R&S®FSMR3000 Measuring Receiver User Manual

1179011602
Version 04

ROHDE&SCHWARZ
Make ideas real

This document describes the following R&S®FSMR3000 models:

- R&S®FSMR3008 (1345.4004K08)
- R&S®FSMR3026 (1345.4004K26)
- R&S®FSMR3050 (1345.4004K50)

The contents of this manual correspond to firmware version 1.20 and higher.

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Throughout this manual, products from Rohde & Schwarz are indicated without the ® symbol , e.g. R&S®FSMR3000 is indicated as R&S FSMR3000.

Contents

1 Safety and regulatory information

The product documentation helps you use the product safely and efficiently. Follow the instructions provided here and in the following chapters.

Intended use

The product is intended for the development, production and verification of electronic components and devices in industrial, administrative, and laboratory environments. Use the product only for its designated purpose. Observe the operating conditions and performance limits stated in the data sheet.

Where do I find safety information?

Safety information is part of the product documentation. It warns you of potential dangers and gives instructions on how to prevent personal injury or damage caused by dangerous situations. Safety information is provided as follows:

- In Chapter 1.1, "Safety instructions", on page 5. The same information is provided in many languages as printed "Safety Instructions". The printed "Safety Instructions" are delivered with the product.
- Throughout the documentation, safety instructions are provided when you need to take care during setup or operation.

1.1 Safety instructions

Products from the Rohde & Schwarz group of companies are manufactured according to the highest technical standards. To use the products safely, follow the instructions provided here and in the product documentation. Keep the product documentation nearby and offer it to other users.

Use the product only for its intended use and within its performance limits. Intended use and limits are described in the product documentation such as the data sheet, manuals and the printed "Safety Instructions". If you are unsure about the appropriate use, contact Rohde & Schwarz customer service.

Using the product requires specialists or specially trained personnel. These users also need sound knowledge of at least one of the languages in which the user interfaces and the product documentation are available.

Reconfigure or adjust the product only as described in the product documentation or the data sheet. Any other modifications can affect safety and are not permitted.

Never open the casing of the product. Only service personnel authorized by Rohde & Schwarz are allowed to repair the product. If any part of the product is damaged or broken, stop using the product. Contact Rohde & Schwarz customer service at https://www.rohde-schwarz.com/support.

Lifting and carrying the product

The product is heavy. Do not move or carry the product by yourself. A single person can only carry a maximum of 18 kg safely depending on age, gender and physical condition. Look up the maximum weight in the data sheet. Use the product handles to move or carry the product. Do not lift by the accessories mounted on the product. Accessories are not designed to carry the weight of the product.

To move the product safely, you can use lifting or transporting equipment such as lift trucks and forklifts. Follow the instructions provided by the equipment manufacturer.

Choosing the operating site

Only use the product indoors. The product casing is not waterproof. Water that enters can electrically connect the casing with live parts, which can lead to electric shock, serious personal injury or death if you touch the casing. If Rohde & Schwarz provides accessories designed for your product, e.g. a carrying bag, you can use the product outdoors.

Unless otherwise specified, you can operate the product up to an altitude of 2000 m above sea level. The product is suitable for pollution degree 2 environments where nonconductive contamination can occur. For more information on environmental conditions such as ambient temperature and humidity, see the data sheet.

Setting up the product

Always place the product on a stable, flat and level surface with the bottom of the product facing down. If the product is designed for different positions, secure the product so that it cannot fall over.

If the product has foldable feet, always fold the feet completely in or out to ensure stability. The feet can collapse if they are not folded out completely or if the product is moved without lifting it. The foldable feet are designed to carry the weight of the product, but not an extra load.

If stacking is possible, keep in mind that a stack of products can fall over and cause injury.

If you mount products in a rack, ensure that the rack has sufficient load capacity and stability. Observe the specifications of the rack manufacturer. Always install the products from the bottom shelf to the top shelf so that the rack stands securely. Secure the product so that it cannot fall off the rack.

Connecting to power

The product is an overvoltage category II product. Connect the product to a fixed installation used to supply energy-consuming equipment such as household appliances and similar loads. Keep in mind that electrically powered products have risks, such as electric shock, fire, personal injury or even death. Replace parts that are relevant to safety only by original parts, e.g. power cables or fuses.

Take the following measures for your safety:

- Before switching on the product, ensure that the voltage and frequency indicated on the product match the available power source. If the power adapter does not adjust automatically, set the correct value and check the rating of the fuse.
- Only use the power cable delivered with the product. It complies with country-specific safety requirements. Only insert the plug into an outlet with protective conductor terminal.
- Only use intact cables and route them carefully so that they cannot be damaged. Check the power cables regularly to ensure that they are undamaged. Also ensure that nobody can trip over loose cables.
- If you connect the product to an external power supply, use the one delivered with the product or recommended in the product documentation. The external power supply must conform to the country-specific regulations.
- Only connect the product to a power source with a fuse protection of maximum 20 A.
- Ensure that you can disconnect the product from the power source at any time. Pull the power plug to disconnect the product. The power plug must be easily accessible. If the product is integrated into a system that does not meet these requirements, provide an easily accessible circuit breaker at the system level.

Using headphones

Take the following measures to prevent hearing damage. Before using headphones, check the volume and reduce it if necessary. If you monitor varying signal levels, take off the headphones and wait until the signal has settled. Then adjust the volume.

Cleaning the product

Use a dry, lint-free cloth to clean the product. When cleaning, keep in mind that the casing is not waterproof. Do not use liquid cleaning agents.

Meaning of safety labels

Safety labels on the product warn against potential hazards.

	Potential hazard Read the product documentation to avoid personal injury or product damage.
	Heavy product Be careful when lifting, moving or carrying the product. Carrying the product requires a sufficient number of persons or transport equipment.
	Electrical hazard Indicates live parts. Risk of electric shock, fire, personal injury or even death.

	Hot surface Do not touch. Risk of skin burns. Risk of fire.
	Protective conductor terminal Connect this terminal to a grounded external conductor or to protective ground. This connection protects you against electric shock if an electric problem occurs.

1.2 Warning messages in the documentation

A warning message points out a risk or danger that you need to be aware of. The signal word indicates the severity of the safety hazard and how likely it will occur if you do not follow the safety precautions.

WARNING

Potentially hazardous situation. Could result in death or serious injury if not avoided.

CAUTION

Potentially hazardous situation. Could result in minor or moderate injury if not avoided.

NOTICE

Potential risks of damage. Could result in damage to the supported product or to other property.

1.3 Korea certification class B

이 기기는 가정용(B급) 전자파 적합기기로서 주로 가정에서 사용하는 것을 목적으로 하며, 모든 지역에서 사용할 수 있습니다.

2 Documentation overview

This section provides an overview of the R&S FSMR3 user documentation. Unless specified otherwise, you find the documents at:

www.rohde-schwarz.com/product/FSMR3000.html/

2.1 Getting started manual

Introduces the R&S FSMR3 and describes how to set up and start working with the product. Includes basic operations, typical measurement examples, and general information, e.g. safety instructions, etc.

A printed version is delivered with the instrument. A PDF version is available for download on the Internet.

2.2 User manuals and help

Separate user manuals are provided for the base unit and the firmware applications:

- Base unit manual
  Contains the description of all instrument modes and functions. It also provides an introduction to remote control, a complete description of the remote control commands with programming examples, and information on maintenance, instrument interfaces and error messages.
- Firmware application manual
  Contains the description of the specific functions of a firmware application, including remote control commands. Basic information on operating the R&S FSMR3 is not included.

The contents of the user manuals are available as help in the R&S FSMR3. The help offers quick, context-sensitive access to the complete information for the base unit and the firmware applications.

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

2.3 Service manual

Describes the performance test for checking the rated specifications, module replacement and repair, firmware update, troubleshooting and fault elimination, and contains mechanical drawings and spare part lists.

The service manual is available for registered users on the global Rohde & Schwarz information system (GLORIS):

2.4 Instrument security procedures

Deals with security issues when working with the R&S FSMR3 in secure areas. It is available for download on the Internet.

2.5 Printed safety instructions

Provides safety information in many languages. The printed document is delivered with the product.

2.6 Data sheets and brochures

The data sheet contains the technical specifications of the R&S FSMR3. It also lists the firmware applications and their order numbers, and optional accessories.

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

See www.rohde-schwarz.com/brochure-datasheet/FSMR3000/

2.7 Release notes and open-source acknowledgment (OSA)

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

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

See www.rohde-schwarz.com/firmware/FSMR3000/

2.8 Application notes, application cards, white papers, etc.

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

See www.rohde-schwarz.com/application/FSMR3000/

3 Welcome to the R&S FSMR3

The R&S FSMR3 is a new high-performance Rohde & Schwarz measuring receiver developed to meet demanding customer requirements. Offering low phase noise, wide analysis bandwidth and straightforward and intuitive operation, the measuring receiver makes measurements fast and easy.

This user manual contains a description of the functionality that the instrument provides, including remote control operation. The latest version is available for download at the product homepage (http://www.rohde-schwarz.com/product/FSMR3000.html).

4 Getting started

4.1 Key features

The R&S FSMR3 measuring receiver is a complete solution for calibration and performance checks of signal generators and fixed or adjustable attenuators. The R&S FSMR3 combines the functionality of multiple instruments such as a level calibrator, modulation analyzer and frequency counter in one. It is capable of calibrating all vital parameters of a signal generator. The R&S FSMR3 provides the following outstanding key features:

- Frequency range from 2 Hz to 8/26.5/50 GHz
- Highly accurate level calibrator with wide level measurement range
- Power meter with integrated support of R&S NRP-Zxx power sensors
- Power sensor with power splitters for simplified measurement process
- Tuned RF Level (TRFL) calibration and power measurements
- AM/FM/PM modulation analysis
- Easy and intuitive to operate via the large touchscreen user interface and optimized user guidance
- SCPI recorder simplifies code generation

For a detailed specification refer to the data sheet.

4.2 Preparing for use

Here, you can find basic information about setting up the product for the first time.

4.2.1 Lifting and carrying

The carrying handles are designed to lift or carry the instrument. Do not apply excessive external force to the handles.

See "Lifting and carrying the product" on page 6.

4.2.2 Unpacking and checking

1. Unpack the R&S FSMR3 carefully.
2. Retain the original packing material. Use it when transporting or shipping the R&S FSMR3 later.
3. Using the delivery notes, check the equipment for completeness.
4. Check the equipment for damage.

   If the delivery is incomplete or equipment is damaged, contact Rohde & Schwarz.

4.2.3 Choosing the operating site

Specific operating conditions ensure proper operation and avoid damage to the product and connected devices. For information on environmental conditions such as ambient temperature and humidity, see the data sheet.

See also "Choosing the operating site" on page 6.

Electromagnetic compatibility classes

The electromagnetic compatibility (EMC) class indicates where you can operate the product. The EMC class of the product is given in the data sheet.

- Class B equipment is suitable for use in:
  – Residential environments
  – Environments that are directly connected to a low-voltage supply network that supplies residential buildings
- Class A equipment is intended for use in industrial environments. It can cause radio disturbances in residential environments due to possible conducted and radiated disturbances. It is therefore not suitable for class B environments.
  If class A equipment causes radio disturbances, take appropriate measures to eliminate them.

4.2.4 Setting up the product

See also:

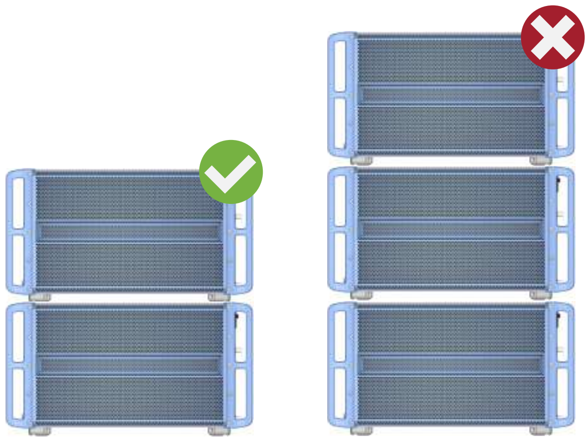
- "Setting up the product" on page 6
- "Intended use" on page 5

4.2.4.1 Placing the product on a bench top

To place the product on a bench top

1. Place the product on a stable, flat and level surface. Ensure that the surface can support the weight of the product. For information on the weight, see the data sheet.
2. **WARNING!** A stack of products can fall over and cause injury. Never stack more than two products. Otherwise, mount them in a rack.

   Stack as follows:
   - All products must have the same dimensions (width and length).
   - Do not exceed a total load of 50 kg placed on the product at the bottom of the stack.



Left = Stacked correctly
Right = Stacked incorrectly, too many products

3. **NOTICE!** Overheating can damage the product.

   Prevent overheating as follows:
   - Keep a minimum distance of 10 cm between the fan openings of the product and any object in the vicinity.
   - Do not place the product next to heat-generating equipment such as radiators or other products.

4.2.4.2 Mounting the R&S FSMR3 in a rack

To prepare the rack

1. Observe the requirements and instructions in "Setting up the product" on page 6.
2. **NOTICE!** Insufficient airflow can cause overheating and damage the product.

   Design and implement an efficient ventilation concept for the rack.

To mount the R&S FSMR3 in a rack

1. Use an adapter kit to prepare the R&S FSMR3 for rack mounting.
   a) Order the rack adapter kit designed for the R&S FSMR3. For the order number, see the data sheet.
   b) Mount the adapter kit. Follow the assembly instructions provided with the adapter kit.
2. Lift the R&S FSMR3 to shelf height.
3. Grab the handles and push the R&S FSMR3 onto the shelf until the rack brackets fit closely to the rack.
4. Tighten all screws in the rack brackets with a tightening torque of 1.2 Nm to secure the R&S FSMR3 in the rack.

To unmount the R&S FSMR3 from a rack

1. Loosen the screws at the rack brackets.
2. Remove the R&S FSMR3 from the rack.
3. If placing the R&S FSMR3 on a bench top again, unmount the adapter kit from the R&S FSMR3. Follow the instructions provided with the adapter kit.

4.2.5 Connecting the AC power

In the standard version, the R&S FSMR3 is equipped with an AC power supply connector.

The R&S FSMR3 can be used with different AC power voltages and adapts itself automatically to it. Refer to the data sheet for the requirements of voltage and frequency.

For safety information, see "Connecting to power" on page 6.

To connect the AC power

1. Plug the AC power cable into the AC power connector on the rear panel of the instrument. Only use the AC power cable delivered with the R&S FSMR3.
2. Plug the AC power cable into a power outlet with ground contact.

   The required ratings are listed next to the AC power connector and in the data sheet.

For details on the connector, refer to Chapter 4.3.2.1, "AC power supply connection and main power switch", on page 35.

4.2.6 Switching the instrument on and off

Table 4-1: Overview of power states

Status	LED on Power key	Position of main power switch
Off	gray	[0]
Standby	orange	[I]
Ready	green	[I]

To switch on the R&S FSMR3

The R&S FSMR3 is off but connected to power.

1. Set the switch on the power supply to position [I].
   See Chapter 4.3.2.1, "AC power supply connection and main power switch", on page 35.

   The LED of the Power key is orange.
   See Chapter 4.3.1.1, "Power key", on page 26.

2. Press the Power key.
   See Chapter 4.3.1.1, "Power key", on page 26.

   The LED changes to green.
   The R&S FSMR3 boots.

   After booting, the instrument is ready for operation.

To shut down the product

The product is in the ready state.

► Press the [Power] key.

  The operating system shuts down. The LED changes to orange.

If the instrument temperature exceeds the limit specified in the data sheet, the R&S FSMR3 automatically shuts down to protect the instrument from damage.

To disconnect from power

The R&S FSMR3 is in the standby state.

1. **NOTICE!** Risk of data loss. If you disconnect the product from power when it is in the ready state, you can lose settings and data. Shut it down first.

   Set the switch on the power supply to position [0].
   See Chapter 4.3.2.1, "AC power supply connection and main power switch", on page 35.

   The LED of the Power key is switched off.

2. Disconnect the R&S FSMR3 from the power source.

4.2.7 Connecting to LAN

You can connect the instrument to a LAN for remote operation via a PC.

Provided the network administrator has assigned you the appropriate rights and adapted the Windows firewall configuration, you can use the interface, for example:

- To transfer data between a controlling device and the test device, e.g. to run a remote control program
- To access or control the measurement from a remote computer using the "Remote Desktop" application (or a similar tool)
- To connect external network devices (e.g. printers)
- To transfer data from a remote computer and back, e.g. using network folders

Network environment

Before connecting the product to a local area network (LAN), consider the following:

- Install the latest firmware to reduce security risks.
- For internet or remote access, use secured connections, if applicable.
- Ensure that the network settings comply with the security policies of your company. Contact your local system administrator or IT department before connecting your product to your company LAN.
- When connected to the LAN, the product may potentially be accessed from the internet, which may be a security risk. For example, attackers might misuse or damage the product. For more information about IT security and how to operate the product in a secure LAN environment, see the Rohde & Schwarz white paper 1EF96: Malware Protection Windows 10.

▶ **NOTICE!** Risk of network failure.
Consult your network administrator before performing the following tasks:
- Connecting the instrument to the network
- Configuring the network
- Changing IP addresses
- Exchanging hardware

Errors can affect the entire network.

Connect the R&S FSMR3 to the LAN via the LAN interface on the rear panel of the instrument.

Windows automatically detects the network connection and activates the required drivers.

By default, the R&S FSMR3 is configured to use DHCP and no static IP address is configured.

The default instrument name is <Type><variant>-<serial_number>, for example, FSMR3026-123456. For information on determining the serial number, see Chapter 4.3.2.14, "Device ID", on page 38.

For more information on LAN configuration, see Chapter 11.7, "How to set up a network and remote control", on page 366.

4.2.8 Connecting a keyboard

The keyboard is detected automatically when it is connected. The default input language is English – US.

However, you can also connect foreign language keyboards; currently the following languages are supported for the R&S FSMR3:

- German
- Swiss
- French
- Russian

To configure the keyboard language

1. To access the Windows operating system, press the Windows key on the external keyboard.
2. Select "Start > Settings > Time & language > Region & language > Add a language" .

4.2.9 Connecting an external monitor

You can connect an external monitor (or projector) to the "DVI" or "Display port" connector on the rear panel of the R&S FSMR3 (see also Chapter 4.3.2.2, "Display port and DVI", on page 35).

Screen resolution and format

The touchscreen of the R&S FSMR3 is calibrated for a 16:10 format. If you connect a monitor or projector using a different format (e.g. 4:3), the calibration is not correct and the screen does not react to your touch actions properly.

The touchscreen has a screen resolution of 1280x800 pixels. Usually, the display of the external monitor is a duplicate of the instrument's monitor.

If you configure the external monitor to be used as the *only* display in the Windows configuration dialog box ("Show only on 2"), the maximum screen resolution of the monitor is used. In this case, you can maximize the R&S FSMR3 application window and see even more details. You cannot change the monitor's screen resolution via the standard Windows configuration dialog box.

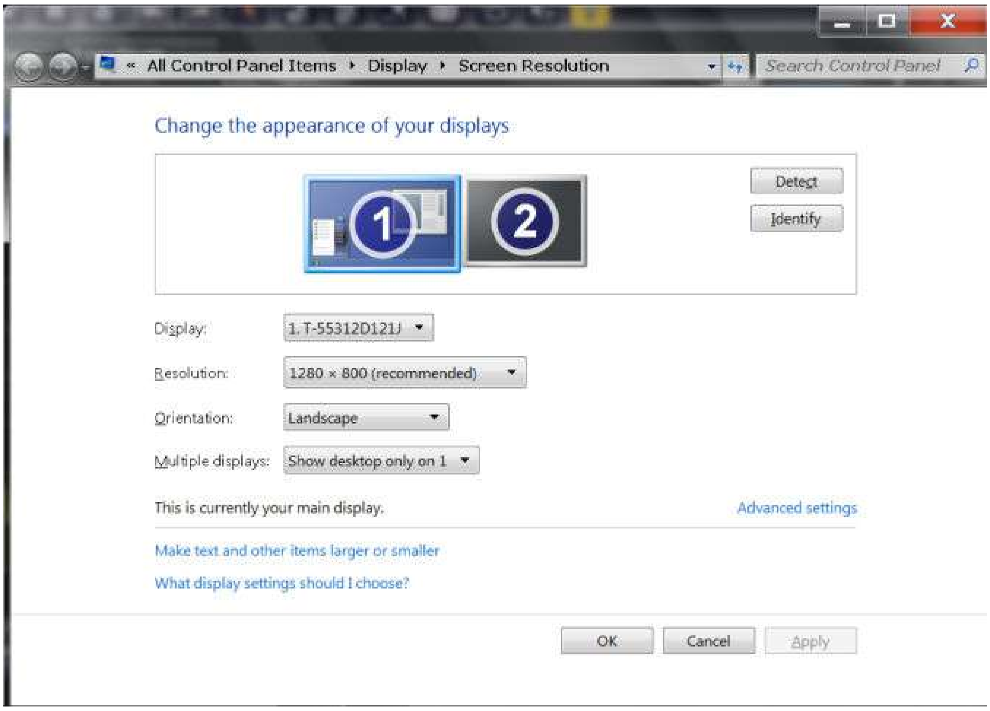
However, you can restore the default instrument resolution (1280x800) on the monitor using the instrument function "Setup" > "Display" > "Configure Monitor" > "Screen Resolution: Restore to default".

The R&S FSMR3 supports a minimum resolution of 1280x768 pixels.

1. Connect the external monitor to the R&S FSMR3.

2. Press the [Setup] key.
3. Press the "Display" softkey.
4. Select the "Configure Monitor" tab in the "Display" dialog box.

   The standard Windows "Screen Resolution" dialog box is displayed.



5. Select the instrument for display:
   - "Display 1": internal monitor only
   - "Display 2": external monitor only
   - "Duplicate": both internal and external monitor
6. Tap "Apply" to try out the settings before they are accepted permanently, then you can easily return to the previous settings, if necessary.
7. Select "OK" if the settings are suitable.

4.2.10 Windows operating system

The instrument contains the Windows 10 operating system which has been configured according to the instrument's features and needs. Changes in the system setup are only required when peripherals like a keyboard or a printer are installed or if the network configuration does not comply with the default settings. After the R&S FSMR3 is started, the operating system boots and the instrument firmware is started automatically.

Tested software

The drivers and programs used on the instrument under Windows 10 are adapted to the instrument. Only install update software released by Rohde & Schwarz to modify existing instrument software.

You can install additional software on the instrument; however, additional software can impair instrument function. Thus, run only programs that Rohde & Schwarz has tested for compatibility with the instrument software.

The following program packages have been tested:

- Symantec Endpoint Security – virus-protection software
- FileShredder - for reliable deletion of files on the hard disk

Service packs and updates

Microsoft regularly creates security updates and other patches to protect Windows-based operating systems. They are released through the Microsoft Update website and associated update server. Update instruments using Windows regularly, especially instruments that connect to a network.

Firewall settings

A firewall protects an instrument by preventing unauthorized users from gaining access to it through a network. Rohde & Schwarz highly recommends using the firewall on your instrument. Rohde & Schwarz instruments are shipped with the Windows firewall enabled. All ports and connections for remote control are enabled.

Note that changing firewall settings requires administrator rights.

Virus protection

Take appropriate steps to protect your instruments from infection. Use strong firewall settings and scan any removable storage device used with a Rohde & Schwarz instrument regularly. It is also recommended that you install anti-virus software on the instrument. Rohde & Schwarz does NOT recommend running anti-virus software in the background ("on-access" mode) on Windows-based instruments, due to potentially degrading instrument performance. However, Rohde & Schwarz does recommend running it during non-critical hours.

For details and recommendations, see the following Rohde & Schwarz white paper:

- 1EF96: Malware Protection Windows 10

To access the "Start" menu

The Windows "Start" menu provides access to the Windows 10 functionality and installed programs.

► Select the "Windows" icon in the toolbar, or press the "Windows" key or the [CTRL + ESC] key combination on the (external) keyboard.

The "Start" menu and the Windows taskbar are displayed.

The Windows taskbar also provides quick access to commonly used programs, for example Paint or WordPad. IECWIN, the auxiliary remote control tool provided free of charge and installed by Rohde & Schwarz, is also available from the taskbar or "Start" menu.

For details on the IECWIN tool, see Chapter 11.4, "The IECWIN tool", on page 338.

All necessary system settings can be defined in the "Start > Settings" menu.

For required settings, refer to the Windows 10 documentation and to the hardware description.

4.2.11 Logging on

Windows 10 requires that users identify themselves by entering a user name and password in a login window. By default, the R&S FSMR3 provides two user accounts:

- **"Instrument"** : a standard user account with limited access
- **"Admin"** or **"Administrator"** (depends on firmware image): an administrator account with unrestricted access to the computer/domain

Some administrative tasks require administrator rights (e.g. the configuration of a LAN network). Refer to the description of the basic instrument Setup ([Setup] menu) to find out which functions are affected.

Secure user mode

If the secure user mode option (R&S FSMR3-K33) is installed, an additional account is provided: the **"SecureUser"**.

The "SecureUser" is a standard user account with limited functionality. In particular, administrative tasks such as LAN configuration or general instrument settings are not available. Furthermore, for a "SecureUser", data that the R&S FSMR3 normally stores on the solid-state drive is redirected to volatile memory instead. You can access data that is stored in volatile memory during the current instrument session. However, when the instrument's power is removed, all data in volatile memory is erased.

For details, see Chapter 9.2, "Protecting data using the secure user mode", on page 238.

Passwords

For all default user accounts, the initial password is *894129*. Note that this password is very weak, and we strongly recommend that you change the password for both users after initial login. An administrator can change the password in Windows 10 for any user at any time via "Start > Settings > Account > SignIn Options > Password > Change".

Auto-login

When shipped, the instrument automatically logs on the default "Instrument" user to Windows 10 using the default password. This function is active until an administrator explicitly deactivates it or changes the password.

Changing the password and use of auto-login function

Note that when you change the default password, the default auto-login function no longer works!

In this case, you must enter the new password manually to log on.

Adapting the auto-login function to a new password

If you change the password that is used during auto-login, this function no longer works. Adapt the settings for the auto-login function first.

1. Select the "Windows" icon in the toolbar to access the operating system of the R&S FSMR3 (see also "To access the "Start" menu" on page 20).
2. Open the `C:\R_S\INSTR\USER\user\AUTOLOGIN.REG` file in any text editor (e.g. Notepad).
3. In the line `"DefaultPassword"="894129"`, replace the default password (`894129`) by the new password for automatic login.
4. Save the changes to the file.
5. In the Windows "Start" menu, select "Run".
   The "Run" dialog box is displayed.
6. Enter the command `C:\R_S\INSTR\USER\user\AUTOLOGIN.REG`.
7. Press the [ENTER] key to confirm.
   The auto-login function is reactivated with the changed password. It will be applied the next time the instrument is switched on.

Switching users when using the auto-login function

Which user account is used is defined during login. If auto-login is active, the login window is not displayed. However, you can switch the user account to be used even when the auto-login function is active.

1. Select the "Windows" icon in the toolbar to access the operating system of the R&S FSMR3 (see also "To access the "Start" menu" on page 20).
2. Press [CTRL] + [ALT] + [DEL], then select "Sign out".

   The "Login" dialog box is displayed, in which you can enter the different user account name and password.

For information on deactivating and reactivating the auto-login function, see "Deactivating the auto-login function" on page 375.

4.2.12 Checking the supplied options

The instrument can be equipped with both hardware and firmware options. To check whether the installed options correspond to the options indicated on the delivery note, proceed as follows.

1. Press the [SETUP] key.
2. Press the "System Config" softkey.
3. Switch to the "Versions + Options" tab in the "System Configuration" dialog box.

   A list with hardware and firmware information is displayed.
4. Check the availability of the hardware options as indicated in the delivery note.

4.2.13 Performing a self-alignment

When temperature changes occur in the environment of the R&S FSMR3, or after updating the firmware, you have to perform a self-alignment to align the data to a reference source.

During self-alignment, do not connect a signal to the RF input connector. Running a self-alignment with a signal connected to the RF input can lead to false measurement results.

Performing a self-alignment

Before performing this alignment, make sure that the instrument has reached its operating temperature (for details, refer to the data sheet).

A message in the status bar ("Instrument warming up...") indicates that the operating temperature has not yet been reached.

Depending on the installation settings, an automatic self-alignment is performed each time the instrument is switched on. A dialog box is displayed indicating how much warm-up time is still required before self-alignment can be performed.

1. Press the [Setup] key.
2. Press the "Alignment" softkey.
3. Select the "Start Self Alignment" button in the "Alignment" dialog box.

   Once the system correction values have been calculated successfully, a message is displayed.

To display the alignment results again later

- Press the [SETUP] key.
- Press the "Alignment" softkey.

4.2.14 Considerations for test setup

Cable selection and electromagnetic interference (EMI)

Electromagnetic interference (EMI) can affect the measurement results.

To suppress electromagnetic radiation during operation:

- Use high-quality shielded cables, for example, double-shielded RF and LAN cables.
- Always terminate open cable ends.
- Ensure that connected external devices comply with EMC regulations.

Signal input and output levels

Information on signal levels is provided in the data sheet and on the instrument, next to the connector. Keep the signal levels within the specified ranges to avoid damage to the R&S FSMR3 and connected devices.

4.3 Instrument tour

On the instrument tour, you can learn about the different control elements and connectors on the front and back panel of the R&S FSMR3.

4.3.1 The front panel

This chapter describes the front panel, including all function keys and connectors.

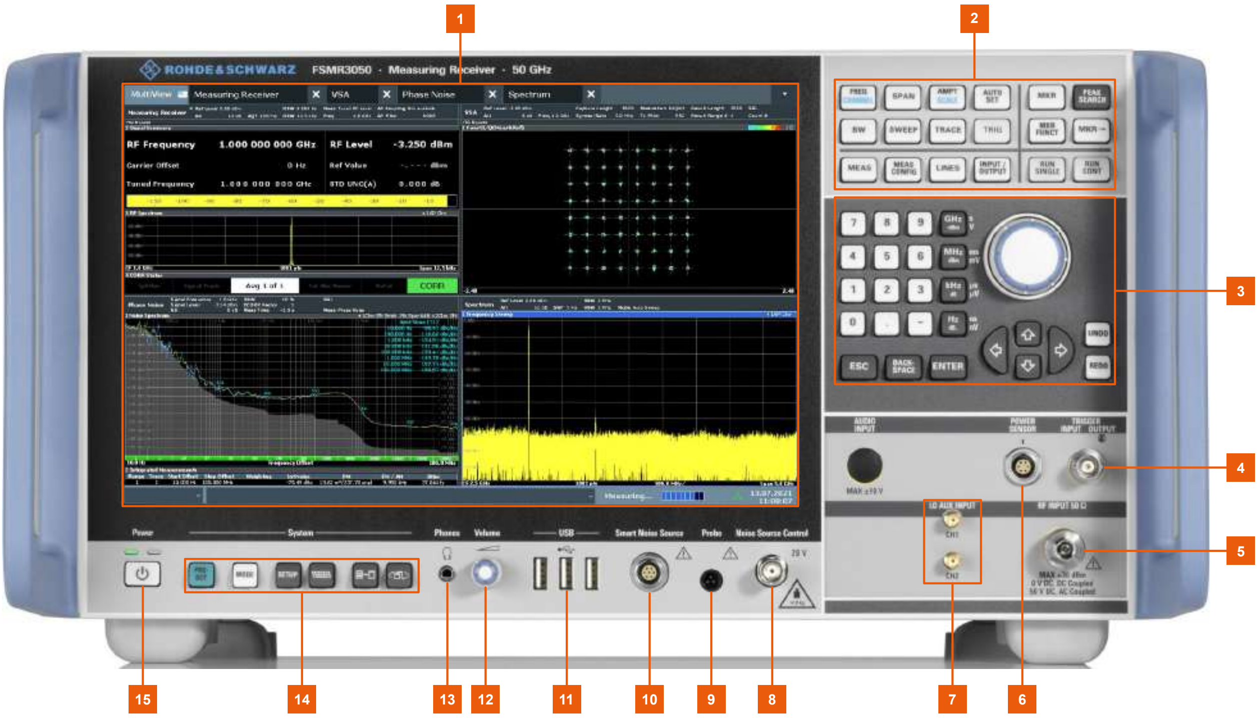
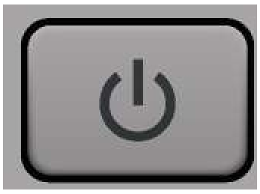


Figure 4-1: Front panel view of R&S FSMR3

1 = Touchscreen
2 = Function keys
3 = Navigation controls
4 = TRIGGER INPUT/OUTPUT
5 = RF INPUT 50 Ω
6 = POWER SENSOR connector
7 = LO AUX INPUT CH1/CH2
8 = NOISE SOURCE CONTROL
9 = PROBE connector
10 = SMART NOISE SOURCE connector
11 = USB connectors
12 = Volume control
13 = Headphones connector
14 = SYSTEM keys
15 = POWER key

4.3.1.1 Power key



The power key is on the lower left corner of the front panel. It starts up and shuts down the instrument.

See also "Connecting to power" on page 6.

4.3.1.2 USB

The front panel provides three female USB connectors (USB-A) to connect devices like a keyboard or a mouse. In addition, a memory stick can be connected to store and reload instrument settings and measurement data.

The rear panel provides further USB connectors, including a male (USB-B) connector. See Chapter 4.3.2.4, "USB", on page 36.

All USB connectors support standard 2.0.

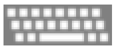
4.3.1.3 System keys

System keys set the instrument to a predefined state, change basic settings, and provide print and display functions.

A detailed description of the corresponding functions is provided in the user manual.

Table 4-2: System keys

System key	Assigned functions
[Preset]	Resets the instrument to the default state.
[Setup]	Provides basic instrument configuration functions, e.g.: • Reference frequency (external/internal), noise source • Date, time, display configuration • LAN interface • Self-alignment • Firmware update and enabling of options • Information about instrument configuration incl. firmware version and System error messages • Service support functions (self-test etc.)
[Print]	Provides print and screenshot functions
[File]	Provides data management functions such as saving and recalling instrument settings or importing and exporting data.

System key	Assigned functions
	Switches between the on-screen keyboard display: ● At the top of the screen ● At the bottom of the screen ● Off
[Mode]	Provides the selection between applications

4.3.1.4 Touchscreen

All measurement results are displayed on the screen on the front panel. Additionally, the screen display provides status and setting information and allows you to switch between various measurement tasks. The screen is touch-sensitive, offering an alternative means of user interaction for quick and easy handling of the instrument.

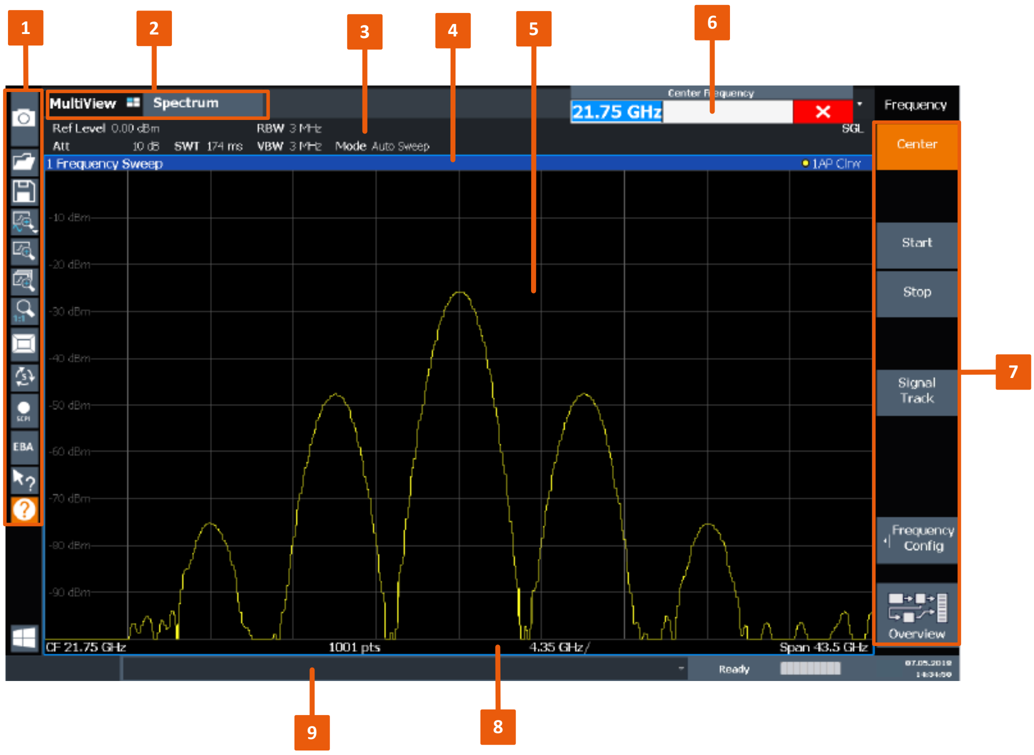


Figure 4-2: Touchscreen elements

1 = Toolbar with standard application functions, e.g. print, save/open file etc.
2 = Tabs for individual measurement channels
3 = Channel bar for firmware and measurement settings
4 = Window title bar with diagram-specific (trace) information
5 = Measurement results area
6 = Input field for measurement setting
7 = Softkeys for function access
8 = Diagram footer with diagram-specific information, depending on application
9 = Instrument status bar with error messages, progress bar and date/time display

All measurement results are displayed on the screen on the front panel. Additionally, the screen display provides status and setting information and allows you to switch between various measurement tasks. The screen is touch-sensitive, offering an alternative means of user interaction for quick and easy handling of the instrument. Any user interface elements that react to a click by a mouse pointer also react to a tap on the screen, and vice versa. Using touchscreen gestures, you can perform the following tasks:

- Changing a setting
- Changing the display
- Moving a marker
- Zooming into a diagram
- Selecting a new evaluation method
- Scrolling through a result list or table
- Saving or printing results and settings

To imitate a right-click by mouse using the touchscreen, for example to open a context-sensitive menu for a specific item, press the screen for about 1 second.

For details on touchscreen gestures, see Chapter 4.5.4, "Touchscreen gestures", on page 73.

4.3.1.5 Function keys

Function keys provide access to the most common measurement settings and functions.

A detailed description of the corresponding functions is provided in the user manual.

Table 4-3: Function keys

Function key	Assigned functions
Basic measurement settings	
[Freq.]	Sets the center frequency and the start and stop frequencies for the frequency range under consideration. This key is also used to set the frequency offset and the signal track function.
[Span]	Sets the frequency span to be analyzed.
[Ampt. / Scale]	Sets the reference level, the displayed dynamic range, the RF attenuation and the unit for the level display. Sets the level offset and the Input impedance. Activates the preamplifier (option RF Preamplifier, R&S FSMR3-B24).
[Auto Set]	Enables automatic settings for level, frequency or sweep type Mode.
[BW]	Sets the resolution bandwidth and the Video bandwidth.
[Sweep]	Sets the sweep time and the number of measurement points. Selects continuous measurement or single measurement.
[Trace]	Configures the measured data acquisition and the analysis of the measurement data.

Function key	Assigned functions
[Trigger]	Sets the trigger mode, the trigger threshold, the trigger delay, and the gate configuration for gated sweep.
Marker functions	
[Marker]	Sets and positions the absolute and relative measurement markers (markers and delta markers).
[Peak Search]	Performs a peak search for active marker. If no marker is active, normal marker 1 is activated and the peak search is performed for it.
[Marker Function]	Provides additional analysis functions of the measurement markers: Frequency counter (Sig Count) Fixed reference point for relative measurement markers (Ref Fixed) Noise marker (Noise Meas) Phase noise (Phase Noise) n dB down function AM/FM audio demodulation Peak list
[Marker ->]	Used for search functions of the measurement markers (maximum/minimum of the trace). Assigns the marker frequency to the center frequency, and the marker level to the reference level. Restricts the search area (Search Limits) and characterizes the maximum points and minimum points (Peak Excursion).
Measurement and evaluation functions	
[Meas]	Provides the measurement functions. Measurement of multicarrier adjacent channel power (Ch Power ACLR) Carrier to noise spacing (C/N C/N_0) Occupied bandwidth (OBW) Spectrum emission mask measurement (Spectrum Emission Mask) Spurious emissions (Spurious Emissions) Measurement of time domain power (Time Domain Power) Signal statistics: amplitude probability distribution (APD) and cumulative complementary distribution function (CCDF) Third-order intercept point (TOI) AM modulation depth (AM Mod Depth)
[Meas Config]	Used to define measurement configuration.
[Lines]	Configures display lines and limit lines.
[Input/Output]	Displays softkeys for In/Out functions.
Measurement start functions	
[Run Single]	Starts a single new measurement (Single Sweep Mode).
[Run Cont.]	Starts a continuous measurement (Continuous Sweep Mode).
Function execution (in navigation controls area)	

Function key	Assigned functions
[Undo]	Reverts last operation
[Redo]	Repeats previously reverted operation.

4.3.1.6 Navigation controls

The navigation controls include a rotary knob, navigation keys, and Undo / Redo keys. They allow you to navigate within the display or within dialog boxes.

Navigating in tables

The easiest way to navigate within tables (both in result tables and configuration tables) is to scroll through the entries with your finger on the touchscreen.

Rotary knob

The rotary knob has several functions:

- For numeric entries: increments (clockwise direction) or decrements (counter-clockwise direction) the instrument parameter at a defined step width
- In lists: toggles between entries
- For markers, limit lines, and other graphical elements on the screen: moves their position
- For active scroll bars: moves the scroll bar vertically
- For dialog boxes: Same effect as the Enter key when pressed

Navigation keys

The navigation keys can be used alternatively to the rotary knob to navigate through dialog boxes, diagrams or tables.

Arrow Up/Arrow Down Keys

The <arrow up> or <arrow down> keys do the following:

- For numeric entries: increments (Arrow Up) or decrements (Arrow Down) the instrument parameter at a defined step width
- In a list: scrolls forward and backward through the list entries
- In a table: moves the selection bar vertically
- In windows or dialog boxes with a vertical scroll bar: moves the scroll bar

Arrow Left/Arrow Right Keys

The <arrow left> or <arrow right> keys do the following:

- In an alphanumeric edit dialog box, move the cursor.
- In a list, scroll forward and backward through the list entries.

- In a table, move the selection bar horizontally.
- In windows or dialog boxes with horizontal scroll bar, move the scroll bar.

4.3.1.7 Undo/redo keys

- The [Undo] key reverts the previous action, i.e. the status before the previous action is retrieved.
  The Undo function is useful, for example, if you are performing a zero span measurement with several markers and a limit line defined and accidentally select a different measurement. In this case, many settings would be lost. However, if you press [Undo] immediately afterwards, the previous status is retrieved, i.e. the zero span measurement and all settings.
- The [Redo] key repeats the previously reverted action, i.e. the most recent action is repeated.

The [Undo] function is not available after a [Preset] or "Recall" operation. When these functions are used, the history of previous actions is deleted.

4.3.1.8 Trigger input / output

Use the female Trigger 1 Input/Output connector to input an external trigger or gate data. Thus, you can control the measurement using an external signal. The voltage levels can range from 0.5 V to 3.5 V. The default value is 1.4 V. The typical Input impedance is 10 kΩ.

The rear panel provides two more Trigger Input / Output connectors, see Chapter 4.3.2.7, "Trigger 2/3 In/Out", on page 36.

4.3.1.9 RF input 50 ohm

Provides RF input from a connected device under test (DUT) to the R&S FSMR3, which is then analyzed in an RF measurement. Connect the DUT to the "RF Input" connector on the R&S FSMR3. Do not overload the input. For maximum allowed values, see the data sheet.

The RF input can be coupled to the DUT 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. 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. For details on coupling, see the chapter on radio frequency input in the R&S FSMR3 user manual.

See also Chapter 4.2.14, "Considerations for test setup", on page 24.

4.3.1.10 Power sensor

The LEMOSA female connector is used to connect Rohde & Schwarz power sensors. For a detailed list of supported sensors, see the data sheet.

For details on configuring and using power sensors, see the User Manual.

4.3.1.11 Noise source control

The noise source control female connector is used to provide the supply voltage for an external noise source. For example, use it to measure the noise figure and gain of amplifiers and frequency converting devices.

Conventional noise sources require a voltage of +28 V to be switched on and 0 V to be switched off. The output supports a maximum load of 100 mA.

4.3.1.12 Probe

The R&S FSMR3 provides a connector for supply voltages of +15 V to -12 V and ground for active probes and preamplifiers. A maximum current of 140 mA is available. This connector is suitable as a power supply for high-impedance probes.

4.3.1.13 Smart noise source

The R&S FSMR3 provides a connector to for smart noise sources. Only one SNS can be active on the R&S FSMR3 at any time.

The identification and setup procedure after connecting the FS-SNS may take up to 10 seconds.

4.3.1.14 AF out and volume

This option allows you to monitor demodulated audio frequencies in time domain measurements acoustically.

The AM and FM audio output is provided to the AF Out connector.

Connect headphones equipped with a miniature jack plug to the AF Out female connector. Set the output voltage using the "Volume" control above the female connector.

See also "Using headphones" on page 7.

4.3.1.15 Keypad

The keypad is used to enter alphanumeric parameters, including the corresponding units (see also Chapter 4.5.3.2, "Entering alphanumeric parameters", on page 72). It contains the following keys:

Table 4-4: Keys on the keypad

Type of key	Description
Alphanumeric keys	Enter numbers and (special) characters in edit dialog boxes.
Decimal point	Inserts a decimal point "." at the cursor position.
Sign key	Changes the sign of a numeric parameter. For an alphanumeric parameter, inserts a "-" at the cursor position.
Unit keys (GHz/-dBm MHz/dBm, kHz/dB and Hz/dB)	Adds the selected unit to the entered numeric value and complete the entry. For level entries (e.g. in dB) or dimensionless values, all units have the value "1" as multiplying factor. Thus, they have the same function as an Enter key.
[Esc] key	Closes all kinds of dialog boxes, if the edit Mode is not active. Quits the edit Mode, if the edit Mode is active. In dialog boxes that contain a "Cancel" button it activates that button. For "Edit" dialog boxes the following mechanism is used: ● If data entry has been started, it retains the original value and closes the dialog box. ● If data entry has not been started or has been completed, it closes the dialog box.
Backspace key	If an alphanumeric entry has already been started, this key deletes the character to the left of the cursor.
Enter key	● Concludes the entry of dimensionless entries. The new value is accepted. ● With other entries, this key can be used instead of the "Hz/dB" unit key. ● In a dialog box, selects the default or focused element.

4.3.2 The rear panel

The rear panel contains various connectors for various purposes.

The meanings of the labels on the R&S FSMR3 are described in Chapter 4.3.2.13, "Labels on R&S FSMR3", on page 38.

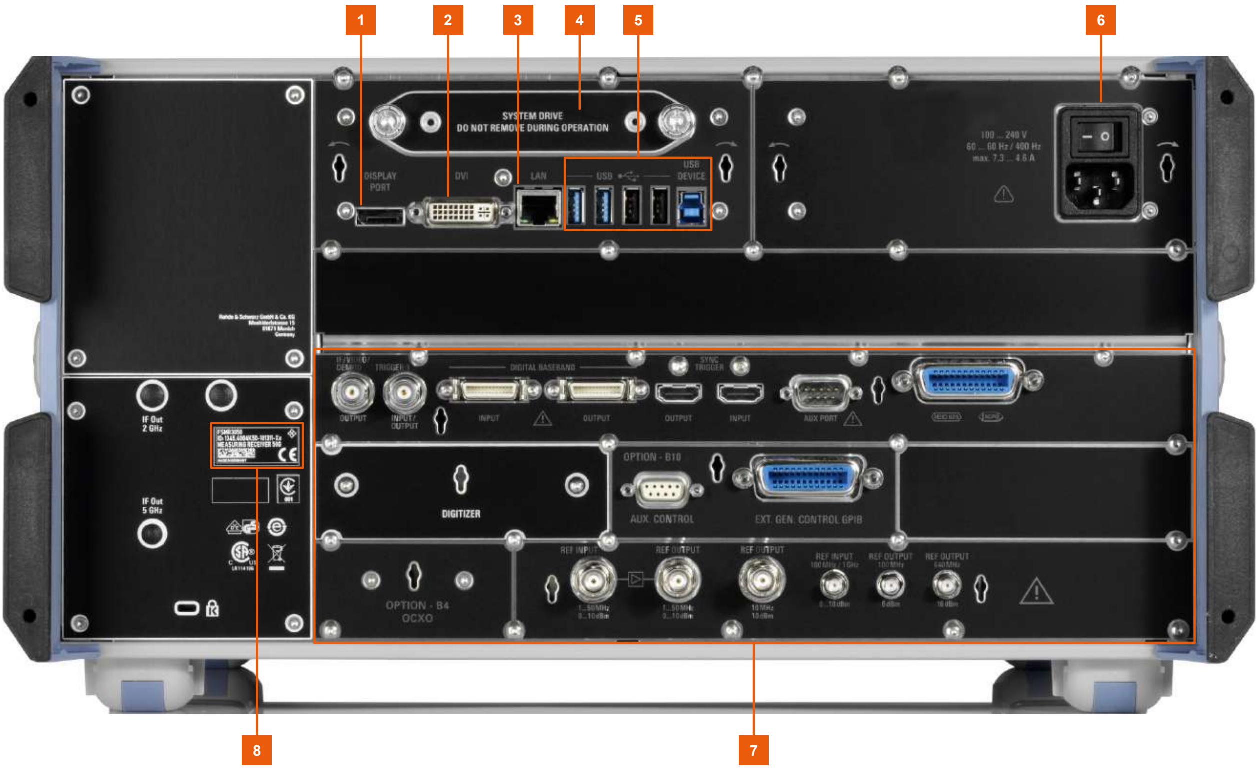


Figure 4-3: Rear panel view of R&S FSMR3

1 = see Chapter 4.3.2.2, "Display port and DVI", on page 35
2 = see Chapter 4.3.2.2, "Display port and DVI", on page 35
3 = see Chapter 4.3.2.3, "LAN", on page 36
4 = System Hard Drive
5 = see Chapter 4.3.2.4, "USB", on page 36
6 = see Chapter 4.3.2.1, "AC power supply connection and main power switch", on page 35
7 = see Figure 4-4
8 = Device ID with serial number and other labels

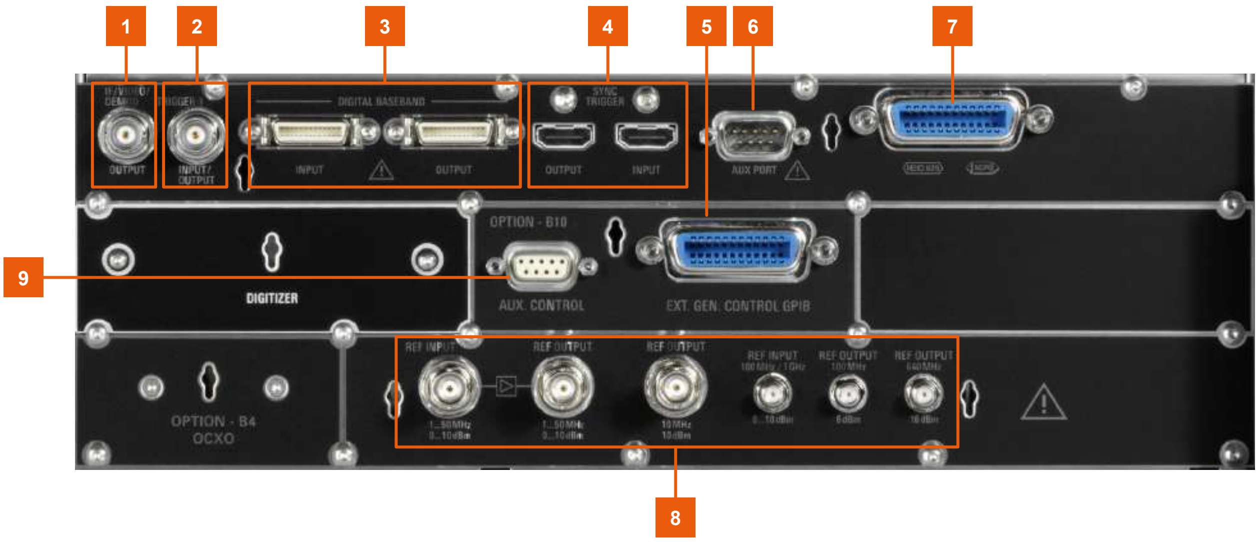


Figure 4-4: Rear panel view - extract 1

1 = IF/VIDEO/DEMOD connector
2 = TRIGGER 3 INPUT/OUTPUT connector
3 = DIGITAL BASEBAND INPUT/OUTPUT connectors (option B17)
4 = SYNC TRIGGER OUTPUT/INPUT
5 = EXT GEN CONTROL interface
6 = AUX PORT
7 = GPIB interface
8 = REF INPUT/OUTPUT connectors
9 = AUX CONTROL (option B10)

4.3.2.1 AC power supply connection and main power switch

An AC power supply connector and main power switch are located in a unit on the rear panel of the instrument.

Main power switch function:

Position 1: The instrument can be started via the Power key on the front panel.

The (optional) OCXO reference frequency is warmed up.

Position O: The entire instrument is disconnected from the AC power supply.

For details, refer to "Connecting to power" on page 6 and Chapter 4.2.5, "Connecting the AC power", on page 15.

4.3.2.2 Display port and DVI

You can connect an external monitor or other display device to the R&S FSMR3 to provide an enlarged display. Two different types of connectors are provided for this purpose:

- Display Port
- DVI (digital visual interface)

For details, see Chapter 4.2.9, "Connecting an external monitor", on page 18.

4.3.2.3 LAN

The R&S FSMR3 is equipped with a 1 GBit Ethernet IEEE 802.3u network interface with Auto-MDI(X) functionality. The assignment of the RJ-45 connector supports twisted-pair category 5 UTP/STP cables in a star configuration (UTP stands for *unshielded twisted pair*, and STP for *shielded twisted pair*).

For details, see Chapter 11, "Network operation and remote control", on page 319.

4.3.2.4 USB

The rear panel provides four additional female USB (USB-A) connectors to connect devices like a keyboard, a mouse or a memory stick (see also Chapter 4.3.1.2, "USB", on page 26).

Furthermore, a male USB Device connector (USB-B) is provided optionally, for example to connect the R&S FSMR3 to a PC for remote control. The device connector requires R&S FSMR3-B114.

All USB connectors support standard 2.0.

4.3.2.5 GPIB interface

The GPIB interface is in compliance with IEEE488 and SCPI. A computer for remote control can be connected via this interface. To set up the connection, a shielded cable is recommended. This interface is part of the "Additional Interfaces" hardware option.

For more details, refer to Chapter 11, "Network operation and remote control", on page 319.

4.3.2.6 Noise source control

The Noise Source Control female connector is used to provide the supply voltage for an external noise source. For example, use it to measure the noise figure and gain of amplifiers and frequency converting devices. This connector requires option R&S FSMR3-B28V.

Conventional noise sources require a voltage of +28 V to be switched on and 0 V to be switched off. The output supports a maximum load of 100 mA.

4.3.2.7 Trigger 2/3 In/Out

The additional female BNC Trigger 2 In/Out connector and the optional Trigger 3 (output) connector allow the R&S FSMR3 to receive additional external signals or to provide signals to another device. The signals are TTL compatible (0 V / 5 V). You control the connector usage in the "Trigger" settings ([Trigger] key).

4.3.2.8 REF input / REF output

The REF Input connectors are used to provide an external reference signal to the R&S FSMR3.

The REF Output connectors can be used to provide an external reference signal (or the optional OCXO reference signal) from the R&S FSMR3 to other devices that are connected to this instrument.

Various connectors are provided for different reference signals:

Connector	Reference signal	Usage
REF Output 2	640 MHz 10 dBm	To provide the internal reference signal from the R&S FSMR3 to another device continuously. Also used to provide OCXO reference signal to another device.
REF Input 2	10 MHz - 1280 MHz 3 dBm - 13 dBm	To provide an external reference signal to the R&S FSMR3.
REF Output 1	1 MHz - 100 MHz > 0 dBm	To provide a 640 MHz reference signal from the R&S FSMR3 to another device.
REF Input 1	1 MHz - 100 MHz 0 dBm - 15 dBm	To provide an external reference signal to the R&S FSMR3.

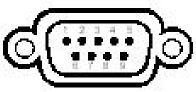
4.3.2.9 IF output

The female BNC connector can be used to output the intermediate frequency (IF).

4.3.2.10 Video output

The female BNC connector can be used to provide video output (1 V).

4.3.2.11 Aux. port



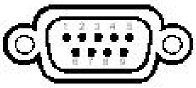
A 9-pole SUB-D male connector used to provide low-voltage TTL control signals (max. 5 V). The output signals can be used to control external devices. This connector is provided by the "Additional Interfaces" option R&S FSMR3-B5.

NOTICE

Short-circuit hazard

Always observe the designated pin assignment. A short-circuit can damage the port.

4.3.2.12 Aux. control



A 9-pole SUB-D male connector used as input for low-voltage TTL control signals (max. 5 V) from a controlling external device, such as an external generator. This connector is provided by the "Additional Interfaces" option R&S FSMR3-B5.

NOTICE

Short-circuit hazard

Always observe the designated pin assignment. A short-circuit can damage the port.

4.3.2.13 Labels on R&S FSMR3

Labels on the casing inform about:

- Personal safety, see "Meaning of safety labels" on page 7
- Product and environment safety, see Table 4-5
- Identification of the product, see Chapter 4.3.2.14, "Device ID", on page 38

Table 4-5: Labels regarding R&S FSMR3 and environment safety

	Labeling in line with EN 50419 for disposal of electrical and electronic equipment after the product has come to the end of its service life. For more information, see "Disposing electrical and electronic equipment" on page 705.

4.3.2.14 Device ID

The unique device identifier is provided as a barcode sticker on the rear panel of the R&S FSMR3.

It consists of the device order number and a serial number.

The serial number is used to define the **default instrument name**, which is:

<Type><variant>-<serial_number>

For example, `FSMR3026-123456`.

The instrument name is required to establish a connection to the instrument in a LAN.

4.4 Trying out the instrument

This chapter introduces the most important functions and settings of the R&S FSMR3 step by step. The complete description of the functionality and its usage is given in the R&S FSMR3 User Manual. Basic instrument operation is described in Chapter 4.5, "Operating the instrument", on page 58.

Prerequisites

- The instrument is set up, connected to the mains system, and started up as described in Chapter 4.2, "Preparing for use", on page 12.

For these first measurements, you use the internal calibration signal, so you do not need any additional signal source or instruments. Try out the following:

4.4.1 Measuring a basic signal in the spectrum application

We will start out by measuring a basic signal, using the internal calibration signal as the input.

To display the internal 64 MHz calibration signal

1. Press the [PRESET] key to start out in a defined instrument configuration.
2. Press the [Setup] key on the front panel.
3. Tap the "Service + Support" softkey.
4. Tap the "Calibration Signal" tab.
5. Tap the "Calibration Frequency RF" option. Leave the frequency at the default 64 MHz, with a narrowband spectrum.

   The calibration signal is now sent to the RF input of the R&S FSMR3. By default, a continuous frequency sweep is performed, so that the spectrum of the calibration signal is now displayed in the standard level versus frequency diagram.

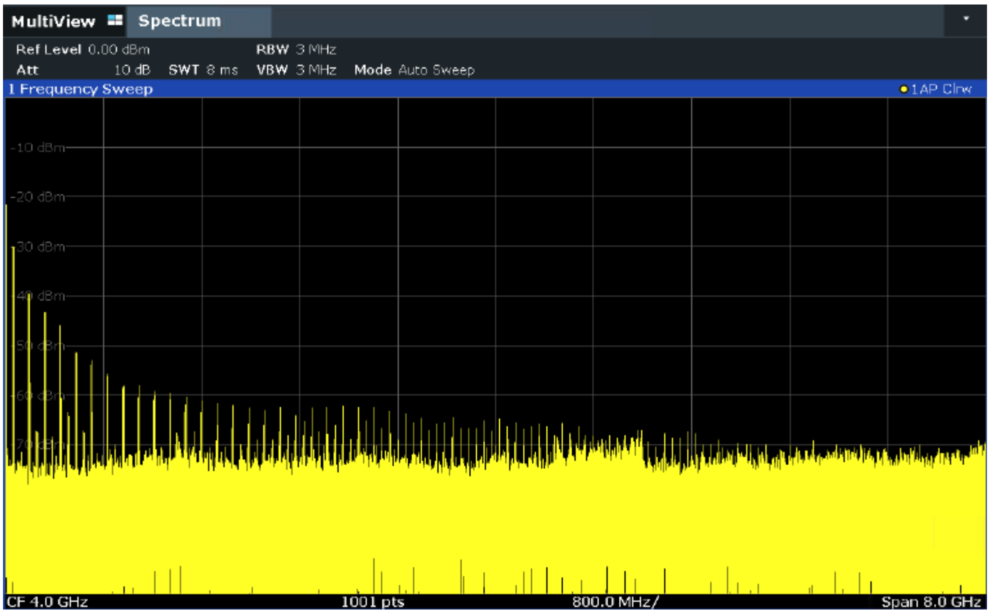


Figure 4-5: Calibration signal as RF input

Instrument warmup time

Note that the instrument requires an initial warmup time after switching it on. A message in the status bar ("Instrument warming up...") indicates that the operating temperature has not yet been reached. Wait until this message is no longer displayed before you start a measurement.

To optimize the display

To optimize the display for the calibration signal, we will adjust the main measurement settings.

1. Set the center frequency to the calibration frequency:
   a) Tap the "Overview" softkey to display the configuration "Overview".
   b) Tap the "Frequency" button.
   c) In the "Center" field, enter *64* on the number pad on the front panel.
   d) Press the "MHz" key next to the number pad.
2. Reduce the span to 20 MHz:
   a) In the "Span" field of the "Frequency" dialog box, enter *20 MHz*.
   b) Close the "Frequency" dialog box.
3. Set the reference level to -25 dBm:
   a) In the configuration "Overview", tap the "Amplitude" button.
   b) In the "Value" field of the "Amplitude" dialog box, enter *-25 dBm*.

   The display of the calibration signal is now improved. The maximum at the center frequency (=calibration frequency) of 64 MHz becomes visible.

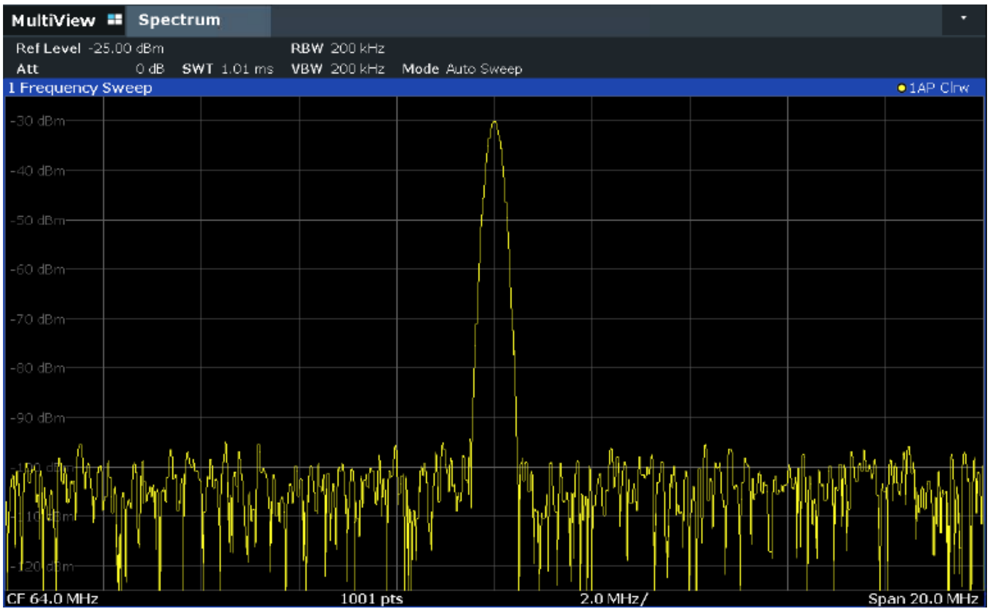


Figure 4-6: Calibration signal with optimized display settings

4.4.2 Displaying a spectrogram

In addition to the standard "level versus frequency" spectrum display, the R&S FSMR3 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. 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.

1. Tap the "Overview" softkey to display the general configuration dialog box.
2. Tap the "Display Config" button.

   The SmartGrid mode is activated, and the evaluation bar with the available evaluation methods is displayed.
3. 

   Drag the "Spectrogram" icon from the evaluation bar to the diagram area. The blue area indicates that the new diagram would replace the previous spectrum display. Since we do not want to replace the spectrum, drag the icon to the lower half of the display to add an additional window instead.

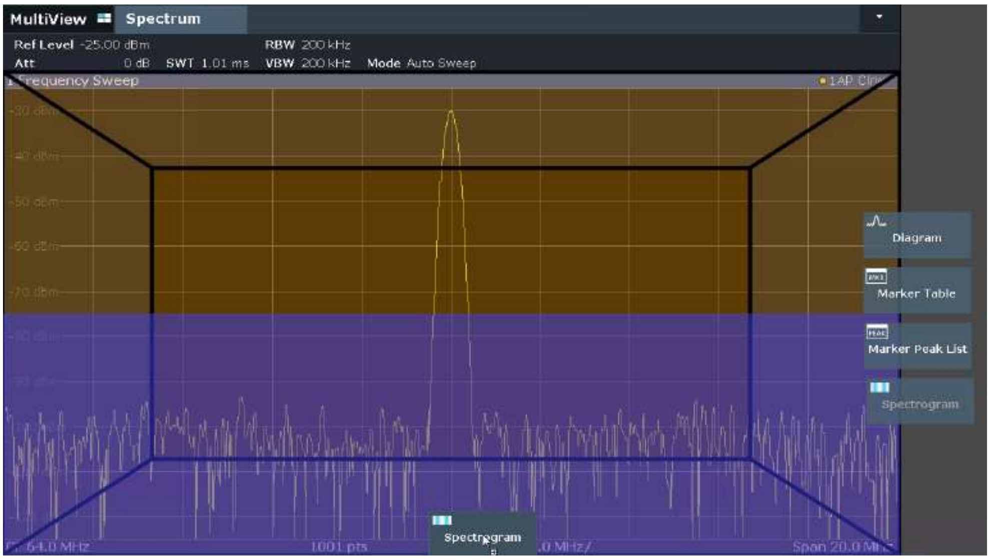


Figure 4-7: Adding a Spectrogram to the display

Drop the icon.

4. Close the SmartGrid mode by tapping the "Close" icon at the top right corner of the toolbar.

You see the spectrogram compared to the standard spectrum display. Since the calibration signal does not change over time, the color of the frequency levels does not change over time, i.e. vertically. The legend at the top of the spectrogram window describes the power levels the colors represent.

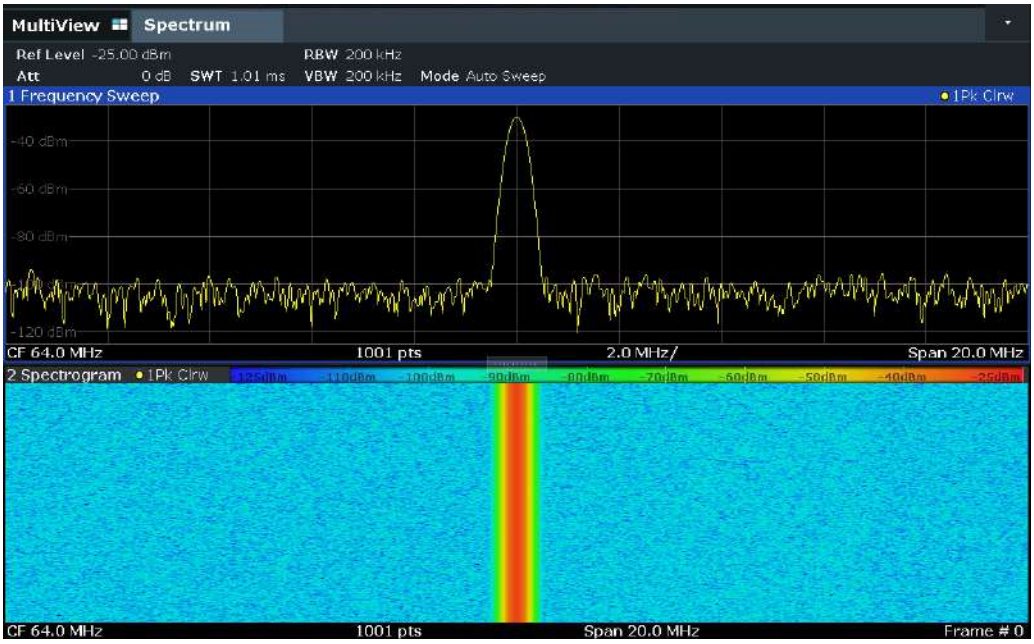


Figure 4-8: Spectrogram of the calibration signal

4.4.3 Activating additional measurement channels

The R&S FSMR3 features multiple measurement channels, i.e. you can define several measurement configurations in parallel and then switch between the channels automatically to perform the measurements sequentially. We will demonstrate this feature by activating additional measurement channels for a different frequency range, a zero span measurement, and an I/Q analysis.

To activate additional measurement channels

1. Press the [Mode] key on the front panel.
2. On the "New Channel" tab of the "Signal + Spectrum Mode" dialog box, tap the "Spectrum" button.

Figure 4-9: Adding a new measurement channel

3. Change the frequency range for this spectrum display:
   In the "Frequency" dialog box, set the **center frequency** to *500 MHz* and the **span** to *1 GHz*.

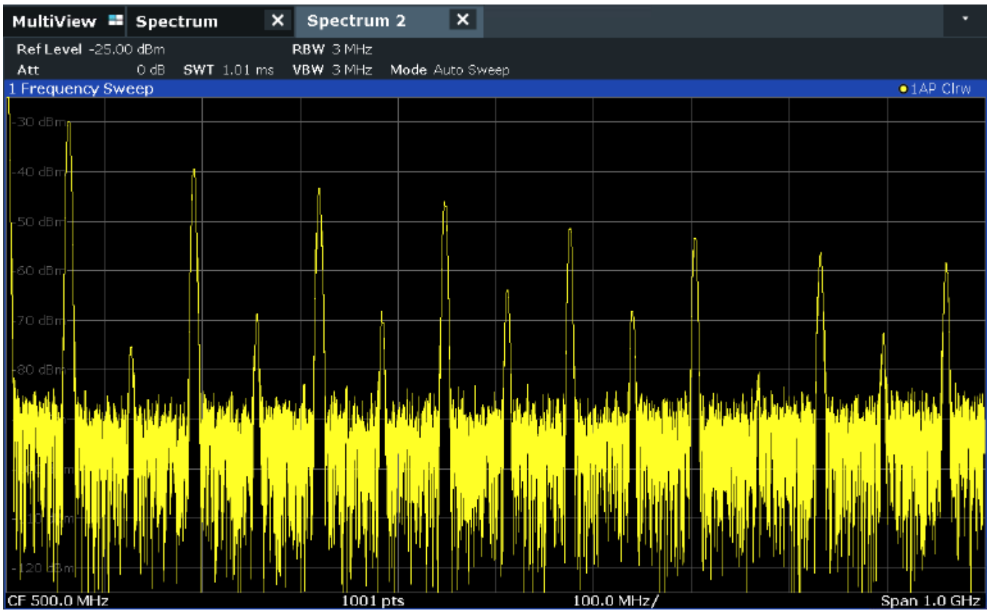


Figure 4-10: Frequency spectrum of the calibration signal with a larger span

4. Repeat the previous steps to activate a third Spectrum window.
   Change the frequency range for this spectrum display:

In the "Frequency" dialog box, set the **center frequency** to *64 MHz* and tap "Zero Span".

As the calibration signal does not vary over time, the level versus time diagram displays a straight line.

Figure 4-11: Time domain display of the calibration signal

5. Create a new channel for I/Q analysis:
   a) Press the [Mode] key.
   b) Tap the "IQ Analyzer" button to activate a channel for the I/Q Analyzer application.
   c) Tap the "Display Config" softkey to activate the SmartGrid mode.

d) Drag the "Real/Imag (I/Q)" icon from the evaluation bar to the SmartGrid.

Figure 4-12: Inserting a Real/Imag diagram for I/Q analysis

e) Close the SmartGrid mode.

The "IQ Analyzer" channel displays the real and imaginary signal parts in separate windows.

To display the MultiView tab

An overview of all active channels is provided in the "MultiView" tab. This tab is always displayed and cannot be closed.

► Tap the "MultiView" tab.

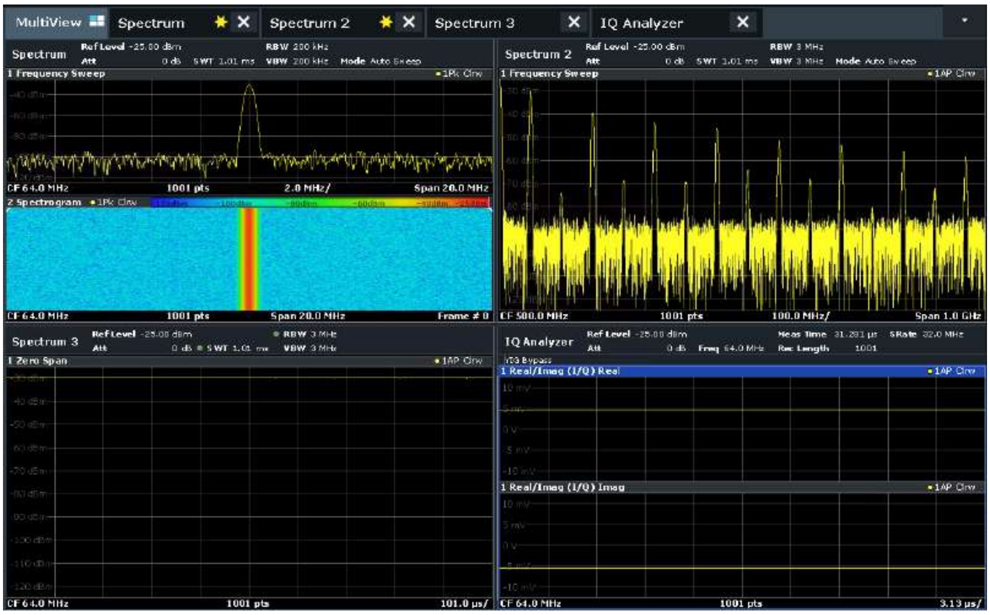


Figure 4-13: The "MultiView" tab

4.4.4 Performing sequential measurements

Although only one measurement can be performed at any one time, the measurements configured in the active channels can be performed sequentially, that means: one after the other, automatically, either once or continuously.

1. 

   Tap the "Sequencer" icon in the toolbar.
2. Toggle the "Sequencer" softkey in the "Sequencer" menu to "On".

   A continuous sequence is started, i.e. each channel measurement is performed one after the other until the Sequencer is stopped.

Figure 4-14: "MultiView" tab with active Sequencer

In Figure 4-14, the "Spectrum 2" measurement is currently active (indicated by the "channel active" icon in the tab label).

3. Stop the Sequencer by tapping the "Sequencer" softkey again.

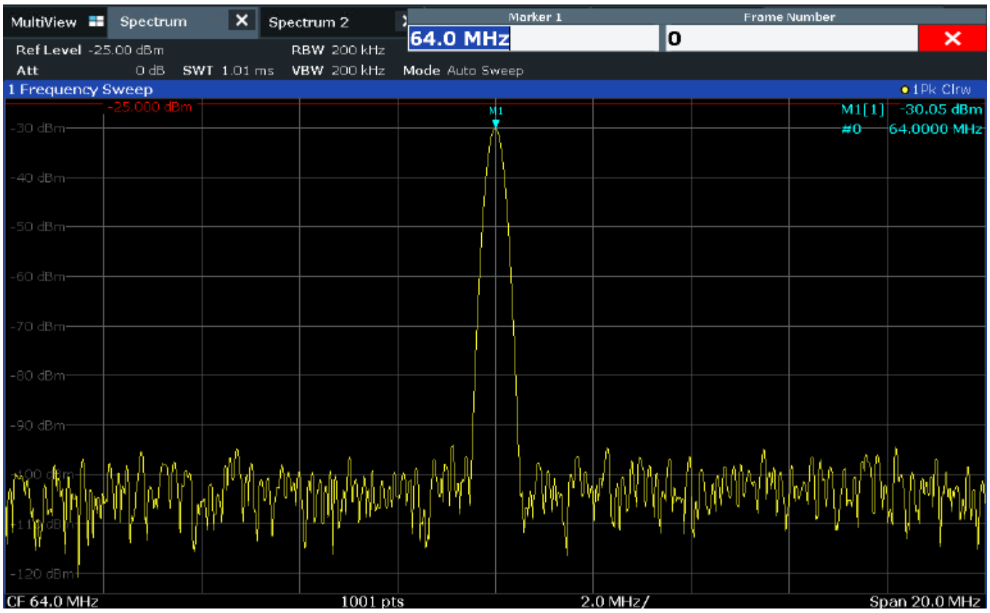
4.4.5 Setting and moving a marker

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 our first Spectrum measurement.

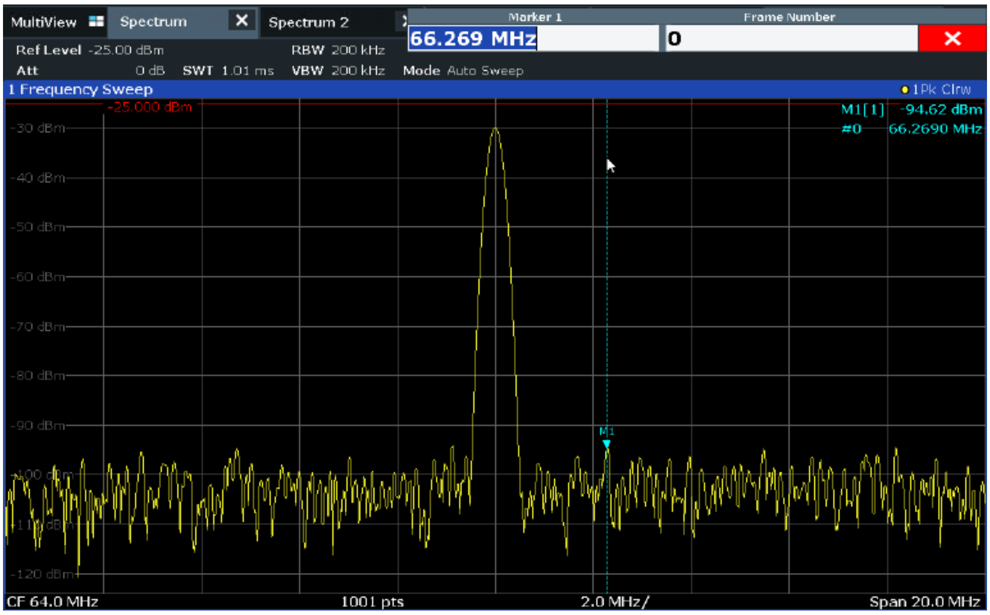
1. In the "MultiView" tab, double-tap the "Spectrum" window (frequency sweep with spectrogram display) to return to the "Spectrum" channel.
2. Tap the spectrum display to set the focus on that window.
3. 

   Press the "Split/Maximize" key on the front panel to maximize the spectrum window, as we currently do not need the spectrogram display.
4. Press the "RUN SINGLE" key on the front panel to perform a single sweep so we have a fixed trace to set a marker on.
5. Press the [MKR] key on the front panel to display the "Marker" menu.

   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].



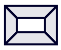
6. Now you can move the marker by tapping and dragging it to a different position. The current position is indicated by a dotted blue line. Notice how the position and value change in the marker area of the diagram.



4.4.6 Displaying a marker peak list

The marker peak list determines the frequencies and levels of peaks in the spectrum automatically. We will display a marker peak list for the Spectrum 2 channel.

1. Tap the "Spectrum 2" tab.

2. Press the "RUN SINGLE" key on the front panel to perform a single sweep for which we will determine the peaks.
3. 

   Tap the "SmartGrid" icon in the toolbar to activate SmartGrid mode.
4. Drag the "Marker Peak List" icon from the evaluation bar to the lower half of the display to add a new window for the peak list.
5. Close the SmartGrid mode.
6. To obtain a more conclusive peak list that does not contain noise peaks, for example, define a threshold that is higher than the noise floor:
   a) Press the [MKR] key on the front panel.
   b) Tap the "Marker Config" softkey in the "Marker" menu.
   c) Tap the "Search" tab in the "Marker" dialog box.
   d) In the "Threshold" field, enter *-68 dBm*.
   e) Tap the "State" box for "Threshold" to activate its use.
      Only peaks that are larger than -68 dBm will be included in the peak list.

   The marker peak list displays the determined peaks that are above the defined threshold.

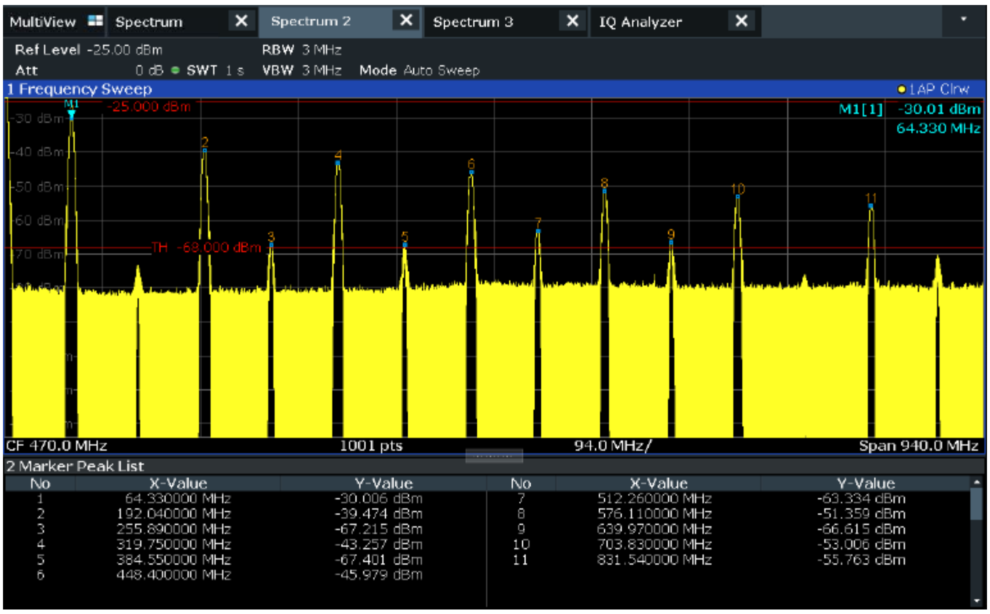


Figure 4-15: Marker Peak List

4.4.7 Zooming into the display

To analyze the areas around the peak levels in more detail, we will zoom into the top 3 peaks.

1. 

   Tap the "Multiple Zoom" icon in the toolbar.

   The icon is highlighted orange to indicate that multiple zoom mode is active.

2. Tap the diagram near the first peak and drag your finger to the opposite corner of the zoom area. A white rectangle is displayed from the point where you tapped to the current position.

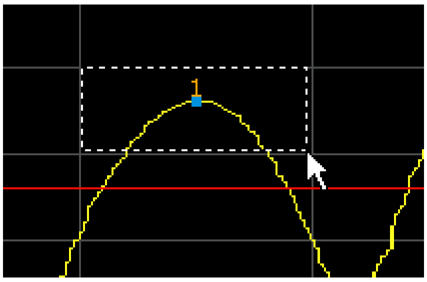


Figure 4-16: Defining the zoom area

When you remove your finger, the zoom area is enlarged in a second (sub-)window.

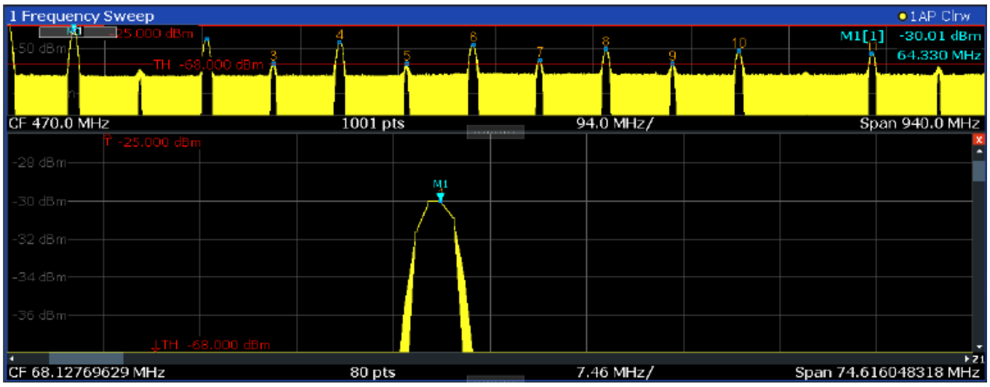


Figure 4-17: Zoomed display around a peak

3. In Figure 4-17, the enlarged peak is represented by a very thick trace. This is due to the insufficient number of sweep points. The missing sweep points for the zoomed display are interpolated, which provides poor results. To optimize the results, we will increase the number of sweep points from the default 1001 to 32001.

   a) Press the [Sweep] key on the front panel.
   b) Tap the "Sweep Config" softkey in the "Sweep" menu.
   c) In the "Sweep Points" field, enter *32001*.
   d) Press the RUN SINGLE key on the front panel to perform a new sweep with the increased number of sweep points.

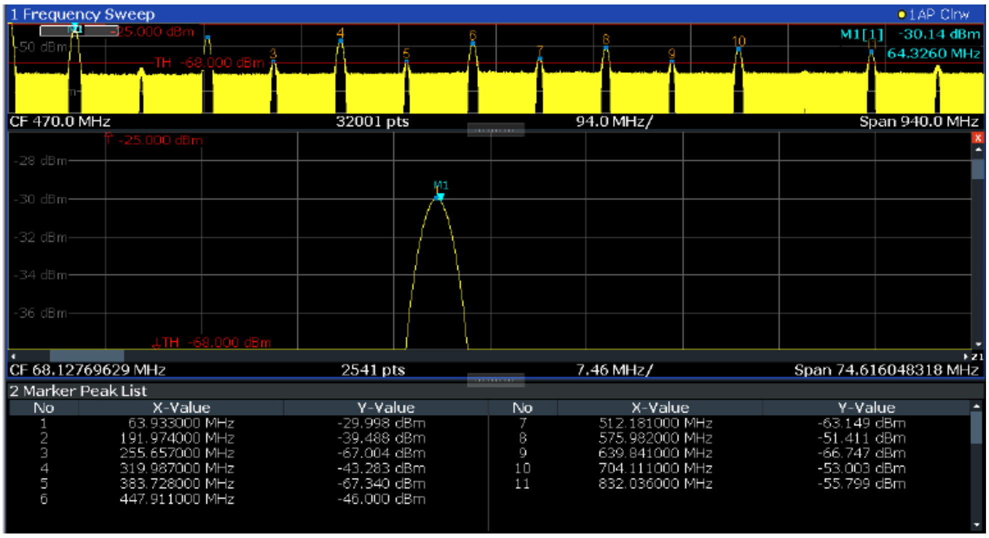


Figure 4-18: Zoomed peak with increased number of sweep points

Note that the trace becomes much more precise.

4. 

   Tap the "Multiple Zoom" icon in the toolbar again and define a zoom area around markers M4, M5 and M6.

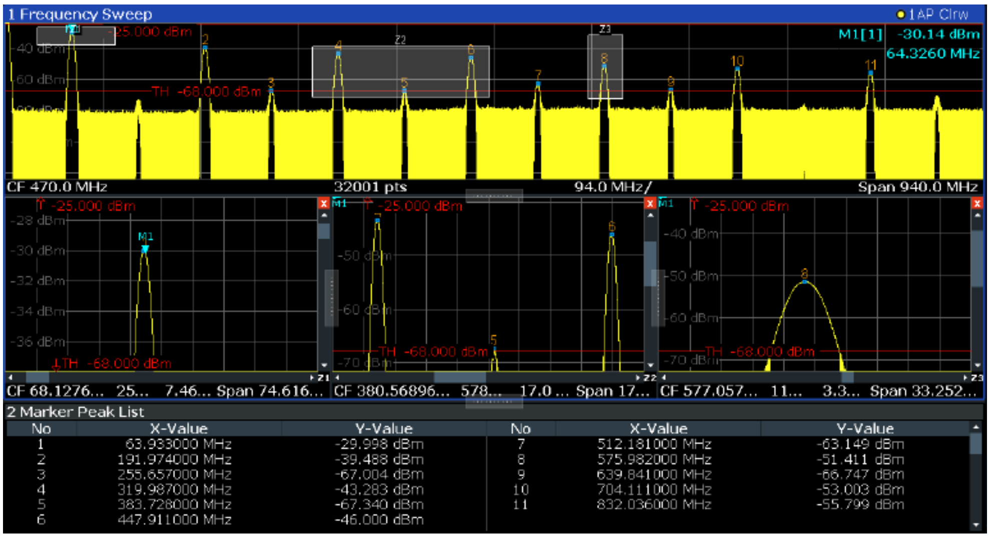


Figure 4-19: Multiple zoom windows

5. Tap the "Multiple Zoom" icon in the toolbar again and define a zoom area around marker M8.
6. To increase the size of the third zoom window, drag the "splitter" between the windows to the left or right or up or down.

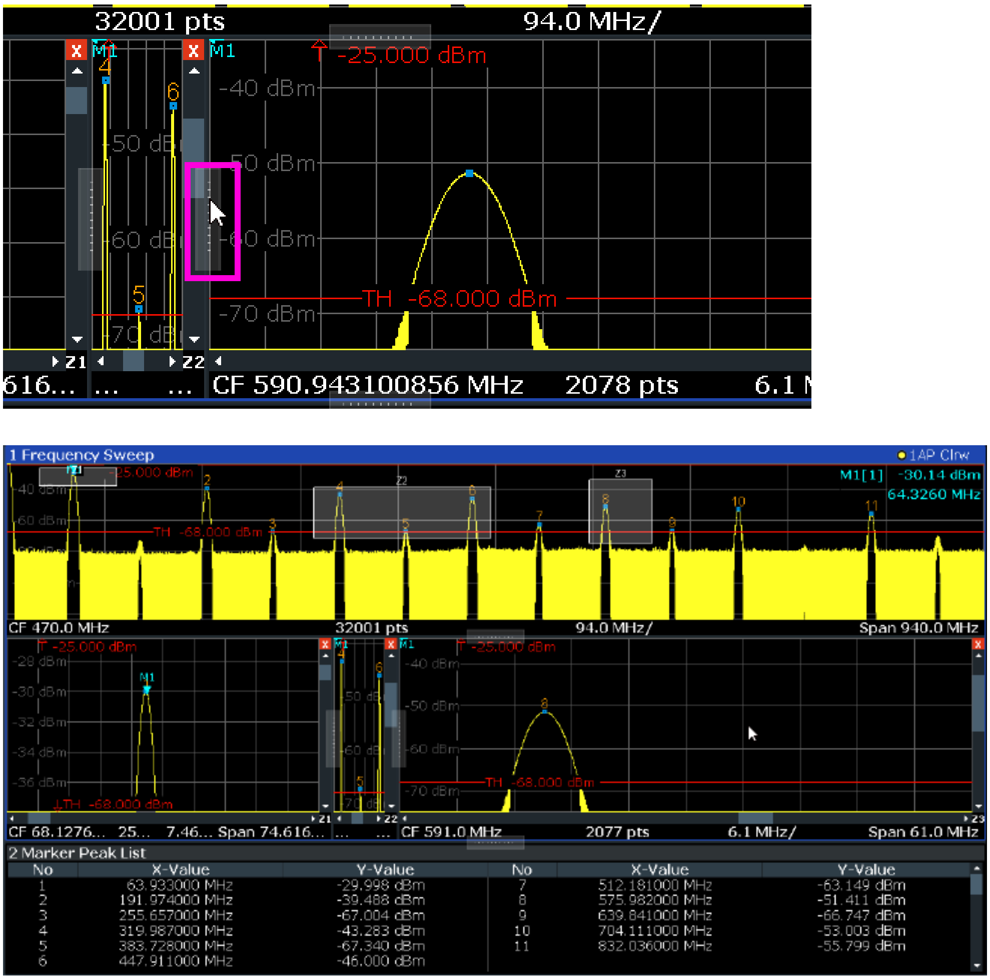


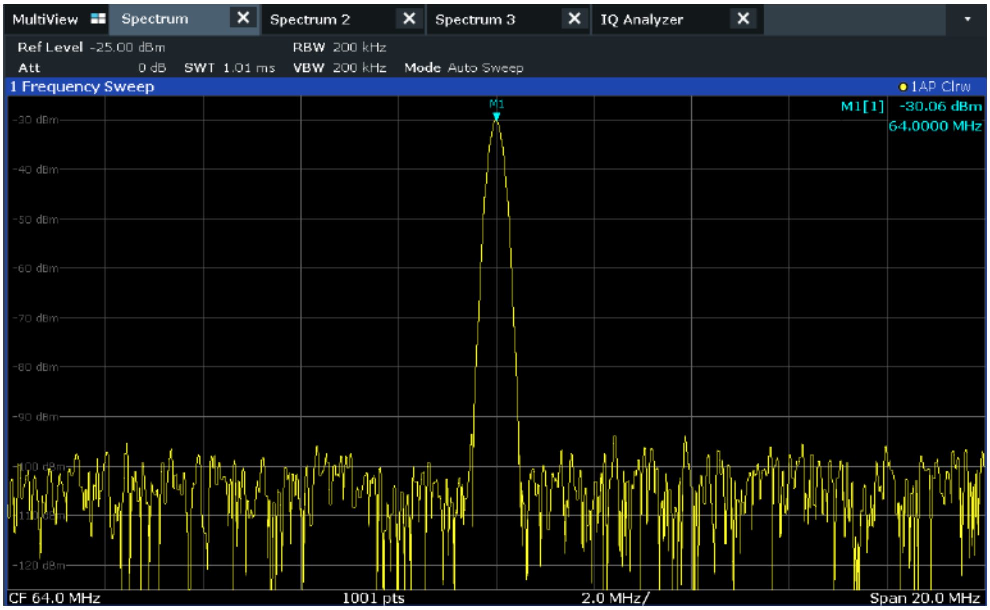
Figure 4-20: Enlarged zoom window

4.4.8 Zooming into the display permanently

The zoomed results from Chapter 4.4.7, "Zooming into the display", on page 50 were only graphical changes to the display. Now we would like to change the measurement settings such that the zoomed result is maintained permanently. We will demonstrate this in the Spectrum channel.

1. Tap the "Spectrum" tab.
2. Double-tap the diagram close to the peak of the measurement.

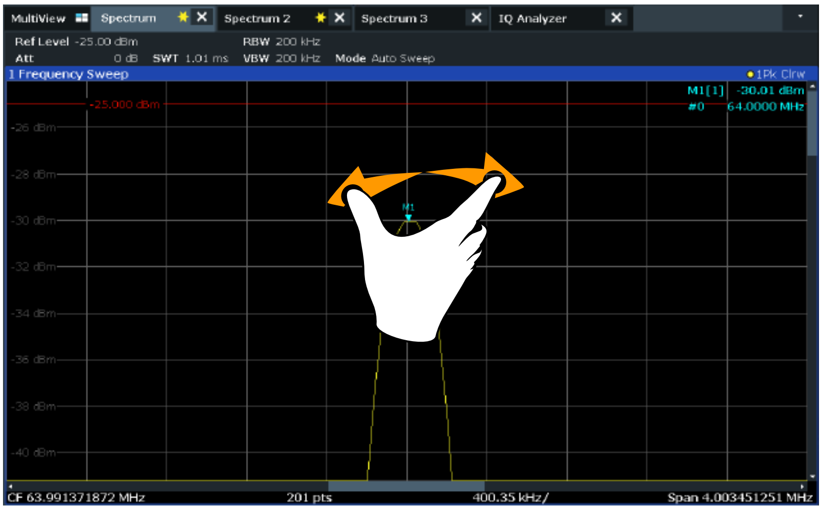
   A peak marker (M1) is inserted at the detected peak.



3. Select the (graphical) zoom icon on the toolbar.

   Any subsequent touch gestures define the zoom area for the zoom display.

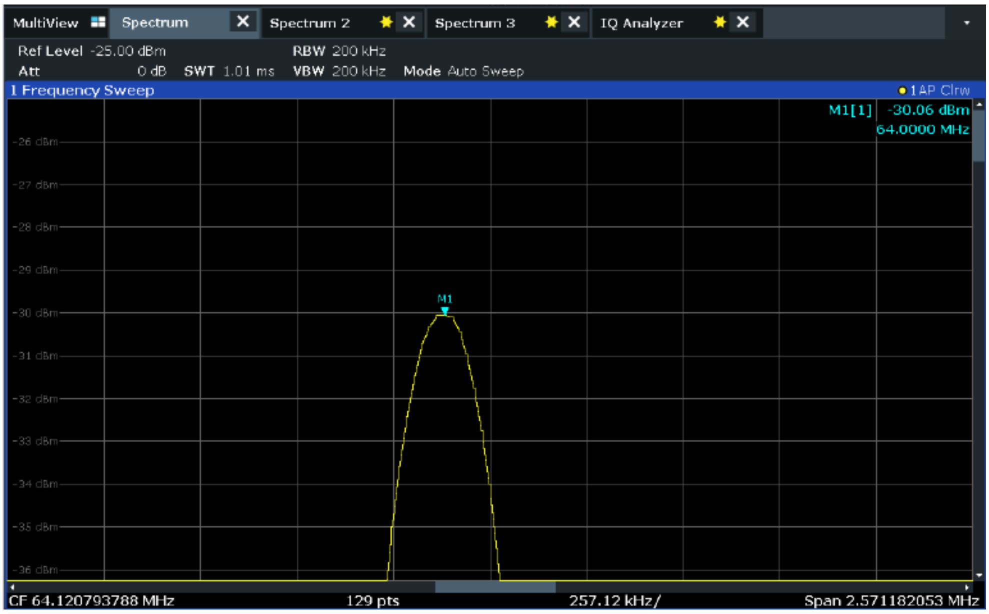
4. Place two fingers on the diagram, to the left and right of the marker, and stretch them apart.



   The area around the marker is enlarged in the result display.

5. When the area has the size you require, remove your fingers from the display.

   The displayed span and the number of displayed sweep points is smaller than before, all other measurement settings remain unchanged.



6. Tap the "Measurement Zoom" icon on the toolbar for a second or so.

   A context menu with further options is displayed.

7. Select "Adapt Hardware to Zoom (selected diagram)".

   The span of the measurement is changed, and due to the automatic coupling of the span to the sweep time, RBW and VBW, those values are also changed. The number of sweep points is restored to the default 1001. The range of the trace is the same as in the graphical zoom. However, due to the smaller RBW filter, the peak is narrower.

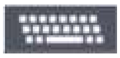
4.4.9 Saving settings

To restore the results of our measurements later, we will store the instrument settings to a file.

To save the instrument settings to a file

1. 

   Tap the "Save" icon in the toolbar.

2. 

   Press the keyboard key on the front panel to display the online keyboard, as you will have to enter text in the next step.

3. In the "Save" dialog box, tap the "File Name" field and enter *MyMultiViewSetup* using the keyboard.
   Keep the default "File Type" setting "Instrument with all Channels" to store the configuration of all channels.

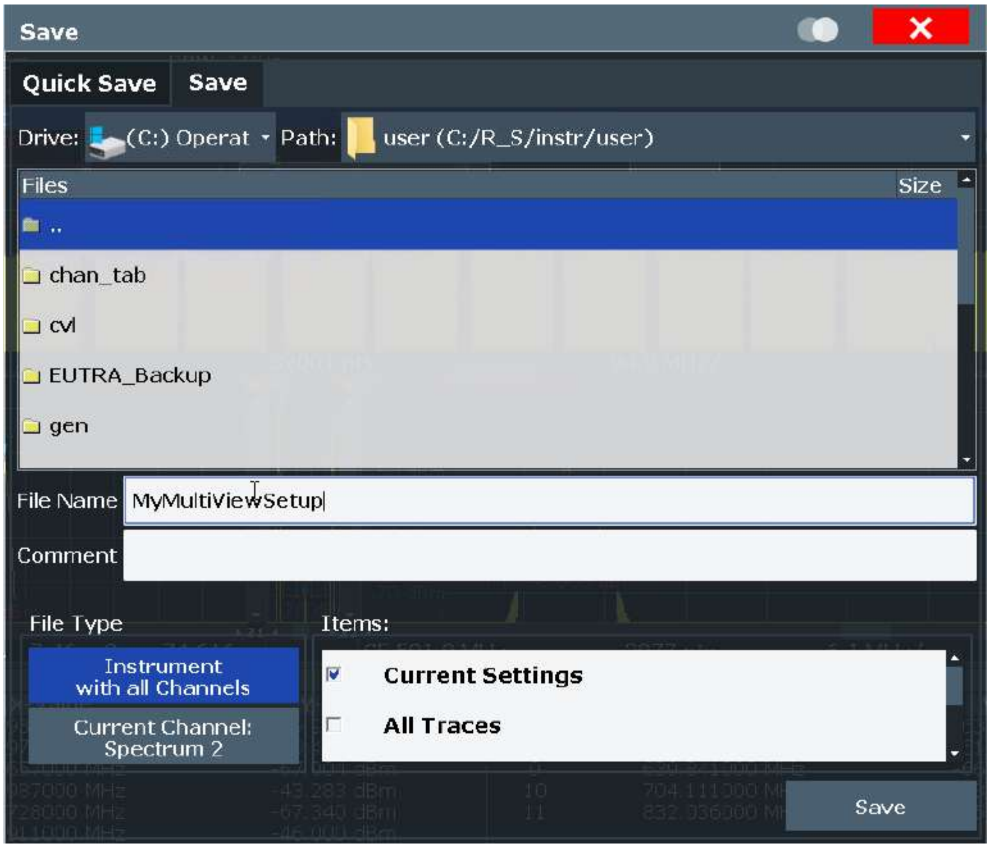


Figure 4-21: Saving the instrument settings to a file

4. Tap the "Save" button.

   The file `MyMultiViewSetup.dfl` is stored in the default directory `C:/R_S/instr/user`.

To load stored instrument settings

You can restore the settings to the instrument at any time using the settings file.

1. Press the [PRESET] button to restore the default instrument settings so you can check that the stored user settings are actually restored afterwards.
2. 

   Tap the "Load" icon in the toolbar.
3. In the "Load" dialog box, select the `MyMultiViewSetup.dfl` file in the default directory `C:/R_S/instr/user`.
4. Tap the "Load" button.

   All instrument settings are restored and the display should resemble Figure 4-20, which shows the instrument display right before the settings were stored.

4.4.10 Printing and saving results

Finally, after a successful measurement, we will document our results. First we will export the numeric trace data, then we will create a screenshot of the graphical display.

To export the trace data

1. Press the [TRACE] key on the front panel.
2. Tap the "Trace Config" softkey.
3. Tap the "Trace Export" tab.
4. Tap the "Export Trace to ASCII File" button.
5. Enter the file name *MyMultiViewResults*.

   The trace data is stored to `MyMultiViewResults.DAT`

To create a screenshot of the display

1. 

   Tap the "Print immediately" icon in the toolbar.

   A screenshot of the current display is created. Note that the colors on the screen are inverted in the screenshot to improve printout results.
2. In the "Save Hardcopy as Portable Network Graphics (PNG)" dialog box, enter a file name, e.g. *MyMultiViewDisplay*.

The screenshot is stored to `MyMultiViewDisplay.png`.

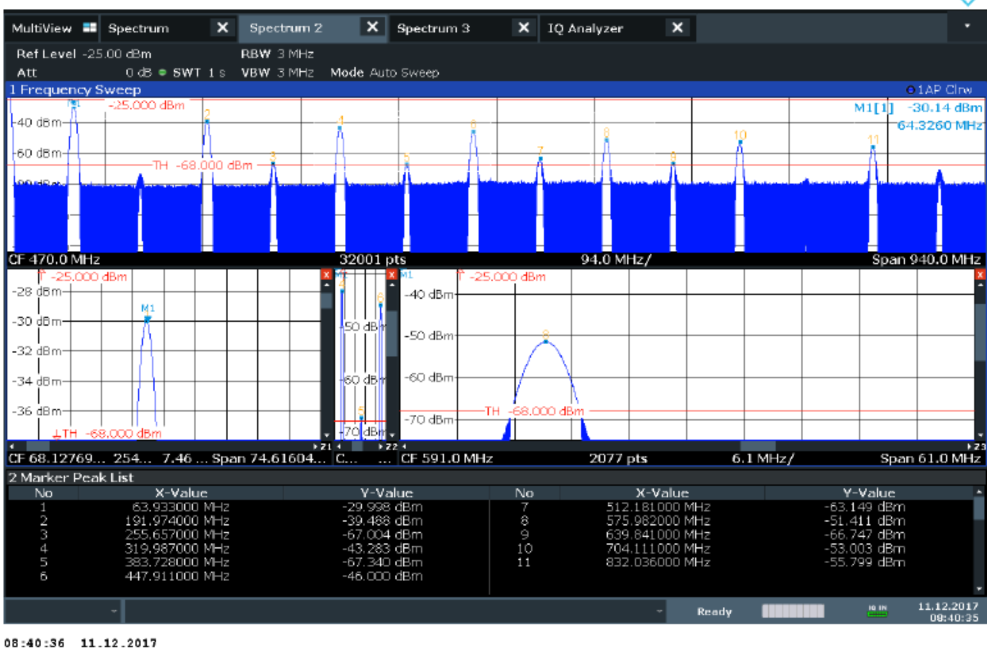


Figure 4-22: Screenshot of the current display

4.5 Operating the instrument

This chapter provides an overview on how to work with the R&S FSMR3.

Remote control

In addition to working with the R&S FSMR3 interactively, located directly at the instrument, it is also possible to operate and control it from a remote PC. Various methods for remote control are supported:

- Connecting the instrument to a (LAN) network
- Using the LXI browser interface in a LAN network
- Using the Windows Remote Desktop application in a LAN network
- Connecting a PC via the GPIB interface

How to configure the remote control interfaces is described in the R&S FSMR3 user manual.

4.5.1 Understanding the display information

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

Figure 4-23: Screen layout of the noise figure measurement application

1 = Toolbar
2 = Channel bar
3 = Diagram header
4 = Result display
5 = Status bar
6 = Softkey bar

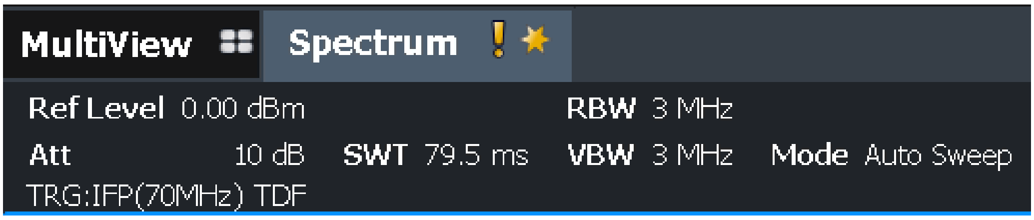
Hiding elements in the display

You can hide some of the elements in the display, for example the status bar or channel bar, to enlarge the display area for the measurement results. ("Setup > Display > Displayed Items")

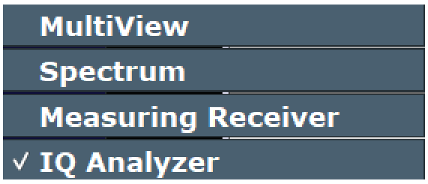
For details, see the R&S FSMR3 User Manual.

4.5.1.1 Channel bar

Using the R&S FSMR3 you can handle several different measurement tasks (channels) at the same time (although they can only be performed asynchronously). For each channel, a separate tab is displayed on the screen. To switch from one channel display to another, simply select the corresponding tab.

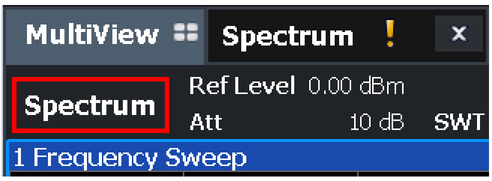


If many tabs are displayed, select the tab selection list icon at the right end of the channel bar. Select the channel you want to switch to from the list.



MultiView tab

An additional tab labeled "MultiView" provides an overview of all active channels at a glance. In the "MultiView" tab, each individual window contains its own channel bar with an additional button. Tap this button, or double-tap in any window, to switch to the corresponding channel display quickly.



Icons in the channel bar

The  yellow star icon on the tab label (sometimes referred to as a "dirty flag") indicates that invalid or inconsistent data is displayed, that is: the trace no longer matches the displayed instrument settings. Thiscan happen, 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.

The icon indicates that an error or warning is available for that measurement channel. This is particularly useful if the MultiView tab is displayed.

The icon indicates the currently active channel during an automatic measurement sequence (**Sequencer** functionality).

Channel-specific settings

Beneath the channel name, information on channel-specific settings for the measurement is displayed in the **channel bar**. Channel information varies depending on the active application.

In the Spectrum application, the R&S FSMR3 shows the following settings:

Table 4-6: Channel settings displayed in the channel bar in the spectrum application

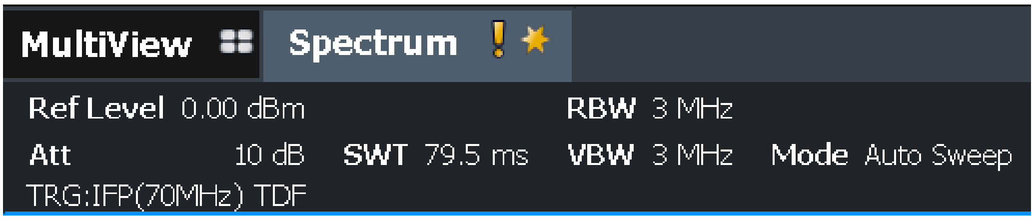
Ref Level	Reference level
m.+el.Att	Mechanical and electronic RF attenuation that has been set.
Ref Offset	Reference level offset
SWT	Sweep time that has been set. If the sweep time does not correspond to the value for automatic coupling, a bullet is displayed in front of the field. The color of the bullet turns red if the sweep time is set below the value for automatic coupling. In addition, the UNCAL flag is shown. In this case, the sweep time must be increased. For FFT sweeps, an estimated duration for data capture *and processing* is indicated behind the sweep time in the channel bar.
Meas Time/AQT	Measurement (acquisition) time, calculated from analysis bandwidth and number of samples (for statistics measurements)
RBW	Resolution bandwidth that has been set. If the bandwidth does not correspond to the value for automatic coupling, a green bullet appears in front of the field.
VBW	Video bandwidth that has been set. If the bandwidth does not correspond to the value for automatic coupling, a green bullet is displayed in front of the field.
AnBW	Analysis bandwidth (for statistics measurements)
Compatible	Compatible device mode (FSP, FSU, default; default not displayed)
Mode	Indicates which sweep mode type is selected: ● "Auto FFT": automatically selected FFT sweep mode ● "Auto sweep": automatically selected swept sweep mode ● "Sweep": manually selected frequency sweep mode ● "FFT": manually selected FFT sweep mode

Icons for individual settings

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.

Common settings

The channel bar above the diagram not only displays the channel-specific settings. It also displays information on instrument settings that affect the measurement results even though it 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 following types of information are displayed, if applicable.

Table 4-7: Common settings displayed in the channel bar

"SGL"	The sweep is set to single sweep mode.
"Sweep Count"	The current signal count for measurement tasks that involve a specific number of subsequent sweeps (see "Sweep Count" setting in "Sweep settings" in the User Manual)
"TRG"	Trigger source (for details see "Trigger settings" in the User Manual) ● **EXT**: External ● **IFP**: IF power (+trigger bandwidth) ● **PSE**: Power sensor ● **RFP**: RF power ● **SQL**: Squelch ● **TIM**: Time ● **VID**: Video
"6dB"/"RRC"/"CHN"	Filter type for sweep bandwidth
"PA" /Ext "PA"	The preamplifier is activated. / Data compensation is performed using data from the (optional) external preamplifier.
"YIG Bypass"	The YIG filter is deactivated.
"GAT"	The frequency sweep is controlled via the TRIGGER INPUT connector.
"TDF"	The specified transducer factor is activated.
"75 Ω"	The input impedance of the instrument is set to 75 Ω.
"FRQ"	A frequency offset ≠ 0 Hz is set.
"DC/AC"	DC or AC coupling is used for the input.

Changing the Channel Name

The measurement channels are labeled with their default name. If that name already exists, a sequential number is added. You can change the name of the measurement channel by double-tapping the name in the channel bar and entering a new name.

For an overview of default names, see `INSTrument:LIST?` on page 395.

Note: Channel name restrictions. Channel names can have a maximum of 31 characters, and must be compatible with the Windows conventions for file names. In particular, they must not contain special characters such as ":", "*", "?".

Remote command:
INSTrument:REName on page 396

4.5.1.2 Window title bar

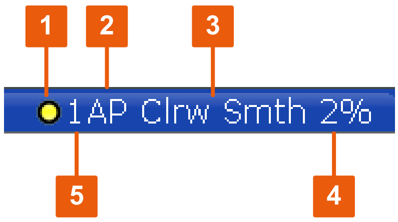
Each channel in the R&S FSMR3 display can contain several windows. Each window can display either a graph or a table as a result of the channel measurement. Which type of result evaluation is displayed in which window is defined in the display configuration (see Chapter 4.5.5, "Displaying results", on page 76). The window title bar indicates which type of evaluation is displayed.

Double-tap the window title bar to enlarge the window temporarily. Double-tap it again to restore the original size.

See also Chapter 4.5.5.4, "Switching between a split and maximized window display", on page 82.

Trace Information in Window Title Bar

Information on the displayed traces is indicated in the window title bar.



(1) **Trace color**		Color of trace display in diagram
(2) **Trace no.**		Trace number (1 to 6)
(3) **Detector**		Selected detector:
	AP	AUTOPEAK detector
	Pk	MAX PEAK detector
	Mi	MIN PEAK detector
	Sa	SAMPLE detector
	Av	AVERAGE detector
	Rm	RMS detector
	QP	QUASIPEAK detector
(4) **Trace Mode**		**Sweep mode:**
	Clrw	CLEAR/WRITE

	Max	MAX HOLD
	Min	MIN HOLD
	Avg	AVERAGE (Lin/Log/Pwr)
	View	VIEW
(5) **Smoothing factor**	Smth	Smoothing factor, if enabled.
Norm/NCor		Correction data is not used.

4.5.1.3 Marker information

Marker information is provided either in the diagram grid or in a separate marker table, depending on the configuration.

Marker information in diagram grid

Within the diagram grid, the x-axis and y-axis positions of the last two markers or delta markers that were set are displayed, if available, as well as their index. The value in the square brackets after the index indicates the trace to which the marker is assigned. (Example: M2[1] defines marker 2 on trace 1.) For more than two markers, a separate marker table is displayed beneath the diagram by default.

Marker information in marker table

In addition to the marker information displayed within the diagram grid, a separate marker table may be displayed beneath the diagram. This table provides the following information for all active markers:

Type	Marker type: N (normal), D (delta), T (temporary, internal), PWR (power sensor)
Ref	Reference (for delta markers)
Trc	Trace to which the marker is assigned
X-value	X-value of the marker
Y-value	Y-value of the marker
Func	Activated marker or measurement function
Func .Result	Result of the active marker or measurement function

The functions are indicated with the following abbreviations:

FXD	Fixed reference marker
PHNoise	Phase noise measurement
CNT	Signal count
TRK	Signal tracking
NOIse	Noise measurement

MDepth	AM modulation depth
TOI	Third order intercept measurement

4.5.1.4 Frequency and span information in diagram footer

The information in the diagram footer (beneath the diagram) depends on the current application, measurement, and result display.

For a default measurement in the Spectrum mode, the Diagram result display contains the following information, for example:

Label	Information
CF	Center frequency
Span	Frequency span (frequency domain display)
ms/	Time per division (time domain display)
Pts	Number of sweep points or (rounded) number of currently displayed points in zoom mode

4.5.1.5 Instrument and status information

Global instrument settings and functions (such as LXI configuration mode), the instrument status and any irregularities are indicated in the status bar beneath the diagram.

In the MultiView tab, the status bar always displays the information for the currently selected measurement.

The following information is displayed:

Instrument status

	The instrument is configured for operation with an external reference.

Progress

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

In the MultiView tab, the progress bar indicates the status of the currently selected measurement, not the measurement a Sequencer is currently performing, for example.

Date and time

The date and time settings of the instrument are 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.

4.5.1.6 Error information

If errors or irregularities are detected, a keyword and an error message, if available, are displayed in the status bar.

Depending on the type of message, the status message is indicated in varying colors.

Table 4-8: Status bar information - color coding

Color	Type	Description
Red	Error	An error occurred at the start or during a measurement, e.g. due to missing data or wrong settings, so that the measurement cannot be started or completed correctly.
Orange	Warning	An irregular situation occurred during measurement, e.g. the settings no longer match the displayed results, or the connection to an external device was interrupted temporarily.
Gray	Information	Information on the status of individual processing steps.
No color	No errors	No message displayed - normal operation.
Green	Measurement successful	Some applications visualize that the measurement was successful by showing a message.

If any error information is available for a channel, an exclamation mark is displayed next to the channel name (!). This is particularly useful when the MultiView tab is displayed, as the status bar in the MultiView tab always displays the information for the currently selected channel only.

For a description of possible errors, see the R&S FSMR3 user manual.

4.5.2 Accessing the functionality

All tasks necessary to operate the instrument can be performed using this user interface. Apart from instrument specific keys, all other keys that correspond to an external keyboard (e.g. arrow keys, ENTER key) operate conform to Microsoft.

For most tasks, there are at least 2 alternative methods to perform them:

- Using the touchscreen
- Using other elements provided by the front panel, e.g. the keypad, rotary knob, or arrow and position keys.

The measurement and instrument functions and settings can be accessed by selecting one of the following elements:

- System and function keys on the front panel of the instrument
- Softkeys on the touchscreen
- Context menus for specific elements on the touchscreen
- Icons on the tool bar in the touchscreen
- Displayed setting on the touchscreen

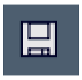
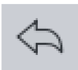
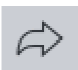
4.5.2.1 Toolbar

Standard functions can be performed via the icons in the toolbar at thetop of the screen.

You can hide the toolbar display, e.g. when using remote control, to enlarge the display area for the measurement results ("Setup > Display > Displayed Items"). See the R&S FSMR3 User Manual for details.

The following functions are available by default:

Table 4-9: Standard Application Functions in the Toolbar

Icon	Description
	Windows: displays the Windows "Start" menu and task bar
	Open: opens a file from the instrument ("Save/Recall" menu)
	Store: stores data on the instrument ("Save/Recall" menu)
	Print: defines print settings ("Print" menu)
	Undo: reverts last operation
	Redo: repeats previously reverted operation

Icon	Description
	Measurement zoom: applies to the next display you select; Displays a dotted rectangle in the diagram that can be expanded to define the zoom area; the selected diagram is replaced by a new diagram with adapted measurement settings which displays the selected extract of the trace. Also provides a context menu to determine the firmware behavior for touch gestures: ● "Level Lock" (Default:) The reference level (and thus the attenuation) remains unchanged during touch gestures on the screen. ● "X-Lock" The x-axis of the diagram is not changed during subsequent touch gestures. ● "Y-Lock" The y-axis of the diagram is not changed during subsequent touch gestures. ● "Adapt Measurement to Zoom (selected diagram)" Automatically adapts the measurement settings to the currently zoomed display
	(Graphical) Zoom mode: applies to the next display you select; Displays a dotted rectangle in the diagram that can be expanded to define the zoom area; the selected diagram is replaced by a new diagram which displays an enlarged extract of the trace. This function changes the behavior of finger gestures such as dragging or stretching a finger (see also "Touch gestures in diagrams change measurement settings" on page 75)
	Multiple (graphical) zoom mode: applies to the next display you select; Allows you to enlarge several different areas of the trace simultaneously. Displays a dotted rectangle in the diagram that can be expanded to define the zoom area; a subwindow is added to display an enlarged extract of the trace This function changes the behavior of finger gestures such as dragging or stretching a finger (see also "Touch gestures in diagrams change measurement settings" on page 75)
1:1	Zoom off: displays the diagram in its original size This function only restores graphically zoomed displays. Measurement zooms, for which measurement settings were adapted, remain untouched.
	SmartGrid: activates "SmartGrid" mode to configure the screen layout
	Sequencer: opens the "Sequencer" menu to perform consecutive measurements
	Help (+ Select): allows you to select an object for which context-specific help is displayed
	Help: displays context-sensitive help topic for currently selected element
	Print immediately: prints the current display (screenshot) as configured
In "SmartGrid" mode only:	
	Exit "SmartGrid" mode

4.5.2.2 Softkeys

Softkeys are virtual keys provided by the software. Thus, more functions can be provided than those that can be accessed directly via the function keys on the instrument. Softkeys are dynamic, i.e. depending on the selected function key, a different list of softkeys is displayed on the right side of the screen.

A list of softkeys for a certain function key is also called a menu. Softkeys can either perform a specific function or open a dialog box.

The "More" softkey indicates that the menu contains more softkeys than can be displayed at once on the screen. When pressed, it displays the next set of softkeys.

Recognizing the softkey status by color

Color	Meaning
Orange	Associated dialog box is open
Blue	Associated function is active; for toggle keys: currently active state
Gray	Instrument function is temporarily not available due to a specific setting or missing option

You can hide the softkey display, e.g. when using remote control, to enlarge the display area for the measurement results ("Setup > Display > Displayed Items"). See the User Manual for details.

4.5.2.3 Context menus

Several items in the diagram area have context menus, such as traces, markers, softkeys, or settings in the channel bar. If you right-click on one of these items (or tap it for about 1 second), a menu is displayed with context-specific menu items for the selected item.

If SCPI Recording is available, the context menu contains a link to the SCPI recorder functions and a link to a help topic for the specific item.

For details, see Chapter 11.5.1, "The context-sensitive SCPI command menu", on page 340.

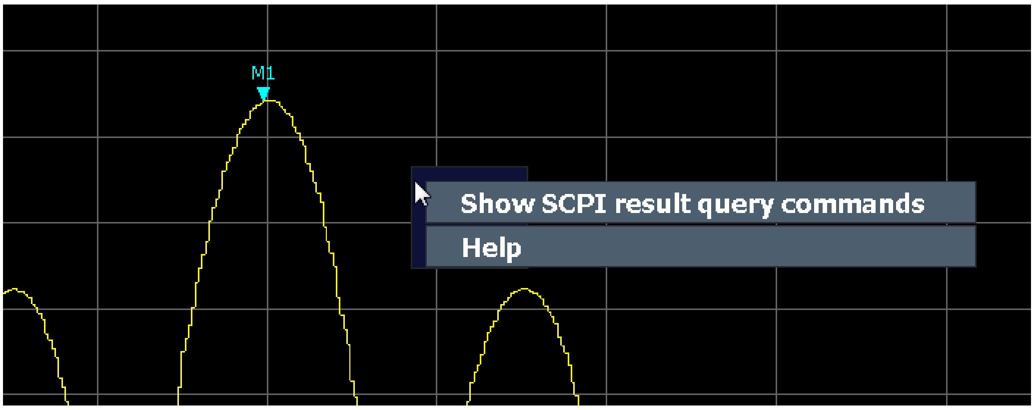


Figure 4-24: Context menu for a result display with SCPI Recorder functions

If SCPI Recorder functions are not available, for example for channel bar settings or in some applications, the context menu contains functions for the selected item. These functions correspond to the functions also provided for the item in softkey menus. This is useful, for example, when the softkey display is hidden.

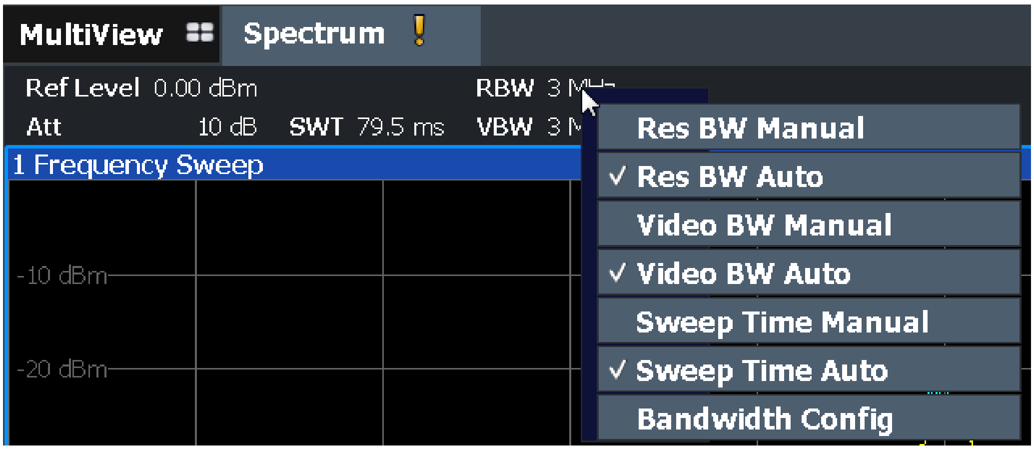
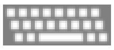


Figure 4-25: Context menu for channel bar setting

4.5.2.4 On-screen keyboard

The on-screen keyboard is an additional means of interacting with the instrument without having to connect an external keyboard.

The on-screen keyboard display can be switched on and off as desired using the "On-Screen Keyboard" function key beneath the screen.



When you press this key, the display switches between the following options:

- Keyboard displayed at the top of the screen
- Keyboard displayed at the bottom of the screen
- No keyboard displayed

You can use the TAB key on the on-screen keyboard to move the focus from one field to another in dialog boxes.

4.5.3 Entering data

You can enter data in dialog boxes using any of the following methods:

- Using the touchscreen, via the on-screen keyboard
- Using other elements provided by the front panel, e.g. the keypad, rotary knob, or navigation keys
  The rotary knob acts like the [ENTER] key when it is pressed.
- Using a connected external keyboard

Transparent dialog boxes

You can change the transparency of the dialog boxes to see the results in the windows behind the dialog box. Thus, you can see the effects that the changes you make to the settings have on the results immediately.

To change the transparency, select the transparency icon at the top of the dialog box. A slider is displayed. To hide the slider, select the transparency icon again.

(The title bar of the dialog box is always slightly transparent and is not affected by the slider.)

Particularities in Windows dialog boxes

In some cases, e.g. if you want to install a printer, original Windows dialog boxes are used. In these dialog boxes, the rotary knob and function keys do not work. Use the touchscreen instead.

4.5.3.1 Entering numeric parameters

If a field requires numeric input, the keypad provides only numbers.

1. Enter the parameter value using the keypad, or change the currently used parameter value by using the rotary knob (small steps) or the [UP] or [DOWN] keys (large steps).
2. After entering the numeric value via keypad, press the corresponding unit key.
   The unit is added to the entry.
3. If the parameter does not require a unit, confirm the entered value by pressing the [ENTER] key or any of the unit keys.
   The editing line is highlighted to confirm the entry.

4.5.3.2 Entering alphanumeric parameters

If a field requires alphanumeric input, you can use the on-screen keyboard to enter numbers and (special) characters (see Chapter 4.5.2.4, "On-screen keyboard", on page 70).

Alternatively, you can use the keypad. Every alphanumeric key represents several characters and one number. The decimal point key (.) represents special characters, and the sign key (-) toggles between capital and small letters. For the assignment, refer to Table 4-10.

You can change the default behavior of the keypad for text input. This is useful if you frequently enter numeric values in text fields, for example to define file names consisting of numbers.

For details, see "Number block behavior" on page 300.

To enter numbers and (special) characters via the keypad

1. Press the key once to enter the first possible value.
2. All characters available via this key are displayed.
3. To choose another value provided by this key, press the key again, until your desired value is displayed.
4. With every key stroke, the next possible value of this key is displayed. If all possible values have been displayed, the series starts with the first value again. For information on the series, refer to Table 4-10.
5. To change from capital to small letters and vice versa, press the sign key (-).
6. When you have chosen the desired value, wait for 2 seconds (to use the same key again), or start the next entry by pressing another key.

To enter a blank

► Press the "Space" bar, or press the "0" key and wait 2 seconds.

To correct an entry

1. Using the arrow keys, move the cursor to the right of the entry you want to delete.
2. Press the [BACKSPACE] key.
   The entry to the left of the cursor is deleted.
3. Enter your correction.

To complete the entry

► Press the [ENTER] key or the rotary knob.

To abort the entry

► Press the [ESC] key.
The dialog box is closed without changing the settings.

Table 4-10: Keys for alphanumeric parameters

Key name (upper inscription)	Series of (special) characters and number provided
7	7 µ Ω ° € ¥ $ ¢
8	A B C 8 Ä ÆÅ Ç
9	D E F 9 É
4	G H I 4
5	J K L 5
6	M N O 6 Ň Ö
1	P Q R S 1
2	T U V 2 Ü
3	W X Y Z 3
0	<blank> 0 – @ + / \ < > = % &
.	. * : _ , ; " ' ? ( ) #
–	<toggles between capital and small letters>

4.5.4 Touchscreen gestures

A touchscreen allows you to interact with the software using various finger gestures on the screen. The basic gestures supported by the software and most applications are described here. Further actions using the same gestures may be possible.

Tapping

Touch the screen quickly, usually on a specific element.

You can tap most elements on the screen; in particular, any elements you can also click on with a mouse pointer.

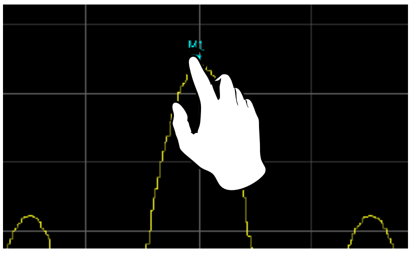
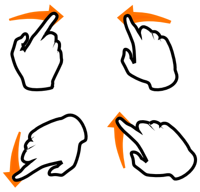


Figure 4-26: Tapping

Double-tapping

Tap the screen twice, in quick succession.

Double-tap a diagram or the window title bar to maximize a window in the display, or to restore the original size.



Dragging

Move your finger from one position to another on the display, keeping your finger on the display the whole time.

By dragging your finger over a table or diagram you can pan the displayed area of the table or diagram to show results that were previously out of view.

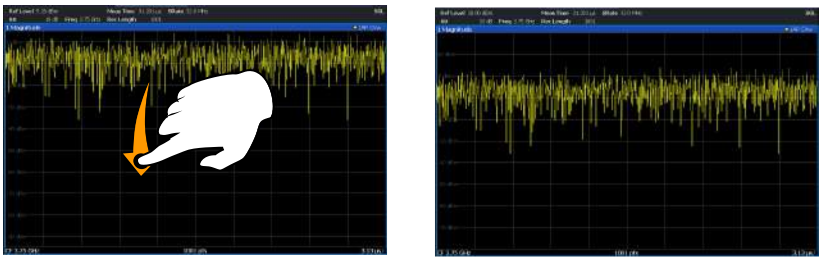
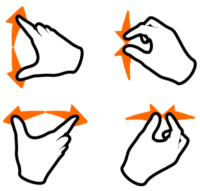


Figure 4-27: Dragging



Pinching and spreading two fingers

Move two fingers together on the display (pinch) or move two fingers apart on the display (spread).

When you pinch two fingers in the display, you decrease the size of the currently displayed area, showing the surrounding areas previously out of view.

When you spread two fingers in the display, you increase the size of the currently displayed area, showing more details.

You can pinch or spread your fingers vertically, horizontally, or diagonally. The direction in which you move your fingers determines which dimension of the display is changed.

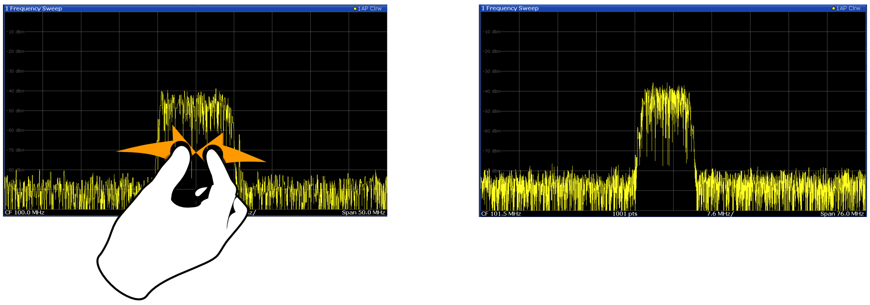


Figure 4-28: Pinching

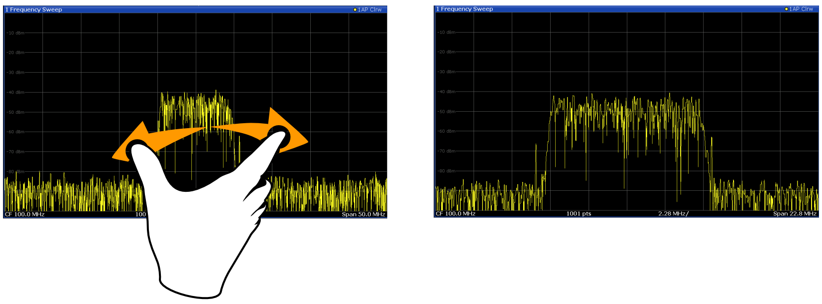
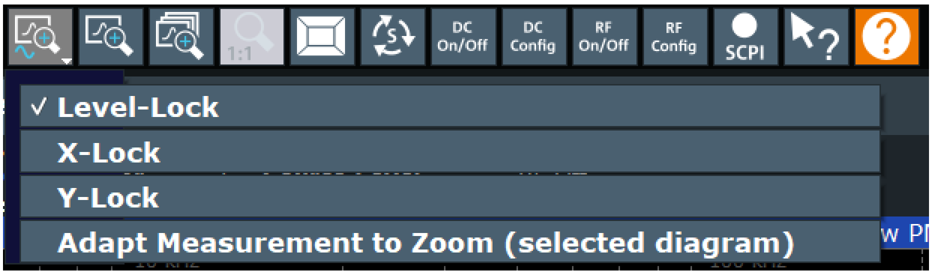


Figure 4-29: Spreading

Touch gestures in diagrams change measurement settings

When you change the display using touch gestures, the corresponding measurement settings are adapted. This is different to selecting an area on the screen in zoom mode, where merely the resolution of the displayed trace points is changed temporarily (graphical zoom).

You can prevent the firmware from changing specific settings using the options in the context menu for the measurement zoom icon. By default, the reference level is locked and thus not changed automatically due to touch gestures.



Mouse vs. touch actions

Any user interface elements that react to actions by a mouse pointer also react to finger gestures on the screen, and vice versa. The following touch actions correspond to mouse actions:

Table 4-11: Correlation of mouse and touch actions

Mouse operation	Touch operation
Click	Tap
Double-click	Double-tap
Click and hold	Touch and hold
Right-click	Touch, hold for 1 second and release
Drag-&-drop (= click and hold, then drag and release)	Touch, then drag and release
Mouse wheel to scroll up or down	Swipe
Dragging scrollbars to scroll up or down, left or right	Swipe
In (graphical) Zoom mode only: dragging the borders of the displayed rectangle to change its size	Touch, then drag and release

Example:

You can scroll through a long table in conventional mouse operation by clicking in the table's scrollbar repeatedly. In touch operation, you would scroll through the table by dragging the table up and down with your finger.

4.5.5 Displaying results

The R&S FSMR3 provides several instrument applications for different analysis tasks and different types of signals, for example the Measuring Receiver application, the Spectrum application or the I/Q Analyzer. For each application, a new measurement channel is created and displayed in a separate tab on the screen.

The results of a measurement channel can be evaluated in many different ways, both graphically and numerically. For each evaluation method the results are displayed in a separate window in the tab.

