R&S®FSW
Signal and Spectrum Analyzer
Getting Started

1312942002

ROHDE&SCHWARZ

This manual applies to the following R&S®FSW models with firmware version 3.10 and higher:

- R&S®FSW8 (1312.8000K08)
- R&S®FSW13 (1312.8000K13)
- R&S®FSW26 (1312.8000K26)
- R&S®FSW43 (1312.8000K43)
- R&S®FSW50 (1312.8000K50)
- R&S®FSW67 (1312.8000K67)
- R&S®FSW85 (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-B517, digital I/Q 40G streaming out interface (1331.6980.16)
- 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)
- R&S®FSW bandwidth extension options: R&S FSW-B160 (1313.1668.02) / (1325.4850.04) / R&S FSW-U160 (1313.3754.02) / (1325.5357.04) / R&S®FSW-B320 (1313.7172.02) / (1325.4867.04) / R&S FSW-U320 (1313.7189.02) / R&S®FSW-B500 (1313.4296.02) / R&S®FSW-B512 (1313.4296.04) / R&S®FSW-U512 (1321.6320.04) / R&S®FSW-U512A (1321.6320.14) / R&S®FSW-B2000 (1325.4750.02)

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

Contents

Contents

1   Preface

1.1   For Your Safety

The R&S FSW is designated for use in industrial, administrative, and laboratory environments. Use the R&S FSW only for its designated purpose. Observe the safety and usage instructions documented in the user manual, as well as operating conditions and performance limits stated in the data sheet.

The product documentation helps you use the R&S FSW safely and efficiently. Keep the product documentation in a safe place and pass it on to subsequent users.

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

- In the "Basic Safety Instructions", safety issues are grouped according to subjects. For example, one subject is electrical safety. The "Basic Safety Instructions" are delivered with the R&S FSW in different languages in print.

- Throughout the documentation, safety instructions are provided when you need to take care during setup or operation. Always read the safety instructions carefully. Make sure to comply fully with them. Do not take risks and do not underestimate the potential danger of small details such as a damaged power cable.

1.2   Key Features

The R&S FSW Signal and Spectrum Analyzer sets standards in RF performance and usability. Outstanding key features are:

- Unmatched phase noise
- Excellent dynamic range
- Up to 160 MHz analysis bandwidth
- 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
- Integrated support of R&S®NRP-Zxx power sensors

For a detailed specification refer to the data sheet.

Due to these features the R&S 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

1.3   Conventions Used in the Documentation

1.3.1   Typographical Conventions

The following text markers are used throughout this documentation:

Convention	Description
"Graphical user interface elements"	All names of graphical user interface elements on the screen, such as dialog boxes, menus, options, buttons, and softkeys are enclosed by quotation marks.
[Keys]	Key and knob names are enclosed by square brackets.
`File names, commands, program code`	File names, commands, coding samples and screen output are distinguished by their font.
Input	Input to be entered by the user is displayed in italics.

Convention	Description
Links	Links that you can click are displayed in blue font.
"References"	References to other parts of the documentation are enclosed by quotation marks.

1.3.2   Conventions for Procedure Descriptions

When operating the instrument, several alternative methods may be available to perform the same task. In this case, the procedure using the touchscreen is described. Any elements that can be activated by touching can also be clicked using an additionally connected mouse. The alternative procedure using the keys on the instrument or the on-screen keyboard is only described if it deviates from the standard operating procedures.

The term "select" may refer to any of the described methods, i.e. using a finger on the touchscreen, a mouse pointer in the display, or a key on the instrument or on a keyboard.

1.3.3   Notes on Screenshots

When describing the functions of the product, we use sample screenshots. These screenshots are meant to illustrate as much as possible of the provided functions and possible interdependencies between parameters. The shown values may not represent realistic usage scenarios.

The screenshots usually show a fully equipped product, that is: with all options installed. Thus, some functions shown in the screenshots may not be available in your particular product configuration.

2   Documentation Overview

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

www.rohde-schwarz.com/manual/FSW

2.1   Getting Started Manual

Introduces the R&S 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 R&S FSW is not included.

The contents of the user manuals are available as help in the R&S 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   Instrument Security Procedures

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

2.5   Basic Safety Instructions

Contains safety instructions, operating conditions and further important information. The printed document is delivered with the instrument.

2.6   Data Sheets and Brochures

The data sheet contains the technical specifications of the R&S 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

2.7 Release Notes and Open Source Acknowledgment (OSA)

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

The open source acknowledgment document provides verbatim license texts of the used open source software.

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

2.8 Application Notes, Application Cards, White Papers, etc.

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

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

3   Preparing for Use

3.1   Putting into Operation

This section describes the basic steps to be taken when setting up the R&S FSW for the first time.

⚠ WARNING

Risk of injury due to disregarding safety information

Observe the information on appropriate operating conditions provided in the data sheet to prevent personal injury or damage to the instrument. Read and observe the basic safety instructions provided with the instrument, in addition to the safety instructions in the following sections. In particular:

- Do not open the instrument casing.

NOTICE

Risk of instrument damage due to inappropriate operating conditions

Specific operating conditions are required to ensure accurate measurements and to avoid damage to the instrument. Observe the information on appropriate operating conditions provided in the basic safety instructions and the instrument's data sheet.

NOTICE

Instrument damage caused by electrostatic discharge

Electrostatic discharge (ESD) can damage the electronic components of the instrument and the device under test (DUT). Electrostatic discharge is most likely to occur when you connect or disconnect a DUT or test fixture to the instrument's test ports. To prevent electrostatic discharge, use a wrist strap and cord and connect yourself to the ground, or use a conductive floor mat and heel strap combination.

