

R&S®VSE-K201

OneWeb Reverse Link Measurement Application User Manual



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Version 02

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-K201 OneWeb Reverse Link Measurement Application (1345.2001.02)
- R&S®VSE-KT201 OneWeb Reverse Link Measurement Application (1345.2018.02)
- R&S®VSE-KP201 OneWeb Reverse Link Measurement Application (1345.2618.02)

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1 Documentation Overview

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

www.rohde-schwarz.com/manual/VSE

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 OneWeb measurement application

The R&S VSE-K201 is a firmware applications that add functionality to perform measurements on reverse link OneWeb signals according to the 3GPP standard to the R&S VSE.

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.

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

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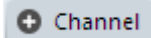
2.1 Installation

Find detailed installing instructions in the Getting Started or the release notes of the R&S VSE.

2.2 Starting the OneWeb measurement application

The OneWeb measurement application adds a new application to the R&S VSE.

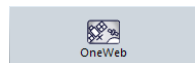
Starting the application

1. 

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

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

2. Select the "OneWeb" item.



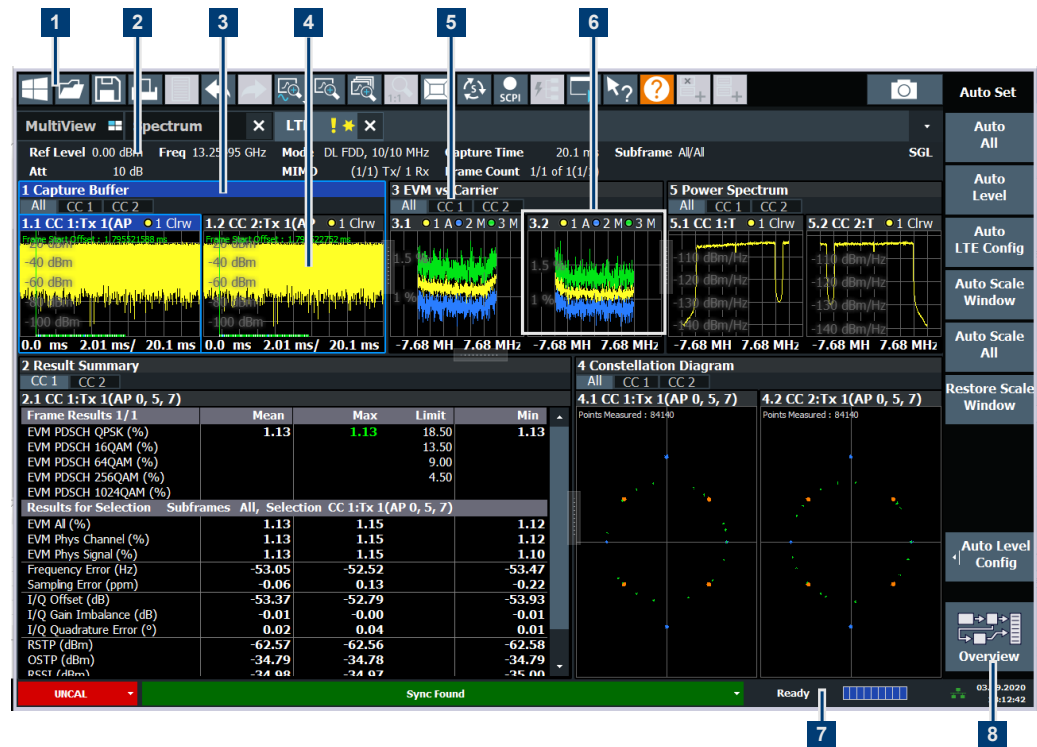
The R&S VSE opens a new measurement channel for the OneWeb application.

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

For more information see [Chapter 4, "Configuration"](#), on page 27.

2.3 Understanding the display information

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



- 1 = Toolbar
- 2 = Channel bar
- 3 = Diagram header
- 4 = Result display
- 5 = Subwindows (if more than one MIMO data stream is displayed at the same time)
- 6 = Status bar
- 7 = Softkeys

Channel bar information

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

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

Ref Level	Reference level
Att	Mechanical and electronic RF attenuation
Freq	Frequency
Mode	OneWeb standard (always "OneWeb SC-FDMA")

MIMO	Number of Tx and Rx antennas in the measurement setup
Capture Time	Signal length that has been captured
Frame Count	Number of frames that have been captured
Selected Slot	Slot considered in the signal analysis
Selected Subframe	Subframe considered in the signal analysis

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

Window title bar information

The information in the window title bar depends on the result display.

The "Constellation Diagram", for example, shows the number of points that have been measured.

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.
There can be three different synchronization errors.
 - Sync Failed (Cyclic Prefix): The cyclic prefix correlation failed.
 - Sync Failed (P-SYNC): The P-SYNC correlation failed.
 - Sync Failed (S-SYNC): The S-SYNC correlation failed.

3 Measurements and result displays

The OneWeb measurement application measures and analyzes various aspects of a OneWeb signal.

It features several measurements and result displays. Measurements represent different ways of processing the captured data during the digital signal processing. Result displays are different representations of the measurement results. They may be diagrams that show the results as a graph or tables that show the results as numbers.

Remote command:

Measurement selection: `CONFigure[:LTE]:MEASurement` on page 125

Result display selection: `LAYout:ADD[:WINDow]?` on page 87

- [Selecting result displays](#).....12
- [Performing measurements](#).....12
- [I/Q measurements](#).....13

3.1 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
- 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 87

3.2 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.

3.3 I/Q measurements

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

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[:LTE]:MEASurement` on page 125

Result display selection: `LAYout:ADD[:WINDow]?` on page 87

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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.

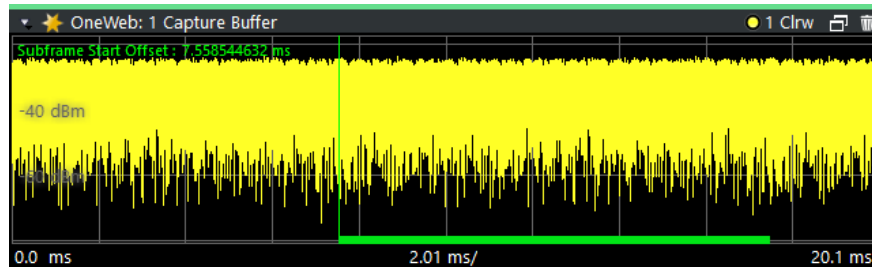


Figure 3-1: Capture buffer without zoom

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

When you zoom into the diagram, you will see that the bar is interrupted at certain positions. Each small bar indicates the useful parts of the OFDM symbol.

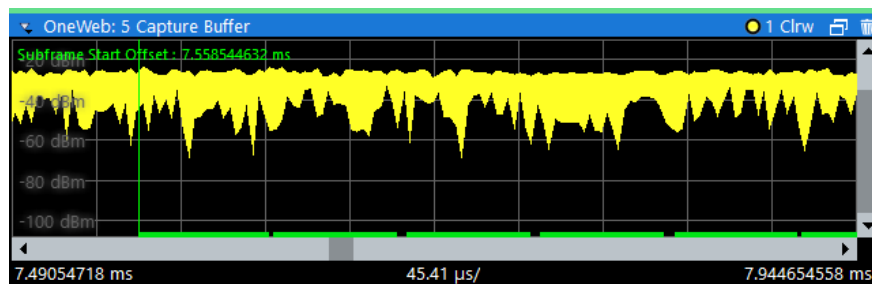


Figure 3-2: Capture buffer after a zoom has been applied

Remote command:

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

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

Query (x-axis): `TRACe<n>[:DATA]:X?` on page 106

Subframe start offset: `FETCh[:CC<cc>]:SUMMary:TFRame?` on page 116

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.

If you analyze all slots, the result display contains three traces.

- Average EVM
This trace shows the subcarrier EVM, averaged over all slots.
- Minimum EVM

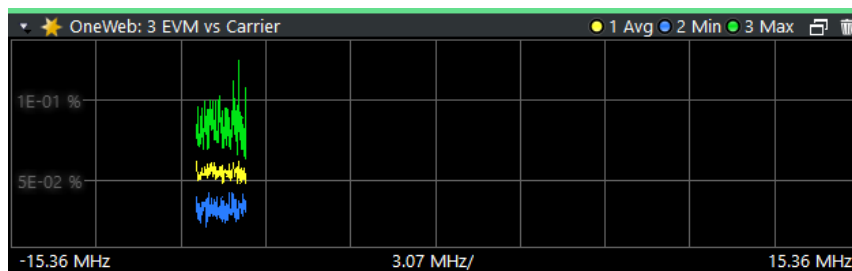
This trace shows the lowest (average) subcarrier EVM that has been found over the analyzed slots.

- Maximum EVM

This trace shows the highest (average) subcarrier EVM that has been found over the analyzed slots.

If you select and analyze one slot only, the result display contains one trace that shows the subcarrier EVM for that slot only. Average, minimum and maximum values in that case are the same. For more information, see "[Slot Selection](#)" on page 73.

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 106

EVM vs Symbol

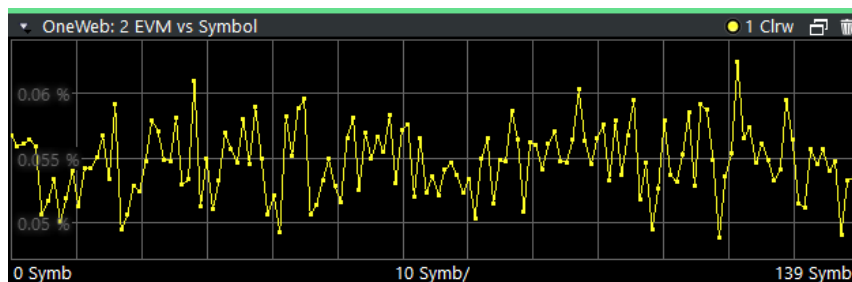
The "EVM vs Symbol" result display shows the error vector magnitude (EVM) of the OFDM symbols. You can use it as a debugging technique to identify any symbols whose EVM is too high.

The results are based on an average EVM that is calculated over all subcarriers that are part of a certain OFDM symbol. This average OFDM symbol EVM is determined for all OFDM symbols in each analyzed slot.

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.

The number of displayed symbols depends on the subframe selection and the length of the cyclic prefix.

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 106

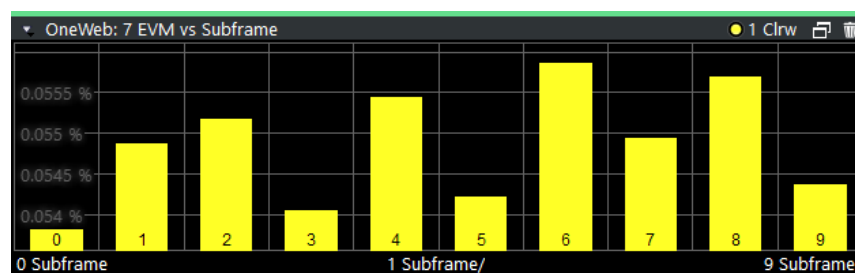
EVM vs Subframe

The "EVM vs Subframe" result display shows the Error Vector Magnitude (EVM) for each subframe. You can use it as a debugging technique to identify a subframe whose EVM is too high.

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

The x-axis represents the subframes, with the number of displayed subframes being 10.

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,EVSU`

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

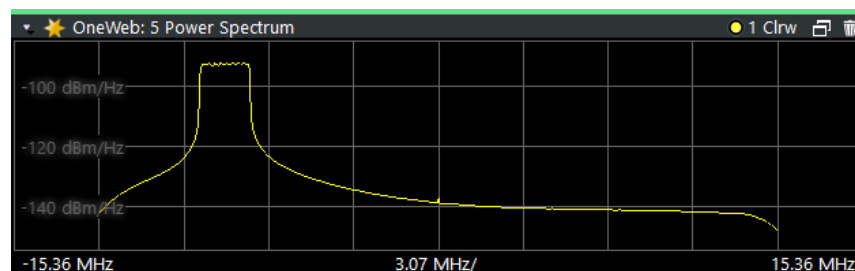
Query (x-axis): `TRACe<n>[:DATA]:X?` on page 106

Power Spectrum

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

The displayed bandwidth is always 20 MHz.

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 106

Inband Emission

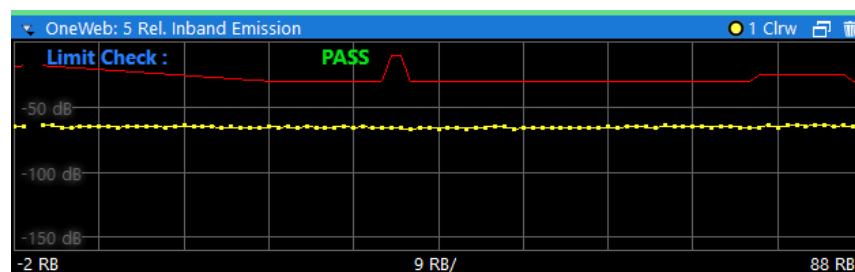
The "Inband Emission" result display shows the power of the unused resource blocks relative to the allocated resource blocks (yellow trace). The diagram also shows the inband emission limit lines (red trace). The allocated resource blocks are not evaluated.

The x-axis represents the resource blocks. The numbering of the resource blocks is based on 3GPP 38.521 as a function of the resource block offset from the edge of the allocated uplink transmission bandwidth.

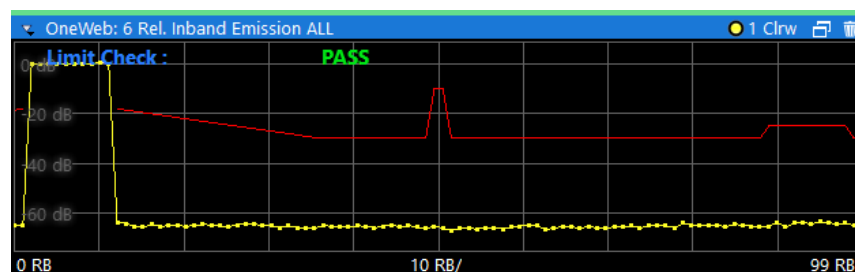
The y-axis shows the measured power for each resource block.

Because the measurement is evaluated over a single slot in the currently selected subframe, you have to select a [specific slot and subframe](#) to get valid measurement results.

Limits for the inband emission are specified in 3GPP 36.101.



You can also display the inband emissions for the allocated resource block in addition to the unused resource blocks when you select the "Inband Emissions All" result display.



Remote command:

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

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

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

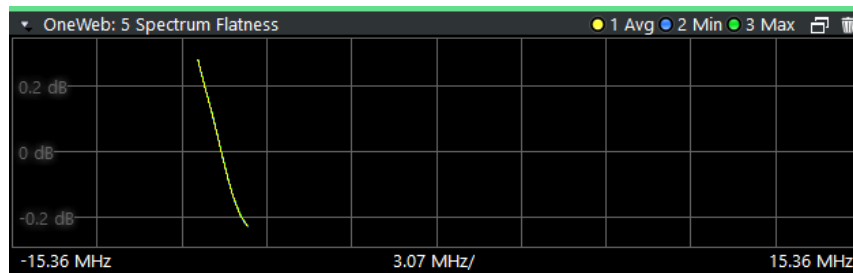
Query (x-axis): `TRACe<n> [:DATA] :X?` on page 106

Spectrum Flatness

The "Spectrum Flatness" result display shows the relative power offset caused by the transmit channel.

The measurement is evaluated over the currently selected slot in the currently selected subframe.

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, SFL`

Querying results:

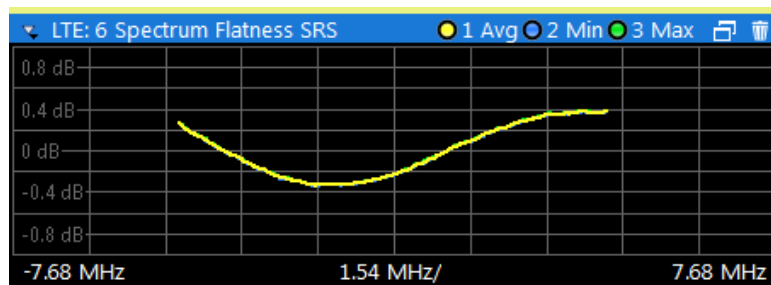
`TRACe:DATA?`

`TRACe<n>[:DATA]:X?` on page 106

Spectrum Flatness SRS

The "Spectrum Flatness SRS" display shows the amplitude of the channel transfer function based on the sounding reference signal.

The measurement is evaluated over the currently selected slot in the currently selected subframe. The slot and subframe selection may be changed in the general settings.



Remote command:

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

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

Query (x-axis): `TRACe<n>[:DATA]:X?` on page 106

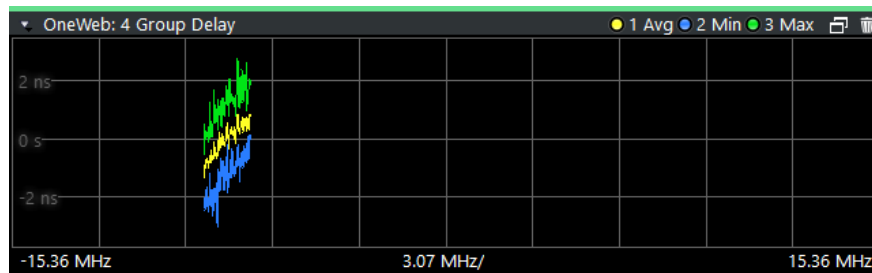
Group Delay

This "Group Delay" shows the group delay of each subcarrier.

The measurement is evaluated over the currently selected slot in the currently selected subframe.

The currently selected subframe depends on your [selection](#).

The x-axis represents the frequency. On the y-axis, the group delay is plotted in ns.



Remote command:

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

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

Query (x-axis): `TRACe<n> [:DATA] :X?` on page 106

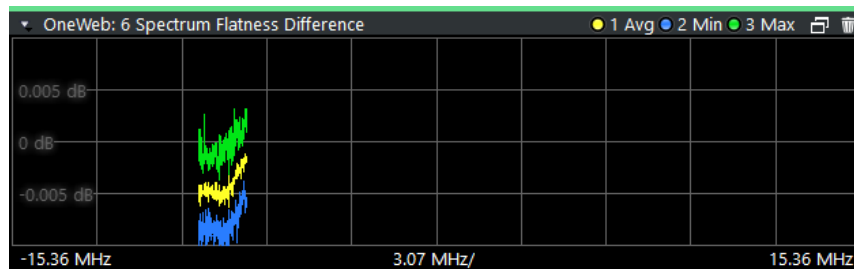
Spectrum Flatness Difference

The "Spectrum Flatness Difference" result display shows the level difference in the spectrum flatness result between two adjacent physical subcarriers.

The measurement is evaluated over the currently selected slot in the currently selected subframe.

The currently selected subframe depends on your [selection](#).

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



Remote command:

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

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

Query (x-axis): `TRACe<n> [:DATA] :X?` on page 106

Constellation Diagram

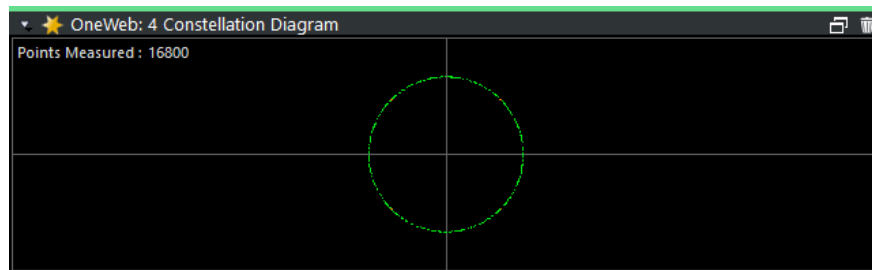
The "Constellation Diagram" shows the in-phase and quadrature phase results and is an indicator of the quality of the modulation of the signal.

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

Each color represents a modulation type.

- █: RBPSK
- █: MIXTURE
- █: QPSK
- █: 16QAM
- █: PSK (CAZAC)
- █: 8PSK

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



The constellation diagram also contains information about the current [evaluation range](#), including the number of points that are displayed in the diagram.

Remote command:

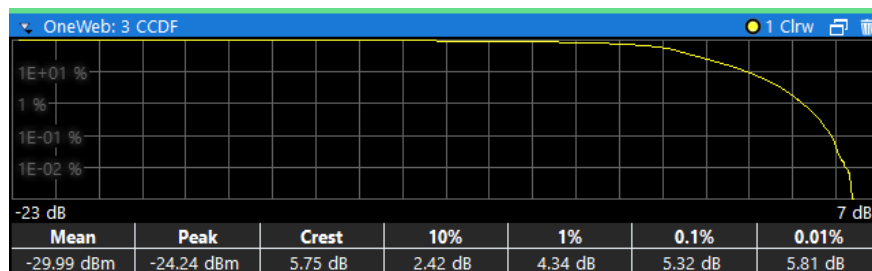
Selection: `LAY:ADD ? '1',LEFT,CONS`

Query: `TRACe:DATA?`

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 119

Numerical results: `CALCulate<n>:STATistics:RESult<res>?` on page 120

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 subframe. A horizontal line indicates the beginning of a new subframe.

SF	Allocation ID	RBs	Offset RB	Mod	Pow [dBm]	EVM [%]
0	PUSCH	10	2	QPSK	-29,990	0,054
	DMRS PUSCH			CAZAC	-29,988	0,055
1	PUSCH	10	2	QPSK	-29,987	0,054
	DMRS PUSCH			CAZAC	-29,988	0,058
2	PUSCH	10	2	QPSK	-29,987	0,055
	DMRS PUSCH			CAZAC	-29,988	0,055

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

- The location of the allocation (subframe number).
- The ID of the allocation (channel type).
- Number of resource blocks used by the allocation.
- The resource block offset of the allocation.
- The modulation of the allocation.
- The power of the allocation in dBm.
- The EVM of the allocation.

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

Click **once** on the header row to open a dialog box that allows you to add and remove columns.

Remote command:

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

Query: `TRACe:DATA?`

Bitstream

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

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.

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

SF	Allocation ID	Code word	Mod	Symbol Index	Bitstream
0	PUSCH	1/1	QPSK	0	02 00 00 02 01 01 02 00 00 02 00 02 03 02 0
0	PUSCH	1/1	QPSK	16	02 00 03 02 02 01 02 00 03 02 02 02 03 02 0
0	PUSCH	1/1	QPSK	32	00 00 01 02 01 01 00 01 01 03 03 00 00 01 0
0	PUSCH	1/1	QPSK	48	00 02 01 02 03 02 02 00 01 03 03 01 03 02 0
0	PUSCH	1/1	QPSK	64	01 01 00 03 03 02 02 02 02 01 01 02 01 01 0
0	PUSCH	1/1	QPSK	80	00 02 01 01 01 00 00 03 02 02 02 01 02 02 0
0	PUSCH	1/1	QPSK	96	03 01 02 03 01 03 00 01 01 00 02 03 02 01 0

The table contains the following information:

- **Subframe**
Number of the subframe the bits belong to.
- **Allocation ID**
Channel the bits belong to.
- **Codeword**
Code word of the allocation.
- **Modulation**
Modulation type of the channels.
- **Symbol Index** or **Bit Index**
Indicates the position of the table row's first bit or symbol within the complete stream.
- **Bit Stream**
The actual bit stream.

Remote command:

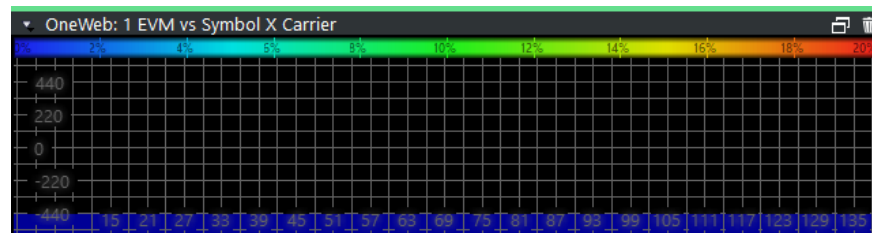
Selection: `LAY:ADD ? '1',LEFT,BSTR`

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:

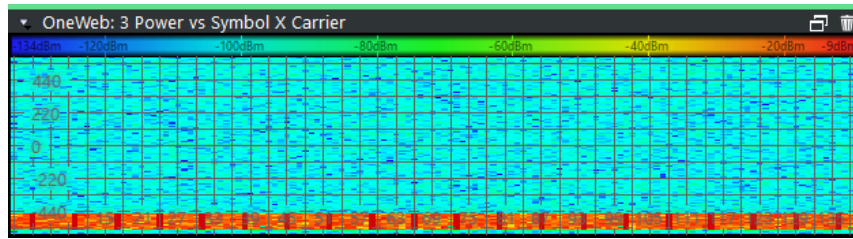
Selection: `LAY:ADD ? '1',LEFT,EVSC`

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?`

Result Summary

The Result Summary shows all relevant measurement results in numerical form, combined in one table.

Remote command:

`LAY:ADD ? '1',LEFT,RSUM`

Contents of the result summary

The contents of the result summary depend on the analysis mode you have selected. The first screenshot shows the results for "PUSCH/PUCCH" analysis mode, the second one those for "PRACH" analysis mode.