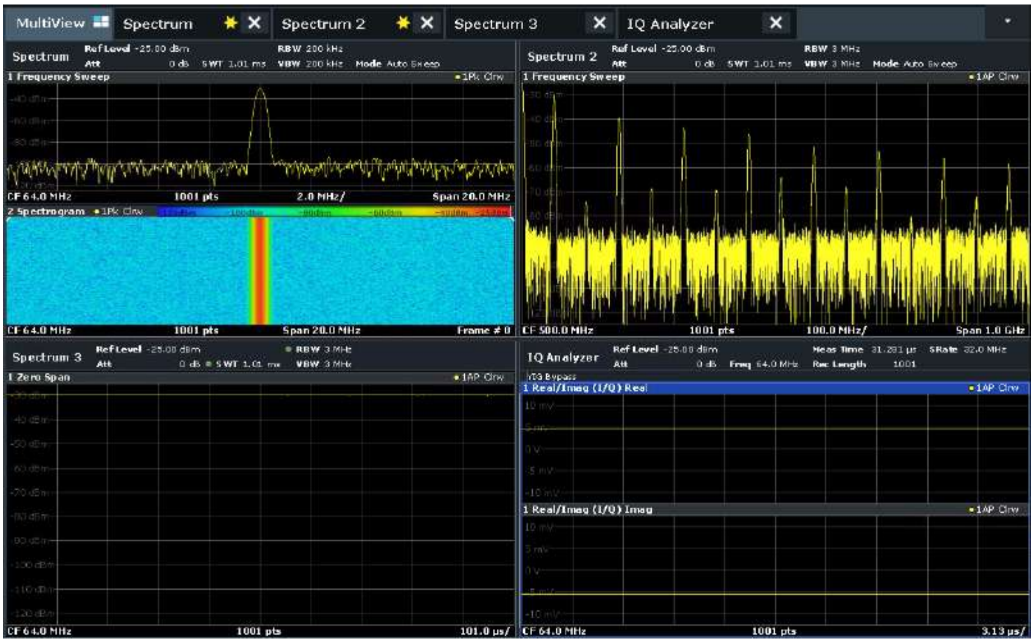
The R&S FSMR3 allows you to configure the display to suit your specific requirements and optimize analysis.

4.5.5.1 Activating and deactivating 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. Each channel is displayed in a separate tab on the screen.

An additional tab ("MultiView") provides an overview of all currently active channels at once.

Only one measurement can be performed at any time, namely the one in the currently active channel. However, in order to perform the configured measurements consecutively, a Sequencer function is provided.



To start a new channel

1. Select the [Mode] key.
2. In the "Mode" dialog box, select the required application on the "New Channel" tab.
   A new tab is displayed for the new channel.

Remote command:

`INSTrument:CREate[:NEW]` on page 394/ `INSTrument:CREate:DUPLicate` on page 394

To change the application in an active channel

1. Select the tab of the channel you want to change.
2. Select the [Mode] key.
3. In the "Mode" dialog box, select the new application to be displayed on the "Replace Current Channel" tab.
   The selected application is displayed in the current channel.

Remote command:

`INSTrument:CREate:REPLace` on page 394

To close a measurement channel

► 

Select the "Close" icon on the tab of the measurement channel.

The tab is closed, any running measurements are aborted, and all results for that channel are deleted.

Remote command:

`INSTrument:DELete` on page 395

4.5.5.2 Laying out the result display with the smartgrid

Measurement results can be evaluated in many different ways, for example graphically, as summary tables, statistical evaluations etc. Each type of evaluation is displayed in a separate window in the channel tab. Up to 16 individual windows can be displayed per channel (i.e. per tab). To arrange the diagrams and tables on the screen, the Rohde & Schwarz SmartGrid function helps you find the target position simply and quickly.

Principally, the layout of the windows on the screen is based on an underlying grid, the SmartGrid. However, the SmartGrid is dynamic and flexible, allowing for many different layout possibilities. The SmartGrid functionality provides the following basic features:

- Windows can be arranged in columns or in rows, or in a combination of both.
- Windows can be arranged in up to four rows and four columns.
- Windows are moved simply by dragging them to a new position on the screen, possibly changing the layout of the other windows, as well.
- All evaluation methods available for the currently selected measurement are displayed as icons in the evaluation bar. If the evaluation bar contains more icons than can be displayed at once on the screen, it can be scrolled vertically. The same evaluation method can be displayed in multiple windows simultaneously.
- New windows are added by dragging an evaluation icon from the evaluation bar to the screen. The position of each new window depends on where you drop the evaluation icon in relation to the existing windows.
- All display configuration actions are only possible in SmartGrid mode. When SmartGrid mode is activated, the evaluation bar replaces the current softkey menu display. When the SmartGrid mode is deactivated again, the previous softkey menu display is restored.

Background information: the smartgrid principle

SmartGrid display

During any positioning action, the underlying SmartGrid is displayed. Different colors and frames indicate the possible new positions. The position in the SmartGrid where you drop the window determines its position on the screen.

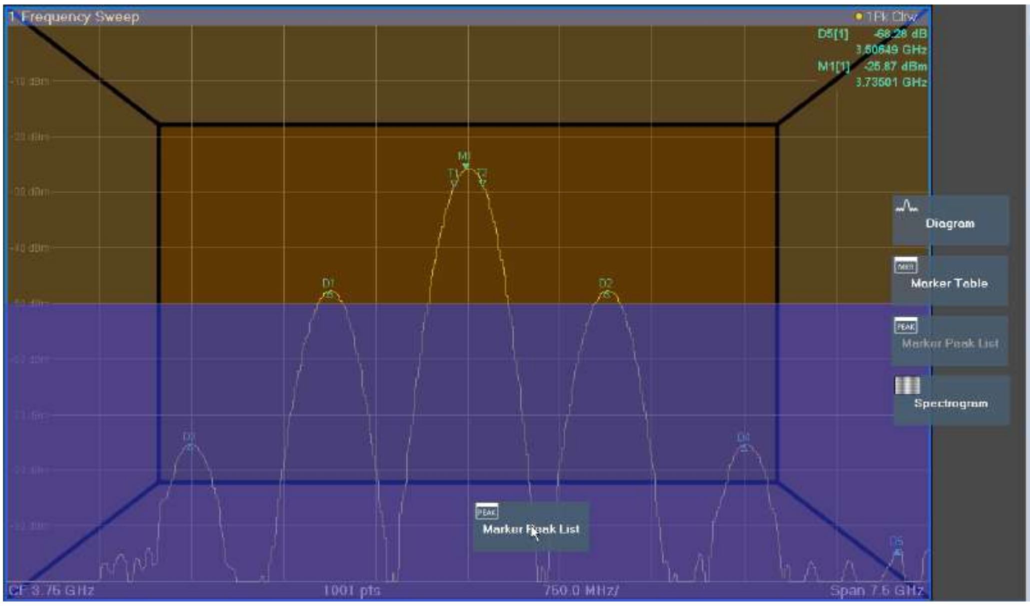


Figure 4-30: Moving a window in SmartGrid mode

The brown area indicates the possible "drop area" for the window, i.e. the area in which the window can be placed. A blue area indicates the (approximate) layout of the window as it would be if the icon were dropped at the current position. The frames indicate the possible destinations of the new window with respect to the existing windows: above/below, right/left or replacement (as illustrated in Figure 4-31). If an existing window would be replaced, the drop area is highlighted in a darker color shade.

Positioning the window

The screen can be divided into up to four rows. Each row can be split into up to four columns, where each row can have a different number of columns. However, rows always span the entire width of the screen and may not be interrupted by a column. A single row is available as the drop area for the window in the SmartGrid. The row can be split into columns, or a new row can be inserted above or below the existing row (if the maximum of 4 has not yet been reached).

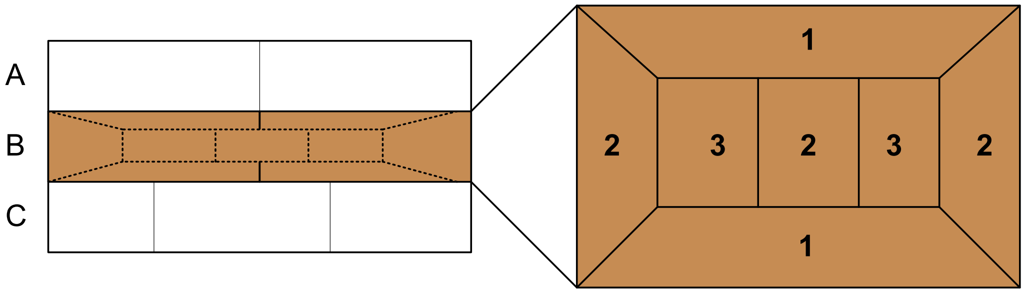


Figure 4-31: SmartGrid window positions

1 = Insert row above or below the existing row
2 = Create a new column in the existing row
3 = Replace a window in the existing row

SmartGrid functions

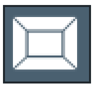
Once the evaluation icon has been dropped, icons in each window provide delete and move functions.

The "Move" icon allows you to move the position of the window, possibly changing the size and position of the other displayed windows.

The "Delete" icon allows you to close the window, enlarging the display of the remaining windows.

How to activate smartgrid mode

All display configuration actions are only possible in SmartGrid mode. In SmartGrid mode the evaluation bar replaces the current softkey menu display. When the SmartGrid mode is deactivated again, the previous softkey menu display is restored.

► To activate SmartGrid mode, do one of the following:
- 

  Select the "SmartGrid" icon from the toolbar.
- Select the "Display Config" button in the configuration "Overview".
- Select the "Display Config" softkey from the [Meas Config] menu.

The SmartGrid functions and the evaluation bar are displayed.

To close the SmartGrid mode and restore the previous softkey menu select the "Close" icon in the right-hand corner of the toolbar, or press any key.

How to add a new result window

Each type of evaluation is displayed in a separate window. Up to 16 individual windows can be displayed per channel (i.e. per tab).

1. Activate SmartGrid mode.

   All evaluation methods available for the currently selected measurement are displayed as icons in the evaluation bar.

2. Select the icon for the required evaluation method from the evaluation bar.
   If the evaluation bar contains more icons than can be displayed at once on the screen, it can be scrolled vertically. Touch the evaluation bar between the icons and move it up or down until the required icon appears.

3. Drag the required icon from the evaluation bar to the SmartGrid, which is displayed in the diagram area, and drop it at the required position. (See "How to arrange the result windows" on page 81 for more information on positioning the window).

Remote command:

`LAYout:ADD[:WINDow]?` on page 403 / `LAYout:WINDow<n>:ADD?` on page 407

How to close a result window

► To close a window, activate SmartGrid mode and select the "Delete" icon for the window.

Remote command:

`LAYout:REMove[:WINDow]` on page 405 / `LAYout:WINDow<n>:REMove` on page 408

How to arrange the result windows

1. Select an icon from the evaluation bar or the "Move" icon for an existing evaluation window.

2. Drag the evaluation over the SmartGrid.
   A blue area shows where the window will be placed.

3. Move the window until a suitable area is indicated in blue.

4. Drop the window in the target area.

   The windows are rearranged to the selected layout, and "Delete" and "Move" icons are displayed in each window.

5. To close a window, select the corresponding "Delete" icon.

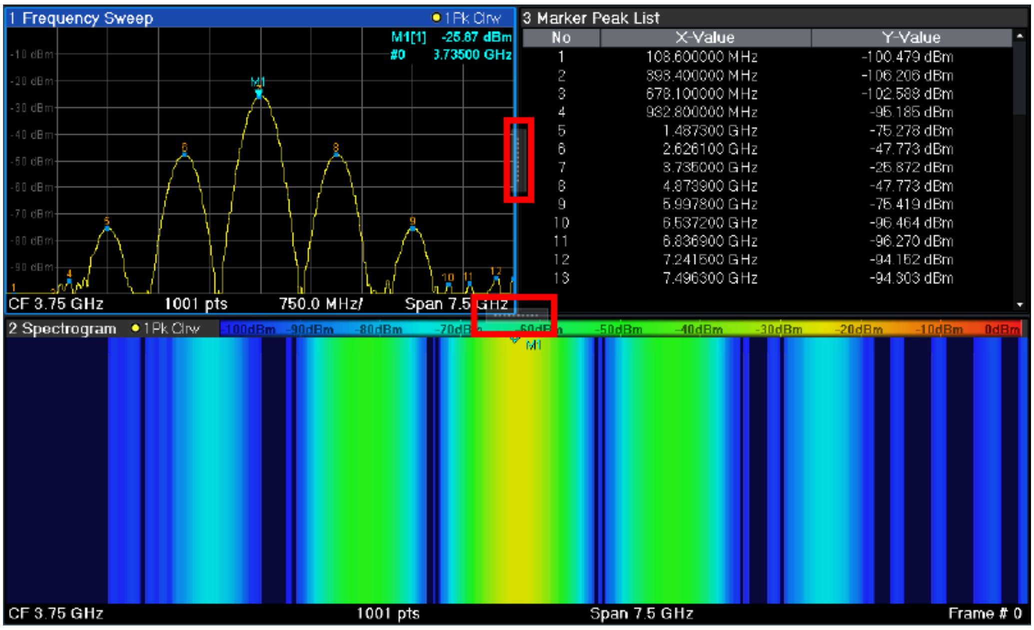
Remote command:

LAYout:REPLace[:WINDow] on page 405 / LAYout:WINDow<n>:REPLace on page 408

LAYout:MOVE[:WINDow] on page 404

4.5.5.3 Changing the size of windows

Each channel tab may contain several windows to evaluate the measurement results using different methods. A "splitter" allows you to change the size of neighboring windows.



The splitters are not available in SmartGrid mode.

► To change the size of two neighboring windows, drag the splitter between the windows in either direction.

4.5.5.4 Switching between a split and maximized window display

To get an overview of the results, displaying several windows at the same time may be helpful. However, the individual windows may become rather small. In this case it is useful to maximize an individual window to the entire screen temporarily in order to analyze the results in more detail.

To switch between a split and a maximized display without having to close and re-open windows, press the [SPLIT/MAXIMIZE] key on the front panel. In maximized display, the currently focused window is maximized. In split display, all active windows are displayed.

Alternatively, double-tap the title bar of a window to maximize it.

4.5.5.5 Changing the display

The display can be optimized for your individual needs. The following display functions are available and are described in detail in Chapter 10.2, "Display settings", on page 275 and Chapter 8.1, "Result display configuration", on page 181.

- Displaying a simulation of the entire front panel of the instrument on the screen ("Front Panel")
- Displaying the main function hardkeys in a separate window on the screen ("Mini Front Panel")
- Hiding or showing various screen elements
- Selecting a display theme and colors
- Changing the display update rate
- Activating or deactivating the touch-sensitivity of the screen
- Zooming into the diagram

4.5.6 Getting help

If any questions or problems concerning the R&S FSMR3 arise, an extensive online help system is provided on the instrument 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.

The online help can be opened at any time by selecting one of the "Help" icons on the toolbar or by pressing the [F1] key on an external or the on-screen keyboard.

To call 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 "Content" tab is displayed.

For standard Windows dialog boxes (e.g. File Properties, Print dialog etc.), no context-sensitive help is available.

to display a help topic for a screen element not currently focused

1. Select the "Help pointer" icon on the toolbar.

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

2. Select the screen element to change the focus.

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

5 Applications

The R&S FSMR3 is a dedicated Measuring Receiver whose main feature is the measuring receiver application.

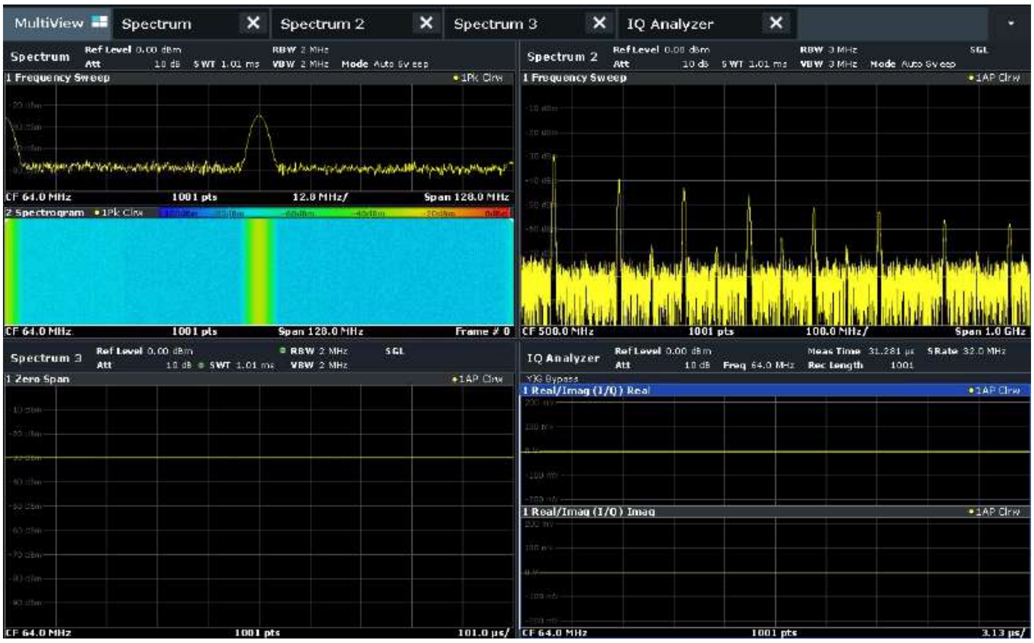
When equipped accordingly (with optional hardware or software), it is able to provide several additional applications for different analysis tasks (for example the spectrum application).

When you activate an application, the R&S FSMR3 creates a new measurement channel which in turn determines the measurement settings for that application. You can use the same application with different measurement settings by creating several channels for the same application. Each channel is represented by a separate tab on the screen.

Note that the number of channels can be limited by the available memory of the R&S FSMR3.

5.1 R&S multiview

Each application is displayed in a separate tab. An additional tab ("MultiView") provides an overview of all currently active channels at a glance. In the "MultiView" tab, each individual window contains its own channel bar with an additional button. Select this button to switch to the corresponding channel display quickly.



Remote command:

DISPlay:FORMat on page 402

5.2 Available applications

Depending on its outfit, the R&S FSMR3 provides one or more applications for specific measurement tasks.

AM/FM/PM Modulation Analysis
The AM/FM/PM Modulation Analysis application requires an instrument equipped with the corresponding optional software. This application provides measurement functions for demodulating AM, FM, or PM signals.

For details see the R&S FSMR3-K7 User Manual.

Remote command:
`INST:SEL ADEM`, see INSTrument[:SELect] on page 396

Avionics
The Avionics application requires an instrument equipped with the corresponding optional software. This application provides measurement functions for measuring avionics (ILS/VOR) signals.

For details see the R&S FSMR3-K15 User Manual.

Remote command:
`INST:SEL AVIONICS`, see INSTrument[:SELect] on page 396

Fast Spur Search
The Fast Spur Search application requires an instrument equipped with the Fast Spur Search option, R&S FSMR3-K50. This application provides measurements and evaluations for spurious signal effects.

For details see the R&S FSMR3-K50 User Manual.

Remote command:
`INST:SEL SPUR`, see INSTrument[:SELect] on page 396

I/Q Analyzer
The I/Q analyzer application requires an instrument equipped with the spectrum analyzer hardware component (R&S FSMR3-B1).

The I/Q analyzer application provides measurement and display functions for I/Q data.

For details, refer to the user manual of the I/Q analyzer.

Remote command:
`INST:SEL IQ`, see `INSTrument[:SELect]` on page 396

Measuring Receiver
The measuring receiver application provides measurement functions to analyze and demodulate the characteristics of a DUT.

This application is used in the initial configuration.

For details, refer to Chapter 6, "Measurements and results", on page 95.

Remote command:
`INST:SEL MREC`, see `INSTrument[:SELect]` on page 396

Noise Figure
The Noise Figure application requires an instrument equipped with the Noise Figure Measurements option R&S FSMR3-K30. This application provides noise figure measurements.

For details see the R&S FSMR3-K30 User Manual.

Remote command:
`INST:SEL NOISE`, see `INSTrument[:SELect]` on page 396

Phase Noise
The Phase Noise application requires an instrument equipped with the Phase Noise Measurements option, R&S FSMR3-K40. This application provides measurements for phase noise tests.

For details see the R&S FSMR3-K40 User Manual.

Remote command:
`INST:SEL PNOISE`, see `INSTrument[:SELect]` on page 396

Phase Noise
The phase noise application provides measurement functions to measure the phase noise characteristics of a DUT.

For details, refer to to the user manual of the Phase Noise application.

Remote command:
`INST:SEL PNO`, see `INSTrument[:SELect]` on page 396

Pulse Measurements
The Pulse application requires an instrument equipped with the Pulse Measurements option, R&S FSMR3-K6. This application provides measurement functions for pulsed signals.

For details see the R&S FSMR3-K6 User Manual.

Remote command:
`INST:SEL PULSE`, see `INSTrument[:SELect]` on page 396

Spectrum
The spectrum application is an optional application that is available with R&S FSMR3-B1.

In the spectrum application, the provided functions correspond to those of a conventional spectrum analyzer. The analyzer measures the frequency spectrum of the RF input signal over the selected frequency range with the selected resolution and sweep time, or, for a fixed frequency, displays the waveform of the video signal.

For details, refer to the user manual of the spectrum analyzer measurement application.

Remote command:
`INST:SEL SAN`, see `INSTrument[:SELect]` on page 396

Spectrum Monitor
The spectrum monitor application provides measurement functions for basic I/Q data analysis.

For details, refer to the user manual of the I/Q analyzer.

Remote command:
`INST:SEL SMONitor`, see `INSTrument[:SELect]` on page 396

Vector Signal Analysis (VSA)
The VSA application requires an instrument equipped with the spectrum analyzer hardware (R&S FSMR3-B1) and the vector signal analysis option (R&S FSMR3-K70). This application provides measurement and evaluations for vector signal analysis.

For details, refer to the VSA user manual.

Remote command:
`INST:SEL DDEM`, see `INSTrument[:SELect]` on page 396

5.3 Selecting the operating mode and applications

Access: [MODE]

The default operating mode is Measuring Receiver mode, however, the presetting can be changed (see "Preset Mode" on page 298).

The available applications are described in Chapter 5.2, "Available applications", on page 86.

Switching between applications

When you switch to a new application, a set of parameters is passed on from the current application to the new one:

- center frequency and frequency offset
- reference level and reference level offset
- attenuation

After initial setup, the parameters for the measurement channel are stored upon exiting and restored upon re-entering the channel. Thus, you can switch between applications quickly and easily.

Selecting an application

To start a new or replace an existing application, select the corresponding button in the correct tab.

Note: The measurement channels are labeled with their default name. If that name already exists, a sequential number is added. You can change the name of the mea-

surement channel by double-tapping the name in the channel bar and entering a new name.
For an overview of default names see INSTrument:LIST? on page 395.

Remote command:
INSTrument[:SELect] on page 396

New Channel ← Selecting an application
The applications selected on this tab are started in a new measurement channel, i.e. a new tab in the display.

Remote command:
INSTrument:CREate[:NEW] on page 394
INSTrument[:SELect] on page 396

Replace Current Channel ← Selecting an application
The applications selected on this tab are started in the currently displayed measurement channel, replacing the current application.

Remote command:
INSTrument:CREate:REPLace on page 394

Duplicate Current Channel ← Selecting an application
The currently active channel can be duplicated, i.e. a new 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 394

Closing an application
To close an application, simply close the corresponding tab by selecting the "x" next to the channel name.

Remote command:
INSTrument:DELete on page 395

5.4 Running a sequence of measurements

Only one measurement can be performed at any time, namely the one in the currently active channel. However, in order to perform the configured measurements consecutively, a Sequencer function is provided.

5.4.1 The sequencer concept

The instrument can only activate one specific channel at any time. Thus, only one measurement can be performed at any time, namely the one in the currently active channel. However, in order to perform the configured measurements consecutively, a Sequencer function is provided, which changes the channel of the instrument as required. If activated, the measurements configured in the currently defined "Channel"s are performed one after the other in the order of the tabs.

For each individual measurement, the sweep count is considered. Thus, each measurement may consist of several sweeps. The currently active measurement is indicated by a ⚙ symbol in the tab label.

The result displays of the individual channels are updated in the tabs as the measurements are performed. Sequential operation itself is independent of the currently *displayed* tab.

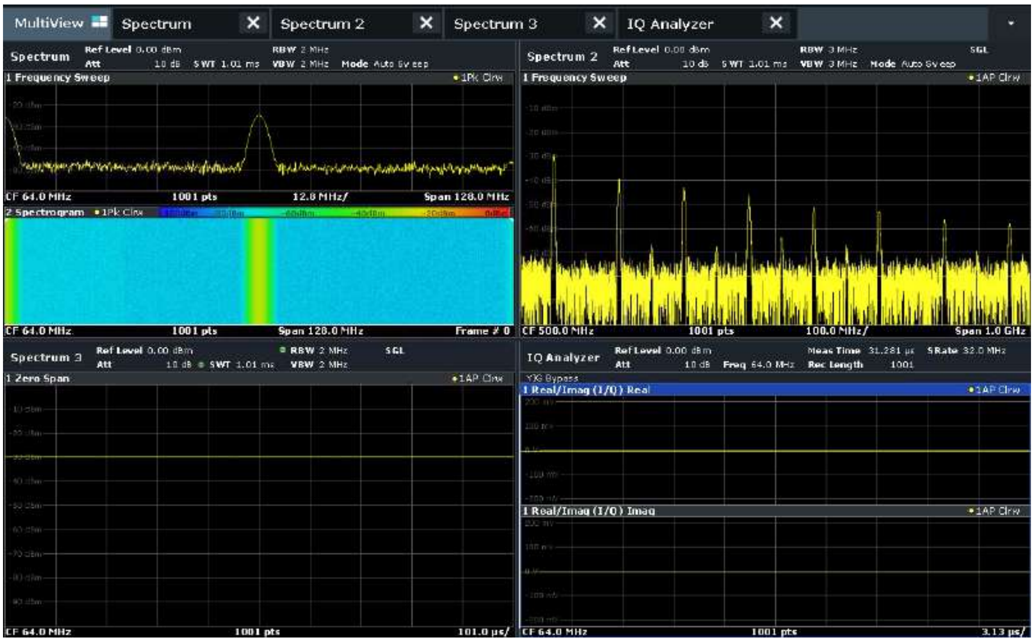
Sequencer modes

Three different Sequencer modes are available:

- **Single Sequence**
  Similar to single sweep mode; each measurement is performed once, until all measurements in all defined "Channel"s have been performed.
- **Continuous Sequence**
  Similar to continuous sweep mode; the measurements in each defined "Channel" are performed one after the other, repeatedly, in the same order, until sequential operation is stopped. This is the default Sequencer mode.
- **Channel-defined Sequence**
  First, a single sequence is performed. Then, only "Channel"s in continuous sweep mode are repeated continuously.

Example: Sequencer procedure

Assume the following active channel definition:



Tab name	Application	Sweep mode	Sweep count
Spectrum	Spectrum	Cont. Sweep	5
Spectrum 2	Spectrum	Single Sweep	6
Spectrum 3	Spectrum	Cont. Sweep	2
IQ Analyzer	IQ Analyzer	Single Sweep	7

For **Single Sequence**, the following sweeps will be performed:

5x Spectrum, 6x Spectrum 2, 2 x Spectrum 3, 7x IQ Analyzer

For **Continuous Sequence**, the following sweeps will be performed:

5x Spectrum, 6x Spectrum 2, 2 x Spectrum 3, 7x IQ Analyzer,

5x Spectrum, 6x Spectrum 2, 2 x Spectrum 3, 7x IQ Analyzer,

...

For **Channel-defined Sequence**, the following sweeps will be performed:

5x Spectrum, 6x Spectrum 2, 2 x Spectrum 3, 7x IQ Analyzer,

5x Spectrum, 2 x Spectrum 3,

5x Spectrum, 2 x Spectrum 3,

...

Run Single/Run Cont and Single Sweep/Sweep Continuous keys

While the Sequencer is active, the [Run Single] and [Run Cont] keys control the Sequencer, not individual sweeps. [Run Single] starts the Sequencer in single mode, while [Run Cont] starts the Sequencer in continuous mode.

The "Single Sweep" and "Continuous Sweep"*softkeys* control the sweep mode for the currently selected channel only; the sweep mode only has an effect the next time the Sequencer activates that channel, and only for a channel-defined sequence. In this case, a channel in single sweep mode is swept only once by the Sequencer. A channel in continuous sweep mode is swept repeatedly.

5.4.2 Sequencer settings

The "Sequencer" menu is available from the toolbar.

Sequencer State

Activates or deactivates the Sequencer. If activated, sequential operation according to the selected Sequencer mode is started immediately.

Remote command:
`SYSTem:SEQuencer` on page 399
`INITiate:SEQuencer:IMMediate` on page 398
`INITiate:SEQuencer:ABORt` on page 397

Sequencer Mode

Defines how often which measurements are performed. The currently selected mode softkey is highlighted blue. During an active Sequencer process, the selected mode softkey is highlighted orange.

"Single Sequence"
Each measurement is performed once, until all measurements in all active channels have been performed.

"Continuous Sequence"
The measurements in each active channel are performed one after the other, repeatedly, in the same order, until sequential operation is stopped.
This is the default Sequencer mode.

Remote command:
`INITiate:SEQuencer:MODE` on page 398

5.4.3 How to set up the sequencer

In order to perform the configured measurements consecutively, a Sequencer function is provided.

1. Configure a channel for each measurement configuration as required, including the sweep mode.
2. In the toolbar, select the "Sequencer" icon.

The "Sequencer" menu is displayed.

3. Toggle the "Sequencer" softkey to "On".

   A continuous sequence is started immediately.

4. To change the Sequencer mode and start a new sequence immediately, select the corresponding mode softkey, or press the [Run Single] or [Run Cont] key.

   The measurements configured in the currently active channels are performed one after the other in the order of the tabs until the Sequencer is stopped.
   The result displays in the individual channels are updated as the measurements are performed.

To stop the sequencer

► To stop the Sequencer temporarily, press the highlighted [Run Single] or [Run Cont] key (not for a channel-defined sequence). To continue the Sequencer, press the key again.
To stop the Sequencer permanently, select the "Sequencer" icon in the toolbar and toggle the "Sequencer" softkey to "Off".

6 Measurements and results

Access: "Overview" > "Select Measurement"

Or: [MEAS]

In the Measuring Receiver application, the R&S FSMR3 provides a variety of different measurement functions.

- **Basic measurements** - measure the RF power or tuned RF level your signal
- **Demodulation measurements** - demodulate AM, FM or PM signals

The individual functions are described in detail in the following chapters.

The measurement function determines which settings, functions and evaluation methods are available in the R&S FSMR3. The various measurement functions are described in detail here.

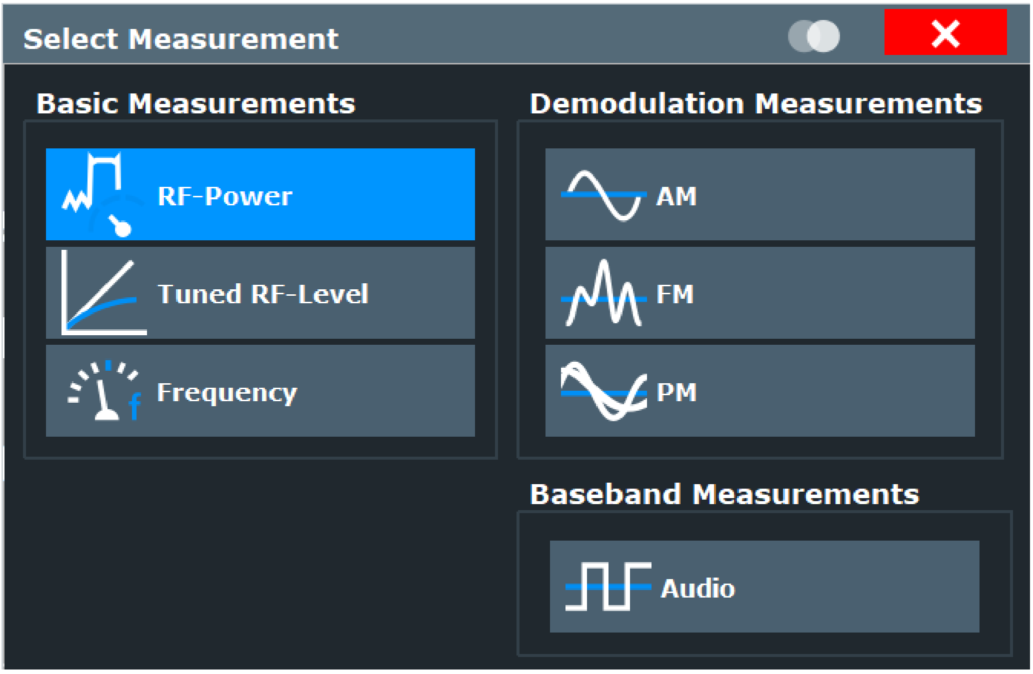
When you select a measurement function, the measurement is started with its default settings immediately and the corresponding measurement configuration menu is displayed. The measurement configuration menu can be displayed at any time by pressing the [MEAS CONFIG] key.

The easiest way to configure measurements is using the configuration "Overview", see Chapter 7.1, "Configuration overview", on page 112.

6.1 Selecting measurements

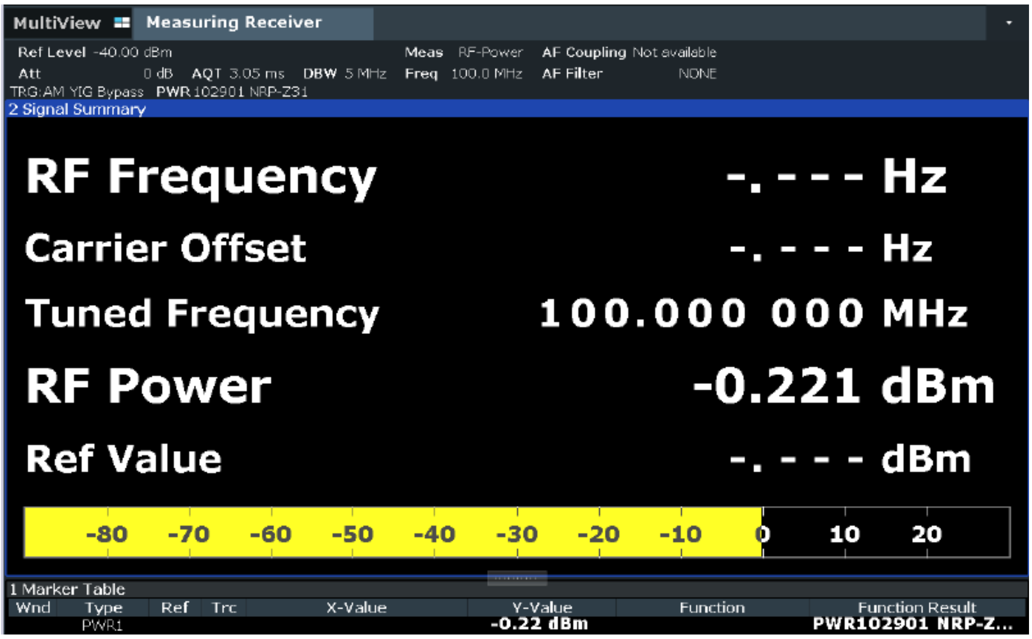
Access: [MEAS]

The R&S FSMR3 provides several measurements, each determining different aspects of different types of signal.



RF-Power

Provides functionality to measure the absolute power and reference power of a signal using a power sensor.



For the configuration of RF-Power measurements, see Chapter 7.2.2, "Power sensors", on page 115.

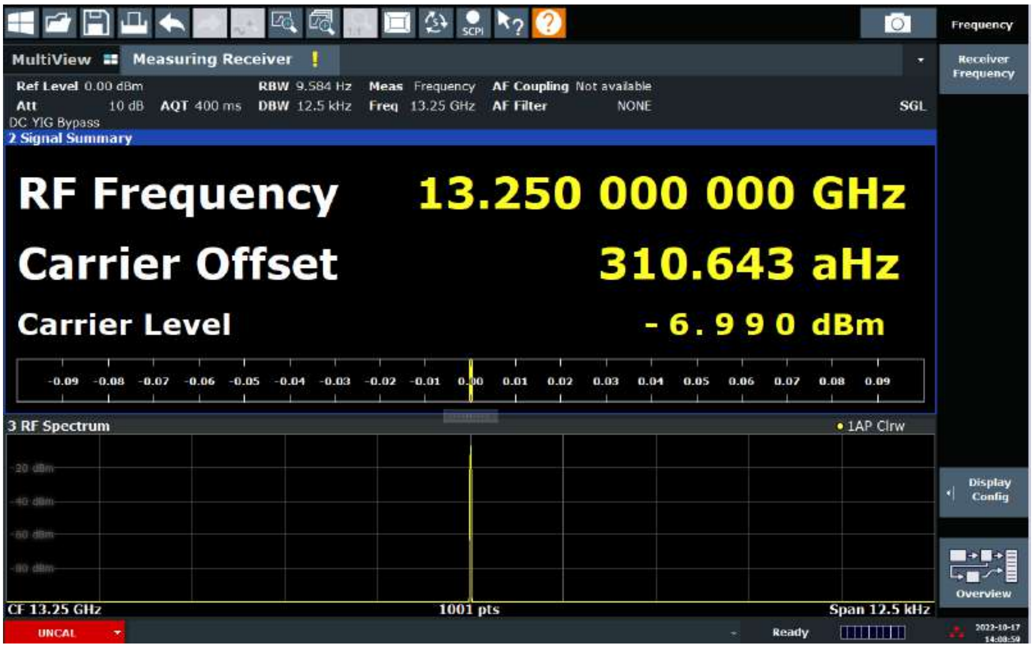
Remote command:
`CONF:MEAS POWer`

Tuned RF-Level
Provides functionality to perform Tuned RF-Level calibration and power measurements.

For the configuration of TRFL measurements, see Chapter 7.7, "Tuned RF Level settings", on page 175.

Remote command:
`CONF:MEAS TRFL`

Frequency
Provides a frequency counter to perform frequency accuracy measurements. For example, it can be used to align or tune a frequency reference oscillator inside of a signal generator.



Remote command:
`CONF:MEAS FREQency`

Demodulation Measurements
Provides functionality to demodulate AM/FM/PM signals and measure key values like modulation depth, frequency deviation and phase deviation.

For the configuration of demodulation measurements, see Chapter 7.6, "Demodulation", on page 161.

Remote command:
`CONF:MEAS AM`
`CONF:MEAS FM`
`CONF:MEAS PM`

Audio
The optional R&S FSMR3-B3 audio input provides functionality to measure baseband audio signals.

For the configuration of Audio measurements, see Chapter 7.8, "Audio settings", on page 179.

Remote command:
`CONF:MEAS AUDio`

6.2 Result displays

Access: "Overview" > "Display Config"

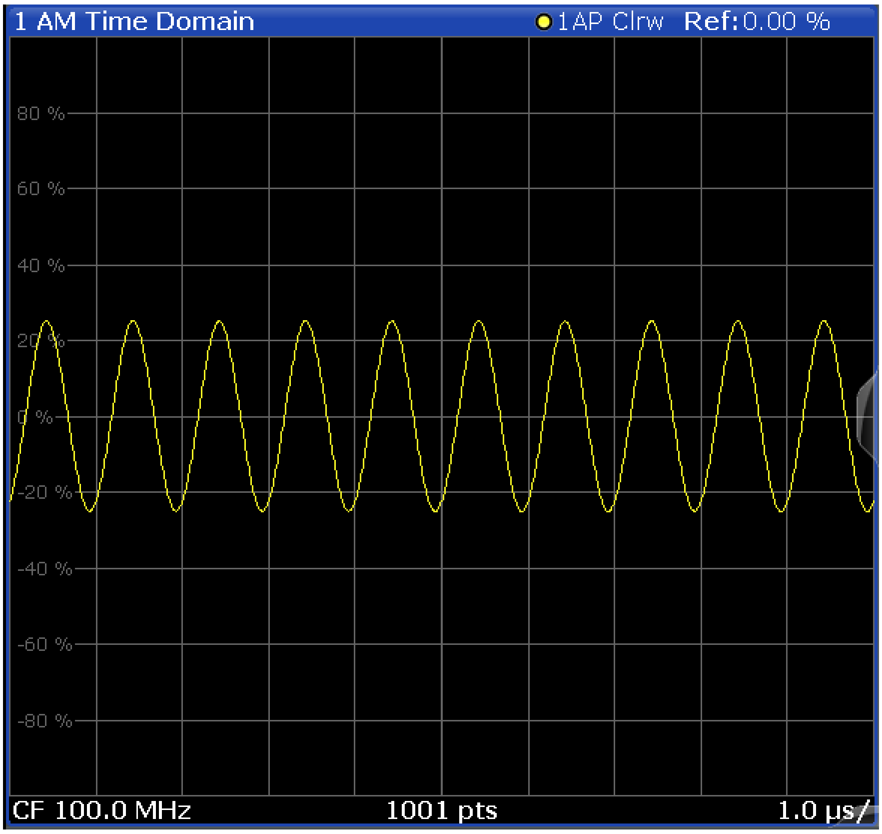
Or: [MEAS] > "Display Config"

The data that was measured by the R&S FSMR3 can be evaluated using various different methods. The results can be displayed as absolute deviations or relative to a reference value or level.

The abbreviation "AF" (for Audio Frequency) refers to the demodulated AM, FM or PM signal.

AM Time Domain

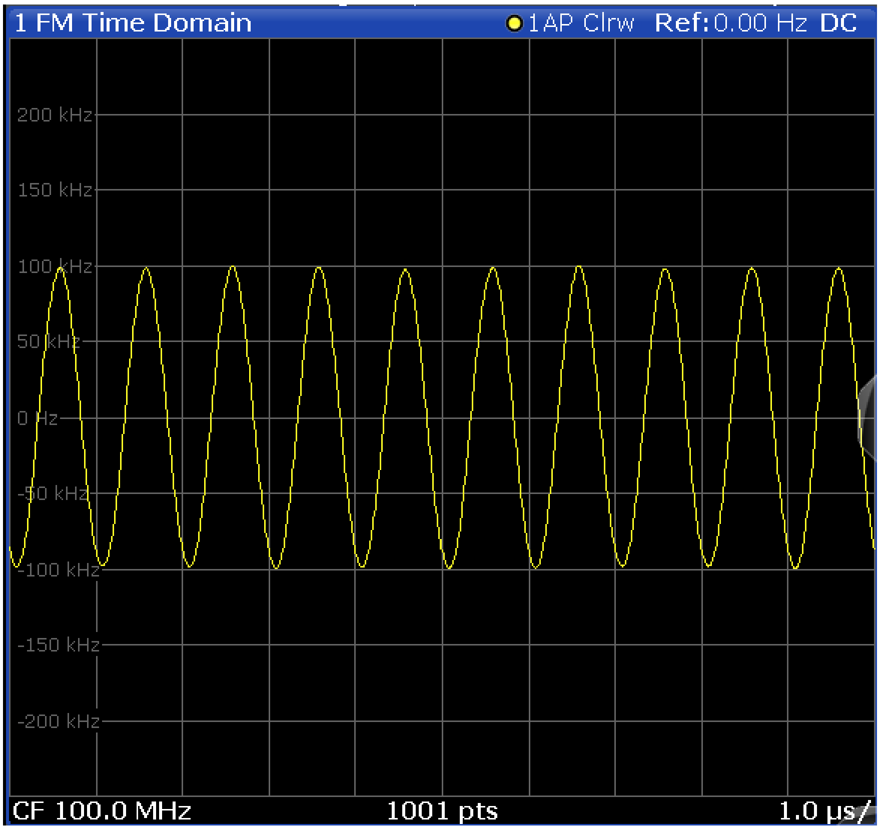
Displays the modulation depth of the demodulated AM signal (in %) versus time.



Remote command:
`LAY:ADD? '1',RIGH,'XTIM:AM:REL'`
(See `LAYout:ADD[:WINDow]?` on page 403)

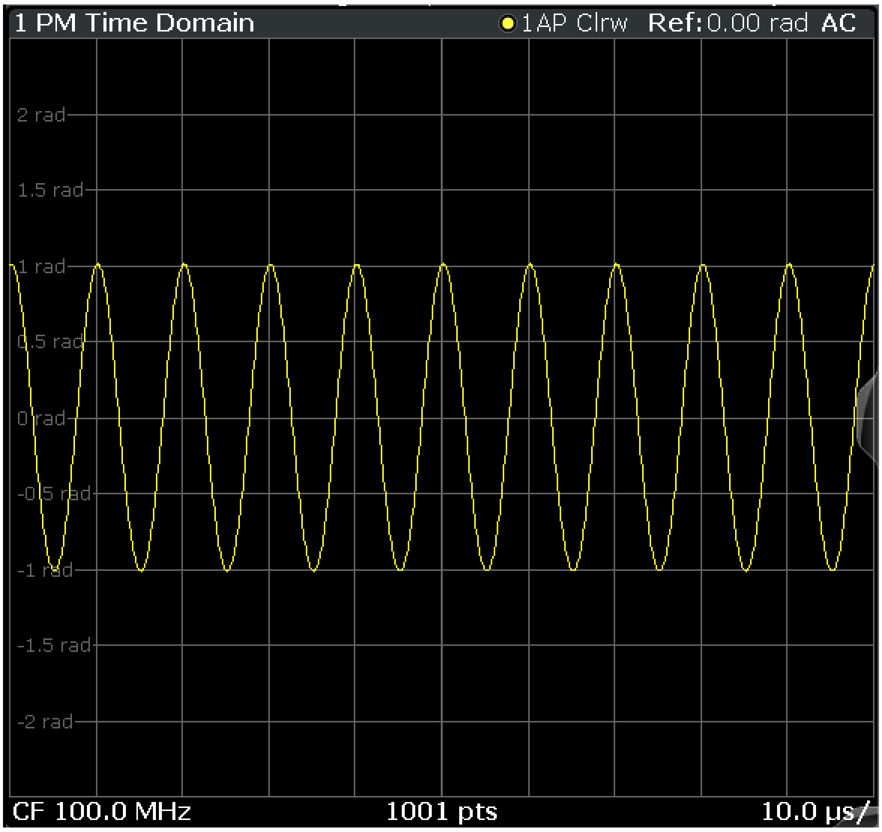
FM Time Domain

Displays the frequency spectrum of the demodulated FM signal versus time.



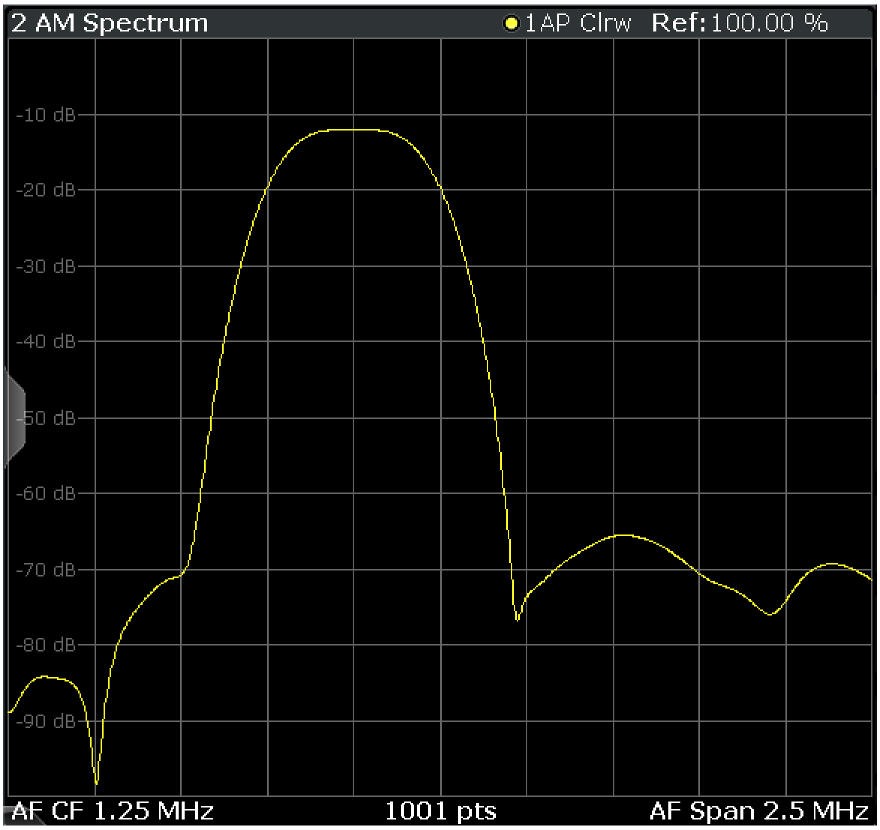
Remote command:
`LAY:ADD? '1',RIGH,'XTIM:FM'`
(See `LAYout:ADD[:WINDow]?` on page 403)

PM Time Domain
Displays the phase deviations of the demodulated PM signal (in rad or °) versus time.



Remote command:
`LAY:ADD? '1',RIGH,'XTIM:PM'`
(See `LAYout:ADD[:WINDow]?` on page 403)

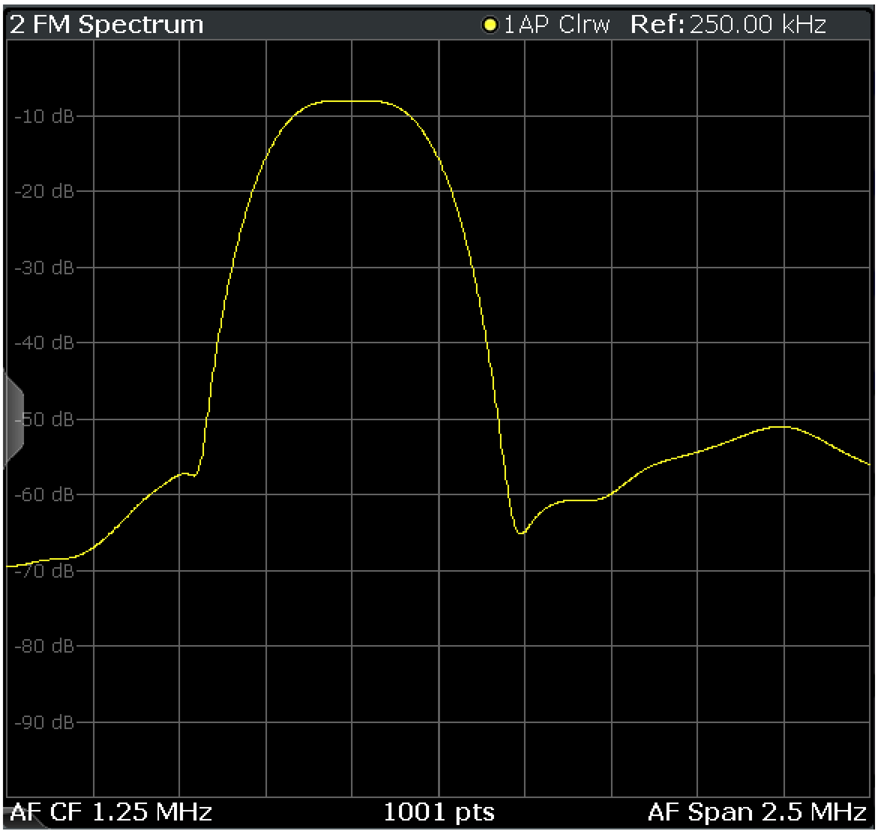
AM Spectrum
Displays the modulation depth of the demodulated AM signal (in % or dB) versus AF span. The spectrum is calculated from the demodulated AM signal in the time domain via FFT.



Note: If a high pass or low pass AF filter is defined, the filter is indicated by a vertical red line in the spectrum display.

Remote command:
`LAY:ADD? '1',RIGH,'XTIMe:AM:REL:AFSPectrum1'`
(see `LAYout:ADD[:WINDow]?` on page 403)

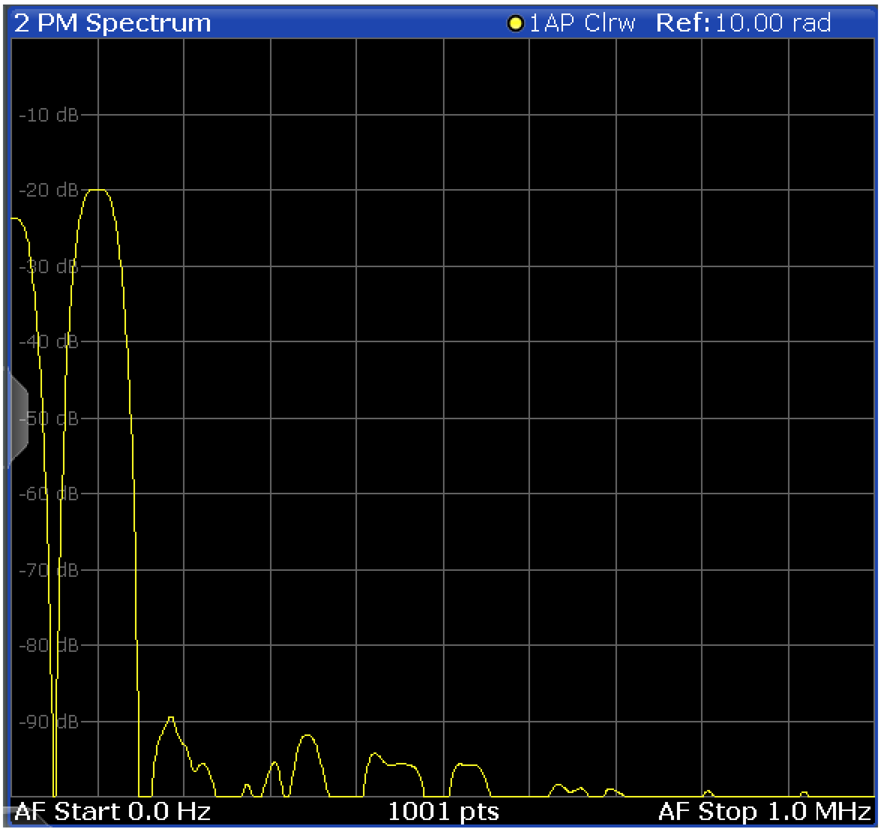
FM Spectrum
Displays the frequency deviations of the demodulated FM signal (in Hz or dB) versus AF span. The spectrum is calculated from the demodulated AM signal in the time domain via FFT.



Note: If a high pass or low pass AF filter is defined, the filter is indicated by a vertical red line in the spectrum display.

Remote command:
`LAY:ADD? '1',RIGH,'XTIMe:FM:AFSPectrum1'`
(see `LAYout:ADD[:WINDow]?` on page 403)

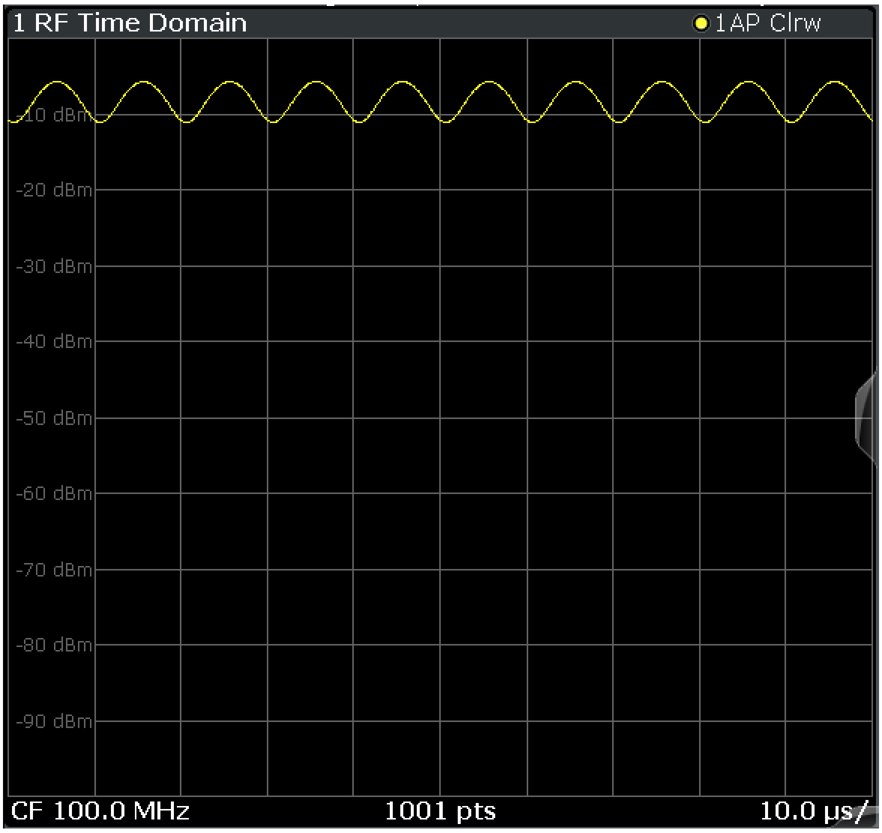
PM Spectrum
Displays the phase deviations of the demodulated PM signal (in rad, ° or dB) versus AF span. The spectrum is calculated from the demodulated AM signal in the time domain via FFT.



Note: If a high pass or low pass AF filter is defined, the filter is indicated by a vertical red line in the spectrum display.

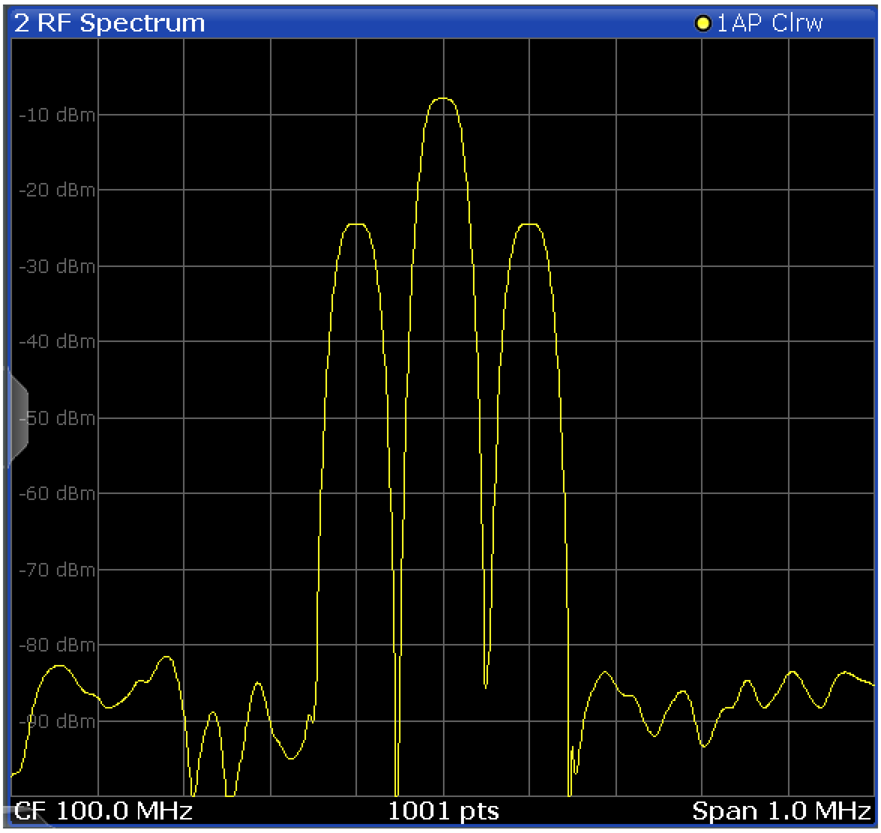
Remote command:
`LAY:ADD? '1',RIGH,'XTIMe:PM:AFSPectrum1'`
(see `LAYout:ADD[:WINDow]?` on page 403)

RF Time Domain
Displays the RF power of the input signal versus time. The level values represent the magnitude of the I/Q data set.



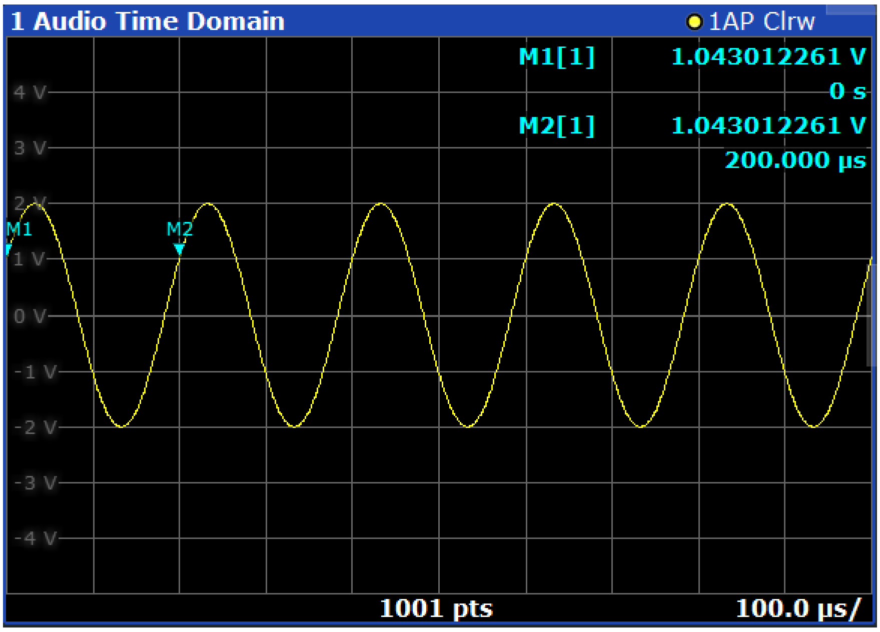
Remote command:
`LAY:ADD? '1',RIGH,'XTIM:AM'`
(see `LAYout:ADD[:WINDow]?` on page 403)

RF Spectrum
Displays the spectrum of the input signal. In contrast to the Spectrum application, the frequency values are determined using FFT from the recorded I/Q data set. A vertical blue line represents the signal frequency used to calculate the RF level.



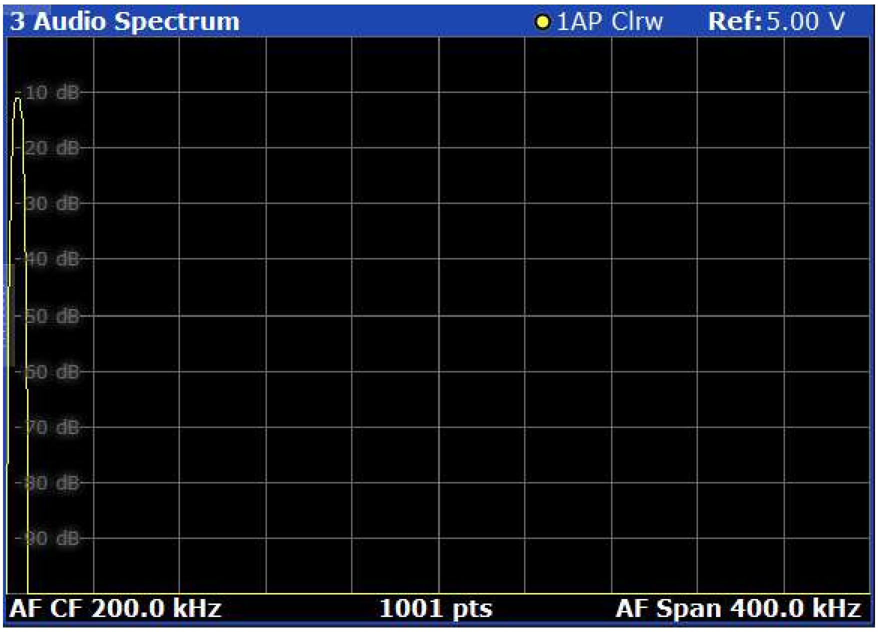
Remote command:
`LAY:ADD? '1',RIGH,'XTIM:SPECTRUM'`
(see `LAYout:ADD[:WINDow]?` on page 403)

Audio Time Domain
Displays the audio signal in the time domain.



Remote command:
`LAY:ADD? '1',RIGH,'XTIM:AC'`
(See `LAYout:ADD[:WINDow]?` on page 403)

Audio Spectrum
Displays the audio signal in the frequency spectrum.



Remote command:
`LAY:ADD? '1',RIGH,'XTIM:AC:AFSPectrum'`
(see `LAYout:ADD[:WINDow]?` on page 403)

Result Summary
The result summary displays the results of the demodulation functions for all windows in a table.

4 Result Summary

	Current	Average	Peak
Mod. Freq.	1.00 kHz		
AM			
+Peak	**30.95 %**	31.06 %	31.48 %
-Peak	**-30.95 %**	-30.92 %	-31.42 %
+-Peak/2	**30.95 %**	30.99 %	31.27 %
RMS	**21.25 %**	21.25 %	21.27 %
RMS Sqrt2	**30.05 %**	30.05 %	30.08 %
Average	**21.25 %**	21.24 %	21.28 %
THD	---	---	---
SINAD	---	---	---
DISTORT	---	---	---

For each demodulation, the following information is provided:

Table 6-1: Result summary description

Label	Description
+Peak	Positive peak (maximum)
-Peak	Negative peak (minimum)
+/-Peak/2	Average of positive and negative peaks
RMS	Root Mean Square value
RMS Sqrt2	Root Mean Square value * √2
Average	Average value
THD	Total harmonic distortion The ratio of the harmonics to the fundamental and harmonics. All harmonics inside the AF spectrum span are considered up to the tenth harmonic. (Calculated only if AF Spectrum is displayed) $THD[dB] = 20 \cdot log\left[\frac{\sqrt{\sum_{i=2}^{\infty} U_i^2}}{\sqrt{\sum_{i=1}^{\infty} U_i^2}}\right]$
SINAD	Signal-to-noise-and-distortion (Calculated only if AF Spectrum is displayed) Measures the ratio of the total power to the power of noise and harmonic distortions. The noise and harmonic power is calculated inside the AF spectrum span. The DC offset is removed before the calculation. $SINAD[dB] = 20 \cdot log[\frac{P_{total}}{P_{Noise} + P_{distortion}}]$
"DISTORT"	Modulation distortion in % (Calculated only if "SINAD" is also calculated) Measures the distortion of the modulation in relation to the total power of the signal inside the AF spectrum span. Indicates the quality of the modulation. $Modulation\ distortion = \frac{\sqrt{P_{total} - P_{signal}}}{\sqrt{P_{total}}} * 100\%$

In addition, the following general information for the input signal is provided:

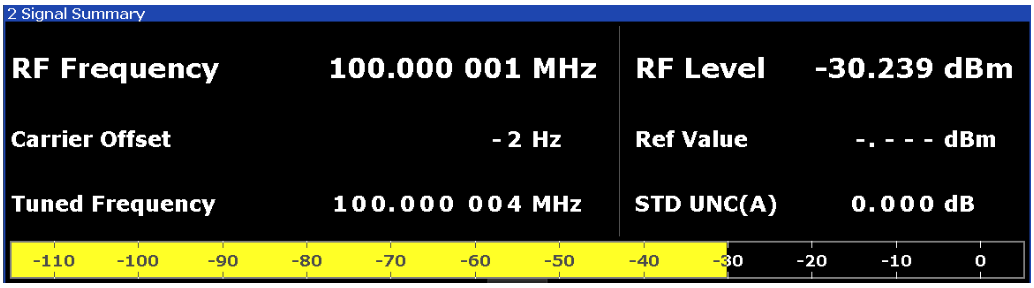
- Carrier Power: the power of the carrier without modulation
- Carrier Offset: the deviation of the calculated carrier frequency to the ideal carrier frequency
- Modulation Depth (AM or RF Time Domain only): the difference in amplitude the carrier signal is modulated with

Remote command:

`LAY:ADD? '1',RIGH,RSUM`, see `LAYout:ADD[:WINDow]?` on page 403

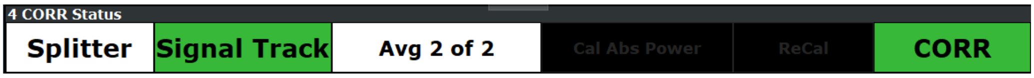
Signal Summary

Displays the frequency and level as a numeric value. Additionally it also displays the level with a bar graph.



Remote command:
`LAY:ADD? '1',RIGH,XTIMe:RFPower:BARG`, see `LAYout:ADD[:WINDow]?` on page 403

CORR Status



Displays the condition of the following functions and device labels:
- Splitter
- Signal Track
- AVG
- Cal Abs Power
- UNCORR
- RE CAL
- CORR

Remote command:
`LAY:ADD? '1',RIGH,CORR`, see `LAYout:ADD[:WINDow]?` on page 403

Marker Table

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

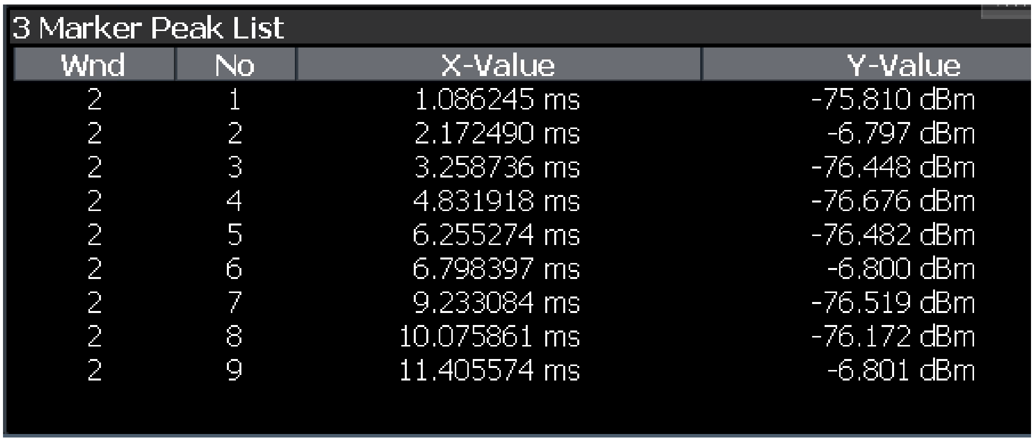
This table is displayed automatically if configured accordingly.

Tip: To navigate within long marker tables, simply scroll through the entries with your finger on the touchscreen.

Remote command:
`LAY:ADD? '1',RIGH, MTAB`, see `LAYout:ADD[:WINDow]?` on page 403
Results:
`CALCulate<n>:MARKer<m>:X` on page 519

Marker Peak List

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



3 Marker Peak List

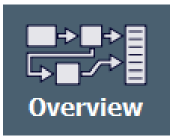
Wnd	No	X-Value	Y-Value
2	1	1.086245 ms	-75.810 dBm
2	2	2.172490 ms	-6.797 dBm
2	3	3.258736 ms	-76.448 dBm
2	4	4.831918 ms	-76.676 dBm
2	5	6.255274 ms	-76.482 dBm
2	6	6.798397 ms	-6.800 dBm
2	7	9.233084 ms	-76.519 dBm
2	8	10.075861 ms	-76.172 dBm
2	9	11.405574 ms	-6.801 dBm

Remote command:
`LAY:ADD? '1',RIGH, PEAK`, see `LAYout:ADD[:WINDow]?` on page 403
Results:
`CALCulate<n>:MARKer<m>:X` on page 519

7 Common measurement settings

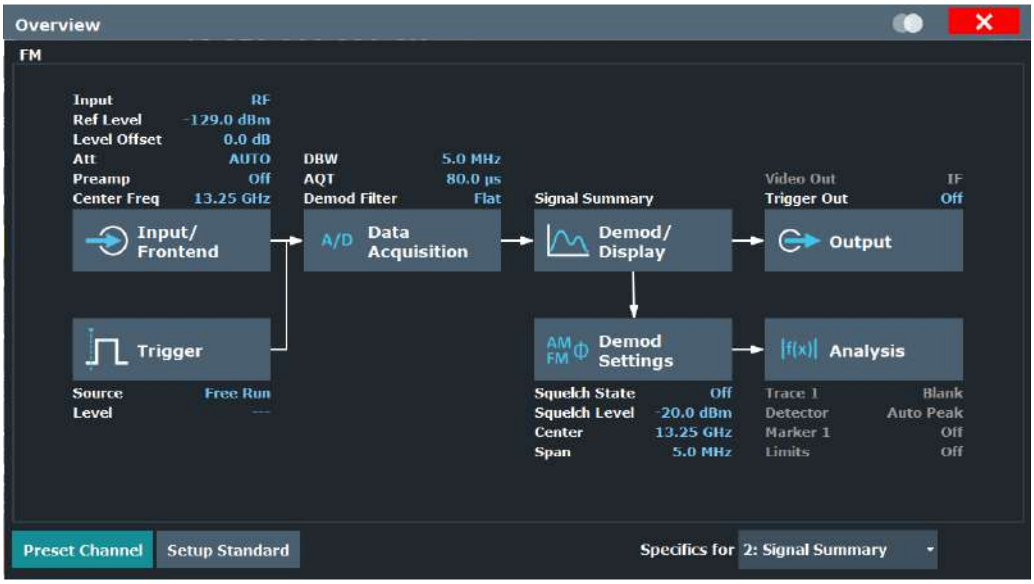
Basic measurement settings that are common to many measurement tasks, regardless of the application or operating mode, are described here. If you are using an application other than the Measuring Receiver application, be sure to check the documentation for that application. The settings can deviate from the common settings described here.

7.1 Configuration overview



Access: "Overview"

Throughout the measurement channel configuration, an overview of the most important currently defined settings is provided in the "Overview". The "Overview" is displayed when you select the "Overview" icon, which is available at the bottom of all softkey menus.



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

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

1. Input
   See Chapter 7.2, "Input and frontend", on page 113.
2. Trigger
   See Chapter 7.3, "Trigger settings", on page 149.
3. Data Aquisition
   See Chapter 7.4, "Data acquisition", on page 154.
4. Demod Settings
   See Chapter 7.6, "Demodulation", on page 161.
5. Output
   See Chapter 7.5, "Output", on page 156.
6. Analysis
   See Chapter 8, "Common analysis and display functions", on page 181.
7. Demod/Display
   See Chapter 6, "Measurements and results", on page 95.

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

Note: Do not confuse the "Preset Channel" button with the [Preset] *key*, which restores the entire instrument to its default values and thus closes *all channels* on the R&S FSMR3 (except for the default channel)!

Remote command:
`SYSTem:PRESet:CHANnel[:EXEC]` on page 571

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

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

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

7.2 Input and frontend

The R&S FSMR3 can analyze signals from different input sources.

7.2.1 Input source settings

7.2.1.1 Radio frequency input

Access: Overview > Input/Frontend > Input Source > Radio Frequency

RF input protection

The RF input connector of the R&S FSMR3 must be protected against signal levels that exceed the ranges specified in the data sheet. Therefore, the R&S FSMR3 is equipped with an overload protection mechanism for DC and signal frequencies up to 30 MHz. This mechanism becomes active as soon as the power at the input mixer exceeds the specified limit. It ensures that the connection between RF input and input mixer is cut off.

When the overload protection is activated, an error message is displayed in the status bar ("INPUT OVLD"), and a message box informs you that the RF input was disconnected. Furthermore, a status bit (bit 3) in the `STAT:QUES:POW` status register is set. In this case, you must decrease the level at the RF input connector and then close the message box. Then measurement is possible again. Reactivating the RF input is also possible via the remote command `INPut<ip>:ATTenuation:PROTection:RESet`.

Radio Frequency State

Activates input from the "RF Input" connector.

Remote command:
`INPut<ip>:SELect` on page 412

Input Coupling
The RF input of the R&S FSMR3 can be coupled by alternating current (AC) or direct current (DC).

AC coupling blocks any DC voltage from the input signal. AC coupling is activated by default to prevent damage to the instrument. Very low frequencies in the input signal can be distorted.

However, some specifications require DC coupling. In this case, you must protect the instrument from damaging DC input voltages manually. For details, refer to the data sheet.

Remote command:
`INPut<ip>:COUPling` on page 410

Direct Path
Enables or disables the use of the direct path for small frequencies.

In spectrum analyzers, passive analog mixers are used for the first conversion of the input signal. In such mixers, the LO signal is coupled into the IF path due to its limited isolation. The coupled LO signal becomes visible at the RF frequency 0 Hz. This effect is referred to as LO feedthrough.

To avoid the LO feedthrough the spectrum analyzer provides an alternative signal path to the A/D converter, referred to as the *direct path*. By default, the direct path is selected automatically for RF frequencies close to zero. However, this behavior can be disabled. If "Direct Path" is set to "Off", the spectrum analyzer always uses the analog mixer path.

"Auto"	(Default) The direct path is used automatically for frequencies close to zero.
"Off"	The analog mixer path is always used.

Remote command:
`INPut<ip>:DPATh` on page 411

YIG-Preselector
Enables or disables the YIG-preselector.

This setting requires an additional option on the R&S FSMR3000.

Note: Note that the YIG-preselector is active only on frequencies greater than 8 GHz. Therefore, switching the YIG-preselector on or off has no effect if the frequency is below that value.

Remote command:
`INPut<ip>:FILTer:YIG[:STATe]` on page 412

7.2.2 Power sensors

The R&S FSMR3 can also analyze data from a connected power sensor.

7.2.2.1 Basics on power sensors

For precise power measurement, up to 4 power sensors can be connected to the instrument via the power sensor interface (on the front panel) or the USB connectors. Both manual operation and remote control are supported.

For a detailed list of supported sensors, see the data sheet.

Power sensors can also be used to trigger a measurement at a specified power level, e.g. from a signal generator (see "Using a power sensor as an external power trigger" on page 116).

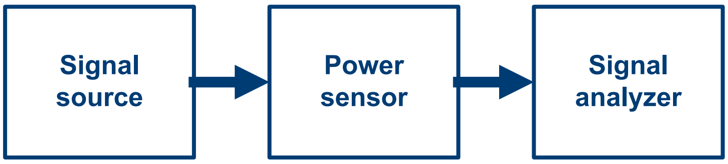


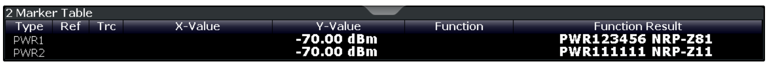
Figure 7-1: Power sensor support – standard test setup

Using the power sensor with several applications

The power sensor cannot be used from the R&S FSMR3 firmware and the R&S Power Viewer Plus (virtual power meter for displaying results of the R&S NRP power sensors) simultaneously.

Result display

The results of the power sensor measurements are displayed in the marker table. For each power sensor, a row is inserted. The sensor index is indicated in the "Type" column.



Using a power sensor as an external power trigger

Power sensors can be used to trigger a measurement at a specified power level, e.g. from a signal generator. For a list of supported power sensors see the data sheet.

With the R&S FSMR3, the power sensors can be connected to the "Power Sensor" interface directly, and no further cables are required. They can then be configured as an external power sensor trigger.

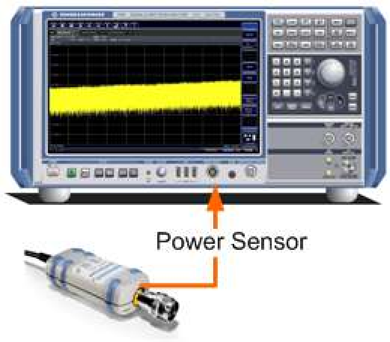


Figure 7-2: Connecting a power sensor using the POWER SENSOR interface

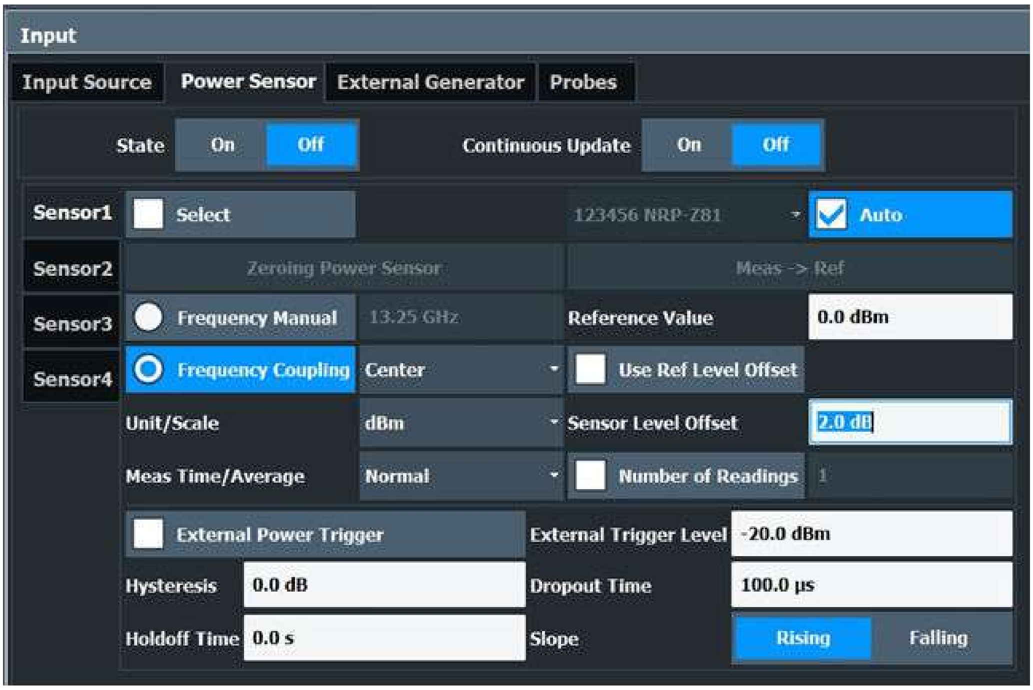
The R&S FSMR3 receives an external trigger signal when the defined trigger level is measured by the power sensor. Power measurement results are provided as usual.

For details see "How to configure a power sensor as an external (PSE) trigger" on page 123.

7.2.2.2 Power sensor settings

Access: "Overview" > "Input" > "Power Sensor" tab

Each sensor is configured on a separate tab.



State

Switches the power measurement for all power sensors on or off. Note that in addition to this general setting, each power sensor can be activated or deactivated individually by the Select setting on each tab. However, the general setting overrides the individual settings.

Continuous Value Update

If activated, the power sensor data is updated continuously during a sweep with a long sweep time, and even after a single sweep has completed.

This function cannot be activated for individual sensors.

If the power sensor is being used as a trigger (see "Using the power sensor as an external trigger" on page 120), continuous update is not possible; this setting is ignored.

Remote command:

`[SENSe:]PMETer<p>:UPDate[:STATe]` on page 420

Select

Selects the individual power sensor for usage if power measurement is generally activated (State function).

The detected **serial numbers** of the power sensors connected to the instrument are provided in a selection list. For each of the four available power sensor indexes ("Power Sensor 1"..."Power Sensor 4"), which correspond to the tabs in the configuration dialog, one of the detected serial numbers can be assigned. The physical sensor is thus assigned to the configuration setting for the selected power sensor index.

By default, serial numbers not yet assigned are automatically assigned to the next free power sensor index for which "Auto Assignment" is selected.

Alternatively, you can assign the sensors manually by deactivating the "Auto" option and selecting a serial number from the list.

Remote command:

`[SENSe:]PMETer<p>[:STATe]` on page 420

`SYSTem:COMMunicate:RDEVice:PMETer<p>:DEFine` on page 414

SYSTem:COMMunicate:RDEVice:PMETer<p>:CONFigure:AUTO[:STATe] on page 413
SYSTem:COMMunicate:RDEVice:PMETer<p>:COUNt? on page 413

Zeroing Power Sensor

Starts zeroing of the power sensor.

Remote command:
CALibration:PMETer<p>:ZERO:AUTO ONCE on page 415

Frequency Manual

Defines the frequency of the signal to be measured. The power sensor has a memory with frequency-dependent correction factors. This allows extreme accuracy for signals of a known frequency.

Remote command:
[SENSe:]PMETer<p>:FREQuency on page 417

Frequency Coupling

Selects the coupling option. The frequency can be coupled automatically to the center frequency of the instrument or to the frequency of marker 1.

Remote command:
[SENSe:]PMETer<p>:FREQuency:LINK on page 418

Unit/Scale

Selects the unit with which the measured power is to be displayed. Available units are dBm, dB, W and %.

If dB or % is selected, the display is relative to the reference value that is defined with either the "Meas -> Ref" setting or the "Reference Value" setting.

Remote command:
UNIT<n>:PMETer<p>:POWer on page 421
UNIT<n>:PMETer<p>:POWer:RATio on page 421

Meas Time/Average

Selects the measurement time or switches to manual averaging mode. In general, results are more precise with longer measurement times. The following settings are recommended for different signal types to obtain stable and precise results:

"Short"	Stationary signals with high power (> -40dBm), because they require only a short measurement time and short measurement time provides the highest repetition rates.
"Normal"	Signals with lower power or modulated signals
"Long"	Signals at the lower end of the measurement range (<-50 dBm) or Signals with lower power to minimize the influence of noise
"Manual"	Manual averaging mode. The average count is set with the Average Count (Number of Readings) setting.

Remote command:
[SENSe:]PMETer<p>:MTIMe on page 418
[SENSe:]PMETer<p>:MTIMe:AVERage[:STATe] on page 419

Setting the Reference Level from the Measurement Meas -> Ref
Sets the currently measured power as a reference value for the relative display. The reference value can also be set manually via the Reference Value setting.

Remote command:
`CALCulate<n>:PMETer<p>:RELative[:MAGNitude]:AUTO ONCE` on page 415

Reference Value
Defines the reference value in dBm used for relative power meter measurements.

Remote command:
`CALCulate<n>:PMETer<p>:RELative[:MAGNitude]` on page 415

Use Ref Level Offset
If deactivated, takes the Sensor Level Offset into account.

Remote command:
`[SENSe:]PMETer<p>:ROFFset[:STATe]` on page 419

Sensor Level Offset
Takes the specified offset into account for the measured power. Only available if Use Ref Level Offset is disabled.

Remote command:
`[SENSe:]PMETer<p>:SOFFset` on page 420

Average Count (Number of Readings)
Defines the number of readings (averages) to be performed after a single sweep has been started. This setting is only available if manual averaging is selected (Meas Time/ Average setting).

The values for the average count range from 0 to 256 in binary steps (1, 2, 4, 8, …). For average count = 0 or 1, one reading is performed. The general averaging and sweep count for the trace are independent from this setting.

Results become more stable with extended average, particularly if signals with low power are measured. This setting can be used to minimize the influence of noise in the power sensor measurement.

Remote command:
`[SENSe:]PMETer<p>:MTIMe:AVERage:COUNt` on page 418

Duty Cycle
Sets the duty cycle to a percent value for the correction of pulse-modulated signals and activates the duty cycle correction. With the correction activated, the sensor calculates the signal pulse power from this value and the mean power.

Remote command:
`[SENSe:]PMETer<p>:DCYCle[:STATe]` on page 416
`[SENSe:]PMETer<p>:DCYCle:VALue` on page 417

Using the power sensor as an external trigger
If activated, the power sensor creates a trigger signal when a power higher than the defined "External Trigger Level" is measured. This trigger signal can be used as an external power trigger by the R&S FSMR3000.

This setting is only available in conjunction with a compatible power sensor.

Remote command:
`[SENSe:]PMETer<p>:TRIGger[:STATe]` on page 423
`TRIG:SOUR PSE`, see `TRIGger[:SEQuence]:SOURce` on page 454

External Trigger Level ← Using the power sensor as an external trigger
Defines the trigger level for the power sensor trigger.

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

Remote command:
`[SENSe:]PMETer<p>:TRIGger:LEVel` on page 422

Hysteresis ← Using the power sensor as an external trigger
Defines the distance in dB to the trigger level that the trigger source must exceed before a trigger event occurs. Setting a hysteresis avoids unwanted trigger events caused by noise oscillation around the trigger level.

Remote command:
`[SENSe:]PMETer<p>:TRIGger:HYSTeresis` on page 422

Trigger Holdoff ← Using the power sensor as an external trigger
Defines the minimum time (in seconds) that must pass between two trigger events. Trigger events that occur during the holdoff time are ignored.

Remote command:
`[SENSe:]PMETer<p>:TRIGger:HOLDoff` on page 422

Drop-Out Time ← Using the power sensor as an external trigger
Defines the time the input signal must stay below the trigger level before triggering again.

Slope ← Using the power sensor as an external trigger
Defines whether triggering occurs when the signal rises to the trigger level or falls down to it.

Remote command:
`[SENSe:]PMETer<p>:TRIGger:SLOPe` on page 423

7.2.2.3 How to work with a power sensor

The following step-by-step instructions demonstrate how to set up a power sensor. For details on individual functions and settings see Chapter 7.2.2.2, "Power sensor settings", on page 117.

Power sensors can also be used to trigger a measurement at a specified power level, e.g. from a signal generator.

This is described in "How to configure a power sensor as an external (PSE) trigger" on page 123.

How to set up a power sensor

Up to 4 external power sensors can be configured separately and used for precise power measurement. All power sensors can be activated and deactivated individually.

The following procedure describes in detail how to configure and activate power sensors.

1. To display the "Power Sensor" tab of the "Input" dialog box, do one of the following:
   - Select "Input" from the "Overview".
   - Select the [INPUT/OUTPUT] key and then the "Power Sensor Config" softkey.
2. Select the tab for the power sensor index you want to configure, e.g. "Power Sensor 1".
3. Press "Select" to analyze the power sensor data according to the current configuration when power measurement is activated.
4. From the selection list with serial numbers of connected power sensors, select the sensor you want to configure.
   To have newly connected power sensors assigned to a tab automatically (default), select "Auto".
5. Define the frequency of the signal whose power you want to measure.
   a) To define the frequency manually, select "Frequency Manual" and enter a frequency.
   b) To determine the frequency automatically, select "Frequency Coupling" and then either "Center", to use the center frequency, or "Marker", to use the frequency defined by marker 1.
6. Select the unit for the power result display.
7. Select the measurement time for which the average is calculated, or define the number of readings to average. To define the number of readings to be taken into account manually, select "Manual" and enter the number in the "Number of Readings" field.
8. To activate the duty cycle correction, select "DutyCycle" and enter a percentage as the correction value.
9. If you selected "dB" or "%" as units (relative display), define a reference value:
   a) To set the currently measured power as a reference value, press the "Meas -> Ref" button.
   b) Alternatively, enter a value manually in the "Reference Value" field.
   c) Optionally, select the "Use Ref Level Offset" option to take the reference level offset set for the analyzer into account for the measured power.
10. To use the power sensor as an external power trigger, select the "External Power Trigger" option and define the trigger settings.
    For details see "How to configure a power sensor as an external (PSE) trigger" on page 123.

11. If necessary, repeat steps 3-10 for another power sensor.
12. Set the "Power Sensor State" at the top of the "Power Sensor" tab to "On" to activate power measurement for the selected power sensors.

    The results of the power measurement are displayed in the marker table (Function: "Sensor <1...4>").

How to zero the power sensor

1. To display the "Power Sensor" tab of the "Input" dialog box, do one of the following:
   - Select "Input" from the "Overview".
   - Select the [INPUT/OUTPUT] key and then the "Power Sensor Config" softkey.
2. Select the tab that is assigned to the power sensor you want to zero.
3. Press the "Zeroing Power Sensor" button.
   A dialog box is displayed that prompts you to disconnect all signals from the input of the power sensor.
4. Disconnect all signals sending input to the power sensor and press [ENTER] to continue.
5. Wait until zeroing is complete.
   A corresponding message is displayed.

How to configure a power sensor as an external (PSE) trigger

The following step-by-step instructions demonstrate how to configure a power sensor to be used as an external power sensor trigger.

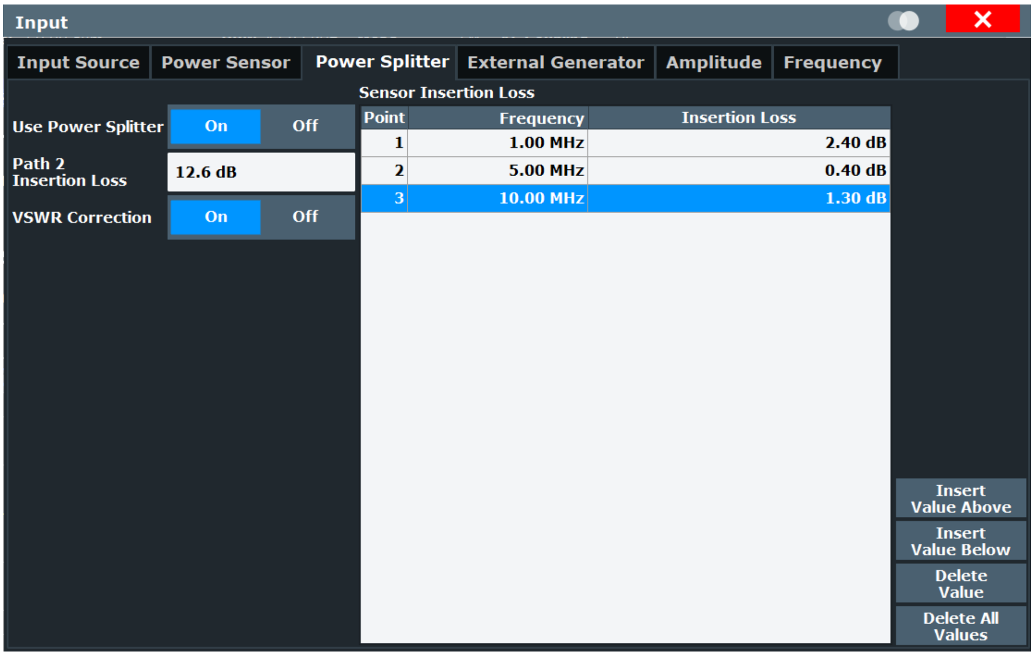
To configure a power sensor as an external power sensor (PSE) trigger

1. Connect a compatible power sensor to the "Power Sensor" interface on the front panel of the R&S FSMR3. (For details on supported sensors see "Using a power sensor as an external power trigger" on page 116).
2. Set up the power sensor as described in "How to set up a power sensor" on page 122.
3. In the "Power Sensor" tab of the "Input" dialog box, select the "External Power Trigger" option.
4. Enter the power level at which a trigger signal is to be generated ("External Trigger Level") and the other trigger settings for the power sensor trigger.
5. Press the [TRIG] key and then select "Trigger/ Gate Config".
6. In the "Trigger And Gate" dialog box, select "Signal Source" = "PSE".

   The R&S FSMR3 is configured to trigger when the defined conditions for the power sensor occur. Power measurement results are provided as usual.

7.2.3 Power splitter

Access: "Overview" > "Input/Frontend" > Power Splitter tab



Use Power Splitter

Enables the usage of a power splitter.

Remote command:

[SENSe:]CORRection:PLOSs:INPut:STATe on page 434

Path2 Insertion Loss

Defines the insertion loss of the power splitter between the signal source and the RF input.

Remote command:

[SENSe:]CORRection:PLOSs:INPut:SPATh on page 434

VSWR Correction

Activates the mismatch correction between the R&S NRP-Z27 or R&S NRP-Z37 power sensor and the RF input of the R&S FSMR3.

This function is only available under certain conditions:

- 10 dB or 30 dB RF attenuation is selected.
- A correction file with VSWR correction values is available in the internal memory of the R&S FSMR3. If the correction file is not present, the softkey will not be present.

Remote command:

[SENSe:]CORRection:VSWR[:STATe] on page 434

Sensor Insertion Loss Table
Provides functionality to enter frequency dependent insertion loss values of the power sensor. They are valid for the path between power meter and signal source.

7.2.4 Optional external generator control

If the R&S FSMR3 optional External Generator Control is installed, you can operate various commercially available generators as an external generator with the R&S FSMR3. Thus, scalar network analysis with the R&S FSMR3 is possible.

7.2.4.1 About external generator control

A common measurement setup includes a signal generator, a device under test (DUT), and a signal and spectrum analyzer, for example the R&S FSMR3. In this setup, the signal analyzer can control which signal the generator is to send, which is in turn measured by the analyzer. This process is referred to as *external generator control*. The generator in this setup is referred to as a *tracking generator*.

A measurement with a tracking generator is useful to measure any effects on the power level caused by the cables and connectors from the signal generator and the signal analyzer in advance. The known effects can then be removed from the measurement results to obtain accurate information on the DUT.

7.2.4.2 Basics on external generator control

Some background knowledge on basic terms and principles used for external generator control is provided here for a better understanding of the required configuration settings.

External generator control is only available in the following applications.

- Spectrum Analyzer
- I/Q Analyzer
- Analog Demodulation
- Noise Figure Measurements

External generator connections

The external generator is controlled either via a LAN connection or via the EXT. GEN. CONTROL GPIB interface of the R&S FSMR3 supplied with the option.

TTL synchronization

In addition, TTL synchronization can be used with some Rohde & Schwarz generators connected via GPIB. The TTL interface is included in the AUX control connector of the External Generator Control option.

Using the TTL interface allows for considerably higher measurement rates than pure GPIB control, because the frequency stepping of the R&S FSMR3 is directly coupled with the frequency stepping of the generator. For details see "Coupling the frequencies" on page 130.

In Figure 7-3 the TTL connection is illustrated using an R&S SMU generator, for example.

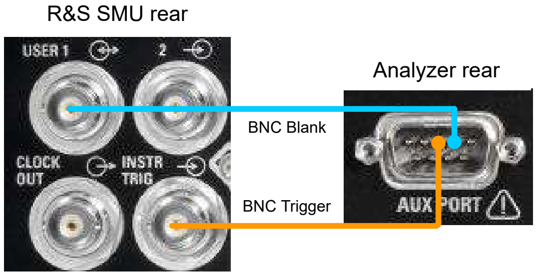


Figure 7-3: TTL connection for an R&S SMU generator

In Figure 7-4, the connection for an R&S SMW is shown.

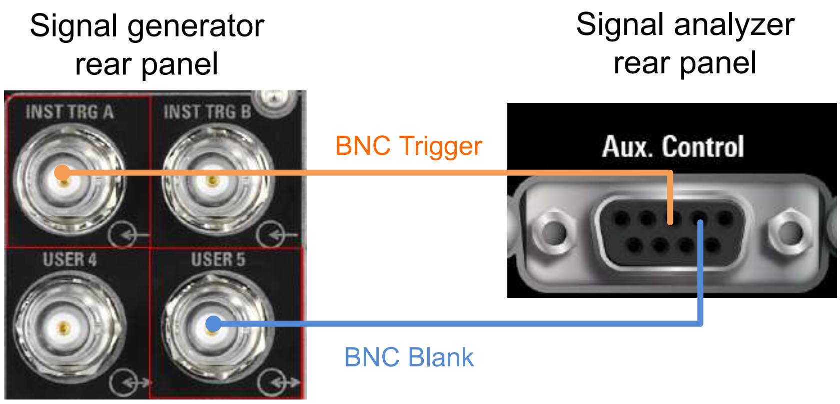


Figure 7-4: TTL connection for an R&S SMW generator

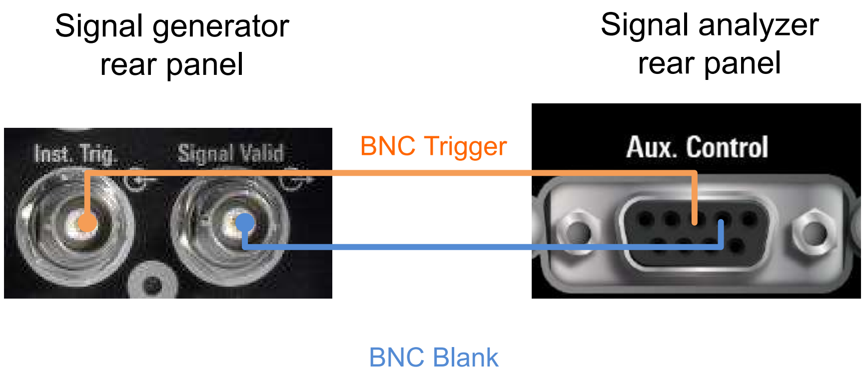


Figure 7-5: TTL connection for an R&S SMA100B generator

The external generator can be used to calibrate the data source by performing either transmission or reflection measurements.

Transmission Measurement

This measurement yields the transmission characteristics of a two-port network. The external generator is used as a signal source. It is connected to the input connector of the DUT. The input of the R&S FSMR3 is fed from the output of the DUT. A calibration can be carried out to compensate for the effects of the test setup (e.g. frequency response of connecting cables).

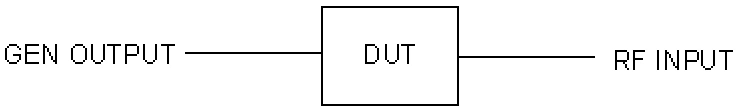


Figure 7-6: Test setup for transmission measurement

Reflection Measurement

Scalar reflection measurements can be carried out using a reflection-coefficient measurement bridge.

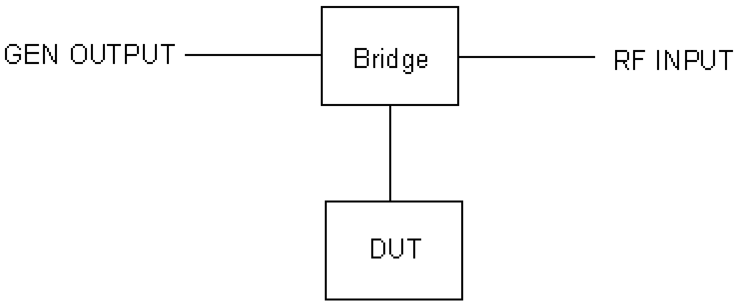


Figure 7-7: Test setup for reflection measurement

Generated signal input

To use the functions of the external generator, an appropriate generator must be connected and configured correctly. In particular, the generator output must be connected to the RF input of the R&S FSMR3.

External reference frequency

To enhance measurement accuracy, use a common reference frequency for both the R&S FSMR3 and the generator. If no independent 10 MHz reference frequency is available, connect the reference output of the generator with the reference input of the R&S FSMR3. Enable usage of the external reference on the R&S FSMR3 via "SETUP" > "Reference" > "External Reference".

Connection errors

If no external generator is connected, if the connection address is not correct, or the generator is not ready for operation, an error message is displayed (e.g."Ext. Generator TCPIP Handshake Error!", see "Displayed information and errors" on page 132).

Overview of supported generators

Generator type	Model	Driver file	TTL support	Generator type	Model	Driver file	TTL support
SGS100A	6 GHz	SGS100A6	-	SMJ	3 GHz	SMJ03	X
	12 GHz	SGS100A12	-		6 GHz	SMJ06	X
SGT100A	3 GHz	SGT100A3	-	SML	1 GHz	SML01	-
	6 GHz	SGT100A6	-		2 GHz	SML02	-
SMA01A	3 GHz	SMA01A [1)]	X		3 GHz	SML03	-
SMA100A	3 GHz	SMA100A3	X	SMM100A	6 GHz	SMM100A06	X
	6 GHz	SMA100A6	X		7 GHz	SMM100A7	X
SMA100B	3 GHz	SMA100B3	X		12 GHz	SMM100A12	X
	6 GHz	SMA100B6	X		20 GHz	SMM100A20	X
	12 GHz	SMA100B12	X		31 GHz	SMM100A31	X
	20 GHz	SMA100B20	X		44 GHz	SMM100A44	X
	32 GHz	SMA100B32	X	SMP	2 GHz	SMP02	X
	40 GHz	SMA100B40	X		3 GHz	SMP03	X
	50 GHz	SMA100B50	X		4 GHz	SMP04	X
	67 GHz	SMA100B67	X		22 GHz	SMP22	X

1) Requires firmware version V2.10.x or later on the signal generator

2) Requires firmware version V1.10.x or later on the signal generator

3) Requires the option SMR-B11 on the signal generator

4) Requires firmware version V3.20.200 or later on the signal generator

Generator type	Model	Driver file	TTL support
SMB100A	1 GHz	SMB100A1	X
	12 GHz	SMB100A12	X
	2 GHz	SMB100A2	X
	20 GHz	SMB100A20	X
	3 GHz	SMB100A3	X
	40 GHz	SMB100A40	X
SMB100B	1 GHz	SMB100B1	X
	3 GHz	SMB100B3	X
	6 GHz	SMB100B6	X
SMBV100A	3 GHz	SMBV100A3	X
	6 GHz	SMBV100A6	X
SMBV100B	3 GHz	SMBV100B3	X
	6 GHz	SMBV100B6	X
SMC100A	1 GHz	SMC100A1	-
	3 GHz	SMC100A3	-
SMCV100B	3 GHz	SMCV100B3	-
	6 GHz	SMCV100B6	-
	7 GHz	SMCV100B7	-
SME	2 GHz	SME02	X
	3 GHz	SME03	X
	6 GHz	SME06	X
SMF100A	43.5 GHz	SMF100A	X
SMF	22 GHz	SMF22	X
	22 GHz	SMF22B2	X
	43 GHz	SMF43	X
	43 GHz	SMF43B2	X
SMG	all	SMG	-
SMGL	all	SMGL	-
SMR	20 GHz	SMR20	-
	20 GHz	SMR20B11 3)	X
	27 GHz	SMR27	X
	27 GHz	SMR27B11 3)	X
	30 GHz	SMR30	X
	30 GHz	SMR30B11 3)	X
	40 GHz	SMR40	X
	40 GHz	SMR40B11 3)	X
	50 GHz	SMR50	X
	50 GHz	SMR50B11 3)	X
	60 GHz	SMR60	X
	60 GHz	SMR60B11 3)	X
SMT	2 GHz	SMT02	-
	3 GHz	SMT03	-
	6 GHz	SMT06	-
SMU	2 GHz	SMU02	X
	2 GHz	SMU02B31 2)	X
	3 GHz	SMU03 2)	X
	3 GHz	SMU03B31 2)	X
	4 GHz	SMU04 2)	X
	4 GHz	SMU04B31 2)	X
	6 GHz	SMU06 2)	X
	6 GHz	SMU06B31 2)	X
SMV	3 GHz	SMV03	-
SMW	3 GHz	SMW03	X4)
	6 GHz	SMW06	X4)
	12.75 GHz	SMW12	X4)
	20 GHz	SMW20	X4)

1) Requires firmware version V2.10.x or later on the signal generator

2) Requires firmware version V1.10.x or later on the signal generator

3) Requires the option SMR-B11 on the signal generator

4) Requires firmware version V3.20.200 or later on the signal generator

Generator type	Model	Driver file	TTL support	Generator type	Model	Driver file	TTL support
SMGU	all	SMGU	-		31.8 GHz	SMW31	X[4)]
SMH	all	SMH	-		40 GHz	SMW40	X[4)]
SMHU		SMHU	-		44 GHz	SMW44	X
SMIQ	2 GHz	SMIQ02	X	SMX	all	SMX	-
	2 GHz	SMIQ02B	X	SMY	1 GHz	SMY01	-
	2 GHz	SMIQ02E	-		2 GHz	SMY02	-
	3 GHz	SMIQ03	X				
	3 GHz	SMIQ03B	X				
	3 GHz	SMIQ03E	-				
	4 GHz	SMIQ04B	X				
	6 GHz	SMIQ06B	X				

1) Requires firmware version V2.10.x or later on the signal generator
2) Requires firmware version V1.10.x or later on the signal generator
3) Requires the option SMR-B11 on the signal generator
4) Requires firmware version V3.20.200 or later on the signal generator

Generator setup files

For each signal generator type to be controlled by the R&S FSMR3, configure a generator setup file and store it on the R&S FSMR3. The setup file defines the frequency and power ranges supported by the generator, and information required for communication. For the signal generators listed in "Overview of supported generators" on page 128, default setup files are provided. If necessary, you can edit or duplicate these files for varying measurement setups or other instruments.

You can display the existing setup files in an editor in read-only mode directly from the "External Generator" configuration dialog box. From there, you can edit them and store them under a different name. Then they are available on the R&S FSMR3.

Coupling the frequencies

Frequency coupling means that the generator frequency and the frequency of the R&S FSMR3 are the same.

- **Manual coupling**: a single frequency is defined
- **Automatic coupling**: a series of frequencies is defined (one for each sweep point), based on the current frequency at the RF input of the R&S FSMR3. The RF frequency range covers the currently defined span of the R&S FSMR3 (unless limited by the range of the signal generator).

Automatic coupling

If automatic coupling is used, the output frequency of the generator (source frequency) is calculated as follows:

$$F_{Generator} = \left| F_{Analyzer} * \frac{Numerator}{Denominator} + F_{Offset} \right|$$

Equation 7-1: Output frequency of the generator

Where:

$F_{Generator}$ = output frequency of the generator

$F_{Analyzer}$ = current frequency at the RF input of the R&S FSMR3

Numerator = multiplication factor for $F_{Analyzer}$

Denominator = division factor for $F_{Analyzer}$

F_{Offset} = frequency offset for $F_{Analyzer}$, for example for frequency-converting measurements or harmonics measurements

The value range for the offset depends on the selected generator. The default setting is 0 Hz. Offsets other than 0 Hz are indicated by the "FRQ" label in the channel bar (see also "Displayed information and errors" on page 132).

Swept frequency range

If the resulting frequency range exceeds the allowed ranges of the signal generator, an error message is displayed (see "Displayed information and errors" on page 132). The Result Frequency Start and Result Frequency Stop values are corrected to comply with the range limits.

TTL synchronization

Some Rohde & Schwarz signal generators support TTL synchronization when connected via GPIB. The TTL interface is included in the AUX control connector of the External Generator Control option.

When pure GPIB connections are used between the R&S FSMR3 and the signal generator, the R&S FSMR3 sets the generator frequency for each frequency point individually via GPIB. Only when the setting procedure is finished, the R&S FSMR3 can measure the next sweep point.

For generators with a TTL interface, the R&S FSMR3 sends a list of the frequencies to be set to the generator before the beginning of the first sweep. Then the R&S FSMR3 starts the sweep and the next frequency point is selected by both the R&S FSMR3 and the generator using the TTL handshake line "TRIGGER". The R&S FSMR3 can only measure a value when the generator signals the end of the setting procedure via the "BLANK" signal.

Using the TTL interface allows for considerably higher measurement rates, because the frequency stepping of the R&S FSMR3 is directly coupled with the frequency stepping of the generator.

Reverse sweep

The frequency offset for automatic coupling can be used to sweep in the reverse direction. To do so, define a negative offset in the external generator measurement configuration. (Note that the frequency is defined as the unsigned value of the equation, thus a negative frequency is not possible.)

Example: Example for reverse sweep

$F_{AnalyzerStart}$= 100 MHz

$F_{AnalyzerStop}$ = 200 MHz

F_{Offset} = -300 MHz

Numerator = Denominator = 1

→$F_{GeneratorStart}$ = 200 MHz

→$F_{GeneratorStop}$ = 100 MHz

If the offset is adjusted so that the sweep of the generator crosses the minimum generator frequency, a message is displayed in the status bar ("Reverse Sweep via min. Ext. Generator Frequency!").

Example: Example for reverse sweep via minimum frequency

$F_{AnalyzerStart}$= 100 MHz

$F_{AnalyzerStop}$ = 200 MHz

F_{Offset} = -150 MHz

F_{min} = 20 MHz

Numerator = Denominator = 1

→$F_{GeneratorStart}$ = 50 MHz

→$F_{GeneratorStop}$ = 50 MHz via F_{min}

Displayed information and errors

Channel bar

If external generator control is active, some additional information is displayed in the channel bar.

Label	Description
EXT TG: <source power>	External generator active; signal sent with <source power> level
LVL	Power Offset (see "Source Offset" on page 136
FRQ	Frequency Offset (see "(Automatic) Source Frequency (Numerator/Denominator/Offset)" on page 137

Error and status messages

The following status and error messages can occur during external generator control.

Message	Description
"Ext. Generator GPIB Handshake Error!" / "Ext. Generator TCPIP Handshake Error!" / "Ext. Generator TTL Handshake Error!"	Connection to the generator is not possible, e.g. due to a cable damage or loose connection or wrong address.
"Ext. Generator Limits Exceeded!"	The allowed frequency or power ranges for the generator were exceeded.
"Reverse Sweep via min. Ext. Generator Fre-quency!"	Reverse sweep is performed; frequencies are reduced to the minimum frequency, then increased again; see "Reverse sweep" on page 131.
"Ext. Generator File Syntax Error!"	Syntax error in the generator setup file (see "Generator setup files" on page 130
"Ext. Generator Command Error!"	Missing or wrong command in the generator setup file (see "Generator setup files" on page 130
"Ext. Generator Visa Error!"	Error with Visa driver provided with installation (very unlikely)

NOTICE

Overloading

At a reference level of -10 dBm and at an external generator output level of the same value, the R&S FSMR3 operates without overrange reserve. That means the R&S FSMR3 is in danger of being overloaded if a signal is applied whose amplitude is higher than the reference line. In this case, either the message "RF OVLD" for overload or "IF OVLD" for exceeded display range (clipping of the trace at the upper diagram border = overrange) is displayed in the status line.

Overloading can be avoided as follows:

- Reducing the output level of the external generator ("Source Power" on page 136 in "External Generator > Measurement Configuration")

7.2.4.3 External generator control settings

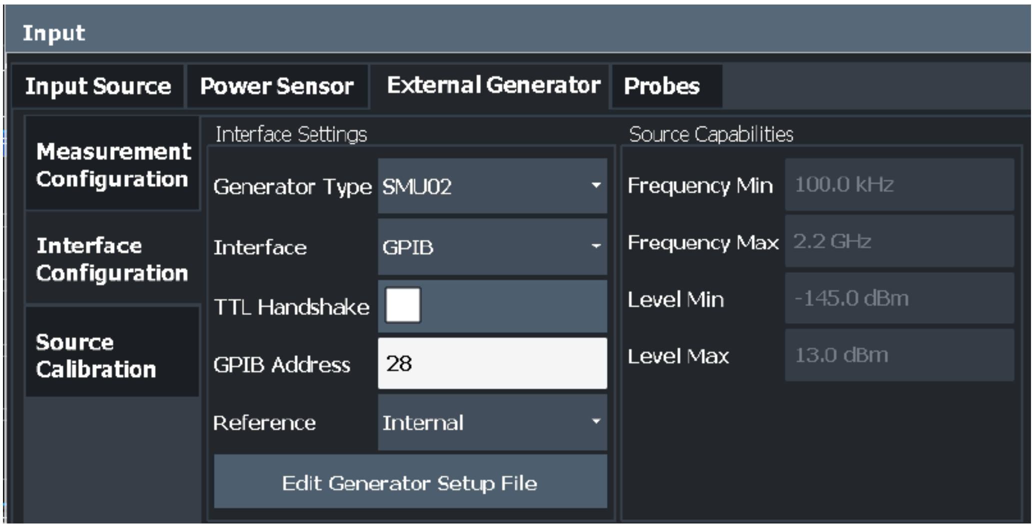
Access: [INPUT/OUPUT] > "External Generator Config"

The "External Generator" settings are available if the R&S FSMR3 External Generator Control option is installed. For each measurement channel, you can configure one external generator. To switch between different configurations, define multiple measurement channels.

For more information on external generator control, see Chapter 7.2.4.2, "Basics on external generator control", on page 125.

Interface configuration settings

Access: "Overview" > "Input" > "External Generator" > "Interface Configuration"



Generator Type

Selects the generator type and thus defines the generator setup file to use.

Remote command:

`SYSTem:COMMunicate:RDEVice:GENerator<gen>:TYPE` on page 429

Interface

Type of interface connection used.

For details on which signal generators support which interfaces, see the documentation of the corresponding signal generator.

- GPIB
- TCP/IP

Remote command:

`SYSTem:COMMunicate:RDEVice:GENerator<gen>:INTerface` on page 428

TTL Handshake

If available for the specified generator type, this option activates TTL synchronization via handshake.

GPIB Address/TCPIP Address / Computer Name

For LAN connections: TCP/IP address of the signal generator

For GPIB connections: GPIB address of the signal generator.

Remote command:
`SYSTem:COMMunicate:GPIB:RDEVice:GENerator<gen>:ADDRess` on page 428
`SYSTem:COMMunicate:TCPip:RDEVice:GENerator<gen>:ADDRess`
on page 429

Reference
Selects the internal R&S FSMR3 or an external frequency reference to synchronize the R&S FSMR3 with the generator (default: internal).

Remote command:
`SOURce<si>:EXTernal<gen>:ROSCillator[:SOURce]` on page 428

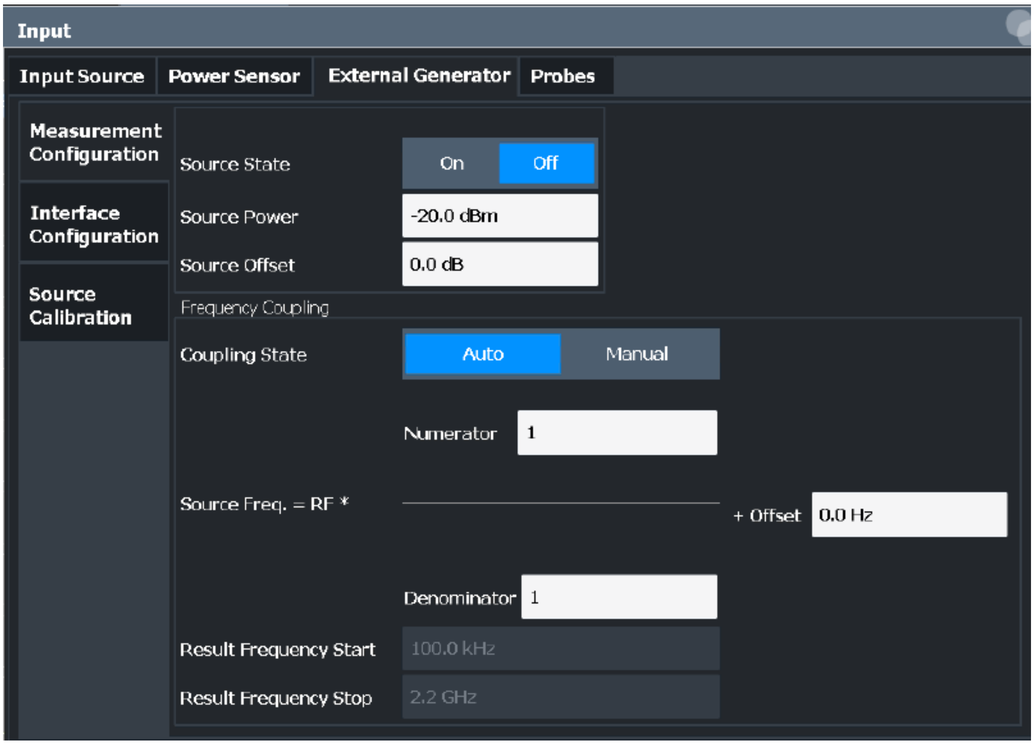
Edit Generator Setup File
Displays the setup file for the currently selected Generator Type in read-only mode in an editor.

Although the existing setup files are displayed in read-only mode in the editor, they can be saved under a different name (using "File > SaveAs").

Frequency Min/ Frequency Max
For reference only: Lower and upper frequency limit for the generator.

Level Min/ Level Max
For reference only: Lower and upper power limit for the generator.

Measurement settings



Source State

Activates or deactivates control of an external generator.

Remote command:
`SOURce<si>:EXTernal<gen>[:STATe]` on page 427

Source Power

The output power of the external generator. The default output power is -20 dBm. The range is specified in the data sheet.

Remote command:
`SOURce<si>:EXTernal<gen>:POWer[:LEVel]` on page 426

Source Offset

Constant level offset for the external generator. Values from -200 dB to +200 dB in 1 dB steps are allowed. The default setting is 0 dB. Offsets are indicated by the "LVL" label in the channel bar (see also "Displayed information and errors" on page 132).

Using this offset, attenuators or amplifiers at the output connector of the external generator can be considered. This is useful, for example, for the displayed output power values on screen or during data entry. Positive offsets apply to an amplifier, while negative offsets apply to an attenuator after the external generator.

Remote command:
`SOURce<si>:POWer[:LEVel][:IMMediate]:OFFSet` on page 427

Source Frequency Coupling

Defines the frequency coupling mode between the R&S FSMR3 and the generator.

For more information on coupling frequencies, see "Coupling the frequencies" on page 130.

"Auto"	Default setting: a series of frequencies is defined (one for each sweep point), based on the current frequency at the RF input of the R&S FSMR3 (see "(Automatic) Source Frequency (Numerator/Denominator/Offset)" on page 137). The RF frequency range covers the currently defined span of the R&S FSMR3 (unless limited by the range of the signal generator).
"Manual"	The generator uses a single fixed frequency, defined by (Manual) Source Frequency which is displayed when you select "Manual" coupling.

Remote command:
`SOURce<si>:EXTernal<gen>:FREQuency:COUPling[:STATe]` on page 424

(Manual) Source Frequency
Defines the fixed frequency to be used by the generator.

Remote command:
SOURce<si>:EXTernal<gen>:FREQuency on page 424

(Automatic) Source Frequency (Numerator/Denominator/Offset)
With automatic frequency coupling, a series of frequencies is defined (one for each sweep point), based on the current frequency at the RF input of the R&S FSMR3.

However, the frequency used by the generator can differ from the input from the R&S FSMR3. The RF frequency can be multiplied by a specified factor, or a frequency offset can be added, or both.

Note: The input for the generator frequency is not validated, i.e. you can enter any values. However, if the allowed frequency ranges of the generator are exceeded, an error message is displayed on the R&S FSMR3. The values for Result Frequency Start and Result Frequency Stop are corrected to comply with the range limits.

The value range for the offset depends on the selected generator. The default setting is 0 Hz. Offsets <> 0 Hz are indicated by the "FRQ" label in the channel bar. Negative offsets can be used to define reverse sweeps.

For more information on coupling frequencies and reverse sweeps, see "Coupling the frequencies" on page 130. For more information on error messages and the channel bar, see "Displayed information and errors" on page 132.

Remote command:
SOURce<si>:EXTernal<gen>:FREQuency[:FACTor]:DENominator on page 425
SOURce<si>:EXTernal<gen>:FREQuency[:FACTor]:NUMerator on page 425
SOURce<si>:EXTernal<gen>:FREQuency:OFFSet on page 426

Result Frequency Start
For reference only: The start frequency for the generator, calculated from the configured generator frequency and the start value defined for the R&S FSMR3.

Result Frequency Stop
For reference only: The stop frequency for the generator, calculated from the configured generator frequency and the stop value defined for the R&S FSMR3.

7.2.4.4 How to work with external generator control

The following step-by-step instructions demonstrate how to work with the optional external generator control.

For remote operation, see "Programming example for external generator control" on page 432.

How to configure an external generator connection via GPIB

1. Connect the signal generator's GPIB interface connector to the "Ext. Gen.Control GPIB" connector on the rear panel of the R&S FSMR3.
2. If the signal generator supports TTL synchronization, connect the signal generator to the optional"Aux.Control" port.
3. Press the [INPUT/OUTPUT] key and select "External Generator Config".
4. In the "Interface Configuration" subtab, select the "Generator Type" connected to the R&S FSMR3.
   If the required generator type is not available, define a new setup file as described in "How to define a new generator setup file" on page 138.
5. Select the type of interface and the address used to connect the generator to the R&S FSMR3.
6. If the generator supports "TTL Synchronization", activate this function.

How to define a new generator setup file

1. Press the [INPUT/OUTPUT] key and select "External Generator Config".
2. In the "Interface Configuration" subtab, select a generator type that has similar characteristics (frequency and power ranges).
3. Select "Edit Generator Setup File".
   The configuration file for the selected generator type is displayed (read-only) in an editor.
4. Edit the configuration values according to your generator. Be sure not to change the syntax of the file - only change the *values* of the parameters.
   Errors are only detected and displayed when you try to use the new generator (see also "Displayed information and errors" on page 132).
5. Save the file under a different name with the extension `.gen`:
   a) In the editor, select "File > SaveAs".
   b) Select "Save as type: All Files (*.*)".
   c) Specify a name with the extension `.gen`.

6. In the R&S FSMR3 firmware, close the "External Generator Config" dialog and re-open it.

   Now you can select the new generator type from the selection list on the "Interface Configuration" tab.

How to calibrate a measurement setup using an external generator

1. Connect the signal generator output to the "RF input" connector of the R&S FSMR3.
2. If the measurement setup does not require the full span of the R&S FSMR3, change the "Frequency Start" and "Frequency Stop" values ([FREQ] key > "Frequency Config" softkey).
3. Press the [INPUT/OUTPUT] key and select "External Generator Config".
4. In the "Interface Configuration" subtab, select "Reference: External" to synchronize the analyzer with the generator.
5. Switch to the "Measurement Configuration" subtab.
6. Set the "Source State" to "On".
7. Define the generator output level as the "Source Power".
8. Optionally, to define a constant level offset for the external generator, define a "Source Offset".
9. The default frequency list for the calibration sweep contains 1001 values, divided in equidistant frequencies between the R&S FSMR3's start and stop frequency. Usually, this automatic coupling is correct. Check the "Result Frequency Start" and "Result Frequency Stop" values to make sure that the required measurement span is covered. If necessary, change the frequency settings on the R&S FSMR3 ([FREQ] key > "Frequency Config" softkey), or use a different generator type.
10. Switch to the "Source Calibration" subtab.
11. Select the "Source Calibration Type": "Transmission" to perform a calibration sweep and store a reference trace for the measurement setup.
12. Select "Source Calibration Normalize": "On".
13. Optionally, shift the reference line further down in the result display by decreasing the "Reference": "Position".

    The measurement setup is now calibrated. Subsequent measurement results are normalized, so that any unwanted effects from the cables and connectors are removed.

How to remove the effects of a particular component from measurement results using calibration

1. Set up the measurement, including the component, and perform a calibration as described in "How to calibrate a measurement setup using an external generator" on page 139.
2. After setting "Source Calibration Normalize": "On", select "Save as Trd Factor" to store the normalized reference trace as a transducer factor.
3. If necessary, switch to another measurement channel for a different R&S FSMR3 application.
4. Press the [Setup] key, then select the "Transducer" softkey.
5. Select the stored transducer in the list of available transducers and select the "Active" setting for it.
6. Perform any measurement with the setup that contains the calibrated component.

   The measurement results do not include the effects from the component.

How to compensate for additional gain or attenuation after calibration

If a gain or an attenuation is inserted in the measurement after calibration, this effect can be reflected in the display of the normalized trace on the R&S FSMR3. Thus, the measured trace and the normalized trace are not so far apart in the display, so that you can zoom into the normalized trace without cropping the measurement trace.

Prerequisite: a calibration has been performed for the original measurement setup, except for the component causing an additional gain or attenuation (as described in "How to calibrate a measurement setup using an external generator" on page 139)

1. Insert the additional component in the calibrated measurement setup and perform a new measurement.
2. Press the [INPUT/OUTPUT] key and select "External Generator Config".
3. Switch to the "Source Calibration" subtab.
4. With active normalization, set the "Reference":" Value" to the same value as the gain or attenuation the inserted component causes.
5. Optionally, shift the reference line further down in the result display by decreasing the "Reference": "Position".

   The normalized reference trace moves to the position of the measured trace.
6. Optionally, zoom into the measured trace by changing the y-axis scaling (or the range: "AMPT > Scale Config > Range").

   The measured trace is still fully visible, and the absolute values are still valid.

7.2.4.5 Measurement example: calibration with an external generator

The following measurement example demonstrates the most common functions using an external generator. This example requires the External Generator Control option.

The example assumes an SMW100A generator is connected to the R&S FSMR3. A band elimination filter is the device under test. After calibration, an additional attenuator is inserted between the DUT and the R&S FSMR3.

The following procedures are described:

- "Calibrating the measurement setup" on page 141
- "Measuring the effects of the DUT" on page 142
- "Compensating the effects of additional attenuation after calibration" on page 144

Calibrating the measurement setup

1. Connect the signal generator's GPIB interface connector to the [Ext. Gen.Control GPIB] connector on the rear panel of the R&S FSMR3.
2. Connect the signal generator output to the [RF input] connector of the R&S FSMR3.
3. Adapt the measurement range of the R&S FSMR3 to the filter to be tested. In this measurement, define the following settings:
   a) Press the [FREQ] key, select "Frequency Config" and enter "Frequency Start": *100 MHz*.
   b) Enter "Frequency Stop": *300 MHz*
4. Press the [INPUT/OUTPUT] key and select "External Generator Config".
5. In the "Interface Configuration" sub-tab, select "Generator Type":"SMW06".
6. Select "Reference: External" to synchronize the analyzer with the generator.
7. Switch to the "Measurement Configuration" sub-tab.
8. Set the "Source State" to "On".
9. Define the generator output level as the "Source Power": *-20 dBm*.
10. Set the "Coupling State" to "Auto".

    The "Result Frequency Start" value for the generator is indicated as *100.0 MHz*. The "Result Frequency Stop" value is indicated as *300.0 MHz*.
11. Switch to the "Source Calibration" sub-tab.
12. Select the "Source Calibration Type": "Transmission" to perform a calibration sweep and store a reference trace for the measurement setup.

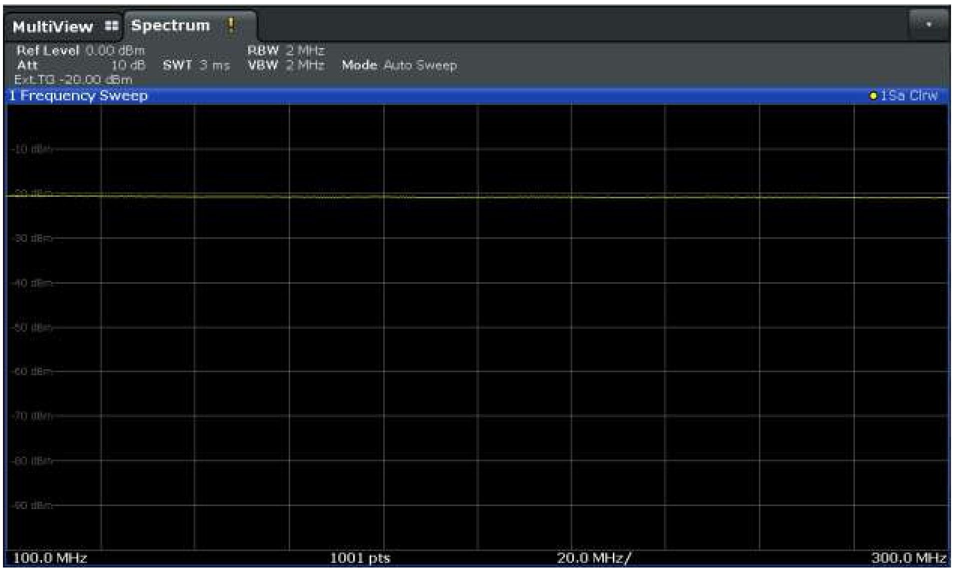


Figure 7-8: Measurement results from generator, analyzer and connecting cables

13. Select "Source Calibration Normalize": "On" to set the measurement results for the current setup to 0, thus eliminating all effects from the generator, the analyzer and the connecting cables from subsequent measurements with the band elimination filter.

    The reference line is displayed at 0 dB at the top of the diagram (100%).

Figure 7-9: Normalized measurement results after calibration

Measuring the effects of the DUT

After calibration we can insert the band elimination filter (our DUT) in the measurement setup.

1. Connect the signal generator output to the band elimination filter.

2. Connect the band elimination filter output to the [RF input] connector of the R&S FSMR3.

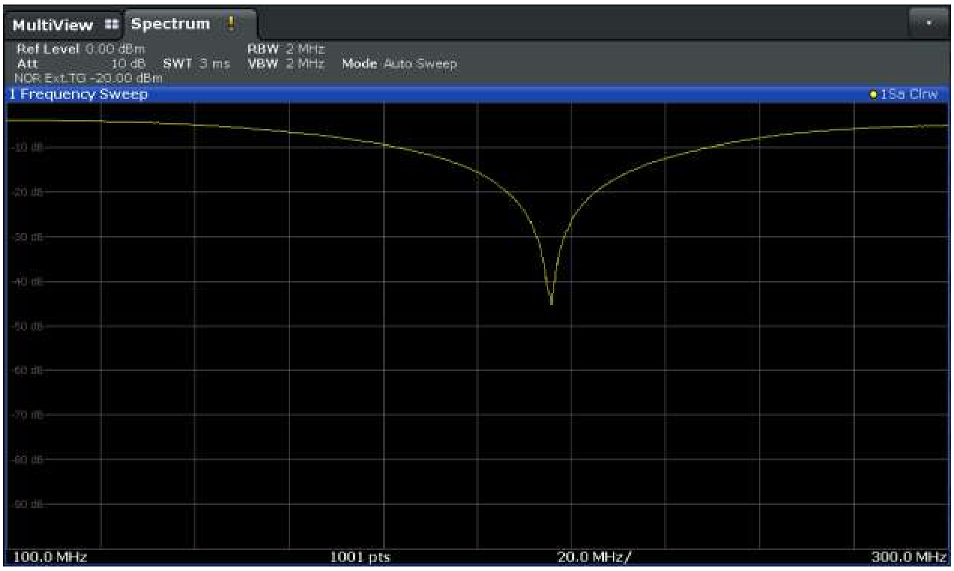


Figure 7-10: Band elimination filter results

3. Shift the reference line from the top of the diagram to the middle of the diagram by changing the position of the reference point *0.0 dB* to *50 %*.
In the "Source Calibration" tab, enter "Position": *50 %*.

   At the same time, the range of the displayed y-axis moves from *[-100.0 dB to 0 dB]* to *[-50 dB to +50 dB]*.

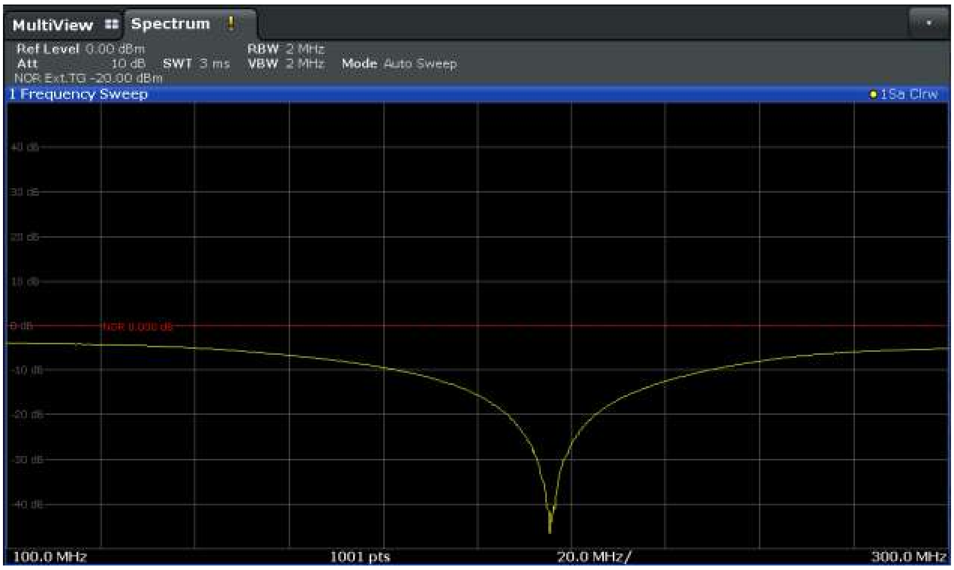


Figure 7-11: Reference line shifted to middle of diagram (50%)

Compensating the effects of additional attenuation after calibration

After calibration, an additional attenuator is inserted between the DUT and the R&S FSMR3. This may be necessary, for example, to protect the analyzer's input connector. Nevertheless, we are only interested in the effects of the DUT, not those of the additional protective attenuator. Thus, we will compensate these effects in the result display on the R&S FSMR3 by moving the reference line.

1. Connect a 3 dB attenuator between the band elimination filter output and the [RF input] connector on the R&S FSMR3.

   The measurement results are now 3 dB lower.

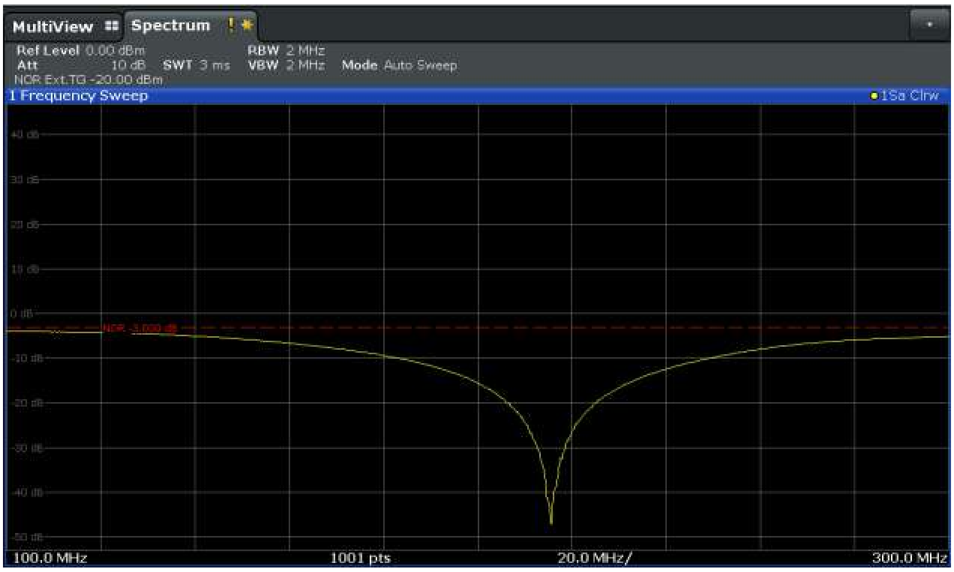


Figure 7-12: Measurement results with additional attenuator

2. In the "Source Calibration" tab, enter "Reference Value": *-3 dB*.

   The reference line is shifted down by 3 dB so that the measurement trace is displayed on the reference line again.
   At the same time, the scaling of the y-axis is changed: -3 dB are now shown at 50% of the diagram; the range is *[-53 dB to +47 dB*].

