK Mean="0.3"></DMRSPUSCHPI_2BPSK>
<!--Unit: linear (1 = 0 dB, 0.1 = -20 dB)-->
<DMRSPUSCHQPSK Mean="0.175"></DMRSPUSCHQPSK>
<!--Unit: linear (1 = 0 dB, 0.1 = -20 dB)-->
<DMRSPUSCH16QAM Mean="0.125"></DMRSPUSCH16QAM>
<!--Unit: linear (1 = 0 dB, 0.1 = -20 dB)-->
<DMRSPUSCH64QAM Mean="0.08"></DMRSPUSCH64QAM>
<!--Unit: linear (1 = 0 dB, 0.1 = -20 dB)-->
<PUCCH Max="0.175"></PUCCH>
<!--Unit: linear (1 = 0 dB, 0.1 = -20 dB)-->
</EVM>
</UL>
</Limits>

```

3.10 Reference: 3GPP test scenarios

3GPP defines several test scenarios for measuring base stations. These test scenarios are described in detail in 3GPP TS 38.141-1 (conducted measurements) and 38.141-2 (radiated measurements).

For radiated measurements, 3GPP only supports test models 1.1, 2, and 3.1. Release 16 also supports test models 2a and 3.1a.

The following table provides an overview which measurements available in the 5G NR application are suited to use for the test scenarios in the 3GPP documents.

Table 3-2: Test scenarios for NR-FR<x>-TMs as defined by 3GPP (38.141-1 / -2)

Test Model	Test scenario	FR1 test described in	FR2 test described in	Measurement
NR-FR-TM1.1	Radiated transmit power	n/a	chapter 6.2	Transmit on / off power
	Base station output power	chapter 6.2	chapter 6.3	Power (→ "Result Summary")
	Transmit on / off power	chapter 6.4	chapter 6.5	Transmit on / off power
	TAE	chapter 6.5.4	chapter 6.6.4	Time alignment error
	Transmitter intermodulation	chapter 6.7	chapter 6.8	ACLR
	Occupied bandwidth	chapter 6.6.1	chapter 6.7.2	Occupied bandwidth ¹
	ACLR	chapter 6.6.2	chapter 6.7.3	ACLR

Test Model	Test scenario	FR1 test described in	FR2 test described in	Measurement
	Operating band unwanted emissions	chapter 6.6.3	chapter 6.7.4	Spectrum emission mask
	Transmitter spurious emissions	chapter 6.6.4	chapter 6.7.5	Spurious emissions ¹
NR-FR-TM1.2	ACLR	chapter 6.6.2	n/a	ACLR
	Operating band unwanted emissions	chapter 6.6.2	n/a	Spectrum emission mask
NR-FR-TM2	Total power dynamic range	chapter 6.3.2	chapter 6.4.3	OSTP (→ "Result Summary")
	Frequency error	chapter 6.5.1	chapter 6.6.2	Frequency Error (→ "Result Summary")
	Error vector magnitude	chapter 6.5.2	chapter 6.6.3	EVM results
NR-FR-TM2a	Total power dynamic range	chapter 6.3.2	n/a	OSTP (→ "Result Summary")
	Error vector magnitude	chapter 6.5.2	n/a	EVM results
	Frequency error	chapter 6.5.1	n/a	Frequency error (→ "Result Summary")
NR-FR-TM2b	Total power dynamic range	chapter 6.3.2	n/a	OSTP (→ "Result Summary")
	Error vector magnitude	chapter 6.5.2	n/a	EVM results
	Frequency error	chapter 6.5.1	n/a	Frequency error (→ "Result Summary")
NR-FR-TM3.1	Total power dynamic range	chapter 6.3.2	chapter 6.4.3	OSTP (→ "Result Summary")
	Frequency error	chapter 6.5.1	chapter 6.6.2	Frequency error (→ "Result Summary")
	Error vector magnitude	chapter 6.5.2	chapter 6.6.3	EVM results
NR-FR-TM3.1a	Total power dynamic range	chapter 6.3.2	n/a	OSTP (→ "Result Summary")
	Error vector magnitude	chapter 6.5.2	n/a	EVM results
	Frequency error	chapter 6.5.1	n/a	Frequency error (→ "Result Summary")
NR-FR-TM3.1b	Total power dynamic range	chapter 6.3.2	n/a	OSTP (→ "Result Summary")
	Error vector magnitude	chapter 6.5.2	n/a	EVM results

Test Model	Test scenario	FR1 test described in	FR2 test described in	Measurement
	Frequency error	chapter 6.5.1	n/a	Frequency error (→ "Result Summary")
NR-FR-TM3.2	Frequency error	chapter 6.5.1	n/a	Frequency error (→ "Result Summary")
	Error vector magnitude	chapter 6.5.2	n/a	EVM results
NR-FR-TM3.3	Frequency error	chapter 6.5.1	n/a	Frequency error (→ "Result Summary")
	Error vector magnitude	chapter 6.5.2	n/a	EVM results

¹These measurements are available in the spectrum application of the Rohde & Schwarz signal and spectrum analyzers (for example the R&S FSW)

4 Configuration

3GPP 5G NR measurements require a special application on the R&S VSE, which you activate using the [MODE] key on the front panel.

When you start the 5G NR application, the R&S VSE starts to measure the input signal with the default configuration or the configuration of the last measurement (when you have not performed a preset since then). After you have started an instance of the 5G NR application, the application displays the "Meas Config" menu which contains functions to define the characteristics of the signal you are measuring.



Unavailable hardkeys

Note that the [SPAN], [BW], [TRACE], [LINES] and [MKR FUNC] keys have no contents and no function in the 5G NR application.

• I/Q measurement.....	58
• Time alignment error configuration.....	156
• Transmit on / off power configuration.....	156
• Frequency sweep measurement configuration.....	157
• Microservice export.....	161
• Time trigger measurement guide.....	161
• Reference: MIMO measurement guide.....	162
• O-RAN measurement guide.....	173
• Reference: structure of .allocation files.....	174

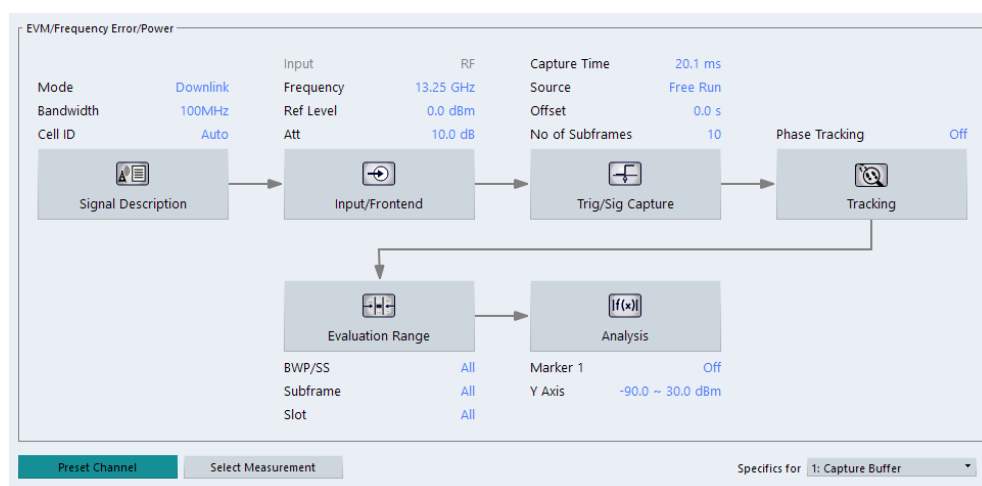
4.1 I/Q measurement

• Configuration overview.....	59
• Automatic measurement configuration.....	60
• Physical signal description.....	64
• Test scenarios.....	66
• Component carrier configuration.....	68
• MIMO configuration.....	73
• Antenna port configuration.....	76
• Radio frame configuration.....	78
• Synchronization signal configuration.....	82
• Bandwidth part configuration.....	88
• Slot configuration.....	93
• PDSCH and PDCCH configuration.....	105
• Advanced settings.....	126
• Generator control.....	133
• Selecting the input and output source.....	136
• Frequency configuration.....	140
• Amplitude configuration.....	141
• Trigger configuration.....	144

- [Data capture](#).....146
- [Tracking](#)..... 150
- [Demodulation](#).....152

4.1.1 Configuration overview

Throughout the measurement channel configuration, an overview of the most important currently defined settings is provided in the "Overview". The "Overview" is displayed when you select the "Overview" menu item from the "Meas Setup" menu.



In addition to the main measurement settings, the "Overview" provides quick access to the main settings dialog boxes. The individual configuration steps are displayed in the order of the data flow. Thus, you can easily configure an entire measurement channel from input over processing to output and analysis by stepping through the dialog boxes as indicated in the "Overview".

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 4.1.3, "Physical signal description"](#), on page 64.
2. Input / Frontend
[Chapter 4.1.15, "Selecting the input and output source"](#), on page 136
3. Trigger / Signal Capture
See [Chapter 4.1.18, "Trigger configuration"](#), on page 144.
See [Chapter 4.1.19, "Data capture"](#), on page 146.
4. Tracking
See [Chapter 4.1.20, "Tracking"](#), on page 150.
5. Demodulation
See [Chapter 4.1.21, "Demodulation"](#), on page 152.
6. Analysis

See [Chapter 5, "Analysis"](#), on page 184.

7. Display Configuration

See [Chapter 3, "Measurements and result displays"](#), on page 17

In addition, the dialog box provides the "Select Measurement" button that serves as a shortcut to select the measurement type.

Configuring the measurement

- ▶ 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	60
Select Measurement	60
Specific Settings for	60

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 272

Select Measurement

Opens a dialog box to select the type of measurement.

For more information about selecting measurements, see [Chapter 3.1, "Selecting measurements"](#), on page 17.

Remote command:

`CONFigure[:NR5G]:MEASurement` on page 271

Specific Settings 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 "Specific Settings 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.

4.1.2 Automatic measurement configuration

The R&S VSE provides various functions to automatically configure measurements based on the signal you are measuring and thus makes these measurements as easy as possible.

Automatic configuration functions are available in different dialog boxes and softkey menus.

Access (auto configuration): [AUTO SET]

Access (auto demodulation): "Overview" > "Signal Description" > "Signal Description"

Automatic measurement configuration

The automatic measurement configuration functions adjust various general measurement settings to achieve the optimal display of the measurement results.

Automatic signal demodulation

The automatic signal demodulation functions determine the characteristics of the signal you are measuring. Based on the signal characteristics, the R&S VSE is then able to demodulate and analyze the signal.

Signal demodulation is available on several levels.

- Detection of all signal characteristics.
- Detection of the bandwidth part configuration, incl. antenna port configuration.
- Detection of the synchronization signal configuration.

For an automatic signal demodulation, all frames must have the same configuration.

Auto Level	61
Auto EVM	61
Auto Scale	62
Complete Signal Demodulation	62
Bandwidth Parts Demodulation	63
Synchronization Signal Demodulation	63

Auto Level

You can use the auto leveling routine for a quick determination of preliminary amplitude settings for the current 5G NR input signal.

For additional information, see "[Auto Level](#)" on page 142.

For measurements with several devices, you can apply the auto level process to "All Devices".

Remote command:

[SENSe:]ADJust:LEVel on page 274

Auto EVM

Adjusts the amplitude settings to achieve the optimal EVM using the maximum dynamic range.

This routine measures the signal several times at various levels to achieve the best results.

If you measure several component carriers, this routine can take several minutes to finish (depending on the number of component carriers).

You can speed up the auto EVM routine by performing it across a certain number of slots only ("Auto EVM # Of Slots To Analyze").

Select "Auto Set" > "Auto Level Config" > "Meas Time Mode" = "Manual" to access this method.

If you are using this method, make sure to:

- Define an appropriate measurement time that corresponds to the number of selected slots. The minimum measurement time is 1 ms.
- Perform a triggered measurement to reliably capture at least one complete slot.

Remote command:

Run measurement: `[SENSe:]ADJust:EVM` on page 274

Slots used: `[SENSe:]ADJust:EVM:SLOTs` on page 274

Auto Scale

Scales the y-axis for best viewing results based on the results.

For more information about y-axis scaling, see ["Automatic scaling of the y-axis"](#) on page 185.

Remote command:

`DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALE]:AUTO`
on page 418

Complete Signal Demodulation

Automatic signal demodulation determines the complete signal configuration.

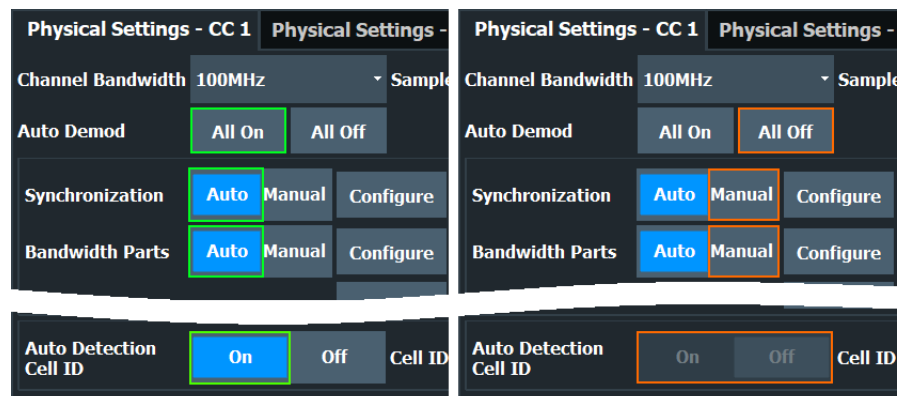
Complete signal demodulation includes:

- Detection of the synchronization signal configuration, including the SS/PBCH block state.
You can still define the relative powers of the PSS, SSS, PBCH and PBCH DMRS.
- Detection of the cell ID.
- Detection of the bandwidth part configuration.
- Detection of the slot configuration.
- Detection of the PDSCH and CORESET configuration, including the enhanced settings.
- Detection of the antenna port configuration.

It is not possible to edit any properties that are automatically detected.

When you turn on complete signal detection, you only have to define the basic signal characteristics like the deployment frequency range, the channel bandwidth or the number of component carriers.

To turn on complete and continuous signal demodulation, select "All On". "All On" automatically turns on automatic demodulation of the synchronization signal, the cell ID and the bandwidth parts.



Instead of continuous automatic demodulation, you can demodulate the signal once for a single capture. This method is useful if you want to change individual parameters like the bandwidth part configuration later on without subsequent automatic demodulation. In addition, it increases the measurement speed, because automatic demodulation occurs only once.

To demodulate the signal once, select the corresponding button in the channel bar.

For a one-off demodulation, all properties remain available to edit.

Similarly, you can turn off automatic signal demodulation with a single step with "All Off". All automatic signal demodulation routines are turned off in that case.

Note that if the signal contains no synchronization signal, you have to define the cell ID manually ("Auto Detection Cell ID" = Off).

For FR2-2 frequency deployment, only auto demodulation of the synchronization signal is supported.

Remote command:

State: `CONFigure[:NR5G]:DL[:CC<cc>]:DEMod:AUTO` on page 275

Demodulate once: `[SENSe:]ADJust:DEMod` on page 273

Bandwidth Parts Demodulation

Determines the configuration of the bandwidth parts.

Bandwidth part demodulation includes:

- Detection of the bandwidth part configuration.
- Detection of the slot configuration.
- Detection of the PDSCH and CORESET configuration, including the enhanced settings.
- Detection of the cell ID in the range of 0 to 10.
If you are using a different cell ID, you have to enter the cell ID manually.

It is not possible to edit any properties that are automatically detected.

When you turn on bandwidth part detection, you only have to define the basic signal characteristics like the deployment, the channel bandwidth or the number of component carriers and the synchronization signal.

Note that auto demodulation is not available for FR2-2 frequency deployment.

Remote command:

`CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:DETection`
on page 275

Synchronization Signal Demodulation

Determines the configuration of the synchronization signal.

Synchronization signal demodulation includes:

- Detection of the synchronization signal configuration, including the SS/PBCH block state.
You can still define the relative powers of the PSS, SSS, PBCH and PBCH DMRS.
- Detection of the cell ID.

It is not possible to edit any properties that are automatically detected.

When you turn on synchronization signal detection, you can still define the basic signal characteristics like the deployment or the channel bandwidth and the complete bandwidth part configuration, including the PDSCH and CORESET allocations.

Note that if the signal contains no synchronization signal, you have to define the cell ID manually ("Auto Detection Cell ID" = Off).

Remote command:

`CONFigure [:NR5G] :DL[:CC<cc>] :SSBLock<ssb>:DETection` on page 276

4.1.3 Physical signal description

Access: "Overview" > "Signal Description" > "Signal Description"

The "Signal Description" dialog box contains general signal characteristics.

The screenshot shows the 'Signal Description' dialog box with the following settings:

- Mode:** Downlink
- Number of Component Carriers:** 2
- Deploy Frequency Range:** FR1 <= 3GHz
- Operating Band:** n1
- Channel Bandwidth:** 100MHz
- Sample Rate:** 122.88 MHz
- Auto Demod:** All On
- Synchronization:** Auto
- Bandwidth Parts:** Auto
- Slot:** Slot Format 0
- PDSCH/PDCCH:** QPSK
- Auto Detection Cell ID:** On



Configuring component carriers

When you are doing measurements on [aggregated carriers](#), you can configure each carrier separately.

When available, each carrier in the dialog boxes is represented by an additional tab labeled "CC<x>", with <x> indicating the number of the component carrier.

Note that the additional tabs are only added to the user interface after you have selected more than "1" component carrier.

The remote commands required to configure the physical signal characteristics are described in [Chapter 6.9.3, "Physical settings"](#), on page 276.

The remote commands required to query measurement results are described in:

- [Chapter 6.8, "Retrieve trace data"](#), on page 248

- [Chapter 6.6, "Remote commands to retrieve numeric results"](#), on page 216

Selecting the 5G NR mode	65
Deployment Frequency Range	65
Operating Band	65
Physical settings of the signal	66

Selecting the 5G NR mode

The "Mode" selects the 5G NR link direction you are testing.

The choices you have depend on the set of options you have installed.

- Option R&S VSE-K144 enables testing of 3GPP 5G NR signals on both the downlink and the uplink.

Downlink (DL) and Uplink (UL) describe the **transmission path**.

- Downlink is the transmission path from the base station to the user equipment. The physical layer mode for the downlink is always OFDMA.
- Uplink is the transmission path from the user equipment to the base station.

Remote command:

Link direction: [CONFigure\[:NR5G\]:LDIRection](#) on page 278

Deployment Frequency Range

A 5G NR signal can be transmitted in several different frequency ranges ("FR").

3GPP release 17 extends the deployment frequency range (FR2-2).

- "FR1 <= 3 GHz": Deployment in frequency range 1 ≤ 3 GHz.
- "FR1 > 3 GHz": Deployment in frequency range 1 above 3 GHz.
- "FR2-1": Deployment in frequency range 2 (high frequencies up to 52.60 GHz).
- "FR2-2": Deployment in frequency range 2 (extra high frequencies up to 71 GHz).

The frequencies that FR1 and FR2 cover are defined by 3GPP.

The selected frequency range has an effect on the following settings.

- Different [channel bandwidths](#) are available in each frequency range.
- Different [subcarrier spacings](#) are available in each frequency range.
- Different [synchronization signal patterns](#) are available in each frequency range.

Remote command:

[CONFigure\[:NR5G\]:DL\[:CC<cc>\]:DFRange](#) on page 277

Operating Band

Selects the operating band that the carriers are in. The operating bands are defined in 3GPP 38.104: 5.2 "Operating Bands".

Depending on the operating band you select for the transmission, the R&S VSE automatically adjusts the minimum requirements for channel spacing between component carriers, especially the [frequency offset to CC1](#).

If the center frequency of the carriers is not within the selected operating band, the R&S VSE shows a corresponding message in the [carrier configuration](#) dialog box.

For a selected set of operating bands, you can select the [channel raster](#) within the component carrier.

3GPP release 16 unlocks additional operating bands.

3GPP release 17 unlocks additional operating bands.

Remote command:

`CONFigure[:NR5G]:OBANd` on page 277

Physical settings of the signal

Physical settings describe the basic structure of the signal you are measuring.

The "Channel Bandwidth" is variable with fixed values in the range from 5 MHz to 400 MHz. The numbers next to the dropdown box show the sample rate of the signal. The sample rate depends on the selected channel bandwidth.

3GPP release 17 extends the channel bandwidths up to 2000 MHz in FR2 and adds additional bandwidths in FR1 (35 MHz and 45 MHz).

The available channel bandwidths depend on the [frequency range](#) you have selected.

Selecting one of the "Configure" buttons opens the [radio frame configuration](#) tab where you can customize the radio frame structure according to your needs.

- "Synchronization": Configuration of [synchronization signal](#) (SS).
The numbers next to the button indicate the subcarrier spacing of the SS and the frequency offset relative to the center of the channel bandwidth.
- "Bandwidth Parts": Configuration of [bandwidth parts](#) (BWP).
The numbers next to the button indicate the number of configured BWPs and their subcarrier spacings.
- "Slot Config": Configuration of individual [slots](#).
The numbers next to the button indicate the slot format used in the BWPs and if a CSI reference signal is present or not.
The slot format determines the usage of the OFDM symbols (UL, DL or flexible).
The slot formats are defined in 3GPP 38.211, table 4.3.2-3.
- "PDSCH / PDCCH Config": Configuration of the [data channel \(PDSCH\)](#) and the control channel (PDCCH)
The numbers next to the button indicate the modulation types used for the allocations in all slots and if a SMUX or phase-tracking reference signal (PT-RS) is present or not.

The physical layer cell ID is responsible for synchronization between network and user equipment. It identifies a specific radio cell in the 5G NR network. The cell ID is a value between 0 and 503.

For automatic detection of the cell ID, turn on the "Auto" function. However, auto detection only works if at least one [SS/PBCH block](#) is included in the signal.

Remote command:

Channel bandwidth: `CONFigure[:NR5G]:DL[:CC<cc>]:BW` on page 277

Cell ID: `CONFigure[:NR5G]:DL[:CC<cc>]:PLC:CID` on page 278

4.1.4 Test scenarios

Access: "Overview" > "Signal Description" > "Test Models"

Test scenarios are descriptions of specific 5G NR signals for standardized testing of DUTs. These test scenarios are stored in `.allocation` files. You can select, manage and create test scenarios in the "Test Models" dialog box.

3GPP test models

Test models are certain signal descriptions defined by 3GPP for various test scenarios. 3GPP calls them NR-TM. These NR-TM are defined in 3GPP 38.141-1 / -2.

There are three main test model groups (NR-TM1, NR-TM2 and NR-TM3). Each of these main groups in turn contain signal descriptions for specific signal configurations (different transmission type, different bandwidth etc.).

Because the complete list of test scenarios is long, you can filter the list by the following criteria.

- "Test Model": Filters by test model group (NR-TM1, NR-TM2 etc.).
- "Transmission": Filters by transmission technology (radiated or conducted).
- "Duplexing": Filters by duplexing mode (FDD or TDD).
- "Bandwidth": Filters by [channel bandwidth](#).
- "Subcarrier Spacing": Filters by [subcarrier spacing](#).

For an overview of the test scenarios, see [Chapter 3.10, "Reference: 3GPP test scenarios"](#), on page 55.

3GPP release 17 adds additional test models.

Remote command:

`MMEMory:LOAD:TMODEl[:CC<cc>]` on page 279

ORAN test cases

In addition to the 3GPP test models, you can also use O-RAN test cases. O-RAN test cases are defined by the O-RAN alliance for standardized measurements.

The test cases comply with O-RAN specification O-RAN.WG4.CONF.0-v05.00.

The O-RAN test cases are based on the 3GPP test models (downlink) and fixed reference channels (uplink) and are customized for the O-RAN applications.

For more information about the test cases themselves, see the O-RAN specifications available on the O-RAN website.

For more information about using O-RAN test cases in measurements with the R&S VSE, see [Chapter 4.8, "O-RAN measurement guide"](#), on page 173.

Remote command:

`MMEMory:LOAD:TMODEl[:CC<cc>]` on page 279

User defined test scenarios

User defined test scenarios are custom signal descriptions for standardized measurements that you can save and restore as you like. To create a custom test scenario, describe a signal as required and then save it with the corresponding button. The R&S VSE stores custom scenarios in `.allocation` files.

If you do not need test scenarios any longer, you can also delete them.

For a description of the `.allocation` files, see [Chapter 4.9, "Reference: structure of .allocation files"](#), on page 174.

Remote command:

Save: `MMEMory:STORE<n>:DEModsetting[:CC<cc>]` on page 280

Restore: `MMEMory:LOAD:DEModsetting[:CC<cc>]` on page 280

Test scenarios for carrier aggregation

When you measure component carriers, you can describe each component carrier separately and save or restore the scenario for each carrier in the corresponding tab ("CC<x>"). Single carrier scenarios are stored in `.allocation` files.

For easier handling of multiple carriers, however, you can also store the descriptions of all carriers in a single file. To do so, configure all component carriers as required and save the test scenario in "All CCs" tab. Multiple carrier test scenarios are stored in `.ccallocation` files. The advantage of this method is, that you do not have to restore a scenario for each component carrier, but can do so in a single step.

The `.ccallocation` files contain the frequency information of the signal.

Remote command:

Save: `MMEemory:STORe<n>:DEModsetting:ALL` on page 280

Restore: `MMEemory:LOAD:DEModsetting:ALL` on page 279

4.1.5 Component carrier configuration

Access: "Overview" > "Signal Description"

Carrier aggregation has been introduced in the 5G NR standard to increase the bandwidth. In those systems, you can use several carriers to transmit a signal.

The 5G NR measurement application supports up to 16 component carriers for measurements on contiguous and non-contiguous intra-band carrier aggregation (the carriers are in the same frequency band).

Each carrier has one of the [channel bandwidths](#) defined by 3GPP. You can deploy the component carriers in different [frequency ranges](#).

The radio frame can be different for each component carrier. For more information about configuring 5G NR radio frames, see [Chapter 4.1.8, "Radio frame configuration"](#), on page 78.

Several measurements support contiguous and non-contiguous intra-band carrier aggregation (the carriers are in the same frequency band).

- I/Q Based Measurements (EVM, Frequency Error, etc.)
- Frequency sweep measurements (multi-carrier ACLR, cumulative ACLR and multi SEM)

Physical Settings - CC 1 Physical Settings - CC 2 **Carrier Configuration**

CC	Center Frequency	Freq Offset to CC1	Bandwidth
1	3.5 GHz	0 Hz	50MHz
2	3.6 GHz	100 MHz	100MHz

Occ BW: 175.0 MHz
Sample Rate: 245.76 MHz
Fixed CC Offset:

Carrier within selected NR band

The remote commands required to configure component carriers are described in [Chapter 6.9.4, "Component carrier configuration"](#), on page 281.

Number of component carriers.....	69
Component carrier data capture.....	69
Views.....	70
Basic component carrier configuration.....	70
L Frequency configuration.....	70
L Bandwidth configuration.....	71
L Channel Raster.....	71
Nominal Channel Spacing.....	72
Additional tools for frequency configuration.....	72
L Center frequency configuration.....	73
L Frequency offset configuration.....	73

Number of component carriers

The supported "Number Of Component Carriers" you can measure is in the range from 1 to 16. When you select more than one component carrier, the R&S VSE expands the "Signal Description" dialog box by several tabs.

One tab for each component carrier you can configure and one tab to define [general properties](#) of the component carrier configuration.

Remote command:

`CONFigure[:NR5G]:NOCC` on page 283

Component carrier data capture

Capturing signals with several component carriers can generate big amounts of data.

The 5G NR application thus provides different "CC Signal Capture" modes that allow you to capture even several component carriers with a large bandwidth.

- "Single": Each configured component carrier is captured consecutively by an individual data capture buffer.
- "Auto": The R&S VSE determines how many component carriers it can capture in a single measurement.

If you select "Auto" mode, the R&S VSE captures as many component carriers as it can in a single measurement and captures the rest in subsequent measurements. The maximum number of component carriers the R&S VSE can analyze in a single capture depends on the available bandwidth.

With the optional 500 MHz bandwidth, for example, it can analyze up to 5 100 MHz carriers in a single capture.

When all required measurements are done, the R&S VSE shows the results for all component carriers.

Remote command:

`CONFigure[:NR5G]:CSCapture` on page 282

Views

Results of component carrier measurements are shown for each component carrier separately. When you measure more than one carrier, each result display shows the information of up to two component carriers. For more than two component carriers, you can select which component carriers are displayed in the [two views](#).

Remote command:

`DISPlay[:WINDow<n>][:SUBWindow<w>]:CCNumber` on page 429

Basic component carrier configuration

Access: "Overview" > "Signal Description" > "Carrier Configuration"

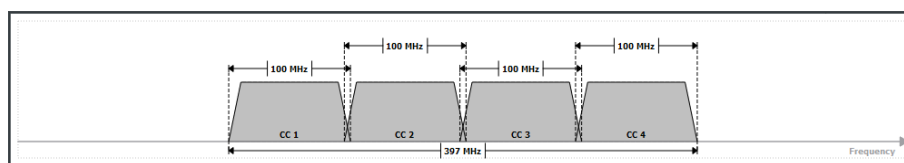
The number of component carriers (CCs) you can select depends on the measurement.

- I/Q based measurements (EVM etc.): up to 16 CCs
- Frequency sweep measurements (ACLR etc.): up to 8 CCs

You can define the characteristics of the CCs in the carrier configuration table.

Depending on the "Number of Component Carriers", the application adjusts the size of the table. Each line corresponds to a component carrier.

The R&S VSE shows a preview of the current carrier configuration in a diagram at the bottom of the dialog.



Frequency configuration ← Basic component carrier configuration

The location of each component carrier in the spectrum is defined by a center frequency. The frequencies of the carriers must be in an ascending order.

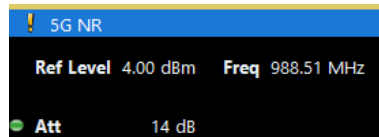
The R&S VSE indicates if the location of the carriers is compatible to the selected [operating band](#).

- "Carrier within selected NR band"
- "Carrier outside of selected NR band"

The actual measurement frequency differs from the carrier frequencies: the application calculates that frequency based on the carrier frequencies. It is somewhere in between the carrier frequencies.

Note that the measurement frequency can change during a capture. If the signal bandwidth is larger than the available analysis bandwidth, the captured data consists of several captures with a smaller bandwidth, each with a different measurement frequency.

The R&S VSE indicates the actual measurement frequency in the channel bar.



In addition to the carrier's center frequency, you have to define a frequency offset. By default, the frequency offset is an offset relative to the first component carrier and an arbitrary value.

- When you change the offset of a carrier in the table, the R&S VSE adjusts its center frequency.
- When you change the frequency of one of the carriers in the table, the R&S VSE adjusts the offset.

You can use [additional tools](#) to define the frequency characteristics of the component carriers.

Remote command:

Frequency: [\[SENSe:\] FREQuency:CENTer \[:CC<cc>\]](#) on page 388

Offset (ref. point = CC1): [\[SENSe:\] FREQuency:CENTer \[:CC<cc>\]:OFFSet](#) on page 389

Offset (ref. point = global MC freq.): [\[SENSe:\] FREQuency:CENTer \[:CC<cc>\]:MCOFFset](#) on page 285

Bandwidth configuration ← Basic component carrier configuration

For each carrier, select the "Bandwidth" from the corresponding dropdown menu.

The combination of bandwidths is arbitrary. If the total bandwidth of all component carriers is too large, the R&S VSE displays a corresponding message.

The R&S VSE also shows the "Occupied Bandwidth" of the aggregated carriers and the "Sample Rate" in a read-only field next to the carrier configuration.

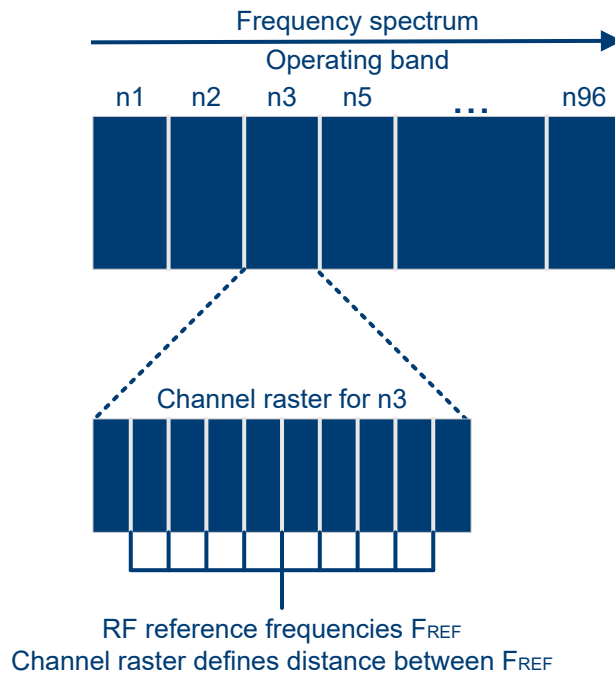
Remote command:

[CONFigure\[:NR5G\]:DL\[:CC<cc>\]:BW](#) on page 277

Channel Raster ← Basic component carrier configuration

Access: "Overview" > "Signal Description" > "Carrier Configuration" > "Global"

Shows the distance between the RF reference frequencies in the selected [operating band](#). The distance between frequencies depends on the channel raster the operating band belongs to (channel raster are defined by 3GPP).



For most operating bands, the channel raster is a fix value of 15 kHz, 60 kHz or 100 kHz.

A few selected operating bands support multiple channel raster.

The channel raster is the basis for the calculation of the channel spacing (distance between component carriers) for intra-band contiguous carrier aggregation.

For details about the channel raster and its effects, see 3GPP 38.104, chapter 5.4.2.

Remote command:

[CONFigure\[:NR5G\]:CRASter](#) on page 282

Nominal Channel Spacing

Resets the channel spacing between component carriers to its default value according to the channel spacings defined by 3GPP.

This setting has an effect if you change the distance (frequency offset) between the component carriers, for example by changing the frequency of one of the carriers.

Remote command:

[CONFigure\[:NR5G\]:NCSPacing](#) on page 283

Additional tools for frequency configuration

Access: "Overview" > "Signal Description" > "Carrier Configuration" > "MC Setup"

You can either define the frequency characteristics of each component carrier separately in the [component carrier table](#), or use the following tools. These tools allow you to change the frequency characteristics of all component carriers at the same time according to a certain logic.

Note that regardless of the changes you make with these tools, the [carrier bandwidth](#) of each carrier remains the same.

Center frequency configuration ← Additional tools for frequency configuration

The global multicarrier frequency is a tool you can use to change the center frequency of all carriers at the same time.

Center frequencies of the component carriers remain the same, as long as you do not change the global MC frequency. When you change the global MC frequency, the center frequencies change and the frequency offset for each carrier remains the same.

You can also synchronize the global MC frequency to the center frequency of all carriers.

Remote command:

Define global MC frequency: [CONFigure\[:NR5G\]:GMCFreq](#) on page 283

Synchronize to center frequency: [CONFigure\[:NR5G\]:CENTer](#) on page 281

Frequency offset configuration ← Additional tools for frequency configuration

The frequency offset configuration tools allow you to change the frequency offset between carriers.

By default, the frequency offset of each component carrier is a frequency relative to the first component carrier (CC1). In that case, the offset of the first carrier is always 0 Hz.

Alternatively, you can set a frequency offset that is relative to the [global multicarrier frequency](#). In that case, the offset can take on negative values if a carrier is on a frequency below the global MC frequency.

For both methods, the offsets are arbitrary values - the spacing between carriers is not equidistant.

If you have a setup in which the distance between carriers is the same, you can use the equidistant frequency offset mode. In this mode, you can define a carrier spacing that is applied to all component carriers. Changing the component carrier's offset separately is no longer possible. Center frequencies of the component carriers are automatically adjusted depending on the carrier spacing you enter.

You can change this logic by turning on a fixed CC offset. When you do, the offset becomes a fixed value (but not necessarily equidistant). Changing the frequency of one carrier adjusts the frequencies of the other carriers. The offset remains the same.

Remote command:

Reference point: [CONFigure\[:NR5G\]:OREL](#) on page 284

Offset mode: [CONFigure\[:NR5G\]:OMODE](#) on page 284

Carrier spacing: [CONFigure\[:NR5G\]:CSPacing](#) on page 282

Fixed offset: [CONFigure\[:NR5G\]:FCOFFset](#) on page 283

4.1.6 MIMO configuration

Access: "Overview" > "Signal Description" > "MIMO / Ant Mapping"

3GPP specifies MIMO scenarios to increase the performance of the radio system by transmitting several data streams simultaneously. Such systems use multiple transmission and receiving antennas. Testing these systems needs a special setup with two or more input channels, depending on the number of antennas in the system.

True MIMO measurements are useful for the following tests:

- To decode the payload of multi layer implementations. For such setups, it is not possible to decode the transmit data using only one antenna.
- To measure the hardware performance of the MIMO transmitter hardware.
- To measure the phase characteristics of beamforming scenarios.

MIMO measurements are restricted to a single component carrier.

For an introduction about different MIMO test setups, see [Chapter 4.7, "Reference: MIMO measurement guide"](#), on page 162.

Config	PSS, SSS, PBCH	PDSCH	PDCCH	CSI-RS
Config 1	4000	1000	2000	3000
Config 2	4000	1001	2000	3000
Config 3	4000	1002	2000	3000
Config 4	4000	1003	2000	3000
Config 5	4000	1004	2000	3000

Source	State	Instrument	Input Source	Antenna Port Mapping
1	Not connected	NONE		Config 1
2	Not connected	NONE		Config 1

Functions in the "MIMO / Ant Mapping" dialog box described elsewhere:

- [Antenna port mapping](#)

Number of Input Sources	74
Input Source Type	75
Measurement Setup Helper	75
Simultaneous Signal Capture Setup	76

Number of Input Sources

Defines the number of input channels.

Each input source corresponds to one (physical) antenna. For a simultaneous signal capture, you can assign a certain [antenna port configuration](#) to each input source. The antenna port configuration contains information about antenna port mapping.

The input source can either be an instrument or an I/Q file.

Remote command:

[CONFigure\[:NR5G\]:NSources](#) on page 367

Input Source Type

The source of the data is either live data recorded with an instrument or previously recorded data stored in a file.

For more information about configuring instruments and using files as input, see the R&S VSE user manual.

Remote command:

[INSTrument:BLOCK:CHANnel\[:SETTings\]:SOURce<si>](#) on page 387

Measurement Setup Helper

The measurement setup helper is a tool that makes it easier to find the correct antenna port configuration for your input sources.

Depending on your test scenario, make sure to select the correct measurement type ("OTA" or "Conducted"). For OTA measurements, the R&S VSE compensates the crosstalk, but not for conducted measurements.

- | | |
|-------------------------|--|
| "Manual" | Select manual configuration to create an arbitrary test scenario. This test scenario can be either a "Conducted" measurement or an "OTA" measurement. Configuration possibilities are the same for both, but the signal processing is different regarding crosstalk compensation. You can use several different antenna port configurations, distribute multiple PDSCH antenna ports to a configuration and assign the antenna port configurations to the input sources as you like. |
| "MIMO" -
"Conducted" | Select a conducted MIMO configuration to test direct transmission (antenna x - antenna x, antenna y - antenna y, etc.). You can use several different antenna port configurations, assign a single PDSCH antenna port to each configuration and assign the antenna port configurations to the input sources as you like. |
| "MIMO" -
"OTA" | Select an over-the-air MIMO configuration to test true MIMO systems (all Rx antennas receive the transmit signal of all Tx antennas, including cross channels). You can use a single antenna port configuration that contains all transmitted PDSCH antenna ports. This configuration is applied to all input sources. |
| "Multi SISO" | Select the multi SISO configuration to determine the phase difference of the input sources (which all transmit the same SISO signal). You can use a single antenna port configuration and assign the single SISO PDSCH antenna port to the configuration. Each input source uses the same antenna port configuration. |

Remote command:

Setup: [CONFigure\[:NR5G\]:MSHelper:MHELper](#) on page 366

MIMO setup: [CONFigure\[:NR5G\]:MSHelper:CONDuctor](#) on page 366

Simultaneous Signal Capture Setup

For measurements with multiple data streams, you have to configure which instrument captures which data stream. The "Simultaneous Signal Capture Setup" table allows you to manage the data streams and the connected instruments.

The number of rows depends on the number of input sources you have defined.

Table for input source = instrument

- "Source": Index number of the connected instrument.
- "State": Shows the connection state (connected or not connected).
- "Instrument": Shows the name of the connected instrument.
- "Input Source": Assigns the instrument to capture a specific data stream.
- "Antenna Port Mapping": Assigns a specific antenna port configuration to the instrument.

Table for input source = file

- "Source": Index number of the input source.
- "State": Shows if the selected file was found or not.
- "File": Shows the name of the selected file.
- "I/Q Channel": Assigns the file to a specific data stream.
- "Antenna Port Mapping": Assigns a specific antenna port configuration to the instrument.

For a comprehensive description about connecting to instruments, see the R&S VSE user manual.

Remote command:

`INSTrument:BLOCK:CHANnel[:SETTings][:CC<cc>]:APMapping<ap>:CONFigure` on page 367

4.1.7 Antenna port configuration

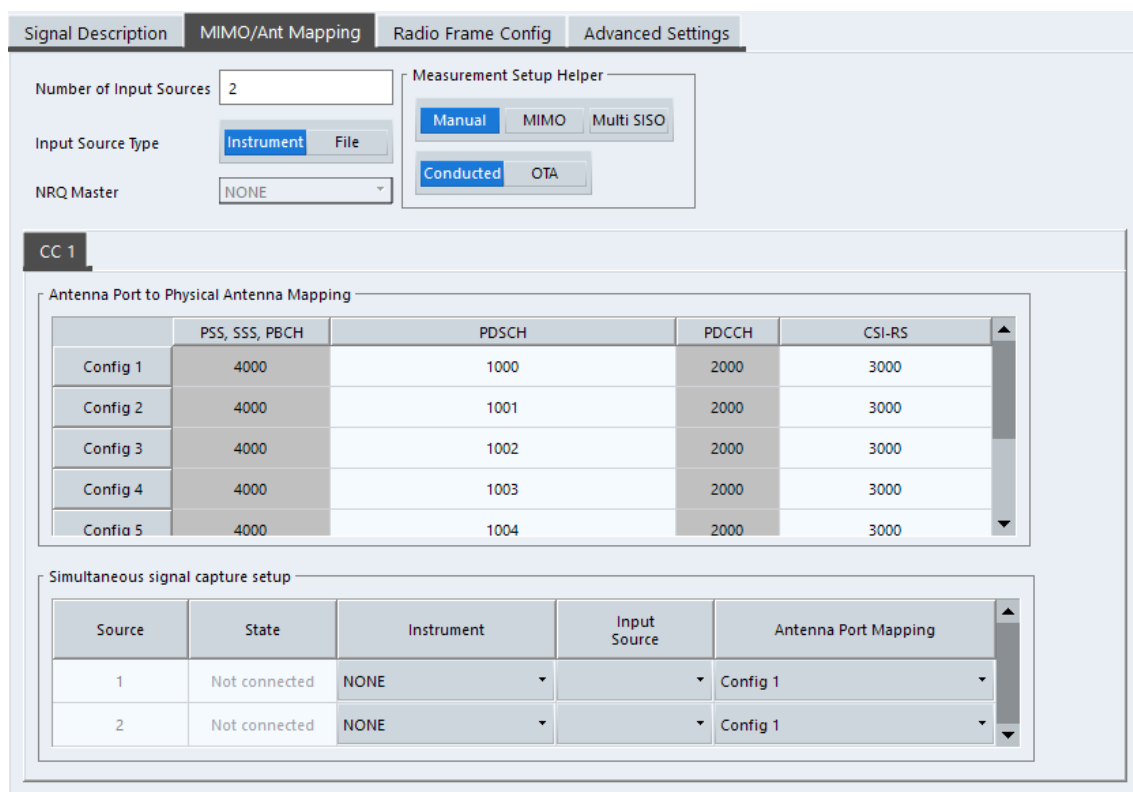
Access: "Overview" > "Signal Description" > "Ant Port Mapping"

Antenna ports are not physical antennas, but rather are a logical concept. Each antenna port carries certain signal components (= physical channels) that should be transmitted under the same conditions. Physical channels can be transmitted on a single antenna port, or on several antenna ports. Each antenna port in turn can be mapped to one of the physical antennas. Typically, one physical antenna combines several antenna ports. However, one specific antenna port can also be transmitted on more than one physical antenna.

The dialog is designed as a table with two rows representing the physical antennas ("Config 1" and "Config 2").

The columns represent the physical channels.

The "Ant Port Mapping" dialog box allows you to map the antenna ports used by the various physical channels defined by 3GPP to up to eight layer configurations.



The remote commands required to configure the antenna ports are described in [Chapter 6.9.17, "Antenna port configuration"](#), on page 364.

State.....77
 PSS, SSS, PBCH.....77
 PDSCH.....78
 CORESET.....78
 CSI-RS.....78

State

Turns the corresponding antenna port configuration on and off and applies it to the measurement.

Note that you can currently measure only one of the two configurations (physical antenna). If you turn on one configuration, the other is automatically turned off.

Remote command:

`CONFigure[:NR5G]:DL[:CC<cc>]:PAMapping<cf>:STATE` on page 365

PSS, SSS, PBCH

Shows the antenna ports that transmit the synchronization signals.

The synchronization signals are assumed to be transmitted on antenna port 4000.

Remote command:

not supported

PDSCH

Selects the antenna ports that transmit the PDSCH. You can assign the PDSCH to multiple antenna ports (1000 to 1011).

When you select the table cell, the R&S VSE opens another dialog box in which you can turn the transmission of the PDSCH on certain antenna ports on and off.

By default, the PDSCH is transmitted on antenna port 1000 (for physical antenna 1) and antenna port 1001 (for physical antenna 2).

Remote command:

`CONFigure[:NR5G]:DL[:CC<cc>]:PAMapping<cf>:PDSCh:AP<ap>`
on page 365

CORESET

Shows the antenna ports that transmit the CORESET.

The CORESET is assumed to be transmitted on antenna port 2000.

Remote command:

not supported

CSI-RS

Selects the antenna ports that transmit the CSI-RS. You can assign the CSI-RS to one or more of several antenna ports (3000 to 3031).

When you select the table cell, the R&S VSE opens another dialog box in which you can turn the transmission of the CSI-RS on a certain antenna port on and off.

By default, the CSI-RS is transmitted on antenna port 3000 (for both physical antennas).

Remote command:

`CONFigure[:NR5G]:DL[:CC<cc>]:PAMapping<cf>:CSIRs:AP<ap>`
on page 364

4.1.8 Radio frame configuration

Access: "Overview" > "Signal Description" > "Radio Frame Config"

Basic frame structure

A radio frame in the 5G NR standard has a length of 10 ms (same as in LTE). It consists of 10 subframes, each with a length of 1 ms.

A subframe contains a variable number of [slots](#), depending on the [subcarrier spacing](#). A subframe can have different subcarrier spacings in different [bandwidth parts](#).

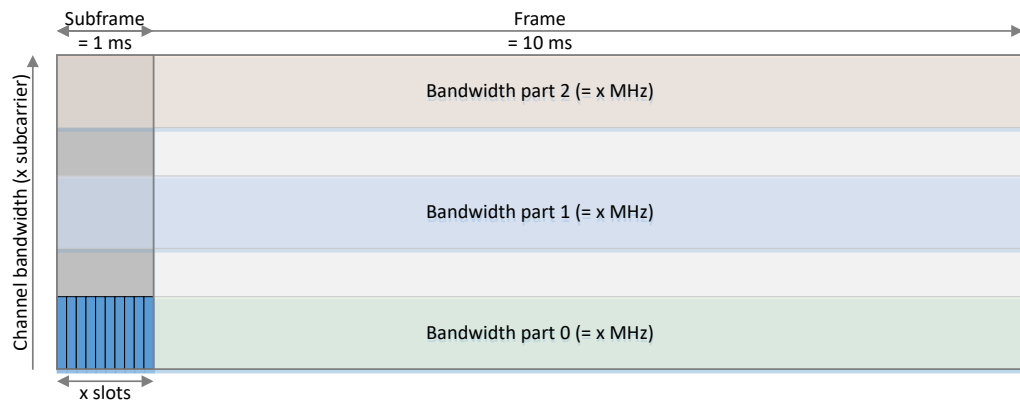


Figure 4-1: Basic frame structure of a 5G NR frame

Slot structure

A slot contains 14 OFDM symbols and has a bandwidth the size of the bandwidth part it is in. A slot can have one of many slot formats, with each slot format representing a different symbol usage. Most of the symbols are usually used by the **PDSCH** for transmission of user data (payload).

Resource blocks

One symbol with a bandwidth of 12 subcarriers makes up a resource block (the size of the subcarrier is variable). One symbol over one subcarrier makes up a resource element, which is the basic quantity in a 5G NR radio frame.

The 5G NR standard differentiates between virtual resource blocks (VRB) and physical resource blocks (PRB). VRBs are all resource blocks that are allocated to the resource grid. PRBs have the same size and number as VRBs, but can be mapped to different subcarriers to according to certain rules defined by 3GPP. Mapping to different subcarriers can be useful to use the resource grid more efficiently.

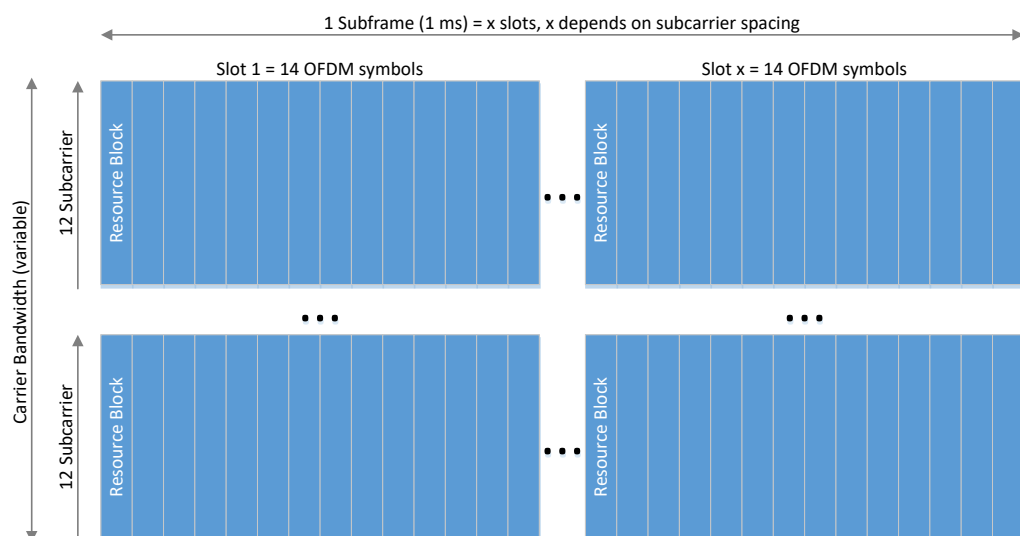


Figure 4-2: Basic slot structure of a 5G NR slot

The radio frame in a 5G NR signal is highly flexible. The location of the synchronization signal is just as variable as the size and number of bandwidth parts and the configuration of each slot in the radio frame.

For more information about configuring the radio frame structure, refer to the following topics.

- [Synchronization Signal](#)
- [Bandwidth parts](#)
- [Slots](#)
- [PDSCH](#)

Measuring multiple radio frames

You can capture and analyze multiple radio frames. Each radio frame can have a different configuration.



Configuring component carriers

When you are doing measurements on [aggregated carriers](#), you can configure each carrier separately.

When available, each carrier in the dialog boxes is represented by an additional tab labeled "CC<x>", with <x> indicating the number of the component carrier.

Note that the additional tabs are only added to the user interface after you have selected more than "1" component carrier.

Frame Configuration	80
Effects of capturing multiple frames on results	81
Frame Configuration Management	81

Frame Configuration

The "# Frames To Configure" input field defines the number of radio frames with a different configuration. If you select more than one frame to configure, you can assign a different slot configuration and PDSCH configuration for the frames. The synchronization signal and bandwidth part configuration is the same for all frames.

To configure a specific frame, enter the corresponding number in the "Selected Frame" field. If you configure only one frame ("# Frames To Configure" = 1), all frames have the same configuration.

After you have configured several frames, you can also select how many frames the R&S VSE actually captures and analyzes with the "[Number of Frames to Analyze](#)" property. If you capture more than the number of configurable frames, the frame configuration is repeated for the surplus frames.

Example:

The number of configurable frames is 2. The number of frames you have captured is 5. In that case, the BWP configuration of frame 0 and 1 is repeated for frames 2 to 4.

If you capture less than the number of configurable frames, only the first frame configurations are applied.

Example:

The number of configurable frames is 3. The number of frames you have captured is 1. In that case, the BWP configuration of frame 0 is used for analysis.

In addition, if the R&S VSE needs more than one capture to analyze all frames, for example if the capture time is too small, the capture always starts with the configuration of the first frame.

Example:

The number of configurable frames is 3. The capture time is 20.1 ms. The number of frames you have captured is 3.

The first capture contains 2 full frames with configuration of frame 0 and 1.

The second capture contains 1 frame, again with configuration of frame 0.

(If you want to capture a frame with the third configuration, you would have to define a capture time of at least 30.1 ms.)

Remote command:

Configurable frames: `CONFigure[:NR5G]:DL[:CC<cc>]:FTConfig` on page 286

Frame selection: via suffix at `FRAMe<fr>`

Effects of capturing multiple frames on results

Analyzing multiple frames has the following effects on results.

- Results in the [result summary](#) are either averaged over all frames or refer to a single frame, depending on your selection.
- All graphical results refer to a single frame.
If there is more than one frame in the capture buffer, you can [select the frame](#) you want to display.
- The R&S VSE can only display graphical results of the last data capture.
If the [capture time](#) is too small to capture all [frames to analyze](#), the R&S VSE captures the signal in multiple capture buffers.
Note that this only applies to graphical results like EVM vs Carrier or the constellation diagram. The result summary still averages over all analyzed frames.

Example:

The capture time is 20.1 ms. The number of frames to analyze is 3. Two data captures are required to analyze all frames.

In that case, the first data capture analyzes the first two frames. The second data capture analyzes the third frame. However, you can only display the results for the third frame in the graphical result displays.

If you analyze multiple component carriers, you can also display the results for a specific frame by assigning a frame to a [view](#).

Remote command:

Select a frame: `[SENSe:]NR5G[:CC<cc>]:FRAMe:SElect` on page 438

Frame Configuration Management

The R&S VSE provides some tools to make frame configuration easier.

- "Copy Frame": Copies the bandwidth part configuration of the selected frame. Note that this includes the [slot configuration](#) and [PDSCH/PDCCH configuration](#) of that frame.
- "Paste Frame": Applies the bandwidth part configuration in the cache to the selected frame.
- "Paste To All": Applies the bandwidth part configuration in the cache to all configurable frames.

Remote command:

Copy: `CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:COPY` on page 285

Paste: `CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:PASTe[:FRAMe]`
on page 286

Paste to all: `CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:PASTe:ALL`
on page 285

4.1.9 Synchronization signal configuration

Access: "Overview" > "Signal Description" > "Radio Frame Config" > "Synchronization"

The 3GPP 5G NR standard defines two synchronization signals (SS), the primary synchronization signal (PSS) and the secondary synchronization signal (SSS). They are bundled in a synchronization signal block (SS/PBCH block). Both synchronization signals are used for radio frame synchronization. The UE also uses the synchronization signals to detect the [physical layer cell ID](#).

In addition to the two synchronization signals, the SS/PBCH block also includes the physical broadcast channel (PBCH). The PBCH carries general system information.

An SS/PBCH block is transmitted on a fix schedule. Each half frame contains either 4, 8 or 64 SS/PBCH blocks, depending on the subcarrier spacing and the deploy frequency range.

The synchronization signals are assigned to fix symbols as defined by 3GPP, but you can adjust the subcarriers on which they are transmitted.



Figure 4-3: Location of synchronization signals in a succession of several slots

Detection of synchronization signal

The R&S VSE supports automatic detection of the synchronization signal characteristics. When you select "Auto" detection mode, the R&S VSE detects various synchronization signal properties like the subcarrier spacing, block pattern and the frequency offset (in terms of resource blocks and subcarriers).

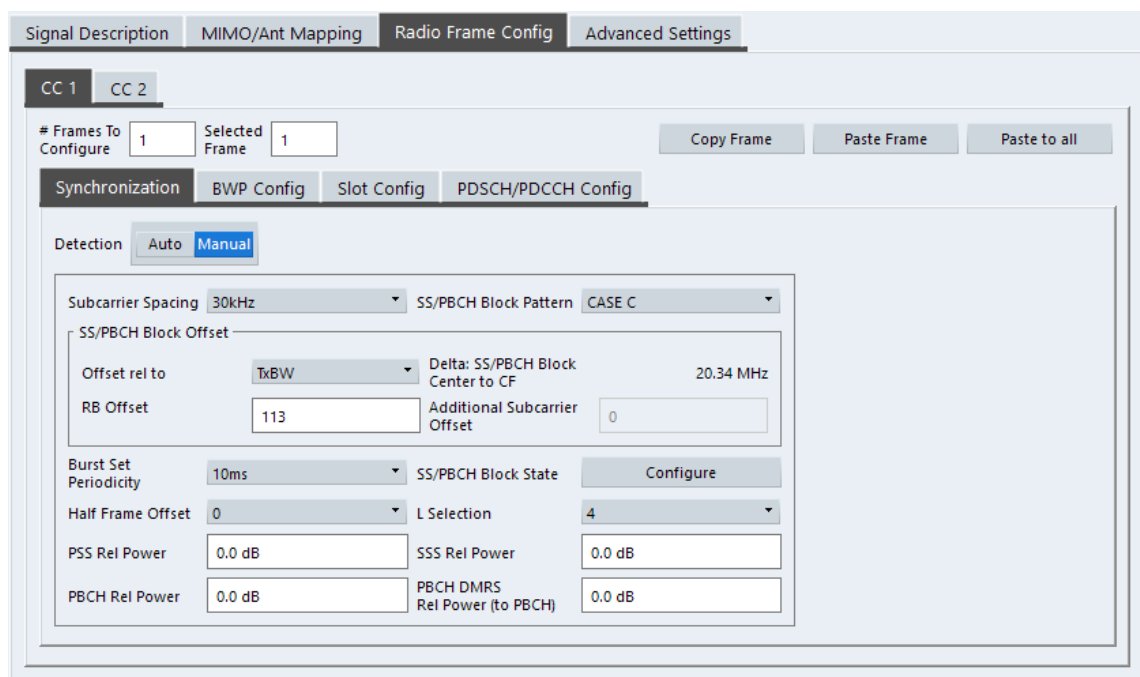
When you select "Manual" mode, you can describe the synchronization signals manually with various characteristics.

If you measure a signal with a bad signal-to-noise ratio, for example due to a low signal level, manual configuration of the synchronization signals can increase the synchronization probability.

When you turn on automatic signal detection, the settings in this dialog box are unavailable.

Synchronization signal in multiple frame analysis

If you measure [multiple frames](#), the configuration of the synchronization signal is the same for all frames. Therefore, the synchronization signal configuration is only available for the first frame.



Configuring component carriers

When you are doing measurements on [aggregated carriers](#), you can configure each carrier separately.

When available, each carrier in the dialog boxes is represented by an additional tab labeled "CC<x>", with <x> indicating the number of the component carrier.

Note that the additional tabs are only added to the user interface after you have selected more than "1" component carrier.

The remote commands required to configure the synchronization signals are described in [Chapter 6.9.6, "Synchronization signal configuration"](#), on page 287.

Subcarrier Spacing (synchronization signal)	84
SS/PBCH Block Pattern	85
Synchronization Signal Offset	85
Burst Set Periodicity	87
SS/PBCH Block State	87
Half Frame Offset	87
Relative Power	88

Subcarrier Spacing (synchronization signal)

The "Subcarrier Spacing" selects the subcarrier spacing for the synchronization signals.

The available subcarrier spacings depend on the [frequency range](#) you have selected.

- FR1: 15 kHz, 30 kHz
(30 kHz unavailable for a 5 MHz [channel bandwidth](#).)
- FR2-1: 120 kHz, 240 kHz
(240 kHz unavailable for a 50 MHz [channel bandwidth](#).)

- FR2-2: 120 kHz, 480 kHz, 960 kHz

Note that a 60 kHz subcarrier spacing is only supported for the [user data](#) transmission. Subcarrier spacings for FR2-2 have been introduced in 3GPP release 17.

Remote command:

[CONFigure\[:NR5G\]:DL\[:CC<cc>\]:SSBLock<ssb>:SSPacing](#) on page 292

SS/PBCH Block Pattern

The "SS Block Pattern" defines which symbols in a slot carry the synchronization signals.

- "Case A": Used for subcarrier spacing of 15 kHz and a carrier frequency in FR1.
- "Case B": Used for subcarrier spacing of 30 kHz and a carrier frequency in FR1.
- "Case C": Used for subcarrier spacing of 30 kHz and a carrier frequency in FR1. The start symbol index for the SS/PBCH blocks is different than "Case B".
- "Case D": Used for subcarrier spacing of 120 kHz and a carrier frequency in FR2.
- "Case E": Used for subcarrier spacing of 240 kHz and a carrier frequency in FR2.
- "Case F": Used for subcarrier spacing of 480 kHz and carrier frequency in FR2-2.
- "Case G": Used for subcarrier spacing of 960 kHz and carrier frequency in FR2-2.

For cases A, B and C, the symbols occupied by the SS further depend on if the carrier frequency is below or above 3 GHz.

For a comprehensive description of the block patterns, refer to 3GPP 38.213, chapter 4.1.

The R&S VSE automatically selects the valid case, depending on the selected [frequency range](#) and [subcarrier spacing](#) - you only have to select the case for a subcarrier spacing of 30 kHz.

Remote command:

[CONFigure\[:NR5G\]:DL\[:CC<cc>\]:SSBLock<ssb>:PATtern](#) on page 289

Synchronization Signal Offset

The "RB Offset" and "Additional Subcarrier Offset" parameters define the location of the synchronization signals in the frequency domain in terms of resource blocks (RB) and subcarrier.

Both values are either relative to the first subcarrier of the channel or the [reference point A](#), depending on the "Offset Rel To" property.

- If you select "TxBW", the offset refers to a resource grid with the subcarrier spacing of the bandwidth part.
- If you select "Reference Point A", the offset refers to a resource grid with a 15 kHz subcarrier spacing (deployment in FR1) or a 60 kHz subcarrier spacing (deployment in FR2).

Note that an offset relative to the "TxBW" is only supported if one of the [bandwidth parts](#) has the same subcarrier spacing as the synchronization signal. Therefore, for a SS/PBCH subcarrier spacing = 240 kHz, the reference is always the reference point A.

The read-only field next to the input fields indicates the frequency offset of the SS/PBCH block in Hz, relative to the center of the channel bandwidth.

Example:

For "Offset Rel To" = "TXBW":

An RB offset = 0 would position the first subcarrier of the SS/PBCH block on the first subcarrier of the channel.

An RB offset = 12 would position the first subcarrier of the SS/PBCH block on the 144th subcarrier of the channel.

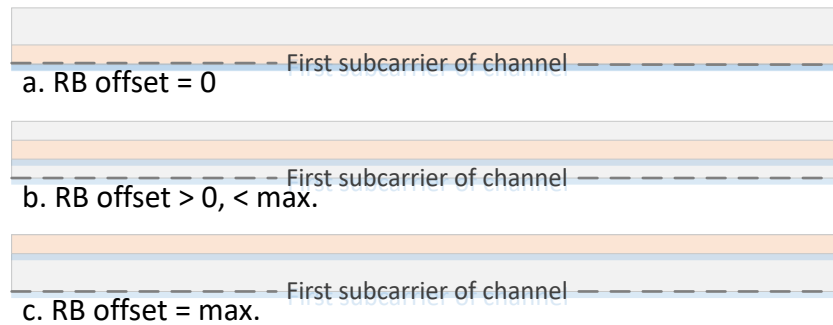


Figure 4-4: Synchronization signal block offset relative to the first subcarrier

For "Offset Rel To" = "Ref Point A":

The RB offset must consider the distance between reference point A and the first subcarrier of the channel (min. offset).

The min. offset would position the first subcarrier of the SS/PBCH block on the first subcarrier of the channel.

An RB offset greater than the minimum RB offset would place the SS/PBCH block on the nth subcarrier of the channel.

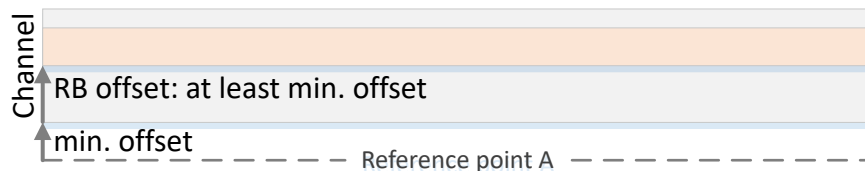


Figure 4-5: Synchronization signal block offset relative to the reference point A

You can fine-tune the location by defining an "Additional Subcarrier Offset".

Example:

An SS block offset = 12 and an additional subcarrier offset = 6 would position the first subcarrier of the SS/PBCH block on the 150th subcarrier of the channel or above the reference point A (provided that the minimum offset is lower than 150 subcarriers).

Remote command:

Resource blocks: [CONFigure\[:NR5G\]:DL\[:CC<cc>\]:SSBLock<ssb>:OFFSet](#)
on page 289

Subcarrier: [CONFigure\[:NR5G\]:DL\[:CC<cc>\]:SSBLock<ssb>:ASOFFset](#)
on page 287

Offset reference: [CONFigure\[:NR5G\]:DL\[:CC<cc>\]:SSBLock<ssb>:RTO](#)
on page 291

Burst Set Periodicity

The "Burst Set Periodicity" determines how often a block of synchronization signals is transmitted.

Currently, the R&S VSE supports a burst set periodicity of 10 ms which corresponds to a transmission in every frame.

The following periodicities are supported.

- 5 ms: transmission in every half frame.
- 10 ms: transmission in every frame.
- 20 ms: transmission in every second frame.
- 40 ms: transmission in every fourth frame.

Burst set periodicities greater than 10 ms are useful for the analysis of [multiple frames](#).

Remote command:

[CONFigure\[:NR5G\]:DL\[:CC<cc>\]:SSBLock<ssb>:BSPeriod](#) on page 287

SS/PBCH Block State

A half frame can contain up to 4, 8 or 64 SS/PBCH blocks, depending on the selected subcarrier spacing and the deploy frequency range. However, you can exclude individual SS/PBCH blocks from the signal description if you measure a signal that contains less than the supported number of SS/PBCH blocks.

When you select the "Configure" button, the R&S VSE opens a dialog box to turn individual SS/PBCH blocks on and off.

The number of SS/PBCH blocks that you can turn on and off (4, 8 or 64) depends on the deployment.

- 4 SS/PBCH blocks for a deployment in FR1 \leq 3 GHz.*
- 8 SS/PBCH blocks for a deployment in FR1 above 3 GHz.
- 64 SS/PBCH blocks for a deployment in FR2.

*A special scenario also allows you to use 8 SS/PBCH blocks for a deployment < 3 GHz:

- Select a 30 kHz [subcarrier spacing](#).
- Select a "Case C" [block pattern](#).
- The "L Selection" parameter becomes available. Select the number of resource blocks to use (4 or 8).

Remote command:

SS/PBCH block state: [CONFigure\[:NR5G\]:DL\[:CC<cc>\]:SSBLock<ssb>\[:STATE<ss>\]](#) on page 293

L selection: [CONFigure\[:NR5G\]:DL\[:CC<cc>\]:SSBLock<ssb>:L](#) on page 288

Half Frame Offset

Selects the half frame in which the synchronization signal is in.

Select "0" if your SSB is in the first half frame, and "1" if it is in the second.

This selection only has an effect for synchronization signals with a [periodicity](#) greater than 5 ms.

Remote command:

[CONFigure\[:NR5G\]:DL\[:CC<cc>\]:SSBLock<ssb>:HFOffset](#) on page 288

Relative Power

You can define an additional boosting for each synchronization signal.

The "PSS Rel Power" defines the relative power of the PSS.

The "SSS Rel Power" defines the relative power of the SSS.

The "PBCH Rel Power" defines the relative power of the PBCH.

The "PBCH DMRS Power" defines the power of the PBCH demodulation reference signal (DMRS) relative to the PBCH power.

Remote command:

PSS: [CONFigure\[:NR5G\]:DL\[:CC<cc>\]:SSBLock<ssb>:PSS:POWer](#)
on page 291

SSS: [CONFigure\[:NR5G\]:DL\[:CC<cc>\]:SSBLock<ssb>:SSS:POWer](#)
on page 292

PBCH: [CONFigure\[:NR5G\]:DL\[:CC<cc>\]:SSBLock<ssb>:PBCH:POWer](#)
on page 290

PBCH DMRS: [CONFigure\[:NR5G\]:DL\[:CC<cc>\]:SSBLock<ssb>:PDMRs:POWer](#)
on page 290

4.1.10 Bandwidth part configuration

Access: "Overview" > "Signal Description" > "Radio Frame Config" > "BWP Config"

One of the defining features of the 5G NR standard is bandwidth parts (BWP). Using bandwidth parts, you can split the complete channel bandwidth into several smaller slices. A bandwidth part is defined as a contiguous set of physical resource blocks that have the same subcarrier spacing (or numerology as the 3GPP standard calls it).

The numerology has several effects on the signal, like the symbol length and the number of slots in a subframe.

Table 4-1: Numerology in 5G NR

Numerology	0	1	2	3	4
Subcarrier spacing	15 kHz	30 kHz	60 kHz	120 kHz	240 kHz
Slot length	1 ms	0.5 ms	0.25 ms	0.125 ms	0.0625 ms
Number of slots in subframe	1	2	4	8	16

Table 4-2: Additional numerology introduced with 3GPP release 17

Numerology	5	6
Subcarrier spacing	480 kHz	960 kHz
Slot length	0.03125 ms	0.015625 ms
Number of slots in subframe	32	64

The number of bandwidth parts you can configure with the R&S VSE is limited to 12. During transmission, each bandwidth part can be assigned to a specific user equipment (UE). Bandwidth parts can overlap, in which case UEs share the resource elements of a bandwidth part.

For measurements on signals with multiple bandwidth parts, it is sufficient to configure only the active bandwidth part.

You can configure bandwidth parts in the bandwidth part configuration table. This table contains the characteristics of all bandwidth parts in the currently selected frame. You can add or remove bandwidth parts and configure them as you like.

Each row in the table corresponds to a bandwidth part.

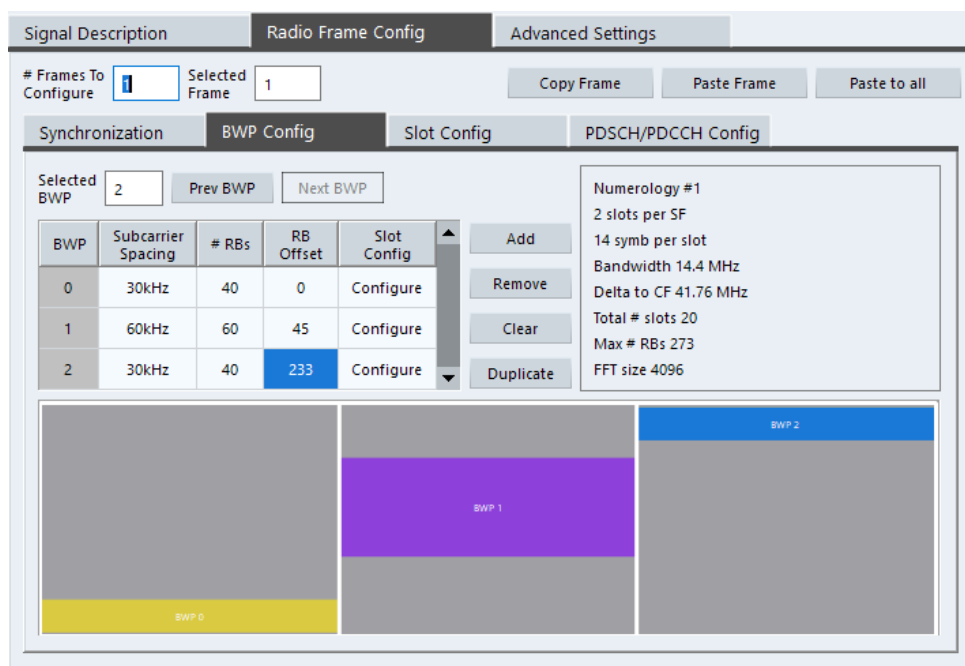
Detection of bandwidth part configuration

The R&S VSE supports [automatic detection](#) of the bandwidth part configuration. When you select "Auto" detection mode, the R&S VSE detects the bandwidth part configuration, slot configuration and PDSCH and CORESET allocations.

When you select "Manual" mode, you can describe the bandwidth part manually with various characteristics.

If you measure a signal with a bad signal-to-noise ratio, for example due to a low signal level, manual configuration of the bandwidth parts can increase the synchronization probability.

When you turn on automatic signal detection, the settings in this dialog box are unavailable.



Configuring component carriers

When you are doing measurements on **aggregated carriers**, you can configure each carrier separately.

When available, each carrier in the dialog boxes is represented by an additional tab labeled "CC<x>", with <x> indicating the number of the component carrier.

Note that the additional tabs are only added to the user interface after you have selected more than "1" component carrier.

The remote commands required to configure the bandwidth parts are described in [Chapter 6.9.7, "Bandwidth part configuration"](#), on page 293.

- [BWP configuration table management](#).....90
- [BWP configuration table](#).....91

4.1.10.1 BWP configuration table management

The R&S VSE provides several tools to manage the configuration table and make the configuration of bandwidth parts easier.

- [Bandwidth Part Selection](#).....90
- [BWP Configuration Tools](#).....91

Bandwidth Part Selection

You can select the bandwidth part you want to configure by entering its number in the "Selected BWP" input field. In the configuration table, the selected bandwidth part is highlighted blue.

You can also select bandwidth parts with the "Prev BWP" and "Next BWP" buttons.

Note that when you select a bandwidth part, the R&S VSE also selects that bandwidth part in the [Slot Config](#) and [PDSCH / PDCCH Config](#) tabs and vice versa.

Remote command:

via suffix at `BWPart<bwp>`

BWP Configuration Tools

The BWP configuration table provides several management tools.

- "Add": Adds a bandwidth part to the table.
- "Remove": Deletes the selected (highlighted) bandwidth part.
- "Clear": Removes all entries from the table.
- "Duplicate": Copies the configuration of the selected bandwidth part to a new bandwidth part.

Note that this includes the [Slot Config](#) and [PDSCH / PDCCH](#).

Remote command:

Add BWP: `CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:ADD`
on page 294

Remove BWP: `CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:REMOVe`
on page 295

Clear table: `CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:CLEAr`
on page 294

Duplicate BWP: `CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:DUPLiCate`
on page 294

4.1.10.2 BWP configuration table

The bandwidth part configuration table consists of several rows, each of which corresponds to a bandwidth part. The size of the table therefore depends on the number of bandwidth parts you have added to the table.

Preview diagram

The preview diagram shows the distribution and location of the bandwidth parts. The x-axis represents the bandwidth part, the y-axis represent the frequency, with the point of origin of the diagram being the first subcarrier. The color depends on the subcarrier spacing selected for the corresponding bandwidth part.

The width of the bandwidth parts depends on the number of resource blocks it occupies. The location of the bandwidth part on the y-axis depends on the resource block offset.

If two or more bandwidth parts overlap (share the same resource blocks), the corresponding parts of the bandwidth part are highlighted by black lines.

Unused parts of the spectrum remain gray.

Numerology

Next to the bandwidth part configuration table, the R&S VSE displays various information about the numerology in the currently selected bandwidth part.

- "Numerology": Shows the [numerology](#) of the bandwidth part as defined by 3GPP.

- "Slots per SF": Shows the number of slots in a subframe in the selected BWP. The number of slots depends on the selected subcarrier spacing.
- "Symbols Per Slot": Shows the number of symbols in a slot in the selected BWP.
- "Bandwidth": Shows the width of the selected BWP in Hz.
- "Delta To CF": Shows the frequency offset of the BWP relative to the center frequency of the complete signal.
- "Total # Slots": Shows the complete number of slots in the BWP over all subframes. The number of slots depends on the selected subcarrier spacing.
- "Max # RBs": Shows the maximum number of resource blocks that the bandwidth part can have.
- "FFT Size": Shows the FFT size in the selected BWP. The FFT size depends on the selected subcarrier spacing.

BWP Number.....	92
Subcarrier Spacing (user data).....	92
# RBs.....	93
RB Offset.....	93
Slot Config.....	93

BWP Number

The "BWP Number" shows the index number of the corresponding BWP.

The bandwidth part number is a consecutive index number that allows you to identify each bandwidth part. The first bandwidth part has the index number 0.

Remote command:

not supported

Subcarrier Spacing (user data)







The "Subcarrier Spacing" selects the subcarrier spacing for the corresponding BWP.

The available subcarrier spacings depend on the [frequency range](#) you have selected.

- FR1: 15 kHz, 30 kHz, 60 kHz
Note that 15 kHz is only available for channel bandwidths < 60 MHz.
- FR2-1: 60 kHz, 120 kHz
- FR2-2: 120 kHz, 480 kHz, 960 kHz
The following restrictions apply:
 - Channel bandwidth = 100 MHz: 120 kHz
 - Channel bandwidth = 400 MHz: 120 kHz, 480 kHz and 960 kHz
 - Channel bandwidth = 800 MHz and 1600 MHz: 480 kHz and 960 kHz
 - Channel bandwidth = 2000 MHz: 960 kHz

Note that a 240 kHz subcarrier spacing is only supported for the [synchronization signal](#).

Subcarrier spacings are indicated by different colors in the preview diagram.

- : 15 kHz
- : 30 kHz
- : 60 kHz
- : 120 kHz
- : 480 kHz
- : 960 kHz

For bandwidth parts with a 60 kHz subcarrier spacing, you can select if it has a normal cyclic prefix (NCP) or an extended cyclic prefix (ECP). Note that the diagrams only show results if you select the BWP with the extended cyclic prefix from the [evaluation range](#).

Remote command:

```
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SSPacing
```

on page 296

RBs

The "# RBs" defines the number of physical resource blocks (PRB) the bandwidth part occupies. The number of physical resource blocks also defines the frequency width of the bandwidth part.

The maximum number of physical resource blocks for a bandwidth part depends on the selected [subcarrier spacing](#) and the overall [channel bandwidth](#), which in turn depend on the selected [frequency range](#). For a detailed overview, see 3GPP 38.104, tables 5.3.2-1 and 5.3.2-2.

Bandwidth parts can share resource blocks.

Remote command:

```
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:RBCount
```

on page 295

RB Offset

The "RB Offset" defines an offset of the first resource block that the bandwidth part uses relative to the first resource block of the channel.

The resource block offset therefore defines the location (frequency) of the bandwidth part in the NR channel.

Remote command:

```
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:RBOffset
```

on page 295

Slot Config

The "Configure" button opens the dialog box to configure the slots in the corresponding bandwidth part.

For details, see [Slot Config](#).

Remote command:

not supported

4.1.11 Slot configuration

Access: "Overview" > "Signal Description" > "Radio Frame Config" > "Slot Config"

Slots

Slots are flexible entities in the 5G NR radio frame, whose characteristics depend on a number of factors.

In the time domain, the length of a slot and the number of slots in a subframe depends on the numerology.

Each slot contains 14 OFDM symbols. Each symbol can have a different scheduling type to make scheduling during transmission as flexible as possible.

Slot configuration table

The slot configuration table represents the frame structure in the time domain. Each row corresponds to one slot, and each slot can have a different configuration.

When you turn on automatic signal detection, the settings in this dialog box are unavailable.

The screenshot shows the 'Slot Config' tab in the configuration software. At the top, there are tabs for 'Signal Description', 'Radio Frame Config', 'Advanced Settings', 'Synchronization', 'BWP Config', 'Slot Config', and 'PDSCH/PDCCH Config'. The 'Slot Config' tab is active. It features a 'Bandwidth Part Number' field set to 2. Below this, there are 'Selected Slot' (0), 'Prev Slot', 'Next Slot', and '# User Configurable Slots (repeat remaining)' (2) fields. A table displays the slot configuration:

SF Number	Slot Number	Slot Allocation	Slot Format	PDSCH Allocations	Repeated Slot No
0	0	Data	0	Configure	User
	1	Data	0	Configure	User
1	2	Data	0		0
	3	Data	0		1
2	4	Data	0		0

Additional controls include 'Copy', 'Paste', 'Paste to all', 'Periodicity 10ms 1.0 ms', '20 slots in BWP 2', and 'Reset Slot Config' buttons. A 'Preview for Slot 0' section at the bottom shows 14 'Downlink' symbols in a row.

Selecting the bandwidth part to configure

- ▶ Enter the number of the bandwidth part you want to configure in the "Bandwidth Part Number" field.

The R&S VSE selects the corresponding bandwidth part.

Note that when you select bandwidth part here, the R&S VSE also selects that bandwidth part in the [BWP Config](#) tab and vice versa.



Configuring component carriers

When you are doing measurements on [aggregated carriers](#), you can configure each carrier separately.

When available, each carrier in the dialog boxes is represented by an additional tab labeled "CC<x>", with <x> indicating the number of the component carrier.

Note that the additional tabs are only added to the user interface after you have selected more than "1" component carrier.

The remote commands required to configure the slots are described in [Chapter 6.9.8, "Slot configuration"](#), on page 297.

• General slot configuration	95
• Slot configuration table	96
• CSI reference signal	98
• Positioning reference signal	102

4.1.11.1 General slot configuration

The slot configuration table contains a variable number of rows, depending on the bandwidth parts configuration.

Selected Slot	95
Number of Configurable Slots	95
Slot Configuration Tools	96

Selected Slot

You can select the slot you want to configure by entering its number in the "Selected Slot" input field. In the configuration table, the selected slot is highlighted blue.

You can also select slots with the "Prev Slot" and "Next Slot" buttons.

Note that when you select a slot, the R&S VSE also selects that slot in the [PDSCH / PDCCH Config](#) tab and vice versa.

Remote command:

via suffix at `SLOT<sl>`

Number of Configurable Slots

You can configure each slot in the radio frame individually, but when more slots have the same configuration (for example each subframe has the same slot configurations), you can configure just a certain number of slots and repeat this configuration on other slots.

The slots you can edit ("# User Configurable Slots") are always the first slots in the table. For example, if the number of configurable slots is "4", you can edit the first four rows in the table. The cells of slots you can edit are white.

The slot configuration is repeated for all other slots. For example, if you can edit the first four slots, the subsequent four slots have the same configuration and so on. The configuration that a specific slot uses is indicated in the last column of the slot configuration table.

The "Periodicity" shown next to the slot configuration table indicates the length of all customized slots. For example, a periodicity of 1 ms in a BWP with a 30 kHz subcarrier spacing indicates that the first two slots have a custom configuration which is repeated every 1 ms.

Remote command:

[CONFigure\[:NR5G\]:DL\[:CC<cc>\]:FRAME<fr>:BWPart<bwp>:CSLot](#)
on page 297

Slot Configuration Tools

The R&S VSE provides some tools to make slot configuration easier.

- "Copy Slot": Copies the slot configuration of the selected slot.
Note that this includes the [PDSCH/PDCCH configuration](#) of that slot.
- "Paste Slot": Applies the slot configuration in the cache to the selected slot.
- "Paste To": Applies the slot configuration to a set of configurable slots.
 - Paste to "Slots": Paste to specific slots or range of slots (e.g. 1,2,5-8)
 - Paste to "Data": Paste to all data slots.
 - Paste to "Unused": Paste to all unused slots (they will turn into data slots).
 - Paste to "Custom": Paste to selected slots according to a certain [logic](#) (period / duration).
- "Paste To All": Applies the slot configuration in the cache to all configurable slots.
- "Reset Slot Config": Restores the default slot configuration (including the PDSCH/PDCCH configuration).

Remote command:

Copy: `CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPART<bwp>:SLOT<sl>:COPY` on page 298

Paste: `CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPART<bwp>:SLOT<sl>:PASTe[:SLOT]` on page 303

Paste to all: `CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPART<bwp>:SLOT<sl>:PASTe:ALL` on page 299

Paste to selected: `CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPART<bwp>:SLOT<sl>:PASTe:TO` on page 301

Reset: `CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPART<bwp>:SLOT<sl>:PRESet` on page 303

4.1.11.2 Slot configuration table

The slot configuration table contains the configuration of all slots in the currently selected bandwidth part. The number of rows (slots) depends on the [subcarrier spacing](#) in the selected bandwidth part.

The complete number of slots in the selected bandwidth part is indicated next to the table ("n Slots in BWP x").

SF Number	Slot Number	Slot Allocation	Slot Format	PDSCH Allocations	Repeated Slot No
0	0	Data	0	Configure	User
	1	Data	0	Configure	User
1	2	Data	0		0
	3	Data	0		1
2	4	Data	0		0

Slot preview

The slot preview shows the scheduling of the OFDM symbols in the selected slot.



Figure 4-6: Preview of symbol usage for slot format 38 as defined in 3GPP 38.211, table 4.3.2-3

The scheduling depends on the selected [slot format](#).

Subframe Number	97
Slot Number	97
Slot Allocation	97
Slot Format	97
PDSCH Allocations	98
Repeated Slot No	98
Ref Signals	98

Subframe Number

The "Subframe Number" shows the index number (0 to 9) of the subframe that the slot belongs to.

The number of subframes is always 10, the number of slots in a subframe varies, depending on the subcarrier spacing / [numerology](#). The first subframe always has the index 0.

Remote command:
not supported

Slot Number

The "Slot Number" shows the index number (0 to n) of the corresponding slot.

The selected slot is highlighted blue.

The number of slots in the frame varies, depending on the subcarrier spacing / [numerology](#). The first slot always has the index 0.

Remote command:
not supported

Slot Allocation

The "Slot Allocation" selects the usage of the corresponding slot.

- "Data": Slot is used for user data transmission.
- "Unused": Slot is not used.

Remote command:

`CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:
ATYPe` on page 298

Slot Format

The "Slot Format" selects one of the slot formats defined by 3GPP for the corresponding slot.

The slot format defines the usage of the OFDM symbols in a slot. Possible symbol usages are:

- Uplink: Symbol carries uplink information.
- Downlink: Symbol carries downlink information.
- Flexible: Symbol usage is undefined and can carry uplink or downlink information.

The symbol usage of the selected slot format is indicated in the [slot preview](#).

For a comprehensive list of all supported slot formats, see 3GPP 38.211, table 4.3.2-3: "Slot formats".

3GPP release 16 unlocks additional slot formats.

Remote command:

`CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:
FORMat` on page 299

PDSCH Allocations

The "Configure" button opens the dialog box to configure the PDSCH or CORESET allocations in the corresponding slot.

For details, see [Chapter 4.1.12, "PDSCH and PDCCH configuration"](#), on page 105.

Remote command:

not supported

Repeated Slot No

The "Repeated Slot No" shows the slot number on which the configuration of a slot is based on.

If the table cell says "User", the slot is configured manually.

If the table cell contains a number, the slot configuration is the same as the slot indicated by that number. For example, if the cell contains the number "1", the slot configuration is the same as the slot with the index number 1.

Remote command:

not supported

Ref Signals

Opens a dialog box to configure reference signals transmitted in the corresponding slot.

For details, see [Chapter 4.1.11.3, "CSI reference signal"](#), on page 98.

Remote command:

not supported

4.1.11.3 CSI reference signal

The channel state information reference signal (CSI-RS) is used to estimate the properties of the signal propagation channel from the base station to the user equipment. This information is quantized and fed back to the base station. The base station makes use of this information for example to calculate the channel quality or to adjust the beamforming parameters.

You can define various parameters to describe the physical attributes and structure of the CSI-RS, for example where it is located in the resource grid or how often it occurs in the signal.

The CSI-RS configuration is specific to a bandwidth part.

Within a bandwidth part, the CSI-RS configuration depends on the number of resources you define. Each resource of the CSI-RS can have a different configuration. You

can allocate the CSI-RS to more than one slot (periodic or aperiodic [transmission method](#)).

Note that the CSI-RS is only analyzed if you assign it to an [antenna port](#).

State On Off Resources

Slot Config	Zero Power	Number of RBs	Start RB	Row	Ports	Density	CDM Type	Bitmap	I0	I1	Scrambling ID	Rel. Power /dB
Periodic	On	50	0	1	1	3	No CDM	1111	9	11	0	0 dB
Periodic	On	100	0	1	1	3	No CDM	1111	9	11	0	0 dB
Periodic	Off	50	0	1	1	3	No CDM	1111	9	11	0	0 dB
Periodic	Off	100	0	1	1	3	No CDM	1111	9	11	0	0 dB

The remote commands required to configure the CSI reference signal are described in [Chapter 6.9.9, "CSI reference signal configuration"](#), on page 304.

State..... 99

Resources..... 99

Slot Config..... 100

 L Periodic transmission..... 100

 L Aperiodic transmission..... 100

Zero Power..... 100

No. RBs..... 101

Start RB..... 101

Row..... 101

Density..... 101

Bitmap..... 102

I0 / I1..... 102

Scrambling ID..... 102

Rel Power..... 102

State

Turns the CSI reference signal on and off.

Remote command:

```
CONFigure[:NR5G]:DL[:CC<cc>]:FRAME<fr>:BWPart<bwp>:CSI<csi>:
STATe on page 312
```

Resources

Defines the number of CSI-RS resources that make up the CSI-RS. Each resource can have a different configuration

Each line in the CSI-RS configuration table corresponds to a resource. Changing the number of resources adjusts the number of rows accordingly.

Remote command:

```
CONFigure[:NR5G]:DL[:CC<cc>]:FRAME<fr>:BWPart<bwp>:CSI<csi>:
RESources on page 308
```

Slot Config

Opens a dialog box to configure in which slots the CSI reference signal appears.

You can select "Periodic" or "Aperiodic" transmission.

Remote command:

Method: `CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:CSI<csi>:SLOT:MODE` on page 310

Periodic transmission ← Slot Config

Periodic transmission transmits the CSI-RS every <x> slots ("Periodicity"). You can also define an "Offset" if you do not want the first occurrence of the CSI-RS in the first slot - for an offset of 2, for example, the first slot that carries the CSI-RS is slot 2.

If you configure and analyze multiple frames, the sequence of CSI-RS is applied in subsequent frames. For example, if you define a periodicity of "4" in 2 frames with 10 slots each, the following slots contain a CSI-RS (assuming, there is no offset):

- First frame: 0 - 4 - 8
- Second frame: 2 - 6 - 10

You can check the distribution of CSI-RS in the "Ref Signals" column of the [slot configuration table](#) when you [select different frames](#).

For a correct analysis of the CSI-RS over multiple frames, you have to define the starting frame. You can do this in different ways.

- Trigger on a fixed system frame number (recommended).
- Select the received frame with the [frame number n_f](#) parameter. You can find out the system frame n_f in the [channel decoder results](#) (an SSB must be available for this to work). After you change n_f, you have to [refresh](#) the results.

Remote command:

Periodicity: `CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:CSI<csi>:SLOT:PERiodicity` on page 310

Offset: `CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:CSI<csi>:SLOT:POFFset` on page 311

Aperiodic transmission ← Slot Config

Aperiodic transmission transmits the CSI-RS in arbitrary slots. Enter the slot numbers that should carry the CSI-RS in the "Slots" input field. For example: 1-3,5,7 to transmit the CSI-RS in slots 1,2,3,5 and 7.

Available slots depend on the subcarrier spacing in the bandwidth part.

For aperiodic transmission over multiple frames, you can define the location of the CSI-RS in each frame manually. If you only define the CSI-RS location for one frame, the R&S VSE assumes that the location is the same in all frames.

Remote command:

Slots: `CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:CSI<csi>:SLOT:APERiodic` on page 309

Zero Power

Turns zero power transmission of the CSI reference signal on and off.

If you turn on zero power transmission, the resource elements are allocated to the CSI-RS as if it were there, but it is not actually transmitted. Results for the CSI-RS, like the EVM, are also not calculated. You can no longer define a scrambling ID or relative power for the CSI-RS.

Remote command:

`CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:CSI<csi>:
ZPOWer` on page 312

No. RBs

Selects the number of resource blocks the CSI reference signal uses.

Remote command:

`CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:CSI<csi>:
NORBs` on page 307

Start RB

Selects the first resource block in the bandwidth part that the CSI reference signal uses.

Remote command:

`CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:CSI<csi>:SRB`
on page 311

Row

Selects one of the CSI-RS location settings defined in 3GPP 38.211, table 7.4.1.5.3-1. The location settings correspond to the rows in this table.

The selection has an effect on the ranges of the following CSI-RS settings:

- [Density](#)
- [Bitmap](#)
(Note that the bitmap has a fixed configuration for some rows.)
- [I0 / I1](#)
(Some location settings reserve two symbols for the CSI-RS transmission.)

The row selection also defines the values for the "Ports" and the "CDM Type" (code domain multiplexing type) parameters. These two values are fixed for each row and therefore read only parameters.

Remote command:

Row selection: `CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:
CSI<csi>:ROW` on page 308

Ports (query): `CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:
CSI<csi>:PORT?` on page 307

CDM type (query): `CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:
BWPart<bwp>:CSI<csi>:CTYPe?` on page 305

Density

Defines how many subcarriers are allocated to the CSI-RS.

The available values depend on the [location settings](#) parameter.

If you select 0.5 density, you can define if the CSI-RS is located on even or odd resource blocks.

Remote command:

CONFigure [:NR5G] :DL[:CC<cc>] :FRAMe<fr>:BWPart<bwp>:CSI<csi>:
DENsity on page 305

Bitmap

Defines the subcarriers on which the CSI-RS is transmitted (location of the CSI-RS in the frequency domain).

For more information about supported bitmap values, see 3GPP 38.211, chapter 7.4.1.5.

Note that the bitmap setting is not available for all [location settings](#).

Remote command:

CONFigure [:NR5G] :DL[:CC<cc>] :FRAMe<fr>:BWPart<bwp>:CSI<csi>:
BITMap on page 304

I0 / I1

Parameters I_0 and I_1 define the location of the CSI-RS in the time domain.

"I0" defines the position of the first symbol of the first CSI-RS in the resource grid.

"I1" becomes available for [location settings](#) that support a two-symbol transmission of the CSI-RS. It defines the resource grid position of the second symbol allocated to the CSI-RS.

Note that I_0 must be smaller than I_1 . I_0 is automatically adjusted if this is not the case.

Remote command:

I_0 : CONFigure [:NR5G] :DL[:CC<cc>] :FRAMe<fr>:BWPart<bwp>:CSI<csi>:
LZERo
 I_1 : CONFigure [:NR5G] :DL[:CC<cc>] :FRAMe<fr>:BWPart<bwp>:CSI<csi>:
LONE on page 306

Scrambling ID

Defines the pseudo-random seed value for the CSI-RS sequence generation.

Remote command:

CONFigure [:NR5G] :DL[:CC<cc>] :FRAMe<fr>:BWPart<bwp>:CSI<csi>:SID
on page 309

Rel Power

Defines the relative power of the CSI-RS in dB.

Remote command:

CONFigure [:NR5G] :DL[:CC<cc>] :FRAMe<fr>:BWPart<bwp>:CSI<csi>:
POWer on page 308

4.1.11.4 Positioning reference signal

The positioning reference signal (PRS) is used to locate user equipment using timing based methods. Compared to other positioning systems like GPS, using the PRS is highly accurate and provides a greater coverage, even indoors. PRS is useful for any type of location based services, for example emergency calls.

You can define various parameters to describe the physical attributes and structure of the PRS, for example where it is located in the resource grid or how often it occurs in the signal.

The PRS configuration is specific to a bandwidth part.

Within a bandwidth part, you can configure a single PRS. You can allocate the PRS to more than one slot (aperiodic [transmission method](#)).

The positioning reference signal is available with 3GPP release 16.

Positioning RS								
State <input type="radio"/> On <input checked="" type="radio"/> Off								
Slot Config	Number of RBs	Start RB	I [^] PRS_start	L_PRS	n [^] PRS_ID,Seq	K [^] PRS_comb	k [^] PRS_offset	Rel. Power/dB
Aperiodic	24	0	0	2	0	2	0	0 dB

The remote commands required to configure the positioning reference signal are described in [Chapter 6.9.10, "Positioning reference signal"](#), on page 313.

State.....	103
Slot Config.....	103
No. RBs.....	103
Start RB.....	104
I [^] PRS_Start.....	104
L_PRS.....	104
n [^] PRS_ID,Seq.....	104
K [^] PRS_comb.....	104
K [^] PRS_Offset.....	104
Rel Power.....	105

State

Turns the positioning reference signal on and off.

Remote command:

```
CONFigure[:NR5G]:DL[:CC<cc>]:FRAME<fr>:BWPpart<bwp>:PRS:STATE
```

on page 316

Slot Config

Opens a dialog box to configure in which slots the positioning reference signal appears.

You can assign the PRS to arbitrary slots. Enter the slot numbers that should carry the PRS in the "Slots" input field. For example: 1-3,5,7 to transmit the PRS in slots 1,2,3,5 and 7.

Available slots depend on the subcarrier spacing in the bandwidth part.

Remote command:

```
CONFigure[:NR5G]:DL[:CC<cc>]:FRAME<fr>:BWPpart<bwp>:PRS:SLOT:
```

APERiodic on page 316

No. RBs

Selects the number of resource blocks the positioning reference signal uses.

Remote command:

`CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:PRS:NORBs`
on page 315

Start RB

Selects the first resource block in the bandwidth part that the positioning reference signal uses.

Remote command:

`CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:PRS:SRB`
on page 316

I^PRS_Start

Defines the first symbol in a slot allocated to the positioning reference signal.

Note that the selection of the start symbol has an effect on the number of symbols [number of symbols](#) the PRS can use. The higher the start symbol, the less symbols the PRS can use.

Remote command:

`CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:PRS:LPStart`
on page 314

L_PRS

Defines the number of symbols allocated to the positioning reference signal.

Note that the selection of the [start symbol](#) has an effect on the number of symbols the PRS can use. The higher the start symbol, the less symbols the PRS can use.

Remote command:

`CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:PRS:LPRS`
on page 314

n^PRS_ID,Seq

Defines the pseudo-random seed value for the PRS sequence generation.

Remote command:

`CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:PRS:NPID`
on page 315

K^PRS_comb

Defines the number of subcarriers allocated to the positioning reference signal.

The number of subcarriers you can use depends on the [size of the PRS](#).

Remote command:

`CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:PRS:KPComb`
on page 313

K^PRS_Offset

Defines an offset for the positioning reference signal in the frequency domain relative to the first subcarrier.

Possible offsets depend on the [number of subcarriers](#) the PRS uses.

Remote command:

`CONFigure [:NR5G] :DL[:CC<cc>] :FRAMe<fr>:BWPart<bwp>:PRS:KPOffset`
on page 313

Rel Power

Defines the relative power of the positioning reference signal in dB.

Remote command:

`CONFigure [:NR5G] :DL[:CC<cc>] :FRAMe<fr>:BWPart<bwp>:PRS:POWer`
on page 315

4.1.12 PDSCH and PDCCH configuration

Access: "Overview" > "Signal Description" > "Radio Frame Config" > "PDSCH / PDCCH Config"

Each slot assigned to carry user data contains one or more resource allocations. Resource allocations are the physical channels that carry user data or information about it. The size of an allocation in the resource grid is variable. An allocation covers one or more physical resource blocks.

PDSCH

The physical downlink shared channel (PDSCH) carries the general user data and is therefore the most prominent channel in a radio frame that occupies the most resources. PDSCH allocations have a variable number of resource blocks and OFDM symbols. Each slot can have one or more PDSCHs. The PDSCH has a dedicated demodulation reference signal (DMRS).

Interleaving means that virtual resource block bundles are mapped to different physical resource block bundles in the physical resource grid. If you do not apply interleaving, the physical resource grid is the same as the virtual resource grid.

The RB bundle size in the frequency domain is variable, in the time domain it still consists of a single OFDM symbol.

CORESET

The physical downlink control channel (PDCCH) carries the downlink control information. The PDCCH is transmitted in a control resource set (CORESET) that has a dedicated demodulation reference signal (DMRS). A CORESET contains the control information for one or more UEs. Each slot can contain one or more CORESETs.

In terms of the resource allocation, a PDCCH consists of several control channel elements (CCEs), depending on the aggregation level. A CCE is a cluster of several REG bundles, which in turn consist of one or more resource element groups (REG). In the resource grid, the REG bundles can be grouped, but can also be distributed over non-contiguous resource blocks (interleaving). A REG corresponds to one resource block (12 resource elements in the frequency domain and one OFDM symbol in the time domain).

The PDCCH also contains the [downlink control information](#) (DCI).

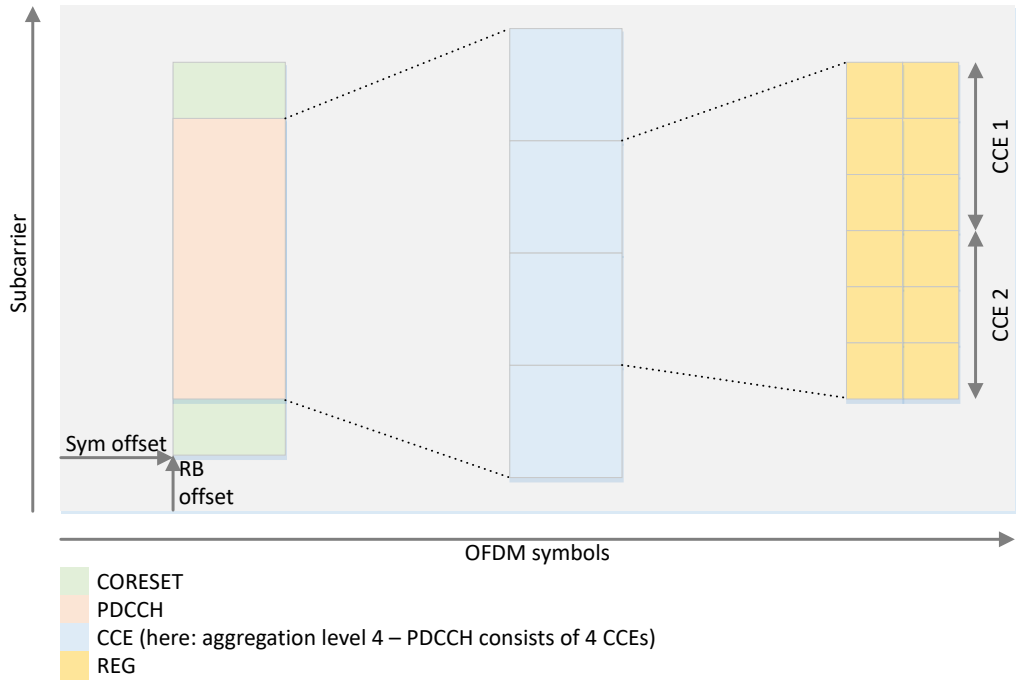


Figure 4-7: PDCCH structure

When you turn on automatic signal detection, the settings in this dialog box are unavailable.

Signal Description MIMO/Ant Mapping Radio Frame Config Advanced Settings

CC 1 CC 2

Frames To Configure: 1 Selected Frame: 1 Copy Frame Paste Frame Paste to all

Synchronization BWP Config Slot Config PDSCH/PDCCH Config

Bandwidth Part Number: 0 Slot Number: 0

PDSCH Allocations: 1 # CORESETs: 1

ID	User ID	Allocation	Code Word	Modulation	Enhanced Settings	Number of RBs	Offset RB	Number of Symb	Offset Symb	Rel. Power /dB	Conflict
0		CORESET		QPSK	...	132	0	1	0	0 dB	
0	0	PDSCH	1/1	QPSK	...	133	0	13	1	0 dB	

Combine PDSCH Allocations with Same User ID: On Off



Configuring component carriers

When you are doing measurements on [aggregated carriers](#), you can configure each carrier separately.

When available, each carrier in the dialog boxes is represented by an additional tab labeled "CC<x>", with <x> indicating the number of the component carrier.

Note that the additional tabs are only added to the user interface after you have selected more than "1" component carrier.

- [General PDSCH / PDCCH configuration](#)..... 107
- [PDSCH / PDCCH configuration table](#)..... 108
- [Enhanced CORESET settings: allocation configuration](#)..... 112
- [Enhanced CORESET settings: PDCCH](#)..... 115
- [Enhanced PDSCH settings: DMRS](#)..... 119
- [Enhanced PDSCH settings: PTRS](#)..... 123
- [Enhanced PDSCH settings: scrambling / coding](#)..... 124

4.1.12.1 General PDSCH / PDCCH configuration

The allocations in the table refer to a specific bandwidth part and slot.

Selecting the bandwidth part to configure

- ▶ Enter the number of the bandwidth part you want to configure in the "Bandwidth Part Number" field.

The R&S VSE selects the corresponding bandwidth part.

Note that when you select bandwidth part here, the R&S VSE also selects that bandwidth part in the [BWP Config](#) tab and vice versa.

Selecting the slot to configure

- ▶ Enter the number of the slot you want to configure in the "Selected Slot" field.
- Note that when you select a slot here, the R&S VSE also selects that slot in the [Slot Config](#) tab and vice versa.

Defining the number of PDSCH and CORESET allocations

The R&S VSE allows you to allocate up to 100 individual CORESETs and PDSCH allocations to a slot.

- ▶ Enter the number of allocations in the "# CORESETs" or "# PDSCH Allocations" field.

The R&S VSE expands the PDSCH configuration table accordingly.

When you add a CORESET, the new CORESET is added after the last existing CORESET and before the first PDSCH allocation. New PDSCH allocations are always added at the end of the table.

Combining PDSCH allocations with the same user ID

Instead of decoding each PDSCH separately, you can bundle PDSCH allocations and decode them as one (PRB bundling), even if they have a different location in the resource grid. You can bundle PDSCH allocations by giving them the same user ID.

1. Assign [user IDs](#) to PDSCH allocations as required.
You can define the user ID for a specific allocation in the "Enhanced Settings" or in the corresponding column in the allocation table.
2. Turn on "Combine PDSCH Allocations With Same User ID".

When you combine allocations, you can change the allocation settings (modulation, number of symbols, enhanced settings etc.) only for the first allocation in the bundle. Number of resource blocks and the resource block offset remain available for all allocations.

Bundling PDSCH allocations has an effect on result displays that show the decoded signal, like the bit stream. Instead of showing the decoded results for each PDSCH allocation, these result display combine the results for bundled allocations.

# PDSCH Allocations.....	108
# CORESETs.....	108
Combine PDSCH Allocations With Same User ID.....	108

PDSCH Allocations

Defines the [number of PDSCH allocations](#) in the slot.

Remote command:

```
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:ALCount on page 324
```

CORESETs

Defines the [number of CORESET allocations](#) in the slot.

Remote command:

```
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:CRSCoUnT on page 323
```

Combine PDSCH Allocations With Same User ID

Turns [PRB bundling](#) on and off.

Remote command:

```
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:CUID on page 330
```

4.1.12.2 PDSCH / PDCCH configuration table

The configuration table contains the PDSCH and PDCCH (CORESET) allocations. Each row corresponds to an allocation. The first part of the table shows the CORESETs, the second part of the table the PDSCH allocations.

Reusing PDSCH allocations

If you are measuring multiple slots with a different configuration, you can copy allocations to other slots once you have defined them in the first slot.

Prerequisite: [# of configurable slots](#) > 1

1. Select "Copy To" to copy the allocation configuration to the clipboard.
The R&S VSE opens a dialog to select the target slots.
2. From the "Copy To" menu, select:
 - "Slots" to copy the allocation to a number of selected slots.
 - "Custom" to copy the allocation to slots based on a certain logic.
3. "Copy To": "Slots":
Select the slots you want to copy the allocation to.
 - Enter a comma-separated list of slots (for example: 1,4,5,7)
 - Enter a range of slots (for example: 3-6)
 - Enter a combination of both (for example: 1,3-5,8)
4. "Copy To": "Custom":
Select the copy logic.
 - "Period": Copy the allocation to every n^{th} slot.
Example: Period = 3 copies the allocation to every 3rd slot, beginning with slot 0 (if selected slot = 0, the copy appears in slots 3,6,9, etc.).
 - "Duration": Copy the allocation to n slots in a row.
Example: Period = 3 and duration = 2 copies the allocation to two slots in a row, every 3rd slot, beginning with slot 0 (if selected slot = 0, the copy appears in slots 1,3,4,6,7,9,10 etc.)

The R&S VSE only copies the allocation to a slot if the slot configuration accepts a [manual configuration](#) (and is not based on the configuration of another slot).



Allocations in the time alignment measurements

For time alignment measurements, you can only configure PDSCH allocations.

In addition, enhanced settings are only available for the PDSCH DMRS. Because the enhanced PDSCH settings are the same for all PDSCH allocations in the entire frame, you can configure them centrally with the corresponding button in the "Slot" configuration tab.

ID	User ID	Allocation	Code Word	Modulation	Enhanced Settings	Number of RBs	Offset RB	Number of Symb	Offset Symb	Rel. Power /dB	Conflict
0		CORESET		QPSK	...	6	0	1	0	0 dB	
1		CORESET		QPSK	...	6	6	1	0	0 dB	
0	0	PDSCH	1/1	QPSK	...	20	26	5	1	0 dB	
1	0	PDSCH	1/1	QPSK	...	20	6	5	1	0 dB	

The remote commands required to configure the PDSCH and CORESET allocations are described in [Chapter 6.9.11, "CORESET allocation configuration"](#), on page 317 and [Chapter 6.9.12, "PDSCH allocation configuration"](#), on page 323.

ID.....	110
Allocation.....	110
Modulation.....	110
Enhanced Settings.....	111
Number of RBs.....	111
Offset RB.....	111
Number of Symbols.....	111
Offset Symbols.....	112
Rel Power / dB.....	112
Copy to.....	112
Conflicts.....	112

ID

The "ID" column shows the unique identifier for the corresponding CORESET or PDSCH allocation.

The counter starts at 0.

Remote command:

```
CONFigure[:NR5G]:DL[:CC<cc>]:FRAME<fr>:BWPart<bwp>:SLOT<sl>:
ALLocation<al>:UEID on page 356
```

Allocation

The "Allocation" column shows the allocation's channel type (CORESET or PDSCH).

Remote command:

not supported

Modulation

The "Modulation" selects the modulation type for the corresponding allocation (channel).

"DMRS Only" analyzes the DMRS and ignores the payload data in the allocation.

The CORESET modulation is always QPSK.

The PDSCH modulation is either QPSK, 16QAM, 64QAM, 256QAM.

3GPP release 17 adds 1024QAM modulation.

Remote command:

CORESET: not supported

PDSCH allocations: [CONFigure\[:NR5G\]:DL\[:CC<cc>\]:FRAMe<fr>:
BWPart<bwp>:SLOT<sl>:ALLocation<al>\[:CW<cw>\]:MODulation](#)
on page 327

Enhanced Settings

Opens the "Enhanced Settings" dialog box.

Enhanced settings for CORESET allocations:

- [CORESET DMRS](#)
- [PDCCH and DCI](#)

Enhanced settings for PDSCH allocations:

- [PDSCH DMRS](#)
- [PTRS](#)
- [Channel coding and PDSCH scrambling](#)

Remote command:

not supported

Number of RBs

The "Number of RBs" defines the number of physical resource blocks that the allocation occupies in the resource grid.

Remote command:

CORESET: [CONFigure\[:NR5G\]:DL\[:CC<cc>\]:FRAMe<fr>:BWPart<bwp>:
SLOT<sl>:COReset<cr>:RBCount](#) on page 321

PDSCH allocation: [CONFigure\[:NR5G\]:DL\[:CC<cc>\]:FRAMe<fr>:
BWPart<bwp>:SLOT<sl>:ALLocation<al>:RBCount](#) on page 328

Offset RB

The "Offset RB" defines the first physical resource block that the allocation uses. The offset is a value relative to the first resource block used by the bandwidth part the allocation is in.

Remote command:

CORESET: [CONFigure\[:NR5G\]:DL\[:CC<cc>\]:FRAMe<fr>:BWPart<bwp>:
SLOT<sl>:COReset<cr>:RBOffset](#) on page 321

PDSCH allocation: [CONFigure\[:NR5G\]:DL\[:CC<cc>\]:FRAMe<fr>:
BWPart<bwp>:SLOT<sl>:ALLocation<al>:RBOffset](#) on page 329

Number of Symbols

The "Number of Symbols" defines the number of symbols that the allocation uses.

The number of symbols a CORESET can use is limited to 3.

3GPP release 16 unlocks additional numbers of symbols a PDSCH can use.

Remote command:

CORESET: [CONFigure\[:NR5G\]:DL\[:CC<cc>\]:FRAMe<fr>:BWPart<bwp>:
SLOT<sl>:COReset<cr>:SCount](#) on page 322

PDSCH allocation: [CONFigure\[:NR5G\]:DL\[:CC<cc>\]:FRAMe<fr>:
BWPart<bwp>:SLOT<sl>:ALLocation<al>:SCount](#) on page 329

Offset Symbols

The "Offset Symbols" defines the first symbol that the allocation uses. The offset is a value relative to the first symbol in the slot.

Remote command:

CORESET: `CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:COReset<cr>:SOFFset` on page 322

PDSCH allocation: `CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:ALLocation<al>:SOFFset` on page 330

Rel Power / dB

The "Rel Power / dB" defines the relative power of the corresponding allocation.

Remote command:

CORESET: `CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:COReset<cr>:POWer` on page 320

PDSCH allocation: `CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:ALLocation<al>:POWer` on page 328

Copy to

Opens a dialog to copy the allocation configuration to other slots.

For details, see ["Reusing PDSCH allocations"](#) on page 109.

Remote command:

PDSCH: `CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:ALLocation<al>:COPY` on page 326

CORESET: `CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:COReset<cr>:COPY` on page 319

Conflicts

The R&S VSE indicates a conflict in the following cases.

- If the allocation is located in a symbol reserved for uplink.
- If two or more allocations use the same resource blocks (overlapping allocations).
- If the total number of resource blocks over all allocations is greater than 273.

To remove a conflict, try to reduce the total number of resource blocks or change the RB offset.

Remote command:

not supported

4.1.12.3 Enhanced CORESET settings: allocation configuration

The enhanced CORESET settings contain settings to configure the CORESET demodulation reference signal (CORESET DMRS) and the characteristics (like the location and [DCI content](#)) of the PDCCH within the CORESET.

General Precoder Granularity: All Contiguous RBs Sequence Generation / Scrambling: N_ID^CELL 0		CORESET DMRS Config Rel Power (to CORESET): 0.0 dB Reference Point: Ref Point A							
Interleaving State: On Off Shift Index: n_shift 0		Bundle Size: 6 Interleaver Size: 2							
PDCCH Config <table border="1"> <thead> <tr> <th>RNTI</th> <th>Aggregation Level</th> <th>CCE Index</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>1</td> <td>0</td> </tr> </tbody> </table>				RNTI	Aggregation Level	CCE Index	0	1	0
RNTI	Aggregation Level	CCE Index							
0	1	0							

The remote commands required to configure CORESET allocations are described in [Chapter 6.9.13, "Enhanced CORESET allocation configuration"](#), on page 331.

Precoder Granularity	113
CORESET DMRS Sequence Generation	113
Allow PDSCH	114
CORESET DMRS Rel Power	114
CORESET DMRS Reference Point	114
Interleaving	114

Precoder Granularity

Defines which resource elements are used by the PDCCH DMRS.

"All Contiguous" PDCCH DMRS expected on all resource blocks of the CORESET. RBs"

"REG Bundle" PDCCH DMRS expected on the resource blocks allocated to the PDCCH.

Remote command:

```
CONFigure[:NR5G]:DL[:CC<cc>]:FRAME<fr>:BWPart<bwp>:SLOT<sl>:
COReset<cr>:PGRanularity on page 347
```

CORESET DMRS Sequence Generation

3GPP (38.211) defines two methods by which the CORESET DMRS sequence can be calculated. You can select the method with the "Use DMRS Scrambling ID" parameter.

"On":

Calculates the sequence based on a pseudo-random seed value. You can define the seed value in the input field that becomes available when you select this method.

"Off":

Calculates the sequence based on the [cell ID](#), if the higher layers provide no value.

"n_ID^Cell" has the same value as the cell ID.

For this method, N_RNTI is assumed to be 0 as defined by 3GPP.

Remote command:

Method: `CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:COREset<cr>:DMRS:SCRam[:STATe]` on page 333

Seed value: `CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:COREset<cr>:DMRS:SID` on page 333

Allow PDSCH

Turns usage of CORESET resources for PDSCH transmission on and off.

By default, resource elements allocated to the CORESET are reserved for the CORESET, even if they are unused. When you allow PDSCH resources within a CORESET, unused CORESET resource elements can be allocated to the PDSCH.

Available if CORESET resources are [not contiguous](#).

Remote command:

`CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:COREset<cr>:PDSCh:STATe` on page 346

CORESET DMRS Rel Power

Defines the power of the CORESET DMRS relative to the power of the CORESET resource elements.

Remote command:

`CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:COREset<cr>:DMRS:POWer` on page 332

CORESET DMRS Reference Point

Defines the reference point for the CORESET DMRS in the resource grid.

The CORESET DMRS position is either relative to the [reference point A](#) or the start of the CORESET.

Select "CORESET Start" if

- the CORESET is configured by the PBCH or
- the CORESET is configured by the controlResourceSetZero field in the PDCCH-ConfigCommon IE.

Remote command:

`CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:COREset<cr>:DMRS:RPOint` on page 332

Interleaving

Interleaving defines the position of the PDCCH resource elements in the resource grid.

As long as you turn off interleaving, all PDCCH resource elements groups (REGs) use subcarriers next to each other. If you turn on interleaving, you can assign the REGs to non-adjacent subcarriers according to certain rules defined in 3GPP 38.211.

The "Bundle Size" defines the number of REGs in a REG bundle.

The "Shift Index" defines an offset of the REG bundles.

You can select one of two methods to define the offset.

- "N_ID^Cell": Select an offset based on the cell ID.
- "n_shift": Select the offset manually.

The "Interleaver Size" defines the distance between individual REG bundles in the frequency domain.

Remote command:

State: [CONFigure \[:NR5G\]:DL\[:CC<cc>\]:FRAMe<fr>:BWPart<bwp>:](#)

[SLOT<sl>:COREset<cr>:INTerleaving:STATe](#) on page 336

Bundle size: [CONFigure \[:NR5G\]:DL\[:CC<cc>\]:FRAMe<fr>:BWPart<bwp>:](#)

[SLOT<sl>:COREset<cr>:INTerleaving:BSIZe](#) on page 334

Shift index method: [CONFigure \[:NR5G\]:DL\[:CC<cc>\]:FRAMe<fr>:](#)

[BWPart<bwp>:SLOT<sl>:COREset<cr>:INTerleaving:SIINDEX](#) on page 335

Shift index: [CONFigure \[:NR5G\]:DL\[:CC<cc>\]:FRAMe<fr>:BWPart<bwp>:](#)

[SLOT<sl>:COREset<cr>:INTerleaving:NSHIFT](#) on page 335

Interleaving size: [CONFigure \[:NR5G\]:DL\[:CC<cc>\]:FRAMe<fr>:BWPart<bwp>:](#)

[SLOT<sl>:COREset<cr>:INTerleaving:ISIZe](#)

4.1.12.4 Enhanced CORESET settings: PDCCH

The enhanced CORESET settings also contains a table to define the downlink control information (DCI) fields (as defined in 38.212) contained in the PDCCH payload.

You can configure one PDCCH in each CORESET.

You can assign an RNTI type to the PDCCH in the CORESET. Each type of RNTI has a certain purpose in the network and the CRC of the information of several DCI formats is scrambled by a RNTI. The DCI format in turn determines the DCI fields that are available.

The base station transmits control information to the user equipment via several DCI formats. The control information can comprise all kinds of information about the transmitted data like resource allocation, bandwidth part usage, modulation type and many others. 3GPP defines various DCI formats, each of which carries different sets of information (DCI fields), depending on the system setup.

You can evaluate the DCI fields in the [channel decoder](#).

The DCI fields you can configure depend on the selected [DCI format](#) and the selected [RNTI type](#).

The DCI fields have a predefined order. This order is represented in the [DCI field configuration table](#), from left to right and top to bottom.

Example:

- RNTI type = C-RNTI
- DCI format = 0_0

	DCI Field	Bit Length		DCI Field	Bit Length
1. field:	Identifier for DCI formats	1	2. field:	Frequency Domain Resource Assignment	Auto
3. field:	Time Domain Resource Assignment	4	4. field:	Frequency Hopping Flag	1
5. field:	Multiplexing and Coding Scheme (TB1)	5	6. field:	New Data Indicator (TB1)	1
7. field:	Redundancy Version (TB1)	2	8. field:	HARQ Process Number	4
9. field:	UL/DL Command for Scheduled PUSCH	2	10. field:	Padding bits	0
11. field:	UL/SUL indicator	0	12. field:	ChannelAccess-CPext	0

Figure 4-8: Order of DCI fields in DCI format 0_0

1 = Name of DCI field

2 = Bit length of DCI fields (grey fields: not editable, white fields: editable)

Order of DCI fields in the PDCCH:

"Identifier For DCI Formats" > "Frequency Domain Resource Assignment" > "Time Domain Resource Assignment" > "Frequency Hopping Flag" etc.

Each DCI field has a certain bit length. The sum of all bits must be the same as the [pattern length](#). The pattern length must be at least 12 bits and must be correct.

The bit lengths for each DCI field are defined in 3GPP 38.212.

- Fix bit lengths are always the same and defined by 3GPP (for example DCI field "X" always uses 1 bit). You cannot edit those values.
- Automatically calculated bit lengths are variable and depend on other parameters. The R&S VSE calculates them according to the conditions defined by 3GPP. You cannot edit those values.
- Variable bit lengths can have different values in a certain value range (for example DCI field "Y" uses either 1, 2 or 4 bits). You can edit those values as required.

Which bit lengths are variable depends on the DCI format and its corresponding RNTIs. Note that in some scenarios all bit lengths are fix.



There are a few test scenarios that allow you to ignore the DCI field bit lengths.

- If you are only interested in the bit stream, it is not necessary to define the bit lengths of each DCI field. The correct pattern length is sufficient in that case and does not have to match the bits of the individual fields.
- If you are only interested in the decoding of certain fields, it is sufficient to define the pattern length and the bit length up to the DCI field you are interested in correctly.
For example, if you are interested in the 4th DCI field, define the complete pattern length and the bit lengths of the first four DCI fields and ignore the subsequent ones.

For some DCI fields, you can define how often they are transmitted in a single PDCCH. For those DCI fields the total bit length = bit length * # indicator.

Example:

- RNTI type = SFI-RNTI
- DCI format = 2_0
- Slot format indicator bit length = 4
- # indicators = 4

Total bit length of the slot format indicator = 16 bits

For some DCI formats, you can define how often the complete set of DCI fields are transmitted in a single PDCCH. In that case the total bit length = bit length of all parameters * # blocks.

Example:

- RNTI type = TPC-PUCCH-RNTI
- DCI format = 2_2
- Closed loop indicator bit length = 4
- TPC commands bit length = 2 (fix value)
- # blocks = 2

Total bit length of the PDCCH = 12 bits

Configuring DCI fields

Here's an example for the usual process to define DCI fields.

1. Select the RNTI "Usage".
2. Select the "DCI Format".
3. Define the PDCCH "Pattern Length".
4. Select "Content" to define the details of the DCI.

For a list of available DCI fields, see [Table 6-3](#). For a comprehensive breakdown of availability of DCI fields, their bit lengths and dependencies, refer to 3GPP 38.212. 3GPP release 16 unlocks additional DCI formats and fields.

Usage.....	117
RNTI.....	118
DCI Format.....	118
Aggregation Level.....	118
CCE Index.....	118
Pattern Length.....	118
Content.....	118

Usage

Selects the type of radio network temporary identifier (RNTI) that the PDCCH uses. It also determines which [DCI formats](#) are available.

Remote command:

```
CONFigure[:NR5G]:DL[:CC<cc>]:FRAME<fr>:BWPart<bwp>:SLOT<sl>:
COReset<cr>:PDCCh<cf>:USAGe on page 346
```

RNTI

Selects the radio network identifier.

Remote command:

```
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:
COReset<cr>:PDCCh<cf>:RNTI on page 345
```

DCI Format

Selects the DCI format.

The available DCI formats depend on the selected [RNTI type](#).

The selected DCI format in turn defines which information the PDCCH can carry.

3GPP release 16 unlocks additional DCI formats and fields.

Remote command:

```
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:
COReset<cr>:PDCCh<cf>:DCIFormat on page 337
```

Aggregation Level

Defines how many [control channel elements](#) (CCEs) the PDCCH uses in the resource grid.

Remote command:

```
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:
COReset<cr>:PDCCh<cf>:ALEVel on page 336
```

CCE Index

Defines an offset of the CCE relative to the first subcarrier.

Remote command:

```
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:
COReset<cr>:PDCCh<cf>:CCEindex on page 337
```

Pattern Length

Defines the number of bits the PDCCH uses. The number of bits is a custom value depending on your signal.

Remote command:

```
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:
COReset<cr>:PDCCh<cf>:PLENgtH on page 345
```

Content

Opens a dialog box to define the information that the PDCCH carries.

The number and type of information depends on the selected [DCI format](#).

You can find an overview of all DCI fields that are available in one or more DCI formats, including the SCPI command you can use to change the bit length of the DCI field in [Table 6-3](#).

Special settings for certain DCI formats:

- DCI format 0_1: "Scope": Selection defines the DCI fields available in format 0_1.
- DCI format 1_0: "Frequency Domain Resource Assignment": Selection defines the DCI fields available in format 1_0.

- For other special fields, see [Chapter 4.1.12.4, "Enhanced CORESET settings: PDCCH"](#), on page 115.

3GPP release 16 unlocks additional DCI formats and fields.

Remote command:

Query DCI fields: `CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:COReset<cr>:PDCCh<cf>:DCISettings:LIST?` on page 342

Configure DCI fields: `CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:COReset<cr>:PDCCh<cf>:DCISettings:ITEM` on page 339

blocks: `CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:COReset<cr>:PDCCh<cf>:DCISettings:NOBLoCk` on page 343

TCP commands: `CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:COReset<cr>:PDCCh<cf>:DCISettings:TCCOMMAND` on page 344

Frequency resource assignment: `CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:COReset<cr>:PDCCh<cf>:DCISettings:FDRASSIGN` on page 338

Scope: `CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:COReset<cr>:PDCCh<cf>:DCISettings:SCOPE` on page 343

4.1.12.5 Enhanced PDSCH settings: DMRS

Access: "Overview" > "Signal Description" > "Radio Frame Config" > "PDSCH / PDCCH Config" > "Enhanced Settings" > "PDSCH DMRS Config"

The screenshot shows the 'PDSCH DMRS Config' window with the following settings:

- User ID: 0
- Config Type: 1
- First DMRS symb rel to (Mapping Type): Slot start (A)
- First DMRS Symb (Type A Pos): 2
- DMRS Add Position Index: 0
- DMRS Length: 1
- Sequence Generation: DMRS-Scrambling-ID, 0
- n_SCID: 0
- Rel Power (to PDSCH): 3.0 dB
- Codeword to Layer Mapping: Layers/Codewords 2/1
- Antenna Ports 1000+: 0,1
- CDM groups w/o data: 2
- Reference Point: Ref Point

The remote commands required to configure the DMRS are described in [Chapter 6.9.14, "Enhanced PDSCH settings: DMRS"](#), on page 347.

User ID.....	120
VRB-to-PRB Interleaver.....	120
PDSCH DMRS Location.....	120
Multi Symbol DMRS.....	120
PDSCH DMRS Sequence Generation.....	121
PDSCH DMRS Rel Power.....	121
Codeword to Layer Mapping.....	121

Antenna Port.....	122
CDM Groups w/o Data.....	122
Reference Point.....	122
DMRS-Downlink.....	122

User ID

Selects the radio network temporary identifier (RNTI) used to identify different users currently accessing the network. The corresponding allocation and its configuration is assigned specifically to the ID you select in this field.

By default, the RNTI is the same the [bandwidth part index](#).

Remote command:

```
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:
ALLocation<al>:UEID on page 356
```

VRB-to-PRB Interleaver

Selects the RB bundle size of the interleaver according to 3GPP 38.211, chapter 7.3.1.6. Interleaving means that virtual resource block bundles are mapped to different physical resource blocks in the physical resource grid.

A VRB bundle can consist of 2 or 4 resource blocks. "Non-interleaved" means that no interleaving or bundling is applied.

Remote command:

```
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:
ALLocation<al>:VTPinter on page 356
```

PDSCH DMRS Location

The "Config Type" defines the mapping of the DMRS to physical resources elements as defined in 3GPP 38.211. You can select from configuration "Type 1" or "Type 2".

The "Mapping Type" defines the position of the first DMRS symbol in the resource grid. Mapping "Type A" is a location relative to the start of the slot. Mapping "Type B" is a location relative to the start of the PDSCH resources.

For mapping type A, you can select an additional parameter "Type A Pos" to select the first symbol that the DMRS uses.

The mapping type also limits the [number of symbols](#) the PDSCH allocations can use.

Remote command:

```
Configuration type: CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:
BWPart<bwp>:SLOT<sl>:ALLocation<al>:DMRS:CTYPe on page 350
Mapping type: CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:
SLOT<sl>:ALLocation<al>:DMRS:MTYPe on page 351
Type A position: CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:
SLOT<sl>:ALLocation<al>:DMRS:TAPos on page 355
```

Multi Symbol DMRS

The DMRS can be transmitted on one or two symbols, depending on the "DMRS Length".

You can also add additional DMRS with the "DMRS Add Position Index".

Remote command:

Length: `CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPART<bwp>:SLOT<sl>:ALLOCATION<al>:DMRS:MSYMBOL:LENGTH` on page 350

Position index: `CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPART<bwp>:SLOT<sl>:ALLOCATION<al>:DMRS:MSYMBOL:APOSITION` on page 350

PDSCH DMRS Sequence Generation

3GPP (38.211) defines two methods by which the PDSCH DMRS sequence can be calculated. You can select the method with the "Sequence Generation" parameter.

"n_ID^DMRS":

Calculates the sequence based on a pseudo-random seed value. You can define the seed value in the input field that becomes available when you select this method.

The scrambling ID "N_ID^1" is for low PAPR DMRS transmission. For other transmission types, use the "N_ID^0" scrambling ID.

"N_ID^1" is available if **DMRS-Downlink** = "On".

"n_ID^Cell":

Calculates the sequence based on the **cell ID**, if the higher layers provide no value.

"n_ID^Cell" has the same value as the cell ID.

Remote command:

Method: `CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPART<bwp>:SLOT<sl>:ALLOCATION<al>:DMRS:SGENERATION` on page 353

Seed value N_ID^0: `CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPART<bwp>:SLOT<sl>:ALLOCATION<al>:DMRS:SID` on page 353

Seed value N_ID^1: `CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPART<bwp>:SLOT<sl>:ALLOCATION<al>:DMRS:SIONE` on page 354

Scrambling ID: `CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPART<bwp>:SLOT<sl>:ALLOCATION<al>:DMRS:NSCID` on page 351

PDSCH DMRS Rel Power

Defines the power of the PDSCH DMRS relative to the power of the PDSCH resource elements.

Remote command:

`CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPART<bwp>:SLOT<sl>:ALLOCATION<al>:DMRS:POWER` on page 352

Codeword to Layer Mapping

Selects the number of layers for a PDSCH allocation and the number of codewords. The combination of layers and number of codewords determines the layer mapping. Each layer is transmitted on a separate **antenna port**.

The number of supported layers depends on:

- **DMRS configuration type**
- **DMRS length**

Remote command:

`CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPART<bwp>:SLOT<sl>:ALLOCATION<al>:CLMAPPING` on page 348

Antenna Port

Each layer of a PDSCH allocation is mapped to a certain antenna port. The "Antenna Port 1000 +" dropdown menu selects the antenna ports that are used for the transmission of the PDSCH allocation.

Note that the R&S VSE has only one RF input and can therefore measure only one PDSCH. Which PDSCH is measured depends on the [antenna port mapping](#).

Example:

- [DMRS configuration type](#) = 1
- [DMRS length](#) = 2
- [Codeword to layer mapping](#) = 4/1, which corresponds to 4 layers

For this configuration you can map the layers to antenna ports "1000,1001,1004,1005", "1000,1002,1004,1006" or "1002,1003,1006,1007".

The antenna ports (layers) that are actually analyzed depend on the [antenna port configuration](#).

The contents of result displays that analyze antenna ports depend on the [beamforming selection](#).

Remote command:

```
CONFigure[:NR5G]:DL[:CC<cc>]:FRAME<fr>:BWPart<bwp>:SLOT<sl>:
ALLocation<al>:DMRS:AP on page 349
```

CDM Groups w/o Data

Selects the number of CDM groups that are reserved and contain no data. They are therefore not used by the PDSCH for data transmission. In the resource grid, the resource elements for CDM (between PDSCH DMRS resource elements) remain empty.

Note that the different values for this parameter change the default values of the [relative DMRS power](#) according to 3GPP 38.214, table 4.1-1.

Remote command:

```
CONFigure[:NR5G]:DL[:CC<cc>]:FRAME<fr>:BWPart<bwp>:SLOT<sl>:
ALLocation<al>:DMRS:CGWD on page 349
```

Reference Point

Defines the reference point for the PDSCH DMRS in the resource grid.

The PDSCH DMRS position is either relative to the [reference point A](#) or the first sub-carrier of the [bandwidth part](#) it is in.

You can use the bandwidth part start as the reference point for the PDSCH DMRS to define the reference point according to 3GPP 38.211 chapter 7.4.1.1.2.

Remote command:

```
CONFigure[:NR5G]:DL[:CC<cc>]:FRAME<fr>:BWPart<bwp>:SLOT<sl>:
ALLocation<al>:RPoint on page 355
```

DMRS-Downlink

Turns the higher layer parameter "dmrs-downlink" on and off.

This parameter reduces the peak-to-average power ratio (PAPR) of the PDSCH DMRS as defined 3GPP, release 16. Using the low PAPR also results in a different calculation of the DMRS sequence.

Remote command:

```
CONFigure[:NR5G]:DL[:CC<cc>]:FRAME<fr>:BWPart<bwp>:SLOT<sl>:
ALLocation<al>:DMRS:RST on page 352
```

4.1.12.6 Enhanced PDSCH settings: PTRS

Access: "Overview" > "Signal Description" > "Radio Frame Config" > "PDSCH / PDCCH Config" > "Enhanced Settings" > "Phase-Tracking RS Config (PTRS)"

The phase tracking reference signal (PTRS) is a reference signal whose main purpose is to track the phase of the transmitter and the receiver. It thus helps to avoid phase errors which can disturb the signal transmission.

If you assign the PDSCH to [antenna ports](#) whose port number is higher than the maximum port that 3GPP allows for the PTRS, the PTRS settings become unavailable. For an overview of supported antenna ports, see 3GPP 38.211, table 6.4.1.2.2.1-1.

The remote commands required to configure the PTRS are described in [Chapter 6.9.15, "Enhanced PDSCH settings: PTRS"](#), on page 357.

Functions in the "PTRS" dialog box described elsewhere:

- "User ID" on page 120
- "VRB-to-PRB Interleaver" on page 120

[PTRS Configuration](#)..... 123

PTRS Configuration

The phase tracking reference signal (PTRS) is a UE-specific reference signal that is used to compensate for the phase noise of the oscillator. The PTRS is transmitted in resource blocks used for the PDSCH.

If the PTRS "State" is on, you can define its "Power" relative to the PDSCH and its location in the resource grid.

The "L_PTRS" defines distance between the PTRS in terms of OFDM symbols (transmission every 1, 2 or 4 OFDM symbols). If the subcarrier used by the PTRS also contains a DMRS, the distance can be larger.

The "K_PTRS" and "DL-PTRS-RE-Offset" define the location of the PTRS in the frequency domain. K_{PTRS} defines the distances between the PTRS in terms of subcarrier. You can also define an additional frequency offset for the PTRS relative to the first sub-carrier.

Remote command:

State: `CONFigure[:NR5G]:DL[:CC<cc>]:FRAME<fr>:BWPart<bwp>:SLOT<sl>:ALLocation<al>:PTRS[:STATe]` on page 359

Power: `CONFigure[:NR5G]:DL[:CC<cc>]:FRAME<fr>:BWPart<bwp>:SLOT<sl>:ALLocation<al>:PTRS:POWer` on page 358

L_{PTRS} : `CONFigure[:NR5G]:DL[:CC<cc>]:FRAME<fr>:BWPart<bwp>:SLOT<sl>:ALLocation<al>:PTRS:L` on page 358

K_{PTRS} : `CONFigure[:NR5G]:DL[:CC<cc>]:FRAME<fr>:BWPart<bwp>:SLOT<sl>:ALLocation<al>:PTRS:K` on page 357

Offset: `CONFigure[:NR5G]:DL[:CC<cc>]:FRAME<fr>:BWPart<bwp>:SLOT<sl>:ALLocation<al>:PTRS:REOffset` on page 359

4.1.12.7 Enhanced PDSCH settings: scrambling / coding

Access: "Overview" > "Signal Description" > "Radio Frame Config" > "PDSCH / PDCCH Config" > "Enhanced Settings" > "Scrambling / Coding"

The remote commands required to configure the channel coding and scrambling are described in [Chapter 6.9.16, "Enhanced PDSCH settings: scrambling / coding"](#), on page 360.

Functions in the "Scrambling / Coding" dialog box described elsewhere:

- "User ID" on page 120
- "VRB-to-PRB Interleaver" on page 120

Channel Coding	125
PDSCH Scrambling	125

Channel Coding

Channel coding parameters determine the code rate of the PDSCH, which is the ratio between transmitted bits and maximum possible bits in a subframe (or 1 ms transport block). Because the number of bits in a subframe is variable, the target code rate has to be derived from the modulation order in combination with an index I_{MCS} .

In addition, the target code rate depends on a transport block scaling factor S .

You can select the modulation order for the PDSCH (one of several tables, one for each modulation type) from the "MCS Table" dropdown menu and select the corresponding index value (defined in the tables) in the "I_MCS" input field. The target code rates for modulation order and index are defined in 3GPP 38.214, chapter 5.1.3.

The size of a transport block (TB) depends on the "TB Scaling Factor S ", which in turn affects the code rate. Transport blocks can continue over combined allocations if you turn on "TB Size Including Allocation Gaps". This is only available when you [combine PDSCH allocations](#).

In addition to the modulation order and I_{MCS} , the number of transmitted bits depends on the "Redundancy Version Index", which is used to re-transmit data in case of transmission errors. Depending on the redundancy version index, the PDSCH contains a different amount of parity bits for error detection: Index 0 adds 1 sequence of parity bits, index 1 adds two sequences of parity bits etc.

Because redundancy version 1 and 2 do not transmit a complete set of data (only new bits that have not been transmitted correctly before), it is not possible to decode such signals, even if the signal-to-noise ration is perfect. Only redundancy version 3 transmits a complete set of data, and can therefore be decoded without the knowledge of previous data.

Remote command:

Modulation order: `CONFigure[:NR5G]:DL[:CC<cc>]:FRAME<fr>:`

`BWPart<bwp>:SLOT<sl>:ALLocation<al>:CCODing:MCSTable` on page 361

MCS index: `CONFigure[:NR5G]:DL[:CC<cc>]:FRAME<fr>:BWPart<bwp>:`

`SLOT<sl>:ALLocation<al>:CCODing:IMCS` on page 360

Redundancy version: `CONFigure[:NR5G]:DL[:CC<cc>]:FRAME<fr>:`

`BWPart<bwp>:SLOT<sl>:ALLocation<al>:CCODing:RVIndex` on page 362

Scaling factor: `CONFigure[:NR5G]:DL[:CC<cc>]:FRAME<fr>:BWPart<bwp>:`

`SLOT<sl>:ALLocation<al>:CCODing:TBSFs` on page 362

TB size including allocation gaps: `CONFigure[:NR5G]:DL[:CC<cc>]:FRAME<fr>:`

`BWPart<bwp>:SLOT<sl>:ALLocation<al>:CCODing:TBSsize` on page 363

PDSCH Scrambling

3GPP (38.211) defines two methods by which the PDSCH scrambling can be calculated. You can select the method with the "Scrambling" parameter.

- "Data-Scrambling-ID"
Scrambles the PDSCH based on a pseudo-random seed value. You can define the seed value in the input field that becomes available when you select this method.
- "n_ID^Cell"
Scrambles the PDSCH based on the [cell ID](#), if the higher layers provide no value for "DMRS-Scrambling-ID". "n_ID^Cell" has the same value as the cell ID.

Remote command:

Method: `CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:ALLocation<al>:SCRambling` on page 363

Seed value: `CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:ALLocation<al>:SCRambling:DSID` on page 364

4.1.13 Advanced settings

Access: "Overview" > "Signal Description" > "Advanced Settings"

Advanced settings contain settings that are independent of the radio frame configuration.



Configuring component carriers

When you are doing measurements on [aggregated carriers](#), you can configure each carrier separately.

When available, each carrier in the dialog boxes is represented by an additional tab labeled "CC<x>", with <x> indicating the number of the component carrier.

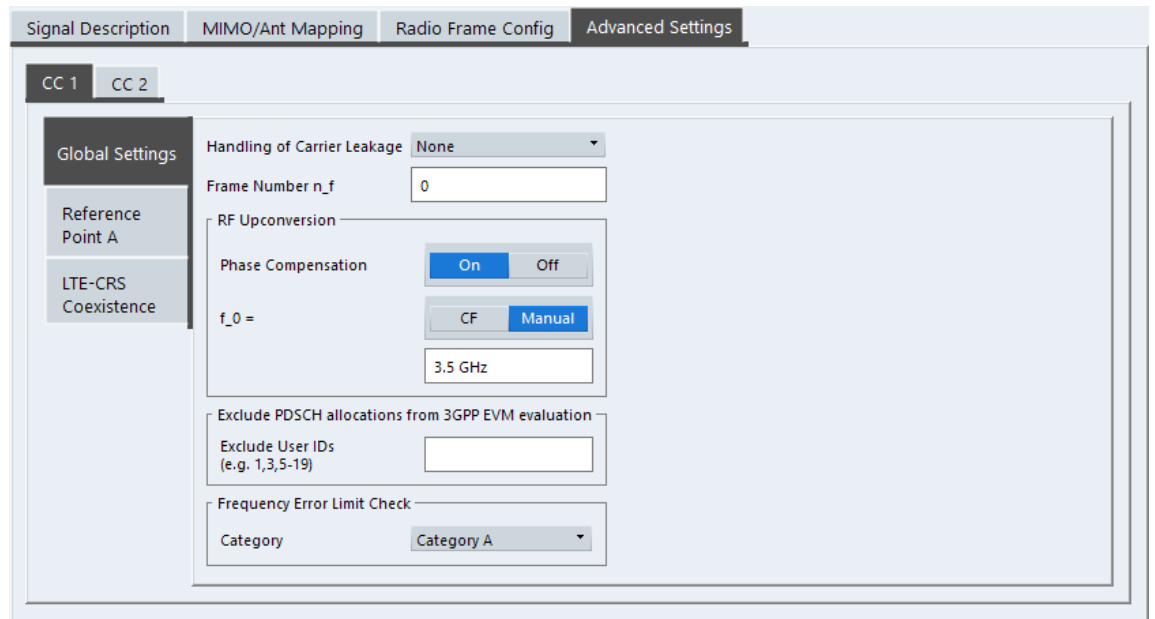
Note that the additional tabs are only added to the user interface after you have selected more than "1" component carrier.

- [Global settings](#)..... 126
- [Reference point A](#)..... 129
- [LTE-CRS coexistence](#)..... 131

4.1.13.1 Global settings

Access: "Overview" > "Signal Description" > "Advanced Settings" > "Global Settings"

The global settings contain various settings that have an effect on how the R&S VSE analyzes the signal.



The remote commands required to configure the global settings are described in [Chapter 6.9.19, "Advanced settings: global"](#), on page 367.

Handling of Carrier Leakage	127
Frame Number n_f	128
RF Upconversion	128
Exclude User IDs	128
Frequency Error Limit Check	128
Category	128
Shared Spectrum Channel Access	129
O-RAN Test Case	129

Handling of Carrier Leakage

Controls the way the DC carrier is handled during signal analysis.

You can either leave the DC carrier as it is, remove it from the analysis or compensate for carrier leakage effects.

Removing the DC carrier or compensating leakage effects is useful if the DC carrier is located on a subcarrier, which would have a negative effect on the EVM.

- If you leave the DC carrier as it is, the R&S VSE includes the DC carrier in all results.
- If you ignore the DC carrier, the R&S VSE removes the DC carrier from all results by ignoring the corresponding subcarriers. The DC carrier is assumed to be in the center of the channel bandwidth.
- If you compensate for carrier leakage, the R&S VSE includes the subcarriers used by the DC carrier in the result analysis, but compensates them mathematically.

Remote command:

[CONFigure\[:NR5G\]:DL\[:CC<cc>\]:IDC](#) on page 368

Frame Number n_f

Defines the system frame number n_f in the capture buffer. For multiple frame analysis it defines the system frame number of the first frame you are analyzing.

You can find out the system frame number in the [channel decoder results](#). The system frame number is useful for evaluation of periodic CSI-RS, for example.

Remote command:

`CONFigure[:NR5G]:DL[:CC<cc>]:FNNF` on page 368

RF Upconversion

It is necessary to upconvert the baseband signal to the radio frequency. The upconversion requires a frequency related phase compensation after each symbol according to 3GPP 38.211: 5.4 "Modulation and Upconversion".

When you turn off "Phase Compensation", the R&S VSE assumes that the applied signal is not phase-compensated and analyzes the signal accordingly.

When you turn on "Phase Compensation", the R&S VSE assumes that the applied signal is already phase-compensated for a specific frequency. This frequency is either the current center frequency ("CF") or an arbitrary frequency ("Manual"). You can define the frequency in the corresponding input field.

Remote command:

State: `CONFigure[:NR5G]:DL[:CC<cc>]:RFUC:STATE` on page 370

Mode: `CONFigure[:NR5G]:DL[:CC<cc>]:RFUC:FZERO:MODE` on page 369

Frequency: `CONFigure[:NR5G]:DL[:CC<cc>]:RFUC:FZERO:FREQUENCY` on page 369

Exclude User IDs

Defines certain [user IDs](#) that are excluded from the calculation of modulation-specific EVM results in the result summary.

You can define the numbers as a comma-separated list (1,2,6,7), a certain range with a dash (1-3), or a combination of both (1-3,5,6).

This is required by some test models defined in 38.141.

Remote command:

`CONFigure[:NR5G]:DL[:CC<cc>]:EUIDs` on page 368

Frequency Error Limit Check

Turns the frequency error limit check on and off.

When you turn on the frequency error limit check, the R&S VSE evaluates the limits of the frequency error and shows the results of the limit check in the [result summary](#).

Remote command:

`CONFigure[:NR5G]:FELC:STATE` on page 370

Category

Selects the base station category of the equipment you are testing (base station or user equipment).

The base station category has an effect on the limits of the [frequency error](#) and the [SEM](#) measurement.

You can select one of the following base station categories:

- Wide area base stations (category A and B)
- Local area base stations
- Medium range base stations

I/Q measurements: The base station category is relevant for the evaluation of the [frequency error](#).

SEM measurements only: For category B base stations, you can select the limit tables from the "Category B Options" dropdown menu.

Remote command:

Category: [\[SENSe:\]POWer:CATegory](#) on page 371

Category B options: [\[SENSe:\]POWer:CATegory:B](#) on page 414

Shared Spectrum Channel Access

Turns an increased number of available [SS/PBCH blocks](#) on and off.

The setting has an effect for FR1 deployments and [block patterns A and C](#).

Available with 3GPP release 16.

Unavailable for FR2-2 deployments.

Remote command:

[CONFigure\[:NR5G\]:DL\[:CC<cc>\]:SSCA](#) on page 370

O-RAN Test Case

Selects the O-RAN test case that the DSP uses for signal analysis.

Select "None" when you do not measure O-RAN signals.

See [Chapter 4.8, "O-RAN measurement guide"](#), on page 173 for more information about O-RAN measurements.

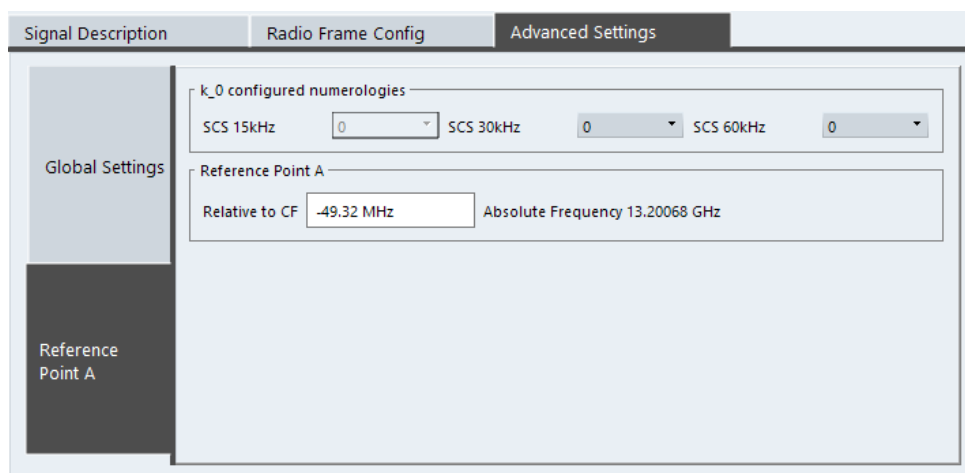
Remote command:

[CONFigure\[:NR5G\]:ORAN:TCASe](#) on page 370

4.1.13.2 Reference point A

Access: "Overview" > "Signal Description" > "Advanced Settings" > "Reference Point A"

Point A, as defined in 3GPP 38.211: 4.4.4.2 "Point A", is a reference point with a fixed frequency. The resource block grid for each subcarrier spacing is defined relative to the reference point A. It is aligned with the center of subcarrier 0 of common resource block 0, independent of the numerology.



The remote commands required to configure the reference point A are described in [Chapter 6.9.19, "Advanced settings: global"](#), on page 367.

k_0	130
Reference Point A	130

k_0

The `k_0` defines an additional (subcarrier) offset of the resource grid with a specific subcarrier spacing relative to the reference point A.

You can select the offset you require from the "SCS <x> kHz" dropdown menus. Note that the dropdown menus are only available if you are using a bandwidth part with the corresponding subcarrier spacing.

Remote command:

SCS 15 kHz: `CONFigure[:NR5G]:DL[:CC<cc>]:RPA:KZERO:SCFT` on page 372

SCS 30 kHz: `CONFigure[:NR5G]:DL[:CC<cc>]:RPA:KZERO:SCTT` on page 374

SCS 60 kHz: `CONFigure[:NR5G]:DL[:CC<cc>]:RPA:KZERO:SCST` on page 373

SCS 120 kHz: `CONFigure[:NR5G]:DL[:CC<cc>]:RPA:KZERO:SCOT` on page 373

SCS 480 kHz: `CONFigure[:NR5G]:DL[:CC<cc>]:RPA:KZERO:SCFE` on page 372

SCS 960 kHz: `CONFigure[:NR5G]:DL[:CC<cc>]:RPA:KZERO:SCNS` on page 372

Reference Point A

You can define the location of the reference point relative to the center frequency of the carrier with the "Relative to CF" parameter.

The value range is limited, depending on various parameters like [channel bandwidth](#) or used [subcarrier spacing](#). You can change it in steps of 12 times the largest subcarrier spacing.

The R&S VSE also displays absolute frequency location of the reference point A and its offset to the first subcarrier of the channel ("TxBW").

Remote command:

Center frequency: `CONFigure[:NR5G]:DL[:CC<cc>]:RPA:RTCF` on page 374

Absolute frequency: `CONFigure[:NR5G]:DL[:CC<cc>]:RPA:AFRequency?`
on page 371

TxBW: `CONFigure[:NR5G]:DL[:CC<cc>]:RPA:TBOFfset?` on page 374

4.1.13.3 LTE-CRS coexistence

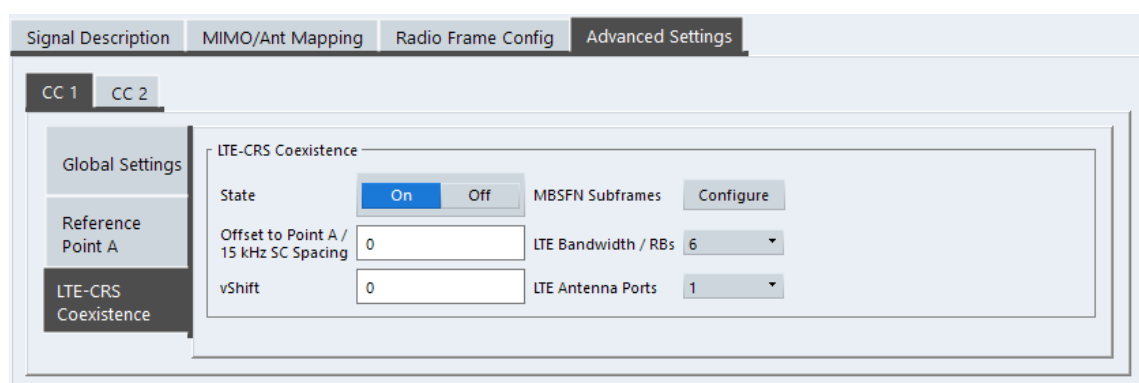
Access: "Overview" > "Signal Description" > "Advanced Settings" > "LTE-CRS Coexistence"

5G NR deployments that are compatible to LTE can share their resources with LTE transmissions, aka dynamic spectrum sharing.

If you deploy such a scenario, the 5G NR are rate matched around the LTE cell specific reference signal (CRS). The reason is that in LTE, the location of the CRS resource elements in the resource grid is fixed, and must not be allocated to the 5G NR allocations. To make sure that this is the case, 5G NR uses rate matching.

Dynamic spectrum sharing is meant for bandwidth parts with 15 kHz subcarrier spacings (the LTE subcarrier spacing). However, you can also measure signals whose 5G resources have different subcarrier spacings than LTE. If you do so, make sure to always turn on spectrum sharing in the 5G application, even if LTE and 5G resources do not overlap. Doing so increases the stability of the synchronization against interferences from the multi-numerology signal configuration.

Note that LTE CRS resources can overlap with the resources used by 5G DMRS symbols. In that case, the 5G DMRS symbols are shifted to a different position according to 38.211.



The remote commands required to configure the LTE coexistence are described in [Chapter 6.9.19, "Advanced settings: global"](#), on page 367.

State	131
MBSFN Subframes	132
Offset to Point A	132
LTE Bandwidth	132
vShift	132
LTE Antenna Ports	132

State

Turns the LTE-CRS coexistence on and off.

The setting is only available for certain 5G NR [signal characteristics](#).

Remote command:

`CONFigure[:NR5G]:DL[:CC<cc>]:LTE:STATE` on page 376

MBSFN Subframes

Opens a dialog box to define subframes that contain MBSFN resource elements. In MBSFN subframe, no LTE CRS are expected.

Remote command:

`CONFigure[:NR5G]:DL[:CC<cc>]:LTE:MBSFN:SUBFrame<sf>:STATE`
on page 375

Offset to Point A

Defines an offset of the LTE carrier in resource blocks relative to [reference point A](#).

The logic here is that an offset of 0 means that the center of the LTE carrier is exactly on the reference point A. This in turn means that one half of the LTE carrier is below the reference point A and parts below this point are not considered by the R&S VSE. Therefore you have to define an offset to reference point A that is at least half the bandwidth of the LTE carrier to align the LTE and 5G NR carriers.

Example:

The LTE carrier has a bandwidth of 5 MHz (or 25 resource blocks). 2.5 MHz of the carrier are above the reference point A (within the 5G NR resource grid), the other 2.5 MHz are below the reference point.

To analyze the complete LTE carrier, you have to define an offset of at least 13 resource blocks to analyze the complete LTE carrier.

Remote command:

`CONFigure[:NR5G]:DL[:CC<cc>]:LTE:POINTa` on page 376

LTE Bandwidth

Selects the bandwidth of the LTE carrier in number of resource blocks.

Channel bandwidth [MHz]	1.4	3	5	10	15	20
Number of resource blocks	6	15	25	50	75	100

Remote command:

`CONFigure[:NR5G]:DL[:CC<cc>]:LTE:CBW` on page 375

vShift

Defines the allocation of resource elements to the CRS.

"vShift" is a function of the cell ID and shifts the CRS patterns in LTE neighbor cells in the range of 0 to 5 subcarriers. The parameter thus prevents CRS pattern overlapping.

Remote command:

`CONFigure[:NR5G]:DL[:CC<cc>]:LTE:VShift` on page 377

LTE Antenna Ports

Selects the number of antenna ports in the LTE configuration. This affects the location of the LTE CRS within the frame.

Remote command:

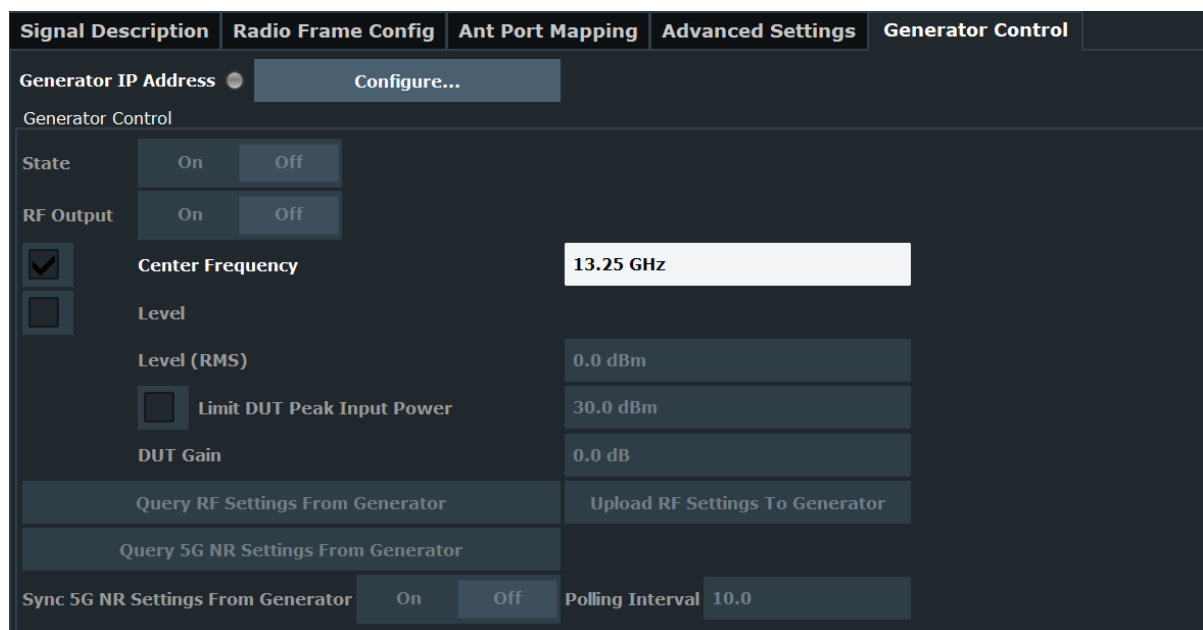
`CONFigure[:NR5G]:DL[:CC<cc>]:LTE:NAP` on page 376

4.1.14 Generator control

Access: "Overview" > "Signal Description" > "Generator Control"

Generator control settings provide an easy way to synchronize settings of the analyzer and a connected signal generator that is also equipped with the 5G NR application.

The generator settings become available after a successful connection to the generator.



The remote commands required to configure the generator control are described in [Chapter 6.9.22, "Generator control"](#), on page 377.

Generator IP Address	133
Generator Control State	134
RF Output State	134
Center Frequency	134
Level Control State	134
L Level (RMS)	135
L Limit DUT Peak Input Power	135
L DUT Gain	135
Upload RF Settings to Generator	135
Query Settings from Generator	135
Periodic synchronization of 5G NR settings	136

Generator IP Address

Opens a dialog box to configure the network properties of the signal generator.

You can connect to the generator either by entering its IP address ("123" button), or its computer name ("ABC" button).

If you are not sure about the IP address or computer name of your generator, check its user interface or kindly ask your IT administrator to provide them.

After you have entered IP address or computer name, use "Connect" to establish the connection. The R&S VSE shows if the connection state, and, if the connection was successful, the connected generator type.

Remote command:

Define IP address: [CONFigure:GENerator:IPConnection:ADDRESS](#) on page 378

Query connection state: [CONFigure:GENerator:IPConnection:LEDState?](#) on page 378

Generator Control State

Activates or disables control of the signal generator by the R&S VSE.

If a connection was defined in another measurement channel, the connection is maintained when you switch to the 5G NR measurement application. However, generator control is disabled to protect the DUT from possibly erroneous or damaging settings. Check the settings, then enable the control state.

Note: While generator control is active, you cannot change the connection information. Only one channel can control a generator at any time. If you switch on generator control while it is still active in another channel, for example for parameter coupling with a generator, the control is disabled in the other channel.

Remote command:

[CONFigure:GENerator:CONTROL\[:STATE\]](#) on page 383

RF Output State

To protect the instrument from possibly erroneous or damaging settings, you must manually activate the RF output on the signal generator to start providing a signal. Check all settings on the signal generator, in particular the level settings, before activating the RF output.

A red LED on the "Generator Control" tab indicates a setting error on the generator.

Remote command:

[CONFigure:GENerator:RFOutput\[:STATE\]](#) on page 382

Center Frequency

Turns frequency synchronization on and off.

If you change the frequency on the analyzer, the generator automatically adjusts its [frequency](#).

Remote command:

Synchronization state: [CONFigure:GENerator:FREQUENCY:CENTer:SYNC\[:STATE\]](#) on page 378

Center frequency: [\[SENSe:\]FREQUENCY:CENTer\[:CC<cc>\]](#) on page 388

Level Control State

If enabled, the R&S VSE automatically controls the signal level provided by the signal generator as input to the R&S VSE. Initially, the [Level \(RMS\)](#) value is applied. Note that the reference level on the R&S VSE is also affected by the signal level:

$\text{Ref_level}_{\text{Analyzer}} = \langle \text{Peak envelope power DUT} \rangle + \text{DUT Gain}$

Where the current peak envelope power (PEP) value of the DUT is determined from the generator.

To protect the signal generator from possibly excess power levels, the level setting control is disabled by default.

Remote command:

[CONFigure:GENerator:POWer:LEVel:STATe](#) on page 379

Level (RMS) ← Level Control State

(Default:) The specified power level is used for the output power by the connected signal generator.

Remote command:

[CONFigure:GENerator:POWer:LEVel](#) on page 380

Limit DUT Peak Input Power ← Level Control State

If enabled, the generator does not exceed the maximum input power (peak envelope power, "PEP") that is currently allowed by the DUT and that is specified on the generator. The defined "PEP" value is indicated.

Remote command:

State: [CONFigure:GENerator:LEVel:DUTLimit:STATe](#) on page 380

Limit: [CONFigure:GENerator:LEVel:DUTLimit](#) on page 379

DUT Gain ← Level Control State

The R&S VSE considers a gain due to the DUT when determining the reference level.

During the reference calibration measurement, in which the DUT is removed from the signal path, the generator level is also adjusted according to the DUT gain value.

Remote command:

[CONFigure:GENerator:LEVel:DUTGain](#) on page 379

Upload RF Settings to Generator

Uploads the RF settings available in this dialog to the generator.

Useful when you change the level or frequency on the generator itself. In that case, those settings remain the same on the R&S VSE. To restore the original settings defined within the R&S VSE, use that button to restore the generator settings.

Remote command:

[CONFigure:GENerator:SETTings:UPDate:RF](#) on page 383

Query Settings from Generator

Downloads the generator settings to the R&S VSE. You can synchronize both, basic RF settings and 5G NR settings.

RF settings include the [frequency](#) and the [level](#) settings.

5G NR settings include the complete signal description.

Remote command:

RF settings: [CONFigure:SETTings:RF](#) on page 382

NR settings: [CONFigure:SETTings:NR5G](#) on page 381

Periodic synchronization of 5G NR settings

Instead of downloading the 5G NR settings from the generator once, you can synchronize the settings on a periodic basis. This synchronization makes sure that the analyzer always has the same signal description as the generator.

"Sync 5G NR Settings from Generator" turns the periodic synchronization of the settings on and off. The "Polling Interval" defines how often the synchronization takes place (in seconds).

Polling automatically stops when you change a parameter in the signal description on the analyzer.

Note that this only applies to the 5G NR settings, not the RF settings.

Remote command:

State: [CONFigure:SETTings:NR5G:SYNC](#) on page 382

Interval: [CONFigure:SETTings:NR5G:PINTerval](#) on page 381

4.1.15 Selecting the input and output source

The application supports several input sources and outputs.

The supported input sources depend on the connected instrument. Refer to the documentation of the instrument in use for a comprehensive description of input sources.

- [RF input](#).....136
- [I/Q file input](#).....138

4.1.15.1 RF input

Functions to configure the RF input described elsewhere:

- ["Input Coupling"](#) on page 144
- ["Impedance"](#) on page 144

Note that the actual functions to configure the RF input depend on the configuration of the connected instrument.

High Pass Filter 1 to 3 GHz	136
YIG-Preselector	137
Capture Mode	137
Oscilloscope Sample Rate	137

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 384

YIG-Preselector

Enables or disables the YIG-preselector.

This setting requires an additional option on the connected instrument.

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 385

Capture Mode

Determines how data from an oscilloscope is input to the R&S VSE software.

This function is only available for a connected R&S oscilloscope with a firmware version 3.0.1.1 or higher (for other versions and instruments the input is always I/Q data).

"I/Q"	<p>The measured waveform is converted to I/Q data directly on the R&S oscilloscope (requires option K11), and input to the R&S VSE software as I/Q data.</p> <p>For data imports with small bandwidths, importing data in this format is quicker. However, the maximum record length is restricted by the R&S oscilloscope. (Memory options on the R&S oscilloscope are not available for I/Q data.)</p>
"Waveform"	<p>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.</p> <p>For data imports with large bandwidths, this format is more convenient as it allows for longer record lengths if appropriate memory options are available on the R&S oscilloscope.</p>
"Auto"	<p>Uses "I/Q" mode when possible, and "Waveform" only when required by the application (e.g. Pulse measurement, oscilloscope baseband input).</p>

Remote command:

[INPut<ip>:RF:CAPMode](#) on page 386

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"	<p>Default for waveform Capture Mode (not available for I/Q Capture Mode); provides maximum record length</p>
----------	---

"20 GHz"	<p>Achieves a higher decimation gain, but reduces the record length by half.</p> <p>Only available for R&S oscilloscope models that support a sample rate of 20 GHz (see data sheet).</p> <p>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</p>
"40 GHz"	<p>Provides a maximum sample rate.</p> <p>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)</p>

Remote command:

Input source R&S FSW via oscilloscope:

[SYSTem:COMMunicate:RDEvice:OSCilloscope:SRATe](#) on page 388

Input source oscilloscope waveform mode:

[INPut<ip>:RF:CAPMode:WAVEform:SRATe](#) on page 387

Input source oscilloscope I/Q mode:

[INPut<ip>:RF:CAPMode:IQ:SRATe](#) on page 386

4.1.15.2 I/Q file input

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



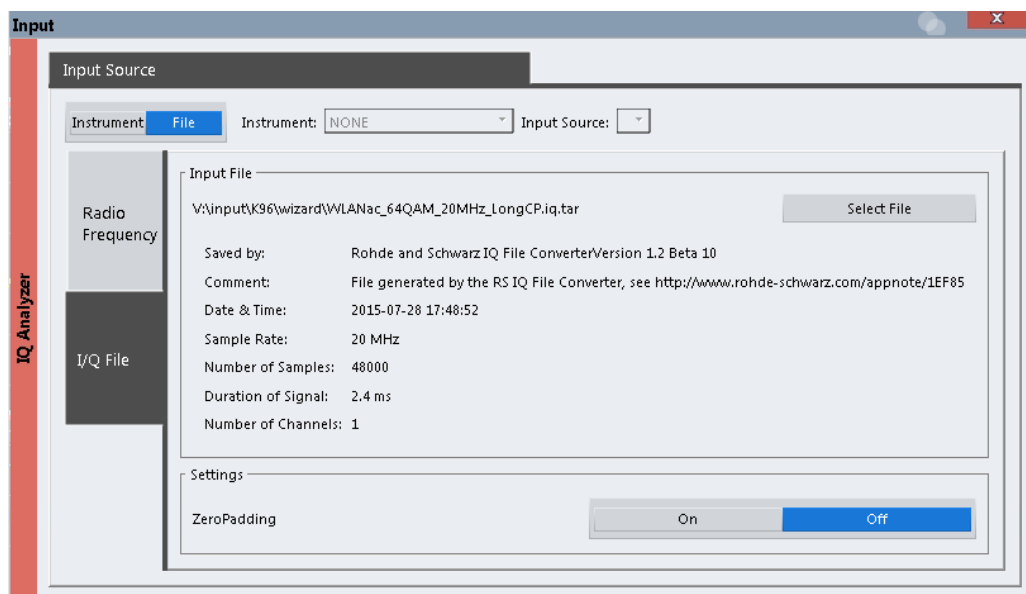
Loading a file via drag&drop

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.



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 5G NR measurement application also supports frequency response correction using Touchstone (.snp) files or .fres files.



Encrypted .wav 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)	139
Input File	139
Zero Padding	140

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 387

[INPut:SElect](#) on page 385

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.

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 384

4.1.16 Frequency configuration

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

Frequency settings define the frequency characteristics of the signal at the RF input. They are part of the "Frequency" tab of the "Signal Characteristics" dialog box.

The remote commands required to configure the frequency are described in [Chapter 6.9.24, "Frequency configuration"](#), on page 388.

Signal Frequency.....	140
L Center Frequency.....	140
L Frequency Stepsize.....	141

Signal Frequency

For measurements with an RF input source, you have to match the **center frequency** of the analyzer to the frequency of the signal.

Center Frequency ← Signal Frequency

Defines the center frequency of the signal and thus the frequency the R&S VSE tunes to.

The frequency range depends on the hardware configuration of the analyzer you are using.

Remote command:

Center frequency: `[SENSe:] FREQuency:CENTer[:CC<cc>]` on page 388

Frequency offset: `[SENSe:] FREQuency:CENTer[:CC<cc>]:OFFSet` on page 389

Frequency Stepsize ← Signal Frequency

In addition to the frequency itself, you can also define a frequency stepsize. The frequency stepsize defines the extent of a frequency change if you change it, for example with the rotary knob.

You can define the stepsize in two ways.

- = Center
One frequency step corresponds to the current center frequency.
- Manual
Define any stepsize you need.

Remote command:

Frequency stepsize: `[SENSe:] FREQuency:CENTer:STEP` on page 389

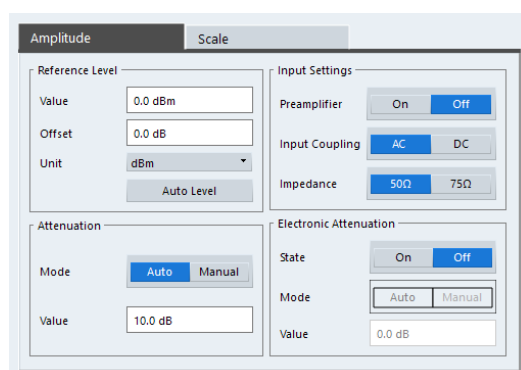
4.1.17 Amplitude configuration

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

Amplitude settings define the expected level characteristics of the signal at the RF input.

Level characteristics are available when you capture data with an instrument. In addition, the functions that are available depend on the configuration of the connected instrument.

For measurements with several instruments (for example MIMO measurements), select the instrument you want to configure from the "Input Source" dropdown menu.



The remote commands required to configure the amplitude are described in [Chapter 6.9.25, "Amplitude configuration"](#), on page 390.

Reference Level.....	142
L Auto Level.....	142
L Reference Level Offset.....	142
Attenuating the Signal.....	143
L RF Attenuation.....	143
L Electronic Attenuation.....	143

Preamplifier.....	143
Input Coupling.....	144
Impedance.....	144

Reference Level

The reference level is the power level the analyzer expects at the RF input. Keep in mind that the power level at the RF input is the peak envelope power for signals with a high crest factor like 5G NR.

To get the best dynamic range, you have to set the reference level as low as possible. At the same time, make sure that the maximum signal level does not exceed the reference level. If it does, it will overload the A/D converter, regardless of the signal power. Measurement results can deteriorate (e.g. EVM), especially for measurements with more than one active channel near the one you are trying to measure (± 6 MHz).

Note that the signal level at the A/D converter can be stronger than the level the application displays, depending on the current resolution bandwidth. This is because the resolution bandwidths are implemented digitally after the A/D converter.

The reference level is a value in dBm.

Remote command:

Reference level: `DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALE]:RLEVel<ant>` on page 390

Auto Level ← Reference Level

Automatically determines the ideal reference level. The automatic leveling process measures the signal and defines the ideal reference signal for the measured signal.

Automatic level detection also optimizes RF attenuation.

Auto leveling slightly increases the measurement time, because of the extra leveling measurement prior to each sweep. By default, the R&S VSE automatically defines the time for auto leveling, but you can also define it manually (`[Auto Set] > "Auto Level Config" > "Meas Time"`).

Remote command:

Automatic: `[SENSe:]ADJust:LEVel` on page 274

Auto level mode: `[SENSe<ip>:]ADJust:CONFigure:LEVel:DURation:MODE` on page 273

Auto level time: `[SENSe<ip>:]ADJust:CONFigure:LEVel:DURation` on page 273

Reference Level Offset ← Reference Level

The reference level offset is an arithmetic level offset. A level offset is useful if the signal is attenuated or amplified before it is fed into the analyzer. All displayed power level results are shifted by this value. Note however, that the reference value ignores the level offset. Thus, it is still mandatory to define the actual power level that the analyzer has to handle as the reference level.

Remote command:

`DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALE]:RLEVel<ant>:OFFSet` on page 390

Attenuating the Signal

Attenuation of the signal becomes necessary if you have to reduce the power of the signal that you have applied. Power reduction is necessary, for example, to prevent an overload of the input mixer.

For a comprehensive information about signal attenuation, refer to the user manual of the R&S VSE.

The 5G NR measurement application provides several attenuation modes.

RF Attenuation ← Attenuating the Signal

Controls the RF (or mechanical) attenuator at the RF input.

If you select automatic signal attenuation, the attenuation level is coupled to the reference level.

If you select manual signal attenuation, you can define an arbitrary attenuation (within the supported value range).

Positive values correspond to signal attenuation and negative values correspond to signal gain.

Remote command:

State: `INPut<ip>:ATTenuation<ant>:AUTO` on page 391

Level: `INPut<ip>:ATTenuation<ant>` on page 391

Electronic Attenuation ← Attenuating the Signal

Controls the optional electronic attenuator.

If you select automatic signal attenuation, the attenuation level is coupled to the reference level.

If you select manual signal attenuation, you can define an arbitrary attenuation (within the supported value range).

Positive values correspond to signal attenuation and negative values correspond to signal gain.

Note that the frequency range must not exceed the specification of the electronic attenuator for it to work.

Remote command:

Electronic attenuation: `INPut<ip>:EATT<ant>:STATE` on page 394

Electronic attenuation: `INPut<ip>:EATT<ant>:AUTO` on page 394

Electronic attenuation: `INPut<ip>:EATT<ant>` on page 393

Preamplifier

If the (optional) internal preamplifier hardware is installed on the connected instrument, a preamplifier can be activated for the RF input signal.

You can use a preamplifier to analyze signals from DUTs with low output power.

Note: If an optional external preamplifier is activated, the internal preamplifier is automatically disabled, and vice versa.

For an active external frontend, a preamplifier is not available.

"Off" Deactivates the preamplifier.

"15 dB" The RF input signal is amplified by about 15 dB.

"30 dB" The RF input signal is amplified by about 30 dB.

Depending on the connected instrument, different settings are available. See the instrument's documentation for details.

Remote command:

[INPut<ip>:GAIN<ant>:STATe](#) on page 392

[INPut<ip>:GAIN<ant>\[:VALue\]](#) on page 392

Input Coupling

The RF input of the R&S VSE can be coupled by alternating current (AC) or direct current (DC).

The RF input of the connected instrument can be coupled by alternating current (AC) or direct current (DC).

For an active external frontend, input coupling is always DC.

Not available for input from the optional "Analog Baseband" interface.

AC coupling blocks any DC voltage from the input signal. AC coupling is activated by default to prevent damage to the instrument. Very low frequencies in the input signal can be distorted.

However, some specifications require DC coupling. In this case, you must protect the instrument from damaging DC input voltages manually. For details, refer to the data sheet.

Remote command:

[INPut<ip>:COUPling<ant>](#) on page 392

Impedance

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

For an active external frontend, impedance is always 50 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 25 Ω in series to the input impedance of the instrument.) The correction value in this case is 1.76 dB = 10 log (75 Ω /50 Ω).

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 393

4.1.18 Trigger configuration

Access: "Overview" > "Trig / Sig Capture" > "Trigger"

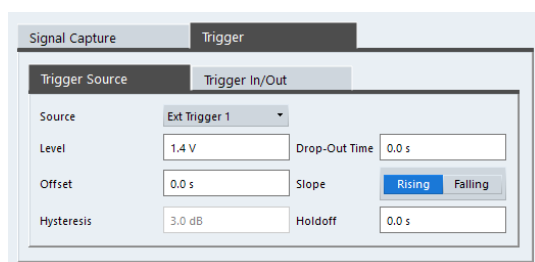
A trigger allows you to capture those parts of the signal that you are really interested in.

While the application runs freely and analyzes all signal data in its default state, no matter if the signal contains information or not, a trigger initiates a measurement only under certain circumstances (the trigger event).

Except for the available trigger sources, the functionality is the same as that of the R&S VSE base system.

For MIMO measurements, you can also use the R&S FS-Z11 to trigger more than one instrument. For a comprehensive description of this device, refer to its user manual.

For a comprehensive description of the available trigger settings not described here, refer to the documentation of the connected instrument.



Trigger Source.....145

Trigger Source

The application supports several trigger modes or sources.

- **Free Run**
Starts the measurement immediately and measures continuously. When you analyze a signal from an [I/Q file](#), then the trigger source is always to "Free Run".
- **External <x>**
The trigger event is the level of an external trigger signal. The measurement starts when this signal meets or exceeds a specified trigger level at the trigger input. Some measurement devices have several trigger ports. When you use one of these, several external trigger sources are available.
- **I/Q Power**
The trigger event is the magnitude of the sampled I/Q data. The measurement starts when the magnitude of the I/Q data meets or exceeds the trigger level.
- **IF Power**
The trigger event is the level of the intermediate frequency (IF). The measurement starts when the level of the IF meets or exceeds the trigger level.
- **RF Power**
The trigger event is the level measured at the RF input. The measurement starts when the level of the signal meets or exceeds the trigger level.
- **Time**
The trigger event is a certain time interval (every <x> seconds).

For all trigger sources, except "Free Run", you can define several trigger characteristics.

For measurements with more than one instrument, you have to configure each instrument individually in the "Source <x>" tabs.

- The trigger "Port" selects the connector acting as the trigger input on the input source. The number of available trigger ports depends on the connected instrument.
- The trigger "Level" defines the signal level that initiates the measurement.

- The trigger "Repetition Interval" defines the time interval that initiates a measurement for the time trigger.
- The trigger "Offset" is the time that must pass between the trigger event and the start of the measurement. This can be a negative value (a pretrigger).
- The trigger "Drop-out Time" defines the time the input signal must stay below the trigger level before triggering again.
- The trigger "Slope" defines whether triggering occurs when the signal rises to the trigger level or falls down to it.
- The trigger "Holdoff" defines a time period that must at least pass between one trigger event and the next.
- The trigger "Hysteresis" is available for the IF power trigger. It defines a distance to the trigger level that the input signal must stay below to fulfill the trigger condition.

For a detailed description of the trigger parameters, see the user manual of the I/Q analyzer.

Remote command:

Source: `TRIGger[:SEquence]:SOURce<ant>` on page 403

Trigger port: `TRIGger[:SEquence]:PORT<ant>` on page 402

Level (external): `TRIGger[:SEquence]:LEVel<ant>[:EXTernal<tp>]` on page 399

Level (I/Q power): `TRIGger[:SEquence]:LEVel<ant>:IQPower` on page 400

Level (IF power): `TRIGger[:SEquence]:LEVel<ant>:IFPower` on page 400

Level (RF power): `TRIGger[:SEquence]:LEVel<ant>:RFPower` on page 401

Offset: `TRIGger[:SEquence]:HOLDoff<ant>[:TIME]` on page 398

Hysteresis: `TRIGger[:SEquence]:IFPower:HYSteresis` on page 399

Drop-out time: `TRIGger[:SEquence]:DTIME` on page 398

Slope: `TRIGger[:SEquence]:SLOPe` on page 402

Holdoff: `TRIGger[:SEquence]:IFPower:HOLDoff` on page 399

4.1.19 Data capture

Access: "Overview" > "Trigger / Signal Capture" > "Signal Capture"

The data capture settings contain settings that control various aspects of the data capture.

The screenshot shows the 'Signal Capture' configuration window. It is divided into two main sections: 'Common Settings' and 'Frame / Subframe Count'.
 In the 'Common Settings' section:
 - 'Sample Rate' is set to 7.68 MHz.
 - 'Capture Time' is set to 20.097 ms.
 - 'Long Capture' is set to Off.
 - 'Swap I/Q' is set to On.
 In the 'Frame / Subframe Count' section:
 - 'Overall Frame Count' is set to On.
 - 'Set Number of Frames to Analyze' is set to Manually.
 - 'Number of Frames to Analyze' is set to 1.
 - 'Max Number of Slots per Frame to Analyze' is set to All.

The "Maximum Number of Subframes per Frame to Analyze" setting available in older firmware versions is no longer supported.

The remote commands required to configure the data capture are described in [Chapter 6.9.26, "Data capture"](#), on page 394.

Capture Time.....	147
Long Capture.....	148
Swap I/Q.....	148
Overall Frame Count.....	148
Auto According to Standard.....	148
Number of Frames to Analyze.....	149
Maximum Number of Slots per Frame to Analyze.....	149
Signal Repeats Max No of Slots to Analyze.....	149

Capture Time

The "Capture Time" corresponds to the time of one measurement. Therefore, it defines the amount of data the application captures during a single measurement (or sweep).

By default, the application captures 20.1 ms of data to make sure that at least one complete 5G NR frame is captured in the measurement.

The maximum capture time is limited when you are only [measuring slots repeatedly](#).

For measurements in FR2-2, you can let the R&S VSE determine the capture time automatically or enter the capture time manually. For an automatic capture time, the R&S VSE makes the capture as small as possible but also makes sure that the first 80 slots are captured in one piece according to 3GPP specifications. If you are measuring a signals with different subcarrier spacings, the capture time is based on the smallest subcarrier spacing.

Remote command:

[SENSe:] SWEep:TIME on page 397

Capture mode (FR2-2): [SENSe:] SWEep:CTMode on page 396

Long Capture

Turns a limitation of the [capture time](#) on and off.

When you turn off the long capture, the capture time is limited to 50.1 ms (maximum of 5 frames).

To capture more frames, turn on the long capture. The long capture allows you to capture data up to 1 s. However, the long capture has the following limitations.

- The long capture captures several frames, but analyzes only one. The analyzed frame is indicated by a horizontal green bar in the capture buffer. The analyzed frame depends on your [selection](#).
- Multiple frame configurations are not possible, because every frame must have the same configuration.
- The frame count settings (overall frame count etc.) are unavailable.
- Averaging results over several frames is not supported. Therefore, the R&S VSE does not evaluate EVM limits for long captures.
- Component carrier measurements are not supported.
- Measurements in FR2-2 are not supported.

Remote command:

[\[SENSe:\] SWEEp:LCAPture](#) on page 397

Swap I/Q

Swaps the real (I branch) and the imaginary (Q branch) parts of the signal.

Remote command:

[\[SENSe:\] SWAPiq](#) on page 396

Overall Frame Count

The "Overall Frame Count" turns the manual selection of the number of frames to capture (and analyze) on and off.

When you turn on the overall frame count, you can define the [number of frames to capture and analyze](#). The measurement runs until all frames have been analyzed, even if it takes more than one capture.

When you turn off the overall frame count, the application analyzes all 5G NR frames found in one capture buffer.

For more information about the effects on the results of capturing more frames than fit in the capture buffer, see [Chapter 4.1.8, "Radio frame configuration"](#), on page 78.

Remote command:

[\[SENSe:\] NR5G:FRAMe:COUNt:STATe](#) on page 395

Auto According to Standard

Turns automatic selection of the number of frames to capture and analyze on and off.

When you turn on this feature, the R&S VSE captures and evaluates a number of frames the 3GPP standard specifies for EVM tests.

If you want to analyze an arbitrary number of frames, turn off the feature.

This parameter is not available when the overall frame count is inactive.

Remote command:

[\[SENSe:\] NR5G:FRAMe:COUNt:AUTO](#) on page 395

Number of Frames to Analyze

Defines the number of frames you want to capture and analyze.

If the number of frames you have set last longer than a [single measurement](#), the application continues the measurement until all frames have been captured.

The parameter is read only in the following cases:

- If you turn off the [overall frame count](#).
- If you capture the data [according to the standard](#).

Remote command:

[\[SENSe:\]NR5G:FRAMe:COUNT](#) on page 395

On / off power measurements: [CONFigure\[:NR5G\]:OOPower:NFRames](#) on page 412

Maximum Number of Slots per Frame to Analyze

Selects the number of slots that the application analyzes.

You can select to analyze "All" slots, or a certain number of slots - select the number from the dropdown menu and enter the number of slots to analyze. The maximum number of slots you can analyze depends on the subcarrier spacing.

If you select a certain number of slots, the R&S VSE analyzes the first <x> slots in a frame. By default, the R&S VSE analyzes 80 slots to comply with 3GPP specifications.

Reducing the number of slots to analyze improves measurement speed.

Remote command:

[\[SENSe:\]NR5G:FRAMe:SLOT](#) on page 396

Signal Repeats Max No of Slots to Analyze

Turns analysis of custom signals with repeating slots on and off.

You can use this setting to measure custom (shortened) signals that only contain a few slots per frame. This setting is useful to achieve a high measurement and analysis speed without trigger availability. Multiple frame analysis tailored to the custom signal is also possible.

Example:

Slot 0 | Slot 0 | Slot 0 etc.

Slot 0 | Slot 1 | Slot 0 | Slot 1 etc.

Note that the slot sequence must start with slot number 0.

Measuring such signals is not possible with the standard signal capture settings without a trigger.

Instead, configure the R&S VSE like this.

- Reduce the capture time based on the number of slots in the repeated signal and the subcarrier spacing. Make sure that the slot sequence is contained at least once in the capture buffer.

For example to measure 3 slots with a subcarrier spacing of 30 kHz (length of one slot = 500 μ s), reduce the capture time to 3.1 ms.

Capturing repeating slots limits the maximum allowed capture time based on the maximum number of slots you are capturing.

- Select a maximum number of slots to analyze that matches the number of slots in your signal.
For example: if you have a sequence of three slots being repeated in your signal, select 3 slots to analyze.
- Turn on the "Signal Repeats Max No of Slots to Analyze" setting.

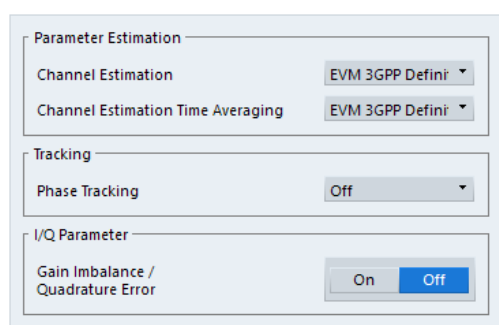
Remote command:

[SENSE:]NR5G:FRAME:SRSLot on page 396

4.1.20 Tracking

Access: "Overview" > "Tracking"

Tracking settings contain settings that compensate various errors.



The remote commands required to configure error tracking are described in [Chapter 6.9.28, "Tracking"](#), on page 404.

Channel Estimation	150
Channel Estimation Time Averaging	151
Phase	151
Time Tracking	152
Level Tracking	152
Gain Imbalance / Quadrature Error	152
Throughput Measurement State	152

Channel Estimation

Selects the channel estimation method.

"EVM 3GPP definition"	Estimates the channel according to 3GPP (38.141-1 / -2, annex H.6). Recommended for standard conform measurements.
"Pilot Only (Linear Interpolation)"	Calculates the equalizer coefficients on all available reference signal subcarriers. All missing subcarriers are interpolated (linear interpolation). Uses the selected time averaging . This estimation method is more prone to noise, because it does not apply a frequency domain moving average. However, the estimation can adapt to the individual subcarrier.

"Pilot And Payload"	<p>Calculates equalizer coefficients on all available resource elements of the reference signal and the payload.</p> <p>This implies that payload symbols could have been demodulated without wrong symbol decisions. If this is not the case, the reference signal generated from the payload is wrong and the calculated equalizer is not ideal.</p> <p>Uses the selected time averaging.</p> <p>This estimation method improves the equalizer estimate, because more subcarriers and symbols are used. This is beneficial for noisy signals (low SNR). Further subcarriers without pilots are taken into account</p>
"Off"	<p>Turns off channel estimation.</p> <p>Turning off channel estimation is useful if you want to see the impact of the channel frequency response on the signal quality (EVM).</p>

Remote command:

[\[SENSe:\]NR5G:DEMod:CESTimation](#) on page 404

Channel Estimation Time Averaging

Select the averaging time interval for channel estimation.

"EVM 3GPP Definition"	<p>Averages equalizer coefficients of DMRS across all symbols according to 38.141-1 / -2, annex H.6.</p> <p>Recommended for standard conform measurements.</p>
"Per Allocation"	<p>Averages equalizer coefficients across one allocation only. Equalizer coefficients between allocations are independent. An allocation is for example a single PDSCH.</p> <p>Because this method does no time averaging, this option is more prone to noise. However, the estimation can adapt better to the individual allocation.</p>

Remote command:

[\[SENSe:\]NR5G:DEMod:CETaverage](#) on page 404

Phase

Turns phase tracking on and off.

Phase tracking aims to remove random phase fluctuations between OFDM symbols. The phases of all pilot subcarriers are estimated and averaged per symbol.

When you turn on phase tracking, the application removes the phase difference between consecutive symbols.

"Off"	<p>Phase tracking is not applied.</p> <p>Allows you to evaluate the impact of phase noise and phase drifts on the signal quality.</p>
"Pilot Only"	<p>Uses the reference signal (PTRS) for phase tracking. Symbols without PTRS are interpolated (linear interpolation).</p>
"Pilot and Payload"	<p>Uses available reference signals (PTRS) and the payload resource elements for phase tracking.</p> <p>Allows you to improve tracking results (a better immunity to noise), because of the analysis of the payload. This method does not interpolate symbols without reference signals.</p>

"EVM 3GPP Definition" Estimation according to the 3GPP definition in 38.141-2, L.6. FR2 uses the PTRS for phase tracking. FR1 does not use phase tracking.
Recommended for standard conform measurements.

Remote command:

[\[SENSe:\]NR5G:TRACking:PHASe](#) on page 405

Time Tracking

Turns time tracking on and off.

Clock deviations (slower or faster sampling time) lead to a drift of the ideal sampling instant over time, causing a rotating constellation diagram.

When you turn on time tracking, the application compensates measurement results for timing errors on a slot level.

Remote command:

[\[SENSe:\]NR5G:TRACking:TIME](#) on page 405

Level Tracking

Turns level tracking on and off.

Gain variations over time, caused for example by temperature drifts in power amplifiers, impact signal quality.

When you turn on level tracking, the R&S VSE corrects a gain value that is constant across frequency on symbol level.

Remote command:

[\[SENSe:\]NR5G:TRACking:LEVel](#) on page 405

Gain Imbalance / Quadrature Error

Turns the calculation of the I/Q gain imbalance and the quadrature error ([result summary](#)) on and off.

Remote command:

[\[SENSe:\]NR5G:IQ:GIQE](#) on page 404

Throughput Measurement State

Turns the throughput and block error rate measurement on and off.

The results of these measurements are displayed in the [result summary](#).

If you turn on the throughput measurement, selecting a [number of frames to analyze](#) according to standard is not supported. If that setting was active when you turn on the throughput measurement, it is automatically set to manual number of frames to analyze.

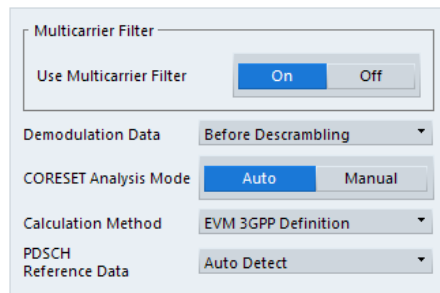
Remote command:

[\[SENSe:\]NR5G:TRACking:TPUT:STATe](#) on page 406

4.1.21 Demodulation

Access: "Overview" > "Demodulation"

Demodulation settings contain settings that describe signal processing and the way the signal is measured.



The remote commands required to configure the demodulation are described in [Chapter 6.9.29, "Demodulation"](#), on page 406.

Filter	153
Demodulation Data	153
CORESET Analysis Mode	154
EVM Calculation Method	154
Symbol Time Adjustment	154
PDSCH Reference Data	155
CORESET Reference Data	155
Extended Frequency Lock Range	156

Filter

Selects the filter to suppress interference of neighboring carriers.

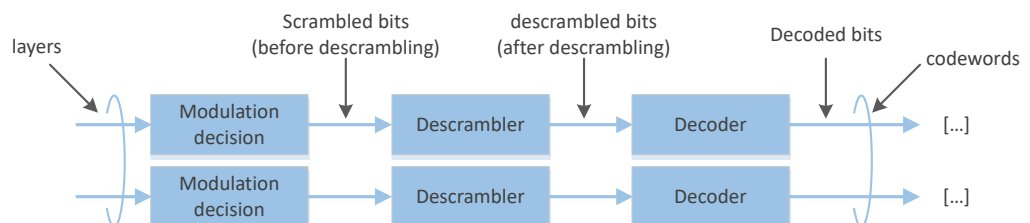
"None"	No suppression of neighboring channels.
"Multicarrier Filter"	Suppresses interference for tests on multiradio base stations (LTE, WCDMA, GSM etc.). The R&S VSE automatically selects the multicarrier filter when you analyze more than 1 component carrier .
"Per BWP"	Suppresses interference for tests on multi BWP signals.

Remote command:

`[SENSe:]NR5G:DEMod:FILTer` on page 408

Demodulation Data

For the [bitstream](#) results, you can get the data at various points in the signal processing chain.



For measurements based on [O-RAN test cases](#), the R&S VSE automatically selects the appropriate setting for the selected test case.

- "Before Descrambling" Demodulates the scrambled data.
- "After Descrambling" Demodulates the descrambled data.
- "Decoded Payload Data" Demodulates the descrambled and decoded PDSCH data.

Remote command:

[\[SENSe:\]NR5G:DEMod:DDATa](#) on page 408

CORESET Analysis Mode

Selects the way the R&S VSE demodulates the PDCCH.

- "Auto" The R&S VSE automatically demodulates the PDCCH by detecting the payload of the CORESET DMRS.
- "Manual" The R&S VSE demodulates the PDCCH based on the [PDCCH parameters](#) you have defined.

Remote command:

[\[SENSe:\]NR5G:DEMod:CAMode](#) on page 406

EVM Calculation Method

Selects the way the EVM is calculated.

- "EVM 3GPP Definition" Calculates the EVM according to 3GPP TS 38.141-1 / -2. Evaluates the EVM at two trial timing positions and then uses the higher EVM of the two.
- "At Optimal Timing Position" Calculates the EVM using the optimal timing position.
- "EVM High Timing Position" Calculates the EVM at the high trial position defined by 3GPP.
- "EVM Low Timing Position" Calculates the EVM at the low trial position defined by 3GPP.

Remote command:

[\[SENSe:\]NR5G:DEMod:CMETHod](#) on page 407

Symbol Time Adjustment

Defines the position of the FFT window within a symbol. The FFT window defines the time over which the FFT is calculated.

The value is a percentage relative to the beginning of the cyclic prefix.

- 0 %: FFT window starts at the beginning of the cyclic prefix.
- 100 %: FFT window starts at the end of the cyclic prefix.

Remote command:

[\[SENSe:\]NR5G:DEMod:STADjust](#) on page 409

PDSCH Reference Data

Selects the type of reference data to calculate the EVM for the PDSCH.

By default, the R&S VSE automatically detects the PDSCH reference values and maps the measured values to the nearest reference point.

If you expect noisy signals with a high EVM, however, the automatic detection is no longer reliable and can yield EVM values that are too good for the analyzed signal - measured values could be mapped to the wrong reference values by mistake, if they are too far from their original position.

Instead, you can set the PDSCH reference values to a fixed value of 0. This setting calculates the correct EVM, regardless of the signal quality. However, you have to make sure that the DUT transmits an all-zero data vector for the PDSCH.

Another option is to base the PDSCH reference values on the pseudo random sequence 23 (PN23) as defined by 3GPP. This method also yield correct EVM values. Again, the signal must use the NR-TM PN23 for this to work.

When you select one of the [ORAN test cases](#), the R&S VSE automatically selects the the ORAN specific PN23 sequence as the PDSCH reference data as defined in the ORAN standard.

"Auto Detect"	Automatically detects the PDSCH reference values.
"All 0"	Assumes the PDSCH to be all 0's, according to test model definitions.
"NR-TM PN23"	Assumes the PDSCH to be based on the pseudo random sequence 23, as defined by 3GPP. Each PDSCH / PDCCH has an individual sequence.
"NR-TM PN23 All Slots"	Assumes the PDSCH to be based on the pseudo random sequence 23, as defined by 3GPP. All PDSCH / PDCCH have the same sequence.
"ORAN PN23"	Assumes the PDSCH to be based on the pseudo random sequence 23, as defined by the ORAN alliance. Note that this type of reference data is automatically selected when you select an ORAN test case. The R&S VSE assumes that the measured signal actually contains the corresponding ORAN PN23 sequence. For this option, each PDSCH has an individual sequence.
"ORAN PN23 All Slots"	Assumes the PDSCH to be based on the pseudo random sequence 23, as defined by the ORAN alliance. Note that this type of reference data is automatically selected when you select an ORAN test case. The R&S VSE assumes that the measured signal actually contains the corresponding ORAN PN23 sequence. For this option, all PDSCH / PDCCH have the same sequence.

Remote command:

[\[SENSe:\]NR5G:DEMod:PRData](#) on page 409

CORESET Reference Data

Selects the type of reference data to calculate the EVM for the CORESET.

The logic and type of reference data is the same as that for the [PDSCH](#).

Remote command:

[\[SENSe:\]NR5G:DEMod:CRData](#) on page 407

Extended Frequency Lock Range

Selects the frequency error tolerance for successful signal synchronization.

Turn the setting off to have a small tolerance (0.5*subcarrier spacing).

Turn the setting on to have a large tolerance (10*subcarrier spacing).

For a large tolerance, we recommend to configure the synchronization signal manually, because the auto demodulation might not work properly depending on the actual frequency error.

Remote command:

[SENSe:]NR5G:DEMod:EFLRange on page 408

4.2 Time alignment error configuration

Access: [MEAS CONFIG]

The settings for time alignment error measurements are similar to the settings of the I/Q measurements. For a comprehensive description of those, refer to the following chapters.

- [Chapter 4.1.3, "Physical signal description"](#), on page 64
- [Chapter 4.1.5, "Component carrier configuration"](#), on page 68 (intra-band component carriers only - contiguous and non-contiguous)
- [Chapter 4.1.9, "Synchronization signal configuration"](#), on page 82 (note that the time alignment error measurement does not support all synchronization signal settings)
- [Chapter 4.1.11, "Slot configuration"](#), on page 93 (configuring individual slots allows measurements according to TDD NR-TM's)
- [Chapter 4.1.12, "PDSCH and PDCCH configuration"](#), on page 105 (note that the enhanced PDSCH settings are the same for all PDSCH allocations in the entire frame and are available centrally in the "Slot" configuration tab - trying to open the enhanced PDSCH settings from the allocation table shows a corresponding message)
- [Chapter 4.1.16, "Frequency configuration"](#), on page 140
- [Chapter 4.1.17, "Amplitude configuration"](#), on page 141
- [Chapter 4.1.19, "Data capture"](#), on page 146
- [Chapter 4.1.18, "Trigger configuration"](#), on page 144
- [Chapter 4.1.21, "Demodulation"](#), on page 152

4.3 Transmit on / off power configuration

Access: [MEAS CONFIG]

The settings for transmit on / off power measurement are similar to the settings of the I/Q measurements.

Settings for the transmit on / off power measurement described elsewhere (not all settings described in the following chapters are available in the transmit on / off power measurement though):

- [5G NR Mode](#)
- [Signal Description / Test Model](#)
- [Deployment](#)
- [Base station type](#)
- [Channel Bandwidth](#)
- [Synchronization signal](#)
- [Bandwidth part configuration](#)
- [Slot configuration](#)
- [PDSCH configuration](#)
- [Antenna port configuration](#)
- [Advanced settings](#)
- [Signal capture](#)
- [Trigger configuration](#)
- [Demodulation settings](#)

[Base station output power](#)..... 157

Base station output power

For transmit on / off power measurements on [2-O type base stations](#), you can define the output power of the base station.

You can define the following rated power values that have an effect on the limits:

- $P_{\text{rated, c, EIRP}}$
- $P_{\text{rated, c, TRP}}$

Remote command:

EIRP: `CONFigure[:NR5G]:DL[:CC<cc>]:PLC:EIRP` on page 411

TRP: `CONFigure[:NR5G]:DL[:CC<cc>]:PLC:TRP` on page 411

4.4 Frequency sweep measurement configuration

Access: [MEAS CONFIG] > "Signal Description"

The signal description for ACLR and SEM measurements contains settings to describe general physical characteristics of the signal you are measuring.



Settings for frequency sweep measurements

When you start the frequency sweep measurement from within the 5G NR application, the R&S VSE automatically configures the measurement and limits according to the specification defined by 3GPP.

Therefore, it is sufficient for you to configure the details of the 5G NR signal description.



Filter type in SEM measurements

The 5G NR application uses a channel filter for SEM measurements by default. The spectrum application on the other hand uses a Gauss filter. If you need a Gauss filter for the SEM measurement in the 5G NR application, change it manually in the sweep list for the corresponding frequency ranges.

Note that ACLR and SEM measurements are currently unavailable for FR2-2 frequency deployment.

Functions in the "Signal Description" dialog box described elsewhere:

- [5G NR Mode](#)
- [Signal Description / Test Model](#)
- [Deployment](#)
- [Channel Bandwidth](#)
- [Subcarrier spacing](#)
(for FR2 deployments)
- For SEM measurements: [Base station category](#)

All other settings available for the ACLR and SEM measurements are the same as in the spectrum application. For more information, refer to the user manual of the R&S VSE.

Base Station Type	158
Adjacent Channels	159
Tx Power	159
Position of SEM and ACLR limits	159
Total Limit Pass Mode	160

Base Station Type

3GPP defines several types of base station for the different deployment [frequency ranges](#).

Each base station class sets different requirements for

- [SEM measurements](#) (the SEM limits)
- [ACLR measurements](#) (the power of the adjacent channels)

See 3GPP 38.141-1 / -2 for details.

The type you should use for the measurement depends on the base station you are testing.

- "1-C": Base station for conducted transmission requirements in FR1.
(Only supported for ACLR and SEM measurements.)
- "1-H": Base station for hybrid transmission requirements (conducted and over-the-air) in FR1.
(Only supported for ACLR and SEM measurements.)
- "1-O": Base station for over-the-air transmission requirements in FR1.
(Only supported for ACLR and SEM measurements.)
- "2-O": Base station for over-the-air transmission requirements in FR2.

[output power](#).

For SEM measurements on 2-O type base stations, you can also define the [output power](#).

For transmit on / off power measurements on 2-O type base stations, you can also define the [output power](#).

The output power in both cases has an effect on the limits.

Remote command:

Base station type: [CONFigure\[:NR5G\]:BStation](#) on page 416

Adjacent Channels

ACLR measurement only

Selects the assumed adjacent channel carrier for the ACLR measurement.

- "NR of Same BW": the neighboring channel is a 5G NR channel with the same bandwidth.
- "5 MHz E-UTRA": the neighboring channel is a LTE channel with 5 MHz bandwidth.

Remote command:

[\[SENSe:\]POWER:ACHannel:AACHannel](#) on page 413

Tx Power

SEM measurement only

For SEM tests on [medium range base station](#) and [2-O type base stations](#), you can measure or manually enter the "Tx Power" of the carrier.

If you select "Manual", you can define the power in the corresponding input field. Otherwise, the R&S VSE measures the power of the Tx channel automatically.

The exact label of the rated power value depends on the selected base station type as defined in 3GPP 38.141-1 / -2.

- "1-O": $P_{\text{rated, c, TRP}}$
- "1-C": $P_{\text{rated, c, AC}}$
- "1-H": $P_{\text{rated, c, cell}}$
- "2-O": $P_{\text{rated, t, TRP}}$

The value range depends on the selected base station type.

For 1-H medium range base station, the supported output power value range also depends on the "N_TXU, countedpercell" and "N_TABconnectors" parameters.

Remote command:

BS power mode: [\[SENSe:\]POWER:SEM:AMPower:AUTO](#) on page 414

BS power value: [\[SENSe:\]POWER:SEM:AMPower](#) on page 414

Position of SEM and ACLR limits

For tests on [1-H type base stations](#), you can also define two parameters "N_TXU, countedpercell" and "# Tab connectors (n)".

For the spectrum emission mask, these two parameters shift the limits according to 3GPP 38.141-1, chapter 6.6.4.5.8. The parameters also select which SEM power class (SEM limits) applies to a given base station [output power](#) (P_{rated}).

For the adjacent channel leakage error, these two parameters define the limits according to 3GPP 38.141-1, chapter 6.6.3.5.4.

Remote command:

$N_{\text{TABconnectors}}$: [\[SENSe:\]POWER:SEM:NTAB](#) on page 415

N_{TXU} : [\[SENSe:\]POWER:SEM:NTXU](#) on page 415

Total Limit Pass Mode

Supported only by the 5G application.

Access (ACLR measurement): "Meas Config" > "CP / ACLR Config" > "Channel Settings" > "Limits"

Access (multi-carrier ACLR measurement): "Meas Config" > "CP / ACLR Config" > "MSR General Settings"

The "Total Limit Pass Mode" selects the logic the ACLR limits are evaluated with if you define both absolute limits and relative limits.

The screenshot shows the 'Limits' configuration page. The 'Limit Checking' is set to 'On'. The 'Total Limit Pass Mode' is set to 'Abs and Rel'. Under 'Relative Limit', there are two rows: 'Adj' with a value of -43.8 dBc and 'Alt 1' with a value of -43.8 dBc. Under 'Absolute Limit', there are two rows: 'Adj' with a value of 6.9 dBm and 'Alt 1' with a value of 6.9 dBm. All checkboxes are checked.

Figure 4-9: Evaluate both absolute and relative limits

If you define only relative or absolute limits, the R&S VSE only evaluates the corresponding limits.

The screenshot shows the 'Limits' configuration page. The 'Limit Checking' is set to 'On'. The 'Total Limit Pass Mode' is set to 'Abs or Rel'. Under 'Relative Limit', there are two rows: 'Adj' with a value of -43.8 dBc and 'Alt 1' with a value of -43.8 dBc. Under 'Absolute Limit', there are two rows: 'Adj' with a value of 6.9 dBm and 'Alt 1' with a value of 6.9 dBm. The checkboxes for 'Adj' and 'Alt 1' in the 'Absolute Limit' section are unchecked.

Figure 4-10: Evaluate only relative limits

If you change the limit evaluation method after the measurement, you have to refresh the measurement.

The selected method adjusts the contents of the following result displays.

- ACLR result summary

The default value is according to 3GPP 38.141-1/2.

"Absolute"	Checks the absolute limits defined for the ACLR. The limit check passes when the signal level is within the absolute limits.
"Relative"	Checks the relative limits defined for the ACLR. The limit check passes when the signal level is within the relative limits.
"Absolute and Relative"	The limit check for both, the absolute and the relative limits, must pass to get an overall pass.
"Absolute or Relative"	The limit check for either the absolute or the relative limits must pass to get an overall pass.

Remote command:

`CALCulate<n>:LIMit:ACPower:PMODE` on page 416

4.5 Microservice export

Access: "Edit" > "Microservice Export"

In addition to [exporting the signal configuration](#) locally, you can export the signal configuration in a file format compatible to the cloud-based microservice (.m5g file extension).

Exporting signal configurations with multiple component carriers writes the configuration of each component carrier into a separate file. The number of files depends on the [analysis mode](#):

- If you analyze the viewed CCs only, the R&S VSE exports those two CCs (two files - config_CC1.m5g, config_CC2.m5g).
- If you analyze all CCs, the R&S VSE exports all CCs. The number of files depends on the number of component carriers (config_CC1.m5g, config_CC2.m5g etc.).

When you change the CC analysis mode (all to viewed or vice versa), you have to either refresh the I/Q data or re-run the sweep to reflect this change in the microservice export.

For a comprehensive description of the microservice, refer to the microservice user manual.

Remote command:

[MMEMory:STORe<n>:MSERvice](#) on page 272

4.6 Time trigger measurement guide

The time trigger initiates a measurement in certain intervals (every <x> seconds). For the 5G NR application this means that you can use the time trigger to initiate a measurement at the start of each frame (every 10 ms). Therefore, the time trigger is a useful tool when you do not have access to a frame trigger (external trigger source), for example when you test a base station on-site.

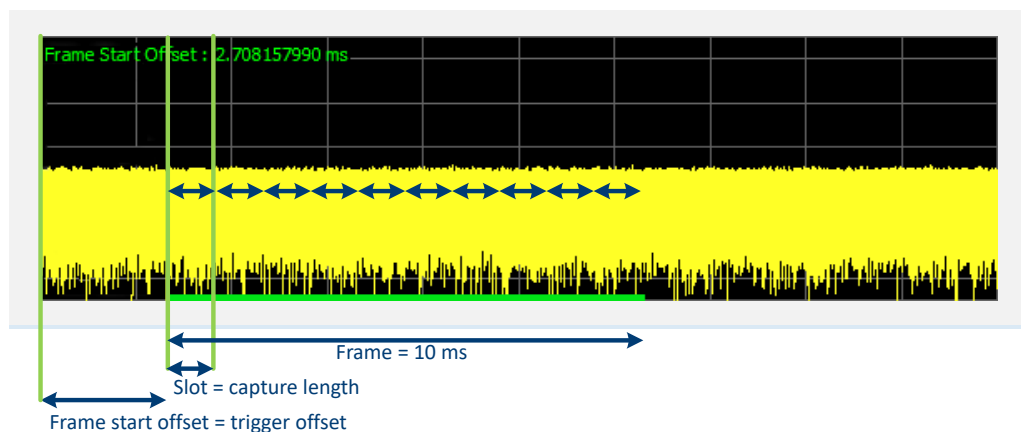
Configured correctly, the time trigger also allows you to focus on the analysis of a single slot, which in turn speeds up the measurement. In that case, the idea is to capture only the I/Q data of a single slot (plus a certain tolerance) which increases the measurement speed accordingly.

Since the frequency references of the DUT and the R&S VSE are not necessarily coupled in such a scenario, the frame start and the time trigger may deviate over time. In this case, you can increase the capture time tolerance or readjust the time trigger offset periodically.

Analyzing signals with a time trigger

1. Connect the R&S VSE to the DUT.
2. Select the time trigger as the trigger source.

- ("Overview" > "Trigger / Signal Capture" > "Trigger" > "Trigger Source" = "Time")
- Define a repetition interval of 10 ms (capture every frame).
("Overview" > "Trigger / Signal Capture" > "Trigger" > "Repetition Interval" = "10 ms")
 - Run a measurement to get the frame start offset readout in the capture buffer result display.
 - Define a trigger offset with a length that equals the [frame start offset](#) to synchronize the start of the measurement with the first slot in the frame.
("Overview" > "Trigger / Signal Capture" > "Trigger" > "Offset" = frame start offset)
 - Select one slot to analyze.
("Overview" > "Trigger / Signal Capture" > "Signal Capture" > "Set Number of Frames to Analyze" = "Manually")
("Overview" > "Trigger / Signal Capture" > "Signal Capture" > "Number of Frames to Analyze" = "1")
 - Define a capture length that corresponds to one slot (plus tolerance). The slot length depends on the [subcarrier spacing](#).
("Overview" > "Trigger / Signal Capture" > "Signal Capture" > "Capture Time" = slot length)
 - Run the measurement.
If synchronization to the signal fails (see message in the status bar), you have to increase the trigger offset slightly (a few μ s).



4.7 Reference: MIMO measurement guide

MIMO measurements require special setups, with one or more measuring devices that you can control with the functionality of the R&S VSE. The setup depends on the scenario you are measuring and the equipment you are using.

Basically, you can use the following equipment:

- One or more signal analyzers.

- One or more oscilloscopes.
- Several power sensors.

Note that phase measurements require phase-coherent input channels. Thus, you have to either use an oscilloscope with several channels, or an array of interconnected power sensors.

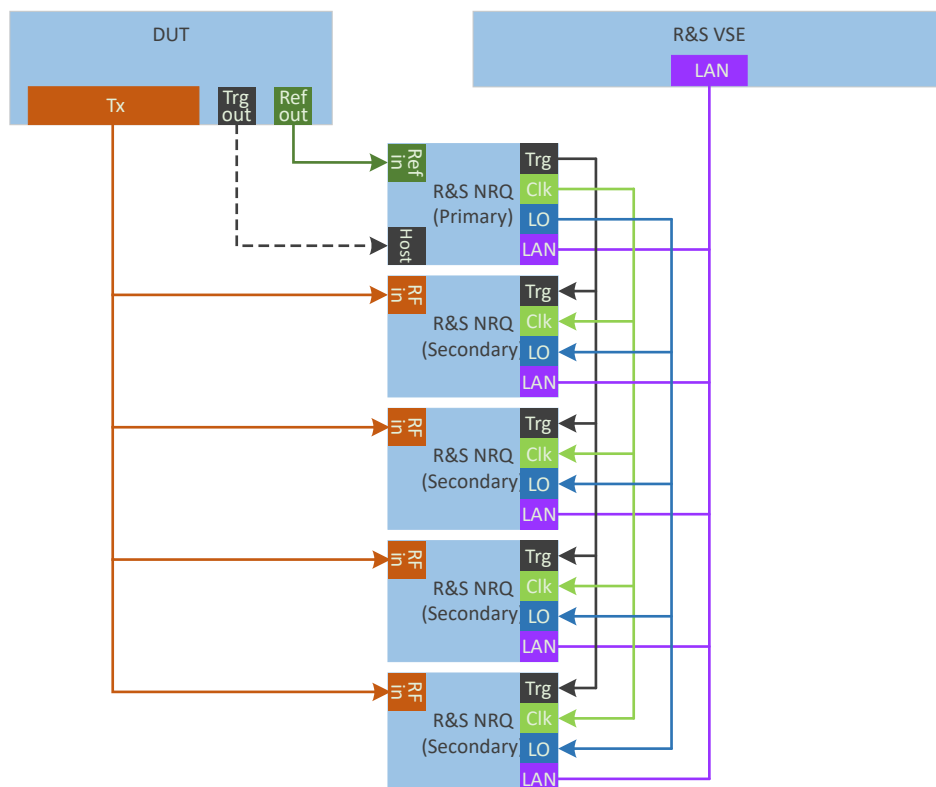
Each instrument, or in case of oscilloscopes each input channel, measures a single data stream (usually an Rx antenna).

4.7.1 Calibration

Calibration of the setup is necessary for all measurement tasks concerning the phase characteristics. During the calibration, the R&S VSE determines the phase characteristics of the components located between the DUT and the measuring device (for example cables). Determining these characteristics allows you to correct the measurement results by removing unwanted phase characteristics.

The calibration requires the R&S VSE-K544.

We recommend to perform the actual measurement directly after the calibration is done, because the environmental conditions can lead to a phase shift in the components. This in turn can lead to invalid measurement results.



Setting up the hardware

1. Connect one data stream to a splitter.

2. Connect the data streams from the splitter to the input channels (oscilloscope or power sensors).
3. The rest of the setup should be the same as for the real measurement (trigger signal, reference frequency etc.). The illustration above shows a calibration setup for measurements with power sensors.

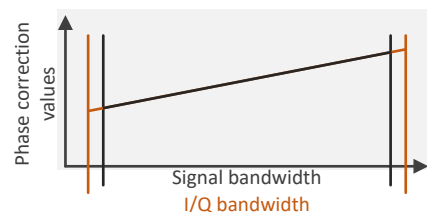
Getting correction data

1. Run a measurement.
2. Open the [RS phase difference](#) result display.
3. Export the results with `TRACe[:DATA]` command.
4. Create a `.fres` file for the R&S VSE-K544 based on the trace points. A `.fres` would look like this:

```
Frequency [Hz] | Level [dB] | Phase [deg]
800000000 0 20
801000000 0 25
802000000 0 22
etc.
```

Depending on your signal, the number of correction points can get very long.

5. We recommend to add one additional value at the beginning and the end of the list to compensate for difference between the signal bandwidth (`TRACe:DATA` return values) and the I/Q capture bandwidth.
Select a value that is in line with the shape of the correction data (linear extrapolation).



Importing correction data

1. Select a channel specific application of the correction data.
("Meas Setup" > "User Correction" > "Apply to": "Channel")
2. Turn on frequency response.
("Meas Setup" > "User Correction" > "Frequency Response Active": "On")
3. Select the input source to which you want to apply the correction data (usually not source 1, but all others).
("Meas Setup" > "User Correction" > "Source <x>" tab)
4. Add the frequency response file you have created (`.fres`).
("Meas Setup" > "User Correction" > "Add Touchstone File")

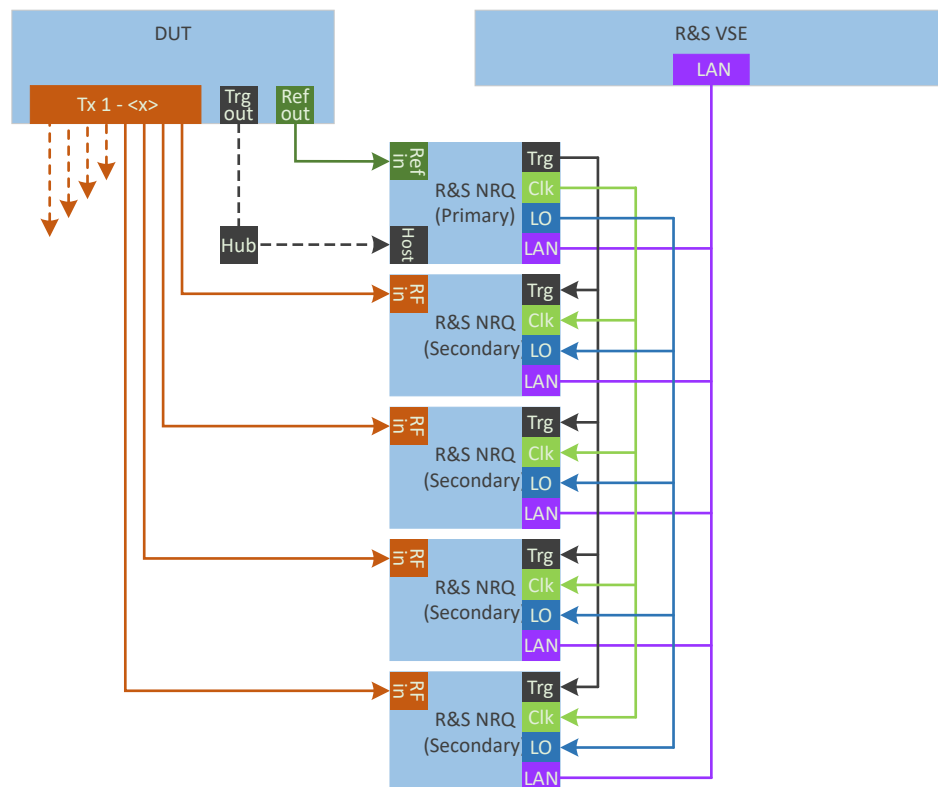
5. Turn on the correction.
("Meas Setup" > "User Correction" > "State": "On")
6. Verify the correction by running a measurement. The RS phase difference result display should show a straight line over the evaluated frequency at around 0 degrees.
7. Change the test setup to run the actual measurement.

4.7.2 Power sensors

For massive MIMO test scenarios (up to 32 data streams), you can use multiple R&S NRQ power sensors. Power sensors can perform phase coherent measurements in addition to measuring the EVM and decoding the bitstream layers.

The number of power sensors you need depends on the number of data streams you would like to capture, plus one additional power sensor that controls the others. So for example, to capture four data streams, you need five power sensors.

Requires an R&S NRQ equipped with options R&S NRQ-K1 (I/Q data interface) and R&S NRQ-K3 (for phase coherent measurements).



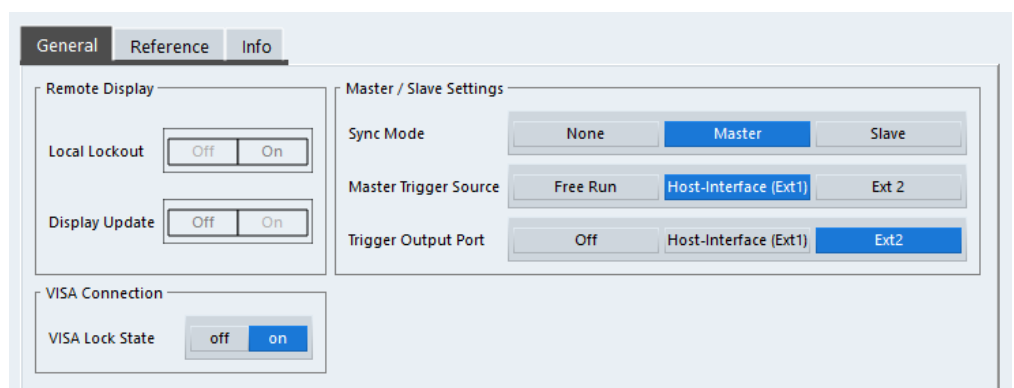
Setting up the hardware

1. Connect all R&S NRQ to the network (LAN).
The LAN connection supplies them with power and allows you to control them via R&S VSE.

2. Define one of the R&S NRQ as the primary power sensor.
The primary sensor provides the clock rate, the local oscillator signal and triggers the secondary devices.
 - a) Feed a reference signal into the primary sensor.
 - b) Optional: feed an external trigger signal into the primary sensor ("Host" connector).
If you use a trigger, you have to add a power sensor hub into the setup, for example the R&S NRP-Z3 or -Z5.
3. Connect the secondary devices to the primary power sensor.
Use a symmetrical setup for the connections between primary and secondary devices (same cable length).
 - a) Synchronize the clock rate between the devices ("Clk" connector).
 - b) Synchronize the local oscillator of the devices ("LO" connector).
 - c) Provide a trigger signal ("Trg2" connector on all devices).
4. Connect one data stream to each R&S NRQ (but not the primary power sensor).

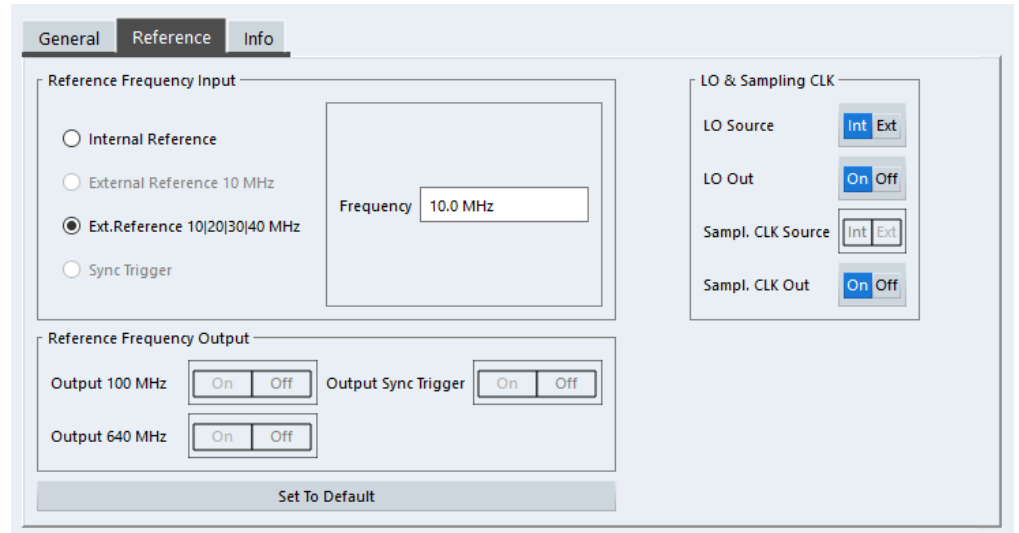
Configuring the power sensors

1. Start R&S VSE and enter the 5G NR application.
2. Select the "Instruments" tool window.
3. Add all power sensors to the instrument list (IP address) to establish a LAN connection.
4. Select "Info & Settings" for each power sensor.
5. For the **primary** power sensor, select the following settings.
Note that you always have to configure the primary power sensor first.
 - a) "General" tab: "VISA Lock State" = "On" (recommended)
 - b) "General" tab: "Sync Mode" = "Primary"
 - c) "General" tab: "Primary Trigger Source" = "Host-Interface" (optional)
 - d) "General" tab: "Trigger Output Port" = "Ext2"

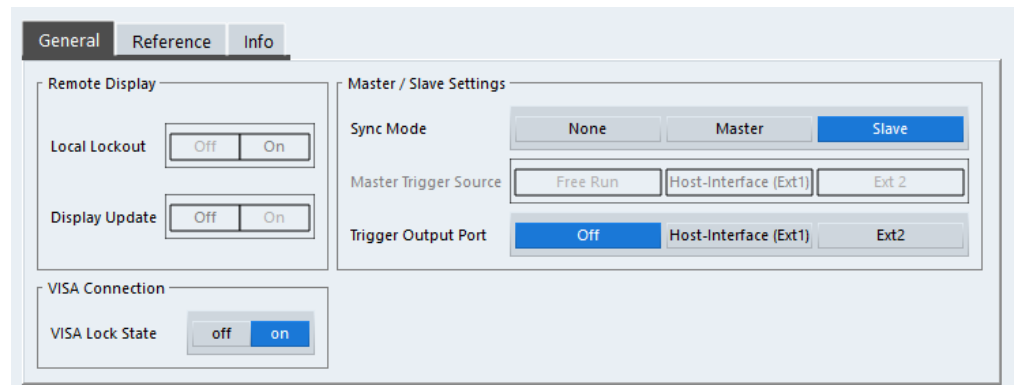


- e) "Reference" tab: "Reference Frequency Input" = "Ext. Reference 10 | 20 | 30 | 40 MHz"
- f) "Reference" tab: "LO Source" = "Int"

- g) "Reference" tab: "LO Out" = "On"
- h) "Reference" tab: "Sampl. CLK Source" = n/a (always "Int")
- i) "Reference" tab: "Sampl. CLK Out" = "On"

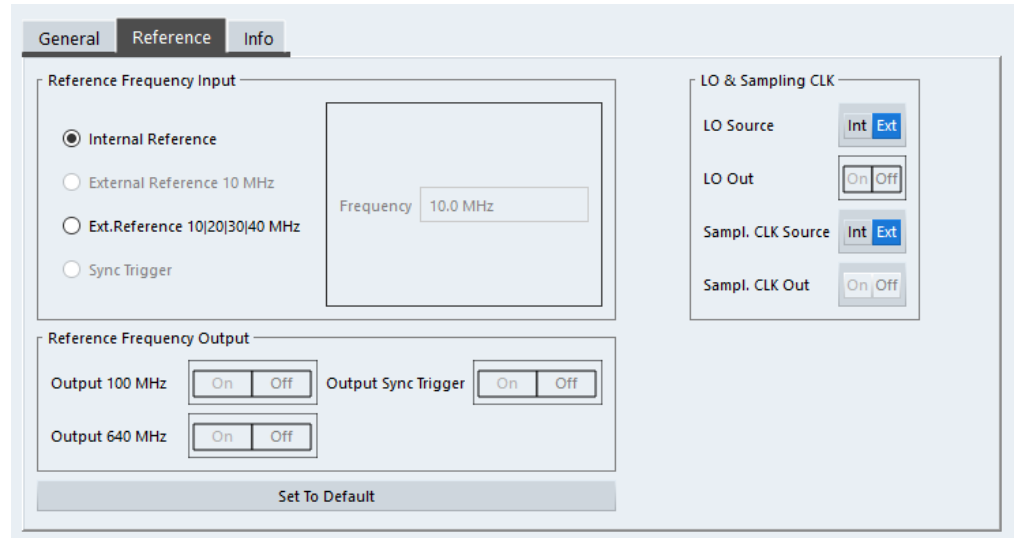


6. For the **secondary** devices, select the following settings.
- a) "General" tab: "VISA Lock State" = "On" (recommended)
 - b) "General" tab: "Sync Mode" = "Secondary"
 - c) "General" tab: "Primary Trigger Source" = n/a
 - d) "General" tab: "Trigger Output Port" = "Off"



- e) "Reference" tab: "Reference Frequency Input" = "Internal"
- f) "Reference" tab: "LO Source" = "Ext"
- g) "Reference" tab: "LO Out" = n/a (always "Off")
- h) "Reference" tab: "Sampl. CLK Source" = "Ext"

- i) "Reference" tab: "Sampl. CLK Out" = n/a (always "Off")



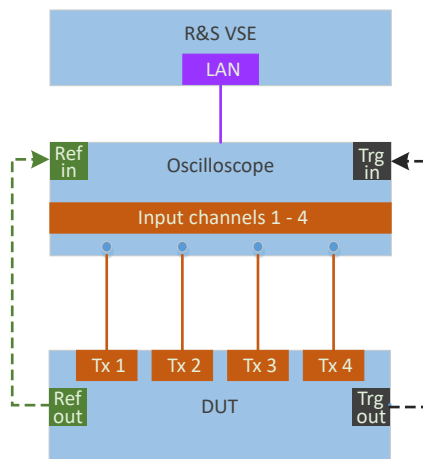
Running the measurement

1. Configure the signal characteristics in the R&S VSE.
2. Configure the test setup in the R&S VSE ("Meas Setup" > "MIMO / Ant Mapping").
3. Calibrate the measurement with R&S VSE-K544.
Calibration is necessary to consider the phase characteristics of the test equipment (for example cables). Note that the setup for calibration is a little different to that of the actual measurement. See [Chapter 4.7.1, "Calibration"](#), on page 163 for details.
4. Run the measurement.

4.7.3 Oscilloscopes

For measurements on up to four data streams, you can use an oscilloscope with several input channels. An oscilloscope can measure the phase and the EVM of the DUT and can decode the bitstream layers.

Requires an oscilloscope equipped with option R&S RTx-K11 (vector signal analysis). An R&S RTO also requires option R&S RTO-B4 (OCXO).



Setting up the hardware

1. Optional: Connect an external frequency reference to the oscilloscope.
2. Optional: Connect an external trigger to the oscilloscope.
3. Connect each data stream to one of the input channels.
4. Establish a LAN connection between the R&S VSE and the oscilloscope.

Connecting to the oscilloscope

1. Start R&S VSE and enter the 5G NR application.
2. Select the "Instruments" tool window.
3. Add the oscilloscope to the instrument list (IP address) to establish a LAN connection.

Running the measurement

1. Configure the signal characteristics in the R&S VSE.
2. Configure the test setup in the R&S VSE ("Meas Setup" > "MIMO / Ant Mapping").
3. Calibrate the measurement with R&S VSE-K544.
Calibration is necessary to consider the phase characteristics of the test equipment (for example cables). Note that the setup for calibration is a little different to that of the actual measurement. See [Chapter 4.7.1, "Calibration"](#), on page 163 for details.
4. Run the measurement.

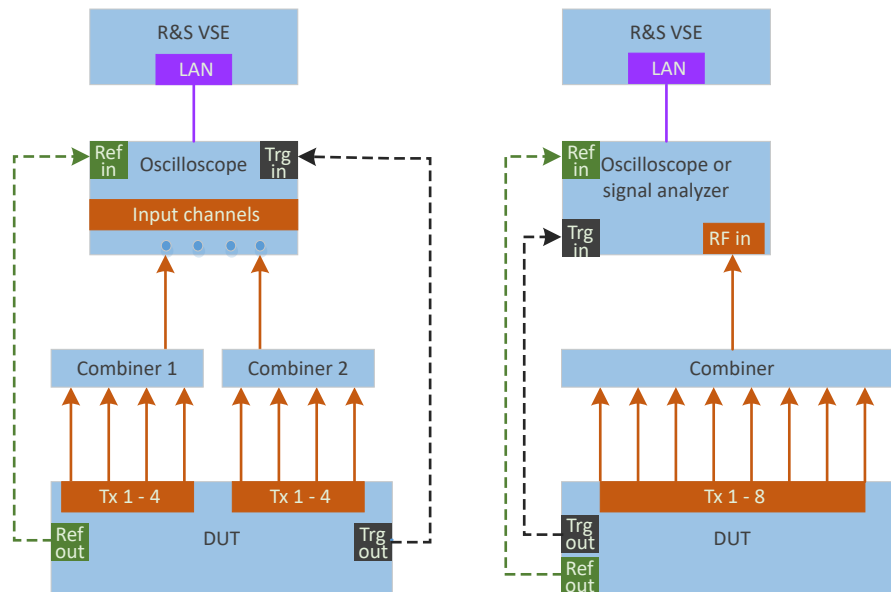
4.7.4 Combiners

Test setups with a combiner are possible because of different PDSCH antenna ports, whose information remains available even after you combine multiple data streams into a single one. Using a combiner, you can measure the phase characteristics of multiple

data streams. Measuring the EVM and decoding the bitstream, however, is not possible, because this information gets lost during the signal combining.

Depending on the number of data streams you want to measure, you need a combiner with a corresponding number of inputs. If you are using an oscilloscope, you can use multiple combiners and distribute the data streams across the oscilloscope's input channels.

Oscilloscope requires option R&S RTx-K11 (vector signal analysis). An R&S RTO also requires option R&S RTO-B4 (OCXO).



Setting up the hardware

1. Optional: Connect an external frequency reference to the oscilloscope.
2. Optional: Connect an external trigger to the oscilloscope.
3. Connect the data streams to the combiner.
4. Connect the combined signal to the input channel(s) (oscilloscope) or the RF input (signal analyzer).

Connecting to the instrument

1. Start R&S VSE and enter the 5G NR application.
2. Select the "Instruments" tool window.
3. Add the oscilloscope or analyzer to the instrument list (IP address) to establish a LAN connection.

Running the measurement

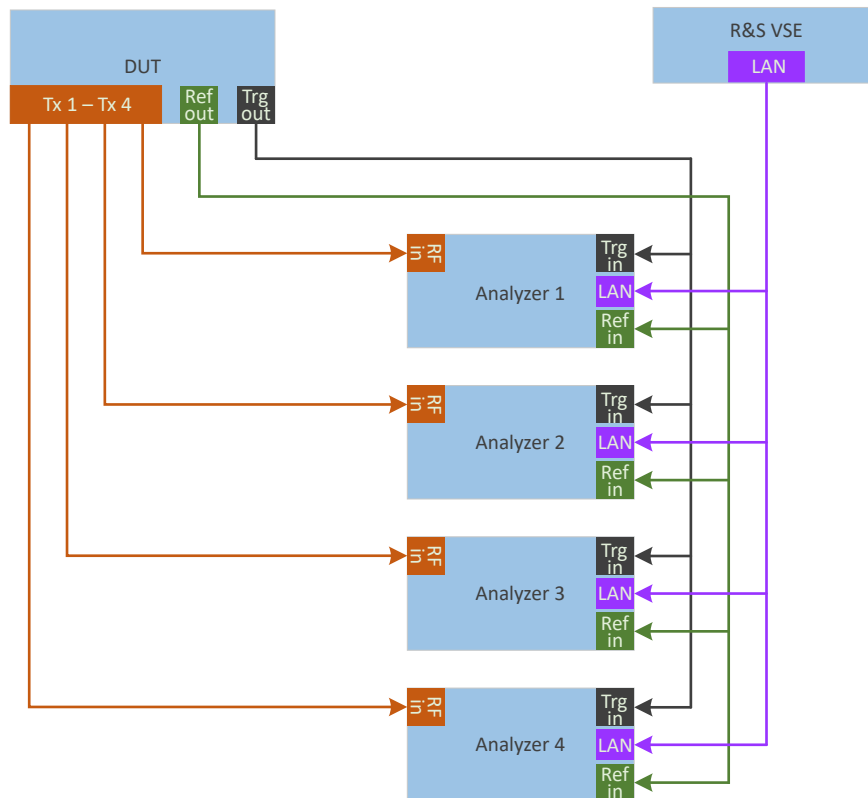
1. Configure the signal characteristics in the R&S VSE.
2. Configure the test setup in the R&S VSE ("Meas Setup" > "MIMO / Ant Mapping").

3. Run the measurement.

4.7.5 Signal analyzers

For test scenarios in which the phase characteristics are irrelevant, you can use multiple signal analyzers. Such test scenarios are useful for measuring the EVM, measuring the level or decoding the bitstream layers.

The number of signal analyzers you need depends on the number of data streams you would like to capture.



Setting up the hardware

1. Connect each data stream to the RF input of one of the analyzers.
2. Connect an (external) reference oscillator to synchronize the frequencies in the setup.
You can configure external references in the "Setup" menu of the analyzers.
3. Connect a trigger signal to the analyzers to capture all data streams simultaneously.
The source of the trigger signal is the DUT. If the data streams come from multiple devices (for example multiple signal generators), you have to select one device that provides the trigger signal for the other devices and the analyzers.

Connecting to the instrument

1. Start R&S VSE and enter the 5G NR application.
2. Select the "Instruments" tool window.
3. Add the analyzers to the instrument list (IP address) to establish a LAN connection.

Running the measurement

1. Configure the signal characteristics in the R&S VSE.
2. Configure the test setup in the R&S VSE ("Meas Setup" > "MIMO / Ant Mapping").
3. Run the measurement.

Trigger delay

Simultaneous capture of the I/Q data requires the trigger inputs of all instruments in the setup to be armed. Arming a trigger does not happen immediately when you start a measurement, but is delayed slightly for a number of reasons, for example:

- Connecting several instruments with a LAN or GPIB connection usually causes a certain network delay.
- Tasks like the auto leveling function require some time to finish.

Because of this, you have to make sure that the trigger event does not occur during this time frame. You can do so, for example, by configuring an appropriate delay time on the DUT. The exact delay depends on the GPIB or network condition and the input settings.

The minimum delay of the trigger signal must now be greater than the measured time multiplied with the number of measured antennas (the number of analyzers), because the analyzers are initialized sequentially.

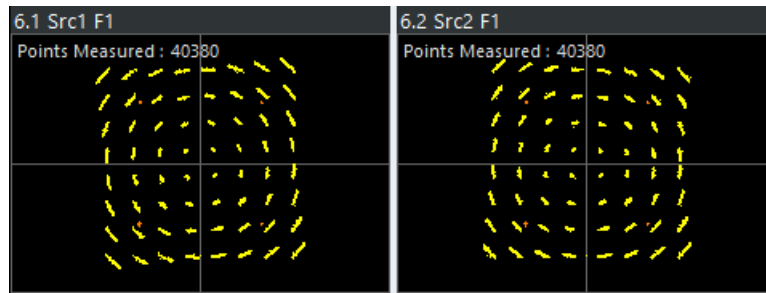
Using a frame trigger is not possible for this measurement setup.

Frame trigger

You can use a frame trigger if all frames have the same frame configuration and contain the same data. In this case, the analyzers in fact capture different frames, but the frames have the same content.

This method to analyze data, however, raises one issue. The phase variations of the reference oscillators of the different signals that are transmitted are not the same, because the data is not captured simultaneously. The result is a phase error which might degrade the EVM.

Using a frame trigger is therefore not ideal to measure hardware performance, but you can certainly use it to decode the payload.



4.8 O-RAN measurement guide

The O-RAN alliance specifies specific signal configurations (test cases) for standardized testing of O-RAN equipment. The R&S VSE provides these O-RAN test cases. When you apply one of them, the measurement configuration automatically adjusts to the values of the selected test case.

Basically, you can verify O-RAN based signals by certain bit sequences in the PDSCH and the positions of those sequences. The position of the bit sequence in the PDSCH is unique for each test case.

The [type of bit sequence](#) depends on the test case.

- Some test cases use a bit sequence of all 0's.
- Some test cases use an O-RAN specific PN23 bit sequence.

In addition, the [data demodulation](#) depends on the test case (before or after descrambling).

As pointed out, these settings are automatically selected, depending on the selected test case.

For valid measurement results, it is essential that the measured signal complies with the selected test case and uses the correct bit sequences in the correct locations. If you get unexpected measurement results, check if the signal is configured correctly. You can do a quick check to validate the signal as follows.

- Check if the selected test case in the "Advanced Settings" is the same as the test case in the "Test Models" dialog.
- Use the [Allocation ID vs Symbol x Carrier](#) result display to verify if the correct PDSCH allocations are analyzed. If the signal contains the correct bit sequence, the EVM should be good.
- Use the [Bitstream](#) result display to verify if the bits match the O-RAN specifications. Each test case has a typical bit sequence. Make sure to select the bit sequence as the [bitstream format](#).

4.9 Reference: structure of .allocation files

.allocation (and .ccallocation) files are basically xml files that follow a certain structure. The structure of the file is based on the structure of the dialogs in the user interface.

Basically, the structure is as follows:

- Each setting is stored in a dedicated element.
Example: <ChannelBandwidth>, <CellID>
- The settings are grouped as in the user interface.
Example: <ChannelBandwidth> and <CellID> belong to the <Physical_Settings> element.
- Some xml elements can occur multiple times.
Examples: <Frame_Config>, <BWP_Config>, <Slot_Config>. The number of occurrences depends on the number of frames, BWPs and slots in the signal.
- The values for all elements are the SCPI parameters of the corresponding setting.
Example: <ChannelBandwidth>BW100</ChannelBandwidth>, <CellID>0</CellID>



Probably the most comfortable way to describe a signal in an xml file is to save an .allocation file after a preset and then change the values within that file.

Root structure

For structure of child elements, see:

- "[<Information> element](#)" on page 175
- "[<PRACH> element](#)" on page 175
- "[<Signal_Description> element](#)" on page 175
- "[<Signal_Capture> element](#)" on page 175
- "[<Parameter_Estimation> element](#)" on page 176
- "[<CCSettings> element](#)" on page 176
- "[<RF_Parameter> element](#)" on page 178
- "[<MultiCarrier> element](#)" on page 178
- "[<MIMOParameter> element](#)" on page 178

```
<NR5G>
  <Information/>
  <!-- PRACH settings are relevant in uplink only -->
  <PRACH/>
  <Signal_Description/>
  <Signal_Capture/>
  <Parameter_Estimation/>
  <!-- CCSettings can occur several times -->
  <CCSettings/>
  <RF_Parameter/>
  <!-- MultiCarrier only for multiple carriers -->
```

```
<MultiCarrier/>
<MIMOParameter/>
</NR5G>
```

<Information> element

The <Information> element is a child element of the <NR5G> element.

```
<Information>
  <FWVersion/>
  <Device/>
  <Type/>
  <IQFrequency/>
  <Mode/>
  <ExportIssues/>
</Information>
```

<PRACH> element

The <PRACH> element is a child element of the <NR5G> element.

