FSW
Signal and Spectrum Analyzer
Getting Started

1338410202
Version 17

ROHDE&SCHWARZ
Make ideas real

This manual applies to the following FSW models with firmware version 6.30 and later:

- R&S®FSW8 (1331.5003K08 / 1312.8000K08)
- R&S®FSW13 (1331.5003K13 / 1312.8000K13)
- R&S®FSW26 (1331.5003K26 / 1312.8000K26)
- R&S®FSW43 (1331.5003K43 / 1312.8000K43)
- R&S®FSW50 (1331.5003K50 / 1312.8000K50)
- R&S®FSW67 (1331.5003K67 / 1312.8000K67)
- R&S®FSW85 (1331.5003K85 / 1312.8000K85)

In addition to the base unit, the following options are described:

- R&S®FSW-B4, OCXO (1313.0703.02)
- R&S®FSW-B10, external generator control (1313.1622.02)
- R&S®FSW-B13, high-pass filter (1313.0761.02)
- R&S®FSW-B17, digital baseband interface (1313.0784.02)
- R&S®FSW-B21, external mixer (1313.1100.26)
- R&S®FSW-B24, preamplifier (1313.0832.XX)
- R&S®FSW-B25, electronic attenuator (1313.0990.02)
- R&S®FSW-B71, analog baseband interface (1313.1651.XX, 1313.6547.02)
- FSW bandwidth extension options: R&S®FSW-B160 (1313.1668.02) / (1325.4850.04) / (1325.5357.04) / R&S®FSW-B320 (1313.7172.02) / R&S®FSW-B512 (1313.4296.04) / R&S®FSW-B1200 (1331.6400.xx) / R&S®FSW-B2000 (1325.4750.xx) / R&S®FSW-B2001 (1331.6916.xx) / R&S®FSW-B4001 (1338.5215.xx) / R&S®FSW-B5000 (1331.6997.xx) / R&S®FSW-B6001 (1338.5221.xx) / R&S®FSW-B8001 (1338.5238.xx)
- R&S®FSW-B517 (1331.6980.02) / R&S®FSW-B1017 (1350.7008.02) Digital I/Q 40G streaming output

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Throughout this manual, R&S® is indicated as R&S.

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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 sections.

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 specifications document.

Target audience

The target audience of this document includes developers and technicians, administrators and maintenance personnel performing RF signal measurements. The required skills and experience of the users depend on the test setup and application of the product.

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 Section 1.1, "Safety instructions", on page 9. The same information is provided in many languages in printed format. The printed "Safety Instructions" for "Mains-Powered Products, Heavy" (document number 1171.1788.99) 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 specifications document, manuals and the printed "Safety Instructions" document. If you are unsure about the appropriate use, contact Rohde & Schwarz customer support.

Using the product requires skilled persons 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 specifications document. 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 support 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 specifications document. 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 outdoor use of your product, e.g. a protective cover, you can use the product outdoors.

You can operate the product up to an altitude of 2000 m above sea level. If a higher altitude is permissible, the value is provided in the specifications document. The product is suitable for pollution degree 2 environments where noncon-

ductive contamination can occur. For more information on environmental conditions such as ambient temperature and humidity, see the specifications document.

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 the product

Before connecting the interfaces or measuring inputs of the product to other products or electrical circuits, make sure that the other products or electrical circuits provide special protection against electric shock. This protection principle is referred to as SELV (safety extra-low voltage) and is based on a low voltage level and increased insulation. Exceptions are indicated by a measurement category on the product and given in the specifications document.

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.
- 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 and its accessories 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 FSW user documentation. Unless specified otherwise, you find the documents at:

www.rohde-schwarz.com/manual/FSW

Further documents are available at:

www.rohde-schwarz.com/product/FSW

2.1 Getting started manual

Introduces the FSW 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. Includes the contents of the getting started manual.
- Firmware application manual
  Contains the description of the specific functions of a firmware application, including remote control commands. Basic information on operating the FSW is not included.

The contents of the user manuals are available as help in the FSW. 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):

https://gloris.rohde-schwarz.com

2.4 Printed safety instructions

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

2.5 Videos

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

2.6 Instrument security procedures

Deals with security issues when working with the FSW in secure areas. It is available for download on the internet.

2.7 Specifications and brochures

The specifications document, also known as the data sheet, contains the technical specifications of the FSW. 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/FSW

2.8 Release notes and open-source acknowledgment (OSA)

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

The software uses 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/FSW

2.9 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/FSW

3 Key features

The FSW Signal and Spectrum Analyzer sets standards in RF performance and usability. The FSW provides the following outstanding key features:

- Unmatched phase noise
- Excellent dynamic range
- Up to 8.3 GHz analysis bandwidth
- 800 MHz real-time analysis bandwidth with 2.4 million FFT/s, 0.46 µs POI and 500 MHz I/Q data streaming interface
- High sensitivity even at low frequencies
- High measurement rates and fast sweep times with sweep rates up to 1000 sweeps per second
- Multiple measurement applications can be run and displayed in parallel
- Easy and intuitive to operate via the large touchscreen user interface and optimized user guidance
- SCPI recorder simplifies code generation
- Integrated support of R&S®NRP-Zxx power sensors

For a detailed specification refer to the specifications document.

Due to these features the FSW is ideal for various measurement tasks, for instance:

- Measuring oscillators for radar and communications applications due to the low phase noise
- Identifying and analyzing spurious emissions due to the large spurious-free dynamic range and low DANL
- Measuring harmonics due to integrated highpass filters
- Measuring wide-band modulated or frequency-agile signals due to the large bandwidth
- Detecting errors caused by interaction between signals by measuring multiple standards simultaneously

4 Preparing for use

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

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4.1 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 10.

4.2 Unpacking and checking

1. Unpack the FSW carefully.
2. Retain the original packing material. Use it when transporting or shipping the FSW 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.

4.3 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 specifications document.

For safety information, see "Choosing the operating site" on page 10.

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 specifications document.

- 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.

4.4 Setting up the product

See also:

- "Setting up the product" on page 11
- "Intended use" on page 9

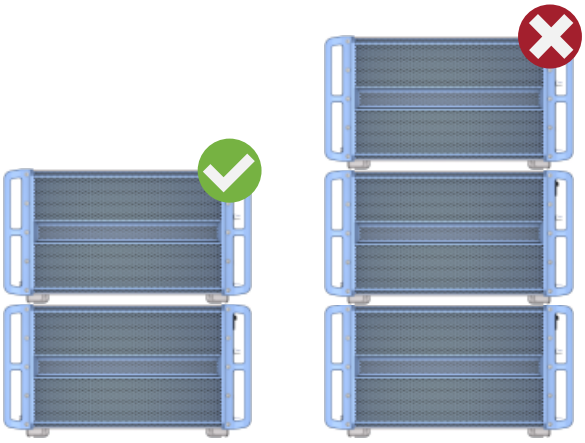
4.4.1 Placing the product on a bench top

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 specifications document.
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 to provide sufficient airflow and ventilation.
   - Do not place the product next to heat-generating equipment such as radiators or other products.

4.4.2 Mounting the FSW in a rack

To prepare the rack

1. Observe the requirements and instructions in "Setting up the product" on page 11.
2. **NOTICE!** Insufficient airflow can cause overheating and damage the product.

   Design and implement an efficient ventilation concept for the rack.

To mount the FSW in a rack

1. Use an adapter kit to prepare the FSW for rack mounting.
   a) Order the rack adapter kit designed for the FSW. For the order number, see the specifications document.
   b) Mount the adapter kit. Follow the assembly instructions provided with the adapter kit.
2. Lift the FSW to shelf height.
3. Grab the handles and push the FSW 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 FSW in the rack.

To unmount the FSW from a rack

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

4.5 Connecting the AC power

In the standard version, the FSW is equipped with an AC power supply connector.

The FSW can be used with different AC power voltages and adapts itself automatically to it. Refer to the specifications document for the requirements of voltage and frequency.

For safety information, see "Connecting to power" on page 11.

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 FSW.

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 specifications document.

For details on the connector, refer to Section 5.2.2, "AC power supply connection and main power switch", on page 56.

4.6 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 FSW

Prerequisites:

The FSW is off but connected to power.

No RF input is connected to the instrument.

1. Set the switch on the power supply to position [I].
   See Section 5.2.2, "AC power supply connection and main power switch", on page 56.

   The LED of the Power key is orange.

   See Section 5.1.1, "Power key", on page 42.

Note: If the FSW was disconnected from power before it was switched off regularly, it automatically switches back on when the power is reconnected.
Using a LAN-controlled power switch, you can take advantage of this behavior to switch the device on and off remotely.

2. Press the Power key.
   See Table 4-1.

   The LED changes to green.
   The FSW boots.

   After booting, the instrument is ready for operation.

Warm-up time for OCXO

When the instrument is switched on, the OCXO requires an extended warm-up time.

To shut down the product

Prerequisites:

The product is in the ready state.

Any RF input is disconnected from the instrument.

► Press the [Power] key.

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

If the instrument temperature exceeds the limit specified in the specifications document, the FSW automatically shuts down to protect the instrument from damage.

To disconnect from power

The FSW 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 Section 5.2.2, "AC power supply connection and main power switch", on page 56.

   The LED of the standby key is switched off.

2. Disconnect the FSW from the power source.

4.7 Connecting to RF coaxial connectors

The most common interface used to provide signal input to the FSW is the RF input 50 ohm connector.

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, protect the instrument from damaging DC input voltages manually, e.g. by inserting a DC blocker or using a bias tee to bias your DUT and supply the DC input to the instrument. For details, refer to the specifications document.

For details on coupling, see the section on radio frequency input in the FSW user manual.

To prepare for connecting

1. **NOTICE!** Damaged or not clean connections can lead to RF insertion loss and mismatch, and even premature wear of the connectors.

   Before connecting to the port, inspect the RF connector visually. Check that it is clean, undamaged and mechanically compatible.

2. Use a high-quality RF cable that matches the RF connector type. See also "Cable selection to minimize electromagnetic interference (EMI)" on page 30.

You can connect to two kinds of connectors:

- "To connect to screwable connectors" on page 25
- "To connect to pluggable connectors" on page 26

To connect to screwable connectors

To connect the cable with the connector, proceed as follows:

1. Carefully align the connector of the cable and the connector along a common axis.

2. Mate the connectors along the common axis until the male pin of the inner connector engages with the female socket of the outer connector.

3. Turn the nut of the outer connector until the connectors are firmly coupled.
4. **NOTICE!** Excessive tightening can damage the connectors.
   Do not fasten the 1.00 mm "RF Input" connector with a torque larger than 0.23 Nm. Rohde & Schwarz delivers an appropriate torque wrench with the instrument (R&S®ZN-ZTW Torque 0.23 Nm).
   Using a calibrated torque wrench, torque the nut to the limit. Hold the opposite connector part stationary with a spanner.

To connect to pluggable connectors

The FSW provides pluggable Bayonet Neill-Concelman (BNC) connectors.

To connect the RF cable with the BNC connector, proceed as follows:

1. Carefully align the connector of the cable and the BNC connector along a common axis.
2. Mate the connectors along the common axis until the male pin of the connector of the cable engages with the female socket of the BNC connector.

4.8 Connecting to LAN

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

For details on the connector, see Section 5.2.4, "LAN", on page 57.

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 FSW 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 FSW is configured to use DHCP and no static IP address is configured.

The default instrument name is <Type><variant>-<serial_number>, for example, FSW8-123456. For information on determining the serial number, see Section 5.2.20, "Device ID", on page 64.

For more information on LAN configuration, see the FSW user manual.

4.9 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 FSW:

- 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" .

4.10 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 FSW (see also Section 5.2.5, "Display port and DVI", on page 57).

Screen resolution and format

The touchscreen of the FSW 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.

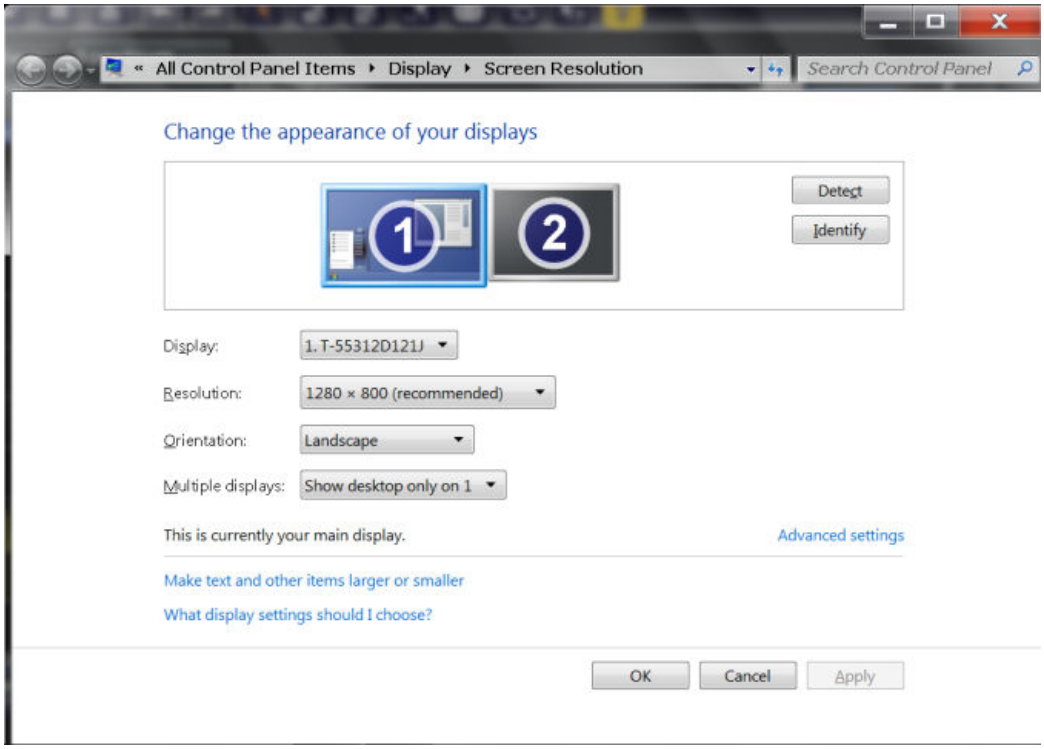
If you configure the external monitor to be used as the *only* display in the Windows configuration dialog box ("Show only on 2"), the maximum screen resolution of the monitor is used. In this case, you can maximize the FSW application window and see even more details. You cannot change the monitor's 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 FSW supports a minimum resolution of 1280x768 pixels.

1. Connect the external monitor to the FSW.
2. Press [Setup].
3. Press "Display".
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.

4.11 Considerations for test setup

An unsuitable test setup can damage the instrument and connected devices.

Cable selection to minimize 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.

Preventing electrostatic discharge (ESD)

Electrostatic discharge is most likely to occur when you connect or disconnect a DUT.

► **NOTICE!** Electrostatic discharge can damage the electronic components of the product and the device under test (DUT).

Ground yourself to prevent electrostatic discharge damage:

a) Use a wrist strap and cord to connect yourself to ground.
b) Use a conductive floor mat and heel strap combination.

Electrostatically discharge the DUT with a short or match before connecting it to the instrument. Even residual charges on cables can cause damage when discharged by the instrument.

Signal input and output levels

Information on signal levels is provided in the specifications document and on the instrument, next to the connector. Keep the signal levels within the specified ranges to avoid damage to the FSW and connected devices.

When measuring unknown signals, attenuate the signal input by at least 10 dB. Using a 0 dB attenuation when measuring unknown signals can damage or destroy the input mixer.

4.12 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 FSW 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:

- R&S Power Viewer Plus - virtual power meter for displaying results of the power sensor R&S NRPxx (install only this component!)
- 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 the "Network and Remote Control" section of the FSW user manual.

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.

4.13 Logging on

Windows 10 requires that users identify themselves by entering a user name and password in a login window. By default, the FSW provides the following user accounts:

- **"Instrument"**: an administrator account with unrestricted access to the computer/domain
- **"NormalUser"**: a standard user account with limited access

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 FSW-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 FSW 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 Section 4.16, "Protecting data using the secure user mode", on page 37.

Passwords

For all default user accounts, the initial password is *894129*. Note that this password is very weak, and it is recommended that you change the password for all 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 (with full access) 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.

Changing the password for auto-login requires administrator rights.

1. Select the "Windows" icon in the toolbar to access the operating system of the FSW (see also "To access the "Start" menu" on page 33).

2. Open the `C:\R_S\INSTR\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\AUTOLOGIN.REG`.
7. Press [ENTER] to confirm.
   The auto-login function is reactivated with the changed password. It is applied the next time you switch on the instrument.

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 FSW (see also "To access the "Start" menu" on page 33).

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 the FSW user manual.

4.14 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 [SETUP].
2. Press "System Config".
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.

4.15 Performing a self-alignment

When temperature changes occur in the environment of the FSW, 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 specifications document).

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 after installation. A dialog box is displayed indicating how much warm-up time is still required before self-alignment can be performed.

1. Press [Setup].
2. Press "Alignment".

3. Select "Start Self Alignment" 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 [SETUP].
- Press "Alignment".

4.16 Protecting data using the secure user mode

During normal operation, the FSW uses a solid-state drive to store its operating system, instrument firmware, instrument self-alignment data, and any user data created during operation.

If necessary, the solid-state drive can be removed from the FSW and locked in a secure place to protect any classified data it may contain.

Redirecting storage to volatile memory

Alternatively, to avoid storing any sensitive data on the FSW permanently, the *secure user mode* was introduced (option R&S FSW-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 FSW 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
- Any data created by other applications installed on the FSW, 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 mem-

ory 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 FSW 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 FSW.

Windows updates

In secure user mode, in rare cases, Windows updates trigger a reboot. We recommend using secure user mode on R&S FSW-K33 only in private LAN without access to the internet or disconnected to LAN to avoid unwanted Windows updates. In preparation for Windows updates, disable secure user mode temporarily.

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 FSW 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 "Shut down" 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 ([Setup] > "System Configuration" > "Config" tab > "Secure User Mode": "ON", see the FSW user manual).

Remote control

Initially after installation of the R&S FSW-K33 option, secure user mode must be enabled manually once before remote control is possible.