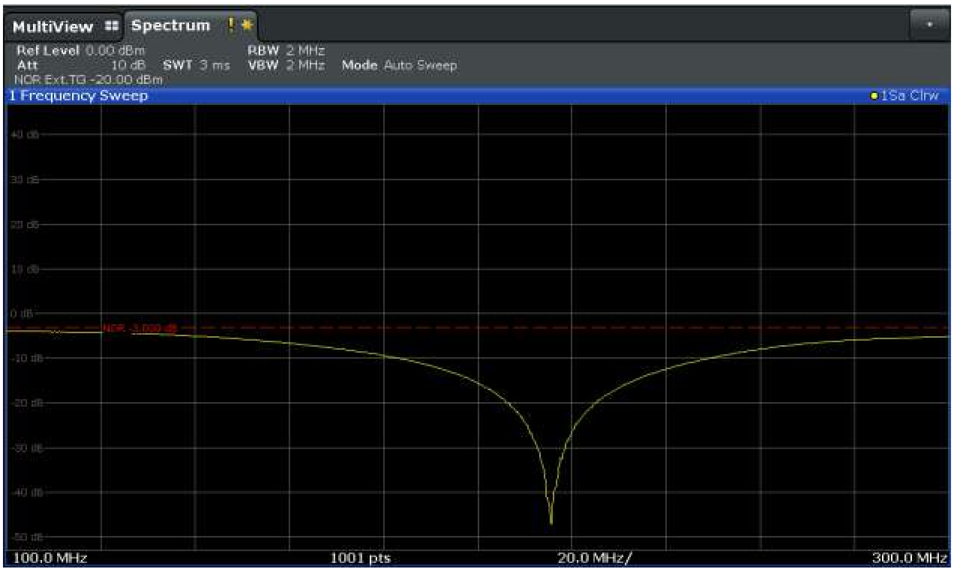


Figure 7-13: Reference line with an offset of -3 dB and shifted to middle of diagram (50%)

3. After the reference trace has been shifted, you can zoom into the measured trace to determine the offsets to the reference line, which represent the effects of the band elimination filter in the measurement setup.
   Change the y-axis scaling to 1 dB/div (or the range to 10 dB).
   a) Press the [AMPT] key, then select "Scale Config" > " Range".
   b) Enter *10 dB*.

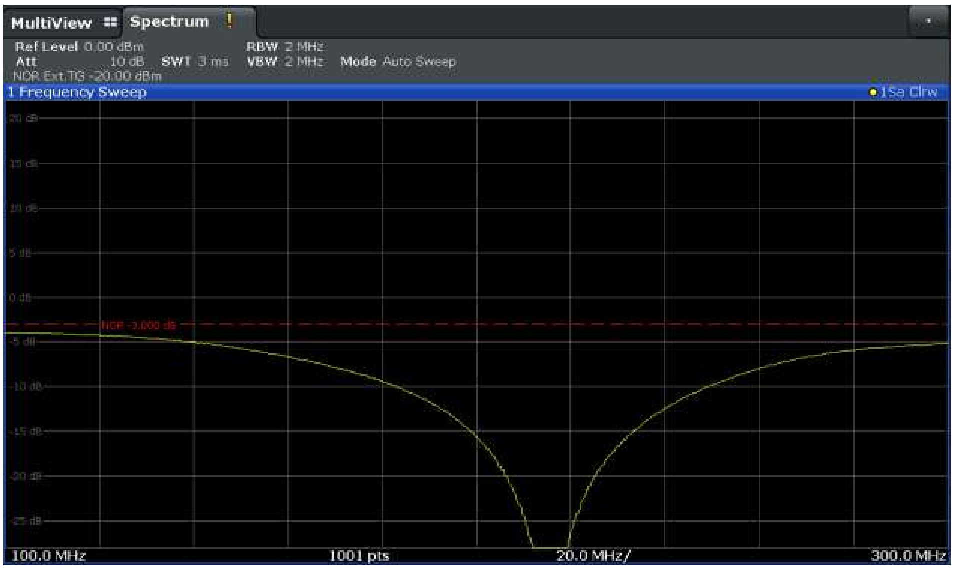


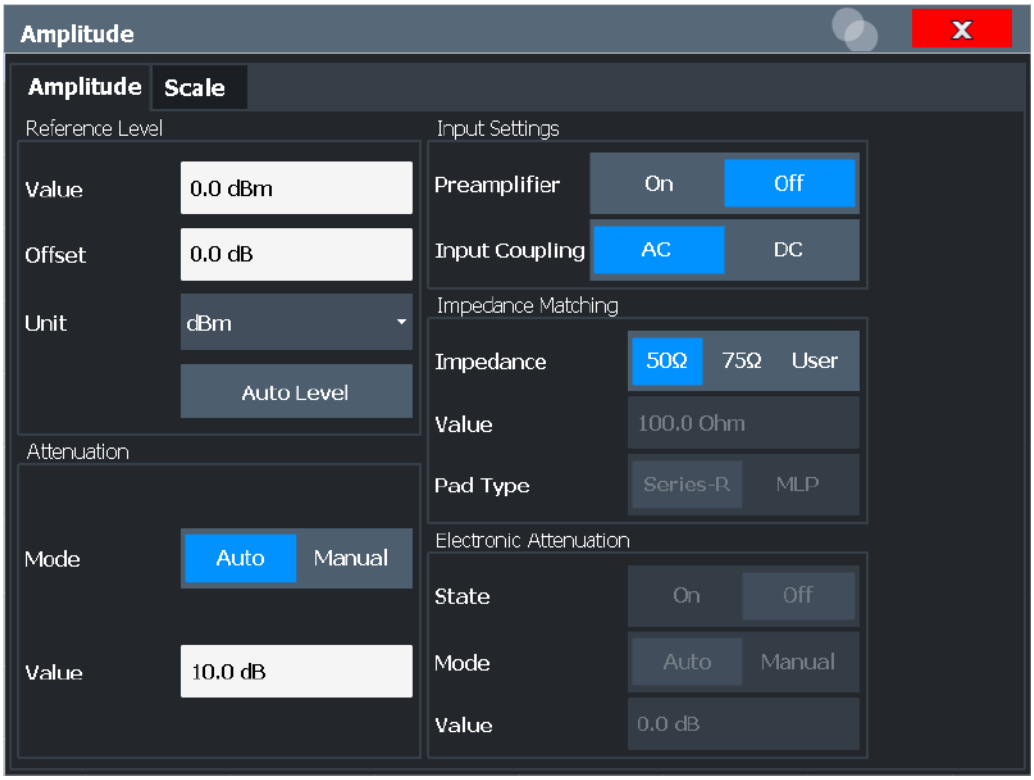
Figure 7-14: Reference line with measurement results using larger scale

7.2.5 Amplitude settings

Amplitude settings determine how the R&S FSMR3000 must process or display the expected input power levels.

Configuring amplitude settings allows you to:

- Adapt the instrument hardware to the expected maximum signal level by setting the Reference Level to this maximum
- Consider an external attenuator or preamplifier (using the "Offset").
- Optimize the SNR of the measurement for low signal levels by configuring the Reference Level as high as possible without introducing compression, clipping or overload. Use early amplification by the preamplifier and a low attenuation.
- Optimize the SNR for high signal levels and ensure that the instrument hardware is not damaged, using high attenuation and AC coupling (for DC input voltage).
- Adapt the reference impedance for power results when measuring in a 75-Ohm system by connecting an external matching pad to the RF input.



Reference Level
Defines the expected maximum reference level. Signal levels above this value are possibly not measured correctly. Signals above the reference level are indicated by an "IF Overload" status display.

The reference level can also be used to scale power diagrams; the reference level is then used for the calculation of the maximum on the y-axis.

Since the hardware of the R&S FSMR3000 is adapted according to this value, it is recommended that you set the reference level close above the expected maximum signal level. Thus you ensure an optimal measurement (no compression, good signal-to-noise ratio).

Remote command:
`DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:RLEVel` on page 440

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 FSMR3 so the application shows correct power results. All displayed power level results are shifted by this value.

The setting range is ±200 dB in 0.01 dB steps.

Note, however, that the *internal* reference level (used to adjust the hardware settings to the expected signal) ignores any "Reference Level Offset". Thus, it is important to keep in mind the actual power level the R&S FSMR3 must handle. Do not rely on the displayed reference level (internal reference level = displayed reference level - offset).

Remote command:
`DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:RLEVel:OFFSet` on page 440

Attenuation Mode / Value
Defines the attenuation applied to the RF input of the R&S FSMR3.

The RF attenuation can be set automatically as a function of the selected reference level (Auto mode). Automatic attenuation ensures that no overload occurs at the RF Input connector for the current reference level. It is the default setting.

In "Manual" mode, you can set the RF attenuation in 1 dB steps (down to 0 dB). Other entries are rounded to the next integer value. The range is specified in the data sheet. If the defined reference level cannot be set for the defined RF attenuation, the reference level is adjusted accordingly and the warning "limit reached" is displayed.

NOTICE! Risk of hardware damage due to high power levels. When decreasing the attenuation manually, ensure that the power level does not exceed the maximum level allowed at the RF input, as an overload can lead to hardware damage.

Remote command:
`INPut<ip>:ATTenuation` on page 441
`INPut<ip>:ATTenuation:AUTO` on page 441

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.

Preamplifier ← Input Settings
If the (optional) internal preamplifier hardware is installed on the R&S FSMR3000, a preamplifier can be activated for the RF input signal.

"Off" Deactivates the preamplifier.

"15 dB" The RF input signal is amplified by about 15 dB.

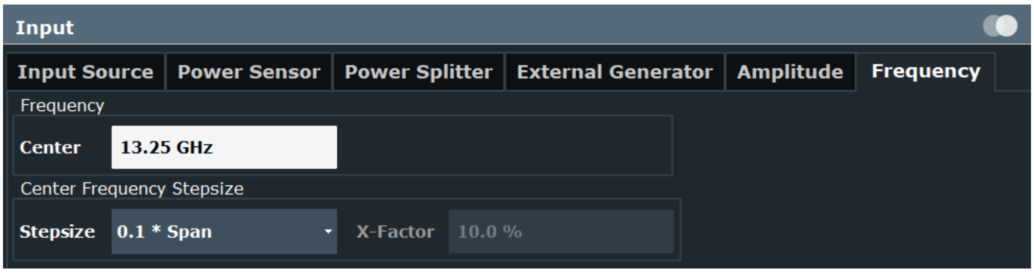
"30 dB" The RF input signal is amplified by about 30 dB.

For FSMR3050, the input signal is amplified by 30 dB if the preamplifier is activated.

Remote command:
`INPut<ip>:GAIN:STATe` on page 442
`INPut<ip>:GAIN[:VALue]` on page 443

7.2.6 Frequency

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



Center Frequency
Defines the center frequency of the signal in Hertz.

Remote command:
`[SENSe:]FREQuency:CENTer` on page 438

Center Frequency Stepsize
Defines the step size by which the center frequency is increased or decreased using the arrow keys.

When you use the rotary knob the center frequency changes in steps of only 1/10 of the span.

The step size can be coupled to another value or it can be manually set to a fixed value.

"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 438

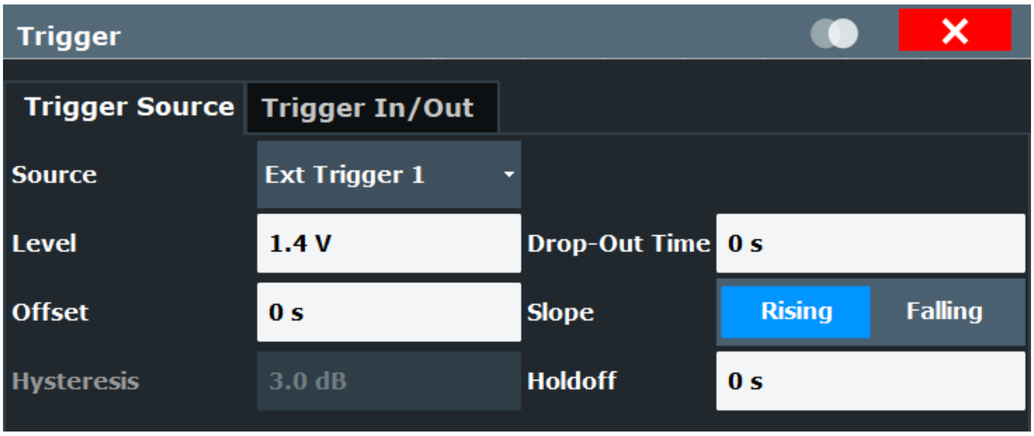
7.3 Trigger settings

Access: Overview > Trigger

Triggering means to capture the interesting part of the signal. Choosing the right trigger type and configuring all trigger settings correctly allows you to detect various incidents in your signals.

7.3.1 Trigger source

Provides functionality to set up a specific trigger source.



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.

Remote command:
TRIGger[:SEQuence]:SOURce on page 454

Free Run ← Trigger Source
No trigger source is considered. Data acquisition is started manually or automatically and continues until stopped explicitly.

Remote command:
`TRIG:SOUR IMM`, see `TRIGger[:SEQuence]:SOURce` on page 454

Ext. Trigger 1/2 ← Trigger Source
Data acquisition starts when the TTL signal fed into the specified input connector meets or exceeds the specified trigger level.

(See "Trigger Level" on page 151).

Note: The "External Trigger 1" softkey automatically selects the trigger signal from the "Trigger Input / Output" connector on the front panel.

For details, see the "Instrument Tour" chapter in the R&S FSMR3 Getting Started manual.

"External Trigger 1"
Trigger signal from the "Trigger Input / Output" connector. (front panel)

"External Trigger 2"
Trigger signal from the "Sync Trigger Input / Output" connector. (rear panel)

Remote command:
`TRIG:SOUR EXT`, `TRIG:SOUR EXT2`
See `TRIGger[:SEQuence]:SOURce` on page 454

Video ← Trigger Source
Defines triggering by the video signal, i.e. the filtered and detected version of the input signal (the envelope of the IF signal), as displayed on the screen.

Define a trigger level from 0 % to 100 % of the diagram height. The absolute trigger level is indicated by a horizontal trigger line in the diagram, which you can also move graphically to change the trigger level.

A fixed hysteresis of ±5 % of the specified trigger value (in V) is applied to the video trigger level automatically and cannot be changed.

Video mode is only available in the time domain, and not for I/Q-based data.

Remote command:
`TRIG:SOUR VID`, see `TRIGger[:SEQuence]:SOURce` on page 454

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.

Remote command:
`TRIG:SOUR IQP`, see `TRIGger[:SEQuence]:SOURce` on page 454

Power Sensor ← Trigger Source
Uses an external power sensor as a trigger source. This option is only available if a power sensor is connected and configured.

Connect the external power sensor to the "Smart Noise Source" connector on the front panel of the R&S FSMR3 when using the power sensor as a trigger source.

Note: For Rohde & Schwarz power sensors, the "Gate Mode" *Lvl* is not supported. The signal sent by these sensors merely reflects the instant the level is first exceeded, rather than a time period. However, only time periods can be used for gating in level mode. Thus, the trigger impulse from the sensors is not long enough for a fully gated measurement; the measurement cannot be completed.

Remote command:
`TRIG:SOUR PSE`, see `TRIGger[:SEQuence]:SOURce` on page 454

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

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

Remote command:
`TRIGger[:SEQuence]:LEVel[:EXTernal<port>]` on page 451

Drop-Out Time
Defines the time that the input signal must stay below the trigger level before triggering again.

Remote command:
`TRIGger[:SEQuence]:DTIMe` on page 450

Trigger Offset
Defines the time offset between the trigger event and the start of the measurement.

Offset > 0:	Start of the measurement is delayed
Offset < 0:	Measurement starts earlier (pretrigger)

Remote command:
`TRIGger[:SEQuence]:HOLDoff[:TIME]` on page 451

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 454

Hysteresis
Defines the distance in dB to the trigger level that the trigger source must exceed before a trigger event occurs. Setting a hysteresis avoids unwanted trigger events caused by noise oscillation around the trigger level.

This setting is only available for "IF Power" trigger sources. The range of the value is between 3 dB and 50 dB with a step width of 1 dB.

Remote command:
`TRIGger[:SEQuence]:IFPower:HYSTeresis` on page 451

Trigger Holdoff

Defines the minimum time (in seconds) that must pass between two trigger events. Trigger events that occur during the holdoff time are ignored.

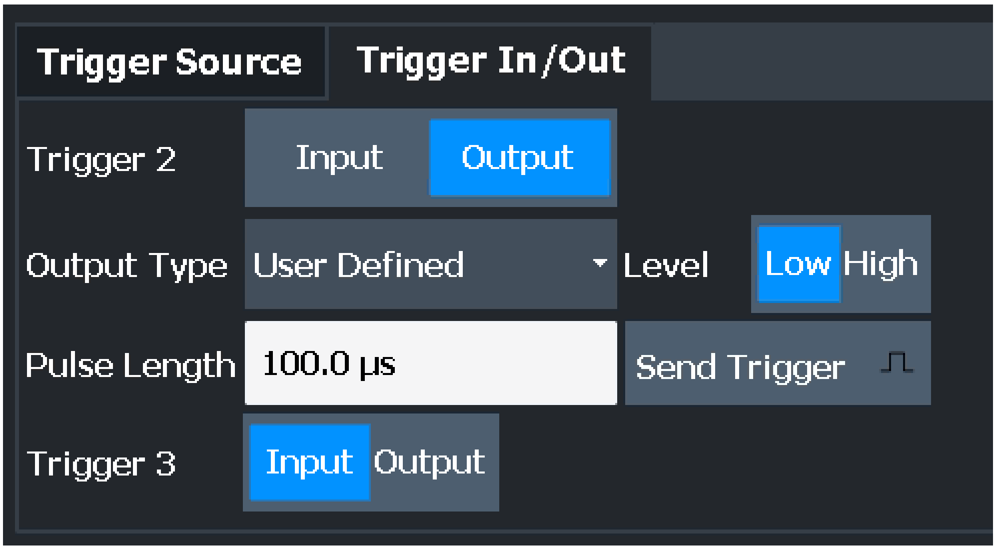
Remote command:
`TRIGger[:SEQuence]:IFPower:HOLDoff` on page 451

7.3.2 Trigger input/output settings

Access: "Overview" > "Trigger" > "Trigger In/Out"

The R&S FSMR3 can use a signal from an external device as a trigger to capture data. Alternatively, the internal trigger signal used by the R&S FSMR3 can be output for use by other connected devices.

Trigger 1/2



The trigger input and output functionality depends on how the variable "Trigger Input/ Output" connectors are used.

"Trigger 1" "Trigger 1": "Trigger Input/Output" connector on the front panel

"Trigger 2" Defines the usage of the variable "Trigger Input/Output" connector on the rear panel.

"Input" The signal at the connector is used as an external trigger source by the R&S FSMR3000. Trigger input parameters are available in the "Trigger" dialog box.

"Output" The R&S FSMR3000 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<up>:TRIGger<tp>:DIRection on page 455

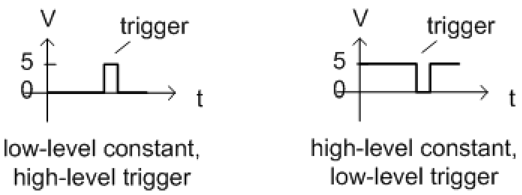
Output Type ← Trigger 1/2
Type of signal to be sent to the output

"Device Triggered"	(Default) Sends a trigger when the R&S FSMR3000 triggers.
"Trigger Armed"	Sends a (high level) trigger when the R&S FSMR3000 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).
"User Defined"	Sends a trigger when you select the "Send Trigger" button. In this case, further parameters are available for the output signal.

Remote command:
OUTPut<up>:TRIGger<tp>:OTYPe on page 456

Level ← Output Type ← Trigger 1/2
Defines whether a high (1) or low (0) constant signal is sent to the trigger output connector (for "Output Type": "User Defined".

The trigger pulse level is always opposite to the constant signal level defined here. For example, for "Level" = "High", a constant high signal is output to the connector until you select the Send Trigger function. Then, a low pulse is provided.



Remote command:
OUTPut<up>:TRIGger<tp>:LEVel on page 455

Pulse Length ← Output Type ← Trigger 1/2
Defines the duration of the pulse (pulse width) sent as a trigger to the output connector.

Remote command:
OUTPut<up>:TRIGger<tp>:PULSe:LENGth on page 456

Send Trigger ← Output Type ← Trigger 1/2
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. For example, for "Level" = "High", a constant high signal is output to the connector until you select the "Send Trigger" function. Then, a low pulse is sent.

Which pulse level is sent is indicated by a graphic on the button.

Remote command:
OUTPut<up>:TRIGger<tp>:PULSe:IMMediate on page 456

7.4 Data acquisition

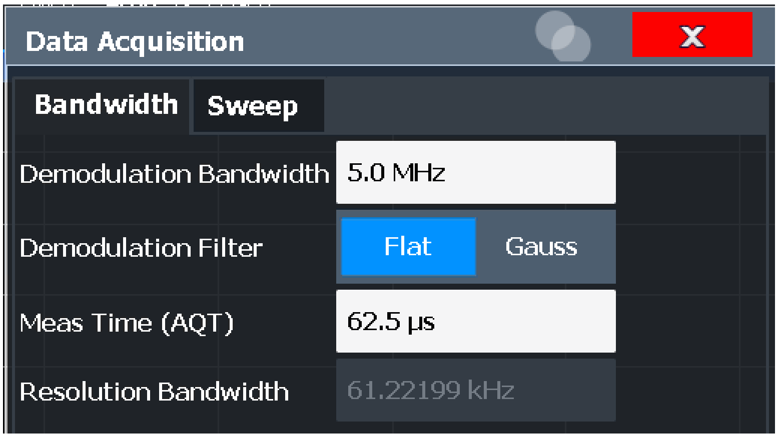
Access: "Overview" > "Data Acquisition"

How data is to be acquired and then demodulated is configured in the "Data Acquisition" dialog box.

7.4.1 Bandwidth settings

Access: "Overview" > "Data Acquisition" > "Bandwidth" tab

The bandwidth settings define which parts of the input signal are acquired and then demodulated.



Demodulation Bandwidth

Defines the demodulation bandwidth of the measurement. The demodulation bandwidth determines the sample rate with which the input signal is captured and analyzed.

The maximum demodulation bandwidth is limited to double the current receiver frequency.

Remote command:
`[SENSe:]BWIDth:DEMod` on page 448

Demodulation Filter

Defines the filter to be used for demodulation.

"Flat" Default

"Gauss" Optimizes the settling behavior of the filter

Remote command:
[SENSe:]BWIDth:DEMod:TYPE on page 448

Measurement Time (AQT)
Defines how long data is acquired for demodulation.

Remote command:
[SENSe:]ADEMod:MTIMe on page 446

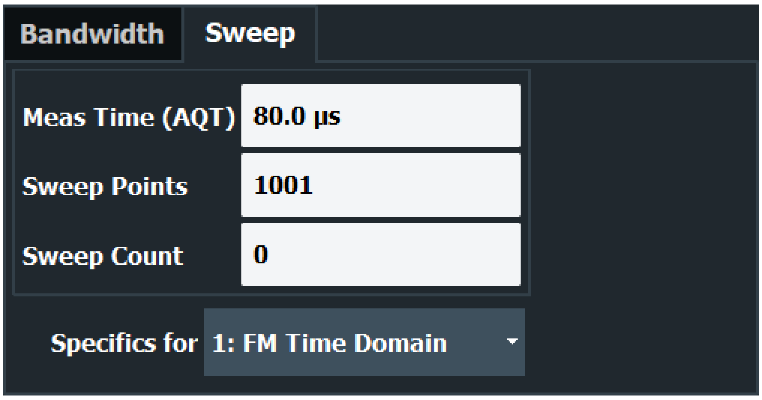
Resolution Bandwidth
Defines the resolution bandwidth for data acquisition. The available range is specified in the data sheet.

Remote command:
[SENSe:]BANDwidth[:RESolution] on page 449

7.4.2 Sweep settings

Access: "Overview" > "Data Acquisition" > "Sweep" tab

The sweep settings define how often data from the input signal is acquired and then demodulated.



Measurement Time (AQT)
Defines how long data is acquired for demodulation.

Remote command:
[SENSe:]ADEMod:MTIMe on page 446

Sweep Points
Defines the number of measured values to be collected during one sweep.

Remote command:
[SENSe:]SWEep[:WINDow<n>]:POINts on page 449

Sweep/Average Count
Defines the number of measurements to be performed in the single sweep mode. Values from 0 to 200000 are allowed. If the values 0 or 1 are set, one measurement is performed.

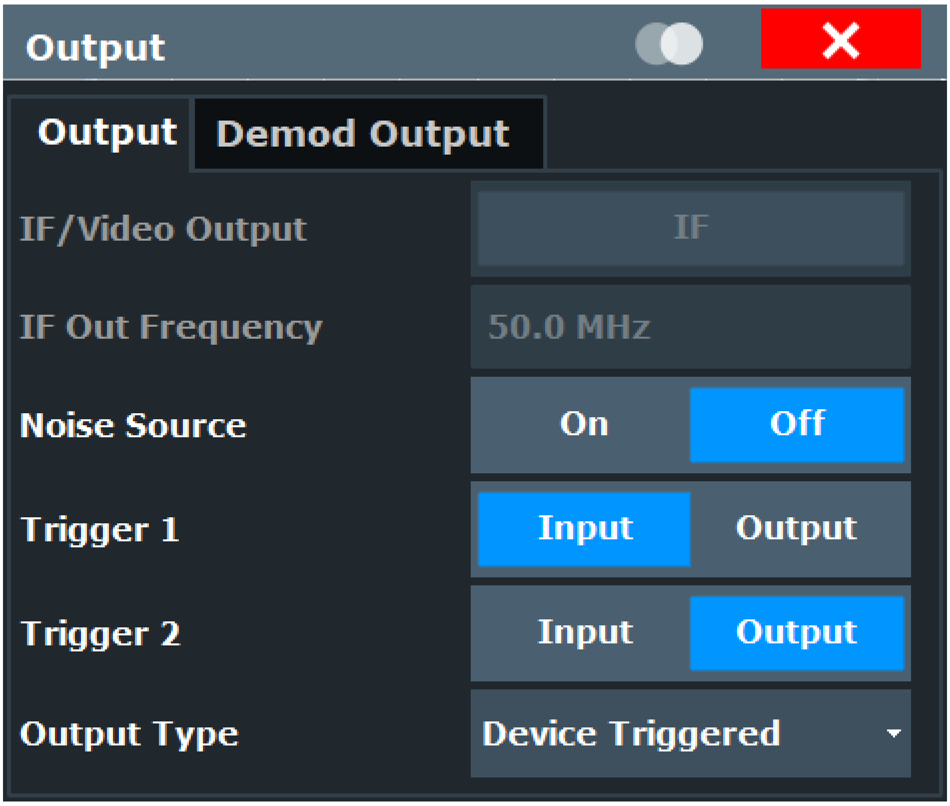
Remote command:
`[SENSe:]SWEep:COUNt` on page 449

7.5 Output

7.5.1 Output settings

The R&S FSMR3 can provide output to special connectors for other devices.

For details on connectors, refer to the R&S FSMR3 Getting Started manual, "Front / Rear Panel View" chapters.



IF/Video Output

Defines the type of signal available at the "IF/Video" output on the rear panel of the R&S FSMR3.

"IF"	The measured IF value is available at the IF/VIDEO/DEMOD output connector.
"Video"	The displayed video signal (i.e. the filtered and detected IF signal) is available at the IF/VIDEO/DEMOD output connector. This setting is required to provide demodulated audio frequencies at the output.

Remote command:
`OUTPut<up>:IF[:SOURce]` on page 435

IF Out Frequency

Defines or indicates the frequency at which the IF signal level is provided at the IF/VIDEO/DEMOD connector if "IF/Video Output" is set to "IF".

Noise Source Control

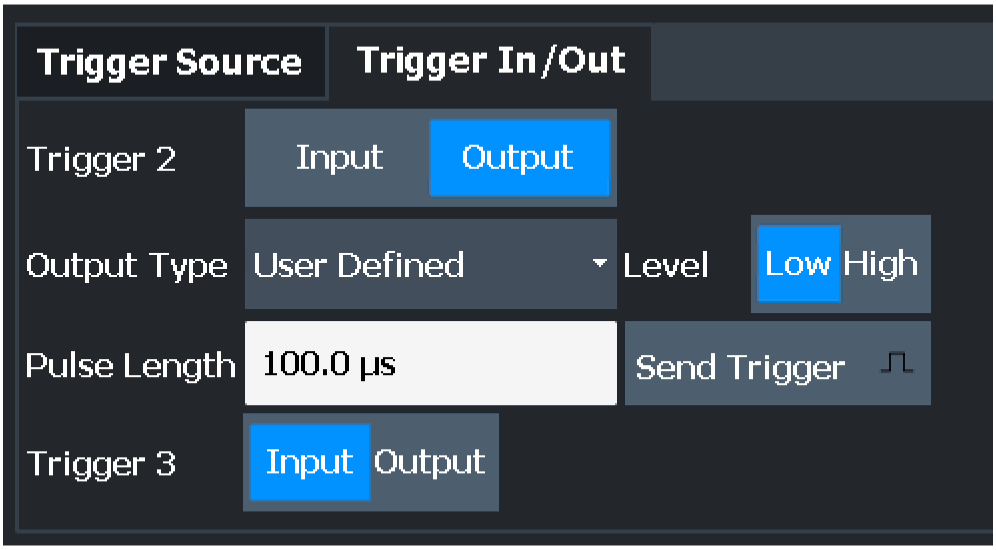
Enables or disables the 28 V voltage supply for an external noise source connected to the "Noise source control / Power sensor") connector. By switching the supply voltage for an external noise source on or off in the firmware, you can enable or disable the device as required.

External noise sources are useful when you are measuring power levels that fall below the noise floor of the R&S FSMR3000 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 R&S FSMR3000 and measure the total noise power. From this value, you can determine the noise power of the R&S FSMR3000. 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.

Remote command:
`DIAGnostic:SERVice:NSOurce` on page 435

Trigger 1/2



The trigger input and output functionality depends on how the variable "Trigger Input/Output" connectors are used.

"Trigger 1" "Trigger 1": "Trigger Input/Output" connector on the front panel

"Trigger 2" Defines the usage of the variable "Trigger Input/Output" connector on the rear panel.

"Input" The signal at the connector is used as an external trigger source by the R&S FSMR3000. Trigger input parameters are available in the "Trigger" dialog box.

"Output" The R&S FSMR3000 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<up>:TRIGger<tp>:DIRection` on page 455

Output Type ← Trigger 1/2
Type of signal to be sent to the output

"Device Triggered" (Default) Sends a trigger when the R&S FSMR3000 triggers.

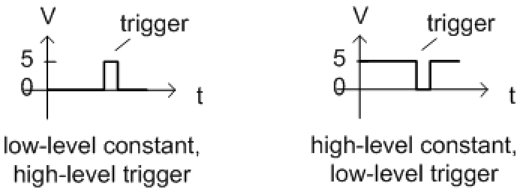
"Trigger Armed" Sends a (high level) trigger when the R&S FSMR3000 is in "Ready for trigger" state.
This state is indicated by a status bit in the `STATus:OPERation` register (bit 5), as well as by a low-level signal at the "AUX" port (pin 9).

"User Defined" Sends a trigger when you select the "Send Trigger" button.
In this case, further parameters are available for the output signal.

Remote command:
`OUTPut<up>:TRIGger<tp>:OTYPe` on page 456

Level ← Output Type ← Trigger 1/2
Defines whether a high (1) or low (0) constant signal is sent to the trigger output connector (for "Output Type": "User Defined".

The trigger pulse level is always opposite to the constant signal level defined here. For example, for "Level" = "High", a constant high signal is output to the connector until you select the Send Trigger function. Then, a low pulse is provided.



Remote command:
`OUTPut<up>:TRIGger<tp>:LEVel` on page 455

Pulse Length ← Output Type ← Trigger 1/2
Defines the duration of the pulse (pulse width) sent as a trigger to the output connector.

Remote command:
`OUTPut<up>:TRIGger<tp>:PULSe:LENGth` on page 456

Send Trigger ← Output Type ← Trigger 1/2
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. For example, for "Level" = "High", a constant high signal is output to the connector until you select the "Send Trigger" function. Then, a low pulse is sent.

Which pulse level is sent is indicated by a graphic on the button.

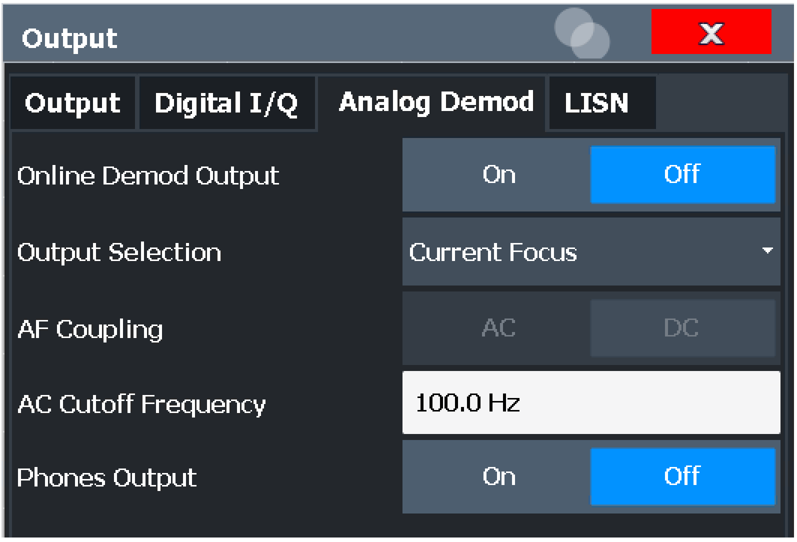
Remote command:
`OUTPut<up>:TRIGger<tp>:PULSe:IMMediate` on page 456

7.5.2 Demod output

Access: "Overview"≥"Output" > Demod Output

The demodulated signal in time domain results can be output to the IF/VIDEO/DEMOD output connector on the R&S FSMR3000.

Note that the audio frequency (AF) filter settings used for demodulation also apply to the online output. However, a maximum of two high pass, low pass or deemphasis filters can be active at the same time if demod output is active.



Online Demodulation Output State

Enables or disables online demodulation output. If enabled, the demodulated audio frequencies are output to the IF/VIDEO/DEMOD output connector on the rear panel of the R&S FSMR3000.

Remote command:
OUTPut<up>:ADEMod[:ONLine][:STATe] on page 436

Output Selection

Selects the result display whose results are output. Only time domain results can be selected. All currently active time domain result displays are listed.

"Current Focus" dynamically switches to the currently selected window. Thus you can easily change the output signal simply by selecting the windows in the display. If a window is selected that does not contain a time-domain result display, the selection is ignored and the previous setting is maintained.

The result display currently used for output is indicated by a "Demod Out" label in the window title bar.

Remote command:
OUTPut<up>:ADEMod[:ONLine]:SOURce on page 436

AF Coupling

Controls the automatic correction of the frequency offset and phase offset of the input signal:

This function is only available for FM or PM time domain evaluations.

- FM time evaluation

If DC is selected, the absolute frequency is displayed. That means, an input signal with an offset relative to the center frequency is not displayed symmetrically to the zero line.
If AC is selected, the frequency offset is automatically corrected, i.e. the trace is always symmetric to the zero line.

- PM time evaluation
  If DC is selected, the phase runs according to the existing frequency offset. In addition, the DC signal contains a phase offset of ± π.
  If AC is selected, the frequency offset and phase offset are automatically corrected, i.e. the trace is always symmetric to the zero line.

Remote command:
`[SENSe:]ADEMod<n>:AF:COUPling` on page 457

AC Cutoff Frequency
Defines the cutoff frequency for the AC highpass filter (for AC coupling only, see AF Coupling).

Note that the audio frequency (AF) filter settings used for demodulation also apply to the online output.

Remote command:
`OUTPut<up>:ADEMod[:ONLine]:AF[:CFRequency]` on page 437

Phones Output
If enabled, the demodulated audio signal is output to the IF/VIDEO/DEMOD connector (on the rear panel of the R&S FSMR3000), as well as to headphones connected on the front panel ([Phones] connector), if available.

CAUTION! Risk of hearing damage. Before putting on the headphones, make sure that the volume setting is not too high to protect your hearing.

Remote command:
`OUTPut<up>:ADEMod[:ONLine]:PHONes` on page 437

7.6 Demodulation

Access: "Overview" > "Demod Settings"

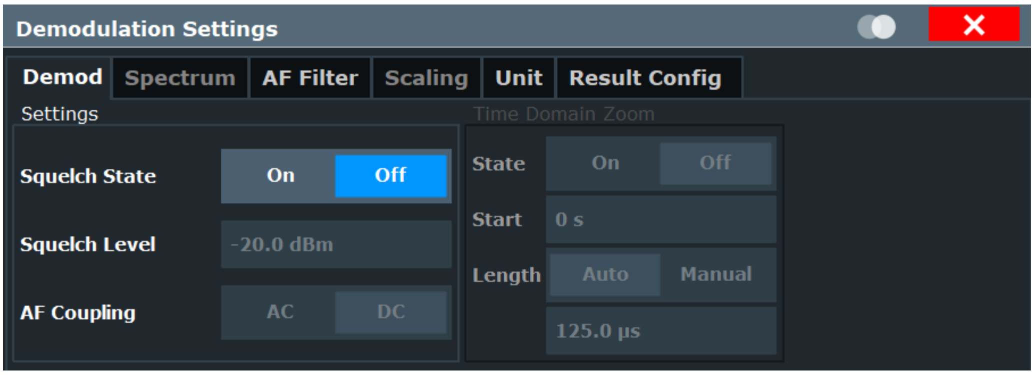
Or: "Meas Setup" > "Demod"

7.6.1 Basic demodulation measurement parameters (demod)

Access: "Overview" > "Demod Settings" > "Demod"

Or: "Meas Setup" > "Demod" > "Demod" tab

The basic demodulation measurement parameters define how the measurement is performed.



Squelch State

Activates the squelch function, that is: if the signal falls below a defined threshold, the demodulated data is automatically set to 0. This is useful, for example, to avoid demodulation noise during transmission breaks.

This function is only available for FM demodulation.

Remote command:
`[SENSe:]ADEMod:SQUelch[:STATe]` on page 458

Squelch Level

Defines the level threshold below which the demodulated data is set to 0 if squelching is enabled. The squelch level is an absolute value.

Remote command:
`[SENSe:]ADEMod:SQUelch:LEVel` on page 458

AF Coupling

Controls the automatic correction of the frequency offset and phase offset of the input signal:

This function is only available for FM or PM time domain evaluations.

- FM time evaluation
  If DC is selected, the absolute frequency is displayed. That means, an input signal with an offset relative to the center frequency is not displayed symmetrically to the zero line.
  If AC is selected, the frequency offset is automatically corrected, i.e. the trace is always symmetric to the zero line.

- PM time evaluation
  If DC is selected, the phase runs according to the existing frequency offset. In addition, the DC signal contains a phase offset of ± π.
  If AC is selected, the frequency offset and phase offset are automatically corrected, i.e. the trace is always symmetric to the zero line.

Remote command:
[SENSe:]ADEMod<n>:AF:COUPling on page 457

Time Domain Zoom
Using the time domain zoom, the demodulated data for a particular time span is extracted and displayed in more detail. This is useful if the measurement time is very large and thus each sweep point represents a large time span. The time domain zoom function distributes the available sweep points only among the time span defined by the zoom area length. The time span displayed per division of the diagram is decreased. Thus, the display of the extracted time span becomes more precise. Note that the time domain zoom area affects not only the diagram display, but the entire evaluation for the current window.

This function is only available for evaluations in the time domain.

Tip: In addition to the Time Domain Zoom, a graphical zoom is available for all diagram evaluations. However, the graphical zoom is useful only if more measured values than trace points are available. The (time) span represented by each measurement point remains the same.

For details see Chapter 8.2.2, "Zoom functions", on page 203.

State ← Time Domain Zoom
Activates or deactivates the time domain zoom mode.

"On"	Activates the time domain zoom.
"Off"	Deactivates the time domain zoom and restores the original display. If more measured values than measurement points are available, several measured values are combined in one measurement point according to the method of the selected trace detector.

Remote command:
[SENSe:]ADEMod<n>:ZOOM[:STATe] on page 461

Start ← Time Domain Zoom
Defines the start time for the time domain zoom area. For spectrum evaluations the start time is always 0.

Remote command:
[SENSe:]ADEMod<n>:ZOOM:STARt on page 461

Length ← Time Domain Zoom
Defines the length of the time domain zoom area. Enter the length as a time value manually, or use the "Auto" setting to set the length to the current number of sweep points automatically.

Remote command:
[SENSe:]ADEMod<n>:ZOOM:LENGth on page 460
[SENSe:]ADEMod<n>:ZOOM:LENGth:MODE on page 460

7.6.2 Demodulation spectrum

Access: "Overview" > "Demod Settings" > "Spectrum"

Or: "Meas Setup" > "Demod" > "Spectrum" tab

The demodulation spectrum defines which span of the demodulated data is evaluated.

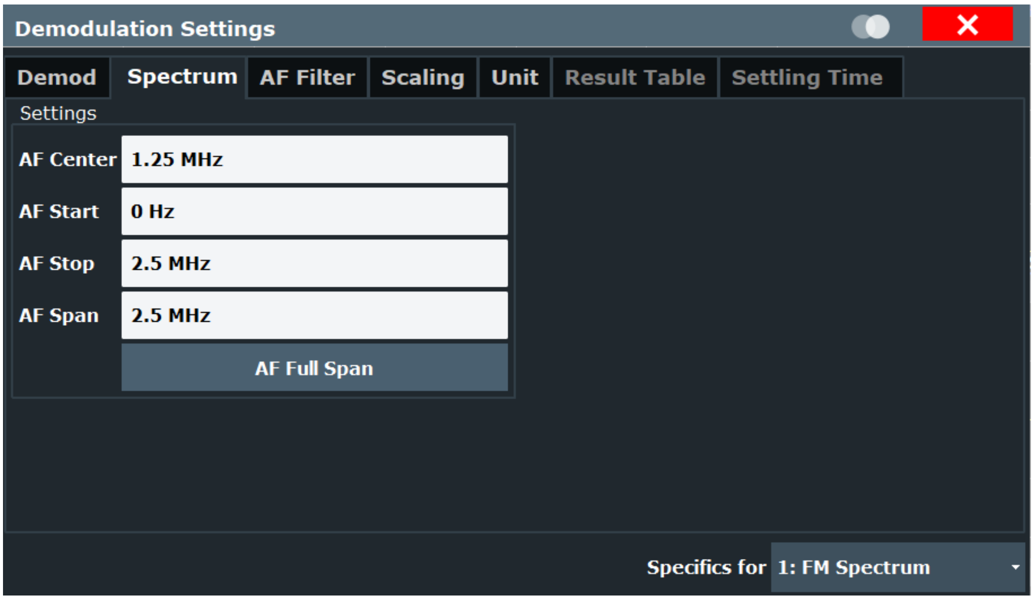
Depending on the evaluation (AF or RF display), the settings vary.

7.6.2.1 AF evaluation

Access: "Overview" > "Demod Settings" > "Spectrum"

Or: "Meas Setup" > "Demod" > "Spectrum" tab

These settings are only available for AF Spectrum evaluations, not in the time domain.



AF Center

Defines the center frequency of the demodulated data to evaluate.

Remote command:
`[SENSe:]ADEMod:AF:CENTer` on page 462

AF Start

Defines the start frequency of the demodulated data to evaluate.

Remote command:
[SENSe:]ADEMod:AF:STARt on page 463

AF Stop
Defines the stop frequency of the demodulated data to evaluate.

The maximum AF stop frequency corresponds to half the demodulation bandwidth.

Remote command:
[SENSe:]ADEMod:AF:STOP on page 463

AF Span
Defines the span (around the center frequency) of the demodulated data to evaluate. The maximum span is DBW/2.

Remote command:
[SENSe:]ADEMod:AF:SPAN on page 462

AF Full Span
Sets the span (around the center frequency) of the demodulated data to the maximum of DBW/2.

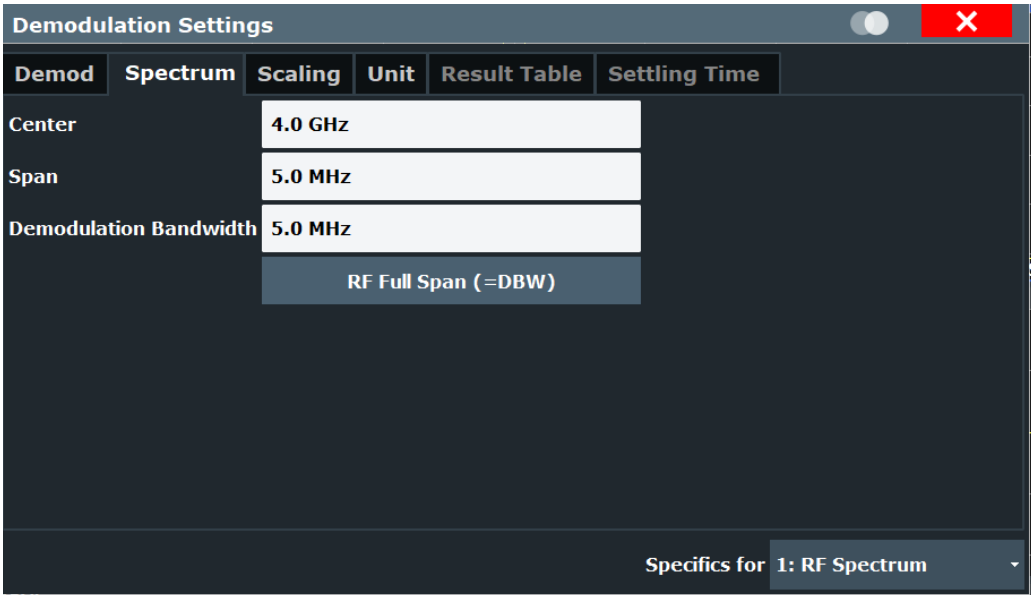
Remote command:
[SENSe:]ADEMod:AF:SPAN:FULL on page 463

7.6.2.2 RF evaluation

Access: "Overview" > "Demod Settings" > "Spectrum"

Or: "Meas Setup" > "Demod" > "Spectrum" tab

These settings are only available for RF evaluation, both in time and frequency domain. Note that for RF data the center frequency and demodulation bandwidth correspond to the settings defined in the "Input" and "Data Acquisition" configuration.



Center Frequency

Defines the center frequency of the signal in Hertz.

Remote command:
`[SENSe:]FREQuency:CENTer` on page 438

Span

Defines the frequency span. The center frequency is kept constant. The following range is allowed:

$span_{min} \leq f_{span} \leq f_{max}$

f_{max} and $span_{min}$ are specified in the data sheet.

Remote command:
`[SENSe:]FREQuency:SPAN` on page 459

Demodulation Bandwidth

Defines the demodulation bandwidth of the measurement. The demodulation bandwidth determines the sample rate with which the input signal is captured and analyzed.

The maximum demodulation bandwidth is limited to double the current receiver frequency.

Remote command:
`[SENSe:]BWIDth:DEMod` on page 448

RF Full Span

Sets the span (around the center frequency) of the RF data to be evaluated to the demodulation bandwidth.

Remote command:
`[SENSe:]ADEMod:SPECtrum:SPAN[:MAXimum]` on page 464

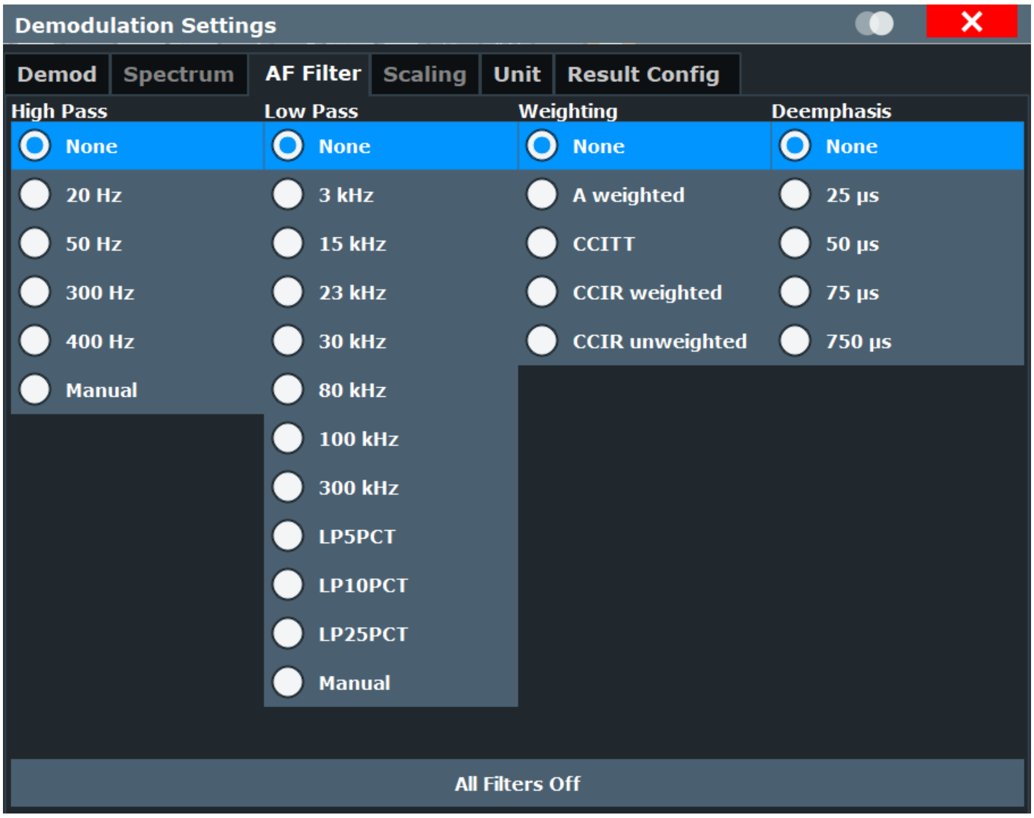
7.6.3 AF filter

Access: "Overview" > "Demod Settings" > "AF Filter"

Or: "Meas Setup" > "Demod" > "AF Filter" tab

The AF filter reduces the evaluated bandwidth of the demodulated signal and can define a weighting function. If a filter is selected by remote control, the respective filter will be activated automatically.

AF filters are only available for AF evaluations, not for RF evaluation.



High Pass

Defines a high pass filter with the given limit to separate the DC component. The filters are indicated by the 3 dB cutoff frequency. The 50 Hz and 300 Hz filters are designed as 2nd-order Butterworth filter (12 dB/octave). The 20 Hz filter is designed as 3rd-order Butterworth filter (18 dB/octave).

The high pass filters are active in the following demodulation bandwidth range:

None	No AF Filter used (default)
20 Hz	100 Hz ≤ demodulation bandwidth ≤ 1.6 MHz
50 Hz:	200 Hz ≤ demodulation bandwidth ≤ 3 MHz
300 Hz:	800 Hz ≤ demodulation bandwidth ≤ 8 MHz
Manual:	A high pass filter with the manually defined frequency is used.

Remote command:
`[SENSe:]FILTer<n>:HPASs[:STATe]` on page 468
`[SENSe:]FILTer<n>:HPASs:FREQuency[:ABSolute]` on page 467
`[SENSe:]FILTer<n>:HPASs:FREQuency:MANual` on page 467

Low Pass

Defines a low pass filter type. Relative and absolute low pass filter are available.

- Absolute low pass filters:
  Absolute filters are indicated by the 3 dB cutoff frequency. The 3 kHz, 15 kHz and 23 kHz filters are designed as 5th-order Butterworth filters (30 dB/octave). The 150 kHz filter is designed as 8th-order Butterworth filter (48 dB/octave).
  The absolute low pass filters are active in the following demodulation bandwidth range:

Filter type	Demodulation bandwidth
3 kHz:	6.4 kHz ≤ demodulation bandwidth ≤ 3 MHz
15 kHz:	50 kHz ≤ demodulation bandwidth ≤ 8 MHz
23 kHz	50 kHz ≤ demodulation bandwidth ≤ 18 MHz
150 kHz:	400 kHz ≤ demodulation bandwidth ≤ 8 MHz
Manual:	A low pass filter with the manually defined frequency is used.

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

Remote command:
`[SENSe:]FILTer<n>:LPASs[:STATe]` on page 469
`[SENSe:]FILTer<n>:LPASs:FREQuency[:ABSolute]` on page 468
`[SENSe:]FILTer<n>:LPASs:FREQuency:RELative` on page 469
`[SENSe:]FILTer<n>:LPASs:FREQuency:MANual` on page 469

Weighting

Selects a weighting AF filter. By default, no weighting filter is active.

"A weighted"	Switches on the A weighted filter. The weighting filter is active in the following demodulation bandwidth range: 100 kHz ≤ demodulation bandwidth ≤ 800 kHz
"CCITT"	Switches on a CCITT P.53 weighting filter. The weighting filter is active in the following demodulation bandwidth range: 20 kHz ≤ demodulation bandwidth ≤ 3 MHz
"CCIR weighted"	Switches on the CCIR weighted filter. The weighting filter is active in the following demodulation bandwidth range: 100 kHz ≤ demodulation bandwidth ≤ 3.0 MHz
"CCIR unweighted"	Switches on the CCIR unweighted filter, which is the combination of the 20 Hz highpass and 23 kHz low pass filter. The weighting filter is active in the following demodulation bandwidth range: 50 kHz ≤ demodulation bandwidth ≤ 1.6 MHz

Remote command:
`[SENSe:]FILTer<n>:CCITt[:STATe]` on page 466
`[SENSe:]FILTer<n>:CCIR[:UNWeighted][:STATe]` on page 466

[SENSe:]FILTer<n>:CCIR:WEIGhted[:STATe] on page 465
[SENSe:]FILTer<n>:AWEighted[:STATe] on page 465

Deemphasis
Activates a deemphasis filter with the given time constant.

Sometimes a modulated signal is extorted by a pre-emphasis filter before transmission, for example to eliminate frequencies that are more prone to interferences. In this case, the emphasis function must be reversed after demodulation, which is done by the deemphasis filter.

The deemphasis filter is active in the following demodulation bandwidth range:

25 µs:	25 kHz ≤ demodulation bandwidth ≤ 40 MHz
50 µs:	6.4 kHz ≤ demodulation bandwidth ≤ 18 MHz
75 µs:	6.4 kHz ≤ demodulation bandwidth ≤ 18 MHz
750 µs:	800 Hz ≤ demodulation bandwidth ≤ 3 MHz

Depending on the deemphasis filter, a minimum demodulation bandwidth is required for an error less than 0.5 dB, up to a maximum AF frequency. The following table shows the dependencies.

Deemphasis [us]	25 µs	50 µs	75 µs	750 µs
Max. AF frequency	25 kHz	12 kHz	8 kHz	800 Hz
Required demodulation bandwidth	≥ 200 kHz	≥ 100 kHz	≥ 50 kHz	≥ 6.4 kHz

For higher AF frequencies, the demodulation bandwidth must be increased.

Remote command:
[SENSe:]FILTer<n>:DEMPhasis[:STATe] on page 467
[SENSe:]FILTer<n>:DEMPhasis:TCONstant on page 466

Deactivating all AF Filters
The "All Filter Off" button deactivates all AF filters for the selected evaluation.

Remote command:
[SENSe:]FILTer<n>:AOFF on page 465

7.6.4 Scaling

Access: "Overview" > "Demod Settings" > "Scaling"

Or: "Meas Setup" > "Demod" > "Scaling" tab

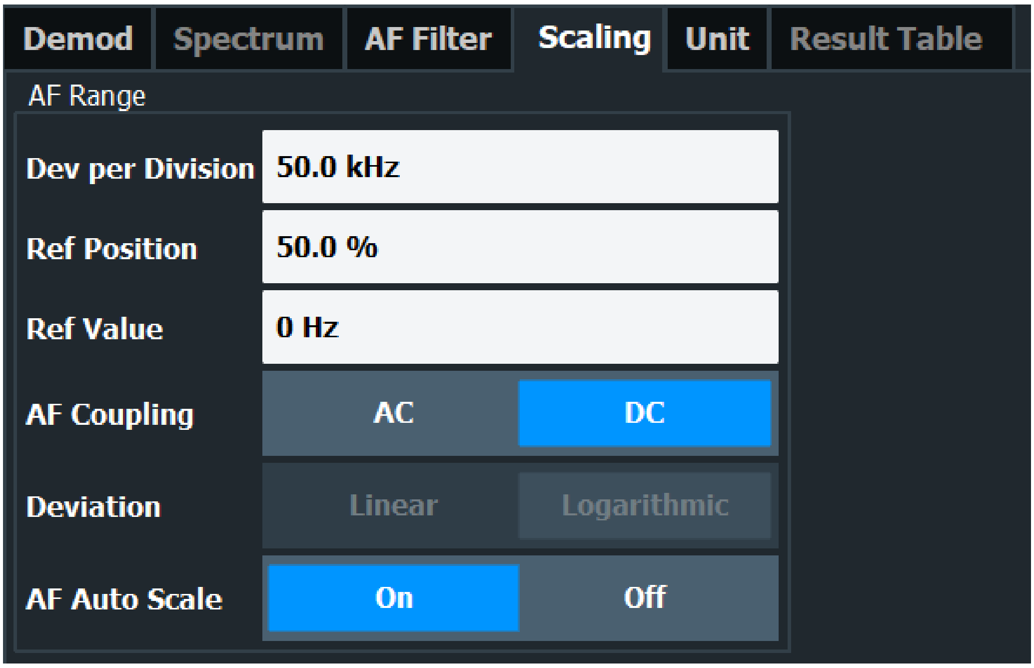
The scaling parameters define the range of the demodulated data to be displayed.

7.6.4.1 AF evaluation

Access: "Overview" > "Demod Settings" > "Scaling"

Or: "Meas Setup" > "Demod" > "Scaling" tab

These settings are only available for AF evaluations.



Dev per Division/ dB per Division

Defines the modulation depth or the phase deviation or frequency deviation per division (logarithmic: 0.1 dB to 20 dB):

AM display:	0.0001 % to 1000 %
FM display:	1 Hz/div to 100 MHz/div
PM display:	0.0001 rad/div to 1000 rad/div

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

Remote command:
`DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:PDIVision`
on page 444

Reference Value Position
Determines the position of the reference value for the modulation depth or the phase deviation or frequency deviation on the y-axis of the diagram.

The position is entered as a percentage of the diagram height with 100 % corresponding to the upper diagram border. The default setting is 50 % (diagram center) for the AF time evaluations and 100 % (upper diagram border) for the AF spectrum evaluations.

Remote command:
`DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:RPOSition`
on page 445

Reference Value
Determines the modulation depth or the phase deviation or the frequency deviation at the reference line of the y-axis. The reference value can be set specifically for each evaluation.

- AF time display
  The trace display takes individual frequency/phase offsets into account (in contrast, the AF Coupling setting permits automatic correction by the average frequency/phase offset of the signal, and therefore cannot be activated simultaneously).
- AF spectrum display
  In the default setting, the reference value defines the modulation depth or the FM/PM deviation at the upper diagram border.

Possible values:
- AM: 0 and ± 10000 %
- FM: 0 and ± 10 MHz
- PM: 0 and ± 10000 rad

Note: The reference value for the AF range in the **window title bar** is displayed with respect to the defined reference *position*. The position may vary for different windows. For time domain and frequency domain windows, for example, a different reference value may be displayed, although the same reference is actually used (but the positions vary).

Remote command:
`DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:RVALue`
on page 470

AF Coupling
Controls the automatic correction of the frequency offset and phase offset of the input signal:

This function is only available for FM or PM time domain evaluations.

- FM time evaluation
  If DC is selected, the absolute frequency is displayed. That means, an input signal with an offset relative to the center frequency is not displayed symmetrically to the zero line.

If AC is selected, the frequency offset is automatically corrected, i.e. the trace is always symmetric to the zero line.

- PM time evaluation
  If DC is selected, the phase runs according to the existing frequency offset. In addition, the DC signal contains a phase offset of ± π.
  If AC is selected, the frequency offset and phase offset are automatically corrected, i.e. the trace is always symmetric to the zero line.

Remote command:
[SENSe:]ADEMod<n>:AF:COUPling on page 457

Deviation
Switches between logarithmic and linear display of the modulation depth or the phase deviation or the frequency deviation.

Remote command:
DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y:SPACing on page 445

AF Auto Scale
Activates automatic scaling of the y-axis for AF measurements. RF power and RF spectrum measurements are not affected by the auto-scaling.

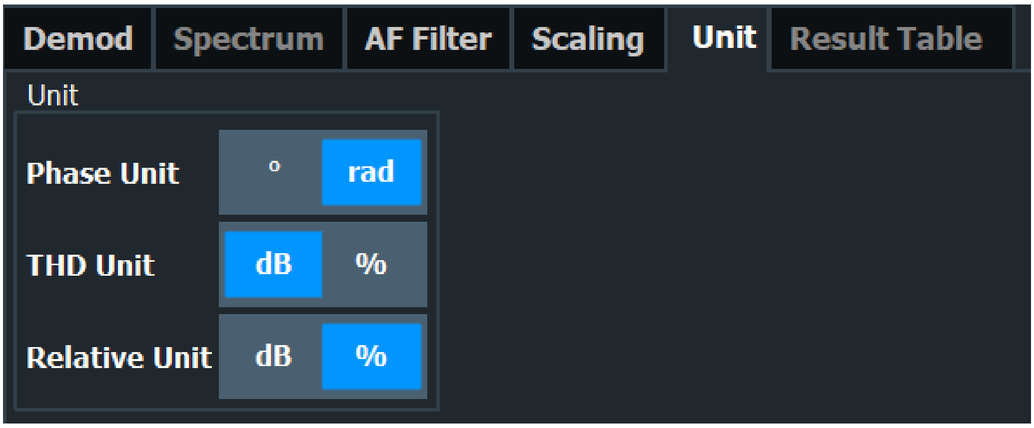
Remote command:
[SENSe:]ADJust:SCALe[:Y]:AUTO[:CONTinuous] on page 483

7.6.5 Units

Access: "Overview" > "Demod Settings" > "Unit"

Or: "Meas Setup" > "Demod" > "Unit" tab

The units define how the demodulated data is displayed.



Phase Unit (Rad/Deg)
Sets the phase unit to rad or deg for displaying PM signals.

Remote command:
`UNIT<n>:ANGLe` on page 471

THD Unit (%/ DB)
Sets the unit to percent or DB for the calculation of the THD (in the Result Summary).

Remote command:
`UNIT<n>:THD` on page 471

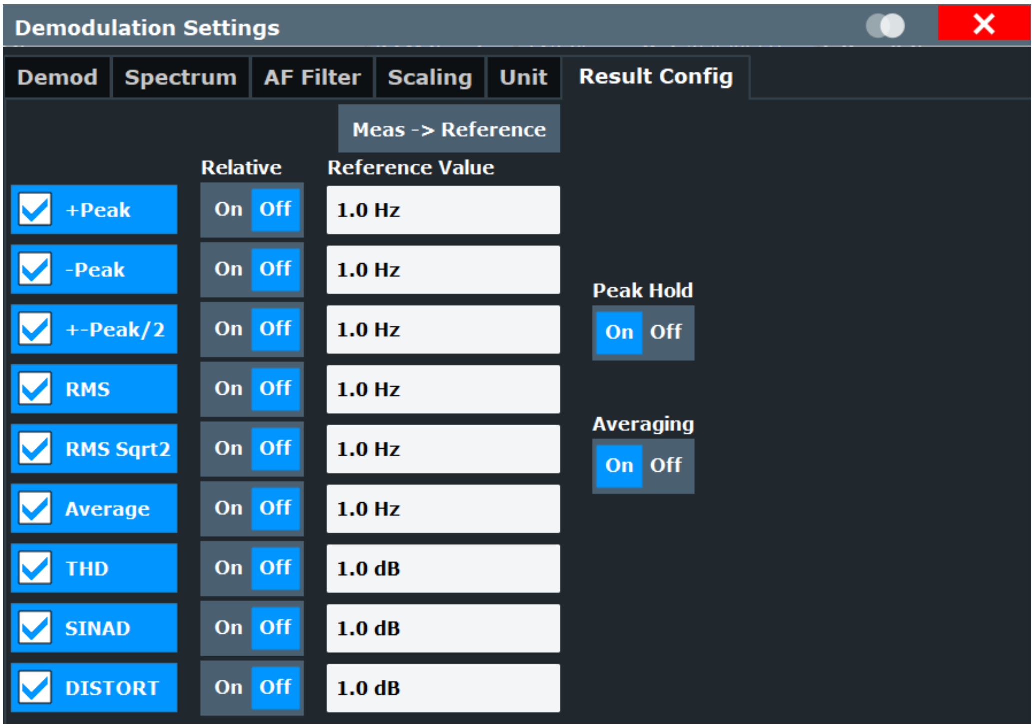
Relative Unit
Defines the unit for relative demodulation results.

Remote command:
`CONFigure:ADEMod:RESults:UNIT` on page 459

7.6.6 Result config

Access: "Overview" > "Demod Settings" > Result Config

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



The demodulation results are displayed in the Result Summary table. The detectors used to determine the results can be configured.

In addition to common absolute demodulation, the Measuring Receiver application also provides demodulation results relative to user-defined or measured reference values in the Result Summary.

The settings for the Result Summary can be defined individually for the different modulation types (FM, AM, PM). For each modulation, a separate tab is provided in the dialog box.

State

Activates or deactivates the selected detector.

Remote command:
`[SENSe:]ADEMod:DETector:AVERage[:STATe]` on page 473
`[SENSe:]ADEMod:DETector:DISTortion[:STATe]` on page 472
`[SENSe:]ADEMod:DETector:MPEak[:STATe]` on page 472
`[SENSe:]ADEMod:DETector:PAVerage[:STATe]` on page 472
`[SENSe:]ADEMod:DETector:PPEak[:STATe]` on page 472
`[SENSe:]ADEMod:DETector:RMS[:STATe]` on page 472
`[SENSe:]ADEMod:DETector:SINad[:STATe]` on page 472
`[SENSe:]ADEMod:DETector:SRMS[:STATe]` on page 472
`[SENSe:]ADEMod:DETector:THD[:STATe]` on page 473

Relative

Activates absolute or relative measurement demodulation for the selected detector. If activated, the demodulated result is set in relation to the "Reference Value" on page 174.

Remote command:
`[SENSe:]ADEMod:DETector:AVERage:MODE` on page 473
`[SENSe:]ADEMod:DETector:DISTortion:MODE` on page 473
`[SENSe:]ADEMod:DETector:MPEak:MODE` on page 473
`[SENSe:]ADEMod:DETector:PAVerage:MODE` on page 473
`[SENSe:]ADEMod:DETector:PPEak:MODE` on page 473
`[SENSe:]ADEMod:DETector:RMS:MODE` on page 473
`[SENSe:]ADEMod:DETector:SINad:MODE` on page 473
`[SENSe:]ADEMod:DETector:SRMS:MODE` on page 473
`[SENSe:]ADEMod:DETector:THD:MODE` on page 473

Reference Value

Sets the reference value for the respective detector to be used for relative demodulation results and recalculates the results. If necessary, the detector is activated.

Note: A reference value *0* would provide infinite results and is thus automatically corrected to *0.1*.

Remote command:
`[SENSe:]ADEMod:DETector:AVERage:REFerence` on page 473
`[SENSe:]ADEMod:DETector:DISTortion:REFerence` on page 473
`[SENSe:]ADEMod:DETector:MPEak:REFerence` on page 473

[SENSe:]ADEMod:DETector:PAVerage:REFerence on page 473
[SENSe:]ADEMod:DETector:PPEak:REFerence on page 473
[SENSe:]ADEMod:DETector:RMS:REFerence on page 473
[SENSe:]ADEMod:DETector:SINad:REFerence on page 473
[SENSe:]ADEMod:DETector:SRMS:REFerence on page 473
[SENSe:]ADEMod:DETector:THD:REFerence on page 473

Meas -> Reference
Sets the reference value to be used for relative demodulation results to the currently measured value *for all relative detectors*.

Note: A reference value *0* would provide infinite results and is thus automatically corrected to *0.1*.

If necessary, the detectors are activated.

Remote command:
[SENSe:]ADEMod:DETector:AVERage:REFerence:AUTO on page 474
[SENSe:]ADEMod:DETector:DISTortion:REFerence:AUTO on page 474
[SENSe:]ADEMod:DETector:MPEak:REFerence:AUTO on page 474
[SENSe:]ADEMod:DETector:PAVerage:REFerence:AUTO on page 474
[SENSe:]ADEMod:DETector:PPEak:REFerence:AUTO on page 474
[SENSe:]ADEMod:DETector:RMS:REFerence:AUTO on page 474
[SENSe:]ADEMod:DETector:SINad:REFerence:AUTO on page 474
[SENSe:]ADEMod:DETector:SRMS:REFerence:AUTO on page 474
[SENSe:]ADEMod:DETector:THD:REFerence:AUTO on page 474

Peak Hold
Switches the display of the highest results in the modulation summary on or off. The averaged results are displayed in addition to the current results.

Remote command:
[SENSe:]ADEMod:PHOLd[:STATe] on page 474

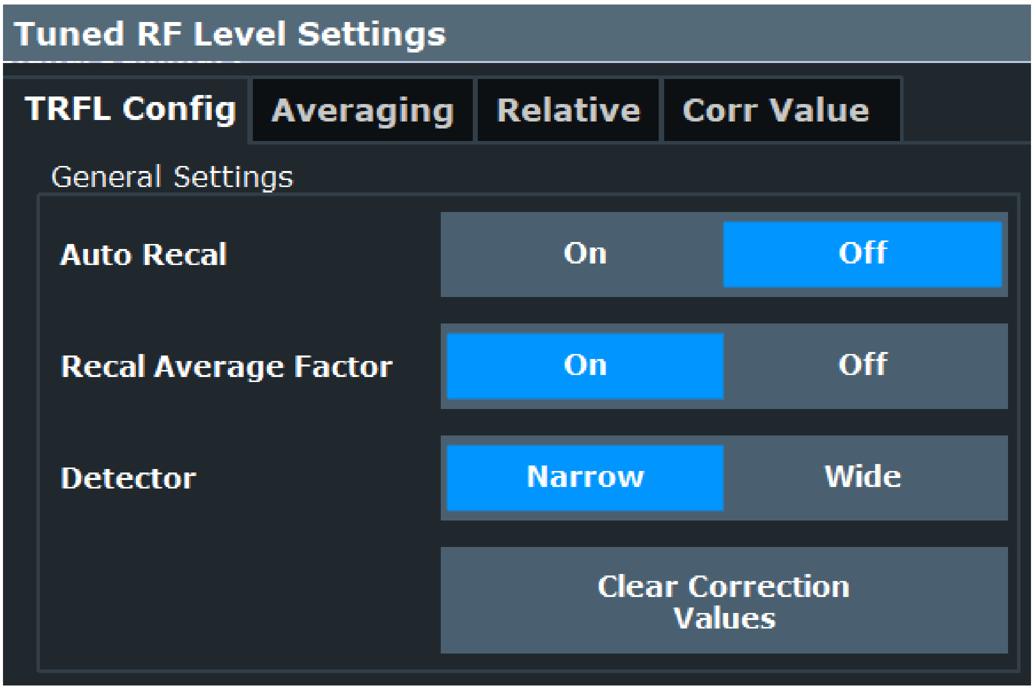
Averaging
Switches the display of the averaged results in the modulation summary on or off. The averaged results are displayed in addition to the current results.

Remote command:
[SENSe:]ADEMod:AVERage[:STATe] on page 474

7.7 Tuned RF Level settings

7.7.1 TRFL Config

The basic measurement parameters define how the tuned RF-level measurement is performed.



Auto Recal

Enables or disables automatic recalibration.

Remote command:
`INPut<ip>:ATTenuation:RECal:AUTO[:STATe]` on page 476

Recal Average Factor

Adjusts the number of averages automatically so that the accuracy of the recalibration is similar in both ranges.

Remote command:
`INPut<ip>:ATTenuation:RECal:FACTor[:STATe]` on page 476

Detector

Selects the type of detector to be used. "Narrow" activates an FFT in the set demodulation bandwidth. The displayed level value is derived from the FFT peak value. The effective measurement bandwidth for this type of measurement is approx. 4 / measurement time. During the measurement time, the signal must remain in the effective bandwidth. "Wide" activates a level measurement in the set demodulation bandwidth. The level is obtained by an RMS (root mean square) computation of all measurement points. Select "Wide" if the signal sources are unstable (frequency drift, residual FM)

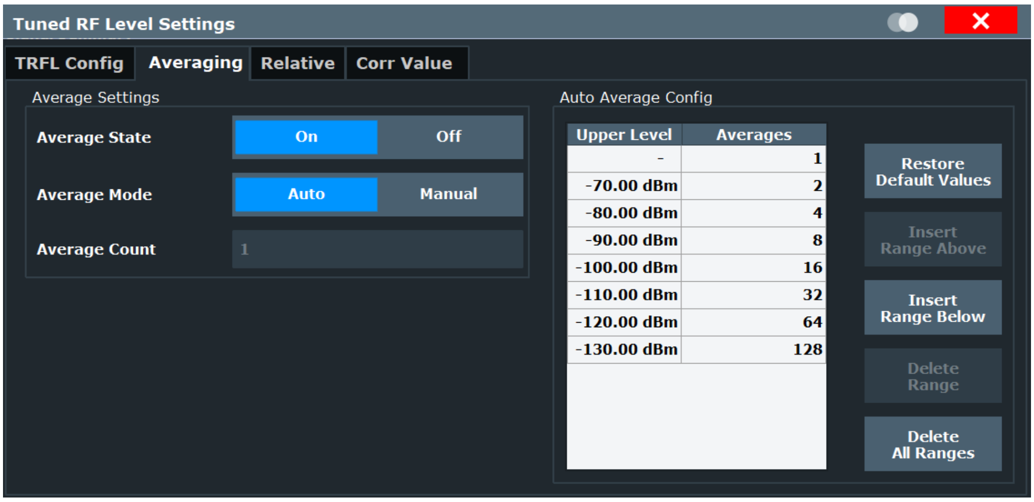
Remote command:
[SENSe:][WINDow<n>:]DETector<t>[:FUNCtion] on page 502

Clear Correction Values
Clears the previously defined correction values.

Remote command:
[SENSe:]CORRection:COLLect[:ACQuire]:CLEar:IMMediate on page 476

7.7.2 Averaging

The basic parameters define how averaging is applied in TRFL measurements.



Averaging
Enables or disables data averaging.

Remote command:
[SENSe:]POWer:AC:AVERage[:STATe] on page 477

Averaging Mode
Selects the averaging mode.

Remote command:
[SENSe:]POWer:AC:AVERage:AUTO on page 477

Averaging Count
Defines an averaging count.

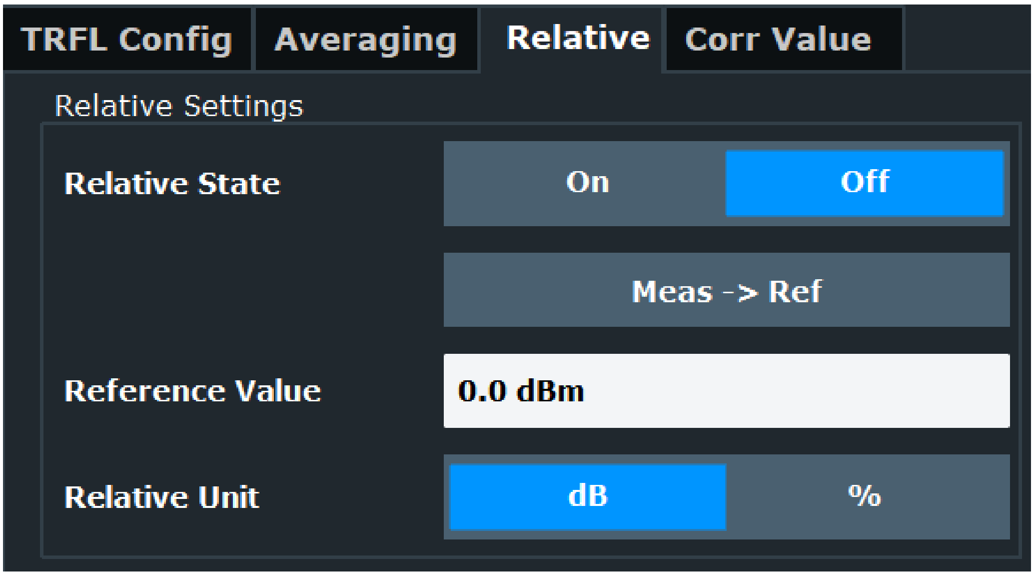
Remote command:
[SENSe:]POWer:AC:AVERage:COUNt on page 478

Averaging Table
Provides functionality to set specific numbers of averages for different level ranges. The defined averages for specific level ranges are preserved during a preset. Use "Restore Default Values" to reset the averaging table to the default values.

Remote command:
`[SENSe:]POWer:AC:AVERage:DATA` on page 478

7.7.3 Relative

The basic parameters define relative settings in TRFL measurements.

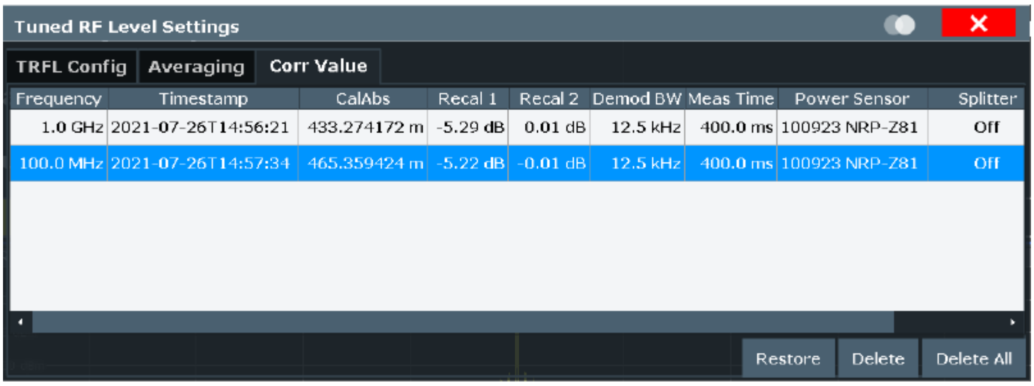


Relative Settings
If the relative settings are enabled, a unit and a reference value can be defined.

Remote command:
`[SENSe:]POWer:AC:REFerence:STATe` on page 476
`UNIT<n>:POWer:RATio` on page 476
`[SENSe:]POWer:AC:REFerence` on page 477
`[SENSe:]POWer:AC:REFerence:AUTO` on page 477

7.7.4 Corr Value

Shows the defined correction values for the RF Input compared to the input from a R&S NRP power sensor.



Corr Table

The correction values can be defined for multiple center frequencies.

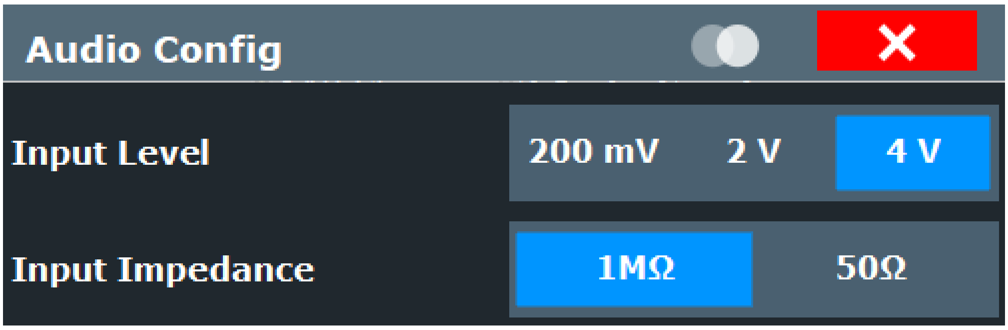
"Restore" sets the instrument back onto the selected center frequency. "Delete" removes a single frequency correction value, "Delete All" clears all previously saved correction values.

Remote command:
`MEMory[:CORRection]:SELect` on page 479
`MEMory[:CORRection]:CATalog?` on page 479
`MEMory[:CORRection]:DELete` on page 479
`MEMory[:CORRection]:DELete:ALL` on page 479

7.8 Audio settings

7.8.1 Audio config

The basic measurement parameters define how the audio measurement is performed.



Input Level

Selects an audio input level.

Remote command:
`[SENSe:]VOLTage:AC:RANGe[:UPPer]` on page 480

Input Impedance

Selects an audio input impedance.

Remote command:
`INPut<ip>:IMPedance` on page 479

8 Common analysis and display functions

Access: "Overview" > "Analysis"

General methods and basic settings to display and analyze measurements, regardless of the operating mode, are described here. If you are performing a specific measurement task, using an operating mode other than Signal and Spectrum Analyzer mode, or an application other than the Spectrum application, be sure to check the specific application or mode description for settings and functions that may deviate from these common settings.

8.1 Result display configuration

Measurement results can be evaluated in many different ways, for example graphically, as summary tables, statistical evaluations etc. Thus, the result display is highly configurable to suit your specific requirements and optimize analysis. Here you can find out how to optimize the display for your measurement results.

Basic operations concerning the R&S FSMR3 display, for example how to use the SmartGrid, are described in Chapter 4.5.5.2, "Laying out the result display with the smartgrid", on page 78.

General display settings that are usually configured during initial instrument setup, independently of the current measurement, e.g. which items or colors are displayed on the screen, are described in Chapter 10.2, "Display settings", on page 275.

8.1.1 Basic evaluation methods

Measurement results can be displayed and evaluated using various different methods, also at the same time. Depending on the currently selected measurement, in particular when using optional firmware applications, not all evaluation methods are available.

The evaluation methods described here are available for most measurements in the Measuring Receiver application.

Diagram

Displays a basic level vs. frequency or level vs. time diagram of the measured data to evaluate the results graphically. This is the default evaluation method. Which data is displayed in the diagram depends on the "Trace" settings. Scaling for the y-axis can be configured.

Remote command:
`LAY:ADD? '1',RIGH, DIAG`, see `LAYout:ADD[:WINDow]?` on page 403
Results:

Marker Table

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

This table is displayed automatically if configured accordingly.

1 Marker Table

Wnd	Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
2	M1		1	2.1725 ms	-6.80 dBm		
2	D2	M1	1	13.859 ms	-0.00 dB		
2	D3	M1	1	4.6259 ms	-0.00 dB		
2	D4	M1	1	9.2331 ms	-0.00 dB		

Tip: To navigate within long marker tables, simply scroll through the entries with your finger on the touchscreen.

Remote command:
`LAY:ADD? '1',RIGH, MTAB`, see `LAYout:ADD[:WINDow]?` on page 403
Results:
`CALCulate<n>:MARKer<m>:X` on page 519

Marker Peak List

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

3 Marker Peak List

Wnd	No	X-Value	Y-Value
2	1	1.086245 ms	-75.810 dBm
2	2	2.172490 ms	-6.797 dBm
2	3	3.258736 ms	-76.448 dBm
2	4	4.831918 ms	-76.676 dBm
2	5	6.255274 ms	-76.482 dBm
2	6	6.798397 ms	-6.800 dBm
2	7	9.233084 ms	-76.519 dBm
2	8	10.075861 ms	-76.172 dBm
2	9	11.405574 ms	-6.801 dBm

Remote command:
`LAY:ADD? '1',RIGH, PEAK`, see `LAYout:ADD[:WINDow]?` on page 403
Results:
`CALCulate<n>:MARKer<m>:X` on page 519

Result Summary
Result summaries provide the results of specific measurement functions in a table for numerical evaluation. The contents of the result summary vary depending on the selected measurement function. See the description of the individual measurement functions for details.

Tip: To navigate within long result summary tables, simply scroll through the entries with your finger on the touchscreen.

Remote command:
`LAY:ADD? '1',RIGH, RSUM`, see `LAYout:ADD[:WINDow]?` on page 403

8.1.2 Laying out the result display with the smartgrid

Measurement results can be evaluated in many different ways, for example graphically, as summary tables, statistical evaluations etc. Each type of evaluation is displayed in a separate window in the channel tab. Up to 16 individual windows can be displayed per channel (i.e. per tab). To arrange the diagrams and tables on the screen, the Rohde & Schwarz SmartGrid function helps you find the target position simply and quickly.

Principally, the layout of the windows on the screen is based on an underlying grid, the SmartGrid. However, the SmartGrid is dynamic and flexible, allowing for many different layout possibilities. The SmartGrid functionality provides the following basic features:

- Windows can be arranged in columns or in rows, or in a combination of both.
- Windows can be arranged in up to four rows and four columns.
- Windows are moved simply by dragging them to a new position on the screen, possibly changing the layout of the other windows, as well.
- All evaluation methods available for the currently selected measurement are displayed as icons in the evaluation bar. If the evaluation bar contains more icons than can be displayed at once on the screen, it can be scrolled vertically. The same evaluation method can be displayed in multiple windows simultaneously.
- New windows are added by dragging an evaluation icon from the evaluation bar to the screen. The position of each new window depends on where you drop the evaluation icon in relation to the existing windows.
- All display configuration actions are only possible in SmartGrid mode. When SmartGrid mode is activated, the evaluation bar replaces the current softkey menu display. When the SmartGrid mode is deactivated again, the previous softkey menu display is restored.

8.1.2.1 Background information: the smartgrid principle

SmartGrid display

During any positioning action, the underlying SmartGrid is displayed. Different colors and frames indicate the possible new positions. The position in the SmartGrid where you drop the window determines its position on the screen.

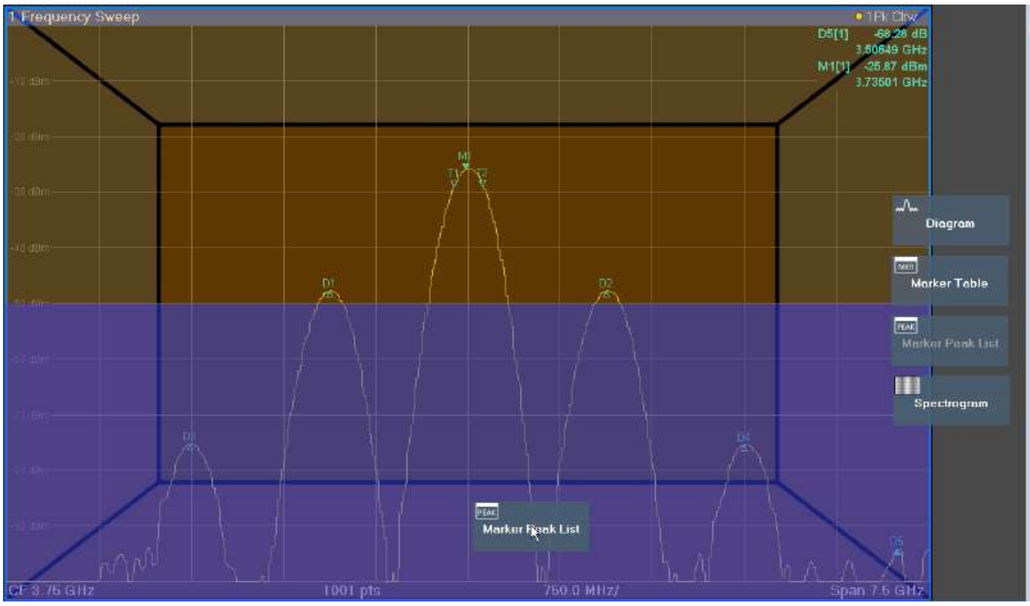


Figure 8-1: Moving a window in SmartGrid mode

The brown area indicates the possible "drop area" for the window, i.e. the area in which the window can be placed. A blue area indicates the (approximate) layout of the window as it would be if the icon were dropped at the current position. The frames indicate the possible destinations of the new window with respect to the existing windows: above/below, right/left or replacement (as illustrated in Figure 4-31). If an existing window would be replaced, the drop area is highlighted in a darker color shade.

Positioning the window

The screen can be divided into up to four rows. Each row can be split into up to four columns, where each row can have a different number of columns. However, rows always span the entire width of the screen and may not be interrupted by a column. A single row is available as the drop area for the window in the SmartGrid. The row can be split into columns, or a new row can be inserted above or below the existing row (if the maximum of 4 has not yet been reached).

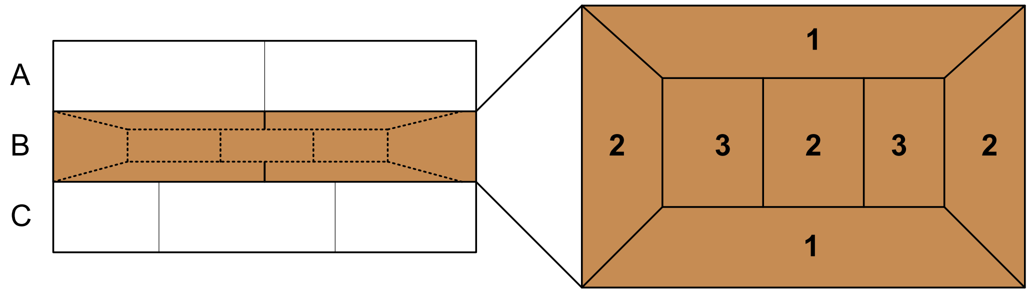


Figure 8-2: SmartGrid window positions

1 = Insert row above or below the existing row
2 = Create a new column in the existing row
3 = Replace a window in the existing row

SmartGrid functions

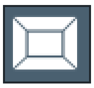
Once the evaluation icon has been dropped, icons in each window provide delete and move functions.

The "Move" icon allows you to move the position of the window, possibly changing the size and position of the other displayed windows.

The "Delete" icon allows you to close the window, enlarging the display of the remaining windows.

8.1.2.2 How to activate smartgrid mode

All display configuration actions are only possible in SmartGrid mode. In SmartGrid mode the evaluation bar replaces the current softkey menu display. When the SmartGrid mode is deactivated again, the previous softkey menu display is restored.

► To activate SmartGrid mode, do one of the following:
- 

  Select the "SmartGrid" icon from the toolbar.
- Select the "Display Config" button in the configuration "Overview".
- Select the "Display Config" softkey from the [Meas Config] menu.

The SmartGrid functions and the evaluation bar are displayed.

To close the SmartGrid mode and restore the previous softkey menu select the "Close" icon in the right-hand corner of the toolbar, or press any key.

8.1.2.3 How to add a new result window

Each type of evaluation is displayed in a separate window. Up to 16 individual windows can be displayed per channel (i.e. per tab).

1. Activate SmartGrid mode.

   All evaluation methods available for the currently selected measurement are displayed as icons in the evaluation bar.
2. Select the icon for the required evaluation method from the evaluation bar.
   If the evaluation bar contains more icons than can be displayed at once on the screen, it can be scrolled vertically. Touch the evaluation bar between the icons and move it up or down until the required icon appears.
3. Drag the required icon from the evaluation bar to the SmartGrid, which is displayed in the diagram area, and drop it at the required position. (See "How to arrange the result windows" on page 81 for more information on positioning the window).

Remote command:

`LAYout:ADD[:WINDow]?` on page 403 / `LAYout:WINDow<n>:ADD?` on page 407

8.1.2.4 How to close a result window

► To close a window, activate SmartGrid mode and select the "Delete" icon for the window.

Remote command:

`LAYout:REMove[:WINDow]` on page 405 / `LAYout:WINDow<n>:REMove` on page 408

8.1.2.5 How to arrange the result windows

1. Select an icon from the evaluation bar or the "Move" icon for an existing evaluation window.

2. Drag the evaluation over the SmartGrid.
   A blue area shows where the window will be placed.

3. Move the window until a suitable area is indicated in blue.
4. Drop the window in the target area.

   The windows are rearranged to the selected layout, and "Delete" and "Move" icons are displayed in each window.
5. To close a window, select the corresponding "Delete" icon.

Remote command:

LAYout:REPLace[:WINDow] on page 405 / LAYout:WINDow<n>:REPLace on page 408

LAYout:MOVE[:WINDow] on page 404

8.1.3 Display and limit lines

Display and limit lines help you analyze a measurement trace.

Access: "Overview" > "Analysis" > "Lines"

8.1.3.1 Display lines

Basics on display lines

Display lines help you analyze a trace – as do markers. The function of a display line is comparable to that of a ruler that can be shifted on the trace in order to mark absolute values. They are used exclusively to visually mark relevant frequencies or points in time (zero span), as well as constant level values. It is not possible to check automatically whether the points are below or above the marked level values - use limit lines for that task (see "Basics on limit lines" on page 189).

Two different types of display lines are provided:

- Two horizontal lines: "Horizontal Line 1" and "Horizontal Line 2".
  These lines are continuous horizontal lines across the entire width of a diagram and can be shifted up and down.
- Four vertical lines: "Vertical Line 1" to "Vertical Line 4"
  These lines are continuous vertical lines across the entire height of the diagram and can be shifted left and right.

Lables

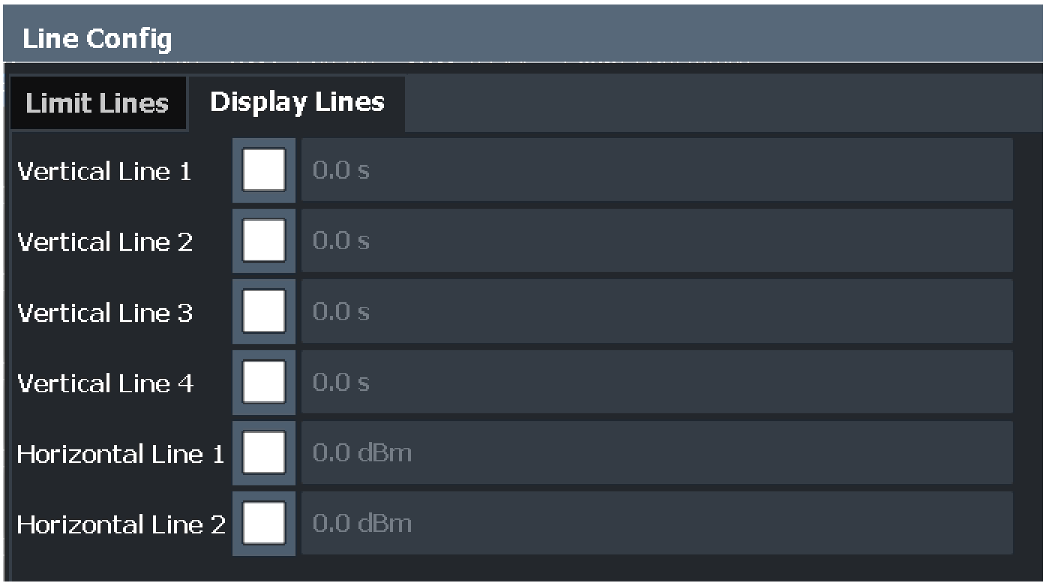
Each line is identified by one of the following abbreviations in the diagrams:

- H1: "Horizontal Line 1"
- H2: "Horizontal Line 2"
- V1: "Vertical Line 1"
- V2: "Vertical Line 2"
- V3: "Vertical Line 3"
- V4: "Vertical Line 4"

Display line settings

Access: "Overview" > "Analysis" > "Lines" > "Display Lines"

Four vertical and two horizontal lines can be defined in the display.



Vertical Line <x>

Activates a vertical display line in the diagram at the specified point of the x-axis, depending on the scale of the axis.

Remote command:

`CALCulate<n>:FLINe<dl>` on page 540
`CALCulate<n>:TLINe<dl>` on page 541

Horizontal Line 1/ Horizontal Line 2

Activates a horizontal display line (H1 or H2) in the diagram at the specified point of the y-axis.

Remote command:

`CALCulate<n>:DLINe<dl>` on page 539
`CALCulate<n>:DLINe<dl>` on page 539

Defining display lines

1. Display lines are configured in the "Lines Config" dialog box. To display this dialog box, press the [Lines] key and then "Lines Config".
2. Select the "Display Lines" tab.
3. To define a vertical line:
   a) Select "Vertical Line 1", 2, 3, or 4.
   b) Enter the x-value at which the line is to be displayed.
4. To define a horizontal line:
   a) Select "Horizontal Line 1" or 2.
   b) Enter the y-value at which the line is to be displayed.

8.1.3.2 Limit lines

Limit lines allow you to check automatically whether the measured points are below or above specified values.

Basics on limit lines

Limit lines are used to define amplitude curves or spectral distribution boundaries in the result diagram which are not to be exceeded. They indicate, for example, the upper limits for interference radiation or spurious waves which are allowed from a device under test (DUT). When transmitting information in TDMA systems (e.g. GSM), the amplitude of the bursts in a time slot must adhere to a curve that falls within a specified tolerance band. The lower and upper limits may each be specified by a limit line. Then, the amplitude curve can be controlled either visually or automatically for any violations of the upper or lower limits (GO/NOGO test).

The R&S FSMR3 supports limit lines with a maximum of 200 data points. Eight of the limit lines stored in the instrument can be activated simultaneously. The number of limit lines stored in the instrument is only limited by the capacity of the storage device used.

Limit line data can also be exported to a file in ASCII (CSV) format for further evaluation in other applications. Limit lines stored in the specified ASCII (CSV) format can also be imported to the R&S FSMR3 for other measurements.

Compatibility

Limit lines are compatible with the current measurement settings, if the following applies:

- The x unit of the limit line has to be identical to the current setting.

Validity

Only limit lines that fulfill the following conditions can be activated:

- Each limit line must consist of a minimum of 2 and a maximum of 200 data points.
- The frequencies/times for each data point must be defined in ascending order; however, for any single frequency or time, two data points may be entered (to define a vertical segment of a limit line).
- Gaps in frequency or time are not allowed. If gaps are desired, two separate limit lines must be defined and then both enabled.
- The entered frequencies or times need not necessarily be selectable in R&S FSMR3. A limit line may also exceed the specified frequency or time range. The minimum frequency for a data point is -200 GHz, the maximum frequency is 200 GHz. For the time range representation, negative times may also be entered. The allowed range is -1000 s to +1000 s.

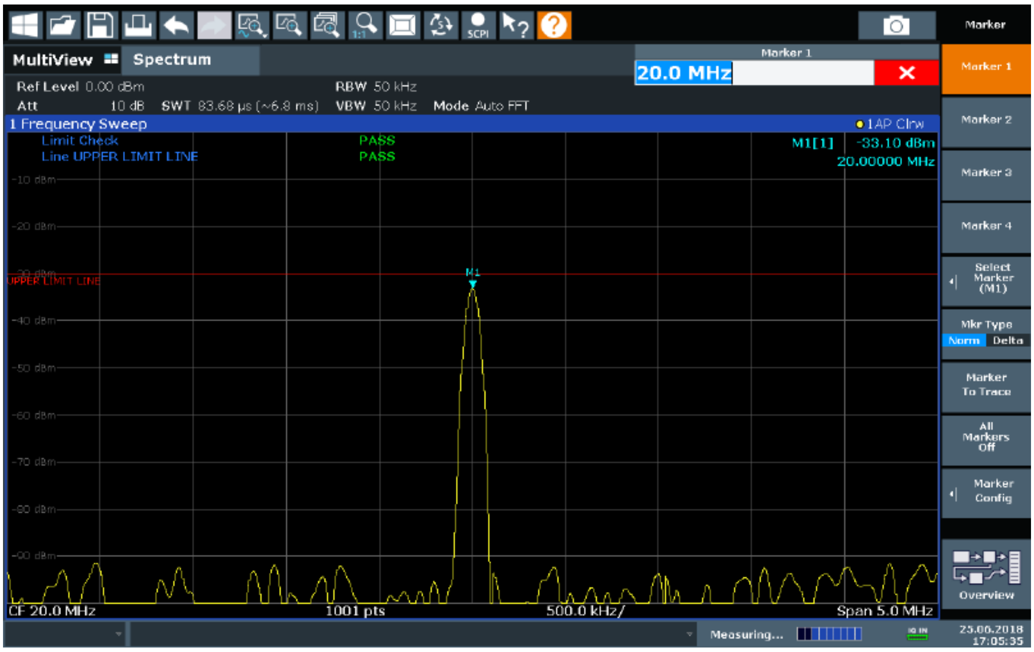
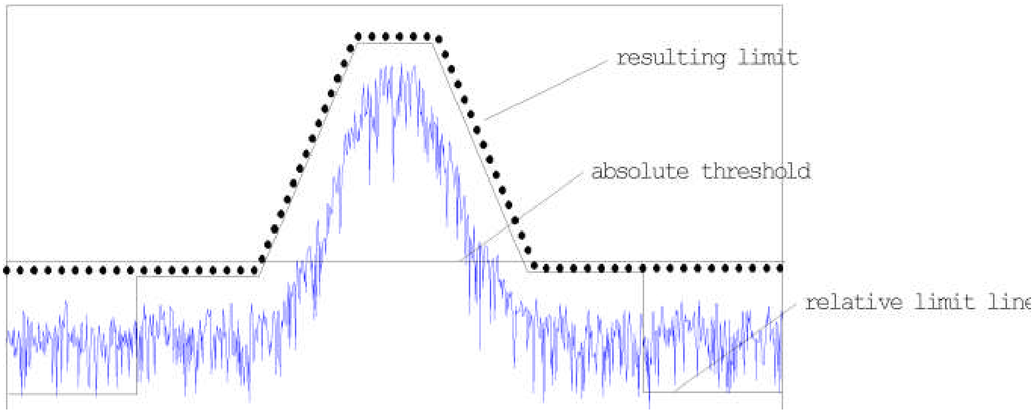


Figure 8-3: Example for an upper limit line

Thresholds

If the y-axis for the limit line data points uses relative scaling, an additional absolute **threshold** can be defined for the limit check. In this case, both the threshold value and the relative limit line must be exceeded before a violation occurs.



Offsets and Shifting

A configured limit line can easily be moved vertically or horizontally. Two different methods to do so are available:

- An **offset** moves the entire line in the diagram without editing the configured values or positions of the individual data points. This option is only available if relative scaling is used.
  Thus, a new limit line can be easily generated based upon an existing limit line which has been shifted horizontally or vertically.
- Defining a **shift** width for the values or position of the individual data points changes the line configuration, thus changing the position of the line in the diagram.

Limit Check Results

A limit check is automatically performed as soon as any of the limit lines is activated ("Visibility" setting). Only the specified "Traces to be Checked" are compared with the active limit lines. The status of the limit check for each limit line is indicated in the diagram. If a violation occurs, the limit check status is set to "MARG" for a margin violation, or to"Fail" for a limit violation.

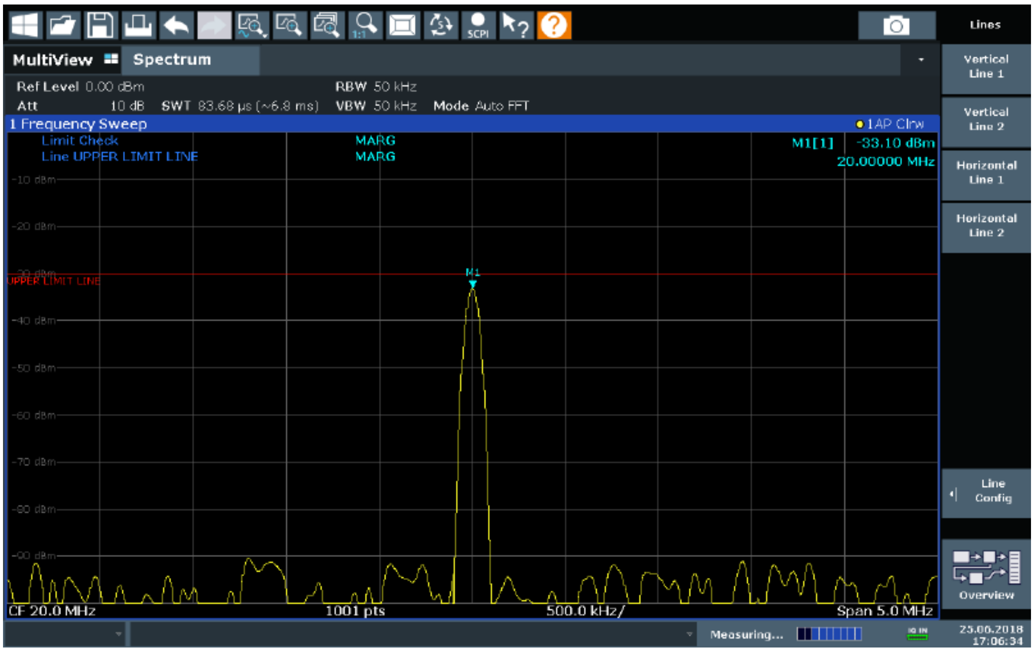


Figure 8-4: Margin violation for limit check

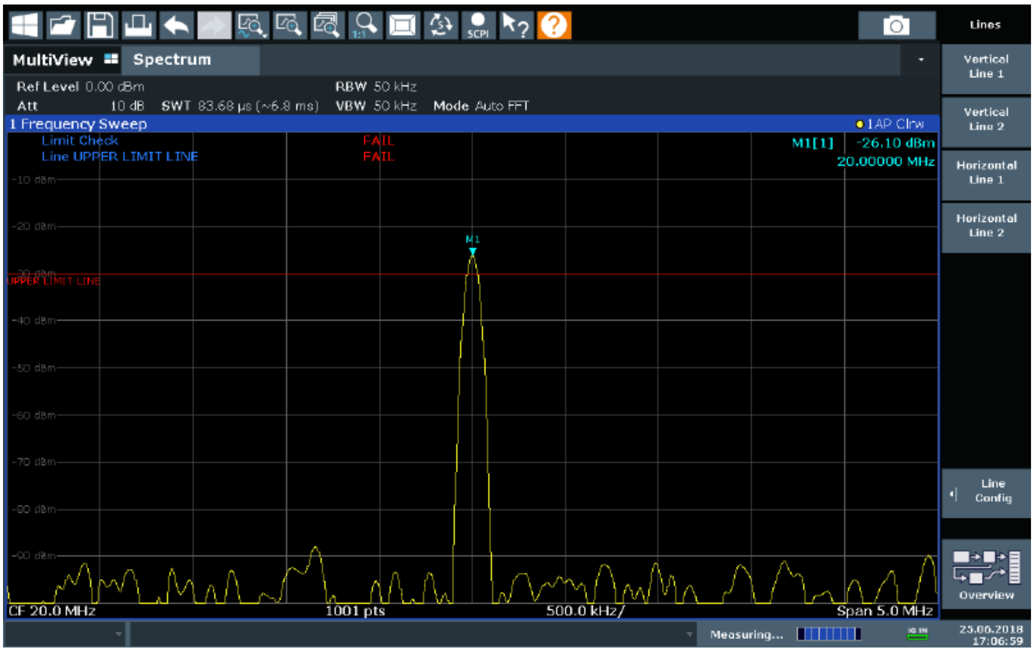


Figure 8-5: Limit violation for limit check

Storing and Recalling Limit Lines

Limit lines can be stored with the configuration settings so they can be recalled for other measurements at a later time. Note, however, that any changes made to the limit lines *after* storing the configuration file cannot be restored and will be overwritten by the stored values when the configuration file is recalled. Always remember to store the settings again after changing the limit line values.

After recalling measurement settings, the limit line values applied to the measurement may be different to those displayed in the "Limit Lines" dialog box.

For more information see the R&S FSMR3 User Manual, chapter "Data Management".

Limit line settings and functions

Stored limit line settings

When storing and recalling limit line settings, consider the information provided in the Data Management chapter of the R&S FSMR3 User Manual.

Limit line management

Access: "Overview" > "Analysis" > "Lines" > "Limit Lines"

or: [LINES] > "Line Config" > "Limit Lines"

For the limit line overview, the R&S FSMR3 searches for all stored limit lines with the file extension `.LIN` in the `limits` subfolder of the main installation folder. The overview allows you to determine which limit lines are available and can be used for the current measurement.

For details on settings for individual lines see "Limit line details" on page 195.

Name

The name of the stored limit line.

Unit
The unit in which the y-values of the data points of the limit line are defined.

Compatibility
Indicates whether the limit line definition is compatible with the current measurement settings.

Visibility
Displays or hides the limit line in the diagram. Up to 8 limit lines can be visible at the same time. Inactive limit lines can also be displayed in the diagram.

Remote command:
`CALCulate<n>:LIMit<li>:LOWer:STATe` on page 547
`CALCulate<n>:LIMit<li>:UPPer:STATe` on page 550
`CALCulate<n>:LIMit<li>:ACTive?` on page 551

Traces to be Checked
Defines which traces are automatically checked for conformance with the limit lines. As soon as a trace to be checked is defined, the assigned limit line is active. One limit line can be activated for several traces simultaneously. If any of the "Traces to be Checked" violate any of the active limit lines, a message is indicated in the diagram.

Remote command:
`CALCulate<n>:LIMit<li>:TRACe<t>:CHECk` on page 553

Comment
An optional description of the limit line.

X-Offset
Shifts a limit line that has been specified for relative frequencies or times (x-axis) horizontally.

This setting does not have any effect on limit lines that are defined by absolute values for the x-axis.

Remote command:
`CALCulate<n>:LIMit<li>:CONTrol:OFFSet` on page 544

Y-Offset
Shifts a limit line that has relative values for the y-axis (levels or linear units such as volt) vertically.

This setting does not have any effect on limit lines that are defined by absolute values for the y-axis.

Remote command:
`CALCulate<n>:LIMit<li>:LOWer:OFFSet` on page 546
`CALCulate<n>:LIMit<li>:UPPer:OFFSet` on page 549

Create New Line
Creates a new limit line.

Edit Line
Edit an existing limit line configuration.

Copy Line
Copy the selected limit line configuration to create a new line.

Remote command:
`CALCulate<n>:LIMit<li>:COPY` on page 552

Delete Line
Delete the selected limit line configuration.

Remote command:
`CALCulate<n>:LIMit<li>:DELete` on page 552

Disable All Lines
Disable all limit lines in one step.

Remote command:
`CALCulate<n>:LIMit<li>:STATe` on page 552

Limit line details

Access: "Overview" > "Analysis" > "Lines" > "Limit Lines" > "New" / "Edit" / "Copy To"

or: [LINES] > "Line Config" > "Limit Lines" > "New" / "Edit" / "Copy To"

Name
Defines the limit line name. All names must be compatible with Windows conventions for file names. The limit line data is stored under this name (with a `.LIN` extension).

Remote command:
`CALCulate<n>:LIMit<li>:NAME` on page 548

Comment
Defines an optional comment for the limit line.

Remote command:
`CALCulate<n>:LIMit<li>:COMMent` on page 542

Data Points
Each limit line is defined by a minimum of 2 and a maximum of 200 data points. Each data point is defined by its position (x-axis) and value (y-value). Data points must be defined in ascending order. The same position can have two different values.

Remote command:
`CALCulate<n>:LIMit<li>:CONTrol[:DATA]` on page 543
`CALCulate<n>:LIMit<li>:LOWer[:DATA]` on page 545
`CALCulate<n>:LIMit<li>:UPPer[:DATA]` on page 548

Insert Value
Inserts a data point in the limit line above the selected one in the "Edit Limit Line" dialog box.

Delete Value
Deletes the selected data point in the "Edit Limit Line" dialog box.

Shift x
Shifts the x-value of each data point horizontally by the defined shift width (as opposed to an additive offset defined for the entire limit line, see "X-Offset" on page 194).

Remote command:
`CALCulate<n>:LIMit<li>:CONTrol:SHIFt` on page 544

Shift y
Shifts the y-value of each data point vertically by the defined shift width (as opposed to an additive offset defined for the entire limit line, see "Y-Offset" on page 194).

Remote command:
`CALCulate<n>:LIMit<li>:LOWer:SHIFt` on page 546
`CALCulate<n>:LIMit<li>:UPPer:SHIFt` on page 550

Save
Saves the currently edited limit line under the name defined in the "Name" field.

Import
Opens a file selection dialog box and loads the limit line from the selected file in `.CSV` format.

Note that a valid import file must contain a minimum of required information for the R&S FSMR3.

Remote command:
`MMEMory:LOAD<n>:LIMit` on page 553

File Explorer ← Import
Opens the Microsoft Windows File Explorer.

Remote command:
not supported

Export
Opens a file selection dialog box and stores the currently displayed limit line to the defined file in `.CSV` format.

The limit line can be imported again later by the R&S FSMR3 for use in other measurements.

Remote command:
MMEMory:STORe<n>:LIMit on page 553

File Explorer ← Export
Opens the Microsoft Windows File Explorer.

Remote command:
not supported

How to define limit lines

Access: "Overview" > "Analysis" > "Lines" > "Limit Lines"

or: [LINES] > "Line Config" > "Limit Lines"

The following tasks are described here:

- "How to find compatible limit lines" on page 197
- "How to activate and deactivate a limit check" on page 197
- "How to edit existing limit lines" on page 198
- "How to copy an existing limit line" on page 198
- "How to delete an existing limit line" on page 198
- "How to configure a new limit line" on page 198
- "How to move the limit line vertically or horizontally" on page 199

How to find compatible limit lines

► In the "Line Config" dialog box, select the "View Filter" option: "Show Compatible".

All stored limit lines with the file extension .LIN in the limits subfolder of the main installation folder of the instrument that are compatible to the current measurement settings are displayed in the overview.

How to activate and deactivate a limit check

A limit check is automatically performed as soon as any of the limit lines is activated.

1. To activate a limit check:
   Select the "Check Traces" setting for a limit line in the overview and select the trace numbers to be included in the limit check. One limit line can be assigned to several traces.

   The specified traces to be checked are compared with the active limit lines. The status of the limit check is indicated in the diagram.

2. To deactivate a limit line, deactivate all "Traces to be Checked" for it.
   To deactivate all limit lines at once, select the "Disable All Lines" button.

   The limit checks for the deactivated limit lines are stopped and the results are removed form the display.

How to edit existing limit lines

Existing limit line configurations can be edited.

1. In the "Line Config" dialog box, select the limit line.
2. Select the "Edit" button.
3. Edit the line configuration as described in "How to configure a new limit line" on page 198.
4. Save the new configuration by selecting the "Save" button.

   If the limit line is active, the edited limit line is displayed in the diagram.

How to copy an existing limit line

1. In the dialog box, select the limit line.
2. Select the"Line Config" "Copy To" button.
3. Define a new name to create a new limit with the same configuration as the source line.
4. Edit the line configuration as described in "How to configure a new limit line" on page 198.
5. Save the new configuration by selecting the "Save" button.

   The new limit line is displayed in the overview and can be activated.

How to delete an existing limit line

1. In the "Line Config" dialog box, select the limit line.
2. Select the "Delete" button.
3. Confirm the message.

   The limit line and the results of the limit check are deleted.

How to configure a new limit line

1. In the "Line Config" dialog box, select the "New" button.

   The "Edit Limit Line" dialog box is displayed. The current line configuration is displayed in the preview area of the dialog box. The preview is updated after each change to the configuration.
2. Define a "Name" and, optionally, a "Comment" for the new limit line.
3. Define the x-axis configuration:
   - Time domain or frequency domain
   - Absolute or relative limits
   - Linear or logarithmic scaling
4. Define the y-axis configuration:
   - Level unit

- Absolute or relative limits
- Upper or lower limit line

5. Define the data points: minimum 2, maximum 200:
   a) Select "Insert Value".
   b) Define the x-value ("Position") and y-value ("Value") of the first data point.
   c) Select "Insert Value" again and define the second data point.
   d) Repeat this to insert all other data points.
   To insert a data point before an existing one, select the data point and then "Insert Value".
   To insert a new data point at the end of the list, move the focus to the line after the last entry and then select "Insert Value".
   To delete a data point, select the entry and then "Delete Value".
6. Check the current line configuration in the preview area of the dialog box. If necessary, correct individual data points or add or delete some.
   If necessary, shift the entire line vertically or horizontally by selecting the "Shift x" or "Shift y" button and defining the shift width.
7. Optionally, define a "Margin" at a fixed distance to the limit line.
   The margin must be within the valid value range and is not displayed in the diagram or preview area.
8. Optionally, if the y-axis uses relative scaling, define an absolute "Threshold" as an additional criteria for a violation.
9. Save the new configuration by selecting the "Save" button.

   The new limit line is displayed in the overview and can be activated.

How to move the limit line vertically or horizontally

A configured limit line can easily be moved vertically or horizontally. Thus, a new limit line can be easily generated based upon an existing limit line which has been shifted horizontally.

1. In the "Line Config" dialog box, select the limit line.
2. To shift the complete limit line parallel in the horizontal direction, select the "X-Offset" button and enter an offset value.
   To shift the complete limit line parallel in the vertical direction, select the "Y-Offset" button and enter an offset value.
3. To shift the individual data points of a limit line by a fixed value (all at once):
   a) Select the "Edit" button.
   b) In the "Edit Limit Line" dialog box, select the "Shift x" or "Shift y" button and define the shift width.
   c) Save the shifted data points by selecting the "Save" button.

   If activated, the limit line is shifted in the diagram.

How to export a limit line

Limit line configurations can be stored to an ASCII file for evaluation in other programs or to be imported later for other measurements.

1. In the "Line Config" dialog box, select the limit line.
2. Select the "New" or "Edit" button.
3. Define the limit line as described in "How to configure a new limit line" on page 198.
4. Select "Export" to save the configuration to a file.

   You are asked whether you would like to save the configuration internally on the R&S FSMR3 first.
5. Select a file name and location for the limit line.
6. Select the decimal separator to be used in the file.
7. Select "Save".

   The limit line is stored to a file with the specified name and the extension `.CSV`. For details on the file format see "Reference: limit line file format" on page 200.

How to import a limit line

Limit line configurations that are stored in an ASCII file and contain a minimum of required data can be imported to the R&S FSMR3.

For details on the required file format see "Reference: limit line file format" on page 200.

1. In the "Line Config" dialog box, select the limit line.
2. Select the "New" or "Edit" button.
3. Select "Import" to load a limit line from a file.

   You are asked whether you would like to save the current configuration on the R&S FSMR3 first.
4. Select the file name of the limit line.
5. Select the decimal separator that was used in the file.
6. Select "Select".

   The limit line is loaded from the specified file and displayed in the "Edit Limit Line" dialog box.
7. Activate the limit line as described in "How to activate and deactivate a limit check" on page 197.

Reference: limit line file format

Limit line data can be exported to a file in ASCII (CSV) format for further evaluation in other applications. Limit lines stored in the specified ASCII (CSV) format can also be imported to the R&S FSMR3 for other measurements (see "How to import a limit line" on page 200). This reference describes in detail the format of the export/import files for limit lines. Note that the **bold** data is **mandatory**, all other data is optional.

Different language versions of evaluation programs may require a different handling of the decimal point. Thus, you can define the decimal separator to be used (see "Decimal Separator" on page 234).

Table 8-1: ASCII file format for limit line files

File contents	Description
Header data	
sep=;	Separator for individual values (required by Microsoft Excel, for example)
Type;RS_LimitLineDefinition;	Type of data
FileFormatVersion;1.00;	File format version
Date;01.Oct 2006;	Date of data set storage
OptionID;SpectrumAnalyzer	Application the limit line was created for
Name;RELFREQ1	Limit line name
Comment;Defines the upper limit line	Description of limit line
Mode;UPPER	Type of limit line (upper, lower)
ThresholdUnit;LEVEL_DBM	Unit of threshold value
ThresholdValue;-200	Threshold value
MarginValue;0	Margin value
XAxisScaling;LINEAR	Scaling of x-axis linear (LIN) or logarithmic (LOG)
XAxisUnit;FREQ_HZ	Unit of x values
XAxisScaleMode;ABSOLUTE	Scaling of x-axis (absolute or relative)
YAxisUnit;LEVEL_DB	Unit of y values
YAxisScaleMode;ABSOLUTE	Scaling of y-axis (absolute or relative)
NoOfPoints;5	Number of points the line is defined by
Data section for individual data points	
-4500000000;-50	**x- and y-values of each data point defining the line**
-2000000000;-30	
-1000000000;0	
0;-30	
2500000000;-50	

8.2 Zoomed displays

You can zoom into the diagram to visualize the measurement results in greater detail. Using the touchscreen or a mouse pointer you can easily define the area to be enlarged.

Graphical Zoom Versus Measurement Zoom

Graphical zooming is merely a visual tool, it does not change any measurement settings, such as the number of sweep points, the frequency range, or the reference level. Graphical zooming only changes the resolution of the displayed trace points temporarily. You must explicitly activate the graphical zoom function (see Chapter 8.2.2, "Zoom functions", on page 203).

When you change the display using touch gestures, however, the corresponding measurement settings are adapted. For example, dragging horizontally in a spectrum display changes the center frequency. Dragging vertically in a spectrum display changes the reference level (for absolute scaling). These changes are permanent for the measurement. This behavior is also referred to as *measurement zoom*, and is active by default in the new R&S FSMR3.However, you can also activate it manually for a display that has already been zoomed graphically. In this case, the temporary changes to the display are replaced by permanent changes to the measurement settings with the same effect.

Example:
Assume you have a spectrum display from a spurious emission measurement. You graphically zoom into the area around a detected spur. If you now activate a measurement zoom, the reference level, the center frequency, the frequency span, and the scaling settings are adapted so that the results of the measurement now indicate only the formerly zoomed area around the detected spur.

8.2.1 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.

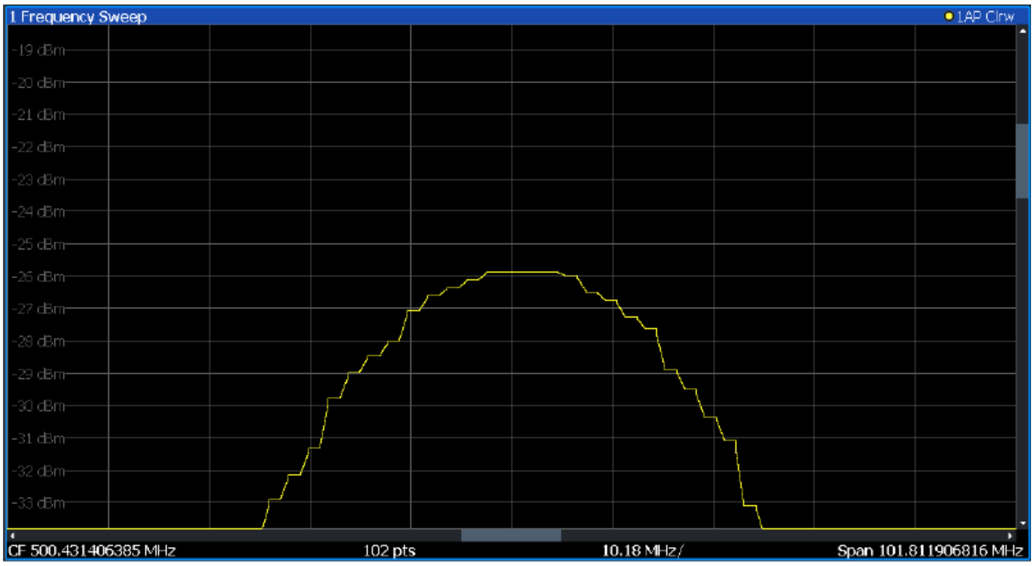


Figure 8-6: Single zoom

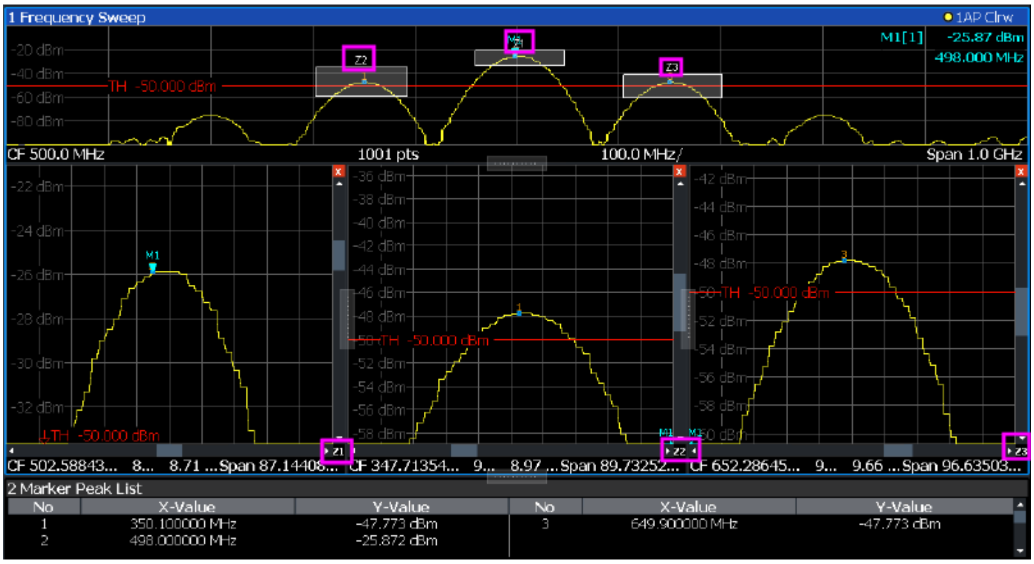


Figure 8-7: Multiple zoom

8.2.2 Zoom functions

Access: "Zoom" icons in toolbar

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>][:SUBWindow<w>]:ZOOM[:STATe]` on page 498
`DISPlay[:WINDow<n>][:SUBWindow<w>]:ZOOM:AREA` on page 497

Multi-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>][:SUBWindow<w>]:ZOOM:MULTiple<zn>[:STATe]`
on page 500
`DISPlay[:WINDow<n>][:SUBWindow<w>]:ZOOM:MULTiple<zn>:AREA`
on page 498

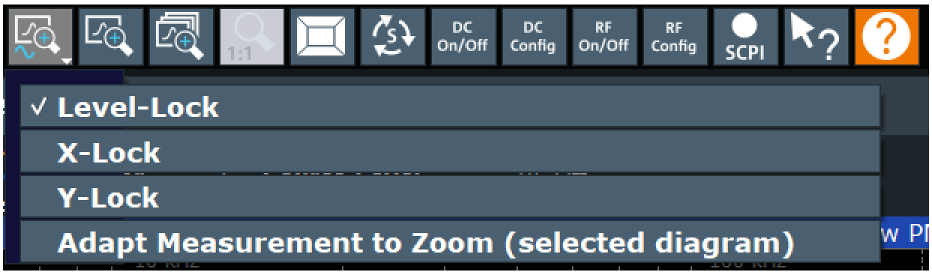
Measurement Zoom
As opposed to the graphical zoom, which is merely a visual tool, the measurement zoom adapts the measurement settings such that the data you are interested in is displayed in the required detail. In measurement zoom mode, you can change the display using touch gestures. This is the default operating mode of the R&S FSMR3.

For details on touch gestures see "Operating Basics" in the R&S FSMR3 Getting Started manual.

Note: The measurement settings are adapted to practical values based on a suitable grid for the current settings, rather than to unwieldy values that reflect precisely the pixel you happen to tap.
If the measurement zoom leads to undesirable results, you can easily return to the original measurement settings using the "UNDO" function.

When you select the "Measurement Zoom" icon, then tap in a diagram, a dotted rectangle is displayed which you can drag to define the zoom area. This allows you to define the zoom area more precisely than by spreading two fingers in the display.

The measurement zoom function provides further options in a context-sensitive menu, which is displayed when you tap the icon for a second or so (or right-click it). These options concern the behavior of the firmware for subsequent touch gestures on the screen. Note that these settings remain unchanged after a channel preset.



Level Lock ← Measurement Zoom
If activated (default), the reference level (and thus the attenuation) is locked, that is: remains unchanged during touch gestures on the screen.

X-Lock ← Measurement Zoom
If activated, the x-axis of the diagram is not changed during subsequent touch gestures.

Y-Lock ← Measurement Zoom
If activated, the y-axis of the diagram is not changed during subsequent touch gestures.

Adapt Measurement to Zoom (selected diagram) ← Measurement Zoom
If you already performed a graphical zoom using the "Single Zoom" on page 204 or "Multi-Zoom" on page 204 functions, this function automatically adapts the measurement settings to maintain the currently zoomed display.

Restore Original Display

Restores the original display, that is, the originally calculated displays for the entire capture buffer, and closes all zoom windows.

Note: This function only restores graphically zoomed displays. Measurement zooms, for which measurement settings were adapted, are recalculated based on the adapted measurement settings. In this case, the zoomed display is maintained.

Remote command:
`DISPlay[:WINDow<n>][:SUBWindow<w>]:ZOOM[:STATe]` on page 498

8.2.3 How to zoom into a diagram

The following tasks are described here:

- "To zoom into the diagram at one position" on page 206
- "To return to original display" on page 206

- "To zoom into multiple positions in the diagram" on page 207
- "To maintain a zoomed display permanently" on page 207

For information on how to zoom into a diagram using touch gestures and change the display permanently, see Chapter 4.5.4, "Touchscreen gestures", on page 73.

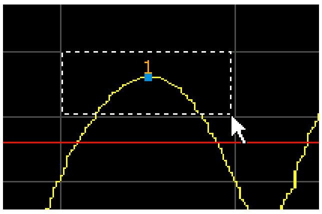
To zoom into the diagram at one position

1. 

   Click on the "Single Zoom" icon in the toolbar.

   Zoom mode is activated.

2. Tap and drag your finger in the diagram to select the area to be enlarged. The selected area is indicated by a dotted rectangle.

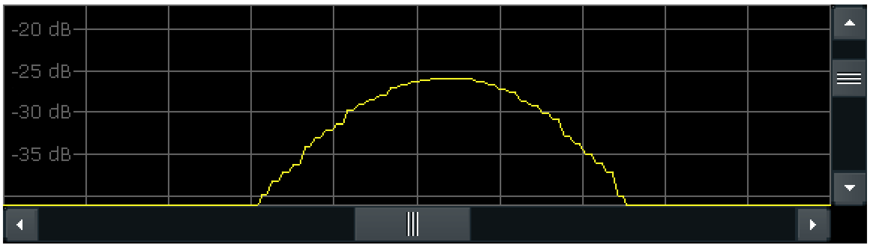
   

   When you leave the touchscreen, the diagram is replaced by the zoomed trace area.

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 original display

► 

Click on the "Zoom Off" icon in the toolbar.

The original trace display is restored. Zoom mode remains active, however.

To zoom into multiple positions in the diagram

1. 

   Click on the "Multi-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 206. 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 8-7.

3. 

   Click on the "Multi-Zoom" icon in the toolbar again.

4. 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.

5. 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.

► To resize a zoom area, tap 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, tap **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.

To maintain a zoomed display permanently

Graphical zooming only changes the resolution of the displayed trace points temporarily. In order to change the display permanently, you must change the corresponding measurement settings.

(Note: Performing a measurement zoom automatically adapts the measurement settings to reflect a graphically zoomed display, see "To perform a measurement zoom" on page 208).

1. Perform a graphical zoom as described in the previous procedures.

2. Select the "Measurement Zoom" icon from the toolbar.

3. Select "Adapt Measurement to Zoom (selected diagram)".

   The measurement settings are adapted as required to obtain the zoomed result display.

To perform a measurement zoom

Performing a measurement zoom automatically adapts the measurement settings to reflect a graphically zoomed display.

1. Select the "Measurement Zoom" icon from the toolbar.
2. Do one of the following to define the zoom area:
   - Stretch two fingers in the diagram to enlarge the area between them.
   - Tap and drag one finger in the diagram to select the area to be enlarged. The selected area is indicated by a dotted rectangle.

   The measurement settings are adapted as required to obtain the zoomed result display.

8.3 Marker usage

Markers help you analyze your measurement results by determining particular values in the diagram. Thus you can extract numeric values from a graphical display both in the time and frequency domain. In addition to basic markers, sophisticated marker functions are provided for special results such as noise or demodulation.

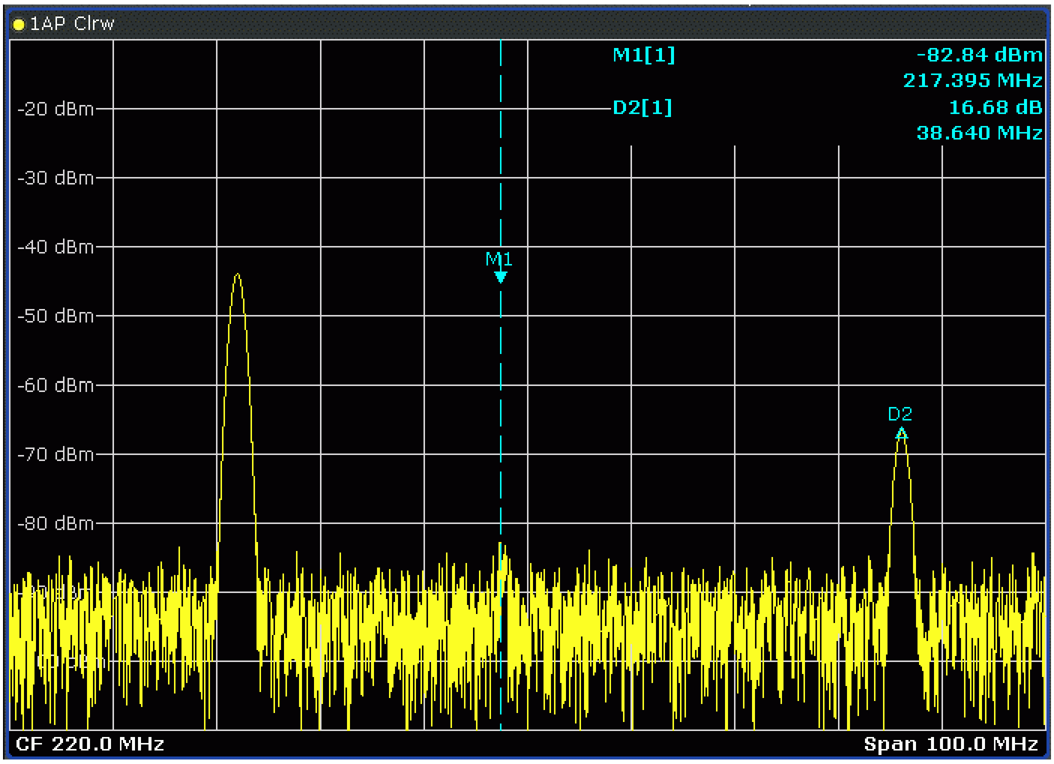
Markers in spectrogram displays

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.

8.3.1 Basics on markers

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 FSMR3 provides 16 markers per display window. In the Spectrum application, the same markers are displayed in all windows.

- 

- Alternatively, change the position of the selected marker using the rotary knob. By default, the marker is moved from one pixel to the next. If you need to position the marker more precisely, change the step size to move from one sweep point to the next (General Marker Setting).
- You can also set an active marker to a new position by defining its x-position numerically. When you select the softkey for a marker, an edit dialog box is displayed.
- The most commonly required marker settings and functions are also available as softkeys or via the context menu. Tap the marker on the touch screen and hold your finger for about 2 seconds until the context menu is opened, then select the required entry.
- Softkeys for active markers (displayed on the screen) are highlighted blue. The softkey for the currently selected marker (for which functions are performed) is highlighted orange.
- To set individual markers very quickly, use the softkeys in the "Marker" menu.
- To set up several markers at once, use the "Marker" dialog box.
- To position the selected marker to a special value, use the softkeys in the "Marker To" menu.
- To determine more sophisticated marker results, use the special functions in the "Marker Function" dialog box.

In addition to basic markers, sophisticated marker functions are provided for special results such as noise or band power measurements.

8.3.1.1 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).

The Spectrum application also features special functions that can be assigned to individual markers. The availability of special marker functions depends on whether the measurement is performed in the frequency or time domain.

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.

8.3.1.2 Activating markers

Only active markers are displayed in the diagram and in the marker table.

Active markers are indicated by a highlighted softkey.

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.

8.3.1.3 Marker results

Normal markers point to a trace point on the x-axis and display the associated numeric value for that trace point. Delta markers indicate an offset between the level at the delta marker position and the level at the position of the assigned reference marker, in dB.

