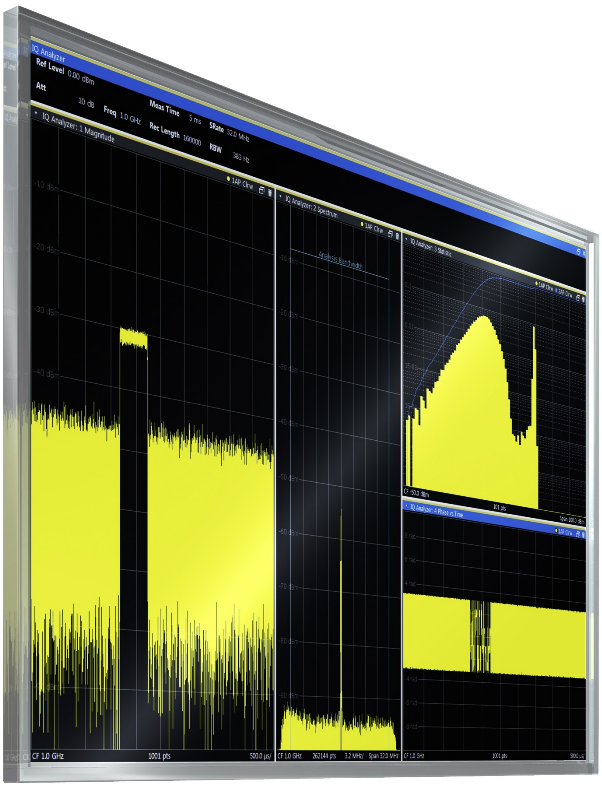
R&S®VSE
Vector Signal Explorer Base Software
User Manual



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Test & Measurement

User Manual

ROHDE&SCHWARZ

This manual applies to the R&S®VSE base software (1320.7500.02) version 1.13 and higher.

The software contained in this product makes use of several valuable open source software packages. For information, see the "Open Source Acknowledgment" 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®Vector Signal Explorer is abbreviated as R&S VSE.

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1 Preface

1.1 About this Manual

This User Manual describes general software functions and settings common to all applications and operating modes in the R&S VSE. Furthermore, it provides all the information specific to **I/Q measurements in the I/Q Analyzer application**. All other applications are described in the specific 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
- **Software Installation and General Configuration**
  Installation and initial configuration of the software
- **Measurements and Results**
  Descriptions of the measurement types available in the R&S VSE software
- **Operating Basics**
  General operating methods and concepts in the R&S VSE software
- **Controlling Instruments and Capturing I/Q Data**
  Methods of data acquisition and description of basic instrument control functions
- **Data Management**
  Description of general functions to handle data files (configuration and result data)
- **General Software Setup**
  Description of general software settings and functions that are independent of the current measurement channel
- **I/Q Analyzer Measurements**
  Description of the settings and functions provided to analyze results with the I/Q Analyzer and the corresponding remote control commands
- **How to Perform Measurements**
  Step-by-step description of performing basic measurements with the R&S VSE software
- **Network and Remote Operation**
  Information on setting up the PC with the R&S VSE software and the instrument in use in a network and operating them remotely.
- **Remote Commands**
  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
- **Troubleshooting**
  Hints and tips on how to handle errors

- **Reference**
  Additional information on data formats and an overview of menu functions
- **List of Commands**
  Alpahabetical list of all remote commands described in the manual
- **Index**

1.2 Typographical Conventions

The following text markers are used throughout this documentation:

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

2 Welcome to the R&S VSE

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

The R&S VSE features analysis of:

- the same data in various applications simultaneously
- I/Q data files
- multiple inputs from a single instrument
- a combination of input from different instruments, including:
  - R&S®FSW
  - R&S®FPS
  - R&S®FSV
  - R&S®FSQ
  - R&S®FSL

This user manual contains a description of the basic functionality that the software provides, including remote control operation. The latest version is available for download at the product homepage (http://www2.rohde-schwarz.com/product/VSE.html).

3 Software Installation

3.1 Installing Required Components

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

- Microsoft .NET Framework 3.5 and 4.0 (both)
- VISA

Installing the Microsoft .NET Framework

When you install the R&S VSE via the provided installation file (see chapter 3.2, "Installing and Starting the R&S VSE Software", on page 12), the installer automatically checks whether the required Microsoft .NET Framework versions are available on the PC. If not, version 3.5 is installed from the R&S VSE CD-ROM, and an internet connection to the Microsoft website is established to download the Framework version 4.0 (due to the large file size). Thus, before attempting to install the R&S VSE software, ensure a strong internet connection is available from the PC, as downloading may take some time. Alternatively, download the Framework 4.0 version from the internet manually before you start the R&S VSE installer.

Installing VISA

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

It is recommended that you use the National Instruments VISA driver. The National Instrument VISA driver CD-ROM is supplied together with the R&S VSE CD-ROM. You can also visit http://www.ni.com/visa to get the latest version for your operating system if you are licensed to.

Once the R&S VSE software is installed, a status icon in the status bar indicates whether the VISA installation is available, see table 6-1.

3.2 Installing and Starting the R&S VSE Software

After installing all required components, you can install the R&S VSE. It is recommended that you copy the file from the installation CD-ROM to your hard disk before you execute it.

To install the R&S VSE software

1. Insert the R&S VSE CD-ROM in the PC.
   If the start page does not open automatically, select the `start.htm` file in the main directory.

2. Switch to the "Installation" tab.
3. Select the link to the `VSESetup_XXX.exe` file.
4. Select a storage location on your hard disk.
5. From the hard disk, select the `VSESetup_XXX.exe` file.
6. Select the required options to be installed.
   Unless you have ensured the required Microsoft .NET Framework versions are installed manually before starting the R&S VSE installation, be sure to keep the "R&S VSE .NET installation" option selected.
7. Select "Install".

The installer performs the following actions:
- Checks for the required Microsoft .NET Framework versions on the PC, and if necessary, downloads the required version from the Internet, before installing both versions
- Installs the R&S VSE software including an uninstall tool
- Creates a shortcut on the desktop (optional)
- If necessary (the software will specifically ask you to), set the required environment variables.
  This step may require administrator rights on the PC.

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

To start the R&S VSE software

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

Demo mode

Without the use of the Smart Card Reader (see chapter 3.3, "Using the Smart Card Reader", on page 13), the software starts in "Demo-Mode". In this case, all (installed) options and remote commands are available. However, no instruments can be configured, no I/Q files and no measurement settings can be loaded or saved.

3.3 Using the Smart Card Reader

The software is licensed by a smart card licensing system. This licensing system requires a smart card to be connected to the PC when you are using the software.

The smart card and reader (R&S FSPC) are provided with the R&S VSE software CD.

You can connect the smart card in two ways.

- Connect the smart card in SIM format.

If you want to connect the smart card in SIM format, use the USB smart card reader that is included in the delivery of the software.

- Connect the smart card in its full format.
  If you want to connect the smart card in full format, an interface compatible to the card format is required.
  The following devices are able to read the smart card in full format.
  – smart card reader integrated in a keyboard
  – smart card reader integrated in a notebook
  – smart card reader integrated in a desktop PC (e.g. OMNIKEY)
  – smart card reader connected to the computer via serial bus or USB (e.g. OMNI-KEY)
  – USB reader connected to a LAN-to-USB converter to distribute the license via the network (e.g DIGI AnaywhereUSB/2)

Licensing support

If you have any difficulties with the licensing system, support is only assured when you are using the USB smart card reader that is delivered with the smart card.

Using the USB smart card reader

1. Included in the delivery of the software is the smart card in full format and a smart card reader.

2. Break out the smart card in SIM format.

3. Insert the smart card into the smart card reader.

a) Turn the smart card reader in a way that the OMNIKEY label faces upward.
b) Insert the smart card with the chip face down and the angled corner facing away from the reader.

4. Push the smart card into the reader as far as possible.

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

Locking the computer

If you have difficulties unlocking the computer while the smart card is connected because MS Windows tries to get log-in information from the card after you have locked the computer.

You can solve this issue by editing the system registry.

Manual change

1. Open the Windows "Start Menu" and select the "Run" item.
2. Enter `regedit` into the dialog box to open the system registry.
3. Look for `HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\Windows\CurrentVersion\policies\system`.
4. Set the value of `DisableCad` to 0.

Administration rights

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

3.4 Deinstalling R&S VSE

Access: "Start" > "All Programs" > "Rohde-Schwarz" > "VSE" > [version_number] > "Uninstall VSE"

or: "Start" > "Control Panel" > "Add or Remove Software"

You can uninstall the software itself via the uninstall tool available in the R&S VSE folder, or via the standard Windows "Add or Remove Software" function.

4 Trying Out the R&S VSE

This chapter introduces the most important functions and settings of the R&S VSE step by step. The complete and detailed description of the functionality can be found in the subsequent chapters. Basic instrument operation is described in chapter 6, "Operating Basics", on page 35.

Prerequisites

- The software is installed and started as described in chapter 3, "Software Installation", on page 12.

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

- Capturing and Analyzing Data from a Connected Instrument................................16
- Analyzing Stored Data from a File.. 25

4.1 Capturing and Analyzing Data from a Connected Instrument

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

Try out the following:

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- Assigning the Instrument to a Channel.. 18
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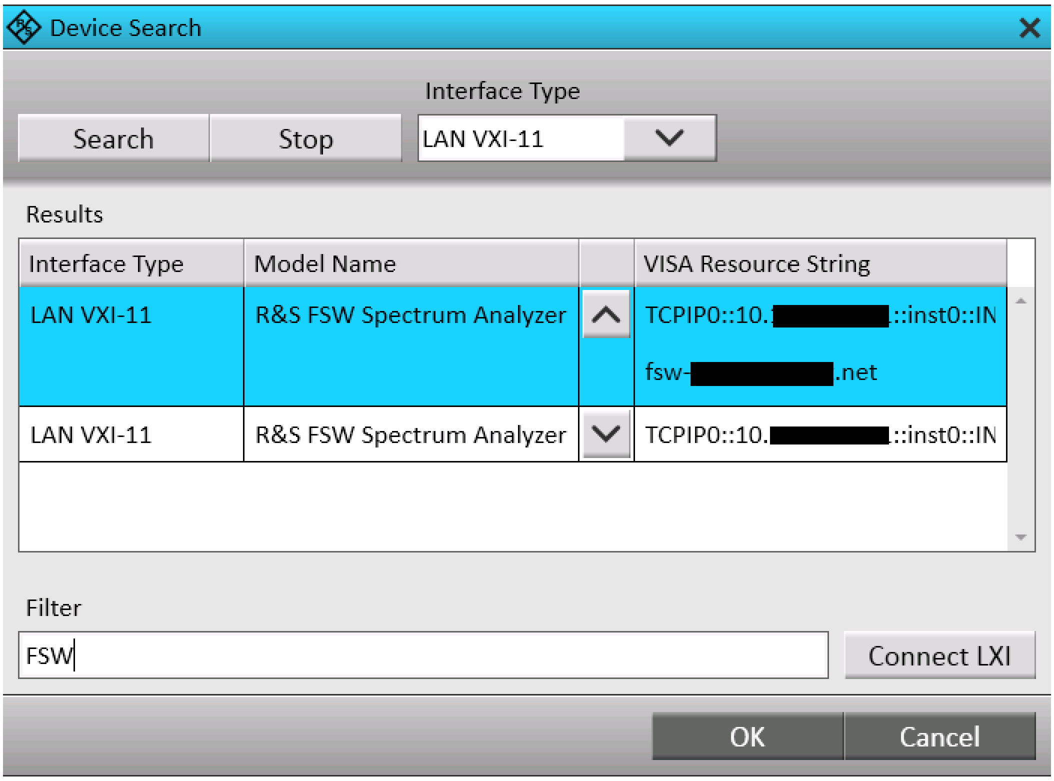
- Recording Measurement Data.. 24

4.1.1 Configuring an Instrument

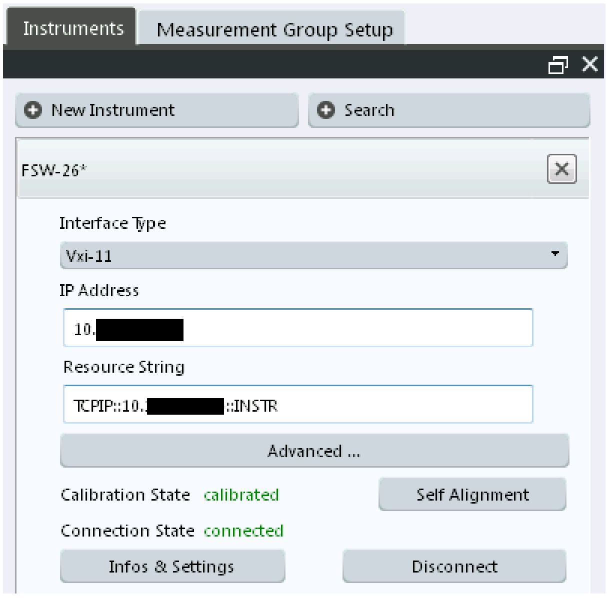
In the first step, we will search for instruments connected to the same network as the PC running the R&S VSE software, and attempt to connect to one of them.

1. Select the "Instruments" tab at the upper left of the R&S VSE window.
2. Select "Search" to search for all instruments in the network.
3. To find instruments using the VXI-11 protocol, in the "Device Search" dialog box, select the interface type "LAN VXI-11" and select "Search".
   If there are very many results, try filtering them by the type of instrument, for example, enter *FSW* in the "Filter" field.



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

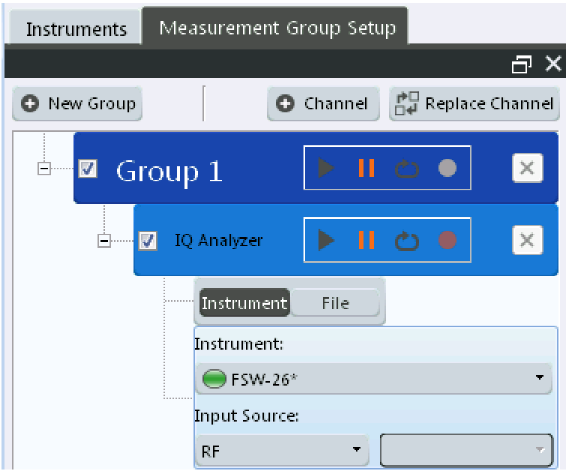
   The connection state should turn green and indicate "connected".



4.1.2 Assigning the Instrument to a Channel

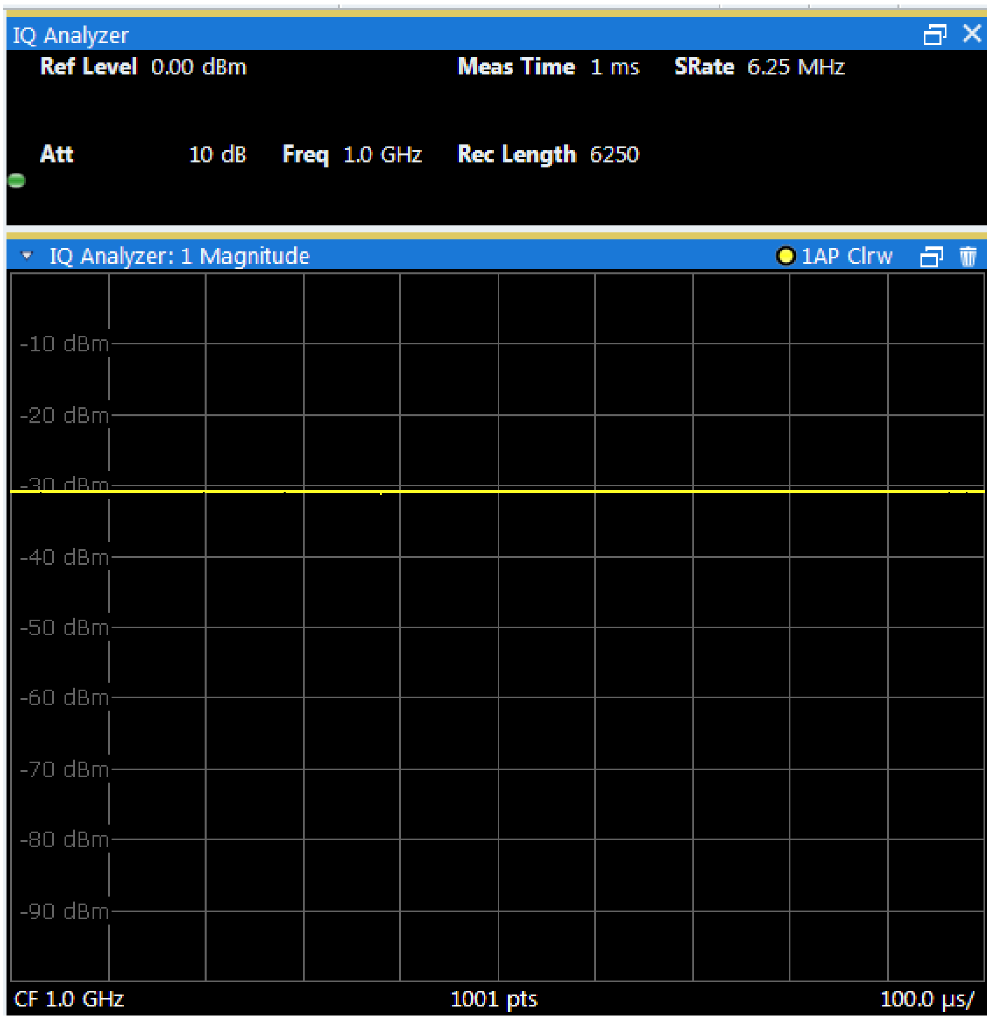
Now we must assign the configured and connected instrument as the input source for the default measurement channel.

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



5. Select the ▶ "Capture" icon for the "IQ Analyzer" measurement channel.

   Since the default measurement mode is continuous, a continuous measurement is started immediately on the connected instrument. The results are displayed in the "IQ Analyzer: Magnitude" result display.

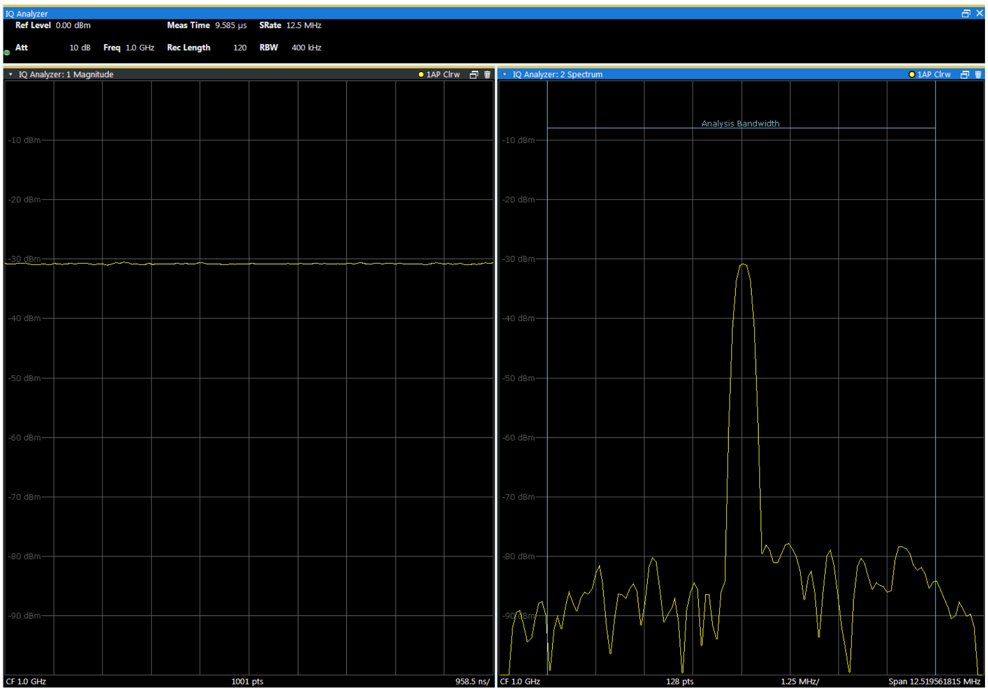


4.1.3 Adding Additional Result Displays

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

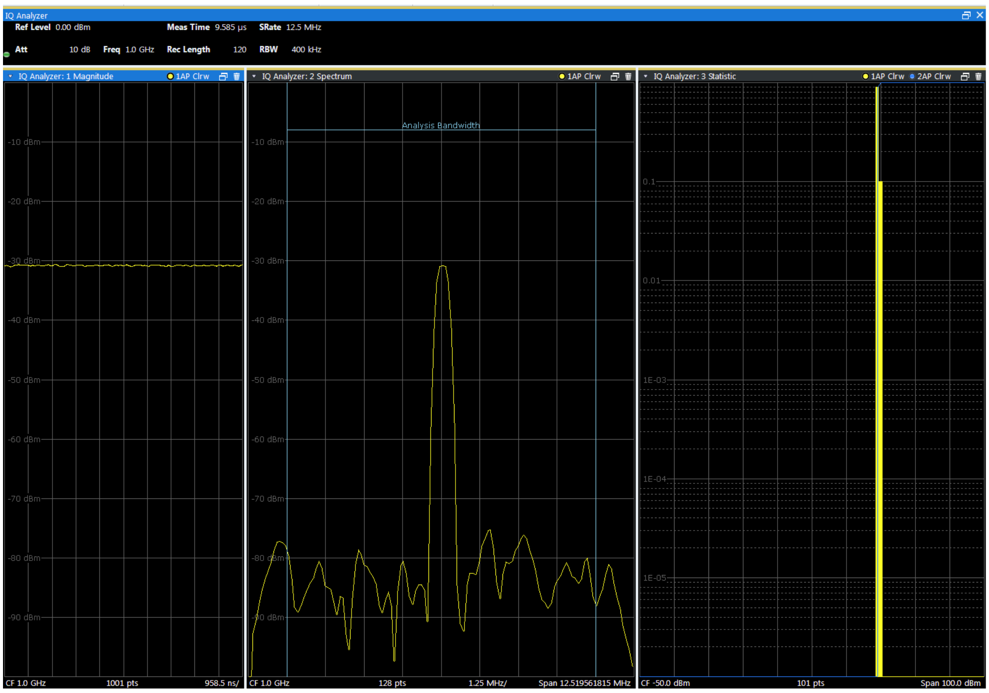
1. Select the "Add Window" icon from the toolbar.
2. Select the "Spectrum" result display.

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



3. Select the "Add Window" icon again and select the "Statistics" result display.

   A new window (3) for the "Statistics" result display is opened.



4.1.4 Rearranging Windows

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

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

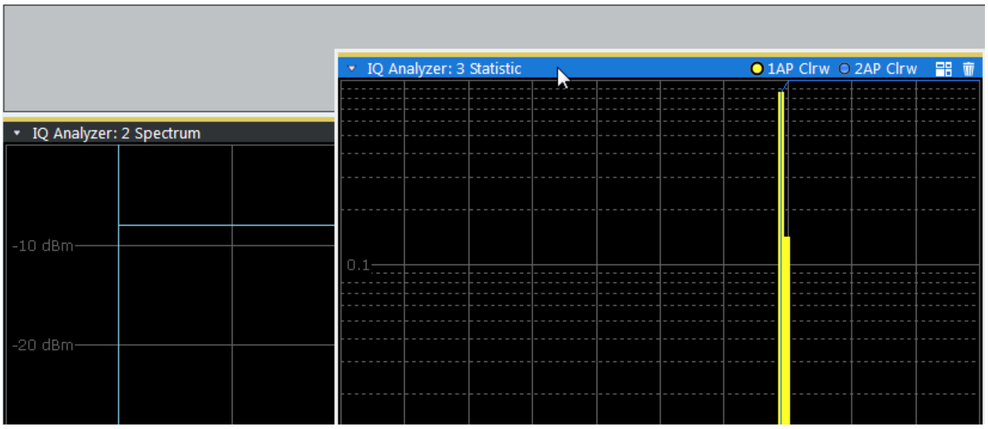


Fig. 4-1: Moving the Statistic window over the Spectrum window

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

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

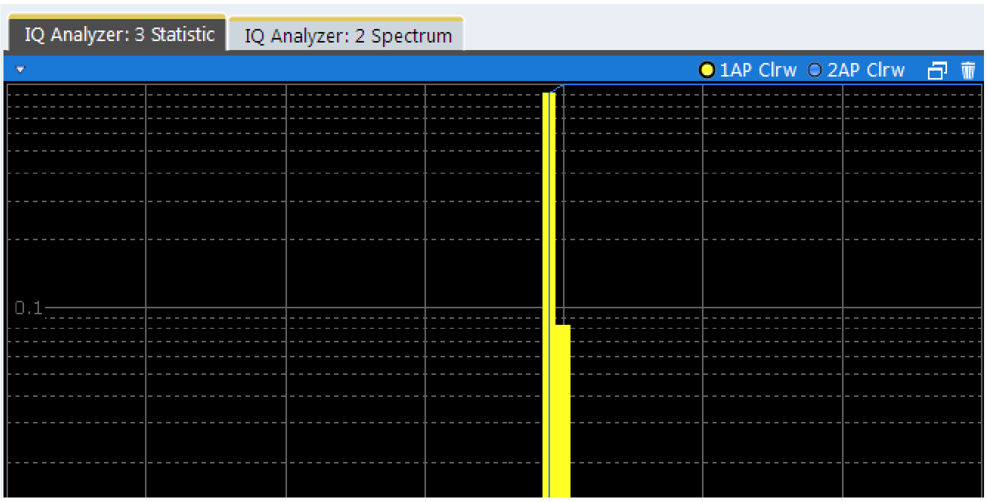


Fig. 4-2: Tabbed windows

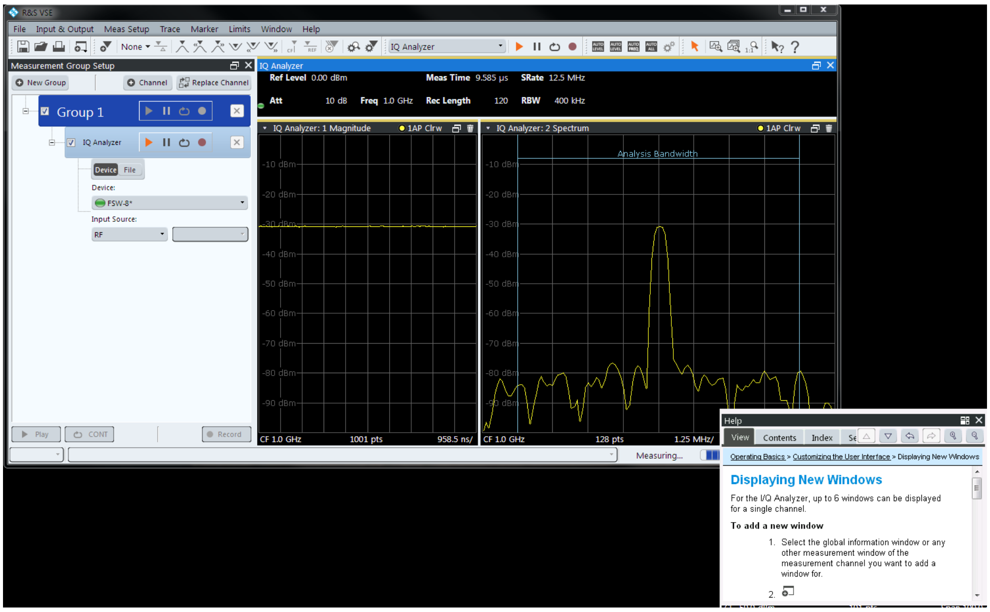
To switch between the two windows, simply select the corresponding tab.

4.1.5 Undocking and Resizing the Help Window

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

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

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



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

4.1.6 Adding Further Measurement Channels

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

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

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

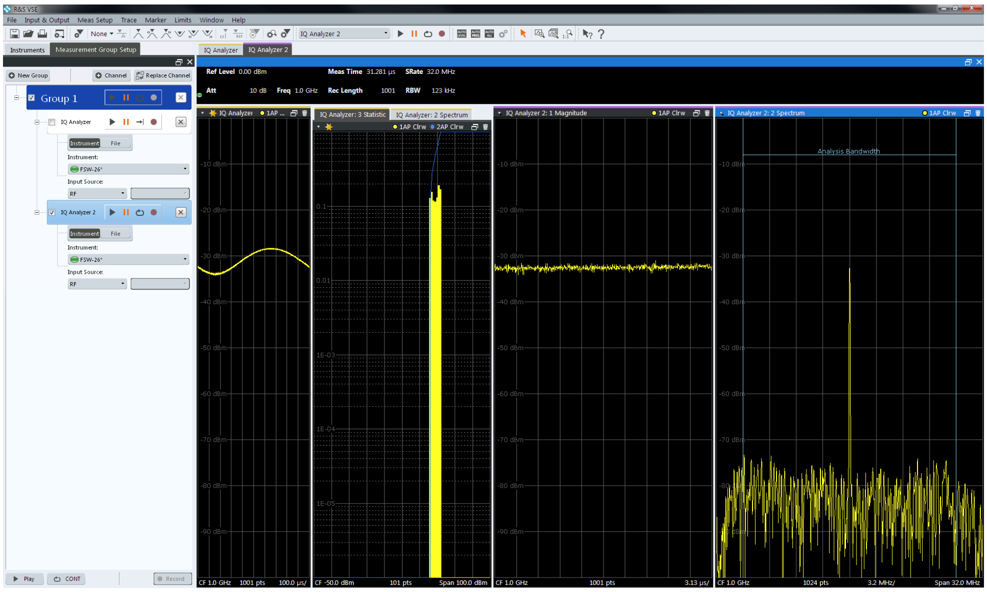
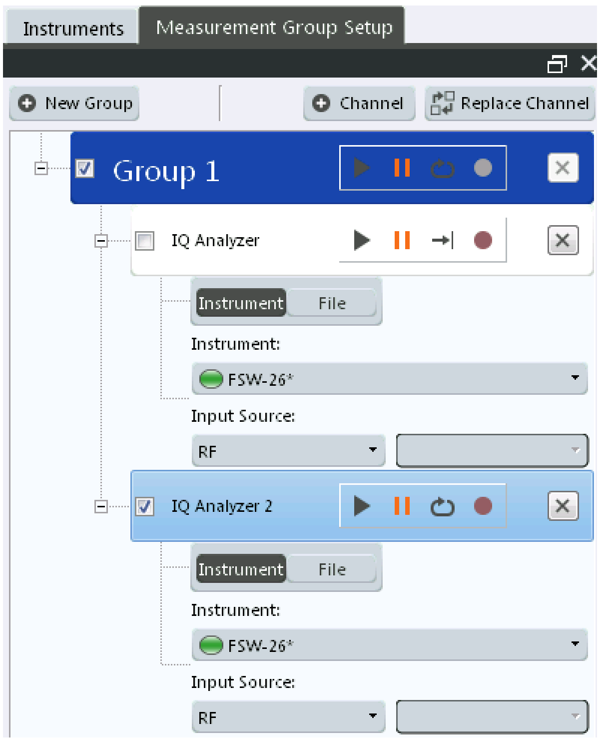


Fig. 4-3: Second IQ Analyzer measurement channel ("IQ Analyzer 2")

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



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

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

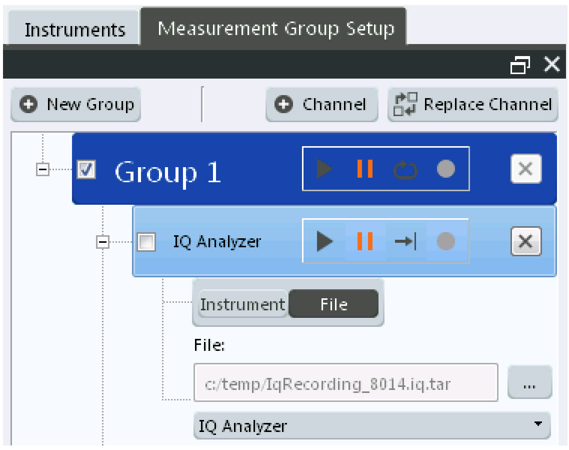
4.1.7 Recording Measurement Data

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

1. From the "File" menu, select "Preferences > Recording".
2. Select the "Always Maximum Record Length" option.
3. Close the "Preferences" dialog box.
4. Select the "Record" function for the "IQ Analyzer" channel in the "Measurement Group Setup" tool window.

   The captured I/Q data is recorded.
5. To stop recording measurement results, select the "Pause" function for the "IQ Analyzer" channel in the "Measurement Group Setup" tool window.

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



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

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

4.2 Analyzing Stored Data from a File

If no instrument is availabe in the network to provide input to the R&S VSE, you can also try out the software using an input file. Several input files are provided with the software for demonstration purposes. Check the `C:\ProgramData\Rohde-Schwarz\VSE\<version_number>\user\predefined` directory for an appropriate file.

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

4.2.1 How to Import I/Q Data for Analysis

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

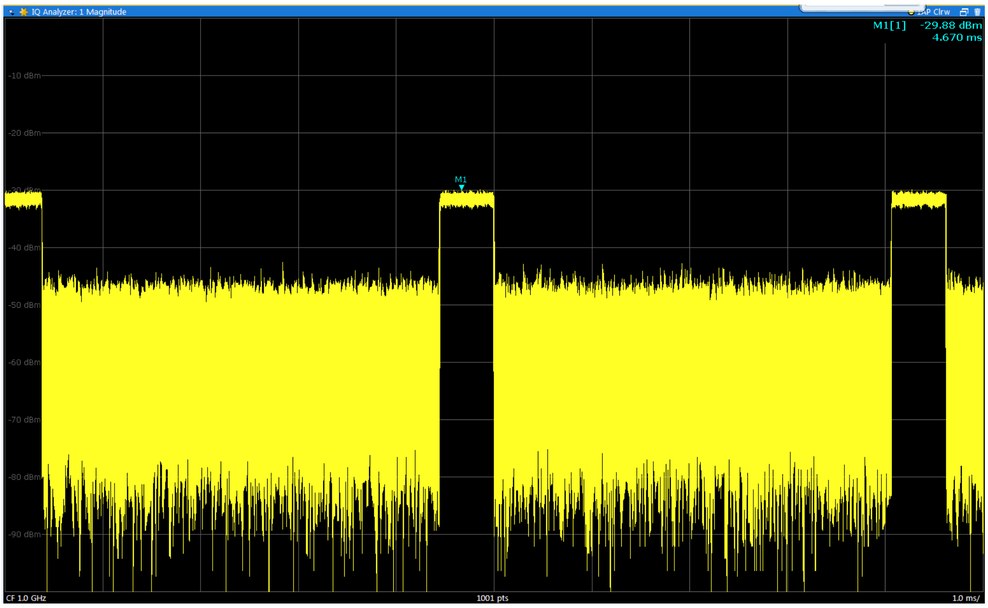
   The stored data is loaded from the file and evaluated in the "IQ Analyzer" result displays.

4.2.2 Setting and Moving a Marker

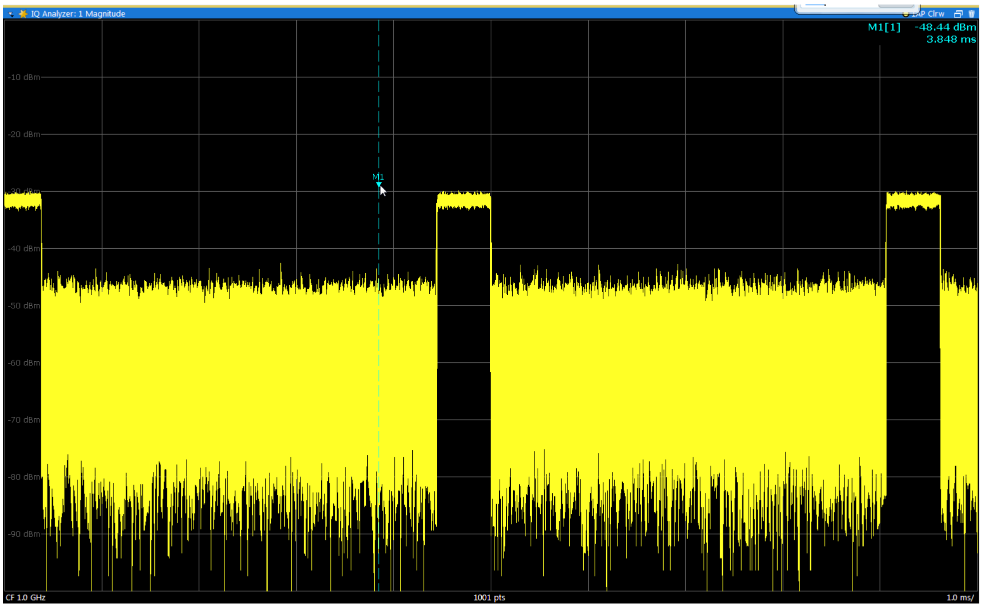
Markers are useful to determine the position of particular effects in the trace. The most common use is to determine a peak, which is the default setting when you activate a marker. We will set a marker on the peak in the Magnitude display of the IQ Analyzer measurement.

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

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



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



5 Measurements and Results

The R&S VSE provides several applications for different analysis tasks and different types of signals. The I/Q Analyzer application is included in the basic R&S VSE software. All other applications, such as Analog Demodulation or Vector Signal Analysis (VSA) are optional additions and require special licenses. (See also chapter 5.2, "Available Applications", on page 32.)

- Measurement Concept....27
- Available Applications....32
- Starting an Application....33

5.1 Measurement Concept

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

Basic measurement process

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

Measurement channels

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

The global information and results for each channel are displayed in separate windows (or tabs) on the screen. The results from multiple applications can be displayed at the same time, with display space being the only limiting factor. Each application may provide different result displays (see the applications' user manual for details). The measurement windows can be rearranged and configured in the R&S VSE to meet your requirements (see chapter 6.3, "Customizing the User Interface", on page 43).

The measurement channels are labeled with their default name. If that name already exists, a sequential number is added. However, the name of the measurement channel can be changed. For details and an overview of default names see `INSTrument:LIST?` on page 291.

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

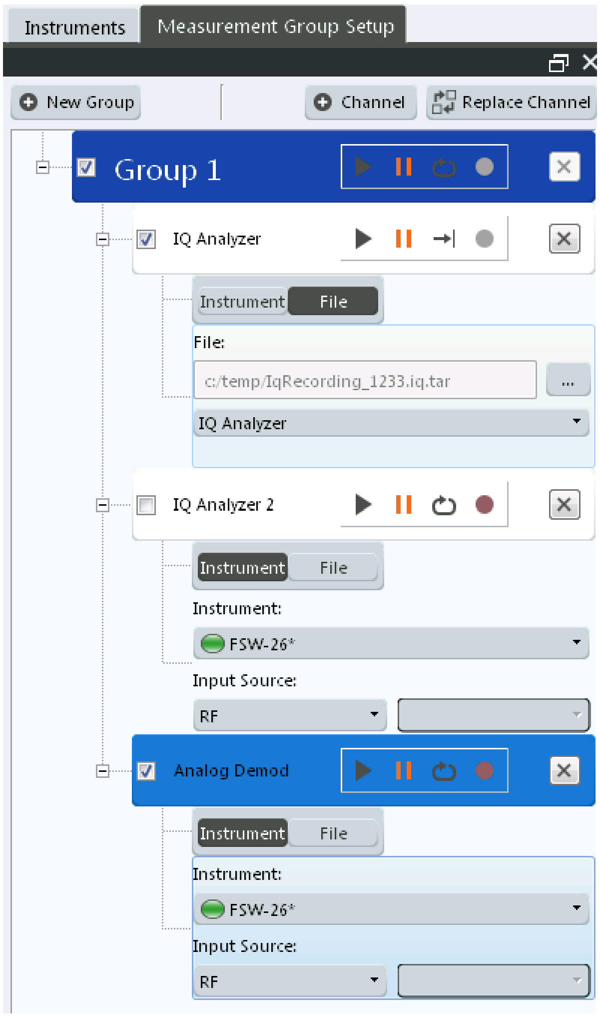


Fig. 5-1: "Measurement Group Setup" tool window

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

You can define any number of measurement channels at the same time (restricted only by memory resources). However, only one measurement channel can be started manually at any time. Before you can start another channel, you must stop the previous measurement channel first.

Measurement groups

As opposed to manual channel control, multiple measurements on *different* instruments or files can be performed in parallel if controlled by the software. All measurement channels that are to be started at the same time must be configured within a *group*. When the group is started, all included (active) measurement channels are started and provide results independently as soon as their measurements are completed.

Note, however, that the individual measurements are not synchronized in any way, and the results are totally independent as the input data is different for each channel.

Configure triggers to synchronize the individual measurements.

Multiple groups of measurement channels can be configured, for example to define individual test scenarios.

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

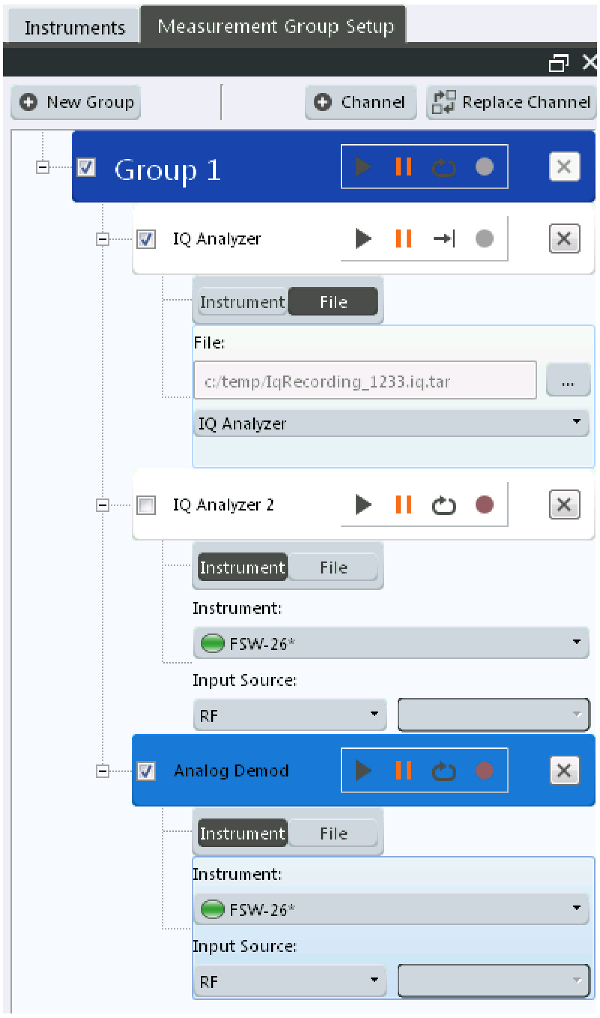


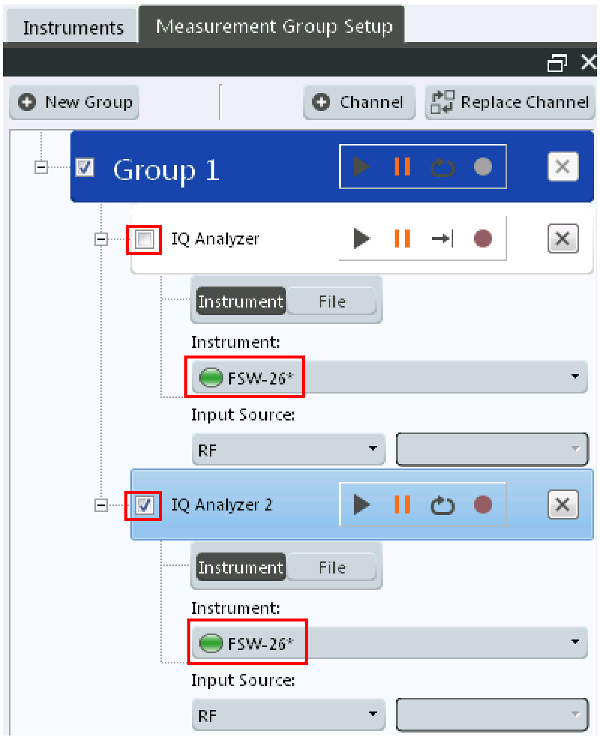
Fig. 5-2: Example for a measurement group

Active vs inactive channels

As mentioned above, only measurements on *different* instruments or on files can be performed in parallel. If the same instrument is assigned to multiple measurement channels of the same group, those channels cannot be processed simultaneously.

Thus, the channel to which the instrument was assigned previously is deactivated. Only active measurements are included in a group measurement.

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



Measurement groups and sequences

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

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

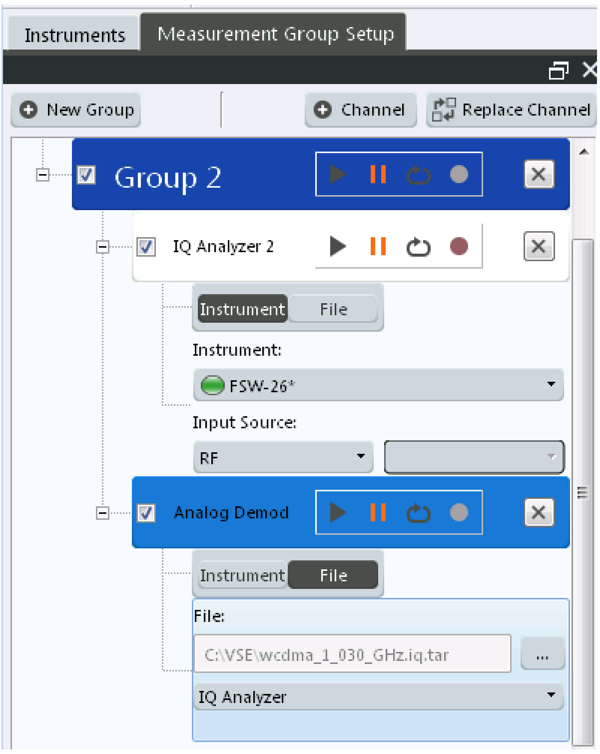


Fig. 5-3: Example for a measurement sequence

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

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

Measurement mode

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

Default measurement

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

5.2 Available Applications

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

I/Q Analyzer........ 32
Analog Demodulation........ 32
Vector Signal Analysis (VSA)........ 32
Pulse Measurements........ 32
3G FDD........ 33
GSM........ 33
WLAN........ 33
LTE........ 33

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

Remote command:
`INST:SEL IQ`, see `INSTrument[:SELect]` on page 292

Analog Demodulation
The Analog Demodulation application requires an additional license. This application provides measurement functions for demodulating AM, FM, or PM signals.

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

Remote command:
`INST:SEL ADEM`, see `INSTrument[:SELect]` on page 292

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

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

Remote command:
`INST:SEL DDEM`, see `INSTrument[:SELect]` on page 292

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

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

Remote command:
`INST:SEL PULSE`, see `INSTrument[:SELect]` on page 292

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

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

Remote command:
`INST:SEL BWCD`, see `INSTrument[:SELect]` on page 292

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

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

Remote command:
`INST:SEL GSM`, see `INSTrument[:SELect]` on page 292

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

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

Remote command:
`INST:SEL WLAN`, see `INSTrument[:SELect]` on page 292

LTE
The LTE application requires the LTE Measurements option R&S VSE-K100x, to be installed, and an additional license. This application provides LTE measurements.

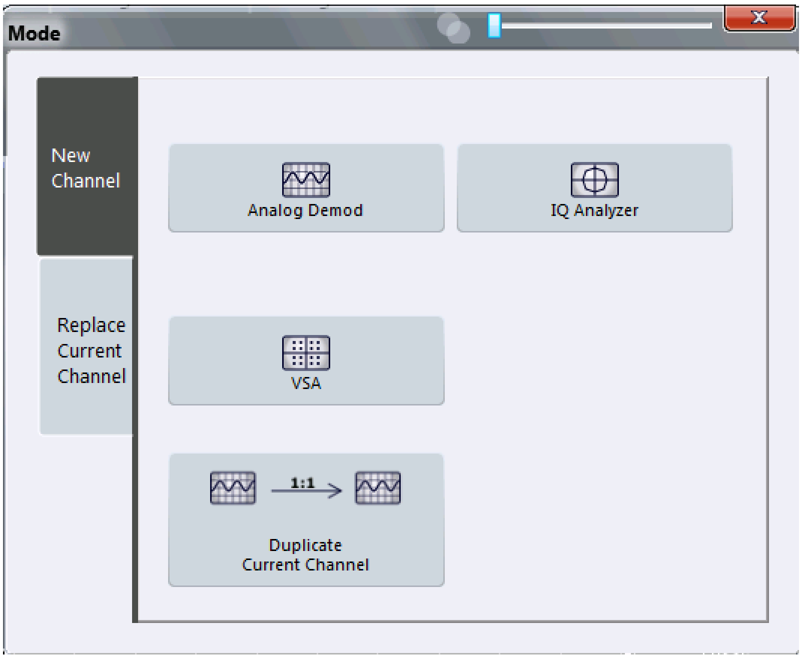
For details see the R&S VSE-K10x (LTE Downlink) User Manual.

Remote command:
`INST:SEL LTE`, see `INSTrument[:SELect]` on page 292

5.3 Starting an Application

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

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



2. Select the required application.

For more information on working with applications see chapter 7, "Controlling Instruments and Capturing I/Q Data", on page 52.

6 Operating Basics

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

- Graphical User Interface Elements..35
- Understanding the I/Q Analyzer Display Information..41
- Customizing the User Interface...43
- Getting Help...49

6.1 Graphical User Interface Elements

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

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

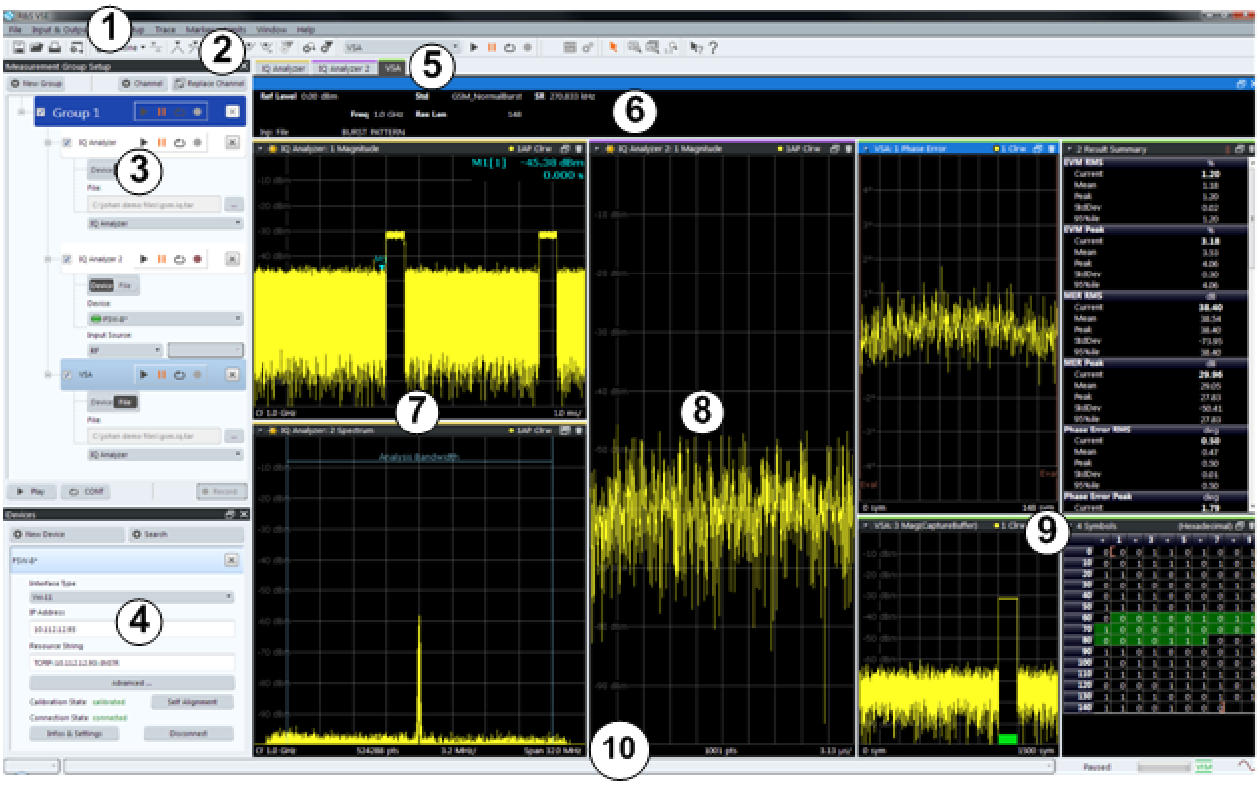


Fig. 6-1: Graphical user interface elements

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

6.1.1 Menus

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

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

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

These functions are described in this manual. An overview is provided in chapter A.1, "Menu Reference", on page 449.

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

- Input
- Measurement Setup
- Trace
- Marker
- Limits

These menu functions are described in the individual application's User Manual and in chapter 10, "I/Q Analyzer Measurements", on page 112.

6.1.2 Toolbars

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

The toolbars can be docked anywhere alongside the outer edge of the R&S VSE window, that is, beneath the menu bar, above the status bar, or on the left or right edges of the window. For details see chapter 6.3, "Customizing the User Interface", on page 43.

For information on how to hide or display individual toolbars see chapter 6.3.4, "Closing and Deactivating Windows and Bars", on page 48.

Note that some icons are only available for specific applications. Those functions are described in the individual application's User Manual.

An overview of all available toolbar functions is provided in chapter A.2, "Reference of Toolbar Functions", on page 454.

6.1.3 Status Bar

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

Hiding the status bar

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

See chapter 9.2.1, "Displayed Items", on page 102.

Software status

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

The following VISA status icons may be displayed:

Table 6-1: VISA status icons

	VISA installation is available; network connections to other instruments are possible
	VISA installation is available, but a firewall may be prohibiting a connection to other instruments in the network. Try one of the following to resolve the problem: ● Check the IP addresses of the instruments configured in the "Instruments" window and make sure you are allowed to connect to those instruments. ● Try using HiSLIP protocol instead of VSI-11 ● Ask your local administrator to loosen the firewall restrictions on your PC. ● Restart the instrument you want to connect to.
	VISA installation is not complete or available; network connections to other instruments are not possible. See "Installing VISA" on page 12 or contact the Rohde & Schwarz Support Center (see chapter 14.3, "Obtaining Technical Support", on page 447).

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

Instrument status

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

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

Progress

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

Error messages

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

6.1.4 Windows

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

- **Tool windows**: provide functionality for specific global tasks, such as configuring instruments or measurement groups; see chapter 7, "Controlling Instruments and Capturing I/Q Data", on page 52
- **Channel bar**: provides information on measurement channel settings (one window per active channel)
- **Result displays**: provide the measurement results

The layout of the individual windows is customizable and highly flexible, see chapter 6.3, "Customizing the User Interface", on page 43.

- Channel bar..38
- Result Displays / Measurement Windows..39

6.1.4.1 Channel bar

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

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

In the default configuration, the channel bars for multiple channels are displayed in separate tabs in the same window. Depending on which result display is currently active, the corresponding channel information tab is displayed. However, you can separate the tabs into individual windows. See chapter 6.3, "Customizing the User Interface", on page 43.

Channel-specific settings

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

Instrument settings

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

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

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

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

6.1.4.2 Result Displays / Measurement Windows

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

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

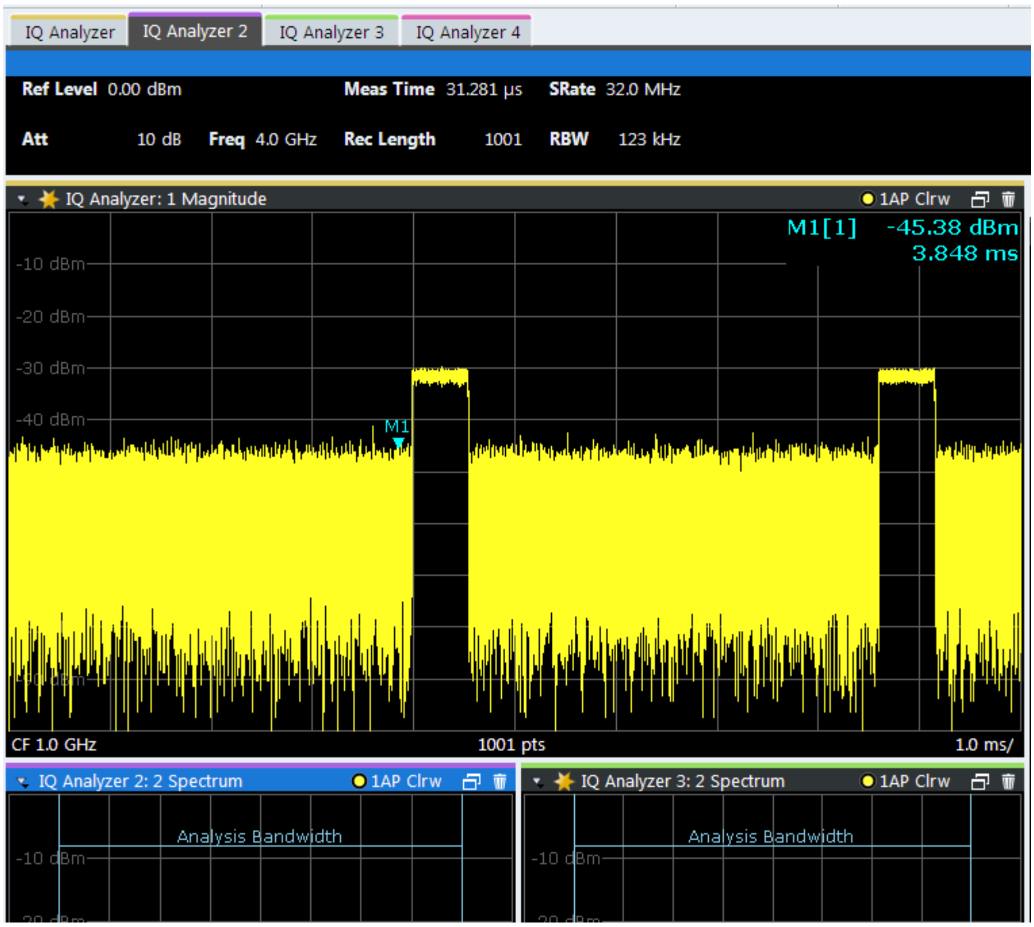


Fig. 6-3: Color-coded windows

Window title bar

The contents of the individual result displays are described in detail in the applications' user manuals.

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

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

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

/	Dock / Undock window	Docks the window to the main R&S VSE window or separates it from the main window. See "Docked and undocked windows" on page 43
	Delete window	Closes the selected window

6.2 Understanding the I/Q Analyzer Display Information

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

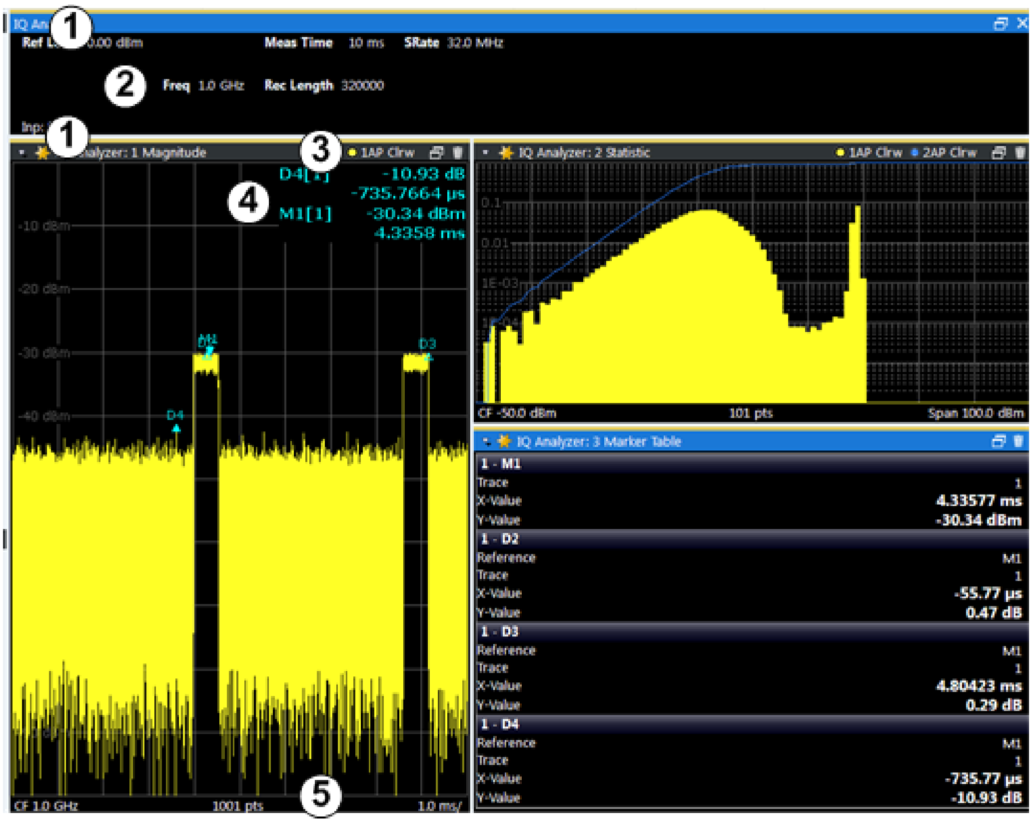


Fig. 6-4: Screen elements in the I/Q Analyzer application

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

Channel bar

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

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

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

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

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

Ref Level	Reference level
(m.+el.)**Att**	(Mechanical and electronic) RF attenuation
Ref Offset	Reference level offset
Freq	Center frequency
Meas Time	Measurement time
Rec Length	Defined record length (number of samples to capture)
SRate	Defined sample rate for data acquisition
RBW	(Spectrum evaluation only) Resolution bandwidth calculated from the sample rate and record length

Window title bar information

For each diagram, the header provides the following information:

Fig. 6-5: Window title bar information in the I/Q Analyzer application

0 = Color coding for windows of same channel
1 = Edit result display function
2 = Invalid data flag
3 = Channel name
4 = Window number
5 = Window type
6 = Trace color, trace number, detector type, trade mode
7 = Dock/undock window function
8 = Close window function

Diagram footer information

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

Magnitude and Spectrum diagrams:

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

I/Q Vector diagram:

- Maximum value on y-axis

6.3 Customizing the User Interface

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

- Windows Concept..43
- Displaying New Windows...46
- Rearranging Windows...47
- Closing and Deactivating Windows and Bars..48

6.3.1 Windows Concept

Docked and undocked windows

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

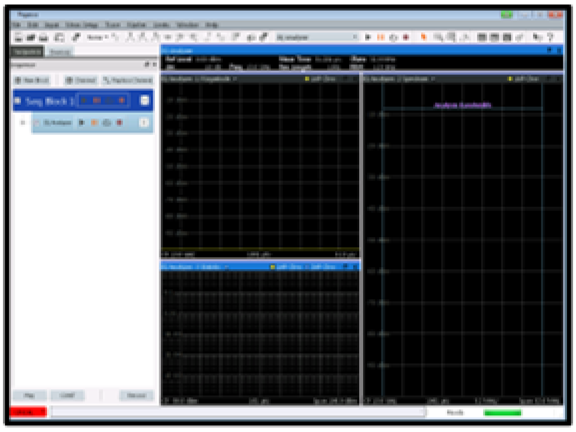


Fig. 6-6: Example for docked windows in the R&S VSE window

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

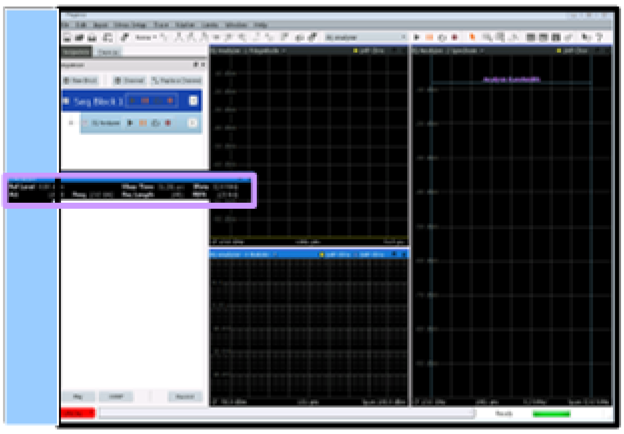


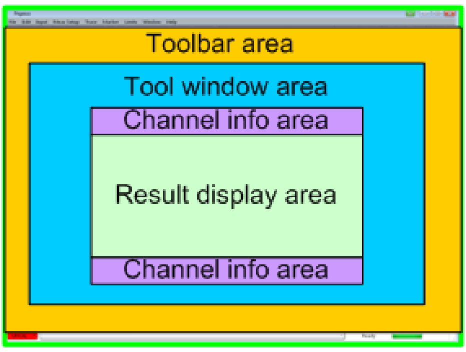
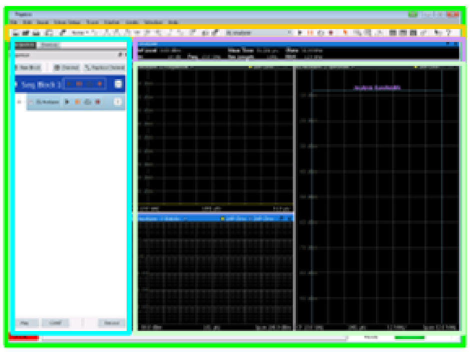
Fig. 6-7: Example for undocked window in the R&S VSE window

Docking areas for interface elements

The windows and other interface elements can be docked within predefined areas in the R&S VSE window. (For details on the window types see chapter 6.1.4, "Windows", on page 38.)

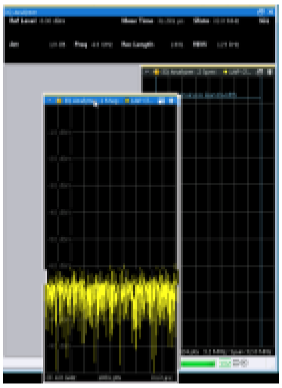
- The **menu bar and status bar** are fixed elements and are always located at the top and bottom edge of the window, respectively. No windows can be docked above the menu bar or below the status bar.
- **Toolbars** can only be placed along the outer edges of the R&S VSE window, below the menu bar and above the status bar.
- **Tool windows** can only be placed along the outer edges of the R&S VSE window, below the menu bar and above the status bar, and not outside of any toolbars.
- **Channel bars** can be placed above or below the result displays, at the top or bottom edges of the R&S VSE window, but not outside of any tool windows or toolbars.
- **Result displays** are surrounded by all other window types and bars. They must be placed within a grid structure of columns and rows. The number of result displays in each column or row is restricted only by the available display space and the minimum window size of the individual windows.

Table 6-5: Docking areas in the R&S VSE window

Docking positions

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



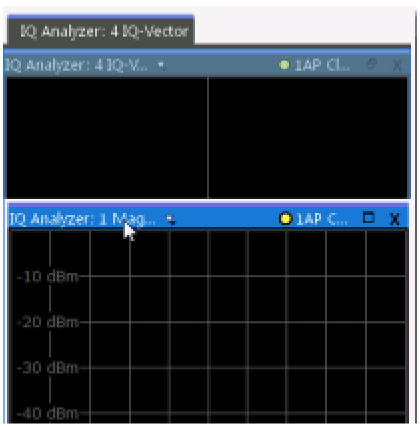
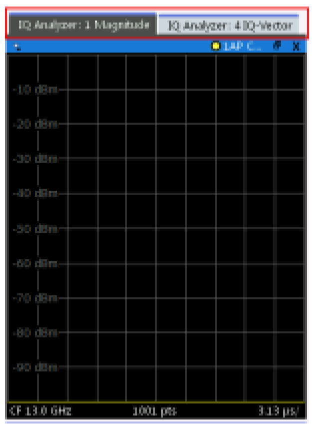
Window tabs

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

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

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

Table 6-6: Docking windows as tabs

	
Possible docking position: tab in existing window	Result: new tab in existing window

Window size

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

Note that since result displays are placed within a grid structure (see "Docking areas for interface elements" on page 44), the minimum width of a window may also be restricted by other result displays in the same column and the minimum height may be restricted by other result displays in the same row.

Active windows, selected window

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

As soon as you select a window, for example by clicking the mouse in it, any window-specific operations you perform subsequently are applied to that window. For example, you can set a marker or zoom in into the display of the window. Furthermore, when you select a window, you also select the channel the selected window belongs to. The channel bar (see chapter 6.1.4.1, "Channel bar", on page 38) for the selected channel is activated, and any channel-specific operations are applied to the selected channel.

Closing vs deactivating windows

If a large number of channels or result displays are active, the display may become very crowded and confusing. Thus, if you do not require the online visualization of the results, you can *temporarily deactivate* windows in the display. Deactivating a window simply hides the display, without losing its settings or contents. A deactivated window can easily be restored to the display without having to reconfigure it.

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

6.3.2 Displaying New Windows

For the I/Q Analyzer, up to 6 windows can be displayed for a single channel.

To add a new window

1. Select the global information window or any other measurement window of the measurement channel you want to add a window for.
2. 

   Select the "Add Window" icon or
   From the "Window" menu, select "New Window".
3. Select the result display you want to add a window for.
   The available result display types depend on the selected application.

For other applications, see the application-specific documentation.

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

To replace the contents of a measurement window

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

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

Remote commands:

`LAYout:GLOBal:ADD[:WINDow]?` on page 299

`LAYout:GLOBal:REPLace[:WINDow]` on page 305

6.3.3 Rearranging Windows

To dock or undock a window

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

   If the window was docked, it is detached and can be moved and resized independantly of the R&S VSE window.
   If the window was undocked, it is docked to its default position in the R&S VSE window.

(For details see "Docked and undocked windows" on page 43.)

To change the position of a window or bar

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

   When you drop the window or bar, it is docked to the selected position.
   If you drop the window on top of an existing window of the same type, the moved window is added as a tab.
   To switch between displayed windows, simply select the corresponding tab.

To resize a window

► To resize a window, select the window frame and drag it to the required size. Note the restrictions concerning the minimum window size described in "Window size" on page 46.

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

6.3.4 Closing and Deactivating Windows and Bars

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

(For details see "Closing vs deactivating windows" on page 46).

To hide or display a toolbar

1. Right-click any toolbar or the menu bar.

   A context menu with a list of all available toolbars is displayed.

2. Select the toolbar you want to hide or display.

   A checkmark indicates that the toolbar is currently displayed.

   The toolbar is toggled on or off.

To deactivate or reactivate a tool window or channel bar

► From the "Window" menu, select the tool window or channel bar.

   The window is toggled on or off.

To deactivate or reactivate a result display

1. From the "Window" menu, select "Active Windows".
   Alternatively, right-click the window title bar of a result display that belongs to the same channel.

2. Select the result display you want to deactivate or reactivate.

   A checkmark indicates that the window is currently active.

   The window is toggled on or off.

To close a result display

►

   Select the "Delete" icon in the window title bar.

   The result display is permanently removed.

Remote command:

`LAYout:GLOBal:REMove[:WINDow]` on page 305

6.4 Getting Help

If any questions or problems concerning the R&S VSE arise, an extensive online help system is provided in the software and can be consulted at any time. The help system is context-sensitive and provides information specifically for the current operation or setting to be performed. In addition, general topics provide an overview on complete tasks or function groups as well as background information.

6.4.1 Calling Up Help

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

Calling context-sensitive help

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

?

The "Help" dialog box "View" tab is displayed. A topic containing information about the focused screen element is displayed.
If no context-specific help topic is available, a more general topic or the "Contents" tab is displayed.

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

► To display a help topic for a screen element not currently focused:

a) Select the "Help pointer" icon on the toolbar.

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

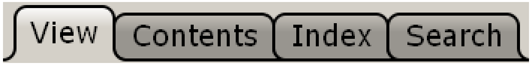
b) Select the screen element to change the focus.

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

6.4.2 Using the Help Window

The Help window contains several tabs:

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



The Help toolbar provides some buttons:

- To browse the topics in the order of the table of contents: Up arrow = previous topic, Down arrow = next topic
- To browse the topics visited before: Left arrow = back, Right arrow = forward
- To increase or decrease the font

To search for a topic in the index

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

1. Switch to the "Index" tab.
2. Select the "Keyboard" icon besides the entry field.
3. Enter the first characters of the keyword you are interested in.

   The entries containing these characters are displayed.
4. Double-click the suitable index entry.

   The "View" tab with the corresponding help topic is displayed.

To search topics for a text string

1. Switch to the "Search" tab.
2. Select the "Keyboard" icon besides the entry field.
3. Enter the string you want to find.
   If you enter several strings with blanks between, topics containing all words are found (same as AND operator).

   For advanced search, consider the following:
   - To find a defined string of several words, enclose it in quotation marks. For example, a search for *"trigger qualification"* finds all topics with exactly *"trigger qualification"*. A search for *trigger qualification* finds all topics that contain the words *trigger* and *qualification*.
   - Use "Match whole word" and "Match case" to refine the search.
   - Use operators AND, OR, and NOT.

To close the Help window

► Select the "Close" icon in the upper right corner of the help window.
Or:
Press the ESC key on the front panel.

7 Controlling Instruments and Capturing I/Q Data

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

- Input Sources..52
- Configuring Instruments..53
- Controlling Measurement Channels, Groups, and Sequences..........67

7.1 Input Sources

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

7.1.1 Connected Instrument

Any instruments that are to provide signals to the R&S VSE must be configured in the software. The R&S VSE then manages all connections to the other instruments. If the instrument configured for a particular measurement channel is changed, the R&S VSE software adapts the measurement settings, if necessary and possible. Thus, the measurement and analysis tasks performed using the R&S VSE software are mostly independent of the underlying instrument.

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

- R&S®FSW Signal and Spectrum Analyzers
- R&S®FSV Signal and Spectrum Analyzers
- R&S®FPS Signal and Spectrum Analyzers
- R&S®FSL Signal and Spectrum Analyzers

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

Input sources

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

- RF
  Captures and analyzes the data from the RF input of the spectrum analyzer in use.

7.1.2 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.

Currently, the following file formats are supported by the R&S VSE software to provide signal input:

- iq.tar (compressed data format)
- csv files
- mat (matlab) files
- iqw

For more information see also chapter 8.3.4, "Recalling Measurement Data from Files", on page 92.

7.2 Configuring Instruments

Access: "Window" > "Instruments"

The R&S VSE can capture and analyze data from various instruments. These instruments must be configured before measurements can be performed on them via the R&S VSE. Instruments are configured in the R&S VSE's "Instruments" tool window.

- Remote Control Interfaces and Protocols.. 53
- Defining the Connection Information Manually.. 56
- Determining the Address with Software Support... 58
- Searching for Connected Instruments Automatically... 61
- Deleting all Instrument Configurations.. 62
- Initializing a Self-Alignment on the instrument in use...63
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7.2.1 Remote Control Interfaces and Protocols

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

Table 7-1: Remote control interfaces and protocols

Interface	Protocols, VISA*) address string	Remarks

Local Area Network (LAN)	• **HiSLIP** High-Speed LAN Instrument Protocol (IVI-6.1)
	`TCPIP::host address::hislip0[::INSTR]`
	• **VXI-11**
	`TCPIP::host address::inst0[::INSTR]`
	Library: VISA
		The interface is based on TCP/IP and supports various protocols.
		For a description of the protocols refer to:
		VXI-11 Protocol
		HiSLIP Protocol

*) VISA is a standardized software interface library providing input and output functions to communicate with instruments. A VISA installation on the controller is a prerequisite for remote control using the indicated interfaces. (See also "VISA library" on page 54).		

7.2.1.1 LAN Interface

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

VISA library

VISA is a standardized software interface library providing input and output functions to communicate with instruments. The I/O channel is selected at initialization time by means of the channel-specific address string ("VISA resource string") indicated in table 7-1, or by an appropriately defined VISA alias (short name).

A VISA installation is a prerequisite for remote control using the LAN interface.

IP address

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

The VISA resource string has the form:

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

where:

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

Example:

- Instrument has the IP address *192.1.2.3*; the valid resource string using VXI-11 protocol is:
  `TCPIP::192.1.2.3::INSTR`
- The DNS host name is *VSE-123456*; the valid resource string using HiSLIP is:
  `TCPIP::VSE-123456::hislip0`

Identifying instruments in a network

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

For details on configuring the LAN connection, see chapter 12.3, "How to Set Up a Network and Remote Control", on page 253.

- VXI-11 Protocol.....55
- HiSLIP Protocol.....55

VXI-11 Protocol

The VXI-11 standard is based on the ONC RPC (Open Network Computing Remote Procedure Call) protocol which in turn relies on TCP/IP as the network/transport layer. The TCP/IP network protocol and the associated network services are preconfigured. TCP/IP ensures connection-oriented communication, where the order of the exchanged messages is adhered to and interrupted links are identified. With this protocol, messages cannot be lost.

HiSLIP Protocol

The HiSLIP (**Hi**gh **S**peed **L**AN **I**nstrument **P**rotocol) is the successor protocol for VXI-11 for TCP-based instruments specified by the IVI foundation. The protocol uses two TCP sockets for a single connection - one for fast data transfer, the other for non-sequential control commands (e.g. `Device Clear` or `SRQ`).

HiSLIP has the following characteristics:

- High performance as with raw socket network connections
- Compatible IEEE 488.2 support for Message Exchange Protocol, Device Clear, Serial Poll, Remote/Local, Trigger, and Service Request
- Uses a single IANA registered port (4880), which simplifies the configuration of firewalls
- Supports simultaneous access of multiple users by providing versatile locking mechanisms
- Usable for IPv6 or IPv4 networks

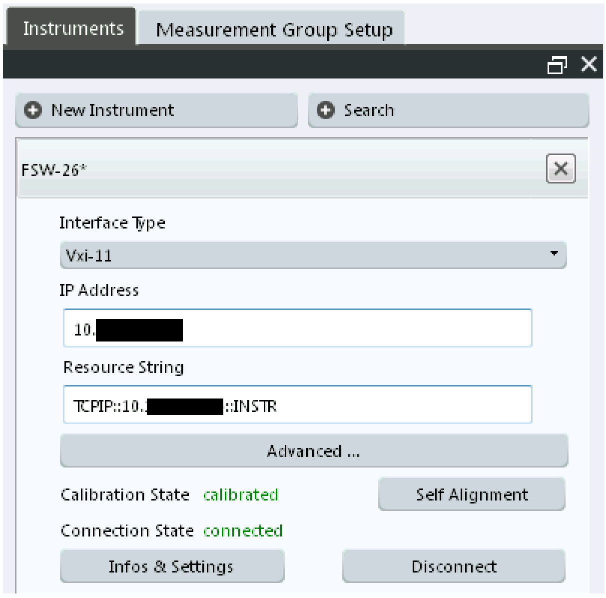
Note that HiSLIP data is sent to the device using the "fire and forget" method with immediate return, as opposed to VXI-11, where each operation is blocked until a VXI-11 device handshake returns. Thus, a successful return of a VISA operation such as `viWrite()` does not guarantee that the instrument has finished or started the requested command, but is delivered to the TCP/IP buffers.

For more information see also the application note: 1MA208: Fast Remote Instrument Control with HiSLIP.

7.2.2 Defining the Connection Information Manually

Access: "Window" > "Instruments" > Setup

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



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Connection State......58
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New Instrument
Displays the configuration dialog for a new instrument. You can also configure instruments that are not connected to the PC running the R&S VSE software.

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

Remote command:
`DEVice:CREate` on page 265

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

(See chapter 7.2.4, "Searching for Connected Instruments Automatically", on page 61).

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

Remote command:
`DEVice:DELete` on page 265

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

For details on interfaces see chapter 7.2.1, "Remote Control Interfaces and Protocols", on page 53

"VXI-11"	Standard TCP/IP-based protocol
"HiSlip"	High performance protocol

Remote command:
`DEVice:TARGet:TYPE` on page 268

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

(To delete this list, select "File > Preset > Reset VSE Layout", see "Restoring User-Specific Settings (Reset VSE Layout)" on page 77.)

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

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

Remote command:
`DEVice:TARGet` on page 267
`DEVice:TARGet?` on page 267

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

(To delete this list, select "File > Preset > Reset VSE layout", see "Restoring User-Specific Settings (Reset VSE Layout)" on page 77.)

For details see chapter 7.2.1.1, "LAN Interface", on page 54.

Advanced Settings
Opens the "VISA Resource String Builder" which supports you in determining the required resource string, see chapter 7.2.3, "Determining the Address with Software Support", on page 58.

Calibration State / Self Alignment
Indicates whether the connected instrument is calibrated. If necessary, a self-alignment can be initiated on the connected instrument (see chapter 7.2.6, "Initializing a Self-Alignment on the instrument in use", on page 63).

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

Remote command:
`DEVice:STATe?` on page 266

Infos & Settings
Displays additional information on the connected instrument, if available. See chapter 7.2.9, "Obtaining Information on Versions and Options on the instrument in use", on page 66.

Remote command:
`DEVice:INFO:HWINfo?` on page 268
`DEVice:INFO:OPT?` on page 269
`DEVice:INFO:IDN?` on page 269

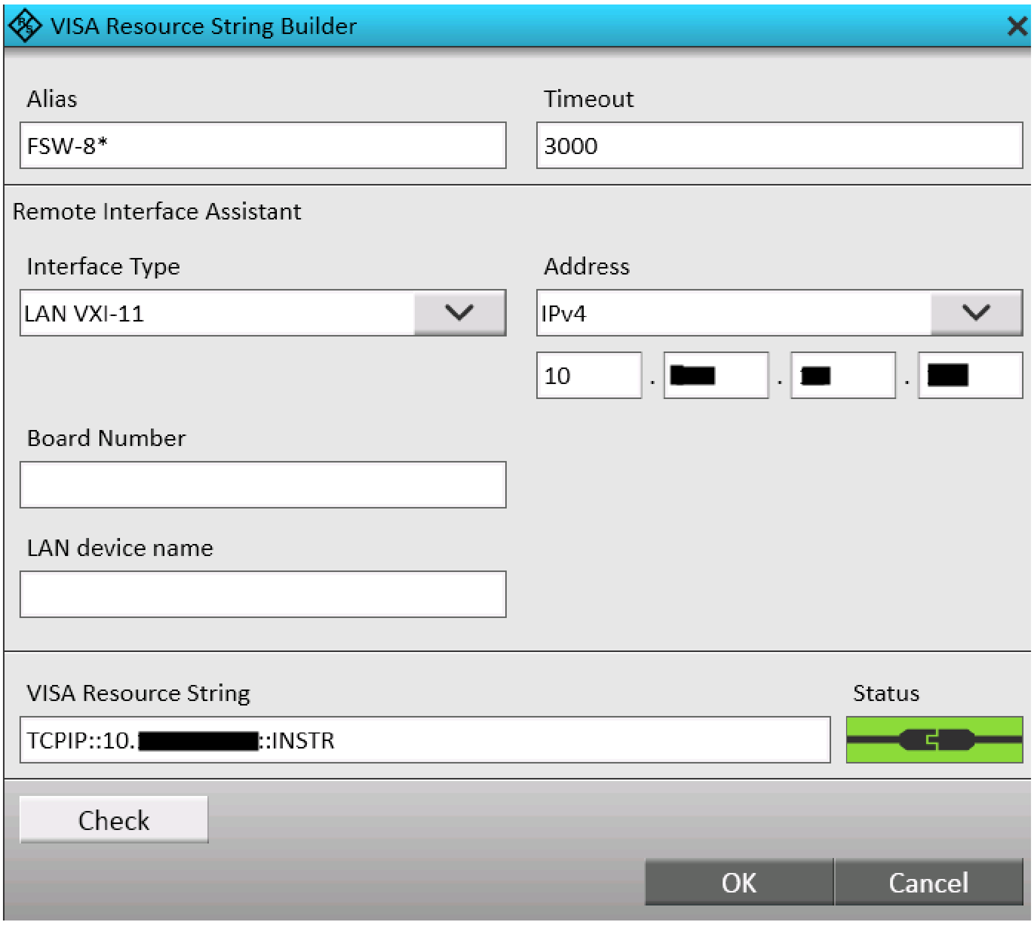
Connect / Disconnect
Establishes a connection to the specified instrument in the network, or disconnects an existing connection.

Remote command:
`DEVice:CREate` on page 265

7.2.3 Determining the Address with Software Support

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

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



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Address (format)....................60
IP address....................60
Host name....................60
Board Number....................60
LAN device name....................60
VISA Resource String....................60
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Alias
A logical name used to identify the instrument more easily in the network and connection settings in the R&S VSE software.

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

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

For details on interfaces see chapter 7.2.1, "Remote Control Interfaces and Protocols", on page 53

"VXI-11"	Standard TCP/IP-based protocol
"HiSlip"	High performance protocol

Remote command:
`DEVice:TARGet:TYPE` on page 268

Address (format)
Defines the format used to specify the instrument's network address

"IPv6"	Internet protocol version 6
"IPv4"	Internet protocol version 4
"Host name"	Computer name of the instrument instead of IP address

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

(To delete this list, select "File > Preset > Reset VSE Layout", see "Restoring User-Specific Settings (Reset VSE Layout)" on page 77.)

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

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

Remote command:
`DEVice:TARGet` on page 267
`DEVice:TARGet?` on page 267

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

Board Number
Unique board number of the connected instrument.

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

"inst0"	VXI-11 protocol
"hislip0"	HiSLIP protocol

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

For details see chapter 7.2.1.1, "LAN Interface", on page 54.

Status

Indicates the current state of the connection to the specified instrument in the network after a Check was performed.

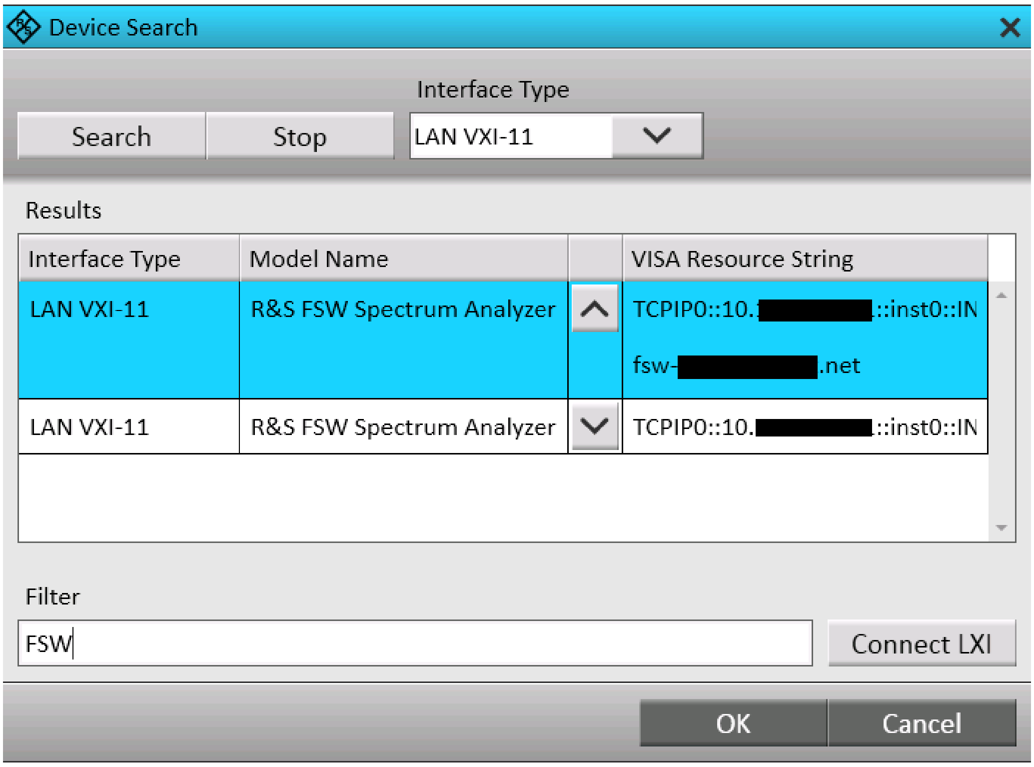
Check

Checks the connection state to the instrument specified by the VISA resource string. The result is indicated under Status.

7.2.4 Searching for Connected Instruments Automatically

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

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



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Search

Starts a network search for connected instruments using the specified Interface Type.

Note that this search may take a while. Results are only displayed when the search is completed.

Stop
Stops a search for connected instruments.

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

For details on interfaces see chapter 7.2.1, "Remote Control Interfaces and Protocols", on page 53

"VXI-11"	Standard TCP/IP-based protocol
"HiSlip"	High performance protocol

Remote command:
`DEVice:TARGet:TYPE` on page 268

Results
For each instrument detected in the network, the following information is provided:
- Interface Type
- Instrument model name
- VISA Resource String
  (The full information is displayed when you select the arrow button for a result entry.)

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

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

7.2.5 Deleting all Instrument Configurations

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

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

Instrument configurations are also deleted when you use the preset function "File" > "Preset" > "All & Delete Instruments", see "Restoring All Default Settings and Deleting Instrument Configurations (Preset All & Delete Instruments)" on page 76.

Remote command:

`DEVice:DELete:ALL` on page 266

7.2.6 Initializing a Self-Alignment on the instrument in use

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

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

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

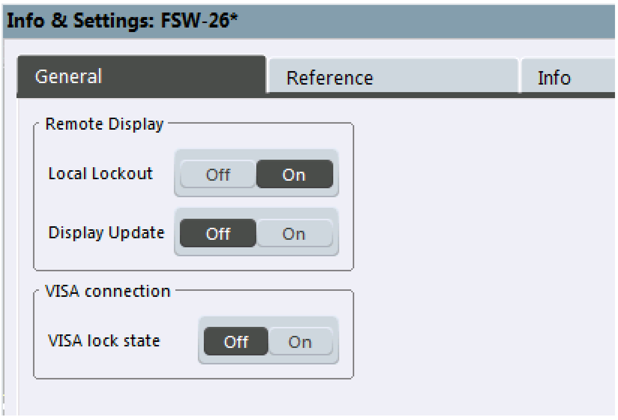
During instrument start, the installed hardware is checked against the current firmware version to ensure the hardware is supported. If not, self-alignment fails until the firmware version is updated.

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

7.2.7 Configuring the Behavior During Remote Control

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

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



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Local Lockout
If enabled, the instrument is set to be controlled remotely (that is, by the R&S VSE software) and the keys or graphical user interface are disabled.

See also chapter 12.1.7, "Locking Instruments for Exclusive Remote Control", on page 250.

Remote command:
`DEVice:GENeral:LLO` on page 270

Display Update
Defines whether the display of the instrument in use is updated while it is being controlled by the R&S VSE software.

Turning off the display update function improves performance.

Tip: you can also turn off the display update function for the R&S VSE software, see "Remote Display Update" on page 251.

Remote command:
`DEVice:GENeral:DISPlay` on page 270

VISA lock state
Locks or unlocks the VISA connection to the selected instrument. If the connection is locked, no other devices can operate the same instrument remotely. If no connection to the instrument has been established yet, any subsequent connection to it is locked immediately (see also chapter 12.1.7, "Locking Instruments for Exclusive Remote Control", on page 250).

Tip: you can change the default value for the VISA lock for subsequent connections in the user preferences, see "Lock new VISA connections" on page 252.

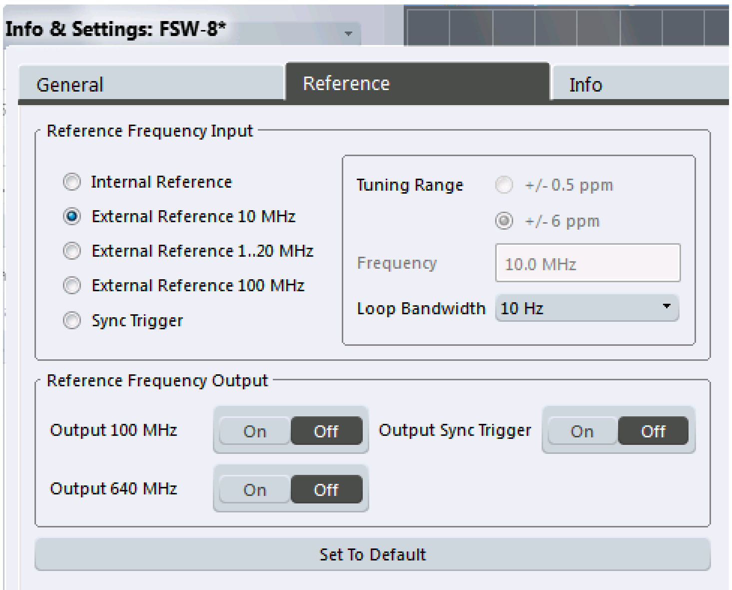
Remote command:
`DEVice:LOCKing` on page 271
`DEVice:LOCKing:ALL` on page 272

7.2.8 Configuring a Frequency Reference for the Connected Instrument

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

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

External references must be connected to the instrument in use correctly. For details see the instrument's "Getting Started" manual.



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

Reference Frequency Input Source..65
Tuning Range..65
Frequency..65
Loop Bandwidth..66
Reference Frequency Output..66
Resetting the Default Values..66

Reference Frequency Input Source

Various sources are available to provide a reference frequency to the instrument in use, depending on the type of instrument. The available reference parameters also depend on the instrument type. For details see the instrument's User Manual.

Remote command:

`DEVice:EXTRef:SOURce` on page 274

Tuning Range

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

For more information see the instrument's User Manual.

Remote command:

`DEVice:EXTRef:TRANge` on page 275

Frequency

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

For more information see the instrument's User Manual.

Remote command:

`DEVice:EXTRef:FREQuency` on page 272

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

For more information see the instrument's User Manual.

Remote command:
`DEVice:EXTRef:LBWidth` on page 273

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

For more information see the instrument's User Manual.

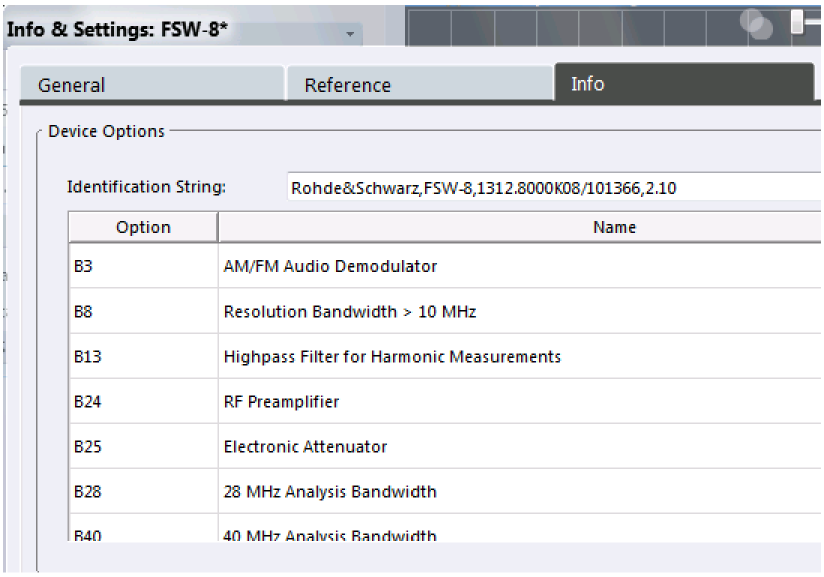
Remote command:
`DEVice:EXTRef:O100` on page 273
`DEVice:EXTRef:O640` on page 274
`DEVice:EXTRef:OSYNc` on page 274

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

7.2.9 Obtaining Information on Versions and Options on the instrument in use

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

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



Identification String.....67
Options.....67

Identification String

Indicates the instrument identification for the selected instrument.

The syntax is:

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

Remote command:

`DEVice:INFO:IDN?` on page 269

Options

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

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

Remote command:

`DEVice:INFO:HWINfo?` on page 268
`DEVice:INFO:OPT?` on page 269

7.3 Controlling Measurement Channels, Groups, and Sequences

Access: "Window" > "Measurement Group Setup"

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

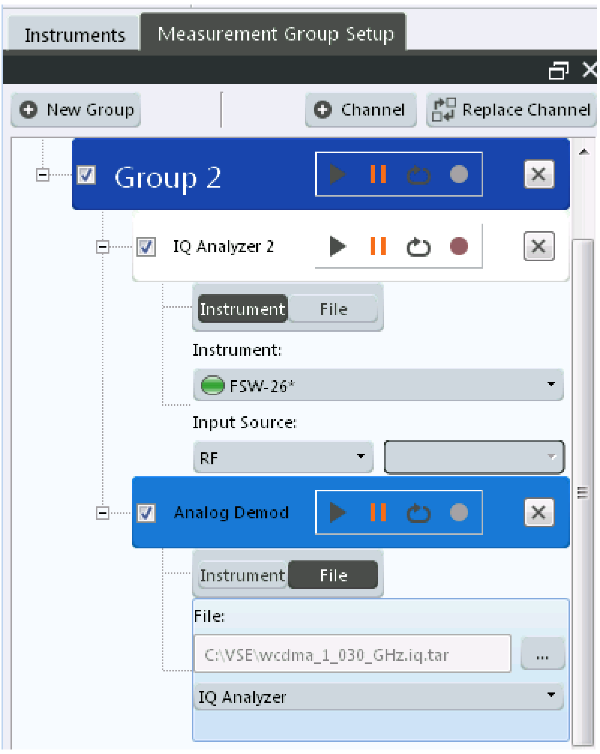
- Sequence Functions.....68
- Group Functions.....69
- Channel Functions.....71

7.3.1 Sequence Functions

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

Measurement sequences consist of a number of measurement groups, and each group may contain multiple channels.