NOTICE

Risk of instrument damage due to inappropriate operating conditions

An unsuitable operating site or test setup can damage the instrument and connected devices. Before switching on the instrument, observe the information on appropriate operating conditions provided in the data sheet. In particular, ensure the following:

- All fan openings are unobstructed and the airflow perforations are unimpeded. The minimum distance from the wall is 10 cm.
- The instrument is dry and shows no sign of condensation.
- The instrument is positioned as described in the following sections.
- The ambient temperature does not exceed the range specified in the data sheet.
- Signal levels at the input connectors are all within the specified ranges.
- Signal outputs are connected correctly and are not overloaded.

EMI impact on measurement results

Electromagnetic interference (EMI) may affect the measurement results.

To suppress generated electromagnetic interference (EMI):

- Use suitable shielded cables of high quality. For example, use double-shielded RF and LAN cables.
- Always terminate open cable ends.
- Note the EMC classification in the data sheet.

3.1.1   Unpacking and Checking the Instrument

Check the equipment for completeness using the delivery note and the accessory lists for the various items. Check the instrument for any damage. If there is damage, immediately contact the carrier who delivered the instrument. Make sure not to discard the box and packing material.

Packing material

Retain the original packing material. If the instrument needs to be transported or shipped later, you can use the material to protect the control elements and connectors.

⚠ WARNING

Risk of injury during transportation

The carrying handles at the front and side of the casing are designed to lift or carry the instrument. Do not apply excessive force to the handles. If a handle is ripped off, the falling instrument can cause injury.

Be aware of the weight of the instrument when lifting it. Observe the information on transporting heavy instruments in the basic safety instructions provided with the instrument.

3.1.2   Accessory List

The instrument comes with the following accessories:

● Power cable
● Printed Getting Started manual

3.1.3 Placing or Mounting the Instrument

The R&S FSW is designed for use under laboratory conditions, either on a bench top or in a rack.

Bench Top Operation

If the R&S FSW is operated on a bench top, the surface should be flat. The instrument can be used in horizontal position, standing on its feet, or with the support feet on the bottom extended.

⚠ **WARNING**

Risk of injury if feet are folded out

The feet can fold in if they are not folded out completely or if the instrument is shifted. Collapsing feet can cause injury or damage the instrument.

● Fold the feet completely in or out to ensure stability of the instrument. Never shift the instrument when the feet are folded out.

● When the feet are folded out, do not work under the instrument or place anything underneath.

● The feet can break if they are overloaded. The overall load on the folded-out feet must not exceed 500 N.
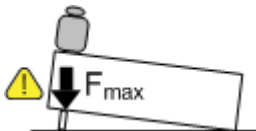
⚠ **WARNING**

Risk of injury when stacking instruments

A stack of instruments can tilt over and cause injury if not stacked correctly. Furthermore, the instruments at the bottom of the stack can be damaged due to the load imposed by the instruments on top.

Observe the following instructions when stacking instruments:

- Never stack more than three instruments. If you need to stack more than three instruments, install them in a rack.

- The overall load imposed on the lowest instrument must not exceed 500 N.

- It is best if all instruments have the same dimensions (width and length). If you need to stack smaller instruments on the top, the overall load imposed on the lowest instrument must not exceed 250 N.

- If the instruments have foldable feet, fold them in completely.

| Correct | Too many instruments | Different dimensions | Feet folded out |
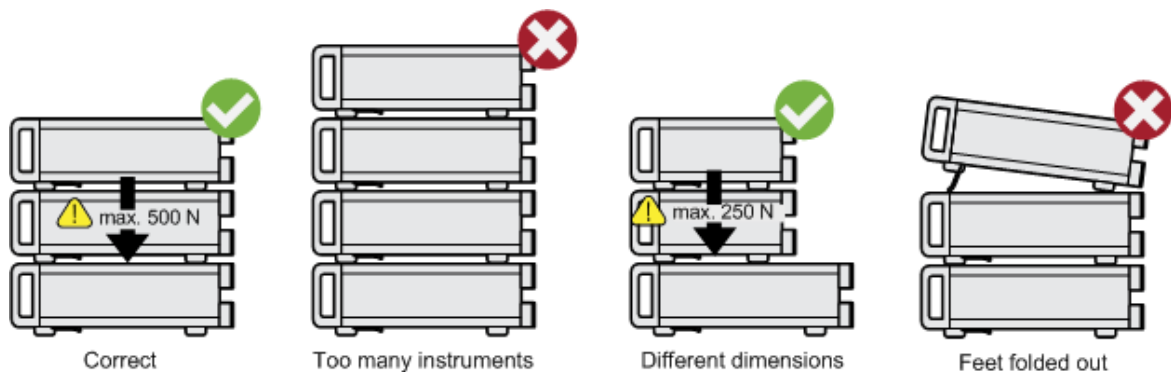
Rackmounting

The R&S FSW can be installed in a rack using a rack adapter kit (order no. see data sheet). The installation instructions are part of the adapter kit.

> **NOTICE**
>
> **Risk of instrument damage due to insufficient airflow in a rack**
>
> If the instrument is run with insufficient airflow for a longer period, the instrument overheats, which can disturb the operation and even cause damage.
>
> Make sure that all fan openings are unobstructed, that the airflow perforations are unimpeded, and that the minimum distance from the wall is 10 cm.