```
<PRACH>
  <PRACHFormat/>
  <PRACHSCS/>
  <L_RA/>
  <Restricted/>
  <LogicalRootSequenceIndex/>
  <ZeroCorrelationZone/>
  <PreambleIndex/>
  <RelPower/>
  <RBOffset/>
</PRACH>
```

<Signal_Description> element

The <Signal_Description> element is a child element of the <NR5G> element.

```
<Signal_Description>
  <Mode/>
  <DeployFrequencyRange/>
  <NumberOfCC/>
  <NumberofInputSource/>
  <ORANTestCase/>
  <FreqErrLimitState/>
  <TestModelName/>
</Signal_Description>
```

<Signal_Capture> element

The <Signal_Capture> element is a child element of the <NR5G> element.

```
<Signal_Capture>
  <SwapIQ/>
```

```

<LongCaptureMode/>
<CaptureTime/>
<CaptureTimeAuto/>
<OverallFrameCount/>
<SetNumberOfFramesToAnalyze/>
<NumOfFramesToAnalyze/>
<MaxOfSlotsPerFrameToAnalyze/>
<AveragedFrame/>
<SignalRepeatsMaxNoOfSlotsToAnalyze/>
</Signal_Capture>

```

<Parameter_Estimation> element

The <Parameter_Estimation> element is a child element of the <NR5G> element.

```

<Parameter_Estimation>
  <ChannelEstimation/>
  <ChannelEstimationTimeAveraging/>
  <TrackPhase/>
  <TrackTiming/>
  <TrackLevel/>
  <MultiCarrierFilter/>
  <DemodulatedData/>
  <IQGainImbalance_QuadratureError/>
  <TPUTState/>
  <CORESETAnalysisMode/>
  <EVMCalculationMethod/>
  <CORESETReferenceData/>
  <PDSCHReferenceData/>
  <ExtendedFrequencyLockRange/>
  <SymbolTimingPosition/>
</Parameter_Estimation>

```

<CCSettings> element

The <CCSettings> element is a child element of the <NR5G> element.

The <CCSettings> element can occur several times, one for each component carrier.

For structure of child elements, see:

- "[<Synchronization> element](#)" on page 179
- "[<Frame_Config> element](#)" on page 179

```

<CCSettings>
  <AutoBWPDetection/>
  <CCFrequency/>
  <FreqOffsetToCC0/>
  <PhysicalSettings>
    <ChannelBandwidth/>
    <CellIDAuto/>
    <CellID/>
    <P_rated_c_EIRP/>

```



```

    <P_rated_c_TRP/>
  </PhysicalSettings>
  <NumofAntPortMapping/>
  <!-- Ant_Port_Mapping occurs several times, once for each AP configuration -->
  <Ant_Port_Mapping>
    <State/>
    <SyncSignal_AP/>
    <PDSCH_APxxxx/>
    <PDCCH_AP/>
    <CSIRS_APx/>
  </Ant_Port_Mapping>
  <!-- Ant_Port_Mapping_SlaveConfig occurs several times, once for each configuration -->
  <Ant_Port_Mapping_SlaveConfig>
    <Selected_Ant_Port_Mapping/>
  </Ant_Port_Mapping_SlaveConfig>
  <Advanced_Settings>
    <IgnoreDC/>
    <RFUpconversion_PhaseCompensation/>
    <RFUpconversion_f_0/>
    <RFUpconversion_f_0_Freq/>
    <FrameNumber_n_f/>
    <RefPointA_SCS15kHz/>
    <RefPointA_SCS30kHz/>
    <RefPointA_SCS60kHz/>
    <RefPointA_SCS120kHz/>
    <RefPointA_SCS480kHz/>
    <RefPointA_SCS960kHz/>
    <RefPointA_RelativeToCF/>
    <ExcludeUserIDs/>
    <SharedSpectrumChannelAccess/>
  </Advanced_Settings>
  <NumofSynchronization/>
  <!-- Contents of synchronization element see below -->
  <Synchronization/>
  <NumofFrame/>
  <!-- Frame_Config can occur several times, contents see below -->
  <Frame_Config/>
  <LTE_CRS_Coexistence/>
    <State/>
    <OffsToPoints/>
    <VShift/>
    <LTBWBRBs/>
    <LTEAntPorts/>
  <!-- The MBSFNSubframeConfiguration occurs once for each MBSFN subframe -->
  <MBSFNSubframeConfiguration/>
    <IndexofSubframe/>
    <Active/>
  </MBSFNSubframeConfiguration>
</LTE_CRS_Coexistence/>
</CCSetting>

```

<RF_Parameter> element

The <RF_Parameter> element is a child element of the <NR5G> element.

```
<RF_Parameter>
  <BaseStationType/>
  <ACLR>
    <AdjacentChannels/>
    <LimitCheckMode/>
  </ACLR>
  <SEM>
    <Category/>
    <CategoryBOption/>
    <TxPowerAuto/>
    <TxPowerValue/>
    <N_TXUcountedpercell/>
    <N_TABconnectors/>
    <IFF/>
  </SEM>
</RF_Parameter>
```

<MultiCarrier> element

The <MultiCarrier> element is a child element of the <NR5G> element.

```
<MultiCarrier>
  <CCSignalCapture/>
  <OperatingBand/>
  <CCResult/>
  <View1ComponentCarrierNo/>
  <View1FrameNo/>
  <View2ComponentCarrierNo/>
  <View2FrameNo/>
  <FixedCCOffset/>
  <GlobalMCCenter/>
  <OffsetRelto/>
  <OffsetMode/>
  <CarrierSpacing/>
</MultiCarrier>
```

<MIMOParameter> element

The <MIMOParameter> element is a child element of the <NR5G> element.

```
<MIMOParameter>
  <View1TxNo/>
  <View2TxNo/>
  <MIMOHelper/>
  <Conductor/>
</MIMOParameter>
```

<Synchronization> element

The <Synchronization> element is a child element of the <CCSettings> element.

```
<Synchronization>
  <SSBC_Detection/>
  <SubcarrierSpacing/>
  <Pattern/>
  <OffsetOption/>
  <RBOffset/>
  <AdditionalSubcarrierOffset/>
  <BurstSetPeriodicity/>
  <!-- One entry for each SSB -->
  <SSBStateX/>
  <NRPSSRelPower/>
  <NRSSRelPower/>
  <NRPBCHRelPower/>
  <PBCHDMRSRelPower/>
  <LSelection/>
  <HalfFrameOffset/>
</Synchronization>
```

<Frame_Config> element

The <Frame_Config> element is a child element of the <CCSettings> element.

- The <Frame_Config> element can occur several times, one for each configurable frame.
- Within the <Frame_Config> element, the <BWP_Config> element can occur several times, one for each bandwidth part.
- Within the <BWP_Config> element, the <Slot_Config> element can occur several times, one for each slot.
- Within the <Slot_Config> element, the <PXCCH> and <PXSCH> elements can occur several times, one for each PXCCH or PXSCH allocation.

For structure of child elements, see:

- "[<PXCCH> element](#)" on page 180
- "[<PXSCH> element](#)" on page 181
- "[<CSI_Settings> element](#)" on page 182

```
<Frame_Config>
  <NumofBWP/>
  <!-- BWP_Config can occur several times -->
  <BWP_Config>
    <SubcarrierSpacing/>
    <NumofRBs/>
    <RBOffset/>
    <NumberofUserConfigurableSlots/>
    <NumofSlot/>
    <!-- Slot_Config can occur several times -->
    <Slot_Config>
```

```

    <SlotAllocation/>
    <SlotFormat/>
    <CombinePDSCHAllocationsWithSameUserID/>
    <NumofPXCCH/>
    <!-- PXCCH can occur several times, description see below -->
    <PXCCH/>
    <NumofPXSCH/>
    <!-- PXSCH can occur several times, description see below -->
    <PXSCH/>
  </Slot_Config>
  <CSISettingsState/>
  <NumofCSI/>
  <!-- Contents of CS-RS element see below -->
  <CSI_Settings/>
  <PRSSettingsState/>
  <NumofPRS/>
  <!-- Contents of PRS element see below -->
  <PRS_Settings/>
</BWP_Config>
</Frame_Config>

```

<PXCCH> element

The <PXCCH> element is a child element of the <Frame_Config> element.

The <PXCCH> element can occur several times, one for each PXCCH allocation.

```

<PXCCH>
  <NumberOfRBs/>
  <OffsetRB/>
  <NumberOfSymbols/>
  <OffsetSymbol/>
  <RelPower_dB/>
  <DMRS>
  <UseDMRSScramblingID/>
  <ScramblingID/>
  <RelPower/>
  <ReferencePoint/>
  <PrecoderGranularity/>
  <AllowPDSCH/>
  <InterleavingState/>
  <BundleSize/>
  <ShiftIndex/>
  <ShiftIndexNID/>
  <InterleaverSize/>
  <NumofPDCCH/>
  <PDCCH/>
  <RNTI/>
  <AggregationLevel/>
  <CCEIndex/>
  <PatternLength/>

```

```

    <DCIFormat/>
    <Usage/>
    <Scope/>
    <NumberOfBlocks/>
    <NumberOfTPCCCommands/>
    <FrequencyDomainResourceAssignment/>
    <!-- DCIBitLength occurs several times, once for each DCI field -->
    <DCIBitLength/>
  </PDCCH>
</DMRS>
</PXCCH>

```

<PXSCH> element

The <PXSCH> element is a child element of the <Slot_Config> element.

The <PXSCH> element can occur several times, one for each PXSCH allocation.

```

<PXSCH>
  <UserID/>
  <VRBtoPRBInterleaver/>
  <Modulation/>
  <NumberOfRBs/>
  <OffsetRB/>
  <NumberOfSymbols/>
  <OffsetSymbol/>
  <RelPower_dB/>
  <ModulationforCodeword2/>
  <DMRS>
    <ConfigType/>
    <FirstDMRSSymbolRelTo/>
    <FirstDMRSSymbol/>
    <DMRSAddPositionIndex/>
    <DMRSLength/>
    <SequenceGeneration/>
    <ScramblingID/>
    <ScramblingID1/>
    <n_SCID/>
    <RelPowerToPDSCH/>
    <Layer_Codewords/>
    <AntennaPort/>
    <CDMGroupWOData/>
    <ReferencePoint/>
    <DMRS_R16/>
  </DMRS>
  <PTRS>
    <State/>
    <RelPower/>
    <L_PTRS/>
    <K_PTRS/>
    <RE_Offset/>

```

```

</PTRS>
<ChannelCoding>
  <MCSTable/>
  <I_MCS/>
  <RedundancyVersionIndex/>
  <TBScalingFactorS/>
  <TBSizeIncAllocGaps/>
</ChannelCoding>
<Scrambling>
  <Type/>
  <DataScramblingID/>
</Scrambling>
</PXSCH>

```

<CSI_Settings> element

The <CSI_Settings> element is a child element of the <BWP_Config> element.

```

<CSI_Settings>
  <SlotConfig>
    <SlotConfigMode/>
    <Periodicity/>
    <Offset/>
    <Slots/>
  </SlotConfig>
  <ZeroPower/>
  <Row/>
  <Ports/>
  <Density/>
  <CDMType/>
  <Bitmap/>
  <l0/>
  <l1/>
  <ScramblingID/>
  <RelPower_dB/>
  <NumberOfRBs/>
  <StartRB/>
</CSI_Settings>

```

<PRS_Settings> element

The <PRS_Settings> element is a child element of the <BWP_Config> element.

```

<PRS_Settings>
  <SlotConfig>
    <SlotConfigMode/>
    <Slots/>
  </SlotConfig>
  <NumberOfRBs/>
  <StartRB/>
  <l_PRS_start/>
  <L_PRS/>

```

Reference: structure of .allocation files

```
<n_PRS_ID/>  
<K_PRS_comb/>  
<k_PRS_offset/>  
<RelPower_dB/>  
</CSI_Settings>
```

5 Analysis

The R&S VSE provides various tools to analyze the measurement results.

- [General analysis tools](#)..... 184
- [Analysis tools for I/Q measurements](#)..... 187
- [Analysis tools for frequency sweep measurements](#)..... 197

5.1 General analysis tools

The general analysis tools are tools available for all measurements.

- [Data export](#)..... 184
- [Diagram scale](#)..... 185
- [Zoom](#)..... 186
- [Markers](#)..... 186

5.1.1 Data export

Access: [TRACE] > "Trace Export Config"

You can export the measurement results to an ASCII file, for example to backup the results or analyze the results with external applications (for example in a Microsoft Excel spreadsheet).

You can also export the I/Q data itself, for example if you want to keep it for later reevaluation.

The data export is available for:

- I/Q measurements
- Time alignment error measurements
- Transmit power on / off measurements

Exporting trace data

1. Select [TRACE] > "Trace Export Config".
2. Select the data you would like to export.
3. Select the results you would like to export from the "Specifics For" dropdown menu.
4. Export the data with the "Export Trace to ASCII File" feature.
5. Select the location where you would like to save the data (as a `.dat` file).

Note that the measurement data stored in the file depend on the selected result display ("Specifics For" selection).

Exporting I/Q data

1. Select the disk icon in the toolbar.

2. Select "Export" > "I/Q Export".
3. Define a file name and location for the I/Q data.
The file type is `iq.tar`.
4. Later on, you can import the I/Q data using the [I/Q file input source](#).

Data import and export

The basic principle for both trace export and I/Q data export and import is the same as in the spectrum application. For a comprehensive description, refer to the R&S VSE user manual.

Remote command:

Trace export: `TRACe<n>[:DATA]?` on page 268

I/Q export: `MMEMory:STORe<n>:IQ:STATe` on page 271

I/Q import: `INPut:FILE<fi>:PATH` on page 384

5.1.2 Diagram scale

Access: "Overview" > "Analysis" > "Scale"

You can change the scale of the y-axis in various diagrams. The y-axis scale determines the vertical resolution of the measurement results.

The scale of the x-axis in the diagrams is fix. If you want to get a better resolution of the x-axis, you have to [zoom](#) into the diagram.

The remote commands required to configure the y-axis scale are described in [Chapter 6.10.1.2, "Diagram scale"](#), on page 418.

Manual scaling of the y-axis	185
Automatic scaling of the y-axis	185

Manual scaling of the y-axis

The "Y Minimum" and "Y Maximum" properties define a custom scale of the y-axis.

The "Y Minimum" corresponds to the value at the origin. The "Y Maximum" corresponds to the last value on the y-axis. The scale you select applies to the currently active window.

You can restore the original scale anytime with "Restore Scale".

Remote command:

`DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALE]:MAXimum`
on page 419

`DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALE]:MINimum`
on page 419

Automatic scaling of the y-axis

Usually, the best way to view the results is if they fit ideally in the diagram area and display the complete trace. The "Auto Scale Once" automatically determines the scale of the y-axis that fits this criteria in the currently active window.

Tip: You can also scale the windows in the "Auto Set" menu. In addition to scaling the selected window ("Auto Scale Window"), you can change the scale of all windows at the same time ("Auto Scale All").

You can restore the original scale anytime with "Restore Scale".

Remote command:

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




on page 418

5.1.3 Zoom

The zoom feature allows you to zoom into any graphical result display. This can be a useful tool if you want to analyze certain parts of a diagram in more detail.

The zoom functionality is the same as in the spectrum application.

The following zoom functions are supported.

- : Magnifies the selected diagram area.
- : Magnifies the selected diagram area, but keeps the original diagram in a separate window.
- : Restores the original diagram.

Note that the zoom is a graphical feature that magnifies the data in the capture buffer. Zooming into the diagram does not reevaluate the I/Q data.

For a comprehensive description of the zoom, refer to the R&S VSE user manual.

5.1.4 Markers

Access: "Overview" > "Analysis" > "Marker"

Markers are a tool that help you to identify measurement results at specific trace points. When you turn on a marker, it gives you the coordinates of its position, for example the frequency and its level value or the symbol and its EVM value.

In general, the marker functionality of setting and positioning markers is similar to the spectrum application.

For I/Q measurement, the R&S VSE supports up to four markers, for frequency sweep measurements there are more. Markers give either absolute values (normal markers) or values relative to the first marker (deltamarkers). If a result display has more than one trace, for example the "EVM vs Symbol" result display, you can position the marker on either trace. By default, all markers are positioned on trace 1.

Note that if you analyze more than one bandwidth part, each bandwidth part is represented by a different trace.

The R&S VSE also supports several automatic positioning mechanisms that allow you to move the marker to the maximum trace value (peak), the minimum trace value or move it from peak to subsequent peak.

The [marker table](#) summarizes the marker characteristics.

For a comprehensive description, refer to the R&S VSE user manual.

Markers in result displays with a third quantity

In result displays that show a third quantity, for example the "EVM vs Symbol x Carrier" result, the R&S VSE provides an extended marker functionality.

You can position the marker on a specific resource element, whose position is defined by the following coordinates:

- The "BWP/SS" dropdown menu selects the bandwidth part.
- The "Symbol" input field selects the symbol.
- The "Carrier" input field selects the carrier.

Alternatively, you can define the marker position in the "Marker Configuration" dialog box, which is expanded accordingly.

The marker information shows the EVM, the power and the allocation ID of the resource element you have selected as the marker position.

5.2 Analysis tools for I/Q measurements

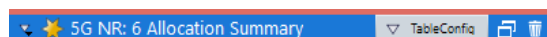
The following analysis tools are available exclusively for I/Q measurements.

- [Layout of numerical results](#)..... 187
- [Result settings](#)..... 187
- [Table configuration](#)..... 190
- [Result views](#)..... 192
- [Evaluation range](#)..... 193
- [Beamforming selection](#)..... 196

5.2.1 Layout of numerical results

You can customize the displayed information of some numerical result displays or tables, for example the [allocation summary](#).

You can identify these result display by the "Table Config" button in the result display header.



When you select the "Table Config" button, the R&S VSE opens a dialog box that allows you to add or remove table columns. Note that some columns are mandatory and cannot be removed.

Alternatively, select some point in the header row of the table to open the dialog box.

5.2.2 Result settings

Access: "Overview" > "Analysis" > "Result Settings"

The result settings control the way various results are displayed.

EVM Unit.....	188
Bit Stream Format.....	188
Carrier Axes.....	188
Symbol Axes.....	188
Carrier Axes Reference.....	189
EVM Max Hold.....	189
Subwindow Coupling.....	189
3D View.....	189
Constellation Diagram Relative Power.....	190
Constellation Color.....	190

EVM Unit

The "EVM Unit" selects the unit for the EVM measurement results in diagrams and numerical result displays.

Possible units are dB and %.

Remote command:

[UNIT:EVM](#) on page 435

Bit Stream Format

Selects the way the bit stream is displayed.

The bit stream is either a stream of raw bits or of symbols. In case of the symbol format, the bits that belong to a symbol are shown as hexadecimal numbers with two digits.

Selecting the bit stream format is possible when [data demodulation](#) occurs before or after descrambling.

Remote command:

[UNIT:BSTR](#) on page 434

Carrier Axes

The "Carrier Axes" selects the unit of the x-axis in result displays that show results over the subcarriers.

- "Hertz"
X-axis shows the results in terms of the subcarrier frequency.
- "Subcarrier Number"
X-axis shows the results in terms of the subcarrier number.

Remote command:

[UNIT:CAXes](#) on page 435

Symbol Axes

The "Symbol Axes" selects the unit of the x-axis in result displays that show results over the OFDM symbols.

- "Time"
X-axis shows the results in terms of time.
- "Symbol Number"
X-axis shows the results in terms of the symbol number.

Remote command:

`UNIT:SAXes` on page 435

Carrier Axes Reference

Selects the way the frequency is displayed in result displays that plot (carrier) frequency information on the x-axis. In these result displays, the x-axis covers the whole [channel bandwidth](#).

"Lowest RB" Frequency values relative to the first resource block in the channel. The origin of the x-axis (0 Hz) corresponds to the first resource block in the channel.

"Relative to CF" Frequency values relative to the center frequency of the carrier. The center frequency of the carrier corresponds to 0 Hz, which is displayed at the center of the x-axis.

Remote command:

`UNIT:CAReference` on page 434

EVM Max Hold

The "EVM Max Hold" turns the display of the highest EVM values in graphical result displays on and off.

Depending on the result display and the evaluation range, this means that

- either the maximum trace is displayed
- or the highest value in a data bin is displayed instead of the average.

Remote command:

`[SENSe:]NR5G:EMHold` on page 432

Subwindow Coupling

Couples or decouples result display tabs (subwindows).

If the coupling is on and you select another tab in a result display, the application automatically selects the same tab for all result displays.

Subwindow coupling is available for measurements with multiple data streams (for example carrier aggregation).

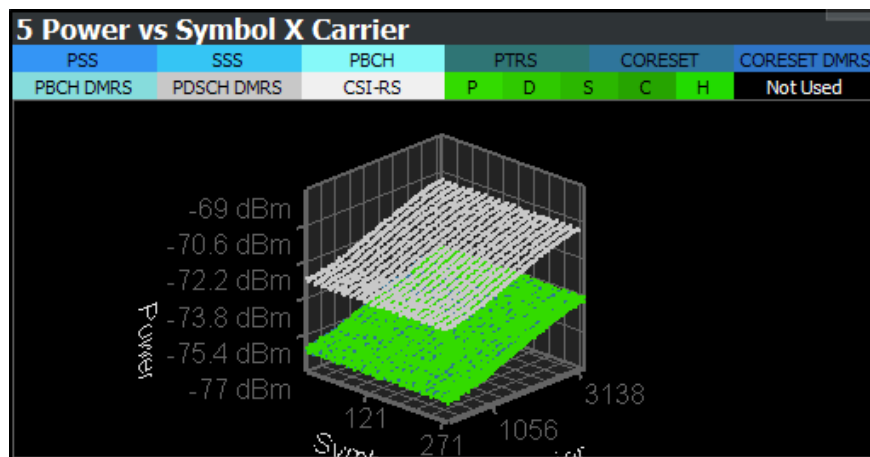
Remote command:

`DISPlay[:WINDow<n>][:SUBWindow<w>]:COUPling` on page 431

3D View

The "3D View" turns the display of a 3D view of the following result displays on and off.

- ["Allocation ID vs Symbol x Carrier"](#) on page 38
- ["EVM vs Symbol x Carrier"](#) on page 38
- ["Power vs Symbol x Carrier"](#) on page 38



The 3D diagram shows a point cloud of all measurement points in the capture buffer. The information is the same as in the 2D views. The 3D diagram can help you find value distributions more easily, for example.

The 3D view supports the following controls:

- Changing the scale of the axes.
- Turning the diagram in any direction.
The view from the top corresponds to the 2D views.
- Zooming in and out of the diagram to see more details.

Remote command:

[\[SENSe:\]NR5G:TDView](#) on page 434

Constellation Diagram Relative Power

Turns the consideration of a boosting factor to calculate the constellation points in the [constellation diagram](#) on and off.

Remote command:

[\[SENSe:\]NR5G:CDRPower](#) on page 432

Constellation Color

Selects the information that the colors of the constellation points in the [constellation diagram](#) represent.

"Modulation" Colors represent modulation types.

"Allocation" Colors represent allocation types.

Remote command:

[\[SENSe:\]NR5G:CCOLor](#) on page 432

5.2.3 Table configuration

Access: "Result Settings" > "Table Config"

The result summary and allocation summary contain all sorts of results and information. If you only want to see a selected set of results, you can customize the contents of these result displays by adding or removing individual results.



Accessing the "Table Config" tab

Note that the contents of the "Table Config" dialog box are only available after you have selected the "Specifics for: Result Summary" or "Specifics for: Allocation Summary" item from the corresponding dropdown menu at the bottom of the dialog box.

Specifics for 2: Result Summary ▾

CC Result

Selects the way the R&S VSE analyzes [multiple carriers](#).

The component carrier analysis method also changes the layout of the [result summary](#).

- | | |
|----------|--|
| "All" | Analyzes all component carriers and shows information about all of them in the result summary overview ("All" tab).
Note that measuring all component carriers can take a while, depending on the number of component carriers. |
| "Viewed" | Analyzes the two component carriers assigned to the two views . The result summary overview ("All" tab) only shows information about those two component carriers. |

Remote command:

[\[SENSe:\]NR5G:RSUMmary:CCResult](#) on page 432

Power Mode

Selects the power averaging mode for the results in the [result summary](#).

Available if the signal only contains a single numerology.

- | | |
|-----------------------------|---|
| "Average
Active Slots" | Averages the power of all OFDM symbols in the slot. |
| "Average
Active Symbols" | Averages the OFDM symbols that are used. If all symbols are occupied, the results are the same as averaging over all symbols.
This setting has an effect on TDD signals that combine both downlink and uplink symbols in a slot. |

Remote command:

[\[SENSe:\]NR5G:RSUMmary:PMODE](#) on page 433

Result state

Turn individual results on and off by selecting or deselecting the corresponding result labels.

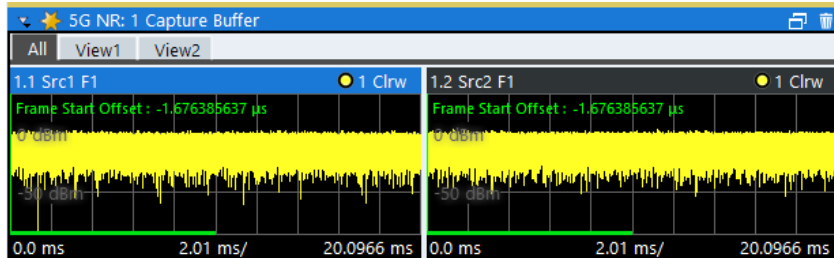
Note that some information is always visible, the corresponding checkboxes are greyed out.

Remote command:

Result selection: [DISPlay\[:WINDow<n>\]:TABLE:ITEM](#) on page 431

5.2.4 Result views

When you capture multiple data streams, for example [several component carriers](#), the R&S VSE displays the results for each single data stream in a separate diagram. Because this can lead to literally dozens of diagrams in each result display, the R&S VSE only shows two data streams simultaneously.



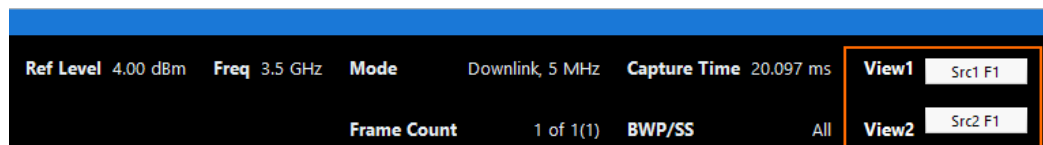
Result displays are made up out of three tabs in such cases.

- The first tab labeled "All" shows the two data streams next to each other, in two subwindows.
- The other two tabs labeled "View <x>" show each of the two data streams in a single window.

There are always just two views, but you can assign the data streams you would like to see to those two views. If you measure more than two data streams, you have to select the data streams you want to display.

If you measure [several frames](#) in addition to multiple data streams, you can also select a specific frame whose information is displayed in the two diagrams.

You can see the currently displayed component carriers in the window title bar and the channel bar.



CC = Component carrier number
 Src = Input source
 F = Frame number

[Component Carrier No](#)..... 192
[Frame No](#)..... 193

Component Carrier No

Selects the number of the component carrier that the R&S VSE displays in the two views.

For MIMO measurements, this input field is labeled "Input Source No" and selects the data stream that the R&S VSE displays in the two views.

Remote command:

`DISPlay[:WINDow<n>][:SUBWindow<w>]:CCNumber` on page 429

`DISPlay[:WINDow<n>][:SUBWindow<w>]:ISNumber` on page 430

Frame No

Selects the frame that the R&S VSE displays in the two views.

Note that the frame selection in the "Result View" dialog box and the "Evaluation Range" dialog box are coupled.

Remote command:

`DISPlay[:WINDow<n>][:SUBWindow<w>]:FNUMBER` on page 430

5.2.5 Evaluation range

Access: "Overview" > "Evaluation Range" > "Global / Constellation"

You can filter various result displays by the type of information they display.

The remote commands required to configure the results are described in [Chapter 6.10.2.3, "Evaluation range"](#), on page 435.

Frame Selection	193
BWP/SS Selection	193
Subframe Selection	194
Slot Selection	195
Evaluation range for the constellation diagram	195

Frame Selection

The "Frame" selection filters the results by a specific frame number.

If you apply the filter, only the results for the frame you have selected are displayed. Otherwise, the R&S VSE shows the results for the first frame.

For more information about the effects on results when you capture multiple frames, see ["Effects of capturing multiple frames on results"](#) on page 81.

Remote command:

`[SENSe:]NR5G[:CC<cc>]:FRAME:SElect` on page 438

BWP/SS Selection

The "BWP/SS" selection filters the results by a specific bandwidth part.

If you apply the filter, only the results for the bandwidth part you have selected are displayed. Otherwise, the R&S VSE shows the results for all bandwidth parts that have been analyzed.

Selecting "SS/PBCH Block" shows only the results for the synchronization signal and PBCH block. Selecting one of the numbers only shows the results for the corresponding bandwidth part.

The R&S VSE shows several traces if the filter is not active, one for each bandwidth part and one for SS/PBCH block.

If you apply the filter, the number of traces depends on the result display. For some result displays, the minimum, maximum and average result are displayed in three traces, for others only one trace.

You can apply the filter to the following result displays.

- EVM vs Carrier
- EVM vs Symbol

- Flatness vs Carrier
- Constellation Diagram
- Allocation Summary
- Alloc ID vs Symbol x Carrier
- EVM vs Symbol x Carrier
- Power vs Symbol x Carrier

Remote command:

[SENSe:]NR5G[:CC<cc>]:BWPart:SElect on page 437

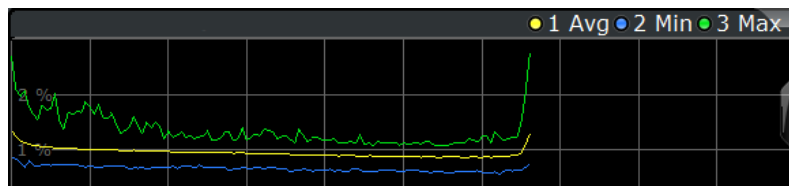
Subframe Selection

The "Subframe" selection filters the results by a specific subframe number.

If you apply the filter, only the results for the subframe you have selected are displayed. Otherwise, the R&S VSE shows the results for all subframes that have been analyzed.

The R&S VSE shows three traces if you display the results for all subframes.

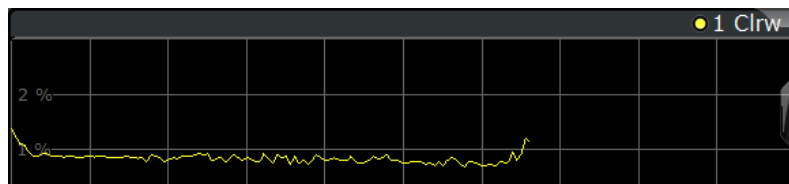
- One trace ("Min") shows the minimum values measured over all analyzed subframes.
- One trace ("Max") shows the maximum values measured over all analyzed subframes.
- One trace ("Avg") shows the average values measured over all subframes.



If you filter by a single subframe, the R&S VSE still shows three traces, but with different information.

- One trace ("Min") shows the minimum values measured over all slots in the selected subframe.
- One trace ("Max") shows the maximum values measured over all slots in the selected subframe.
- One trace ("Avg") shows the average values measured over all slots in the selected subframe.

The number of traces is only reduced to one trace if you filter by a single [slot](#).



You can apply the filter to the following result displays.

- EVM vs Carrier
- EVM vs Symbol
- Flatness vs Carrier
- Constellation Diagram
- Allocation Summary
- Alloc ID vs Symbol x Carrier

- EVM vs Symbol x Carrier
- Power vs Symbol x Carrier

Remote command:

[\[SENSe:\]NR5G\[:CC<cc>\]:SUBFrame:SElect](#) on page 440

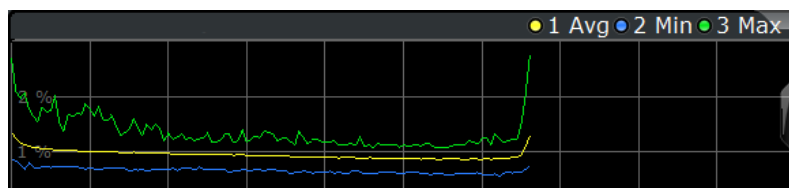
Slot Selection

The "Slot" selection filters the results by a specific slot number.

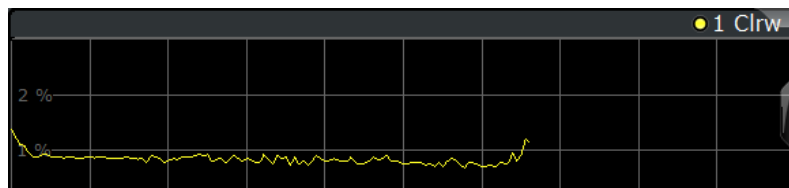
If you apply the filter, only the results for the slot you have selected are displayed. Otherwise, the R&S VSE shows the results for all slots.

The R&S VSE shows three traces if you display the results for all slots.

- One trace ("Min") shows the minimum values measured over all slots.
- One trace ("Max") shows the maximum values measured over all slots.
- One trace ("Avg") shows the average values measured over all slots.



If you filter by a single slot, the R&S VSE shows one trace that represents the values measured for that slot only.



You can apply the filter to the following result displays.

- EVM vs Carrier
- EVM vs Symbol
- Flatness vs Carrier
- Constellation Diagram
- Allocation Summary
- Alloc ID vs Symbol x Carrier
- EVM vs Symbol x Carrier
- Power vs Symbol x Carrier

Remote command:

[\[SENSe:\]NR5G\[:CC<cc>\]:SLOT:SElect](#) on page 439

Evaluation range for the constellation diagram

The "Evaluation Range" for the constellation diagram selects the information displayed in the [constellation diagram](#).

By default, the constellation diagram contains the constellation points of the complete data that has been analyzed. However, you can filter the results by several aspects.

- Modulation
 - Filters the results by the selected type of modulation.
- Allocation

- Filters the results by a certain type of allocation.
- Symbol (OFDM)
Filters the results by a certain OFDM symbol.
- Carrier
Filters the results by a certain subcarrier.
- Location (for MIMO measurements only)
Selects the point in the signal processing at which the constellation diagram is created, before or after the MIMO encoding. If you have selected "After MIMO Decoder", the constellation points for all input sources are combined in one diagram.
Available for [OTA](#) MIMO setups.
- Antenna port (for MIMO measurements only)
Filters the results by a certain antenna port. Available for "Location" = "After MIMO Decoder".

Remote command:

Modulation: [\[SENSe:\]NR5G\[:CC<cc>\]:MODulation:SElect](#) on page 438

Allocation: [\[SENSe:\]NR5G\[:CC<cc>\]:ALlocation:SElect](#) on page 436

Symbol: [\[SENSe:\]NR5G\[:CC<cc>\]:SYMBOL:SElect](#) on page 440

Carrier: [\[SENSe:\]NR5G\[:CC<cc>\]:CARRIER:SElect](#) on page 437

Location: [\[SENSe:\]NR5G\[:CC<cc>\]:LOCation:SElect](#) on page 438

Antenna port: [\[SENSe:\]NR5G\[:CC<cc>\]:ANTenna:SElect](#) on page 437

5.2.6 Beamforming selection

Access: "Overview" > "Evaluation Range" > "Beamforming"

You can filter various beamforming result displays by the type of information they display.

The remote commands required to configure the results are described in [Chapter 6.10.2.3, "Evaluation range"](#), on page 435.

RS Weights	196
Reference AP	196
Reference Antenna	197

RS Weights

Filters the displayed results to include only certain antenna port(s).

The availability of antenna ports depends on the number of channels and the number of beamforming layers you are testing.

Remote command:

[CONFigure\[:NR5G\]:DL\[:CC<cc>\]:BF:AP\[:UERS\]](#) on page 436

Reference AP

Selects the reference antenna port for relative beamforming results.

Remote command:

[\[SENSe:\]NR5G\[:CC<cc>\]:RAP](#) on page 439

Reference Antenna

Selects the physical reference antenna (input source) for relative beamforming results.

Remote command:

[SENSe:]NR5G:RANTenna on page 440

5.3 Analysis tools for frequency sweep measurements

Access: "Overview" > "Analysis"

Access: "Overview" > "Analysis"

The analysis tools available for the frequency sweep measurements are the same as in the spectrum analyzer.

For more information, refer to the R&S VSE user manual.

6 Remote control

The following remote control commands are required to configure and perform 5G NR measurements in a remote environment. The R&S VSE must already be set up for remote operation in a network as described in the base unit manual.



Universal functionality

Note that basic tasks that are also performed in the base unit in the same way are not described here. For a description of such tasks, see the R&S VSE User Manual.

In particular, this includes:

- Managing Settings and Results, i.e. storing and loading settings and result data.
- Basic instrument configuration, e.g. checking the system configuration, customizing the screen layout, or configuring networks and remote operation.
- Using the common status registers.

• Common suffixes	198
• Introduction	199
• 5G NR application selection	204
• Screen layout	204
• Measurement control	214
• Remote commands to retrieve numeric results	216
• Limit check results	235
• Retrieve trace data	248
• Configuration	269
• Analysis	417

6.1 Common suffixes

In the 5G NR measurement application, the following common suffixes are used in remote commands:

Table 6-1: Common suffixes used in remote commands in the 5G NR measurement application

Suffix	Value range	Description
<m>	1..4	Marker
<n>	1..16	Window (in the currently selected channel)
<t>	1..6	Trace
	1 to 8	Limit line
<al>	0..99	Selects a subframe allocation.
<ant>	1..32	Selects an input source for MIMO measurements (downlink only)
<bwp>	1..12	Selects a bandwidth part.

Suffix	Value range	Description
<cc>	1..16	Selects a component carrier.
<csi>	1..64	Selects a CSI-RS.
<fr>	1..n	Selects a frame. The maximum value depends on the signal configuration.
<k>	---	Selects a limit line. Irrelevant for the 5G NR application.
<sf>	0..n	Selects a subframe. The maximum value depends on the signal configuration.
<sl>	0..n	Selects a slot. The maximum value depends on the signal configuration.
<ss>	0..64	Selects a synchronization signal block (SSB).
<ssb>	1..4	irrelevant
<sym>	0..13	Selects an OFDM symbol
<w>	1..2	Selects a subwindow (view)

6.2 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.

6.2.1 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.

6.2.2 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.

6.2.3 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.

6.2.4 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.

6.2.5 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`.

6.2.6 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.

- [Numeric values](#)..... 202
- [Boolean](#)..... 203
- [Character data](#)..... 203
- [Character strings](#)..... 203
- [Block data](#)..... 204

6.2.6.1 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.

6.2.6.2 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`

6.2.6.3 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 6.2.2, "Long and short form"](#), on page 200.

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`

6.2.6.4 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'
```

6.2.6.5 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.

6.3 5G NR application selection

INSTRument[:SElect].....204

INSTRument[:SElect] <ChannelType>

Selects a new measurement channel with the defined channel type.

Parameters:

<ChannelType>	NR5G
	5G NR measurement channel

Example: //Select 5G NR application
INST NR5G

6.4 Screen layout

- [General layout](#).....204
- [Layout over all channels](#)..... 205
- [Layout of a single channel](#)..... 208

6.4.1 General layout

The following commands are required to configure general window layout, independent of the application.

Note that the suffix <n> always refers to the window *in the currently selected measurement channel*.

DISPlay[:WINDow<n>][:SUBWindow<w>]:SElect..... 205
DISPlay[:WINDow<n>]:TAB<tab>:SElect..... 205

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

DISPlay[:WINDow<n>]:TAB<tab>:SElect

Selects a tab in diagrams with multiple subwindows (or views).

Note that selecting a tab does not actually select a subwindow. To select a subwindow, for example to query the results of a subwindow, use `DISPlay[:WINDow<n>][:SUBWindow<w>]:SElect`.

Suffix:

<n>	Window
<tab>	1..n Tab

Example: //Select a tab
DISP:WIND2:TAB2:SEL

6.4.2 Layout over all channels

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 6.4.3, "Layout of a single channel"](#), on page 208 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]?	206
LAYout:GLOBal:CATalog[:WINDow]?	206
LAYout:GLOBal:IDENtify[:WINDow]?	207
LAYout:GLOBal:REMove[:WINDow]	208
LAYout:GLOBal:REPLace[:WINDow]	208

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 <code>LAYout:GLOBal:IDENTify[:WINDow]?</code> 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

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

6.4.3 Layout of a single channel

The following commands are required to change the evaluation type and rearrange the screen layout for a measurement channel as you do using the SmartGrid in manual operation. Since the available evaluation types depend on the selected application, some parameters for the following commands also depend on the selected measurement channel.

Note that the suffix <n> always refers to the window *in the currently selected measurement channel*.

LAYout:ADD[:WINDow]?	208
LAYout:CATalog[:WINDow]?	210
LAYout:IDENtify[:WINDow]?	211
LAYout:REMOve[:WINDow]	211
LAYout:REPLace[:WINDow]	212
LAYout:WINDow<n>:ADD?	212
LAYout:WINDow<n>:IDENtify?	213
LAYout:WINDow<n>:REMOve	213
LAYout:WINDow<n>:REPLace	213
LAYout:WINDow<n>:TYPE	214

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:

<code><WindowName></code>	String containing the name of the existing window the new window is inserted next to. By default, the name of a window is the same as its index. To determine the name and index of all active windows, use the <code>LAYout:CATalog[:WINDow]? query</code> .
<code><Direction></code>	LEFT RIGHT ABOVE BELOW Direction the new window is added relative to the existing window.
<code><WindowType></code>	text value Type of result display (evaluation method) you want to add. See the table below for available parameter values. Note that the window type must be valid for the active channel. To create a window for a different channel, use the <code>LAYout:GLOBal:REPLace[:WINDow]</code> command.

Return values:

<code><NewWindowName></code>	When adding a new window, the command returns its name (by default the same as its number) as a result.
------------------------------------	---

Usage: Query only

Manual operation:

- See "Capture Buffer" on page 27
- See "EVM vs Carrier" on page 28
- See "EVM vs Symbol" on page 29
- See "EVM vs RB" on page 30
- See "Frequency Error vs Symbol" on page 30
- See "Frequency Error vs Subframe" on page 31
- See "Power Spectrum" on page 32
- See "Flatness" on page 32
- See "CCDF" on page 33
- See "Constellation Diagram" on page 34
- See "Allocation Summary" on page 34
- See "Channel Decoder Results" on page 35
- See "Bitstream" on page 36
- See "EVM vs Symbol x Carrier" on page 38
- See "Power vs Symbol x Carrier" on page 38
- See "Allocation ID vs Symbol x Carrier" on page 38
- See "RS Magnitude" on page 39
- See "RS Phase" on page 40
- See "RS Phase Difference" on page 41
- See "Beamforming Summary" on page 41
- See "Marker Table" on page 42
- See "Time Alignment Error" on page 45
- See "Marker Peak List" on page 53

Table 6-2: <WindowType> parameter values for 5G NR measurement application

Parameter value	Window type
I/Q measurements	
AISC	"Allocation ID vs. Symbol X Carrier"
ASUM	"Allocation Summary"
BSUM	"Beamforming Summary"
BSTR	"Bitstream"
CBUF	"Capture Buffer"
CCDF	"CCDF"
CDEC	"Channel Decoder"
CONS	"Constellation Diagram"
EVCA	"EVM vs. Carrier"
EVRB	"EVM vs. RB"
EVSC	"EVM vs. Symbol X Carrier"
EVSY	"EVM vs. Symbol"
FEVS	"Frequency Error vs Symbol"
FLAT	"Channel Flatness"
FVSU	"Frequency Error vs Subframe"
MTAB	"Marker Table"
PSPE	"Power Spectrum"
PVSC	"Power vs. Symbol X Carrier"
RSUM	"Result Summary"
RSMA	"RS Magnitude"
RSPD	"RS Phase Difference"
RSWP	"RS Phase"

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: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 208 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 208 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 208 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 208.

Note that this command is not available in all applications and measurements.

Suffix:

<n> 1..n
[Window](#)

Parameters:

<WindowType>

Example:

`LAY:WIND2:TYPE?`

6.5 Measurement control

ABORt	214
INITiate<n>:CONTinuous	215
INITiate<n>[:IMMediate]	216
[SENSe:]SYNC[:CC<cc>][:STATe]?	216

ABORt

Aborts the measurement in the current channel and resets the trigger system.

To prevent overlapping execution of the subsequent command before the measurement has been aborted successfully, use the `*OPC?` or `*WAI` command after `ABOR` and before the next command.

For details on overlapping execution see [Remote control via SCPI](#).

Note on blocked remote control programs:

If a sequential command cannot be completed, for example because a triggered sweep never receives a trigger, the remote control program will never finish and the remote channel to the connected instrument is blocked for further commands. In this case, you must interrupt processing on the remote channel first in order to abort the measurement.

To do so, send a "Device Clear" command from the control instrument to the connected instrument on a parallel channel to clear all currently active remote channels. Depending on the used interface and protocol, send the following commands:

- **Visa:** `viClear()`
- **GPIB:** `ibclr()`
- **RSIB:** `RSDLLibclr()`

Now you can send the `ABORt` command on the remote channel performing the measurement.

Example: `ABOR; :INIT:IMM`
Aborts the current measurement and immediately starts a new one.

Example: `ABOR; *WAI`
`INIT:IMM`
Aborts the current measurement and starts a new one once abortion has been completed.

Usage: Event

INITiate<n>:CONTInuous <State>

Controls the measurement mode for an individual channel.

Note that in single measurement mode, you can synchronize to the end of the measurement with `*OPC`, `*OPC?` or `*WAI`. In continuous measurement mode, synchronization to the end of the measurement is not possible. Thus, it is not recommended that you use continuous measurement mode in remote control, as results like trace data or markers are only valid after a single measurement end synchronization.

For details on synchronization see [Remote control via SCPI](#).

Suffix:
<n> irrelevant

Parameters:
<State> `ON | OFF | 0 | 1`
ON | 1
Continuous measurement
OFF | 0
Single measurement
***RST:** 1 (some applications can differ)

Example:

```
INIT:CONT OFF
Switches the measurement mode to single measurement.
INIT:CONT ON
Switches the measurement mode to continuous measurement.
```

INITiate<n>[:IMMediate]

Starts a (single) new measurement.

You can synchronize to the end of the measurement with *OPC, *OPC? or *WAI.

For details on synchronization see [Remote control via SCPI](#).

Suffix:

<n> irrelevant

Usage: Asynchronous command

[SENSe:]SYNC[:CC<cc>][:STATe]?

Queries the current synchronization state.

Suffix:

<cc> irrelevant

Return values:

<State> The string contains the following information:
A zero represents a failure and a one represents a successful synchronization.

Example:

```
//Query synchronization state
SYNC:STAT?
```

Usage: Query only

6.6 Remote commands to retrieve numeric results

- [Result summary](#)..... 216
- [Time alignment error](#)..... 230
- [Marker table](#)..... 230
- [CCDF table](#)..... 233

6.6.1 Result summary

FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:ALL?.....	218
FETCh[:CC<cc>][:ISRC<ant>]:SUMMary:CRESt[:AVERAge]?	219
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:BLER:MAXimum?	219
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:BLER:MINimum?	219
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:BLER[:AVERAge]?	219
FETCh:ALL:SUMMary:EVM:ALL?.....	219

Remote commands to retrieve numeric results

FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:EVM[:ALL]:MAXimum?.....	219
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:EVM[:ALL]:MINimum?.....	219
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:EVM[:ALL][:AVERage]?.....	219
FETCh:ALL:SUMMary:EVM:DS1K?.....	220
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:EVM:DS1K:MAXimum?.....	220
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:EVM:DS1K:MINimum?.....	220
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:EVM:DS1K[:AVERage]?.....	220
FETCh:ALL:SUMMary:EVM:DSQP?.....	220
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:EVM:DSQP:MAXimum?.....	220
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:EVM:DSQP:MINimum?.....	221
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:EVM:DSQP[:AVERage]?.....	221
FETCh:ALL:SUMMary:EVM:DSSF?.....	221
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:EVM:DSSF:MAXimum?.....	221
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:EVM:DSSF:MINimum?.....	221
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:EVM:DSSF[:AVERage]?.....	221
FETCh:ALL:SUMMary:EVM:DSST?.....	222
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:EVM:DSST:MAXimum?.....	222
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:EVM:DSST:MINimum?.....	222
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:EVM:DSST[:AVERage]?.....	222
FETCh:ALL:SUMMary:EVM:DSTS?.....	222
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:EVM:DSTS:MAXimum?.....	222
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:EVM:DSTS:MINimum?.....	222
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:EVM:DSTS[:AVERage]?.....	222
FETCh:ALL:SUMMary:EVM:PCHannel?.....	223
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:EVM:PCHannel:MAXimum?.....	223
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:EVM:PCHannel:MINimum?.....	223
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:EVM:PCHannel[:AVERage]?.....	223
FETCh:ALL:SUMMary:EVM:PEAK?.....	223
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:EVM:PEAK:MAXimum?.....	223
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:EVM:PEAK:MINimum?.....	223
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:EVM:PEAK[:AVERage]?.....	223
FETCh:ALL:SUMMary:EVM:PSIGnal?.....	224
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:EVM:PSIGnal:MAXimum?.....	224
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:EVM:PSIGnal:MINimum?.....	224
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:EVM:PSIGnal[:AVERage]?.....	224
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:FERRor:MAXimum?.....	224
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:FERRor:MINimum?.....	224
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:FERRor[:AVERage]?.....	224
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:GIMBalance:MAXimum?.....	225
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:GIMBalance:MINimum?.....	225
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:GIMBalance[:AVERage]?.....	225
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:IQOFfset:MAXimum?.....	225
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:IQOFfset:MINimum?.....	225
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:IQOFfset[:AVERage]?.....	225
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:OSTP:MAXimum?.....	226
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:OSTP:MINimum?.....	226
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:OSTP[:AVERage]?.....	226
FETCh:ALL:SUMMary:POWer?.....	226
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:POWer:MAXimum?.....	226
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:POWer:MINimum?.....	226

Remote commands to retrieve numeric results

FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:POWer[:AVERAge]?	226
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:QUADerror:MAXimum?	227
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:QUADerror:MINimum?	227
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:QUADerror[:AVERAge]?	227
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:RSRP:CSI:MAXimum?	227
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:RSRP:CSI:MINimum?	227
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:RSRP:CSI[:AVERAge]?	227
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:RSRP:SS:MAXimum?	227
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:RSRP:SS:MINimum?	227
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:RSRP:SS[:AVERAge]?	227
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:RSTP:MAXimum?	228
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:RSTP:MINimum?	228
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:RSTP[:AVERAge]?	228
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:SERRor:MAXimum?	228
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:SERRor:MINimum?	228
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:SERRor[:AVERAge]?	228
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:TPUT:MAXimum?	229
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:TPUT:MINimum?	229
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:TPUT[:AVERAge]?	229
FETCh[:CC<cc>][:ISRC<ant>]:SUMMary:TFRame?	229

FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:ALL?

Queries all results in the numerical result summary.

Suffix:

<cc>	Component Carrier
<ant>	Input source
<fr>	Frame

Return values:

<Result>	String containing all results in the following format. <ResultType>, <AverageResult>, <MaximumResult>, <MinimumResult> If a result has not been calculated, the command returns NAN.
----------	---

Example:

```
//Query all numerical results
FETC:SUMM:ALL?
would return, e.g.
EVM PDSCH QPSK,
+2.695721388E-001, +2.695721388E-001,
+2.695721388E-001,
EVM PDSCH 16QAM, NAN, NAN, NAN,
...
```

Usage: Query only

Manual operation: See "Remote queries" on page 22

FETCH[:CC<cc>][:ISRC<ant>]:SUMMARY:CRESt[:AVERAge]?

Queries the average crest factor as shown in the result summary.

Suffix:

<cc> [Component Carrier](#)
 <ant> [Input source](#)

Return values:

<CrestFactor> Default unit: dB

Example:

```
//Query crest factor
FETC:SUMM:CRES?
```

Usage:

Query only

Manual operation: See "[Crest Factor](#)" on page 26

FETCH[:CC<cc>][:ISRC<ant>][:FRAME<fr>]:SUMMARY:BLER:MAXimum?
FETCH[:CC<cc>][:ISRC<ant>][:FRAME<fr>]:SUMMARY:BLER:MINimum?
FETCH[:CC<cc>][:ISRC<ant>][:FRAME<fr>]:SUMMARY:BLER[:AVERAge]?

Queries the EVM of all resource elements.

Prerequisites for this command

- Turn on throughput measurement ([\[SENSe:\]NR5G:TRACking:TPUT:STATe](#)).
- Turn on BLER measurement ([DISPlay\[:WINDow<n>\]:TABLE:ITEM](#)).

Suffix:

<cc> [Component Carrier](#)
 <ant> [Input source](#)
 <fr> [Frame](#)

Return values:

<BLER> Default unit: PCT

Example:

```
//Query BLER
NR5G:TRAC:TPUT:STAT ON
DISP:TABL:ITEM BLER,ON
FETC:CC2:FRAM3:SUMM:BLER?
```

Usage:

Query only

Manual operation: See "[BLER \(%\)](#)" on page 23

FETCH:ALL:SUMMARY:EVM:ALL? <Result>
FETCH[:CC<cc>][:ISRC<ant>][:FRAME<fr>]:SUMMARY:EVM[:ALL]:MAXimum?
 [<Result>]
FETCH[:CC<cc>][:ISRC<ant>][:FRAME<fr>]:SUMMARY:EVM[:ALL]:MINimum?
 [<Result>]
FETCH[:CC<cc>][:ISRC<ant>][:FRAME<fr>]:SUMMARY:EVM[:ALL][:AVERAge]?

Queries the EVM of all resource elements.

FETCh:ALL:SUMMary:EVM:ALL queries the average result over all carriers. Prerequisites:

- Select to evaluate all carriers (`[SENSe:]NR5G:RSUMmary:CCResult`).

Suffix:

<cc> [Component Carrier](#)

<ant> [Input source](#)

<fr> [Frame](#)

Return values:

<EVM> EVM in % or dB.

Example:

```
//Query EVM
FETC:CC2:FRAM3:SUMM:EVM?
```

Usage:

Query only

Manual operation: See ["EVM All"](#) on page 24

```
FETCh:ALL:SUMMary:EVM:DS1K? <Result>
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:EVM:DS1K:MAXimum?
  [<Result>]
```

```
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:EVM:DS1K:MINimum?
  [<Result>]
```

```
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:EVM:DS1K[:AVERage]?
```

Queries the EVM of all PDSCH resource elements with a 1024QAM modulation.

FETCh:ALL:SUMMary:EVM:DS1K queries the average result over all carriers. Prerequisites:

- Select to evaluate all carriers (`[SENSe:]NR5G:RSUMmary:CCResult`).

Suffix:

<cc> [Component Carrier](#)

<ant> [Input source](#)

<fr> [Frame](#)

Return values:

<EVM> EVM in % or dB.

Example:

```
//Query EVM
FETC:CC2:FRAM3:SUMM:EVM:DS1K?
```

Usage:

Query only

Manual operation: See ["EVM PDSCH"](#) on page 23

```
FETCh:ALL:SUMMary:EVM:DSQP? <Result>
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:EVM:DSQP:MAXimum?
  [<Result>]
```

FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:EVM:DSQP:MINimum?
[<Result>]

FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:EVM:DSQP[:AVERage]?

Queries the EVM of all PDSCH resource elements with a QPSK modulation.

FETCh:ALL:SUMMary:EVM:DSQP queries the average result over all carriers. Prerequisites:

- Select to evaluate all carriers ([\[SENSe:\]NR5G:RSUMmary:CCResult](#)).

Suffix:

<cc> [Component Carrier](#)

<ant> [Input source](#)

<fr> [Frame](#)

Return values:

<EVM> EVM in % or dB.

Example: //Query EVM
FETC:CC2:FRAM3:SUMM:EVM:DSQP?

Usage: Query only

Manual operation: See "[EVM PDSCH](#)" on page 23

FETCh:ALL:SUMMary:EVM:DSSF? <Result>

FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:EVM:DSSF:MAXimum?
[<Result>]

FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:EVM:DSSF:MINimum?
[<Result>]

FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:EVM:DSSF[:AVERage]?

Queries the EVM of all PDSCH resource elements with a 64QAM modulation.

FETCh:ALL:SUMMary:EVM:DSSF queries the average result over all carriers. Prerequisites:

- Select to evaluate all carriers ([\[SENSe:\]NR5G:RSUMmary:CCResult](#)).

Suffix:

<cc> [Component Carrier](#)

<ant> [Input source](#)

<fr> [Frame](#)

Return values:

<EVM> EVM in % or dB.

Example: //Query EVM
FETC:CC2:FRAM3:SUMM:EVM:DSSF?

Usage: Query only

Manual operation: See "[EVM PDSCH](#)" on page 23

```

FETCh:ALL:SUMMary:EVM:DSST? <Result>
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:EVM:DSST:MAXimum?
  [<Result>]
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:EVM:DSST:MINimum?
  [<Result>]
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:EVM:DSST[:AVERage]?

```

Queries the EVM of all PDSCH resource elements with a 16QAM modulation.

FETCh:ALL:SUMMary:EVM:DSST queries the average result over all carriers. Prerequisites:

- Select to evaluate all carriers (`[SENSe:]NR5G:RSUMmary:CCResult`).

Suffix:

<cc> [Component Carrier](#)
 <ant> [Input source](#)
 <fr> [Frame](#)

Return values:

<EVM> EVM in % or dB.

Example:

```
//Query EVM
FETC:CC2:FRAM3:SUMM:EVM:DSST?
```

Usage:

Query only

Manual operation: See "[EVM PDSCH](#)" on page 23

```

FETCh:ALL:SUMMary:EVM:DSTS? <Result>
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:EVM:DSTS:MAXimum?
  [<Result>]
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:EVM:DSTS:MINimum?
  [<Result>]
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:EVM:DSTS[:AVERage]?

```

Queries the EVM of all PDSCH resource elements with a 256QAM modulation.

FETCh:ALL:SUMMary:EVM:DSTS queries the average result over all carriers. Prerequisites:

- Select to evaluate all carriers (`[SENSe:]NR5G:RSUMmary:CCResult`).

Suffix:

<cc> [Component Carrier](#)
 <ant> [Input source](#)
 <fr> [Frame](#)

Return values:

<EVM> EVM in % or dB.

Example:

```
//Query EVM
FETC:CC2:FRAM3:SUMM:EVM:DSTS?
```

Usage:

Query only

Manual operation: See "EVM PDSCH" on page 23

```
FETCh:ALL:SUMMary:EVM:PCHannel? <Result>
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:EVM:PCHannel:
  MAXimum? [<Result>]
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:EVM:PCHannel:MINimum?
  [<Result>]
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:EVM:PCHannel[:
  AVERAge]?
```

Queries the EVM of the physical channel.

FETCh:ALL:SUMMary:EVM:PCHannel queries the average result over all carriers.

Prerequisites:

- Select to evaluate all carriers ([SENSe:]NR5G:RSUMmary:CCResult).

Suffix:

<cc>	Component Carrier
<ant>	Input source
<fr>	Frame

Return values:

<EVM>	EVM in % or dB.
-------	-----------------

Example:

```
//Query EVM
FETC:CC2:FRAM3:SUMM:EVM:PCH?
```

Usage:

Query only

Manual operation: See "EVM Phys Channel" on page 24

```
FETCh:ALL:SUMMary:EVM:PEAK? <Result>
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:EVM:PEAK:MAXimum?
  [<Result>]
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:EVM:PEAK:MINimum?
  [<Result>]
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:EVM:PEAK[:AVERAge]?
```

Queries the peak EVM.

FETCh:ALL:SUMMary:EVM:PEAK queries the average result over all carriers. Prerequisites:

- Select to evaluate all carriers ([SENSe:]NR5G:RSUMmary:CCResult).

Suffix:

<cc>	Component Carrier
<ant>	irrelevant
<fr>	Frame

Return values:

<EVM>	EVM in % or dB.
-------	-----------------

Example: //Query peak EVM
FETC:CC2:FRAM3:SUMM:EVM:PEAK?

Usage: Query only

Manual operation: See "EVM Peak" on page 24

FETCh:ALL:SUMMary:EVM:PSIGnal? <Result>
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:EVM:PSIGnal:MAXimum?
 [<Result>]
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:EVM:PSIGnal:MINimum?
 [<Result>]
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:EVM:PSIGnal[:AVERage]?
 Queries the EVM of the physical signal.

FETCh:ALL:SUMMary:EVM:PSIGnal queries the average result over all carriers.

Prerequisites:

- Select to evaluate all carriers ([SENSe:]NR5G:RSUMmary:CCResult).

Suffix:

<cc> [Component Carrier](#)

<ant> [Input source](#)

<fr> [Frame](#)

Return values:

<EVM> EVM in % or dB.

Example: //Query EVM
FETC:CC2:FRAM3:SUMM:EVM:PSIG?

Usage: Query only

FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:FERRor:MAXimum?
 [<Result>]
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:FERRor:MINimum?
 [<Result>]
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:FERRor[:AVERage]?
 Queries the frequency error.

Suffix:

<cc> [Component Carrier](#)

<ant> irrelevant

<fr> [Frame](#)

Return values:

<FrequencyError> Default unit: Hz

Example: //Query frequency error
FETC:CC2:FRAM3:SUMM:FERR?

Usage: Query only

Manual operation: See "[Frequency Error](#)" on page 25

FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:GIMBalance:MAXimum?
 [<Result>]

FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:GIMBalance:MINimum?
 [<Result>]

FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:GIMBalance[:AVERage]?

Queries the gain imbalance.

Suffix:

<cc> [Component Carrier](#)

<ant> [Input source](#)

<fr> [Frame](#)

Return values:

<GainImbalance> Default unit: dB

Example: //Query gain imbalance
 FETC:CC2:FRAM3:SUMM:GIMB?

Usage: Query only

Manual operation: See "[I/Q Gain Imbalance](#)" on page 25

FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:IQOFfset:MAXimum?
 [<Result>]

FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:IQOFfset:MINimum?
 [<Result>]

FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:IQOFfset[:AVERage]?

Queries the I/Q offset.

Suffix:

<cc> [Component Carrier](#)

<ant> [Input source](#)

<fr> [Frame](#)

Return values:

<IQOffset> Default unit: dB

Example: //Query I/Q offset
 FETC:CC2:FRAM3:SUMM:IQOF?

Usage: Query only

Manual operation: See "[I/Q Offset](#)" on page 25

```
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:OSTP:MAXimum?
  [<Result>]
```

```
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:OSTP:MINimum?
  [<Result>]
```

```
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:OSTP[:AVERAge]?
```

Queries the OSTP.

Suffix:

<cc> [Component Carrier](#)

<ant> [Input source](#)

<fr> [Frame](#)

Return values:

<OSTP> Default unit: dBm

Example:

```
//Query OSTP
FETC:CC2:FRAM3:SUMM:OSTP?
```

Usage:

Query only

Manual operation: See "[OSTP](#)" on page 26

```
FETCh:ALL:SUMMary:POWer? <Result>
```

```
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:POWer:MAXimum?
  [<Result>]
```

```
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:POWer:MINimum?
  [<Result>]
```

```
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:POWer[:AVERAge]?
```

Queries the total signal power.

FETCh:ALL:SUMMary:POWer queries the average result over all carriers. Prerequisites:

- Select to evaluate all carriers ([\[SENSe:\]NR5G:RSUMmary:CCResult](#)).

Suffix:

<cc> [Component Carrier](#)

<ant> [Input source](#)

<fr> [Frame](#)

Return values:

<Power> Default unit: dBm

Example:

```
//Query signal power
FETC:CC2:FRAM3:SUMM:POW?
```

Usage:

Query only

Manual operation: See "[Power](#)" on page 25

```
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:QUADerror:MAXimum?
  [<Result>]
```

```
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:QUADerror:MINimum?
  [<Result>]
```

```
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:QUADerror[:AVERage]?
```

Queries the quadrature error.

Suffix:

<cc> [Component Carrier](#)

<ant> [Input source](#)

<fr> [Frame](#)

Return values:

<QuadratureError> Default unit: DEG

Example:

```
//Query quadrature error
FETC:CC2:FRAM3:SUMM:QUAD?
```

Usage: Query only

```
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:RSRP:CSI:MAXimum?
  [<Result>]
```

```
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:RSRP:CSI:MINimum?
  [<Result>]
```

```
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:RSRP:CSI[:AVERage]?
```

Queries the CSI-RSRP.

Suffix:

<cc> [Component Carrier](#)

<ant> [Input source](#)

<fr> [Frame](#)

Return values:

<EVM> Default unit: dBm

Example:

```
//Query CSI-RSRP
FETC:CC2:FRAM3:SUMM:RSRP:CSI?
```

Usage: Query only

Manual operation: See "[RSRP](#)" on page 26

```
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:RSRP:SS:MAXimum?
  [<Result>]
```

```
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:RSRP:SS:MINimum?
  [<Result>]
```

```
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:RSRP:SS[:AVERage]?
```

Queries the SS-RSRP.

Suffix:

<cc> [Component Carrier](#)

<ant> [Input source](#)

<fr> [Frame](#)

Return values:

<EVM> Default unit: dBm

Example:

```
//Query SS-RSRP
FETC:CC2:FRAM3:SUMM:RSRP:SS?
```

Usage:

Query only

Manual operation: See "[RSRP](#)" on page 26

```
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:RSTP:MAXimum?
    [<Result>]
```

```
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:RSTP:MINimum? [<Result>]
```

```
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:RSTP[:AVERage]?
```

Queries the RSTP.

Suffix:

<cc> [Component Carrier](#)

<ant> [Input source](#)

<fr> [Frame](#)

Return values:

<RSTP> Default unit: dBm

Example:

```
//Query RSTP
FETC:CC2:FRAM3:SUMM:RSTP?
```

Usage:

Query only

Manual operation: See "[RSTP](#)" on page 26

```
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:SERRor:MAXimum?
    [<Result>]
```

```
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:SERRor:MINimum?
    [<Result>]
```

```
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:SERRor[:AVERage]?
```

Queries the sampling error.

Suffix:

<cc> [Component Carrier](#)

<ant> irrelevant

<fr> [Frame](#)

Return values:

<SamplingError> Default unit: ppm

Example: //Query sampling error
FETC:CC2:FRAM3:SUMM:SERR?

Usage: Query only

Manual operation: See "[Sampling Error](#)" on page 25

FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:TPUT:MAXimum?
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:TPUT:MINimum?
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:TPUT[:AVERage]?

Queries the EVM of all resource elements.

Prerequisites for this command

- Turn on throughput measurement ([\[SENSe:\]NR5G:TRACking:TPUT:STATe](#)).

Suffix:

<cc> [Component Carrier](#)

<ant> [Input source](#)

<fr> [Frame](#)

Return values:

<TPUT> Default unit: PCT

Example: //Query BLER
NR5G:TRAC:TPUT:STAT ON
FETC:CC2:FRAM3:SUMM:TPUT?

Usage: Query only

Manual operation: See "[TPUT \(%\)](#)" on page 24

FETCh[:CC<cc>][:ISRC<ant>]:SUMMary:TFRame?

Queries the frame start offset as shown in the capture buffer.

Suffix:

<cc> [Component Carrier](#)

<ant> irrelevant

Return values:

<Offset> Default unit: s

Example: //Query frame start offset
FETC:SUMM:TFR?

Usage: Query only

Manual operation: See "[Frame Start Offset](#)" on page 24
See "[Capture Buffer](#)" on page 27

6.6.2 Time alignment error

FETCh:TAERror[:CC<cc>]:AP<ap>:MAXimum?	230
FETCh:TAERror[:CC<cc>]:AP<ap>:MINimum?	230
FETCh:TAERror[:CC<cc>]:AP<ap>[:AVERage]?	230

FETCh:TAERror[:CC<cc>]:AP<ap>:MAXimum?
FETCh:TAERror[:CC<cc>]:AP<ap>:MINimum?
FETCh:TAERror[:CC<cc>]:AP<ap>[:AVERage]?

Suffix:

<cc>	Component Carrier
<ap>	1000 ... 1011 Antenna port

Return values:

<TAE>	Minimum, maximum or average time alignment error, depending on the last command syntax element.
-------	---

Example:

```
//Query average TAE between reference antenna port and
antenna port 1006
FETC:TAER:AP1001?
```

Usage:

Query only

Manual operation:

See "Time Alignment Error" on page 45

6.6.3 Marker table

CALCulate<n>:DELTaMarker<m>:X.....	230
CALCulate<n>:DELTaMarker<m>:Y?.....	231
CALCulate<n>:MARKer<m>:X.....	231
CALCulate<n>:MARKer<m>:Y.....	232
CALCulate<n>:MARKer<m>:Z?.....	232
CALCulate<n>:MARKer<m>:Z:ALL?.....	233

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.

CALCulate<n>:DELTaMarker<m>:Y?

Queries the position of a deltamarker on the y-axis.

If necessary, the command activates the deltamarker first.

To get a valid result, you have to perform a complete measurement with synchronization to the end of the measurement before reading out the result. This is only possible for single measurement mode.

Note that result displays with a third aspect (for example "EVM vs Symbol x Carrier") do not support deltamarkers.

Suffix:

<n> [Window](#)

<m> [Marker](#)

Return values:

<Result> <numeric value>

Result at the deltamarker position. The return value is a value relative to the position of marker 1.

The type of value and its unit depend on the selected result display.

Example: `//Query coordinates of deltamarker 2 in window 4`
 `CALC4:DELT2:X?`
 `CALC4:DELT2:Y?`

Usage: Query only

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](#)

Note that 3D diagrams only support one 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 42
See "[Marker Peak List](#)" on page 53

CALCulate<n>:MARKer<m>:Y <Result>

Queries the position of a marker on the y-axis.

In result displays with a third aspect (for example "EVM vs Symbol x Carrier"), you can also use the command to define the position of the marker on the y-axis.

If necessary, the command activates the marker first.

To get a valid result, you have to perform a complete measurement with synchronization to the end of the measurement before reading out the result. This is only possible for single measurement mode.

Suffix:

<n> [Window](#)

<m> [Marker](#)

Note that 3D diagrams only support one marker.

Parameters:

<Result> <numeric value>

Result at the marker position.

The type of value and its unit depend on the selected result display.

Example: //Query coordinates of marker 2 in window 4
`CALC4:MARK2:X?`
`CALC4:MARK2:Y?`

Example: //Define position of marker in 3D diagram
`CALC:MARK:X 16`
`CALC:MARK:Y 6`

Manual operation: See "[Marker Table](#)" on page 42
See "[Marker Peak List](#)" on page 53

CALCulate<n>:MARKer<m>:Z?

Queries the marker position on the z-axis of three-dimensional result displays.

Returns the type of value displayed in the selected result display (EVM, Power or Allocation ID).

Suffix:

<n> [Window](#)

<m> [Marker](#)

Return values:

<Position> <numeric value>
 Default unit: Depends on result display

Example: //Query marker position
 CALC:MARK:Z?

Usage: Query only

Manual operation: See "[Marker Table](#)" on page 42

CALCulate<n>:MARKer<m>:Z:ALL?

Queries the marker position on the z-axis of three-dimensional result displays.

Instead of returning a certain type of value (EVM, Power **or** Allocation ID), which is possible with [CALCulate<n>:MARKer<m>:Z?](#), this command returns all types of values (EVM, Power **and** Allocation ID), regardless of the result display type.

Suffix:

<n> [Window](#)

<m> irrelevant

Return values:

<Position> <numeric value>

EVM

EVM at the marker position.

Power

Power at the marker position.

Allocation ID

Allocation ID at the marker position.

Example: //Query EVM, Power and Allocation ID at the marker position.
 CALC:MARK:Z:ALL?

Usage: Query only

Manual operation: See "[Marker Table](#)" on page 42

6.6.4 CCDF table

CALCulate<n>:STATistics:CCDF:X<t>?	233
CALCulate<n>:STATistics:RESult<res>?	234

CALCulate<n>:STATistics:CCDF:X<t>? <Probability>

Queries the results of the CCDF.

Suffix:

<n> [Window](#)

<t> [Trace](#)

Query parameters:

<Probability> **P0_01**
Level value for 0.01 % probability

P0_1
Level value for 0.1 % probability

P1
P1: Level value for 1 % probability

P10
Level value for 10 % probability

Return values:

<CCDF Result>

Example:

CALC:STAT:CCDF:X1? P10

Returns the level values that are over 10 % above the mean value.

Usage:

Query only

Manual operation:

See "[CCDF](#)" on page 33

CALCulate<n>:STATistics:RESult<res>? <ResultType>

Queries the results of a measurement for a specific trace.

Suffix:

<n> [Window](#)

<res> [Trace](#)

Query parameters:

<ResultType> **MEAN**
Average (=RMS) power in dBm measured during the measurement time.

PEAK
Peak power in dBm measured during the measurement time.

CFACTOR
Determined crest factor (= ratio of peak power to average power) in dB.

ALL
Results of all three measurements mentioned before, separated by commas: <mean power>,<peak power>,<crest factor>

Example:

CALC:STAT:RES2? ALL

Reads out the three measurement results of trace 2. Example of answer string: 5.56,19.25,13.69 i.e. mean power: 5.56 dBm, peak power 19.25 dBm, crest factor 13.69 dB

Usage:

Query only

Manual operation:

See "[CCDF](#)" on page 33

6.7 Limit check results

- EVM limits..... 235
- Transmit power on / off limits..... 239
- Frequency sweep limits..... 240

6.7.1 EVM limits

CALCulate<n>:LIMit[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMARY:ALL:RESult?.....	235
CALCulate<n>:LIMit[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMARY:EVM:DS1K[: AVERAge]:RESult?.....	236
CALCulate<n>:LIMit[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMARY:EVM:DSQP[: AVERAge]:RESult?.....	236
CALCulate<n>:LIMit[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMARY:EVM:DSSF[: AVERAge]:RESult?.....	237
CALCulate<n>:LIMit[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMARY:EVM:DSST[: AVERAge]:RESult?.....	238
CALCulate<n>:LIMit[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMARY:EVM:DSTS[: AVERAge]:RESult?.....	238
CALCulate<n>:LIMit[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMARY:EVM:FERRor[: AVERAge]:RESult?.....	239

CALCulate<n>:LIMit[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMARY:ALL:RESult?

Queries the limits and limit check results for all numerical results that evaluate 3GPP limits.

Suffix:

<n>	irrelevant
	irrelevant
<cc>	irrelevant
<ant>	irrelevant
<fr>	irrelevant

Return values:

<Result> String containing the limit information for all results that evaluate limits.

For each limit, the command returns the following information:
<ResultType>, <Limit>, <LimitCheckAverage>,
<LimitCheckMin>, <LimitCheckMax>

For results that are not checked against a limit, the command returns NOTEVALUATED.

Example: //Query limit check information
 CALC:LIM:SUMM:ALL:RES?
 would return, e.g.
 EVM PDSCH QPSK,
 +1.850000000E+001, PASSED, NOTEVALUATED,
 NOTEVALUATED,
 EVM PDSCH 16QAM,
 +1.350000000E+001, NOTEVALUATED, NOTEVALUATED,
 NOTEVALUATED,
 . . .

Usage: Query only

Manual operation: See "[Remote queries](#)" on page 22

**CALCulate<n>:LIMit[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:EVM:
 DS1K[:AVERAge]:RESult?**

Queries the limit specified by 3GPP for the EVM of all PDSCH resource elements with a 1024QAM modulation.

Suffix:

<n>	irrelevant
	irrelevant
<cc>	irrelevant
<ant>	irrelevant
<fr>	irrelevant

Return values:

<LimitCheck>	FAILED Limit check has failed.
	PASSED Limit check has passed.
	NOTEVALUATED Limits have not been evaluated.

Example: //Query limit check result
 CALC:LIM:SUMM:EVM:DS1K:RES?

Usage: Query only

Manual operation: See "[EVM PDSCH](#)" on page 23

**CALCulate<n>:LIMit[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:EVM:
 DSQP[:AVERAge]:RESult?**

Queries the limit specified by 3GPP for the EVM of all PDSCH resource elements with a QPSK modulation.

Suffix:

<n>	irrelevant
	irrelevant
<cc>	irrelevant
<ant>	irrelevant
<fr>	irrelevant

Return values:

<LimitCheck>	FAILED Limit check has failed.
	PASSED Limit check has passed.
	NOTEVALUATED Limits have not been evaluated.

Example:

```
//Query limit check result
CALC:LIM:SUMM:EVM:DSQP:RES?
```

Usage:

Query only

Manual operation:

See "EVM PDSCH" on page 23

**CALCulate<n>:LIMit[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMery:EVM:
DSSF[:AVERAge]:RESult?**

Queries the limit specified by 3GPP for the EVM of all PDSCH resource elements with a 64QAM modulation.

Suffix:

<n>	irrelevant
	irrelevant
<cc>	irrelevant
<ant>	irrelevant
<fr>	irrelevant

Return values:

<LimitCheck>	FAILED Limit check has failed.
	PASSED Limit check has passed.
	NOTEVALUATED Limits have not been evaluated.

Example:

```
//Query limit check result
CALC:LIM:SUMM:EVM:DSSF:RES?
```

Usage:

Query only

Manual operation:

See "EVM PDSCH" on page 23

CALCulate<n>:LIMit[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:EVM:DSST[:AVERAge]:RESult?

Queries the limit specified by 3GPP for the EVM of all PDSCH resource elements with a 16QAM modulation.

Suffix:

<n>	irrelevant
	irrelevant
<cc>	irrelevant
<ant>	irrelevant
<fr>	irrelevant

Return values:

<LimitCheck>	FAILED Limit check has failed.
	PASSED Limit check has passed.
	NOTEVALUATED Limits have not been evaluated.

Example: //Query limit check result
CALC:LIM:SUMM:EVM:DSST:RES?

Usage: Query only

Manual operation: See "[EVM PDSCH](#)" on page 23

CALCulate<n>:LIMit[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:EVM:DSTS[:AVERAge]:RESult?

Queries the limit specified by 3GPP for the EVM of all PDSCH resource elements with a 256QAM modulation.

Suffix:

<n>	irrelevant
	irrelevant
<cc>	irrelevant
<ant>	irrelevant
<fr>	irrelevant

Return values:

<LimitCheck>	FAILED Limit check has failed.
	PASSED Limit check has passed.
	NOTEVALUATED Limits have not been evaluated.

Example: //Query limit check result
CALC:LIM:SUMM:EVM:DSTS:RES?

Usage: Query only

Manual operation: See "EVM PDSCH" on page 23

**CALCulate<n>:LIMit[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:EVM:
FERRor[:AVERAge]:RESult?**

Queries the limit specified by 3GPP for the frequency error.

Suffix:

<n> irrelevant
 irrelevant
<cc> irrelevant
<ant> irrelevant
<fr> irrelevant

Return values:

<LimitCheck> **FAILED**
Limit check has failed.

PASSED
Limit check has passed.

NOTEVALUATED
Limits have not been evaluated.

Example: //Query limit check result
CALC:LIM:SUMM:EVM:FERR:RES?

Usage: Query only

Manual operation: See "Frequency Error" on page 25

6.7.2 Transmit power on / off limits

CALCulate<n>:LIMit:OOPower:OFFPower? 239
CALCulate<n>:LIMit:OOPower:TRANSient? 240

CALCulate<n>:LIMit:OOPower:OFFPower?

Queries the results of the limit check in the "Off" periods of On/Off Power measurements.

Suffix:

<n> irrelevant
 irrelevant

Return values:

<Results> Returns one value for every "Off" period.

PASSED

Limit check has passed.

FAILED

Limit check has failed.

Example: //Query the results for the limit check during the signal OFF periods
CALC:LIM:OOP:OFFP?

Usage: Query only

CALCulate<n>:LIMit:OOPower:TRANsient? <Result>

Queries the results of the limit check during the transient periods of the On/Off power measurement.

Suffix:

<n> irrelevant

 irrelevant

Query parameters:

<Result>

ALL

Queries the overall limit check results.

FALLing

Queries the limit check results of falling transients.

RISing

Queries the limit check results of rising transients.

Return values:

<LimitCheck>

Returns one value for every "Off" period.

PASSED

Limit check has passed.

FAILED

Limit check has failed.

Example: //Query the limit check result of rising transients
CALC:LIM:OOP:TRAN? RIS

Usage: Query only

6.7.3 Frequency sweep limits

CALCulate<n>:LIMit:ACPower:ACHannel:RESult?	241
CALCulate<n>:LIMit:ACPower:ACHannel:RESult:ABSolute	241
CALCulate<n>:LIMit:ACPower:ACHannel:RESult:RELative	242
CALCulate<n>:LIMit:ACPower:ALternate<alt>:RESult?	242
CALCulate<n>:LIMit:ACPower:ALternate<ch>:RESult:ABSolute	243
CALCulate<n>:LIMit:ACPower:ALternate<ch>:RESult:RELative	243
CALCulate<n>:LIMit:ACPower:GAP<gap>:ACLR:RESult?	244
CALCulate<n>:LIMit:ACPower:GAP<gap>:ACLR:RESult:ABSolute?	244

CALCulate<n>:LIMit:ACPpower:GAP<gap>:ACLR:RESult:RELative?.....	245
CALCulate<n>:LIMit:ACPpower:GAP<gap>[:CACLR]:RESult?.....	245
CALCulate<n>:LIMit:ACPpower:GAP<gap>[:CACLR]:RESult:ABSolute?.....	246
CALCulate<n>:LIMit:ACPpower:GAP<gap>[:CACLR]:RESult:RELative?.....	246
CALCulate<n>:LIMit:FAIL?.....	247

CALCulate<n>:LIMit:ACPpower:ACHannel:RESult? [<Result>]

Queries the limit check results for the adjacent channels during ACLR measurements.