Frame Results 2/6	Mean	Limit	Max	Min
EVM PUSCH QPSK (%)	0.06	12.50		
EVM PUSCH 8PSK (%)		12.50		
EVM PUSCH 16QAM (%)				
EVM PUACH QPSK (%)		12.50		
EVM PUACH 8PSK (%)		12.50		
EVM PUACH 16QAM (%)				
EVM DMRS PUSCH QPSK (%)	0.06	12.50		
EVM DMRS PUSCH 8PSK (%)		12.50		
EVM DMRS PUSCH 16QAM (%)				
EVM DMRS PUACH QPSK (%)		12.50		
EVM DMRS PUACH 8PSK (%)		12.50		
EVM DMRS PUACH 16QAM (%)				
EVM PUCCH (%)		12.50		
EVM DMRS PUCCH (%)		12.50		
Results for Selection SF All, Slots All				
EVM All (%)	0.05		0.06	0.05

Figure 3-3: Result summary in PUSCH/PUCCH analysis mode

3GPP EVM Results	Mean	Limit	Max	Min
EVM PRACH (%)		12.50		
Results for Selection PA All, PA Cnt 0/0				
EVM All (%)				
Frequency Error (Hz)				
Sampling Error (ppm)				
I/Q Offset (dB)				
I/Q Gain Imbalance (dB)				
I/Q Quadrature Error (°)				
Power (dBm)				
Crest Factor (dB)				

Figure 3-4: Result summary in PRACH analysis mode

The table is split in two parts. The first part shows results that refer to the complete frame. It also indicates limit check results where available. The font of 'Pass' results is green and that of 'Fail' results is red.

In addition to the red font, the application also puts a red star (*** 25.6dB**) in front of failed results.

The second part of the table shows results that refer to a specific selection of the frame. The statistic is always evaluated over the slots. The header row of the table contains information about the selection you have made (like the subframe).

Note: The EVM results on a frame level (first part of the table) are calculated as defined by 3GPP at the edges of the cyclic prefix.

The other EVM results (lower part of the table) are calculated at the optimal timing position in the middle of the cyclic prefix.

Because of inter-symbol interference, the EVM calculated at the edges of the cyclic prefix is higher than the EVM calculated in the middle of the cyclic prefix.

By default, all EVM results are in %. To view the EVM results in dB, change the [EVM Unit](#).

Table 3-1: Result summary: part containing results as defined by 3GPP (PUSCH/PUCCH analysis)

EVM PUSCH QPSK	Shows the EVM for all QPSK-modulated resource elements of the PUSCH channel in the analyzed frame. FETCh[:CC<cc>]:SUMMary:EVM:USQP[:AVERAge]? on page 110
EVM PUSCH 8PSK	Shows the EVM for all 8PSK-modulated resource elements of the PUSCH channel in the analyzed frame. FETCh[:CC<cc>]:SUMMary:EVM:USOP[:AVERAge]? on page 110
EVM PUSCH 16QAM	Shows the EVM for all 16QAM-modulated resource elements of the PUSCH channel in the analyzed frame. FETCh[:CC<cc>]:SUMMary:EVM:USST[:AVERAge]? on page 111
EVM PUACH QPSK	Shows the EVM for all QPSK-modulated resource elements of the PUACH channel in the analyzed frame. FETCh[:CC<cc>]:SUMMary:EVM:UPQP[:AVERAge]? on page 109
EVM PUACH 8PSK	Shows the EVM for all 8PSK-modulated resource elements of the PUACH channel in the analyzed frame. FETCh[:CC<cc>]:SUMMary:EVM:UPOP[:AVERAge]? on page 109
EVM PUACH 16QAM	Shows the EVM for all 16QAM-modulated resource elements of the PUACH channel in the analyzed frame. FETCh[:CC<cc>]:SUMMary:EVM:UPST[:AVERAge]? on page 110
EVM DMRS PUSCH QPSK	Shows the EVM of all DMRS resource elements with QPSK modulation of the PUSCH in the analyzed frame. FETCh[:CC<cc>]:SUMMary:EVM:SDQP[:AVERAge]? on page 107
EVM DMRS PUSCH 8PSK	Shows the EVM of all DMRS resource elements with 8PSK modulation of the PUSCH in the analyzed frame. FETCh[:CC<cc>]:SUMMary:EVM:SDOP[:AVERAge]? on page 107

EVM DMRS PUSCH 16QAM	Shows the EVM of all DMRS resource elements with 16QAM modulation of the PUSCH in the analyzed frame. FETCh[:CC<cc>]:SUMMary:EVM:SDST[:AVERage]? on page 107
EVM DMRS PUACH QPSK	Shows the EVM of all DMRS resource elements with QPSK modulation of the PUACH in the analyzed frame. FETCh[:CC<cc>]:SUMMary:EVM:SPQP[:AVERage]? on page 108
EVM DMRS PUACH 8PSK	Shows the EVM of all DMRS resource elements with 8PSK modulation of the PUACH in the analyzed frame. FETCh[:CC<cc>]:SUMMary:EVM:SPOP[:AVERage]? on page 108
EVM DMRS PUACH 16QAM	Shows the EVM of all DMRS resource elements with 16QAM modulation of the PUACH in the analyzed frame. FETCh[:CC<cc>]:SUMMary:EVM:SPST[:AVERage]? on page 108
EVM PUCCH	Shows the EVM of all resource elements of the PUCCH channel in the analyzed frame. FETCh[:CC<cc>]:SUMMary:EVM:UCCH[:AVERage]? on page 109
EVM DMRS PUCCH	Shows the EVM of all DMRS resource elements of the PUCCH channel in the analyzed frame. FETCh[:CC<cc>]:SUMMary:EVM:UCCD[:AVERage]? on page 108

Table 3-2: Result summary: part containing results as defined by 3GPP (PRACH analysis)

EVM PRACH	Shows the EVM of all resource elements of the PRACH channel in the analyzed frame. FETCh[:CC<cc>]:SUMMary:EVM:UPRA[:AVERage]? on page 110
------------------	--

Table 3-3: Result summary: part containing results for a specific selection

EVM All	Shows the EVM for all resource elements in the analyzed frame. FETCh[:CC<cc>]:SUMMary:EVM[:ALL][:AVERage]? on page 112
EVM Phys Channel	Shows the EVM for all physical channel resource elements in the analyzed frame. A physical channel corresponds to a set of resource elements carrying information from higher layers. PUSCH, PUCCH and PRACH are physical channels. For more information, see 3GPP 36.211. FETCh[:CC<cc>]:SUMMary:EVM:PCHannel[:AVERage]? on page 112 ("PUSCH/PUCCH" analysis mode only.)
EVM Phys Signal	Shows the EVM for all physical signal resource elements in the analyzed frame. The reference signal is a physical signal. For more information, see 3GPP 36.211. FETCh[:CC<cc>]:SUMMary:EVM:PSIGNAL[:AVERage]? on page 113 ("PUSCH/PUCCH" analysis mode only.)
Frequency Error	Shows the difference in the measured center frequency and the reference center frequency. FETCh[:CC<cc>]:SUMMary:FERRor[:AVERage]? on page 113
Sampling Error	Shows the difference in measured symbol clock and reference symbol clock relative to the system sampling rate. FETCh[:CC<cc>]:SUMMary:SERRor[:AVERage]? on page 115

I/Q Offset	Shows the power at spectral line 0 normalized to the total transmitted power. FETCh[:CC<cc>]:SUMMARY:IQOffset[:AVERage]? on page 114
I/Q Gain Imbalance	Shows the logarithm of the gain ratio of the Q-channel to the I-channel. FETCh[:CC<cc>]:SUMMARY:GIMBalance[:AVERage]? on page 114
I/Q Quadrature Error	Shows the measure of the phase angle between Q-channel and I-channel deviating from the ideal 90 degrees. FETCh[:CC<cc>]:SUMMARY:QUADerror[:AVERage]? on page 115
Power	Shows the average time domain power of the allocated resource blocks of the analyzed signal. FETCh[:CC<cc>]:SUMMARY:POWer[:AVERage]? on page 114
Crest Factor	Shows the peak-to-average power ratio of captured signal. FETCh[:CC<cc>]:SUMMARY:CRESt[:AVERage]? on page 112

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. Only in 3D result displays (for example "EVM vs Symbol x Carrier").
Z-Power	
Z-Alloc ID	

Wnd	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 87

Results:

[CALCulate<n>:MARKer<m>:X](#) on page 117

[CALCulate<n>:MARKer<m>:Y](#) on page 117

[CALCulate<n>:MARKer<m>:Z?](#) on page 118

[CALCulate<n>:MARKer<m>:Z:ALL?](#) on page 118

4 Configuration

OneWeb measurements require a special application on the R&S VSE, which you can select by adding a new measurement channel or replacing an existing one.

For more information on controlling measurement applications, refer to the documentation of the R&S VSE base software.

When you start the OneWeb application, the R&S VSE starts to measure the input signal with the default configuration or the configuration of the last measurement (when you haven't performed a preset since then).



Automatic refresh of preview and visualization in dialog boxes after configuration changes

The R&S VSE supports you in finding the correct measurement settings quickly and easily - after each change in settings in dialog boxes, the preview and visualization areas are updated immediately and automatically to reflect the changes. Thus, you can see if the setting is appropriate or not before accepting the changes.



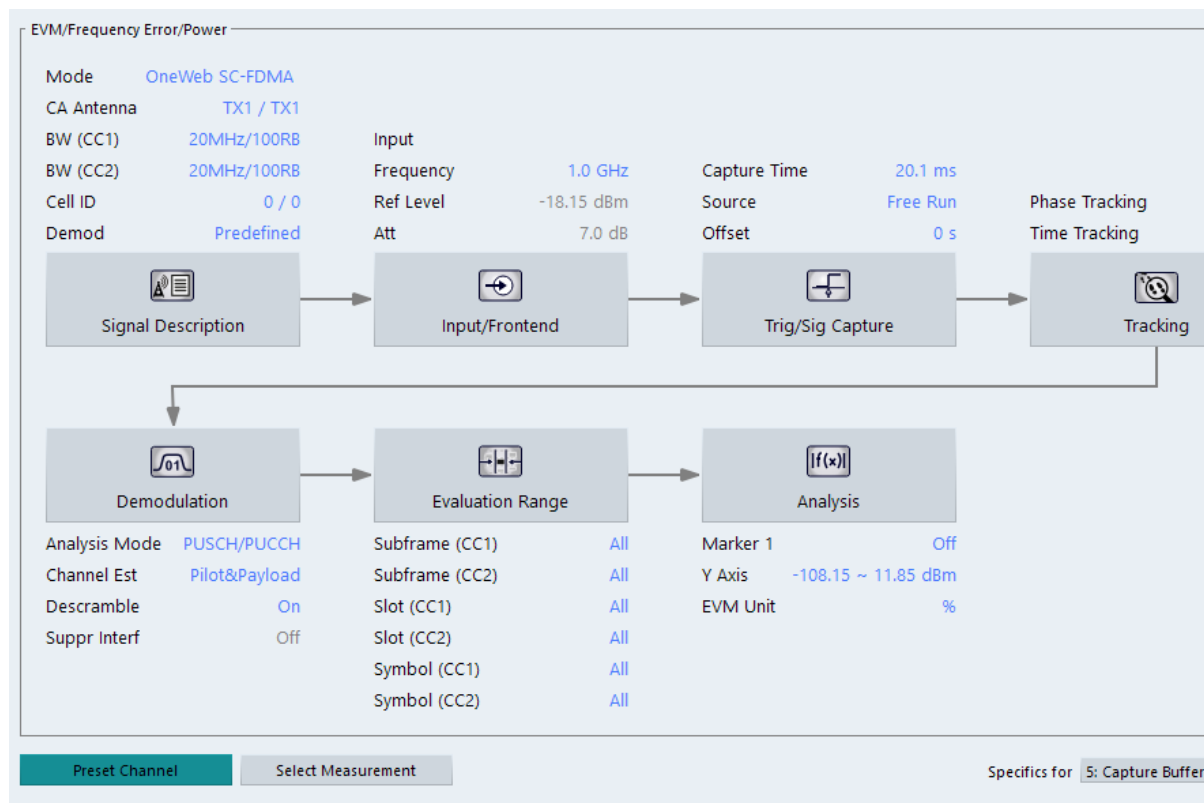
Unavailable menus

Note that the "Trace" and "Limits" menus have no contents and no function in the OneWeb application.

- [Configuration overview](#).....27
- [Configuring I/Q measurements](#)..... 29

4.1 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 4.2.1, "Signal characteristics"](#), on page 30.
2. Input / Frontend
See [Chapter 4.2.10, "Selecting the input and output source"](#), on page 52.
3. Trigger / Signal Capture
See [Chapter 4.2.14, "Trigger configuration"](#), on page 63.
See [Chapter 4.2.13, "Data capture"](#), on page 61
4. Tracking
See [Chapter 4.2.15, "Tracking configuration"](#), on page 64.
5. Demodulation
See [Chapter 4.2.16, "Signal demodulation"](#), on page 65.
6. Evaluation Range
See [Chapter 5.2.2, "Evaluation range"](#), on page 71.

7. Analysis
See [Chapter 5, "Analysis"](#), on page 68.
8. Display Configuration
See [Chapter 3, "Measurements and result displays"](#), on page 12.

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

To configure settings

- ▶ Select any button in the "Overview" to open the corresponding dialog box.
Select a setting in the channel bar (at the top of the measurement channel tab) to change a specific setting.

Preset Channel

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

Remote command:

[SYSTem:PRESet:CHANnel\[:EXEC\]](#) on page 126

Select Measurement

Opens a dialog box to select the type of measurement.

Remote command:

[CONFigure\[:LTE\]:MEASurement](#) on page 125

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.

4.2 Configuring I/Q measurements

• Signal characteristics	30
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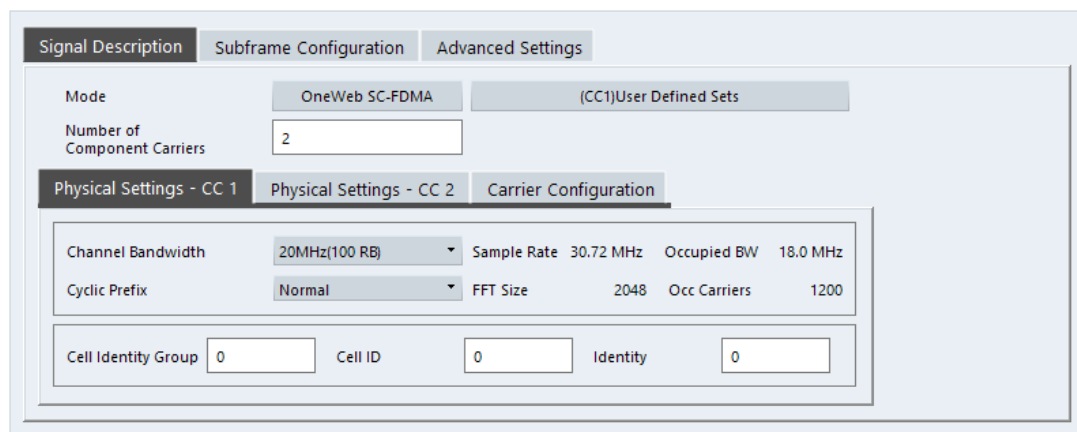
- [Frequency configuration](#).....56
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- [Data capture](#).....61
- [Trigger configuration](#).....63
- [Tracking configuration](#).....64
- [Signal demodulation](#).....65
- [Automatic configuration](#).....67

4.2.1 Signal characteristics

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

The general signal characteristics contain settings to describe the general physical attributes of the signal.

The OneWeb application supports measurements on the reverse link direction (uplink). The "Mode" corresponds to the access scheme this is based upon, which is always SC-FDMA for reverse link signals.



- [Carrier Aggregation](#).....30
 - [Basic component carrier configuration](#).....31
 - [Features of the I/Q measurements](#).....31
 - [Remote commands to configure carrier aggregation](#).....32
- [Channel Bandwidth / Number of Resource Blocks](#).....32
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Carrier Aggregation

Carrier aggregation has been introduced in the OneWeb standard to increase the bandwidth. In those systems, several carriers can be used to transmit a signal.

Each carrier has the same bandwidth of 20 MHz.

The R&S VSE features several measurements that 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.)

Basic component carrier configuration ← Carrier Aggregation

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

- I/Q based measurements (EVM etc.): up to 2 CCs
- The "Center Frequency" defines the carrier frequency of the carriers.
- Each carrier has a bandwidth of 20 MHz.
- For all component carriers, the R&S VSE also shows the "Frequency Offset" relative to the center frequency of the first carrier.

Note that the application automatically calculates the frequency and offset of the second (or subsequent) carrier according to the specification.

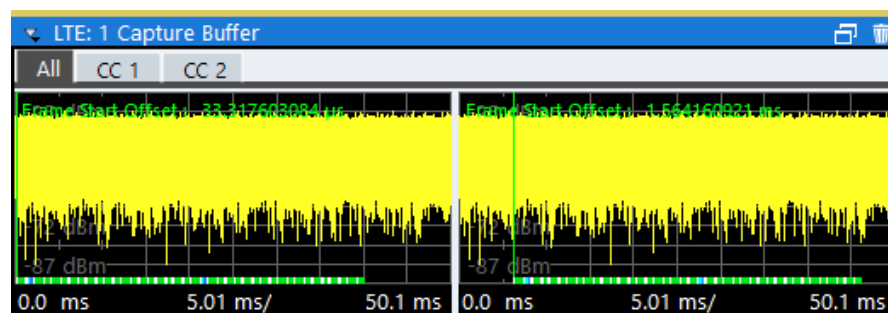
Note that the actual measurement frequency differs from the carrier frequencies: the application calculates that frequency based on the carrier frequencies. It is somewhere in between the carrier frequencies.

The measurement frequency is displayed in the channel bar.

When the defined carrier configuration is not supported by the application, a corresponding error message is displayed. This can be the case, for example, if the carriers occupy a bandwidth that is too large.

Features of the I/Q measurements ← Carrier Aggregation

For measurements on component carriers, results are shown for each component carrier separately. The layout of the diagrams is adjusted like this:



- The first tab ("All") shows the results for all component carriers.
- The other tabs ("CC <x>") show the results for each component carrier individually.

The application also shows the "Occupied Bandwidth" of the aggregated carriers and the "Sample Rate" in a read-only field below the carrier configuration.

Occ BW	14.9 MHz
Sample Rate	30.72 MHz

The application also allows you to select the location of the local oscillator (LO) in your system. You can thus define if your system uses one LO (for both carriers) or two LOs (one for each carrier). This can be useful if you want to reliably exclude the DC component from the measurement results in both scenarios.

The application supports the following "LO locations".

- **Center of each component carrier**

One LO for each carrier that is located at the center frequency of the component carrier. See [Basic component carrier configuration](#) for information about how center frequencies are defined.

- **Center of aggregated channel bandwidth**
One LO for both carriers that is located at the center of the aggregated carriers.
- **User defined**
One LO for both carriers that is not necessarily located at the center of the aggregated carriers.
When you select this option, the application opens an input field to define the real "LO Frequency", which you arbitrarily define.

Remote commands to configure carrier aggregation ← Carrier Aggregation

Remote command:

Number of carriers: [CONFigure\[:LTE\]:NOCC](#) on page 128

Carrier frequency: [\[SENSe:\]FREQuency:CENTer\[:CC<cc>\]](#) on page 152

Measurement frequency: [SENSe:FREQuency:CENTer?](#)

Offset: [\[SENSe:\]FREQuency:CENTer\[:CC<cc>\]:OFFSet](#) on page 153

Channel bandwidth: [CONFigure\[:LTE\]:UL\[:CC<cc>\]:BW](#) on page 127

LO location: [\[SENSe:\] \[LTE:\] UL:DEMod:LOLocation](#) on page 130

LO frequency: [\[SENSe:\] \[LTE:\] UL:DEMod:LOFrequency](#) on page 130

Channel Bandwidth / Number of Resource Blocks

Specifies the channel bandwidth and number of resource blocks (RB).

The channel bandwidth and number of resource blocks (RB) are interdependent. In the OneWeb application, the channel bandwidth is a fix value of 20 MHz.

The application also calculates the FFT size, sampling rate, occupied bandwidth and occupied carriers from the channel bandwidth. Those are read only.

Channel Bandwidth [MHz]	1.4	3	5	10	15	20
Number of Resource Blocks	6	15	25	50	75	100
Sample Rate [MHz]	1.92	3.84	7.68	15.36	30.72	30.72
FFT Size	128	256	512	1024	2048	2048

For more information about configuring aggregated carriers, see ["Carrier Aggregation"](#) on page 30.

The application shows the currently selected OneWeb mode (including the bandwidth) in the channel bar.

Remote command:

[CONFigure\[:LTE\]:UL\[:CC<cc>\]:BW](#) on page 127

Cyclic Prefix

The cyclic prefix serves as a guard interval between OFDM symbols to avoid interferences. The standard specifies two cyclic prefix modes with a different length each.

The cyclic prefix mode defines the number of OFDM symbols in a slot.

- Normal
A slot contains 7 OFDM symbols.
In the OneWeb application, the cyclic prefix is always normal.

Remote command:
not supported

Configuring the Physical Layer Cell Identity

The "Cell ID", "Cell Identity Group" and physical layer "Identity" are interdependent parameters. In combination, they are responsible for synchronization between network and user equipment.

The physical layer cell ID identifies a particular radio cell in the OneWeb network. The cell identities are divided into 168 unique cell identity groups. Each group consists of 3 physical layer identities. According to:

$$N_{ID}^{cell} = 3 \cdot N_{ID}^{(1)} + N_{ID}^{(2)}$$

$N^{(1)}$ = cell identity group, {0...167}
 $N^{(2)}$ = physical layer identity, {0...2}

there is a total of 504 different cell IDs.

If you change one of these three parameters, the application automatically updates the other two.

The cell ID determines:

- The reference signal grouping hopping pattern
- The reference signal sequence hopping
- The PUSCH demodulation reference signal pseudo-random sequence
- The cyclic shifts for PUCCH formats 1/1a/1b and sequences for PUCCH formats 2/2a/2b
- The pseudo-random sequence used for scrambling

Remote command:

Cell ID: [CONFigure \[:LTE\] :UL\[:CC<cc>\] :PLC:CID](#) on page 127

Cell Identity Group: [CONFigure \[:LTE\] :UL\[:CC<cc>\] :PLC:CIDGroup](#)
on page 127

Identity: [CONFigure \[:LTE\] :UL\[:CC<cc>\] :PLC:PLID](#) on page 128

4.2.2 Test scenarios

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

Test scenarios are descriptions of specific OneWeb 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.

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.

Remote command:

Save: `MMEMemory:STORE<n>[:CC<cc>]:DEModsetting` on page 130

Restore: `MMEMemory:LOAD[:CC<cc>]:DEModsetting` on page 129

4.2.3 Subframe configuration

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

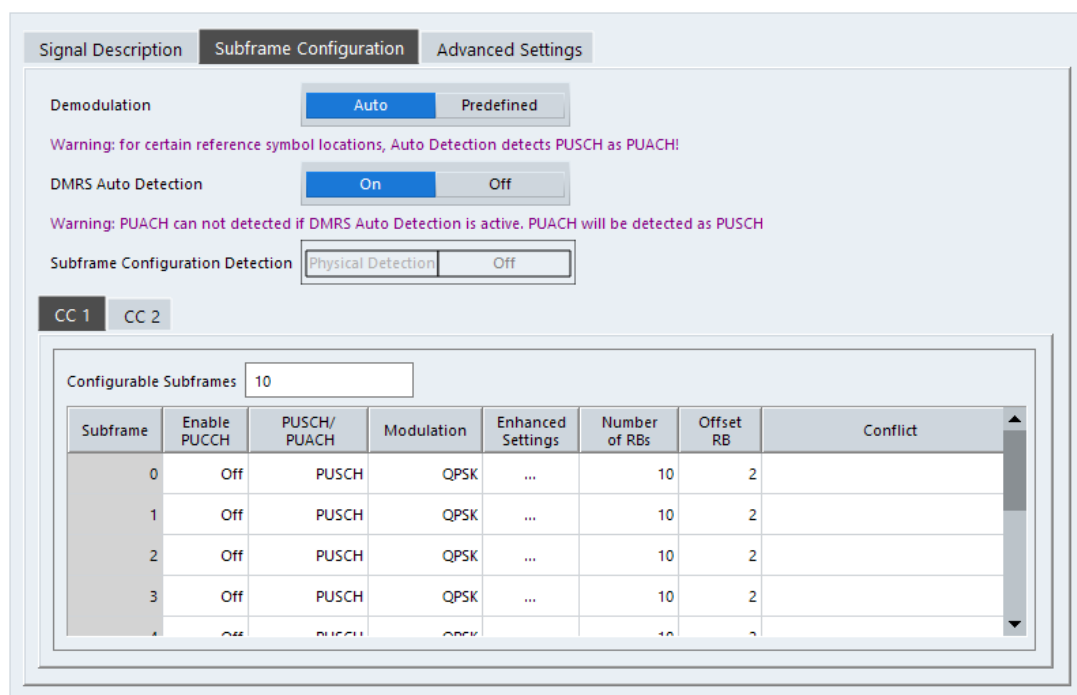
An OneWeb frame consists of 10 subframes. Each individual subframe can have a different resource block configuration. This configuration is shown in the "Subframe Configuration Table".

The application supports two ways to determine the characteristics of each subframe.