3.1.4   Connecting the AC Power

In the standard version, the R&S FSW is equipped with an AC power supply connector. The R&S FSW can be used with different AC power voltages and adapts itself automatically to it. Refer to the datasheet for the requirements of voltage and frequency. The AC power connector is located on the rear panel of the instrument.

For details on the connector, refer to Chapter 4.2.2, "AC Power Supply Connection and Main Power Switch", on page 54.

► Connect the R&S FSW to the AC power supply using the supplied power cable.
  Since the instrument is assembled in line with the specifications for safety class EN61010, it must only be connected to an outlet that has a ground contact.

3.1.5   Switching the Instrument On and Off

Switching on the instrument

► Press the AC power switch on the rear panel to position "I".

  The instrument is supplied with AC power. After booting, the instrument is ready for operation. A green LED above the [POWER] key indicates this. An orange LED indicates the instrument is in standby mode

Warm-up time for OCXO

When the instrument is switched on, the OCXO requires an extended warm-up time (see data sheet).

Switching off the instrument

1. Press the [POWER] key on the front panel.

    The R&S FSW switches to standby mode.

2. Set the AC power switch on the rear panel to position "O", or disconnect the instrument from the AC power supply.

    The R&S FSW changes into off mode.

> **NOTICE**
>
> **Risk of losing data**
>
> If you switch off the running instrument using the rear panel switch or by disconnecting the power cord, the instrument loses its current settings. Furthermore, program data can be lost.
>
> Press the Power key first to shut down the application properly.

3.1.6   Performing a Self-Alignment and a Selftest

During instrument start, the installed hardware is checked against the current firmware version to ensure the hardware is supported. If not, an error message is displayed ("WRONG_FW") and you are asked to update the firmware. Until the firmware version is updated, self-alignment fails.

(For details refer to the R&S FSW User Manual).

When strong temperature changes occur, you may have to perform a self-alignment to align the data to a reference source.

Operating temperature

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

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

Performing a self-alignment

1. Press the [SETUP] key.

2. Press the "Alignment" softkey.

3. Select the "Start Self-Alignment" button in the "Alignment" dialog box.

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

To display the alignment results again later
- Press the [SETUP] key.
- Press the "Alignment" softkey.

Performing a selftest

You do not have to repeat the selftest every time the instrument is switched on. It is only necessary when instrument malfunction is suspected.

1. Press the [SETUP] key.

2. Press the "Service" softkey.

3. Switch to the "Selftest" tab in the "Service" dialog box.

4. Select the "Start Selftest" button.

   Once the instrument modules have been checked successfully, a message is displayed.

3.1.7   Checking the Supplied Options

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

1. Press the [SETUP] key.

2. Press the "System Config" softkey.

3. Switch to the "Versions + Options" tab in the "System Configuration" dialog box.

   A list with hardware and firmware information is displayed.

4. Check the availability of the hardware options as indicated in the delivery note.

3.2   Windows Operating System

The instrument contains the Windows 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 keyboard or a printer are installed or if the network configuration does not comply with the default settings. After the R&S FSW is started, the operating system boots and the instrument firmware is started automatically.

To ensure that the instrument software functions properly, certain rules must be adhered to concerning the operating system.

NOTICE

Risk of rendering instrument unusable

The instrument is equipped with the Windows operating system. 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 drivers and programs used on the instrument under Windows are adapted to the instrument. Only install update software released by Rohde & Schwarz to modify existing 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 NRP-Zxx (install only this component!)
- Symantec Endpoint Security – virus-protection software
- FileShredder - for reliable deletion of files on the hard disk

3.2.1   Virus Protection

Take appropriate steps to protect your instruments from infection. Use strong fire-wall 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

3.2.2   Service Packs and Updates

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

For details and recommendations, see the Rohde & Schwarz White Paper 1EF96: Malware Protection Windows 10.

3.2.3   Login

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

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

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 R&S 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 Chapter 3.7, "Protecting Data Using the Secure User Mode", on page 35.

Automatic login

For the administrator account, an automatic login function is active by default. If activated, login is carried out automatically for the administrator (with full access) in the background when the R&S FSW is started, without having to enter a password. This function is active until you explicitly deactivate it or change the password.

For information on how to deactivate or reactivate the automatic login, refer to Chapter 3.2.3.1, "Automatic Login Function", on page 22.

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 both users after initial login.

You can change the password in Windows for any user at any time via "Start > Settings > Account > SignIn Options > Password > Change".

When the secure user mode is activated the first time after installation, the user is prompted to change the passwords for all user accounts to improve system security.

> ⓘ **Changing the password and use of auto-login function**
>
> Note that when you change the default passwords, the default auto-login function no longer works! Reactivate it manually as described in "Reactivating the automatic login function" on page 23.

3.2.3.1   Automatic Login Function

When shipped, the instrument automatically logs on the default "Instrument" user to Windows using the default password.

Switching users when using the automatic login function

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

1. Select the "Windows" icon in the toolbar to access the operating system of the R&S FSW (see also Chapter 3.2.4, "Accessing the Start Menu",
   on page 23).

   ⊞

2. Press [CTRL + ALT + DEL], then select "Sign out".

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

Deactivating the automatic login function

To deactivate the automatic login function, perform the following steps:

1. Select the "Windows" icon in the toolbar to access the operating system of the R&S FSW (see also Chapter 3.2.4, "Accessing the Start Menu",
   on page 23).