Manual activation is necessary to prompt for a change of passwords.

5 Instrument tour

5.1 Front panel view

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

(Note: the graphic shows a 26 GHz model of the FSW. Some connectors on the 85 GHz model differ slightly; differences are indicated for the individual connectors.)

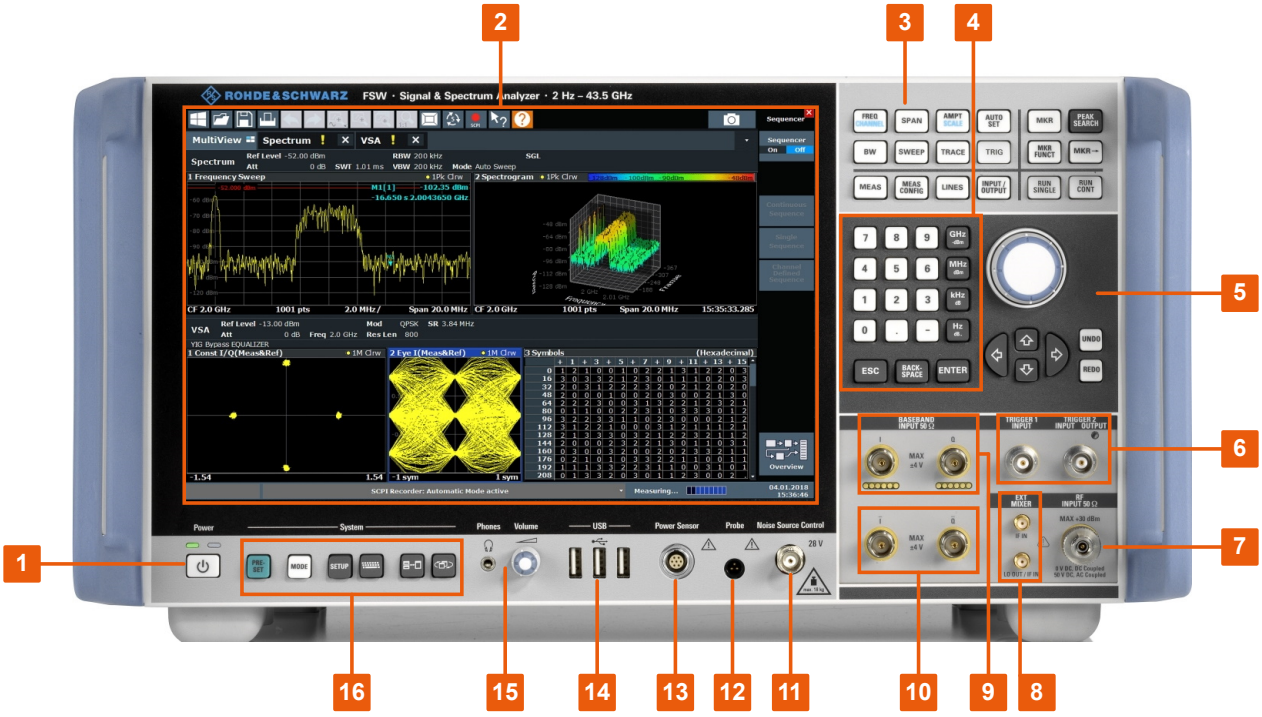


Figure 5-1: Front panel view of FSW26

1 = POWER key
2 = Touchscreen
3 = Function keys
4 = Keypad
5 = Navigation controls
6 = TRIGGER INPUT/OUTPUT connectors
7 = RF Input 50 Ω connector
8 = EXT MIXER connector (optional)
9 = (Analog) Baseband Input 50Ω connectors for I/Q signal or Rohde & Schwarz active probes (optional)
10 = (Analog) Baseband Input 50Ω connectors for inverse part of differential I/Q signal (optional, not for FSW85)

11 = NOISE SOURCE CONTROL
12 = PROBE connector
13 = POWER SENSOR connector
14 = USB connectors
15 = Headphones connector and volume control
16 = SYSTEM keys

5.1.1 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 11.

5.1.2 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.

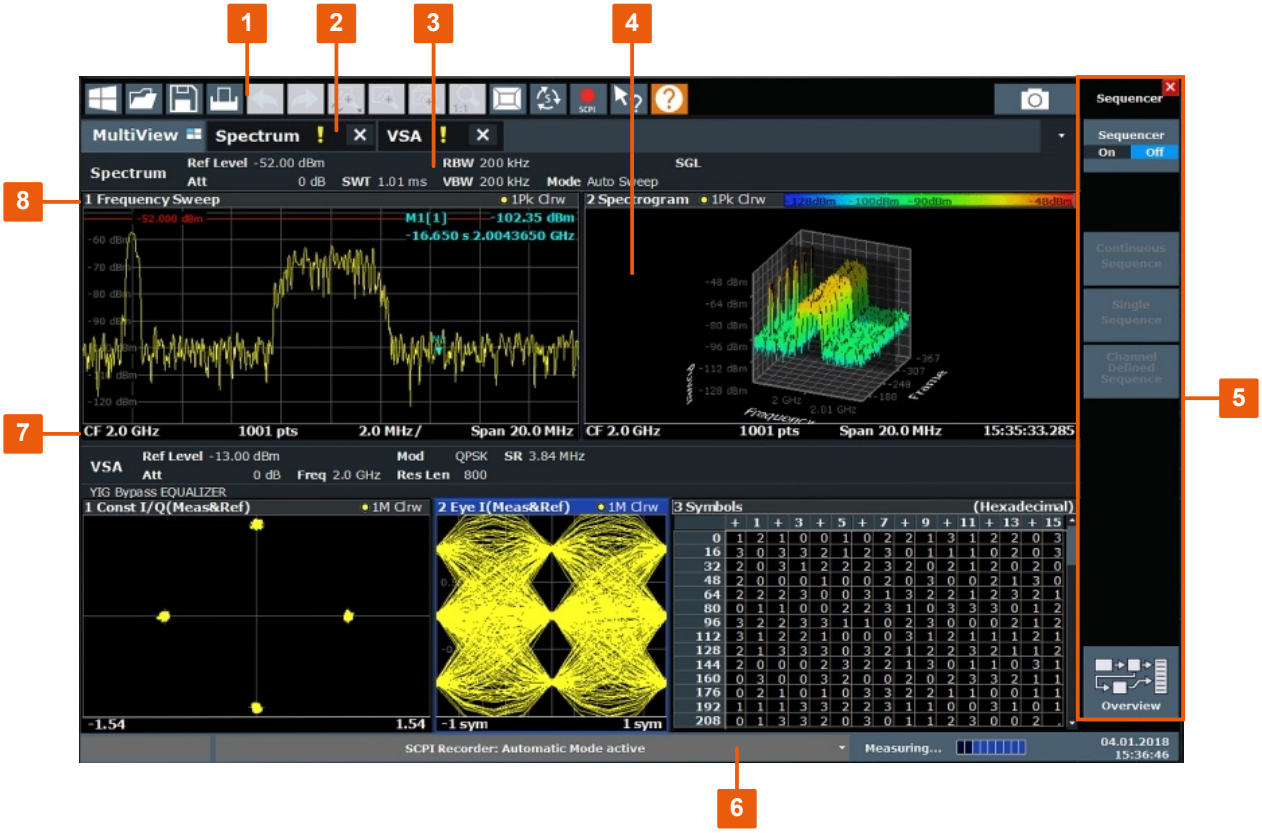


Figure 5-2: Touchscreen elements

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 = Measurement results area
5 = Softkeys for function access
6 = Instrument status bar with error messages, progress bar and date/time display
7 = Diagram footer with diagram-specific information, depending on application
8 = Window title bar with diagram-specific (trace) information

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 (among others, see also Section 6, "Trying out the instrument", on page 65):

- 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 Section 7.5, "Touchscreen gestures", on page 109.

5.1.3 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 5-1: 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]	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 FSW-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.
[TRIG]	Sets the trigger mode, the trigger threshold, the trigger delay, and the gate configuration in the case of gated sweep.
Marker functions	
[MKR]	Sets and positions the absolute and relative measurement markers (markers and delta markers).

Function key	Assigned functions
[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.
[MKR FUNC]	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
[MKR->]	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 input/output functions.
Measurement start functions	
[RUN SINGLE]	Starts a single new measurement (Single Sweep Mode).
[RUN CONT]	Starts a continuous measurement (Continuous Sweep Mode).

Function key	Assigned functions
Function execution (in navigation controls area)	
[UNDO]	Reverts last operation
[REDO]	Repeats previously reverted operation.

5.1.4 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.

5.1.4.1 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

5.1.4.2 Navigation keys

You can use the navigation keys as an alternative 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.

5.1.4.3 Undo/redo keys

- [Undo] reverts the previous action, i.e. the state before the previous action is retrieved.
  The undo function is useful, for example, if you accidentally select a different measurement. In this case, many settings are lost. However, if you press [Undo] immediately afterwards, the previous state is retrieved, i.e. the previous measurement and all settings.
- [Redo] 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 you use these functions, the history of previous actions is deleted.

5.1.5 Keypad

The keypad is used to enter alphanumeric parameters, including the corresponding units (see also Section 7.4.2, "Entering alphanumeric parameters", on page 108). It contains the following keys:

Table 5-2: 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.

5.1.6 TRIGGER INPUT / OUTPUT

Use the female "TRIGGER INPUT" 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.

Use the female BNC "TRIGGER INPUT / OUTPUT" connector to receive a second external signal or to provide a signal to another device. The signal is TTL compatible (0 V / 5 V). You control the connector usage in the "Trigger" settings ([TRIG] key).

The trigger output also controls signals by the frequency mask trigger available in Real-Time mode.

The rear panel provides a third "TRIGGER INPUT / OUTPUT" connector, see Section 5.2.12, "TRIGGER 3 INPUT/ OUTPUT", on page 60. (Not models 1312.8000Kxx)

For FSW85 models, the second trigger (female BNC "TRIGGER INPUT / OUTPUT" connector) on the front panel is not available due to the second RF input connector (see Section 5.1.7, "RF input 50 ohm", on page 49).

5.1.7 RF input 50 ohm

Provides RF input from a connected device under test (DUT) to the FSW, which is then analyzed in an RF measurement. Connect the DUT to the "RF Input" connector on the FSW *after* switching on the instrument. Disconnect the RF input before switching off the instrument. Do not overload the input. For maximum allowed values, see the specifications document.

The specific connector type depends on the instrument model:

- **FSW26**: APC 3.5 mm male (compatible with R&S SMA)
- **FSW43**: 2.92 mm male (compatible with R&S SMA)
- **FSW50/67**: 1.85 mm male (compatible with 2.4 mm)
- **FSW85**:
  - Input 1: 1.00 mm RF input connector for frequencies up to 85 GHz (90 GHz with option R&S FSW-B90G)
  - Input 2: 1.85 mm RF input connector for frequencies up to 67 GHz

  For models 1312.8000Kxx:
  1.00 mm RF input connector for frequencies up to 85 GHz (90 GHz with option R&S FSW-B90G)

For more information on connecting devices to this input, see Section 4.7, "Connecting to RF coaxial connectors", on page 25.

See also Section 4.11, "Considerations for test setup", on page 30.

For FSW85 models, which have two input connectors, you must define which input source is used for each measurement channel.

5.1.8 EXT MIXER connector (optional)

Connect external mixers to the "EXT MIXER LO OUT/IF IN" and "IF IN" female connectors to increase the available frequency range. These connectors are optional and only available with R&S FSW-B21.

If no external mixers are connected to the FSW, cover the two front connectors "LO OUT / IF IN" and "IF IN" with the supplied SMA caps.

5.1.9 (Analog) baseband input 50 ohm connectors (optional)

The "Analog Baseband" interface option provides four "Baseband input" BNC connectors on the front panel of the FSW for analog I and Q signals.

(FSW85: two connectors)

The upper BNC connectors BASEBAND INPUT I and BASEBAND INPUT Q are used to input:

- Single-ended signals
- The positive signal input for differential signals
- Input from active Rohde & Schwarz probes (see specifications document)

The lower BNC connectors Ī and Q̄ are used to input the negative signal for differential signals.

FSW85

The FSW85 provides only two connectors; differential input is not supported.

Complex signal input (I+jQ)

For complex signal input (I+jQ), always use two identical cables for the I and Q connectors (same length, same type, same manufacturer). Otherwise, time delay or gain imbalance can occur between the different cables, which cannot be calibrated.

All connectors have a fixed impedance of 50 Ω. Do not overload the input. For maximum allowed values, see the specifications document.

Input via the "Analog Baseband" interface can be enabled in the I/Q Analyzer or in one of the optional applications that process I/Q data (where available).

For more information on the "Analog Baseband" interface, see the FSW I/Q Analyzer and I/Q Input User Manual.

5.1.10 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.

For smart noise sources, use the Lemosa Power sensor connector.

5.1.11 Probe

The FSW 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.

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

5.1.12 Power sensor

The "Lemosa" female connector is used to connect Rohde & Schwarz power sensors, but also smart noise sources. For a detailed list of supported sensors and smart noise sources, see the specifications document.

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

A smart noise source (SNS) provides its own ENR and uncertainty tables and a temperature value from an internal measurement. Thus, accuracy is improved and less configuration efforts are required compared to common noise sources.

Connect the smart noise source to the Lemosa "Power Sensor" connector on the FSW. Then connect the SNS output to the DUT or the "RF Input" connector on the FSW.

When you connect a smart noise source, the FSW automatically loads its ENR table and stores it for future measurements. The ENR table remains stored on the instrument even after the noise source is disconnected. If the table already exists on the FSW, the contents are updated, if necessary. The identification and setup procedure after connecting the R&S FS-SNS can take up to 10 seconds.

For details on Rohde & Schwarz smart noise sources, see the product documentation.

5.1.13 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 Section 5.2.3, "USB", on page 56.

All USB connectors support standard 2.0.

5.1.14 Phones and volume

You can use headphones to monitor demodulated audio frequencies in time domain measurements acoustically.

Connect headphones equipped with a miniature jack plug to the "PHONES" female connector. Set the output voltage using the "Volume" control to the right of the female connector. The maximum output voltage (volume) is 1 V. If a headphone is plugged into the instrument, the internal loudspeaker is automatically switched off.

The output provided to the "PHONES" connector is the same as the (video) output at the IF/VIDEO/DEMOD OUTPUT connector.

See also "Using headphones" on page 12.

5.1.15 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 5-3: SYSTEM keys

SYSTEM key	Assigned functions
[PRESET]	Resets the instrument to the default state.
[MODE]	Provides the selection between applications
[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.)
	Switches between the on-screen keyboard display: • At the top of the screen • At the bottom of the screen • Off
	Switches between maximized and split display of focus area.
	Moves focus area from one active window to the next.

5.2 Rear panel view

This figure shows the rear panel view of the FSW. The individual elements are described in more detail in the subsequent sections.

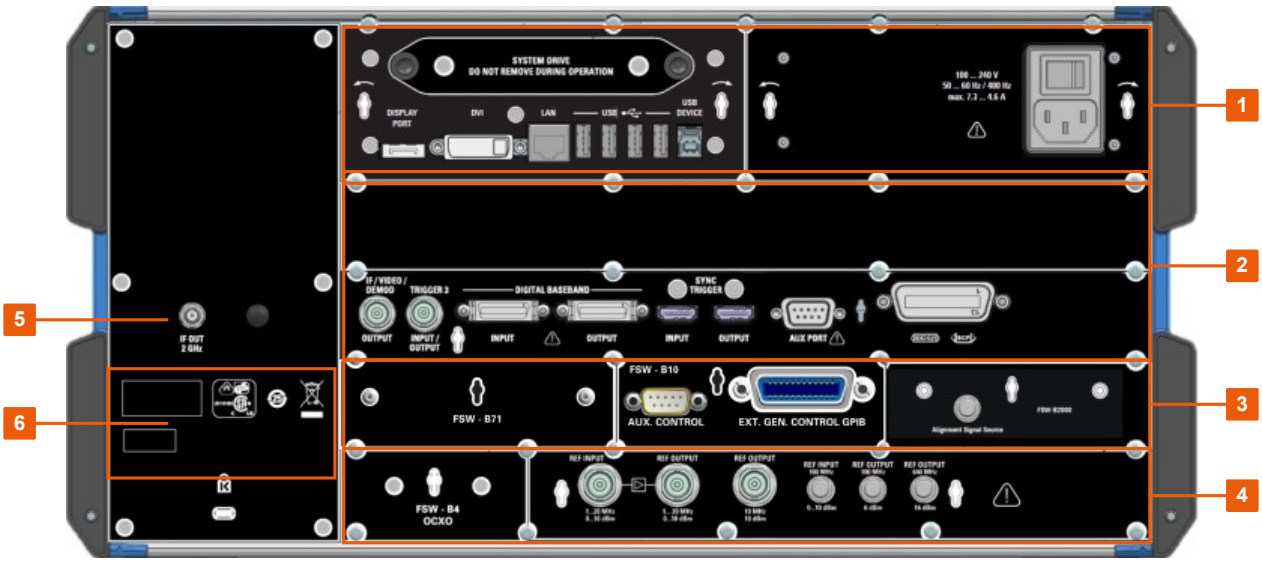


Figure 5-3: Rear panel view

1 = see Figure 5-4
2 = see Figure 5-5
3 = see Figure 5-6
4 = see Figure 5-7
5 = IF OUT 2 GHz connector
6 = Device ID with serial number and other labels

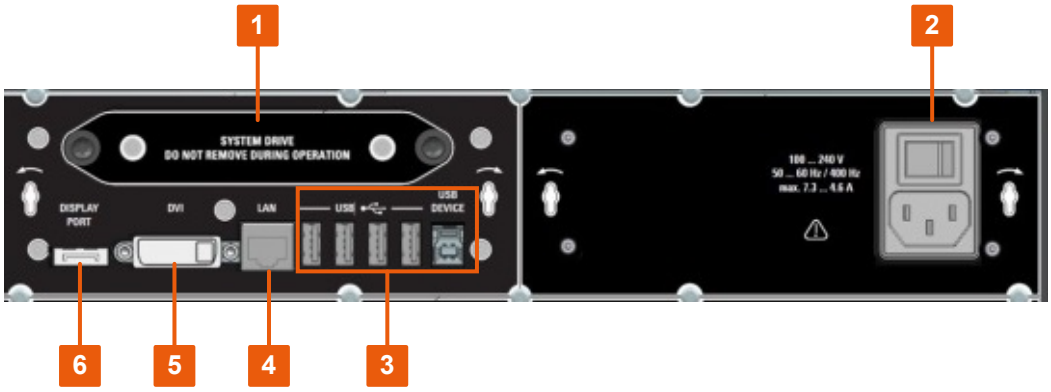


Figure 5-4: Rear panel view - extract 1

1 = Removable system hard drive
2 = AC Power Supply Connection and Main Power Switch
3 = USB (DEVICE) connectors
4 = LAN connector
5 = DVI connector for external display
6 = DISPLAY PORT for external display