- Automatic demodulation of the channel configuration and detection of the subframe characteristics.
For automatic demodulation, the contents of the table are determined according to the signal currently evaluated.
For more information, see "[Auto Demodulation](#)" on page 35.
- Custom configuration of the configuration of each subframe.
For manual configuration, you can customize the table according to the signal that you expect. The signal is demodulated even if the signal does not fit the description in the table or, for [Physical Detection](#), only if the frame fits the description in the table.

Remote command:

Conf. subframes: `CONFigure[:LTE]:UL[:CC<cc>]:CSUBframes` on page 131



Frame number offset

A frame number offset is also supported. The frame number offset assigns a number to the demodulated frame in order to identify it in a series of transmitted (and captured) frames. You can define this frame in the [Global Settings](#).

Remote command:

`CONFigure[:LTE]:UL[:CC<cc>]:SFNO on page 136`

- [General subframe configuration](#).....35
- [Individual subframe configuration](#).....36
- [Enhanced settings](#).....38

4.2.3.1 General subframe configuration

- [Auto Demodulation](#).....35
- [Subframe Configuration Detection](#).....36

Auto Demodulation

Turns automatic demodulation on and off.

When you select "Predefined" mode, you can [configure the subframe manually](#).

When you select "Auto" mode, the R&S VSE automatically detects the characteristics of each subframe in the signal (resource allocation of the signal). Two methods of detection are supported:

- Auto Demodulation, **DMRS Auto Detection (Off)**
This method automatically determines the characteristics for each subframe as shown in the [Subframe Configuration Table](#).
The table is populated accordingly.

Note that for certain reference symbol locations, the automatic detection routine detects PUSCH as PUACH.

- Subframe Configuration & DMRS

Auto Demodulation, **DMRS Auto Detection (On)**

This method automatically detects the PUSCH and SRS (i.e. no PUCCH can be detected).

To determine these characteristics, the software detects the CAZAC base parameters. Thus, the DMRS configuration parameters are not required for the synchronization and therefore are not available using this method.

Note however that it is not possible to derive the DMRS configuration parameters from the CAZAC base parameters so that the disabled DMRS configuration parameters do not reflect the current parameters used for the synchronization. Also note that it can happen that the software successfully synchronizes on non-3GPP signals without a warning.

Note also that the automatic DMRS detection routine detects PUACH as PUSCH.

Remote command:

[\[SENSe:\] \[LTE:\] UL:DEMod:ACON](#) on page 135

Subframe Configuration Detection

Turns the detection of the subframe configuration on and off.

When you select "Physical Detection", the R&S VSE compares the currently demodulated OneWeb frame to the subframe configuration you have defined in the table. The application only analyzes the OneWeb frame if the signal is consistent with the configuration.

When you turn the feature "Off", the software analyzes the signal even if it is not consistent with the current subframe configuration.

Subframe configuration detection is available if you are using a [Predefined](#) subframe configuration.

Remote command:

[\[SENSe:\] \[LTE:\] UL:FORMat:SCD](#) on page 135

4.2.3.2 Individual subframe configuration

The "Subframe Configuration Table" contains the characteristics for each subframe. The software supports a maximum uplink OneWeb frame size of 10 subframes. The subframe number in the table depends on the number of "Configurable Subframes" that you have defined or that have been detected for automatic demodulation.

Subframe	Enable PUCCH	PUSCH/PUACH	Modulation	Enhanced Settings	Number of RBs	Offset RB	Conflict
0	Off	PUSCH	QPSK	...	10	2	
1	Off	PUSCH	QPSK	...	10	2	
2	Off	PUSCH	QPSK	...	10	2	
3	Off	PUSCH	QPSK	...	10	2	

Each row of the table represents one subframe. If the fields in a row are unavailable for editing, the corresponding subframe is occupied by a downlink subframe or the special subframe (in TDD systems).



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.

Subframe Number.....	37
Enable PUCCH.....	37
Enable PUSCH / PUACH.....	37
Modulation.....	37
Enhanced Settings.....	37
Number of RB.....	38
Offset RB.....	38

Subframe Number

Shows the number of a subframe.

Enable PUCCH

Turns the PUCCH in the corresponding subframe on and off.

Remote command:

`CONFigure[:LTE]:UL[:CC<cc>]:SUBFrame<sf>:ALLoc:CONT` on page 131

Enable PUSCH / PUACH

Turns the PUSCH or PUACH in the corresponding subframe on and off.

If you turn on a PUSCH or PUACH, "Modulation", "Number of RBs" and "Offset RB" become available.

Transmitting both PUSCH and PUACH in a single allocation is not possible.

Remote command:

`CONFigure[:LTE]:UL[:CC<cc>]:SUBFrame<sf>:ALLoc:CONT` on page 131

Modulation

Selects the modulation scheme for the corresponding PUSCH allocation.

The modulation scheme is either QPSK, 8PSK or 16QAM.

Remote command:

`CONFigure[:LTE]:UL[:CC<cc>]:SUBFrame<sf>:ALLoc:MODulation`
on page 132

Enhanced Settings

Opens a dialog box to configure enhanced functionality for selected channels in each subframe.

For more information see [Enhanced settings](#).

Number of RB

Sets the number of resource blocks the PUSCH allocation covers. The number of resource blocks defines the size or bandwidth of the PUSCH allocation.

Remote command:

```
CONFigure[:LTE]:UL[:CC<cc>]:SUBFrame<sf>:ALLoc[:CLUSter<cl>]:
RBCount on page 134
```

Offset RB

Sets the resource block at which the PUSCH allocation begins.

Remote command:

```
CONFigure[:LTE]:UL[:CC<cc>]:SUBFrame<sf>:ALLoc[:CLUSter<cl>]:
RBOffset on page 134
```

4.2.3.3 Enhanced settings

The "Enhanced Settings" contain functionality to define enhanced characteristics for selected channels.

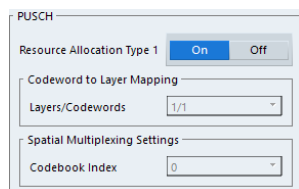
Note that currently not all features available in the dialog are supported.

Note that currently not all features available in the dialog are supported.

Enhanced PUSCH Configuration.....	38
Enhanced Demodulation Reference Signal Configuration.....	39
Enhanced PUCCH Configuration.....	39

Enhanced PUSCH Configuration

Configures the PUSCH in individual subframes.



Note: The Codeword to Layer Mapping and Spatial Multiplexing are not yet supported.

Resource Allocation Type 1

Turns a clustered PUSCH allocation on and off. If on, a second row is added to the corresponding allocation. This second row represents the second cluster.

You can define the number of resource block, the offset resource block and modulation for each cluster. All other parameters are the same for both clusters.

Note that clustered PUSCH are not supported. This feature is therefore always "Off".

Precoding Settings

If you measure several antennas, you can define the number of layers and the codebook index for any allocation.

The number of layers of an allocation in combination with the number of code words determines the layer mapping. The available number of layers depends on the number of transmission antennas. Thus, the maximum number of layers you can select is four.

The codebook index determines the precoding matrix. The available number of indices depends on the number of transmission antennas in use. The range is from 0 to 23.

Remote command:
not supported

Enhanced Demodulation Reference Signal Configuration

Configures the Demodulation Reference Signal in individual subframes.

n(2)_DMRS

Defines the part of the demodulation reference signal index that is part of the uplink scheduling assignment. Thus, this part of the index is valid for corresponding UE and subframe only.

The index applies when multiple shifts within a cell are used. It is used for the calculation of the DMRS sequence.

Cyclic Shift Field

Not supported by the OneWeb application. The demodulation reference signal is always configured by the n(2)_DMRS parameter.

Delta_PUACH

Defines the parameter δ_{PUACH} as defined in the OneWeb standard.

Remote command:

`CONFigure[:LTE]:UL[:CC<cc>]:SUBFrame<sf>:ALLoc:PUSCh:NDMRs`
on page 133

`CONFigure[:LTE]:UL[:CC<cc>]:SUBFrame<sf>:ALLoc:PUACH:DPUach`
on page 132

Enhanced PUCCH Configuration

Configures the PUCCH in individual subframes.

n_PUCCH

Defines the n_PUCCH parameter for the selected subframe.

Available only if you have selected "Per Subframe" for the [N_PUCCH](#).

PUCCH Format

Selects the PUCCH format for the selected subframe.

Available only if you have selected "Per Subframe" for the [Format](#).

Remote command:

`n_PUCCH: CONFigure[:LTE]:UL[:CC<cc>]:SUBFrame<sf>:ALLoc:PUCCh:`
`NPAR` on page 133

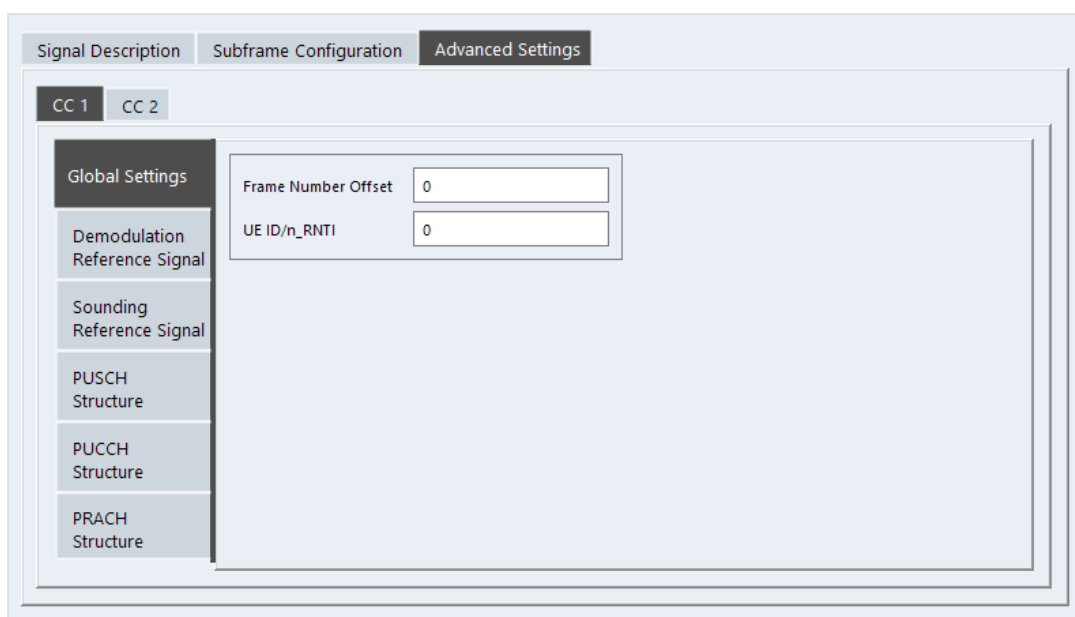
`Format: CONFigure[:LTE]:UL[:CC<cc>]:SUBFrame<sf>:ALLoc:PUCCh:`
`FORMat` on page 133

4.2.4 Global signal characteristics

Access: "Overview" > "Signal Description" > "Advanced Settings" > "Global Settings"

The global settings contain settings that apply to the complete signal.

The global signal settings are part of the "Advanced Settings" tab of the "Signal Description" dialog box.



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 Number Offset	40
UE ID/n_RNTI	40
SCell Index	41

Frame Number Offset

Defines a frame number offset for the analyzed frame.

The frame number offset assigns a number to the demodulated frame in order to identify it in a series of transmitted (and captured) frames.

Remote command:

[CONFigure\[:LTE\]:UL\[:CC<cc>\]:SFNO](#) on page 136

UE ID/n_RNTI

Sets the radio network temporary identifier (RNTI) of the UE.

Remote command:

`CONFigure[:LTE]:UL[:CC<cc>]:UEID` on page 136

SCell Index

Defines the secondary cell index as defined in the OneWeb standard.

This is only available for a second component carrier.

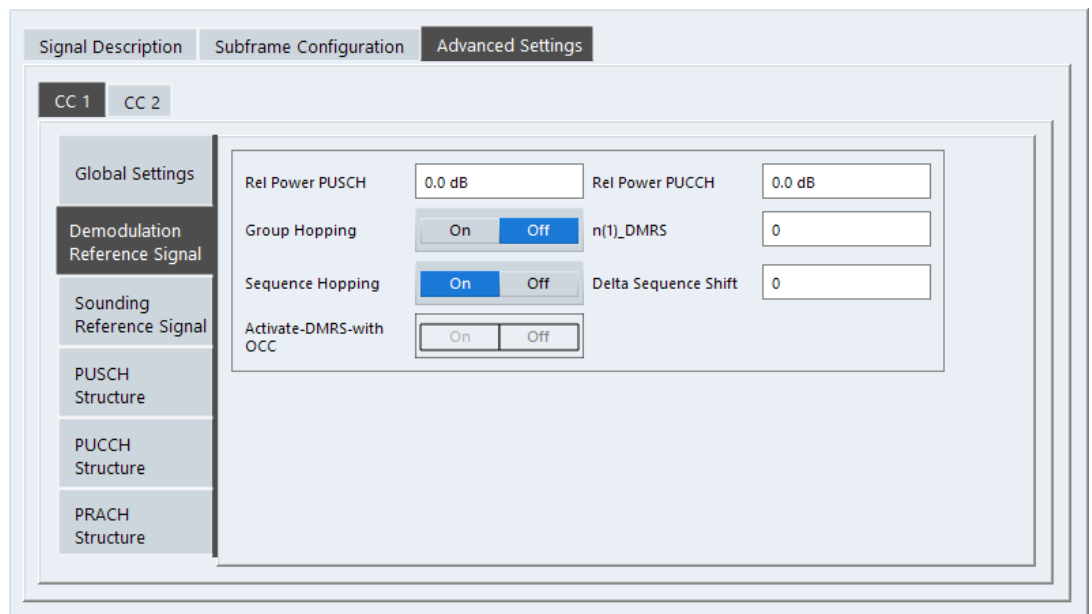
Remote command:

`CONFigure[:LTE]:UL[:CC<cc>]:SCIN` on page 136

4.2.5 Demodulation reference signal configuration

Access: "Overview" > "Signal Description" > "Advanced Settings" > "Demodulation Reference Signal"

The demodulation reference signal (DRS) settings contain settings that define the physical attributes and structure of the demodulation reference signal. This reference signal helps to demodulate the PUSCH.



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.

Relative Power PUSCH.....	42
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Sequence Hopping.....	42
Relative Power PUCCH.....	42
n(1)_DMRS.....	43
Delta Sequence Shift.....	43
Activate-DMRS-With OCC.....	43

Relative Power PUSCH

Defines the power of the DMRS relative to the power level of the PUSCH allocation in the corresponding subframe ($P_{\text{DMRS_Offset}}$).

The effective power level of the DMRS depends on the allocation of the subframe and is calculated as follows.

$$P_{\text{DMRS}} = P_{\text{UE}} + P_{\text{PUSCH}} + P_{\text{DMRS_Offset}}$$

The relative power of the DMRS is applied to all subframes.

The power of the PUSCH (P_{PUSCH}) may be different in each subframe.

Remote command:

[CONFigure\[:LTE\]:UL\[:CC<cc>\]:DRS\[:PUSCh\]:POWer](#) on page 138

Group Hopping

Turns group hopping for the demodulation reference signal on and off.

The group hopping pattern is based on 17 hopping patterns and 30 sequence shift patterns. It is generated by a pseudo-random sequence generator.

If on, PUSCH and PUCCH use the same group hopping pattern.

Remote command:

[CONFigure\[:LTE\]:UL\[:CC<cc>\]:DRS:GRPHopping](#) on page 137

Sequence Hopping

Turns sequence hopping for the uplink demodulation reference signal on and off.

Sequence hopping is generated by a pseudo-random sequence generator.

Remote command:

[CONFigure\[:LTE\]:UL\[:CC<cc>\]:DRS:SEQHopping](#) on page 138

Relative Power PUCCH

Defines the power of the DMRS relative to the power level of the PUCCH allocation in the corresponding subframe ($P_{\text{DMRS_Offset}}$).

The effective power level of the DMRS depends on the allocation of the subframe and is calculated as follows.

$$P_{\text{DMRS}} = P_{\text{UE}} + P_{\text{PUCCH}} + P_{\text{DMRS_Offset}}$$

The relative power of the DMRS is applied to all subframes.

The power of the PUCCH (P_{PUCCH}) may be different in each subframe.

Remote command:

[CONFigure\[:LTE\]:UL\[:CC<cc>\]:DRS:PUCCh:POWer](#) on page 138

n(1)_DMRS

Defines the part of the demodulation reference signal index that is broadcast. It is valid for the whole cell.

The index applies when multiple shifts within a cell are used. It is used for the calculation of the DMRS sequence.

The n_DMRS parameter can be found in 3GPP TS36.211 V8.5.0, 5.5.2.1.1 Reference signal sequence.

Remote command:

[CONFigure\[:LTE\]:UL\[:CC<cc>\]:DRS:NDMRs](#) on page 138

Delta Sequence Shift

Defines the delta sequence shift Δ_{SS} .

The standard defines a sequence shift pattern f_{ss} for the PUCCH. The corresponding sequence shift pattern for the PUSCH is a function of f_{ss}^{PUCCH} and the delta sequence shift.

For more information refer to 3GPP TS 36.211, chapter 5.5.1.3 "Group Hopping".

Remote command:

[CONFigure\[:LTE\]:UL\[:CC<cc>\]:DRS:DSShift](#) on page 137

Activate-DMRS-With OCC

Turns the configuration of the demodulation reference signal on a subframe basis via the "Cyclic Shift Field" on and off.

If on, the "Cyclic Shift Field" becomes available. Otherwise, the demodulation reference signal is configured by the n(2)_DMRS parameter.

Note that this parameter is always turned off in the OneWeb application.

Remote command:

not supported

4.2.6 Sounding reference signal configuration

Access: "Overview" > "Signal Description" > "Advanced Settings" > "Sounding Reference Signal"

The sounding reference signal (SRS) settings contain settings that define the physical attributes and structure of the sounding reference signal.



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.

Present	44
SRS Subframe Configuration	44
SRS MaxUpPts	45
SRS Bandwidth B_SRS	45
Hopping BW b_hop	45
SRS Cyclic Shift N_CS	45
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SRS BW Conf. C_SRS	46
Conf. Index I_SRS	46
Transm. Comb. k_TC	46
Freq. Domain Pos. n_RRC	46
A/N + SRS Simultaneous TX	47

Present

Includes or excludes the sounding reference signal (SRS) from the test setup.

Remote command:

`CONFigure[:LTE]:UL[:CC<cc>]:SRS:STAT` on page 142

SRS Subframe Configuration

Defines the subframe configuration of the SRS.

The subframe configuration of the SRS is specific to a cell. The UE sends a shortened PUCCH/PUSCH in these subframes, regardless of whether the UE is configured to send an SRS in the corresponding subframe or not.

Remote command:

[CONFigure\[:LTE\]:UL\[:CC<cc>\]:SRS:SUConfig](#) on page 142

SRS MaxUpPts

Turns the parameter `srs_MaxUpPts` on and off.

`srs_MaxUpPts` controls the SRS transmission in the UpPTS field in TDD systems. If on, the SRS is transmitted in a frequency range of the UpPTS field that does not overlap with resources reserved for PRACH preamble 4 transmissions.

To avoid an overlap, the number of SRS resource blocks otherwise determined by `C_SRS` and `B_SRS` is reconfigured.

This parameter is always turned off in the OneWeb application.

Remote command:

not supported

SRS Bandwidth B_SRS

Defines the parameter `BSRS`.

`BSRS` is a UE specific parameter that defines the bandwidth of the SRS. The SRS either spans the entire frequency bandwidth or uses frequency hopping when several narrow-band SRS cover the same total bandwidth.

The standard defines up to four bandwidths for the SRS. The most narrow SRS bandwidth (`BSRS = 3`) spans four resource blocks and is available for all channel bandwidths. The other three values of `BSRS` define more wideband SRS bandwidths. Their availability depends on the channel bandwidth.

The availability of SRS bandwidths additionally depends on the bandwidth configuration of the SRS (`CSRS`).

For more information refer to 3GPP TS 36.211, chapter 5.5.3.2 "Mapping to Physical Resources" for the Sounding Reference Signal.

Remote command:

[CONFigure\[:LTE\]:UL\[:CC<cc>\]:SRS:BSRS](#) on page 140

Hopping BW b_hop

Defines the parameter `bhop`.

`bhop` is a UE specific parameter that defines the frequency hopping bandwidth. SRS frequency hopping is active if `bhop < BSRS`.

For more information refer to 3GPP TS 36.211, chapter 5.5.3.2 "Mapping to Physical Resources" for the Sounding Reference Signal.

Remote command:

[CONFigure\[:LTE\]:UL\[:CC<cc>\]:SRS:BHOP](#) on page 139

SRS Cyclic Shift N_CS

Defines the cyclic shift (`nCS`) used for the generation of the SRS CAZAC sequence.

Because the different shifts of the same Zadoff-Chu sequence are orthogonal to each other, applying different SRS cyclic shifts can be used to schedule different UE to simultaneously transmit their SRS.

Remote command:

[CONFigure\[:LTE\]:UL\[:CC<cc>\]:SRS:CYCS](#) on page 140

SRS Rel Power

Defines the power of the SRS relative to the power of the corresponding UE ($P_{\text{SRS_Offset}}$).

The effective power level of the SRS is calculated as follows.

$$P_{\text{SRS}} = P_{\text{UE}} + P_{\text{SRS_Offset}}$$

The relative power of the SRS is applied to all subframes.

Remote command:

[CONFigure\[:LTE\]:UL\[:CC<cc>\]:SRS:POWer](#) on page 141

SRS BW Conf. C_SRS

Defines the bandwidth configuration of the SRS.

The bandwidth configuration is a cell-specific parameter that, in combination with the SRS bandwidth and the channel bandwidth, defines the length of the sounding reference signal sequence. For more information on the calculation, refer to 3GPP TS 36.211 chapter 5.5.3 "Sounding Reference Signal".

Remote command:

[CONFigure\[:LTE\]:UL\[:CC<cc>\]:SRS:CSRS](#) on page 140

Conf. Index I_SRS

Defines the configuration index of the SRS.

The configuration index I_{SRS} is a cell specific parameter that determines the SRS periodicity (T_{SRS}) and the SRS subframe offset (T_{offset}). The effects of the configuration index on T_{SRS} and T_{offset} depends on the duplexing mode.

For more information refer to 3GPP TS 36.213, Table 8.2-1 (FDD) and 8.2-2 (TDD).

Remote command:

[CONFigure\[:LTE\]:UL\[:CC<cc>\]:SRS:ISRS](#) on page 141

Transm. Comb. k_TC

Defines the transmission comb k_{TC} .

The transmission comb. is a UE specific parameter. For more information refer to 3GPP TS 36.211, chapter 5.5.3.2 "Mapping to Physical Resources" for the Sounding Reference Signal.

Remote command:

[CONFigure\[:LTE\]:UL\[:CC<cc>\]:SRS:TRComb](#) on page 142

Freq. Domain Pos. n_RRC

Defines the parameter n_{RRC} .

n_{RRC} is a UE specific parameter and determines the starting physical resource block of the SRS transmission.

For more information refer to 3GPP TS 36.211, chapter 5.5.3.2 "Mapping to Physical Resources" for the Sounding Reference Signal.

Remote command:

[CONFigure\[:LTE\]:UL\[:CC<cc>\]:SRS:NRRC](#) on page 141

A/N + SRS Simultaneous TX

Turns simultaneous transmission of the Sounding Reference Signal (SRS) and ACK/NACK messages (via PUCCH) on and off.

By turning the parameter on, you allow for simultaneous transmission of PUCCH and SRS in the same subframe.

If off, the SRS not transmitted in the subframe for which you have configured simultaneous transmission of PUCCH and SRS.

Note that simultaneous transmission of SRS and PUCCH is available only if the PUCCH format is either 1, 1a, 1b or 3. The other PUCCH formats contain CQI reports which are not transmitted with the SRS.

Remote command:

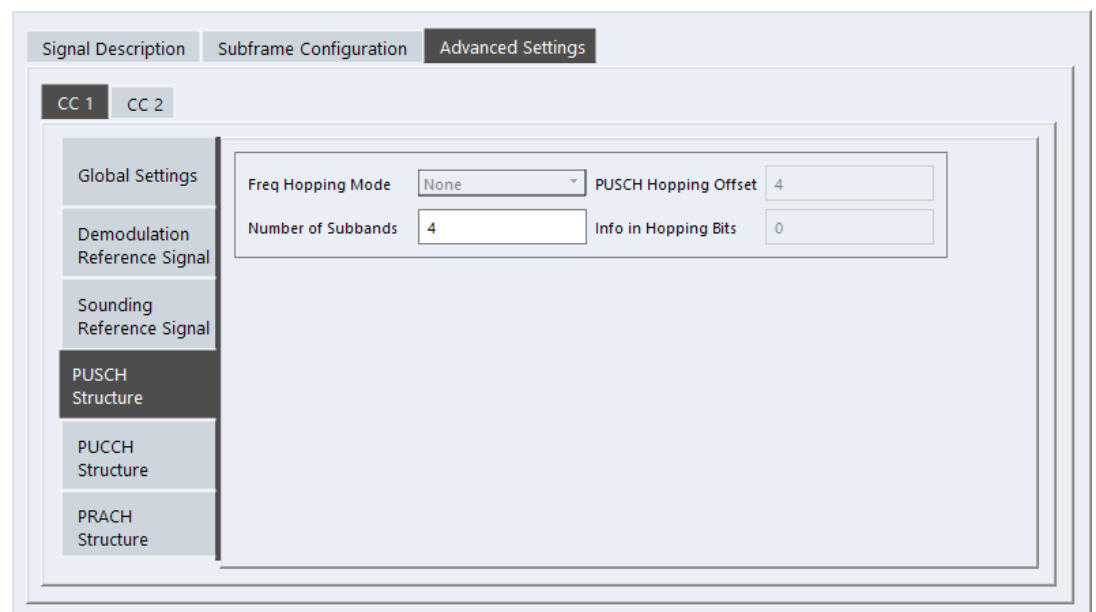
[CONFigure\[:LTE\]:UL\[:CC<cc>\]:SRS:ANST](#) on page 139

4.2.7 PUSCH structure

Access: "Overview" > "Signal Description" > "Advanced Settings" > "PUSCH Structure"

The PUSCH structure settings contain settings that describe the physical attributes and structure of the PUSCH.