Suffix:

<n>	irrelevant
	irrelevant

Query parameters:

<Result>	REL Queries the channel power limit check results.
	ABS Queries the distance to the limit line.

Return values:

<LimitCheck>	Returns two values, one for the upper and one for the lower adjacent channel.
	PASSED Limit check has passed.
	FAILED Limit check has failed.

Example: //Query results of the adjacent channel limit check
CALC:LIM:ACP:ACH:RES?

Example: //Query results of the adjacent channel limit check
CALC:LIM:ACP:ACH:RES? ABS

Usage: Query only

CALCulate<n>:LIMit:ACPpower:ACHannel:RESult:ABSolute

Queries the absolute limit check results for adjacent channels (ACLR measurements).

Prerequisites for this command

- Select absolute limit check mode evaluation mode
ACLR: CALCulate<n>:LIMit:ACPpower:PMODE.

Suffix:

<n>	irrelevant
	irrelevant

Return values:

<LimitCheck>	Returns two values, one for the upper and one for the lower adjacent channel.
--------------	---

PASSED

Limit check has passed.

FAILED

Limit check has failed.

Example: //Query results of the adjacent channel limit check
 CALC:LIM:ACP:ACH:RES:ABS?

Manual operation: See "[Result summary](#)" on page 52

CALCulate<n>:LIMit:ACPpower:ACHannel:RESult:RELative

Queries the relative limit check results for the adjacent channels (ACLR measurements).

Prerequisites for this command

- Select relative limit check mode
 ACLR: `CALCulate<n>:LIMit:ACPpower:PMODE.`

Suffix:

<n> irrelevant
 irrelevant

Return values:

<LimitCheck> Returns two values, one for the upper and one for the lower adjacent channel.

PASSED

Limit check has passed.

FAILED

Limit check has failed.

Example: //Query results of the adjacent channel limit check
 CALC:LIM:ACP:ACH:RES:REL?

Manual operation: See "[Result summary](#)" on page 52

CALCulate<n>:LIMit:ACPpower:ALTErnate<alt>:RESult? [<Result>]

Queries the limit check results for the alternate channels during ACLR measurements.

Suffix:

<n> irrelevant
 irrelevant
 <alt> irrelevant

Query parameters:

<Result> **REL**
 Queries the channel power limit check results.

ABS

Queries the distance to the limit line.

Return values:

<LimitCheck> Returns two values, one for the upper and one for the lower alternate channel.

PASSED

Limit check has passed.

FAILED

Limit check has failed.

Example:

```
//Query results of the alternate channel limit check
CALC:LIM:ACP:ALT:RES?
```

Example:

```
//Query results of the alternate channel limit check
CALC:LIM:ACP:ACH:RES? ABS
```

Usage:

Query only

CALCulate<n>:LIMit:ACPower:ALternate<ch>:RESult:ABSolute

Queries the absolute limit check results for the alternate channels (MC ACLR measurements).

Prerequisites for this command

- Select absolute limit check mode
ACLR: `CALCulate<n>:LIMit:ACPower:PMODE`.

Suffix:

<n> irrelevant

 irrelevant

<ch> irrelevant

Return values:

<LimitCheck> Returns two values, one for the upper and one for the lower adjacent channel.

PASSED

Limit check has passed.

FAILED

Limit check has failed.

Example:

```
//Query results of the alternate channel limit check
CALC:LIM:ACP:ALT:RES:ABS?
```

CALCulate<n>:LIMit:ACPower:ALternate<ch>:RESult:RELative

Queries the relative limit check results for the alternate channels (MC ACLR measurements).

Prerequisites for this command

- Select relative limit check mode

ACLR: `CALCulate<n>:LIMit:ACPower:PMODE.`

Suffix:

<n>	irrelevant
	irrelevant
<ch>	irrelevant

Return values:

<LimitCheck> Returns two values, one for the upper and one for the lower adjacent channel.

PASSED

Limit check has passed.

FAILED

Limit check has failed.

Example:

```
//Query results of the alternate channel limit check
CALC:LIM:ACP:ALT:RES:REL?
```

CALCulate<n>:LIMit:ACPower:GAP<gap>:ACLR:RESult?

Queries the ACLR power limit check results for the gap channels (MC ACLR measurements).

Suffix:

<n>	irrelevant
	irrelevant
<gap>	irrelevant

Return values:

<LimitCheck> Returns two values, one for the upper and one for the lower adjacent channel.

PASSED

Limit check has passed.

FAILED

Limit check has failed.

Example:

```
//Query results of the gap channel limit check
CALC:LIM:ACP:GAP:ACLR:RES?
```

Usage:

Query only

CALCulate<n>:LIMit:ACPower:GAP<gap>:ACLR:RESult:ABSolute?

Queries the absolute power limit check results for the gap channels (MC ACLR measurements).

Prerequisites for this command

- Select absolute limit check mode evaluation mode

ACLR: `CALCulate<n>:LIMit:ACPower:PMODE.`

Suffix:

<n>	irrelevant
	irrelevant
<gap>	irrelevant

Return values:

<LimitCheck> Returns two values, one for the upper and one for the lower adjacent channel.

PASSED

Limit check has passed.

FAILED

Limit check has failed.

Example:

```
//Query results of the gap channel limit check
CALC:LIM:ACP:GAP:ACLR:RES:ABS?
```

Usage:

Query only

CALCulate<n>:LIMit:ACPpower:GAP<gap>:ACLR:RESult:RELative?

Queries the relative power limit check results for the gap channels (MC ACLR measurements).

Prerequisites for this command

- Select relative limit check mode evaluation mode

ACLR: `CALCulate<n>:LIMit:ACPpower:PMODE.`

Suffix:

<n>	irrelevant
	irrelevant
<gap>	irrelevant

Return values:

<LimitCheck> Returns two values, one for the upper and one for the lower adjacent channel.

PASSED

Limit check has passed.

FAILED

Limit check has failed.

Example:

```
//Query results of the gap channel limit check
CALC:LIM:ACP:GAP:ACLR:RES:REL?
```

Usage:

Query only

CALCulate<n>:LIMit:ACPpower:GAP<gap>[:CACLR]:RESult?

Queries the limit check results for the gap channels (MC ACLR measurements).

Suffix:

<n>	irrelevant
	irrelevant
<gap>	irrelevant

Return values:

<LimitCheck> Returns two values, one for the upper and one for the lower adjacent channel.

PASSED

Limit check has passed.

FAILED

Limit check has failed.

Example:

```
//Query results of the gap channel limit check
CALC:LIM:ACP:GAP:RES?
```

Usage:

Query only

CALCulate<n>:LIMit:ACPpower:GAP<gap>[:CACLR]:RESult:ABSolute?

Queries the absolute limit check results for the gap channels (MC ACLR measurements).

Prerequisites for this command

- Select absolute limit check mode evaluation mode

ACLR: `CALCulate<n>:LIMit:ACPpower:PMODE.`

Suffix:

<n>	irrelevant
	irrelevant
<gap>	irrelevant

Return values:

<LimitCheck> Returns two values, one for the upper and one for the lower adjacent channel.

PASSED

Limit check has passed.

FAILED

Limit check has failed.

Example:

```
//Query results of the gap channel limit check
CALC:LIM:ACP:GAP:RES:ABS?
```

Usage:

Query only

CALCulate<n>:LIMit:ACPpower:GAP<gap>[:CACLR]:RESult:RELative?

Queries the relative limit check results for the gap channels (MC ACLR measurements).

Prerequisites for this command

- Select relative limit check mode evaluation mode
ACLR: `CALCulate<n>:LIMit:ACPower:PMODE.`

Suffix:

<n>	irrelevant
	irrelevant
<gap>	irrelevant

Return values:

<LimitCheck> Returns two values, one for the upper and one for the lower adjacent channel.

PASSED

Limit check has passed.

FAILED

Limit check has failed.

Example: `//Query results of the gap channel limit check
CALC:LIM:ACP:GAP:RES:REL?`

Usage: Query only

CALCulate<n>:LIMit:FAIL?

Queries the limit check results for all measurements that feature a limit check.

For ACLR measurements: Returns the result of the overall limit check (absolute and relative limit evaluation).

Suffix:

<n>	1..n Window
	irrelevant

Return values:

<LimitCheck> **0**
Limit check has passed.

1
Limit check has failed.
For spectrum flatness: Limit out of selected band.

2
For spectrum flatness: Limit out of band.

3
For spectrum flatness: Limit check has failed.

Example: `//Query the limit check in the active result display
CALC:LIM:FAIL?`

Usage: Query only

Manual operation: See "Result summary" on page 52

6.8 Retrieve trace data

- [Using the TRACe\[:DATA\] command](#)..... 248
- [Read measurement results](#)..... 266

6.8.1 Using the TRACe[:DATA] command

This chapter contains information on the `TRACe:DATA` command and a detailed description of the characteristics of that command.

The `TRACe:DATA` command queries the trace data or results of the currently active measurement or result display. The type, number and structure of the return values are specific for each result display. In case of results that have any kind of unit, the command returns the results in the unit you have currently set for that result display.

For several result displays, the command also supports various SCPI parameters in combination with the query. If available, each SCPI parameter returns a different aspect of the results. If SCPI parameters are supported, you have to quote one in the query.

Example:

```
TRAC2:DATA? TRACE1
```

The format of the return values is either in ASCII or binary characters and depends on the format you have set with `FORMat[:DATA]`.

Following this detailed description, you will find a short summary of the most important functions of the command (`TRACe<n>[:DATA]?`).



Selecting a measurement window

Before querying results, you have to select the measurement window with the suffix `<n>` at `TRACe`. The range of `<n>` depends on the number of active measurement windows.

For measurements on aggregated carriers, where each measurement window has subwindows, you have to select the subwindow first with `DISPlay[:WINDow<n>][:SUBWindow<w>]:SElect`.

- [Capture buffer](#)..... 249
- [EVM vs carrier](#)..... 249
- [EVM vs symbol](#)..... 250
- [EVM vs RB](#)..... 250
- [Frequency error vs symbol](#)..... 251
- [Frequency error vs subframe](#)..... 252
- [Power spectrum](#)..... 252
- [Flatness vs carrier](#)..... 252

● CCDF.....	253
● Constellation diagram.....	254
● Allocation summary.....	254
● Bitstream.....	256
● Channel decoder results.....	257
● EVM vs symbol x carrier.....	258
● Power vs symbol x carrier.....	258
● Allocation ID vs symbol x carrier.....	259
● RS phase.....	260
● RS magnitude.....	260
● RS phase difference.....	261
● Beamforming summary.....	262
● Adjacent channel leakage ratio.....	262
● Spectrum emission mask.....	263
● On/off power.....	264
● Return value codes.....	264

6.8.1.1 Capture buffer

For the capture buffer result display, the command returns one value for each I/Q sample in the capture buffer.

```
<absolute power>, ...
```

The unit is always dBm.

The following parameters are supported.

- TRAC:DATA TRACE1

Note that the command returns positive peak values only.

6.8.1.2 EVM vs carrier

For the EVM vs carrier result display, the command returns one value for each subcarrier that has been analyzed.

```
<EVM>, ...
```

The unit depends on [UNIT:EVM](#).

The following parameters are supported.

- TRAC:DATA TRACE1

The return values depend on the evaluation range:

- All bandwidth parts: average EVM of the SS/PBCH block over all subframes (or the first bandwidth part if the SS/PBCH block does not exist).
- A specific bandwidth part: average EVM of the selected BWP over all subframes.
- A specific subframe: average EVM of that subframe over all slots.
- A specific slot: EVM of that slot.

- TRAC:DATA TRACE2

The return values depend on the evaluation range:

- All bandwidth parts: average EVM of the first BWP over all subframes.
- A specific bandwidth part: minimum EVM of the selected BWP block over all subframes.
- A specific subframe: minimum EVM of that subframe over all slots.
- A specific slot: not supported.

- `TRAC:DATA TRACE3`

The return values depend on the evaluation range:

- All bandwidth parts: average EVM of the second BWP over all subframes.
- A specific bandwidth part: maximum EVM of the selected BWP block over all subframes.
- A specific subframe: maximum EVM of that subframe over all slots.
- A specific slot: not supported.

- `TRAC:DATA TRACE4 | TRACE5 | TRACE6 | TRACE7 | TRACE8`

Only supported for evaluation over all bandwidth parts.

Returns the average EVM of the corresponding bandwidth part over all subframes (for example TRACE4 for the 4th bandwidth part).

6.8.1.3 EVM vs symbol

For the EVM vs symbol result display, the command returns one value for each OFDM symbol that has been analyzed.

<EVM>, ...

The unit depends on `UNIT:EVM`.

The following parameters are supported.

- `TRAC:DATA TRACE1`

The return values depend on the evaluation range:

- All bandwidth parts: EVM of the SS/PBCH block over all subframes (or the first bandwidth part if the SS/PBCH block does not exist).
- A specific bandwidth part: EVM of the selected BWP over all subframes.
- A specific subframe: EVM of that subframe over all slots.
- A specific slot: EVM of that slot.

- `TRAC:DATA TRACE2 to TRACE8`

Only supported for evaluation over all bandwidth parts.

Returns the EVM of the corresponding bandwidth part over all subframes (for example TRACE4 for the 4th bandwidth part).

6.8.1.4 EVM vs RB

For the EVM vs RB result display, the command returns one value for each resource block that has been analyzed.

<EVM>, ...

The unit depends on `UNIT:EVM`.

The following parameters are supported.

- `TRAC:DATA TRACE1`

The return values depend on the evaluation range:

- All bandwidth parts: average EVM of the first bandwidth part if the SS/PBCH block does not exist (if the SS/PBCH block exists, it returns an error).
- A specific bandwidth part: average EVM of the selected BWP over all subframes.
- A specific subframe: average EVM of that subframe over all slots.
- A specific slot: EVM of that slot.

- `TRAC:DATA TRACE2`

The return values depend on the evaluation range:

- All bandwidth parts: average EVM of the first bandwidth part if the SS/PBCH block does exist. If the SS/PBCH block does not exist, it returns the results of the second bandwidth part).
- A specific bandwidth part: minimum EVM of the selected BWP block over all subframes.
- A specific subframe: minimum EVM of that subframe over all slots.
- A specific slot: not supported.

- `TRAC:DATA TRACE3`

The return values depend on the evaluation range:

- All bandwidth parts: average EVM of the third BWP over all subframes.
- A specific bandwidth part: maximum EVM of the selected BWP block over all subframes.
- A specific subframe: maximum EVM of that subframe over all slots.
- A specific slot: not supported.

- `TRAC:DATA TRACE4 | TRACE5 | TRACE6 | TRACE7 | TRACE8`

Only supported for evaluation over all bandwidth parts.

Returns the average EVM of the corresponding bandwidth part over all subframes (for example TRACE4 for the 4th bandwidth part).

6.8.1.5 Frequency error vs symbol

For the frequency error vs symbol result display, the command returns one value for each OFDM symbol that has been analyzed.

`<frequency error>,...`

The unit is always Hz.

The following parameters are supported.

- `TRAC:DATA TRACE1`

The return values depend on the evaluation range:

- All bandwidth parts: Frequency error of the SS/PBCH block over all subframes (or the first bandwidth part if the SS/PBCH block does not exist).

- A specific bandwidth part: Frequency error of the selected BWP over all subframes.
- A specific subframe: Frequency error of that subframe over all slots.
- A specific slot: Frequency error of that slot.
- `TRAC:DATA TRACE2 to TRACE8`
Only supported for evaluation over all bandwidth parts.
Returns the average EVM of the corresponding bandwidth part over all subframes (for example TRACE4 for the 4th bandwidth part).

6.8.1.6 Frequency error vs subframe

For the frequency error vs symbol result display, the command returns one value for each of the nine subframes that have been analyzed.

`<frequency error>, ...`

The unit is always Hz.

The following parameters are supported.

- `TRAC:DATA TRACE1`
The return values depend on the evaluation range:
 - All bandwidth parts: Frequency error for the subframes of the SS/PBCH block (or the first bandwidth part if the SS/PBCH block does not exist).
 - A specific bandwidth part: Frequency error for the subframes of the selected BWP.
- `TRAC:DATA TRACE2 to TRACE8`
Only supported for evaluation over all bandwidth parts.
Returns the frequency error for the subframes of the corresponding bandwidth part (for example TRACE4 for the 4th bandwidth part).

6.8.1.7 Power spectrum

For the power spectrum result display, the command returns one value for each trace point.

`<power>, ...`

The unit is always dBm/Hz.

The following parameters are supported.

- `TRAC:DATA TRACE1`

6.8.1.8 Flatness vs carrier

For the flatness vs carrier result display, the command returns one value for each trace point.

`<relative power>, ...`

The unit is always dB. The number of values depends on the selected 5G NR bandwidth.

The following parameters are supported.

- TRAC:DATA TRACE1

The return values depend on the evaluation range:

- All bandwidth parts: average power of the SS/PBCH block over all subframes.
- A specific bandwidth part: average power of the selected BWP over all subframes.
- A specific subframe: average power of that subframe over all slots.
- A specific slot: power of that slot.

- TRAC:DATA TRACE2

The return values depend on the evaluation range:

- All bandwidth parts: average power of the first BWP over all subframes.
- A specific bandwidth part: minimum power of the selected BWP block over all subframes.
- A specific subframe: minimum power of that subframe over all slots.
- A specific slot: not supported.

- TRAC:DATA TRACE3

The return values depend on the evaluation range:

- All bandwidth parts: average power of the second BWP over all subframes.
- A specific bandwidth part: maximum power of the selected BWP block over all subframes.
- A specific subframe: maximum power of that subframe over all slots.
- A specific slot: not supported.

- TRAC:DATA TRACE4 | TRACE5 | TRACE6 | TRACE7 | TRACE8

Only supported for evaluation over all bandwidth parts.

Returns the average EVM of the corresponding bandwidth part over all subframes (for example TRACE4 for the 4th bandwidth part).

6.8.1.9 CCDF

For the CCDF result display, the type of return values depends on the parameter.

- TRAC:DATA TRACE1

Returns the probability values (y-axis).

<# of values>, <probability>, ...

The unit is always %.

The first value that is returned is the number of the following values.

- TRAC:DATA TRACE2

Returns the corresponding power levels (x-axis).

<# of values>, <relative power>, ...

The unit is always dB.

The first value that is returned is the number of the following values.

6.8.1.10 Constellation diagram

For the constellation diagram, the command returns two values for each constellation point.

```
<I[SF0][Sym0][Carrier1]>, <Q[SF0][Sym0][Carrier1]>, ..., <I[SF0][Sym0][Carrier(n)]>, <Q[SF0][Sym0][Carrier(n)]>,
<I[SF0][Sym1][Carrier1]>, <Q[SF0][Sym1][Carrier1]>, ..., <I[SF0][Sym1][Carrier(n)]>, <Q[SF0][Sym1][Carrier(n)]>,
<I[SF0][Sym(n)][Carrier1]>, <Q[SF0][Sym(n)][Carrier1]>, ..., <I[SF0][Sym(n)][Carrier(n)]>, <Q[SF0][Sym(n)][Carrier(n)]>,
<I[SF1][Sym0][Carrier1]>, <Q[SF1][Sym0][Carrier1]>, ..., <I[SF1][Sym0][Carrier(n)]>, <Q[SF1][Sym0][Carrier(n)]>,
<I[SF1][Sym1][Carrier1]>, <Q[SF1][Sym1][Carrier1]>, ..., <I[SF1][Sym1][Carrier(n)]>, <Q[SF1][Sym1][Carrier(n)]>,
<I[SF(n)][Sym(n)][Carrier1]>, <Q[SF(n)][Sym(n)][Carrier1]>, ..., <I[SF(n)][Sym(n)][Carrier(n)]>, <Q[SF(n)][Sym(n)][Carrier(n)]>
```

With SF = subframe and Sym = symbol of that subframe.

The I and Q values have no unit.

The number of return values depends on the constellation selection. By default, it returns all resource elements including the DC carrier.

For each bandwidth part, the command returns the values for all resource elements. However, only the resource elements allocated to the corresponding bandwidth part have a value. All others are returned as NAN. If you query the constellation for a signal with SS/PBCH and 2 bandwidth parts, for example, the stream of values would look like this:

- 1st block of values: NAN, NAN, (. . .) , RE [SS/PBCH] , RE [SS/PBCH] , (. . .) , NAN, NAN, (. . .)
- 2nd block of values: NAN, NAN, (. . .) , RE [BWP0] , RE [BWP0] , (. . .) , NAN, NAN, (. . .)
- 3rd block of values: NAN, NAN, (. . .) , RE [BWP1] , RE [BWP1] , (. . .) , NAN, NAN, (. . .)

The following parameters are supported.

- TRAC:DATA TRACE1
Returns all constellation points included in the selection.

6.8.1.11 Allocation summary

For the allocation summary, the command returns several values for each line of the table.

- <bwp>
- <subframe>
- <slot>
- <allocation ID>

- <number of RB>
- <relative power>
- <modulation>
- <absolute power>
- <EVM>

The data format of the return values is always ASCII.

The return values have the following characteristics.

- The <bwp> for bandwidth part containing the synchronization signals is -1. For all other bandwidth parts, the corresponding bandwidth part number, beginning with 0.
- The <allocation ID is encoded.
For the code assignment, see [Chapter 6.8.1.24, "Return value codes"](#), on page 264.
- The unit for <relative power> is always dB.
- The <modulation> is encoded.
For the code assignment, see [Chapter 6.8.1.24, "Return value codes"](#), on page 264.
- The unit for <absolute power> is always dBm.
- The unit for <EVM> depends on [UNIT:EVM](#).

Example:

BWP/SF/Slot	Allocation ID	No of RBs	Rel Power [dB]	Modulation	Power per RE [dBm]	EVM [%]
SS / 0 / 0	PSS		0.000	RBPSK	-16.611	3.781
	SSS		0.000	RBPSK	-17.569	0.219
	PBCH DMRS		0.000	QPSK	-17.117	5.935
	PBCH		0.000	QPSK	-17.229	3.278

TRAC:DATA? TRACE1 would return:

```
-1,0,0,-20,,+0.000000000,1,-1.611724981E+001,+3.781490920E-003,
-1,0,0,-21,,+0.000000000,1,-1.756929651E+001,+0.219507916E-003,
-1,0,0,-11,,+0.000000000,2,-1.711705594E+001,+5.935088581E-003,
-1,0,0,-30,,+0.000000000,2,-1.722917126E+001,+3.278761694E-003,
```

Additional information "ALL"

In addition, there is a line at the end of the allocation summary that shows the average EVM over all analyzed subframes. This information is also added as the last return values. The "ALL" information has the subframe ID and allocation ID code "-2".

A query result would thus look like this, for example:

```
//For subframe 0:
0, -40, 10, 2, 2, -84.7431947342849, 2.68723483754626E-06,
0, -41, 0, 0, 6, -84.7431432845264, 2.37549449584568E-06,
(...)
//For subframe 1:
1, -40, 10, 2, 2, -84.7431947342849, 2.68723483754626E-06,
1, -41, 0, 0, 6, -84.7431432845264, 2.37549449584568E-06,
```

```
(...)
//ALL for all subframes
-2,-2,,,,,2.13196434228374E-06
```

6.8.1.12 Bitstream

For the bitstream result display, the number of return values depends on the parameter.

- `TRAC:DATA TRACE1`
Returns several values and the bitstream for each line of the table.
<bwp>, <subframe>, <slot>, <allocation ID>, <codeword>, <modulation>, <# of decoded bits>, <# of decoded bit errors>, <# of symbols/bits>, <hexadecimal/binary numbers>,...
- `TRAC:DATA TRACE2`
Returns the CRC status of an allocation, but not the bitstream.
<bwp>, <subframe>, <slot>, <allocation ID>, <codeword>, <crc status>,...
- `TRAC:DATA TRACE3`
Returns all informative values of an allocation, but not the bitstream.
<bwp>, <subframe>, <slot>, <allocation ID>, <codeword>, <crc status>, <modulation>, <# of decoded bits>, <# of decoded bit errors>, <# of symbols/bits>,...
- `TRAC:DATA TRACE4`
Note that this query is only available under certain circumstances. For more information see the description of the [bitstream](#) result display.
Returns all informative values of an allocation, including the totals over all PDSCH allocations that contribute to the bitstream, but not the bitstream itself.
<bwp>, <subframe>, <slot>, <allocation ID>, <codeword>, <crc status>, <modulation>, <# of decoded bits>, <# of decoded bit errors>, <# of symbols/bits>, ..., <total # decoded bits>, <total # bit errors>, <total # bits>, <total bit error rate>
- `TRAC:DATA TRACE5`
Returns the CRC status of an allocation, including the number of bits in the bitstream.
<bwp>, <subframe>, <slot>, <allocation ID>, <codeword>, <crc status>, <#Bits>,...
- `TRAC:DATA TRACE6`
Note that this query is only available under certain circumstances. For more information see the description of the [bitstream](#) result display.
Returns all informative values of an allocation, including the totals over all PDSCH allocations that contribute to the bitstream, but not the bitstream itself. The difference to TRACE3 is that this query includes the Bit/s result.
<bwp>, <subframe>, <slot>, <allocation ID>, <codeword>, <crc status>, <modulation>, <# of decoded bits>, <# of decoded bit errors>, <# of symbols/bits>, ..., <total # decoded bits>, <total # bit errors>, <total # bits>, <total bit error rate>, <bit per second>

All values have no unit. The format of the bitstream depends on the [demodulation data](#) property.

The <allocation ID>, <codeword>, <crc status> and <modulation> are encoded. For the code assignment see [Chapter 6.8.1.24, "Return value codes"](#), on page 264.

For symbols or bits that are not transmitted, the command returns

- "FFFF" if the bitstream is analyzed [before decoding](#)
- "9" if the bitstream is analyzed [after decoding](#).

Note that the data format of the return values is always ASCII.

Example:

Sub-frame	Allocation ID	Code-word	Modulation	Symbol Index	Bit Stream
0	PBCH	1/1	QPSK	0	01 01 00 02 03 00 01 02 01 02 01 00 03 00 02 02
0	PBCH	1/1	QPSK	16	02 03 02 03 03 03 00 02 00 03 00 02 02 03 01 01
0	PBCH	1/1	QPSK	32	03 02 03 03 03 03 01 03 00 03 00 03 03 00 03 02

TRAC:DATA? TRACE1 would return:

```
-1,0,0,-500200,0,2,0,0,432, 01, 01, 00, 02, 03, 00, 01, 02, 01, 02, 01, ...
```

<continues like this until the next data block starts or the end of data is reached>

```
0,0,0,-200000,0,2,0,0,2430,02,03,03,03,01,01, 01, 03, 00, 03, ...
```

6.8.1.13 Channel decoder results

For the channel decoder Results, the number and type of return values depend on the parameter.

- TRAC:DATA CORESET
Returns the results for DCI decoding. The results are made up out of the following values.
<bwp>, <subframe>, <slot>, <allocationID>, <dci_info>
The <allocationID> is encoded. For the code assignment see [Chapter 6.8.1.24, "Return value codes"](#), on page 264.
If decoding was not successful, the command returns NAN.
<dci_info> is a string with information about the DCI field:
<field_name:bit_length>
- TRAC:DATA PBCH
Returns the results for the PBCH if PBCH decoding (or CRC check) was successful. The results are made up out of the following values.
<subframe>, <ssb>, <ik0_msb_fr1>, <ia6a7_reserved_fr1>, <ssb_index>, <half frame>, <system frame>, <subcarrier spacing>, <subcarrier offset>, <dmrs type a position>, <pdccch config>, <cell barred>, <intra frequency reselection>, <spare>
The unit for <subcarrier spacing> is Hz. All other values have no unit.
The <cell barred> and <intra frequency reselection> are encoded.
For the code assignment see [Chapter 6.8.1.24, "Return value codes"](#), on page 264.

If PBCH decoding was not successful, the command returns NAN.

6.8.1.14 EVM vs symbol x carrier

For the EVM vs symbol x carrier, the command returns one value for each resource element.

```
<SS/BWP>,<Subcarrier Spacing>,<Symbol Start Offset>,  
<Freq Start Offset>,<#Symbols>,<#Carriers>,  
<EVM[Symbol(0),Carrier(1)]>, ..., <EVM[Symbol(0),Carrier(n)]>,  
<EVM[Symbol(1),Carrier(1)]>, ..., <EVM[Symbol(1),Carrier(n)]>,  
...  
<EVM[Symbol(n),Carrier(1)]>, ..., <EVM[Symbol(n),Carrier(n)]>
```

The unit depends on [UNIT:EVM](#).

The number of values depends on the [evaluation range](#).

Resource elements that are unused return NAN.

The following parameters are supported.

- TRAC:DATA TRACE1
 - The return values depend on the evaluation range:
 - All bandwidth parts: EVM of the SS/PBCH block (or the first bandwidth part if the SS/PBCH block does not exist).
 - A specific bandwidth part: EVM of the selected BWP.
- TRAC:DATA TRACE2 to TRACE8
 - Only supported for evaluation over all bandwidth parts.
 - Returns the EVM of the corresponding bandwidth part (for example TRACE4 for the 4th bandwidth part).

6.8.1.15 Power vs symbol x carrier

For the power vs symbol x carrier, the command returns one value for each resource element.

```
<SS/BWP>,<Subcarrier Spacing>,<Symbol Start Offset>,  
<Freq Start Offset>,<#Symbols>,<#Carriers>,  
<P[Symbol(0),Carrier(1)]>, ..., <P[Symbol(0),Carrier(n)]>,  
<P[Symbol(1),Carrier(1)]>, ..., <P[Symbol(1),Carrier(n)]>,  
...  
<P[Symbol(n),Carrier(1)]>, ..., <P[Symbol(n),Carrier(n)]>
```

with P = Power of a resource element.

The unit is always dBm.

The number of values depends on the [evaluation range](#).

Resource elements that are unused return NAN.

The following parameters are supported.

- TRAC:DATA TRACE1

The return values depend on the evaluation range:

- All bandwidth parts: EVM of the SS/PBCH block (or the first bandwidth part if the SS/PBCH block does not exist).
- A specific bandwidth part: EVM of the selected BWP.

- TRAC:DATA TRACE2 to TRACE8

Only supported for evaluation over all bandwidth parts.

Returns the EVM of the corresponding bandwidth part (for example TRACE4 for the 4th bandwidth part).

6.8.1.16 Allocation ID vs symbol x carrier

For the allocation ID vs symbol x carrier, the command returns one value for each resource element.

```
<SS/BWP>,<Subcarrier Spacing>,<Symbol Start Offset>,  
<Freq Start Offset>,<#Symbols>,<#Carriers>,  
<ID[Symbol(0),Carrier(1)]>, ..., <ID[Symbol(0),Carrier(n)]>,  
<ID[Symbol(1),Carrier(1)]>, ..., <ID[Symbol(1),Carrier(n)]>,  
...  
<ID[Symbol(n),Carrier(1)]>, ..., <ID[Symbol(n),Carrier(n)]>
```

The <allocation ID> is encoded.

For the code assignment, see [Chapter 6.8.1.24, "Return value codes"](#), on page 264.

The number of values depends on the [evaluation range](#).

The following parameters are supported.

- TRAC:DATA TRACE1

The return values depend on the evaluation range:

- All bandwidth parts: EVM of the SS/PBCH block (or the first bandwidth part if the SS/PBCH block does not exist).
- A specific bandwidth part: EVM of the selected BWP.

- TRAC:DATA TRACE2 to TRACE8

Only supported for evaluation over all bandwidth parts.

Returns the EVM of the corresponding bandwidth part (for example TRACE4 for the 4th bandwidth part).

6.8.1.17 RS phase

For the RS phase result display, the command returns one value for each subcarrier that has been analyzed.

<Phase>, ...

The unit is degrees.

The following parameters are supported.

- TRAC:DATA TRACE1

The return values depend on the evaluation range:

- All antenna ports: average phase of the antenna port mapped to trace 1.
- A specific antenna port: average phase of the selected antenna port over all slots.
- A specific bandwidth part or subframe: average phase of the selected antenna port over all slots.
- A specific slot: phase of that slot.

- TRAC:DATA TRACE2

The return values depend on the evaluation range:

- All antenna ports: average phase of the antenna port mapped to trace 1.
- A specific antenna port: minimum phase of the selected antenna port over all slots.
- A specific bandwidth part or subframe: minimum phase of the selected antenna port over all slots.
- A specific slot: not supported.

- TRAC:DATA TRACE3

The return values depend on the evaluation range:

- All antenna ports: average phase of the antenna port mapped to trace 1.
- A specific antenna port: maximum phase of the selected antenna port over all slots.
- A specific bandwidth part or subframe: maximum phase of the selected antenna port over all slots.
- A specific slot: not supported.

- TRAC:DATA TRACE4 | TRACE5 | TRACE6 | TRACE7 | TRACE8

Only supported for evaluation over all antenna ports.

Returns the average phase of the corresponding antenna port over all subcarriers (for example TRACE4 for the antenna port mapped to the 4th trace).

6.8.1.18 RS magnitude

For the RS magnitude result display, the command returns one value for each subcarrier that has been analyzed.

<Magnitude>, ...

The unit is dB.

The following parameters are supported.

- `TRAC:DATA TRACE1`

The return values depend on the evaluation range:

- All antenna ports: average magnitude of the antenna port mapped to trace 1.
- A specific antenna port: average magnitude of the selected antenna port over all slots.
- A specific bandwidth part or subframe: average magnitude of the selected antenna port over all slots.
- A specific slot: magnitude of that slot.

- `TRAC:DATA TRACE2`

The return values depend on the evaluation range:

- All antenna ports: average magnitude of the antenna port mapped to trace 1.
- A specific antenna port: minimum magnitude of the selected antenna port over all slots.
- A specific bandwidth part or subframe: minimum magnitude of the selected antenna port over all slots.
- A specific slot: not supported.

- `TRAC:DATA TRACE3`

The return values depend on the evaluation range:

- All antenna ports: average magnitude of the antenna port mapped to trace 1.
- A specific antenna port: maximum magnitude of the selected antenna port over all slots.
- A specific bandwidth part or subframe: maximum magnitude of the selected antenna port over all slots.
- A specific slot: not supported.

- `TRAC:DATA TRACE4 | TRACE5 | TRACE6 | TRACE7 | TRACE8`

Only supported for evaluation over all antenna ports.

Returns the average magnitude of the corresponding antenna port over all subcarriers (for example `TRACE4` for the antenna port mapped to the 4th trace).

6.8.1.19 RS phase difference

For the RS phase difference result display, the command returns one value for each subcarrier that has been analyzed. The value is the phase deviation to a reference antenna port.

<Phase>, ...

The unit is degrees.

The following parameters are supported.

- `TRAC:DATA TRACE1`

The return values depend on the evaluation range:

- All antenna ports: average phase deviation of the antenna port mapped to trace 1.

- A specific antenna port: average phase deviation of the selected antenna port over all slots.
- A specific bandwidth part or subframe: average phase deviation of the selected antenna port over all slots.
- A specific slot: phase deviation of that slot.
- TRAC:DATA TRACE2
The return values depend on the evaluation range:
 - All antenna ports: average phase deviation of the antenna port mapped to trace 1.
 - A specific antenna port: minimum phase deviation of the selected antenna port over all slots.
 - A specific bandwidth part or subframe: minimum phase deviation of the selected antenna port over all slots.
 - A specific slot: not supported.
- TRAC:DATA TRACE3
The return values depend on the evaluation range:
 - All antenna ports: average phase deviation of the antenna port mapped to trace 1.
 - A specific antenna port: maximum phase deviation of the selected antenna port over all slots.
 - A specific bandwidth part or subframe: maximum phase deviation of the selected antenna port over all slots.
 - A specific slot: not supported.
- TRAC:DATA TRACE4 | TRACE5 | TRACE6 | TRACE7 | TRACE8
Only supported for evaluation over all antenna ports.
Returns the average phase deviation of the corresponding antenna port over all subcarriers (for example TRACE4 for the antenna port mapped to the 4th trace).

6.8.1.20 Beamforming summary

For the beamforming summary result display, the command returns four values for each allocation that has been found.

```
<BWP>, <Subframe>, <Slot>, <AllocationType>, <AP>, <Phase>,
<PhaseDifference>, ...
```

The unit for <Phase> and <PhaseDifference> is always degrees. The other values have no unit.

The <AllocationType> is encoded. For the code assignment see [Chapter 6.8.1.24, "Return value codes"](#), on page 264.

6.8.1.21 Adjacent channel leakage ratio

For the ACLR result display, the number and type of returns values depend on the parameter.

- `TRAC:DATA TRACE1`
Returns one value for each trace point.
- `TRAC:DATA RESult`
Combined mode only. Returns the results for all ACLR measurements in a measurement sequence.
For each measurement event, the command returns the following information.
`<event number>`, `<channel power>`,
`<abs. power lower adj. ch.>`, `<abs. power upper adj. ch.>`,
`<rel. power lower adj. ch.>`, `<rel. power upper adj. ch.>`,
`<abs. power lower alt. ch.>`, `<abs. power upper alt. ch.>`,
`<rel. power lower alt. ch.>`, `<rel. power upper alt. ch.>`,
etc.
The number of values for alternate channels depends on the number of alternate channels in the measurement.
- `TRAC:DATA LIMit`
Combined mode only. Returns the results for all ACLR limit checks in a measurement sequence.
For each measurement event, the command returns the following information.
`<event number>`,
`<adj. ch. limit check result>`,
`<abs. limit lower adj. ch.>`, `<abs. limit upper adj. ch.>`,
`<rel. limit lower adj. ch.>`, `<rel. limit upper adj. ch.>`,
`<alt. ch. limit check result>`,
`<abs. power lower alt. ch.>`, `<abs. power upper alt. ch.>`,
`<rel. power lower alt. ch.>`, `<rel. power upper alt. ch.>`
etc.
The limit check results are either `PASSED` or `FAILED`. The number of results for alternate channels depends on the number of alternate channels in the measurement.

6.8.1.22 Spectrum emission mask

For the SEM measurement, the number and type of returns values depend on the parameter.

- `TRAC:DATA TRACE1`
Returns one value for each trace point.
`<absolute power>`, ...
The unit is always dBm.
- `TRAC:DATA LIST`
Returns the contents of the SEM table. For every frequency in the spectrum emission mask, it returns 11 values.
`<index>`, `<start frequency in Hz>`, `<stop frequency in Hz>`,
`<RBW in Hz>`, `<limit fail frequency in Hz>`, `<absolute power in dBm>`,
`<relative power in dBc>`, `<limit distance in dB>`, `<limit check result>`,
`<reserved>`, `<reserved>`...
The `<limit check result>` is either a 0 (for PASS) or a 1 (for FAIL).
- `TRAC:DATA RESult`
Combined mode only. Returns the results for all SEM measurements in a measurement sequence.

For each measurement event, the command returns the following information.
 <event number>, <channel power>, <range index>, <start frequency in Hz>, <stop frequency in Hz>, <RBW in Hz>, <frequency>, <absolute power in dBm>, <relative power in dBc>, <limit distance in dB>, <limit check result>, <reserved>, <reserved>, etc.

The number of SEM ranges depend on the SEM configuration.

- TRAC:DATA LIMIt

Combined mode only. Returns the results for all SEM limit checks in a measurement sequence.

For each measurement event, the command returns the following information.
 <event number>, <limit check result>, etc.

The limit check results are either PASSED or FAILED.

6.8.1.23 On/off power

For the on/off power measurement, the number and type of return values depend on the parameter.

- TRAC:DATA TRACE1
Returns the power for the Off power regions.
<absolute power>, ...
The unit is always dBm.
- TRAC:DATA TRACE2
Returns the power for the transient regions.
<absolute power>, ...
The unit is always dBm.
- TRAC:DATA LIST
Returns the contents of the on/off power table. For each line, it returns seven values.
<off period start limit>, <off period stop limit>, <time at delta to limit>, <absolute off power>, <distance to limit>, <falling transient period>, <rising transient period>, ...
The unit for the <absolute off power> is dBm. The unit for the <distance to limit> is dB. All other values have the unit s.

6.8.1.24 Return value codes

<allocation ID>

Represents the allocation ID. The range is as follows.

- **0xxxxx** = PDSCH
- **-1** = INVALID
- **-1xxxxx** = PDSCH DMRS
- **-2xxxxx** = CORESET
- **-3xxxxx** = CORESET DMRS

- **-4xxxxx** = PDSCH PTRS
 - **-5000xx** = PSS
 - **-5001xx** = SSS
 - **-5002xx** = PBCH
 - **-5003xx** = PBCH DMRS
- Note. **xxxxx** is a placeholder for the ID of the channel.
If the channel has, for example, the ID 22, the return value would be -100022, -200022 or -300022 (depending on the configuration)

<AllocationType>

- **0** = SS/PBCH
- **1** = CORESET
- **2** = PDSCH
- **3** = CSI-RS

<modulation>

Represents the modulation scheme.

- **0** = unrecognized
- **1** = RBPSK
- **2** = QPSK
- **3** = 16QAM
- **4** = 64QAM
- **14** = 256QAM
- **15** = 1024QAM

<crc status>

The range is {0...1}.

- **0** = fail
- **1** = pass

<cell barred>

The range is {0...1}.

- **0** = not barred
- **1** = barred

<intra frequency reselection>

The range is {0...1}.

- **0** = not allowed
- **1** = allowed

<codeword>

Represents the codeword of an allocation. The range is {0...6}.

- 0 = 1/1
- 1 = 1/2
- 2 = 2/2
- 3 = 1/4
- 4 = 2/4
- 5 = 3/4
- 6 = 4/4

6.8.2 Read measurement results

CALCulate<n>:MARKer<m>:FUNction:POWer<sb>:RESult[:CURRent]?.....	266
FORMat[:DATA].....	267
TRACe<n>:CATalog?.....	267
TRACe<n>[:DATA]?.....	268
TRACe<n>[:DATA]:X?.....	269

CALCulate<n>:MARKer<m>:FUNction:POWer<sb>:RESult[:CURRent]? [:<Measurement>]

Queries the results of the ACLR measurement or the total signal power level of the SEM measurement.

To get a valid result, you have to perform a complete measurement with synchronization to the end of the measurement before reading out the result. This is only possible for single sweeps.

Suffix:

<n>	Window
<m>	Marker
<sb>	irrelevant

Query parameters:

<Measurement>	CPOW This parameter queries the channel power of the reference range.
	MCAC Queries the channel powers of the ACLR measurements as shown in the ACLR table. Where available, this parameter also queries the power of the adjacent channels (for example in the ACLR measurement).

Return values:

<Result>	Results for the Spectrum Emission Mask measurement: Power level in dBm.
----------	---

Results for the ACLR measurements:

Relative power levels of the ACLR channels. The number of return values depends on the number of transmission and adjacent channels. The order of return values is:

- <TXChannelPower> is the power of the transmission channel in dBm
- <LowerAdjChannelPower> is the relative power of the lower adjacent channel in dB
- <UpperAdjChannelPower> is the relative power of the upper adjacent channel in dB
- <1stLowerAltChannelPower> is the relative power of the first lower alternate channel in dB
- <1stUpperAltChannelPower> is the relative power of the first lower alternate channel in dB
- (...)
- <nthLowerAltChannelPower> is the relative power of a subsequent lower alternate channel in dB
- <nthUpperAltChannelPower> is the relative power of a subsequent lower alternate channel in dB

Example:

```
CALC1:MARK:FUNC:POW:RES? MCAC
```

Returns the current ACLR measurement results.

Usage:

Query only

Manual operation:

See "[Result summary](#)" on page 52

FORMat[:DATA] <Format>

Selects the data format for the data transmission between the R&S VSE and the remote client.

Parameters:

```
<Format>      ASCii | REAL
               *RST:      ASCii
```

Example:

```
//Select data format
FORM REAL
```

TRACe<n>:CATalog?

Queries the types of traces in a diagram.

Prerequisites for this command

- Query results in a window that contains one or more line traces.

Suffix:

```
<n>           Window
```

Return values:

```
<TraceType>  CLRW | SSB<x> | BWP<x> | AVG | MIN | MAX
```

CLRW

For result displays with a single trace (for example the capture buffer).

SSB<x> | BWP<x>

For unfiltered result displays that show all signal parts (for example unfiltered EVM vs Carrier).

(SSB = synchronization signal block, BWP = bandwidth part)

AVG | MIN | MAX

For result displays that are filtered by a specific bandwidth part or subframe and show the average, minimum or maximum results of the slots (for example filtered EVM vs Carrier).

Example: //Query trace types
TRAC2:CAT?

Usage: Query only

TRACe<n>[:DATA]? <Result>

This command queries the trace data for each measurement point (y-axis values).

In combination with [TRACe<n>\[:DATA\]:X?](#), you can thus query the coordinates of each measurement point.

Suffix:

<n> [Window](#)

Parameters:

RESult Combined mode only:
Queries the results of all ACLR or SEM measurements in a measurement sequence.

LIMit Combined mode only:
Queries the limit check results of all ACLR or SEM measurements in a measurement sequence.

Query parameters:

<TraceNumber> **TRACE1 | TRACE2 | TRACE3**
Queries the trace data of the corresponding trace.

PBCH Queries the results for the PBCH in the channel decoder.

CORESET Queries the results for the PDCCH in the channel decoder.

Return values:

<TraceData> For more information about the type of return values in the different result displays, see [Chapter 6.8.1, "Using the TRACe\[:DATA\] command"](#), on page 248.

Example: //Query results of the second measurement window. The type of data that is returned by the parameter (TRACE1) depends on the result display shown in measurement window 2.

TRAC2? TRACE1

Example:	//Query results of the channel decoder result display TRAC2? PBCH TRAC2? CORESET
Usage:	Query only
Manual operation:	See "Data import and export" on page 185

TRACe<n>[:DATA]:X? <Result>

Queries the horizontal trace data for each measurement point (x-axis values).

In combination with [TRACe<n>\[:DATA\]?](#), you can thus query the coordinates of each measurement point.

Suffix:

<n> [Window](#)

Query parameters:

<TraceNumber> TRACe1 | TRACe2 | TRACe3 | TRACe4 | TRACe5 | TRACe6

Return values:

<TraceData> The type of value depends on the information displayed on the x-axis of the result display whose contents you query.

Example: //Query trace data of trace 1 in window 2
TRAC2? TRACE1
TRAC2:X? TRACE1

Usage: Query only

Manual operation: See "Capture Buffer" on page 27
See "EVM vs Carrier" on page 28
See "EVM vs Symbol" on page 29
See "EVM vs RB" on page 30
See "Frequency Error vs Symbol" on page 30
See "Frequency Error vs Subframe" on page 31
See "Power Spectrum" on page 32
See "Flatness" on page 32

6.9 Configuration

- [General configuration](#).....270
- [Automatic configuration](#).....272
- [Physical settings](#).....276
- [Component carrier configuration](#).....281
- [General radio frame configuration](#).....285
- [Synchronization signal configuration](#).....287
- [Bandwidth part configuration](#).....293
- [Slot configuration](#).....297
- [CSI reference signal configuration](#).....304
- [Positioning reference signal](#).....313

• CORESET allocation configuration.....	317
• PDSCH allocation configuration.....	323
• Enhanced CORESET allocation configuration.....	331
• Enhanced PDSCH settings: DMRS.....	347
• Enhanced PDSCH settings: PTRS.....	357
• Enhanced PDSCH settings: scrambling / coding.....	360
• Antenna port configuration.....	364
• MIMO configuration.....	366
• Advanced settings: global.....	367
• Advanced settings: reference point A.....	371
• Advanced settings: LTE-CRS coexistence.....	375
• Generator control.....	377
• Inputs configuration.....	383
• Frequency configuration.....	388
• Amplitude configuration.....	390
• Data capture.....	394
• Trigger.....	398
• Tracking.....	404
• Demodulation.....	406
• Time alignment measurement.....	409
• Transmit on/off power measurements.....	410
• Frequency sweep measurements.....	413

6.9.1 General configuration

The following remote control command control general configuration of the application.

The remote control commands to select the result displays for I/Q measurements are described in [Chapter 6.4, "Screen layout"](#), on page 204.



To load several file based I/Q data streams and treat them as separate input sources, for example to test a MIMO setup, use the following commands. The suffix <fi> assigns the file to an input source.

- **General:** `INSTRUMENT:BLOCK:FILE<fi>`
- **Replace a file:** `INSTRUMENT:BLOCK:FILE<fi>:REPLACE`
- **csv file:** `INSTRUMENT:BLOCK:FILE<fi>:CSV`
- **iq.tar file:** `INSTRUMENT:BLOCK:FILE<fi>:IQTar`
- **iqw file:** `INSTRUMENT:BLOCK:FILE<fi>:IQW`
- **iqx file:** `INSTRUMENT:BLOCK:FILE<fi>:IQX`
- **matlab file:** `INSTRUMENT:BLOCK:FILE<fi>:MAT`
- **wv file:** `INSTRUMENT:BLOCK:FILE<fi>:WV`

For a comprehensive description of these commands, refer to the user manual of the R&S VSE software.

CONFigure[:NR5G]:MEASurement.....	271
MMEMory:STORe<n>:IQ:STATe.....	271
MMEMory:STORe<n>:MSERvice.....	272
SYSTem:PRESet:CHANnel[:EXEC].....	272

CONFigure[:NR5G]:MEASurement <Measurement>

Selects the measurement type.

Parameters:

<Measurement>	ACLR Selects the adjacent channel leakage ratio (ACLR) measurement.
	ESpectrum Selects the spectrum emission mask (SEM) measurement.
	EVM Selects I/Q measurements.
	TAERor Selects the time alignment error measurement.
	TPOO Selects the transmit on / off power measurement.
*RST:	EVM

Example: //Select a measurement
CONF:MEAS EVM

Manual operation: See "EVM" on page 17
See "Time alignment error" on page 18
See "Transmit on / off power" on page 18
See "Channel power ACLR" on page 18
See "SEM" on page 18
See "Transmit On / Off Power" on page 47
See "Adjacent Channel Leakage Ratio (ACLR)" on page 51
See "Spectrum Emission Mask (SEM)" on page 52
See "Select Measurement" on page 60

MMEMory:STORe<n>:IQ:STATe <Value>,<FileName>

Saves I/Q data to a file.

Suffix:

<n> irrelevant

Parameters:

<Value> 1
<FileName> String containing the path and name of the target file.

Example: MMEM:STOR:IQ:STAT 'C:
\R_S\Instr\user\data.iq.tar'
Saves I/Q data to the specified file.

Manual operation: See ["Data import and export"](#) on page 185

MMEMory:STORe<n>:MSERvice <FileName>

Exports the signal configuration to the microservice.

Suffix:

<n> irrelevant

Parameters:

<FileName> String containing the path and name of the file.
The file extension is .m5g.

Example:

```
//Export to microservice
MMEM:STOR:MSER 'signal.xxx'
```

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 60

6.9.2 Automatic configuration

Commands to automatically configure measurements described elsewhere.

- `DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALE]:AUTO`
on page 418

<code>[SENSe<ip>:]ADJust:CONFigure:LEVel:DURation</code>	273
<code>[SENSe<ip>:]ADJust:CONFigure:LEVel:DURation:MODE</code>	273
<code>[SENSe:]ADJust:DEMod</code>	273
<code>[SENSe:]ADJust:EVM</code>	274
<code>[SENSe:]ADJust:EVM:SLOTs</code>	274
<code>[SENSe:]ADJust:LEVel</code>	274
<code>[SENSe:]ADJust:LEVel<ant>:ALL</code>	275
<code>CONFigure[:NR5G]:DL[:CC<cc>]:DEMod:AUTO</code>	275
<code>CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPART<bwp>:DETectIon</code>	275
<code>CONFigure[:NR5G]:DL[:CC<cc>]:SSBLock<ssb>:DETectIon</code>	276

[SENSe<ip>:]ADJust:CONFigure:LEVel:DURation <Duration>

To determine the ideal reference level, the R&S VSE performs a measurement on the current input data. This command defines the length of the measurement if [\[SENSe<ip>:\]ADJust:CONFigure:LEVel:DURation:MODE](#) is set to `MANual`.

Suffix:

<ip> 1..n

Parameters:

<Duration> Numeric value in seconds
 Range: 0.001 to 16000.0
 *RST: 0.001
 Default unit: s

Example:

`ADJ:CONF:DUR:MODE MAN`
 Selects manual definition of the measurement length.
`ADJ:CONF:LEV:DUR 5ms`
 Length of the measurement is 5 ms.

Manual operation: See ["Auto Level"](#) on page 142

[SENSe<ip>:]ADJust:CONFigure:LEVel:DURation:MODE <Mode>

To determine the ideal reference level, the R&S VSE performs a measurement on the current input data. This command selects the way the R&S VSE determines the length of the measurement .

Suffix:

<ip> 1..n

Parameters:

<Mode> **AUTO**
 The R&S VSE determines the measurement length automatically according to the current input data.
MANual
 The R&S VSE uses the measurement length defined by [\[SENSe<ip>:\]ADJust:CONFigure:LEVel:DURation](#) on page 273.
 *RST: AUTO

Manual operation: See ["Auto Level"](#) on page 142

[SENSe:]ADJust:DEMod

Automatically demodulates the signal once.

For continuous automatic demodulation, use [CONFigure\[:NR5G\]:DL\[:CC<cc>\]:DEMod:AUTO](#).

Usage: Event

Manual operation: See ["Complete Signal Demodulation"](#) on page 62

[SENSe:]ADJust:EVM

Adjusts the amplitude settings, including attenuator and preamplifier, to achieve the optimal EVM using the maximum dynamic range.

For the auto EVM routine, it is sufficient to send this command. It is not necessary to send `INITiate<n>[:IMMEDIATE]`.

Example: //Optimize EVM
 ADJ:EVM

Usage: Event

Manual operation: See "Auto EVM" on page 61

[SENSe:]ADJust:EVM:SLOTs <Slots>

Selects the number of slots to be used during the auto EVM routine.

Prerequisites for this command

- Select manual automatic measurement time mode (`[SENSe<ip>:]ADJust:CONFigure:LEVel:DURation:MODE`).
- Define an appropriate automatic measurement time (`[SENSe<ip>:]ADJust:CONFigure:LEVel:DURation` on page 273).

Parameters:

<Slots> *RST: 1

Example: //Define number of slots for automatic EVM measurement
 CONF:LEV:DUR:MODE MAN
 ADJ:EVM:SLOT 2

Manual operation: See "Auto EVM" on page 61

[SENSe:]ADJust:LEVel

Adjusts the level settings, including attenuator and preamplifier, to achieve the best dynamic range.

Compared to `[SENSe:]ADJust:EVM` on page 274, which achieves the best amplitude settings to optimize the EVM, you can use this command for a quick determination of preliminary amplitude settings.

Example: //Adjust level settings
 ADJ:LEV

Usage: Event

Manual operation: See "Auto Level" on page 61
 See "Auto Level" on page 142

[SENSe:]ADJust:LEVel<ant>:ALL

Determines the ideal reference level based on the current measurement data and settings on all connected input sources.

This ensures that the settings of the RF attenuation and the reference level are optimally adjusted to the signal level without overloading the R&S VSE or limiting the dynamic range by an S/N ratio that is too small.

The command is available for MIMO measurements with more than one input source.

Suffix:

<ant> irrelevant

Example:

```
//Auto level all connected instruments
ADJ:LEV:ALL
```

Usage:

Event

CONFigure[:NR5G]:DL[:CC<cc>]:DEMod:AUTO <Mode>

Turns automatic signal demodulation on and off.

Suffix:

<cc> [Component Carrier](#)

Parameters:

<Mode> ON | OFF | 1 | 0

ON

Automatically detects the following signal properties.

- Synchronization signal configuration
- Bandwidth part configuration
- Slot configuration
- PDSCH and CORESET configuration

OFF

Lets you configure the signal manually.

*RST: MANual

Example:

```
//Select manual configuration mode
CONF:DL:CC2:DEMod:AUTO OFF
```

Usage:

Setting only

Manual operation: See "[Complete Signal Demodulation](#)" on page 62

CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPART<bwp>:DETEction <State>

Turns automatic detection of the bandwidth part configuration on and off.

Suffix:

<cc> [Component Carrier](#)

<fr> irrelevant

<bwp> irrelevant

Parameters:

<State>

AUTO

Automatically detects the following signal properties.

- Bandwidth part configuration
- Slot configuration
- PDSCH and CORESET configuration

MANual

Lets you configure the bandwidth parts manually.

*RST: MANual

Example:

```
//Select configuration mode
CONF:DL:CC2:FRAM:BWP:DET AUTO
```

Manual operation: See "[Bandwidth Parts Demodulation](#)" on page 63

CONFigure[:NR5G]:DL[:CC<cc>]:SSBLoCk<ssb>:DETectioN <Mode>

Turns automatic detection of the synchronization signal configuration on and off.

Suffix:

<cc> [Component Carrier](#)

<ssb> irrelevant

Parameters:

<Mode>

AUTO

Automatically detects the following synchronization signal properties.

- Subcarrier spacing
- SS/PBCH block pattern
- RB offset
- Additional subcarrier offset
- Cell ID

MANual

Lets you configure the SS/PBCH block manually.

*RST: AUTO

Example:

```
//Select configuration mode
CONF:DL:CC2:SSBL:DET AUTO
```

Manual operation: See "[Synchronization Signal Demodulation](#)" on page 63

6.9.3 Physical settings

CONFigure[:NR5G]:OBANd.....	277
CONFigure[:NR5G]:DL[:CC<cc>]:BW.....	277
CONFigure[:NR5G]:DL[:CC<cc>]:DFRanGe.....	277
CONFigure[:NR5G]:DL[:CC<cc>]:PLC:CID.....	278
CONFigure[:NR5G]:LDIRectioN.....	278

FETCh[:CC<cc>]:PLC:CID?.....	279
MMEMory:LOAD:TMODeI[:CC<cc>].....	279
MMEMory:LOAD:DEModsetting:ALL.....	279
MMEMory:LOAD:DEModsetting[:CC<cc>].....	280
MMEMory:STORe<n>:DEModsetting:ALL.....	280
MMEMory:STORe<n>:DEModsetting[:CC<cc>].....	280

CONFigure[:NR5G]:OBANd <OperatingBand>

Selects the operating band.

Prerequisites for this command

- Select at least 2 component carriers ([CONFigure\[:NR5G\]:NOCC](#) on page 283).

Parameters:

<OperatingBand> N1 | N2 | N3 | N5 | N7 | N8 | N12 | N13 | N14 | N18 | N20 | N24 |
 N25 | N26 | N28 | N29 | N30 | N34 | N38 | N39 | N40 | N41 |
 N46 | N48 | N50 | N51 | N53 | N65 | N66 | N67 | N70 | N71 |
 N74 | N75 | N76 | N77 | N78 | N79 | N80 | N81 | N82 | N83 |
 N84 | N85 | N86 | N89 | N90 | N91 | N92 | N93 | N94 | N95 |
 N96 | N97 | N98 | N99 | N100 | N101 | N102 | N257 | N258 |
 N259 | N260 | N261 | N262 | N263
 *RST: n1

Example: //Select operating band
 CONF:NOCC 2
 CONF:OBAN N20

Manual operation: See "[Operating Band](#)" on page 65

CONFigure[:NR5G]:DL[:CC<cc>]:BW <Bandwidth>

Selects the channel bandwidth of the 5G NR carrier.

Suffix:

<cc> [Component Carrier](#)

Parameters:

<Bandwidth> BW5 | BW10 | BW15 | BW20 | BW25 | BW30 | BW35 | BW40 |
 BW45 | BW50 | BW60 | BW70 | BW80 | BW90 | BW100 |
 BW200 | BW400 | BW800 | BW1600 | BW2000
 *RST: BW100

Example: //Select carrier bandwidth
 CONF:DL:BW BW20

Manual operation: See "[Physical settings of the signal](#)" on page 66
 See "[Bandwidth configuration](#)" on page 71

CONFigure[:NR5G]:DL[:CC<cc>]:DFRRange <Deployment>

Selects the deployment frequency range of the signal.

Suffix:`<cc>` [Component Carrier](#)**Parameters:**`<Deployment>`**LOW**

Deployment in FR1 ≤ 3 GHz.

MIDDLE

Deployment in FR1 > 3 GHz.

HIGH

Deployment in FR2-1.

EHIGH

Deployment in FR2-2.

*RST: MIDDLE

Example:

```
//Select frequency range of signal
CONF:DL:DFR LOW
```

Manual operation: See ["Deployment Frequency Range"](#) on page 65**CONFigure[:NR5G]:DL[:CC<cc>]:PLC:CID <CellID>**

Defines the cell ID.

Suffix:`<cc>` [Component Carrier](#)**Parameters:**`<CellID>`**AUTO**

Automatically determines the cell ID.

<numeric value> (integer only)

Number of the cell ID.

Range: 0 to 503

Example:

```
//Define cell ID
CONF:DL:CC2:PLC:CID 12
```

Manual operation: See ["Physical settings of the signal"](#) on page 66**CONFigure[:NR5G]:LDIRection <Mode>**

Selects the link direction you want to analyze.

Parameters:`<Mode>`**DL**

Selects the downlink application to analyze 5G NR downlink signals.

Requires option R&S VSE-K144.

UL

Selects the uplink application to analyze 5G NR uplink signals.

Requires option R&S VSE-K145.

Example: //Select uplink application
CONF:LDIR UL

Manual operation: See ["Selecting the 5G NR mode"](#) on page 65

FETCH[:CC<cc>]:PLC:CID?

Queries the cell ID.

Suffix:
<cc> [Component Carrier](#)

Return values:
<CellID> <numeric value> (integer only)

Example: //Query cell ID
FETC:PLC:CID?

Usage: Query only

MMEMory:LOAD:TMODeI[:CC<cc>] <TestModel>

Loads a test model (NR-FR-TM) as defined by 3GPP (38.141-1 / -2).

You can also select an O-RAN test case with the command.

Suffix:
<cc> [Component Carrier](#)

Parameters:
<TestModel> String containing the name of the test model (file name).
Alternatively, a string that contains the name of the O-RAN test case, e.g. 'ORAN-FR1-TC32311__FDD_5MHZ_15KHZ'.

Example: //Select test model
:MMEM:LOAD:TMOD:CC1
'NR-FR1-TM1_1__FDD_5MHZ_15KHZ'

Example: //Select O-RAN test case
MMEM:LOAD:TMOD:DL
'ORAN-FR1-TC32311__FDD_5MHZ_15KHZ'

Manual operation: See ["3GPP test models"](#) on page 67
See ["ORAN test cases"](#) on page 67

MMEMory:LOAD:DEModsetting:ALL <FileName>

Restores the signal description of multiple carriers from a single file.

Parameters:
<FileName> String containing the path and name of the file.
The file extension is .ccallocation.

Example: //Restore signal description for multiple carriers in a single files
 CONF:NOCC 2
 MMEM:LOAD:DEM:ALL 'c:\TestSignal.ccallocation'

Manual operation: See ["Test scenarios for carrier aggregation"](#) on page 68

MMEMory:LOAD:DEModsetting[:CC<cc>] <FileName>[, <Item>, <Item>, <Item>, <Item>, <Item>]

Restores the signal description.

Suffix:

<cc> [Component Carrier](#)

Parameters:

<FileName> String containing the path and name of the file.
 The file extension is .allocation.

<Item> Not supported

Example: //Restore signal description for a single component carrier
 MMEM:LOAD:DEM 'c:\TestSignal.allocation'

Example: //Restore signal description for multiple carriers in individual files
 CONF:NOCC 2
 MMEM:LOAD:DEM:CC1 'c:\TestSignalCC1.allocation'
 MMEM:LOAD:DEM:CC2 'c:\TestSignalCC2.allocation'

Manual operation: See ["User defined test scenarios"](#) on page 67

MMEMory:STORe<n>:DEModsetting:ALL <FileName>

Saves the signal description of multiple carriers in a single file.

Suffix:

<n> irrelevant

Parameters:

<FileName> String containing the path and name of the file.
 The file extension is .ccallocation.

Example: //Save signal description for multiple carriers in a single files
 CONF:NOCC 2
 MMEM:STOR:DEM:ALL 'c:\TestSignal.ccallocation'

Manual operation: See ["Test scenarios for carrier aggregation"](#) on page 68

MMEMory:STORe<n>:DEModsetting[:CC<cc>] <FileName>

Saves the signal description.

Suffix:

<n> irrelevant

<cc> [Component Carrier](#)

Parameters:

<FileName> String containing the path and name of the file.
The file extension is .allocation.

Example:

```
//Save signal description for a single component carrier
MMEM:STOR:DEM 'c:\TestSignal.allocation'
```

Example:

```
//Save signal description for multiple carriers in individual files
CONF:NOCC 2
MMEM:STOR:DEM:CC1 'c:\TestSignalCC1.allocation'
MMEM:STOR:DEM:CC2 'c:\TestSignalCC2.allocation'
```

Manual operation: See "[User defined test scenarios](#)" on page 67

6.9.4 Component carrier configuration

Commands to configure component carrier described elsewhere.

- [\[SENSe:\]FREQuency:CENTer\[:CC<cc>\]](#)
- [\[SENSe:\]FREQuency:CENTer\[:CC<cc>\]:OFFSet](#)
- [CONFigure\[:NR5G\]:DL\[:CC<cc>\]:BW](#)

CONFigure[:NR5G]:CENTer	281
CONFigure[:NR5G]:CRASter	282
CONFigure[:NR5G]:CSPacing	282
CONFigure[:NR5G]:CSCapture	282
CONFigure[:NR5G]:FCOFset	283
CONFigure[:NR5G]:GMCFreq	283
CONFigure[:NR5G]:NCSPacing	283
CONFigure[:NR5G]:NOCC	283
CONFigure[:NR5G]:OMODE	284
CONFigure[:NR5G]:OREL	284
[SENSe:]FREQuency:CENTer[:CC<cc>]:MCOFset	285

CONFigure[:NR5G]:CENTer

Synchronizes the global multicarrier frequency to the current center frequency (= center of all carriers).

Use [CONFigure\[:NR5G\]:GMCFreq](#) to query the global multicarrier frequency.

Example:

```
//Synchronize global multicarrier frequency
CONF:CENT
//Query global MC frequency
CONF:GMCF?
```

Usage:

Event

Manual operation: See "[Center frequency configuration](#)" on page 73

CONFigure[:NR5G]:CRASter <Bandwidth>

Selects the channel raster of a component carrier.

Prerequisites for this command

- Select an operating band that supports different channel raster (**CONFigure[:NR5G]:OBANd**).
For all other operating bands, the command works as a query only.

Parameters:

<Bandwidth> **C15**
 15 kHz channel raster

C15
 100 kHz channel raster

Example: //Select channel raster
 CONF:OBAN N90
 CONF:CRAS C100

Manual operation: See "[Channel Raster](#)" on page 71

CONFigure[:NR5G]:CSPacing <Frequency>

Defines the carrier spacing for equidistant frequency offsets in a multicarrier setup. This frequency offset applies to all component carriers in the setup.

Prerequisites for this command

- Select equidistant frequency offset (**CONFigure[:NR5G]:OMODe**).

Parameters:

<Frequency> *RST: 0
 Default unit: Hz

Example: //Define carrier spacing
 CONF:OMOD EQU
 CONF:CSP 500MHZ

Manual operation: See "[Frequency offset configuration](#)" on page 73

CONFigure[:NR5G]:CSCapture <Mode>

Selects the capture mode for measurements on multiple component carriers.

Parameters:

<Mode> **AUTO**
 Automatically selects the number of component carriers that can be analyzed in a single capture. If there are more carriers than can be analyzed in a single measurement, the other carriers are analyzed in subsequent measurements.

SINGLE
 Capture each component carrier subsequently in individual measurements.

*RST: AUTO

Example: //Select component carrier capture mode
CONF:CSC AUTO

Manual operation: See "[Component carrier data capture](#)" on page 69

CONFigure[:NR5G]:FCOffset <State>

Turns a fixed frequency offset for component carriers on and off.

Parameters:

<State> ON | OFF | 1 | 0

*RST: OFF

Example: //Turn on fixed frequency offset
CONF:FCOF ON

Manual operation: See "[Frequency offset configuration](#)" on page 73

CONFigure[:NR5G]:GMCFreq <Frequency>

Defines the global multicarrier frequency for component carrier setups.

Parameters:

<Frequency> Default unit: Hz

Example: //Define global MC frequency
CONF:GMCF 950MHZ

Manual operation: See "[Center frequency configuration](#)" on page 73

CONFigure[:NR5G]:NCSPacing

Resets the channel spacing of component carriers to its default value.

Example: //Reset channel spacing
CONF:NCSP

Usage: Event

Manual operation: See "[Nominal Channel Spacing](#)" on page 72

CONFigure[:NR5G]:NOCC <Carrier>

Selects the number of component carriers analyzed in the measurement.

Parameters:

<Carrier> Number of the component carriers that you would like to measure. The range depends on the measurement. For more information see [Chapter 4.1.5, "Component carrier configuration"](#), on page 68.

*RST: 1

Example: //Select number of component carriers
CONF:NOCC 2

Manual operation: See ["Number of component carriers"](#) on page 69

CONFigure[:NR5G]:OMODE <Mode>

Selects the frequency offset mode for component carriers in a multicarrier setup.

Parameters:

<Mode>

ARbitrary

Distance between component carriers is arbitrary.

You can define the frequency offsets with [\[SENSe : \] FREQuency:CENTer \[:CC<cc> \] :OFFSet](#).

EQUidistant

Component carriers have the same distance between each other.

You can define the spacing between carriers with [CONFigure \[: NR5G \] : CSPacing](#).

*RST: ARB

Example: //Select arbitrary frequency offsets relative to CC1
CONF:OREL CC1
CONF:OMOD ARB
FREQ:CENT:CC2:OFFS 200MHZ
FREQ:CENT:CC3:OFFS 300MHZ
FREQ:CENT:CC4:OFFS 800MHZ

Example: //Select equidistant frequency offsets relative to CC1
CONF:OREL CC1
CONF:OMOD EQU
CONF:CSP 200MHZ

Manual operation: See ["Frequency offset configuration"](#) on page 73

CONFigure[:NR5G]:OREL <Reference>

Selects the reference point for frequency offsets of component carriers in a multicarrier setup.

Parameters:

<Reference>

CC1

Reference point is the center frequency of first component carrier.

GMCFreq

Reference point the global multicarrier frequency.

*RST: CC1

Example: //Select reference point for frequency offsets
CONF:OREL GMCF

Manual operation: See ["Frequency offset configuration"](#) on page 73

[SENSe:]FREQuency:CENTer[:CC<cc>]:MCOFFset <Offset>

Defines the frequency offset of a component carrier.

Prerequisites for this command

- Select the global MC frequency as the reference point for the frequency offset (`CONFigure[:NR5G]:OREL`).

Suffix:

<cc> [Component Carrier](#)

Parameters:

<Offset> <numeric value>

- Component carrier offset: frequency offset relative to the first component carrier in Hz.

Default unit: Hz

Example:

//Define a frequency offset of 15 MHz for the second component carrier relative to the first component carrier.

```
CONF:OREL GMCF
```

```
FREQ:CENT:CC2:OFFS 150MHZ
```

Manual operation: See "[Frequency configuration](#)" on page 70

6.9.5 General radio frame configuration

<code>CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:COPY</code>	285
<code>CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:PASTe:ALL</code>	285
<code>CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:PASTe[:FRAMe]</code>	286
<code>CONFigure[:NR5G]:DL[:CC<cc>]:FTConfig</code>	286

CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:COPY

Copies a frame configuration.

Suffix:

<cc> [Component Carrier](#)

<fr> [Frame](#)

Example:

//Copy configuration of frame 3

```
CONF:DL:CC2:FRAM3:COPY
```

Usage:

Event

Manual operation: See "[Frame Configuration Management](#)" on page 81

CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:PASTe:ALL

Applies an existing frame configuration to all other frames.

Prerequisites for this command

- Copy a frame configuration (`CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:COPY` on page 285).

Suffix:

<cc> [Component Carrier](#)

<fr> irrelevant

Example:

```
//Copy configuration of frame 3
CONF:DL:CC2:FRAM3:COPY
//Apply configuration to all other frames
CONF:DL:CC2:FRAM:PAST:ALL
```

Usage: Event

Manual operation: See "[Frame Configuration Management](#)" on page 81

`CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:PASTe[:FRAMe]`

Applies an existing frame configuration to another one.

Prerequisites for this command

- Copy a frame configuration (`CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:COPY` on page 285).

Suffix:

<cc> [Component Carrier](#)

<fr> [Frame](#)

Example:

```
//Copy configuration of frame 3
CONF:DL:CC2:FRAM3:COPY
//Apply configuration to frame 4
CONF:DL:CC2:FRAM4:PAST
```

Usage: Event

Manual operation: See "[Frame Configuration Management](#)" on page 81

`CONFigure[:NR5G]:DL[:CC<cc>]:FTConfig <Frames>`

Defines the number of configurable frames.

Suffix:

<cc> [Component Carrier](#)

Parameters:

<Frames> <numeric value> (integer only)

*RST: 1

Example:

```
//Define number of configurable frames
CONF:DL:CC2:FTC 2
```

Manual operation: See "[Frame Configuration](#)" on page 80

6.9.6 Synchronization signal configuration

CONFigure[:NR5G]:DL[:CC<cc>]:SSBLock<ssb>:ASOffset.....	287
CONFigure[:NR5G]:DL[:CC<cc>]:SSBLock<ssb>:BSPeriod.....	287
CONFigure[:NR5G]:DL[:CC<cc>]:SSBLock<ssb>:HFOffset.....	288
CONFigure[:NR5G]:DL[:CC<cc>]:SSBLock<ssb>:L.....	288
CONFigure[:NR5G]:DL[:CC<cc>]:SSBLock<ssb>:OFFSet.....	289
CONFigure[:NR5G]:DL[:CC<cc>]:SSBLock<ssb>:PATtern.....	289
CONFigure[:NR5G]:DL[:CC<cc>]:SSBLock<ssb>:PBCH:POWer.....	290
CONFigure[:NR5G]:DL[:CC<cc>]:SSBLock<ssb>:PDMRs:POWer.....	290
CONFigure[:NR5G]:DL[:CC<cc>]:SSBLock<ssb>:PSS:POWer.....	291
CONFigure[:NR5G]:DL[:CC<cc>]:SSBLock<ssb>:RTO.....	291
CONFigure[:NR5G]:DL[:CC<cc>]:SSBLock<ssb>:SSPacing.....	292
CONFigure[:NR5G]:DL[:CC<cc>]:SSBLock<ssb>:SSS:POWer.....	292
CONFigure[:NR5G]:DL[:CC<cc>]:SSBLock<ssb>[:STATE<ss>].....	293

CONFigure[:NR5G]:DL[:CC<cc>]:SSBLock<ssb>:ASOffset <Offset>

Defines a frequency offset for the synchronization signal block.

Prerequisites for this command

- Select manual configuration mode for SS (CONFigure[:NR5G]:DL[:CC<cc>]:SSBLock<ssb>:DETEction).

Suffix:

<cc>	Component Carrier
<ssb>	irrelevant

Parameters:

<Offset>	<numeric value> (integer only)
	Offset in terms of subcarrier, relative to the first subcarrier of a resource block.
Range:	0 to 11
*RST:	0

Example:

```
//Define synchronization signal offset in terms of resource blocks
CONF:DL:CC2:SSBL:DET MAN
CONF:DL:CC2:SSBL:OFFS 50
//Define additional offset in terms of subcarrier
CONF:DL:CC2:SSBL:OFFS 6
```

Manual operation: See "Synchronization Signal Offset" on page 85

CONFigure[:NR5G]:DL[:CC<cc>]:SSBLock<ssb>:BSPeriod <Periodicity>

Selects the burst set periodicity of a synchronization signal block.

Suffix:

<cc>	Component Carrier
------	-------------------

<ssb> irrelevant

Parameters:

<Periodicity>

AUTO

Determines the burst set periodicity of the signal automatically.

MS05 | MS10 | MS20 | MS40

Selects one of the following periodicities:

5 ms, 10 ms, 20 ms, 40 ms

*RST: MS10

Example:

//Select burst set periodicity

CONF:DL:CC2:SSBL:BSP MS05

Manual operation: See "[Burst Set Periodicity](#)" on page 87

CONFigure[:NR5G]:DL[:CC<cc>]:SSBLock<ssb>:HFOffset <HalfFrame>

Selects the half frame that contains the synchronization signal.

Prerequisites for this command

- Select a SSB periodicity > 5 ms ([CONFigure\[:NR5G\]:DL\[:CC<cc>\]:SSBLock<ssb>:BSPeriod](#) on page 287).

Suffix:

<cc>

[Component Carrier](#)

<ssb>

irrelevant

Parameters:

<HalfFrame>

ZERO

SSB in first half frame.

ONE

SSB in second half frame.

*RST: ZERO

Example:

//Select half frame that contains SSB

CONF:DL:CC2:SSBL:BSP MS10

CONF:DL:CC2:SSBL:HFOF ONE

Manual operation: See "[Half Frame Offset](#)" on page 87

CONFigure[:NR5G]:DL[:CC<cc>]:SSBLock<ssb>:L <Blocks>

Selects the number of SS/PBCH blocks in the deployment range < 3 GHz.

Prerequisites for this command

- Select a deployment < 3 GHz ([CONFigure\[:NR5G\]:DL\[:CC<cc>\]:DFRange](#)).
- Select a 30 kHz subcarrier spacing ([CONFigure\[:NR5G\]:DL\[:CC<cc>\]:SSBLock<ssb>:SSPacing](#)).
- Select the case C block pattern ([CONFigure\[:NR5G\]:DL\[:CC<cc>\]:SSBLock<ssb>:PATtern](#)).

Suffix:

<cc> [Component Carrier](#)

<ssb> irrelevant

Parameters:

<Blocks> 4 | 8

*RST: 4

Example:

```
//Select 8 SS/PBCH blocks
CONF:DL:CC2:DFR LOW
CONF:DL:CC2:SSBL:SSP SS30
CONF:DL:CC2:SSBL:PATT C
CONF:DL:CC2:SSBL:L 8
```

Manual operation: See "[SS/PBCH Block State](#)" on page 87

CONFigure[:NR5G]:DL[:CC<cc>]:SSBLoCk<ssb>:OFFSet <Offset>

Defines a frequency offset for the synchronization signal block.

Prerequisites for this command

- Select manual configuration mode for SS ([CONFigure\[:NR5G\]:DL\[:CC<cc>\]:SSBLoCk<ssb>:DETectioN](#)).

Suffix:

<cc> [Component Carrier](#)

<ssb> irrelevant

Parameters:

<Offset> <numeric value> (integer only)

Offset in terms of resource blocks, relative to the first subcarrier.

*RST: 125

Example:

```
//Define synchronization signal offset
CONF:DL:CC2:SSBL:DET MAN
CONF:DL:CC2:SSBL:OFFS 50
```

Manual operation: See "[Synchronization Signal Offset](#)" on page 85

CONFigure[:NR5G]:DL[:CC<cc>]:SSBLoCk<ssb>:PATTern <Pattern>

Selects the pattern of a synchronization signal block.

Prerequisites for this command

- Select manual configuration mode for SS ([CONFigure\[:NR5G\]:DL\[:CC<cc>\]:SSBLoCk<ssb>:DETectioN](#)).

Suffix:

<cc> [Component Carrier](#)

<ssb> irrelevant

Parameters:

<Pattern> A | B | C | D | E | F | G

The SSB patterns are linked to the subcarrier spacing. Patterns A, D, E, F and G cannot be set. They are always selected automatically when you select a subcarrier spacing of 15 kHz (pattern A), 120 kHz (pattern D), 240 kHz (pattern E), 480 kHz (pattern F) or 960 kHz (pattern G). For these subcarrier spacing, the command is a query only. For subcarrier spacing of 30 kHz, you can select pattern B or C.

*RST: B

Example:

```
//Query SSB pattern
CONF:DL:CC2:SSBL:SSP SS15
CONF:DL:CC2:SSBL:PATT?
returns
A
//Select SSB pattern
CONF:DL:CC2:DFR LOW
CONF:DL:CC2:SSBL:DET MAN
CONF:DL:CC2:SSBL:SSP SS30
CONF:DL:CC2:SSBL:PATT B
```

Manual operation: See "[SS/PBCH Block Pattern](#)" on page 85

CONFigure[:NR5G]:DL[:CC<cc>]:SSBLock<ssb>:PBCH:POWer <Power>

Defines the relative power of the PBCH.

Suffix:

<cc> [Component Carrier](#)

<ssb> irrelevant

Parameters:

<Power> <numeric value>

*RST: 0

Default unit: dB

Example:

```
//Define relative power of the PBCH
CONF:DL:CC2:SSB:PBCH:POW 3
```

Manual operation: See "[Relative Power](#)" on page 88

CONFigure[:NR5G]:DL[:CC<cc>]:SSBLock<ssb>:PDMRs:POWer <Power>

Defines the relative power of the PBCH DMRS.

Suffix:

<cc> [Component Carrier](#)

<ssb> irrelevant

Parameters:

<Power> <numeric value>
 *RST: 0
 Default unit: dB

Example: //Define relative power of the PBCH DMRS
 CONF:DL:CC2:SSB:PDMR:POW 3

Manual operation: See "[Relative Power](#)" on page 88

CONFigure[:NR5G]:DL[:CC<cc>]:SSBLock<ssb>:PSS:POWer <Power>

Defines the relative power of the primary synchronization signal (PSS).