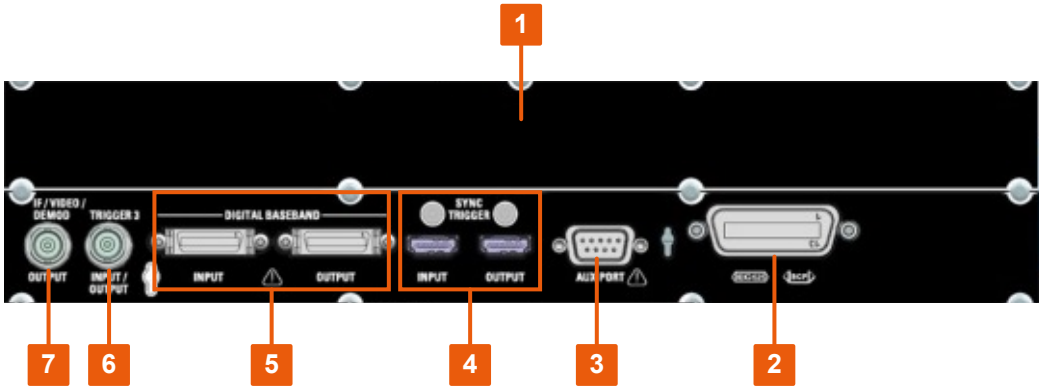


Figure 5-5: Rear panel view - extract 2

1 = Bandwidth extension options, with "IF WIDE OUTPUT" connector (option -B160/-B320-B512) and Digital I/Q 40G Streaming Output QSFP+ connector (option B517/B1017)
2 = GPIB interface
3 = AUX PORT
4 = SYNC TRIGGER OUTPUT/INPUT
5 = DIGITAL BASEBAND INPUT/OUTPUT connectors (option B17)
6 = TRIGGER 3 INPUT/OUTPUT connector
7 = IF/VIDEO/DEMOD connector

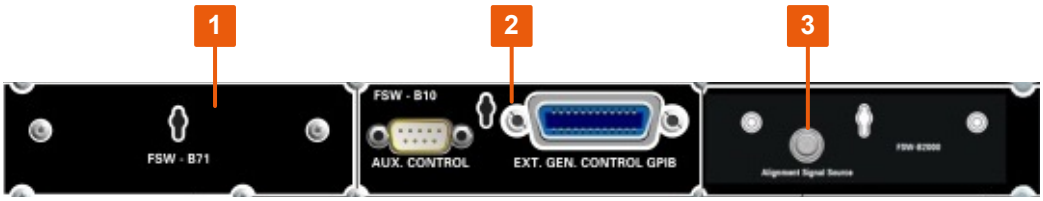


Figure 5-6: Rear panel view - extract 3

1 = Analog baseband interface (option B71)
2 = External generator control (option B10)
3 = Alignment Signal Source (obsolete)

Figure 5-7: Rear panel view - extract 4

1 = OCXO external reference (option B4)
2 = REF INPUT/OUTPUT connectors

5.2.1 Removable system hard drive

The removable system hard drive contains all measurement data from the FSW, allowing you to store the data securely in an external location.

5.2.2 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 11 and Section 4.5, "Connecting the AC power", on page 22.

5.2.3 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 Section 5.1.13, "USB", on page 52).

Furthermore, a male "USB DEVICE" connector ("USB-B") is provided, for example to connect the FSW to a PC for remote control. (Not available for instruments with CPU board 1206.3874.00. Check [Setup] > "System Configuration" > "Hardware Info".)

All USB connectors support standard 2.0.

5.2.4 LAN

The FSW 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 the FSW user manual.

5.2.5 Display port and DVI

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

- Display Port
- DVI (digital visual interface)

For details, see Section 4.10, "Connecting an external monitor", on page 28.

5.2.6 Bandwidth extension options and IF WIDE OUTPUT connector

You can extend the signal analysis bandwidth of the FSW by a hardware option (R&S FSW-B160/-B320/-B512/-B1200/-B2001/-B4001/-B8001 or R&S FSW-Uxxx). The bandwidth extension allows for an output sample rate of up to 10 GHz and a linear bandwidth up to:

- 160 MHz (with option B160/U160)
- 320 MHz (with option B320/U320)
- 512 MHz (with option B512/U512)
- 1200 MHz (with option B1200/U1200)
- 2001 MHz (with option B2001/U2001)
- 4001 MHz (with option B4001/U4001)
- 6001 MHz (with option B6001/U6001)
- 8001 MHz (with option B8001/U8001)

While the extension can be activated or deactivated manually in the FSW base unit (I/Q Analyzer application), it is activated automatically in some applications that also support I/Q data analysis. See the application-specific documentation for details.

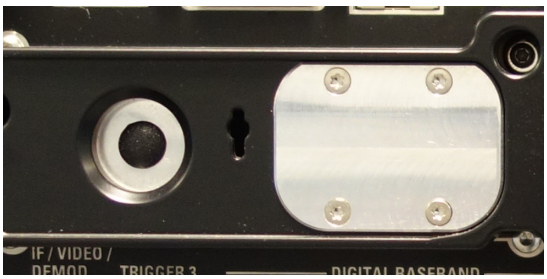
IF WIDE OUTPUT connector

Together with the bandwidth extension options B160/B320/B512, an additional IF output connector is provided ("IF WIDE OUTPUT"). As opposed to the default IF/VIDEO/DEMOD OUTPUT connector, the IF output frequency of the optional connector cannot be defined manually, but is determined automatically depending on the center frequency. For details on the used frequencies, see the specifications document. The "IF WIDE OUTPUT" connector is used automatically when the bandwidth extension is activated (i.e. for bandwidths > 80 MHz).

5.2.7 Digital I/Q 40G streaming output connector (R&S FSW-B517/-B1017)

The Digital I/Q 40G Streaming Output (QSFP+) connector is provided by the hardware of any bandwidth extension option for 512 MHz or more.

If necessary, remove the metal cover from the connector on the rear panel of the FSW.



The output connector provides I/Q data streams with a sample rate of up to 600 MHz, if the R&S FSW-B517 option is installed and active. With R&S FSW-B1017 installed, output rates up to 1200 MHz are available.

Output is activated in the software ([INPUT/OUTPUT] key).

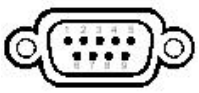
See the FSW I/Q Analyzer and I/Q Input User Manual for details.

5.2.8 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.

For more details, refer to "Setting Up Remote Control" in the FSW user manual.

5.2.9 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.

5.2.10 SYNC TRIGGER OUTPUT/INPUT

Use the "SYNC TRIGGER OUTPUT/INPUT" connectors to synchronize several devices (e.g. two FSWs) to a common trigger signal or reference frequency. The FSW can output a 100 MHz signal as a trigger or reference signal to another device. The FSW can also receive an external trigger or reference signal at the input connector.

5.2.11 DIGITAL BASEBAND INPUT / OUTPUT (R&S FSW-B17)

The optional "DIGITAL BASEBAND" connectors allow you to provide digital I/Q data for measurements with the FSW. Using the output connector you can provide RF input from the FSW to a connected device as digital I/Q data. The digital input and output connectors cannot be used simultaneously.

It is recommended that you use the R&S®SMU-Z6 (1415.0201.02) cable to connect other devices to the Digital Baseband Interface of the FSW.

For high output rates, use the Digital I/Q 40G Streaming Output option (R&S FSW-B517), see Section 5.2.7, "Digital I/Q 40G streaming output connector (R&S FSW-B517/-B1017)", on page 58.

5.2.12 TRIGGER 3 INPUT/ OUTPUT

The additional female BNC "TRIGGER INPUT / OUTPUT" connector can be used to receive a third external signal or to provide a signal to another device. The signal is TTL compatible (0 V / 5 V). You can control the connector usage in the "Trigger" settings ([TRIG] key).

5.2.13 IF/VIDEO/DEMOD OUTPUT

The female BNC connector can be used for various outputs:

- Intermediate frequency (IF) output of approximately 20 MHz
- Video output (1V)

Which output is provided is defined in the software ([INPUT/OUTPUT] key).

For details, see the User Manual.

5.2.14 (Analog) baseband input 50 ohm connectors (optional)

The "Analog Baseband" interface option provides four "Baseband input" BNC connectors on the front panel of the FSW for analog I and Q signals.

(FSW85: two connectors)

The upper BNC connectors BASEBAND INPUT I and BASEBAND INPUT Q are used to input:

- Single-ended signals
- The positive signal input for differential signals
- Input from active Rohde & Schwarz probes (see specifications document)

The lower BNC connectors Ī and Q̄ are used to input the negative signal for differential signals.

FSW85

The FSW85 provides only two connectors; differential input is not supported.

Complex signal input (I+jQ)

For complex signal input (I+jQ), always use two identical cables for the I and Q connectors (same length, same type, same manufacturer). Otherwise, time delay or gain imbalance can occur between the different cables, which cannot be calibrated.

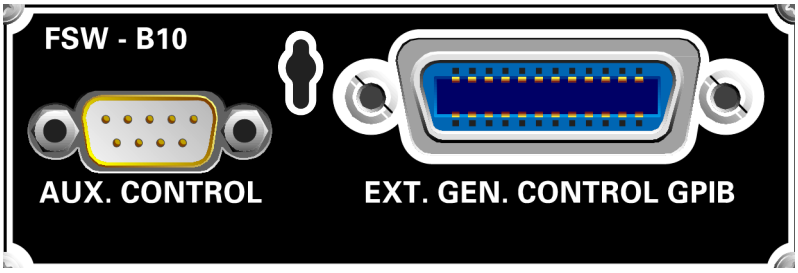
All connectors have a fixed impedance of 50 Ω. Do not overload the input. For maximum allowed values, see the specifications document.

Input via the "Analog Baseband" interface can be enabled in the I/Q Analyzer or in one of the optional applications that process I/Q data (where available).

For more information on the "Analog Baseband" interface, see the FSW I/Q Analyzer and I/Q Input User Manual.

5.2.15 External generator control option (R&S FSW-B10)

The external generator control option provides an additional GPIB and an "AUX control" connector.



The GPIB connector can be used to connect the external generator to the FSW.

The 9-pole SUB-D female "AUX control" connector is required for TTL synchronization, if supported by the generator.

For details on connecting an external generator, see the "External Generator Control" section of the FSW User Manual.

5.2.16 REF INPUT / REF OUTPUT

The "REF INPUT" connectors are used to provide an external reference signal to the FSW.

The "REF OUTPUT" connectors can be used to provide an external reference signal (or the optional OCXO reference signal) from the FSW to other devices that are connected to this instrument.

Various connectors are provided for different reference signals:

Connector	Reference signal	Usage
"REF INPUT"	1...50 MHz 0...10 dBm	To provide an external reference signal on the FSW.
"REF OUTPUT"	1...50 MHz 0...10 dBm	To provide the same external reference signal received by the "REF INPUT 1...50 MHz" connector to another device, when available.
"REF OUTPUT"	10 MHz 10 dBm	To provide the internal reference signal from the FSW to another device continuously. Also used to provide OCXO reference signal to another device.
"REF INPUT"	100 MHz / 1 GHz 0...10 dBm	To provide an external reference signal on the FSW.
"REF OUTPUT"	100 MHz 6 dBm	To provide a 100 MHz reference signal from the FSW to another device.
"REF OUTPUT"	640 MHz 16 dBm	To provide a 640 MHz reference signal from the FSW to another device.

SYNC TRIGGER

The "SYNC TRIGGER" connector can also be used to synchronize the reference frequency on several devices (see Section 5.2.10, "SYNC TRIGGER OUTPUT/INPUT", on page 59).

5.2.17 OCXO option (R&S FSW-B4)

This option generates a 10 MHz reference signal with a very precise frequency. If installed, and if no external signal is used, this signal is used as an internal reference. It can also be used to synchronize other connected devices via the "REF OUTPUT 10 MHz" connector.

Warm-up time for OCXO

When the instrument is switched on, the OCXO requires an extended warm-up time.

For details, refer to the specifications document.

5.2.18 IF OUT 2 GHz / 5 GHz connector

The female SMA connector is only available for instrument models FSW26/43/50/67/85. It can be used to provide intermediate frequency (IF) output of approximately 2 GHz at a frequency of 2 GHz.

Output is activated in the software ([INPUT/OUTPUT] key).

For details, see the FSW I/Q Analyzer and I/Q Input User Manual.

5.2.19 Labels on FSW

Labels on the casing inform about:

- Personal safety, see "Meaning of safety labels" on page 12
- Product and environment safety, see Table 5-4
- Identification of the product, see Section 5.2.20, "Device ID", on page 64

Table 5-4: Labels regarding FSW 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 the product user manual, section "Disposal".

5.2.20 Device ID

The unique device identifier is provided as a barcode sticker on the rear panel of the FSW.

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, `FSW8-123456`.
The instrument name is required to establish a connection to the instrument in a LAN.

6 Trying out the instrument

This section introduces the most important functions and settings of the FSW step by step. The complete description of the functionality and its usage is given in the FSW User Manual. Basic instrument operation is described in Section 7, "Operating the instrument", on page 88.

Prerequisites

- The instrument is set up, connected to the mains system, and started up as described in Section 4, "Preparing for use", on page 19.

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:

- Measuring a basic signal....65
- Displaying a spectrogram....67
- Activating additional measurement channels....69
- Performing sequential measurements....74
- Setting and moving a marker....75
- Displaying a marker peak list....77
- Zooming into the display....78
- Zooming into the display permanently....82
- Saving settings....84
- Printing and saving results....86

6.1 Measuring a basic signal

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 [PRESET] to start out in a defined instrument configuration.
2. Press [Setup] on the front panel.
3. Tap "Service + Support".
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 FSW. 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.

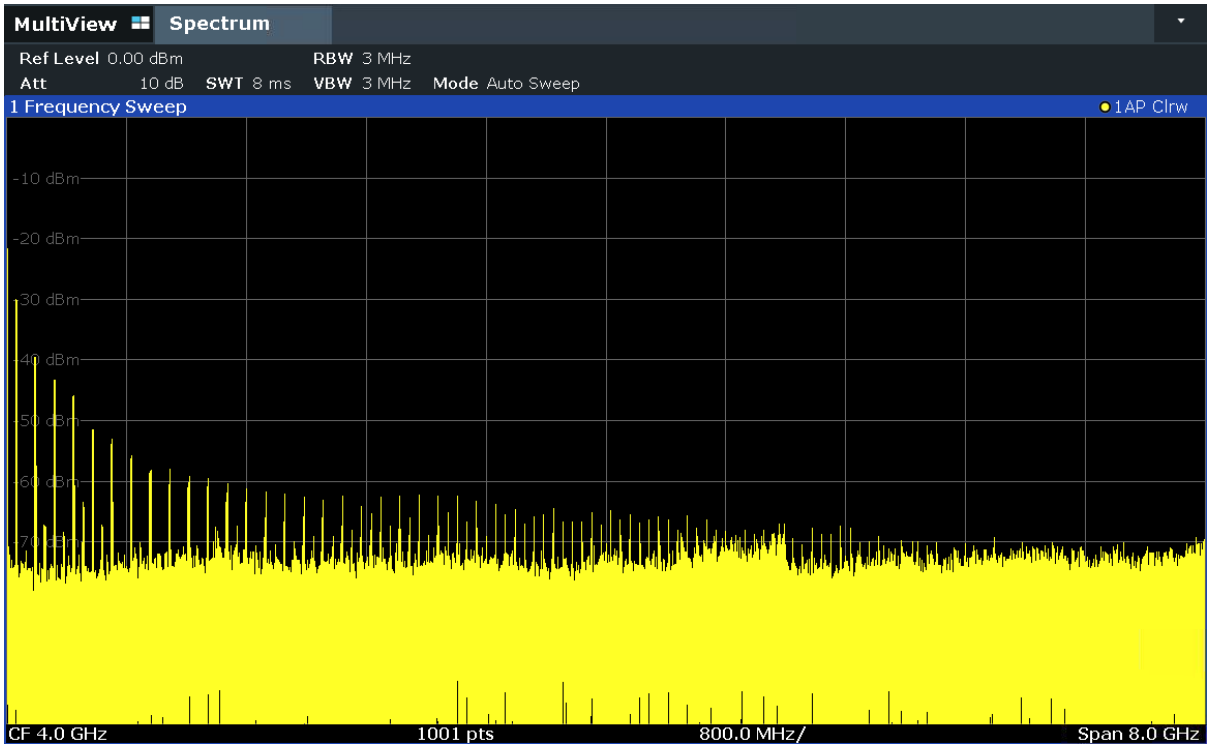


Figure 6-1: Calibration signal as RF input

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 obtain accurate results.

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 "Overview" to display the configuration "Overview".

b) Tap "Frequency".
c) In the "Center" field, enter *64* on the number pad on the front panel.
d) Press "MHz" 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 "Amplitude".
   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.

