

R&S® VSE-K10x (LTE Uplink)

LTE Uplink Measurements

User Manual



1176.8997.02 – 01

This manual applies to the R&S®VSE base software (1320.7500.02) version 1.10 and higher.

This manual describes functionality of the following R&S®VSE options:

- R&S®VSE-K100 LTE FDD Measurement Application (1320.7545K02)
- R&S®VSE-K104 LTE FDD Measurement Application (1320.7568K02)

The firmware of the instrument makes use of several valuable open source software packages. For information, see the "Open Source Acknowledgement" on the user documentation CD-ROM (included in delivery).

Rohde & Schwarz would like to thank the open source community for their valuable contribution to embedded computing.

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

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1 Preface

1.1 About this Manual

This User Manual describes information specific to **measurements in the LTE measurement application**. All other applications are described in the corresponding application manuals.

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


- **Welcome to the R&S VSE**
Introduction to and getting familiar with the software
- **Measurements and Results**
Descriptions of the measurement types available in the R&S VSE software
- **Controlling Instruments and Capturing I/Q Data**
Methods of data acquisition and description of basic instrument control functions
- **LTE Measurements**
Description of the settings and functions provided to analyze results with the software and the corresponding remote control commands
- **Remote Commands for LTE Measurements**
Remote commands required to configure and perform measurements in a remote environment, sorted by tasks
Remote commands required to set up the environment and to perform common tasks in the software, sorted by tasks
Programming examples demonstrate the use of many commands and can usually be executed directly for test purposes
- **List of Commands**
Alphabetical list of all remote commands described in the manual
- **Index**

1.2 Documentation Overview

The user documentation for the R&S VSE consists of the following parts:

- "Getting Started" printed manual
- Online Help system in the software
- CD-ROM including the following documentation:
 - Getting Started
 - User Manuals for base software and options
 - Service Manual
 - Release Notes
 - Data sheet and product brochures

Online Help

The Online Help is embedded in the software. It offers quick, context-sensitive access to the complete information needed for operation and programming. Online help is available using the  icon on the toolbar of the R&S VSE.

Getting Started

This manual is delivered with the software in printed form and in PDF format on the CD. It provides the information needed to set up and start working with the software. Basic operations and handling are described. Safety information is also included.

User Manuals

User manuals are provided for the base software and each additional (software) option.

The user manuals are available in PDF format - in printable form - on the CD-ROM delivered with the software. In the user manuals, all software functions are described in detail. Furthermore, they provide a complete description of the remote control commands with programming examples.

The user manual for the base software provides basic information on operating the R&S VSE in general, and the I/Q Analyzer application in particular. Furthermore, the software functions that enhance the basic functionality for various applications are described here. An introduction to remote control is provided, as well as information on troubleshooting.

In the individual application manuals, the specific software functions of the application are described in detail. For additional information on default settings and parameters, refer to the data sheets. Basic information on operating the R&S VSE is not included in the application manuals.

Release Notes

The release notes describe the installation of the software, new and modified functions, eliminated problems, and last minute changes to the documentation. The corresponding software version is indicated on the title page of the release notes.

1.3 Typographical Conventions

The following text markers are used throughout this documentation:

| Convention | Description |
|-------------------------------------|--|
| "Graphical user interface elements" | All names of graphical user interface elements on the screen, such as dialog boxes, menus, options, buttons, and softkeys are enclosed by quotation marks. |
| KEYS | Key names are written in capital letters. |
| File names, commands, program code | File names, commands, coding samples and screen output are distinguished by their font. |

| Convention | Description |
|-----------------------|---|
| <i>Input</i> | Input to be entered by the user is displayed in italics. |
| Links | Links that you can click are displayed in blue font. |
| "References" | References to other parts of the documentation are enclosed by quotation marks. |

2 Welcome to the LTE Measurement Application

The R&S VSE-K101 and -K105 are firmware applications that add functionality to perform measurements on LTE signals according to the 3GPP standard to the R&S VSE.

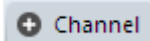
This user manual contains a description of the functionality that the application provides, including remote control operation. Functions that are not discussed in this manual are the same as in the Spectrum application and are described in the R&S VSE User Manual. The latest versions of the manuals are available for download at the product homepage.

- [Starting the LTE Measurement Application](#).....10
- [Understanding the Display Information](#)..... 10

2.1 Starting the LTE Measurement Application

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

To activate the LTE application

1.  Channel

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

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

2. Select the "LTE" item.



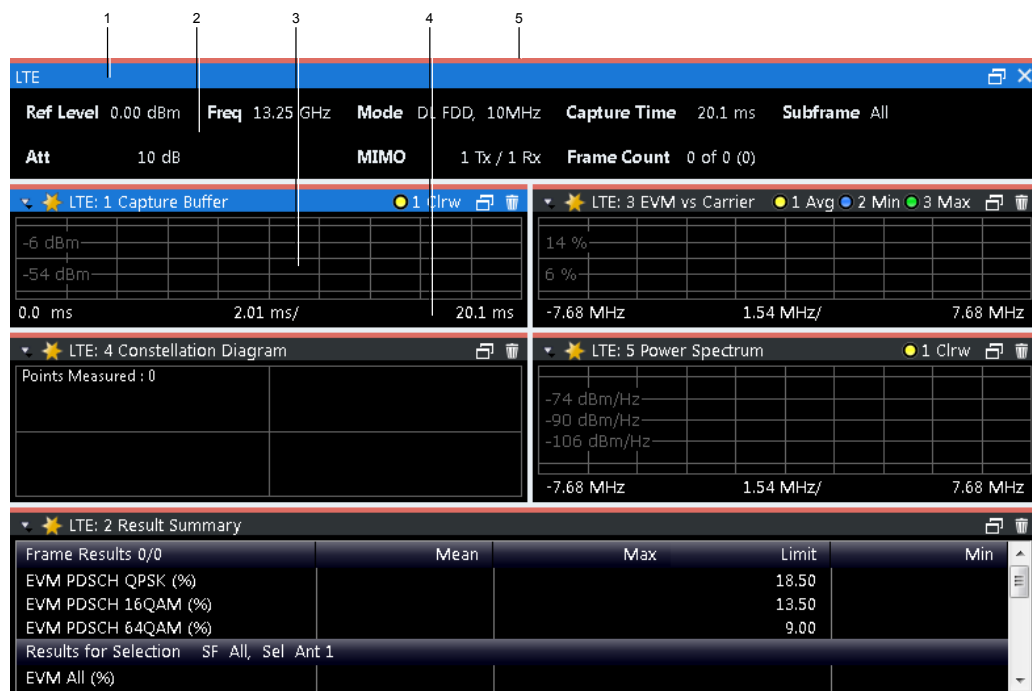
The R&S VSE opens a new measurement channel for the LTE application.

The application is started with the default settings. It can be configured in the "Overview" dialog box, which is displayed when you select the "Overview" softkey from the "Meas Setup" menu.

For more information see [chapter 4, "Configuration"](#), on page 26.

2.2 Understanding the Display Information

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



- 1 = Window title bar with information about the diagram and its traces
- 2 = Channel bar with measurement settings
- 3 = Diagram area
- 4 = Diagram footer with information about the contents of the diagram
- 5 = Color code for windows of the same channel (here: red)

Channel bar information

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

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

| | |
|--------------------------|---|
| Ref Level | Reference level |
| Att | Mechanical and electronic RF attenuation |
| Freq | Frequency |
| Mode | LTE standard |
| 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 LTE measurement application measures and analyzes various aspects of an LTE 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.

- [Selecting Measurements](#).....13
- [Selecting Result Displays](#).....13
- [Performing Measurements](#).....14
- [I/Q Measurements](#).....14

3.1 Selecting Measurements

- ▶ Select the "Select Meas" menu item from the "Meas Setup" menu.

The application opens a dialog box that contains several buttons.

Each button represents a set of result displays that thematically belong together and that have a particular display configuration. If these predefined display configurations do not suit your requirements you can add or remove result displays as you like. For more information about selecting result displays see [chapter 3.2, "Selecting Result Displays"](#), on page 13.


Depending on the button you select, the application changes the way the R&S VSE captures and processes the raw signal data.

- When you select "EVM", the application processes the I/Q data of the signal. For more information on available I/Q result displays see [chapter 3.4, "I/Q Measurements"](#), on page 14.
When you select one of the result displays available for I/Q measurements, you can combine the result displays available for I/Q measurements in any way.

Remote command:

`CONFigure[:LTE]:MEASurement` on page 107

3.2 Selecting Result Displays

- ▶ Select the "New Window" menu item from the "Window" menu or select a new window with the  icon in the toolbar. Depending on the number of LTE channel 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 76

Note that you can customize the contents of some numerical result displays. For more information see [chapter 5.1, "Configuring Tables / Numerical Results"](#), on page 59.

3.3 Performing Measurements

By default, the application measures the signal continuously. In "Continuous Sweep" mode, the application captures and analyzes the data again and again. The amount of data depends on the capture time (I/Q measurements) or the sweep time (frequency sweep measurements). In "Single Sweep" mode, the application stops measuring after it has captured the data once. The amount of data again depends on the capture time or the sweep time.

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

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

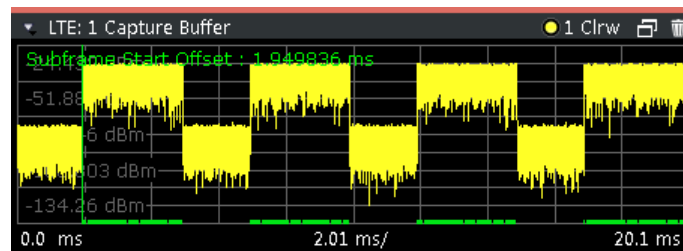
3.4 I/Q Measurements

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Capture Buffer

The Capture Buffer result display 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).



A green vertical line at the beginning of the green bar in the Capture Buffer display marks the subframe start. Additionally, the diagram 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 may be interrupted at certain positions. Each small bar indicates the useful parts of the OFDM symbol.

Remote command:

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

Querying results: `TRACe:DATA?`

Querying the subframe start offset: `FETCh:SUMMary:TFRame?` on page 98

EVM vs Carrier

Starts the EVM vs Carrier result display.

This 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.

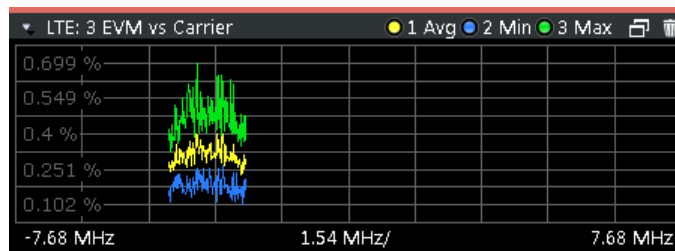
The results are based on an average EVM that is calculated over the resource elements for each subcarrier. This average subcarrier EVM is determined for each analyzed slot in the capture buffer.

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 ["Subframe Selection"](#) on page 59

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



Remote command:

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

Querying results: `TRACe:DATA?`

EVM vs Symbol

Starts the EVM vs Symbol result display.

This 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 particular OFDM symbol. This average OFDM symbol EVM is determined for all OFDM symbols in each analyzed slot.

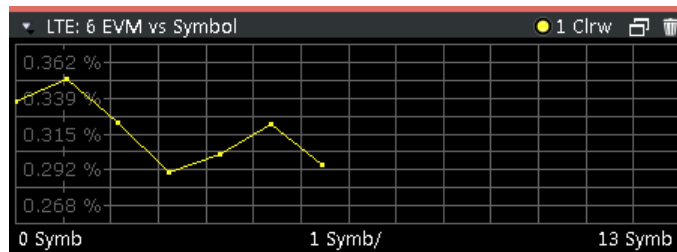
If you analyze all subframes, the result display contains three traces.

- Average EVM
This trace shows the OFDM symbol EVM averaged over all slots.
- Minimum EVM
This trace shows the lowest (average) OFDM symbol EVM that has been found over the analyzed slots.
- Maximum EVM
This trace shows the highest (average) OFDM symbol 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 OFDM symbol EVM for that slot only. Average, minimum and maximum values in that case are the same. For more information see "[Subframe Selection](#)" on page 59

The x-axis represents the OFDM symbols, with each symbol represented by a dot on the line. The number of displayed symbols depends on the Subframe Selection and the length of the cyclic prefix. Any missing connections from one dot to another mean that the R&S VSE could not determine the EVM for that symbol. In case of TDD signals, the result display does not show OFDM symbols that are not part of the measured link direction.

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



Remote command:

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

Querying results: `TRACe:DATA?`

EVM vs Subframe

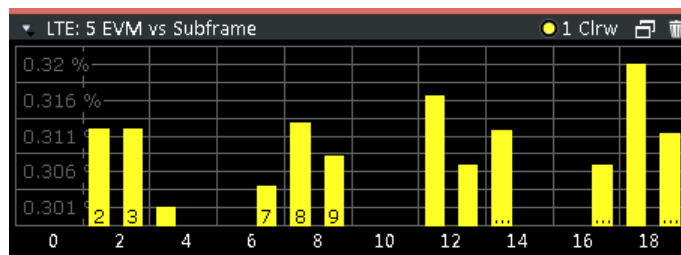
Starts the EVM vs Subframe result display.

This 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:

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

Querying results: `TRACe:DATA?`

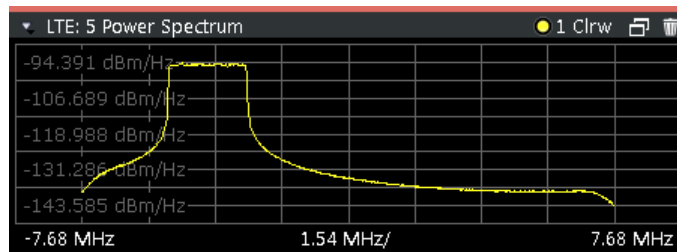
Power Spectrum

Starts the Power Spectrum result display.

This result display shows the power density of the complete capture buffer in dBm/Hz. The displayed bandwidth depends on bandwidth or number of resource blocks you have set.

For more information see "[Channel Bandwidth / Number of Resource Blocks](#)" on page 30.

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



Remote command:

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

Querying results: `TRACe:DATA?`

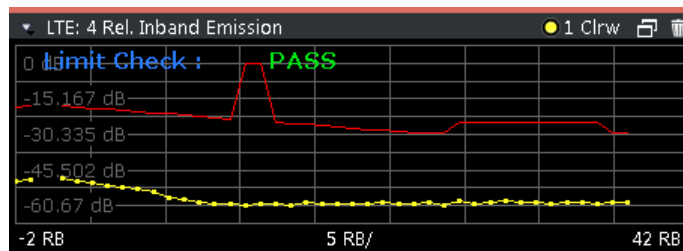
Inband Emission

Starts the Inband Emission result display.

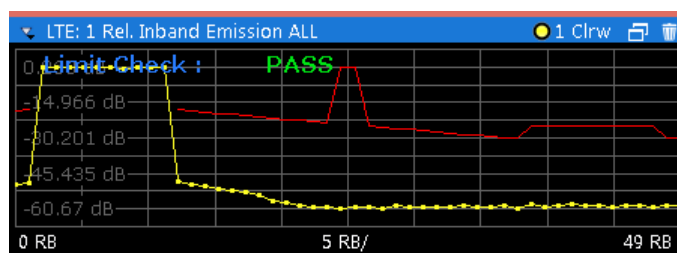
This result display shows the relative power of the unused resource blocks (yellow trace) and the inband emission limit lines (red trace) specified by the LTE standard document 3GPP TS36.101.

The measurement is evaluated over the currently selected slot in the currently selected subframe. The currently selected subframe depends on your [selection](#).

Note that you have to select a specific subframe and slot to get valid measurement results.



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:

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

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

Querying results: `TRACe:DATA?`

Spectrum Flatness

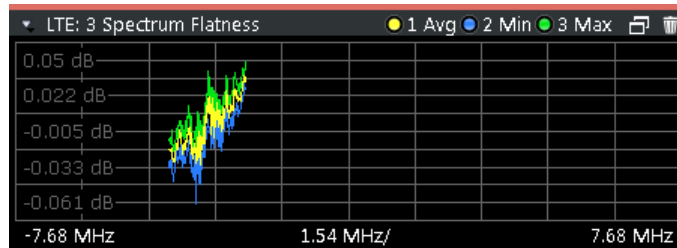
Starts the Spectrum Flatness result display.

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

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



Note that the limit lines are only displayed if you match the [Operating Band](#) to the center frequency. Limits are defined for each operating band in the standard. The shape of the limit line is different when "[Extreme Conditions](#)" on page 32 are on.

Remote command:

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

Querying results: `TRACe:DATA?`

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:

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

Querying results: `TRACe:DATA`

Channel Group Delay

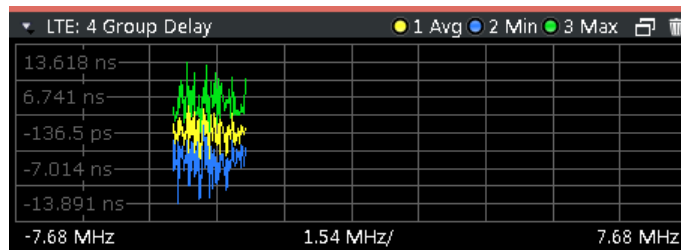
Starts the Channel Group Delay result display.

This result display 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:

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

Querying results: `TRACe:DATA?`

Spectrum Flatness Difference

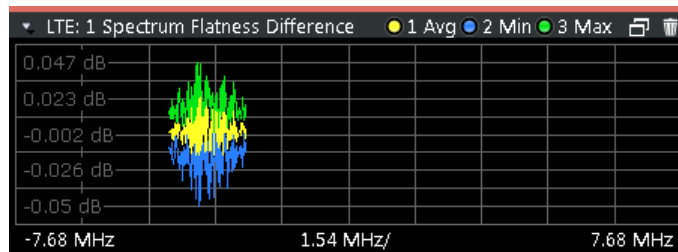
Starts the Spectrum Flatness Difference result display.

This 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:

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

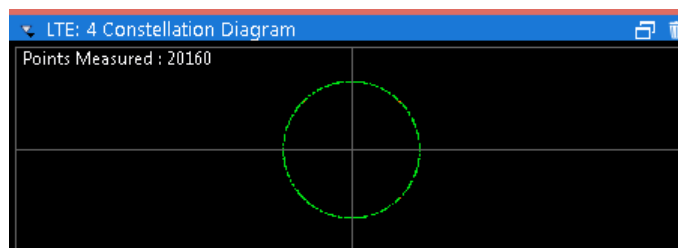
Querying results: `TRACe:DATA?`

Constellation Diagram

Starts the Constellation Diagram result display.

This result display shows the inphase 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. You can filter the results by changing the [evaluation range](#).



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

Remote command:

Selecting the result display: [LAY:ADD ? '1',LEFT,CONS](#)

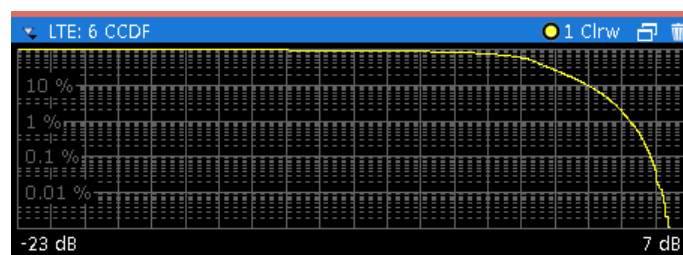
Querying results: [TRACe:DATA?](#)

CCDF

Starts the Complementary Cumulative Distribution Function (CCDF) result display.

This result display 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 %.



Remote command:

Selecting the result display: [LAY:ADD ? '1',LEFT,CCDF](#)

Querying results: [TRACe:DATA?](#)

Allocation Summary

Starts the Allocation Summary result display.

This result display shows the results of the measured allocations in tabular form.

| SF | Allocation ID | RBs | Offset RB | Mod | Pow [dBm] | EVM [%] |
|----|---------------|-----|-----------|-------|-----------|---------|
| 2 | PUSCH | 10 | 2 | QPSK | -30.458 | 0.315 |
| | DMRS PUSCH | | | CAZAC | -30.456 | 0.290 |
| 3 | PUSCH | 10 | 2 | QPSK | -30.455 | 0.312 |

The rows in the table represent the allocations. A set of allocations form a subframe. The subframes are separated by a dashed line. The columns of the table contain the following information:

- **Subframe**
Shows the subframe number.
- **Allocation ID**
Shows the type / ID of the allocation.
- **Number of RB**
Shows the number of resource blocks assigned to the corresponding allocation.
- **Offset RB**
Shows the resource block offset of the allocation.
- **Modulation**

- Shows the modulation type.
- **Power**
Shows the power of the allocation in dBm.
- **EVM**
Shows the EVM of the allocation. The unit depends on your [selection](#).

Note: Contents of the Allocation Summary

The number of columns shown in the Allocation Summary is variable. To add or remove a column, click on the header row of the table *once*. The application opens a dialog box to select the columns which you'd like to display.

Remote command:

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

Querying results: `TRACe:DATA?`

Bit Stream

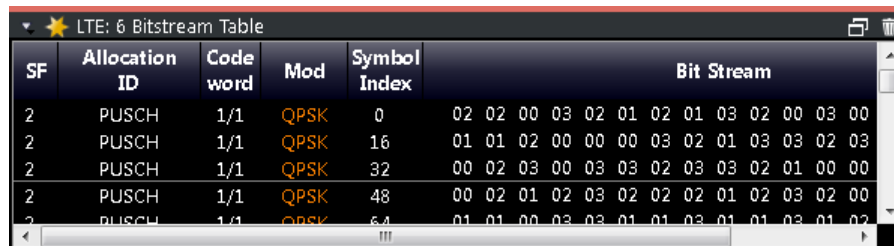
Starts the Bit Stream result display.