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

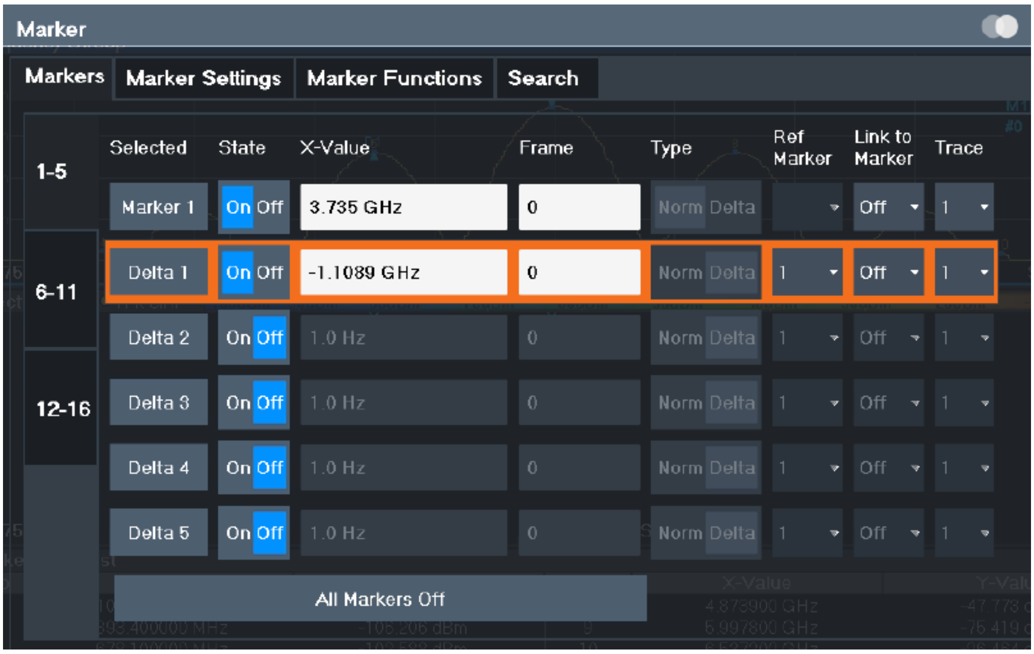
In addition to the marker information displayed within the diagram area, a separate marker table may be displayed beneath the diagram. This table provides the following information for all active markers:

8.3.2 Marker settings

Or: [MKR] > "Marker Config"

8.3.2.1 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.

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 519
`CALCulate<n>:DELTamarker<m>[:STATe]` on page 516

Marker Position X-value

Defines the position (x-value) of the marker in the diagram. For normal markers, the absolute position is indicated. For delta markers, the position relative to the reference marker is provided.

Remote command:
CALCulate<n>:MARKer<m>:X on page 519
CALCulate<n>:DELTamarker<m>:X on page 517

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 519
CALCulate<n>:DELTamarker<m>[:STATe] on page 516

Reference Marker

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

Remote command:
CALCulate<n>:DELTamarker<m>:MREFerence on page 516

Linking to Another Marker

Links the current marker to the marker selected from the list of active markers. If the x-axis value of the initial marker is changed, the linked marker follows to the same position on the x-axis. Linking is off by default.

Using this function you can set two markers on different traces to measure the difference (e.g. between a max hold trace and a min hold trace or between a measurement and a reference trace).

Remote command:
CALCulate<n>:MARKer<ms>:LINK:TO:MARKer<md> on page 518
CALCulate<n>:DELTamarker<ms>:LINK:TO:MARKer<md> on page 515
CALCulate<n>:DELTamarker<m>:LINK on page 514

Assigning the Marker to a Trace

The "Trace" setting assigns the selected marker to an active trace. The trace determines which value the marker shows at the marker position. If the marker was previously assigned to a different trace, the marker remains on the previous frequency or time, but indicates the value of the new trace.

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

Remote command:
CALCulate<n>:MARKer<m>:TRACe on page 519

Select Marker
The "Select Marker" function opens a dialog box to select and activate or deactivate one or more markers quickly.

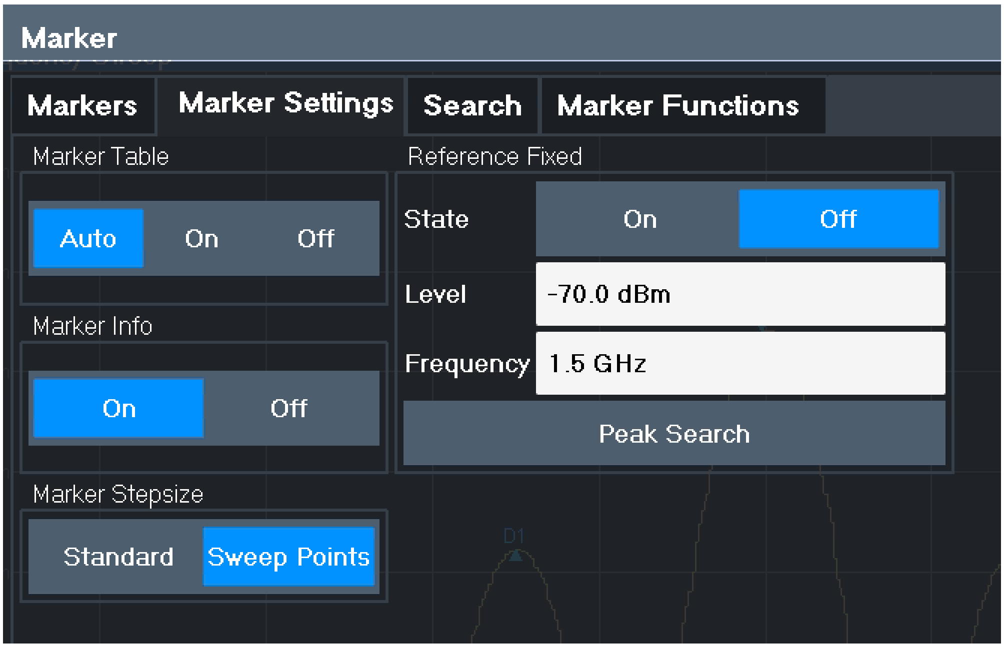
Remote command:
`CALCulate<n>:MARKer<m>[:STATe]` on page 519
`CALCulate<n>:DELTamarker<m>[:STATe]` on page 516

All Markers Off
Deactivates all markers in one step.

Remote command:
`CALCulate<n>:MARKer<m>:AOFF` on page 517

8.3.2.2 General marker settings

Some general marker settings allow you to influence the marker behavior for all markers.



Marker Table Display

Defines how the marker information is displayed.

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

"Off" No separate marker table is displayed.

Remote command:
`DISPlay[:WINDow<n>]:MTABle` on page 520

Marker Stepsize

Defines the size of the steps that the marker position is moved using the rotary knob.

"Standard" The marker position is moved in steps of (Span/1000), 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.

"Sweep Points" The marker position is moved from one sweep point to the next. This setting is required for a very precise positioning if more sweep 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 520

8.3.3 Marker peak list

Access: "Overview" > "Analysis" > "Marker Functions" > "Marker Peak List"

Or: [MKR FUNC] > "Marker Peak List"

A common measurement task is to determine peak values, i.e. maximum or minimum signal levels. The R&S FSMR3 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)
- Creating a "marker table" with all or a defined number of peak values for one measurement ("Marker Peak List")
- Updating the marker position to the current peak value automatically after each measurement (Auto Peak Search)
- Creating a fixed reference marker at the current peak value of a trace (Fixed Reference)

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, noise values are 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.

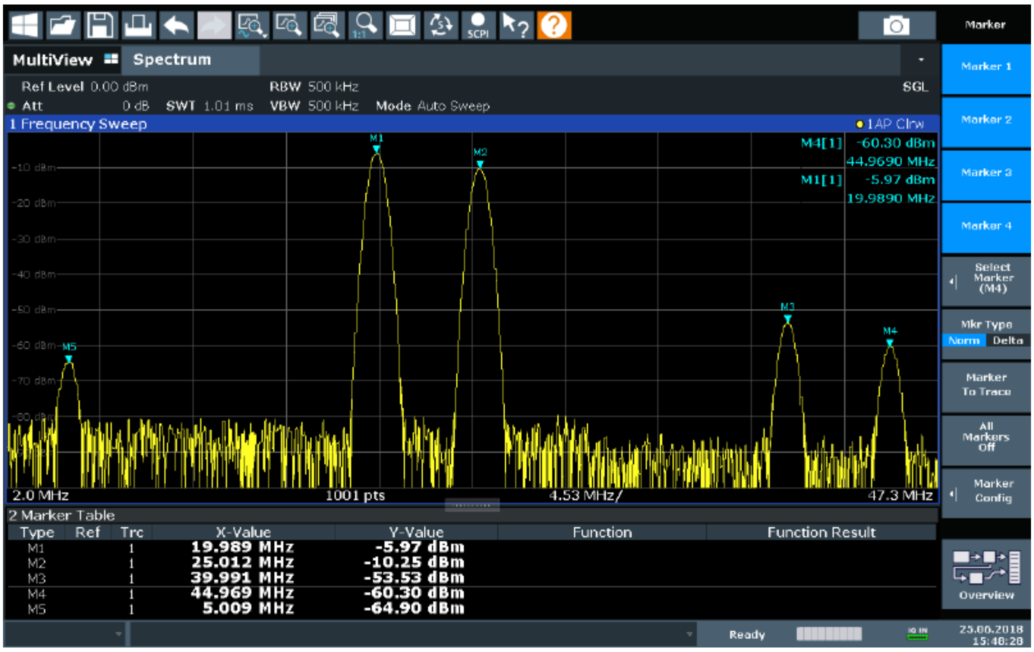


Figure 8-8: Trace example

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	80 dB
2	80 dB
3	55 dB
4	39 dB
5	32 dB

To eliminate the smaller peaks M3, M4 and M5 in the example above, a peak excursion of at least 60 dB is required. In this case, the amplitude must rise at least 60 dB before falling again before a peak is detected.

Marker peak list

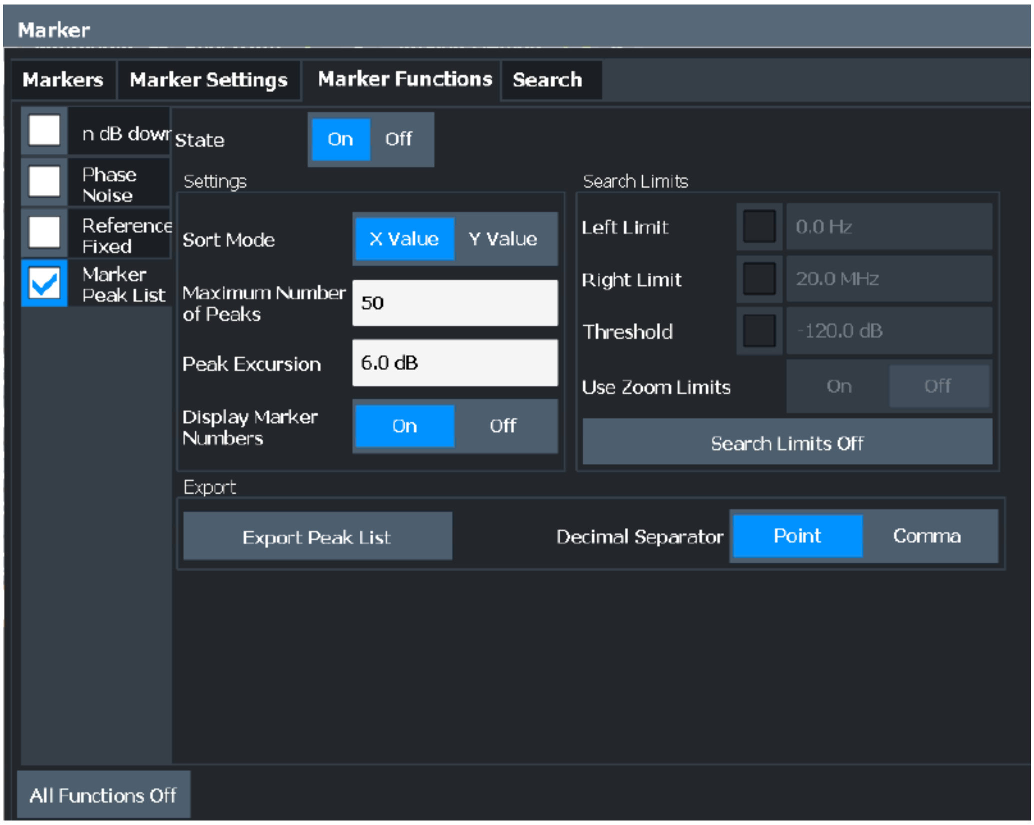
The marker peak list determines the frequencies and levels of peaks in the spectrum. It is updated automatically after each measurement. How many peaks are displayed can be defined, as well as the sort order. In addition, the detected peaks can be indicated in the diagram. The peak list can also be exported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

Automatic peak search

A peak search can be repeated automatically after each measurement to keep the maximum value as the reference point for a phase noise measurement. Automatic peak search is useful to track a drifting source. The delta marker 2, which shows the phase noise measurement result, keeps the delta frequency value. Therefore, the phase noise measurement leads to reliable results in a certain offset although the source is drifting.

Using a peak as a fixed reference marker

Some results are analyzed in relation to a peak value, for example a carrier frequency level. In this case, the maximum level can be determined by an initial peak search and then be used as a reference point for further measurement results.



Remote commands:

CALCulate<n>:MARKer<m>:FUNCtion:FPEaks:STATe on page 538

`TRAC? LIST,`

Peak List State
Activates/deactivates the marker peak list. If activated, the peak list is displayed and the peaks are indicated in the trace display.

For each listed peak, the frequency/time ("X-value") and level ("Y-Value") values are given.

Remote command:
CALCulate<n>:MARKer<m>:FUNCtion:FPEaks:STATe on page 538

Sort Mode
Defines whether the peak list is sorted according to the x-values or y-values. In either case, the values are sorted in ascending order.

Remote command:
CALCulate<n>:MARKer<m>:FUNCtion:FPEaks:SORT on page 537

Maximum Number of Peaks
Defines the maximum number of peaks to be determined and displayed.

Remote command:
CALCulate<n>:MARKer<m>:FUNCtion:FPEaks:LIST:SIZE on page 537

Peak Excursion
Defines the minimum level value by which a signal must rise or fall so that it is identified as a maximum or a minimum by the search functions.

Remote command:
CALCulate<n>:MARKer<m>:PEXCursion on page 521

Display Marker Numbers
By default, the marker numbers are indicated in the diagram so you can find the peaks from the list. However, for large numbers of peaks, the marker numbers can decrease readability; in this case, deactivate the marker number display.

Remote command:
CALCulate<n>:MARKer<m>:FUNCtion:FPEaks:ANNotation:LABel[:STATe] on page 536

Export Peak List
The peak list can be exported to an ASCII file (.DAT) for analysis in an external application.

Remote command:
MMEMory:STORe<n>:PEAK on page 583
FORMat:DEXPort:DSEParator on page 559

8.3.4 How to work with markers

The following step-by-step instructions demonstrate in detail how to work with markers.

8.3.4.1 How to analyze a signal point in detail

When you need to analyze a characteristic point in the signal in more detail, the following procedure can be helpful:

1. Perform a peak search to determine the characteristic point roughly by pressing the [Peak Search] key.
2. If the required signal point is not the maximum, continue the peak search to one of the subsequent maxima or minima:
   a) Press the [Mkr ->] key.
   b) Select the "Next Peak" or "Next Min" key.
   c) If necessary, change the search settings by selecting the "Search Config" softkey.
3. Center the display around the determined signal point by setting the marker value to the center frequency. Select the "Center = Mkr Freq" softkey.
4. Determine the precise frequency of the signal point:
   a) Select the "Select Marker Function" softkey.
   b) Select the "Signal Count" button.
   c) Select the "Signal Count Resolution" softkey.
   d) Select the resolution depending on how precise the result needs to be.

8.3.4.2 How to use a fixed reference marker

By default, delta markers refer to marker 1. However, they can also refer to a fixed reference marker.

How to Define and Move a Fixed Reference Marker

1. To display a fixed reference marker, do one of the following:
   - Press the [MKR FUNC] key, then select the "Reference Fixed" marker function.
   - In the "Marker" dialog box, in the "Reference Fixed" area of the "Marker Config" tab, set the "State" to "On".

   A vertical and a horizontal red display line are displayed, marked as "FXD". The normal marker 1 is activated and set to the peak value of the trace assigned to marker 1, and a delta marker to the next peak. The fixed reference marker is set to the position of marker 1 at the peak value.
2. To move the fixed reference marker, do one of the following:
   - Change the "Level" and "Frequency" of the reference point in the "Marker Config" tab of the "Marker" dialog box, . By default, the current peak value of trace 1 is set.
   - Set the fixed reference marker to the current peak value by selecting the "Peak Search" button in the "Marker Config" tab of the "Marker" dialog box.
   - Move the "FXD" display lines that define the position of the fixed reference marker by dragging them on the screen.

How to Assign a Fixed Reference Marker to Delta Markers

1. In the "Marker" dialog box, select the horizontal "Markers" tab.
2. For the active delta marker that is to refer to the fixed reference marker, select "FXD" from the "Reference Marker" list.

   The delta marker indicates the offset of the current trace value at the marker position from the fixed reference value.

8.3.4.3 How to export a peak list

You can save the results of a marker peak list to an ASCII file.

1. Press the [MKR FUNCT] key.
2. Select the "Marker Peak List" softkey.
3. Configure the peak search and list settings as described in Chapter 8.3.3, "Marker peak list", on page 215.
4. Set the marker peak list "State" to "On".
5. Press the [RUN SINGLE] key to perform a single sweep measurement and create a marker peak list.
6. Select the "Marker Peak List" softkey to display the "Marker Peak List" dialog box again.
7. If necessary, change the decimal separator to be used for the ASCII export file.
8. Select the "Export Peak List" button.
9. In the file selection dialog box, select the storage location and file name for the export file.
10. Select "Save" to close the dialog box and export the peak list data to the file.

8.3.4.4 How to output the demodulated signal accoustically

For long sweep times you may wish to monitor a measurement accoustically rather than visually to determine when a certain signal level is reached.

1. Set marker 1 to the signal level you want to monitor.
2. Press the [Mkr FUNCT] key.
3. Select the "Select Marker Function" softkey.
4. Select the "Marker Demodulation" button.
5. Select the "Marker Demod Config" softkey.

   The marker function results are determined immediately according to the default settings.

6. Define how long you want to hear the output signal when the marker value is reached by entering the duration in the "Marker Stop Time" field.
   Alternatively, the audio signal can be output continuously, regardless of the marker value; in this case, set "Continuous Demodulation" to "On".
7. Select the modulation type (AM/FM/PM) of the signal.
8. To avoid listening to noise during continuous output, set "Squelch" to "On" and define the signal level below which the signal is ignored ("Squelch").
9. Set "Marker Demodulation" to "On".
10. **CAUTION!** Risk of hearing damage. To protect your hearing, make sure that the volume setting is not too high before putting on the headphones.
    Plug your headphones into the PHONES connector on the front panel of the R&S FSMR3.
11. Adjust the volume using the rotary knob next to the PHONES connector.

    During the next or currently running measurement, when the sweep reaches the marker position, the demodulated signal is output as an audio signal via the headphones for the given duration. Or, depending on the configuration, the demodulated signal is continuously output via the headphones, if the signal level exceeds the squelch level.

8.4 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.

8.4.1 Standard traces

8.4.1.1 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

A trace displays the values measured at the measurement points. The number of samples taken during a measurement can be much larger than the number of measurement points that are displayed in the measurement trace.

Example:

Assume the following measurement parameters:

- Sample rate: 32 MSamples / s
- measurement points: 1000
- measurement time: 100 ms
- Span: 5 GHz

During a single measurement, 3.2 * 10^6 samples are collected and distributed to 1000 measurement points, i.e. 3200 samples are collected per measurement point. For each measurement point, the measured data for a frequency span of 5 MHz (span/<measurement points>) is analyzed.

Note that if you increase the number of measurement points, the frequency span analyzed for each point in the trace decreases, making the result more stable.

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.

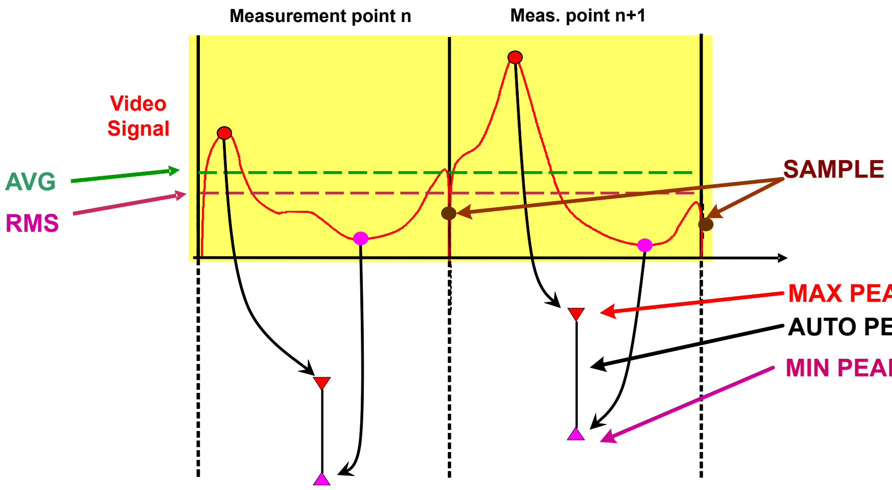
The trace detector can analyze the measured data using various methods:

The detector activated for the specific trace is indicated in the corresponding trace information by an abbreviation.

Table 8-2: 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
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.
Average	Av	Calculates the linear average of all samples contained in a measurement point.
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.



You can define the trace detector to be used for the individual traces manually, or the R&S FSMR3 can select the appropriate detector automatically.

The detectors of the R&S FSMR3 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.

RMS detector and VBW

If the RMS detector is selected, the video bandwidth in the hardware is bypassed. Thus, duplicate trace averaging with small VBWs and RMS detector no longer occurs. However, the VBW is still considered when calculating the sweep time. This leads to a longer sweep time for small VBW values. Thus, you can reduce the VBW value to achieve more stable trace curves even when using an RMS detector. Normally, if the RMS detector is used, the sweep time should be increased to get more stable traces.

Auto detector

If the R&S FSMR3 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	–

X-value of the measurement point

As described in "Mapping samples to measurement points with the trace detector" on page 222, the number of samples taken during a measurement can be much larger than the number of measurement points that are displayed in the measurement trace.

To determine the x-value of the measurement point, two different methods are available:

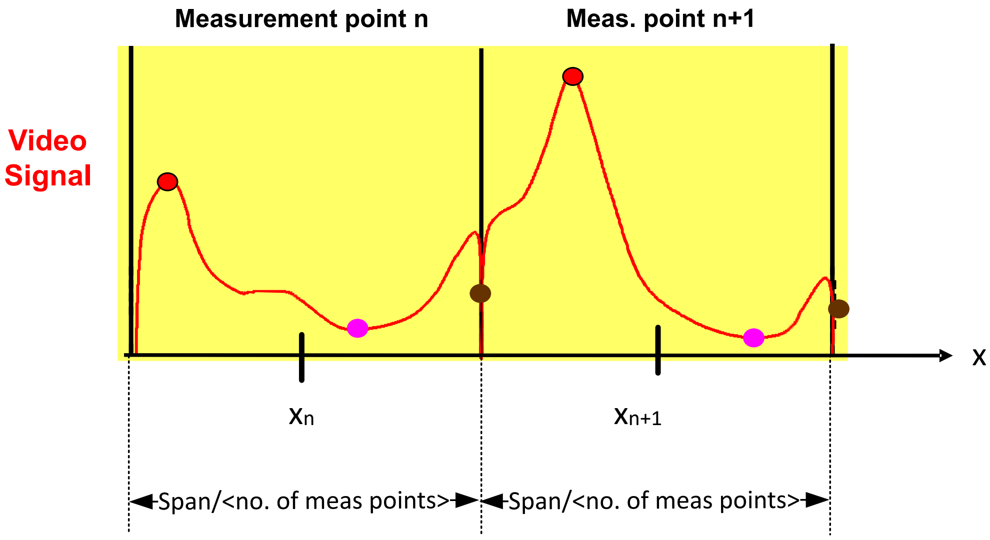
- Start/stop
- Bin-centered

Start/stop

This is the default (legacy) method for trace values in the frequency domain. The x-value of the first measurement point corresponds to the starting point of the full measurement span. The x-value of the last measurement point corresponds to the end point of the full measurement span. All other measurement points are divided evenly between the first and last points. The distance between two measurement points is span/(<no_measurement_points> -1).

Bin-centered

This is the default method for all marker values. The full measurement span is divided by the number of measurement points. The result is the span that is evaluated for an individual measurement point, also referred to as a *bin*. The x-value of the measurement point is then defined as the x-value at the center of the bin (bin/2).



Using the bin-centered method, the first and last x-values of the trace are not identical to the exact starting and end point of the measurement span. The distance between two measurement points is span/(<no_measurement_points>) or span/bin_size.

Marker values are always determined using the bin-centered method. Markers placed on the first and last x-values of the measured span indicate the same results as the first and last trace point.

Example:

Assume the following measurement parameters:

- Start frequency: 1.000 GHz
- Stop frequency: 6.000 GHz
- => Span: 5 GHz
- measurement points: 1000
- =>bin: 5 MHz (span/<measurement points>)

The first trace point is displayed at (< f_{start} > + bin/2) = 1.0025 GHz.

The last trace point is displayed at (< f_{stop} > - bin/2) = 5.9975 GHz.

A marker placed at 1.000 GHz indicates the same result as a marker placed at 1.0025 GHz, since no other value is available.

For trace values in the frequency domain, you can select which method is used to determine the x-values in the frequency domain, that is:

- In the result displays
- When exporting traces
- For the `TRACe<n>[:DATA]:X?` command

Note the possible minor discrepancy between marker values and trace values using the start/stop method.

Analyzing several traces - trace mode

If several measurements are performed one after the other, or continuous measurements 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 you change the trace mode, the selected trace memory is cleared.

The R&S FSMR3 supports the following trace modes:

Table 8-3: 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.
Max Hold	The maximum value is determined over several measurements and displayed. The R&S FSMR3 saves the measurement result in the trace memory only if the new value is greater than the previous one.

Trace Mode	Description
Min Hold	The minimum value is determined from several measurements and displayed. The R&S FSMR3 saves the measurement result in the trace memory only if the new value is lower than the previous one.
Average	The average is formed over several measurements and displayed. The Sweep/Average Count determines the number of averaging procedures.
View	The current contents of the trace memory are frozen and displayed.

If a trace is frozen ("View" mode), you can change the measurement settings, apart from scaling settings, without impact on the displayed trace. The fact that the displayed trace no longer matches the current measurement settings is indicated by a yellow asterisk on the tab label.

If you change any parameters that affect the scaling of the diagram axes, the R&S FSMR3 automatically adapts the trace data to the changed display range. Thus, you can zoom into the diagram after the measurement to show details of the trace.

How many traces are averaged - sweep count + Measurement mode

In "Average" trace mode, the sweep 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 sweep count.

- **sweep count = 0** (default)
  - In **"Continuous"** measurement mode, a continuous average is calculated for 10 measurements, according to the following formula:

    $$Trace = \frac{9 * Trace_{old} + MeasValue}{10}$$

    Figure 8-9: 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.

- **sweep count = 1**
  The currently measured trace is displayed and stored in the trace memory. No averaging is performed.
- **sweep 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:

$$Trace_n = \frac{1}{n} \cdot \left[\sum_{i=1}^{n-1} (T_i) + MeasValue_n \right]$$

Figure 8-10: Equation 2

Where n is the number of the current measurement (n = 2 ... sweep 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 "Sweep Count" is attained, averaging is continued in continuous measurement mode or for "Continue Single Sweep" according to the following formula:

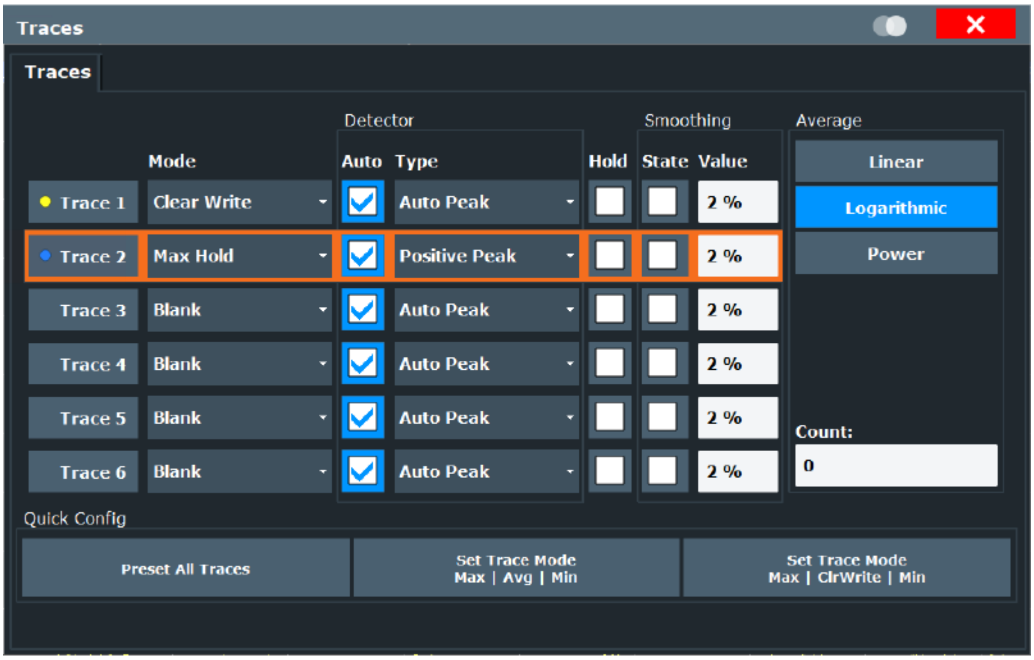
$$Trace = \frac{(N-1) * Trace_{old} + MeasValue}{N}$$

Where N is the sweep count

8.4.1.2 Trace settings

Access: "Overview" > "Analysis" > "Traces"

You can configure the settings for up to 6 individual traces in the same result display. Each trace is displayed in a different color, indicated in the window title bar and the trace settings.



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

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

Remote command:
Selected via numeric suffix of:`TRACe<1...6>` commands
`DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>[:STATe]` on page 502

Trace Mode

Defines the update mode for subsequent traces.

"Clear/ Write" Overwrite mode (default): the trace is overwritten by each measurement.

"Max Hold" The maximum value is determined over several measurements and displayed. The R&S FSMR3 saves each trace point in the trace memory only if the new value is greater than the previous one.

"Min Hold" The minimum value is determined from several measurements and displayed. The R&S FSMR3 saves each trace point in the trace memory only if the new value is lower than the previous one.

"Average" The average is formed over several 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>][:SUBWindow<w>]:TRACe<t>:MODE on page 501

Detector

Defines the trace detector to be used for trace analysis.

"Auto" (default:) Selects the optimum detector for the selected trace and filter mode

"Type" Defines the selected detector type.

Remote command:
[SENSe:][WINDow<n>:]DETector<t>[:FUNCtion] on page 502
[SENSe:][WINDow<n>:]DETector<t>[:FUNCtion]:AUTO on page 502

Hold

If activated, traces in "Min Hold", "Max Hold" and "Average" mode are not reset after specific parameter changes have been made.

Normally, the measurement is started again after parameter changes, before the measurement results are analyzed (e.g. using a marker). In all cases that require a new measurement after parameter changes, the trace is reset automatically to avoid false results (e.g. with span changes). For applications that require no reset after parameter changes, the automatic reset can be switched off.

The default setting is off.

Remote command:
DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:MODE:HCONtinuous on page 501

Average Mode

Defines the mode with which the trace is averaged over several measurements.

This setting is generally applicable if trace mode "Average" is selected.

For FFT sweeps, the setting also affects the VBW (regardless of whether the trace is averaged).

"Linear" The power level values are converted into linear units before 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 before 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.
In particular, for small VBW values (smaller than the RBW), use power averaging mode for correct power measurements in FFT sweep mode.

Remote command:
[SENSe:]AVERage<n>:TYPE on page 513

Predefined Trace Settings - Quick Config
Commonly required trace settings have been predefined and can be applied very quickly by selecting the appropriate button.

Function	Trace Settings	
Preset All Traces	Trace 1:	Clear Write
		Blank
Set Trace Mode Max | Avg | Min	Trace 1:	Max Hold
	Trace 2:	Average
	Trace 3:	Min Hold
		Blank
Set Trace Mode Max | ClrWrite | Min	Trace 1:	Max Hold
	Trace 2:	Clear Write
	Trace 3:	Min Hold
		Blank

8.4.1.3 How to configure a standard trace

Step-by-step instructions on configuring the trace settings are provided here.

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.

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 Max | Avg | Min"
   - "Set Trace Mode Max | ClrWrite | Min"
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 "Sweep Points" or the "Sweep Time" (in the "Sweep" 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.
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.

8.5 Importing and exporting measurement results for evaluation

The R&S FSMR3 provides various evaluation methods for the results of the performed measurements. However, you may want to evaluate the data with further, external applications. In this case, you can export the measurement data to a standard format file (ASCII or XML). Some of the data stored in these formats can also be re-imported to the R&S FSMR3 for further evaluation later, for example in other applications.

The following data types can be exported (depending on the application):
- Trace data
- Table results, such as result summaries, marker peak lists etc.

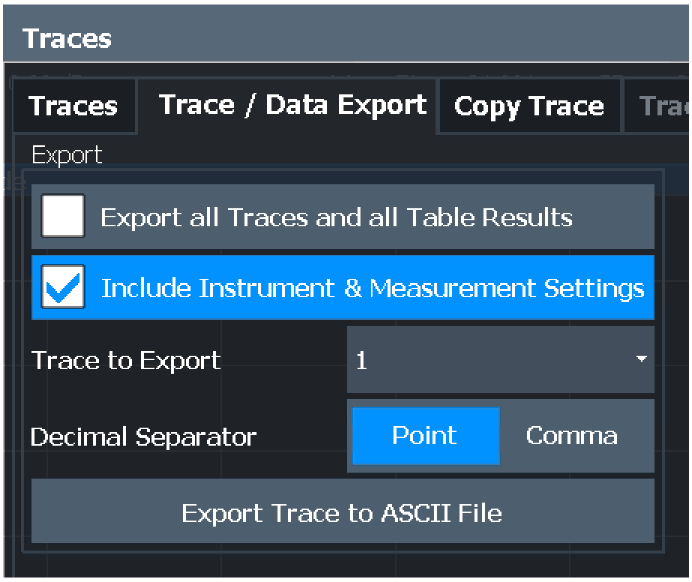
I/Q data can only be imported and exported in applications that process I/Q data, such as the I/Q Analyzer or optional applications.
See the corresponding user manuals for those applications for details.

8.5.1 Trace / data export configuration

Access: "Save" > "Export" > "Export Configuration"

Or: [TRACE] > "Trace Config" > "Trace / Data Export"

The standard data management functions (e.g. saving or loading instrument settings) that are available for all R&S FSMR3 applications are not described here.



Export all Traces and all Table Results

Selects all displayed traces and result tables (e.g. "Result Summary", marker table etc.) in the current application for export to an ASCII file.

Alternatively, you can select one specific trace only for export (see Trace to Export).

The results are output in the same order as they are displayed on the screen: window by window, trace by trace, and table row by table row.

Remote command:
`FORMat:DEXPort:TRACes` on page 508

Include Instrument & Measurement Settings

Includes additional instrument and measurement settings in the header of the export file for result data.

Remote command:
`FORMat:DEXPort:HEADer` on page 582

Trace to Export

Defines an individual trace to be exported to a file.

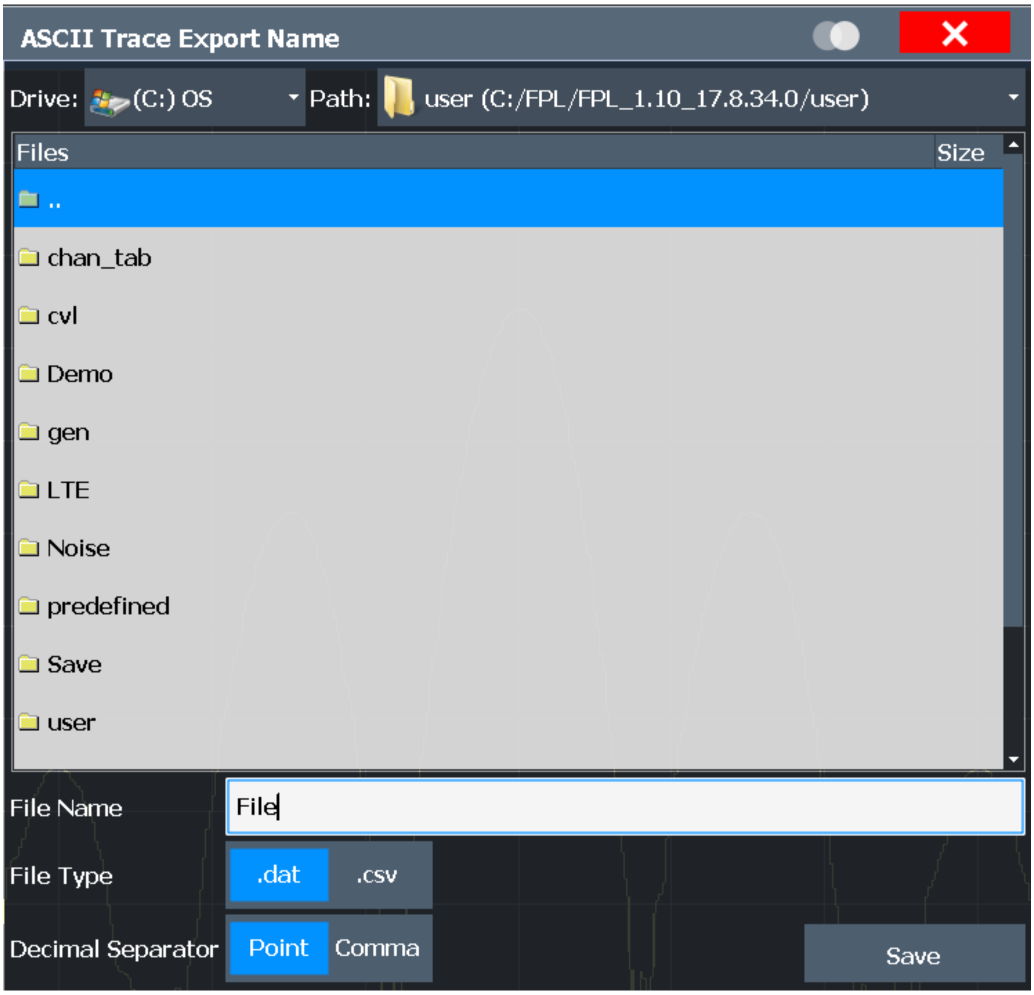
This setting is not available if Export all Traces and all Table Results is selected.

Decimal Separator
Defines the decimal separator for floating-point numerals for the data export/import files. Evaluation programs require different separators in different languages.

Remote command:
`FORMat:DEXPort:DSEParator` on page 559

Export Trace to ASCII File
Saves the selected trace or all traces in the currently active result display to the specified file and directory in the selected ASCII format.

"File Explorer": Instead of using the file manager of the R&S FSMR3 firmware, you can also use the Microsoft Windows File Explorer to manage files.



If the spectrogram display is selected when you perform this function, the entire histogram buffer with all frames is exported to a file. The data for a particular frame begins with information about the frame number and the time that frame was recorded. For large history buffers the export operation can take some time.

For details on the file format in the Spectrum application, see Chapter 8.5.3, "Reference: ASCII file export format", on page 236.

Note: Secure user mode.

In secure user mode, settings that are stored on the instrument are stored to volatile memory, which is restricted to 256 MB. Thus, a "memory limit reached" error can occur although the hard disk indicates that storage space is still available.

To store data permanently, select an external storage location such as a USB memory device.

Remote command:
MMEMory:STORe<n>:TRACe on page 509
MMEMory:STORe<n>:SPECtrogram on page 584

File Type ← Export Trace to ASCII File
Determines the format of the ASCII file to be imported or exported.

Depending on the external program in which the data file was created or is evaluated, a comma-separated list (CSV) or a plain data format (DAT) file is required.

Remote command:
FORMat:DEXPort:FORMat on page 508

Decimal Separator ← Export Trace to ASCII File
Defines the decimal separator for floating-point numerals for the data export/import files. Evaluation programs require different separators in different languages.

Remote command:
FORMat:DEXPort:DSEParator on page 559

File Explorer ← Export Trace to ASCII File
Opens the Microsoft Windows File Explorer.

Remote command:
not supported

8.5.2 How to export trace data and numerical results

The measured trace data and numerical measurement results in tables can be exported to an ASCII file. For each measurement point, the measured trace position and value are output.

The file is stored with a .DAT or .CSV extension. For details on the storage format, see Chapter 8.5.3, "Reference: ASCII file export format", on page 236.

To export trace data and table results

1. Select [TRACE] > "Trace Config" > "Trace / Data Export" tab.
2. Select "Export all Traces and all Table Results" to export all available measurement result data for the current application, or select a specific "Trace to Export".
3. Optionally, select "Include Instrument & Measurement Settings" to insert additional information in the export file header.
4. Select "Export Trace to ASCII File".

5. In the file selection dialog box, select the storage location and file name for the export file.
6. If necessary, change the decimal separator for the ASCII export file.
7. Select the data format of the ASCII file.
8. Select "Save" to close the dialog box and export the data to the file.

8.5.3 Reference: ASCII file export format

Trace data can be exported to a file in ASCII format for further evaluation in other applications. This reference describes in detail the format of the export files for result data.

The file consists of the header information (general configuration of the measurement) and the measurement results. Optionally, the header can be excluded from the file.

The data of the file header consist of three columns, each separated by a semicolon: parameter name; numeric value; basic unit. The data section starts with the keyword "Trace <n>" (<n> = number of stored trace). The measured data follows in one or several columns (depending on the measurement), which are also separated by a semicolon.

The results are output in the same order as they are displayed on the screen: window by window, trace by trace, and table row by table row.

Generally, the format of this ASCII file can be processed by spreadsheet calculation programs, e.g. MS Excel. Different language versions of evaluation programs can require a different handling of the decimal point. Thus, you can define the decimal separator to use (decimal point or comma).

9 Data management

The R&S FSMR3 allows you to store and load instrument settings, as well as import and export measurement data for analysis later. Finally, you can store or print the measurement results displayed on the screen.

General storage and import/export functions are available via the toolbar. Some special storage functions are (also) available via softkeys or dialog boxes in the corresponding menus, for example trace data export.

9.1 Restoring the default instrument configuration (preset)

When delivered, the R&S FSMR3 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.

Factory default configuration

The factory default configuration is selected such that the RF input is always protected against overload, provided that the applied signal levels are in the allowed range for the instrument.

Alternatively to the factory default settings, you can define user-specific recall settings to be restored after a preset or reboot, see "To recall settings automatically after preset or reboot" on page 251.

To restore the default instrument configuration for all channels at once

► Press the [PRESET] key.

After you use the [PRESET] function, the history of previous actions is deleted, i.e. any actions performed previously cannot be undone or redone using the [UNDO/REDO] keys.

Remote command:

`*RST` or `SYSTem:PRESet`

To restore the default configuration for a single channel

The default measurement settings can also be reset for an individual channel only, rather than resetting the entire instrument.

► In the "Overview", select the "Preset Channel" button.

The factory default settings are restored to the current channel. Note that a user-defined recall settings file is **NOT** restored.

Remote command:

`SYSTem:PRESet:CHANnel[:EXEC]` on page 571

9.2 Protecting data using the secure user mode

During normal operation, the R&S FSMR3 uses a solid-state drive to store its operating system, instrument firmware, instrument self-alignment data, and any user data created during operation.

Redirecting storage to volatile memory

Alternatively, to avoid storing any sensitive data on the R&S FSMR3 permanently, the *secure user mode* was introduced (option R&S FSMR3-K33). In secure user mode, the instrument's solid-state drive is write-protected so that no information can be written to memory permanently. Data that the R&S FSMR3 normally stores on the solid-state drive is redirected to volatile memory instead, which remains available only until the instrument is switched off. This data includes:

- Windows operating system files
- Firmware shutdown files containing information on last instrument state
- Self-alignment data
- General instrument settings such as the IP address
- Measurement settings
- User data created during operation
  (see also Table 9-1)
- Any data created by other applications installed on the R&S FSMR3, for example, text editors (Notepad), the clipboard, or drawing tools.

Users can access data that is stored in volatile memory just as in normal operation. However, when the instrument's power is switched off, all data in this memory is cleared. Thus, in secure user mode, the instrument always starts in a defined, fixed state when switched on.

To store data such as measurement results permanently, it must be stored to an external storage device, such as a memory stick.

Limited storage space

The volatile memory used to store data in secure user mode is restricted to 256 MB. Thus, a "Memory full" error can occur although the hard disk indicates that storage space is still available.

Storing required data permanently

Any data that is to be available for subsequent sessions with the R&S FSMR3 must be stored on the instrument permanently, *before activating the secure user mode*. This includes predefined instrument settings, transducer factors and self-alignment data.

Self-alignment data

Note that self-alignment data becomes invalid with time and due to temperature changes. Therefore, to achieve optimal accuracy, it can be preferable to perform a new self-alignment at the start of each new session on the R&S FSMR3.

Restricted operation

Since permanent storage is not possible, the following functions are not available in secure user mode:

- Firmware update
- Activating a new option key

Furthermore, since the "SecureUser" used in secure user mode does not have administrator rights, **administrative tasks** such as LAN configuration and some general instrument settings are not available. Refer to the description of the basic instrument setup ([SETUP] menu) to find out which functions are affected.

Activating and deactivating secure user mode

Only a user with administrator rights can activate (and deactivate) the secure user mode. Once activated, a restart is required. The special user "SecureUser" is then logged on to the R&S FSMR3 automatically using the auto-login function. While the secure user mode is active, a message is displayed in the status bar at the bottom of the screen.

Secure passwords

By default, the initial password for both the administrator account and the "SecureUser" account is "894129". When the secure user mode is activated the first time after installation, you are prompted to change the passwords for all user accounts to improve system security. Although it is possible to continue without changing the passwords, it is strongly recommended that you do so.

You can change the password in Windows 10 for any user at any time via:

"Start > Settings > Account > SignIn Options > Password > Change"

To deactivate the secure user mode, the "SecureUser" must log off and a user with administrator rights must log on.

Switching users when using the auto-login function

In the "Start" menu, select the arrow next to the "Shut down" button and then "Log off".

The "Login" dialog box is displayed, in which you can enter the different user account name and password.

The secure user mode setting and auto-login is automatically deactivated when another user logs on. The "SecureUser" is no longer available.

For users with administrator rights, the secure user mode setting is available in the general system configuration settings (see "SecureUser Mode" on page 299).

Remote control

Initially after installation of the R&S FSMR3-K33 option, secure user mode must be enabled manually once before remote control is possible.

(See `SYSTem:SECurity[:STATe]`.)

Manual activation is necessary to prompt for a change of passwords.

9.3 Storing and recalling instrument settings and measurement data

Access: "Save"/ "Open" icon in the toolbar

Possibly you would like to restore or repeat a measurement you performed under specific conditions on the instrument. Or you want to evaluate imported data in another application on the R&S FSMR3 and would like to restore the measurement settings applied during measurement. In these cases, you can store and recall instrument and measurement settings, and possibly other related measurement data.

Two different methods are available for managing instrument settings:

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

Restrictions when recalling measurement settings

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

- The R&S FSMR3 must support the frequency range defined in the configuration file.
- Configuration files created on a R&S FSMR3 with certain options in use do not work on an R&S FSMR3 without these options.
- Files created with newer firmware versions may not work with a previous version.
- Files created on an instrument other than the R&S FSMR3 do not work on the R&S FSMR3.

Saving instrument settings in secure user mode

Be sure to store instrument settings that you require beyond the current session before SecureUser Mode is enabled; see Chapter 9.2, "Protecting data using the secure user mode", on page 238.

Settings that are saved via QuickSave in secure user mode are only available during the current session. As soon as the power is switched off on the R&S FSMR3, the data is cleared.

Saving and recalling transducer and limit line settings

If a transducer file was in use when the save set was stored (with the save item "Current Settings" only) the R&S FSMR3 assumes that these transducer values should remain valid after every recall of that save set. Thus, even if the transducer file is changed and the original save set file is recalled later, the *originally stored* transducer values are recalled and applied to the measurement. In the "Edit" transducer dialog box, however, the *changed* transducer file values are displayed, as no updated transducer file was loaded.

The same applies to limit line settings.

The same applies to integrated measurements' weighting filter.

Similarly, if you want to apply the changed limit values after recalling the save set, you must force the application to reload the limit file. To do so, simply open the "Edit Limit Line" dialog box (see "Limit line settings and functions" on page 193) and toggle the "Y-Axis" unit. Due to that change, the limit line file is automatically reloaded, and the changed limit values are applied to the current measurement. Now a new save set with the updated limit values can be created.

9.3.1 Quick save/quick recall

The "Quick Save" and "Quick Recall" functions allow you to store instrument settings or channels very easily and quickly in one step. Up to ten different sets of settings can be stored to or recalled from "save sets". Each save set is identified by its storage date and type (instrument or specific "Channel") in the display. The save sets are stored in the `C:\R_S\INSTR\QuickSave` directory, in files named `QuickSave1.dfl` to `QuickSave10.dfl`. Only the current measurement settings are stored, not any additional data such as traces, limit line or transducer files (see Chapter 9.3.2.1, "Stored data types", on page 244).

Source calibration files for an optional external generator, if available, are included.

Saving instrument settings in secure user mode

Settings that are saved via Quick Save in secure user mode are stored to the SDRAM, and are only available during the current session. As soon as the power is switched off on the R&S FSMR3, the data is cleared (see Chapter 9.2, "Protecting data using the secure user mode", on page 238).

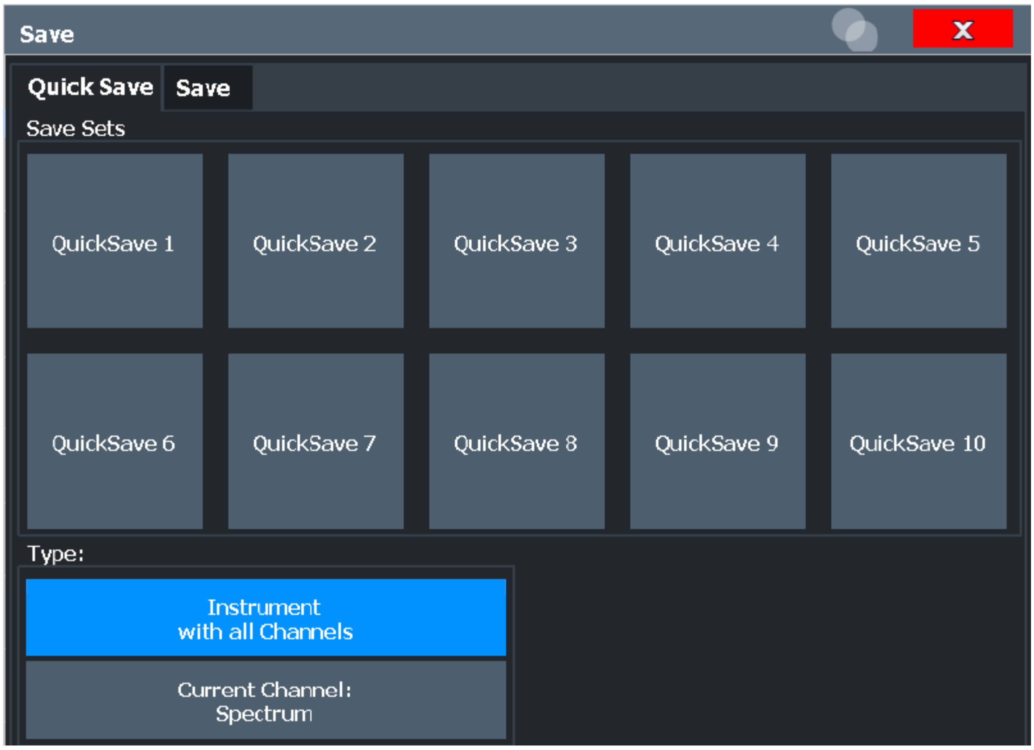
During recall, save sets of type "Instrument" replace the settings of the entire instrument. All other save sets start a new channel with the stored settings.

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

9.3.1.1 Quick save / quick recall settings

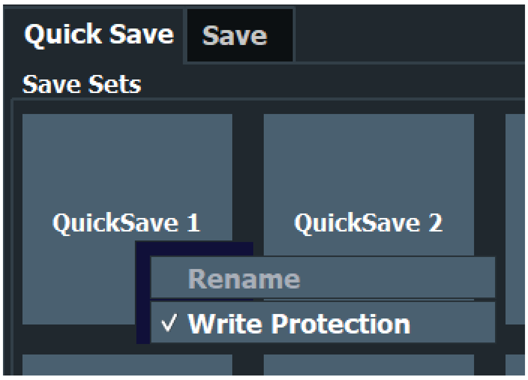
Access: "Save"/ "Open" icon in the toolbar > "Quick Save" / "Quick Recall"

Both dialog boxes are very similar and closely related.



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.

Right-click on one of the QuickSave buttons to display a context menu with additional functions for the save set.



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

Note: Saving instrument settings in secure user mode.
Settings that are saved via Quick Save in secure user mode are only available during the current session. As soon as the power is switched off on the R&S FSMR3, the data is cleared (see Chapter 9.2, "Protecting data using the secure user mode", on page 238).

Rename ← QuickSave 1 / ... / QuickSave 10
Displays an input field to rename the save set, if write protection is disabled.

Write Protection ← QuickSave 1 / ... / QuickSave 10
Enables or disables write protection for the save set. If enabled, the save set cannot be renamed or overwritten.

Storage Type (Save only)
Defines which type of settings are stored in the save set.

"Instrument with all Channels"	The instrument settings for all currently active "Channel"s are stored.
"Current Channel"	Only the instrument settings for the currently selected measurement "Channel"s are stored.

Recall
Restores the instrument 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 all "Channel"s and instrument settings are overwritten with the stored settings.

Note: After you use the "Recall" function, the history of previous actions is deleted, i.e. any actions performed previously cannot be undone or redone using the [UNDO/ REDO] keys.

Remote command:
`MMEMory:LOAD:STATe` on page 568

9.3.2 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.

9.3.2.1 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 FSMR3:

Table 9-1: Items that can be stored to files

Item	Description
Current Settings	Current instrument and measurement settings.
All Transducers	All transducer factor *files*. (Note: Restoring a saveset overwrites transducer factor files on the hard disk that have the same name as those in the saveset. For more information, see "Saving and recalling transducer and limit line settings" on page 241.) (Not in the phase noise application.)
All Traces	All active traces.
All Limit Lines	All limit line *files*.
Spectrograms	Spectrogram trace data (only available if spectrogram display is currently active). (Only in applications that feature a spectrogram, for example the (optional) spectrum application.)

9.3.2.2 Storage location and filename

The data is stored on the internal flash disk or, if selected, on a memory stick or network drive. The operating system, firmware and stored instrument settings are located on drive C.

Saving instrument settings in secure user mode

In secure user mode all data is stored to the SDRAM, and is only available during the current session. As soon as the power is switched off on the R&S FSMR3, the data is cleared (see Chapter 9.2, "Protecting data using the secure user mode", on page 238).

Other storage locations cannot be selected in this mode.

The storage location and filename 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:\R_S\INSTR\Save`.

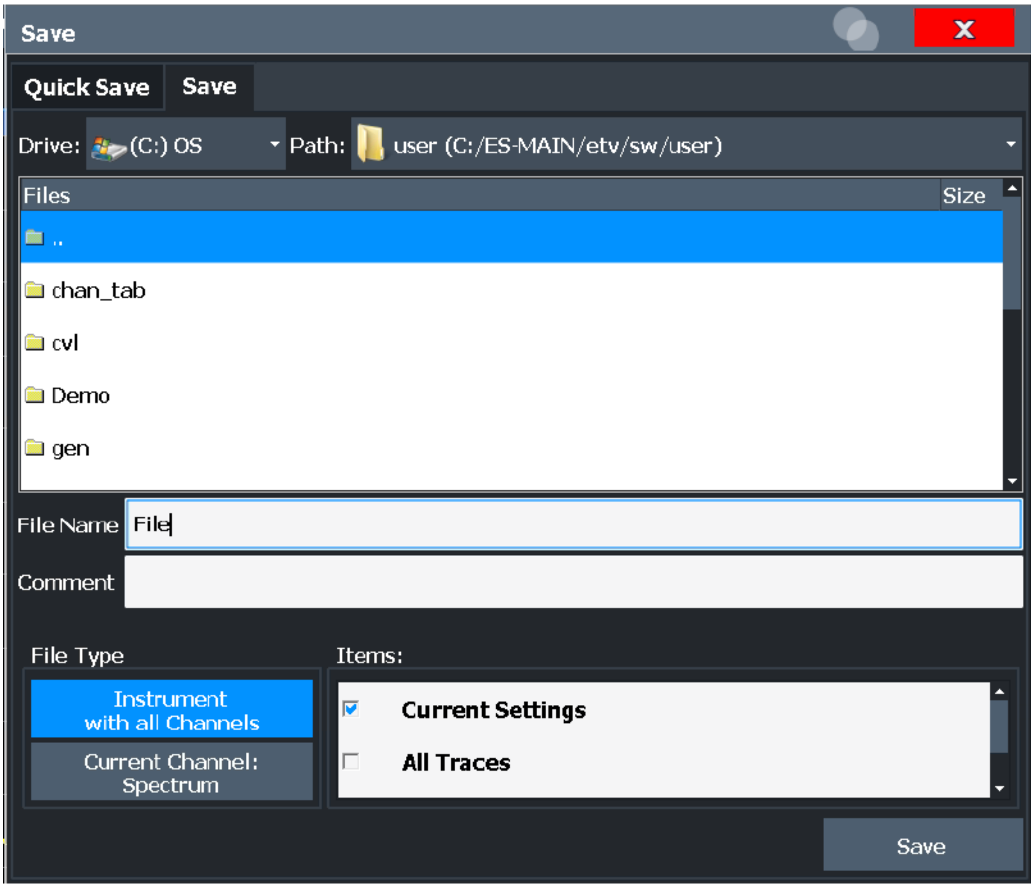
File name restrictions

File names must be compatible with the Windows conventions for file names. In particular, they must not contain special characters such as ":", "*", "?".

9.3.2.3 Save and recall dialog boxes

Access: "Save"/ "Open" icon in the toolbar > "Save" / "Recall"

Both dialog boxes are very similar and closely related.



Selecting Storage Location - Drive/ Path/ Files

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

Note: Saving instrument settings in secure user mode.

In secure user mode, settings that are stored on the instrument are stored to volatile memory, which is restricted to 256 MB. Thus, a "memory limit reached" error can occur although the hard disk indicates that storage space is still available.

To store data permanently, select an external storage location such as a USB memory device.

Remote command:

`MMEMory:CATalog` on page 559

File Name

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

File names must be compatible with the Windows conventions for file names. In particular, they must not contain special characters such as ":", "*", "?".

For details on the filename and location, see Chapter 9.3.2.2, "Storage location and filename", on page 244.

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

Remote command:
`MMEMory:COMMent` on page 560

File Explorer
Opens the Microsoft Windows File Explorer.

Remote command:
not supported

File Type
Determines whether the global instrument settings with all "Channel"s are stored or recalled, or the current "Channel" settings only.

Items:
Defines which data and settings are stored or are recalled. Depending on the "File Type", either channels only, or global settings are available. Which items are available also depends on the installed options (see also Chapter 9.3.2.1, "Stored data types", on page 244).

Depending on the application, items may or may not be available. For example, saving spectrogram data is only possible in applications that feature a spectrogram.

Remote command:
`MMEMory:SELect[:ITEM]:ALL` on page 564
`MMEMory:SELect[:ITEM]:DEFault` on page 565
`MMEMory:SELect[:ITEM]:NONE` on page 566
`MMEMory:SELect[:ITEM]:HWSettings` on page 565
`MMEMory:SELect[:ITEM]:LINes:ALL` on page 565
`MMEMory:SELect[:ITEM]:SGRam` on page 566
`MMEMory:SELect[:ITEM]:TRACe<1...3>[:ACTive]` on page 567
`MMEMory:SELect[:ITEM]:TRANsducer:ALL` on page 567

Save File
Saves the settings file with the defined filename.

Note: Secure user mode. In secure user mode, settings that are stored on the instrument are stored to volatile memory, which is restricted to 256 MB. Thus, a "memory limit reached" error can occur although the hard disk indicates that storage space is still available.
For details, see Chapter 9.2, "Protecting data using the secure user mode", on page 238.

Remote command:
`MMEMory:STORe<1|2>:STATe` on page 570
`MMEMory:STORe<1|2>:STATe:NEXT` on page 570

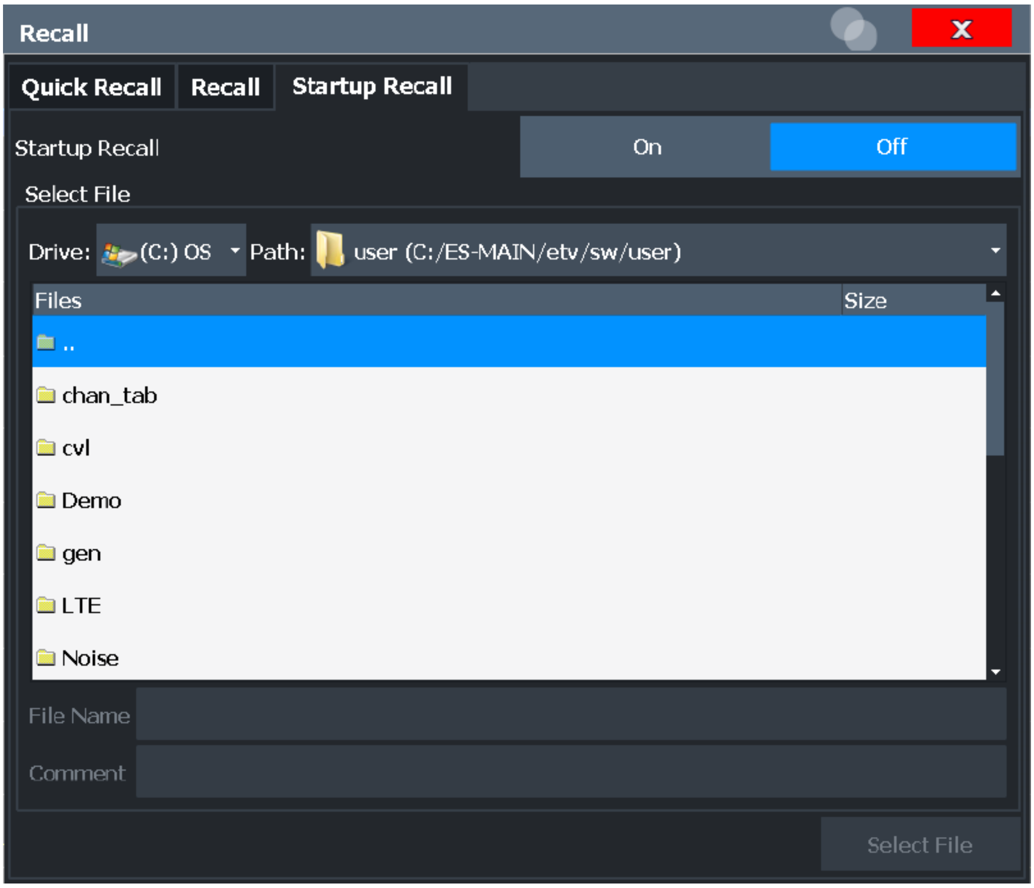
Recall in New Channel / Recall in Current Channel
Restores the instrument settings as saved in the selected settings file. If the settings file contains settings for a specific "Channel" only, select "Recall in New Channel" to activate a new channel with the stored settings. Select "Recall in Current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

Note: After you use the "Recall" function, the history of previous actions is deleted, i.e. any actions performed previously cannot be undone or redone using the [UNDO/ REDO] keys.

Remote command:
`MMEMory:LOAD:STATe` on page 568

9.3.2.4 Startup recall settings

Access: "Open" icon in the toolbar > "Startup Recall"



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

Note that only *instrument* settings files can be selected for the startup recall function, not "Channel" files.

Remote command:
`MMEMory:LOAD:AUTO` on page 568

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

Note: Saving instrument settings in secure user mode.
In secure user mode, settings that are stored on the instrument are stored to volatile memory, which is restricted to 256 MB. Thus, a "memory limit reached" error can occur although the hard disk indicates that storage space is still available.

To store data permanently, select an external storage location such as a USB memory device.

Remote command:
`MMEMory:CATalog` on page 559

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

File names must be compatible with the Windows conventions for file names. In particular, they must not contain special characters such as ":", "*", "?".

For details on the filename and location, see Chapter 9.3.2.2, "Storage location and filename", on page 244.

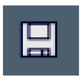
Comment
An optional description for the data file. A maximum of 60 characters can be displayed.

Remote command:
`MMEMory:COMMent` on page 560

9.3.3 How to save and load instrument settings

Instrument settings can be saved to a file and loaded again later, so that you can repeat the measurement with the same settings. Optionally, user-defined measurement settings can automatically be restored each time you start or preset the instrument.

To save and recall instrument settings using the Quick Save function



1. Select the "Save" icon from the toolbar.
2. Select whether the instrument settings for **all**"Channel"s are stored, or only those for the **current**"Channel".
3. Select one of the save sets in which the settings are stored ("QuickSaveX").

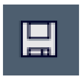
The selected settings are stored to the file
`C:\R_S\INSTR\QuickSave\QuickSaveX.dfl`.

Note: If you make any changes to the settings *after* storing the configuration file, remember to save the settings again. Otherwise those settings cannot be restored and will be overwritten by the stored values when the configuration file is recalled.

4. To restore the settings, select the "Open" icon from the toolbar.
5. Select the save set in which the settings were stored ("QuickSaveX").

   The selected settings are restored to the instrument or channel.

To save configurable instrument 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 filename and storage location for the settings file.
4. Optionally, define a comment to describe the stored settings.
5. Select whether the instrument settings for **all**"Channel"s are 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 the settings for all "Channel"s can be stored. Various other items, such as lines or traces etc., can be stored as well (see Chapter 9.3.2.1, "Stored data types", on page 244).
7. Select "Save".

   A file with the defined name and path and the extension `.dfl` is created.

If you make any changes to the settings *after* storing the configuration file, remember to save the settings again. Otherwise those settings cannot be restored and will be overwritten by the stored values when the configuration file is recalled.

To recall configurable instrument 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 filename and storage location of the settings file.

   Note: The "File Type" indicates whether the file contains instrument settings for **all**"Channel"s, or only those for the current "Channel".
4. If several items were saved, select which items are restored.

5. If a "Channel" was 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.
   Note that any changes made to the settings *after* storing the configuration file will be overwritten by the stored values when the configuration file is recalled.

To recall settings automatically after preset or reboot

You can define the settings that are restored when you preset or reboot the instrument.

1. Configure the settings as required and save them as described in "To save configurable instrument settings" on page 250.
2. In the "Save/Recall" menu, select "Startup Recall".
3. From the file selection dialog box, select the recall settings to restore.
4. Select "Select File".
5. Set "Startup Recall" to "On".

   Now when you press the [PRESET] key or reboot the instrument, the defined settings will be restored.
6. To restore the factory preset settings, set "Startup Recall" to "Off".

9.4 Import/export functions

Access: "Save"/ "Open" icon in the toolbar > "Import" / "Export"

The R&S FSMR3 provides various evaluation methods for the results of the performed measurements. However, you may want to evaluate the data with further, external applications. In this case, you can export the measurement data to a standard format file (ASCII or XML). Some of the data stored in these formats can also be re-imported to the R&S FSMR3 for further evaluation later, for example in other applications.

The following data types can be exported (depending on the application):

- Trace data
- Table results, such as result summaries, marker peak lists etc.
- I/Q data

I/Q data can only be imported and exported in applications that process I/Q data, such as the I/Q Analyzer or optional applications.
See the corresponding user manuals for those applications for details.

These functions are only available if no measurement is running.

In particular, if a continuous measurement is running, the import/export functions are not available.

Export
Access: "Save/Recall" > Export

Opens a submenu to configure data export.

Export Configuration ← Export
Opens the "Traces" dialog box to configure the trace and data export settings.

I/Q Export ← Export
Opens a file selection dialog box to define an export file name to which the I/Q data is stored. This function is only available in single sweep mode.

It is only available in applications that process I/Q data, such as the I/Q Analyzer or other optional applications.

For details, see the description in the R&S FSMR3 I/Q Analyzer User Manual ("Importing and Exporting I/Q Data").

Note: Storing large amounts of I/Q data (several Gigabytes) can exceed the available (internal) storage space on the R&S FSMR3. In this case, it can be necessary to use an external storage medium.

Note: Secure user mode.
In secure user mode, settings that are stored on the instrument are stored to volatile memory, which is restricted to 256 MB. Thus, a "memory limit reached" error can occur although the hard disk indicates that storage space is still available.

To store data permanently, select an external storage location such as a USB memory device.

File Explorer ← I/Q Export ← Export
Opens the Microsoft Windows File Explorer.

Remote command:
not supported

9.5 Creating screenshots of current measurement results and settings

To document the graphical results and the most important settings for the currently performed measurement, you can create a screenshot of the current display. Screenshots can either be printed or stored to a file.

9.5.1 Print and screenshot settings

Access: "Print" icon in the toolbar

For step-by-step instructions, see Chapter 9.5.2, "How to store or print screenshots of the display", on page 264.

Remote commands for these settings are described in Chapter 12.8.4, "Storing or printing screenshots", on page 572.

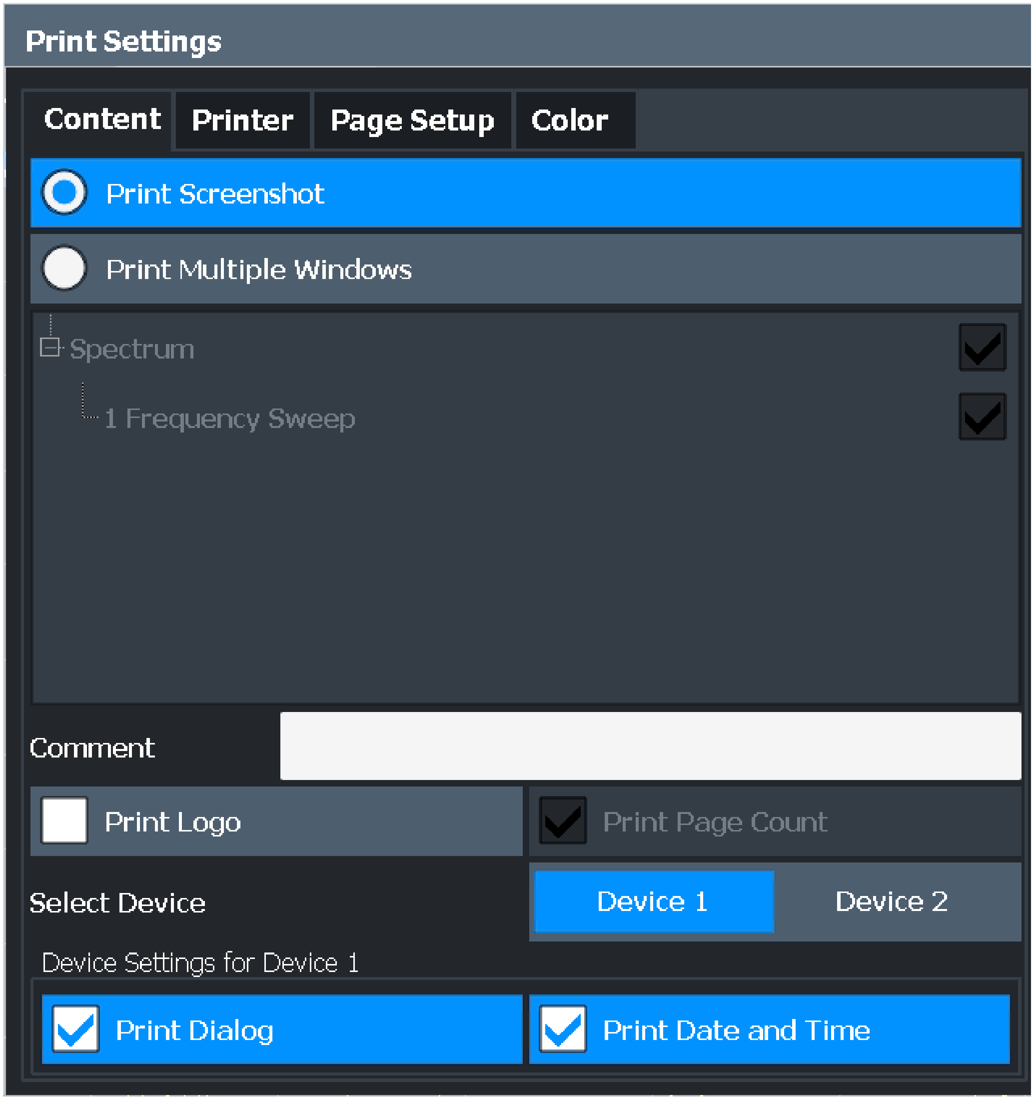
To print a screenshot of the current display with the current settings immediately, without switching to the "Print" menu, use the "Print immediately" icon in the toolbar.

9.5.1.1 Print content settings

Access: "Print" > "Print Config" > "Content" tab

The content settings determine which data is included in the printout.

Note that some content settings are independent of the selected printing device, others are printing device-specific.



Print Screenshot

Selects all measurement results displayed on the screen for the current channel (or "MultiView"): diagrams, traces, markers, marker lists, limit lines, etc., including the channel bar and status bar, for printout on a single page. Displayed items belonging to the software user interface (e.g. softkeys) are not included. The position and size of the elements in the printout is identical to the display.

This setting is independent of the printing device.

Remote command:
`HCOPy:CONTent` on page 573

Print Multiple Windows
Includes only the selected windows in the printout. All currently active windows for the current channel (or "MultiView") are available for selection. How many windows are printed on a single page of the printout is user-definable (see "Windows Per Page" on page 262).

This option is only available when printing on a printer or to a PDF file (see "Destination" on page 260). If the Destination is currently set to an image file or the clipboard for the selected printing device, it is automatically changed to be a PDF file.

Remote command:
`HCOPy:CONTent` on page 573
`HCOPy:PAGE:WINDow:STATe` on page 581
`HCOPy:PAGE:WINDow:CHANnel:STATe` on page 579

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

The comment is printed in the top left corner of each printout page. If a comment should not be printed, it must be deleted.

This setting is independent of the printing device.

Tip: The current date and time can be inserted automatically, see "Print Date and Time" on page 256.

Remote command:
`HCOPy:ITEM:WINDow:TEXT` on page 577

Print Logo
Activates/deactivates the printout of the Rohde & Schwarz company logo in the upper right corner.

This setting is independent of the printing device.

Remote command:
`DISPlay:LOGO` on page 573

Print Page Count
Includes the page number for printouts consisting of multiple windows ("Print Multiple Windows" on page 255).

This setting is independent of the printing device.

Remote command:
`HCOPy:PAGE:COUNt:STATe` on page 578

Select Device 1/2
Selects the printing device to be configured.

Two different printout devices can be configured, for example one for printing and one for storage to a file. When you execute the "Print immediately" function, the selected printing device and its settings determine the behavior of the R&S FSMR3.

Print Dialog

Includes any currently displayed dialog in the screenshot printout.

This setting is (printing) device-specific and only available if Print Screenshot is selected.

Print Date and Time

Includes or removes the current date and time at the bottom of the printout.

This setting is (printing) device-specific.

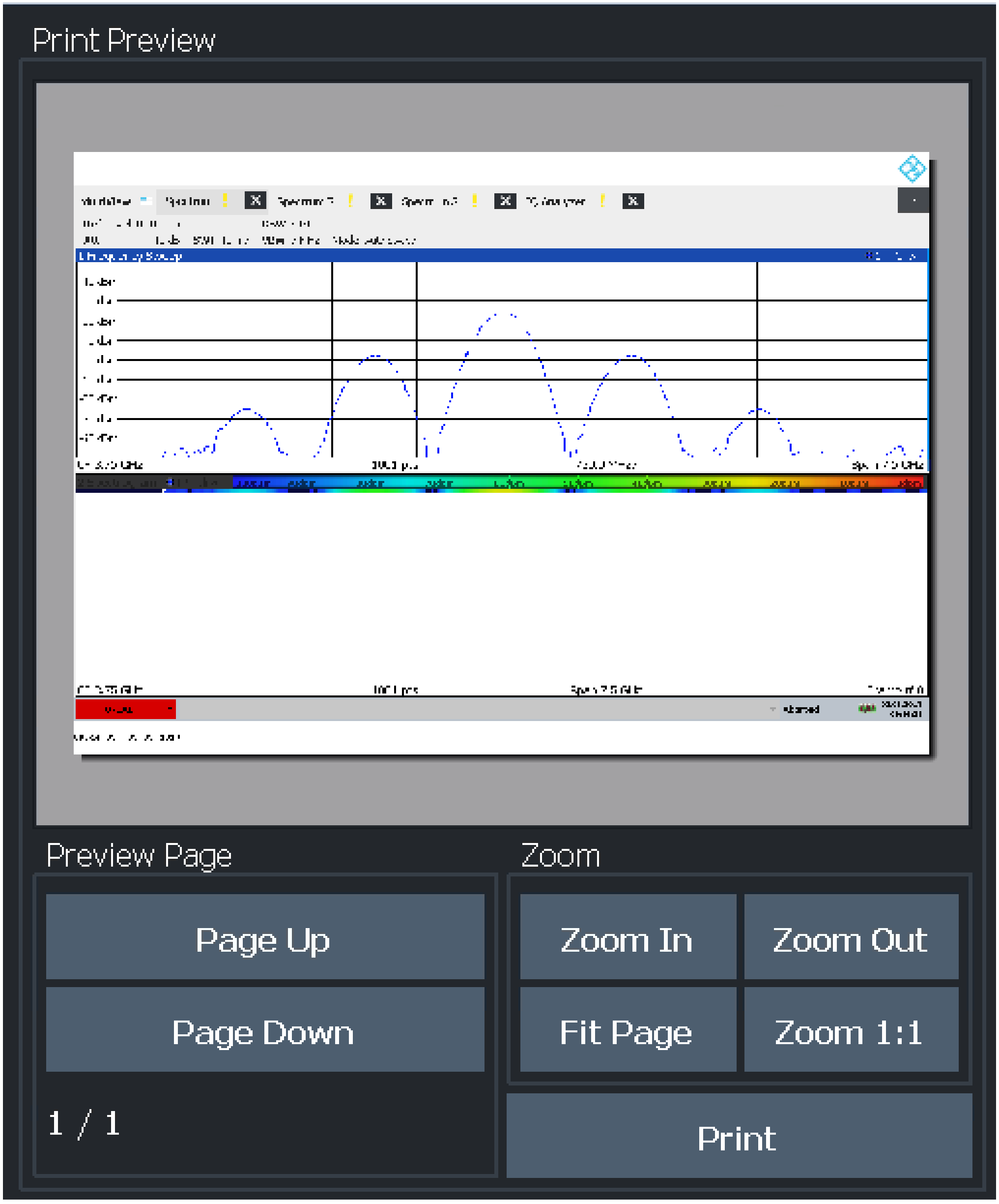
Remote command:
`HCOPy:TDSTamp:STATe` on page 581

9.5.1.2 Print preview functions

Access: "Print"

The "Print Preview" of the printout according to the current configuration is available in all "Print Settings" dialog tabs.

The preview display (not the functions) is device-specific (see "Select Device 1/2" on page 255).



Zoom In / Zoom Out

Zooms into (enlarges) or zooms out of (decreases) the preview display. Note that the zoom functions affect only the preview, not the printout itself.

Fit Page
Adapts the preview display zoom factor so that one complete page is visible as large as possible in the available display space. Note that the zoom functions affect only the preview, not the printout itself.

Zoom 1:1
Displays the printout in its original size, as it will be printed.

Page Up / Page Down
Depending on the selected contents (see Chapter 9.5.1.1, "Print content settings", on page 253), the printout can consist of multiple pages. Use these functions to scroll within the preview to see the individual pages.

Print
Starts to print or store the selected screen contents to a file (see Chapter 9.5.1.1, "Print content settings", on page 253).

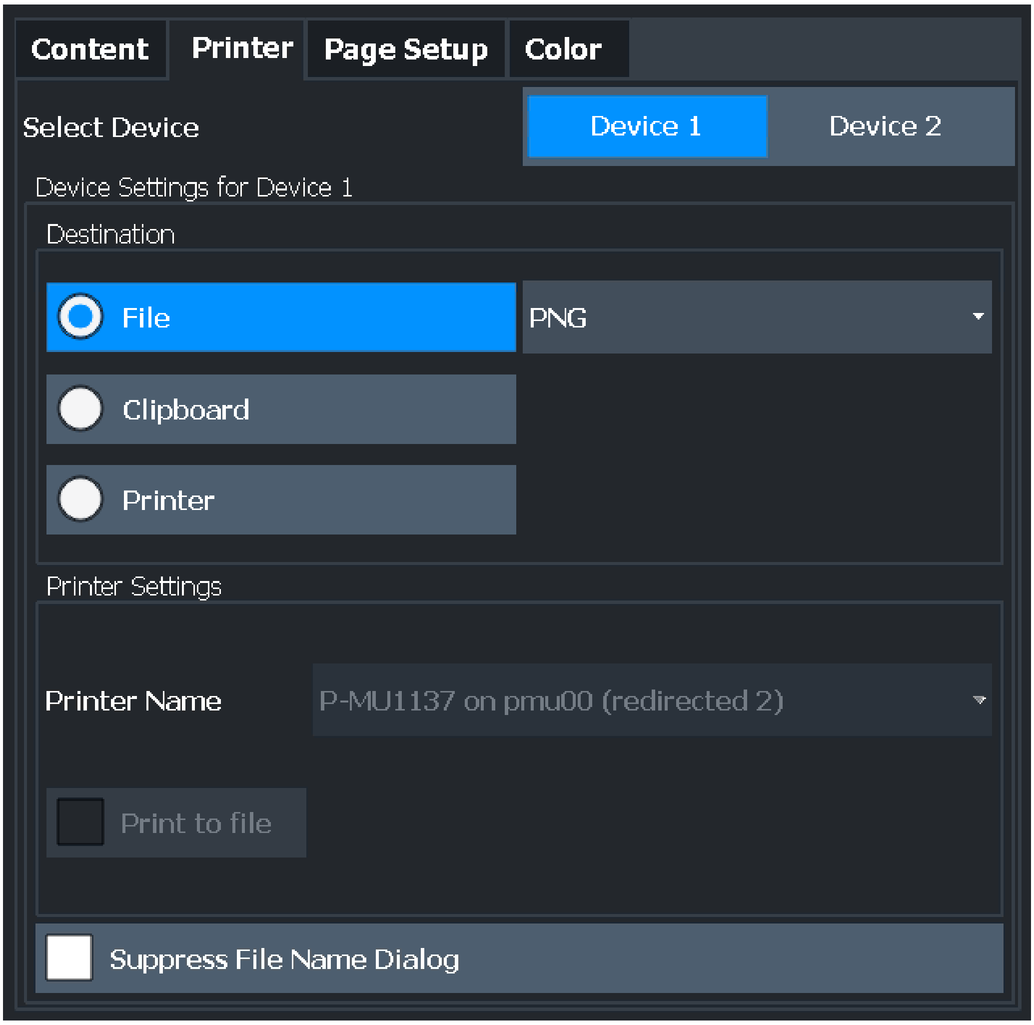
Whether the output is sent to the printer or stored in a file or the clipboard depends on the selected printing device and the printing device settings (see Chapter 9.5.1.3, "Printer settings", on page 258).

If the output is stored to a file, a file selection dialog box is opened to select the filename and location. The default path is C:\R_S\INSTR\USER.

Remote command:
`HCOPy[:IMMediate]` on page 577
`HCOPy[:IMMediate]:NEXT` on page 577

9.5.1.3 Printer settings

Access: "Print" > "Print Config" > "Printer" tab



Printer settings are (printing) device-specific. That means you can configure two different printing devices (for example, a printer and a file) and switch between configurations easily simply by selecting the appropriate device before printing.

Select Device 1/2

Selects the printing device to be configured.

Two different printout devices can be configured, for example one for printing and one for storage to a file. When you execute the "Print immediately" function, the selected printing device and its settings determine the behavior of the R&S FSMR3.

Destination
Defines the medium to which the printout is output.

Destination: File ← Destination
Stores the printout to a file in the selected format. The filename is queried at the time of storage, or a default name is used (see Suppress File Name Dialog).

Multiple windows can only be printed to a file in PDF format. If you select an image file format, the content setting is automatically set to Print Screenshot. Page settings are not available for image files; however, you can configure the colors used for the screenshot (see Chapter 9.5.1.5, "Print color settings", on page 263).

Remote command:
`HCOPy:DEVice:LANGuage` on page 577

Destination: Clipboard ← Destination
Copies the printout to the clipboard. Since only single pages can be copied, only screenshots can be copied to this destination, not multiple windows (see Chapter 9.5.1.1, "Print content settings", on page 253). Page settings are not available; however, you can configure the colors used for the screenshot (see Chapter 9.5.1.5, "Print color settings", on page 263).

If you select the clipboard as the printing destination, the content setting is automatically set to Print Screenshot.

Remote command:
`HCOP:DEST1 'SYSTem:COMMunicate:CLIPboard'`

Destination: Printer ← Destination
Sends the printout to the printer selected from the Printer Name list.

Remote command:
`HCOP:DEST1 'SYSTem:COMMunicate:PRINter'`

Suppress File Name Dialog
If the Destination is a file, the file selection dialog box is not displayed. Instead, the default storage location and filename are used.

(C:\R_S\INSTR\USER`\FSMR3_ScreenShot_<date and time>`).

Printer Name
Defines the printer to print to if a printer is selected as the Destination.

Any printers detected in the network are listed for selection.

Tip: the printout can also be stored in a print file using the selected printer driver, see "Print to file" on page 261.

Remote command:
`SYSTem:COMMunicate:PRINter:ENUMerate[:NEXT]` on page 582
`SYSTem:COMMunicate:PRINter:ENUMerate:FIRSt` on page 581
`SYSTem:COMMunicate:PRINter:SELect<di>` on page 582

Print to file

If a printer is selected as the Destination, use this option to store the data in a `.prn` file using the selected printer driver.

Remote command:
To enable: `HCOP:DEST1 'MMEM'`
To disable: `HCOP:DEST1 'SYSTem:COMMunicate:PRINter'`

Install Printer

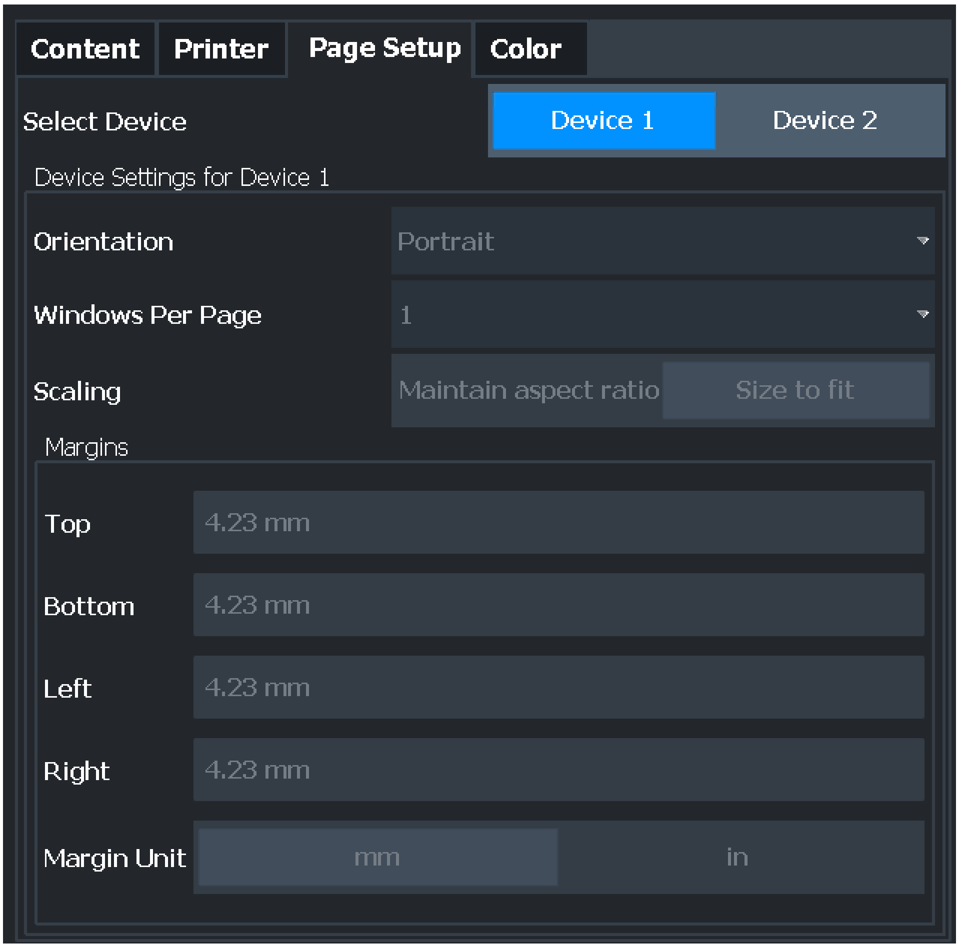
This softkey opens the standard Windows dialog box to install a new printer. All printers that are already installed are displayed.

Only user accounts with administrator rights can install a printer.

For further information, refer to the Microsoft Windows documentation.

9.5.1.4 Page setup

Access: "Print" > "Print Config" > "Page Setup" tab



Page settings are (printing) device-specific. That means you can configure two different printing devices (for example, a printer and a file) and switch between configurations easily simply by selecting the appropriate device before printing.

Page settings are only available when printing on a printer or to a PDF file (see "Destination" on page 260).

Select Device 1/2

Selects the printing device to be configured.

Two different printout devices can be configured, for example one for printing and one for storage to a file. When you execute the "Print immediately" function, the selected printing device and its settings determine the behavior of the R&S FSMR3.

Orientation

Selects the page orientation of the printout: portrait or landscape.

Remote command:
`HCOPy:PAGE:ORIentation` on page 579

Windows Per Page

Defines how many windows are displayed on a single page of the printout. This setting is only available if Print Multiple Windows is active (see Chapter 9.5.1.1, "Print content settings", on page 253).

If more than one window is printed on one page, each window is printed in equal size.

Remote command:
`HCOPy:PAGE:WINDow:COUNt` on page 580

Scaling

Determines the scaling of the windows in the printout if Print Multiple Windows is active (see Chapter 9.5.1.1, "Print content settings", on page 253).

If more than one window is printed on one page (see Windows Per Page), each window is printed in equal size.

"Maintain aspect ratio"	Each window is printed as large as possible while maintaining the aspect ratio of the original display.
"Size to fit"	Each window is scaled to fit the page size optimally, not regarding the aspect ratio of the original display.

Remote command:
`HCOPy:PAGE:WINDow:SCALe` on page 580

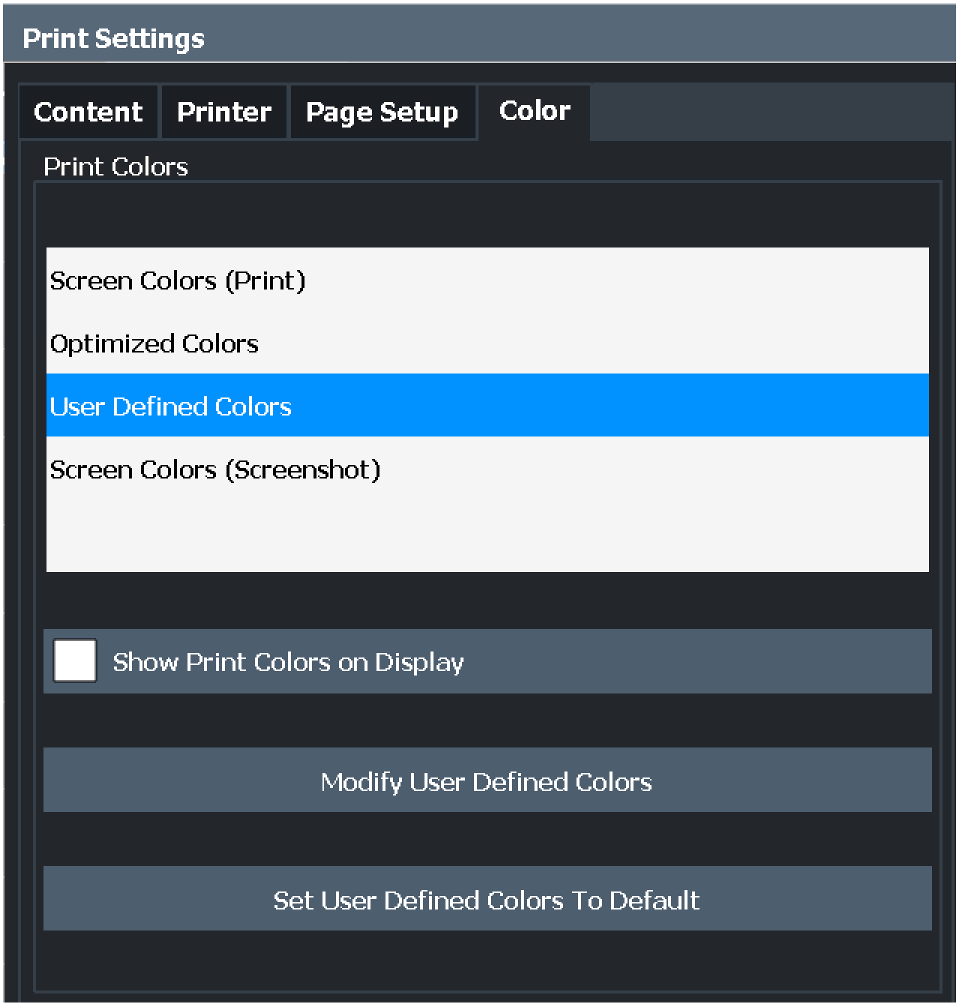
Margins

Defines margins for the printout page on which no elements are printed. The margins are defined according to the selected unit.

Remote command:
`HCOPy:PAGE:MARGin:BOTTom` on page 578
`HCOPy:PAGE:MARGin:LEFT` on page 578
`HCOPy:PAGE:MARGin:RIGHt` on page 578
`HCOPy:PAGE:MARGin:TOP` on page 579
`HCOPy:PAGE:MARGin:UNIT` on page 579

9.5.1.5 Print color settings

Access: "Print" > "Print Config" > "Color" tab



The settings provided here are identical to those in the "Print Colors" section of the "Display" > "Theme + Color" dialog box.

See "Print Colors" on page 283.

9.5.2 How to store or print screenshots of the display

The measurement results displayed on the screen can be printed or stored to a file very easily.

Two different scenarios can be configured in parallel, assigned to different printing devices. You can then perform one or the other simply by selecting the corresponding printing device and the "Print" function.

For a programming example, see Chapter 12.8.6, "Examples: managing data", on page 585.

To start printing or storing results to a file

► If the R&S FSMR3 has already been set up according to your current requirements, simply press the "Print immediate" icon at the far right end of the toolbar.

The current measurement display is printed or stored to a file, as configured.

To print a screenshot

This configuration assumes a printer has already been installed. To install a new printer, use the Install Printer function (common Microsoft Windows procedure).

1. Select the "Printer" tool in the toolbar.

   The "Print Settings" dialog box is displayed.
2. Select "Device 1" or "Device 2" to define which printing device you want to configure.
   (Note: Some settings are independent of the printing-device.)
3. In the "Content" tab, define the elements of the screen and additional information to be included in the printout.
   a) Select "Print Screenshot" to include all elements displayed on the screen in a single-page printout.
   b) Optionally, add a comment to be printed at the top of the printout.
   c) Optionally, activate the date and time or the logo so they are added to the printout.
   d) Optionally, activate "Print Dialog" to include any dialog boxes currently displayed on the screen in the printout. This is useful, for example, to document the used settings for a particular result.
   e) Check the "Print Preview" to make sure all relevant elements of the display are visible.
4. In the "Printer" tab, select "Printer" as the "Destination".
5. Select the "Printer Name" to print to from the list of installed printers.
6. In the "Page Setup" tab, configure the layout of the printout page.
   a) Select the page orientation.
   b) Define the page margins.

c) Check the "Print Preview" to make sure all relevant elements of the display are visible.

7. In the "Color" tab, define the colors to be used for the printout.
   a) By default, "Optimized Colors" are used to improve the visibility of the colors. The background is always printed in white and the grid in black.
   For a printout that reflects exactly what you see on the screen, select "Screen Colors (Screenshot)".
   b) Check the "Print Preview" to find out if the setting is appropriate.

8. Select "Print" to execute the print function.

   The screenshot is printed on the printer as configured.

9. To print another screenshot using the same configuration any other time, simply press the "Print immediate" icon at the far right end of the toolbar.
   If you use different printing scenarios alternately, perform the following steps to print another screenshot:
   a) Select the "Printer" tool in the toolbar.
   b) Select "Device 1" or "Device 2" to select the configured printing device.
   c) Select "Print" to execute the print function.

To store a printout containing multiple windows

1. Select the "Printer" tool in the toolbar.

   The "Print Settings" dialog box is displayed.

2. Select "Device 1" or "Device 2" to define which printing device you want to configure.

3. In the "Content" tab, define the elements of the screen and additional information to be included in the printout.
   a) Select "Print Selected Windows" to include the selected windows in the printout, possibly on multiple pages.
   b) Select the result displays in the currently selected channel to be included in the printout.
   Tip: Select the "MultiView" before configuring the printout to include result displays from any active channel.
   c) Optionally, add a comment to be printed at the top of each page of the printout.
   d) Optionally, activate the date and time or the logo so they are added to the printout pages.

4. Check the "Print Preview" to make sure all required result displays are included.
   a) Scroll through the individual pages of the printout using "Page Up" and "Page Down".
   b) Use the zoom functions to make sure all relevant parts of the result display are visible.

5. In the "Printer" tab, select "File" as the "Destination".

6. Select the file format from the selection list.
7. By default, you define the filename individually for each print operation. To avoid having the "File Selection" dialog box being displayed for each print operation, select "Suppress File Name Dialog". In this case, the previously used or default storage location and filename are used.
   (C:\R_S\INSTR\USER\FSMR3_ScreenShot_<date and time>).
8. In the "Page Setup" tab, configure the layout of the printout page.
   a) Select the page orientation.
   b) Define the page margins.
   c) Check the "Print Preview" to make sure all relevant elements of the display are visible.
9. In the "Color" tab, define the colors to be used for the printout.
   a) By default, "Optimized Colors" are used to improve the visibility of the colors. The background is always printed in white and the grid in black.
      For a printout that reflects the colors you see on the screen, but with a white background, select "Screen Colors (Print)".
   b) Check the "Print Preview" to find out if the setting is appropriate.
10. Select "Print" to execute the print function.
11. If you did not select the option to suppress the dialog, enter a filename in the file selection dialog box.

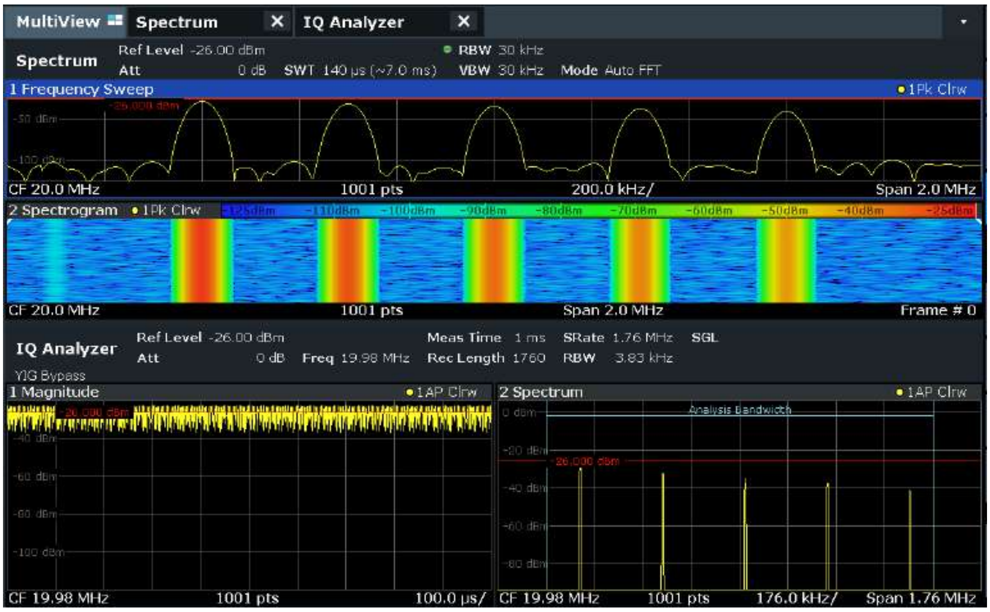
    The selected data elements are stored to the file as configured.

12. To store another file using the same configuration any other time, simply press the "Print immediate" icon at the far right end of the toolbar.
    If you use different printing scenarios alternately, perform the following steps to store another file:
    a) Select the "Printer" tool in the toolbar.
    b) Select "Device 1" or "Device 2" to select the configured printing device.
    c) Select "Print" to execute the print function.

9.5.3 Example for storing multiple measurement results to a PDF file

The following example describes the procedure to store results from measurements in the Spectrum application and the I/Q Analyzer to a single PDF file.

1. Configure and perform the measurements in the Spectrum application and I/Q Analyzer as required. Configure at least the following result displays:
   - Frequency Sweep, Spectrogram (Spectrum)
   - Magnitude, Spectrum (I/Q Analyzer)
2. Switch to the "MultiView" tab to display an overview of the result displays in all active channels.



3. Select the "Printer" tool in the toolbar.

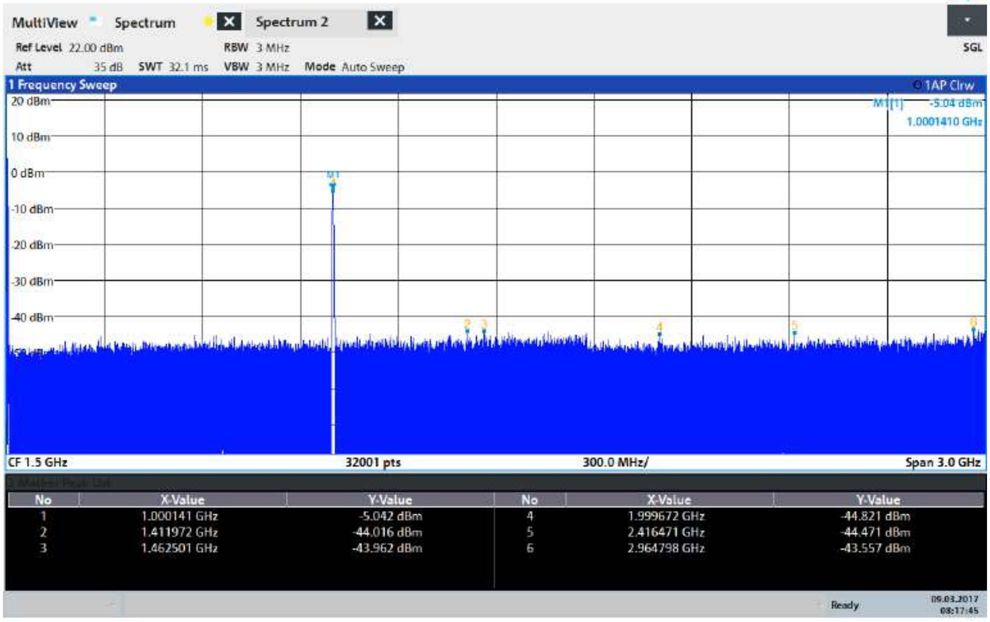
   The "Print Settings" dialog box is displayed.

4. Select "Device 1" to configure the settings for this printing device.
5. In the "Content" tab, select "Print Selected Windows".
6. Select the result displays listed in step 1.
7. Enter the comment *Measurement Test Report* to be inserted at the top of each page.
8. Select "Print Page Count" and "Print Date and Time".
9. In the "Content" tab, select "Print Selected Windows".
10. In the "Printer" tab, select "File" as the "Destination".
11. Select "PDF" from the file format selection list.
12. Select "Suppress File Name Dialog".
13. In the "Page Setup" tab, select "Landscape" as the "Orientation".
14. Select "Windows Per Page": *1* to print a single result display on each page.
15. Select the "Scaling" option "Size to fit" to maximize the result display on each page.
16. In the "Color" tab, select "Screen Colors (Print)" for a printout that reflects the colors you see on the screen, but with a white background.
17. Check the "Print Preview" to make sure all required result displays are included and all relevant data elements are visible.
    a) Scroll through the individual pages of the printout using "Page Up" and "Page Down".

b) Use the zoom functions to make sure all relevant parts of the result display are visible.

18. Select "Print" to execute the print function.

The selected data elements are stored to the file as configured.



08:17:47 09.03.2017

10 General instrument setup

Access: [SETUP]

Some basic instrument 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 instrument 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.

Network and remote settings, display settings

Settings for network and remote operation are described in Chapter 11, "Network operation and remote control", on page 319.

Display settings are described in Chapter 10.2.1, "Display settings", on page 275.

10.1 Alignment

10.1.1 Basics on alignment

When you put the instrument into operation for the first time or when strong temperature changes occur, align the data to a reference source (see "Temperature check" on page 270).

The firmware determines the correction data and characteristics required for the alignment. It compares the results at different settings with the known characteristics of the high-precision calibration signal source at 64 MHz.

Basic operation of the R&S FSMR3 can be affected before or after a self-alignment in the following ways:

- Depending on the installation settings, an automatic self-alignment is performed directly after installation, and a dialog is displayed indicating how much warm-up time is still required before self-alignment can be performed.
- During instrument start, the firmware checks whether the installed hardware is supported. If not, an error message is displayed ("Wrong Firmware Version") and you are asked to update the firmware. Until the firmware version is updated, self-alignment fails.

- If you start a self-alignment remotely and 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.
- During self-alignment, do not connect a signal to the RF input connector. Running a self-alignment with a signal connected to the RF input can lead to false measurement results.

Alignment results

The alignment results are displayed and contain the following information:

- Date and time of last correction data record
- Overall results of correction data record
- List of performed alignment steps

The results are classified as follows:

PASSED	Calibration successful without any restrictions
CHECK	Deviation of correction value larger than expected, correction could however be performed
FAILED	Deviations of correction value too large, no correction was possible. The found correction data is not applicable.

The results are available until the next self-alignment process is started or the instrument is switched off.

Temperature check

During self-alignment, the instrument's frontend temperature is measured (if activated, only after the instrument has warmed up completely, see "Await Warm-Up Operation before Self Alignment" on page 273). This temperature is used as a reference for a continuous temperature check during operation. If the current temperature deviates from the stored self-alignment temperature by a certain degree, a warning is displayed in the status bar. The warning indicates the resulting deviation in the measured power levels. A status bit in the `STATUs:QUEStionable:TEMPerature` register indicates a possible deviation. The current temperature of the frontend can be queried using a remote command (see `SOURce<si>:TEMPerature:FRONtend` on page 598).

Touchscreen alignment

When the device is delivered, the touchscreen is initially calibrated. However, to ensure that the touchscreen responds to the finger contact correctly, a touchscreen alignment is required.

Alignment of the touchscreen is useful:

- At first use
- After an image update or after exchanging a hard disk
- If you notice that touching a specific point on the screen does not achieve the correct response

- If the position of the instrument has been changed and you cannot look straight on the screen
- If another person operates the instrument

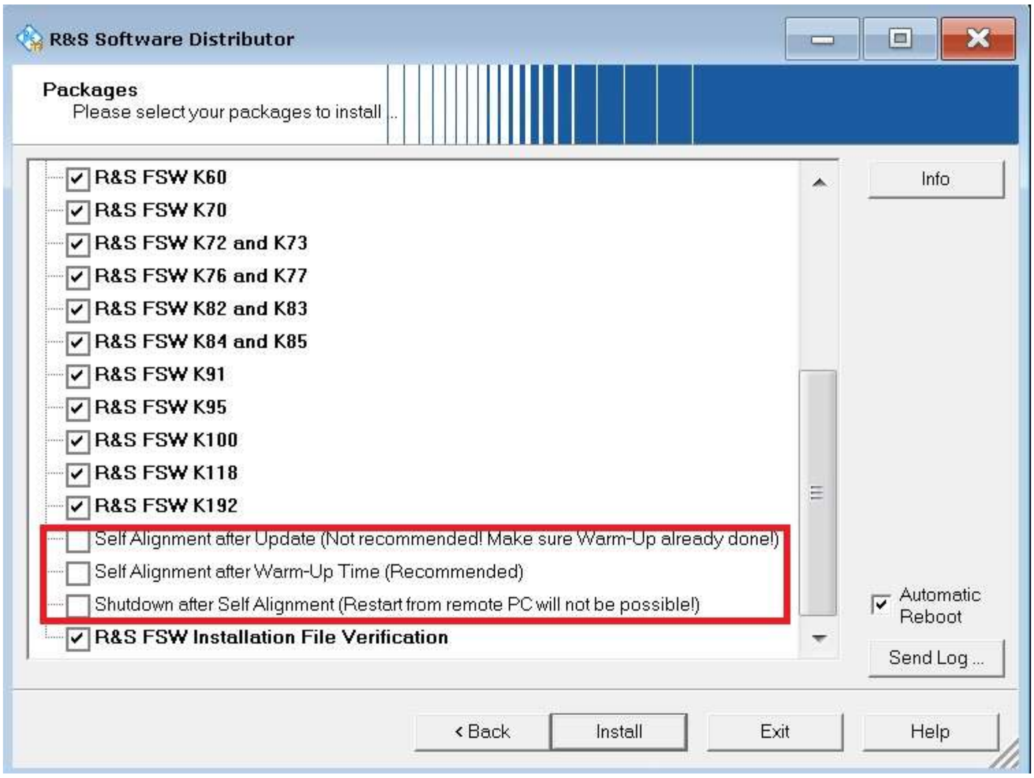
10.1.2 Alignment settings

Access: [Setup] > "Alignment"

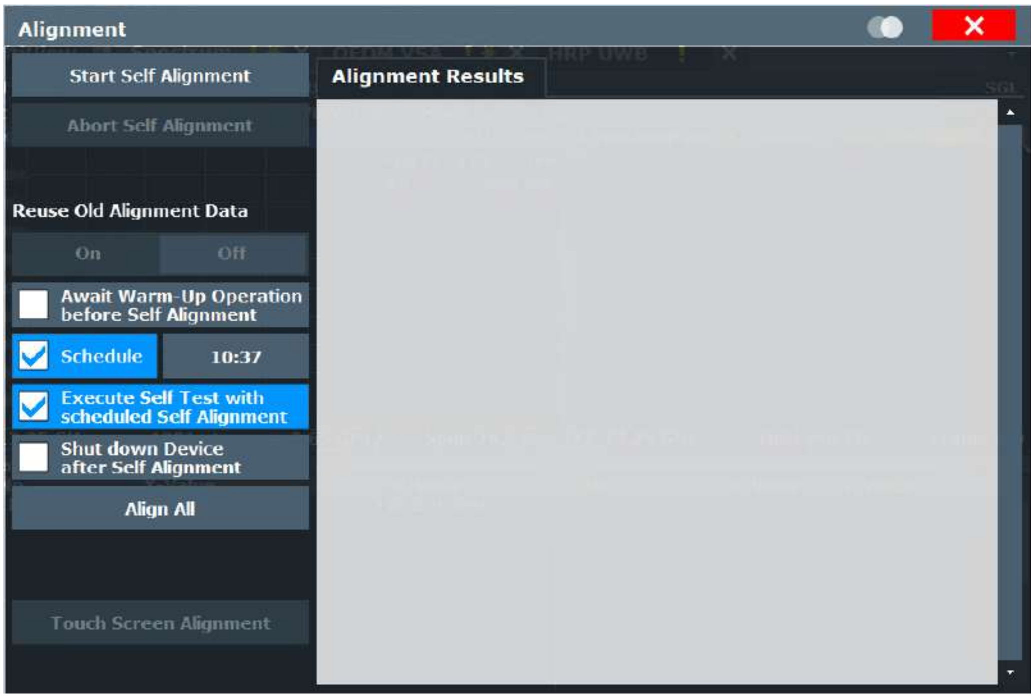
Both the instrument and the touchscreen can be aligned when necessary (see Chapter 10.1.1, "Basics on alignment", on page 269).

Automatic self-alignment

During installation of the R&S FSMR3 firmware, you can configure an automatic self-alignment to be performed directly after installation. In addition, you can activate a preceding warmup time before self-alignment, which is strongly recommended. If you do not activate this option, make sure the instrument has reached its operating temperature before installing the firmware. Furthermore, you can force the instrument to shut down after self-alignment. Note, however, that you cannot switch the instrument back on remotely afterwards.



The additional settings for self-alignment can also be activated or deactivated during operation in the "Alignment" settings dialog (see Await Warm-Up Operation before Self Alignment and Shut down Device after Self Alignment.)



Self-alignment results in secure user mode

Be sure to store self-alignment results before SecureUser Mode is enabled; see Chapter 9.2, "Protecting data using the secure user mode", on page 238.

In secure user mode, the results are not stored permanently. Thus, if the currently stored self-alignment results are not suitable, you must perform a self-alignment each time you switch on the R&S FSMR3.

Start Self Alignment

Starts recording correction data for the instrument. If the correction data acquisition fails or if the correction values are deactivated, a corresponding message is displayed in the status field.

For details, see Chapter 10.1.1, "Basics on alignment", on page 269.

Note:

A running Sequencer operation is aborted when you start a self-alignment.

During self-alignment, do not connect a signal to the RF input connector. Running a self-alignment with a signal connected to the RF input can lead to false measurement results.

Remote command:
`*CAL?` on page 389, see also `CALibration[:ALL]?` on page 593

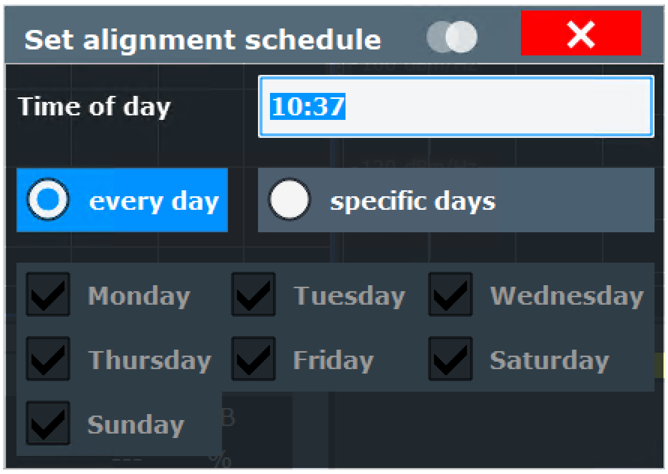
Abort Self Alignment
As long as the self-alignment data is being collected, the procedure can be canceled using the "Abort Self Alignment" button.

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. In this case, you cannot abort a self-alignment manually.

Await Warm-Up Operation before Self Alignment
Displays a message indicating the remaining warmup time required before self-alignment is performed. After the warmup operation has completed, self-alignment is started automatically.

Remote command:
`CALibration:DUE:WARMup` on page 595

Schedule
If enabled, a self-alignment is performed regularly at specific days and time.



Remote command:
`CALibration:DUE:SCHedule` on page 594
`CALibration:DUE:DAYS` on page 593
`CALibration:DUE:TIME` on page 595

Shut down Device after Self Alignment
If activated, the R&S FSMR3 is automatically shut down after self-alignment is completed. Note that the instrument cannot be restarted via remote control.

Remote command:
`CALibration:DUE:SHUTdown` on page 595

Reuse Old Alignment Data
If data from a previous self-alignment is available on the instrument, it can be reused even though the instrument claims the instrument is uncalibrated. This is useful, for example, after activating a software option or updating the firmware to a beta version. After rebooting the instrument, you must re-activate this function if you still want to reuse the old alignment data.

Note, however, that **re-using old alignment data can lead to inaccurate measurement results, or even cause the R&S FSMR3 firmware to fail altogether**. For measurements using old alignment data, an [OLD CAL] message is indicated in the status bar (instead of [UNCAL], which indicates that a new self-alignment is actually required.)

To measure with the accuracy specified in the data sheet, always perform a self-alignment when the instrument calls for it.

Starting Touch Screen Alignment
Starts the touchscreen alignment.

Tap the 4 markers on the screen as you are asked to do. The touchscreen is aligned according to the executed pointing operations.

Alignment Results:
Information on whether the alignment was performed successfully and on the applied correction data is displayed. The results are available until the next self-alignment process is started or the instrument is switched off.

Remote command:
`CALibration:RESult?` on page 596

10.1.3 How to perform a self-test

You do not have to repeat the self-test every time you switch on the instrument. It is only necessary when instrument malfunction is suspected.

Operating temperature
Before performing this alignment, make sure that the instrument has reached its operating temperature (for details, refer to the data sheet).

1. Select [SETUP].
2. Select "Service".
3. Select "Selftest".

   Once the instrument modules have been checked successfully, a message is displayed.

10.1.4 How to align the instrument

Operating temperature

Before performing this alignment, make sure that the instrument has reached its operating temperature (for details, refer to the data sheet).

To perform a self-alignment

Make sure no signal is connected to the RF input connector. Running a self-alignment with a signal connected to the RF input can lead to false measurement results.

1. Select [SETUP].
2. Select "Alignment".
3. Select "Start Self Alignment".
4. To abort the self-alignment process, select "Abort Self Alignment".

   Once the system correction values have been calculated successfully, a message is displayed.

To display the alignment results again later

► Select [SETUP] > "Alignment".

10.1.5 How to align the touchscreen

To align the touchscreen

1. Press the [Setup] key.
2. Select the "Alignment" softkey.
3. Select "Touch Screen Alignment".

   A blinking cross appears in the lower left corner of the screen.
4. Touch and hold the blinking cross until it stops blinking.
   Repeat this action for the crosses in the other corners.

10.2 Display settings

10.2.1 Display settings

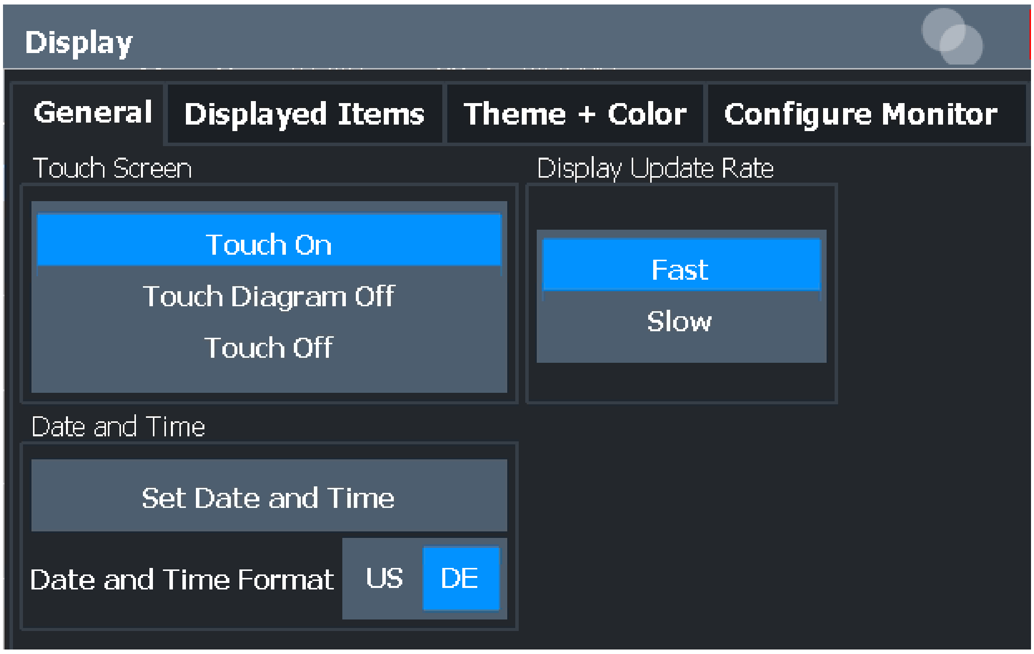
Access: [Setup] > "Display"

Some general display settings are available regardless of the current application or operating mode. For information on optimizing your display for measurement results, see the application-specific result configuration descriptions.

10.2.1.1 General display settings

Access: [Setup] > "Display" > "General"

This section includes general screen display behavior and date and time display.



Deactivating and Activating the Touchscreen

The touchscreen function can be deactivated, e.g. when the instrument is being used for demonstration purposes and tapping the screen must not provoke an action.

To reactivate the touchscreen, simply press the [Setup] key on the front panel. The "Display" dialog box is opened automatically and the "Touch Screen" option is set to "On".

"Touch On"	Touchscreen function is active for the entire screen.
"Touch Off"	Touchscreen is deactivated for the entire screen.

"Touch Diagram Off"
Touchscreen is deactivated for the diagram area of the screen, but active for the surrounding softkeys, toolbars and menus.

Remote command:
DISPlay:TOUChscreen[:STATe] on page 600

Display Update Rate

By default, a fast update rate ensures the most recent measurement results on the display. However, when performance is poor due to slow data transfer (for example during remote control), it can be helpful to decrease the frequency with which the screen display is updated.

Set Date and Time

Sets the current date and time for the internal real-time clock on the instrument. This function uses the standard Windows "Date and Time Properties" dialog box. Setting the clock requires administrator rights.

Select the "Set Date and Time" button in the "Display" dialog box, or select the date and time display in the status bar to open the Windows dialog box.

Remote command:
SYSTem:DATE on page 601
SYSTem:TIME on page 602

Date and Time Format

Switches the time and date display on the screen between US, ISO and German (DE) format.

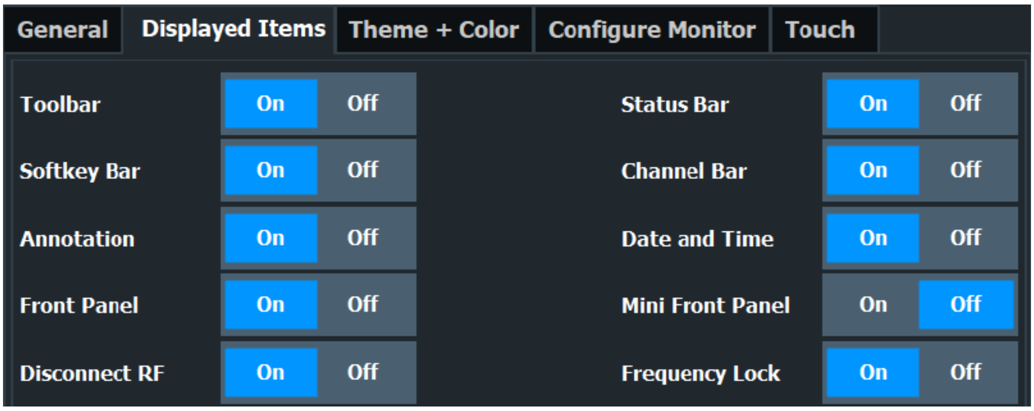
"DE"	dd.mm.yyyy hh:mm:ss 24 hour format.
"US"	mm/dd/yyyy hh:mm:ss 12 hour format.
"ISO"	yyyy-mm-dd hh:mm:ss 24 hour format.

Remote command:
DISPlay[:WINDow<n>]:TIME:FORMat on page 601

10.2.1.2 Displayed items

Access: [Setup] > "Display" > "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.



Toolbar

The toolbar provides access to frequently used functions via icons at the top of the screen. Some functions, such as zooming, finding help, printing screenshots or storing and loading files are not accessible at all without the toolbar.

Remote command:

`DISPlay:TBAR[:STATe]` on page 600

Status Bar

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

Remote command:

`DISPlay:SBAR[:STATe]` on page 599

Softkey Bar

Softkeys are virtual keys provided by the software. Thus, more functions can be provided than can be accessed directly via the function keys on the device.

The functions provided by the softkeys are often also available via dialog boxes. However, some functions are not accessible at all without the softkey bar.

Note: The softkey bar is hidden while the SmartGrid is displayed and restored automatically when the SmartGrid is closed.

Remote command:

`DISPlay:SKEYs[:STATe]` on page 600

Channel Bar

The channel bar provides information on firmware and measurement settings for a specific channel.

Remote command:
DISPlay:ANNotation:CBAR on page 599

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
- The number of sweep points

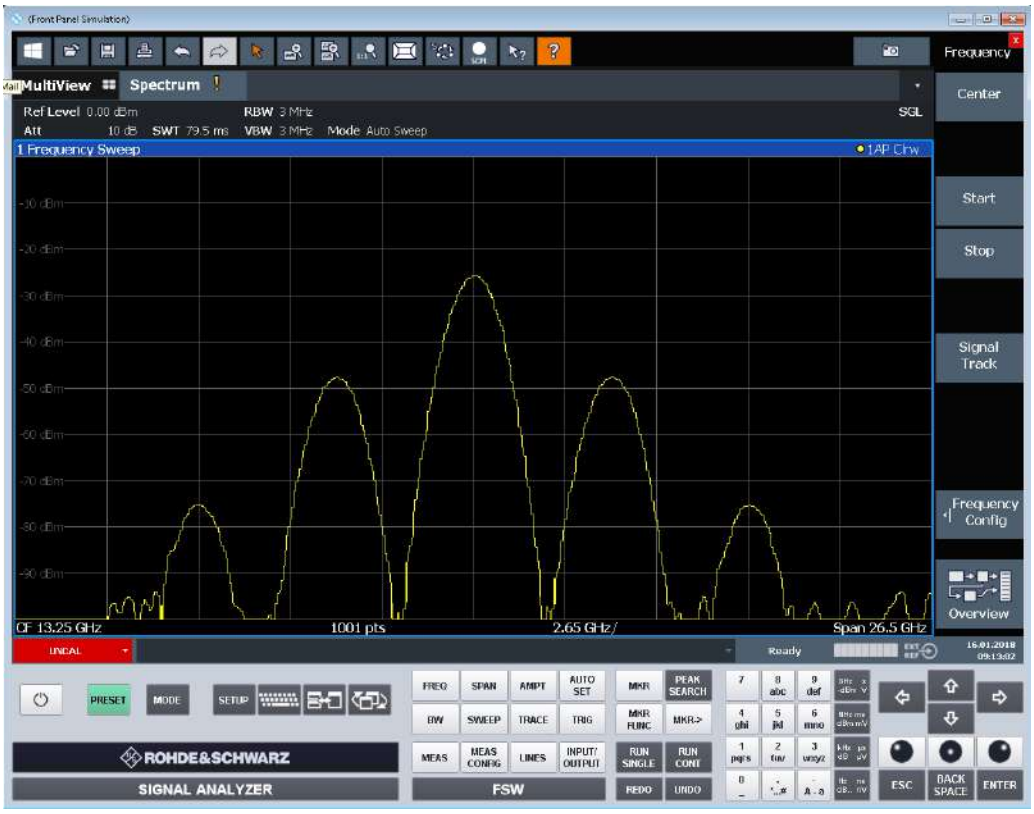
Remote command:
DISPlay:ANNotation:FREQuency on page 599

Date and Time
The date and time display can be switched off independently of the status bar.

You can set the current date and time and configure the display format in the "General" tab of the "Display" dialog box.

Remote command:
DISPlay[:WINDow<n>]:TIME on page 600

Front Panel
The "Front Panel" display simulates the entire front panel of the device (except for the external connectors) on the screen. Thus, you can interact with the R&S FSMR3 without the keypad and keys on the front panel of the device. That is useful, for example, when working with an external monitor or operating via remote control from a computer.



To activate or deactivate the front panel temporarily, press the [F6] key on the external keyboard (if available) or the remote computer.

For more information, see Chapter 10.2.3, "How to work with the soft front panels", on page 288.

Remote command:
`SYSTem:DISPlay:FPANel[:STATe]` on page 601

Mini Front Panel
If you require a front panel display but do not want to lose too much space for results in the display area, a mini front panel is available. The mini version displays only the main function keys in a separate window in the display area.

Note:
You can also activate the mini front panel using the key combination [ALT + m] (be aware of the keyboard language defined in the operating system!). That is useful when you are working from a remote PC and the front panel function is not active.

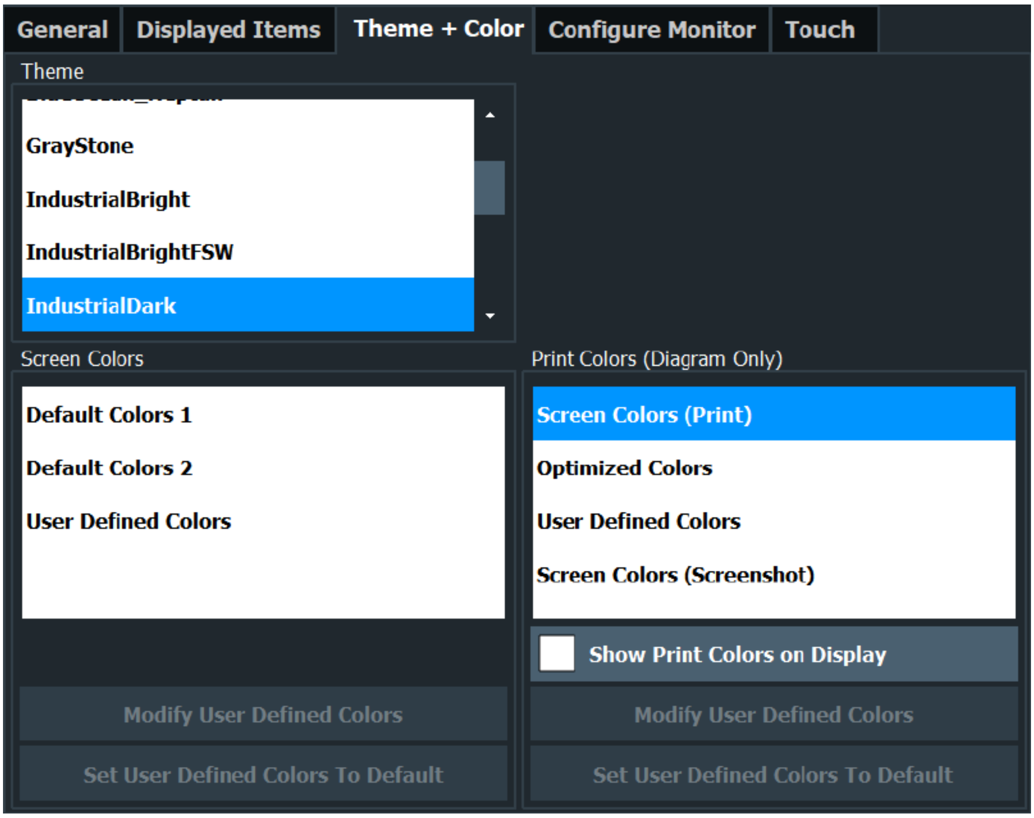
Remote command:
`SYSTem:DISPlay:FPANel[:STATe]` on page 601

10.2.1.3 Display theme and colors

Access: [Setup] > "Display" > "Theme + Color"

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

For step-by-step instructions see Chapter 10.2.2, "How to configure the colors for display and printing", on page 287.



Theme

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

The default theme is "IndustrialDark".

Remote command:
`DISPlay:THEMe:SELect` on page 604

Screen Colors

Two different color sets are provided by the instrument, 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 285).

Remote command:
`DISPlay:CMAP<it>:DEFault<ci>` on page 602

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 285).

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

Gui setting	Description	Remote command
"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.	`HCOP:CMAP:DEF2`
"Screen Colors (Print)"	Selects the current screen colors for the printout. The background is always printed in white and the grid in black.	`HCOP:CMAP:DEF1`
"Screen Colors (Screenshot)"	Selects the current screen colors without any changes for a screenshot.	`HCOP:CMAP:DEF4`
"User Defined Colors"	Selects the user-defined color setting.	`HCOP:CMAP:DEF3`

Remote command:
`HCOPy:CMAP<it>:DEFault<ci>` on page 574

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 12.9.3.3, "CMAP suffix assignment", on page 604.

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<it>:PDEFined` on page 575

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<it>:HSL` on page 574

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 283).

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<it>:PDEFined` on page 603

10.2.1.4 External monitor settings

Access: [Setup] > "Display" > "Configure Monitor"

You can connect an external monitor (or projector) to the "DVI" or "display port" connector on the instrument's rear panel.

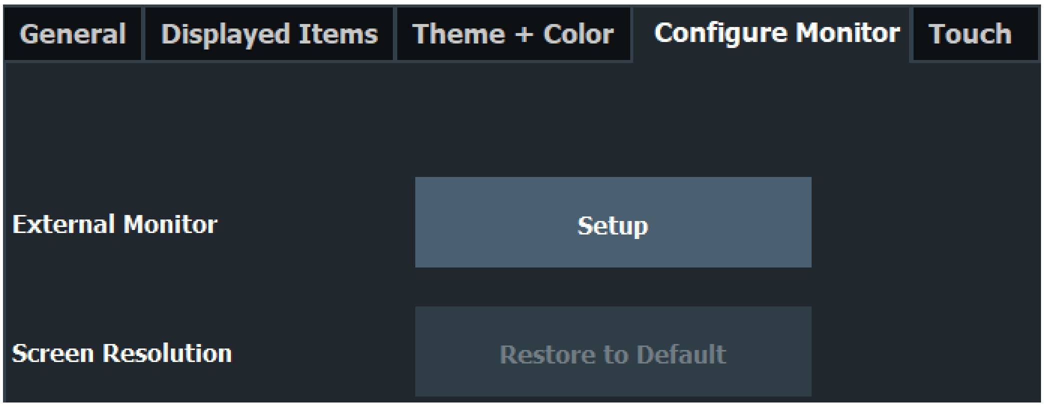
Screen resolution and format

The touchscreen of the R&S FSMR3 is calibrated for a 16:10 format. If you connect a monitor or projector using a different format (e.g. 4:3), the calibration is not correct and the screen does not react to your touch actions properly.

The touchscreen has a screen resolution of 1280x800 pixels. Usually, the display of the external monitor is a duplicate of the instrument's monitor.

If you configure the external monitor to be used as the *only* display in the Windows configuration dialog box ("Show only on 2"), the maximum screen resolution of the monitor is used. In this case, you can maximize the R&S FSMR3 application window and see even more details. You cannot change the monitor's screen resolution via the standard Windows configuration dialog box.

However, you can restore the default instrument resolution (1280x800) on the monitor using the instrument function "Setup" > "Display" > "Configure Monitor" > "Screen Resolution: Restore to default".



Setup

Opens the standard Windows configuration dialog box to configure the used display devices.

Screen Resolution: Restore to Default

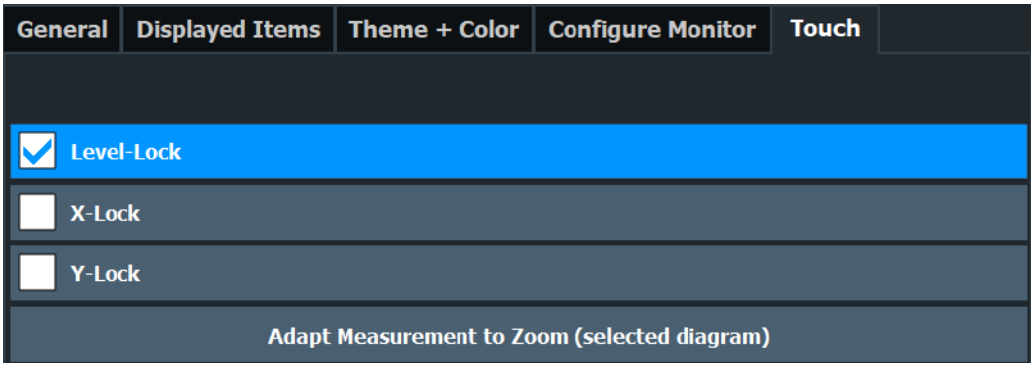
The default screen resolution (1280 x 800) is restored in the Windows configuration settings. This is useful, for instance, if the instrument was connected to a display device and was adapted to different requirements.

10.2.1.5 Touch(screen) settings

Access: [Setup] > "Display" > "Touch"

These options concern the behavior of the firmware for touch gestures on the screen.

Note that these settings remain unchanged after a channel preset.



Level Lock
If activated (default), the reference level (and thus the attenuation) is locked, that is: remains unchanged during touch gestures on the screen.

X-Lock
If activated, the x-axis of the diagram is not changed during subsequent touch gestures.

Y-Lock
If activated, the y-axis of the diagram is not changed during subsequent touch gestures.

Adapt Measurement to Zoom (selected diagram)
If you already performed a graphical zoom using the "Single Zoom" on page 204 or "Multi-Zoom" on page 204 functions, this function automatically adapts the measurement settings to maintain the currently zoomed display.

10.2.2 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. Press the [Setup] key and select the "Display" softkey.
2. Select the "Theme + Color" tab.