For details see "Measurement groups and sequences" on page 30.



Play......68
Stop......68
Measurement mode (Single / Continuous)......69
Record......69

Play

"Play" starts a new measurement sequence according to the "Measurement mode (Single / Continuous)" on page 69.

Remote command:
`INITiate:SEQuencer:IMMediate` on page 298

Stop

Stops a running measurement sequence.

Remote command:
`INITiate:SEQuencer:ABORt` on page 297

Measurement mode (Single / Continuous)
Defines the measurement mode for the entire measurement sequence and all measurement groups and channels it contains.

For details see "Measurement mode" on page 31.

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

"Continuous" Each measurement group is started one after the other in the order of definition. All measurement channels in a group are started simultaneously and performed once. After *all* measurements are completed, the next group is started. After the last group, the measurement sequence restarts with the first one and continues until it is stopped explicitely (see "Play" on page 68).

Remote command:
`INITiate:SEQuencer:MODE` on page 298

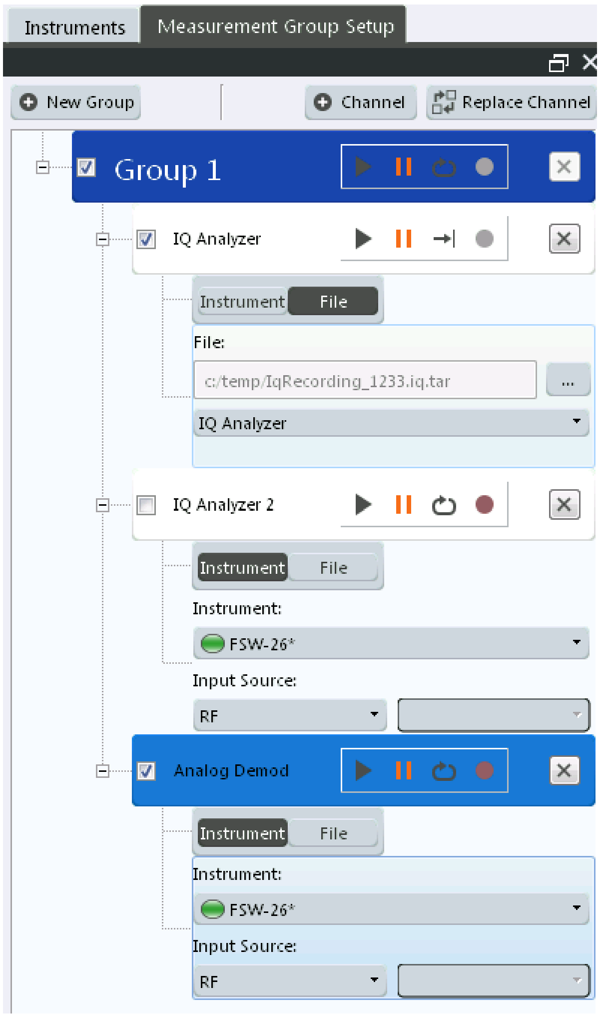
Record
Currently not available.

7.3.2 Group Functions

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

Multiple groups of measurement channels can be configured, for example to group measurements for a specific test scenario.

For details see "Measurement groups" on page 28.



Activate/Deactivate Group........70
New Group........70
Capture........71
Pause / Cont........71
Measurement mode (Single / Continuous)........71
Record........71
Close........71

Activate/Deactivate Group

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

Remote command:

`INSTrument:BLOCk:USE` on page 297

New Group

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

Remote command:

`INSTrument:BLOCk:CREate[:NEW]` on page 295

Capture

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

Remote command:
`INITiate:BLOCk:IMMediate` on page 294

Pause / Cont

"Pause" stops a running measurement on the group.

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

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

Remote command:
`INITiate:BLOCk:ABORt` on page 293
`INITiate:BLOCk:CONMeas` on page 293

Measurement mode (Single / Continuous)

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

For details see "Measurement mode" on page 31.

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

Remote command:
`INITiate:BLOCk:CONTinuous` on page 293

Record

Currently not available.

Close

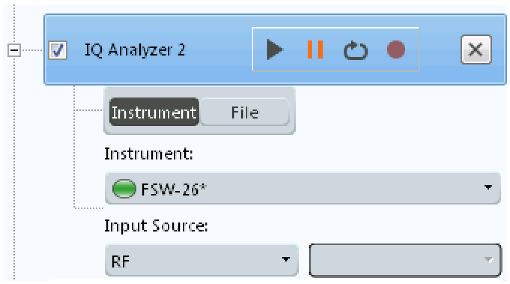
Removes the group and closes all measurement channels and windows it included.

Remote command:
`INSTrument:BLOCk:DELete` on page 296

7.3.3 Channel Functions

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

For details see "Measurement channels" on page 27.



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Assigning the Channel Input Source....................72
└ Input Type....................72
└ Instrument....................73
└ Input Source....................73
└ File....................73
Channel New Channel....................73
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Replace Current Channel....................73
Capture....................74
Pause / Cont....................74
Measurement mode (Single / Continuous)....................74
Record....................74
New Measurement Window....................74
Close....................75
Select Channel....................75

Activate/Deactivate Channel

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

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

Remote command:

`INSTrument:BLOCk:CHANnel[:SETTings]:USE` on page 295

Assigning the Channel Input Source

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

Input Type ← Assigning the Channel Input Source

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

Remote command:

`INSTrument:BLOCk:CHANnel[:SETTings]:SOURce` on page 285

`INPut:SELect` on page 314

Instrument ← Assigning the Channel Input Source

Specifies a configured instrument to be used for input.

Remote command:

INSTrument:BLOCk:CHANnel[:SETTings]:DEVice<d> on page 284

Input Source ← Instrument ← Assigning the Channel Input Source

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

"RF" Radio Frequency ("RF INPUT" connector)

"Channel 1 | Channel 2 | Channel 3 | Channel 4 "

Oscilloscope input channel 1, 2, 3, or 4.

Remote command:

INSTrument:BLOCk:CHANnel[:SETTings]:SOURce:TYPE on page 285

File ← Assigning the Channel Input Source

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

Select a file from the list of recently loaded files, or select "..." to open the "Load I/Q File" dialog box (see chapter 8.3.4.1, "Loading the I/Q Data File and Essential Measurement Information", on page 92).

Remote command:

INSTrument:BLOCk:CHANnel[:SETTings]:FILE<i>[:IQTar] on page 283

INSTrument:BLOCk:CHANnel[:SETTings]:FILE<i>:CSV on page 277

INSTrument:BLOCk:CHANnel[:SETTings]:FILE<i>:IQW on page 278

INSTrument:BLOCk:CHANnel[:SETTings]:FILE<i>:MAT on page 279

New Channel

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

For a list of available applications see chapter 5.2, "Available Applications", on page 32

Remote command:

INSTrument:CREate[:NEW] on page 289

INSTrument[:SELect] on page 292

Duplicate Current Channel ← New Channel

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

Remote command:

INSTrument:CREate:DUPLicate on page 289

Replace Current Channel

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

For a list of available applications see chapter 5.2, "Available Applications", on page 32

Remote command:
`INSTrument:CREate:REPLace` on page 290

Capture

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

Remote command:
`INITiate<n>[:IMMediate]` on page 288

Pause / Cont

"Pause" stops a running measurement.

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

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

Remote command:
`ABORt` on page 286
`INITiate<n>:CONMeas` on page 287

Measurement mode (Single / Continuous)

Defines how data is captured during the measurement.

For details see "Measurement mode" on page 31.

"Single"	A single measurement is performed, that is: data is captured for the specified measurement time. For the "Input Source": "File", a single record is replayed. To replay subsequent records, continue the measurement using the ("Pause/Continue") function.
"Continuous"	A continuous measurement is performed, that is: data is captured continuously until the measurement is stopped manually using the the ("Pause/Continue") function. For the "Input Source": "File", the data from the I/Q file is replayed continuously until stopped.

Remote command:
`INITiate<n>:CONTinuous` on page 287

Record

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

For details see chapter 8.3.1, "Recording Measurement Data", on page 86.

Remote command:
`INSTrument:BLOCk:CHANnel[:SETTings]:RECord` on page 289

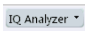
New Measurement Window

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

Close

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

Select Channel



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

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

Remote command:
`INSTrument[:SELect]` on page 292

8 Data Management

The captured data and measurement results from the R&S VSE can be stored to files. Furthermore, measurement and software settings can be stored.

- Restoring the Default Software Configuration (Preset)....................76
- Storing and Recalling Measurement Settings....................77
- Recording and Recalling Captured I/Q Data for Evaluation....................85
- Printing Current Measurement Results....................97

8.1 Restoring the Default Software Configuration (Preset)

Access: "File" > "Preset"

When delivered, the R&S VSE has a default configuration. You can restore this defined initial state at any time as a known starting point for measurements. This is often recommendable as a first step in troubleshooting when unusual measurement results arise.

Settings can be restored in different levels:

Restoring All Default Settings (Preset All)....................76
Restoring All Default Settings and Deleting Instrument Configurations (Preset All & Delete Instruments)....................76
Restoring Channel Settings (Preset Selected Channel)....................77
Restoring User-Specific Settings (Reset VSE Layout)....................77

Restoring All Default Settings (Preset All)

Restores the initial software state, that is: **all measurement sequences, groups and channels** are stopped and **all windows** are closed; the default group and I/Q Analyzer measurement channel are restored.

Settings concerning the layout of the R&S VSE window, for example the display and position of toolbars and special tool windows, remain unchanged.

Note:

The initial software state is also restored if you delete the shutdown file (see "Deleting the Shutdown File" on page 102).

Remote command:

`*RST` on page 263 or `SYSTem:PRESet` on page 388

Restoring All Default Settings and Deleting Instrument Configurations (Preset All & Delete Instruments)

Restores the initial software state, that is: **all measurement sequences, groups and channels** are stopped and **all windows** are closed; the default group and I/Q Analyzer measurement channel are restored.

In addition, all instrument configurations are deleted (see).

Settings concerning the layout of the R&S VSE window, for example the display and position of toolbars and special tool windows, remain unchanged.

Remote command:
`*RST` on page 263 or `SYSTem:PRESet` on page 388
+
`DEVice:DELete:ALL` on page 266

Restoring Channel Settings (Preset Selected Channel)
Resets the **currently selected measurement channel only** to its default settings.

This function has the same effect as the "Preset Channel" on page 128 function in the Configuration "Overview".

Remote command:
`SYSTem:PRESet:CHANnel[:EXECute]` on page 388

Restoring User-Specific Settings (Reset VSE Layout)
Restores user-defined settings, for example the display and position of toolbars and special tool windows or lists of most recently defined input values (e.g. IP addresses of connected instruments).

Measurement channels remain unchanged.

User-defined settings are stored in the file
`C:\ProgramData\Rohde-Schwarz\VSE\<version_number>\user\settings_pcsw_user.xml`.

8.2 Storing and Recalling Measurement Settings

Possibly you would like to restore or repeat a measurement you performed under specific conditions using the R&S VSE. In this case, you can store and recall software and measurement settings, and possibly other related measurement data.

Two different methods are available for managing measurement settings:

- Quick Save/Quick Recall - a defined set of measurement or channel settings are stored or recalled quickly in just one step
- Configurable Save/Recall - a user-defined set of measurement or channel settings are stored to a definable storage location

Restrictions when recalling measurement settings

When recalling a saved configuration file, the following restrictions apply:

- The frequency range defined in the configuration file must be supported by the instrument in use for the channel to which the file is to be recalled.
- Configuration files created using an instrument with certain options in use will not work using an instrument without these options
- Files created with newer software versions may not work with a previous version
- Depending on the general software setting, instrument configurations are restored, but the connections may have to be established manually (see "Reconnect saved connections after recall" on page 102).

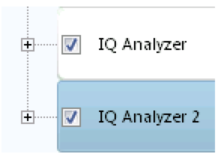
- Quick Save/Quick Recall..78
- Configurable Storage and Recall.. 80

8.2.1 Quick Save/Quick Recall

The Quick Save and Quick Recall functions allow you to store channel settings very easily and quickly in one step. Up to 10 different sets of settings can be stored to or recalled from "save sets". Each save set is identified by its storage date and contents (all channels or specific channel) in the display. The save sets are stored in the C:/ProgramData/Rohde-Schwarz/VSE/<version>/user/QuickSave directory, in files named QuickSave1.dfl to QuickSave10.dfl. The storage file names and locations cannot be changed.

During recall, save sets of type "All channels" replace the settings of the entire software. All other save sets start a new measurement channel with the stored settings.

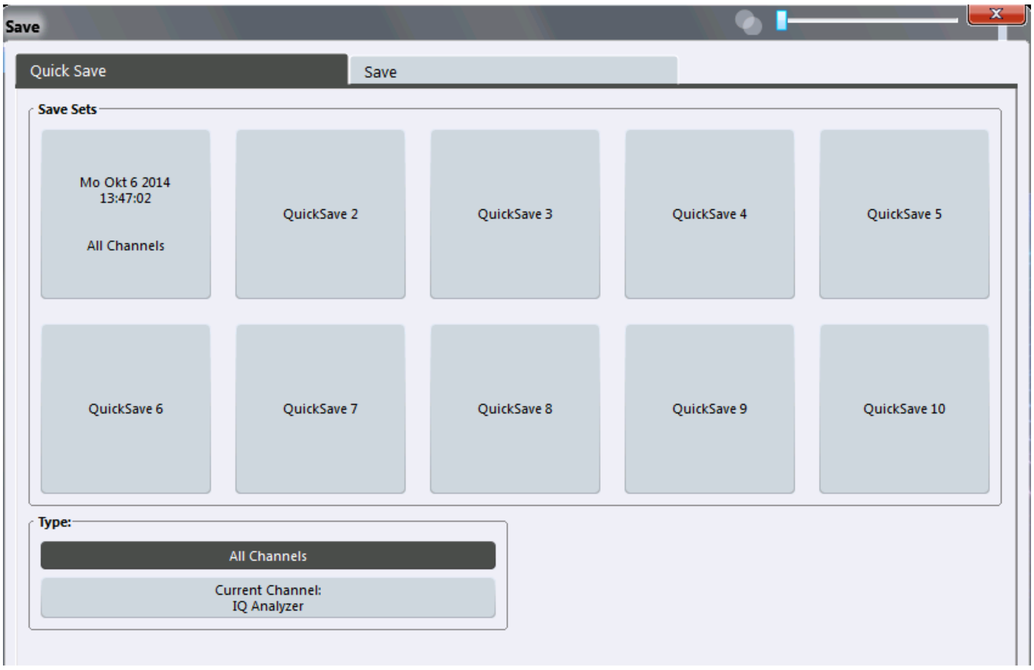
If a measurement channel with the same name as the channel to be restored is already active, the channel name for the new channel is extended by a consecutive number:



8.2.1.1 Quick Save / Quick Recall Settings

Access: "File" > "Save"/"Recall" > "Quick Save"/ "Quick Recall"

The "Quick Save" and "Quick Recall" dialog boxes are very similar and closely related.



QuickSave 1 / ... / QuickSave 10 79
Storage Type (Save only) 79
Recall 79

QuickSave 1 / ... / QuickSave 10

Selects one of the save sets to store the current settings in or to be recalled. At the time of storage, the "QuickSave 1 / ... / QuickSave 10" placeholder is replaced by a label indicating the storage date and time and the storage type.

During recall, save sets of type "All channels" replace the measurement settings of the entire software. All other save sets start a new measurement channel with the stored settings.

Storage Type (Save only)

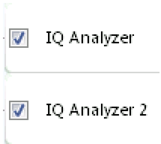
Defines which type of settings is to be stored in the save set.

"All channels"	The measurement settings for all currently active channels are stored.
"Current Channel"	Only the measurement settings for the currently selected measurement channel are stored.

Recall

Restores the channel settings as saved in the selected settings file. If the settings file contains settings for a specific channel only a new channel with the stored settings is activated, otherwise the entire measurement settings are loaded.

Note: If a measurement channel with the same name as the channel to be restored (in a new channel) is already active, the channel name for the new channel is extended by a consecutive number:



In remote commands, you must append this number to the channel name, as well.

Remote command:
`MMEMory:LOAD:STATe` on page 398

8.2.2 Configurable Storage and Recall

The more sophisticated storage and recall functions allow you to define which settings are stored, and where the settings file is stored to. Any settings file can be selected for recall.

- Stored Data Types..80
- Storage Location and File Name....................................80
- Save and Recall Dialog Boxes.......................................81
- Startup Recall Settings..83

8.2.2.1 Stored Data Types

The following types of data can be stored to and loaded from files via the "Save" dialog box on the R&S VSE:

Table 8-1: Items that can be stored to files

Item	Description
Current Settings	Current software and measurement settings
All Traces	All active traces;
All Limit Lines	All limit lines (Note: information on which limit lines are active is stored with the "Current Settings") Not available for I/Q Analyzer
Spectrogram	Spectrogram display Only available for I/Q Analyzer and Analog Demod applications

8.2.2.2 Storage Location and File Name

The storage location and file name are selected in a file selection dialog box which is displayed when you perform a storage function.

By default, the name of a settings file consists of a base name followed by an underscore and three numbers, e.g. `limit_lines_005`. In the example, the base name is `limit_lines`. The base name can contain characters, numbers and underscores. The file extension `dfl` is added automatically. The default folder for settings files is `C:/ProgramData/Rohde-Schwarz/VSE/<version>/user`.

Hidden folder

Note that the `ProgramData` folder is not visible in the Windows Explorer in its default settings. However, if you enter the path with the file name, you can access the files stored there.

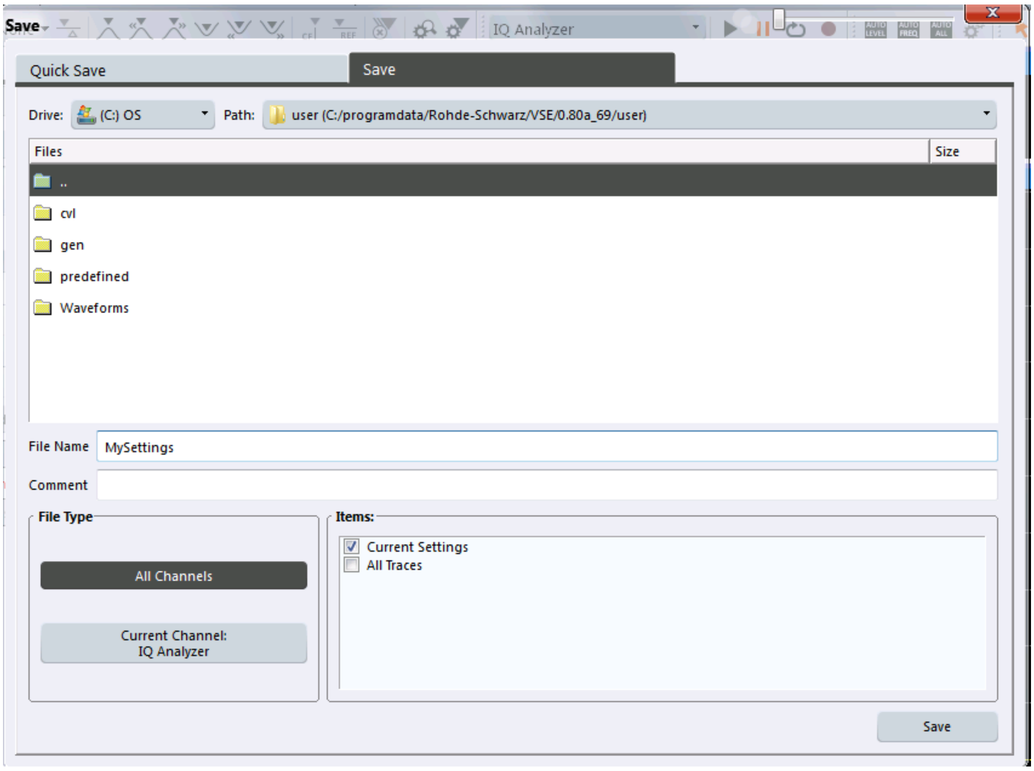
Alternatively, enable the "Files and Folders: Hidden files and folders: Show hidden files, folders, and drives" option in the Windows Explorer. (Press the ALT key to display the menu bar. Select "Tools > Folder Options" > "View" tab.)

For more information refer to the Microsoft Windows documentation.

8.2.2.3 Save and Recall Dialog Boxes

Access: "File" > "Save"/"Recall" > "Save"/"Recall"

The "Save" and "Recall" dialog boxes are very similar and closely related.



Selecting the Storage Location - Drive/ Path/ Files....................81
File Name....................82
Comment....................82
File Type....................82
Items....................82
Save File....................83
Recall in New Channel / Recall in Current Channel....................83

Selecting the Storage Location - Drive/ Path/ Files

Select the storage location of the settings file on the software or an external drive.

The "Drive" indicates the internal (C:) or any connected external drives (e.g. a USB storage device).

The "Path" contains the drive and the complete file path to the currently selected folder.

The "Files" list contains all subfolders and files of the currently selected path.

The default storage location for the settings files is:
`C:\ProgramData\Rohde-Schwarz\VSE\<version>\user`.

Note that the `ProgramData` folder is not visible in the Windows Explorer in its default settings. However, if you enter the path with the file name, you can access the files stored there. See also "Hidden folder" on page 81.

Remote command:
`MMEMory:CATalog?` on page 389

File Name
Contains the name of the data file without the path or extension.

By default, the name of a settings file consists of a base name followed by an underscore. Multiple files with the same base name are extended by three numbers, e.g. `limit_lines_005`.

For details on the file name and location see chapter 8.2.2.2, "Storage Location and File Name", on page 80.

Comment
An optional description for the data file. A maximum of 60 characters can be displayed.

Remote command:
`MMEMory:COMMent` on page 390

File Type
Determines whether the global software settings with all channels will be stored or recalled, or the current channel settings only.

Items
Defines which data and settings are stored or will be recalled. Depending on the "File Type", only channel settings or global settings are available. Which items are available also depends on the installed options (see also chapter 8.2.2.1, "Stored Data Types", on page 80).

Remote command:
`MMEMory:SELect[:ITEM]:ALL` on page 395
`MMEMory:SELect[:ITEM]:DEFault` on page 395
`MMEMory:SELect[:ITEM]:HWSettings` on page 396
`MMEMory:SELect[:ITEM]:LINes:ALL` on page 396
`MMEMory:SELect[:ITEM]:NONE` on page 396
`MMEMory:SELect[:ITEM]:TRACe[:ACTive]` on page 397

Save File

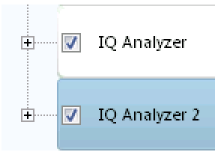
Saves the settings file with the defined file name.

Remote command:
`MMEMory:STORe<n>:STATe` on page 400
`MMEMory:STORe<n>:STATe:NEXT` on page 400

Recall in New Channel / Recall in Current Channel

Restores the measurement settings as saved in the selected settings file. If the settings file contains settings for a specific channel only, select "Recall in New Channel" to activate a new channel with the stored settings, or "Recall in Current Channel" to replace the current channel settings.

Note: If a measurement channel with the same name as the channel to be restored (in a new channel) is already active, the channel name for the new channel is extended by a consecutive number:



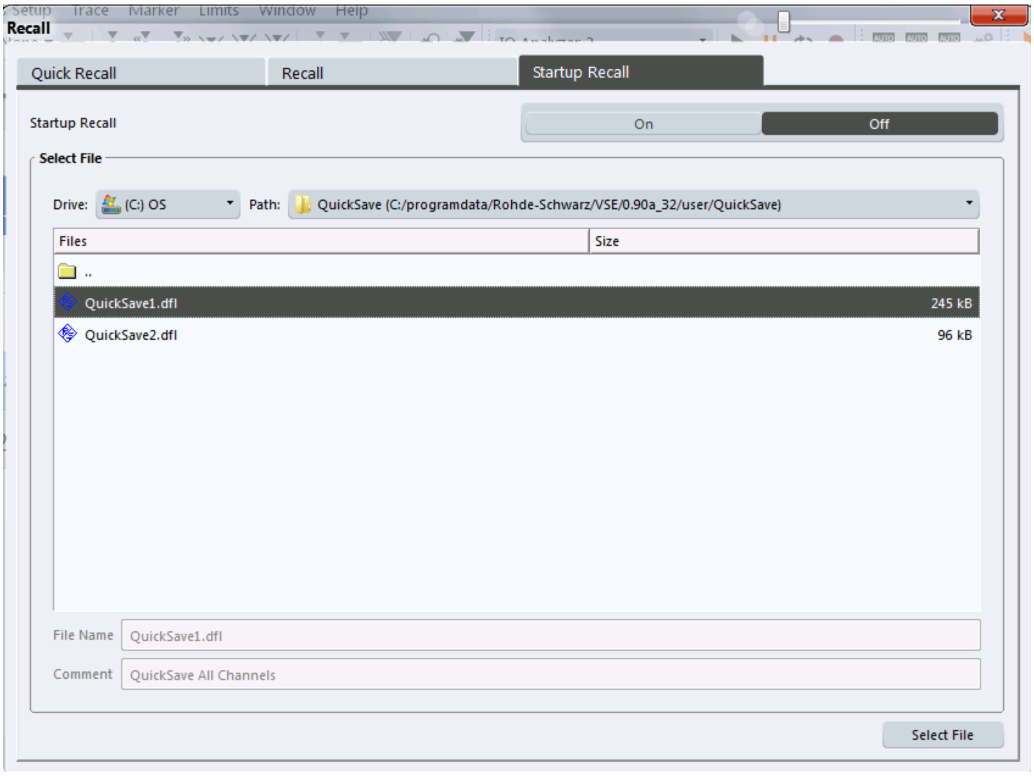
In remote commands, you must append this number to the channel name, as well.

Remote command:
`MMEMory:LOAD:STATe` on page 398

8.2.2.4 Startup Recall Settings

Access: "File" > "Recall"> "Startup Recall"

By default, the settings from the shutdown file (see "Create Shutdown File" on page 101) or the default settings are restored when the R&S VSE software is started. However, you can select a different settings file to be restored.



Startup Recall..84
Selecting the Storage Location - Drive/ Path/ Files...84
File Name...85
Comment..85

Startup Recall

Activates or deactivates the startup recall function. If activated, the settings stored in the selected file are loaded each time the software is started or preset. If deactivated, the default settings are loaded.

Note that only *All Channels* settings files can be selected for the startup recall function, not single channel settings files.

Remote command:
`MMEMory:LOAD:AUTO` on page 398

Selecting the Storage Location - Drive/ Path/ Files

Select the storage location of the settings file on the software or an external drive.

The "Drive" indicates the internal (C:) or any connected external drives (e.g. a USB storage device).

The "Path" contains the drive and the complete file path to the currently selected folder.

The "Files" list contains all subfolders and files of the currently selected path.

The default storage location for the settings files is:
`C:\ProgramData\Rohde-Schwarz\VSE\<version>\user`.

Note that the `ProgramData` folder is not visible in the Windows Explorer in its default settings. However, if you enter the path with the file name, you can access the files stored there. See also "Hidden folder" on page 81.

Remote command:
`MMEMory:CATalog?` on page 389

File Name

Contains the name of the data file without the path or extension.

By default, the name of a settings file consists of a base name followed by an underscore. Multiple files with the same base name are extended by three numbers, e.g. `limit_lines_005`.

For details on the file name and location see chapter 8.2.2.2, "Storage Location and File Name", on page 80.

Comment

An optional description for the data file. A maximum of 60 characters can be displayed.

Remote command:
`MMEMory:COMMent` on page 390

8.3 Recording and Recalling Captured I/Q Data for Evaluation

By default, when data is captured during a measurement, it is stored on the instrument in use. The R&S VSE software accesses this data to analyze and display the results for the channel.

If the captured I/Q data is required for further analysis at a later time or in a different application, possibly using different settings, you can record the captured data. In this case, the I/Q data is stored to a temporary file on the PC running the R&S VSE software. These files can then be exported, that is: stored to a file permanently, at a user-defined storage location. Exported I/Q data can then be recalled and used as input for further measurements and analysis by the R&S VSE software.

Difference between Save and Export functions

The "Save" function described in chapter 8.2, "Storing and Recalling Measurement Settings", on page 77 stores the finished measurement results (and settings), so that the same results can be restored later in the same application.

However, if you would like to store the raw I/Q data as it is captured, without further evaluation functions applied, in order to evaluate it using other functions or in a different application, you must use the "Save I/Q Recording" functions described here. Note that in order to export the raw (resampled) data, you must start recording directly at the time of capture. Once the data has been captured without being recorded, it can no longer be exported as raw (resampled) data.

- Recording Measurement Data...86
- General Recording Settings...87
- Exporting Recorded I/Q Data...88
- Recalling Measurement Data from Files...92

8.3.1 Recording Measurement Data

If the captured I/Q data is required for further analysis at a later time or in a different application, you can record the measurement results for a specific channel. In this case, the (resampled) I/Q data is stored to a temporary file on the PC running the R&S VSE software. The record length is defined as:

[<Measurement time> * <Number of records>] + <Additional settling samples>

where <Measurement time> is defined in the channel capture settings, and <Number of records> and <Additional settling samples> are general recording settings (see chapter 8.3.2, "General Recording Settings", on page 87).

Alternatively, the measurement time can be set to the maximum provided by the instrument in use automatically.

When the recording is finished, the temporary file is automatically set to be the input source for the selected channel. The measurement results stored in the first record are immediately displayed. The temporary file can then be exported, that is: stored to a file permanently. Recorded I/Q data files are available for export until one of the following actions occur:

- A new measurement is performed. The temporary file is overwritten with each measurement.
- The measurement channel is closed.
- The R&S VSE software is closed.
- The data acquisition settings are changed. In this case, the stored data no longer matches the current settings and the data becomes "invalid". It can no longer be exported.

Note that if a recording is aborted before it has completed, the temporary file is deleted and the captured data is not available for evaluation or display.

To start recording measurement data for a channel

► To record measurement results select the "Record" function for the channel in the "Measurement Group Setup" tool window (see also "Record" on page 74). Alternatively, select the "Record" icon in the toolbar to record the results for the currently active measurement channel.

  The captured I/Q data is recorded until the defined number of records have been captured or recording is stopped manually.
  The first recorded record is displayed immediately in the channel's result displays. After recording has finished, the I/Q data can be exported to a file permanently, see chapter 8.3.3, "Exporting Recorded I/Q Data", on page 88.

To stop data recording

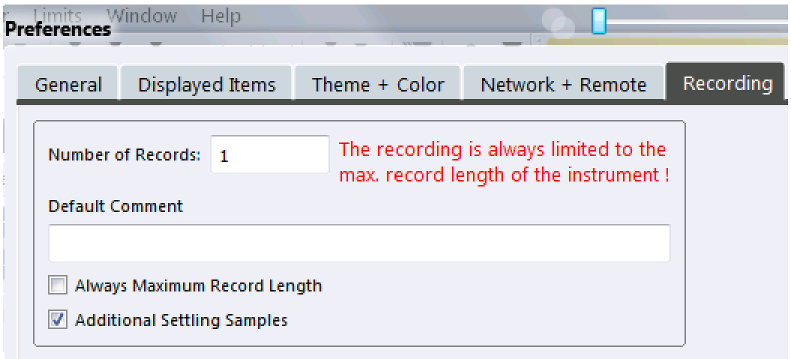
► To stop recording measurement results, select the "Pause" function for the channel in the "Measurement Group Setup" tool window.

Note that if a recording is aborted before it has completed, the temporary file is deleted and the captured data is not available for evaluation or display.

8.3.2 General Recording Settings

Access: "File" > "Preferences" > "Recording"

Some general settings concerning recording in the R&S VSE are available in the general software settings.



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Additional Settling Samples......88

Number of Records

Defines the number of records to be stored. One record contains the data captured during the defined measurement time for a single channel. If more measurements are available than the specified number (x) of records, only the most recent (x) measurement results are stored.As a rule, the recording is limited by the maximum record length provided by the instrument.

Alternatively, all available records for a channel can be stored (see "Always Maximum Record Length" on page 88). In this case, the "Number of Records" are disabled.

Remote command:
`RECord:COUNt` on page 406

Default Comment

Defines a default text for the comment to the stored data file. This default comment is displayed in the "Save I/Q Recording" dialog box (see Comment).

Remote command:
`RECord:COMMent[:DEFault]` on page 406

Always Maximum Record Length
If enabled, all available records for a channel are stored. The "Number of Records" is ignored (and disabled).

If disabled, only the most recent "Number of Records" on page 87 are stored.

Remote command:
`RECord:MAXimum:RLEN` on page 407

Additional Settling Samples
Stores additional samples (in addition to the specified capture time) for the channel to compensate for settling effects.

This setting is required for connected instruments that require resampling. The additional samples compensate for settling effects in the filters used by the resampler.

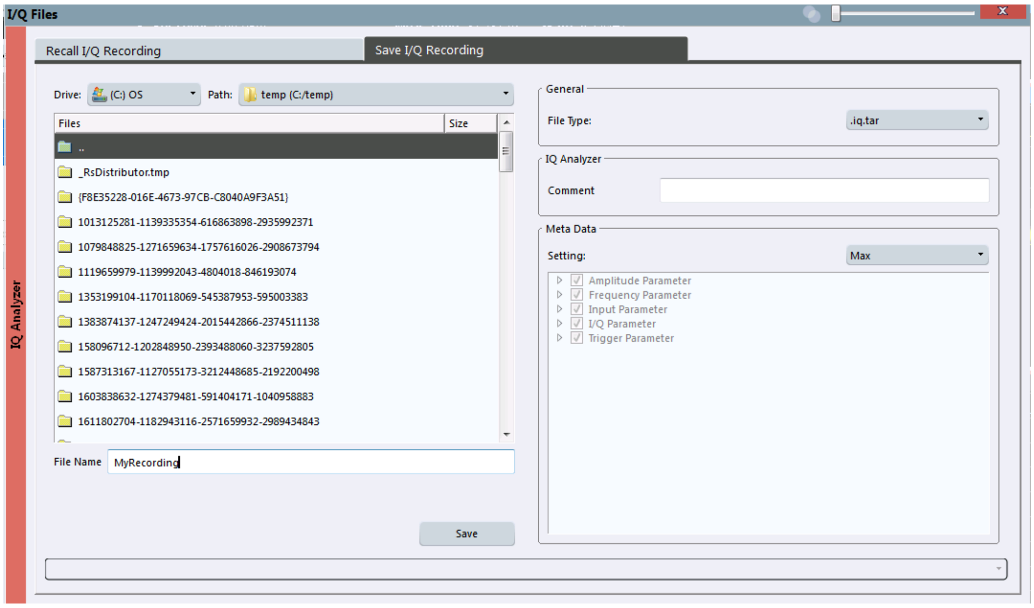
You can recognize the use of a resampler by the "Resampler active" message in the status bar of the R&S VSE.

Remote command:
`RECord:SETTling:TIME` on page 407

8.3.3 Exporting Recorded I/Q Data

Access: "File" > "Save I/Q Recording"

Recorded data from a instrument in use can be stored to a file permanently. You can then use the data in the export file as input for analysis at a later time or using a different application.



Results can only be stored for the currently selected measurement channel and only after measurement data has explicitely been recorded (see chapter 8.3.1, "Recording Measurement Data", on page 86).

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File Name....89
File Type....89
Comment....89
Meta Data Settings....90
Save....91

Selecting the Storage Location - Drive/ Path/ Files
Select the storage location of the I/Q data file on the PC or an external drive.

The "Drive" indicates the internal (C:) or any connected external drives (e.g. a USB storage device).

The "Path" contains the drive and the complete file path to the currently selected folder.

The "Files" list contains all subfolders and files of the currently selected path.

Remote command:
`MMEMory:CATalog?` on page 389

File Name
Contains the name of the data file without the path or extension.

For details on the file name and location see chapter 8.2.2.2, "Storage Location and File Name", on page 80.

Remote command:
`INSTrument:BLOCk:CHANnel[:SETTings]:FILE<i>[:IQTar]` on page 283
`INSTrument:BLOCk:CHANnel[:SETTings]:FILE<i>:CSV` on page 277
`INSTrument:BLOCk:CHANnel[:SETTings]:FILE<i>:IQW` on page 278
`INSTrument:BLOCk:CHANnel[:SETTings]:FILE<i>:MAT` on page 279

File Type
Various file types are supported for I/Q data import and export.

Note: For best performance and to ensure comprehensive meta data is available, use the iq.tar format. This is a widely used file format for Rohde & Schwarz products.

For details on the supported file formats see chapter A.5, "Reference: Supported File Formats", on page 460.

"iq.tar"	Compressed file format for an individual measurement channel or several channels with identical capture settings (sample rate, bandwidth)
"csv"	Comma-separated ASCII file format
"iqw"	Binary file format; contains only I/Q data from a single channel, without any meta data
"mat"	Matlab file format v.4 or v.7 (v.7 requires Matlab Runtime installation)

Remote command:
Exporting I/Q recording files:
`EXPort:IQ:FORMat` on page 402

Comment
Inserts a descriptive comment to the data file.

Tip: if a default comment is defined in the general recording settings (see "Default Comment" on page 87), it is provided as a default here.

Remote command:
`MMEMory:STORe<n>:IQ:COMMent` on page 405

Meta Data Settings
Defines which meta data is included in the data file. Meta data is required to restore the measurement settings when the data file is recalled as input for the R&S VSE software later.

Note that only the settings used during recording are stored; subsequent changes to the settings are ignored.

For `iqw` file format, no meta data is available.

"Min" The minimum set of measurement settings required to restore the channel later are stored. In particular, this includes:

- Reference level
- Center frequency
- Input path
- Analysis bandwidth

"Max" All available meta data from the entire signal processing chain (input path to the output) is stored.

In particular, this may include (depending on the type of measurement channel and instrument in use):

- Amplitude parameters:
  – Reference level
  – Electronic attenuation
  – Mechanical attenuation
  – Preamplifier
  – Input impedance
  – Input coupling
  – Range
- Frequency parameters:
  – Center frequency
- Input parameters:
  – Recording device (instrument providing the data)
  – Calibration state
  – External reference
  – Input path
  – Highpass filter state
  – YIG preselector
- I/Q parameters:
  – Analysis bandwidth
  – Filter settings
- Trigger parameters:
  – Trigger source
  – Trigger position
  – Trigger level
  – Trigger slope
  – Trigger holdoff
  – Trigger hysteresis

"Custom" A user-definable set of meta data (subset of "Full") is stored.

Remote command:
EXPort:IQ:META:DATA on page 402
EXPort:IQ:META:DATA:SET on page 403

Save
Stores the captured data to the specified file.

Remote command:
EXPort:IQ:FILE on page 402
MMEMory:STORe<n>:IQ:STATe on page 405

8.3.4 Recalling Measurement Data from Files

When measurement (I/Q) data is recorded to a file, not only the result data is stored, but also the essential instrument and measurement settings required to obtain those results. Thus, when you recall a measurement file, the stored settings are restored in the R&S VSE software, as well. This enables you to repeat the stored measurement under the same conditions - assuming the file was recorded on a compatible instrument and contains the required measurement information.

Recalling measurement data from a file results in a measurement channel being activated with the input source "File". You can then "replay" the measurement and the stored results, or even just an extract of the entire measurement.

When measurement results are recorded, the recorded data is immediately used as input for further analysis in the R&S VSE software. Therefore, the input source is switched to "File", rather than "Instrument". However, the instrument settings are maintained so that you can switch back to the instrument as an input source quickly.

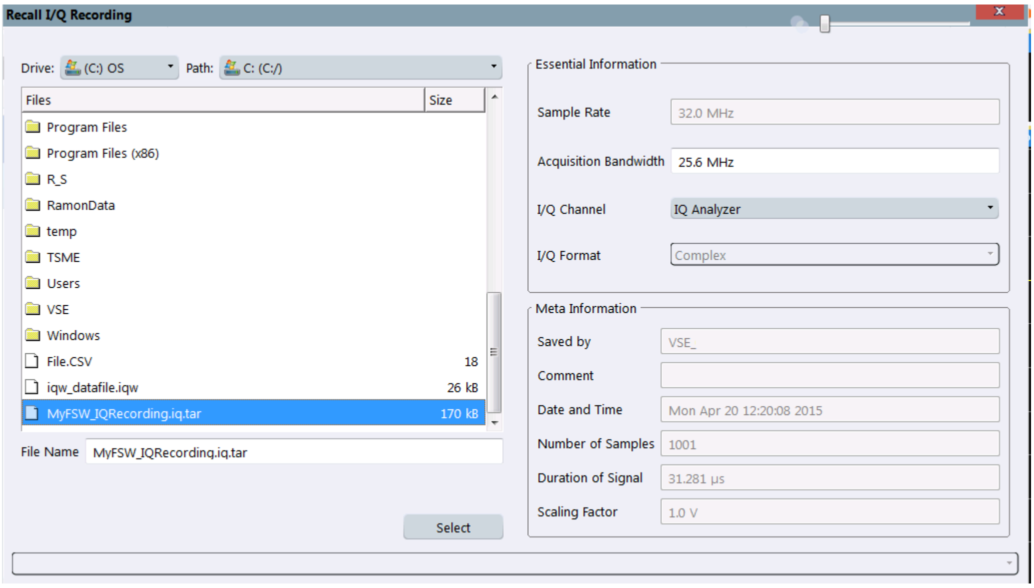
In order to recall measurement results, the I/Q data file and essential measurement information must first be selected. Then the results of the entire measurement, or only a specific extract of it, can be restored.

● Loading the I/Q Data File and Essential Measurement Information........................ 92
● Restoring the Measurement Results - R&S VSE Player..94

8.3.4.1 Loading the I/Q Data File and Essential Measurement Information

Access: I/Q files are recalled using the "Recall I/Q Recording" dialog box which is displayed when you do one of the following:

- Select the "Recall I/Q Recording" icon from the main toolbar.
- Select the "File > Recall IQ Recording" menu item.
- Select the "Input & Output > Input Source" menu item and switch to the "I/Q File" tab. Select the "Select file" button.
- Select the "Input source": "File" for a measurement channel, then select the "..." button to select the I/Q data file to be loaded.
- In the R&S VSE Player ("Window > Player"), select the "..." button to select the I/Q data file to be loaded.



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└ Sample Rate....94
└ Acquisition Bandwidth....94
└ I/Q Format....94
Meta Information....94

Selecting the Storage Location - Drive/ Path/ Files

Select the storage location of the I/Q data file on the PC or an external drive.

The "Drive" indicates the internal (C:) or any connected external drives (e.g. a USB storage device).

The "Path" contains the drive and the complete file path to the currently selected folder.

The "Files" list contains all subfolders and files of the currently selected path.

Remote command:
`MMEMory:CATalog?` on page 389

File Name

Contains the name of the data file without the path or extension.

For details on the file name and location see chapter 8.2.2.2, "Storage Location and File Name", on page 80.

Remote command:
`INSTrument:BLOCk:CHANnel[:SETTings]:FILE<i>[:IQTar]` on page 283
`INSTrument:BLOCk:CHANnel[:SETTings]:FILE<i>:CSV` on page 277
`INSTrument:BLOCk:CHANnel[:SETTings]:FILE<i>:IQW` on page 278
`INSTrument:BLOCk:CHANnel[:SETTings]:FILE<i>:MAT` on page 279

Essential Information
Defines the channel-specific information required to re-configure the recorded measurement. If the I/Q data file contains measurement information, it is displayed read-only. For `iqw` files or files stored by applications other than R&S VSE that do not contain this information, the essential information must be provided manually.

Sample Rate ← Essential Information
If a stored sample rate is available, it is indicated for reference only and cannot be changed. If not available, the sample rate used to obtain the stored data must be specified manually.

Acquisition Bandwidth ← Essential Information
The bandwidth of the data that was stored to the file.

If the bandwidth of the stored data is available, it is indicated and cannot be changed.

If the bandwidth was not stored, a default value of 0.8 * Sample Rate is used. This value can be changed manually.

I/Q Format ← Essential Information
Determines how the stored I/Q data is to be interpreted. The available formats depend on the file type.

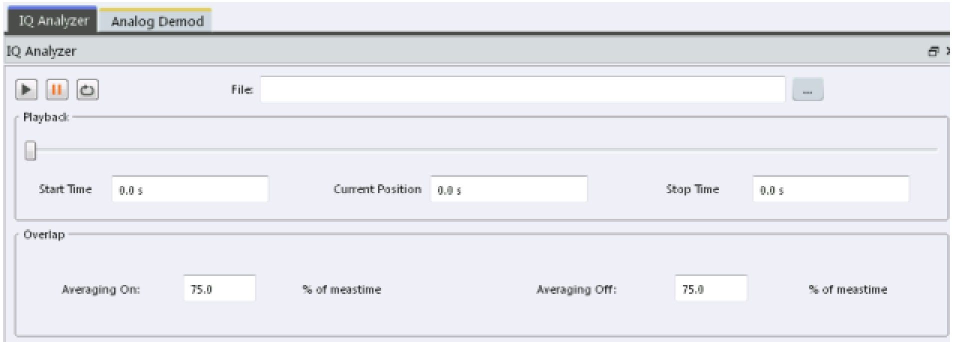
"IIQQ | IQBLock"	First all I-values are listed, then the Q-values (I,I,I,I,I,I,...Q,Q,Q,Q,Q,Q) .iqw format only
"IQIQ | IQPair"	One pair of I/Q values after the other is listed (I,Q,I,Q,I,Q...). .iqw format only
"Complex"	.iq.tar format only (cannot be edited)
"Polar"	.iq.tar format only (cannot be edited)

Meta Information
Provides additional general information on the data file, if available. This information is provided for reference only and cannot be edited.

8.3.4.2 Restoring the Measurement Results - R&S VSE Player

In order to replay the stored measurements in individual channels, the R&S VSE software provides a special tool: the R&S VSE Player. Using the R&S VSE Player you can play back the entire measurement, or only a specific time span, and you can define how to process multiple records.

The R&S VSE Player is available via the "Window > Player" menu item.



If available, the loaded I/Q file for the selected measurement channel is displayed. You can also load a different I/Q file directly in the R&S VSE Player.

Alternatively to the R&S VSE Player you can use the ▶ ("Play") function in the "Measurement Group Setup" tool window to replay a channel for which the "Input Source": "File" is selected and a file is loaded.

For details see "Play" on page 68.

Changing data acquisition settings for a stored measurement

When replaying stored measurement data from a file, you can change the Data Acquisition and Bandwidth Settings, for example:

- **Sample rate / Analysis bandwidth:** The R&S VSE provides an internal resampler, which allows you to change the sample rate, or bandwidth, or both, of the replayed I/Q data
- **Center frequency:** You can shift the center frequency of the current measurement compared to the stored measurement data. The maximum shift depends on the channel's current analysis bandwidth.
  For details see "Center frequency" on page 144.
- **I and Q paths:** Swap the I and Q values for the measurement, for example to compare the data to another measurement in which the instrument ports were swapped.

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Overlap Settings..97

Capture

Starts replaying the data from the I/Q file from the beginning for the measurement channel. Any averaging procedures are restarted.

In "Single" measurement mode, the first record in the I/Q data file is replayed.

In "Continuous" measurement mode, the entire measurement in the I/Q data file is replayed continuously, starting at the beginning.

Remote command:
`INITiate<n>[:IMMediate]` on page 288

Pause / Cont
"Pause" stops replaying data.

"Cont" continues replaying data (including any averaging procedures) at the current position.

In "Single" measurement mode, the next record in the I/Q data file is replayed.

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

Remote command:
`ABORt` on page 286
`INITiate<n>:CONMeas` on page 287

Measurement mode (Single / Continuous)
Defines how data is replayed during the measurement.

"Single"	A single record is replayed. To replay subsequent records, continue the measurement using the ("Pause/Continue") function.
"Continuous"	The data from the I/Q file is replayed continuously until stopped.

Remote command:
`INITiate<n>:CONTinuous` on page 287

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

Select a file from the list of recently loaded files, or select "..." to open the "Load I/Q File" dialog box (see chapter 8.3.4.1, "Loading the I/Q Data File and Essential Measurement Information", on page 92).

Remote command:
`INSTrument:BLOCk:CHANnel[:SETTings]:FILE<i>[:IQTar]` on page 283
`INSTrument:BLOCk:CHANnel[:SETTings]:FILE<i>:CSV` on page 277
`INSTrument:BLOCk:CHANnel[:SETTings]:FILE<i>:IQW` on page 278
`INSTrument:BLOCk:CHANnel[:SETTings]:FILE<i>:MAT` on page 279

Playback Settings
The data to be replayed can be restricted to a specified capture time within the stored measurement data.

Use the sliders or enter time values to define:
- **Start time**: the measurement time at which replay starts
- **Current Position**: the time in the measurement span that is currently being displayed

- **Stop time**: the measurement time at which replay stops

Remote command:
`INSTrument:BLOCk:CHANnel[:SETTings]:FILE<i>:STARt:TIME` on page 282
`INSTrument:BLOCk:CHANnel[:SETTings]:FILE<i>:STARt:SAMPle` on page 281
`INSTrument:BLOCk:CHANnel[:SETTings]:FILE<i>:CURRent:TIME` on page 278
`INSTrument:BLOCk:CHANnel[:SETTings]:FILE<i>:CURRent:SAMPle` on page 277
`INSTrument:BLOCk:CHANnel[:SETTings]:FILE<i>:STOP:TIME` on page 283
`INSTrument:BLOCk:CHANnel[:SETTings]:FILE<i>:STOP:SAMPle` on page 282

Overlap Settings
The overlap settings determine how successive records within one data file are replayed.

After the first record has been replayed, the specified percentage (x) of the next record is displayed together with the remaining data (meas time - x) from the previous record.

The larger the overlap, the slower the display is updated.

The behaviour can be defined depending on the used trace mode. Note that the behaviour is applied to all windows of the same channel.

"Averaging On:"	Applies if any trace in the channel uses average, max hold or average trace mode.
"Averaging Off:"	Applies if no averaging trace modes are used in the channel.

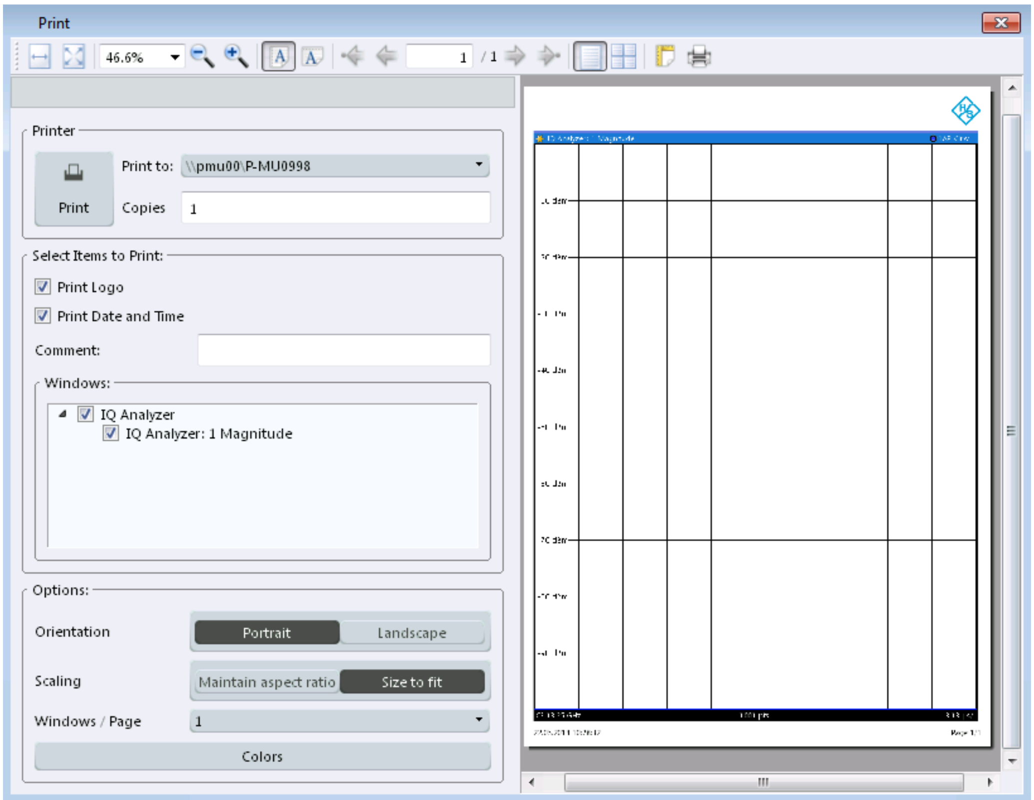
Remote command:
`INSTrument:BLOCk:CHANnel[:SETTings]:FILE<i>:OVERlap:AVG:ON` on page 281
`INSTrument:BLOCk:CHANnel[:SETTings]:FILE<i>:OVERlap:AVG:OFF` on page 280

8.4 Printing Current Measurement Results

Access: "File" > "Print"

In order to document the graphical results and the most important settings for the currently performed measurement, you can create a hardcopy or screenshot of the current display.

Remote commands for these settings are described in chapter 13.7.6, "Storing or Printing Screenshots", on page 407.



To print a screenshot of the current display with the current settings immediately, without switching to the "Print" dialog, use the "Print" icon in the toolbar.

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Print Logo.........99
Print Date and Time.........99
Comment.........99
Windows.........99
Orientation.........99
Scaling.........99
Windows / Page.........100
Colors.........100

Print

Starts printing out all measurement results displayed on the screen: diagrams, traces, markers, marker lists, limit lines, etc.. Optionally, comments and the date and time are included at the bottom margin of the printout. All displayed items belonging to the software user interface (e.g. toolbars or dialog boxes) are not printed out.

Remote command:
`HCOPy:ITEM:ALL` on page 411
`HCOPy[:IMMediate<device>]` on page 411
`HCOPy[:IMMediate<device>]:NEXT` on page 411

Print to

Specifies a printer configured for the PC the R&S VSE software is installed on.

Copies

Defines the number of copies to be printed.

Print Logo

Activates/deactivates the printout of the Rohde & Schwarz company logo in the upper left corner.

Remote command:
`DISPlay:LOGO` on page 408

Print Date and Time

Activates/deactivates the printout of the current date and time at the bottom of the screenshot.

Remote command:
`HCOPy:TDSTamp:STATe<device>` on page 412

Comment

Defines an optional comment to be printed with the screenshot of the display. Maximum 120 characters are allowed. 60 characters fit in one line. In the first line, at any point a manual line-feed can be forced by entering "@".

The comment is printed below the diagram area, but not displayed on the screen.

Remote command:
`HCOPy:ITEM:WINDow:TEXT` on page 411

Windows

Selects the result display windows to be included in the screenshot. By default, all active windows are included.

Orientation

Selects the page orientation of the printout: portrait or landscape

Remote command:
`HCOPy:PAGE:ORIentation<device>` on page 412

Scaling

Selects the scaling of the printout on the paper. A preview using the selected setting is displayed in the dialog box.

"Maintain aspect ratio"	The diagram is scaled only as required to fit the available paper size, while maintaining the original aspect ratio.
"Size to fit"	(Default) Scales the printout to fit the paper size optimally.

Windows / Page
Defines the number of diagrams to be printed on a single page.

Colors
Opens the "Print Color" dialog box to configure the colors for printing screenshots. For details see "Print colors" on page 105.

9 General Software Preferences

Some basic software settings can be configured independently of the selected operating mode or application. Usually, you will configure most of these settings initially when you set up the software according to your personal preferences or requirements and then only adapt individual settings to special circumstances when necessary. Some special functions are provided for service and basic system configuration.

Recording, Network and Remote Settings

Recording settings are described in chapter 8, "Data Management", on page 76.

Settings for network and remote operation are described in chapter 12.2, "Network and Remote Control Settings", on page 250.

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- Display Settings....102
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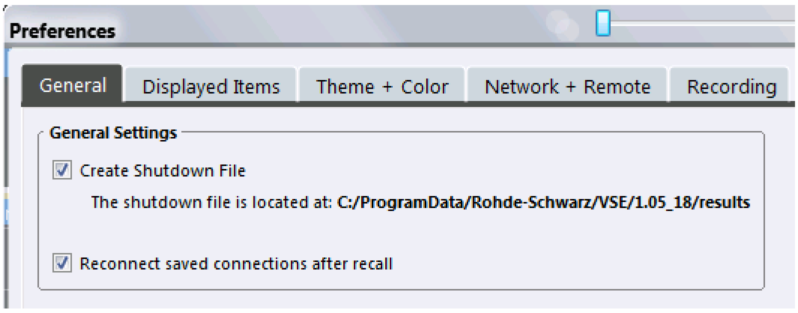
9.1 General Software Behavior

Access: "File" > "Preferences" > "General"

You can determine the behavior of the software when it is being shut down and restarted.



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Create Shutdown File

If activated, a shutdown file is created when the R&S VSE software is closed. The shutdown file contains information on the defined connections, as well as measurement sequence and channel configuration, such as which input sources are used for which measurement channels and which result displays are active.

When the R&S VSE software is started again, the previously stored configuration is restored. If you delete the shutdown file (see "Deleting the Shutdown File" on page 102), the R&S VSE software starts in the default configuration the next time.

The shutdown file is stored located at `C:\ProgramData\Rohde-Schwarz\VSE\<version_number>\results\Shutdown.dfl`.

Reconnect saved connections after recall
If activated, when stored measurement settings are recalled, a connection is automatically established to all configured instruments (see chapter 8.2, "Storing and Recalling Measurement Settings", on page 77).

If deactivated, the instrument configurations are restored in the "Instruments" window; however, the connections must be established manually (see "Connect / Disconnect" on page 58).

Deleting the Shutdown File
Access: "Start" > "All Programs" > "Rohde-Schwarz" > "VSE" > <version_number> > "Delete Shutdown File"

In the Windows "Start" menu, an additional function is provided to delete the file that stores the current software configuration during shutdown, if available (see "Create Shutdown File" on page 101). If you delete the shutdown file, the R&S VSE software starts in the default configuration the next time the R&S VSE software is started again.

Deleting the shutdown file does not affect settings concerning the layout of the basic R&S VSE window. The display and position of toolbars and special tool windows are retained.

Deleting the shutdown file has the same effect as Restoring All Default Settings (Preset All) directly after startup.

Defining a Startup Settings File
You can define a settings file other than the shutdown file to be restored during software startup, see chapter 8.2.2.4, "Startup Recall Settings", on page 83.

9.2 Display Settings

Some general display settings are available regardless of the current application or operating mode.

Access: "File" > "Preferences"

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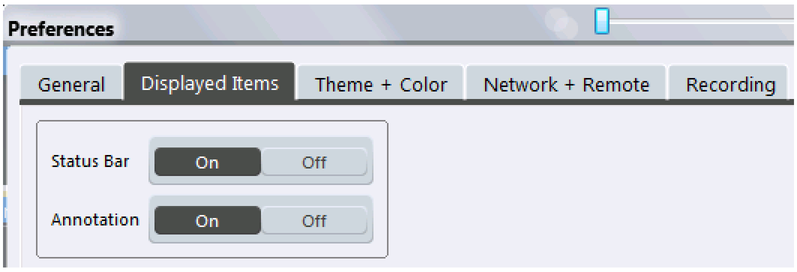
9.2.1 Displayed Items

Access: "File" > "Preferences" > "Displayed Items"

Several elements on the screen display can be hidden or shown as required, for example to enlarge the display area for the measurement results.



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Status Bar

The status bar beneath the diagram indicates the global software settings, the software status and any irregularities during measurement or display.

Some of the information displayed in the status bar can be queried from the status registry via remote commands, see chapter 13.10.1, "Using the Status Register", on page 424.

Remote command:
`DISPlay:SBAR[:STATe]` on page 418

Diagram Footer (Annotation)

The diagram footer beneath the diagram contains information on the x-axis of the diagram display, such as the current center frequency and span settings, the displayed span per division and the number of measurement points.

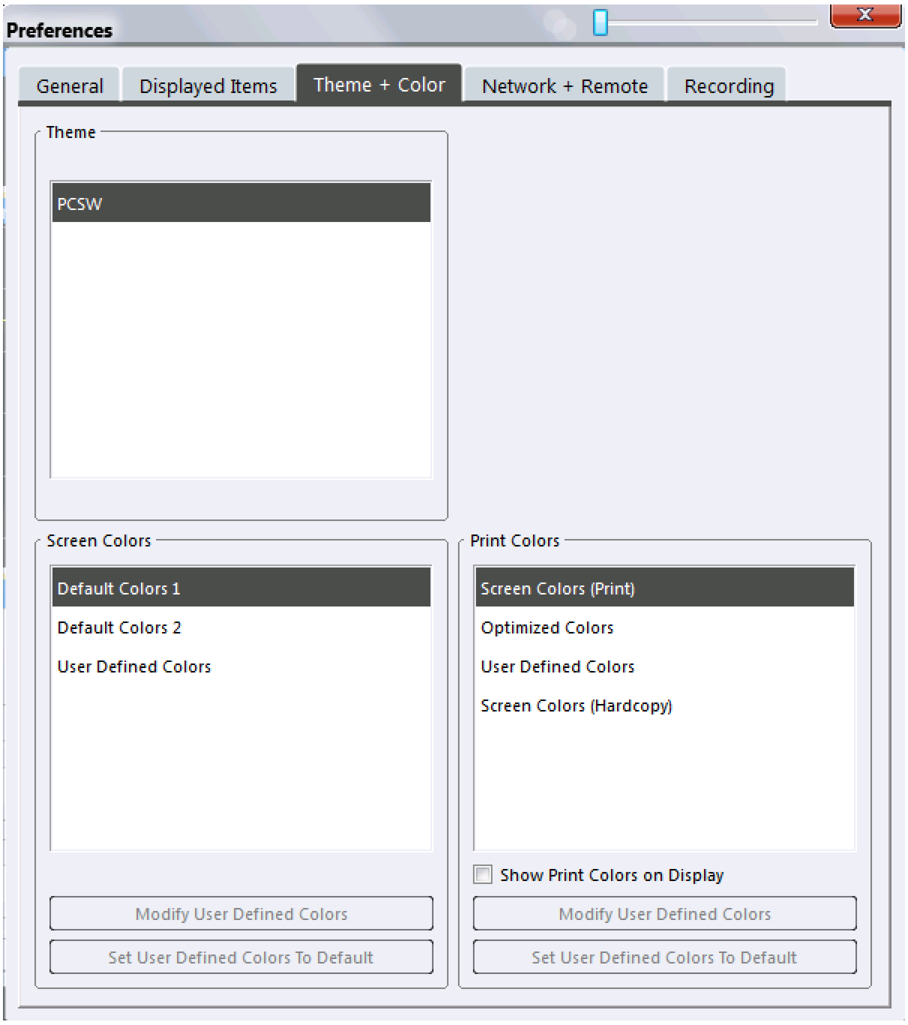
Remote command:
`DISPlay:ANNotation:FREQuency` on page 417

9.2.2 Display Theme and Colors

Access: "File" > "Preferences" > "Theme + Color".

You can configure the used colors and styles of display elements on the screen.

For step-by-step instructions see chapter 9.3, "How to Configure the Colors for Display and Printing", on page 107.



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Theme

The theme defines the colors and style used to display softkeys and other screen objects.

The default theme is "PCSW".

Remote command:
`DISPlay:THEMe:SELect` on page 420

Screen colors

Two different color sets are provided by the software, a third user-defined set can be configured.

The default color schemes provide optimum visibility of all screen objects when regarding the screen from above or below. Default setting is "Default Colors 1".

If "User Defined Colors" is selected, a user-defined color set can be defined (see "Defining User-specific Colors" on page 106).

Remote command:
`DISPlay:CMAP<item>:DEFault<colors>` on page 418

Print colors

Defines the color settings used for printout. In addition to the predefined settings, a user-defined color set can be configured (see "Defining User-specific Colors" on page 106).

If "Show Print Colors on Display" is activated, the currently selected print colors are displayed as a preview for your selection.

Optimized Colors	Selects an optimized color setting for the printout to improve the visibility of the colors (default setting). Trace 1 is blue, trace 2 black, trace 3 green, and the markers are turquoise. The background is always printed in white and the grid in black.
Screen Colors (Print)	Selects the current screen colors for the printout. The background is always printed in white and the grid in black.
Screen Colors (Hardcopy)	Selects the current screen colors without any changes for a hardcopy.
User Defined Colors	Selects the user-defined color setting.

Remote command:
`HCOPy:CMAP<item>:DEFault<colors>` on page 408

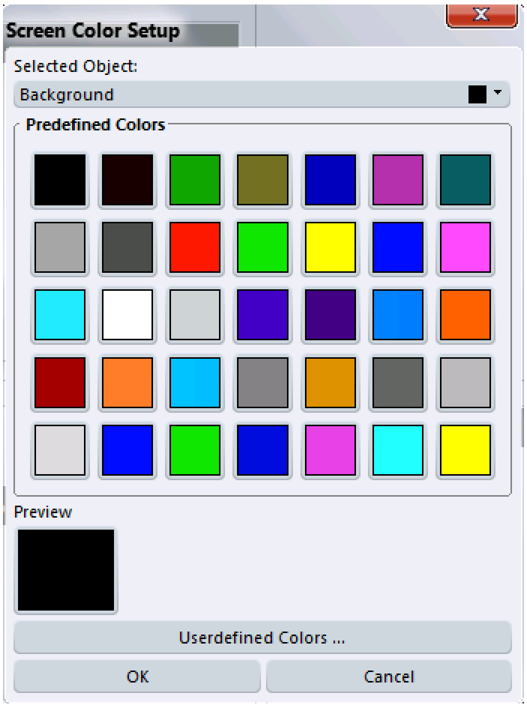
Showing Print Colors on Display

Temporarily shows the currently selected print colors on the screen display. This function can be used as a preview for printing.

Modifying User-Defined Color Assignments

You can configure the colors used to display and print individual screen objects according to your specific requirements.

The colors are configured in the (identical) "Screen Color Setup"/"Printer Color Setup" dialog boxes.



Selecting the Object ← Modifying User-Defined Color Assignments
Selects the object for which the color is to be defined. Colors can be defined for the following objects:

- Background
- Grid
- Individual traces
- Display lines
- Limit lines and check results
- Markers and marker information

Remote command:
Each object is assigned to a specific suffix of the CMAP commands, see chapter 13.8.4, "CMAP Suffix Assignment", on page 420.

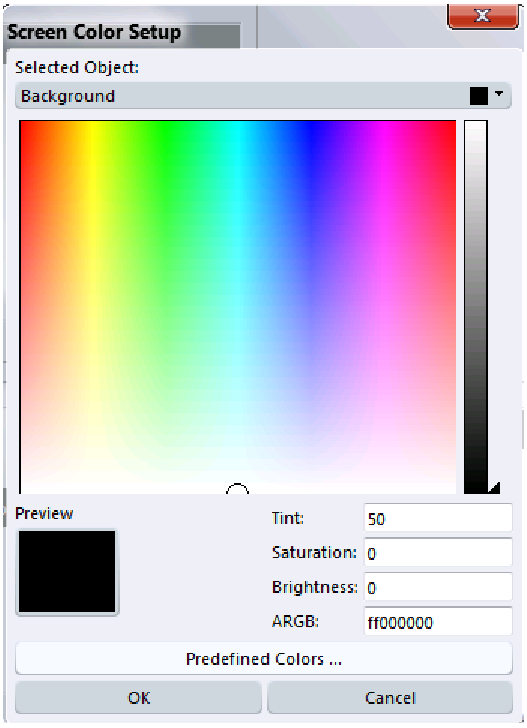
Predefined Colors ← Modifying User-Defined Color Assignments
Displays the available colors from the predefined color set that can be used for the selected object.

Remote command:
`HCOPy:CMAP<item>:PDEFined` on page 409

Preview ← Modifying User-Defined Color Assignments
Indicates the currently selected color that will be used for the selected object.

Defining User-specific Colors
In addition to the colors in the predefined color set you can configure a user-specific color to be used for the selected object.

When you select "Userdefined Colors", the set of predefined colors is replaced by a color palette and color configuration settings.



The color palette allows you to select the color directly. The color settings allow you to define values for tint, saturation and brightness.

Remote command:
`HCOPy:CMAP<item>:HSL` on page 409

Restoring the User Settings to Default Colors
In addition to the predefined color settings, a user-defined setting can be configured. By default, the same settings as defined in "Default Colors 1" are used. They can then be modified according to user-specific requirements (see "Modifying User-Defined Color Assignments" on page 105).

The "Set to Default" function restores the original default settings for the user-defined color set. You can select which of the three default settings are restored.

Remote command:
`DISPlay:CMAP<item>:PDEFined` on page 419

9.3 How to Configure the Colors for Display and Printing

You can configure the style and colors with which various screen objects are displayed or printed.

To select a color set

1. Select "File" > "Preferences" > "Theme + Color".
2. In the "Screen Colors" area, select a predefined set of colors to be used for screen display, or select "User Defined Colors" to configure the color set yourself.

3. In the "Print Colors" area, select a predefined set of colors to be used for printing screenshots, or select "User Defined Colors" to configure the color set yourself.
   Activate the "Show Print Colors on Display" option to see a preview of the print colors.

To configure a user-defined color set

1. In the "Theme + Color" tab of the "Preferences" dialog box select "User Defined Colors" either for the screen or the print colors.
2. Select "Modify User Defined Colors".

   The "Screen Color Setup" dialog box is opened.
3. From the "Selected Object" list, select the object to which you want to assign a color.
4. Select a color from the "Predefined Colors" or select the "Userdefined Colors..." button to define a different color.

   The "Preview" area indicates the currently selected color.
5. To assign a user-specific color to the selected object, do one of the following:
   - Select the color from the palette.
   - Enter values for the "Tint", "Saturation", and "Brightness".
     Note: In the continuous color spectrum ("Tint") red is represented by 0% and blue by 100%.
   - Enter an "ARGB" value in hexadecimal format.
6. Select the next object to which you want to assign a color from the "Selected Object" list and assign a color as described.
   Repeat these steps until all objects you want to configure have been assigned a color.
7. Select "OK" to close the dialog box and apply the colors to the assigned objects.

9.4 Software Information and Support

Some general software functions are available concerning optional functionality, licenses, service functions, or system messages. These settings are available from the "Help" menu.

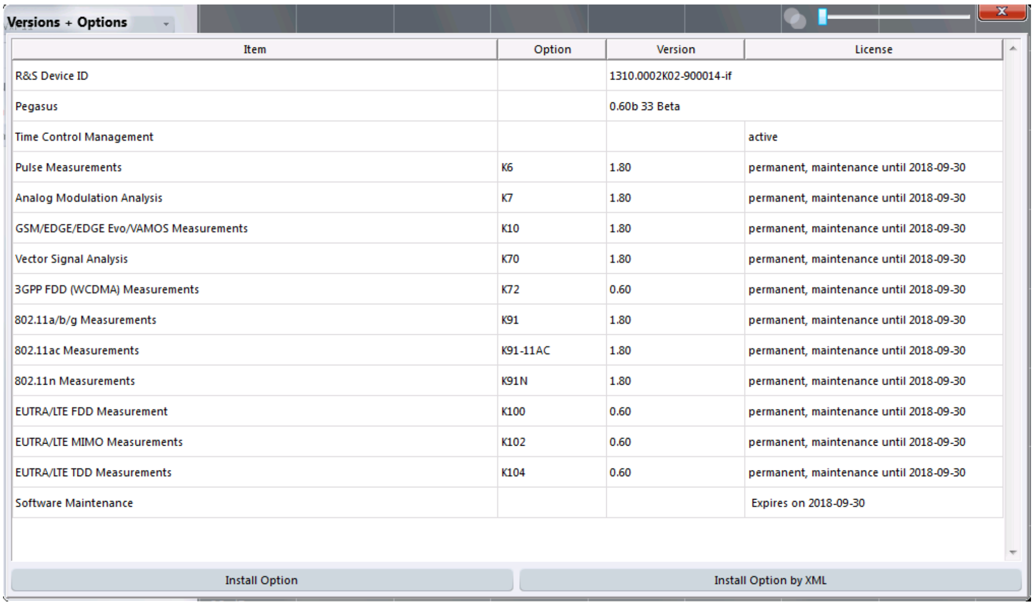
- Licensing, Versions and Options....................108
- R&S Support Information....................110

9.4.1 Licensing, Versions and Options

Access: "Help" > "License"

Information on the R&S VSE software version and additional licensed options is provided in the "Versions + Options" dialog box. The unique Rohde & Schwarz device ID is also indicated here, as it is required for license and option administration. Furthermore, you can also install new firmware options in this dialog box.

To simply find out the version of the R&S VSE software, select "Help > About".


Versions + Options

Item	Option	Version	License
R&S Device ID		1310.0002K02-900014-if	
Pegasus		0.60b 33 Beta	
Time Control Management			active
Pulse Measurements	K6	1.80	permanent, maintenance until 2018-09-30
Analog Modulation Analysis	K7	1.80	permanent, maintenance until 2018-09-30
GSM/EDGE/EDGE Evo/VAMOS Measurements	K10	1.80	permanent, maintenance until 2018-09-30
Vector Signal Analysis	K70	1.80	permanent, maintenance until 2018-09-30
3GPP FDD (WCDMA) Measurements	K72	0.60	permanent, maintenance until 2018-09-30
802.11a/b/g Measurements	K91	1.80	permanent, maintenance until 2018-09-30
802.11ac Measurements	K91-11AC	1.80	permanent, maintenance until 2018-09-30
802.11n Measurements	K91N	1.80	permanent, maintenance until 2018-09-30
EUTRA/LTE FDD Measurement	K100	0.60	permanent, maintenance until 2018-09-30
EUTRA/LTE MIMO Measurements	K102	0.60	permanent, maintenance until 2018-09-30
EUTRA/LTE TDD Measurements	K104	0.60	permanent, maintenance until 2018-09-30
Software Maintenance			Expires on 2018-09-30

Install Option
Install Option by XML

Expired option licenses

If an option is about to expire, a message box is displayed to inform you. You can then use the "Install Option" function to enter a new license key.

If an option has already expired, a message box appears for you to confirm. In this case, all software functions are unavailable (including remote control) until the R&S VSE is rebooted. You must then use the "Install Option" function to enter the new license key.

Remote commands:

DIAGnostic:SERVice:VERSinfo? on page 417

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Install Option

Opens an edit dialog box to enter the license key for the option that you want to install.

Only user accounts with administrator rights are able to install options.

Install Option by XML

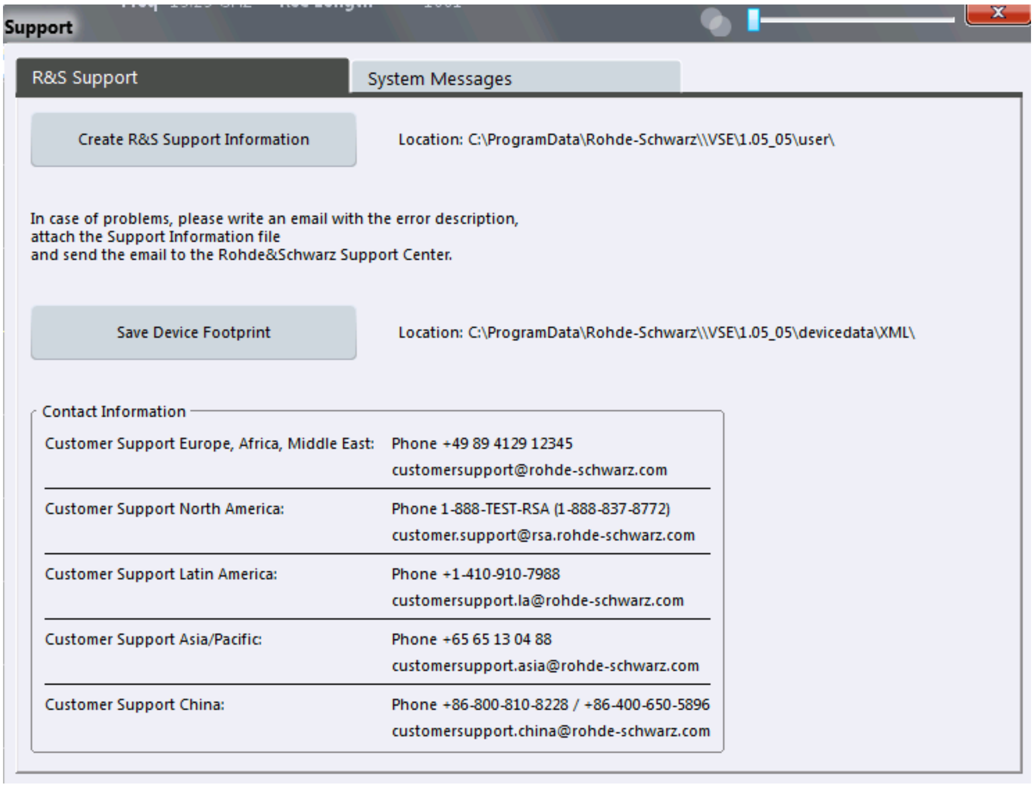
Opens a file selection dialog box to install an additional option to the R&S VSE using an XML file. Enter or browse for the name of an XML file that contains the option key and press "Select".

Only user accounts with administrator rights are able to install options.

9.4.2 R&S Support Information

Access: "Help" > "Support" > "R&S Support"

In case of errors you can store useful information for troubleshooting and send it to your Rohde & Schwarz support center.



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Creating R&S Support Information

Creates a *.zip file with important support information. The *.zip file contains the system configuration information ("device footprint"), the current eeprom data and a screenshot of the screen display.

This data is stored to the following directory on the PC the R&S VSE software is installed on:

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

The file name consists of the unique device ID and the current date and time of the file creation.

Example: VSE_1310.0002K02-900014-if_20140807_091003.zip.

If you contact the Rohde&Schwarz support to get help for a certain problem, send these files to the support in order to identify and solve the problem faster.

Remote command:
DIAGnostic:SERVice:SINFo? on page 416

Save Device Footprint

Creates an *.xml file with licensing information on installed software versions.

This data is stored to the following directory on the PC the R&S VSE software is installed on:

C:\ProgramData\Rohde-Schwarz\VSE\<version_no>\devicedata\xml\.

It is also included in the service.zip file.

The file name consists of the unique device ID and the current date and time of the file creation, e.g.
DeviceFootprint_1310.0002K02-900014-if_2014-08-07T06-58-29.xml.

10 I/Q Analyzer Measurements

10.1 Result Displays for the I/Q Analyzer

The I/Q Analyzer analyzes the I/Q data that was captured by the instrument in use or imported to the R&S VSE in various different result displays.

Spectrograms

Spectrograms are not configured as separate result displays, but as a subwindow of an existing I/Q Analyzer Spectrum or Magnitude window. They are activated and deactivated in the "Spectrogram" tab of the "Traces" settings (see "Spectrogram Settings" on page 178).

Magnitude....112
Spectrum....113
I/Q-Vector....114
Real/Imag (I/Q)....114
Statistic....115
Phase vs. Time....116
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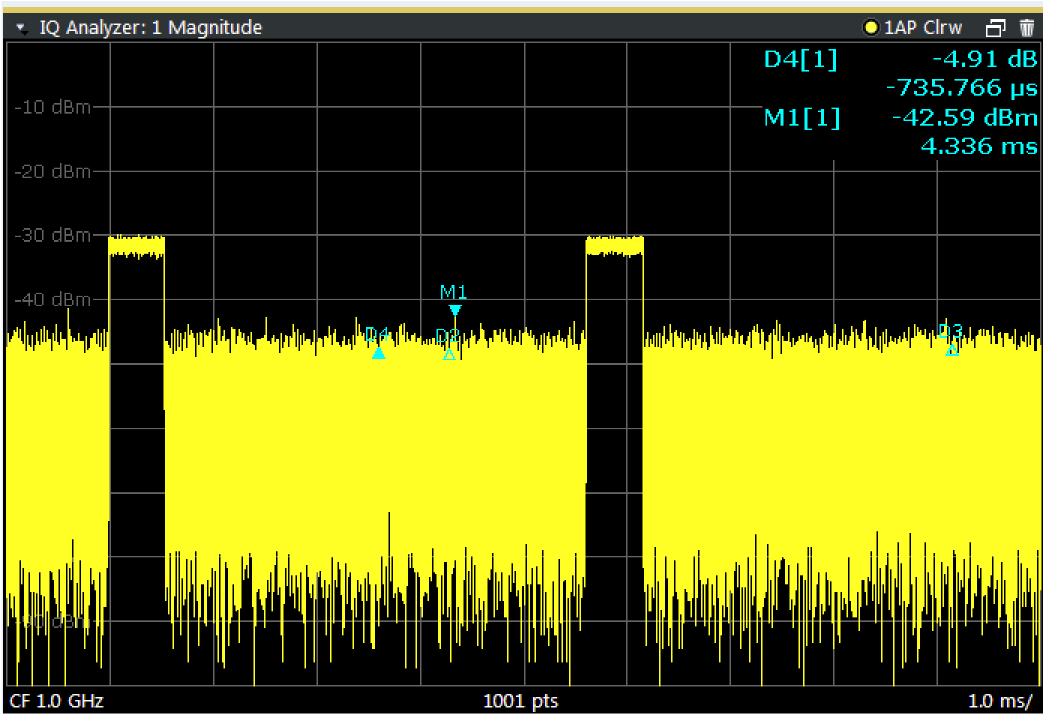
Magnitude

Shows the level values in time domain.



Remote command:

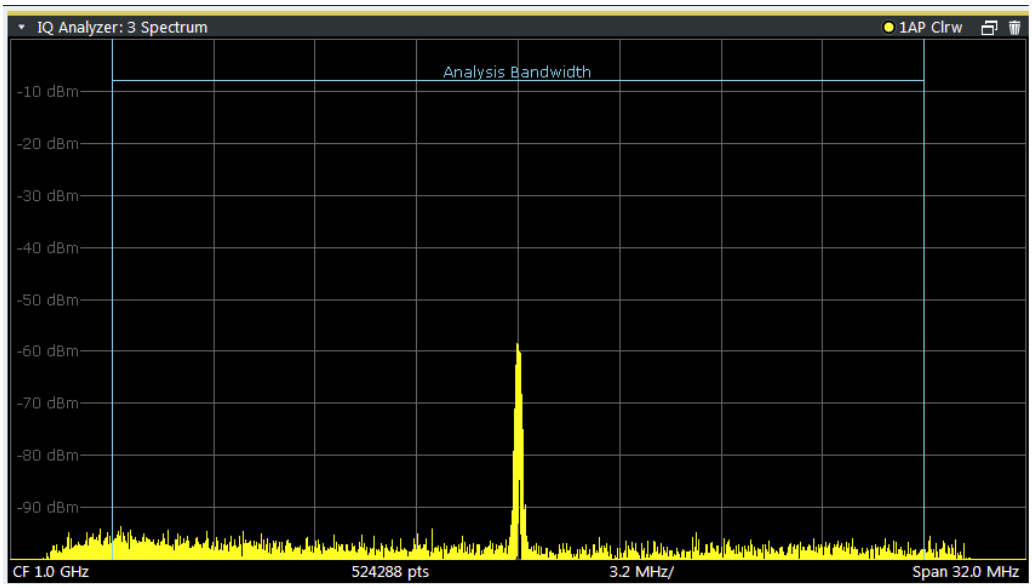
`LAY:ADD:WIND? '1',RIGH,MAGN`, see `LAYout:ADD[:WINDow]?` on page 306

Results:

`TRACe<n>[:DATA]?` on page 384

Spectrum

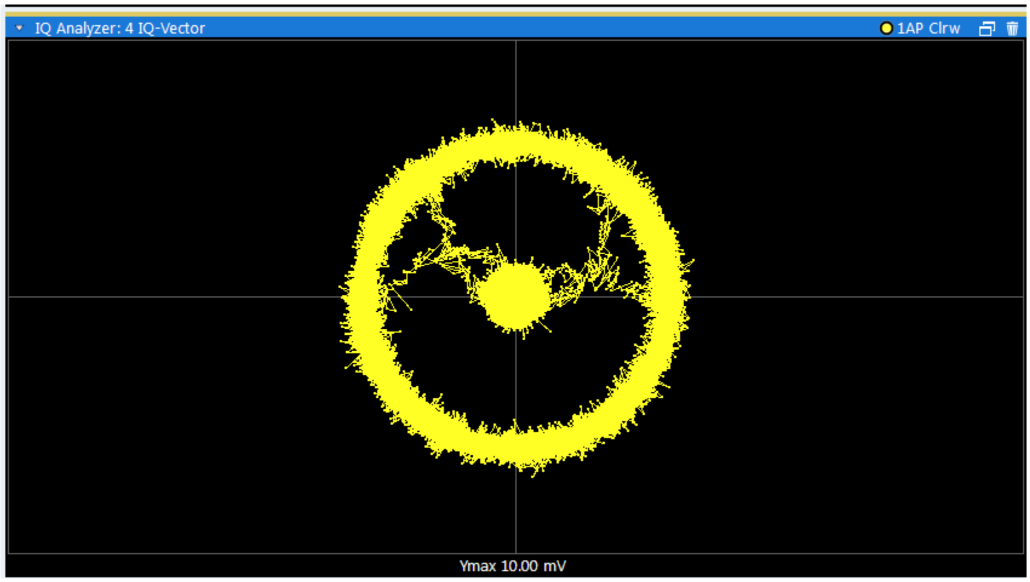
Displays the frequency spectrum of the captured I/Q samples.



Tip: You can analyze the levels per frequency over time using a Spectrogram, see "Working with Spectrograms" on page 169.

Remote command:
`LAY:ADD:WIND? '1',RIGH,FREQ`, see `LAYout:ADD[:WINDow]?` on page 306
Results:
`TRACe<n>[:DATA]?` on page 384

I/Q-Vector
Displays the captured samples in an I/Q-plot. The samples are connected by a line.



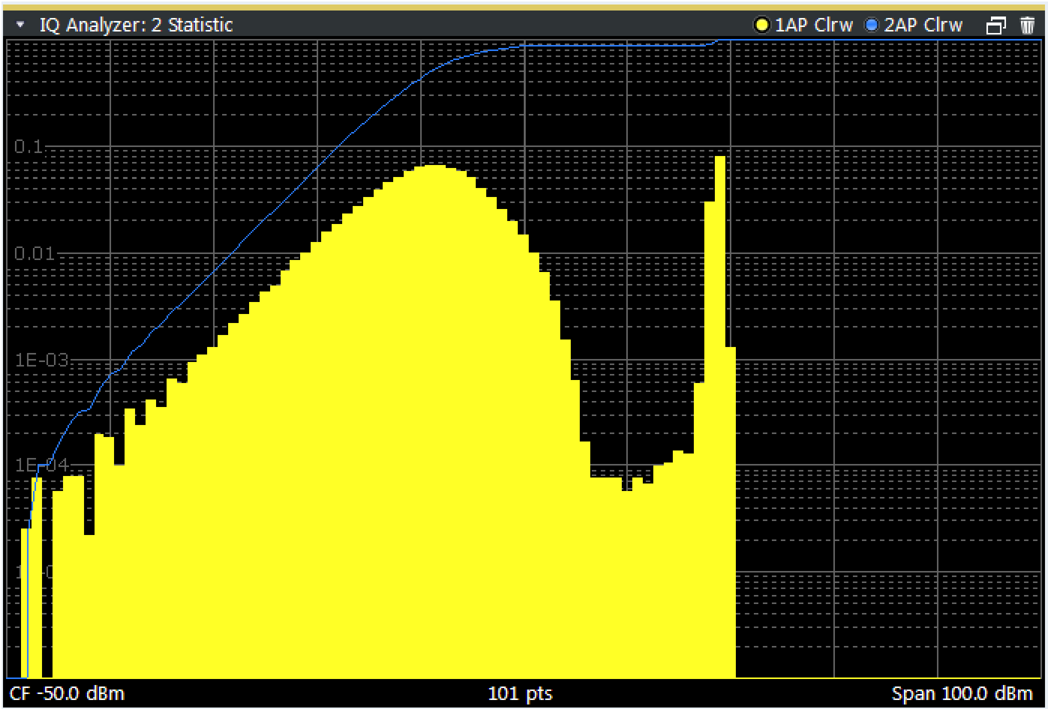
Note: For the I/Q vector result display the number of I/Q samples to record ("Record Length") is automatically set to the number of measurement points. The number of measurement points cannot be changed for this result display.

Remote command:
`LAY:ADD:WIND? '1',RIGH,VECT`, see `LAYout:ADD[:WINDow]?` on page 306
Results:
`TRACe<n>[:DATA]?` on page 384

Real/Imag (I/Q)
Displays the I and Q values in separate diagrams.

Remote command:
`LAY:ADD:WIND? '1',RIGH,RIM`, see `LAYout:ADD[:WINDow]?` on page 306
Results:
`TRACe<n>[:DATA]?` on page 384

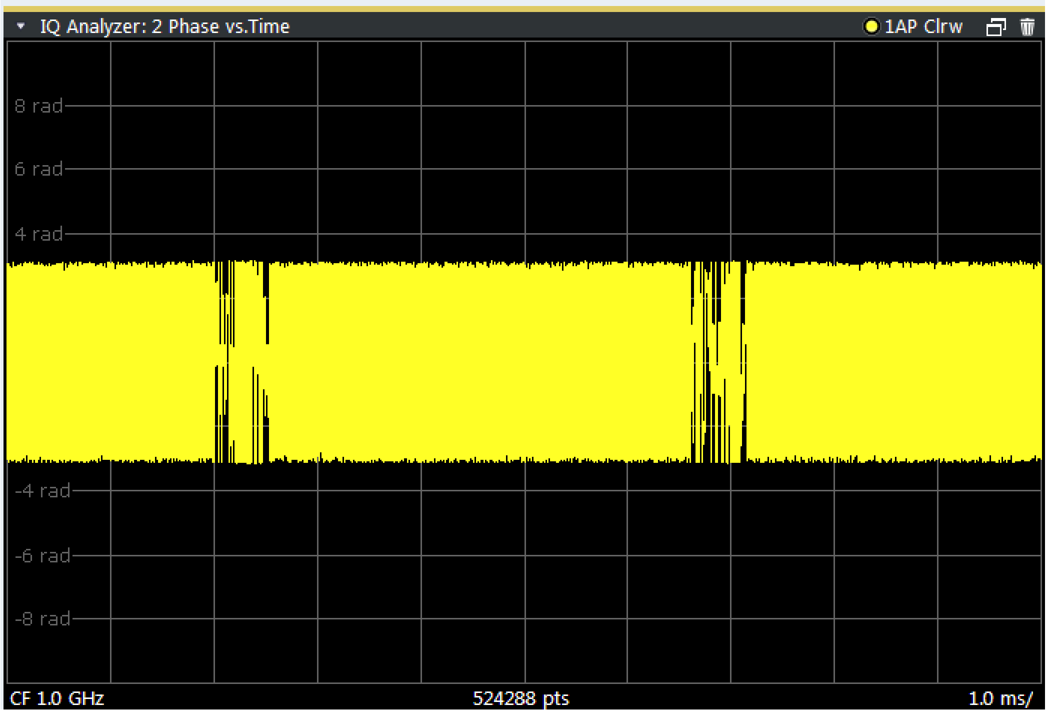
Statistic
Shows a histogram of measured I/Q magnitudes. The number of bins used for the histogram, that is, the number of different measurement values the statistical occurrence is determined for, can be defined.



Remote command:
`LAY:ADD? '1',RIGH,STAT`, see `LAYout:ADD[:WINDow]?` on page 306

Phase vs. Time

Shows the phase values in the time domain.



Remote command:
`LAY:ADD? '1',RIGH, POLar`, see `LAYout:ADD[:WINDow]?` on page 306

Marker Table

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

This table may be displayed automatically if configured accordingly (see "Marker Table Display" on page 198).

3 Marker Table

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

Remote command:
`LAY:ADD? '1',RIGH, MTAB`, see `LAYout:ADD[:WINDow]?` on page 306
Results:
`CALCulate<n>:MARKer<m>:X` on page 358
`CALCulate<n>:MARKer<m>:Y?` on page 386

10.2 Basics on I/Q Data Acquisition and Processing

Some background knowledge on basic terms and principles used when describing I/Q data processing in the R&S VSE software in general, and in the I/Q Analyzer application in particular, is provided here for a better understanding of the required configuration settings.

Principally, the R&S VSE (and all its applications) analyze data that was captured on a connected instrument, or directly from a file with stored I/Q data. The software itself does not capture data.

Complex baseband data

In the telephone systems of the past, baseband data was transmitted unchanged as an analog signal. In modern phone systems and in radio communication, however, the baseband data is modulated on a carrier frequency, which is then transmitted and must be demodulated by the receiver. When using modern modulation methods (e.g. QPSK, QAM etc.), the baseband signal becomes complex. Complex data (or: *I/Q* data) consists of an imaginary (I) and a real (Q) component.

The R&S VSE software is capable of analyzing the individual I and Q components of the complex signal.

I/Q Analyzer - analyzing complex data

The I/Q Analyzer is a standard application used to analyze I/Q data with the R&S VSE. By default, it assumes the I/Q data is modulated on a carrier frequency.

- How Much Data is Measured: Capture Count and Measurement Points............ 118
- Sample Rate, Record Length and Analysis Bandwidth...................................... 119
- Basics on FFT... 119
- Receiving Data Input and Providing Data Output... 125

10.2.1 How Much Data is Measured: Capture Count and Measurement Points

The number of measurements to be performed in single measurement mode is defined by the "Capture Count". Values from 0 to 200000 are allowed. If the values 0 or 1 are set, one measurement is performed. The capture count is applied to all the traces in a diagram.

If the trace configurations "Average", "Max Hold" or "Min Hold" are set, the "Capture Count" also determines the number of averaging or maximum search procedures (see "Analyzing Several Traces - Trace Mode" on page 166).

The number of points configured in the capture settings is not actually the number of points to be captured (that is defined as the Record Length), but rather the number of points to be evaluated in each trace (also referred to as *measurement points*). Thus, the number of measurement points is window-specific. (However, all time-based displays (except for I/Q Vector) use the same number of measurement points.)

For *I/Q Vector* displays, the number of measurement points is always coupled to the Record Length, which has a maximum of 524288 points.

For *Spectrum* displays and all *time-based* displays (except for the I/Q Vector), the number of measurement points can either be defined manually or automatically.

In Auto mode, the number is coupled to the number of frequency points ("FFT Length" on page 158).

In Manual mode, all values from 51 to 524288 can be set. The default value is 1001 points.

For details on how the number of points and the capture count affect the trace results on the screen, see "Mapping Samples to measurement Points with the Trace Detector" on page 164.

10.2.2 Sample Rate, Record Length and Analysis Bandwidth

Definitions

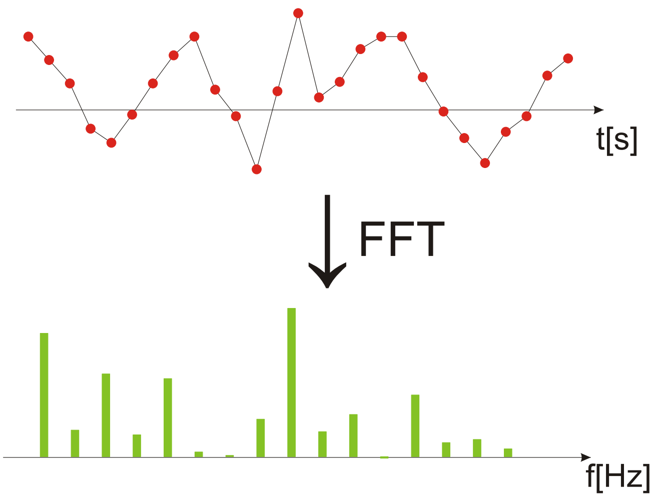
- **Input sample rate (ISR)**: the sample rate of the useful data provided by the device connected to the input of the instrument in use
- (User, Output) **Sample rate (SR)**: the sample rate that is defined by the user (e.g. in the "Data Aquisition" dialog box in the "I/Q Analyzer" application) and which is used as the basis for analysis or output
- **Usable I/Q (Analysis) bandwidth**: the bandwidth range in which the signal remains undistorted in regard to amplitude characteristic and group delay; this range can be used for accurate analysis by the R&S VSE
- **Record length**: Number of I/Q samples the instrument in use captures during the specified measurement time; calculated as the measurement time multiplied by the sample rate. By default, the record length is set to the number of measurement points, and the measurement time and sample rate are adapted accordingly. The maximum record length is 524288, but may not exceed the number of samples provided by the instrument in use.