This result display shows the demodulated data stream for each data allocation. Depending on the [Bit Stream Format](#), the numbers represent either bits (bit order) or symbols (symbol order).

Selecting symbol format shows the bit stream as symbols. In that case the bits belonging to one symbol are shown as hexadecimal numbers with two digits. In the case of bit format, each number represents one raw bit.

Symbols or bits that are not transmitted are represented by a "-".

If a symbol could not be decoded because the number of layers exceeds the number of receive antennas, the application shows a "#" sign.



| SF | Allocation ID | Code word | Mod | Symbol Index | Bit Stream |
|----|---------------|-----------|------|--------------|--|
| 2 | PUSCH | 1/1 | QPSK | 0 | 02 02 00 03 02 01 02 01 03 02 00 03 00 |
| 2 | PUSCH | 1/1 | QPSK | 16 | 01 01 02 00 00 00 03 02 01 03 03 02 03 |
| 2 | PUSCH | 1/1 | QPSK | 32 | 00 02 03 00 03 03 02 03 03 02 01 00 00 |
| 2 | PUSCH | 1/1 | QPSK | 48 | 00 02 01 02 03 02 02 02 01 02 03 02 00 |
| 2 | PUSCH | 1/1 | QPSK | 64 | 01 01 00 03 03 01 01 03 01 01 03 01 02 |

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**
Shows the position of the table row's first bit or symbol within the complete stream.
- **Bit Stream**

The actual bit stream.

Remote command:

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

Querying results: `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

| LTE: 2 Result Summary | | | | |
|---|--------|-------|--------|--------|
| Frame Results 5/10 | Mean | Limit | Max | Min |
| EVM PUSCH QPSK (%) | 0.31 | 17.50 | | |
| EVM PUSCH 16QAM (%) | | 12.50 | | |
| EVM PUSCH 64QAM (%) | | | | |
| EVM DMRS PUSCH QPSK (%) | 0.30 | 17.50 | | |
| EVM DMRS PUSCH 16QAM (%) | | 12.50 | | |
| EVM DMRS PUSCH 64QAM (%) | | | | |
| EVM PUCCH (%) | | 17.50 | | |
| EVM DMRS PUCCH (%) | | 17.50 | | |
| Results for Selection SF All, Slots All | | | | |
| EVM All (%) | 0.31 | | 0.32 | 0.30 |
| EVM Phys Channel (%) | 0.31 | | 0.32 | 0.29 |
| EVM Phys Signal (%) | 0.30 | | 0.34 | 0.27 |
| Frequency Error (Hz) | -0.01 | | 0.90 | -0.86 |
| Sampling Error (ppm) | | | | |
| IQ Offset (dB) | -66.10 | | -65.20 | -67.14 |
| IQ Gain Imbalance (dB) | | | | |
| IQ Quadrature Error (°) | | | | |
| Power (dBm) | -30.46 | | -30.45 | -30.46 |
| Crest Factor (dB) | 21.34 | | 29.75 | 5.34 |

| LTE: 2 Result Summary | | | | |
|---|--------|-------|--------|--------|
| 3GPP EVM Results | Mean | Limit | Max | Min |
| EVM PRACH (%) | | 17.50 | | |
| Results for Selection PA All, PA Cnt 5/10 | | | | |
| EVM All (%) | 0.31 | | 0.32 | 0.30 |
| Frequency Error (Hz) | -0.01 | | 0.90 | -0.86 |
| Sampling Error (ppm) | | | | |
| IQ Offset (dB) | -66.10 | | -65.20 | -67.14 |
| IQ Gain Imbalance (dB) | | | | |
| IQ Quadrature Error (°) | | | | |
| Power (dBm) | -30.46 | | -30.45 | -30.46 |
| Crest Factor (dB) | 21.34 | | 29.75 | 5.34 |

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.

Note that the contents of the table depend on whether you are measuring in PUCCH/ PUSCH or PRACH analysis mode. For more information see "[Analysis Mode](#)" on page 57.

In addition to the red font, the application also puts a red star (*** 25.60**) in front of failed results.

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.

| | |
|-----------------------------|---|
| EVM PUSCH QPSK | Shows the EVM for all QPSK-modulated resource elements of the PUSCH channel in the analyzed frame. FETCh:SUMMary:EVM:USQP[:AVERage]? on page 92 |
| EVM PUSCH 16QAM | Shows the EVM for all 16QAM-modulated resource elements of the PUSCH channel in the analyzed frame. FETCh:SUMMary:EVM:USST[:AVERage]? on page 93 |
| EVM PUSCH 64QAM | Shows the EVM for all 64QAM-modulated resource elements of the PUSCH channel in the analyzed frame. FETCh:SUMMary:EVM:USSF[:AVERage]? on page 93 |
| EVM DRMS PUSCH QPSK | Shows the EVM of all DMRS resource elements with QPSK modulation of the PUSCH in the analyzed frame. FETCh:SUMMary:EVM:SDQP[:AVERage]? on page 91 |
| EVM DRMS PUSCH 16QAM | Shows the EVM of all DMRS resource elements with 16QAM modulation of the PUSCH in the analyzed frame. FETCh:SUMMary:EVM:SDST[:AVERage]? on page 91 |
| EVM DRMS PUSCH 64QAM | Shows the EVM of all DMRS resource elements with 64QAM modulation of the PUSCH in the analyzed frame. FETCh:SUMMary:EVM:SDSF[:AVERage]? on page 91 |
| EVM PUCCH | Shows the EVM of all resource elements of the PUCCH channel in the analyzed frame. FETCh:SUMMary:EVM:UCCH[:AVERage]? on page 92 |
| EVM DMRS PUCCH | Shows the EVM of all DMRS resource elements of the PUCCH channel in the analyzed frame. FETCh:SUMMary:EVM:UCCD[:AVERage]? on page 92 |
| EVM PRACH | Shows the EVM of all resource elements of the PRACH channel in the analyzed frame. FETCh:SUMMary:EVM:UPRA[:AVERage]? on page 92 |

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

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).

| | |
|-----------------------------|--|
| EVM All | Shows the EVM for all resource elements in the analyzed frame. FETCh[:CC<cci>]:SUMMary:EVM[:ALL][:AVERAge]? on page 94 |
| 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<cci>]:SUMMary:EVM:PCHannel[:AVERAge]? on page 95 |
| 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<cci>]:SUMMary:EVM:PSIGnal[:AVERAge]? on page 95 |
| Frequency Error | Shows the difference in the measured center frequency and the reference center frequency. FETCh[:CC<cci>]:SUMMary:FERRor[:AVERAge]? on page 95 |
| Sampling Error | Shows the difference in measured symbol clock and reference symbol clock relative to the system sampling rate. FETCh[:CC<cci>]:SUMMary:SERRor[:AVERAge]? on page 97 |
| I/Q Offset | Shows the power at spectral line 0 normalized to the total transmitted power. FETCh[:CC<cci>]:SUMMary:IQOFFset[:AVERAge]? on page 96 |
| I/Q Gain Imbalance | Shows the logarithm of the gain ratio of the Q-channel to the I-channel. FETCh[:CC<cci>]:SUMMary:GIMBalance[:AVERAge]? on page 96 |
| 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<cci>]:SUMMary:QUADerror[:AVERAge]? on page 97 |
| Power | Shows the average time domain power of the allocated resource blocks of the analyzed signal. FETCh[:CC<cci>]:SUMMary:POWer[:AVERAge]? on page 97 |
| Crest Factor | Shows the peak-to-average power ratio of captured signal. FETCh[:CC<cci>]:SUMMary:CRESt[:AVERAge]? on page 94 |

Marker Table

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



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

Remote command:

LAY:ADD? '1', RIGH, MTAB, see [LAYout:ADD\[:WINDow\]? on page 76](#)

Results:

[CALCulate<n>:MARKer<m>:X on page 99](#)

[CALCulate<n>:MARKer<m>:Y? on page 99](#)

4 Configuration

LTE measurements require a special application on the R&S VSE, which you activate using the MODE key on the front panel.

When you start the LTE 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.



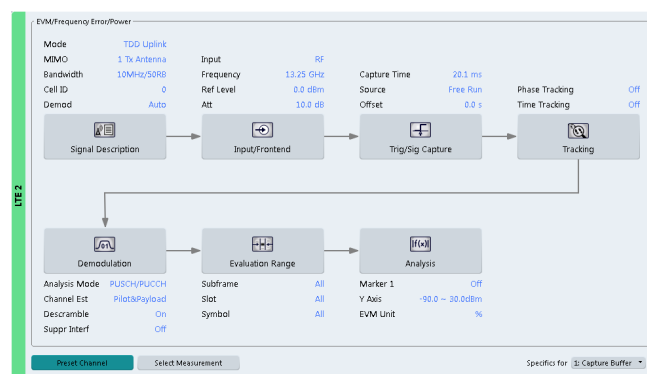
Unavailable menus

Note that the "Trace" and "Lines" menus have no contents and no function in the LTE application.

- [Configuration Overview](#).....26
- [Configuring I/Q Measurements](#)..... 28

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, "Defining Signal Characteristics"](#), on page 28.
2. Input / Frontend
See [chapter 4.2.10, "Selecting the Input and Output Source"](#), on page 49.
3. Trigger / Signal Capture
See [chapter 4.2.14, "Triggering Measurements"](#), on page 55
See [chapter 4.2.13, "Configuring the Data Capture"](#), on page 54
4. Tracking
See [chapter 4.2.15, "Tracking"](#), on page 56.
5. Demodulation
see [chapter 4.2.16, "Signal Demodulation"](#), on page 56.
6. Evaluation Range
See [chapter 5.2, "Evaluation Range"](#), on page 59.
7. Analysis
See [chapter 5, "Analysis"](#), on page 59.
8. Display Configuration
See [chapter 3, "Measurements and Result Displays"](#), on page 13.

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 the "Preset Channel" button in the lower lefthand corner of the "Overview" to restore all measurement settings **in the current channel** to their default values.

Remote command:

[SYSTem:PRESet:CHANnel\[:EXECute\]](#) on page 108

Select Measurement

Opens a dialog box to select the type of measurement.

Using this button has the same effect as selecting the "Select Measurement" menu item in the "Meas Setup" menu.

For more information see [chapter 3.1, "Selecting Measurements"](#), on page 13.

Remote command:

[CONFigure\[:LTE\]:MEASurement](#) on page 107

Specifics for

The measurement channel may contain several windows for different results. Thus, the settings indicated in the "Overview" and configured in the dialog boxes vary depending on the selected window.

Select an active window from the "Specifics for" selection list that is displayed in the "Overview" and in all window-specific configuration dialog boxes.

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

4.2 Configuring I/Q Measurements

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| • Configuring the Data Capture..... | 54 |
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| • Tracking..... | 56 |
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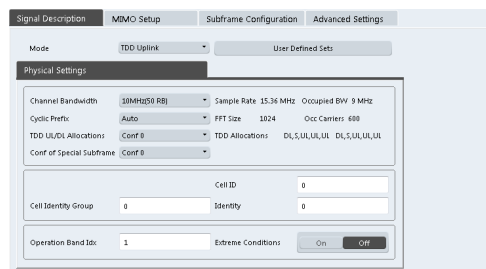
4.2.1 Defining Signal Characteristics

The general signal characteristics contain settings to describe the general physical attributes of the signal. They are part of the "Signal Description" tab of the "Signal Description" dialog box.

To define signal characteristics

Signal characteristics settings can be defined in the "Signal Description" dialog box.

1. Select "Signal Description" from the "Overview" dialog box.
2. Press the MEAS CONFIG key and select the "Signal Description" softkey.



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| L TDD UL/DL Allocations..... | 31 |
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Selecting the LTE Mode

The standard defines the LTE mode you are testing.

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

- Option xxx-K100 enables testing of 3GPP LTE FDD signals on both uplink and downlink
- Option xxx-K104 enables testing of 3GPP LTE MIMO signals on both uplink and downlink

FDD and TDD are **duplexing** methods.

- FDD mode uses different frequencies for the uplink and the downlink.
- TDD mode uses the same frequency for the uplink and the downlink.

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

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

Remote command:

Link direction: `CONFigure[:LTE]:LDIRection` on page 109

Duplexing mode: `CONFigure[:LTE]:DUPLexing` on page 109

Using Test Models

Test models are descriptions of LTE signals that you can use for particular test scenarios.

The "Test Models" dialog box contains functionality to select, manage and create test models.

- "Specification"
The "Specification" tab contains predefined test models as defined by 3GPP. Predefined test models are supported in downlink mode.
- "User Defined"

The "User Defined" tab contains functionality to manage custom test models. Custom test models are supported in downlink and uplink mode.

To create a custom test model, describe a signal as required and then save it via the "Test Models" dialog box.

Here, you can also restore custom test models and delete ones you do not need anymore.

Predefined test models (E-TM)

In case of downlink signals, the 3GPP standard (TS 36.141) already defines several EUTRA test models (E-TM) for specific test scenarios. These test models are split into three main groups (E-TM1, E-TM2 and E-TM3) and are defined by the following characteristics.

- single antenna port, single code word, single layer and no precoding
- duration of one frame
- normal cyclic prefix
- localized virtual resource blocks, no intra-subframe hopping for PDSCH
- UE-specific reference signal not used

The data content of the physical channels and signals are defined in the 3GPP standard. Each E-TM is defined for all bandwidths defined in the standard (1.4 MHz / 3 MHz / 5 MHz / 10 MHz / 15 MHz / 20 MHz).

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. Currently, the LTE standard recommends six bandwidths (see table below).

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 |

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

Remote command:

`CONFigure[:LTE]:UL[:CC<cci>]:BW` on page 109

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.
- Extended

A slot contains 6 OFDM symbols.

The extended cyclic prefix is able to cover larger cell sizes with higher delay spread of the radio channel.

- Auto
The application automatically detects the cyclic prefix mode in use.

Remote command:

`CONFigure[:LTE]:UL[:CC<cci>]:CYCPrefix` on page 110

Configuring TDD Frames

TDD frames contain both uplink and downlink information separated in time with every subframe being responsible for either uplink or downlink transmission. The standard specifies several subframe configurations or resource allocations for TDD systems.

TDD UL/DL Allocations ← Configuring TDD Frames

Selects the configuration of the subframes in a radio frame in TDD systems.

The UL/DL configuration (or allocation) defines the way each subframe is used: for uplink, downlink or if it is a special subframe. The standard specifies seven different configurations.

| Configuration | Subframe Number and Usage | | | | | | | | | |
|---------------|---------------------------|---|---|---|---|---|---|---|---|---|
| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 0 | D | S | U | U | U | D | S | U | U | U |
| 1 | D | S | U | U | D | D | S | U | U | D |
| 2 | D | S | U | D | D | D | S | U | D | D |
| 3 | D | S | U | U | U | D | D | D | D | D |
| 4 | D | S | U | U | D | D | D | D | D | D |
| 5 | D | S | U | D | D | D | D | D | D | D |
| 6 | D | S | U | U | U | D | S | U | U | D |

U = uplink

D = downlink

S = special subframe

Remote command:

Subframe: `CONFigure[:LTE]:UL[:CC<cci>]:TDD:UDConf` on page 111

Conf. of Special Subframe ← Configuring TDD Frames

In combination with the cyclic prefix, the special subframes serve as guard periods for switches from uplink to downlink. They contain three parts or fields.

- DwPTS
The DwPTS is the downlink part of the special subframe. It is used to transmit downlink data.
- GP
The guard period makes sure that there are no overlaps of up- and downlink signals during a switch.
- UpPTS
The UpPTS is the uplink part of the special subframe. It is used to transmit uplink data.

The length of the three fields is variable. This results in several possible configurations of the special subframe. The LTE standard defines 10 different configurations for the special subframe. However, configurations 8 and 9 only work for a normal cyclic prefix.

If you select configurations 8 or 9 using an extended cyclic prefix or automatic detection of the cyclic prefix, the application will show an error message.

Remote command:

Special subframe: `CONFigure[:LTE]:UL[:CC<cci>]:TDD:SPSC` on page 111

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 LTE 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
- the pseudo-random sequence used for type 2 PUSCH frequency hopping

Remote command:

Cell ID: `CONFigure[:LTE]:UL[:CC<cci>]:PLC:CID` on page 110

Cell Identity Group: `CONFigure[:LTE]:UL[:CC<cci>]:PLC:CIDGroup`
on page 111

Identity: `CONFigure[:LTE]:UL[:CC<cci>]:PLC:PLID` on page 111

Operating Band Index

Selects one of the 40 operating bands for spectrum flatness measurements as defined in TS 36.101.

The operating band defines the frequency band and the dedicated duplex mode.

Remote command:

`[SENSe][:LTE]:SFlatness:OBANd` on page 113

Extreme Conditions

Turns extreme conditions on and off.

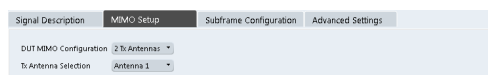
If you turn the extreme conditions on, the software will modify the limit lines for the limit check of the spectral flatness measurement.

Remote command:

[\[SENSe\] \[:LTE\] :SFLatness:ECONditions](#) on page 113

4.2.2 Configuring MIMO Setups

The MIMO Configuration contains settings to configure MIMO test setups.



[MIMO Configuration](#)..... 33

MIMO Configuration

Selects the antenna configuration and test conditions for a MIMO system.

In setups with multiple antennas, the **antenna selection** defines the antenna you'd like to test. Note that as soon as you have selected a transmission on more than one antenna for one of the channels, the corresponding number of antennas becomes available for testing.

| | |
|-----------|-----------------------|
| Antenna 1 | Tests antenna 1 only. |
| Antenna 2 | Tests antenna 2 only. |
| Antenna 3 | Tests antenna 3 only. |
| Antenna 4 | Tests antenna 4 only. |

Remote command:

[CONFigure\[:LTE\] :UL:MIMO:ASElection](#) on page 113

4.2.3 Configuring Subframes

An LTE frame consists of 10 subframes. Each individual subframe may 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.
 In case of automatic demodulation, the contents of the table are determined according to the signal currently evaluated.
 For more information see ["Auto Demodulation"](#) on page 34.
- Custom configuration of the configuration of each subframe.
 In case of 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, in case of [Physical Detection](#), only if the frame fits the description in the table.

Remote command:

Conf. subframes: `CONFigure[:LTE]:UL:CSUBframes` on page 114

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:SFNO` on page 118

- [General Subframe Configuration](#)..... 34
- [Individual Subframe Configuration](#)..... 35
- [Enhanced Settings](#)..... 37

4.2.3.1 General Subframe Configuration

| | |
|--|----|
| Auto Demodulation | 34 |
| Subframe Configuration Detection | 34 |

Auto Demodulation

Turns automatic demodulation on and off.

If active, 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.
- 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.

Automatic demodulation is not available if the Suppressed Interference Synchronization is active.

Remote command:

`[SENSe][:LTE]:UL:DEMod:ACON` on page 118

Subframe Configuration Detection

Turns the detection of the subframe configuration on and off.

Upon activation, the software compares the current demodulated LTE frame to the subframe configuration you have set. Only if the signal is consistent with the configuration, the software will further analyze the LTE frame.

If inactive, 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 118

4.2.3.2 Individual Subframe Configuration

The "Subframe Configuration Table" contains the characteristics for each subframe. The software supports a maximum uplink LTE 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 in case of automatic demodulation.

| Subframe | Enable PUCCH | Enable PUSCH | Modulation | Enhanced Settings | Number of RBs | Offset RB | Conflict |
|----------|--------------|--------------|------------|-------------------|---------------|-----------|----------|
| 0 | Off | On | QPSK | ... | 10 | 2 | |
| 1 | Off | On | QPSK | ... | 10 | 2 | |
| 2 | Off | On | QPSK | ... | 10 | 2 | |
| 3 | Off | On | 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).

| | |
|---|----|
| Subframe Number | 35 |
| Enable PUCCH | 35 |
| Enable PUSCH | 36 |
| Modulation | 36 |
| Enhanced Settings | 36 |
| Number of RB | 36 |
| Offset RB | 36 |

Subframe Number

Shows the number of a subframe.

Note that, depending on the TDD configuration, some subframes may not be available for editing. The R&S VSE labels those subframes "(not used)".

Enable PUCCH

Turns the PUCCH in the corresponding subframe on and off.

If you enable PUCCH, the application automatically turns PUSCH off. "Modulation", "Number of RBs" and "Offset RB" are unavailable for that subframe. If you disable PUCCH, the application automatically turns PUSCH on. "Modulation", "Number of RBs" and "Offset RB" become available

Remote command:

```
CONFigure[:LTE]:UL[:CC<cci>]:SUBFrame<subframe>:ALLoc:CONT
```

on page 114

Enable PUSCH

Turns the PUSCH in the corresponding subframe on and off.

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

Remote command:

```
CONFigure[:LTE]:UL[:CC<cci>]:SUBFrame<subframe>:ALLoc:CONT
```

on page 114

Modulation

Selects the modulation scheme for the corresponding PUSCH allocation.

The modulation scheme is either QPSK, 16QAM or 64QAM.