3. In the "Screen Colors" area, do one of the following:
   - Select a predefined set of colors for screen display.
   - Select "User Defined Colors" to configure the color set yourself.
4. In the "Print Colors" area, do one of the following:
   - Select a predefined set of colors for printing screenshots.
   - Select "User Defined Colors" to configure the color set yourself.
5. 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 "Display" 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. Do one of the following:
   - Select a color from the "Predefined Colors".
   - 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:"), 0 % represents red and 100 % represents blue.
   - 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.
7. Repeat these steps until you have assigned a color to all objects you want to configure.
8. Select "OK" to close the dialog box.

   The colors are applied to the assigned objects.

10.2.3 How to work with the soft front panels

Basic operation with the soft front panels is identical to normal operation, except for the following aspects:

To activate a key, select the key on the touchscreen.

To simulate the use of the rotary knob, use the additional keys displayed between the keypad and the arrow keys:

Icon	Function
●	Turn left
●	Enter
●	Turn right

Mini front panel

The mini front panel provides only the keys on the touchscreen, to operate the R&S FSMR3 via an external monitor or remote desktop.

By default, the "Auto close" option is activated and the mini front panel window closes automatically after you select a key. This is useful if you only require the mini front panel display occasionally to press a single function key.

If you want the window to remain open, deactivate the "Auto close" option. You can close the window manually by selecting "Close planel" or the key combination [ALT + M] (be aware of the keyboard language defined in the operating system!).

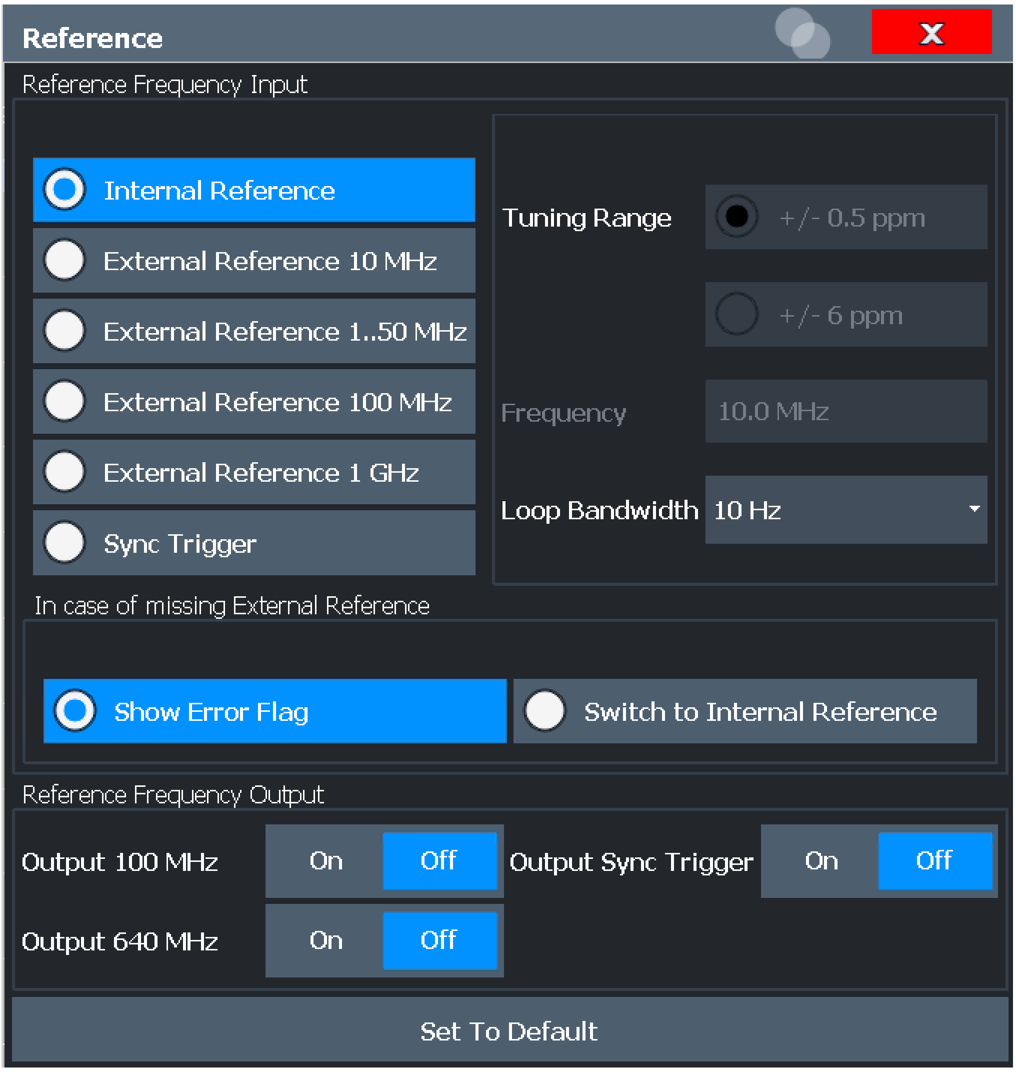
To display the soft front panel or mini front panel

1. Press the [Setup] key and select the "Display" softkey.
2. Select the "Displayed Items" tab.
3. Select "Front Panel": "On" or "Mini Front Panel": "On".

To activate or deactivate the front panel temporarily, press the [F6] key on the external keyboard (if available) or on the remote computer.

10.3 Reference frequency settings

Access: [Setup] > "Reference"



Reference Frequency Input

The R&S FSMR3 can use the internal reference source or an external reference source as the frequency standard for all internal oscillators. A 10 MHz crystal oscillator is used as the internal reference source. In the external reference setting, all internal oscillators of the R&S FSMR3 are synchronized to the external reference frequency.

External references are connected to one of the REF INPUT or the SYNC TRIGGER connectors on the rear panel.

Note: The optional, and more precise OCXO signal can replace the internal reference source.

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

The following reference inputs are available:

Table 10-1: Available Reference Frequency Input

Setting	Source Connector	Frequency	Tuning Range	Loop Band-width	Description
Internal	(OCXO)	10 MHz	-	1-100 Hz	Internal reference signal or optional OCXO
External Reference 10 MHz	REF INPUT 1..50 MHz	10 MHz	+/- 6 ppm	1-100 Hz	Fixed external 10 MHZ reference frequency Good phase noise performance
External Reference 1..50MHz	REF INPUT 1..50 MHz	1..50 MHz in 1 Hz steps	+/- 0.5 ppm	0.1 Hz (fixed)	Variable external reference frequency in 1 Hz steps Good external phase noise suppression. Small tuning range.
			+/- 6 ppm	1-30 Hz	Variable external reference frequency in 1 Hz steps Wide tuning range.
External Reference 100 MHz	REF INPUT 100 MHz / 1 GHz	100 MHz	+/- 6 ppm	1-300 Hz	External reference Good phase noise performance
External Reference 1 GHz	REF INPUT 100 MHz / 1 GHz	1 GHz	+/- 6 ppm	1-300 Hz	External reference
Sync Trigger	SYNC TRIGGER INPUT	100 MHz	+/- 6 ppm	1-300 Hz	External reference

Remote command:
[SENSe:]ROSCillator:SOURce on page 591
SOURce<si>:EXTernal<ext>:ROSCillator:EXTernal:FREQuency on page 590

Behavior in case of missing external reference ← Reference Frequency Input
If an external reference is selected but none is available, there are different ways the instrument can react.

"Show Error Flag" The error message "External reference missing" is displayed if no valid external reference signal is available. Additionally, the flag "NO REF" is displayed to indicate that no synchronization was performed *for the last measurement*.

"Switch to internal reference" The instrument automatically switches back to the internal reference if no external reference is available. Note that you must re-activate the external reference if it becomes available again at a later time.

Remote command:
[SENSe:]ROSCillator:EXTernal:FALLback on page 590

Tuning Range ← Reference Frequency Input
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}).

"+/- 0.5 ppm" With this smaller deviation 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.

"+/- 6 ppm" The larger deviation allows the instrument to synchronize to less precise external reference input signals.

Remote command:
`[SENSe:]ROSCillator:TRANge` on page 592

Frequency ← Reference Frequency Input
Defines the external reference frequency to be used (for variable connectors only).

Loop Bandwidth ← Reference Frequency Input
Defines the speed of internal synchronization with the reference frequency. 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.

Remote command:
`[SENSe:]ROSCillator:LBWidth` on page 589

Reference Frequency Output
A reference frequency can be provided by the R&S FSMR3 to other devices that are connected to this instrument. If activated, the reference signal is output to the corresponding connector.

"Output 100 MHz"
Provides a 100 MHz reference signal to the REF OUTPUT 100 MHz connector.

"Output 640 MHz"
Provides a 640 MHz reference signal to the REF OUTPUT 640 MHz connector.

"Output Sync Trigger"
Provides a 100 MHz reference signal to the SYNC TRIGGER OUTPUT connector.

Remote command:
`[SENSe:]ROSCillator:O640` on page 589
`[SENSe:]ROSCillator:OSYNc` on page 590

Resetting the Default Values
The values for the "Tuning Range", "Frequency" and "Loop Bandwidth" are stored for each source of "Reference Frequency Input".

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.

10.4 System configuration settings

Access: [Setup] > "System Configuration"

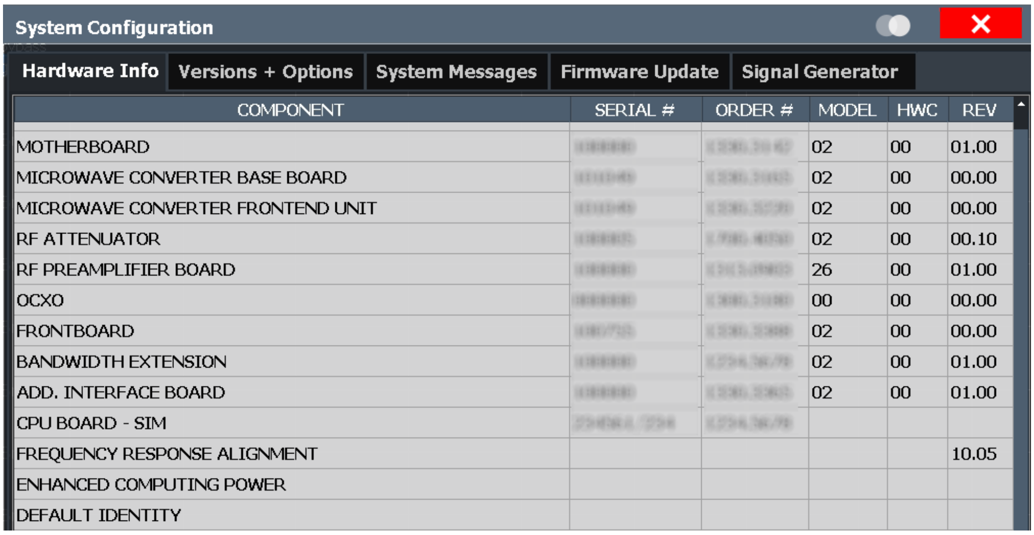
10.4.1 Hardware information

Access: [Setup] > "System Configuration" > "Hardware Info"

An overview of the installed hardware in your R&S FSMR3 is provided.

Every listed component is described by its serial number, part number, model information, hardware code, and hardware revision.

This information can be useful when problems occur with the instrument and you require support from Rohde & Schwarz.


System Configuration

Hardware Info | Versions + Options | System Messages | Firmware Update | Signal Generator

COMPONENT	SERIAL #	ORDER #	MODEL	HWC	REV
MOTHERBOARD	[illegible]	[illegible]	02	00	01.00
MICROWAVE CONVERTER BASE BOARD	[illegible]	[illegible]	02	00	00.00
MICROWAVE CONVERTER FRONTEND UNIT	[illegible]	[illegible]	02	00	00.00
RF ATTENUATOR	[illegible]	[illegible]	02	00	00.10
RF PREAMPLIFIER BOARD	[illegible]	[illegible]	26	00	01.00
OCXO	[illegible]	[illegible]	00	00	00.00
FRONTBOARD	[illegible]	[illegible]	02	00	00.00
BANDWIDTH EXTENSION	[illegible]	[illegible]	02	00	01.00
ADD. INTERFACE BOARD	[illegible]	[illegible]	02	00	01.00
CPU BOARD - SIM	[illegible]	[illegible]			
FREQUENCY RESPONSE ALIGNMENT					10.05
ENHANCED COMPUTING POWER					
DEFAULT IDENTITY					

Remote command:

`DIAGnostic:SERVice:HWINfo?` on page 619

10.4.2 Information on versions and options

Access: [Setup] > "System Configuration" > "Versions + Options"

Information on the firmware version and options installed on your instrument is provided. The unique Rohde & Schwarz device ID is also indicated here, as it is required for license and option administration.

You can also install new firmware options in this dialog box.

The table also contains:

- The open source acknowledgements (`PDF` file) for the firmware and other software packages used by the R&S FSMR3

Installing options in secure user mode

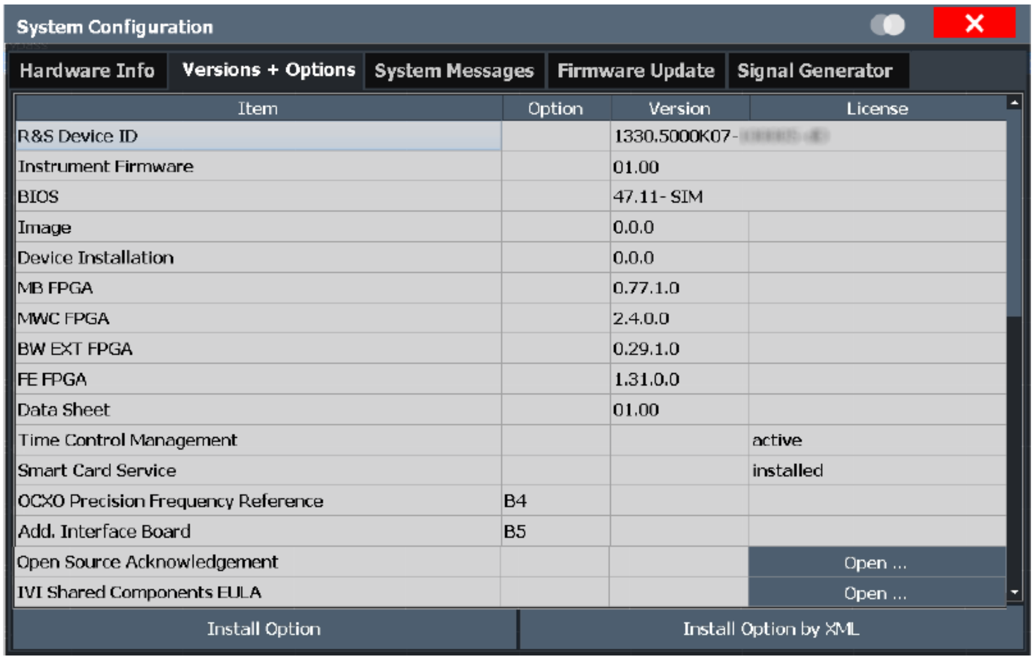
Be sure to install any new options before SecureUser Mode is enabled; see Chapter 9.2, "Protecting data using the secure user mode", on page 238.

For restricted users in secure user mode, this function is not available!

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 instrument functions are unavailable (including remote control) until the R&S FSMR3 is rebooted. You must then use the "Install Option" function to enter the new license key.



Remote commands:

`SYSTem:FORMat:IDENt` on page 621

`DIAGnostic:SERVice:BIOSinfo?` on page 618

`DIAGnostic:SERVice:VERSinfo?` on page 619

Open Source Acknowledgment: Open
Displays a PDF file containing information on open source code used by the R&S FSMR3 firmware.

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 FSMR3 using an XML file. Enter or browse for the name of an XML file that contains the option key and select "Select".

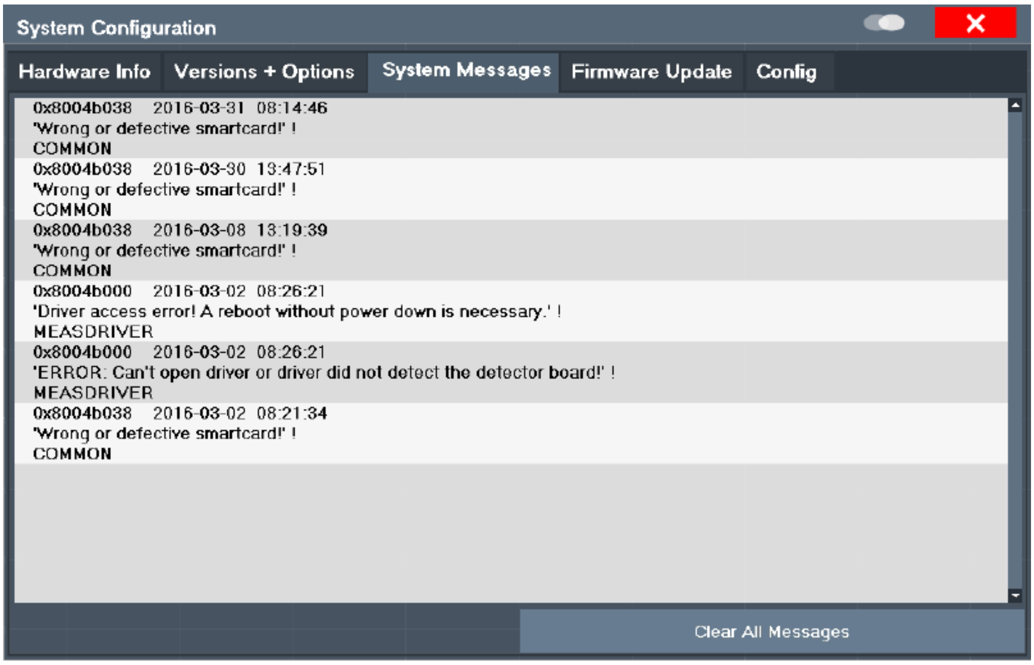
Only user accounts with administrator rights are able to install options.

10.4.3 System messages

Access: [Setup] > "System Configuration" > "System Messages"

The system messages generated by the R&S FSMR3 are displayed.

The messages are displayed in the order of their occurrence; the most recent messages are placed at the top of the list. Messages that have occurred since you last visited the system messages tab are marked with an asterisk '*'.



If the number of error messages exceeds the capacity of the error buffer, "Message Buffer Overflow" is displayed. To clear the message buffer, use the "Clear All Messages" button.

The following information is available:

No	device-specific error code
Message	brief description of the message
Component	hardware messages: name of the affected module
	software messages: name of the affected software
Date/Time	date and time of the occurrence of the message

Remote command:

SYSTem:ERRor:LIST? on page 620

10.4.4 Firmware updates

Access: [Setup] > "System Configuration" > "Firmware Update"

During instrument start, the R&S FSMR3 checks the installed hardware against the current firmware version to ensure that the hardware is supported. If not, an error message is displayed ("Wrong Firmware Version") and you are asked to update the firmware. Until the firmware version is updated, self-alignment fails. To see which components are not supported, see the System messages.

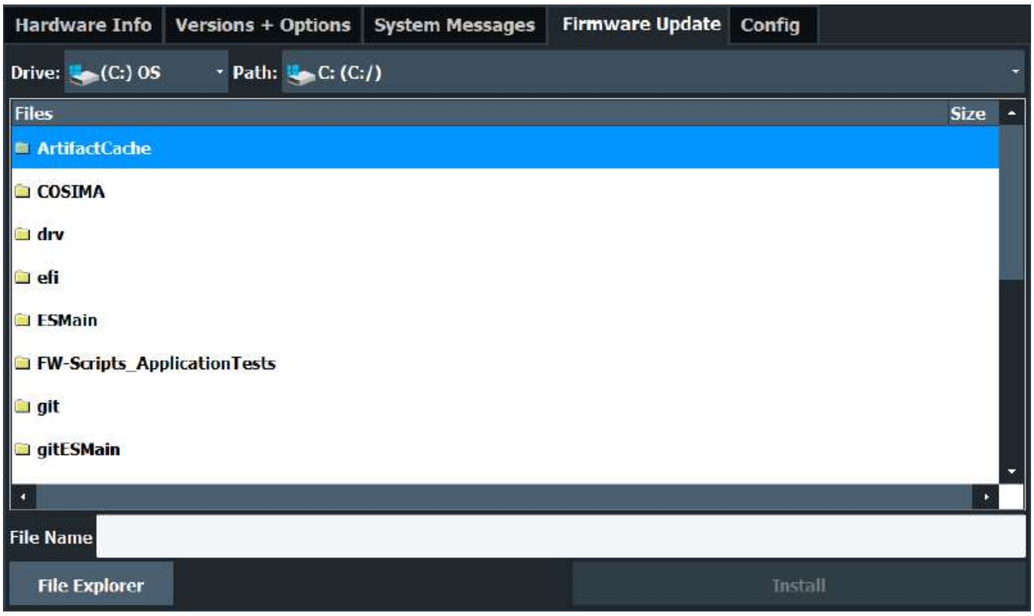
Possibly, you also have to update the firmware on your R&S FSMR3 to enable additional new features or if reasons for improvement come up. Ask your sales representative or check the Rohde & Schwarz website for availability of firmware updates. A firmware update package includes at least a setup file and release notes.

Before updating the firmware on your instrument, read the release notes delivered with the firmware version.

Installing options in secure user mode

Be sure to perform any firmware updates before SecureUser Mode is enabled; see Chapter 9.2, "Protecting data using the secure user mode", on page 238.

For restricted users in secure user mode, this function is not available.



Enter the name or browse for the firmware installation file and press the "Install" button.

Remote command:

`SYSTem:FIRMware:UPDate` on page 621

How to update the instrument firmware

1. Download the update package from the Rohde & Schwarz website and store it on a memory stick, on the instrument, or on a server network drive that the instrument can access.
2. **NOTICE!** Stop measurement. Do not update the firmware during a running measurement.

   If a measurement is running, stop it by pressing the highlighted [Run Cont] or [Run Single] key.
3. Select the [Setup] key.

4. Select the "System Config" softkey.
5. Select the "Firmware Update" tab.
6. In the file selection dialog box, select the `FSMR3000Setup*.exe` file.
   "File Explorer": Instead of using the file manager of the R&S FSMR3 firmware, you can also use the Microsoft Windows File Explorer to manage files.
7. Select "Install" to start the update.
8. After the firmware update, the R&S FSMR3 reboots automatically.
9. Depending on the previous firmware version, a reconfiguration of the hardware might be required during the first startup of the firmware. The reconfiguration starts automatically, and a message box informs you about the process. When the reconfiguration has finished, the instrument again reboots automatically.

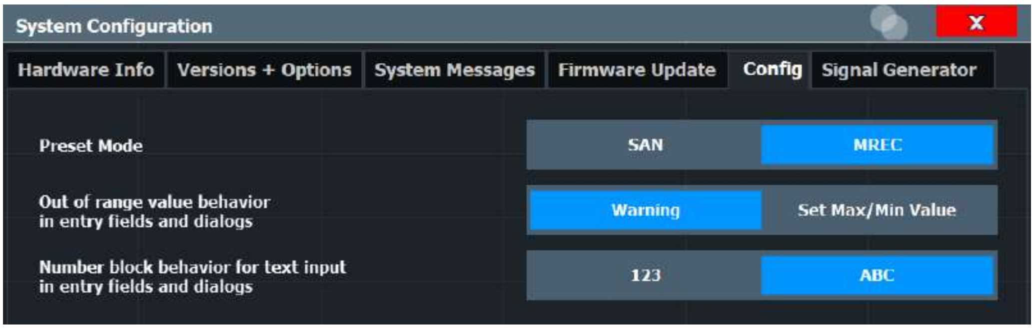
   Note: Do not switch off the instrument during the reconfiguration process.

   Now the firmware update is complete.
   It is recommended that you perform a self-alignment after the update (see Chapter 10.1.4, "How to align the instrument", on page 275).

10.4.5 General configuration settings

Access: [Setup] > "System Configuration" > "Config"

General system settings, for example concerning the initial behaviour of the R&S FSMR3 after booting, can also be configured.



Preset Mode
The preset mode selects the application that is started after an instrument preset.

The presettings can be defined in the "Config" tab of the "System Configuration" dialog box.

"SAN"	Signal and Spectrum Analyzer mode (Only when the optional Spectrum application has been installed.)

MREC Measuring Receiver application

Remote command:
`SYSTem:PRESet:COMPatible` on page 648

Out-of-range value behavior
By default, if you enter a value that is outside the valid range in an input field for a setting, a warning is displayed and the value is not accepted. Alternatively, entries below the minimum value can automatically be set to the minimum entry, and entries above the maximum value set to the maximum entry. This behavior avoids errors and facilitates setting correct values.

SecureUser Mode
If activated, the R&S FSMR3 requires a reboot and then automatically logs in using the "SecureUser" account.

Data that the R&S FSMR3 normally stores on the solid-state drive is redirected to volatile memory instead. Data that is stored in volatile memory can be accessed by the user during the current instrument session. However, when the instrument's power is removed, all data in volatile memory is erased.

The Secure User Mode can only be activated or deactivated by a user with administrator rights.

Note: Storing instrument settings permanently. Before you activate secure user mode, store any instrument settings that are required beyond the current session, such as predefined instrument settings, transducer files, or self-alignment data.

For details on the secure user mode, see Chapter 9.2, "Protecting data using the secure user mode", on page 238.

Remote command:
`SYSTem:SECurity[:STATe]` on page 621
Note: Initially after installation of the R&S FSMR3-K33 option, secure user mode must be enabled manually once before remote control is possible.

Changing the password ← SecureUser Mode
When the secure user mode is activated the first time after installation, you are prompted to change the passwords for all user accounts to improve system security.

To save the new password, select "Save". The password dialog for the next user is displayed, until you have been prompted to change the password all user accounts.

If you cancel the dialog without changing the password, the password dialog for the next user is displayed, until you have been prompted to change the password for all user accounts. It is possible to continue in secure user mode without changing the passwords, and you will not be prompted to do so again. However, we strongly recommend that you do define a more secure password for all users.

By default, the password characters are not displayed to ensure confidentiality during input. To display the characters, select "Show password".

To display the onscreen keyboard, select "Keyboard".

Number block behavior
Defines the default behavior of the keypad on the front panel of the R&S FSMR3 for **text** input. Depending on the type of values you most frequently enter using the keypad, a different default is useful.

"123"	Numeric values are entered when you press a key on the keypad. To enter alphanumeric values, use an external or the on-screen keyboard, or switch this setting.
"ABC"	(Default) Every key on the keypad represents several characters and one number. If you press the key multiple times in quick succession, you toggle through the symbols assigned to the key. For the assignment, refer to Table 4-10.

10.4.6 Signal generator settings

Access: [Setup] > "System Configuration" > "Signal Generator"

These settings configure a connected signal generator that can then be used for various tasks, for example for external generator control or NPR measurements.

IP Address or Computer name of Signal Generator
The IP address or computer name of the signal generator connected to the R&S FSMR3 via LAN.

By default, the IP address is expected. To enter the computer name, toggle the "123"/"ABC" button to "ABC".

Note: While a connection to a signal generator is established, you cannot change the connection information.
The IP address / computer name is maintained after a [PRESET], and is transferred between applications. However, when you switch applications, the control is disabled in the other applications. Only one application can control a generator at any time.

If a connection to a signal generator is already configured, the connection data is provided for information only.

Remote command:
`CONFigure:GENerator:IPConnection:ADDRess` on page 623

123/ABC ← IP Address or Computer name of Signal Generator
By default, the TCPIP address is expected. To enter the computer name, toggle the "123"/"ABC" button to "ABC".

Password ← IP Address or Computer name of Signal Generator
Enter the password required to operate the connected signal generator.

Test Connection
The R&S FSMR3 attempts to establish a connection to the signal generator.

If an instrument is connected, the following information is displayed:
- Device type
- Name and serial number
- Connection state

Remote command:
`CONFigure:GENerator:CONNection:CSTate?` on page 622
`CONFigure:GENerator:CONNection[:STATe]` on page 622

Connect/Disconnect
The R&S FSMR3 attempts to establish a connection to the signal generator, or disconnects it.

If an instrument is connected, the following information is displayed:
- Device type
- Name and serial number
- Connection state

Remote command:
`CONFigure:GENerator:CONNection[:STATe]` on page 622
`CONFigure:GENerator:CONNection:CSTate?` on page 622

10.4.7 AC power loss behavior

Access: BIOS

Using a specific configuration setting in the BIOS of the R&S FSMR3, you can define how the instrument behaves after the AC power supply is interrupted. The setting applies regardless whether the interruption occurs due to an irregular power outage in the mains supply, by removing the power cable, or by switching the instrument power supply off.

The setting supports the following values:
- "Power Off ": Instrument remains switched off.
- "Power On ": Instrument automatically switches on as soon as power supply is restored.
- "Last State ": (Default) Instrument restores the state that it was in before the outage occurred.

To change the instrument's power loss behavior

Prerequisite: the instrument is switched off and a keyboard is connected.

1. Switch on the power switch on the rear panel of the R&S FSMR3.
2. Watch for the prompt on the display, then press [DEL] on the keyboard to enter the BIOS setup.
3. In the BIOS menu, select "Chipset" > "PCH-IO Configuration" > "Restore AC Power Loss".
4. Select the required setting as described above.
5. In the BIOS menu, select "Save & Exit" > "Save Changes and Exit".

10.5 Service functions

Access: [Setup] > "Service"

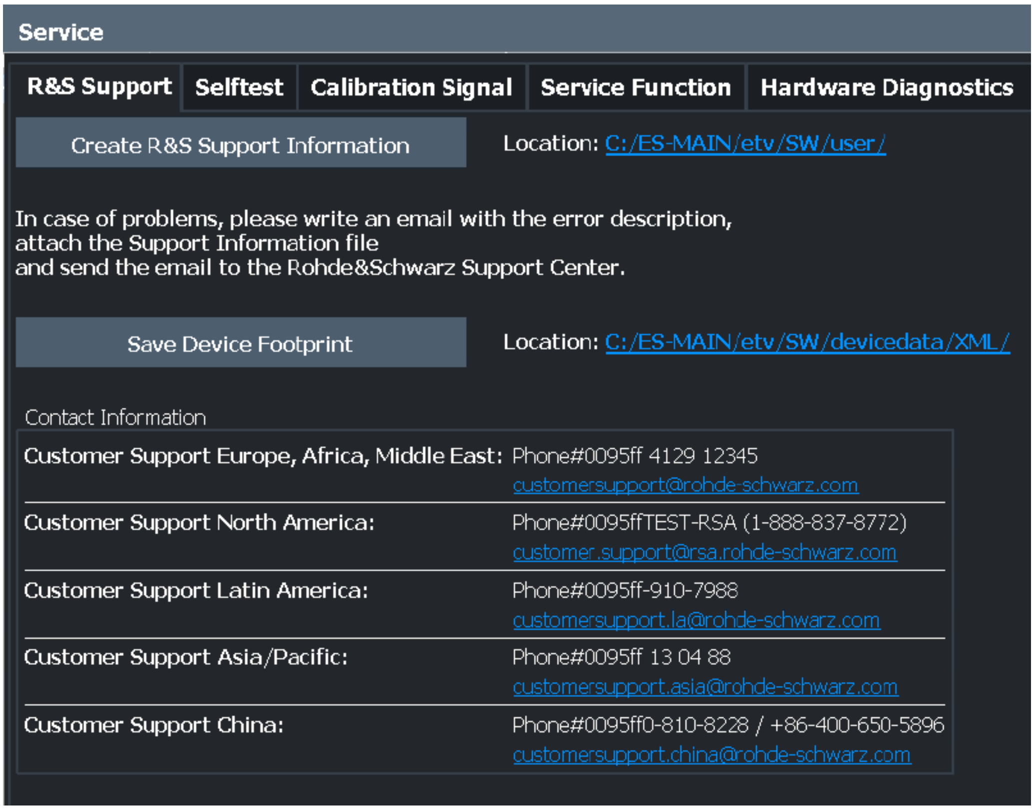
When unexpected problems arise with the R&S FSMR3 some service functions may help you solve them.

For more helpful information for support, see also Chapter 13.6, "Collecting information for support", on page 700

10.5.1 R&S support information

Access: [Setup] > "Service" > "R&S Support"

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



Create 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 C:\R_S\INSTR\USER directory on the instrument.

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

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 624

Save Device Footprint

Creates an *.xml file with information on installed hardware, software, image and FPGA versions. The *.xml file is stored under C:\Program Files (x86)\Rohde-Schwarz\FSMR3000\<version>\devicedata\xml\ on the instrument. It is also included in the service ZIP file (see "Create R&S Support Information" on page 303).

Remote command:
SYSTem:DFPRint on page 619

10.5.2 Self-test settings and results

Access: [Setup] > "Service" > "Selftest"

If the R&S FSMR3 fails you can perform a self-test of the instrument to identify any defective modules.

Once the self-test is started, all modules are checked consecutively and the test result is displayed. You can abort a running test.

In case of failure a short description of the failed test, the defective module, the associated value range and the corresponding test results are indicated.

A running Sequencer process is aborted when you start a self-test.

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.

Remote command:

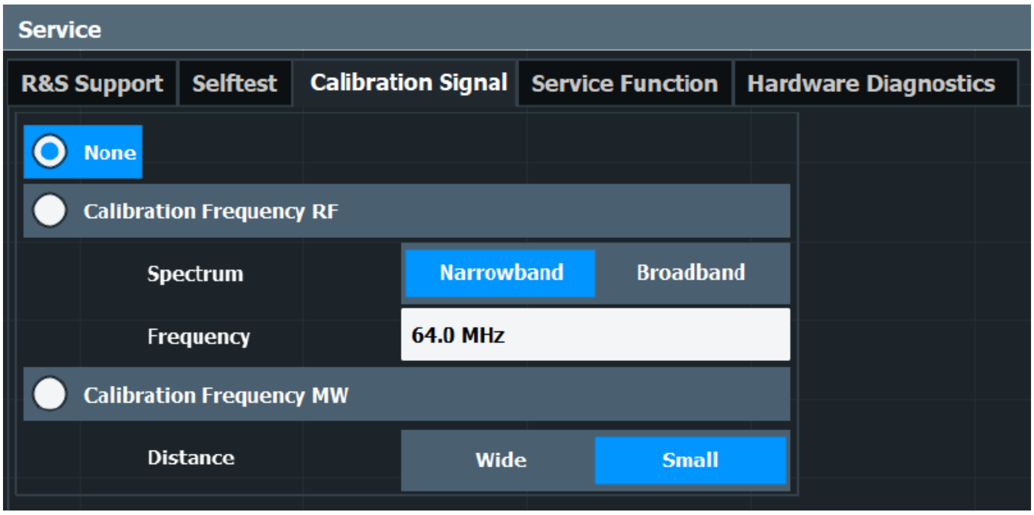
`*TST?` on page 392

`DIAGnostic:SERVice:STESt:RESult?` on page 598

10.5.3 Calibration signal display

Access: [Setup] > "Service" > "Calibration Signal"

As an alternative to the RF input signal from the front panel connector, you can use the instrument's calibration signal as the input signal, for example to perform service functions on.



NONE

Uses the current RF signal at the input, i.e. no calibration signal (default).

Remote command:
`DIAGnostic:SERVice:INPut[:SELect]` on page 597

Calibration Frequency RF

Uses the internal calibration signal as the RF input signal.

Remote command:
`DIAGnostic:SERVice:INPut[:SELect]` on page 597
`DIAGnostic:SERVice:INPut:PULSed:CFRequency` on page 596

Spectrum ← Calibration Frequency RF

Defines whether a broadband or narrowband calibration signal is sent to the RF input.

"Narrowband" Used to calibrate the absolute level of the frontend at 64 MHz.

"Broadband" Used to calibrate the IF filter.

Remote command:
`DIAGnostic:SERVice:INPut:RF[:SPECtrum]` on page 597

Frequency ← Calibration Frequency RF

Defines the frequency of the internal broadband calibration signal to be used for IF filter calibration (max. 64 MHz).

For narrowband signals, 64 MHz is sent.

Calibration Frequency MW
Uses the microwave calibration signal as the RF input (for frequencies higher than 8 GHz). This function is used to calibrate the YIG-filter on the microwave converter. The microwave calibration signal is pulsed.

You can define whether the distance between input pulses is small or wide.

Remote command:
`DIAGnostic:SERVice:INPut[:SELect]` on page 597
`DIAGnostic:SERVice:INPut:MC[:DISTance]` on page 649

10.5.4 Service functions

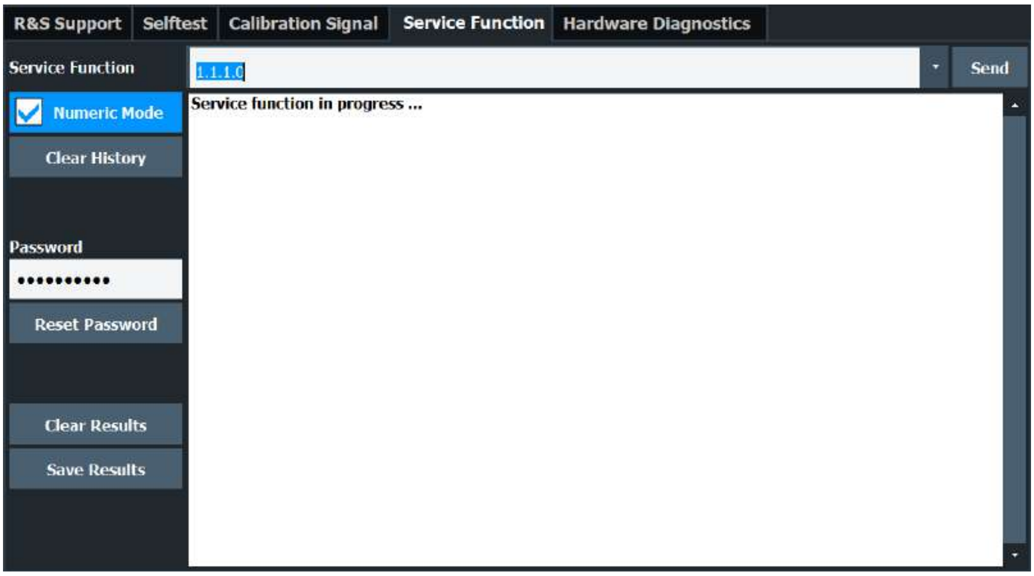
Access: [Setup] > "Service" > "Service Function"

NOTICE

Using service functions

The service functions are not necessary for normal measurement operation. Incorrect use can affect correct operation and/or data integrity of the R&S FSMR3.

Therefore, only user accounts with administrator rights can use service functions and many of the functions can only be used after entering a password. These functions are described in the instrument service manual.



Service Function

Selects the service function by its numeric code or textual name.

The selection list includes all functions previously selected (since the last "Clear History" action).

Remote command:
`DIAGnostic:SERVice:SFUNction` on page 623

Send

Starts the selected service function.

Remote command:
`DIAGnostic:SERVice:SFUNction` on page 623

Numeric Mode

If activated, the service function is selected by its numeric code. Otherwise, the function is selected by its textual name.

Clear History

Deletes the list of previously selected service functions.

Password

Most service functions require a special password as they may disrupt normal operation of the R&S FSMR3. There are different levels of service functions, depending on how restrictive their use is handled. Each service level has a different password.

"Reset Password" clears any previously entered password and returns to the most restrictive service level.

Remote command:
`SYSTem:PASSword[:CENable]` on page 625
`SYSTem:PASSword:RESet` on page 625

Clear Results

Clears the result display for all previously performed service functions.

Remote command:
`DIAGnostic:SERVice:SFUNction:RESults:DELete` on page 624

Save Results

Saves the results of all previously performed service functions to a file stored as `C:\R_S\INSTR\results\Servicelog.txt`.

Remote command:
`DIAGnostic:SERVice:SFUNction:RESults:SAVE` on page 624

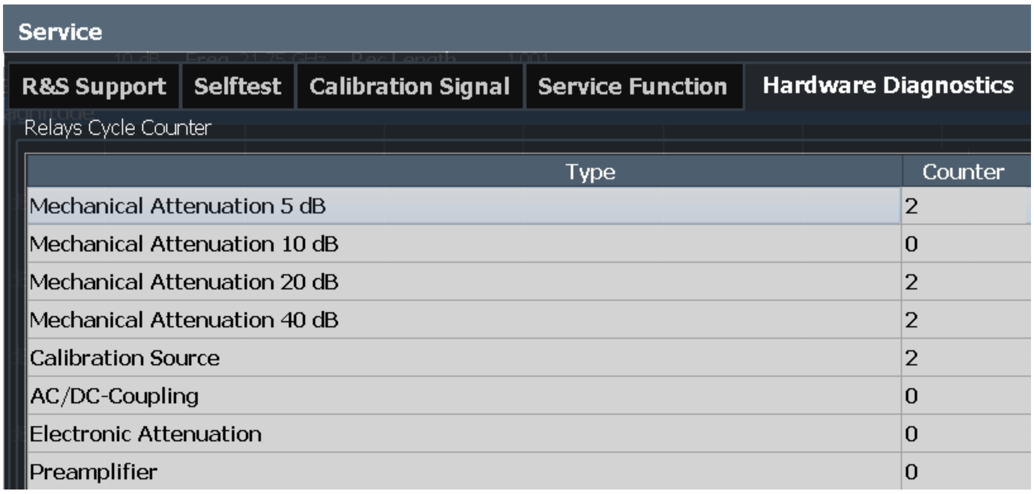
Result List

The Results List indicates the status and results of the executed service functions.

10.5.5 Hardware diagnostics

In case problems occur with the instrument hardware, some diagnostic tools provide information that may support troubleshooting.

The hardware diagnostics tools are available in the "Hardware Diagnostics" tab of the "Service" dialog box.



Relays Cycle Counter
The hardware relays built into the R&S FSMR3 may fail after a large number of switching cycles (see data sheet). The counter indicates how many switching cycles the individual relays have performed since they were installed.

Remote command:
`DIAGnostic:INFO:CCOunt?` on page 617

10.6 Synchronizing measurement channel configuration

Access: [SETUP] > "Parameter Coupling"

Each of the applications of the R&S FSMR3 is usually treated as an independent entity regarding their configuration: changing a setting in one measurement channel does not automatically change the corresponding setting in another channel.

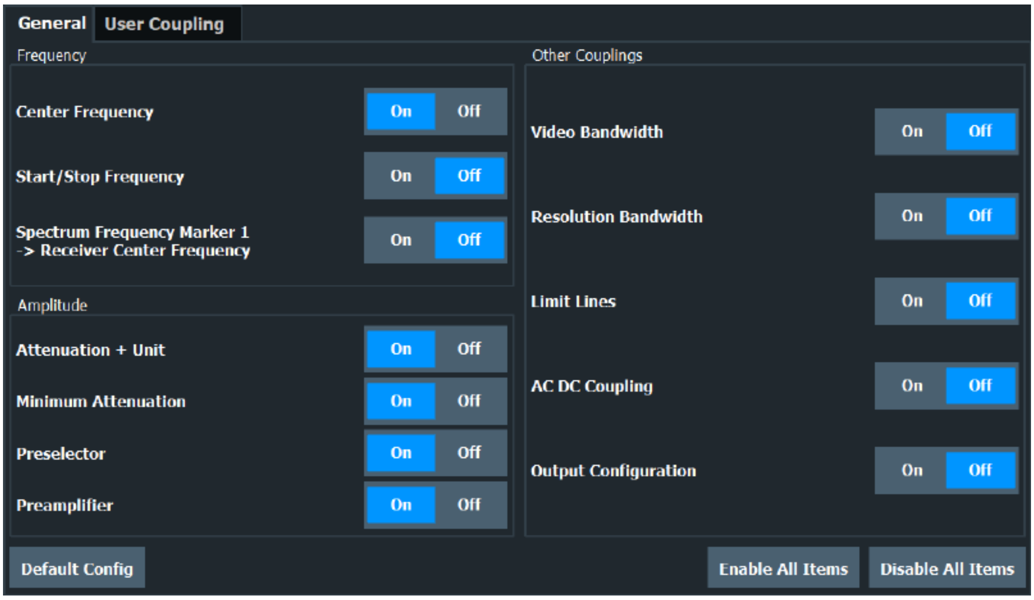
However, sharing settings can be convenient for certain measurement tasks. The R&S FSMR3 provides a tool to couple (or synchronize) selected parameters across applications - the coupling manager.

The coupling managers allows you not only to couple parameters, but also markers and lines accross applications.

10.6.1 General parameter coupling

Access: [SETUP] > "Parameter Coupling" > "General"

The "General" tab of the coupling manager contains several parameters that you can couple across all (active) measurement channels - if the channel supports the corresponding parameter.



When you couple a parameter across all active measurement channels, a change in the currently selected application is passed on to all other active measurement channels.

Synchronizing parameters across all measurement channels

To synchronize a specific parameter, turn on the corresponding function.

Note that you cannot synchronize all parameters at the same time, because some parameters are interdependent. For example, you cannot synchronize the resolution and video bandwidth simultaneously, because the video bandwidth depends on the resolution bandwidth and vice versa.

"Center Frequency"

Synchronizes the center frequency

Remote command:
`INSTrument:COUPle:CENTer` on page 628

"Start / Stop Frequency"
Synchronizes the start and stop frequencies for measurements in the frequency domain
Note: The start and stop frequencies can automatically change when you change another frequency parameter (such as center frequency or span).

Remote command:
`INSTrument:COUPle:SPAN` on page 631

"Reference Level"
Synchronizes the reference level

Remote command:
`INSTrument:COUPle:RLEVel` on page 631

"Attenuation"
Synchronizes the attenuation

Remote command:
`INSTrument:COUPle:ATTen` on page 627

"Preamplifier"
Synchronizes the gain of the optional preamplifier

Remote command:
`INSTrument:COUPle:GAIN` on page 629

"Amplitude Unit"
Synchronizes the unit of the level axis

Remote command:
`INSTrument:COUPle:AUNit` on page 627

"Video Bandwidth"
Synchronizes the video bandwidth
Note: You cannot synchronize the video bandwidth and the resolution bandwidth is not possible.

Remote command:
`INSTrument:COUPle:VBW` on page 632

"Resolution Bandwidth"
Synchronizes the measurement bandwidth
Note: You cannot synchronize the video bandwidth and the resolution bandwidth simultaneously.

Remote command:
`INSTrument:COUPle:BANDwidth` on page 628

"Limit Lines"
Activates the limit line over all channels
Note: Limit lines are only synchronized over channels if the limit line is compatible to the channel configuration (especially units of the x- and y-axis).

Remote command:
`INSTrument:COUPle:LIMit` on page 629

"AC DC Coupling"
Synchronizes the Input Coupling

Remote command:
`INSTrument:COUPle:ACDC` on page 627

"Impedance"
Synchronizes the impedance for RF input

Remote command:
`INSTrument:COUPle:IMPedance` on page 629

Selecting all or no coupling mechanisms
Select all items available in the general coupling manager using the "Enable All Items" button.

Note that you cannot actually select all items, because some of them are mutually exclusive.

Deselect all items available in the coupling manager using the "Disable All Items" button.

Remote command:
not supported

Restoring the default configuration
You can restore the default parameter coupling configuration any time with the "Default Config" button.

Remote command:
not supported

10.6.2 User-defined parameter coupling

Access: [SETUP] > "Parameter Coupling" > "User Coupling"

User couplings allow you to synchronize user-defined parameters, as well as markers and lines, between measurement channels.

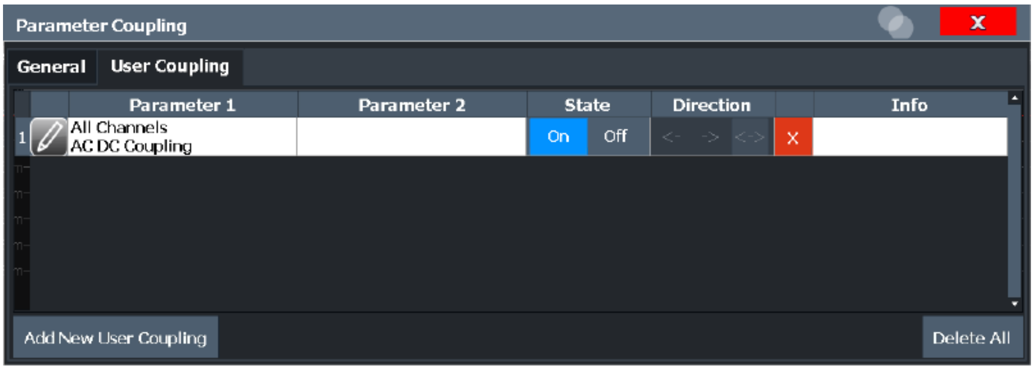
Compared to the predefined couplings, user couplings do not necessarily have to synchronize all active measurement channels. Instead you can define specific channels that are synchronized with each other, in any combination, while other channels remain independent.

Example:

You currently run two instances of the Spectrum application, two instances of the VSA application, and one instance of the AM/FM/PM Analog Demod application.

You can synchronize only the first instance of the Spectrum application with the first instance of the VSA application, while the other three channels remain independent.

Alternatively, you can synchronize all instances of the VSA application, while the Spectrum and AM/FM/PM Analog Demod applications remain independent.



Any existing user-defined couplings are displayed in the dialog box.

Index

Index of the user-defined parameter coupling, used to identify the definition in remote operation.

Remote command:
INSTrument:COUPle:USER<uc>:NUMBers:LIST? on page 638

Edit coupling definition

Opens a dialog box to edit the selected coupling. See "Add New User Coupling" on page 313.

Remote command:
INSTrument:COUPle:USER<uc> on page 632

Parameter 1 / Parameter 2

The coupled parameters, markers, or lines.

Remote command:
INSTrument:COUPle:USER<uc>:NEW? on page 636

State

Enables or disables the coupling.

Remote command:
INSTrument:COUPle:USER<uc>:STATe on page 639

Direction

Determines which parameter controls the other.

"<-" Parameter 2 controls parameter 1. If parameter 2 is changed, parameter 1 is adapted. If parameter 1 is changed, parameter 2 remains unchanged.

Remote command:
INST:COUP:USER:REL RTOL

"->" Parameter 1 controls parameter 2. If parameter 1 is changed, parameter 2 is adapted. If parameter 2 is changed, parameter 1 remains unchanged.

Remote command:
INST:COUP:USER:REL LTOR

"<->" Both parameters are equal. If one parameter is changed, the other parameter is adapted and vice versa.

Remote command:
INST:COUP:USER:REL BID

Delete coupling definition

Deletes the selected coupling definition permanently.

Remote command:
INSTrument:COUPle:USER<uc>:REMove on page 639

Info

Shows information for the selected coupling, for example, restrictions regarding the coupling.

Note that usually, no information is displayed.

Remote command:
INSTrument:COUPle:USER<uc>:INFO on page 635

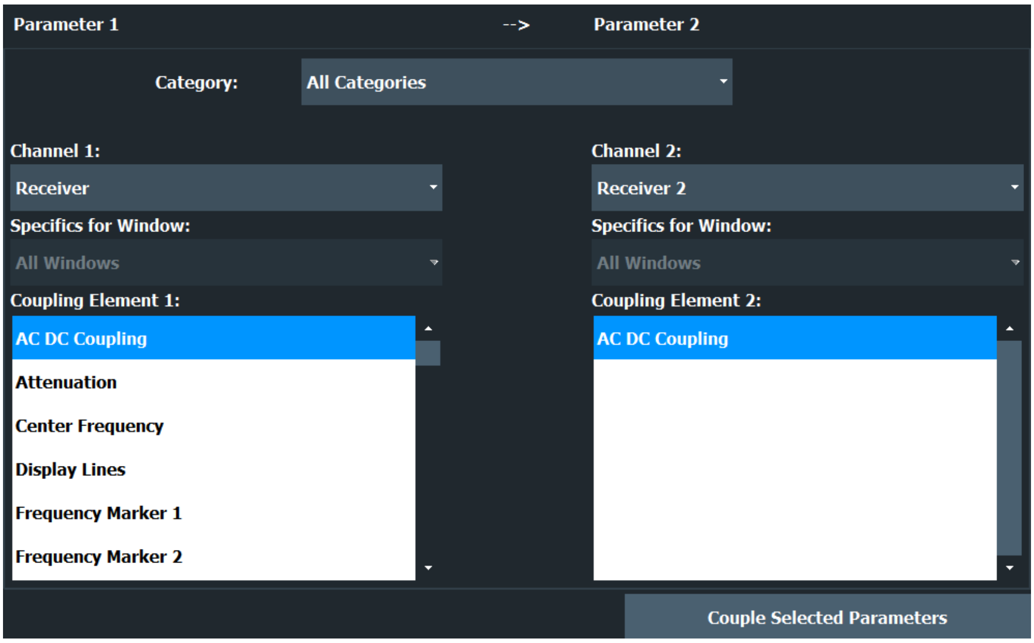
Delete All

Deletes all current coupling definitions. Parameters are no longer coupled.

Remote command:
INSTrument:COUPle:USER<uc>:REMove on page 639

Add New User Coupling

Opens a dialog box to create a new user-defined coupling definition.



Remote command:
INSTrument:COUPle:USER<uc>:NEW? on page 636

Category ← Add New User Coupling
Selects the category of parameters to be displayed in the Coupling Element 1 / Coupling Element 2 selection list.

Channel 1 / Channel 2 ← Add New User Coupling
Selects the channels for which the parameters are coupled. Only active channels are available for selection. If no other active measurement channels have the selected parameter, "Channel 2" is not available.

The following selections are possible:
- Individual channels
- All channels of the same type
- All channels

Remote command:
INSTrument:COUPle:USER<uc>:CHANnel:LIST? on page 634

Specifics for Window ← Add New User Coupling
Selects the windows of the selected channel for which the parameters are coupled. This setting is only available for AM/FM/PM Analog Demod channels. Individual windows can only be coupled for frequency markers.

Remote command:
INSTrument:COUPle:USER<uc>:WINDow:LIST? on page 640

Coupling Element 1 / Coupling Element 2 ← Add New User Coupling
Defines the parameter or marker to be coupled. All available elements in the selected applications are displayed. If no other active measurement channels have the selected "Coupling Element 1", "Coupling Element 2" is not available.

Remote command:
INSTrument:COUPle:USER<uc>:ELEMent:LIST? on page 634

Couple Selected Parameters ← Add New User Coupling
Closes the dialog box and adds the new user-defined coupling definition to the list.

10.6.3 How to synchronize parameters

Access: [SETUP] > "Parameter Coupling"

User-defined couplings allow you to couple parameters other than those available in the "General" tab of the coupling manager. Thus, you can create highly customized couplings between measurement channels.

Compared to the predefined couplings, user couplings do not necessarily have to synchronize all active measurement channels. Instead you can define specific channels that are synchronized with each other, in any combination, while other channels remain independent.

How to use predefined parameter couplings

1. Select the [SETUP] key.
2. Select "Parameter Coupling".
3. In the "General" tab, set the parameter you want to synchronize over all measurement channels to "On".
4. Close the dialog box.

How to create user-defined parameter couplings

1. Select the [SETUP] key.
2. Select "Parameter Coupling".
3. Select the "User Coupling" tab.
4. Select "Add New User Coupling".
5. From the "Channel 1" list, select the channels or type of channel to couple.
6. From the "Coupling Element 1" list, select the parameter or marker to couple for the selected measurement channels.
   To shorten the list and restrict it to a certain type of parameters, select a "Category" first.
7. For AM/FM/PM Analog Demod channels and frequency markers only, select the individual windows (in the frequency domain) to couple.
8. To couple specific channels rather than all channels of a type:
   a) Select the second channel for coupling from the "Channel 2" list

b) Select the parameter to which the first parameter is coupled from the "Coupling Element 2" list.
c) For AM/FM/PM Analog Demod channels and frequency markers only, select the individual windows (in the frequency domain) from the second AM/FM/PM Analog Demod channel to couple.

9. Select "Couple Selected Parameters".

   The "Add New User Coupling" dialog box is closed, and the new user-defined coupling is added to the list in the "Parameter Coupling" dialog box.

10. If specific channels are coupled, select the "Direction" to define which channel controls the other, that is: in which channel the parameter is adapted if the other is changed.

11. Close the dialog box.

    From now on, if you change a coupled parameter in one channel, the parameter in the coupled channel or channels is set to the same value.

How to edit user-defined parameter couplings

1. Select the [SETUP] key.
2. Select "Parameter Coupling".
3. Select the "User Coupling" tab.
4. Select the "Edit" icon for the parameter coupling you want to edit.
5. Continue as described in How to create user-defined parameter couplings, step 5.

How to deactivate user-defined parameter couplings

1. Select the [SETUP] key.
2. Select "Parameter Coupling".
3. Select the "User Coupling" tab.
4. To deactivate the coupling temporarily, without deleting the coupling definition entirely, set the "State" of the coupling to "Off".
   To delete the coupling permanently, select the "Delete" icon for the parameter coupling you want to remove.
5. Close the dialog box.

10.6.4 Example for a user-defined parameter coupling

Currently two Spectrum application channels are active, one VSA channel, and two AM/FM/PM Analog Demod channels.

Synchronizing all Spectrum channels

The following example demonstrates how to synchronize the center frequency in all Spectrum application channels, while the VSA and AM/FM/PM Analog Demod applications remain independent.

1. Select the [SETUP] key.
2. Select "Parameter Coupling".
3. Select the "User Coupling" tab.
4. Select "Add New User Coupling".
5. From the "Channel 1" list, select "All Spectrum".
6. From the "Coupling Element 1" list, select "Center Frequency".
7. Select "Couple Selected Parameters".
8. Close the "Parameter Coupling" dialog box.
9. In the first Spectrum channel, change the "Center Frequency" to 1 GHz.
10. Switch to the second Spectrum channel.

    The center frequency in the second Spectrum channel is also set to 1 GHz.

Synchronizing specific channels

The following example demonstrates how to synchronize the attenuation only for the first Spectrum channel and the first AM/FM/PM Analog Demod channel, while the other three channels remain independent.

1. Select "Add New User Coupling".
2. From the "Channel 1" list, select "Spectrum 1".
3. From the "Coupling Element 1" list, select "Attenuation".
4. From the "Channel 2" list, select "AnaDemod 1".
5. From the "Coupling Element 2" list, select "Attenuation".
6. Select "Couple Selected Parameters".
7. Close the "Parameter Coupling" dialog box.
8. In the first Spectrum channel, change the "Attenuation" to 15 dB.
9. Switch to the first AM/FM/PM Analog Demod channel.

    The attenuation in the second AM/FM/PM Analog Demod channel is also set to 15 dB.

Synchronizing markers in AM/FM/PM Analog Demod windows

Now you have two AM/FM/PM Analog Demod channels. AnaDemod1 has an FM Spectrum and an FM Time Domain window. AnaDemod2 has an RF Spectrum and an RF Time Domain window. Only when the frequency marker in the FM Spectrum window is moved, the marker in the RF Spectrum window is to move to the same position.

1. Select "Add New User Coupling".
2. From the "Channel 1" list, select "AnaDemod 1".
3. From the "Coupling Element 1" list, select "Frequency Marker 1".
4. From the "Specifics for Window" list, select window "1" (which is the FM Spectrum window).
5. From the "Channel 2" list, select "AnaDemod 2".
6. From the "Coupling Element 2" list, select "Frequency Marker 1".
7. From the "Specifics for Window" list, select window "1" (which is the RF Spectrum window).
8. Select "Couple Selected Parameters".
9. In the "Parameter Coupling" dialog box, for the coupling definition for the frequency markers in the AM/FM/PM Analog Demod channels, select the "Direction": "->"
10. Close the "Parameter Coupling" dialog box.
11. In the first AnaDemod channel, set the frequency marker in the FM Spectrum to 900 MHz.

    In the second AnaDemod channel, the frequency marker in the RF Spectrum is also at 900 MHz.
12. In the second AnaDemod channel, set the frequency marker in the RF Spectrum to 1100 MHz.

    In the first AnaDemod channel, the frequency marker in the FM Spectrum is still at 900 MHz.

11 Network operation and remote control

In addition to working with the R&S FSMR3 interactively, located directly at the instrument, it is also possible to operate and control it from a remote PC. Various methods for remote operation are supported:

- Connecting the instrument to a (LAN) network
- Using the web browser interface in a LAN network
- Using the Windows Remote Desktop application in a LAN network
- Connecting a PC via the GPIB interface

Basic information on operating the R&S FSMR3000 via remote control is provided here. This information applies to all applications and operating modes on the R&S FSMR3000.

For additional information on remote control of spectrum analyzers see the following documents available from the Rohde & Schwarz website:

- Remote control via SCPI
- 1EF62: Hints and Tricks for Remote Control of Spectrum and Network Analyzers
- 1MA171: How to use Rohde & Schwarz Instruments in MATLAB
- 1MA208: Fast Remote Instrument Control with HiSLIP

How to configure the remote control interfaces is described in Chapter 11.7, "How to set up a network and remote control", on page 366.

11.1 Remote control interfaces and protocols

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

For a description of the protocols refer to Remote control via SCPI.

Table 11-1: Remote control interfaces and protocols

Interface	Protocols, VISA*) address string	Port **)	Remarks
Local Area Network (LAN)	**HiSLIP** High-Speed LAN Instrument Protocol (IVI-6.1) `TCPIP::host address::hislip0[::INSTR]`	TCP port: 4880	A LAN connector is located on the rear panel of the instrument.
	VXI-11 `TCPIP::host address::inst0[::INSTR]` Library: VISA	TCP or UDP port: 111 TCP port: well-known ports (600 - 1023) for Linux or registered ports (1024 - 49151) for Windows	
	socket communication (Raw Ethernet, simple Telnet) `TCPIP::host address[::LAN device name]::<port>::SOCKET` Library: VISA or socket controller	SCPI raw, TCP port: 5025, 5125 SCPI telnet, TCP port: 5024, 5124	
	VNC	via VNC client: 5800/5900 Device web: 5850	
	Device web / web control	80	
GPIB (IEC/IEEE Bus Interface)	VISA*) address string: `GPIB::primary address[::INSTR]` (no secondary address)		A GPIB bus interface according to the IEC 625.1/IEEE 488.1 standard is located on the rear panel of the instrument.
USB	VISA*) address string: `USB::<vendor ID>::<product_ID>::<serial_number>[::INSTR]`		USB connectors are located on the front and rear panel of the instrument.

*) 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.

**) By default, R&S FSMR3 use these ports for communication via LAN control interface. If necessary, adapt your firrewall to allow for use of these ports.

11.1.1 LAN interface

To be integrated in a LAN, the instrument is equipped with a LAN interface, consisting of a connector, a network interface card and protocols. The network card can be operated with the following interfaces:

- 10 Mbit/s Ethernet IEEE 802.3
- 100 Mbit/s Ethernet IEEE 802.3u
- 1Gbit/s Ethernet IEEE 802.3ab

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.

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]`

or

`TCPIP::host address::port::SOCKET`

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 subinstrument;
  – `inst0` selects the VXI-11 protocol (default)
  – `hislip0` selects the newer HiSLIP protocol
- **INSTR** indicates the instrument resource class (optional)
- **port** determines the used port number
- **SOCKET** indicates the raw network socket resource class

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 *FSMR3026-123456*; the valid resource string using HiSLIP is:
  `TCPIP::FSMR3026-123456::hislip0`
- A raw socket connection can be established using:
  `TCPIP::192.1.2.3::5025::SOCKET`

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 the resource string.

For details on configuring the LAN connection, see Chapter 11.7.1, "How to configure a network", on page 367.

11.1.1.1 LAN web browser interface

The LAN web browser interface allows for easy configuration of the LAN and remote control of the R&S FSMR3 without additional installation requirements.

The instrument's LAN web browser interface works correctly with all W3C compliant browsers.

Via the web browser interface to the R&S FSMR3 you can control the instrument remotely from another PC. Manual instrument controls are available via the front panel simulation. File upload and download between the instrument and the remote PC is also available. Using this feature, several users can access *and operate* the R&S FSMR3 simultaneously. This is useful for troubleshooting or training purposes.

For details, see Chapter 11.7.1.4, "How to configure the LAN using the web browser interface", on page 371 and Chapter 11.7.5, "How to control the R&S FSMR3 via the web browser interface", on page 376.

If you do not want other users in the LAN to be able to access and operate the R&S FSMR3 you can deactivate this function.

See Chapter 11.7.6, "How to deactivate the web browser interface", on page 378.

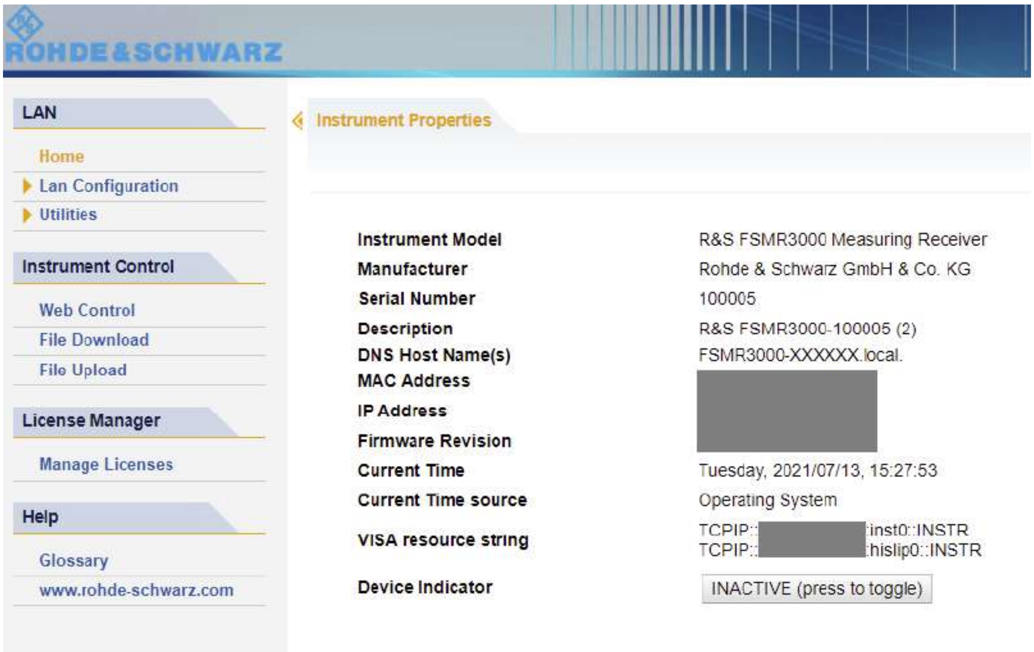
Restrictions

Only user accounts with administrator rights can use the LAN web browser functionality.

To display the LAN web browser interface

► In the address field of the browser on your PC, type the host name or IP address of the instrument, for example: *http://10.113.10.203*.

The instrument home page (welcome page) opens.



The navigation pane of the browser interface contains the following elements:

- "LAN"

  - "Home" opens the instrument home page.
    The home page displays device information, including the VISA resource string in read-only format.
    The "Device Indicator" button allows you to physically identify the instrument. This is useful if you have several instruments and want to know which instrument the LAN home page belongs to. To identify the instrument, activate the "Device Indicator". Then check the "LAN Status" indicator of the instruments.
  - "LAN Configuration" allows you to configure LAN parameters and to initiate a ping.
    (See "Ping client" on page 372.)
  - "Utilities" provides access to an event log.
- "Instrument Control"
  - "Web Control" provides remote access to the instrument via VNC (no installation required). Manual instrument controls are available via the front panel simulation.
  - "File Download" downloads files from the instrument.
  - "File Upload" uploads files to the instrument.

  (See Chapter 11.7.5, "How to control the R&S FSMR3 via the web browser interface", on page 376.)
- "License Manager"
  - "License Manager" allows you to install or uninstall license keys and to activate, register or unregister licenses.
- "Help"
  "www.rohde-schwarz.com" opens the Rohde & Schwarz home page.

11.1.2 USB interface

For remote control via the USB connection, the PC and the instrument must be connected via the USB type B interface. A USB connection requires the VISA library to be installed. VISA detects and configures the R&S instrument automatically when the USB connection is established. You do not have to enter an address string or install a separate driver.

USB address

The used USB address string is:

```
USB::<vendor ID>::<product ID>::<serial number>[::INSTR]
```

where:

- <vendor ID> is the vendor ID for Rohde & Schwarz (0x0AAD)
- <product ID> is the product ID for the Rohde & Schwarz instrument
- <serial number> is the individual serial number on the rear of the instrument

Table 11-2: Product IDs for R&S FSMR3

Instrument model	Product ID
FSMR3008	258
FSMR3026	259
FSMR3050	25A

Example:

`USB0::0x0AAD::0x0259::100001::INSTR`

0x0AAD is the vendor ID for Rohde&Schwarz

0x0259 is the product ID for the R&S FSMR326

100001 is the serial number of the particular instrument

11.2 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 using the `STATus`... commands.

(See Chapter 12.10, "Using the status register", on page 643).

For details on the status reporting system, see Remote control via SCPI.

11.2.1 Hierarchy of status registers

As shown in the following figure, the status information is of hierarchical structure.

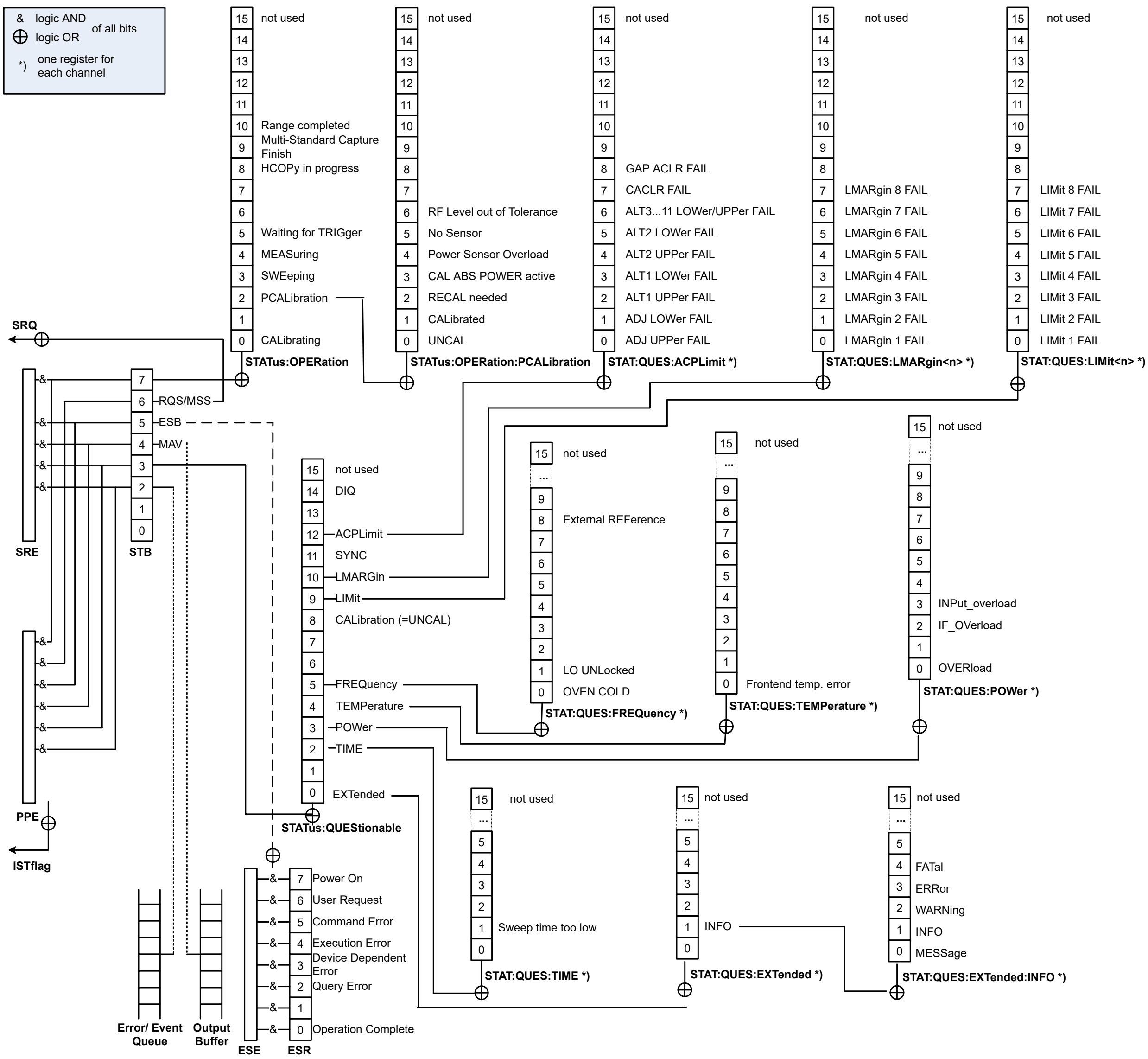


Figure 11-1: Graphical overview of the R&S FSMR3 status registers hierarchy

All status registers have the same internal structure.

11.2.2 Contents of the status registers

In the following sections, the contents of the status registers are described in more detail.

STATus:QUEStionable:SYNC register

The `STATus:QUEStionable:SYNC` register is used by the R&S FSMR3 applications and is described in the individual sections (manuals) for each application.

11.2.2.1 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 11-3: 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.

Bit No.	Meaning
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.
6	MSS bit (main 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.

11.2.2.2 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 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?.

11.2.2.3 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 11-4: 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.

Bit No.	Meaning
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.
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.

11.2.2.4 STATus:OPERation register

The `STATus:OPERation` register contains information on current activities of the R&S FSMR3000. It also contains information on activities that have been executed since the last read out.

Table 11-5: Meaning of the bits used in the STATus:OPERation register

Bit No.	Meaning
0	`CALibrating` This bit is set as long as the instrument is performing a self-alignment.
1-2	Not used
3	`SWEeping` Sweep is being performed in base unit (applications are not considered); identical to bit 4 In applications, this bit is not used.
4	`MEASuring` Measurement is being performed in base unit (applications are not considered); identical to bit 3 In applications, this bit is not used.
5	`Waiting for TRIgger` Instrument is ready to trigger and waiting for trigger signal.
6-7	Not used
8	`HardCOPy` in progress This bit is set while the instrument is printing a hardcopy.
9	not used

Bit No.	Meaning
11-14	Not used
15	This bit is always 0.

11.2.2.5 STATus:QUEStionable register

The STATus:QUEStionable register contains information on instrument states that do not meet the specifications.

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.

Table 11-6: Meaning of the bits used in the STATus:QUEStionable register

Bit No.	Meaning
0	"EXTended" This bit indicates further status information not covered by the other status registers in any of the active channels.
1	Unused
2	"TIMe" This bit is set if a time error occurs in any of the active channels. The STATus:QUEStionable:TIMe register provides more information on the error type.
3	"POWer" This bit is set if the measured power level in any of the active channels is questionable. The STATus:QUEStionable:POWer register provides more information on the error type.
4	"TEMPerature" This bit is set if the temperature is questionable.
5	"FREQuency" This bit is set if there is anything wrong with the frequency of the local oscillator or the reference frequency in any of the active channels. The STATus:QUEStionable:FREQuency register provides more information on the error type.
6 - 7	Unused
8	"CALibration" This bit is set if the R&S FSMR3 is unaligned ("UNCAL" display)

Bit No.	Meaning
9	"LIMit" (device-specific) This bit is set if a limit value is violated in any of the active channels in any window. The STATus:QUEStionable:LIMit register provides more information on the error type.
10	"LMARgin" (device-specific) This bit is set if a margin is violated in any of the active channels in any window. The STATus:QUEStionable:LMARgin register provides more information on the error type.
11	"SYNC" (device-specific) This bit is set if the R&S FSMR3 is not synchronized to the signal that is applied. The R&S FSMR3 is not synchronized if: ● it cannot synchronize to midamble during a measurement or premeasurement ● it cannot find a burst during a measurement or premeasurement ● the results deviate too much from the expected value during premeasurements
12	"ACPLimit" (device-specific) This bit is set if a limit during ACLR measurements is violated in any of the active channels. The STATus:QUEStionable:ACPLimit register provides more information on the error type.
13 13-14	Unused
15	This bit is always 0.

11.2.2.6 STATus:QUEStionable:ACPLimit register

Available for the Spectrum application.

The STATus:QUEStionable:ACPLimit register contains information about the results of a limit check during ACLR measurements. A separate ACPLimit register exists for each active channel.

You can read out the register with `STATus:QUEStionable:ACPLimit:CONDition?` or `STATus:QUEStionable:ACPLimit[:EVENt]?`

Table 11-7: Meaning of the bits used in the STATus:QUEStionable:ACPLimit register

Bit No.	Meaning
0	ADJ UPPer FAIL This bit is set if the limit is exceeded in the **upper adjacent** channel
1	ADJ LOWer FAIL This bit is set if the limit is exceeded in the **lower adjacent** channel.
2	ALT1 UPPer FAIL This bit is set if the limit is exceeded in the **upper 1st alternate** channel.
3	ALT1 LOWer FAIL This bit is set if the limit is exceeded in the **lower 1st alternate** channel.
4	ALT2 UPPer FAIL This bit is set if the limit is exceeded in the **upper 2nd alternate** channel.

Bit No.	Meaning
5	ALT2 LOWer FAIL This bit is set if the limit is exceeded in the **lower 2nd alternate** channel.
6	ALT3 … 11 LOWer/UPPer FAIL This bit is set if the limit is exceeded in one of the lower or upper alternate channels 3 … 11.
7	CACLR FAIL This bit is set if the CACLR limit is exceeded in one of the gap channels.
8	GAP ACLR FAIL This bit is set if the ACLR limit is exceeded in one of the gap channels.
9 to 14	Unused
15	This bit is always 0.

11.2.2.7 STATus:QUEStionable:EXTended register

The `STATus:QUEStionable:EXTended` register contains further status information not covered by the other status registers of the R&S FSMR3000. 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 11-8: 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.

11.2.2.8 STATus:QUEStionable:EXTended:INFO register

The `STATus:QUEStionable:EXTended:INFO` register contains information on the type of messages that occur during operation of the R&S FSMR3000. 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 648.

Table 11-9: 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.

11.2.2.9 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 11-10: Meaning of the bits used in the STATus:QUEStionable:FREQuency register

Bit No.	Meaning
0	OVEN COLD This bit is set if the reference oscillator has not yet attained its operating temperature. "OCXO" is displayed.
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.

11.2.2.10 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.

Table 11-11: 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.
8 to 14	Unused
15	This bit is always 0.

11.2.2.11 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 11-12: 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.

Bit No.	Meaning
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.

11.2.2.12 STATus:QUEStionable:POWer register

The `STATus:QUEStionable:POWer` register contains information about possible overload situations that may occur during operation of the R&S FSMR3000. 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]?`

Table 11-13: Meaning of the bits used in the STATus:QUEStionable:POWer register

Bit No.	Meaning
0	OVERload This bit is set if an overload occurs at the RF input, causing signal distortion but not yet causing damage to the device. The R&S FSMR3 displays the keyword "RF OVLD".
1	Unused
2	IF_OVerload This bit is set if an overload occurs in the IF path. The R&S FSMR3 displays the keyword "IF OVLD".
3	Input Overload This bit is set if the signal level at the RF input connector exceeds the maximum. The RF input is disconnected from the input mixer to protect the device. In order to re-enable measurement, decrease the level at the RF input connector and reconnect the RF input to the mixer input. The R&S FSMR3 displays the keyword "INPUT OVLD".

Bit No.	Meaning
4 to 14	Unused
15	This bit is always 0.

11.2.2.13 STATus:QUEStionable:TEMPerature register

The STATus:QUEStionable:TEMPerature register contains information about possible temperature deviations that may occur during operation of the R&S FSMR3000. A separate temperature register exists for each active channel.

You can read out the register with `STATus:QUEStionable:TEMPerature:CONDition?` or `STATus:QUEStionable:TEMPerature[:EVENt]?`

Table 11-14: Meaning of the bits used in the STATus:QUEStionable:TEMPerature register

Bit No.	Meaning
0	This bit is set if the frontend temperature sensor deviates by a certain degree from the self-alignment temperature. During warmup, this bit is always 1. For details see "Temperature check" on page 270.
1 to 14	Unused
15	This bit is always 0.

11.2.2.14 STATus:QUEStionable:TIMe register

Available for the Spectrum application.

The `STATus:QUEStionable:TIMe` register contains information about possible time errors that may occur during operation of the R&S FSMR3000. A separate time register exists for each active channel.

Table 11-15: 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.
2 to 14	Unused
15	This bit is always 0.

11.2.3 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 11-16: Resetting the status reporting system

Event	Switching on supply voltage Power-On-Status-Clear		DCL, SDC (Device Clear, Selected Device Clear)	*RST or SYS-Tem:PRESet	STA-Tus: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.						

11.3 GPIB languages

The R&S FSMR3 analyzer family supports a subset of the GPIB commands used by other devices. Thus it can emulate other devices in order to use existing remote control programs.

The device model to be emulated is selected manually using "SETUP > Network + Remote > GPIB tab > Language". Via the GPIB interface using the `SYSTem:LANGuage` on page 655 command.

In order to emulate device models that are not part of the selection list of the GPIB "Language" setting, you can modify the identification string received in response to the ID command ("Identification String" setting). Thus, any device model whose command set is compatible with one of the supported device models can be emulated.

Supported languages

Language	Comment
SCPI	
71100C	Compatible to 8566A/B
71200C	Compatible to 8566A/B
71209A	Compatible to 8566A/B
8560E	
8561E	
8562E	
8563E	
8564E	
8565E	
8566A	Command sets A and B are available. Command sets A and B differ in the rules regarding the command structure.
8566B	
8568A	Command sets A and B are available. Command sets A and B differ in the rules regarding the command structure.
8568A_DC	Uses DC input coupling by default if supported by the instrument
8568B	Command sets A and B are available. Command sets A and B differ in the rules regarding the command structure.
8568B_DC	Uses DC input coupling by default if supported by the instrument
8591E	Compatible to 8594E
8594E	Command sets A and B are available. Command sets A and B differ in the rules regarding the command structure.
PSA89600	
PSA	

Notes:

- If you select a language other than "SCPI", the GPIB address is set to 18 if it was 20 before.
- The Start/stop frequency, reference level and number of sweep points are adapted to the selected instrument model.
- When you switch between remote control languages, the following settings or changes are made:
  SCPI:
  The instrument performs a PRESET.
  8566A/B, 8568A/B, 8594E; FSEA, FSEB, FSEM; FSEK:
  – The instrument performs a PRESET.
  – The following instrument settings are changed:

Table 11-17: Instrument settings for emulation of 8566A/B, 8568A/B, 8594E; FSEA, FSEB, FSEM; FSEK instruments

Model	# of Trace Points	Start Freq.	Stop Freq.	Ref Level	Input Coupling
8566A/B	1001	2 GHz	22 GHz	0 dBm	AC
8568A/B	1001	0 Hz	1.5 GHz	0 dBm	AC
8560E	601	0 Hz	2.9 GHz	0 dBm	AC
8561E	601	0 Hz	6.5 GHz	0 dBm	AC
8562E	601	0 Hz	13.2 GHz	0 dBm	AC
8563E	601	0 Hz	26.5 GHz	0 dBm	AC
8564E	601	0 Hz	40 GHz	0 dBm	AC
8565E	601	0 Hz	50 GHz	0 dBm	AC
8594E	401	0 Hz	3 GHz	0 dBm	AC

Note: The stop frequency indicated in the table may be limited to the corresponding frequency of the R&S FSMR3, if required.

11.4 The IECWIN tool

The R&S FSMR3 is delivered with *IECWIN* installed, an auxiliary tool provided free of charge by R&S. IECWIN is a program to send SCPI commands to a measuring instrument either interactively or from a command script.

The R&S IECWIN32 tool is provided free of charge. The functionality may change in a future version without notice.

IECWIN offers the following features:

- Connection to instrument via several interfaces/protocols (GPIB, VISA, named pipe (if IECWIN is run on the instrument itself), RSIB)
- Interactive command entry
- Browsing available commands on the instrument
- Error checking following every command
- Execution of command scripts
- Storing binary data to a file
- Reading binary data from a file
- Generation of a log file

For command scripts, IECWIN offers the following features:

- Synchronization with the instrument on every command
- Checking expected result for query commands (as string or numeric value)
- Checking for expected errors codes

- Optional pause on error
- Nested command scripts
- Single step mode
- Conditional execution, based on the *IDN and *OPT strings

You can use the IECWIN to try out the programming examples provided in the R&S FSMR3 User Manuals.

Starting IECWIN

IECWIN is available from the Windows "Start" menu on the R&S FSMR3, or by executing the following file:

`C:\Program Files (x86)\Rohde-Schwarz\FSMR3000\<version>\iecwin32.exe`

You can also copy the program to any Windows PC or laptop. Simply copy the `iecwin32.exe`, `iecwin.chm` and `rsib32.dll` files from the location above to the same folder on the target computer.

When the tool is started, a "Connection settings" dialog box is displayed. Define the connection from the computer the IECWIN tool is installed on to the R&S FSMR3 you want to control. If you are using the tool directly on the R&S FSMR3, you can use an NT Pipe (COM Parser) connection, which requires no further configuration. For help on setting up other connection types, check the tool's online help (by clicking the "Help" button in the dialog box).

The IECWIN offers an online help with extensive information on how to work with the tool.

11.5 Automating tasks with remote command scripts

To configure a test setup quickly and make complex test setups or repetitive measurements reproducible, you can automate the required settings with scripts. A script contains a series of SCPI commands corresponding to the settings. When completed, it is converted to an executable format, saved in a file, and can be run whenever needed.

Creating a SCPI script

Using the SCPI Recorder functions, you can create a SCPI script directly on the instrument and then export the script for use on the controller. You can also edit or write a script manually, using a suitable editor on the controller. For manual creation, the instrument supports you by showing the corresponding command syntax for the current setting value.

You can create a SCPI script directly on the instrument at any time of operation, in the following ways:

- Recording individual steps manually

In manual recording mode, you can record an individual SCPI command using the "Add SCPI Command to Recording" function, see "How to record SCPI commands manually" on page 347.

- Recording all performed steps automatically
  The instrument records the SCPI command and settings value of each step you perform, and then writes the commands to the file system, see "How to record SCPI commands automatically" on page 346. You can start, stop and resume automatic recording, and also record individual commands manually.
- Copying commands from the context-sensitive SCPI Recorder menu and pasting them into an editor
  The SCPI Recorder enables you to copy the SCPI command and the current setting shown in the context-sensitive menu and paste them into any suitable editor, see "To edit a SCPI command list" on page 347.

11.5.1 The context-sensitive SCPI command menu

The SCPI Recorder provides information on the required SCPI command for the available measurement settings, functions, and results in a context-sensitive menu. The SCPI command menu is displayed when you tap and hold (right-click) any interface element that allows you to define a setting, perform a function, or displays results, for example:

- Softkeys
- Buttons or input fields in dialog boxes
- Traces or markers in a diagram

Figure 11-2: Context-sensitive SCPI command menu for a trace in a result display

The menu provides the syntax of the remote command with the current setting, and some functions to help you create your script.

Show SCPI result query commands
This menu item is displayed if you selected a result display.

All possible commands to query the results in the diagram are displayed. Select the query command you are interested in to display the SCPI command dialog box, as described in "Show SCPI command" on page 341.

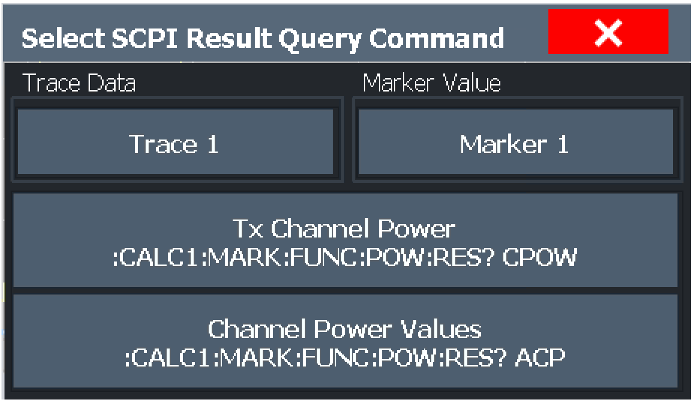


Figure 11-3: Possible result query commands for an ACLR measurement

Show SCPI command

This menu item is displayed if you selected a setting or function.

A dialog box displays the SCPI command required to perform the setting or function, or to query the trace or marker results.

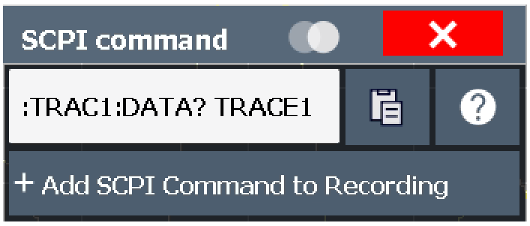


Figure 11-4: SCPI command dialog for a trace in a result display

Copy SCPI Command to Clipboard ← Show SCPI command

Copies the command and the current value for the selected setting to the clipboard.

Help ← Show SCPI command

Provides help on the displayed SCPI command, its syntax and possible parameter values.

Add SCPI Command to Recording ← Show SCPI command

Adds the command and the current value for the selected setting to the recorded SCPI list.

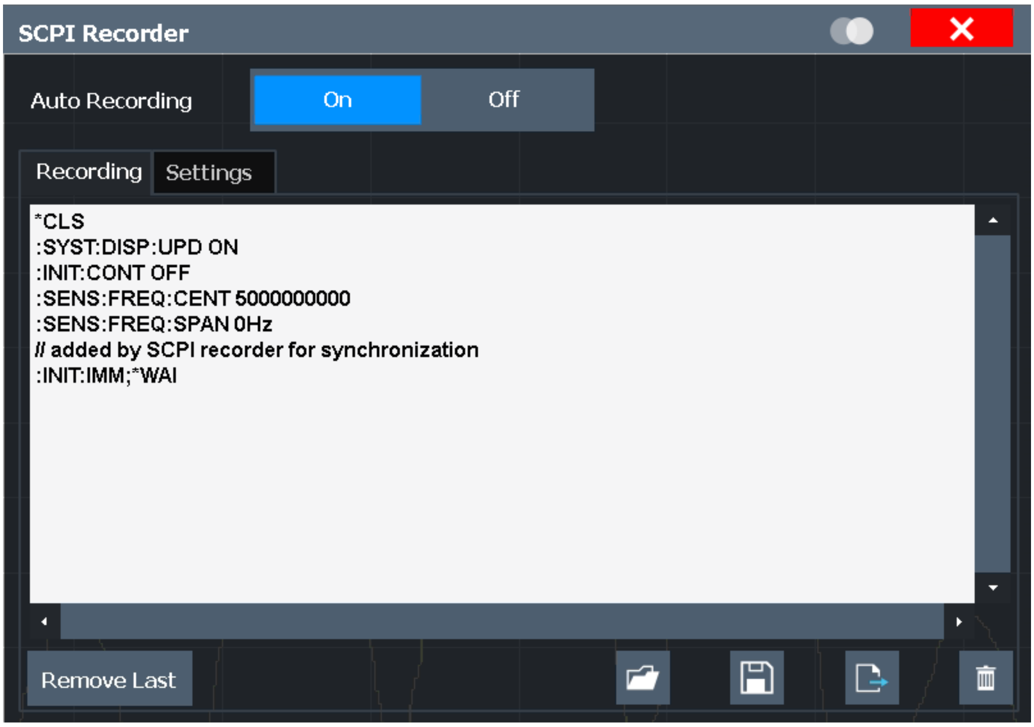
Help

Provides help on the selected setting, function, or result display, as opposed to the SCPI command itself. This function is identical to selecting the context-sensitive help icon in the toolbar and then the interface element.

11.5.2 The SCPI recorder

Access: Toolbar

The SCPI Recorder displays a list of the currently recorded commands and provides functions to create and export a script of SCPI commands. Some additional settings for recording are provided on a separate tab in the dialog box.



Auto Recording

If enabled, the SCPI Recorder automatically records the required SCPI commands and parameter values for the settings and functions you use while operating the R&S FSMR3.

To view the list of currently recorded SCPI commands at any time, select the SCPI Recorder icon in the toolbar.

Recording is stopped when you deactivate "Auto Recording".

To continue recording, reactivate "Auto Recording".

To start a new SCPI command list, select Clear All before activating "Auto Recording".

Note:

- Some parameters cannot be set by a SCPI command.
  In this case, *no SCPI command found* is entered in the list instead of a command when you record settings automatically.
- The R&S FSMR3000 automatically clears the SCPI command list after booting.

Remote command:
`SYSTem:SRECorder[:AUTO]` on page 649

List of recorded commands / script editor
The currently recorded commands are displayed in a basic editor directly in the SCPI Recorder dialog box. Right-click the editor to display a context-sensitive menu with basic editing functions for the list, such as copy, paste, delete, undo and redo.

Remote command:
`SYSTem:SRECorder:DATA[:ALL]?` on page 650

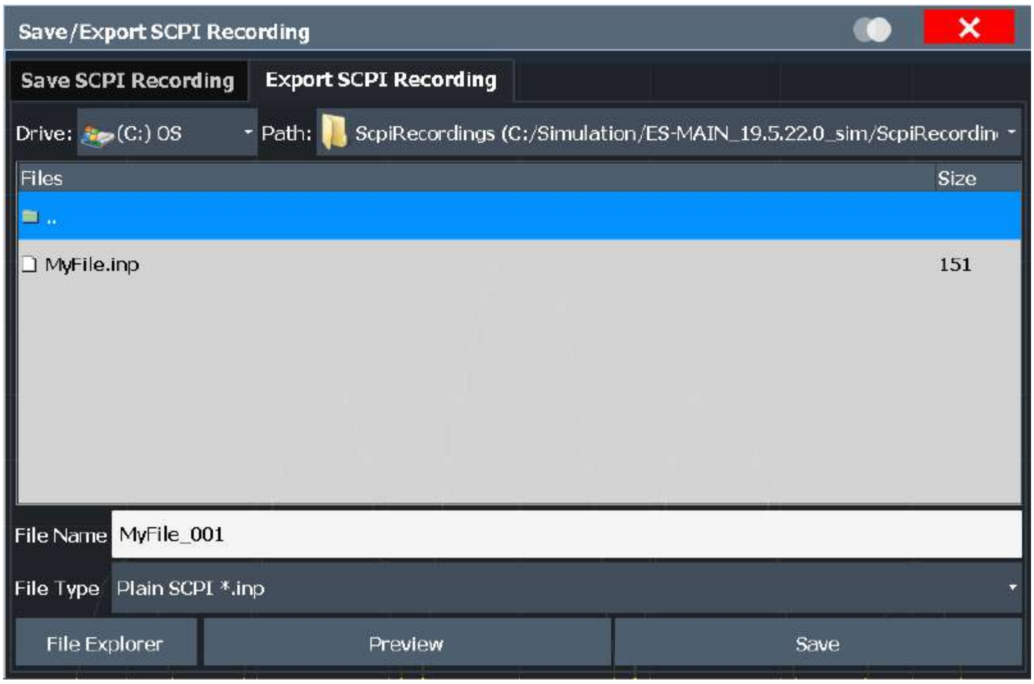
Remove Last
Deletes the last recorded SCPI command from the list.

Load Recording
Loads an existing script in ASCII format (`*.inp`) from a file to the script editor. If the editor contains recorded commands, you must confirm a message to overwrite them. A file selection dialog box is displayed.

Save As
Saves the current SCPI command list to the `C:\R_S\INSTR\ScpiRecordings` directory in ASCII format with the file extension `.inp`.

Tip: You can execute the command list in an `.inp` file without further editing using the IECWIN tool provided with the R&S FSMR3, see Chapter 11.4, "The IECWIN tool", on page 338. You can also reload `.inp` files to the script editor later.

Export
Exports the current SCPI command list to the specified file and directory in the selected format. By default, the file is stored in the `C:\R_S\INSTR\ScpiRecordings` directory. Besides the recorded commands themselves, the exported script includes all format-specific header data required to execute the script using an external program on the controller.



Before storing the file, you can display a **"Preview"** of the file in the selected format.

Currently, the following file formats are supported:

"C#" — A commonly used general programming language for various applications (`*.cs`)

"C++" — A commonly used general programming language for various applications (`*.cpp`)

"MATLAB (Instrument Control Toolbox)" — A programming environment, frequently used in signal processing and test and measurement applications (`*.m`)
You can use this format directly with the MATLAB© Instrument Control Toolbox.

"MATLAB (R&S Toolkit)" — You can use this format directly with the MATLAB© Toolkit.

"NICVI" — An ANSI C programming environment designed for measurements and tests (`*.cvi`)
You can use this format directly with National Instruments LabWindows CVI.

"Plain SCPI" — Represents SCPI base format, that is ASCII format, saved as a text file (`*.inp`); contains no additional header data
Use this format to load a recorded script back to the editor later.

"Python" — A commonly used general programming language for various applications (`.py`)

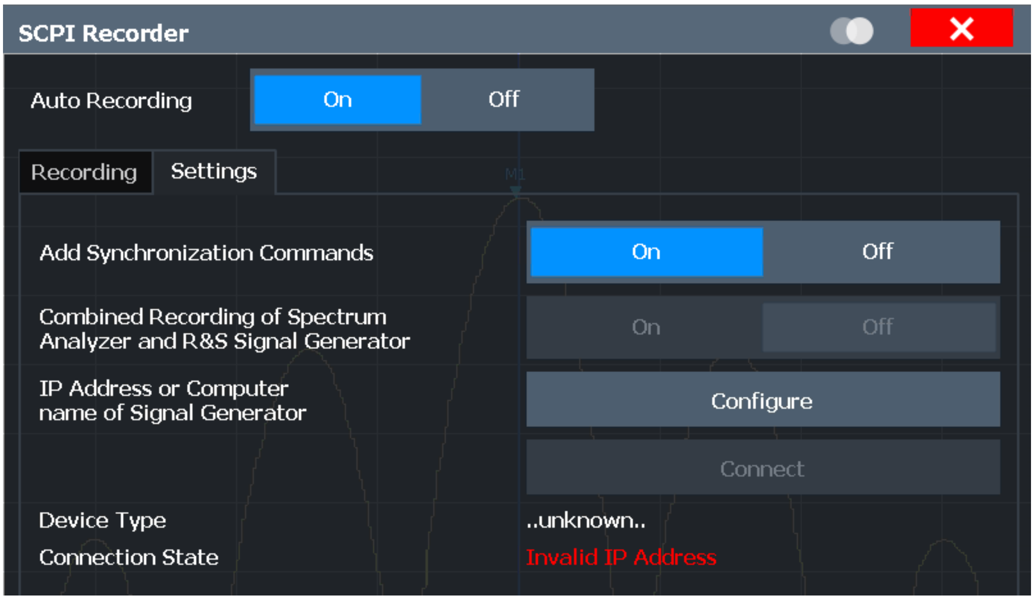
Remote command:
`SYSTem:SRECorder:EXPort` on page 652

Clear All

Removes all recorded commands from the current SCPI command list.

Remote command:
SYSTem:SRECorder:CLEar on page 650

Settings



Some additional settings are available to configure the exported SCPI command files.

Add Synchronization Commands ← Settings

If enabled, additional commands are included in the script to synchronize the recorded commands when necessary. For instance, when a measurement is started, a `*WAI` command is inserted to ensure that the next command is only executed after the measurement has finished.

Remote command:
SYSTem:SRECorder:SYNC on page 653

11.5.3 How to determine the required SCPI command

The SCPI Recorder provides information on the required SCPI command for the available measurement settings, functions, and results in a context-sensitive menu.

1. Define the setting or navigate to the function you need the SCPI command for.
   To find the query command for trace or marker results, select the result diagram.
2. On the screen, tap and hold, or right-click the measurement setting, function, or result display.

   The context-sensitive menu for that particular setting, function, or result is displayed.

   Tip: If the SCPI command menu is not displayed, you probably tapped outside of a softkey or input field, for example in a block diagram. Tap within the corresponding softkey, button or input field, or in a result display, to display the context-sensitive SCPI command menu.

3. Select "Show SCPI result query commands" or "Show SCPI command", depending on which item you selected.

   A dialog box with the required command and some functions is displayed.
   If multiple commands are possible, for example to query different measurement results, all possible commands are displayed.

4. To display the SCPI command dialog box for a query command, select the query command you are interested in from the list.

11.5.4 How to create and export SCPI scripts

Using the SCPI Recorder functions, you can create a SCPI script directly on the instrument and then export the script for use on the controller. The SCPI Recorder allows you to record SCPI command lists either automatically or manually.

How to record SCPI commands automatically

The following procedure explains how to record SCPI commands automatically during operation.

1. Define the setting or navigate to the function you want to record.
   To query trace or marker results, select the result diagram.

2. On the screen, tap and hold, or right-click the measurement setting, function, or result display.

   The context-sensitive menu containing the SCPI command for that particular setting, function, or result is displayed.

   Tip: If the SCPI command menu is not displayed, you probably tapped outside of a softkey or input field, for example in a block diagram. Tap within the corresponding softkey, button or input field, or in a result display, to display the context-sensitive SCPI command menu.

3. Select "Show SCPI result query commands" or "Show SCPI command", depending on which item you selected.

4. On the toolbar, select the SCPI Recorder icon.

   The SCPI Recorder dialog box is displayed.

5. Select "Auto Recording": "On".

   From now on, the commands required to execute all steps you perform on the instrument are recorded.

6. To query results in the SCPI script:

   a) Right-click (or tap and hold) in the result display.
      All possible commands to query the results in the diagram are displayed in the SCPI command menu.

b) Select the results you want to query.
c) Select "Add SCPI Command to Recording".

7. To stop SCPI recording, select the SCPI Recorder icon again.

   The SCPI Recorder dialog box with the recorded command list is displayed.

8. Select "Auto Recording": "Off".

9. Save the recorded command list to a file for later use.
   a) Select "Save As".
   b) Define a file name for the script file.

How to record SCPI commands manually

1. Determine the required SCPI command as described in Chapter 11.5.3, "How to determine the required SCPI command", on page 345.

2. From the SCPI command dialog box, select "Add SCPI Command to Recording".

   The command is added to the SCPI Recorder command list.

3. Repeat these steps for any settings, functions, or results you want to record.

4. To check the progress of the recording, select the SCPI Recorder icon in the toolbar.

   The SCPI Recorder dialog box with the currently recorded command list is displayed.

5. Save the recorded command list to a file for later use.
   a) Select "Save As".
   b) Define a file name for the script file.

To edit a SCPI command list

All command lists can be edited after recording, either directly on the instrument or in any suitable editor on the controller. The following functions describe how to edit the SCPI command list directly in the SCPI Recorder dialog box.

1. On the toolbar, select the SCPI Recorder icon.

   The SCPI Recorder dialog box with the currently recorded command list is displayed.

2. To load a stored script in ASCII format:
   a) Select "Load Recording" in the SCPI Recorder dialog box.
   b) If necessary, confirm the message to overwrite existing commands in the editor.
   c) Select the stored `*.inp` file.
   d) Select "Select".

   The stored commands are displayed in the editor.

3. To remove the most recently recorded command, select "Remove Last" in the SCPI Recorder dialog box.

4. To remove any other command in the recorded command list:
   a) Select the command by tapping it or using the arrow keys.
   b) Press the [BACK SPACE] key on the front panel of the instrument, or press the [Delete] key on a connected keyboard.
5. To insert a command within the recorded command list:
   a) Define the setting or navigate to the function you want to record.
   b) Select "Copy SCPI Command to ClipBoard".
   c) Tap and hold or right-click the position in the SCPI command list at which you want to insert the new command.
   d) From the context menu, select "Paste".
6. Select "Save As" to store the changes to the script.

How to check a SCPI script

The easiest way to check a script is to execute it, for example in the auxiliary tool IEC-WIN, which is provided with the R&S FSMR3 firmware (see Chapter 11.4, "The IEC-WIN tool", on page 338).

The tool shows an error message if a command could not be executed.

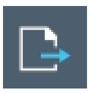
Some suggestions on how you can check and improve a recorded SCPI script:

- Search and remove missing command entries.
  If a configured setting or performed function does not have a corresponding command, `:SYST:INF:SCPI 'SCPI command not available'` is entered in the list instead.
- Remove unnecessary commands written after a preset.
- Rearrange the commands to a reasonable order. For example, if you move a `STATe` command to the end of your script, you can avoid intermediate calculations of the signal.
- Check the script for completeness by comparing its results with the modified settings in manual mode.

How to export a SCPI script

When you save a command list to a file, only the recorded commands are stored in a text file. However, to execute a script in an external programming environment, it requires additional header data according to the specific format.

1. On the toolbar, select the SCPI Recorder icon.
   The SCPI Recorder dialog box with the currently recorded command list is displayed.



2. Select "Export".
3. Define a file name and storage location for the script file.
4. Select the "File Type" which defines the format of the script.

5. Select "Save".

   A script with the required header data for the selected format is stored to a file.

11.6 Network and remote control settings

Access: [SETUP] > "Network + Remote"

Network settings in secure user mode

Be sure to store all network settings beforeSecureUser Mode is enabled; see Chapter 9.2, "Protecting data using the secure user mode", on page 238.

If the currently stored network settings are not suitable, you must correct them each time you switch on the R&S FSMR3 in secure user mode, as the settings are not stored permanently in this case.

The remote commands required to define these settings are described in Chapter 12.9.5, "Configuring the network and remote control", on page 606.

Step-by-step instructions are provided in Chapter 11.7, "How to set up a network and remote control", on page 366.

11.6.1 General network settings

Access: [SETUP] > "Network + Remote" > "Network" tab

The R&S FSMR3 can be operated in a local area network (LAN), for example to control the instrument from a remote PC or use a network printer.

Network settings can only be edited in the firmware if a LAN cable is connected to the R&S FSMR3000.

NOTICE

Risk of network problems

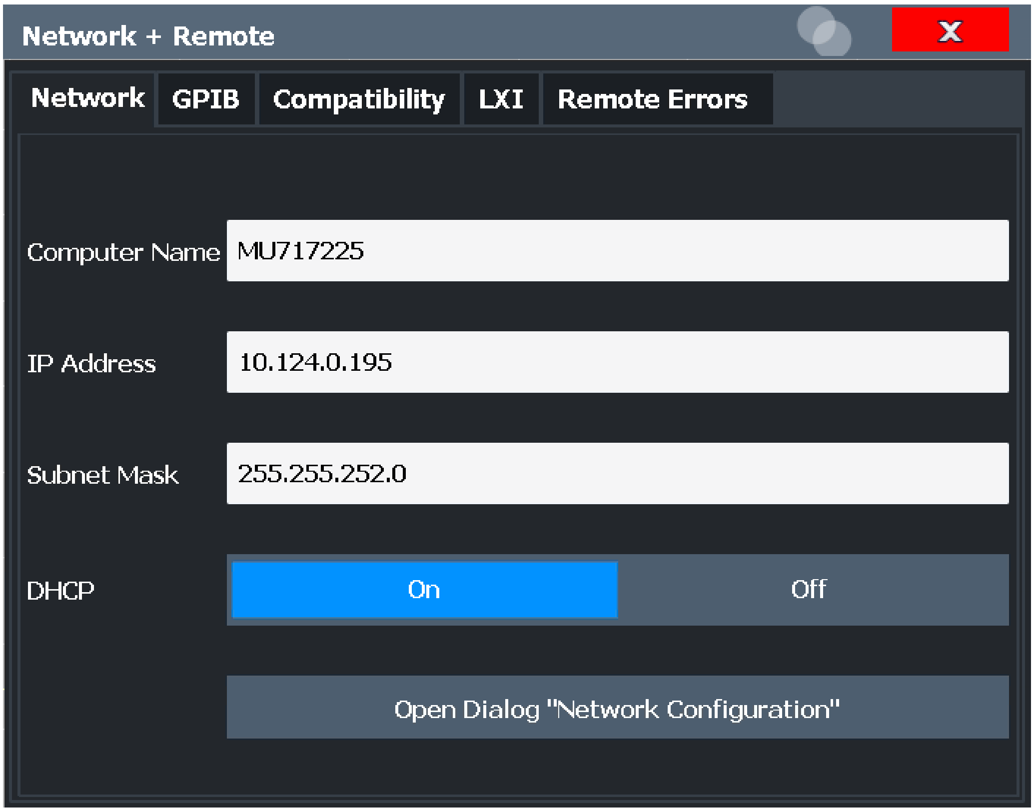
All parameters can be edited here; however, beware that changing the computer name has major effects in a network.

For details, see Chapter 11.7, "How to set up a network and remote control", on page 366.

Network settings in secure user mode

Be sure to store all network settings before SecureUser Mode is enabled; see Chapter 9.2, "Protecting data using the secure user mode", on page 238.

If the currently stored network settings are not suitable, you must correct them each time you switch on the R&S FSMR3 in secure user mode, as the settings are not stored permanently in this case.



Computer Name

Each instrument is delivered with an assigned computer name, but this name can be changed. The naming conventions of Windows apply. If too many characters and/or numbers are entered, an error message is displayed in the status line.

The default instrument name is a non-case-sensitive string with the following syntax:

<Type><variant>-<serial_number>

For example `FSMR3026-123456`

For example `FSMR3-123456`

The serial number can be found on the rear panel of the instrument. It is the third part of the device ID printed on the bar code sticker:

IP Address
Defines the IP address. The TCP/IP protocol is preinstalled with the IP address 10.0.0.10. If the DHCP server is available ("DHCP On"), the setting is read-only.

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

Subnet Mask
Defines the subnet mask. The TCP/IP protocol is preinstalled with the subnet mask 255.255.255.0. If the DHCP server is available ("DHCP On"), this setting is read-only.

The subnet mask consists of four number blocks separated by dots. Each block contains 3 numbers in maximum (e.g. 100.100.100.100), but also one or two numbers are allowed in a block (as an example see the preinstalled address).

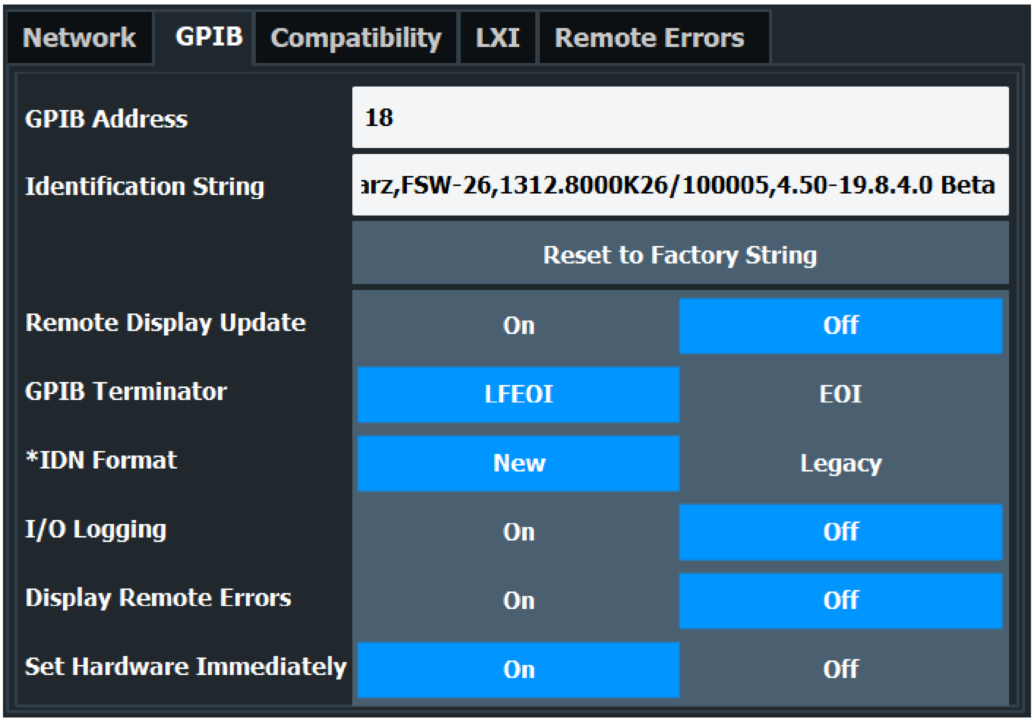
DHCP
Switches between DHCP server available (On) or not available (Off). If a DHCP server is available in the network, the IP address and subnet mask of the instrument are obtained automatically from the DHCP server.

Network Configuration
Opens the standard Windows "Network Configuration" dialog box for further configuration.

11.6.2 GPIB settings

Access: [SETUP] > "Network + Remote" > "GPIB" tab

Alternatively to connecting the R&S FSMR3 to a LAN, the GPIB interface can be used to connect a remote PC. For details see Chapter 11.1, "Remote control interfaces and protocols", on page 319).



GPIB Address

Defines the GPIB address. Values from 0 to 30 are allowed. The default address is 20.

Remote command:
`SYSTem:COMMunicate:GPIB[:SELF]:ADDRess` on page 607

Identification String

Defines the identification string for the R&S FSMR3 which is provided as a response to the `*IDN?` query. Maximum 36 characters are allowed.

Remote command:
`SYSTem:IDENtify[:STRing]` on page 609

Reset to Factory String

Restores the default identification string. Each R&S FSMR3 has a unique ID according to the following syntax:

Rohde&Schwarz,FSMR3,<Unique number>

Remote command:
`SYSTem:IDENtify:FACTory` on page 609

Remote Display Update

Defines whether the display of the R&S FSMR3 is updated when changing from manual operation to remote control.

Turning off the display update function improves performance during remote control.

Note: Usually, this function remains available on the display during remote operation. However, it can be disabled remotely. In this case, the display is not updated during remote operation, and cannot be turned on again locally until local operation is resumed.

Remote command:
`SYSTem:DISPlay:UPDate` on page 608

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 607

***IDN Format**

Defines the response format to the remote command `*IDN?` (see `*IDN?` on page 390). This function is intended for re-use of existing control programs together with the R&S FSMR3.

"Leg" Legacy format, as in the R&S FSP/FSU/FSQ family.

"New" R&S FSMR3 format.

Remote command:
`SYSTem:FORMat:IDENt` on page 621

I/O Logging

Activates or deactivates the SCPI error log function. All remote control commands received by the R&S FSMR3 are recorded in a log file. The files are named according to the following syntax:

`C:\R_S\INSTR\ScpiLogging\ScpiLog.<no.>`

where <no.> is a sequential number

A new log file is started each time logging was stopped and is restarted.

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 647

Display Remote Errors
Activates and deactivates the display of errors that occur during remote operation of the R&S FSMR3. If activated, the R&S FSMR3 displays a message box at the bottom of the screen that contains the type of error and the command that caused the error.

The error message remains in place when you switch to "Local" mode. To close the message box, select the "Close" icon.

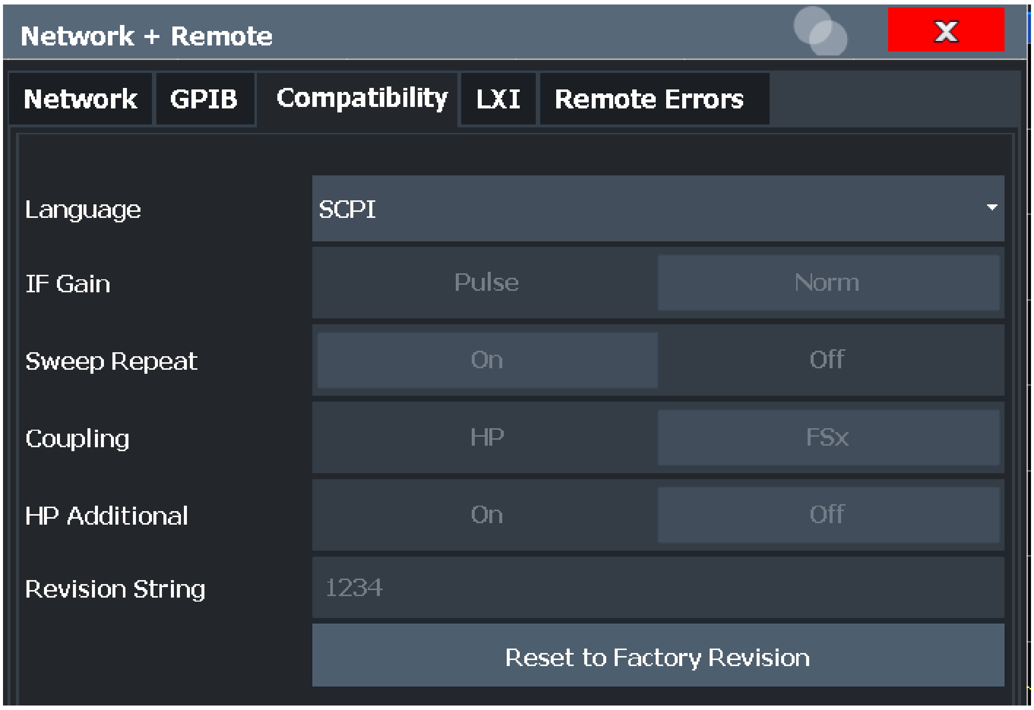
Only the most recent error is displayed in remote mode. However, in local mode, all errors that occurred during remote operation are listed in a separate tab of the "Network + Remote" dialog box (see Chapter 11.6.6, "Remote errors", on page 364).

Remote command:
`SYSTem:ERRor:DISPlay` on page 608
`SYSTem:ERRor:CLEar:REMote` on page 620

11.6.3 Compatibility settings

The R&S FSMR3 can emulate the GPIB interface of other signal and spectrum analyzers, e.g. in order to use existing control applications.

The required settings are configured in the "Compatibility" tab of the "Network +Remote" dialog box.



Language

Defines the system language used to control the instrument.

For details on the available GPIB languages, see Chapter 12.13.2, "Reference: GPIB commands of emulated HP models", on page 656.

Remote command:
`SYSTem:LANGuage` on page 655

IF Gain

Configures the internal IF gain settings in HP emulation mode due to the application needs. This setting is only taken into account for resolution bandwidth < 300 kHz.

NORM	Optimized for high dynamic range, overload limit is close to reference level.
PULS	Optimized for pulsed signals, overload limit up to 10 dB above reference level.

This setting is only available if an HP language is selected (see "Language" on page 355).

Remote command:
`SYSTem:IFGain:MODE` on page 654

Sweep Repeat

Controls a repeated sweep of the E1 and MKPK HI HP model commands (for details on the commands refer to Chapter 12.13.2, "Reference: GPIB commands of emulated HP models", on page 656). If the repeated sweep is OFF, the marker is set without sweeping before.

Note: In single sweep mode, switch off this setting before you set the marker via the E1 and MKPK HI commands in order to avoid sweeping again.

This setting is only available if a HP language is selected (see "Language" on page 355).

Remote command:
`SYSTem:RSWeep` on page 656

Coupling

Controls the default coupling ratios in the HP emulation mode for:

- span and resolution bandwidth (Span/RBW)
- resolution bandwidth and video bandwidth (RBW/VBW)

For FSx, the standard parameter coupling of the instrument is used. As a result, in most cases a shorter sweep time is used than in case of HP.

This setting is only available if a HP language is selected (see "Language" on page 355).

Remote command:
`SYSTem:HPCoupling` on page 654

Revision String
Defines the response to the `REV?` query for the revision number.

(HP emulation only, see "Language" on page 355).

Max. 36 characters are allowed.

Remote command:
`SYSTem:REVision[:STRing]` on page 655

Resetting the Factory Revision
Resets the response to the `REV?` query for the revision number to the factory default (HP emulation only, see "Language" on page 355).

Remote command:
`SYSTem:REVision:FACTory` on page 610

11.6.4 LAN settings

Access: [SETUP] > "Network + Remote" > "LAN" tab

In a LAN network, the R&S FSMR3 can be accessed via any web browser (e.g. the Microsoft Internet Explorer) to perform the following tasks:

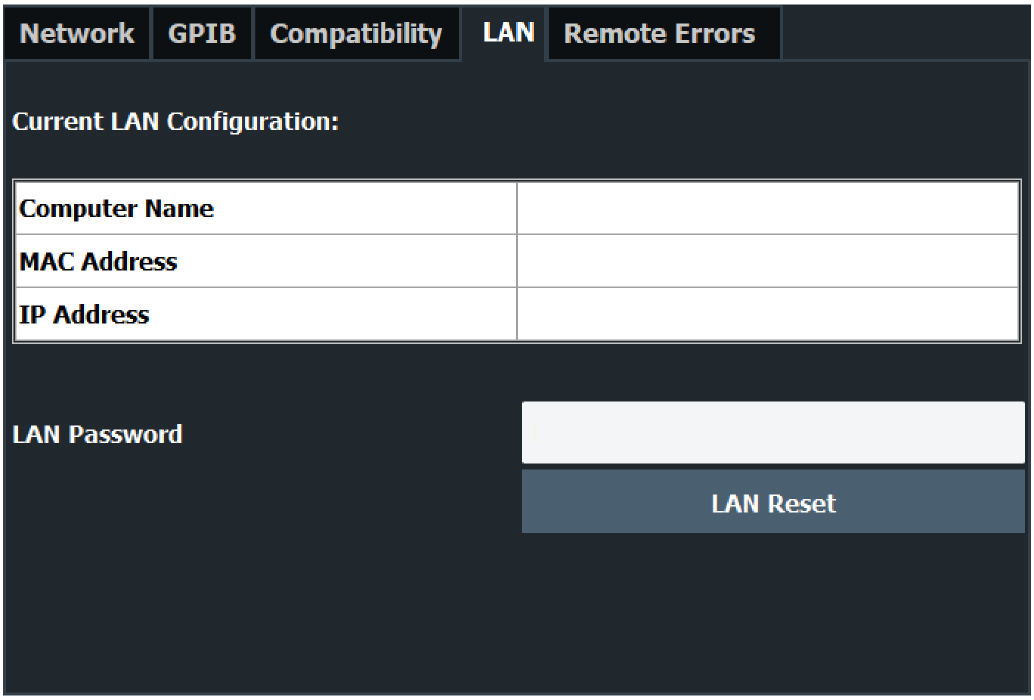
- Modifying network configurations
- Modifying device configurations
- Monitoring connections from the device to other devices

The "LAN" tab of the "Network + Remote" dialog box provides basic LAN configuration functions and information for the R&S FSMR3.

Alternatively, you can change the LAN settings using the web browser interface.

For details see Chapter 11.7.1.4, "How to configure the LAN using the web browser interface", on page 371.

Only user accounts with administrator rights are able to use LAN configuration and web browser functionality.



Current LAN Configuration

Displays the current LAN information from the R&S FSMR3 (read-only).

"Computer name"	Name of the R&S FSMR3 as defined in the operating system (see also "Computer Name" on page 350)
"MAC address"	Media Access Control address (MAC address), a unique identifier for the network card in the R&S FSMR3
"IP address"	IP address of the R&S FSMR3 as defined in the operating system (see also "IP Address" on page 351).

LAN Password

Password for LAN configuration. The default password is *LxiWebIfc*.

Remote command:
`SYSTem:LXI:PASSword` on page 610

LAN Reset

Resets the "LAN" configuration to its default settings (LCI function).

Parameter	Value
TCP/IP Mode	DHCP + Auto IP Address
Dynamic DNS	Enabled

Parameter	Value
ICMP Ping	Enabled
Password for "LAN" configuration	LxiWebIfc

The LAN settings are configured in the "Network" tab of the "Network + Remote" dialog box or using the instrument's "LAN" web browser interface.

Remote command:
`SYSTem:LXI:LANReset` on page 609

11.6.5 HUMS settings

Available with option R&S FSMR3-K980.

The R&S FSMR3 comes with a health and utilization monitoring system (HUMS) providing information about the R&S FSMR3. Aim is to increase the overall utilization, to avoid downtime and to increase the overall security level of a fleet of instruments.

HUMS provides, for example, information about:

- Instrument identification, hardware components, software packages, licenses
- Usage of remote control, usage via keyboard / mouse, usage of test applications
- Hardware utilization and status, including S.M.A.R.T. data of the system drive
- User-defined static information, for example, an inventory code

Interfaces and protocols

The HUMS installation on the R&S FSMR3 includes an SNMP agent and a REST service with HTTP endpoints. So you can access the health and usage information via LAN, using the SNMP protocol or the REST protocol. Accessing the data does not interfere with remote control via SCPI commands or with measurement execution.

Reference information for both protocols is available on the R&S FSMR3 at the address *http://<instrument>/api/hums/v1/documents?name=<interface>*.

For *<instrument>*, enter the hostname (e.g. *fsmr3026-123456*) or the IP address (e.g. *10.121.0.34*) of your instrument, as for access to the GUI.

For *<interface>* = *snmp*, you get a `.zip` file containing the MIB files for SNMP. For *<interface>* = *rest*, you get a `.yaml` file with the OpenAPI specification of the REST API.

Address example: *http://fsmr3026-123456/api/hums/v1/documents?name=snmp*.

The following table lists the REST endpoints and the SNMP MIB file names.

For further information about the HUMS service itself, see R&S HUMS user manual. You can download or view the manual on the internet.

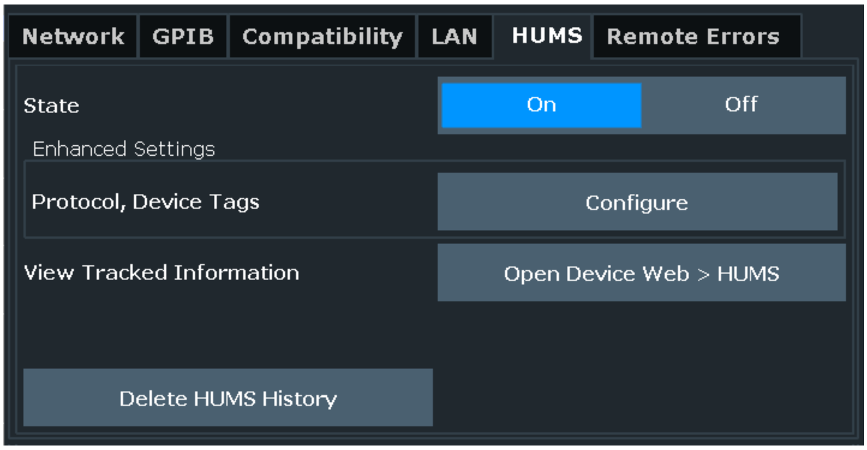
11.6.5.1 Basic settings

Access: [SETUP] > "Network + Remote" > "HUMS" tab

The "HUMS" tab of the "Network + Remote" dialog provides basic R&S HUMS configuration functions.

To export the complete HUMS history, use the REST API with the endpoint:

```
http://<IP>/api/hums/v1/dump
```



The remote commands to configure HUMS are described in Chapter 12.9.6, "Configuring HUMS", on page 610.

State

Turns HUMS on or off.

If you want to track HUMS data, turn on this function.

If HUMS has been used before, turning on restores the previous protocol settings.

Remote command:
`DIAGnostic:HUMS:STATe` on page 611

Enhanced Settings

Opens the dialog to configure the protocol settings and device tags.

View Tracked Information

Opens the R&S HUMS device web in the web browser of the R&S FSMR3.

For more information about the R&S HUMS device web, see its user manual.

You can also reach the device web from a remote PC by entering the following address into a browser's address bar:

http://<instrumentaddress>/hums/

The <instrumentaddress> is either the IP address of the instrument or the instrument name.

Delete HUMS History

Deletes complete HUMS data which includes the device history, device tags, SCPI connections, utilization history, utilization (table values).

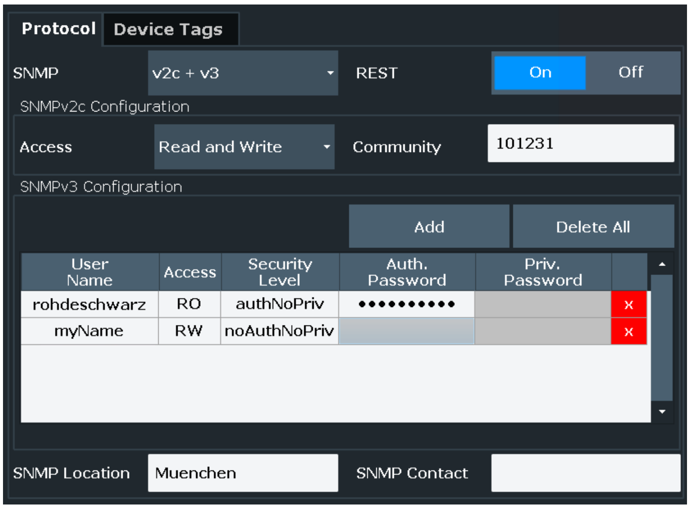
Remote command:

DIAGnostic:HUMS:DELete:ALL on page 611

11.6.5.2 Protocol settings

Access: [SETUP] > "Network + Remote" > "HUMS" > "Enhanced Settings" > "Configure" > "Protocol"

The "Protocol" tab of the "Enhanced Settings" dialog provides protocol settings for SNMP or REST protocol.



SNMP

Selects the SNMP version to communicate with the service.

"None" Do not use SNMP.

"v2c"	Select SNMP version v2c, which also activates v1. Unlocks the settings available for SNMP v2c.
"v3"	Select SNMP version v3. Unlocks the settings available for SNMP v3.
"v2c + v3"	Select both SNMP versions v2c and v3. Unlocks the settings for both SNMP v2c and v3.

Remote command:
`SYSTem:COMMunicate:SNMP:VERSion` on page 616

REST
Turns communication via REST API on or off.

Remote command:
`SYSTem:COMMunicate:REST:ENABle` on page 613

SNMPv2c Configuration
For SNMPv2c/v1 authentication, you can define the "Access" and "Community".

Access ← SNMPv2c Configuration
Defines the access an SNMP user can have for a specific SNMP community: read-write = RW, read-only = RO.

"RW"	Read-write access allows the user to read and change information. By default, the user has read-write access rights.
"RO"	Read-only access allows the user to only read information.

Remote command:
`SYSTem:COMMunicate:SNMP:COMMunity:RO` on page 613
`SYSTem:COMMunicate:SNMP:COMMunity:RW` on page 613

Community ← SNMPv2c Configuration
Defines the SNMP community string. An SNMP community represents a collection of devices and agents grouped to monitor them. Authorized managers and the managed devices belong to an SNMP community.

You can define an individual community for each read-write and read-only access.

The default community is the serial number of the instrument (same community for read-only and for read-write).

Entering a community is mandatory.

SNMPv3 Configuration
For SNMPv3 authentication, you can define user profiles. You can manage them via a table.

To add a new user, select the "Add" button and enter the data.

To delete all user profiles, select the "Delete All" button.

To delete a single user profile, select the "x" in the appropriate user line of the table.

Remote command:
Create user: `SYSTem:COMMunicate:SNMP:USM:USER` on page 614
Query all users: `SYSTem:COMMunicate:SNMP:USM:USER:ALL?` on page 615

Delete a single user: SYSTem:COMMunicate:SNMP:USM:USER:DELete on page 615
Delete all users: SYSTem:COMMunicate:SNMP:USM:USER:DELete:ALL on page 616

User Name ← SNMPv3 Configuration
Defines the name of the user who should have specific user rights.

Entering a user name is mandatory.

Access ← SNMPv3 Configuration
Defines the access right a user can have: read-write = RW, read-only = RO.

"RW"	Read-write access allows the user to read and change information.
"RO"	Read-only access allows the user to only read information.

Security Level ← SNMPv3 Configuration
Defines the security level for access: noAuthNoPriv, authNoPriv or authPriv.

For security reasons, we recommend that you only allow access via passwords.

"noAuthNo-Priv"	Low security level: no authentication, no data transfer encryption, user name query only. No authentication password and no privacy password to be defined.
"authNoPriv"	Medium security level: authentication, no data transfer encryption, user name and password query. Authentication password to be defined, privacy password is not available.
"authPriv"	High security level: authentication, data transfer encryption, user name, password and encryption password query. Authentication password and privacy password to be defined. If no privacy password is defined, the HUMS service uses the authentication password as privacy password.

Passwords ← SNMPv3 Configuration
Depending on the selected Security Level, you have to define specific passwords: authentication password (Auth. Password) and privacy password (Priv. Password).

"Auth. Password"	For authentication, you have to define an authentication password. For authentication password, the R&S FSMR3 supports the MD5 protocol. Authentication passwords must have 8 to 12 characters with any combination of ASCII characters.
"Priv. Password"	For stronger encryption, you have to define a second password, the privacy password. For privacy password, the R&S FSMR3 supports the DES protocol. Private passwords must have at least 8 characters with any combination of ASCII characters.

SNMP Location
"SNMP Location" defines the SNMP location information. This information complies with the server's physical location and is used for identification of the SNMP server. By default, this input field is empty.

Remote command:
`SYSTem:COMMunicate:SNMP:LOCation` on page 614

SNMP Contact
"SNMP Contact" defines the SNMP contact information. This information complies with the person who manages the SNMP server and is used for identification of the SNMP server. By default, this input field is empty.

Remote command:
`SYSTem:COMMunicate:SNMP:CONTact` on page 614

11.6.5.3 Device tags

Access: [SETUP] > "Network + Remote" > "HUMS" > "Enhanced Settings" > "Configure" > "Device Tags"

The "Device Tags" tab of the "Enhanced Settings" dialogs displays the defined device tags. You can also add or delete device tags here.

A device tag is a label to assign to your instrument. You can create any device tag for your instrument and define it by a specific key and value.

Add
Adds a new device tag.

Remote command:
`DIAGnostic:HUMS:TAGS[:VALue]` on page 612

Index
Index (ID) of the created device tag. You can change the ID if necessary.

Key
Defines a key for your device tag. A device tag key represents the type of tag.

Value
Defines the actual value of the device tag or key.

Example:
- "Key" = Location
- "Value" = Building 1

Remote command:
DIAGnostic:HUMS:TAGS:ALL? on page 612

Delete All
Deletes all defined device tags.

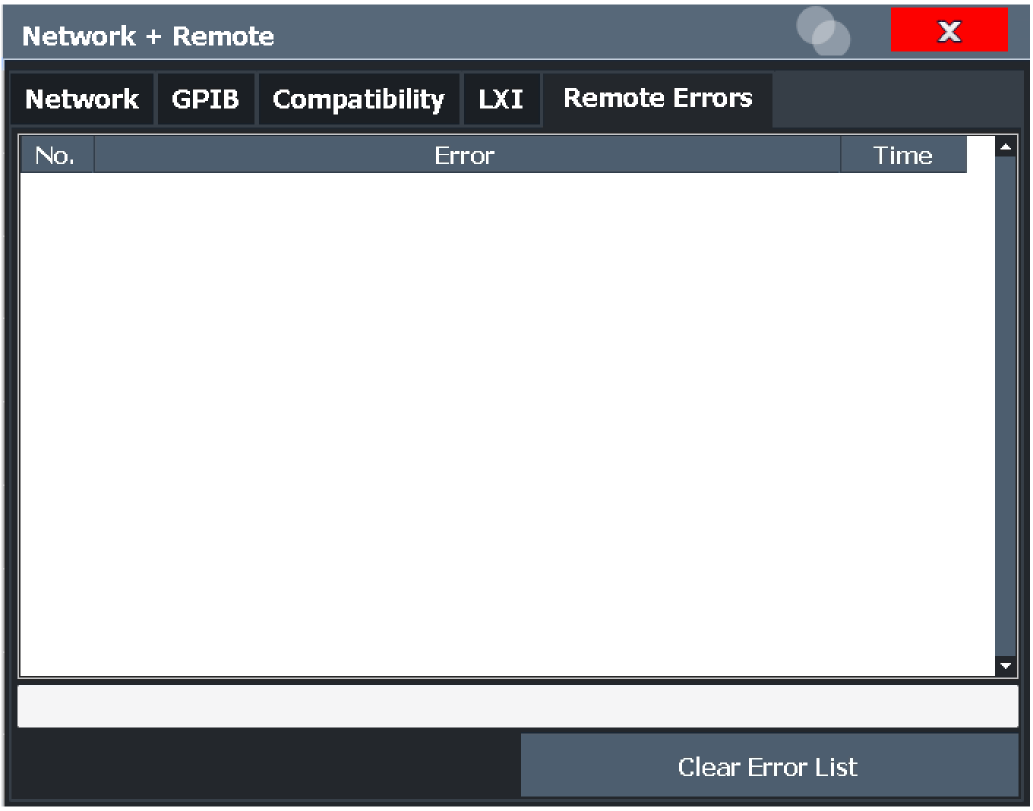
Remote command:
Delete all device tags:DIAGnostic:HUMS:TAGS:DELete:ALL on page 612
Delete a single device tag:DIAGnostic:HUMS:TAGS:DELete on page 612

11.6.6 Remote errors

Access: [SETUP] > "Network + Remote" > "Remote Errors " tab

The error messages generated by the R&S FSMR3 during remote operation are displayed here.

The messages are displayed in the order of their occurrence; the most recent messages are placed at the top of the list.



The most recent error message during remote operation can be displayed on the screen, see "Display Remote Errors" on page 354.

If the number of error messages exceeds the capacity of the error buffer, the oldest error message is removed before the newest one is inserted. To clear the message buffer use the "Clear Error List" button. It is automatically cleared when the R&S FSMR3 is shut down.

The following information is available:

No	Device-specific error code
Error	Brief description of the error
Date/Time	Time the message occurred

Remote command:

`SYSTem:ERRor:LIST?` on page 620

Clear Error List
Deletes the error message buffer for remote operation.