   ⊞

2. In the "Start" menu, select "All applications > Windows System > Run".
   The "Run" dialog box is displayed.

3. Enter the command `C:\R_S\INSTR\USER\NO_AUTOLOGIN.REG`.

4. Press the [ENTER] key to confirm.
   This command deactivates the automatic login function. The next time you switch on the instrument, the operating system prompts you to enter your user name and password before it starts the firmware.

Adapting the automatic login function to a new password

If you change the "Instrument" user's password, which is used during automatic login, this function no longer works. Adapt the settings for the command that activates the auto login function first.

1. Open the `C:\R_S\INSTR\USER\NO_AUTOLOGIN.REG` file in any text editor (e.g. Notepad).

2. In the line `"DefaultPassword"="894129"`, replace the default password (`894129`) by the new password for automatic login.

3. Save the changes to the file.

Reactivating the automatic login function

1. Select the "Windows" icon in the toolbar to access the operating system of the R&S FSW (see also Chapter 3.2.4, "Accessing the Start Menu", on page 23).

2. In the "Start" menu, select "All applications > Windows System > Run".
   The "Run" dialog box is displayed.

3. Enter the command `C:\R_S\INSTR\USER\AUTOLOGIN.REG`.

4. Press the [ENTER] key to confirm.
   This command reactivates automatic login function. It is active the next time the instrument reboots.

3.2.4   Accessing the Start Menu

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

To open the "Start" menu:

► In Windows 10:

Press the "Windows" key or the [CTRL + ESC] key combination on your (external) keyboard.

All necessary system settings can be defined in the "Start > Settings" menu (for required settings refer to the Windows documentation and to the hardware description).

3.2.5   Accessing the Windows Taskbar

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 task-bar.

For details on the IECWIN tool, see the "Network and Remote Control" chapter of the R&S FSW user manual.

To open the taskbar, select the "Windows" icon on the R&S FSW toolbar, or press the "Windows" key or the [CTRL + ESC] key combination on your (external) keyboard.

3.3   Connecting USB Devices

The USB interfaces of the R&S FSW allow you to connect USB devices directly to the instrument. Increase the number of possible connections using USB hubs. Due to the large number of available USB devices, there is almost no limit to the expansions that are possible with the R&S FSW.

The following list shows various USB devices that can be useful:

● Memory stick for easy transfer of data to/from a computer (e.g. firmware updates)

● CD-ROM drives for easy installation of firmware applications

- Keyboard or mouse to simplify the entry of data, comments, filenames, etc.
- Printer for printing measurement results
- Power sensors, e.g. of the NRP Zxy family

Installing USB devices is easy under Windows, because all USB devices are plug&play. After a device is connected to the USB interface, the operating system automatically searches for a suitable device driver.

If Windows does not find a suitable driver, it prompts you to specify a directory that contains the driver software. If the driver software is on a CD, connect a USB CD-ROM drive to the instrument before proceeding.

When a USB device is then disconnected from the R&S FSW, Windows immediately detects the change in hardware configuration and deactivates the corresponding driver.

All USB devices can be connected to or disconnected from the instrument during operation.

Connecting a memory stick or CD-ROM drive

If installation of a memory stick or CD-ROM drive is successful, Windows informs you that the device is ready to use. The device is made available as a new drive and is displayed in Windows Explorer. The name of the drive depends on the manufacturer.

Connecting a keyboard

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

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

- German
- Swiss
- French
- Russian

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

Connecting a mouse

The mouse is detected automatically when it is connected.

Select "Start > Settings > Devices > Mouse & touchpad" to configure the mouse properties. To access the Windows operating system, press the Windows key on the external keyboard.

Connecting a printer

When printing a file, the instrument checks whether a printer is connected and turned on and whether the appropriate printer driver is installed. If necessary, printer driver installation is initiated. You only have to install a printer driver once.

To install a printer, select "Start > Settings > Devices > Add a printer or scanner". To access the Windows operating system, press the Windows key on the external keyboard.

You can load updated and improved driver versions or new drivers from an installation disk, USB memory stick or another external storage medium. If the instrument is integrated in a network, you can also install driver data stored in a network directory.

Select "Start > Settings > Devices > Device Manager > Update Device drivers" to install the driver.

3.4   Connecting an External Monitor

You can connect an external monitor (or projector) to the "DVI" or "display port" connector on the rear panel of the R&S FSW (see also Chapter 4.2.3, "DISPLAY PORT and DVI", on page 54).

> **Screen resolution and format**
>
> The touchscreen of the R&S 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 will not be correct and the screen will not react to your touch actions properly.
>
> The touchscreen has a screen resolution of 1280x800 pixels. Most external monitors have a higher screen resolution. If the screen resolution of the monitor is set higher than the instrument's resolution, the application window uses an area of 1280x800 pixels on the monitor display. For full screen display, adjust the monitor's screen resolution.
>
> The R&S FSW supports a minimum resolution of 1280x768 pixels.