For the I/Q data acquisition, digital decimation filters are used internally in the instrument in use. The passband of these digital filters determines the *maximum usable I/Q bandwidth*. In consequence, signals within the usable I/Q bandwidth (passband) remain unchanged, while signals outside the usable I/Q bandwidth (passband) are suppressed. Usually, the suppressed signals are noise, artifacts, and the second IF side band. If frequencies of interest to you are also suppressed, you should try to increase the output sample rate, since this increases the maximum usable I/Q bandwidth.

As a rule, the usable I/Q bandwidth is proportional to the output sample rate. However, the bandwidth used by the R&S VSE software is restricted by the bandwidth provided by the instrument in use.

10.2.3 Basics on FFT

The I/Q Analyzer measures the power of the signal over time. In order to convert the time domain signal to a frequency spectrum, an FFT (Fast Fourier Transformation) is performed which converts a vector of input values into a discrete spectrum of frequencies.



10.2.3.1 Frequency Resolution of FFT Results - RBW

The **resolution bandwidth** defines the minimum frequency separation at which the individual components of a spectrum can be distinguished. Small values result in a high precision, as the distance between two distinguishable frequencies is small. Higher values decrease the precision, but increase measurement speed.

The RBW is determined by the following equation:

$$RBW = Normalized\,Bandwidth * \frac{Sample\ Rate}{Window\ Length}$$

Definition of RBW (10 - 1)

(Note: The normalized bandwidth is a fixed value that takes the noise bandwidth of the window function into consideration.)

The maximum RBW is restricted by the Analysis Bandwidth, or by the following equation, whichever is higher:

$$RBW_{max} = \frac{Normalized\,Bandwidth * Sample\ Rate}{3}$$

If a higher spectral resolution is required, the number of samples must be increased by using a higher sample rate or longer record length.

The minimum achievable RBW depends on the sample rate and record length, according to the following equation:

$$RBW_{min} = \frac{Normalized\,Bandwidth * Sample\ Rate}{524288}$$

RBW and FFT mode

Depending on the selected RBW mode, the resolution bandwidth is either determined automatically or can be defined manually.

Auto mode:

This is the default mode in the I/Q Analyzer. The RBW is determined automatically depending on the Sample Rate and the Record Length.

A single window is used, thus the Window Length corresponds to the Record Length.

A Flatop window function is used.

(Note: if you enter an RBW value in Auto mode, the mode is automatically switched to Manual.

Manual mode:

The RBW can be defined by the user. The required Sample Rate, Record Length and the "Meas Time" on page 156 are adapted accordingly.

A single window is used, thus the Window Length corresponds to the Record Length.

A Flatop window function is used.

Advanced FFT mode

The RBW is determined by the advanced FFT parameters. Using advanced FFT mode, multiple overlapping FFT windows can be used with an averaging transformation algorithm (see "Combining Results - Trace Detector" on page 123).

10.2.3.2 FFT Calculation Methods

FFT calculation can be performed using different methods.

Single

In single mode, one FFT is calculated for the entire record length, that means the window length is identical to the FFT length, and both are identical to the record length.

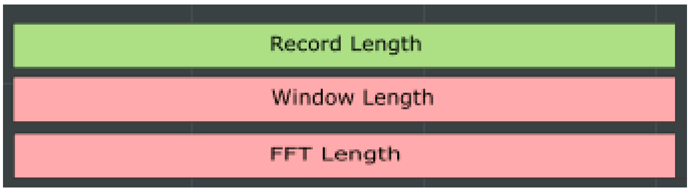


Fig. 10-1: FFT parameters for single FFT calculation

Averaging

In averaging mode, several overlapping FFTs are calculated for each record; the results are combined to determine the final FFT result for the record.

The number of FFTs to be combined is determined by the Window Overlap and the Window Length.

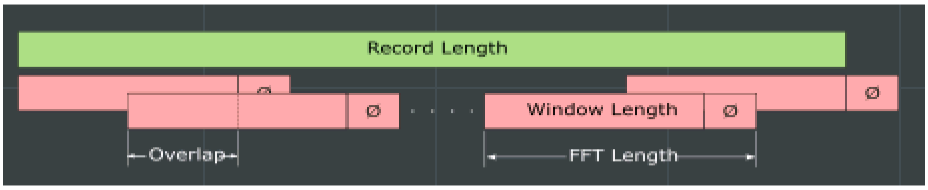


Fig. 10-2: FFT parameters for averaged FFT calculation

Window Functions

In advanced FFT mode, the Fourier transformation is not performed on the entire captured data in one step. In this case, an averaging transformation algorithm is used, which uses only a limited number of samples to calculate an individual result. This process is called windowing.

After sampling in the time domain, each window is multiplied with a specific window function. Windowing helps minimize the discontinuities at the end of the measured signal interval and thus reduces the effect of spectral leakage, increasing the frequency resolution.

Various different window functions are provided in the R&S VSE to suit different input signals. Each of the window functions has specific characteristics, including some advantages and some trade-offs. These characteristics need to be considered carefully to find the optimum solution for the measurement task.

Ignoring the window function - rectangular window

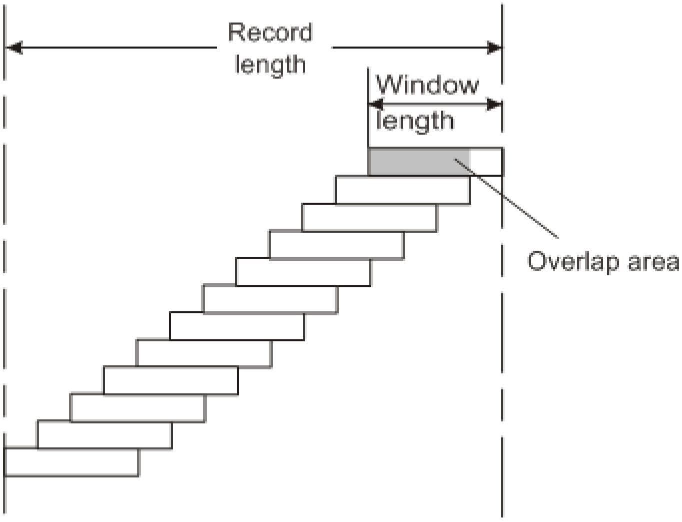
The regtangular window function is in effect not a function at all, it maintains the original sampled data. This may be useful to minimize the required bandwidth; however, be aware that if the window does not contain exactly one period of your signal, heavy sidelobes may occur, which do not exist in the original signal.

Table 10-1: Characteristics of typical FFT window functions

Window type	Frequency resolution	Magnitude resolution	Sidelobe suppression	Measurement recommendation
Rectangular	Best	Worst	Worst	No function applied. Separation of two tones with almost equal amplitudes and a small frequency distance
Blackman-Harris (default)	Good	Good	Good	Harmonic detection and spurious emission detection
Gauss (Alpha = 0.4)	Good	Good	Good	Weak signals and short duration
Flattop	Worst	Best	Good	Accurate single tone measurements
5-Term	Good	Good	Best	Measurements with very high dynamic range

Overlapping

The averaging transformation algorithm in advanced FFT mode calculates multiple FFTs per measurement by dividing one captured record into several windows. Consecutive windows may overlap. Overlapping "reuses" samples that were already used to calculate the preceding FFT result.



In advanced FFT mode with averaging, the overlapping factor can be set freely. The higher the overlap factor, the more windows are used. This leads to more individual results and improves detection of transient signal effects. However, it also extends the duration of the calculation. The size of the window can be defined manually according to the record length, the overlap factor, and and the FFT length.

With an overlap of the FFTs of 67%, for example, the second data block the R&S VSE performs the FFT on covers the last 67% of the data of the first FFT with only 33% new data. The third data block still covers 33% of the first data block and 67% of the second data block and so on.

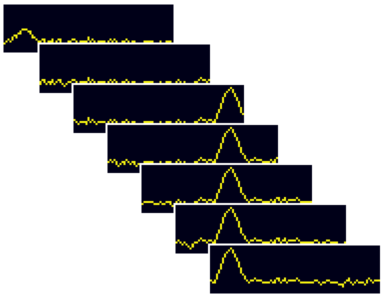
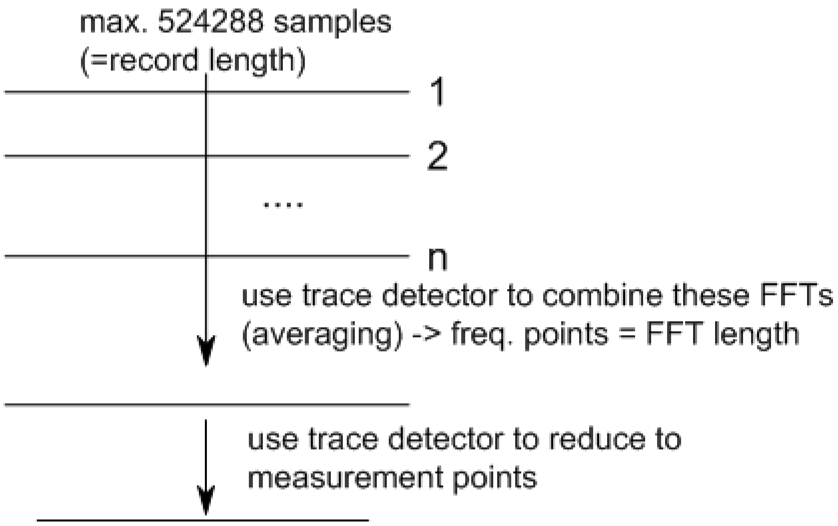


Fig. 10-3: Overlapping FFTs

Combining Results - Trace Detector

Multiple overlapping windows are combined to create the final spectrum using the selected trace detector. If necessary, the trace detector is also used to reduce the number of calculated frequency points (defined by the FFT length) to the defined number of measurement points. By default, the Autopeak trace detector is used.

Due to the fact that the frequency points are reduced to the number of measurement points, using a detector other than Auto Peak may lead to wrong level results if the measurement points are fewer than the number of calculated frequency points (defined by the FFT length) .



Dependencies Between FFT Parameters in Averaging Mode

Advanced FFT analysis in the R&S VSE is highly configurable. Several parameters, including the record length, FFT length, and Window length, can be defined according to the user's requirements. Note, however, that these parameters are correlated and can not be configured independently of the others.

Record Length

Defines the number of I/Q samples to capture from the instrument in use. By default, the number of measurement points is used. The record length is calculated as the measurement time multiplied by the sample rate.

The maximum record length is 524288, but may not exceed the instrument in use or the number of samples provided by the input file.

FFT Length

Defines the number of frequency points determined by each FFT calculation. The more points are used, the higher the resolution in the spectrum becomes, but the longer the calculation takes.

If you use the arrow keys or the mouse wheel to change the FFT length, the value is incremented or decremented by powers of 2. If you enter the value manually, any integer value from 3 to 524288 is available.

If the FFT length is longer than the Window Length the sample data is filled up with zeros up to the FFT length. The FFT is then performed using interpolated frequency points.

For an FFT length that is not a power of 2, a DFT (discrete Fourier transform) is performed, which requires more time for calculation, but avoids the effects of interpolation.

In order to display all calculated frequency points (defined by the FFT length), the number of measurement points is set to the FFT length automatically in advanced FFT mode.

Window Length

Defines the number of samples to be included in a single window in averaging mode.

Values from 3 to 524288 are available. However, the window length may not be longer than the FFT Length.

If the window length is shorter than the FFT Length, the sample data is filled up with zeros up to the FFT length.

If the window length is longer than the Record Length (that is, not enough samples are available), a window length the size of the Record Length is used for calculation.

The window length and the Window Overlap determine how many FFT calculations must be performed for each record in averaging mode (see "Transformation Algorithm" on page 158).

10.2.4 Receiving Data Input and Providing Data Output

The R&S VSE can analyze signals from different input sources and provide various types of output (such as noise or trigger signals).

10.2.4.1 Input from Noise Sources

The instrument in use may provide a connector (NOISE SOURCE CONTROL) with a voltage supply for an external noise source. By switching the supply voltage for an external noise source on or off via the software, you can activate or deactive the connected device as required.

External noise sources are useful when you are measuring power levels that fall below the noise floor of the instrument in use itself, for example when measuring the noise level of an amplifier.

In this case, you can first connect an external noise source (whose noise power level is known in advance) to the instrument in use and measure the total noise power. From this value you can determine the noise power of the instrument in use. Then when you measure the power level of the actual DUT, you can deduct the known noise level from the total power to obtain the power level of the DUT.

The noise source is controlled in the "Output" settings, see "Noise Source" on page 133

10.2.4.2 Receiving and Providing Trigger Signals

Using one of the TRIGGER INPUT / OUTPUT connectors of the instrument in use, the R&S VSE can use a signal from an external device as a trigger to capture data. Alternatively, the internal trigger signal used by the instrument in use can be output for use by other connected devices. Using the same trigger on several devices is useful to synchronize the transmitted and received signals within a measurement.

For details on the connectors see the R&S VSE "Getting Started" manual.

External trigger as input

If the trigger signal for the R&S VSE is provided by an external device, the trigger signal source must be connected to the instrument in use and the trigger source must be defined as "External" for the R&S VSE.

Trigger output

The instrument in use can provide output to another device either to pass on the internal trigger signal, or to indicate that the instrument in use itself is ready to trigger.

The trigger signal can be output by the instrument in use automatically, or manually by the user. If it is provided automatically, a high signal is output when the instrument in use has triggered due to a measurement start ("Device Triggered"), or when the instrument in use is ready to receive a trigger signal after a measurement start ("Trigger Armed").

Manual triggering

If the trigger output signal is initiated manually, the length and level (high/low) of the trigger pulse is also user-definable. Note, however, that the trigger pulse level is always opposite to the constant signal level defined by the output "Level" setting, e.g. for "Level = High", a constant high signal is output to the connector until the "Send Trigger" button is selected. Then, a low pulse is provided.

Providing trigger signals as output is described in detail in the R&S VSE User Manual.

10.3 Configuration

Access: "Meas Setup" > "Overview"

The easiest way to configure a measurement channel is via the "Overview" dialog box.

Alternatively, you can access the individual dialog boxes from the corresponding menu items, or via tools in the toolbars, if available.

In this documentation, only the most convenient method of accessing the dialog boxes is indicated - usually via the "Overview". For an overview of all available menu items and toolbar icons see chapter A.1, "Menu Reference", on page 449 and chapter A.2, "Reference of Toolbar Functions", on page 454.

The remote commands required to perform these tasks are described in chapter 13.6, "Remote Commands for the I/Q Analyzer", on page 311.

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- Data Input and Output Settings......129
- Amplitude......135
- Frequency Settings......143
- Triggers......145
- Data Acquisition and Bandwidth Settings......154
- Adjusting Settings Automatically......161

10.3.1 Configuration Overview

Access: "Meas Setup" > "Overview"

The easiest way to configure an I/Q Analysis channel is via the "Overview" dialog box.

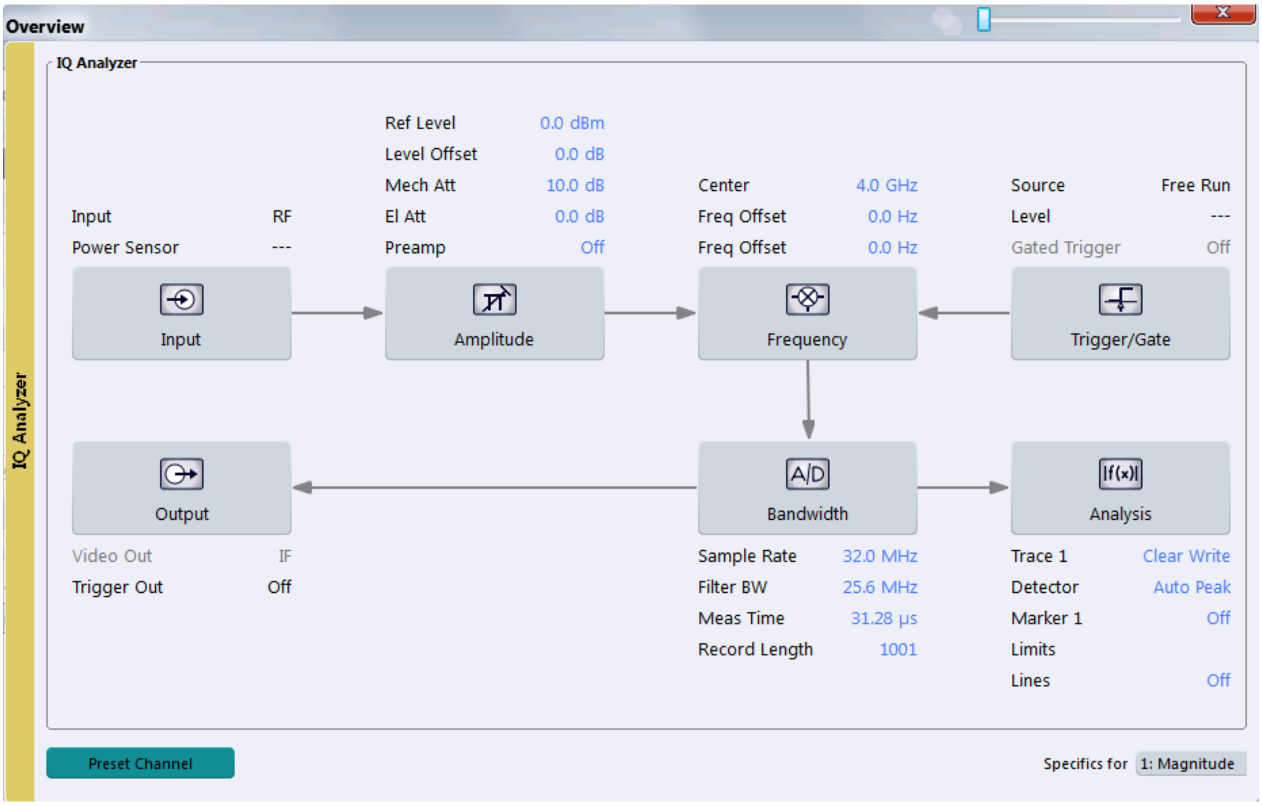

Fig. 10-4: Configuration Overview for I/Q Analyzer

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

The Overview varies depending on the application; for detailed descriptions see the corresponding application's User Manual.

The "Overview" for the I/Q Analyzer provides quick access to the following configuration dialog boxes (listed in the recommended order of processing):

1. Input settings
   See chapter 10.3.2, "Data Input and Output Settings", on page 129
2. Amplitude settings
   See chapter 10.3.3, "Amplitude", on page 135
3. Frequency settings
   See chapter 10.3.4, "Frequency Settings", on page 143
4. Optionally, Trigger/Gate settings
   See chapter 10.3.5, "Triggers", on page 145
5. Bandwidth (data acquisition and capture) settings
   See chapter 10.3.6, "Data Acquisition and Bandwidth Settings", on page 154
6. Optionally, output settings
   See chapter 10.3.2, "Data Input and Output Settings", on page 129
7. Analysis settings and functions
   See chapter 10.4, "Analysis", on page 164

To configure settings

► Select any button in the "Overview" or select a setting in the channel's global info bar to open the corresponding dialog box.

For step-by-step instructions on configuring I/Q Analyzer measurements, see chapter 11, "How To Perform Measurements with the R&S VSE", on page 213.

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

This function has the same effect as the "Preset > Selected Channel" menu item.

Remote command:
`SYSTem:PRESet:CHANnel[:EXECute]` on page 388

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.

10.3.2 Data Input and Output Settings

Access: "Input & Output"

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

- Radio Frequency Input..129
- I/Q File Input..132
- Output Settings..133

10.3.2.1 Radio Frequency Input

Access: "Overview" > "Input" > "Input Source" > "Radio Frequency"

or: "Input & Output" > "Input Source" > "IQ File"

The default input source for the instrument in use is "Radio Frequency". Depending on the instrument in use, different input parameters are available.

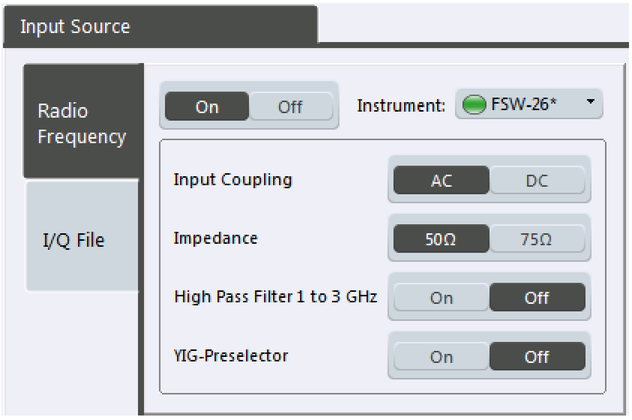

Fig. 10-5: RF input source settings for an R&S FSW

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Input Coupling..130
Impedance..130
High-Pass Filter 1...3 GHz..130
YIG-Preselector..130
Preselector State..131
Preselector Mode..131
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Input Type

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

Remote command:

`INSTrument:BLOCk:CHANnel[:SETTings]:SOURce` on page 285

`INPut:SELect` on page 314

Instrument
Specifies a configured instrument to be used for input.

Input Coupling
The RF input of the instrument in use 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 312

Impedance
For some measurements, the reference impedance for the measured levels of the instrument in use 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).

Remote command:
`INPut:IMPedance` on page 313

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 instrument in use.

Remote command:
`INPut:FILTer:HPASs[:STATe]` on page 312

YIG-Preselector
Activates or deactivates the YIG-preselector, if available on the instrument in use.

An internal YIG-preselector at the input of the instrument in use 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 instrument in use, which may lead to image-frequency display.

Note:
For the following measurements, the YIG-Preselector is off by default (if available).
- I/Q Analyzer
- GSM
- VSA

Remote command:
`INPut:FILTer:YIG[:STATe]` on page 313

Preselector State

Turns the preselector on and off.

When you turn the preselector on, you can configure the characteristics of the preselector and add the preamplifier into the signal path.

When you turn the preselector off, the signal bypasses the preselector and the preamplifier, and is fed into the input mixer directly.

Remote command:
`INPut:PRESelection[:STATe]` on page 313

Preselector Mode

Selects the preselection filters to be applied to the measurement.

"Auto" Performs a measurement by automatically applying all available bandpass filters.
Available with the optional preamplifier.

"Auto Wide" Performs a measurement by automatically applying the wideband filters consecutively:

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

Available with the optional preselector.

"Auto Narrow" Performs a measurement by automatically applying the most suitable narrowband preselection filters, depending on the bandwidth you have selected.
For measurement frequencies up to 30 MHz, the instrument in use uses combinations of lowpass and highpass filters. For higher frequencies, the instrument in use uses bandpass filters.
Available with the optional preselector.

"Manual" Performs a measurement with the filter settings you have defined manually.

Remote command:
`INPut:PRESelection:SET` on page 313

10 dB Minimum Attenuation

Turns the availabilty of attenuation levels of less than 10 dB on and off.

When you turn the feature on, the attenuation level is always at least 10 dB to protect the input mixer and avoid accidental setting of 0 dB, especially if you measure DUTs with high RFI voltage.

When you turn it off, you can also select attenuation levels of less than 10 dB.

The setting applies to a manual selection of the attenuation as well as the automatic selection of the attenuation.

Remote command:
`INPut:ATTenuation:PROTection[:STATe]` on page 312

Input Selection
Selects the RF input you would like to use for a measurement.

Note that you can not use both RF inputs simultaneously.

Remote command:
Global: `INPut:TYPE` on page 314

10.3.2.2 I/Q File Input

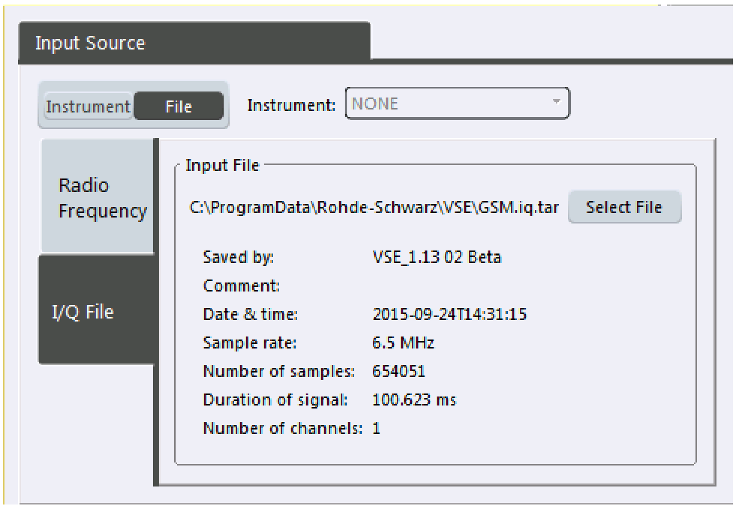
Access: "Overview" > "Input" > "Input Source" > "IQ File"

or: "Input & Output" > "Input Source" > "IQ File"

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.

(See "Assigning the Channel Input Source" on page 72).



Input Type 132
Input File 132

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

Remote command:
`INSTrument:BLOCk:CHANnel[:SETTings]:SOURce` on page 285
`INPut:SELect` on page 314

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

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

(See chapter 8.3.4.1, "Loading the I/Q Data File and Essential Measurement Information", on page 92).

10.3.2.3 Output Settings

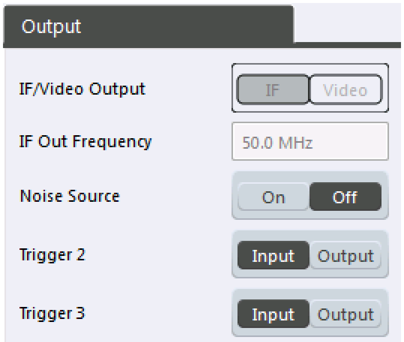
Access: "Overview" > "Output"

or: "Input & Output" > "Output"

The R&S VSE can control the output provided by the instrument in use to special connectors for other devices.

Which output settings and connectors are available depends on the instrument in use.

For details on the output connectors refer to the instrument's Getting Started manual.



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Noise Source......133
Trigger 2/3......134
└ Output Type......134
└ Level......134
└ Pulse Length......134
└ Send Trigger......135

IF/VIDEO/DEMOD Output

This function is currently not available.

IF Out Frequency

This function is currently not available.

Noise Source

Switches the supply voltage for an external noise source on the instrument in use on or off, if available.

External noise sources are useful when you are measuring power levels that fall below the noise floor of the instrument in use itself, for example when measuring the noise level of a DUT.

For details see chapter 10.2.4.1, "Input from Noise Sources", on page 125

Remote command:
`DIAGnostic:SERVice:NSOurce` on page 315

Trigger 2/3
Defines the usage of variable trigger input/output connectors on the instrument in use. Which output settings are available depends on the type of instrument in use. For details see the instrument's documentation.

"Input"	The signal at the connector is used as an external trigger source by the instrument in use. Trigger input parameters are available in the "Trigger" dialog box.
"Output"	The instrument in use sends a trigger signal to the output connector to be used by connected devices. Further trigger parameters are available for the connector.

Remote command:
`OUTPut:TRIGger<port>:LEVel` on page 332
`OUTPut:TRIGger<port>:DIRection` on page 332

Output Type ← Trigger 2/3
Type of signal to be sent to the output

"Device Triggered"	(Default) Sends a trigger when the instrument in use triggers.
"Trigger Armed"	Sends a (high level) trigger when the instrument in use is in "Ready for trigger" state. This state is indicated by a status bit in the `STATus:OPERation` register (bit 5), as well as by a low level signal at the AUX port (pin 9) of the instrument in use, if available. For details see "STATus:OPERation Register" on page 242 and the instrument's documentation.
"User Defined"	Sends a trigger when user selects "Send Trigger" button. In this case, further parameters are available for the output signal.

Remote command:
`OUTPut:TRIGger<port>:OTYPe` on page 332

Level ← Output Type ← Trigger 2/3
Defines whether a constant high (1) or low (0) signal is sent to the output connector.

Remote command:
`OUTPut:TRIGger<port>:LEVel` on page 332

Pulse Length ← Output Type ← Trigger 2/3
Defines the length of the pulse sent as a trigger to the output connector.

Remote command:
`OUTPut:TRIGger<port>:PULSe:LENGth` on page 333

Send Trigger ← Output Type ← Trigger 2/3
Sends a user-defined trigger to the output connector immediately. Note that the trigger pulse level is always opposite to the constant signal level defined by the output "Level" setting, e.g. for "Level = High", a constant high signal is output to the connector until the "Send Trigger" button is selected. Then, a low pulse is sent.

Which pulse level will be sent is indicated by a graphic on the button.

Remote command:
`OUTPut:TRIGger<port>:PULSe:IMMediate` on page 333

10.3.3 Amplitude

Access: "Overview" > "Amplitude"

or: "Input & Output" > "Amplitude"

Amplitude settings affect the y-axis display in power diagrams.

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- Amplitude Settings....137
- Scaling the Y-Axis....141
- Scaling Statistics Displays....142

10.3.3.1 Impact of the Vertical Axis Settings

Some background knowledge on the impact of the described settings is provided here for a better understanding of the required configuration.

- Reference Level....135
- RF Attenuation....136
- Scaling....137

Reference Level

The reference level value is the maximum value the AD converter can handle without distortion of the measured value. Signal levels above this value will not be measured correctly, which is indicated by the "IF OVLD" status display.

Internally, the reference level is also used to determine the optimum hardware settings for the R&S VSE. The defined reference level should correspond with the maximum expected RF input level.

When determining the expected input level, consider that the power from *all* input signals contribute to the total power. The reference level must be higher than the total power from all signals.

The optimum reference level for the current measurement settings can be set automatically by the R&S VSE (see "Reference Level" on page 138).

In general, the instrument in use measures the signal voltage at the RF input. The level display is calibrated in RMS values of an unmodulated sine wave signal. In the default state, the level is displayed at a power of 1 mW (= dBm). Via the known input impedance (50 Ω or 75 Ω, see "Impedance" on page 130), conversion to other units is possible.

Reference level offset

If the signal is attenuated or amplified before it is fed into the R&S VSE, you can define an (arithmetic) offset to the reference level so the application shows correct power results. All displayed power level results are shifted by this value, and the scaling of the y-axis is changed accordingly.

To determine the required offset, consider the external attenuation or gain applied to the input signal. For attenuation, define a positive offset so the R&S VSE increases the displayed power values.

If an external gain is applied, define a negative offset so the R&S VSE decreases the displayed power values.

Note, however, that the *internal* reference level (used to adjust the hardware settings to the expected signal optimally) ignores any "Reference Level Offset". Thus, it is important to keep in mind the actual power level the R&S VSE must handle, and not to rely on the displayed reference level.

internal reference level = displayed reference level - offset

Example

1. The initial reference level is 2 dBm with no offset.

   Both the displayed reference level and the internal reference level are 2 dBm.

2. An offset of 3 dB is defined.

   The displayed reference level is adjusted to 5 dBm.
   The internal reference level remains at 2 dBm.
   (5 dBm (displayed ref level) - 3 dB (offset) = 2 dBm)

3. Now the user decreases the reference level to 1 dBm.

   The displayed reference level is adjusted to 1 dBm.
   The internal reference level is adjusted to:
   1 dBm (displayed ref level) - 3 dB (offset) = -2 dBm.

RF Attenuation

The attenuation is meant to protect the input mixer from high RF input levels. The level at the input mixer is determined by the set RF attenuation according to the formula:

"$level_{mixer}$ = $level_{input}$ – RF attenuation"

The maximum mixer level allowed is 0 dBm. Mixer levels above this value may lead to incorrect measurement results, which is indicated by the "RF OVLD" status display. Furthermore, higher input levels may damage the instrument. Therefore, the required RF attenuation is determined automatically according to the reference level by default.

High attenuation levels also avoid intermodulation. On the other hand, attenuation must be compensated for by re-amplifying the signal levels after the mixer. Thus, high attenuation values cause the inherent noise (i.e the noise floor) to rise and the sensitivity of the analyzer decreases.

For ideal sinusoidal signals, the displayed signal level is independent of the RF attenuation.

Depending on the type of measurement evaluation that is required, a compromise must be found between a low noise floor and high intermodulation levels, and protecting the instrument from high input levels. This is best done by letting the instrument in use determine the optimum level automatically (see "Attenuation Mode / Value" on page 140).

Scaling

In a linear display, the measurement values are distributed linearly throughout the grid. That means the entire range of measured values is divided by the number of rows in the grid (10) and each row corresponds to 1/10 of the total range. Linear scaling is useful to determine precise levels for a small range of values. However, if large and small values appear in the same display, it is difficult to determine individual values precisely or to distinguish values that are close together.

In a logarithmic display, smaller values are distributed among a much larger area of the display, while large values are condensed to a smaller area. Now it is much easier to distinguish several lower values, as they are spread over a wider area. Logarithmic scaling is useful when large ranges of values must be combined in one display. Logarithmic scaling is best applied to measurement values in logarithmic units (dB, dBm etc.).

In addition to linear or logarithmic scaling, the vertical axis can be set to display either absolute or relative values. Absolute values show the measured levels, while relative values show the difference between the measured level and the defined reference level. Relative values are indicated in percent for linear scaling, and in dB for logarithmic scaling.

10.3.3.2 Amplitude Settings

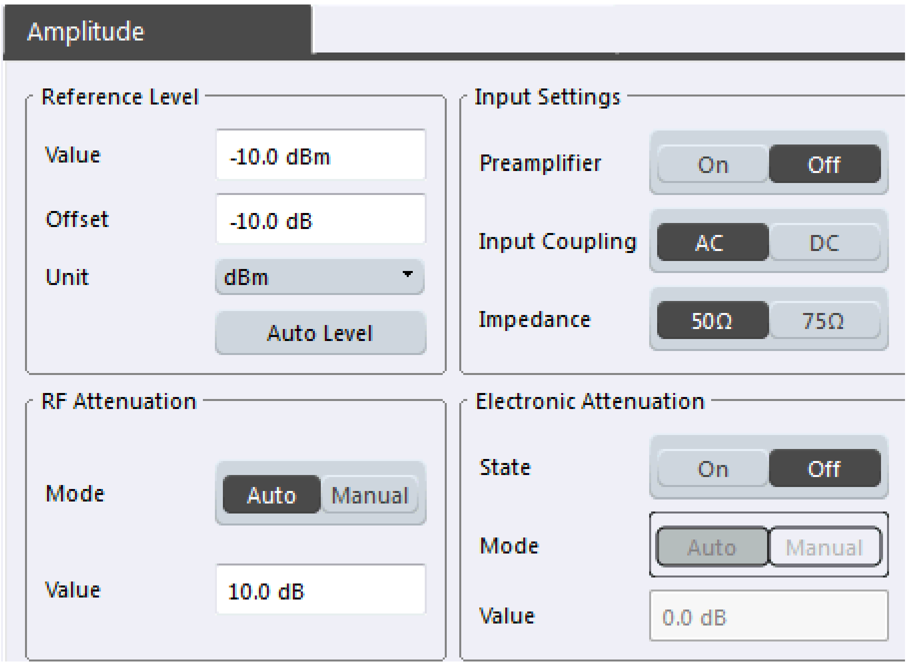
Access: "Overview" > "Input/Frontend" > "Amplitude"

or: "Input & Output" > "Amplitude"

Amplitude settings determine how the instrument in use must process or display the expected input power levels.

Which amplitude settings are available depends on the instrument in use.

The remote commands required to define these settings are described in "Amplitude Settings" on page 315.



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└ Unit...139
└ Setting the Reference Level Automatically (Auto Level)..............................139
RF Attenuation...139
└ Attenuation Mode / Value...140
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Input Settings...140
└ Preamplifier..141

Reference Level

Defines the expected maximum reference level. Signal levels above this value may not be measured correctly, which is indicated by the "IF OVLD" status display ("OVLD" for analog baseband or digitial baseband input).

The reference level is also used to scale power diagrams; the reference level is then used as the maximum on the y-axis.

Since the hardware of the instrument in use is adapted according to this value, it is recommended that you set the reference level close above the expected maximum signal level to ensure an optimum measurement (no compression, good signal-to-noise ratio).

For details see "Reference Level" on page 135.

Remote command:
`DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:RLEVel` on page 316

Shifting the Display (Offset) ← Reference Level

Defines an arithmetic level offset. This offset is added to the measured level. In some result displays, the scaling of the y-axis is changed accordingly.

Define an offset if the signal is attenuated or amplified before it is fed into the R&S VSE so the application shows correct power results. All displayed power level results will be shifted by this value.

The setting range is ±200 dB in 0.01 dB steps.

Note, however, that the *internal* reference level (used to adjust the hardware settings to the expected signal optimally) ignores any "Reference Level Offset". Thus, it is important to keep in mind the actual power level the R&S VSE must handle, and not to rely on the displayed reference level (internal reference level = displayed reference level - offset).

For details see "Reference level offset" on page 136.

Remote command:
`DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:RLEVel:OFFSet` on page 316

Unit ← Reference Level
The instrument in use measures the signal voltage at the RF input.

In the default state, the level is displayed at a power of 1 mW (= dBm). Via the known input impedance (50 Ω or 75 Ω, see "Impedance" on page 130), conversion to other units is possible.

The following units are available and directly convertible:
- dBm
- dBmV
- dBμV
- dBμA
- dBpW
- Volt
- Ampere
- Watt

Remote command:
`INPut:IMPedance` on page 313
`CALCulate<n>:UNIT:POWer` on page 316

Setting the Reference Level Automatically (Auto Level) ← Reference Level
The instrument in use automatically determines the optimal reference level for the current input data. At the same time, the internal attenuators and the preamplifier are adjusted so the signal-to-noise ratio is optimized, while signal compression, clipping and overload conditions are minimized. This function is not available on all supported instruments.

You can change the measurement time for the level measurement if necessary (see "Automatic Measurement Time Mode and Value" on page 163).

Remote command:
`[SENSe:]ADJust:LEVel` on page 317

RF Attenuation
Defines the attenuation applied to the RF input of the R&S VSE.

Attenuation Mode / Value ← RF Attenuation

The RF attenuation can be set automatically as a function of the selected reference level (Auto mode). This ensures that no overload occurs at the RF INPUT connector for the current reference level. It is the default setting.

In "Manual" mode, you can set the RF attenuation in 1 dB steps (down to 0 dB). Other entries are rounded to the next integer value. The range is specified in the data sheet. If the defined reference level cannot be set for the defined RF attenuation, the reference level is adjusted accordingly and the warning "Limit reached" is displayed.

NOTICE! Risk of hardware damage due to high power levels. When decreasing the attenuation manually, ensure that the power level does not exceed the maximum level allowed at the RF input, as an overload may lead to hardware damage.

For details see "RF Attenuation" on page 136.

Remote command:
`INPut:ATTenuation` on page 317
`INPut:ATTenuation:AUTO` on page 317

Using Electronic Attenuation

If the (optional) Electronic Attenuation hardware is installed on the instrument in use, you can also activate an electronic attenuator.

In "Auto" mode, the settings are defined automatically; in "Manual" mode, you can define the mechanical and electronic attenuation separately.

Note: Note that restrictions may apply concerning which frequencies electronic attenuation is available for, depending on which instrument is connected to the R&S VSE software. Check your instrument documentation for details.
In "Auto" mode, RF attenuation is provided by the electronic attenuator as much as possible to reduce the amount of mechanical switching required. Mechanical attenuation may provide a better signal-to-noise ratio, however.

When you switch off electronic attenuation, the RF attenuation is automatically set to the same mode (auto/manual) as the electronic attenuation was set to. Thus, the RF attenuation may be set to automatic mode, and the full attenuation is provided by the mechanical attenuator, if possible.

If the defined reference level cannot be set for the given attenuation, the reference level is adjusted accordingly and the warning "Limit reached" is displayed in the status bar.

Remote command:
`INPut:EATT:STATe` on page 318
`INPut:EATT:AUTO` on page 318
`INPut:EATT` on page 318

Input Settings

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

The parameters "Input Coupling" and "Impedance" are identical to those in the "Input" settings.

See chapter 10.3.2.1, "Radio Frequency Input", on page 129.

Preamplifier ← Input Settings
If the (optional) Preamplifier hardware is installed on the instrument in use, a preamplifier can be activated for the RF input signal.

You can use a preamplifier to analyze signals from DUTs with low input power.

Depending on the connected instrument, different settings are available. See the instrument's documentation for details.

Remote command:
`INPut:GAIN:STATe` on page 319
`INPut:GAIN[:VALue]` on page 319

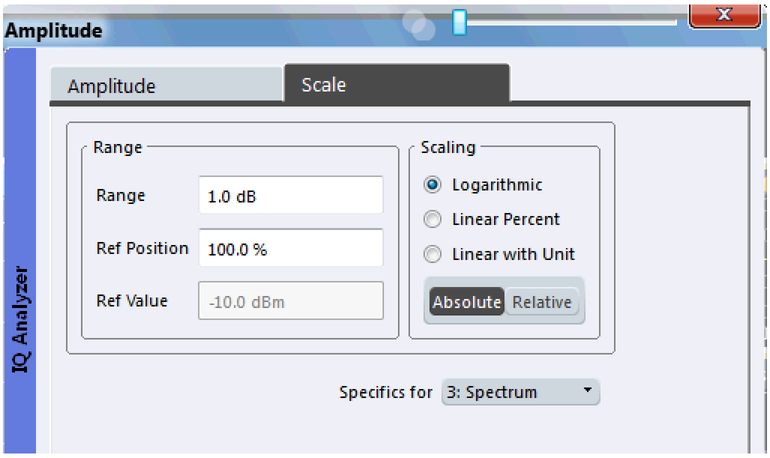
10.3.3.3 Scaling the Y-Axis

The individual scaling settings that affect the vertical axis are described here.

Access: "Overview" > "Amplitude" > "Scale" tab

or: "Input & Output" > "Scale"

The remote commands required to define these settings are described in chapter 13.6.1.2, "Configuring the Vertical Axis (Amplitude, Scaling)", on page 315.



Range....141
Ref Level Position....142
Ref Value....142
Scaling....142
Y-Axis Max....142

Range
Defines the displayed y-axis range in dB.

The default value is 100 dB.

Remote command:
`DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]` on page 320

Ref Level Position

Defines the reference level position, i.e. the position of the maximum AD converter value on the level axis in %, where 0 % corresponds to the lower and 100 % to the upper limit of the diagram.

For spectrograms, this value defines the position of the reference level value within the span covered by the color map. In this case, the value is given in %, where 0 % corresponds to the maximum (right end) and 100 % to the minimum (left end) of the color map.

Remote command:
`DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:RPOSition` on page 321

Ref Value

The reference level value (configured in Amplitude Settings), indicated for reference only.

Scaling

Defines the scaling method for the y-axis.

For more information see "Scaling" on page 137.

"Logarithmic"	Logarithmic scaling (only available for logarithmic units - dB..., and A, V, Watt)
"Linear Unit"	Linear scaling in the unit of the measured signal
"Linear Percent"	Linear scaling in percentages from 0 to 100
"Absolute"	The labeling of the level lines refers to the absolute value of the reference level (not available for "Linear Percent")
"Relative"	The scaling is in dB, relative to the reference level (only available for logarithmic units - dB...). The upper line of the grid (reference level) is always at 0 dB.

Remote command:
`DISPlay[:WINDow<n>]:TRACe<t>:Y:SPACing` on page 321
`DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:MODE` on page 320

Y-Axis Max

Defines the maximum value of the y-axis in the currently selected diagram in either direction (in Volts). Thus, the y-axis scale starts at -<Y-Axis Max> and ends at +<Y-Axis Max>.

This command is only available if the evaluation mode for the I/Q Analyzer is set to "IQ Vector" or "Real/Imag".

Remote command:
`DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]` on page 320

10.3.3.4 Scaling Statistics Displays

Access: "Overview" > "Amplitude" > "Scale" tab

or: "Input & Output" > "Scale"

For statistics displays, scale settings are available for both the y-axis and the x-axis.

X-Axis Reference Value......143
Range......143
Offset......143
Quantize Bins......143
Y-Max / Y-Min......143

X-Axis Reference Value
The reference value on the x-axis in the current unit. The reference value is the highest value displayed on the x-axis.

Remote command:
`CALCulate<n>:IQ:STATistics:SCALe:X:RVALue` on page 323

Range
Range of x-axis in dB

Remote command:
`CALCulate<n>:IQ:STATistics:SCALe:X:RANGe` on page 322

Offset
Defines an arithmetic level offset. This offset is added to the measured level irrespective of the selected unit. The scaling of the x-axis is changed accordingly.

Remote command:
`CALCulate<n>:IQ:STATistics:SCALe:X:RLEVel:OFFSet` on page 322

Quantize Bins
For **Statistics** displays, this value defines the number of **quantize bins** used to create the histogram, that is, the number of different measurement values the statistical occurrence is determined for.

Remote command:
`CALCulate<n>:IQ:STATistics:SCALe:X:QUANtize` on page 322

Y-Max / Y-Min
Defines the displayed range using minimum and maximum values.

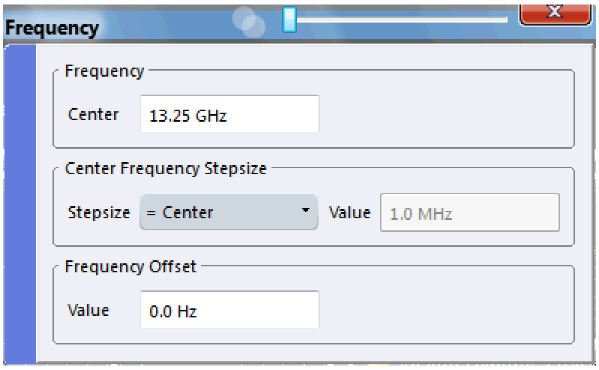
Values in the range $1e^{-9} < value < 0.1$ are allowed. The distance between max and min value must be at least one decade.

Remote command:
`CALCulate<n>:IQ:STATistics:SCALe:Y:UPPer` on page 323
`CALCulate<n>:IQ:STATistics:SCALe:Y:LOWer` on page 323

10.3.4 Frequency Settings

Access: "Overview" > "Frequency"

or: "Input & Output" > "Frequency"



Center frequency..144
Center Frequency Stepsize..144
Frequency Offset..144

Center frequency

Defines the center frequency of the signal in Hertz.

0 Hz ≤ f_{center} ≤ f_{max}

f_{max} and $span_{min}$ depend on the instrument and are specified in the data sheet.

Note: For file input you can shift the center frequency of the current measurement compared to the stored measurement data. The maximum shift depends on the channel's current analysis bandwidth.

$$CFshift_{max} = CF_{file} \pm \frac{ABW_{file} - ABW_{channel}}{2}$$

If the file does not provide the center frequency, it is assumed to be 0 Hz.

Remote command:
`[SENSe:]FREQuency:CENTer` on page 324

Center Frequency Stepsize

Defines the step size by which the center frequency is increased or decreased using the arrow keys.

When you use the mouse wheel, the center frequency changes in steps of only 1/10 of the "Center Frequency Stepsize".

The step size can be coupled to another value or it can be manually set to a fixed value.

"= Center" Sets the step size to the value of the center frequency. The used value is indicated in the "Value" field.

"Manual" Defines a fixed step size for the center frequency. Enter the step size in the "Value" field.

Remote command:
`[SENSe:]FREQuency:CENTer:STEP` on page 324

Frequency Offset

Shifts the displayed frequency range along the x-axis by the defined offset.

This parameter has no effect on the instrument's hardware, or on the captured data or on data processing. It is simply a manipulation of the final results in which absolute frequency values are displayed. Thus, the x-axis of a spectrum display is shifted by a constant offset if it shows absolute frequencies, but not if it shows frequencies relative to the signal's center frequency.

A frequency offset can be used to correct the display of a signal that is slightly distorted by the measurement setup, for example.

The allowed values range from -100 GHz to 100 GHz. The default setting is 0 Hz.

Remote command:
`[SENSe:]FREQuency:OFFSet` on page 325

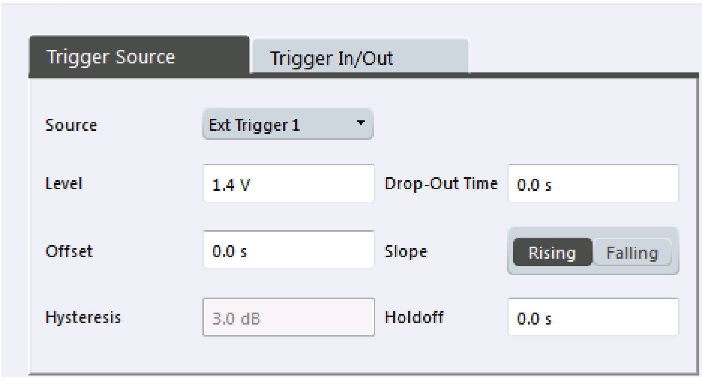
10.3.5 Triggers

Access: "Overview" > "Trigger/Gate"

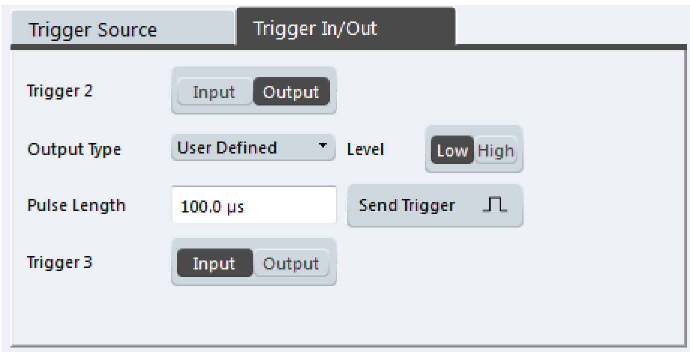
or: "Input & Output" > "Trigger"

Trigger settings determine when the input signal is measured.

Which settings are available depends on the instrument in use.



External triggers from one of the TRIGGER INPUT/OUTPUT connectors on the instrument in use are configured in a separate tab of the dialog box.



● Triggered Measurements......146
● Trigger Settings......148

10.3.5.1 Triggered Measurements

In a basic measurement with default settings, the measurement is started immediately when you select the ▶"Capture" icon. However, sometimes you want the measurement to start only when a specific condition is fulfilled on the instrument in use, for example a signal level is exceeded, or in certain time intervals. For these cases you can define a trigger for the measurement.

An "Offset" can be defined to delay the measurement after the trigger event, or to include data before the actual trigger event in time domain measurements (pre-trigger offset).

For complex tasks, advanced trigger settings are available:

- Hysteresis to avoid unwanted trigger events caused by noise
- Holdoff to define exactly which trigger event will cause the trigger in a jittering signal

- Trigger Source 146
- Trigger Offset 146
- Trigger Hysteresis 146
- Trigger Drop-Out Time 147
- Trigger Holdoff 148

Trigger Source

The trigger source defines which source must fulfill the condition that triggers the measurement. Basically, this can be:

- Time: the measurement is repeated in a regular interval
- Power: an input signal is checked for a defined power level
  The trigger signal can be any of the following:
  – The input signal at one of various stages in the signal analysis process - before or after the input mixer, after the video filter etc.
  – A signal from an external device via one of the TRIGGER INPUT / OUTPUT connectors on the instrument
  – A signal from one of the input channels from a connected oscilloscope

For details on the available trigger sources see "Trigger Source" on page 150.

Trigger Offset

An offset can be defined to delay the measurement after the trigger event, or to include data before the actual trigger event in time domain measurements (pre-trigger offset). Pre-trigger offsets are possible because the R&S VSE captures data continuously in the time domain, even before the trigger occurs.

See "Trigger Offset" on page 152.

Trigger Hysteresis

Setting a hysteresis for the trigger helps avoid unwanted trigger events caused by noise, for example. The hysteresis is a threshold to the trigger level that the signal must fall below on a rising slope or rise above on a falling slope before another trigger event occurs.

Example:

In the following example, the second possible trigger event is ignored as the signal does not exceed the hysteresis (threshold) before it reaches the trigger level again on the rising edge. On the falling edge, however, two trigger events occur as the signal exceeds the hysteresis before it falls to the trigger level the second time.

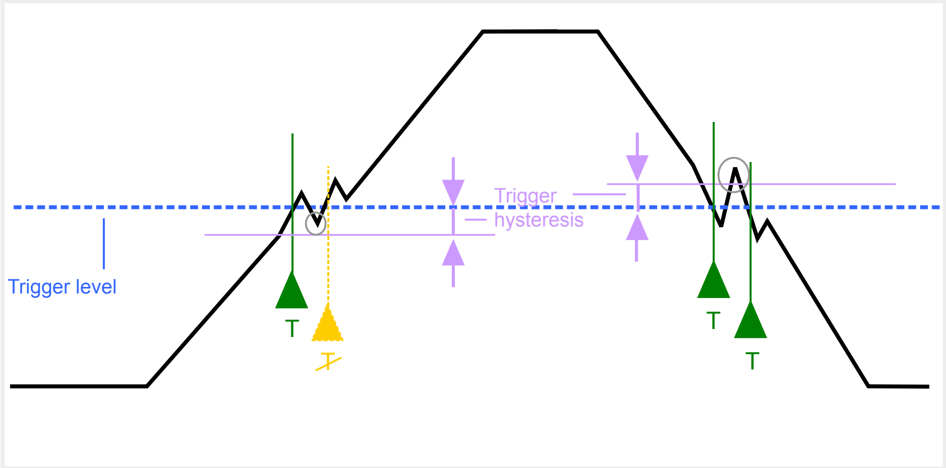


Fig. 10-6: Effects of the trigger hysteresis

See "Hysteresis" on page 152

Trigger Drop-Out Time

If a modulated signal is instable and produces occassional "drop-outs" during a burst, you can define a minimum duration that the input signal must stay below the trigger level before triggering again. This is called the "drop-out" time. Defining a dropout time helps you stabilize triggering when the analyzer is triggering on undesired events.

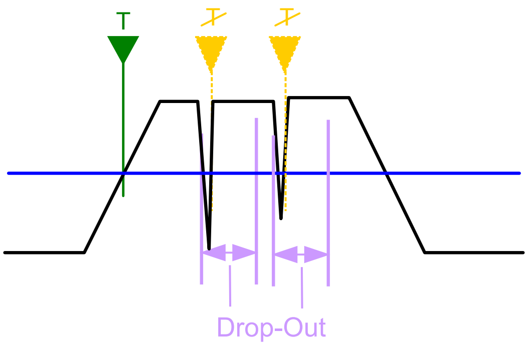


Fig. 10-7: Effect of the trigger drop-out time

See "Drop-Out Time" on page 152.

Drop-out times for falling edge triggers

If a trigger is set to a falling edge ("Slope" = "Falling", see "Slope" on page 153) the measurement is to start when the power level falls below a certain level. This is useful, for example, to trigger at the end of a burst, similar to triggering on the rising edge for the beginning of a burst.

If a drop-out time is defined, the power level must remain below the trigger level at least for the duration of the drop-out time (as defined above). However, if a drop-out time is defined that is longer than the pulse width, this condition cannot be met before the final pulse, so a trigger event will not occur until the pulsed signal is over!

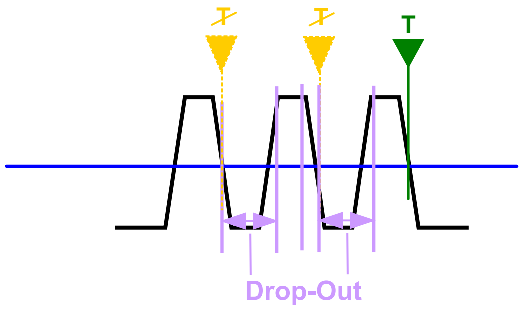


Fig. 10-8: Trigger drop-out time for falling edge trigger

Trigger Holdoff

The trigger holdoff defines a waiting period before the next trigger after the current one will be recognized.

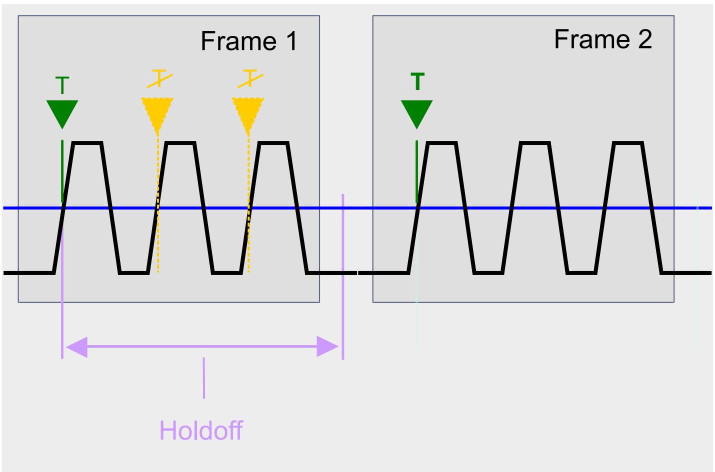


Fig. 10-9: Effect of the trigger holdoff

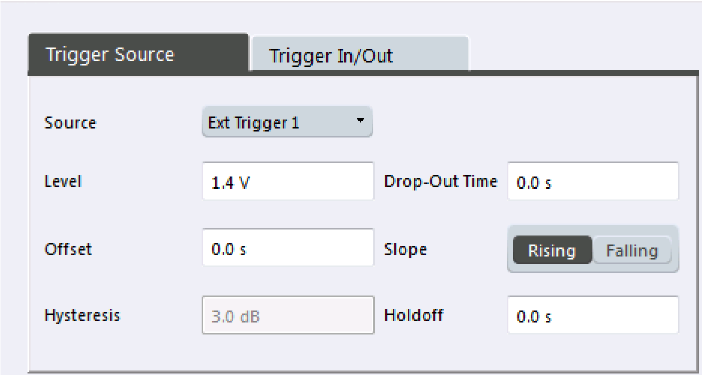
See "Trigger Holdoff" on page 152.

10.3.5.2 Trigger Settings

Access: "Overview" > "Trigger/Gate"

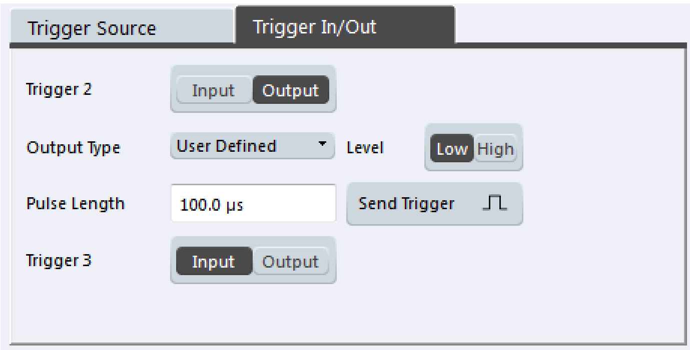
or: "Input & Output" > "Trigger"

Trigger settings determine when the input signal is measured. Which settings are available depends on the instrument in use.



Gate settings are currently not available.

External triggers from one of the TRIGGER INPUT/OUTPUT connectors on the instrument in use are configured in a separate tab of the dialog box.



Trigger Source.......... 150
└ Free Run.......... 150
└ External Trigger<X>.......... 150
└ IF Power.......... 150
└ I/Q Power.......... 150
└ RF Power.......... 151
└ Time.......... 151
└ Magnitude (offline).......... 151
Trigger Level.......... 151
Repetition Interval.......... 151
Drop-Out Time.......... 152
Trigger Offset.......... 152
Hysteresis.......... 152
Trigger Holdoff.......... 152
Slope.......... 153
Trigger 2/3.......... 153

└ Output Type.....153
└ Level.....153
└ Pulse Length.....154
└ Send Trigger.....154

Trigger Source
Selects the trigger source. If a trigger source other than "Free Run" is set, "TRG" is displayed in the channel bar and the trigger source is indicated.

For more information see "Trigger Source" on page 146.

Note that the availability of trigger sources depends on the instrument in use.

Remote command:
`TRIGger[:SEQuence]:SOURce` on page 330

Free Run ← Trigger Source
No trigger source is considered. Data acquisition is started manually or automatically and continues until stopped explicitely.

Remote command:
`TRIG:SOUR IMM`, see `TRIGger[:SEQuence]:SOURce` on page 330

External Trigger<X> ← Trigger Source
Data acquisition starts when the signal fed into the specified input connector or input channel of the instrument in use meets or exceeds the specified trigger level.

(See "Trigger Level" on page 151).

Note: Which input and output connectors are available depends on the connected instrument. For details see the "Instrument Tour" chapter in the instrument's Getting Started manual.

Remote command:
`TRIG:SOUR EXT`, `TRIG:SOUR EXT2`, `TRIG:SOUR EXT3`, `TRIG:SOUR EXT4`
See `TRIGger[:SEQuence]:SOURce` on page 330

IF Power ← Trigger Source
The R&S VSE starts capturing data as soon as the trigger level is exceeded around the third intermediate frequency.

(The third IF represents the center frequency.)

This trigger source is only available for RF input.

The available trigger levels depend on the RF attenuation and preamplification. A reference level offset, if defined, is also considered.

For details on available trigger levels and trigger bandwidths see the data sheet.

Remote command:
`TRIG:SOUR IFP`, see `TRIGger[:SEQuence]:SOURce` on page 330

I/Q Power ← Trigger Source
This trigger source is only available in the I/Q Analyzer application and in applications that process I/Q data.

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

The trigger bandwidth corresponds to the bandwidth setting for I/Q data acquisition.

(See "Analysis Bandwidth" on page 155.)

Remote command:
`TRIG:SOUR IQP`, see `TRIGger[:SEQuence]:SOURce` on page 330

RF Power ← Trigger Source
Defines triggering of the measurement via signals which are outside the displayed measurement range.

For this purpose the software uses a level detector at the first intermediate frequency.

The resulting trigger level at the RF input depends on the RF attenuation and preamplification. For details on available trigger levels see the instrument's data sheet.

Note: If the input signal contains frequencies outside of this range (e.g. for fullspan measurements), the measurement may be aborted and a message indicating the allowed input frequencies is displayed in the status bar.

A "Trigger Offset", "Trigger Polarity" and "Trigger Holdoff" (to improve the trigger stability) can be defined for the RF trigger, but no "Hysteresis".

Remote command:
`TRIG:SOUR RFP`, see `TRIGger[:SEQuence]:SOURce` on page 330

Time ← Trigger Source
Triggers in a specified repetition interval.

Remote command:
`TRIG:SOUR TIME`, see `TRIGger[:SEQuence]:SOURce` on page 330

Magnitude (offline) ← Trigger Source
For (offline) input from a file, rather than an instrument. Triggers on a specified signal level.

Remote command:
`TRIG:SOUR MAGN`, see `TRIGger[:SEQuence]:SOURce` on page 330

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

For gated measurements, this setting also defines the gate level.

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

Remote command:
`TRIGger[:SEQuence]:LEVel:IFPower` on page 328
`TRIGger[:SEQuence]:LEVel:IQPower` on page 328
`TRIGger[:SEQuence]:LEVel[:EXTernal<port>]` on page 327
`TRIGger[:SEQuence]:LEVel:RFPower` on page 329
`TRIGger[:SEQuence]:LEVel:MAPower` on page 328

Repetition Interval
Defines the repetition interval for a time trigger. The shortest interval is 2 ms.

The repetition interval should be set to the exact pulse period, burst length, frame length or other repetitive signal characteristic.

Remote command:
TRIGger[:SEQuence]:TIME:RINTerval on page 331

Drop-Out Time

Defines the time the input signal must stay below the trigger level before triggering again.

For more information on the drop-out time see "Trigger Drop-Out Time" on page 147.

Remote command:
TRIGger[:SEQuence]:DTIMe on page 326

Trigger Offset

Defines the time offset between the trigger event and the start of the measurement.

For more information see "Trigger Offset" on page 146.

offset > 0:	Start of the measurement is delayed
offset < 0:	Measurement starts earlier (pre-trigger) Only possible for zero span (e.g. I/Q Analyzer application) and gated trigger switched off Maximum allowed range limited by the measurement time: $pretrigger_{max}$ = measurement $time_{max}$

Tip: To determine the trigger point in the sample (for "External" or "IF Power" trigger source), use the TRACe:IQ:TPISample? command.

(If supported by the instrument in use.)

Remote command:
TRIGger[:SEQuence]:HOLDoff[:TIME] on page 326

Hysteresis

Defines the distance in dB to the trigger level that the trigger source must exceed before a trigger event occurs. Settting a hysteresis avoids unwanted trigger events caused by noise oscillation around the trigger level.

This setting is only available for "IF Power" or "Magnitude (offline)" trigger sources. The range of the value depends on the instrument in use.

For more information see "Trigger Hysteresis" on page 146.

Remote command:
TRIGger[:SEQuence]:IFPower:HYSTeresis on page 327
TRIGger[:SEQuence]:MAPower:HYSTeresis on page 329

Trigger Holdoff

Defines the minimum time (in seconds) that must pass between two trigger events. Trigger events that occur during the holdoff time are ignored.

For more information see "Trigger Holdoff" on page 148.

Remote command:
`TRIGger[:SEQuence]:IFPower:HOLDoff` on page 327
`TRIGger[:SEQuence]:MAPower:HOLDoff` on page 329

Slope
For all trigger sources except time you can define whether triggering occurs when the signal rises to the trigger level or falls down to it.

Remote command:
`TRIGger[:SEQuence]:SLOPe` on page 330

Trigger 2/3
Defines the usage of variable trigger input/output connectors on the instrument in use. Which output settings are available depends on the type of instrument in use. For details see the instrument's documentation.

"Input"	The signal at the connector is used as an external trigger source by the instrument in use. Trigger input parameters are available in the "Trigger" dialog box.
"Output"	The instrument in use sends a trigger signal to the output connector to be used by connected devices. Further trigger parameters are available for the connector.

Remote command:
`OUTPut:TRIGger<port>:LEVel` on page 332
`OUTPut:TRIGger<port>:DIRection` on page 332

Output Type ← Trigger 2/3
Type of signal to be sent to the output

"Device Triggered"	(Default) Sends a trigger when the instrument in use triggers.
"Trigger Armed"	Sends a (high level) trigger when the instrument in use is in "Ready for trigger" state. This state is indicated by a status bit in the `STATus:OPERation` register (bit 5), as well as by a low level signal at the AUX port (pin 9) of the instrument in use, if available. For details see "STATus:OPERation Register" on page 242 and the instrument's documentation.
"User Defined"	Sends a trigger when user selects "Send Trigger" button. In this case, further parameters are available for the output signal.

Remote command:
`OUTPut:TRIGger<port>:OTYPe` on page 332

Level ← Output Type ← Trigger 2/3
Defines whether a constant high (1) or low (0) signal is sent to the output connector.

Remote command:
`OUTPut:TRIGger<port>:LEVel` on page 332

Pulse Length ← Output Type ← Trigger 2/3
Defines the length of the pulse sent as a trigger to the output connector.

Remote command:
`OUTPut:TRIGger<port>:PULSe:LENGth` on page 333

Send Trigger ← Output Type ← Trigger 2/3
Sends a user-defined trigger to the output connector immediately. Note that the trigger pulse level is always opposite to the constant signal level defined by the output "Level" setting, e.g. for "Level = High", a constant high signal is output to the connector until the "Send Trigger" button is selected. Then, a low pulse is sent.

Which pulse level will be sent is indicated by a graphic on the button.

Remote command:
`OUTPut:TRIGger<port>:PULSe:IMMediate` on page 333

10.3.6 Data Acquisition and Bandwidth Settings

Access: "Overview" > "Bandwidth"

or: "Meas Setup" > "Data Acquisition"

The signal bandwidth to be captured and analyzed is configurable.

- Data Acquisition.. 154
- Capture Settings.. 159

10.3.6.1 Data Acquisition

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

or: "Meas Setup" > "Data Acquisition"

The data acquisition settings define which parts of the input signal are captured for further evaluation in the applications.

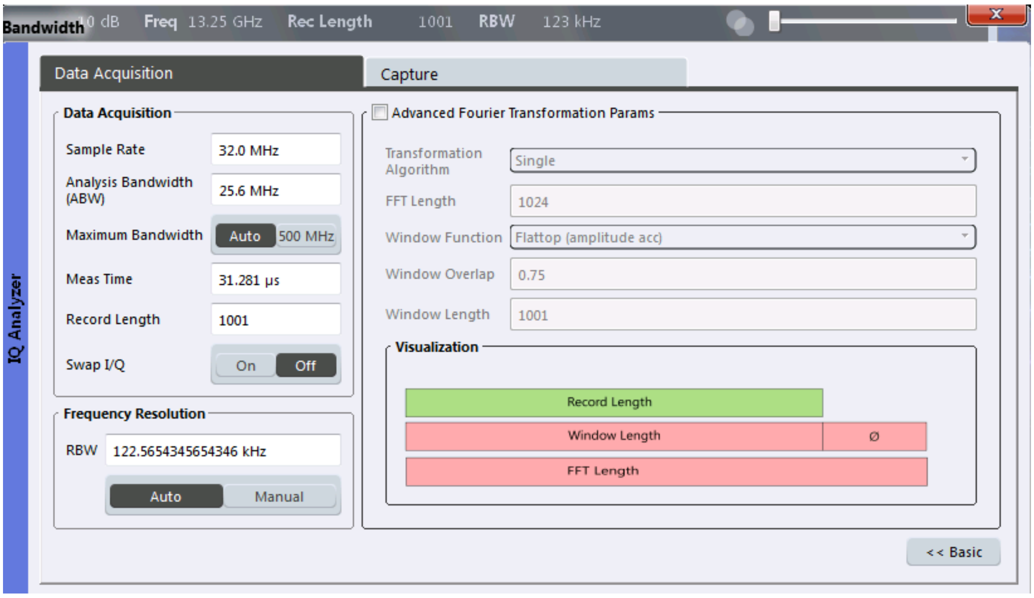


Fig. 10-10: Data acquisition settings with advanced FFT parameters

The remote commands required to perform these tasks are described in chapter 13.6.1.6, "Configuring Data Acquisition", on page 333.

Sample Rate......155
Analysis Bandwidth......155
Maximum Bandwidth......156
Meas Time......156
Record Length......156
Swap I/Q......156
RBW......157
Advanced FFT mode / Basic settings......157
└ Transformation Algorithm......158
└ FFT Length......158
└ Window Function......158
└ Window Overlap......158
└ Window Length......158

Sample Rate

Defines the I/Q data sample rate of the R&S VSE. This value is dependent on the defined Analysis Bandwidth and the defined signal source.

sample rate = analysis bandwidth / 0.8

For details on the dependencies see chapter 10.2.2, "Sample Rate, Record Length and Analysis Bandwidth", on page 119.

Remote command:

`TRACe:IQ:SRATe` on page 340

Analysis Bandwidth

Defines the flat, usable bandwidth of the final I/Q data. This value is dependent on the defined Sample Rate and the defined signal source.

*analysis bandwidth = 0.8 * sample rate*

However, the analysis bandwidth used by the R&S VSE software may be restricted by the bandwidth provided by the instrument in use.

Remote command:
`TRACe:IQ:BWIDth` on page 338

Maximum Bandwidth
Depending on the instrument in use, the maximum bandwidth to be used by the R&S VSE for I/Q data acquisition can be restricted. This setting is only available if a bandwidth extension option is installed on the instrument in use. Otherwise the maximum bandwidth is determined automatically.

The available values depend on the instrument and the installed bandwidth extension options. For details see the instrument's documentation.

Remote command:
`TRACe:IQ:WBANd[:STATe]` on page 341
`TRACe:IQ:WBANd:MBWIDTH` on page 341

Meas Time
Defines the I/Q acquisition time. By default, the measurement time is calculated as the number of I/Q samples ("Record Length") divided by the sample rate. If you change the measurement time, the Record Length is automatically changed, as well.

For details on the maximum number of samples see also chapter 10.2.2, "Sample Rate, Record Length and Analysis Bandwidth", on page 119. Note that the measurement time used by the R&S VSE software may be restricted by the measurement time available on the instrument in use.

Remote command:
`[SENSe:]SWEep:TIME` on page 338

Record Length
Defines the number of I/Q samples to record. By default, the number of measurement points is used. The record length is calculated as the measurement time multiplied by the sample rate. If you change the record length, the Meas Time is automatically changed, as well.

Note: For the I/Q vector result display, the number of I/Q samples to record ("Record Length") must be identical to the number of trace points to be displayed ("Measurement Points"). Thus, the measurement points are not editable for this result display. If the "Record Length" is edited, the measurement points are adapted automatically.
For record lengths outside the valid range of measurement points (see "Points" on page 159) the diagram does not show valid results.

Remote command:
`TRACe:IQ:RLENgth` on page 338
`TRACe:IQ:SET` on page 339

Swap I/Q
Activates or deactivates the inverted I/Q modulation. If the I and Q parts of the signal from the DUT are interchanged, the R&S VSE can do the same to compensate for it.

On	I and Q signals are interchanged Inverted sideband, Q+j*I
Off	I and Q signals are not interchanged Normal sideband, I+j*Q

Remote command:
[SENSe:]SWAPiq on page 337

RBW
Defines the resolution bandwidth for Spectrum results. The available RBW values depend on the sample rate and record length.

Depending on the selected RBW mode, the value is either determined automatically or can be defined manually. As soon as you enter a value in the input field, the RBW mode is changed to "Manual".

This setting is only available if a Spectrum window is active.

If the "Advanced Fourier Transformation Params" option is enabled, advanced FFT mode is selected and the RBW cannot be defined directly.

Note that the RBW is correlated with the Sample Rate and Record Length (and possibly the Window Function and Window Length). Changing any one of these parameters may cause a change to one or more of the other parameters. For more information see chapter 10.2.3.1, "Frequency Resolution of FFT Results - RBW", on page 120.

"Auto mode" (Default) The RBW is determined automatically depending on the Sample Rate and Record Length. A single window function is used (window length = record length). The number of measurement points is automatically adapted to the FFT length.

"Manual mode" The RBW can be defined by the user.
The user-defined RBW is used and the Window Length (and possibly Sample Rate) are adapted accordingly. A single window function is used (window length = record length)

"Advanced FFT mode" This mode is used if the "Advanced Fourier Transformation Params" option is enabled.
The RBW is determined by the advanced FFT parameters.
An averaging window function can be used (window length ≤ record length).

Remote command:
[SENSe:]IQ:BANDwidth|BWIDth:MODE on page 334
[SENSe:]IQ:BANDwidth|BWIDth:RESolution on page 334

Advanced FFT mode / Basic settings
Shows or hides the "Advanced Fourier Transformation" parameters in the "Data Acquisition" dialog box.

These parameters are required for Spectrum results and are thus only available if a Spectrum window is active.

Note that if the advanced FFT mode is used, the RBW settings are not available.

For more information see chapter 10.2.3.2, "FFT Calculation Methods", on page 121.

Transformation Algorithm ← Advanced FFT mode / Basic settings
Defines the FFT calculation method.

"Single"	One FFT is calculated for the entire record length; if the FFT Length is larger than the record length, zeros are appended to the captured data.
"Averaging"	Several overlapping FFTs are calculated for each record; the results are combined to determine the final FFT result for the record. The number of FFTs to be averaged is determined by the Window Overlap and the Window Length.

Remote command:
`[SENSe:]IQ:FFT:ALGorithm` on page 335

FFT Length ← Advanced FFT mode / Basic settings
Defines the number of frequency points determined by each FFT calculation. The more points are used, the higher the resolution in the spectrum becomes, but the longer the calculation takes.

For Spectrum displays, the number of measurement points is set to the FFT length automatically.

Note: If you use the arrow keys or the mouse wheel to change the FFT length, the value is incremented or decremented by powers of 2.
If you enter the value manually, any integer value from 3 to 524288 is available.

Remote command:
`[SENSe:]IQ:FFT:LENGth` on page 335

Window Function ← Advanced FFT mode / Basic settings
In the I/Q analyzer you can select one of several FFT window types.

The following window types are available:
- Blackman-Harris
- Flattop
- Gauss
- Rectangular
- 5-Term

Remote command:
`[SENSe:]IQ:FFT:WINDow:TYPE` on page 336

Window Overlap ← Advanced FFT mode / Basic settings
Defines the part of a single FFT window that is re-calculated by the next FFT calculation when using multiple FFT windows.

Remote command:
`[SENSe:]IQ:FFT:WINDow:OVERlap` on page 336

Window Length ← Advanced FFT mode / Basic settings
Defines the number of samples to be included in a single FFT window in averaging mode. (In single mode, the window length corresponds to the "Record Length" on page 156.)

In manual or advanced FFT mode, values from 3 to 524288 are available. (In Auto mode, averaging is not used.)

However, the window length may not be longer than the FFT Length.

Remote command:
[SENSe:]IQ:FFT:WINDow:LENGth on page 336

10.3.6.2 Capture Settings

Access: "Overview" > "Bandwidth" > "Capture"

or: "Meas Setup" > "Capture"

Spectrogram settings are only available if a spectrogram is active for the selected window (see "State" on page 179).

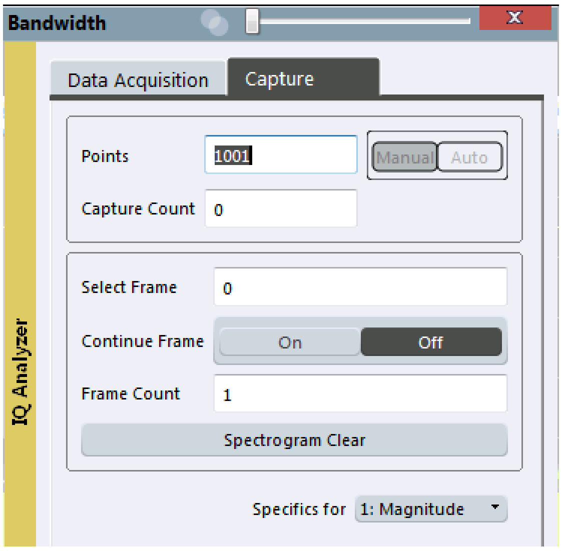


Fig. 10-11: Capture settings with active spectrogram

Points.. 159
Quantize Bins...160
Capture Count...160
Selecting a frame to display.. 160
Continue Frame...161
Frame Count.. 161
Clear Spectrogram...161

Points
This value defines the number of measurement points that are evaluated and displayed in the result diagrams.

In "Auto" mode, the number of capture points is coupled with the FFT Length.

In "Manual" mode or Advanced FFT mode, the number is user-definable.

Note: The capture settings are window-specific. For some result displays, the points may not be editable as they are determined automatically, or restrictions may apply.

For the I/Q vector result display, the number of I/Q samples to record ("Record Length") must be identical to the number of trace points to be displayed ("Points"). Thus, the points are not editable for this result display. If the "Record Length" is edited, the points are adapted automatically. For record lengths outside the valid range of points, i.e. fewer than 51 points or more than 524288 points, the diagram does not show valid results.

Using fewer points than the FFT Length with a detector other than Auto Peak may lead to wrong level results. For details see "Combining Results - Trace Detector" on page 123.

Remote command:
`[SENSe:]SWEep:POINts` on page 338

Quantize Bins
For **Statistics** displays, this value defines the number of **quantize bins** used to create the histogram, that is, the number of different measurement values the statistical occurrence is determined for.

Remote command:
`CALCulate<n>:IQ:STATistics:SCALe:X:QUANtize` on page 322

Capture Count
Defines the number of times data is captured in single measurement mode. Values from 0 to 200000 are allowed. If the values 0 or 1 are set, one measurement is performed.

The capture count is applied to all the traces in all diagrams.

If the trace modes "Average", "Max Hold" or "Min Hold" are set, this value also determines the number of averaging or maximum search procedures.

In continuous measurement mode, if capture count = 0 (default), averaging is performed over 10 measurement. For capture count =1, no averaging, maxhold or minhold operations are performed.

For more information see chapter 10.2.1, "How Much Data is Measured: Capture Count and Measurement Points", on page 118.

For spectrogram displays, the capture count determines how many captures are combined in one frame in the spectrogram, i.e. how many captures the R&S VSE performs to plot one trace in the spectrogram result display. For more details see "Time Frames" on page 171.

Remote command:
`[SENSe:]AVERage<n>:COUNt` on page 348

Selecting a frame to display
Selects a specific frame, loads the corresponding trace from the memory, and displays it in the Spectrum window.

Note that activating a marker or changing the position of the active marker automatically selects the frame that belongs to that marker.

This function is only available in single sweep mode or if the sweep is stopped, and only if a spectrogram is selected.

The most recent frame is number 0, all previous frames have a negative number.

For more details see "Time Frames" on page 171.

Remote command:
`CALCulate<n>:SPECtrogram:FRAMe:SELect` on page 351

Continue Frame
Determines whether the results of the previous sweeps are included in the analysis of the next sweeps for trace modes "Max Hold", "Min Hold", and "Average".

This function is available in single sweep mode only.

- **On**
  When the average or peak values are determined for the new sweep, the results of the previous sweeps in the spectrogram are also taken into account.
- **Off**
  The average or peak values are determined from the results of the newly swept frames only.

Remote command:
`CALCulate<n>:SPECtrogram:CONT` on page 350

Frame Count
Determines how many frames are plotted during a single sweep measurement (as opposed to a continuous sweep). The maximum number of possible frames depends on the history depth (see "History Depth" on page 180).

For more details see "Time Frames" on page 171.

Remote command:
`CALCulate<n>:SPECtrogram:FRAMe:COUNt` on page 350

Clear Spectrogram
Resets the spectrogram result display and clears the history buffer.

This function is only available if a spectrogram is selected.

Remote command:
`CALCulate<n>:SPECtrogram:CLEar[:IMMediate]` on page 350

10.3.7 Adjusting Settings Automatically

Access: "Auto Set" toolbar

Depending on the instrument in use, some settings can be adjusted by the instrument automatically according to the current measurement settings. In order to do so, a measurement is performed. The duration of this measurement can be defined automatically or manually.

To activate the automatic adjustment of a setting from the R&S VSE, select the corresponding function in the "Auto Set" toolbar or in the configuration dialog box for the setting, where available.

Adjusting settings automatically during triggered measurements

When you select an auto adjust function a measurement is performed to determine the optimal settings. If you select an auto adjust function for a triggered measurement, you are asked how the instrument in use should behave:

- (default:) The measurement for adjustment waits for the next trigger
- The measurement for adjustment is performed without waiting for a trigger.
  The trigger source is temporarily set to "Free Run". After the measurement is completed, the original trigger source is restored. The trigger level is adjusted as follows for IF Power and RF Power triggers:
  Trigger Level = Reference Level - 15 dB

Remote command:

[SENSe:]ADJust:CONFigure:TRIG on page 343

Adjusting all Determinable Settings Automatically (Auto All).................................... 162
Adjusting the Center Frequency Automatically (Auto Freq).. 162
Setting the Reference Level Automatically (Auto Level).. 162
Auto Settings Configuration.. 163
└ Automatic Measurement Time Mode and Value.. 163
└ Upper Level Hysteresis.. 163
└ Lower Level Hysteresis.. 163

Adjusting all Determinable Settings Automatically (Auto All)

Activates all automatic adjustment functions for the current measurement settings.

This includes:

- Auto Frequency
- "Setting the Reference Level Automatically (Auto Level)" on page 139

Remote command:
[SENSe:]ADJust:ALL on page 342

Adjusting the Center Frequency Automatically (Auto Freq)

The instrument in use adjusts the center frequency automatically.

The optimum center frequency is the frequency with the highest S/N ratio in the frequency span. As this function uses the signal counter, it is intended for use with sinusoidal signals.

Remote command:
[SENSe:]ADJust:FREQuency on page 344

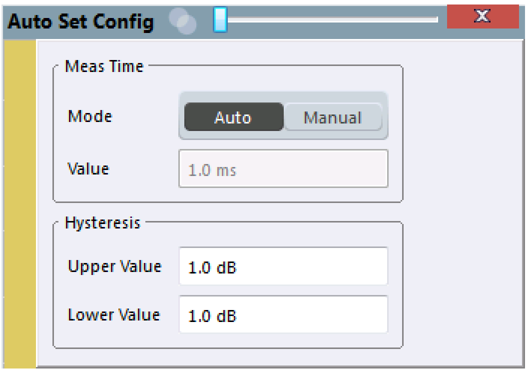
Setting the Reference Level Automatically (Auto Level)

The instrument in use automatically determines the optimal reference level for the current input data. At the same time, the internal attenuators and the preamplifier are adjusted so the signal-to-noise ratio is optimized, while signal compression, clipping and overload conditions are minimized. This function is not available on all supported instruments.

You can change the measurement time for the level measurement if necessary (see "Automatic Measurement Time Mode and Value" on page 163).

Remote command:
[SENSe:]ADJust:LEVel on page 317

Auto Settings Configuration
For some automatic settings, additional parameters can be configured. The "Auto Set Config" dialog box is available when you select the icon from the "Auto Set" toolbar.



Automatic Measurement Time Mode and Value ← Auto Settings Configuration
To determine the optimal reference level automatically, a level measurement is performed on the instrument in use. You can define whether the duration of this measurement is determined automatically or manually.

To define the duration manually, enter a value in seconds.

Remote command:
[SENSe:]ADJust:CONFigure:DURation:MODE on page 343
[SENSe:]ADJust:CONFigure:DURation on page 342

Upper Level Hysteresis ← Auto Settings Configuration
When the reference level is adjusted automatically using the Auto Level function, the internal attenuators and the preamplifier (if available) of the instrument in use are also adjusted. In order to avoid frequent adaptation due to small changes in the input signal, you can define a hysteresis. This setting defines a lower threshold the signal must fall below (compared to the last measurement) before the reference level is adapted automatically.

Remote command:
[SENSe:]ADJust:CONFigure:HYSTeresis:UPPer on page 343

Lower Level Hysteresis ← Auto Settings Configuration
When the reference level is adjusted automatically using the Auto Level function, the internal attenuators and the preamplifier (if available) of the instrument in use are also adjusted. In order to avoid frequent adaptation due to small changes in the input signal, you can define a hysteresis. This setting defines a lower threshold the signal must fall below (compared to the last measurement) before the reference level is adapted automatically.

Remote command:
[SENSe:]ADJust:CONFigure:HYSTeresis:LOWer on page 343

10.4 Analysis

General result analysis settings concerning the trace, markers, lines etc..

- Trace Configuration....................164
- Marker Usage....................187
- Zoomed Displays....................207

10.4.1 Trace Configuration

A trace is a collection of measured data points. The trace settings determine how the measured data is analyzed and displayed on the screen.

- Basics on Setting up Traces....................164
- Trace Configuration....................174
- How to Configure Traces....................182

10.4.1.1 Basics on Setting up Traces

Some background knowledge on traces is provided here for a better understanding of the required configuration settings.

- Mapping Samples to measurement Points with the Trace Detector....................164
- Analyzing Several Traces - Trace Mode....................166
- How Many Traces are Averaged - Capture Count + Measurement Mode....................167
- How Trace Data is Averaged - the Averaging Mode....................168
- Working with Spectrograms....................169

Mapping Samples to measurement Points with the Trace Detector

A trace displays the values measured at the measurement points. The number of samples taken during a measurement may be much larger than the number of measurement points that are displayed in the measurement trace.

Obviously, a data reduction must be performed to determine which of the samples are displayed for each measurement point. This is the trace detector's task.

The trace detector can analyze the measured data using various methods:

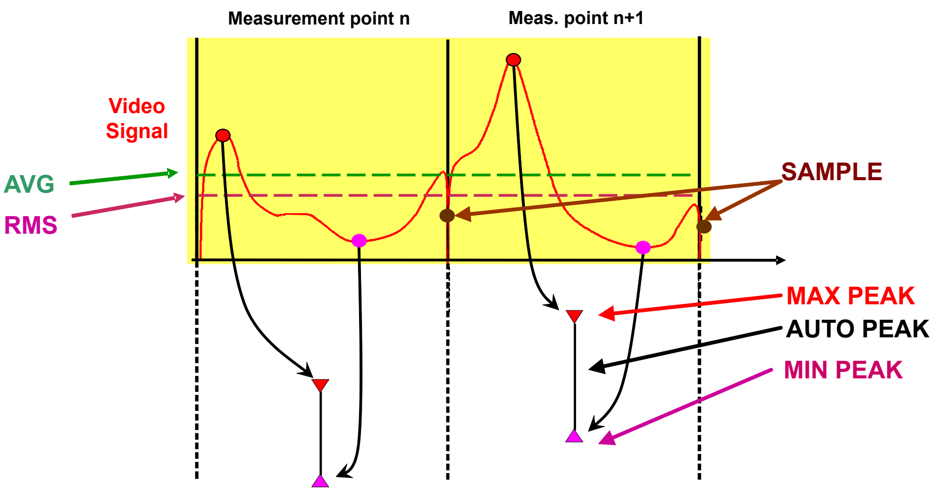
The detector activated for the specific trace is indicated in the corresponding trace information by an abbreviation.

Table 10-2: Detector types

Detector	Abbrev.	Description
Positive Peak	Pk	Determines the largest of all positive peak values of the levels measured at the individual frequencies which are displayed in one sample point
Negative Peak	Mi	Determines the smallest of all negative peak values of the levels measured at the individual frequencies which are displayed in one sample point

Detector	Abbrev.	Description
Auto Peak	Ap	Combines the peak detectors; determines the maximum and the minimum value of the levels measured at the individual frequencies which are displayed in one sample point
RMS	Rm	Calculates the root mean square of all samples contained in a measurement point. To this effect, R&S VSE uses the linear voltage after envelope detection. The sampled linear values are squared, summed and the sum is divided by the number of samples (= root mean square). For logarithmic display the logarithm is formed from the square sum. For linear display the root mean square value is displayed. Each measurement point thus corresponds to the power of the measured values summed up in the measurement point. The RMS detector supplies the power of the signal irrespective of the waveform (CW carrier, modulated carrier, white noise or impulsive signal). Correction factors as needed for other detectors to measure the power of the different signal classes are not required.
Average	Av	Calculates the linear average of all samples contained in a measurement point. To this effect, R&S VSE uses the linear voltage after envelope detection. The sampled linear values are summed up and the sum is divided by the number of samples (= linear average value). For logarithmic display the logarithm is formed from the average value. For linear display the average value is displayed. Each measurement point thus corresponds to the average of the measured values summed up in the measurement point. The average detector supplies the average value of the signal irrespective of the waveform (CW carrier, modulated carrier, white noise or impulsive signal).
Sample	Sa	Selects the last measured value of the levels measured at the individual frequencies which are displayed in one sample point; all other measured values for the frequency range are ignored

The result obtained from the selected detector for a measurement point is displayed as the value at this frequency point in the trace.



The trace detector for the individual traces can be selected manually by the user or set automatically by the R&S VSE.

The detectors of the R&S VSE are implemented as pure digital devices. All detectors work in parallel in the background, which means that the measurement speed is independent of the detector combination used for different traces.

Auto detector

If the R&S VSE is set to define the appropriate detector automatically, the detector is set depending on the selected trace mode:

Trace mode	Detector
Clear Write	Auto Peak
Max Hold	Positive Peak
Min Hold	Negative Peak
Average	Sample Peak
View	–
Blank	–

Analyzing Several Traces - Trace Mode

If several measurement are performed one after the other, or continuous measurement are performed, the trace mode determines how the data for subsequent traces is processed. After each measurement, the trace mode determines whether:

- the data is frozen (View)
- the data is hidden (Blank)
- the data is replaced by new values (Clear Write)
- the data is replaced selectively (Max Hold, Min Hold, Average)

Each time the trace mode is changed, the selected trace memory is cleared.

The trace mode also determines the detector type if the detector is set automatically, see "Mapping Samples to measurement Points with the Trace Detector" on page 164.

The R&S VSE supports the following trace modes:

Table 10-3: Overview of available trace modes

Trace Mode	Description
Blank	Hides the selected trace.
Clear Write	Overwrite mode: the trace is overwritten by each measurement. This is the default setting. All available detectors can be selected.

Trace Mode	Description
Max Hold	The maximum value is determined over several measurements and displayed. The R&S VSE saves the measurement result in the trace memory only if the new value is greater than the previous one. This mode is especially useful with modulated or pulsed signals. The signal spectrum is filled up upon each measurement until all signal components are detected in a kind of envelope. This mode is not available for statistics measurements.
Min Hold	The minimum value is determined from several measurements and displayed. The R&S VSE saves the measurement result in the trace memory only if the new value is lower than the previous one. This mode is useful for example for making an unmodulated carrier in a composite signal visible. Noise, interference signals or modulated signals are suppressed, whereas a CW signal is recognized by its constant level. This mode is not available for statistics measurements.
Average	The average is formed over several measurements and displayed. The Capture Count determines the number of averaging procedures. This mode is not available for statistics measurements.
View	The current contents of the trace memory are frozen and displayed.

If a trace is frozen ("View" mode), the measurement settings, apart from scaling settings, can be changed without impact on the displayed trace. The fact that the displayed trace no longer matches the current measurement settings is indicated by a yellow asterisk on the tab label.

If you change any parameters that have an effect on the scaling of the diagram axes, the R&S VSE automatically adapts the trace data to the changed display range. This allows you to zoom into the diagram after the measurement in order to show details of the trace.

How Many Traces are Averaged - Capture Count + Measurement Mode

In "Average" trace mode, the capture count and measurement mode determine how many traces are averaged. The more traces are averaged, the smoother the trace is likely to become.

The algorithm for averaging traces depends on the measurement mode and capture count.

- **capture count = 0** (default)
  - In **"Continuous"** measurement mode, a continuous average is calculated for 10 measurements, according to the following formula:

$$Trace = \frac{9 * Trace_{old} + MeasValue}{10}$$

Fig. 10-12: Equation 1

Due to the weighting between the current trace and the average trace, past values have practically no influence on the displayed trace after about ten measurements. With this setting, signal noise is effectively reduced without need for restarting the averaging process after a change of the signal.

– In **"Single"** measurement mode, the current trace is averaged with the previously stored averaged trace. No averaging is carried out for the first measurement but the measured value is stored in the trace memory. The next time a measurement is performed, the trace average is calculated according to the following formula:

$$Trace = \frac{Trace_{old} + MeasValue}{2}$$

The averaged trace is then stored in the trace memory.

- **capture count = 1**
  The currently measured trace is displayed and stored in the trace memory. No averaging is performed.
- **capture count > 1**
  For both **"Single"** measurement mode and **"Continuous"** measurement mode, averaging takes place over the selected number of measurements. In this case the displayed trace is determined during averaging according to the following formula:

$$Trace_n = \frac{1}{n} \cdot \left[\sum_{i=1}^{n-1} (T_i) + MeasValue_n \right]$$

Fig. 10-13: Equation 2

where n is the number of the current measurement (n = 2 ... Capture Count).
No averaging is carried out for the first measurement but the measured value is stored in the trace memory. With increasing n, the displayed trace is increasingly smoothed since there are more individual measurements for averaging.
After the selected number of measurements the average trace is saved in the trace memory. Until this number of measurements is reached, a preliminary average is displayed. When the averaging length defined by the "Capture Count" is attained, averaging is continued in continuous measurement mode or for "Continue Single Measurement" according to the following formula:

$$Trace = \frac{(N-1) * Trace_{old} + MeasValue}{N}$$

where N is the capture count

How Trace Data is Averaged - the Averaging Mode

When the trace is averaged over several sweeps (Trace mode: "Average"), different methods are available to determine the trace average.

With logarithmic averaging, the dB values of the display voltage are averaged or substracted from each other with trace mathematical functions.

With linear averaging, the level values in dB are converted into linear voltages or powers prior to averaging. Voltage or power values are averaged or offset against each other and reconverted into level values.

For stationary signals the two methods yield the same result.

Logarithmic averaging is recommended if sinewave signals are to be clearly visible against noise since with this type of averaging noise suppression is improved while the sinewave signals remain unchanged.

For noise or pseudo-noise signals the positive peak amplitudes are decreased in logarithmic averaging due to the characteristic involved and the negative peak values are increased relative to the average value. If the distorted amplitude distribution is averaged, a value is obtained that is smaller than the actual average value. The difference is -2.5 dB.