Note: The remote error list is automatically cleared when the R&S FSMR3 is shut down.

Remote command:
`SYSTem:ERRor:CLEar:REMote` on page 620

11.6.7 Returning to manual mode ("local")

When switched on, the instrument is always in the manual measurement mode and can be operated via the front panel. As soon as the instrument receives a remote command, it is switched to the remote control mode.

In remote control mode, all keys of the instrument except the [PRESET] key are disabled. The "LOCAL" softkey and the Remote Display Update softkey are displayed.

Local
The instrument switches from remote to manual operation.

Note:
- If the local lockout function (`LLO` or `SYST:KLOC ON`) has been activated in the remote control mode, manual operation is no longer available until `GTL` (or `SYST:KLOC OFF`) is executed.
- Before you switch back to manual operation, all remote command processing must be completed. Otherwise, the instrument will switch back to remote control immediately.
- If you select the "Local" softkey while a self-alignment or a self-test is still running (which was started remotely), the instrument only returns to the manual operation state when the alignment or test is completed.

Furthermore, when you return to manual operation, the following happens:

- All front panel keys are enabled.
- The main softkey menu of the current mode is displayed.
- The measurement diagrams, traces and display fields are displayed again.
- If, at the time of pressing the "LOCAL" softkey, the synchronization mechanism via `*OPC`, `*OPC?` or `*WAI` is active, the currently running measurement procedure is aborted and synchronization is achieved by setting the corresponding bits in the registers of the status reporting system.
- Bit 6 (User Request) of the Event Status Register is set.
  If the status reporting system is configured accordingly, this bit immediately causes the generation of a service request (SRQ) to inform the control software that the user wishes to return to front panel control. For example, this can be used to interrupt the control program and to correct instrument settings manually. This bit is set each time the "LOCAL" softkey is pressed.

Remote command:
`SYST:COMM:INT:REM OFF`, see `SYSTem:COMMunicate:INTernal:REMote` on page 607

11.7 How to set up a network and remote control

Remote operation

You can operate the instrument remotely from a connected computer using SCPI commands. Before you send remote commands you must configure the instrument in a LAN network or connect it to a PC via the GPIB interface as described in Chapter 11.7.1, "How to configure a network", on page 367.

Remote Desktop

In production test and measurement, a common requirement is central monitoring of the T&M instruments for remote maintenance and remote diagnostics. Equipped with the Remote Desktop software of Windows, the R&S FSMR3 ideally meets requirements for use in production. The computer that is used for remote operation is called "controller" here.

The following tasks can be performed using Remote Desktop:

- Access to the control functions via a virtual front panel (soft front panel)
- Printout of measurement results directly from the controller
- Storage of measured data on the controller's hard disk

This documentation provides basic instructions on setting up the Remote Desktop for the R&S FSMR3. For details refer to the Windows 10 operating system documentation.

11.7.1 How to configure a network

A precondition for operating or monitoring the instrument remotely is that it is connected to a LAN network or a PC connected to the GPIB interface. Setup is described here.

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 Windows 10 help system and the R&S White Paper (available from the Rohde & Schwarz website):

1EF96: Malware Protection Windows 10

11.7.1.1 How to connect the instrument to the network

There are two methods to establish a LAN connection to the instrument:

- A non-dedicated network (Ethernet) connection from the instrument to an existing network made with an ordinary RJ-45 network cable. The instrument is assigned an IP address and can coexist with a computer and with other hosts on the same network.
- A dedicated network connection (Point-to-point connection) between the instrument and a single computer made with a (crossover) RJ-45 network cable. The computer must be equipped with a network adapter and is directly connected to the instrument. The use of hubs, switches, or gateways is not required, however, data transfer is still performed using the TCP/IP protocol. An IP address has to be assigned to the instrument and the computer, see Chapter 11.7.1.2, "How to assign the IP address", on page 368.
  Note: As the R&S FSMR3 uses a 1 GBit LAN, a crossover cable is not necessary (due to Auto-MDI(X) functionality).

► To establish a non-dedicated network connection, connect a commercial RJ-45 cable to one of the LAN ports.
To establish a dedicated connection, connect a (crossover) RJ-45 cable between the instrument and a single PC.

If the instrument is connected to the LAN, Windows automatically detects the network connection and activates the required drivers.

The network card can be operated with a 1 GBit Ethernet IEEE 802.3u interface.

11.7.1.2 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, the instrument is 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 369).

Assigning the IP address on the instrument

NOTICE

Risk of network errors

Connection errors can affect the entire network. Contact your network administrator to obtain a valid IP address.

1. Press the [SETUP] key.
2. Press the "Network + Remote" softkey.
3. Select the "Network" tab.
4. In the "Network + Remote" dialog, toggle the "DHCP On/Off" setting to the required mode.
   If DHCP is "Off", you must enter the IP address manually, as described in the following steps.
   Note: When DHCP is changed from "On" to "Off", the previously set IP address and subnet mask are retrieved.
   If DHCP is "On", the IP address of the DHCP server is obtained automatically. The configuration is saved, and you are prompted to restart the instrument. You can skip the remaining steps.
   Note: When a DHCP server is used, a new IP address may be assigned each time the instrument is restarted. This address must first be determined on the instrument 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 369 and Chapter 11.7.1.3, "How to change the instrument name", on page 370).

5. Enter the "IP Address", for example *192.0.2.0*. The IP address consists of four number blocks separated by dots. Every block contains a maximum of 3 numbers.
6. Enter the "Subnet Mask", for example *255.255.255.0*. The subnet mask consists of four number blocks separated by dots. Every block contains a maximum of 3 numbers.
7. Close the dialog box.

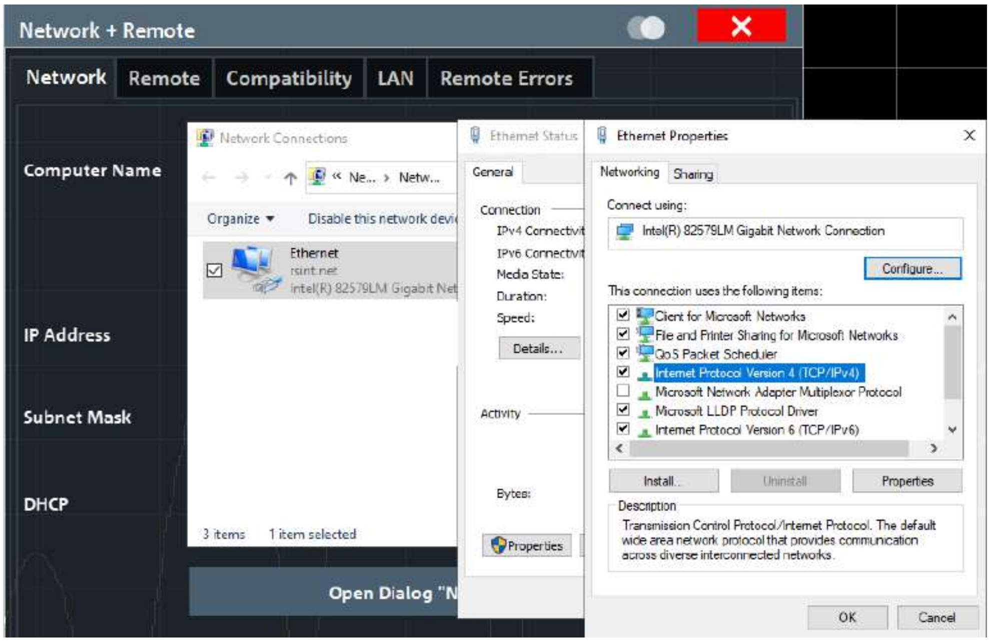
   If you have entered an invalid IP address or subnet mask, the message "out of range" is displayed in the status line. If the settings are correct, the configuration is saved, and you are prompted to restart the instrument.
8. Confirm the displayed message ("Yes" button) to restart the instrument.

Using a DNS server to determine the IP address

If a DNS server is configured on the R&S FSMR3, the server can determine the current IP address for the connection using the permanent computer name.

1. Obtain the name of your DNS domain and the IP addresses of the DNS and WINS servers on your network (see Chapter 11.7.1.3, "How to change the instrument name", on page 370).
2. Press the [Setup] key and then the "Network + Remote" softkey.
3. In the "Network" tab, select the "Open Dialog 'Network Connections'" button.
4. Double-tap the "Ethernet" entry.
5. In the "Ethernet Status" dialog box, select the "Properties" button.

   The items used by the Ethernet connection are displayed.
6. Tap the entry named "Internet Protocol Version 4 (TCP/IPv4)" to highlight it.



7. Select the "Properties" button.
8. On the "General" tab, select "Use the following DNS server addresses" and enter your own DNS addresses.

   For more information refer to the Windows 10 operating system Help.

11.7.1.3 How to change the instrument name

In a LAN that uses a DNS server (Domain Name System server), each PC or instrument connected in the LAN can be accessed via an unambiguous computer name instead of the IP address. The DNS server translates the host name to the IP address. This is especially useful when a DHCP server is used, as a new IP address may be assigned each time the instrument is restarted.

Each instrument is delivered with an assigned computer name, but this name can be changed.

To change the instrument's computer name

1. Press the [Setup] key and then the "Network + Remote" softkey.
   The current "Computer Name" is displayed in the "Network" tab.
2. Enter the new computer name and close the dialog box.

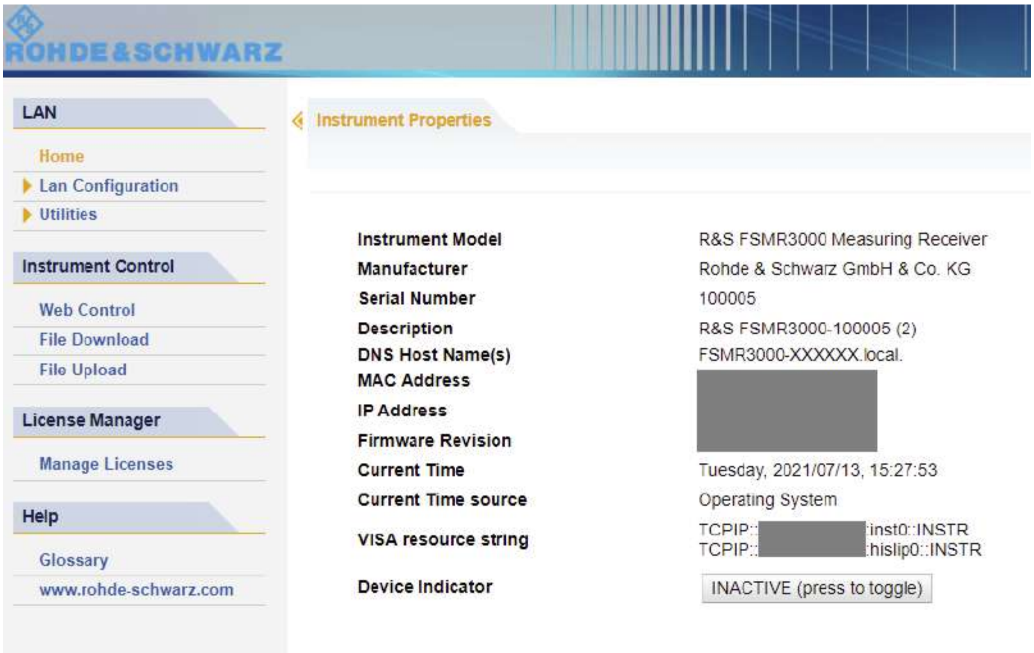
   The configuration is saved, and you are prompted to restart the instrument.
3. Confirm the displayed message ("Yes" button) to restart the instrument.

11.7.1.4 How to configure the LAN using the web browser interface

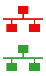
The instrument's "LAN" web browser interface works correctly with all W3C compliant browsers.

► In the web browser, open the `http://<instrument-hostname>` or `http://<instrument-ip-address>` page, e.g. *http://10.113.10.203*.
The default password to change "LAN" configurations is *LxiWebIfc*.

The "Instrument Home Page" (welcome page) opens.



The instrument home page displays device information, including the VISA resource string, in read-only format.



► Press the "Device Indicator" button on the "Instrument Home Page" to activate or deactivate the "LAN" status icon on the status bar of the R&S FSMR3. A green "LAN" status symbol indicates that a LAN connection has been established; a red symbol indicates an error, for example, that no LAN cable is connected. When a device is connecting to the instrument, the "LAN" icon blinks. The "Device Indicator" setting is not password-protected.

The most important control elements in the navigation pane of the browser interface are the following:

- "LAN Configuration" opens the menu with configuration pages.
- "Status" displays information about the "LAN" status of the instrument.

LAN configuration

The LAN configuration consists of three parts:

- "IP configuration" provides all mandatory LAN parameters.
- "Advanced LAN Configuration" provides further LAN settings.
- "Ping Client" provides the ping utility to verify the connection between the instrument and other devices.

IP configuration

The "LAN Configuration > IP configuration" web page displays all mandatory LAN parameters and allows their modification.

The "TCP/IP Mode" configuration field controls how the IP address for the instrument gets assigned (see also Chapter 11.7.1.2, "How to assign the IP address", on page 368).

For the manual configuration mode, the static IP address, subnet mask, and default gateway are used to configure the LAN. The automatic configuration mode uses DHCP server or Dynamic Link Local Addressing (Automatic IP) to obtain the instrument IP address.

Changing the LAN configuration is password-protected. The default password is *LxiWebIfc* (notice upper and lower case characters).

You can change the LAN password in the "Network + Remote" dialog box, see Chapter 11.6.4, "LAN settings", on page 356.

Advanced LAN configuration

The "LAN Configuration > Advanced LAN Configuration" parameters are used as follows:

- "mDNS and DNS-SD" are two additional protocols: Multicast DNS and DNS Service Discovery. They are used for device communication in zero configuration networks working without DNS and DHCP
- "ICMP Ping" must be enabled to use the ping utility.
- "VXI-11" is the protocol that is used to detect the instrument in the LAN.

Ping client

Ping is a utility that verifies the connection between the instrument and another device. The ping command uses the `ICMP` echo request and echo reply packets to determine whether the LAN connection is functional. Ping is useful for diagnosing IP network or router failures. The ping utility is not password-protected.

To initiate a ping between the instrument and a second connected device:

To initiate a ping between the instrument and a second connected device

1. Enable "ICMP Ping" on the "Advanced LAN Configuration" page (enabled after an LCI).

2. Enter the IP address of the second device **without the ping command and without any further parameters** into the "Destination Address" field (e.g. *10.113.10.203*).
3. Select "Submit".

11.7.1.5 How to change the GPIB instrument address

In order to operate the instrument via remote control, it must be addressed using the GPIB address. The remote control address is factory-set to 20, but it can be changed if it does not fit in the network environment. For remote control, addresses 0 through 30 are allowed. The GPIB address is maintained after a reset of the instrument settings.

Setting the GPIB address

1. On the R&S FSMR3, press the [SETUP] key.
2. Press the "Network + Remote" softkey.
3. In the "Network + Remote" dialog box, select the "GPIB" tab.
4. In the "GPIB Address" field, enter a value between 0 and 30.

Remote command:

```
SYST:COMM:GPIB:ADDR 18
```

11.7.2 How to operate the instrument without a network

To operate the instrument without a network connection either temporarily or permanently, no special measures are necessary. Windows 10 automatically detects the interruption of the network connection and does not set up the connection when the instrument is switched on.

If you are not prompted to enter the user name and password, proceed as described in Chapter 11.7.3.3, "How to configure the automatic login mechanism", on page 375.

11.7.3 How to log on to the network

Windows 10 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. The instrument provides 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 10 for any user at any time. Some administrative tasks require administrator rights (e.g. firmware updates or the configuration of a LAN network). If so, it is mentioned in the function descriptions.

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.

11.7.3.1 How to create users

After the software for the network has been installed, the instrument issues an error message the next time it is switched on because there is no user named "instrument" (= default user ID for Windows auto-login) in the network. Thus, a matching user must be created in the R&S FSMR3 and in the network, the password must be adapted to the network password, and the auto-login mechanism must then be deactivated.

The network administrator is responsible for creating new users in the network.

1. Select the "Windows" icon in the toolbar to access the operating system.
2. Select "Start > Settings > Accounts > Other users".
3. Select "Add someone else to this PC".
4. In the "Microsoft account" dialog box, enter the new user name and password.
5. Select "OK".
6. Select "Finish".
   The new user is created.

11.7.3.2 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.

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.

11.7.3.3 How to configure the automatic login mechanism

Adapting the auto-login function to a new password

If you change the password that is used during auto-login, this function no longer works. Adapt the settings for the auto-login function first.

1. Select the "Windows" icon in the toolbar to access the operating system of the R&S FSMR3 (see also "To access the "Start" menu" on page 20).
2. Open the `C:\R_S\INSTR\USER\user\AUTOLOGIN.REG` file in any text editor (e.g. Notepad).
3. In the line `"DefaultPassword"="894129"`, replace the default password (`894129`) by the new password for automatic login.
4. Save the changes to the file.
5. In the Windows "Start" menu, select "Run".
   The "Run" dialog box is displayed.
6. Enter the command `C:\R_S\INSTR\USER\user\AUTOLOGIN.REG`.
7. Press the [ENTER] key to confirm.
   The auto-login function is reactivated with the changed password. It will be applied the next time the instrument is switched on.

Switching users when using the auto-login function

Which user account is used is defined during login. If auto-login is active, the login window is not displayed. However, you can switch the user account to be used even when the auto-login function is active.

1. Select the "Windows" icon in the toolbar to access the operating system of the R&S FSMR3 (see also "To access the "Start" menu" on page 20).
2. Press [CTRL] + [ALT] + [DEL], then select "Sign out".

   The "Login" dialog box is displayed, in which you can enter the different user account name and password.

Deactivating the auto-login function

When shipped, the instrument is already configured to automatically log on the "instrument" user under Windows 10. To deactivate the auto-login function, perform the following steps:

1. In the "Start" menu, select "Run".
   The "Run" dialog box is displayed.
2. Enter the command `C:\R_S\INSTR\USER\user\NO_AUTOLOGIN.REG`.
3. Press the [ENTER] key to confirm.

The auto-login function is deactivated. The next time you switch on the instrument, you are prompted to enter your user name and password before the firmware is started.

Reactivating the auto-login function

To reactivate the auto-login function after manually deactivating it, perform the following steps:

1. In the "Start" menu, select "Run".
   The "Run" dialog box is displayed.
2. Enter the command `C:\R_S\INSTR\USER\user\AUTOLOGIN.REG`.
3. Press the [ENTER] key to confirm.
   The auto-login function is reactivated. It will be applied the next time the instrument is switched on.

11.7.4 How to share directories (only with microsoft networks)

Sharing directories makes data available for other users. This is only possible in Microsoft networks. Sharing is a property of a file or directory.

1. In the "Start" menu, select "Programs", "Accessories" and then select "Windows Explorer".
2. Select the desired folder with the right mouse button.
3. In the context menu, select "Sharing with > Specific people".
   The dialog box for sharing a directory is displayed.
4. Select a user from the list or add a new name and select the "Add" button.
5. Select the "Share" button.
6. Select "Done" to close the dialog box.
   The drive is shared and can be accessed by the selected users.

11.7.5 How to control the R&S FSMR3 via the web browser interface

Via the LAN web browser interface to the R&S FSMR3, one or more users can control the instrument remotely from another PC without additional installation. Most instrument controls are available via the front panel simulation. File upload and download between the instrument and the remote PC is also available.

To access the R&S FSMR3 via the web browser interface

1. Start a web browser that supports html5 (W3C compliant).
2. Enter the IP address of the R&S FSMR3 in the browser's address bar.

   The R&S FSMR3's Welcome page is displayed.

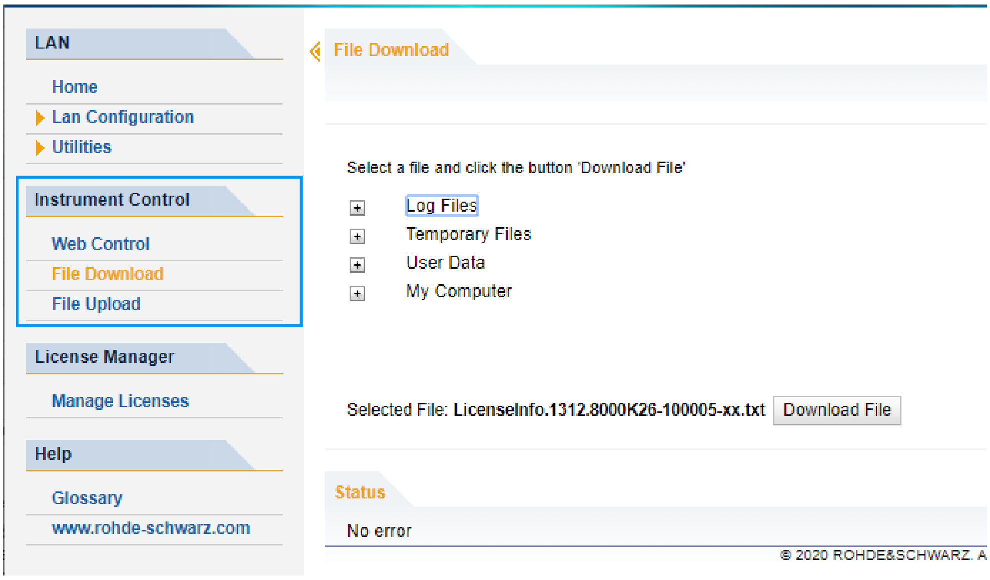
3. In the navigation pane, select "Instrument Control > Web Control".

   The instrument's display is shown in a new browser window, with a software front panel displayed beside or below it.
4. Use the mouse cursor to access the functionality in the software front panel or in the display as you would directly on the instrument's front panel.

To exchange files with the R&S FSMR3

You can download files, for example stored measurement data, from the R&S FSMR3 to the remote PC, or upload files, for example limit line definitions, from the PC to the R&S FSMR3.

1. In the web browser, select the Welcome page window.
2. In the navigation pane, select "Instrument Control" > "File Upload" or "File Download".



   The most commonly used folders on the instrument are displayed, for example those that contain user data, as well as the top-most `My Computer` folder, from which you can access all other folders on the instrument.
3. To download a file from the R&S FSMR3, select the file from the displayed folders and then select "Download File".
4. To upload a file to the R&S FSMR3:
   a) From the displayed folders in the web browser window, select the folder on the R&S FSMR3 to which you want to copy a file.
   b) Under "File to Upload", select "Browse" to open a file selection dialog box and select the required file on the PC.
   c) Select "Upload" to copy the file from the PC to the defined folder on the R&S FSMR3.

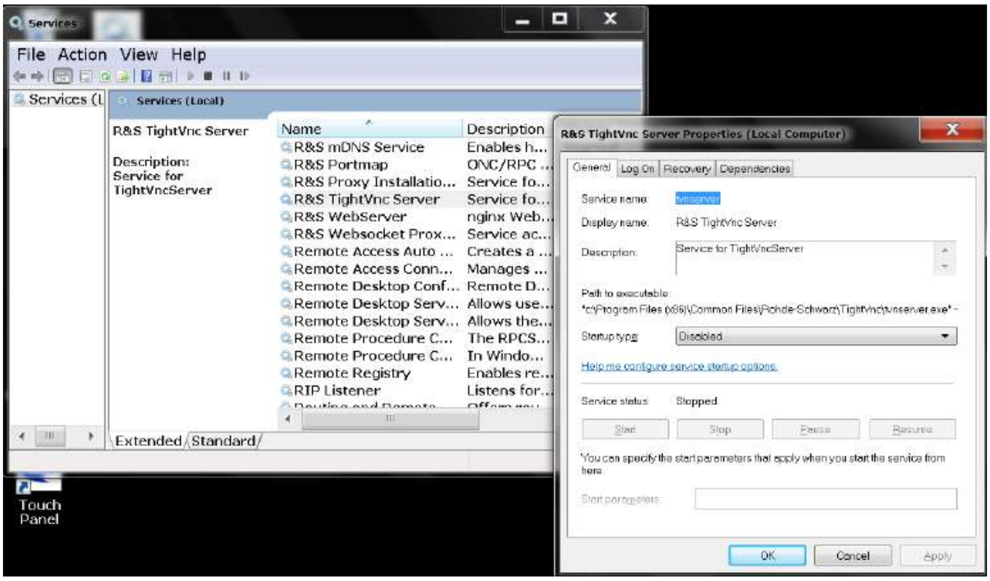
11.7.6 How to deactivate the web browser interface

If you want to prevent other users in the LAN from accessing or operating the R&S FSMR3 via its LAN web browser interface, you must deactivate this function. Note that **after a firmware update** the function is **automatically active** again until you deactivate it manually.

To deactivate the LAN web browser interface

1. 

   Select the "Windows" icon in the toolbar to access the operating system.
2. In the "Start" menu, select "Control Panel".
3. Select "System and Security" > "Administrative Tools".
4. From the list on the right, select "Services".
5. From the list of local services, select "R&S TightVNC Server".

6. Set "Startup type" to "Disabled".
7. Select "Stop".
8. Select "Apply".

   The next time a user enters the IP address of the instrument in a web browser, an error message is displayed:
   `Failed to connect to server (code. 1006)`

11.7.7 How to set up remote desktop

Remote Desktop is a Windows application which can be used to access and control the instrument from a remote computer through a LAN connection. While the instrument is in operation, the instrument screen contents are displayed on the remote computer, and Remote Desktop provides access to all of the applications, files, and network resources of the instrument. Thus, remote operation of the R&S FSMR3 is possible.

With Windows 10, Remote Desktop Client is part of the operating system. For other versions of Windows, Microsoft offers the Remote Desktop Client as an add-on. For details refer to the Windows 10 operating system documentation.

With the factory settings, the default "instrument" user can connect to the R&S FSMR3 with the Remote Desktop program of the controller immediately. No further configuration is required. However, if the connection fails or other users need to connect, this section provides basic instructions on setting up the Remote Desktop for the R&S FSMR3.

11.7.7.1 How to configure the R&S FSMR3 for remote operation via remote desktop

1. Create a fixed IP address for the TCP/IP protocol as described in Chapter 11.7.1.2, "How to assign the IP address", on page 368.

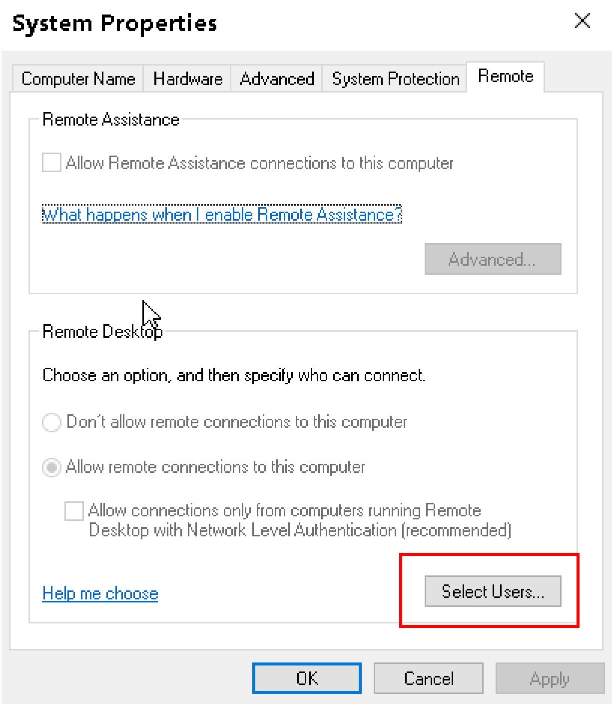
   Note: To avoid problems, use a fixed IP address.
   When a DHCP server is used, a new IP address is assigned each time the instrument is restarted. This address must first be determined on the instrument itself. Thus, using a DHCP server is not suitable for remote operation of the R&S FSMR3 via Remote Desktop.

2. 

   Select the "Windows" icon in the toolbar to access the operating system.

3. In the Windows "Start" menu, select "Settings > System".
4. Search for "remote access".
5. Select "Allow remote access to your computer".
6. Define which users are to be given access to the R&S FSMR3 via Remote Desktop.

   Note: The user account under which configuration is carried out is automatically enabled for Remote Desktop.



a) Select the "Select Users" button.
b) Select the users or create new user accounts as described in Chapter 11.7.3.1, "How to create users", on page 374.
c) Select "OK" to confirm the settings.

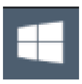
7. The R&S FSMR3 is now ready for connection setup with the Remote Desktop program of the controller.

11.7.7.2 How to configure the controller

Remote Desktop Client

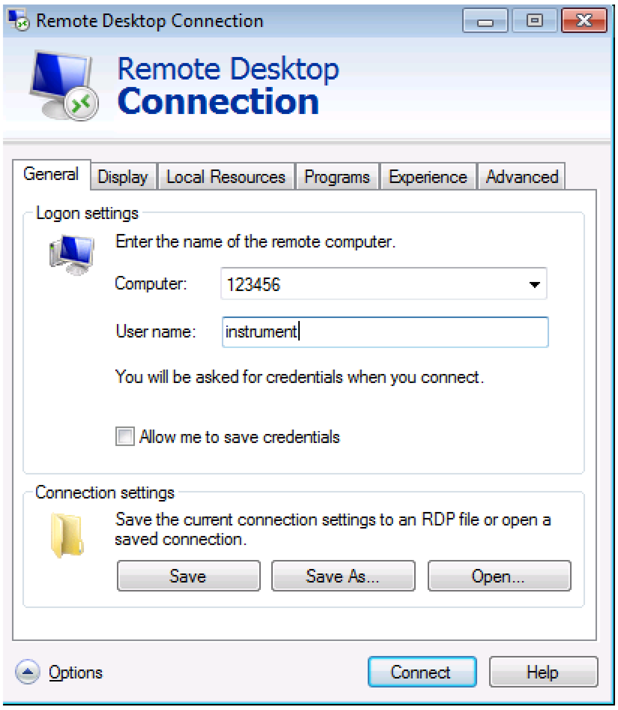
With Windows 10, Remote Desktop Client is part of the operating system and can be accessed via "Start > Programs > Accessories > Remote Desktop Connection".

For other versions of Windows, Microsoft offers the Remote Desktop Client as an add-on.

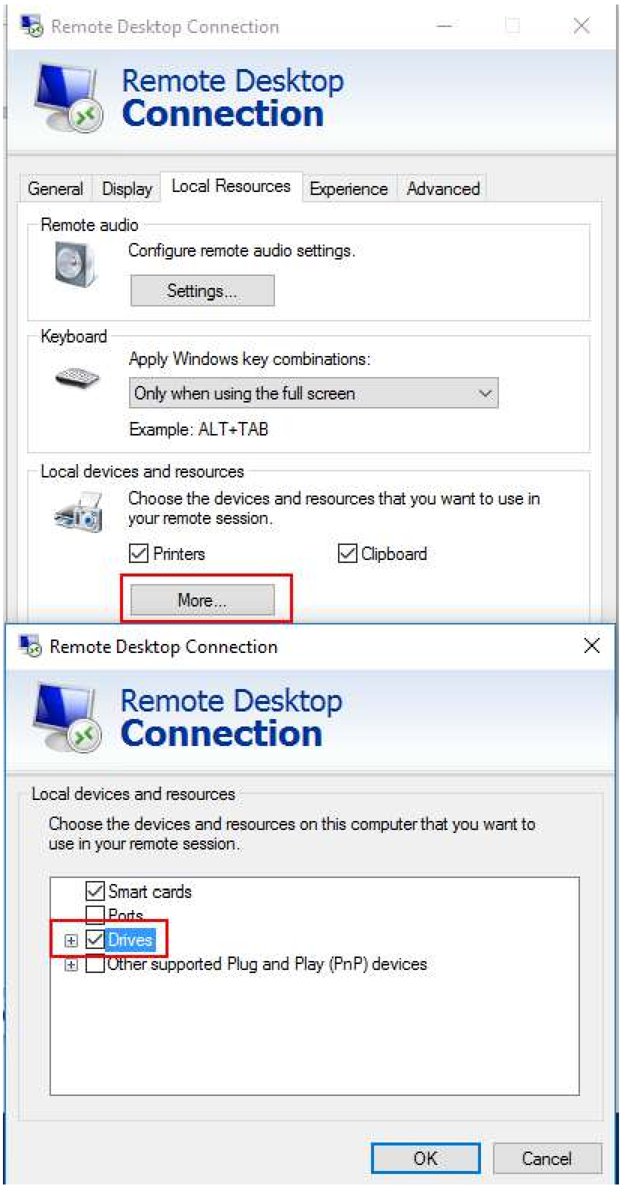
1. 

   Select the "Windows" icon in the toolbar to access the operating system.
2. From the "Start" menu, select "All Programs > Accessories > Remote Desktop Connection".
   The "Remote Desktop Connection" dialog box is displayed.
3. Select the "Options >>" button.

The dialog box is expanded to display the configuration data.



4. Open the "Experience" tab.
   The settings on this tab are used to select and optimize the connection speed.
5. In the list, select the appropriate connection (for example: LAN (10 Mbps or higher)).
   Depending on your selection (and how powerful the connection is), the options are activated or deactivated.
6. To improve the performance, you can deactivate the "Desktop background", "Show contents of window while dragging" and "Menu and window animation" options.
7. Open the "Local Resources" tab for enabling printers, local drives and serial interfaces.
8. If you will need to access drives of the controller from the R&S FSMR3 (e.g. in order to store settings or to copy files from the controller to the R&S FSMR3), select "More", then enable the "Drives" option.



Windows will then map drives of the controller to the corresponding network drives.

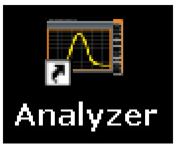
9. To use printers connected to the controller while accessing them from the R&S FSMR3, activate the "Printers" option. Do not change the remaining settings.
10. Open the "Display" tab.
    The options for configuring the R&S FSMR3 screen display are displayed.
11. Under "Remote desktop size", you can set the size of the R&S FSMR3 window on the desktop of the controller.
12. Under "Colors", do not change the settings.
13. Set the "Display the connection bar when I use the full screen" option:

- If activated, a bar showing the network address of the R&S FSMR3 will appear at the top edge of the screen. You can use this bar to reduce, minimize or close the window.
- If deactivated, the only way you can return to the controller desktop from the R&S FSMR3 screen in full screen mode is to select "Disconnect" from the "Start" menu.

11.7.7.3 How to start and close the remote desktop

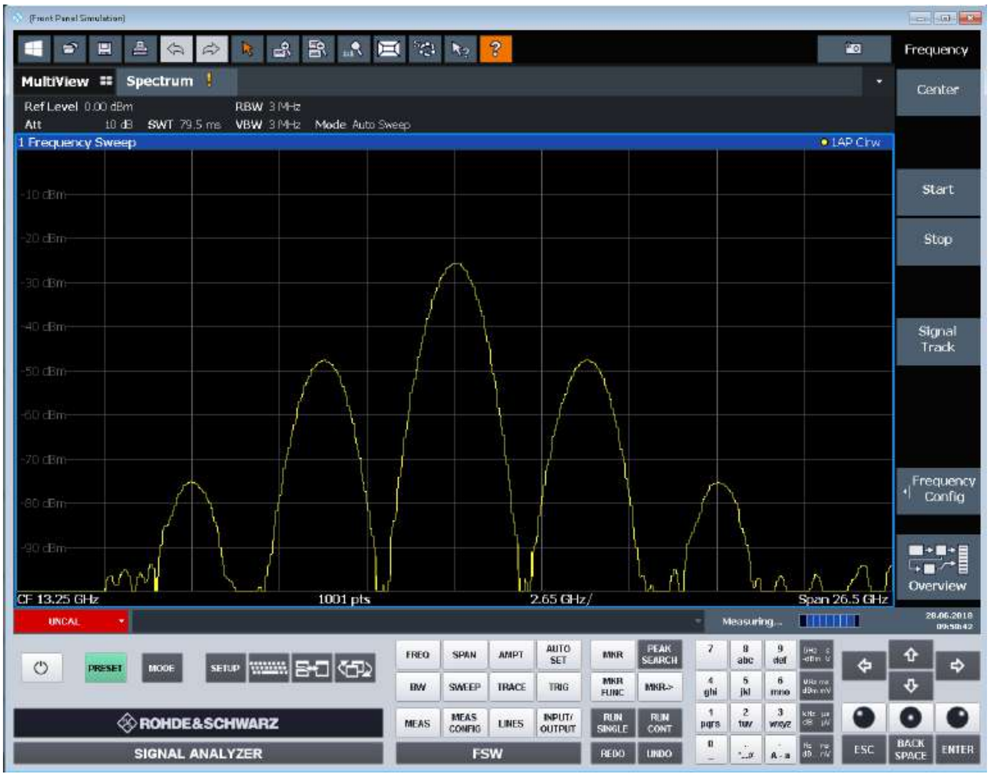
To set up a connection to the R&S FSMR3

1. In the "Remote Desktop Connection" dialog box (see Chapter 11.7.7.2, "How to configure the controller", on page 380), open the "General" tab.
2. In the "Computer" field, enter the IP address of the R&S FSMR3.
   In the "User name" field, enter *instrument* to log in as an administrator, or *Normal User* to log in as a standard user.
   In the "Password" field, enter *894129*.
3. To save the connection configuration for later use:
   a) Select the "Save As" button.
      The "Save As" dialog box is displayed.
   b) Enter the name for the connection information (`*.RDP`).
4. To load an existing connection configuration:
   a) Select the "Open" button.
      The "Open" dialog box is displayed.
   b) Select the `*.RDP` file.
5. Select the "Connect" button.
   The connection is set up.
6. If the "Disk drives" option is activated on the "Local Resources" tab, a warning is displayed indicating that the drives are enabled for access from the R&S FSMR3. Select "OK" to confirm the warning.
7. After a few moments, the R&S FSMR3 screen is displayed.
   If a dark screen appears or a dark square appears in the upper left-hand corner of the screen, you must restart the R&S FSMR3 in order to see the modified screen resolution.

	• Press the key combination [ALT] + [F4]. • The R&S FSMR3 firmware is shut down, which may take a few seconds. • On the desktop, double-tap the "Analyzer" icon.

The firmware restarts and then automatically opens the "Soft Front Panel", i.e. the user interface on which all front panel controls and the rotary knob are mapped to buttons.
For more information see Chapter 10.2.3, "How to work with the soft front panels", on page 288.

8. To deactivate or activate the "Softfrontpanel", press the [F6] key.
After the connection is established, the R&S FSMR3 screen is displayed in the "Remote Desktop" application window.



The Windows "Start" menu can be made available by expanding the "Remote Desktop" window to full size.
During the connection with the controller, the login entry is displayed on the R&S FSMR3 screen.

To terminate Remote Desktop control

The connection can be terminated by the controller or by a user at the R&S FSMR3:

1. On the controller, close the "Remote Desktop" window at any time.
The connection to the R&S FSMR3 is terminated.

2. On the R&S FSMR3, a user logs on.
The connection to the controller is terminated as a result. A message is displayed on the controller display indicating that another user has assumed control of the instrument.

Restoring the connection to the R&S FSMR3

Follow the instructions above for setting up a connection to the R&S FSMR3. If the connection is terminated and then restored, the R&S FSMR3 remains in the same state.

11.7.7.4 How to shut down the R&S FSMR3 via remote operation

1. Select the R&S FSMR3 softfrontpanel and close the application with the key combination [ALT] + [F4].
2. Select the desktop and press the key combination [ALT] + [F4].
   A safety query is displayed to warn you that the instrument cannot be reactivated via remote operation and asks you whether you want to continue the shutdown process.
3. Respond to the safety query with "Yes".
   The connection with the controller is terminated and the R&S FSMR3 is shut down.

11.7.8 How to start a remote control session from a PC

When you switch on the R&S FSMR3, it is always in manual operation state ("local" state) and can be operated via the front panel.

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. During program execution, send the `SYSTem:DISPlay:UPDate ON` command to activate the display of results (see `SYSTem:DISPlay:UPDate` on page 608).

   The changes in the device settings and the recorded measurement values are displayed on the instrument screen.
3. To obtain optimum performance during remote control, send the `SYSTem:DISPlay:UPDate OFF` command to hide the display of results and diagrams again (default setting in remote control).
4. To prevent unintentional return to manual operation, disable the keys of the instrument using the universal command `LLO`.

Switching to manual mode is only possible via remote control then. This function is only available for the GPIB interface.

5. To enable the keys of the R&S FSMR3 again, switch the instrument to local mode (`GTL` - Go to Local), i.e. deactivate the `REN` line of the remote control interface.

If the instrument is operated exclusively in remote control, it is recommended that you switch off the display. For details see "Remote Display Update" on page 353.

11.7.9 How to return to manual operation

Before you switch back to manual operation, all remote command processing must be completed. Otherwise, the instrument will switch back to remote control immediately.

► Select the "Local" softkey, or use the following GPIB command:
`status = viGpibControlREN(vi, VI_GPIB_REN_ADDRESS_GTL)`

If you select the "Local" softkey while a self-alignment or a self-test is still running (which was started remotely), the instrument only returns to the manual operation state when the alignment or test is completed.

12 Remote commands

The commands required to perform measurements in the Spectrum application in a remote environment are described here.

It is assumed that the R&S FSMR3 has already been set up for remote operation in a network as described in Chapter 11.7, "How to set up a network and remote control", on page 366.

Compatibility with former R&S signal and spectrum analyzers

As a rule, the R&S FSMR3 supports most commands from previous R&S signal and spectrum analyzers such as the FSQ, FSP, FSU, or FSV. However, the default values, in particular the number of sweep points or particular bandwidths, may vary. Therefore, the R&S FSMR3 can emulate these other devices, including their default values, in order to repeat previous measurements or support existing control applications as in legacy systems.

12.1 Conventions used in SCPI command descriptions

The following conventions are used in the remote command descriptions:

- **Command usage**
  If not specified otherwise, commands can be used both for setting and for querying parameters.
  If a command can be used for setting or querying only, or if it initiates an event, the usage is stated explicitly.
- **Parameter usage**
  If not specified otherwise, a parameter can be used to set a value and it is the result of a query.
  Parameters required only for setting are indicated as **Setting parameters**.
  Parameters required only to refine a query are indicated as **Query parameters**.

Parameters that are only returned as the result of a query are indicated as **Return values**.

- **Conformity**
  Commands that are taken from the SCPI standard are indicated as **SCPI confirmed**. All commands used by the R&S FSMR3 follow the SCPI syntax rules.
- **Asynchronous commands**
  A command which does not automatically finish executing before the next command starts executing (overlapping command) is indicated as an **Asynchronous command**.
- **Reset values (*RST)**
  Default parameter values that are used directly after resetting the instrument (`*RST` command) are indicated as ***RST** values, if available.
- **Default unit**
  The default unit is used for numeric values if no other unit is provided with the parameter.
- **Manual operation**
  If the result of a remote command can also be achieved in manual operation, a link to the description is inserted.

12.2 Common suffixes

In the Measuring Receiver application, the following common suffixes are used in remote commands:

Table 12-1: Common suffixes used in remote commands in the Measuring Receiver application

Suffix	Value range	Description
<m>	1 to 16	Marker
<n>	1 to 16	Window (**in the currently selected channel**)
<t>	1 to 6	Trace
	1 to 8	Limit line

12.3 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?**

Calibration query

Initiates a calibration of the instrument and then 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

Manual operation: See "Start Self Alignment" on page 272

***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 then sets the register to zero.

Return values:

<Contents>	Range:	0 to 255
Usage:	Query only	

***IDN?**

Identification

Returns the instrument identification.

Return values:

<ID>	"Rohde&Schwarz,<device type>,<part number>/<serial number>,<firmware version>"
Example:	`Rohde&Schwarz,FSMR3026,1312.8000K26/100005,1.30`
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 writes a "1" into the output buffer when all preceding commands have been executed, which is useful 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.

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.
Note that B3 (Audio demodulator), K9 (Power Meter) and K14 (Spectrograms) are displayed for compatibility reasons only; in fact they are standard functionality of the R&S FSMR3 base unit and do not require additional ordering.

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

***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.

*TRG corresponds to the INITiate:IMMediate command (see INITiate<n>[:IMMediate] on page 485).

Usage: Event

***TST?**

Self-test query

Initiates self-tests of the instrument and returns an error code.

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.

Return values:

<ErrorCode> **integer > 0 (in decimal format)**
An error occurred.
(For details, see the Service Manual supplied with the instrument).

0
No errors occurred.

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

12.4 Selecting the operating mode and application

The following commands are required to select the operating mode or the application and to configure a Sequencer in a remote environment.

12.4.1 Selecting the mode and applications

DISPlay:ATAB <State>

This command switches between the MultiView tab and the most recently displayed channel. If only one channel is active, this command has no effect.

Parameters:

<State> ON | OFF | 0 | 1

OFF | 0
Switches the function off

ON | 1
Switches the function on

INSTrument:CREate:DUPLicate

This command duplicates the currently selected channel, i.e creates a new 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" -> "IQAnalyzer 2").

The channel to be duplicated must be selected first using the `INST:SEL` command.

Example:
```
INST:SEL 'Measuring Receiver'
INST:CRE:DUPL
```
Duplicates the channel named 'Measuring Receiver' and creates a new channel named 'Measuring Receiver 2'.

Usage: Event

Manual operation: See "Duplicate Current Channel" on page 90

INSTrument:CREate[:NEW] <ChannelType>, <ChannelName>

This command adds a measurement channel. You can configure up to 10 measurement channels at the same time (depending on available memory).

See also
- `INSTrument[:SELect]` on page 396
- `INSTrument:DELete` on page 395

Parameters:

<ChannelType> Channel type of the new channel.
For a list of available channel types, see `INSTrument:LIST?` on page 395.

<ChannelName> String containing the name of the channel.
Note that you cannot assign an existing channel name to a new channel. If you do, an error occurs.

Example:
```
INST:CRE SAN, 'Spectrum 2'
```
Adds a spectrum display named "Spectrum 2".

Manual operation: See "New Channel" on page 90

INSTrument:CREate:REPLace <ChannelName1>,<ChannelType>,<ChannelName2>

This command replaces a channel with another one.

Setting parameters:

<ChannelName1> String containing the name of the channel you want to replace.

<ChannelType> Channel type of the new channel.
For a list of available channel types, see `INSTrument:LIST?` on page 395.

<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 395).
Channel names can have a maximum of 31 characters, and must be compatible with the Windows conventions for file names. In particular, they must not contain special characters such as ":", "*", "?".

Example: `INST:CRE:REPL 'Measuring Receiver 2',MREC,'Measuring Receiver 3'`
Replaces the channel named "Measuring Receiver 2" by a new channel of type "Measuring Receiver" named "Measuring Receiver 3".

Usage: Setting only

Manual operation: See "Replace Current Channel" on page 90

INSTrument:DELete <ChannelName>

This command deletes a channel.

If you delete the last channel, the default Measuring Receiver channel is activated.

Setting parameters:
<ChannelName> String containing the name of the channel you want to delete.
A channel must exist to delete it.

Example: `INST:DEL 'Measuring Receiver 2'`
Deletes the channel with the name 'Measuring Receiver 2'.

Usage: Setting only

Manual operation: See "Closing an application" on page 90

INSTrument:LIST?

This command queries all active channels. The query is useful to obtain the names of the existing channels, which are required 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 2 channels:
`'MREC','Measuring Receiver','MREC','Measuring Receiver 2'`

Usage: Query only

Table 12-2: Available channel types and default channel names

Application	<ChannelType> Parameter	Default Channel Name*)
Measuring Receiver	MRECeiver	Measuring Receiver
Spectrum (R&S FSMR3-B1)	SANalyzer	Spectrum
I/Q Analyzer (R&S FSMR3-B1)	IQ	IQ Analyzer
Phase Noise (R&S FSMR3-B60)	PNOise	Phase Noise
Pulse (R&S FSMR3-K6)	PULSE	Pulse
Avionics (R&S FSMR3-K15)	AVIonics	Avionics
Vector Signal Analysis (VSA, R&S FSMR3-K70)	DDEM	VSA
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 channel.

Setting parameters:

<ChannelName1> String containing the name of the channel you want to rename.

<ChannelName2> String containing the new channel name.
Note that you cannot assign an existing channel name to a new channel. If you do, an error occurs.
Channel names can have a maximum of 31 characters, and must be compatible with the Windows conventions for file names. In particular, they must not contain special characters such as ":", "*", "?".

Example: `INST:REN 'Measuring Receiver 2','Measuring Receiver 3'`
Renames the channel with the name 'Measuring Receiver 2' to 'Measuring Receiver 3'.

Usage: Setting only

Manual operation: See "Changing the Channel Name" on page 62

INSTrument[:SELect] <ChannelType> | <ChannelName>

This command activates a new channel with the defined channel type, or selects an existing channel with the specified name.

Also see

- `INSTrument:CREate[:NEW]` on page 394

- Chapter 12.4.3, "Programming example: performing a sequence of measurements", on page 399

Parameters:

<ChannelType> Channel type of the new channel.
For a list of available channel types see `INSTrument:LIST?` on page 395.

<ChannelName> String containing the name of the channel.

Example:
`INST IQ`
Activates a channel for the I/Q Analyzer application (evaluation mode).
`INST 'MyIQSpectrum'`
Selects the channel named 'MyIQSpectrum' (for example before executing further commands for that channel).

Manual operation:
See "AM/FM/PM Modulation Analysis" on page 86
See "Avionics" on page 86
See "Fast Spur Search" on page 86
See "I/Q Analyzer" on page 87
See "Measuring Receiver" on page 87
See "Noise Figure" on page 87
See "Phase Noise" on page 87
See "Phase Noise" on page 87
See "Pulse Measurements" on page 87
See "Spectrum" on page 88
See "Spectrum Monitor" on page 88
See "Vector Signal Analysis (VSA)" on page 88
See "Selecting an application" on page 89
See "New Channel" on page 90

12.4.2 Performing a sequence of measurements

The following commands control the sequencer.

For details on the Sequencer see Chapter 5.4.1, "The sequencer concept", on page 91.

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 398.

Usage: Event

Manual operation: See "Sequencer State" on page 93

INITiate:SEQuencer:IMMediate

This command starts a new sequence of measurements by the Sequencer.

Its effect is similar to the `INITiate<n>[:IMMediate]` command used for a single measurement.

Before this command can be executed, the Sequencer must be activated (see `SYSTem:SEQuencer` on page 399).

Example:
`SYST:SEQ ON`
Activates the Sequencer.
`INIT:SEQ:MODE SING`
Sets single sequence mode so each active measurement is performed once.
`INIT:SEQ:IMM`
Starts the sequential measurements.

Manual operation: See "Sequencer State" on page 93

INITiate:SEQuencer:MODE <Mode>

Defines the capture mode for the entire measurement sequence and all measurement groups and channels it contains.

Note: To synchronize to the end of a measurement sequence using `*OPC`, `*OPC?` or `*WAI`, use `SINGle` Sequencer 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 explicitly.

*RST: CONTinuous

Manual operation: See "Sequencer Mode" on page 93

SYSTem:SEQuencer <State>

This command turns the Sequencer on and off. The Sequencer must be active before any other Sequencer commands (`INIT:SEQ...`) are executed, otherwise an error occurs.

A detailed programming example is provided in Chapter 12.4.3, "Programming example: performing a sequence of measurements", on page 399.

Parameters:

<State> ON | OFF | 0 | 1

ON | 1
The Sequencer is activated and a sequential measurement is started immediately.

OFF | 0
The Sequencer is deactivated. Any running sequential measurements are stopped. Further Sequencer commands (`INIT:SEQ...`) are not available.

*RST: 0

Example:

`SYST:SEQ ON`
Activates the Sequencer.
`INIT:SEQ:MODE SING`
Sets single Sequencer mode so each active measurement is performed once.
`INIT:SEQ:IMM`
Starts the sequential measurements.
`SYST:SEQ OFF`

Manual operation: See "Sequencer State" on page 93

12.4.3 Programming example: performing a sequence of measurements

This example demonstrates how to perform several measurements in a sequence in a remote environment.

```
//2xSpectrumanalyzer + 2xIQ, start Sequencer at the end, test OPC?
// -------------------------------------------------------------------------


//------Preparing the instrument and first channel -----------
*RST
//Activate new IQ channel
INSTrument:CREate:NEW IQ,'IQ 1'
//Set sweep count for new IQ channel
SENS:SWEEP:COUNT 6
//Change trace modes for IQ channel
DISP:TRAC1:MODE BLANK
DISP:TRAC2:MODE MAXH
DISP:TRAC3:MODE MINH
```

```
//Switch to single sweep mode
INIT:CONT OFF
//switch back to first (default) analyzer channel
INST:SEL 'Spectrum';*WAI
//Switch into SEM
SENSe:SWEep:MODE ESPectrum
//Load Sem standard file for W-CDMA
SENSe:ESPectrum:PRESet:STANdard 'WCDMA\3GPP\DL\3GPP_DL.xml'
//Set sweep count in Spectrum channel
SENS:SWEEP:COUNT 5

//----------Creating a second measurement channel ----------------

//Create second IQ channel
INSTrument:CREate:NEW IQ,'IQ 2'
//Set sweep count
SENS:SWEEP:COUNT 2
//Change trace modes
DISP:TRAC1:MODE MAXH
DISP:TRAC2:MODE MINH
//Create new analyzer channel
INSTrument:CREate:NEW SANalyzer,'Spectrum 2'
//Activate ACLR measurement in channel 'Spectrum 2'
CALCulate:MARKer:FUNCtion:POWer:SELect ACPower
//Load W-CDMA Standard
CALCulate:MARKer:FUNCtion:POWer:PRESet FW3Gppcdma
//Change trace modes
DISP:TRAC2:MODE MAXH
DISP:TRAC1:MODE MINH

//--------Performing a sweep and retrieving results----------------

//Change sweep count
SENS:SWEep:COUNt 7
//Single Sweep mode
INIT:CONT OFF
//Switch back to first IQ channel
INST:SEL 'IQ 1';*WAI
//Perform a measurement
INIT:IMM;*OPC?
//Retrieve results
CALC:MARK:Y?
//Activate Multiview
DISPlay:ATAB    ON

//---------Performing a sequence of measurements with the Sequencer------------
//Activate Sequencer
SYSTem:SEQuencer ON
//Start sweep in Sequencer
INITiate:SEQuencer:IMMediate;*OPC?
```

```
//Switch into first IQ channel to get results
INST:SEL 'IQ 1';*WAI
CALCulate:MARKer:MAXimum
CALC:MARK:Y?
//Change sweep time in IQ
SENS:SWE:TIME 300us
//Switch to single Sequencer mode
INITiate:SEQuencer:MODE SINGle
//Sweep all channels once, taking the sweep count in each channel into account
INITiate:SEQuencer:IMMediate;*OPC?
//Set marker to maximum in IQ1 and query result
CALCulate:MARKer:MAXimum
CALC:MARK:Y?
//Switch to second IQ channel and retrieve results
INST:SEL 'IQ 2';*WAI
CALCulate:MARKer:MIN
CALC:MARK:Y?
//Switch to first Spectrum channel
INST:SEL 'Spectrum';*WAI
//Query one of the SEM results
CALCulate:MARKer:FUNCtion:POWer:RESult? CPOWer
//Switch to second Spectrum channel
INST:SEL 'Spectrum 2';*WAI
//Query channel power result
CALCulate:MARKer:FUNCtion:POWer:RESult? ACPower
```

12.5 Configuring the result display

The commands required to configure the screen display in a remote environment are described here.

12.5.1 General window commands

The following commands are required to configure general window layout, independent of the application.

DISPlay:FORMat <Format>

This command determines which tab is displayed.

Parameters:

<Format> **SPLit**
Displays the MultiView tab with an overview of all active channels

SINGle
Displays the measurement channel that was previously focused.

*RST: SING

Example: `DISP:FORM SPL`

DISPlay[:WINDow<n>]:SIZE <Size>

This command maximizes the size of the selected result display window *temporarily*. To change the size of several windows on the screen permanently, use the `LAY:SPL` command (see `LAYout:SPLitter` on page 406).

Suffix:

<n> Window

Parameters:

<Size> **LARGe**
Maximizes the selected window to full screen.
Other windows are still active in the background.

SMALl
Reduces the size of the selected window to its original size.
If more than one measurement window was displayed originally, these are visible again.

*RST: SMALl

Example: `DISP:WIND2:SIZE LARG`

12.5.2 Working with windows in the display

The following commands are required to change the evaluation type and rearrange the screen layout for a 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 channel.

Note that the suffix <n> always refers to the window *in the currently selected channel*.

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

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

Query parameters:

<WindowName> String containing the name of the existing window the new window is inserted next to.
By default, the name of a window is the same as its index. To determine the name and index of all active windows, use the `LAYout:CATalog[:WINDow]?` query.

<Direction> LEFT | RIGHt | ABOVe | BELow

Direction the new window is added relative to the existing window.

<WindowType> text value

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

Return values:

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

Usage: Query only

Manual operation: See "AM Time Domain" on page 100
See "FM Time Domain" on page 100
See "PM Time Domain" on page 101
See "AM Spectrum" on page 102
See "FM Spectrum" on page 103
See "PM Spectrum" on page 104
See "RF Time Domain" on page 105
See "RF Spectrum" on page 106
See "Audio Time Domain" on page 107
See "Audio Spectrum" on page 108
See "Result Summary" on page 108
See "Signal Summary" on page 109
See "CORR Status" on page 110
See "Marker Table" on page 110
See "Marker Peak List" on page 110
See "Diagram" on page 182
See "Result Summary" on page 183

LAYout:CATalog[:WINDow]?

This command queries the name and index of all active windows in the active channel from top left to bottom right. The result is a comma-separated list of values for each window, with the syntax:

<WindowName_1>,<WindowIndex_1>..<WindowName_n>,<WindowIndex_n>

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 channel.

Note: to query the **name** of a particular window, use the `LAYout:WINDow<n>:IDENtify?` query.

Query parameters:

<WindowName> String containing the name of a window.

Return values:

<WindowIndex> Index number of the window.

Example: `LAY:IDEN:WIND? '2'`
Queries the index of the result display named '2'.
Response:
`2`

Usage: Query only

LAYout:MOVE[:WINDow] <WindowName>, <WindowName>, <Direction>

Setting parameters:

<WindowName> String containing the name of an existing window that is to be moved.
By default, the name of a window is the same as its index. To determine the name and index of all active windows in the active channel, use the `LAYout:CATalog[:WINDow]?` query.

<WindowName>	String containing the name of an existing window the selected window is placed next to or replaces. By default, the name of a window is the same as its index. To determine the name and index of all active windows in the active channel, use the `LAYout:CATalog[:WINDow]?` query.
<Direction>	LEFT | RIGHt | ABOVe | BELow | REPLace Destination the selected window is moved to, relative to the reference window.
Example:	`LAY:MOVE '4','1',LEFT` Moves the window named '4' to the left of window 1.
Example:	`LAY:MOVE '1','3',REPL` Replaces the window named '3' by window 1. Window 3 is deleted.
Usage:	Setting only

LAYout:REMove[:WINDow] <WindowName>

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

Setting parameters:

<WindowName>	String containing the name of the window. In the default state, the name of the window is its index.
Example:	`LAY:REM '2'` Removes the result display in the window named '2'.
Usage:	Setting only

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

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

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

Setting parameters:

<WindowName>	String containing the name of the existing window. By default, the name of a window is the same as its index. To determine the name and index of all active windows in the active channel, use the `LAYout:CATalog[:WINDow]?` query.
<WindowType>	Type of result display you want to use in the existing window. See `LAYout:ADD[:WINDow]?` on page 403 for a list of available window types.
Example:	`LAY:REPL:WIND '1',MTAB` Replaces the result display in window 1 with a marker table.
Usage:	Setting only

LAYout:SPLitter <Index1>, <Index2>, <Position>

This command changes the position of a splitter and thus controls the size of the windows on each side of the splitter.

Compared to the `DISPlay[:WINDow<n>]:SIZE` on page 402 command, the `LAYout:SPLitter` changes the size of all windows to either side of the splitter permanently, it does not just maximize a single window temporarily.

Note that windows must have a certain minimum size. If the position you define conflicts with the minimum size of any of the affected windows, the command does not work, but does not return an error.

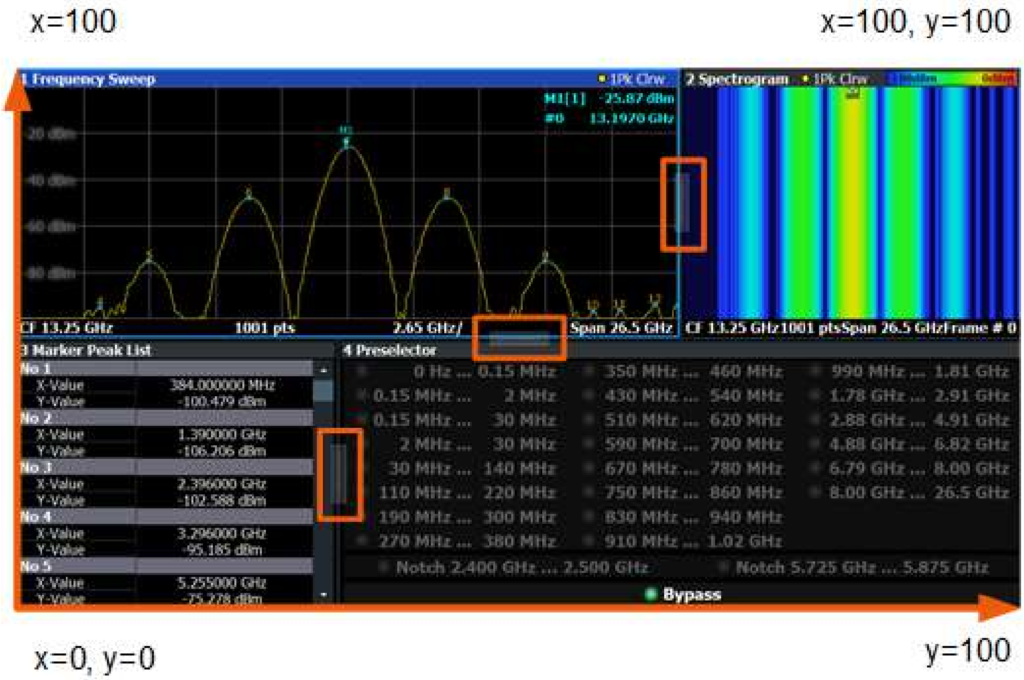


Figure 12-1: SmartGrid coordinates for remote control of the splitters

Setting parameters:

<Index1> The index of one window the splitter controls.

<Index2> The index of a window on the other side of the splitter.

<Position> New vertical or horizontal position of the splitter as a fraction of the screen area (without channel and status bar and softkey menu).
The point of origin (x = 0, y = 0) is in the lower left corner of the screen. The end point (x = 100, y = 100) is in the upper right corner of the screen. (See Figure 12-1.)
The direction in which the splitter is moved depends on the screen layout. If the windows are positioned horizontally, the splitter also moves horizontally. If the windows are positioned vertically, the splitter also moves vertically.

Range: 0 to 100

Example: `LAY:SPL 1,3,50`
Moves the splitter between window 1 ('Frequency Sweep') and 3 ('"Marker Table"') to the center (50%) of the screen, i.e. in the figure above, to the left.

Example: `LAY:SPL 1,4,70`
Moves the splitter between window 1 ('Frequency Sweep') and 3 ('"Marker Peak List"') towards the top (70%) of the screen.
The following commands have the exact same effect, as any combination of windows above and below the splitter moves the splitter vertically.
`LAY:SPL 3,2,70`
`LAY:SPL 4,1,70`
`LAY:SPL 2,1,70`

Usage: Setting only

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. Unlike `LAYout:ADD[:WINDow]?`, for which the existing window is defined by a parameter.

To replace an existing window, use the `LAYout:WINDow<n>:REPLace` command.

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

Suffix:
<n> Window

Query parameters:
<Direction> LEFT | RIGHt | ABOVe | BELow

<WindowType> Type of measurement window you want to add.
See `LAYout:ADD[:WINDow]?` on page 403 for a list of available window types.

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 channel.

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

Suffix:

<n> Window

Return values:

<WindowName> String containing the name of a window.
In the default state, the name of the window is its index.

Example: `LAY:WIND2:IDEN?`
Queries the name of the result display in window 2.
Response:
`'2'`

Usage: Query only

LAYout:WINDow<n>:REMove

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

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

Suffix:

<n> Window

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 channel.

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

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

Suffix:

<n> Window

Setting parameters:

<WindowType> Type of measurement window you want to replace another one with.
See `LAYout:ADD[:WINDow]?` on page 403 for a list of available window types.

Example: `LAY:WIND2:REPL MTAB`
Replaces the result display in window 2 with a marker table.

Usage: Setting only

LAYout:WINDow<n>:TYPE <WindowType>

Queries or defines the window type of the window specified by the index <n>. The window type determines which results are displayed. For a list of possible window types, see `LAYout:ADD[:WINDow]?` on page 403.

Note that this command is not available in all applications and measurements.

Suffix:
<n> 1..n
Window

Parameters:
<WindowType>

Example: `LAY:WIND2:TYPE?`

12.6 Configuring the measurement

The following remote commands are required to configure the Measuring Receiver

12.6.1 Configuring the input

12.6.1.1 RF input

INPut<ip>:ATTenuation:PROTection:RESet

This command resets the attenuator and reconnects the RF input with the input mixer for the R&S FSMR3000 after an overload condition occurred and the protection mechanism intervened. The error status bit (bit 3 in the `STAT:QUES:POW` status register) and the `INPUT OVLD` message in the status bar are cleared.

The command works only if the overload condition has been eliminated first.

Suffix:

<ip> 1 | 2
irrelevant

Example: `INP:ATT:PROT:RES`

INPut<ip>:ATTenuation:PROTection[:STATe] <State>

This command turns the availability of attenuation levels of 10 dB or less on and off.

Suffix:

<ip> 1 | 2
irrelevant

Parameters:

<State> ON | OFF | 1 | 0

ON | 1
Attenuation levels of 10 dB or less are not allowed to protect the RF input connector of the R&S FSMR3000.

OFF | 0
Attenuation levels of 10 dB or less are not blocked. Provide appropriate protection for the RF input connector of the R&S FSMR3000 yourself.

*RST: 1

Example: `INP:ATT:PROT ON`
Turns on the input protection.

INPut<ip>:COUPling <CouplingType>

This command selects the coupling type of the RF input.

Suffix:
<ip> 1 | 2
irrelevant

Parameters:
<CouplingType> AC | DC

AC
AC coupling

DC
DC coupling

*RST: AC

Example: `INP:COUP DC`

Manual operation: See "Input Coupling" on page 115

INPut<ip>:DPATh <DirectPath>

Enables or disables the use of the direct path for frequencies close to 0 Hz.

Suffix:
<ip> 1 | 2
irrelevant

Parameters:
<DirectPath> AUTO | OFF

AUTO | 1
(Default) the direct path is used automatically for frequencies close to 0 Hz.

OFF | 0
The analog mixer path is always used.

Example: `INP:DPAT OFF`

Manual operation: See "Direct Path" on page 115

INPut<ip>:FILTer:HPASs[:STATe] <State>

Activates an additional internal high-pass filter for RF input signals from 1 GHz to 3 GHz. This filter is used to remove the harmonics of the R&S FSMR3000 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-preselector, if available.)

Suffix:

<ip>	1 | 2 irrelevant

Parameters:

<State>	ON | OFF | 0 | 1 **OFF | 0** Switches the function off **ON | 1** Switches the function on *RST: 0
Example:	`INP:FILT:HPAS ON` Turns on the filter.

INPut<ip>:FILTer:YIG[:STATe] <State>

Enables or disables the YIG filter.

Suffix:

<ip>	1 | 2 irrelevant
Example:	`INP:FILT:YIG OFF` Deactivates the YIG-preselector.
Manual operation:	See "YIG-Preselector" on page 115

INPut<ip>:IMPedance <Impedance>

This command selects the nominal input impedance of the RF input. In some applications, only 50 Ω are supported.

Suffix:

<ip>	1 | 2 irrelevant

Parameters:

<Impedance>	50 | 75 *RST: 50 Ω Default unit: OHM
Example:	`INP:IMP 75`

INPut<ip>: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 FSMR3.

Suffix:

<ip>	1 | 2 irrelevant

Parameters:

<Source>	**RF** Radio Frequency ("RF INPUT" connector) *RST: RF
Manual operation:	See "Radio Frequency State" on page 114

12.6.1.2 Working with power sensors

The following commands describe how to work with power sensors.

These commands require the use of a Rohde & Schwarz power sensor. For a list of supported sensors, see the data sheet.

Configuring power sensors

SYSTem:COMMunicate:RDEVice:PMETer<p>:CONFigure:AUTO[:STATe] <State>

This command turns automatic assignment of a power sensor to the power sensor index on and off.

Suffix:

<p>	Power sensor index

Parameters:

<State>	ON | OFF | 0 | 1 *RST: 1
Example:	`SYST:COMM:RDEV:PMET:CONF:AUTO OFF`
Manual operation:	See "Select" on page 118

SYSTem:COMMunicate:RDEVice:PMETer<p>:COUNt?

This command queries the number of power sensors currently connected to the R&S FSMR3.

Suffix:

<p>	Power sensor index

Return values:

<NumberSensors>	Number of connected power sensors.
Example:	`SYST:COMM:RDEV:PMET:COUN?`
Usage:	Query only

Manual operation: See "Select" on page 118

SYSTem:COMMunicate:RDEVice:PMETer<p>:DEFine <Placeholder>, <Type>, <Interface>, <SerialNo>

This command assigns the power sensor with the specified serial number to the selected power sensor index (configuration).

The query returns the power sensor type and serial number of the sensor assigned to the specified index.

Suffix:

<p> Power sensor index

Parameters:

<Placeholder> Currently not used

<Type> Detected power sensor type, e.g. "NRP-Z81".

<Interface> Interface the power sensor is connected to; always "USB"

<SerialNo> Serial number of the power sensor assigned to the specified index

Example:

```
SYST:COMM:RDEV:PMET2:DEF '','NRP-Z81','',
'123456'
```

Assigns the power sensor with the serial number '123456' to the configuration "Power Sensor 2".

```
SYST:COMM:RDEV:PMET2:DEF?
```

Queries the sensor assigned to "Power Sensor 2".

Result:

```
'','NRP-Z81','USB','123456'
```

The NRP-Z81 power sensor with the serial number '123456' is assigned to the "Power Sensor 2".

Manual operation: See "Select" on page 118

Configuring power sensor measurements

CALibration:PMETer<p>:ZERO:AUTO ONCE

This command zeroes the power sensor.

Note that you have to disconnect the signals from the power sensor input before you start to zero the power sensor. Otherwise, results are invalid.

Suffix:
<p> Power sensor index

Example: `CAL:PMET2:ZERO:AUTO ONCE;*WAI`
Starts zeroing the power sensor 2 and delays the execution of further commands until zeroing is concluded.

Usage: Event

Manual operation: See "Zeroing Power Sensor" on page 119

CALCulate<n>:PMETer<p>:RELative[:MAGNitude] <RefValue>

This command defines the reference value for relative measurements.

Suffix:
<n> Window

<p> Power sensor index

Parameters:
<RefValue> Range: -200 dBm to 200 dBm
*RST: 0
Default unit: DBM

Example: `CALC:PMET2:REL -30`
Sets the reference value for relative measurements to -30 dBm for power sensor 2.

Manual operation: See "Reference Value" on page 120

CALCulate<n>:PMETer<p>:RELative[:MAGNitude]:AUTO ONCE

This command sets the current measurement result as the reference level for relative measurements.

Suffix:
<n> Window

<p> Power sensor index

Example: `CALC:PMET2:REL:AUTO ONCE`
Takes the current measurement value as reference value for relative measurements for power sensor 2.

Usage: Event

Manual operation: See "Setting the Reference Level from the Measurement Meas -> Ref" on page 120

CALCulate<n>:PMETer<p>:RELative:STATe <State>

This command turns relative power sensor measurements on and off.

Suffix:

<n> Window

<p> Power sensor index

Parameters:

<State> ON | OFF | 0 | 1

OFF | 0
Switches the function off

ON | 1
Switches the function on

Example: `CALC:PMET2:REL:STAT ON`
Activates the relative display of the measured value for power sensor 2.

FETCh:PMETer<p>?

This command queries the results of power sensor measurements.

Suffix:

<p> Power sensor index

Usage: Query only

READ:PMETer<p>?

This command initiates a power sensor measurement and queries the results.

Suffix:

<p> Power sensor index

Usage: Query only

[SENSe:]PMETer<p>:DCYCle[:STATe] <State>

This command turns the duty cycle correction on and off.

Suffix:
<p> Power sensor index

Parameters:
<State> ON | OFF | 0 | 1

OFF | 0
Switches the function off

ON | 1
Switches the function on

Example: `PMET2:DCYC:STAT ON`

Manual operation: See "Duty Cycle" on page 120

[SENSe:]PMETer<p>:DCYCle:VALue <Percentage>

This command defines the duty cycle for the correction of pulse signals.

The power sensor uses the duty cycle in combination with the mean power to calculate the power of the pulse.

Suffix:
<p> Power sensor

Parameters:
<Percentage> Range: 0.001 to 99.999
*RST: 99.999
Default unit: %

Example: `PMET2:DCYC:STAT ON`
Activates the duty cycle correction.
`PMET2:DCYC:VAL 0.5`
Sets the correction value to 0.5%.

Manual operation: See "Duty Cycle" on page 120

[SENSe:]PMETer<p>:FREQuency <Frequency>

This command defines the frequency of the power sensor.

Suffix:
<p> Power sensor index

Parameters:
<Frequency> The available value range is specified in the data sheet of the power sensor in use.
*RST: 50 MHz
Default unit: HZ

Example: `PMET2:FREQ 1GHZ`
Sets the frequency of the power sensor to 1 GHz.

Manual operation: See "Frequency Manual" on page 119

[SENSe:]PMETer<p>:FREQuency:LINK <Coupling>

This command selects the frequency coupling for power sensor measurements.

Suffix:

<p> Power sensor index

Parameters:

<Coupling>

CENTer
Couples the frequency to the center frequency of the analyzer

MARKer1
Couples the frequency to the position of marker 1

OFF
Switches the frequency coupling off

*RST: CENTer

Example: `PMET2:FREQ:LINK CENT`
Couples the frequency to the center frequency of the analyzer

Manual operation: See "Frequency Coupling" on page 119

[SENSe:]PMETer<p>:MTIMe <Duration>

This command selects the duration of power sensor measurements.

Suffix:

<p> Power sensor index

Parameters:

<Duration> SHORt | NORMal | LONG

*RST: NORMal

Example: `PMET2:MTIM SHOR`
Sets a short measurement duration for measurements of stationary high power signals for the selected power sensor.

Manual operation: See "Meas Time/Average" on page 119

[SENSe:]PMETer<p>:MTIMe:AVERage:COUNt <NumberReadings>

This command sets the number of power readings included in the averaging process of power sensor measurements.

Extended averaging yields more stable results for power sensor measurements, especially for measurements on signals with a low power, because it minimizes the effects of noise.

Suffix:

<p> Power sensor index

Parameters:

<NumberReadings> An average count of 0 or 1 performs one power reading.

Range: 0 to 256
Increment: binary steps (1, 2, 4, 8, ...)

Example: `PMET2:MTIM:AVER ON`
Activates manual averaging.
`PMET2:MTIM:AVER:COUN 8`
Sets the number of readings to 8.

Manual operation: See "Average Count (Number of Readings)" on page 120

[SENSe:]PMETer<p>:MTIMe:AVERage[:STATe] <State>

This command turns averaging for power sensor measurements on and off.

Suffix:

<p> Power sensor index

Parameters:

<State> ON | OFF | 0 | 1

OFF | 0
Switches the function off

ON | 1
Switches the function on

Example: `PMET2:MTIM:AVER ON`
Activates manual averaging.

Manual operation: See "Meas Time/Average" on page 119

[SENSe:]PMETer<p>:ROFFset[:STATe] <State>

This command includes or excludes the reference level offset of the analyzer for power sensor measurements.

Suffix:

<p> Power sensor index

Parameters:

<State> ON | OFF | 0 | 1

OFF | 0
Switches the function off

ON | 1
Switches the function on

Example: `PMET2:ROFF OFF`
Takes no offset into account for the measured power.

Manual operation: See "Use Ref Level Offset" on page 120

[SENSe:]PMETer<p>:SOFFset <SensorOffset>

Takes the specified offset into account for the measured power. Only available if `[SENSe:]PMETer<p>:ROFFset[:STATe]` is disabled.

Suffix:

<p> Power sensor index

Parameters:

<SensorOffset> Default unit: DB

Example: `PMET2:SOFF 0.001`

Manual operation: See "Sensor Level Offset" on page 120

[SENSe:]PMETer<p>[:STATe] <State>

This command turns a power sensor on and off.

Suffix:

<p> Power sensor index

Parameters:

<State> ON | OFF | 0 | 1

OFF | 0
Switches the function off

ON | 1
Switches the function on

Example: `PMET1 ON`
Switches the power sensor measurements on.

Manual operation: See "Select" on page 118

[SENSe:]PMETer<p>:UPDate[:STATe] <State>

This command turns continuous update of power sensor measurements on and off.

If on, the results are updated even if a single sweep is complete.

Suffix:

<p> Power sensor index

Parameters:

<State> ON | OFF | 0 | 1

OFF | 0
Switches the function off

ON | 1
Switches the function on

Example: `PMET1:UPD ON`
The data from power sensor 1 is updated continuously.

Manual operation: See "Continuous Value Update" on page 118

UNIT<n>:PMETer<p>:POWer <Unit>

This command selects the unit for absolute power sensor measurements.

Suffix:

<n>	irrelevant
<p>	Power sensor index

Parameters:

<Unit>	DBM | WATT | W | DB | PCT *RST: DBM

Example: `UNIT:PMET:POW DBM`

Manual operation: See "Unit/Scale" on page 119

UNIT<n>:PMETer<p>:POWer:RATio <Unit>

This command selects the unit for relative power sensor measurements.

Suffix:

<n>	irrelevant
<p>	Power sensor index

Parameters:

<Unit>	DB | PCT *RST: DB

Example: `UNIT:PMET:POW:RAT DB`

Manual operation: See "Unit/Scale" on page 119

Triggering with power sensors

[SENSe:]PMETer<p>:TRIGger:DTIMe <Time>

This command defines the time period that the input signal has to stay below the IF power trigger level before the measurement starts.

Suffix:

<p>	Power sensor index

Parameters:

<Time>

Range: 0 s to 1 s
Increment: 100 ns
*RST: 100 µs
Default unit: S

Example: `PMET2:TRIG:DTIMe 0.001`

[SENSe:]PMETer<p>:TRIGger:HOLDoff <Holdoff>

This command defines the trigger holdoff for external power triggers.

Suffix:

<p> Power sensor index

Parameters:

<Holdoff> Time period that has to pass between the trigger event and the start of the measurement, in case another trigger event occurs.

Range: 0 s to 1 s
Increment: 100 ns
*RST: 0 s
Default unit: S

Example: `PMET2:TRIG:HOLD 0.1`
Sets the holdoff time of the trigger to 100 ms

Manual operation: See "Trigger Holdoff" on page 121

[SENSe:]PMETer<p>:TRIGger:HYSTeresis <Hysteresis>

This command defines the trigger hysteresis for external power triggers.

The hysteresis in dB is the value the input signal must stay below the IF power trigger level to allow a trigger to start the measurement.

Suffix:

<p> Power sensor index

Parameters:

<Hysteresis>

Range: 3 dB to 50 dB
Increment: 1 dB
*RST: 0 dB
Default unit: DB

Example: `PMET2:TRIG:HYST 10`
Sets the hysteresis of the trigger to 10 dB.

Manual operation: See "Hysteresis" on page 121

[SENSe:]PMETer<p>:TRIGger:LEVel <Level>

This command defines the trigger level for external power triggers.

Suffix:
<p> Power sensor index

Parameters:
<Level> -20 to +20 dBm

Range: -20 dBm to 20 dBm
*RST: -10 dBm
Default unit: DBM

Example: `PMET2:TRIG:LEV -10 dBm`
Sets the level of the trigger

Manual operation: See "External Trigger Level" on page 121

[SENSe:]PMETer<p>:TRIGger:SLOPe <Edge>

This command selects the trigger condition for external power triggers.

Suffix:
<p> Power sensor index

Parameters:
<Edge>

POSitive
The measurement starts in case the trigger signal shows a positive edge.

NEGative
The measurement starts in case the trigger signal shows a negative edge.

*RST: POSitive

Example: `PMET2:TRIG:SLOP NEG`

Manual operation: See "Slope" on page 121

[SENSe:]PMETer<p>:TRIGger[:STATe] <State>

This command turns the external power trigger on and off.

Suffix:
<p> Power sensor index

Parameters:
<State> ON | OFF | 0 | 1

OFF | 0
Switches the function off

ON | 1
Switches the function on

Example: `PMET2:TRIG ON`
Switches the external power trigger on

Manual operation: See "Using the power sensor as an external trigger" on page 120

12.6.1.3 External generator control

For each measurement channel, you can configure one external generator. To switch between different configurations, define multiple measurement channels.

Measurement configuration

The following commands are required to activate external generator control and to configure a calibration measurement with an external tracking generator.

SOURce<si>:EXTernal<gen>:FREQuency <Frequency>

This command defines a fixed source frequency for the external generator.

Suffix:

<si> irrelevant

<gen>

Parameters:

<Frequency> Source frequency of the external generator.

*RST: 1100050000
Default unit: HZ

Example: //Define frequency of the generator
`SOUR:EXT:FREQ 10MHz`

Manual operation: See "(Manual) Source Frequency" on page 137

SOURce<si>:EXTernal<gen>:FREQuency:COUPling[:STATe] <State>

This command couples the frequency of the external generator output to the R&S FSMR3.

Suffix:

<si> irrelevant

<gen>

Parameters:

<State> ON | OFF | 0 | 1

ON | 1
Default setting: a series of frequencies is defined (one for each sweep point), based on the current frequency at the RF input of the R&S FSMR3. The RF frequency range covers the currently defined span of the R&S FSMR3 (unless limited by the range of the signal generator).

OFF | 0
The generator uses a single fixed frequency, defined by `SOURce<si>:EXTernal<gen>:FREQuency`.

*RST: 1

Example: `SOUR:EXT:FREQ:COUP ON`

Manual operation: See "Source Frequency Coupling" on page 136

SOURce<si>:EXTernal<gen>:FREQuency[:FACTor]:DENominator <Value>

This command defines the denominator of the factor with which the analyzer frequency is multiplied to obtain the transmit frequency of the selected generator.

Select the multiplication factor such that the frequency range of the generator is not exceeded if the following formula is applied to the start and stop frequency of the analyzer:

$$F_{Generator} = \left| F_{Analyzer} * \frac{Numerator}{Denominator} + F_{Offset} \right|$$

Suffix:
<si> irrelevant

<gen>

Parameters:
<Value> <numeric value>

*RST: 1

Example: //Define multiplication factor of 4/3; the transmit frequency of the generator is 4/3 times the analyzer frequency
```
SOUR:EXT:FREQ:NUM 4
SOUR:EXT:FREQ:DEN 3
```

Manual operation: See "(Automatic) Source Frequency (Numerator/Denominator/Offset)" on page 137

SOURce<si>:EXTernal<gen>:FREQuency[:FACTor]:NUMerator <Value>

This command defines the numerator of the factor with which the analyzer frequency is multiplied to obtain the transmit frequency of the selected generator.

Select the multiplication factor such that the frequency range of the generator is not exceeded if the following formula is applied to the start and stop frequency of the analyzer:

$$F_{Generator} = \left| F_{Analyzer} * \frac{Numerator}{Denominator} + F_{Offset} \right|$$

Suffix:

<si> irrelevant

<gen>

Parameters:

<Value> <numeric value>

*RST: 1

Example: //Define multiplication factor of 4/3; the transmit frequency of the generator is 4/3 times the analyzer frequency

```
SOUR:EXT:FREQ:NUM 4
SOUR:EXT:FREQ:DEN 3
```

Manual operation: See "(Automatic) Source Frequency (Numerator/Denominator/ Offset)" on page 137

SOURce<si>:EXTernal<gen>:FREQuency:OFFSet <Offset>

This command defines the frequency offset of the generator with reference to the analyzer frequency.

Select the offset such that the frequency range of the generator is not exceeded if the following formula is applied to the start and stop frequency of the analyzer:

$$F_{Generator} = \left| F_{Analyzer} * \frac{Numerator}{Denominator} + F_{Offset} \right|$$

Suffix:

<si> irrelevant

<gen>

Parameters:

<Offset> <numeric value>, specified in Hz, kHz, MHz or GHz, rounded to the nearest Hz

*RST: 0 Hz
Default unit: HZ

Example: //Define an offset between generator output frequency and analyzer frequency

```
SOUR:EXT:FREQ:OFFS 10HZ
```

Manual operation: See "(Automatic) Source Frequency (Numerator/Denominator/ Offset)" on page 137

SOURce<si>:EXTernal<gen>:POWer[:LEVel] <Level>

This command sets the output power of the selected generator.

Suffix:
<si> irrelevant

<gen>

Parameters:
<Level> <numeric value>

*RST: -20 dBm
Default unit: DBM

Example: //Define generator output level
`SOUR:EXT:POW -30dBm`

Manual operation: See "Source Power" on page 136

SOURce<si>:EXTernal<gen>[:STATe] <State>

This command activates or deactivates the connected external generator.

Suffix:
<si> irrelevant

<gen>

Parameters:
<State> ON | OFF | 0 | 1

OFF | 0
Switches the function off

ON | 1
Switches the function on

Manual operation: See "Source State" on page 136

SOURce<si>:POWer[:LEVel][:IMMediate]:OFFSet <Offset>

Suffix:
<si> irrelevant

Parameters:
<Offset> Range: -200 dB to +200 dB
*RST: 0dB
Default unit: DB

Example: `SOUR:POW:OFFS -10dB`

Manual operation: See "Source Offset" on page 136

Interface configuration

The following commands are required to configure the interface for the connection to the external generator.

SOURce<si>:EXTernal<gen>:ROSCillator[:SOURce] <Source>

This command controls selection of the reference oscillator for the external generator.

If the external reference oscillator is selected, the reference signal must be connected to the rear panel of the instrument.

Suffix:

<si> irrelevant

<gen> irrelevant

Parameters:

<Source>

INTernal
Uses the internal reference.

EXTernal
Uses the external reference; if none is available, an error flag is displayed in the status bar.

*RST: INT

Example: //Select an external reference oscillator
`SOUR:EXT:ROSC EXT`

Manual operation: See "Reference" on page 135

SYSTem:COMMunicate:GPIB:RDEVice:GENerator<gen>:ADDRess <Number>

Changes the IEC/IEEE-bus address of the external generator.

Suffix:

<gen> 1..n

Parameters:

<Number> Range: 0 to 30
*RST: 28

Example: `SYST:COMM:GPIB:RDEV:GEN:ADDR 15`

Manual operation: See "GPIB Address/TCPIP Address / Computer Name" on page 134

SYSTem:COMMunicate:RDEVice:GENerator<gen>:INTerface <Type>

Defines the interface used for the connection to the external generator.

This command is only available if external generator control is active (see `SOURce<si>:EXTernal<gen>[:STATe]` on page 427).

Suffix:
<gen>

Parameters:

<Type> **GPIB**
TCPip

Example: `SYST:COMM:RDEV:GEN:INT TCP`

Manual operation: See "Interface" on page 134

SYSTem:COMMunicate:RDEVice:GENerator<gen>:TYPE <Type>

This command selects the type of external generator.

For a list of the available generator types, see "Overview of supported generators" on page 128.

Suffix:
<gen>

Parameters:

<Name> <Generator name as string value>
*RST: SMU02

Example: //Select an external generator
`SYST:COMM:RDEV:GEN:TYPE 'SMW06'`

Manual operation: See "Generator Type" on page 134

SYSTem:COMMunicate:TCPip:RDEVice:GENerator<gen>:ADDRess <Address>

Configures the TCP/IP address for the external generator.

Suffix:
<gen>

Parameters:

<Address> TCP/IP address between 0.0.0.0 and 0.255.255.255
*RST: 0.0.0.0

Example: `SYST:COMM:TCP:RDEV:GEN:ADDR 130.094.122.195`

Manual operation: See "GPIB Address/TCPIP Address / Computer Name" on page 134

Source calibration

The following commands are required to activate the calibration functions of the external tracking generator. However, they are only available if external generator control is active (see `SOURce<si>:EXTernal<gen>[:STATe]` on page 427).

Useful commands for source calibration described elsewhere:

- DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:RPOSition on page 445

Remote commands exclusive to source calibration:

[SENSe:]CORRection:COLLect[:ACQuire] <MeasType>

This command initiates a reference measurement (calibration). The reference measurement is the basis for the measurement normalization. The result depends on whether a reflection measurement or transmission measurement is performed (see [SENSe:]CORRection:METHod on page 430).

To obtain a correct reference measurement, a complete sweep with synchronization to the end of the sweep must have been carried out. This is only possible in the single sweep mode.

This command is only available if external generator control is active (see SOURce<si>:EXTernal<gen>[:STATe] on page 427).

Setting parameters:

<MeasType> THRough | OPEN

THRough
"TRANsmission" mode: calibration with direct connection between generator and device input
"REFLection" mode: calibration with short circuit at the input

OPEN
only allowed in "REFLection" mode: calibration with open input

Example:
`INIT:CONT OFF`
Selects single sweep operation
`CORR:METH TRAN`
Selects a transmission measurement.
`CORR:COLL THR;*WAI`
Starts the measurement of reference data using direct connection between generator and device input and waits for the sweep end.

Usage: Setting only

[SENSe:]CORRection:METHod <Type>

This command selects the type of measurement to be performed with the generator.

This command is only available if external generator control is active (see `SOURce<si>:EXTernal<gen>[:STATe]` on page 427).

Parameters:

<Type>

REFLection
Selects reflection measurements.

TRANsmission
Selects transmission measurements.

*RST: TRANsmission

Example: `CORR:METH TRAN`
Sets the type of measurement to "transmission".

[SENSe:]CORRection:RECall

This command restores the measurement configuration used for calibration.

This command is only available if external generator control is active (see `SOURce<si>:EXTernal<gen>[:STATe]` on page 427).

Example: `CORR:REC`

[SENSe:]CORRection[:STATe] <State>

This command turns correction of measurement results (normalization) on and off.

The command is available after you have created a reference trace for the selected measurement type with `[SENSe:]CORRection:COLLect[:ACQuire]` on page 430.

This command is only available if external generator control is active (see `SOURce<si>:EXTernal<gen>[:STATe]` on page 427).

Parameters:

<State> ON | OFF | 0 | 1

OFF | 0
Switches the function off

ON | 1
Switches the function on

*RST: 1

Example: `CORR ON`
Activates normalization.

[SENSe:]CORRection:TRANsducer:GENerate <Name>

This command uses the normalized measurement data to generate a transducer factor with up to 1001 points. The trace data is converted to a transducer with unit dB and stored in a file with the specified name and the suffix `.trd` under `C:\Program Files (x86)\Rohde-Schwarz\FSMR3000\<version>\trd`. The frequency points are allocated in equidistant steps between start and stop frequency.

Parameters:
<Name> '<name>'

Example: `CORR:TRAN:GEN 'MyGenerator'`
Creates the transducer file
`C:\r_s\instr\trd\MyGenerator.trd`.

Programming example for external generator control

The following example demonstrates how to work with an external generator in a remote environment.

It assumes that a signal generator of the type SMW06 is connected to the R&S FSMR3, including TTL synchronization, as described in the R&S FSMR3 User Manual.

```
//--------------Preparing the instrument -----------

//Reset the instrument
*RST

//Set the frequency span.
SENS:FREQ:STAR 10HZ
SENS:FREQ:STOP 1MHZ

//--------------Configuring the interface -----------

//Set the generator type to SMW06 with a frequency range of 100 kHz to 4GHz
SYST:COMM:RDEV:GEN:TYPE 'SMW06'

//Set the interface used to the GPIB address 28
SYST:COMM:RDEV:GEN:INT GPIB
SYST:COMM:GPIB:RDEV:GEN:ADDR 28

//Activate the use of TTL synchronization to optimize measurement speed
SYST:COMM:RDEV:GEN:LINK TTL

//Activate the use of the external reference frequency at 10 MHz on the generator
SOUR:EXT:ROSC EXT

//--------------Configuring the calibration measurement -----------

//Activate external generator control.
SOUR:EXT:STAT ON
//Set the generator output level to -10 dBm.
SOUR:EXT:POW -10DBM
//Set the frequency coupling to automatic
SOUR:EXT:FREQ:COUP:STAT ON

//--------------Configuring the generator frequency range -----------
```

```
//Define a series of frequencies (one for each sweep point) based on the current
//frequency at the RF input of the analyzer; the generator frequency is half the
//frequency of the analyzer, with an offset of 100 kHz;
// analyzer start:            10 Hz
// analyzer stop:             1 MHz
// analyzer span:             999.99 KHz
// generator frequency start: 100.005 KHz
// generator frequency stop:  600 KHz
// generator span:            499.995 KHz

SOUR:EXT:FREQ:FACT:NUM 1
SOUR:EXT:FREQ:FACT:DEN 2
SOUR:EXT:FREQ:OFFS 100KHZ

//--------------Performing the calibration measurement -----------

//Perform a transmission measurement with direct connection between the generator
//and the analyzer and wait till the end
SENS:CORR:METH TRAN
SENS:CORR:COLL:ACQ THR; *WAI

//--------------Retrieving the calibration trace results -----------

//Retrieve the measured frequencies (10 Hz - 600 kHz)
TRAC:DATA:X? TRACE1

//Retrieve the measured power levels; = 0 between 10 Hz and 100 kHz (below
//generator minimum frequency); nominal -5dBm as of 100 kHz;
TRAC:DATA? TRACE1

//--------------Normalizing the calibration trace results -----------

//Retrieve the normalized power levels (= power offsets from calibration results)
//Should be 0 for all sweep points directly after calibration
SENS:CORR:STAT ON
TRAC:DATA? TRACE1

//--------------Changing the display of the calibration results -----------
//Shift the reference line so the -5 dB level is displayed in the center
DISP:TRAC:Y:SCAL:RVAL -5DB
DISP:TRAC:Y:SCAL:RPOS 50PCT
```

12.6.1.4 Configuring a power splitter

[SENSe:]CORRection:PLOSs:INPut {<Frequency>, <Level>}...

Inserts a table to define a frequency specific insertion loss.

Parameters:

<Frequency> <numeric value>

<Level> <numeric value>

Example: `SENS:CORR:PLOS:INP 1e6,4.6,2e6,4.85`

[SENSe:]CORRection:PLOSs:INPut:STATe <state>

Enables the usage of a power splitter.

Parameters:

<State> ON | OFF | 1 | 0

Example: `SENS:CORR:PLOS:INP:STAT ON`

Manual operation: See "Use Power Splitter" on page 124

[SENSe:]CORRection:PLOSs:INPut:SPATh <value>

Defines the insertion loss of the power splitter between the signal source and the RF input.

Parameters:

<value> <numeric value>
Default unit: dB

Example: `SENS:CORR:PLOS:INP:SPAT 4 DB`

Manual operation: See "Path2 Insertion Loss" on page 124

[SENSe:]CORRection:VSWR[:STATe] <state>

Activates the mismatch correction between the R&S NRP-Z27 or R&S NRP-Z37 power sensor and the RF input of the R&S FSMR3.

This function is only available under certain conditions:

- 10 dB or 30 dB RF attenuation is selected.
- A correction file with VSWR correction values is available in the internal memory of the R&S FSMR3. If the correction file is not present, the softkey will not be present.

Parameters:

<State> ON | OFF | 1 | 0
*RST: 0

Example: `SENS:CORR:VSWR:STAT ON`

Manual operation: See "VSWR Correction" on page 124

12.6.2 Configuring the output

The following commands configure signal output.

DIAGnostic:SERVice:NSOurce <State>

This command turns the 28 V supply of the BNC connector labeled [noise source control] on the R&S FSMR3000 on and off.

Parameters:

<State> ON | OFF | 0 | 1

OFF | 0
Switches the function off

ON | 1
Switches the function on

Example: `DIAG:SERV:NSO ON`

Manual operation: See "Noise Source Control" on page 157

SYSTem:SPEaker:VOLume <Volume>

This command defines the volume of the built-in loudspeaker for demodulated signals. This setting is maintained for all applications.

The command is available in the time domain in Spectrum mode and in Analog Modulation Analysis mode.

Parameters:

<Volume> Percentage of the maximum possible volume.

Range: 0 to 1
*RST: 0.5

Example: `SYST:SPE:VOL 0`
Switches the loudspeaker to mute.

OUTPut<up>:IF[:SOURce] <Source>

Defines the type of signal available at one of the output connectors of the R&S FSMR3000.

Suffix:

<up>

Parameters:
<Source> **IF**
The measured IF value is available at the IF/VIDEO/DEMOD output connector.
*RST: IF

Example: `OUTP:IF VID`
Selects the video signal for the IF/VIDEO/DEMOD output connector.

Manual operation: See "IF/Video Output" on page 157

CALCulate<n>:MARKer<m>:FUNCtion:DEModulation[:STATe] <State>
OUTPut<up>:ADEMod[:ONLine][:STATe] <State>

This command enables or disables online demodulation output to the IF/VIDEO/DEMOD output connector on the rear panel of the R&S FSMR3.

Suffix:
<up>

Parameters:
<State> ON | OFF | 0 | 1

OFF | 0
Switches the function off

ON | 1
Switches the function on

Example: `OUTP:ADEM ON`

Manual operation: See "Online Demodulation Output State" on page 160

OUTPut<up>:ADEMod[:ONLine]:SOURce <WindowName>

This command selects the result display whose results are output. Only active time domain results can be selected.

Suffix:
<up>

Parameters:
<WindowName> **<string>**
String containing the name of the window.
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.

FOCus
Dynamically switches to the currently selected window. If a window is selected that does not contain a time-domain result display, the selection is ignored and the previous setting is maintained.

Example: `OUTP:ADEM:ONL:SOUR 'AnalogDemod'`
OR:
`DISP:WIND1:SEL`
`OUTP:ADEM:SOUR FOC`

Manual operation: See "Output Selection" on page 160

OUTPut<up>:ADEMod[:ONLine]:AF[:CFRequency] <Frequency>

This command defines the cutoff frequency for the AC highpass filter (for AC coupling only, see `[SENSe:]ADEMod<n>:AF:COUPling` on page 457).

Suffix:
<up>

Parameters:
<Frequency> numeric value
Range: 10 Hz to DemodBW/10 (= 300 kHz for active demodulation output)
*RST: 100 Hz
Default unit: HZ

Example: `OUTP:ADEM:ONL:AF:CFR 100Hz`

Manual operation: See "AC Cutoff Frequency" on page 161

OUTPut<up>:ADEMod[:ONLine]:PHONes <State>

In addition to sending the output to the IF/VIDEO/DEMOD output connector (on the rear panel of the R&S FSMR3), it can also be output to headphones connected on the front panel ([Phones] connector).

CAUTION: To protect your hearing, make sure that the volume setting is not too high before putting on the headphones.

If you do not hear output on the connected headphones despite having enabled both general online demod output `OUTPut<up>:ADEMod[:ONLine][:STATe]` on page 436 and this command, adjust the volume setting.

Suffix:
<up>

Parameters:
<State> ON | OFF | 0 | 1

OFF | 0
Switches the function off

ON | 1
Switches the function on

Example: `OUTP:ADEM:PHON ON`

Manual operation: See "Phones Output" on page 161

12.6.3 Frequency settings

[SENSe:]FREQuency:CENTer <Frequency>

This command defines the center frequency.

Parameters:

<Frequency> The allowed range and f_{max} is specified in the data sheet.

*RST: fmax/2
Default unit: Hz

Example:

```
FREQ:CENT 100 MHz
FREQ:CENT:STEP 10 MHz
FREQ:CENT UP
```

Sets the center frequency to 110 MHz.

Manual operation: See "Center Frequency" on page 148

[SENSe:]FREQuency:CENTer:STEP <StepSize>

This command defines the center frequency step size.

Parameters:

<StepSize> f_{max} is specified in the data sheet.

Range: 1 to fMAX
*RST: 0.1 x span
Default unit: Hz

Example: //Set the center frequency to 110 MHz.

```
FREQ:CENT 100 MHz
FREQ:CENT:STEP 10 MHz
FREQ:CENT UP
```

Manual operation: See "Center Frequency Stepsize" on page 148

[SENSe:]FREQuency:CENTer:STEP:LINK <CouplingType>

This command couples and decouples the center frequency step size to the span or the resolution bandwidth.

Parameters:

<CouplingType> SPAN | RBW | OFF

SPAN
Couples the step size to the span. Available for measurements in the frequency domain.

OFF
Decouples the step size.

*RST: SPAN

Example: //Couple step size to span
`FREQ:CENT:STEP:LINK SPAN`

[SENSe:]FREQuency:CENTer:STEP:LINK:FACTor <Factor>

Parameters:

<Factor> 1 to 100 PCT

*RST: 10
Default unit: PCT

Example: //Couple frequency step size to span and define a step size factor
`FREQ:CENT:STEP:LINK SPAN`
`FREQ:CENT:STEP:LINK:FACT 20PCT`

[SENSe:]FREQuency:CW:AFC <state>

Executes an automatic signal search and activates a function to track a drifting signal. If the measured signal frequency is too far away from the tuned center frequency and the level is above the threshold, the center frequency of the R&S FSMR3 will be changed to the new signal frequency.

Parameters:

<State>

Example: `FREQ:CW:AFC ONCE`

12.6.4 Configuring the vertical axis (amplitude, scaling)

The following commands are required to configure the amplitude and vertical axis settings in a remote environment.

12.6.4.1 Amplitude settings

Remote commands exclusive to amplitude configuration:

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.

Suffix:

<n> Window

<m> Marker

Example: `CALC:MARK2:FUNC:REF`
Sets the reference level to the level of marker 2.

DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:RLEVel <ReferenceLevel>

This command defines the reference level (for all traces in all windows).

With a reference level offset ≠ 0, the value range of the reference level is modified by the offset.

Suffix:

<n> irrelevant

<w> subwindow
Not supported by all applications

<t> irrelevant

Parameters:

<ReferenceLevel> The unit is variable.

Range: see datasheet
*RST: 0 dBm
Default unit: DBM

Example: `DISP:TRAC:Y:RLEV -60dBm`

Manual operation: See "Reference Level" on page 147

DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:RLEVel:OFFSet <Offset>

This command defines a reference level offset (for all traces in all windows).

Suffix:

<n> irrelevant

<w> subwindow
Not supported by all applications

<t> irrelevant

Parameters:

<Offset> Range: -200 dB to 200 dB
*RST: 0dB
Default unit: DB

Example: `DISP:TRAC:Y:RLEV:OFFS -10dB`

Manual operation: See "Shifting the Display (Offset)" on page 147

12.6.4.2 Configuring the attenuation

INPut<ip>: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.

Suffix:

<ip> 1 | 2
irrelevant

Parameters:

<Attenuation> Range: see data sheet
Increment: 5 dB (with optional electr. attenuator: 1 dB)
*RST: 10 dB (AUTO is set to ON)
Default unit: DB

Example: `INP:ATT 30dB`
Defines a 30 dB attenuation and decouples the attenuation from the reference level.

Manual operation: See "Attenuation Mode / Value" on page 147

INPut<ip>:ATTenuation:AUTO <State>

This command couples or decouples the attenuation to the reference level. Thus, when the reference level is changed, the R&S FSMR3 determines the signal level for optimal internal data processing and sets the required attenuation accordingly.

Suffix:

<ip> 1 | 2
irrelevant

Parameters:

<State> ON | OFF | 0 | 1
*RST: 1

Example: `INP:ATT:AUTO ON`
Couples the attenuation to the reference level.

Manual operation: See "Attenuation Mode / Value" on page 147

INPut<ip>:ATTenuation:AUTO <State>

This command couples or decouples the attenuation to the reference level. Thus, when the reference level is changed, the R&S FSMR3 determines the signal level for optimal internal data processing and sets the required attenuation accordingly.

Suffix:
<ip> 1 | 2
irrelevant

Parameters:
<State> ON | OFF | 0 | 1
*RST: 1

Example: `INP:ATT:AUTO ON`
Couples the attenuation to the reference level.

12.6.4.3 Configuring a preamplifier

INPut<ip>:GAIN:STATe <State>

This command turns the internal preamplifier on and off. It requires the optional preamplifier hardware.

The preamplification value is defined using the `INPut<ip>:GAIN[:VALue]` on page 443.

Suffix:
<ip> 1 | 2
irrelevant

Parameters:
<State> ON | OFF | 0 | 1

OFF | 0
Switches the function off

ON | 1
Switches the function on

*RST: 0

Example: `INP:GAIN:STAT ON`
`INP:GAIN:VAL 15`
Switches on 15 dB preamplification.

Manual operation: See "Preamplifier" on page 148

INPut<ip>:GAIN[:VALue] <Gain>

This command selects the "gain" if the preamplifier is activated (`INP:GAIN:STAT ON`, see `INPut<ip>:GAIN:STATe` on page 442).

The command requires the additional preamplifier hardware option.

Suffix:

<ip> 1 | 2
irrelevant

Parameters:

<Gain> For FSMR3008 and FSMR3026, the following settings are available:
15 dB and 30 dB
All other values are rounded to the nearest of these two.
FSMR3050:
30 dB

Default unit: DB

Example:
```
INP:GAIN:STAT ON
INP:GAIN:VAL 30
```
Switches on 30 dB preamplification.

Manual operation: See "Preamplifier" on page 148

12.6.4.4 Scaling the Y-axis

DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe] <Range>

This command defines the display range of the y-axis (for all traces).

Suffix:

<n> Window

<w> subwindow
Not supported by all applications

<t> irrelevant

Example:
```
DISP:TRAC:Y 110dB
```

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

Automatic scaling of the y-axis is performed once, then switched off again (for all traces).

Suffix:

<n> Window

<t> irrelevant

DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:MODE <Mode>

This command selects the type of scaling of the y-axis (for all traces).

When the display update during remote control is off, this command has no immediate effect.

Suffix:

<n> Window

<w> subwindow

<t> irrelevant

Parameters:

<Mode>

ABSolute
absolute scaling of the y-axis

RELative
relative scaling of the y-axis

*RST: ABSolute

Example: `DISP:TRAC:Y:MODE REL`

DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:PDIVision <Value>

This remote command determines the grid spacing on the Y-axis for all diagrams, where possible.

In spectrum displays, for example, this command is not available.

Suffix:

<n> Window

<w> subwindow
Not supported by all applications

<t> irrelevant

Parameters:

<Value> numeric value WITHOUT UNIT (unit according to the result display)

Defines the range per division (total range = 10*<Value>)

*RST: depends on the result display
Default unit: DBM

Example: `DISP:TRAC:Y:PDIV 10`
Sets the grid spacing to 10 units (e.g. dB) per division

Manual operation: See "Dev per Division/ dB per Division" on page 170

DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:RPOSition <Position>

This command defines the vertical position of the reference level on the display grid (for all traces).

The R&S FSMR3 adjusts the scaling of the y-axis accordingly.

Suffix:

<n>	Window
<w>	subwindow Not supported by all applications
<t>	irrelevant

Example: `DISP:TRAC:Y:RPOS 50PCT`

Manual operation: See "Reference Value Position" on page 171

DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y:SPACing <ScalingType>

This command selects the scaling of the y-axis (for all traces, <t> is irrelevant).

Suffix:

<n>	Window
<w>	subwindow
<t>	Trace

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 %.

Manual operation: See "Deviation" on page 172

12.6.5 Configuring data acquisition

The following remote commands are required to configure which data is to be acquired and then demodulated in a remote environment.

[SENSe:]ADEMod[:STATe] <State>

Switches to FM demodulation mode.

Parameters:

<State> ON | OFF | 0 | 1

OFF | 0
Switches FM demodulation mode off

ON | 1
Switches FM demodulation mode on

*RST: 0

Example: `ADEM ON`

[SENSe:]ADEMod:MTIMe <Time>

This command defines the measurement time for Analog Modulation Analysis.

Parameters:

<Time> *RST: 62.5us
Default unit: S

Example: `ADEM:MTIM 62.5us`
Sets the measurement time to 62.5 μs.

Manual operation: See "Measurement Time (AQT)" on page 155

[SENSe:]ADEMod:RLENgth

[SENSe:]ADEMod:SET <SampleRate>, <RecordLength>, <TriggerSource>, <TriggerSlope>, <OffsetSamples>, <NoOfMeas>

This command configures the analog demodulator of the instrument.

Parameters:

<SampleRate>
: **numeric value**
The frequency at which measurement values are taken from the A/D-converter and stored in I/Q memory.
*RST: 8 MHz
Default unit: HZ

<RecordLength>
: Number of samples to be stored in I/Q memory.
Range: 1 to 400001 with AF filter or AF trigger active, 1 to 480001 with both AF filter and AF trigger deactive
*RST: 501)

<TriggerSource>
: **IMMediate | EXTernal | EXT2 | EXT3 | IFPower | RFPower| AF | AM | AMRelative | FM | PM**
Note: After selecting IF Power, the trigger threshold can be set with the `TRIGger[:SEQuence]:LEVel:IFPower` command.
*RST: IMMediate

<TriggerSlope>
: POSitive | NEGative
Used slope of the trigger signal.
The value indicated here will be ignored for <trigger source> = IMMediate.
*RST: POSitive

<OffsetSamples>
: Number of samples to be used as an offset to the trigger signal. The value indicated here is ignored for <trigger source> = "IMMediate".
*RST: 0

<NoOfMeas>
: Number of repetitions of the measurement to be executed. The value indicated here is especially necessary for the average/maxhold/minhold function.
Range: 0 to 32767
*RST: 0

Example:
`ADEM:SET 8MHz,32000,EXT,POS,-500,30`
Performs a measurement at:
sample rate = 8 MHz
record length = 32000
trigger source = EXTernal
trigger slope = POSitive
offset samples = -500 (500 samples before trigger occurred)
# of meas = 30

[SENSe:]ADEMod<n>:SPECtrum:BANDwidth[:RESolution] <Bandwidth>
[SENSe:]ADEMod:SPECtrum:BWIDth[:RESolution] <Bandwidth>

Defines the resolution bandwidth for data acquisition.

From the specified RBW and the demodulation span set by `[SENSe:]ADEMod:SPECtrum:SPAN[:MAXimum]` on page 464 or `[SENSe:]BWIDth:DEMod` on page 448, the required measurement time is calculated. If the available measurement time is not sufficient for the given bandwidth, the measurement time is set to its maximum and the resolution bandwidth is increased to the resulting bandwidth.

This command is identical to `SENS:BAND:RES`, see the R&S FSMR3 User Manual.

Parameters:
<Bandwidth> refer to data sheet

*RST: 61.2 kHz
Default unit: HZ

Example: `ADEM:SPEC:BAND 61.2kHz`
Sets the resolution bandwidth to 61.2 kHz.

[SENSe:]ADEMod:SRATe

[SENSe:]BANDwidth:DEMod <Bandwidth>
[SENSe:]BWIDth:DEMod <Bandwidth>

This command sets the bandwidth for Analog Modulation Analysis. Depending on the selected demodulation bandwidth, the instrument selects the required sample rate.

This command is identical to `SENS:ADEM:BAND:DEM`.

Parameters:
<Bandwidth> *RST: 5 MHz
Default unit: HZ

Example: `BAND:DEM 1MHz`
Sets demodulation bandwidth to 1 MHz

Manual operation: See "Demodulation Bandwidth" on page 154

[SENSe:]BANDwidth:DEMod:TYPE <FilterType>
[SENSe:]BWIDth:DEMod:TYPE <FilterType>

This command defines the type of demodulation filter to be used.

This command is identical to `SENS:ADEM:BAND:DEM:TYPE`:

Parameters:
<FilterType>

FLAT
Standard flat demodulation filter

GAUSs
Gaussian filter for optimized settling behavior

*RST: FLAT

Manual operation: See "Demodulation Filter" on page 154

[SENSe:]BANDwidth[:RESolution] <Bandwidth>

This command defines the resolution bandwidth and decouples the resolution bandwidth from the span.

Example: `BAND 1 MHz`
Sets the resolution bandwidth to 1 MHz

Manual operation: See "Resolution Bandwidth" on page 155

[SENSe:]SWEep:COUNt <SweepCount>

This command defines the number of measurements that the application uses to average traces.

In continuous measurement mode, the application calculates the moving average over the average count.

In single measurement mode, the application stops the measurement and calculates the average after the average count has been reached.

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.

Manual operation: See "Sweep/Average Count" on page 156

[SENSe:]SWEep[:WINDow<n>]:POINts <SweepPoints>

This command defines the number of measurement points to analyze after a measurement.

Suffix:
<n>

Example: `SWE:POIN 251`

Manual operation: See "Sweep Points" on page 155

CALCulate<n>:FEED <Evaluation>

Selects result type for evaluation.

Suffix:
<n> 1..n
Window

Parameters:
<Evaluation> string
'XTIM:RFP:BARG'
Signal Summary

'XTIM:AC:TDOM'
Audio Timedomain

'XTIM:AC:SPEC'
Audio Spectrum

12.6.6 Triggering

The following remote commands are required to configure a triggered measurement in a remote environment.

*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.

12.6.6.1 Configuring the triggering conditions

The following commands are required to configure a triggered measurement.

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
Default unit: S

Manual operation: See "Drop-Out Time" on page 151

TRIGger[:SEQuence]:HOLDoff[:TIME] <Offset>

Defines the time offset between the trigger event and the start of the measurement.

Parameters:

<Offset> *RST: 0 s
Default unit: S

Example: `TRIG:HOLD 500us`

Manual operation: See "Trigger Offset" on page 151

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).

Parameters:

<Period> Range: 0 s to 10 s
*RST: 0 s
Default unit: S

Example: `TRIG:SOUR EXT`
Sets an external trigger source.
`TRIG:IFP:HOLD 200 ns`
Sets the holding time to 200 ns.

Manual operation: See "Trigger Holdoff" on page 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
Default unit: DB

Example: `TRIG:SOUR IFP`
Sets the IF power trigger source.
`TRIG:IFP:HYST 10DB`
Sets the hysteresis limit value.

Manual operation: See "Hysteresis" on page 151

TRIGger[:SEQuence]:LEVel[:EXTernal<port>] <TriggerLevel>

This command defines the level the external signal must exceed to cause a trigger event.

Suffix:

<port> Selects the trigger port.
1 = trigger port 1(TRIGGER INPUT/OUTPUT connector on front panel)
2 = trigger port 2 (TRIGGER INPUT/OUTPUT connector on rear panel)

Parameters:

<TriggerLevel> Range: 0.5 V to 3.5 V
*RST: 1.4 V
Default unit: V

Example: `TRIG:LEV 2V`

Manual operation: See "Trigger Level" on page 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: -20 dBm
Default unit: DBM

Example: `TRIG:LEV:IFP -30DBM`

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. If defined, a reference level offset is also considered.

Parameters:

<TriggerLevel> Range: -130 dBm to 30 dBm
*RST: -20 dBm
Default unit: DBM

Example: `TRIG:LEV:IQP -30DBM`

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
Default unit: DBM

Example: `TRIG:LEV:RFP -30dBm`

TRIGger[:SEQuence]:LEVel:AM:RELative <Level>

The command sets the level when AM-modulated signals are used as trigger source.

For triggering to be successful, the measurement time must cover at least 5 periods of the audio signal.

Parameters:

<Level> Range: -100 to +100
*RST: 0 %
Default unit: %

Example: `TRIG:LEV:AM:REL -20 %`
Sets the AM trigger threshold to -20 %

TRIGger[:SEQuence]:LEVel:AM[:ABSolute] <Level>

The command sets the level when RF power signals are used as trigger source.

For triggering to be successful, the measurement time must cover at least 5 periods of the audio signal.

Parameters:

<Level> Range: -100 to +30
*RST: -20 dBm
Default unit: dBm

Example: `TRIG:LEV:AM -30 dBm`
Sets the RF power signal trigger threshold to -30 dBm

TRIGger[:SEQuence]:LEVel:FM <Level>

The command sets the level when FM-modulated signals are used as trigger source.

For triggering to be successful, the measurement time must cover at least 5 periods of the audio signal.

Parameters:

<Level> Range: -10 to +10
*RST: 0 Hz
Default unit: MHz

Example: `TRIG:LEV:FM 10 kHz`
Sets the FM trigger threshold to 10 kHz

TRIGger[:SEQuence]:LEVel:PM <Level>

The command sets the level when PM-modulated signals are used as trigger source.

For triggering to be successful, the measurement time must cover at least 5 periods of the audio signal.

Parameters:

<Level>
Range: -1000 to +1000
*RST: 0 RAD
Default unit: RAD | DEG

Example: `TRIG:LEV:PM 1.2 RAD`
Sets the PM trigger threshold to 1.2 rad

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 151

TRIGger[:SEQuence]:SOURce <Source>

This command selects the trigger source.

Note on external triggers:

If a measurement is configured to wait for an external trigger signal in a remote control program, remote control is blocked until the trigger is received and the program can continue. Make sure that this situation is avoided in your remote control programs.

For troubleshooting tips, see "Incompleted sequential commands - blocked remote channels" on page 697.

Parameters:

<Source>

IMMediate
Free Run

EXT | EXT2
Trigger signal from one of the "Trigger Input/Output" connectors.
Note: Connector must be configured for "Input".

*RST: IMMediate

Example: `TRIG:SOUR EXT`
Selects the external trigger input as source of the trigger signal

Manual operation: See "Using the power sensor as an external trigger" on page 120
See "Trigger Source" on page 149
See "Free Run" on page 150
See "Ext. Trigger 1/2" on page 150
See "Video" on page 150
See "I/Q Power" on page 150
See "Power Sensor" on page 151

12.6.6.2 Configuring the trigger output

The following commands are required to send the trigger signal to one of the variable "TRIGGER INPUT/OUTPUT" connectors on the R&S FSMR3000.

OUTPut<up>:TRIGger<tp>:DIRection <Direction>

This command selects the trigger direction for trigger ports that serve as an input as well as an output.

Suffix:

<up> irrelevant

<tp> Selects the used trigger port.
<2>: selects trigger port 2 (on the rear panel).

Parameters:

<Direction> INPut | OUTPut

INPut
Port works as an input.

OUTPut
Port works as an output.

*RST: INPut

Manual operation: See "Trigger 1/2" on page 152

OUTPut<up>:TRIGger<tp>:LEVel <Level>

This command defines the level of the (TTL compatible) signal generated at the trigger output.

This command works only if you have selected a user-defined output with `OUTPut<up>:TRIGger<tp>:OTYPe`.

Suffix:

<up> 1..n

<tp>	Selects the trigger port to which the output is sent.

Parameters:

<Level>	**HIGH** 5 V **LOW** 0 V *RST: LOW
Example:	`OUTP:TRIG2:LEV HIGH`
Manual operation:	See "Level" on page 153

OUTPut<up>:TRIGger<tp>:OTYPe <OutputType>

This command selects the type of signal generated at the trigger output.

Suffix:

<up>	1..n
<tp>	Selects the trigger port to which the output is sent. 2 = trigger port 2 (rear panel)

Parameters:

<OutputType>	**DEVice** Sends a trigger signal when the R&S FSMR3 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<up>:TRIGger<tp>:LEVel`. *RST: DEVice
Manual operation:	See "Output Type" on page 153

OUTPut<up>:TRIGger<tp>:PULSe:IMMediate

This command generates a pulse at the trigger output.

Suffix:

<up>	Selects the trigger port to which the output is sent. 2 = trigger port 2 (rear)
<tp>	1..n
Manual operation:	See "Send Trigger" on page 153

OUTPut<up>:TRIGger<tp>:PULSe:LENGth <Length>

This command defines the length of the pulse generated at the trigger output.

Suffix:

<up>	1..n
<tp>	Selects the trigger port to which the output is sent. 2 = trigger port 2 (rear)

Parameters:

<Length>	Pulse length in seconds. Default unit: S

Example: `OUTP:TRIG2:PULS:LENG 0.02`

Manual operation: See "Pulse Length" on page 153

12.6.7 Configuring demodulation

The following remote commands are required to configure the demodulation parameters in a remote environment.

12.6.7.1 Basic demodulation settings

The basic demodulation measurement parameters define how the measurement is performed.

Basic demodulation commands:

[SENSe:]ADEMod<n>:AF:COUPling <Coupling>

This command selects the coupling of the AF path of the analyzer in the specified window.

Suffix:

<n>	irrelevant

Parameters:

<Coupling> AC | DC

*RST: AC (PM); DC (FM)

Example: `ADEM:AF:COUP DC`
Switches on DC coupling.

Manual operation: See "AF Coupling" on page 160

[SENSe:]ADEMod:PM:RPOint[:X] <Time>

This command determines the position where the phase of the PM-demodulated signal is set to 0 rad. The maximum value depends on the measurement time selected in the instrument; this value is output in response to the query `ADEM:PM:RPO:X? MAX`.

Parameters:

<Time> 0 s to measurement time

*RST: 0 s
Default unit: S

Example: `ADEM:PM:RPO 500us`
Sets the position where the phase to 0 rad setting to 500 µs.

[SENSe:]ADEMod:SQUelch[:STATe] <State>

This command activates the squelch function, i.e. if the signal falls below a defined threshold (see `[SENSe:]ADEMod:SQUelch:LEVel` on page 458), the demodulated data is automatically set to 0.

Parameters:

<State> ON | OFF | 0 | 1

OFF | 0
Switches the function off

ON | 1
Switches the function on

Example: `DEM:SQU ON`
Signals below the level threshold are squelched.

Manual operation: See "Squelch State" on page 162

[SENSe:]ADEMod:SQUelch:LEVel <Threshold>

This command defines the level threshold below which the demodulated data is set to 0 if squelching is enabled (see `[SENSe:]ADEMod:SQUelch[:STATe]` on page 458).

Parameters:

<Threshold> numeric value

The absolute threshold level

Range: -150 dBm to 30 dBm
*RST: -40 dBm

Example: `DEM:SQU:LEV -80`
If the signal drops below -80 dBm, the demodulated data is set to 0.

Manual operation: See "Squelch Level" on page 162

CALCulate<n>:FORMat <Evaluation>

This command activates/deactivates the phase wrap for the specified PM time domain display with DC coupling.

Suffix:
<n> 1..n

Parameters:
<Evaluation>

PHAS
The phase is wrapped.

UPH
The phase is not wrapped.

*RST: UPH

Example: `LAY:ADD? '1',BEL,'XTIM:PM'`
Activates PM time domain display. Result: window '2'
`INP:COUP DC`
Selects DC coupling.
`CALC2:FORM PHAS`
Selects a wrapped phase display in the PM time domain window.

[SENSe:]FREQuency:SPAN <Span>

This command defines the frequency span.

If you set a span of 0 Hz in the Spectrum application, the R&S FSMR3 starts a measurement in the time domain.

Parameters:
<Span> The minimum span for measurements in the frequency domain is 10 Hz.

Range: 0 Hz to fmax
*RST: Full span
Default unit: Hz

Manual operation: See "Span" on page 166

CONFigure:ADEMod:RESults:UNIT <Unit>

This command selects the unit for relative demodulation results.

Parameters:

<Unit> PCT | DB

*RST: PCT

Example: `CONF:ADEM:RES:AM:DET2:STAT ON`
Activates relative demodulation for the negative peak detector.
`CONF:ADEM:RES:AM:DET2:MODE AVER`
Sets the negative peak detector to average mode.
`CONF:ADEM:RES:UNIT PCT`
Defines the unit for relative values as percent.
`CONF:ADEM:RES:AM:DET2:REF 1.415%`
Sets the reference value for relative results to 1.415 %.

Manual operation: See "Relative Unit" on page 173

12.6.7.2 Time domain zoom settings

Using the time domain zoom, the demodulated data for a particular time span is extracted and displayed in more detail.

[SENSe:]ADEMod<n>:ZOOM:LENGth <Length>

The command allows you to define the length of the time domain zoom area for the analog-demodulated measurement data in the specified window manually. If the length is defined manually using this command, the zoom mode is also set to manual.

Suffix:

<n> Window

Parameters:

<Length> *RST: sweep time
Default unit: S
Length of the zoom area in seconds.

Example: `ADEM:ZOOM:LENG 2s`
Zoom mode is set to manual and the zoom length to 2 seconds.

Manual operation: See "Length" on page 163

[SENSe:]ADEMod<n>:ZOOM:LENGth:MODE <Mode>

The command defines whether the length of the zoom area for the analog-demodulated measurement data is defined automatically or manually in the specified window.

Suffix:
<n> Window

Parameters:
<Mode> AUTO | MAN

AUTO
(Default:) The number of sweep points is used as the zoom length.

MAN
The zoom length is defined manually using `[SENSe:]ADEMod<n>:ZOOM:LENGth`.

*RST: AUTO

Example: `ADEM:ZOOM:LENG:MODE MAN`
Zoom function uses the length defined manually.

Manual operation: See "Length" on page 163

[SENSe:]ADEMod<n>:ZOOM:STARt <Time>

The command selects the start time for the zoomed display of analog-demodulated measurements in the specified window. The maximum value depends on the measurement time, which is set and can be queried with the `[SENSe:]ADEMod:MTIMe` command.

If the zoom function is enabled, the defined number of sweep points are displayed from the start time specified with this command.

Suffix:
<n> Window

Parameters:
<Time> Range: 0 s to (measurement time – zoom length)
*RST: 0 s
Default unit: S

Example: `ADEM:ZOOM:STAT ON`
Switches on the zoom function
`ADEM:ZOOM:STAR 500us`
Sets the starting point of the display to 500 µs.

Manual operation: See "Start" on page 163

[SENSe:]ADEMod<n>:ZOOM[:STATe] <State>

The command enables or disables the time domain zoom function for the analog-demodulated measurement data in the specified window.

If the zoom function is enabled, the defined number of sweep points are displayed from the start time specified with `[SENSe:]ADEMod<n>:ZOOM:STARt` on page 461.

If the zoom function is disabled, data reduction is used to adapt the measurement points to the number of points available on the display.

Suffix:
<n> Window

Parameters:
<State> ON | OFF | 0 | 1

OFF | 0
Switches the function off

ON | 1
Switches the function on

Example: `ADEM:ZOOM ON`
Switches on the zoom function

Manual operation: See "State" on page 163

12.6.7.3 Configuring the demodulation spectrum

The demodulation spectrum defines which span of the demodulated data is evaluated.

AF evaluation

These settings are only available for AF Spectrum evaluations, not in the time domain.

[SENSe:]ADEMod:AF:CENTer <Frequency>

This command sets the center frequency for AF spectrum result display.

Parameters:
<Frequency> *RST: 1.25 MHz
Default unit: HZ

Manual operation: See "AF Center" on page 164

[SENSe:]ADEMod:AF:SPAN <Span>

This command sets the span (around the center frequency) for AF spectrum result display.

The span is limited to DBW/2 (see `[SENSe:]BWIDth:DEMod` on page 448).

Parameters:
<Span> *RST: 9 MHz
Default unit: HZ

Example: `ADEM:AF:SPAN 200 kHz`
Sets the AF span to 200 kHz

Manual operation: See "AF Span" on page 165

[SENSe:]ADEMod:AF:SPAN:FULL

This command sets the maximum span for AF spectrum result display.

The maximum span corresponds to DBW/2 (see `[SENSe:]BWIDth:DEMod` on page 448).

Example: `ADEM:BAND 5 MHz`
Sets the demodulation bandwidth to 5 MHz
`ADEM:AF:SPAN:FULL`
Sets the AF span to 2.5 MHz

Manual operation: See "AF Full Span" on page 165

[SENSe:]ADEMod:AF:STARt <Frequency>

This command sets the start frequency for AF spectrum result display.

Parameters:
<Frequency> *RST: 0 MHz
Default unit: HZ

Example: `ADEM:AF:STAR 0 kHz`
Sets the AF start frequency to 0 kHz
`ADEM:AF:STOP 500 kHz`
Sets the AF stop frequency to 500 kHz

Manual operation: See "AF Start" on page 164

[SENSe:]ADEMod:AF:STOP <Frequency>

This command sets the stop frequency for AF spectrum result display.

Parameters:
<Frequency> *RST: 9 MHz
Default unit: HZ

Example: `ADEM:AF:STAR 0 kHz`
Sets the AF start frequency to 0 kHz
`ADEM:AF:STOP 500 kHz`
Sets the AF stop frequency to 500 kHz

Manual operation: See "AF Stop" on page 165

RF evaluation

These settings are only available for RF evaluation, both in time and frequency domain.

Useful commands described elsewhere

- [SENSe:]FREQuency:CENTer on page 438
- [SENSe:]BWIDth:DEMod on page 448

Specific commands:

[SENSe:]ADEMod:SPECtrum:SPAN:ZOOM <Span>

This command sets the span (around the center frequency) for RF spectrum result display.

The span is limited to the demodulation bandwidth (see [SENSe:]BWIDth:DEMod on page 448).

Parameters:

<Span>	*RST:	5 MHz
	Default unit:	HZ

Example: `ADEM:SPEC:SPAN:ZOOM 200 kHz`
Sets the rF span to 200 kHz

[SENSe:]ADEMod:SPECtrum:SPAN[:MAXimum] <FreqRange>

Sets the DBW to the specified value and the span (around the center frequency) of the RF data to be evaluated to its new maximum (the demodulation bandwidth).

Parameters:

<FreqRange>	*RST:	5 MHz
	Default unit:	Hz

Manual operation: See "RF Full Span" on page 166

12.6.7.4 (post-processing) AF filters

The AF filter reduces the evaluated bandwidth of the demodulated signal and can define a weighting function. AF filters are only available for AM or FM time domain evaluations.

[SENSe:]FILTer<n>:AWEighted[:STATe] <State>

This command activates/deactivates the "A" weighting filter for the specified evaluation.

For details on weighting filters, see "Weighting" on page 168.

Suffix:
<n> Window

Parameters:
<State> ON | OFF | 0 | 1

OFF | 0
Switches the function off

ON | 1
Switches the function on

Example: `FILT:AWE ON`
Activates the A weighting filter.

Manual operation: See "Weighting" on page 168

[SENSe:]FILTer<n>:AOFF

Suffix:
<n> 1..n

Manual operation: See "Deactivating all AF Filters" on page 169

[SENSe:]FILTer<n>:CCIR:WEIGhted[:STATe] <State>

This command activates/deactivates the weighted CCIR filter for the specified evaluation.

For details on weighting filters, see "Weighting" on page 168.

Suffix:
<n> Window

Parameters:
<State> ON | OFF | 0 | 1

OFF | 0
Switches the function off

ON | 1
Switches the function on

Example: `FILT:CCIR:WEIG ON`
Activates the weighted CCIR filter.

Manual operation: See "Weighting" on page 168

[SENSe:]FILTer<n>:CCIR[:UNWeighted][:STATe] <State>

This command activates/deactivates the unweighted CCIR filter in the specified window.

For details on weighting filters, see "Weighting" on page 168.

Suffix:
<n> Window

Parameters:
<State> ON | OFF | 0 | 1

OFF | 0
Switches the function off

ON | 1
Switches the function on

Example: `FILT:CCIR:UNW ON`
Activates the unweighted CCIR filter.

Manual operation: See "Weighting" on page 168

[SENSe:]FILTer<n>:CCITt[:STATe] <State>

Suffix:
<n> 1..n

Parameters:
<State>

Manual operation: See "Weighting" on page 168

[SENSe:]FILTer<n>:DEMPhasis:TCONstant <Value>

This command selects the deemphasis for the specified evaluation.

For details on deemphasis refer to "Deemphasis" on page 169.

Suffix:
<n> Window

Parameters:
<Value> 25 us | 50 us | 75 us | 750 us

*RST: 50 us
Default unit: S

Example: `FILT:DEMP:TCON 750us`
Selects the deemphasis for the demodulation bandwidth range from 800 Hz to 4 MHz with a time constant of 750 µs.

Manual operation: See "Deemphasis" on page 169

[SENSe:]FILTer<n>:DEMPhasis[:STATe] <State>

This command activates/deactivates the selected deemphasis for the specified evaluation.

For details about deemphasis refer to "Deemphasis" on page 169.

Suffix:
<n> Window

Parameters:
<State> ON | OFF | 0 | 1

OFF | 0
Switches the function off

ON | 1
Switches the function on

Example: `FILT:DEMP ON`
Activates the selected deemphasis.

Manual operation: See "Deemphasis" on page 169

[SENSe:]FILTer<n>:HPASs:FREQuency[:ABSolute] <Frequency>

This command selects the high pass filter type for the specified evaluation.

For details on the high pass filters, refer to "High Pass" on page 167.

Suffix:
<n> Window

Parameters:
<Frequency> 20 Hz | 50 Hz | 300 Hz

*RST: 300Hz
Default unit: Hz

Example: `FILT:HPAS:FREQ 300Hz`
Selects the high pass filter for the demodulation bandwidth range from 800 Hz to 8 MHz.

Manual operation: See "High Pass" on page 167

[SENSe:]FILTer<n>:HPASs:FREQuency:MANual <Frequency>

This command selects the cutoff frequency of the high pass filter for the specified evaluation.

For details on the high pass filters, refer to "High Pass" on page 167.

Suffix:
<n> Window

Parameters:

<Frequency> numeric value

Range: 0 to 3 MHz
*RST: 15kHz
Default unit: HZ

Example: `FILT:HPAS:FREQ:MAN 3MHz`
The AF results are restricted to frequencies lower than 3 MHz.

Manual operation: See "High Pass" on page 167

[SENSe:]FILTer<n>:HPASs[:STATe] <State>

This command activates/deactivates the selected high pass filter for the specified evaluation.

For details on the high pass filter, refer to "High Pass" on page 167.

Suffix:

<n> Window

Parameters:

<State> ON | OFF | 0 | 1

OFF | 0
Switches the function off

ON | 1
Switches the function on

Example: `FILT:HPAS ON`
Activates the selected high pass filter.

Manual operation: See "High Pass" on page 167

[SENSe:]FILTer<n>:LPASs:FREQuency[:ABSolute] <Frequency>

This command selects the absolute low pass filter type for the specified evaluation

For details on the low pass filter, refer to "Low Pass" on page 168.

Suffix:

<n> Window

Parameters:

<Frequency> 3kHz | 15kHz | 150kHz

*RST: 15kHz
Default unit: HZ

Example: `FILT:LPAS:FREQ 150kHz`
Selects the low pass filter for the demodulation bandwidth range from 400 kHz to 16 MHz.

Manual operation: See "Low Pass" on page 168

[SENSe:]FILTer<n>:LPASs:FREQuency:MANual <Frequency>

This command selects the cutoff frequency of the low pass filter for the specified evaluation.

For details on the low pass filter, refer to "Low Pass" on page 168.

Suffix:
<n> Window

Parameters:
<Frequency> numeric value

Range: 0 to 3 MHz
*RST: 15kHz
Default unit: HZ

Example: `FILT:LPAS:FREQ:MAN 150kHz`
The AF results are restricted to frequencies lower than 150 kHz.

Manual operation: See "Low Pass" on page 168

[SENSe:]FILTer<n>:LPASs:FREQuency:RELative <Frequency>

This command selects the relative low pass filter type for the specified evaluation

For details on the low pass filter, refer to "Low Pass" on page 168.

Suffix:
<n> Window

Parameters:
<Frequency> 5PCT | 10PCT | 25PCT

*RST: 25PCT
Default unit: PCT

Example: `FILT:LPAS:FREQ:REL 25PCT`
Selects the low pass filter as 25 % of the demodulation bandwidth.

Manual operation: See "Low Pass" on page 168

[SENSe:]FILTer<n>:LPASs[:STATe] <State>

This command activates/deactivates the selected low pass filter for the specified evaluation.

For details on the low pass filter, refer to "Low Pass" on page 168.

Suffix:
<n> Window

Parameters:
<State> ON | OFF | 0 | 1

OFF | 0
Switches the function off

ON | 1
Switches the function on

Example: `FILT:LPAS ON`
Activates the selected low pass filter.

Manual operation: See "Low Pass" on page 168

12.6.7.5 Defining the scaling and units

The scaling parameters define the range of the demodulated data to be displayed.

12.6.7.6 Scaling for AF evaluation

These settings are only available for AF evaluations.

Useful commands described elsewhere:

- `[SENSe:]ADJust:SCALe[:Y]:AUTO[:CONTinuous]` on page 483
- `[SENSe:]ADEMod<n>:AF:COUPling` on page 457
- `DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:RPOSition` on page 445
- `DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y:SPACing` on page 445

Specific commands:

DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:RVALue <Value>

This command defines the reference value assigned to the reference position in the specified window. Separate reference values are maintained for the various displays.

Suffix:

<n> Window

<w> subwindow

<t> irrelevant

Parameters:

<Value> Default unit: DB

Example: `DISP:TRAC:Y:RVAL 0`
Sets the value assigned to the reference position to 0 Hz

Manual operation: See "Reference Value" on page 171

12.6.7.7 Scaling for RF evaluation

These commands are required for RF evaluations and the result summary.

- DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:RPOSition on page 445
- DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y:SPACing on page 445
- DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe] on page 443
- DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:MODE on page 444

12.6.7.8 Units

The units define how the demodulated data is displayed.

UNIT<n>:ANGLe <Unit>

This command selects the unit for angles (for PM display, <n> is irrelevant).

This command is identical to `CALC:UNIT:ANGL`

Suffix:
<n> Window

Parameters:
<Unit> DEG | RAD
*RST: RAD

Example: `UNIT:ANGL DEG`

Manual operation: See "Phase Unit (Rad/Deg)" on page 172

UNIT<n>:THD <Mode>

Selects the unit for THD measurements (<n> is irrelevant).

This command is identical to `CALC:UNIT:THD`

Suffix:
<n> Window

Parameters:
<Mode> DB | PCT
*RST: DB

Example: `UNIT:THD PCT`

Manual operation: See "THD Unit (%/ DB)" on page 173

12.6.7.9 Demodulation results

The following commands are required to obtain demodulation results.

[SENSe:]ADEMod:DETector:DISTortion[:STATe] <State>
[SENSe:]ADEMod:DETector:MPEak[:STATe] <State>
[SENSe:]ADEMod:DETector:PAVerage[:STATe] <State>
[SENSe:]ADEMod:DETector:PPEak[:STATe] <State>
[SENSe:]ADEMod:DETector:RMS[:STATe] <State>
[SENSe:]ADEMod:DETector:SINad[:STATe] <State>
[SENSe:]ADEMod:DETector:SRMS[:STATe] <State>

[SENSe:]ADEMod:DETector:THD[:STATe] <State>
[SENSe:]ADEMod:DETector:AVERage[:STATe] <State>

Activates or deactivates the average detector in the modulation summary.

Parameters:

<State> ON | OFF | 0 | 1

OFF | 0
Switches the function off

ON | 1
Switches the function on

Example: `ADEM:DET:AVER ON`

Manual operation: See "State" on page 174

[SENSe:]ADEMod:DETector:DISTortion:MODE <Mode>
[SENSe:]ADEMod:DETector:MPEak:MODE <Mode>
[SENSe:]ADEMod:DETector:PAVerage:MODE <Mode>
[SENSe:]ADEMod:DETector:PPEak:MODE <Mode>
[SENSe:]ADEMod:DETector:RMS:MODE <Mode>
[SENSe:]ADEMod:DETector:SINad:MODE <Mode>
[SENSe:]ADEMod:DETector:SRMS:MODE <Mode>
[SENSe:]ADEMod:DETector:THD:MODE <Mode>
[SENSe:]ADEMod:DETector:AVERage:MODE <Mode>

Activates absolute or relative measurement demodulation for the selected detector.Each time the relative measurement mode is switched on, the current measured value is taken as a reference for the subsequent relative measurements.

Parameters:

<Mode> **RELative**
Relative mode: Switches on relative measurement.

ABSolute
Absolute mode: Switches on absolute measurement.

Example: `ADEM:DET:AVER:MODE REL`

Manual operation: See "Relative" on page 174

[SENSe:]ADEMod:DETector:DISTortion:REFerence <Reference>
[SENSe:]ADEMod:DETector:MPEak:REFerence <Reference>
[SENSe:]ADEMod:DETector:PAVerage:REFerence <Reference>
[SENSe:]ADEMod:DETector:PPEak:REFerence <Reference>
[SENSe:]ADEMod:DETector:RMS:REFerence <Reference>
[SENSe:]ADEMod:DETector:SINad:REFerence <Reference>
[SENSe:]ADEMod:DETector:SRMS:REFerence <Reference>
[SENSe:]ADEMod:DETector:THD:REFerence <Reference>
[SENSe:]ADEMod:DETector:AVERage:REFerence <Reference>

Sets or queries the reference value for the relative measurement for the average detector in the modulation summary.

Parameters:
<Reference> <numeric value>

Example: `ADEM:DET:AVER:REF 20 kHz`

Manual operation: See "Reference Value" on page 174

[SENSe:]ADEMod:DETector:DISTortion:REFerence:AUTO <Event>
[SENSe:]ADEMod:DETector:MPEak:REFerence:AUTO <Event>
[SENSe:]ADEMod:DETector:PAVerage:REFerence:AUTO <Event>
[SENSe:]ADEMod:DETector:PPEak:REFerence:AUTO <Event>
[SENSe:]ADEMod:DETector:RMS:REFerence:AUTO <Event>
[SENSe:]ADEMod:DETector:SINad:REFerence:AUTO <Event>
[SENSe:]ADEMod:DETector:SRMS:REFerence:AUTO <Event>
[SENSe:]ADEMod:DETector:THD:REFerence:AUTO <Event>
[SENSe:]ADEMod:DETector:AVERage:REFerence:AUTO <Event>

Uses the current measured value as a reference for the relative measurement for the average detector in the modulation summary.

Setting parameters:
<Event>

Example: `ADEM:DET:AVER:REF:AUTO ONCE`

Usage: Setting only

Manual operation: See "Meas -> Reference" on page 175

[SENSe:]ADEMod:AVERage[:STATe] <State>

Switches the display of the averaged results in the modulation summary on or off. The averaged results are displayed in addition to the current results.

Parameters:
<State> ON | OFF | 0 | 1

OFF | 0
Switches the function off

ON | 1
Switches the function on

Example: `ADEM:AVER ON`

Manual operation: See "Averaging" on page 175

[SENSe:]ADEMod:PHOLd[:STATe] <State>

Switches the display of the highest results in the modulation summary on or off. The averaged results are displayed in addition to the current results.

Parameters:
<State> ON | OFF | 0 | 1

OFF | 0
Switches the function off

ON | 1
Switches the function on

Example: `ADEM:PHOL ON`

Manual operation: See "Peak Hold" on page 175

12.6.8 Configuring tuned RF level measurements

[SENSe:]POWer:AC:STATe <State>

Switches to Tuned RF Level mode.

Parameters:
<State> ON | OFF | 0 | 1

OFF | 0
Switches Tuned RF Level mode off

ON | 1
Switches Tuned RF Level mode on

*RST: 0

Example: `POW:AC:STAT ON`

CONFigure:MEASurement <Source>

Selects the measurement

Parameters:
<Source> AM | FM | PM | AUDio | TRFL | POWer | FREQuency

Example: CONF:MEAS AM

INPut<ip>:ATTenuation:RECal:AUTO[:STATe] <State>

Suffix:
<ip> 1..n

Parameters:
<State>

Manual operation: See "Auto Recal" on page 176

INPut<ip>:ATTenuation:RECal:FACTor[:STATe] <State>

Suffix:
<ip> 1..n

Parameters:
<State>

Manual operation: See "Recal Average Factor" on page 176

[SENSe:]CORRection:COLLect[:ACQuire]:CLEar:IMMediate

Clears the previously defined correction values.

Usage: Event

Manual operation: See "Clear Correction Values" on page 177

[SENSe:]POWer:AC:REFerence:STATe <State>

Sswitches on absolute or relative measured-value display in the Tuned RF Level mode

Parameters:
<State> ON | OFF | 1 | 0

Example: POW:AC:STAT ON

Manual operation: See "Relative Settings" on page 178

UNIT<n>:POWer:RATio <Unit>

Defines the unit of the relative measurement value

Suffix:
<n> 1..n

Parameters:
<Unit> **PCT**
%
DB
dB

Example: `UNIT:POW:RAT PCT`

Manual operation: See "Relative Settings" on page 178

[SENSe:]POWer:AC:REFerence <Value>

Defines the reference value for the relative measured-value display.

Parameters:

<Value> <numeric value>

Default unit: dBm

Example: `POW:AC:REF -28 dBm`

Manual operation: See "Relative Settings" on page 178

[SENSe:]POWer:AC:REFerence:AUTO <Event>

Uses the current measured value as a reference for the relative measured-level display.

Parameters:

<Event>

Example: `POW:AC:REF:AUTO ONCE`

Manual operation: See "Relative Settings" on page 178

[SENSe:]POWer:AC:AVERage[:STATe] <State>

Switches on or off averaging of the measured level values in Tuned RF Level mode

Parameters:

<State> ON | OFF | 1 | 0

Example: `POW:AC:AVER ON`

Manual operation: See "Averaging" on page 177

[SENSe:]POWer:AC:AVERage:AUTO <State>

Activates or deactivates the auto average mode.

Parameters:

<State> ON | OFF | 1 | 0

Example: `POW:AC:AVER:AUTO ON`

Manual operation: See "Averaging Mode" on page 177

[SENSe:]POWer:AC:AVERage:COUNt <Value>

Defines the number of measurements that are started as "single measurements" and used to form an average. The value "0" causes a sliding average to be generated over ten measurements.

Parameters:

<Value> <numeric value>

Example: `SENS:POW:AC:AVER:COUN 30`

Manual operation: See "Averaging Count" on page 177

[SENSe:]POWer:AC:AVERage:DATA {<Level>, <Count>}...

Queries and fills the averaging data table.

Parameters:

<Level> irrelevant

<Count>

Example: `SENS:POW:AC:AVER:DATA 1,2,3,4,5,6`

Manual operation: See "Averaging Table" on page 178

[SENSe:]CORRection:COLLect[:ACQuire] <MeasType>

Carries out the various steps of absolute level calibration in the Tuned RF Level mode.

Setting parameters:

<MeasType> INPut | PMETer | PSPLitter | THRough | OPEN

INPut
Measures the comparison value at the receiver's RF input and corrects it to the reference level

PMETer
Measures the reference level with a power meter

PSPLitter
Measures the reference level and then the comparison value. For this measurement, the power meter and the receiver's RF input must be connected to the DUT via a power splitter

THRough
Calibration with direct connection between tracking generator and device input.

OPEN
Calibration with open input

Example: `CORR:COLL PSPL;*WAI`

Usage: Setting only

MEMory[:CORRection]:SELect <Frequency>

Activates a correction data set with the selected frequency.

Setting parameters:
<Frequency>

Example: `MEM:SEL '100000000'`

Usage: Setting only

Manual operation: See "Corr Table" on page 179

MEMory[:CORRection]:CATalog?

Returns the names of all saved correction sets and the corresponding settings.

Example: `MEM:CAT?`

Usage: Query only

Manual operation: See "Corr Table" on page 179

MEMory[:CORRection]:DELete <Frequency>

Deletes a correction data set for a specific frequency.

Setting parameters:
<Frequency> <numeric value>

Example: `MEM:DEL '100000000'`

Usage: Setting only

Manual operation: See "Corr Table" on page 179

MEMory[:CORRection]:DELete:ALL

Deletes all correction data sets.

Example: `MEM:DEL:ALL`

Usage: Event

Manual operation: See "Corr Table" on page 179

12.6.9 Configuring audio measurements

INPut<ip>:IMPedance <Impedance>

Selects an audio input impedance.

Suffix:
<ip> 1..n

Parameters:
<Impedance> <numeric value>
Default unit: Ohm

Example: `INP:IMP 50`

Manual operation: See "Input Impedance" on page 180

[SENSe:]VOLTage:AC:RANGe[:UPPer] <InputVoltage>

Selects an audio input level.

Parameters:
<InputVoltage> <numeric value>

Example: `VOLT:AC:RANG 4V`

Manual operation: See "Input Level" on page 180

TRIGger[:SEQuence]:LEVel:AUDio <Level>

The command sets the level when audio signals are used as trigger source.

For triggering to be successful, the measurement time must cover at least 5 periods of the audio signal.

Parameters:
<Level> <numeric value>
Default unit: V

Example: `TRIG:LEV:AUD 0.5V`

12.6.10 Adjusting settings automatically

The following remote commands are required to adjust settings automatically in a remote environment.

[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`

[SENSe:]ADJust:CONFigure:LEVel:DURation <Duration>

To determine the ideal reference level, the R&S FSMR3 performs a measurement on the current input data. This command defines the length of the measurement if `[SENSe:]ADJust:CONFigure:LEVel: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.

[SENSe:]ADJust:CONFigure:LEVel:DURation:MODE <Mode>

To determine the ideal reference level, the R&S FSMR3 performs a measurement on the current input data. This command selects the way the R&S FSMR3 determines the length of the measurement .

Parameters:

<Mode>

AUTO
The R&S FSMR3 determines the measurement length automatically according to the current input data.

MANual
The R&S FSMR3 uses the measurement length defined by `[SENSe:]ADJust:CONFigure:LEVel:DURation` on page 481.

*RST: AUTO

[SENSe:]ADJust:CONFigure:HYSTeresis:LOWer <Threshold>

When the reference level is adjusted automatically using the `[SENSe:]ADJust:LEVel` on page 483 command, the internal attenuators and the preamplifier are also adjusted. 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.

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 is only adjusted when the signal level falls below 18 dBm.

[SENSe:]ADJust:CONFigure:HYSTeresis:UPPer <Threshold>

When the reference level is adjusted automatically using the `[SENSe:]ADJust:LEVel` on page 483 command, the internal attenuators and the preamplifier are also adjusted. To avoid frequent adaptation due to small changes in the input signal, you can define a hysteresis. This setting defines an upper threshold the signal must exceed (compared to the last measurement) before the reference level is adapted automatically.

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 is only adjusted when the signal level rises above 22 dBm.

[SENSe:]ADJust:CONFigure:SMODe <Search Mode>

Determines the search mode for the automatic measurement performed to determine the optimal measurement configuration.

Parameters:

<Search Mode> FAST | POPTimzed

FAST
The measurement is optimized for speed.

POPTimzed
The measurement is optimized to analyze pulse signals adequately.

Example: `ADJ:CONF:SMOD POPT`

[SENSe:]ADJust:CONFigure:TRIGger <State>

Defines the behavior of the measurement when adjusting a setting automatically (using `SENS:ADJ:LEV ON`, for example).

Parameters:

<State> ON | OFF | 0 | 1

OFF | 0
Switches the function off

ON | 1
Switches the function on

[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`

[SENSe:]ADJust:LEVel

Initiates a single (internal) measurement that evaluates and sets the ideal reference level for the current input data and measurement settings. Thus, the settings of the RF attenuation and the reference level are optimized for the signal level. The R&S FSMR3 is not overloaded and the dynamic range is not limited by an S/N ratio that is too small.

Example: `ADJ:LEV`

[SENSe:]ADJust:SCALe[:Y]:AUTO[:CONTinuous] <State>

Activates automatic scaling of the y-axis in all diagrams according to the current measurement results. Currently auto-scaling is only available for AF measurements. RF power and RF spectrum measurements are not affected by the auto-scaling.

Parameters:

<State> ON | OFF | 0 | 1

OFF | 0
Switches the function off

ON | 1
Switches the function on

Example: `SENS:ADJ:SCAL:Y:AUTO ON`

Manual operation: See "AF Auto Scale" on page 172

12.6.11 Capturing data and performing sweeps

The following commands are required to capture data.

ABORt

This command aborts the measurement in the current channel and resets the trigger system.

To prevent overlapping execution of the subsequent command before the measurement has been aborted successfully, use the `*OPC?` or `*WAI` command after `ABOR` and before the next command.

For details on overlapping execution see Remote control via SCPI.

Note on blocked remote control programs:

If a sequential command cannot be completed, for example because a triggered sweep never receives a trigger, the remote control program will never finish and the remote channel to the R&S FSMR3000 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 R&S FSMR3000 on a parallel channel to clear all currently active remote channels. Depending on the used interface and protocol, send the following commands:

- **Visa**: `viClear()`
- **GPIB**: `ibclr()`
- **RSIB**: `RSDLLibclr()`

Now you can send the `ABORt` command on the remote channel performing the measurement.

Example: `ABOR;:INIT:IMM`
Aborts the current measurement and immediately starts a new one.

Example: `ABOR;*WAI`
`INIT:IMM`
Aborts the current measurement and starts a new one once abortion has been completed.

Usage: Event

INITiate<n>: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.

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.

INITiate<n>:CONTinuous <State>

This command controls the measurement mode for an individual channel.

Note that in single measurement mode, you can synchronize to the end of the measurement with *OPC, *OPC? or *WAI. In continuous measurement mode, synchronization to the end of the measurement is not possible. Thus, it is not recommended that you use continuous measurement mode in remote control, as results like trace data or markers are only valid after a single measurement end synchronization.

For details on synchronization see Remote control via SCPI.

Suffix:
<n> irrelevant

Parameters:
<State> ON | OFF | 0 | 1

ON | 1
Continuous measurement

OFF | 0
Single measurement

*RST: 1

Example:
`INIT:CONT OFF`
Switches the measurement mode to single measurement.
`INIT:CONT ON`
Switches the measurement mode to continuous measurement.

INITiate<n>[:IMMediate]

This command starts a (single) new measurement.

You can synchronize to the end of the measurement with *OPC, *OPC? or *WAI.

For details on synchronization see Remote control via SCPI.

Suffix:

<n>	irrelevant

INITiate<n>:REFResh

This command updates the current measurement results to reflect the current measurement settings.

No new I/Q data is captured. Thus, measurement settings apply to the I/Q data currently in the capture buffer.

The command applies exclusively to I/Q measurements. It requires I/Q data.

Suffix:

<n>	irrelevant

Example: `INIT:REFR`
Updates the IQ measurement results.

12.6.12 Configuring the result display

The following remote commands are required to configure the screen display in a remote environment.

12.6.12.1 General window commands

The following commands are required to configure general window layout, independent of the application.

DISPlay:FORMat <Format>

This command determines which tab is displayed.

Parameters:

<Format>

SPLit
Displays the MultiView tab with an overview of all active channels

SINGle
Displays the measurement channel that was previously focused.

*RST: SING

Example: `DISP:FORM SPL`

DISPlay[:WINDow<n>]:SIZE <Size>

This command maximizes the size of the selected result display window *temporarily*. To change the size of several windows on the screen permanently, use the `LAY:SPL` command (see `LAYout:SPLitter` on page 406).

Suffix:
<n> Window

Parameters:
<Size>

LARGe
Maximizes the selected window to full screen.
Other windows are still active in the background.

SMALl
Reduces the size of the selected window to its original size.
If more than one measurement window was displayed originally, these are visible again.

*RST: SMALl

Example: `DISP:WIND2:SIZE LARG`

12.6.12.2 Working with windows in the display

The following commands are required to change the evaluation type and rearrange the screen layout for a 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 channel.

Note that the suffix <n> always refers to the window *in the currently selected channel*.

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

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

Query parameters:

<WindowName> String containing the name of the existing window the new window is inserted next to.
By default, the name of a window is the same as its index. To determine the name and index of all active windows, use the LAYout:CATalog[:WINDow]? query.

<Direction> LEFT | RIGHt | ABOVe | BELow
Direction the new window is added relative to the existing window.

<WindowType> text value
Type of result display (evaluation method) you want to add.
See the table below for available parameter values.

Return values:

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

Usage: Query only

Manual operation:
See "AM Time Domain" on page 100
See "FM Time Domain" on page 100
See "PM Time Domain" on page 101
See "AM Spectrum" on page 102
See "FM Spectrum" on page 103
See "PM Spectrum" on page 104
See "RF Time Domain" on page 105
See "RF Spectrum" on page 106
See "Audio Time Domain" on page 107
See "Audio Spectrum" on page 108
See "Result Summary" on page 108
See "Signal Summary" on page 109
See "CORR Status" on page 110
See "Marker Table" on page 110
See "Marker Peak List" on page 110
See "Diagram" on page 182
See "Result Summary" on page 183

LAYout:CATalog[:WINDow]?

This command queries the name and index of all active windows in the active channel from top left to bottom right. The result is a comma-separated list of values for each window, with the syntax:

<WindowName_1>,<WindowIndex_1>..<WindowName_n>,<WindowIndex_n>

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 channel.

Note: to query the **name** of a particular window, use the `LAYout:WINDow<n>:IDENtify?` query.

Query parameters:

<WindowName>	String containing the name of a window.

Return values:

<WindowIndex>	Index number of the window.

Example:	`LAY:IDEN:WIND? '2'`
	Queries the index of the result display named '2'.
	Response:
	`2`

Usage:	Query only

LAYout:MOVE[:WINDow] <WindowName>, <WindowName>, <Direction>

Setting parameters:

<WindowName>	String containing the name of an existing window that is to be moved. By default, the name of a window is the same as its index. To determine the name and index of all active windows in the active channel, use the `LAYout:CATalog[:WINDow]?` query.
<WindowName>	String containing the name of an existing window the selected window is placed next to or replaces. By default, the name of a window is the same as its index. To determine the name and index of all active windows in the active channel, use the `LAYout:CATalog[:WINDow]?` query.
<Direction>	LEFT | RIGHt | ABOVe | BELow | REPLace Destination the selected window is moved to, relative to the reference window.
Example:	`LAY:MOVE '4','1',LEFT` Moves the window named '4' to the left of window 1.

Example: `LAY:MOVE '1','3',REPL`
Replaces the window named '3' by window 1. Window 3 is deleted.

Usage: Setting only

LAYout:REMove[:WINDow] <WindowName>

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

Setting parameters:
<WindowName> String containing the name of the window. In the default state, the name of the window is its index.

Example: `LAY:REM '2'`
Removes the result display in the window named '2'.

Usage: Setting only

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

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

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

Setting parameters:
<WindowName> String containing the name of the existing window.
By default, the name of a window is the same as its index. To determine the name and index of all active windows in the active channel, use the `LAYout:CATalog[:WINDow]?` query.

<WindowType> Type of result display you want to use in the existing window.
See `LAYout:ADD[:WINDow]?` on page 403 for a list of available window types.

Example: `LAY:REPL:WIND '1',MTAB`
Replaces the result display in window 1 with a marker table.

Usage: Setting only

LAYout:SPLitter <Index1>, <Index2>, <Position>

This command changes the position of a splitter and thus controls the size of the windows on each side of the splitter.

Compared to the `DISPlay[:WINDow<n>]:SIZE` on page 402 command, the `LAYout:SPLitter` changes the size of all windows to either side of the splitter permanently, it does not just maximize a single window temporarily.

Note that windows must have a certain minimum size. If the position you define conflicts with the minimum size of any of the affected windows, the command does not work, but does not return an error.

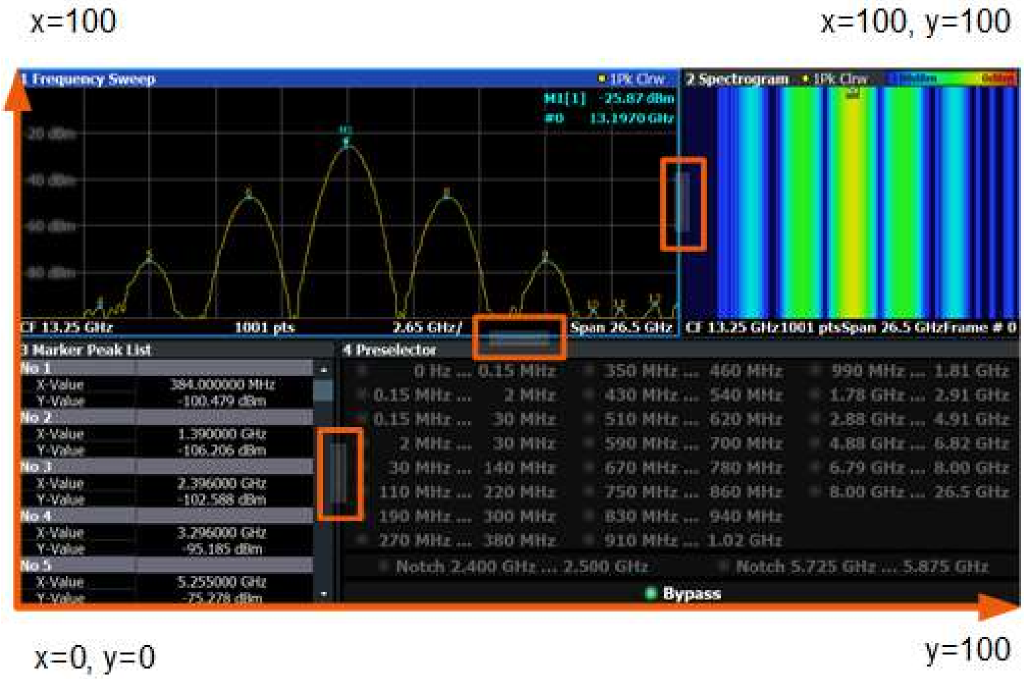


Figure 12-2: SmartGrid coordinates for remote control of the splitters

Setting parameters:

<Index1> The index of one window the splitter controls.

<Index2> The index of a window on the other side of the splitter.

<Position> New vertical or horizontal position of the splitter as a fraction of the screen area (without channel and status bar and softkey menu).
The point of origin (x = 0, y = 0) is in the lower left corner of the screen. The end point (x = 100, y = 100) is in the upper right corner of the screen. (See Figure 12-1.)
The direction in which the splitter is moved depends on the screen layout. If the windows are positioned horizontally, the splitter also moves horizontally. If the windows are positioned vertically, the splitter also moves vertically.

Range: 0 to 100

Example: `LAY:SPL 1,3,50`
Moves the splitter between window 1 ('Frequency Sweep') and 3 ('"Marker Table"') to the center (50%) of the screen, i.e. in the figure above, to the left.

Example: `LAY:SPL 1,4,70`
Moves the splitter between window 1 ('Frequency Sweep') and 3 ('"Marker Peak List"') towards the top (70%) of the screen.
The following commands have the exact same effect, as any combination of windows above and below the splitter moves the splitter vertically.
`LAY:SPL 3,2,70`
`LAY:SPL 4,1,70`
`LAY:SPL 2,1,70`

Usage: Setting only

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. Unlike `LAYout:ADD[:WINDow]?`, for which the existing window is defined by a parameter.

To replace an existing window, use the `LAYout:WINDow<n>:REPLace` command.

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

Suffix:
<n> Window

Query parameters:
<Direction> LEFT | RIGHt | ABOVe | BELow

<WindowType> Type of measurement window you want to add.
See `LAYout:ADD[:WINDow]?` on page 403 for a list of available window types.

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 channel.

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

Suffix:
<n> Window

Return values:
<WindowName> String containing the name of a window.
In the default state, the name of the window is its index.

Example: `LAY:WIND2:IDEN?`
Queries the name of the result display in window 2.
Response:
`'2'`

Usage: Query only

LAYout:WINDow<n>:REMove

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

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

Suffix:
<n> Window

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 channel.

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

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

Suffix:
<n> Window

Setting parameters:
<WindowType> Type of measurement window you want to replace another one with.
See `LAYout:ADD[:WINDow]?` on page 403 for a list of available window types.

Example: `LAY:WIND2:REPL MTAB`
Replaces the result display in window 2 with a marker table.

Usage: Setting only

LAYout:WINDow<n>:TYPE <WindowType>

Queries or defines the window type of the window specified by the index <n>. The window type determines which results are displayed. For a list of possible window types, see `LAYout:ADD[:WINDow]?` on page 403.

Note that this command is not available in all applications and measurements.

Suffix:

<n> 1..n
Window

Parameters:

<WindowType>

Example: `LAY:WIND2:TYPE?`

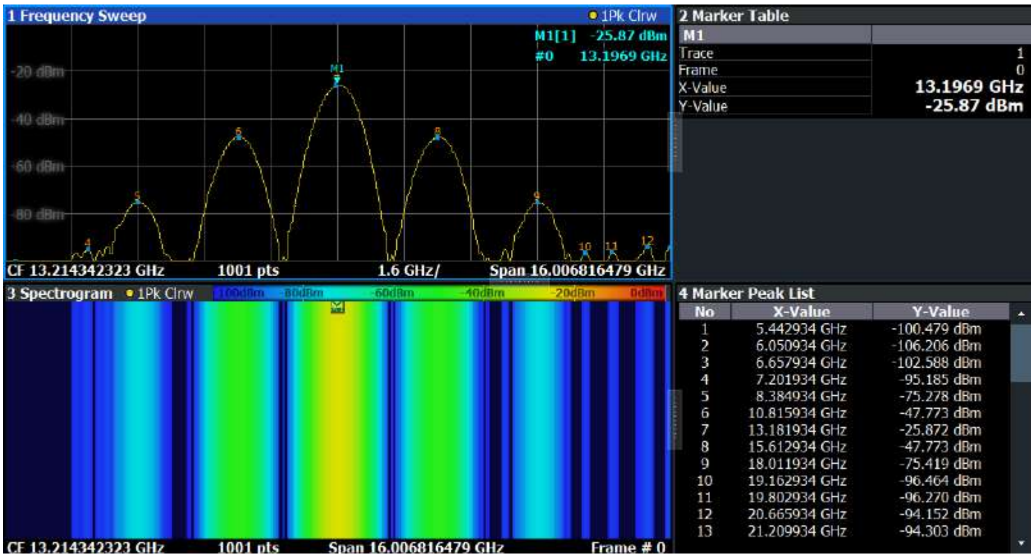
12.6.12.3 Examples: configuring the result display

The following example demonstrates how to configure result displays in a remote environment.

Example 1: adding and arranging windows

Starting from the default initial display in the Spectrum application (Frequency Sweep), we will configure the following result displays:

1 Frequency Sweep	3 "Marker Table"
2 Spectrogram	4 "Marker Peak List"

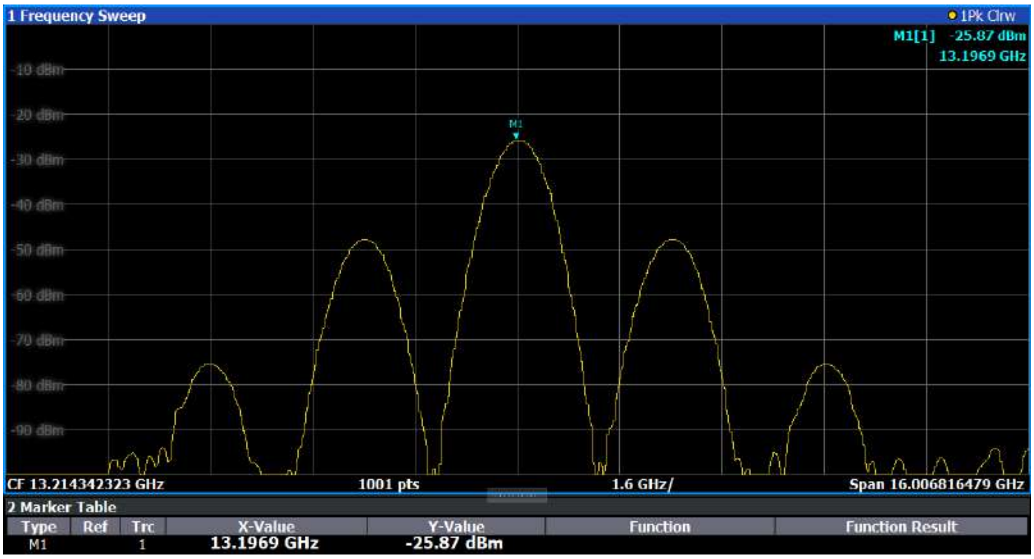



```
//--------------Resetting the instrument -----------
*RST
//--------------- Adding new windows --------------------
//Add a Spectrogram window beneath the Frequency Sweep window
```

```
LAY:ADD? '1',BEL,SGR
//Result: window number: '2'
//Add a Marker Table window to the right of the Frequency Sweep window
LAY:ADD? '1',RIGH,MTAB
//Result: window number: '3'
//Add a Marker Peak List window to the right of the Spectrogram window
LAY:WIND2:ADD? RIGH,PEAK
//Result: window number: '4'

//--------------- Changing the size of individual windows -------------
//Move the splitter between the Frequency Sweep window and the Marker Table
//window to enlarge the spectrum display to 60% of the entire width.
LAY:SPL 1,3,60
//Move the splitter between the Spectrogram window and the Marker Peak List
//window to enlarge the Spectrogram display to 60% of the entire width.
LAY:SPL 2,4,60

//--------------- Querying all displayed windows ------------------
//Query the name and number of all displayed windows
//(from top left to bottom right)
LAY:CAT?
//Result : '1',1,'2',2,'3',3,'4',4

//------------- Maximizing a Window ------------------
//Maximize the window "2 Spectrogram"
DISP:WIND2:SIZE LARG

//-------------Restore multiple window display -----------
DISP:WIND2:SIZE SMAL
```

Example 2: replacing and removing windows

Starting from the display configured in Example 1: adding and arranging windows, we will remove and replace result displays to obtain the following configuration:




```
//-------------- Preparing the configuration from example 1 -----------
*RST
LAY:ADD? '1',BEL,SGR
LAY:ADD? '1',RIGH,MTAB
LAY:WIND2:ADD? RIGH,PEAK
LAY:CAT?
//Result : '1',1,'2',2,'3',3,'4',4
//Remove Spectrogram
LAY:WIND2:REM //Remove Marker Table window
LAY:REM '3'
//Replace Marker Peak List window by Marker Table
LAY:REPL '4',MTAB

//--------------- Querying all displayed windows ------------------
//Query the name and number of all displayed windows (from top left to bottom right)
LAY:CAT?
//Result : '1',1,'4',4

//--------------- Changing the size of individual windows -------------
//Move the splitter between the Frequency Sweep window and the Marker Table window
//to enlarge the spectrum display to 80% of the entire height.
LAY:SPL 1,4,80
```

12.7 Analyzing measurements (basics)

The commands for general analysis tasks are described here.

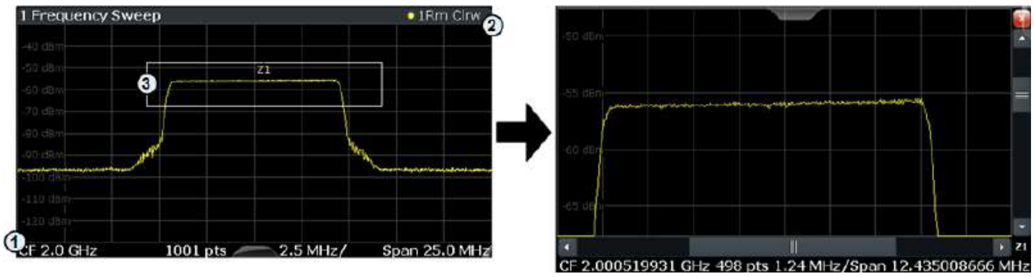
12.7.1 Zooming into the display

12.7.1.1 Using the single zoom

DISPlay[:WINDow<n>][:SUBWindow<w>]: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)

Suffix:

<n>	Window
<w>	subwindow Not supported by all applications

Parameters:

<x1>
Diagram coordinates in % of the complete diagram that define the zoom area.
The lower left corner is the origin of coordinate system. The upper right corner is the end point of the system.

Range: 0 to 100
Default unit: PCT

<y1>
Diagram coordinates in % of the complete diagram that define the zoom area.
The lower left corner is the origin of coordinate system. The upper right corner is the end point of the system.

Range: 0 to 100
Default unit: PCT

<x2> Diagram coordinates in % of the complete diagram that define the zoom area.
The lower left corner is the origin of coordinate system. The upper right corner is the end point of the system.
Range: 0 to 100
Default unit: PCT

<y2> Diagram coordinates in % of the complete diagram that define the zoom area.
The lower left corner is the origin of coordinate system. The upper right corner is the end point of the system.
Range: 0 to 100
Default unit: PCT

Manual operation: See "Single Zoom" on page 204

DISPlay[:WINDow<n>][:SUBWindow<w>]:ZOOM[:STATe] <State>

This command turns the zoom on and off.

Suffix:
<n> Window

<w> subwindow
Not supported by all applications

Parameters:
<State> ON | OFF | 0 | 1

OFF | 0
Switches the function off

ON | 1
Switches the function on

Example: `DISP:ZOOM ON`
Activates the zoom mode.

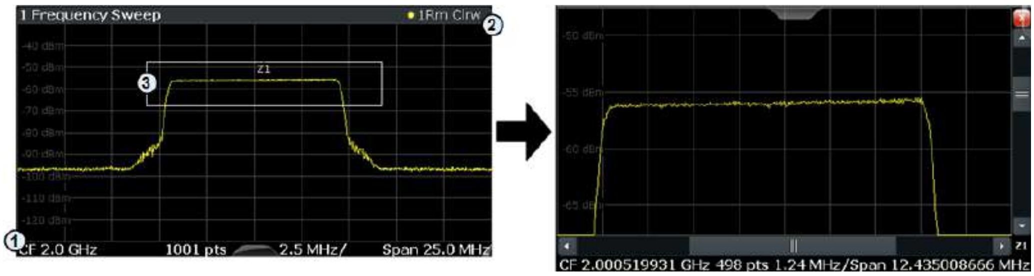
Manual operation: See "Single Zoom" on page 204
See "Restore Original Display" on page 205

12.7.1.2 Using the multiple zoom

DISPlay[:WINDow<n>][:SUBWindow<w>]:ZOOM:MULTiple<zn>: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:

<n> Window

<w> subwindow
Not supported by all applications

<zn> Selects the zoom window.

Parameters:

<x1> Diagram coordinates in % of the complete diagram that define the zoom area.
The lower left corner is the origin of coordinate system. The upper right corner is the end point of the system.

Range: 0 to 100
Default unit: PCT

<y1> Diagram coordinates in % of the complete diagram that define the zoom area.
The lower left corner is the origin of coordinate system. The upper right corner is the end point of the system.

Range: 0 to 100
Default unit: PCT

<x2> Diagram coordinates in % of the complete diagram that define the zoom area.
The lower left corner is the origin of coordinate system. The upper right corner is the end point of the system.

Range: 0 to 100
Default unit: PCT

<y2> Diagram coordinates in % of the complete diagram that define the zoom area.
The lower left corner is the origin of coordinate system. The upper right corner is the end point of the system.

Range: 0 to 100
Default unit: PCT

Manual operation: See "Multi-Zoom" on page 204

DISPlay[:WINDow<n>][:SUBWindow<w>]:ZOOM:MULTiple<zn>[:STATe] <State>

This command turns the multiple zoom on and off.

Suffix:

<n>	Window
<w>	subwindow Not supported by all applications
<zn>	Selects the zoom window. If you turn off one of the zoom windows, all subsequent zoom windows move up one position.

Parameters:

<State>	ON | OFF | 0 | 1 **OFF | 0** Switches the function off **ON | 1** Switches the function on

Manual operation: See "Multi-Zoom" on page 204

12.7.2 Configuring the trace display and retrieving trace data

The commands required to work with traces are described here.

Commands required to export traces (and other result data) are described in Chapter 12.8.5, "Storing measurement results", on page 582.

12.7.2.1 Configuring standard traces

Useful commands for trace configuration described elsewhere

- `DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y:SPACing` on page 445
- `DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]` on page 443

Remote commands exclusive to trace configuration

DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:MODE <Mode>

This command selects the trace mode. If necessary, the selected trace is also activated.

Suffix:

<n> Window

<w> subwindow
Not supported by all applications

<t> Trace

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 229

DISPlay[:WINDow<n>][:SUBWindow<w>]: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

Suffix:

<n> Window

<w> subwindow

<t> Trace

Parameters:

<State> ON | OFF | 0 | 1

OFF | 0
Switches the function off

ON | 1
Switches the function on

Example: `DISP:WIND:TRAC3:MODE:HCON ON`
Switches off the reset function.

Manual operation: See "Hold" on page 230

DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>[:STATe] <State>

This command turns a trace on and off.

The measurement continues in the background.

Suffix:

<n> Window

<w> subwindow
Not supported by all applications

<t> Trace

Example: `DISP:TRAC3 ON`

Manual operation: See "Trace 1/Trace 2/Trace 3/Trace 4/Trace 5/Trace 6" on page 229

[SENSe:][WINDow<n>:]DETector<t>[:FUNCtion] <Detector>

Defines the trace detector to be used for trace analysis.

Suffix:

<n> Window

<t> Trace

Parameters:

<Detector>
NARRow
Narrow

WIDE
Wide

Example: `DET POS`
Sets the detector to "positive peak".

Manual operation: See "Detector" on page 176
See "Detector" on page 230

[SENSe:][WINDow<n>:]DETector<t>[:FUNCtion]:AUTO <State>

This command couples and decouples the detector to the trace mode.

Suffix:

<n> Window

<t> Trace

Parameters:
<State> ON | OFF | 0 | 1
*RST: 1

Example: `DET:AUTO OFF`
The selection of the detector is not coupled to the trace mode.

Manual operation: See "Detector" on page 230

12.7.2.2 Using trace mathematics

The following commands control trace mathematics.

CALCulate<n>:MATH<t>[:EXPRession][:DEFine] <Expression>

This command selects the mathematical expression for trace mathematics.

Before you can use the command, you have to turn trace mathematics on.

Suffix:
<n> Window

<t> irrelevant

Parameters:
<Expression> **(TRACE1-TRACE2)**
Subtracts trace 2 from trace 1.

(TRACE1-TRACE3)
Subtracts trace 3 from trace 1.

(TRACE1-TRACE4)
Subtracts trace 4 from trace 1.

(TRACE1-TRACE5)
Subtracts trace 5 from trace 1.

(TRACE1-TRACE6)
Subtracts trace 6 from trace 1.

Example: `CALC:MATH:STAT ON`
Turns trace mathematics on.
`CALC:MATH:EXPR:DEF (TRACE1-TRACE3)`
Subtracts trace 3 from trace 1.

CALCulate<n>:MATH<t>:MODE <Mode>

This command selects the way the R&S FSMR3 calculates trace mathematics.

Suffix:
<n> Window

<t> irrelevant

Parameters:
<Mode> For more information on the way each mode works see Trace Math Mode.

LINear
Linear calculation.

LOGarithmic
Logarithmic calculation.

POWer
Linear power calculation.

*RST: LOGarithmic

Example: `CALC:MATH:MODE LIN`
Selects linear calculation.

CALCulate<n>:MATH<t>:POSition <Position>

This command defines the position of the trace resulting from the mathematical operation.

Suffix:
<n> Window

<t> irrelevant

Parameters:
<Position> Vertical position of the trace in % of the height of the diagram area.
100 PCT corresponds to the upper diagram border.

Range: -100 to 200
*RST: 50
Default unit: PCT

Example: `CALC:MATH:POS 100`
Moves the trace to the top of the diagram area.

CALCulate<n>:MATH<t>:STATe <State>

This command turns the trace mathematics on and off.

Suffix:
<n> Window

<t> irrelevant

Parameters:
<State> ON | OFF | 0 | 1

OFF | 0
Switches the function off

ON | 1
Switches the function on

Example: `CALC:MATH:STAT ON`
Turns on trace mathematics.

12.7.2.3 Retrieving trace results

This chapter describes how to retrieve data from standard traces.

For details on the format of the retrieved trace data see also Chapter 12.7.2.4, "Formats for returned values: ASCII format and binary format", on page 507.

FORMat[:DATA] <Format>[, <BitLength>]

This command selects the data format that is used for transmission of trace data from the R&S FSMR3 to the controlling computer.

Note that the command has no effect for data that you send to the R&S FSMR3. The R&S FSMR3 automatically recognizes the data it receives, regardless of the format.

Parameters:

<Format>

ASCii
ASCii format, separated by commas.
This format is almost always suitable, regardless of the actual data format. However, the data is not as compact as other formats can be.

REAL
Floating-point numbers (according to IEEE 754) in the "definite length block format".
The format setting `REAL` is used for the binary transmission of trace data.

<BitLength>

Length in bits for floating-point results

16
16-bit floating-point numbers.
Compared to `REAL,32` format, half as many numbers are returned.

32
32-bit floating-point numbers
For I/Q data, 8 bytes per sample are returned for this format setting.

64
64-bit floating-point numbers
Compared to `REAL,32` format, twice as many numbers are returned.

Example: `FORM REAL,32`

TRACe<n>[:DATA]

This command queries current trace data and measurement results.

The data format depends on `FORMat[:DATA]` on page 505.

Suffix:
<n> Window

Query parameters:
<ResultType> Selects the type of result to be returned.

TRACE1 | ... | TRACE6
Returns the trace data for the corresponding trace.

Example: `TRAC? TRACE3`
Queries the data of trace 3.

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 returns the same results as `TRAC:DATA? TRACE1`.

Suffix:
<n> Window

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.

Return values:
<SweepPointValues>

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.

Suffix:
<n> Window

Query parameters:
<TraceNumber> Trace number.

Return values:
<X-Values>

Example: `TRAC3:X? TRACE1`
Returns the x-values for trace 1 in window 3.

Usage: Query only

12.7.2.4 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]` on page 505. 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,16/32/64):
  The data is stored as binary data (definite length block data according to IEEE 488.2), each measurement value being formatted in 16-bit/32-bit/64-bit IEEE 754 floating-point-format.
  The schema of the result string is as follows:
  `#<Length of length><Length of data><value1><value2>…<value n>`
  with:

<Length of length>	Number of digits of the following number of data bytes
<Length of data>	Number of following data bytes
<Value>	2-byte/4-byte/8-byte floating point value

Example: `#41024`<Data>... contains 1024 data bytes

Data blocks larger than 999,999,999 bytes

According to SCPI, the header of the block data format allows for a maximum of 9 characters to describe the data length. Thus, the maximum REAL 32 data that can be represented is 999,999,999 bytes. However, the R&S FSMR3 is able to send larger data blocks. In this case, the length of the data block is placed in brackets, e.g. `#(1234567890)`<value1><value2>…

Reading out data in binary format is quicker than in ASCII format. Thus, binary format is recommended for large amounts of data.

12.7.2.5 Importing and exporting traces

FORMat:DEXPort:FORMat <FileFormat>

Determines the format of the ASCII file to be imported or exported. Depending on the external program that creates the data file or evaluates it, a comma-separated list (CSV) or a plain data format (DAT) file is required.

Parameters:

<FileFormat> CSV | DAT

*RST: DAT

Example: `FORM:DEXP:FORM CSV`

Manual operation: See "File Type" on page 235

FORMat:DEXPort:TRACes <Selection>

This command selects the data to be included in a data export file (see `MMEMory:STORe<n>:TRACe` on page 509).

Parameters:

<Selection> SINGle | ALL

SINGle
Only a single trace is selected for export, namely the one specified by the `MMEMory:STORe<n>:TRACe` command.

ALL
Selects all active traces and result tables (e.g. "Result Summary", marker peak list etc.) in the current application for export to an ASCII file.
The <trace> parameter for the `MMEMory:STORe<n>:TRACe` command is ignored.

*RST: SINGle

Manual operation: See "Export all Traces and all Table Results" on page 233

FORMat:DEXPort:XDIStrib <XDistribution>

Defines how the x-values of the trace are determined in the frequency domain.

Parameters:

<XDistribution> STARtstop | BINCentered

BINCentered
The full measurement span is divided by the number of measurement points to obtain *bin*s. The x-value of the measurement point is defined as the x-value at the center of the bin (bin/2).

STARtstop
(Default): The x-value of the first measurement point corresponds to the starting point of the full measurement span. The x-value of the last measurement point corresponds to the end point of the full measurement span. All other measurement points are divided evenly between the first and last points.

Example: `FORM:DEXP:XDIS BINC`

FORMat:DIMPort:TRACes <Selection>

This command selects the data to be included in a data import file (see `MMEMory:LOAD<n>:TRACe` on page 509).

Parameters:

<Selection> SINGle | ALL

SINGle
Only a single trace is selected for import, namely the one specified by the `MMEMory:LOAD<n>:TRACe` on page 509 command.

ALL
Imports several traces at once, overwriting the existing trace data for any active trace in the result display with the same trace number. Data from the import file for currently not active traces is not imported.
The <trace> parameter for the `MMEMory:LOAD<n>:TRACe` on page 509 command is ignored.

*RST: SINGle

MMEMory:LOAD<n>:TRACe <Trace>, <FileName>

This command imports trace data from the specified window to an ASCII file.

Suffix:

<n> Window

Parameters:

<Trace> Number of the trace to be stored
(This parameter is ignored for `FORMat:DIMPort:TRACesALL`).

<FileName> String containing the path and name of the import file.

MMEMory:STORe<n>:TRACe <Trace>, <FileName>

This command exports trace data from the specified window to an ASCII file.

Secure User Mode

In secure user mode, settings that are stored on the instrument are stored to volatile memory, which is restricted to 256 MB. Thus, a "memory limit reached" error can occur although the hard disk indicates that storage space is still available.

To store data permanently, select an external storage location such as a USB memory device.

Suffix:
<n> Window

Parameters:
<Trace> Number of the trace to be stored

<FileName> String containing the path and name of the target file.

Example: `MMEM:STOR1:TRAC 1,'C:\TEST.ASC'`
Stores trace 1 from window 1 in the file `TEST.ASC`.

Manual operation: See "Export Trace to ASCII File" on page 234

MMEMory:STORe<n>:IQ:STATe <Number>, <FileName>

This command stores the currently captured I/Q data to a file.

In secure user mode, settings that are stored on the instrument are stored to volatile memory, which is restricted to 256 MB. Thus, a "memory limit reached" error can occur although the hard disk indicates that storage space is still available.

To store data permanently, select an external storage location such as a USB memory device.

Suffix:
<n> 1..n
irrelevant

Setting parameters:
<Number> Always '1'.

<FileName> String containing the path and file name.
The file type is .iq.tar.

Example:
```
MMEM:STOR:IQ:COMM 'A sensible comment'
MMEM:STOR:IQ:STAT 1,'C:\IQData\Amplfier.iq.tar'
```
Saves the I/Q data to the specified file and adds a sensible comment.

Usage: Setting only

12.7.3 Trace demodulation

[SENSe:]ADEMod<n>:AM[:ABSolute][:TDOMain][:TYPE] <TraceMode1>, <TraceMode2>, <TraceMode3>, <TraceMode4>, <TraceMode5>, <TraceMode6>
[SENSe:]ADEMod<n>:AM:RELative[:TDOMain][:TYPE] <TraceMode1>, <TraceMode2>, <TraceMode3>, <TraceMode4>, <TraceMode5>, <TraceMode6>
[SENSe:]ADEMod<n>:AM:RELative:AFSPectrum[:TYPE] <TraceMode1>, <TraceMode2>, <TraceMode3>, <TraceMode4>, <TraceMode5>, <TraceMode6>
[SENSe:]ADEMod<n>:FM[:TDOMain][:TYPE] <TraceMode1>, <TraceMode2>, <TraceMode3>, <TraceMode4>, <TraceMode5>, <TraceMode6>
[SENSe:]ADEMod<n>:FM:AFSPectrum[:TYPE] <TraceMode1>, <TraceMode2>, <TraceMode3>, <TraceMode4>, <TraceMode5>, <TraceMode6>
[SENSe:]ADEMod<n>:PM[:TDOMain][:TYPE] <TraceMode1>, <TraceMode2>, <TraceMode3>, <TraceMode4>, <TraceMode5>, <TraceMode6>
[SENSe:]ADEMod<n>:PM:AFSPectrum[:TYPE] <TraceMode1>, <TraceMode2>, <TraceMode3>, <TraceMode4>, <TraceMode5>, <TraceMode6>
[SENSe:]ADEMod<n>:SPECtrum[:TYPE] <TraceMode1>, <TraceMode2>, <TraceMode3>, <TraceMode4>, <TraceMode5>, <TraceMode6>

This command selects the trace modes of the evaluated signal to be measured simultaneously. For each of the six available traces a mode can be defined.

The trace modes are configured identically for all windows with a specific evaluation. The following table indicates which command syntax refers to which evaluation method.

Command syntax	Evaluation method
ACV[:TDOMain]	AC-Video time domain
ACV:AFSpectrum	AC-Video spectrum
AM[:ABSolute][:TDOMain]	RF time domain
AM:RELative[:TDOMain]	AM time domain
AM:RELative:AFSPectrum	AM spectrum (relative)
FM[:TDOMain]	FM time domain
FM:AFSPectrum	FM spectrum
PM[:TDOMain]	PM time domain
PM:AFSPectrum	PM spectrum
SPECtrum	RF spectrum

Suffix:

<n> irrelevant

Parameters:

<TraceMode>

WRITe
Overwrite mode: the trace is overwritten by each sweep. This is the default setting.

AVERage
The average is formed over several sweeps.

MAXHold
The maximum value is determined over several sweeps and displayed. The R&S FSMR3 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 FSMR3 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.

OFF
Hides the selected trace.

*RST: WRITe,OFF,OFF,OFF,OFF,OFF

Example:

`ADEM:AM AVER,MAXH,MINH,OFF,OFF,OFF`
Determines average, max hold and min hold values simultaneously for the traces 1-3 of the RF time domain evaluation.

`ADEM:AM WRIT,OFF,OFF,OFF,OFF,OFF`
Determines only the current measurement values for trace 1.

`ADEM:AM OFF,OFF,OFF,OFF,OFF,OFF`
Switches AM demodulation off.

[SENSe:]AVERage<n>:COUNt <AverageCount>

This command defines the number of measurements that the application uses to average traces.

In case of continuous sweep mode, the application calculates the moving average over the average count.

In case of single sweep mode, the application stops the measurement and calculates the average after the average count has been reached.

Suffix:

<n> irrelevant

[SENSe:]AVERage<n>[:STATe<t>] <State>

This command turns averaging for a particular trace in a particular window on and off.

Suffix:

<n> Window

<t> Trace

Parameters:

<State> ON | OFF | 1 | 0

[SENSe:]AVERage<n>:TYPE <Mode>

This command selects the trace averaging mode.

Suffix:

<n> 1..n
Window

Parameters:

<Mode>

LOGarithmic
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.

Example: `AVER:TYPE LIN`
Switches to linear average calculation.

Manual operation: See "Average Mode" on page 230

12.7.4 Working with markers

The result summary contains measurement values that are calculated from the trace data.

12.7.4.1 Setting up individual markers

The following commands define the position of markers in the diagram.

CALCulate<n>:DELTamarker<m>:AOFF

This command turns off *all* delta markers.

Suffix:

<n> Window

<m> irrelevant

Example: `CALC:DELT:AOFF`
Turns off all delta markers.

CALCulate<n>:DELTamarker<m>:LINK <State>

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.

Suffix:

<n> Window

<m> Marker

Parameters:

<State> ON | OFF | 0 | 1

OFF | 0
Switches the function off

ON | 1
Switches the function on

Example: `CALC:DELT2:LINK ON`

Manual operation: See "Linking to Another Marker" on page 213

CALCulate<n>:DELTamarker<ms>:LINK:TO:DELTa<md> <State>

This command links the delta source marker <ms> to any active destination delta marker <md>.

If you change the horizontal position of marker <md>, marker <ms> changes its horizontal position to the same value.

Suffix:

<n>	Window
<ms>	source marker, see Marker
<md>	destination marker, see Marker

Parameters:

<State> ON | OFF | 0 | 1

OFF | 0
Switches the function off

ON | 1
Switches the function on

Example:
`CALC:DELT2:LINK:TO:DELT3 ON`
Links D2 and D3.

CALCulate<n>:DELTamarker<ms>:LINK:TO:MARKer<md> <State>

This command links the delta source marker <ms> to any active destination marker <md> (normal or delta marker).

Suffix:

<n>	Window
<ms>	source marker, see Marker
<md>	destination marker, see Marker

Parameters:

<State> ON | OFF | 0 | 1

OFF | 0
Switches the function off

ON | 1
Switches the function on

Example:
`CALC:DELT4:LINK:TO:MARK2 ON`
Links the delta marker 4 to the marker 2.

Manual operation: See "Linking to Another Marker" on page 213

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. Note that this setting applies to *all* windows.

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 517)!

Suffix:

<n> irrelevant

<m> irrelevant

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>:MREFerence <Reference>

This command selects a reference marker for a delta marker other than marker 1.

Suffix:

<n> Window

<m> Marker

Parameters:

<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 213

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.

Suffix:

<n> Window

<m> Marker

Parameters:

<State> ON | OFF | 0 | 1

OFF | 0
Switches the function off

ON | 1
Switches the function on

Example: `CALC:DELT2 ON`
Turns on delta marker 2.

Manual operation: See "Marker State" on page 212
See "Marker Type" on page 213
See "Select Marker" on page 214

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.

Suffix:

<n> Window

<m> Marker

Parameters:

<Trace> Trace number the marker is assigned to.

Example: `CALC:DELT2:TRAC 2`
Positions delta marker 2 on trace 2.

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

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.

Suffix:

<n> Window

<m> Marker

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

Manual operation: See "Marker Position X-value" on page 212

CALCulate<n>:MARKer<m>:AOFF

This command turns off all markers.

Suffix:

<n> Window

<m> Marker

Example: `CALC:MARK:AOFF`
Switches off all markers.

Manual operation: See "All Markers Off" on page 214

CALCulate<n>:MARKer<ms>:LINK:TO:DELTa<md> <State>

This command links the normal source marker <ms> to any active delta destination marker <md>.

If you change the horizontal position of marker <md>, marker <ms> changes its horizontal position to the same value.

Suffix:

<n>	Window
<ms>	source marker, see Marker
<md>	destination marker, see Marker

Parameters:

<State> ON \| OFF \| 0 \| 1

OFF | 0
Switches the function off

ON | 1
Switches the function on

Example:
`CALC:MARK4:LINK:TO:DELT2 ON`
Links marker 4 to delta marker 2.

CALCulate<n>:MARKer<ms>:LINK:TO:MARKer<md> <State>

This command links the normal source marker <ms> to any active destination marker <md> (normal or delta marker).

If you change the horizontal position of marker <md>, marker <ms> changes its horizontal position to the same value.

Suffix:

<n>	Window
<ms>	source marker, see Marker
<md>	destination marker, see Marker

Parameters:

<State> ON \| OFF \| 0 \| 1

OFF | 0
Switches the function off

ON | 1
Switches the function on

Example:
`CALC:MARK4:LINK:TO:MARK2 ON`
Links marker 4 to marker 2.

Manual operation: See "Linking to Another Marker" on page 213

CALCulate<n>:MARKer<m>[:STATe] <State>

This command turns markers on and off. If the corresponding marker number is currently active as a delta marker, it is turned into a normal marker.

Suffix:

<n> Window

<m> Marker

Parameters:

<State> ON | OFF | 0 | 1

OFF | 0
Switches the function off

ON | 1
Switches the function on

Example: `CALC:MARK3 ON`
Switches on marker 3.

Manual operation: See "Marker State" on page 212
See "Marker Type" on page 213
See "Select Marker" on page 214

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.

Suffix:

<n> Window

<m> Marker

Parameters:

<Trace>

Example: //Assign marker to trace 1
`CALC:MARK3:TRAC 2`

Manual operation: See "Assigning the Marker to a Trace" on page 213

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

This command moves a marker to a specific coordinate on the x-axis.

If necessary, the command activates the marker.

If the marker has been used as a delta marker, the command turns it into a normal marker.

Suffix:

<n> Window

<m> Marker

Parameters:
<Position> Numeric value that defines the marker position on the x-axis. The unit depends on the result display.

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

Example:
`CALC:MARK2:X 1.7MHz`
Positions marker 2 to frequency 1.7 MHz.

Manual operation:
See "Marker Table" on page 110
See "Marker Peak List" on page 110
See "Marker Position X-value" on page 212

12.7.4.2 General marker settings

The following commands control general marker functionality.

Remote commands exclusive to general marker functionality

DISPlay[:WINDow<n>]:MTABle <DisplayMode>

This command turns the marker table on and off.

Suffix:
<n> irrelevant

Parameters:
<DisplayMode>

ON | 1
Turns on the marker table.

OFF | 0
Turns off the marker table.

*RST: AUTO

Example:
`DISP:MTAB ON`
Activates the marker table.

Manual operation:
See "Marker Table Display" on page 215

CALCulate<n>:MARKer<m>:X:SSIZe <StepSize>

This command selects the marker step size mode for *all* markers in *all* windows.

The step size defines the distance the marker moves when you move it with the rotary knob.

It therefore takes effect in manual operation only.

Suffix:
<n> irrelevant

<m> irrelevant

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 215

12.7.4.3 Configuring and performing a marker search

The following commands control the marker search.

CALCulate<n>:MARKer<m>:PEXCursion <Excursion>

This command defines the peak excursion (for *all* markers in *all* windows).

The peak excursion sets the requirements for a peak to be detected during a peak search.

The unit depends on the measurement.

Suffix:
<n> irrelevant

<m> irrelevant

Manual operation: See "Peak Excursion" on page 219

CALCulate<n>:MARKer<m>:X:SLIMits[:STATe] <State>

This command turns marker search limits on and off for *all* markers in *all* windows.

Suffix:
<n> irrelevant

<m> irrelevant

Parameters:
<State> ON | OFF | 0 | 1

OFF | 0
Switches the function off

ON | 1
Switches the function on

Example: `CALC:MARK:X:SLIM ON`
Switches on search limitation.

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.

Suffix:

<n> irrelevant

<m> irrelevant

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
Default unit: HZ

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.

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.

Suffix:

<n> irrelevant

<m> irrelevant

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.

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.

Suffix:
<n> irrelevant

<m> irrelevant

Parameters:
<State> ON | OFF | 0 | 1

OFF | 0
Switches the function off

ON | 1
Switches the function on

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.

CALCulate<n>:THReshold <Level>

This command defines a threshold level for the marker peak search (for *all* markers in *all* windows).

Note that you must enable the use of the threshold using `CALCulate<n>:THReshold:STATe` on page 523.

Suffix:
<n> irrelevant

Parameters:
<Level> Numeric value. The value range and unit are variable.

*RST: -120 dBm
Default unit: DBM

Example: `CALC:THR:STAT ON`

Example: `CALC:THR -82DBM`
Enables the search threshold and sets the threshold value to -82 dBm.

CALCulate<n>:THReshold:STATe <State>

This command turns a threshold for the marker peak search on and off (for *all* markers in *all* windows).

Suffix:
<n> irrelevant

Parameters:
<State> ON | OFF | 0 | 1

OFF | 0
Switches the function off

ON | 1
Switches the function on

Example: `CALC:THR:STAT ON`
Switches on the threshold line.

12.7.4.4 Positioning the marker

This chapter contains remote commands necessary to position the marker on a trace.

Positioning normal markers

The following commands position markers on the trace.

CALCulate<n>:MARKer<m>:MAXimum:LEFT

This command moves a marker to the next positive peak.

The search includes only measurement values to the left of the current marker position.

Suffix:

<n> Window

<m> Marker

CALCulate<n>:MARKer<m>:MAXimum:NEXT

This command moves a marker to the next positive peak.

Suffix:

<n> Window

<m> Marker

CALCulate<n>:MARKer<m>:MAXimum[:PEAK]

This command moves a marker to the highest level.

If the marker is not yet active, the command first activates the marker.

Suffix:

<n> Window

<m> Marker

CALCulate<n>:MARKer<m>:MAXimum:RIGHt

This command moves a marker to the next positive peak.

The search includes only measurement values to the right of the current marker position.

Suffix:

<n>	Window
<m>	Marker

CALCulate<n>:MARKer<m>:MINimum:LEFT

This command moves a marker to the next minimum peak value.

The search includes only measurement values to the right of the current marker position.

Suffix:

<n>	Window
<m>	Marker

CALCulate<n>:MARKer<m>:MINimum:NEXT

This command moves a marker to the next minimum peak value.

Suffix:

<n>	Window
<m>	Marker

CALCulate<n>:MARKer<m>:MINimum[:PEAK]

This command moves a marker to the minimum level.

If the marker is not yet active, the command first activates the marker.

Suffix:

<n>	Window
<m>	Marker

CALCulate<n>:MARKer<m>:MINimum:RIGHt

This command moves a marker to the next minimum peak value.

The search includes only measurement values to the right of the current marker position.

Suffix:

<n>	Window
<m>	Marker

Positioning delta markers

The following commands position delta markers on the trace.

CALCulate<n>:DELTamarker<m>:MAXimum:LEFT

This command moves a delta marker to the next positive peak value.

The search includes only measurement values to the left of the current marker position.

Suffix:

<n>	Window
<m>	Marker

CALCulate<n>:DELTamarker<m>:MAXimum:NEXT

This command moves a marker to the next positive peak value.

Suffix:

<n>	1..n Window
<m>	1..n Marker

CALCulate<n>:DELTamarker<m>:MAXimum[:PEAK]

This command moves a delta marker to the highest level.

If the marker is not yet active, the command first activates the marker.

Suffix:

<n>	Window
<m>	Marker

CALCulate<n>:DELTamarker<m>:MAXimum:RIGHt

This command moves a delta marker to the next positive peak value on the trace.

The search includes only measurement values to the right of the current marker position.

Suffix:

<n>	Window
<m>	Marker

CALCulate<n>:DELTamarker<m>:MINimum:LEFT

This command moves a delta marker to the next minimum peak value.

The search includes only measurement values to the right of the current marker position.

Suffix:

<n>	Window
<m>	Marker

CALCulate<n>:DELTamarker<m>:MINimum:NEXT

This command moves a marker to the next minimum peak value.

Suffix:

<n>	Window
<m>	Marker

CALCulate<n>:DELTamarker<m>:MINimum[:PEAK]

This command moves a delta marker to the minimum level.

If the marker is not yet active, the command first activates the marker.

Suffix:

<n>	Window
<m>	Marker

CALCulate<n>:DELTamarker<m>:MINimum:RIGHt

This command moves a delta marker to the next minimum peak value.

The search includes only measurement values to the right of the current marker position.

Suffix:

<n>	Window
<m>	Marker

12.7.4.5 Retrieving marker results

The following commands are used to retrieve the results of markers.

You can use the marker values to position the reference level directly using the following command:

- `CALCulate<n>:MARKer<m>:FUNCtion:REFerence` on page 440

Useful commands for retrieving results described elsewhere:

- `CALCulate<n>:DELTamarker<m>:X` on page 517
- `CALCulate<n>:MARKer<m>:X` on page 519
- `CALCulate<n>:MARKer<m>:FUNCtion:FPEaks:COUNt?` on page 536
- `CALCulate<n>:MARKer<m>:FUNCtion:FPEaks:X?` on page 538
- `CALCulate<n>:MARKer<m>:FUNCtion:FPEaks:Y?` on page 539

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.

Suffix:

<n>	Window
<m>	Marker

Return values:

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

Example: `CALC:DELT3:X:REL?`
Outputs the frequency of delta marker 3 relative to marker 1 or relative to the reference position.

Usage: Query only

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

Queries the result at the position of the specified delta marker.

Suffix:

<n>	1..n
<m>	1..n

Return values:

<Result> Result at the position of the delta marker.
The unit is variable and depends on the one you have currently set.
Default unit: DBM

Usage: Query only

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

Queries the result at the position of the specified marker.

Suffix:

<n> 1..n

<m> 1..n

Return values:

<Result> Default unit: DBM

Usage: Query only

CALCulate<n>:MARKer<m>:FUNCtion:VOLTage[:WRITe][:RESult]? <MeasType>

Queries the voltage results.

Suffix:

<m> 1..n
Marker

<n> 1..n
Window

Query parameters:

<MeasType> PPEak | RMS | THD | SINad | DIST

Return values:

<MeasTypeResult> <numeric value>

Example: `CALC:MARK:FUNC:VOLT? PPE`

Usage: Query only

CALCulate<n>:MARKer<m>:FUNCtion:MDEPth:RESult<t>?

This command queries the results of the AM modulation depth measurement..

To get a valid result, you have to perform a complete measurement with synchronization to the end of the measurement before reading out the result. This is only possible for single measurement mode.

See also `INITiate<n>:CONTinuous` on page 485.

Suffix:

<n> Window

<m> Marker

<t> Trace

Return values:

<ModulationDepth> Modulation depth in %.

Usage: Query only

CALCulate<n>:MARKer<m>:FUNCtion:MDEPth[:STATe] <State>

This command turns the AM Modulation Depth measurement on and off.

To work correctly, the measurement requires an AM modulated signal.

Suffix:

<n> Window

<m> Marker

Parameters:

<State> ON | OFF | 1 | 0

*RST: 0

CALCulate<n>:MARKer<m>:FUNCtion:ADEMod:ACV[:RESult<t>]? <MeasType>
CALCulate<n>:MARKer<m>:FUNCtion:ADEMod:ACV[:RESult<t>]:RELative? <MeasType>
CALCulate<n>:MARKer<m>:FUNCtion:ADEMod:AFRequency[:RESult]?
CALCulate<n>:MARKer<m>:FUNCtion:ADEMod:AM:AVERage[:RESult]? <MeasType>
CALCulate<n>:MARKer<m>:FUNCtion:ADEMod:AM:AVERage[:RESult]:RELative? <MeasType>
CALCulate<n>:MARKer<m>:FUNCtion:ADEMod:AM:PHOLd[:RESult]? <MeasType>
CALCulate<n>:MARKer<m>:FUNCtion:ADEMod:AM:PHOLd[:RESult]:RELative? <MeasType>
CALCulate<n>:MARKer<m>:FUNCtion:ADEMod:AM[:RESult<t>]? <MeasType>
CALCulate<n>:MARKer<m>:FUNCtion:ADEMod:AM[:RESult<t>]:RELative? <MeasType>
CALCulate<n>:MARKer<m>:FUNCtion:ADEMod:AM[:WRITe][:RESult]? <MeasType>
CALCulate<n>:MARKer<m>:FUNCtion:ADEMod:AM[:WRITe][:RESult]:RELative? <MeasType>
CALCulate<n>:MARKer<m>:FUNCtion:ADEMod:CARRier:SUNCertainty?
CALCulate<n>:MARKer<m>:FUNCtion:ADEMod:CARRier[:RESult]?
CALCulate<n>:MARKer<m>:FUNCtion:ADEMod:CARRier[:RESult]:RELative?
CALCulate<n>:MARKer<m>:FUNCtion:ADEMod:DISTortion:AVERage:RESult<t>?
CALCulate<n>:MARKer<m>:FUNCtion:ADEMod:DISTortion:AVERage:RESult<t>:RELative?
CALCulate<n>:MARKer<m>:FUNCtion:ADEMod:DISTortion:PHOLd:RESult<t>?
CALCulate<n>:MARKer<m>:FUNCtion:ADEMod:DISTortion:PHOLd:RESult<t>:RELative?

CALCulate<n>:MARKer<m>:FUNCtion:ADEMod:DISTortion[:WRITe]:RESult<t>?
CALCulate<n>:MARKer<m>:FUNCtion:ADEMod:DISTortion[:WRITe]:RESult<t>:RELative?
CALCulate<n>:MARKer<m>:FUNCtion:ADEMod:FERRor[:RESult]?
CALCulate<n>:MARKer<m>:FUNCtion:ADEMod:FM:AVERage[:RESult]? <MeasType>
CALCulate<n>:MARKer<m>:FUNCtion:ADEMod:FM:AVERage[:RESult]:RELative? <MeasType>
CALCulate<n>:MARKer<m>:FUNCtion:ADEMod:FM:PHOLd[:RESult]? <MeasType>
CALCulate<n>:MARKer<m>:FUNCtion:ADEMod:FM:PHOLd[:RESult]:RELative? <MeasType>
CALCulate<n>:MARKer<m>:FUNCtion:ADEMod:FM[:RESult<t>]? <MeasType>
CALCulate<n>:MARKer<m>:FUNCtion:ADEMod:FM[:RESult<t>]:RELative? <MeasType>
CALCulate<n>:MARKer<m>:FUNCtion:ADEMod:FM[:WRITe][:RESult]? <MeasType>
CALCulate<n>:MARKer<m>:FUNCtion:ADEMod:FM[:WRITe][:RESult]:RELative? <MeasType>
CALCulate<n>:MARKer<m>:FUNCtion:ADEMod:PM:AVERage[:RESult]? <MeasType>
CALCulate<n>:MARKer<m>:FUNCtion:ADEMod:PM:AVERage[:RESult]:RELative? <MeasType>
CALCulate<n>:MARKer<m>:FUNCtion:ADEMod:PM:PHOLd[:RESult]? <MeasType>
CALCulate<n>:MARKer<m>:FUNCtion:ADEMod:PM:PHOLd[:RESult]:RELative? <MeasType>
CALCulate<n>:MARKer<m>:FUNCtion:ADEMod:PM[:RESult<t>]? <MeasType>
CALCulate<n>:MARKer<m>:FUNCtion:ADEMod:PM[:RESult<t>]:RELative? <MeasType>
CALCulate<n>:MARKer<m>:FUNCtion:ADEMod:PM[:WRITe][:RESult]? <MeasType>
CALCulate<n>:MARKer<m>:FUNCtion:ADEMod:PM[:WRITe][:RESult]:RELative? <MeasType>
CALCulate<n>:MARKer<m>:FUNCtion:ADEMod:SINad:AVERage:RESult?
CALCulate<n>:MARKer<m>:FUNCtion:ADEMod:SINad:AVERage:RESult:RELative?
CALCulate<n>:MARKer<m>:FUNCtion:ADEMod:SINad:PHOLd:RESult?
CALCulate<n>:MARKer<m>:FUNCtion:ADEMod:SINad:PHOLd:RESult:RELative?
CALCulate<n>:MARKer<m>:FUNCtion:ADEMod:SINad:RESult<t>?
CALCulate<n>:MARKer<m>:FUNCtion:ADEMod:SINad[:WRITe]:RESult?
CALCulate<n>:MARKer<m>:FUNCtion:ADEMod:SINad[:WRITe]:RESult:RELative?
CALCulate<n>:MARKer<m>:FUNCtion:ADEMod:THD:AVERage:RESult?
CALCulate<n>:MARKer<m>:FUNCtion:ADEMod:THD:AVERage:RESult:RELative?
CALCulate<n>:MARKer<m>:FUNCtion:ADEMod:THD:PHOLd:RESult?
CALCulate<n>:MARKer<m>:FUNCtion:ADEMod:THD:PHOLd:RESult:RELative?
CALCulate<n>:MARKer<m>:FUNCtion:ADEMod:THD:RESult<t>?
CALCulate<n>:MARKer<m>:FUNCtion:ADEMod:THD[:WRITe]:RESult?

CALCulate<n>:MARKer<m>:FUNCtion:ADEMod:THD[:WRITe]:RESult:RELative?
CALCulate<n>:MARKer<m>:FUNCtion:ADEMod:RFFRequency[:RESult<t>]?

Queries the result of the RF frequency counter measurement.

Suffix:

<n>	Window
<m>	Marker
<t>	Trace

Return values:

<Value>	<numeric value>
Example:	`CALC:MARK:FUNC:ADEM:RFFR?`
Usage:	Query only

[SENSe:]DEMod:SQUelch:LEVel <Threshold>

This command defines the threshold for selective demodulation.

All signals below the threshold are not demodulated.

Parameters:

<Threshold> Percentage of the display height.

Range: 0 to 100
*RST: 50

Example: `DEM:SQU:LEV 80`
Sets the squelch level to 80% of the displayed signal.

[SENSe:]DEMod:SQUelch[:STATe] <State>

This command turns selective demodulation at the marker position on and off.

For selective demodulation, the R&S FSMR3 turns on a video trigger whose level correponds to the squelch level. Therefore it turns other triggers or gates off.

Parameters:

<State> ON | OFF | 0 | 1

OFF | 0
Switches the function off

ON | 1
Switches the function on

Example: `DEM:SQU ON`
Signals below the level threshold are not sent to the audio output.

12.7.4.6 Fixed reference marker settings

The following commands configure a fixed reference marker.

CALCulate<n>:DELTamarker<m>:FUNCtion:FIXed:RPOint:MAXimum[:PEAK]

This command moves the fixed reference marker to the peak power.

Suffix:

<n> Window

<m> Marker

Example: `CALC:DELT:FUNC:FIX:RPO:MAX`
Sets the reference point level for delta markers to the peak of the selected trace.

CALCulate<n>:DELTamarker<m>:FUNCtion:FIXed:RPOint:X <RefPoint>

This command defines the horizontal position of the fixed delta marker reference point. The coordinates of the reference may be anywhere in the diagram.

Suffix:

<n> Window

<m> Marker

Parameters:

<RefPoint> Numeric value that defines the horizontal position of the reference.
For frequency domain measurements, it is a frequency in Hz.
For time domain measurements, it is a point in time in s.
*RST: Fixed Reference: OFF
Default unit: HZ

Example: `CALC:DELT:FUNC:FIX:RPO:X 128 MHz`
Sets the frequency reference to 128 MHz.

CALCulate<n>:DELTamarker<m>:FUNCtion:FIXed:RPOint:Y <RefPointLevel>

This command defines the vertical position of the fixed delta marker reference point. The coordinates of the reference may be anywhere in the diagram.

Suffix:

<n> Window

<m> Marker

Parameters:

<RefPoint> Numeric value that defines the vertical position of the reference. The unit and value range is variable.

*RST: Fixed Reference: OFF
Default unit: DBM

Example:
`CALC:DELT:FUNC:FIX:RPO:Y -10dBm`
Sets the reference point level for delta markers to -10 dBm.

CALCulate<n>:DELTamarker<m>:FUNCtion:FIXed:RPOint:Y:OFFSet <Offset>

This command defines a level offset for the fixed delta marker reference point.

Suffix:

<n> Window

<m> Marker

Parameters:

<Offset> Numeric value

*RST: 0
Default unit: dB

CALCulate<n>:DELTamarker<m>:FUNCtion:FIXed[:STATe] <State>

This command activates or deactivates a marker that defines a fixed reference point for relative marker analysis.

If necessary, the command activates a marker and positions it on the peak power.

Subsequently, you can change the coordinates of the fixed reference independent of the marker. The fixed reference is independent of the trace and is applied to all active delta markers.

Suffix:

<n> Window

<m> Marker

Parameters:

<State> ON | OFF | 0 | 1

OFF | 0
Switches the function off

ON | 1
Switches the function on

Example:
`CALC:DELT:FUNC:FIX ON`
Switches on the measurement with fixed reference value for all delta markers.
`CALC:DELT:FUNC:FIX:RPO:X 128 MHZ`
Sets the frequency reference to 128 MHz.
`CALC:DELT:FUNC:FIX:RPO:Y 30 DBM`
Sets the reference level to +30 dBm.

12.7.4.7 Marker peak lists

Useful commands for peak lists described elsewhere

- `CALCulate<n>:MARKer<m>:PEXCursion` on page 521
- `MMEMory:STORe<n>:PEAK` on page 583

Remote commands exclusive to peak lists

CALCulate<n>:MARKer<m>:FUNCtion:FPEaks:ANNotation:LABel[:STATe] <State>

This command turns labels for peaks found during a peak search on and off.

The labels correspond to the marker number in the marker peak list.

Suffix:

<n> Window

<m> Marker

Parameters:

<State> ON | OFF | 0 | 1

*RST: 1

Example: `CALC:MARK:FUNC:FPE:ANN:LAB:STAT OFF`
Removes the peak labels from the diagram

Manual operation: See "Display Marker Numbers" on page 219

CALCulate<n>:MARKer<m>:FUNCtion:FPEaks:COUNt?

This command queries the number of peaks that have been found during a peak search.

The actual number of peaks that have been found may differ from the number of peaks you have set to be found because of the peak excursion.

Suffix:

<n> irrelevant

<m> irrelevant

Return values:

<NumberOfPeaks>

Example: `CALC:MARK:FUNC:FPE:COUN?`
Queries the number of peaks.

Usage: Query only

CALCulate<n>:MARKer<m>:FUNCtion:FPEaks[:IMMediate] <Peaks>

This command initiates a peak search.

Suffix:
<n> Window

<m> Marker

Parameters:
<Peaks> This parameter defines the number of peaks to find during the search.
Note that the actual number of peaks found during the search also depends on the peak excursion you have set with `CALCulate<n>:MARKer<m>:PEXCursion`.

Range: 1 to 200

Example: `CALC:MARK:PEXC 5`
Defines a peak excursion of 5 dB, i.e. peaks must be at least 5 dB apart to be detected as a peak.
`CALC:MARK:FUNC:FPE 10`
Initiates a search for 10 peaks on the current trace.

CALCulate<n>:MARKer<m>:FUNCtion:FPEaks:LIST:SIZE <MaxNoPeaks>

This command defines the maximum number of peaks that the R&S FSMR3 looks for during a peak search.

Suffix:
<n> Window

<m> Marker

Parameters:
<MaxNoPeaks> Maximum number of peaks to be determined.

Range: 1 to 500
*RST: 50

Example: `CALC:MARK:FUNC:FPE:LIST:SIZE 10`
The marker peak list will contain a maximum of 10 peaks.

Manual operation: See "Maximum Number of Peaks" on page 219

CALCulate<n>:MARKer<m>:FUNCtion:FPEaks:SORT <SortMode>

This command selects the order in which the results of a peak search are returned.

Suffix:

<n> Window

<m> Marker

Parameters:

<SortMode>

X
Sorts the peaks according to increasing position on the x-axis.

Y
Sorts the peaks according to decreasing position on the y-axis.

*RST: X

Example: `CALC:MARK:FUNC:FPE:SORT Y`
Sets the sort mode to decreasing y values

Manual operation: See "Sort Mode" on page 219

CALCulate<n>:MARKer<m>:FUNCtion:FPEaks:STATe <State>

This command turns a peak search on and off.

Suffix:

<n> Window

<m> Marker

Parameters:

<State> ON | OFF | 0 | 1

OFF | 0
Switches the function off

ON | 1
Switches the function on

Example: `CALC:MARK:FUNC:FPE:STAT ON`
Activates marker peak search

Manual operation: See "Peak List State" on page 218

CALCulate<n>:MARKer<m>:FUNCtion:FPEaks:X?

This command queries the position of the peaks on the x-axis.

The order depends on the sort order that has been set with `CALCulate<n>:MARKer<m>:FUNCtion:FPEaks:SORT`.

Suffix:

<n> irrelevant

<m> irrelevant

Return values:

<PeakPosition> Position of the peaks on the x-axis. The unit depends on the measurement.

Usage: Query only

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

This command queries the position of the peaks on the y-axis.

The order depends on the sort order that has been set with `CALCulate<n>:MARKer<m>:FUNCtion:FPEaks:SORT`.

Suffix:

<n> irrelevant

<m> irrelevant

Return values:

<PeakPosition> Position of the peaks on the y-axis. The unit depends on the measurement.

Usage: Query only

12.7.5 Configuring display lines

The commands required to configure display lines in a remote environment are described here.

CALCulate<n>:DLINe<dl> <Position>

This command defines the (horizontal) position of a display line.

Suffix:

<n> Window

<dl> 1 | 2

Parameters:

<Position> The value range is variable.
You can use any unit you want, the R&S FSMR3 then converts the unit to the currently selected unit. If you omit a unit, the R&S FSMR3 uses the currently selected unit.

*RST: (state is OFF)
Default unit: DBM

Example: `CALC:DLIN2 -20dBm`
Positions the second display line at -20 dBm.

Manual operation: See "Horizontal Line 1/ Horizontal Line 2" on page 188

CALCulate<n>:DLINe<dl>:STATe <State>

This command turns a display line on and off

Suffix:

<n> Window

<dl> 1 | 2

Parameters:

<State> ON | OFF | 0 | 1

OFF | 0
Switches the function off

ON | 1
Switches the function on

Example:

```
CALC:DLIN2:STAT ON
```

Turns on display line 2.

CALCulate<n>:FLINe<dl> <Frequency>

This command defines the position of a frequency line.

Suffix:

<n> Window

<dl> 1 to 4
frequency line

Parameters:

<Frequency> Note that you can not set a frequency line to a position that is outside the current span.

Range: 0 Hz to Fmax
*RST: (STATe to OFF)
Default unit: HZ

Example:

```
CALC:FLIN2 120MHz
```

Sets frequency line 2 to a frequency of 120 MHz.

Manual operation: See "Vertical Line <x>" on page 188

CALCulate<n>:FLINe<dl>:STATe <State>

This command turns a frequency line on and off

Suffix:

<n> Window

<dl> 1 to 4
frequency line

Parameters:

<State> ON | OFF | 0 | 1

OFF | 0
Switches the function off

ON | 1
Switches the function on

Example: `CALC:FLIN2:STAT ON`
Turns frequency line 2 on.

CALCulate<n>:TLINe<dl> <Time>

This command defines the position of a time line.

Suffix:

<n> Window

<dl> 1 to 4
time line

Parameters:

<Time> Note that you can not set a time line to a position that is higher than the current sweep time.

Range: 0 s to 1600 s
*RST: (STATe to OFF)
Default unit: S

Example: `CALC:TLIN 10ms`
Sets the first time line to 10 ms.

Manual operation: See "Vertical Line <x>" on page 188

CALCulate<n>:TLINe<dl>:STATe <State>

This command turns a time line on and off

Suffix:

<n> Window

<dl> 1 to 4
time line

Parameters:

<State> ON | OFF | 0 | 1

OFF | 0
Switches the function off

ON | 1
Switches the function on

Example: `CALC:TLIN:STAT ON`
Turns the first time line on.

12.7.6 Defining limit checks

Note that in remote control, upper and lower limit lines are configured using separate commands. Thus, you must decide in advance which you want to configure. The x-values for both upper and lower limit lines are defined as a common control line. This control line is the reference for the y-values for both upper and lower limit lines.

12.7.6.1 Configuring limit lines

CALCulate<n>:LIMit<li>:COMMent <Comment>

This command defines a comment for a limit line.

Suffix:

<n>	irrelevant
	Limit line

Parameters:

<Comment>	String containing the description of the limit line.

Manual operation: See "Comment" on page 195

CALCulate<n>:LIMit<li>:CONTrol[:DATA] <LimitLinePoints>

This command defines the horizontal definition points of a limit line.

Suffix:

<n> irrelevant

 Limit line

Parameters:

<LimitLinePoints> Variable number of x-axis values.
Note that the number of horizontal values has to be the same as the number of vertical values set with `CALCulate<n>:LIMit<li>:LOWer[:DATA]` or `CALCulate<n>:LIMit<li>:UPPer[:DATA]`. If not, the R&S FSMR3 either adds missing values or ignores surplus values.

*RST: -
Default unit: HZ

Manual operation: See "Data Points" on page 195

CALCulate<n>:LIMit<li>:CONTrol:DOMain <SpanSetting>

This command selects the domain of the limit line.

Suffix:

<n> irrelevant

 Limit line

Parameters:

<SpanSetting> FREQuency | TIME

FREQuency
For limit lines that apply to a range of frequencies.

TIME
For limit lines that apply to a period of time.

*RST: FREQuency

Example: `CALC:LIM:CONT:DOM FREQ`
Select a limit line in the frequency domain.

CALCulate<n>:LIMit<li>:CONTrol:MODE <Mode>

This command selects the horizontal limit line scaling.

Suffix:

<n> irrelevant

 Limit line

Parameters:

<Mode>

ABSolute
Limit line is defined by absolute physical values (Hz or s).

RELative
Limit line is defined by relative values related to the center frequency (frequency domain) or the left diagram border (time domain).

*RST: ABSolute

CALCulate<n>:LIMit<li>:CONTrol:OFFSet <Offset>

This command defines an offset for a complete limit line.

Compared to shifting the limit line, an offset does not actually change the limit line definition points.

Suffix:

<n> irrelevant

 Limit line

Parameters:

<Offset> Numeric value.
The unit depends on the scale of the x-axis.
*RST: 0
Default unit: HZ

Manual operation: See "X-Offset" on page 194

CALCulate<n>:LIMit<li>:CONTrol:SHIFt <Distance>

This command moves a complete limit line horizontally.

Compared to defining an offset, this command actually changes the limit line definition points by the value you define.

Suffix:

<n> irrelevant

 Limit line

Parameters:

<Distance> Numeric value.
The unit depends on the scale of the x-axis.
Default unit: HZ

Manual operation: See "Shift x" on page 196

CALCulate<n>:LIMit<li>:CONTrol:SPACing <InterpolMode>

This command selects linear or logarithmic interpolation for the calculation of limit lines from one horizontal point to the next.

Suffix:

<n> Window

 Limit line

Parameters:

<InterpolMode> LINear | LOGarithmic

*RST: LIN

Example: `CALC:LIM:CONT:SPAC LIN`

CALCulate<n>:LIMit<li>:LOWer[:DATA] <LimitLinePoints>

This command defines the vertical definition points of a lower limit line.

Suffix:

<n> irrelevant

 Limit line

Parameters:

<LimitLinePoints> Variable number of level values.
Note that the number of vertical values has to be the same as the number of horizontal values set with `CALCulate<n>:LIMit<li>:CONTrol[:DATA]`. If not, the R&S FSMR3 either adds missing values or ignores surplus values.

*RST: Limit line state is OFF
Default unit: DBM

Manual operation: See "Data Points" on page 195

CALCulate<n>:LIMit<li>:LOWer:MARGin <Margin>

This command defines an area around a lower limit line where limit check violations are still tolerated.

Suffix:

<n> irrelevant

 Limit line

Parameters:

<Margin> **numeric value**

*RST: 0
Default unit: dB

CALCulate<n>:LIMit<li>:LOWer:MODE <Mode>

This command selects the vertical limit line scaling.

Suffix:

<n> Window

 Limit line

Parameters:

<Mode>

ABSolute
Limit line is defined by absolute physical values.
The unit is variable.

RELative
Limit line is defined by relative values related to the reference level (dB).

*RST: ABSolute

CALCulate<n>:LIMit<li>:LOWer:OFFSet <Offset>

This command defines an offset for a complete lower limit line.

Compared to shifting the limit line, an offset does not actually change the limit line definition points.

Suffix:

<n> Window

 Limit line

Parameters:

<Offset> Numeric value.

*RST: 0
Default unit: dB

Manual operation: See "Y-Offset" on page 194

CALCulate<n>:LIMit<li>:LOWer:SHIFt <Distance>

This command moves a complete lower limit line vertically.

Compared to defining an offset, this command actually changes the limit line definition points by the value you define.

Suffix:

<n> Window

 Limit line

Parameters:

<Distance> Defines the distance that the limit line moves.

Default unit: DB

Manual operation: See "Shift y" on page 196

CALCulate<n>:LIMit<li>:LOWer:SPACing <InterpolType>

This command selects linear or logarithmic interpolation for the calculation of a lower limit line from one horizontal point to the next.

Suffix:

<n>	Window
	Limit line

Parameters:

<InterpolType>	LINear | LOGarithmic *RST: LIN

CALCulate<n>:LIMit<li>:LOWer:STATe <State>

This command turns a lower limit line on and off.

Before you can use the command, you have to select a limit line with `CALCulate<n>:LIMit<li>:NAME` on page 548.

Suffix:

<n>	irrelevant
	Limit line

Parameters:

<State>	ON | OFF | 0 | 1 **OFF | 0** Switches the function off **ON | 1** Switches the function on
Manual operation:	See "Visibility" on page 194

CALCulate<n>:LIMit<li>:LOWer:THReshold <Threshold>

This command defines a threshold for relative limit lines.

The R&S FSMR3 uses the threshold for the limit check, if the limit line violates the threshold.

Suffix:

<n>	irrelevant
	Limit line

Parameters:

<Threshold>	Numeric value. The unit depends on `CALCulate<n>:LIMit<li>:UNIT` on page 548. *RST: -200 dBm Default unit: DBM

CALCulate<n>:LIMit<li>:NAME <Name>

This command selects a limit line that already exists or defines a name for a new limit line.

Suffix:

<n> Window

 Limit line

Parameters:

<Name> String containing the limit line name.

*RST: REM1 to REM8 for lines 1 to 8

Manual operation: See "Name" on page 195

CALCulate<n>:LIMit<li>:UNIT <Unit>

This command defines the unit of a limit line.

Suffix:

<n> irrelevant

 Limit line

Parameters:

<Unit> If you select a dB-based unit for the limit line, the command automatically turns the limit line into a relative limit line.

*RST: DBM

CALCulate<n>:LIMit<li>:UPPer[:DATA] <LimitLinePoints>

This command defines the vertical definition points of an upper limit line.

Suffix:

<n> irrelevant

 Limit line

Parameters:

<LimitLinePoints> Variable number of level values.
Note that the number of vertical values has to be the same as the number of horizontal values set with `CALCulate<n>:LIMit<li>:CONTrol[:DATA]`. If not, the R&S FSMR3 either adds missing values or ignores surplus values.

*RST: Limit line state is OFF
Default unit: DBM

Manual operation: See "Data Points" on page 195

CALCulate<n>:LIMit<li>:UPPer:MARGin <Margin>

This command defines an area around an upper limit line where limit check violations are still tolerated.

Suffix:

<n>	irrelevant
	Limit line

Parameters:

<Margin> **numeric value**

*RST: 0
Default unit: dB

CALCulate<n>:LIMit<li>:UPPer:MODE <Mode>

This command selects the vertical limit line scaling.

Suffix:

<n>	Window
	Limit line

Parameters:

<Mode>

ABSolute
Limit line is defined by absolute physical values.
The unit is variable.

RELative
Limit line is defined by relative values related to the reference level (dB).

*RST: ABSolute

CALCulate<n>:LIMit<li>:UPPer:OFFSet <Offset>

This command defines an offset for a complete upper limit line.

Compared to shifting the limit line, an offset does not actually change the limit line definition points.

Suffix:

<n>	irrelevant
	Limit line

Parameters:

<Offset> Numeric value.

*RST: 0
Default unit: dB

Manual operation: See "Y-Offset" on page 194

CALCulate<n>:LIMit<li>:UPPer:SHIFt <Distance>

This command moves a complete upper limit line vertically.

Compared to defining an offset, this command actually changes the limit line definition points by the value you define.

Suffix:

<n>	irrelevant
	Limit line

Parameters:

<Distance>	Defines the distance that the limit line moves.
Manual operation:	See "Shift y" on page 196

CALCulate<n>:LIMit<li>:UPPer:SPACing <InterpolType>

This command selects linear or logarithmic interpolation for the calculation of an upper limit line from one horizontal point to the next.

Suffix:

<n>	Window
	Limit line

Parameters:

<InterpolType>	LINear | LOGarithmic *RST: LIN

CALCulate<n>:LIMit<li>:UPPer:STATe <State>

This command turns an upper limit line on and off.

Before you can use the command, you have to select a limit line with `CALCulate<n>:LIMit<li>:NAME` on page 548.

Suffix:

<n>	irrelevant
	Limit line

Parameters:

<State>	ON | OFF | 0 | 1 **OFF | 0** Switches the function off **ON | 1** Switches the function on
Manual operation:	See "Visibility" on page 194

CALCulate<n>:LIMit<li>:UPPer:THReshold <Limit>

This command defines an absolute limit for limit lines with a relative scale.

The R&S FSMR3 uses the threshold for the limit check, if the limit line violates the threshold.

Suffix:

<n>	irrelevant
	Limit line

Parameters:

<Limit>	Numeric value. The unit depends on `CALCulate<n>:LIMit<li>:UNIT` on page 548. *RST: -200 Default unit: dBm

12.7.6.2 Managing limit lines

Useful commands for managing limit lines described in the R&S FSMR3 User Manual:

- `MMEM:SEL[:ITEM]:LIN:ALL`
- `MMEM:STOR:TYPE`
- `MMEM:LOAD:TYPE`

Remote commands exclusive to managing limit lines:

CALCulate<n>:LIMit<li>:ACTive?

This command queries the names of *all* active limit lines.

Suffix:

<n>	irrelevant
	irrelevant

Return values:

<LimitLines>	String containing the names of all active limit lines in alphabetical order.

Example: `CALC:LIM:ACT?`
Queries the names of all active limit lines.

Usage: Query only

Manual operation: See "Visibility" on page 194

CALCulate<n>:LIMit<li>:COPY <Line>

This command copies a limit line.

Suffix:

<n> Window

 Limit line

Parameters:

<Line> **1 to 8**
number of the new limit line

<name>
String containing the name of the limit line.

Example:
`CALC:LIM1:COPY 2`
Copies limit line 1 to line 2.
`CALC:LIM1:COPY 'FM2'`
Copies limit line 1 to a new line named FM2.

Manual operation: See "Copy Line" on page 195

CALCulate<n>:LIMit<li>:DELete

This command deletes a limit line.

Suffix:

<n> Window

 Limit line

Manual operation: See "Delete Line" on page 195

CALCulate<n>:LIMit<li>:STATe <State>

This command turns the limit check for a specific limit line on and off.

To query the limit check result, use `CALCulate<n>:LIMit<li>:FAIL?`.

Note that a new command exists to activate the limit check and define the trace to be checked in one step (see `CALCulate<n>:LIMit<li>:TRACe<t>:CHECk` on page 553).

Suffix:

<n> irrelevant

 Limit line

Parameters:

<State> ON | OFF | 0 | 1

OFF | 0
Switches the function off

ON | 1
Switches the function on

Example: `CALC:LIM:STAT ON`
Switches on the limit check for limit line 1.

Manual operation: See "Disable All Lines" on page 195

CALCulate<n>:LIMit<li>:TRACe<t>:CHECk <State>

This command turns the limit check for a specific trace on and off.

To query the limit check result, use `CALCulate<n>:LIMit<li>:FAIL?`.

Suffix:

<n> Window

 Limit line

<t> Trace

Parameters:

<State> ON | OFF | 0 | 1

OFF | 0
Switches the function off

ON | 1
Switches the function on

Example: `CALC:LIM3:TRAC2:CHEC ON`
Switches on the limit check for limit line 3 on trace 2.

Manual operation: See "Traces to be Checked" on page 194

MMEMory:LOAD<n>:LIMit <FileName>

Loads the limit line from the selected file in `.CSV` format.

Suffix:

<n> irrelevant

Parameters:

<FileName> String containing the path and name of the `CSV` import file.

Example: `MMEM:LOAD:LIM 'C:\TEST.CSV'`

Manual operation: See "Import" on page 196

MMEMory:STORe<n>:LIMit <FileName>, <LimitLineName>

This command exports limit line data to an ASCII (CSV) file.

Suffix:

<n> irrelevant

Parameters:

<FileName> String containing the path and name of the target file.

<LimitLineName> Name of the limit line to be exported.

Example: `MMEM:STOR:LIM 'C:\TEST', 'UpperLimitLine'`
Stores the limit line named "UpperLimitLine" in the file `TEST.CSV`.

Manual operation: See "Export" on page 196

12.7.6.3 Checking the results of a limit check

CALCulate<n>:LIMit<li>:CLEar[:IMMediate]

This command deletes the result of the current limit check.

The command works on *all* limit lines in *all* measurement windows at the same time.

Suffix:

<n> Window

 irrelevant

Example: `CALC:LIM:CLE`
Deletes the result of the limit check.

CALCulate<n>:LIMit<li>:FAIL?

This command queries the result of a limit check in the specified window.

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 485.

Suffix:

<n> Window

 Limit line

Return values:

<Result> **0**
PASS
1
FAIL

Example: `INIT;*WAI`
Starts a new sweep and waits for its end.
`CALC2:LIM3:FAIL?`
Queries the result of the check for limit line 3 in window 2.

Usage: Query only

12.7.6.4 Programming example: using limit lines

The following examples demonstrate how to work with limit lines in a remote environment.

Example: configuring limit lines

This example demonstrates how to configure 2 limit lines - an upper and a lower limit - for a measurement in a remote environment.

```
//------------- Configuing the limit lines ---------------------
CALC:LIM1:NAME 'FM1'
//Names limit line 1 'FM1'.

CALC:LIM1:CONT:MODE ABS
//Selects absolute scaling for the horizontal axis.
CALC:LIM1:CONT 1 MHz,50MHz,100 MHz,150MHz,200MHz
//Defines 5 horizontal definition points for limit line 1.
CALC:LIM1:UPP:MODE ABS
//Selects an absolute vertical scale for limit line 1.
CALC:LIM1:UNIT DBM
//Selects the unit dBm for limit line 1.
CALC:LIM1:UPP -10,-5,0,-5,-10
//Defines 5 definition points for limit line 1.

CALC:LIM1:UPP:MARG 5dB
//Defines an area of 5 dB around limit line 1 where limit check violations
//are still tolerated.

CALC:LIM1:UPP:SHIF -10DB
//Shifts the limit line 1 by -10 dB.
CALC:LIM1:UPP:OFFS -3dB
//Defines an additional -3 dB offset for limit line 1.

CALC:LIM3:NAME 'FM3'
//Names limit line 3 'FM3'.

CALC:LIM3:LOW:MODE REL
//Selects a relative vertical scale for limit line 3.
CALC:LIM3:UNIT DB

CALC:LIM3:CONT 1 MHz,50MHz,100 MHz,150MHz,200MHz
//Defines 5 horizontal definition points for limit line 3.
CALC:LIM3:LOW -90,-60,-40,-60,-90
//Defines 5 definition points relative to the reference level for limit line 3.
```

```
CALC:LIM3:LOW:SHIF 2
//Shifts the limit line 3 by 2dB.
CALC:LIM3:LOW:OFFS 3
//Defines an additional 3 dB offset for limit line 3.

CALC:LIM3:LOW:THR -200DBM
//Defines a power threshold of -200dBm that must be exceeded for limit to be checked

CALC:LIM3:LOW:MARG 5dB
//Defines an area of 5dB around limit line 3 where limit check violations
//are still tolerated.

//-------------- Storing the limit lines -----------------------
MMEM:SEL:CHAN:LIN:ALL ON
MMEM:STOR:TYPE CHAN
MMEM:STOR:STAT 1,'LimitLines_FM1_FM3'
```

Example: performing a limit check

This example demonstrates how to perform a limit check during a basic frequency sweep measurement in a remote environment. The limit lines configured in "Example: configuring limit lines" on page 555 are assumed to exist and be active.

```
//--------------Preparing the instrument ---------------------
*RST
//Resets the instrument
INIT:CONT OFF
//Selects single sweep mode.

//--------------Configuring the measurement -------------
FREQ:CENT 100MHz
//Defines the center frequency
FREQ:SPAN 200MHz
//Sets the span to 100 MHz on either side of the center frequency.
SENS:SWE:COUN 10
//Defines 10 sweeps to be performed in each measurement.
DISP:TRAC1:Y:RLEV 0dBm
//Sets the reference level to 0 dBm.
TRIG:SOUR IFP
TRIG:LEV:IFP -10dBm
//Defines triggering when the second intermediate frequency rises to a level
//of -10 dBm.

//--------------Configuring the Trace--------------------------
DISP:TRAC2 ON
DISP:TRAC2:MODE AVER
DISP:TRAC3 ON
DISP:TRAC3:MODE MAXH
//Configures 3 traces: 1 (default): clear/write; 2: average; 3: max hold

//------------- Configuring the limit check -------------------
```

```
MMEM:LOAD:TYPE REPL
MMEM:LOAD:STAT 1,'LimitLines_FM1_FM3'
//Loads the limit lines stored in 'LimitLines_FM1_FM3'
CALC:LIM1:NAME 'FM1'
CALC:LIM1:UPP:STAT ON
//Activates upper limit FM1 as line 1.
CALC:LIM3:NAME 'FM3'
CALC:LIM3:LOW:STAT ON
//Activates lower limit line FM3 as line 3.
CALC:LIM:ACT?
//Queries the names of all active limit lines
//Result: 'FM1,FM3'
CALC:LIM1:TRAC3:CHEC ON
//Activates the upper limit to be checked against trace3 (maxhold trace)
CALC:LIM3:TRAC2:CHEC ON
//Activates the upper limit to be checked against trace2 (average trace)
CALC:LIM:CLE
//Clears the previous limit check results

//------------- Performing the measurement---------------------
INIT;*WAI
//Initiates a new measurement and waits until the last sweep has finished.

//-------------- Retrieving limit check results----------------------------

CALC:LIM1:FAIL?
//Queries the result of the upper limit line check
CALC:LIM3:FAIL?
//Queries the result of the lower limit line check
```

12.8 Managing settings and results

The commands required to store and load instrument settings and import and export measurement results in a remote environment are described here.

The tasks for manual operation are described in Chapter 9, "Data management", on page 237.

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 9.3.2.2, "Storage location and filename", on page 244.

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.

Secure user mode

In secure user mode, settings that are to be stored on the instrument are stored to volatile memory, which is restricted to 256 MHz. Thus, a "Memory full" error may occur although the hard disk indicates that storage space is still available.

12.8.1 General data storage and loading commands

The following commands are available for all applications.

See also:

- `FORMat[:DATA]` on page 505

FORMat:DEXPort:DSEParator <Separator>

This command selects the decimal separator for data exported in ASCII format.

Parameters:

<Separator> POINt | COMMa

COMMa
Uses a comma as decimal separator, e.g. *4,05*.

POINt
Uses a point as decimal separator, e.g. *4.05*.

*RST: *RST has no effect on the decimal separator.
Default is POINt.

Example: `FORM:DEXP:DSEP POIN`
Sets the decimal point as separator.

Manual operation: See "Export Peak List" on page 219
See "Decimal Separator" on page 234

MMEMory:CATalog <FileName>

This command returns the contents of a particular directory.

Parameters:

<FileName> String containing the path and directory
If you leave out the path, the command returns the contents of the directory selected with `MMEMory:CDIRectory` on page 560.
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"`).

Example: `MMEM:CAT? 'C:\Data\SPOOL?.PNG'`
Returns all files in `C:\Data\` whose names start with `SPOOL`, have 6 characters and the extension `.PNG`, e.g.:
`SPOOL1.PNG,SPOOL2.PNG,SPOOL3.PNG`

Example: `MMEM:CAT? 'C:\Data\SPOOL6.PNG'`
Query whether the file '`SPOOL6.PNG`' also exists in the directory;
Result:
`-256,"File name not found;:MMEMory:CATalog?`
`'C:\Data\SPOOL6.PNG'`

Manual operation: See "Selecting Storage Location - Drive/ Path/ Files" on page 246

MMEMory:CATalog:LONG <Directory>

This command returns the contents of a particular directory with additional information about the files.

Parameters:

<Directory> String containing the path and directory.
If you leave out the path, the command returns the contents of the directory selected with `MMEMory:CDIRectory` on page 560.
The path may be relative or absolute. Using wildcards ('*') is possible to query a certain type of files 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.

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 247

MMEMory:COPY <FileName>, <FileName>

This command copies one or more files to another directory.

Parameters:

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

<FileName> String containing the path and name of the target file.
The path may be relative or absolute.

MMEMory:DATA <FileName>[, <Data>]
MMEMory:DATA? <FileName>

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 instrument or for transferring them to the instrument

Parameters:

<Data> <block_data>

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.

Parameters for setting and query:

<FileName>

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.
`MMEM:DATA? 'Testfile.txt'`
Returns the contents of the file.

MMEMory:DELete:IMMediate <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.

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.

MMEMory:MOVE <FileName>, <FileName>

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

<FileName> 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:\.

MMEMory:MSIS <Drive>

This command selects the default storage device used by all MMEMory commands.

Parameters:
<Drive> 'A:' | 'C:' | … | 'Z:'
String containing the device drive name
*RST: n.a.

MMEMory:NAME <FileName>

This command has several purposes, depending on the context it is used in.

- It creates a new and empty file.
- It defines the file name for screenshots taken with `HCOPy[:IMMediate]`. 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:\Data\PRINT1.BMP'`
Selects the file name.

MMEMory:NETWork:DISConnect <Drive>[, <State>]

This command disconnects a network drive.

Parameters:
<Drive> String containing the drive name.

<State> 1 | 0 | ON | OFF
Optional: determines whether disconnection is forced or not

1 | ON
Disconnection is forced.

0 | OFF
Disconnect only if not in use.

*RST: 0

MMEMory:NETWork:MAP <FilePath>, <IP>[, <UserName>, <Password>, <State>]

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:

<FilePath> String containing the drive name or path of the directory you want to map.

<IP> 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 <UserName>.
The password is optional.

<State> ON | OFF | 1 | 0

ON | 1
Reconnects at logon with the same user name.

OFF | 0
Does not reconnect at logon.

MMEMory:NETWork:UNUSeddrives

This command returns a list of unused network drives.

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 | 1
Returns a list of all drives in use including the folder information.

OFF | 0
Returns a list of all drives in use.

MMEMory:RDIRectory <arg0>

This command deletes the indicated directory.

Parameters:

<arg0> String containing the path of the directory to delete.
Note that the directory you want to remove must be empty.

12.8.2 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 instrument (`MMEMory:SELect[:ITEM]...`), or only those from the currently selected channel (`MMEM:SELect:CHANnel[:ITEM]...`) are stored.

MMEMory:SELect:CHANnel[:ITEM]:ALL
MMEMory:SELect[:ITEM]:ALL

This command includes all items when storing or loading a configuration file.

The items are:

- Hardware configuration: `MMEMory:SELect[:ITEM]:HWSettings` on page 565
- Limit lines: `MMEMory:SELect[:ITEM]:LINes:ALL` on page 565
- Spectrogram data: `MMEMory:SELect[:ITEM]:SGRam` on page 566
- Trace data: `MMEMory:SELect[:ITEM]:TRACe<1...3>[:ACTive]` on page 567
- Transducers: `MMEMory:SELect[:ITEM]:TRANsducer:ALL` on page 567

Example: `MMEM:SEL:ALL`

Manual operation: See "Items:" on page 247

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.

Manual operation: See "Items:" on page 247

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` on page 568.
- color settings
- configuration for the hardcopy output

Parameters:

<State> ON | OFF | 0 | 1
*RST: 1

Example: `MMEM:SEL:HWS ON`

Manual operation: See "Items:" on page 247

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 | 1 | 0
*RST: 0

Example: `MMEM:SEL:LIN:ALL ON`

Manual operation: See "Items:" on page 247

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` on page 565
- Limit lines: `MMEMory:SELect[:ITEM]:LINes:ALL` on page 565
- Spectrogram data: `MMEMory:SELect[:ITEM]:SGRam` on page 566
- Trace data: `MMEMory:SELect[:ITEM]:TRACe<1...3>[:ACTive]` on page 567
- Transducers: `MMEMory:SELect[:ITEM]:TRANsducer:ALL` on page 567

Example: `MMEM:SEL:NONE`

Manual operation: See "Items:" on page 247

MMEMory:SELect:CHANnel[:ITEM]:SCData <State>
MMEMory:SELect[:ITEM]:SCData <State>

This command includes or excludes source calibration data for an optional external generator when storing or loading a configuration file.

Parameters:

<State> ON | OFF | 1 | 0
*RST: 0

Example: `MMEM:SEL:SCD ON`
Adds the source calibration data to the list of data subsets.

MMEMory:SELect:CHANnel[:ITEM]:SPECtrogram <State>
MMEMory:SELect:CHANnel[:ITEM]:SGRam <State>
MMEMory:SELect[:ITEM]:SPECtrogram <State>
MMEMory:SELect[:ITEM]:SGRam <State>

This command includes or excludes spectrogram data when storing or loading a configuration file.

Parameters:

<State> ON | OFF | 1 | 0
*RST: 0

Example: `MMEM:SEL:SGR ON`
Adds the spectrogram data to the list of data subsets.

Manual operation: See "Items:" on page 247

MMEMory:SELect:CHANnel[:ITEM]:TRACe[:ACTive] <State>
MMEMory:SELect[:ITEM]:TRACe<1...3>[:ACTive] <State>

This command includes or excludes trace data when storing or loading a configuration file.

Suffix:

<1...3> irrelevant

Parameters:

<State> ON | OFF | 1 | 0

*RST: 0, i.e. no traces are stored

Example: `MMEM:SEL:TRAC ON`

Manual operation: See "Items:" on page 247

MMEMory:SELect:CHANnel[:ITEM]:TRANsducer:ALL <State>
MMEMory:SELect[:ITEM]:TRANsducer:ALL <State>

This command includes or excludes transducer factors when storing or loading a configuration file.

The command is available in the optional Spectrum application.

Parameters:

<State> ON | OFF | 1 | 0

*RST: 0

Example: `MMEM:SEL:TRAN:ALL ON`

Manual operation: See "Items:" on page 247

12.8.3 Storing and loading instrument settings

See also:

- `INSTrument[:SELect]` on page 396 to select the channel.

MMEMory:CLEar:ALL

This command deletes all instrument configuration files in the current directory.

You can select the directory with MMEMory:CDIRectory on page 560.

Example: MMEM:CLE:ALL

MMEMory:CLEar:STATe <1>, <FileName>

This command deletes an 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'

MMEMory:LOAD:AUTO <1>, <FileName>

This command restores an instrument 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 FSMR3.

Parameters:
<1>

<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 *instrument* settings files can be selected for the startup recall function; channel files cause an error.

Example: MMEM:LOAD:AUTO 1,'C:\R_S\INSTR\USER\TEST'

Manual operation: See "Startup Recall" on page 249

MMEMory:LOAD:STATe <1>, <FileName>

This command restores and activates the instrument 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 FSMR3.
`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 instrument.
`MMEM:LOAD:STAT 1,'C:\R_S\INSTR\USER\TEST01'`
//Selected items are retained. Reloads user settings and all limit lines.
Restart the instrument.
(Switch the [ON/OFF] key off and on).
`MMEM:LOAD:STAT 1,'C:\R_S\INSTR\USER\TEST01'`
// Selected items are set to default. Reloads only the user settings.

Manual operation: See "Recall" on page 243
See "Recall in New Channel / Recall in Current Channel" on page 248

MMEMory:LOAD:TYPE <Type>

This command defines whether the channels that will be loaded with the subsequent `MMEM:LOAD:STAT` command will replace the current channel or activate a new channel.

Parameters:
<Type> 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 channel 'SPECTRUM2'.
MMEM:STOR:TYP CHAN
//Specifies that channel data is to be stored.
MMEM:STOR:STAT 1, 'C:\Analyzer\Spectrum'
//Stores the settings from channel
//'SPECTRUM2' to the file 'C:\Analyzer\Spectrum'.
MMEM:LOAD:TYPE NEW
//Specifies that channels are to be loaded
//in a new channel.
MMEM:LOAD:STAT 1, 'C:\Analyzer\Spectrum'
//Loads the channel from the file
//'C:\Analyzer\Spectrum' to the new channel
//'SPECTRUM2*'.
```

MMEMory:STORe<1|2>:STATe <1>, <FileName>

This command saves the current instrument configuration in a *.dfl file.

Secure User Mode

In secure user mode, settings that are stored on the instrument are stored to volatile memory, which is restricted to 256 MB. Thus, a "memory limit reached" error can occur although the hard disk indicates that storage space is still available.

To store data permanently, select an external storage location such as a USB memory device.

Suffix:

<1|2>	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 instrument settings in the file `Save.dfl`.

Manual operation: See "Save File" on page 247

MMEMory:STORe<1|2>:STATe:NEXT

This command saves the current instrument configuration in a *.dfl file.

The file name depends on the one you have set with `MMEMory:STORe<1|2>:STATe` on page 570. This command adds a consecutive number to the file name.

Secure User Mode

In secure user mode, settings that are stored on the instrument are stored to volatile memory, which is restricted to 256 MB. Thus, a "memory limit reached" error can occur although the hard disk indicates that storage space is still available.

To store data permanently, select an external storage location such as a USB memory device.

Suffix:
<1|2> irrelevant

Example: `MMEM:STOR:STAT 1,'Save'`
Saves the current instrument settings in the file `Save.dfl`.
`MMEM:STOR:STAT:NEXT`
Saves the current instrument settings in the file `Save_001.dfl`
`MMEM:STOR:STAT:NEXT`
Saves the current instrument settings in the file `Save_002.dfl`

Manual operation: See "Save File" on page 247

MMEMory:STORe<1|2>:TYPE <Type>

This command defines whether the data from the entire instrument or only from the current channel is stored with the subsequent `MMEM:STOR`... command.

Suffix:
<1|2> irrelevant

Parameters:
<Type> INSTrument | CHANnel

INSTrument
Stores data from the entire instrument.

CHANnel
Stores data from an individual channel.

*RST: INST

Example: `INST:SEL 'SPECTRUM2'`
Selects channel `'SPECTRUM2'`.
`MMEM:STOR:TYPE CHAN`
Specifies that channel data is to be stored.

SYSTem:PRESet

This command presets the R&S FSMR3. It is identical to `*RST`.

Example: `SYST:PRES`

Usage: Event

SYSTem:PRESet:CHANnel[:EXEC]

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

Use `INST:SEL` to select the channel.

For details see Chapter 9.1, "Restoring the default instrument configuration (preset)", on page 237.

Example: `INST:SEL 'Spectrum2'`
Selects the channel for "Spectrum2".
`SYST:PRES:CHAN:EXEC`
Restores the factory default settings to the "Spectrum2"channel.

Usage: Event

Manual operation: See "Preset Channel" on page 113

12.8.4 Storing or printing screenshots

Useful commands to configure screenshots described elsewhere

- `MMEMory:NAME` on page 562

Remote commands exclusive to configuring screenshots

DISPlay:LOGO <State>

Activates/deactivates the printout of the Rohde & Schwarz company logo at the top of each page.

Parameters:

<State> 1 | 0 | ON | OFF

1 | ON
Logo is printed.

0 | OFF
Logo is not printed.

*RST: 1

Example: `DISP:LOGO OFF`

Manual operation: See "Print Logo" on page 255

HCOPy:ABORt

This command aborts a running hardcopy output.

Example: `HCOP:ABOR`

HCOPy:CONTent <Content>

This command determines the type of content included in the printout.

This setting is independent of the printing device.

Parameters:

<Content> WINDows | HCOPy

WINDows
Includes only the selected windows in the printout. All currently active windows for the current channel (or "MultiView") are available for selection. How many windows are printed on a each page of the printout is defined by `HCOPy:PAGE:WINDow:COUNt` on page 580.
This option is not available when copying to the clipboard (`HCOP:DEST 'SYST:COMM:CLIP'` or an image file (see `HCOPy:DEVice:LANGuage` on page 577).
If the destination is currently set to an image file or the clipboard, it is automatically changed to be a PDF file for the currently selected printing device.

HCOPy
Selects all measurement results displayed on the screen for the current channel (or "MultiView"): diagrams, traces, markers, marker lists, limit lines, etc., including the channel bar and status bar, for printout on a single page. Displayed items belonging to the software user interface (e.g. softkeys) are not included. The size and position of the elements in the printout is identical to the screen display.

*RST: HCOPy

Example:
```
HCOP:DEST1 'SYST:COMM:CLIP'
HCOP:CONT WIND
HCOP:DEST1?
//Result: 'MMEM'
HCOP:DEV:LANG1?
//Result: 'PDF'
```
"Print to clipboard" is automatically switched to "print to PDF file" when the contents are switched to "multiple windows".

Manual operation: See "Print Screenshot" on page 254
See "Print Multiple Windows" on page 255

HCOPy:CMAP<it>:DEFault<ci>

This command defines the color scheme for print jobs.

For details see "Print Colors" on page 283.

Suffix:

<it> Irrelevant.

<ci> See table below

Example:
```
HCOP:CMAP:DEF2
```
Selects the optimized color set for the color settings of a printout.

Manual operation: See "Print Colors" on page 283

Gui setting	Description	Remote command
"Screen Colors (Print)"	Selects the current screen colors for the printout. The background is always printed in white and the grid in black.	HCOP:CMAP:DEF1
"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.	HCOP:CMAP:DEF2
"User Defined Colors"	Selects the user-defined color setting.	HCOP:CMAP:DEF3
"Screen Colors (Screenshot)"	Selects the current screen colors without any changes for a screenshot.	HCOP:CMAP:DEF4

HCOPy:CMAP<it>:HSL <hue>, <sat>, <lum>

This command selects the color for various screen elements in print jobs.

Suffix:

<it> Selects the item for which the color scheme is to be defined. For more information see Chapter 12.9.3.3, "CMAP suffix assignment", on page 604.

Parameters:

<hue> **hue**
tint
Range: 0 to 1

<sat> **sat**
saturation
Range: 0 to 1

<lum> **lum**
brightness
Range: 0 to 1

Example: `HCOP:CMAP2:HSL 0.3,0.8,1.0`
Changes the grid color

Manual operation: See "Defining User-specific Colors" on page 285

HCOPy:CMAP<it>:PDEFined <Color>

This command selects a predefined color for various screen elements in print jobs.

Suffix:

<it> 1..n
Selects the item for which the color scheme is to be defined.
For more information see Chapter 12.9.3.3, "CMAP suffix assignment", on page 604.

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 284

HCOPy:DESTination<di> <Destination>

This command selects the destination of a print job.

Note: To print a screenshot to a file, see `HCOPy:DEVice:LANGuage` on page 577.

Suffix:

<di> Printing device.

Parameters:

<Destination>

'MMEM'
Activates "Print to file". Thus, if the destination of the print function is set to "printer" (see `HCOP:DEST1 'SYSTem:COMMunicate:PRINter'` or `HCOP:DEV:LANG GDI`), the output is redirected to a `.PRN` file using the selected printer driver.
Select the file name with `MMEMory:NAME`.
Note: To save a screenshot to a file, see `HCOPy:DEVice:LANGuage` on page 577.

'SYSTem:COMMunicate:PRINter'
Sends the hardcopy to a printer and deactivates "print to file".
Select the printer with `SYSTem:COMMunicate:PRINter:SELect<di>` .

'SYSTem:COMMunicate:CLIPboard'
Sends the hardcopy to the clipboard.

*RST: 'SYST:COMM:CLIP'

Example: To print on a printer:

```
//Destination: printer, deactivate "print to file"
HCOP:DEST1 'SYSTem:COMMunicate:PRINter'
//Define the printer name
SYST:COMM:PRIN:SEL 'myFavoritePrinter'
//Print
HCOP:IMM
```

Example: To print to a *PRN file:

```
//Destination: printer
HCOP:DEV:LANG GDI
//Define the printer name
SYST:COMM:PRIN:SEL 'myFavoritePrinter'
//Redirect the printer output to a file
HCOP:DEST1 'MMEM'
//Define file name
MMEM:NAME 'C:\R_S\instr\user\MeasurementTestReport.png'
//Print
HCOP:IMM
```

Manual operation: See "Destination: Clipboard" on page 260
See "Destination: Printer" on page 260
See "Print to file" on page 261

HCOPy:DEVice:COLor <State>

This command turns color printing on and off.

Parameters:

<State> ON | OFF | 0 | 1

ON | 1
Color printing

OFF | 0
Black and white printing

*RST: 1

Example: `HCOP:DEV:COL ON`

HCOPy:DEVice:LANGuage <Language>

This command selects the file format for a print job or to store a screenshot to a file.

Parameters:

<Language>

GDI
Graphics Device Interface
Default format for output to a printer configured under Windows.
Must be selected for output to the printer interface.
Can be used for output to a file. The printer driver configured under Windows is used to generate a printer-specific file format.

BMP | JPG | PNG | PDF | SVG
Data format for output to files

Example: To print a screenshot to a PNG file:

```
//Destination: PNG file
HCOP:DEV:LANG PNG
//Define file name
MMEM:NAME 'C:\R_S\instr\user\MeasurementTestReport.png'
//Print
HCOP:IMM
```

Manual operation: See "Destination: File" on page 260

HCOPy[:IMMediate]

This command initiates a print job.

If you are printing to a file, the file name depends on `MMEMory:NAME`.

Manual operation: See "Print" on page 258

HCOPy[:IMMediate]: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.

Manual operation: See "Print" on page 258

HCOPy:ITEM:WINDow:TEXT <Comment>

This command defines a comment to be added to the printout.

Parameters:

<Comment> String containing the comment.

Manual operation: See "Comment" on page 255

HCOPy:PAGE:COUNt:STATe <State>

This command includes or excludes the page number for printouts consisting of multiple pages (HCOPy:CONTent on page 573).

Parameters:
<State> 1 | 0 | ON | OFF

1 | ON
The page number is printed.

0 | OFF
The page number is not printed.

*RST: 1

Example: `HCOP:PAGE:COUN:STAT ON`

Manual operation: See "Print Page Count" on page 255

HCOPy:PAGE:MARGin:BOTTom <Bottom>

This command defines the margin at the bottom of the printout page on which no elements are printed. The margins are defined according to HCOPy:PAGE:MARGin:UNIT on page 579.

Parameters:
<Bottom> *RST: 4.23 mm

Example: `HCOP:PAGE:MARG2:BOTT 2`

Manual operation: See "Margins" on page 262

HCOPy:PAGE:MARGin:LEFT <Left>

This command defines the margin at the left side of the printout page on which no elements are printed. The margins are defined according to HCOPy:PAGE:MARGin:UNIT on page 579.

Parameters:
<Left> *RST: 4.23 mm

Example: `HCOP:PAGE:MARG2:LEFT 2`

Manual operation: See "Margins" on page 262

HCOPy:PAGE:MARGin:RIGHt <Right>

This command defines the margin at the right side of the printout page on which no elements are printed. The margins are defined according to HCOPy:PAGE:MARGin:UNIT on page 579.

Parameters:
<Right> *RST: 4.23 mm

Example: `HCOP:PAGE:MARG2:RIGH 2`

Manual operation: See "Margins" on page 262

HCOPy:PAGE:MARGin:TOP <Top>

This command defines the margin at the top of the printout page on which no elements are printed. The margins are defined according to `HCOPy:PAGE:MARGin:UNIT` on page 579.

Parameters:
<Top> *RST: 4.23 mm

Example: `HCOP:PAGE:MARG2:TOP 2`

Manual operation: See "Margins" on page 262

HCOPy:PAGE:MARGin:UNIT <Unit>

This command defines the unit in which the margins for the printout page are configured.

Parameters:
<Unit> MM | IN

MM
millimeters

IN
inches

*RST: MM

Example: `HCOP:PAGE:MARG2:BOTT 2`

Manual operation: See "Margins" on page 262

HCOPy:PAGE:ORIentation <Orientation>

The command selects the page orientation of the printout.

The command is only available if the output device is a printer or a PDF file.

Parameters:
<Orientation> LANDscape | PORTrait

*RST: PORTrait

Example:
```
HCOP:DEV:LANG1 PDF
HCOP:PAGE:ORI2 LAND
```

Manual operation: See "Orientation" on page 262

HCOPy:PAGE:WINDow:CHANnel:STATe <Channel>, <State>

This command selects all windows of the specified channel to be included in the printout for `HCOPy:CONTent` on page 573.

Parameters:

<Channel> String containing the name of the channel.
For a list of available channel types use `INSTrument:LIST?` on page 395.

<State> 1 | 0 | ON | OFF

1 | ON
The channel windows are included in the printout.

0 | OFF
The channel windows are not included in the printout.

*RST: 1

Example:
```
HCOP:CONT WIND
HCOP:PAGE:WIND2:CHAN 'IQ Analyzer',0
HCOP:PAGE:WIND2:STAT 'IQ Analyzer','1',1
```
Prints only window 1 in the IQ Analyzer channel.

Manual operation: See "Print Multiple Windows" on page 255

HCOPy:PAGE:WINDow:COUNt <Count>

This command defines how many windows are displayed on a single page of the printout for `HCOPy:CONTent` on page 573.

Parameters:

<Count> integer

*RST: 1

Example: `HCOP:PAGE:WIND2:COUN 2`

Manual operation: See "Windows Per Page" on page 262

HCOPy:PAGE:WINDow:SCALe <Scale>

This command determines the scaling of the windows in the printout for `HCOPy:CONTent` on page 573.

Parameters:

<Scale> 1 | 0 | ON | OFF

1 | ON
Each window is scaled to fit the page size optimally, not regarding the aspect ratio of the original display. If more than one window is printed on one page (see `HCOPy:PAGE:WINDow:COUNt` on page 580), each window is printed in equal size.
("Size to fit")

0 | OFF
Each window is printed as large as possible while maintaining the aspect ratio of the original display.
("Maintain aspect ratio")

*RST: 1

Example: `HCOP:PAGE:WIND2:SCAL 0`

Manual operation: See "Scaling" on page 262

HCOPy:PAGE:WINDow:STATe <Channel>, <Window>, <State>

This command selects the windows to be included in the printout for `HCOPy:CONTent` on page 573.

Parameters:

<Channel> String containing the name of the channel.
For a list of available channel types use `INSTrument:LIST?` on page 395.

<Window> String containing the name of the existing window.
By default, the name of a window is the same as its index.
To determine the name and index of all active windows in the active channel, use the `LAYout:CATalog[:WINDow]?` query.

<State> 1 | 0 | ON | OFF

1 | ON
The window is included in the printout.

0 | OFF
The window is not included in the printout.

*RST: 1

Example: `HCOP:PAGE:WIND2:STAT 'IQ Analyzer','1',1`

Manual operation: See "Print Multiple Windows" on page 255

HCOPy:TDSTamp:STATe <State>

This command includes or excludes the time and date in the printout.

Parameters:

<State> 1 | 0 | ON | OFF

1 | ON
The time and date are printed.

0 | OFF
The time and date are not printed.

*RST: 1

Manual operation: See "Print Date and Time" on page 256

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]` on page 582.

Manual operation: See "Printer Name" on page 260

SYSTem:COMMunicate:PRINter:ENUMerate[:NEXT]

This command queries the name of available printers.

You have to use `SYSTem:COMMunicate:PRINter:ENUMerate:FIRSt` on page 581 for this command to work properly.

Manual operation: See "Printer Name" on page 260

SYSTem:COMMunicate:PRINter:SELect<di> <Printer>

This command selects the printer that processes jobs sent by the R&S FSMR3.

Use `HCOPy:DESTination<di>` to select another output destination.

Suffix:

<di> 1..n
Printing device.

Parameters:

<Printer> String containing the printer name.
Use
•`SYSTem:COMMunicate:PRINter:ENUMerate:FIRSt`
on page 581and
•`SYSTem:COMMunicate:PRINter:ENUMerate[:NEXT]`
on page 582
to query all available printers.

*RST: NONE

Manual operation: See "Printer Name" on page 260

12.8.5 Storing measurement results

The following commands can be used to store the results of a measurement.

Useful commands for storing results described elsewhere:

- `FORMat[:DATA]` on page 505

Remote commands exclusive to storing results:

FORMat:DEXPort:HEADer <State>

If enabled, additional instrument and measurement settings are included in the header of the export file for result data. If disabled, only the pure result data from the selected traces and tables is exported.

Parameters:

<State> ON | OFF | 0 | 1

*RST: 1

Manual operation: See "Include Instrument & Measurement Settings" on page 233

MMEMory:STORe<n>:LIST <FileName>

This command exports the SEM and spurious emission list evaluation to a file.

The file format is *.dat.

Secure User Mode

In secure user mode, settings that are stored on the instrument are stored to volatile memory, which is restricted to 256 MB. Thus, a "memory limit reached" error can occur although the hard disk indicates that storage space is still available.

To store data permanently, select an external storage location such as a USB memory device.

Suffix:

<n> Window

Parameters:

<FileName> String containing the path and name of the target file.

Example: `MMEM:STOR:LIST 'test'`
Stores the current list evaluation results in the `test.dat` file.

MMEMory:STORe<n>:PEAK <FileName>

This command exports the marker peak list to a file.

Secure User Mode

In secure user mode, settings that are stored on the instrument are stored to volatile memory, which is restricted to 256 MB. Thus, a "memory limit reached" error can occur although the hard disk indicates that storage space is still available.

To store data permanently, select an external storage location such as a USB memory device.

Suffix:

<n> Window

Parameters:

<FileName> String containing the path,name and extension of the target file.

Example: `MMEM:STOR:PEAK 'test.dat'`
Saves the current marker peak list in the file `test.dat`.

Manual operation: See "Export Peak List" on page 219

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.

Secure User Mode

In secure user mode, settings that are stored on the instrument are stored to volatile memory, which is restricted to 256 MB. Thus, a "memory limit reached" error can occur although the hard disk indicates that storage space is still available.

To store data permanently, select an external storage location such as a USB memory device.

Suffix:
<n> Window

Parameters:
<FileName> String containing the path and name of the target file.

Example: `MMEM:STOR:SGR 'Spectrogram'`
Copies the spectrogram data to a file.

Manual operation: See "Export Trace to ASCII File" on page 234

MMEMory:STORe<n>:SPURious <FileName>

This command exports the marker peak list available for spurious emission measurements to a file.

Secure User Mode

In secure user mode, settings that are stored on the instrument are stored to volatile memory, which is restricted to 256 MB. Thus, a "memory limit reached" error can occur although the hard disk indicates that storage space is still available.

To store data permanently, select an external storage location such as a USB memory device.

Suffix:
<n> irrelevant

Parameters:
<FileName> String containing the path and name of the target file.

Example: `MMEM:STOR:SPUR 'test'`
Saves the current marker peak list in the file test.dat.

12.8.6 Examples: managing data

12.8.6.1 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 'Q:','Server\ACLRTest'
//Maps drive Q: to the directory 'Server\ACLRTest'

//-----Saving data on the instrument-----
MMEM:MDIR 'C:\R_S\INSTR\USER\Results'
//Creates a directory called 'Results' on drive C:
MMEM:NAME 'C:\R_S\INSTR\USER\Results\Test001.txt'
//Defines a file called 'Test001.txt'
MMEM:COMM 'ACLR test results'
//Creates a comment for the settings to be displayed in gui.
MMEM:DATA 'Test001.txt',#212FileContents
//Creates the file 'Test001.txt'and writes 12 characters to it

//-----Copying the data to another location---
MMEM:COPY 'C:\R_S\INSTR\USER\Results\Test001.txt','Q:'
//Copies the specified file to network drive Q:.
MMEM:DEL 'C:\R_S\INSTR\USER\Results\Test001.txt'
//Deletes the specified file from the instrument hard disk.
//or
//MMEM:MOVE 'C:\R_S\INSTR\USER\Results\Test001.xml','Q:\TestResults.txt'//
//Moves the file 'Test001.txt' to drive Q:, renames it to 'Testresults.txt'
//and removes it from the instrument hard disk.
MMEM:RDIR 'C:\R_S\INSTR\USER\Results'
//Deletes the directory called 'Results' from drive C:, unless it still
//contains any content.

//-----Disconnecting the network drive---
MMEM:NETW:DISC 'Q:'
//Disconnect drive Q:.
```

12.8.6.2 Loading data

```
MMEM:CDIR?
//Returns the path of the current directory.
//e.g.
C:\R_S\Instr\user\
MMEM:CDIR 'C:\R_S\INSTR\USER\Results'
//Changes the current directory.
MMEM:CAT? 'C:\R_S\INSTR\USER\Results\*.xml'
//or
MMEM:CAT? '*.xml'
//Returns a list of all xml files in the directory 'C:\R_S\INSTR\USER\Results'.
MMEM:CAT:LONG? '*.xml'
//Returns additional information about the xml files in the directory
// 'C:\R_S\INSTR\USER\Results'.
```

12.8.6.3 Storing instrument settings

In this example we will store the instrument settings for the "Spectrum" channel.

```
INST:SEL 'SPECTRUM'
//Selects measurement channel 'SPECTRUM'.
MEMM:STOR:TYPE CHAN
//Specifies that channel-specific data is to be stored.
MMEM:STOR:STAT 1, 'C:\R_S\Instr\user\Spectrum'
//Stores the channel settings from the 'Spectrum' channel
// to the file 'Spectrum.dfl'.
```

12.8.6.4 Loading instrument settings

In this example we will load the hardware settings from the configuration file `Spectrum.dfl` to a new "Spectrum2" channel.

```
MEMM:LOAD:TYPE NEW
//Specifies that settings will be loaded to a new channel besides the existing
//'Spectrum' channel.
MMEM:SEL:CHAN:HWS ON
//Selects only hardware settings to be loaded.
MMEM:LOAD:STAT 1, 'C:\R_S\Instr\user\Spectrum'
//Loads the channel-specific settings from the file 'C:\R_S\Instr\user\Spectrum.dfl'
//to a new channel. The new channel is named 'Spectrum2' to avoid a naming conflict
//with the existing 'Spectrum' channel.
INST:REN 'Spectrum2','Spectrum3'
//Renames the loaded channel to 'Spectrum3'.
```

12.8.6.5 Printing to a file

```
//Select bmp as the file format.
HCOP:DEV:LANG BMP
```

```
//Select the file name for the printout.
MMEM:NAME 'C:\R_S\INSTR\USER\Screenshot.bmp'
//Select all screen elements for printing
HCOP:ITEM:ALL
//Add a comment to the printout.
HCOP:ITEM:WIND:TEXT 'ACLRResults'
//Store the printout in a file called 'Screenshot.bmp'.
HCOP
//Store another printout in a file called 'Screenshot_001.bmp'.
HCOP:NEXT
```

12.8.6.6 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.
```

12.8.6.7 Storing multiple graphical measurement results to a PDF file

This example demonstrates how to store graphical results from measurements in the Spectrum application and the I/Q Analyzer to a single PDF file. It assumes the Spectrum and I/Q Analyzer measurements have already been configured and performed, with the following screen layout:

'Spectrum': 1 Frequency Sweep

'Spectrum': 2 Spectrogram

'IQ Analyzer': 1 Magnitude

'IQ Analyzer': 2 Spectrum

```
//Switch to MultiView tab
DISP:ATAB ON

//Select windows to be stored to file
```

```
HCOP:CONT WIND
HCOP:PAGE:WIND:STAT 'Spectrum','1',ON
HCOP:PAGE:WIND:STAT 'Spectrum','2',ON
HCOP:PAGE:WIND:STAT 'IQ Analyzer','1',ON
HCOP:PAGE:WIND:STAT 'IQ Analyzer','2',ON

//Define contents to be printed on each page (logo, timestamp, page count)
DISP:LOGO ON
HCOP:TDST:STAT ON
HCOP:PAGE:COUN:STAT ON
//Define comment to be printed on each page
HCOP:ITEM:WIND:TEXT 'Measurement Test Report'

//Configure page layout (landscape, 1 display per page, margins 2cm on each side)
HCOP:PAGE:ORI1 LAND
HCOP:PAGE:WIND1:COUN 1
HCOP:PAGE:WIND1:SCAL 1
HCOP:PAGE:MARG1:BOTT 20
HCOP:PAGE:MARG1:LEFT 20
HCOP:PAGE:MARG1:RIGH 20
HCOP:PAGE:MARG1:TOP 20

//Configure the use of optimized colors for printout
HCOP:CMAP:DEF2

//Set format of printout to PDF.
HCOP:DEV:LANG1 PDF
//Define file name of printout
MMEM:NAME 'C:\R_S\instr\user\MeasurementTestReport.pdf'

//Store pdf of printout to file
HCOP:IMM
```

12.9 Configuring the R&S FSMR3

The remote commands required to set up the R&S FSMR3 are described here.

12.9.1 Configuring the reference frequency

[SENSe:]ROSCillator:LBWidth <Bandwidth>

Defines the loop bandwidth, that is, the speed of internal synchronization with the reference frequency. 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 Table 10-1).

Default unit: Hz

Example: `ROSC:LBW 3`

Manual operation: See "Loop Bandwidth" on page 292

[SENSe:]ROSCillator:O100 <State>
[SENSe:]ROSCillator:O640 <State>

This command turns the output of a reference signal on the corresponding connector ("Ref Output") on and off.

`[SENSe:]ROSCillator:O100`: Provides a 100 MHz reference signal on corresponding connector.

`[SENSe:]ROSCillator:O640`: Provides a 640 MHz reference signal on corresponding connector.

Parameters:

<State> ON | OFF | 1 | 0

OFF | 0
Switches the reference off.

ON | 1
Switches the reference on

Example: //Output reference signal of 100 MHz.
`ROSC:O100 ON`

Manual operation: See "Reference Frequency Output" on page 292

[SENSe:]ROSCillator:EXTernal:FALLback <State>

Defines how the instrument reacts if an external reference is selected but none is available.

Parameters:

<State> ON | OFF | 0 | 1

OFF | 0
If no valid external reference signal is available, the error message "External reference missing" is displayed. Additionally, the flag "NO REF" is displayed to indicate that no synchronization was performed *for the last measurement*.

ON | 1
If no external reference is available, the instrument automatically switches back to the internal reference. Note that you must reactivate the external reference if it becomes available again at a later time.

*RST: 0

Manual operation: See "Behavior in case of missing external reference" on page 291

SOURce<si>:EXTernal<ext>:ROSCillator:EXTernal:FREQuency <Frequency>

This command defines the frequency of the external reference oscillator.

If the external reference oscillator is selected, the reference signal must be connected to the rear panel of the instrument.

Suffix:

<si> 1..n

<ext> 1..n

Parameters:

<Frequency> Range: 1 MHz to 50 MHz
Default unit: HZ

Example:
```
ROSC:EXT:FREQ 13MHZ
```
Sets the frequency to 13 MHz.
```
SOUR:EXT:ROSC:EXT:FREQ 13MHZ
```

Manual operation: See "Reference Frequency Input" on page 290

[SENSe:]ROSCillator:OSYNc <State>

If enabled, a 100 MHz reference signal is provided to the "SYNC TRIGGER OUTPUT" connector.

Parameters:

<State> ON | OFF | 1 | 0

*RST: 0

Example: `ROSC:OSYN ON`

Manual operation: See "Reference Frequency Output" on page 292

[SENSe:]ROSCillator:SOURce <Source>

This command selects the reference oscillator.

If you want to select the external reference, it must be connected to the R&S FSMR3.

Parameters:

<Source>

INTernal
The internal reference is used (10 MHz).

EXTernal | EXTernal1 | EXT1
The external reference from the "REF INPUT 10 MHZ" connector is used; if none is available, an error flag is displayed in the status bar.

E10
The external reference from "REF INPUT 1..50 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 the "REF INPUT 100 MHZ / 1 GHz" connector is used with a fixed 100 MHZ frequency; if none is available, an error flag is displayed in the status bar.

E1000
The external reference from "REF INPUT 100 MHZ / 1 GHz" connector is used with a fixed 1 GHZ frequency; 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.

Example: `ROSC:SOUR EXT`

Manual operation: See "Reference Frequency Input" on page 290

[SENSe:]ROSCillator:SOURce:EAUTo?

This command queries the current reference type in case you have activated an automatic switch to the internal reference if the external reference is missing.

Return values:

<Reference> INT | EXT

INT
internal reference

EXT
external reference

Example: `SENS:ROSC:SOUR:EAUT?`
Queries the currently available reference type.

Usage: Query only

[SENSe:]ROSCillator:TRANge <Range>

Defines the 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}).

Parameters:

<Range> WIDE | SMALl

The possible values depend on the reference source (see Table 10-1).

SMALl
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.

Example: `ROSC:TRAN WIDE`

Manual operation: See "Tuning Range" on page 292

12.9.2 Calibration and checks

The following commands control calibration and checks on the R&S FSMR3.

CALibration[:ALL]?

This command initiates a calibration (self-alignment) routine and queries if calibration was successful.

During the acquisition of correction data the instrument does not accept any remote control commands.

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.

In order to recognize when the acquisition of correction data is completed, the MAV bit in the status byte can be used. If the associated bit is set in the Service Request Enable (SRE) register, the instrument generates a service request after the acquisition of correction data has been completed.

Return values:

<CalibrationFailed> ON | OFF | 0 | 1

OFF | 0
Calibration was successful.

ON | 1
Calibration was not successful.

Example:

`*CLS`
Resets the status management.
`*SRE 16`
Enables MAV bit in the Service Request Enable register.
`*CAL?`
Starts the correction data recording, and then a service request is generated.

Usage: Query only

Manual operation: See "Start Self Alignment" on page 272

CALibration:DUE:DAYS <Day1>[, <Day2>, <Day3>, <Day4>, <Day5>, <Day6>, <Day7>]

Defines the days on which a self-alignment is scheduled for `CALibration:DUE:SCHedule ON`. Up to 7 different days can be scheduled.

Parameters:

<Day1> ALL | MONDay | TUESday | WEDNesday | THURsday | FRIDay | SATurday | SUNDay

<Day2> ALL | MONDay | TUESday | WEDNesday | THURsday | FRIDay | SATurday | SUNDay

<Day3>	ALL | MONDay | TUESday | WEDNesday | THURsday | FRIDay | SATurday | SUNDay
<Day4>	ALL | MONDay | TUESday | WEDNesday | THURsday | FRIDay | SATurday | SUNDay
<Day5>	ALL | MONDay | TUESday | WEDNesday | THURsday | FRIDay | SATurday | SUNDay
<Day6>	ALL | MONDay | TUESday | WEDNesday | THURsday | FRIDay | SATurday | SUNDay
<Day7>	ALL | MONDay | TUESday | WEDNesday | THURsday | FRIDay | SATurday | SUNDay

Example: //Schedule a self-alignment every Monday and Friday

```
CAL:DUE:DAYS MOND,FRID
```

Example: //Schedule a self-alignment every Sunday at 2 AM after a warmup period, then shut down instrument.