The following settings are not supported by the OneWeb application: "Freq Hopping Mode", "PUSCH Hopping Offset" and "Info In Hopping Bits".





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.

[Number of Subbands](#)..... 48

Number of Subbands

Defines the number of subbands reserved for PUSCH.

For more information refer to 3GPP TS 36.211, chapter 5.5.3.2 "Mapping to Physical Resources" for the Sounding Reference Signal.

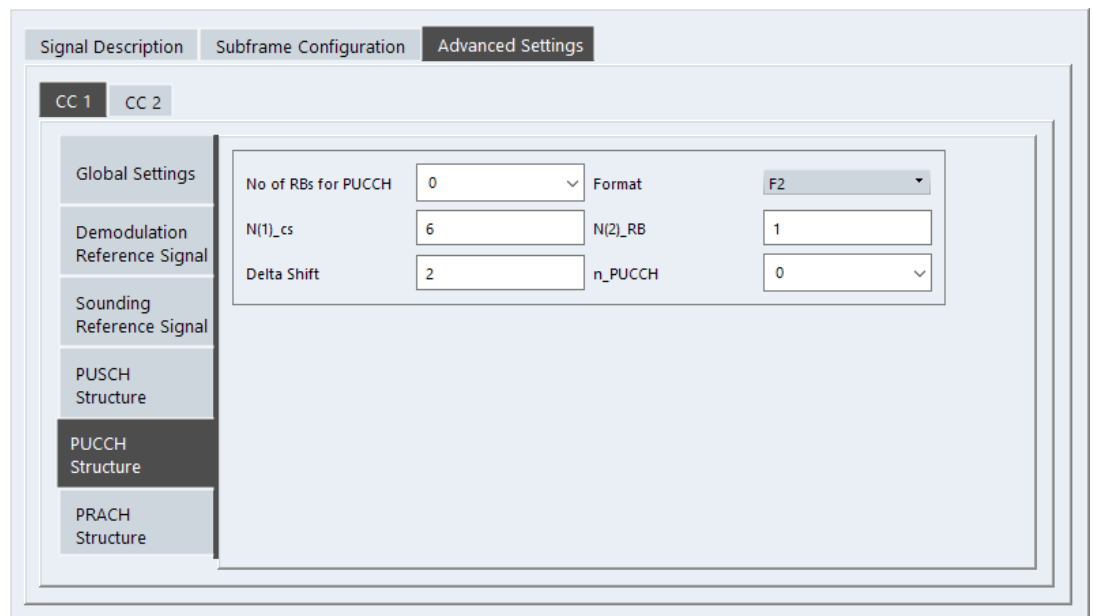
Remote command:

`CONFigure [:LTE] :UL[:CC<cc>] :PUSCh:NOSM` on page 143

4.2.8 PUCCH structure

Access: "Overview" > "Signal Description" > "Advanced Settings" > "PUCCH Structure"

The PUCCH structure settings contain settings that describe the physical attributes and structure of the PUCCH.





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.

No. of RBs for PUCCH.....	49
N(1)_cs.....	49
Delta Shift.....	49
Format.....	50
N(2)_RB.....	50
N_PUCCH.....	50

No. of RBs for PUCCH

Defines the number of resource blocks reserved for PUCCH.

The resource blocks for PUCCH are always allocated at the edges of the OneWeb spectrum.

In case of an even number of PUCCH resource blocks, half of the available PUCCH resource blocks is allocated on the lower, the other half on the upper edge of the OneWeb spectrum (outermost resource blocks).

In case of an odd number of PUCCH resource blocks, the number of resource blocks on the lower edge is one resource block larger than the number of resource blocks on the upper edge of the OneWeb spectrum.

If you select the "Auto" menu item, the application automatically detects the number of RBs.

Remote command:

`CONFigure[:LTE]:UL[:CC<cc>]:PUCCh:NORB` on page 145

N(1)_cs

Defines the number of cyclic shifts used for PUCCH format 1/1a/1b in a resource block used for a combination of the formats 1/1a/1b and 2/2a/2b.

Only one resource block per slot can support a combination of the PUCCH formats 1/1a/1b and 2/2a/2b.

The number of cyclic shifts available for PUCCH format 2/2a/2b N(2)_cs in a block with combination of PUCCH formats is calculated as follows.

$$N(2)_cs = 12 - N(1)_cs - 2$$

For more information refer to 3GPP TS36.211, chapter 5.4 "Physical Uplink Control Channel".

Remote command:

`CONFigure[:LTE]:UL[:CC<cc>]:PUCCh:N1CS` on page 144

Delta Shift

Defines the delta shift parameter.

The delta shift is the difference between two adjacent PUCCH resource indices with the same orthogonal cover sequence (OC).

It determines the number of available sequences in a resource block that can be used for PUCCH formats 1/1a/1b.

For more information refer to 3GPP TS36.211, chapter 5.4 "Physical Uplink Control Channel".

Remote command:

`CONFigure[:LTE]:UL[:CC<cc>]:PUCCh:DESHift` on page 143

Format

Selects the format of the PUCCH.

You can define the PUCCH format for all subframes or define the PUCCH format for each subframe individually.

- F1, F1a, F1b, F2, F2a, F2b, F3
Selects the PUCCH format globally for every subframe.
- Per Subframe
You can select the PUCCH format for each subframe separately in the [Enhanced settings](#) of the "Subframe Configuration".

Note that formats F2a and F2b are only supported for normal cyclic prefix length.

For more information refer to 3GPP TS36.211, table 5.4-1 "Supported PUCCH Formats".

Remote command:

`CONFigure[:LTE]:UL[:CC<cc>]:PUCCh:FORMat` on page 143

N(2)_RB

Defines bandwidth in terms of resource blocks that are reserved for PUCCH formats 2/2a/2b transmission in each subframe.

Since there can be only one resource block per slot that supports a combination of the PUCCH formats 1/1a/1b and 2/2a/2b, the number of resource block(s) per slot available for PUCCH format 1/1a/1b is determined by N(2)_RB.

For more information refer to 3GPP TS36.211, chapter 5.4 "Physical Uplink Control Channel".

Remote command:

`CONFigure[:LTE]:UL[:CC<cc>]:PUCCh:N2RB` on page 144

N_PUCCH

Defines the resource index for PUCCH format 1/1a/1b respectively 2/2a/2b.

You can select the PUCCH format manually or allow the application to determine the PUCCH format automatically based on the measurement.

It is also possible to define N_{PUCCH} on a subframe level by selecting the "Per Subframe" menu item. For more information see [Chapter 4.2.3, "Subframe configuration"](#), on page 34.

Remote command:

`CONFigure[:LTE]:UL[:CC<cc>]:PUCCh:NPAr` on page 145

4.2.9 PRACH structure

Access: "Overview" > "Signal Description" > "Advanced Settings" > "PRACH Structure"

The PRACH structure settings contain settings that describe the physical attributes and structure of the PRACH.



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.

PRACH Configuration	51
Restricted Set	52
Frequency Offset	52
Ncs Conf	52
Logical Root Sequ. Idx	52
Sequence Index (v)	52

PRACH Configuration

Sets the PRACH configuration index as defined in the 3GPP TS 36.211, i.e. defines the subframes in which random access preamble transmission is allowed.

The preamble format is automatically derived from the PRACH Configuration.

Remote command:

`CONFigure[:LTE]:UL[:CC<cc>]:PRACH:CONF` on page 145

Restricted Set

This command turns the restricted preamble set on and off.

A restricted preamble set corresponds to high speed mode. An unrestricted preamble set to normal mode.

Remote command:

`CONFigure[:LTE]:UL[:CC<cc>]:PRACH:RSET` on page 147

Frequency Offset

The "Frequency Offset" defines the PRACH frequency offset for preamble formats 0 to 3 as defined in the 3GPP TS 36.211. The frequency offset determines the first physical resource block available for PRACH expressed as a physical resource block number.

Remote command:

`CONFigure[:LTE]:UL[:CC<cc>]:PRACH:FOFFset` on page 146

Ncs Conf

Selects the Ncs configuration, i.e. determines the Ncs value set according to TS 36.211, table 5.7.2.-2 and 5.7.2-3.

Remote command:

`CONFigure[:LTE]:UL[:CC<cc>]:PRACH:NCSC` on page 146

Logical Root Sequ. Idx

Selects the logical root sequence index.

The logical root sequence index is used to generate PRACH preamble sequences. It is provided by higher layers.

Remote command:

`CONFigure[:LTE]:UL[:CC<cc>]:PRACH:RSEQ` on page 146

Sequence Index (v)

Defines the sequence index (v).

The sequence index controls which of the 64 preambles available in a cell is used.

If you select the "Auto" menu item, the software automatically selects the required sequence index.

Remote command:

`CONFigure[:LTE]:UL[:CC<cc>]:PRACH:SINDEX` on page 147

4.2.10 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](#).....53
- [I/Q file input](#)..... 54

4.2.10.1 RF input

Functions to configure the RF input described elsewhere:

- "Input Coupling" on page 60
- "Impedance" on page 60

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.....	53
YIG-Preselector.....	53
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Oscilloscope Sample Rate.....	54

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 148

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 149

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 150

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 152

Input source oscilloscope waveform mode:

[INPut<ip>:RF:CAPMode:WAVeform:SRATe](#) on page 151

Input source oscilloscope I/Q mode:

[INPut<ip>:RF:CAPMode:IQ:SRATe](#) on page 150

4.2.10.2 I/Q file input

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



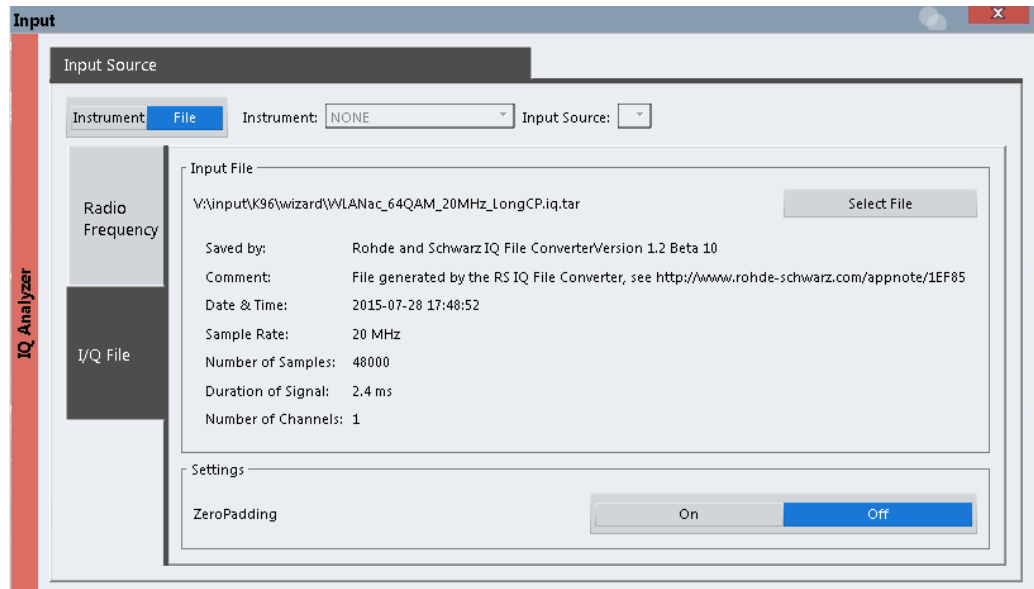
Loading a file via drag&drop

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 One-Web 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 \(Instrument / File\)](#)..... 55

[Input File](#)..... 56

[Zero Padding](#)..... 56

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 151

`INPut:SELEct` on page 149

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 148

4.2.11 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 6.9.2.3, "Frequency configuration"](#), on page 152.

Signal Frequency.....	57
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L Frequency Stepsize.....	57

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 152

Frequency offset: `[SENSe:] FREQuency:CENTer[:CC<cc>]:OFFSet` on page 153

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:

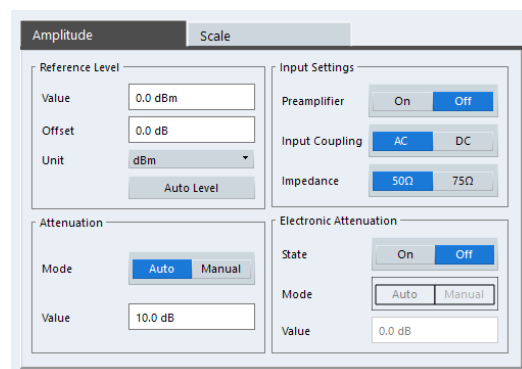
Frequency stepsize: `[SENSe:] FREQuency:CENTer:STEP` on page 154

4.2.12 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.



The remote commands required to configure the amplitude are described in [Chapter 6.9.2.4, "Amplitude configuration"](#), on page 154.

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L Electronic Attenuation.....	59
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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 OneWeb.

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 154

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<ant>` on page 170

Auto level mode: `[SENSe<ip>:]ADJust:CONFigure:LEVel:DURation:MODE` on page 170

Auto level time: `[SENSe<ip>:]ADJust:CONFigure:LEVel:DURation` on page 169

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 155

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 OneWeb 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 156

Level: `INPut<ip>:ATTenuation<ant>` on page 155

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 159

Electronic attenuation: `INPut<ip>:EATT<ant>:AUTO` on page 158

Electronic attenuation: `INPut<ip>:EATT<ant>` on page 158

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.

This function is not available for input from the (optional) "Digital Baseband" interface.

"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 157

[INPut<ip>:GAIN<ant>\[:VALue\]](#) on page 157

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.

Not available for input from the optional "Digital 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 156

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 "Digital Baseband" interface.

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

Remote command:

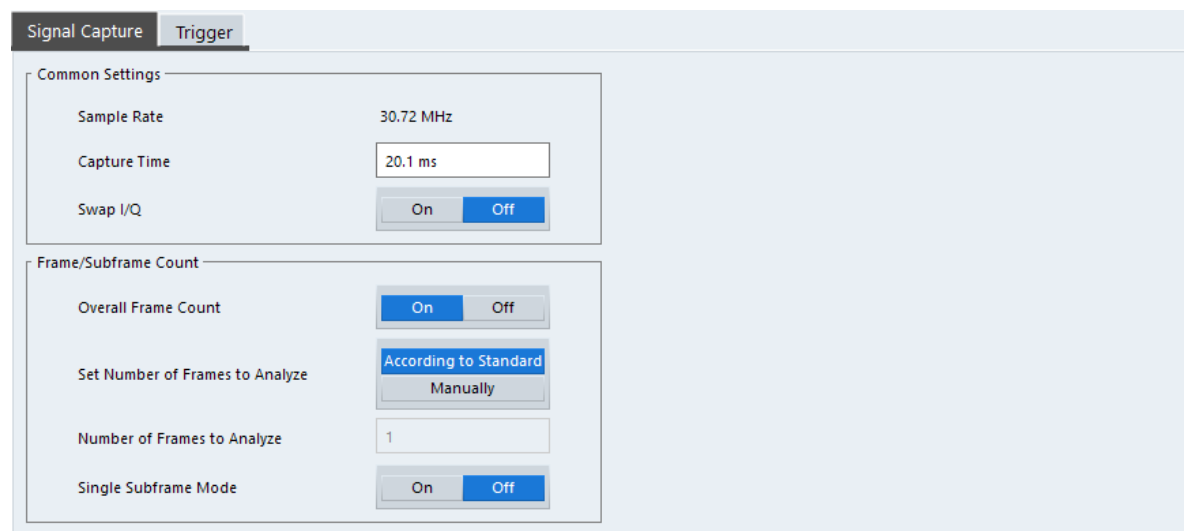
[INPut<ip>:IMPedance<ant>](#) on page 158

4.2.13 Data capture

Access: "Overview" > "Trig / Sig Capture" > "Signal Capture"

The data capture settings contain settings that control the data capture.

The data capture settings are part of the "Signal Capture" tab of the "Trigger/Signal Capture" dialog box.



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Swap I/Q.....	61
Overall Frame Count.....	62
Auto According to Standard.....	62
Number of Frames to Analyze.....	62
Single Subframe Mode.....	62

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 OneWeb frame is captured in the measurement.

Remote command:

[\[SENSe:\] SWEEp:TIME](#) on page 161

Swap I/Q

Swaps the real (I branch) and the imaginary (Q branch) parts of the signal.

Remote command:

[SENSe:] SWAPiQ on page 160

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.

The results are an average of the captured frames.

When you turn off the overall frame count, the application analyzes all OneWeb frames found in one capture buffer.

Remote command:

[SENSe:] [LTE:] FRAME:COUNT:STATE on page 160

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:] [LTE:] FRAME:COUNT:AUTO on page 160

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:] [LTE:] FRAME:COUNT on page 159

Single Subframe Mode

Turns the evaluation of a single subframe only on and off.

Evaluating a single subframe only improves the measurement speed. For successful synchronization, the subframe must be located within the captured data (= 1.2 ms). You can make sure that this is the case by using, for example, an external frame trigger signal.

For maximum measurement speed, the application turns off [Auto According to Standard](#) and sets the [Number of Frames to Analyze](#) to 1. These settings prevent the application from capturing data more than once for a single run measurement.

Remote command:

[SENSe:] [LTE:] FRAME:SSUBframe on page 160

4.2.14 Trigger configuration

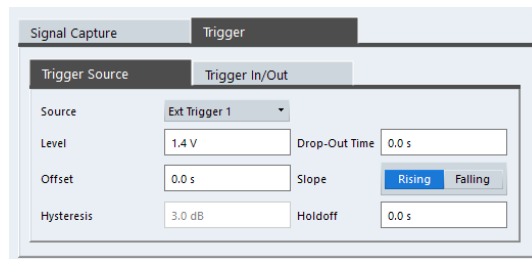
Access: "Overview" > "Trig / Sig Capture" > "Trigger"

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 a comprehensive description of the available trigger settings not described here, refer to the documentation of the connected instrument.



Trigger Source.....63

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.

For all trigger sources, except "Free Run", you can define several trigger characteristics.

- The trigger "Level" defines the signal level that initiates the measurement.

- 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 166

Level (external): `TRIGger[:SEquence]:LEVel<ant>[:EXTErnal<tp>]` on page 163

Level (I/Q power): `TRIGger[:SEquence]:LEVel<ant>:IQPower` on page 163

Level (IF power): `TRIGger[:SEquence]:LEVel<ant>:IFPower` on page 163

Level (RF power): `TRIGger[:SEquence]:LEVel<ant>:RFPower` on page 164

Offset: `TRIGger[:SEquence]:HOLDoff<ant>[:TIME]` on page 162

Hysteresis: `TRIGger[:SEquence]:IFPower:HYSteresis` on page 162

Drop-out time: `TRIGger[:SEquence]:DTIME` on page 161

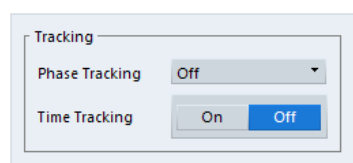
Slope: `TRIGger[:SEquence]:SLOPe` on page 165

Holdoff: `TRIGger[:SEquence]:IFPower:HOLDoff` on page 162

4.2.15 Tracking configuration

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

The tracking settings contain settings that compensate for various common measurement errors that may occur.



Phase.....	64
Time Tracking.....	65

Phase

Turns phase tracking on and off.

When you turn on phase tracking, the application compensates the measurement results for the phase error on a symbol level.

"Off" Phase tracking is not applied.

"Pilot Only" Only the reference signal is used for the estimation of the phase error.

"Pilot and Payload" Both reference signal and payload resource elements are used for the estimation of the phase error.

Remote command:

[SENSe:] [LTE:] UL:TRACking:PHASe on page 169

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.

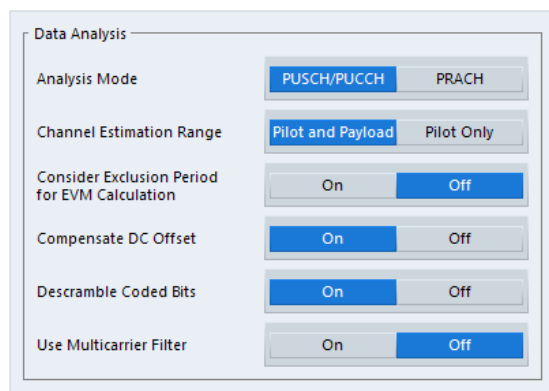
When you turn on time tracking, the application compensates the measurement results for timing errors on a symbol level.

Remote command:

[SENSe:] [LTE:] UL:TRACking:TIME on page 169

4.2.16 Signal demodulation

Access: "Overview" > "Demodulation"



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Channel Estimation Range.....	66
EVM with Exclusion Period.....	66
Compensate DC Offset.....	66
Scrambling of Coded Bits.....	66
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Analysis Mode

Selects the channel analysis mode.

You can select from "PUSCH/PUCCH" mode and "PRACH" mode.

"PUSCH/PUCCH" mode analyzes the PUSCH and PUCCH (default mode).

"PRACH" mode analyzes the PRACH only. In PRACH analysis mode, no subframe or slot selection is available. Instead you can select a particular preamble that the results are shown for. Note that PRACH analysis mode does not support all result displays.

Remote command:

[SENSe:] [LTE:] UL:DEMod:MODE on page 167

Channel Estimation Range

Selects the method for channel estimation.

You can select if only the pilot symbols are used to perform channel estimation or if both pilot and payload carriers are used.

Remote command:

[\[SENSe:\] \[LTE:\] UL:DEMod:CEStimation](#) on page 167

EVM with Exclusion Period

Turns exclusion periods for EVM measurements as defined in 3GPP TS 36.521 on and off.

The exclusion period affects the PUSCH data EVM of the first and last symbol.

The software automatically determines the length of the exclusion period according to 3GPP TS 36.521-1.

The exclusion period has no effect on the EVM vs Carrier and EVM vs Symbol x Carrier result displays.

Remote command:

[\[SENSe:\] \[LTE:\] UL:DEMod:EEPeriod](#) on page 167

Compensate DC Offset

Turns DC offset compensation when calculating measurement results on and off.

According to 3GPP TS 36.101 (Annex F.4), the R&S VSE removes the carrier leakage (I/Q origin offset) from the evaluated signal before it calculates the EVM and in-band emissions.

Remote command:

[\[SENSe:\] \[LTE:\] UL:DEMod:CDcoffset](#) on page 168

Scrambling of Coded Bits

Turns the scrambling of coded bits for the PUSCH on and off.

The scrambling of coded bits affects the bitstream results.

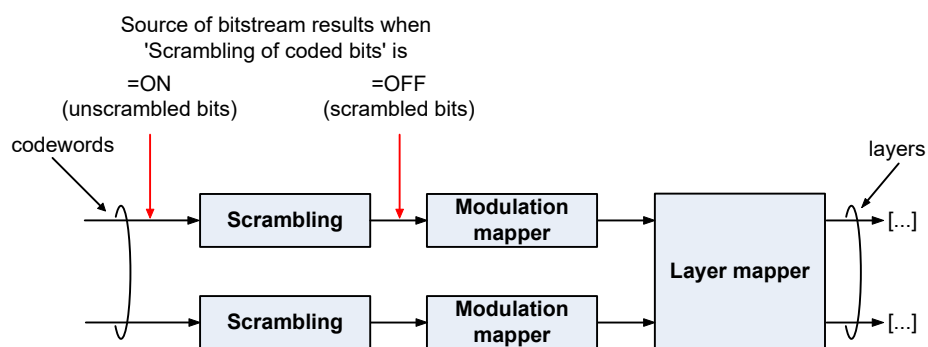


Figure 4-1: Source for bitstream results if scrambling for coded bits is on and off

Remote command:

[\[SENSe:\] \[LTE:\] UL:DEMod:CBScrambling](#) on page 168

Multicarrier Filter

Turns the suppression of interference of neighboring carriers on and off.

The R&S VSE automatically selects the multicarrier filter when you analyze more than 1 component carrier.

Remote command:

`[SENSe:] [LTE:] UL:DEMod:MCFilter` on page 168

4.2.17 Automatic configuration

Access: in the toolbar: "Auto Level" / "Auto Config" / "Auto Scale" / "Auto S-All" / "Auto All"

The R&S VSE features several automatic configuration routines. When you use one of those, the R&S VSE configures different parameters based on the signal that you are measuring.

Auto leveling

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

Remote command:

`[SENSe:] ADJust:LEVel<ant>` on page 170

Auto Scaling

Scales the y-axis for best viewing results. Also see "[Automatic scaling of the y-axis](#)" on page 69.

Remote command:

`DISPlay[:WINDow<n>] [:SUBWindow<w>]:TRACe<t>:Y[:SCALE]:AUTO`
on page 175

5 Analysis

The R&S VSE provides various tools to analyze the measurement results.