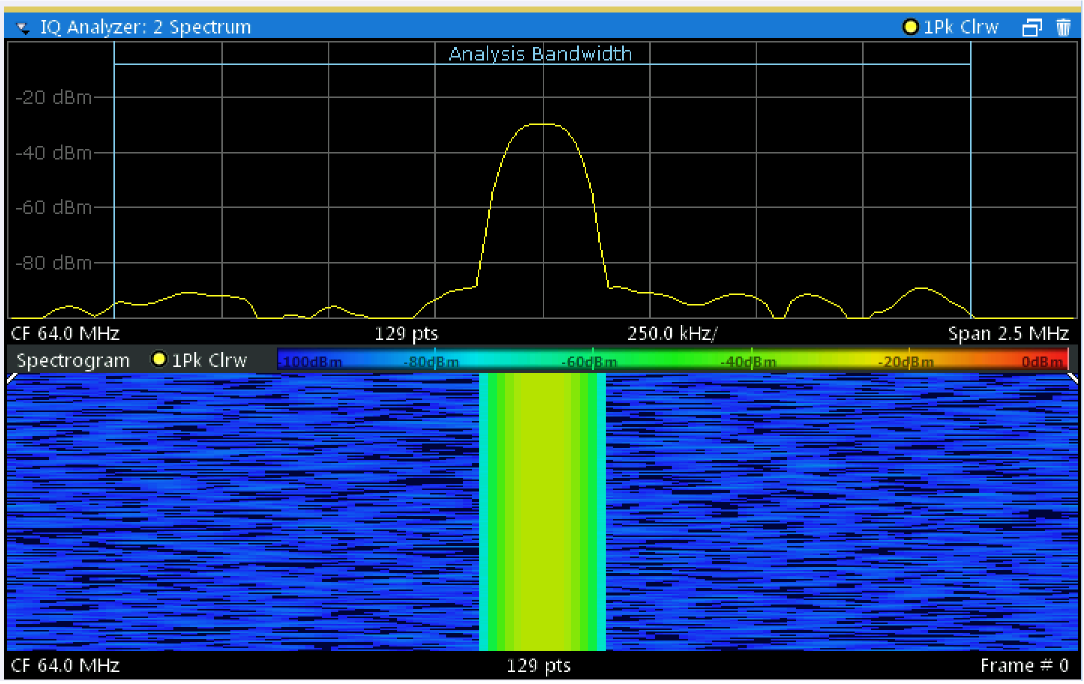
This low average value is usually corrected in noise power measurements by a 2.5 dB factor. Therefore the R&S VSE offers the selection of linear averaging. The trace data is linearized prior to averaging, then averaged and logarithmized again for display on the screen. The average value is always displayed correctly irrespective of the signal characteristic.

Working with Spectrograms

In addition to the standard "level versus frequency" or "level versus time" traces, the I/Q Analyzer also provides a spectrogram display of the measured data. A special feature of the R&S VSE software is that it provides spectrograms for applications based on I/Q data, such as the I/Q Analyzer and the Analog Demodulation application.

A spectrogram shows how the spectral density of a signal varies over time. The x-axis shows the frequency, the y-axis shows the time. A third dimension, the power level, is indicated by different colors. Thus you can see how the strength of the signal varies over time for different frequencies.

Example:



In this example you see the spectrogram for the calibration signal of an R&S FSW, compared to the standard spectrum display. Since the signal does not change over time, the color of the frequency levels does not change over time, i.e. vertically. The legend above the spectrogram display describes the power levels the colors represent.

Spectrogram based on specific trace

The R&S VSE software allows you to define which trace of a particular result display the Spectrogram is calculated from, if multiple traces are available. For example, if a Spectrum is displayed with a Maxhold, a Minhold and an Average trace, you can activate a Spectrogram that displays the maximum, minimum, or average power levels over time and frequency.

Result display

The spectrogram result can consist of the following elements:

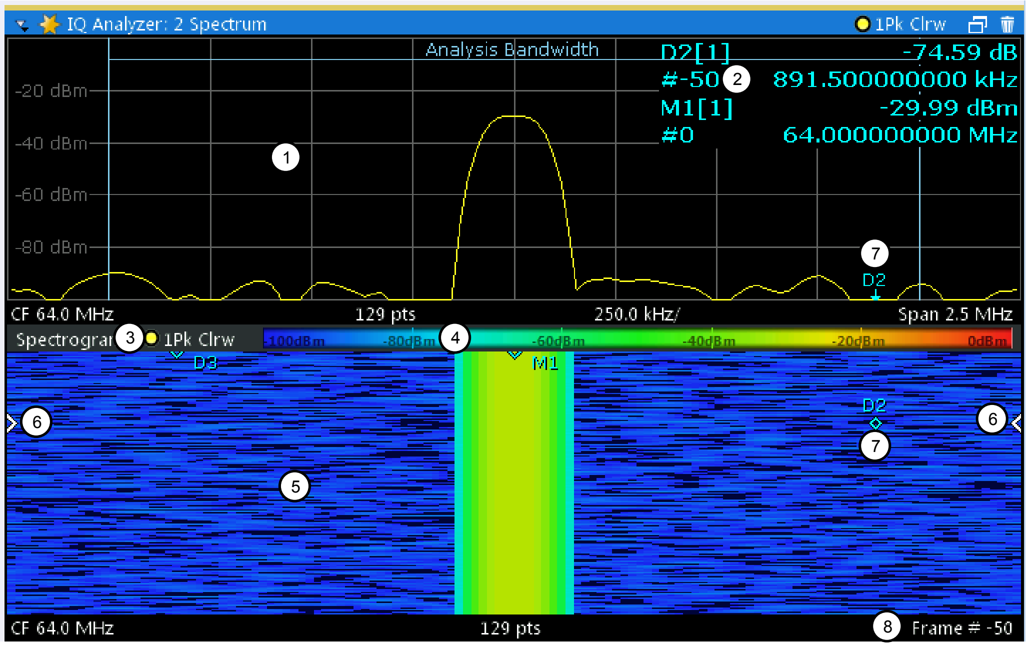


Fig. 10-14: Display elements for a result display with a spectrogram subwindow

1 = Main result display (in this case: Spectrum)
2 = Marker info with frame number
3 = Spectrogram subwindow title with trace information
4 = Color map
5 = Spectrogram subwindow
6 = Current frame indicators
7 = Deltamarker in Spectrogram and Spectrum displays
8 = Current frame number

For more information about spectrogram configuration see "Spectrogram Settings" on page 178.

Remote commands:

Activating and configuring spectrograms:

chapter 13.6.2.2, "Configuring Spectrograms", on page 349

Storing results:

`MMEMory:STORe<n>:SPECtrogram` on page 406

- Time Frames......171
- Color Maps......172

Time Frames

The time information in the spectrogram is displayed vertically, along the y-axis. Each line (or trace) of the y-axis represents one or more captured measurement and is called a **time frame** or simply "frame". As with standard spectrum traces, several measured values are combined in one measurement point using the selected detector.

(See "Mapping Samples to measurement Points with the Trace Detector" on page 164).

Frames are sorted in chronological order, beginning with the most recently recorded frame at the top of the diagram (frame number 0). With the next measurement, the previous frame is moved further down in the diagram, until the maximum number of captured frames is reached. The display is updated continuously during the measurement, and the measured trace data is stored. Spectrogram displays are continued even after single measurements unless they are cleared manually.

The maximum number of frames that you can capture depends on the number of measurement points that are analyzed during the measurement.

The scaling of the time axis (y-axis) is not configurable. However, you can enlarge the spectrogram display to the full window size using the State: "Full".

Displaying individual frames

The spectrogram diagram contains all stored frames since it was last cleared. Arrows on the left and right border of the spectrogram indicate the currently selected frame. The spectrum diagram always displays the spectrum for the currently selected frame.

The current frame number is indicated in the diagram footer. The current frame, displayed at the top of the diagram, is frame number 0. Older frames further down in the diagram are indicated by a negative index, e.g."-10". You can display the spectrum diagram of a previous frame by changing the current frame number.

Color Maps

Spectrograms assign power levels to different colors in order to visualize them. The legend above the spectrogram display describes the power levels the colors represent.

The color display is highly configurable to adapt the spectrograms to your needs. You can define:

- Which colors to use (Color scheme)
- Which value range to apply the color scheme to
- How the colors are distributed within the value range, i.e where the focus of the visualization lies (shape of the color curve)

The individual colors are assigned to the power levels automatically by the R&S VSE.

The Color Scheme

You can select which colors are assigned to the measured values. Four different color ranges or "schemes" are available:

- **Hot**

  Uses a color range from blue to red. Blue colors indicate low levels, red colors indicate high ones.
- **Cold**

Uses a color range from red to blue. Red colors indicate low levels, blue colors indicate high ones.
The "Cold" color scheme is the inverse "Hot" color scheme.

- **Radar**

Uses a color range from black over green to light turquoise with shades of green in between. Dark colors indicate low levels, light colors indicate high ones.

- **Grayscale**

Shows the results in shades of gray. Dark gray indicates low levels, light gray indicates high ones.

The Value Range of the Color Map

If the measured values only cover a small area in the spectrogram, you can optimize the displayed value range so it becomes easier to distinguish between values that are close together, and only parts of interest are displayed at all.

The Shape and Focus of the Color Curve

The color mapping function assigns a specified color to a specified power level in the spectrogram display. By default, colors on the color map are distributed evenly. However, if a certain area of the value range is to be visualized in greater detail than the rest, you can set the focus of the color mapping to that area. Changing the focus is performed by changing the shape of the color curve.

The color curve is a tool to shift the focus of the color distribution on the color map. By default, the color curve is linear. If you shift the curve to the left or right, the distribution becomes non-linear. The slope of the color curve increases or decreases. One end of the color palette then covers a large amount of results, while the other end distributes several colors over a relatively small result range.

You can use this feature to put the focus on a particular region in the diagram and to be able to detect small variations of the signal.

Example:

Fig. 10-15: Linear color curve shape = 0; colors are distributed evenly over the complete result range

In the color map based on the linear color curve, the range from -105.5 dBm to -60 dBm is covered by blue and a few shades of green only. The range from -60 dBm to -20 dBm is covered by red, yellow and a few shades of green.

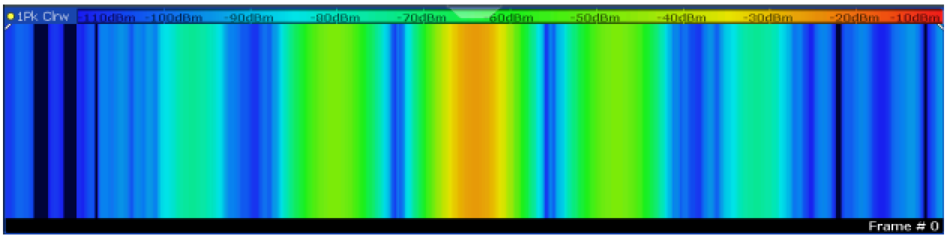


Fig. 10-16: Spectrogram with default color curve

The sample spectrogram is dominated by blue and green colors. After shifting the color curve to the left (negative value), more colors cover the range from -105.5 dBm to -60 dBm (blue, green and yellow), which occurs more often in the example. The range from -60 dBm to -20 dBm, on the other hand, is dominated by various shades of red only.

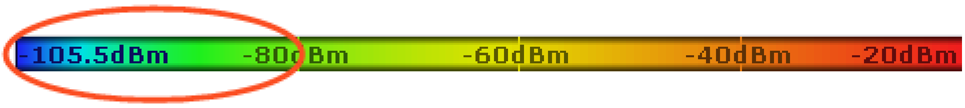


Fig. 10-17: Non-linear color curve shape = -0.5

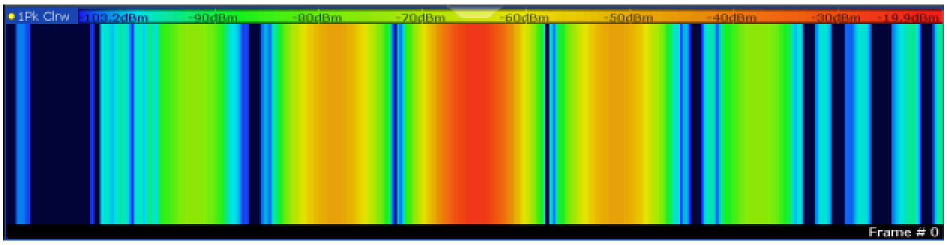


Fig. 10-18: Spectrogram with shifted color curve

10.4.1.2 Trace Configuration

or: "Trace"

Trace configuration includes the following settings and functions:

● Trace Settings..174
● Spectrogram Settings...178

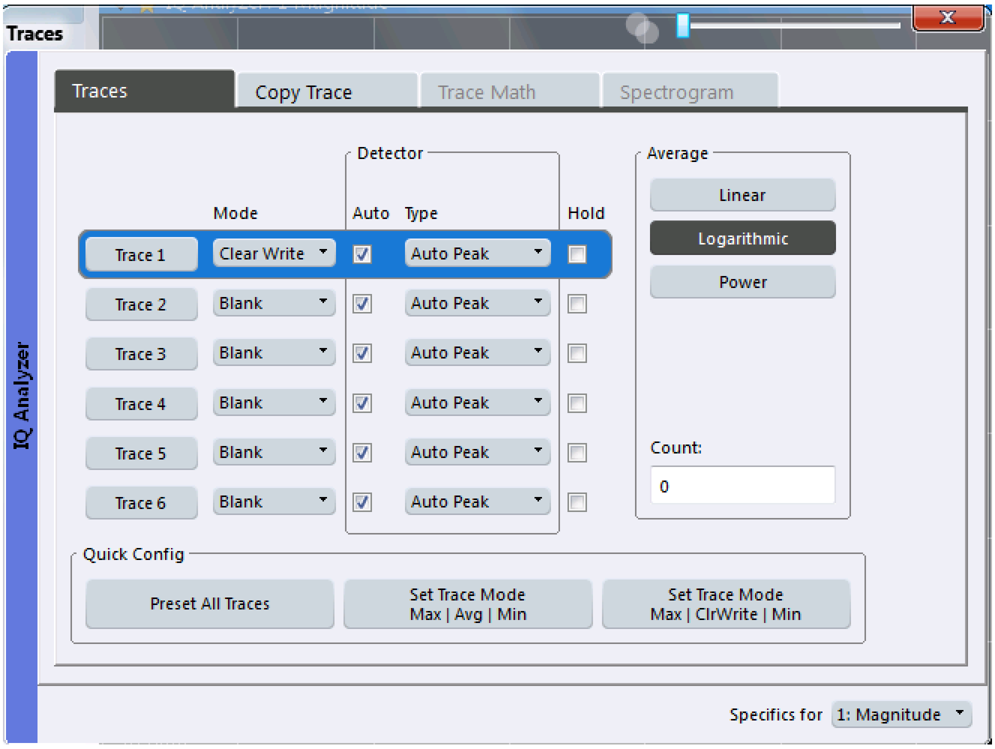
Trace Settings

Access: "Overview" > "Analysis" > "Traces"

or: "Trace" > "Trace"

You can configure the settings for up to 6 individual traces.

For I/Q Vector evaluation mode, only 1 trace is available and the detector is not editable.



Trace 1/Trace 2/Trace 3/Trace 4/Trace 5/Trace 6 175
Trace Mode 175
Detector 176
Hold 176
Average Mode 177
Average Count 177
Predefined Trace Settings - Quick Config 177
Copy Trace 178

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

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

"How to Configure a Standard Trace" on page 182

Remote command:
Selected via numeric suffix of:`TRACe<1...6>` commands
`DISPlay[:WINDow<n>]:TRACe<t>[:STATe]` on page 346

Trace Mode

Defines the update mode for subsequent traces.

For details see "Analyzing Several Traces - Trace Mode" on page 166.

"Clear Write" Overwrite mode: the trace is overwritten by each measurement. This is the default setting.
The "Detector" is automatically set to "Auto Peak".

"Max Hold" The maximum value is determined over several measurements and displayed. The R&S VSE saves each trace point in the trace memory only if the new value is greater than the previous one.
The "Detector" is automatically set to "Positive Peak".
This mode is not available for statistics measurements.

"Min Hold" The minimum value is determined from several measurements and displayed. The R&S VSE saves each trace point in the trace memory only if the new value is lower than the previous one.
The "Detector" is automatically set to "Negative Peak".
This mode is not available for statistics measurements.

"Average" The average is formed over several measurements.
The Capture Count determines the number of averaging procedures.
The "Detector" is automatically set to "Sample".
This mode is not available for statistics measurements.

"View" The current contents of the trace memory are frozen and displayed.

"Blank" Removes the selected trace from the display.

Remote command:
`DISPlay[:WINDow<n>]:TRACe<t>:MODE` on page 345

Detector
Defines the trace detector to be used for trace analysis.

For details see "Mapping Samples to measurement Points with the Trace Detector" on page 164.

The trace detector is used to combine multiple FFT window results to create the final spectrum. (Note: in previous versions of the R&S VSE, the I/Q Analyzer always used the linear average detector.) If necessary, the trace detector is also used to reduce the number of calculated frequency points (defined by the FFT length) to the defined number of measurement points. By default, the Autopeak trace detector is used.

"Auto" Selects the optimum detector for the selected trace and filter mode.
This is the default setting.

"Type" Defines the selected detector type.

Remote command:
`[SENSe:][WINDow<n>:]DETector<t>[:FUNCtion]` on page 347
`[SENSe:][WINDow<n>:]DETector<t>[:FUNCtion]:AUTO` on page 347

Hold
If activated, traces in "Min Hold", "Max Hold" and "Average" mode are not reset after specific parameter changes have been made.

Normally, the measurement is started again after parameter changes, before the measurement results are analyzed (e.g. using a marker). In all cases that require a new measurement after parameter changes, the trace is reset automatically to avoid false results (e.g. with span changes). For applications that require no reset after parameter changes, the automatic reset can be switched off.

The default setting is off.

Remote command:
`DISPlay[:WINDow<n>]:TRACe<t>:MODE:HCONtinuous` on page 346

Average Mode

Defines the mode with which the trace is averaged over several measurements. A different averaging mode can be defined for each trace.

This setting is only applicable if trace mode "Average" is selected.

The Capture Count determines the number of averaging procedures.

For details see "How Trace Data is Averaged - the Averaging Mode" on page 168.

"Linear" The power level values are converted into linear units prior to averaging. After the averaging, the data is converted back into its original unit.

"Logarithmic" For logarithmic scaling, the values are averaged in dBm. For linear scaling, the behavior is the same as with linear averaging.

"Power" Activates linear power averaging.
The power level values are converted into unit Watt prior to averaging. After the averaging, the data is converted back into its original unit.
Use this mode to average power values in Volts or Amperes correctly.

Remote command:
`[SENSe:]AVERage<n>:TYPE` on page 347

Average Count

Determines the number of averaging or maximum search procedures If the trace modes "Average", "Max Hold" or "Min Hold" are set.

In continuous measurement mode, if capture count = 0 (default), averaging is performed over 10 measurements. For capture count =1, no averaging, maxhold or minhold operations are performed.

This value is identical to the Capture Count setting in the "Capture" settings.

Remote command:
`[SENSe:]AVERage<n>:COUNt` on page 348
`TRACe:IQ:AVERage:COUNt` on page 348

Predefined Trace Settings - Quick Config

Commonly required trace settings have been predefined and can be applied very quickly by selecting the appropriate button.

Function	Trace Settings	
Preset All Traces	Trace 1:	Clear Write Auto Detector (Auto Peak)
	Traces 2-6:	Blank Auto Detector

Function	Trace Settings	
Set Trace Mode Max | Avg | Min	Trace 1:	Max Hold Auto Detector (Positive Peak)
	Trace 2:	Average Auto Detector (Sample)
	Trace 3:	Min Hold Auto Detector (Negative Peak)
	Traces 4-6:	Blank Auto Detector
Set Trace Mode Max | ClrWrite | Min	Trace 1:	Max Hold Auto Detector (Positive Peak)
	Trace 2:	Clear Write Auto Detector (Auto Peak)
	Trace 3:	Min Hold Auto Detector (Negative Peak)
	Traces 4-6:	Blank Auto Detector

Copy Trace
Access: "Overview" > "Analysis" > "Traces" > "Copy Trace"

or: "Trace" > "Copy Trace"

Copies trace data to another trace.

The first group of buttons (labelled "Trace 1" to "Trace 6") select the source trace. The second group of buttons (labelled "Copy to Trace 1" to "Copy to Trace 6") select the destination.

Remote command:
`TRACe<n>:COPY` on page 348

Spectrogram Settings

Access: "Overview" > "Analysis" > "Traces" > "Spectrogram"

or: "Trace" > Spectrogram

The individual settings available for spectrogram display are described here. For settings on color mapping, see "Color Map Settings" on page 180.

Settings concerning the frames and how they are handled during a measurement are provided as additional capture settings for spectrogram display, see chapter 10.3.6.2, "Capture Settings", on page 159.

For background information see also "Working with Spectrograms" on page 169.

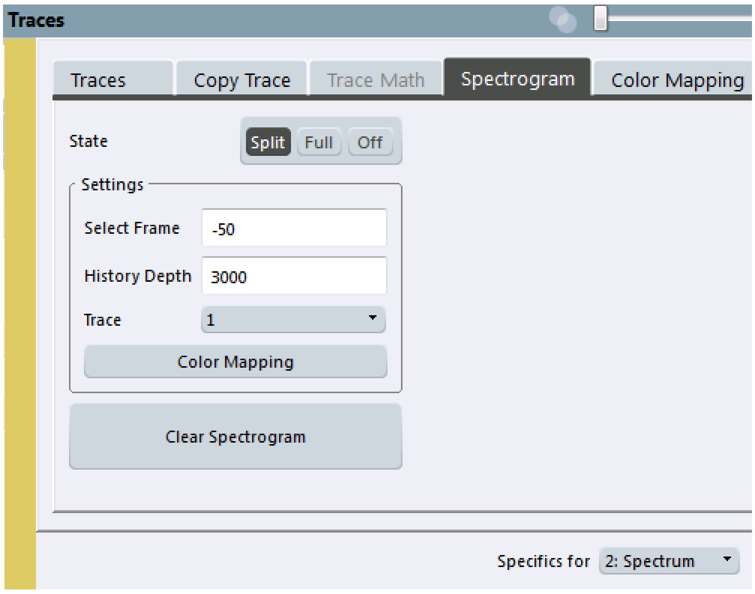
- General Spectrogram Settings..179
- Color Map Settings...180

General Spectrogram Settings

Access: "Overview" > "Analysis" > "Traces" > "Spectrogram"

or: "Trace" > "Spectrogram"

This section describes general settings for spectrogram display.



State....179
Selecting a frame to display....179
History Depth....180
Color Mapping....180
Clear Spectrogram....180

State

Activates and deactivates a Spectrogram subwindow.

"Split" Displays the Spectrogram as a subwindow in the original result display.

"Full" Displays the Spectrogram in a subwindow in the full size of the original result display.

"Off" Closes the Spectrogram subwindow.

Remote command:
`CALCulate<n>:SPECtrogram[:STATe]` on page 351

Selecting a frame to display

Selects a specific frame, loads the corresponding trace from the memory, and displays it in the Spectrum window.

Note that activating a marker or changing the position of the active marker automatically selects the frame that belongs to that marker.

This function is only available in single sweep mode or if the sweep is stopped, and only if a spectrogram is selected.

The most recent frame is number 0, all previous frames have a negative number.

For more details see "Time Frames" on page 171.

Remote command:
`CALCulate<n>:SPECtrogram:FRAMe:SELect` on page 351

History Depth

Sets the number of frames that the R&S VSE stores in its memory.

If the memory is full, the R&S VSE deletes the oldest frames stored in the memory and replaces them with the new data.

Remote command:
`CALCulate<n>:SPECtrogram:HDEPth` on page 351

Color Mapping

Opens the "Color Map" dialog.

For details see "Color Maps" on page 172.

Clear Spectrogram

Resets the spectrogram result display and clears the history buffer.

This function is only available if a spectrogram is selected.

Remote command:
`CALCulate<n>:SPECtrogram:CLEar[:IMMediate]` on page 350

Color Map Settings

Access: "Overview" > "Analysis" > "Traces" > "Color Mapping"

or: "Trace" > "Spectrogram" > "Color Mapping"

For more information on color maps see "Color Maps" on page 172.

In addition to the available color settings, the dialog box displays the current color map and provides a preview of the display with the current settings.

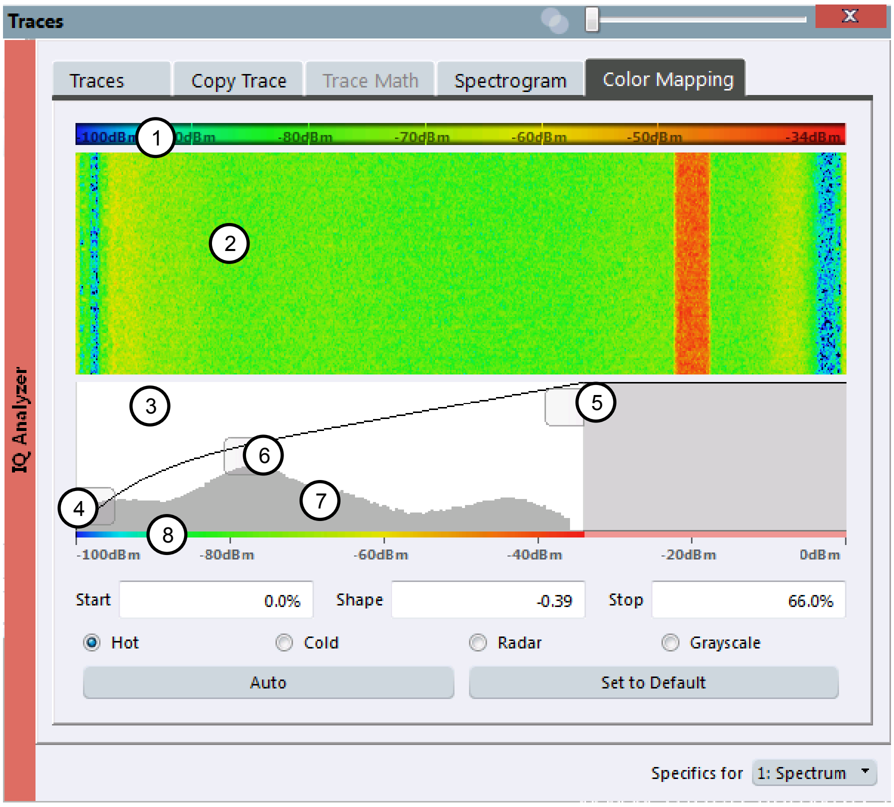


Fig. 10-19: Color Mapping dialog box

1 = Color map: shows the current color distribution
2 = Preview pane: shows a preview of the spectrogram with any changes that you make to the color scheme
3 = Color curve pane: graphical representation of all settings available to customize the color scheme
4/5 = Color range start and stop sliders: define the range of the color map or amplitudes for the spectrogram
6 = Color curve slider: adjusts the focus of the color curve
7 = Histogram: shows the distribution of measured values
8 = Scale of the horizontal axis (value range)

Start / Stop

Defines the lower and upper boundaries of the value range of the spectrogram.

Remote command:
`DISPlay[:WINDow<n>]:SPECtrogram:COLor:LOWer` on page 352
`DISPlay[:WINDow<n>]:SPECtrogram:COLor:UPPer` on page 353

Shape

Defines the shape and focus of the color curve for the spectrogram result display.

"-1 to <0"	More colors are distributed among the lower values
"0"	Colors are distributed linearly among the values
">0 to 1"	More colors are distributed among the higher values

Remote command:
`DISPlay[:WINDow<n>]:SPECtrogram:COLor:SHAPe` on page 353

Hot/Cold/Radar/Grayscale
Sets the color scheme for the spectrogram.

Remote command:
`DISPlay[:WINDow<n>]:SPECtrogram:COLor[:STYLe]` on page 353

Auto
Defines the color range automatically according to the existing measured values for optimized display.

Set to Default
Sets the color mapping to the default settings.

Remote command:
`DISPlay[:WINDow<n>]:SPECtrogram:COLor:DEFault` on page 352

10.4.1.3 How to Configure Traces

The following step-by-step procedures describe the following tasks:

- How to Configure a Standard Trace....................182
- How to Display and Configure a Spectrogram....................183
- How to Copy Traces....................187

How to Configure a Standard Trace

Step-by-step instructions on configuring the trace settings are provided here. For details on individual functions and settings see "Trace Settings" on page 174.

Trace settings are configured in the "Traces" dialog box.

To display the "Traces" dialog box, do one of the following:

- Select "Analysis" from the "Overview", then select the "Traces" tab.
- Select the "Trace > Trace" menu item.

1. For each trace, select the "Trace Mode" and "Trace Detector". Traces with the trace mode "Blank" are not displayed.
2. To configure several traces to predefined display modes in one step, press the button for the required function:
   - "Preset All Traces"
   - "Set Trace Mode Avg | Max | Min"
   - "Set Trace Mode Max | ClrWrite | Min"

   For details see "Trace Settings" on page 174.
3. For "Average" trace mode, define the number of measurements to be averaged in the "Count" field.
4. If linear scaling is used, select the "Average Mode: Linear".

5. To improve the trace stability, increase the number of "Measurement Points" or the "Measurement Time" (in the "Capture" settings).

   All configured traces (not set to "Blank") are displayed after the next measurement.

How to Copy Traces

1. A trace copy function is provided in a separate tab of the "Traces" dialog box. To display this tab do one of the following:
   - Select "Analysis" from the "Overview", then select the "Trace Copy" tab.
   - Select the "Trace > Copy Trace" menu item.
2. Select the "Source" trace to be copied.
3. Select the "Copy to trace..." button for the trace to which the settings are to be applied.

   The settings from the source trace are applied to the destination trace. The newly configured trace (if not set to "Blank") is displayed after the next measurement.

How to Display and Configure a Spectrogram

Step-by-step instructions on how to display and configure a spectrogram are provided here. For details on individual functions and settings see "Spectrogram Settings" on page 178.

The remote commands required to perform these tasks are described in chapter 13.6.2.2, "Configuring Spectrograms", on page 349.

The following tasks are described here:

- "To display a spectrogram" on page 183
- "To remove the spectrogram display" on page 184
- "To set a marker in the spectrogram" on page 184
- "To configure a spectrogram" on page 184
- "To select a color scheme" on page 185
- "To set the value range graphically using the color range sliders" on page 185
- "To set the value range numerically" on page 186
- "To set the color curve shape graphically using the slider" on page 187
- "To set the color curve shape numerically" on page 187

To display a spectrogram

1. Select a Magnitude or Spectrum result display.
2. From the "Trace" menu, select "Spectrogram".

   The Spectrogram is automatically displayed as a subwindow of the selected result display, where each subwindow is the same size.
3. To enlarge the Spectrogram to the full window size, select "State: Full".
4. To clear an existing spectrogram display, select "Clear Spectrogram".

5. Close the dialog box.

   The spectrogram is updated continuously with each new capture.

To display the Spectrum or Magnitude diagram for a specific time frame:

1. Stop the continuous measurement or wait until the single capture is completed.
2. Select the frame number in the diagram footer of the Spectrogram.
3. Enter the required frame number in the edit dialog box.
   Note that the most recent sweep is frame number 0, all previous frames have negative numbers.

To remove the spectrogram display

1. Select the result display that contains the Spectrogram subwindow.
2. From the "Trace" menu, select "Spectrogram".
3. Select "State: Off"

   The Spectrogram subwindow is closed, and the original result display is restored in full window size.

To set a marker in the spectrogram

1. While a spectrogram is displayed, select the "Place Next Marker" icon in the "Marker" toolbar.
2. Select a "Marker" softkey.
3. Enter the frequency or time (x-value) of the marker or delta marker.
4. Enter the frame number for which the marker is to be set, for example *0* for the current frame, or *-2* for the second to last frame. Note that the frame number is always 0 or a negative value!
   The marker is only visible in the spectrum diagram if it is defined for the currently selected frame. In the spectrogram result display all markers are visible that are positioned on a visible frame.

To configure a spectrogram

1. Configure the spectrogram frames:
   a) From the Meas Setup menu, select "Capture".
   b) In the "Capture Count" field, define how many captures are to be analyzed to create a single frame.
   c) In the "Frame Count" field, define how many frames are to be plotted during a single measurement.
   d) To include frames from previous measurements in the analysis of the new frame (for "Max Hold", "Min Hold" and "Average" trace modes only), select "Continue Frame" = "ON".
2. Define how many frames are to be stored in total:

a) From the "Trace" menu, select "Spectrogram".
b) In the "History Depth" field, enter the maximum number of frames to store.

3. If necessary, adapt the color mapping for the spectrogram to a different value range or color scheme as described in "How to Configure the Color Mapping" on page 185.

How to Configure the Color Mapping

The color display is highly configurable to adapt the spectrograms to your needs.

The settings for color mapping are defined in the "Color Mapping" dialog box. To display this dialog box, do one of the following:

- Select the color map in the spectrogram display.
- From the "Trace" menu, select "Spectrogram", then select "Color Mapping", or switch to the "Color Mapping" tab directly.

To select a color scheme

You can select which colors are assigned to the measured values.

► In the "Color Mapping" dialog box, select the option for the color scheme to be used.

Editing the value range of the color map

The distribution of the measured values is displayed as a histogram in the "Color Mapping" dialog box. To cover the entire measurement value range, make sure the first and last bar of the histogram are included.

To ignore noise in a spectrogram, for example, exclude the lower power levels from the histogram.

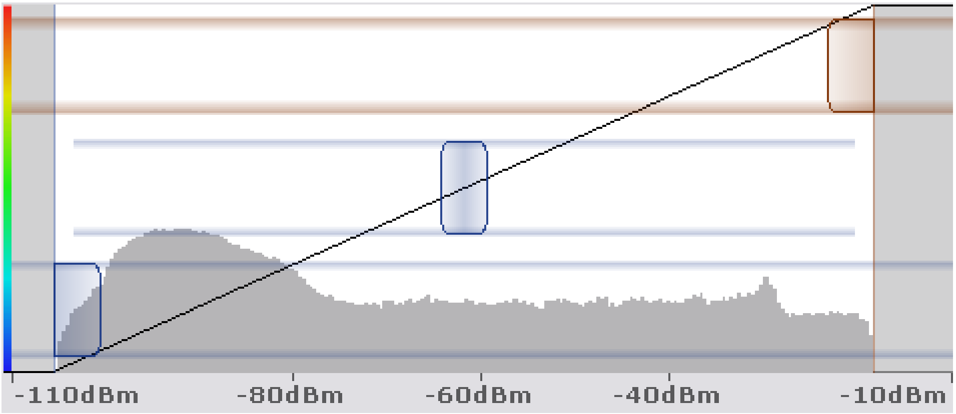
> The value range of the color map must cover at least 10% of the value range on the horizontal axis of the diagram, that means, the difference between the start and stop values must be at least 10%.

The value range can be set numerically or graphically.

To set the value range graphically using the color range sliders

1. Select and drag the bottom color curve slider (indicated by a gray box at the left of the color curve pane) to the lowest value you want to include in the color mapping.

2. Select and drag the top color curve slider (indicated by a gray box at the right of the color curve pane) to the highest value you want to include in the color mapping.



To set the value range numerically

1. In the "Start" field, enter the percentage from the left border of the histogram that marks the beginning of the value range.
2. In the "Stop" field, enter the percentage from the right border of the histogram that marks the end of the value range.

Example:

The color map starts at -100 dBm and ends at 0 dBm (i.e. a range of 100 dB). In order to suppress the noise, you only want the color map to start at -90 dBm. Thus, you enter *10%* in the "Start" field. The R&S VSE shifts the start point 10% to the right, to -90 dBm.

Adjusting the reference level and level range

Note that changing the reference level and level range of the measurement also affects the color mapping in the spectrogram.

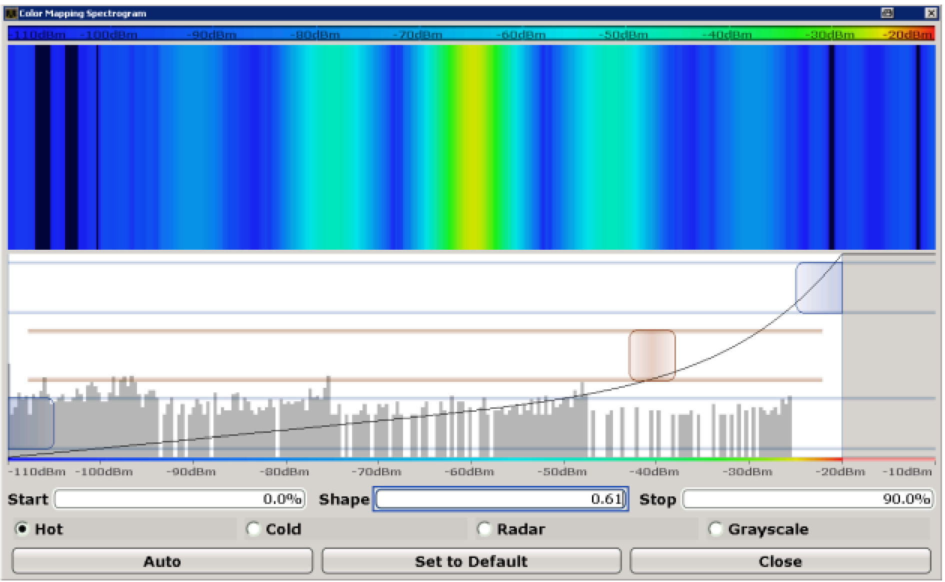
Editing the shape of the color curve

The color curve is a tool to shift the focus of the color distribution on the color map. By default, the color curve is linear, i.e. the colors on the color map are distributed evenly. If you shift the curve to the left or right, the distribution becomes non-linear. The slope of the color curve increases or decreases. One end of the color palette then covers a large amount of results, while the other end distributes several colors over a relatively small result range.

The color curve shape can be set numerically or graphically.

To set the color curve shape graphically using the slider

► Select and drag the color curve shape slider (indicated by a gray box in the middle of the color curve) to the left or right. The area beneath the slider is focussed, i.e. more colors are distributed there.



To set the color curve shape numerically

► In the "Shape" field, enter a value to change the shape of the curve:

- A negative value (-1 to <0) focusses the lower values
- 0 defines a linear distribution
- A positive value (>0 to 1) focusses the higher values

How to Copy Traces

You can copy the trace settings from one trace to another in the "Copy Trace" tab of the "Traces" dialog box.

► Select the "Source" trace and then the button for the "Copy to" trace.

Remote command:

TRACe<n>:COPY on page 348

10.4.2 Marker Usage

The following marker settings and functions are available in the I/Q Analyzer application.

Marker settings are window-specific.

For "I/Q Vector" displays markers are not available.

In the I/Q Analyzer application, the resolution with which the frequency can be measured with a marker depends on the filter bandwidth, which is derived from the defined sample rate, as well as the number of measurement points and the used detector (see chapter 10.2.3.1, "Frequency Resolution of FFT Results - RBW", on page 120).

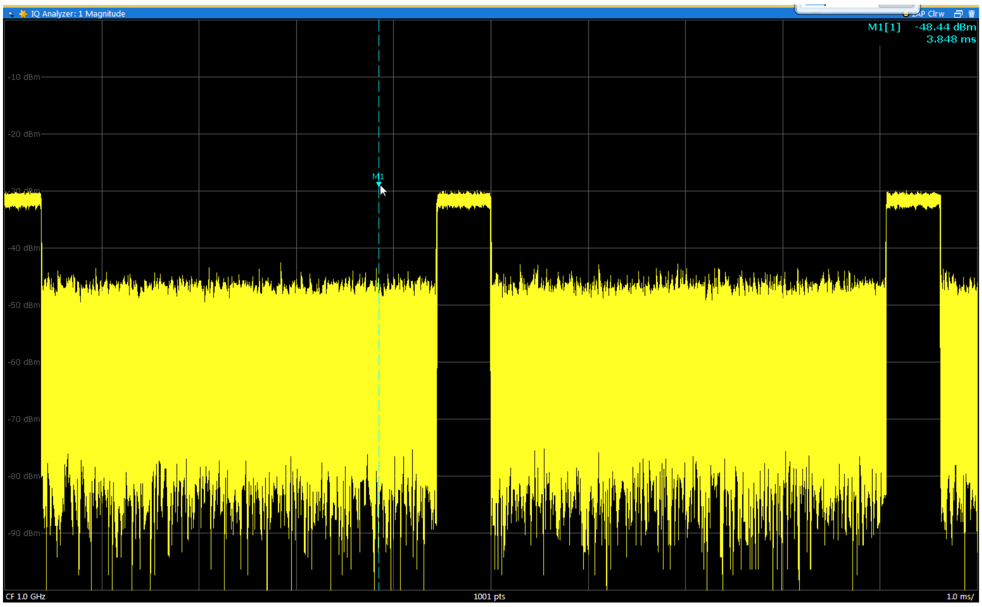
- Basics on Markers and Marker Functions..188
- Marker Settings...193
- Marker Search Settings and Positioning Functions..198
- Band Power Marker...206
- Deactivating All Marker Functions...207

10.4.2.1 Basics on Markers and Marker Functions

Some background knowledge on marker settings and functions is provided here for a better understanding of the required configuration settings.

Markers are used to mark points on traces, to read out measurement results and to select a display section quickly. R&S VSE provides 16 markers per display window.

- The easiest way to work with markers is using a mouse. Simply drag the marker and drop it at the required position. When you select the marker label in the display, a vertical line is displayed which indicates the marker's current x-value.



- You can also set an active marker to a new position by defining its x-position numerically. When you select a marker from the list in the "Marker" toolbar or from the "Marker" menu, an edit dialog box is displayed.
- To select or set individual markers very quickly, use the functions in the "Marker" menu or in the "Marker" toolbar.

- To set up several markers at once, use the "Marker" dialog box (select or "Marker > Marker").
- To determine more sophisticated marker results, use the special functions in the "Marker Function" dialog box (select "Marker > Marker Function").

- Marker Types.. 189
- Activating Markers...189
- Marker Results... 189
- Searching for Signal Peaks...190
- Measuring the Power in a Channel (Band).. 192
- Markers in the Spectrogram..193

Marker Types

All markers can be used either as normal markers or delta markers. A normal marker indicates the absolute signal value at the defined position in the diagram. A delta marker indicates the value of the marker relative to the specified reference marker (by default marker 1).

In addition, special functions can be assigned to the individual markers. The availability of special marker functions depends on whether the measurement is performed in the frequency or time domain, and on the type of measurement.

Temporary markers are used in addition to the markers and delta markers to analyze the measurement results for special marker functions. They disappear when the associated function is deactivated.

Activating Markers

Only active markers are displayed in the diagram and in the marker table.

Active markers are indicated by a checkmark in the marker selection lists.

By default, marker 1 is active and positioned on the maximum value (peak) of trace 1 as a normal marker. If several traces are displayed, the marker is set to the maximum value of the trace which has the lowest number and is not frozen (View mode). The next marker to be activated is set to the frequency of the next lower level (next peak) as a delta marker; its value is indicated as an offset to marker 1.

A marker can only be activated when at least one trace in the corresponding window is visible. If a trace is switched off, the corresponding markers and marker functions are also deactivated. If the trace is switched on again, the markers along with coupled functions are restored to their original positions, provided the markers have not been used on another trace.

Marker Results

The results can be displayed directly within the diagram area or in a separate table. By default, the first two active markers are displayed in the diagram area. If more markers are activated, the results are displayed in a marker table.

Marker information in diagram area

By default, the results of the last two markers or delta markers that were activated are displayed in the diagram area.

The following information is displayed there:

- The marker type (M for normal, D for delta, or special function name)
- The marker number (1 to 16)
- The assigned trace number in square brackets [ ]
- The marker value on the y-axis, or the result of the marker function
- The marker position on the x-axis

Marker information in marker table

In addition to the marker information displayed within the diagram area, a separate marker table may be displayed beneath the diagram. This table provides the following information for all active markers:

Table 10-4: Contents of the marker table in the I/Q Analyzer application

Wnd	Window within the application
Type	Marker type: N (normal), D (delta), T (temporary, internal) and number
Ref	Reference marker for delta markers
Trc	Trace to which the marker is assigned
Frame	Spectrogram frame the marker is positioned in. Displayed only when the Spectro-gram is displayed.
X-value	X-value of the marker
Y-value	Y-value of the marker
Function	Activated marker or measurement function
Function Result	Result of the active marker or measurement function

Searching for Signal Peaks

A common measurement task is to determine peak values, i.e. maximum or minimum signal levels. The R&S VSE provides various peak search functions and applications:

- Setting a marker to a peak value once (Peak Search)
- Searching for a peak value within a restricted search area (Search Limits)

Peak search limits

The peak search can be restricted to a search area. The search area is defined by limit lines which are also indicated in the diagram. In addition, a minimum value (threshold) can be defined as a further search condition.

When is a peak a peak? - Peak excursion

During a peak search, for example when a marker peak table is displayed, noise values may be detected as a peak if the signal is very flat or does not contain many peaks. Therefore, you can define a relative threshold ("Peak excursion"). The signal level must increase by the threshold value before falling again before a peak is detected. To avoid identifying noise peaks as maxima or minima, enter a peak excursion value that is higher than the difference between the highest and the lowest value measured for the displayed inherent noise.

Effect of peak excursion settings (example)

The following figure shows a trace to be analyzed.

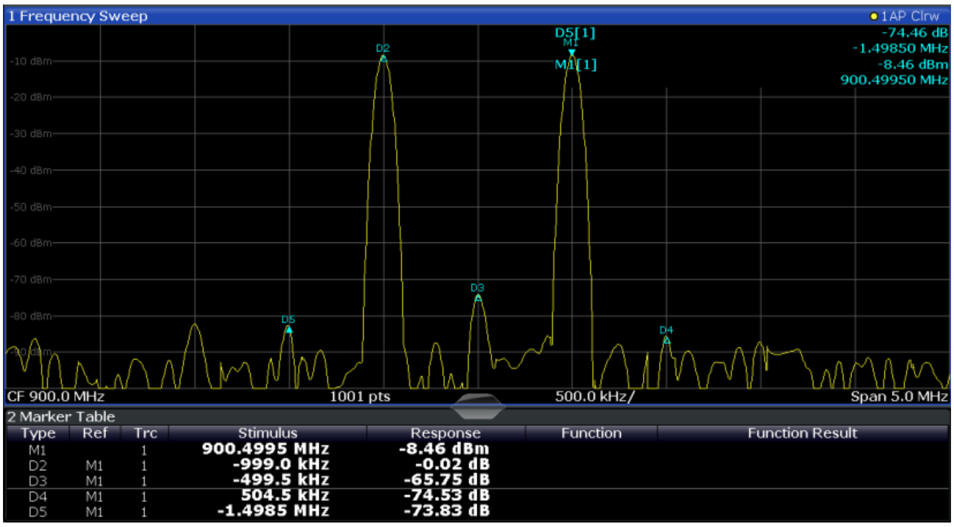


Fig. 10-20: Trace example

The following table lists the peaks as indicated by the marker numbers in the diagram above, as well as the minimum decrease in amplitude to either side of the peak:

Marker #	Min. amplitude decrease to either side of the signal
1	30 dB
2	29.85 dB
3	20 dB
4	10 dB
5	18 dB

In order to eliminate the smaller peaks M3,M4 and M5 in the example above, a peak excursion of at least 20 dB is required. In this case, the amplitude must rise at least 20 dB before falling again before a peak is detected.

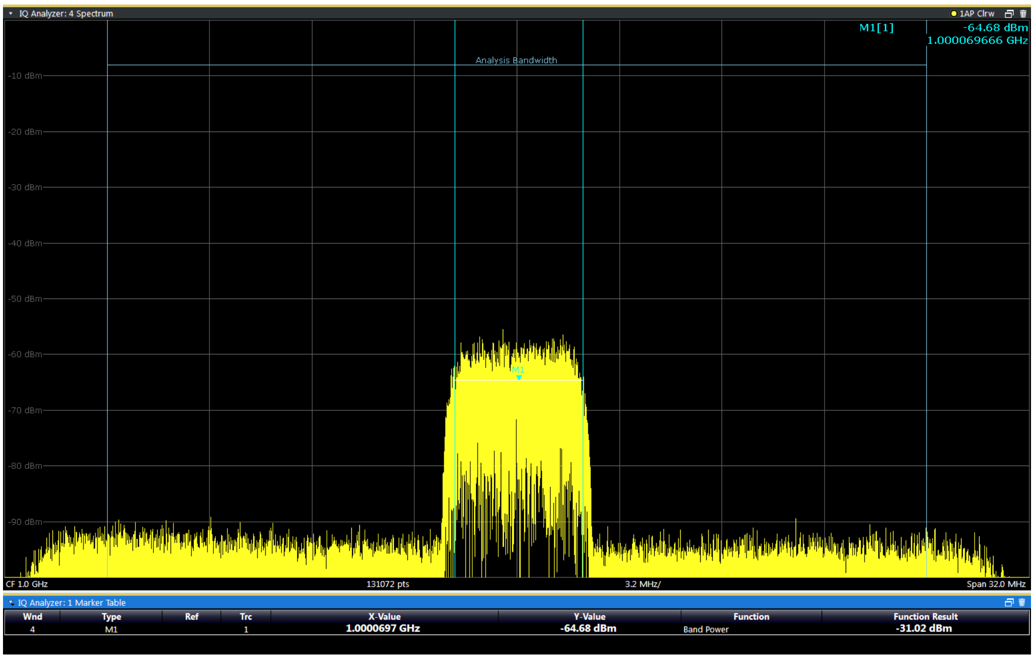
Measuring the Power in a Channel (Band)

To determine the noise power in a transmission channel, you could use a noise marker and multiply the result with the channel bandwidth. However, the results would only be accurate for flat noise.

Band power markers allow you to measure the integrated power for a defined span (band) around a marker (similar to ACP measurements). By default, 5 % of the current span is used. The span is indicated by limit lines in the diagram. The results can be displayed either as a power (dBm) or density (dBm/Hz) value and are indicated in the marker table for each band power marker.

Band power markers are only available for result displays in the frequency domain.

The entire band must lie within the display. If it is moved out of the display, the result cannot be calculated (indicated by "- - -" as the "Function Result"). However, the width of the band is maintained so that the band power can be calculated again when it returns to the display.



All markers can be defined as band power markers, each with a different span. When a band power marker is activated, if no marker is active yet, marker 1 is activated. Otherwise, the currently active marker is used as a band power marker (all other marker functions for this marker are deactivated).

If the detector mode for the marker trace is set to "Auto", the RMS detector is used.

Remote commands:

`CALCulate<n>:MARKer<m>:FUNCtion:BPOWer[:STATe]` on page 376

`CALCulate<n>:MARKer<m>:FUNCtion:BPOWer:RESult?` on page 376

Markers in the Spectrogram

Markers and delta markers are shaped like diamonds in the spectrogram. They are only displayed in the spectrogram if the marker position is inside the visible area of the spectrogram. If more than two markers are active, the marker values are displayed in a separate marker table.

In the spectrum result display, the markers and their frequency and level values (1) are displayed as usual. Additionally, the frame number is displayed to indicate the position of the marker in time (2).

In the spectrogram result display, you can activate up to 16 markers or delta markers at the same time. Each marker can be assigned to a different frame. Therefore, in addition to the frequency you also define the frame number when activating a new marker. If no frame number is specified, the marker is positioned on the currently selected frame. All markers are visible that are positioned on a visible frame. Special search functions are provided for spectrogram markers.

In the spectrum result display, only the markers positioned on the currently selected frame are visible. In "Continuous Sweep" mode this means that only markers positioned on frame 0 are visible. To view markers that are positioned on a frame other than frame 0 in the spectrum result display, you must stop the measurement and select the corresponding frame.

10.4.2.2 Marker Settings

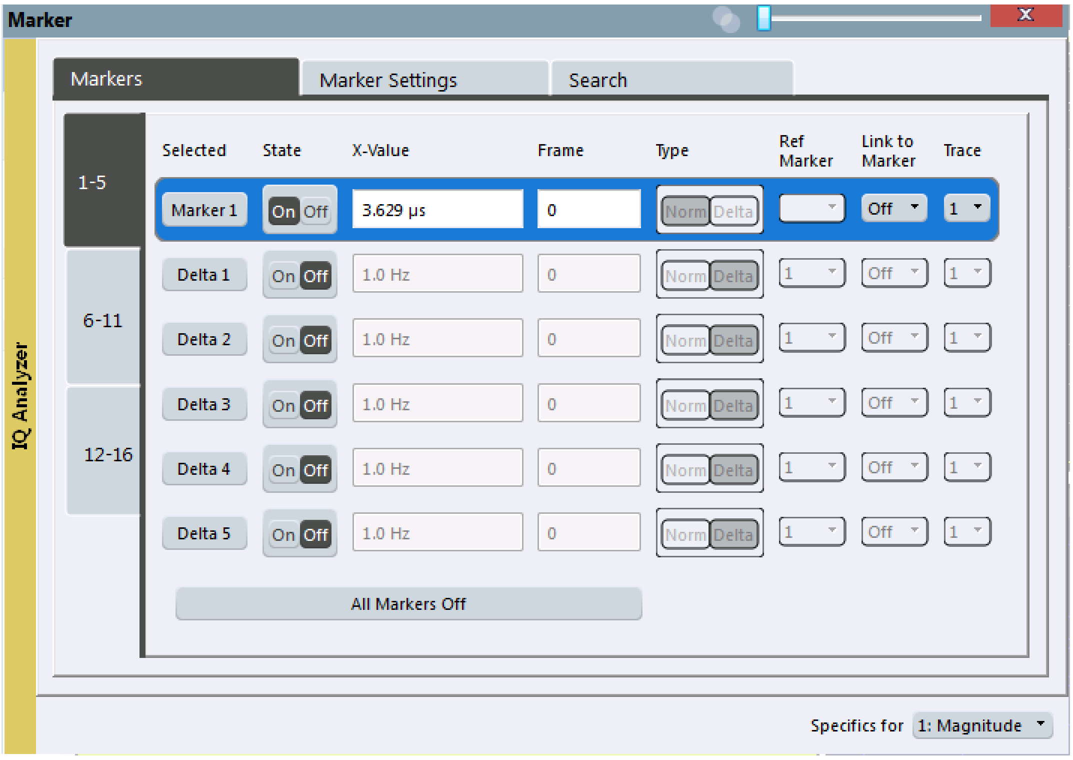
or: "Marker" > "Marker"

The remote commands required to define these settings are described in "Setting Up Individual Markers" on page 354.

● Individual Marker Setup.. 193
● General Marker Settings.. 197

Individual Marker Setup

Up to 17 markers or delta markers can be activated for each window simultaneously. Initial marker setup is performed using the "Marker" dialog box.



The markers are distributed among 3 tabs for a better overview. By default, the first marker is defined as a normal marker, whereas all others are defined as delta markers with reference to the first marker. All markers are assigned to trace 1, but only the first marker is active.

Place New Marker....................194
Marker 1/ Delta 1/ Delta 2/.../Delta 16....................195
Selected Marker....................195
Marker State....................195
Marker Position (X-value)....................195
Frame (Spectrogram only)....................196
Marker Type....................196
Reference Marker....................196
Linking to Another Marker....................196
Assigning the Marker to a Trace....................196
Select Marker....................197
All Markers Off....................197

Place New Marker

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

If a spectrogram is active, an edit field is displayed for the frame number (≤ 0) in which the marker is to be placed.

Marker 1/ Delta 1/ Delta 2/.../Delta 16

When you select the arrow on the marker selection list in the toolbar, or select a marker from the "Marker > Select Marker" menu, the marker is activated and an edit dialog box is displayed to enter the marker position ("X-value").

If a spectrogram is active, the frame number (≤ 0) in which the marker is to be placed can also be defined.

To deactivate a marker, select the marker name in the marker selection list in the toolbar (not the arrow) to display the "Select Marker" dialog box. Change the "State" to "Off".

Marker 1 is always the default reference marker for relative measurements. If activated, markers 2 to 16 are delta markers that refer to marker 1. These markers can be converted into markers with absolute value display using the "Marker Type" function.

Several markers can be configured very easily using the "Marker" dialog box, see chapter 10.4.2.2, "Marker Settings", on page 193.

Remote command:
`CALCulate<n>:MARKer<m>[:STATe]` on page 357
`CALCulate<n>:MARKer<m>:X` on page 358
`CALCulate<n>:MARKer<m>:Y?` on page 386
`CALCulate<n>:DELTamarker<m>[:STATe]` on page 356
`CALCulate<n>:DELTamarker<m>:X` on page 356
`CALCulate<n>:DELTamarker<m>:X:RELative?` on page 385
`CALCulate<n>:DELTamarker<m>:Y?` on page 386
For spectrogram display:
`CALCulate<n>:DELTamarker<m>:SPECtrogram:FRAMe` on page 364
`CALCulate<n>:MARKer<m>:SPECtrogram:FRAMe` on page 360

Selected Marker

Marker name. The marker which is currently selected for editing is highlighted orange.

Remote command:
Marker selected via suffix <m> in remote commands.

Marker State

Activates or deactivates the marker in the diagram.

Remote command:
`CALCulate<n>:MARKer<m>[:STATe]` on page 357
`CALCulate<n>:DELTamarker<m>[:STATe]` on page 356

Marker Position (X-value)

Defines the position (x-value) of the marker in the diagram.

Remote command:
`CALCulate<n>:MARKer<m>:X` on page 358
`CALCulate<n>:DELTamarker<m>:X` on page 356

Frame (Spectrogram only)

Spectrogram frame the marker is assigned to.

Remote command:
CALCulate<n>:MARKer<m>:SPECtrogram:FRAMe on page 360
CALCulate<n>:DELTamarker<m>:SPECtrogram:FRAMe on page 364

Marker Type

Toggles the marker type.

The type for marker 1 is always "Normal", the type for delta marker 1 is always "Delta". These types cannot be changed.

Note: If normal marker 1 is the active marker, switching the "Mkr Type" activates an additional delta marker 1. For any other marker, switching the marker type does not activate an additional marker, it only switches the type of the selected marker.

"Normal"	A normal marker indicates the absolute value at the defined position in the diagram.
"Delta"	A delta marker defines the value of the marker relative to the specified reference marker (marker 1 by default).

Remote command:
CALCulate<n>:MARKer<m>[:STATe] on page 357
CALCulate<n>:DELTamarker<m>[:STATe] on page 356

Reference Marker

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

Remote command:
CALCulate<n>:DELTamarker<m>:MREF on page 356

Linking to Another Marker

Links the current marker to the marker selected from the list of active markers. If the x-axis value of the inital marker is changed, the linked marker follows on the same x-position. Linking is off by default.

Using this function you can set two markers on different traces to measure the difference (e.g. between a max hold trace and a min hold trace or between a measurement and a reference trace).

Remote command:
CALCulate<n>:MARKer<m>:LINK:TO:MARKer<m> on page 357
CALCulate<n>:DELTamarker<m>:LINK:TO:MARKer<m> on page 355
CALCulate<n>:DELTamarker<m>:LINK on page 355

Assigning the Marker to a Trace

The "Trace" setting assigns the selected marker to an active trace. The trace determines which value the marker shows at the marker position. If the marker was previously assigned to a different trace, the marker remains on the previous frequency or time, but indicates the value of the new trace.

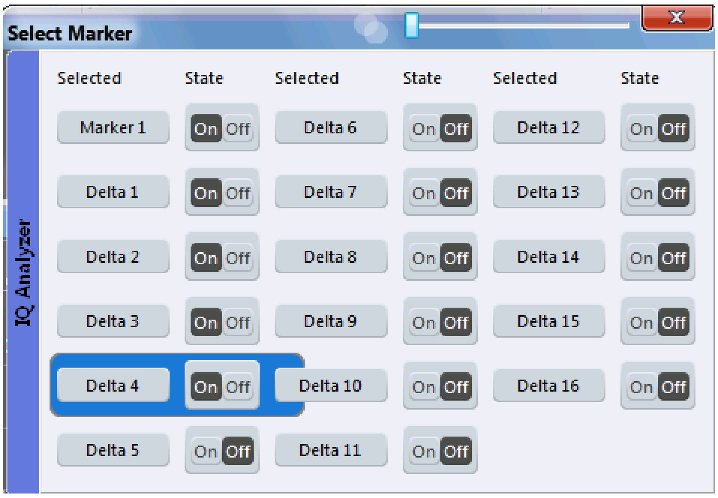
The marker can also be assigned to the currently active trace using the "Marker > Marker to Trace" menu item.

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

Remote command:
`CALCulate<n>:MARKer<m>:TRACe` on page 358

Select Marker

The "Select Marker" function opens a dialog box to select and activate or deactivate one or more markers quickly.



Remote command:
Marker selected via suffix <m> in remote commands.

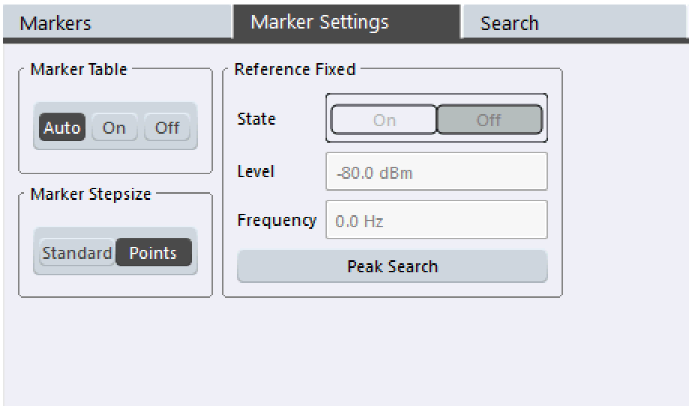
All Markers Off

Deactivates all markers in one step.

Remote command:
`CALCulate<n>:MARKer<m>:AOFF` on page 357

General Marker Settings

Some general marker settings allow you to influence the marker behavior for all markers.



Marker Table Display....198
Marker Stepsize....198

Marker Table Display

Defines how the marker information is displayed.

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

"Off" Displays the marker information within the diagram area.

"Auto" (Default) Up to two markers are displayed in the diagram area. If more markers are active, the marker table is displayed automatically.

Remote command:

`DISPlay:MTABle` on page 359

Marker Stepsize

Defines the size of the steps that the marker position is moved using the mouse wheel.

"Standard" The marker position is moved in (Span/1000) steps, which corresponds approximately to the number of pixels for the default display of 1001 measurement points. This setting is most suitable to move the marker over a larger distance.

"Points" The marker position is moved from one measurement point to the next. This setting is required for a very precise positioning if more measurement points are collected than the number of pixels that can be displayed on the screen. It is the default mode.

Remote command:

`CALCulate<n>:MARKer<m>:X:SSIZe` on page 359

10.4.2.3 Marker Search Settings and Positioning Functions

Access: "Overview" > "Analysis" > "Marker" > "Search"

or: "Marker" > "Search"

Several functions are available to set the marker to a specific position very quickly and easily, or to use the current marker position to define another characteristic value. In order to determine the required marker position, searches may be performed. The search results can be influenced by special settings.

In I/Q Analyzer mode, the search settings for "Real/Imag (I/Q)" evaluation include an additional parameter, see "Branch for Peak Search" on page 201.

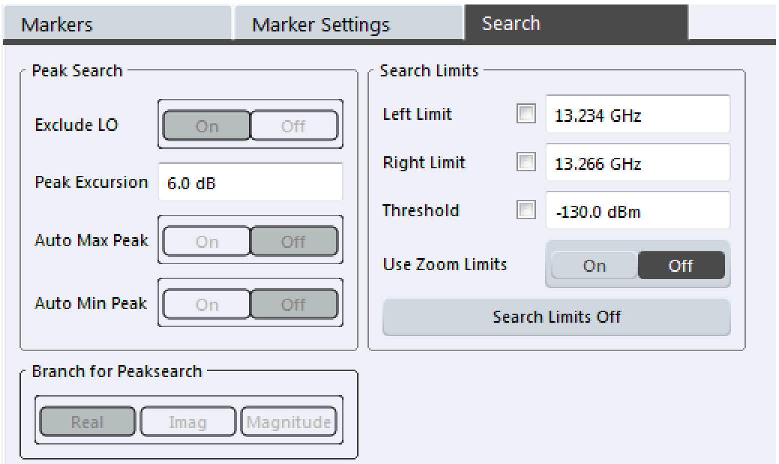
- Marker Search Settings....199
- Marker Search Settings for Spectrograms....201
- Positioning Functions....204

Marker Search Settings

Access: "Overview" > "Analysis" > "Markers" > "Search Settings"

or: "Marker" > "Search"

Markers are commonly used to determine peak values, i.e. maximum or minimum values, in the measured signal. Configuration settings allow you to influence the peak search results.



Search Mode for Next Peak....199
Exclude LO....200
Peak Excursion....200
Auto Max / Min Peak Search....200
Search Limits....200
└ Search Limits (Left / Right)....200
└ Search Threshold....201
└ Using Zoom Limits....201
└ Deactivating All Search Limits....201
Branch for Peak Search....201

Search Mode for Next Peak
Selects the search mode for the next peak search.

"Left" Determines the next maximum/minimum to the left of the current peak.

"Absolute" Determines the next maximum/minimum to either side of the current peak.

"Right" Determines the next maximum/minimum to the right of the current peak.

Remote command:
"Positioning the Marker" on page 370

Exclude LO

If activated, restricts the frequency range for the marker search functions.

"ON" The minimum frequency included in the peak search range is ≥ 5 × resolution bandwidth (RBW).
Due to the interference by the first local oscillator to the first intermediate frequency at the input mixer, the LO is represented as a signal at 0 Hz. To avoid the peak marker jumping to the LO signal at 0 Hz, this frequency is excluded from the peak search.

"OFF" No restriction to the search range. The frequency 0 Hz is included in the marker search functions.

Remote command:
`CALCulate<n>:MARKer<m>:LOEXclude` on page 367

Peak Excursion

Defines the minimum level value by which a signal must rise or fall so that it will be identified as a maximum or a minimum by the search functions.

Entries from 0 dB to 80 dB are allowed; the resolution is 0.1 dB. The default setting for the peak excursion is 6 dB.

Remote command:
`CALCulate<n>:MARKer<m>:PEXCursion` on page 367

Auto Max / Min Peak Search

If activated, a maximum or minimum peak search is performed automatically for marker 1 after each measurement.

Remote command:
`CALCulate<n>:MARKer<m>:MAXimum:AUTO` on page 371
`CALCulate<n>:MARKer<m>:MINimum:AUTO` on page 372

Search Limits

The search results can be restricted by limiting the search area or adding search conditions.

Search Limits (Left / Right) ← Search Limits

If activated, limit lines are defined and displayed for the search. Only results within the limited search range are considered.

Remote command:
`CALCulate<n>:MARKer<m>:X:SLIMits[:STATe]` on page 368
`CALCulate<n>:MARKer<m>:X:SLIMits:LEFT` on page 369
`CALCulate<n>:MARKer<m>:X:SLIMits:RIGHT` on page 369

Search Threshold ← Search Limits
Defines an absolute threshold as an additional condition for the peak search. Only peaks that exceed the threshold are detected.

Remote command:
`CALCulate<n>:THReshold` on page 370

Using Zoom Limits ← Search Limits
If activated, the peak search is restricted to the active zoom area defined for a single zoom (see "Single Zoom" on page 209).

Remote command:
`CALCulate<n>:MARKer<m>:X:SLIMits:ZOOM[:STATe]` on page 369

Deactivating All Search Limits ← Search Limits
Deactivates the search range limits.

Remote command:
`CALCulate<n>:MARKer<m>:X:SLIMits[:STATe]` on page 368
`CALCulate<n>:THReshold:STATe` on page 370

Branch for Peak Search
Defines which data is used for marker search functions in I/Q data.

This function is only available for the display configuration "Real/Imag (I/Q)" (see "Real/Imag (I/Q)" on page 114).

Note: The search settings apply to all markers, not only the currently selected one.

"Real"
Marker search functions are performed on the real trace of the I/Q measurement.

"Imag"
Marker search functions are performed on the imaginary trace of the I/Q measurement.

"Magnitude"
Marker search functions are performed on the magnitude of the I and Q data.

Remote command:
`CALCulate<n>:MARKer<m>:SEARch` on page 368

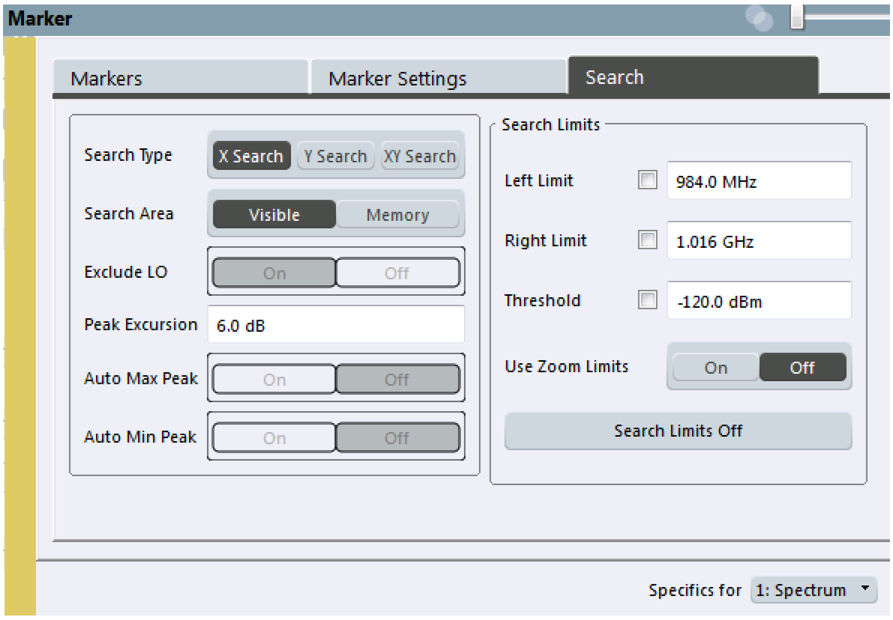
Marker Search Settings for Spectrograms

Access: "Overview" > "Analysis" > "Markers" > "Search"

or: "Marker" > "Search"

Spectrograms show not only the current sweep results, but also the sweep history. Thus, when searching for peaks, you must define the search settings within a single time frame (x-direction) and within several time frames (y-direction).

These settings are only available for spectrogram displays.



Marker Search Type......202
Marker Search Area......202
Exclude LO......202
Peak Excursion......203
Auto Max / Min Peak Search......203
Search Limits......203
└ Search Limits (Left / Right)......203
└ Search Threshold......203
└ Using Zoom Limits......204
└ Deactivating All Search Limits......204

Marker Search Type

Defines the type of search to be performed in the spectrogram.

"X-Search" Searches only within the currently selected frame.

"Y-Search" Searches within all frames but only at the current frequency position.

"XY-Search" Searches in all frames at all positions.

Remote command:
Defined by the search function, see "Marker Search (Spectrograms)" on page 359

Marker Search Area

Defines which frames the search is performed in.

"Visible" Only the visible frames are searched.

"Memory" All frames stored in the memory are searched.

Remote command:
`CALCulate<n>:MARKer<m>:SPECtrogram:SARea` on page 361
`CALCulate<n>:DELTamarker<m>:SPECtrogram:SARea` on page 364

Exclude LO

If activated, restricts the frequency range for the marker search functions.

"ON"	The minimum frequency included in the peak search range is ≥ 5 × resolution bandwidth (RBW). Due to the interference by the first local oscillator to the first intermediate frequency at the input mixer, the LO is represented as a signal at 0 Hz. To avoid the peak marker jumping to the LO signal at 0 Hz, this frequency is excluded from the peak search.
"OFF"	No restriction to the search range. The frequency 0 Hz is included in the marker search functions.

Remote command:
`CALCulate<n>:MARKer<m>:LOEXclude` on page 367

Peak Excursion

Defines the minimum level value by which a signal must rise or fall so that it will be identified as a maximum or a minimum by the search functions.

Entries from 0 dB to 80 dB are allowed; the resolution is 0.1 dB. The default setting for the peak excursion is 6 dB.

Remote command:
`CALCulate<n>:MARKer<m>:PEXCursion` on page 367

Auto Max / Min Peak Search

If activated, a maximum or minimum peak search is performed automatically for marker 1 after each measurement.

Remote command:
`CALCulate<n>:MARKer<m>:MAXimum:AUTO` on page 371
`CALCulate<n>:MARKer<m>:MINimum:AUTO` on page 372

Search Limits

The search results can be restricted by limiting the search area or adding search conditions.

Search Limits (Left / Right) ← Search Limits

If activated, limit lines are defined and displayed for the search. Only results within the limited search range are considered.

Remote command:
`CALCulate<n>:MARKer<m>:X:SLIMits[:STATe]` on page 368
`CALCulate<n>:MARKer<m>:X:SLIMits:LEFT` on page 369
`CALCulate<n>:MARKer<m>:X:SLIMits:RIGHT` on page 369

Search Threshold ← Search Limits

Defines an absolute threshold as an additional condition for the peak search. Only peaks that exceed the threshold are detected.

Remote command:
`CALCulate<n>:THReshold` on page 370

Using Zoom Limits ← Search Limits
If activated, the peak search is restricted to the active zoom area defined for a single zoom (see "Single Zoom" on page 209).

Remote command:
`CALCulate<n>:MARKer<m>:X:SLIMits:ZOOM[:STATe]` on page 369

Deactivating All Search Limits ← Search Limits
Deactivates the search range limits.

Remote command:
`CALCulate<n>:MARKer<m>:X:SLIMits[:STATe]` on page 368
`CALCulate<n>:THReshold:STATe` on page 370

Positioning Functions

Access: "Marker" toolbar

The following functions set the currently selected marker to the result of a peak search or set other characteristic values to the current marker value.

Peak Search..204
Search Next Peak..204
Search Minimum..205
Search Next Minimum..205
Center Frequency = Marker Frequency..205
Reference Level = Marker Level..205

Peak Search

Sets the selected marker/delta marker to the maximum of the trace. If no marker is active, marker 1 is activated.

For spectrogram displays, define which frame the peak is to be searched in.

Remote command:
`CALCulate<n>:MARKer<m>:MAXimum[:PEAK]` on page 371
`CALCulate<n>:DELTamarker<m>:MAXimum[:PEAK]` on page 374

Search Next Peak
Sets the selected marker/delta marker to the next (lower) maximum of the assigned trace. If no marker is active, marker 1 is activated.

, 

For spectrogram displays, define which frame the next peak is to be searched in.

For the Next Peak Up/Down functions, the search is automatically performed in all frames above or below the currently selected frame, respectively.

Remote command:
CALCulate<n>:MARKer<m>:MAXimum:NEXT on page 371
CALCulate<n>:MARKer<m>:MAXimum:RIGHt on page 372
CALCulate<n>:MARKer<m>:MAXimum:LEFT on page 371
CALCulate<n>:DELTamarker<m>:MAXimum:NEXT on page 374
CALCulate<n>:DELTamarker<m>:MAXimum:RIGHt on page 374
CALCulate<n>:DELTamarker<m>:MAXimum:LEFT on page 373

Search Minimum

Sets the selected marker/delta marker to the minimum of the trace. If no marker is active, marker 1 is activated.

For spectrogram displays, define which frame the minimum is to be searched in.

Remote command:
CALCulate<n>:MARKer<m>:MINimum[:PEAK] on page 373
CALCulate<n>:DELTamarker<m>:MINimum[:PEAK] on page 375

Search Next Minimum
Sets the selected marker/delta marker to the next (higher) minimum of the selected trace. If no marker is active, marker 1 is activated.

,

For spectrogram displays, define which frame the next minimum is to be searched in.

For the Next Min Up/Down functions, the search is automatically performed in all frames above or below the currently selected frame, respectively.

Remote command:
CALCulate<n>:MARKer<m>:MINimum:NEXT on page 372
CALCulate<n>:MARKer<m>:MINimum:LEFT on page 372
CALCulate<n>:MARKer<m>:MINimum:RIGHt on page 373
CALCulate<n>:DELTamarker<m>:MINimum:NEXT on page 374
CALCulate<n>:DELTamarker<m>:MINimum:LEFT on page 374
CALCulate<n>:DELTamarker<m>:MINimum:RIGHt on page 375

Center Frequency = Marker Frequency

Sets the center frequency to the selected marker or delta marker frequency. A peak can thus be set as center frequency, for example to analyze it in detail with a smaller span.

Remote command:
CALCulate<n>:MARKer<m>:FUNCtion:CENTer on page 324

Reference Level = Marker Level

Sets the reference level to the selected marker level.

Remote command:
`CALCulate<n>:MARKer<m>:FUNCtion:REFerence` on page 315

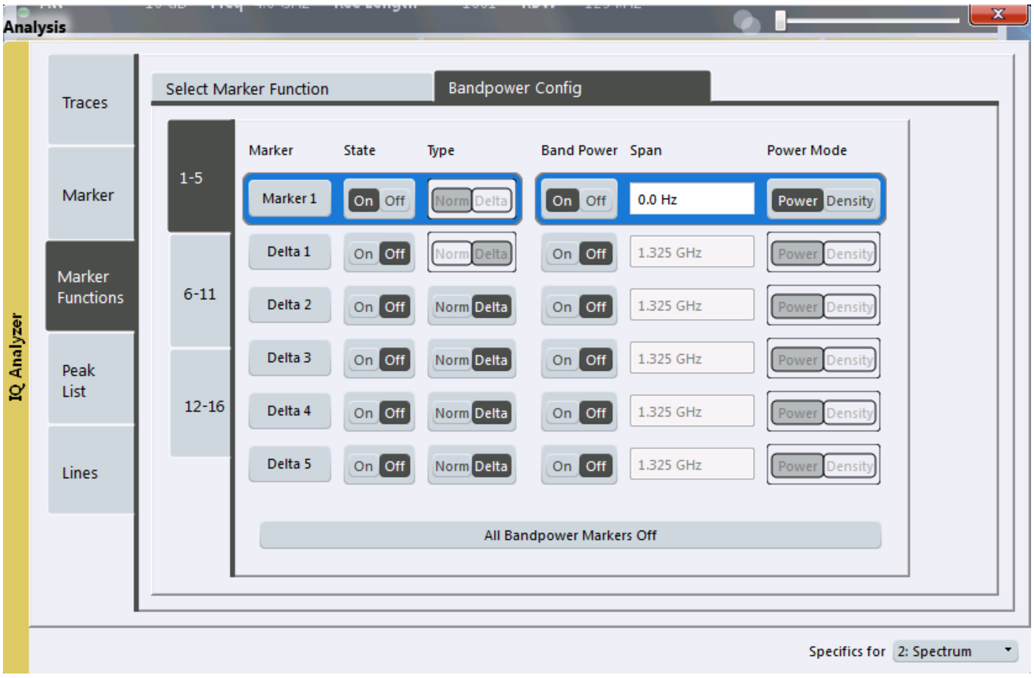
10.4.2.4 Band Power Marker

Access: "Overview" > "Analysis" > "Marker Functions" > "Band Power" > "Band Power Config"

or: "Marker" > "Marker Function" > "Band Power"

For each of the 16 markers band power measurement can be activated.

The individual marker settings correspond to those defined in the "Marker" dialog box (see "Individual Marker Setup" on page 193). Any settings to the marker state or type changed in the "Marker Function" dialog box are also changed in the "Marker" dialog box and vice versa.



For more information see "Measuring the Power in a Channel (Band)" on page 192.

Band Power Measurement State 206
Span 207
Power Mode 207
Switching All Band Power Measurements Off 207

Band Power Measurement State

Activates or deactivates band power measurement for the marker in the diagram.

Band power markers are only available for standard frequency measurements (not zero span) in the Spectrum application.

If activated, the markers display the power or density measured in the band around the current marker position.

For details see "Measuring the Power in a Channel (Band)" on page 192.

Remote command:
`CALCulate<n>:MARKer<m>:FUNCtion:BPOWer[:STATe]` on page 376
`CALCulate<n>:DELTamarker<m>:FUNCtion:BPOWer[:STATe]` on page 378

Span
Defines the span (band) around the marker for which the power is measured. The span is indicated by lines in the diagram.

Remote command:
`CALCulate<n>:MARKer<m>:FUNCtion:BPOWer:SPAN` on page 376
`CALCulate<n>:DELTamarker<m>:FUNCtion:BPOWer:SPAN` on page 377

Power Mode
Defines the mode of the power measurement result.

"Power" The result is an absolute power level. The power unit depends on the Unit setting.

"Density" The result is a power level in relation to the bandwidth, displayed in dBm/Hz.

Remote command:
`CALCulate<n>:MARKer<m>:FUNCtion:BPOWer:MODE` on page 375
`CALCulate<n>:DELTamarker<m>:FUNCtion:BPOWer:MODE` on page 377

Switching All Band Power Measurements Off
Deactivates band power measurement for all markers.

Remote command:
`CALCulate<n>:MARKer<m>:FUNCtion:BPOWer[:STATe]` on page 376
`CALCulate<n>:DELTamarker<m>:FUNCtion:BPOWer[:STATe]` on page 378

10.4.2.5 Deactivating All Marker Functions

Access: "Overview" > "Analysis" > "Marker Functions" > "All Functions Off"

or: "Marker" > "All Markers Off"

All special marker functions can be deactivated in one step.

10.4.3 Zoomed Displays

You can zoom into the diagram to visualize the measurement results in greater detail. Using a mouse pointer you can easily define the area to be enlarged.

Zoom and the number of trace points

Note that zooming is merely a visual tool, it does not change any measurement settings, such as the number of trace points!

You should increase the number of trace points before zooming, as otherwise the function has no real effect (see chapter 10.2.1, "How Much Data is Measured: Capture Count and Measurement Points", on page 118).

- Single Zoom Versus Multiple Zoom....................208
- Zoom Functions....................209
- How to Zoom Into a Diagram....................210

10.4.3.1 Single Zoom Versus Multiple Zoom

Two different (graphical) zoom modes are available: single zoom and multiple zoom. A single zoom replaces the current diagram by a new diagram which displays an enlarged extract of the trace. This function can be used repetitively until the required details are visible. In multiple zoom mode, you can enlarge up to four different areas of the trace simultaneously. An overview window indicates the zoom areas in the original trace, while the zoomed trace areas are displayed in individual windows. The zoom areas can be moved and resized any time. The zoom area that corresponds to the individual zoom display is indicated in the lower right corner, between the scrollbars.

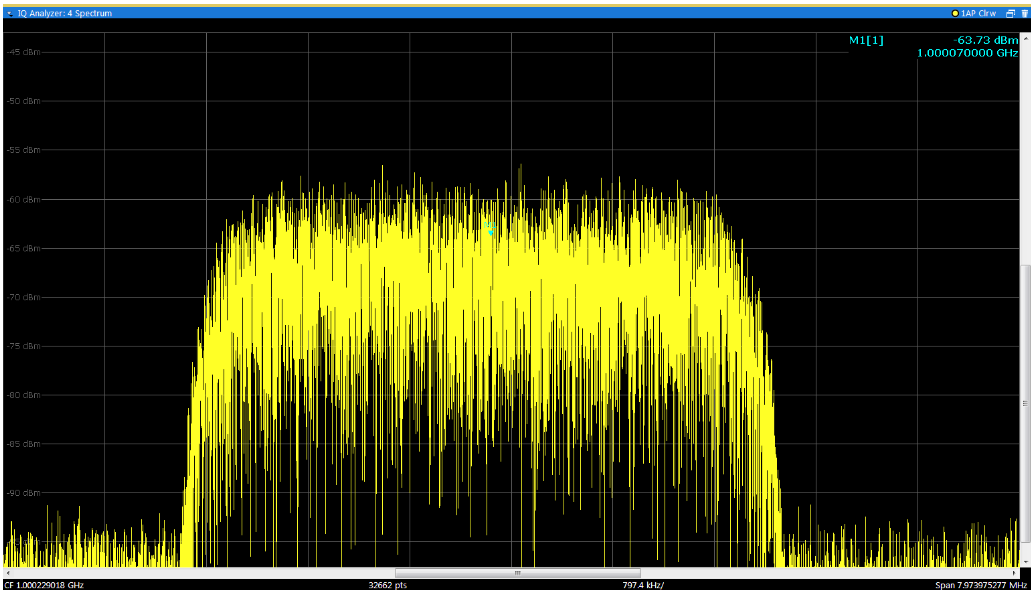


Fig. 10-21: Single zoom

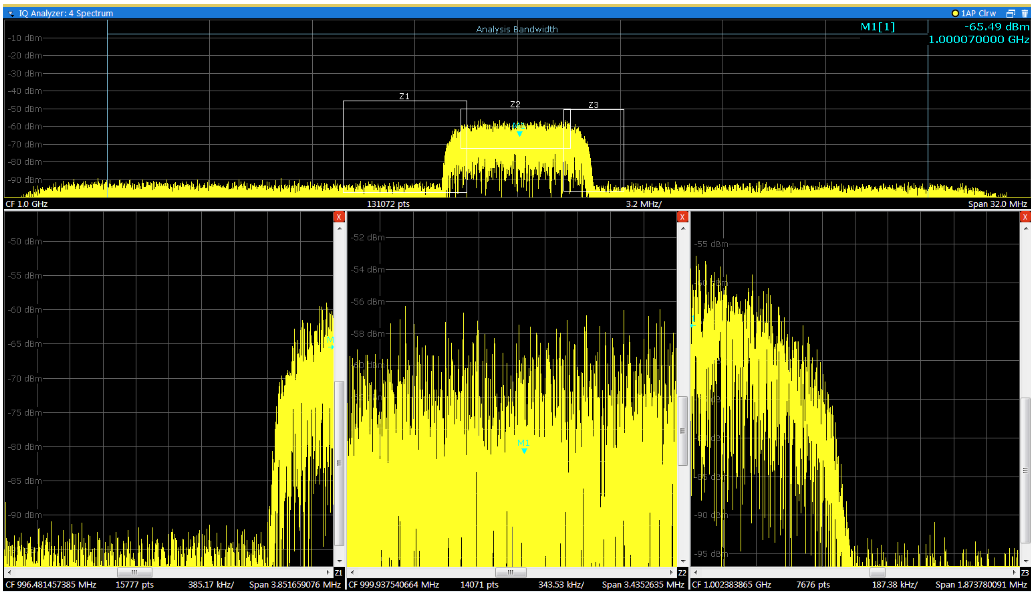


Fig. 10-22: Multiple zoom

Using the zoom area to restrict a peak search

The selected zoom area can be used to restrict the search range for a peak search, but only in single zoom mode (see "Using Zoom Limits" on page 201).

10.4.3.2 Zoom Functions

Access: "Zoom" icons in toolbar

Single Zoom.......209
Multiple Zoom.......209
Restore Original Display.......210
Deactivating Zoom (Selection mode).......210

Single Zoom

A single zoom replaces the current diagram by a new diagram which displays an enlarged extract of the trace. This function can be used repetitively until the required details are visible.

Remote command:
`DISPlay[:WINDow<n>]:ZOOM:STATe` on page 378
`DISPlay[:WINDow<n>]:ZOOM:AREA` on page 378

Multiple Zoom

In multiple zoom mode, you can enlarge several different areas of the trace simultaneously. An overview window indicates the zoom areas in the original trace, while the zoomed trace areas are displayed in individual windows. The zoom area that corresponds to the individual zoom display is indicated in the lower right corner, between the scrollbars.

Remote command:
`DISPlay[:WINDow<n>]:ZOOM:MULTiple<zoom>:STATe` on page 379
`DISPlay[:WINDow<n>]:ZOOM:MULTiple<zoom>:AREA` on page 379

Restore Original Display

Restores the original display, that is, the originally calculated displays for the entire capture buffer, and closes all zoom windows.

Remote command:
single zoom:
`DISPlay[:WINDow<n>]:ZOOM:STATe` on page 378
multiple zoom:
`DISPlay[:WINDow<n>]:ZOOM:MULTiple<zoom>:STATe` on page 379 (for each multiple zoom window)

Deactivating Zoom (Selection mode)
Deactivates any zoom mode.

Selecting a point in the display no longer invokes a zoom, but selects an object.

Remote command:
single zoom:
`DISPlay[:WINDow<n>]:ZOOM:STATe` on page 378
multiple zoom:
`DISPlay[:WINDow<n>]:ZOOM:MULTiple<zoom>:STATe` on page 379 (for each multiple zoom window)

10.4.3.3 How to Zoom Into a Diagram

The remote commands required to zoom into a display are described in chapter 13.6.2.4, "Zooming into the Display", on page 378.

The following tasks are described here:

- "To zoom into the diagram at one position" on page 210
- "To return to selection mode in the diagram" on page 211
- "To return to original display" on page 211
- "To zoom into multiple positions in the diagram" on page 211

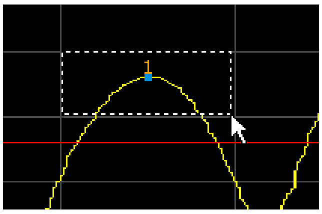
To zoom into the diagram at one position

1. 

   Click on the "Single Zoom" icon in the toolbar.

Zoom mode is activated.

2. Select the area in the diagram to be enlarged using the mouse pointer. The selected area is indicated by a dotted rectangle.

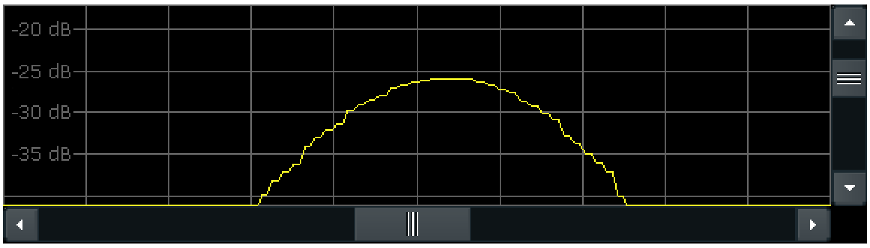


When you drop the mouse pointer, the diagram is replaced by the zoomed trace area.

3. Repeat these steps, if necessary, to enlarge the diagram further.

Scrolling in the zoomed display

You can scroll the diagram area to display the entire diagram using the scrollbars at the right and at the bottom of the diagram.



To return to selection mode in the diagram

While you are in zoom mode, selecting points in the display changes the zoom area. In order to select or move a trace or marker, you must switch back to selection mode:

► 

Select the "Selection mode" icon in the toolbar.

To return to original display

► 

Click on the "Zoom Off" icon in the toolbar.

The original trace display is restored. Zoom mode remains active, however.
To switch off zoom mode and return to selection mode, select the "Selection mode" icon in the toolbar.

To zoom into multiple positions in the diagram

1. 

Click on the "Multiple Zoom" icon in the toolbar.

Multiple zoom mode is activated.

2. Select the first area in the diagram to be enlarged as described in "To zoom into the diagram at one position" on page 210. The selected area is indicated by a dotted rectangle.

   When you have completed your selection, the original trace is shown in an overview diagram with the selected area indicated by a dotted rectangle. The zoomed trace area is displayed in a separate window (see figure 10-22.
3. In the overview diagram, select the next area to be enlarged.

   The second zoom area is indicated in the overview diagram, and a second zoom window is displayed.
4. Repeat these steps, if necessary, to zoom into further trace areas (up to four).

To move or change zoom areas

In multiple zoom mode, you can change the size or position of the individual zoom areas easily at any time.

1. If necessary, switch off zoom mode and return to selection mode by selecting the "Selection mode" icon in the toolbar.
2. To resize a zoom area, set the mouse pointer directly **on** the corresponding frame in the overview window and drag the line to change the size of the frame.
   To move a zoom area, set the mouse pointer **inside** the corresponding frame in the overview window and drag the frame to the new position.

   The contents of the zoom windows are adapted accordingly.

11 How To Perform Measurements with the R&S VSE

The following step-by-step instructions demonstrate how to load and store I/Q data and perform basic measurements with the R&S VSE in general, and how to configure data acquisition and analyze data in the I/Q Analyzer application.

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- How to Import I/Q Data for Analysis....215
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- How to Perform a Sequence of Measurements on a Single File or Instrument....217
- How to Save and Load Measurement Settings....218
- How to Export I/Q Data....219
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11.1 How to Perform a Basic Measurement with Instrument Input

The following step-by-step instructions demonstrate how to perform a very simple measurement on input from a connected instrument using the R&S VSE.

1. Configure a instrument from which data is to be captured:
   a) In the "Instruments" tool window, select "New Instrument".
   b) Select "Search" to search for all instruments in the network and select the instrument from which data is to be captured.
      Alternatively, enter the connection information for the new instrument manually.
   c) Select "Connect" to establish a connection to the specified instrument.
   d) If necessary, select "Self Alignment" to calibrate the instrument.
   e) Optionally, select "Infos & Settings" to do one of the following:
      - Configure the use of an external reference on the instrument
      - Control the display of the remote controlled instrument
      - Obtain information on the options installed on the connected instrument
2. Assign the configured instrument to the default measurement channel:
   a) In the "Measurement Group Setup" tool window, for the default group 1, select the "+" icon in front of the default measurement channel "IQ Analyzer".
   b) Select "Instrument" as the input type.
   c) If several instruments are configured, select the instrument to be used for the measurement from the "Instrument" selection list.
   d) If optional interfaces for data input to the instrument are available, select the input source to be used for the measurement from the "Input Source" selection list.

3. Configure further input source settings as required for the selected signal source (see chapter 11.7, "How to Capture Baseband (I/Q) Data in the I/Q Analyzer", on page 220.
4. Select the "Capture mode" icon for the "IQ Analyzer" measurement channel to toggle between single and continuous measurements. For single capture mode, a fixed number of measurements is performed (defined by the measurement settings), whereas in continuous capture mode, measurements are performed continuously until they are stopped manually.
5. Select the "Capture" icon for the "IQ Analyzer" measurement channel.

   One or more measurements are performed on the input data from the connected instrument and the results are displayed in the"IQ Analyzer: Magnitude" result display.

   Analyze the captured data as described in chapter 11.8, "How to Analyze Data in the I/Q Analyzer", on page 221, or add further measurement channels to analyze the input data in other applications as described in chapter 11.3, "How to Perform Measurements on Multiple Files and Instruments", on page 216.

To add further measurement channels

1. In the "Measurement Group Setup" tool window, select the "+ Channel" button to add a new measurement channel to the group.
2. Select the measurement mode or a copy of the currently selected measurement channel ("Duplicate Current Channel").

   The channel bar and the default result displays for the new measurement channel are displayed. If necessary, the previously displayed windows are cumulated in tabs to create room on the display.
3. Select the input type for the new measurement channel and assign a configured instrument or import a file (see chapter 11.1, "How to Perform a Basic Measurement with Instrument Input", on page 213 or chapter 11.2, "How to Import I/Q Data for Analysis", on page 215).
4. Configure further input source or measurement settings as required for the individual channels (see the applications' user manual for details).
5. Repeat these steps to add further measurement channels to the group.
6. Select the "Capture mode" icon to toggle between single and continuous measurements for each measurement channel.
7. Select the "Capture" icon for a measurement channel to perform a measurement on that channel. Only one channel can be started manually at a time. Before you can start another channel, you must stop the previous measurement by selecting the "Stop" icon for that channel first.

To start multiple measurements (on diffferent input types) at the same time, perform a measurement on the entire group; see chapter 11.3, "How to Perform Measurements on Multiple Files and Instruments", on page 216.

To perform several measurements on the same instrument sequentially, configure a measurement sequence; see chapter 11.4, "How to Perform a Sequence of Measurements on a Single File or Instrument", on page 217.

11.2 How to Import I/Q Data for Analysis

To import data via the "Measurement Group Setup" window

1. In the "Measurement Group Setup" tool window, select the "+" icon in front of the measurement channel.
2. Select "File" as the input type.
3. Select the "..." icon to open a file selection dialog box and select the storage location and the file name.
   Alternatively, select a file from the selection list of recently imported files.
4. Select the ▶ "Capture" icon for the measurement channel.

   The stored data is loaded from the file and evaluated in the selected application.

To import data via the "Input" dialog box

Alternatively to the procedure described above, starting in the "Measurement Group Setup" tool window, you can also import data via the "Input" dialog box.

1. From the "Input & Output" menu, select "Input Source".
2. Select "I/Q File" as the input source.
3. Select "Select File" to open a file selection dialog box and select the storage location and the file name.
4. Set the state of the I/Q file input source to "On".
5. Close the "Input" dialog box.
6. Select the ▶ "Capture" icon for the measurement channel.

   The stored data is loaded from the file and evaluated in the selected application.

11.3 How to Perform Measurements on Multiple Files and Instruments

Multiple measurements on different instruments or files can be performed quasi in parallel. All measurements are started at the same time, and provide results independently as they are completed in each measurement channel.

1. In the "Instruments" tool window, configure all instruments on which measurements are to be performed (see also chapter 11.1, "How to Perform a Basic Measurement with Instrument Input", on page 213).
2. In the "Measurement Group Setup" tool window, select the "+ Channel" button to add a new measurement channel to the group.
3. Select the measurement mode or a copy of the currently selected measurement channel ("Duplicate Current Channel").

   The channel bar and the default result displays for the new measurement channel are displayed. If necessary, the previously displayed windows are cumulated in tabs to create room on the display.
4. Select the input type for the new measurement channel and assign a configured instrument or import a file (see chapter 11.1, "How to Perform a Basic Measurement with Instrument Input", on page 213 or chapter 11.2, "How to Import I/Q Data for Analysis", on page 215).

   If the same instrument is assigned to multiple measurement channels of the same group, the channel to which the instrument was assigned last is deactivated (the checkmark for the channel in the "Measurement Group Setup" tool window is removed).
5. Configure further input source or measurement settings as required for the individual channels (see the applications' user manual for details).
6. Repeat these steps to add further measurement channels to the group.
7. Select the "Capture mode" icon (→| / ⟳) for the group to toggle between single and continuous measurements. For single capture mode, each measurement channel is processed a single time, whereas in continuous capture mode, the measurements are performed continuously until the group measurement is stopped manually.

   Note that the capture mode of the group automatically defines the capture mode of the individual channels as the same mode.
8. Select the ▶"Capture" icon for the group to start all active measurement channels.

   One or more measurements are performed on the input data for each active measurement channel at the same time, and the results are displayed in the channels' result displays when available.