Remote command:

```
CONFigure[:LTE]:UL[:CC<cci>]:SUBFrame<subframe>:ALLoc:MODulation
```

on page 114

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<cci>]:SUBFrame<subframe>:ALLoc[:
```

```
CLUster<cluster>]:RBCount on page 117
```

Offset RB

Sets the resource block at which the PUSCH allocation begins.

Make sure not to allocate PUSCH allocations into regions reserved for PUCCH allocations.

Remote command:

```
CONFigure[:LTE]:UL[:CC<cci>]:SUBFrame<subframe>:ALLoc[:
```

```
CLUster<cluster>]:RBOffset on page 117
```

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.

| | |
|---|----|
| Enhanced PUSCH Configuration..... | 37 |
| Enhanced Demodulation Reference Signal Configuration..... | 37 |
| Enhanced PUCCH Configuration..... | 38 |

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 and the offset resource block for each cluster. All other parameters (power, modulation etc.) are the same for both clusters.

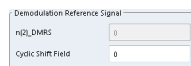
Remote command:

`CONFigure[:LTE]:UL[:CC<cci>]:SUBFrame<subframe>:ALLoc:RAT0`

on page 117

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

If **Activate-DMRS-With OCC** is on, the "Cyclic Shift Field" becomes available to define the cyclic shift field.

The Cyclic Shift Field is signalled by the PDCCH downlink channel in DCI format 0 and 4. It selects n(2)_DMRS and the orthogonal sequence (OCC) for signals according to LTE release 10.

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

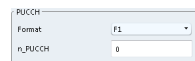
Remote command:

CONFigure[:LTE]:UL[:CC<cci>]:SUBFrame<subframe>:ALLoc:PUSCh:NDMRs on page 117

CONFigure[:LTE]:UL[:CC<cci>]:SUBFrame<subframe>:ALLoc:PUSCh:CSField on page 116

Enhanced PUCCH Configuration

Configures the PUSCH 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:

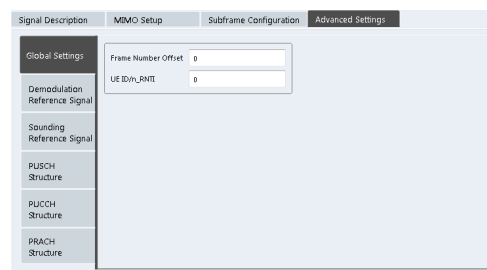
n_PUCCH: CONFigure[:LTE]:UL[:CC<cci>]:SUBFrame<subframe>:ALLoc:PUSCh:NPAr on page 116

Format: CONFigure[:LTE]:UL[:CC<cci>]:SUBFrame<subframe>:ALLoc:PUSCh:FORMat on page 115

4.2.4 Defining Global Signal Characteristics

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.



Frame Number Offset..... 38
 UE ID/n_RNTI..... 39

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:SFNO` on page 118

UE ID/n_RNTI

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

Remote command:

`CONFigure[:LTE]:UL:UEID` on page 119

4.2.5 Configuring the 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.

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



| | |
|-----------------------------|----|
| Relative Power PUSCH..... | 39 |
| Group Hopping..... | 40 |
| Sequence Hopping..... | 40 |
| Relative Power PUCCH..... | 40 |
| n(1)_DMRS..... | 40 |
| Delta Sequence Shift..... | 40 |
| Activate-DMRS-With OCC..... | 41 |

Relative Power PUSCH

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

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

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

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<cci>]:DRS[:PUSCh]:POWer` on page 120

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<cci>]:DRS:GRPHopping` on page 120

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<cci>]:DRS:SEQHopping` on page 120

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<cci>]:DRS:PUCCh:POWer` on page 120

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<cci>]:DRS:NDRMs` on page 120

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 $f_{\text{SS}}^{\text{PUCCH}}$ 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<cci>]:DRS:DSSHift` on page 119

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 automatically turned on if at least one of the physical channels uses more than one antenna.

For more information see [Enhanced Settings](#) and [MIMO Configuration](#).

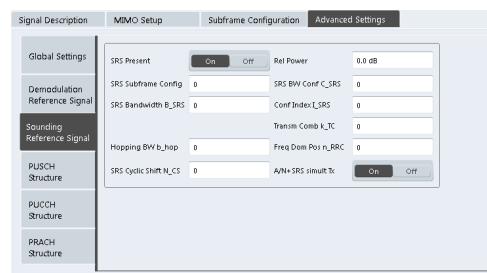
Remote command:

`CONFigure[:LTE]:UL[:CC<cci>]:DRS:AOC` on page 119

4.2.6 Configuring the Sounding Reference Signal

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

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



| | |
|--------------------------------|----|
| Present..... | 41 |
| SRS Subframe Conf..... | 41 |
| SRS MaxUpPts..... | 42 |
| SRS Bandwidth B_SRS..... | 42 |
| Hopping BW b_hop..... | 42 |
| SRS Cyclic Shift N_CS..... | 42 |
| SRS Rel Power..... | 43 |
| SRS BW Conf. C_SRS..... | 43 |
| Conf. Index I_SRS..... | 43 |
| Transm. Comb. k_TC..... | 43 |
| Freq. Domain Pos. n_RRC..... | 43 |
| A/N + SRS Simultaneous TX..... | 44 |

Present

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

Remote command:

`CONFigure[:LTE]:UL:SRS:STAT` on page 123

SRS Subframe Conf.

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:SRS:SUConfig](#) on page 124

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.

Remote command:

[CONFigure\[:LTE\]:UL:SRS:MUPT](#) on page 123

SRS Bandwidth B_SRS

Defines the parameter B_{SRS} .

B_{SRS} 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 ($B_{SRS} = 3$) spans four resource blocks and is available for all channel bandwidths. The other three values of B_{SRS} 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 (C_{SRS}).

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:SRS:BSRS](#) on page 122

Hopping BW b_hop

Defines the parameter b_{hop} .

b_{hop} is a UE specific parameter that defines the frequency hopping bandwidth. SRS frequency hopping is active if $b_{hop} < B_{SRS}$.

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:SRS:BHOP](#) on page 121

SRS Cyclic Shift N_CS

Defines the cyclic shift (n_{CS}) 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:SRS:CYCS](#) on page 122

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:SRS:POWer](#) on page 123

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:SRS:CSRS](#) on page 122

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:SRS:ISRS](#) on page 122

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:SRS:TRComb](#) on page 124

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:SRS:NRRC](#) on page 123

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.

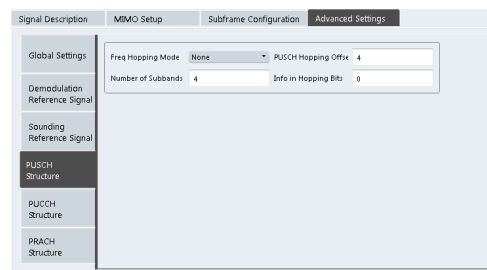
Remote command:

[CONFigure\[:LTE\]:UL:SRS:ANST](#) on page 121

4.2.7 Defining the PUSCH Structure

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

The PUSCH structure settings are part of the "Advanced Settings" tab of the "Signal Description" dialog box.



| | |
|--|----|
| Frequency Hopping Mode | 44 |
| Number of Subbands | 45 |
| PUSCH Hopping Offset | 45 |
| Info. in Hopping Bits | 45 |

Frequency Hopping Mode

Selects the frequency hopping mode of the PUSCH.

Several hopping modes are supported.

- None
No frequency hopping.
- Inter Subframe Hopping
PUSCH changes the frequency from one subframe to another.
- Intra Subframe Hopping

PUSCH also changes the frequency within a subframe.

Remote command:

`CONFigure[:LTE]:UL[:CC<cci>]:PUSCh:FHMode` on page 124

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<cci>]:PUSCh:NOSM` on page 125

PUSCH Hopping Offset

Defines the PUSCH Hopping Offset N_{RB}^{HO} .

The PUSCH Hopping Offset determines the first physical resource block and the maximum number of physical resource blocks available for PUSCH transmission if PUSCH frequency hopping is active.

Remote command:

`CONFigure[:LTE]:UL[:CC<cci>]:PUSCh:FHOOffset` on page 125

Info. in Hopping Bits

Defines the information available in the hopping bits according to the PDCCH DCI format 0 hopping bit definition.

The information in the hopping bits determines whether type 1 or type 2 hopping is used in the subframe and, in case of type 1, additionally determines the exact hopping function to use.

For more information on PUSCH frequency hopping refer to 3GPP TS36.213.

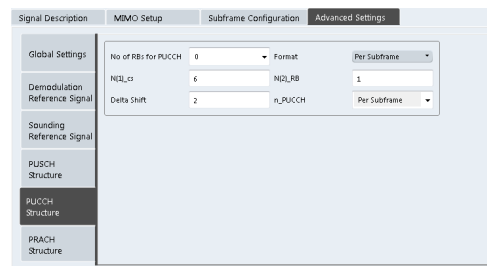
Remote command:

`CONFigure[:LTE]:UL[:CC<cci>]:PUSCh:FHOP:IIHB` on page 125

4.2.8 Defining the PUCCH Structure

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

The PUCCH structure settings are part of the "Advanced Settings" tab of the "Signal Description" dialog box.



| | |
|---------------------------|----|
| No. of RBs for PUCCH..... | 46 |
| N(1)_cs..... | 46 |
| Delta Shift..... | 46 |
| Format..... | 47 |
| N(2)_RB..... | 47 |
| N_PUCCH..... | 47 |

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 LTE 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 LTE 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 LTE spectrum.

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

Remote command:

`CONFigure[:LTE]:UL:PUCCh:NORB` on page 127

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:PUCCh:N1CS` on page 126

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:PUCCh:DEShift` on page 125

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:PUCCh:FORMat](#) on page 126

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:PUCCh:N2RB](#) on page 126

N_PUCCH

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

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, "Configuring Subframes"](#), on page 33.

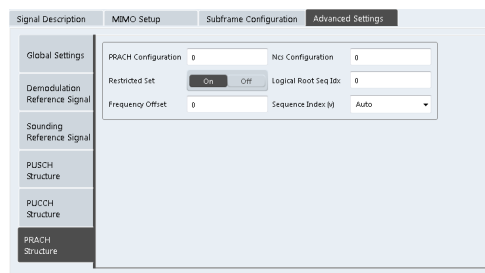
Remote command:

[CONFigure\[:LTE\]:UL:PUCCh:NPAr](#) on page 127

4.2.9 Defining the PRACH Structure

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

The PRACH structure settings are part of the "Advanced Settings" tab of the "Signal Description" dialog box.



| | |
|-----------------------------|----|
| PRACH Configuration..... | 48 |
| Restricted Set..... | 48 |
| Frequency Offset..... | 48 |
| PRACH Preamble Mapping..... | 48 |
| Ncs Conf..... | 49 |
| Logical Root Sequ. Idx..... | 49 |
| Sequence Index (v)..... | 49 |

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:PRACH:CONF` on page 128

Restricted Set

Selects whether a restricted preamble set (high speed mode) or the unrestricted preamble set (normal mode) will be used.

Remote command:

`CONFigure[:LTE]:UL:PRACH:RSET` on page 129

Frequency Offset

For preamble formats 0-3, sets the PRACH Frequency Offset as defined in the 3GPP TS 36.211, i.e. determines the first physical resource block available for PRACH expressed as a physical resource block number.

Remote command:

`CONFigure[:LTE]:UL:PRACH:FOFFset` on page 128

PRACH Preamble Mapping

The frequency resource index f_{RA} and the half frame indicator $t1_{RA}$ are necessary to clearly specify the physical resource mapping of the PRACH in case a PRACH configuration index has more than one mapping alternative.

If you turn on the "Auto Preamble Mapping", the software automatically detects f_{RA} and $t1_{RA}$.

The values for both parameters are defined in table '5.7.1-4: Frame structure type 2 random access preamble mapping in time and frequency' (3GPP TS 36.211 v10.2.0).

The frequency resource index and half frame indicator are available in TDD mode.

Remote command:

[CONFigure\[:LTE\]:UL:PRACH:APM](#) on page 128

[CONFigure\[:LTE\]:UL:PRACH:FRINdex](#) on page 128

[CONFigure\[:LTE\]:UL:PRACH:HFINDicator](#) on page 129

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:PRACH:NCSC](#) on page 129

Logical Root Sequ. Idx

Selects the logical root sequence index.

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

Remote command:

[CONFigure\[:LTE\]:UL:PRACH:RSEQ](#) on page 129

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:PRACH:SINdex](#) on page 129

4.2.10 Selecting the Input and Output Source

The application supports several input sources and outputs.

For a comprehensive description of the supported inputs and outputs, please refer to the documentation of the connected instrument.

- [RF Input](#)..... 49
- [I/Q File Input](#).....50

4.2.10.1 RF Input

Functions to configure the RF input described elsewhere:

- ["Input Coupling"](#) on page 53
- ["Impedance"](#) on page 54

Note that the actual functions to configure the RF input depend on the configuration of the connected instrument.

| | |
|---------------------------------|----|
| High-Pass Filter 1...3 GHz..... | 50 |
| YIG-Preselector..... | 50 |

High-Pass Filter 1...3 GHz

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 analyzer in order to measure the harmonics for a DUT, for example.

This function may require an additional hardware option on the connected instrument.

Remote command:

`INPut:FILTer:HPASs[:STATe]` on page 130

YIG-Preselector

Activates or deactivates the YIG-preselector, if available on the connected instrument.

An internal YIG-preselector at the input of the connected instrument ensures that image frequencies are rejected. However, this is only possible for a restricted bandwidth. In order to use the maximum bandwidth for signal analysis you can deactivate the YIG-preselector at the input of the connected instrument, which may lead to image-frequency display.

Remote command:

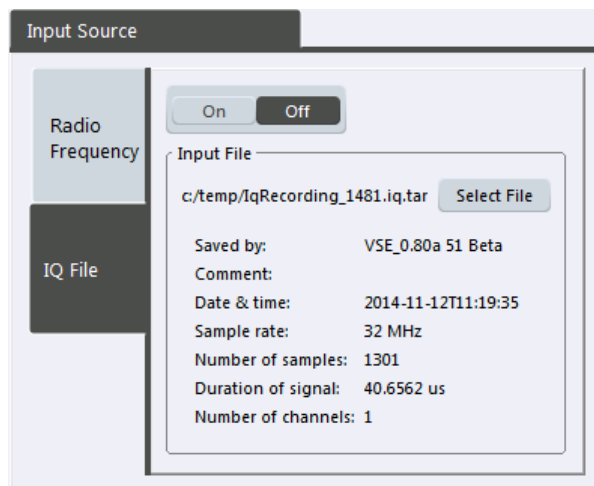
`INPut:FILTer:YIG[:STATe]` on page 130

4.2.10.2 I/Q File Input

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



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.



[I/Q File State](#)..... 51
[Input File](#)..... 51

I/Q File State

Activates input from the selected I/Q data file.

Remote command:

[INPut:SElect](#) on page 131

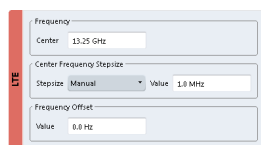
Input File

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

Select "Select File" to open the "Load I/Q File" dialog box.

4.2.11 Defining the 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.



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Defining the 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.

The available frequency range depends on the hardware configuration of the analyzer you are using.

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. Define the stepsize in two ways.

- = Center

- One frequency step corresponds to the current center frequency.
- Manual
 - Define a any stepsize you need.

Remote command:

Center frequency: `[SENSe]:FREQuency:CENTer[:CC<cci>]` on page 131

Frequency stepsize: `[SENSe:]FREQuency:CENTer:STEP` on page 132

Frequency offset: `[SENSe]:FREQuency:CENTer[:CC<cci>]:OFFSet` on page 132

4.2.12 Defining Level Characteristics

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.



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| Attenuating the Signal..... | 53 |
| Input Coupling..... | 53 |
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Defining a 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 in case of signals with a high crest factor like LTE.

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 may deteriorate (e.g. EVM). This applies 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 may 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.

You can specify the reference level in several **units** and define 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 will be 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.

You can also use **automatic detection** of the reference level with the "Auto Level" function.

If active, the application measures and sets the reference level to its ideal value.

Automatic level detection also optimizes RF attenuation.

Remote command:

Manual: `DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:RLEVel` on page 134

Automatic: `[SENSe:]ADJust:LEVel` on page 137

Offset: `DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:RLEVel:OFFSet` on page 134

Unit: `CALCulate<n>:UNIT:POWer` on page 133

Attenuating the Signal

Attenuation of the signal may become 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.

The LTE measurement application provides several attenuation modes.

- **Mechanical** (or RF) attenuation is always available. The mechanical attenuator controls attenuation at the RF input.
- **Electronic** attenuation is available when the connected instrument is equipped with the corresponding option. Note that the frequency range may not exceed the specification of the electronic attenuator for it to work.
For both methods, the application provides **automatic** detection of the ideal attenuation level. Alternatively, you can define the attenuation level **manually**. The range is from 0 dB to 79 dB (RF attenuation) or 30 dB (electronic attenuation) in 1 dB steps.

For more information on attenuating the signal see the manual of the connected instrument.

Remote command:

RF attenuation: `INPut:ATTenuation` on page 134

Electronic attenuation: `INPut<n>:EATT:STATe` on page 137

Electronic attenuation: `INPut<n>:EATT:AUTO` on page 137

Electronic attenuation: `INPut<n>:EATT` on page 136

Input Coupling

The RF input of the connected instrument can be coupled by alternating current (AC) or direct current (DC).

AC coupling blocks any DC voltage from the input signal. This is the default setting to prevent damage to the instrument. Very low frequencies in the input signal may 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:COUPling` on page 135

Impedance

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

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

This value also affects the unit conversion.

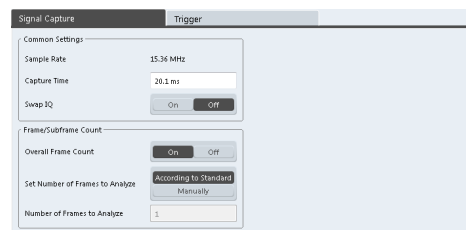
Remote command:

`INPut : IMPedance` on page 136

4.2.13 Configuring the Data 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..... | 54 |
| Overall Frame Count..... | 54 |
| Auto According to Standard..... | 55 |
| Number of Frames to Analyze..... | 55 |

Capture Time

Defines the capture time.

The capture time corresponds to the time of one measurement. Hence, 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 LTE frame is captured in the measurement.

Remote command:

`[SENSe] : SWEEp : TIME` on page 139

Swap I/Q

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

Remote command:

`[SENSe] : SWAPiQ` on page 139

Overall Frame Count

Turns the manual selection of the number of frames to capture (and analyze) on and off.

If the overall frame count is active, you can define a particular number of frames to capture and analyze. The measurement runs until all required frames have been analyzed, even if it takes more than one sweep. The results are an average of the captured frames.

If the overall frame count is inactive, the application analyzes all complete LTE frames currently in the capture buffer.

Remote command:

[SENSe] [:LTE] :FRAMe:COUNT:STATe on page 138

Auto According to Standard

Turns automatic selection of the number of frames to capture and analyze on and off.

If active, the application evaluates the number of frames as defined for EVM tests in the LTE standard.

If inactive, you can set the number of frames you want to analyze.

This parameter is not available if the overall frame count is inactive.

Remote command:

[SENSe] [:LTE] :FRAMe:COUNT:AUTO on page 138

Number of Frames to Analyze

Sets the number of frames that 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 if

- the overall frame count is inactive,
- the data is captured [according to the standard](#).

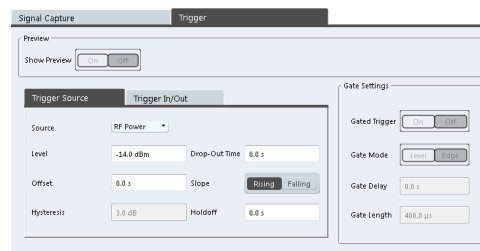
Remote command:

[SENSe] [:LTE] :FRAMe:COUNT on page 138

4.2.14 Triggering Measurements

The trigger functionality of the LTE measurement application is the same as that of the connected instrument. For a comprehensive description of the available trigger settings see the documentation of the connected instrument.

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



For more information on triggering measurements see the documentation of the connected instrument.

4.2.15 Tracking

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

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Phase

Specifies whether or not the measurement results should be compensated for common phase error. When phase compensation is used, the measurement results will be compensated for phase error on a per-symbol basis.

- "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 144

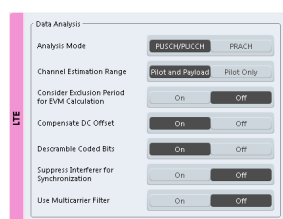
Timing

Specifies whether or not the measurement results should be compensated for timing error. When timing compensation is used, the measurement results will be compensated for timing error on a per-symbol basis.

Remote command:

[SENSE] [:LTE] :UL:TRACking:TIME on page 144

4.2.16 Signal Demodulation



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 Compensate DC Offset..... 57
 Scrambling of Coded Bits..... 57
 Suppressed Interference Synchronization..... 58
 Multicarrier Filter..... 58

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. This is the default.

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 142

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 142

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 142

Analyze TDD Transient Slots

Includes or excludes the transient slots present after a switch from downlink to uplink in the analysis.

If on, the transient slots are not included in the measurement.

Remote command:

`[SENSe] [:LTE]:UL:DEMod:ATTSlots` on page 141

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 142

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.

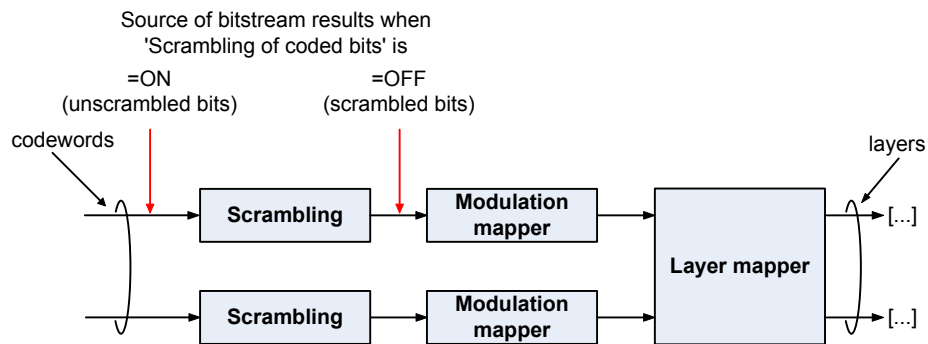


Fig. 4-1: Source for bitstream results if scrambling for coded bits is on and off

Remote command:

[\[SENSe\] \[:LTE\]:UL:DEMod:CBSCrambling](#) on page 143

Suppressed Interference Synchronization

Turns suppressed interference synchronization on and off.

If active, the synchronization on signals containing more than one user equipment (UE) is more robust. Additionally, the EVM is lower in case the UEs have different frequency offsets. Note that Auto Demodulation is not supported in this synchronization mode and the EVM may be higher in case only one UE is present in the signal.

Remote command:

[\[SENSe\] \[:LTE\]:UL:DEMod:SISync](#) on page 143

Multicarrier Filter

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

Remote command:

[\[SENSe\] \[:LTE\]:UL:DEMod:MCFilter](#) on page 143

5 Analysis

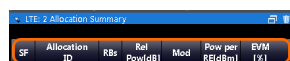
The application provides several tool for detailed analysis of the captured and measured data.

- [Configuring Tables / Numerical Results](#).....59
- [Evaluation Range](#).....59
- [Scale](#)..... 61
- [Result Settings](#).....62
- [Markers](#)..... 63

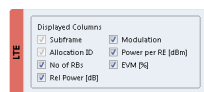
5.1 Configuring Tables / Numerical Results

The application allows you to customize the number of columns for some numeric result displays, for example the Allocation Summary.

- ▶ Click somewhere in the header row of the table.

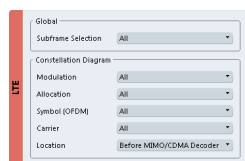


The application opens a dialog box to add or remove columns.



5.2 Evaluation Range

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



- [Subframe Selection](#).....59
- [Slot Selection](#).....60
- [Preamble Selection](#).....60
- [Evaluation Range for the Constellation Diagram](#)..... 61

Subframe Selection

Selects a particular subframe whose results the application displays.

You can select a particular subframe for the following measurements.

- 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
- DFT Precoded Constellation
- Allocation Summary
- Bit Stream

Selecting "All" either displays the results over all subframes or calculates a statistic over all subframes that have been analyzed.

Example: Subframe selection

If you select all subframes ("All"), the application shows three traces. One trace shows the subframe with the minimum level characteristics, the second trace shows the subframe with the maximum level characteristics and the third subframe shows the averaged level characteristics of all subframes.



- PK: peak value
- AV: average value
- MI: minimum value

If you select a specific subframe, the application shows one trace. This trace contains the results for that subframe only.



Remote command:

`[SENSe] [:LTE]:SUBFrame:SElect` on page 147

Slot Selection

Selects a particular slot whose measurement results you want to see.

You can select a particular slot for the following measurements.

Result Summary, EVM vs Carrier, EVM vs Symbol, EVM vs Symbol x Carrier, Inband Emission, Channel Flatness, Spectrum Flatness SRS, Channel Group Delay, Spectrum Flatness Difference, Power vs Symbol x Carrier, Constellation Diagram, DFT Precoded Constellation Diagram and Time Alignment.

In PRACH analysis mode, you can not select a particular slot.

Remote command:

`[SENSe] [:LTE]:SLOT:SElect` on page 146

Preamble Selection

Selects a particular preamble for measurements that analyze individual preambles.

Selecting preambles is available in PRACH analysis mode.

Remote command:

`[SENSe] [:LTE]:PREamble:SElect` on page 146

Evaluation Range for the Constellation Diagram

The "Evaluation Range" dialog box defines the type of constellation points that are displayed in the Constellation Diagram.

By default the application displays all constellation points of the data that have been evaluated. However, you can filter the results by several aspects.

- Modulation
Filters the results to include only the selected type of modulation.
- Allocation
Filters the results to include only a particular type of allocation.
- Symbol
Filters the results to include only a particular OFDM symbol.
- Carrier
Filters the results to include only a particular subcarrier.

The result display is updated as soon as you make the changes.

Note that the constellation selection is applied to all windows in split screen mode if the windows contain constellation diagrams.

Remote command:

Modulation: `[SENSe] [:LTE]:MODulation:SElect` on page 145

Allocation: `[SENSe] [:LTE]:ALlocation:SElect` on page 145

Symbol: `[SENSe] [:LTE]:SYMBOL:SElect` on page 147

Carrier: `[SENSe] [:LTE]:CARRIER:SElect` on page 145

5.3 Scale

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Y-Axis Scale

The y-axis scaling determines the vertical resolution of the measurement results. The scaling you select always applies to the currently active screen and the corresponding result display.

Usually, the best way to view the results is if they fit ideally in the diagram area in order to view the complete trace. This is the way the application scales the y-axis if you are using the **automatic scale** function.

But it may become necessary to see a more detailed version of the results. In that case, turn on fixed scaling for the y-axis by defining the **minimum** and **maximum** values displayed on the vertical axis. Possible values and units depend on the result display you want to adjust the scale of.

You can restore the default scale at any time with "Restore Scale".

Tip:

Alternatively, you can scale the windows in the "Auto Set" menu. In addition to scaling the window currently in focus ("Auto Scale Window"), there you can scale **all windows** at the same time ("Auto Scale All").

Remote command:

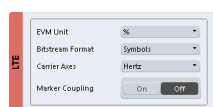
`DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:AUTO ONCE` on page 147

`DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:MAXimum` on page 148

`DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:MINimum` on page 148

5.4 Result Settings

Result settings define the way certain measurement results are displayed.



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| EVM Unit..... | 62 |
| Bit Stream Format..... | 62 |
| Carrier Axes..... | 63 |
| Subwindow Coupling..... | 63 |
| Marker Coupling..... | 63 |

EVM Unit

Selects the unit for graphic and numerical EVM measurement results.

Possible units are dB and %.

Remote command:

`UNIT:EVM` on page 149

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.

Examples:

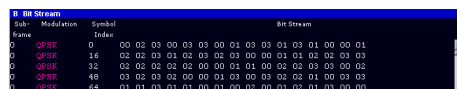


Fig. 5-1: Bit stream display in uplink application if the bit stream format is set to "symbols"

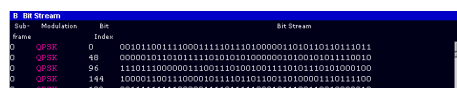


Fig. 5-2: Bit stream display in uplink application if the bit stream format is set to "bits"

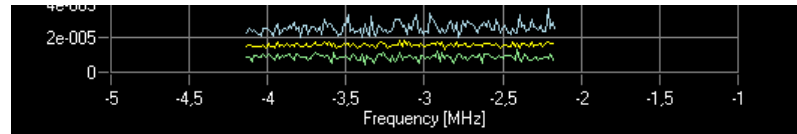
Remote command:

`UNIT:BSTR` on page 149

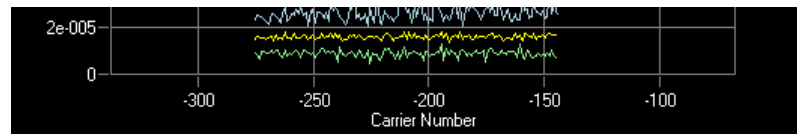
Carrier Axes

Selects the scale of the x-axis for result displays that show results of OFDM subcarriers.

- X-axis shows the frequency of the subcarrier



- X-axis shows the number of the subcarrier



Remote command:

[UNIT:CAXes](#) on page 149

Subwindow Coupling

Couples or decouples result display tabs (subwindows).

If the coupling is on and you select another tab in a result display, the application automatically selects the same tab for all result displays

Subwindow coupling is available for measurements with multiple data streams (MIMO).

Marker Coupling

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

When you turn this feature on, 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:MARKer:COUPling](#) on page 148

5.5 Markers

Markers are available for most of the I/Q measurement result displays. The functionality (setting and positioning) is the same as in the base software.



Markers in result displays with a third aspect

In result displays that have a third dimension (EVM vs Symbol x Carrier etc.), you can position a marker on a particular symbol in a particular carrier.

When you activate a marker, you can select the symbol and carrier you want to position the marker on. Alternatively, you can define the marker position in the "Marker Configuration" dialog box, which is expanded accordingly.

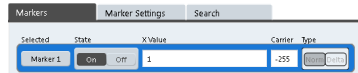


Fig. 5-3: Marker Configuration dialog, the "Carrier" field is only available for result displays with a third dimension.

For a comprehensive description of the marker functionality see the corresponding chapters in the documentation of the connected instrument.

6 Remote Control

The following remote control commands are required to configure and perform noise figure 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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| • Configuring the Screen Layout | 71 |
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| • Remote Commands to Configure the Application | 107 |
| • Analysis | 144 |

6.1 Overview of Remote Command Suffixes

The remote commands for the LTE Measurement application support the following suffixes.

| Suffix | Description |
|--------------|--|
| <allocation> | Selects an allocation. |
| <analyzer> | No effect. |
| <antenna> | Selects an antenna for MIMO measurements. |
| <cluster> | Selects a cluster (uplink only). |
| <cwnum> | Selects a codeword. |
| <k> | Selects a limit line. Irrelevant for the LTE application. |
| <m> | Selects a marker. |
| <n> | Selects a measurement window. |

| Suffix | Description |
|------------|---|
| <subframe> | Selects a subframe. |
| <t> | Selects a trace. Irrelevant for the LTE application. |

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, in most cases, 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, these 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 may not be supported by this particular application.

6.2.1 Conventions used in Descriptions

Note the following conventions 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**
This is the unit 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 upper case 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 don't 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.

Note that 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, these are separated by a comma.

Example:

```
LAYout:ADD:WINDow Spectrum,LEFT,MTABLE
```

Parameters may have different forms of values.

- [Numeric Values](#).....69
- [Boolean](#).....69
- [Character Data](#).....70
- [Character Strings](#).....70
- [Block Data](#).....70

6.2.6.1 Numeric Values

Numeric values can be entered in any form, i.e. with sign, decimal point or exponent. In case of 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. in case of 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. In some cases you can customize the step size with a corresponding command.

Querying numeric values

When you query numeric values, the system returns a number. In case of physical quantities, it applies the basic unit (e.g. Hz in case of 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`

In some cases, numeric values may be 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 in case of errors.

6.2.6.2 Boolean

Boolean parameters represent two states. The "ON" state (logically true) is represented by "ON" or a 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 67.

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. In the example the 4 following digits indicate the length to be 5168 bytes. 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 a `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 Remote Commands to Select the LTE Application

[INSTrument\[:SElect\]](#).....71

INSTrument[:SElect] <ChannelType>

This command selects a new measurement channel with the defined channel type.

Parameters:

<ChannelType> **LTE**
 LTE measurement channel (R&S VSE-K10x)

Example: INST LTE
 Selects the LTE application.

6.4 Configuring the Screen Layout

- [General Layout](#).....71
- [Configuring the Layout over all Channels](#).....71
- [Configuring the Layout of a Channel](#).....75

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\[:WINDow<n>\]:SElect](#)..... 71

DISPlay[:WINDow<n>]:SElect

This command sets the focus on the selected result display window.

This window is then the active window.

Example: DISP:WIND1:SEL
 Sets the window 1 active.

Usage: Setting only

6.4.2 Configuring the 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, "Configuring the Layout of a Channel"](#), on page 75 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]? | 72 |
| LAYout:GLOBal:CATalog[:WINDow]? | 73 |
| LAYout:GLOBal:IDENtify[:WINDow]? | 74 |
| LAYout:GLOBal:REMove[:WINDow] | 75 |
| LAYout:GLOBal:REPLace[:WINDow] | 75 |

LAYout:GLOBal:ADD[:WINDow]?

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

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

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

Parameters:

- <ExChanName> string
Name of an existing channel

- <ExWinName> string
Name of the existing window within the <ExChanName> channel the new window is inserted next to.
By default, the name of a window is the same as its index. To determine the name and index of all active windows use the `LAYout:GLOBal:IDENtify[:WINDow]? query`.

- <Direction> LEFT | RIGHT | ABOVE | BELOW | TAB
Direction the new window is added relative to the existing window.
TAB
The new window is added as a new tab in the specified existing window.

- <NewChanName> string
Name of the channel for which a new window is to be added.

- <NewWinType> string
Type of result display (evaluation method) you want to add. See the table below for available parameter values.

Return values:

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

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

Usage: Query only

Table 6-1: <WindowType> parameter values for LTE Uplink Measurement application

| Parameter value | Window type |
|-----------------|------------------------------|
| 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 |
| FEVS | Frequency Error vs Symbol |
| 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:GLOBal:CATalog[:WINDow]?

This command 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>

This command 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',RIGHT,
'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>

This command removes a window from the display.

Parameters:

<ChannelName> String containing the name of the channel.

<WindowName> String containing the name of the window.

Usage: Event

LAYout:GLOBal:REPLace[:WINDow]

<ExChannelName>,<WindowName>,<NewChannelName>,<WindowType>

This command replaces the window type (for example from "Diagram" to "Result Summary") of an already existing window while keeping its position, index and window name.

To add a new window, use the `LAYout:GLOBal:ADD[:WINDow]?` command.

Parameters:

<ExChannelName> String containing the name of the channel in which a window is to be replaced. The channel name is displayed as the tab label for the measurement channel.

<WindowName> String containing the name of the existing window.
To determine the name and index of all active windows, use the `LAYout:GLOBal:CATalog[:WINDow]?` query.

<NewChannelName> String containing the name of the channel for which a new window will be created.

<WindowType> Type of result display you want to use in the existing window. Note that the window type must be valid for the specified channel (<NewChannelName>).
See `LAYout:ADD[:WINDow]?` on page 76 for a list of available window types.

Example: `LAY:GLOB:REPL:WIND 'IQ Analyzer','1',
'AnalogDemod',MTAB`
Replaces the I/Q Analyzer result display in window 1 by a marker table for the AnalogDemod channel.

6.4.3 Configuring the Layout of a 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]? | 76 |
| LAYout:CATalog[:WINDow]? | 78 |
| LAYout:IDENtify[:WINDow]? | 78 |
| LAYout:REMove[:WINDow] | 78 |
| LAYout:REPLace[:WINDow] | 79 |
| LAYout:WINDow<n>:ADD? | 79 |
| LAYout:WINDow<n>:IDENtify? | 80 |
| LAYout:WINDow<n>:REMove | 80 |
| LAYout:WINDow<n>:REPLace | 81 |

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

This command adds a window to the display in the active measurement channel.

This command 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.

Note: Use this command to select a result display instead of `CALCulate:FEED` (still supported for compatibility reasons, but deprecated).

Parameters:

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

Return values:

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

Example:

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

Result:

```
'2'
```

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

| | |
|--------------------------|---|
| Usage: | Query only |
| Manual operation: | See "Capture Buffer" on page 15 |
| | See "EVM vs Carrier" on page 15 |
| | See "EVM vs Symbol" on page 16 |
| | See "EVM vs Subframe" on page 17 |
| | See "Power Spectrum" on page 17 |
| | See "Inband Emission" on page 18 |
| | See "Spectrum Flatness" on page 18 |
| | See "Spectrum Flatness SRS" on page 19 |
| | See "Channel Group Delay" on page 19 |
| | See "Spectrum Flatness Difference" on page 20 |
| | See "Constellation Diagram" on page 20 |
| | See "CCDF" on page 21 |
| | See "Allocation Summary" on page 21 |
| | See "Bit Stream" on page 22 |
| | See "Result Summary" on page 23 |
| | See "Marker Table" on page 25 |

Table 6-2: <WindowType> parameter values for LTE Uplink Measurement application

| Parameter value | Window type |
|-----------------|------------------------------|
| 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 |
| FEVS | Frequency Error vs Symbol |
| 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]?

This command queries the name and index of all active windows in the active measurement 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 measurement 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>

This command queries the **index** of a particular display window in the active measurement 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 measurement 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:WIND:IDEN? '2'
```

Queries the index of the result display named '2'.

Response:

```
2
```

Usage: Query only

LAYout:REMOve[:WINDow] <WindowName>

This command removes a window from the display in the active measurement channel.

To remove a window for a different measurement channel use the `LAYout:GLOBal:REMove[:WINDow]` command.

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:

Event

LAYout:REPLace[:WINDow] <WindowName>,<WindowType>

This command replaces the window type (for example from "Diagram" to "Result Summary") of an already existing window in the active measurement channel while keeping its position, index and window name.

To add a new window, use the `LAYout:ADD[:WINDow]?` command.

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 measurement 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 76 for a list of available window types.
Note that the window type must be valid for the active measurement channel. To create a window for a different measurement 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.

LAYout:WINDow<n>:ADD? <Direction>,<WindowType>

This command 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, as opposed to `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.

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

Parameters:

<Direction> LEFT | RIGHT | ABOVE | BELOW

<WindowType> Type of measurement window you want to add.
See [LAYout:ADD\[:WINDow\]?](#) on page 76 for a list of available window types.
Note that the window type must be valid for the active measurement channel. To create a window for a different measurement 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?

This command queries the **name** of a particular display window (indicated by the <n> suffix) in the active measurement channel.

Note: to query the **index** of a particular window, use the [LAYout:IDENtify\[:WINDow\]?](#) command.

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

This command removes the window specified by the suffix <n> from the display in the active measurement channel.

The result of this command is identical to the [LAYout:REMOve\[:WINDow\]](#) command.

To remove a window in a different measurement channel use the [LAYout:GLOBal:REMOve\[:WINDow\]](#) command.

Example:

```
LAY:WIND2:REM
```

Removes the result display in window 2.

Usage:

Event

LAYout:WINDow<n>:REPLace <WindowType>

This command changes the window type of an existing window (specified by the suffix <n>) in the active measurement channel.

The result of this command is identical to the `LAYout:REPLace[:WINDow]` command.

To add a new window, use the `LAYout:WINDow<n>:ADD?` command.

Parameters:

<WindowType> Type of measurement window you want to replace another one with.
See `LAYout:ADD[:WINDow]?` on page 76 for a list of available window types.
Note that the window type must be valid for the active measurement channel. To create a window for a different measurement channel use the `LAYout:GLOBal:REPLace[:WINDow]` command.

Example:

```
LAY:WIND2:REPL MTAB
```

Replaces the result display in window 2 with a marker table.

6.5 Remote Commands to Read Trace Data

- [Using the TRACe\[:DATA\] Command](#).....81
- [Remote Commands to Read Measurement Results](#).....90

6.5.1 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

Compared to the LTE application on the R&S FSQ or R&S FSV, you have to select the measurement window directly with the suffix `<n>` at `TRACe`. The range of `<n>` depends on the number of active measurement windows.

- Allocation Summary..... 82
- Bit Stream..... 83
- Capture Buffer..... 84
- CCDF..... 84
- Channel and Spectrum Flatness..... 84
- Channel and Spectrum Flatness Difference..... 84
- Channel Flatness SRS..... 85
- Channel Group Delay..... 85
- Constellation Diagram..... 86
- EVM vs Carrier..... 86
- EVM vs Subframe..... 87
- EVM vs Symbol..... 87
- EVM vs Symbol x Carrier..... 87
- Frequency Error vs Symbol..... 88
- Inband Emission..... 88
- Power Spectrum..... 88
- Power vs Symbol x Carrier..... 88
- Return Value Codes..... 89

6.5.1.1 Allocation Summary

For the Allocation Summary, the command returns seven values for each line of the table.

```
<subframe>, <allocation ID>, <number of RB>, <offset RB>,
<modulation>, <absolute power>, <EVM>, ...
```

The unit for `<absolute power>` is always dBm. The unit for `<EVM>` depends on `UNIT:EVM`. All other values have no unit.

The `<allocation ID>` and `<modulation>` are encoded. For the code assignment see [chapter 6.5.1.18, "Return Value Codes"](#), on page 89.

Note that the data format of the return values is always ASCII.

Example:

| Allocation Summary | | | | | | |
|--------------------|-----------|--------------|-----------|------------|-----------|-------|
| Sub-frame | Alloc. ID | Number of RB | Offset RB | Modulation | Power/dBm | EVH/% |
| 0 | PUSCH | 10 | 2 | QPSK | -84,743 | 0,002 |
| | DMRS | | | 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,
...
```

6.5.1.2 Bit Stream

For the Bit Stream result display, the command returns five 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 bitstream depends on [Bit Stream Format](#).

The <modulation> is encoded. For the code assignment see [chapter 6.5.1.18, "Return Value Codes"](#), on page 89.

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:

| Bit Stream | | | | | |
|------------|---------------|-----------|------------|--------------|--|
| 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 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 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, ...
```

6.5.1.3 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.

- TRACE1

6.5.1.4 CCDF

For the CCDF result display, the type of return values depends on the parameter.

- 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.
- 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.

6.5.1.5 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.

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

6.5.1.6 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 LTE bandwidth.

The following parameters are supported.

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

6.5.1.7 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.

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

6.5.1.8 Channel Group Delay

For the Channel 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 LTE bandwidth.

The following parameters are supported.