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

2. Press the [SETUP] key.

3. Press the "Display" softkey.

4. Select the "Configure Monitor" tab in the "Display" dialog box.

   The standard Windows "Screen Resolution" dialog box is displayed.
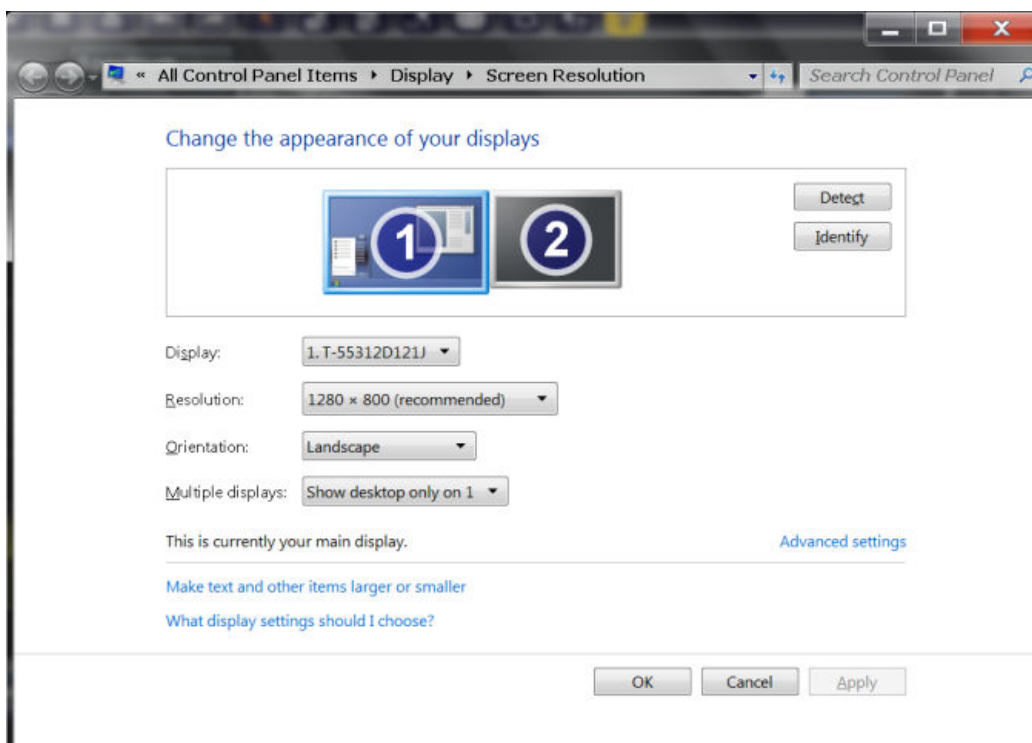
5. If necessary, change the screen resolution to be used. Consider the information in the note above.

6. Select the instrument to be used for display:
   - "Display 1": internal monitor only
   - "Display 2": external monitor only
   - "Duplicate": both internal and external monitor

7. Tap "Apply" to try out the settings before they are accepted permanently, then you can easily return to the previous settings, if necessary.

8. Select "OK" if the settings are suitable.

3.5 Setting Up a Network (LAN) Connection

A LAN connection is the prerequisite for all network operations. The LAN connection settings can be configured directly in the Windows operating system.

The R&S FSW is equipped with a network interface and can be connected to an Ethernet LAN (local area network). 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.
  See chapter "Remote Control" in the R&S FSW user manual.
- 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

This section describes how to configure the LAN interface. It includes the following topics:

- Chapter 3.5.1, "Connecting the Instrument to the Network", on page 29
- Chapter 3.5.2, "Assigning the IP Address", on page 30

Note that only user accounts with administrator rights can configure LAN networks.

LXI

The R&S FSW supports the LXI core features. LXI gives you direct access to the LAN settings described below.

For further information on the LXI interface, refer to the user manual.

3.5.1   Connecting the Instrument to the Network

There are two methods to establish a LAN connection to the instrument:

● A non-dedicated network (Ethernet) connection from the instrument to an existing network made with an ordinary RJ-45 network cable. The instrument is assigned an IP address and can coexist with a computer and with other hosts on the same network.

● A dedicated network connection (Point-to-point connection) between the instrument and a single computer made with a (crossover) RJ-45 network cable. The computer must be equipped with a network adapter and is directly connected to the instrument. The use of hubs, switches, or gateways is not required, however, data transfer is still performed using the TCP/IP protocol. You must assign an IP address to the instrument and the computer, see Chapter 3.5.2, "Assigning the IP Address", on page 30.
Note: As the R&S FSW uses a 1 GBit LAN, a crossover cable is not necessary (due to Auto-MDI(X) functionality).

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

Errors can affect the entire network.

► To establish a non-dedicated network connection, connect a commercial RJ-45 cable to one of the LAN ports.
To establish a dedicated connection, connect a (crossover) RJ-45 cable between the instrument and a single PC.

If the instrument is connected to the LAN, Windows automatically detects the network connection and activates the required drivers.

The network card can be operated with a 1 GBit Ethernet IEEE 802.3u interface.

3.5.2 Assigning the IP Address

Depending on the network capacities, the TCP/IP address information for the instrument can be obtained in different ways.

- If the network supports dynamic TCP/IP configuration using the Dynamic Host Configuration Protocol (DHCP), all address information can be assigned automatically.

- If the network does not support DHCP, or if the instrument is set to use alternate TCP/IP configuration, the addresses must be set manually.

By default, the instrument is configured to use dynamic TCP/IP configuration and obtain all address information automatically. This means that it is safe to establish a physical connection to the LAN without any previous instrument configuration.

NOTICE

Risk of network errors

Connection errors can affect the entire network. If your network does not support DHCP, or if you choose to disable dynamic TCP/IP configuration, you must assign valid address information before connecting the instrument to the LAN. Contact your network administrator to obtain a valid IP address.