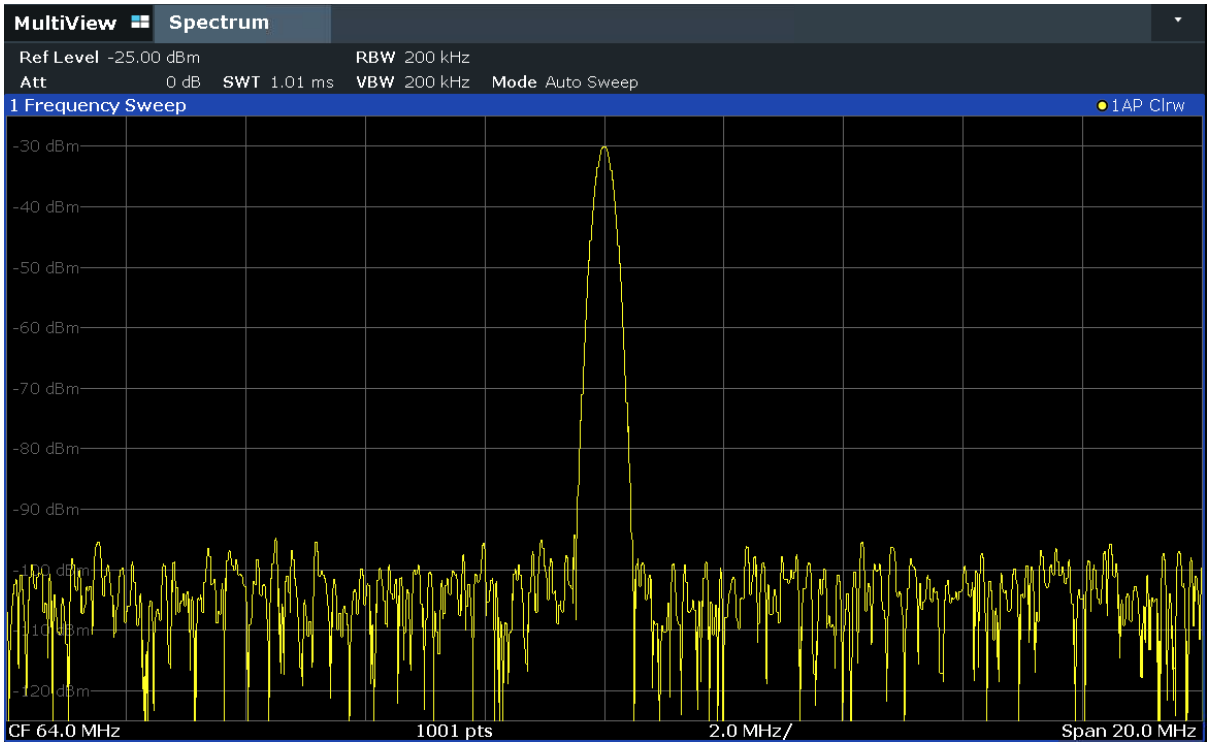


Figure 6-2: Calibration signal with optimized display settings

6.2 Displaying a spectrogram

In addition to the standard "level versus frequency" spectrum display, the FSW 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 fre-

quency, 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 "Overview" to display the general configuration dialog box.
2. Tap "Display Config".

   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.

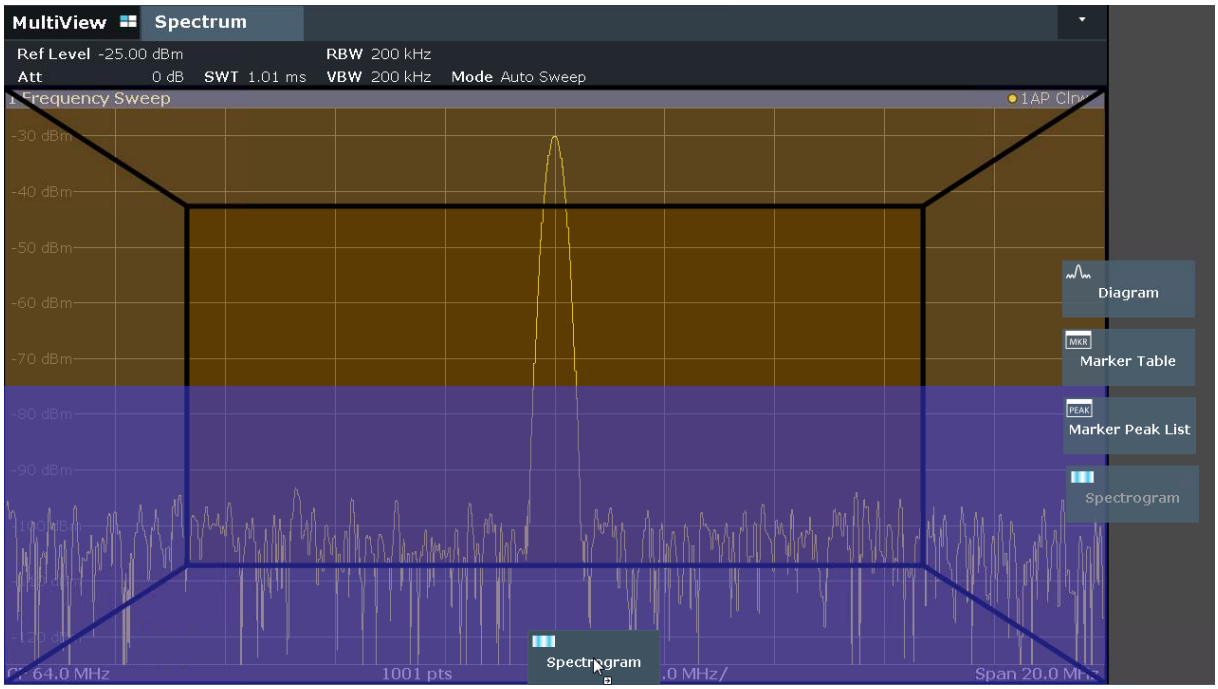


Figure 6-3: Adding a Spectrogram to the display

   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.

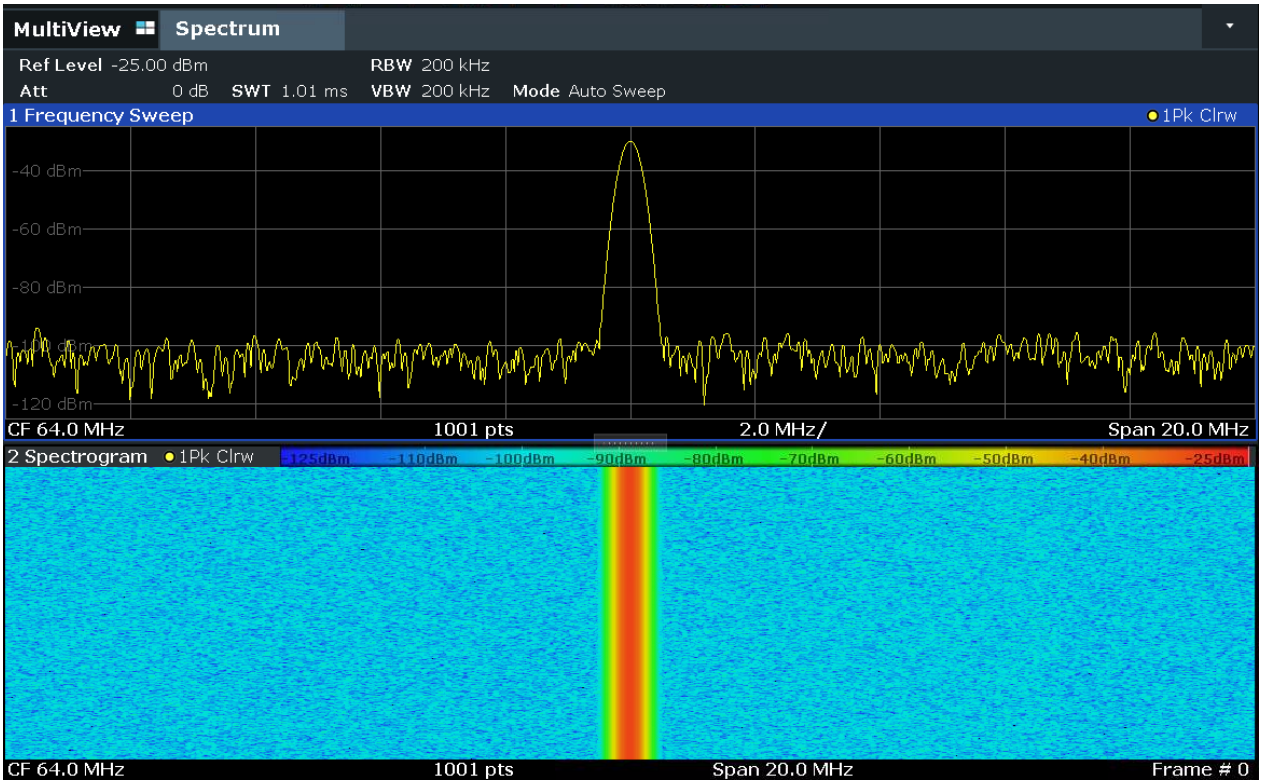


Figure 6-4: Spectrogram of the calibration signal

6.3 Activating additional measurement channels

The FSW 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 [Mode] on the front panel.

2. On the "New Channel" tab of the "Signal + Spectrum Mode" dialog box, tap "Spectrum".

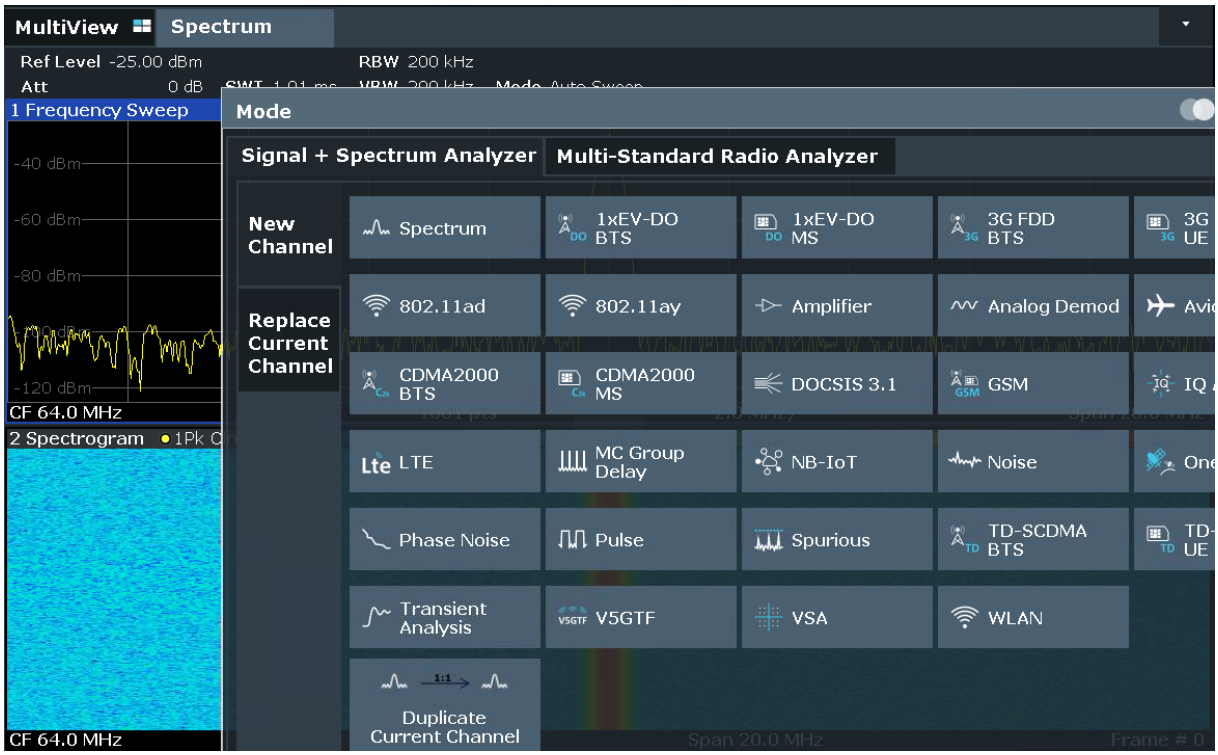


Figure 6-5: Adding a new measurement channel

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*.

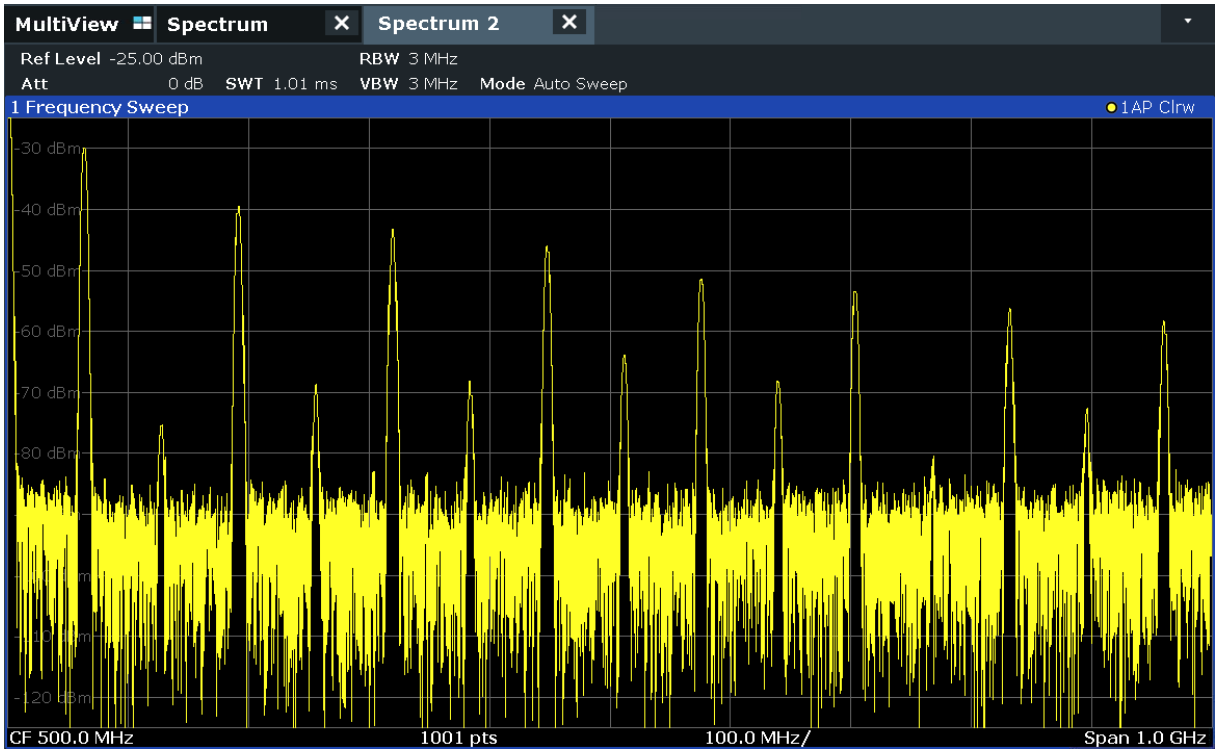


Figure 6-6: Frequency spectrum of the calibration signal with a larger span

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 6-7: Time domain display of the calibration signal

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

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

Figure 6-8: 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.

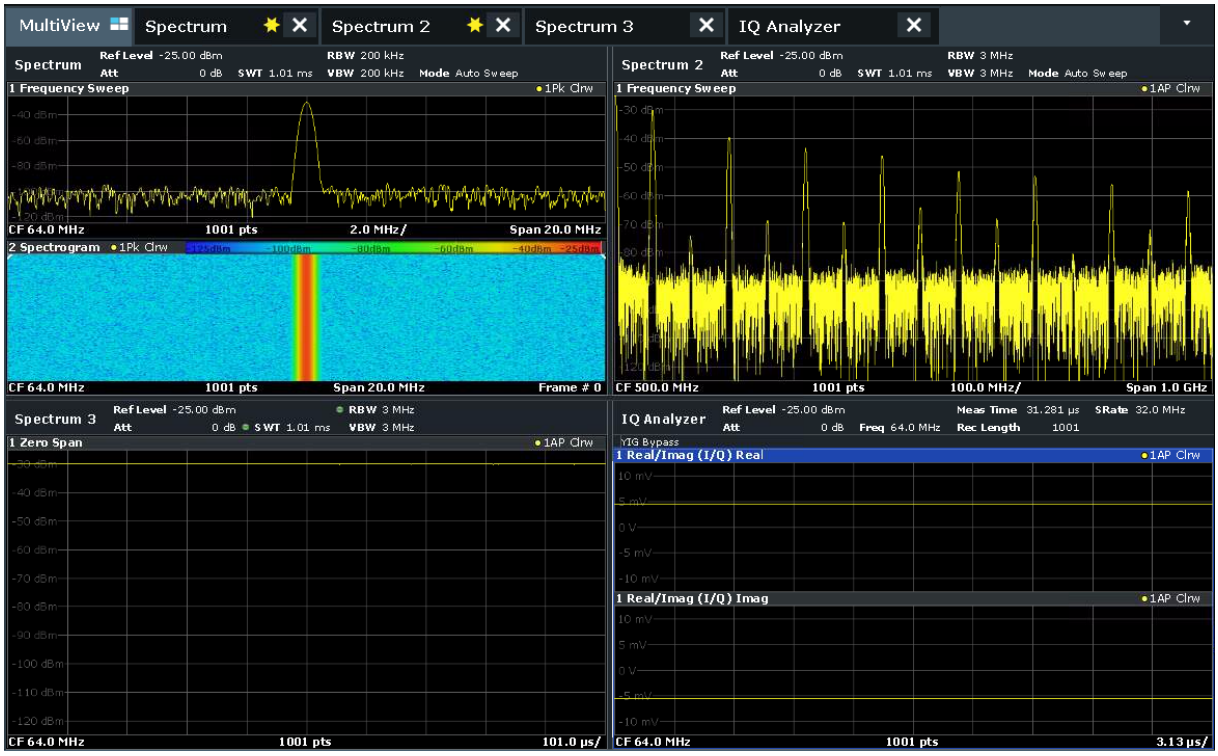


Figure 6-9: The "MultiView" tab

6.4 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 "Sequencer" 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 6-10: "MultiView" tab with active Sequencer

In Figure 6-10, the "Spectrum 2" measurement is currently active (indicated by the "channel active" icon in the tab label).

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

6.5 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.