   Note: You can perform a measurement for a single channel by selecting the ▶"Capture" icon for that measurement channel. However, only one channel can be started manually at a time. Before you can start another channel, you must stop the previous measurement by selecting the "Pause" icon for that channel first.

Analyze the captured data as described in chapter 11.8, "How to Analyze Data in the I/Q Analyzer", on page 221.

11.4 How to Perform a Sequence of Measurements on a Single File or Instrument

A single instrument can perform only one measurement at a time; however, a sequence of measurements can be performed in just one step.

1. In the "Instruments" tool window, configure the instrument on which the measurements are to be performed (see also chapter 11.1, "How to Perform a Basic Measurement with Instrument Input", on page 213).
2. In the "Measurement Group Setup" tool window, select the "+ New Group" button to add a measurement group, that is: a measurement channel for the same instrument or file.
3. Select the input type for the new measurement channel and assign the same configured instrument or import the same file as for the other groups (see chapter 11.1, "How to Perform a Basic Measurement with Instrument Input", on page 213 or chapter 11.2, "How to Import I/Q Data for Analysis", on page 215).
4. Optionally, you can add further measurement channels *on different instruments/ files* to a group (see chapter 11.3, "How to Perform Measurements on Multiple Files and Instruments", on page 216).
5. Repeat these steps to add further groups.
6. Toggle the "CONT" / "SGL" button at the bottom of the "Measurement Group Setup" tool window to toggle between single and continuous measurements for the entire measurement sequence. For single capture mode, each group is processed a single time in the defined sequence, whereas in continuous capture mode, the groups are performed in the defined sequence continuously until measurement is stopped manually.

   Note that the capture mode of the entire measurement sequence automatically defines the capture mode of the individual groups and channels as the same mode.
7. Select the "Capture" button at the bottom of the "Measurement Group Setup" tool window to start the active groups in the defined order.

The measurements for a single group are performed and the results are displayed in the channels' result displays. When that group has completed its measurements, the next group in the sequence is started.

Analyze the captured data as described in chapter 11.8, "How to Analyze Data in the I/Q Analyzer", on page 221.

11.5 How to Save and Load Measurement Settings

Measurement settings can be saved to a file and loaded again later, so that you can repeat the measurement with the same settings.

To save configurable measurement settings

1. Select the "Save" icon from the toolbar.
2. In the "Save" dialog box, switch to the "Save" tab.
3. In the file selection dialog box, select a file name and storage location for the settings file.
4. Optionally, define a comment to describe the stored settings.
5. Select whether the measurement settings for **all** channels are to be stored, or only those for the **current** channel.
6. Select the items to be saved with the settings. Either the settings for the currently selected channel only or for all channels can be stored, and various other items such as lines or traces etc. can be stored as well (see chapter 8.2.2.1, "Stored Data Types", on page 80).
7. Select "Save".

   A file with the defined name and path and the extension `.dfl` is created.

To recall configurable measurement settings

1. Select the "Open" icon from the toolbar.
2. In the "Recall" dialog box, switch to the "Recall" tab.
3. In the file selection dialog box, select the file name and storage location of the settings file.

   Note: The "File Type" indicates whether the file contains instrument settings for **all** channels, or only those for the current channel.
4. If several items were saved, select which items are to be restored.
5. If channel settings were saved, select whether the settings will replace the settings in the current channel, or whether a new channel with the saved settings will be opened.

6. Select "Recall".

   The settings and selected items from the saved measurement are restored and you can repeat the measurement with the same settings.

11.6 How to Export I/Q Data

Note that in order to export the raw data, you must start recording directly at the time of capture. Once the data has been captured without being recorded, it can no longer be exported as raw data.

To save results of data that has been captured, but not recorded, use the "Save settings" functions (see chapter 11.5, "How to Save and Load Measurement Settings", on page 218).

To record I/Q data

► Configure the measurement as required (see also chapter 11.7, "How to Capture Baseband (I/Q) Data in the I/Q Analyzer", on page 220), but use the "Record" function to start the measurement (instead of the "Capture" function).

To export the I/Q data recording

1. Select "File > Save I/Q Recording".
2. Select the storage location for the I/Q data file.
3. Select the file type (format).
4. Select which set of meta data is to be stored with the I/Q data.
5. Select "Save".

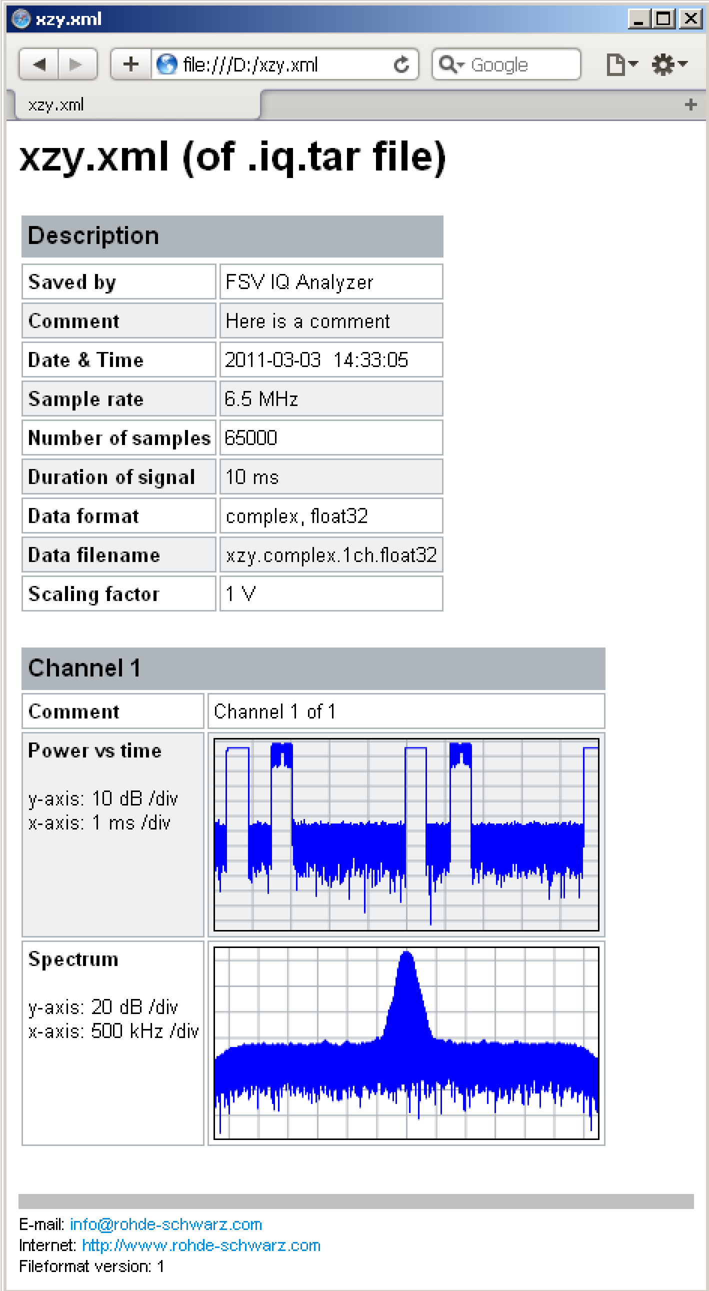
   To import the stored data file to the R&S VSE again as input, see chapter 11.2, "How to Import I/Q Data for Analysis", on page 215.

Previewing the I/Q data from an iq-tar file in a web browser

The `iq-tar` file format allows you to preview the exported I/Q data in a web browser.

1. Use an archive tool (e.g. WinZip® or PowerArchiver®) to unpack the `iq-tar` file into a folder.
2. Locate the folder using Windows Explorer.
3. Open your web browser.

4. Drag the I/Q parameter XML file, e.g. `example.xml`, into your web browser.



11.7 How to Capture Baseband (I/Q) Data in the I/Q Analyzer

By default, the I/Q Analyzer assumes the captured data is modulated on a carrier frequency and consists of two components (I/Q).

Make sure the I/Q Analyzer measurement channel is currently active before you attempt to change its configuration, for example by selecting one of its windows or the application in the toolbar selection list.

1. From the "Meas Setup" menu, select "Overview" to display the configuration "Overview" that guides you through the configuration steps.
2. Select "Input" to configure the "RF Input" signal source.
3. Select "Amplitude" to define the attenuation, reference level or other settings that affect the input signal's amplitude and scaling.
4. Select "Frequency" to define the input signal's center frequency.
5. Optionally, select "Trigger" to define a trigger for data acquisition, for example an I/Q Power trigger to start capturing data only when a specific power is exceeded.
6. Select "Bandwidth" and define the bandwidth parameters for data acquisition:
   - "Sample rate" or "Analysis Bandwidth:" the span of the input signal to be captured for analysis, or the rate at which samples are captured (both values are correlated)
   - Optionally, if a bandwidth extension for 160 MHz or 320 MHz is installed on the instrument, the "Maximum Bandwidth", depending on whether you require a larger bandwidth or not.
   - "Measurement Time:" how long the data is to be captured
   - "Record Length": the number of samples to be captured (also defined by sample rate and measurement time)
7. Switch to the "Capture" tab of the "Data Acquisition" dialog box and define the number of measurements to be performed ("Capture Count"). The setting "Capture Count = 0" is only useful for continuous capture mode.
8. From the "Window" menu, select "New Window" and then the result displays that are of interest to you.
   Arrange the windows on the display to suit your preferences by moving them around or changing their size (see also chapter 6.3, "Customizing the User Interface", on page 43).
9. Perform a measurement with the defined settings as described in chapter 11.1, "How to Perform a Basic Measurement with Instrument Input", on page 213.

11.8 How to Analyze Data in the I/Q Analyzer

1. Select the "I/Q Analyzer" measurement channel.
2. Select the "Meas Setup > Overview" menu item to display the configuration "Overview".

3. Select the "Analysis" button to make use of the advanced analysis functions in the displays.

   For example:

   - Configure a trace to display the average over a series of measurements (on the "Trace" tab; if necessary, increase the "Average Count").
   - Configure markers and delta markers to determine deviations and offsets within the signal (on the "Marker" tab).

12 Network and Remote Operation

The R&S VSE software can capture and analyze data from a connected instrument in a network. In this case, the R&S VSE software controls the connected instrument remotely. The R&S VSE software, in turn, can be controlled remotely from another PC in the network. Various methods for remote control are supported:

- Connecting the host PC with the R&S VSE software installed and the instrument in use to a network to capture data directly from the instrument.
  This is the basic operating scenario for the R&S VSE software and is described in detail in chapter 7, "Controlling Instruments and Capturing I/Q Data", on page 52
- Using the Windows Remote Desktop application in a LAN network to work with the R&S VSE software interactively
- Connecting a controller PC to the network to operate both the R&S VSE software and the instrument in use remotely from the same PC.

How to configure the remote control interfaces is described in chapter 12.3, "How to Set Up a Network and Remote Control", on page 253.

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12.1 Remote Control Basics

Basic information on operating an instrument via remote control is provided here. This information applies to all applications and operating modes on the R&S VSE.

See also chapter 7.2.1, "Remote Control Interfaces and Protocols", on page 53.

12.1.1 SCPI (Standard Commands for Programmable Instruments)

SCPI commands - messages - are used for remote control. Commands that are not taken from the SCPI standard follow the SCPI syntax rules. The R&S VSE supports the SCPI version 1999. The SCPI standard is based on standard IEEE 488.2 and aims at the standardization of device-specific commands, error handling and the status registers. The tutorial "Automatic Measurement Control - A tutorial on SCPI and IEEE 488.2" from John M. Pieper (R&S order number 0002.3536.00) offers detailed information on concepts and definitions of SCPI.

Tables provide a fast overview of the bit assignment in the status registers. The tables are supplemented by a comprehensive description of the status registers.

12.1.2 Messages

The messages transferred on the data lines are divided into the following categories:

- Interface messages
  Interface messages are transmitted to the instrument on the data lines, with the attention line being active (LOW). They are used to communicate between the controller and the instrument. Interface messages can only be sent by instruments that have GPIB bus functionality. For details see the sections for the required interface.
- Instrument messages
  Instrument messages are employed in the same way for all interfaces, if not indicated otherwise in the description. Structure and syntax of the instrument messages are described in chapter 12.1.3, "SCPI Command Structure", on page 225. A detailed description of all messages available for the instrument is provided in the chapter "Remote Control Commands".
  There are different types of instrument messages, depending on the direction they are sent:
  – Commands
  – Instrument responses

Commands

Commands (program messages) are messages the controller sends to the instrument. They operate the instrument functions and request information. The commands are subdivided according to two criteria:

- According to the effect they have on the instrument:
  – **Setting commands** cause instrument settings such as a reset of the instrument or setting the frequency.
  – **Queries** cause data to be provided for remote control, e.g. for identification of the instrument or polling a parameter value. Queries are formed by directly appending a question mark to the command header.
- According to their definition in standards:
  – **Common commands**: their function and syntax are precisely defined in standard IEEE 488.2. They are employed identically on all instruments (if implemented). They refer to functions such as management of the standardized status registers, reset and self-test.
  – **Instrument control commands** refer to functions depending on the features of the instrument such as frequency settings. Many of these commands have also been standardized by the SCPI committee. These commands are marked as "SCPI confirmed" in the command reference chapters. Commands without this SCPI label are device-specific; however, their syntax follows SCPI rules as permitted by the standard.

Instrument responses

Instrument responses (response messages and service requests) are messages the instrument sends to the controller after a query. They can contain measurement results, instrument settings and information on the instrument status.

12.1.3 SCPI Command Structure

SCPI commands consist of a so-called header and, in most cases, one or more parameters. The header and the parameters are separated by a "white space" (ASCII code 0 to 9, 11 to 32 decimal, e.g. blank). The headers may consist of several mnemonics (keywords). Queries are formed by appending a question mark directly to the header.

The commands can be either device-specific or device-independent (common commands). Common and device-specific commands differ in their syntax.

12.1.3.1 Syntax for Common Commands

Common (=device-independent) commands consist of a header preceded by an asterisk (*) and possibly one or more parameters.

Examples:

*RST	RESET	Resets the instrument.
*ESE	EVENT STATUS ENABLE	Sets the bits of the event status enable registers.
*ESR?	EVENT STATUS QUERY	Queries the contents of the event status register.
*IDN?	IDENTIFICATION QUERY	Queries the instrument identification string.

12.1.3.2 Syntax for Device-Specific Commands

Not all commands used in the following examples are necessarily implemented in the instrument.

For demonstration purposes only, assume the existence of the following commands for this section:

- `DISPlay[:WINDow<1...4>]:MAXimize <Boolean>`
- `FORMat:READings:DATA <type>[,<length>]`
- `HCOPy:DEVice:COLor <Boolean>`
- `HCOPy:DEVice:CMAP:COLor:RGB <red>,<green>,<blue>`
- `HCOPy[:IMMediate]`
- `HCOPy:ITEM:ALL`
- `HCOPy:ITEM:LABel <string>`
- `HCOPy:PAGE:DIMensions:QUADrant[<N>]`
- `HCOPy:PAGE:ORIentation LANDscape | PORTrait`
- `HCOPy:PAGE:SCALe <numeric value>`
- `MMEMory:COPY <file_source>,<file_destination>`
- `SENSE:BANDwidth|BWIDth[:RESolution] <numeric_value>`
- `SENSe:FREQuency:STOP <numeric value>`
- `SENSe:LIST:FREQuency <numeric_value>{,<numeric_value>}`

Long and short form

The mnemonics feature a long form and a short form. The short form is marked by upper case letters, the long form corresponds to the complete word. Either the short form or the long form can be entered; other abbreviations are not permitted.

Example:

`HCOPy:DEVice:COLor ON` is equivalent to `HCOP:DEV:COL ON`.

Case-insensitivity

Upper case and lower case notation only serves to distinguish the two forms in the manual, the instrument itself is case-insensitive.

Numeric suffixes

If a command can be applied to multiple instances of an object, e.g. specific channels or sources, the required instances can be specified by a suffix added to the command. Numeric suffixes are indicated by angular brackets (<1...4>, <n>, <i>) and are replaced by a single value in the command. Entries without a suffix are interpreted as having the suffix 1.

Example:

Definition: `HCOPy:PAGE:DIMensions:QUADrant[<N>]`

Command: `HCOP:PAGE:DIM:QUAD2`

This command refers to the quadrant 2.

Different numbering in remote control

For remote control, the suffix may differ from the number of the corresponding selection used in manual operation. SCPI prescribes that suffix counting starts with 1. Suffix 1 is the default state and used when no specific suffix is specified.

Some standards define a fixed numbering, starting with 0. If the numbering differs in manual operation and remote control, it is indicated for the corresponding command.

Optional mnemonics

Some command systems permit certain mnemonics to be inserted into the header or omitted. These mnemonics are marked by square brackets in the description. The instrument must recognize the long command to comply with the SCPI standard. Some commands are considerably shortened by these optional mnemonics.

Example:

Definition: `HCOPy[:IMMediate]`

Command: `HCOP:IMM` is equivalent to `HCOP`

Optional mnemonics with numeric suffixes

Do not omit an optional mnemonic if it includes a numeric suffix that is relevant for the effect of the command.

Example:

Definition:`DISPlay[:WINDow<1...4>]:MAXimize <Boolean>`

Command: `DISP:MAX ON` refers to window 1.

In order to refer to a window other than 1, you must include the optional `WINDow` parameter with the suffix for the required window.

`DISP:WIND2:MAX ON` refers to window 2.

Parameters

Parameters must be separated from the header by a "white space". If several parameters are specified in a command, they are separated by a comma (,). For a description of the parameter types, refer to chapter 12.1.3.3, "SCPI Parameters", on page 228.

Example:

Definition:`HCOPy:DEVice:CMAP:COLor:RGB <red>,<green>,<blue>`

Command:`HCOP:DEV:CMAP:COL:RGB 3,32,44`

Special characters

|	**Parameters**
	A vertical stroke in parameter definitions indicates alternative possibilities in the sense of "or". The effect of the command differs, depending on which parameter is used.
	Example:
	Definition:`HCOPy:PAGE:ORIentation LANDscape | PORTrait`
	Command `HCOP:PAGE:ORI LAND` specifies landscape orientation
	Command `HCOP:PAGE:ORI PORT` specifies portrait orientation
	Mnemonics
	A selection of mnemonics with an identical effect exists for several commands. These mnemonics are indicated in the same line; they are separated by a vertical stroke. Only one of these mnemonics needs to be included in the header of the command. The effect of the command is independent of which of the mnemonics is used.
	Example:
	Definition`SENSE:BANDwidth|BWIDth[:RESolution] <numeric_value>`
	The two following commands with identical meaning can be created:
	`SENS:BAND:RES 1`
	`SENS:BWID:RES 1`

[ ]	Mnemonics in square brackets are optional and may be inserted into the header or omitted. **Example**: `HCOPy[:IMMediate]` `HCOP:IMM` is equivalent to `HCOP`

{ }	Parameters in curly brackets are optional and can be inserted once or several times, or omitted.
	Example: `SENSe:LIST:FREQuency <numeric_value>{,<numeric_value>}`
	The following are valid commands:
	`SENS:LIST:FREQ 10`
	`SENS:LIST:FREQ 10,20`
	`SENS:LIST:FREQ 10,20,30,40`

12.1.3.3 SCPI Parameters

Many commands are supplemented by a parameter or a list of parameters. The parameters must be separated from the header by a "white space" (ASCII code 0 to 9, 11 to 32 decimal, e.g. blank). Allowed parameters are:

- Numeric values
- Special numeric values
- Boolean parameters
- Text
- Character strings
- Block data

The parameters required for each command and the allowed range of values are specified in the command description.

Numeric values

Numeric values can be entered in any form, i.e. with sign, decimal point and exponent. Values exceeding the resolution of the instrument are rounded up or down. The mantissa may comprise up to 255 characters, the exponent must lie inside the value range -32000 to 32000. The exponent is introduced by an "E" or "e". Entry of the exponent alone is not allowed. In the case of physical quantities, the unit can be entered. Allowed unit prefixes are G (giga), MA (mega), MOHM and MHZ are also allowed), K (kilo), M (milli), U (micro) and N (nano). If the unit is missing, the basic unit is used.

Example: `SENS:FREQ:STOP 1.5GHz` = `SENS:FREQ:STOP 1.5E9`

Units

For physical quantities, the unit can be entered. Allowed unit prefixes are:

- G (giga)
- MA (mega), MOHM, MHZ
- K (kilo)
- M (milli)
- U (micro)
- N (nano)

If the unit is missing, the basic unit is used.

Example:

`SENSe:FREQ:STOP 1.5GHz` = `SENSe:FREQ:STOP 1.5E9`

Some settings allow relative values to be stated in percent. According to SCPI, this unit is represented by the `PCT` string.

Example:

`HCOP:PAGE:SCAL 90PCT`

Special numeric values

The texts listed below are interpreted as special numeric values. In the case of a query, the numeric value is provided.

- **MIN/MAX**
  MINimum and MAXimum denote the minimum and maximum value.
- **DEF**
  DEFault denotes a preset value which has been stored in the EPROM. This value conforms to the default setting, as it is called by the *RST command.
- **UP/DOWN**
  UP, DOWN increases or reduces the numeric value by one step. The step width can be specified via an allocated step command for each parameter which can be set via UP, DOWN.
- **INF/NINF**

INFinity, Negative INFinity (NINF) represent the numeric values 9.9E37 or -9.9E37, respectively. INF and NINF are only sent as instrument responses.

- **NAN**
  Not A Number (NAN) represents the value 9.91E37. NAN is only sent as a instrument response. This value is not defined. Possible causes are the division of zero by zero, the subtraction of infinite from infinite and the representation of missing values.

Example:

Setting command: `SENSe:LIST:FREQ MAXimum`

Query: `SENS:LIST:FREQ?, Response: 3.5E9`

Queries for special numeric values

The numeric values associated to `MAXimum/MINimum/DEFault` can be queried by adding the corresponding mnemonics to the command. They must be entered following the quotation mark.

Example: `SENSe:LIST:FREQ? MAXimum`

Returns the maximum numeric value as a result.

Boolean Parameters

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. The numeric values are provided as the response for a query.

Example:

Setting command: `HCOPy:DEV:COL ON`

Query: `HCOPy:DEV:COL?`

Response: `1`

Text parameters

Text parameters observe the syntactic rules for mnemonics, i.e. they can be entered using a short or long form. Like any parameter, they have to be separated from the header by a white space. In the case of a query, the short form of the text is provided.

Example:

Setting command: `HCOPy:PAGE:ORIentation LANDscape`

Query: `HCOP:PAGE:ORI?`

Response: `LAND`

Character strings

Strings must always be entered in quotation marks (' or ").

Example:

`HCOP:ITEM:LABel "Test1"` or `HCOP:ITEM:LABel 'Test1'`

Block data

Block data is a format which is suitable for the transmission of large amounts of data. A command using a block data parameter has the following structure:

Example:

`FORMat:READings:DATA #45168xxxxxxxx`

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.

12.1.3.4 Overview of Syntax Elements

The following table provides an overview of the syntax elements:

:	The colon separates the mnemonics of a command. In a command line the separating semicolon marks the uppermost command level.
;	The semicolon separates two commands of a command line. It does not alter the path.
,	The comma separates several parameters of a command.
?	The question mark forms a query.
*****	The asterisk marks a common command.
' ' **"**	Quotation marks introduce a string and terminate it (both single and double quotation marks are possible).
#	The hash symbol introduces binary, octal, hexadecimal and block data. • Binary: #B10110 • Octal: #O7612 • Hexa: #HF3A7 • Block: #21312
	A "white space" (ASCII-Code 0 to 9, 11 to 32 decimal, e.g. blank) separates the header from the parameters.

12.1.3.5 Structure of a command line

A command line may consist of one or several commands. It is terminated by one of the following:

- a <New Line>
- a <New Line> with EOI
- an EOI together with the last data byte

Several commands in a command line must be separated by a semicolon ";". If the next command belongs to a different command system, the semicolon is followed by a colon.

Example:

`MMEM:COPY "Test1","MeasurementXY";:HCOP:ITEM ALL`

This command line contains two commands. The first command belongs to the MMEM system, the second command belongs to the HCOP system.

If the successive commands belong to the same system, having one or several levels in common, the command line can be abbreviated. To this end, the second command after the semicolon starts with the level that lies below the common levels. The colon following the semicolon must be omitted in this case.

Example:

`HCOP:ITEM ALL;:HCOP:IMM`

This command line contains two commands. Both commands are part of the `HCOP` command system, i.e. they have one level in common.

When abbreviating the command line, the second command begins with the level below HCOP. The colon after the semicolon is omitted. The abbreviated form of the command line reads as follows:

`HCOP:ITEM ALL;IMM`

A new command line always begins with the complete path.

Example:

`HCOP:ITEM ALL`

`HCOP:IMM`

12.1.3.6 Responses to Queries

A query is defined for each setting command unless explicitly specified otherwise. It is formed by adding a question mark to the associated setting command. According to SCPI, the responses to queries are partly subject to stricter rules than in standard IEEE 488.2.

- The requested parameter is transmitted without a header.
  Example: `HCOP:PAGE:ORI?`, Response: `LAND`
- Maximum values, minimum values and all other quantities that are requested via a special text parameter are returned as numeric values.
  Example: `SENSe:FREQuency:STOP? MAX`, Response: `3.5E9`

- Numeric values are output without a unit. Physical quantities are referred to the basic units or to the units set using the `Unit` command. The response `3.5E9` in the previous example stands for 3.5 GHz.
- Truth values (Boolean values) are returned as `0` (for OFF) and `1` (for ON).
  Example:
  Setting command: `HCOPy:DEV:COL ON`
  Query: `HCOPy:DEV:COL?`
  Response: `1`
- Text (character data) is returned in a short form.
  Example:
  Setting command: `HCOPy:PAGE:ORIentation LANDscape`
  Query: `HCOP:PAGE:ORI?`
  Response: `LAND`

12.1.4 Command Sequence and Synchronization

IEEE 488.2 defines a distinction between overlapped and sequential commands:

- A sequential command is one which finishes executing before the next command starts executing. Commands that are processed quickly are usually implemented as sequential commands.
- An overlapping command is one which does not automatically finish executing before the next command starts executing. Usually, overlapping commands take longer to process and allow the program to do other tasks while being executed. If overlapping commands do have to be executed in a defined order, e.g. in order to avoid wrong measurement results, they must be serviced sequentially. This is called synchronization between the controller and the instrument.

Setting commands within one command line, even though they may be implemented as sequential commands, are not necessarily serviced in the order in which they have been received. In order to make sure that commands are actually carried out in a certain order, each command must be sent in a separate command line.

Example: Commands and queries in one message

The response to a query combined in a program message with commands that affect the queried value is not predictable.

The following commands always return the specified result:

`:FREQ:STAR 1GHZ;SPAN 100;:FREQ:STAR?`

Result:

`1000000000` (1 GHz)

Whereas the result for the following commands is not specified by SCPI:

`:FREQ:STAR 1GHz;STAR?;SPAN 1000000`

The result could be the value of `STARt` before the command was sent since the instrument might defer executing the individual commands until a program message terminator is received. The result could also be 1 GHz if the instrument executes commands as they are received.

As a general rule, send commands and queries in different program messages.

Example: Overlapping command with *OPC

The instrument implements `INITiate[:IMMediate]` as an overlapped command. Assuming that `INITiate[:IMMediate]` takes longer to execute than `*OPC`, sending the following command sequence results in initiating a sweep and, after some time, setting the `OPC` bit in the `ESR`:

`INIT; *OPC.`

Sending the following commands still initiates a sweep:

`INIT; *OPC; *CLS`

However, since the operation is still pending when the instrument executes `*CLS`, forcing it into the "Operation Complete Command Idle" State (OCIS), `*OPC` is effectively skipped. The `OPC` bit is not set until the instrument executes another `*OPC` command.

12.1.4.1 Preventing Overlapping Execution

To prevent an overlapping execution of commands, one of the commands *OPC, *OPC? or *WAI can be used. All three commands cause a certain action only to be carried out after the hardware has been set. By suitable programming, the controller can be forced to wait for the corresponding action to occur.

*Table 12-1: Synchronization using *OPC, *OPC? and *WAI*

Command	Action	Programming the controller
*OPC	Sets the Operation Complete bit in the ESR after all previous commands have been executed.	• Setting bit 0 in the ESE • Setting bit 5 in the SRE • Waiting for service request (SRQ)
*OPC?	Stops command processing until 1 is returned. This is only the case after the Operation Complete bit has been set in the ESR. This bit indicates that the previous setting has been completed.	Sending *OPC? directly after the command whose processing should be terminated before other commands can be executed.
*WAI	Stops further command processing until all commands sent before *WAI have been executed.	Sending *WAI directly after the command whose processing should be terminated before other commands are executed.

Command synchronization using *WAI or *OPC? appended to an overlapped command is a good choice if the overlapped command takes only little time to process. The two synchronization techniques simply block overlapped execution of the command.

For time consuming overlapped commands it is usually desirable to allow the controller or the instrument to do other useful work while waiting for command execution. Use one of the following methods:

***OPC with a service request**

1. Set the OPC mask bit (bit no. 0) in the ESE: *ESE 1

2. Set bit no. 5 in the SRE: *SRE 32 to enable ESB service request.
3. Send the overlapped command with *OPC
4. Wait for a service request

   The service request indicates that the overlapped command has finished.

***OPC? with a service request**

1. Set bit no. 4 in the SRE: *SRE 16 to enable MAV service request.
2. Send the overlapped command with *OPC?
3. Wait for a service request

   The service request indicates that the overlapped command has finished.

Event Status Register (ESE)

1. Set the OPC mask bit (bit no. 0) in the ESE: *ESE 1
2. Send the overlapped command without *OPC, *OPC? or *WAI
3. Poll the operation complete state periodically (by means of a timer) using the sequence: *OPC; *ESR?

   A return value (LSB) of 1 indicates that the overlapped command has finished.

***OPC? with short timeout**

1. Send the overlapped command without *OPC, *OPC? or *WAI
2. Poll the operation complete state periodically (by means of a timer) using the sequence: <short timeout>; *OPC?
3. A return value (LSB) of 1 indicates that the overlapped command has finished. In case of a timeout, the operation is ongoing.
4. Reset timeout to former value
5. Clear the error queue with `SYStem:ERRor?` to remove the "-410, Query interrupted" entries.

Using several threads in the controller application

As an alternative, provided the programming environment of the controller application supports threads, separate threads can be used for the application GUI and for controlling the instrument(s) via SCPI.

A thread waiting for a *OPC? thus will not block the GUI or the communication with other instruments.

12.1.5 Status Reporting System

The status reporting system stores all information on the current operating state of the instrument, and on errors which have occurred. This information is stored in the status registers and in the error queue. Both can be queried via GPIB bus or LAN interface (`STATus`... commands, see chapter 13.10.1, "Using the Status Register", on page 424).

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- Structure of a SCPI Status Register..238
- Contents of the Status Registers.. 239
- Application of the Status Reporting System..246
- Reset Values of the Status Reporting System...248

12.1.5.1 Hierarchy of Status Registers

As shown in the following figure, the status information is of hierarchical structure.

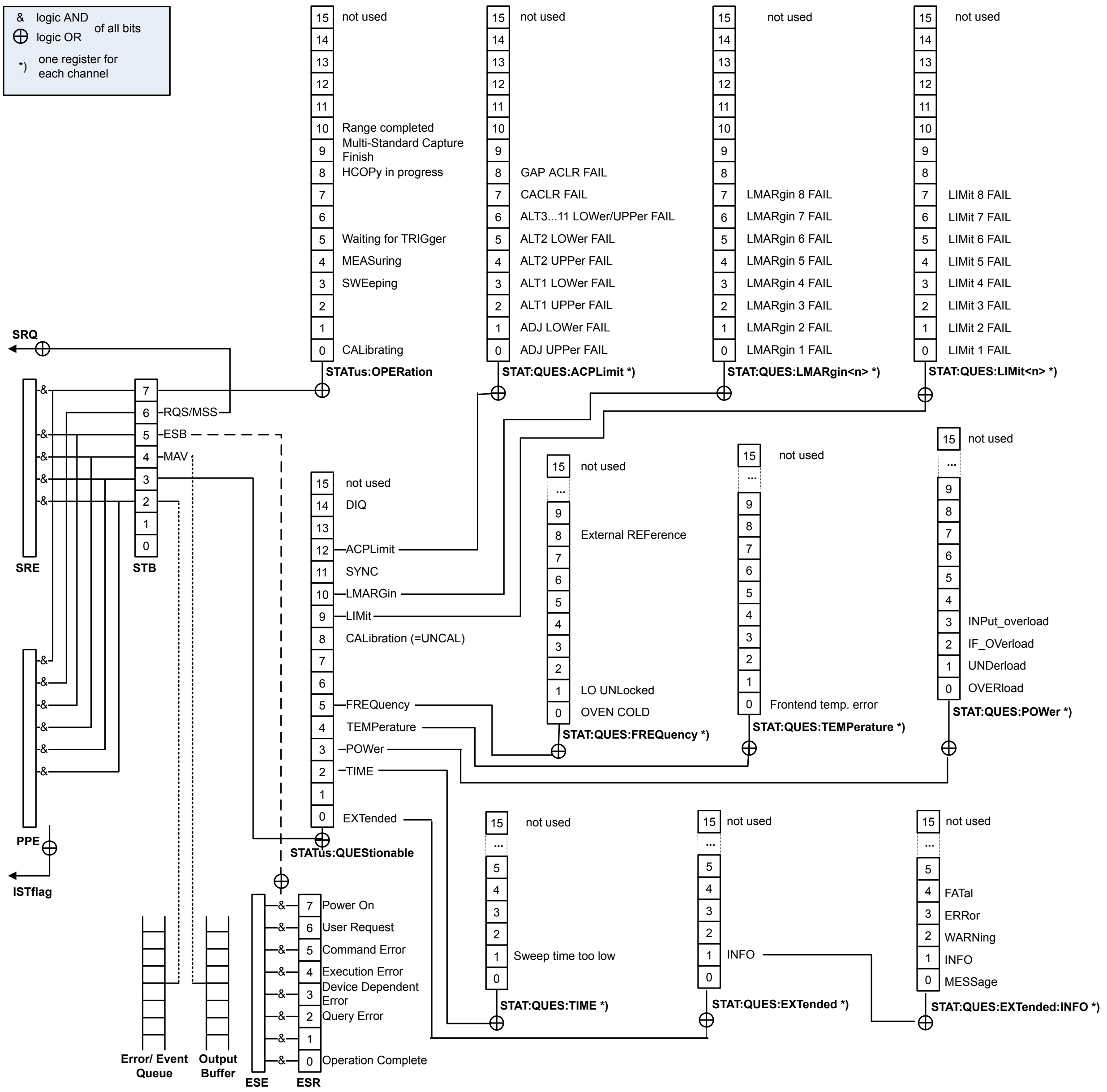


Fig. 12-1: Graphical overview of the R&S VSE status registers hierarchy

- **STB, SRE**
  The STatus Byte (`STB`) register and its associated mask register Service Request Enable (`SRE`) form the highest level of the status reporting system. The `STB` provides a rough overview of the instrument status, collecting the information of the lower-level registers.
- **ESR, SCPI registers**
  The STB receives its information from the following registers:
  – The Event Status Register (`ESR`) with the associated mask register standard Event Status Enable (`ESE`).
  – The `STATus:OPERation` and `STATus:QUEStionable` registers which are defined by SCPI and contain detailed information on the instrument.

- **IST, PPE**
  The IST flag ("Individual STatus"), like the SRQ, combines the entire instrument status in a single bit. The PPE fulfills the same function for the IST flag as the SRE for the service request.
- **Output buffer**
  The output buffer contains the messages the instrument returns to the controller. It is not part of the status reporting system but determines the value of the MAV bit in the STB and thus is represented in the overview.

All status registers have the same internal structure.

SRE, ESE

The service request enable register SRE can be used as ENABle part of the STB if the STB is structured according to SCPI. By analogy, the ESE can be used as the ENABle part of the ESR.

12.1.5.2 Structure of a SCPI Status Register

Each standard SCPI register consists of 5 parts. Each part has a width of 16 bits and has different functions. The individual bits are independent of each other, i.e. each hardware status is assigned a bit number which is valid for all five parts. Bit 15 (the most significant bit) is set to zero for all parts. Thus the contents of the register parts can be processed by the controller as positive integers.

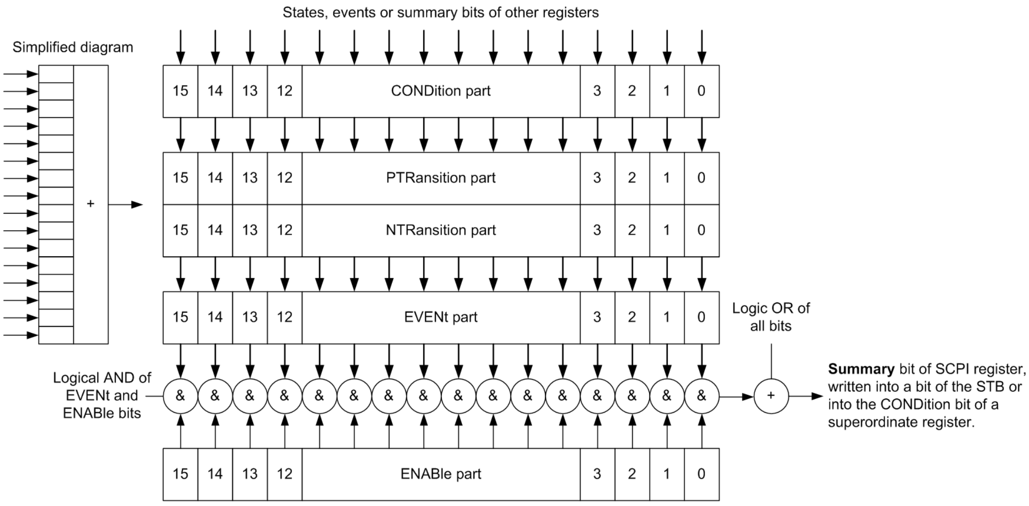


Fig. 12-2: The status-register model

Description of the five status register parts

The five parts of a SCPI register have different properties and functions:

- **CONDition**
  The CONDition part is written into directly by the hardware or the sum bit of the next lower register. Its contents reflect the current instrument status. This register

part can only be read, but not written into or cleared. Its contents are not affected by reading.

- **PTRansition / NTRansition**
  The two transition register parts define which state transition of the CONDition part (none, 0 to 1, 1 to 0 or both) is stored in the EVENt part.
  The **Positive-TRansition** part acts as a transition filter. When a bit of the CONDition part is changed from 0 to 1, the associated PTR bit decides whether the EVENt bit is set to 1.
  – PTR bit =1: the EVENt bit is set.
  – PTR bit =0: the EVENt bit is not set.

  This part can be written into and read as required. Its contents are not affected by reading.
  The **Negative-TRansition** part also acts as a transition filter. When a bit of the CONDition part is changed from 1 to 0, the associated NTR bit decides whether the EVENt bit is set to 1.
  – NTR bit =1: the EVENt bit is set.
  – NTR bit =0: the EVENt bit is not set.

  This part can be written into and read as required. Its contents are not affected by reading.
- **EVENt**
  The EVENt part indicates whether an event has occurred since the last reading, it is the "memory" of the condition part. It only indicates events passed on by the transition filters. It is permanently updated by the instrument. This part can only be read by the user. Reading the register clears it. This part is often equated with the entire register.
- **ENABle**
  The ENABle part determines whether the associated EVENt bit contributes to the sum bit (see below). Each bit of the EVENt part is "ANDed" with the associated ENABle bit (symbol '&'). The results of all logical operations of this part are passed on to the sum bit via an "OR" function (symbol '+').
  ENABle bit = 0: the associated EVENt bit does not contribute to the sum bit
  ENABle bit = 1: if the associated EVENt bit is "1", the sum bit is set to "1" as well.
  This part can be written into and read by the user as required. Its contents are not affected by reading.

Sum bit

The sum bit is obtained from the EVENt and ENABle part for each register. The result is then entered into a bit of the CONDition part of the higher-order register.

The instrument automatically generates the sum bit for each register. Thus an event can lead to a service request throughout all levels of the hierarchy.

12.1.5.3 Contents of the Status Registers

In the following sections, the contents of the status registers are described in more detail.

- Status Byte (STB) and Service Request Enable Register (SRE)..........................240
- IST Flag and Parallel Poll Enable Register (PPE)... 241
- Event Status Register (ESR) and Event Status Enable Register (ESE)...............241
- STATus:OPERation Register...242
- STATus:QUEStionable Register..242
- STATus:QUEStionable:EXTended Register...242
- STATus:QUEStionable:EXTended:INFO Register... 243
- STATus:QUEStionable:FREQuency Register.. 243
- STATus:QUEStionable:LIMit Register..244
- STATus:QUEStionable:LMARgin Register... 245
- STATus:QUEStionable:POWer Register...245
- STATus:QUEStionable:TIMe Register...246

Status Byte (STB) and Service Request Enable Register (SRE)

The `STatus Byte` (STB) is already defined in IEEE 488.2. It provides a rough overview of the instrument status by collecting the pieces of information of the lower registers. A special feature is that bit 6 acts as the sum bit of the remaining bits of the status byte.

The STB can thus be compared with the `CONDition` part of an SCPI register and assumes the highest level within the SCPI hierarchy.

The STB is read using the command `*STB?` or a serial poll.

The `STatus Byte` (STB) is linked to the `Service Request Enable` (SRE) register. Each bit of the STB is assigned a bit in the SRE. Bit 6 of the SRE is ignored. If a bit is set in the SRE and the associated bit in the STB changes from 0 to 1, a service request (SRQ) is generated. The SRE can be set using the command `*SRE` and read using the command `*SRE?`.

Table 12-2: Meaning of the bits used in the status byte

Bit No.	Meaning
0...1	Not used
2	Error Queue not empty The bit is set when an entry is made in the error queue. If this bit is enabled by the SRE, each entry of the error queue generates a service request. Thus an error can be recognized and specified in greater detail by polling the error queue. The poll provides an informative error message. This procedure is to be recommended since it considerably reduces the problems involved with remote control.
3	QUEStionable status register summary bit The bit is set if an `EVENt` bit is set in the `QUEStionable` status register and the associated `ENABle` bit is set to 1. A set bit indicates a questionable instrument status, which can be specified in greater detail by querying the `STATus:QUEStionable` status register.
4	MAV bit (message available) The bit is set if a message is available in the output queue which can be read. This bit can be used to enable data to be automatically read from the instrument to the controller.
5	ESB bit Sum bit of the event status register. It is set if one of the bits in the event status register is set and enabled in the event status enable register. Setting of this bit indicates a serious error which can be specified in greater detail by polling the event status register.

Bit No.	Meaning
6	MSS bit (master status summary bit) The bit is set if the instrument triggers a service request. This is the case if one of the other bits of this registers is set together with its mask bit in the service request enable register SRE.
7	STATus:OPERation status register summary bit The bit is set if an EVENt bit is set in the OPERation status register and the associated ENABle bit is set to 1. A set bit indicates that the instrument is just performing an action. The type of action can be determined by querying the STATus:OPERation status register.

IST Flag and Parallel Poll Enable Register (PPE)

As with the SRQ, the IST flag combines the entire status information in a single bit. It can be read by means of a parallel poll (see "Parallel Poll" on page 247) or using the command *IST?.

The parallel poll enable register (PPE) determines which bits of the STB contribute to the IST flag. The bits of the STB are "ANDed" with the corresponding bits of the PPE, with bit 6 being used as well in contrast to the SRE. The IST flag results from the "ORing" of all results. The PPE can be set using commands *PRE and read using command *PRE?.

Event Status Register (ESR) and Event Status Enable Register (ESE)

The ESR is defined in IEEE 488.2. It can be compared with the EVENt part of a SCPI register. The event status register can be read out using command *ESR?.

The ESE corresponds to the ENABle part of a SCPI register. If a bit is set in the ESE and the associated bit in the ESR changes from 0 to 1, the ESB bit in the STB is set. The ESE register can be set using the command *ESE and read using the command *ESE?.

Table 12-3: Meaning of the bits used in the event status register

Bit No.	Meaning
0	Operation Complete This bit is set on receipt of the command *OPC exactly when all previous commands have been executed.
1	Not used
2	Query Error This bit is set if either the controller wants to read data from the instrument without having sent a query, or if it does not fetch requested data and sends new instructions to the instrument instead. The cause is often a query which is faulty and hence cannot be executed.
3	Device-dependent Error This bit is set if a device-dependent error occurs. An error message with a number between -300 and -399 or a positive error number, which denotes the error in greater detail, is entered into the error queue.
4	Execution Error This bit is set if a received command is syntactically correct but cannot be performed for other reasons. An error message with a number between -200 and -300, which denotes the error in greater detail, is entered into the error queue.

Bit No.	Meaning
5	Command Error This bit is set if a command is received, which is undefined or syntactically incorrect. An error message with a number between -100 and -200, which denotes the error in greater detail, is entered into the error queue.
6	User Request This bit is set when the instrument is switched over to manual control.
7	Power On (supply voltage on) This bit is set on switching on the instrument.

STATus:OPERation Register

The `STATus:OPERation` register contains information on current activities of the instrument in use. It also contains information on activities that have been executed since the last read out.

You can read out the register with `STATus:OPERation:CONDition?` or `STATus:OPERation[:EVENt]?`.

STATus:QUEStionable Register

The STATus:QUEStionable register contains information on instrument states that do not meet the specifications.

The `STAT:QUES:SYNC` register is used by the applications and is thus described in the individual applications' User Manuals.

You can read out the register with `STAT:QUES:COND` or `STAT:QUES:EVEN`.

The `STATus:QUEStionable` register "sums up" the information from all subregisters (e.g. bit 2 sums up the information for all `STATus:QUEStionable:TIMe` registers). For some subregisters, there may be separate registers for each active channel. Thus, if a status bit in the `STATus:QUEStionable` register indicates an error, the error may have occurred in any of the channel-specific subregisters. In this case, you must check the subregister of each channel to determine which channel caused the error. By default, querying the status of a subregister always returns the result for the currently selected channel.

STATus:QUEStionable:EXTended Register

The `STATus:QUEStionable:EXTended` register contains further status information not covered by the other status registers of the instrument in use. A separate `EXTended` register exists for each active channel.

You can read out the register with `STATus:QUEStionable:EXTended:CONDition?` or `STATus:QUEStionable:EXTended[:EVENt]?`

Table 12-4: Meaning of the bits used in the STATus:QUEStionable:EXTended register

Bit No.	Meaning
0	not used
1	INFO This bit is set if a status message is available for the application. Which type of message occurred is indicated in the STATus:QUEStionable:EXTended:INFO Register.
2 to 14	Unused
15	This bit is always 0.

STATus:QUEStionable:EXTended:INFO Register

The `STATus:QUEStionable:EXTended:INFO` register contains information on the type of messages that occur during operation of the instrument in use. A separate `INFO` register exists for each active channel.

You can read out the register with `STATus:QUEStionable:EXTended:INFO:CONDition?` or `STATus:QUEStionable:EXTended:INFO[:EVENt]?`. You can query all messages that occur for a specific channel using the command `SYSTem:ERRor:EXTended?` on page 428.

Table 12-5: Meaning of the bits used in the STATus:QUEStionable:EXTended:INFO register

Bit No.	Meaning
0	MESSage This bit is set if event or state has occurred that may lead to an error during further operation.
1	INFO This bit is set if an informational status message is available for the application.
2	WARNing This bit is set if an irregular situation occurs during measurement, e.g. the settings no longer match the displayed results, or the connection to an external device was interrupted temporarily.
3	ERRor This bit is set if an error occurs during a measurement, e.g. due to missing data or wrong settings, so that the measurement cannot be completed correctly.
4	FATal This bit is set if a serious error occurs in the application and regular operation is no longer possible.
5 to 14	Unused
15	This bit is always 0.

STATus:QUEStionable:FREQuency Register

The STATus:QUEStionable:FREQuency register contains information about the condition of the local oscillator and the reference frequency. A separate frequency register exists for each active channel.

You can read out the register with STATus:QUEStionable:FREQuency:CONDition? or STATus:QUEStionable:FREQuency[:EVENt]?.

Table 12-6: Meaning of the bits used in the STATus:QUEStionable:FREQuency register

Bit No.	Meaning
1	LO UNLocked This bit is set if the local oscillator no longer locks. "LOUNL" is displayed.
2 to 7	Not used
8	EXTernalREFerence This bit is set if you have selected an external reference oscillator but did not connect a useable external reference source. In that case the synthesizer can not lock. The frequency in all probability is not accurate.
9 to 14	Not used
15	This bit is always 0.

STATus:QUEStionable:LIMit Register

The STATus:QUEStionable:LIMit register contains information about the results of a limit check when you are working with limit lines.

A separate LIMit register exists for each active channel and for each window.

You can read out the register with STATus:QUEStionable:LIMit<n>:CONDition? or STATus:QUEStionable:LIMit<n>[:EVENt]?.

Table 12-7: Meaning of the bits used in the STATus:QUEStionable:LIMit register

Bit No.	Meaning
0	LIMit 1 FAIL This bit is set if limit line 1 is violated.
1	LIMit 2 FAIL This bit is set if limit line 2 is violated.
2	LIMit 3 FAIL This bit is set if limit line 3 is violated.
3	LIMit 4 FAIL This bit is set if limit line 4 is violated.
4	LIMit 5 FAIL This bit is set if limit line 5 is violated.
5	LIMit 6 FAIL This bit is set if limit line 6 is violated.
6	LIMit 7 FAIL This bit is set if limit line 7 is violated.
7	LIMit 8 FAIL This bit is set if limit line 8 is violated.

Bit No.	Meaning
8 to 14	Unused
15	This bit is always 0.

STATus:QUEStionable:LMARgin Register

This register contains information about the observance of limit margins.

A separate LMARgin register exists for each active channel and for each window.

It can be read using the commands `STATus:QUEStionable:LMARgin:CONDition?` and `STATus:QUEStionable:LMARgin[:EVENt]?`.

Table 12-8: Meaning of the bits used in the STATus:QUEStionable:LMARgin register

Bit No.	Meaning
0	LMARgin 1 FAIL This bit is set if limit margin 1 is violated.
1	LMARgin 2 FAIL This bit is set if limit margin 2 is violated.
2	LMARgin 3 FAIL This bit is set if limit margin 3 is violated.
3	LMARgin 4 FAIL This bit is set if limit margin 4 is violated.
4	LMARgin 5 FAIL This bit is set if limit margin 5 is violated.
5	LMARgin 6 FAIL This bit is set if limit margin 6 is violated.
6	LMARgin 7 FAIL This bit is set if limit margin 7 is violated.
7	LMARgin 8 FAIL This bit is set if limit margin 8 is violated.
8 to 14	Not used
15	This bit is always 0.

STATus:QUEStionable:POWer Register

The `STATus:QUEStionable:POWer` register contains information about possible overload situations that may occur during operation of the instrument in use. A separate power register exists for each active channel.

You can read out the register with `STATus:QUEStionable:POWer:CONDition?` or `STATus:QUEStionable:POWer[:EVENt]?`

STATus:QUEStionable:TIMe Register

The STATus:QUEStionable:TIMe register contains information about possible time errors that may occur during operation of the instrument in use. A separate time register exists for each active channel.

You can read out the register with STATus:QUEStionable:TIME:CONDition? or STATus:QUEStionable:TIME[:EVENt]?

Table 12-9: Meaning of the bits used in the STATus:QUEStionable:TIMe register

Bit No.	Meaning
0	not used
1	Sweep time too low This bit is set if the sweep time is too low and thus calibration fails. Note: the STATus:QUEStionable bit for CALibration is not affected by this error.
2 to 14	Unused
15	This bit is always 0.

12.1.5.4 Application of the Status Reporting System

The purpose of the status reporting system is to monitor the status of one or several devices in a measuring system. To do this and react appropriately, the controller must receive and evaluate the information of all devices. The following standard methods are used:

- **Service request** (SRQ) initiated by the instrument
- **Serial poll** of all devices in the bus system, initiated by the controller in order to find out who sent a SRQ and why
- **Parallel poll** of all devices
- Query of a **specific instrument status** by means of commands
- Query of the **error queue**

Service Request

Under certain circumstances, the instrument can send a service request (SRQ) to the controller. A service request is a request from an instrument for information, advice or treatment by the controller. Usually this service request initiates an interrupt at the controller, to which the control program can react appropriately. As evident from figure 12-1, an SRQ is always initiated if one or several of bits 2, 3, 4, 5 or 7 of the status byte are set and enabled in the SRE. Each of these bits combines the information of a further register, the error queue or the output buffer. The ENABle parts of the status registers can be set such that arbitrary bits in an arbitrary status register initiate an SRQ. In order to make use of the possibilities of the service request effectively, all bits should be set to "1" in enable registers SRE and ESE.

The service request is the only possibility for the instrument to become active on its own. Each controller program should cause the instrument to initiate a service request if errors occur. The program should react appropriately to the service request.

Use of the command *OPC to generate an SRQ at the end of a sweep

1. `CALL InstrWrite(analyzer, "*ESE 1")` 'Set bit 0 in the ESE (Operation Complete)
2. `CALL InstrWrite(analyzer, "*SRE 32")` 'Set bit 5 in the SRE (ESB)
3. `CALL InstrWrite(analyzer, "*INIT;*OPC")` ' Generate an SRQ after operation complete

   After its settings have been completed, the instrument generates an SRQ.

Serial Poll

In a serial poll, just as with command `*STB`, the status byte of an instrument is queried. However, the query is realized via interface messages and is thus clearly faster.

The serial poll method is defined in IEEE 488.1 and used to be the only standard possibility for different instruments to poll the status byte. The method also works for instruments which do not adhere to SCPI or IEEE 488.2.

The serial poll is mainly used to obtain a fast overview of the state of several instruments connected to the controller.

Parallel Poll

In a parallel poll, up to eight instruments are simultaneously requested by the controller using a single command to transmit 1 bit of information each on the data lines, i.e., to set the data line allocated to each instrument to a logical "0" or "1".

In addition to the SRE register, which determines the conditions under which an SRQ is generated, there is a Parallel Poll Enable register (PPE) which is ANDed with the STB bit by bit, considering bit 6 as well. This register is ANDed with the STB bit by bit, considering bit 6 as well. The results are ORed, the result is possibly inverted and then sent as a response to the parallel poll of the controller. The result can also be queried without parallel poll using the command `*IST?`.

The instrument first has to be set for the parallel poll using the command `PPC`. This command allocates a data line to the instrument and determines whether the response is to be inverted. The parallel poll itself is executed using `PPE`.

The parallel poll method is mainly used to find out quickly which one of the instruments connected to the controller has sent a service request. To this effect, SRE and PPE must be set to the same value.

Query of an instrument status

Each part of any status register can be read using queries. There are two types of commands:

- The common commands `*ESR?`, `*IDN?`, `*IST?`, `*STB?` query the higher-level registers.
- The commands of the `STATus` system query the SCPI registers (`STATus:QUEStionable`...)

The returned value is always a decimal number that represents the bit pattern of the queried register. This number is evaluated by the controller program.

Queries are usually used after an SRQ in order to obtain more detailed information on the cause of the SRQ.

Decimal representation of a bit pattern

The STB and ESR registers contain 8 bits, the SCPI registers 16 bits. The contents of a status register are specified and transferred as a single decimal number. To make this possible, each bit is assigned a weighted value. The decimal number is calculated as the sum of the weighted values of all bits in the register that are set to 1.

Bits	0	1	2	3	4	5	6	7	...
Weight	1	2	4	8	16	32	64	128	...

Example:

The decimal value 40 = 32 + 8 indicates that bits no. 3 and 5 in the status register (e.g. the QUEStionable status summary bit and the ESB bit in the STatus Byte) are set.

Error Queue

Each error state in the instrument leads to an entry in the error queue. The entries of the error queue are detailed plain text error messages that can be looked up in the Error Log or queried via remote control using SYSTem:ERRor[:NEXT]? or SYSTem:ERRor:ALL?. Each call of SYSTem:ERRor[:NEXT]? provides one entry from the error queue. If no error messages are stored there any more, the instrument responds with 0, "No error".

The error queue should be queried after every SRQ in the controller program as the entries describe the cause of an error more precisely than the status registers. Especially in the test phase of a controller program the error queue should be queried regularly since faulty commands from the controller to the instrument are recorded there as well.

12.1.5.5 Reset Values of the Status Reporting System

The following table contains the different commands and events causing the status reporting system to be reset. None of the commands, except *RST and SYSTem:PRESet, influence the functional instrument settings. In particular, DCL does not change the instrument settings.

Table 12-10: Resetting the status reporting system

Event	Switching on supply voltage Power-On-Status-Clear		DCL, SDC (Device Clear, Selected Device Clear)	*RST or SYSTem:PRESet	STATus:PRESet	*CLS
Effect	**0**	**1**				
Clear STB, ESR	-	yes	-	-	-	yes
Clear SRE, ESE	-	yes	-	-	-	-
Clear PPE	-	yes	-	-	-	-
Clear EVENt parts of the registers	-	yes	-	-	-	yes
Clear ENABle parts of all OPERation and QUEStionable registers; Fill ENABle parts of all other registers with "1".	-	yes	-	-	yes	-
Fill PTRansition parts with "1"; Clear NTRansition parts	-	yes	-	-	yes	-
Clear error queue	yes	yes	-	-	-	yes
Clear output buffer	yes	yes	yes	1)	1)	1)
Clear command processing and input buffer	yes	yes	yes	-	-	-
1) The first command in a command line that immediately follows a <PROGRAM MESSAGE TERMINATOR> clears the output buffer.						

12.1.6 General Programming Recommendations

Initial instrument status before changing settings

Manual operation is designed for maximum possible operating convenience. In contrast, the priority of remote control is the "predictability" of the instrument status. Thus, when a command attempts to define incompatible settings, the command is ignored and the instrument status remains unchanged, i.e. other settings are not automatically adapted. Therefore, control programs should always define an initial instrument status (e.g. using the *RST command) and then implement the required settings.

Command sequence

As a general rule, send commands and queries in different program messages. Otherwise, the result of the query may vary depending on which operation is performed first (see also chapter 12.1.4.1, "Preventing Overlapping Execution", on page 234).

Reacting to malfunctions

The service request is the only possibility for the instrument to become active on its own. Each controller program should instruct the instrument to initiate a service request in case of malfunction. The program should react appropriately to the service request.

Error queues

The error queue should be queried after every service request in the controller program as the entries describe the cause of an error more precisely than the status registers. Especially in the test phase of a controller program the error queue should be queried regularly since faulty commands from the controller to the instrument are recorded there as well.

12.1.7 Locking Instruments for Exclusive Remote Control

In order to keep full control of the instrument while performing a specific task, it is important to prevent access by other users or devices during remote control.

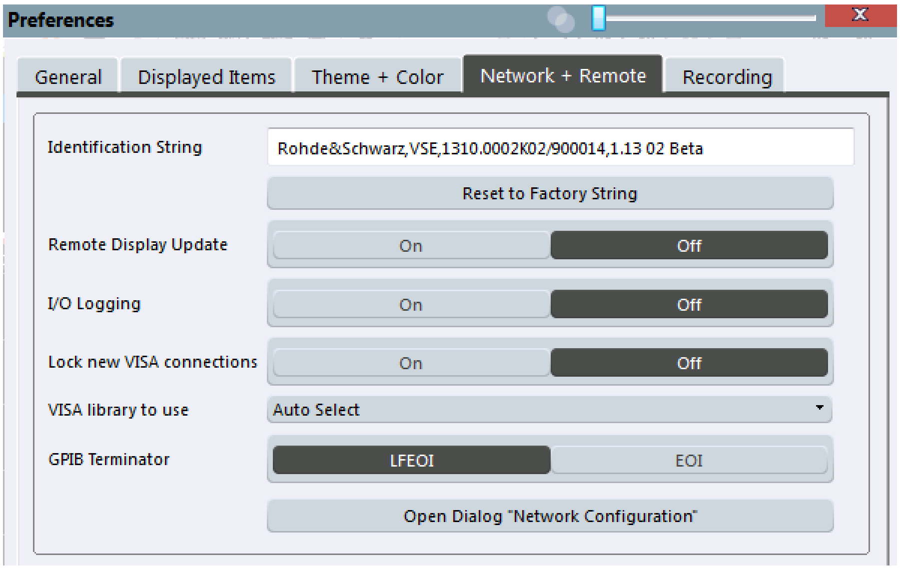
While in remote mode, you can prevent manual operation using the Local Lockout function. If enabled, the instrument in use can no longer be operated by the keys on the front panel or using the touchscreen. A remote command is required to enable manual operation again.

Similarly, remote control by any other device can be prevented using the VISA lock (see chapter 7.2.7, "Configuring the Behavior During Remote Control", on page 63). If enabled, the connection to the instrument in use is locked by the first device to establish a connection, so that no other devices can access the instrument. The R&S VSE software can be configured to lock all connections by default (see "Lock new VISA connections" on page 252), or individual connections can be locked.

Note, however, that if you exclude manual operation and use the VISA lock, then if the remote connection from the control PC to the instrument in use is interrupted, regaining control of the instrument in use may cause problems (see "To regain control over a blocked remote channel" on page 445).

12.2 Network and Remote Control Settings

Access: "File""Preferences" > "Network + Remote"



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Identification String

Defines the identification string for the R&S VSE which is provided as a response to the `*IDN?` query. Maximum 36 characters are allowed.

Remote command:
`SYSTem:IDENtify[:STRing]` on page 423

Reset to Factory String

Restores the default identification string. Each R&S VSE has a unique ID according to the following syntax:

Rohde&Schwarz,VSE,<Unique number>

Remote command:
`SYSTem:IDENtify:FACTory` on page 423

Remote Display Update

Defines whether the display of the R&S VSE is updated when changing from manual operation to remote control.

Turning off the display update function improves performance during remote control.

Tip: you can also turn off the display update function on the instrument in use when it is being controlled by the R&S VSE software, see "Display Update" on page 64.

Remote command:
`SYSTem:DISPlay:UPDate` on page 423

I/O Logging

Activates or deactivates the SCPI error log function. All remote control commands received by the R&S VSE are recorded in the following log file:

`C:\ProgramData\Rohde-Schwarz\VSE\<version_number>\scpilogging\ScpiLog.txt`

Logging the commands may be extremely useful for debug purposes, e.g. in order to find misspelled keywords in control programs.

Remote command:
`SYSTem:CLOGging` on page 422

Lock new VISA connections

Defines the default setting for the VISA connection lock for all subsequent instrument connections (see "VISA lock state" on page 64). If the connection is locked, no other devices can operate the same instrument remotely.

Tip: In order to lock existing connections, use the VISA lock state function (see chapter 7.2.7, "Configuring the Behavior During Remote Control", on page 63).

Remote command:
`DEVice:LOCKing:DEFault` on page 422

VISA library to use

Defines the VISA library to be used for subsequent instrument connections. Only VISA libraries that were detected in the network when the software was started are listed. However, you can select further libraries from the network manually.

If you change the VISA library to use and confirm the message, all currently established connections are closed and the VISA library is deactivated. Then the new VISA library is activated and the defined connections are re-established.

If the selected VISA library is not available at the time of connection, an error message is displayed.

"<VISA Library>"	Selects one of the VISA libraries detected in the network
"..."	Opens a file selection dialog box to select a `.dll` file containing a VISA library manually.
"Auto Select"	Automatically selects the first available VISA library in the list to be used

Remote command:
not available

GPIB Terminator

Changes the GPIB receive terminator.

"LFEOI"	According to the standard, the terminator in ASCII is <LF> and/or <EOI>.

"EOI" For binary data transfers (e.g. trace data) from the control computer to the instrument, the binary code used for <LF> might be included in the binary data block, and therefore should not be interpreted as a terminator in this particular case. This can be avoided by using only the receive terminator `EOI`.

Remote command:
`SYSTem:COMMunicate:GPIB[:SELF]:RTERminator` on page 422

Network Configuration
Opens the standard Windows "Network Configuration" dialog box for further configuration.

12.3 How to Set Up a Network and Remote Control

Remote operation of the R&S VSE software is possible using SCPI commands (see chapter 12.1.1, "SCPI (Standard Commands for Programmable Instruments)", on page 223).

12.3.1 How to Configure a Network

In order to operate the R&S Vector Signal Explorer Base Software remotely, the PC running the R&S VSE software as well as the instrument in use must be connected to a LAN network.

How to configure the R&S VSE software is described here. For details on configuring the instrument in use see the instrument's documentation.

Windows Firewall Settings
A firewall protects an instrument by preventing unauthorized users from gaining access to it through a network. Rohde & Schwarz highly recommends the use of the firewall on your instrument. R&S instruments are shipped with the Windows firewall enabled and preconfigured in such a way that all ports and connections for remote control are enabled.

For more details on firewall configuration, see the Rohde & Schwarz White Paper 1DC01: Malware Protection.

12.3.1.1 How to Assign the IP Address

Depending on the network capacities, the TCP/IP address information for the instrument can be obtained in different ways.

- If the network supports dynamic TCP/IP configuration using the Dynamic Host Configuration Protocol (DHCP), all address information can be assigned automatically.
- If the network does not support DHCP, or if the instrument is set to use alternate TCP/IP configuration, the addresses must be set manually.

By default, most instrument in use are configured to use dynamic TCP/IP configuration and obtain all address information automatically. This means that it is safe to establish a physical connection to the LAN without any previous instrument configuration.

When a DHCP server is used, a new IP address may be assigned each time the PC is restarted. This address must first be determined on the PC itself. Thus, when using a DHCP server, it is recommended that you use the permanent computer name, which determines the address via the DNS server (see "Using a DNS server to determine the IP address" on page 256).

NOTICE

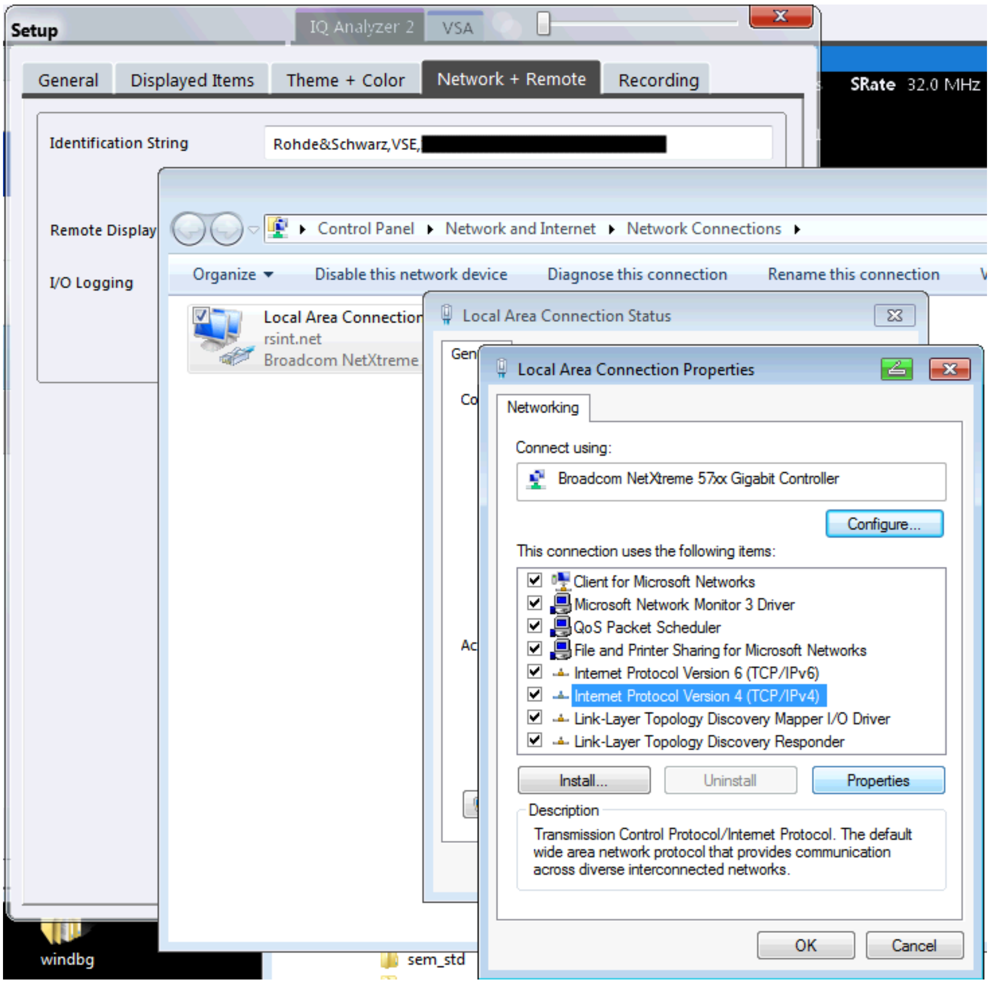
Risk of network errors

Connection errors can affect the entire network. If your network does not support DHCP, or if you choose to disable dynamic TCP/IP configuration, you must assign valid address information before connecting the instrument to the LAN. Contact your network administrator to obtain a valid IP address.

Assigning the IP address on the PC running the R&S VSE software

1. Select "File > Preferences > Network + Remote".
2. Select "Open Network Configuration".
3. Double-click the "Local Area Connection" icon.
4. In the "Local Area Connection Status" dialog box, select the "Properties" button.

   The items used by the LAN connection are displayed.
5. Click the entry named "Internet Protocol Version 4 (TCP/IPv4)" to highlight it.



6. Select the "Properties" button.
7. In the "General" tab, select "Use the following IP address" .
8. Enter the "IP Address", for example *10.0.0.10*. The IP address consists of four number blocks separated by dots. Every block contains 3 numbers in maximum.
9. Enter the "Subnet Mask", for example *255.255.255.0*. The subnet mask consists of four number blocks separated by dots. Every block contains 3 numbers in maximum.
10. Close the dialog box.

    If you have entered an invalid IP address or subnet mask, the message "out of range" is displayed in the status line. If the settings are correct, the configuration is saved, and you are prompted to restart the PC.
11. Confirm the displayed message ("Yes" button) to restart the PC.

Using a DNS server to determine the IP address

If a DNS server is configured on the PC running the R&S VSE software, the server can determine the current IP address for the connection using the permanent computer name.

1. For the instrument in use:
   a) Obtain the name of your DNS domain and the IP addresses of the DNS and WINS servers on your network.
   b) Press the SETUP key and then the "Network + Remote" softkey.
   c) In the "Network" tab, select the "Open Dialog 'Network Connections'" button.
2. For the PC running the R&S VSE software:
   a) Select "File > Preferences > Network + Remote".
   b) Select "Open Network Configuration".
3. click the "Local Area Network" icon.
4. In the "Local Area Connection Status" dialog box, select the "Properties" button.

   The items used by the LAN connection are displayed.
5. Click the entry named "Internet Protocol Version 4 (TCP/IPv4)" to highlight it.
6. Select the "Properties" button.
7. On the "General" tab, select "Use the following DNS server addresses" and enter your own DNS addresses.

   For more information refer to the Windows 7 operating system Help.

12.3.2 How to Log on to the Network

Windows 7 requires that users identify themselves by entering a user name and password in a login window. You can set up two types of user accounts, either an administrator account with unrestricted access to the computer/domain or a standard user account with limited access. Most instrumentss provide an auto-login function for the administrator account, i.e. login with unrestricted access is carried out automatically in the background. By default, the user name for the administrator account is "Instrument", and the user name for the standard user account is "NormalUser". In both cases the initial password is "894129". You can change the password in Windows 7 for any user at any time. Some administrative tasks require administrator rights (e.g. changing the computer name or the configuration of a LAN network).

At the same time you log on to the operating system, you are automatically logged on to the network. As a prerequisite, the user name and the password must be identical on the instrument and on the network.

12.3.2.1 How to Change the User Password

After the new user has been created on the instrument, the password must be adapted to the network password. This is also done using the "User Accounts" dialog box.

1. Select the "Windows" icon in the toolbar to access the operating system.
2. Press CTRL + ALT + DELETE, then select "Change a password".
3. Enter the user account name.
4. Enter the old password.
5. Enter the new password in the upper text line and repeat it in the following line.
6. Press ENTER.
   The new password is now active.

12.3.3 How to Start a Remote Control Session from a PC

To start remote control

1. Send an addressed command (`GTR` - Go to Remote) from a controller to the instrument.

   The instrument is switched to remote control ("remote" state). Operation via the front panel is disabled. Only the "Local" softkey is displayed to return to manual operation. The instrument remains in the remote state until it is reset to the manual state via the instrument or via remote control interfaces. Switching from manual operation to remote control and vice versa does not affect the other instrument settings.
2. To obtain optimum performance during remote control, send the `SYST:DISPlay:UPDate OFF` command to deactivate the display of results on the instrument in use.
3. Send the `DEV:GEN:DISP:UPD ON` command to activate the display of results in the R&S VSE software (see `DEVice:GENeral:DISPlay` on page 270).

   The changes in the device settings and the recorded measurement values are displayed in the software window.
4. To prevent other users from taking remote control of the instrument in use, lock the connection using the `DEVice:LOCKing` or `DEVice:LOCKing:ALL` commands.
5. To prevent other users from taking manual control of the instrument in use, disable the keys of the instrument and the "Local" function using the command DEV:GEN:LLO ON.

Switching to manual mode is only possible via remote control then.

6. To enable the keys of the instrument in use again use `DEV:GEN:LLO OFF`, or switch the instrument to local mode (`GTL` - Go to Local), i.e. deactivate the `REN` line of the remote control interface.

12.3.4 How to Return to Manual Operation on the Instrument

Before you switch the instrument back to manual operation, all remote command processing must be completed. Otherwise, the instrument will switch back to remote control immediately.

1. If necessary, enable the keys of the instrument and the "Local" function using the command DEV:GEN:LLO OFF.
2. On the instrument, if available, select the "Local" softkey or the PRESET key. Alternatively, send the `@LOC` command to the instrument in use.

13 Remote Commands

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13.1 Conventions used in SCPI Command 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 explicitely.
- **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.

13.2 Common Suffixes

In the I/Q Analyzer application, the following common suffixes are used in remote commands:

Suffix	Value range	Description
<m>	1 1..16	Marker Deltamarker
<n>	1..16	Window
<t>	1..6	Trace

13.3 Common Commands

Common commands are described in the IEEE 488.2 (IEC 625-2) standard. These commands have the same effect and are employed in the same way on different devices. The headers of these commands consist of "*" followed by three letters. Many common commands are related to the Status Reporting System.

Available common commands:

*CAL?......260
*CLS......261
*ESE......261
*ESR?......261
*IDN?......261
*IST?......261
*OPC......262
*OPT?......262
*PCB......262
*PRE......262
*PSC......262
*RST......263
*SRE......263
*STB?......263
*TRG......263
*TST?......264
*WAI......264

***CAL?**

Calibration query

Initiates a calibration of the instrument and subsequently queries the calibration status. Responses > 0 indicate errors.

Note: If you start a self-alignment remotely, then select the "Local" softkey while the alignment is still running, the instrument only returns to the manual operation state after the alignment is completed.

Usage: Query only

***CLS**

Clear status

Sets the status byte (STB), the standard event register (ESR) and the `EVENt` part of the `QUEStionable` and the `OPERation` registers to zero. The command does not alter the mask and transition parts of the registers. It clears the output buffer.

Usage: Setting only

***ESE** <Value>

Event status enable

Sets the event status enable register to the specified value. The query returns the contents of the event status enable register in decimal form.

Parameters:

<Value> Range: 0 to 255

***ESR?**

Event status read

Returns the contents of the event status register in decimal form and subsequently sets the register to zero.

Return values:

<Contents> Range: 0 to 255

Usage: Query only

***IDN?**

Identification

Returns the instrument identification.

Usage: Query only

***IST?**

Individual status query

Returns the contents of the IST flag in decimal form. The IST flag is the status bit which is sent during a parallel poll.

Return values:

<ISTflag>	0 | 1
Usage:	Query only

***OPC**

Operation complete

Sets bit 0 in the event status register when all preceding commands have been executed. This bit can be used to initiate a service request. The query form writes a "1" into the output buffer as soon as all preceding commands have been executed. This is used for command synchronization.

***OPT?**

Option identification query

Queries the options included in the instrument. For a list of all available options and their description refer to the data sheet.

Usage: Query only

***PCB** <Address>

Pass control back

Indicates the controller address to which remote control is returned after termination of the triggered action.

Setting parameters:

<Address>	Range:	0 to 30
Usage:	Setting only	

***PRE** <Value>

Parallel poll register enable

Sets parallel poll enable register to the indicated value. The query returns the contents of the parallel poll enable register in decimal form.

Parameters:

<Value>	Range:	0 to 255

***PSC** <Action>

Power on status clear

Determines whether the contents of the ENABle registers are preserved or reset when the instrument is switched on. Thus a service request can be triggered when the instrument is switched on, if the status registers ESE and SRE are suitably configured. The query reads out the contents of the "power-on-status-clear" flag.

Parameters:

<Action> 0 | 1

0
The contents of the status registers are preserved.

1
Resets the status registers.

***RST**

Reset

Sets the instrument to a defined default status. The default settings are indicated in the description of commands.

The command is equivalent to `SYSTem:PRESet`.

Usage: Setting only

Manual operation: See "Restoring All Default Settings (Preset All)" on page 76

***SRE** <Contents>

Service request enable

Sets the service request enable register to the indicated value. This command determines under which conditions a service request is triggered.

Parameters:

<Contents> Contents of the service request enable register in decimal form. Bit 6 (MSS mask bit) is always 0.

Range: 0 to 255

***STB?**

Status byte query

Reads the contents of the status byte in decimal form.

Usage: Query only

***TRG**

Trigger

Triggers all actions waiting for a trigger event. In particular, *TRG generates a manual trigger signal. This common command complements the commands of the `TRIGger` subsystem.

Usage: Event

***TST?**

Self-test query

Initiates self-tests of the instrument and returns an error code in decimal form (see Service Manual supplied with the instrument). "0" indicates no errors occured.

Note: If you start a self-test remotely, then select the "Local" softkey while the test is still running, the instrument only returns to the manual operation state after the test is completed. In this case, the self-test cannot be aborted.

Usage: Query only

***WAI**

Wait to continue

Prevents servicing of the subsequent commands until all preceding commands have been executed and all signals have settled (see also command synchronization and `*OPC`).

Usage: Event

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13.4.1 Configuring Instruments

The R&S VSE can capture and analyze data from various instruments. These instruments must be configured before measurements can be performed on them via the R&S VSE.

How to configure instruments in manual mode is described in chapter 7.2, "Configuring Instruments", on page 53.

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13.4.1.1 Configuring the Basic Connection Data

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DEVice:DELete ... 265
DEVice:DELete:ALL ... 266
DEVice:LIST? ... 266
DEVice:STATe? ... 266
DEVice:TARGet ... 267
DEVice:TARGet? ... 267
DEVice:TARGet:TYPE ... 268

DEVice:CREate <DevName>,<Address>,<Protocol>

Defines a new connection to a instrument to be controlled by the R&S VSE software.

Setting parameters:

<DevName> string

Name of the instrument to be used for subsequent reference

<Address> string

Network address of the instrument, for example IP address

<Protocol> Interface protocol used to connect the specified instrument to the network

VXI11
Standard TCP/IP-based protocol

HiSlip
High performance protocol

Example: `DEV:CRE 'SpecAnalyzer','100.100.100.100',VXI11`

Usage: Setting only

Manual operation: See "New Instrument" on page 57

DEVice:DELete <DevName>

Deletes the connection settings of the specified instrument. Note that after deleting a connection, the instrument is no longer known to the R&S VSE software.

Setting parameters:

<DevName> string

Name of a configured instrument (see `DEVice:CREate` on page 265)

Example:
```
DEV:CRE 'SpecAnalyzer','100.100.100.100',
'VXI11'
DEV:DEL 'SpecAnalyzer'
```

Usage: Setting only

Manual operation: See "Close Instrument" on page 57

DEVice:DELete:ALL

Deletes the connection settings of all defined instruments. Note that after deleting a connection, the instrument is no longer known to the R&S VSE software.

Usage: Event

Manual operation: See "Restoring All Default Settings and Deleting Instrument Configurations (Preset All & Delete Instruments)" on page 76

DEVice:LIST?

Queries the names of all defined instruments, whether they are currently connected or not. Defined instruments with no (valid) IP address are also included. The names are returned as a comma-separated list in the order of their definition.

Return values:

<InstName> string

Name of the instrument

Example: `DEV:LIST?`

Result:

`'FSW-8*','New Instrument*','New Instrument (2)*'`

Usage: Query only

DEVice:STATe? <DevName>

Queries the connection status of the specified instrument.

Parameters:

<State> ON | OFF | 1 | 0

ON | 1
Instrument is connected to the network

OFF | 0
No connection to the instrument established.

*RST: OFF

Query parameters:

<DevName> string

Name of a configured instrument (see `DEVice:CREate` on page 265)

Example: `DEV:STAT? 'SpecAnalyzer'`

Usage: Query only

Manual operation: See "Connection State" on page 58

DEVice:TARGet <DevName>,<Address>[,<Protocol>]

Changes the network address and, optionally, the interface protocol of the specified instrument.

Setting parameters:

<DevName> string

Name of a configured instrument (see DEVice:CREate on page 265)

<Address> string

Network address of the instrument, for example IP address

<Protocol> Interface protocol used to connect the specified instrument to the network

VXI11
Standard TCP/IP-based protocol

HiSlip
High performance protocol

Example:
```
DEV:TARG 'SpecAnalyzer','100.100.100.100',
'VXI11'
```

Usage: Setting only

Manual operation: See "IP address" on page 57

DEVice:TARGet? <DevName>

Queries the network address of the specified instrument.

Query parameters:

<DevName> string

Name of a configured instrument (see DEVice:CREate on page 265)

Return values:

<Address> string

Network address of the instrument, for example IP address

Example:
```
DEV:TARG 'SpecAnalyzer','100.100.100.100',
'VXI11'
DEV:TARG? 'SpecAnalyzer'
```
Result:
```
'100.100.100.100'
```

Usage: Query only

Manual operation: See "IP address" on page 57

DEVice:TARGet:TYPE <DevName>,<Protocol>
DEVice:TARGet:TYPE? <DevName>

Defines or queries the interface protocol used to connect the specified instrument to the network.

For details on interfaces see chapter 7.2.1, "Remote Control Interfaces and Protocols", on page 53

Setting parameters:

<Protocol> Interface protocol used to connect the specified instrument to the network

VXI11
Standard TCP/IP-based protocol

HiSlip
High performance protocol

Parameters for setting and query:

<DevName> string

Name of a configured instrument (see `DEVice:CREate` on page 265)

Example: `DEV:TARG:TYPE 'SpecAnalyzer','VXI11'`

Manual operation: See "Interface Type" on page 57

13.4.1.2 Obtaining Information on Connected Instruments

The following commands are required to query information on the firmware version and options installed on the instrument in use.

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

DEVice:INFO:HWINfo?....................268
DEVice:INFO:IDN?....................269
DEVice:INFO:OPT?....................269

DEVice:INFO:HWINfo? <DevName>

This command queries hardware information for the instrument in use.

Query parameters:

<DevName> string

Name of a configured instrument (see `DEVice:CREate` on page 265)

Return values:

<Info> String containing the following information for every hardware component.
<component>: name of the hardware component
<serial#>: serial number of the component
<order#>: order number of the component
<model>: model of the component
<code>: code of the component
<revision>: revision of the component

Example:
```
DEV:INFO:HWIN? 'SpecAnalyzer'
```
Queries the hardware information for the instrument named 'SpecAnalyzer'.
```
"FRONTEND|100001/003|1300.3009|03|01|00|00",
"MOTHERBOARD|123456/002|1300.3080|02|00|00|00",
...
```

Usage: Query only

Manual operation: See "Infos & Settings" on page 58

DEVice:INFO:IDN? <DevName>

Returns the instrument identification for the specified instrument.

Query parameters:

<DevName> string
Name of a configured instrument (see `DEVice:CREate` on page 265)

Return values:

<ID> "Rohde&Schwarz,<device type>,<part number>/serial number>,<firmware version>"

Example:
```
DEV:INFO:IDN? 'SpecAnalyzer'
Rohde&Schwarz,FSW-26,1312.8000K26/100005,1.30
```

Usage: Query only

Manual operation: See "Infos & Settings" on page 58

DEVice:INFO:OPT? <DevName>

Queries the options included in the specified instrument. For a list of all available options and their description refer to the data sheet.

Query parameters:

<DevName> string
Name of a configured instrument (see `DEVice:CREate` on page 265)

Return values:

<Options> The query returns a list of all installed and activated options, separated by commas, where:
B<number> describes hardware options
K<number> describes software options

Example:
```
DEV:INFO:OPT? 'SpecAnalyzer'
B4,B5,B6,B7,B8,B10,B22,B30,B31,K7,K70
```

Usage: Query only

Manual operation: See "Infos & Settings" on page 58

13.4.1.3 General Instrument Setup

The following commands are required to configure initial instrument settings relevant for control by the software.

DEVice:GENeral:DISPlay....270
DEVice:GENeral:LLO....270
DEVice:LOCKing....271
DEVice:LOCKing:ALL....272

DEVice:GENeral:DISPlay <DevName>

Activates or deactivates the display update function on the specified instrument.

Parameters:

<State> ON | OFF | 1 | 0

ON | 1
The instrument display is updated while it is being controlled remotely (e.g. by the R&S VSE software)

OFF | 0
The instrument's display is deactivated while it is being controlled remotely. This improves performance during remote control.

*RST: OFF

Parameters for setting and query:

<DevName> string

Name of a configured instrument (see `DEVice:CREate` on page 265)

Example:
```
DEV:GEN:DISP 'SpecAnalyzer', ON
```

Manual operation: See "Display Update" on page 64

DEVice:GENeral:LLO <DevName>

Activates or deactivates the local lockout function on the specified instrument.

Parameters:

<State> ON | OFF | 1 | 0

ON | 1
Instrument is set to be controlled remotely (that is, by the R&S VSE software)

OFF | 0
Instrument is set to be operated locally (via its graphical user interface).

*RST: OFF

Query parameters:

<DevName> string

Name of a configured instrument (see `DEVice:CREate` on page 265)

Example: `DEV:GEN:LLO 'SpecAnalyzer', ON`

Manual operation: See "Local Lockout" on page 63

DEVice:LOCKing <DevName>,<STATe>
DEVice:LOCKing? <DevName>

Locks or unlocks the VISA connection to the selected instrument. If the connection is locked, no other devices can operate the same instrument remotely. If no connection to the instrument has been established yet, any subsequent connection to it is locked immediately.

This command is similar to the `DEVice:GENeral:LLO` command, but for remote operation.

Parameters:

<State> ON | OFF | 1 | 0

ON | 1
Connection is locked, no other devices can establish a connection to the same instrument

OFF | 0
Connection is unlocked, other devices in the network can connect to the instrument

*RST: OFF

Parameters for setting and query:

<DevName> string

Name of a configured instrument (see `DEVice:CREate` on page 265)

Example: `DEV:LOCK 'SpecAnalyzer', ON`

Manual operation: See "VISA lock state" on page 64

DEVice:LOCKing:ALL <STATe>

Locks or unlocks the VISA connection for *all* currently connected instruments. (The command has the same effect as the `DEVice:LOCKing` command for all currently connected instruments.)

Parameters:

<State> ON | OFF | 1 | 0

ON | 1
All instrument connections are locked; no other devices can establish a connection to any of the instruments

OFF | 0
All instrument connections are unlocked; other devices in the network can connect to all instruments

*RST: OFF

Example: `DEV:LOCK:ALL ON`

Usage: Setting only

Manual operation: See "VISA lock state" on page 64

13.4.1.4 Configuring an External Reference on the Instrument

The following commands are required to configure the use of an external reference on the instrument in use.

For manual operation see chapter 13.4.1.4, "Configuring an External Reference on the Instrument", on page 272.

DEVice:EXTRef:FREQuency....................272
DEVice:EXTRef:LBWidth....................273
DEVice:EXTRef:O100....................273
DEVice:EXTRef:O640....................274
DEVice:EXTRef:OSYNc....................274
DEVice:EXTRef:SOURce....................274
DEVice:EXTRef:TRANge....................275

DEVice:EXTRef:FREQuency <DevName>,<Frequency>
DEVice:EXTRef:FREQuency? <DevName>

This command defines the frequency of the external reference oscillator of the instrument in use.

The reference signal must be connected to the rear panel of the instrument.

Parameters:

<Frequency> Range: 1 MHz to 20 MHz

Parameters for setting and query:

<DevName> string

Name of a configured instrument (see `DEVice:CREate` on page 265)

Example: `DEV:EXTR:FREQ 'SpecAnalyzer',13MHZ`
Sets the frequency for the 'SpecAnalyzer' instrument to 13 MHz.

Example: `DEV:EXTR:FREQ? 'SpecAnalyzer'`
Queries the external reference frequency for the 'SpecAnalyzer' instrument.
Result: `13MHZ`

Manual operation: See "Frequency" on page 65

DEVice:EXTRef:LBWidth <DevName>,<Bandwidth>
DEVice:EXTRef:LBWidth? <DevName>

Defines the loop bandwidth, that is, the speed of internal synchronization with the reference frequency on the instrument in use. The setting requires a compromise between performance and increasing phase noise.

For a variable external reference frequency with a narrow tuning range (+/- 0.5 ppm), the loop bandwidth is fixed to 0.1 Hz and cannot be changed.

Parameters:

<Bandwidth> 0.1 Hz | 1 Hz | 3 Hz | 10 Hz | 30 Hz | 100 Hz | 300 Hz
The possible values depend on the reference source and tuning range (see instrument documentation).
Default unit: Hz

Parameters for setting and query:

<DevName> string
Name of a configured instrument (see `DEVice:CREate` on page 265)

Example: `DEV:EXTR::LBW 3`

Manual operation: See "Loop Bandwidth" on page 66

DEVice:EXTRef:O100 <DevName>,<State>
DEVice:EXTRef:O100? <DevName>

If enabled, a 100 MHz reference signal is provided to the REF OUTPUT 100 MHZ connector of the instrument in use.

Parameters:

<State> ON | OFF
*RST: OFF

Parameters for setting and query:

<DevName> string
Name of a configured instrument (see `DEVice:CREate` on page 265)

Example: `DEV:EXTR:O100 ON`

Manual operation: See "Reference Frequency Output" on page 66

DEVice:EXTRef:O640 <DevName>,<State>
DEVice:EXTRef:O640? <DevName>

If enabled, a 640 MHz reference signal is provided to the REF OUTPUT 640 MHZ connector of the instrument in use.

Parameters:

<State> ON | OFF
*RST: OFF

Parameters for setting and query:

<DevName> string
Name of a configured instrument (see `DEVice:CREate` on page 265)

Example: `DEV:EXTR:O640 ON`

Manual operation: See "Reference Frequency Output" on page 66

DEVice:EXTRef:OSYNc <DevName>,<State>
DEVice:EXTRef:OSYNc? <DevName>

If enabled, a 100 MHz reference signal is provided to the SYNC TRIGGER OUTPUT connector of the instrument in use.

Parameters:

<State> ON | OFF
*RST: OFF

Parameters for setting and query:

<DevName> string
Name of a configured instrument (see `DEVice:CREate` on page 265)

Example: `DEV:EXTR:OSYN ON`

Manual operation: See "Reference Frequency Output" on page 66

DEVice:EXTRef:SOURce <DevName>,<Source>
DEVice:EXTRef:SOURce? <DevName>

This command selects the reference oscillator for the instrument in use.

The external reference must be connected to the instrument in use.

Note that depending on the type of instrument connected to the R&S VSE software, not all options may be available.

Parameters:

<Source>

INTernal
the internal reference is used (10 MHz)

EXTernal
the external reference from the REF INPUT 1..20 MHZ connector is used with a variable frequency; if none is available, an error flag is displayed in the status bar

E10
the external reference from REF INPUT 1..20 MHZ connector is used with a fixed 10 MHZ frequency; if none is available, an error flag is displayed in the status bar

E100
the external reference from REF INPUT 100 MHZ connector is used; if none is available, an error flag is displayed in the status bar

EAUTo
the external reference is used as long as it is available, then the instrument switches to the internal reference

SYNC
the external reference is used; if none is available, an error flag is displayed in the status bar

Parameters for setting and query:

<DevName> string

Name of a configured instrument (see `DEVice:CREate` on page 265)

Example: `DEV:EXTR:SOUR EXT`

Usage: SCPI confirmed

Manual operation: See "Reference Frequency Input Source" on page 65

DEVice:EXTRef:TRANge <DevName>,<Range>
DEVice:EXTRef:TRANge? <DevName>

Defines the tuning range of the external reference for the instrument in use. The tuning range is only available for the variable external reference frequency (DEV:EXTR:SOUR EXT). It determines how far the frequency may deviate from the defined level in parts per million (10^{-6}).

Parameters:

<Range> The possible values depend on the reference source (see instrument documentation).

SMALI
With this smaller deviation (+/- 0.5 ppm) a very narrow fixed loop bandwidth of 0.1 Hz is realized. With this setting the instrument can synchronize to an external reference signal with a very precise frequency. Due to the very narrow loop bandwidth, unwanted noise or spurious components on the external reference input signal are strongly attenuated. Furthermore, the loop requires about 30 seconds to reach a locked state. During this locking process, "NO REF" is displayed in the status bar.

WIDE
The larger deviation (+/- 6 ppm) allows the instrument to synchronize to less precise external reference input signals.

Parameters for setting and query:

<DevName> string

Name of a configured instrument (see `DEVice:CREate` on page 265)

Example: `DEV:EXTR:TRAN WIDE`

Manual operation: See "Tuning Range" on page 65

13.4.2 Loading Input Files

The following commands are required to load measurement data from files to be used as input. (See also chapter 8.3.4, "Recalling Measurement Data from Files", on page 92).

Useful commands for using input files described elsewhere:

- `INSTrument:BLOCk:CHANnel[:SETTings]:SOURce` on page 285
- `EXPort:IQ:META:DATA<I>:VALue?` on page 404

Remote commands exclusive to loading input files:

INSTrument:BLOCk:CHANnel[:SETTings]:FILE<i>:CSV 277
INSTrument:BLOCk:CHANnel[:SETTings]:FILE<i>:CURRent:SAMPle 277
INSTrument:BLOCk:CHANnel[:SETTings]:FILE<i>:CURRent:TIME 278
INSTrument:BLOCk:CHANnel[:SETTings]:FILE<i>:IQW 278
INSTrument:BLOCk:CHANnel[:SETTings]:FILE<i>:MAT 279
INSTrument:BLOCk:CHANnel[:SETTings]:FILE<i>:OVERlap:AVG:OFF 280
INSTrument:BLOCk:CHANnel[:SETTings]:FILE<i>:OVERlap:AVG:ON 281
INSTrument:BLOCk:CHANnel[:SETTings]:FILE<i>:STARt:SAMPle 281
INSTrument:BLOCk:CHANnel[:SETTings]:FILE<i>:STARt:TIME 282
INSTrument:BLOCk:CHANnel[:SETTings]:FILE<i>:STOP:SAMPle 282
INSTrument:BLOCk:CHANnel[:SETTings]:FILE<i>:STOP:TIME 283
INSTrument:BLOCk:CHANnel[:SETTings]:FILE<i>[:IQTar] 283

INSTrument:BLOCk:CHANnel[:SETTings]:FILE<i>:CSV <FileName>,<ABW>[,<IQChannel]

Assigns the specified .csv file as the input source for the currently selected channel. The file is automatically loaded to the R&S VSE software and assigned the sequential number provided as the FILE<i> suffix. Subsequent commands concerning file input from this file must use the same suffix.

Suffix:

<i> 1..99
Sequential number of the source

Parameters:

<FileName> String containing the path and file name of the file to be loaded.

<ABW> The analysis bandwidth to be used by the measurement. The bandwidth must be smaller than or equal to the bandwidth of the data that was stored in the file.
Tip: If the file was stored using the R&S VSE software, the ABW is included in the meta data information in the file (see "Meta Data Settings" on page 90).

<IQChannel> ID of the I/Q channel in the stored file which is to be restored to the selected measurement channel.
If this parameter is omitted, the first channel found is restored.
Tip: If the file was stored using the R&S VSE software, the I/Q channel is included in the meta data information in the file (see "Meta Data Settings" on page 90).

Example:

```
INST:SEL 'IQ Analyzer'
INST:BLOC:CHAN:FILE:CSV 'C:
\Users\ImportFile.csv',10MHZ,2
```

The data from the second I/Q channel stored in the file is used as input for the current measurement channel 'IQ Analyzer'. The displayed bandwidth is restricted to 10 MHz.

Manual operation: See "File" on page 73

INSTrument:BLOCk:CHANnel[:SETTings]:FILE<i>:CURRent:SAMPle <Sample>

This command defines the sample within the input file <i> which is currently displayed.