```
CAL:DUE:WARM
CAL:DUE:SCH ON
CAL:DUE:DAYS SUND
CAL:DUE:TIME '2:00'
CAL:DUE:SHUT
```

Manual operation: See "Schedule" on page 273

CALibration:DUE:SCHedule <State>

If enabled, a self-alignment is performed regularly at specific days and time. Specify the date and time using the `CALibration:DUE:DAYS` and `CALibration:DUE:TIME` commands.

Parameters:

<State> ON | OFF | 0 | 1

OFF | 0
Switches the function off

ON | 1
Switches the function on

*RST: 0

Example: //Schedule a self-alignment every Sunday at 2 AM after a warmup period, then shut down instrument.

```
CAL:DUE:WARM
CAL:DUE:SCH ON
CAL:DUE:DAYS SUND
CAL:DUE:TIME '2:00'
CAL:DUE:SHUT
```

Manual operation: See "Schedule" on page 273

CALibration:DUE:SHUTdown <State>

If activated, the R&S FSMR3 is automatically shut down after self-alignment is completed. Note that the instrument cannot be restarted via remote control.

Parameters:

<State> ON | OFF | 0 | 1

OFF | 0
Switches the function off

ON | 1
Switches the function on

*RST: 0

Example: //Schedule a self-alignment every Sunday at 2 AM after a warmup period, then shut down instrument.

```
CAL:DUE:WARM
CAL:DUE:SCH ON
CAL:DUE:DAYS SUND
CAL:DUE:TIME '2:00'
CAL:DUE:SHUT
```

Manual operation: See "Shut down Device after Self Alignment" on page 273

CALibration:DUE:TIME <Time>

Defines the time at which a self-alignment is scheduled for the days specified by `CALibration:DUE:DAYS`, if `CALibration:DUE:SCHedule ON`.

Parameters:

<Time> string with format 'hh:mm' (24 hours)

Example: //Schedule a self-alignment every Sunday at 2 AM after a warmup period, then shut down instrument.

```
CAL:DUE:WARM
CAL:DUE:SCH ON
CAL:DUE:DAYS SUND
CAL:DUE:TIME '2:00'
CAL:DUE:SHUT
```

Manual operation: See "Schedule" on page 273

CALibration:DUE:WARMup <State>

If enabled, self-alignment is started automatically after the warmup operation has completed.

Parameters:

<State> ON | OFF | 0 | 1

OFF | 0
Switches the function off

ON | 1
Switches the function on

*RST: 0

Example: //Schedule a self-alignment every Sunday at 2 AM after a warmup period, then shut down instrument.

```
CAL:DUE:WARM
CAL:DUE:SCH ON
CAL:DUE:DAYS SUND
CAL:DUE:TIME '2:00'
CAL:DUE:SHUT
```

Manual operation: See "Await Warm-Up Operation before Self Alignment" on page 273

CALibration:RESult?

This command returns the results collected during calibration.

Return values:
<CalibrationData> String containing the calibration data.

Example: `CAL:RES?`
would return, e.g.

```
Total Calibration Status:
PASSED, Date (dd/mm/yyyy): 12/07/2004,
Time: 16:24:54,Runtime: 00.06
```

Usage: Query only

Manual operation: See "Alignment Results:" on page 274

DIAGnostic:SERVice:INPut:PULSed:CFRequency <Frequency>

This command defines the frequency of the calibration signal.

Before you can use the command, you have to feed in a calibration signal with `DIAGnostic:SERVice:INPut[:SELect]` on page 597.

Manual operation: See "Calibration Frequency RF" on page 305

DIAGnostic:SERVice:INPut:PULSed:MCFRequency <Frequency>

This command sets the calibration frequency for frequencies greater than 7 GHz. This command only takes effect if a microwave calibration signal is selected for input (`DIAGnostic:SERVice:INPut[:SELect]` on page 597).

Parameters:
<Frequency> *RST: 7 GHz
Default unit: Hz

Example: `DIAG:SERV:INP:PULS:MCFR 7,1 GHz`

DIAGnostic:SERVice:INPut:RF[:SPECtrum] <Bandwidth>

This command selects the bandwidth of the calibration signal.

Parameters:

<Bandwidth> NARRowband | BROadband

NARRowband
Narrowband signal for power calibration of the frontend.

BROadband
Broadband signal for calibration of the IF filter.

Manual operation: See "Spectrum" on page 305

DIAGnostic:SERVice:INPut:AIQ[:TYPE] <SignalType>

This command defines the type of calibration signal to be used for Analog Baseband.
This command is only available if the R&S FSMR3-B71 option is installed.

Parameters:

<SignalType> AC | DC | DCZero

AC
1.5625 MHz square wave AC signal

DC
DC signal

DCZero
no signal

*RST: AC

Example: `DIAG:SERV:INP:AIQ:TYPE DCZ`

DIAGnostic:SERVice:INPut[:SELect] <Signal>

This command activates or deactivates the use of an internal calibration signal as input for the R&S FSMR3.

Parameters:

<Signal>

CALibration
Uses the calibration signal as RF input.

MCALibration
Uses the calibration signal for the microwave range as RF input.

RF
Uses the signal from the RF input.

*RST: RF

Example: `DIAG:SERV:INP CAL`
Uses the calibration signal as RF input.

Manual operation: See "NONE" on page 305
See "Calibration Frequency RF" on page 305
See "Calibration Frequency MW" on page 306

DIAGnostic:SERVice:STESt:RESult?

This command queries the self-test results.

Return values:

<Results>	String of data containing the results. The rows of the self-test result table are separated by commas.

Example:	`DIAG:SERV:STES:RES?`
	would return, e.g.
	`"Total Selftest Status: PASSED", "Date (dd/mm/yyyy): 09/07/2004 TIME: 16:24:54", "Runtime: 00:06", "...`

Usage:	Query only

SOURce<si>:TEMPerature:FRONtend

This command queries the current frontend temperature of the R&S FSMR3.

During self-alignment, the instrument's (frontend) temperature is also measured (as soon as the instrument has warmed up completely). This temperature is used as a reference for a continuous temperature check during operation. If the current temperature deviates from the stored self-alignment temperature by a certain degree, a warning is displayed in the status bar indicating the resulting deviation in the measured power levels. A status bit in the `STATUs:QUEStionable:TEMPerature` register indicates a possible deviation.

Suffix:

<si>	irrelevant

Return values:

<Temperature>	Temperature in degrees Celsius.
Example:	`SOUR:TEMP:FRON?` Queries the temperature of the frontend sensor.

12.9.3 Customizing the screen layout

The remote commands required to set up the display of the R&S FSMR3 are described here.

12.9.3.1 General display settings and items

The following commands add, remove or customize general display and screen elements.

Useful commands for general display settings described elsewhere

- `DISPlay[:WINDow<n>]:MTABle` on page 520
- `DISPlay:FORMat` on page 402

Remote commands exclusive to general display settings

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`

Manual operation: See "Channel Bar" on page 278

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`

Manual operation: See "Diagram Footer (Annotation)" on page 279

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 278

DISPlay:SKEYs[:STATe] <State>

This command turns the softkey bar on and off.

Parameters:

<State> ON | OFF | 0 | 1

*RST: 1

Example: `DISP:SKEY:OFF`

Manual operation: See "Softkey Bar" on page 278

DISPlay:TBAR[:STATe] <State>

This command turns the toolbar on or off.

Parameters:

<State> ON | OFF | 1 | 0

*RST: 0

Example: `DISP:TBAR ON`

Manual operation: See "Toolbar" on page 278

DISPlay:TOUChscreen[:STATe] <State>

This command controls the touch screen functionality.

Parameters:

<State> ON | FRAMe | OFF

ON | 1
Touch screen is active for entire screen

OFF | 0
Touch screen is inactivate for entire screen

FRAMe
Touch screen is inactivate for the diagram area of the screen, but active for softkeys, toolbars and menus.

*RST: 1

Example: `DISP:TOUC:STAT ON`

Manual operation: See "Deactivating and Activating the Touchscreen" on page 276

DISPlay[:WINDow<n>]:TIME <State>

This command adds or removes the date and time from the display.

Suffix:

<n> irrelevant

Parameters:

<State> ON | OFF | 1 | 0

*RST: 0

Example: `DISP:TIME ON`

Manual operation: See "Date and Time" on page 279

DISPlay[:WINDow<n>]:TIME:FORMat <Format>

This command selects the time and date format.

Suffix:

<n> irrelevant

Parameters:

<Format> US | DE | ISO

DE
dd.mm.yyyy hh:mm:ss
24 hour format.

US
mm/dd/yyyy hh:mm:ss
12 hour format.

ISO
yyyy-mm-dd hh:mm:ss
24 hour format.

*RST: ISO

Example: `DISP:TIME ON`
Switches the screen display of date and time on.
`DISP:TIME:FORM US`
Switches the date and time format to US.

Manual operation: See "Date and Time Format" on page 277

SYSTem:DISPlay:FPANel[:STATe] <State>

This command includes or excludes the front panel keys when working with the remote desktop.

Parameters:

<State> ON | OFF | 0 | 1

*RST: 1

Manual operation: See "Front Panel" on page 279
See "Mini Front Panel" on page 280

SYSTem:DATE <Year>, <Month>, <Day>

Configures the date on the instrument.

Parameters:
<Year>

<Month>

<Day>

Example: `SYST:DATE 2020,04,23`

Manual operation: See "Set Date and Time" on page 277

SYSTem:TIME <Year>, <Month>, <Day>

Configures the time on the internal real-time clock on the instrument.

Parameters:

<Hour>	Range:	0 to 23
<Minutes>	Range:	0 to 59
<Seconds>	Range:	0 to 59

Example: `SYST:TIME 10,52,33`

Manual operation: See "Set Date and Time" on page 277

12.9.3.2 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<it>:DEFault<ci>` on page 574
- `HCOPy:CMAP<it>:HSL` on page 574
- `HCOPy:CMAP<it>:PDEFined` on page 575

Remote commands exclusive to customize the display colors and themes

---

DISPlay:CMAP<it>:DEFault<ci>

This command selects the color scheme for the display. The query returns the default color scheme.

Suffix:
<it> Irrelevant.

<ci> 1
Default color set 1 with a black background and white grid.
2
Default color set 2 with a white background and a black grid.
3
User-defined colors.
Suffix irrelevant for query

Return values:

<DefScheme> 1 | 2 | 3
The default color scheme used for the screen, as specified by the <ci> suffix.

Example:
```
DISP:CMAP:DEF2
```
Selects default setting 2 (white background and a black grid) for screen colors.
```
DISP:CMAP:DEF?
//Result: 2
```

Manual operation: See "Screen Colors" on page 282

DISPlay:CMAP<it>:HSL <hue>, <sat>, <lum>

This command selects the color for various screen elements in the display.

Suffix:

<it> 1..n
Selects the item for which the color scheme is to be defined.
For more information see Chapter 12.9.3.3, "CMAP suffix assignment", on page 604.

Parameters:

<hue> tint
Range: 0 to 1

<sat> saturation
Range: 0 to 1

<lum> brightness
Range: 0 to 1

Example:
```
DISP:CMAP2:HSL 0.3,0.8,1.0
```
Changes the grid color.

DISPlay:CMAP<it>:PDEFined <Color>

This command selects a predefined color for various screen elements.

Suffix:

<it> 1..n
Selects the item for which the color scheme is to be defined.
For more information see Chapter 12.9.3.3, "CMAP suffix assignment", on page 604.

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 285

DISPlay:THEMe:CATalog?

This command queries all available display themes.

Return values:

<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 "BlueOcean"`

Manual operation: See "Theme" on page 282

12.9.3.3 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

Suffix	Description
CMAP6 *)	Text Special 1
CMAP7 *)	Text Special 2
CMAP8	Trace 1
CMAP9	Trace 2
CMAP10	Trace 3
CMAP11	Marker Info Text
CMAP12	Limit Lines
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

Suffix	Description
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

12.9.4 Remote commands for language settings

SYSTem:DISPlay:LANGuage <Language>

Defines the language of the software-defined interface elements (such as softkeys, dialog boxes, diagram texts etc.).

Parameters:

<Language> 'EN' | 'ZH_CH' | 'ZH_TW' | 'JA' | 'KO' | 'RU'

'ZH_CH'
Simplified Chinese

'ZH_TW'
Traditional Chinese

*RST: 'EN'

Example: `SYST:DISP:LANG 'JA'`
Switches the language of the instrument to Japanese.

12.9.5 Configuring the network and remote control

The following commands are required to configure a network or remote control for the R&S FSMR3.

Useful commands for configuring remote control described elsewhere:

- SYSTem:LANGuage on page 655

Remote commands exclusive to configuring a network and remote control

SYSTem:COMMunicate:GPIB[:SELF]:ADDRess <Address>

This command sets the GPIB address of the R&S FSMR3.

Parameters:

<Address> Range: 0 to 30
*RST: (no influence on this parameter, factory default 20)

Example: `SYST:COMM:GPIB:ADDR 18`

Manual operation: See "GPIB Address" on page 352

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 353

SYSTem:COMMunicate:INTernal:REMote <State>

The instrument switches between manual and remote operation.

Note: If the local lockout function (`LLO` or `SYST:KLOC ON`) has been activated in the remote control mode, manual operation is no longer available until `GTL` (or `SYST:KLOC OFF`) is executed.

For details, see Chapter 11.6.7, "Returning to manual mode ("local")", on page 365.

Parameters:

<State> ON | OFF | 0 | 1

OFF | 0
The instrument switches from remote to manual operation. You can operate the instrument locally.

ON | 1
The instrument switches from manual to remote operation.

*RST: 0

Example: `SYST:COMM:INT:REM OFF`
The instrument switches from remote to manual operation (corresponds to @LOC or selecting the "Local" softkey).

Manual operation: See "Local" on page 365

SYSTem:DISPlay:LOCK <State>

Defines whether the "Display Update" function remains available in remote operation or not.

Parameters:
<State> ON | OFF | 0 | 1

OFF | 0
The function remains available.

ON | 1
The function is not available and the display is not updated during remote operation.

*RST: 0

SYSTem:DISPlay:UPDate <State>

This command turns the display during remote operation on and off.

If on, the R&S FSMR3 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 | 1 | 0

*RST: 0

Example: `SYST:DISP:UPD ON`

Manual operation: See "Remote Display Update" on page 353

SYSTem:ERRor:DISPlay <State>

This command the error display during remote operation on and off.

If activated, the R&S FSMR3 displays a message box at the bottom of the screen that contains the most recent type of error and the command that caused the error.

Parameters:
<State> ON | OFF | 1 | 0
*RST: 0

Example: `SYST:ERR:DISP ON`

Manual operation: See "Display Remote Errors" on page 354

SYSTem:IDENtify:FACTory

This command resets the query to `*IDN?` to its default value.

Manual operation: See "Reset to Factory String" on page 352

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 352

SYSTem:KLOCk <State>

This command locks or unlocks manual operation.

Parameters:
<State> **ON**
LLO (local lockout). The instrument can only be operated remotely, not locally.
OFF
Unlocks the manual operation mode. To operate the instrument locally again, you must execute `SYST:COMM:INT:REM OFF` or select the "Local" softkey first.
*RST: state not affected by *RST

Example: `SYST:KLOC ON`
Activates LLO (remote control only)

Example: `SYST:KLOC OFF`
`SYST:COMM:INT:REM OFF`
You can operate the instrument locally.

SYSTem:LXI:LANReset

This command resets the LAN configuration, as well as the "LAN" password and instrument description.

Manual operation: See " LAN Reset" on page 357

SYSTem:LXI:MDEScription <Description>

This command defines the "LAN" instrument description.

Parameters:
<Description> String containing the instrument description.

SYSTem:LXI:PASSword <Password>

This command defines the "LAN" password.

Parameters:
<Password> String containing the password.

Return values:
<Password>

Manual operation: See "LAN Password" on page 357

SYSTem:REVision:FACTory

Resets the response to the `REV?` query to the factory default value.

For example, after a user string was defined using the `SYSTem:REVision[:STRing]` on page 655 command. (`REV?` query available for HP emulation only, see `SYSTem:LANGuage` on page 655.)

Example: Define the system language:
`SYST:LANG '8563E'`
Set the response back to factory setting:
`SYS:REV:FACT`
Query the revision:
`REV?`
Response:
`920528`

Usage: Event

Manual operation: See "Resetting the Factory Revision" on page 356

12.9.6 Configuring HUMS

This section includes all commands needed for R&S HUMS remote operations.

DIAGnostic:HUMS:DELete:ALL

Deletes the complete HUMS data. This includes device history, device tags, SCPI connections, utilization history and utilizations.

Example: //Delete HUMS data
`DIAG:HUMS:DEL:ALL`

Usage: Event

Manual operation: See "Delete HUMS History" on page 360

DIAGnostic:HUMS:FORMat <DataFormat>

Selects the format for the queried HUMS data. You can query the HUMS data either in `JSON` format or `XML` format.

The defined format affects all other commands that return block data.

Parameters:
<DataFormat> JSON | XML

JSON
Returns the HUMS data in `JSON` format.

XML
Returns the HUMS data in `XML` format.

*RST: JSON

Example: //Return data in `JSON` format
`DIAG:HUMS:FORM JSON`

DIAGnostic:HUMS:STATe <State>

Turns the HUMS service and data collection on and off.

Parameters:
<State> ON | OFF | 1 | 0

*RST: ON

Example: //Turn on HUMS service
`DIAG:HUMS:STAT ON`

Manual operation: See "State" on page 359

DIAGnostic:HUMS:TAGS:ALL?

Queries all key-value tags that you have assigend to the instrument. Depending on the set data format, the queried data is either displayed in `XML` or `JSON` format. For more information about setting the data format, see `DIAGnostic:HUMS:FORMat` on page 611.

Return values:

<ID> — ID number of the defined tag.

<Key> — String containing key name of the defined tag.

<Value> — String containing value of the defined tag.

Example: //Return all tags
`DIAG:HUMS:TAGS:ALL?`
`1,"location","building_11",2,"time zone","CET"`

Usage: Query only

Manual operation: See "Value" on page 364

DIAGnostic:HUMS:TAGS:DELete:ALL

Deletes all key-value tags you have assigned to the instrument.

Example: //Delete all tags
`DIAG:HUMS:TAGS:DEL:ALL`

Usage: Event

Manual operation: See "Delete All" on page 364

DIAGnostic:HUMS:TAGS:DELete <ID>

Deletes a certain tag you assigned to your instrument, including its key and value.

Setting parameters:

<ID> — ID number of the tag you want to delete.
To identify the ID number, query all device tags from the system first. For more information, see `DIAGnostic:HUMS:TAGS:ALL?` on page 612.

Example: //Delete tag
`DIAG:HUMS:TAGS:DEL 0`

Usage: Setting only

Manual operation: See "Delete All" on page 364

DIAGnostic:HUMS:TAGS[:VALue] <ID>, <Key>, <Value>
DIAGnostic:HUMS:TAGS[:VALue]? <ID>

Adds or modifies a key-value pair (device tag).

The query returns the key-value pair for a given ID or an empty string if the ID is unknown.

Parameters:

<Key> String containing key name of the queried tag.

<Value> String containing value of the queried tag.

Parameters for setting and query:

<ID> 0 - 31
ID number of the tag you want to modify or query.
To identify the ID number, query all device tags from the system first. For more information, read here `DIAGnostic:HUMS:TAGS:ALL?` on page 612.

Example: //Add or modify a tag (tag 1)
`DIAG:HUMS:TAGS 1,'location','building_11'`

Manual operation: See "Add" on page 363

SYSTem:COMMunicate:REST:ENABle <RestState>

Turns communication via the REST API on and off.

Parameters:

<RestState> ON | OFF | 0 | 1

Example: //Return REST state
`SYST:COMM:REST:ENAB?`

Manual operation: See "REST" on page 361

SYSTem:COMMunicate:SNMP:COMMunity:RO <CommunityString>

Defines the SNMP community string for read-only access.

Prerequisites for this command:

- Select an SNMP version that supports communities (`SYSTem:COMMunicate:SNMP:VERSion` on page 616).

Setting parameters:

<CommunityString> String containing the community name.

Example: //Set community name
`SYST:COMM:SNMP:VERS V12`
`SYST:COMM:SNMP:COMM:RO 'ABC'`

Usage: Setting only

Manual operation: See "Access" on page 361

SYSTem:COMMunicate:SNMP:COMMunity:RW <CommunityString>

Defines the SNMP community string for read-write access.

Prerequisites for this command:

- Select an SNMP version that supports communities (`SYSTem:COMMunicate:SNMP:VERSion` on page 616).

Setting parameters:

<CommunityString> String containing the community name.

Example: //Set read-write access
`SYST:COMM:SNMP:VERS V12`
`SYST:COMM:SNMP:COMM:RW 'ABC'`

Usage: Setting only

Manual operation: See "Access" on page 361

SYSTem:COMMunicate:SNMP:CONTact <SnmpContact>

Defines the SNMP contact information for the administrator.

You can also set the contact information via SNMP if you do not set it via SCPI.

Parameters for setting and query:

<SnmpContact> String containing SNMP contact.
*RST: "" (empty string)

Example: //Set SNMP contact
`SYST:COMM:SNMP:CONT 'ABC'`

Manual operation: See "SNMP Contact" on page 363

SYSTem:COMMunicate:SNMP:LOCation <SnmpLocation>

Defines the SNMP location information for the administrator.

You can also set the location information via SNMP if you do not set it via SCPI.

Parameters for setting and query:

<SnmpLocation> String containing SNMP location.
*RST: "" (empty string)

Example: //Return SNMP location
`SYST:COMM:SNMP:LOC?`

Manual operation: See "SNMP Location" on page 363

SYSTem:COMMunicate:SNMP:USM:USER <Name>, <Access>, <Level>[, <Auth_pwd>[, <Priv_pwd>]]

Defines an SNMP user profile.

Prerequisites for this command:

- Select SNMPv3 (`SYSTem:COMMunicate:SNMP:VERSion` on page 616).

Setting parameters:

<Name> String containing name of the user.

<Access> RO | RW
Defines the access right a user can have.

<Level> NOAuth | AUTH | PRIVacy
Defines the security level.

<Auth_pwd> String containing the authentication password.

<Priv_pwd> String containing the privacy password.

Example: //Create user profile
```
SYST:COMM:SNMP:VERS V123
SYST:COMM:SNMP:USM:USER 'Peter','RO','PRIV',
'1234','XYZ'
```

Usage: Setting only

Manual operation: See "SNMPv3 Configuration" on page 361

SYSTem:COMMunicate:SNMP:USM:USER:ALL?

Queries the number of users and a list of all SNMP users for SNMPv3.

Prerequisites for this command:

- Select SNMPv3 (SYSTem:COMMunicate:SNMP:VERSion on page 616).

Return values:

<Count> Total number of registered SNMP users.

<Name> List of all user names as a comma-separated list.

Example: //Return all SNMP users
```
SYST:COMM:SNMP:USM:USER:ALL?
```

Usage: Query only

Manual operation: See "SNMPv3 Configuration" on page 361

SYSTem:COMMunicate:SNMP:USM:USER:DELete <UserName>

Deletes a specific SNMP user profile.

Setting parameters:

<UserName> String containing name of SNMP user profile to be deleted.

Example: //Delete SNMP user profile
```
SYST:COMM:SNMP:USM:USER:DEL "Peter"
```

Usage: Setting only

Manual operation: See "SNMPv3 Configuration" on page 361

SYSTem:COMMunicate:SNMP:USM:USER:DELete:ALL

Deletes all SNMP user profiles.

Example: //Delete all SNMP user profiles
`SYST:COMM:SNMP:USM:USER:DEL:ALL`

Usage: Event

Manual operation: See "SNMPv3 Configuration" on page 361

SYSTem:COMMunicate:SNMP:VERSion <SnmpVersion>

Selects the SNMP version.

Parameters for setting and query:

<SnmpVersion> OFF | V12 | V123 | V3 | DEFault

OFF
SNMP communication is off.

V12
SNMP communication with SNMPv2 or lower.

V123
SNMP communication with SNMPv2 and SNMPv3.

V3
SNMP communication with SNMPv3.

*RST: V123

Example: //Select the SNMP version
`SYST:COMM:SNMP:VERS V12`

Manual operation: See "SNMP" on page 360

12.9.7 Checking the system configuration

The following commands are required to check the system configuration on the R&S FSMR3.

Useful commands for obtaining system information described elsewhere:

- `DIAGnostic:SERVice:SINFo?` on page 624

Remote commands exclusive to obtaining system information:

DIAGnostic:INFO:CCOunt? <Relay>

This command queries how many switching cycles the individual relays have performed since they were installed.

Query parameters:

<Relay>

ATT5
Mechanical Attenuation 05 DB

ATT10
Mechanical Attenuation 10 DB

ATT20
Mechanical Attenuation 20 DB

ATT40
Mechanical Attenuation 40 DB

CAL
Mechanical Calibration Source

ACDC
Mechanical Attenuation Coupling

PREamp
Preamplifier Bypass

PRES
Preselector 1: PRESEL

RFAB
Preselector 1: RFAB

PRE
Preselector 1: PREAMP30MHZ

ATT
Preselector 1: ATTINPUT2

INP
Preselector 1: INPUT2

EXT_
Preselector 2: EXT_RELAIS

Return values:

<Cycles> Number of switching cycles.

Example: `DIAG:INFO:CCO? CAL`

Usage: Query only

Manual operation: See "Relays Cycle Counter" on page 308

DEVice:INFO:HWBand?

Queries the frequency bands used for measurement by the R&S FSMR3 hardware. The start frequency of each band is provided.

The bands are instrument-specific and depend on the currently defined RBW, VBW and YIG preselector state. The precise frequency bands are required to define correction data for the correct bands, in particular for frequency-drifting DUTs.

This query is only available in zero span mode.

Return values:
<StartFreq>

Example:

```
//Set to zero span mode
FREQ:SPAN 0
//Set RBW
BAND:RES 1000000
//Set VBW
BAND:VID 10000
//Activate YIG filter
INP:FILT:YIG ON
//Query used hardware bands
DEV:INFO:HWB?
//Result:
//0,50000000,450000000,1000000000,3000000000,4000000000,5200000000,...
```

The used bands for this instrument and measurement setup are:
0 Hz to 49999999 Hz
50000000 Hz to 44999999
450000000 Hz to 999999999
1000000000 Hz to 2999999999
3000000000 Hz to 3999999999
4000000000 Hz to 5199999999
5200000000 Hz to ...

Usage: Query only

DIAGnostic:SERVice:BIOSinfo?

This command queries the BIOS version of the CPU board.

Return values:
<BiosInformation> String containing the BIOS version.

Example: `DIAG:SERV:BIOS?`
Returns the BIOS version.

Usage: Query only

DIAGnostic:SERVice:HWINfo?

This command queries hardware information.

Return values:

<Hardware> 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
<subrevision>: subrevision of the component

Example: `DIAG:SERV:HWIN?`
Queries the hardware information.
`"FRONTEND|100001/003|1300.3009|03|01|00|00",`
`"MOTHERBOARD|123456/002|1300.3080|02|00|00|00",`
`...`

Usage: Query only

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:

Usage: Query only

SYSTem:ERRor:CLEar:ALL

This command deletes all contents of the "System Messages" table.

Example: `SYST:ERR:CLE:ALL`

SYSTem:DFPRint

Creates an `*.xml` file with information on installed hardware, software, image and FPGA versions. The `*.xml` file is stored under `C:\R_S\INSTR\devicedata\xml\DeviceFootprint_*` on the instrument. It is also output to the remote interface as binary data.

Return values:

<InfoFile> Contents of the xml file in binary format.

Example: `SYST:DFPR?`

Manual operation: See "Save Device Footprint" on page 303

SYSTem:ERRor:CLEar:REMote

This command deletes all contents of the "Remote Errors" table.

Note: The remote error list is automatically cleared when the R&S FSMR3 is shut down.

Example: `SYST:ERR:CLE:REM`

Manual operation: See "Display Remote Errors" on page 354
See "Clear Error List" on page 365

SYSTem:ERRor:LIST? [<MessType>]

This command queries the error messages that occur during R&S FSMR3 operation.

Query parameters:

<MessType> SMSG | REMote

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 FSMR3 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

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 11.2, "Status reporting system", on page 324.

Usage: Query only

SYSTem:FIRMware:UPDate <Directory>

This command starts a firmware update using the *.msi files in the selected directory. The default path is `D:\FW_UPDATE`. The path is changed via the `MMEMory:COMMent` command. To store the update files the `MMEMory:DATA` command is used.

Only user accounts with administrator rights can perform a firmware update.

Setting parameters:
<Directory>

Example: `SYST:FIRM:UPD 'D:\FW_UPDATE'`
Starts the firmware update from directory "`D:\FW_UPDATE`".

SYSTem:FORMat:IDENt <IDNFormat>

This command selects the response format to the `*IDN?` query.

Parameters:

<IDNFormat>

LEGacy
Format is compatible to R&S FSP/FSU/FSQ/FSG family.

NEW | FSL
R&S FSMR3 format
Format is also compatible to the R&S FSL and R&S FSV family

*RST: not reset!

Example: `SYST:FORM:IDEN LEG`
Adapts the return value of *IDN? to the R&S FSP/FSU/FSQ family.

Manual operation: See "*IDN Format" on page 353

SYSTem:SECurity[:STATe] <State>

Activates or queries secure user mode.

Note: Before you activate secure user mode, store any instrument settings that are required beyond the current session, such as predefined instrument settings, transducer files, or self-alignment data.

Note: Initially after installation of the R&S FSMR3-K33 option, secure user mode must be enabled manually once before remote control is possible. This is necessary to prompt for a change of passwords.

For details on the secure user mode see Chapter 9.2, "Protecting data using the secure user mode", on page 238.

Parameters:

<State> ON | OFF | 0 | 1

ON | 1
The R&S FSMR3 automatically reboots and starts in secure user mode. In secure user mode, no data is written to the instrument's internal solid-state drive. Data that the R&S FSMR3 normally stores on the solid-state drive is redirected to SDRAM.

OFF | 0
The R&S FSMR3 is set to normal instrument mode. Data is stored to the internal solid-state drive.
Note: this parameter is for query only. Secure user mode cannot be deactivated via remote operation.

*RST: 0

Manual operation: See "SecureUser Mode" on page 299

12.9.8 Signal generator control commands

The remote commands required to control connected generators are described here.

CONFigure:GENerator:CONNection:CSTate?

Queries the state of the connected signal generator.

Return values:
<ConnectionState>

UNKNown
no signal generator connected

CONNected
connection established

NCONnected
connection could not be established, possibly due to an incompatible instrument or invalid IP address

Example: `CONFigure:GENerator:CONNection:CSTate?`

Usage: Query only

Manual operation: See "Test Connection" on page 301
See "Connect/Disconnect" on page 301

CONFigure:GENerator:CONNection[:STATe] <State>

Connects or disconnects the signal generator specified by `CONFigure:GENerator:IPConnection:ADDRess` on page 623. The IP address must be specified before you use this command.

Parameters:
<State> ON | OFF | 0 | 1

OFF | 0
Disconnects the generator.

ON | 1
Connects the generator.

*RST: 0

Example:
```
CONF:GEN:IPC:ADDR '192.168.114.90'
CONF:GEN:CONN:STAT ON
```

Manual operation: See "Test Connection" on page 301
See "Connect/Disconnect" on page 301

CONFigure:GENerator:IPConnection:ADDRess <IPAddress>

The TCPIP address or computer name of the signal generator connected to the R&S FSMR3 via LAN.

The IP address / computer name is maintained after a [PRESET], and is transferred between applications.

Parameters:
<IPAddress> IP address or computer name

Example:
```
CONF:GEN:IPC:ADDR '192.168.114.90'
```

Manual operation: See "IP Address or Computer name of Signal Generator" on page 301

12.9.9 Using service functions

DIAGnostic:SERVice:SFUNction <ServiceFunction>
DIAGnostic:SERVice:SFUNction? <ServiceFunction>

This command starts a service function.

The service functions are available after you have entered the level 1 or level 2 system password.

Parameters for setting and query:
<ServiceFunction> String containing the ID of the service function.
The ID of the service function is made up out of five numbers, separated by a point.
• function group number
• board number

• function number
• parameter 1 (see the Service Manual)
• parameter 2 (see the Service Manual)

Return values:
<Result>

Example:
```
DIAG:SERV:SFUN 'Function1'
DIAG:SERV:SFUN? 'Function2'
```

Manual operation: See "Service Function" on page 307
See "Send" on page 307

DIAGnostic:SERVice:SFUNction:LASTresult?

This command queries the results of the most recent service function you have used.

Return values:
<Result>

Usage: Query only

DIAGnostic:SERVice:SFUNction:RESults:DELete

This command deletes the results in the output buffer for service functions you have used.

Usage: Event

Manual operation: See "Clear Results" on page 307

DIAGnostic:SERVice:SFUNction:RESults:SAVE [<FileName>]

This command saves the results in the output buffer for service functions you have used to a file.

If no <FileName> parameter is provided, the results are stored to `C:\R_S\INSTR\results\Servicelog.txt`.

Note that if the buffer is empty, the function returns an error.

Parameters:
<FileName> String containing the path and file name.

Manual operation: See "Save Results" on page 307

DIAGnostic:SERVice:SINFo?

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 `C:\R_S\INSTR\USER` directory on the instrument.

As a result of this command, the created file name (including the drive and path) is returned.

You can use the resulting file name information as a parameter for the `MMEM:COPY` command to store the file on the controller PC.

(See `MMEMory:COPY` on page 560)

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:\R_S\INSTR\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 10.4.2, "Information on versions and options", on page 294)
<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:\Program Files (x86)\Rohde-Schwarz\FSMR3000\<version>\user\FSMR3026_1345.`
`MMEM:COPY "C:\Program Files (x86)\Rohde-Schwarz\FSMR3000\<version>\user\F`
`"S:\Debug\C:\Program Files (x86)\Rohde-Schwarz\FSMR3000\<version>\user\FS`

Usage: Query only

Manual operation: See "Create R&S Support Information" on page 303

SYSTem:PASSword[:CENable] <arg0>

Provides a password for subsequent service functions.

Parameters:

<arg0> string

Example: `SYST:PASS:CEN '894129'`

Manual operation: See "Password" on page 307

SYSTem:PASSword:RESet

Clears any previously provided password and returns to the most restrictive service level.

Manual operation: See "Password" on page 307

12.9.10 Remote commands for synchronizing parameters

The commands for manual operation are described in Chapter 10.6, "Synchronizing measurement channel configuration", on page 308

12.9.10.1 Predefined parameter coupling

INSTrument:COUPle:ABIMpedance <State>

This command turns synchronization of the amplitude baseband impedance configuration between measurement channels on and off.

Parameters:

<State> ALL | NONE

ALL
Turns on synchronization.

NONE
Turns off synchronization.

*RST: NONE

Example: `INST:COUP:ABIM ALL`

INSTrument:COUPle:ACDC <State>

This command turns synchronization of the AC / DC Coupling state between measurement channels on and off.

Parameters:

<State> ALL | NONE

ALL
Turns on synchronization.

NONE
Turns off synchronization.

*RST: ALL

Example: `INST:COUP:ACDC ALL`
Synchronizes the "AC/DC Coupling" parameter.

Manual operation: See "Synchronizing parameters across all measurement channels" on page 309

INSTrument:COUPle:ATTen <State>

This command turns synchronization of the attenuation and unit between measurement channels on and off.

Parameters:

<State> ALL | NONE

ALL
Turns on synchronization.

NONE
Turns off synchronization.

*RST: ALL

Example: `INST:COUP:ATT ALL`
Synchronizes the attenuation.

Manual operation: See "Synchronizing parameters across all measurement channels" on page 309

INSTrument:COUPle:AUNit <State>

This command turns synchronization of the amplitude unit configuration between measurement channels on and off.

Parameters:

<State> ALL | NONE

ALL
Turns on synchronization.

NONE
Turns off synchronization.

*RST: NONE

Example: `INST:COUP:AUN ALL`

Manual operation: See "Synchronizing parameters across all measurement channels" on page 309

INSTrument:COUPle:BANDwidth <State>
INSTrument:COUPle:BWIDth <State>

This command turns synchronization of the resolution bandwidth (and filter type) between measurement channels on and off.

Parameters:

<State> ALL | NONE

ALL
Turns on synchronization.

NONE
Turns on synchronization.

*RST: NONE

Example: `INST:COUP:BWID ALL`
Synchronizes the resolution bandwidth.

INSTrument:COUPle:CENTer <State>

This command turns synchronization of the frequency between measurement channels on and off.

Parameters:

<State> ALL | NONE

ALL
Turns on synchronization.

NONE
Turns off synchronization.

*RST: ALL

Example: `INST:COUP:CENT ALL`
Synchronizes the center frequency.

Manual operation: See "Synchronizing parameters across all measurement channels" on page 309

INSTrument:COUPle:DEMod <State>

This command turns synchronization of the audio demodulator configuration between measurement channels on and off.

Parameters:

<State> ALL | NONE

ALL
Turns on synchronization.

NONE
Turns off synchronization.
*RST: NONE

Example: `INST:COUP:DEM ALL`
Synchronizes the audio demodulator configuration.

INSTrument:COUPle:GAIN <State>

This command turns synchronization of the preamplifier configuration between measurement channels on and off.

Parameters:
<State> ALL | NONE

ALL
Turns on synchronization.

NONE
Turns off synchronization.
*RST: NONE

Example: `INST:COUP:GAIN ALL`
Synchronizes the preamplifier configuration.

Manual operation: See "Synchronizing parameters across all measurement channels" on page 309

INSTrument:COUPle:IMPedance <State>

This command turns synchronization of the impedance configuration between measurement channels on and off.

Parameters:
<State> ALL | NONE

ALL
Turns on synchronization.

NONE
Turns off synchronization.
*RST: NONE

Example: `INST:COUP:IMP ALL`

Manual operation: See "Synchronizing parameters across all measurement channels" on page 309

INSTrument:COUPle:LIMit <State>

This command turns synchronization of limit results between measurement channels on and off.

Parameters:
<State> ALL | NONE

ALL
Turns on synchronization.
Limit lines have to be compatible to the x-axis and y-axis configuration for successful synchronization.

NONE
Turns off synchronization.

*RST: ALL

Example: `INST:COUP:LIM ALL`
Synchronizes the limit values.

Manual operation: See "Synchronizing parameters across all measurement channels" on page 309

INSTrument:COUPle:LLINes <State>

This command turns synchronization of the limit lines between measurement channels on and off.

Parameters:

<State> ALL | NONE

ALL
Turns on synchronization.

NONE
Turns off synchronization.

*RST: NONE

INSTrument:COUPle:MARKer <State>

This command turns synchronization of the marker frequency between measurement channels on and off.

Parameters:

<State> ALL | NONE

ALL
Turns on synchronization.

NONE
Turns off synchronization.

*RST: NONE

Example: `INST:COUP:MARK ALL`
Synchronizes the receiver frequency and the marker frequency.

INSTrument:COUPle:PRESel <State>

This command turns synchronization of the preselector state between measurement channels on and off.

Parameters:

<State> ALL | NONE

ALL
Turns on synchronization.

NONE
Turns off synchronization.

*RST: ALL

Example: `INST:COUP:PRES ALL`
Synchronizes the preselector configuration.

INSTrument:COUPle:RLEVel <State>

This command turns synchronization of the reference level between measurement channels on and off.

Parameters:

<State> ALL | NONE

ALL
Turns on synchronization.

NONE
Turns off synchronization.

*RST: NONE

Example: `INST:COUP:RLEV ALL`

Manual operation: See "Synchronizing parameters across all measurement channels" on page 309

INSTrument:COUPle:SPAN <State>

This command turns synchronization of the start and stop frequency between measurement channels on and off.

Parameters:

<State> ALL | NONE

ALL
Turns on synchronization.

NONE
Turns off synchronization.

*RST: NONE

Example: `INST:COUP:SPAN ALL`
Synchronizes the start and stop frequency.

Manual operation: See "Synchronizing parameters across all measurement channels" on page 309

INSTrument:COUPle:VBW <State>

This command turns synchronization of the video bandwidth between measurement channels on and off.

Parameters:

<State> ALL | NONE

ALL
Turns on synchronization.

NONE
Turns off synchronization.

*RST: NONE

Example:
```
INST:COUP:VBW ALL
```
Synchronizes the video bandwidth.

Manual operation: See "Synchronizing parameters across all measurement channels" on page 309

12.9.10.2 User-defined parameter coupling

INSTrument:COUPle:USER<uc> <ChannelName>, <Window>, <Parameter>, <ChannelName>, <Window>, <Parameter>, <arg6>, <State>

This command edits an existing user-defined coupling definition.

The parameters for this command are identical to `INSTrument:COUPle:USER<uc>:NEW?`. Note, however, that for `INSTrument:COUPling:USER<uc>`, the last two parameters (<Direction> and <State>) are **not optional**.

Note: Make sure to specify the right index number via the `USER` suffix.

Suffix:

<uc> Index of a user-defined parameter coupling. To obtain the list of indexes for currently defined coupling, see `INSTrument:COUPle:USER<uc>:NUMBers:LIST?`.

Parameters:

<ChannelName> String containing the name of a measurement channel or channel type.

<Name>
To synchronize two specific measurement channels.

'All Spectrum'
To synchronize all spectrum channels.

'All IQ Analyzer'
To synchronize all I/Q analyzer channels.

'All Analog Demod'
To synchronize all analog demodulation channels.

'All Channels'
To synchronize all channels, regardless of their type.

<Window> String containing the name of a measurement window.

<Name>
To synchronize a specific window (only possible in the Analog Demodulation application).

'All Windows'
To synchronize all measurement windows.

<Parameter> String containing the name of a synchronizable parameter.

<ChannelName> String containing the name of a measurement channel or channel type.
The second channel name is only necessary for synchronization between two specific channels. If you synchronize all channels of the same type or all channels, the string has to be empty.

<Window> String containing the name of a measurement window.
The second window name is only necessary for synchronization between two specific channels. If you synchronize all channels of the same type or all channels, the string has to be empty.

<Parameter> String containing the name of a synchronizable parameter.
The second parameter name is only necessary for synchronization between two specific channels. If you synchronize all channels of the same type or all channels, the string has to be empty.

<arg6> LTOR | RTOL | BIDir

Selects the direction in which synchronization works.

BIDir
Changes of a parameter are applied both ways (from channel 1 to channel 2 and vice versa).

LTOR
Changes of a parameter are applied from channel 1 to channel 2, but not the other way around.

RTOL
Changes of a parameter are applied from channel 2 to channel 1, but not the other way around.

<State> ON | OFF | 0 | 1

Enables or disables the coupling

OFF | 0
Switches the coupling off

ON | 1
Switches the coupling on

*RST: 1

Example:
```
INST:COUP:USER3 'Spectrum1','All
Windows','Attenuation','Spectrum 2','All
Windows','Attenuation',BID,ON
```
Synchronizes the attenuation between the channels named 'Spectrum1' and 'Spectrum 2' in both directions and turns on the coupling.

Manual operation: See "Edit coupling definition" on page 312

INSTrument:COUPle:USER<uc>:CHANnel:LIST?

This command queries the names of the measurement channels that can be synchronized.

Suffix:
<uc> irrelevant

Return values:
<SynchronizableChannel> Comma-separated list of strings

All channels that can be synchronized.

Example:
```
INST:COUP:USER:CHAN:LIST?
```
Result:
```
'SPEC1','AD1','All Spectrum','All
Channels','All Analog Demod'
```

Usage: Query only

Manual operation: See "Channel 1 / Channel 2" on page 314

INSTrument:COUPle:USER<uc>:ELEMent:LIST? [<ChannelName>, <Parameter>]

This command queries parameters that can be synchronized.

Suffix:
<uc> irrelevant

Query parameters:

<ChannelName> Optional SCPI parameter.
String containing the name of a measurement channel.

<Parameter> Optional SCPI parameter.
String containing the name of a parameter that you can synchronize.

Return values:

<SynchronizableParameter> Comma-separated list of parameters.

No parameters provided
Parameters that can be synchronized for all channels

Channel name provided
Parameters that can be synchronized for the selected channel

Parameter and channel name provided
Parameters that can be synchronized with the specified parameter for the selected channel.

Example: `INST:COUP:USER:ELEM:LIST?`
Result: all parameters that can be coupled:
`'AC DC Coupling', 'Attenuation', 'Center Frequency', 'Display Lines', 'Frequency Marker 1',...`

Example: `INST:COUP:USER:ELEM:LIST? 'Spectrum'`
Result: all parameters that can be coupled in the 'Spectrum' channel:
`'AC DC Coupling','Attenuation','Center Frequency','Display Lines',...`

Example: `INST:COUP:USER:ELEM:LIST? 'Spectrum', 'Attenuation'`
Result: all parameters that can be coupled to 'Attenuation' in the 'Spectrum' channel:
`'Attenuation'`
(Attenuation is the only parameter that can be coupled to attenuation.)

Usage: Query only

Manual operation: See "Coupling Element 1 / Coupling Element 2" on page 314

INSTrument:COUPle:USER<uc>:INFO

This command queries additional information about the specified user-defined parameter coupling.

Suffix:

<uc> Index of a user-defined parameter coupling. To obtain the list of indexes for currently defined coupling, see `INSTrument:COUPle:USER<uc>:NUMBers:LIST?`.

Return values:

<Information> String containing the message as displayed in the coupling manager.
If the coupling message contains no message, an empty string is returned.

Example: `INST:COUP:USER2:INFO?`
Queries possible information about the user coupling with index 2.
Result:
`'Only one limit line allowed'`

Manual operation: See "Info" on page 313

INSTrument:COUPle:USER<uc>:NEW? <ChannelName>, <Window>, <Parameter>, <ChannelName>, <Window>, <Parameter>, <Direction>, <State>

This command creates a new user-defined parameter coupling.

After the new coupling has been created, the command returns the index number of the new coupling. Therefore, the command is implemented as a query.

Suffix:

<uc> irrelevant

Query parameters:

<ChannelName> String containing the name of a measurement channel or channel type.

<Name>
To synchronize two specific measurement channels.

'All Spectrum'
To synchronize all spectrum channels.

'All IQ Analyzer'
To synchronize all I/Q analyzer channels.

'All Analog Demod'
To synchronize all analog demodulation channels.

'All Channels'
To synchronize all channels, regardless of their type.

<Window> String containing the name of a measurement window.

<Name>
To synchronize a specific window (only possible in the Analog Demodulation application).

'All Windows'
To synchronize all measurement windows.

<Parameter> String containing the name of a synchronizable parameter.

<ChannelName>	String containing the name of a measurement channel or channel type. The second channel name is only necessary for synchronization between two specific channels. If you synchronize all channels of the same type or all channels, the string has to be empty.
<Window>	String containing the name of a measurement window. The second window name is only necessary for synchronization between two specific channels. If you synchronize all channels of the same type or all channels, the string has to be empty.
<Parameter>	String containing the name of a synchronizable parameter. The second parameter name is only necessary for synchronization between two specific channels. If you synchronize all channels of the same type or all channels, the string has to be empty.
<Direction>	LTOR | RTOL | BIDir Optional: Selects the direction in which synchronization works. **BIDir** Changes of a parameter are applied both ways (from channel 1 to channel 2 and vice versa). **LTOR** Changes of a parameter are applied from channel 1 to channel 2, but not the other way around. **RTOL** Changes of a parameter are applied from channel 2 to channel 1, but not the other way around.
<State>	ON | OFF | 0 | 1 Optional. Enables or disables coupling. **OFF | 0** Switches the coupling off **ON | 1** Switches the coupling on *RST: 1

Return values:

<Index>	Index number of the new user-defined coupling. Note that the returned index numbers do not necessarily have to be the same as those shown in the user interface.

Example:

```
INST:COUP:USER:NEW? 'Spectrum1','All
Windows','Attenuation','Spectrum2','All
Windows','Attenuation',BID,ON
```

Result:

```
3
```

Synchronizes the attenuation between the channels named 'Spectrum1' and 'Spectrum2' in both directions and turns on the coupling. Also returns the index number of the user-defined coupling.

Example: `INST:COUP:USER:NEW? 'All Spectrum','All Windows','Attenuation','','','',BID,ON`
Result:
`3`
Synchronizes the attenuation between all Spectrum channels in both directions and turns on the coupling. Also returns the index number of the user-defined coupling.

Usage: Query only

Manual operation: See "Parameter 1 / Parameter 2" on page 312
See "Add New User Coupling" on page 313

INSTrument:COUPle:USER<uc>:NUMBers:LIST?

This command queries the index numbers of user-defined parameter couplings. The index numbers are used to refer to the specific coupling in remote commands with a `USER<uc>` suffix.

Suffix:
<uc> irrelevant

Return values:
<Index> Comma-separated list of strings

Index numbers of all available user-defined couplings
Note that the returned index numbers are not necessarily the same as those shown in the user interface.

Example: `INST:COUP:USER:NUMB:LIST?`
Result:
`'1','2','4'`
Number '3' is not returned, because a coupling with that index does not exist anymore.

Usage: Query only

Manual operation: See "Index" on page 312

INSTrument:COUPle:USER<uc>:RELation <Direction>

This command selects the direction in which synchronization works.

Note that the command is not available if you synchronize over all channels or all channels of the same application.

Suffix:
<uc> Index of a user-defined parameter coupling. To obtain the list of indexes for currently defined coupling, see `INSTrument:COUPle:USER<uc>:NUMBers:LIST?`.

Parameters:
<Direction> LTOR | RTOL | BIDir

BIDir
Changes of a parameter are applied both ways (from channel 1 to channel 2 and vice versa).

LTOR
Changes of a parameter are applied from channel 1 to channel 2, but not the other way around.

RTOL
Changes of a parameter are applied from channel 2 to channel 1, but not the other way around.

Example: `INST:COUP:USER:REL BID`
Selects bidirectional changes for the user-defined coupling with the index number 1.

Manual operation: See "Direction" on page 313

INSTrument:COUPle:USER<uc>:REMove [<Scope>]

This command deletes a user-defined coupling mechanism.

Suffix:
<uc>
Index of a user-defined parameter coupling. To obtain the list of indexes for currently defined coupling, see `INSTrument:COUPle:USER<uc>:NUMBers:LIST?`.

Parameters:
<Scope>
ALL
Optional SCPI parameter, used instead of the <uc> suffix.
Deletes all user-defined couplings.

Example: `INST:COUP:USER3:REM`
Removes the user-defined coupling with the index number 3.

Manual operation: See "Delete coupling definition" on page 313
See "Delete All" on page 313

INSTrument:COUPle:USER<uc>:STATe <State>

Enables or disables the specified user-defined parameter coupling.

Suffix:
<uc>
Index of a user-defined parameter coupling. To obtain the list of indexes for currently defined coupling, see `INSTrument:COUPle:USER<uc>:NUMBers:LIST?`.

Parameters:
<State>
ON | OFF | 1 | 0

OFF | 0
Switches the function off

ON | 1
Switches the function on

*RST: 0

Example: `INST:COUP:USER2:STAT ON`
Turns on the coupling with the index number 2.

Manual operation: See "State" on page 312

INSTrument:COUPle:USER<uc>:WINDow:LIST? [<ChannelName>, <Parameter>]

This command queries the measurement windows that can be synchronized with another channel (or measurement window).

Note that synchronizing with a specific measurement window is only possible in the Analog Demodulation application.

Suffix:
<uc> irrelevant

Query parameters:
<ChannelName> Optional SCPI parameter.
String containing the name of a measurement channel.

<Parameter> Optional SCPI parameter.
String containing the name of a parameter that you can synchronize.

Return values:
<SyncWindow> comma-separated list of strings

'All Windows'
All windows can be synchronized. This value is always returned if no parameters are provided with the command.

Comma-separated list of strings
String containing the names of the measurement windows that can be synchronized.
This value is only available for marker coupling, which can be set independently of the measurement window.

Example: `INST:COUP:USER:WIND:LIST?`
Result:
`'All Windows'`

Example: `INST:COUP:USER:WIND:LIST? 'Analog Demod','Frequency Marker 1'`
Result:
`'All Windows','1','2','3','4','5','6'`
The "Specifics for Window" list contains the entries "All Windows" and each of the windows 1 to 6. The frequency marker 1 can be synchronized in any or all of the windows in the 'Analog Demod' channel.

Usage: Query only

Manual operation: See "Specifics for Window" on page 314

12.9.10.3 Generator coupling

INSTrument:COUPle:GENerator:CENTer:OFFSet <Frequency>

Defines a fixed offset to the center frequency of the R&S FSMR3 for the coupled signal generator.

This command requires the `INSTrument:COUPle:GENerator:STATe` and the `INSTrument:COUPle:GENerator:CENTer[:STATe]` to be ON.

Parameters:

<Frequency> Default unit: HZ

Example:

```
INST:COUP:GEN:STAT ON
INST:COUP:GEN:CENT:STAT ON
INST:COUP:GEN:CENT:OFFS 5
```

INSTrument:COUPle:GENerator:CENTer[:STATe] <State>

Couples the center frequency of the connected signal generator to the R&S FSMR3.

This command requires the `INSTrument:COUPle:GENerator:STATe` to be ON.

Parameters:

<State> ON | OFF | 0 | 1

OFF | 0
Switches the function off

ON | 1
Switches the function on

*RST: 0

Example:

```
INST:COUP:GEN:STAT ON
INST:COUP:GEN:CENT:STAT ON
```

INSTrument:COUPle:GENerator:RLEVel:OFFSet <Level>

Defines a fixed offset to the reference level of the R&S FSMR3 for the coupled signal generator.

This command requires the `INSTrument:COUPle:GENerator:STATe` and the `INSTrument:COUPle:GENerator:RLEVel[:STATe]` to be ON.

Parameters:

<Level> Default unit: DB

Example:
```
INST:COUP:GEN:STAT ON
INST:COUP:GEN:RLEV:STAT ON
INST:COUP:GEN:RLEV:OFFS 5
```

INSTrument:COUPle:GENerator:RLEVel[:STATe] <State>

Couples the reference level of the connected signal generator to the R&S FSMR3.

This command requires the `INSTrument:COUPle:GENerator:STATe` to be ON.

Parameters:

<State> ON | OFF | 0 | 1

OFF | 0
Switches the function off

ON | 1
Switches the function on

*RST: 0

Example:
```
INST:COUP:GEN:STAT ON
INST:COUP:GEN:RLEV:STAT ON
```

INSTrument:COUPle:GENerator:STATe <State>

Enables or disables coupling between the R&S FSMR3 and a connected signal generator.

Parameters:

<State> ON | OFF | 0 | 1

OFF | 0
Switches the function off

ON | 1
Switches the function on

*RST: 0

Example:
```
INST:COUP:GEN:STAT ON
```

12.9.11 Programming examples for instrument setup

12.9.11.1 Programming example: Working with the application starter

The following programming example demonstrates how to use the remote commands for the application starter.

```
//Add the notepad application to the "External" tab of the application starter manually
//via the graphical user interface of the instrument

//Select the notepad application for further configuration
SYSTem:PLUGin:APPStarter:SELect 'External','Notepad++'
```

```
//Change the displayed name of the notepad application
SYSTem:PLUGin:APPStarter:NAME 'MyEditor'
//Add an icon to display in the dialog box
SYSTem:PLUGin:APPStarter:ICON 'C:\temp\script_icon.png','0'
//Define the working directory for the application
SYSTem:PLUGin:APPStarter:DIRectory 'C:\Scripts\'
//Define the file to open in the editor
SYSTem:PLUGin:APPStarter:PARams 'freqsweep.inp'
//Execute the application
SYSTem:PLUGin:APPStarter:EXECute 'External','MyEditor'

//*************************************************************************************
//Configure the default IECWIN application to execute a predefined script.
//Add the IECWIN application to the "External" tab of the application starter manually
//via the graphical user interface of the instrument
SYSTem:PLUGin:APPStarter:SELect 'External','IECWIN'
//Define the working directory for the application
SYSTem:PLUGin:APPStarter:DIRectory 'C:\Scripts\'
//Define the script to perform in the IECWIN application
SYSTem:PLUGin:APPStarter:PARams 'freqsweep.inp'
//Execute the script
SYSTem:PLUGin:APPStarter:EXECute 'External','IECWIN'
```

12.10 Using the status register

For more information on the contents of the status registers see:

- Remote control via SCPI
- Chapter 11.2.2.4, "STATus:OPERation register", on page 328
- Chapter 11.2.2.6, "STATus:QUEStionable:ACPLimit register", on page 330
- Chapter 11.2.2.7, "STATus:QUEStionable:EXTended register", on page 331
- Chapter 11.2.2.9, "STATus:QUEStionable:FREQuency register", on page 332
- Chapter 11.2.2.10, "STATus:QUEStionable:LIMit register", on page 333
- Chapter 11.2.2.11, "STATus:QUEStionable:LMARgin register", on page 333
- Chapter 11.2.2.12, "STATus:QUEStionable:POWer register", on page 334
- Chapter 11.2.2.13, "STATus:QUEStionable:TEMPerature register", on page 335
- Chapter 11.2.2.14, "STATus:QUEStionable:TIMe register", on page 335

12.10.1 General status register commands

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

12.10.2 Reading out the CONDition part

STATus:OPERation:CONDition?
STATus:QUEStionable:CONDition?
STATus:QUEStionable:ACPLimit:CONDition? <ChannelName>
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.

Suffix:
<n> Window

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

12.10.3 Reading out the EVENt part

STATus:OPERation[:EVENt]?
STATus:QUEStionable[:EVENt]?
STATus:QUEStionable:ACPLimit[:EVENt]? <ChannelName>
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.

Suffix:

<n> Window

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

12.10.4 Controlling the ENABle part

STATus:OPERation:ENABle <SumBit>
STATus:QUEStionable:ENABle <SumBit>
STATus:QUEStionable:ACPLimit:ENABle <SumBit>,<ChannelName>
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.

Suffix:

<n>	Window

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.

12.10.5 Controlling the negative transition part

STATus:OPERation:NTRansition <SumBit>
STATus:QUEStionable:NTRansition <SumBit>
STATus:QUEStionable:ACPLimit:NTRansition <SumBit>,<ChannelName>
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.

Suffix:

<n>	Window

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.

12.10.6 Controlling the positive transition part

STATus:OPERation:PTRansition <SumBit>
STATus:QUEStionable:PTRansition <SumBit>
STATus:QUEStionable:ACPLimit:PTRansition <SumBit>,<ChannelName>
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.

Suffix:

<n>	Window

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.

12.11 Commands for remote instrument operation

The following commands are required to shutdown or reboot the R&S FSMR3 from a remote PC.

SYSTem:CLOGging <State>

This command turns logging of remote commands on and off.

Parameters:

<State> ON | OFF | 1 | 0

ON | 1
Writes all remote commands that have been sent to a file.
The destination is `C:\R_S\INSTR\ScpiLogging\ScpiLog.<no.>`.
where <no.> is a sequential number
A new log file is started each time logging was stopped and is restarted.

OFF | 0

*RST: 0

Manual operation: See "I/O Logging" on page 353

SYSTem:REBoot

This command reboots the instrument, including the operating system.

SYSTem:SHUTdown

This command shuts down the instrument.

SYSTem:PRESet:COMPatible <OpMode>

This command defines the operating mode that is activated when you switch on the R&S FSMR3 or press the [PRESET] key.

Parameters:

<OpMode> **SANalyzer**
Defines Signal and Spectrum Analyzer operating mode as the presetting.

Manual operation: See "Preset Mode" on page 298

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 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 Chapter 11.2.2.8, "STATus:QUEStionable:EXTended:INFO register", on page 331).

Parameters:

<MessageType> ALL | INFO | WARNing | FATal | ERRor | 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 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

DIAGnostic:SERVice:INPut:MC[:DISTance] <Bandwidth>

This command selects the distance of the peaks of the microwave calibration signal for calibration of the YIG filter.

Parameters:

<Bandwidth> WIDE | SMALl

SMALl
Small offset of combline frequencies.

WIDE
Wide offset of combline frequencies.

Manual operation: See "Calibration Frequency MW" on page 306

12.12 Recording SCPI Commands Automatically

Using the SCPI Recorder functions, you can create a SCPI script directly on the instrument and then export the script for use on the controller.

See also Chapter 11.5, "Automating tasks with remote command scripts", on page 339.

SYSTem:SRECorder[:AUTO] <State>

If enabled, the SCPI Recorder automatically records the required SCPI commands and parameter values for the settings and functions you use while operating the R&S FSMR3.

See Chapter 11.5, "Automating tasks with remote command scripts", on page 339.

Parameters:

<State> ON | OFF | 0 | 1

OFF | 0
Switches the function off

ON | 1
Switches the function on

*RST: 0

Example:
```
//Enable automatic rcording
SYST:SREC:AUTO ON
//Include synchronization commands
SYST:SREC:SYNC ON
//Perform measurement task to record required commands
//...
//Display recorded commands
SYST:REC:DATA?
//Store commands to a file in python format
SYST:SREC:EXP PYTH, 'C:\TEMP\SCPI_EXAMPLE.py'
//Clear currently recorded commands
SYST:SREC:CLE
```

Manual operation: See "Auto Recording" on page 342

SYSTem:SRECorder:CLEar

Removes all recorded commands from the current SCPI command list.

Usage: Event

Manual operation: See "Clear All" on page 344

SYSTem:SRECorder:DATA[:ALL]?

Returns the currently recorded commands.

Return values:

<Result> string

String containing the complete SCPI recording. Each individual command is introduced by a "#" character.

Example: `SYST:REC:DATA?`

Usage: Query only

Manual operation: See "List of recorded commands / script editor" on page 343

Example:

Assume the following recorded commands:

```
*RST
*CLS
:SYST:DISP:UPD ON
:INIT:CONT OFF
:INST:CRE:NEW SANALYZER, 'Spectrum 2'
:INIT:CONT OFF
:CALC:MARK:FUNC:POW:SEL ACP
```

Result for SCPI format:

```
#*RST
#*CLS
#:SYST:DISP:UPD ON
#:INIT:CONT OFF
#:INST:CRE:NEW SANALYZER, 'Spectrum 2'
#:INIT:CONT OFF
#:CALC:MARK:FUNC:POW:SEL ACP
```

Result for PYTHon format:

```
# python script created by FSW: 24:08:2022 14:05:23
#import pyvisa as visa #def write_command(instrument, command) :
# instrument.write(command)
# return process_system_error(instrument)
#def write_query(instrument, command) :
# buffer = instrument.query(command)
# bSuccess = process_system_error(instrument)
# return bSuccess, buffer #def process_system_error(instrument) :

# bSuccess = True
# EsrErrorMask = 0x3C
# if ((get_esr(instrument) & EsrErrorMask) != 0) :
# print(instrument.query(":SYST:ERR?"))
# instrument.write("*CLS")
# bSuccess = False
# return bSuccess
#def get_esr(instrument) :
# esr = instrument.query("*ESR?")
# return int(esr)
#VisaResourceManager = visa.ResourceManager()
# connect to analyzer
#Analyzer = VisaResourceManager.open_resource("TCPIP::
10.111.0.161::inst0::INSTR")
#success = write_command( Analyzer, "*RST" )
#success = write_command( Analyzer, "*CLS" )
#success = write_command( Analyzer, ":SYST:DISP:UPD ON" )
```

```
#success = write_command( Analyzer, ":INIT:CONT OFF" )

#success = write_command( Analyzer, ":INST:CRE:NEW SANALYZER,
'Spectrum 2'" )

#success = write_command( Analyzer, ":INIT:CONT OFF" )

#success = write_command( Analyzer, ":CALC:MARK:FUNC:POW:SEL
ACP" )

# back to local mode

#success = write_command(Analyzer, "@LOC")

# cleanup #Analyzer.close()

#VisaResourceManager.close()
```

SYSTem:SRECorder:EXPort <Format>, <FileName>

Exports the current SCPI command list to the specified file and directory in the selected format. By default, the file is stored in the `C:\R_S\INSTR\ScpiRecordings` directory. Besides the recorded commands themselves, the exported script includes all format-specific header data required to execute the script using an external program on the controller.

Parameters:

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

Setting parameters:

<Format> SCPI | PYTHon | MATLab | CPLusplus | CVI

CPLusplus
A commonly used general programming language for various applications (`*.cpp`)

MATLab (Instrument Control Toolbox)
A programming environment, frequently used in signal processing and test and measurement applications (`*.m`)
You can use this format directly with the MATLAB© Toolkit.

CVI
An ANSI C programming environment designed for measurements and tests (`*.cvi`)
You can use this format directly with National Instruments LabWindows CVI.

SCPI
Represents SCPI base format, that is ASCII format, saved as a text file (`*.inp`); contains no additional header data
Use this format to load a recorded script back to the editor later.

PYTHon
A commonly used general programming language for various applications (`.py`)

Example: `SYST:SREC:EXP PYTH, 'C:\TEMP\SCPI_EXAMPLE.py'`

Usage: Setting only

Manual operation: See "Export" on page 343

SYSTem:SRECorder:SYNC <Sync>

If enabled, additional commands are included in the script to synchronize the recorded commands when necessary. For instance, when a measurement is started, a `*WAI` command is inserted to ensure that the next command is only executed after the measurement has finished.

Parameters:

<State> ON | OFF | 0 | 1

OFF | 0
Switches the function off

ON | 1
Switches the function on

*RST: 0

Example: `SYST:SREC:SYNC ON`

Manual operation: See "Add Synchronization Commands" on page 345

12.13 Emulating other instruments' commands

The R&S FSMR3 analyzer family supports a subset of the GPIB commands of several HP and PSA instruments.

For details see Chapter 11.3, "GPIB languages", on page 336.

12.13.1 Setting up instrument emulation

The following commands are required to set up the use of commands to emulate other instruments.

Useful commands for emulating other instruments described elsewhere:

- `SYSTem:REVision:FACTory` on page 610

Remote commands exclusive to emulating other instruments:

SYSTem:HPCoupling <CouplingType>

Controls the default coupling ratios in the HP emulation mode for:

- span and resolution bandwidth (Span/RBW) and
- resolution bandwidth and video bandwidth (RBW/VBW)

This command is only available if a HP language is selected using `SYSTem:LANGuage` on page 655.

Parameters:

<CouplingType> HP | FSP

*RST: FSP

Example: `SYSTem:HPC HP`

Manual operation: See "Coupling" on page 355

SYSTem:IFGain:MODE <Mode>

Configures the internal IF gain settings in HP emulation mode due to the application needs. This setting is only taken into account for resolution bandwidth < 300 kHz and is only available if a HP language is selected using `SYSTem:LANGuage` on page 655.

Parameters:

<Mode> NORMal | PULSe

NORMal
Optimized for high dynamic range, overload limit is close to reference level.

PULSe
Optimized for pulsed signals, overload limit up to 10 dB above reference level.

*RST: NORM

Example: `SYST:IFG:MODE PULS`

Manual operation: See "IF Gain" on page 355

SYSTem:HPADditional <State>

Allows the use of HP commands *in addition to* SCPI commands for R&S FSP/FSQ/FSU emulation (see `SYSTem:LANGuage` on page 655).

Parameters:

<State> ON | OFF | 1 | 0

OFF | 0
Switches the function off

ON | 1
Switches the function on

*RST: 0

SYSTem:LANGuage <Language>

This command selects the system language.

For details see Chapter 11.3, "GPIB languages", on page 336.

Parameters:

<Language> "SCPI" | "8560E" | "8561E" | "8562E" | "8563E" | "8564E" | "8565E" | "8566A" | "8566B" | "8568A" | "8568A_DC" | "8568B" | "8568B_DC" | "8591E" | "8594E" | "71100C" | "71200C" | "71209A" | "PSA89600" | "PSA" | "PXA" | "FSP" | "FSU" | "FSQ" | "FSV" | "FSEA" | "FSEB" | "FSEM" | "FSEK"

*RST: SCPI

Example: `SYST:LANG 'PSA'`
Emulates the PSA.

Manual operation: See "Language" on page 355

Note: If you use **"PSA89600"**, you must switch to an HP language first before returning to SCPI (in remote operation only). For the identical language "PSA", this intermediate step is not necessary.

SYSTem:PSA:WIDeband <State>

This command defines which option is returned when the `*OPT?` query is executed, depending on the state of the wideband option.

It is only available for PSA89600 emulation.

Parameters:

<State> ON | OFF | HIGH

OFF
The option is indicated as "B7J"

ON
The 40 MHz wideband is used.
The option is indicated as "B7J, 140".

HIGH
The 80 MHz wideband is used.
The option is indicated as "B7J, 122".

*RST: OFF

SYSTem:REVision[:STRing] <Name>

Sets the response to the `REV?` query to the defined string (HP emulation only, see `SYSTem:LANGuage` on page 655).

Parameters:
<Name>

Example: Define the system language:
`SYST:LANG '8563E'`
Query the revision:
`REV?`
Response:
`920528`
Set the response to 'NewRevision':
`SYST:REV:STR 'NewRevision'`
Query the response:
`SYST:REV:STR?`
Response:
`NewRevision`

Manual operation: See "Revision String" on page 356

SYSTem:RSWeep <State>

Controls a repeated sweep of the E1 and MKPK HI HP model commands (for details on the commands refer to Chapter 12.13.2, "Reference: GPIB commands of emulated HP models", on page 656). If the repeated sweep is OFF, the marker is set without sweeping before.

This command is only available if a HP language is selected using `SYSTem:LANGuage` on page 655

Parameters:
<State> ON | OFF | 1 | 0
*RST: 0

Example: `SYSTem:RSW ON`

Manual operation: See "Sweep Repeat" on page 355

12.13.2 Reference: GPIB commands of emulated HP models

The R&S FSMR3 analyzer family supports a subset of the GPIB commands of HP models 8560E, 8561E, 8562E, 8563E, 8564E, 8565E, 8566A, 8566B, 8568A, 8568B and 8594E.

Despite the differences in system architecture and device features, the supported commands have been implemented in a way to ensure a sufficiently high degree of correspondence with the original.

This includes the support of syntax rules for not only newer device families (B and E models) but for the previous A family as well.

In many cases the selection of commands supported by the R&S FSMR3 is sufficient to run an existing GPIB program without adaptation.

After the introduction, this section includes the following topics:

12.13.2.1 Command set of models 8560E, 8561E, 8562E, 8563E, 8564E, 8565E, 8566A/B, 8568A/B, 8591E, 8594E, 71100C, 71200C, and 71209A

As with the original units, the R&S FSMR3 includes the command set of the A models in the command set of the B models.

The HP model 8591E is compatible to HP model 8594E, the HP models 71100C, 71200C, and 71209A are compatible to HP models 8566A/B.

Command	Supported subset	Function	Corresp. HP-Models	Status
A1	A1	Clear/Write A	HP 8566A/ HP 8568A	available
A2	A2	Max Hold A	HP 8566A/ HP 8568A	available
A3	A3	View A	HP 8566A/ HP 8568A	available
A4	A4	Blank A	HP 8566A/ HP 8568A	available
ABORT 1)	ABORT	Stop previous function	HP 856xE/ HP 8566B/HP 8568B/HP 8594E	available
ADD		Add	HP 8566B/ HP 8568B/ HP 8594E	available
ADJALL	ADJALL	Adjust all	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available

Command	Supported subset	Function	Corresp. HP-Models	Status
ADJCRT [2)]	ADJCRT	Adjust CRT	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
ADJIF [2)]	ADJIF	Auto adjust IF	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
AMB	AMB ON|OFF AMB 1|0 AMB?	Trace A – B -> Trace A	HP 856xE/ HP 8594E	available
AMBPL	AMBPL ON|OFF AMBPL 1|0 AMBPL?		HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
ANNOT	ANNOT ON|OFF ANNOT 1|0 ANNOT?	Annotation	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
APB	APB	Trace A + B -> Trace A	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
AT	AT <numeric_value> DB | DM AT DN AT UP AT AUTO AT?	Attenuation	HP 8566A/ HP 8568A/ HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
AUNITS	AUNITS DBM | DBMV | DBUV | AUNITS?	Amplitude Units	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
AUTOCPL	AUTOCPL	Coupling default	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available

Command	Supported subset	Function	Corresp. HP-Models	Status
AXB	AXB	Exchange trace A and B	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
B1	B1	Clear/Write B	HP 8566A/ HP 8568A	available
B2	B2	Max Hold B	HP 8566A/ HP 8568A	available
B3	B3	View B	HP 8566A/ HP 8568A	available
B4	B4	Blank B	HP 8566A/ HP 8568A	available
BL	BL	Trace B – Display Line -> Trace B	HP 8566A/ HP 8568A	available
BML	BML	Trace B – Display Line -> Trace B	HP 856xE/ HP8594E	available
BTC	BTC	Transfer Trace B -> C	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
BXC	BXC	Exchange Trace B and C	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
BLANK	BLANK TRA|TRB|TRC	Blank Trace	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
C1	C1	A-B off	HP 8566A/ HP 8568A	available
C2	C2	A-B -> A	HP 8566A/ HP 8568A	available
CA	CA	Couple Attenuation	HP 8566A/ HP 8568A	available
CAL [1)]	CAL ALL CAL ON CAL OFF	Start analyzer self align-ment	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available

Command	Supported subset	Function	Corresp. HP-Models	Status
CF	CF <numeric_value> HZ|KHZ|MHZ|GHZ CF UP CF DN CF?	Center Frequency	HP 8566A/ HP 8568A/ HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
CHANPWR	CHANPWR TRA|TRB, <numeric_value>,?	Channel Power Measurement	HP 856xE/ HP 8594E	available
CHPWRBW	CHPWRBW <numeric_value> HZ|KHZ|MHZ|GHZ	Channel Power Bandwidth	HP 856xE/ HP 8594E	available
CLRW	CLRW TRA|TRB|TRC	Clear/Write Trace	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
CLS [1]	CLS	Clear all status bits	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
CONTS	CONTS		HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
COUPLE	COUPLE AC|DC	Input coupling	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
CR	CR	Couple RBW	HP 8566A/ HP 8568A	available
CS	CS	Couple Step Size	HP 8566A/ HP 8568A	available
CT	CT	Couple SWT	HP 8566A/ HP 8568A	available
CTA		Convert to absolute units	HP 8566B/ HP 8568B/ HP 8594E	available
CV	CV	Couple VBW	HP 8566A/ HP 8568A	available
D1 [2]	D1	Display Size normal	HP 8566A/ HP 8568A	available

Command	Supported subset	Function	Corresp. HP-Models	Status
DA [2)]	DA	Display address		available
DEMOD [1)]	DEMOD ON|OFF|AM|FM	AF Demodulator	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
DEMODAGC [2)]	DEMODAGC ON|OFF|1|0 DEMODAGC?	Demodulation AGC	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
DEMODT	DEMODT <numeric_value> S|MS|US|SC DEMODT UP|DN DEMODT?	Demodulation time	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
DET	DET POS|SMP|NEG DET?	Detector	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
DISPOSE [2)]	ONEOS | TRMATH | ONSWP | ALL | <numeric_value>			available
DIV		Divide	HP 8566B/ HP 8568B/ HP 8594E	available
DL	DL <numeric_value> DB|DM DL DN DL UP DL ON DL OFF DL?	Display Line	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
DLE	DLE ON|OFF	Display Line enable	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
DONE	DONE DONE?	Done query	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
DW [2)]	DW	Write to display and increment address		available

Command	Supported subset	Function	Corresp. HP-Models	Status
E1	E1	Peak Search	HP 8566A/ HP 8568A	available
E2	E2	Marker to Center Freq.	HP 8566A/ HP 8568A	available
E3	E3	Deltamarker Step Size	HP 8566A/ HP 8568A	available
E4	E4	Marker to Ref. Level	available	available
EDITDONE		limit line edit done	HP 856xE	available
EDITLIML		edit limit line	HP 856xE	available
ERR	ERR 250 cal level error ERR 300 LO unlock ERR 472 cal error digital filter ERR 473 cal error analog filter ERR 552 cal error log amp ERR 902 unscale tracking generator ERR 906 oven cold ERR 117 numeric unit error ERR 112 Unrecognized Command	Now some FSx errors are mapped to HP errors.	HP8568A HP856xE	not yet available
ERR?	ERR?	Error queue query	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	not yet available
EX	EX	Exchange trace A and B	HP 8566A/ HP 8568A	available
FA	FA <numeric_value> HZ|KHZ|MHZ|GHZ FA UP FA DN FA?	Start Frequency	HP 8566A/ HP 8568A/ HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
FB	FB <numeric_value> HZ|KHZ|MHZ|GHZ FB UP FB DN FB?	Stop Frequency	HP 8566A/ HP 8568A/ HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available

Command	Supported subset	Function	Corresp. HP-Models	Status
FDSP		Frequency display off	8560E 8561E 8562E 8563E 8564E 8565E	available
FOFFSET [1)]	FOFFSET <numeric_value> HZ|KHZ|MHZ|GHZ FOFFSET?	Frequency Offset	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
FREF	FREF INT|EXT	Reference Frequency	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
FS	FS	Full Span	HP 8566A/ HP 8568A	available
FUNCDEF		Define Function Function must be in one line between delimiters @	HP 8594E/ HP 856xE/ HP 8566B	available
GATE [1)]	GATE ON|OFF GATE 1|0		HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
GATECTL [1)]	GATECTL EDGE|LEVEL GATECTL?		HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
GD [1)]	GD <numeric_value> US|MS|SC GD DN GD UP GD?		HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
GL [1)]	GL <numeric_value> US|MS|SC GL DN GL UP GL?		HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
GP [1)]	GP POS|NEG GP?		HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available

Command	Supported subset	Function	Corresp. HP-Models	Status
GRAT [2)]	GRAT ON|OFF	Graticule	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
I1	I1		HP 8566A/ HP 8568A	available
I2	I2		HP 8566A/ HP 8568A	available
ID	ID ID?	Identify	HP 8566A/ HP 8568A/ HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
INZ [1)]	INZ 75 INZ 50 INZ?	Input Impedance	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
IP	IP	Instrument preset	HP 8566A/ HP 8568A	available
KEYDEF	KEYDEF	Key definition	HP 8566B/ HP 856xE/ HP 859xE	available
KEYEXEC	KEYEXEC	Key execute	HP 8566B	available
KS=	KS= <numeric_value> HZ|KHZ|MHZ|GHZ KS= DN KS= UP KS=?	Marker Frequency Counter Resolution	HP 8566A/ HP 8568A	available
KS/	KS/	Manual Peaking	HP 8566A/ HP 8568A	available
KS(	KS(	Lock register	HP 8566A/ HP 8568A	available
KS)	KS)	Unlock register	HP 8566A/ HP 8568A	available
KS91	KS91	Read Amplitude Error	HP 8566A/ HP 8568A	available
KSA	KSA	Amplitude Units in dBm	HP 8566A/ HP 8568A	available

Command	Supported subset	Function	Corresp. HP-Models	Status
KSB	KSB	Amplitude Units in dBmV	HP 8566A/ HP 8568A	available
KSC	KSC	Amplitude Units in dBuV	HP 8566A/ HP 8568A	available
KSD	KSD	Amplitude Units in V	HP 8566A/ HP 8568A	available
KSE	KSE <numeric_value>| <char data>@	Title mode	HP 8566A/ HP 8568A	available
KSG	KSG KSG ON KSG <numeric_value>	Video Averaging on	HP 8566A/ HP 8568A	available
KSH	KSH	Video Averaging Off	HP 8566A/ HP 8568A	available
KSK		Marker to Next Peak	HP 8566A/ HP 8568A	available
KSL		Marker Noise off	HP 8566A/ HP 8568A	available
KSM		Marker Noise on	HP 8566A/ HP 8568A	available
KSO	KSO	Deltamarker to span	HP 8566A/ HP 8568A	available
KSP	KSP <numeric_value>	HPIB address	HP 8566A/ HP 8568A	available
KSQ 2)	KSQ	Band lock off	HP 8566A/ HP 8568A	available
KST	KST	Fast Preset	HP 8566A/ HP 8568A	available
KSV	KSV <numeric_value> HZ|KHZ|MHZ|GHZ KSV?	Frequency Offset	HP 8566A/ HP 8568A	available
KSW	KSW	Error Correction Routine	HP 8566A/ HP 8568A	available
KSX	KSX	Correction Values On	HP 8566A/ HP 8568A	available
KSY	KSY	Correction Values Off	HP 8566A/ HP 8568A	available

Command	Supported subset	Function	Corresp. HP-Models	Status
KSZ	KSZ <numeric_value> DB KSZ?	Reference Value Offset	HP 8566A/ HP 8568A	available
KSa	KSa	Normal Detection	HP 8566A/ HP 8568A	available
KSb	KSb	Pos Peak Detection	HP 8566A/ HP 8568A	available
KSd	KSd	Neg Peak Detection	HP 8566A/ HP 8568A	available
KSe	KSe	Sample Detection	HP 8566A/ HP 8568A	available
KSg		CRT beam off		available
KSh		CRT beam on		available
KSj	KSj	View Trace C	HP 8566A/ HP 8568A	available
KSk	KSk	Blank Trace C	HP 8566A/ HP 8568A	available
KSl	KSl	Transfer B to C	HP 8566A/ HP 8568A	available
KSm	KSm	Graticule off	HP 8566A/ HP 8568A	available
KSn[2)]	KSn	Grid on	HP 8566A/ HP 8568A	available
KSo	KSn	Character display off	HP 8566A/ HP 8568A	available
KSp	KSp	Character display on	HP 8566A/ HP 8568A	available
KSr	KSr	Create service request	HP 8566A/ HP 8568A	available
KSt [2)]	KSt	Band lock on	HP 8566A/ HP 8568A	available
KSv [2)]	KSv	Signal ident on	HP 8566A/ HP 8568A	available
L0	L0	Display line off	HP 8566A/ HP 8568A	available
LB	LB <numeric_value>| <char data>@	Label	HP 8566A/ HP 8568A	available

Command	Supported subset	Function	Corresp. HP-Models	Status
LF	LF	Low frequency band preset	HP 8566A/ HP 8568A	available
LIMD		limit line delta	HP 856xE	available
LIMF		limit line frequency	HP 856xE	available
LIMIFAIL		limit fail query	HP 856xE	available
LIMIPURGE		purge limit line	HP 856xE	available
LIMIRCL		recall limit line	HP 856xE	available
LIMIREL		relative limit line	HP 856xE	available
LIMISAV		save limit line	HP 856xE	available
LIMITEST		limit line test	HP 856xE	available
LIML		lower limit line value	HP 856xE	available
LIMM		middle limit line value	HP 856xE	available
LIMTFL		flat limit line segment	HP 856xE	available
LIMTSL		slope limit line segment	HP 856xE	available
LIMU		upper limit line value	HP 856xE	available
LG	LG <numeric_value> DB | DM LG?	Amplitude Scale Log	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
LL [2)]	LL	Plot command	HP 8566A/ HP 8568A	available
LN	LN	Amplitude Scale Lin	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
M1	M1	Marker Off	HP 8566A/ HP 8568A	available
M2	M2 M2 <numeric_value> HZ|KHZ|MHZ|GHZ M2 DN M2 UP M2?	Marker Normal	HP 8566A/ HP 8568A	available

Command	Supported subset	Function	Corresp. HP-Models	Status
M3	M3 M3 <numeric_value> HZ|KHZ|MHZ|GHZ M3 DN M3 UP M3?	Delta Marker	HP 8566A/ HP 8568A	available
M4	M4 <numeric_value> HZ|KHZ|MHZ|GHZ	Marker Zoom	HP 8566A/ HP 8568A	available
MA	MA	Marker Amplitude	HP 8566A/ HP 8568A	available
MC0	MC0	Marker Count off	HP 8566A/ HP 8568A	available
MC1	MC1	Marker Count on	HP 8566A/ HP 8568A	available
MDS	MDS	Measurement data size	HP 8566B	available
MEAS		Measurement status	HP 856xE	available
MF	MF MF?	Marker Frequency	HP 8566A/ HP 8568A/ HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
MINH[1)]	MINH TRC	Minimum Hold	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
MKA	MKA <numeric_value> MKA?	Marker Amplitude	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
MKACT	MKACT 1 MKACT?	Select the active marker	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	not available
MKBW [1)]	MKBW <numeric_value> MKBW ON MKBW OFF	N dB Down	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available

Command	Supported subset	Function	Corresp. HP-Models	Status
MKD	MKD MKD <numeric_value> HZ|KHZ| MHZ|GHZ MKD DN MKD UP MKD ON MKD OFF MKD?	Delta Marker	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
MKDR	MKDR <numeric_value> HZ|KHZ| MHZ|GHZ| S|SC|MS|MSEC| USMKDR?	Delta Marker reverse	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
MKDR?		Delta Marker reverse query		available
MKF	MKF <numeric_value> HZ|KHZ|MHZ|GHZ MKF?	Set Marker Frequency	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
MKFC	MKFC ON|OFF	Frequency Counter on/off	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
MKFCR [1)]	MKFCR <numeric_value> HZ|KHZ| MHZ|GHZ MKFCR DN MKFCR UP MKFCR?	Frequency Counter Resolution	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
MKMIN	MKMIN	Marker -> Min	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
MKN	MKN MKN <numeric_value> HZ|KHZ|MHZ|GHZ MKN DN MKN UP MKN ON MKN OFF MKN?	Normal Marker	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available

Command	Supported subset	Function	Corresp. HP-Models	Status
MKNOISE	MKNOISE ON|OFF MKNOISE 1|0 MKNOISE?	Noise Measurement	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
MKOFF	MKOFF MKOFF ALL	Marker off	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
MKP	MKP <numeric_value> MKP?	Marker position	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
MKPK	MKPK MKPK HI MKPK NH MKPK NR MKPK NL	Marker Search	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
MKPT	MKPT MKPT HI MKPT NH MKPT NR MKPT NL	Marker Peak Threshold	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
MKPX	MKPX <numeric_value> DB MKPX DN MKPX UP MKPX?	Peak Excursion	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
MKRL	MKRL	Ref Level = Marker Level	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
MKSP	MKSP	Deltamarker to span	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
MKSS	MKSS	CF Stepsize = Marker Freq	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available

Command	Supported subset	Function	Corresp. HP-Models	Status
MKT	MKT <numeric_value> S|MS|US|SC MKT?	MKF = fstart + MKT/ SWT*Span	HP 856xE/ HP 8594E	available
MKTRACE	MKTRACE TRA|TRB| TRC	Marker to Trace	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
MKTRACK	MKTRACK ON|OFF MKTRACK 1|0 MKTRACK?	Signal Track	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
MKTYPE	MKTYPE AMP MK TYPE?	Marker type	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
ML		Mixer level	HP 856xE	available
MOV	MOV TRA|TRB|TRC, TRA|TRB|T RC	Move Trace Contents	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
MPY		Multiply	HP 8566B/ HP 8568B/ HP 8594E	available
MT0	MT0	Marker Track Off	HP 8566A/ HP 8568A	available
MT1	MT1	Marker Track On	HP 8566A/ HP 8568A	available
MXMH	MXMH TRA|TRB	Maximum Hold	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
NORMALIZE	NORMALIZE	Normalize trace	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	not available available
NRL [1)]	NRL <numeric_value> DB | DM NRL?	Normalized Reference Level	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available

Command	Supported subset	Function	Corresp. HP-Models	Status
NRPOS	NRPOS <numeric_value> NRL?	Normalize position	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
O1	O1	Format ASCII, Values 0 to 4095	HP 8566A/ HP 8568A	available
O2	O2	Format Binary, Values 0 to 4095	HP 8566A/ HP 8568A	available
O3	O3	Format ASCII	HP 8566A/ HP 8568A	available
OA	OA	Output All	HP 8566A/ HP 8568A	available
OL	OL <80 characters> OL?	Output Learn String	HP 8566A/ HP 8568A	available
OT	OT	Output Trace Annotations	HP 8566A/ HP 8568A	available
PA	PA <numeric_value>, <numeric_value	Plot command	HP 8566A/ HP 8568A	available
PD	PD <numeric_value>, <numeric_value	Plot command	HP 8566A/ HP 8568A	available
PH_MKF		Spot frequency in Hz	HP 856xE	available
PH_FMIN		Min offset frequency to be measured	HP 856xE	available
PH_FMAX		Max offset frequency to be measured	HP 856xE	available
PH_MKA		Queries amplitude at the spot frequency	HP 856xE	available
PH_DRIFT		0: for stable signals, 1: for drifty	HP 856xE	available
PH_RLVL		Reference level for the log plot	HP 856xE	available
PH_SMTHV		Trace smoothing	HP 856xE	available
PH_VBR		Filtering	HP 856xE	available
PH_RMSPT		Amount of data points to skip when doing the integration	HP 856xE	available
PH_RMSFL		Lower integration frequency in Hz	HP 856xE	available
PH_RMSFU		Upper integration frequency in Hz	HP 856xE	available

Command	Supported subset	Function	Corresp. HP-Models	Status
PH_EXIT		Quits phase noise	HP 856xE	available
PH_F_UDT		Updates internal frequency variables	HP 856xE	available
PH_LMT_L		Apply limits to PH_FMIN and PH_FMAX	HP 856xE	available
PH_MEAS		Generates log frequency plot	HP 856xE	available
PH_MKF_D		Updates the spot frequency	HP 856xE	available
PH_RMS		Requests the rms phase noise	HP 856xE	available
PH_RMSFT		Updates internal frequency variables	HP 856xE	available
PH_RMSX		Calculates the rms phase noise	HP 856xE	available
PH_SPOTF		Executes the spot frequency measurement	HP 856xE	available
PLOTORG [2)]	PLOTORG DSP|GRT	Plot command	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
PLOTSRC [2)]	PLOTSRC ANNT|GRT| TRB| TRA|ALLDSP|GRT	Plot command	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
PP	PP	Preselector Peaking	HP 8566A/ HP 8568A	available
PRINT [1)]	PRINT PRINT 1|0	Hardcopy	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
PSDAC [2)]	PSDAC <numeric_value> PSDAC UP|DN	Preselector DAC value	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
PSTATE [2)]	PSTATE ON|OFF|1|0	Protect State	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
PU	PU	Pen Up	HP 8566A/ HP 8568A	available

Command	Supported subset	Function	Corresp. HP-Models	Status
PWRBW	PWRBW	Power Bandwidth	HP 8566B/ HP 859x/ HP 856xE	available
R1	R1	Set Status Bit Enable	HP 8566A/ HP 8568A	available
R2	R2	Set Status Bit Enable	HP 8566A/ HP 8568A	available
R3	R3	Set Status Bit Enable	HP 8566A/ HP 8568A	available
R4	R4	Set Status Bit Enable	HP 8566A/ HP 8568A	available
RB	RB <numeric_value> HZ|KHZ|MHZ|GHZ RB DN RB UP RB AUTO RB?	Resolution Bandwidth	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
RBR	RBR <numeric_value> RBR DN RBR UP RBR?	Resolution Bandwidth Ratio	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
RC1…6	RC1…6	Recall Last State	HP 8566A/ HP 8568A	available
RCLS	RCLS <numeric_value>	Recall State Register	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
RCLT	RCLT TRA|TRB, <number>	Recall Trace	HP856xE/ HP8594E	available
RESET	RESET	Instrument preset	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
REV	REV REV?	Firmware revision	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available

Command	Supported subset	Function	Corresp. HP-Models	Status
RL	RL <numeric_value> DB|DM RL DN RL UP RL?	Reference Level	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
RLCAL	RLCAL <numeric_value> RL?	Reference Level Calibration	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
RCLOSCAL	RCLOSCAL	Recall Open/Short Average	HP 856xE/ HP 8594E	not available
RCLTHRU	RCLTHRU	Recall Thru	HP 856xE/ HP 8594E	not available
RLPOS [1)]	RLPOS <numeric_value> RLPOS DN RLPOS UP RLPOS?	Reference Level Position	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
ROFFSET	ROFFSET <numeric_value> DB | DM ROFFSET?	Reference Level Offset	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
RQS	RQS	Service Request Bit mask	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
S1	S1	Continuous Sweep	HP 8566A/ HP 8568A	available
S2	S2	Single Sweep	HP 8566A/ HP 8568A	available
SADD		add a limit line segment	HP 856xE	available
SAVES	SAVES <numeric_value>	Save State Register	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
SAVET	SAVET TRA|TRB,<number>	Save Trace	HP856xE/ HP8594E	available
SDEL		delete limit line segment	HP 856xE	available
SDON		limit line segment done	HP 856xE	available

Command	Supported subset	Function	Corresp. HP-Models	Status
SEDI		edit limit line segment	HP 856xE	available
SMOOTH	SMOOTH TRA|TRB|TRC, <number of points>	Smooth Trace	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
SNGLS	SNGLS	Single Sweep	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
SQUELCH [2)]	SQUELCH <numeric_value> DM | DB SQUELCH UP|DN SQUELCH ON|OFF	Squelch	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
SP	SP <numeric_value> HZ|KHZ|MHZ|GHZ SP DN SP UP SP?	Span	HP 8566A/ HP 8568A/ HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
SRCNORM [1)]	SRCNORM ON|OFF SRCNORM 1|0	Source Normalization	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	not available
SRCPOFS [1)]	SRCPOFS <numeric_value> DB | DM SRCPOFS DN SRCPOFS UP SRCPOFS?	Source Power Offset	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	not available
SRCPWR [1)]	SRCPWR <numeric_value> DB | DM SRCPWR DN SRCPWR UP SRCPWR ON SRCPWR OFF SRCPWR?	Source Power	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	not available

Command	Supported subset	Function	Corresp. HP-Models	Status
SS	SS <numeric_value> HZ|KHZ|MHZ|GHZ SS DN SS UP SS AUTO SS?	CF Step Size	HP 8566A/ HP 8568A/ HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
ST	ST <numeric_value> US|MS|SC ST DN ST UP ST AUTO ST?	Sweep Time	HP 8566A/ HP 8568A/ HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
STB	STB	Status byte query	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
STOREOPEN	STOREOPEN	Store Open	HP 856xE/ HP 8594E	not available
STORESHORT	STORESHORT	Store Short	HP 856xE/ HP 8594E	not available
STORETHRU	STORETHRU	Store Thru	HP 856xE/ HP 8594E	not available
SUB		Subtract	HP 8566B/ HP 8568B/ HP 8594E	available
SUM		sum of trace amplitudes	HP 8566B/ HP 8568B/ HP 8594E	available
SV1…6	SV1…6	Save State	HP 8566A/ HP 8568A	available
SWPCPL [2)]	SWPCPL SA | SR SWPCPL?	Sweep Couple	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
SWPOUT [2)]	SWPOUT FAV|FAVA|RAMP SWPOUT?	Sweep Output	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
T0	T0	Threshold off	HP 8566A/ HP 8568A	available

Command	Supported subset	Function	Corresp. HP-Models	Status
T1	T1	Free Run Trigger	HP 8566A/ HP 8568A	available
T2 2)	T2	Line Trigger	HP 8566A/ HP 8568A	available
T3	T3	External Trigger	HP 8566A/ HP 8568A	available
T4	T4	Video Trigger	HP 8566A/ HP 8568A	available
TA	TA	Transfer A	HP 8566A/ HP 8568A	available
TACL	TACL?	Returns instantaneous measurement results. See TRACe<trace #>:IMMediate:LEVel? for full description.		not available
TBCL	TBCL?			
TCCL	TCCL?			
TACR	TACR?	Returns instantaneous measurement results. See TRACe<trace #>:IMMediate:LEVel? for full description.		not available
TBCR	TBCR?			
TCCR	TCCR?			
TB	TB	Transfer B	HP 8566A/ HP 8568A	available
TDF	TDF P TDF M TDF B TDF A TDF I	Trace Data Format	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
TH	TH <numeric_value> DB|DM TH DN TH UP TH ON TH OFF TH AUTO TH?	Threshold	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available

Command	Supported subset	Function	Corresp. HP-Models	Status
THE	THE ON| OFF	Threshold Line enable	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
TIMEDSP [1)]	TIMEDSP ON|OFF TIMEDSP 1|0 TIMEDSP?	Time Display	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
TM	TM FREE|VID|EXT|LINE[2)] TM?	Trigger Mode	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
TM LINE [2)]	TM LINE	Trigger Line	HP 8566B	available
TRA	TRA B TRA A TRA I	Transfer A	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
TRB	TRB B TRB A TRB I	Transfer B	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
TRSTAT	TRSTAT?	Trace State Query	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
TS	TS	Take Sweep	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
UR [2)]	UR	Plot Command	HP 8566A/ HP 8568A	available
VARDEF	VARDEF	Variable definition, arrays are not supported	HP 8566B/ HP 8568B/ HP 8594E	available
VAVG	VAVG VAVG TRA|TRB|TRC	Video Averaging	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available

Command	Supported subset	Function	Corresp. HP-Models	Status
VB	VB <numeric_value> HZ|KHZ|MHZ|GHZ VB DN VB UP VB AUTO VB?	Video Bandwidth	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
VBR [1)]	VBR <numeric_value> VBR DN VBR UP VBR?	Video Bandwidth Ratio	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
VIEW	VIEW TRA|TRB|TRC		HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
VTL	VTL <numeric_value> DB|DM VTL DN VTL UP VTL?	Video Trigger Level	HP 856xE/ HP 8594E	not available
1) HP 8594E only				
2) Command is accepted without error message, but is ignored				

12.13.2.2 Special features of the syntax parsing algorithms for 8566A and 8568A models

The command syntax is very different for models A and B. Different names are assigned to identical instrument functions, and the command structure likewise differs considerably between models A and models B.

The command structure for models A is as follows:

```
<command>::= <command code>[<SPC>][<data>|<step>][<SPC>][<delimiter>][<command code>]…<delimiter>

<data>::= <Value>[<SPC>][<units code>][<SPC>][<delimiter>][<SPC>][<data>]…

<step>::= UP|DN
```

where

<command code> = see Table "Supported Commands"

<Value> = integer or floating-point numerical value

<units code> = DM | -DM | DB | HZ | KZ | MZ | GZ | MV | UV | SC | MS | US

<delimiter> = <CR> | <LF> | <,> | <;> | <ETX>

`<SPC>` = 32_{10}

`<ETX>` = 3_{10}

Command sections given in [ ] are optional.

The R&S FSMR3 GPIB hardware differs from that used in the HP analyzers. Therefore, the following constraint exists:

`<LF>| <EOI>` are still used as delimiters since the GPIB hardware is able to identify them. The other delimiters are identified and evaluated during syntax analysis.

12.13.2.3 Special behavior of commands

Command	Known Differences
ABORT	Does not automatically set the command complete bit (bit 4) in the status byte. An additional DONE is required for that purpose.
ANNOT	Only frequency axis annotation is affected.
AT	AT DN/UP: Step size
CAL	The CAL commands do not automatically set the command complete bit (bit 4) in the status byte. An additional DONE command is required for that purpose.
CF	Default value, range, step size
CR	Default ratio Span/RBW
CT	Formula for coupled sweep time
CV	Default ratio RBW/VBW
DET	DET? returns SAMP instead of SMP on the R&S FSMR3. DET not automatically set the command complete bit (bit 4) in the status byte. An additional DONE is required for that purpose.
ERR?	Deletes the error bit in the status register but always returns a '0' in response.
FA	Default value, range, step size
FB	Default value, range, step size
ID	Query of instrument ID. The instrument ID defined in "SETUP > Network + Remote > GPIB > Identification String" is returned.
M2	Default value, range, step size
M3	Default value, range, step size
MKACT	Only marker 1 is supported as the active marker.
MKBW	Default value
MKPT	Step size
MKPX	Step size

Command	Known Differences
OL?	Storage of instrument settings: 80 characters are returned as information on the instrument settings. The contents of the 80 characters returned does not correspond to the original data contents of the 8566A/8568A family.
OL	Readout of instrument settings: The 80 characters read by means of OL? are accepted as information on the corresponding instrument settings. The contents of the 80 characters read does not correspond to the original data contents of the 8566A/8568A family.
RB	Default value, range, step size
RL	Default value, step size
RLPOS	Adapts the position of the reference level even if the tracking generator normalization is not active.
RQS	Supported bits: 1 (Units key pressed) 2 (End of Sweep) 3 (Device error) 4 (Command complete) 5 (Illegal command)

12.13.2.4 Model-dependent default settings

If the GPIB language is switched over to an 85xx model, the GPIB address is automatically switched over to 18 provided that the default address of the R&S FSMR3 (20) is still set. If a different value is set, this value is maintained. Upon return to SCPI, this address remains unchanged.

The following table shows the default settings obtained after a change of the GPIB language and for the commands IP, KST and RESET:

Model	# of Trace Points	Start Freq.	Stop Freq.	Ref Level	Input Coupling
8566A/B	1001	2 GHz	22 GHz	0 dBm	AC
8568A/B	1001	0 Hz	1.5 GHz	0 dBm	AC
8560E	601	0 Hz	2.9 GHz	0 dBm	AC
8561E	601	0 Hz	6.5 GHz	0 dBm	AC
8562E	601	0 Hz	13.2 GHz	0 dBm	AC
8563E	601	0 Hz	26.5 GHz	0 dBm	AC
8564E	601	0 Hz	40 GHz	0 dBm	AC
8565E	601	0 Hz	50 GHz	0 dBm	AC
8594E	401	0 Hz	3 GHz	0 dBm	AC

Stop frequency

The stop frequency given in the table may be limited to the corresponding frequency range of the R&S FSMR3.

Command LF sets the stop frequency for 8566A/B to a maximum value of 2 GHz.

Test points (trace points)

The number of trace points is switched over only upon transition to the REMOTE state.

12.13.2.5 Data output formats

In the case of the SCPI and IEEE488.2 standards, the output formats for numerical data are flexible to a large extent. The output format for the HP units, by contrast, is accurately defined with respect to the number of digits. The memory areas for reading instrument data have therefore been adapted accordingly in the remote-control programs for instruments of this series.

Therefore, in response to a query, the R&S FSMR3 returns data of the same structure as that used by the original instruments; this applies in particular to the number of characters returned.

Two formats are currently supported when trace data is output: Display Units (command O1) and physical values (command O2, O3 or TDF P). As to the "Display Units" format, the level data of the R&S FSMR3 is converted to match the value range and the resolution of the 8566/8568 series. Upon transition to the **REMOTE** state, the R&S FSMR3 is reconfigured such that the number of test points (trace points) corresponds to that of the 85xx families (1001 for 8566A/B and 8568A/B, 601 for 8560E to 8565E, 401 for 8594E).

12.13.2.6 Trace data output formats

All formats are supported for trace data output: display units (command O1), display units in two byte binary data (command O2 or TDF B and MDS W), display units in one byte binary data (command O4 or TDF B and MDS B) and physical values (commands O3 or TDF P). With format "display units" the level data is converted into value range and resolution of the 8566/8568 models. On transition to REMOTE state the number of trace points are reconfigured in order to be conform to the selected instrument model (1001 for 8566A/B and 8568 A/B, 601 for 8560E to 8565E, 401 for 8594E).

12.13.2.7 Trace data input formats

Trace data input is only supported for binary date (TDF B, TDF A, TDF I, MDS W, MDS B).

12.13.2.8 GPIB status reporting

The assignment of status bits by commands R1, R2, R3, R4, RQS is supported.

The STB command and the serial poll respond with an 8-bit value with the following assignment:

Bit enabled by RQS	Description
0	not used (value 0)
1	Units key pressed
2	End of Sweep
3	Device Error
4	Command Complete
5	Illegal Command
6	Service Request
7	not used (value 0)

Bits 0 and 7 are not used and always have the value 0.

Please note that the R&S FSMR3 reports any key pressed on the front panel rather than only the unit keys if bit 1 was enabled.

Another difference is the behavior of bit 6 when using the STB? query. On the HP analyzers this bit monitors the state of the SRQ line on the bus. On the R&S FSMR3 this is not possible. Therefore this bit is set, as soon as one of the bits 1 to 5 is set. It won't be reset by performing a serial poll.

12.13.3 Reference: command set of emulated PSA models

The R&S FSMR3 analyzer family supports a subset of the GPIB commands of PSA89600 and ESA instruments.

Despite the differences in system architecture and device features, the supported commands have been implemented in a way to ensure a sufficiently high degree of correspondence with the original.

In many cases the selection of commands supported by the R&S FSMR3 is sufficient to run an existing GPIB program without adaptation.

Supported 89600 commands
*CAL?
*CLS
*ESE
*ESR?
*IDN?
*IST?
*OPC
*OPT?
*PCB

Supported 89600 commands
*PRE
*PSC
*RST
*SRE
*STB?
*TRG
*TST?
*WAI
:CALibration:AUTO OFF|ON|ALERt
:CALibration:TCORrections AUTO|ON|OFF
:CONFigure:WAVeform
:DIAGnostic:EABY ON|OFF
:DIAGnostic:LATCh:VALue <numeric>
:DIAGnostic:LATCh:SELect <string>
:DISPlay:ANNotation:TITLe:DATA <string>
:DISPlay:ENABle OFF|ON
:DISPlay:WINDow:TRACe:Y:[SCALe]:PDIVision <numeric>
:DISPlay:WINDow:TRACe:Y:[SCALe]:RLEVel <numeric>
:DISPlay:WINDow:TRACe:Y:[SCALe]:RLEVel:OFFSet <numeric>
:FORMat:BORDer NORMal|SWAPped
:FORMat[:DATA] ASCii|REAL|UINT|MATLAB,<numeric>
:INITiate:CONTinuous OFF|ON
:INITiate[:IMMediate]
:INSTrument:CATalog?
:INSTrument:NSELect <numeric>
:MMEMory:CATalog? <dir_name>
:MMEMory:COPY <‘file_name1’>,<‘file_name2’>
:MMEMory:DATA <‘file_name’>,<definite_length_block>
:MMEMory:DELete <‘file_name’>
:MMEMory:LOAD:STATe 1,<‘file_name’>
:MMEMory:LOAD:TRACe 1,<‘file_name’>
:MMEMory:MDIRectory <‘dir_name’>
:MMEMory:MOVE <‘file_name1’>,<‘file_name2’>

Supported 89600 commands
:MMEMory:STORe:STATe 1,<‘file_name’>
:MMEMory:STORe:TRACe <numeric>,<‘file_name’>
:READ:WAVform?
[:SENSe]:FREQuency:CENTer <numeric>
[:SENSe]:FREQuency:STARt <numeric>
[:SENSe]:FREQuency:STOP <numeric>
[:SENSe]:FREQuency:SPAN <numeric>
[:SENSe]:POWer:ATTenuation <numeric>
[:SENSe]:ROSCillator:EXTernal:FREQuency <numeric>
[:SENSe]:ROSCillator:OUTPut OFF|ON
[:SENSe]:ROSCillator:SOURce INTernal|EXTernal|EAUTo
[:SENSe]:SPECtrum:TRIGger:SOURce EXTernal<1|2>|IF|IMMediate
[:SENSe]:WAVeform:ADC:RANGe P6
[:SENSe]:WAVeform:APER?
[:SENSe]:WAVeform:AVERage:TACount <numeric>
[:SENSe]:WAVeform:BWIDth:ACTive?
[:SENSe]:WAVeform:BWIDth:TYPE FLAT|GAUSsian
[:SENSe]:WAVeform:IFGain <numeric>
[:SENSe]:WAVeform:IFPath NARRow|WIDE
[:SENSe]:WAVeform:NCPTrace ON|OFF
[:SENSe]:WAVeform:PDIT ON|OFF
[:SENSe]:WAVeform:SRATe <numeric>
[:SENSe]:WAVeform:SWEep:TIME <numeric>
[:SENSe]:WAVeform:TRIGger:EOFFset?
[:SENSe]:WAVeform:TRIGger:INTerpolation ON|OFF
[:SENSe]:WAVeform:TRIGger:SOURce EXTernal<1|2>|IF|IMMediate
:STATus:QUEStionable:CONDition?
:STATus:QUEStionable:ENABle <number>
:STATus:QUEStionable:NTRansition <number>
:STATus:QUEStionable:PTRansition <number>
:STATus:QUEStionable[:EVENt]?
:STATus:QUEStionable:CALibration:CONDition?
:STATus:QUEStionable:CALibration:ENABle <number>

Supported 89600 commands
:STATus:QUEStionable:CALibration:NTRansition <number>
:STATus:QUEStionable:CALibration:PTRansition <number>
:STATus:QUEStionable:CALibration[:EVENt]?
:STATus:QUEStionable:FREQuency:CONDition?
:STATus:QUEStionable:FREQuency:ENABle <number>
:STATus:QUEStionable:FREQuency:NTRansition <number>
:STATus:QUEStionable:FREQuency:PTRansition <number>
:STATus:QUEStionable:FREQuency[:EVENt]?
:STATus:QUEStionable:INTegrity:CONDition?
:STATus:QUEStionable:INTegrity:ENABle <number>
:STATus:QUEStionable:INTegrity:NTRansition <number>
:STATus:QUEStionable:INTegrity:PTRansition <number>
:STATus:QUEStionable:INTegrity[:EVENt]?
:STATus:OPERation:CONDition?
:STATus:OPERation:ENABle <integer>
:STATus:OPERation:NTRansition <integer>
:STATus:OPERation:PTRansition <integer>
:STATus:OPERation[:EVENt]?
:SYSTem:COMMunicate:GPIB[:SELF]:ADDRess <integer>
:SYSTem:DATE <year>,<month>,<day>
:SYSTem:ERRor[:NEXT]?
:SYSTem:KLOCK?
:SYSTem:MESSage <string>
:SYSTem:PRESet
:SYSTem:TIME <hour>,<minute>,<second>
:SYSTem:VERSion?
:TRACe:COPY <src_trace>,<dest_trace>
:TRACe[:DATA] TRACE1 | TRACE2 | TRACE3 | TRACE4 | TRACE5 | TRACE6, <definite_length_block> | <comma_separated_ASCII_data>
:TRACe:MODE WRITe|MAXHold|MINHold|VIEW|BLANk
:TRIGger[:SEQuence]:DELay <numeric>
:TRIGger[:SEQuence]:DELay:STATe OFF|ON|0|1
:TRIGger[:SEQuence]:EXTermal:DELay <numeric>
:TRIGger[:SEQuence]:EXTermal:LEVel <numeric>

Supported 89600 commands
:TRIGger[:SEQuence]:EXTermal:SLOPe POSitive|NEGative
:TRIGger[:SEQuence]:HOLDoff <numeric>
:TRIGger[:SEQuence]:IF:DELay <numeric>
:TRIGger[:SEQuence]:IF:LEVel <numeric>
:TRIGger[:SEQuence]:IF:SLOPe POSitive|NEGative
:TRIGger[:SEQuence]:SLOPe POSitive|NEGative
:TRIGger[:SEQuence]:SOURce IMMediate|VIDeo|EXTernal<1|2>
:TRIGger[:SEQuence]:VIDeo:LEVel <numeric>
:TRIGger[:SEQuence]:VIDeo:LEVel:FREQuency <freq>

12.13.4 Reference: command set of emulated PXA models

The R&S FSMR3 analyzer family supports a subset of the GPIB commands of PXA instruments.

Despite the differences in system architecture and device features, the supported commands have been implemented in a way to ensure a sufficiently high degree of correspondence with the original.

In many cases the selection of commands supported by the R&S FSMR3 is sufficient to run an existing GPIB program without adaptation.

Table 12-3: Supported PXA commands

ABORt
CALCulate:MARKer:AOFF
CALCulate:MARKer[1]|2|...12:MAXimum
CALCulate:MARKer[1]|2|...12:MAXimum:LEFT
CALCulate:MARKer[1]|2|...12:MAXimum:NEXT
CALCulate:MARKer[1]|2|...12:MAXimum:RIGHt
CALCulate:MARKer[1]|2|...12:MINimum
CALCulate:MARKer[1]|2|...12:MODE POSition | DELTa | FIXed | OFF
CALCulate:MARKer[1]|2|...12:MODE[?] SPAN | BAND
CALCulate:MARKer[1]|2|...12[:SET]:CENTer
CALCulate:MARKer[1]|2|...12[:SET]:RLEVel
CALCulate:MARKer[1]|2|...12[:SET]:STARt
CALCulate:MARKer[1]|2|...12[:SET]:STOP
CALCulate:MARKer[1]|2|...12:STATe[?] OFF | ON | 0 | 1
CALCulate:MARKer[1]|2|...12:X[?] <freq | time>

CALCulate:MARKer[1]|2|...12:X:POSition[?] <real>
CALCulate:MARKer[1]|2|...4:X:SPAN
CALCulate:MARKer[1]|2|...4:X:STARt
CALCulate:MARKer[1]|2|...4:X:STOP
CALCulate:MARKer[1]|2|...12:Y[?] <real>
CALibration[:ALL][?]
CALibration:AUTO[?] ON | PARTial | OFF | ALERt
CALibration:AUTO:ALERt[?] TTEMperature | DAY | WEEK | NONE
CALibration:AUTO:MODE[?] ALL | NRF
CALibration:AUTO:TIME:OFF?
CONFigure? SAN
DISPlay:WINDow[1]:TRACe:Y[:SCALe]:RLEVel[?] <real>
DISPlay:WINDow[1]:TRACe:Y[:SCALe]:RLEVel:OFFSet[?] <rel_ampl>
INITiate:CONTinuous[?] OFF | ON | 0 | 1
INITiate[:IMMediate]
INPut:COUPling[?] AC | DC
MMEMory:CATalog? [<directory_name>]
MMEMory:CDIRectory[?] [<directory_name>]
MMEMory:COPY <string>, <string>[, <string>, <string>]
MMEMory:DATA[?] <file_name>, <data>
MMEMory:DELete <file_name>[, <directory_name>]
MMEMory:LOAD:STATe 1, <filename>
MMEMory:MDIRectory <directory_name>
MMEMory:MOVE <string>, <string>[, <string>, <string>]
MMEMory:RDIRectory <directory_name>
MMEMory:STORe:STATe 1, <filename>
[:SENSe]:AVERage:COUNt[?] <integer>
[:SENSe]:AVERage[:STATe][?] ON | OFF | 1 | 0
[:SENSe]:AVERage:TYPE[?] RMS | LOG | SCALar[:SENSe]:AVERage:TYPE?
[:SENSe]:BANDwidth|BWIDth[:RESolution][?] <freq>
[:SENSe]:BANDwidth|BWIDth[:RESolution]:AUTO[?] OFF | ON | 0 | 1
[:SENSe]:BANDwidth|BWIDth:VIDeo[?] <freq>
[:SENSe]:BANDwidth|BWIDth:VIDeo:AUTO[?] OFF | ON | 0 | 1
[:SENSe]:BANDwidth|BWIDth:VIDeo:RATio[?] <real>

[:SENSe]:BANDwidth|BWIDth:VIDeo:RATio:AUTO[?] OFF | ON | 0 | 1
[:SENSe]:DETector:AUTO[?] ON | OFF | 1 | 0
[:SENSe]:FREQuency:CENTer[?] <freq>
[:SENSe]:FREQuency:CENTer:STEP:AUTO[?] OFF | ON | 0 | 1
[:SENSe]:FREQuency:OFFSet[?] <freq>
[:SENSe]:FREQuency:SPAN[?] <freq>
[:SENSe]:FREQuency:SPAN:FULL
[:SENSe]:FREQuency:STARt[?] <freq>
[:SENSe]:FREQuency:STOP[?] <freq>
[:SENSe]:POWer[:RF]:ATTenuation[?] <rel_ampl>
[:SENSe]:POWer[:RF]:ATTenuation:AUTO[?] OFF | ON | 0 | 1
[:SENSe]:SWEep:POINts? <integer>
[:SENSe]:SWEep:TIME? <time>
[:SENSe]:SWEep:TIME:AUTO? OFF | ON | 0 | 1
TRIGger[:SEQuence]:EXTernal2:DELay[?] <time>
TRIGger[:SEQuence]:EXTernal1:DELay[?] <time>
TRIGger[:SEQuence]:EXTernal2:DELay:STATe[?] OFF | ON | 0 | 1
TRIGger[:SEQuence]:EXTernal1:DELay:STATe[?] OFF | ON | 0 | 1
TRIGger[:SEQuence]:EXTernal2:LEVel[?] <level>
TRIGger[:SEQuence]:EXTernal1:LEVel[?] <level>
TRIGger[:SEQuence]:EXTernal2:SLOPe[?] POSitive | NEGative
TRIGger[:SEQuence]:EXTernal1:SLOPe[?] POSitive | NEGative
TRIGger[:SEQuence]:IF:LEVel[?]
TRIGger[:SEQuence]:IF:SLOPe[?] NEGative | POSitive
TRIGger[:SEQuence]:SOURCe EXTernal | IMMediate | VIDeo | LINE | EXTernal1 | EXT1 | EXTernal2 | EXT2 | RFBurst | FRAMe
TRIGger[:SEQuence]:VIDeo:DELay[?] <time>
TRIGger[:SEQuence]:VIDeo:DELay:STATe[?] OFF | ON | 0 | 1
TRIGger[:SEQuence]:VIDeo:LEVel[?] <ampl>
TRIGger[:SEQuence]:VIDeo:SLOPe[?] POSitive | NEGative

12.14 Using the status register

For more information on the contents of the status registers see:

- Remote control via SCPI

12.14.1 General status register commands

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

12.14.2 Reading out the CONDition part

STATus:OPERation:CONDition?
STATus:QUEStionable:CONDition?
STATus:QUEStionable:ACPLimit:CONDition? <ChannelName>
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.

Suffix:

<n>	Window

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

12.14.3 Reading out the EVENt part

STATus:OPERation[:EVENt]?
STATus:QUEStionable[:EVENt]?
STATus:QUEStionable:ACPLimit[:EVENt]? <ChannelName>
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.

Suffix:

<n>	Window

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

12.14.4 Controlling the ENABle part

STATus:OPERation:ENABle <SumBit>
STATus:QUEStionable:ENABle <SumBit>
STATus:QUEStionable:ACPLimit:ENABle <SumBit>,<ChannelName>
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.

Suffix:
<n> Window

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.

12.14.5 Controlling the negative transition part

STATus:OPERation:NTRansition <SumBit>
STATus:QUEStionable:NTRansition <SumBit>
STATus:QUEStionable:ACPLimit:NTRansition <SumBit>,<ChannelName>
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.

Suffix:
<n> Window

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.

12.14.6 Controlling the positive transition part

STATus:OPERation:PTRansition <SumBit>
STATus:QUEStionable:PTRansition <SumBit>
STATus:QUEStionable:ACPLimit:PTRansition <SumBit>,<ChannelName>
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.

Suffix:
<n> Window

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 Troubleshooting

If the results do not meet your expectations, the following sections may contain helpful hints and information.

13.1 Error information

If errors or irregularities are detected, a keyword and an error message, if available, are displayed in the status bar.

Depending on the type of message, the status message is indicated in varying colors.

Table 13-1: Status bar information - color coding

Color	Type	Description
Red	Error	An error occurred at the start or during a measurement, e.g. due to missing data or wrong settings, so that the measurement cannot be started or completed correctly.
Orange	Warning	An irregular situation occurred during measurement, e.g. the settings no longer match the displayed results, or the connection to an external device was interrupted temporarily.
Gray	Information	Information on the status of individual processing steps.
No color	No errors	No message displayed - normal operation.
Green	Measurement successful	Some applications visualize that the measurement was successful by showing a message.

If any error information is available for a channel, an exclamation mark is displayed next to the channel name (!). This is particularly useful when the MultiView tab is displayed, as the status bar in the MultiView tab always displays the information for the currently selected measurement only.

Furthermore, a status bit is set in the `STATus:QUEStionable:EXTended:INFO` register for the application concerned. Messages of a specific type can be queried using the `SYSTem:ERRor:EXTended?` command. Some errors also change particular status bits in other registers, as indicated in Table 13-2. For more information, see the R&S FSMR3 User Manual.

Table 13-2: List of keywords

Keyword	Description	Bit in status register
"INPUT OVLD"	The signal level at the RF input connector exceeds the maximum. The RF input is disconnected from the input mixer to protect the device. To re-enable measurement, decrease the level at the RF input connector and reconnect the RF input to the mixer input.	`STATus:QUEStionable:POWer`, bit 3
"RF OVLD"	Overload of the input mixer or of the analog IF path. ● Increase the RF attenuation (for RF input). ● Reduce the input level (for digital input)	`STATus:QUEStionable:POWer`, bit 0
"LO UNL"	Error in the instrument's frequency processing hardware was detected.	`STAT:QUES:FREQuency`, bit 1
"NO REF"	Instrument was set to an external reference but no signal was detected on the reference input.	`STAT:QUES:FREQuency`, bit 8
"OVENCOLD"	The optional OCXO reference frequency has not yet reached its operating temperature. The message usually disappears a few minutes after power has been switched on.	`STAT:QUES:FREQuency`, bit 0
"UNCAL"	One of the following conditions applies: ● Correction data has been switched off. ● No correction values are available, for example after a firmware update. ● Record the correction data by performing a self alignment	`STATus:QUEStionable`, bit 8
"WRONG_FW"	The firmware version is out-of-date and does not support the currently installed hardware. Until the firmware version is updated, this error message is displayed and self-alignment fails.	

13.2 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 FSMR3 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 13-3: 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.
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.

13.3 Troubleshooting remote operation

If problems arise during measurement in remote operation, try the following methods to solve them.

Incompleted 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 FSMR3 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 R&S FSMR3000 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 FSMR3 to clear all currently active remote channels. Depending on the used interface and protocol, send the following commands:
   - **Visa**: `viClear()`
   - **GPIB**: `ibclr()`
   - **RSIB**: `RSDLLibclr()`

   The remote channel currently processing the incompleted 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 R&S FSMR3000 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 - log file

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 FSMR3 are recorded in log files with the following syntax:

`C:\R_S\INSTR\ScpiLogging\ScpiLog.<xx>`

where <xx> is a consecutive number, starting with 00;

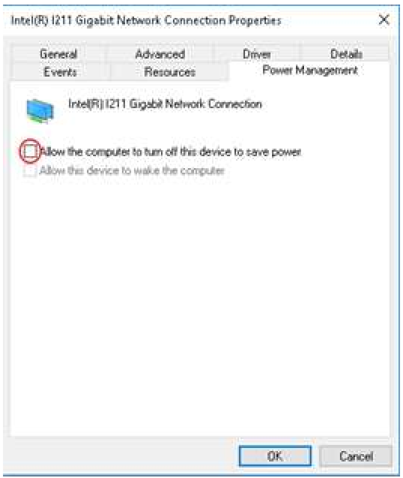
A new file is created each time you stop and restart the logging function. The lowest available number is used for the <xx> extension.

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.

Interrupted VISA connection to R&S FSMR3

Sometimes, in combination with a certain LAN-switch (SMC Switch 210), the VISA remote connection to the R&S FSMR3 is interrupted. In this case, disable the power save mode for the network controller on the R&S FSMR3.

1. On the R&S FSMR3, open the Windows "Start" menu.
2. Search for the network connection properties.
3. On the "Power Management" tab, disable the power save option.



13.4 Miscellaneous troubleshooting hints

Power levels for low frequency signals not correct
By default, the R&S FSMR3 uses AC coupling for RF input. For very low frequencies, the input signal may be distorted with this setting. In this case, use DC coupling instead. To change the setting, select "INPUT/OUPUT" > "Input Source Config > Radio Frequency > Input Coupling > DC".

Invalid trace display
If output to the "IF 2 GHz OUT" connector is activated, the measured values are no longer sent to the display; thus, the trace data currently displayed on the R&S FSMR3 becomes invalid. A message in the status bar indicates this situation.

Web browser access to instrument fails
If an error message ("Failed to connect to server (code. 1006)") is displayed in the web browser instead of the instrument's user interface then the LAN web browser interface was probably deactivated.

13.5 System recovery

The system drive of the R&S FSMR3 is delivered with a recovery partition that allows you to restore the original operating system image and firmware.

To restore the original operating system image and firmware

1. Select the "Windows" icon in the toolbar, or press the "Windows" key or the [CTRL] + [ESC] key combination on the (external) keyboard.
2. Open the Windows "Settings".
3. Select "Update & Security" > "Recovery".
4. In the "Advanced Startup" section, select "Restart Now".
   The "R&S Recovery Environment" starts.
5. In the "R&S Recovery Environment", select "Factory Default Restore".
   The default image is restored.
6. Reboot the instrument.

After the default image is restored, upgrade to the desired firmware version (see Chapter 10.4.4, "Firmware updates", on page 296).

13.6 Collecting information for support

If problems occur, the instrument generates error messages which in most cases will be sufficient for you to detect the cause of an error and find a remedy.

In addition, our customer support centers are there to assist you in solving any problems that you may encounter with your R&S FSMR3. We will find solutions more quickly and efficiently if you provide us with the information listed below.

- **Windows Event Log Files**
  Windows records important actions of applications and the operating system in event logs. You can create event log files to summarize and save the existing event logs (see "To create windows event log files" on page 701).
- **System Configuration:** The "System Configuration" dialog box (in the "Setup" menu) provides information on:
  - **Hardware Info:** hardware assemblies
  - **Versions and Options:** the status of all software and hardware options installed on your instrument
  - **System Messages:** messages on any errors that may have occurred

  An .xml file with information on the system configuration ("Device Footprint") can be created automatically (using the `DIAGnostic:SERVice:SINFo` command or as described in "To collect the support information" on page 701).

- **Error Log:** The `RSError.log` file (in the `C:\Program Files (x86)\Rohde-Schwarz\FSMR3000\<version>\log` directory) contains a chronological record of errors.
- **Support file:** a *.zip file with important support information can be created automatically (in the `C:\Program Files (x86)\Rohde-Schwarz\FSMR3000\<version>\user` directory). The *.zip file contains the system configuration information ("Device Footprint"), the current eeprom data and a screenshot of the screen display.

To collect the support information

1. Press the [Setup] key.
2. Select "Service" > "R&S Support" and then "Create R&S Support Information".

   For example
   `C:\Program Files (x86)\Rohde-Schwarz\FSMR3000\<version>\user\FSMR3_*.zip`

To create windows event log files

1. Select the "Windows Start Button" in the bottom left corner.
2. Enter *Event Viewer* and select "Enter".
3. Select and expand "Windows Logs" in the "Console Tree".
4. Right-click on each subsection and select "Save All Events As...".

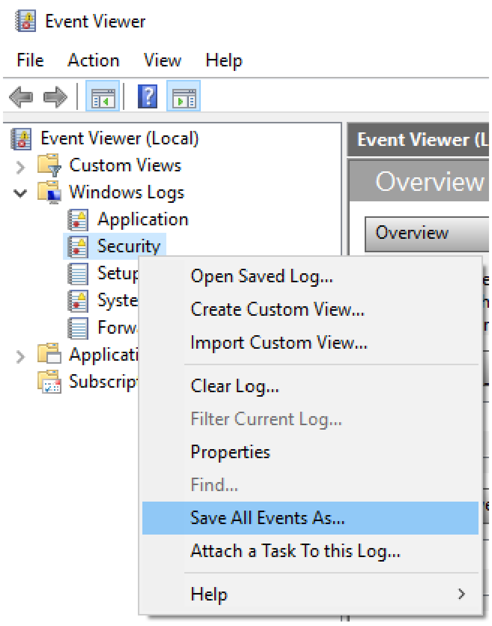


Figure 13-1: Event Viewer

5. Enter a file name and select "Save"

Collect the error information and attach it to an email in which you describe the problem. Send the email to the customer support address for your region as listed in Chapter 13.7, "Contacting customer support", on page 702.

Packing and transporting the instrument

If the instrument needs to be transported or shipped, observe the notes described in Chapter 14, "Transporting", on page 703.

13.7 Contacting customer support

Technical support – where and when you need it

For quick, expert help with any Rohde & Schwarz product, contact our customer support center. A team of highly qualified engineers provides support and works with you to find a solution to your query on any aspect of the operation, programming or applications of Rohde & Schwarz products.

Contact information

Contact our customer support center at www.rohde-schwarz.com/support, or follow this QR code:

Figure 13-2: QR code to the Rohde & Schwarz support page

14 Transporting

Lifting and carrying

See:

- "Lifting and carrying the product" on page 6
- Chapter 4.2.1, "Lifting and carrying", on page 13.

Packing

Use the original packaging material. It consists of antistatic wrap for electrostatic protection and packing material designed for the product.

If you do not have the original packaging, use similar materials that provide the same level of protection.

Securing

When moving the product in a vehicle or using transporting equipment, make sure that the product is properly secured. Only use items intended for securing objects.

Transport altitude

The maximum transport altitude without pressure compensation is 4600 m above sea level.

15 Maintenance, storage, transport and disposal

The product does not require regular maintenance. It only requires occasional cleaning. It is however advisable to check the nominal data from time to time.

15.1 Cleaning

How to clean the product is described in "Cleaning the product" on page 7.

Do not use any liquids for cleaning. Cleaning agents, solvents, acids and bases can damage the front panel labeling, plastic parts and display.

15.2 Storage

Protect the product against dust. Ensure that the environmental conditions, e.g. temperature range and climatic load, meet the values specified in the data sheet.

15.3 Transporting

Lifting and carrying

See:

- "Lifting and carrying the product" on page 6
- Chapter 4.2.1, "Lifting and carrying", on page 13.

Packing

Use the original packaging material. It consists of antistatic wrap for electrostatic protection and packing material designed for the product.

If you do not have the original packaging, use similar materials that provide the same level of protection.

Securing

When moving the product in a vehicle or using transporting equipment, make sure that the product is properly secured. Only use items intended for securing objects.

Transport altitude

The maximum transport altitude without pressure compensation is 4600 m above sea level.

15.4 Disposal

Rohde & Schwarz is committed to making careful, ecologically sound use of natural resources and minimizing the environmental footprint of our products. Help us by disposing of waste in a way that causes minimum environmental impact.

Disposing electrical and electronic equipment

A product that is labeled as follows cannot be disposed of in normal household waste after it has come to the end of its service life. Even disposal via the municipal collection points for waste electrical and electronic equipment is not permitted.

Figure 15-1: Labeling in line with EU directive WEEE

Rohde & Schwarz has developed a disposal concept for the eco-friendly disposal or recycling of waste material. As a manufacturer, Rohde & Schwarz completely fulfills its obligation to take back and dispose of electrical and electronic waste. Contact your local service representative to dispose of the product.

List of commands

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