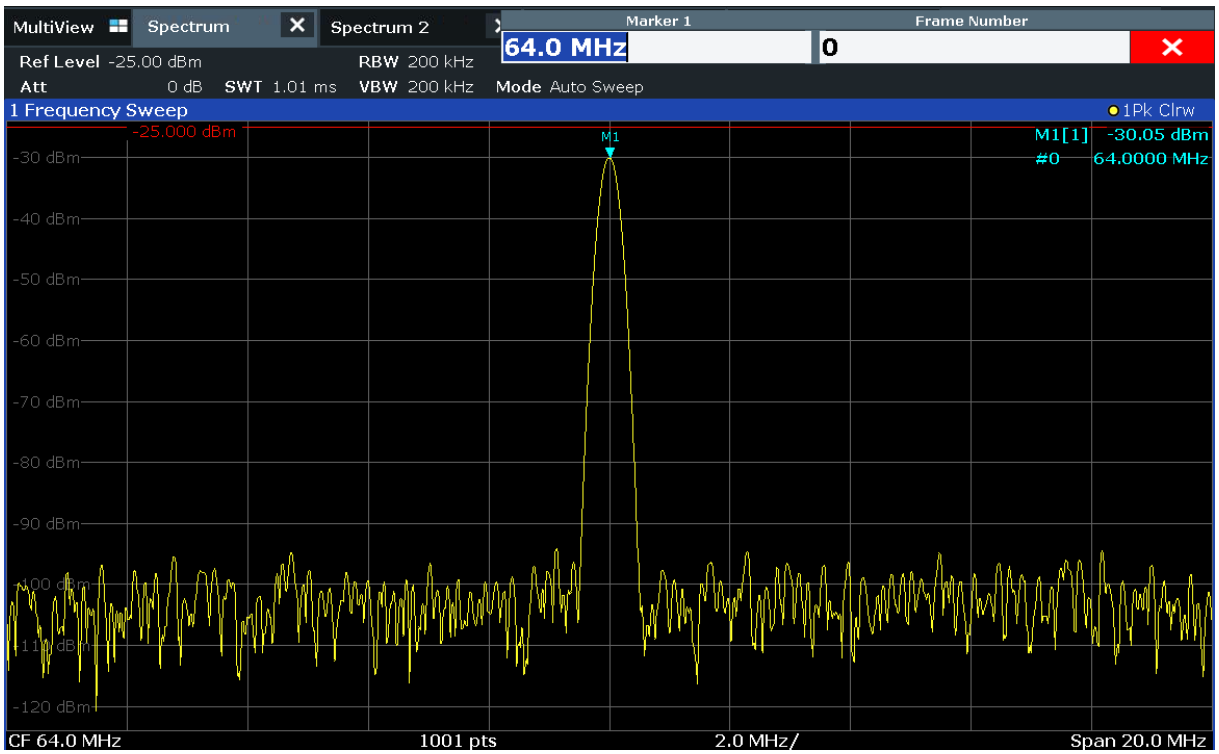
1. In the "MultiView" tab, double-tap the "Spectrum" window (frequency sweep with spectrogram display) to return to the "Spectrum" channel.
2. Tap the spectrum display to set the focus on that window.

3. Press "Split/Maximize" on the front panel to maximize the spectrum window, as we currently do not need the spectrogram display.

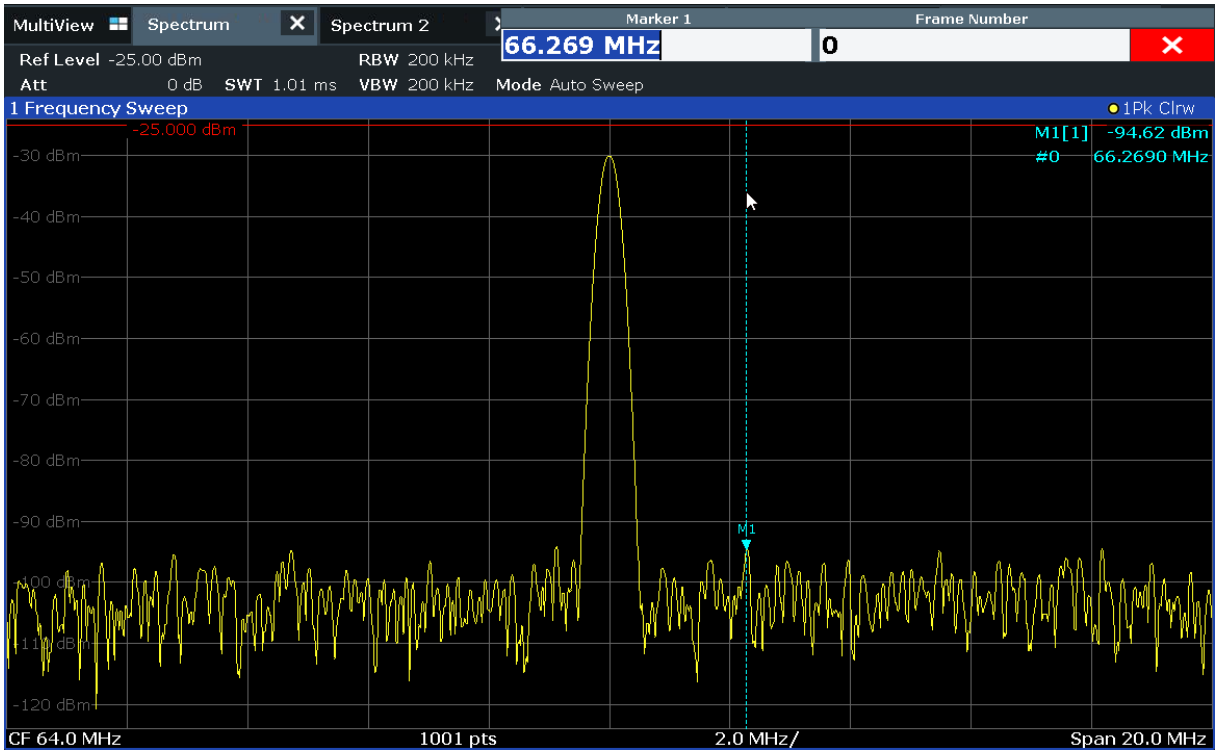
4. Press "RUN SINGLE" on the front panel to perform a single sweep so we have a fixed trace to set a marker on.

5. Press [MKR] 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.



6.6 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 "RUN SINGLE" 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 [MKR] on the front panel.

b) Tap "Marker Config" 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.

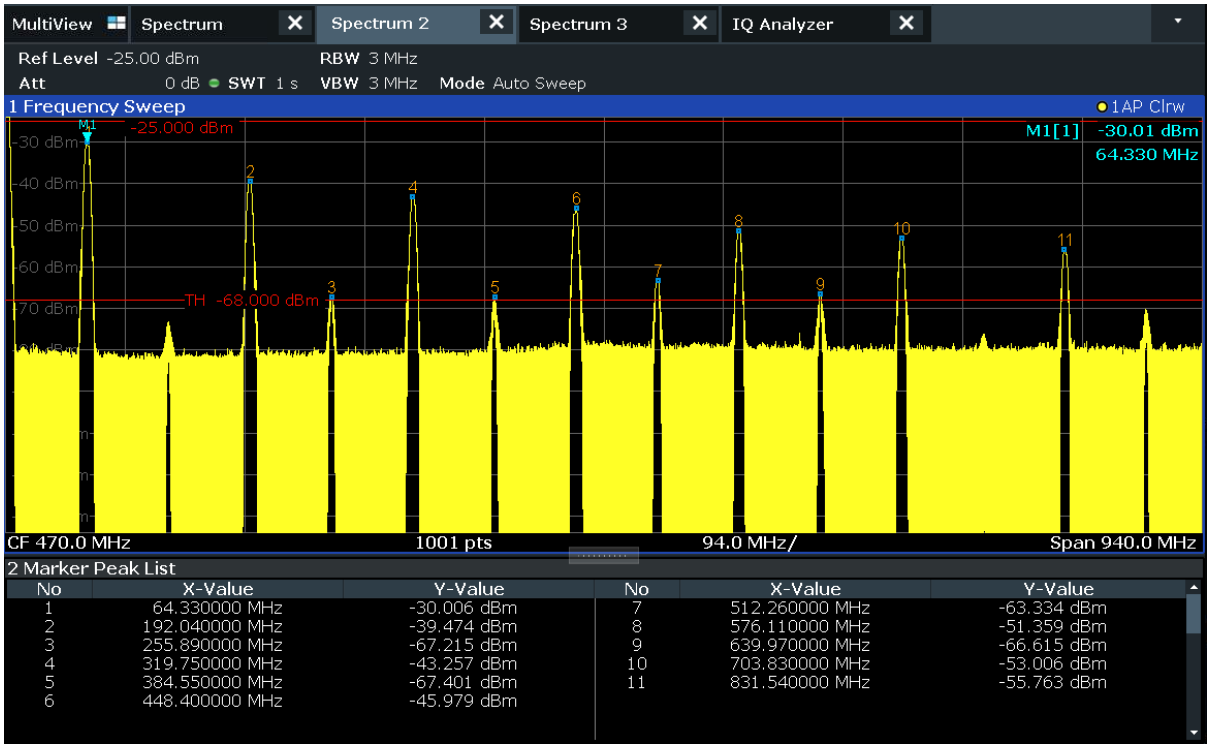


Figure 6-11: Marker Peak List

6.7 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.

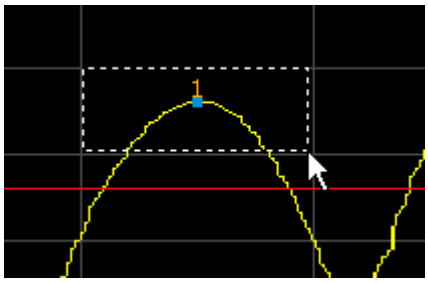


Figure 6-12: Defining the zoom area

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

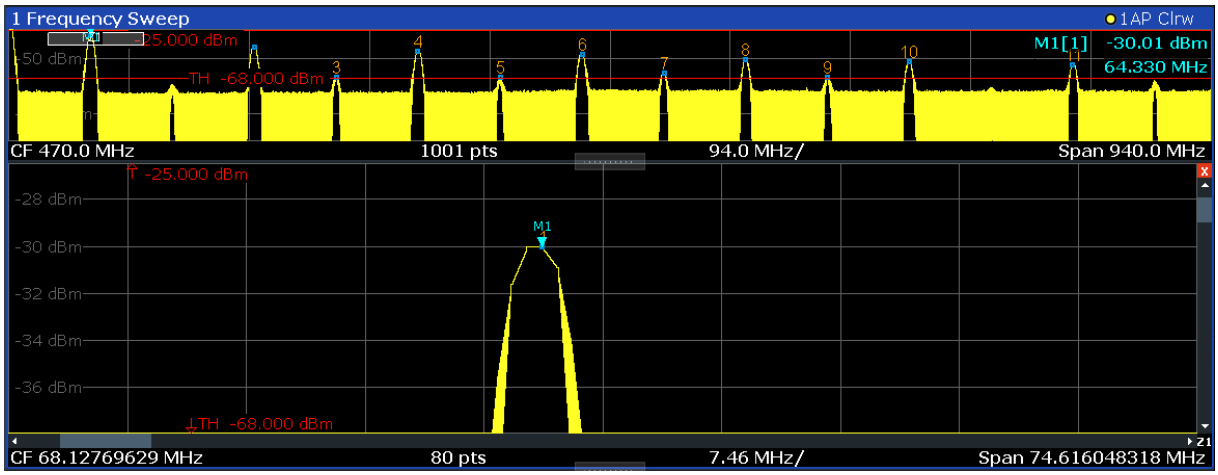


Figure 6-13: Zoomed display around a peak

3. In Figure 6-13, 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 [Sweep] on the front panel.
   b) Tap "Sweep Config" in the "Sweep" menu.
   c) In the "Sweep Points" field, enter *32001*.
   d) Press RUN SINGLE on the front panel to perform a new sweep with the increased number of sweep points.

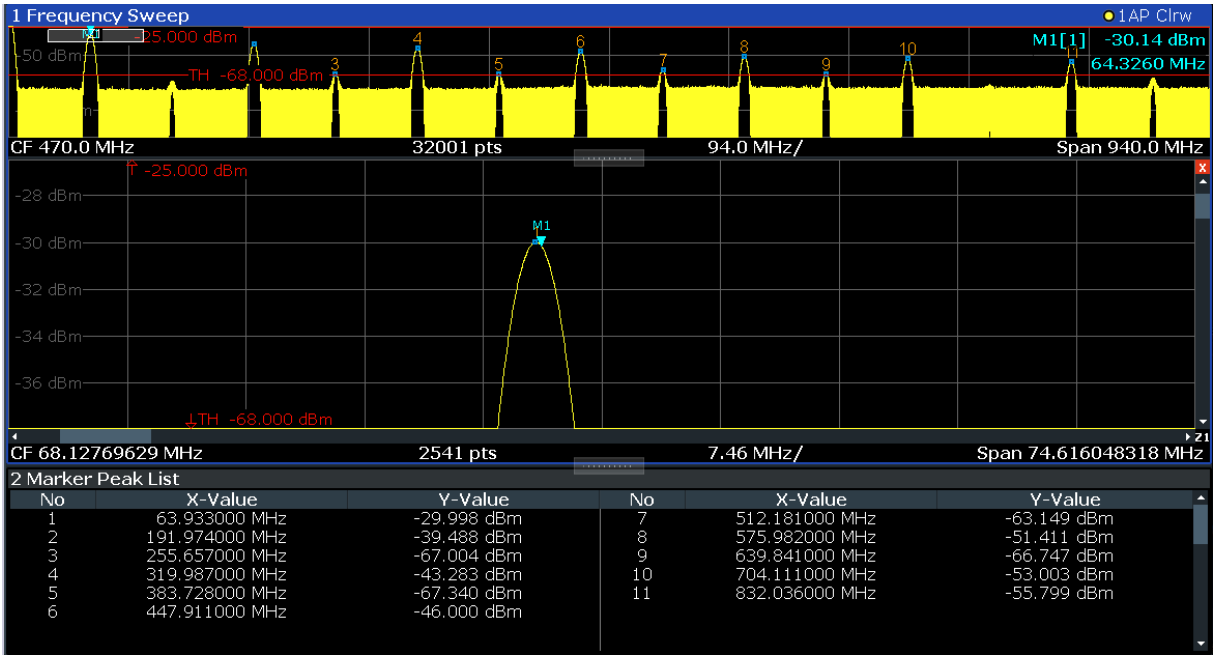


Figure 6-14: Zoomed peak with increased number of sweep points

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.

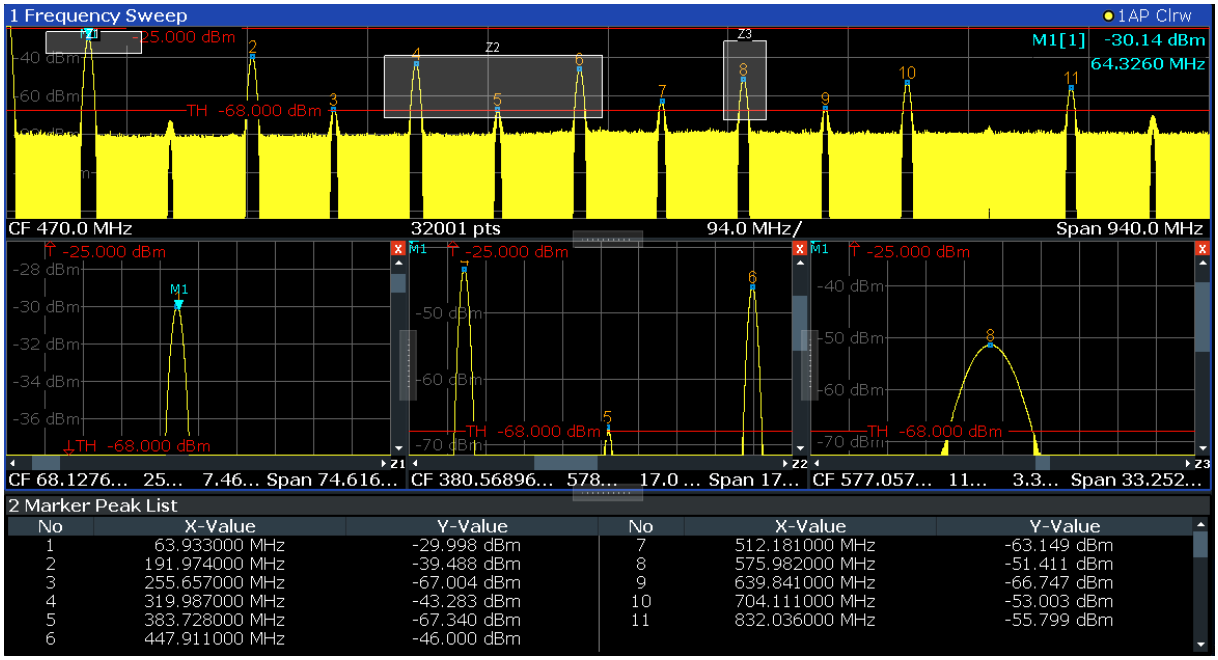
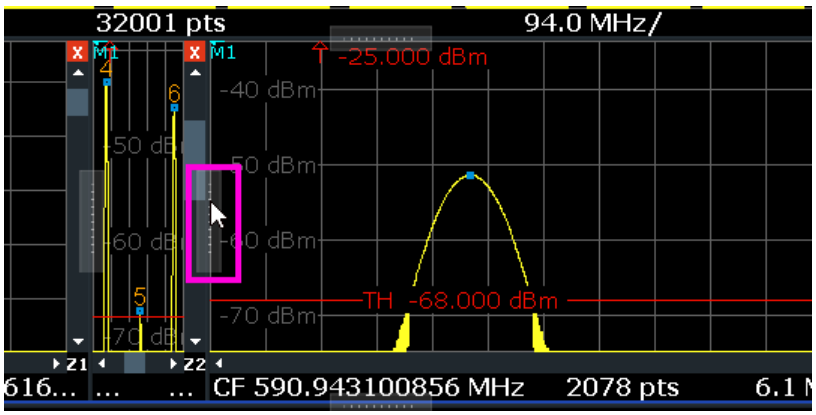


Figure 6-15: Multiple zoom windows

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.