Suffix:

<i> 1..99
Sequential number of a configured input file (required only if multiple files are loaded for a single channel)

Parameters:

<Sample> numeric value
Range: 0 to record length of stored data

Example:
```
INST:BLOC:CHAN:FILE:STAR:SAMP 10
INST:BLOC:CHAN:FILE:STOP:SAMP 1000
INST:BLOC:CHAN:FILE:CURR:SAMP 120
```
Data from the input file is replayed starting with sample number 10 and ending with sample number 1000. The current display is at sample 120.

Manual operation: See "Playback Settings" on page 96

INSTrument:BLOCk:CHANnel[:SETTings]:FILE<i>:CURRent:TIME <Time>

This command defines the (absolute) time within the input file <i> which is currently displayed.

Suffix:

<i> 1..99
Sequential number of a configured input file (required only if multiple files are loaded for a single channel)

Parameters:

<Time> double value

Absolute time

Range: 0 to meas time of stored data
Default unit: s

Example:
```
INST:BLOC:CHAN:FILE:STAR:TIME 0.32s
INST:BLOC:CHAN:FILE:STOP:TIME 0.64s
INST:BLOC:CHAN:FILE:CURR:TIME 0.40s
```
Data from the input file is replayed starting at 0.32 s and ending at 0.64 s of the captured data. The current display is at 0.40 s.

Manual operation: See "Playback Settings" on page 96

INSTrument:BLOCk:CHANnel[:SETTings]:FILE<i>:IQW
<FileName>,<ABW>,<SampleRate>[,Format][,<IQChannel]

Assigns the specified .iqw file as the input source for the currently selected channel. The file is automatically loaded to the R&S VSE software and assigned the sequential number provided as the FILE<i> suffix. Subsequent commands concerning file input from this file must use the same suffix.

Suffix:

<i> 1..99
Sequential number of the source

Parameters:

<FileName> String containing the path and file name of the file to be loaded.

<ABW> The analysis bandwidth to be used by the measurement. The bandwidth must be smaller than or equal to the bandwidth of the data that was stored in the file.
Tip: If the file was stored using the R&S VSE software, the ABW is included in the meta data information in the file (see "Meta Data Settings" on page 90).

<SampleRate> The sample rate used to obtain the stored data.
Tip: If the file was stored using the R&S VSE software, the sample rate is included in the meta data information in the file (see "Meta Data Settings" on page 90).

<Format> The format in which the I/Q data is provided

IIQQ | IQBLock
First all I-values are listed, then the Q-values (I,I,I,I,I,...Q,Q,Q,Q,Q,Q)

IQIQ | IQPair
One pair of I/Q values after the other is listed (I,Q,I,Q,I,Q...).

*RST: IQPair

<IQChannel> ID of the I/Q channel in the stored file which is to be restored to the selected measurement channel.
If this parameter is omitted, the first channel found is restored.
Tip: If the file was stored using the R&S VSE software, the I/Q channel is included in the meta data information in the file (see "Meta Data Settings" on page 90).

Example:

```
INST:SEL 'IQ Analyzer'
INST:BLOC:CHAN:FILE:IQW 'C:
\Users\ImportFile.iqw',10MHZ,32MHz,IIQQ,2
```

The data from the second I/Q channel stored in the file is used as input for the current measurement channel 'IQ Analyzer'. The displayed bandwidth is restricted to 10 MHz. A sample rate of 32 MHz is applied. The data is interpreted in the format "IIQQ".

Manual operation: See "File" on page 73

INSTrument:BLOCk:CHANnel[:SETTings]:FILE<i>:MAT <FileName>,<ABW>,<SampleRate>[,Format][,<IQChannel]

Assigns the specified .mat file as the input source for the currently selected channel. The file is automatically loaded to the R&S VSE software and assigned the sequential number provided as the FILE<i> suffix. Subsequent commands concerning file input from this file must use the same suffix.

Suffix:

<i> 1..99
Sequential number of the source

Parameters:

<FileName> String containing the path and file name of the file to be loaded.

<ABW> The analysis bandwidth to be used by the measurement. The bandwidth must be smaller than or equal to the bandwidth of the data that was stored in the file.
Tip: If the file was stored using the R&S VSE software, the ABW is included in the meta data information in the file (see "Meta Data Settings" on page 90).

<SampleRate> The sample rate used to obtain the stored data.
Tip: If the file was stored using the R&S VSE software, the sample rate is included in the meta data information in the file (see "Meta Data Settings" on page 90).

<Format> IIQQ | IQPair

The format in which the I/Q data is provided

IIQQ
First all I-values are listed, then the Q-values (I,I,I,I,I,I,...Q,Q,Q,Q,Q,Q)

IQPair
One pair of I/Q values after the other is listed (I,Q,I,Q,I,Q...).

*RST: IQPair

<IQChannel> ID of the I/Q channel in the stored file which is to be restored to the selected measurement channel.
If this parameter is omitted, the first channel found is restored.
Tip: If the file was stored using the R&S VSE software, the I/Q channel is included in the meta data information in the file (see "Meta Data Settings" on page 90).

Example:

```
INST:SEL 'IQ Analyzer'
INST:BLOC:CHAN:FILE:MAT 'C:
\Users\ImportFile.mat',10MHZ,32MHz,IIQQ,2
```

The data from the second I/Q channel stored in the file is used as input for the current measurement channel 'IQ Analyzer'. The displayed bandwidth is restricted to 10 MHz. A sample rate of 32 MHz is applied. The data is interpreted in the format "IIQQ".

Manual operation: See "File" on page 73

INSTrument:BLOCk:CHANnel[:SETTings]:FILE<i>:OVERlap:AVG:OFF <Percentage>

The overlap settings determine how successive records within one data file are replayed.

This command defines the behaviour if a non-averaging trace detector is used.

After the first record has been replayed, the specified percentage (x) of the next record is displayed together with the remaining data (meas time - x) from the previous record. This leads to a smoother trace update; whereas without any overlap, the trace appears to "jump" after each record.

Suffix:

<i>	1..99 Sequential number of a configured input file (required only if multiple files are loaded for a single channel)

Parameters:

<Percentage>	numeric value Range: 0 to 100 *RST: 90

Example: `INST:BLOC:CHAN:FILE1:OVER:AVG:OFF 75`
For normal clear/write traces, after each update, the display shows 25% of the previous record and 75% of the next record.

Manual operation: See "Overlap Settings" on page 97

INSTrument:BLOCk:CHANnel[:SETTings]:FILE<i>:OVERlap:AVG:ON <Percentage>

The overlap settings determine how successive records within one data file are replayed.

This command defines the behaviour if an averaging trace detector is used.

After the first record has been replayed, the specified percentage (x) of the next record is displayed together with the remaining data (meas time - x) from the previous record. This leads to a smoother trace update; whereas without any overlap, the trace appears to "jump" after each record.

On the other hand, if an overlap is applied, the overlapping data is included in multiple averaging calculations, thus distorting the overall average.

Suffix:

<i>	1..99 Sequential number of a configured input file (required only if multiple files are loaded for a single channel)

Parameters:

<Percentage>	numeric value Range: 0 to 100 *RST: 0

Example: `INST:BLOC:CHAN:FILE1:OVER:AVG:ON 99`
For averaged traces, after each update, the display shows 1% of the previous record and 99% of the next record. Thus, 1% of each record is included in multiple averaging calculations.

Manual operation: See "Overlap Settings" on page 97

INSTrument:BLOCk:CHANnel[:SETTings]:FILE<i>:STARt:SAMPle <Sample>

This command defines the sample within the input file <i> at which replay starts.

Suffix:

<i> 1..99
Sequential number of a configured input file (required only if multiple files are loaded for a single channel)

Parameters:

<Sample> numeric value

Range: 0 to record length of stored data

Example:
```
INST:BLOC:CHAN:FILE:START:SAMP 10
```
Data from the input file is replayed starting with sample number 10.

Manual operation: See "Playback Settings" on page 96

INSTrument:BLOCk:CHANnel[:SETTings]:FILE<i>:STARt:TIME <Time>

This command defines the start time within the input file <i> at which replay starts.

Suffix:

<i> 1..99
Sequential number of a configured input file (required only if multiple files are loaded for a single channel)

Parameters:

<Time> double value

Absolute start time

Range: 0 to meas time of stored data
Default unit: s

Example:
```
INST:BLOC:CHAN:FILE:START:TIME 0.32s
```
Data from the input file is replayed starting at 0.32 s of the captured data.

Manual operation: See "Playback Settings" on page 96

INSTrument:BLOCk:CHANnel[:SETTings]:FILE<i>:STOP:SAMPle <Sample>

This command defines the sample within the input file <i> at which replay stops.

Suffix:

<i> 1..99
Sequential number of a configured input file (required only if multiple files are loaded for a single channel)

Parameters:

<Sample> numeric value

Range: 0 to record length of stored data

Example:
```
INST:BLOC:CHAN:FILE:STAR:SAMP 10
INST:BLOC:CHAN:FILE:STOP:SAMP 1000
```
Data from the input file is replayed starting with sample number 10 and ending with sample number 1000.

Manual operation: See "Playback Settings" on page 96

INSTrument:BLOCk:CHANnel[:SETTings]:FILE<i>:STOP:TIME <Time>

This command defines the (absolute) time within the input file <i> at which replay stops.

Suffix:

<i> 1..99
Sequential number of a configured input file (required only if multiple files are loaded for a single channel)

Parameters:

<Time> double value

Absolute stop time (not duration)

Range: 0 to meas time of stored data
Default unit: s

Example:
```
INST:BLOC:CHAN:FILE:START:TIME 0.32s
INST:BLOC:CHAN:FILE:STOP:TIME 0.64s
```
Data from the input file is replayed starting at 0.32 s and ending at 0.64 s of the captured data.

Manual operation: See "Playback Settings" on page 96

INSTrument:BLOCk:CHANnel[:SETTings]:FILE<i>[:IQTar] <FileName>,<ABW>[,<IQChannel]

Assigns the specified iq.tar file as the input source for the currently selected channel. The file is automatically loaded to the R&S VSE software and assigned the sequential number provided as the FILE<i> suffix. Subsequent commands concerning file input from this file must use the same suffix.

To query the values of the stored meta data after loading the file, see `EXPort:IQ:META:DATA<I>:VALue?` on page 404.

Suffix:

<i> 1..99
Sequential number of the source

Parameters:

<FileName> String containing the path and file name of the file to be loaded.

<ABW> The analysis bandwidth to be used by the measurement. The bandwidth must be smaller than or equal to the bandwidth of the data that was stored in the file.
Tip: If the file was stored using the R&S VSE software, the ABW is included in the meta data information in the file (see "Meta Data Settings" on page 90).

<IQChannel>	ID of the I/Q channel in the stored file which is to be restored to the selected measurement channel. If this parameter is omitted, the first channel found is restored. Tip: If the file was stored using the R&S VSE software, the I/Q channel is included in the meta data information in the file (see "Meta Data Settings" on page 90).

Example:
```
INST:SEL 'IQ Analyzer'
INST:BLOC:CHAN:FILE 'C:
\Users\ImportFile.iqtar',10MHZ,2
```
The data from the second I/Q channel stored in the file is used as input for the current measurement channel 'IQ Analyzer'. The displayed bandwidth is restricted to 10 MHz.

Manual operation: See "File" on page 73

13.4.3 Configuring Channel Input Sources

The following commands define which type of input is used for a measurement channel.

The commands for input from a file are described in chapter 13.4.2, "Loading Input Files", on page 276.

INSTrument:BLOCk:CHANnel[:SETTings]:DEVice<d>..284
INSTrument:BLOCk:CHANnel[:SETTings]:SOURce... 285
INSTrument:BLOCk:CHANnel[:SETTings]:SOURce:TYPE... 285

INSTrument:BLOCk:CHANnel[:SETTings]:DEVice<d> <DevName>

Assigns the specified instrument as the input source for the currently selected channel. The instrument must have been configured before it can be assigned (see chapter 13.4.1, "Configuring Instruments", on page 264).

Suffix:

<d>	1..99 Sequential number of the source

Parameters:

<DevName>	string Name of a configured instrument. **'NONE'** No instrument or file is defined as the input source.

Example:
```
INST:BLOCK:CHAN:DEV 'MyFSW'
```

Manual operation: See "Instrument" on page 73

INSTrument:BLOCk:CHANnel[:SETTings]:SOURce <Type>

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

Parameters:

<Type> FILE | DEVice | NONE

FILE
A loaded file is used for input.
(See chapter 13.4.2, "Loading Input Files", on page 276.)

DEVice
A configured device provides input for the measurement
(See chapter 13.4.1, "Configuring Instruments", on page 264.)

NONE
No input source defined.

Manual operation: See "Input Type" on page 72

INSTrument:BLOCk:CHANnel[:SETTings]:SOURce:TYPE <Source>

Configures the source of input to be used from the selected instrument.

See also chapter 7.1, "Input Sources", on page 52.

Parameters:

<Source> **RF**
Radio Frequency ("RF INPUT" connector)

'Channel 1' | 'Channel 2' | 'Channel 3' | 'Channel 4'
Oscilloscope input channel 1, 2, 3, or 4.

*RST: RF

Manual operation: See "Input Source" on page 73

13.4.4 Configuring Measurement Channels

The following commands are required to configure a measurement channel and select the application in a remote environment. The tasks for manual operation are described in chapter 7.3, "Controlling Measurement Channels, Groups, and Sequences", on page 67.

Useful commands for configuring measurement channels described elsewhere:

- `INSTrument:BLOCk:CHANnel[:SETTings]:USE` on page 295
- `INSTrument:BLOCk:CHANnel:MOVE` on page 294
- chapter 13.4.3, "Configuring Channel Input Sources", on page 284
- chapter 13.4.2, "Loading Input Files", on page 276
- `SYSTem:PRESet:CHANnel[:EXECute]` on page 388

Remote commands exclusive to configuring measurement channels:

ABORt..286
INITiate<n>:CONMeas..287
INITiate<n>:CONTinuous..287
INITiate<n>[:IMMediate]...288
INSTrument:BLOCk:CHANnel[:SETTings]:RECord.......................................289
INSTrument:CREate:DUPLicate...289
INSTrument:CREate[:NEW]...289
INSTrument:CREate:REPLace...290
INSTrument:DELete..290
INSTrument:LIST?..291
INSTrument:REName..291
INSTrument[:SELect]..292

ABORt

This command aborts the measurement in the current measurement channel and resets the trigger system.

To prevent overlapping execution of the subsequent command before the measurement has been aborted successfully, use the `*OPC?` or `*WAI` command after `ABOR` and before the next command.

For details see chapter 12.1.4.1, "Preventing Overlapping Execution", on page 234.

To abort an entire group of measurements, use the `INITiate:BLOCk:ABORt` command.

To abort the entire sequence of measurements, use the `INITiate:SEQuencer:ABORt` command.

Note on blocked remote control programs:

If a sequential command cannot be completed, for example because a triggered sweep never receives a trigger, the remote control program will never finish and the remote channel to the instrument in use is blocked for further commands. In this case, you must interrupt processing on the remote channel first in order to abort the measurement.

To do so, send a "Device Clear" command from the control instrument to the instrument in use on a parallel channel to clear all currently active remote channels. Depending on the used interface and protocol, send the following commands:

- **Visa**: `viClear()`
- **GPIB**: `ibclr()`
- **RSIB**: `RSDLLibclr()`

Now you can send the `ABORt` command on the remote channel performing the measurement.

Example: `ABOR;:INIT:IMM`
Aborts the current measurement and immediately starts a new one.

Example: `ABOR;*WAI`
`INIT:IMM`
Aborts the current measurement and starts a new one once abortion has been completed.

Usage: Event
SCPI confirmed

Manual operation: See "Pause / Cont" on page 74

INITiate<n>:CONMeas

This command restarts a (single) measurement that has been stopped (using `ABORt`) or finished in single measurement mode.

The measurement is restarted at the beginning, not where the previous measurement was stopped.

As opposed to `INITiate<n>[:IMMediate]`, this command does not reset traces in maxhold, minhold or average mode. Therefore it can be used to continue measurements using maxhold or averaging functions.

Tip: To continue all measurements in a group, use the `INITiate:BLOCk:CONMeas` command.

Suffix:
<n> irrelevant

Example: `INIT:CONT OFF`
Switches to single measurement mode.
`DISP:WIND:TRAC:MODE AVER`
Switches on trace averaging.
`SWE:COUN 20`
Setting the measurement counter to 20 measurements.
`INIT;*WAI`
Starts the measurement and waits for the end of the 20 measurements.
`INIT:CONM;*WAI`
Continues the measurement (next 20 measurements) and waits for the end.
Result: Averaging is performed over 40 measurements.

Usage: Event

Manual operation: See "Pause / Cont" on page 74

INITiate<n>:CONTinuous <State>

This command controls the measurement mode for an individual measurement channel.

Note that in single measurement mode, you can synchronize to the end of the measurement with *OPC, *OPC? or *WAI. In continuous measurement mode, synchronization to the end of the measurement is not possible. Thus, it is not recommended that you use continuous measurement mode in remote control, as results like trace data or markers are only valid after a single measurement end synchronization.

For details on synchronization see chapter 12.1.4, "Command Sequence and Synchronization", on page 233.

If the measurement mode is changed for a measurement channel while a measurement sequence is active (see `INITiate:SEQuencer:IMMediate` on page 298) the mode is only considered the next time the group containing the measurement channel is started.

Tip: To change the measurement mode for an entire group, use the `INITiate:BLOCk:CONTinuous` command.

Suffix:

<n>	irrelevant

Parameters:

<State> ON | OFF | 0 | 1

ON | 1
Continuous measurement

OFF | 0
Single measurement

*RST: 1

Example:
`INIT:CONT OFF`
Switches the measurement mode to single measurement.
`INIT:CONT ON`
Switches the measurement mode to continuous measurement.

Manual operation: See "Measurement mode (Single / Continuous)" on page 74

INITiate<n>[:IMMediate]

This command starts a (single) new measurement.

With measurement count or average count > 0, this means a restart of the corresponding number of measurements. With trace mode MAXHold, MINHold and AVERage, the previous results are reset on restarting the measurement.

You can synchronize to the end of the measurement with *OPC, *OPC? or *WAI.

For details on synchronization see chapter 12.1.4, "Command Sequence and Synchronization", on page 233.

Suffix:

<n>	irrelevant

Example:
`INIT:CONT OFF`
Switches to single measurement mode.
`DISP:WIND:TRAC:MODE AVER`
Switches on trace averaging.
`SWE:COUN 20`
Sets the measurement counter to 20 measurements.
`INIT;*WAI`
Starts the measurement and waits for the end of the 20 measurements.

Usage: Event

Manual operation: See "Capture" on page 74

INSTrument:BLOCk:CHANnel[:SETTings]:RECord

Starts a measurement for the currently selected channel and stores the measurement data to a temporary file.

You can store the file permanently using `EXPort:IQ:FILE`) .

For details see chapter 8.3.1, "Recording Measurement Data", on page 86.

Usage: Event

Manual operation: See "Record" on page 74

INSTrument:CREate:DUPLicate

This command duplicates the currently selected measurement channel, i.e creates a new measurement channel of the same type and with the identical measurement settings. The name of the new channel is the same as the copied channel, extended by a consecutive number (e.g. "IQAnalyzer" -> "IQAnalyzer2").

The channel to be duplicated must be selected first using the `INST:SEL` command.

The new channel is inserted in the currently selected group of the measurement sequence (see `INSTrument:BLOCk[:SELect]` on page 297).

Example:
`INST:SEL 'IQAnalyzer'`
`INST:CRE:DUPL`
Duplicates the channel named 'IQAnalyzer' and creates a new measurement channel named 'IQAnalyzer2'.

Usage: Event

Manual operation: See "Duplicate Current Channel" on page 73

INSTrument:CREate[:NEW] <ChannelType>, <ChannelName>

This command adds an additional measurement channel.

The new channel is inserted in the currently selected group of the measurement sequence (see `INSTrument:BLOCk[:SELect]` on page 297).

See also

- INSTrument[:SELect] on page 292
- INSTrument:CREate:DUPLicate on page 289

Parameters:

<ChannelType> Channel type of the new channel.
For a list of available channel types see INSTrument:LIST? on page 291.

<ChannelName> String containing the name of the channel. The channel name is displayed as the tab label for the measurement channel.
Note: If the specified name for a new channel already exists, the default name, extended by a sequential number, is used for the new channel (see INSTrument:LIST? on page 291).

Example: `INST:CRE IQ, 'IQAnalyzer2'`
Adds an additional I/Q Analyzer channel named "IQAnalyzer2".

Manual operation: See "New Channel" on page 73

INSTrument:CREate:REPLace <ChannelName1>,<ChannelType>,<ChannelName2>

This command replaces a measurement channel with another one.

Setting parameters:

<ChannelName1> String containing the name of the measurement channel you want to replace.

<ChannelType> Channel type of the new channel.
For a list of available channel types see INSTrument:LIST? on page 291.

<ChannelName2> String containing the name of the new channel.
Note: If the specified name for a new channel already exists, the default name, extended by a sequential number, is used for the new channel (see INSTrument:LIST? on page 291).

Example: `INST:CRE:REPL 'IQAnalyzer2',IQ,'IQAnalyzer'`
Replaces the channel named 'IQAnalyzer2' by a new measurement channel of type 'IQ Analyzer' named 'IQAnalyzer'.

Usage: Setting only

Manual operation: See "Replace Current Channel" on page 73

INSTrument:DELete <ChannelName>

This command deletes a measurement channel.

The last measurement channel cannot be deleted; at least one channel must always be defined.

Tip: To remove a measurement channel without deleting it permanently, deactivate it using INSTrument:BLOCk:CHANnel[:SETTings]:USE on page 295.

Parameters:

<ChannelName> String containing the name of the channel you want to delete.
A measurement channel must exist in order to be able delete it.

Example: `INST:DEL 'IQAnalyzer4'`
Deletes the channel with the name 'IQAnalyzer4'.

Usage: Event

INSTrument:LIST?

This command queries all active measurement channels. This is useful in order to obtain the names of the existing measurement channels, which are required in order to replace or delete the channels.

Return values:

<ChannelType>, <ChannelName> For each channel, the command returns the channel type and channel name (see tables below).
Tip: to change the channel name, use the `INSTrument:REName` command.

Example: `INST:LIST?`
Result for 3 measurement channels:
`'ADEM','Analog Demod','IQ','IQ Analyzer','IQ','IQ Analyzer2'`

Usage: Query only

Table 13-1: Available measurement channel types and default channel names

Application	<ChannelType> Parameter	Default Channel Name*)
I/Q Analyzer	IQ	IQ Analyzer
Analog Demodulation	ADEM	Analog Demod
Pulse (R&S VSE-K6)	PULSE	Pulse
GSM (R&S VSE-K10)	GSM	GSM
VSA (R&S VSE-K70)	DDEM	VSA
3GPP FDD BTS (R&S VSE-K72)	BWCD	3G FDD BTS
3GPP FDD UE (R&S VSE-K72)	MWCD	3G FDD UE
WLAN (R&S VSE-K91)	WLAN	WLAN
LTE (R&S VSE-K10x)	LTE	LTE
Note: the default channel name is also listed in the table. If the specified name for a new channel already exists, the default name, extended by a sequential number, is used for the new channel.		

INSTrument:REName <ChannelName1>, <ChannelName2>

This command renames a measurement channel.

Parameters:

<ChannelName1>	String containing the name of the channel you want to rename.
<ChannelName2>	String containing the new channel name. Note that you can not assign an existing channel name to a new channel; this will cause an error.
Example:	`INST:REN 'IQAnalyzer2','IQAnalyzer3'` Renames the channel with the name 'IQAnalyzer2' to 'IQAnalyzer3'.
Usage:	Setting only

INSTrument[:SELect] <ChannelType> | <ChannelName>

This command activates a new measurement channel with the defined channel type, or selects an existing measurement channel with the specified name.

Also see

- `INSTrument:CREate[:NEW]` on page 289

Parameters:

<ChannelType>	Channel type of the new channel. For a list of available channel types see `INSTrument:LIST?` on page 291.
<ChannelName>	String containing the name of the channel.

Example:	`INST IQ`
	Activates a measurement channel for the I/Q Analyzer application.
	`INST 'MyIQSpectrum'`
	Selects the measurement channel named 'MyIQSpectrum' (for example before executing further commands for that channel).

Usage:	SCPI confirmed
Manual operation:	See "I/Q Analyzer" on page 32

13.4.5 Controlling Measurement Groups

The following commands are required to control measurement sequences in a remote environment. The functions for manual operation are described in chapter 7.3.1, "Sequence Functions", on page 68 and chapter 7.3.2, "Group Functions", on page 69.

INITiate:BLOCk:ABORt....................293
INITiate:BLOCk:CONMeas....................293
INITiate:BLOCk:CONTinuous....................293
INITiate:BLOCk:IMMediate....................294
INSTrument:BLOCk:CHANnel:MOVE....................294
INSTrument:BLOCk:CHANnel[:SETTings]:USE....................295
INSTrument:BLOCk:CREate[:NEW]....................295
INSTrument:BLOCk:DELete....................296

INSTrument:BLOCk:LIST?.....296
INSTrument:BLOCk:MOVE.....296
INSTrument:BLOCk[:SELect].....297
INSTrument:BLOCk:USE.....297

INITiate:BLOCk:ABORt

This command stops the currently active measurement group.

To continue the measurement for the group, use `INITiate:BLOCk:CONMeas` on page 293. To start a new measurement for the group, use `INITiate:SEQuencer:IMMediate` on page 298.

To abort the entire measurement sequence, use `INITiate:SEQuencer:ABORt` on page 297.

Usage: Event

Manual operation: See "Pause / Cont" on page 71

INITiate:BLOCk:CONMeas [<GroupName>]

This command restarts a measurement that has been stopped in single capture mode.

The measurement is restarted from the beginning.

As opposed to `INITiate:BLOCk:IMMediate` on page 294, this command does not reset traces in maxhold, minhold or average mode. Therefore it can be used to continue measurements using max hold or averaging functions.

Parameters:

<GroupName> String containing the name of the group for which the measurement is continued.
If no group parameter is provided, the currently selected group is continued (see `INSTrument:BLOCk[:SELect]` on page 297).

Usage: Event

Manual operation: See "Pause / Cont" on page 71

INITiate:BLOCk:CONTinuous <State> [,<GroupName>]

Defines the capture mode for the measurement group and channels it contains.

For details see "Measurement mode" on page 31.

To change the capture mode for an individual channel, use the `INITiate<n>:CONTinuous` command.

Note: In order to synchronize to the end of a measurement sequence using *OPC, *OPC? or *WAI you must use `SINGle` capture mode.

If the capture mode is changed for a measurement channel while a measurement sequence is active (see `INITiate:SEQuencer:IMMediate` on page 298) the mode is only considered the next time the measurement in that channel is activated by the Sequencer.

Parameters:

<State> ON | OFF | 1 | 0

ON | 1
Continuous measurement

OFF | 0
Single measurement

*RST: OFF

Setting parameters:

<GroupName> String containing the name of the group for which the capture mode is defined.
If no group parameter is provided, the currently selected group is configured (see `INSTrument:BLOCk[:SELect]` on page 297).

Example: `INITiate:BLOCk:CONT OFF,'Group 2'`

Manual operation: See "Measurement mode (Single / Continuous)" on page 71

INITiate:BLOCk:IMMediate [<GroupName>]

This command starts a new measurement for all active channels in the selected or specified group.

Depending on the capture mode, a single or continuous measurements are performed (see `INITiate:BLOCk:CONTinuous` on page 293).

Setting parameters:

<GroupName> String containing the name of the group for which a measurement is started.
If no group parameter is provided, the currently selected group is started (see `INSTrument:BLOCk[:SELect]` on page 297).

Usage: Event

Manual operation: See "Capture" on page 70

INSTrument:BLOCk:CHANnel:MOVE <GroupName>, <Predecessor>, <ChannelName>

This command moves the specified channel to a different group. This command is useful to change the order in which the measurements are performed within a sequence (within a single group, all measurements are performed synchronously).

To move an entire group within a sequence, see `INSTrument:BLOCk:MOVE` on page 296.

Setting parameters:

<GroupName> String containing the name of the group in which the channel is to be included.
For a list of available groups see `INSTrument:SEQuencer:LIST?` on page 298.

<Predecessor> String containing the name of an existing channel in the specified group after which the specified channel will be inserted.
Use an empty string to move the channel to the first position in the group.

<ChannelName> String containing the name of the channel to be moved.

Example: `INST:BLOC:CHAN:MOVE 'Group 1','IQ Analyzer','IQ Analyzer2'`
Moves the measurement channel named `IQ Analyzer2` to the group 1, after the `IQ Analyzer` measurement channel.

Usage: Setting only

INSTrument:BLOCk:CHANnel[:SETTings]:USE <State>,<ChannelName>

If activated, the specified measurement channel is included in the currently selected group measurement.

Parameters:

<State> 1 | 0

<ChannelName> String containing the name of the channel.

Example: `INST:BLOC:CHAN:USE 1,'IQAnalyzer'`

Manual operation: See "Activate/Deactivate Channel" on page 72

INSTrument:BLOCk:CREate[:NEW] <GroupName>, <Predecessor>

This command inserts a new group in the measurement sequence. The new group is automatically selected for further group operations.

Tip: To insert a measurement channel in the group see `INSTrument:CREate[:NEW]` on page 289.

Parameters:

<Predecessor> String containing the name of an existing group after which the new group will be inserted.
Use an empty string to create the new group at the first position.

Setting parameters:

<GroupName> String containing the name of the group you want to create.

Example: `INST:BLOC:CRE 'AdemodGroup', 'Group 1'`
Adds an additional group named "AdemodGroup2" after the existing group named "Group 1".

Usage: Setting only

Manual operation: See "New Group" on page 70

INSTrument:BLOCk:DELete <GroupName>

This command deletes a measurement group. At least one group with one measurement channel must remain in the sequence.

Tip: To delete an individual measurement channel use INSTrument:DELete on page 290.

To remove a group from the measurement sequence without deleting it permanently, deactivate it using INSTrument:BLOCk:USE on page 297.

Parameters:

<GroupName> String containing the name of the group you want to delete. The last existing group in a sequence cannot be deleted.

Example: `INST:BLOC:DEL 'Group 1'`

Usage: Event

Manual operation: See "Close" on page 71

INSTrument:BLOCk:LIST?

This command queries all active measurement channels in the currently selected group. This is useful in order to obtain the names of the existing measurement channels, which are required in order to replace or delete the channels.

For a list of available channel types and names see INSTrument:LIST? on page 291.

Return values:

<ChannelName> Comma-separated list of strings containing the name of an active channel in the group

Example: `INST:BLOC:LIST?`
Result for 3 measurement channels:
`'Analog Demod','IQ Analyzer','IQ Analyzer 2'`

Usage: Query only

INSTrument:BLOCk:MOVE <Predecessor>

This command moves the selected group to a different position within the measurement sequence.

Tip: To move an individual channel between groups, see INSTrument:BLOCk:CHANnel:MOVE on page 294.

Parameters:

<Predecessor> String containing the name of an existing group after which the selected group will be inserted.
Use an empty string to move the new group to the first position in the sequence.

Usage: Event

INSTrument:BLOCk[:SELect] <GroupName>

This command selects a measurement group for further operations, for example channel functions.

Parameters:

<GroupName> String containing the name of the group.

Usage: Setting only

INSTrument:BLOCk:USE <State>,<GroupName>

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

Parameters:

<State> 1 | 0

Setting parameters:

<GroupName> String containing the name of the group.

Example: `INST:BLOC:USE 1,'Group 1'`

Manual operation: See "Activate/Deactivate Group" on page 70

13.4.6 Controlling Measurement Sequences

The following commands are required to control measurement sequences in a remote environment. The functions for manual operation are described in chapter 7.3.1, "Sequence Functions", on page 68 and chapter 7.3.2, "Group Functions", on page 69.

INITiate:SEQuencer:ABORt..297
INITiate:SEQuencer:IMMediate..298
INITiate:SEQuencer:MODE..298
INSTrument:SEQuencer:LIST?..298

INITiate:SEQuencer:ABORt

This command stops the currently active sequence of measurements.

You can start a new sequence any time using `INITiate:SEQuencer:IMMediate` on page 298.

Tip: To stop the currently active group only - and continue the measurement sequence with that group later - use the `INITiate:BLOCk:ABORt` and `INITiate:BLOCk:CONMeas` commands.

Usage: Event

Manual operation: See "Stop" on page 68

INITiate:SEQuencer:IMMediate

This command starts a new measurement sequence according to the capture mode specified using `INITiate:SEQuencer:MODE` on page 298.

Usage: Event

Manual operation: See "Play" on page 68

INITiate:SEQuencer:MODE <Mode>

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

For details see "Measurement mode" on page 31.

Note: In order to synchronize to the end of a measurement sequence using *OPC, *OPC? or *WAI you must use `SINGle` Sequence mode.

Parameters:

<Mode>

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

CONTinuous
Each measurement group is started one after the other in the order of definition. All measurement channels in a group are started simultaneously and performed once. After *all* measurements are completed, the next group is started. After the last group, the measurement sequence restarts with the first one and continues until it is stopped explicitely (see "Play" on page 68).

*RST: CONTinuous

Manual operation: See "Measurement mode (Single / Continuous)" on page 68

INSTrument:SEQuencer:LIST?

This command queries all active groups in a measurement sequence. This is useful in order to obtain the names of the existing groups, which are required in order to replace or delete the groups.

Return values:

<Groups> Comma-separated list of strings containing the name of an active group.

Example: `INST:SEQ:LIST?`
Result for 2 groups:
`'Group 1','Group 2'`

Usage: Query only

13.5 Configuring the Result Display

The commands required to configure the screen display in a remote environment are described here.

The tasks for manual operation are described in chapter 6, "Operating Basics", on page 35.

- Global Layout Commands....................299
- Working with Windows in the Display....................305
- General Window Commands....................310

13.5.1 Global Layout Commands

The following commands are required to change the evaluation type and rearrange the screen layout across measurement channels as you do in manual operation.

For compatibility with other Rohde & Schwarz Signal and Spectrum Analyzers, the layout commands described in chapter 13.5.2, "Working with Windows in the Display", on page 305 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]?....................299
LAYout:GLOBal:CATalog[:WINDow]?....................303
LAYout:GLOBal:IDENtify[:WINDow]?....................304
LAYout:GLOBal:REMove[:WINDow]....................305
LAYout:GLOBal:REPLace[:WINDow]....................305

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.
(See also "Window tabs" on page 45).

<NewChanName> string

Name of the channel for which a new window is to be added.

<NewWinType> string

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

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

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

Usage: Query only

Table 13-2: <WindowType> parameter values for IQ Analyzer application

Parameter value	Window type
'FREQ'	Spectrum
'MAGN'	Magnitude
'MTABle'	Marker table
'PEAKlist'	Marker peak list
'RIMAG'	Real/Imag (I/Q)
'VECT'	I/Q Vector

Table 13-3: <WindowType> parameter values for Pulse application

Parameter value	Window type
MCAPture	Magnitude Capture Buffer
MTABle	Marker Table
PDIStribution	Parameter Distribution

Parameter value	Window type
PFRequency	Pulse Frequency
PMAGnitude	Pulse Magnitude
PPHase	Pulse Phase
PPWrapped	Pulse phase, wrapped
PRESults	Pulse Results
PSPectrum	Parameter Spectrum
PSTatistics	Pulse Statistics
PTRend	Parameter Trend
RRSPectrum	Result Range Spectrum

Table 13-4: <WindowType> parameter values for AnalogDemod application

Parameter value	Window type
MTABle	Marker table
PEAKlist	Marker peak list
RSUMmary	Result summary
'XTIM:AM'	RF Time Domain (= RF power)
'XTIM:AM:RELative'	AM Time Domain
'XTIM:AM:RELative:AFSPectrum'	AM Spectrum
'XTIM:FM'	FM Time Domain
'XTIM:FM:AFSPectrum'	FM Spectrum
'XTIM:PM'	PM Time Domain
'XTIM:PM:AFSPectrum'	PM Spectrum
'XTIM:SPECtrum'	RF Spectrum

Table 13-5: <WindowType> parameter values for GSM application

Parameter value	Window type
CONStell	Constellation
ETIMe	EVM vs Time
MCAPture	Magnitude Capture
MERRor	Magnitude Error vs Time
MTABle	Marker Table
MACCuracy	Modulation Accuracy
MSFDomain	Modulation Spectrum Graph (Frequency domain)
MSTable	Modulation Spectrum Table

Parameter value	Window type
PERRor	Phase Error vs Time
PSTable	Power vs Slot
PTFull	PvT Full Burst
TGSGraph	Trigger to Sync Graph
TGSTable	Trigger to Sync Table
TSFDomain	Transient Spectrum Graph (Frequency domain)
TSTable	Transient Spectrum Table

Table 13-6: <WindowType> parameter values for VSA application

Parameter value	Data source (+default result display)
CBUFfer	Capture buffer (Magnitude absolute)
MEAS	Meas & Ref (Magnitude relative)
REF	
EQUalizer	Equalizer
EVECtor	Error vector (EVM)
MACCuracy	Modulation Accuracy (Result Summary)
MERRor	Modulation Errors (Magnitude error)
SYMB	Symbols (Hexadecimal)

Table 13-7: <WindowType> parameter values for 3GPP FDD application

Parameter value	Window type
BITStream	Bitstream
CCONst	Composite Constellation
CDPower	Code Domain Power
CDEPower	Code Domain Error Power
CEVM	Composite EVM
CTABle	Channel Table
EVMChip	EVM vs Chip
FESLot	Frequency Error vs Slot
MECHip	Magnitude Error vs Chip
MTABle	Marker table
PCDerror	Peak Code Domain Error
PDSLot	Phase Discontinuity vs Slot
PECHip	Phase Error vs Chip

Parameter value	**Window type**
PSLot	Power vs Slot
PSYMbol	Power vs Symbol
RSUMmary	Result Summary
SCONst	Symbol Constellation
SEVM	Symbol EVM
SMERror	Symbol Magnitude Error
SPERror	Symbol Phase Error

Table 13-8: <WindowType> parameter values for WLAN application

Parameter value	**Window type**
BITStream	Bitstream
CMEMory	Magnitude Capture
CONStellation	Constellation
CVCarrier	Constellation vs Carrier (**IEEE 802.11a, ac, g (OFDM), n** only)
EVCarrier	EVM vs Carrier (**IEEE 802.11a, ac, g (OFDM), n** only)
EVCHip	EVM vs Chip (**IEEE 802.11b and g (DSSS)** only)
EVSYmbol	EVM vs Symbol (**IEEE 802.11a, ac, g (OFDM), n** only)
FSPectrum	FFT Spectrum
GDELay	Group Delay (**IEEE 802.11a, ac, g (OFDM), n** only)
PFPPdu	PvT Full PPDU
RSDetailed	Result Summary Detailed (**IEEE 802.11a, ac, g (OFDM), n** only)
RSGLobal	Result Summary Global
SFIeld	Signal Field (**IEEE 802.11a, ac, g (OFDM), n**) PLCP Header (**IEEE 802.11b and g (DSSS)**)
SFLatness	Spectrum Flatness (**IEEE 802.11a, ac, g (OFDM), n** only)

LAYout:GLOBal:CATalog[:WINDow]?