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

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

6.5.1.9 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)]>
```

With SF = subframe and Sym = symbol of that subframe.

The I and Q values have no unit.

The number of return values depends on the constellation selection. By default, it returns all resource elements including the DC carrier.

The following parameters are supported.

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

6.5.1.10 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.

- TRACE1
Returns the average EVM over all subframes
- TRACE2
Returns the minimum EVM found over all subframes. If you are analyzing a particular subframe, it returns nothing.

- TRACE3
Returns the maximum EVM found over all subframes. If you are analyzing a particular subframe, it returns nothing.

6.5.1.11 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.

- TRACE1

6.5.1.12 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.

- TRACE1

6.5.1.13 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.

- TRACE1

6.5.1.14 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.

- TRACE1

6.5.1.15 Inband Emission

For the Inband Emission result display, the number and type of returns values depend on the parameter.

- TRACE1
Returns the relative resource block indices (x-axis values).
`<RB index>, ...`
The resource block index has no unit.
- TRACE2
Returns one value for each resource block index.
`<relative power>, ...`
The unit of the relative inband emission is dB.
- 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.

6.5.1.16 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.

- TRACE1

6.5.1.17 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.

- TRACE1

6.5.1.18 Return Value Codes

This chapter contains a list for encoded return values.

<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
- -50 = PUCCH
- -51 = DMRS PUCCH
- -70 = PRACH

<modulation>

Represents the modulation scheme. The range is {0...14}.

- 0 = unrecognized
- 1 = RBPSK
- 2 = QPSK
- 3 = 16QAM
- 4 = 64QAM
- 5 = 8PSK
- 6 = PSK
- 7 = mixed modulation
- 8 = BPSK

<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.

TRACe<n>[:DATA]? <Result>

This command returns the trace data for the current measurement or result display.

For more information see [chapter 6.5.1, "Using the TRACe\[:DATA\] Command"](#), on page 81.

Query parameters:

<TraceNumber> **TRACE1 | TRACE2 | TRACE3**

LIST

Example: TRAC2? TRACE1
 Queries 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.

Usage: Query only

6.5.2 Remote Commands to Read Measurement Results

[FORMat\[:DATA\]](#).....90

FORMat[:DATA] [<Format>]

This command specifies the data format for the data transmission between the LTE measurement application and the remote client. Supported formats are ASCII or REAL32.

Parameters:

<Format> ASCII | REAL
 *RST: ASCII

Example: FORM REAL
 The software will send binary data in Real32 data format.

6.6 Remote Commands to Read Numeric Results

- [Frame Results](#).....90
- [Result for Selection](#).....93
- [Marker Table](#).....98

6.6.1 Frame Results

[FETCh:SUMMary:EVM:SDQP\[:AVERage\]?](#).....91

[FETCh:SUMMary:EVM:SDSF\[:AVERage\]?](#).....91

[FETCh:SUMMary:EVM:SDST\[:AVERage\]?](#).....91

[FETCh:SUMMary:EVM:UCCD\[:AVERage\]?](#).....92

[FETCh:SUMMary:EVM:UCCH\[:AVERage\]?](#).....92

| | |
|-----------------------------------|----|
| FETCh:SUMMary:EVM:UPRA[:AVERAge]? | 92 |
| FETCh:SUMMary:EVM:USQP[:AVERAge]? | 92 |
| FETCh:SUMMary:EVM:USSF[:AVERAge]? | 93 |
| FETCh:SUMMary:EVM:USST[:AVERAge]? | 93 |

FETCh:SUMMary:EVM:SDQP[:AVERAge]?

This command queries the EVM of all DMRS resource elements with QPSK modulation of the PUSCH.

Return values:

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

Example:

FETC:SUMM:EVM:SDQP?
Returns the EVM of all DMRS resource elements with QPSK modulation.

Usage: Query only

Manual operation: See "[Result Summary](#)" on page 23

FETCh:SUMMary:EVM:SDSF[:AVERAge]?

This command queries the EVM of all DMRS resource elements with 64QAM modulation of the PUSCH.

Return values:

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

Example:

FETC:SUMM:EVM:SDSF?
Returns the maximum EVM of all DMRS resource elements with 64QAM modulation.

Usage: Query only

Manual operation: See "[Result Summary](#)" on page 23

FETCh:SUMMary:EVM:SDST[:AVERAge]?

This command queries the EVM of all DMRS resource elements with 16QAM modulation of the PUSCH.

Return values:

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

Example:

FETC:SUMM:EVM:SDST?
Returns the EVM of all DMRS resource elements with 16QAM modulation.

Usage: Query only

Manual operation: See ["Result Summary"](#) on page 23

FETCh:SUMM:ary:EVM:UCCD[:AVERage]?

This command queries the EVM of all DMRS resource elements of the PUCCH as shown in the result summary.

Return values:

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

Example:

FETC:SUMM:EVM:UCCD?

Returns the average EVM of all DMRS resource elements.

Usage:

Query only

Manual operation: See ["Result Summary"](#) on page 23

FETCh:SUMM:ary:EVM:UCCH[:AVERage]?

This command queries the EVM of all resource elements of the PUCCH as shown in the result summary.

Return values:

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

Example:

FETC:SUMM:EVM:UCCH?

Returns the average EVM of all resource elements.

Usage:

Query only

Manual operation: See ["Result Summary"](#) on page 23

FETCh:SUMM:ary:EVM:UPRA[:AVERage]?

This command queries the EVM of all resource elements of the PRACH as shown in the result summary.

Return values:

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

Example:

FETC:SUMM:EVM:UPRA?

Returns the average EVM of all resource elements.

Usage:

Query only

Manual operation: See ["Result Summary"](#) on page 23

FETCh:SUMM:ary:EVM:USQP[:AVERage]?

This query returns the EVM for all QPSK-modulated resource elements of the PUSCH.

Return values:

<EVM> <numeric value>

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

Example: FETC : SUMM : EVM : USQP ?
 Queries the PUSCH QPSK EVM.

Usage: Query only

Manual operation: See "Result Summary" on page 23

FETCh:SUMMary:EVM:USSF[:AVERAge]?

This command queries the EVM for all 64QAM-modulated resource elements of the PUSCH.

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

Example: FETC : SUMM : EVM : USSF ?
 Queries the PUSCH 64QAM EVM.

Usage: Query only

Manual operation: See "Result Summary" on page 23

FETCh:SUMMary:EVM:USST[:AVERAge]?

This query returns the the EVM for all 16QAM-modulated resource elements of the PUSCH.

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

Example: FETC : SUMM : EVM : USST ?
 Queries the PUSCH 16QAM EVM.

Usage: Query only

Manual operation: See "Result Summary" on page 23

6.6.2 Result for Selection

FETCh[:CC<cci>]:SUMMary:CRESt[:AVERAge]?..... 94

FETCh[:CC<cci>]:SUMMary:EVM[:ALL]:MAXimum?..... 94

FETCh[:CC<cci>]:SUMMary:EVM[:ALL]:MINimum?..... 94

FETCh[:CC<cci>]:SUMMary:EVM[:ALL][:AVERAge]?..... 94

FETCh[:CC<cci>]:SUMMary:EVM:PCHannel:MAXimum?..... 95

FETCh[:CC<cci>]:SUMMary:EVM:PCHannel:MINimum?..... 95

FETCh[:CC<cci>]:SUMMary:EVM:PCHannel[:AVERAge]?..... 95

FETCh[:CC<cci>]:SUMMary:EVM:PSIGnal:MAXimum?..... 95

FETCh[:CC<cci>]:SUMMary:EVM:PSIGnal:MINimum?..... 95

FETCh[:CC<cci>]:SUMMary:EVM:PSIGnal[:AVERAge]?..... 95

FETCh[:CC<cci>]:SUMMary:FERRor:MAXimum?..... 95

FETCh[:CC<cci>]:SUMMary:FERRor:MINimum?..... 95

FETCh[:CC<cci>]:SUMMary:FERRor[:AVERAge]?..... 95

| | |
|---|----|
| FETCh[:CC<cci>]:SUMMary:GIMBalance:MAXimum? | 96 |
| FETCh[:CC<cci>]:SUMMary:GIMBalance:MINimum? | 96 |
| FETCh[:CC<cci>]:SUMMary:GIMBalance[:AVERage]? | 96 |
| FETCh[:CC<cci>]:SUMMary:IQOFfset:MAXimum? | 96 |
| FETCh[:CC<cci>]:SUMMary:IQOFfset:MINimum? | 96 |
| FETCh[:CC<cci>]:SUMMary:IQOFfset[:AVERage]? | 96 |
| FETCh[:CC<cci>]:SUMMary:POWer:MAXimum? | 97 |
| FETCh[:CC<cci>]:SUMMary:POWer:MINimum? | 97 |
| FETCh[:CC<cci>]:SUMMary:POWer[:AVERage]? | 97 |
| FETCh[:CC<cci>]:SUMMary:QUADerror:MAXimum? | 97 |
| FETCh[:CC<cci>]:SUMMary:QUADerror:MINimum? | 97 |
| FETCh[:CC<cci>]:SUMMary:QUADerror[:AVERage]? | 97 |
| FETCh[:CC<cci>]:SUMMary:SERRor:MAXimum? | 97 |
| FETCh[:CC<cci>]:SUMMary:SERRor:MINimum? | 97 |
| FETCh[:CC<cci>]:SUMMary:SERRor[:AVERage]? | 97 |
| FETCh:SUMMary:TFRame? | 98 |

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

This command queries the average crest factor as shown in the result summary.

Suffix:

<cci> 1..2

Return values:

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

Example:

FETC : SUMM : CRES ?
Returns the current crest factor in dB.

Usage: Query only

Manual operation: See "[Result Summary](#)" on page 23

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

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

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

This command queries the EVM of all resource elements.

Suffix:

<cci> 1..2

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:

FETC : SUMM : EVM ?
Returns the mean value.

Usage: Query only

Manual operation: See ["Result Summary"](#) on page 23

FETCh[:CC<cci>]:SUMMary:EVM:PCHannel:MAXimum?
FETCh[:CC<cci>]:SUMMary:EVM:PCHannel:MINimum?
FETCh[:CC<cci>]:SUMMary:EVM:PCHannel[:AVERage]?

This command queries the EVM of all physical channel resource elements.

Suffix:
 <cci> 1..2

Return values:
 <EVM>

Usage: Query only

Manual operation: See ["Result Summary"](#) on page 23

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

This command queries the EVM of all physical signal resource elements.

Suffix:
 <cci> 1..2

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: FETC:SUMM:EVM:PSIG?
 Returns the mean value.

Usage: Query only

Manual operation: See ["Result Summary"](#) on page 23

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

This command queries the frequency error.

Suffix:
 <cci> 1..2

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

Example: FETC : SUMM : FERR?
Returns the average frequency error in Hz.

Usage: Query only

Manual operation: See "[Result Summary](#)" on page 23

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

This command queries the I/Q gain imbalance.

Suffix:
 <cci> 1..2

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

Example: FETC : SUMM : GIMB?
Returns the current gain imbalance in dB.

Usage: Query only

Manual operation: See "[Result Summary](#)" on page 23

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

This command queries the I/Q offset.

Suffix:
 <cci> 1..2

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

Example: FETC : SUMM : IQOF?
Returns the current IQ-offset in dB

Usage: Query only

Manual operation: See "[Result Summary](#)" on page 23

FETCh[:CC<cci>]:SUMMary:POWer:MAXimum?
FETCh[:CC<cci>]:SUMMary:POWer:MINimum?
FETCh[:CC<cci>]:SUMMary:POWer[:AVERage]?

This command queries the total power.

Suffix:

<cci> 1..2

Return values:

<Power> <numeric value>

Minimum, maximum or average power, depending on the last command syntax element.

Default unit: dBm

Example:

FETC : SUMM : POW ?

Returns the total power in dBm

Usage:

Query only

Manual operation: See "[Result Summary](#)" on page 23

FETCh[:CC<cci>]:SUMMary:QUADerror:MAXimum?
FETCh[:CC<cci>]:SUMMary:QUADerror:MINimum?
FETCh[:CC<cci>]:SUMMary:QUADerror[:AVERage]?

This command queries the quadrature error.

Suffix:

<cci> 1..2

Return values:

<QuadError> <numeric value>

Minimum, maximum or average quadrature error, depending on the last command syntax element.

Default unit: deg

Example:

FETC : SUMM : QUAD ?

Returns the current mean quadrature error in degrees.

Usage:

Query only

Manual operation: See "[Result Summary](#)" on page 23

FETCh[:CC<cci>]:SUMMary:SERRor:MAXimum?
FETCh[:CC<cci>]:SUMMary:SERRor:MINimum?
FETCh[:CC<cci>]:SUMMary:SERRor[:AVERage]?

This command queries the sampling error.

Suffix:

<cci> 1..2

Return values:

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

Example:

FETC:SUMM:SERR?
 Returns the current mean sampling error in ppm.

Usage:

Query only

Manual operation: See ["Result Summary"](#) on page 23

FETCh:SUMMary:TFRame?

This command queries the (sub)frame start offset as shown in the Capture Buffer result display.

Note that you have to select a particular subframe; otherwise the command returns an error.

Return values:

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

Example:

FETC:SUMM:TFR?
 Returns the (sub)frame start offset.

Usage:

Query only

Manual operation: See ["Capture Buffer"](#) on page 15

6.6.3 Marker Table

| | |
|--|----|
| CALCulate<n>:DELTamarker<m>:X | 98 |
| CALCulate<n>:DELTamarker<m>:Y? | 99 |
| CALCulate<n>:MARKer<m>:X | 99 |
| CALCulate<n>:MARKer<m>:Y? | 99 |

CALCulate<n>:DELTamarker<m>:X <Position>

This command 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.

Example:

CALC:DELT:X?
 Outputs the absolute x-value of delta marker 1.

CALCulate<n>:DELTaMarker<m>:Y?

This command queries the relative position of a delta marker on the y-axis.

If necessary, the command activates the delta 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.

The unit depends on the application of the command.

Return values:

<Position> Position of the delta marker in relation to the reference marker.

Example:

```
INIT:CONT OFF
```

Switches to single sweep mode.

```
INIT;*WAI
```

Starts a sweep and waits for its end.

```
CALC:DELT2 ON
```

Switches on delta marker 2.

```
CALC:DELT2:Y?
```

Outputs measurement value of delta marker 2.

Usage:

Query only

CALCulate<n>:MARKer<m>:X <Position>

This command moves a marker to a particular 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.

Parameters:

<Position> Numeric value that defines the marker position on the x-axis.

Range: The range depends on the current x-axis range.

Example:

```
CALC:MARK2:X 1.7MHz
```

Positions marker 2 to frequency 1.7 MHz.

Manual operation: See "[Marker Table](#)" on page 25

CALCulate<n>:MARKer<m>:Y?

This command queries the position of a 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.

Return values:

<Result> Result at the marker position.

Example: INIT:CONT OFF
 Switches to single measurement mode.
 CALC:MARK2 ON
 Switches marker 2.
 INIT;*WAI
 Starts a measurement and waits for the end.
 CALC:MARK2:Y?
 Outputs the measured value of marker 2.

Usage: Query only

Manual operation: See "Marker Table" on page 25

6.7 Remote Commands to Read Limit Check Results

- [Checking Limits for Numerical Result Display](#)..... 100

6.7.1 Checking Limits for Numerical Result Display

| | |
|---|-----|
| CALCulate<n>:LIMit<k>:SUMMary:EVM[:ALL]:MAXimum:RESult..... | 101 |
| CALCulate<n>:LIMit<k>:SUMMary:EVM[:ALL][:AVERage]:RESult?..... | 101 |
| CALCulate<n>:LIMit<k>:SUMMary:EVM:PCHannel:MAXimum:RESult..... | 101 |
| CALCulate<n>:LIMit<k>:SUMMary:EVM:PCHannel[:AVERage]:RESult?..... | 101 |
| CALCulate<n>:LIMit<k>:SUMMary:EVM:PSIGnal:MAXimum:RESult..... | 101 |
| CALCulate<n>:LIMit<k>:SUMMary:EVM:PSIGnal[:AVERage]:RESult?..... | 101 |
| CALCulate<n>:LIMit<k>:SUMMary:EVM:SDQP[:AVERage]:RESult?..... | 102 |
| CALCulate<n>:LIMit<k>:SUMMary:EVM:SDSF[:AVERage]:RESult?..... | 102 |
| CALCulate<n>:LIMit<k>:SUMMary:EVM:SDST[:AVERage]:RESult?..... | 103 |
| CALCulate<n>:LIMit<k>:SUMMary:EVM:UCCD[:AVERage]:RESult?..... | 103 |
| CALCulate<n>:LIMit<k>:SUMMary:EVM:UCCH[:AVERage]:RESult?..... | 103 |
| CALCulate<n>:LIMit<k>:SUMMary:EVM:UPRA[:AVERage]:RESult?..... | 104 |
| CALCulate<n>:LIMit<k>:SUMMary:EVM:USQP[:AVERage]:RESult?..... | 104 |
| CALCulate<n>:LIMit<k>:SUMMary:EVM:USSF[:AVERage]:RESult?..... | 104 |
| CALCulate<n>:LIMit<k>:SUMMary:EVM:USST[:AVERage]:RESult?..... | 105 |
| CALCulate<n>:LIMit<k>:SUMMary:FERRor:MAXimum:RESult..... | 105 |
| CALCulate<n>:LIMit<k>:SUMMary:FERRor[:AVERage]:RESult?..... | 105 |
| CALCulate<n>:LIMit<k>:SUMMary:GIMBalance:MAXimum:RESult..... | 105 |
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CALCulate<n>:LIMit<k>:SUMMary:EVM[:ALL]:MAXimum:RESult
CALCulate<n>:LIMit<k>:SUMMary:EVM[:ALL][:AVERAge]:RESult?

This command queries the results of the EVM limit check of all resource elements.

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:

`CALC:LIM:SUMM:EVM:RES?`
 Queries the limit check.

Usage:

Query only

CALCulate<n>:LIMit<k>:SUMMary:EVM:PCHannel:MAXimum:RESult
CALCulate<n>:LIMit<k>:SUMMary:EVM:PCHannel[:AVERAge]:RESult?

This command queries the results of the EVM limit check of all physical channel resource elements.

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:

`CALC:LIM:SUMM:EVM:PCH:RES?`
 Queries the limit check.

Usage:

Query only

CALCulate<n>:LIMit<k>:SUMMary:EVM:PSIGNAL:MAXimum:RESult
CALCulate<n>:LIMit<k>:SUMMary:EVM:PSIGNAL[:AVERAge]:RESult?

This command queries the results of the EVM limit check of all physical signal resource elements.

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:

```
CALC:LIM:SUMM:EVM:PSIG:RES?
```

Queries the limit check.

Usage:

Query only

CALCulate<n>:LIMit<k>:SUMMary:EVM:SDQP[:AVERAge]:RESult?

This command queries the results of the EVM limit check of all PUSCH DMRS resource elements with a QPSK modulation.

Return values:

<LimitCheck>

FAILED

Limit check has failed.

PASSED

Limit check has passed.

NOTEVALUATED

Limits have not been evaluated.

Example:

```
CALC:LIM:SUMM:EVM:SDQP:RES?
```

Queries the limit check.

Usage:

Query only

CALCulate<n>:LIMit<k>:SUMMary:EVM:SDSF[:AVERAge]:RESult?

This command queries the results of the EVM limit check of all PUSCH DMRS resource elements with a 64QAM modulation.

Return values:

<LimitCheck>

FAILED

Limit check has failed.

PASSED

Limit check has passed.

NOTEVALUATED

Limits have not been evaluated.

Example:

```
CALC:LIM:SUMM:EVM:SDSF:RES?
```

Queries the limit check.

Usage:

Query only

CALCulate<n>:LIMit<k>:SUMMary:EVM:SDST[:AVERAge]:RESult?

This command queries the results of the EVM limit check of all PUSCH DMRS resource elements with a 16QAM modulation.

Return values:

<LimitCheck> **FAILED**
Limit check has failed.

PASSED
Limit check has passed.

NOTEVALUATED
Limits have not been evaluated.

Example: CALC:LIM:SUMM:EVM:SDST:RES?
Queries the limit check.

Usage: Query only

CALCulate<n>:LIMit<k>:SUMMary:EVM:UCCD[:AVERAge]:RESult?

This command queries the results of the EVM limit check of all PUCCH DMRS resource elements.

Return values:

<LimitCheck> **FAILED**
Limit check has failed.

PASSED
Limit check has passed.

NOTEVALUATED
Limits have not been evaluated.

Example: CALC:LIM:SUMM:EVM:UCCD:RES?
Queries the limit check.

Usage: Query only

CALCulate<n>:LIMit<k>:SUMMary:EVM:UCCH[:AVERAge]:RESult?

This command queries the results of the EVM limit check of all PUCCH resource elements.

Return values:

<LimitCheck> **FAILED**
Limit check has failed.

PASSED
Limit check has passed.

NOTEVALUATED
Limits have not been evaluated.

Example: CALC:LIM:SUMM:EVM:UCCH:RES?
Queries the limit check.

Usage: Query only

CALCulate<n>:LIMit<k>:SUMMary:EVM:UPRA[:AVERAge]:RESult?

This command queries the results of the EVM limit check of all PRACH resource elements.

Return values:

<LimitCheck> **FAILED**
Limit check has failed.

PASSED
Limit check has passed.

NOTEVALUATED
Limits have not been evaluated.

Example: `CALC:LIM:SUMM:EVM:UPRA:RES?`
Queries the limit check.

Usage: Query only

CALCulate<n>:LIMit<k>:SUMMary:EVM:USQP[:AVERAge]:RESult?

This command queries the results of the EVM limit check of all PUSCH resource elements with a QPSK modulation

Return values:

<LimitCheck> **FAILED**
Limit check has failed.

PASSED
Limit check has passed.

NOTEVALUATED
Limits have not been evaluated.

Example: `CALC:LIM:SUMM:EVM:USQP:RES?`
Queries the limit check.

Usage: Query only

CALCulate<n>:LIMit<k>:SUMMary:EVM:USSF[:AVERAge]:RESult?

This command queries the results of the EVM limit check of all PUSCH resource elements with a 64QAM modulation.

Return values:

<LimitCheck> **FAILED**
Limit check has failed.

PASSED
Limit check has passed.

NOTEVALUATED
Limits have not been evaluated.

Example: `CALC:LIM:SUMM:EVM:USSF:RES?`
Queries the limit check.

Usage: Query only

CALCulate<n>:LIMit<k>:SUMMary:EVM:USST[:AVERAge]:RESult?

This command queries the results of the EVM limit check of all PUSCH resource elements with a 16QAM modulation.

Return values:

<LimitCheck> **FAILED**
Limit check has failed.
PASSED
Limit check has passed.
NOTEVALUATED
Limits have not been evaluated.

Example: `CALC:LIM:SUMM:EVM:USST:RES?`
Queries the limit check.

Usage: Query only

CALCulate<n>:LIMit<k>:SUMMary:FERRor:MAXimum:RESult CALCulate<n>:LIMit<k>:SUMMary:FERRor[:AVERAge]:RESult?

This command queries the result of the frequency error limit check.

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: `CALC:LIM:SUMM:SERR:RES?`
Queries the limit check.

Usage: Query only

CALCulate<n>:LIMit<k>:SUMMary:GIMBalance:MAXimum:RESult CALCulate<n>:LIMit<k>:SUMMary:GIMBalance[:AVERAge]:RESult?

This command queries the result of the gain imbalance limit check.

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:

```
CALC:LIM:SUMM:GIMB:RES?
```

Queries the limit check.

Usage:

Query only

CALCulate<n>:LIMit<k>:SUMMary:IQOffset:MAXimum:RESult

CALCulate<n>:LIMit<k>:SUMMary:IQOffset[:AVERage]:RESult?

This command queries the result of the I/Q offset limit check.

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:

```
CALC:LIM:SUMM:IQOF:MAX:RES?
```

Queries the limit check.

Usage:

Query only

CALCulate<n>:LIMit<k>:SUMMary:QUADerror:MAXimum:RESult

CALCulate<n>:LIMit<k>:SUMMary:QUADerror[:AVERage]:RESult?

This command queries the result of the quadrature error limit check.

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: `CALC:LIM:SUMM:QUAD:RES?`
Queries the limit check.

Usage: Query only

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

This command queries the results of the sampling error limit check.

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: `CALC:LIM:SUMM:SERR:RES?`
Queries the limit check.

Usage: Query only

6.8 Remote Commands to Configure the Application

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6.8.1 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, "Configuring the Screen Layout"](#), on page 71.

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CONFigure[:LTE]:MEASurement <Measurement>

This command selects the measurement.

Parameters:

<Measurement> **EVM**
Selects I/Q measurements with the "EVM" display configuration.

Example: `CONF:MEAS:ACLR`
Selects the ACLR measurement.

Manual operation: See ["Select Measurement"](#) on page 27

MMEMory:LOAD:IQ:STATE <Path>

This command restores I/Q data from a file.

Setting parameters:

<Path> String containing the path and name of the source file.

Usage: Setting only

SYSTem:PRESet:CHANnel[:EXECute]

This command restores the default software settings in the current channel.

Use `INST:SEL` to select the channel.

Example: `INST '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 27

6.8.2 Configuring I/Q Measurements

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Signal Characteristics

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CONFigure[:LTE]:DUPLexing <Duplexing>

This command selects the duplexing mode.

Parameters:

| | |
|-------------|---|
| <Duplexing> | TDD Time division duplex |
| | FDD Frequency division duplex |
| | *RST: FDD |

Example: CONF:DUPL TDD
Activates time division duplex.

Manual operation: See "[Selecting the LTE Mode](#)" on page 29

CONFigure[:LTE]:LDIRection <Direction>

This command selects the link direction

Parameters:

| | |
|-------------|-----------------------|
| <Direction> | DL Downlink |
| | UL Uplink |

Example: CONF:LDIR DL
EUTRA/LTE option is configured to analyze downlink signals.

Manual operation: See "[Selecting the LTE Mode](#)" on page 29

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

This command selects the channel bandwidth.

- Parameters:**
 <Bandwidth> BW1_40 | BW3_00 | BW5_00 | BW10_00 | BW15_00 | BW20_00
- Example:** Single carrier measurement:
 CONF:UL:BW BW1_40
 Defines a channel bandwidth of 1.4 MHz.
- Example:** Aggregated carrier measurement:
 CONF:UL:CC1:BW BW5_00
 Defines a channel bandwidth of 5 MHz for the first carrier.
- Manual operation:** See "[Channel Bandwidth / Number of Resource Blocks](#)" on page 30

CONFigure[LTE]:UL[:CC<cci>]:CYCPrefix <PrefixLength>

This command selects the cyclic prefix.

- Parameters:**
 <PrefixLength> **NORM**
 Normal cyclic prefix length
EXT
 Extended cyclic prefix length
AUTO
 Automatic cyclic prefix length detection
 *RST: AUTO
- Example:** Single carrier measurements:
 CONF:UL:CYCP EXT
 Selects an extended cyclic prefix.
- Example:** Aggregated carrier measurements:
 CONF:UL:CC1:CYCP EXT
 Selects an extended cyclic prefix for the first carrier.
- Manual operation:** See "[Cyclic Prefix](#)" on page 30

CONFigure[LTE]:UL[:CC<cci>]:PLC:CID <CellId>

This command defines the cell ID.

- Parameters:**
 <CellId> **AUTO**
 Automatically defines the cell ID.
<numeric value>
 Number of the cell ID.
 Range: 0 to 503
- Example:** CONF:UL:PLC:CID AUTO
 Automatically detects the cell ID.
- Manual operation:** See "[Configuring the Physical Layer Cell Identity](#)" on page 32

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

This command selects the cell identity group for uplink signals.

Parameters:

<GroupNumber> Range: 1 to 167
 *RST: 0

Example: CONF:UL:PLCI:CIDG 12
 Selects cell identity group 12.

Manual operation: See "[Configuring the Physical Layer Cell Identity](#)" on page 32

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

This command selects the physical layer identity for uplink signals.

Parameters:

<Identity> **0...2**
 Manual selection
 *RST: AUTO

Example: CONF:DL:PLC:PLID 2
 Sets the physical layer identity to 2.

Manual operation: See "[Configuring the Physical Layer Cell Identity](#)" on page 32

CONFigure[:LTE]:UL[:CC<cci>]:TDD:SPSC <Configuration>

This command selects the special TDD subframe configuration.

Parameters:

<Configuration> <numeric value>

Example: Single carrier measurements:
 CONF:UL:TDD:SPSC 2
 Selects special subframe configuration 2.

Example: Carrier aggregation measurements:
 CONF:UL:CC1:TDD:SPSC 2
 Selects special subframe configuration 2 for the first carrier.

Manual operation: See "[Conf. of Special Subframe](#)" on page 31

CONFigure[:LTE]:UL[:CC<cci>]:TDD:UDConf <Configuration>

This command selects the subframe configuration for TDD signals.

Parameters:

<Configuration> Range: 0 to 6
 *RST: 0

- Example:** Single carrier measurements:
`CONF:UL:TDD:UDC 4`
 Selects allocation configuration number 4.
- Example:** Carrier aggregation measurements:
`CONF:UL:CC1:TDD:UDC 4`
 Selects allocation configuration number 4 for the first carrier.
- Manual operation:** See "[TDD UL/DL Allocations](#)" on page 31

MMEMory:LOAD:DEModsetting <Path>

This command 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.

Setting parameters:

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

Example: `MMEM:LOAD:DEM 'D:\USER\Settingsfile.allocation'`

Usage: Setting only

MMEMory:LOAD:TMOD:DL <TestModel>

This command loads an EUTRA test model (E-TM).

The test models are in accordance with 3GPP TS 36.141.

Setting parameters:

<TestModel> **'E-TM1_1__20MHz'**
 EUTRA Test Model 1.1 (E-TM1.1)

'E-TM1_2__20MHz'
 EUTRA Test Model 1.2 (E-TM1.2)

'E-TM2__20MHz'
 EUTRA Test Model 2 (E-TM2)

'E-TM3_1__20MHz'
 EUTRA Test Model 3.1 (E-TM3.1)

'E-TM3_2__20MHz'
 EUTRA Test Model 3.2 (E-TM3.2)

'E-TM3_3__20MHz'
 EUTRA Test Model 3.3 (E-TM3.3)

To select a test model for a different bandwidth, replace "20MHz" with either "1_4MHz", "3MHz", "5MHz", "10MHz" or "15MHz".

Example: `MMEM:LOAD:TMOD:DL 'E-TM2__10MHz'`
 Selects test model 2 for a 10 MHz bandwidth.

Usage: Setting only

[SENSe]:[LTE]:SFLatness:ECONditions <State>

This command turns extreme conditions for spectrum flatness measurements on and off.

Parameters:

<State> ON | OFF
*RST: OFF

Example:

SFL:ECON ON
Turns extreme conditions on.

Manual operation: See "[Extreme Conditions](#)" on page 32

[SENSe]:[LTE]:SFLatness:OBANd <NofSubbands>

This command selects the operating band for spectrum flatness Measurements.

Parameters:

<NofSubbands> <numeric value>
Range: 1 to 40
*RST: 1

Example:

SFL:OBAN 10
Selects operating band 10.

Manual operation: See "[Operating Band Index](#)" on page 32

MIMO Configuration

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CONFigure:[LTE]:UL:MIMO:ASElection <Antenna>

This command selects the antenna for measurements with MIMO setups.

Parameters:

<Antenna> **ANT1 | ANT2 | ANT3 | ANT4**
Select a single antenna to be analyzed
ALL
Select all antennas to be analyzed

Example:

CONF:UL:MIMO:ASEL ANT2
Selects antenna 2 to be analyzed.

Manual operation: See "[MIMO Configuration](#)" on page 33

Subframe Configuration

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CONFigure[:LTE]:UL:CSUBframes <NofSubframes>

This command selects the number of configurable subframes in the uplink signal.

Parameters:

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

Example:

CONF:UL:CSUB 5
 Sets the number of configurable subframes to 5.

CONFigure[:LTE]:UL[:CC<cci>]:SUBFrame<subframe>:ALLoc:CONT <Content>

This command allocates a PUCCH or PUSCH to an uplink allocation.

Parameters:

<Content> **NONE**
 Turns off the PUSCH and the PUCCH.
 PUCCh
 Turns on the PUCCH.
 PUSCh
 Turns on the PUSCH.
 PSCC
 Turns on the PUCCH as well as the PUSCH.
 *RST: PUSC

Example:

CONF:UL:SUBF8:ALL:CONT PUCc
 Subframe 8 contains a PUCCH.

Manual operation:

See "Enable PUCCH" on page 35
 See "Enable PUSCH" on page 36

CONFigure[:LTE]:UL[:CC<cci>]:SUBFrame<subframe>:ALLoc:MODulation <Modulation>

This command selects the modulation of an uplink allocation.

Parameters:

<Modulation> QPSK | QAM16 | QAM64
 *RST: QPSK

Example:

CONF:UL:SUBF8:ALL:MOD QPSK
 The modulation of the allocation in subframe 8 is QPSK.

Manual operation: See "[Modulation](#)" on page 36

**CONFigure[:LTE]:UL[:CC<cci>]:SUBFrame<subframe>:ALLoc:PRECoding:
 CBIndex <CBIndex>**

This command selects the codebook index for a PUSCH allocation.

Parameters:

<CBIndex> Range: 0 to 5
 *RST: 0

Example:

CONF:UL:SUBF:ALL:PREC:CBIN 1
 Selects codebook index 1 for the PUSCH allocation.

**CONFigure[:LTE]:UL[:CC<cci>]:SUBFrame<subframe>:ALLoc:PRECoding:
 CLMapping <Mapping>**

This command selects the codeword to layer mapping for a PUSCH allocation.

Parameters:

<Mapping> LC11 | LC21 | LC22

Example:

CONF:UL:SUBF2:ALL:PREC:CLM LC11
 Assigns codeword-to-layer mapping 1/1 to subframe 2.

**CONFigure[:LTE]:UL[:CC<cci>]:SUBFrame<subframe>:ALLoc:PUCCh:FORMat
 <Format>**

This command selects the PUCCH format for a particular subframe.

The command is available if you have selected PUCCH format selection on subframe basis with [CONFigure\[:LTE\]:UL:PUCCh:FORMat](#).

Parameters:

<Format> **F1N (F1 normal)**
 F1S (F1 shortened)
 F1AN (F1a normal)
 F1AS (F1a shortened)
 F1BN (F1b normal)
 F1BS (F1b shortened)
 F2 (F2)
 F2A (F2a)
 F2B (F2b)
 F3 (F3)

Example:

`CONF:UL:SUBF4:ALL:PUCCH:FORM F3`
 Selects format F3 for the PUCCH in subframe 4.

Manual operation: See ["Enhanced PUCCH Configuration"](#) on page 38

CONFigure[:LTE]:UL[:CC<cci>]:SUBFrame<subframe>:ALLoc:PUCCh:NPAr
 <Parameter>

This command defines N_PUCCH on a subframe basis.

The command is available if `CONFigure[:LTE]:UL:PUCCh:NPAr` on page 127 is turned on.

Parameters:

<Parameter> <numeric value>

Example:

`CONF:UL:SUBF:ALL:PUCCH:NPAr 2`
 Sets N_PUCCH to 2.

Manual operation: See ["Enhanced PUCCH Configuration"](#) on page 38

CONFigure[:LTE]:UL[:CC<cci>]:SUBFrame<subframe>:ALLoc:PUSCh:CSField
 <CyclicShiftField>

This command defines the cyclic shift field of the demodulation reference signal.

Available if `CONFigure[:LTE]:UL[:CC<cci>]:DRS:AOCc` on page 119 has been turned on.

Parameters:

<CyclicShiftField> Range: 0 to 7
 *RST: 0

Example:

`CONF:UL:SUBF:ALL:PUSC:CSF 4`
 Defines cyclic shift field 4.

Manual operation: See ["Enhanced Demodulation Reference Signal Configuration"](#) on page 37

CONFigure[:LTE]:UL[:CC<cci>]:SUBFrame<subframe>:ALLoc:PUSCh:NDMRs
 <PuschNDMRS>

This command defines the part of the DMRS index that is used for the uplink scheduling assignment.

Parameters:

<PuschNDMRS> <numeric value>
 Range: 0 to 11
 *RST: 0

Example: CONF:UL:SUBF:ALL:PUSC:NDMR 2
 Defines index 2.

Manual operation: See ["Enhanced Demodulation Reference Signal Configuration"](#) on page 37

CONFigure[:LTE]:UL[:CC<cci>]:SUBFrame<subframe>:ALLoc:RATO <State>

This command turns the resource allocation type 1 on and off.

Parameters:

<State> ON | OFF
 *RST: OFF

Example: CONF:UL:SUBF:ALL:RATO ON
 Turns resource allocation type 1 on.

Manual operation: See ["Enhanced PUSCH Configuration"](#) on page 37

CONFigure[:LTE]:UL[:CC<cci>]:SUBFrame<subframe>:ALLoc[:
CLUSter<cluster>]:RBCount <ResourceBlocks>

This command selects the number of resource blocks in an uplink subframe.

Parameters:

<NofRBs> <numeric value>
 *RST: 11

Example: CONF:UL:SUBF8:ALL:RBC 8
 Subframe 8 consists of 8 resource blocks.

Manual operation: See ["Number of RB"](#) on page 36

CONFigure[:LTE]:UL[:CC<cci>]:SUBFrame<subframe>:ALLoc[:
CLUSter<cluster>]:RBOffset <Offset>

This command defines the resource block offset in an uplink subframe.

Parameters:

<RBOffset> <numeric value>
 *RST: 2

Example: `CONF:UL:SUBF8:ALL:RBOF 5`
 Subframe 8 has a resource block offset of 5.

Manual operation: See ["Offset RB"](#) on page 36

[SENSe][:LTE]:UL:DEMod:ACON <Type>

This command selects the method of automatic demodulation for uplink signals.

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: `UL:DEM:ACON OFF`
 Turns automatic demodulation off.

Manual operation: See ["Auto Demodulation"](#) on page 34

[SENSe][:LTE]:UL:FORMat:SCD <State>

This command turns detection of the subframe configuration on and off.

The command is available if "Auto Demodulation" is turned off.

Parameters:
 <State> ON | OFF
 *RST: OFF

Example: `UL:FORM:SCD ON`
 Turns detection of the subframe configuration on.

Manual operation: See ["Subframe Configuration Detection"](#) on page 34

Global Settings

[CONFigure\[:LTE\]:UL:SFNO](#)..... 118
[CONFigure\[:LTE\]:UL:UEID](#)..... 119

CONFigure[:LTE]:UL:SFNO <Offset>

This command defines the system frame number offset.

The application uses the offset to demodulate the frame.

Parameters:
 <Offset> <numeric value>
 *RST: 0

Example: `CONF:UL:SFNO 2`
Selects frame number offset 2.

Manual operation: See "[Frame Number Offset](#)" on page 38

CONFigure[:LTE]:UL:UEID <ID>

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

Parameters:

<ID> <numeric value>
*RST: 0

Example: `CONF:UL:UEID 2`
Sets the UE ID to 2.

Manual operation: See "[UE ID/n_RNTI](#)" on page 39

Demodulation Reference Signal

| | |
|--|-----|
| CONFigure[:LTE]:UL[:CC<cci>]:DRS:AOCc | 119 |
| CONFigure[:LTE]:UL[:CC<cci>]:DRS:DSSHift | 119 |
| CONFigure[:LTE]:UL[:CC<cci>]:DRS:GRPHopping | 120 |
| CONFigure[:LTE]:UL[:CC<cci>]:DRS:NDMRs | 120 |
| CONFigure[:LTE]:UL[:CC<cci>]:DRS:PUCCh:POWer | 120 |
| CONFigure[:LTE]:UL[:CC<cci>]:DRS[:PUSCh]:POWer | 120 |
| CONFigure[:LTE]:UL[:CC<cci>]:DRS:SEQHopping | 120 |

CONFigure[:LTE]:UL[:CC<cci>]:DRS:AOCc <State>

This command turns the configuration of the demodulation reference signal on a sub-frame basis via the "Cyclic Field Shift" on and off.

Parameters:

<State> ON | OFF

Example: `CONF:UL:DRS:AOCc ON`
Turns Activate-DMRS-with OCC on.

Manual operation: See "[Activate-DMRS-With OCC](#)" on page 41

CONFigure[:LTE]:UL[:CC<cci>]:DRS:DSSHift <Shift>

This command selects the delta sequence shift of the uplink signal.

Parameters:

<Shift> <numeric value>
*RST: 0

Example: `CONF:UL:DRS:DSSH 3`
Sets the delta sequence shift to 3.

Manual operation: See "[Delta Sequence Shift](#)" on page 40

CONFigure[:LTE]:UL[:CC<cci>]:DRS:GRPHopping <State>

This command turns group hopping for uplink signals on and off.

Parameters:

<State> ON | OFF
 *RST: OFF

Example: CONF:UL:DRS:GRPHopping ON
 Activates group hopping.

Manual operation: See " [Group Hopping](#)" on page 40

CONFigure[:LTE]:UL[:CC<cci>]:DRS:NDMRs <nDMRS>

This command defines the n_{DMRS} .

Parameters:

<nDMRS> <numeric value>

Example: CONF:UL:DRS:NDMR 0
 Selects n_{DMRS} 0.

Manual operation: See " [n\(1\)_DMRS](#)" on page 40

CONFigure[:LTE]:UL[:CC<cci>]:DRS:PUCCh:POWER <Power>

This command sets the relative power of the PUCCH.

Parameters:

<Power> *RST: 0
 Default unit: DB

Example: CONF:UL:DRS:PUCC:POW 2
 Sets the power of the PUCCH to 2 dB.

Manual operation: See " [Relative Power PUCCH](#)" on page 40

CONFigure[:LTE]:UL[:CC<cci>]:DRS[:PUSCh]:POWER <Power>

This command sets the relative power of the PUSCH.

Parameters:

<Power> *RST: 0
 Default unit: DB

Example: CONF:UL:DRS:POW 2
 Sets the relative power of the PUSCH to 2 dB.

Manual operation: See " [Relative Power PUSCH](#)" on page 39

CONFigure[:LTE]:UL[:CC<cci>]:DRS:SEQHopping <State>

This command turns sequence hopping for uplink signals on and off.

Parameters:

<State> ON | OFF
 *RST: OFF

Example:

CONF:UL:DRS:SEQH ON
 Activates sequence hopping.

Manual operation: See " [Sequence Hopping](#)" on page 40

Sounding Reference Signal

| | |
|-------------------------------------|-----|
| CONFigure[LTE]:UL:SRS:ANST..... | 121 |
| CONFigure[LTE]:UL:SRS:BHOP..... | 121 |
| CONFigure[LTE]:UL:SRS:BSRS..... | 122 |
| CONFigure[LTE]:UL:SRS:CSRS..... | 122 |
| CONFigure[LTE]:UL:SRS:CYCS..... | 122 |
| CONFigure[LTE]:UL:SRS:ISRS..... | 122 |
| CONFigure[LTE]:UL:SRS:MUPT..... | 123 |
| CONFigure[LTE]:UL:SRS:NRRC..... | 123 |
| CONFigure[LTE]:UL:SRS:POWER..... | 123 |
| CONFigure[LTE]:UL:SRS:STAT..... | 123 |
| CONFigure[LTE]:UL:SRS:SUConfig..... | 124 |
| CONFigure[LTE]:UL:SRS:TRComb..... | 124 |

CONFigure[LTE]:UL:SRS:ANST <State>

This command 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.

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:

CONF:UL:SRS:ANST ON
 Turns simultaneous transmission of the SRS and PUCCH in one subframe on.

Manual operation: See "[A/N + SRS Simultaneous TX](#)" on page 44

CONFigure[LTE]:UL:SRS:BHOP <Bandwidth>

This command defines the frequency hopping bandwidth b_{hop} .

Parameters:

<Bandwidth> <numeric value>
 *RST: 0

Example: `CONF:UL:SRS:BHOP 1`
Sets the frequency hopping bandwidth to 1.

Manual operation: See "[Hopping BW b_hop](#)" on page 42

CONFigure[LTE]:UL:SRS:BSRS <Bandwidth>

This command defines the bandwidth of the SRS (B_{SRS}).

Parameters:
<Bandwidth> <numeric value>
*RST: 0

Example: `CONF:UL:SRS:BSRS 1`
Sets the SRS bandwidth to 1.

Manual operation: See "[SRS Bandwidth B_SRS](#)" on page 42

CONFigure[LTE]:UL:SRS:CSRS <Configuration>

This command defines the SRS bandwidth configuration (C_{SRS}).

Parameters:
<Configuration> <numeric value>
*RST: 0

Example: `CONF:UL:SRS:CSRS 2`
Sets the SRS bandwidth configuration to 2.

Manual operation: See "[SRS BW Conf. C_SRS](#)" on page 43

CONFigure[LTE]:UL:SRS:CYCS <CyclicShift>

Sets the cyclic shift n_{CS} used for the generation of the sounding reference signal CAZAC sequence.

Parameters:
<CyclicShift> <numeric value>
*RST: 0

Example: `CONF:UL:SRS:CYCS 2`
Sets the cyclic shift to 2.

Manual operation: See "[SRS Cyclic Shift N_CS](#)" on page 42

CONFigure[LTE]:UL:SRS:ISRS <ConfIndex>

This command defines the SRS configuration index (I_{SRS}).

Parameters:
<ConfIndex> <numeric value>
*RST: 0

Example: `CONF:UL:SRS:ISRS 1`
Sets the configuration index to 1.

Manual operation: See "[Conf. Index I_SRS](#)" on page 43

CONFigure[:LTE]:UL:SRS:MUPT <State>

This command turns SRS MaxUpPts on and off.

Parameters:
<State> ON | OFF
*RST: OFF

Manual operation: See "[SRS MaxUpPts](#)" on page 42

CONFigure[:LTE]:UL:SRS:NRRC <FreqDomPos>

Sets the UE specific parameter Freq. Domain Position n_{RRC} .

Parameters:
<FreqDomPos> <numeric value>
*RST: 0

Example: `CONF:UL:SRS:NRRC 1`
Sets n_{RRC} to 1.

Manual operation: See "[Freq. Domain Pos. \$n_{\text{RRC}}\$](#) " on page 43

CONFigure[:LTE]:UL:SRS:POWer <Power>

Defines the relative power of the sounding reference signal.

Parameters:
<Power> <numeric value>
*RST: 0
Default unit: DB

Example: `CONF:UL:SRS:POW -1.2`
Sets the power to -1.2 dB.

Manual operation: See "[SRS Rel Power](#)" on page 43

CONFigure[:LTE]:UL:SRS:STAT <State>

Activates or deactivates the sounding reference signal.

Parameters:
<State> ON | OFF
*RST: OFF

Example: `CONF:UL:SRS:STAT ON`
Activates the sounding reference signal.

Manual operation: See "[Present](#)" on page 41

CONFigure[:LTE]:UL:SRS:SUConfig <Configuration>

This command defines the SRS subframe configuration.

Parameters:

<Configuration> <numeric value>
*RST: 0

Example: CONF:UL:SRS:SUC 4
Sets SRS subframe configuration to 4.

Manual operation: See "[SRS Subframe Conf.](#)" on page 41

CONFigure[:LTE]:UL:SRS:TRComb <TransComb>

This command defines the transmission comb (k_{TC}).

Parameters:

<TransComb> <numeric value>
*RST: 0

Example: CONF:UL:SRS:TRC 1
Sets transmission comb to 1.

Manual operation: See "[Transm. Comb. \$k_{TC}\$](#) " on page 43

PUSCH Structure

| | |
|---|-----|
| CONFigure[:LTE]:UL[:CC<cci>]:PUSCh:FHMode..... | 124 |
| CONFigure[:LTE]:UL[:CC<cci>]:PUSCh:FHOFFset..... | 125 |
| CONFigure[:LTE]:UL[:CC<cci>]:PUSCh:FHOP:IIHB..... | 125 |
| CONFigure[:LTE]:UL[:CC<cci>]:PUSCh:NOSM..... | 125 |

CONFigure[:LTE]:UL[:CC<cci>]:PUSCh:FHMode <HoppingMode>

This command selects the frequency hopping mode in the PUSCH structure.

Parameters:

<HoppingMode> **NONE**
No hopping
INTer
Inter subframe hopping
INTRa
Intra subframe hopping
*RST: NONE

Example: CONF:UL:PUSC:FHM NONE
Deactivates frequency hopping for the PUSCH.

Manual operation: See "[Frequency Hopping Mode](#)" on page 44

CONFigure[:LTE]:UL[:CC<cci>]:PUSCh:FHOFFset <Offset>

This command defines the frequency hopping offset for the PUSCH.

Parameters:

<Offset> <numeric value>
*RST: 4

Example: CONF:UL:PUSCh:FHOFF 5
Sets the hopping offset to 5.

Manual operation: See "[PUSCH Hopping Offset](#)" on page 45

CONFigure[:LTE]:UL[:CC<cci>]:PUSCh:FHOP:IIHB <HBInfo>

This command defines the information in hopping bits of the PUSCH.

Parameters:

<HBInfo> <numeric value>
Range: 0 to 3
*RST: 0

Example: CONF:UL:PUSCh:FHOP:IIHB 1
Defines type 1 as the information in hopping bits.

Manual operation: See "[Info. in Hopping Bits](#)" on page 45

CONFigure[:LTE]:UL[:CC<cci>]:PUSCh:NOSM <NofSubbands>

This command defines the number of subbands/M of the PUSCH.

Parameters:

<NofSubbands> <numeric value>
*RST: 4

Example: CONF:UL:PUSCh:NOSM 2
Sets the number of subbands to 2.

Manual operation: See "[Number of Subbands](#)" on page 45

PUCCH Structure

| | |
|--|-----|
| CONFigure[:LTE]:UL:PUCCh:DESHift | 125 |
| CONFigure[:LTE]:UL:PUCCh:FORMat | 126 |
| CONFigure[:LTE]:UL:PUCCh:N1CS | 126 |
| CONFigure[:LTE]:UL:PUCCh:N2RB | 126 |
| CONFigure[:LTE]:UL:PUCCh:NORB | 127 |
| CONFigure[:LTE]:UL:PUCCh:NPAr | 127 |

CONFigure[:LTE]:UL:PUCCh:DESHift <Shift>

This command defines the delta shift of the PUCCH.

Parameters:

<Shift> <numeric value>
 Range: 1 to 3
 *RST: 2

Example:

CONF:UL:PUCCH:DESH 3
 Sets the delta shift of the PUCCH to 3.

Manual operation: See "[Delta Shift](#)" on page 46

CONFigure[LTE]:UL:PUCCh:FORMat <Format>

This command selects the PUCCH format.

Note that formats 2a and 2b are available for normal cyclic prefix length only.

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:

CONF:UL:PUCCH:FORM F1B
 Sets the PUCCH format to F1B.

Manual operation: See "[Format](#)" on page 47

CONFigure[LTE]:UL:PUCCh:N1CS <N1cs>

This command defines the N(1)_cs of the PUCCH.

Parameters:

<N1cs> <numeric value>
 *RST: 6

Example:

CONF:UL:PUCCH:N1CS 4
 Sets N(1)_cs to 4.

Manual operation: See "[N\(1\)_cs](#)" on page 46

CONFigure[LTE]:UL:PUCCh:N2RB <N2RB>

This command defines the N(2)_RB of the PUCCH.

Parameters:

<N2RB> <numeric value>
 *RST: 1

Example:

CONF:UL:PUCCh:N2RB 2
 Sets N2_RB to 2.

Manual operation: See " N(2)_RB" on page 47

CONFigure[:LTE]:UL:PUCCh:NORB <ResourceBlocks>

This command selects the number of resource blocks for the PUCCH.

Parameters:

<ResourceBlocks> <numeric value>
 Selects the number of RBs.
AUTO
 Detects the number of RBs automatically.
 *RST: 0

Example:

CONF:UL:PUCCh:NORB 6
 Sets the number of resource blocks to 6.

Manual operation: See " No. of RBs for PUCCH" on page 46

CONFigure[:LTE]:UL:PUCCh:NPAR <Format>

This command defines the N_PUCCH parameter in the PUCCH structure settings.

Parameters:

<Format> <numeric value>
 <numeric value>
SUBF
 Selects the definition of N_PUCCH on subframe level.
 *RST: 0

Example:

CONF:UL:PUCCh:NPAR 2
 Sets N_PUCCH to 2.

Manual operation: See " N_PUCCH" on page 47

PRACH Structure

CONFigure[:LTE]:UL:PRACH:APM..... 128
 CONFigure[:LTE]:UL:PRACH:CONF..... 128
 CONFigure[:LTE]:UL:PRACH:FOFFset..... 128
 CONFigure[:LTE]:UL:PRACH:FRIndex..... 128
 CONFigure[:LTE]:UL:PRACH:HFIndicator..... 129
 CONFigure[:LTE]:UL:PRACH:NCSC..... 129

| | |
|--------------------------------------|-----|
| CONFigure[:LTE]:UL:PRACH:RSEQ..... | 129 |
| CONFigure[:LTE]:UL:PRACH:RSET..... | 129 |
| CONFigure[:LTE]:UL:PRACH:SINdex..... | 129 |

CONFigure[:LTE]:UL:PRACH:APM <State>

This command turns automatic preamble mapping for the PRACH on and off.

Parameters:

<State> ON | OFF

Example:

CONF:UL:PRAC:APM ON
Turns automatic preamble mapping on.

Manual operation: See "[PRACH Preamble Mapping](#)" on page 48

CONFigure[:LTE]:UL:PRACH:CONF <Configuration>

This command selects the PRACH preamble format.

Parameters:

<Configuration> <numeric value>

Example:

CONF:UL:PRAC:CONF 2
Selects PRACH configuration 2.

Manual operation: See "[PRACH Configuration](#)" on page 48

CONFigure[:LTE]:UL:PRACH:FOFFset <Offset>

This command defines the PRACH frequency offset.

The command is available for preamble formats 0 to 3.

Parameters:

<Offset> Resource block offset.

Example:

CONF:UL:PRAC:FOFF 5
Defines a frequency offset of 5 resource blocks.

Manual operation: See "[Frequency Offset](#)" on page 48

CONFigure[:LTE]:UL:PRACH:FRINdex <FRINdex>

This command selects the PRACH frequency index.

Parameters:

<FRINdex> <numeric value>

Example:

CONF:UL:PRAC:FRIN 10
Selects the frequency index 10.

Manual operation: See "[PRACH Preamble Mapping](#)" on page 48

CONFigure[LTE]:UL:PRACH:HFINDicator <HFINDicator>

This command defines the PRACH half frame indicator.

Parameters:

<HFINDicator> <numeric value>

Example:

CONF:UL:PRAC:HFIN 5
Selects half frame indicator 5.

Manual operation: See "[PRACH Preamble Mapping](#)" on page 48

CONFigure[LTE]:UL:PRACH:NCSC <Configuration>

This command defines the Ncs configuration for the PRACH.

Parameters:

<Configuration> <numeric value>

Example:

CONF:UL:PRAC:NCSC 1
Selects Ncs configuration 1.

Manual operation: See "[Ncs Conf](#)" on page 49

CONFigure[LTE]:UL:PRACH:RSEQ <RootSeqIdx>

This command defines the PRACH logical root sequence index.

Parameters:

<RootSeqIdx> <numeric value>

Example:

CONF:UL:PRAC:RSEQ 2
Selects logical root sequence index 2.

Manual operation: See "[Logical Root Sequ. Idx](#)" on page 49

CONFigure[LTE]:UL:PRACH:RSET <State>

This command turns the restricted preamble set for PRACH on and off.

Parameters:

<State> ON | OFF
*RST: OFF

Example:

CONF:UL:PRAC:RSET ON
Turns the restricted set on.

Manual operation: See "[Restricted Set](#)" on page 48

CONFigure[LTE]:UL:PRACH:SINDEX <Index>

This command selects the PRACH sequence index.

Parameters:

<Index> <IndexValue>
 Number that defines the index manually.
AUTO
 Automatically determines the index.

Example:

CONF:UL:PRAC:SIND 2
 Selects sequence index 2.

Manual operation: See "Sequence Index (v)" on page 49

6.8.2.2 Configuring Inputs and Outputs

Useful commands to perform measurements described elsewhere:

- INPut:COUPling on page 135
- INPut:IMPedance on page 136

INPut:FILTer:HPASs[:STATe]..... 130
 INPut:FILTer:YIG[:STATe]..... 130
 INPut:SElect..... 131

INPut: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 in order to measure the harmonics for a DUT, for example.

This function 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 filter.)

Parameters:

<State> ON | OFF
 *RST: OFF

Example:

INP:FILT:HPAS ON
 Turns on the filter.

Usage:

SCPI confirmed

Manual operation: See "High-Pass Filter 1...3 GHz" on page 50

INPut:FILTer:YIG[:STATe] <State>

This command turns the YIG-preselector on and off.

Note the special conditions and restrictions for the YIG filter described in "YIG-Preselector" on page 50.

Example:

INP:FILT:YIG OFF
 Deactivates the YIG-preselector.

Manual operation: See "YIG-Preselector" on page 50

INPut:SElect <Source>

This command selects the signal source for measurements, i.e. it defines which connector is used to input data to the R&S VSE.

Parameters:

<Source> **RF**
 Radio Frequency ("RF INPUT" connector)

FIQ
 I/Q data file

*RST: RF

Manual operation: See "I/Q File State" on page 51

6.8.2.3 Defining the Frequency

| | |
|--|-----|
| [SENSe]:FREQuency:CENTer[:CC<cci>]..... | 131 |
| [SENSe]:FREQuency:CENTer[:CC<cci>]:OFFSet..... | 132 |
| [SENSe:]FREQuency:CENTer:STEP..... | 132 |
| [SENSe:]FREQuency:CENTer:STEP:LINK..... | 133 |
| [SENSe:]FREQuency:CENTer:STEP:LINK:FACTor..... | 133 |

[SENSe]:FREQuency:CENTer[:CC<cci>] <Frequency>

This command 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).

Parameters:

<Frequency> <numeric value>

 Range: fmin to fmax

 *RST: 1 GHz

 Default unit: Hz

Example: Measurement on one carrier:
`FREQ:CENT 1GHZ`
 Defines a center frequency of 1 GHz

Example: Measurement on aggregated carriers:
`FREQ:CENT:CC1 850MHZ`
 Defines a center frequency of 850 MHz for the first carrier.

Manual operation: See "Defining the Signal Frequency" on page 51

[SENSe]:FREQUENCY:CENTer[:CC<cci>]:OFFSet <Frequency>

This command defines the general frequency offset or the frequency offset for a component carrier.

The effect of the command depends on the syntax:

- When you omit the [CC<cci>] 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<cci>] 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.

Parameters:

<Frequency>

- General frequency offset: frequency offset in Hz.
- Component carrier offset: frequency offset relative to the first component carrier in Hz.

Example:

```
FREQ:CENT:OFFS 50HZ
```

Adds 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:CC2:OFFS 15MHZ
```

Defines a frequency offset of 15 MHz for the second component carrier relative to the first component carrier.

Manual operation: See ["Defining the Signal Frequency"](#) on page 51

[SENSe:]FREQUENCY:CENTer:STEP <StepSize>

This command defines the center frequency step size.

You can increase or decrease the center frequency quickly in fixed steps using the `SENS:FREQ UP` and `SENS:FREQ DOWN` commands, see [\[SENSe\]:FREQUENCY:CENTer\[:CC<cci>\]](#) on page 131.

Parameters:

<StepSize>

f_{max} is specified in the data sheet.

Range: 1 to fMAX

*RST: 0.1 x span

Default unit: Hz

Example:

```
FREQ:CENT 100 MHz
```

```
FREQ:CENT:STEP 10 MHz
```

```
FREQ:CENT UP
```

Sets the center frequency to 110 MHz.

Manual operation: See ["Defining the Signal Frequency"](#) on page 51

[SENSe:]FREQuency:CENTer:STEP:LINK <CouplingType>

This command couples and decouples the center frequency step size to the span or the resolution bandwidth.

Parameters:

| | |
|----------------|---|
| <CouplingType> | SPAN Couples the step size to the span. Available for measurements in the frequency domain. |
| | OFF Decouples the step size. |
| *RST: | SPAN |

Example:

```
FREQ:CENT:STEP:LINK SPAN
```

[SENSe:]FREQuency:CENTer:STEP:LINK:FACTor <Factor>**Parameters:**

| | |
|----------|--------------|
| <Factor> | 1 to 100 PCT |
| *RST: | 10 |

Example:

```
FREQ:CENT:STEP:LINK:FACT 20PCT
```

6.8.2.4 Configuring Amplitude Characteristics

The commands are available when you capture data with an instrument. In addition, the commands that are available depend on the configuration of the connected instrument.

| | |
|---|-----|
| CALCulate<n>:UNIT:POWer..... | 133 |
| DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALE]:RLEVel..... | 134 |
| DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALE]:RLEVel:OFFSet..... | 134 |
| INPut:ATTenuation..... | 134 |
| INPut:ATTenuation:AUTO..... | 135 |
| INPut:COUpling..... | 135 |
| INPut:GAIN[:VALue]..... | 135 |
| INPut:GAIN:STATe..... | 136 |
| INPut:IMPedance..... | 136 |
| INPut<n>:EATT..... | 136 |
| INPut<n>:EATT:AUTO..... | 137 |
| INPut<n>:EATT:STATe..... | 137 |
| [SENSe:]ADJust:LEVel..... | 137 |

CALCulate<n>:UNIT:POWer <Unit>

This command selects the unit of the y-axis.

The unit applies to all measurement windows.

Parameters:

<Unit> DBM | V | A | W | DBPW | WATT | DBUV | DBMV | VOLT |
 DBUA | AMPere
 *RST: dBm

Example:

CALC:UNIT:POW DBM
 Sets the power unit to dBm.

Manual operation: See ["Defining a Reference Level"](#) on page 52

DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:RLEVel <ReferenceLevel>

This command defines the reference level (for all traces, <t> is irrelevant).

With a reference level offset ≠ 0, the value range of the reference level is modified by the offset.

Parameters:

<ReferenceLevel> The unit is variable.
 Range: see datasheet
 *RST: 0 dBm

Example:

DISP:TRAC:Y:RLEV -60dBm

Usage:

SCPI confirmed

Manual operation: See ["Defining a Reference Level"](#) on page 52

DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:RLEVel:OFFSet <Offset>

This command defines a reference level offset (for all traces, <t> is irrelevant).

Parameters:

<Offset> Range: -200 dB to 200 dB
 *RST: 0dB

Example:

DISP:TRAC:Y:RLEV:OFFS -10dB

Manual operation: See ["Defining a Reference Level"](#) on page 52

INPut:ATTenuation <Attenuation>

This command defines the total attenuation for RF input.

If you set the attenuation manually, it is no longer coupled to the reference level, but the reference level is coupled to the attenuation. Thus, if the current reference level is not compatible with an attenuation that has been set manually, the command also adjusts the reference level.

Parameters:

<Attenuation> Range: see data sheet
 Increment: 5 dB
 *RST: 10 dB (AUTO is set to ON)

- Example:** `INP:ATT 30dB`
 Defines a 30 dB attenuation and decouples the attenuation from the reference level.
- Usage:** SCPI confirmed
- Manual operation:** See "[Attenuating the Signal](#)" on page 53

INPut:ATTenuation:AUTO <State>

This command couples or decouples the attenuation to the reference level. Thus, when the reference level is changed, the R&S VSE determines the signal level for optimal internal data processing and sets the required attenuation accordingly.

Parameters:

<State> ON | OFF | 0 | 1
 *RST: 1

- Example:** `INP:ATT:AUTO ON`
 Couples the attenuation to the reference level.

Usage: SCPI confirmed

INPut:COUPling <CouplingType>

This command selects the coupling type of the RF input.

Parameters:

<CouplingType> **AC**
 AC coupling
DC
 DC coupling
 *RST: AC

- Example:** `INP:COUP DC`

Usage: SCPI confirmed

Manual operation: See "[Input Coupling](#)" on page 53

INPut:GAIN[:VALue] <Gain>

This command selects the gain level if the preamplifier is activated (`INP:GAIN:STAT ON`, see [INPut:GAIN:STATe](#) on page 136).

The command requires the additional preamplifier hardware option.

Parameters:

<Gain> 15 dB | 30 dB
 The availability of gain levels depends on the model of the connected instrument.
 *RST: OFF

Example: `INP:GAIN:VAL 30`
Switches on 30 dB preamplification.

Usage: SCPI confirmed

INPut:GAIN:STATe <State>

This command turns the preamplifier on the connected instrument on and off. It requires the additional preamplifier hardware option on the connected instrument.

Parameters:

<State> ON | OFF
*RST: OFF

Example: `INP:GAIN:STAT ON`
Switches on 30 dB preamplification.

Usage: SCPI confirmed

INPut:IMPedance <Impedance>

This command selects the nominal input impedance of the RF input. In some applications, only 50 Ω are supported.

75 Ω should be selected if the 50 Ω input impedance is transformed to a higher impedance using a matching pad of the RAZ type (= 25 Ω in series to the input impedance of the instrument). The power loss correction value in this case is 1.76 dB = 10 log (75Ω/50Ω).

Parameters:

<Impedance> 50 | 75
*RST: 50 Ω

Example: `INP:IMP 75`

Usage: SCPI confirmed

Manual operation: See "[Impedance](#)" on page 54

INPut<n>:EATT <Attenuation>

This command 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.

Parameters:

<Attenuation> Attenuation level in dB.
Default unit: dB

Example: `INP:EATT 10`
Defines an attenuation level of 10 dB.

Manual operation: See "[Attenuating the Signal](#)" on page 53

INPut<n>:EATT:AUTO <State>

This command turns automatic selection of the electronic attenuation on and off. If on, electronic attenuation reduces the mechanical attenuation whenever possible.