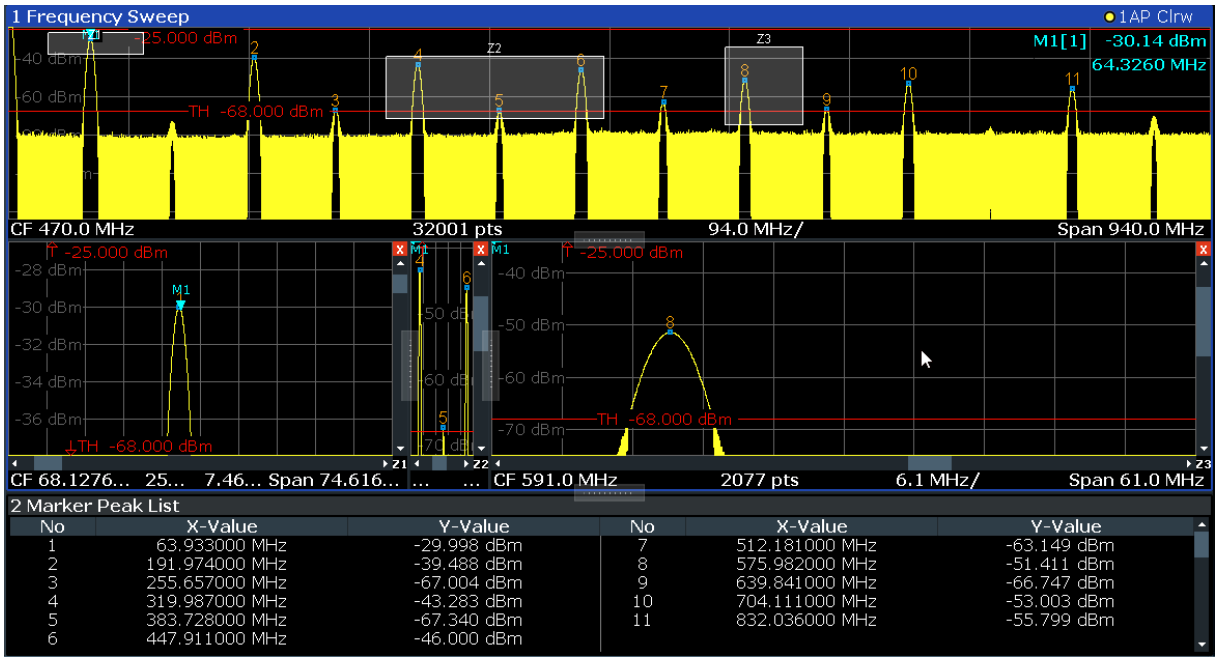


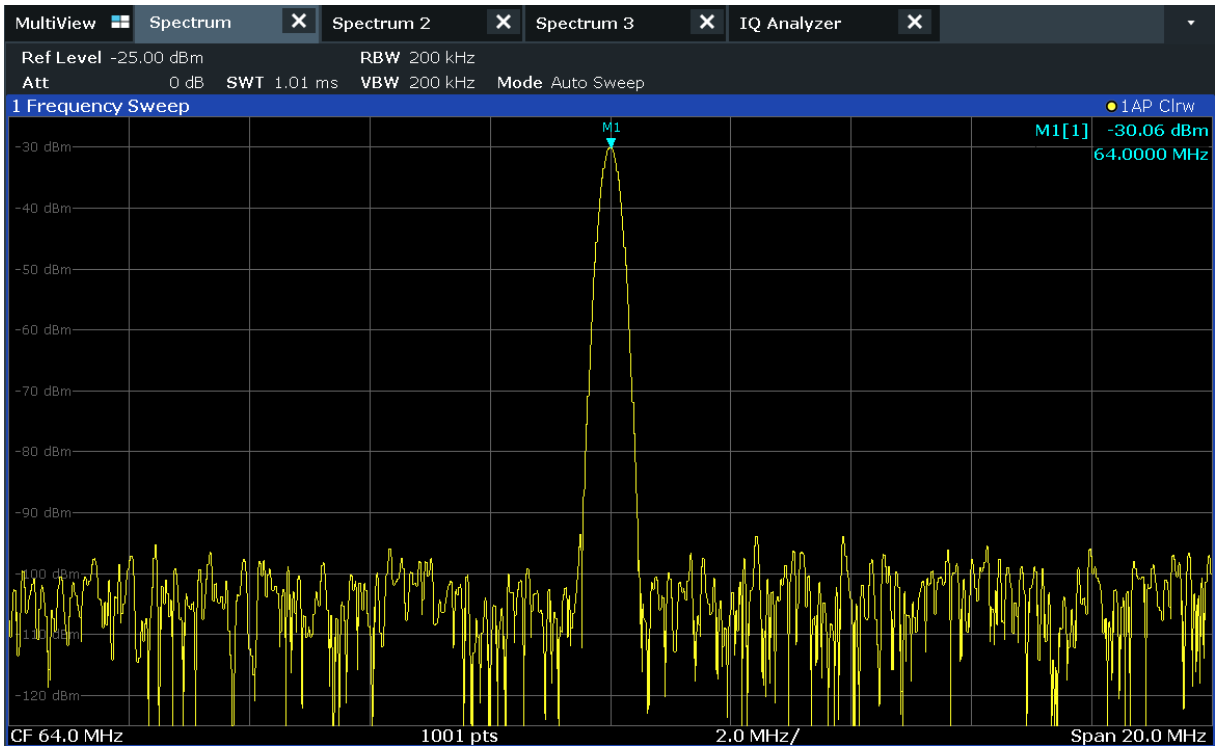
Figure 6-16: Enlarged zoom window

6.8 Zooming into the display permanently

The zoomed results from Section 6.7, "Zooming into the display", on page 78 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.

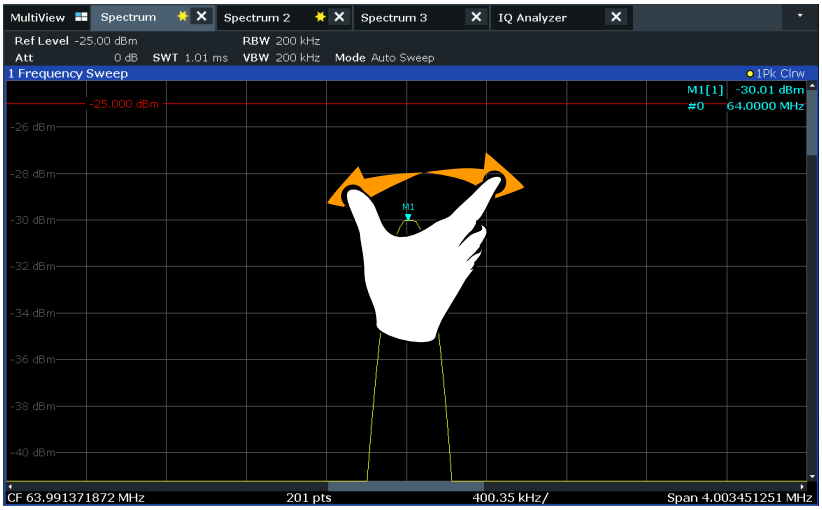
1. Tap the "Spectrum" tab.
2. Double-tap the diagram close to the peak of the measurement.

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



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

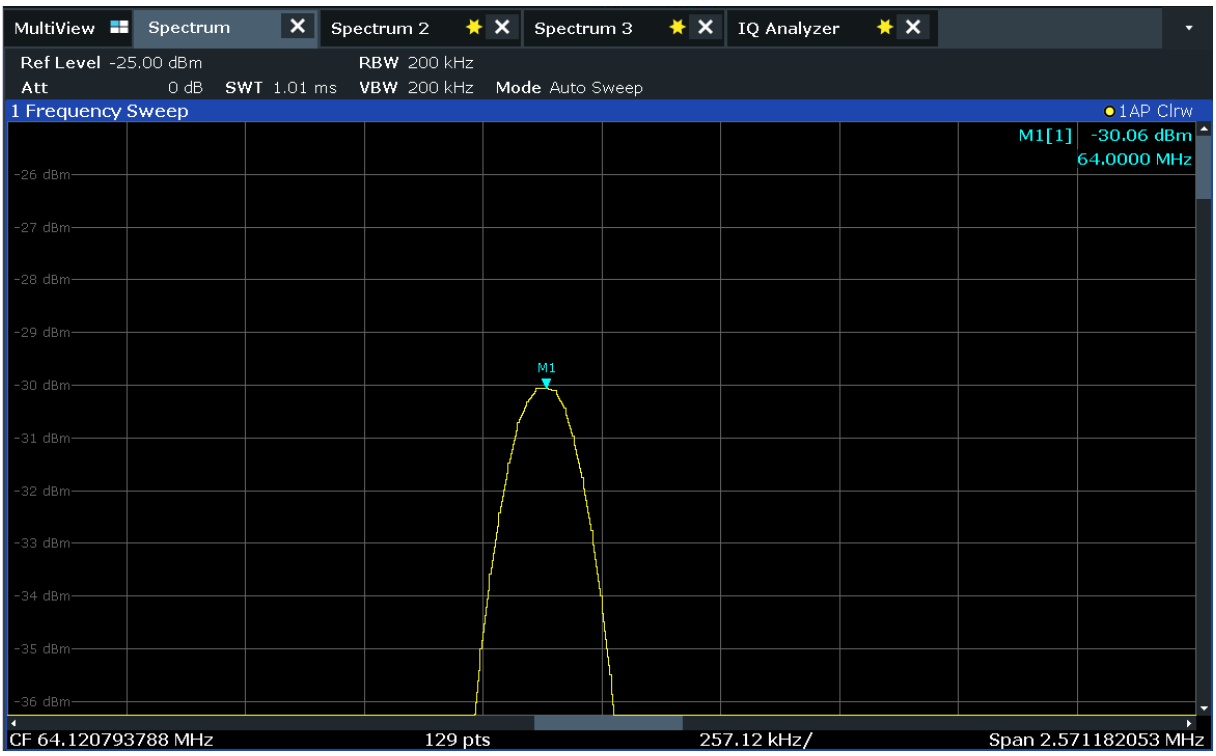
   Any subsequent touch gestures define the zoom area for the zoom display.
4. Place two fingers on the diagram, to the left and right of the marker, and stretch them apart.



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.

6.9 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 on-screen 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 *MyMultiView-Setup* using the external or onscreen keyboard.
   Keep the default "File Type" setting "Instrument with all Channels" to store the configuration of all channels.

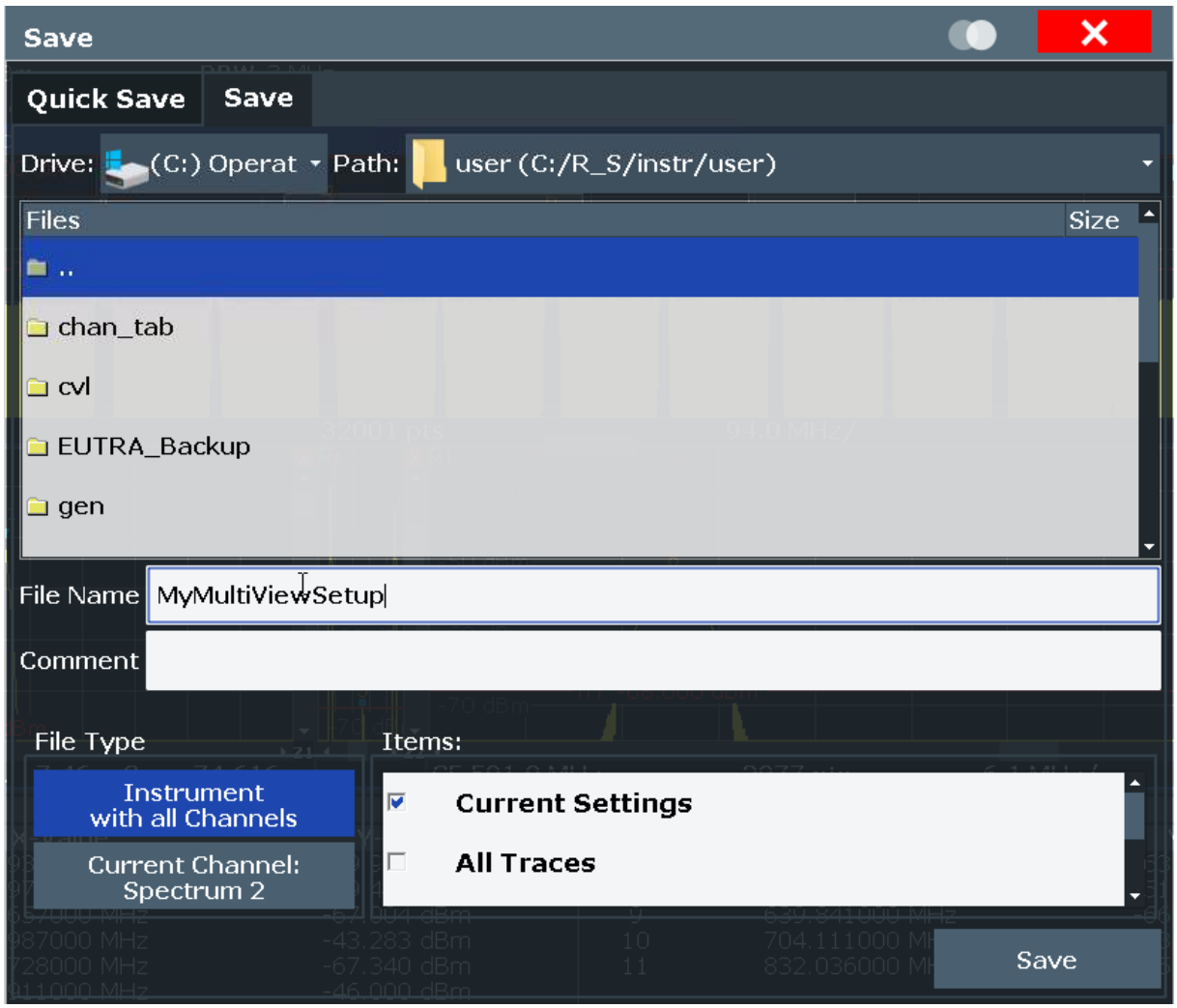


Figure 6-17: Saving the instrument settings to a file

4. Tap "Save".

   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 [PRESET] 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 6-16, which shows the instrument display right before the settings were stored.

6.10 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 [TRACE] on the front panel.
2. Tap "Trace Config".
3. Tap the "Trace Export" tab.
4. Tap "Export Trace to ASCII File".
5. Enter the file name *MyPeakResults* using the external or onscreen keyboard.

   The trace data is stored to `MyPeakResults.DAT`

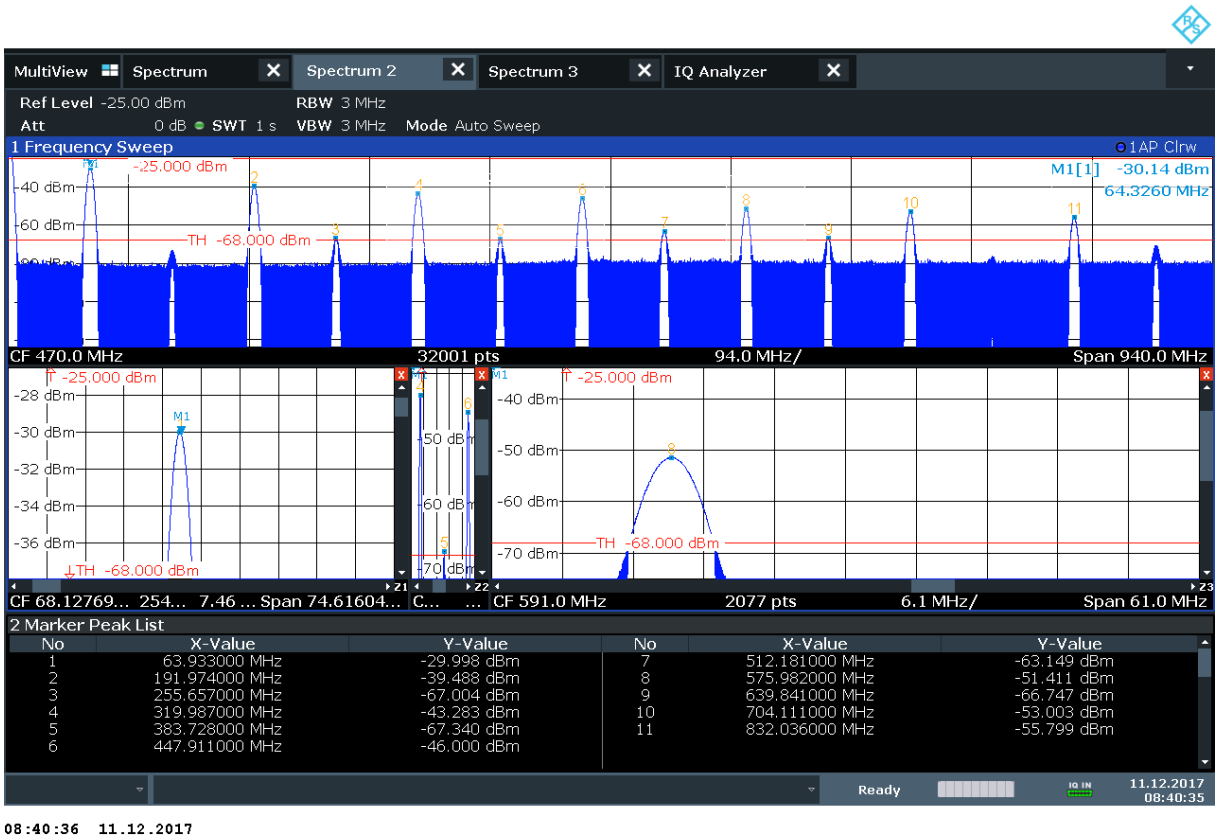
To create a screenshot of the display

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. *MyPeakDisplay*.

The screenshot is stored to `MyPeakDisplay.png`.



08:40:36 11.12.2017

Figure 6-18: Screenshot of the current display

7 Operating the instrument

This section provides an overview on how to work with the FSW.