Assigning the IP address on the instrument

1. Press the [SETUP] key.

2. Press the "Network + Remote" softkey.

3. Select the "Network" tab.

4. In the "Network + Remote" dialog, toggle the "DHCP On/Off" setting to the required mode.
   If DHCP is "Off", you must enter the IP address manually, as described in the following steps.
   Note: When DHCP is changed from "On" to "Off", the previously set IP address and subnet mask are retrieved.
   If DHCP is "On", the IP address of the DHCP server is obtained automatically. The configuration is saved, and you are prompted to restart the instrument. You can skip the remaining steps.
   Note: When a DHCP server is used, a new IP address may be assigned each time the instrument is restarted. This address must first be determined on the instrument itself. Thus, when using a DHCP server, it is recommended that

you use the permanent computer name, which determines the address via the DNS server
(See "Using a DNS server to determine the IP address" on page 31 and Chapter 3.5.3, "Using Computer Names", on page 33).

5. Enter the "IP Address", for example *192.0.2.0*. The IP address consists of four number blocks separated by dots. Every block contains a maximum of 3 numbers.

6. Enter the "Subnet Mask", for example *255.255.255.0*. The subnet mask consists of four number blocks separated by dots. Every block contains a maximum of 3 numbers.

7. Select "Configure Network".

   If you have entered an invalid IP address or subnet mask, the message "out of range" is displayed in the status line. If the settings are correct, the configuration is saved, and you are prompted to restart the instrument.

8. Confirm the displayed message ("Yes" button) to restart the instrument.

Using a DNS server to determine the IP address

If a DNS server is configured on the R&S FSW, the server can determine the current IP address for the connection using the permanent computer name.

1. Obtain the name of your DNS domain and the IP addresses of the DNS and WINS servers on your network.

2. Press the "Windows" key on the external keyboard or the [CTRL + ESC] key combination on your keyboard to access the operating system.

3. Select "Start > Settings > Network & Internet > Ethernet > Network and Sharing Center > Connections: Ethernet".
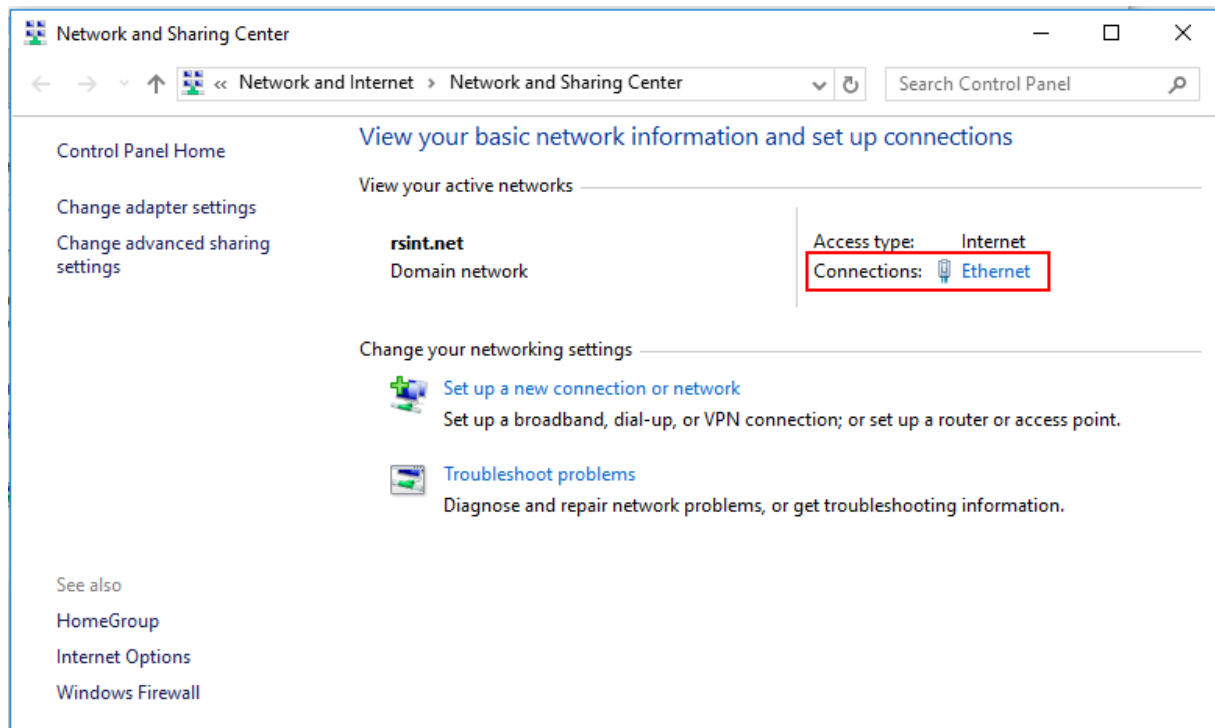
4. In the "Ethernet Status" dialog box, select the "Properties" button.