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',RIGH,
'Spectrum',FREQ
```
Adds a new window named 'Spectrum' with a Spectrum display to the right of window 1.

Example:
```
LAYout:GLOBal:IDENtify? 'IQ Analyzer',
'Spectrum'
```
Result:
```
2
```
Window index is: 2.

Usage: Query only

LAYout:GLOBal:REMove[:WINDow] <ChannelName>,<WindowName>

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 306 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.

13.5.2 Working with Windows in the Display

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*.

(See `INSTrument[:SELect]` on page 292).

To configure the layout of windows across measurement channels, use the chapter 13.5.1, "Global Layout Commands", on page 299.

LAYout:ADD[:WINDow]?....................306
LAYout:CATalog[:WINDow]?....................307
LAYout:IDENtify[:WINDow]?....................307
LAYout:REMove[:WINDow]....................308
LAYout:REPLace[:WINDow]....................308
LAYout:WINDow<n>:ADD?....................309
LAYout:WINDow<n>:IDENtify?....................309
LAYout:WINDow<n>:REMove....................310
LAYout:WINDow<n>:REPLace....................310

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.

Parameters:

<WindowName> String containing the name of the existing window the new window is inserted next to.
By default, the name of a window is the same as its index. To determine the name and index of all active windows, use the `LAYout:CATalog[:WINDow]?` query.

<Direction> LEFT | RIGHt | ABOVe | BELow
Direction the new window is added relative to the existing window.

<WindowType> text value
Type of result display (evaluation method) you want to add.
See the table below for available parameter values.
Note that the window type must be valid for the active measurement channel. To create a window for a different measurement channel use the `LAYout:GLOBal:REPLace[:WINDow]` command.

Return values:

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

Example: `LAY:ADD? '1',LEFT,MTAB`
Result:
`'2'`
Adds a new window named '2' with a marker table to the left of window 1.

Usage: Query only

Manual operation: See "Magnitude" on page 112

Table 13-9: <WindowType> parameter values for IQ Analyzer application

Parameter value	Window type
FREQ	Spectrum
MAGN	Magnitude
MTABle	Marker table
PEAKlist	Marker peak list
POLar	Phase vs. time
RIMAG	Real/Imag (I/Q)
STATistic	Statistics diagram
VECT	I/Q Vector

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 306 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 306 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 306 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.

13.5.3 General Window Commands

The following commands are required to work with windows, independently of the application.

Note that the suffix <n> always refers to the window *in the currently selected measurement channel*.

(See `INSTrument[:SELect]` on page 292).

DISPlay[:WINDow<n>]:SELect......................311

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

13.6 Remote Commands for the I/Q Analyzer

- Configuring I/Q Analyzer Measurements....311
- I/Q Analysis....344
- Retrieving Results....380

13.6.1 Configuring I/Q Analyzer Measurements

The following commands configure the I/Q Analyzer measurements.

- Configuring the Data Input and Output....311
- Configuring the Vertical Axis (Amplitude, Scaling)....315
- Configuring the Axes for Statistical Displays....322
- Frequency....323
- Triggering....325
- Configuring Data Acquisition....333
- Adjusting Settings Automatically....342

13.6.1.1 Configuring the Data Input and Output

The following commands are required to configure data input and output.

- RF Input....311
- Configuring the Outputs....315

RF Input

INPut:ATTenuation:PROTection[:STATe]....312
INPut:COUPling....312
INPut:FILTer:HPASs[:STATe]....312
INPut:FILTer:YIG[:STATe]....313
INPut:IMPedance....313
INPut:PRESelection:SET....313
INPut:PRESelection[:STATe]....313
INPut:SELect....314
INPut:TYPE....314
INSTrument:BLOCk:CHANnel[:SETTings]:SOURce....314

INPut:ATTenuation:PROTection[:STATe] <State>

This command turns the availability of attenuation levels of 10 dB or less on and off.

Parameters:

<State> ON | OFF

*RST: OFF

Example: `INP:ATT:PROT ON`

Manual operation: See "10 dB Minimum Attenuation" on page 131

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 130

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 instrument in use 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 130

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 130.

Example: `INP:FILT:YIG OFF`
Deactivates the YIG-preselector.

Manual operation: See "YIG-Preselector" on page 130

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 130

INPut:PRESelection:SET <Mode>

This command selects the preselector mode.

The command is available with the optional preselector.

Parameters:
<Mode>

NARRow
Performs a measurement by automatically applying all available combinations of low and high pass filters consecutively. These combinations all have a narrow bandwidth.

WIDE
Performs a measurement by automatically applying all available bandpass filters consecutively. The bandpass filters have a wide bandwidth.

Manual operation: See "Preselector Mode" on page 131

INPut:PRESelection[:STATe] <State>

This command turns the preselector on and off.

Manual operation: See "Preselector State" on page 131

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.

This command is identical to `INSTrument:BLOCk:CHANnel[:SETTings]:SOURce` on page 285, applied to the currently selected channel and block.

Parameters:

<Source>

RF
Radio Frequency ("RF INPUT" connector)

FIQ
I/Q data file

*RST: RF

Manual operation: See "Input Type" on page 72

INPut:TYPE <Input>

The command selects the signal source.

Parameters:

<Input>

INPUT1
Selects RF input 1.

INPUT2
Selects RF input 2.

*RST: INPUT1

Example: `INP:TYPE INPUT1`
Selects RF input 1.

Manual operation: See "Input Selection" on page 132

INSTrument:BLOCk:CHANnel[:SETTings]:SOURce <Type>

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

Parameters:

<Type> FILE | DEVice | NONE

FILE
A loaded file is used for input.
(See chapter 13.4.2, "Loading Input Files", on page 276.)

DEVice
A configured device provides input for the measurement
(See chapter 13.4.1, "Configuring Instruments", on page 264.)

NONE
No input source defined.

Manual operation: See "Input Type" on page 72

Configuring the Outputs

Configuring trigger input/output is described in "Configuring the Trigger Output" on page 332.

DIAGnostic:SERVice:NSOurce..315

DIAGnostic:SERVice:NSOurce <State>

This command turns the 28 V supply of the BNC connector labeled NOISE SOURCE CONTROL on the instrument in use on and off.

For details see chapter 10.2.4.1, "Input from Noise Sources", on page 125.

Parameters:

<State> ON | OFF

*RST: OFF

Example: `DIAG:SERV:NSO ON`

Manual operation: See "Noise Source" on page 133

13.6.1.2 Configuring the Vertical Axis (Amplitude, Scaling)

The following commands are required to configure the amplitude and vertical axis settings in a remote environment.

- Amplitude Settings..315
- Configuring the Attenuation..317
- Configuring a Preamplifier..319
- Scaling the Y-Axis..320

Amplitude Settings

The tasks for manual configuration are described in chapter 10.3.3.2, "Amplitude Settings", on page 137.

Remote commands exclusive to amplitude configuration:

CALCulate<n>:MARKer<m>:FUNCtion:REFerence..315
CALCulate<n>:UNIT:POWer..316
DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:RLEVel... 316
DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:RLEVel:OFFSet... 316
[SENSe:]ADJust:LEVel..317

CALCulate<n>:MARKer<m>:FUNCtion:REFerence

This command matches the reference level to the power level of a marker.

If you use the command in combination with a delta marker, that delta marker is turned into a normal marker.

Example: `CALC:MARK2:FUNC:REF`
Sets the reference level to the level of marker 2.

Usage: Event

Manual operation: See "Reference Level = Marker Level" on page 205

CALCulate<n>:UNIT:POWer <Unit>

This command selects the unit of the y-axis.

The unit applies to all power-based measurement windows (regardless of the <n> suffix).

Parameters:
<Unit> DBM | V | A | W | DBPW | WATT | DBUV | DBMV | VOLT | DBUA | AMPere
*RST: dBm

Example: `CALC:UNIT:POW DBM`
Sets the power unit to dBm.

Manual operation: See "Unit" on page 139

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 "Reference Level" on page 138

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 "Shifting the Display (Offset)" on page 138

[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 "Setting the Reference Level Automatically (Auto Level)" on page 139

Configuring the Attenuation

INPut:ATTenuation....317
INPut:ATTenuation:AUTO....317
INPut:EATT....318
INPut:EATT:AUTO....318
INPut:EATT:STATe....318

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 "Attenuation Mode / Value" on page 140

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

Manual operation: See "Attenuation Mode / Value" on page 140

INPut:EATT <Attenuation>

This command defines an electronic attenuation manually. Automatic mode must be switched off (`INP:EATT:AUTO OFF`, see `INPut:EATT:AUTO` on page 318).

If the current reference level is not compatible with an attenuation that has been set manually, the command also adjusts the reference level.

This command requires the electronic attenuation hardware option.

Parameters:

<Attenuation> attenuation in dB

Range: see data sheet
Increment: 1 dB
*RST: 0 dB (OFF)

Example: `INP:EATT:AUTO OFF`
`INP:EATT 10 dB`

Manual operation: See "Using Electronic Attenuation" on page 140

INPut: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.

This command requires the electronic attenuation hardware option.

Parameters:

<State> 1 | 0 | ON | OFF

1 | ON

0 | OFF

*RST: 1

Example: `INP:EATT:AUTO OFF`

Manual operation: See "Using Electronic Attenuation" on page 140

INPut:EATT:STATe <State>

This command turns the electronic attenuator on and off.

This command requires the electronic attenuation hardware option.

Parameters:

<State> 1 | 0 | ON | OFF

1 | ON

0 | OFF

*RST: 0

Example: `INP:EATT:STAT ON`
Switches the electronic attenuator into the signal path.

Manual operation: See "Using Electronic Attenuation" on page 140

Configuring a Preamplifier

INPut:GAIN:STATe..319
INPut:GAIN[:VALue]..319

INPut:GAIN:STATe <State>

This command turns the preamplifier on the instrument in use on and off. It requires the additional preamplifiier hardware option on the connected instrument.

Depending on the instrument in use, the preamplification is defined by `INPut:GAIN[:VALue]`.

Parameters:

<State> ON | OFF

*RST: OFF

Example: `INP:GAIN:STAT ON`
Switches on 30 dB preamplification.

Usage: SCPI confirmed

Manual operation: See "Preamplifier" on page 141

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 319).

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 instrument in use.

*RST: OFF

Example: `INP:GAIN:VAL 30`
Switches on 30 dB preamplification.

Usage: SCPI confirmed

Manual operation: See "Preamplifier" on page 141

Scaling the Y-Axis

DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe] 320
DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:AUTO ONCE 320
DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:MODE 320
DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:PDIVision 321
DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:RPOSition 321
DISPlay[:WINDow<n>]:TRACe<t>:Y:SPACing 321

DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe] <Range>

This command defines the display range of the y-axis (for all traces, <t> is irrelevant).

Note that the command works only for a logarithmic scaling. You can select the scaling with `DISPlay[:WINDow<n>]:TRACe<t>:Y:SPACing`.

Parameters:

<Range> Range: 1 dB to 200 dB
*RST: 100 dB

Example: `DISP:TRAC:Y 110dB`

Usage: SCPI confirmed

Manual operation: See "Range" on page 141

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

DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:MODE <Mode>

This command selects the type of scaling of the y-axis (for all traces, <t> is irrelevant).

When the display update during remote control is off, this command has no immediate effect.

Parameters:

<Mode>

ABSolute
absolute scaling of the y-axis

RELative
relative scaling of the y-axis

*RST: ABSolute

Example: `DISP:TRAC:Y:MODE REL`

Manual operation: See "Scaling" on page 142

DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:PDIVision <Value>

This remote command determines the grid spacing on the Y-axis for all diagrams, where possible.

The suffix <t> is irrelevant.

Parameters:

<Value> numeric value WITHOUT UNIT (unit according to the result display)

Defines the range per division (total range = 10*<Value>)

*RST: depends on the result display

Example: `DISP:TRAC:Y:PDIV 10`

Sets the grid spacing to 10 units (e.g. dB) per division

DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:RPOSition <Position>

This command defines the vertical position of the reference level on the display grid (for all traces, <t> is irrelevant).

The R&S VSE adjusts the scaling of the y-axis accordingly.

Parameters:

<Position> 0 PCT corresponds to the lower display border, 100% corresponds to the upper display border.

*RST: 100 PCT = frequency display; 50 PCT = time display

Example: `DISP:TRAC:Y:RPOS 50PCT`

Usage: SCPI confirmed

Manual operation: See "Ref Level Position" on page 142

DISPlay[:WINDow<n>]:TRACe<t>:Y:SPACing <ScalingType>

This command selects the scaling of the y-axis (for all traces, <t> is irrelevant).

Parameters:

<ScalingType>

LOGarithmic
Logarithmic scaling.

LINear
Linear scaling in %.

LDB
Linear scaling in the specified unit.

PERCent
Linear scaling in %.

*RST: LOGarithmic

Example: `DISP:TRAC:Y:SPAC LIN`

Selects linear scaling in %.

Usage: SCPI confirmed

Manual operation: See "Scaling" on page 142

13.6.1.3 Configuring the Axes for Statistical Displays

For statistical displays, the scaling can be configured for both the x-axis and the y-axis.

CALCulate<n>:IQ:STATistics:SCALe:X:QUANtize....322
CALCulate<n>:IQ:STATistics:SCALe:X:RANGe....322
CALCulate<n>:IQ:STATistics:SCALe:X:RLEVel:OFFSet....322
CALCulate<n>:IQ:STATistics:SCALe:X:RVALue....323
CALCulate<n>:IQ:STATistics:SCALe:Y:LOWer....323
CALCulate<n>:IQ:STATistics:SCALe:Y:UPPer....323

CALCulate<n>:IQ:STATistics:SCALe:X:QUANtize <StatNofColumns>

This command defines the number of columns for the statistical distribution.

Setting parameters:

<StatNofColumns> numeric value

Range: 2 to 1024
*RST: 101
Default unit: NONE

Example: `CALC:IQ:STAT:SCAL:X:QUAN 10`

Manual operation: See "Quantize Bins" on page 143

CALCulate<n>:IQ:STATistics:SCALe:X:RANGe <Range>

This command defines the display range of the x-axis for statistical measurements.

The effects are identical to `DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]`.

Parameters:

<Range> Range: 1 dB to 200 dB
*RST: 100 dB

Example: `CALC:IQ:STAT:SCAL:X:RANG 20dB`

Manual operation: See "Range" on page 143

CALCulate<n>:IQ:STATistics:SCALe:X:RLEVel:OFFSet <Level>

This command defines an arithmetic level offset. This offset is added to the measured level irrespective of the selected unit. The scaling of the x-axis is changed accordingly.

Parameters:

<Level> The unit is variable.

Example: `CALC:IQ:STAT:SCAL:X:RLEV:OFFS -10dBm`

Manual operation: See "Offset" on page 143

CALCulate<n>:IQ:STATistics:SCALe:X:RVALue <RefLevel>

This command sets the reference level for statistical measurements. The effects are identical to `DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:RLEVel`.

Note that in case of statistical measurements the reference level applies to the x-axis.

Parameters:

<RefLevel> The unit is variable.
If a reference level offset is included, the range is adjusted by that offset.

Range: -130 dBm to 30 dBm
*RST: 0 dBm

Example: `CALC:IQ:STAT:SCAL:X:RVAL -60dBm`

Manual operation: See "X-Axis Reference Value" on page 143

CALCulate<n>:IQ:STATistics:SCALe:Y:LOWer <Magnitude>

This command defines the lower vertical limit of the diagram.

Parameters:

<Magnitude> The number is a statistical value and therefore dimensionless.

Range: 1E-9 to 0.1
*RST: 1E-6

Example: `CALC:IQ:STAT:SCAL:Y:LOW 0.001`

Manual operation: See "Y-Max / Y-Min" on page 143

CALCulate<n>:IQ:STATistics:SCALe:Y:UPPer <Magnitude>

This command defines the upper vertical limit of the diagram.

Parameters:

<Magnitude> The number is a statistical value and therefore dimensionless.

Range: 1E-5 to 1.0
*RST: 1.0

Example: `CALC:IQ:STAT:SCAL:Y:UPP 0.01`

Manual operation: See "Y-Max / Y-Min" on page 143

13.6.1.4 Frequency

CALCulate<n>:MARKer<m>:FUNCtion:CENTer....324
[SENSe:]FREQuency:CENTer....324
[SENSe:]FREQuency:CENTer:STEP....324
[SENSe:]FREQuency:CENTer:STEP:AUTO....325
[SENSe:]FREQuency:OFFSet....325

CALCulate<n>:MARKer<m>:FUNCtion:CENTer

This command matches the center frequency to the frequency of a marker.

If you use the command in combination with a delta marker, that delta marker is turned into a normal marker.

Example: `CALC:MARK2:FUNC:CENT`
Sets the center frequency to the frequency of marker 2.

Usage: Event

Manual operation: See "Center Frequency = Marker Frequency" on page 205

[SENSe:]FREQuency:CENTer <Frequency>

This command defines the center frequency.

Parameters:

<Frequency> The allowed range and f_{max} is specified in the data sheet.

UP
Increases the center frequency by the step defined using the `[SENSe:]FREQuency:CENTer:STEP` command.

DOWN
Decreases the center frequency by the step defined using the `[SENSe:]FREQuency:CENTer:STEP` command.

*RST: fmax/2
Default unit: Hz

Example:
```
FREQ:CENT 100 MHz
FREQ:CENT:STEP 10 MHz
FREQ:CENT UP
```
Sets the center frequency to 110 MHz.

Usage: SCPI confirmed

Manual operation: See "Center frequency" on page 144

[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` on page 324.

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 "Center Frequency Stepsize" on page 144

[SENSe:]FREQuency:CENTer:STEP:AUTO <State>

This command couples or decouples the center frequency step size to the span.

In time domain (zero span) measurements, the center frequency is coupled to the RBW.

Parameters:

<State> ON | OFF | 0 | 1

*RST: 1

Example:
```
FREQ:CENT:STEP:AUTO ON
```
Activates the coupling of the step size to the span.

[SENSe:]FREQuency:OFFSet <Offset>

This command defines a frequency offset.

If this value is not 0 Hz, the application assumes that the input signal was frequency shifted outside the application. All results of type "frequency" will be corrected for this shift numerically by the application.

See also "Frequency Offset" on page 144.

Parameters:

<Offset> Range: -100 GHz to 100 GHz

*RST: 0 Hz

Example:
```
FREQ:OFFS 1GHZ
```

Usage: SCPI confirmed

Manual operation: See "Frequency Offset" on page 144

13.6.1.5 Triggering

The following remote commands are required to configure a triggered measurement in a remote environment. More details are described for manual operation in chapter 10.3.5.2, "Trigger Settings", on page 148.

Note that the availability of trigger settings depends on the instrument in use.

*OPC should be used after requesting data. This will hold off any subsequent changes to the selected trigger source, until after the sweep is completed and the data is returned.

- Configuring the Triggering Conditions......326
- Configuring the Trigger Output......332

Configuring the Triggering Conditions

The following commands are required to configure a triggered measurement.

Note that the availability of trigger sources depends on the instrument in use.

TRIGger[:SEQuence]:DTIMe......326
TRIGger[:SEQuence]:HOLDoff[:TIME]......326
TRIGger[:SEQuence]:IFPower:HOLDoff......327
TRIGger[:SEQuence]:IFPower:HYSTeresis......327
TRIGger[:SEQuence]:LEVel[:EXTernal<port>]......327
TRIGger[:SEQuence]:LEVel:IFPower......328
TRIGger[:SEQuence]:LEVel:IQPower......328
TRIGger[:SEQuence]:LEVel:MAPower......328
TRIGger[:SEQuence]:LEVel:RFPower......329
TRIGger[:SEQuence]:MAPower:HOLDoff......329
TRIGger[:SEQuence]:MAPower:HYSTeresis......329
TRIGger[:SEQuence]:SLOPe......330
TRIGger[:SEQuence]:SOURce......330
TRIGger[:SEQuence]:TIME:RINTerval......331

TRIGger[:SEQuence]:DTIMe <DropoutTime>

Defines the time the input signal must stay below the trigger level before a trigger is detected again.

Parameters:

<DropoutTime> Dropout time of the trigger.

Range: 0 s to 10.0 s
*RST: 0 s

Manual operation: See "Drop-Out Time" on page 152

TRIGger[:SEQuence]:HOLDoff[:TIME] <Offset>

Defines the time offset between the trigger event and the start of the measurement.

A negative offset is possible for time domain measurements.

Parameters:

<Offset> For measurements in the frequency domain, the range is 0 s to 30 s.
For measurements in the time domain, the range is the negative measurement time to 30 s.

*RST: 0 s

Example: `TRIG:HOLD 500us`

Manual operation: See "Trigger Offset" on page 152

TRIGger[:SEQuence]:IFPower:HOLDoff <Period>

This command defines the holding time before the next trigger event.

Note that this command can be used for **any trigger source**, not just IF Power (despite the legacy keyword).

For (offline) input from a file, this command does not apply. In this case, use `TRIGger[:SEQuence]:MAPower:HOLDoff` on page 329.

Parameters:

<Period> Range: 0 s to 10 s
*RST: 0 s

Example: `TRIG:SOUR EXT`
Sets an external trigger source.
`TRIG:IFP:HOLD 200 ns`
Sets the holding time to 200 ns.

Manual operation: See "Trigger Holdoff" on page 152

TRIGger[:SEQuence]:IFPower:HYSTeresis <Hysteresis>

This command defines the trigger hysteresis, which is only available for "IF Power" trigger sources.

Parameters:

<Hysteresis> Range: 3 dB to 50 dB
*RST: 3 dB

Example: `TRIG:SOUR IFP`
Sets the IF power trigger source.
`TRIG:IFP:HYST 10DB`
Sets the hysteresis limit value.

Manual operation: See "Hysteresis" on page 152

TRIGger[:SEQuence]:LEVel[:EXTernal<port>] <TriggerLevel>

This command defines the level the external signal must exceed to cause a trigger event.

In the I/Q Analyzer application only `EXTernal1` is supported.

Suffix:

<port> Selects the trigger port.
1 = trigger port 1 (TRIGGER INPUT connector on front panel)
2 = trigger port 2 (TRIGGER INPUT/OUTPUT connector on front panel)
3 = trigger port 3 (TRIGGER3 INPUT/OUTPUT connector on rear panel)

Parameters:

<TriggerLevel> Range: 0.5 V to 3.5 V
*RST: 1.4 V

Example: `TRIG:LEV 2V`

Manual operation: See "Trigger Level" on page 151

TRIGger[:SEQuence]:LEVel:IFPower <TriggerLevel>

This command defines the power level at the third intermediate frequency that must be exceeded to cause a trigger event. Note that any RF attenuation or preamplification is considered when the trigger level is analyzed. If defined, a reference level offset is also considered.

Parameters:

<TriggerLevel> For details on available trigger levels and trigger bandwidths see the data sheet.
*RST: -10 dBm

Example: `TRIG:LEV:IFP -30DBM`

Manual operation: See "Trigger Level" on page 151

TRIGger[:SEQuence]:LEVel:IQPower <TriggerLevel>

This command defines the magnitude the I/Q data must exceed to cause a trigger event. Note that any RF attenuation or preamplification is considered when the trigger level is analyzed.

Parameters:

<TriggerLevel> Range: -130 dBm to 30 dBm
*RST: -20 dBm

Example: `TRIG:LEV:IQP -30DBM`

Manual operation: See "Trigger Level" on page 151

TRIGger[:SEQuence]:LEVel:MAPower <TriggerLevel>

This command defines the power level that must be exceeded to cause a trigger event for (offline) input from a file.

Parameters:

<TriggerLevel>	For details on available trigger levels and trigger bandwidths see the data sheet.

Example: `TRIG:LEV:MAP -30DBM`

Manual operation: See "Trigger Level" on page 151

TRIGger[:SEQuence]:LEVel:RFPower <TriggerLevel>

This command defines the power level the RF input must exceed to cause a trigger event. Note that any RF attenuation or preamplification is considered when the trigger level is analyzed. If defined, a reference level offset is also considered.

The input signal must be between 500 MHz and 8 GHz.

Parameters:

<TriggerLevel>	For details on available trigger levels and trigger bandwidths see the data sheet. *RST: -20 dBm

Example: `TRIG:LEV:RFP -30dBm`

Manual operation: See "Trigger Level" on page 151

TRIGger[:SEQuence]:MAPower:HOLDoff <Period>

This command defines the holding time before the next trigger event for (offline) input from a file.

Parameters:

<Period>	Range: 0 s to 10 s *RST: 0 s

Example:

`TRIG:SOUR MAGN`
Sets an offline magnitude trigger source.
`TRIG:MAP:HOLD 200 ns`
Sets the holding time to 200 ns.

Manual operation: See "Trigger Holdoff" on page 152

TRIGger[:SEQuence]:MAPower:HYSTeresis <Hysteresis>

This command defines the trigger hysteresis for the (offline) magnitude trigger source (used for input from a file).

Parameters:

<Hysteresis>	Range: 3 dB to 50 dB *RST: 3 dB

Example:

`TRIG:SOUR MAP`
Sets the (offline) magnitude trigger source.
`TRIG:MAP:HYST 10DB`
Sets the hysteresis limit value.

Manual operation: See "Hysteresis" on page 152

TRIGger[:SEQuence]:SLOPe <Type>

Parameters:

<Type> POSitive | NEGative

POSitive
Triggers when the signal rises to the trigger level (rising edge).

NEGative
Triggers when the signal drops to the trigger level (falling edge).

*RST: POSitive

Example: `TRIG:SLOP NEG`

Manual operation: See "Slope" on page 153

TRIGger[:SEQuence]:SOURce <Source>

This command selects the trigger source.

Note that the availability of trigger sources depends on the instrument in use.

For details on trigger sources see "Trigger Source" on page 150.

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.

For troubleshooting tips see "Uncompleted sequential commands - blocked remote channels" on page 445.

Parameters:

<Source>

IMMediate
Free Run

EXT | EXT2 | EXT3 | EXT4
Trigger signal from the corresponding TRIGGER INPUT/ OUTPUT connector on the instrument in use, 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.

VIDeo
Video mode is available in the time domain and only in the Spectrum application.

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

Manual operation: See "Trigger Source" on page 150

TRIGger[:SEQuence]:TIME:RINTerval <Interval>

This command defines the repetition interval for the time trigger.

Parameters:

<Interval>

2.0 ms to 5000

Range: 2 ms to 5000 s
*RST: 1.0 s

Example:
`TRIG:SOUR TIME`
Selects the time trigger input for triggering.
`TRIG:TIME:RINT 50`
The measurement starts every 50 s.

Manual operation: See "Repetition Interval" on page 151

Configuring the Trigger Output

The following commands are required to send the trigger signal to one of the variable TRIGGER INPUT/OUTPUT connectors on the instrument in use.

OUTPut:TRIGger<port>:DIRection....................332
OUTPut:TRIGger<port>:LEVel....................332
OUTPut:TRIGger<port>:OTYPe....................332
OUTPut:TRIGger<port>:PULSe:IMMediate....................333
OUTPut:TRIGger<port>:PULSe:LENGth....................333

OUTPut:TRIGger<port>:DIRection <Direction>

This command selects the trigger direction for trigger ports that serve as an input as well as an output.

Suffix:
<port>

Parameters:

<Direction> **INPut**
Port works as an input.
OUTPut
Port works as an output.
*RST: INPut

Manual operation: See "Trigger 2/3" on page 134

OUTPut:TRIGger<port>:LEVel <Level>

This command defines the level of the signal generated at the trigger output.

This command works only if you have selected a user defined output with `OUTPut:TRIGger<port>:OTYPe`.

Suffix:
<port> Selects the trigger port to which the output is sent.

Parameters:

<Level> **HIGH**
TTL signal.
LOW
0 V
*RST: LOW

Manual operation: See "Trigger 2/3" on page 134

OUTPut:TRIGger<port>:OTYPe <OutputType>

This command selects the type of signal generated at the trigger output.

Suffix:
<port> Selects the trigger port to which the output is sent.

Parameters:

<OutputType>

DEVice
Sends a trigger signal when the R&S VSE has triggered internally.

TARMed
Sends a trigger signal when the trigger is armed and ready for an external trigger event.

UDEFined
Sends a user defined trigger signal. For more information see `OUTPut:TRIGger<port>:LEVel`.

*RST: DEVice

Manual operation: See "Output Type" on page 134

OUTPut:TRIGger<port>:PULSe:IMMediate

This command generates a pulse at the trigger output.

Suffix:

<port> Selects the trigger port to which the output is sent.

Usage: Event

Manual operation: See "Send Trigger" on page 135

OUTPut:TRIGger<port>:PULSe:LENGth <Length>

This command defines the length of the pulse generated at the trigger output.

Suffix:

<port> Selects the trigger port to which the output is sent.

Parameters:

<Length> Pulse length in seconds.

Manual operation: See "Pulse Length" on page 134

13.6.1.6 Configuring Data Acquisition

The following commands are required to capture data in the I/Q Analyzer.

Remote commands exclusive to I/Q data acquisition

[SENSe:]IQ:BANDwidth|BWIDth:MODE 334
[SENSe:]IQ:BANDwidth|BWIDth:RESolution 334
[SENSe:]IQ:FFT:ALGorithm 335
[SENSe:]IQ:FFT:LENGth 335
[SENSe:]IQ:FFT:WINDow:LENGth 336
[SENSe:]IQ:FFT:WINDow:OVERlap 336
[SENSe:]IQ:FFT:WINDow:TYPE 336
[SENSe:]SWAPiq 337
[SENSe:]SWEep:COUNt 337

[SENSe:]SWEep:POINts..338
[SENSe:]SWEep:TIME...338
TRACe:IQ:BWIDth...338
TRACe:IQ:RLENgth...338
TRACe:IQ:SET..339
TRACe:IQ:SRATe..340
TRACe:IQ:TPISample?...340
TRACe:IQ:WBANd[:STATe]..341
TRACe:IQ:WBANd:MBWIDTH...341

[SENSe:]IQ:BANDwidth|BWIDth:MODE <Mode>

This command defines how the resolution bandwidth is determined.

Parameters:

<Mode> AUTO | MANual | FFT

AUTO
(Default) The RBW is determined automatically depending on the sample rate and record length.

MANual
The user-defined RBW is used and the (FFT) window length (and possibly the sample rate) are adapted accordingly. The RBW is defined using the `[SENSe:]IQ:BANDwidth|BWIDth:RESolution` command.

FFT
The RBW is determined by the FFT parameters.

*RST: AUTO

Example: `IQ:BAND:MODE MAN`
Switches to manual RBW mode.
`IQ:BAND:RES 120000`
Sets the RBW to 120 kHz.

Usage: SCPI confirmed

Manual operation: See "RBW" on page 157

[SENSe:]IQ:BANDwidth|BWIDth:RESolution <Bandwidth>

This command defines the resolution bandwidth manually if `[SENSe:]IQ:BANDwidth|BWIDth:MODE` is set to `MAN`.

Defines the resolution bandwidth. The available RBW values depend on the sample rate and record length.

For details see chapter 10.2.3.1, "Frequency Resolution of FFT Results - RBW", on page 120.

Parameters:

<Bandwidth> refer to data sheet

*RST: RBW: AUTO mode is used

Example: IQ:BAND:MODE MAN
Switches to manual RBW mode.
IQ:BAND:RES 120000
Sets the RBW to 120 kHz.

Usage: SCPI confirmed

Manual operation: See "RBW" on page 157

[SENSe:]IQ:FFT:ALGorithm <Method>

Defines the FFT calculation method.

Parameters:

<Method>

SINGle
One FFT is calculated for the entire record length; if the FFT length is larger than the record length (see [SENSe:]IQ:FFT:LENGth and TRACe:IQ:RLENgth), zeros are appended to the captured data.

AVERage
Several overlapping FFTs are calculated for each record; the results are averaged to determine the final FFT result for the record.
The user-defined window length and window overlap are used (see [SENSe:]IQ:FFT:WINDow:LENGth and [SENSe:]IQ:FFT:WINDow:OVERlap).

*RST: AVER

Example: IQ:FFT:ALG SING

Usage: SCPI confirmed

Manual operation: See "Transformation Algorithm" on page 158

[SENSe:]IQ:FFT:LENGth <NoOfBins>

Defines the number of frequency points determined by each FFT calculation. The more points are used, the higher the resolution in the spectrum becomes, but the longer the calculation takes.

Parameters:

<NoOfBins> integer value

Range: 3 to 524288
*RST: 4096

Example: IQ:FFT:LENG 2048

Usage: SCPI confirmed

Manual operation: See "FFT Length" on page 158

[SENSe:]IQ:FFT:WINDow:LENGth <NoOfFFT>

Defines the number of samples to be included in a single FFT window when multiple FFT windows are used.

Parameters:

<NoOfFFT> integer value

Range: 3 to 1001
*RST: 1001

Example: `IQ:FFT:WIND:LENG 500`

Usage: SCPI confirmed

Manual operation: See "Window Length" on page 158

[SENSe:]IQ:FFT:WINDow:OVERlap <Rate>

Defines the part of a single FFT window that is re-calculated by the next FFT calculation.

Parameters:

<Rate> double value

Percentage rate

Range: 0 to 1
*RST: 0.75

Example: `IQ:FFT:WIND:OVER 0.5`
Half of each window overlaps the previous window in FFT calculation.

Usage: SCPI confirmed

Manual operation: See "Window Overlap" on page 158

[SENSe:]IQ:FFT:WINDow:TYPE <Function>

In the I/Q Analyzer you can select one of several FFT window types.

Parameters:

<Function>

BLACkharris
Blackman-Harris

FLATtop
Flattop

GAUSsian
Gauss

RECTangular
Rectangular

P5
5-Term

*RST: FLAT

Example: `IQ:FFT:WIND:TYPE GAUS`

Usage: SCPI confirmed

Manual operation: See "Window Function" on page 158

[SENSe:]SWAPiq <State>

This command defines whether or not the recorded I/Q pairs should be swapped (I<->Q) before being processed. Swapping I and Q inverts the sideband.

This is useful if the DUT interchanged the I and Q parts of the signal; then the R&S VSE can do the same to compensate for it.

Parameters:

<State>

ON
I and Q signals are interchanged
Inverted sideband, Q+j*I

OFF
I and Q signals are not interchanged
Normal sideband, I+j*Q

*RST: OFF

Manual operation: See "Swap I/Q" on page 156

[SENSe:]SWEep:COUNt <SweepCount>

This command defines the number of measurements that the application uses to average traces.

In case of continuous measurement mode, the application calculates the moving average over the average count.

In case of single measurement mode, the application stops the measurement and calculates the average after the average count has been reached.

Parameters:

<SweepCount>

When you set a capture count of 0 or 1, the R&S VSE performs one single measurement in single measurement mode.
In continuous measurement mode, if the capture count is set to 0, a moving average over 10 measurements is performed.

Range: 0 to 200000
*RST: 0

Example:

`SWE:COUN 64`
Sets the number of measurements to 64.
`INIT:CONT OFF`
Switches to single measurement mode.
`INIT;*WAI`
Starts a measurement and waits for its end.

Usage: SCPI confirmed

[SENSe:]SWEep:POINts <MeasPoints>

This command defines the number of measurement points to analyze after a measurement.

Note that the number of measurement points is limited to 10001 when measuring spurious emissions.

Parameters:

<MeasPoints>	Range:	51 to 524288
	*RST:	1001

Example: `SWE:POIN 251`

Usage: SCPI confirmed

Manual operation: See "Points" on page 159

[SENSe:]SWEep:TIME <Time>

This command defines the measurement time.

Parameters:

<Time>	refer to data sheet	
	*RST:	depends on current settings (determined automatically)

Example: `SWE:TIME 10s`

Usage: SCPI confirmed

Manual operation: See "Meas Time" on page 156

TRACe:IQ:BWIDth

This command defines or queries the bandwidth of the resampling filter.

The bandwidth of the resampling filter depends on the sample rate.

Parameters:

<Bandwidth> For details on the maximum bandwidth see chapter 10.2.2, "Sample Rate, Record Length and Analysis Bandwidth", on page 119.

Manual operation: See "Analysis Bandwidth" on page 155

TRACe:IQ:RLENgth <NoOfSamples>

This command sets the record length for the acquired I/Q data.

Increasing the record length also increases the measurement time.

Note: Alternatively, you can define the measurement time using the `SENS:SWE:TIME` command.

Parameters:

<NoOfSamples> Number of samples to record.
See chapter 10.2.2, "Sample Rate, Record Length and Analysis Bandwidth", on page 119

*RST: 1001

Example: `TRAC:IQ:RLEN 256`

Manual operation: See "Record Length" on page 156

TRACe:IQ:SET NORM, 0, <SampleRate>, <TriggerMode>, <TriggerSlope>, <PretriggerSamp>, <NumberSamples>

This command sets up the R&S VSE for I/Q measurements.

If you do not use this command to set up I/Q measurements, the R&S VSE will use its current settings for I/Q measurements.

If the I/Q Analyzer has not been turned on previously, the command also switches to the I/Q Analyzer.

Note: If you use the default settings with `TRACe:IQ:DATA?`?, the following minimum buffer sizes for the response data are recommended:

ASCII format: 10 kBytes

4

Binary format: 2 kBytes

Parameters:

NORM This value is always `NORM`.

0 This value is always `0`.

<SampleRate> Sample rate for the data acquisition.

Range: 100 Hz to 10 GHz, continuously adjustable
*RST: 32000000

<TriggerMode> Selection of the trigger source used for the measurement.

IMMediate | EXTernal | EXT2 | EXT3 | IFPower
For IMM mode, gating is automatically deactivated.

*RST: IMM

<TriggerSlope> Used trigger slope.

POSitive | NEGative

*RST: POS

<PretriggerSamp> Defines the trigger offset in terms of pretrigger samples. Negative values correspond to a trigger delay.
This value also defines the interval between the trigger signal and the gate edge in samples.

Range: -461373339 to 461373339
*RST: 0

<NumberSamples>	Number of measurement values to record (including the pretrigger samples). See chapter 10.2.2, "Sample Rate, Record Length and Analysis Bandwidth", on page 119. *RST: 1001

Example:	`TRAC:IQ:SET NORM,0,32MHz,EXT,POS,0,2048`
	Reads 2048 I/Q-values starting at the trigger point.
	sample rate = 32 MHz
	trigger = External
	slope = Positive
	`TRAC:IQ:SET NORM,0,4 MHz,EXT,POS,1024,512`
	Reads 512 I/Q-values from 1024 measurement points before the trigger point.
	filter type = NORMAL
	sample rate = 4 MHz
	trigger = External
	slope = Positive

Manual operation:	See "Record Length" on page 156

TRACe:IQ:SRATe <SampleRate>

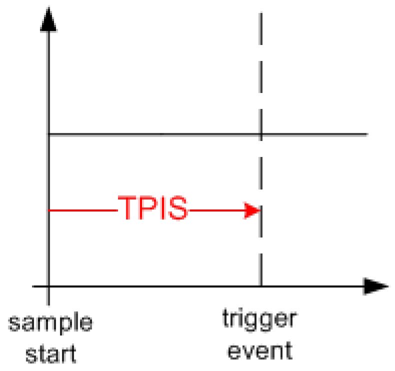
This command sets the final user sample rate for the acquired I/Q data. Thus, the user sample rate can be modified without affecting the actual data capturing settings on the R&S VSE.

Parameters:

<SampleRate>	The valid sample rates depend on the instrument in use. Refer to the instrument's documentation. *RST: 32 MHz
Manual operation:	See "Sample Rate" on page 155

TRACe:IQ:TPISample?

This command queries the time offset between the sample start and the trigger event (trigger point in sample = TPIS). Since the R&S VSE usually samples with a much higher sample rate than the specific application actually requires, the trigger point determined internally is much more precise than the one determined from the (downsampled) data in the application. Thus, the TPIS indicates the offset between the sample start and the actual trigger event.



This value can only be determined in triggered measurements using external or IFPower triggers, otherwise the value is 0.

Example: `TRAC:IQ:TPIS?`
Result for a sample rate of 1 MHz: between 0 and 1/1 MHz, i.e. between 0 and 1 µs (the duration of 1 sample).

Usage: Query only

Manual operation: See "Trigger Offset" on page 152

TRACe:IQ:WBANd[:STATe] <State>

This command determines whether the wideband provided by bandwidth extension options is used or not (if installed).

Parameters:

<State> ON | OFF

ON
If enabled, bandwidth extension options installed on the instrument in use can be used.

OFF
No bandwidth extension options installed on the instrument in use are used. The maximum analysis bandwidth is restricted, depending on the used instrument.

*RST: ON

Manual operation: See "Maximum Bandwidth" on page 156

TRACe:IQ:WBANd:MBWIDTH <Limit>

Defines the maximum analysis bandwidth. Any value can be specified; the next higher fixed bandwidth is used.

The available fixed values depend on the instrument in use and the installed bandwidth extenstion options.

Manual operation: See "Maximum Bandwidth" on page 156

13.6.1.7 Adjusting Settings Automatically

The commands required to adjust settings automatically in a remote environment are described here.

[SENSe:]ADJust:ALL....................342
[SENSe:]ADJust:CONFigure:DURation....................342
[SENSe:]ADJust:CONFigure:DURation:MODE....................343
[SENSe:]ADJust:CONFigure:HYSTeresis:LOWer....................343
[SENSe:]ADJust:CONFigure:HYSTeresis:UPPer....................343
[SENSe:]ADJust:CONFigure:TRIG....................343
[SENSe:]ADJust:FREQuency....................344
[SENSe:]ADJust:LEVel....................344

[SENSe:]ADJust:ALL

This command initiates a measurement to determine and set the ideal settings for the current task automatically (only once for the current measurement).

This includes:

- Center frequency
- Reference level

Example: `ADJ:ALL`

Usage: Event

Manual operation: See "Adjusting all Determinable Settings Automatically (Auto All)" on page 162

[SENSe:]ADJust:CONFigure:DURation <Duration>

In order to determine the ideal reference level, the R&S VSE performs a measurement on the current input data. This command defines the length of the measurement if `[SENSe:]ADJust:CONFigure:DURation:MODE` is set to `MANual`.

Parameters:

<Duration> Numeric value in seconds

Range: 0.001 to 16000.0
*RST: 0.001
Default unit: s

Example: `ADJ:CONF:DUR:MODE MAN`
Selects manual definition of the measurement length.
`ADJ:CONF:LEV:DUR 5ms`
Length of the measurement is 5 ms.

Manual operation: See "Automatic Measurement Time Mode and Value" on page 163

[SENSe:]ADJust:CONFigure:DURation:MODE <Mode>

In order to determine the ideal reference level, the R&S VSE performs a measurement on the current input data. This command selects the way the R&S VSE determines the length of the measurement .

Parameters:

<Mode>
AUTO
The R&S VSE determines the measurement length automatically according to the current input data.
MANual
The R&S VSE uses the measurement length defined by `[SENSe:]ADJust:CONFigure:DURation` on page 342.
*RST: AUTO

Manual operation: See "Automatic Measurement Time Mode and Value" on page 163

[SENSe:]ADJust:CONFigure:HYSTeresis:LOWer <Threshold>

Parameters:

<Threshold>
Range: 0 dB to 200 dB
*RST: +1 dB
Default unit: dB

Example: `SENS:ADJ:CONF:HYST:LOW 2`
For an input signal level of currently 20 dBm, the reference level will only be adjusted when the signal level falls below 18 dBm.

Manual operation: See "Lower Level Hysteresis" on page 163

[SENSe:]ADJust:CONFigure:HYSTeresis:UPPer <Threshold>

Parameters:

<Threshold>
Range: 0 dB to 200 dB
*RST: +1 dB
Default unit: dB

Example: `SENS:ADJ:CONF:HYST:UPP 2`

Example: For an input signal level of currently 20 dBm, the reference level will only be adjusted when the signal level rises above 22 dBm.

Manual operation: See "Upper Level Hysteresis" on page 163

[SENSe:]ADJust:CONFigure:TRIG <State>

Defines the behaviour of the measurement when adjusting a setting automatically (using `SENS:ADJ:LEV ON`, for example).

Parameters:

<State>

ON | 1
The measurement for automatic adjustment waits for the trigger.

OFF | 0
The measurement for automatic adjustment is performed immediately, without waiting for a trigger.

*RST: 1

[SENSe:]ADJust:FREQuency

This command sets the center frequency to the frequency with the highest signal level in the current frequency range.

Example: `ADJ:FREQ`

Usage: Event

Manual operation: See "Adjusting the Center Frequency Automatically (Auto Freq)" on page 162

[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 "Setting the Reference Level Automatically (Auto Level)" on page 139

13.6.2 I/Q Analysis

General result analysis settings concerning the trace, markers, etc. can be configured using the following commands. They are identical to the analysis functions in the Spectrum application except for the special marker functions.

- Configuring Standard Traces....................................345
- Configuring Spectrograms....................................349
- Using Markers....................................354
- Zooming into the Display....................................378

13.6.2.1 Configuring Standard Traces

Useful commands for trace configuration described elsewhere

- `DISPlay[:WINDow<n>]:TRACe<t>:Y:SPACing` on page 321
- `DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]` on page 320

Remote commands exclusive to trace configuration

DISPlay[:WINDow<n>]:TRACe<t>:MODE......345
DISPlay[:WINDow<n>]:TRACe<t>:MODE:HCONtinuous......346
DISPlay[:WINDow<n>]:TRACe<t>[:STATe]......346
[SENSe:]AVERage<n>:TYPE......347
[SENSe:][WINDow<n>:]DETector<t>[:FUNCtion]......347
[SENSe:][WINDow<n>:]DETector<t>[:FUNCtion]:AUTO......347
TRACe<n>:COPY......348
[SENSe:]AVERage<n>:COUNt......348
TRACe:IQ:AVERage:COUNt......348
[SENSe:]AVERage<n>[:STATe<t>]......348
TRACe:IQ:AVERage[:STATe]......348

DISPlay[:WINDow<n>]:TRACe<t>:MODE <Mode>

This command selects the trace mode.

Parameters:

<Mode>

WRITe
Overwrite mode: the trace is overwritten by each sweep. This is the default setting.

AVERage
The average is formed over several sweeps. The "Sweep/Average Count" determines the number of averaging procedures.

MAXHold
The maximum value is determined over several sweeps and displayed. The R&S VSE saves the sweep result in the trace memory only if the new value is greater than the previous one.

MINHold
The minimum value is determined from several measurements and displayed. The R&S VSE saves the sweep result in the trace memory only if the new value is lower than the previous one.

VIEW
The current contents of the trace memory are frozen and displayed.

BLANk
Hides the selected trace.

*RST: Trace 1: WRITe, Trace 2-6: BLANk

Example:

`INIT:CONT OFF`
Switching to single sweep mode.
`SWE:COUN 16`
Sets the number of measurements to 16.
`DISP:TRAC3:MODE WRIT`
Selects clear/write mode for trace 3.
`INIT;*WAI`
Starts the measurement and waits for the end of the measurement.

Manual operation: See "Trace Mode" on page 175

DISPlay[:WINDow<n>]:TRACe<t>:MODE:HCONtinuous <State>

This command turns an automatic reset of a trace on and off after a parameter has changed.

The reset works for trace modes min hold, max hold and average.

Note that the command has no effect if critical parameters like the span have been changed to avoid invalid measurement results

Parameters:

<State>

ON
The automatic reset is off.

OFF
The automatic reset is on.

*RST: OFF

Example:

`DISP:WIND:TRAC3:MODE:HCON ON`
Switches off the reset function.

Manual operation: See "Hold" on page 176

DISPlay[:WINDow<n>]:TRACe<t>[:STATe] <State>

This command turns a trace on and off.

The measurement continues in the background.

Parameters:

<State> ON | OFF | 0 | 1

*RST: 1 for TRACe1, 0 for TRACe 2 to 6

Example: `DISP:TRAC3 ON`

Usage: SCPI confirmed

Manual operation: See "Trace 1/Trace 2/Trace 3/Trace 4/Trace 5/Trace 6" on page 175

[SENSe:]AVERage<n>:TYPE <Mode>

This command selects the trace averaging mode.

Parameters:

<Mode>

VIDeo
The logarithmic power values are averaged.

LINear
The power values are averaged before they are converted to logarithmic values.

POWer
The power level values are converted into unit Watt prior to averaging. After the averaging, the data is converted back into its original unit.

*RST: VIDeo

Example: `AVER:TYPE LIN`
Switches to linear average calculation.

Usage: SCPI confirmed

Manual operation: See "Average Mode" on page 177

[SENSe:][WINDow<n>:]DETector<t>[:FUNCtion] <Detector>

Defines the trace detector to be used for trace analysis.

For details see "Mapping Samples to measurement Points with the Trace Detector" on page 164.

Parameters:

<Detector>

APEak
Autopeak

NEGative
Negative peak

POSitive
Positive peak

SAMPle
First value detected per trace point

*RST: APEak

Example: `DET POS`
Sets the detector to "positive peak".

Manual operation: See "Detector" on page 176

[SENSe:][WINDow<n>:]DETector<t>[:FUNCtion]:AUTO <State>

This command couples and decouples the detector to the trace mode.

Parameters:

<State>	ON | OFF | 0 | 1 *RST: 1
Example:	`DET:AUTO OFF` The selection of the detector is not coupled to the trace mode.
Manual operation:	See "Detector" on page 176

TRACe<n>:COPY <TraceNumber>, <TraceNumber>

This command copies data from one trace to another.

Parameters:

<TraceNumber>, <TraceNumber>	**TRACE1 | TRACE2 | TRACE3 | TRACE4 | TRACE5 | TRACE6** The first parameter is the destination trace, the second parameter is the source. (Note the 'e' in the parameter is required!)
Example:	`TRAC:COPY TRACE1,TRACE2` Copies the data from trace 2 to trace 1.
Usage:	SCPI confirmed
Manual operation:	See "Copy Trace" on page 178

[SENSe:]AVERage<n>:COUNt <AverageCount>
TRACe:IQ:AVERage:COUNt <NumberSets>

This command defines the number of I/Q data sets that the averaging is based on.

Parameters:

<NumberSets>	Range: 0 to 32767 *RST: 0

Example:	`TRAC:IQ ON`
	Switches on acquisition of I/Q data.
	`TRAC:IQ:AVER ON`
	Enables averaging of the I/Q measurement data
	`TRAC:IQ:AVER:COUN 10`
	Selects averaging over 10 data sets
	`TRAC:IQ:DATA?`
	Starts the measurement and reads out the averaged data.

Manual operation:	See "Average Count" on page 177

[SENSe:]AVERage<n>[:STATe<t>] <State>
TRACe:IQ:AVERage[:STATe] <State>

This command turns averaging of the I/Q data on and off.

If averaging is on, the maximum amount of I/Q data that can be recorded is 512kS (524288 samples).

Parameters:

<State> ON | OFF

*RST: OFF

Example:

`TRAC:IQ ON`
Switches on acquisition of I/Q data.
`TRAC:IQ:AVER ON`
Enables averaging of the I/Q measurement data.
`TRAC:IQ:AVER:COUN 10`
Selects averaging over 10 data sets.
`TRAC:IQ:DATA?`
Starts the measurement and reads out the averaged data.

13.6.2.2 Configuring Spectrograms

In addition to the standard "level versus frequency" or "level versus time" spectrum traces, the R&S VSE also provides a spectrogram display of the measured data. A spectrogram shows how the spectral density of a signal varies over time. The x-axis shows the frequency, the y-axis shows the time. The commands required to configure spectrograms in a remote environment are described here. For details and manual operation see "Spectrogram Settings" on page 178.

When configuring spectrograms, the window suffix is irrelevant. The settings are always applied to the spectrogram window, or to all spectrogram windows, if several are active for the same measurement channel.

For commands to set markers in spectrograms, see "Marker Search (Spectrograms)" on page 359.

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Configuring the Color Map.. 352

Configuring a Spectrogram Measurement

CALCulate<n>:SGRam:CLEar[:IMMediate]..350
CALCulate<n>:SPECtrogram:CLEar[:IMMediate].. 350
CALCulate<n>:SGRam:CONT..350
CALCulate<n>:SPECtrogram:CONT...350
CALCulate<n>:SGRam:FRAMe:COUNt...350
CALCulate<n>:SPECtrogram:FRAMe:COUNt...350
CALCulate<n>:SGRam:FRAMe:SELect.. 351
CALCulate<n>:SPECtrogram:FRAMe:SELect...351
CALCulate<n>:SGRam:HDEPth...351
CALCulate<n>:SPECtrogram:HDEPth...351
CALCulate<n>:SGRam[:STATe]...351
CALCulate<n>:SPECtrogram[:STATe]...351
CALCulate<n>:SGRam:TRACe...352
CALCulate<n>:SPECtrogram:TRACe...352

CALCulate<n>:SGRam:CLEar[:IMMediate]
CALCulate<n>:SPECtrogram:CLEar[:IMMediate]

This command resets the spectrogram and clears the history buffer.

(<n> is irrelevant.)

Example: `CALC:SGR:CLE`
Resets the result display and clears the memory.

Usage: Event

Manual operation: See "Clear Spectrogram" on page 161

CALCulate<n>:SGRam:CONT <State>
CALCulate<n>:SPECtrogram:CONT <State>

This command determines whether the results of the last measurement are deleted before starting a new measurement in single sweep mode.

(<n> is irrelevant.)

Parameters:

<State> ON | OFF
*RST: OFF

Example: `INIT:CONT OFF`
Selects single sweep mode.
`INIT;*WAI`
Starts the sweep and waits for the end of the sweep.
`CALC:SGR:CONT ON`
Repeats the single sweep measurement without deleting the results of the last measurement.

Manual operation: See "Continue Frame" on page 161

CALCulate<n>:SGRam:FRAMe:COUNt <Frames>
CALCulate<n>:SPECtrogram:FRAMe:COUNt <Frames>

This command defines the number of frames to be recorded in a single capture.

(<n> is irrelevant.)

Parameters:

<Frames> The maximum number of frames depends on the history depth.
Range: 1 to history depth
Increment: 1
*RST: 1

Example: `INIT:CONT OFF`
Selects single capture mode.
`CALC:SGR:FRAM:COUN 200`
Sets the number of frames to 200.

Manual operation: See "Frame Count" on page 161

CALCulate<n>:SGRam:FRAMe:SELect <Frame> | <Time>
CALCulate<n>:SPECtrogram:FRAMe:SELect <Frame> | <Time>

This command selects a specific frame for further analysis.

(<n> is irrelevant.)

The command is available if no measurement is running or after a single sweep has ended.

Parameters:

<Frame> Selects a frame directly by the frame number. Valid if the time stamp is off.
The range depends on the history depth.

<Time> Selects a frame via its time stamp. Valid if the time stamp is on.
The number is the distance to frame 0 in seconds. The range depends on the history depth.

Example:
`INIT:CONT OFF`
Stop the continuous sweep.
`CALC:SGR:FRAM:SEL -25`
Selects frame number -25.

Manual operation: See "Selecting a frame to display" on page 160

CALCulate<n>:SGRam:HDEPth <History>
CALCulate<n>:SPECtrogram:HDEPth <History>

This command defines the number of frames to be stored in the R&S VSE memory.

(<n> is irrelevant.)

Parameters:

<History> The maximum number of frames depends on the number of sweep points.

Range: 781 to 20000
Increment: 1
*RST: 3000

Example:
`CALC:SGR:SPEC 1500`
Sets the history depth to 1500.

Manual operation: See "History Depth" on page 180

CALCulate<n>:SGRam[:STATe] <State>
CALCulate<n>:SPECtrogram[:STATe] <State>

This command turns the spectrogram on and off.

(<n> is irrelevant.)

Parameters:

<State> ON | OFF

*RST: OFF

Example: `CALC:SGR ON`
Activates the Spectrogram result display.

Manual operation: See "State" on page 179

CALCulate<n>:SGRam:TRACe <Trace>
CALCulate<n>:SPECtrogram:TRACe <Trace>

This command determines the trace in the result display the Spectrogram is based on.

Query parameters:

<Trace> TRACE1 | TRACE2 | TRACE3 | TRACE4 | TRACE5 | TRACE6

How many traces are available depends on the selected result display.

Example: `CALC2:SPEC:TRAC TRACE3`

Configuring the Color Map

DISPlay[:WINDow<n>]:SGRam:COLor:DEFault....352
DISPlay[:WINDow<n>]:SPECtrogram:COLor:DEFault....352
DISPlay[:WINDow<n>]:SGRam:COLor:LOWer....352
DISPlay[:WINDow<n>]:SPECtrogram:COLor:LOWer....352
DISPlay[:WINDow<n>]:SGRam:COLor:SHAPe....353
DISPlay[:WINDow<n>]:SPECtrogram:COLor:SHAPe....353
DISPlay[:WINDow<n>]:SGRam:COLor:UPPer....353
DISPlay[:WINDow<n>]:SPECtrogram:COLor:UPPer....353
DISPlay[:WINDow<n>]:SGRam:COLor[:STYLe]....353
DISPlay[:WINDow<n>]:SPECtrogram:COLor[:STYLe]....353

DISPlay[:WINDow<n>]:SGRam:COLor:DEFault
DISPlay[:WINDow<n>]:SPECtrogram:COLor:DEFault

This command restores the original color map.

Usage: Event

Manual operation: See "Set to Default" on page 182

DISPlay[:WINDow<n>]:SGRam:COLor:LOWer <Percentage>
DISPlay[:WINDow<n>]:SPECtrogram:COLor:LOWer <Percentage>

This command defines the starting point of the color map.

Parameters:

<Percentage> Statistical frequency percentage.

Range: 0 to 66
*RST: 0
Default unit: %

Example: `DISP:WIND:SGR:COL:LOW 10`
Sets the start of the color map to 10%.

Manual operation: See "Start / Stop" on page 181

DISPlay[:WINDow<n>]:SGRam:COLor:SHAPe <Shape>
DISPlay[:WINDow<n>]:SPECtrogram:COLor:SHAPe <Shape>

This command defines the shape and focus of the color curve for the spectrogram result display.

Parameters:

<Shape> Shape of the color curve.

Range: -1 to 1
*RST: 0

Manual operation: See "Shape" on page 181

DISPlay[:WINDow<n>]:SGRam:COLor:UPPer <Percentage>
DISPlay[:WINDow<n>]:SPECtrogram:COLor:UPPer <Percentage>

This command defines the end point of the color map.

Parameters:

<Percentage> Statistical frequency percentage.

Range: 0 to 66
*RST: 0
Default unit: %

Example: `DISP:WIND:SGR:COL:UPP 95`
Sets the start of the color map to 95%.

Manual operation: See "Start / Stop" on page 181

DISPlay[:WINDow<n>]:SGRam:COLor[:STYLe] <ColorScheme>
DISPlay[:WINDow<n>]:SPECtrogram:COLor[:STYLe] <ColorScheme>

This command selects the color scheme.

Parameters:

<ColorScheme>

HOT
Uses a color range from blue to red. Blue colors indicate low levels, red colors indicate high ones.

COLD
Uses a color range from red to blue. Red colors indicate low levels, blue colors indicate high ones.

RADar
Uses a color range from black over green to light turquoise with shades of green in between.

GRAYscale
Shows the results in shades of gray.

*RST: HOT

Example: `DISP:WIND:SPEC:COL GRAY`
Changes the color scheme of the spectrogram to black and white.

Manual operation: See "Hot/Cold/Radar/Grayscale" on page 182

13.6.2.3 Using Markers

The following commands are available for marker settings and functions in the I/Q Analyzer application.

For "I/Q Vector" displays markers are not available.

- Setting Up Individual Markers.....354
- General Marker Settings.....358
- Marker Search (Spectrograms).....359
- Configuring and Performing a Marker Search.....367
- Positioning the Marker.....370
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Setting Up Individual Markers

The following commands define the position of markers in the diagram.

CALCulate<n>:DELTamarker<m>:AOFF.....354
CALCulate<n>:DELTamarker<m>:LINK.....355
CALCulate<n>:DELTamarker<m>:LINK:TO:MARKer<m>.....355
CALCulate<n>:DELTamarker<m>:MODE.....355
CALCulate<n>:DELTamarker<m>:MREF.....356
CALCulate<n>:DELTamarker<m>[:STATe].....356
CALCulate<n>:DELTamarker<m>:TRACe.....356
CALCulate<n>:DELTamarker<m>:X.....356
CALCulate<n>:MARKer<m>:AOFF.....357
CALCulate<n>:MARKer<m>:LINK:TO:MARKer<m>.....357
CALCulate<n>:MARKer<m>[:STATe].....357
CALCulate<n>:MARKer<m>:TRACe.....358
CALCulate<n>:MARKer<m>:X.....358

CALCulate<n>:DELTamarker<m>:AOFF

This command turns *all* delta markers off.

(<m> is irrelevant)

Example: `CALC:DELT:AOFF`
Turns all delta markers off.

Usage: Event

CALCulate<n>:DELTamarker<m>:LINK <State>

This command links delta marker <m> to marker 1.

If you change the horizontal position (x-value) of marker 1, delta marker <m> changes its horizontal position to the same value.

Tip: to link any marker to a different marker than marker 1, use the `CALCulate<n>:DELTamarker<m>:LINK:TO:MARKer<m>` or `CALCulate<n>:MARKer<m>:LINK:TO:MARKer<m>` commands.

Parameters:

<State> ON | OFF

*RST: OFF

Example: `CALC:DELT2:LINK ON`

Manual operation: See "Linking to Another Marker" on page 196

CALCulate<n>:DELTamarker<m>:LINK:TO:MARKer<m> <State>

This command links delta marker <m1> to any active normal marker <m2>.

If you change the horizontal position of marker <m2>, delta marker <m1> changes its horizontal position to the same value.

Parameters:

<State> ON | OFF

*RST: OFF

Example: `CALC:DELT4:LINK:TO:MARK2 ON`

Links the delta marker 4 to the marker 2.

Manual operation: See "Linking to Another Marker" on page 196

CALCulate<n>:DELTamarker<m>:MODE <Mode>

This command defines whether the position of a delta marker is provided as an absolute value or relative to a reference marker (for *all* delta markers, <m> is irrelevant).

Note that when the position of a delta marker is *queried*, the result is always an absolute value (see `CALCulate<n>:DELTamarker<m>:X` on page 356)!

Parameters:

<Mode>

ABSolute
Delta marker position in absolute terms.

RELative
Delta marker position in relation to a reference marker.

*RST: RELative

Example: `CALC:DELT:MODE ABS`

Absolute delta marker position.

CALCulate<n>:DELTamarker<m>:MREF <Reference>

This command selects a reference marker for a delta marker other than marker 1.

Parameters:

<Reference> **1 to 16**
Selects markers 1 to 16 as the reference.

Example: `CALC:DELT3:MREF 2`
Specifies that the values of delta marker 3 are relative to marker 2.

Manual operation: See "Reference Marker" on page 196

CALCulate<n>:DELTamarker<m>[:STATe] <State>

This command turns delta markers on and off.

If necessary, the command activates the delta marker first.

No suffix at DELTamarker turns on delta marker 1.

Parameters:

<State> ON | OFF
*RST: OFF

Example: `CALC:DELT2 ON`
Turns on delta marker 2.

Manual operation: See "M1 Marker 1/ Delta 1/ Delta 2/.../Delta 16" on page 195

CALCulate<n>:DELTamarker<m>:TRACe <Trace>

This command selects the trace a delta marker is positioned on.

Note that the corresponding trace must have a trace mode other than "Blank".

If necessary, the command activates the marker first.

Parameters:

<Trace> Trace number the marker is assigned to.

Example: `CALC:DELT2:TRAC 2`
Positions delta marker 2 on trace 2.

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

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.

Parameters:

<Position> Numeric value that defines the marker position on the x-axis.
The position is relative to the reference marker.
To select an absolute position you have to change the delta marker mode with CALCulate<n>:DELTamarker<m>:MODE on page 355.
A query returns the absolute position of the delta marker.

Range: The value range and unit depend on the measurement and scale of the x-axis.

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

Range: The value range and unit depend on the measurement and scale of the x-axis.

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

Manual operation: See "M1 Marker 1/ Delta 1/ Delta 2/.../Delta 16" on page 195

CALCulate<n>:MARKer<m>:AOFF

This command turns all markers off.

Example: `CALC:MARK:AOFF`
Switches off all markers.

Usage: Event

Manual operation: See "All Markers Off" on page 197

CALCulate<n>:MARKer<m>:LINK:TO:MARKer<m> <State>

This command links normal marker <m1> to any active normal marker <m2>.

If you change the horizontal position of marker <m2>, marker <m1> changes its horizontal position to the same value.

Parameters:

<State> ON | OFF

*RST: OFF

Example: `CALC:MARK4:LINK:TO:MARK2 ON`
Links marker 4 to marker 2.

Manual operation: See "Linking to Another Marker" on page 196

CALCulate<n>:MARKer<m>[:STATe] <State>

This command turns markers on and off. If the corresponding marker number is currently active as a deltamarker, it is turned into a normal marker.

Parameters:

<State> ON | OFF
*RST: OFF

Example: `CALC:MARK3 ON`
Switches on marker 3.

Manual operation: See "Marker 1/ Delta 1/ Delta 2/.../Delta 16" on page 195

CALCulate<n>:MARKer<m>:TRACe <Trace>

This command selects the trace the marker is positioned on.

Note that the corresponding trace must have a trace mode other than "Blank".

If necessary, the command activates the marker first.

Parameters:

<Trace> **1 to 6**
Trace number the marker is assigned to.

Example: `CALC:MARK3:TRAC 2`
Assigns marker 3 to trace 2.

Manual operation: See "Assigning the Marker to a Trace" on page 196

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.
The unit is either Hz (frequency domain) or s (time domain) or dB (statistics).
The unit depends on the result display.
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 117

General Marker Settings

The following commands control general marker functionality.

Remote commands exclusive to general marker functionality

DISPlay:MTABle..359
CALCulate<n>:MARKer<m>:X:SSIZe.. 359

DISPlay:MTABle <DisplayMode>

This command turns the marker table on and off.

Parameters:
<DisplayMode>

ON
Turns the marker table on.

OFF
Turns the marker table off.

AUTO
Turns the marker table on if 3 or more markers are active.

*RST: AUTO

Example: `DISP:MTAB ON`
Activates the marker table.

Manual operation: See "Marker Table Display" on page 198

CALCulate<n>:MARKer<m>:X:SSIZe <StepSize>

This command selects the marker step size mode for *all* markers in *all* windows (<m>, <n> are irrelevant).

The step size defines the distance the marker moves when you move it with the mouse wheel.

It therefore takes effect in manual operation only.

Parameters:
<StepSize>

STANdard
the marker moves from one pixel to the next

POINts
the marker moves from one sweep point to the next

*RST: POINts

Example: `CALC:MARK:X:SSIZ STAN`
Sets the marker step size to one pixel.

Manual operation: See "Marker Stepsize" on page 198

Marker Search (Spectrograms)

The following commands automatically define the marker and delta marker position in the spectrogram.

Using Markers

The following commands control spectrogram markers.

Useful commands for spectrogram markers described elsewhere

The following commands define the horizontal position of the markers.

- `CALCulate<n>:MARKer<m>:MAXimum:LEFT` on page 371

- CALCulate<n>:MARKer<m>:MAXimum:NEXT on page 371
- CALCulate<n>:MARKer<m>:MAXimum[:PEAK] on page 371
- CALCulate<n>:MARKer<m>:MAXimum:RIGHt on page 372
- CALCulate<n>:MARKer<m>:MINimum:LEFT on page 372
- CALCulate<n>:MARKer<m>:MINimum:NEXT on page 372
- CALCulate<n>:MARKer<m>:MINimum[:PEAK] on page 373
- CALCulate<n>:MARKer<m>:MINimum:RIGHt on page 373

Remote commands exclusive to spectrogram markers

CALCulate<n>:MARKer<m>:SGRam:FRAMe....360
CALCulate<n>:MARKer<m>:SPECtrogram:FRAMe....360
CALCulate<n>:MARKer<m>:SGRam:SARea....361
CALCulate<n>:MARKer<m>:SPECtrogram:SARea....361
CALCulate<n>:MARKer<m>:SGRam:XY:MAXimum[:PEAK]....361
CALCulate<n>:MARKer<m>:SPECtrogram:XY:MAXimum[:PEAK]....361
CALCulate<n>:MARKer<m>:SGRam:XY:MINimum[:PEAK]....361
CALCulate<n>:MARKer<m>:SPECtrogram:XY:MINimum[:PEAK]....361
CALCulate<n>:MARKer<m>:SGRam:Y:MAXimum:ABOVe....361
CALCulate<n>:MARKer<m>:SPECtrogram:Y:MAXimum:ABOVe....361
CALCulate<n>:MARKer<m>:SGRam:Y:MAXimum:BELow....362
CALCulate<n>:MARKer<m>:SPECtrogram:Y:MAXimum:BELow....362
CALCulate<n>:MARKer<m>:SGRam:Y:MAXimum:NEXT....362
CALCulate<n>:MARKer<m>:SPECtrogram:Y:MAXimum:NEXT....362
CALCulate<n>:MARKer<m>:SGRam:Y:MAXimum[:PEAK]....362
CALCulate<n>:MARKer<m>:SPECtrogram:Y:MAXimum[:PEAK]....362
CALCulate<n>:MARKer<m>:SGRam:Y:MINimum:ABOVe....362
CALCulate<n>:MARKer<m>:SPECtrogram:Y:MINimum:ABOVe....362
CALCulate<n>:MARKer<m>:SGRam:Y:MINimum:BELow....362
CALCulate<n>:MARKer<m>:SPECtrogram:Y:MINimum:BELow....362
CALCulate<n>:MARKer<m>:SGRam:Y:MINimum:NEXT....363
CALCulate<n>:MARKer<m>:SPECtrogram:Y:MINimum:NEXT....363
CALCulate<n>:MARKer<m>:SGRam:Y:MINimum[:PEAK]....363
CALCulate<n>:MARKer<m>:SPECtrogram:Y:MINimum[:PEAK]....363

CALCulate<n>:MARKer<m>:SGRam:FRAMe <Frame> | <Time>
CALCulate<n>:MARKer<m>:SPECtrogram:FRAMe <Frame> | <Time>

This command positions a marker on a particular frame.

Parameters:

<Frame>	Selects a frame directly by the frame number. Valid if the time stamp is off. The range depends on the history depth.
<Time>	Selects a frame via its time stamp. Valid if the time stamp is on. The number is the (negative) distance to frame 0 in seconds. The range depends on the history depth.

Example: `CALC:MARK:SGR:FRAM -20`
Sets the marker on the 20th frame before the present.
`CALC:MARK2:SGR:FRAM -2s`
Sets second marker on the frame 2 seconds ago.

Manual operation: See "Marker 1/ Delta 1/ Delta 2/.../Delta 16" on page 195

CALCulate<n>:MARKer<m>:SGRam:SARea <SearchArea>
CALCulate<n>:MARKer<m>:SPECtrogram:SARea <SearchArea>

This command defines the marker search area for all spectrogram markers in the measurement channel (<n>, <m> are irrelevant).

Parameters:
<SearchArea>

VISible
Performs a search within the visible frames.
Note that the command does not work if the spectrogram is not visible for any reason (e.g. if the display update is off).

MEMory
Performs a search within all frames in the memory.

*RST: VISible

Manual operation: See "Marker Search Area" on page 202

CALCulate<n>:MARKer<m>:SGRam:XY:MAXimum[:PEAK]
CALCulate<n>:MARKer<m>:SPECtrogram:XY:MAXimum[:PEAK]

This command moves a marker to the highest level of the spectrogram.

Usage: Event

CALCulate<n>:MARKer<m>:SGRam:XY:MINimum[:PEAK]
CALCulate<n>:MARKer<m>:SPECtrogram:XY:MINimum[:PEAK]

This command moves a marker to the minimum level of the spectrogram.

Usage: Event

CALCulate<n>:MARKer<m>:SGRam:Y:MAXimum:ABOVe
CALCulate<n>:MARKer<m>:SPECtrogram:Y:MAXimum:ABOVe

This command moves a marker vertically to the next lower peak level for the current frequency.

The search includes only frames above the current marker position. It does not change the horizontal position of the marker.

Usage: Event

CALCulate<n>:MARKer<m>:SGRam:Y:MAXimum:BELow
CALCulate<n>:MARKer<m>:SPECtrogram:Y:MAXimum:BELow

This command moves a marker vertically to the next lower peak level for the current frequency.

The search includes only frames below the current marker position. It does not change the horizontal position of the marker.

Usage: Event

CALCulate<n>:MARKer<m>:SGRam:Y:MAXimum:NEXT
CALCulate<n>:MARKer<m>:SPECtrogram:Y:MAXimum:NEXT

This command moves a marker vertically to the next lower peak level for the current frequency.

The search includes all frames. It does not change the horizontal position of the marker.

Usage: Event

CALCulate<n>:MARKer<m>:SGRam:Y:MAXimum[:PEAK]
CALCulate<n>:MARKer<m>:SPECtrogram:Y:MAXimum[:PEAK]

This command moves a marker vertically to the highest level for the current frequency.

The search includes all frames. It does not change the horizontal position of the marker.

If the marker hasn't been active yet, the command looks for the peak level in the whole spectrogram.

Usage: Event

CALCulate<n>:MARKer<m>:SGRam:Y:MINimum:ABOVe
CALCulate<n>:MARKer<m>:SPECtrogram:Y:MINimum:ABOVe

This command moves a marker vertically to the next higher minimum level for the current frequency.

The search includes only frames above the current marker position. It does not change the horizontal position of the marker.

Usage: Event

CALCulate<n>:MARKer<m>:SGRam:Y:MINimum:BELow
CALCulate<n>:MARKer<m>:SPECtrogram:Y:MINimum:BELow

This command moves a marker vertically to the next higher minimum level for the current frequency.

The search includes only frames below the current marker position. It does not change the horizontal position of the marker.

Usage: Event

CALCulate<n>:MARKer<m>:SGRam:Y:MINimum:NEXT
CALCulate<n>:MARKer<m>:SPECtrogram:Y:MINimum:NEXT

This command moves a marker vertically to the next higher minimum level for the current frequency.

The search includes all frames. It does not change the horizontal position of the marker.

Usage: Event

CALCulate<n>:MARKer<m>:SGRam:Y:MINimum[:PEAK]
CALCulate<n>:MARKer<m>:SPECtrogram:Y:MINimum[:PEAK]

This command moves a marker vertically to the minimum level for the current frequency.

The search includes all frames. It does not change the horizontal position of the marker.

If the marker hasn't been active yet, the command first looks for the peak level for all frequencies and moves the marker vertically to the minimum level.

Usage: Event

Using Delta Markers

The following commands control spectrogram delta markers.

Useful commands for spectrogram markers described elsewhere

The following commands define the horizontal position of the delta markers.

- `CALCulate<n>:DELTamarker<m>:MAXimum:LEFT` on page 373
- `CALCulate<n>:DELTamarker<m>:MAXimum:NEXT` on page 374
- `CALCulate<n>:DELTamarker<m>:MAXimum[:PEAK]` on page 374
- `CALCulate<n>:DELTamarker<m>:MAXimum:RIGHt` on page 374
- `CALCulate<n>:DELTamarker<m>:MINimum:LEFT` on page 374
- `CALCulate<n>:DELTamarker<m>:MINimum:NEXT` on page 374
- `CALCulate<n>:DELTamarker<m>:MINimum[:PEAK]` on page 375
- `CALCulate<n>:DELTamarker<m>:MINimum:RIGHt` on page 375

Remote commands exclusive to spectrogram markers

CALCulate<n>:DELTamarker<m>:SGRam:FRAMe.. 364
CALCulate<n>:DELTamarker<m>:SPECtrogram:FRAMe..364
CALCulate<n>:DELTamarker<m>:SGRam:SARea...364
CALCulate<n>:DELTamarker<m>:SPECtrogram:SARea... 364
CALCulate<n>:DELTamarker<m>:SGRam:XY:MAXimum[:PEAK].....................................365

CALCulate<n>:DELTamarker<m>:SPECtrogram:XY:MAXimum[:PEAK]............................. 365
CALCulate<n>:DELTamarker<m>:SGRam:XY:MINimum[:PEAK].......................................365
CALCulate<n>:DELTamarker<m>:SPECtrogram:XY:MINimum[:PEAK].............................. 365
CALCulate<n>:DELTamarker<m>:SGRam:Y:MAXimum:ABOVe...................................... 365
CALCulate<n>:DELTamarker<m>:SPECtrogram:Y:MAXimum:ABOVe...............................365
CALCulate<n>:DELTamarker<m>:SGRam:Y:MAXimum:BELow..365
CALCulate<n>:DELTamarker<m>:SPECtrogram:Y:MAXimum:BELow................................365
CALCulate<n>:DELTamarker<m>:SGRam:Y:MAXimum:NEXT...366
CALCulate<n>:DELTamarker<m>:SPECtrogram:Y:MAXimum:NEXT................................. 366
CALCulate<n>:DELTamarker<m>:SGRam:Y:MAXimum[:PEAK]..366
CALCulate<n>:DELTamarker<m>:SPECtrogram:Y:MAXimum[:PEAK].............................. 366
CALCulate<n>:DELTamarker<m>:SGRam:Y:MINimum:ABOVe...366
CALCulate<n>:DELTamarker<m>:SPECtrogram:Y:MINimum:ABOVe................................ 366
CALCulate<n>:DELTamarker<m>:SGRam:Y:MINimum:BELow... 366
CALCulate<n>:DELTamarker<m>:SPECtrogram:Y:MINimum:BELow.................................366
CALCulate<n>:DELTamarker<m>:SGRam:Y:MINimum:NEXT..366
CALCulate<n>:DELTamarker<m>:SPECtrogram:Y:MINimum:NEXT.................................. 366
CALCulate<n>:DELTamarker<m>:SGRam:Y:MINimum[:PEAK]...367
CALCulate<n>:DELTamarker<m>:SPECtrogram:Y:MINimum[:PEAK]................................ 367

CALCulate<n>:DELTamarker<m>:SGRam:FRAMe <Frame> | <Time>
CALCulate<n>:DELTamarker<m>:SPECtrogram:FRAMe <Frame> | <Time>

This command positions a delta marker on a particular frame. The frame is relative to the position of marker 1.

The command is available for the spectrogram.

Parameters:

<Frame> — Selects a frame directly by the frame number. Valid if the time stamp is off.
The range depends on the history depth.

<Time> — Selects a frame via its time stamp. Valid if the time stamp is on.
The number is the distance to frame 0 in seconds. The range depends on the history depth.

Example:

`CALC:DELT4:SGR:FRAM -20`
Sets fourth deltamarker 20 frames below marker 1.
`CALC:DELT4:SGR:FRAM 2 s`
Sets fourth deltamarker 2 seconds above the position of marker 1.

Manual operation: See "M1 Marker 1/ Delta 1/ Delta 2/.../Delta 16" on page 195

CALCulate<n>:DELTamarker<m>:SGRam:SARea <SearchArea>
CALCulate<n>:DELTamarker<m>:SPECtrogram:SARea <SearchArea>

This command defines the marker search area for *all* spectrogram markers in the measurement channel (<n> and <m> are irrelevant).

Parameters:
<SearchArea> **VISible**
Performs a search within the visible frames.
Note that the command does not work if the spectrogram is not visible for any reason (e.g. if the display update is off).

MEMory
Performs a search within all frames in the memory.

*RST: VISible

Manual operation: See "Marker Search Area" on page 202

CALCulate<n>:DELTamarker<m>:SGRam:XY:MAXimum[:PEAK]
CALCulate<n>:DELTamarker<m>:SPECtrogram:XY:MAXimum[:PEAK]

This command moves a marker to the highest level of the spectrogram over all frequencies.

Usage: Event

CALCulate<n>:DELTamarker<m>:SGRam:XY:MINimum[:PEAK]
CALCulate<n>:DELTamarker<m>:SPECtrogram:XY:MINimum[:PEAK]

This command moves a delta marker to the minimum level of the spectrogram over all frequencies.

Usage: Event

CALCulate<n>:DELTamarker<m>:SGRam:Y:MAXimum:ABOVe
CALCulate<n>:DELTamarker<m>:SPECtrogram:Y:MAXimum:ABOVe

This command moves a marker vertically to the next higher level for the current frequency.

The search includes only frames above the current marker position. It does not change the horizontal position of the marker.

Usage: Event

CALCulate<n>:DELTamarker<m>:SGRam:Y:MAXimum:BELow
CALCulate<n>:DELTamarker<m>:SPECtrogram:Y:MAXimum:BELow

This command moves a marker vertically to the next higher level for the current frequency.

The search includes only frames below the current marker position. It does not change the horizontal position of the marker.

Usage: Event

CALCulate<n>:DELTamarker<m>:SGRam:Y:MAXimum:NEXT
CALCulate<n>:DELTamarker<m>:SPECtrogram:Y:MAXimum:NEXT

This command moves a delta marker vertically to the next higher level for the current frequency.

The search includes all frames. It does not change the horizontal position of the marker.

Usage: Event

CALCulate<n>:DELTamarker<m>:SGRam:Y:MAXimum[:PEAK]
CALCulate<n>:DELTamarker<m>:SPECtrogram:Y:MAXimum[:PEAK]

This command moves a delta marker vertically to the highest level for the current frequency.

The search includes all frames. It does not change the horizontal position of the marker.

If the marker hasn't been active yet, the command looks for the peak level in the whole spectrogram.

Usage: Event

CALCulate<n>:DELTamarker<m>:SGRam:Y:MINimum:ABOVe
CALCulate<n>:DELTamarker<m>:SPECtrogram:Y:MINimum:ABOVe

This command moves a delta marker vertically to the next minimum level for the current frequency.

The search includes only frames above the current marker position. It does not change the horizontal position of the marker.

Usage: Event

CALCulate<n>:DELTamarker<m>:SGRam:Y:MINimum:BELow
CALCulate<n>:DELTamarker<m>:SPECtrogram:Y:MINimum:BELow

This command moves a delta marker vertically to the next minimum level for the current frequency.

The search includes only frames below the current marker position. It does not change the horizontal position of the marker.

Usage: Event

CALCulate<n>:DELTamarker<m>:SGRam:Y:MINimum:NEXT
CALCulate<n>:DELTamarker<m>:SPECtrogram:Y:MINimum:NEXT

This command moves a delta marker vertically to the next minimum level for the current frequency.

The search includes all frames. It does not change the horizontal position of the marker.

Usage: Event

CALCulate<n>:DELTamarker<m>:SGRam:Y:MINimum[:PEAK]
CALCulate<n>:DELTamarker<m>:SPECtrogram:Y:MINimum[:PEAK]

This command moves a delta marker vertically to the minimum level for the current frequency.

The search includes all frames. It does not change the horizontal position of the marker.

If the marker hasn't been active yet, the command first looks for the peak level in the whole spectrogram and moves the marker vertically to the minimum level.

Usage: Event

Configuring and Performing a Marker Search

The following commands control the marker search.

CALCulate<n>:MARKer<m>:LOEXclude....................367
CALCulate<n>:MARKer<m>:PEXCursion....................367
CALCulate<n>:MARKer<m>:SEARch....................368
CALCulate<n>:MARKer<m>:X:SLIMits[:STATe]....................368
CALCulate<n>:MARKer<m>:X:SLIMits:LEFT....................369
CALCulate<n>:MARKer<m>:X:SLIMits:RIGHT....................369
CALCulate<n>:MARKer<m>:X:SLIMits:ZOOM[:STATe]....................369
CALCulate<n>:THReshold....................370
CALCulate<n>:THReshold:STATe....................370

CALCulate<n>:MARKer<m>:LOEXclude <State>

This command turns the suppression of the local oscillator during automatic marker positioning on and off (for *all* markers in *all* windows; <m>, <n> are irrelevant).

Parameters:

<State> ON | OFF | 0 | 1

*RST: 1

Example: `CALC:MARK:LOEX ON`

Manual operation: See "Exclude LO" on page 200

CALCulate<n>:MARKer<m>:PEXCursion <Excursion>

This command defines the peak excursion (for *all* markers in *all* windows; <m>, <n> are irrelevant).

The peak excursion sets the requirements for a peak to be detected during a peak search.

The unit depends on the measurement.

Application/Result display	Unit
Spectrum	dB

Example: `CALC:MARK:PEXC 10dB`
Defines peak excursion as 10 dB.

Manual operation: See "Peak Excursion" on page 200

CALCulate<n>:MARKer<m>:SEARch <MarkRealImag>

This command selects the trace type a marker search is performed on.

(For *all* markers, <m> is irrelevant.)

Parameters:
<MarkRealImag>

REAL
Marker search functions are performed on the real trace of the "I/Q" measurement.

IMAG
Marker search functions are performed on the imaginary trace of the "I/Q" measurement.

MAGN
Marker search functions are performed on the magnitude of the I and Q data.

*RST: REAL

Example: `CALC4:MARK:SEAR IMAG`

Manual operation: See "Branch for Peak Search" on page 201

CALCulate<n>:MARKer<m>:X:SLIMits[:STATe] <State>

This command turns marker search limits on and off for *all* markers in *all* windows (<m>, <n> are irrelevant).

If you perform a measurement in the time domain, this command limits the range of the trace to be analyzed.

Parameters:
<State> ON | OFF

*RST: OFF

Example: `CALC:MARK:X:SLIM ON`
Switches on search limitation.

Manual operation: See "Search Limits (Left / Right)" on page 200

CALCulate<n>:MARKer<m>:X:SLIMits:LEFT <SearchLimit>

This command defines the left limit of the marker search range for *all* markers in *all* windows (<m>, <n> are irrelevant).

If you perform a measurement in the time domain, this command limits the range of the trace to be analyzed.

Parameters:

<SearchLimit> The value range depends on the frequency range or measurement time.
The unit is Hz for frequency domain measurements and s for time domain measurements.
*RST: left diagram border

Example: `CALC:MARK:X:SLIM ON`
Switches the search limit function on.
`CALC:MARK:X:SLIM:LEFT 10MHz`
Sets the left limit of the search range to 10 MHz.

Manual operation: See "Search Limits (Left / Right)" on page 200

CALCulate<n>:MARKer<m>:X:SLIMits:RIGHT <SearchLimit>

This command defines the right limit of the marker search range for *all* markers in *all* windows (<m>, <n> are irrelevant).

If you perform a measurement in the time domain, this command limits the range of the trace to be analyzed.

Parameters:

<Limit> The value range depends on the frequency range or measurement time.
The unit is Hz for frequency domain measurements and s for time domain measurements.
*RST: right diagram border

Example: `CALC:MARK:X:SLIM ON`
Switches the search limit function on.
`CALC:MARK:X:SLIM:RIGH 20MHz`
Sets the right limit of the search range to 20 MHz.

Manual operation: See "Search Limits (Left / Right)" on page 200

CALCulate<n>:MARKer<m>:X:SLIMits:ZOOM[:STATe] <State>

This command adjusts the marker search range to the zoom area for *all* markers in *all* windows (<m>, <n> are irrelevant).

Parameters:

<State> ON | OFF
*RST: OFF

Example:
`CALC:MARK:X:SLIM:ZOOM ON`
Switches the search limit function on.
`CALC:MARK:X:SLIM:RIGH 20MHz`
Sets the right limit of the search range to 20 MHz.

Manual operation: See "Using Zoom Limits" on page 201

CALCulate<n>:THReshold <Level>

This command defines a threshold level for the marker peak search (for *all* markers in *all* windows; <n> is irrelevant).

Parameters:
<Level> Numeric value. The value range and unit are variable.
*RST: -120 dBm

Example:
`CALC:THR -82DBM`
Sets the threshold value to -82 dBm.

Manual operation: See "Search Threshold" on page 201

CALCulate<n>:THReshold:STATe <State>

This command turns a threshold for the marker peak search on and off (for *all* markers in *all* windows; <n> is irrelevant).

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

Example:
`CALC:THR:STAT ON`
Switches on the threshold line.

Manual operation: See "Deactivating All Search Limits" on page 201

Positioning the Marker

This chapter contains remote commands necessary to position the marker on a trace.

- Positioning Normal Markers 370
- Positioning Delta Markers....................373

Positioning Normal Markers

The following commands position markers on the trace.

CALCulate<n>:MARKer<m>:MAXimum:AUTO....................371
CALCulate<n>:MARKer<m>:MAXimum:LEFT....................371
CALCulate<n>:MARKer<m>:MAXimum:NEXT....................371
CALCulate<n>:MARKer<m>:MAXimum[:PEAK]....................371
CALCulate<n>:MARKer<m>:MAXimum:RIGHt....................372
CALCulate<n>:MARKer<m>:MINimum:AUTO....................372
CALCulate<n>:MARKer<m>:MINimum:LEFT....................372

CALCulate<n>:MARKer<m>:MINimum:NEXT....372
CALCulate<n>:MARKer<m>:MINimum[:PEAK]....373
CALCulate<n>:MARKer<m>:MINimum:RIGHt....373

CALCulate<n>:MARKer<m>:MAXimum:AUTO <State>

This command turns an automatic marker peak search for a trace maximum on and off. The R&S VSE performs the peak search after each sweep.

Parameters:

<State> ON | OFF

*RST: OFF

Example: `CALC:MARK:MAX:AUTO ON`

Activates the automatic peak search function for marker 1 at the end of each particular sweep.

Manual operation: See "Auto Max / Min Peak Search" on page 200

CALCulate<n>:MARKer<m>:MAXimum:LEFT

This command moves a marker to the next lower peak.

The search includes only measurement values to the left of the current marker position.

In the spectrogram, the command moves a marker horizontally to the maximum level in the currently selected frame. The vertical marker position remains the same.

Usage: Event

Manual operation: See "Search Next Peak" on page 204

CALCulate<n>:MARKer<m>:MAXimum:NEXT

This command moves a marker to the next lower peak.

In the spectrogram, the command moves a marker horizontally to the maximum level in the currently selected frame. The vertical marker position remains the same.

Usage: Event

Manual operation: See "Search Next Peak" on page 204

CALCulate<n>:MARKer<m>:MAXimum[:PEAK]

This command moves a marker to the highest level.

In the spectrogram, the command moves a marker horizontally to the maximum level in the currently selected frame. The vertical marker position remains the same.

If the marker is not yet active, the command first activates the marker.

Usage: Event

Manual operation: See "Peak Search" on page 204

CALCulate<n>:MARKer<m>:MAXimum:RIGHt

This command moves a marker to the next lower peak.

The search includes only measurement values to the right of the current marker position.

In the spectrogram, the command moves a marker horizontally to the maximum level in the currently selected frame. The vertical marker position remains the same.

Usage: Event

Manual operation: See "Search Next Peak" on page 204

CALCulate<n>:MARKer<m>:MINimum:AUTO <State>

This command turns an automatic marker peak search for a trace minimum on and off. The R&S VSE performs the peak search after each sweep.

Parameters:

<State> ON | OFF

*RST: OFF

Example: `CALC:MARK:MIN:AUTO ON`

Activates the automatic minimum value search function for marker 1 at the end of each particular sweep.

Manual operation: See "Auto Max / Min Peak Search" on page 200

CALCulate<n>:MARKer<m>:MINimum:LEFT

This command moves a marker to the next minimum value.

The search includes only measurement values to the right of the current marker position.

In the spectrogram, the command moves a marker horizontally to the minimum level in the currently selected frame. The vertical marker position remains the same.

Usage: Event

Manual operation: See "Search Next Minimum" on page 205

CALCulate<n>:MARKer<m>:MINimum:NEXT

This command moves a marker to the next minimum value.

In the spectrogram, the command moves a marker horizontally to the minimum level in the currently selected frame. The vertical marker position remains the same.

Usage: Event

Manual operation: See "Search Next Minimum" on page 205

CALCulate<n>:MARKer<m>:MINimum[:PEAK]

This command moves a marker to the minimum level.

In the spectrogram, the command moves a marker horizontally to the minimum level in the currently selected frame. The vertical marker position remains the same.

If the marker is not yet active, the command first activates the marker.

Usage: Event

Manual operation: See "Search Minimum" on page 205

CALCulate<n>:MARKer<m>:MINimum:RIGHt

This command moves a marker to the next minimum value.

The search includes only measurement values to the right of the current marker position.

In the spectrogram, the command moves a marker horizontally to the minimum level in the currently selected frame. The vertical marker position remains the same.

Usage: Event

Manual operation: See "Search Next Minimum" on page 205

Positioning Delta Markers

The following commands position delta markers on the trace.

CALCulate<n>:DELTamarker<m>:MAXimum:LEFT....373
CALCulate<n>:DELTamarker<m>:MAXimum:NEXT....374
CALCulate<n>:DELTamarker<m>:MAXimum[:PEAK]....374
CALCulate<n>:DELTamarker<m>:MAXimum:RIGHt....374
CALCulate<n>:DELTamarker<m>:MINimum:LEFT....374
CALCulate<n>:DELTamarker<m>:MINimum:NEXT....374
CALCulate<n>:DELTamarker<m>:MINimum[:PEAK]....375
CALCulate<n>:DELTamarker<m>:MINimum:RIGHt....375

CALCulate<n>:DELTamarker<m>:MAXimum:LEFT

This command moves a delta marker to the next higher value.

The search includes only measurement values to the left of the current marker position.

In the spectrogram, the command moves a marker horizontally to the maximum level in the currently selected frame. The vertical marker position remains the same.

Usage: Event

Manual operation: See "Search Next Peak" on page 204

CALCulate<n>:DELTamarker<m>:MAXimum:NEXT

This command moves a marker to the next higher value.

In the spectrogram, the command moves a marker horizontally to the maximum level in the currently selected frame. The vertical marker position remains the same.

Usage: Event

Manual operation: See "Search Next Peak" on page 204

CALCulate<n>:DELTamarker<m>:MAXimum[:PEAK]

This command moves a delta marker to the highest level.

In the spectrogram, the command moves a marker horizontally to the maximum level in the currently selected frame. The vertical marker position remains the same.

If the marker is not yet active, the command first activates the marker.

Usage: Event

Manual operation: See "Peak Search" on page 204

CALCulate<n>:DELTamarker<m>:MAXimum:RIGHt

This command moves a delta marker to the next higher value.

The search includes only measurement values to the right of the current marker position.

In the spectrogram, the command moves a marker horizontally to the maximum level in the currently selected frame. The vertical marker position remains the same.

Usage: Event

Manual operation: See "Search Next Peak" on page 204

CALCulate<n>:DELTamarker<m>:MINimum:LEFT

This command moves a delta marker to the next higher minimum value.

The search includes only measurement values to the right of the current marker position.

In the spectrogram, the command moves a marker horizontally to the minimum level in the currently selected frame. The vertical marker position remains the same.

Usage: Event

Manual operation: See "Search Next Minimum" on page 205

CALCulate<n>:DELTamarker<m>:MINimum:NEXT

This command moves a marker to the next higher minimum value.

In the spectrogram, the command moves a marker horizontally to the minimum level in the currently selected frame. The vertical marker position remains the same.

Usage: Event

Manual operation: See "Search Next Minimum" on page 205

CALCulate<n>:DELTamarker<m>:MINimum[:PEAK]

This command moves a delta marker to the minimum level.

In the spectrogram, the command moves a marker horizontally to the minimum level in the currently selected frame. The vertical marker position remains the same.

If the marker is not yet active, the command first activates the marker.

Usage: Event

Manual operation: See "Search Minimum" on page 205

CALCulate<n>:DELTamarker<m>:MINimum:RIGHt

This command moves a delta marker to the next higher minimum value.

The search includes only measurement values to the right of the current marker position.

In the spectrogram, the command moves a marker horizontally to the minimum level in the currently selected frame. The vertical marker position remains the same.

Usage: Event

Manual operation: See "Search Next Minimum" on page 205

Band Power Marker

The following commands control the marker for band power measurements.

Using Markers

CALCulate<n>:MARKer<m>:FUNCtion:BPOWer:MODE....................375
CALCulate<n>:MARKer<m>:FUNCtion:BPOWer:RESult?....................376
CALCulate<n>:MARKer<m>:FUNCtion:BPOWer:SPAN....................376
CALCulate<n>:MARKer<m>:FUNCtion:BPOWer[:STATe]....................376

CALCulate<n>:MARKer<m>:FUNCtion:BPOWer:MODE <Mode>

This command selects the way the results for a band power marker are displayed.

Parameters:

<Mode>

POWer
Result is displayed as an absolute power. The power unit depends on the `CALCulate<n>:UNIT:POWer` setting.
setting.

DENSity
Result is displayed as a density in dBm/Hz.

*RST: POWer

Example:
`CALC:MARK4:FUNC:BPOW:MODE DENS`
Configures marker 4 to show the measurement results in dBm/Hz.

Manual operation: See "Power Mode" on page 207

CALCulate<n>:MARKer<m>:FUNCtion:BPOWer:RESult?

This command queries the results of the band power measurement.

Return values:

<Power> Signal power over the marker bandwidth.

Example:
Activate the band power marker:
`CALC:MARK:FUNC:BPOW:STAT ON`
Select the density mode for the result:
`CALC:MARK:FUNC:BPOW:MODE DENS`
Query the result:
`CALC:MARK:FUNC:BPOW:RES?`
Response:
`20dBm/Hz`

Usage: Query only

CALCulate<n>:MARKer<m>:FUNCtion:BPOWer:SPAN <Span>

This command defines the bandwidth around the marker position.

Parameters:

<Span> Frequency. The maximum span depends on the marker position and R&S VSE model.

*RST: 5% of current span
Default unit: Hz

Example:
`CALC:MARK:FUNC:BPOW:SPAN 2MHz`
Measures the band power over 2 MHz around the marker.

Manual operation: See "Span" on page 207

CALCulate<n>:MARKer<m>:FUNCtion:BPOWer[:STATe] <State>

This command turns markers for band power measurements on and off.

Parameters:

<State> ON | OFF

*RST: OFF

Example: `CALC:MARK4:FUNC:BPOW:STAT ON`
Activates or turns marker 4 into a band power marker.

Manual operation: See "Band Power Measurement State" on page 206

Using Delta Markers

CALCulate<n>:DELTamarker<m>:FUNCtion:BPOWer:MODE....377
CALCulate<n>:DELTamarker<m>:FUNCtion:BPOWer:RESult?....377
CALCulate<n>:DELTamarker<m>:FUNCtion:BPOWer:SPAN....377
CALCulate<n>:DELTamarker<m>:FUNCtion:BPOWer[:STATe]....378

CALCulate<n>:DELTamarker<m>:FUNCtion:BPOWer:MODE <Mode>

This command selects the way the results for a band power delta marker are displayed.

Parameters:

<Mode>

POWer
Result is displayed as an absolute power. The power unit depends on the `CALCulate<n>:UNIT:POWer` setting.

DENSity
Result is displayed as a density in dBm/Hz.

*RST: POWer

Manual operation: See "Power Mode" on page 207

CALCulate<n>:DELTamarker<m>:FUNCtion:BPOWer:RESult?

This command queries the results of the band power measurement.

Return values:

<Power> Signal power over the delta marker bandwidth.

Usage: Query only

CALCulate<n>:DELTamarker<m>:FUNCtion:BPOWer:SPAN <Span>

This command defines the bandwidth around the delta marker position.

Parameters:

<Span> Frequency. The maximum span depends on the marker position and R&S VSE model.

*RST: 5% of current span
Default unit: Hz

Manual operation: See "Span" on page 207

CALCulate<n>:DELTamarker<m>:FUNCtion:BPOWer[:STATe] <State>

This command turns delta markers for band power measurements on and off.

If neccessary, the command also turns on a reference marker.

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

Manual operation: See "Band Power Measurement State" on page 206

13.6.2.4 Zooming into the Display

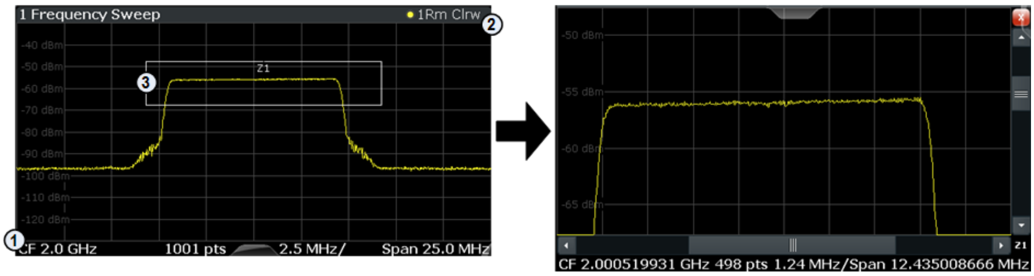
Using the Single Zoom

DISPlay[:WINDow<n>]:ZOOM:AREA....378
DISPlay[:WINDow<n>]:ZOOM:STATe....378

DISPlay[:WINDow<n>]:ZOOM:AREA <x1>,<y1>,<x2>,<y2>

This command defines the zoom area.

To define a zoom area, you first have to turn the zoom on.



1 = origin of coordinate system (x1 = 0, y1 = 0)
2 = end point of system (x2 = 100, y2= 100)
3 = zoom area (e.g. x1 = 60, y1 = 30, x2 = 80, y2 = 75)

Parameters:
<x1>,<y1>, <x2>,<y2> Diagram coordinates in % of the complete diagram that define the zoom area.
The lower left corner is the origin of coordinate system. The upper right corner is the end point of the system.
Range: 0 to 100
Default unit: PCT

Manual operation: See "Single Zoom" on page 209

DISPlay[:WINDow<n>]:ZOOM:STATe <State>

This command turns the zoom on and off.

Parameters:

<State> ON | OFF

*RST: OFF

Example: `DISP:ZOOM ON`

Activates the zoom mode.

Manual operation: See "Single Zoom" on page 209

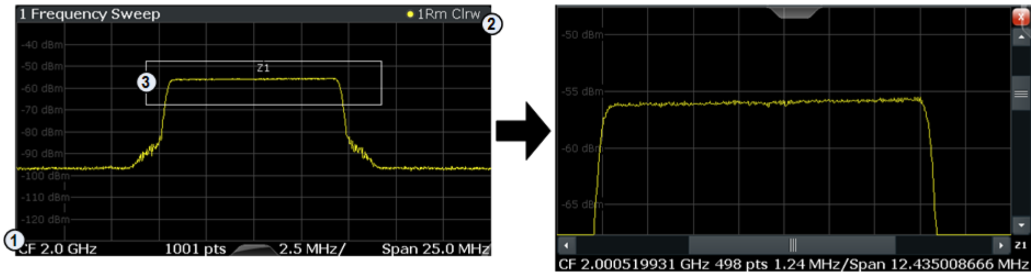
Using the Multiple Zoom

DISPlay[:WINDow<n>]:ZOOM:MULTiple<zoom>:AREA..379
DISPlay[:WINDow<n>]:ZOOM:MULTiple<zoom>:STATe.. 379

DISPlay[:WINDow<n>]:ZOOM:MULTiple<zoom>:AREA <x1>,<y1>,<x2>,<y2>

This command defines the zoom area for a multiple zoom.

To define a zoom area, you first have to turn the zoom on.



1 = origin of coordinate system (x1 = 0, y1 = 0)
2 = end point of system (x2 = 100, y2= 100)
3 = zoom area (e.g. x1 = 60, y1 = 30, x2 = 80, y2 = 75)

Suffix:

<zoom> 1...4

Selects the zoom window.

Parameters:

<x1>,<y1>, <x2>,<y2> Diagram coordinates in % of the complete diagram that define the zoom area.

The lower left corner is the origin of coordinate system. The upper right corner is the end point of the system.

Range: 0 to 100

Default unit: PCT

Manual operation: See "Multiple Zoom" on page 209

DISPlay[:WINDow<n>]:ZOOM:MULTiple<zoom>:STATe <State>

This command turns the mutliple zoom on and off.

Suffix:

<zoom> 1...4
Selects the zoom window.
If you turn off one of the zoom windows, all subsequent zoom windows move up one position.

Parameters:

<State> ON | OFF
*RST: OFF

Manual operation: See "Multiple Zoom" on page 209

13.6.3 Retrieving Results

The following commands can be used to retrieve the results of the I/Q Analyzer measurement.

- Retrieving Captured I/Q Data....................380
- Retrieving I/Q Trace Data....................383
- Retrieving Marker and Peak Search Results....................385

13.6.3.1 Retrieving Captured I/Q Data

The captured I/Q data is output in the form of a list, three different formats can be selected for this list (see `TRACe:IQ:DATA:FORMat` on page 381).

For details on formats refer to chapter A.4, "Reference: Format Description for I/Q Data Files", on page 458.

TRACe:IQ:DATA?....................380
TRACe:IQ:DATA:FORMat....................381
TRACe:IQ:DATA:MEMory?....................381

TRACe:IQ:DATA?

This command queries the captured data from measurements with the I/Q Analyzer.

To get the results, the command also initiates a measurement with the current settings of the R&S VSE.

Note: Using the command with the *RST values for the `TRACe:IQ:SET` command, the following minimum buffer sizes for the response data are recommended: ASCII format 10 kBytes, binary format: 2 kBytes

Return values:

<Results> Measured voltage for I and Q component for each sample that has been captured during the measurement.
The number of samples depends on `TRACe:IQ:SET`. In ASCII format, the number of results is 2* the number of samples.
The data format depends on `TRACe:IQ:DATA:FORMat` on page 381.
Default unit: V

Example:

`TRAC:IQ:STAT ON`
Enables acquisition of I/Q data
`TRAC:IQ:SET NORM,10MHz,32MHz,EXT,POS,0,4096`
Measurement configuration:
Sample Rate = 32 MHz
Trigger Source = External
Trigger Slope = Positive
Pretrigger Samples = 0
Number of Samples = 4096
`FORMat REAL,32`
Selects format of response data
`TRAC:IQ:DATA?`
Starts measurement and reads results

Usage: Query only

TRACe:IQ:DATA:FORMat <Format>

This command selects the order of the I/Q data.

For details see chapter A.4, "Reference: Format Description for I/Q Data Files", on page 458.

Parameters:

<Format> COMPatible | IQBLock | IQPair

COMPatible
I and Q values are separated and collected in blocks: A block (512k) of I values is followed by a block (512k) of Q values, followed by a block of I values, followed by a block of Q values etc. (I,I,I,I,Q,Q,Q,Q,I,I,I,I,Q,Q,Q,Q...)

IQBLock
First all I-values are listed, then the Q-values (I,I,I,I,I,I,...Q,Q,Q,Q,Q,Q)

IQPair
One pair of I/Q values after the other is listed (I,Q,I,Q,I,Q...).

*RST: IQBL

TRACe:IQ:DATA:MEMory? [<OffsetSamples>,<NoOfSamples>]

This command queries the I/Q data currently stored in the memory of the R&S VSE.

By default, the command returns all I/Q data in the memory. You can, however, narrow down the amount of data that the command returns using the optional parameters.

By default, the amount of available data depends on `TRACe:IQ:SET`.

Parameters:

<OffsetSamples> Selects an offset at which the output of data should start in relation to the first data. If omitted, all captured samples are output, starting with the first sample.

Range: 0 to <# of samples> – 1, with <# of samples> being the maximum number of captured values

*RST: 0

<NoOfSamples> Number of samples you want to query, beginning at the offset you have defined. If omitted, all captured samples (starting at offset) are output.

Range: 1 to <# of samples> - <offset samples> with <# of samples> maximum number of captured values

*RST: <# of samples>

Return values:

<IQData> Measured value pair (I,Q) for each sample that has been recorded.

The data format depends on `FORMat[:DATA]`.

Default unit: V

Example:

`TRAC:IQ:STAT ON`
Enables acquisition of I/Q data
`TRAC:IQ:SET NORM,10MHz,32MHz,EXT,POS,100,4096`
Measurement configuration:
Sample Rate = 32 MHz
Trigger Source = External
Trigger Slope = Positive
Pretrigger Samples = 100
Number of Samples = 4096
`INIT;*WAI`
Starts measurement and wait for sync
`FORMat REAL,32`
Determines output format
To read the results:
`TRAC:IQ:DATA:MEM?`
Reads all 4096 I/Q data
`TRAC:IQ:DATA:MEM? 0,2048`
Reads 2048 I/Q data starting at the beginning of data acquisition
`TRAC:IQ:DATA:MEM? 2048,1024`
Reads 1024 I/Q data from half of the recorded data
`TRAC:IQ:DATA:MEM? 100,512`
Reads 512 I/Q data starting at the trigger point (<Pretrigger Samples> was 100)

Usage: Query only

13.6.3.2 Retrieving I/Q Trace Data

In addition to the raw captured I/Q data, the results from I/Q analysis as shown in the result displays can also be retrieved.

FORMat[:DATA]..383
FORMat:DEXPort:DSEParator..383
TRACe<n>[:DATA]?..384
TRACe<n>[:DATA]:MEMory?..384
TRACe<n>[:DATA]:X?..385

FORMat[:DATA] <Format>

This command selects the data format that is used for transmission of trace data from the R&S VSE to the controlling computer.

Note that the command has no effect for data that you send to the R&S VSE. The R&S VSE automatically recognizes the data it receives, regardless of the format.

For details on data formats see chapter A.3, "Formats for Returned Values: ASCII Format and Binary Format", on page 458.

Parameters:

<Format>

ASCii
ASCii format, separated by commas.
This format is almost always suitable, regardless of the actual data format. However, the data is not as compact as other formats may be.

REAL,32
32-bit IEEE 754 floating-point numbers in the "definite length block format".
For I/Q data, 8 bytes per sample are returned for this format setting.

*RST: ASCII

Example: `FORM REAL,32`

Usage: SCPI confirmed

FORMat:DEXPort:DSEParator <Separator>

This command selects the decimal separator for data exported in ASCII format.

Parameters:

<Separator>

COMMa
Uses a comma as decimal separator, e.g. *4,05*.

POINt
Uses a point as decimal separator, e.g. *4.05*.

*RST: *RST has no effect on the decimal separator. Default is POINt.

Example: `FORM:DEXP:DSEP POIN`
Sets the decimal point as separator.

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

This command queries current trace data and measurement results.

The data format depends on `FORMat[:DATA]`.

Query parameters:

<ResultType> Selects the type of result to be returned.

TRACE1 | ... | TRACE6
Returns the trace data for the corresponding trace.

SPECtrogram | SGRam
Returns the results of the spectrogram result display.
For details see table 13-10.

Return values:

<TraceData> Returns the sweep point values as shown in the result display.
If you are measuring with the auto peak detector, the command returns positive peak values only. (To retrieve negative peak values, define a second trace with a negative peak detector.)
For the Magnitude and Spectrum result displays in the I/Q Analyzer application, this command returns the magnitude of the I and Q values (I+jQ) for each sweep point (=1001 values).
For the Real/Imag (I/Q) result display, the command returns first the real parts for each trace point, then the imaginary parts ($I_1,...,I_{1001}, Q_1,...,Q_{1001}$).
For the I/Q Vector result display, the I and Q values for each trace point are returned (1001 pairs of I and Q values).

Example: `TRAC? TRACE3`
Queries the data of trace 3.

Usage: SCPI confirmed

Manual operation: See "Magnitude" on page 112

Table 13-10: Return values for SPECtrogram parameter

For every frame in the spectrogram, the command returns the power levels that have been measured, one for each sweep point. The number of frames depends on the size of the history depth. The power level depends on the unit you have currently set.

TRACe<n>[:DATA]:MEMory? <Trace>,<OffsSwPoint>,<NoOfSwPoints>

This command queries the previously captured trace data for the specified trace from the memory. As an offset and number of sweep points to be retrieved can be specified, the trace data can be retrieved in smaller portions, making the command faster than the `TRAC:DATA?` command. This is useful if only specific parts of the trace data are of interest.

If no parameters are specified with the command, the entire trace data is retrieved; in this case, the command is identical to `TRAC:DATA? TRACE1`

For details on the returned values see the TRAC:DATA? <TRACE...> command.

Query parameters:

<Trace> TRACE1 | TRACE2 | TRACE3 | TRACE4 | TRACE5 | TRACE6

<OffsSwPoint> The offset in sweep points related to the start of the measurement at which data retrieval is to start.

<NoOfSwPoints> Number of sweep points to be retrieved from the trace.

Example: `TRAC:DATA:MEM? TRACE1,25,100`
Retrieves 100 sweep points from trace 1, starting at sweep point 25.

Usage: Query only

TRACe<n>[:DATA]:X? <TraceNumber>

This command queries the horizontal trace data for each sweep point in the specified window, for example the frequency in frequency domain or the time in time domain measurements.

This is especially useful for traces with non-equidistant x-values.

Query parameters:

<TraceNumber> Trace number.
TRACE1 | ... | TRACE6

Example: `TRAC3:X? TRACE1`
Returns the x-values for trace 1 in window 3.

Usage: Query only

13.6.3.3 Retrieving Marker and Peak Search Results

The following commands are required to retrieve the results of markers and peak searches.

Useful commands for retrieving marker results described elsewhere:

- `CALCulate<n>:DELTamarker<m>:X` on page 356
- `CALCulate<n>:MARKer<m>:X` on page 358

Remote commands exclusive to retrieving marker results:

CALCulate<n>:DELTamarker<m>:X:RELative?....................385
CALCulate<n>:DELTamarker<m>:Y?....................386
CALCulate<n>:MARKer<m>:Y?....................386

CALCulate<n>:DELTamarker<m>:X:RELative?

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

If necessary, the command activates the delta marker first.

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

Example: `CALC:DELT3:X:REL?`
Outputs the frequency of delta marker 3 relative to marker 1 or relative to the reference position.

Usage: Query only

Manual operation: See "Marker 1/ Delta 1/ Delta 2/.../Delta 16" on page 195

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.

See also `INITiate<n>:CONTinuous` on page 287.

The unit depends on the application of the command.

Table 13-11: Base unit

Parameter, measuring function or result display	Output unit
DBM | DBPW | DBUV | DBMV | DBUA	dB (lin/log)
WATT | VOLT | AMPere	dB (lin), % (log)
statistics function (APD or CCDF) on	dimensionless output

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

Manual operation: See "Marker 1/ Delta 1/ Delta 2/.../Delta 16" on page 195

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.

See also `INITiate<n>:CONTinuous` on page 287.

Return values:

<Result>	Result at the marker position. The unit is variable and depends on the one you have currently set. In the Real/Imag (I/Q) result display of the I/Q Analyzer, the command returns the real part first, then the imaginary part.

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.
	In I/Q Analyzer application, for "Real/Imag (I/Q)", for example:
	`1.852719887E-011,0`

Usage:	Query only
Manual operation:	See "Marker Table" on page 117

13.7 Managing Settings and Results

The commands required to store and load software settings and import and export measurement results in a remote environment are described here.

The tasks for manual operation are described in chapter 8, "Data Management", on page 76.

Addressing drives

The various drives can be addressed via the "mass storage instrument specifier" <msis> using the conventional Windows syntax. The internal hard disk is addressed by "C:".

For details on storage locations refer to chapter 8.2.2.2, "Storage Location and File Name", on page 80.

The file names (<FileName> parameter) are given as string parameters enclosed in quotation marks. They also comply with Windows conventions. Windows file names do not distinguish between uppercase and lowercase notation.

Wildcards

The two characters "*" and "?" can be used as "wildcards", i.e., they are variables for a selection of several files. The question mark "?" replaces exactly one character, the asterisk replaces any of the remaining characters in the file name. "*.*" thus means all files in a directory.

Path names

Storage locations can be specified either as absolute (including the entire path) or relative paths (including only subfolders of the current folder). Use the `MMEM:CDIR?` query to determine the current folder.

- Restoring the Default Configuration (Preset)....................388
- General Data Storage and Loading Commands....................389
- Selecting the Items to Store....................395
- Storing and Loading Measurement Settings....................397
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13.7.1 Restoring the Default Configuration (Preset)

SYSTem:PRESet....................388
SYSTem:PRESet:CHANnel[:EXECute]....................388

SYSTem:PRESet

This command presets the R&S VSE.

Example: `SYST:PRES`

Usage: Event
SCPI confirmed

Manual operation: See "Restoring All Default Settings (Preset All)" on page 76

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 "Restoring Channel Settings (Preset Selected Channel)" on page 77

13.7.2 General Data Storage and Loading Commands

See also:

- `FORMat[:DATA]` on page 383

MMEMory:CATalog? ... 389
MMEMory:CATalog:LONG? ... 390
MMEMory:CDIRectory ... 390
MMEMory:COMMent ... 390
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MMEMory:DATA ... 391
MMEMory:DELete ... 392
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MMEMory:NETWork:DISConnect ... 393
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MMEMory:NETWork:UNUSeddrives? ... 394
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MMEMory:CATalog? <Path>

This command returns the contents of a particular directory.

Query parameters:

<Path>
String containing the path and directory
If you leave out the path, the command returns the contents of the directory selected with `MMEMory:CDIRectory`.
The path may be relative or absolute. Using wildcards ('*') is possible to query a certain type of files only.
If you use a specific file as a parameter, the command returns the name of the file if the file is found in the specified directory, or an error if the file is not found (`"-256,"File name not found"`).

Return values:

<FileNames>
List of file and directory names, separated by commas
If no files are found, an error is displayed: `"-256,"File name not found"`

Example:
`MMEM:CAT? 'C:\R_S\Instr\user\SPOOL?.PNG'`
Returns all files in C:\R_S\Instr\user whose names start with SPOOL, have 6 letters and the extension ".PNG", e.g.:
`SPOOL1.PNG,SPOOL2.PNG,SPOOL3.PNG`

Example:
`MMEM:CAT? 'C:\R_S\Instr\user\SPOOL6.PNG'`
Query whether the file '`SPOOL6.PNG`' also exists in the directory;
Result:
`-256,"File name not found;:MMEMory:CATalog? 'C:\R_S\Instr\user\SPOOL6.PNG'`

Usage: Query only
SCPI confirmed

Manual operation: See "Selecting the Storage Location - Drive/ Path/ Files" on page 81

MMEMory:CATalog:LONG? <Path>

This command returns the contents of a particular directory with additional information about the files.

Query parameters:

<Path> String containing the path and directory.
If you leave out the path, the command returns the contents of the directory selected with `MMEMory:CDIRectory`.
The path may be relative or absolute. Using wildcards ('*') is possible to query a certain type of files only.

Return values:

<UsedDiskSpace> Byte size of all files in the directory.

<FreeDiskSpace> Remaining disk space in bytes.

<FileInfo> <NameFileN>,<SuffixFileN>,<SizeFileN>
Describes the individual file.
<NameFileN>
Name of the file.
<SuffixFileN>
Type of the file. Possible suffixes are: ASCii, BINary, DIRectory, STAT
<SizeFileN>
Size of the file in bytes.

Usage: Query only

MMEMory:CDIRectory <Directory>

This command changes the current directory.

Parameters:

<Directory> String containing the path to another directory.
The path may be relative or absolute.

Usage: SCPI confirmed

MMEMory:COMMent <Comment>

This command defines a comment for the stored settings.

Parameters:

<Comment> String containing the comment.

Example:

`MMEMory:COMMent "ACP measurement with Standard Tetra from 23.05."`
`MMEMory::MMEMory:STORe1:STATe 1, "ACP_T"`
As a result, in the selection list for recall settings, the comment `"ACP measurement with Standard Tetra from 23.05."` is added to the ACP entry.

Manual operation: See "Comment" on page 82

MMEMory:COPY <SourceFile>,<DestinationFile>

This command copies one or more files to another directory.

Parameters:

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

<DestinationFile> String containing the path and name of the target file.
The path may be relative or absolute.

Usage: SCPI confirmed

MMEMory:DATA <FileName>, [<Block>]

This command writes block data into a file. The delimiter must be set to EOI to obtain error-free data transfer.

When you query the contents of a file, you can save them in a file on the remote control computer.

The command is useful for reading stored settings files or trace data from the software or for transferring them to the software

Parameters:

<FileName> String containing the path and name of the target file.

<Block> Data block with the following structure.
#
Hash sign.
<number>
Length of the length information.
<number>
Length information of the binary data (number of bytes).
<data>
Binary data with the indicated <number> of bytes.

Example:
`MMEM:NAME '\Public\User\Testfile.txt'`
Creates a new file called 'testfile.txt'.
`MMEM:DATA 'Testfile.txt',#220Contents of the file`
The parameter means:
#2: hash sign and length of the length information (20 bytes = 2 digits)
20: indicates the number of subsequent binary data bytes.
Contents of the file: store 20 binary bytes (characters) to the file.

Usage: SCPI confirmed

MMEMory:DELete <FileName>

This command deletes a file.

Parameters:
<FileName> String containing the path and file name of the file to delete.
The path may be relative or absolute.

Usage: Event
SCPI confirmed

MMEMory:MDIRectory <Directory>

This command creates a new directory.

Parameters:
<Directory> String containing the path and new directory name
The path may be relative or absolute.

Usage: Event

MMEMory:MOVE <SourceFile>,<NewFileName>

This command moves a file to another directory.

The command also renames the file if you define a new name in the target directory.

If you do not include a path for <NewFileName>, the command just renames the file.

Parameters:
<SourceFile> String containing the path and file name of the source file.

<NewFileName> String containing the path and name of the target file.

Example:
`MMEM:MOVE 'C:\TEST01.CFG','SETUP.CFG'`
Renames TEST01.CFG in SETUP.CFG in directory C:\.

Usage: Event
SCPI confirmed

MMEMory:MSIS <Device>

This command selects the default storage device used by all MMEMory commands.

Parameters:

<Device> 'A:' | 'C:' | … | 'Z:'
String containing the device drive name
*RST: 'C:'

Usage: SCPI confirmed

MMEMory:NAME <FileName>

This command creates a new and empty file.

It also sets the file name for screenshots taken with `HCOPy[:IMMediate<device>]`. Note that you have to route the printer output to a file.

Parameters:

<FileName> String containing the path and name of the target file.

Example: `MMEM:NAME 'C:\R_S\instr\user\PRINT1.BMP'`
Selects the file name.

Usage: Event
SCPI confirmed

MMEMory:NETWork:DISConnect <Drive>

This command disconnects a network drive.

Parameters:

<Drive> String containing the drive name.

Usage: Event

MMEMory:NETWork:MAP <Drive>, <HostName> [, <UserName>, <Password>][, <Reconnect>]

This command maps a drive to a server or server directory of the network.

Note that you have to allow sharing for a server or folder in Microsoft networks first.

Parameters:

<Drive> String containing the drive name or path of the directory you want to map.

<HostName> String containing the host name of the computer or the IP address and the share name of the drive.
'<\host name or IP address\share name>'

<UserName> String containing a user name in the network.
The user name is optional.

<Password>	String containing the password corresponding to the <User-Name>. The password is optional.
<Reconnect>	ON | OFF **ON** Reconnects at logon with the same user name. **OFF** Does not reconnect at logon.
Usage:	Event

MMEMory:NETWork:UNUSeddrives?

This command returns a list of unused network drives.

Return values:

<DriveName>	List of network drives in alphabetically descending order, e.g. 'W:,V:,U:,...'
Usage:	Query only

MMEMory:NETWork:USEDdrives? <State>

This command returns a list of all network drives in use.

Parameters:

<State>	You do not have to use the parameter. If you do not include the parameter, the command returns a list of all drives in use. This is the same behavior as if you were using the parameter OFF. **ON** Returns a list of all drives in use including the folder information. **OFF** Returns al list of all drives in use.
Usage:	Query only

MMEMory:RDIRectory <Directory>

This command deletes the indicated directory.

Parameters:

<Directory>	String containing the path of the directory to delete. Note that the directory you want to remove must be empty.
Usage:	Event

13.7.3 Selecting the Items to Store

The following commands select the items to be included in the configuration file.

Depending on the used command, either the items from the entire software (`MMEMory:SELect[:ITEM]...`), or only those from the currently selected channel (`MMEM:SELect:CHANnel[:ITEM]...`) are stored.

MMEMory:SELect:CHANnel[:ITEM]:ALL....395
MMEMory:SELect[:ITEM]:ALL....395
MMEMory:SELect:CHANnel[:ITEM]:DEFault....395
MMEMory:SELect[:ITEM]:DEFault....395
MMEMory:SELect:CHANnel[:ITEM]:HWSettings....396
MMEMory:SELect[:ITEM]:HWSettings....396
MMEMory:SELect:CHANnel[:ITEM]:LINes:ALL....396
MMEMory:SELect[:ITEM]:LINes:ALL....396
MMEMory:SELect:CHANnel[:ITEM]:NONE....396
MMEMory:SELect[:ITEM]:NONE....396
MMEMory:SELect:CHANnel[:ITEM]:SGRam....397
MMEMory:SELect[:ITEM]:SGRam....397
MMEMory:SELect:CHANnel[:ITEM]:TRACe[:ACTive]....397
MMEMory:SELect[:ITEM]:TRACe[:ACTive]....397

MMEMory:SELect:CHANnel[:ITEM]:ALL
MMEMory:SELect[:ITEM]:ALL

This command includes all items when storing or loading a configuration file.

The items are:

- Limit lines: `MMEMory:SELect[:ITEM]:LINes:ALL`
- Spectrogram data: `MMEMory:SELect[:ITEM]:SGRam`
- Trace data: `MMEMory:SELect[:ITEM]:TRACe[:ACTive]`

Example: `MMEM:SEL:ALL`

Usage: Event

Manual operation: See "Items" on page 82

MMEMory:SELect:CHANnel[:ITEM]:DEFault
MMEMory:SELect[:ITEM]:DEFault

This command selects the current settings as the only item to store to and load from a configuration file.

Usage: Event

Manual operation: See "Items" on page 82

MMEMory:SELect:CHANnel[:ITEM]:HWSettings <State>
MMEMory:SELect[:ITEM]:HWSettings <State>

This command includes or excludes measurement (hardware) settings when storing or loading a configuration file.

Measurement settings include:

- general channel configuration
- measurement hardware configuration including markers
- limit lines
  Note that a configuration may include no more than 8 limit lines. This number includes active limit lines as well as inactive limit lines that were used last. Therefore the combination of inactivate limit lines depends on the sequence of use with `MMEMory:LOAD:STATe`.
- color settings

Depending on the used command, either the items for all channels (`MMEMory:SELect[:ITEM]...`), or only those from the currently selected channel (`MMEM:SELect:CHANnel[:ITEM]...`) are stored or loaded.

Parameters:

<State> ON | OFF | 0 | 1

*RST: 1

Example: `MMEM:SEL:HWS ON`

Manual operation: See "Items" on page 82

MMEMory:SELect:CHANnel[:ITEM]:LINes:ALL <State>
MMEMory:SELect[:ITEM]:LINes:ALL <State>

This command includes or excludes all limit lines (active and inactive) when storing or loading a configuration file.

Parameters:

<State> ON | OFF

*RST: OFF

Example: `MMEM:SEL:LIN:ALL ON`

Manual operation: See "Items" on page 82

MMEMory:SELect:CHANnel[:ITEM]:NONE
MMEMory:SELect[:ITEM]:NONE

This command does not include any of the following items when storing or loading a configuration file.

- Hardware configuration: `MMEMory:SELect[:ITEM]:HWSettings`
- Limit lines: `MMEMory:SELect[:ITEM]:LINes:ALL`
- Spectrogram data: `MMEMory:SELect[:ITEM]:SGRam`

- Trace data: MMEMory:SELect[:ITEM]:TRACe[:ACTive]

Example: MMEM:SEL:NONE

Usage: Event

Manual operation: See "Items" on page 82

MMEMory:SELect:CHANnel[:ITEM]:SGRam <State>
MMEMory:SELect[:ITEM]:SGRam <State>

This command includes or excludes spectrogram data when storing or loading a configuration file.

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

Example: MMEM:SEL:SGR ON
Adds the spectrogram data to the list of data subsets.

MMEMory:SELect:CHANnel[:ITEM]:TRACe[:ACTive] <State>
MMEMory:SELect[:ITEM]:TRACe[:ACTive] <State>

This command includes or excludes trace data when storing or loading a configuration file.

Parameters:
<State> ON | OFF
*RST: OFF, i.e. no traces is stored

Example: MMEM:SEL:TRAC ON

Manual operation: See "Items" on page 82

13.7.4 Storing and Loading Measurement Settings

See also:

- INSTrument[:SELect] on page 292 to select the channel.

MMEMory:CLEar:ALL....397
MMEMory:CLEar:STATe....398
MMEMory:LOAD:AUTO....398
MMEMory:LOAD:STATe....398
MMEMory:LOAD:TYPE....399
MMEMory:STORe<n>:STATe....400
MMEMory:STORe<n>:STATe:NEXT....400
MMEMory:STORe<n>:TYPE....401

MMEMory:CLEar:ALL

This command deletes all software configuration files in the current directory.

You can select the directory with `MMEMory:CDIRectory`.

Example: `MMEM:CLE:ALL`

Usage: Event

MMEMory:CLEar:STATe 1,<FileName>

This command deletes a instrument configuration file.

Parameters:

1

<FileName> String containing the path and name of the file to delete.
The string may or may not contain the file's extension.

Example: `MMEM:CLE:STAT 1,'TEST'`

Usage: Event

MMEMory:LOAD:AUTO 1, 'Factory' | <FileName>

This command restores an software configuration and defines that configuration as the default state.

The default state is restored after a preset (`*RST`) or after you turn on the R&S VSE.

Parameters:

1

'Factory' | <FileName>

'Factory'
Restores the factory settings as the default state.

'<file_name>
String containing the path and name of the configuration file.
Note that only *All channels* settings files can be selected for the startup recall function; single channel settings files cause an error.

Example: `MMEM:LOAD:AUTO 1,'C:\R_S\Instr\user\TEST'`

Usage: Event

Manual operation: See "Startup Recall" on page 84

MMEMory:LOAD:STATe 1, <FileName>

This command restores and activates the software configuration stored in a *.dfl file.

Note that files with other formats cannot be loaded with this command.

The contents that are reloaded from the file are defined by the last selection made either in the "Save/Recall" dialogs (manual operation) or through the `MMEMory:SELect[:ITEM]` commands (remote operation; the settings are identical in both cases).

By default, the selection is limited to the user settings ("User Settings" selection in the dialogs, `HWSettings` in SCPI). The selection is not reset by PRESET or `*RST`.

As a consequence, the results of a SCPI script using the `MMEMory:LOAD:STATe` command without a previous `MMEMory:SELect[:ITEM]` command may vary, depending on previous actions in the GUI or in previous scripts, even if the script starts with the `*RST` command.

It is therefore recommended that you use the appropriate `MMEMory:SELect[:ITEM]` command before using `MMEMory:LOAD:STATe`.

Parameters:
1

<FileName> String containing the path and name of the file to load.
The string may or may not include the file's extension.

Example:
`MMEM:SEL:ALL`
//Save all items (User Settings, All Traces, All Limit Lines) from the R&S VSE.
`MMEM:LOAD:STAT 1,'C:\R_S\Instr\user\TEST01'`
//Reloads all items
In the "Recall" dialog, select only "User Settings" and "All Limit Lines".
`MMEM:LOAD:STAT 1,'C:\R_S\Instr\user\TEST01'`
//Reloads user settings and all limit lines.
`*RST`
//Reset software.
`MMEM:LOAD:STAT 1,'C:\R_S\Instr\user\TEST01'`
//Selected items are retained. Reloads user settings and all limit lines.
Restart the software.
`MMEM:LOAD:STAT 1,'C:\R_S\Instr\user\TEST01'`
// Selected items are set to default. Reloads only the user settings.

Usage: SCPI confirmed

Manual operation: See "Recall" on page 79

MMEMory:LOAD:TYPE <Mode>

This command defines whether the channel-specific settings that will be loaded with the subsequent `MMEM:LOAD:STAT` command will replace the current channel or activate a new channel.

Parameters:

<Mode> NEW | REPLace

NEW
The loaded settings will be activated in a new channel.

REPLace
The loaded settings will replace the currently active channel.

*RST: NEW

Example:
`INST:SEL 'SPECTRUM2'`
Selects measurement channel `'SPECTRUM2'`.
`MMEM:STOR:TYP CHAN`
Specifies that channel-specific data is to be stored.
`MMEM:STOR:STAT 1, 'C:\R_S\Instr\user\Spectrum'`
Stores the settings from channel `'SPECTRUM2'` to the file `'C:\R_S\Instr\user\Spectrum'`.
`MMEM:LOAD:TYPE NEW`
Specifies that channel-specific settings are to be activated in a new channel.
`MMEM:LOAD:STAT 1, 'C:\R_S\Instr\user\Spectrum'`
Loads the channel-specific settings from the file `'C:\R_S\Instr\user\Spectrum'` to the new channel `'SPECTRUM2*'`.

MMEMory:STORe<n>:STATe 1,<FileName>

This command saves the current software configuration in a *.dfl file.

The suffix <n> is irrelevant.

Parameters:

1

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

Example:
`MMEM:STOR:STAT 1,'Save'`
Saves the current software settings in the file `Save.dfl`.

Usage:
Event
SCPI confirmed

Manual operation: See "Save File" on page 83

MMEMory:STORe<n>:STATe:NEXT

This command saves the current software configuration in a *.dfl file.

The suffix <n> is irrelevant.

The file name depends on the one you have set with `MMEMory:STORe<n>:STATe`. This command adds a consecutive number to the file name.

Example:
`MMEM:STOR:STAT 1,'Save'`
Saves the current software settings in the file `Save.dfl`.
`MMEM:STOR:STAT:NEXT`
Saves the current software settings in the file `Save_001.dfl`
`MMEM:STOR:STAT:NEXT`
Saves the current software settings in the file `Save_002.dfl`

Usage: Event

Manual operation: See "Save File" on page 83

MMEMory:STORe<n>:TYPE <Mode>

This command defines whether the data from the entire software or only from the current channel is stored with the subsequent `MMEM:STOR`... command.

The suffix <n> is irrelevant.

Parameters:
<Mode> INSTrument | CHANnel

INSTrument
Stores data from the entire software.

CHANnel
Stores data from an individual channel.

*RST: INST

Example:
`INST:SEL 'SPECTRUM2'`
Selects measurement channel `'SPECTRUM2'`.
`MMEM:STOR:TYPE CHAN`
Specifies that channel-specific data is to be stored.

13.7.5 Exporting Recorded I/Q Data

The following commands are required to export I/Q recording files

Useful commands for exporting recorded data described elsewhere:

- `INSTrument:BLOCk:CHANnel[:SETTings]:RECord` on page 289

Remote commands exclusive to exporting recorded data:

EXPort:IQ:FILE....................402
EXPort:IQ:FORMat....................402
EXPort:IQ:META:DATA....................402
EXPort:IQ:META:DATA:SET....................403
EXPort:IQ:META:DATA<I>:VALue?....................404
MMEMory:LOAD:IQ:STATe....................405
MMEMory:STORe<n>:IQ:COMMent....................405
MMEMory:STORe<n>:IQ:STATe....................405
MMEMory:STORe<n>:SGRam....................406
MMEMory:STORe<n>:SPECtrogram....................406

RECord:COMMent[:DEFault]....406
RECord:COUNt....406
RECord:MAXimum:RLEN....407
RECord:SETTling:TIME....407

EXPort:IQ:FILE <FileName>

This command writes the captured I/Q data to a file.

The file type is defined using `EXPort:IQ:FORMat` on page 402.

Parameters:

<FileName> String containing the path and name of the target file.

Example:

```
EXP:IQ:FORM IQTAR
EXP:IQ:FILE 'C:\R_S\Instr\user\data.iq.tar'
```

Stores the captured I/Q data to the specified file.

Manual operation: See "Save" on page 91

EXPort:IQ:FORMat <FileType>

Defines the file type used to store the I/Q data.

For details on file formats see chapter A.5, "Reference: Supported File Formats", on page 460.

Parameters:

<FileType>

IQTAR
Compressed file format for an individual measurement channel

CSV
Comma-separated ASCII file format

IQW
Binary file format; contains only I/Q data from a single channel, without any meta data

MAT
Matlab file format

Manual operation: See "File Type" on page 89

EXPort:IQ:META:DATA <Datatype>,<State>{,<Datatype>,<State>}

Defines which meta data is included in the data file if a user-defined set is specified (see `EXPort:IQ:META:DATA:SET` on page 403).

Note that only the settings used during recording are stored; subsequent changes to the settings are ignored.

To query the values of the stored meta data after loading the file, see `EXPort:IQ:META:DATA<I>:VALue?` on page 404.

Parameters:

<Datatype> 'AttenuElecState' | 'AttenuElecValue[dB]' | 'AttenuMech[dB]' | 'CalibrationState' | 'DeviceHwInfo' | 'DeviceId' | 'DeviceOptions' | 'FilterSettings' | 'HighPassFilterState' | 'Impedance[Ohm]' | 'InputCoupling' | 'InputPath' | 'MeasBandwith[Hz]' | 'NumberOfPreSamples' | 'NumberOfPostSamples' | 'PreampGain[dB]' | 'PreampState' | 'RefLevel[dBm]' | 'RefLevelOffset[dB]' | 'RefOscillatorInput' | 'RefOscillatorFreq[Hz]' | 'TrgDropOut[s]' | 'TrgHoldoff[s]' | 'TrgHysteresis[dB]' | 'TrgLevel[dBm]' | 'TrgOffset[s]' | 'TrgSlope' | 'TrgSource' | 'YigPreSelectorState' |

Individual meta data type

<State> ON | OFF | 1 | 0

All parameters that are ON are included in file.

*RST: OFF

Example:

```
EXP:IQ:META:DATA MIN
```

Includes minimum set of meta data.

Example:

```
EXP:IQ:META:DATA MIN
EXP:IQ:META:DATA 'InputPath',ON
EXP:IQ:META:DATA 'AttenuMech[dB]',ON
EXP:IQ:META:DATA 'PreampState',ON
EXP:IQ:META:DATA 'Impedance[Ohm]',ON
```

Includes minimum set of data except for input path, plus mechanical attentuation, preamplifier, input impedance

Manual operation: See "Meta Data Settings" on page 90

EXPort:IQ:META:DATA:SET <Set>

Defines which meta data is included in the data file. Either a fixed set of data can be specified, or a user-defined set of data types can be included.

Note that only the settings used during recording are stored; subsequent changes to the settings are ignored.

For `iqw` file format, no meta data is available.

To query the values of the stored meta data after loading the file, see `EXPort:IQ:META:DATA<I>:VALue?` on page 404.

Parameters:

<Set> Defines a fixed set of meta data. For a detailed description of these sets see "Meta Data Settings" on page 90.

MINimum
The minimum set of measurement settings required to restore the channel later are stored.

MAXimum
All available meta data from the entire signal processing chain (input path to the output) is stored.

CUSTom
A user-defined set of individual data types is included. The data types are defined using `EXPort:IQ:META:DATA` on page 402.

Example: `EXP:IQ:META:DATA:SET MIN`
Includes minimum set of meta data.

Manual operation: See "Meta Data Settings" on page 90

EXPort:IQ:META:DATA<I>:VALue? <Datatype>

Queries the meta data stored in the specified input source file, if available (see `EXPort:IQ:META:DATA` on page 402).

Suffix:

<i> 1..99
Sequential number of the source

Parameters:

<Datatype> 'AttenuElecState' | 'AttenuElecValue[dB]' | 'AttenuMech[dB]' | 'CalibrationState' | 'DeviceHwInfo' | 'DeviceId' | 'DeviceOptions' | 'FilterSettings' | 'HighPassFilterState' | 'Impedance[Ohm]' | 'InputCoupling' | 'InputPath' | 'InputSelection' | 'MeasBandwith[Hz]' | 'NumberOfPreSamples' | 'NumberOfPostSamples' | 'PreampGain[dB]' | 'PreampState' | 'PreselectorState' | 'PreselectorType' | 'RefLevel[dBm]' | 'RefLevelOffset[dB]' | 'RefOscillatorInput' | 'RefOscillatorFreq[Hz]' | 'TrgDropOut[s]' | 'TrgHoldoff[s]' | 'TrgHysteresis[dB]' | 'TrgLevel[dBm]' | 'TrgOffset[s]' | 'TrgSlope' | 'TrgSource' | 'YigPreSelectorState' |

String containing the individual meta data type
(Note: 'InputSelection', 'PreselectorState' , 'PreselectorType' are only available if an R&S FSWT is connected.)

Return values:

<Result> Value of the specified datatype

Example: `EXPort:IQ:META:DATA:VALue? 'AttenuElecState'`
Result:
`OFF`

Usage: Query only

MMEMory:LOAD:IQ:STATe 1,<FileName>

This command restores I/Q data from a file.

The file extension is *.iq.tar.

Note: This command is maintained for compatiblity with various Rohde & Schwarz signal and spectrum analyzers only. For new R&S VSE remote control programs, use the `INSTrument:BLOCk:CHANnel[:SETTings]:FILE<i>[:IQTar]` command.

Parameters:

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

Example: `MMEM:LOAD:IQ:STAT 1, 'C:\R_S\Instr\user\data.iq.tar'`
Loads IQ data from the specified file.

Usage: Setting only

MMEMory:STORe<n>:IQ:COMMent <Comment>

This command adds a comment to a file that contains I/Q data.

The suffix <n> is irrelevant.

Parameters:

<Comment> String containing the comment.

Example: `MMEM:STOR:IQ:COMM 'Device test 1b'`
Creates a description for the export file.
`MMEM:STOR:IQ:STAT 1, 'C:\R_S\Instr\user\data.iq.tar'`
Stores I/Q data and the comment to the specified file.

Manual operation: See "Comment" on page 89

MMEMory:STORe<n>:IQ:STATe 1, <FileName>

This command writes the captured I/Q data to a file.

The suffix <n> is irrelevant.

The file extension is *.iq.tar. By default, the contents of the file are in 32-bit floating point format.

Note: This command is maintained for compatiblity with various Rohde & Schwarz signal and spectrum analyzers only. For new R&S VSE remote control programs, use the `EXPort:IQ:FILE` command.

Parameters:

1

<FileName> String containing the path and name of the target file.

Example: `MMEM:STOR:IQ:STAT 1, 'C:\R_S\Instr\user\data.iq.tar'`
Stores the captured I/Q data to the specified file.

Manual operation: See "Save" on page 91

MMEMory:STORe<n>:SGRam <FileName>
MMEMory:STORe<n>:SPECtrogram <FileName>

This command exports spectrogram data to an ASCII file.

The file contains the data for every frame in the history buffer. The data corresponding to a particular frame begins with information about the frame number and the time that frame was recorded.

Note that, depending on the size of the history buffer, the process of exporting the data can take a while.

Parameters:
<FileName> String containing the path and name of the target file.

Example: `MMEM:STOR:SGR 'Spectrogram'`
Copies the spectrogram data to a file.

RECord:COMMent[:DEFault] <Comment>

Defines a default text for the comment to the stored data file. This default comment is displayed in the "Save I/Q Recording" dialog box (see Comment).

Parameters:
<Comment> string

Manual operation: See "Default Comment" on page 87

RECord:COUNt <NoRecords>

Defines the number of records to be stored. One record contains the data captured during the defined measurement time for a single channel. If more measurements are available than the specified number (x) of records, only the most recent (x) measurement results are stored.

As a rule, the recording is limited by the maximum record length provided by the instrument.

This setting is ignored for `RECord:MAXimum:RLEN ON`.

Parameters:
<NoRecords> numeric value
*RST: 1

Manual operation: See "Number of Records" on page 87

RECord:MAXimum:RLEN <State>

Defines how many records are stored.

Parameters:

<State> ON | OFF | 1 | 0

ON | 1
All available records for the channel are stored. The `RECord:COUNt` command is ignored.

OFF | 0
Only the most recent records (defined by `RECord:COUNt`) are stored.

*RST: ON

Manual operation: See "Always Maximum Record Length" on page 88

RECord:SETTling:TIME <State>

If enabled, additional samples (in addition to the specified capture time) are stored for the channel to compensate for settling effects.

This setting is required for instrument in uses that do not support the standard bandwidth-to-sample-rate-ratio of 0.8 and thus require an upsampler. The additional samples compensate for settling effects in the filters used by the upsampler.

Parameters:

<State> ON | OFF | 1 | 0

*RST: OFF

Manual operation: See "Additional Settling Samples" on page 88

13.7.6 Storing or Printing Screenshots

Useful commands to configure screenshots described elsewhere

- `MMEMory:NAME` on page 393

Remote commands exclusive to configure screenshots

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HCOPy:CMAP<item>:DEFault<colors> ... 408
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SYSTem:COMMunicate:PRINter:ENUMerate:FIRSt?.....412
SYSTem:COMMunicate:PRINter:ENUMerate[:NEXT]?.....412
SYSTem:COMMunicate:PRINter:SELect<device>.....413

DISPlay:LOGO <State>

Activates/deactivates the printout of the Rohde & Schwarz company logo in the upper left corner.

Parameters:

<State> ON | OFF
*RST: ON

Example: `DISP:LOGO OFF`

Manual operation: See "Print Logo" on page 99

HCOPy:ABORt

This command aborts a running hardcopy output.

Example: `HCOP:ABOR`

Usage: Event
SCPI confirmed

HCOPy:CMAP<item>:DEFault<colors>

This command defines the color scheme for print jobs.

Suffix:

<item> Selects the item for which the color scheme is to be defined.
For more information see chapter 13.8.4, "CMAP Suffix Assignment", on page 420.

<colors> 1...4
1
Current colors with a white background and a black grid.
2
Optimized colors.
3
Customized colors.
4
Current screen colors (setting for hardcopies).

Example: `HCOP:CMAP:DEF2`
Selects the optimized color set for the color settings of a printout or a hardcopy.

Usage: Event

Manual operation: See "Print colors" on page 105

HCOPy:CMAP<item>:HSL <Color>

This command selects the color for various screen elements in print jobs.

Suffix:
<item> Selects the item for which the color scheme is to be defined.
For more information see chapter 13.8.4, "CMAP Suffix Assignment", on page 420.

Parameters:
<Color>
hue
tint
sat
saturation
lum
brightness
The value range is 0 to 1 for all parameters.

Example: `HCOP:CMAP2:HSL 0.3,0.8,1.0`
Changes the grid color

Manual operation: See "Defining User-specific Colors" on page 106

HCOPy:CMAP<item>:PDEFined <Color>

This command selects a predefined color for various screen elements in print jobs.

Suffix:
<item> Selects the item for which the color scheme is to be defined.
For more information see chapter 13.8.4, "CMAP Suffix Assignment", on page 420.

Parameters:
<Color> BLACk | BLUE | BROWn | GREEn | CYAN | RED | MAGenta | YELLow | WHITe | DGRAy | LGRAy | LBLUe | LGREen | LCYan | LRED | LMAGenta

Example: `HCOP:CMAP2:PDEF GRE`

Manual operation: See "Predefined Colors" on page 106

HCOPy:DESTination<device> <Destination>

This command selects the destination of a print job.

Suffix:
<device> 1 | 2
Printing device.

Parameters:
<Destination>

'MMEM'
Sends the hardcopy to a file.
You can select the file name with MMEMory:NAME.
You can select the file format with HCOPy:DEVice:LANGuage<device>.

'SYST:COMM:PRIN'
Sends the hardcopy to a printer.
You can select the printer with SYSTem:COMMunicate:PRINter:SELect<device> .

'SYST:COMM:CLIP'
Sends the hardcopy to the clipboard.
The format should be WEMF.

*RST: 'SYST:COMM:CLIP'

Usage: SCPI confirmed

HCOPy:DEVice:COLor <State>

This command turns color printing on and off.

Parameters:
<State>

ON
Color printing

OFF
Black and white printing

*RST: OFF

Example: `HCOP:DEV:COL ON`

Usage: SCPI confirmed

HCOPy:DEVice:LANGuage<device> <Format>

This command selects the file format for a print job.

Suffix:
<device> 1 | 2
Printing device.

Parameters:
<Format>

GDI
Graphics Device Interface.
Default format for the output to a printer configured under Windows. Must be selected for the output to the printer interface.
Can be used for the output to a file. The printer driver configured under Windows is used in this case and a printer-specific file format is thus generated.

BMP, JPG, PNG
Data format for output to files only.

Usage: SCPI confirmed

HCOPy[:IMMediate<device>]

This command initiates a print job.

If you are printing to a file, the file name depends on `MMEMory:NAME`.

Suffix:
<device> 1 | 2
Printing device.

Usage: Event
SCPI confirmed

Manual operation: See "Print" on page 99

HCOPy[:IMMediate<device>]:NEXT

This command initiates a print job.

If you are printing to a file, the file name depends on `MMEMory:NAME`. This command adds a consecutive number to the file name.

Suffix:
<device> 1 | 2
Printing device.

Usage: Event

Manual operation: See "Print" on page 99

HCOPy:ITEM:ALL

This command includes all screen elements in the printout.

The screen elements include comments, title, time and date.

Usage: SCPI confirmed

Manual operation: See "Print" on page 99

HCOPy:ITEM:WINDow:TEXT <Comment>

This command defines a comment to be added to the printout.

Parameters:
<Comment> String containing the comment.

Usage: SCPI confirmed

Manual operation: See "Comment" on page 99

HCOPy:PAGE:ORIentation<device> <Orientation>

The command selects the format of the print job.

The command is only available if the output device is a printer.

Suffix:
<device> 1 | 2
Printing device.

Parameters:
<Orientation> LANDscape | PORTrait
*RST: PORTrait

Usage: SCPI confirmed

Manual operation: See "Orientation" on page 99

HCOPy:TDSTamp:STATe<device> <State>

This command includes or excludes the time and date in the printout.

Suffix:
<device> 1 | 2
Printing device.

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

Manual operation: See "Print Date and Time" on page 99

SYSTem:COMMunicate:PRINter:ENUMerate:FIRSt?

This command queries the name of the first available printer.

To query the name of other installed printers, use `SYSTem:COMMunicate:PRINter:ENUMerate[:NEXT]?`.

Return values:
<PrinterName> String containing the name of the first printer as defined in Windows.
If the command cannot find a printer, it returns an empty string (' ').

Usage: Query only

SYSTem:COMMunicate:PRINter:ENUMerate[:NEXT]?

This command queries the name of available printers.

You have to use `SYSTem:COMMunicate:PRINter:ENUMerate:FIRSt?` for this command to work properly.

Return values:

<PrinterName> String containing the name of one printer as defined in Windows. To get a complete list of printers you have to send this query several times until no more printers could be found. In that case, the return value is an empty string (' '). Further queries after the empty string result in an error.

Usage: Query only

SYSTem:COMMunicate:PRINter:SELect<device> <PrinterName>

This command selects the printer that processes jobs sent by the R&S VSE.

Use `HCOPy:DESTination<device>` to select another output destination.

Suffix:

<device> 1 | 2
Printing device.

Parameters:

<PrinterName> String containing the printer name.
Use
- `SYSTem:COMMunicate:PRINter:ENUMerate:FIRSt?` and
- `SYSTem:COMMunicate:PRINter:ENUMerate[:NEXT]?`

to query all available printers.

*RST: NONE

13.7.7 Examples: Managing Data

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- Loading Data....................414
- Storing Software Settings....................414
- Loading Software Settings....................415
- Printing to a File....................415
- Printing on a Printer....................415

13.7.7.1 Storing Data

```
MMEM:MSIS 'C:'
//Selects drive C: as the default storage device.
-----Connecting a network drive--------
MMEM:NETW:USED?
//Returns a list of all drives in use in the network.
MMEM:NETW:UNUS?
//Returns a list of free drive names in the network.
MMEM:NETW:MAP 'T:','Server\ACLRTest'
//Maps drive T: to the directory 'Server\ACLRTest'
-----Saving data from the software
MMEM:MDIR 'C:\R_S\INST\USER\ACLRTest'
```

```
//Creates a directory called 'ACLRTest' on drive C:
MMEM:NAME 'C:\R_S\INST\USER\Test001.txt'
//Creates a file called 'Test001.txt'
MMEM:COMM 'ACLR test results'
//Creates a comment for the file.
MMEM:DATA 'Test001.txt',#212FileContents
//Writes 12 characters to the file 'Test001.txt'
-----Copying the data to another location---
MMEM:COPY 'C:\R_S\INST\USER\Results\Test001.txt','T:'
//Copies the specified file to network drive T:.
MMEM:DEL 'C:\R_S\INST\USER\Results\Test001.txt'
//Deletes the specified file from the instrument hard disk.
//or
MMEM:MOVE 'C:\R_S\INST\USER\Results\Test001.xml','D:\TestResults.txt'//
//Moves the file 'Test001.txt' to drive T:, renames it to 'Testresults.txt'
//and removes it from the instrument hard disk.
MMEM:RDIR 'C:\R_S\INST\USER\Results'
//Deletes the directory called 'Results' from drive C:, unless it still contains any content.
-----Disconnecting the network drive---
MMEM:NETW:DISC 'T:'
//Disconnect drive T:.
```

13.7.7.2 Loading Data

```
MMEM:CDIR?
//Returns the path of the current directory.
//e.g.
C:\R_S\Instr\user\
MMEM:CDIR 'C:\R_S\INST\USER\Results'
//Changes the current directory.
MMEM:CAT? 'C:\R_S\INST\USER\Results\*.xml'
//or
MMEM:CAT? '*.xml'
//Returns a list of all xml files in the directory 'C:\R_S\INST\USER\Results'.
MMEM:CAT:LONG? '*.xml'
//Returns additional information about the xml files in the directory 'C:\R_S\INST\USER\Resul
```

13.7.7.3 Storing Software Settings

In this example we will store the software settings for the "IQ Analyzer" channel.

```
INST:SEL 'IQ Analyzer'
//Selects measurement channel 'IQ Analyzer'.
MEMM:STOR:TYPE CHAN
//Specifies that channel-specific data is to be stored.
MMEM:STOR:STAT 1, 'C:\R_S\Instr\user\IQAnalyzer'
//Stores the channel settings from the 'IQ Analyzer' channel
// to the file 'IQAnalyzer.dfl'.
```

13.7.7.4 Loading Software Settings

In this example we will load the software settings from the configuration file `IQAnalyzer.dfl` to a new "IQ Analyzer 2" channel.