Remote control

In addition to working with the FSW 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:

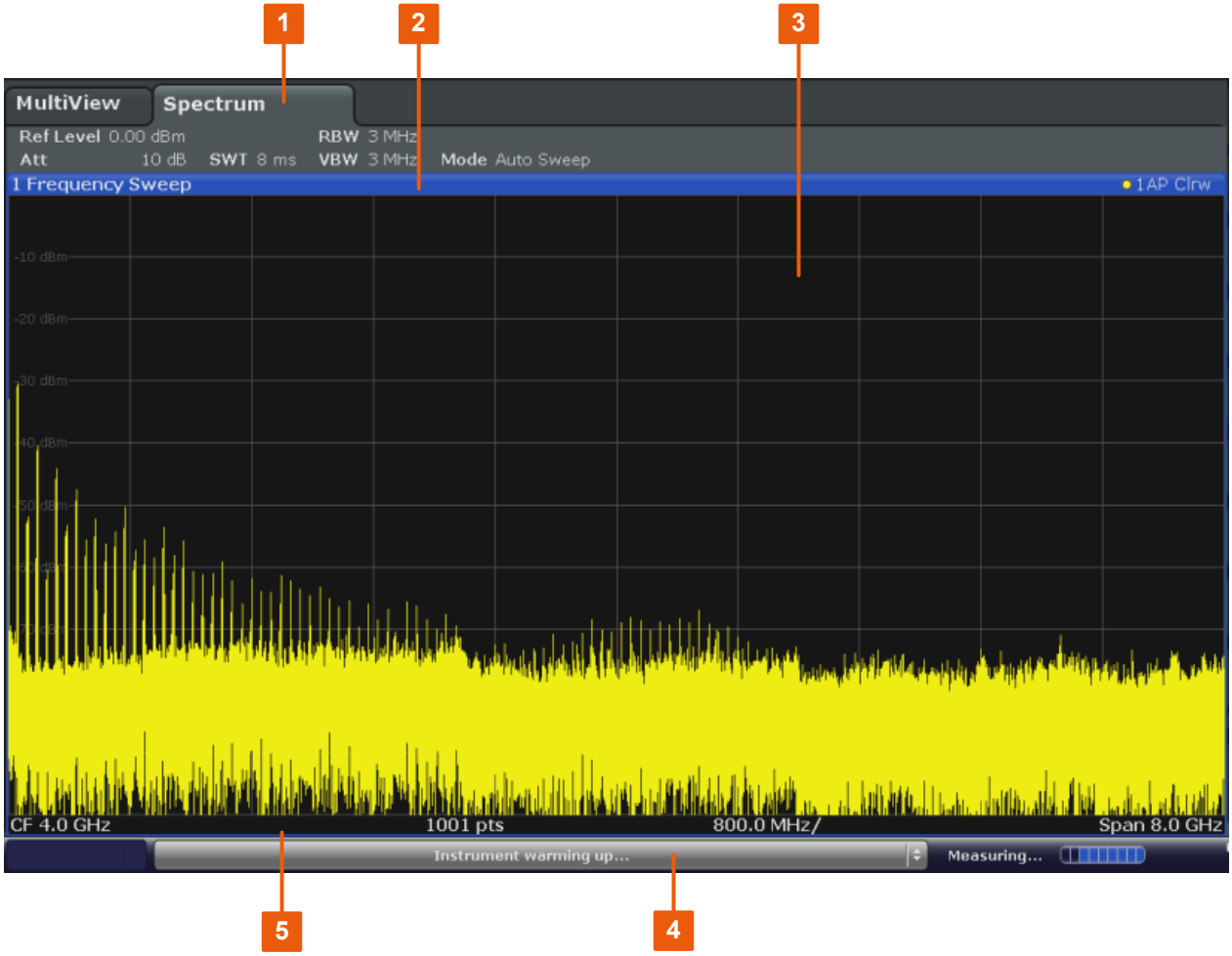
- Connecting the instrument to a (LAN) network
- Using the web browser interface in a LAN network
- Using the Windows Remote Desktop application in a LAN network
- Connecting a PC via the GPIB interface

How to configure the remote control interfaces is described in the FSW user manual.

- Understanding the display information....88
- Accessing the functionality....99
- Changing the focus....105
- Entering data....106
- Touchscreen gestures....109
- Displaying results....113
- Getting help....121

7.1 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.



1 = Channel bar for firmware and measurement settings
2 = Window title bar with diagram-specific (trace) information
3 = Diagram area with marker information
4 = Instrument status bar with error messages, progress bar and date/time display
5 = Diagram footer with diagram-specific information, depending on measurement application

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")

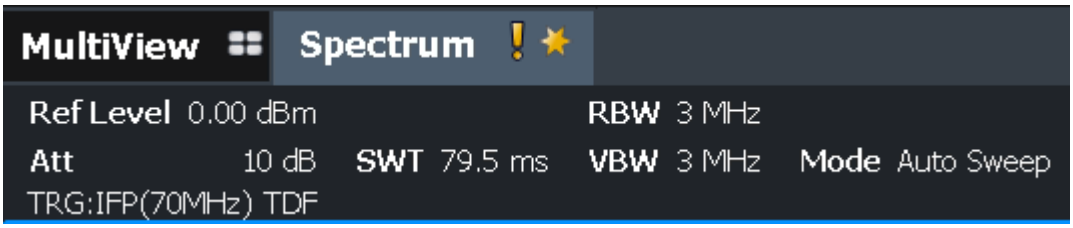
For details, see the FSW User Manual.

- Channel bar.....90
- Window title bar.....94
- Marker information.....96

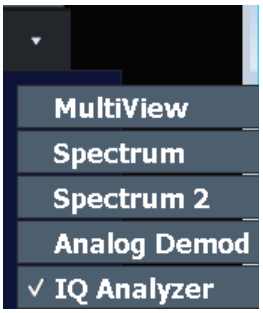
- Frequency and span information in diagram footer.....97
- Instrument and status information.....97
- Error information..... 98

7.1.1 Channel bar

Using the FSW 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. For example, after you change the measurement bandwidth, 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.

"IQ" in the channel tab indicates that the results for the channel no longer match the data currently in the capture buffer.

In MSRA mode, the results in an MSRA secondary application no longer match the data captured by the MSRA primary application. The "IQ" disappears after you refresh the results in the outdated application.

For applications using a long capture buffer, this icon appears if you switch channels. The icon disappears after you switch back to the application and perform a new measurement.

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 FSW shows the following settings:

Table 7-1: Channel settings displayed in the channel bar in the Spectrum application

"Ref Level"	Reference level
"m.+el.Att"	Mechanical and electronic RF attenuation
"SAN: Att"	Analyzer attenuation when using an (optional) external frontend
"ExtFE: Att"	External frontend attenuation when measuring external frontend input.
"Ref Offset"	Reference level offset

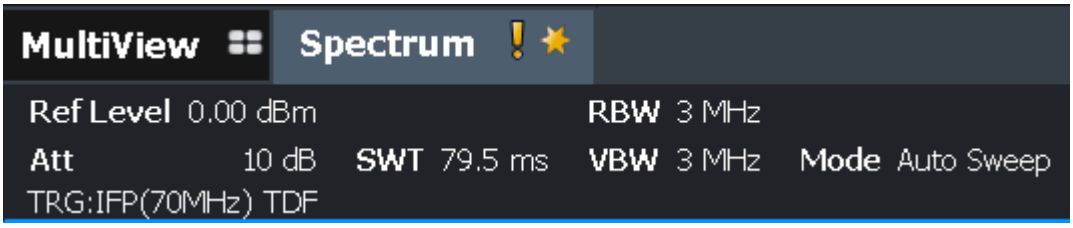
"SWT"	Sweep time If the sweep time does not correspond to the value for automatic coupling, a bullet is displayed in front of the field. The color of the bullet turns red if the sweep time is set below the value for automatic coupling. In addition, the UNCAL flag is shown. In this case, the sweep time 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. (CISPR) indicates that a CISPR bandwidth filter is being used, e.g. due to an active CISPR trace detector. For details see the EMI measurement in the FSW user manual. 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 7-2: 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) • "BBP": Baseband power (with Digital Baseband Interface R&S FSW-B17 only) • "EXT": External • "GP_0": General purpose bit (with Digital Baseband Interface R&S FSW-B17 only) • "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 (see "Bandwidth settings" in the User Manual)
"PA"/"Ext PA"	The preamplifier is activated. / Data compensation is performed using data from the (optional) external preamplifier.
"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.
"ExtMix" <band>	An external mixer is activated for input (requires option R&S FSW-B21); the used band is also indicated

"Ext. Gen" <"NOR" | "APX">	The FSW is controlling an external generator (requires option R&S FSW-B10). "NOR": the measurements are normalized with the results of the external generator calibration "APX" (approximation): the measurements are normalized with the results of the external generator calibration; however, the measurement settings have been changed since calibration If neither label is displayed, no calibration has been performed yet or normalization is not active.
"Inp:ExtFe" "IF High" / "IF Low" / "Spur optimized" / "EVM optimized" / <IF frequency range> / "Shared LO"	An external frontend is active (requires option R&S FSW-K553); the used frequency band configuration is indicated for reference.
"LO EXT"	The frontend uses an external LO signal.
"LO EXT"	The frontend uses an external LO signal.
"IFCorr"	IF cable correction for an active external frontend is enabled and a valid correction file is available.
"LVL"	A level offset is applied to the external generator signal (only if external generator control is active).
"Inp: Input 2"	For FSW85 models with two RF input connectors only: the second input connector "RF2" is the current input source for the channel

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.

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 ":", "*", "?".

7.1.2 Window title bar

Each channel in the FSW 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 Section 7.6, "Displaying results", on page 113). 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 Section 7.6.4, "Switching between a split and maximized window display", on page 120.

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.

7.1.3 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

7.1.4 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:

Table 7-3: Frequency domain display

Label	Information
CF / Span or none (first / last value)	Center frequency / Frequency span or Start frequency / Stop frequency (Depending on how the range was defined)
Pts	Number of sweep points or (rounded) number of currently displayed points in zoom mode
MHz/	Span per division

Table 7-4: Time domain display

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

7.1.5 Instrument and status information

Global instrument settings and functions, 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

EXT REF	The instrument is configured for operation with an external reference.
IQ IN	The optional Digital Baseband Interface (R&S FSW-B17) is being used for digital input For details on the Digital Baseband Interface (R&S FSW-B17), see the FSW I/Q Analyzer User Manual.
IQ OUT	The optional Digital Baseband Interface (R&S FSW-B17) is being used to provide digital output. For details on the Digital Baseband Interface (R&S FSW-B17), see the FSW I/Q Analyzer User Manual.
IQ 40G	The optional Digital I/Q 40G Streaming Output Connector (R&S FSW-B517) is being used to provide digital output. For details on the Digital I/Q 40G Streaming Output Connector, see the FSW I/Q Analyzer User Manual.

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.

7.1.6 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 7-5: 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 FSW user manual.

7.2 Accessing the functionality

You can operate all instrument functions using this user interface.

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

7.2.1 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 FSW User Manual for details.

The following functions are available by default:

Table 7-6: 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)
	Report Menu: Displays the "Report" menu to configure a report.
	Undo: reverts last operation
	Redo: repeats previously reverted operation

Icon	Description
	Selection mode: the cursor can be used to select (and move) markers in a zoomed display (This function is only available and required for older instruments that do not support multi-touch gestures.)
	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 111)
	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 111)
	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.
	Data shift: Shifts the data to be evaluated in the result display and re-evaluates the new data. Currently, this function is only available in the Transient Analysis application.
	Data zoom: Decreases the amount of data to be evaluated in the result display and re-evaluates the new data, thus enlarging the display of the remaining data. Currently, this function is only available in the Transient Analysis application.

Icon	Description
	SmartGrid: activates "SmartGrid" mode to configure the screen layout
	Sequencer: opens the "Sequencer" menu to perform consecutive measurements
	SCPI Recorder: opens a dialog to record SCPI commands during operation
	Event based actions manager: opens a dialog to configure actions based on specific events For details see General Instrument Setup in the FSW base unit user manual.
	Application starter: opens a dialog to start an external application directly from the FSW firmware. For details see General Instrument Setup in the FSW base unit user manual. To return to the FSW window, use the [Alt]+[Tab] keys.
	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
	Report New: Deletes all currently stored datasets and creates a new one.
	Report Append: Adds a new dataset to the existing ones for the next test report.
	Print immediately: prints the current display (screenshot) as configured
In "SmartGrid" mode only:	
	Exit "SmartGrid" mode

7.2.2 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.

7.2.3 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 the FSW User Manual.

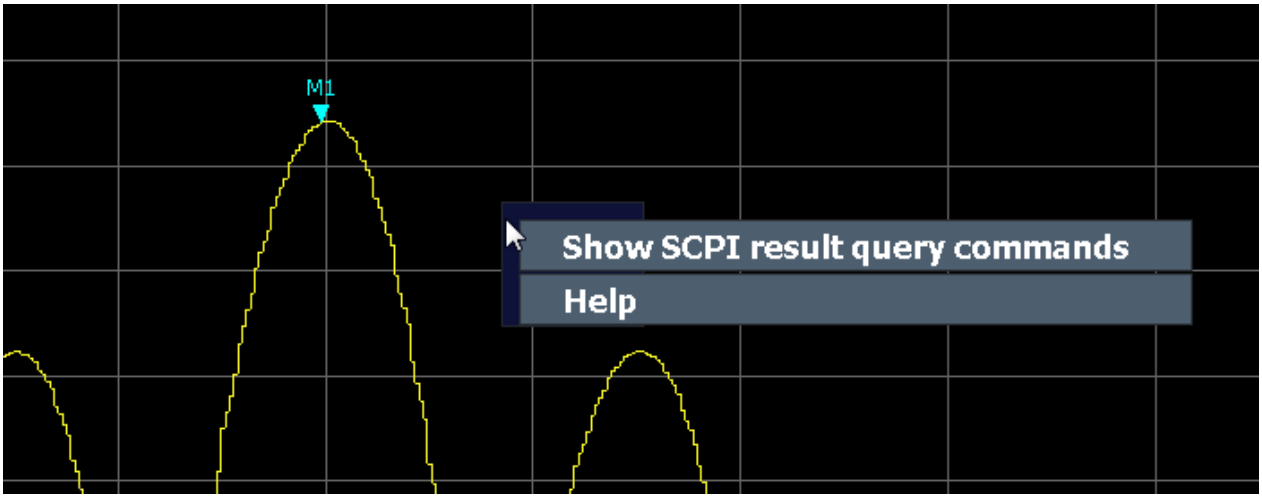


Figure 7-1: Context menu for a result display with SCPI Recorder functions

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.

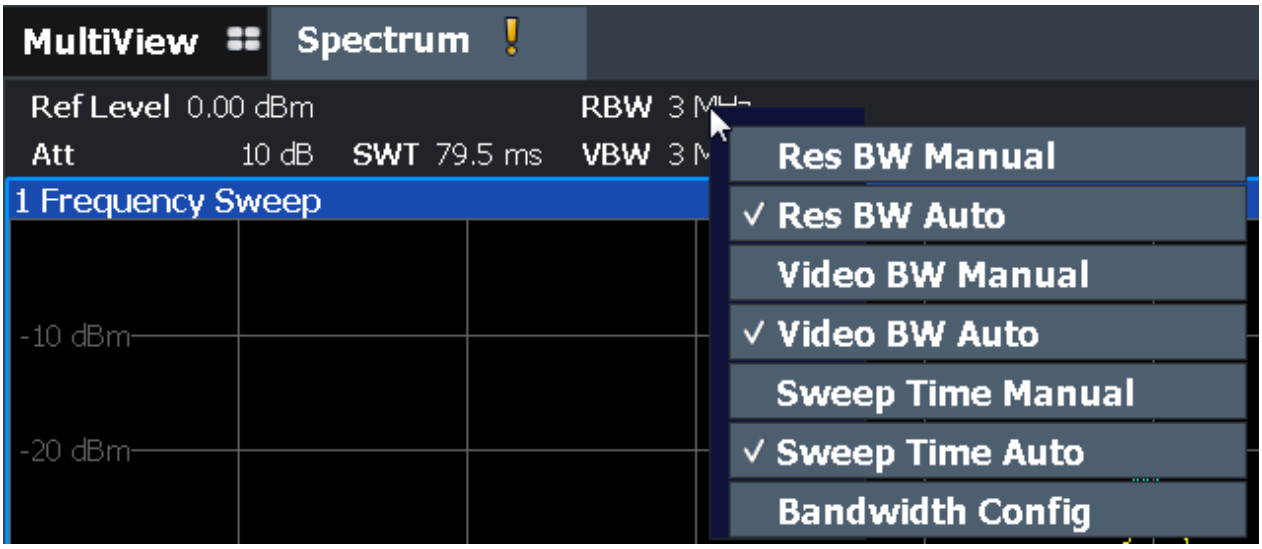
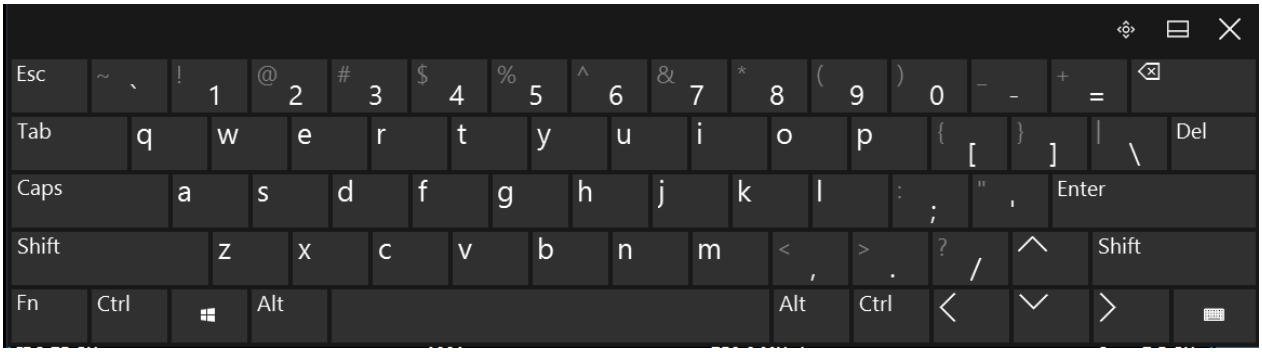


Figure 7-2: Context menu for channel bar setting

7.2.4 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.