    The items used by the LAN connection are displayed.
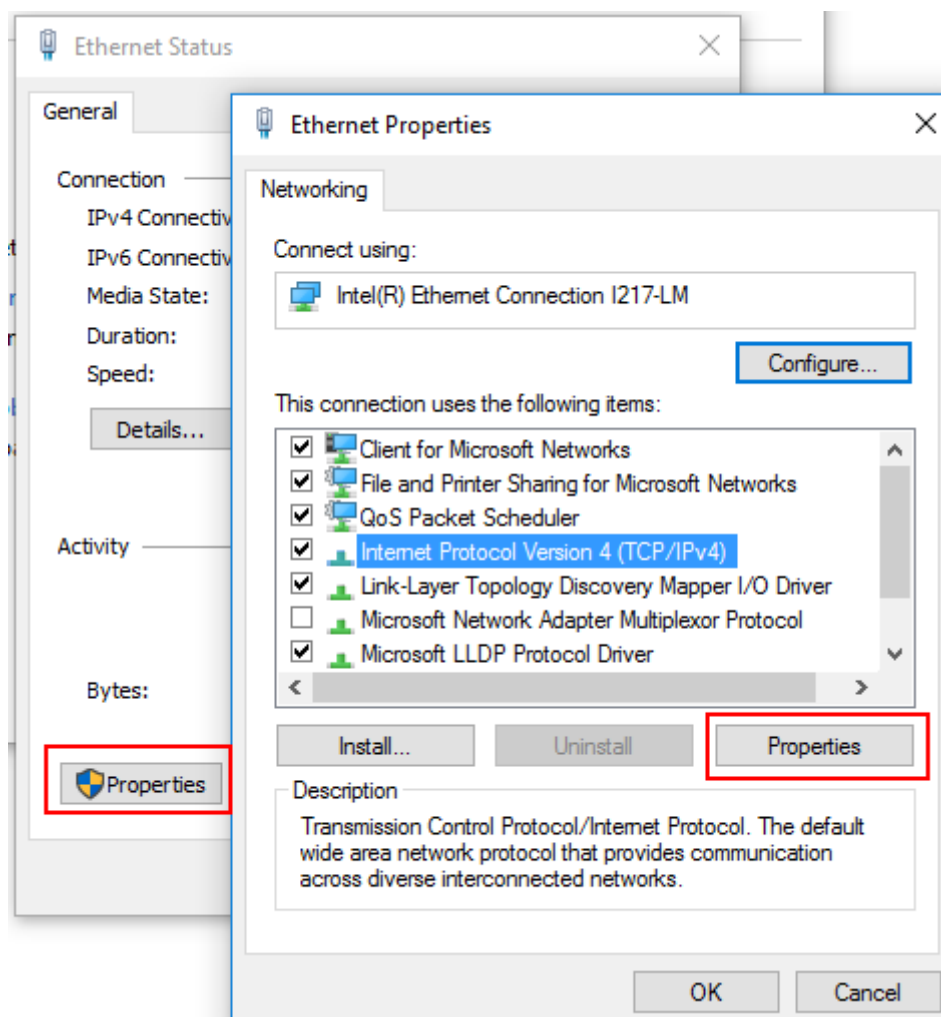
5. Tap the entry named "Internet Protocol Version 4 (TCP/IPv4)" to highlight it.

6. Select the "Properties" button.

7. On the "General" tab, select "Use the following DNS server addresses" and enter your own DNS addresses.

   For more information, refer to the Windows operating system help.

3.5.3 Using Computer Names

In a LAN that uses a DNS server (Domain Name System server), each PC or instrument connected in the LAN can be accessed via an unambiguous computer name instead of the IP address. The DNS server translates the host name to the IP address. This is especially useful when a DHCP server is used, as a new IP address may be assigned each time the instrument is restarted.

Each instrument is delivered with an assigned computer name, but this name can be changed.

The default instrument name is a non-case-sensitive string with the following syntax:

<Type><variant>-<serial_number>

The serial number can be found on the rear panel of the instrument. It is the third part of the device ID printed on the bar code sticker:

For example, FSW13-123456

To change the computer name

1. Press the [Setup] key and then the "Network + Remote" softkey.
   The current "Computer Name" is displayed in the "Network" tab.

2. Enter the new computer name.

3. Close the dialog box.

3.5.4 Changing the Windows Firewall Settings

A firewall protects an instrument by preventing unauthorized users from gaining access to it through a network. Rohde & Schwarz highly recommends the use of the firewall on your instrument. Rohde & Schwarz instruments are shipped with the Windows firewall enabled and preconfigured in such a way that all ports and connections for remote control are enabled.

For more details on firewall configuration, see the following Rohde & Schwarz White Paper:

- 1EF96: Malware Protection Windows 10

Note that changing firewall settings requires administrator rights.

3.6   Configuring the Initial Instrument Settings

This section describes how to setup the R&S FSW initially. For further basic instrument settings, see the R&S FSW User Manual.

3.6.1   Setting the Date and Time

Users with administrator rights can set the date and time for the internal real time clock as follows:

Opening the Date and Time Properties dialog box

1. Press the [SETUP] key.

2. Press the "Display" softkey.

3. Select the "General" tab in the "Display" dialog box.

4. Press the "Set Date and Time" button to open the standard Windows "Date and Time Properties" dialog box.

5. If necessary, toggle the "Date and Time Format" between German (DE) and US.

   After you have changed the setting and closed the dialog box, the instrument adopts the new date and time.

3.7   Protecting Data Using the Secure User Mode

During normal operation, the R&S 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 R&S 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 R&S 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 R&S 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 R&S FSW, for example text editors (Notepad), the Clipboard, drawing tools, etc.

Users can access data that is stored in volatile memory just as in normal operation. However, when the instrument's power is switched off, all data in this memory is cleared. Thus, in secure user mode, the instrument always starts in a defined, fixed state when switched on.

To store data such as measurement results permanently, it must be stored to an external storage device, such as a memory stick.

Limited storage space

The volatile memory used to store data in secure user mode is restricted to 256 MB. Thus, a "Memory full" error can occur although the hard disk indicates that storage space is still available.