```
MEMM:LOAD:TYPE NEW
//Specifies that settings will be loaded to a new channel besides the existing
//'IQ Analyzer' channel.
MMEM:LOAD:STAT 1, 'C:\R_S\Instr\user\IQAnalyzer'
//Loads the channel-specific settings from the file 'C:\R_S\Instr\user\IQAnalyzer.dfl'
//to a new channel. The new channel is named 'IQ Analyzer 2' to avoid a naming conflict
//with the existing 'IQ Analyzer' channel.
INST:REN 'IQ Analyzer 2','IQ Analyzer 3'
//Renames the loaded channel to 'IQ Analyzer 3'.
```

13.7.7.5 Printing to a File

```
HCOP:DEST 'MMEM'
//Prints the data to a file.
HCOP:DEV:LANG BMP
//Selects bmp as the file format.
MMEM:NAME 'C:\R_S\INST\USER\Screenshot.bmp'
//Selects the file name for the printout.
HCOP:ITEM:ALL
//Prints all screen elements
HCOP:ITEM:WIND:TEXT 'ACLRResults'
//Adds a comment to the printout.
HCOP
//Stores the printout in a file called 'Screenshot.bmp'.
HCOP:NEXT
//Stores the printout in a file called 'Screenshot_001.bmp'.
```

13.7.7.6 Printing on a Printer

```
HCOP:DEST2 'SYST:COMM:PRIN'
//Prints the data on a printer.
SYST:COMM:PRIN:ENUM:FIRS?
SYST:COMM:PRIN:ENUM?
//Returns the available printers, e.g.
'LASER on LPT1'
''
//Means that one printer is available.
SYST:COMM:PRIN:SEL2 'LASER on LPT1'
//Selects the printer for the print job on device 2.
HCOP:PAGE:ORI2 LAND
//Selects the landscape format for the printout.
HCOP:TDST:STAT2 ON
//Includes date and time on the printout.
HCOP:ITEM:ALL
```

```
//Prints all screen elements
HCOP
//Initiates the printout.
```

13.8 Configuring the Software

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- Colors and Themes....418
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13.8.1 Software Support and Information

The following commands are required to obtain information concerning optional functionality, licenses, service functions, or system messages.

DIAGnostic:SERVice:SINFo?....416
DIAGnostic:SERVice:VERSinfo?....417

DIAGnostic:SERVice:SINFo? <FileName>

This command creates a *.zip file with important support information. The *.zip file contains the system configuration information ("device footprint"), the current eeprom data and a screenshot of the screen display (if available).

This data is stored to the following directory on the PC the R&S VSE software is installed on:

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

As a result of this command, the created file name (including the drive and path) is returned.

If you contact the Rohde&Schwarz support to get help for a certain problem, send this file to the support in order to identify and solve the problem faster.

Return values:

<FileName> C:\ProgramData\Rohde-Schwarz\VSE\<version_no>\user\<R&S Device ID>_<CurrentDate>_<CurrentTime>

String containing the drive, path and file name of the created support file, where the file name consists of the following elements:
<R&S Device ID>: The unique R&S device ID indicated in the "Versions + Options" information
(See chapter 9.4.1, "Licensing, Versions and Options", on page 108)
<CurrentDate>: The date on which the file is created (<YYYYMMDD>)
<CurrentTime>: The time at which the file is created (<HHMMSS>)

Example: `DIAG:SERV:SINF?`
Result:
`C:\ProgramData\Rohde-Schwarz\VSE\0.80a_63\user\`
`VSE_1310.0002K02-900014-if_20140807_091003.zip`

Usage: Query only

Manual operation: See "Creating R&S Support Information" on page 110

DIAGnostic:SERVice:VERSinfo?

This command queries information about the hardware and software components.

Return values:
<Information> String containing the version of hardware and software components including the types of licenses for installed options.

Example: `DIAG:SERV:VERS?`
Queries the version information.
Response:
```
R&S VSE |0.80a 51 Beta,
Time Control Management ||active,
Analog Modulation Analysis K7|0.70|permanent,
 maintenance until 2018-09-30,
Software Maintenance || Expires on 2018-09-30
```

Usage: Query only
SCPI confirmed

13.8.2 General Display

DISPlay:ANNotation:CBAR......417
DISPlay:ANNotation:FREQuency......417
DISPlay:SBAR[:STATe]......418

DISPlay:ANNotation:CBAR <State>

This command hides or displays the channel bar information.

Parameters:
<State> ON | OFF | 0 | 1
*RST: 1

Example: `DISP:ANN:CBAR OFF`

Usage: SCPI confirmed

DISPlay:ANNotation:FREQuency <State>

This command turns the label of the x-axis on and off.

Parameters:

<State>	ON | OFF | 0 | 1 *RST: 1
Example:	`DISP:ANN:FREQ OFF`
Usage:	SCPI confirmed
Manual operation:	See "Diagram Footer (Annotation)" on page 103

DISPlay:SBAR[:STATe] <State>

This command turns the status bar on and off.

Parameters:

<State>	ON | OFF | 0 | 1 *RST: 1
Example:	`DISP:SBAR:OFF`
Manual operation:	See "Status Bar" on page 103

13.8.3 Colors and Themes

Useful commands to customize display colors described elsewhere

The HCOPY commands define the print colors and thus only take effect on the display colors, if the display shows the printing colors.

- `HCOPy:CMAP<item>:DEFault<colors>` on page 408
- `HCOPy:CMAP<item>:HSL` on page 409
- `HCOPy:CMAP<item>:PDEFined` on page 409

Remote commands exclusive to customize the display colors and themes

DISPlay:CMAP<item>:DEFault<colors>.......... 418
DISPlay:CMAP<item>:HSL.......... 419
DISPlay:CMAP<item>:PDEFined.......... 419
DISPlay:THEMe:CATalog?.......... 420
DISPlay:THEMe:SELect.......... 420

DISPlay:CMAP<item>:DEFault<colors>

This command resets the color scheme for the display.

Suffix:

<item>	Selects the item for which the color scheme is to be defined. For more information see chapter 13.8.4, "CMAP Suffix Assignment", on page 420.

<colors> 1...4
1
Current colors with a white background and a black grid.
2
Optimized colors.
3
Customized colors.
4
Current screen colors (setting for hardcopies).

Example: `DISP:CMAP:DEF2`
Selects default setting 2 for setting the colors.

Usage: Event
SCPI confirmed

Manual operation: See "Screen colors" on page 105

DISPlay:CMAP<item>:HSL <Color>

This command selects the color for various screen elements in the display.

Suffix:
<item> Selects the item for which the color scheme is to be defined.
For more information see chapter 13.8.4, "CMAP Suffix Assignment", on page 420.

Parameters:
<Color>
hue
tint
sat
saturation
lum
brightness
The value range is 0 to 1 for all parameters.

Example: `DISP:CMAP2:HSL 0.3,0.8,1.0`
Changes the grid color.

DISPlay:CMAP<item>:PDEFined <Color>

This command selects a predefined color for various screen elements.

Suffix:
<item> Selects the item for which the color scheme is to be defined.
For more information see chapter 13.8.4, "CMAP Suffix Assignment", on page 420.

Parameters:
<Color> BLACk | BLUE | BROWn | GREen | CYAN | RED | MAGenta | YELLow | WHITe | DGRAy | LGRAy | LBLUe | LGREen | LCYan | LRED | LMAGenta

Example: `DISP:CMAP2:PDEF GRE`

Manual operation: See "Restoring the User Settings to Default Colors" on page 107

DISPlay:THEMe:CATalog?

This command queries all available display themes.

Parameters:

<Themes> String containing all available display themes.

Example: `DISP:THEMe:CAT?`

Usage: Query only

DISPlay:THEMe:SELect <Theme>

This command selects the display theme.

Parameters:

<Theme> String containing the name of the theme.

*RST: SPL

Example: `DISP:THEM:SEL "OceanBlue"`

Manual operation: See "Theme" on page 104

13.8.4 CMAP Suffix Assignment

Several commands to change the color settings of individual items of the display or printout are available. Which item is to be configured is defined using a <CMAP> suffix. The following assignment applies:

Suffix	Description
CMAP1	Background
CMAP2	Grid
CMAP3 *)	Common Text
CMAP4 *)	Check Status OK
CMAP5 *)	Check Status Error
CMAP6 *)	Text Special 1
CMAP7 *)	Text Special 2
CMAP8	Trace 1
CMAP9	Trace 2
CMAP10	Trace 3
CMAP11	Marker Info Text
CMAP12	Limit Lines

Suffix	Description
CMAP13	Limit and Margin Check – "Pass"
CMAP14	Limit and Margin Check – "Fail"
CMAP15 *)	Softkey Text
CMAP16 *)	Softkey Background
CMAP17 *)	Selected Field Text
CMAP18 *)	Selected Field Background
CMAP19 *)	Softkey 3D Bright Part
CMAP20 *)	Softkey 3D Dark Part
CMAP21 *)	Softkey State "On"
CMAP22 *)	Softkey State "Dialog open"
CMAP23 *)	Softkey Text Disabled
CMAP24	Logo
CMAP25	Trace 4
CMAP26	Grid – Minorlines
CMAP27	Marker
CMAP28	Display Lines
CMAP29 *)	Sweepcount – Text
CMAP30	Limit and Margin Check – Text
CMAP31	Limit and Margin Check – \"Margin\"
CMAP32 *)	Table Overall – Title Text
CMAP33 *)	Table Overall – Title Background
CMAP34 *)	Table Overall – Text
CMAP35 *)	Table Overall – Background
CMAP36 *)	Table Value – Title Text
CMAP37 *)	Table Value – Title Background
CMAP38 *)	Table Value – Text
CMAP39 *)	Table Value – Background
CMAP40	Trace 5
CMAP41	Trace 6

*) these settings can only be defined via the theme (`DISPlay:THEMe:SELect`) and are thus ignored in the SCPI command

13.9 Commands for Remote Instrument Operation

The following commands are required to shutdown or reboot the R&S VSE from a remote PC.

DEVice:LOCKing:DEFault....................422
SYSTem:CLOGging....................422
SYSTem:COMMunicate:GPIB[:SELF]:RTERminator....................422
SYSTem:DISPlay:UPDate.................... 423
SYSTem:IDENtify:FACTory....................423
SYSTem:IDENtify[:STRing]....................423

DEVice:LOCKing:DEFault <STATe>

Defines the default setting for the VISA connection lock for all subsequent instrument connections (see `DEVice:LOCKing` on page 271).

Parameters:

<State> ON | OFF | 1 | 0

ON | 1
Connection is locked, no other devices can establish a connection to the same instrument

OFF | 0
Connection is unlocked, other devices in the network can connect to the instrument

*RST: OFF

Example: `DEV:LOCK:DEF ON`

Manual operation: See "Lock new VISA connections" on page 252

SYSTem:CLOGging <State>

This command turns logging of remote commands on and off.

Parameters:

<State> **ON**
Writes all remote commands that have been sent to a file.
The destination is `C:\R_S\instr\ScpiLogging\ScpiLog.txt`.

OFF

*RST: OFF

Manual operation: See "I/O Logging" on page 252

SYSTem:COMMunicate:GPIB[:SELF]:RTERminator <Terminator>

This command selects the GPIB receive terminator.

Output of binary data from the instrument to the control computer does not require such a terminator change.

Parameters:

<Terminator> LFEOI | EOI

LFEOI
According to the standard, the terminator in ASCII is <LF> and/or <EOI>.

EOI
For binary data transfers (e.g. trace data) from the control computer to the instrument, the binary code used for <LF> might be included in the binary data block, and therefore should not be interpreted as a terminator in this particular case. This can be avoided by using only the receive terminator `EOI`.

*RST: LFEOI

Example: `SYST:COMM:GPIB:RTER EOI`

Manual operation: See "GPIB Terminator" on page 252

SYSTem:DISPlay:UPDate <State>

This command turns the display during remote operation on and off.

If on, the R&S VSE updates the diagrams, traces and display fields only.

The best performance is obtained if the display is off during remote control operation.

Parameters:

<State> ON | OFF

*RST: OFF

Example: `SYST:DISP:UPD ON`

Manual operation: See "Remote Display Update" on page 251

SYSTem:IDENtify:FACTory

This command resets the query to `*IDN?` to its default value.

Usage: Event

Manual operation: See "Reset to Factory String" on page 251

SYSTem:IDENtify[:STRing] <String>

This command defines the response to `*IDN?`.

Parameters:

<String> String containing the description of the instrument.

Manual operation: See "Identification String" on page 251

13.10 Working with Status Registers

● Using the Status Register... 424

13.10.1 Using the Status Register

For more information on the contents of the status registers see:

● "STATus:OPERation Register" on page 242
● "STATus:QUEStionable:EXTended Register" on page 242
● "STATus:QUEStionable:FREQuency Register" on page 243
● "STATus:QUEStionable:LIMit Register" on page 244
● "STATus:QUEStionable:LMARgin Register" on page 245
● "STATus:QUEStionable:POWer Register" on page 245
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● Reading Out the CONDition Part.. 425
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13.10.1.1 General Status Register Commands

STATus:PRESet.. 424
STATus:QUEue[:NEXT]?... 424

STATus:PRESet

This command resets the edge detectors and `ENABle` parts of all registers to a defined value. All `PTRansition` parts are set to `FFFFh`, i.e. all transitions from 0 to 1 are detected. All `NTRansition` parts are set to 0, i.e. a transition from 1 to 0 in a `CONDition` bit is not detected. The `ENABle` part of the `STATus:OPERation` and `STATus:QUEStionable` registers are set to 0, i.e. all events in these registers are not passed on.

Usage: Event

STATus:QUEue[:NEXT]?

This command queries the most recent error queue entry and deletes it.

Positive error numbers indicate device-specific errors, negative error numbers are error messages defined by SCPI. If the error queue is empty, the error number 0, "No error", is returned.

This command is identical to the `SYSTem:ERRor[:NEXT]?` command.

Usage: Query only

13.10.1.2 Reading Out the CONDition Part

For more information on the condition part see chapter 12.1.5.2, "Structure of a SCPI Status Register", on page 238.

STATus:OPERation:CONDition?
STATus:QUEStionable:CONDition?
STATus:QUEStionable:EXTended:CONDition? <ChannelName>
STATus:QUEStionable:EXTended:INFO:CONDition? <ChannelName>
STATus:QUEStionable:FREQuency:CONDition? <ChannelName>
STATus:QUEStionable:LIMit<n>:CONDition? <ChannelName>
STATus:QUEStionable:LMARgin<n>:CONDition? <ChannelName>
STATus:QUEStionable:POWer:CONDition? <ChannelName>
STATus:QUEStionable:TEMPerature:CONDition? <ChannelName>
STATus:QUEStionable:TIME:CONDition? <ChannelName>

These commands read out the CONDition section of the status register.

The commands do not delete the contents of the CONDition section.

Query parameters:
<ChannelName> String containing the name of the channel.
The parameter is optional. If you omit it, the command works for the currently active channel.

Usage: Query only

13.10.1.3 Reading Out the EVENt Part

For more information on the event part see chapter 12.1.5.2, "Structure of a SCPI Status Register", on page 238.

STATus:OPERation[:EVENt]?
STATus:QUEStionable[:EVENt]?
STATus:QUEStionable:EXTended[:EVENt]? <ChannelName>
STATus:QUEStionable:EXTended:INFO[:EVENt]? <ChannelName>
STATus:QUEStionable:FREQuency[:EVENt]? <ChannelName>
STATus:QUEStionable:LIMit<n>[:EVENt]? <ChannelName>
STATus:QUEStionable:LMARgin<n>[:EVENt]? <ChannelName>
STATus:QUEStionable:POWer[:EVENt]? <ChannelName>
STATus:QUEStionable:TEMPerature[:EVENt]? <ChannelName>
STATus:QUEStionable:TIME[:EVENt]? <ChannelName>

These commands read out the EVENt section of the status register.

At the same time, the commands delete the contents of the EVENt section.

Query parameters:
<ChannelName> String containing the name of the channel.
The parameter is optional. If you omit it, the command works for the currently active channel.

Usage: Query only

13.10.1.4 Controlling the ENABle Part

For more information on the enable part see chapter 12.1.5.2, "Structure of a SCPI Status Register", on page 238.

STATus:OPERation:ENABle <SumBit>
STATus:QUEStionable:ENABle <SumBit>
STATus:QUEStionable:EXTended:ENABle <SumBit>,<ChannelName>
STATus:QUEStionable:EXTended:INFO:ENABle <SumBit>,<ChannelName>
STATus:QUEStionable:FREQuency:ENABle <SumBit>,<ChannelName>
STATus:QUEStionable:LIMit<n>:ENABle <SumBit>,<ChannelName>
STATus:QUEStionable:LMARgin<n>:ENABle <SumBit>,<ChannelName>
STATus:QUEStionable:POWer:ENABle <SumBit>,<ChannelName>
STATus:QUEStionable:TEMPerature:ENABle <SumBit>,<ChannelName>
STATus:QUEStionable:TIME:ENABle <SumBit>,<ChannelName>

These commands control the ENABle part of a register.

The ENABle part allows true conditions in the EVENt part of the status register to bereported in the summary bit. If a bit is 1 in the enable register and its associated event bit transitions to true, a positive transition will occur in the summary bit reported to the next higher level.

Parameters:

<SumBit>	Range:	0 to 65535
<ChannelName>	String containing the name of the channel. The parameter is optional. If you omit it, the command works for the currently active channel.	

13.10.1.5 Controlling the Negative Transition Part

For more information on the positive transition part see chapter 12.1.5.2, "Structure of a SCPI Status Register", on page 238.

STATus:OPERation:NTRansition <SumBit>
STATus:QUEStionable:NTRansition <SumBit>
STATus:QUEStionable:EXTended:NTRansition <SumBit>,<ChannelName>
STATus:QUEStionable:EXTended:INFO:NTRansition <SumBit>,<ChannelName>
STATus:QUEStionable:FREQuency:NTRansition <SumBit>,<ChannelName>
STATus:QUEStionable:LIMit<n>:NTRansition <SumBit>,<ChannelName>
STATus:QUEStionable:LMARgin<n>:NTRansition <SumBit>,<ChannelName>
STATus:QUEStionable:POWer:NTRansition <SumBit>,<ChannelName>
STATus:QUEStionable:TEMPerature:NTRansition <SumBit>,<ChannelName>
STATus:QUEStionable:TIME:NTRansition <SumBit>,<ChannelName>

These commands control the Negative TRansition part of a register.

Setting a bit causes a 1 to 0 transition in the corresponding bit of the associated register. The transition also writes a 1 into the associated bit of the corresponding EVENt register.

Parameters:

<SumBit>	Range: 0 to 65535
<ChannelName>	String containing the name of the channel. The parameter is optional. If you omit it, the command works for the currently active channel.

13.10.1.6 Controlling the Positive Transition Part

For more information on the negative transition part see chapter 12.1.5.2, "Structure of a SCPI Status Register", on page 238.

STATus:OPERation:PTRansition <SumBit>
STATus:QUEStionable:PTRansition <SumBit>
STATus:QUEStionable:EXTended:PTRansition <SumBit>,<ChannelName>
STATus:QUEStionable:EXTended:INFO:PTRansition <SumBit>,<ChannelName>
STATus:QUEStionable:FREQuency:PTRansition <SumBit>,<ChannelName>
STATus:QUEStionable:LIMit<n>:PTRansition <SumBit>,<ChannelName>
STATus:QUEStionable:LMARgin<n>:PTRansition <SumBit>,<ChannelName>
STATus:QUEStionable:POWer:PTRansition <SumBit>,<ChannelName>
STATus:QUEStionable:TEMPerature:PTRansition <SumBit>,<ChannelName>
STATus:QUEStionable:TIME:PTRansition <SumBit>,<ChannelName>

These commands control the Positive TRansition part of a register.

Setting a bit causes a 0 to 1 transition in the corresponding bit of the associated register. The transition also writes a 1 into the associated bit of the corresponding EVENt register.

Parameters:

<SumBit>	Range: 0 to 65535
<ChannelName>	String containing the name of the channel. The parameter is optional. If you omit it, the command works for the currently active channel.

13.11 Retrieving Error Messages

SYSTem:ERRor:CLEar:ALL....427
SYSTem:ERRor:EXTended?....428
SYSTem:ERRor:LIST?....428
SYSTem:ERRor[:NEXT]?....429

SYSTem:ERRor:CLEar:ALL

This command deletes all contents of the "System Messages" table.

Example: `SYST:ERR:CLE:ALL`

Usage: Event

SYSTem:ERRor:EXTended? <MessageType>[, <ChannelName>]

This command queries all system messages, or all messages of a defined type, displayed in the status bar for a specific measurement channel (application).

Note: This command queries the strings displayed for manual operation. For remote programs, do not define processing steps depending on these results. Instead, query the results of the `STATus:QUEStionable:EXTended:INFO` status register, which indicates whether messages of a certain type have occurred (see "STATus:QUEStionable:EXTended:INFO Register" on page 243).

Query parameters:

<MessageType> ALL | INFO | WARNing | ERRor | FATal | MESSage

<ChannelName> String containing the name of the channel.
The parameter is optional. If you omit it, the command works for the currently active channel.

Return values:

<Messages> String containing all messages of the selected type for the specified measurement channel. Each message is separated by a comma and inserted in parentheses. If no messages are available, empty parentheses are returned.

Example: `SYST:ERR:EXT? ALL`
Returns all messages for the currently active application, e.g. *"Message 1","Message 2"*.

Example: `SYST:ERR:EXT? FAT,'Spectrum2'`
Queries fatal errors in the 'Spectrum2' application. If none have occurred, the result is: *" "*.

Usage: Query only

SYSTem:ERRor:LIST? [<MessType>]

This command queries the error messages that occur during R&S VSE operation.

Query parameters:

<MessType> **SMSG**
(default) Queries the system messages which occurred during manual operation.

REMote
Queries the error messages that occurred during remote operation.
Note: The remote error list is automatically cleared when the R&S VSE is shut down.

Return values:

<SystemMessages> String containing all messages in the "System Messages" table.

<RemoteErrors>	<Error_no> | <Description> | <Command> | <Date> | <Time> Comma-separated list of errors from the "Remote Errors" table, where: `<Error_no>`: device-specific error code `<Description>`: brief description of the error `<Command>`: remote command causing the error `<Date>|<Time>`: date and time the error occurred
Example:	`SYST:ERR:LIST?`
Usage:	Query only

SYSTem:ERRor[:NEXT]?

This command queries the most recent error queue entry and deletes it.

Positive error numbers indicate device-specific errors, negative error numbers are error messages defined by SCPI. If the error queue is empty, the error number 0, "No error", is returned.

For details on error queues see chapter 12.1.5, "Status Reporting System", on page 236.

Usage: Query only

13.12 Programming Examples

The following programming examples demonstrate how to capture I/Q data and perform basic I/Q data analysis using the I/Q Analyzer in a remote environment.

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- Configuring Input from an Instrument....430
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- Basic I/Q Analysis....433
- Recording I/Q Data....436
- Saving and Loading Measurement Settings....437
- Programming Example: Complete Sequential Measurement with Data Export....438

13.12.1 Configuring File Input

This example demonstrates how to configure input from a file for a measurement in a remote environment.

```
//********** Prepare software **********
*RST

//Assign the file as input source for the default channel 1 in VSE **********
INST:BLOC:CHAN:SETT:SOUR FILE
```

```
//Define file to load
INST:BLOC:CHAN:FILE 'C:\ProgramData\Rohde-Schwarz\VSE\1.0_11\user\vsa\DemoSignals\
GSM_8PSK.iq.tar',866KHZ

//Load 10ms of measurement time, starting at 1ms; current display at 2.5ms from start
INST:BLOC:CHAN:SETT:FILE:STAR:TIME   0.001
INST:BLOC:CHAN:SETT:FILE:STOP:TIME   0.01
INST:BLOC:CHAN:SETT:FILE:CURR:TIME   0.0025


//Start playing the data from the current position in single measurement mode
INIT:CONT OFF
INIT:IMM;*WAI
```

13.12.2 Configuring Input from an Instrument

This example demonstrates how to configure two different connected instruments for a measurement in a remote environment. Only one instrument is used for input in this example. For a more complex example see chapter 13.12.3, "Performing a Sequence of Measurements", on page 431.

```
//Prepare software
*RST
//Configure connection to MyFSW at 123.456.789.100 using VSI11 protocol
DEV:CRE 'MyFSW','123.456.789.100',VXI11;*WAI
//Query the network address of MyFSW
DEV:TARG? 'MyFSW'
//Result: '123.456.789.100'
//Query connection state to MyFSW
DEV:STAT? 'MyFSW'
//Result: 1 (connection established)

//Query information on MyFSW
//Installed hardware?
DEV:INFO:HWIN? 'MyFSW'
//Instrument ID?
DEV:INFO:IDN? 'MyFSW'
//Installed options?
DEV:INFO:OPT? 'MyFSW'

//Define the use of an external reference on MyFSW
DEV:EXTR:SOUR 'MyFSW',EXT
DEV:EXTR:FREQ  'MyFSW',13MHZ

//Assign MyFSW as input source for default channel 1 in VSE
INST:BLOC:CHAN:SETT:SOUR DEV
INST:BLOC:CHAN:SETT:DEV  'MyFSW'

//Configure connection to YourFSW at 100.100.100.99 using HiSlip protocol
```

```
DEV:CRE 'YourFSW','100.100.100.99',HiSlip

//Start capturing data from MyFSW
//Select default channel 1
INST 'IQ Analyzer'
//Start measurement on channel 1
INIT:IMM;*WAI
```

13.12.3 Performing a Sequence of Measurements

This example demonstrates how to configure and perform a sequence of measurements in a remote environment. It assumes the instruments 'MyFSW' and 'YourFSW' have been configured, as described in chapter 13.12.2, "Configuring Input from an Instrument", on page 430.

```
//********** Prepare software **********
*RST

//********** Configure four channels **********
//1) (default): IQ Analyzer: I/Q Analyzer for instrument input from 'MyFSW',
//2) AnalogDemodFSW: AnalogDemod for instrument input from 'MyFSW',
//3) Your IQ Analyzer: I/Q Analyzer for instrument input from 'YourFSW'
//4) AnalogDemodFile: AnalogDemod for file input

//Create channel 2
INST:CRE:NEW ADEM,'AnalogDemodFSW'
//Duplicate default channel 1 to create channel 3
INST:SEL 'IQ Analyzer'
INST:CRE:DUPL
//Result: 'IQ Analyzer 2'
INST:REN 'IQ Analyzer 2','Your IQ Analyzer'
//Create channel 4
INST:CRE:NEW ADEM,'AnalogDemodFile'
//Query list of channels
INST:LIST?
//Result: 'IQ','IQ Analyzer', 'ADEM','AnalogDemodFSW', 'IQ','Your IQ Analyzer',
//'ADEM','AnalogDemodFile'

//Configure input sources for each channel
INST:SEL 'IQ Analyzer'
INST:BLOC:CHAN:SETT:SOUR DEV
INST:BLOC:CHAN:SETT:DEV  'MyFSW'

INST:SEL 'AnalogDemodFSW'
INST:BLOC:CHAN:SETT:SOUR DEV
INST:BLOC:CHAN:SETT:DEV 'MyFSW'

INST:SEL 'Your IQ Analyzer'
INST:BLOC:CHAN:SETT:SOUR DEV
```

```
INST:BLOC:CHAN:SETT:DEV 'YourFSW'

INST:SEL 'AnalogDemodFile'
INST:BLOC:CHAN:SETT:SOUR FILE
INST:BLOC:CHAN:FILE 'C:\ProgramData\Rohde-Schwarz\VSE\0.90a_32\user\vsa\
DemoSignals\GSM_8PSK.iq.tar',866KHZ

//********** Configure two groups **********
//Measurements on one instrument cannot be performed simultaneously
//-> Separate channels using same instrument as input into different groups:
//Group 1: (default)'Group 1': channels 1,3
//Group 2: 'AdemodGroup': channels 2,4

//Create new group 2:
INST:BLOC:CRE 'AdemodGroup', 'Group 1'
//Move channels 2+4 to new group:
INST:BLOC:CHAN:MOVE 'AdemodGroup','','AnalogDemodFSW'
INST:BLOC:CHAN:MOVE 'AdemodGroup','AnalogDemodFSW','AnalogDemodFile'

//Query list of channels in group 2:
INST:BLOC:LIST?
//Result: 'AnalogDemodFSW','AnalogDemodFile'
//Query list of channels in group 1:
INST:BLOC:SEL 'Group 1'
INST:BLOC:LIST?
//Result: 'IQ Analyzer','Your IQ Analyzer'

//********** Activate all channels and groups for measurement **********
INST:BLOC:CHAN:USE 1,'IQ Analyzer'
INST:BLOC:CHAN:USE 1,'AnalogDemodFSW'
INST:BLOC:CHAN:USE 1,'Your IQ Analyzer'
INST:BLOC:CHAN:USE 1,'AnalogDemodFile'
INST:BLOC:USE 1, 'Group 1'
INST:BLOC:USE 1, 'AdemodGroup'

//********** Perform a single measurement on all groups **********
//Measurements 1+3 are started simultaneously;
//When I/Q Analyzer measurements on both instruments are finished,
//measurements 2+4 are started;
INIT:SEQ:MODE SING
INIT:SEQ:IMM;*WAI

//********** Retrieve results for I/Q Analyzer channel **********
INST:SEL 'IQ Analyzer'
TRAC:DATA? TRACE1
//Returns the magnitude for each trace point
```

13.12.4 Basic I/Q Analysis

This example demonstrates how to configure and perform a basic I/Q data acquisition and analyze the data using the I/Q Analyzer in a remote environment.

```
//--------------Activate the I/Q Analyzer application ---------------------
//Reset the software
*RST
//Default channel is I/Q Analyzer with Magnitude result display
//For demonstration purposes, create a new channel for I/Q Analyzer
INST:CRE:NEW IQ,'My IQ Analyzer'
INST:BLOC:CHAN:SETT:SOUR DEV
INST:BLOC:CHAN:SETT:DEV 'MyFSW'

//--------------Configure data acquisition-------------
//Define the sample rate
TRAC:IQ:SRAT 32MHZ
//Set the record length (number of samples to capture) to 1000 samples
TRAC:IQ:RLEN 1000
//Query the bandwidth of the resampling filter, determined by the sample rate
TRAC:IQ:BWID?


//--------------Configure the trace--------------------
//Define averaging for the I/Q trace
TRAC:IQ:AVER ON
//Define an average over 10 measurements
TRAC:IQ:AVER:COUN 10

//Add traces with different trace modes
DISP:TRAC1:MODE WRIT
DISP:TRAC2:MODE MAXH
DISP:TRAC3:MODE MINH


//--------------Perform the measurement---------------------
//Initiate a new measurement and wait until the measurement has finished
INIT:CONT OFF
INIT;*WAI

//---------------Retrieve results----------------------------
//Format the data as 32-byte real values
INST:SEL 'My IQ Analyzer'
//Use real 32-bit format for data
FORM:DATA REAL,32
//List all I values first, then all Q values in the trace results
TRAC:IQ:DATA:FORM IQP

//Query the magnitude for each trace point
TRAC:DATA? TRACE1
```

```
TRAC:DATA? TRACE2
TRAC:DATA? TRACE3

//Change the result display to Real/Imag (I/Q)
LAY:REPL:WIND '1',RIMAG

//Configure searches to search both I and Q branches
CALC:MARK:SEAR MAGN
//Query the result of the peak search on both branches
CALC:MARK:Y?

//Query the first 500 samples of the stored I/Q data for the measurement
TRAC:IQ:DATA:MEM? 0,500
//For each sample, first the I-value, then the Q-value is listed.

//Query the second half of the 1000 captured sample values
TRAC:IQ:DATA:MEM? 500,500
```

13.12.4.1 Programming Example: Configuring a Spectrogram

This example demonstrates how to configure a spectrogram for a basic I/Q measurement in a remote environment. The spectrogram is displayed in a subwindow of the Spectrum display. In addition, the usage of special spectrogram markers is demonstrated (see "Marker Search (Spectrograms)" on page 359).

```
//-----------Preparing the Measurement ------------
//Reset the I/Q Analyzer channel settings, but not the instrument assignment
INST:SEL 'My IQ Analyzer'
SYST:PRES:CHAN
//Add a Spectrum result display
LAY:ADD:WIND? '1',RIGH,FREQ
//Result is window name: '2'
//Display a Spectrogram
CALC2:SPEC:STAT ON
//The spectrogram is updated with each new measurement.


//--------------Configuring the Spectrogram--------------
//Clear the displayed spectrogram to start a new one
CALC2:SGR:CLE
//Configure a continuous spectrogram for a series of measurements.
//The display is not cleared when a new measurement is started.
CALC2:SGR:CONT ON
//Set the number of frames to be recorded per measurement to 100.
CALC2:SGR:FRAM:COUN 100
//Set the number of frames to be stored to 1000 (=10 measurements)
CALC2:SGR:HDEP 1000

//--------------Configuring the Color Map----------------
//Define a gray-scaled coloring: low values light gray, high values dark gray
```

```
DISP:WIND2:SGR:COL GRAY
//Define a color map for a range that comprises 40% of the measurement range,
//excluding 30% at each end. The colors are not scaled linearly; the light gray
//colors are stretched to distinguish low values better.
DISP:WIND2:SGR:COL:LOW 30
DISP:WIND2:SGR:COL:UPP 70
DISP:WIND2:SGR:COL:SHAP 0.8

//--------------Performing the Measurement---------------
//Select single capture mode.
INIT:CONT OFF
//Define 10 captures to be performed per measurement
SENS:AVER:COUN 10
//Initiate a new measurement and wait until the captures have finished
INIT;*WAI
//The spectrogram is updated with each new capture


//--------------Positioning Markers----------------------
//Includes all frames in the memory in the search area
CALC2:MARK:SGR:SAR MEM
//Set marker 1 to the frame 1 second after measurement begin. (Note the
//negative value!
CALC2:MARK1:SGR:FRAM -1s
//Set marker 1 to the minimum level in this frame
CALC2:MARK1:MIN
//Set marker 1 to the minimum level for the same frequency the marker is
//currently positioned at in all frames.
CALC2:MARK1:SGR:Y:MIN
//Set marker 2 to the maximum level in the entire spectrogram.
CALC2:MARK2:SGR:XY:MAX
//Set the deltamarker 1 to the frame number -3. By default
//it is set to the peak of that frame and displays the level difference to marker 1.
//Note the negative value!
CALC2:DELT1:SGR:FRAM -3
//Set deltamarker 1 to the minimum level in this frame.
CALC2:DELT1:MIN
//Set deltamarker 3 to the maximum level in the entire spectrogram. By default
//its value is the difference to marker 1. We will change it to refer to marker 2.
CALC2:DELT3:SGR:XY:MAX
CALC2:DELT3:MREF 2
//Deltamarker 3 now refers to marker 2, both are positioned on the maximum of the
//spectrogram. Thus, D3=0.

//---------------Retrieving Results----------------------
//Query the frequency (x), level (y) and frame values of marker 1.
CALC2:MARK1:X?
CALC2:MARK1:Y?
CALC2:MARK1:SGR:FRAM?
```

```
//Query the frequency (x), level (y) and frame values of marker 2.
CALC2:MARK2:X?
CALC2:MARK2:Y?
CALC2:MARK2:SGR:FRAM?

//Query the frequency (x), level (y) and frame values of deltamarker 1.
CALC2:DELT1:X?
CALC2:DELT1:Y?
CALC2:DELT1:SGR:FRAM?

//Query the frequency (x), level (y) and frame values of deltamarker 3.
CALC2:DELT3:X?
CALC2:DELT3:Y?
CALC2:DELT3:SGR:FRAM?

//Select the frame that was captured 1 second after measurement start (Note the
//negative value!). This frame is displayed in the Spectrum window.
CALC2:SGR:FRAM:SEL -1
//Retrieve the Spectrum trace data for the selected frame only.
TRAC2:DATA? TRACE1
```

13.12.4.2 Programming Example: Marker Search in Spectrograms

This example demonstrates how to search for peak values in spectrograms in a remote environment. It assumes a spectrogram is already available (see chapter 13.12.4.1, "Programming Example: Configuring a Spectrogram", on page 434) and thus does not begin by presetting the instrument.

```
//---------------- Analyzing the results using markers -------------------
//Set marker1 on the peak power in the most recent spectrum and query
//its position
CALC2:SPEC:FRAM:SEL 0
CALC2:MARK1 ON
CALC2:MARK1:X?
CALC2:MARK1:Y?

//Set marker3 on peak power level in the entire spectrogram in memory and
//query its position
CALC2:MARK3 ON
CALC2:MARK:SPEC:SAR MEM
CALC2:MARK3:SPEC:XY:MAX
CALC2:MARK3:X?
CALC2:MARK3:Y?
```

13.12.5 Recording I/Q Data

This example demonstrates how to record I/Q data in a remote environment. It assumes a measurement has been configured as described in chapter 13.12.4, "Basic I/Q Analysis", on page 433.

How to recall recorded I/Q data in a remote environment is described in chapter 13.12.1, "Configuring File Input", on page 429.

```
//********** Configure recording **********
//Store most recent 10 measurements (10 * 1000 records)
REC:COUN 10
REC:MAX:RLEN OFF
//Configure default comment to be 'FSW_data_'
REC:COMM 'FSW_data_'
//Store additional samples for settling time (for demonstration purposes only)
REC:SETT:TIME ON

//********** Perform the measurement **********
INST:SEL 'My IQ Analyzer'
INST:BLOC:CHAN:REC;*WAI

//********** Export the recorded data **********
//Include minimum set of meta data except for input path, plus
//preamplifier, input impedance
EXP:IQ:META:DATA:SET MIN
EXP:IQ:META:DATA:SET CUST
EXP:IQ:META:DATA 'InputCoupling',OFF
EXP:IQ:META:DATA 'PreampState',ON

//Store the data to an iq.tar file
EXP:IQ:FORM IQTAR;*WAI;
EXP:IQ:FILE 'C:\ProgramData\Rohde-Schwarz\VSE\1.0_11\user\
MyFSW_IQanalyzer_results.iq.tar'
```

13.12.6 Saving and Loading Measurement Settings

This example demonstrates how to save and load measurement settings in a remote environment. It assumes a measurement has been configured as described in chapter 13.12.4, "Basic I/Q Analysis", on page 433.

```
//********* Store the channel settings **********

//Select the channel whose settings are to be saved
INST:SEL 'My IQ Analyzer'
//Specify that channel-specific data is to be stored.
MMEM:STOR:TYPE CHAN
//Store the channel settings from the 'My IQ Analyzer' channel
// to the file 'MyFSW_IQanalyzer.dfl'.
MMEM:STOR:STAT 1, 'C:\temp\MyFSW_IQanalyzer.dfl'

//********* Load the channel settings **********

//Specify that settings will be loaded to a new channel besides the existing
```

```
//'My IQ Analyzer' channel.
MMEM:LOAD:TYPE NEW
//Select all settings and results to be loaded.
MMEM:SEL:CHAN:ALL
//Load the channel-specific settings from the file 'MyFSW_IQanalyzer.dfl'
//to a new channel. The new channel is named 'My IQ Analyzer 2' by default
MMEM:LOAD:STAT 1, 'C:\temp\MyFSW_IQanalyzer.dfl'
//Rename the loaded channel to 'MyFSW_IQanalyzer_FromFile'.
INST:REN 'My IQ Analyzer 2','MyFSW_IQanalyzer_FromFile'
```

13.12.7 Programming Example: Complete Sequential Measurement with Data Export

The following example comprises many of the tasks described above to provide a complete measurement example in one script.

For this measurement, two instruments (R&S FSW) are configured for input. The measurement consists of four measurement channels:

1) IQ Analyzer: I/Q Analyzer for instrument input from 'MyFSW',

2) AnalogDemodFSW: AnalogDemod for instrument input from 'MyFSW',

3) Your IQ Analyzer: I/Q Analyzer for instrument input from 'YourFSW'

4) AnalogDemodFile: AnalogDemod for file input

The individual measurements are configured, then performed and the captured data is recorded. Finally, the recorded data and the measurement results are stored to a file.

```
//****************************************
//********** Prepare software **********
//****************************************
*RST

//******************************************************
//********** Configure instrument connections **********
//******************************************************

//Configure connection to MyFSW at 123.456.789.100 using VSI11 protocol
DEV:CRE 'MyFSW','123.456.789.100',VXI11
//Query the network address of MyFSW
DEV:TARG? 'MyFSW'
//Result: '123.456.789.100'
//Query connection state to MyFSW
DEV:STAT? 'MyFSW'
//Result: 1 (connection established)

//Query information on MyFSW
//Installed hardware?
DEV:INFO:HWIN? 'MyFSW'
```

```
//Instrument ID?
DEV:INFO:IDN? 'MyFSW'
//Installed options?
DEV:INFO:OPT? 'MyFSW'

//Define the use of an external reference on MyFSW
DEV:EXTR:SOUR 'MyFSW',EXT
DEV:EXTR:FREQ  'MyFSW',13MHZ

//Assign MyFSW as input source for default channel 1
INST:BLOC:CHAN:SETT:SOUR DEV
INST:BLOC:CHAN:SETT:DEV  'MyFSW'

//Configure connection to YourFSW at 100.100.100.99 using HiSlip protocol
DEV:CRE 'YourFSW','100.100.100.99',HiSlip

//*********************************************
//********** Configure four channels **********
//*********************************************

//1) (default): IQ Analyzer: I/Q Analyzer for instrument input from 'MyFSW',
//2) AnalogDemodFSW: AnalogDemod for instrument input from 'MyFSW',
//3) Your IQ Analyzer: I/Q Analyzer for instrument input from 'YourFSW'
//4) AnalogDemodFile: AnalogDemod for file input

//Create channel 2
INST:CRE:NEW ADEM,'AnalogDemodFSW'
//Duplicate default channel 1 to create channel 3
INST:SEL 'IQ Analyzer'
INST:CRE:DUPL
//Result: 'IQ Analyzer 2'
INST:REN 'IQ Analyzer 2','Your IQ Analyzer'
//Create channel 4
INST:CRE:NEW ADEM,'AnalogDemodFile'
//Query list of channels
INST:LIST?
//Result: 'IQ','IQ Analyzer', 'ADEM','AnalogDemodFSW', 'IQ','Your IQ Analyzer',
//'ADEM','AnalogDemodFile'

//Configure input sources for each channel
INST:SEL 'IQ Analyzer'
INST:BLOC:CHAN:SETT:SOUR DEV
INST:BLOC:CHAN:SETT:DEV  'MyFSW'

INST:SEL 'AnalogDemodFSW'
INST:BLOC:CHAN:SETT:SOUR DEV
INST:BLOC:CHAN:SETT:DEV  'MyFSW'

INST:SEL 'Your IQ Analyzer'
INST:BLOC:CHAN:SETT:SOUR DEV
```

```
INST:BLOC:CHAN:SETT:DEV  'YourFSW'

INST:SEL 'AnalogDemodFile'
INST:BLOC:CHAN:SETT:SOUR FILE
INST:BLOC:CHAN:FILE 'C:\temp\vsa\
DemoSignals\GSM_8PSK.iq.tar',866KHZ
//Load 10ms of measurement time, starting at 1ms; current display at 2.5ms from start
INST:BLOC:CHAN:SETT:FILE:STAR:TIME 0.001
INST:BLOC:CHAN:SETT:FILE:STOP:TIME 0.01
INST:BLOC:CHAN:SETT:FILE:CURR:TIME 0.0025

//*******************************************
//********** Configure two groups **********
//*******************************************

//Measurements on one instrument cannot be performed simultaneously
//-> Separate channels using same instrument as input into different groups:
//Group 1: (default)'Group 1': channels 1,3
//Group 2: 'AdemodGroup': channels 2,4

//Create new group 2:
INST:BLOC:CRE 'AdemodGroup', 'Group 1'
//Move channels 2+4 to new group:
INST:BLOC:CHAN:MOVE 'AdemodGroup','','AnalogDemodFSW'
INST:BLOC:CHAN:MOVE 'AdemodGroup','AnalogDemodFSW','AnalogDemodFile'

//Query list of channels in group 2:
INST:BLOC:LIST?
//Result: 'AnalogDemodFSW','AnalogDemodFile'
//Query list of channels in group 1:
INST:BLOC:SEL 'Group 1'
INST:BLOC:LIST?
//Result: 'IQ Analyzer','Your IQ Analyzer'

//Activate all channels and groups for measurement
INST:BLOC:CHAN:USE 1,'IQ Analyzer'
INST:BLOC:CHAN:USE 1,'AnalogDemodFSW'
INST:BLOC:CHAN:USE 1,'Your IQ Analyzer'
INST:BLOC:CHAN:USE 1,'AnalogDemodFile'
INST:BLOC:USE 1, 'Group 1'
INST:BLOC:USE 1, 'AdemodGroup'

//**************************************************************
//********** Configure the I/Q Analyzer application **********
//**************************************************************

//Select the channel
INST:SEL 'IQ Analyzer'

//********** Configure data acquisition **********
```

```
//Define the sample rate.
TRAC:IQ:SRAT 32MHZ
//Set the record length (number of samples to capture) to 1000 samples.
TRAC:IQ:RLEN 1000
//Query the bandwidth of the resampling filter, determined by the sample rate
TRAC:IQ:BWID?
//Format the data as 32-byte real values.
FORM:DATA REAL,32
//List all I values first, then all Q values in the trace results.
TRAC:IQ:DATA:FORM IQP

//********** Configure the trace **********
//Define averaging for the I/Q trace.
TRAC:IQ:AVER ON
//Define an average over 10 captures.
TRAC:IQ:AVER:COUN 10

//Change the trace modes.
DISP:TRAC1:MODE WRIT
DISP:TRAC2:MODE MAXH
DISP:TRAC3:MODE MINH

//**********************************************************************
//**********  Configure the Analog Demod measurement channel **********
//**********************************************************************

//Select Analog Demod channel
INST:SEL 'AnalogDemodFSW'

//Set the center frequency to 500 MHz
FREQ:CENT 500 MHz
//Set the reference level to 0 dBm
DISP:TRAC:Y:SCAL:RLEV 0

//**********  Configure data acquisition **********

//Set the measurement time to 1 ms (=10 periods)
ADEM:MTIM 1ms
//Optimize the scaling of the y-axis for the current measurement (continuously)
SENS:ADJ:SCAL:Y:AUTO ON
//Set the demodulation bandwidth to 400 kHz
BAND:DEM 400 kHz
//Use (offline) FM trigger
TRIG:SOUR IQP
//Trigger when magnitude of I/Q data reaches -50dBm
TRIG:LEV:IQP -50

//**********  Configure the result display **********

//Add an FM Spectrum result display below FM Time Domain
```

```
LAY:ADD:WIND? '1',BEL,'XTIM:FM:AFSP'
//Define two traces in the FM Spectrum: 1: Clear/write, 2: average
ADEM:FM:AFSP WRIT,AVER,OFF,OFF,OFF,OFF
//Define two traces in the FM Time domain: 1: Clear/write, 2: average
ADEM:FM:AFSP WRIT,AVER,OFF,OFF,OFF,OFF
//Set analog demodulator to execute 30 captures with 32000 samples each
//at a sample rate of 8 MHz; use IQP trigger, trigger on positive slope
//with a pretrigger offset of 500 samples
ADEM:SET 8MHz,32000,IQP,POS,-500,30

//****************************************************************
//********** Perform a single measurement on all groups **********
//****************************************************************

//Measurements 1+3 are started simultaneously;
//When I/Q Analyzer measurements on both instruments are finished,
//measurements 2+4 are started;
INIT:SEQ:MODE SING
INIT:SEQ:IMM;*WAI

//*******************************************************
//********** Retrieve results for I/Q Analyzer**********
//*******************************************************

//Return the magnitude for each trace point
INST:SEL 'IQ Analyzer'
TRAC:DATA? TRACE1
TRAC:DATA? TRACE2
TRAC:DATA? TRACE3

//Change the result display to Real/Imag (I/Q)
LAY:REPL:WIND '1',RIMAG

//Configure searches to search both I and Q branches.
CALC:MARK:SEAR MAGN
//Query the result of the peak search on both branches.
CALC:MARK:Y?

//Return the first 500 samples of the stored I/Q data for the measurement.
//For each sample, first the I-value, then the Q-value is listed.
TRAC:IQ:DATA:MEM? 0,500

//Return the second half of the 1000 captured sample values.
TRAC:IQ:DATA:MEM? 500,500

//**************************************************************
//********** Retrieve Results for Analog Demodulation **********
//**************************************************************

INST:SEL 'AnalogDemodFSW'
```

```
//Query the carrier power
CALC:MARK:FUNC:ADEM:CARR?
//Result: -10.37 [dBm]
//Retrieve the trace data of the most recent measurement (trace 1)
TRAC:DATA? TRACE1
//Result: -1.201362252,-1.173495054,-1.187217355,-1.186594367,-1.171583891,
//-1.188250422,-1.204138160,-1.181404829,-1.186317205,-1.197872400, [...]
//Retrieve the averaged trace data for all 30 measurements (trace 2)
TRAC:DATA? TRACE2
//Result: -1.201362252,-1.173495054,-1.187217355,-1.186594367,-1.171583891,
//-1.188250422,-1.204138160,-1.181404829,-1.186317205,-1.197872400, [...]


//*****************************************
//********** Configure recording **********
//*****************************************

//Store most recent 10 measurements (10 * 1000 records)
REC:COUN 10
REC:MAX:RLEN OFF
//Configure default comment to be 'FSW_data_'
REC:COMM 'FSW_data_'
//Store additional samples for settling time (for demonstration purposes only)
REC:SETT:TIME ON

//Perform the measurement
INST:SEL 'IQ Analyzer'
INST:BLOC:CHAN:REC

//Export the recorded data
//Include minimum set of meta data except for input path, plus
//preamplifier, input impedance
EXP:IQ:META:DATA:SET MIN
EXP:IQ:META:DATA:SET CUST
EXP:IQ:META:DATA 'InputCoupling',OFF
EXP:IQ:META:DATA 'PreampState',ON

//Store the data to an iq.tar file
EXP:IQ:FORM IQTAR;*WAI
EXP:IQ:FILE 'C:\temp\MyFSW_IQanalyzer_results.iq.tar'

//***********************************************
//********* Store the channel settings **********
//***********************************************

//Select the channel whose settings are to be saved
INST:SEL 'IQ Analyzer'
//Specify that channel-specific data is to be stored.
MMEM:STOR:TYPE CHAN
```

```
//Store the channel settings from the 'IQ Analyzer' channel
// to the file 'MyFSW_IQanalyzer.dfl'.
MMEM:STOR:STAT 1, 'C:\temp\MyFSW_IQanalyzer.dfl'

//**********************************************
//********* Load the channel settings **********
//**********************************************

//Specify that settings will be loaded to a new channel besides the existing
//'IQ Analyzer' channel.
MMEM:LOAD:TYPE NEW
//Select all settings and results to be loaded.
MMEM:SEL:CHAN:ALL
//Load the channel-specific settings from the file 'MyFSW_IQanalyzer.dfl'
//to a new channel. The new channel is named 'IQ Analyzer 2' by default
MMEM:LOAD:STAT 1, 'C:\temp\MyFSW_IQanalyzer.dfl'
//Rename the loaded channel to 'MyFSW_IQanalyzer_FromFile'.
INST:REN 'IQ Analyzer 2','MyFSW_IQanalyzer_FromFile'
```

14 Troubleshooting

If the results do not meet your expectations, or problems occur, the following information may help you solve your problem.

- Troubleshooting Remote Operation..445
- Error Messages in Remote Control Mode..446
- Obtaining Technical Support...447

14.1 Troubleshooting Remote Operation

If problems arise during measurement in remote operation, try the following methods to solve them.

Uncompleted sequential commands - blocked remote channels

If a sequential command cannot be completed, for example because a triggered sweep never receives a trigger, the remote control program will never finish and the remote channel to the R&S VSE is blocked for further commands. In this case, you must interrupt processing on the remote channel in order to abort the measurement.

To regain control over a blocked remote channel

Usually, if you wait a minute for the VISA connection to detect the lost connection and clear the control channel by itself, you can then re-establish the connection again. If this fails, try the following:

1. Press "Local" on the front panel of the instrument in use to return to manual operation (if not disabled). Then re-establish the connection.
2. Send a "Device Clear" command from the control instrument to the R&S VSE to clear all currently active remote channels. Depending on the used interface and protocol, send the following commands:
   - **Visa**: `viClear()`

   The remote channel currently processing the uncompleted command is then ready to receive further commands again.
3. On the remote channel performing the measurement, send the SCPI command `ABORt` to abort the current measurement and reset the trigger system.
4. If the instrument in use still does not react to the remote commands, switch it off and back on.

Ignored commands

When a remote command attempts to define incompatible settings, the command is ignored and the instrument status remains unchanged, i.e. other settings are not automatically adapted. Therefore, control programs should always define an initial instrument status (e.g. using the *RST command) and then implement the required settings.

Detecting false commands

If a remote program does not provide the expected results and you are using a GPIB connection, you can log the commands and any errors that may occur. To activate the SCPI error log function, in the "Network + Remote" dialog box, in the "GPIB" tab, select"I/O Logging".

All remote control commands received by the R&S VSE are recorded in the following log file:

`C:\R_S\instr\ScpiLogging\ScpiLog.txt`

Logging the commands may be extremely useful for debug purposes, e.g. in order to find misspelled keywords in control programs. However, remember to turn off the logging function after debugging to avoid unnecessary access to the hard drive and use of storage space.

14.2 Error Messages in Remote Control Mode

In remote control mode error messages are entered in the error/event queue of the status reporting system and can be queried with the command `SYSTem:ERRor?`. The answer format of R&S VSE to the command is as follows:

```
<error code>, "<error text with queue query>;<remote control command concerned>"
```

The indication of the remote control command with prefixed semicolon is optional.

Example:

The command `TEST:COMMAND` generates the following answer to the query `SYSTem:ERRor?`

```
-113,"Undefined header;TEST:COMMAND"
```

There are two types of error messages:

- Error messages defined by SCPI are marked by negative error codes. These messages are defined and described in the SCPI standard and not listed here.
- Device-specific error messages use positive error codes. These messages are described below.

Table 14-1: Device-specific error messages

Error code	Error text in the case of queue poll Error explanation
1052	**Frontend LO is Unlocked** This message is displayed when the phase regulation of the local oscillator fails in the RF front-end.
1060	**Trigger-Block Gate Delay Error- gate length < Gate Delay** This message is displayed when the gate signal length is not sufficient for the pull-in delay with a predefined gate delay.

Error code	Error text in the case of queue poll Error explanation
1064	**Tracking LO is Unlocked** This message is displayed when the phase regulation of the local oscillator fails on the external generator module.
2028	**Hardcopy not possible during measurement sequence** This message is displayed when a printout is started during scan sequences that cannot be interrupted. Such sequences are for example: ● Recording the system error correction data (alignment) ● Instrument self-test In such cases synchronization to the end of the scan sequence should be performed prior to starting the printout.
2033	**Printer Not Available** This message is displayed when the selected printer is not included in the list of available output devices. A possible cause is that the required printer driver is missing or incorrectly installed.
2034	**CPU Temperature is too high** This message is displayed when the temperature of the processor exceeds 70 °C.

14.3 Obtaining Technical Support

If problems occur, the software generates error messages which in most cases will be sufficient for you to detect the cause of an error and find a remedy.

Error messages are described in chapter 14, "Troubleshooting", on page 445.

In addition, our customer support centers are there to assist you in solving any problems that you may encounter with your R&S VSE. We will find solutions more quickly and efficiently if you provide us with the information listed below.

- **Error Log:** The log file (C:\ProgramData\Rohde-Schwarz\VSE\<version_number>\log\RSError.log contains a chronological record of errors.
- **Support file:** a *.zip file with important support information can be created automatically. The *.zip file contains the system configuration information, the current software data and a screenshot of the screen display.

See also chapter 9.4.2, "R&S Support Information", on page 110.

To collect the support information

► Select "Help > Support" and then "Create R&S Support Information".

This data is stored to the following directory on the PC the R&S VSE software is installed on:
C:\ProgramData\Rohde-Schwarz\VSE\<version_no>\user.

Attach the files to an e-mail in which you describe the problem and send it to the customer support address for your region as listed in the Internet (http://www.rohde-schwarz.com/en/service-support/customer_support_107711.html).

A Reference

A.1 Menu Reference

Most functions in the R&S VSE are available from the menus.

- Common R&S VSE Menus..449
- I/Q Analyzer Menus..452

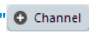
A.1.1 Common R&S VSE Menus

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

- File Menu..449
- Window Menu..451
- Help Menu..452

A.1.1.1 File Menu

The "File" menu includes all functionality directly related to any file operations, printing or setting up general parameters.

Menu item	Correspond-ing icon in toolbar	Description
Save		Saves the current software configuration to a file See chapter 8.2, "Storing and Recalling Measurement Settings", on page 77
Recall		Recalls a saved software configuration from a file See chapter 8.2, "Storing and Recalling Measurement Settings", on page 77
Save IQ Recording	-	Saves the recorded I/Q data from a measurement channel to a file See chapter 8.3.3, "Exporting Recorded I/Q Data", on page 88
Recall IQ Recording	-	Loads the recorded I/Q data from a file See chapter 8.3.4, "Recalling Measurement Data from Files", on page 92
Measurement Group >	-	Configures measurement channels and groups See chapter 7.3, "Controlling Measurement Channels, Groups, and Sequences", on page 67
> New Group	-	Inserts a new group in the measurement sequence See "New Group" on page 70
> New Measurement Channel	-	Inserts a new channel in the selected group See " New Channel" on page 73

Menu item	Corresponding icon in toolbar	Description
> Replace Measurement Channel	-	Replaces the currently selected channel by the selected application. See "Replace Current Channel" on page 73
> Delete Current Measurement Channel	-	Deletes the currently selected channel. See "Close" on page 75
> Measurement Group Setup	-	Displays the "Measurement Group Setup" tool window. See chapter 7.3, "Controlling Measurement Channels, Groups, and Sequences", on page 67
Instruments >	-	Configures instruments to be used for input to the R&S VSE software See chapter 7.2, "Configuring Instruments", on page 53
> New	-	Creates a new instrument configuration See chapter 7.2.2, "Defining the Connection Information Manually", on page 56
> Search	-	Searches for connected instruments in the network See chapter 7.2.4, "Searching for Connected Instruments Automatically", on page 61
> Delete All	-	Deletes all current instrument configurations See chapter 7.2.5, "Deleting all Instrument Configurations", on page 62
> Setup	-	Hides or displays the "Instrument" tool window See chapter 7.2, "Configuring Instruments", on page 53
Preset >	-	Restores stored settings See chapter 8.1, "Restoring the Default Software Configuration (Preset)", on page 76
> All	-	Restores the default software configuration globally for the entire software See "Restoring All Default Settings (Preset All)" on page 76
> All & Delete Instruments		Restores the default software configuration globally for the entire software and deletes all instrument configurations See "Restoring All Default Settings and Deleting Instrument Configurations (Preset All & Delete Instruments)" on page 76
> Selected Channel	-	Restores the default software configuration for an individual channel See "Restoring Channel Settings (Preset Selected Channel)" on page 77
> Reset VSE Layout	-	Restores the default layout of windows, toolbars etc. in the R&S VSE software See "Restoring User-Specific Settings (Reset VSE Layout)" on page 77
> Digital Standards	-	VSA application only

Menu item	**Correspond-ing icon in toolbar**	**Description**
> Restore VSA Factory Settings	-	VSA application only: Restores the standards predefined by Rohde & Schwarz available at the time of delivery. Note that this function will overwrite customized standards that have the same name as predefined standards.
Preferences >	-	Configures global software settings See chapter 9.1, "General Software Behavior", on page 101
> General	-	See chapter 9.1, "General Software Behavior", on page 101
> Displayed Items	-	Hides or shows individual screen elements See chapter 9.2.1, "Displayed Items", on page 102
> Theme & Color	-	Configures the style of individual screen elements See chapter 9.2.2, "Display Theme and Colors", on page 103
> Network & Remote	-	Configures the network settings and remote access to or from other devices See chapter 12.2, "Network and Remote Control Settings", on page 250
> Recording	-	Configures general recording parameters See chapter 8.3.2, "General Recording Settings", on page 87
Print	-	Opens "Print" dialog to print selected measurement results See chapter 8.4, "Printing Current Measurement Results", on page 97
Exit	-	Closes the R&S VSE software

A.1.1.2 Window Menu

The "Window" menu allows you to hide or show individual windows.

Menu item	**Correspond-ing icon in toolbar**	**Description**
Player...	-	Displays the "Player" tool window to recall I/Q data recordings See chapter 8.3.4.2, "Restoring the Measurement Results - R&S VSE Player", on page 94
Instrument Setup...	-	Displays the "Instruments" window to configure input instruments See chapter 7.2, "Configuring Instruments", on page 53
Measurement Group Setup...	-	Displays the "Measurement Group Setup" window to configure a measurement sequence See chapter 7.3, "Controlling Measurement Channels, Groups, and Sequences", on page 67
New Window >		Inserts a new result display window for the selected measurement channel See "New Measurement Window" on page 74

Menu item	Correspond-ing icon in toolbar	Description
Channel Infos >	-	Displays the channel bar with global channel information for the selected meausrement channel See "Channel bar" on page 41
Active Windows >	-	Selects a result display as the active window; the corresponding channel is also activated See "Active windows, selected window" on page 46
Configure Selected Result Window	-	Displays the "Window Configuration" dialog box to configure result-specific settings

A.1.1.3 Help Menu

The "Help" menu provides access to help, support and licensing functions.

Menu item	Correspond-ing icon in toolbar	Description
Help	?	Opens the Online help window See chapter 6.4, "Getting Help", on page 49
License	-	Licensing, version and options information See chapter 9.4.1, "Licensing, Versions and Options", on page 108
Support	-	Support functions See chapter 9.4.2, "R&S Support Information", on page 110
Register VSE	-	Attempts to create an email with the default mail program (if available) to the Rohde & Schwarz support address for registra-tion.
Online Support	-	Opens the default web browser and attempts to establish an Internet connection to the Rohde & Schwarz product site.
About	-	Software version information

A.1.2 I/Q Analyzer Menus

The following menus are only available if an I/Q Analyzer measurement channel is selected.

- Input & Output Menu......453
- Meas Setup Menu......453
- Trace Menu......453
- Marker Menu......454

A.1.2.1 Input & Output Menu

The "Input & Output" menu provides functions to configure the input source, frontend parameters and output settings for the measurement.

This menu is application-specific.

Table 1-1: "Input" menu items for the I/Q Analyzer

Menu item	Description
Amplitude	chapter 10.3.3, "Amplitude", on page 135
Scale	chapter 10.3.3.3, "Scaling the Y-Axis", on page 141
Frequency	chapter 10.3.4, "Frequency Settings", on page 143
Trigger	chapter 10.3.5.2, "Trigger Settings", on page 148
Input Source	chapter 10.3.2.1, "Radio Frequency Input", on page 129
Output	chapter 10.3.2.3, "Output Settings", on page 133

A.1.2.2 Meas Setup Menu

The "Meas Setup" menu provides access to most measurement-specific settings, as well as bandwidth, sweep and auto configuration settings, and the configuration "Over-view" window.

This menu is application-specific.

Table 1-2: "Meas Setup" menu items for the I/Q Analyzer

Menu item	Description
Data acquisition	chapter 10.3.6.1, "Data Acquisition", on page 154
Capture	chapter 10.3.6.2, "Capture Settings", on page 159
Overview	chapter 10.3.1, "Configuration Overview", on page 127

A.1.2.3 Trace Menu

The "Trace" menu provides access to trace-specific functions.

See chapter 10.4.1, "Trace Configuration", on page 164

This menu is application-specific.

Table 1-3: "Trace" menu items for the I/Q Analyzer

Menu item	Description
Trace <x>	Selects the corresponding trace for configuration. The currently selected trace is highlighted blue
Copy Trace	Copies trace data to another trace

Menu item	Description
Spectrogram	
Trace	Opens the "Traces" configuration dialog box

A.1.2.4 Marker Menu

The "Marker" menu provides access to marker-specific functions.

This menu is application-specific.

Table 1-4: "Marker" menu items for the I/Q Analyzer

Menu item	Correspond-ing icon in toolbar	Description
Place New Marker		" Place New Marker" on page 194
Select marker <x>	M1	"Select Marker" on page 197
Marker to Trace	-	"Assigning the Marker to a Trace" on page 196
All Markers Off		"All Markers Off" on page 197
Marker...		"Individual Marker Setup" on page 193
Search...		"Marker Search Settings" on page 199
Marker Function...	-	chapter 10.4.2, "Marker Usage", on page 187

A.2 Reference of Toolbar Functions

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

Individual toolbars can be hidden or displayed.

Hiding and displaying a toolbar

1. Right-click any toolbar or the menu bar.

   A context menu with a list of all available toolbars is displayed.

2. Select the toolbar you want to hide or display.

   A checkmark indicates that the toolbar is currently displayed.

   The toolbar is toggled on or off.

Note that some icons are only available for specific applications. Those functions are described in the individual application's User Manual.

General toolbars

The following functions are generally available for all applications:

"Main" toolbar

For a description of these functions see chapter 8, "Data Management", on page 76.

Table 1-5: Functions in the "Main" toolbar

Icon	Description
	Overview: Displays the configuration overview for the current measurement channel
	Save: Saves the current software configuration to a file
	Recall: Recalls a saved software configuration from a file
	Save I/Q recording: Stores the recorded I/Q data to a file
	Recall I/Q recording: Loads recorded I/Q data from a file
	Print immediately: prints the current display (screenshot) as configured
	Add Window: Inserts a new result display window for the selected measurement channel

"Control" toolbar

For a description of these functions see chapter 7, "Controlling Instruments and Capturing I/Q Data", on page 52.

Table 1-6: Functions in the "Control" toolbar

Icon	Description
IQ Analyzer ▾	Selects the currently active channel
	Capture: performs the selected measurement
	Pause: temporarily stops the current measurement
	Continuous: toggles to continuous measurement mode for next capture
	Single: toggles to single measurement mode for next capture
	Record: performs the selected measurement and records the captured data and results
	Refresh: Repeats the evaluation of the data currently in the capture buffer without capturing new data (VSA application only).

"Help" toolbar

For a description of these functions see chapter 6.4, "Getting Help", on page 49.

Table 1-7: Functions in the "Help" toolbar

Icon	Description
?	Help (+ Select): allows you to select an object for which context-specific help is displayed (not available in standard Windows dialog boxes or measurement result windows)
?	Help: displays context-sensitive help topic for currently selected element

Application-specific toolbars

The following toolbars are application-specific; not all functions shown here may be available in each application:

"Zoom" toolbar

For a description of these functions see chapter 10.4.3, "Zoomed Displays", on page 207.

Table 1-8: Functions in the "Zoom" toolbar

Icon	Description
	Normal mouse mode: the cursor can be used to select (and move) markers in a zoomed display
	Zoom mode: displays a dotted rectangle in the diagram that can be expanded to define the zoom area
	Multiple zoom mode: multiple zoom areas can be defined for the same diagram
1:1	Zoom off: displays the diagram in its original size

Table 1-9: Functions in the "Marker" toolbar

Icon	Description
	Place new marker
M1	Select marker
	Marker type "normal"
	Marker type "delta"
	Global peak
	Absolute peak (Currently only for GSM application)
«	Next peak to the left

Icon	Description
	Next peak to the right
	Next peak up (for spectrograms only: search in more recent frames)
	Next peak down (for spectrograms only: search in previous frames)
	Global minimum
	Next minimum left
	Next minimum right
	Next min up (for spectrograms only: search in more recent frames)
	Next min down (for spectrograms only: search in previous frames)
	Set marker value to center frequency
	Set reference level to marker value
	All markers off
	Marker search configuration
	Marker configuration

Table 1-10: Functions in the "AutoSet" toolbar

Icon	Description
	Auto level
	Auto frequency
	Auto trigger (R&S VSE GSM application only)
	Auto frame (R&S VSE GSM application only)
	Auto search (R&S VSE 3GPP FDD application only)
	Auto scale (R&S VSE 3GPP FDD + Pulse applications only)
	Auto scale all (R&S VSE 3GPP FDD + Pulse applications only)
	Auto all
	Configure auto settings

A.3 Formats for Returned Values: ASCII Format and Binary Format

When trace data is retrieved using the `TRAC:DATA` or `TRAC:IQ:DATA` command, the data is returned in the format defined using the `FORMat[:DATA]`. The possible formats are described here.

- ASCII Format (FORMat ASCII):
  The data is stored as a list of comma separated values (CSV) of the measured values in floating point format.
- Binary Format (FORMat REAL,32):
  The data is stored as binary data (Definite Length Block Data according to IEEE 488.2), each measurement value being formatted in 32 Bit IEEE 754 Floating-Point-Format.
  The schema of the result string is as follows:
  `#41024<value1><value2>…<value n>` with

#4	number of digits (= 4 in the example) of the following number of data bytes
1024	number of following data bytes (= 1024 in the example)
<Value>	4-byte floating point value

Reading out data in binary format is quicker than in ASCII format. Thus, binary format is recommended for large amounts of data.

A.4 Reference: Format Description for I/Q Data Files

This section describes how I/Q data is transferred to the memory during remote control (see `TRACe:IQ:DATA:FORMat` on page 381 command).

For details on the format of the individual values, see chapter A.3, "Formats for Returned Values: ASCII Format and Binary Format", on page 458.

For details on the format of I/Q export files (using the "I/Q Export" function), seechapter A.5, "Reference: Supported File Formats", on page 460 .

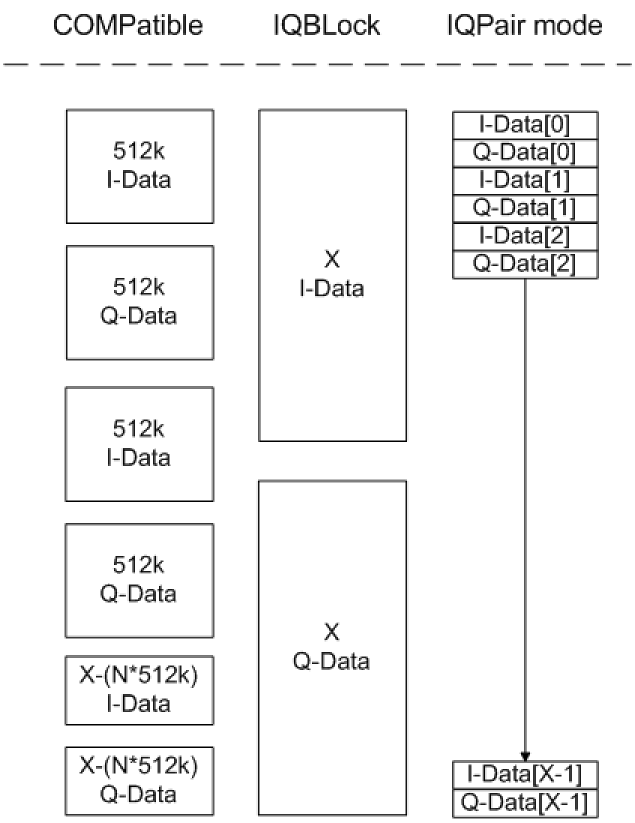


Fig. 1-1: I/Q data formats

Note: 512k corresponds to 524288 samples

For maximum performance, the formats "Compatible" or "IQPair" should be used. Furthermore, for large amounts of data, the data should be in binary format to improve performance.

In binary format, the number of I- and Q-data can be calculated as follows:

$$\#\,of\ I - Data \;=\; \#\,of\ Q - Data \;=\; \frac{\#\ of\ DataBytes}{8}$$

For the format "QBLock", the offset of Q-data in the output buffer can be calculated as follows:

$$Q - Data - Offset \;=\; \frac{(\#\ of\ DataBytes)}{2} + LengthIndicatorDigits$$

with "LengthIndicatorDigits" being the number of digits of the length indicator including the #. In the example above (#41024…), this results in a value of 6 for "LengthIndicatorDigits" and the offset for the Q-data results in 512 + 6 = 518.

A.5 Reference: Supported File Formats

Various file types are supported for I/Q data import and export (see chapter 8.3, "Recording and Recalling Captured I/Q Data for Evaluation", on page 85). The most important characteristics as well as optional and mandatory data elements for each format are described here.

For best performance and to ensure comprehensive meta data is available, use the iq.tar format. This is a widely used file format for Rohde & Schwarz products.

File format	File extension	Comment
iq-tar	.iq.tar	An iq-tar file contains I/Q data in binary format together with meta information that describes the nature and the source of data, e.g. thesample rate. The objective of the iq-tar file format is to separate I/Q data from the meta information while still having both inside one file. In addition, the file format allows a preview of the I/Q data in a web browser, and inclusion of user-specific data. **Limitations**: Recorded files > 2 GB do not contain an xml-preview of the I/Q data.
IQW (IQIQIQ)	.iqw	A file that contains float32 data in a binary format (values are stored interleaved starting with the first I value). The file does not contain any additional infromation as a header.
CSV	.csv	A file containing I/Q data as comma-separated values (CSV). Additional metadata can be saved.
Matlab® v4	.mat	A file containing I/Q data in Matlab® file format v4. Channel-related information is stored in matlab variables with names starting with 'ChX_'. 'X' represents the number of the channel with a lower bound of 1, e.g. the variable Ch1_ChannelName contains the name of the first channel. The corresponding data is contained in ChX_Data. Optional user data can be saved to variables named UserDataX, where 'X' starts at 0. The variable UserData_Count contains the number of UserData variables. For compatibility reasons user data needs to be saved as a 2xN char array, where the first row contains the key of the user data and the second row the actual value. Both rows must have the same column count and are therefore right-padded with white spaces. Variables can be written to the *.mat files in arbitrary order. **Limitations**: In general, the file format is limited to a maximum of 2 GB. A maximum of 100000000 values can be stored in a single variable, e.g. 50000000 complex data samples.
Matlab® v7.3	.mat	A file containing I/Q data in Matlab® file format v7.3. **Limitations**: The Matlab® v7.3. file format requires the Matlab® Compiler Runtime (MCR) to be installed on the system and registered in the PATH environment variable. Download an MCR version ≥ 7.2 from http://www.mathworks.de/products/compiler/mcr/.

- IQ-tar File Format....................461
- CSV File Format....................465
- IQW File Format....................467
- Matlab® v. 4 / v. 7.3 File Format....................468

A.5.1 IQ-tar File Format

I/Q data is packed in a file with the extension `.iq.tar`. An iq-tar file contains I/Q data in binary format together with meta information that describes the nature and the source of data, e.g. the sample rate. The objective of the iq-tar file format is to separate I/Q data from the meta information while still having both inside one file. In addition, the file format allows you to preview the I/Q data in a web browser, and allows you to include user-specific data.

For more details see the specification, available from the Rohde & Schwarz Internet site: http://www.rohde-schwarz.com/en/manual/rohde-schwarz-iq-tar-file-format-specification-manuals-gb1_78701-37313.html.

- Mandatory Data Elements.....461
- Optional Data Elements.....461
- Example.....463

A.5.1.1 Mandatory Data Elements

The following infromation must be available in all iq-tar files used to import data to the R&S VSE software. This information is always provided by an iq-tar file export from the R&S VSE software.

Parameter Name	Possible Values
Name	String
Comment	String
DateTime	Year-Month-DayTHour:Min:Sec
Format	complex
DataType	float32
NumberOfChannels	Integer
CH<n>_ChannelName	String
CH<n>_Samples	Integer
CH<n>_Clock[Hz]	double
CH<n>_CenterFrequency[Hz]	Double
IQ Data Header	<Channel Name>_I; <Channel Name>_Q (IQ data value)
-----	Double ; Double (IQ data I/Q pairs)

A.5.1.2 Optional Data Elements

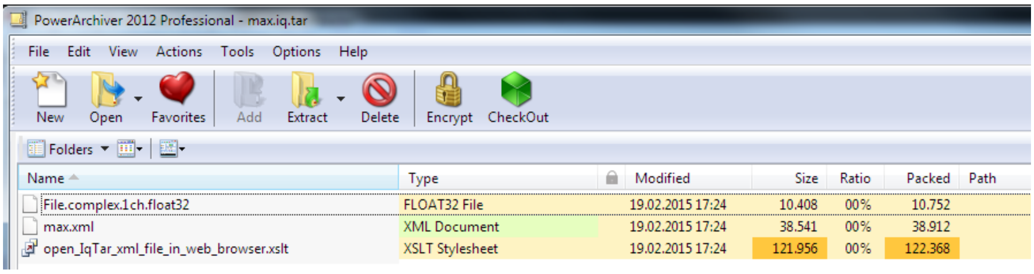
The following infromation may optionally be available in iq-tar files used to import data to the R&S VSE software. This information may also be provided by an iq-tar file export from the R&S VSE software, if selected. Note that the available parameters during data export depend on the instrument in use.

Parameter name	Possible Values
Ch<n>_AttenuElecState	ON | OFF
Ch<n>_AttenuElecValue[dB]	Integer
Ch<n>_AttenuMech[dB]	Integer
Ch<n>_CalibrationState	ON | OFF
Ch<n>_DeviceHwInfo	String
Ch<n>_DeviceId	String
Ch<n>_DeviceOptions	String
Ch<n>_DeviceVersions	String
Ch<n>_FilterSettings	FLAT | GAUSS | OFF
Ch<n>_HighPassFilterState	ON | OFF
Ch<n>_Impedance[Ohm]	50 | 75
Ch<n>_InputCoupling	AC | DC
Ch<n>_InputPath	RF
Ch<n>_InputSelection	INPUT1 | INPUT2 (R&S FSWT only)
Ch<n>_MeasBandwidth[Hz]	double
Ch<n>_NumberOfPostSamples	Integer
Ch<n>_NumberOfPreSamples	Integer
Ch<n>_PreampGain[dB]	Integer
Ch<n>_PreampState	ON | OFF
Ch<n>_PreSelectorState	ON | OFF (R&S FSWT only)
Ch<n>_PreSelectorType	NARROW | WIDE (R&S FSWT only)
Ch<n>_RefLevelOffset[dB]	Double
Ch<n>_RefLevel[dBm]	Double
Ch<n>_RefOscillatorInput	OFF | ON
Ch<n>_RefOscillatorFreq[Hz]	Double
Ch<n>_TrgSource	Extern <1 ..4> | I/Q Power | IF Power | RF Power | Power Sensor | Time
Ch<n>_TrgLevel[dB]	Double
Ch<n>_TrgHysteresis[dB]	Double
Ch<n>_TrgTpis[s]	Double

Parameter name	Possible Values
Ch<n>_TrgOffset[s]	Double
Ch<n>_TrgSlope	Rising | Falling | Rising/Falling
Ch<n>_TrgHoldoff[s]	Double
Ch<n>_TrgDropOut[s]	Double
Ch<n>_YigPreSelectorState	ON | OFF

A.5.1.3 Example

The following example demonstrates the XML description inside the iq-tar file.



Open the xml file in a web browser. If the stylesheet `open_IqTar_xml_file_in_web_browser.xslt` is in the same directory, the web browser displays the xml file in a readable format.

C:\temp\max.xml max.xml

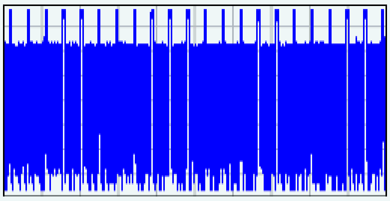
max.xml (of .iq.tar file)

Description	
Saved by	VSE_1.10
Date & Time	2014-11-24 14:34:06
Sample rate	32 MHz
Number of samples	3200300
Duration of signal	100.009 ms
Data format	complex, float32
Data filename	File.complex.1ch.float32
Scaling factor	1 V

IQ Analyzer

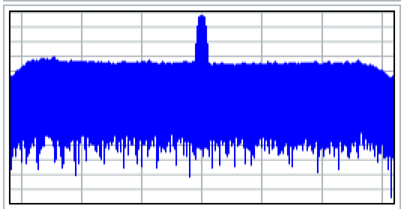
Power vs time

y-axis: 10 dB /div
x-axis: 10 ms /div

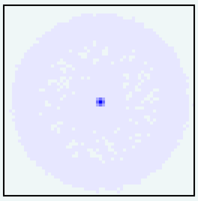


Spectrum

y-axis: 10 dB /div
x-axis: 5 MHz /div



I/Q




```
<?xml version="1.0" encoding="UTF-8"?>
<?xml-stylesheet type="text/xsl" href="open_IqTar_xml_file_in_web_browser.xslt"?>
<RS_IQ_TAR_FileFormat fileFormatVersion="1" xsi:noNamespaceSchemaLocation=
"http://www.rohde-schwarz.com/file/RsIqTar.xsd" xmlns:xsi=
"http://www.w3.org/2001/XMLSchema-instance">
  <Name>VSE_1.10a 29 Beta</Name>
  <Comment></Comment>
  <DateTime>2015-02-19T15:24:58</DateTime>
  <Samples>1301</Samples>
  <Clock unit="Hz">32000000</Clock>
  <Format>complex</Format>
  <DataType>float32</DataType>
```

```
  <ScalingFactor unit="V">1</ScalingFactor>
  <NumberOfChannels>1</NumberOfChannels>
  <DataFilename>File.complex.1ch.float32</DataFilename>

<UserData>
    <RohdeSchwarz>
      <DataImportExport_MandatoryData>
        <ChannelNames>
          <ChannelName>IQ Analyzer</ChannelName>
        </ChannelNames>
        <CenterFrequency unit="Hz">0</CenterFrequency>
      </DataImportExport_MandatoryData>
      <DataImportExport_OptionalData>
        <Key name="Ch1_NumberOfPostSamples">150</Key>
        <Key name="Ch1_NumberOfPreSamples">150</Key>
      </DataImportExport_OptionalData>
    </RohdeSchwarz>
  </UserData>

</RS_IQ_TAR_FileFormat>
```

A.5.2 CSV File Format

CSV files contain I/Q data as comma-separated values. Additional metadata can be saved.

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- Optional Data Elements.....466
- Example.....467

A.5.2.1 Mandatory Data Elements

Parameter Name	Possible Values
Name	String
Comment	String
DateTime	Year-Month-DayTHour:Min:Sec
Format	complex
DataType	float32
NumberOfChannels	Integer
CH<n>_ChannelName	String
CH<n>_Samples	Integer
CH<n>_Clock[Hz]	double
CH<n>_CenterFrequency[Hz]	Double

Parameter Name	Possible Values
IQ Data Header	<Channel Name>_I; <Channel Name>_Q (IQ data value)
-----	Double ; Double (IQ data I/Q pairs)

A.5.2.2 Optional Data Elements

Parameter name	Possible Values
Ch<n>_AttenuElecState	ON | OFF
Ch<n>_AttenuElecValue[dB]	Integer
Ch<n>_AttenuMech[dB]	Integer
Ch<n>_CalibrationState	ON | OFF
Ch<n>_DeviceHwInfo	String
Ch<n>_DeviceId	String
Ch<n>_DeviceOptions	String
Ch<n>_DeviceVersions	String
Ch<n>_FilterSettings	FLAT | GAUSS | OFF
Ch<n>_HighPassFilterState	ON | OFF
Ch<n>_Impedance[Ohm]	50 | 75
Ch<n>_InputCoupling	AC | DC
Ch<n>_InputPath	RF
Ch<n>_MeasBandwidth[Hz]	double
Ch<n>_NumberOfPostSamples	Integer
Ch<n>_NumberOfPreSamples	Integer
Ch<n>_PreampGain[dB]	Integer
Ch<n>_PreampState	ON | OFF
Ch<n>_RefLevelOffset[dB]	Double
Ch<n>_RefLevel[dBm]	Double
Ch<n>_RefOscillatorInput	OFF | ON
Ch<n>_RefOscillatorFreq[Hz]	Double
Ch<n>_TrgSource	Extern <1 ..4> | I/Q Power | IF Power | RF Power | Power Sensor | Time
Ch<n>_TrgLevel[dB]	Double
Ch<n>_TrgHysteresis[dB]	Double
Ch<n>_TrgTpis[s]	Double

Parameter name	Possible Values
Ch<n>_TrgOffset[s]	Double
Ch<n>_TrgSlope	Rising | Falling | Rising/Falling
Ch<n>_TrgHoldoff[s]	Double
Ch<n>_TrgDropOut[s]	Double
Ch<n>_YigPreSelectorState	ON | OFF

A.5.2.3 Example

DataImportExport_MandatoryData;
```
Name;ExampleFile
Comment;Example Comment
DateTime;2015-02-19T15:26:33
Format;complex
DataType;float32
NumberOfChannels;1
Ch1_ChannelName;Example_Channel
Ch1_Samples;10
Ch1_Clock[Hz];3,2000000E+007
Ch1_CenterFrequency[Hz];100,0000000E+007
```
DataImportExport_EndHeaderSection;
Example_Channel_I;Example_Channel_Q
```
-5,9390777E-006;-3,4644620E-006
9,8984629E-007;-8,4631858E-005
-5,9885701E-005;4,1078620E-005
2,0786772E-005;7,8692778E-005
-4,9492314E-006;-1,5095156E-004
1,6332464E-005;1,8312156E-005
-5,4936470E-005;4,5532928E-005
-4,8997390E-005;9,7004937E-005
-1,1383232E-005;4,5532928E-005
-8,2157239E-005;3,2170003E-005
```

A.5.3 IQW File Format

IQW is a binary file format containing one channel of complex IQ data.

Format description details:

- IQDataFormat: Complex
- IQDataType: Float32
- Byte order: Intel
- Data order: IQIQIQ (I/Q paired or interleaved) or IIIQQQ (I/Q blocks, default)
  Currently, the R&S VSE software saves I/Q data in interleaved order for IQW file format.

Mandatory Data Elements

Only the binary I/Q data.

Optional Data Elements

None.

A.5.4 Matlab® v. 4 / v. 7.3 File Format

In Matlab®files, channel-related information is stored in matlab variables with names starting with 'ChX_'. 'X' represents the number of the channel with a lower bound of 1, e.g. the variable Ch1_ChannelName contains the name of the first channel. The corresponding data is contained in ChX_Data.

Optional user data can be saved to variables named UserDataX, where 'X' starts at 0. The variable UserData_Count contains the number of UserData variables. For compatibility reasons user data needs to be saved as a 2xN char array, where the first row contains the key of the user data and the second row the actual value. Both rows must have the same column count and are therefore right-padded with white spaces.

Variables can be written to the *.mat files in arbitrary order.

The Matlab® v7.3. file format requires the Matlab® Compiler Runtime (MCR) to be installed on the system and registered in the PATH environment variable.

● Mandatory Data Elements....468
● Optional Data Elements....469
● Example....470

A.5.4.1 Mandatory Data Elements

Variable name	Class	Format / possible values
Name	char	
Comment	char	
DateTime	char	Year-Month-DayTHour:Min:Sec
Format	char	complex
DataType	char	float32
NumberOfChannels	Double	
CH<n>_ChannelName	char	
CH<n>_Samples	double	
CH<n>_Clock_Hz	double	
CH<n>_CFrequency_Hz	Double	

Variable name	Class	Format / possible values
CH<n>_Data	Double, Double	I,Q
UserData_Count	Double	(Number of optional user data variables)

A.5.4.2 Optional Data Elements

Optional user data can be saved to variables named `UserDataX`, where '`X`' starts at 0. The variable `UserData_Count` contains the number of `UserData` variables. For compatibility reasons user data needs to be saved as a 2xN char array, where the first row contains the key of the user data and the second row the actual value. Both rows must have the same column count and are therefore right-padded with white spaces.

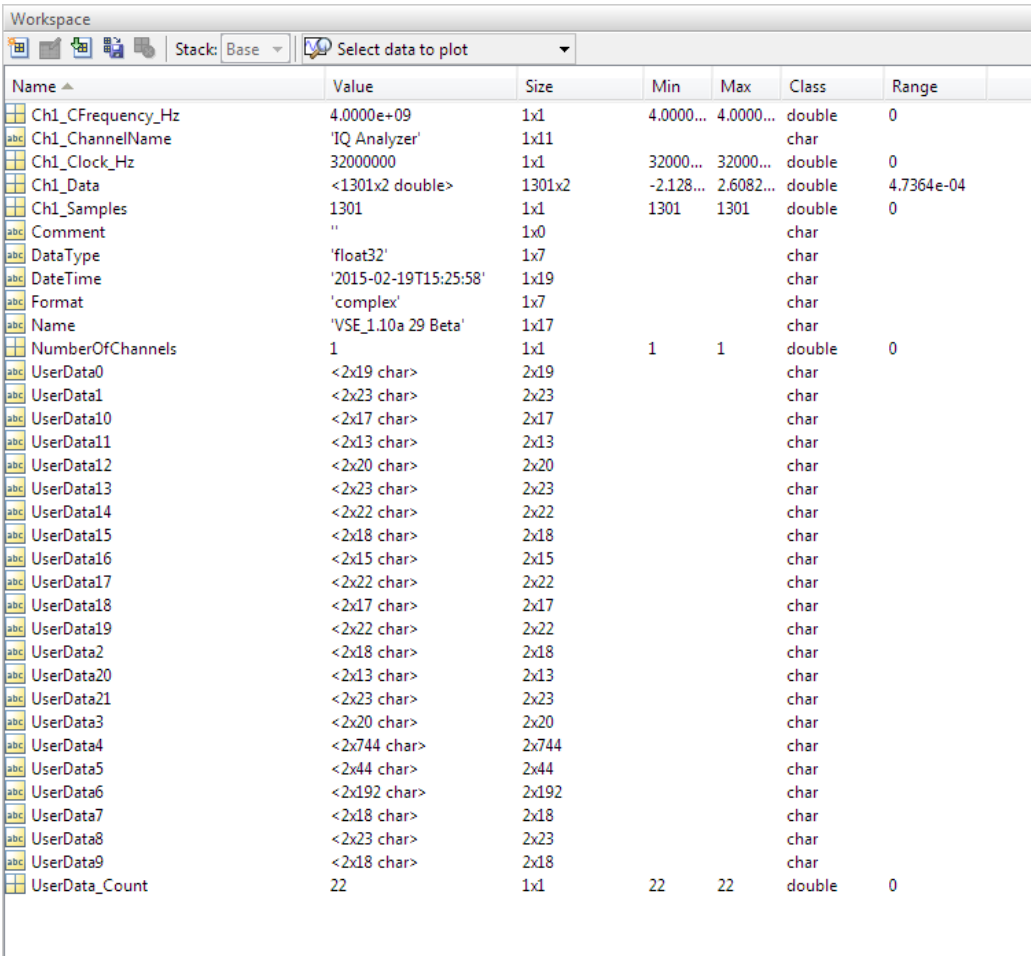
Variable name	Class	Format
UserData<n>	char	Optional Data Parameter name, Value

Table 1-11: Optional parameter names to be defined in UserData<n> variables

Parameter name	Possible Values
Ch<n>_AttenuElecState	ON | OFF
Ch<n>_AttenuElecValue_dB	Integer
Ch<n>_AttenuMech_dB	Integer
Ch<n>_CalibrationState	ON | OFF
Ch<n>_DeviceHwInfo	String
Ch<n>_DeviceId	String
Ch<n>_DeviceOptions	String
Ch<n>_DeviceVersions	String
Ch<n>_FilterSettings	FLAT | GAUSS | OFF
Ch<n>_HighPassFilterState	ON | OFF
Ch<n>_Impedance_Ohm	50 | 75
Ch<n>_InputCoupling	AC | DC
Ch<n>_InputPath	RF
Ch<n>_MeasBandwidth_Hz	double
Ch<n>_NumberOfPostSamples	Integer
Ch<n>_NumberOfPreSamples	Integer
Ch<n>_PreampGain_dB	Integer
Ch<n>_PreampState	ON | OFF
Ch<n>_RefLevelOffset_dB	Double
Ch<n>_RefLevel_dBm	Double

Parameter name	Possible Values
Ch<n>_RefOscillatorInput	OFF | ON
Ch<n>_RefOscillatorFreq_Hz	Double
Ch<n>_TrgSource	Extern <1 ..4> | I/Q Power | IF Power | RF Power | Power Sensor | Time
Ch<n>_TrgLevel_dB	Double
Ch<n>_TrgHysteresis_dB	Double
Ch<n>_TrgTpis_s	Double
Ch<n>_TrgOffset_s	Double
Ch<n>_TrgSlope	Rising | Falling | Rising/Falling
Ch<n>_TrgHoldoff_s	Double
Ch<n>_TrgDropOut_s	Double
Ch<n>_YigPreSelectorState	ON | OFF

A.5.4.3 Example


Workspace
Stack: Base
Select data to plot

Name	Value	Size	Min	Max	Class	Range
Ch1_CFrequency_Hz	4.0000e+09	1x1	4.0000...	4.0000...	double	0
Ch1_ChannelName	'IQ Analyzer'	1x11			char	
Ch1_Clock_Hz	32000000	1x1	32000...	32000...	double	0
Ch1_Data	<1301x2 double>	1301x2	-2.128...	2.6082...	double	4.7364e-04
Ch1_Samples	1301	1x1	1301	1301	double	0
Comment	''	1x0			char	
DataType	'float32'	1x7			char	
DateTime	'2015-02-19T15:25:58'	1x19			char	
Format	'complex'	1x7			char	
Name	'VSE_1.10a 29 Beta'	1x17			char	
NumberOfChannels	1	1x1	1	1	double	0
UserData0	<2x19 char>	2x19			char	
UserData1	<2x23 char>	2x23			char	
UserData10	<2x17 char>	2x17			char	
UserData11	<2x13 char>	2x13			char	
UserData12	<2x20 char>	2x20			char	
UserData13	<2x23 char>	2x23			char	
UserData14	<2x22 char>	2x22			char	
UserData15	<2x18 char>	2x18			char	
UserData16	<2x15 char>	2x15			char	
UserData17	<2x22 char>	2x22			char	
UserData18	<2x17 char>	2x17			char	
UserData19	<2x22 char>	2x22			char	
UserData2	<2x18 char>	2x18			char	
UserData20	<2x13 char>	2x13			char	
UserData21	<2x23 char>	2x23			char	
UserData3	<2x20 char>	2x20			char	
UserData4	<2x744 char>	2x744			char	
UserData5	<2x44 char>	2x44			char	
UserData6	<2x192 char>	2x192			char	
UserData7	<2x18 char>	2x18			char	
UserData8	<2x23 char>	2x23			char	
UserData9	<2x18 char>	2x18			char	
UserData_Count	22	1x1	22	22	double	0

List of remote commands (basic software)

[SENSe:][WINDow<n>:]DETector<t>[:FUNCtion]....347
[SENSe:][WINDow<n>:]DETector<t>[:FUNCtion]:AUTO....347
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[SENSe:]ADJust:CONFigure:DURation....342
[SENSe:]ADJust:CONFigure:DURation:MODE....343
[SENSe:]ADJust:CONFigure:HYSTeresis:LOWer....343
[SENSe:]ADJust:CONFigure:HYSTeresis:UPPer....343
[SENSe:]ADJust:CONFigure:TRIG....343
[SENSe:]ADJust:FREQuency....344
[SENSe:]ADJust:LEVel....317
[SENSe:]ADJust:LEVel....344
[SENSe:]AVERage<n>:COUNt....348
[SENSe:]AVERage<n>:TYPE....347
[SENSe:]AVERage<n>[:STATe<t>]....348
[SENSe:]FREQuency:CENTer....324
[SENSe:]FREQuency:CENTer:STEP....324
[SENSe:]FREQuency:CENTer:STEP:AUTO....325
[SENSe:]FREQuency:OFFSet....325
[SENSe:]IQ:BANDwidth|BWIDth:MODE....334
[SENSe:]IQ:BANDwidth|BWIDth:RESolution....334
[SENSe:]IQ:FFT:ALGorithm....335
[SENSe:]IQ:FFT:LENGth....335
[SENSe:]IQ:FFT:WINDow:LENGth....336
[SENSe:]IQ:FFT:WINDow:OVERlap....336
[SENSe:]IQ:FFT:WINDow:TYPE....336
[SENSe:]SWAPiq....337
[SENSe:]SWEep:COUNt....337
[SENSe:]SWEep:POINts....338
[SENSe:]SWEep:TIME....338
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*ESE....261
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CALCulate<n>:DELTamarker<m>:FUNCtion:BPOWer:RESult?....377
CALCulate<n>:DELTamarker<m>:FUNCtion:BPOWer:SPAN....377
CALCulate<n>:DELTamarker<m>:FUNCtion:BPOWer[:STATe]....378
CALCulate<n>:DELTamarker<m>:LINK....355
CALCulate<n>:DELTamarker<m>:LINK:TO:MARKer<m>....355
CALCulate<n>:DELTamarker<m>:MAXimum:LEFT....373
CALCulate<n>:DELTamarker<m>:MAXimum:NEXT....374
CALCulate<n>:DELTamarker<m>:MAXimum:RIGHt....374
CALCulate<n>:DELTamarker<m>:MAXimum[:PEAK]....374
CALCulate<n>:DELTamarker<m>:MINimum:LEFT....374
CALCulate<n>:DELTamarker<m>:MINimum:NEXT....374
CALCulate<n>:DELTamarker<m>:MINimum:RIGHt....375
CALCulate<n>:DELTamarker<m>:MINimum[:PEAK]....375
CALCulate<n>:DELTamarker<m>:MODE....355
CALCulate<n>:DELTamarker<m>:MREF....356
CALCulate<n>:DELTamarker<m>:SGRam:FRAMe....364
CALCulate<n>:DELTamarker<m>:SGRam:SARea....364
CALCulate<n>:DELTamarker<m>:SGRam:XY:MAXimum[:PEAK]....365
CALCulate<n>:DELTamarker<m>:SGRam:XY:MINimum[:PEAK]....365
CALCulate<n>:DELTamarker<m>:SGRam:Y:MAXimum:ABOVe....365
CALCulate<n>:DELTamarker<m>:SGRam:Y:MAXimum:BELow....365
CALCulate<n>:DELTamarker<m>:SGRam:Y:MAXimum:NEXT....366
CALCulate<n>:DELTamarker<m>:SGRam:Y:MAXimum[:PEAK]....366
CALCulate<n>:DELTamarker<m>:SGRam:Y:MINimum:ABOVe....366
CALCulate<n>:DELTamarker<m>:SGRam:Y:MINimum:BELow....366
CALCulate<n>:DELTamarker<m>:SGRam:Y:MINimum:NEXT....366
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