Suffix:

<cc> [Component Carrier](#)
 <ssb> irrelevant

Parameters:

<Power> <numeric value>
 *RST: 0
 Default unit: dB

Example: //Define relative power of the PSS
 CONF:DL:CC2:SSB:PSS:POW 3

Manual operation: See "[Relative Power](#)" on page 88

CONFigure[:NR5G]:DL[:CC<cc>]:SSBLock<ssb>:RTO <Reference>

Selects the reference point for a synchronization signal offset.

Prerequisites for this command

- For selection of TxBW: Use at least one bandwidth part that has the same subcarrier spacing as the synchronization signal.
 For subcarrier spacing = 240 kHz, TxBW is not supported.

Suffix:

<cc> [Component Carrier](#)
 <ssb> irrelevant

Parameters:

<Reference> **RPA**
 Offset relative to the reference point A.
TXBW
 Offset relative to the the first subcarrier.
 *RST: TXBW

Example: //Select reference point for SSB offset
 CONF:DL:CC2:SSBL:RTO TXBW

Manual operation: See "[Synchronization Signal Offset](#)" on page 85

CONFigure[:NR5G]:DL[:CC<cc>]:SSBLock<ssb>:SSPacing <SubcarrierSpacing>

Selects the subcarrier spacing of a synchronization signal block.

Prerequisites for this command

- Select manual configuration mode for SS (**CONFigure[:NR5G]:DL[:CC<cc>]:SSBLock<ssb>:DETection**).

Suffix:

<cc> [Component Carrier](#)

<ssb> irrelevant

Parameters:

<SubcarrierSpacing> **SS15**
15 kHz subcarrier spacing.
Only for signal deployment in FR1.

SS30
30 kHz subcarrier spacing.
Only for signal deployment in FR1.

SS120
120 kHz subcarrier spacing.
Only for signal deployment in FR2.

SS240
240 kHz subcarrier spacing.
Only for signal deployment in FR2.

SS480
240 kHz subcarrier spacing.
Only for signal deployment in FR2-2.

SS960
240 kHz subcarrier spacing.
Only for signal deployment in FR2-2.

*RST: SS30

Example:

```
//Select subcarrier spacing
CONF:DL:CC2:DFR LOW
CONF:DL:CC2:SSBL:DET MAN
CONF:DL:CC2:SSBL:SSP SS30
```

Manual operation: See "[Subcarrier Spacing \(synchronization signal\)](#)" on page 84

CONFigure[:NR5G]:DL[:CC<cc>]:SSBLock<ssb>:SSS:POWer <Power>

Defines the relative power of the secondary synchronization signal (SSS).

Suffix:

<cc> [Component Carrier](#)

<ssb> irrelevant

Parameters:

<Power> <numeric value>
 *RST: 0
 Default unit: dB

Example:

```
//Define relative power of the SSS
CONF:DL:CC2:SSB:SSS:POW 3
```

Manual operation: See "[Relative Power](#)" on page 88

CONFigure[:NR5G]:DL[:CC<cc>]:SSBLock<ssb>[:STATe<ss>] <State>

Turns an individual SS/PBCH block on and off.

Suffix:

<cc> [Component Carrier](#)
 <ssb> [SS block](#)
 <ss> 1...64
 SS/PBCH block

Parameters:

<State> **ALL**
 Turns on all synchronization blocks.

NONE
 Turns off all synchronization blocks.

ON | 1
 Turns on a single synchronization block (selected by the suffix at STATe).

ON | 1
 Turns off a single synchronization block (selected by the suffix at STATe).

*RST: ON

Example:

```
//Configure first four SS blocks
CONF:DL:CC2:SSBL:STAT0 ON
CONF:DL:CC2:SSBL:STAT1 ON
CONF:DL:CC2:SSBL:STAT2 OFF
CONF:DL:CC2:SSBL:STAT3 OFF
```

Manual operation: See "[SS/PBCH Block State](#)" on page 87

6.9.7 Bandwidth part configuration

CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:ADD.....294
 CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:CLEAr.....294
 CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:DUPLicate.....294
 CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:RBCount.....295
 CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:RBOFFset.....295

CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:REMove.....	295
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SSPacing.....	296
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPCount?.....	297

CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:ADD

Adds a bandwidth part to the signal configuration.

The new bandwidth part has the highest index number. Index numbers start at 0. For example, if you already have three bandwidth parts and add a fourth one, the new one has the index number 3.

Suffix:

<cc>	Component Carrier
<fr>	irrelevant
<bwp>	irrelevant

Example: //Add a bandwidth part
CONF : DL : CC2 : FRAM : BWP : ADD

Usage: Event

Manual operation: See "[BWP Configuration Tools](#)" on page 91

CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:CLEAr

Deletes all bandwidth parts.

Suffix:

<cc>	Component Carrier
<fr>	irrelevant
<bwp>	irrelevant

Example: //Delete all bandwidth parts
CONF : DL : CC2 : FRAM : BWP : CLE

Usage: Event

Manual operation: See "[BWP Configuration Tools](#)" on page 91

CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:DUPLicate

Duplicates an existing bandwidth part.

A duplication of a bandwidth part also duplicates its slot and PDSCH configuration.

Suffix:

<cc>	irrelevant
<fr>	Frame
<bwp>	Bandwidth part

Example: //Duplicate a bandwidth part
CONF:DL:CC2:FRAM:BWP2:DUPL

Usage: Event

Manual operation: See "[BWP Configuration Tools](#)" on page 91

CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:RBCount
<ResourceBlocks>

Defines the number of physical resource blocks a bandwidth part occupies.

Suffix:

<cc> [Component Carrier](#)

<fr> irrelevant

<bwp> [Bandwidth part](#)

Parameters:

<ResourceBlocks> <numeric value> (integer only)

*RST: 10

Example: //Define number of PRB for a BWP
CONF:DL:CC2:FRAM:BWP2:RBC 20

Manual operation: See "[# RBs](#)" on page 93

CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:RBOffset <Offset>

Defines a resource block offset for a bandwidth part.

Suffix:

<cc> [Component Carrier](#)

<fr> irrelevant

<bwp> [Bandwidth part](#)

Parameters:

<Offset> <numeric value> (integer only)

*RST: 0

Example: //Define resource block offset for BWP
CONF:DL:CC2:FRAM:BWP2:RBOF 6

Manual operation: See "[RB Offset](#)" on page 93

CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:REMOve

Deletes a bandwidth part.

Suffix:

<cc> [Component Carrier](#)

<fr> irrelevant

<bwp> [Bandwidth part](#)

Example: //Remove a bandwidth part
CONF:DL:CC2:FRAM:BWP2:REM

Usage: Event

Manual operation: See "[BWP Configuration Tools](#)" on page 91

CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SSPacing
<SubcarrierSpacing>

Selects the subcarrier spacing of a bandwidth part.

Suffix:

<cc> [Component Carrier](#)

<fr> [Frame](#)

<bwp> [Bandwidth part](#)

Parameters:

<SubcarrierSpacing> **SS15**
15 kHz subcarrier spacing.
Only for signal deployment in FR1.

SS30
30 kHz subcarrier spacing.
Only for signal deployment in FR1.

SS60
60 kHz subcarrier spacing with normal cyclic prefix.
For all signal deployments.

SS120
120 kHz subcarrier spacing.
Only for signal deployment in FR2.

SS480
480 kHz subcarrier spacing.
Only for signal deployment in FR2-2.

SS960
960 kHz subcarrier spacing.
Only for signal deployment in FR2-2 and a 2000 MHz bandwidth.

X60
60 kHz subcarrier spacing with extended cyclic prefix.
For all signal deployments.

Example: //Select BWP subcarrier spacing
CONF:DL:DFR LOW
CONF:DL:FRAM:BWP2:SSP SS30

Manual operation: See "[Subcarrier Spacing \(user data\)](#)" on page 92

CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPCount?

Queries the number of analyzed bandwidth parts.

Suffix:

<cc> [Component Carrier](#)
<fr> irrelevant

Return values:

<BWPs> <numeric value> (integer)

Example:

```
//Query number of bandwidth parts
CONF:DL:FRAM:BWPC?
```

Usage:

Query only

6.9.8 Slot configuration

CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:CSLot.....	297
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SCOut?.....	298
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:ATYPe.....	298
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:COPY.....	298
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:FORMat.....	299
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:PASTe:ALL.....	299
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:PASTe:TO: DURation.....	300
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:PASTe:TO:MODE...	300
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:PASTe:TO.....	301
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:PASTe:TO:PERiod..	302
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:PASTe:TO:SLOTs...	302
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:PASTe[:SLOT].....	303
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:PRESet.....	303

CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:CSLot <Slots>

Defines the number of slots that you can configure.

Suffix:

<cc> [Component Carrier](#)
<fr> [Frame](#)
<bwp> [Bandwidth part](#)

Parameters:

<Slots> <numeric value> (integer only)

The maximum number of configurable slots depends on the sub-carrier spacing in the bandwidth part.

*RST: 1

Example:

```
//Select number of custom slots
CONF:DL:CC2:FRAM3:BWPart2:CSL 2
```

Manual operation: See ["Number of Configurable Slots"](#) on page 95

CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SCOunt?

Queries the number of analyzed slots.

Suffix:

<cc>	Component Carrier
<fr>	Frame
<bwp>	Bandwidth part

Return values:

<Slots> <numeric value> (integer)

Example: //Query number of analyzed slots
CONF:DL:CC2:FRAM3:BWP2:SCO?

Usage: Query only

CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:ATYPe <Type>

Selects the allocation type of a slot.

Suffix:

<cc>	Component Carrier
<fr>	Frame
<bwp>	Bandwidth part
<sl>	Bandwidth part

Parameters:

<Type> **DATA**
Slot contains information.
UNUSed
Slot contains no information.
*RST: DATA

Example: //Select slot allocation
CONF:DL:CC2:FRAM3:BWP2:SLOT4:ATYP DATA

Manual operation: See ["Slot Allocation"](#) on page 97

CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:COPY

Copies a slot configuration.

Suffix:

<cc>	Component Carrier
<fr>	Frame

<bwp>	Bandwidth part
<sl>	Bandwidth part
Example:	//Copy configuration of a slot CONF:DL:CC2:FRAM3:BWP2:SLOT4:COPY
Usage:	Event
Manual operation:	See "Slot Configuration Tools" on page 96

CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:FORMat <SlotFormat>

Selects the slot format for a slot.

Suffix:

<cc>	Component Carrier
<fr>	Frame
<bwp>	Bandwidth part
<sl>	Bandwidth part

Parameters:

<SlotFormat>	<numeric value> (integer only)
	Range: 0 to 61
	*RST: 0

Example: //Select a slot format
CONF:DL:CC2:FRAM3:BWP2:SLOT4:ATYP 6

Manual operation: See "Slot Format" on page 97

CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:PASTe: ALL

Applies an existing slot configuration to all other slots.

Prerequisites for this command

- Copy a slot configuration (CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:COPY).

Suffix:

<cc>	Component Carrier
<fr>	Frame
<bwp>	Bandwidth part
<sl>	Bandwidth part

Example: //Copy configuration of slot 4
CONF:DL:CC2:FRAM3:BWP2:SLOT4:COPY
//Apply configuration to all other slots
CONF:DL:CC2:FRAM3:BWP2:SLOT:PAST:ALL

Usage: Event

Manual operation: See "Slot Configuration Tools" on page 96

**CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:PASTe:
TO:DURation <Value>**

Defines to which slots a slot configuration is copied to.

Prerequisites for this command

- A slot configuration is in the clipboard (`CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:COPY`).
- Number of configurable slots > 1 (`CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:CSLot`).
- Select custom paste mode (`CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:PASTe:TO:MODE`).

Suffix:

<cc> [Component Carrier](#)

<fr> [Frame](#)

<bwp> [Bandwidth part](#)

<sl> [Bandwidth part](#)

Parameters:

<Value> The paste duration corresponds to a certain number of slots in a row.

*RST: 1

Example: //Paste configuration of slot 0 to 2 slots in a row, every 3rd slot (0,1,3,4,6,7,9,10,12)

```
CONF:DL:CC2:FRAM3:BWP2:CSL 12
```

```
CONF:DL:CC2:FRAM3:BWP2:SLOT0:COPY
```

```
CONF:DL:CC2:FRAM3:BWP2:SLOT0:PAST:TO:MODE CUST
```

```
CONF:DL:CC2:FRAM3:BWP2:SLOT0:PAST:TO:PER 3
```

```
CONF:DL:CC2:FRAM3:BWP2:SLOT0:PAST:TO:DUR 2
```

**CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:PASTe:
TO:MODE <Mode>**

Selects the paste logic when you copy a slot configuration to other slots.

Prerequisites for this command

- A slot configuration is in the clipboard (`CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:COPY`).
- Number of configurable slots > 1 (`CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:CSLot`).

Suffix:

<cc> [Component Carrier](#)

<fr> Frame

<bwp> Bandwidth part

<sl> Bandwidth part

Parameters:

<Mode>

CUSTOM

Copies the slot configuration to specific set of slots according to the logic defined with:

• `CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:`

`BWPart<bwp>:SLOT<sl>:PASTe:TO:PERiod`

• `CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:`

`BWPart<bwp>:SLOT<sl>:PASTe:TO:DURation`

DATA

Copies the slot configuration to all data slots.

SLOTS

Copies the slot configuration to a specific set of slots.

UNUSed

Copies the slot configuration to all unused slots.

Example:

//Paste configuration of slot 0 to every DATA slot

`CONF:DL:CC2:FRAM3:BWP2:CSL 12`

`CONF:DL:CC2:FRAM3:BWP2:SLOT0:COPY`

`CONF:DL:CC2:FRAM3:BWP2:SLOT0:PAST:TO:MODE DATA`

CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:PASTe:TO

Copies a slot configuration to other slots.

Prerequisites for this command

- A slot configuration is in the clipboard (`CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:COPY`).
- Number of configurable slots > 1 (`CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:CSLot`).
- Select custom paste mode (`CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:PASTe:TO:MODE`).

Suffix:

<cc> Component Carrier

<fr> Frame

<bwp> Bandwidth part

<sl> Bandwidth part

Example: //Paste configuration of slot 0 to 2 slots in a row, every 3rd slot (0,1,3,4,6,7,9,10,12)
 CONF:DL:CC2:FRAM3:BWP2:CSL 12
 CONF:DL:CC2:FRAM3:BWP2:SLOT0:COPY
 CONF:DL:CC2:FRAM3:BWP2:SLOT0:PAST:TO:MODE CUST
 CONF:DL:CC2:FRAM3:BWP2:SLOT0:PAST:TO:PER 3
 CONF:DL:CC2:FRAM3:BWP2:SLOT0:PAST:TO:DUR 2
 CONF:DL:CC2:FRAM3:BWP2:SLOT0:PAST:TO

Usage: Event

Manual operation: See "[Slot Configuration Tools](#)" on page 96

CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:PASTe:TO:PERiod <Period>

Defines to which slots a slot configuration is copied to.

Prerequisites for this command

- A slot configuration is in the clipboard ([CONFigure\[:NR5G\]:DL\[:CC<cc>\]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:COPY](#)).
- Number of configurable slots > 1 ([CONFigure\[:NR5G\]:DL\[:CC<cc>\]:FRAMe<fr>:BWPart<bwp>:CSLot](#)).
- Select custom paste mode ([CONFigure\[:NR5G\]:DL\[:CC<cc>\]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:PASTe:TO:MODE](#)).

Suffix:

<cc> [Component Carrier](#)
 <fr> [Frame](#)
 <bwp> [Bandwidth part](#)
 <sl> [Bandwidth part](#)

Parameters:

<Period> The paste period corresponds to every nth slot.
 *RST: 1

Example: //Paste configuration of slot 0 to every 3rd slot (0,3,6,9,12)
 CONF:DL:CC2:FRAM3:BWP2:CSL 12
 CONF:DL:CC2:FRAM3:BWP2:SLOT0:COPY
 CONF:DL:CC2:FRAM3:BWP2:SLOT0:PAST:TO:MODE CUST
 CONF:DL:CC2:FRAM3:BWP2:SLOT0:PAST:TO:PER 3

CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:PASTe:TO:SLOTs <Slot>

Copies a slot configuration to a specific set of slots.

Prerequisites for this command

- Number of configurable slots > 1 (`CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:CSLot`).
- Select slot paste mode (`CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:PASTe:TO:MODE`).

Suffix:

<cc>	Component Carrier
<fr>	Frame
<bwp>	Bandwidth part
<sl>	Slot

Parameters:

<Slot> String that contains a list of slots either as comma-separated list ("2,5,8"), a range ("3-5") or a combination of both ("2-5,8,10").

Example:

```
//Copy allocation configuration to several slots
CONF:DL:CC2:FRAM3:BWP2:CSL 12
CONF:DL:CC2:FRAM3:BWP2:SLOT0:PAST:TO:MODE SLOT
CONF:DL:CC2:FRAM3:BWP2:SLOT0:PAST:TO:SLOT
"3,6,9"
```

CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:PASTe[:SLOT]

Applies an existing slot configuration to another one.

Prerequisites for this command

- Copy a slot configuration (`CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:COPY`).

Suffix:

<cc>	Component Carrier
<fr>	Frame
<bwp>	Bandwidth part
<sl>	Bandwidth part

Example:

```
//Copy configuration of slot 4
CONF:DL:CC2:FRAM3:BWP2:SLOT4:COPY
//Apply configuration to slot 3
CONF:DL:CC2:FRAM3:BWP2:SLOT5:PAST
```

Usage: Event

Manual operation: See "[Slot Configuration Tools](#)" on page 96

CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:PRESet

Resets the slot configuration of a bandwidth part to its default state.

Suffix:	
<cc>	Component Carrier
<fr>	Frame
<bwp>	Bandwidth part
<sl>	irrelevant
Example:	//Reset the slot configuration CONF:DL:CC2:FRAM3:BWP2:SLOT:PRES
Usage:	Event
Manual operation:	See "Slot Configuration Tools" on page 96

6.9.9 CSI reference signal configuration

CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:CSI<csi>:BITMap.....	304
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:CSI<csi>:CTYPe?.....	305
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:CSI<csi>:DENSity.....	305
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:CSI<csi>:LONE.....	306
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:CSI<csi>:LZERo.....	306
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:CSI<csi>:NORBs.....	307
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:CSI<csi>:PORT?.....	307
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:CSI<csi>:POWer.....	308
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:CSI<csi>:RESources.....	308
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:CSI<csi>:ROW.....	308
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:CSI<csi>:SID.....	309
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:CSI<csi>:SLOT:APERiodic.....	309
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:CSI<csi>:SLOT:MODE.....	310
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:CSI<csi>:SLOT:PERiodicity.....	310
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:CSI<csi>:SLOT:POFFset.....	311
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:CSI<csi>:SRB.....	311
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:CSI<csi>:STATe.....	312
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:CSI<csi>:ZPOWer.....	312

CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:CSI<csi>:BITMap <Value>

Defines the bitmap setting for the CSI-RS.

Note that you cannot change the bitmap value for selected location settings (CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:CSI<csi>:ROW on page 308).

Suffix:	
<cc>	Component Carrier
<fr>	Frame
<bwp>	Bandwidth part
<csi>	CSI-RS

Parameters:

<Value> The value range depends on the selected location setting.

Example:

```
//Define bitmap
CONF:DL:CC2:FRAM:BWP2:CSI:ROW 1
CONF:DL:CC2:FRAM:BWP2:CSI:BITM 0011
```

Manual operation: See "Bitmap" on page 102

CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPPart<bwp>:CSI<csi>:CTYPe?

Queries the CDM type of the CSI-RS.

Suffix:

<cc> [Component Carrier](#)
 <fr> [Frame](#)
 <bwp> [Bandwidth part](#)
 <csi> [CSI-RS](#)

Return values:

<CDMType> NOCDm | FDm2 | CDM4 | CDM8

Example:

```
//Query CDM type
CONF:DL:CC2:FRAM:BWP2:CSI:ROW 4
CONF:DL:CC2:FRAM:BWP2:CSI:CTYP?
returns: FDm2
```

Usage: Query only

Manual operation: See "Row" on page 101

**CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPPart<bwp>:CSI<csi>:DENSity
<Configuration>**

Selects the density configuration for the CSI-RS.

Suffix:

<cc> [Component Carrier](#)
 <fr> [Frame](#)
 <bwp> [Bandwidth part](#)
 <csi> [CSI-RS](#)

Parameters:

<Configuration> DEN1 | DEN3 | EVEN | ODD

The availability and default value of the configurations depends on the location setting ([CONFigure\[:NR5G\]:DL\[:CC<cc>\]:FRAMe<fr>:BWPPart<bwp>:CSI<csi>:ROW](#)).

Example:

```
//Define density
CONF:DL:CC2:FRAM:BWP2:CSI:ROW 4
CONF:DL:CC2:FRAM:BWP2:CSI:DENS DEN1
```

Manual operation: See "Density" on page 101

CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:CSI<csi>:LONE
<Value>

Defines parameter I_1 of the CSI-RS.

Prerequisites for this command

- Select a location setting that supports I_1 (CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:CSI<csi>:ROW).

Effects of this command

- Changing I_1 can have an effect on the value of I_0 (CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:CSI<csi>:LZERo).

Suffix:

<cc>	Component Carrier
<fr>	Frame
<bwp>	Bandwidth part
<csi>	CSI-RS

Parameters:

<Value> The range of values and default value depend on the selected CSI-RS location setting.

Example: //Define location of CSI-RS
CONF:DL:CC2:FRAM:BWP2:CSI:ROW 16
CONF:DL:CC2:FRAM:BWP2:CSI:LZER 10

Manual operation: See "I0 / I1" on page 102

CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:CSI<csi>:LZERo
<Value>

Defines parameter I_0 of the CSI-RS.

Effects of this command

- Changing I_0 can have an effect on the value of I_1 (CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:CSI<csi>:LONE).

Suffix:

<cc>	Component Carrier
<fr>	Frame
<bwp>	Bandwidth part
<csi>	CSI-RS

Parameters:

<Value> The range of values and default value depend on the selected CSI-RS location setting (`CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:CSI<csi>:ROW`).

Example:

```
//Define location of CSI-RS
CONF:DL:CC2:FRAM:BWP2:CSI:ROW 1
CONF:DL:CC2:FRAM:BWP2:CSI:LZER 5
```

Manual operation: See "IO / I1" on page 102

CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:CSI<csi>:NORBs
<ResourceBlocks>

Selects the number of resource blocks occupied by the CSI reference signal.

Suffix:

<cc> [Component Carrier](#)
 <fr> [Frame](#)
 <bwp> [Bandwidth part](#)
 <csi> [CSI-RS](#)

Parameters:

<ResourceBlocks>

Example:

```
//Select number of resource blocks
CONF:DL:CC2:FRAM:BWP2:CSI:NORB 4
```

Manual operation: See "No. RBs" on page 101

CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:CSI<csi>:PORT?

Queries the port configuration of the CSI-RS.

Suffix:

<cc> [Component Carrier](#)
 <fr> [Frame](#)
 <bwp> [Bandwidth part](#)
 <csi> [CSI-RS](#)

Return values:

<Value>

Example:

```
//Query ports
CONF:DL:CC2:FRAM:BWP2:CSI:ROW 16
CONF:DL:CC2:FRAM:BWP2:CSI:PORT?
returns: 32
```

Usage: Query only

Manual operation: See "Row" on page 101

CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:CSI<csi>:POWER
 <Power>

Defines the relative power of the CSI-RS.

Suffix:

<cc>	Component Carrier
<fr>	Frame
<bwp>	Bandwidth part
<csi>	CSI-RS

Parameters:

<Power>	*RST: 0 Default unit: dB
---------	-----------------------------

Example: //Define relative power
 CONF:DL:CC2:FRAM:BWP2:CSI:POW 6

Manual operation: See "Rel Power" on page 102

CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:CSI<csi>:RESources
 <Resource>

Defines the number of different CSI-RS resources.

Suffix:

<cc>	Component Carrier
<fr>	Frame
<bwp>	Bandwidth part
<csi>	CSI-RS

Parameters:

<Resource>	*RST: 1
------------	---------

Example: //Define number of CSI-RS resources
 CONF:DL:CC2:FRAM:BWP2:CSI:RES 5

Manual operation: See "Resources" on page 99

CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:CSI<csi>:ROW
 <Value>

Selects the location setting for the CSI-RS.

Effects of this command

- Selecting a location setting has effects on the range and availability of the other CSI-RS parameters.

Suffix:

<cc>	Component Carrier
------	-------------------

<fr> [Frame](#)

<bwp> [Bandwidth part](#)

<csi> [CSI-RS](#)

Parameters:

<Value> The numeric value corresponds to the number of the row in 3GPP 38.211, table 7.4.1.5.3-1.

Range: 1 to 18

*RST: 1

Example: //Select row
CONF:DL:CC2:FRAM:BWP2:CSI:ROW 16

Manual operation: See "[Row](#)" on page 101

CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:CSI<csi>:SID
<Value>

Defines the seed value for the CSI-RS sequence generation.

Suffix:

<cc> [Component Carrier](#)

<fr> [Frame](#)

<bwp> [Bandwidth part](#)

<csi> [CSI-RS](#)

Parameters:

<Value> *RST: 0

Example: //Define seed value
CONF:DL:CC2:FRAM:BWP2:CSI:SID 4

Manual operation: See "[Scrambling ID](#)" on page 102

CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:CSI<csi>:SLOT:
APERiodic <Slot>

Defines the slots in which a CSI reference signal is transmitted.

Prerequisites for this command

- Select aperiodic transmission ([CONFigure\[:NR5G\]:DL\[:CC<cc>\]:FRAMe<fr>:BWPart<bwp>:CSI<csi>:SLOT:MODE](#)).

Suffix:

<cc> [Component Carrier](#)

<fr> [Frame](#)

<bwp> [Bandwidth part](#)

<csi> [CSI-RS](#)

Parameters:

<Slot> String containing the slot numbers a CSI-RS is allocated to.
 Example: To transmit the CSI-RS in slots 1,2,3,4,5,7,11, enter the string '1-5,7,11'.

Example:

```
//Define CSI-RS transmission
CONF:DL:CC2:FRAM:BWP2:CSI:SLOT:MODE APER
CONF:DL:CC2:FRAM:BWP2:CSI:SLOT:APER '1,3,5-10'
```

Manual operation: See "[Aperiodic transmission](#)" on page 100

**CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPPart<bwp>:CSI<csi>:SLOT:
 MODE <Configuration>**

Selects the transmission method for the CSI reference signal.

Suffix:

<cc> [Component Carrier](#)
 <fr> [Frame](#)
 <bwp> [Bandwidth part](#)
 <csi> [CSI-RS](#)

Parameters:

<Configuration> **APERiodic**
 Aperiodic transmission.
PERiodic
 Periodic transmission every <x> slots.
 *RST: PERiodic

Example:

```
//Select transmission method for CSI-RS
CONF:DL:CC2:FRAM:BWP2:CSI:SLOT:MODE PER
```

Manual operation: See "[Slot Config](#)" on page 100

**CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPPart<bwp>:CSI<csi>:SLOT:
 PERiodicity <Slot>**

Selects the periodicity of CSI-RS transmission in terms of slots.

Prerequisites for this command

- Select periodic transmission (CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:
[BWPPart<bwp>:CSI<csi>:SLOT:MODE](#)).

Suffix:

<cc> [Component Carrier](#)
 <fr> [Frame](#)
 <bwp> [Bandwidth part](#)
 <csi> [CSI-RS](#)

Parameters:

<Slot> SL4 | SL5 | SL8 | SL10 | SL16 | SL20 | SL32 | SL40 | SL64 | SL80 | S160 | S320 | S640

Example: SL4 selects a periodicity of 4 (transmission every four slots).

The availability of parameters depends on the subcarrier spacing in the bandwidth part you are configuring.

*RST: SL4

Example:

```
//Define CSI-RS transmission periodicity
CONF:DL:CC2:FRAM:BWP2:CSI:SLOT:MODE PER
CONF:DL:CC2:FRAM:BWP2:CSI:SLOT:PER SL8
```

Manual operation: See "[Periodic transmission](#)" on page 100

CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:CSI<csi>:SLOT:POFFset <Offset>

This command defines an offset for the first CSI-RS relative to the first slot in a bandwidth part.

Prerequisites for this command

- Select periodic transmission (CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:CSI<csi>:SLOT:MODE).

Suffix:

<cc> [Component Carrier](#)

<fr> [Frame](#)

<bwp> [Bandwidth part](#)

<csi> [CSI-RS](#)

Parameters:

<Offset> Example: An offset of 2 assigns the first CSI-RS to the second slot.

*RST: 0

Example:

```
//Define CSI-RS transmission periodicity
CONF:DL:CC2:FRAM:BWP2:CSI:SLOT:MODE PER
CONF:DL:CC2:FRAM:BWP2:CSI:SLOT:POFF 2
```

Manual operation: See "[Periodic transmission](#)" on page 100

CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:CSI<csi>:SRB<ResourceBlock>

Select the first resource block occupied by the CSI reference signal.

Suffix:

<cc> [Component Carrier](#)

<fr> [Frame](#)

<bwp> Bandwidth part

<csi> CSI-RS

Parameters:

<ResourceBlock>

Example: //Select starting resource block
CONF:DL:CC2:FRAM:BWP2:CSI:NORB 10

Manual operation: See "Start RB" on page 101

CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:CSI<csi>:STATe
 <State>

Turns the transmission of the CSI reference signal on and off.

Suffix:

<cc> Component Carrier

<fr> Frame

<bwp> Bandwidth part

<csi> CSI-RS

Parameters:

<State> ON | OFF | 1 | 0

*RST: OFF

Example: //Turn on transmission of CSI-RS
CONF:DL:CC2:FRAM:BWP2:CSI:STAT ON

Manual operation: See "State" on page 99

CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:CSI<csi>:ZPOWER
 <State>

Turns zero power transmission of the CSI reference signal on and off.

Effects of this command

- Turning on zero power transmission disables the scrambling ID and relative power parameters (CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:CSI<csi>:SID and CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:CSI<csi>:POWER).

Suffix:

<cc> Component Carrier

<fr> Frame

<bwp> Bandwidth part

<csi> CSI-RS

Parameters:

<State> ON | OFF | 1 | 0
 *RST: OFF

Example:

//Turn on zero power transmission
 CONF:DL:CC2:FRAM:BWP2:CSI:ZPOW ON

Manual operation: See "Zero Power" on page 100

6.9.10 Positioning reference signal

CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:PRS:KPComb.....	313
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:PRS:KPOFset.....	313
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:PRS:LPRS.....	314
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:PRS:LPStart.....	314
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:PRS:NORBs.....	315
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:PRS:NPID.....	315
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:PRS:POWer.....	315
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:PRS:SLOT:APERiodic.....	316
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:PRS:SRB.....	316
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:PRS:STATE.....	316

CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:PRS:KPComb <Subcarrier>

Defines the number of subcarriers the positioning reference signal uses.

Suffix:

<cc> Component Carrier
 <fr> Frame
 <bwp> Bandwidth part

Parameters:

<Subcarrier> Available values depend on the number of symbols the PRS uses (CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:PRS:LPRS).
 *RST: 2

Example:

//Select number of subcarrier
 CONF:DL:CC2:FRAM:BWP2:PRS:LPRS 4
 CONF:DL:CC2:FRAM:BWP2:PRS:KPC 4

Manual operation: See "K^PRS_comb" on page 104

CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:PRS:KPOFset <Offset>

Defines an offset in the frequency domain for the positioning reference signal.

Suffix:
 <cc> [Component Carrier](#)
 <fr> [Frame](#)
 <bwp> [Bandwidth part](#)

Parameters:
 <Offset> *RST: 0

Example: //Define offset in frequency domain
 CONF:DL:CC2:FRAM:BWP2:PRS:KPOF 4

Manual operation: See "[K^PRS_Offset](#)" on page 104

CONFigure[;NR5G]:DL[;CC<cc>]:FRAMe<fr>:BWPart<bwp>:PRS:LPRS
 <Symbols>

Defines the number of symbols the positioning reference signal uses.

Suffix:
 <cc> [Component Carrier](#)
 <fr> [Frame](#)
 <bwp> [Bandwidth part](#)

Parameters:
 <Symbols> *RST: 2

Example: //Select number of symbold for PRS
 CONF:DL:CC2:FRAM:BWP2:PRS:LPRS 6

Manual operation: See "[L_PRS](#)" on page 104

CONFigure[;NR5G]:DL[;CC<cc>]:FRAMe<fr>:BWPart<bwp>:PRS:LPSTart
 <Symbol>

Defines the first symbol the positioning reference signal uses.

Suffix:
 <cc> [Component Carrier](#)
 <fr> [Frame](#)
 <bwp> [Bandwidth part](#)

Parameters:
 <Symbol> *RST: 0

Example: //Select first symbol for PRS
 CONF:DL:CC2:FRAM:BWP2:PRS:LPST 4

Manual operation: See "[I^PRS_Start](#)" on page 104

CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:PRS:NORBs
 <ResourceBlocks>

Selects the number of resource blocks occupied by the positioning reference signal.

Suffix:

<cc> [Component Carrier](#)
 <fr> [Frame](#)
 <bwp> [Bandwidth part](#)

Parameters:

<ResourceBlocks>

Example:

```
//Select number of resource blocks
CONF:DL:CC2:FRAM:BWP2:PRS:NORB 4
```

Manual operation: See "[No. RBs](#)" on page 103

CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:PRS:NPID <Value>

Defines the seed value for the positioning reference signal sequence generation.

Suffix:

<cc> [Component Carrier](#)
 <fr> [Frame](#)
 <bwp> [Bandwidth part](#)

Parameters:

<Value> *RST: 0

Example:

```
//Define seed value
CONF:DL:CC2:FRAM:BWP2:PRS:SID 4
```

Manual operation: See "[n^PRS_ID,Seq](#)" on page 104

CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:PRS:POWER <Power>

Defines the relative power of the positioning reference signal.

Suffix:

<cc> [Component Carrier](#)
 <fr> [Frame](#)
 <bwp> [Bandwidth part](#)

Parameters:

<Power> *RST: 0
 Default unit: dB

Example:

```
//Define relative power
CONF:DL:CC2:FRAM:BWP2:PRS:POW 6
```

Manual operation: See "[Rel Power](#)" on page 105

**CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:PRS:SLOT:
APERiodic <Slot>**

Defines the slots in which a positioning reference signal is transmitted.

Suffix:

<cc>	Component Carrier
<fr>	Frame
<bwp>	Bandwidth part

Parameters:

<Slot>	String containing the slot numbers a PRS is allocated to. Example: To transmit the CSI-RS in slots 1,2,3,4,5,7,11, enter the string '1-5,7,11'.
--------	--

Example: //Define PRS transmission
CONF:DL:CC2:FRAM:BWP2:CSI:SLOT:APER '1,3,5-10'

Manual operation: See "Slot Config" on page 103

**CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:PRS:SRB
<ResourceBlock>**

Select the first resource block occupied by the positioning reference signal.

Suffix:

<cc>	Component Carrier
<fr>	Frame
<bwp>	Bandwidth part

Parameters:

<ResourceBlock>

Example: //Select starting resource block
CONF:DL:CC2:FRAM:BWP2:PRS:NORB 10

Manual operation: See "Start RB" on page 104

CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:PRS:STATE <State>

Turns the transmission of the positioning reference signal on and off.

Suffix:

<cc>	Component Carrier
<fr>	Frame
<bwp>	Bandwidth part

Parameters:

<State> ON | OFF | 1 | 0
*RST: OFF

Example: //Turn on transmission of PRS
 CONF:DL:CC2:FRAM:BWP2:PRS:STAT ON

Manual operation: See "State" on page 103

6.9.11 CORESET allocation configuration

CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:COReset<cr>: COPY:DURation.....	317
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:COReset<cr>: COPY:MODE.....	318
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:COReset<cr>: COPY.....	319
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:COReset<cr>: COPY:PERiod.....	319
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:COReset<cr>: COPY:SLOT.....	320
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:COReset<cr>: POWer.....	320
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:COReset<cr>: RBCount.....	321
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:COReset<cr>: RBOFset.....	321
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:COReset<cr>: SCOut.....	322
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:COReset<cr>: SOFFset.....	322
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:CRSCount.....	323

**CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:
COReset<cr>:COPY:DURation <Value>**

Defines to which slots a CORESET configuration is copied to.

Prerequisites for this command

- Number of configurable slots > 1 (CONFigure[:NR5G]:DL[:CC<cc>]:
FRAMe<fr>:BWPart<bwp>:CSLot).
- Select custom paste mode (CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:
BWPart<bwp>:SLOT<sl>:COReset<cr>:COPY:MODE).

Suffix:

<cc>	Component Carrier
<fr>	Frame
<bwp>	Bandwidth part
<sl>	Bandwidth part
<cr>	CORESET

Parameters:

<Value> The paste duration corresponds to a certain number of slots in a row.

*RST: 1

Example:

```
//Paste CORESET configuration to 2 slots in a row, every 3rd
slot (0,1,3,4,6,7,9,10,12)
CONF:DL:CC2:FRAM3:BWP2:CSL 12
CONF:DL:CC2:FRAM3:BWP2:SLOT0:COR2:COPY:MODE
CUST
CONF:DL:CC2:FRAM3:BWP2:SLOT0:COR2:COPY:PER 3
CONF:DL:CC2:FRAM3:BWP2:SLOT0:COR2:COPY:DUR 2
```

**CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:
COReset<cr>:COPY:MODE <Mode>**

Selects the paste logic when you copy a CORESET configuration to other slots.

Prerequisites for this command

- Number of configurable slots > 1 (CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:CSLot).

Suffix:

<cc> Component Carrier

<fr> Frame

<bwp> Bandwidth part

<sl> Bandwidth part

<cr> CORESET

Parameters:

<Mode>

CUSTOM

Copies the slot configuration to specific set of slots according to the logic defined with:

- CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:COReset<cr>:COPY:PERiod
- CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:COReset<cr>:COPY:DURation

SLOT

Copies the slot configuration to a specific set of slots.

Select the slots with CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:COReset<cr>:COPY:SLOT.

Example:

```
//Select paste mode
CONF:DL:CC2:FRAM3:BWP2:CSL 12
CONF:DL:CC2:FRAM3:BWP2:SLOT0:COR2:COPY:MODE
SLOT
```

**CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:
COREset<cr>:COPY**

Copies a CORESET configuration to other slots.

Prerequisites for this command

- Number of configurable slots > 1 (CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:CSLot).
- Select paste mode (CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:COREset<cr>:COPY:MODE).

Suffix:

<cc>	Component Carrier
<fr>	Frame
<bwp>	Bandwidth part
<sl>	Bandwidth part
<cr>	<100 CORESET

Example: //Paste CORESET configuration to 2 slots in a row, every 3rd slot (0,1,3,4,6,7,9,10,12)
CONF:DL:CC2:FRAM3:BWP2:CSL 12
CONF:DL:CC2:FRAM3:BWP2:SLOT0:COR2:COPY:MODE
CUST
CONF:DL:CC2:FRAM3:BWP2:SLOT0:COR2:COPY:PER 3
CONF:DL:CC2:FRAM3:BWP2:SLOT0:COR2:COPY:DUR 2
CONF:DL:CC2:FRAM3:BWP2:SLOT0:COR2:COPY

Manual operation: See "Copy to" on page 112

**CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:
COREset<cr>:COPY:PERiod <Period>**

Defines to which slots a CORESET configuration is copied to.

Prerequisites for this command

- Number of configurable slots > 1 (CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:CSLot).
- Select custom paste mode (CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:COREset<cr>:COPY:MODE).

Suffix:

<cc>	Component Carrier
<fr>	Frame
<bwp>	Bandwidth part
<sl>	Bandwidth part
<cr>	CORESET

Parameters:

<Period> The paste period corresponds to every nth slot.

*RST: 1

Example:

```
//Paste CORESET configuration to every 3rd slot (0,3,6,9,12)
CONF:DL:CC2:FRAM3:BWP2:CSL 12
CONF:DL:CC2:FRAM3:BWP2:SLOT0:COR2:COPY:MODE
CUST
CONF:DL:CC2:FRAM3:BWP2:SLOT0:COR2:COPY:PER 3
```

**CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPART<bwp>:SLOT<sl>:
COReset<cr>:COPY:SLOT <Slot>**

Copies a CORESET allocation configuration to a specific set of slots.

Prerequisites for this command

- Number of configurable slots > 1 (CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPART<bwp>:CSLOT).
- Select slot paste mode (CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPART<bwp>:SLOT<sl>:COReset<cr>:COPY:MODE).

Suffix:

<cc> Component Carrier

<fr> Frame

<bwp> Bandwidth part

<sl> Slot

<cr> PUCCH

Parameters:

<Slot> List of slots either as comma-separated list (2,5,8), a range (3-5) or a combination of both (2-5,8,10).

Example:

```
//Copy allocation configuration to several slots
CONF:DL:CC2:FRAM3:BWP2:CSL 12
CONF:DL:CC2:FRAM3:BWP2:SLOT0:COR2:COPY:MODE
SLOT
CONF:DL:CC2:FRAM3:BWP2:SLOT0:COR2:COPY:SLOT
'3,6,9'
```

**CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPART<bwp>:SLOT<sl>:
COReset<cr>:POWER <Power>**

Defines the relative power of a CORESET.

Suffix:

<cc> irrelevant

<fr> irrelevant

<bwp> Bandwidth part

<sl> [Bandwidth part](#)

<cr> [CORESET](#)

Parameters:

<Power> <numeric value>
 *RST: 0
 Default unit: dB

Example: //Define CORESET power
 CONF:DL:CC2:FRAM3:BWP2:SLOT4:COR3:POW 3

Manual operation: See "[Rel Power / dB](#)" on page 112

**CONFigure[:NR5G]:DL[:CC<cc>]:FRAME<fr>:BWPart<bwp>:SLOT<sl>:
 COREset<cr>:RBCount <ResourceBlocks>**

Selects the number of resource blocks that a CORESET allocation occupies.

Suffix:

<cc> [Component Carrier](#)

<fr> [Frame](#)

<bwp> [Bandwidth part](#)

<sl> [Bandwidth part](#)

<cr> [CORESET](#)

Parameters:

<ResourceBlocks> <numeric value> (integer only)
 *RST: 270

Example: //Define number of CORESET resource blocks
 CONF:DL:CC2:FRAM3:BWP2:SLOT4:COR3:RBC 40

Manual operation: See "[Number of RBs](#)" on page 111

**CONFigure[:NR5G]:DL[:CC<cc>]:FRAME<fr>:BWPart<bwp>:SLOT<sl>:
 COREset<cr>:RBOffset <Offset>**

Defines the resource block offset of a CORESET allocation.

Suffix:

<cc> [Component Carrier](#)

<fr> [Frame](#)

<bwp> [Bandwidth part](#)

<sl> [Bandwidth part](#)

<cr> [CORESET](#)

Parameters:

<Offset> <numeric value> (integer only)
 The offset is a value relative to the first resource block of the slot.

*RST: 0

Example:

```
//Define RB offset of CORESET
CONF:DL:CC2:FRAM3:BWP2:SLOT4:COR3:RBOF 10
```

Manual operation: See "[Offset RB](#)" on page 111

**CONFigure[:NR5G]:DL[:CC<cc>]:FRAME<fr>:BWPpart<bwp>:SLOT<sl>:
 COREset<cr>:SCOunt <Symbols>**

Selects the number of symbols that a CORESET allocation occupies.

Suffix:

<cc> [Component Carrier](#)
 <fr> [Frame](#)
 <bwp> [Bandwidth part](#)
 <sl> [Bandwidth part](#)
 <cr> [CORESET](#)

Parameters:

<Symbols> <numeric value> (integer only)

*RST: 14

Example:

```
//Define number of CORESET symbols
CONF:DL:CC2:FRAM3:BWP2:SLOT4:COR3:SCO 7
```

Manual operation: See "[Number of Symbols](#)" on page 111

**CONFigure[:NR5G]:DL[:CC<cc>]:FRAME<fr>:BWPpart<bwp>:SLOT<sl>:
 COREset<cr>:SOFFset <Offset>**

Defines the symbol offset of a CORESET allocation.

Suffix:

<cc> [Component Carrier](#)
 <fr> [Frame](#)
 <bwp> [Bandwidth part](#)
 <sl> [Bandwidth part](#)
 <cr> [CORESET](#)

Parameters:

<Offset> <numeric value> (integer only)

The offset is a value relative to the first symbol in the slot.

*RST: 0

Example: //Define CORESET symbol offset
CONF:DL:CC2:FRAM3:BWP2:SLOT4:COR3:SOFF 2

Manual operation: See "Offset Symbols" on page 112

**CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:
CRSCount <CORESETs>**

Defines the number of CORESETs in a slot.

Suffix:

<cc> Component Carrier
<fr> Frame
<bwp> Bandwidth part
<sl> Bandwidth part

Parameters:

<CORESETs> <numeric value> (integer only)
Range: 0 to 100
*RST: 1

Example: //Define number of CORESETs
CONF:DL:CC2:FRAM3:BWP2:SLOT4:ALC 10

Manual operation: See "# CORESETs" on page 108

6.9.12 PDSCH allocation configuration

CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:ALCount.....	324
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>: ALLocation<al>:COPY:DURation.....	324
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>: ALLocation<al>:COPY:MODE.....	325
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>: ALLocation<al>:COPY.....	326
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>: ALLocation<al>:COPY:PERiod.....	326
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>: ALLocation<al>:COPY:SLOT.....	327
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>: ALLocation<al>[:CW<cw>]:MODulation.....	327
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>: ALLocation<al>:POWER.....	328
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>: ALLocation<al>:RBCount.....	328
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>: ALLocation<al>:RBOffset.....	329

CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>: ALLocation<al>:SCOunt.....	329
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>: ALLocation<al>:SOFFset.....	330
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:CUID.....	330

CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:ALCount <Allocations>

Defines the number of PDSCH allocations in a slot.

Suffix:

<cc>	Component Carrier
<fr>	Frame
<bwp>	Bandwidth part
<sl>	Bandwidth part

Parameters:

<Allocations>	<numeric value> (integer only)
	Range: 0 to 100
	*RST: 1

Example: //Define number of PDSCH allocations
CONF:DL:CC2:FRAM3:BWP2:SLOT4:ALC 10

Manual operation: See "[# PDSCH Allocations](#)" on page 108

CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>: ALLocation<al>:COPY:DURation <Value>

Defines to which slots a PDSCH configuration is copied to.

Prerequisites for this command

- Number of configurable slots > 1 (CONFigure[:NR5G]:DL[:CC<cc>]:
 FRAMe<fr>:BWPart<bwp>:CSLot).
- Select custom paste mode (CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:
 BWPart<bwp>:SLOT<sl>:ALLocation<al>:COPY:MODE).

Suffix:

<cc>	Component Carrier
<fr>	Frame
<bwp>	Bandwidth part
<sl>	Bandwidth part
<al>	Allocation

Parameters:

<Value> The paste duration corresponds to a certain number of slots in a row.

*RST: 1

Example:

```
//Paste PDSCH configuration to 2 slots in a row, every 3rd slot
(0,1,3,4,6,7,9,10,12)
CONF:DL:CC2:FRAM3:BWP2:CSL 12
CONF:DL:CC2:FRAM3:BWP2:SLOT0:ALL2:COPY:MODE
CUST
CONF:DL:CC2:FRAM3:BWP2:SLOT0:ALL2:COPY:PER 3
CONF:DL:CC2:FRAM3:BWP2:SLOT0:ALL2:COPY:DUR 2
```

**CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:
ALLocation<al>:COPY:MODE <Mode>**

Selects the paste logic when you copy a PDSCH configuration to other slots.

Prerequisites for this command

- Number of configurable slots > 1 (CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:CSLot).

Suffix:

<cc> Component Carrier

<fr> Frame

<bwp> Bandwidth part

<sl> Bandwidth part

<al> Allocation

Parameters:

<Mode>

CUSTOM

Copies the slot configuration to specific set of slots according to the logic defined with:

- CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:ALLocation<al>:COPY:PERiod
- CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:ALLocation<al>:COPY:DURation

SLOT

Copies the slot configuration to a specific set of slots.

Select the slots with CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:ALLocation<al>:COPY:SLOT.

Example:

```
//Select paste mode
CONF:DL:CC2:FRAM3:BWP2:CSL 12
CONF:DL:CC2:FRAM3:BWP2:SLOT0:ALL2:COPY:MODE
SLOT
```

**CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:
ALLOcation<al>:COPY**

Copies a PDSCH configuration to other slots.

Prerequisites for this command

- Number of configurable slots > 1 (CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:CSLot).
- Select paste mode (CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:ALLOcation<al>:COPY:MODE).

Suffix:

<cc>	Component Carrier
<fr>	Frame
<bwp>	Bandwidth part
<sl>	Bandwidth part
<al>	<100 Allocation

Example: //Paste PDSCH configuration to 2 slots in a row, every 3rd slot (0,1,3,4,6,7,9,10,12)
 CONF:DL:CC2:FRAM3:BWP2:CSL 12
 CONF:DL:CC2:FRAM3:BWP2:SLOT0:ALL2:COPY:MODE CUST
 CONF:DL:CC2:FRAM3:BWP2:SLOT0:ALL2:COPY:PER 3
 CONF:DL:CC2:FRAM3:BWP2:SLOT0:ALL2:COPY:DUR 2
 CONF:DL:CC2:FRAM3:BWP2:SLOT0:ALL2:COPY

Manual operation: See "Copy to" on page 112

**CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:
ALLOcation<al>:COPY:PERiod <Period>**

Defines to which slots a PDSCH configuration is copied to.

Prerequisites for this command

- Number of configurable slots > 1 (CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:CSLot).
- Select custom paste mode (CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:ALLOcation<al>:COPY:MODE).

Suffix:

<cc>	Component Carrier
<fr>	Frame
<bwp>	Bandwidth part
<sl>	Bandwidth part
<al>	Allocation

Parameters:

<Period> The paste period corresponds to every nth slot.

*RST: 1

Example:

```
//Paste PDSCH configuration to every 3rd slot (0,3,6,9,12)
CONF:DL:CC2:FRAM3:BWP2:CSL 12
CONF:DL:CC2:FRAM3:BWP2:SLOT0:ALL2:COPY:MODE
CUST
CONF:DL:CC2:FRAM3:BWP2:SLOT0:ALL2:COPY:PER 3
```

**CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:
ALLocation<al>:COPY:SLOT <Slot>**

Copies a PDSCH allocation configuration to a specific set of slots.

Prerequisites for this command

- Number of configurable slots > 1 (CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:CSLot).
- Select slot paste mode (CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:ALLocation<al>:COPY:MODE).

Suffix:

<cc> [Component Carrier](#)

<fr> [Frame](#)

<bwp> [Bandwidth part](#)

<sl> [Slot](#)

<al> [Allocation](#)

Parameters:

<Slot> String that contains a list of slots either as comma-separated list ("2,5,8"), a range ("3-5") or a combination of both ("2-5,8,10").

Example:

```
//Copy allocation configuration to several slots
CONF:DL:CC2:FRAM3:BWP2:CSL 12
CONF:DL:CC2:FRAM3:BWP2:SLOT0:ALL2:COPY:MODE
SLOT
CONF:DL:CC2:FRAM3:BWP2:SLOT0:ALL2:COPY:SLOT
"3, 6, 9"
```

**CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:
ALLocation<al>[:CW<cw>]:MODulation <Modulation>**

Selects the modulation of a PDSCH allocation.

Suffix:

<cc> [Component Carrier](#)

<fr> [Frame](#)

<bwp> [Bandwidth part](#)

<sl> [Bandwidth part](#)

<al> [Allocation](#)

<cw> [Codeword](#)

Parameters:

<Modulation> DMRS | Q1K | QPSK | QAM16 | QAM64 | QAM256
*RST: QPSK

Example: //Define allocation modulation
CONF:DL:CC2:FRAM3:BWP2:SLOT4:ALL5:MOD QAM16

Manual operation: See "[Modulation](#)" on page 110

**CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:
ALLocation<al>:POWer <Power>**

Defines the relative power of a PDSCH allocation.

Suffix:

<cc> [Component Carrier](#)

<fr> [Frame](#)

<bwp> [Bandwidth part](#)

<sl> [Bandwidth part](#)

<al> [Allocation](#)

Parameters:

<Power> <numeric value>
*RST: 0
Default unit: dB

Example: //Define relative allocation power
CONF:DL:CC2:FRAM3:BWP2:SLOT4:ALL5:POW 6

Manual operation: See "[Rel Power / dB](#)" on page 112

**CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:
ALLocation<al>:RBCount <ResourceBlocks>**

Selects the number of resource blocks that a PDSCH allocation occupies.

Suffix:

<cc> [Component Carrier](#)

<fr> [Frame](#)

<bwp> [Bandwidth part](#)

<sl> [Bandwidth part](#)

<al> [Allocation](#)

Parameters:

<ResourceBlocks> <numeric value> (integer only)

*RST: 273

Example:

```
//Define number of PDSCH resource blocks
CONF:DL:CC2:FRAM3:BWP2:SLOT4:ALL5:RBC 40
```

Manual operation: See "[Number of RBs](#)" on page 111

**CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:
ALLOcation<al>:RBOFset <Offset>**

Defines the resource block offset of a PDSCH allocation.

Suffix:

<cc> [Component Carrier](#)

<fr> [Frame](#)

<bwp> [Bandwidth part](#)

<sl> [Bandwidth part](#)

<al> [Allocation](#)

Parameters:

<Offset> <numeric value> (integer only)

The offset is a value relative to the first resource block of the slot.

*RST: 0

Example:

```
//Define allocation RB offset
CONF:DL:CC2:FRAM3:BWP2:SLOT4:ALL5:RBOF 10
```

Manual operation: See "[Offset RB](#)" on page 111

**CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:
ALLOcation<al>:SCOunt <Symbols>**

Selects the number of symbols that a PDSCH allocation occupies.

Suffix:

<cc> [Component Carrier](#)

<fr> [Frame](#)

<bwp> [Bandwidth part](#)

<sl> [Bandwidth part](#)

<al> [Allocation](#)

Parameters:

<Symbols> <numeric value> (integer only)

*RST: 14

Example: //Define number of allocation symbols
 CONF:DL:CC2:FRAM3:BWP2:SLOT4:ALL5:SCO 7

Manual operation: See "Number of Symbols" on page 111

**CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:
 ALLocation<al>:SOFFset <Offset>**

Defines the symbol offset of a PDSCH allocation.

Suffix:

<cc> Component Carrier
 <fr> Frame
 <bwp> Bandwidth part
 <sl> Bandwidth part
 <al> Allocation

Parameters:

<Offset> <numeric value> (integer only)
 The offset is a value relative to the first symbol in the slot.
 *RST: 0

Example: //Define allocation symbol offset
 CONF:DL:CC2:FRAM3:BWP2:SLOT4:ALL5:SOFF 2

Manual operation: See "Offset Symbols" on page 112

**CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:CUID
 <State>**

Turns PRB bundling for PDSCH allocations on and off.

Suffix:

<cc> Component Carrier
 <fr> Frame
 <bwp> Bandwidth part
 <sl> Bandwidth part

Parameters:

<State> ON | OFF | 1 | 0
 *RST: OFF

Example: //Combine PDSCH allocations
 CONF:DL:CC2:FRAM3:BWP2:SLOT4:CUID ON

Manual operation: See "Combine PDSCH Allocations With Same User ID" on page 108

6.9.13 Enhanced CORESET allocation configuration

CONFigure[:NR5G]:DL[:CC<cc>]:FRAME<fr>:BWPart<bwp>:SLOT<sl>:COReset<cr>: DMRS:POWer.....	332
CONFigure[:NR5G]:DL[:CC<cc>]:FRAME<fr>:BWPart<bwp>:SLOT<sl>:COReset<cr>: DMRS:RPOint.....	332
CONFigure[:NR5G]:DL[:CC<cc>]:FRAME<fr>:BWPart<bwp>:SLOT<sl>:COReset<cr>: DMRS:SID.....	333
CONFigure[:NR5G]:DL[:CC<cc>]:FRAME<fr>:BWPart<bwp>:SLOT<sl>:COReset<cr>: DMRS:SCRam[:STATe].....	333
CONFigure[:NR5G]:DL[:CC<cc>]:FRAME<fr>:BWPart<bwp>:SLOT<sl>:COReset<cr>: INTerleaving:BSIZe.....	334
CONFigure[:NR5G]:DL[:CC<cc>]:FRAME<fr>:BWPart<bwp>:SLOT<sl>:COReset<cr>: INTerleaving:ISIZe.....	334
CONFigure[:NR5G]:DL[:CC<cc>]:FRAME<fr>:BWPart<bwp>:SLOT<sl>:COReset<cr>: INTerleaving:NSHift.....	335
CONFigure[:NR5G]:DL[:CC<cc>]:FRAME<fr>:BWPart<bwp>:SLOT<sl>:COReset<cr>: INTerleaving:SINDeX.....	335
CONFigure[:NR5G]:DL[:CC<cc>]:FRAME<fr>:BWPart<bwp>:SLOT<sl>:COReset<cr>: INTerleaving:STATe.....	336
CONFigure[:NR5G]:DL[:CC<cc>]:FRAME<fr>:BWPart<bwp>:SLOT<sl>:COReset<cr>: PDCCh<cf>:ALEVel.....	336
CONFigure[:NR5G]:DL[:CC<cc>]:FRAME<fr>:BWPart<bwp>:SLOT<sl>:COReset<cr>: PDCCh<cf>:CCEindex.....	337
CONFigure[:NR5G]:DL[:CC<cc>]:FRAME<fr>:BWPart<bwp>:SLOT<sl>:COReset<cr>: PDCCh<cf>:DCIFormat.....	337
CONFigure[:NR5G]:DL[:CC<cc>]:FRAME<fr>:BWPart<bwp>:SLOT<sl>:COReset<cr>: PDCCh<cf>:DCISettings:FDRassign.....	338
CONFigure[:NR5G]:DL[:CC<cc>]:FRAME<fr>:BWPart<bwp>:SLOT<sl>:COReset<cr>: PDCCh<cf>:DCISettings:ITEM.....	339
CONFigure[:NR5G]:DL[:CC<cc>]:FRAME<fr>:BWPart<bwp>:SLOT<sl>:COReset<cr>: PDCCh<cf>:DCISettings:LIST?.....	342
CONFigure[:NR5G]:DL[:CC<cc>]:FRAME<fr>:BWPart<bwp>:SLOT<sl>:COReset<cr>: PDCCh<cf>:DCISettings:NOBLoCk.....	343
CONFigure[:NR5G]:DL[:CC<cc>]:FRAME<fr>:BWPart<bwp>:SLOT<sl>:COReset<cr>: PDCCh<cf>:DCISettings:SCOPE.....	343
CONFigure[:NR5G]:DL[:CC<cc>]:FRAME<fr>:BWPart<bwp>:SLOT<sl>:COReset<cr>: PDCCh<cf>:DCISettings:TPCCommand.....	344
CONFigure[:NR5G]:DL[:CC<cc>]:FRAME<fr>:BWPart<bwp>:SLOT<sl>:COReset<cr>: PDCCh<cf>:PLENgtH.....	345
CONFigure[:NR5G]:DL[:CC<cc>]:FRAME<fr>:BWPart<bwp>:SLOT<sl>:COReset<cr>: PDCCh<cf>:RNTI.....	345
CONFigure[:NR5G]:DL[:CC<cc>]:FRAME<fr>:BWPart<bwp>:SLOT<sl>:COReset<cr>: PDCCh<cf>:USAGe.....	346
CONFigure[:NR5G]:DL[:CC<cc>]:FRAME<fr>:BWPart<bwp>:SLOT<sl>:COReset<cr>: PDSCh:STATe.....	346
CONFigure[:NR5G]:DL[:CC<cc>]:FRAME<fr>:BWPart<bwp>:SLOT<sl>:COReset<cr>: PGRanularity.....	347

```
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:
COReset<cr>:DMRS:POWer <Power>
```

Defines the power of a CORESET DM-RS relative to the CORESET.

Suffix:

<cc> [Component Carrier](#)
 <fr> [Frame](#)
 <bwp> [Bandwidth part](#)
 <sl> [Bandwidth part](#)
 <cr> [CORESET](#)

Parameters:

<Power> <numeric value>
 *RST: 0
 Default unit: dB

Example: //Define CORESET power
 CONF:DL:CC2:FRAM3:BWP2:SLOT4:COR3:DMRS:POW 1.5

Manual operation: See "[CORESET DMRS Rel Power](#)" on page 114

```
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:
COReset<cr>:DMRS:RPOint <Reference>
```

Defines the reference point of the CORESET DMRS.

Suffix:

<cc> [Component Carrier](#)
 <fr> [Frame](#)
 <bwp> [Bandwidth part](#)
 <sl> [Bandwidth part](#)
 <cr> [CORESET](#)

Parameters:

<Reference> **CStart**
 Reference point is the start of the CORESET.
RPA
 Reference point is the reference point A.
 *RST: RPA

Example: //Select reference point for CORESET DMRS
 CONF:DL:CC2:FRAM3:BWP2:SLOT4:COR2:DMRS:RPO RPA

Manual operation: See "[CORESET DMRS Reference Point](#)" on page 114

**CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPART<bwp>:SLOT<sl>:
COReset<cr>:DMRS:SID <Value>**

Defines the seed value for the CORESET DM-RS sequence generation.

Prerequisites for this command

- Select sequence generation method "n_ID^DMRS" (CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPART<bwp>:SLOT<sl>:COReset<cr>:DMRS:SCRam[:STATe]).

Suffix:

<cc>	Component Carrier
<fr>	Frame
<bwp>	Bandwidth part
<sl>	Bandwidth part
<cr>	CORESET

Parameters:

<Value>	<numeric value> (integer only)
*RST:	0

Example:

```
//Define seed value
CONF:DL:CC2:FRAM3:BWP2:SLOT4:COR3:DMRS:SGEN
DSID
CONF:DL:CC2:FRAM3:BWP2:SLOT4:COR3:DMRS:SID 15
```

Manual operation: See "CORESET DMRS Sequence Generation" on page 113

**CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPART<bwp>:SLOT<sl>:
COReset<cr>:DMRS:SCRam[:STATe] <State>**

Selects the CORESET DM-RS sequence generation method.

Suffix:

<cc>	Component Carrier
<fr>	Frame
<bwp>	Bandwidth part
<sl>	Bandwidth part
<cr>	CORESET

Parameters:

<State>	ON Sequence generation based on a pseudo-random seed value.
	OFF Sequence generation based on the cell ID.
*RST:	OFF

Example: //Select CORESET sequence generation method
 CONF:DL:CC2:FRAM3:BWP2:SLOT4:COR3:DMRS:SCR ON

Manual operation: See "[CORESET DMRS Sequence Generation](#)" on page 113

**CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:
 COREset<cr>:INTERleaving:BSIZe <Size>**

Selects the REG bundle size of the PDCCH.

Prerequisites for this command

- Turn on interleaving ([CONFigure\[:NR5G\]:DL\[:CC<cc>\]:FRAMe<fr>:
 BWPart<bwp>:SLOT<sl>:COREset<cr>:INTERleaving:STATe](#)).

Suffix:

<cc>	Component Carrier
<fr>	Frame
<bwp>	Bandwidth part
<sl>	Bandwidth part
<cr>	CORESET

Parameters:

<Size>	2 6
*RST:	6

Example: //Define bundle size
 CONF:DL:CC2:FRAM3:BWP2:SLOT4:COR3:INT:STAT ON
 CONF:DL:CC2:FRAM3:BWP2:SLOT4:COR3:INT:BSIZ 2

Manual operation: See "[Interleaving](#)" on page 114

**CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:
 COREset<cr>:INTERleaving:ISIZe <Size>**

Selects the interleaving size of the PDCCH.

Prerequisites for this command

- Turn on interleaving ([CONFigure\[:NR5G\]:DL\[:CC<cc>\]:FRAMe<fr>:
 BWPart<bwp>:SLOT<sl>:COREset<cr>:INTERleaving:STATe](#)).

Suffix:

<cc>	Component Carrier
<fr>	Frame
<bwp>	Bandwidth part
<sl>	Bandwidth part
<cr>	CORESET

Parameters:

<Size> 2 | 3 | 6
 *RST: 2

Example:

```
//Define interleaving size
CONF:DL:CC2:FRAM3:BWP2:SLOT4:COR3:INT:STAT ON
CONF:DL:CC2:FRAM3:BWP2:SLOT4:COR3:INT:ISIZ 3
```

Manual operation: See ["Interleaving"](#) on page 114

**CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:
 COREset<cr>:INTERleaving:NSHift <Value>**

Defines the shift index of the PDCCH.

Prerequisites for this command

- Turn on interleaving (`CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:COREset<cr>:INTERleaving:STATe`).
- Select manual shift index (`CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:COREset<cr>:INTERleaving:SINDex`).

Suffix:

<cc> Component Carrier
 <fr> Frame
 <bwp> Bandwidth part
 <sl> Bandwidth part
 <cr> CORESET

Parameters:

<Value> *RST: 0

Example:

```
//Define shift index
CONF:DL:CC2:FRAM3:BWP2:SLOT4:COR3:INT:STAT ON
CONF:DL:CC2:FRAM3:BWP2:SLOT4:COR3:INT:SIND NSH
CONF:DL:CC2:FRAM3:BWP2:SLOT4:COR3:INT:NSH 2
```

Manual operation: See ["Interleaving"](#) on page 114

**CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:
 COREset<cr>:INTERleaving:SINDex <Method>**

Defines the shift index of the PDCCH.

Prerequisites for this command

- Turn on interleaving (`CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:COREset<cr>:INTERleaving:STATe`).

Suffix:

<cc> Component Carrier
 <fr> Frame

<bwp> Bandwidth part
 <sl> Bandwidth part
 <cr> CORESET

Parameters:

<Method> **NIDCell**
 Shift index based on cell ID.

NShift
 Manual shift index (CONFigure[:NR5G]:DL[:CC<cc>]:
 FRAME<fr>:BWPpart<bwp>:SLOT<sl>:COReset<cr>:
 INTerleaving:NShift).

Example: //Define shift index calculation method
 CONF:DL:CC2:FRAM3:BWP2:SLOT4:COR3:INT:STAT ON
 CONF:DL:CC2:FRAM3:BWP2:SLOT4:COR3:INT:SIND NIDC

Manual operation: See "Interleaving" on page 114

**CONFigure[:NR5G]:DL[:CC<cc>]:FRAME<fr>:BWPpart<bwp>:SLOT<sl>:
 COReset<cr>:INTerleaving:STATE <State>**

Turns interleaving of the PDCCH on and off.

Suffix:

<cc> Component Carrier
 <fr> Frame
 <bwp> Bandwidth part
 <sl> Bandwidth part
 <cr> CORESET

Parameters:

<State> ON | OFF | 1 | 0

Example: //Turn on interleaving
 CONF:DL:CC2:FRAM3:BWP2:SLOT4:COR3:INT:STAT ON

Manual operation: See "Interleaving" on page 114

**CONFigure[:NR5G]:DL[:CC<cc>]:FRAME<fr>:BWPpart<bwp>:SLOT<sl>:
 COReset<cr>:PDCCh<cf>:ALEVel <Value>**

Selects the aggregation level of the PDCCH.

Suffix:

<cc> Component Carrier
 <fr> Frame
 <bwp> Bandwidth part
 <sl> Bandwidth part

<cr> CORESET

<cf> 0

Parameters:

<Value> *RST: 1

Example:

//Select aggregation level
CONF:DL:CC2:FRAM3:BWP2:SLOT4:COR3:PDCC0:ALEV 2

Manual operation: See "[Aggregation Level](#)" on page 118

**CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPART<bwp>:SLOT<sl>:
COReset<cr>:PDCCh<cf>:CCEindex <Value>**

Select the CCE index for the PDCCH.

Suffix:

<cc> Component Carrier

<fr> Frame

<bwp> Bandwidth part

<sl> Bandwidth part

<cr> CORESET

<cf> 0

Parameters:

<Value> *RST: 0

Example:

//Select CCE index
CONF:DL:CC2:FRAM3:BWP2:SLOT4:COR3:PDCC0:CCE 2

Manual operation: See "[CCE Index](#)" on page 118

**CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPART<bwp>:SLOT<sl>:
COReset<cr>:PDCCh<cf>:DCIFormat <Format>**

Selects the DCI format for a PDCCH.

Prerequisites for this command

- The availability of DCI formats depends on the selected RNTI type ([CONFigure\[:NR5G\]:DL\[:CC<cc>\]:FRAMe<fr>:BWPART<bwp>:SLOT<sl>:COReset<cr>:PDCCh<cf>:USAGE](#)).

Suffix:

<cc> Component Carrier

<fr> Frame

<bwp> Bandwidth part

<sl> Bandwidth part

<cr> CORESET

<cf> 0

Parameters:

<Format> F00 | F01 | F02 | F10 | F11 | F12 | F20 | F21 | F22 | F23 | F24 |
F25 | F26
*RST: F00

Example:

```
//Select DCI format
CONF:DL:CC2:FRAM3:BWP2:SLOT4:COR3:PDCC0:USAG
CRNT
CONF:DL:CC2:FRAM3:BWP2:SLOT4:COR3:PDCC0:DCIF
F00
```

Manual operation: See "DCI Format" on page 118

**CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:
COREset<cr>:PDCCh<cf>:DCISettings:FDRAssign <Assignment>**

Defines the frequency domain resource assignment of the DCI fields.

Prerequisites for this command

- Select DCI format 1_0 (CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:
BWPart<bwp>:SLOT<sl>:COREset<cr>:PDCCh<cf>:DCIFormat).

Suffix:

<cc> Component Carrier
<fr> Frame
<bwp> Bandwidth part
<sl> Bandwidth part
<cr> CORESET
<cf> 0

Parameters:

<Assignment> **CUSTOM**
Custom
ALL
All ones
*RST: CUSTOM

Example:

```
//Select frequency resource assignment for DCI transmission
CONF:DL:CC2:FRAM3:BWP2:SLOT4:COR3:PDCC0:USAG
CRNT
CONF:DL:CC2:FRAM3:BWP2:SLOT4:COR3:PDCC0:DCIF
F10
CONF:DL:CC2:FRAM3:BWP2:SLOT4:COR3:PDCC0:DCIS:
SCOP ALL
```

Manual operation: See "Content" on page 118

CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPART<bwp>:SLOT<sl>:COREset<cr>:PDCCh<cf>:DCISettings:ITEM <DCIField>, <BitLength>

Defines the bit length for DCI fields.

Prerequisites for this command

- Availability of parameters depend on the selected DCI format ([CONFigure\[:NR5G\]:DL\[:CC<cc>\]:FRAMe<fr>:BWPART<bwp>:SLOT<sl>:COREset<cr>:PDCCh<cf>:DCIFormat](#) on page 337).

Note that, depending on the DCI format, some bit lengths are fix and cannot be changed.

Suffix:

<cc>	Component Carrier
<fr>	Frame
<bwp>	Bandwidth part
<sl>	Bandwidth part
<cr>	CORESET
<cf>	0

Parameters:

<DCIField>	For an overview of parameters, see Table 6-3 .
<BitLength>	*RST: depends on DCI field

Example:

```
//Define bit length for "Time Domain Resource Assignment"
CONF:DL:CC2:FRAM3:BWP2:SLOT4:COR3:PDCC0:USAG
CRNT
CONF:DL:CC2:FRAM3:BWP2:SLOT4:COR3:PDCC0:DCIF
F01
CONF:DL:CC2:FRAM3:BWP2:SLOT4:COR3:PDCC0:DCIS:
ITEM TDR, 2
```

Example:

```
//Define bit length for "Slot Format Indicator" incl. number of indi-
cators
CONF:DL:CC2:FRAM3:BWP2:SLOT4:COR3:PDCC0:USAG
SFIR
CONF:DL:CC2:FRAM3:BWP2:SLOT4:COR3:PDCC0:DCIF
F20
CONF:DL:CC2:FRAM3:BWP2:SLOT4:COR3:PDCC0:DCIS:
ITEM SFIN, 4
CONF:DL:CC2:FRAM3:BWP2:SLOT4:COR3:PDCC0:DCIS:
ITEM N, 2
```

Manual operation: See ["Content"](#) on page 118

Table 6-3: List of DCI fields

DCI field	SCPI parameter
"Identifier for DCI formats"	IFDFormats
"Frequency Domain Resource Assignment"	FDRAssign
"Time Domain Resource Assignment"	TDRAssign
"Frequency Hopping Flag"	FHFLag
"Modulation and Coding Scheme (TB1)"	MCS1
"New Data Indicator (TB1)"	NDI1
"Redundancy Version (TB1)"	RV1
"HARQ Process Number"	HPNumber
"TPC Command for Scheduled PUSCH"	TCSPush
"Padding Bits"	PBITs
"UL/SUL Indicator"	USUL
"ChannelAccess-Cpext"	CACPext
"Carrier Indicator"	CARRier
"DFI Flag"	DFIFlag
"HARQ-ACK Bitmap"	HABitmap
"Bandwidth Part Indicator"	BPIndicator
"(1st) Downlink Assignment Index"	DAI1
"2nd Downlink Assignment Index"	DAI2
"SRS Resource Indicator"	SRIndicator
"Precoding Information and Number of Layers"	PINLayers
"Antenna Ports"	APORTs
"SRS Request"	SRSRequest
"CSI Request"	CSIRequest
"CBG Transmission Information (CBGTI)"	CBGTi
"PTRS-DMRS Association"	PDASso
"beta_offset Indicator"	BOIndicator
"DMRS Sequence Initialization"	DSINit
"UL-SCH Indicator"	USCH
"ChannelAccess-Cpext-CAPC"	CAPC
"Open-loop Power Control Parameter Set Indication"	OPCParam
"Priority Indicator"	PIndicator
"Invalid Symbol Pattern Indicator"	ISPIndicator

DCI field	SCPI parameter
"Minimum Applicable Scheduling Offset Indicator"	MASoffset
"SCell Dormancy Indication"	SDIndicator
"Random Access Preamble Index"	RAPIndex
"SS/PBCH Index"	SPIndex
"PRACH Mask Index"	PMIndex
"Reserved Bits"	RBITS
"VRB-to-PRB Mapping"	VTPMapping
"PUCCH Resource Indicator"	PRIndicator
"PDSCH-to-HARQ Feedback Timing Indicator"	PHFTiming
"Short Message Indicator"	SMIndicator
"Short Message"	SMESsage
"TB Scaling"	TBScaling
"System Information Indicator"	SIIndicator
"LBSs of SFN"	LOSFn
"PRB Bundling Size Indicator"	PBSindicator
"Rate Matching Indicator"	RMIndicator
"ZP CSI-RS Trigger"	ZCRTrigger
"Modulation and Coding Scheme (TB2)"	MCS2
"New Data Indicator (TB2)"	NDI2
"Redundancy Version (TB2)"	RV2
"One-shot HARQ-ACK Request"	OHARrequest
"PDSCH Group Index"	PGIndex
"New Feedback Indicator"	NFIndicator
"Number of Requested PDSCH Group"	NRPGroup
"Transmission Configuration Indication"	TCIndication
"CBG Flushing out Information (CBGFI)"	CBGFi
"Slot Format Indicator" Indicator index	SFIndicator N
"Available RB Set Indicator" Indicator index	ARBSet N1
"COT Duration Indicator" Indicator index	COTDuration N2
"Monitoring Group Flag" Indicator index	MGFLag M

DCI field	SCPI parameter
"Pre-emption Indication" Indicator index	PEINdication N
"Closed Loop Indicator"	CLINdicator
"TPC Command"	TPCCommand
"Cancellation Indication" Indicator index	CINdication N
"Availability Indicator" Indicator index	AINdicator N
"Wake Up Indication"	WUINdication
"SCell Dormancy Indication"	SDINdication

**CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:
COReset<cr>:PDCCh<cf>:DCISettings:LIST?**

Queries the DCI fields available for the currently selected DCI format and the number of bits each DCI field uses.

Prerequisites for this command

- Select a DCI format `(CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:COReset<cr>:PDCCh<cf>:DCIFormat)`.
- Assign bits to the DCI fields `(CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:COReset<cr>:PDCCh<cf>:DCISettings:ITEM)`.

Suffix:

<cc>	Component Carrier
<fr>	Frame
<bwp>	Bandwidth part
<sl>	Bandwidth part
<cr>	CORESET
<cf>	0

Return values:

<List> String that contains the names of the DCI fields and the number of bits they use as a comma separated list.

Example: //Query DCI field information
 CONF:DL:CC2:FRAM3:BWP2:SLOT4:COR3:PDCC0:USAG
 TPUC
 CONF:DL:CC2:FRAM3:BWP2:SLOT4:COR3:PDCC0:DCIF
 F22
 CONF:DL:CC2:FRAM3:BWP2:SLOT4:COR3:PDCC0:DCIS:
 LIST?
 would return:
 'Closed Loop Indicator,0,TPC Command,2'

Usage: Query only

Manual operation: See "[Content](#)" on page 118

**CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:
 COREset<cr>:PDCCh<cf>:DCISettings:NOBLock <Blocks>**

Defines the number of blocks that DCI is transmitted in.

Prerequisites for this command

- Select a DCI format that supports multiple transmission (CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:COREset<cr>:PDCCh<cf>:DCIFormat).

Suffix:

<cc>	Component Carrier
<fr>	Frame
<bwp>	Bandwidth part
<sl>	Bandwidth part
<cr>	CORESET
<cf>	0

Parameters:

<Blocks>	*RST: 1
----------	---------

Example: //Select number of blocks for DCI transmission
 CONF:DL:CC2:FRAM3:BWP2:SLOT4:COR3:PDCC0:USAG
 TPUS
 CONF:DL:CC2:FRAM3:BWP2:SLOT4:COR3:PDCC0:DCIF
 F22
 CONF:DL:CC2:FRAM3:BWP2:SLOT4:COR3:PDCC0:DCIS:
 NOBL 4

Manual operation: See "[Content](#)" on page 118

**CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:
 COREset<cr>:PDCCh<cf>:DCISettings:SCOPE <Scope>**

Defines the scope of the DCI fields.

Prerequisites for this command

- Select DCI format 0_1 (`CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:COReset<cr>:PDCCh<cf>:DCIFormat`).

Suffix:

<cc>	Component Carrier
<fr>	Frame
<bwp>	Bandwidth part
<sl>	Bandwidth part
<cr>	CORESET
<cf>	0

Parameters:

<Scope>	ICDF Indicate CG-DFI
	SPUS Schedule PUSCH
	*RST: ICDF

Example:

```
//Select scope of DCI transmission
CONF:DL:CC2:FRAM3:BWP2:SLOT4:COR3:PDCCH0:USAG
SPCR
CONF:DL:CC2:FRAM3:BWP2:SLOT4:COR3:PDCCH0:DCIF
F01
CONF:DL:CC2:FRAM3:BWP2:SLOT4:COR3:PDCCH0:DCIS:
SCOP SPUS
```

Manual operation: See "[Content](#)" on page 118

**CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:
COReset<cr>:PDCCh<cf>:DCISettings:TPCCommand <Value>**

Defines the number of TCP commands that are transmitted in the DCI.

Prerequisites for this command

- Select a DCI format that supports transmission of multiple TCP commands (`CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:COReset<cr>:PDCCh<cf>:DCIFormat`).

Suffix:

<cc>	Component Carrier
<fr>	Frame
<bwp>	Bandwidth part
<sl>	Bandwidth part
<cr>	CORESET
<cf>	0

Parameters:

<Value> *RST: 1

Example:

```
//Select number of TCP commands
CONF:DL:CC2:FRAM3:BWP2:SLOT4:COR3:PDCC0:USAG
TSRN
CONF:DL:CC2:FRAM3:BWP2:SLOT4:COR3:PDCC0:DCIF
F23
CONF:DL:CC2:FRAM3:BWP2:SLOT4:COR3:PDCC0:DCIS:
TPCC 2
```

Manual operation: See ["Content"](#) on page 118

**CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:
COReset<cr>:PDCCh<cf>:PLENgtH <Bits>**

Defines the bit length of the PDCCH.

Suffix:

<cc> [Component Carrier](#)
 <fr> [Frame](#)
 <bwp> [Bandwidth part](#)
 <sl> [Bandwidth part](#)
 <cr> [CORESET](#)
 <cf> 0

Parameters:

<Bits> *RST: 44

Example:

```
//Select PDCCH pattern length
CONF:DL:CC2:FRAM3:BWP2:SLOT4:COR3:PDCC0:PLEN 22
```

Manual operation: See ["Pattern Length"](#) on page 118

**CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:
COReset<cr>:PDCCh<cf>:RNTI <Value>**

Selects the CORESET radio network identifier (RNTI).

Suffix:

<cc> [Component Carrier](#)
 <fr> [Frame](#)
 <bwp> [Bandwidth part](#)
 <sl> [Bandwidth part](#)
 <cr> [CORESET](#)
 <cf> 0

Parameters:

<Value> *RST: 0

Example:

```
//Select RNTI
CONF:DL:CC2:FRAM3:BWP2:SLOT4:COR3:PDCC0:RNTI 2
```

Manual operation: See "RNTI" on page 118

**CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPPart<bwp>:SLOT<sl>:
COReset<cr>:PDCCh<cf>:USAGe <Usage>**

Selects the RNTI type for a PDCCH.