7.3 Changing the focus

Any interaction using the keypad, scrollbar or knobs always affects the currently focused element in the display, e.g. a dialog field, diagram, or table row. The currently focused element is indicated by a blue frame (diagram, window, table) or is otherwise highlighted (softkey, marker etc.). To move the focus, select the element on the touchscreen.

To move the focus between any displayed diagrams or tables in a window, press "Change focus" on the front panel. The focus moves from the diagram to the first table to the next table etc. and then back to the diagram, within the same window.

In fullscreen mode, where a single window is displayed in full size on the screen, this key switches the focus (and the display) from one active window to the next.

7.4 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.

7.4.1 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 [ENTER] or any of the unit keys.
   The editing line is highlighted to confirm the entry.

Digit-based data entry

By default, when you enter a numeric value in an input field, you overwrite the existing value. If you edit the value using the arrow keys or rotary knob, the value is increased or decreased linearly. An extended digit-based data entry mode allows you to edit individual digits and change the unit quickly.

1. In the input field for a numeric value, select the pencil icon to switch to extended data entry mode.

2. Use the left and right arrow keys to scroll through the individual digits of the indicated value.
3. Change the required digit using the up and down arrow keys or the rotary knob to scroll through the values 0 to 9.

   The new value is applied immediately, without further confirmation.

   Note:
   - If you enter a digit using the keypad, the entire value is overwritten, as in normal data entry mode.
   - To add a digit to the existing value, you must return to normal data entry mode. Select the pencil icon to toggle between entry modes.
4. To change the unit:
   a) Press the right arrow key and scroll past the last digit to select the unit list.
   b) Use the up and down arrow keys to scroll through the available units.
   c) Press the left arrow key to return to the last digit of the numeric value.

   The new unit is applied immediately, without further confirmation.
5. Select the "X" to close the input field.

7.4.2 Entering alphanumeric parameters

If a field requires alphanumeric input, you can use the on-screen keyboard to enter numbers and (special) characters (see Section 7.2.4, "On-screen keyboard", on page 104).

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 7-7.

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 "System Configuration Setttings" in the FSW base unit user manual.

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 7-7.
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 "0" 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 [BACKSPACE].
   The entry to the left of the cursor is deleted.
3. Enter your correction.

To complete the entry

► Press [ENTER] or the rotary knob.

To abort the entry

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

Table 7-7: 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>

7.5 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.

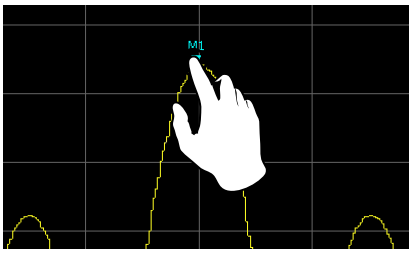


Figure 7-3: Tapping

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.

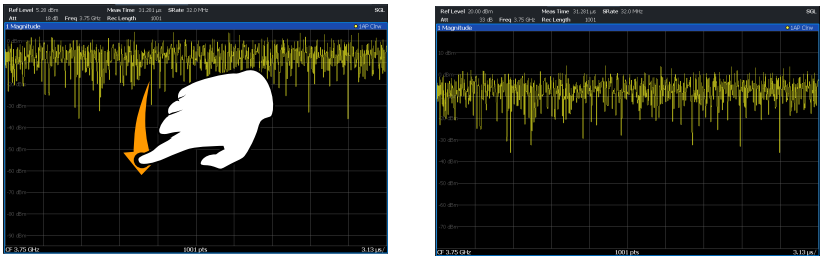


Figure 7-4: Dragging

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.

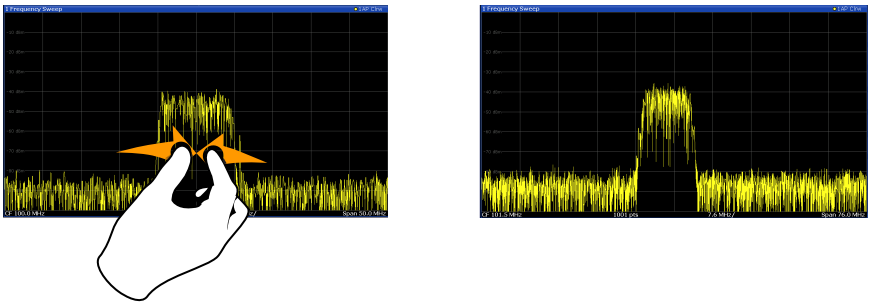


Figure 7-5: Pinching

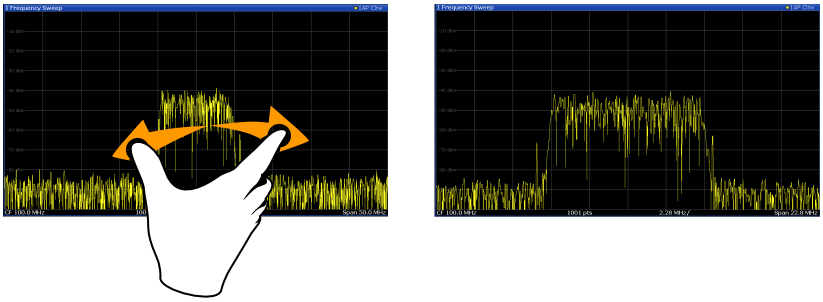


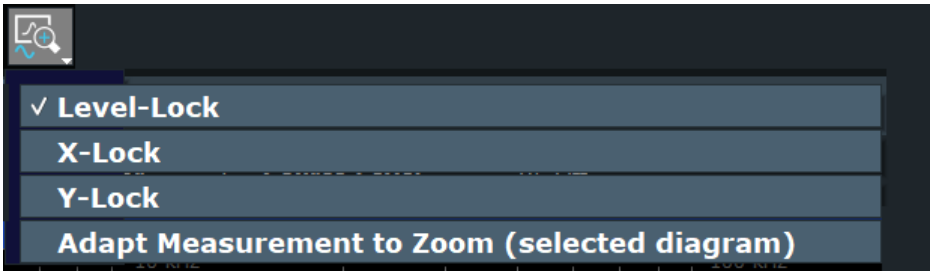
Figure 7-6: Spreading

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.

(See Section 7.2.1, "Toolbar", on page 100 and the FSW User Manual).



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 7-8: 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
n.a. (Change hardware settings)	Spread and pinch two fingers
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.

7.6 Displaying results

The FSW provides several instrument applications for different analysis tasks and different types of signals, e.g. 3G FDD, I/Q analysis or basic spectrum analysis. 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.

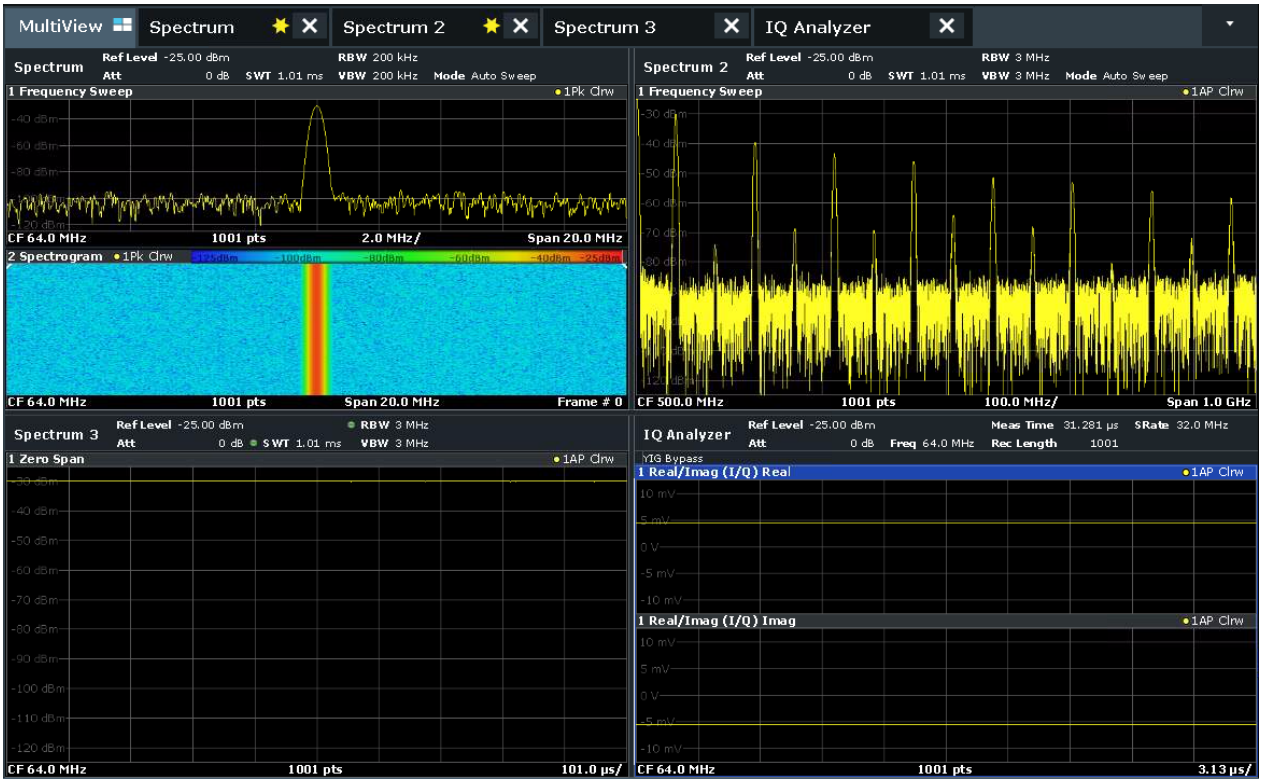
The FSW allows you to configure the display to suit your specific requirements and optimize analysis.

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

To change the application in an active channel

1. Select the tab of the channel you want to change.
2. Select [Mode].
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.

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.

7.6.2 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.

(For details on evaluation methods see the User Manual.)

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.

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- How to close a result window..... 118
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7.6.2.1 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.

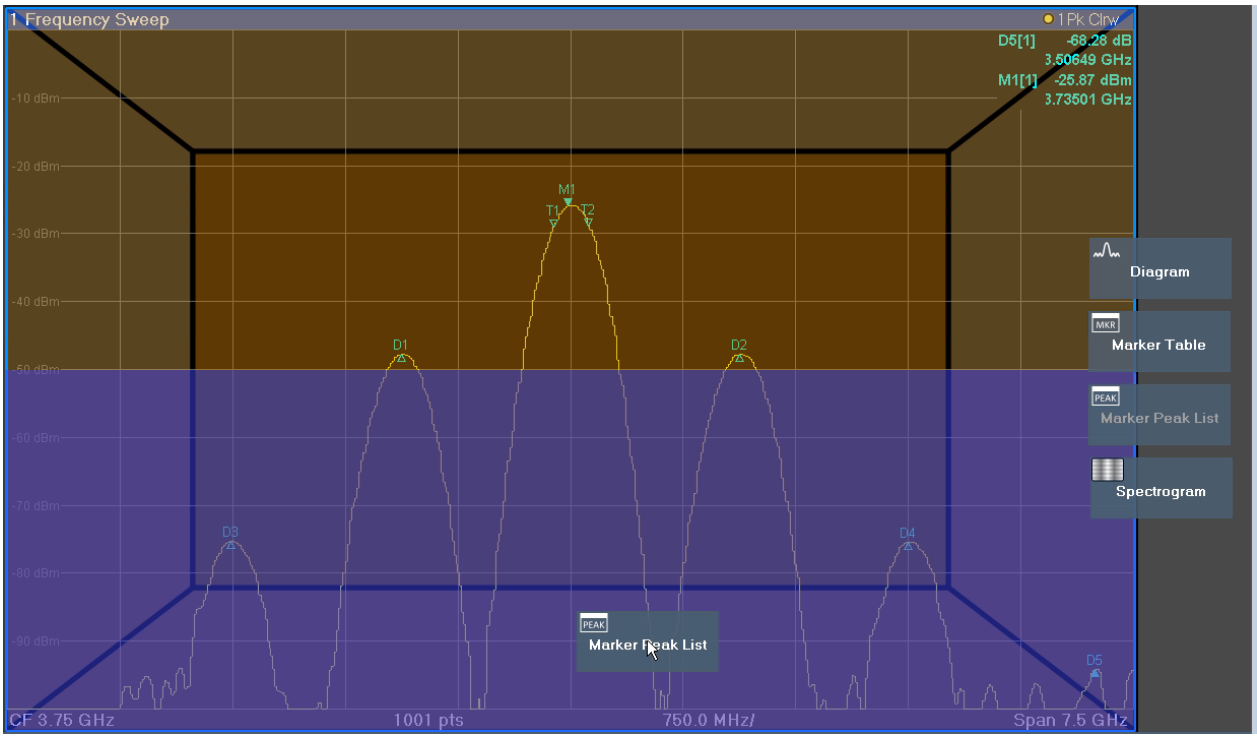


Figure 7-7: Moving a window in SmartGrid mode

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 Fig-

ure 7-8). 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).

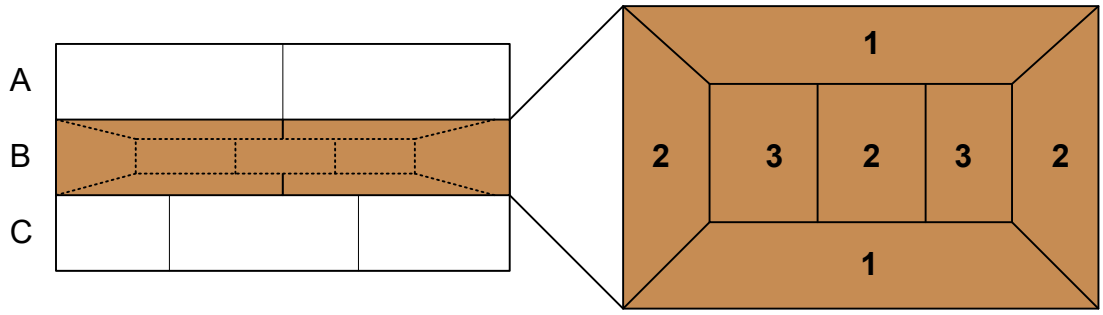


Figure 7-8: SmartGrid window positions

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.

7.6.2.2 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 "Display Config" in the configuration "Overview".
- Select "Display Config" 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, or press any key.

7.6.2.3 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 Section 7.6.2.5, "How to arrange the result windows", on page 119 for more information on positioning the window).

7.6.2.4 How to close a result window

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

7.6.2.5 How to arrange the result windows

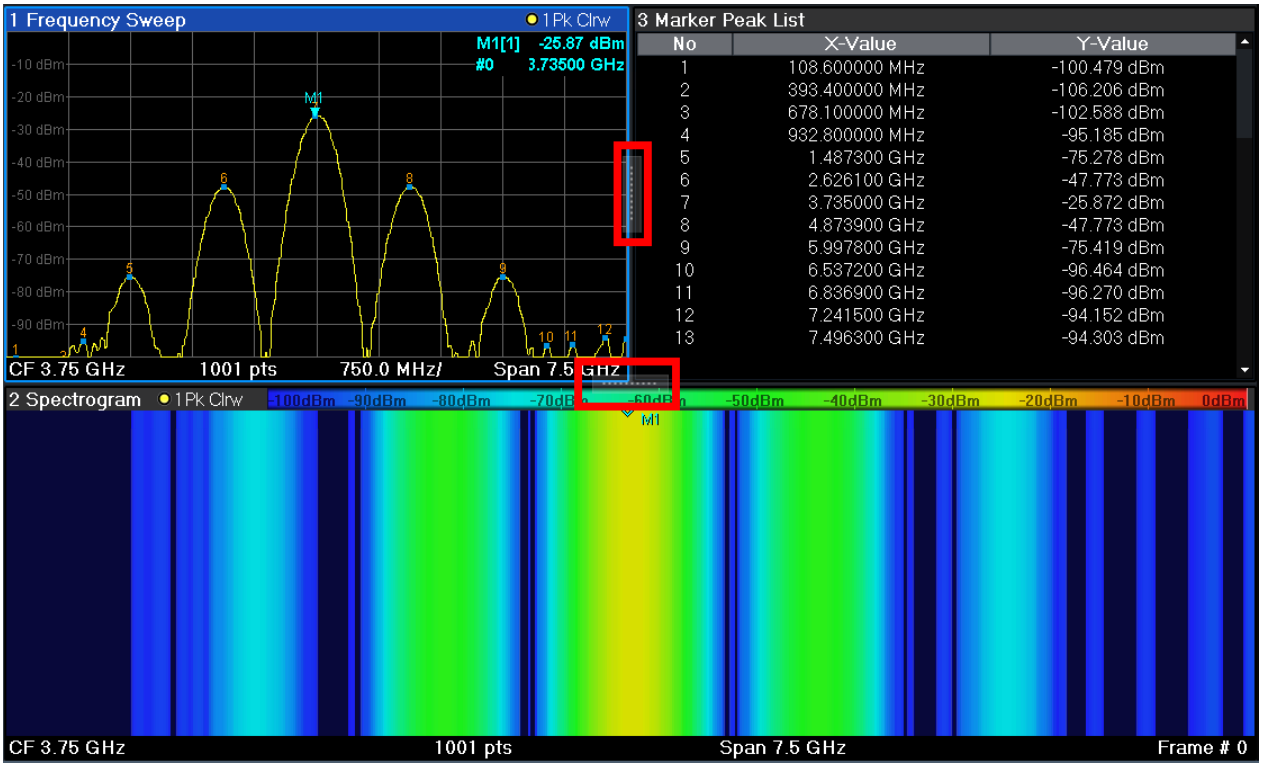
1. Select an icon from the evaluation bar or the "Move" icon for an existing evaluation window.

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.

7.6.3 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.

7.6.4 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 [SPLIT/MAXIMIZE] 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.

7.6.5 Changing the display

The display can be optimized for your individual needs. The following display functions are available and are described in detail in the User Manual.

- 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

7.7 Getting help

If any questions or problems concerning the FSW 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 [F1] 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.

8 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 8-1: QR code to the Rohde & Schwarz support page

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