- [General analysis tools](#).....68
- [Analysis tools for I/Q measurements](#)..... 71

5.1 General analysis tools

The general analysis tools are tools available for all measurements.

- [Data export](#).....68
- [Diagram scale](#)..... 69
- [Zoom](#)..... 70
- [Markers](#)..... 70

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

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`.

- 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 105

I/Q export: `MMEMory:STORe<n>:IQ:STATe` on page 125

I/Q import: `INPut:FILE<fi>:PATH` on page 148

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 6.10.3, "Y-axis scale"](#), on page 175.

Manual scaling of the y-axis	69
Automatic scaling of the y-axis	69

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 176

`DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:MINimum`
on page 176

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 175

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 "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

- [Layout of numerical results](#).....71
- [Evaluation range](#).....71
- [Result settings](#).....75

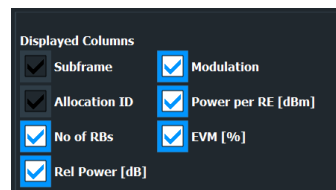
5.2.1 Layout of numerical results

You can customize the displayed information of some numerical result displays or tables, for example the [allocation summary](#).

- ▶ Select some point in the header row of the table.

Sub-frame	Allocation ID	Rel Power [dB]	Modulation	EVM [%]
-----------	---------------	----------------	------------	---------

The application opens a dialog box to add or remove columns.

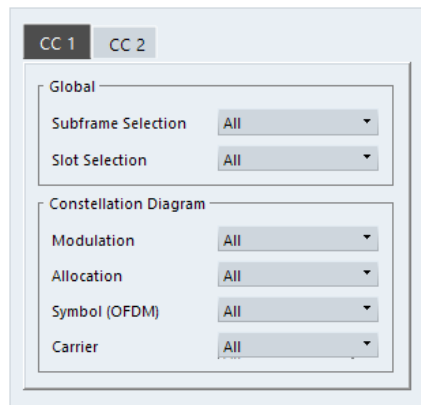


Add and remove columns as required.

5.2.2 Evaluation range

Access: "Overview" > "Evaluation Range"

The evaluation range defines the signal parts that are considered during signal analysis.



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.

[Subframe Selection](#).....72
[Slot Selection](#).....73
[Preamble Selection](#).....74
[Evaluation range for the constellation diagram](#).....74

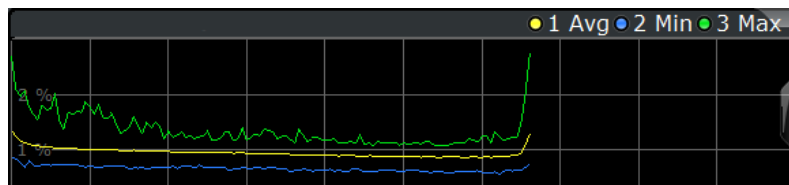
Subframe Selection

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.

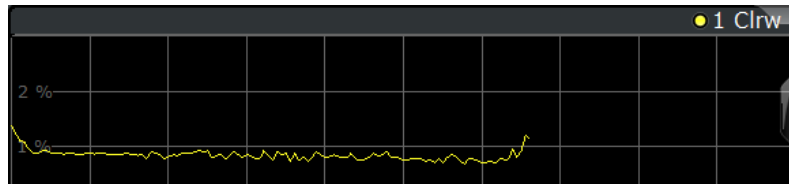


If you filter by a single subframe, the R&S VSE still shows three traces, but with different information.

- 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](#).



In PRACH analysis mode, you cannot filter by a single subframe.

You can apply the filter to the following result displays.

- Result Summary
- EVM vs Carrier / EVM vs Symbol / EVM vs Symbol X Carrier
- Spectrum Flatness / Spectrum Flatness SRS / Spectrum Flatness Difference
- Inband Emission
- Group Delay
- Power vs Symbol X Carrier
- Constellation Diagram
- Allocation Summary
- Bit Stream
- Time Alignment Error

Remote command:

`[SENSe:] [LTE:] [CC<cc>:] SUBFrame:SElect` on page 174

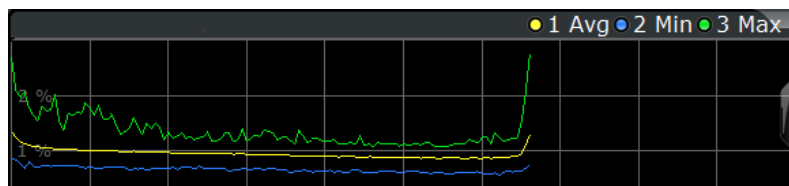
Slot Selection

The "Slot" selection filters the results by a specific slot number.

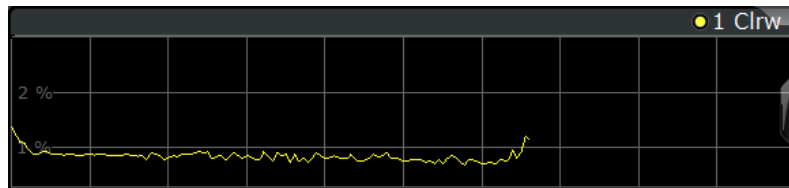
If you apply the filter, only the results for the slot you have selected are displayed. Otherwise, the R&S VSE shows the results for all slots.

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.



In PRACH analysis mode, you cannot filter by a single slot.

You can apply the filter to the following result displays.

- Result Summary
- EVM vs Carrier / EVM vs Symbol / EVM vs Symbol X Carrier
- Inband Emission
- Spectrum Flatness / Spectrum Flatness Difference
- Group Delay
- Power vs Symbol X Carrier
- Constellation Diagram

Remote command:

`[SENSe:] [LTE:] [CC<cc>:] SLOT:SElect` on page 174

Preamble Selection

The "Preamble" selection filters the results by a specific preamble.

The R&S VSE shows three traces if you display the results for all preambles.

- One trace ("Min") shows the minimum values measured over all preambles.
- One trace ("Max") shows the maximum values measured over all preambles.
- One trace ("Avg") shows the average values measured over all preambles.

If you filter by a single preamble, the R&S VSE shows one trace that represents the values measured for that preamble only.

Remote command:

`[SENSe:] [LTE:] [CC<cc>:] PREamble:SElect` on page 174

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.

Remote command:

Modulation: `[SENSe:] [LTE:] [CC<cc>:] MODulation:SElect` on page 173

Allocation: `[SENSe:] [LTE:] [CC<cc>:] ALLocation:SElect` on page 172

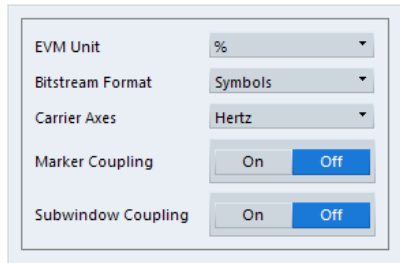
Symbol: `[SENSe:] [LTE:] [CC<cc>:] SYMBol:SElect` on page 175

Carrier: `[SENSe:] [LTE:] [CC<cc>:] CARRier:SElect` on page 173

5.2.3 Result settings

Access: "Overview" > "Analysis" > "Result Settings"

Result settings define the way certain measurement results are displayed.



EVM Unit.....75
 Bit Stream Format.....75
 Carrier Axes.....76
 Marker Coupling.....76

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 178

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.

Example:

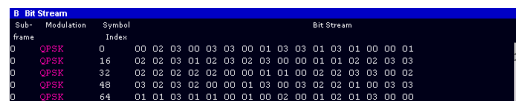


Figure 5-1: Bit stream display in uplink application if the bit stream format is set to "symbols"

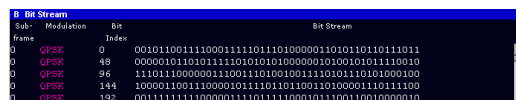


Figure 5-2: Bit stream display in uplink application if the bit stream format is set to "bits"

Remote command:

`UNIT: BSTR` on page 177

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 178

Marker Coupling

Couples or decouples markers that are active in multiple result displays.

When you turn on this feature, the application moves the marker to its new position in all active result displays.

When you turn it off, you can move the markers in different result displays independent from each other.

Remote command:

[CALCulate<n>:MARKer<m>:COUPling](#) on page 177

6 Remote control

The following remote control commands are required to configure and perform One-Web 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 (specific status registers for Pulse measurements are not used).

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6.1 Common suffixes

In the OneWeb measurement application, the following common suffixes are used in remote commands:

Table 6-1: Common suffixes used in remote commands in the OneWeb 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..110	Selects a subframe allocation.
<in>		Selects an instrument for MIMO measurements.
<ant>	1..4	Selects an antenna for MIMO measurements.

Suffix	Value range	Description
<cc>	1..5	Selects a component carrier. The actual number of supported component carriers depends on the selected measurement
<cluster>	1..2	Selects a cluster (uplink only).
<cw>	1..n	Selects a codeword.
<k>	---	Selects a limit line. Irrelevant for the OneWeb application.
<sf>	DL: 0..49 UL: 0..9	Selects a subframe.

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](#)..... 81
- [Boolean](#)..... 82
- [Character data](#)..... 82
- [Character strings](#)..... 82
- [Block data](#)..... 82

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 79.

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 OneWeb application selection

[INSTrument\[:SElect\]](#).....83

INSTrument[:SElect] <ChannelType>

Selects a new measurement channel with the defined channel type.

Parameters:

<ChannelType> **OWEB**
 OneWeb measurement channel

Example: //Select OneWeb application
 INST OWEB

6.4 Screen layout

- [General layout](#).....83
- [Layout over all channels](#)..... 84
- [Layout of a single channel](#)..... 87

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](#)..... 83

[DISPlay\[:WINDow<n>\]:TAB<tab>:SElect](#).....84

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 87 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]?	84
LAYout:GLOBal:CATalog[:WINDow]?	85
LAYout:GLOBal:IDENtify[:WINDow]?	86
LAYout:GLOBal:REMOve[:WINDow]	86
LAYout:GLOBal:REPLace[:WINDow]	87

LAYout:GLOBal:ADD[:WINDow]?

<ExChanName>,<ExWinName>,<Direction>,<NewChanName>,<NewWinType>

Adds a window to the display next to an existing window. The new window may belong to a different channel than the existing window.

To replace an existing window, use the `LAYout:GLOBal:REPLace[:WINDow]` command.

Parameters:

<ExChanName>	string Name of an existing channel
<ExWinName>	string Name of the existing window within the <ExChanName> channel the new window is inserted next to. By default, the name of a window is the same as its index. To determine the name and index of all active windows use the LAYout:GLOBal:IDENtify[:WINDow]? query .
<Direction>	LEFT RIGHT ABOVE BELOW TAB Direction the new window is added relative to the existing window. TAB The new window is added as a new tab in the specified existing window.
<NewChanName>	string Name of the channel for which a new window is to be added.
<NewWinType>	string Type of result display (evaluation method) you want to add. See the table below for available parameter values.

Return values:

<NewWindowName>	When adding a new window, the command returns its name (by default the same as its number) as a result.
-----------------	---

Example:

```
LAYout:GLOBal:ADD:WINDow? 'IQ
Analyzer', '1', RIGH, 'IQ Analyzer2', 'FREQ'
Adds a new window named 'Spectrum' with a Spectrum display
to the right of window 1 in the channel 'IQ Analyzer'.
```

Usage:

Query only

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]?	87
LAYout:CATalog[:WINDow]?	89
LAYout:IDENtify[:WINDow]?	90
LAYout:REMOve[:WINDow]	90
LAYout:REPLace[:WINDow]	90
LAYout:WINDow<n>:ADD?	91
LAYout:WINDow<n>:IDENtify?	92
LAYout:WINDow<n>:REMOve	92
LAYout:WINDow<n>:REPLace	92
LAYout:WINDow<n>:TYPE	93

LAYout:ADD[:WINDow]? <WindowName>, <Direction>, <WindowType>

Adds a window to the display in the active channel.

Is always used as a query so that you immediately obtain the name of the new window as a result.

To replace an existing window, use the `LAYout:REPLace[:WINDow]` command.

Query parameters:

<WindowName>	String containing the name of the existing window the new window is inserted next to. By default, the name of a window is the same as its index. To determine the name and index of all active windows, use the LAYout:CATalog[:WINDow]? query .
<Direction>	LEFT RIGHT ABOVE BELOW Direction the new window is added relative to the existing window.
<WindowType>	text value Type of result display (evaluation method) you want to add. See the table below for available parameter values. Note that the window type must be valid for the active channel. To create a window for a different channel, use the LAYout:GLOBal:REPLace[:WINDow] command.

Return values:

<NewWindowName>	When adding a new window, the command returns its name (by default the same as its number) as a result.
-----------------	---

Example:

```
LAY:ADD? '1', LEFT, MTAB
```

Result:

```
'2'
```

Adds a new window named '2' with a marker table to the left of window 1.

Usage:

Query only

Manual operation:

See ["Capture Buffer"](#) on page 13
 See ["EVM vs Carrier"](#) on page 14
 See ["EVM vs Symbol"](#) on page 15
 See ["EVM vs Subframe"](#) on page 16
 See ["Power Spectrum"](#) on page 16
 See ["Inband Emission"](#) on page 17
 See ["Spectrum Flatness"](#) on page 17
 See ["Spectrum Flatness SRS"](#) on page 18
 See ["Group Delay"](#) on page 18
 See ["Spectrum Flatness Difference"](#) on page 19
 See ["Constellation Diagram"](#) on page 19
 See ["CCDF"](#) on page 20
 See ["Allocation Summary"](#) on page 21
 See ["Bitstream"](#) on page 21
 See ["EVM vs Symbol x Carrier"](#) on page 22
 See ["Power vs Symbol x Carrier"](#) on page 22
 See ["Marker Table"](#) on page 26

Table 6-2: <WindowType> parameter values for OneWeb reverse link measurement application

Parameter value	Window type
I/Q measurements	
ASUM	"Allocation Summary"
BSTR	"Bitstream"
CBUF	"Capture Buffer"
CCDF	"CCDF"
CONS	"Constellation Diagram"
EVCA	"EVM vs. Carrier"
EVSU	"EVM vs. Subframe"
EVSY	"EVM vs. Symbol"
EVSC	"EVM vs. Symbol X Carrier"
GDEL	"Group Delay"
IE	"Inband Emission"
IEA	"Inband Emission All"
MTAB	"Marker Table"
PSPE	"Power Spectrum"
PVSC	"Power vs. Symbol X Carrier"
RSUM	"Result Summary"
SFD	"Spectrum Flatness Difference"
SFL	"Spectrum Flatness"
SFSR	"Spectrum Flatness SRS"

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 87 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 87 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 87 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 87.

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

6.5.1 Measurements

ABORt	93
INITiate<n>:CONTinuous	94
INITiate<n>:[IMMEDIATE]	95
[SENSe:]SYNC[:CC<cc>]:[STATe]?	95

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?
Would return, e.g. '1' for successful synchronization.
```

Usage: Query only

6.6 Trace data readout

- [Using the TRACe\[:DATA\] command](#)..... 95

6.6.1 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.

Note also that return values for results that are available for both downlink and uplink may be different.

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.

On an R&S FSQ or R&S FSV, the suffix `<n>` was not supported. On these instruments, you had to select the measurement window with `DISPlay:WINDow<n>:SElect` first.

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6.6.1.1 Allocation summary

For the allocation summary, the command returns several values for each line of the table.

- `<subframe>`

- <allocation ID>
- <number of RB>
- <offset RB>
- <modulation>
- <absolute power>
- <EVM>

The data format of the return values is always ASCII.

The return values have the following characteristics.

- The <allocation ID is encoded.
For the code assignment, see [Chapter 6.6.1.18, "Return value codes"](#), on page 104.
- The <modulation> is encoded.
For the code assignment, see [Chapter 6.6.1.18, "Return value codes"](#), on page 104.
- The unit for <absolute power> is always dBm.
- The unit for <EVM> depends on [UNIT:EVM](#).

Example:

Allocation Summary						
Sub-frame	Alloc. ID	Number of RB	Offset RB	Modulation	Power/dBm	EVM/%
0	PUSCH	10	2	QPSK	-84,743	0,002
	DMRS PUSCH			CAZAC	-84,743	0,002
	SRS			CAZAC	-80,940	0,003

TRAC:DATA? TRACE1 would return:

```
0, -40, 10, 2, 2, -84.7431947342849, 2.68723483754626E-06,
0, -41, 0, 0, 6, -84.7431432845264, 2.37549449584568E-06,
0, -42, 0, 0, 6, -80.9404231343884, 3.97834623871343E-06,
...
```

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
```

6.6.1.2 Bit stream

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.
<subframe>, <modulation>, <# of symbols/bits>,
<hexadecimal/binary numbers>, ...

All values have no unit. The format of the bit stream depends on [Bit Stream Format](#).

The <modulation> is encoded. For the code assignment see [Chapter 6.6.1.18, "Return value codes"](#), on page 104.

For symbols or bits that are not transmitted, the command returns

- "FFF" if the bit stream format is "Symbols"
- "9" if the bit stream format is "Bits".

For symbols or bits that could not be decoded because the number of layer exceeds the number of receive antennas, the command returns

- "FFE" if the bit stream format is "Symbols"
- "8" if the bit stream format is "Bits".

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	PUSCH	1/1	QPSK	0	03 01 02 03 03 00 00 00 01 02 02 01 02 01 00 00
0	PUSCH	1/1	QPSK	16	00 03 03 03 02 02 01 00 03 01 02 03 03 03 01
0	PUSCH	1/1	QPSK	32	03 03 00 00 03 01 02 00 01 00 02 00 02 00 00 03

`TRAC:DATA? TRACE1` would return:

```
0, -40, 0, 2, 0, 03, 01, 02, 03, 03, 00, 00, 00, 01, 02, 02, ...
<continues like this until the next data block starts or the end of data is reached>
0, -40, 0, 2, 32, 03, 03, 00, 00, 03, 01, 02, 00, 01, 00, ...
```

6.6.1.3 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.

6.6.1.4 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.

6.6.1.5 Channel and spectrum flatness

For the channel flatness result display, the command returns one value for each trace point.

<relative power>, ...

The unit is always dB.

The following parameters are supported.

- `TRAC:DATA TRACE1`
Returns the average power over all subframes.
- `TRAC:DATA TRACE2`
Returns the minimum power found over all subframes. If you are analyzing a particular subframe, it returns nothing.
- `TRAC:DATA TRACE3`
Returns the maximum power found over all subframes. If you are analyzing a particular subframe, it returns nothing.

6.6.1.6 Channel and spectrum flatness difference

For the channel flatness difference 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 OneWeb bandwidth.

The following parameters are supported.

- `TRAC:DATA TRACE1`
Returns the average power over all subframes.
- `TRAC:DATA TRACE2`
Returns the minimum power found over all subframes. If you are analyzing a particular subframe, it returns nothing.
- `TRAC:DATA TRACE3`

Returns the maximum power found over all subframes. If you are analyzing a particular subframe, it returns nothing.

6.6.1.7 Channel flatness SRS

For the channel flatness SRS result display, the command returns one value for each trace point.

<relative power>, ...

The unit is always dB.

The following parameters are supported.

- `TRAC:DATA TRACE1`
Returns the average power over all subframes.
- `TRAC:DATA TRACE2`
Returns the minimum power found over all subframes. If you are analyzing a particular subframe, it returns nothing.
- `TRAC:DATA TRACE3`
Returns the maximum power found over all subframes. If you are analyzing a particular subframe, it returns nothing.

6.6.1.8 Group delay

For the group delay result display, the command returns one value for each trace point.

<group delay>, ...

The unit is always ns. The number of values depends on the selected OneWeb bandwidth.

The following parameters are supported.

- `TRAC:DATA TRACE1`
Returns the average group delay over all subframes.
- `TRAC:DATA TRACE2`
Returns the minimum group delay found over all subframes. If you are analyzing a particular subframe, it returns nothing.
- `TRAC:DATA TRACE3`
Returns the maximum group delay found over all subframes. If you are analyzing a particular subframe, it returns nothing.

6.6.1.9 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)]>

```

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.

The following parameters are supported.

- TRAC:DATA TRACE1
Returns all constellation points included in the selection.
- TRAC:DATA TRACE2
Returns the constellation points of the reference symbols included in the selection.
- TRAC:DATA TRACE3
Returns the constellation points of the SRS included in the selection.

6.6.1.10 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
Returns the average EVM over all subframes
- TRAC:DATA TRACE2
Returns the minimum EVM found over all subframes. If you are analyzing a particular subframe, it returns nothing.
- TRAC:DATA TRACE3
Returns the maximum EVM found over all subframes. If you are analyzing a particular subframe, it returns nothing.

6.6.1.11 EVM vs subframe

For the EVM vs subframe result display, the command returns one value for each subframe that has been analyzed.

<EVM>, ...

The unit depends on [UNIT:EVM](#).

The following parameters are supported.

- TRAC:DATA TRACE1

6.6.1.12 EVM vs symbol

For the EVM vs symbol result display, the command returns one value for each OFDM symbol that has been analyzed.

<EVM>, ...

For measurements on a single subframe, the command returns the symbols of that subframe only.

The unit depends on [UNIT:EVM](#).

The following parameters are supported.

- TRAC:DATA TRACE1

6.6.1.13 EVM vs symbol x carrier

For the EVM vs symbol x carrier, the command returns one value for each resource element.

<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](#).

Resource elements that are unused return NAN.

The following parameters are supported.

- TRAC:DATA TRACE1

6.6.1.14 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

6.6.1.15 Inband emission

For the inband emission result display, the number and type of returns values depend on the parameter.

- `TRAC:DATA TRACE1`
Returns the relative resource block indices (x-axis values).
<RB index>, ...
The resource block index has no unit.
- `TRAC:DATA TRACE2`
Returns one value for each resource block index.
<relative power>, ...
The unit of the relative inband emission is dB.
- `TRAC:DATA TRACE3`
Returns the data points of the upper limit line.
<limit>, ...
The unit is always dB.

Note that you have to select a particular subframe to get results.

6.6.1.16 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`

6.6.1.17 Power vs symbol x carrier

For the power vs symbol x carrier, the command returns one value for each resource element.

<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.

Resource elements that are unused return NAN.

The following parameters are supported.

- `TRAC:DATA TRACE1`

6.6.1.18 Return value codes

<number of symbols or bits>

In hexadecimal mode, this represents the number of symbols to be transmitted. In binary mode, it represents the number of bits to be transmitted.

<allocation ID>

Represents the allocation ID. The value is a number in the range {1...-70}.

- 1 = Reference symbol
- 0 = Data symbol
- -1 = Invalid
- -40 = PUSCH
- -41 = DMRS PUSCH
- -42 = SRS PUSCH
- -43 = PUACH
- -44 = DMRS PUACH
- -50 = PUCCH
- -51 = DMRS PUCCH
- -70 = PRACH

<channel type>

- 0 = TX channel
- 1 = adjacent channel
- 2 = alternate channel

<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

<modulation>

Represents the modulation scheme.

- 0 = unrecognized
- 1 = RBPSK
- 2 = QPSK

- 3 = 16QAM
- 4 = 64QAM
- 5 = 8PSK
- 6 = CAZAC
- 7 = mixed modulation
- 8 = BPSK
- 14 = 256QAM

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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>[: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](#)

Query parameters:

<TraceNumber> **TRACE1 | TRACE2 | TRACE3**
 Queries the trace data of the corresponding trace.

LIST Queries the results for the SEM measurement.

Return values:

<TraceData>

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

Usage: Query only

Manual operation: See "[Data import and export](#)" on page 69

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 13
 See ["EVM vs Carrier"](#) on page 14
 See ["EVM vs Symbol"](#) on page 15
 See ["EVM vs Subframe"](#) on page 16
 See ["Power Spectrum"](#) on page 16
 See ["Inband Emission"](#) on page 17
 See ["Spectrum Flatness"](#) on page 17
 See ["Spectrum Flatness SRS"](#) on page 18
 See ["Group Delay"](#) on page 18
 See ["Spectrum Flatness Difference"](#) on page 19

6.7 Numeric result readout

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- [Result for selection](#)..... 111
- [Marker table](#)..... 116
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6.7.1 Frame results

FETCh[:CC<cc>]:SUMMary:EVM:SDOP[:AVERage]?	107
FETCh[:CC<cc>]:SUMMary:EVM:SDQP[:AVERage]?	107
FETCh[:CC<cc>]:SUMMary:EVM:SDST[:AVERage]?	107
FETCh[:CC<cc>]:SUMMary:EVM:SPOP[:AVERage]?	108
FETCh[:CC<cc>]:SUMMary:EVM:SPQP[:AVERage]?	108
FETCh[:CC<cc>]:SUMMary:EVM:SPST[:AVERage]?	108
FETCh[:CC<cc>]:SUMMary:EVM:UCCD[:AVERage]?	108

FETCh[:CC<cc>]:SUMMary:EVM:UCCH[:AVERage]?	109
FETCh[:CC<cc>]:SUMMary:EVM:UPOP[:AVERage]?	109
FETCh[:CC<cc>]:SUMMary:EVM:UPQP[:AVERage]?	109
FETCh[:CC<cc>]:SUMMary:EVM:UPRA[:AVERage]?	110
FETCh[:CC<cc>]:SUMMary:EVM:UPST[:AVERage]?	110
FETCh[:CC<cc>]:SUMMary:EVM:USOP[:AVERage]?	110
FETCh[:CC<cc>]:SUMMary:EVM:USQP[:AVERage]?	110
FETCh[:CC<cc>]:SUMMary:EVM:USST[:AVERage]?	111

FETCh[:CC<cc>]:SUMMary:EVM:SDOP[:AVERage]?

Queries the EVM of all DMRS PUSCH resource elements with 8PSK modulation.

Suffix:

<cc> [Component Carrier](#)

Return values:

<EVM> <numeric value>
 EVM in % or dB, depending on the unit you have set.

Example:

```
//Query EVM
FETC : SUMM : EVM : SDOP ?
```

Usage:

Query only

FETCh[:CC<cc>]:SUMMary:EVM:SDQP[:AVERage]?

Queries the EVM of all DMRS PUSCH resource elements with QPSK modulation.

Suffix:

<cc> [Component Carrier](#)

Return values:

<EVM> <numeric value>
 EVM in % or dB, depending on the unit you have set.

Example:

```
//Query EVM
FETC : SUMM : EVM : SDQP ?
```

Usage:

Query only

FETCh[:CC<cc>]:SUMMary:EVM:SDST[:AVERage]?

Queries the EVM of all DMRS PUSCH resource elements with 16QAM modulation.

Suffix:

<cc> [Component Carrier](#)

Return values:

<EVM> <numeric value>
 EVM in % or dB, depending on the unit you have set.

Example:

```
//Query EVM
FETC : SUMM : EVM : SDST ?
```

Usage: Query only

FETCh[:CC<cc>]:SUMMary:EVM:SPOP[:AVERAge]?

Queries the EVM of all PUACH resource elements with 8PSK modulation.

Suffix:

<cc> [Component Carrier](#)

Return values:

<EVM> <numeric value>
EVM in % or dB, depending on the unit you have set.

Example: //Query EVM
FETC : SUMM : EVM : SPOP ?

Usage: Query only

FETCh[:CC<cc>]:SUMMary:EVM:SPQP[:AVERAge]?

Queries the EVM of all PUACH resource elements with QPSK modulation.

Suffix:

<cc> [Component Carrier](#)

Return values:

<EVM> <numeric value>
EVM in % or dB, depending on the unit you have set.

Example: //Query EVM
FETC : SUMM : EVM : SPQP ?

Usage: Query only

FETCh[:CC<cc>]:SUMMary:EVM:SPST[:AVERAge]?

Queries the EVM of all PUACH resource elements with 16QAM modulation.

Suffix:

<cc> [Component Carrier](#)

Return values:

<EVM> <numeric value>
EVM in % or dB, depending on the unit you have set.

Example: //Query EVM
FETC : SUMM : EVM : SPST ?

Usage: Query only

FETCh[:CC<cc>]:SUMMary:EVM:UCCD[:AVERAge]?

Queries the EVM of all DMRS PUCCH resource elements.

Suffix:
 <cc> [Component Carrier](#)

Return values:
 <EVM> EVM in % or dB, depending on the unit you have set.

Example:
 //Query EVM
 FETC : SUMM : EVM : UCCD ?

Usage: Query only

FETCh[:CC<cc>]:SUMMary:EVM:UCCH[:AVERAge]?

Queries the EVM of all PUCCH resource elements.

Suffix:
 <cc> [Component Carrier](#)

Return values:
 <EVM> EVM in % or dB, depending on the unit you have set.

Example:
 //Query EVM
 FETC : SUMM : EVM : UCCH ?

Usage: Query only

FETCh[:CC<cc>]:SUMMary:EVM:UPOP[:AVERAge]?

Queries the EVM of all PUACH resource elements with 8PSK modulation.

Suffix:
 <cc> [Component Carrier](#)

Return values:
 <EVM> <numeric value>
 EVM in % or dB, depending on the unit you have set.

Example:
 //Query EVM
 FETC : SUMM : EVM : UPOP ?

Usage: Query only

FETCh[:CC<cc>]:SUMMary:EVM:UPQP[:AVERAge]?

Queries the EVM of all PUACH resource elements with QPSK modulation.

Suffix:
 <cc> [Component Carrier](#)

Return values:
 <EVM> <numeric value>
 EVM in % or dB, depending on the unit you have set.

Example:
 //Query EVM
 FETC : SUMM : EVM : UPQP ?

Usage: Query only

FETCh[:CC<cc>]:SUMMary:EVM:UPRA[:AVERAge]?

Queries the EVM of all PRACH resource elements.

Suffix:

<cc> [Component Carrier](#)

Return values:

<EVM> EVM in % or dB, depending on the unit you have set.

Example:

```
//Query EVM
FETC : SUMM : EVM : UPRA ?
```

Usage: Query only

FETCh[:CC<cc>]:SUMMary:EVM:UPST[:AVERAge]?

Queries the EVM of all PUACH resource elements with 16QAM modulation.

Suffix:

<cc> [Component Carrier](#)

Return values:

<EVM> <numeric value>
EVM in % or dB, depending on the unit you have set.

Example:

```
//Query EVM
FETC : SUMM : EVM : UPST ?
```

Usage: Query only

FETCh[:CC<cc>]:SUMMary:EVM:USOP[:AVERAge]?

Queries the EVM of all PUSCH resource elements with 8PSK modulation.

Suffix:

<cc> [Component Carrier](#)

Return values:

<EVM> <numeric value>
EVM in % or dB, depending on the unit you have set.

Example:

```
//Query EVM
FETC : SUMM : EVM : USOP ?
```

Usage: Query only

FETCh[:CC<cc>]:SUMMary:EVM:USQP[:AVERAge]?

Queries the EVM of all PUSCH resource elements with QPSK modulation.

Suffix:	
<cc>	Component Carrier
Return values:	
<EVM>	<numeric value> EVM in % or dB, depending on the unit you have set.
Example:	//Query EVM FETC : SUMM : EVM : USQP ?
Usage:	Query only

FETCh[:CC<cc>]:SUMMary:EVM:USST[:AVERage]?

Queries the EVM of all PUSCH resource elements with 16QAM modulation.

Suffix:	
<cc>	Component Carrier
Return values:	
<EVM>	EVM in % or dB, depending on the unit you have set.
Example:	//Query EVM FETC : SUMM : EVM : USST ?
Usage:	Query only

6.7.2 Result for selection

FETCh[:CC<cc>]:SUMMary:CRESt[:AVERage]?	112
FETCh[:CC<cc>]:SUMMary:EVM[:ALL]:MAXimum?	112
FETCh[:CC<cc>]:SUMMary:EVM[:ALL]:MINimum?	112
FETCh[:CC<cc>]:SUMMary:EVM[:ALL][:AVERage]?	112
FETCh[:CC<cc>]:SUMMary:EVM:PCHannel:MAXimum?	112
FETCh[:CC<cc>]:SUMMary:EVM:PCHannel:MINimum?	112
FETCh[:CC<cc>]:SUMMary:EVM:PCHannel[:AVERage]?	112
FETCh[:CC<cc>]:SUMMary:EVM:PSIGnal:MAXimum?	113
FETCh[:CC<cc>]:SUMMary:EVM:PSIGnal:MINimum?	113
FETCh[:CC<cc>]:SUMMary:EVM:PSIGnal[:AVERage]?	113
FETCh[:CC<cc>]:SUMMary:FERRor:MAXimum?	113
FETCh[:CC<cc>]:SUMMary:FERRor:MINimum?	113
FETCh[:CC<cc>]:SUMMary:FERRor[:AVERage]?	113
FETCh[:CC<cc>]:SUMMary:GIMBalance:MAXimum?	114
FETCh[:CC<cc>]:SUMMary:GIMBalance:MINimum?	114
FETCh[:CC<cc>]:SUMMary:GIMBalance[:AVERage]?	114
FETCh[:CC<cc>]:SUMMary:IQOffset:MAXimum?	114
FETCh[:CC<cc>]:SUMMary:IQOffset:MINimum?	114
FETCh[:CC<cc>]:SUMMary:IQOffset[:AVERage]?	114
FETCh[:CC<cc>]:SUMMary:POWer:MAXimum?	114
FETCh[:CC<cc>]:SUMMary:POWer:MINimum?	114
FETCh[:CC<cc>]:SUMMary:POWer[:AVERage]?	114
FETCh[:CC<cc>]:SUMMary:QUADerror:MAXimum?	115

FETCh[:CC<cc>]:SUMMary:QUADerror:MINimum?.....	115
FETCh[:CC<cc>]:SUMMary:QUADerror[:AVERage]?.....	115
FETCh[:CC<cc>]:SUMMary:SERRor:MAXimum?.....	115
FETCh[:CC<cc>]:SUMMary:SERRor:MINimum?.....	115
FETCh[:CC<cc>]:SUMMary:SERRor[:AVERage]?.....	115
FETCh[:CC<cc>]:SUMMary:TFRame?.....	116

FETCh[:CC<cc>]:SUMMary:CRESt[:AVERage]?

Queries the average crest factor as shown in the result summary.

Suffix:

<cc> [Component Carrier](#)

Return values:

<CrestFactor> <numeric value>
Crest Factor in dB.

Example: //Query crest factor
FETC : SUMM : CRES ?

Usage: Query only

FETCh[:CC<cc>]:SUMMary:EVM[:ALL]:MAXimum?

FETCh[:CC<cc>]:SUMMary:EVM[:ALL]:MINimum?

FETCh[:CC<cc>]:SUMMary:EVM[:ALL][:AVERage]?

Queries the EVM of all resource elements.

Suffix:

<cc> [Component Carrier](#)

Return values:

<EVM> <numeric value>
Minimum, maximum or average EVM, depending on the last
command syntax element.
The unit is % or dB, depending on your selection.

Example: //Query EVM
FETC : SUMM : EVM ?

Usage: Query only

FETCh[:CC<cc>]:SUMMary:EVM:PCHannel:MAXimum?

FETCh[:CC<cc>]:SUMMary:EVM:PCHannel:MINimum?

FETCh[:CC<cc>]:SUMMary:EVM:PCHannel[:AVERage]?

Queries the EVM of all physical channel resource elements.

Suffix:

<cc> [Component Carrier](#)

Return values:

<EVM> <numeric value>
EVM in % or dB, depending on the unit you have set.

Example:

```
//Query EVM
FETC:SUMM:EVM:PCH?
```

Usage:

Query only

```
FETCh[:CC<cc>]:SUMMary:EVM:PSIGnal:MAXimum?
FETCh[:CC<cc>]:SUMMary:EVM:PSIGnal:MINimum?
FETCh[:CC<cc>]:SUMMary:EVM:PSIGnal[:AVERage]?
```

Queries the EVM of all physical signal resource elements.

Suffix:

<cc> [Component Carrier](#)

Return values:

<EVM> <numeric value>
Minimum, maximum or average EVM, depending on the last command syntax element.
The unit is % or dB, depending on your selection.

Example:

```
//Query EVM
FETC:SUMM:EVM:PSIG?
```

Usage:

Query only

```
FETCh[:CC<cc>]:SUMMary:FERRor:MAXimum?
FETCh[:CC<cc>]:SUMMary:FERRor:MINimum?
FETCh[:CC<cc>]:SUMMary:FERRor[:AVERage]?
```

Queries the frequency error.

Suffix:

<cc> [Component Carrier](#)

Return values:

<FrequencyError> <numeric value>
Minimum, maximum or average frequency error, depending on the last command syntax element.
Default unit: Hz

Example:

```
//Query average frequency error
FETC:SUMM:FERR?
```

Usage:

Query only

FETCh[:CC<cc>]:SUMMary:GIMBalance:MAXimum?
FETCh[:CC<cc>]:SUMMary:GIMBalance:MINimum?
FETCh[:CC<cc>]:SUMMary:GIMBalance[:AVERage]?

Queries the I/Q gain imbalance.

Suffix:

<cc> [Component Carrier](#)

Return values:

<GainImbalance> <numeric value>
 Minimum, maximum or average I/Q imbalance, depending on the last command syntax element.
 Default unit: dB

Example: //Query average gain imbalance
 FETC : SUMM : GIMB ?

Usage: Query only

FETCh[:CC<cc>]:SUMMary:IQOFfset:MAXimum?
FETCh[:CC<cc>]:SUMMary:IQOFfset:MINimum?
FETCh[:CC<cc>]:SUMMary:IQOFfset[:AVERage]?

Queries the I/Q offset.

Suffix:

<cc> [Component Carrier](#)

Return values:

<IQOffset> <numeric value>
 Minimum, maximum or average I/Q offset, depending on the last command syntax element.
 Default unit: dB

Example: //Query average IQ offset
 FETC : SUMM : IQOF ?

Usage: Query only

FETCh[:CC<cc>]:SUMMary:POWER:MAXimum?
FETCh[:CC<cc>]:SUMMary:POWER:MINimum?
FETCh[:CC<cc>]:SUMMary:POWER[:AVERage]?

Queries the total power.

Suffix:

<cc> [Component Carrier](#)

Return values:

<Power> <numeric value>
Minimum, maximum or average power, depending on the last command syntax element.

Default unit: dBm

Example:

```
//Query average total power
FETC : SUMM : POW ?
```

Usage:

Query only

FETCh[:CC<cc>]:SUMMary:QUADerror:MAXimum?

FETCh[:CC<cc>]:SUMMary:QUADerror:MINimum?

FETCh[:CC<cc>]:SUMMary:QUADerror[:AVERage]?

Queries the quadrature error.

Suffix:

<cc> [Component Carrier](#)

Return values:

<QuadratureError> <numeric value>
Minimum, maximum or average quadrature error, depending on the last command syntax element.

Default unit: deg

Example:

```
//Query average quadrature error
FETC : SUMM : QUAD ?
```

Usage:

Query only

FETCh[:CC<cc>]:SUMMary:SERRor:MAXimum?

FETCh[:CC<cc>]:SUMMary:SERRor:MINimum?

FETCh[:CC<cc>]:SUMMary:SERRor[:AVERage]?

Queries the sampling error.

Suffix:

<cc> [Component Carrier](#)

Return values:

<SamplingError> <numeric value>
Minimum, maximum or average sampling error, depending on the last command syntax element.

Default unit: ppm

Example:

```
//Query average sampling error
FETC : SUMM : SERR ?
```

Usage:

Query only

FETCh[:CC<cc>]:SUMMary:TFRame?

Queries the (sub)frame start offset as shown in the capture buffer.

Suffix:

<cc> [Component Carrier](#)

Return values:

<Offset> Time difference between the (sub)frame start and capture buffer start.

Default unit: s

Example:

//Query subframe start offset

FETC : SUMM : TFR ?

Usage:

Query only

Manual operation: See "[Capture Buffer](#)" on page 13

6.7.3 Marker table

CALCulate<n>:DELTaMarker<m>:X.....	116
CALCulate<n>:DELTaMarker<m>:Y?.....	116
CALCulate<n>:MARKer<m>:X.....	117
CALCulate<n>:MARKer<m>:Y.....	117
CALCulate<n>:MARKer<m>:Z?.....	118
CALCulate<n>:MARKer<m>:Z:ALL?.....	118

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 26

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 26

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 or Power).

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 26

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 **or** Power), which is possible with `CALCulate<n>:MARKer<m>:Z?`, this command returns all types of values (EVM **and** Power), 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.

Example:

```
//Query EVM and Power at the marker position.
CALC:MARK:Z:ALL?
```

Usage:

Query only

Manual operation:

See "[Marker Table](#)" on page 26

6.7.4 CCDF table

[CALCulate<n>:STATistics:CCDF:X<t>?](#)..... 119

[CALCulate<n>:STATistics:RESult<res>?](#)..... 120

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 20

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 20

6.8 Limit check result readout

- [Limits for numerical result display](#)..... 120

6.8.1 Limits for numerical result display

CALCulate<n>:LIMit[:CC<cc>]:SUMMARY:EVM[:ALL]:MAXimum:RESult?	121
CALCulate<n>:LIMit[:CC<cc>]:SUMMARY:EVM[:ALL][:AVERage]:RESult?	121
CALCulate<n>:LIMit[:CC<cc>]:SUMMARY:EVM:PCHannel:MAXimum:RESult?	121
CALCulate<n>:LIMit[:CC<cc>]:SUMMARY:EVM:PCHannel[:AVERage]:RESult?	121
CALCulate<n>:LIMit[:CC<cc>]:SUMMARY:EVM:PSIGnal:MAXimum:RESult?	122
CALCulate<n>:LIMit[:CC<cc>]:SUMMARY:EVM:PSIGnal[:AVERage]:RESult?	122
CALCulate<n>:LIMit[:CC<cc>]:SUMMARY:FERRor:MAXimum:RESult?	122
CALCulate<n>:LIMit[:CC<cc>]:SUMMARY:FERRor[:AVERage]:RESult?	122

CALCulate<n>:LIMit[:CC<cc>]:SUMMARY:GIMBalance:MAXimum:RESult?.....	123
CALCulate<n>:LIMit[:CC<cc>]:SUMMARY:GIMBalance[:AVERage]:RESult?.....	123
CALCulate<n>:LIMit[:CC<cc>]:SUMMARY:IQOFset:MAXimum:RESult?.....	123
CALCulate<n>:LIMit[:CC<cc>]:SUMMARY:IQOFset[:AVERage]:RESult?.....	123
CALCulate<n>:LIMit[:CC<cc>]:SUMMARY:QUADerror:MAXimum:RESult?.....	124
CALCulate<n>:LIMit[:CC<cc>]:SUMMARY:QUADerror[:AVERage]:RESult?.....	124
CALCulate<n>:LIMit[:CC<cc>]:SUMMARY:SERRor:MAXimum:RESult?.....	124
CALCulate<n>:LIMit[:CC<cc>]:SUMMARY:SERRor[:AVERage]:RESult?.....	124

CALCulate<n>:LIMit[:CC<cc>]:SUMMARY:EVM[:ALL]:MAXimum:RESult?

CALCulate<n>:LIMit[:CC<cc>]:SUMMARY:EVM[:ALL][:AVERage]:RESult?

Queries the results of the EVM limit check of all resource elements.

Suffix:

<n>	irrelevant
	irrelevant
<cc>	Component Carrier

Return values:

<LimitCheck> The type of limit (average or maximum) that is queried depends on the last syntax element.

FAILED

Limit check has failed.

PASSED

Limit check has passed.

NOTEVALUATED

Limits have not been evaluated.

Example:

```
//Query EVM limit check results
CALC:LIM:SUMM:EVM:RES?
```

Usage:

Query only

CALCulate<n>:LIMit[:CC<cc>]:SUMMARY:EVM:PCHannel:MAXimum:RESult?

CALCulate<n>:LIMit[:CC<cc>]:SUMMARY:EVM:PCHannel[:AVERage]:RESult?

Queries the results of the EVM limit check of all physical channel resource elements.

Suffix:

<n>	irrelevant
	irrelevant
<cc>	Component Carrier

Return values:

<LimitCheck> The type of limit (average or maximum) that is queried depends on the last syntax element.

FAILED

Limit check has failed.

PASSED

Limit check has passed.

NOTEVALUATED

Limits have not been evaluated.

Example: //Query physical channel limit check result
CALC:LIM:SUMM:EVM:PCH:RES?

Usage: Query only

CALCulate<n>:LIMit[:CC<cc>]:SUMMary:EVM:PSIGnal:MAXimum:RESult?
CALCulate<n>:LIMit[:CC<cc>]:SUMMary:EVM:PSIGnal[:AVERage]:RESult?

Queries the results of the EVM limit check of all physical signal resource elements.

Suffix:

<n> irrelevant

 irrelevant

<cc> [Component Carrier](#)

Return values:

<LimitCheck> The type of limit (average or maximum) that is queried depends on the last syntax element.

FAILED

Limit check has failed.

PASSED

Limit check has passed.

NOTEVALUATED

Limits have not been evaluated.

Example: //Query physical signal limit check result
CALC:LIM:SUMM:EVM:PSIG:RES?

Usage: Query only

CALCulate<n>:LIMit[:CC<cc>]:SUMMary:FERRor:MAXimum:RESult?
CALCulate<n>:LIMit[:CC<cc>]:SUMMary:FERRor[:AVERage]:RESult?

Queries the result of the frequency error limit check.

Suffix:

<n> irrelevant

 irrelevant

<cc> [Component Carrier](#)

Return values:

<LimitCheck> The type of limit (average or maximum) that is queried depends on the last syntax element.

FAILED

Limit check has failed.

PASSED

Limit check has passed.

NOTEVALUATED

Limits have not been evaluated.

Example: //Query frequency error limit check result
 CALC:LIM:SUMM:SERR:RES?

Usage: Query only

CALCulate<n>:LIMit[:CC<cc>]:SUMMary:GIMBalance:MAXimum:RESult?
CALCulate<n>:LIMit[:CC<cc>]:SUMMary:GIMBalance[:AVERage]:RESult?

Queries the result of the gain imbalance limit check.

Suffix:

<n> irrelevant

 irrelevant

<cc> [Component Carrier](#)

Return values:

<LimitCheck> The type of limit (average or maximum) that is queried depends on the last syntax element.

FAILED

Limit check has failed.

PASSED

Limit check has passed.

NOTEVALUATED

Limits have not been evaluated.

Example: //Query gain imbalance limit check result
 CALC:LIM:SUMM:GIMB:RES?

Usage: Query only

CALCulate<n>:LIMit[:CC<cc>]:SUMMary:IQOFfset:MAXimum:RESult?
CALCulate<n>:LIMit[:CC<cc>]:SUMMary:IQOFfset[:AVERage]:RESult?

Queries the result of the I/Q offset limit check.

Suffix:

<n> irrelevant

 irrelevant

<cc> [Component Carrier](#)

Return values:

<LimitCheck> The type of limit (average or maximum) that is queried depends on the last syntax element.

FAILED

Limit check has failed.

PASSED

Limit check has passed.

NOTEVALUATED

Limits have not been evaluated.

Example: //Query I/Q offset limit check result
CALC:LIM:SUMM:IQOF:MAX:RES?

Usage: Query only

CALCulate<n>:LIMit[:CC<cc>]:SUMMary:QUADerror:MAXimum:RESult?
CALCulate<n>:LIMit[:CC<cc>]:SUMMary:QUADerror[:AVERage]:RESult?

Queries the result of the quadrature error limit check.

Suffix:

<n> irrelevant

 irrelevant

<cc> [Component Carrier](#)

Return values:

<LimitCheck> The type of limit (average or maximum) that is queried depends on the last syntax element.

FAILED

Limit check has failed.

PASSED

Limit check has passed.

NOTEVALUATED

Limits have not been evaluated.

Example: //Query quadrature error limit check results
CALC:LIM:SUMM:QUAD:RES?

Usage: Query only

CALCulate<n>:LIMit[:CC<cc>]:SUMMary:SERRor:MAXimum:RESult?
CALCulate<n>:LIMit[:CC<cc>]:SUMMary:SERRor[:AVERage]:RESult?

Queries the results of the sampling error limit check.

Suffix:

<n> irrelevant

 irrelevant

<cc> [Component Carrier](#)

Return values:

<LimitCheck> The type of limit (average or maximum) that is queried depends on the last syntax element.

FAILED

Limit check has failed.

PASSED

Limit check has passed.

NOTEVALUATED

Limits have not been evaluated.

Example: //Query sample error limit check result
CALC:LIM:SUMM:SERR:RES?

Usage: Query only

6.9 Configuration

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 83.

CONFigure[LTE]:MEASurement.....	125
MMEMory:STORe<n>:IQ:STATe.....	125
SYSTem:PRESet:CHANnel[:EXEC].....	126

CONFigure[LTE]:MEASurement <Measurement>

Selects the measurement.

Parameters:

<Measurement> **EVM**
Selects I/Q measurements.
*RST: EVM

Example: //Select measurement
CONF:MEAS EVM

Manual operation: See "[Select Measurement](#)" on page 29

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 69

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 29

6.9.2 I/Q measurements

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6.9.2.1 Signal description

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CONFigure[:LTE]:UL[:CC<cc>]:BW <Bandwidth>

Selects the channel bandwidth.

Suffix:

<cc> [Component Carrier](#)

Parameters:

<Bandwidth> BW20_00

Example:

```
//Select bandwidth for first component carrier
CONF:UL:CC1:BW BW20_00
```

Manual operation: See ["Remote commands to configure carrier aggregation"](#) on page 32
See ["Channel Bandwidth / Number of Resource Blocks"](#) on page 32

CONFigure[:LTE]:UL[: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:

```
//Select automatic detection of the cell ID
CONF:UL:PLC:CID AUTO
```

Manual operation: See ["Configuring the Physical Layer Cell Identity"](#) on page 33

CONFigure[:LTE]:UL[:CC<cc>]:PLC:CIDGroup <GroupNumber>

Selects the cell identity group.

Suffix:

<cc> [Component Carrier](#)

Parameters:

<GroupNumber> <numeric value> (integer only)
 Range: 1 to 167
 *RST: 0

Example:

```
//Select cell identity group 12
CONF:UL:PLCI:CIDG 12
```

Manual operation: See "[Configuring the Physical Layer Cell Identity](#)" on page 33

CONFigure[:LTE]:UL[:CC<cc>]:PLC:PLID <Identity>

Selects the physical layer identity.

Suffix:

<cc> [Component Carrier](#)

Parameters:

<Identity> 0 | 1 | 2

Example:

```
//Select physical layer identity 2
CONF:DL:PLC:PLID 2
```

Manual operation: See "[Configuring the Physical Layer Cell Identity](#)" on page 33

CONFigure[:LTE]: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 "[Carrier Aggregation](#)" on page 30.
 *RST: 1

Example:

```
//Select number of component carriers
CONF:NOCC 2
```

Manual operation: See "[Remote commands to configure carrier aggregation](#)" on page 32

FETCh[:CC<cc>]:CYCPrefix?

Queries the cyclic prefix type that has been detected.

Suffix:

<cc> [Component Carrier](#)

Return values:

<PrefixType> The command returns -1 if no valid result has been detected yet.
NORM
 Normal cyclic prefix length detected

EXT

Extended cyclic prefix length detected

Example: //Query current cyclic prefix length type
FETC:CYCP?

Usage: Query only

FEtCh[:CC<cc>]:PLC:CIDGroup?

Queries the cell identity group that has been detected.

Suffix:

<cc> [Component Carrier](#)

Return values:

<CIDGroup> The command returns -1 if no valid result has been detected yet.
Range: 0 to 167

Example: //Query the current cell identity group
FETC:PLC:CIDG?

Usage: Query only

FEtCh[:CC<cc>]:PLC:PLID?

Queries the cell identity that has been detected.

Suffix:

<cc> [Component Carrier](#)

Return values:

<Identity> The command returns -1 if no valid result has been detected yet.
Range: 0 to 2

Example: //Query the current cell identity
FETC:PLC:PLID?

Usage: Query only

MMEMory:LOAD[:CC<cc>]:DEModsetting <File>

Restores previously saved demodulation settings.

The file must be of type `.allocation` and depends on the link direction that was currently selected when the file was saved. You can load only files with correct link directions.

Suffix:

<cc> [Component Carrier](#)

Parameters:

<File> String containing the path and name of the file.

Example: //Load allocation file
 MMEM:LOAD:DEM 'D:\USER\Settingsfile.allocation'

Manual operation: See ["User defined test scenarios"](#) on page 34

MMEMory:STORe<n>[:CC<cc>]:DEModsetting <FileName>

Saves the signal description.

Suffix:

<n> irrelevant

<cc> irrelevant

Parameters:

<FileName> String containing the path and name of the file.
 The file extension is .allocation.

Example: //Save signal description
 MMEM:STOR:DEM 'c:\TestSignal.allocation'

Manual operation: See ["User defined test scenarios"](#) on page 34

[SENSe:][LTE:]UL:DEMod:LOFrequency <Frequency>

Defines the LO frequency when its location is not at the center of the channel bandwidth.

Prerequisites for this command

- Turn on custom LO location ([\[SENSe:\] \[LTE:\]UL:DEMod:LOLocation](#)).

Parameters:

<Frequency> <numeric value>
 Default unit: Hz

Example: //Define LO frequency
 UL:DEM:LOL USER
 UL:DEM:LOFR 850MHZ

Manual operation: See ["Remote commands to configure carrier aggregation"](#) on page 32

[SENSe:][LTE:]UL:DEMod:LOLocation <Location>

Selects the location of the local oscillator in a system with contiguous aggregated carriers.

Parameters:

<Location> **CACB**
 LO is at the center of the aggregated channel bandwidth.
CCC
 One LO is at the center of each component carrier.

USER

One LO is used for all component carriers. The frequency is not necessarily at the center of the aggregated channel bandwidth. You can define the LO frequency with .

*RST: CABC

Example: //Use an LO for each component carrier.
UL:DEM:LOL CCC

Manual operation: See "[Remote commands to configure carrier aggregation](#)" on page 32

Subframe configuration

CONFigure[:LTE]:UL[:CC<cc>]:CSUBframes.....	131
CONFigure[:LTE]:UL[:CC<cc>]:SUBFrame<sf>:ALLoc:CONT.....	131
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CONFigure[:LTE]:UL[:CC<cc>]:SUBFrame<sf>:ALLoc:PUCCh:FORMat.....	133
CONFigure[:LTE]:UL[:CC<cc>]:SUBFrame<sf>:ALLoc:PUCCh:NPAR.....	133
CONFigure[:LTE]:UL[:CC<cc>]:SUBFrame<sf>:ALLoc:PUSCh:NDMRs.....	133
CONFigure[:LTE]:UL[:CC<cc>]:SUBFrame<sf>:ALLoc:RATO.....	134
CONFigure[:LTE]:UL[:CC<cc>]:SUBFrame<sf>:ALLoc[:CLUSter<cl>]:RBCount.....	134
CONFigure[:LTE]:UL[:CC<cc>]:SUBFrame<sf>:ALLoc[:CLUSter<cl>]:RBOFset.....	134
[SENSe:][:LTE:]UL:DEMod:ACON.....	135
[SENSe:][:LTE:]UL:FORMat:SCD.....	135

CONFigure[:LTE]:UL[:CC<cc>]:CSUBframes <Subframes>

Selects the number of configurable subframes in the uplink signal.

Suffix:

<cc> [Component Carrier](#)

Parameters:

<Subframes> Range: 1 to 10
*RST: 1

Example: //Define number of configurable subframes
CONF:UL:CSUB 5

CONFigure[:LTE]:UL[:CC<cc>]:SUBFrame<sf>:ALLoc:CONT <AllocationContent>

Allocates a PUCCH or PUSCH to an uplink allocation.

Suffix:

<cc> [Component Carrier](#)

<sf> [Subframe](#)

Parameters:

<AllocationContent> **NONE**
Turns off the PUSCH and the PUCCH.

PUSCh

Turns on the PUSCH.

PSCC

Turns on the PUCCH as well as the PUSCH.

PUACh

Turns on the PUACH.

*RST: PUSCh

Example: //Assign PUCCH allocation to a subframe
 CONF:UL:SUBF8:ALL:CONT PUCC

Manual operation: See ["Enable PUCCH"](#) on page 37
 See ["Enable PUSCH / PUACH"](#) on page 37

CONFigure[:LTE]:UL[:CC<cc>]:SUBFrame<sf>:ALLoc:MODulation <Modulation>

Selects the modulation of an uplink allocation.

Suffix:<cc> [Component Carrier](#)<sf> [Subframe](#)**Parameters:**

<Modulation> PSK8 | QPSK | QAM16

*RST: QPSK

Example: //Define modulation of the allocation in subframe 8
 CONF:UL:SUBF8:ALL:MOD QPSK

Manual operation: See ["Modulation"](#) on page 37

CONFigure[:LTE]:UL[:CC<cc>]:SUBFrame<sf>:ALLoc:PUACh:DPUach <Value>Defines the parameter δ_{PUACH} .**Suffix:**<cc> [Component Carrier](#)<sf> [Subframe](#)**Parameters:**

<Value> <numeric value> (integer only)

*RST: 0

Example: //Define delta_PUACH for subframe 1
 CONF:UL:SUBF1:ALL:PUAC:DPU 2

Manual operation: See ["Enhanced Demodulation Reference Signal Configuration"](#) on page 39

CONFigure[:LTE]:UL[:CC<cc>]:SUBFrame<sf>:ALLoc:PUCCh:FORMat <Format>

Selects the PUCCH format for a specific subframe.

The command is available if you have selected PUCCH format selection on subframe basis with `CONFigure[:LTE]:UL[:CC<cc>]:PUCCh:FORMat`.

Suffix:

<cc> [Component Carrier](#)

<sf> [Subframe](#)

Parameters:

<Format> **F1 (F1)**
F1A (F1a)
F1B (F1b)
F2 (F2)
F2A (F2a)
F2B (F2b)
F3 (F3)

Example: //Select PUCCH format in subframe 4
 CONF:UL:SUBF4:ALL:PUCCh:FORM F3

Manual operation: See ["Enhanced PUCCH Configuration"](#) on page 39

CONFigure[:LTE]:UL[:CC<cc>]:SUBFrame<sf>:ALLoc:PUCCh:NPAR <Configuration>

Defines N_PUCCH on a subframe basis.

The command is available if `CONFigure[:LTE]:UL[:CC<cc>]:PUCCh:NPAR` on page 145 is turned on.

Suffix:

<cc> [Component Carrier](#)

<sf> [Subframe](#)

Parameters:

<Configuration> <numeric value>

Example: //Select N_PUCCH
 CONF:UL:SUBF:ALL:PUCCh:NPAR 2

Manual operation: See ["Enhanced PUCCH Configuration"](#) on page 39

CONFigure[:LTE]:UL[:CC<cc>]:SUBFrame<sf>:ALLoc:PUSCh:NDMRs <Value>

Defines the part of the DMRS index that is used for the uplink scheduling assignment.

Suffix:

<cc> [Component Carrier](#)

<sf> [Subframe](#)

Parameters:

<Value> <numeric value>
 Range: 0 to 11
 *RST: 0

Example: //Defines DMRS index
 CONF:UL:SUBF:ALL:PUSC:NDMR 2

Manual operation: See "[Enhanced Demodulation Reference Signal Configuration](#)" on page 39

CONFigure[:LTE]:UL[:CC<cc>]:SUBFrame<sf>:ALLoc:RATO <State>

Turns the resource allocation type 1 on and off.

Suffix:

<cc> [Component Carrier](#)

<sf> [Subframe](#)

Parameters:

<State> ON | OFF | 1 | 0
 *RST: OFF

Example: //Turn on resource allocation type 1
 CONF:UL:SUBF:ALL:RATO ON

CONFigure[:LTE]:UL[:CC<cc>]:SUBFrame<sf>:ALLoc[:CLUster<cl>]:RBCount <ResourceBlocks>

Selects the number of resource blocks in an uplink subframe.

Suffix:

<cc> [Component Carrier](#)

<sf> [Subframe](#)

<cl> [Cluster](#)

Parameters:

<ResourceBlocks> <numeric value>
 *RST: 11

Example: //Select number of resource blocks for subframe 8
 CONF:UL:SUBF8:ALL:RBC 8

Manual operation: See "[Number of RB](#)" on page 38

CONFigure[:LTE]:UL[:CC<cc>]:SUBFrame<sf>:ALLoc[:CLUster<cl>]:RBOffset <Offset>

Defines the resource block offset in an uplink subframe.

Suffix:

<cc> [Component Carrier](#)

<sf> [Subframe](#)

<cl> [Cluster](#)

Parameters:

<Offset> <numeric value>

*RST: 2

Example:

```
//Define resource block offset
CONF:UL:SUBF8:ALL:RBOF 5
```

Manual operation: See "[Offset RB](#)" on page 38

[SENSe:][LTE:]UL:DEMod:ACON <Type>

Selects the method of automatic demodulation.

Parameters:

<Type>

ALL

Automatically detects and demodulates the PUSCH and SRS.

OFF

Automatic demodulation is off.

SCON

Automatically detects and demodulates the values available in the subframe configuration table.

Example:

```
//Turn off automatic demodulation off
UL:DEM:ACON OFF
```

Manual operation: See "[Auto Demodulation](#)" on page 35

[SENSe:][LTE:]UL:FORMat:SCD <State>

Turns detection of the subframe configuration on and off.

Prerequisites for this command

- Turn off auto demodulation [\[SENSe:\] \[LTE:\]UL:DEMod:ACON](#)

Parameters:

<State>

ON | OFF | 1 | 0

*RST: OFF

Example:

```
//Turn on automatic subframe configuration
UL:FORM:SCD ON
```

Manual operation: See "[Subframe Configuration Detection](#)" on page 36

Global settings

CONFigure[:LTE]:UL[:CC<cc>]:SCIN.....	136
CONFigure[:LTE]:UL[:CC<cc>]:SFNO.....	136
CONFigure[:LTE]:UL[:CC<cc>]:UEID.....	136

CONFigure[:LTE]:UL[:CC<cc>]:SCIN <Index>

Defines the secondary cell index.

Prerequisites for this command

- Turn on a second component carrier (CONFigure[:LTE]:NOCC).

Suffix:

<cc> [Component Carrier](#)

Parameters:

<Index> <numeric value> (integer only)
 Range: 0 to 7
 *RST: 0

Example: //Define secondary cell index
 CONF:UL:SCIN 4

Manual operation: See "[SCell Index](#)" on page 41

CONFigure[:LTE]:UL[:CC<cc>]:SFNO <Offset>

Defines the system frame number offset.

The application uses the offset to demodulate the frame.

Suffix:

<cc> [Component Carrier](#)

Parameters:

<Offset> <numeric value> (integer only)
 *RST: 0

Example: //Select frame number offset
 CONF:UL:SFNO 2

Manual operation: See "[Frame Number Offset](#)" on page 40

CONFigure[:LTE]:UL[:CC<cc>]:UEID <ID>

Defines the radio network temporary identifier (RNTI) of the UE.

Suffix:

<cc> [Component Carrier](#)

Parameters:

<ID> <numeric value> (integer only)
 Range: 0 to 65535
 *RST: 0

Example: //Define a RNTI of 2
 CONF:UL:UEID 2

Manual operation: See "[UE ID/n_RNTI](#)" on page 40

Demodulation reference signal

CONFigure[LTE]:UL[CC<cc>]:DRS:DSSHift.....	137
CONFigure[LTE]:UL[CC<cc>]:DRS:GRPHopping.....	137
CONFigure[LTE]:UL[CC<cc>]:DRS:NDMRs.....	138
CONFigure[LTE]:UL[CC<cc>]:DRS:PUCCh:POWer.....	138
CONFigure[LTE]:UL[CC<cc>]:DRS[:PUSCh]:POWer.....	138
CONFigure[LTE]:UL[CC<cc>]:DRS:SEQHopping.....	138

CONFigure[LTE]:UL[CC<cc>]:DRS:DSSHift <Shift>

Selects the delta sequence shift of the uplink signal.

Suffix:

<cc> [Component Carrier](#)

Parameters:

<Shift> <numeric value> (integer only)
 *RST: 0

Example: //Select delta sequence shift
 CONF:UL:DRS:DSSH 3

Manual operation: See "[Delta Sequence Shift](#)" on page 43

CONFigure[LTE]:UL[CC<cc>]:DRS:GRPHopping <State>

Turns group hopping for uplink signals on and off.

Suffix:

<cc> [Component Carrier](#)

Parameters:

<State> ON | OFF | 1 | 0
 *RST: OFF

Example: //Turn on group hopping
 CONF:UL:DRS:GRPH ON

Manual operation: See "[Group Hopping](#)" on page 42

CONFigure[:LTE]:UL[:CC<cc>]:DRS:NDMRs <Value>

Defines the n_{DMRS} .

Suffix:

<cc> [Component Carrier](#)

Parameters:

<Value> <numeric value>

Example:

```
//Select  $n_{\text{DMRS}}$  0.  
CONF:UL:DRS:NDMR 0
```

Manual operation: See "[n\(1\)_DMRS](#)" on page 43

CONFigure[:LTE]:UL[:CC<cc>]:DRS:PUCCh:POWer <Power>

Sets the relative power of the PUCCH.

Suffix:

<cc> [Component Carrier](#)

Parameters:

<Power> <numeric value>

*RST: 0
Default unit: dB

Example:

```
//Define power of the PUCCH  
CONF:UL:DRS:PUCC:POW 2
```

Manual operation: See "[Relative Power PUCCH](#)" on page 42

CONFigure[:LTE]:UL[:CC<cc>]:DRS[:PUSCh]:POWer <Power>

Sets the relative power of the PUSCH.

Suffix:

<cc> [Component Carrier](#)

Parameters:

<Power> <numeric value>

*RST: 0
Default unit: dB

Example:

```
//Define power of the PUSCH  
CONF:UL:DRS:POW 2
```

Manual operation: See "[Relative Power PUSCH](#)" on page 42

CONFigure[:LTE]:UL[:CC<cc>]:DRS:SEQHopping <State>

Turns sequence hopping for uplink signals on and off.

Suffix:`<cc>` [Component Carrier](#)**Parameters:**`<State>` ON | OFF | 1 | 0
*RST: OFF**Example:**//Turn on sequence hopping
CONF:UL:DRS:SEQH ON**Manual operation:** See "[Sequence Hopping](#)" on page 42**Sounding reference signal**

CONFigure[:LTE]:UL[:CC<cc>]:SRS:ANST.....	139
CONFigure[:LTE]:UL[:CC<cc>]:SRS:BHOP.....	139
CONFigure[:LTE]:UL[:CC<cc>]:SRS:BSRS.....	140
CONFigure[:LTE]:UL[:CC<cc>]:SRS:CSRS.....	140
CONFigure[:LTE]:UL[:CC<cc>]:SRS:CYCS.....	140
CONFigure[:LTE]:UL[:CC<cc>]:SRS:ISRS.....	141
CONFigure[:LTE]:UL[:CC<cc>]:SRS:NRRC.....	141
CONFigure[:LTE]:UL[:CC<cc>]:SRS:POWer.....	141
CONFigure[:LTE]:UL[:CC<cc>]:SRS:STAT.....	142
CONFigure[:LTE]:UL[:CC<cc>]:SRS:SUConfig.....	142
CONFigure[:LTE]:UL[:CC<cc>]:SRS:TRComb.....	142

CONFigure[:LTE]:UL[:CC<cc>]:SRS:ANST <State>

Turns simultaneous transmission of the sounding reference signal (SRS) and ACK/NACK messages (via PUCCH) on and off.

Simultaneous transmission works only if the PUCCH format ist either 1, 1a, 1b or 3.

Suffix:`<cc>` [Component Carrier](#)**Parameters:**`<State>` **ON**
Allows simultaneous transmission of SRS and PUCCH.
OFF
SRS not transmitted in the subframe for which you have configured simultaneous transmission of PUCCH and SRS.**Example:**//Turn on simultaneous transmission of the SRS and PUCCH in one subframe
CONF:UL:SRS:ANST ON**Manual operation:** See "[A/N + SRS Simultaneous TX](#)" on page 47**CONFigure[:LTE]:UL[:CC<cc>]:SRS:BHOP <Bandwidth>**Defines the frequency hopping bandwidth b_{hop} .

Suffix:

<cc> [Component Carrier](#)

Parameters:

<Bandwidth> <numeric value>

*RST: 0

Example:

//Define frequency hopping bandwidth

CONF:UL:SRS:BHOP 1

Manual operation: See "[Hopping BW b_hop](#)" on page 45

CONFigure[:LTE]:UL[:CC<cc>]:SRS:BSRS <Bandwidth>

Defines the bandwidth of the SRS (B_{SRS}).

Suffix:

<cc> [Component Carrier](#)

Parameters:

<Bandwidth> <numeric value>

*RST: 0

Example:

//Select SRS bandwidth

CONF:UL:SRS:BSRS 1

Manual operation: See "[SRS Bandwidth B_SRS](#)" on page 45

CONFigure[:LTE]:UL[:CC<cc>]:SRS:CSRS <Configuration>

Defines the SRS bandwidth configuration (C_{SRS}).

Suffix:

<cc> [Component Carrier](#)

Parameters:

<Configuration> <numeric value>

*RST: 0

Example:

//Select SRS bandwidth configuration

CONF:UL:SRS:CSRS 2

Manual operation: See "[SRS BW Conf. C_SRS](#)" on page 46

CONFigure[:LTE]:UL[:CC<cc>]:SRS:CYCS <CyclicShift>

Sets the cyclic shift n_{CS} used for the generation of the sounding reference signal CAZAC sequence.

Suffix:

<cc> [Component Carrier](#)

Parameters:

<CyclicShift> <numeric value>
 *RST: 0

Example:

//Select cyclic shift
 CONF:UL:SRS:CYCS 2

Manual operation: See "[SRS Cyclic Shift N_CS](#)" on page 45

CONFigure[:LTE]:UL[:CC<cc>]:SRS:ISRS <Index>

Defines the SRS configuration index (I_{SRS}).

Suffix:

<cc> [Component Carrier](#)

Parameters:

<Index> <numeric value>
 *RST: 0

Example:

//Select configuration index
 CONF:UL:SRS:ISRS 1

Manual operation: See "[Conf. Index I_SRS](#)" on page 46

CONFigure[:LTE]:UL[:CC<cc>]:SRS:NRRC <Value>

Defines the UE-specific parameter frequency domain position n_{RRC} .

Suffix:

<cc> [Component Carrier](#)

Parameters:

<Value> <numeric value>
 *RST: 0

Example:

//Select n_{RRC}
 CONF:UL:SRS:NRRC 1

Manual operation: See "[Freq. Domain Pos. n_RRC](#)" on page 46

CONFigure[:LTE]:UL[:CC<cc>]:SRS:POWer <Power>

Defines the relative power of the sounding reference signal.

Suffix:

<cc> [Component Carrier](#)

Parameters:

<Power> <numeric value>
 *RST: 0

Example:

//Define the power of sounding reference signal
 CONF:UL:SRS:POW -1.2

Manual operation: See "[SRS Rel Power](#)" on page 46

CONFigure[:LTE]:UL[:CC<cc>]:SRS:STAT <State>

Turns the sounding reference signal on and off.

Suffix:

<cc> [Component Carrier](#)

Parameters:

<State> ON | OFF | 1 | 0
*RST: OFF

Example: //Turn on the sounding reference signal
CONF:UL:SRS:STAT ON

Manual operation: See "[Present](#)" on page 44

CONFigure[:LTE]:UL[:CC<cc>]:SRS:SUConfig <Configuration>

Defines the SRS subframe configuration.

Prerequisites for this command

- Turn on the sounding reference signal with [CONFigure\[:LTE\]:UL\[:CC<cc>\]:SRS:STAT](#).

Suffix:

<cc> [Component Carrier](#)

Parameters:

<Configuration> <numeric value> (integer only)
Range: 0 to 14
*RST: 0

Example: //Select SRS subframe configuration 4
CONF:UL:SRS:SUC 4

Manual operation: See "[SRS Subframe Configuration](#)" on page 44

CONFigure[:LTE]:UL[:CC<cc>]:SRS:TRComb <Value>

Defines the transmission comb (k_{TC}).

Suffix:

<cc> [Component Carrier](#)

Parameters:

<Value> <numeric value>
*RST: 0

Example: //Define transmission comb
CONF:UL:SRS:TRC 1

Manual operation: See "[Transm. Comb. \$k_{TC}\$](#) " on page 46

PUSCH structure

[CONFigure\[:LTE\]:UL\[:CC<cc>\]:PUSCh:NOSM](#)..... 143

CONFigure[:LTE]:UL[:CC<cc>]:PUSCh:NOSM <NoOfSubbands>

Defines the number of subbands/M of the PUSCH.

Suffix:

<cc> [Component Carrier](#)

Parameters:

<NoOfSubbands> <numeric value>

*RST: 4

Example:

//Select number of subbands

CONF:UL:PUSC:NOSM 2

Manual operation: See "[Number of Subbands](#)" on page 48

PUCCH structure

[CONFigure\[:LTE\]:UL\[:CC<cc>\]:PUCCh:DESHift](#)..... 143

[CONFigure\[:LTE\]:UL\[:CC<cc>\]:PUCCh:FORMat](#)..... 143

[CONFigure\[:LTE\]:UL\[:CC<cc>\]:PUCCh:N1CS](#)..... 144

[CONFigure\[:LTE\]:UL\[:CC<cc>\]:PUCCh:N2RB](#)..... 144

[CONFigure\[:LTE\]:UL\[:CC<cc>\]:PUCCh:NORB](#)..... 145

[CONFigure\[:LTE\]:UL\[:CC<cc>\]:PUCCh:NPAr](#)..... 145

CONFigure[:LTE]:UL[:CC<cc>]:PUCCh:DESHift <Shift>

Defines the delta shift of the PUCCH.

Suffix:

<cc> [Component Carrier](#)

Parameters:

<Shift> <numeric value>

Range: 1 to 3

*RST: 2

Example:

//Select a delta shift for the PUCCH

CONF:UL:PUCCh:DESH 3

Manual operation: See "[Delta Shift](#)" on page 49

CONFigure[:LTE]:UL[:CC<cc>]:PUCCh:FORMat <Format>

Selects the PUCCH format.

Note that formats 2a and 2b are available for normal cyclic prefix length only.

Suffix:

<cc> [Component Carrier](#)

Parameters:

<Format> **F1 (F1)**
F1A (F1a)
F1B (F1b)
F2 (F2)
F2A (F2a)
F2B (F2b)
F3 (F3)
SUBF

Allows you to define the PUCCH format for each subframe separately with .

*RST: F1

Example:

```
//Select PUCCH format
CONF:UL:PUCCH:FORM F1B
```

Manual operation: See "[Format](#)" on page 50

CONFigure[:LTE]:UL[:CC<cc>]:PUCCh:N1CS <Value>

Defines the N(1)_cs of the PUCCH.

Suffix:

<cc> [Component Carrier](#)

Parameters:

<Value> <numeric value> (integer only)
 *RST: 6

Example:

```
//Select N(1)_cs
CONF:UL:PUCCH:N1CS 4
```

Manual operation: See "[N\(1\)_cs](#)" on page 49

CONFigure[:LTE]:UL[:CC<cc>]:PUCCh:N2RB <Value>

Defines the N(2)_RB of the PUCCH.

Suffix:

<cc> [Component Carrier](#)

Parameters:

<Value> <numeric value> (integer only)
 *RST: 1

Example:

```
//Define N2_RB
CONF:UL:PUCCH:N2RB 2
```

Manual operation: See "[N\(2\)_RB](#)" on page 50

CONFigure[:LTE]:UL[:CC<cc>]:PUCCh:NORB <ResourceBlocks>

Selects the number of resource blocks for the PUCCH.

Suffix:

<cc> [Component Carrier](#)

Parameters:

<ResourceBlocks> **<numeric value>**
Selects the number of RBs.

AUTO

Detects the number of RBs automatically.

*RST: 0

Example: //Define number of resource blocks for PUCCH
CONF:UL:PUCCh:NORB 6

Manual operation: See "[No. of RBs for PUCCH](#)" on page 49

CONFigure[:LTE]:UL[:CC<cc>]:PUCCh:NPAR <Value>

Defines the N_PUCCH parameter in the PUCCH structure settings.

Suffix:

<cc> [Component Carrier](#)

Parameters:

<Value> <numeric value>
<numeric value>

AUTO

Determines the N_PUCCH based on the measurement.

SUBF

Selects the definition of N_PUCCH on subframe level.

*RST: 0

Example: //Select N_PUCCH
CONF:UL:PUCCh:NPAR 2

Manual operation: See "[N_PUCCH](#)" on page 50

PRACH structure

CONFigure[:LTE]:UL[:CC<cc>]:PRACH:CONF	145
CONFigure[:LTE]:UL[:CC<cc>]:PRACH:FOFFset	146
CONFigure[:LTE]:UL[:CC<cc>]:PRACH:NCSC	146
CONFigure[:LTE]:UL[:CC<cc>]:PRACH:RSEQ	146
CONFigure[:LTE]:UL[:CC<cc>]:PRACH:RSET	147
CONFigure[:LTE]:UL[:CC<cc>]:PRACH:SINdex	147

CONFigure[:LTE]:UL[:CC<cc>]:PRACH:CONF <Configuration>

Selects the PRACH preamble format.

Suffix:

<cc> [Component Carrier](#)

Parameters:

<Configuration> <numeric value> (integer only)

Example:

```
//Select PRACH configuration 2
CONF:UL:PRAC:CONF 2
```

Manual operation: See "[PRACH Configuration](#)" on page 51

CONFigure[LTE]:UL[:CC<cc>]:PRACH:FOFFset <Offset>

Defines the PRACH frequency offset.

The command is available for preamble formats 0 to 3.

Suffix:

<cc> [Component Carrier](#)

Parameters:

<Offset> <numeric value> (integer only)
Frequency offset in terms of resource blocks.
*RST: 0

Example:

```
//Define a frequency offset
CONF:UL:PRAC:FOFF 5
```

Manual operation: See "[Frequency Offset](#)" on page 52

CONFigure[LTE]:UL[:CC<cc>]:PRACH:NCSC <Configuration>

Defines the Ncs configuration for the PRACH.

Suffix:

<cc> [Component Carrier](#)

Parameters:

<Configuration> <numeric value> (integer only)

Example:

```
//Selects Ncs configuration
CONF:UL:PRAC:NCSC 1
```

Manual operation: See "[Ncs Conf](#)" on page 52

CONFigure[LTE]:UL[:CC<cc>]:PRACH:RSEQ <Index>

Defines the PRACH logical root sequence index.

Suffix:

<cc> [Component Carrier](#)

Parameters:

<Index> <numeric value> (integer only)

Example: //Select logical root sequence index
CONF:UL:PRAC:RSEQ 2

Manual operation: See "[Logical Root Sequ. Idx](#)" on page 52

CONFigure[:LTE]:UL[:CC<cc>]:PRACH:RSET <State>

Turns the restricted preamble set for PRACH on and off.

Suffix:

<cc> [Component Carrier](#)

Parameters:

<State> ON | OFF | 1 | 0
*RST: OFF

Example: //Turn on restricted set
CONF:UL:PRAC:RSET ON

Manual operation: See "[Restricted Set](#)" on page 52

CONFigure[:LTE]:UL[:CC<cc>]:PRACH:SINdEx <Index>

Selects the PRACH sequence index.

Suffix:

<cc> [Component Carrier](#)

Parameters:

<Index> **<IndexValue>**
Number that defines the index manually.
AUTO
Automatically determines the index.

Example: //Select sequence index
CONF:UL:PRAC:SIND 2

Manual operation: See "[Sequence Index \(v\)](#)" on page 52

6.9.2.2 Inputs configuration

Useful commands to perform measurements described elsewhere:

- [INPut<ip>:COUPling<ant>](#) on page 156
- [INPut<ip>:IMPedance<ant>](#) on page 158

INPut:FILE<fi>:PATH	148
INPut<ip>:FILE:ZPADing	148
INPut<ip>:FILTer:HPASs[:STATe]	148
INPut<ip>:FILTer:YIG[:STATe]	149
INPut:SElect	149
INPut<ip>:RF:CAPMode	150
INPut<ip>:RF:CAPMode:IQ:SRATe	150

INPut<ip>:RF:CAPMode:WAVeform:SRATe.....	151
INSTrument:BLOCK:CHANnel[:SETTings]:SOURce<si>.....	151
SYSTem:COMMunicate:RDEVice:OSCilloscope:SRATe.....	152

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 69

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 56

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 53

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 53

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 55

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 53

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 150).

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 54

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 150).

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 54

INSTrument:BLOCK:CHANnel[:SETTings]:SOURce<si> <Type>

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

Suffix:

<si> 1 to 99
 LTE-MIMO only: input source number

Parameters:

<Type> FILE | DEvice | NONE

FILE
 A loaded file is used for input.

DEvice
 A configured device provides input for the measurement

NONE
 No input source defined.

Manual operation: See "[Input Type \(Instrument / File\)](#)" on page 55

SYSTem:COMMunicate:RDEvice:OSCilloscope:SRATe <Rate>

Determines whether the 10 GHz mode (default) or 20 GHz mode of the connected oscilloscope is used. The 20 GHz mode achieves a higher decimation gain, but reduces the record length by half.

Parameters:

<Rate> 10 GHz | 20 GHz
 No other sample rate values are allowed.

*RST: 10 GHz
 Default unit: HZ

Example:

```
TRAC:IQ:SRAT?
//Result: 100000000
TRAC:IQ:RLEN?
//Result: 3128
SYST:COMM:RDEV:OSC:SRAT 20GHZ
TRAC:IQ:SRAT?
//Result: 200000000
TRAC:IQ:RLEN?
//Result: 1564
```

Manual operation: See "[Oscilloscope Sample Rate](#)" on page 54

6.9.2.3 Frequency configuration

[SENSe:]FREQuency:CENTer[:CC<cc>].....	152
[SENSe:]FREQuency:CENTer[:CC<cc>]:OFFSet.....	153
[SENSe:]FREQuency:CENTer:STEP.....	154

[SENSe:]FREQuency:CENTer[:CC<cc>] <Frequency>

Sets the center frequency for RF measurements.

Component carrier measurements

- Defining or querying the frequency of the first carrier is possible with `FREQ:CENT:CC1`. The `CC1` part of the syntax is mandatory in that case.
- `FREQ:CENT?` queries the measurement frequency (center of the two carriers).

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`

Example: //Define frequency for measurement on aggregated carriers:
`FREQ:CENT:CC1 850MHZ`

Manual operation: See ["Remote commands to configure carrier aggregation"](#) on page 32
 See ["Center Frequency"](#) on page 57

[SENSe:]FREQuency:CENTer[:CC<cc>]:OFFSet <Offset>

Defines the general frequency offset.

For measurements on multiple component carriers, the command defines the frequency offset for a component carrier. The effect of the command depends on the syntax:

- When you omit the `[CC<cc>]` syntax element, the command defines the overall frequency offset.
 In that case, the value is added to the measurement frequency and, in case of measurements with component carriers, the center frequency of the component carriers.
- When you include the `[CC<cc>]` syntax element, the command defines the offset of the component carrier relative the first component carrier.
 In that case, the command is not available for the first component carrier - thus, `...:CC1:...` is not possible.

Suffix:

<cc> [Component Carrier](#)

Parameters:

<Offset> <numeric value>

- General frequency offset: frequency offset in Hz.
- Component carrier offset: frequency offset relative to the first component carrier in Hz.

Default unit: Hz

- Example:** //Add a frequency offset of 50 Hz to the measurement frequency.
//If you are measuring component carriers, the value is also added to the center frequencies of those carriers.
FREQ:CENT:OFFS 50HZ
- Example:** //Define a frequency offset of 15 MHz for the second component carrier relative to the first component carrier.
FREQ:CENT:CC2:OFFS 15MHZ
- Manual operation:** See ["Remote commands to configure carrier aggregation"](#) on page 32
See ["Center Frequency"](#) on page 57

[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 57

6.9.2.4 Amplitude configuration

DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:RLEVel<ant>.....	154
DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:RLEVel<ant>:OFFSet.....	155
INPut<ip>:ATTenuation<ant>.....	155
INPut<ip>:ATTenuation<ant>:AUTO.....	156
INPut<ip>:COUPling<ant>.....	156
INPut<ip>:GAIN<ant>:STATe.....	157
INPut<ip>:GAIN<ant>[:VALue].....	157
INPut<ip>:IMPedance<ant>.....	158
INPut<ip>:EATT<ant>.....	158
INPut<ip>:EATT<ant>:AUTO.....	158
INPut<ip>:EATT<ant>:STATe.....	159

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 58

**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 59

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 59

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 59

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 60

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 60

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 157).

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 60

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 60

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 59

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 59

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 59

6.9.2.5 Data capture

[SENSe:][LTE:]FRAMe:COUNT	159
[SENSe:][LTE:]FRAMe:COUNT:AUTO	160
[SENSe:][LTE:]FRAMe:COUNT:STATe	160
[SENSe:][LTE:]FRAMe:SSUBframe	160
[SENSe:]SWAPiq	160
[SENSe:]SWEep:TIME	161

[SENSe:][LTE:]FRAMe:COUNT <Subframes>

Defines the number of frames you want to analyze.

Prerequisites for this command

- Turn on overall frame count ([\[SENSe:\] \[LTE:\] FRAMe:COUNT:STATe](#)).
- Turn on manual selection of frames to analyze ([\[SENSe:\] \[LTE:\] FRAMe:COUNT:AUTO](#)).

Parameters:

<Subframes> <numeric value> (integer only)
*RST: 1

Example: //Define number of frames to analyze manually
FRAM:COUN:STAT ON
FRAM:COUN:AUTO OFF
FRAM:COUN 20

Manual operation: See ["Number of Frames to Analyze"](#) on page 62

[SENSe:][LTE:]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 according to the One-Web standard.

OFF | 0
 Turns on manual selection of the number of frames.

Example: //Turn on automatic selection of analyzed frames
 FRAM:COUN:AUTO ON

Manual operation: See "[Auto According to Standard](#)" on page 62

[SENSe:][LTE:]FRAMe:COUNT:STATe <State>

Turns manual selection of the number of frames you want to analyze on and off.

Parameters:

<State> **ON | 1**
 You can set the number of frames to analyze.

OFF | 0
 The R&S VSE analyzes the frames captured in a single sweep.

*RST: ON

Example: //Turn on manual selection of number of frames
 FRAM:COUN:STAT ON

Manual operation: See "[Overall Frame Count](#)" on page 62

[SENSe:][LTE:]FRAMe:SSUBframe <State>

Turns the analysis of a single subframe only on and off.

Parameters:

<State> ON | OFF | 1 | 0

*RST: OFF

Example: //Evaluate a single subframe only
 FRAM:SSUB ON

Manual operation: See "[Single Subframe Mode](#)" on page 62

[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 61

[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 61

6.9.2.6 Trigger

The trigger functionality of the OneWeb measurement application is the same as that of the R&S VSE.

For a comprehensive description of the available remote control commands for trigger configuration, see the documentation of the R&S VSE.

TRIGger[:SEquence]:DTIME.....	161
TRIGger[:SEquence]:HOLDoff<ant>[:TIME].....	162
TRIGger[:SEquence]:IFPower:HOLDoff.....	162
TRIGger[:SEquence]:IFPower:HYSteresis.....	162
TRIGger[:SEquence]:LEVel<ant>[:EXternal<tp>].....	163
TRIGger[:SEquence]:LEVel<ant>:IFPower.....	163
TRIGger[:SEquence]:LEVel<ant>:IQPower.....	163
TRIGger[:SEquence]:LEVel<ant>:RFPower.....	164
TRIGger[:SEquence]:LEVel:MAPower.....	164
TRIGger[:SEquence]:MAPower:HOLDoff.....	165
TRIGger[:SEquence]:MAPower:HYSteresis.....	165
TRIGger[:SEquence]:PORT<ant>.....	165
TRIGger[:SEquence]:SLOPe.....	165
TRIGger[:SEquence]:SOURce<ant>.....	166

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 63

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 63

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 63

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 63

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 63

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 63

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 63

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 63

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
```

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 63

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 63

6.9.2.7 Demodulation

[SENSe:][LTE:]UL:DEMod:MODE.....	167
[SENSe:][LTE:]UL:DEMod:CESTimation.....	167
[SENSe:][LTE:]UL:DEMod:EEPeriod.....	167
[SENSe:][LTE:]UL:DEMod:CDOffset.....	168
[SENSe:][LTE:]UL:DEMod:CBSCrambling.....	168
[SENSe:][LTE:]UL:DEMod:MCFilter.....	168

[SENSe:][LTE:]UL:DEMod:MODE <Mode>

Selects the uplink analysis mode.

Parameters:

<Mode>

PUSCh
Analyzes the PUSCH and PUCCH.

PRACH
Analyzes the PRACH.

*RST: PUSCh

Example: //Select PRACH analysis mode
UL:DEM:MODE PRAC

Manual operation: See ["Analysis Mode"](#) on page 65

[SENSe:][LTE:]UL:DEMod:CESTimation <Type>

Selects the channel estimation type.

Parameters:

<Type>

PIL
Pilot only

PILP
Pilot and payload

*RST: PILP

Example: //Use the pilot signal for channel estimation
UL:DEM:CEST PIL

Manual operation: See ["Channel Estimation Range"](#) on page 66

[SENSe:][LTE:]UL:DEMod:EEPeriod <State>

Includes or excludes the exclusion period from EVM results.

Parameters:

<State> ON | OFF | 1 | 0

Example: //Turn on exclusion periods for EVM calculation
UL:DEM:EEP ON

Manual operation: See ["EVM with Exclusion Period"](#) on page 66

[SENSe:][LTE:]UL:DEMod:CDCCoffset <State>

Turns DC offset compensation on and off.

Parameters:

<State> ON | OFF | 1 | 0
*RST: ON

Example: //Turn off DC offset compensation
UL:DEM:CDC OFF

Manual operation: See ["Compensate DC Offset"](#) on page 66

[SENSe:][LTE:]UL:DEMod:CBSCrambling <State>

Turns scrambling of coded bits on and off.

Parameters:

<State> ON | OFF | 1 | 0
*RST: ON

Example: //Turn off descrambling of coded bits
UL:DEM:CBSC OFF

Manual operation: See ["Scrambling of Coded Bits"](#) on page 66

[SENSe:][LTE:]UL:DEMod:MCFilter <State>

Turns suppression of interfering neighboring carriers on and off (for example LTE, WCDMA, GSM etc.).

Parameters:

<State> ON | OFF | 1 | 0
*RST: OFF

Example: //Turn on interference suppression
UL:DEM:MCF ON

Manual operation: See ["Multicarrier Filter"](#) on page 67

6.9.2.8 Tracking

[\[SENSe:\]\[LTE:\]UL:TRACking:PHASe.....](#) 169
[\[SENSe:\]\[LTE:\]UL:TRACking:TIME.....](#) 169

[SENSe:][LTE:]UL:TRACking:PHASe <Type>

Selects the phase tracking method.

Parameters:

<Type> **OFF**
Deactivate phase tracking

PIL
Pilot only

PILP
Pilot and payload

*RST: OFF

Example: //Use pilots and payload for channel estimation
 SENS:UL:TRAC:PHAS PILP

Manual operation: See "Phase" on page 64

[SENSe:][LTE:]UL:TRACking:TIME <State>

Turns timing tracking on and off.

Parameters:

<State> ON | OFF | 1 | 0

*RST: OFF

Example: //Turn on time tracking
 UL:TRAC:TIME ON

Manual operation: See "Time Tracking" on page 65

6.9.2.9 Automatic configuration

Commands to configure the application automatically described elsewhere.

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

`[SENSe<ip>:]ADJust:CONFigure:LEVel:DURation`..... 169

`[SENSe<ip>:]ADJust:CONFigure:LEVel:DURation:MODE`..... 170

`[SENSe:]ADJust:LEVel<ant>`..... 170

[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 58

[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 169.
 *RST: AUTO

Manual operation: See ["Auto Level"](#) on page 58

[SENSe:]ADJust:LEVel<ant>

Initiates a single (internal) measurement that evaluates and sets the ideal reference level for the current input data and measurement settings. 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.

Suffix:

<ant> 1...4
 Connected instrument

Example:

//Auto level on one instrument
 ADJ:LEV2

Usage:

Event

Manual operation: See ["Auto Level"](#) on page 58
 See ["Auto leveling"](#) on page 67

6.10 Analysis

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6.10.1 Trace export

FORMat:DEXPort:DSEParator.....	171
FORMat:DEXPort:HEADer.....	171
FORMat:DEXPort:TRACes.....	171
MMEMory:STORe<n>:TRACe.....	172

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 172).

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:

`MMEMoRY:STOR1:TRAC 1, 'C:\TEST.ASC'`

Stores trace 1 from window 1 in the file `TEST.ASC`.

6.10.2 Evaluation range

<code>[SENSe:][LTE:][CC<cc>:]ALlocation:SElect</code>	172
<code>[SENSe:][LTE:][CC<cc>:]CARRier:SElect</code>	173
<code>[SENSe:][LTE:][CC<cc>:]MODulation:SElect</code>	173
<code>[SENSe:][LTE:][CC<cc>:]PREamble:SElect</code>	174
<code>[SENSe:][LTE:][CC<cc>:]SLOT:SElect</code>	174
<code>[SENSe:][LTE:][CC<cc>:]SUBFrame:SElect</code>	174
<code>[SENSe:][LTE:][CC<cc>:]SYMBol:SElect</code>	175

[SENSe:][LTE:][CC<cc>:]ALlocation:SElect <Allocation>

Filters the displayed results in the constellation diagram by a certain type of allocation.

Suffix:

<cc> Component Carrier

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 6.6.1.18, "Return value codes"](#), on page 104.

*RST: ALL

Example: //Display results for PUSCH
ALL:SEL -40

Manual operation: See ["Evaluation range for the constellation diagram"](#) on page 74

[SENSe:][LTE:][CC<cc>:]CARRier:SElect <Carrier>

Filters the results in the constellation diagram by a certain subcarrier.

Suffix:

<cc> [Component Carrier](#)

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 subcarrier 1
CARR:SEL 1

Manual operation: See ["Evaluation range for the constellation diagram"](#) on page 74

[SENSe:][LTE:][CC<cc>:]MODulation:SElect <Modulation>

Filters the results in the constellation diagram by a certain type of modulation.

Suffix:

<cc> [Component Carrier](#)

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 6.6.1.18, "Return value codes"](#), on page 104.

*RST: ALL

Example: //Display results for all elements with a QPSK modulation
MOD:SEL 2

Manual operation: See ["Evaluation range for the constellation diagram"](#) on page 74

[SENSe:][LTE:][CC<cc>:]PREamble:SElect <Subframe>

Selects a certain preamble for measurements that analyze individual preambles.

Prerequisites for this command

- Select PRACH analysis mode ([SENSe:] [LTE:] UL:DEMod:MODE on page 167).

Suffix:

<cc> [Component Carrier](#)

Parameters:

<Preamble>

ALL

Analyzes all preambles.

<numeric value> (integer only)

Analyzes a single preamble.

*RST: ALL

Example:

```
//Analyze all preambles
PRE:SEL ALL
```

Manual operation: See "[Preamble Selection](#)" on page 74

[SENSe:][LTE:][CC<cc>:]SLOT:SElect <Slot>

Filters the results in the constellation diagram by a particular slot.

Suffix:

<cc> [Component Carrier](#)

Parameters:

<Slot>

S0

Slot 0

S1

Slot 1

ALL

Both slots

*RST: ALL

Example:

```
//Display results for all slots
SLOT:SEL ALL
```

Manual operation: See "[Slot Selection](#)" on page 73

[SENSe:][LTE:][CC<cc>:]SUBFrame:SElect <Subframe>

Selects the subframe to be analyzed.

Suffix:

<cc> [Component Carrier](#)

Parameters:

<Subframe>

ALL | <numeric value>

ALL

Select all subframes

0...39

Select a single subframe

***RST:** ALL

Example: //Display results for all subframes
SUBF:SEL ALL

Manual operation: See "[Subframe Selection](#)" on page 72

[SENSe:][LTE:][CC<cc>:]SYMBOL:SElect <Symbol>

Filters the results in the constellation diagram by a certain OFDM symbol.

Suffix:

<cc> [Component Carrier](#)

Parameters:

<Symbol>

ALL

Shows the results for all subcarriers.

<numeric_value> (integer only)

Shows the results for a single OFDM symbol.

***RST:** ALL

Example: //Display result for OFDM symbol 2
SYMB:SEL 2

Manual operation: See "[Evaluation range for the constellation diagram](#)" on page 74

6.10.3 Y-axis scale

[DISPlay\[:WINDow<n>\]\[:SUBWindow<w>\]:TRACe<t>:Y\[:SCALE\]:AUTO](#)..... 175

[DISPlay\[:WINDow<n>\]\[:SUBWindow<w>\]:TRACe<t>:Y\[:SCALE\]:MAXimum](#)..... 176

[DISPlay\[:WINDow<n>\]\[:SUBWindow<w>\]:TRACe<t>:Y\[:SCALE\]:MINimum](#)..... 176

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 Scaling"](#) on page 67
See ["Automatic scaling of the y-axis"](#) on page 69

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 69

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 69

6.10.4 Result settings

CALCulate<n>:MARKer<m>:COUPling.....	177
DISPlay[:WINDow<n>][:SUBWindow<w>]:COUPling.....	177
UNIT:BSTR.....	177
UNIT:CAXes.....	178
UNIT:EVM.....	178

CALCulate<n>:MARKer<m>:COUPling <State>

Couples or decouples markers in different result displays to each other.

Suffix:

<n>	irrelevant
<m>	irrelevant

Parameters:

<State>	ON OFF 1 0
*RST:	OFF

Example: //Couple markers to each other.
CALC:MARK:COUP ON

Manual operation: See "[Marker Coupling](#)" on page 76

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

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 75

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 76

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 75

7 Annex: reference

- [Menu reference](#)..... 179
- [Reference of toolbar functions](#)..... 183

7.1 Menu reference

Most functions in the R&S VSE are available from the menus.

- [Common R&S VSE menus](#)..... 179
- [LTE measurement menus](#)..... 181



7.1.1 Common R&S VSE menus

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

- [File menu](#)..... 179
- [Window menu](#)..... 180
- [Help menu](#)..... 181

7.1.1.1 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
> Replace Measurement Channel	-	Replaces the currently selected channel by the selected application.
> Rename Measurement Channel	-	Changes the name of the selected channel.

Menu item	Corresponding icon in toolbar	Description
> 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

7.1.1.2 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

Menu item	Corresponding icon in toolbar	Description
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

7.1.1.3 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

7.1.2 LTE measurement menus

- [Input & output menu](#)..... 181
- [Meas setup menu](#)..... 182
- [Trace menu](#)..... 182
- [Marker menu](#)..... 182
- [Limits menu](#)..... 182

7.1.2.1 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 7-1: "Input" menu items for LTE measurements

Menu item	Description
Amplitude	Chapter 4.2.12, "Amplitude configuration" , on page 57
Scale	Chapter 5.1.2, "Diagram scale" , on page 69
Frequency	Chapter 4.2.11, "Frequency configuration" , on page 56
Trigger	Chapter 4.2.14, "Trigger configuration" , on page 63
Input Source	Chapter 4.2.10, "Selecting the input and output source" , on page 52
Output Source	

7.1.2.2 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.

7.1.2.3 Trace menu




The "Trace" does not contain any functions for LTE measurements, traces are generally not configurable.

7.1.2.4 Marker menu

The "Marker" menu provides access to marker-specific functions.

This menu is application-specific.

Table 7-2: "Marker" menu items for OneWeb measurements

Menu item	Corresponding icon in toolbar	Description
Select marker <x>		Chapter 5.1.4, "Markers" , on page 70
Marker to Trace	-	Chapter 5.1.4, "Markers" , on page 70
All Markers Off		Chapter 5.1.4, "Markers" , on page 70
Marker...		Chapter 5.1.4, "Markers" , on page 70
Search	-	Chapter 5.1.4, "Markers" , on page 70

7.1.2.5 Limits menu

The "Limits" menu does not contain any functions for LTE measurements.

7.2 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

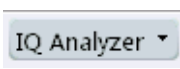






The following functions are generally available for all applications:

"Main" toolbar



Table 7-3: 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 7-4: 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 7-5: 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 7-6: 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 7-7: Functions in the "Marker" toolbar























Icon	Description
	Place new marker
	Percent Marker (CCDF only)
	Select marker
	Marker type "normal"
	Marker type "delta"
	Global peak
	Absolute peak (Currently only for GSM application)
	Next peak to the left
	Next peak to the right
	Next peak up (for spectrograms only: search in more recent frames)
	Next peak down (for spectrograms only: search in previous frames)
	Global minimum
	Next minimum left
	Next minimum right
	Next min up (for spectrograms only: search in more recent frames)
	Next min down (for spectrograms only: search in previous frames)
	Set marker value to center frequency
	Set reference level to marker value
	All markers off
	Marker search configuration
	Marker configuration

Table 7-8: 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

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