Parameters:

<State> ON | OFF
 *RST: OFF

Example:

INP:EATT:AUTO ON
 Turns automatic selection of electronic attenuation level on.

Manual operation: See "[Attenuating the Signal](#)" on page 53

INPut<n>:EATT:STATe <State>

This command turns the electronic attenuator on and off.

Parameters:

<State> ON | OFF
 *RST: OFF

Example:

INP:EATT:STAT ON
 Turns the electronic attenuator on.

Manual operation: See "[Attenuating the Signal](#)" on page 53

[SENSe:]ADJust:LEVel

This command 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.

Example: ADJ:LEV

Usage: Event

Manual operation: See "[Defining a Reference Level](#)" on page 52

6.8.2.5 Signal Capture

- [Data Capture](#)..... 138
- [Trigger](#)..... 139

Data Capture

[SENSe][:LTE]:FRAMe:COUNT..... 138
 [SENSe][:LTE]:FRAMe:COUNT:AUTO..... 138
 [SENSe][:LTE]:FRAMe:COUNT:STATe..... 138
 [SENSe]:SWAPiq..... 139
 [SENSe]:SWEp:TIME..... 139

[SENSe][:LTE]:FRAMe:COUNT <Subframes>

This command sets the number of frames you want to analyze.

Parameters:

<Subframes> <numeric value>
 *RST: 1

Example:

```
FRAM:COUN:STAT ON
FRAM:COUN:AUTO OFF
Activates manual input of frames to be analyzed.
FRAM:COUN 20
Analyzes 20 frames.
```

Manual operation: See "[Number of Frames to Analyze](#)" on page 55

[SENSe][:LTE]:FRAMe:COUNT:AUTO <State>

This command turns automatic selection of the number of frames to analyze on and off.

Parameters:

<State> **ON**
 Selects the number of frames to analyze according to the LTE standard.
 OFF
 Turns manual selection of the frame number on.

Example:

```
FRAM:COUN:AUTO ON
Turns automatic selection of the analyzed frames on.
```

Manual operation: See "[Auto According to Standard](#)" on page 55

[SENSe][:LTE]:FRAMe:COUNT:STATe <State>

This command turns manual selection of the number of frames you want to analyze on and off.

Parameters:

<State> **ON**
 You can set the number of frames to analyze.
 OFF
 The R&S VSE analyzes a single sweep.
 *RST: ON

Example: FRAM:COUN:STAT ON
Turns manual setting of number of frames to analyze on.

Manual operation: See ["Overall Frame Count"](#) on page 54

[SENSe]:SWAPiq <State>

This command turns a swap of the I and Q branches on and off.

Parameters:
<State> ON | OFF
*RST: OFF

Example: SWAP ON
Turns a swap of the I and Q branches on.

Manual operation: See ["Swap I/Q"](#) on page 54

[SENSe]:SWEep:TIME <CaptLength>

This command sets the capture time.

Parameters:
<CaptLength> Numeric value in seconds.
Default unit: s

Example: SWE:TIME 40ms
Defines a capture time of 40 milliseconds.

Manual operation: See ["Capture Time"](#) on page 54

Trigger

The trigger functionality of the LTE 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]:HOLDoff<instrument> | 139 |
| TRIGger[:SEQuence]:LEVel<instrument>[:EXTErnal] | 140 |
| TRIGger[:SEQuence]:PORT<instrument> | 140 |
| TRIGger[:SEQuence]:SLOPe | 140 |
| TRIGger[:SEQuence]:SOURce | 140 |

TRIGger[:SEQuence]:HOLDoff<instrument> <Offset>

This command defines the trigger offset.

Parameters:
<Offset> <numeric value>
*RST: 0 s
Default unit: s

Example: `TRIG:HOLD 5MS`
Sets the trigger offset to 5 ms.

TRIGger[:SEQuence]:LEVel<instrument>[:EXternal] <Level>

This command defines the level for an external trigger.

Parameters:

<Level> Range: 0.5 V to 3.5 V
 *RST: 1.4 V
 Default unit: V

Example: `TRIG:LEV 2V`
Defines a trigger level of 2 V.

TRIGger[:SEQuence]:PORT<instrument> <Port>

This command selects the trigger port for measurements with devices that have several trigger ports.

Parameters:

<Port> **PORT1**
 PORT2
 PORT3

Example: `TRIG:PORT PORT1`
Selects trigger port 1.

TRIGger[:SEQuence]:SLOPe <Type>

Parameters:

<Type> POSitive | NEGative
 POSitive
 Triggers when the signal rises to the trigger level (rising edge).
 NEGative
 Triggers when the signal drops to the trigger level (falling edge).
 *RST: POSitive

Example: `TRIG:SLOP NEG`

TRIGger[:SEQuence]:SOURce <Source>

This command 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.

Parameters:

<Source>

IMMediate

Free Run

EXT1 | EXT2 | EXT3 | EXT4

Trigger signal from the corresponding TRIGGER INPUT/ OUTPUT connector on the connected instrument, or the oscilloscope's corresponding input channel.

For details on the connectors see the instrument's Getting Started manual.

RFPower

First intermediate frequency

IFPower

Second intermediate frequency

IQPower

Magnitude of sampled I/Q data

For applications that process I/Q data, such as the I/Q Analyzer or optional applications.

MAGNitude

For (offline) input from a file, rather than an instrument. Triggers on a specified signal level.

*RST: IMMediate

Example:

TRIG:SOUR EXT

Selects the external trigger input as source of the trigger signal

6.8.2.6 Demodulation

| | |
|--|-----|
| [SENSe][:LTE]:UL:DEMod:ATTSlots..... | 141 |
| [SENSe][:LTE]:UL:DEMod:MODE..... | 142 |
| [SENSe][:LTE]:UL:DEMod:CESTimation..... | 142 |
| [SENSe][:LTE]:UL:DEMod:EEPeriod..... | 142 |
| [SENSe][:LTE]:UL:DEMod:CDOffset..... | 142 |
| [SENSe][:LTE]:UL:DEMod:CBSCrambling..... | 143 |
| [SENSe][:LTE]:UL:DEMod:SISync..... | 143 |
| [SENSe][:LTE]:UL:DEMod:MCFilter..... | 143 |

[SENSe][:LTE]:UL:DEMod:ATTSlots <State>

This command includes or excludes the transient slots present after a switch from downlink to uplink in the analysis.

Parameters:

<State>

ON | OFF

Example:

UL:DEM:ATTS ON

Includes the transient slots in the analysis.

Manual operation:See "[Analyze TDD Transient Slots](#)" on page 57

[SENSe][:LTE]:UL:DEMod:MODE <Reference>

This command selects the uplink analysis mode.

Parameters:

<Reference> **PUSCh**
 Analyzes the PUSCH and PUCCH.

PRACH
 Analyzes the PRACH.

*RST: PUSCh

Example: UL:DEMod:MODE PRACH
 Selects PRACH analysis mode.

Manual operation: See "[Analysis Mode](#)" on page 57

[SENSe][:LTE]:UL:DEMod:CESTimation <Type>

This command selects the channel estimation type for uplink signals.

Parameters:

<Type> PIL | PILPAY

PIL
 Pilot only

PILP
 Pilot and payload

*RST: PILP

Example: UL:DEMod:CEST PIL
 Uses only the pilot signal for channel estimation.

Manual operation: See "[Channel Estimation Range](#)" on page 57

[SENSe][:LTE]:UL:DEMod:EEPeriod <State>

This command includes or excludes the exclusion period from EVM results.

Parameters:

<State> ON | OFF

Example: UL:DEMod:EEPeriod ON
 Turns the exclusion periods for EVM calculation on.

Manual operation: See "[EVM with Exclusion Period](#)" on page 57

[SENSe][:LTE]:UL:DEMod:CDOffset <State>

This command turns DC offset compensation for uplink signals on and off.

Parameters:

<State> ON | OFF

*RST: ON

Example: `UL:DEM:CDC OFF`
Deactivates DC offset compensation.

Manual operation: See ["Compensate DC Offset"](#) on page 57

[SENSe][:LTE]:UL:DEMod:CBSCrambling <State>

This command turns scrambling of coded bits for uplink signals on and off.

Parameters:
<State> ON | OFF
*RST: ON

Example: `UL:DEM:CBSC OFF`
Deactivates the scrambling.

Manual operation: See ["Scrambling of Coded Bits"](#) on page 57

[SENSe][:LTE]:UL:DEMod:SISync <State>

This command turns suppressed interference synchronization on and off.

Parameters:
<State> ON | OFF
*RST: OFF

Example: `UL:DEM:SISY ON`
Turns suppressed interference synchronization on.

Manual operation: See ["Suppressed Interference Synchronization"](#) on page 58

[SENSe][:LTE]:UL:DEMod:MCFilter <State>

This command turns suppression of interfering neighboring carriers on and off (e.g. LTE, WCDMA, GSM etc).

Parameters:
<State> ON | OFF
*RST: OFF

Example: `UL:DEM:MCF ON`
Turns suppression on of neighboring carriers on.

Manual operation: See ["Multicarrier Filter"](#) on page 58

6.8.2.7 Tracking

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[SENSe][:LTE]:UL:TRACking:TIME..... 144

[SENSe][:LTE]:UL:TRACking:PHASe <Type>

This command selects the phase tracking type for uplink signals.

Parameters:

- <Type> **OFF**
Deactivate phase tracking
- PIL**
Pilot only
- PILP**
Pilot and payload
- *RST: OFF

Example: SENS:UL:TRAC:PHAS PILP
Use pilots and payload for channel estimation.

Manual operation: See "Phase" on page 56

[SENSe][:LTE]:UL:TRACking:TIME <State>

This command turns timing tracking for uplink signals on and off.

Parameters:

- <State> ON | OFF
- *RST: OFF

Example: UL:TRAC:TIME ON
Activates timing tracking.

Manual operation: See "Timing" on page 56

6.9 Analysis

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- [Y-Axis Scale](#)..... 147
- [Result Settings](#)..... 148

6.9.1 Evaluation Range

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- [\[SENSe\]\[:LTE\]:MODulation:SElect](#)..... 145
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[SENSe][:LTE]:ALlocation:SElect <Allocation>

This command filters the displayed results in the constellation diagram by a particular type of allocation.

Parameters:

<Allocation>

ALL

Shows the results for all allocations.

<numeric_value>

Shows the results for a particular allocation type.

Allocation types are mapped to numeric values. For the code assignment see [chapter 6.5.1.18, "Return Value Codes"](#), on page 89.

*RST: ALL

Example:

```
ALL:SEL 2
```

Shows the results for PDSCH allocation 2.

Manual operation: See ["Evaluation Range for the Constellation Diagram"](#) on page 61

[SENSe][:LTE]:CARRier:SElect <Carrier>

This command filters the displayed results in the constellation diagram by a particular subcarrier.

Parameters:

<Carrier>

ALL

Shows the results for all subcarriers.

<numeric_value>

Shows the results for a particular subcarrier.

*RST: ALL

Example:

```
CARR:SEL 1
```

Shows the results for subcarrier 1.

Manual operation: See ["Evaluation Range for the Constellation Diagram"](#) on page 61

[SENSe][:LTE]:MODulation:SElect <Modulation>

This command filters the displayed results in the constellation diagram by a particular type of modulation.

Parameters:

<Modulation>

ALL

Shows the results for all modulation types.

<numeric_value>

Shows the results for a particular modulation type.

Modulation types are mapped to numeric values. For the code assignment see [chapter 6.5.1.18, "Return Value Codes"](#), on page 89.***RST:** ALL**Example:**

MOD:SEL 3

Shows the results for all elements with a 16QAM modulation

Manual operation:See "[Evaluation Range for the Constellation Diagram](#)" on page 61**[SENSe][:LTE]:PREamble:SElect <Subframe>**

This command selects a particular preamble for measurements that analyze individual preambles.

The command is available in PRACH analysis mode.

Parameters:

<Subframe>

ALL

Analyzes all preambles.

<numeric value>

Selects the preamble to analyze.

***RST:** ALL**Example:**

PRE:SEL ALL

Analyzes all preambles.

Manual operation:See "[Preamble Selection](#)" on page 60**[SENSe][:LTE]:SLOT:SElect <Slot>**

This command selects the slot to analyze.

Parameters:

<Slot>

S0

Slot 0

S1

Slot 1

ALL

Both slots

***RST:** ALL**Example:**

SLOT:SEL S1

Selects slot 1 for analysis.

Manual operation:See "[Slot Selection](#)" on page 60

[SENSe][:LTE]:SUBFrame:SElect <Subframe>

This command selects the subframe to be analyzed.

Parameters:

<Subframe> ALL | <numeric value>
ALL
 Select all subframes
0...39
 Select a single subframe
 *RST: ALL

Example:

SUBF:SEL ALL
 Select all subframes for analysis.

Manual operation: See "[Subframe Selection](#)" on page 59

[SENSe][:LTE]:SYMBOL:SElect <Symbol>

This command filters the displayed results in the constellation diagram by a particular OFDM symbol.

Parameters:

<Symbol> **ALL**
 Shows the results for all subcarriers.
<numeric_value>
 Shows the results for a particular OFDM symbol.
 *RST: ALL

Example:

SYMB:SEL 2
 Shows the results for the second OFDM symbol.

Manual operation: See "[Evaluation Range for the Constellation Diagram](#)" on page 61

6.9.2 Y-Axis Scale

| | |
|---|-----|
| DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:AUTO ONCE..... | 147 |
| DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:MAXimum..... | 148 |
| DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:MINimum..... | 148 |

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

Automatic scaling of the y-axis is performed once, then switched off again (for all traces, <t> is irrelevant).

Usage: SCPI confirmed

Manual operation: See "[Y-Axis Scale](#)" on page 61

DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:MAXimum <Value>

This command defines the maximum value of the y-axis for all traces in the selected result display.

The suffix <t> is irrelevant.

Parameters:

<Value> <numeric value>
 *RST: depends on the result display
 The unit and range depend on the result display.

Example:

DISP:TRAC:Y:MIN -60
 DISP:TRAC:Y:MAX 0
 Defines the y-axis with a minimum value of -60 and maximum value of 0.

Manual operation: See "[Y-Axis Scale](#)" on page 61

DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:MINimum <Value>

This command defines the minimum value of the y-axis for all traces in the selected result display.

The suffix <t> is irrelevant.

Parameters:

<Value> <numeric value>
 *RST: depends on the result display
 The unit and range depend on the result display.

Example:

DISP:TRAC:Y:MIN -60
 DISP:TRAC:Y:MAX 0
 Defines the y-axis with a minimum value of -60 and maximum value of 0.

Manual operation: See "[Y-Axis Scale](#)" on page 61

6.9.3 Result Settings

| | |
|---|-----|
| CALCulate:MARKer:COUPling | 148 |
| UNIT:BSTR | 149 |
| UNIT:CAXes | 149 |
| UNIT:EVM | 149 |

CALCulate:MARKer:COUPling <State>

This command couples or decouples markers in different result displays to each other.

Parameters:

<State> ON | OFF

Example: `CALC:MARK:COUP ON`
Couples the markers to each other.

Manual operation: See "[Marker Coupling](#)" on page 63

UNIT:BSTR <Unit>

This command 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: `UNIT:BSTR BIT`
Bit stream gets displayed using Bits.

Manual operation: See "[Bit Stream Format](#)" on page 62

UNIT:CAXes <Unit>

This command 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: `UNIT:CAX HZ`
Selects frequency scale for the x-axis.

Manual operation: See "[Carrier Axes](#)" on page 63

UNIT:EVM <Unit>

This command selects the EVM unit.

Parameters:

<Unit>

DB
EVM results returned in dB

PCT
EVM results returned in %

*RST: PCT

Example: `UNIT:EVM PCT`
EVM results to be returned in %.

Manual operation: See "[EVM Unit](#)" on page 62

A Annex: Reference

- [Common R&S VSE Menus](#)..... 150
- [LTE Measurement Menus](#)..... 152

A.1 Common R&S VSE Menus



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

- [File Menu](#)..... 150
- [Window Menu](#)..... 151
- [Help Menu](#)..... 152

A.1.1 File Menu

The "File" menu includes all functionality directly related to any file operations, printing or setting up general parameters.

For a description of these functions see the "Data Management" chapter in the R&S VSE User Manual.


| 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 |
| > New Measurement Channel | - | Inserts a new channel in the selected group |
| > Replace Measurement Channel | - | Replaces the currently selected channel by the selected application. |
| > 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 |

| Menu item | Corresponding icon in toolbar | Description |
|----------------------------|-------------------------------|--|
| > 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 |
| > 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 |
| > Selected Channel | - | Restores the default software configuration for an individual channel |
| > Reset VSE Layout | - | Restores the default layout of windows, toolbars etc. in the R&S VSE software |
| 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 software |

A.1.2 Window Menu

The "Window" menu allows you to hide or show individual windows.

For a description of these functions see the "Controlling Instruments and Capturing Data" chapter in the R&S VSE User Manual.

| Menu item | Corresponding icon in toolbar | Description |
|----------------------------|---|---|
| Player... | - | Displays the "Player" tool window to recall I/Q data recordings |
| Instrument Setup... | - | Displays the "Instruments" window to configure input instruments |
| Measurement Group Setup... | - | Displays the "Measurement Group Setup" window to configure a measurement sequence |
| New Window > |  | Inserts a new result display window for the selected measurement channel |

| Menu item | Corresponding icon in toolbar | Description |
|----------------------------------|-------------------------------|---|
| Channel Infos > | - | 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 |
| Configure Selected Result Window | - | Displays the "Window Configuration" dialog box to configure result-specific settings |

A.1.3 Help Menu

The "Help" menu provides access to help, support and licensing functions.

For a description of these functions see the "Basic Operations" and "General Software Settings" chapters in the R&S VSE User Manual.

| Menu item | Corresponding icon in toolbar | Description |
|-----------|-------------------------------|--|
| Help | ? | Opens the Online help window |
| License | - | Licensing, version and options information |
| Support | - | Support functions |
| About | - | Software version information |

A.2 LTE Measurement Menus

- [Input & Output Menu](#)..... 152
- [Meas Setup Menu](#)..... 153
- [Trace Menu](#)..... 153
- [Marker Menu](#)..... 153
- [Limits Menu](#)..... 154

A.2.1 Input & Output Menu

The "Input & Output" menu provides functions to configure the input source, frontend parameters and output settings for the measurement.

This menu is application-specific.

Table 1-1: "Input" menu items for LTE measurements

| Menu item | Description |
|---------------|--|
| Amplitude | chapter 4.2.12, "Defining Level Characteristics" , on page 52 |
| Scale | chapter 5.3, "Scale" , on page 61 |
| Frequency | chapter 4.2.11, "Defining the Frequency" , on page 51 |
| Trigger | chapter 4.2.14, "Triggering Measurements" , on page 55 |
| Input Source | chapter 4.2.10, "Selecting the Input and Output Source" , on page 49 |
| Output Source | |

A.2.2 Meas Setup Menu

The "Meas Setup" menu provides access to most measurement-specific settings, as well as bandwidth, sweep and auto configuration settings, and the configuration "Overview" window.

This menu is application-specific.

Table 1-2: "Meas Setup" menu items for LTE measurements

| Menu item | Description |
|--------------------------|---|
| Select Measurement | chapter 3, "Measurements and Result Displays" , on page 13 |
| Signal Description | chapter 4.2.1, "Defining Signal Characteristics" , on page 28 |
| MIMO Setup | chapter 4.2.2, "Configuring MIMO Setups" , on page 33 |
| Subframe Configuration | chapter 4.2.3, "Configuring Subframes" , on page 33 |
| Trigger / Signal Capture | chapter 4.2.13, "Configuring the Data Capture" , on page 54 |
| Tracking | chapter 4.2.15, "Tracking" , on page 56 |
| Demod | chapter 4.2.16, "Signal Demodulation" , on page 56 |
| Evaluation Range | chapter 5.2, "Evaluation Range" , on page 59 |
| Result Settings | chapter 5.4, "Result Settings" , on page 62 |
| Overview | chapter 4.1, "Configuration Overview" , on page 26 |

A.2.3 Trace Menu




The "Trace" does not contain any functions for LTE measurements, traces are generally not configurable.

A.2.4 Marker Menu

The "Marker" menu provides access to marker-specific functions.

This menu is application-specific.

Table 1-3: "Marker" menu items for LTE measurements

| Menu item | Corresponding icon in toolbar | Description |
|-------------------|---|---|
| Select marker <x> |  | chapter 5.5, "Markers" , on page 63 |
| Marker to Trace | - | chapter 5.5, "Markers" , on page 63 |
| All Markers Off |  | chapter 5.5, "Markers" , on page 63 |
| Marker... |  | chapter 5.5, "Markers" , on page 63 |
| Search | - | chapter 5.5, "Markers" , on page 63 |

A.2.5 Limits Menu

The "Limits" menu does not contain any functions for LTE measurements.

List of Commands

| | |
|--|-----|
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| [SENSe:]FREQUency:CENTer:STEP:LINK..... | 133 |
| [SENSe:]FREQUency:CENTer:STEP:LINK:FACTor..... | 133 |
| [SENSe:]FREQUency:CENTer[CC<cci>]..... | 131 |
| [SENSe:]FREQUency:CENTer[CC<cci>]:OFFSet..... | 132 |
| [SENSe]:SWAPiq..... | 139 |
| [SENSe]:SWEep:TIME..... | 139 |
| [SENSe][:LTE]:ALLocation:SElect..... | 145 |
| [SENSe][:LTE]:CARRier:SElect..... | 145 |
| [SENSe][:LTE]:FRAMe:COUNT..... | 138 |
| [SENSe][:LTE]:FRAMe:COUNT:AUTO..... | 138 |
| [SENSe][:LTE]:FRAMe:COUNT:STATe..... | 138 |
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