Suffix:

<cc> [Component Carrier](#)
 <fr> [Frame](#)
 <bwp> [Bandwidth part](#)
 <sl> [Bandwidth part](#)
 <cr> [CORESET](#)
 <cf> 0

Parameters:

<Usage> CRNT | CSRN | MCSC | TCRN | SPCR | PRNT | SIRN | RNRN |
 MSGB | SFIR | INTR | TPUS | TPUC | TSRN | CIRN | AIRN |
 PSRN
 *RST: CRNT

Example:

```
//Select RNTI type
CONF:DL:CC2:FRAM3:BWP2:SLOT4:COR3:PDCC0:USAG  

CSRN
```

Manual operation: See "Usage" on page 117

**CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPPart<bwp>:SLOT<sl>:
COReset<cr>:PDSCh:STATe <State>**

Turns usage of CORESET allocations for PDSCH transmission on and off.

Prerequisites for this command

- Select precoder granularity = REG bundle ([CONFigure\[:NR5G\]:DL\[:CC<cc>\]:
FRAMe<fr>:BWPPart<bwp>:SLOT<sl>:COReset<cr>:PGRanularity](#)).

Suffix:

<cc> [Component Carrier](#)
 <fr> [Frame](#)
 <bwp> [Bandwidth part](#)
 <sl> [Bandwidth part](#)
 <cr> [CORESET](#)

Parameters:

<State> ON | OFF | 1 | 0
 *RST: OFF

Example:

```
//Allow PDSCH transmission in CORESET
CONF:DL:CC2:FRAM3:BWP2:SLOT4:COR3:PGR REGB
CONF:DL:CC2:FRAM3:BWP2:SLOT4:COR3:PDSC:STAT ON
```

Manual operation: See "Allow PDSCH" on page 114

**CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:
 COREset<cr>:PGRanularity <Method>**

Selects the precoder granularity for the PDCCH DMRS.

Suffix:

<cc> Component Carrier
 <fr> Frame
 <bwp> Bandwidth part
 <sl> Bandwidth part
 <cr> CORESET

Parameters:

<Method> **ACRBs**
 All contiguous RBs.
REGBundle
 REG bundles only.

Example:

```
//Define precoder granularity
CONF:DL:CC2:FRAM3:BWP2:SLOT4:COR3:PGR ACRB
```

Manual operation: See "Precoder Granularity" on page 113

6.9.14 Enhanced PDSCH settings: DMRS

CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>: ALLocation<al>:CLMapping.....	348
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>: ALLocation<al>:DMRS:AP.....	349
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>: ALLocation<al>:DMRS:CGWD.....	349
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>: ALLocation<al>:DMRS:CTYPe.....	350
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>: ALLocation<al>:DMRS:MSYMBOL:APOSITION.....	350
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>: ALLocation<al>:DMRS:MSYMBOL:LENGTH.....	350
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>: ALLocation<al>:DMRS:MTYPe.....	351

CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>: ALLocation<al>:DMRS:NSCid.....	351
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>: ALLocation<al>:DMRS:POWer.....	352
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>: ALLocation<al>:DMRS:RST.....	352
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>: ALLocation<al>:DMRS:SGENeration.....	353
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>: ALLocation<al>:DMRS:SID.....	353
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>: ALLocation<al>:DMRS:SIONe.....	354
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>: ALLocation<al>:DMRS:TAPos.....	355
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>: ALLocation<al>:RPOint.....	355
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>: ALLocation<al>:UEID.....	356
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>: ALLocation<al>:VTPinter.....	356

CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>: ALLocation<al>:CLMapping <Mapping>

Selects the codeword to layer mapping.

Suffix:

<cc>	Component Carrier
<fr>	Frame
<bwp>	Bandwidth part
<sl>	Slot
<al>	Allocation

Parameters:

<Mapping> LC11 | LC21 | LC31 | LC41 | LC51 | LC61 | LC71 | LC81 | LC91 |
LC101 | LC111 | LC121 | LC22 | LC32 | LC42 | LC52 | LC62 |
LC72 | LC82

The availability of codeword to layer mappings depends on:

- DM-RS configuration type (CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:
ALLocation<al>:DMRS:CTYPE)
- DM-RS length (CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:ALLocation<al>:
DMRS:MSYMBOL:LENGTH)

*RST: LC11

Example:

```
//Select codeword to layer mapping
CONF:DL:CC2:FRAM3:BWP2:SLOT4:ALL5:CLM LC21
```

Manual operation: See ["Codeword to Layer Mapping"](#) on page 121

**CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:
ALLocation<al>:DMRS:AP <AntennaPorts>...**

Selects the antenna ports for PDSCH transmission.

Suffix:

<cc>	Component Carrier
<fr>	Frame
<bwp>	Bandwidth part
<sl>	Slot
<al>	Allocation

Parameters:

<AntennaPorts> The number of numeric values depends on how many layers you have. For a single layer, add one value. For two layers, add two values etc.
The value range depends on the codeword to layer mapping you have selected (`CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:ALLocation<al>:CLMapping`).

Example:

```
//Map layers to antenna ports
CONF:DL:CC2:FRAM3:BWP2:SLOT4:ALL5:CLM LC21
CONF:DL:CC2:FRAM3:BWP2:SLOT4:ALL5:DMRS:AP
1000,1001
```

Manual operation: See ["Antenna Port"](#) on page 122

**CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:
ALLocation<al>:DMRS:CGWD <CDMGroups>**

Suffix:

<cc>	Component Carrier
<fr>	Frame
<bwp>	Bandwidth part
<sl>	Slot
<al>	Allocation

Parameters:

<CDMGroups> *RST: 0

Example:

```
//Select CMD groups without data
CONF:DL:CC2:FRAM3:BWP2:SLOT4:ALL5:DMRS:CGWD 2
```

Manual operation: See ["CDM Groups w/o Data"](#) on page 122

**CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPART<bw>:SLOT<sl>:
ALLOCATION<al>:DMRS:CTYPE <Configuration>**

Selects the PDSCH DM-RS configuration type.

Suffix:

<cc>	Component Carrier
<fr>	Frame
<bw>	Bandwidth part
<sl>	Bandwidth part
<al>	Allocation

Parameters:

<Configuration>	1 2
*RST:	1

Example:

```
//Define DM-RS configuration
CONF:DL:CC2:FRAM3:BWP2:SLOT4:ALL5:DMRS:CTYP 1
```

Manual operation: See "[PDSCH DMRS Location](#)" on page 120

**CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPART<bw>:SLOT<sl>:
ALLOCATION<al>:DMRS:MSYMBOL:APOSITION <Symbol>**

Defines the position of additional DM-RS.

Suffix:

<cc>	Component Carrier
<fr>	Frame
<bw>	Bandwidth part
<sl>	Bandwidth part
<al>	Allocation

Parameters:

<Symbol>	0 1 2 3
----------	---------------

Example:

```
//Define position of additional DM-RS
CONF:DL:CC2:FRAM3:BWP2:SLOT4:ALL5:DMRS:MSYM:
APOS 3
```

Manual operation: See "[Multi Symbol DMRS](#)" on page 120

**CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPART<bw>:SLOT<sl>:
ALLOCATION<al>:DMRS:MSYMBOL:LENGTH <Symbols>**

Defines the length of the DM-RS.

Suffix:

<cc>	Component Carrier
------	-------------------

<fr>	Frame
<bwp>	Bandwidth part
<sl>	Bandwidth part
<al>	Allocation

Parameters:

<Symbols>	1 DM-RS transmitted on 1 symbol.
	2 DM-RS transmitted on 2 symbols.
*RST:	1

Example: //Define DM-RS length
CONF : DL : CC2 : FRAM3 : BWP2 : SLOT4 : ALL5 : DMRS : MSYM :
LENG 2

Manual operation: See "[Multi Symbol DMRS](#)" on page 120

**CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPPart<bwp>:SLOT<sl>:
ALLocation<al>:DMRS:MTYPE <Mapping>**

Selects the mapping type of the PDSCH DM-RS.

Suffix:

<cc>	Component Carrier
<fr>	Frame
<bwp>	Bandwidth part
<sl>	Bandwidth part
<al>	Allocation

Parameters:

<Mapping>	A Location of DM-RS relative to the start of the slot.
	B Location relative to the start of the PDSCH resource elements.
*RST:	A

Example: //Define DM-RS mapping
CONF : DL : CC2 : FRAM3 : BWP2 : SLOT4 : ALL5 : DMRS : MTYP B

Manual operation: See "[PDSCH DMRS Location](#)" on page 120

**CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPPart<bwp>:SLOT<sl>:
ALLocation<al>:DMRS:NSCid <Value>**

Defines the scrambling ID for the PDSCH DM-RS sequence generation.

Prerequisites for this command

- Select sequence generation method "n_ID^DMRS" (CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:ALLocation<al>:DMRS:SGENeration).

Suffix:

<cc>	Component Carrier
<fr>	Frame
<bwp>	Bandwidth part
<sl>	Bandwidth part
<al>	Allocation

Parameters:

<Value> 0 | 1

Example:

```
//Define DM-RS scrambling ID
CONF:DL:CC2:FRAM3:BWP2:SLOT4:ALL5:DMRS:SGEN
DSID
CONF:DL:CC2:FRAM3:BWP2:SLOT4:ALL5:DMRS:NSC 1
```

Manual operation: See "PDSCH DMRS Sequence Generation" on page 121

**CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:
ALLocation<al>:DMRS:POWER <Power>**

Defines the PDSCH DM-RS power relative to the PDSCH.

Suffix:

<cc>	Component Carrier
<fr>	Frame
<bwp>	Bandwidth part
<sl>	Bandwidth part
<al>	Allocation

Parameters:

<Power> <numeric value>
*RST: 0
Default unit: dB

Example:

```
//Define DM-RS power
CONF:DL:CC2:FRAM3:BWP2:SLOT4:ALL5:DMRS:POW 0.5
```

Manual operation: See "PDSCH DMRS Rel Power" on page 121

**CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:
ALLocation<al>:DMRS:RST <State>**

Turns low peak to average power ratio for the PDSCH DMRS on and off.

Suffix:

<cc>	Component Carrier
<fr>	Frame
<bwp>	Bandwidth part
<sl>	Slot
<al>	Allocation

Parameters:

<State>	ON OFF 1 0
*RST:	OFF

Example:

```
//Turn on dmrs-downlink-r16
CONF:DL:CC2:FRAM3:BWP2:SLOT4:ALL5:DMRS:RST ON
```

Manual operation: See "[DMRS-Downlink](#)" on page 122

**CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:
ALLOcation<al>:DMRS:SGENeration <Method>**

Selects the PDSCH DM-RS sequence generation method.

Suffix:

<cc>	Component Carrier
<fr>	Frame
<bwp>	Bandwidth part
<sl>	Bandwidth part
<al>	Allocation

Parameters:

<Method>	NIDCell Sequence generation based on the cell ID.
	NIDDmrs Sequence generation based on a pseudo-random seed value.
*RST:	NIDCell

Example:

```
//Define DM-RS sequence type
CONF:DL:CC2:FRAM3:BWP2:SLOT4:ALL5:DMRS:SGEN
NIDC
```

Manual operation: See "[PDSCH DMRS Sequence Generation](#)" on page 121

**CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:
ALLOcation<al>:DMRS:SID <Value>**

Defines the seed value ("N_ID^0") for the PDSCH DM-RS sequence generation.

Prerequisites for this command

- Select sequence generation method DMRS-Scrambling-ID (`CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:ALLocation<al>:DMRS:SGENeration`).

Suffix:

<cc>	Component Carrier
<fr>	Frame
<bwp>	Bandwidth part
<sl>	Bandwidth part
<al>	Allocation

Parameters:

<Value>	<numeric value> (integer only)
*RST:	0

Example:

```
//Define seed value
CONF:DL:CC2:FRAM3:BWPart2:SLOT4:ALL5:DMRS:SGEN
DSID
CONF:DL:CC2:FRAM3:BWPart2:SLOT4:ALL5:DMRS:SID 15
```

Manual operation: See "PDSCH DMRS Sequence Generation" on page 121

CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:ALLocation<al>:DMRS:SIONe <Value>

Defines the scrambling ID ("N_ID^1") for the PDSCH DM-RS sequence generation.

Prerequisites for this command

- Select sequence generation method "n_ID^DMRS" (`CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:ALLocation<al>:DMRS:SGENeration`).
- Turn on "DMRS-Downlink" (`CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:ALLocation<al>:DMRS:RST`).

Suffix:

<cc>	Component Carrier
<fr>	Frame
<bwp>	Bandwidth part
<sl>	Bandwidth part
<al>	Allocation

Parameters:

<Value>	*RST: 0
---------	---------

Example: //Define DM-RS scrambling ID
 CONF:DL:CC2:FRAM3:BWP2:SLOT4:ALL5:DMRS:SGEN
 DSID
 CONF:DL:CC2:FRAM3:BWP2:SLOT4:ALL5:DMRS:RST ON
 CONF:DL:CC2:FRAM3:BWP2:SLOT4:ALL5:DMRS:SION 15

Manual operation: See "[PDSCH DMRS Sequence Generation](#)" on page 121

**CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:
 ALLocation<al>:DMRS:TAPos <Symbol>**

Defines the first symbol that the DM-RS uses.

Prerequisites for this command

- Select DM-RS mapping type A (CONFigure[:NR5G]:DL[:CC<cc>]:
 FRAMe<fr>:BWPart<bwp>:SLOT<sl>:ALLocation<al>:DMRS:MTYPe).

Suffix:

<cc>	Component Carrier
<fr>	Frame
<bwp>	Bandwidth part
<sl>	Bandwidth part
<al>	Allocation

Parameters:

<Symbol>	2 3
----------	-------

Example: //Define position of DM-RS
 CONF:DL:CC2:FRAM3:BWP2:SLOT4:ALL5:DMRS:MTYP A
 CONF:DL:CC2:FRAM3:BWP2:SLOT4:ALL5:DMRS:TAP 3

Manual operation: See "[PDSCH DMRS Location](#)" on page 120

**CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:
 ALLocation<al>:RPOint <Reference>**

Defines the reference point of the PDSCH DMRS.

Suffix:

<cc>	Component Carrier
<fr>	Frame
<bwp>	Bandwidth part
<sl>	Bandwidth part
<al>	Allocation

Parameters:

<Reference>	BWPStart Reference point is the first subcarrier of the bandwidth part the PDSCH DMRS is in.
-------------	--

RPA

Reference point is the reference point A.

*RST: RPA

Example: //Select reference point for PDSCH DMRS
CONF:DL:CC2:FRAM3:BWP2:SLOT4:ALL5:RPO BWPS

Manual operation: See "Reference Point" on page 122

**CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:
ALLocation<al>:UEID <ID>**

Defines the user ID of a PDSCH allocation.

Suffix:

<cc> Component Carrier
<fr> Frame
<bwp> Bandwidth part
<sl> Bandwidth part
<al> Allocation

Parameters:

<ID> <numeric value> (integer only)

Example: //Define allocation ID
CONF:DL:CC2:FRAM3:BWP2:SLOT4:ALL5:UEID 8

Manual operation: See "ID" on page 110
See "User ID" on page 120

**CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:
ALLocation<al>:VTPinter <Type>**

Selects the interleaving size of VRB bundles.

Suffix:

<cc> Component Carrier
<fr> Frame
<bwp> Bandwidth part
<sl> Bandwidth part
<al> Allocation

Parameters:

<Type> **NINT**
No resource block bundling.
<numeric_value> (integer only)
Size of a VRB bundle (2 or 4 resource blocks).
*RST: NINT

Example: //Select interleaving size
CONF:DL:CC2:FRAM3:BWP2:SLOT4:ALL5:VTP 4

Manual operation: See "[VRB-to-PRB Interleaver](#)" on page 120

6.9.15 Enhanced PDSCH settings: PTRS

Commands to configure the PTRS described elsewhere.

- `CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:ALLocation<al>:UEID` on page 356

<code>CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:ALLocation<al>:PTRS:K</code>	357
<code>CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:ALLocation<al>:PTRS:L</code>	358
<code>CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:ALLocation<al>:PTRS:POWer</code>	358
<code>CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:ALLocation<al>:PTRS:REOfset</code>	359
<code>CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:ALLocation<al>:PTRS[:STATe]</code>	359

CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:ALLocation<al>:PTRS:K <Value>

Defines an offset for the PTRS in the frequency domain.

Prerequisites for this command

- Turn on PTRS (`CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:ALLocation<al>:PTRS[:STATe]`).

Suffix:

<cc>	Component Carrier
<fr>	Frame
<bwp>	Bandwidth part
<sl>	Bandwidth part
<al>	Allocation

Parameters:

<Value> 2 | 4 [subcarrier]
*RST: 1

Example: //Define PTRS offset
CONF:DL:CC2:FRAM3:BWP2:SLOT4:ALL5:PTRS ON
CONF:DL:CC2:FRAM3:BWP2:SLOT4:ALL5:PTRS:K 4

Manual operation: See "[PTRS Configuration](#)" on page 123

**CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:
ALLocation<al>:PTRS:L <Value>**

Defines an offset for the PTRS in the time domain.

Prerequisites for this command

- Turn on PTRS (`CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:
BWPart<bwp>:SLOT<sl>:ALLocation<al>:PTRS[:STATe]`).

Suffix:

<cc>	Component Carrier
<fr>	Frame
<bwp>	Bandwidth part
<sl>	Bandwidth part
<al>	Allocation

Parameters:

<Value>	1 2 4 [OFDM symbols]
*RST:	1

Example:

```
//Define PTRS offset
CONF:DL:CC2:FRAM3:BWP2:SLOT4:ALL5:PTRS ON
CONF:DL:CC2:FRAM3:BWP2:SLOT4:ALL5:PTRS:L 4
```

Manual operation: See "[PTRS Configuration](#)" on page 123

**CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:
ALLocation<al>:PTRS:POWer <Power>**

Defines the relative power of the PTRS.

Prerequisites for this command

- Turn on PTRS (`CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:
BWPart<bwp>:SLOT<sl>:ALLocation<al>:PTRS[:STATe]`).

Suffix:

<cc>	Component Carrier
<fr>	Frame
<bwp>	Bandwidth part
<sl>	Bandwidth part
<al>	Allocation

Parameters:

<Power>	<numeric value>
*RST:	0
	Default unit: dB

Example: //Define PTRS power
 CONF:DL:CC2:FRAM3:BWP2:SLOT4:ALL5:PTRS ON
 CONF:DL:CC2:FRAM3:BWP2:SLOT4:ALL5:PTRS:POW 1DB

Manual operation: See "[PTRS Configuration](#)" on page 123

**CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:
 ALLocation<al>:PTRS:REOffset <Offset>**

Defines the location of the PTRS in the frequency domain relative to the first subcarrier.

Prerequisites for this command

- Turn on PTRS (CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:ALLocation<al>:PTRS[:STATE]).

Suffix:

<cc>	Component Carrier
<fr>	Frame
<bwp>	Bandwidth part
<sl>	Bandwidth part
<al>	Allocation

Parameters:

<Offset>	OS00 OS01 OS10 OS11 Defines an offset.
	NONE No offset.
	*RST: 00

Example: //Define PTRS offset
 CONF:DL:CC2:FRAM3:BWP2:SLOT4:ALL5:PTRS ON
 CONF:DL:CC2:FRAM3:BWP2:SLOT4:ALL5:PTRS:REOF
 OS10

Manual operation: See "[PTRS Configuration](#)" on page 123

**CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:
 ALLocation<al>:PTRS[:STATE] <State>**

Turns the PTRS on and off.

Suffix:

<cc>	Component Carrier
<fr>	Frame
<bwp>	Bandwidth part
<sl>	Bandwidth part
<al>	Allocation

Parameters:

<State> ON | OFF | 1 | 0
 *RST: OFF

Example:

//Turn on PTRS
 CONF:DL:CC2:FRAM3:BWP2:SLOT4:ALL5:PTRS ON

Manual operation: See "[PTRS Configuration](#)" on page 123

6.9.16 Enhanced PDSCH settings: scrambling / coding

Commands to configure the PTRS described elsewhere.

- `CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:ALLocation<al>:UEID` on page 356

<code>CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:ALLocation<al>:CCODing:IMCS</code>	360
<code>CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:ALLocation<al>:CCODing:MCSTable</code>	361
<code>CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:ALLocation<al>:CCODing:RVIndex</code>	362
<code>CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:ALLocation<al>:CCODing:TBSFs</code>	362
<code>CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:ALLocation<al>:CCODing:TBSsize</code>	363
<code>CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:ALLocation<al>:SCRambling</code>	363
<code>CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:ALLocation<al>:SCRambling:DSID</code>	364

`CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:ALLocation<al>:CCODing:IMCS` <Value>

Selects the MCS index (I_{MCS}).

Suffix:

<cc> Component Carrier
 <fr> Frame
 <bwp> Bandwidth part
 <sl> Slot
 <al> Allocation

Parameters:

<Value> The value range depends on:

- The modulation order (CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:ALLocation<al>:CCODing:MCSTable).
- The modulation scheme of the PDSCH (CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:ALLocation<al>[:CW<cw>]:MODulation).

*RST: 0

Example:

```
//Select MCS index for modulation order 256QAM
CONF:DL:CC2:FRAM3:BWP2:SLOT4:ALL5:MOD QAM256
CONF:DL:CC2:FRAM3:BWP2:SLOT4:ALL5:CCOD:MCST
Q256
CONF:DL:CC2:FRAM3:BWP2:SLOT4:ALL5:CCOD:IMCS 2
```

Manual operation: See "Channel Coding" on page 125

**CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:
ALLocation<al>:CCODing:MCSTable <Table>**

Selects the modulation order (MCS table) of the PDSCH.

Suffix:

<cc> Component Carrier
 <fr> Frame
 <bwp> Bandwidth part
 <sl> Slot
 <al> Allocation

Parameters:

<Table> **Q64**
Table for 64QAM.
Q64L
Table for 64QAM LowSE.
Q256
Table for 256QAM.
Q1024
Table for 1024QAM.
 *RST: Q64

Example:

```
//Select modulation order
CONF:DL:CC2:FRAM3:BWP2:SLOT4:ALL5:CCOD:MCST Q64
```

Manual operation: See "Channel Coding" on page 125

**CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:
ALLOcation<al>:CCODing:RVINdex <Index>**

Selects the redundancy version index.

Suffix:

<cc>	Component Carrier
<fr>	Frame
<bwp>	Bandwidth part
<sl>	Slot
<al>	Allocation

Parameters:

<Index>	Range: 0 to 3
	*RST: 0

Example: //Select redundancy version index
CONF:DL:CC2:FRAM3:BWP2:SLOT4:ALL5:CCOD:RVIN 1

Manual operation: See "Channel Coding" on page 125

**CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:
ALLOcation<al>:CCODing:TBSFs <Factor>**

Selects the transport block scaling factor S.

Suffix:

<cc>	Component Carrier
<fr>	Frame
<bwp>	Bandwidth part
<sl>	Slot
<al>	Allocation

Parameters:

<Factor>	ONE S = 1
	HALF S = 0.5
	QUAR S = 0.25
	*RST: ONE

Example: //Select TB scaling factor S
CONF:DL:CC2:FRAM3:BWP2:SLOT4:ALL5:CCOD:TBSF
HALF

Manual operation: See "Channel Coding" on page 125

**CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:
 ALLOcation<al>:CCODing:TBSize <State>**

Turns transport block size calculation including allocation gaps on and off.

Prerequisites for this command

- Combine PDSCH allocations ([CONFigure\[:NR5G\]:DL\[:CC<cc>\]:FRAMe<fr>:
BWPart<bwp>:SLOT<sl>:CUID](#) on page 330).

Suffix:

<cc>	Component Carrier
<fr>	Frame
<bwp>	Bandwidth part
<sl>	Slot
<al>	Allocation

Parameters:

<State>	ON OFF 1 0
*RST:	OFF

Example: //Calculate transport block size including allocation gaps
 CONF:DL:CC2:FRAM3:BWP2:SLOT4:CUID ON
 CONF:DL:CC2:FRAM3:BWP2:SLOT4:ALL5:CCOD:TBS ON

Manual operation: See "[Channel Coding](#)" on page 125

**CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:
 ALLOcation<al>:SCRambling <Method>**

Selects the PDSCH scrambling method.

Suffix:

<cc>	Component Carrier
<fr>	Frame
<bwp>	Bandwidth part
<sl>	Slot
<al>	Allocation

Parameters:

<Method>	DSID Sequence generation based on a pseudo-random seed value.
	NIDCell Sequence generation based on the cell ID.
*RST:	NIDCell

Example: //Define PDSCH scrambling method
 CONF:DL:CC2:FRAM3:BWP2:SLOT4:ALL5:SCR NIDC

Manual operation: See "[PDSCH Scrambling](#)" on page 125

**CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:
ALLocation<al>:SCRambling:DSID <Value>**

Defines the seed value for the PDSCH scrambling.

Prerequisites for this command

- Select sequence generation method DMRS-Scrambling-ID (**CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:ALLocation<al>:SCRambling**).

Suffix:

<cc>	Component Carrier
<fr>	Frame
<bwp>	Bandwidth part
<sl>	Slot
<al>	Allocation

Parameters:

<Value>	<numeric value> (integer only)
*RST:	0

Example:

```
//Define seed value
CONF:DL:CC2:FRAM3:BWP2:SLOT4:ALL5:SCR DSID
CONF:DL:CC2:FRAM3:BWP2:SLOT4:ALL5:SCR:DSID 10
```

Manual operation: See "PDSCH Scrambling" on page 125

6.9.17 Antenna port configuration

CONFigure[:NR5G]:DL[:CC<cc>]:PAMapping<cf>:CSIRs:AP<ap>.....	364
CONFigure[:NR5G]:DL[:CC<cc>]:PAMapping<cf>:PDSCh:AP<ap>.....	365
CONFigure[:NR5G]:DL[:CC<cc>]:PAMapping<cf>:STATE.....	365

CONFigure[:NR5G]:DL[:CC<cc>]:PAMapping<cf>:CSIRs:AP<ap> <State>

Selects the antenna port(s) on which the CSI reference signal is transmitted.

Suffix:

<cc>	Component Carrier
<cf>	1...2 Antenna port configuration
<ap>	3000...3031 Antenna port

Parameters:

<State>	ON OFF 1 0 Turns a specific CSI-RS antenna port on and off.
	ALL NONE Turns all CSI-RS antenna port on and off.

*RST: AP 3000 = ON

Example: //Transmit CSI RS on antenna port 3010 in configuration 2
CONF:DL:CC2:PAM2:CSIR:AP3010

Manual operation: See "[CSI-RS](#)" on page 78

CONFigure[:NR5G]:DL[:CC<cc>]:PAMapping<cf>:PDSCh:AP<ap> <State>

Selects the antenna port(s) on which the PDSCH is transmitted.

Suffix:

<cc> [Component Carrier](#)
<cf> 1...2
[Antenna port configuration](#)
<ap> 1000...1011
[Antenna port](#)

Parameters:

<State> **ON | OFF | 1 | 0**
Turns the transmission on a specific antenna port on and off.
ALL
Turns on the transmission on all antenna ports (1000 to 1011).
NONE
Turns off the transmission on all antenna ports.
By default, the transmission is on antenna port 1000 (configuration 1) and 1001 (configuration 2).

Example: //Turn on transmission on antenna port 1002 in configuration 1
CONF:DL:CC1:PAM1:PDSCH:AP1002 ON

Manual operation: See "[PDSCH](#)" on page 78

CONFigure[:NR5G]:DL[:CC<cc>]:PAMapping<cf>:STATE <State>

Selects one of the antenna port configurations.

Effects of this command

- If you turn on a configuration, the other antenna port configuration is automatically turned off (and vice versa).

Suffix:

<cc> [Component Carrier](#)
<cf> 1...2
[Antenna port configuration](#)

Parameters:

<State> **ON | OFF | 1 | 0**
*RST: ON for configuration 1

Example: //Turn on antenna port configuration 2
CONF:DL:CC2:PAM2:STAT ON

Manual operation: See "State" on page 77

6.9.18 MIMO configuration

Commands to configure MIMO setups described elsewhere.

- INSTRUMENT:BLOCK:CHANNEL[:SETTINGS]:SOURCE<si>

CONFigure[:NR5G]:MSHelper:CONDUCTor.....	366
CONFigure[:NR5G]:MSHelper:MHELper.....	366
CONFigure[:NR5G]:NSources.....	367
INSTRUMENT:BLOCK:CHANNEL[:SETTINGS]:CC<cc>:APMapping<ap>:CONFigure.....	367

CONFigure[:NR5G]:MSHelper:CONDUCTor <Format>

Selects the type of MIMO measurement.

Prerequisites for this command

- Select MIMO setup (CONFigure[:NR5G]:MSHelper:MHELper).

Effects of this command

- The command has an effect on the possibilities in the signal capture setup.

Parameters:

<Format>	CONDUCTed Selects conducted MIMO measurement.
	OTA Select over-the-air MIMO measurement.
	*RST: CONDUCTed

Example: //Select setup
CONF:MSH:MHEL MIMO
CONF:MSH:COND COND

Manual operation: See "Measurement Setup Helper" on page 75

CONFigure[:NR5G]:MSHelper:MHELper <Format>

Selects the type of setup for measurements with multiple data streams.

Effects of this command

- The command has an effect on the possibilities in the signal capture setup.

Parameters:

<Format>	MANual Selects a manual setup.
	MIMO Selects a MIMO setup.

MULTIsiso

Selects a multi SISO setup.

*RST: MANual

Example: //Select setup
CONF:MSH:MHEL MIMO

Manual operation: See "[Measurement Setup Helper](#)" on page 75

CONFigure[:NR5G]:NSources <InputSources>

Selects the number of input channels you are using to capture several streams of I/Q data.

Parameters:

<InputSources> *RST: 1

Example: //Select number of input sources
CONF:NSO 4

Manual operation: See "[Number of Input Sources](#)" on page 74

INSTrument:BLOCK:CHANnel[:SETTings][:CC<cc>]:APMapping<ap>:CONFigure <Configuration>

Selects the input source to capture a certain antenna port configuration.

Suffix:

<cc> [Component Carrier](#)

<ap> [Antenna Port](#)

Parameters:

<Configuration> The value range depends on the number of input sources ([CONFigure\[:NR5G\]:NSources](#)).

Example: //AP configuration 2 captured by input source 4
INST:BLOC:CHAN:APM2:CONF 4

Manual operation: See "[Simultaneous Signal Capture Setup](#)" on page 76

6.9.19 Advanced settings: global

CONFigure[:NR5G]:DL[:CC<cc>]:EUIDs	368
CONFigure[:NR5G]:DL[:CC<cc>]:FNNF	368
CONFigure[:NR5G]:DL[:CC<cc>]:IDC	368
CONFigure[:NR5G]:DL[:CC<cc>]:RFUC:FZERo:FREQuency	369
CONFigure[:NR5G]:DL[:CC<cc>]:RFUC:FZERo:MODE	369
CONFigure[:NR5G]:DL[:CC<cc>]:RFUC:STATe	370
CONFigure[:NR5G]:DL[:CC<cc>]:SSCA	370
CONFigure[:NR5G]:FELC:STATe	370
CONFigure[:NR5G]:ORAN:TCASe	370
[SENSe:]POWer:CATegory	371

CONFigure[:NR5G]:DL[:CC<cc>]:EUIDs <IDs>

Defines user IDs that are excluded from the calculation of modulation-specific EVM results.

Suffix:

<cc> [Component Carrier](#)

Parameters:

<IDs> String containing the user IDs to exclude. This is either a comma-separated list (1,2,5,6), a range (1-6) or a combination of both.

Example:

```
//Exclude user IDs
CONF:DL:EUID "1, 3, 5-6"
```

Manual operation: See ["Exclude User IDs"](#) on page 128

CONFigure[:NR5G]:DL[:CC<cc>]:FNNF <FrameNumber>

Defines the 5G NR system frame number.

Suffix:

<cc> irrelevant

Parameters:

<FrameNumber> *RST: 0

Example:

```
//Define frame number
CONF:UL:FNNF 432
```

Manual operation: See ["Frame Number n_f"](#) on page 128

CONFigure[:NR5G]:DL[:CC<cc>]:IDC <State>

Turns analysis of the DC carrier on and off.

Suffix:

<cc> [Component Carrier](#)

Parameters:

<State> **OFF | 0**
Includes the DC carrier in the analysis.
ON | 1
Excludes the DC carrier from the analysis.
COMPensate
Compensates the DC carrier.
*RST: OFF

Example:

```
//Do not analyze DC carrier
CONF:DL:CC2:IDC ON
```

Manual operation: See ["Handling of Carrier Leakage"](#) on page 127

CONFigure[:NR5G]:DL[:CC<cc>]:RFUC:FZERo:FREQuency <Frequency>

Selects a frequency for RF upconversion.

Prerequisites for this command

- Turn on phase compensation ([CONFigure\[:NR5G\]:DL\[:CC<cc>\]:RFUC:STATE](#)).
- Select mode to select custom frequency ([CONFigure\[:NR5G\]:DL\[:CC<cc>\]:RFUC:FZERo:MODE](#)).

Suffix:

<cc> [Component Carrier](#)

Parameters:

<Frequency> <numeric value>
 *RST: 0
 Default unit: Hz

Example:

```
//Define frequency for RF upconversion
CONF:DL:CC2:RFUC:STAT ON
CONF:DL:CC2:RFUC:FZER:MODE MAN
CONF:DL:CC2:RFUC:FZER:FREQ 800MHZ
```

Manual operation: See "[RF Upconversion](#)" on page 128

CONFigure[:NR5G]:DL[:CC<cc>]:RFUC:FZERo:MODE <Mode>

Selects the frequency selection mode for RF upconversion.

Prerequisites for this command

- Turn on phase compensation ([CONFigure\[:NR5G\]:DL\[:CC<cc>\]:RFUC:STATE](#)).

Suffix:

<cc> [Component Carrier](#)

Parameters:

<Mode> **CF**
 Converts the signal to the center frequency.
MANual
 Converts the signal to another frequency.
 You can define the frequency with [CONFigure\[:NR5G\]:DL\[:CC<cc>\]:RFUC:FZERo:FREQuency](#).
 *RST: CF

Example:

```
//Select frequency mode for RF upconversion
CONF:DL:CC2:RFUC:STAT ON
CONF:DL:CC2:RFUC:FZER:MODE CF
```

Manual operation: See "[RF Upconversion](#)" on page 128

CONFigure[:NR5G]:DL[:CC<cc>]:RFUC:STATe <State>

Turns RF upconversion and corresponding phase compensation on and off.

Suffix:

<cc> [Component Carrier](#)

Parameters:

<State> ON | OFF | 1 | 0

*RST: ON

Example:

```
//Turn on phase compensation
CONF:DL:CC2:RFUC:STAT ON
```

Manual operation: See "[RF Upconversion](#)" on page 128

CONFigure[:NR5G]:DL[:CC<cc>]:SSCA <State>

Turn shared spectrum channel access on and off.

Suffix:

<cc> [Component Carrier](#)

Parameters:

<State> ON | OFF | 1 | 0

*RST: OFF

Example:

```
//Turn on shared spectrum channel acces
CONF:DL:SSCA ON
```

Manual operation: See "[Shared Spectrum Channel Access](#)" on page 129

CONFigure[:NR5G]:FELC:STATe <State>

Turns the frequency error limit check on and off.

Parameters:

<State> ON | OFF | 1 | 0

*RST: ON

Example:

```
//Turn on frequency error limit check
CONF:FELC:STAT ON
```

Manual operation: See "[Frequency Error Limit Check](#)" on page 128

CONFigure[:NR5G]:ORAN:TCASe <Testcase>

Selects an O-RAN test case.

Parameters:

<Testcase> **<string>**
 String containing the name of the test case, e.g. "TC 3.2.3.1.1".
 The string "NONE" removes a test case.
 *RST: NONE

Example:

```
//Select O-RAN test case TC 3.2.3.1.4
CONF:ORAN:TCAS "TC 3.2.3.1.4"
```

Manual operation: See "[O-RAN Test Case](#)" on page 129

[SENSe:]POWer:CAteGory <Category>

Selects the base station category-

Parameters:

<Category> **A**
 Category A base station.
B
 Category B base station.
LARE
 Large area base station.
MED
 Medium area base station.
 *RST: A

Example:

```
//Select base station category
POW:CAT B
```

Manual operation: See "[Category](#)" on page 128

6.9.20 Advanced settings: reference point A

CONFigure[:NR5G]:DL[:CC<cc>]:RPA:AFRequency?.....	371
CONFigure[:NR5G]:DL[:CC<cc>]:RPA:KZERo:SCFE.....	372
CONFigure[:NR5G]:DL[:CC<cc>]:RPA:KZERo:SCFT.....	372
CONFigure[:NR5G]:DL[:CC<cc>]:RPA:KZERo:SCNS.....	372
CONFigure[:NR5G]:DL[:CC<cc>]:RPA:KZERo:SCOT.....	373
CONFigure[:NR5G]:DL[:CC<cc>]:RPA:KZERo:SCST.....	373
CONFigure[:NR5G]:DL[:CC<cc>]:RPA:KZERo:SCTT.....	374
CONFigure[:NR5G]:DL[:CC<cc>]:RPA:RTCF.....	374
CONFigure[:NR5G]:DL[:CC<cc>]:RPA:TBOFset?.....	374

CONFigure[:NR5G]:DL[:CC<cc>]:RPA:AFRequency?

Queries the absolute frequency of the reference point A.

Suffix:

<cc> [Component Carrier](#)

Return values:

<Frequency> <numeric value>
 Default unit: Hz

Example: //Query location of reference point A
 CONF:DL:CC2:RPA:AFR?

Usage: Query only

Manual operation: See "[Reference Point A](#)" on page 130

CONFigure[:NR5G]:DL[:CC<cc>]:RPA:KZERo:SCFE <Offset>

Defines an offset relative to reference point A for bandwidth parts with 480 kHz subcarrier spacing.

Prerequisites for this command

- Bandwidth part with 480 kHz subcarrier spacing is available.

Suffix:

<cc> [Component Carrier](#)

Parameters:

<Offset> -6 | 0 | 6

Example: //Define offset
 CONF:DL:CC2:RPA:KZER:SCFE 0

Manual operation: See "[k_0](#)" on page 130

CONFigure[:NR5G]:DL[:CC<cc>]:RPA:KZERo:SCFT <Offset>

Defines an offset relative to reference point A for bandwidth parts with 15 kHz subcarrier spacing.

Prerequisites for this command

- Bandwidth part with 15 kHz subcarrier spacing is available.

Suffix:

<cc> [Component Carrier](#)

Parameters:

<Offset> -6 | 0 | 6

Example: //Define offset
 CONF:DL:CC2:RPA:KZER:SCFT 0

Manual operation: See "[k_0](#)" on page 130

CONFigure[:NR5G]:DL[:CC<cc>]:RPA:KZERo:SCNS <Offset>

Defines an offset relative to reference point A for bandwidth parts with 960 kHz subcarrier spacing.

Prerequisites for this command

- Bandwidth part with 960 kHz subcarrier spacing is available.

Suffix:

<cc> [Component Carrier](#)

Parameters:

<Offset> -6 | 0 | 6

Example:

```
//Define offset
CONF:DL:CC2:RPA:KZER:SCNS 0
```

Manual operation: See "[k_0](#)" on page 130

CONFigure[:NR5G]:DL[:CC<cc>]:RPA:KZERo:SCOT <Offset>

Defines an offset relative to reference point A for bandwidth parts with 120 kHz subcarrier spacing.

Prerequisites for this command

- Bandwidth part with 120 kHz subcarrier spacing is available.

Suffix:

<cc> [Component Carrier](#)

Parameters:

<Offset> -6 | 0 | 6

Example:

```
//Define offset
CONF:DL:CC2:RPA:KZER:SCOT 0
```

Manual operation: See "[k_0](#)" on page 130

CONFigure[:NR5G]:DL[:CC<cc>]:RPA:KZERo:SCST <Offset>

Defines an offset relative to reference point A for bandwidth parts with 60 kHz subcarrier spacing.

Prerequisites for this command

- Bandwidth part with 60 kHz subcarrier spacing is available.

Suffix:

<cc> [Component Carrier](#)

Parameters:

<Offset> -6 | 0 | 6

Example:

```
//Define offset
CONF:DL:CC2:RPA:KZER:SCST 0
```

Manual operation: See "[k_0](#)" on page 130

CONFigure[:NR5G]:DL[:CC<cc>]:RPA:KZERo:SCTT <Offset>

Defines an offset relative to reference point A for bandwidth parts with 30 kHz subcarrier spacing.

Prerequisites for this command

- Bandwidth part with 30 kHz subcarrier spacing is available.

Suffix:

<cc> [Component Carrier](#)

Parameters:

<Offset> -6 | 0 | 6

Example:

```
//Define offset
CONF:DL:CC2:RPA:KZER:SCTT 0
```

Manual operation: See "[k_0](#)" on page 130

CONFigure[:NR5G]:DL[:CC<cc>]:RPA:RTCF <Frequency>

Defines the frequency of the reference point A relative to the carrier's center frequency.

Suffix:

<cc> [Component Carrier](#)

Parameters:

<Frequency> <numeric value>
Default unit: Hz

Example:

```
//Define location of reference point A
CONF:DL:CC2:RPA:RTCF -54.5MHZ
```

Manual operation: See "[Reference Point A](#)" on page 130

CONFigure[:NR5G]:DL[:CC<cc>]:RPA:TBOFset?

Queries the TxBW offset of the reference point A.

Suffix:

<cc> [Component Carrier](#)

Return values:

<Offset> <numeric value>
Default unit: Hz

Example:

```
//Query TxBW offset
CONF:DL:CC2:RPA:TBOF?
```

Usage:

Query only

Manual operation: See "[Reference Point A](#)" on page 130

6.9.21 Advanced settings: LTE-CRS coexistence

CONFigure[:NR5G]:DL[:CC<cc>]:LTE:CBW.....	375
CONFigure[:NR5G]:DL[:CC<cc>]:LTE:MBSFn:SUBFrame<sf>:STATe.....	375
CONFigure[:NR5G]:DL[:CC<cc>]:LTE:NAP.....	376
CONFigure[:NR5G]:DL[:CC<cc>]:LTE:POINta.....	376
CONFigure[:NR5G]:DL[:CC<cc>]:LTE:STATe.....	376
CONFigure[:NR5G]:DL[:CC<cc>]:LTE:VSHift.....	377

CONFigure[:NR5G]:DL[:CC<cc>]:LTE:CBW <ResourceBlocks>

Selects the channel bandwidth of an LTE carrier.

Prerequisites for this command

- Turn on LTE-CRS coexistence (`CONFigure[:NR5G]:DL[:CC<cc>]:LTE:STATe`).

Suffix:

<cc> [Component Carrier](#)

Parameters:

<ResourceBlocks> N6 | N15 | N25 | N50 | N75 | N100
*RST: N6

Example:

```
//Select LTE channel bandwidth
CONF:DL:CC2:LTE:STAT ON
CONF:DL:CC2:LTE:CBW N25
```

Manual operation: See "[LTE Bandwidth](#)" on page 132

CONFigure[:NR5G]:DL[:CC<cc>]:LTE:MBSFn:SUBFrame<sf>:STATe <State>

Turns MBSFN transmission in specific subframes on and off.

Prerequisites for this command

- Turn on LTE-CRS coexistence (`CONFigure[:NR5G]:DL[:CC<cc>]:LTE:STATe`).

Suffix:

<cc> [Component Carrier](#)

<sf> 1...9
Subframe

Parameters:

<State> ON | OFF | 1 | 0
*RST: OFF (all subframes)

Example:

```
//Turn on MBSFN transmission in subframe 2
CONF:DL:LTE:MBSF:SUBF2:STAT ON
```

Manual operation: See "[MBSFN Subframes](#)" on page 132

CONFigure[:NR5G]:DL[:CC<cc>]:LTE:NAP <APs>

Selects the number of antenna ports for an LTE signal.

Prerequisites for this command

- Turn on LTE-CRS coexistence ([CONFigure\[:NR5G\]:DL\[:CC<cc>\]:LTE:STATE](#)).

Suffix:

<cc> [Component Carrier](#)

Parameters:

<APs> AP1 | AP2 | AP4
1-, 2-, or 4 antenna port configurations.
*RST: AP1

Example:

```
//Select number of LTE antenna ports
CONF:DL:CC2:LTE:STAT ON
CONF:DL:CC2:LTE:NAP AP2
```

Manual operation: See "[LTE Antenna Ports](#)" on page 132

CONFigure[:NR5G]:DL[:CC<cc>]:LTE:POINta <Offset>

Defines an LTE carrier offset relative to reference point A (in terms of resource blocks).

Prerequisites for this command

- Turn on LTE-CRS coexistence ([CONFigure\[:NR5G\]:DL\[:CC<cc>\]:LTE:STATE](#)).

Suffix:

<cc> [Component Carrier](#)

Parameters:

<Offset> *RST: 0

Example:

```
//Define carrier offset
CONF:DL:CC2:LTE:STAT ON
CONF:DL:CC2:LTE:POIN 25
```

Manual operation: See "[Offset to Point A](#)" on page 132

CONFigure[:NR5G]:DL[:CC<cc>]:LTE:STATE <State>

Turns coexistence with LTE resources on and off.

Prerequisites for this command

- Select subcarrier spacing of 15 kHz ([CONFigure\[:NR5G\]:DL\[:CC<cc>\]:FRAME<fr>:BWPpart<bwp>:SSPacing](#)).

Suffix:

<cc> [Component Carrier](#)

Parameters:

<State> ON | OFF | 1 | 0
 *RST: OFF

Example:

```
//Turn on LTE coexistence
CONF:DL:CC2:FRAM:BWP1:SSP SS15
CONF:DL:CC2:LTE:STAT ON
```

Manual operation: See "State" on page 131

CONFigure[:NR5G]:DL[:CC<cc>]:LTE:VShifT <Value>

Selects the vShift parameter for an LTE signal.

Prerequisites for this command

- Turn on LTE-CRS coexistence (CONFigure[:NR5G]:DL[:CC<cc>]:LTE:STATe).

Suffix:

<cc> Component Carrier

Parameters:

<Value> *RST: 0

Example:

```
//Define vShift parameter
CONF:DL:CC2:LTE:STAT ON
CONF:DL:CC2:LTE:VSH 2
```

Manual operation: See "vShift" on page 132

6.9.22 Generator control

CONFigure:GENerator:FREQuency:CENTer:SYNC[:STATe].....	378
CONFigure:GENerator:IPConnection:ADDRess.....	378
CONFigure:GENerator:IPConnection:LEDState?.....	378
CONFigure:GENerator:POWer:LEVel:STATe.....	379
CONFigure:GENerator:LEVel:DUTGain.....	379
CONFigure:GENerator:LEVel:DUTLimit.....	379
CONFigure:GENerator:LEVel:DUTLimit:STATe.....	380
CONFigure:GENerator:POWer:LEVel.....	380
CONFigure:GENerator:QERRor?.....	381
CONFigure:SETTings:NR5G.....	381
CONFigure:SETTings:NR5G:PINterval.....	381
CONFigure:SETTings:NR5G:SYNC.....	382
CONFigure:SETTings:RF.....	382
CONFigure:GENerator:RFOutput[:STATe].....	382
CONFigure:GENerator:CONTrol[:STATe].....	383
CONFigure:GENerator:SETTings:UPDate:RF.....	383

CONFigure:GENerator:FREQuency:CENTer:SYNC[:STATe] <State>

Turns frequency synchronization between analyzer and generator on and off.

You can define the frequency itself with [*SENSe*:] *FREQuency:CENTer[:CC<cc>]*.

Prerequisites for this command

- IP connection to a signal generator.
- Generator control state is on (*CONFigure:GENerator:CONTrol[:STATe]*).

Parameters:

<State> ON | OFF | 1 | 0
*RST: OFF

Example: //Turn on RF output
CONF:GEN:CONT ON
CONF:GEN:FREQ:CENT ON

Manual operation: See "[Center Frequency](#)" on page 134

CONFigure:GENerator:IPConnection:ADDRess <IPAddress>

This command defines the IP address of the connected signal generator.

Make sure to synchronize with *OPC? or *WAI to make sure that the command was successfully applied on the generator before sending the next command.

Parameters:

<IPAddress> String containing the IP address or computer name.

Example: //Connect to the generator with the stated IP address
CONF:GEN:IPC:ADDR '192.0.2.0';*WAI

Example: //Connect to the generator with a computer name
CONF:GEN:IPC:ADDR 'MyGenerator';*WAI

Manual operation: See "[Generator IP Address](#)" on page 133

CONFigure:GENerator:IPConnection:LEDState?

This command queries the state of connection to the signal generator.

Return values:

<State> **GREen**
 Connection was successful.
 GREY
 Unknown connection state.
 RED
 Connection was not successful.

Example: CONF:GEN:IPC:LEDS?
 would return, e.g.:
 RED

Usage: Query only

Manual operation: See "[Generator IP Address](#)" on page 133

CONFigure:GENerator:POWer:LEVel:STATe <State>

Turns level synchronization between analyzer and generator on and off.

Prerequisites for this command

- IP connection to a signal generator.
- Generator control state is on ([CONFigure:GENerator:CONTRol\[:STATe\]](#)).

Parameters:

<State> ON | OFF | 1 | 0
 *RST: OFF

Example: //Turn on level synchronization
 CONF:GEN:CONT ON
 CONF:GEN:POW:LEV:STAT ON

Manual operation: See "[Level Control State](#)" on page 134

CONFigure:GENerator:LEVel:DUTGain <Level>

Defines DUT level gain for generator level control.

Prerequisites for this command

- IP connection to a signal generator.
- Generator control state is on ([CONFigure:GENerator:CONTRol\[:STATe\]](#)).
- Level control is on ([CONFigure:GENerator:POWer:LEVel:STATe](#)).

Parameters:

<Level> *RST: 0
 Default unit: dB

Example: //Define DUT gain
 CONF:GEN:CONT ON
 CONF:GEN:LEV:DUTG ON

Manual operation: See "[DUT Gain](#)" on page 135

CONFigure:GENerator:LEVel:DUTLimit <Level>

Defines the output power RMS level of the generator.

Prerequisites for this command

- IP connection to a signal generator.
- Generator control state is on ([CONFigure:GENerator:CONTRol\[:STATe\]](#)).
- Level control is on ([CONFigure:GENerator:POWer:LEVel:STATe](#)).
- DUT peak input power limit is on ([CONFigure:GENerator:LEVel:DUTLimit:STATe](#)).

Parameters:

<Level> *RST: 30
 Default unit: dB

Example:

```
//Define peak input power
CONF:GEN:CONT ON
CONF:GEN:POW:LEV:STAT ON
CONF:GEN:LEV:DUTL:STAT ON
CONF:GEN:LEV:DUTL 10
```

Manual operation: See "[Limit DUT Peak Input Power](#)" on page 135

CONFigure:GENerator:LEVel:DUTLimit:STATE <State>

Turns a limitation of the DUT peak input power on and off.

Define the peak input power with [CONFigure:GENerator:LEVel:DUTLimit](#).

Prerequisites for this command

- IP connection to a signal generator.
- Generator control state is on ([CONFigure:GENerator:CONTROL\[:STATE\]](#)).
- Level control is on ([CONFigure:GENerator:POWer:LEVel:STATE](#)).

Parameters:

<State> ON | OFF | 1 | 0
 *RST: OFF

Example:

```
//Turn on DUT input power limitation
CONF:GEN:CONT ON
CONF:GEN:POW:LEV:STAT ON
CONF:GEN:LEV:DUTL:STAT ON
```

Manual operation: See "[Limit DUT Peak Input Power](#)" on page 135

CONFigure:GENerator:POWer:LEVel <Level>

Defines the output power RMS level of the generator.

Prerequisites for this command

- IP connection to a signal generator.
- Generator control state is on ([CONFigure:GENerator:CONTROL\[:STATE\]](#)).
- Level control is on ([CONFigure:GENerator:POWer:LEVel:STATE](#)).

Parameters:

<Level> *RST: 0
 Default unit: dBm

Example:

```
//Define generator output level
CONF:GEN:CONT ON
CONF:GEN:POW:LEV:STAT ON
CONF:GEN:POW:LEV -10
```

Manual operation: See "[Level \(RMS\)](#)" on page 135

CONFigure:GENerator:QERRor?

Queries any errors that might have occurred for the generator control

Return values:

<Message> String containing the error messages.

Example: //Query error messages
CONF:GEN:QERR?

Usage: Query only

CONFigure:SETTings:NR5G

Downloads the NR signal description from the generator to the analyzer.

Prerequisites for this command

- IP connection to a signal generator.
- Generator control state is on ([CONFigure:GENerator:CONTrol\[:STATE\]](#)).

Example: //Synchronize signal description
CONF:GEN:CONT ON
CONF:SETT:NR5G

Usage: Event

Manual operation: See "[Query Settings from Generator](#)" on page 135

CONFigure:SETTings:NR5G:PINTerval <Time>

Defines the polling interval for periodic synchronization between analyzer and generator.

Prerequisites for this command

- IP connection to a signal generator.
- Generator control state is on ([CONFigure:GENerator:CONTrol\[:STATE\]](#)).
- Periodic synchronization is on ([CONFigure:SETTings:NR5G:SYNC](#)).

Parameters:

<Time> Default unit: s

Example: //Define polling interval
CONF:GEN:CONT ON
CONF:SETT:NR5G:SYNC ON
CONF:SETT:NR5G:PINT 30

Manual operation: See "[Periodic synchronization of 5G NR settings](#)" on page 136

CONFigure:SETTings:NR5G:SYNC <State>

Turns periodic synchronization of the signal description on the analyzer on and off.

Prerequisites for this command

- IP connection to a signal generator.
- Generator control state is on (`CONFigure:GENerator:CONTRol[:STATe]`).

Parameters:

<State> ON | OFF | 1 | 0
 *RST: OFF

Example: //Define polling interval
 CONF:GEN:CONT ON
 CONF:SETT:NR5G:SYNC ON

Manual operation: See ["Periodic synchronization of 5G NR settings"](#) on page 136

CONFigure:SETTings:RF

Downloads the RF settings (frequency, level) from the generator to the analyzer.

Prerequisites for this command

- IP connection to a signal generator.
- Generator control state is on (`CONFigure:GENerator:CONTRol[:STATe]`).

Example: //Synchronize signal description
 CONF:GEN:CONT ON
 CONF:SETT:RF

Usage: Event

Manual operation: See ["Query Settings from Generator"](#) on page 135

CONFigure:GENerator:RFOutput[:STATe] <State>

Turns the RF output of the generator on and off.

Prerequisites for this command

- IP connection to a signal generator.
- Generator control state is on (`CONFigure:GENerator:CONTRol[:STATe]`).

Parameters:

<State> ON | OFF | 1 | 0
 *RST: OFF

Example: //Turn on RF output
 CONF:GEN:CONT ON
 CONF:GEN:RFO ON

Manual operation: See ["RF Output State"](#) on page 134

CONFigure:GENerator:CONTRol[:STATe] <State>

Turns control over the signal generator on and off.

Prerequisites for this command

- IP connection to a signal generator.

Parameters:

<State> ON | OFF | 1 | 0
*RST: OFF

Example: //Turn on generator control
CONF:GEN:CONT ON

Manual operation: See "[Generator Control State](#)" on page 134

CONFigure:GENerator:SETTings:UPDate:RF

Uploads the RF settings (frequency, level) from analyzer to the generator.

Prerequisites for this command

- IP connection to a signal generator.
- Generator control state is on (`CONFigure:GENerator:CONTRol[:STATe]`).

Example: //Upload RF settings
CONF:GEN:CONT ON
CONF:GEN:SETT:UPD:RF

Usage: Event

Manual operation: See "[Upload RF Settings to Generator](#)" on page 135

6.9.23 Inputs configuration

Useful commands to perform measurements described elsewhere:

- `INPut<ip>:COUPling<ant>` on page 392
- `INPut<ip>:IMPedance<ant>` on page 393

<code>INPut:FILE<fi>:PATH</code>	384
<code>INPut<ip>:FILE:ZPADing</code>	384
<code>INPut<ip>:FILTer:HPASs[:STATe]</code>	384
<code>INPut<ip>:FILTer:YIG[:STATe]</code>	385
<code>INPut:SELEct</code>	385
<code>INPut<ip>:RF:CAPMode</code>	386
<code>INPut<ip>:RF:CAPMode:IQ:SRATe</code>	386
<code>INPut<ip>:RF:CAPMode:WAVeform:SRATe</code>	387
<code>INSTrument:BLOCK:CHANnel[:SETTings]:SOURce<si></code>	387
<code>SYSTem:COMMunicate:RDEVice:OSCilloscope:SRATe</code>	388

INPut:FILE<fi>:PATH <FileName>[, <AnalysisBW>]

Selects the I/Q data file to be used as input for further measurements.

Suffix:

<fi> 1..n

Parameters:

<FileName> String containing the path and name of the source file.
The file extension is *.iq.tar.

<AnalysisBW> Optionally: The analysis bandwidth to be used by the measurement. The bandwidth must be smaller than or equal to the bandwidth of the data that was stored in the file.
Default unit: HZ

Example: INP:FILE:PATH 'C:\R_S\Instr\user\data.iq.tar'
Uses I/Q data from the specified file as input.

Manual operation: See ["Data import and export"](#) on page 185

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 140

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 136

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 137

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 139

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 137

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 386).

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 137

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 386).

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 137

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 Source Type"](#) on page 75
 See ["Input Type \(Instrument / File\)"](#) on page 139

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: 1000000000
TRAC:IQ:RLEN?
//Result: 3128
SYST:COMM:RDEV:OSC:SRAT 20GHZ
TRAC:IQ:SRAT?
//Result: 2000000000
TRAC:IQ:RLEN?
//Result: 1564
```

Manual operation: See ["Oscilloscope Sample Rate"](#) on page 137

6.9.24 Frequency configuration

[SENSe:]FREQUENCY:CENTer[:CC<cc>]	388
[SENSe:]FREQUENCY:CENTer[:CC<cc>]:OFFSet	389
[SENSe:]FREQUENCY:CENTer:STEP	389

[SENSe:]FREQUENCY:CENTer[:CC<cc>] <Frequency>

Sets the center frequency for RF measurements.

Suffix:

<cc> [Component Carrier](#)

Parameters:

<Frequency> <numeric value>
 Range: fmin to fmax
 *RST: 1 GHz
 Default unit: Hz

Example:

//Define frequency for measurement on one carrier:
 FREQ:CENT 1GHZ

Manual operation:

See "[Frequency configuration](#)" on page 70
 See "[Center Frequency](#)" on page 134
 See "[Center Frequency](#)" on page 140

[SENSe:]FREQUENCY:CENTer[:CC<cc>]:OFFSet <Offset>

Defines the general frequency offset.

Prerequisites for this command

- Select the first component carrier (CC1) as the reference point for the frequency offset ([CONFigure\[:NR5G\]:OREL](#)).

Suffix:

<cc> [Component Carrier](#)

Parameters:

<Offset> <numeric value>
 • General frequency offset: frequency offset in Hz.
 Default unit: Hz

Example:

//Add a frequency offset of 50 Hz to the measurement frequency.
 FREQ:CENT:OFFS 50HZ

Manual operation:

See "[Frequency configuration](#)" on page 70
 See "[Center Frequency](#)" on page 140

[SENSe:]FREQUENCY:CENTer:STEP <StepSize>

Defines the center frequency step size.

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 "Frequency Stepsize" on page 141

6.9.25 Amplitude configuration

DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:RLEVel<ant>.....	390
DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:RLEVel<ant>:OFFSet.....	390
INPut<ip>:ATTenuation<ant>.....	391
INPut<ip>:ATTenuation<ant>:AUTO.....	391
INPut<ip>:COUPling<ant>.....	392
INPut<ip>:GAIN<ant>:STATe.....	392
INPut<ip>:GAIN<ant>[:VALue].....	392
INPut<ip>:IMPedance<ant>.....	393
INPut<ip>:EATT<ant>.....	393
INPut<ip>:EATT<ant>:AUTO.....	394
INPut<ip>:EATT<ant>:STATe.....	394

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 $\neq 0$, 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 142

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 " Reference Level Offset " on page 142

INPut<ip>:ATTenuation<ant> <Attenuation>

Defines the RF attenuation level.

Prerequisites for this command

- Decouple attenuation from reference level (INPut<ip>:ATTenuation<ant>: [AUTO](#)).

Suffix:

<ip>	irrelevant
<ant>	irrelevant

Parameters:

<Attenuation>	*RST: 10 dB Default unit: dB
---------------	---------------------------------

Example: //Define RF attenuation
INP:ATT:AUTO OFF
INP:ATT 10

Manual operation: See "[RF Attenuation](#)" on page 143

INPut<ip>:ATTenuation<ant>:AUTO <State>

Couples and decouples the RF attenuation to the reference level.

Suffix:

<ip>	irrelevant
<ant>	irrelevant

Parameters:

<State>	ON OFF 1 0 *RST: ON
---------	------------------------------

Example: //Couple attenuation to reference level (auto attenuation)
INP:ATT:AUTO ON

Manual operation: See "[RF Attenuation](#)" on page 143

INPut<ip>:COUPling<ant> <CouplingType>

Selects the coupling type of the RF input.

If an external frontend is active, the coupling is automatically set to AC.

Suffix:

<ip> 1 | 2
irrelevant

<ant> [Input source](#) (for MIMO measurements only)

Parameters:

<CouplingType> AC | DC
AC
AC coupling
DC
DC coupling
*RST: AC

Example: INP:COUP DC

Manual operation: See "[Input Coupling](#)" on page 144

INPut<ip>:GAIN<ant>:STATe <State>

Turns the internal preamplifier on the connected instrument on and off. It requires the additional preamplifier hardware option on the connected instrument.

Suffix:

<ip> 1 | 2
irrelevant

<ant> [Input source](#) (for MIMO measurements only)

Parameters:

<State> ON | OFF | 0 | 1
OFF | 0
Switches the function off
ON | 1
Switches the function on
*RST: 0

Example: INP:GAIN:STAT ON
INP:GAIN:VAL 15
Switches on 15 dB preamplification.

Manual operation: See "[Preamplifier](#)" on page 143

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 392).

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 143

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 144

INPut<ip>:EATT<ant> <Attenuation>

Defines the electronic attenuation level.

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> irrelevant
<ant> Connected instrument

Parameters:

<Attenuation> Attenuation level in dB.
Default unit: dB

Example: //Define signal attenuation
INP:EATT 10

Manual operation: See "[Electronic Attenuation](#)" on page 143

INPut<ip>:EATT<ant>:AUTO <State>

Turns automatic selection of the electronic attenuation on and off.

If on, electronic attenuation reduces the mechanical attenuation whenever possible.

Suffix:

<ip> irrelevant
<ant> 1...4
Connected instrument

Parameters:

<State> ON | OFF | 1 | 0
*RST: OFF

Example: //Turn on automatic selection of electronic attenuation
INP:EATT:AUTO ON

Manual operation: See "[Electronic Attenuation](#)" on page 143

INPut<ip>:EATT<ant>:STATe <State>

Turns the electronic attenuator on and off.

Suffix:

<ip> irrelevant
<ant> 1...4
Connected instrument

Parameters:

<State> ON | OFF
*RST: OFF

Example: //Turn on electronic attenuation
INP:EATT:STAT ON

Manual operation: See "[Electronic Attenuation](#)" on page 143

6.9.26 Data capture

[SENSe:]NR5G:FRAMe:COUNt.....	395
[SENSe:]NR5G:FRAMe:COUNt:AUTO.....	395
[SENSe:]NR5G:FRAMe:COUNt:STATe.....	395
[SENSe:]NR5G:FRAMe:SLOT.....	396
[SENSe:]NR5G:FRAMe:SRSLot.....	396
[SENSe:]SWAPiq.....	396

[SENSe:]SWEep:CTMode.....	396
[SENSe:]SWEep:LCAPture.....	397
[SENSe:]SWEep:TIME.....	397
TRACe:IQ:SRATe?.....	398

[SENSe:]NR5G:FRAMe:COUnT <Frames>

Defines the number of frames to analyze.

Prerequisites for this command

- Turn on overall frame count ([SENSe:]NR5G:FRAMe:COUnT:STATe on page 395).
If the overall frame count is off, this command is a query only.

Parameters:

<Frames> <numeric value> (integer only)
*RST: 1

Example: //Define number of frames to analyze manually
NR5G:FRAM:COUn:STAT ON
NR5G:FRAM:COUn 10

Manual operation: See "[Number of Frames to Analyze](#)" on page 149

[SENSe:]NR5G:FRAMe:COUnT:AUTO <State>

Turns automatic selection of the number of frames to analyze on and off.

Parameters:

<State> **ON | 1**
 Selects the analyzed number of frames as specified by 3GPP.
OFF | 0
 Turns on manual selection of the number of frames.

Example: //Turn on automatic selection of analyzed frames
NR5G:FRAM:COUn:AUTO ON

Manual operation: See "[Auto According to Standard](#)" on page 148

[SENSe:]NR5G:FRAMe:COUnT:STATe <State>

Turns manual definition of number of frames to analyze on and off.

Parameters:

<State> **OFF | 0**
 The R&S VSE analyzes all frames in the capture buffer.
ON | 1
 Define the number of frames to analyze with [SENSe:]NR5G:FRAMe:COUnT.
*RST: ON

Example: //Turn on overall frame count.
NR5G:FRAM:COUN:STAT ON

Manual operation: See ["Overall Frame Count"](#) on page 148

[SENSe:]NR5G:FRAMe:SLOT <Slots>

Defines the number of slots that are analyzed.

Parameters:

<Slots> **ALL**
Analyzes all slots in a frame.
<numeric value> (integer only)
Analyzes a certain number of slots in a frame.
***RST:** ALL

Example: //Analyze all slots in a frame
NR5G:FRAM:SLOT ALL

Manual operation: See ["Maximum Number of Slots per Frame to Analyze"](#) on page 149

[SENSe:]NR5G:FRAMe:SRSLot <State>

Turns analysis of custom signals with repeating slots on and off.

Parameters:

<State> ON | OFF | 1 | 0
***RST:** OFF

Example: //Turn on repeated slot analysis
NR5G:FRAM:SRSL ON

Manual operation: See ["Signal Repeats Max No of Slots to Analyze"](#) on page 149

[SENSe:]SWAPiq <State>

Turns a swap of the I and Q branches on and off.

Parameters:

<State> ON | OFF | 1 | 0
***RST:** OFF

Example: //Swap I and Q branches
SWAP ON

Manual operation: See ["Swap I/Q"](#) on page 148

[SENSe:]SWEep:CTMode <Mode>

Selects the capture mode.

Prerequisites for this command

- Select FR2-2 (`CONFigure [:NR5G]:DL[:CC<cc>]:DFRange`).

Parameters:

<Mode> **AUTO**
Automatic determination of the capture time.

MANual
Manual definition of the capture time.
Define the capture time with `[SENSe:]SWEep:TIME`.

Example:

```
//Select capture time mode
CONF:DL:DFR EHIG
SWE:CTM AUTO
```

Manual operation: See "Capture Time" on page 147

[SENSe:]SWEep:LCAPture <State>

Turns the long capture on and off.

Prerequisites for this command

- Number of component carriers must be "1" (`CONFigure [:NR5G]:NOCC`).
- Multi frame configuration is not supported. Every frame must have the same configuration.

Effects of this command

- Frame count functions become unavailable:
`[SENSe:]NR5G:FRAME:COUNT`
`[SENSe:]NR5G:FRAME:COUNT:AUTO`
- `[SENSe:]NR5G:FRAME:COUNT:STATE`

Parameters:

<State> ON | OFF | 1 | 0
*RST: OFF

Example:

```
//Turn on long capture
SWE:LCAP ON
```

Manual operation: See "Long Capture" on page 148

[SENSe:]SWEep:TIME <CaptureLength>

Defines the capture time.

Parameters:

<CaptureLength> <numeric value>
*RST: 20.1 ms
Default unit: s

Example:

```
//Define capture time
SWE:TIME 40ms
```

Manual operation: See ["Capture Time"](#) on page 147

TRACe:IQ:SRATe?

Queries the capture sampling rate.

Return values:

<SamplingRate> <numeric value> (integer only)

Example:

```
//Query sample rate
TRAC:IQ:SRAT?
```

Usage:

Query only

6.9.27 Trigger

TRIGger[:SEQuence]:DTIME.....	398
TRIGger[:SEQuence]:HOLDoff<ant>[:TIME].....	398
TRIGger[:SEQuence]:IFPower:HOLDoff.....	399
TRIGger[:SEQuence]:IFPower:HYSteresis.....	399
TRIGger[:SEQuence]:LEVel<ant>[:EXternal<tp>].....	399
TRIGger[:SEQuence]:LEVel<ant>:IFPower.....	400
TRIGger[:SEQuence]:LEVel<ant>:IQPower.....	400
TRIGger[:SEQuence]:LEVel<ant>:RFPower.....	401
TRIGger[:SEQuence]:LEVel:MAPower.....	401
TRIGger[:SEQuence]:MAPower:HOLDoff.....	401
TRIGger[:SEQuence]:MAPower:HYSteresis.....	402
TRIGger[:SEQuence]:PORT<ant>.....	402
TRIGger[:SEQuence]:SLOPe.....	402
TRIGger[:SEQuence]:SOURce<ant>.....	403

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 ["Trigger Source"](#) on page 145

TRIGger[:SEQuence]:HOLDoff<ant>[:TIME] <Offset>

Defines the trigger offset.

Suffix:<ant> [Instrument](#)**Parameters:**

<Offset> <numeric value>
 *RST: 0 s
 Default unit: s

Example: //Define trigger offset
 TRIG:HOLD 5MS

Manual operation: See "[Trigger Source](#)" on page 145

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 Source](#)" on page 145

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 "[Trigger Source](#)" on page 145

TRIGger[:SEQUence]:LEVel<ant>[:EXtErnal<tp>] <Level>

Defines the level for an external trigger.

Suffix:<ant> [Instrument](#)

<tp> [Trigger port](#)

Parameters:

<Level> Range: 0.5 V to 3.5 V
 *RST: 1.4 V
 Default unit: V

Example: //Define trigger level
 TRIG:LEV 2V

Manual operation: See "[Trigger Source](#)" on page 145

TRIGger[:SEquence]:LEVel<ant>:IFPower <Level>

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.

Suffix:

<ant> [Instrument](#)

Parameters:

<Level> <numeric value>
 For details on available trigger levels and trigger bandwidths see the data sheet.
 *RST: -10 dBm
 Default unit: dBm

Example: //Define trigger level
 TRIG:SOUR IFP
 TRIG:LEV:IFP -30dBm

Manual operation: See "[Trigger Source](#)" on page 145

TRIGger[:SEquence]:LEVel<ant>:IQPower <Level>

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.

Suffix:

<ant> [Instrument](#)

Parameters:

<Level> <numeric value>
 Range: -130 dBm to 30 dBm
 *RST: -20 dBm
 Default unit: dBm

Example: //Define trigger level
 TRIG:SOUR IQP
 TRIG:LEV:IQP -30dBm

Manual operation: See "[Trigger Source](#)" on page 145

TRIGger[:SEquence]:LEVel<ant>:RFPower <Level>

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.

Suffix:

<ant> Instrument

Parameters:

<Level> <numeric value>

For details on available trigger levels and trigger bandwidths see the data sheet.

*RST: -20 dBm

Default unit: dBm

Example: //Define trigger level
 TRIG:SOUR RFP
 TRIG:LEV:RFP -30dBm

Manual operation: See "[Trigger Source](#)" on page 145

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.

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.

TRIGger[:SEQUence]:PORT<ant> <port>

Selects the trigger port for measurements with devices that have several trigger ports.

Suffix:
<ant> Analyzer

Parameters:
<port> **PORT1**
 PORT2
 PORT3

Example: //Select trigger port 1
TRIG:PORT PORT1

Manual operation: See "Trigger Source" on page 145

TRIGger[:SEQUence]:SLOPe <Type>

Selects the trigger slope.

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 "Trigger Source" on page 145

TRIGger[:SEQuence]:SOURce<ant> <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 this situation is avoided in your remote control programs.

Suffix:

<ant> [Analyzer](#)

Parameters:

<Source>

IMMediate

Free run (no trigger event to start a measurement).

EXT | EXT2 | EXT3 | EXT4

Trigger signal from the corresponding "Trigger Input / Output" connector on the connected instrument, or the oscilloscope's corresponding input channel (if not used as an input source).

For details on the connectors see the instrument's Getting Started manual.

RFPower

Measurement starts when the first intermediate frequency exceeds a certain level.

(Frequency and time domain measurements only.)

IFPower

Measurement starts when the second intermediate frequency exceeds a certain level.

IQPower

Measurement starts when the sampled I/Q data exceeds a certain magnitude.

For applications that process I/Q data, such as the I/Q analyzer or optional applications.

PSEN

External power sensor

MAGNitude

For (offline) input from a file, rather than an instrument.

The trigger level is specified by [TRIGger\[:SEQuence\]:LEVel:MAPower](#).

*RST: IMMediate

Manual operation: See "[Trigger Source](#)" on page 145

6.9.28 Tracking

[SENSe:]NR5G:DEMod:CESTimation.....	404
[SENSe:]NR5G:DEMod:CETaverage.....	404
[SENSe:]NR5G:IQ:GIQE.....	404
[SENSe:]NR5G:TRACking:LEVel.....	405
[SENSe:]NR5G:TRACking:PHASe.....	405
[SENSe:]NR5G:TRACking:TIME.....	405
[SENSe:]NR5G:TRACking:TPUT:STATe.....	406

[SENSe:]NR5G:DEMod:CESTimation <State>

Selects the channel estimation method.

Parameters:

<State>

LINT

Channel estimation by interpolating the missing information.

NORMAl

Channel estimation according to 3GPP.

OFF

Turns off channel estimation.

PILPay

Channel estimation by examining both the reference signal and the payload resource elements.

Example:

```
//Select channel estimation method
NR5G:DEM:CEST PILP
```

Manual operation: See "[Channel Estimation](#)" on page 150

[SENSe:]NR5G:DEMod:CETaverage <State>

Select the averaging interval for channel estimation.

Parameters:

<State>

PALL

Averaging every allocation.

TGPP

Averaging according to 3GPP.

*RST: TGPP

Example:

```
//Select time averaging
NR5G:DEM:CET PALL
```

Manual operation: See "[Channel Estimation Time Averaging](#)" on page 151

[SENSe:]NR5G:IQ:GIQE <State>

Turns the calculation of the gain imbalance and the quadrature error in the result summary on and off.

Parameters:

<State> ON | OFF | 1 | 0
 *RST: ON

Example:

//Turn off calculation of results
 NR5G:IQ:GIQE OFF

Manual operation: See "[Gain Imbalance / Quadrature Error](#)" on page 152

[SENSe:]NR5G:TRACking:LEVeI <State>

Turns level tracking on and off.

Parameters:

<State> ON | OFF | 0 | 1
 *RST: OFF

Example:

//Turn on level tracking
 TRAC:LEV ON

Manual operation: See "[Level Tracking](#)" on page 152

[SENSe:]NR5G:TRACking:PHASe <State>

Turns phase tracking on and off.

Parameters:

<State> **OFF**
 Deactivate phase tracking
PIL
 Pilot only
PILPAY
 Pilot and payload
TGPP
 3GPP EVM
 *RST: OFF

Example:

//Use pilots and payload for channel estimation
 SENS:TRAC:PHAS PILPAY

Manual operation: See "[Phase](#)" on page 151

[SENSe:]NR5G:TRACking:TIME <State>

Turns time tracking on and off.

Parameters:

<State> ON | OFF | 1 | 0
 *RST: OFF

Example:

//Turn on time tracking
 NR5G:TRAC:TIME ON

Manual operation: See ["Time Tracking"](#) on page 152

[SENSe:]NR5G:TRACking:TPUT:STATe <State>

Turns the throuput measurement on and off.

Effects of this command

- Number of analyzed frames is set to manual (`[SENSe:]NR5G:FRAMe:COUNT:AUtO`).

Parameters:

<State> ON | OFF | 1 | 0
 *RST: OFF

Example: //Turn on throughput measurement
 NR5G:TRAC:TPUT:STAT ON

Manual operation: See ["Throughput Measurement State"](#) on page 152

6.9.29 Demodulation

<code>[SENSe:]NR5G:DEMod:CAMode</code>	406
<code>[SENSe:]NR5G:DEMod:CMETHod</code>	407
<code>[SENSe:]NR5G:DEMod:CRData</code>	407
<code>[SENSe:]NR5G:DEMod:DDATa</code>	408
<code>[SENSe:]NR5G:DEMod:EFLRange</code>	408
<code>[SENSe:]NR5G:DEMod:FILTer</code>	408
<code>[SENSe:]NR5G:DEMod:PRData</code>	409
<code>[SENSe:]NR5G:DEMod:STADjust</code>	409

[SENSe:]NR5G:DEMod:CAMode <Mode>

Selects the CORESET analysis mode.

Parameters:

<Mode> **AUTO**
 Automatic demodulation of the PDCCH.
 MANual
 Demodulation based on the PDCCH configuration.
 *RST: AUTO

Example: //Select PDCCH demodulation mode
 NR5G:DEM:CAM MAN

Manual operation: See ["CORESET Analysis Mode"](#) on page 154

[SENSe:]NR5G:DEMod:CMETHOD <State>

Selects the EVM calculation method.

Parameters:

<State>

HPOS
EVM at high timing position

LPOS
EVM at low timing position

OTP
EVM at optimal timing position

TGPP
EVM according to 3GPP definition

*RST: TGPP

Example: //Select EVM calculation method
NR5G:DEMod:CMETHOD TGPP

Manual operation: See "[EVM Calculation Method](#)" on page 154

[SENSe:]NR5G:DEMod:CRData <Reference>

Selects the CORESET reference data.

Parameters:

<Reference>

AUTO
Automatic detection of reference values.

ALL0
CORESET consists of 0's only.

PASLots
CORESET based on NR-TM PN23 (pseudo random sequence 23) with all PDCCH having the same sequence.
If an ORAN test case is selected ([CONFigure\[:NR5G\]:ORAN:TCASe](#)), this parameter selects the ORAN PN23 sequence for all PDCCH.

PN23
CORESET based on NR-TM PN23 (pseudo random sequence 23).

*RST: AUTO

Example: //Select CORESET reference data
NR5G:DEMod:CRData ALL0

Manual operation: See "[CORESET Reference Data](#)" on page 155

[SENSe:]NR5G:DEMod:DDATa <State>

Selects the point at which the data is demodulated for the bitstream.

Parameters:

<State>

ADEScramble
Demodulates the descrambled data.

BDEScramble
Demodulates the scrambled data.

DPData
Demodulates the decoded data.

*RST: BDEScramble

Example: //Demodulate decoded data
NR5G:DEM:DDAT DPD

Manual operation: See "[Demodulation Data](#)" on page 153

[SENSe:]NR5G:DEMod:EFLRange <State>

Turns the extended frequency lock range on and off.

Parameters:

<State> ON | OFF | 1 | 0

*RST: OFF

Example: Turn on extended frequency lock range
NR5G:DEM:EFLR ON

Manual operation: See "[Extended Frequency Lock Range](#)" on page 156

[SENSe:]NR5G:DEMod:FILTer <Filter>

Selects the filter for suppression of neighboring channels.

Parameters:

<Filter>

MFILter
Multicarrier filter.

NONE
No filter.

PBWP
Bandwidthpart filter.

*RST: NONE

Example: //Select multicarrier filter
NR5G:DEM:FILT MFIL

Manual operation: See "[Filter](#)" on page 153

[SENSe:]NR5G:DEMod:PRData <Reference>

Selects the PDSCH reference data.

Note that when you select an ORAN test case, this setting is automatically adjusted to the ORAN test case.

Parameters:

<Reference>

AUTO

Automatic detection of reference values.

ALLO

PDSCH consists of 0's only.

PASLots

PDSCH based on NR-TM PN23 (pseudo random sequence 23) with all PDSCH having the same sequence.

If an ORAN test case is selected ([CONFigure\[:NR5G\]:ORAN:TCASe](#)), this parameter selects the ORAN PN23 sequence for all PDSCH.

PN23

PDSCH based on NR-TM PN23 (pseudo random sequence 23) with each PDSCH getting its own sequence.

If an ORAN test case is selected ([CONFigure\[:NR5G\]:ORAN:TCASe](#)), this parameter selects the ORAN PN23 sequence.

*RST: AUTO

Example:

```
//Select PDSCH reference data
NR5G:DEMod:PRD AUTO
```

Manual operation: See "[PDSCH Reference Data](#)" on page 155

[SENSe:]NR5G:DEMod:STADjust <Value>

Defines the symbol time adjustment.

Parameters:

<Value>

Range: 0 to 100

*RST: 50

Default unit: PCT

Example:

```
//Define symbol time adjustment
NR5G:DEMod:STAD 75
```

Manual operation: See "[Symbol Time Adjustment](#)" on page 154

6.9.30 Time alignment measurement

Commands to configure time alignment measurements described elsewhere.

- General configuration: [Chapter 6.9.1, "General configuration"](#), on page 270
- Physical settings: [Chapter 6.9.3, "Physical settings"](#), on page 276
(Component carrier are not supported in the time alignment measurement.)

- Radio frame configuration: [Chapter 6.9.5, "General radio frame configuration"](#), on page 285
- Synchronization signal: [Chapter 6.9.6, "Synchronization signal configuration"](#), on page 287
- Bandwidth parts: [Chapter 6.9.7, "Bandwidth part configuration"](#), on page 293
- Slot configuration: [Chapter 6.9.8, "Slot configuration"](#), on page 297
- PDSCH allocations: [Chapter 6.9.12, "PDSCH allocation configuration"](#), on page 323
(Only one PDSCH allocation is supported in the time alignment measurement.)
- PDSCH DMRS: [Chapter 6.9.14, "Enhanced PDSCH settings: DMRS"](#), on page 347
- Advanced signal configuration: [Chapter 6.9.19, "Advanced settings: global"](#), on page 367
- Frequency: [Chapter 6.9.24, "Frequency configuration"](#), on page 388
- Amplitude: [Chapter 6.9.25, "Amplitude configuration"](#), on page 390
- Data capture: [Chapter 6.9.26, "Data capture"](#), on page 394
- Trigger: [Chapter 6.9.27, "Trigger"](#), on page 398
- Demodulation: [Chapter 6.9.29, "Demodulation"](#), on page 406
- Automatic configuration: [Chapter 6.9.2, "Automatic configuration"](#), on page 272

6.9.31 Transmit on/off power measurements

Commands to configure time alignment measurements described elsewhere.

- General configuration: [Chapter 6.9.1, "General configuration"](#), on page 270
- Physical settings: [Chapter 6.9.3, "Physical settings"](#), on page 276
(Component carrier are not supported in the time alignment measurement.)
- Radio frame configuration: [Chapter 6.9.5, "General radio frame configuration"](#), on page 285
- Synchronization signal: [Chapter 6.9.6, "Synchronization signal configuration"](#), on page 287
- Bandwidth parts: [Chapter 6.9.7, "Bandwidth part configuration"](#), on page 293
- Slot configuration: [Chapter 6.9.8, "Slot configuration"](#), on page 297
- PDSCH / CORESET allocations: [Chapter 6.9.12, "PDSCH allocation configuration"](#), on page 323
- CORESET DMRS: [Chapter 6.9.13, "Enhanced CORESET allocation configuration"](#), on page 331
- PDSCH DMRS: [Chapter 6.9.14, "Enhanced PDSCH settings: DMRS"](#), on page 347
- PTRS: [Chapter 6.9.15, "Enhanced PDSCH settings: PTRS"](#), on page 357
- Scrambling / Coding: [Chapter 6.9.16, "Enhanced PDSCH settings: scrambling / coding"](#), on page 360
- Advanced signal configuration: [Chapter 6.9.19, "Advanced settings: global"](#), on page 367
- Frequency: [Chapter 6.9.24, "Frequency configuration"](#), on page 388

- Amplitude: [Chapter 6.9.25, "Amplitude configuration"](#), on page 390
- Data capture: [Chapter 6.9.26, "Data capture"](#), on page 394
- Trigger: [Chapter 6.9.27, "Trigger"](#), on page 398
- Demodulation: [Chapter 6.9.29, "Demodulation"](#), on page 406
- Automatic configuration: [Chapter 6.9.2, "Automatic configuration"](#), on page 272

CONFigure[:NR5G]:DL[:CC<cc>]:PLC:EIRP	411
CONFigure[:NR5G]:DL[:CC<cc>]:PLC:TRP	411
CONFigure[:NR5G]:OOPower:NFRames	412
DISPlay[:WINDow<n>]:TPOO:PERiod:SELect	412
[SENSe:]NR5G:OOPower:ATIMing	412
[SENSe:]NR5G:OOPower:NCORrection	412
UNIT:OPOWer	413

CONFigure[:NR5G]:DL[:CC<cc>]:PLC:EIRP <Power>

Defines the base station output power for limit selection (P_{rated} , c, EIRP).

Prerequisites for this command

- Select FR2 deployment ([CONFigure\[:NR5G\]:DL\[:CC<cc>\]:DFRange](#)).

Suffix:

<cc> [Component Carrier](#)

Parameters:

<Power> Default unit: dBm

Example:

```
//Define output power
CONF:DL:DFR HIGH
CONF:DL:PLC:EIRP 0.5
```

Manual operation: See ["Base station output power"](#) on page 157

CONFigure[:NR5G]:DL[:CC<cc>]:PLC:TRP <Power>

Defines the base station output power for limit selection (P_{rated} , c, TRP).

Prerequisites for this command

- Select FR2 deployment ([CONFigure\[:NR5G\]:DL\[:CC<cc>\]:DFRange](#)).

Suffix:

<cc> [Component Carrier](#)

Parameters:

<Power> Default unit: dBm

Example:

```
//Define output power
CONF:DL:DFR HIGH
CONF:DL:PLC:TRP 0.5
```

Manual operation: See ["Base station output power"](#) on page 157

CONFigure[:NR5G]:OOPower:NFRames <Frames>

Defines the number of frames to analyze in on / off power measurements.

Parameters:

<Frames> *RST: 25

Example: //Define number of frames to analyze
CONF:OOP:NFR 20

Manual operation: See "[Number of Frames to Analyze](#)" on page 149

DISPlay[:WINDow<n>]:TPOO:PERiod:SElect <Period>

Selects the period to display the rising or falling edge in the on / off power measurement.

Suffix:

<n> [Window](#)

Parameters:

<Period>

Example: //Add diagram for rising edge and view edge for period 2
LAY:ADD? '1',BEL,RIS
DISP:WIND2:TPOO:PER:SEL 2

Manual operation: See "[Transmit On / Off Power](#)" on page 47

[SENSe:]NR5G:OOPower:ATIMing

Adjusts the timing for on / off power measurements.

Example: //Adjust the on / off power timing
NR5G:OOP:ATIM

Usage: Event

Manual operation: See "[Adjust Timing](#)" on page 50

[SENSe:]NR5G:OOPower:NCORrection <State>

Turns noise correction for transmit on / off power measurements on and off.

Parameters:

<State> ON | OFF | 1 | 0
*RST: OFF

Example: //Turn on noise cancelling
NR5G:OOP:NCOR ON

Manual operation: See "[Noise Cancellation](#)" on page 50

UNIT:OPOWer <Unit>

Selects the unit the off power (transmit on / off power measurements) is displayed in.

Parameters:

<Unit>	DBM
	Displays the power as an absolute value in dBm.
	DMHZ
	Displays the power as a relative value in dBm/MHz.
	*RST: DMHZ

Example: //Select the unit dBm.
UNIT:OPOW DBM

6.9.32 Frequency sweep measurements

Commands to configure frequency sweep measurements described elsewhere.

- [CONFigure\[:NR5G\]:LDIRectIon](#) on page 278
- [MMEMemory:LOAD:DEModsetting:ALL](#) on page 279
- [MMEMemory:LOAD:DEModsetting\[:CC<cc>\]](#) on page 280
- [MMEMemory:STORe<n>:DEModsetting:ALL](#) on page 280
- [MMEMemory:STORe<n>:DEModsetting\[:CC<cc>\]](#) on page 280
- [CONFigure\[:NR5G\]:DL\[:CC<cc>\]:BW](#) on page 277
- [\[SENSe:\]POWer:CATegory](#) on page 371

Refer also to the user manual of the R&S VSE base unit for a list of commands supported by the frequency sweep measurements that are not specific to the 5G NR application.

[SENSe:]POWer:ACHannel:AACHannel	413
[SENSe:]POWer:CATegory:B	414
[SENSe:]POWer:SEM:AMPower	414
[SENSe:]POWer:SEM:AMPower:AUTO	414
[SENSe:]POWer:SEM:NTAB	415
[SENSe:]POWer:SEM:NTXU	415
CALCulate<n>:LIMit:ACPower:PMODE	416
CONFigure[:NR5G]:BSTation	416

[SENSe:]POWer:ACHannel:AACHannel <Channel>

Selects the bandwidth of the adjacent channel for ACLR measurements.

Parameters:

<Channel>	E500
	Selects an LTE signal with 5 MHz bandwidth as assumed adjacent channel carrier.
	NOSBw
	Selects an 5G NR signal as assumed adjacent channel carrier.

*RST: NOSBw

Example: //Select assumed adjacent channel
POW:ACH:AACH NOSB

Manual operation: See "[Adjacent Channels](#)" on page 159

[SENSe:]POWer:CATegory:B <Category>

Selects the limit table for category B stations.

Prerequisites for this command

- Select category B base station ([\[SENSe:\]POWer:CATegory](#)).

Parameters:

<Category> OPT1 | OPT2
*RST: OPT1

Example: //Select limits for category B base station
POW:CAT B
POW:CAT:B OPT1

Manual operation: See "[Category](#)" on page 128

[SENSe:]POWer:SEM:AMPower <Power>

Defines the power of a medium range base station.

Prerequisites for this command

- Select a medium range base station ([\[SENSe:\]POWer:CATegory](#)).
- Select manual definition of Tx power ([\[SENSe:\]POWer:SEM:AMPower:AUTO](#)).

Parameters:

<Power> <numeric value>
*RST: 0
Default unit: dBm

Example: //Determine power of medium range base station
POW:CAT MED
POW:SEM:AMP:AUTO OFF
POW:SEM:AMP 3

Manual operation: See "[Tx Power](#)" on page 159

[SENSe:]POWer:SEM:AMPower:AUTO <State>

Selects how the R&S VSE determines the power of a medium range base station.

Prerequisites for this command

- Select a medium range base station (`[SENSe:]POWer:CATegory`).

Parameters:

<State> **ON | 1**
Automatically determines the Tx power.

OFF | 0
Define a Tx power manually with `[SENSe:]POWer:SEM:AMPower`.

*RST: ON

Example: `//Determine power of medium range base station`
`POW:CAT MED`
`POW:SEM:AMP:AUTO ON`

Manual operation: See "[Tx Power](#)" on page 159

[SENSe:]POWer:SEM:NTAB <Value>

Defines the parameter $N_{TABconnectors}$ that defines the position of the spectrum emission mask for 1-H base stations.

Prerequisites for this command

- Select a 1-H base station (`CONFigure[:NR5G]:BSTation`).

Parameters:

<Value> *RST: 1

Example: `//Define N_TABconnector`
`CONF:BST FR1H`
`POW:SEM:NTAB 5`

Manual operation: See "[Position of SEM and ACLR limits](#)" on page 159

[SENSe:]POWer:SEM:NTXU <Value>

Defines the parameter N_{TXU} that defines the position of the spectrum emission mask for 1-H base stations.

Prerequisites for this command

- Select a 1-H base station (`CONFigure[:NR5G]:BSTation`).

Parameters:

<Value> *RST: 1

Example: `//Define N_TXU`
`CONF:BST FR1H`
`POW:SEM:NTXU 5`

Manual operation: See "[Position of SEM and ACLR limits](#)" on page 159

CALCulate<n>:LIMit:ACPpower:PMODE <Mode>

Selects the limit evaluation mode for ACLR measurements.

Supported for ACLR measurements in the 5G application.

Suffix:

<n> irrelevant

 irrelevant

Parameters:

<Mode>

AND

Overall limit check passes if both absolute and relative limit checks pass.

OR

Overall limit check passes if either absolute or relative limit checks pass.

*RST: AND

Example:

```
//Select evaluation mode
CALC:LIM:ACP:PMOD AND
```

Manual operation: See "[Total Limit Pass Mode](#)" on page 160

CONFigure[:NR5G]:BSTation <BSType>

Selects the base station type.

Parameters:

<BSType>

FR1C

Base station for conducted requirements.

FR1H

Base station for hybrid requirements.

FR1O

Base station for over-the-air requirements in FR1.
(Only for ACLR and SEM measurements.)

FR2O

Base station for over-the-air requirements in FR2.
(Only for ACLR and SEM measurements.)

*RST: FR1O

Example:

```
//Select base station type
CONF:BST FR1H
```

Manual operation: See "[Base Station Type](#)" on page 158

6.10 Analysis

- [General analysis tools](#).....417
- [Analysis tools for I/Q measurements](#)..... 429

6.10.1 General analysis tools

- [Trace export](#).....417
- [Diagram scale](#).....418
- [Zoom](#).....420
- [Markers](#).....423

6.10.1.1 Trace export

FORMat:DEXPort:DSEParator	417
FORMat:DEXPort:HEADer	418
FORMat:DEXPort:TRACes	418
MMEMory:STORe<n>:TRACe	418

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.

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

FORMat:DEXPort:TRACes <Selection>

Selects the data to be included in a data export file (see [MMEMory:STORe<n>:TRACe](#) on page 418).

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

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.

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.

6.10.1.2 Diagram scale

[DISPlay\[:WINDow<n>\]\[:SUBWindow<w>\]:TRACe<t>:Y\[:SCALe\]:AUTO](#)..... 418

[DISPlay\[:WINDow<n>\]\[:SUBWindow<w>\]:TRACe<t>:Y\[:SCALe\]:MAXimum](#)..... 419

[DISPlay\[:WINDow<n>\]\[:SUBWindow<w>\]:TRACe<t>:Y\[:SCALe\]:MINimum](#)..... 419

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

Automatically scales the y-axis of a diagram based on the displayed results.

Suffix:

<n>

[Window](#)

<w>

[Subwindow](#)

<t> irrelevant

Setting parameters:

<ONCE>

ALL

Scales the y-axis in all windows for an ideal viewing experience.

DEfault

Restores the default scale of the y-axis.

ONCE

Scales the y-axis in a specific window for an ideal viewing experience.

Example:

```
//Automatically scale the y-axis in subwindow 2 of window 2
DISP:WIND2:SUBW2:TRAC:Y:AUTO ONCE
```

Usage:

Setting only

Manual operation:

See ["Auto Scale"](#) on page 62

See ["Automatic scaling of the y-axis"](#) on page 185

DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:MAXimum
<Value>

Defines the maximum value displayed on the y-axis of a diagram.

Suffix:

<n> [Window](#)

<w> [Subwindow](#)

<t> irrelevant

Parameters:

<Value>

Maximum displayed value. The unit and value range depend on the selected diagram.

Example:

```
//Define maximum value on y-axis in subwindow 2 of window 2
DISP:WIND2:SUBW2:TRAC:Y:MAX 0
```

Manual operation:

See ["Manual scaling of the y-axis"](#) on page 185

DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:MINimum
<Value>

Defines the minimum value displayed on the vertical diagram axis.

Suffix:

<n> [Window](#)

<w> [Subwindow](#)

<t> irrelevant

Parameters:

<Value>

Minimum displayed value. The unit and value range depend on the selected diagram.

Example: //Define minimum value on y-axis in subwindow 2 of window 2
 DISP:WIND2:SUBW2:TRAC:Y:MIN -50

Manual operation: See "Manual scaling of the y-axis" on page 185

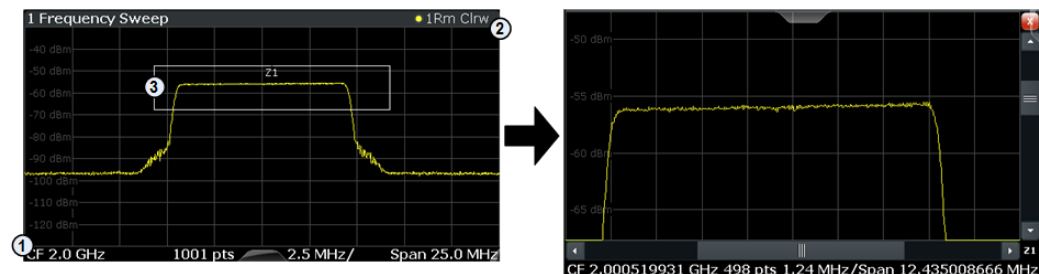
6.10.1.3 Zoom

DISPlay[:WINDow<n>][:SUBWindow<w>]:ZOOM:AREA.....	420
DISPlay[:WINDow<n>][:SUBWindow<w>]:ZOOM:MULTiple<zn>:AREA.....	421
DISPlay[:WINDow<n>][:SUBWindow<w>]:ZOOM:MULTiple<zn>[:STATE].....	422
DISPlay[:WINDow<n>][:SUBWindow<w>]:ZOOM[:STATE].....	422

DISPlay[:WINDow<n>][:SUBWindow<w>]:ZOOM:AREA <x1>,<y1>,<x2>,<y2>

Defines the zoom area.

To define a zoom area, you first have to turn the zoom on.



- 1 = origin of coordinate system (x1 = 0, y1 = 0)
- 2 = end point of system (x2 = 100, y2 = 100)
- 3 = zoom area (e.g. x1 = 60, y1 = 30, x2 = 80, y2 = 75)

Suffix:

<n>	Window
<w>	subwindow Not supported by all applications

Parameters:

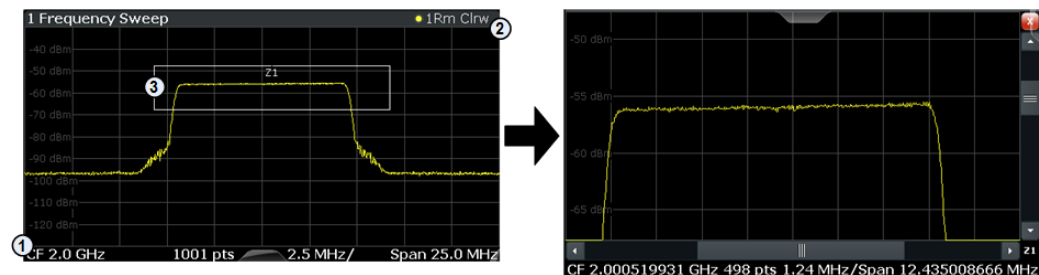
<x1>	Diagram coordinates in % of the complete diagram that define the zoom area. The lower left corner is the origin of coordinate system. The upper right corner is the end point of the system. Range: 0 to 100 Default unit: PCT
<y1>	Diagram coordinates in % of the complete diagram that define the zoom area. The lower left corner is the origin of coordinate system. The upper right corner is the end point of the system. Range: 0 to 100 Default unit: PCT

- <x2> Diagram coordinates in % of the complete diagram that define the zoom area.
The lower left corner is the origin of coordinate system. The upper right corner is the end point of the system.
Range: 0 to 100
Default unit: PCT
- <y2> Diagram coordinates in % of the complete diagram that define the zoom area.
The lower left corner is the origin of coordinate system. The upper right corner is the end point of the system.
Range: 0 to 100
Default unit: PCT

DISPlay[:WINDow<n>][:SUBWindow<w>]:ZOOM:MULTiple<zn>:AREA
 <x1>,<y1>,<x2>,<y2>

Defines the zoom area for a multiple zoom.

To define a zoom area, you first have to turn the zoom on.



- 1 = origin of coordinate system (x1 = 0, y1 = 0)
 2 = end point of system (x2 = 100, y2 = 100)
 3 = zoom area (e.g. x1 = 60, y1 = 30, x2 = 80, y2 = 75)

Suffix:

- <n> [Window](#)
- <w> subwindow
Not supported by all applications
- <zn> Selects the zoom window.

Parameters:

- <x1> Diagram coordinates in % of the complete diagram that define the zoom area.
The lower left corner is the origin of coordinate system. The upper right corner is the end point of the system.
Range: 0 to 100
Default unit: PCT

<y1>	Diagram coordinates in % of the complete diagram that define the zoom area. The lower left corner is the origin of coordinate system. The upper right corner is the end point of the system. Range: 0 to 100 Default unit: PCT
<x2>	Diagram coordinates in % of the complete diagram that define the zoom area. The lower left corner is the origin of coordinate system. The upper right corner is the end point of the system. Range: 0 to 100 Default unit: PCT
<y2>	Diagram coordinates in % of the complete diagram that define the zoom area. The lower left corner is the origin of coordinate system. The upper right corner is the end point of the system. Range: 0 to 100 Default unit: PCT

DISPlay[:WINDow<n>][:SUBWindow<w>]:ZOOM:MULTiple<zn>[:STATe] <State>

Turns the multiple zoom on and off.

Suffix:

<n>	Window
<w>	subwindow Not supported by all applications
<zn>	Selects the zoom window. If you turn off one of the zoom windows, all subsequent zoom windows move up one position.

Parameters:

<State>	ON OFF 0 1 OFF 0 Switches the function off ON 1 Switches the function on
---------	--

DISPlay[:WINDow<n>][:SUBWindow<w>]:ZOOM[:STATe] <State>

Turns the zoom on and off.

Suffix:

<n>	Window
-----	--------

<w> subwindow
Not supported by all applications

Parameters:

<State> ON | OFF | 0 | 1
OFF | 0
Switches the function off
ON | 1
Switches the function on

Example: DISP:ZOOM ON
Activates the zoom mode.

6.10.1.4 Markers

Commands to configure markers described elsewhere.

- CALCulate<n>:DELTaMarker<m>:X
- CALCulate<n>:DELTaMarker<m>:Y?
- CALCulate<n>:MARKer<m>:X
- CALCulate<n>:MARKer<m>:Y
- CALCulate<n>:MARKer<m>:Z?
- CALCulate<n>:MARKer<m>:Z:ALL?

CALCulate<n>:DELTaMarker<m>:AOFF.....	423
CALCulate<n>:DELTaMarker<m>:MAXimum:LEFT.....	424
CALCulate<n>:DELTaMarker<m>:MAXimum:NEXT.....	424
CALCulate<n>:DELTaMarker<m>:MAXimum:RIGHT.....	424
CALCulate<n>:DELTaMarker<m>:MAXimum[:PEAK].....	424
CALCulate<n>:DELTaMarker<m>:MINimum:LEFT.....	425
CALCulate<n>:DELTaMarker<m>:MINimum:NEXT.....	425
CALCulate<n>:DELTaMarker<m>:MINimum:RIGHT.....	425
CALCulate<n>:DELTaMarker<m>:MINimum[:PEAK].....	425
CALCulate<n>:DELTaMarker<m>[:STATe].....	425
CALCulate<n>:DELTaMarker<m>:TRACe.....	426
CALCulate<n>:MARKer<m>:AOFF.....	426
CALCulate<n>:MARKer<m>:MAXimum:LEFT.....	426
CALCulate<n>:MARKer<m>:MAXimum:NEXT.....	427
CALCulate<n>:MARKer<m>:MAXimum:RIGHT.....	427
CALCulate<n>:MARKer<m>:MAXimum[:PEAK].....	427
CALCulate<n>:MARKer<m>:MINimum:LEFT.....	427
CALCulate<n>:MARKer<m>:MINimum:NEXT.....	427
CALCulate<n>:MARKer<m>:MINimum:RIGHT.....	428
CALCulate<n>:MARKer<m>[:STATe].....	428
CALCulate<n>:MARKer<m>:TRACe.....	428
DISPlay[:WINDow<n>]:MTABLE.....	429

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>: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](#)**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>: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](#)

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](#)

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](#)

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](#)

CALCulate<n>:DELTamarker<m>[:STATE] <State>

Turns delta markers on and off.

If necessary, the command activates the delta marker first.

No suffix at DELTmarker turns on delta marker 1.

Suffix:

<n> [Window](#)

<m> [Marker](#)

Parameters:

<State> ON | OFF | 0 | 1
OFF | 0
 Switches the function off
ON | 1
 Switches the function on

Example: `CALC:DELT2 ON`
 Turns on delta marker 2.

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>:MARKer<m>:AOFF

Turns off all markers.

Suffix:

<n> [Window](#)

<m> [Marker](#)

Example: `CALC:MARK:AOFF`
 Switches off all markers.

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](#)

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>: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](#)

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](#)

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](#)

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.
```

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> **1 to 16**

Trace number (or bandwidth part if the trace represents one) the marker is assigned to.

Example:

```
//Assign marker to trace 1
CALC:MARK3:TRAC 2
```

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.

6.10.2 Analysis tools for I/Q measurements

- [Result views](#).....429
- [Result settings](#).....430
- [Evaluation range](#).....435

6.10.2.1 Result views

[DISPlay\[:WINDow<n>\]\[:SUBWindow<w>\]:CCNumber](#)..... 429

[DISPlay\[:WINDow<n>\]\[:SUBWindow<w>\]:FNUMber](#).....430

[DISPlay\[:WINDow<n>\]\[:SUBWindow<w>\]:ISNumber](#)..... 430

DISPlay[:WINDow<n>][:SUBWindow<w>]:CCNumber <Carrier>

Assigns a specific component carrier to a view.

Prerequisites for this command

- Capture more than one component carrier.

Suffix:

<n> irrelevant

<w> [View](#)

Parameters:

<Carrier> <numeric value> (integer only)

Example:

//Select a component carrier to analyze in view 2

DISP:SUBW2:CCN 2

Manual operation:

See "[Views](#)" on page 70

See "[Component Carrier No](#)" on page 192

DISPlay[:WINDow<n>][:SUBWindow<w>]:FNUMber <Frame>

Assigns a specific frame to a view.

Prerequisites for this command

- Capture more than one frame.

Suffix:

<n> irrelevant

<w> [View](#)

Parameters:

<Frame> <numeric value> (integer only)

Example: //Select a frame to analyze in view 2
DISP:SUBW2:FNUM 2

Manual operation: See "[Frame No](#)" on page 193

DISPlay[:WINDow<n>][:SUBWindow<w>]:ISNumber <InputSource>

Assigns a specific input source to a view.

Prerequisites for this command

- Capture with more than one input source.

Suffix:

<n> irrelevant

<w> [View](#)

Parameters:

<InputSource> <numeric value> (integer only)

Example: //Select an input source to analyze in view 2
DISP:SUBW2:ISN 2

Manual operation: See "[Component Carrier No](#)" on page 192

6.10.2.2 Result settings

DISPlay[:WINDow<n>][:SUBWindow<w>]:COUPling	431
DISPlay[:WINDow<n>]:TABLe:ITEM	431
[SENSe:]NR5G:CCOLor	432
[SENSe:]NR5G:CDRPower	432
[SENSe:]NR5G:EMHold	432
[SENSe:]NR5G:RSUMmary:CCResult	432
[SENSe:]NR5G:RSUMmary:PMODE	433
[SENSe:]NR5G:RSUMmary:SHOW	433
[SENSe:]NR5G:TDView	434
UNIT:BSTR	434
UNIT:CAReference	434

UNIT:CAXes.....	435
UNIT:EVM.....	435
UNIT:SAXes.....	435

DISPlay[:WINDow<n>][:SUBWindow<w>]:COUPling <State>

Couples or decouples result display tabs (subwindows).

Subwindow coupling is available for measurements with multiple data streams (like carrier aggregation).

Suffix:

<n> [Window](#)

<w> [Subwindow](#)

Parameters:

<State> ON | OFF | 1 | 0
 *RST: OFF

Example: //Turn on subwindow coupling
 DISP:COUP ON

Manual operation: See "[Subwindow Coupling](#)" on page 189

DISPlay[:WINDow<n>]:TABLe:ITEM <Result>, <State>

Turns the display of individual results in the numerical result summary on and off.

Suffix:

<n> [Window](#)

Parameters:

<Result> BLER | CRES | DSQP | DSSF | DSST | DSTS | UPRach |
 FSOFFset | EVM | EVMPeak | FERRor | GIMBalance | IQOFFset
 | MODulation | NORB | OSTP | RSTP | SSPower | CSIPower |
 PCHannel | POWer | PPRE | PSIGnal | QUADrature | SDPB |
 SDQP | SDSF | SDST | SDTS | SERRor | TPUT | UCCD | UCCH
 | USPB | USQP | USSF | USST | USTS

<State> ON | OFF | 1 | 0

Example: //Display or hide results
 DISP:WIND2:TABL:ITEM DSSF,ON
 DISP:WIND2:TABL:ITEM DSQP,OFF

Manual operation: See "[Result state](#)" on page 191

[SENSe:]NR5G:CCOLor <Type>

Selects the information that the colors of the constellation points in the constellation diagram represent.

Parameters:

<Type>

ALLocation

Colors represent allocation types.

MODulation

Colors represent modulation types.

*RST: MODulation

Example:

```
//Select colors for constellation diagram
NR5G:CCOL MOD
```

Manual operation: See ["Constellation Color"](#) on page 190

[SENSe:]NR5G:CDRPower <State>

Turns the consideration of a boosting factor to calculate the constellation points in the constellation diagram on and off.

Parameters:

<State>

ON | OFF | 1 | 0

*RST: OFF

Example:

```
//Turn on boosting factor
NR5G:CDRP ON
```

Manual operation: See ["Constellation Diagram Relative Power"](#) on page 190

[SENSe:]NR5G:EMHold <State>

Turns the EVM max hold function on and off.

Parameters:

<State>

ON | OFF | 1 | 0

*RST: OFF

Example:

```
//Turn on EVM max hold
NR5G:EMH ON
```

Manual operation: See ["EVM Max Hold"](#) on page 189

[SENSe:]NR5G:RSUMmary:CCResult <Result>

Selects the way multiple carriers are analyzed.

Prerequisites for this command

- Select mutiple carriers (`CONFigure[:NR5G]:NOCC`).

Parameters:

<Result> **ALL**
Analyzes all component carriers and shows information about all of them in the result summary.

VIEWed

Analyzes the two component carriers assigned to the two views. The result summary only shows information about those two component carriers.

*RST: VIEWed

Example: //Analyze all carriers
CONF:NOCC 4
NR5G:RSUM:CCR ALL

Manual operation: See "[CC Result](#)" on page 191

[SENSe:]NR5G:RSUMmary:PMODE <Result>

Selects the power averaging mode.

Parameters:

<Result> **AASL**
Power avergaing over all symbols in a slot.

AASY

Power avergaing over all used symbols in a slot.

*RST: AASL

Example: //Select power averaging mode
NR5G:RSUM:PMOD AASY

Manual operation: See "[Power Mode](#)" on page 191

[SENSe:]NR5G:RSUMmary:SHOW <Result>

Selects the way the contents of the result summary are calculated.

Parameters:

<Result> **AVERage**
Shows the average over all analyzed frames.

SINGle

Shows the result for the frame selected with `[SENSe:]NR5G[:CC<cc>]:FRAMe:SElect`.

If only one frame has been captured, the results are the same in both cases.

*RST: AVERage

Example: //Display results for a single frame
 DISP:SUBW2:FNUM 2
 NR5G:RSUM:SHOW SING

[SENSe:]NR5G:TDView <State>

Turns the 3D view for [selected diagrams](#) on and off.

Parameters:

<State> ON | OFF | 1 | 0
 *RST: OFF

Example: //Turn on 3D view
 NR5G:TDV ON

Manual operation: See "[3D View](#)" on page 189

UNIT:BSTR <Unit>

Selects the way the bit stream is displayed.

Parameters:

<Unit> **SYMBOLS**
 Displays the bit stream using symbols
BITS
 Displays the bit stream using bits
 *RST: SYMBOLS

Example: //Display bit stream as bits
 UNIT:BSTR BIT

Manual operation: See "[Bit Stream Format](#)" on page 188

UNIT:CARReference <Reference>

Selects the reference for result displays whose x-axis shows frequency characteristics of the signal.

Parameters:

<Reference> **LRB**
 Frequency values relative to the lowest resource block.
RTCF
 Frequency values relative to the center frequency of the carrier.
 *RST: LRB

Example: //Select carrier reference
 UNIT:CAR RTCF

Manual operation: See "[Carrier Axes Reference](#)" on page 189

UNIT:CAXes <Unit>

Selects the scale of the x-axis for result displays that show subcarrier results.

Parameters:

<Unit>	CARR Shows the number of the subcarriers on the x-axis.
	HZ Shows the frequency of the subcarriers on the x-axis.

Example: //Display frequency on the x-axis
UNIT:CAX HZ

Manual operation: See "[Carrier Axes](#)" on page 188

UNIT:EVM <Unit>

Selects the EVM unit.

Parameters:

<Unit>	DB EVM results returned in dB
	PCT EVM results returned in % *RST: PCT

Example: //Display EVM results in %
UNIT:EVM PCT

Manual operation: See "[EVM Unit](#)" on page 188

UNIT:SAXes <Unit>

Selects the scale of the x-axis for result displays that show symbol results.

Parameters:

<Unit>	SYMBOL Shows the number of the symbol on the x-axis.
	TIME Shows the time stamp of the symbols on the x-axis.

Example: //Display symbol numbers on the x-axis
UNIT:SAX SYMB

Manual operation: See "[Symbol Axes](#)" on page 188

6.10.2.3 Evaluation range

CONFigure[:NR5G]:DL[:CC<cc>]:BF:AP[:UERS].....	436
[SENSe:]NR5G[:CC<cc>]:ALlocation:SElect.....	436
[SENSe:]NR5G[:CC<cc>]:ANTenna:SElect.....	437
[SENSe:]NR5G[:CC<cc>]:BWPart:SElect.....	437

[SENSe:]NR5G[:CC<cc>]:CARRier:SElect.....	437
[SENSe:]NR5G[:CC<cc>]:FRAMe:SElect.....	438
[SENSe:]NR5G[:CC<cc>]:LOCation:SElect.....	438
[SENSe:]NR5G[:CC<cc>]:MODulation:SElect.....	438
[SENSe:]NR5G[:CC<cc>]:RAP.....	439
[SENSe:]NR5G[:CC<cc>]:SLOT:SElect.....	439
[SENSe:]NR5G[:CC<cc>]:SUBFrame:SElect.....	440
[SENSe:]NR5G[:CC<cc>]:SYMBol:SElect.....	440
[SENSe:]NR5G:RANTenna.....	440

CONFigure[:NR5G]:DL[:CC<cc>]:BF:AP[:UERS] <Port>

Selects an antenna port to analyze.

Suffix:

<cc> Component Carrier

Parameters:

<Port> **ALL**
 Selects all antenna ports.

<numeric_value> (integer only)
 Selects a specific antenna port. The value corresponds to the antenna port number.

*RST: ALL

Example: //Select antenna port
 CONF:DL:BF:AP 1002

Manual operation: See "RS Weights" on page 196

[SENSe:]NR5G[:CC<cc>]:ALlocation:SElect <Allocation>

Filters the displayed results in the constellation diagram by a certain allocation.

Suffix:

<cc> irrelevant

Parameters:

<Allocation> **ALL**
 Shows the results for all allocations.

<numeric value> (integer only)
 Shows the results for a single allocation type.
 Allocation types are mapped to numeric values. For the code assignment, see [Chapter 6.8.1.24, "Return value codes"](#), on page 264.

*RST: ALL

Example: //Display results for all allocations
 NR5G:ALL:SEL ALL

Manual operation: See "Evaluation range for the constellation diagram" on page 195

[SENSe:]NR5G[:CC<cc>]:ANTenna:SElect <Antenna>

Filters the constellation points by a certain antenna port.

Prerequisites for this command

- Create the constellation diagram after MIMO decoding (`[SENSe:]NR5G[:CC<cc>]:LOCation:SElect`).

Suffix:

<cc> irrelevant

Parameters:

<Antenna> Number of the antenna port (for example 1001).

Example:

```
//Filter constellation points by antenna port
NR5G:LOC:SEL AMD
NR5G:ANT:SEL 1001
```

Manual operation: See ["Evaluation range for the constellation diagram"](#) on page 195

[SENSe:]NR5G[:CC<cc>]:BWPart:SElect <BWP>

Filters the displayed results by a certain bandwidth part.

Suffix:

<cc> irrelevant

Parameters:

<BWP> **ALL**
Shows the results for all bandwidth parts, including the SS/PBCH block.

SSBLock

Shows the results for the SS/PBCH block.

<numeric value> (integer only)

Shows the results for a single bandwidth part.

*RST: ALL

Example:

```
//Display results for SS/PBCH block
NR5G:BWP:SEL SSBL
```

Manual operation: See ["BWP/SS Selection"](#) on page 193

[SENSe:]NR5G[:CC<cc>]:CARRier:SElect <Carrier>

Filters the displayed results in the constellation diagram by a certain subcarrier.

Suffix:

<cc> irrelevant

Parameters:

<Carrier> **ALL**
Shows the results for all subcarriers.

<numeric value> (integer only)

Shows the results for a single subcarrier.

***RST:** ALL

Example: //Display results for all subcarriers
NR5G:CARR:SEL ALL

Manual operation: See ["Evaluation range for the constellation diagram"](#) on page 195

[SENSe:]NR5G[:CC<cc>]:FRAMe:SELEct <Frame>

Filters the displayed results by a specific frame.

Suffix:

<cc> irrelevant

Parameters:<Frame> ***RST:** 1

Example: //Display results for frame 2
NR5G:FRAM:SEL 2

Manual operation: See ["Effects of capturing multiple frames on results"](#) on page 81
See ["Frame Selection"](#) on page 193

[SENSe:]NR5G[:CC<cc>]:LOCation:SELEct <Location>

Selects the point in the signal processing at which the constellation diagram is created.

Suffix:

<cc> irrelevant

Parameters:

<Location> **AMD**
After MIMO decoding.
BMD
Before MIMO decoding.
***RST:** BMD

Example: //Select constellation diagram data source
NR5G:LOC:SEL AMD

Manual operation: See ["Evaluation range for the constellation diagram"](#) on page 195

[SENSe:]NR5G[:CC<cc>]:MODulation:SELEct <Modulation>

Filters the displayed results in the constellation diagram by a certain modulation type.

Suffix:

<cc> irrelevant

Parameters:

<Modulation>

ALL

Shows the results for all modulation types.

<numeric value> (integer only)

Shows the results for a single modulation type.

Modulation types are mapped to numeric values. For the code assignment, see [Chapter 6.8.1.24, "Return value codes"](#), on page 264.

*RST: ALL

Example:

```
//Display results for all elements with a QPSK modulation
NR5G:MOD:SEL 2
```

Manual operation:

See ["Evaluation range for the constellation diagram"](#) on page 195

[SENSe:]NR5G[:CC<cc>]:RAP <Port>

Selects the reference antenna port for relative beamforming results.

Suffix:

<cc> irrelevant

Parameters:

<Port>

Value corresponds to the antenna port.

*RST: 1000

Example:

```
//Select reference antenna port
NR5G:RAP 2000
```

Manual operation:

See ["Reference AP"](#) on page 196

[SENSe:]NR5G[:CC<cc>]:SLOT:SElect <Slot>

Filters the displayed results by a certain slot.

Suffix:

<cc> irrelevant

Parameters:

<Slot>

ALL

Shows the results for all slots.

<numeric value> (integer only)

Shows the results for a single slot.

*RST: ALL

Example:

```
//Display result for slot 4
NR5G:SLOT:SEL 4
```

Manual operation:

See ["Slot Selection"](#) on page 195

[SENSe:]NR5G[:CC<cc>]:SUBFrame:SElect <Subframe>

Filters the displayed results by a certain OFDM subframe.

Suffix:

<cc> irrelevant

Parameters:

<Subframe>

ALL

Shows the results for all subframes.

<numeric value> (integer only)

Shows the results for a single subframe.

*RST: ALL

Example:

```
//Display result for subframe 1
NR5G:SUBF:SEL 1
```

Manual operation: See "[Subframe Selection](#)" on page 194

[SENSe:]NR5G[:CC<cc>]:SYMBOL:SElect <Symbol>

Filters the displayed results in the constellation diagram by a certain OFDM symbol.

Suffix:

<cc> irrelevant

Parameters:

<Symbol>

ALL

Shows the results for all symbols.

<numeric value> (integer only)

Shows the results for a single OFDM symbol.

*RST: ALL

Example:

```
//Display result for OFDM symbol 2
NR5G:SYMB:SEL 2
```

Manual operation: See "[Evaluation range for the constellation diagram](#)" on page 195

[SENSe:]NR5G:RANTenna <Antenna>

Selects the (physical) reference antenna for relative beamforming results.

Parameters:

<Antenna>

RX1 | RX2 | RX3 | RX4 | RX5 | RX6 | RX7 | RX8

*RST: RX1

Example:

```
//Select reference antenna
NR5G:RANT RX2
```

Manual operation: See "[Reference Antenna](#)" on page 197

Annex

A Annex: reference

- [Menu reference](#)..... 441
- [Reference of toolbar functions](#)..... 445

A.1 Menu reference

Most functions in the R&S VSE are available from the menus.

- [Common R&S VSE menus](#)..... 441
- [LTE measurement menus](#)..... 443



A.1.1 Common R&S VSE menus

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

- [File menu](#)..... 441
- [Window menu](#)..... 442
- [Help menu](#)..... 443

A.1.1.1 File menu


The "File" menu includes all functionality directly related to any file operations, printing or setting up general parameters.

Menu item	Corresponding icon in toolbar	Description
Save		Saves the current software configuration to a file
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
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

Menu item	Corresponding icon in toolbar	Description
> Replace Measurement Channel	-	Replaces the currently selected channel by the selected application.
> Rename Measurement Channel	-	Changes the name of the selected channel.
> Delete Current Measurement 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 software
> 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 Instruments	-	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.1.1.2 Window menu

The "Window" menu allows you to hide or show individual windows.

Menu item	Corresponding icon in toolbar	Description
Player	-	Displays the "Player" tool window to recall I/Q data recordings
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.1.1.3 Help menu

The "Help" menu provides access to help, support and licensing functions.

Menu item	Corresponding icon in toolbar	Description
Help		Opens the Online help window
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.1.2 LTE measurement menus

- [Input & output menu](#).....443
- [Meas setup menu](#).....444
- [Trace menu](#).....444
- [Marker menu](#).....444
- [Limits menu](#).....445

A.1.2.1 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 LTE measurements

Menu item	Description
Amplitude	Chapter 4.1.17, "Amplitude configuration" , on page 141
Scale	Chapter 5.1.2, "Diagram scale" , on page 185
Frequency	Chapter 4.1.16, "Frequency configuration" , on page 140
Trigger	Chapter 4.1.18, "Trigger configuration" , on page 144
Input Source	Chapter 4.1.15, "Selecting the input and output source" , on page 136
Output Source	

A.1.2.2 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 5G NR measurements

Menu item	Description
Select Measurement	Chapter 3, "Measurements and result displays" , on page 17
Signal Description	Chapter 4.1.3, "Physical signal description" , on page 64
Radio Frame	Chapter 4.1.8, "Radio frame configuration" , on page 78
Trigger / Signal Capture	Chapter 4.1.19, "Data capture" , on page 146 Chapter 4.1.18, "Trigger configuration" , on page 144
Tracking	Chapter 4.1.20, "Tracking" , on page 150
Demod	Chapter 4.1.21, "Demodulation" , on page 152
Evaluation Range	Chapter 5.2.5, "Evaluation range" , on page 193
Result Settings	Chapter 5.2.2, "Result settings" , on page 187
Overview	Chapter 4.1.1, "Configuration overview" , on page 59

A.1.2.3 Trace menu




The "Trace" does not contain any functions for LTE measurements, traces are generally not configurable.

A.1.2.4 Marker menu

The "Marker" menu provides access to marker-specific functions.

This menu is application-specific.

Table A-3: "Marker" menu items for 5G NR measurements

Menu item	Corresponding icon in toolbar	Description
Select marker <x>		Chapter 5.1.4, "Markers" , on page 186
Marker to Trace	-	Chapter 5.1.4, "Markers" , on page 186
All Markers Off		Chapter 5.1.4, "Markers" , on page 186
Marker...		Chapter 5.1.4, "Markers" , on page 186
Search	-	Chapter 5.1.4, "Markers" , on page 186

A.1.2.5 Limits menu

The "Limits" menu does not contain any functions for LTE measurements.

A.2 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.

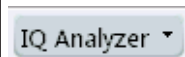






General toolbars

The following functions are generally available for all applications:

"Main" toolbar**Table A-4: 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**Table A-5: 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

Table A-6: 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

Table A-7: Functions in the "Zoom" toolbar







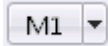






Icon	Description
	Normal mouse mode: the cursor can be used to select (and move) markers in a zoomed display
	Zoom mode: displays a dotted rectangle in the diagram that can be expanded to define the zoom area
	Multiple zoom mode: multiple zoom areas can be defined for the same diagram
	Zoom off: displays the diagram in its original size

Table A-8: 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

Reference of toolbar functions














Icon	Description
	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
	Marker search configuration
	Marker configuration

Table A-9: Functions in the "AutoSet" toolbar

Icon	Description
	Refresh measurement results (R&S VSE VSA and OFDM VSA applications only)
	Auto level
	Auto frequency
	Auto trigger (R&S VSE GSM application only)
	Auto frame (R&S VSE GSM application only)
	Auto search (R&S VSE 3GPP FDD application only)
	Auto scale (R&S VSE 3GPP FDD + Pulse applications only)
	Auto scale all (R&S VSE 3GPP FDD + Pulse applications only)
	Auto all
	Configure auto settings

List of commands (5G NR downlink)

[SENSe:]ADJust:DEMod.....	273
[SENSe:]ADJust:EVM.....	274
[SENSe:]ADJust:EVM:SLOTs.....	274
[SENSe:]ADJust:LEVel.....	274
[SENSe:]ADJust:LEVel<ant>:ALL.....	275
[SENSe:]FREQuency:CENTer:STEP.....	389
[SENSe:]FREQuency:CENTer[:CC<cc>].....	388
[SENSe:]FREQuency:CENTer[:CC<cc>]:MCOFFset.....	285
[SENSe:]FREQuency:CENTer[:CC<cc>]:OFFSet.....	389
[SENSe:]NR5G:CCOLor.....	432
[SENSe:]NR5G:CDRPower.....	432
[SENSe:]NR5G:DEMod:CAMode.....	406
[SENSe:]NR5G:DEMod:CESTimation.....	404
[SENSe:]NR5G:DEMod:CETaverage.....	404
[SENSe:]NR5G:DEMod:CMETHod.....	407
[SENSe:]NR5G:DEMod:CRData.....	407
[SENSe:]NR5G:DEMod:DDATA.....	408
[SENSe:]NR5G:DEMod:EFLRange.....	408
[SENSe:]NR5G:DEMod:FILTer.....	408
[SENSe:]NR5G:DEMod:PRData.....	409
[SENSe:]NR5G:DEMod:STADjust.....	409
[SENSe:]NR5G:EMHold.....	432
[SENSe:]NR5G:FRAMe:COUNT.....	395
[SENSe:]NR5G:FRAMe:COUNT:AUTO.....	395
[SENSe:]NR5G:FRAMe:COUNT:STATe.....	395
[SENSe:]NR5G:FRAMe:SLOT.....	396
[SENSe:]NR5G:FRAMe:SRSLot.....	396
[SENSe:]NR5G:IQ:GIQE.....	404
[SENSe:]NR5G:OOPower:ATIMing.....	412
[SENSe:]NR5G:OOPower:NCORrection.....	412
[SENSe:]NR5G:RANTenna.....	440
[SENSe:]NR5G:RSUMmary:CCResult.....	432
[SENSe:]NR5G:RSUMmary:PMODE.....	433
[SENSe:]NR5G:RSUMmary:SHOW.....	433
[SENSe:]NR5G:TDView.....	434
[SENSe:]NR5G:TRACking:LEVel.....	405
[SENSe:]NR5G:TRACking:PHASe.....	405
[SENSe:]NR5G:TRACking:TIME.....	405
[SENSe:]NR5G:TRACking:TPUT:STATe.....	406
[SENSe:]NR5G[:CC<cc>]:ALLocation:SElect.....	436
[SENSe:]NR5G[:CC<cc>]:ANTenna:SElect.....	437
[SENSe:]NR5G[:CC<cc>]:BWPart:SElect.....	437
[SENSe:]NR5G[:CC<cc>]:CARRier:SElect.....	437
[SENSe:]NR5G[:CC<cc>]:FRAMe:SElect.....	438
[SENSe:]NR5G[:CC<cc>]:LOCation:SElect.....	438
[SENSe:]NR5G[:CC<cc>]:MODulation:SElect.....	438
[SENSe:]NR5G[:CC<cc>]:RAP.....	439

[SENSe:]NR5G[:CC<cc>]:SLOT:SElect.....	439
[SENSe:]NR5G[:CC<cc>]:SUBFrame:SElect.....	440
[SENSe:]NR5G[:CC<cc>]:SYMBol:SElect.....	440
[SENSe:]POWer:ACHannel:AACHannel.....	413
[SENSe:]POWer:CATegory.....	371
[SENSe:]POWer:CATegory:B.....	414
[SENSe:]POWer:SEM:AMPower.....	414
[SENSe:]POWer:SEM:AMPower:AUTO.....	414
[SENSe:]POWer:SEM:NTAB.....	415
[SENSe:]POWer:SEM:NTXU.....	415
[SENSe:]SWAPiq.....	396
[SENSe:]SWEep:CTMode.....	396
[SENSe:]SWEep:LCAPture.....	397
[SENSe:]SWEep:TIME.....	397
[SENSe:]SYNC[:CC<cc>][:STATe]?	216
[SENSe<ip>:]ADJust:CONFigure:LEVel:DURation.....	273
[SENSe<ip>:]ADJust:CONFigure:LEVel:DURation:MODE.....	273
ABORT.....	214
CALCulate<n>:DELTamarker<m>:AOFF.....	423
CALCulate<n>:DELTamarker<m>:MAXimum:LEFT.....	424
CALCulate<n>:DELTamarker<m>:MAXimum:NEXT.....	424
CALCulate<n>:DELTamarker<m>:MAXimum:RIGHT.....	424
CALCulate<n>:DELTamarker<m>:MAXimum[:PEAK].....	424
CALCulate<n>:DELTamarker<m>:MINimum:LEFT.....	425
CALCulate<n>:DELTamarker<m>:MINimum:NEXT.....	425
CALCulate<n>:DELTamarker<m>:MINimum:RIGHT.....	425
CALCulate<n>:DELTamarker<m>:MINimum[:PEAK].....	425
CALCulate<n>:DELTamarker<m>:TRACe.....	426
CALCulate<n>:DELTamarker<m>:X.....	230
CALCulate<n>:DELTamarker<m>:Y?.....	231
CALCulate<n>:DELTamarker<m>[:STATe].....	425
CALCulate<n>:LIMit:ACPower:ACHannel:RESult:ABSolute.....	241
CALCulate<n>:LIMit:ACPower:ACHannel:RESult:RELative.....	242
CALCulate<n>:LIMit:ACPower:ACHannel:RESult?.....	241
CALCulate<n>:LIMit:ACPower:ALTErnate<alt>:RESult?.....	242
CALCulate<n>:LIMit:ACPower:ALTErnate<ch>:RESult:ABSolute.....	243
CALCulate<n>:LIMit:ACPower:ALTErnate<ch>:RESult:RELative.....	243
CALCulate<n>:LIMit:ACPower:GAP<gap>:ACLR:RESult:ABSolute?.....	244
CALCulate<n>:LIMit:ACPower:GAP<gap>:ACLR:RESult:RELative?.....	245
CALCulate<n>:LIMit:ACPower:GAP<gap>:ACLR:RESult?.....	244
CALCulate<n>:LIMit:ACPower:GAP<gap>[:CACLR]:RESult:ABSolute?.....	246
CALCulate<n>:LIMit:ACPower:GAP<gap>[:CACLR]:RESult:RELative?.....	246
CALCulate<n>:LIMit:ACPower:GAP<gap>[:CACLR]:RESult?.....	245
CALCulate<n>:LIMit:ACPower:PMODE.....	416
CALCulate<n>:LIMit:FAIL?.....	247
CALCulate<n>:LIMit:OOPower:OFFPower?.....	239
CALCulate<n>:LIMit:OOPower:TRANsient?.....	240
CALCulate<n>:LIMit[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:ALL:RESult?.....	235
CALCulate<n>:LIMit[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:EVM:DS1K[:AVERAge]:RESult?.....	236
CALCulate<n>:LIMit[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:EVM:DSQP[:AVERAge]:RESult?.....	236

CALCulate<n>:LIMit[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:EVM:DSSF[:AVERAge]:RESult?.	237
CALCulate<n>:LIMit[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:EVM:DSST[:AVERAge]:RESult?.	238
CALCulate<n>:LIMit[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:EVM:DSTS[:AVERAge]:RESult?.	238
CALCulate<n>:LIMit[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:EVM:FERRor[:AVERAge]:RESult?.....	239
CALCulate<n>:MARKer<m>:AOFF.....	426
CALCulate<n>:MARKer<m>:FUNctioN:POWer<sb>:RESult[:CURRent]?	266
CALCulate<n>:MARKer<m>:MAXimum:LEFT.....	426
CALCulate<n>:MARKer<m>:MAXimum:NEXT.....	427
CALCulate<n>:MARKer<m>:MAXimum:RIGHT.....	427
CALCulate<n>:MARKer<m>:MAXimum[:PEAK].....	427
CALCulate<n>:MARKer<m>:MINimum:LEFT.....	427
CALCulate<n>:MARKer<m>:MINimum:NEXT.....	427
CALCulate<n>:MARKer<m>:MINimum:RIGHT.....	428
CALCulate<n>:MARKer<m>:TRACe.....	428
CALCulate<n>:MARKer<m>:X.....	231
CALCulate<n>:MARKer<m>:Y.....	232
CALCulate<n>:MARKer<m>:Z:ALL?.....	233
CALCulate<n>:MARKer<m>:Z?.....	232
CALCulate<n>:MARKer<m>[:STATe].....	428
CALCulate<n>:STATistics:CCDF:X<t>?.....	233
CALCulate<n>:STATistics:RESult<res>?.....	234
CONFigure:GENerator:CONTRol[:STATe].....	383
CONFigure:GENerator:FREQuency:CENTer:SYNC[:STATe].....	378
CONFigure:GENerator:IPConnection:ADDReSS.....	378
CONFigure:GENerator:IPConnection:LEDState?.....	378
CONFigure:GENerator:LEVel:DUTGain.....	379
CONFigure:GENerator:LEVel:DUTLimit.....	379
CONFigure:GENerator:LEVel:DUTLimit:STATe.....	380
CONFigure:GENerator:POWer:LEVel.....	380
CONFigure:GENerator:POWer:LEVel:STATe.....	379
CONFigure:GENerator:QERRor?.....	381
CONFigure:GENerator:RFOutput[:STATe].....	382
CONFigure:GENerator:SETTings:UPDate:RF.....	383
CONFigure:SETTings:NR5G.....	381
CONFigure:SETTings:NR5G:PINterVal.....	381
CONFigure:SETTings:NR5G:SYNC.....	382
CONFigure:SETTings:RF.....	382
CONFigure[:NR5G]:BSTation.....	416
CONFigure[:NR5G]:CENTer.....	281
CONFigure[:NR5G]:CRASter.....	282
CONFigure[:NR5G]:CSCapture.....	282
CONFigure[:NR5G]:CSPacing.....	282
CONFigure[:NR5G]:DL[:CC<cc>]:BF:AP[:UERS].....	436
CONFigure[:NR5G]:DL[:CC<cc>]:BW.....	277
CONFigure[:NR5G]:DL[:CC<cc>]:DEMod:AUTO.....	275
CONFigure[:NR5G]:DL[:CC<cc>]:DFRAnge.....	277
CONFigure[:NR5G]:DL[:CC<cc>]:EUIDs.....	368
CONFigure[:NR5G]:DL[:CC<cc>]:FNNF.....	368
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:ADD.....	294

CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:CLEar.....	294
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:CSI<csi>:BITMap.....	304
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:CSI<csi>:CTYPe?.....	305
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:CSI<csi>:DENSity.....	305
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:CSI<csi>:LONE.....	306
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:CSI<csi>:LZERo.....	306
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:CSI<csi>:NORBs.....	307
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:CSI<csi>:PORT?.....	307
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:CSI<csi>:POWER.....	308
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:CSI<csi>:RESources.....	308
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:CSI<csi>:ROW.....	308
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:CSI<csi>:SID.....	309
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:CSI<csi>:SLOT:APERiodic.....	309
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:CSI<csi>:SLOT:MODE.....	310
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:CSI<csi>:SLOT:PERiodicity.....	310
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:CSI<csi>:SLOT:POFFset.....	311
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:CSI<csi>:SRB.....	311
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:CSI<csi>:STATe.....	312
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:CSI<csi>:ZPOWER.....	312
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:CSLot.....	297
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:DETEction.....	275
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:DUPLicate.....	294
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:PRS:KPComb.....	313
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:PRS:KPOFFset.....	313
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:PRS:LPRS.....	314
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:PRS:LPStart.....	314
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:PRS:NORBs.....	315
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:PRS:NPID.....	315
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:PRS:POWER.....	315
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:PRS:SLOT:APERiodic.....	316
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:PRS:SRB.....	316
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:PRS:STATe.....	316
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:RBCount.....	295
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:RBOFFset.....	295
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:REMOve.....	295
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SCOUNT?.....	298
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:ALCount.....	324
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:ALLocation<al>:CCODing:	
MCSTable.....	361
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:ALLocation<al>:CCODing:	
RVINDEX.....	362
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:ALLocation<al>:CCODing:	
TBSFs.....	362
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:ALLocation<al>:CCODing:	
TBSize.....	363
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:ALLocation<al>:CLMapping.....	348
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:ALLocation<al>:COPY.....	326
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:ALLocation<al>:COPY:DURATION324	
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:ALLocation<al>:COPY:MODE....	325

CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:ALLocation<al>:COPY:PERiod...	326
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:ALLocation<al>:COPY:SLOT.....	327
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:ALLocation<al>:DMRS:AP.....	349
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:ALLocation<al>:DMRS:CGWD...	349
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:ALLocation<al>:DMRS:CTYPe...	350
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:ALLocation<al>:DMRS: MSYMBOL:APOSition.....	350
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:ALLocation<al>:DMRS: MSYMBOL:LENGth.....	350
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:ALLocation<al>:DMRS:MTYPe...	351
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:ALLocation<al>:DMRS:NSCid....	351
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:ALLocation<al>:DMRS:POWer...	352
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:ALLocation<al>:DMRS:RST.....	352
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:ALLocation<al>:DMRS: SGENeration.....	353
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:ALLocation<al>:DMRS:SID.....	353
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:ALLocation<al>:DMRS:SIONe....	354
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:ALLocation<al>:DMRS:TAPos....	355
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:ALLocation<al>:POWer.....	328
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:ALLocation<al>:PTRS:K.....	357
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:ALLocation<al>:PTRS:L.....	358
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:ALLocation<al>:PTRS:POWer....	358
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:ALLocation<al>:PTRS:REOffset	359
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:ALLocation<al>:PTRS[:STATe]...	359
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:ALLocation<al>:RBCount.....	328
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:ALLocation<al>:RBOffset.....	329
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:ALLocation<al>:RPOint.....	355
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:ALLocation<al>:SCOUnt.....	329
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:ALLocation<al>:SCRambling.....	363
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:ALLocation<al>: SCRambling:DSID.....	364
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:ALLocation<al>:SOFFset.....	330
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:ALLocation<al>:UEID.....	356
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:ALLocation<al>:VTPinter.....	356
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:ALLocation<al>[: CW<cw>]:MODulation.....	327
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:ATYPe.....	298
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:COPY.....	298
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:COReset<cr>:COPY.....	319
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:COReset<cr>:COPY:DURation...	317
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:COReset<cr>:COPY:MODE.....	318
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:COReset<cr>:COPY:PERiod.....	319
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:COReset<cr>:COPY:SLOT.....	320
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:COReset<cr>:DMRS:POWer.....	332
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:COReset<cr>:DMRS:RPOint.....	332
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:COReset<cr>:DMRS: SCRam[:STATe].....	333
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:COReset<cr>:DMRS:SID.....	333
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:COReset<cr>: INTerleaving:BSIZe.....	334

CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:COReset<cr>:INTerleaving:ISIZE334	
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:COReset<cr>: INTerleaving:NSHift.....	335
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:COReset<cr>: INTerleaving:SINDEX.....	335
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:COReset<cr>: INTerleaving:STATe.....	336
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:COReset<cr>:PDCCh<cf>: ALEVel.....	336
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:COReset<cr>:PDCCh<cf>: CCEindex.....	337
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:COReset<cr>:PDCCh<cf>: DCIFormat.....	337
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:COReset<cr>:PDCCh<cf>: DCISettings:FDRAssign.....	338
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:COReset<cr>:PDCCh<cf>: DCISettings:ITEM.....	339
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:COReset<cr>:PDCCh<cf>: DCISettings:LIST?.....	342
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:COReset<cr>:PDCCh<cf>: DCISettings:NOBLock.....	343
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:COReset<cr>:PDCCh<cf>: DCISettings:SCOPE.....	343
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:COReset<cr>:PDCCh<cf>: DCISettings:TPCCCommand.....	344
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:COReset<cr>:PDCCh<cf>: PLENght.....	345
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:COReset<cr>:PDCCh<cf>:RNTI.345	
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:COReset<cr>:PDCCh<cf>: USAGe.....	346
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:COReset<cr>:PDSCCh:STATe.....	346
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:COReset<cr>:PGRanularity.....	347
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:COReset<cr>:POWer.....	320
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:COReset<cr>:RBCount.....	321
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:COReset<cr>:RBOFFset.....	321
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:COReset<cr>:SCOUNT.....	322
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:COReset<cr>:SOFFset.....	322
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:CRSCOUNT.....	323
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:CUID.....	330
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:FORMAt.....	299
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:PASTe:ALL.....	299
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:PASTe:TO.....	301
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:PASTe:TO:DURation.....	300
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:PASTe:TO:MODE.....	300
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:PASTe:TO:PERiod.....	302
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:PASTe:TO:SLOTs.....	302
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:PASTe[SLOT].....	303
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SLOT<sl>:PRESet.....	303
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPart<bwp>:SSPacing.....	296
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:BWPCount?.....	297

CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:COPY.....	285
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:PASTe:ALL.....	285
CONFigure[:NR5G]:DL[:CC<cc>]:FRAMe<fr>:PASTe[:FRAMe].....	286
CONFigure[:NR5G]:DL[:CC<cc>]:FTConfig.....	286
CONFigure[:NR5G]:DL[:CC<cc>]:IDC.....	368
CONFigure[:NR5G]:DL[:CC<cc>]:LTE:CBW.....	375
CONFigure[:NR5G]:DL[:CC<cc>]:LTE:MBSFn:SUBFrame<sf>:STATe.....	375
CONFigure[:NR5G]:DL[:CC<cc>]:LTE:NAP.....	376
CONFigure[:NR5G]:DL[:CC<cc>]:LTE:POINta.....	376
CONFigure[:NR5G]:DL[:CC<cc>]:LTE:STATe.....	376
CONFigure[:NR5G]:DL[:CC<cc>]:LTE:VSHift.....	377
CONFigure[:NR5G]:DL[:CC<cc>]:PAMapping<cf>:CSIRs:AP<ap>.....	364
CONFigure[:NR5G]:DL[:CC<cc>]:PAMapping<cf>:PDSch:AP<ap>.....	365
CONFigure[:NR5G]:DL[:CC<cc>]:PAMapping<cf>:STATe.....	365
CONFigure[:NR5G]:DL[:CC<cc>]:PLC:CID.....	278
CONFigure[:NR5G]:DL[:CC<cc>]:PLC:EIRP.....	411
CONFigure[:NR5G]:DL[:CC<cc>]:PLC:TRP.....	411
CONFigure[:NR5G]:DL[:CC<cc>]:RFUC:FZERo:FREQuency.....	369
CONFigure[:NR5G]:DL[:CC<cc>]:RFUC:FZERo:MODE.....	369
CONFigure[:NR5G]:DL[:CC<cc>]:RFUC:STATe.....	370
CONFigure[:NR5G]:DL[:CC<cc>]:RPA:AFREquency?.....	371
CONFigure[:NR5G]:DL[:CC<cc>]:RPA:KZERo:SCFE.....	372
CONFigure[:NR5G]:DL[:CC<cc>]:RPA:KZERo:SCFT.....	372
CONFigure[:NR5G]:DL[:CC<cc>]:RPA:KZERo:SCNS.....	372
CONFigure[:NR5G]:DL[:CC<cc>]:RPA:KZERo:SCOT.....	373
CONFigure[:NR5G]:DL[:CC<cc>]:RPA:KZERo:SCST.....	373
CONFigure[:NR5G]:DL[:CC<cc>]:RPA:KZERo:SCTT.....	374
CONFigure[:NR5G]:DL[:CC<cc>]:RPA:RTCF.....	374
CONFigure[:NR5G]:DL[:CC<cc>]:RPA:TBOFset?.....	374
CONFigure[:NR5G]:DL[:CC<cc>]:SSBLock<ssb>:ASOFset.....	287
CONFigure[:NR5G]:DL[:CC<cc>]:SSBLock<ssb>:BSPeriod.....	287
CONFigure[:NR5G]:DL[:CC<cc>]:SSBLock<ssb>:DETectioN.....	276
CONFigure[:NR5G]:DL[:CC<cc>]:SSBLock<ssb>:HFOFset.....	288
CONFigure[:NR5G]:DL[:CC<cc>]:SSBLock<ssb>:L.....	288
CONFigure[:NR5G]:DL[:CC<cc>]:SSBLock<ssb>:OFFSet.....	289
CONFigure[:NR5G]:DL[:CC<cc>]:SSBLock<ssb>:PATtern.....	289
CONFigure[:NR5G]:DL[:CC<cc>]:SSBLock<ssb>:PBCH:POWer.....	290
CONFigure[:NR5G]:DL[:CC<cc>]:SSBLock<ssb>:PDMRs:POWer.....	290
CONFigure[:NR5G]:DL[:CC<cc>]:SSBLock<ssb>:PSS:POWer.....	291
CONFigure[:NR5G]:DL[:CC<cc>]:SSBLock<ssb>:RTO.....	291
CONFigure[:NR5G]:DL[:CC<cc>]:SSBLock<ssb>:SSPacing.....	292
CONFigure[:NR5G]:DL[:CC<cc>]:SSBLock<ssb>:SSS:POWer.....	292
CONFigure[:NR5G]:DL[:CC<cc>]:SSBLock<ssb>[:STATe<ss>].....	293
CONFigure[:NR5G]:DL[:CC<cc>]:SSCA.....	370
CONFigure[:NR5G]:FCOFset.....	283
CONFigure[:NR5G]:FELC:STATe.....	370
CONFigure[:NR5G]:GMCFreq.....	283
CONFigure[:NR5G]:LDIRectioN.....	278
CONFigure[:NR5G]:MEASurement.....	271
CONFigure[:NR5G]:MSHelper:CONDuctor.....	366

CONFigure[:NR5G]:MSHelper:MHELper.....	366
CONFigure[:NR5G]:NCSPacing.....	283
CONFigure[:NR5G]:NOCC.....	283
CONFigure[:NR5G]:NSources.....	367
CONFigure[:NR5G]:OBANd.....	277
CONFigure[:NR5G]:OMODE.....	284
CONFigure[:NR5G]:OOPower:NFRames.....	412
CONFigure[:NR5G]:ORAN:TCASe.....	370
CONFigure[:NR5G]:OREL.....	284
DISPlay[:WINDow<n>]:MTABLE.....	429
DISPlay[:WINDow<n>]:TAB<tab>:SElect.....	205
DISPlay[:WINDow<n>]:TABLE:ITEM.....	431
DISPlay[:WINDow<n>]:TPOO:PERiod:SElect.....	412
DISPlay[:WINDow<n>][:SUBWindow<w>]:CCNumber.....	429
DISPlay[:WINDow<n>][:SUBWindow<w>]:COUPling.....	431
DISPlay[:WINDow<n>][:SUBWindow<w>]:FNUMber.....	430
DISPlay[:WINDow<n>][:SUBWindow<w>]:ISNumber.....	430
DISPlay[:WINDow<n>][:SUBWindow<w>]:SElect.....	205
DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:AUTO.....	418
DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:MAXimum.....	419
DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:MINimum.....	419
DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:RLEVel<ant>.....	390
DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:RLEVel<ant>:OFFSet.....	390
DISPlay[:WINDow<n>][:SUBWindow<w>]:ZOOM:AREA.....	420
DISPlay[:WINDow<n>][:SUBWindow<w>]:ZOOM:MULTiple<zn>:AREA.....	421
DISPlay[:WINDow<n>][:SUBWindow<w>]:ZOOM:MULTiple<zn>[:STATE].....	422
DISPlay[:WINDow<n>][:SUBWindow<w>]:ZOOM[:STATE].....	422
FETCh:ALL:SUMMary:EVM:ALL?.....	219
FETCh:ALL:SUMMary:EVM:DS1K?.....	220
FETCh:ALL:SUMMary:EVM:DSQP?.....	220
FETCh:ALL:SUMMary:EVM:DSSF?.....	221
FETCh:ALL:SUMMary:EVM:DSST?.....	222
FETCh:ALL:SUMMary:EVM:DSTS?.....	222
FETCh:ALL:SUMMary:EVM:PCHannel?.....	223
FETCh:ALL:SUMMary:EVM:PEAK?.....	223
FETCh:ALL:SUMMary:EVM:PSIGnal?.....	224
FETCh:ALL:SUMMary:POWer?.....	226
FETCh:TAERror[:CC<cc>]:AP<ap>:MAXimum?.....	230
FETCh:TAERror[:CC<cc>]:AP<ap>:MINimum?.....	230
FETCh:TAERror[:CC<cc>]:AP<ap>[:AVERAge]?.....	230
FETCh[:CC<cc>]:PLC:CID?.....	279
FETCh[:CC<cc>][:ISRC<ant>]:SUMMary:CRESt[:AVERAge]?.....	219
FETCh[:CC<cc>][:ISRC<ant>]:SUMMary:TFRame?.....	229
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:ALL?.....	218
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:BLER:MAXimum?.....	219
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:BLER:MINimum?.....	219
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:BLER[:AVERAge]?.....	219
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:EVM:DS1K:MAXimum?.....	220
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:EVM:DS1K:MINimum?.....	220
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:EVM:DS1K[:AVERAge]?.....	220

FETCh[CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:EVM:DSQP:MAXimum?.....	220
FETCh[CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:EVM:DSQP:MINimum?.....	221
FETCh[CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:EVM:DSQP[:AVERAge]?.....	221
FETCh[CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:EVM:DSSF:MAXimum?.....	221
FETCh[CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:EVM:DSSF:MINimum?.....	221
FETCh[CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:EVM:DSSF[:AVERAge]?.....	221
FETCh[CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:EVM:DSST:MAXimum?.....	222
FETCh[CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:EVM:DSST:MINimum?.....	222
FETCh[CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:EVM:DSST[:AVERAge]?.....	222
FETCh[CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:EVM:DSTS:MAXimum?.....	222
FETCh[CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:EVM:DSTS:MINimum?.....	222
FETCh[CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:EVM:DSTS[:AVERAge]?.....	222
FETCh[CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:EVM:PCHannel:MAXimum?.....	223
FETCh[CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:EVM:PCHannel:MINimum?.....	223
FETCh[CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:EVM:PCHannel[:AVERAge]?.....	223
FETCh[CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:EVM:PEAK:MAXimum?.....	223
FETCh[CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:EVM:PEAK:MINimum?.....	223
FETCh[CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:EVM:PEAK[:AVERAge]?.....	223
FETCh[CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:EVM:PSIGnal:MAXimum?.....	224
FETCh[CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:EVM:PSIGnal:MINimum?.....	224
FETCh[CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:EVM:PSIGnal[:AVERAge]?.....	224
FETCh[CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:EVM[:ALL]:MAXimum?.....	219
FETCh[CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:EVM[:ALL]:MINimum?.....	219
FETCh[CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:EVM[:ALL][:AVERAge]?.....	219
FETCh[CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:FERRor:MAXimum?.....	224
FETCh[CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:FERRor:MINimum?.....	224
FETCh[CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:FERRor[:AVERAge]?.....	224
FETCh[CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:GIMBalance:MAXimum?.....	225
FETCh[CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:GIMBalance:MINimum?.....	225
FETCh[CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:GIMBalance[:AVERAge]?.....	225
FETCh[CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:IQOFfset:MAXimum?.....	225
FETCh[CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:IQOFfset:MINimum?.....	225
FETCh[CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:IQOFfset[:AVERAge]?.....	225
FETCh[CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:OSTP:MAXimum?.....	226
FETCh[CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:OSTP:MINimum?.....	226
FETCh[CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:OSTP[:AVERAge]?.....	226
FETCh[CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:POWer:MAXimum?.....	226
FETCh[CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:POWer:MINimum?.....	226
FETCh[CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:POWer[:AVERAge]?.....	226
FETCh[CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:QUADerror:MAXimum?.....	227
FETCh[CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:QUADerror:MINimum?.....	227
FETCh[CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:QUADerror[:AVERAge]?.....	227
FETCh[CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:RSRP:CSI:MAXimum?.....	227
FETCh[CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:RSRP:CSI:MINimum?.....	227
FETCh[CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:RSRP:CSI[:AVERAge]?.....	227
FETCh[CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:RSRP:SS:MAXimum?.....	227
FETCh[CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:RSRP:SS:MINimum?.....	227
FETCh[CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:RSRP:SS[:AVERAge]?.....	227
FETCh[CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:RSTP:MAXimum?.....	228
FETCh[CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:RSTP:MINimum?.....	228

FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:RSTP[:AVERAge]?	228
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:SERRor:MAXimum?	228
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:SERRor:MINimum?	228
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:SERRor[:AVERAge]?	228
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:TPUT:MAXimum?	229
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:TPUT:MINimum?	229
FETCh[:CC<cc>][:ISRC<ant>][:FRAMe<fr>]:SUMMary:TPUT[:AVERAge]?	229
FORMat:DEXPort:DSEParator	417
FORMat:DEXPort:HEADer	417
FORMat:DEXPort:TRACes	418
FORMat[:DATA]	267
INITiate<n>:CONTinuous	215
INITiate<n>[:IMMediate]	216
INPut:FILE<fi>:PATH	384
INPut:SElect	385
INPut<ip>:ATTenuation<ant>	391
INPut<ip>:ATTenuation<ant>:AUTO	391
INPut<ip>:COUPling<ant>	392
INPut<ip>:EATT<ant>	393
INPut<ip>:EATT<ant>:AUTO	394
INPut<ip>:EATT<ant>:STATe	394
INPut<ip>:FILE:ZPADing	384
INPut<ip>:FILTer:HPASs[:STATe]	384
INPut<ip>:FILTer:YIG[:STATe]	385
INPut<ip>:GAIN<ant>:STATe	392
INPut<ip>:GAIN<ant>[:VALue]	392
INPut<ip>:IMPedance<ant>	393
INPut<ip>:RF:CAPMode	386
INPut<ip>:RF:CAPMode:IQ:SRATe	386
INPut<ip>:RF:CAPMode:WAVEform:SRATe	387
INSTrument:BLOCK:CHANnel[:SETTings]:SOURce<si>	387
INSTrument:BLOCK:CHANnel[:SETTings][:CC<cc>]:APMapping<ap>:CONFigure	367
INSTrument[:SElect]	204
LAYout:ADD[:WINDow]?	208
LAYout:CATalog[:WINDow]?	210
LAYout:GLOBal:ADD[:WINDow]?	206
LAYout:GLOBal:CATalog[:WINDow]?	206
LAYout:GLOBal:IDENtify[:WINDow]?	207
LAYout:GLOBal:REMove[:WINDow]	208
LAYout:GLOBal:REPLace[:WINDow]	208
LAYout:IDENtify[:WINDow]?	211
LAYout:REMove[:WINDow]	211
LAYout:REPLace[:WINDow]	212
LAYout:WINDow<n>:ADD?	212
LAYout:WINDow<n>:IDENtify?	213
LAYout:WINDow<n>:REMove	213
LAYout:WINDow<n>:REPLace	213
LAYout:WINDow<n>:TYPE	214
MMEMory:LOAD:DEModsetting:ALL	279
MMEMory:LOAD:DEModsetting[:CC<cc>]	280

MMEMory:LOAD:TMODeI[:CC<cc>].....	279
MMEMory:STORe<n>:DEModsetting:ALL.....	280
MMEMory:STORe<n>:DEModsetting[:CC<cc>].....	280
MMEMory:STORe<n>:IQ:STATe.....	271
MMEMory:STORe<n>:MSERvice.....	272
MMEMory:STORe<n>:TRACe.....	418
SYSTem:COMMunicate:RDEvice:OSCilloscope:SRATe.....	388
SYSTem:PRESet:CHANnel[:EXEC].....	272
TRACe:IQ:SRATe?.....	398
TRACe<n>:CATalog?.....	267
TRACe<n>[:DATA]:X?.....	269
TRACe<n>[:DATA]?.....	268
TRIGger[:SEQuence]:DTIME.....	398
TRIGger[:SEQuence]:HOLDoff<ant>[:TIME].....	398
TRIGger[:SEQuence]:IFPower:HOLDoff.....	399
TRIGger[:SEQuence]:IFPower:HYSTeresis.....	399
TRIGger[:SEQuence]:LEVel:MAPower.....	401
TRIGger[:SEQuence]:LEVel<ant>:IFPower.....	400
TRIGger[:SEQuence]:LEVel<ant>:IQPower.....	400
TRIGger[:SEQuence]:LEVel<ant>:RFPower.....	401
TRIGger[:SEQuence]:LEVel<ant>[:EXternal<tp>].....	399
TRIGger[:SEQuence]:MAPower:HOLDoff.....	401
TRIGger[:SEQuence]:MAPower:HYSTeresis.....	402
TRIGger[:SEQuence]:PORT<ant>.....	402
TRIGger[:SEQuence]:SLOPe.....	402
TRIGger[:SEQuence]:SOURce<ant>.....	403
UNIT:BSTR.....	434
UNIT:CAReference.....	434
UNIT:CAXes.....	435
UNIT:EVM.....	435
UNIT:OPower.....	413
UNIT:SAXes.....	435

Index

A

AC/DC coupling	144
ACLR	51
Adjust timing	50
Allocation	
Filter by	195
Allocation ID vs symbol x carrier	38
Allocation summary	34
Amplitude	142
Application cards	10
Application notes	10
Attenuation	143
Auto level	142

B

Beamforming summary	41
Bit stream	36
Bitstream format	188
Brochures	9

C

Capture buffer	27
Capture time	147
Carrier	
Filter by	195
Carrier axis scale	188
CCDF	33
Center frequency	140
Channel decoder results	35
Closing	
Windows (remote)	213
Configuration overview	59
Constellation diagram	34
Configuration	195
Constellation selection	195
Conventions	
SCPI commands	200

D

Data capture	146
Data format	
Remote	417, 418
Data input	136
Data sheets	9
Duplexing	65

E

Evaluation methods	
Remote	206, 208
EVM calculation method	154
EVM unit	188
EVM vs Carrier	28
EVM vs RB	30
EVM vs symbol	29
EVM vs symbol x carrier	38
External Attenuation	143

F

Filters	
High-pass (RF input)	136
YIG (remote)	385
Flatness vs carrier	32
Format	
Data (remote)	417, 418
Frequency	
Configuration	140
Frequency error vs subframe	31
Frequency error vs symbol	30
Frequency sweep	50

H

Hardware settings	
Displayed	15
High-pass filter	
RF input	136

I

I/Q measurement	27
Impedance	
Setting	144
Input	
Coupling	144
Input source	136
Input sources	
Channels	139
Installation	14

L

Level configuration	142
Link direction	65

M

Marker table	
Evaluation method	42
Markers	
Table (evaluation method)	42
Measurement	17
ACLR	51
alloc ID vs sym x carrier	38
allocation summary	34
Beamforming summary	41
bit stream	36
Capture buffer	27
CCDF	33
channel decoder results	35
constellation	34
Continuous	19
EVM vs carrier	28
EVM vs RB	30
EVM vs sym x carr	38
EVM vs symbol	29
flatness vs carrier	32
freq err vs subframe	31
freq err vs symbol	30
on/off power	47
power spectrum	32

power vs sym x carr	38
Refresh	19
Result displays	19
Single	19
spectrum mask	52
Measurement channels	
Input source	139
Measurement time	147
Modulation	
Filter by	195
N	
Noise cancellation	50
O	
Offset	
Frequency	140
Reference level	142
On/off power	47
Options	
High-pass filter	136
Preamplifier	143
Overview	59
P	
PDSCH reference data	155
Peak list	
Evaluation method	53
Phase error	151
Physical signal description	64
Power spectrum	32
Power vs symbol x carrier	38
Preamplifier	
Setting	143
Softkey	143
Presetting	
Channels	60
R	
Reference Level	142
Release notes	10
Remote commands	
Basics on syntax	199
Boolean values	203
Capitalization	200
Character data	203
Data blocks	204
Numeric values	202
Optional keywords	201
Parameters	202
Strings	203
Suffixes	201
Restoring	
Channel settings	60
Result displays	19
Marker table	42
Peak list	53
Results	
Data format (remote)	417, 418
RF input	136
RF measurement	50
S	
SEM position	159
Sequences	
Remote	215
Settings	
Bitstream format	188
Capture time	147
Carrier axes	188
Constellation selection	195
EVM calculation method	154
EVM unit	188
Ext Att	143
Frequency	140
PDSCH reference data	155
Phase tracking	151
Ref Level	142
Slot selection	195
Standard	65
Subframe selection	194
Swap I/Q	148
Timing error	152
Signal capture	146
Signal description	64
Slope	
Trigger	402
Slot selection	195
Softkeys	
Preamp	143
Specifics for	
Configuration	60
Spectrum mask	52
Standard selection	65
Step size	140
Subframe selection	194
Suffixes	
Common	198
Remote commands	201
Swap I/Q	148
Symbol	
Filter by	195
T	
Time alignment error	43
Timing error	152
Toolbars	
AutoSet	448
Control	446
Functions	445
Help	447
Main	446
Marker	447
Overview	445
Zoom	447
Tracking	150
Phase	151
Timing	152
Transmission path	65
Transmit on / off power	46
Trigger	
Slope	402
Trigger configuration	144
Trigger source	145

V

Videos 10

W

White papers 10

Window title bar information 16

Windows

Adding (remote) 206, 208

Closing (remote) 213

Configuring 60

Querying (remote) 206, 207, 210, 211

Replacing (remote) 212

Types (remote) 206, 208

Y

YIG-preselector

Activating/Deactivating 137

Activating/Deactivating (remote) 385

Z

Zoom

Capture buffer 27

Zooming

Activating (remote) 422

Area (Multiple mode, remote) 421

Area (remote) 420

Multiple mode (remote) 422