Storing required data permanently

Any data that is to be available for subsequent sessions with the R&S 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 may be preferable to perform a new self-alignment at the start of each new session on the R&S FSW.

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 the secure user mode. Once activated, a restart is required. The special user "SecureUser" is then logged on to the R&S FSW automatically (using the automatic login function, see Chapter 3.2.3.1, "Automatic Login Function", on page 22). 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 ("Instrument") 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 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 the "Instrument" user (administrator) must log on.

> **Switching users when using the automatic login function**
>
> In the "Start" menu, select the arrow next to the "Shut down" button and then "Log off".
>
> The "Login" dialog box is displayed, in which you can enter the different user account name and password.

The secure user mode setting and automatic login is automatically deactivated when the "Instrument" user logs on. The "SecureUser" is no longer available.

For administrators ("Instrument" user), the secure user mode setting is available in the general system configuration settings ([Setup] key > "System Configuration" softkey > "Config" tab > "Secure User Mode": "ON", see the R&S 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.

This is necessary to prompt for a change of passwords.

4 Instrument Tour

4.1 Front Panel View

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

(Note: the graphic shows a 26 GHz model of the R&S FSW. Some of connectors on the 85 GHz model differ slightly; this is indicated for the individual connectors.)
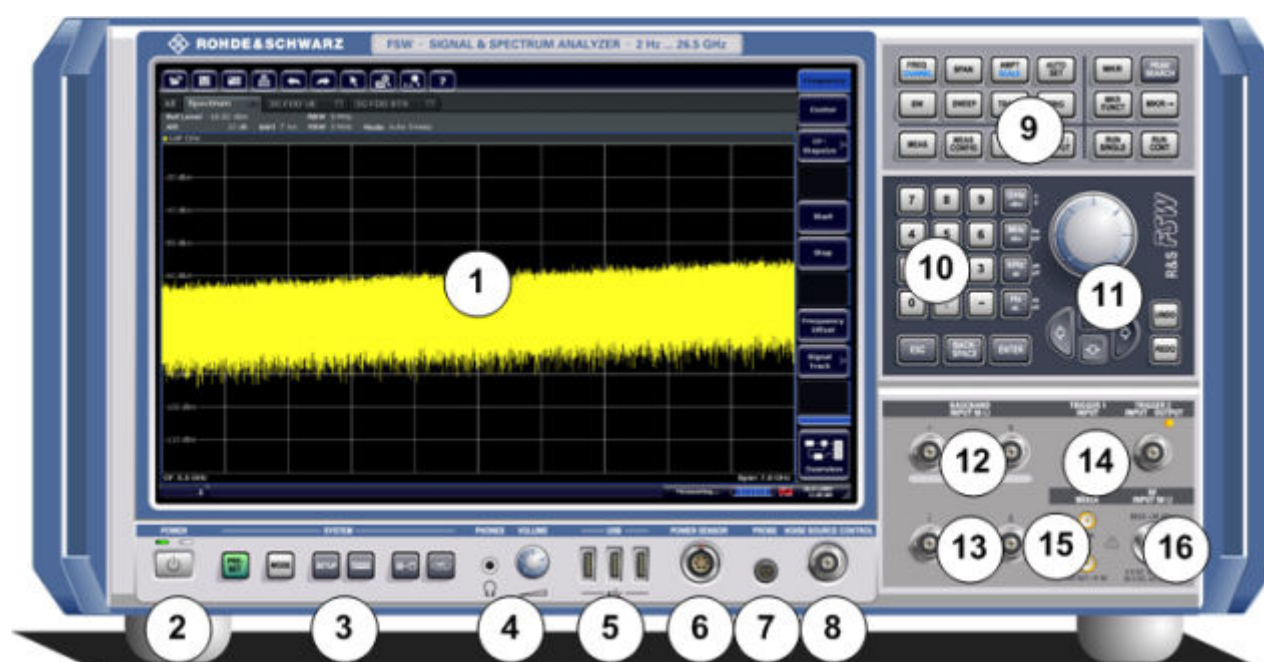
Figure 4-1: Front panel view of FSW26

1 = Touchscreen
2 = POWER key
3 = SYSTEM keys
4 = Headphones connector and volume control
5 = USB connectors
6 = POWER SENSOR connector
7 = PROBE connector
8 = NOISE SOURCE CONTROL
9 = Function keys
10 = Keypad
11 = Navigation controls
12 = (Analog) Baseband Input 50Ω connectors for I/Q signal or Rohde & Schwarz active probes (optional)

13 = (Analog) Baseband Input 50Ω connectors for inverse part of differential I/Q signal (optional, not for R&S FSW85)
14 = TRIGGER INPUT/OUTPUT connectors
15 = EXT MIXER connector (optional)
16 = RF Input 50 Ω connector

NOTICE

Instrument damage caused by cleaning agents

Cleaning agents contain substances such as solvents (thinners, acetone, etc.), acids, bases, or other substances. Solvents can damage the front panel labeling, plastic parts, or screens, for example.

Never use cleaning agents to clean the outside of the instrument. Use a soft, dry, lint-free dust cloth instead.

4.1.1   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.

NOTICE

Risk of touchscreen damage

Inappropriate tools or excessive force can damage the touchscreen.

Observe the following instructions when operating the touchscreen:

● Never touch the screen with ball point pens or other sharp objects, use your fingers instead.
  As an alternative, you can use a stylus pen with a smooth soft tip.

● Never apply excessive force to the screen. Touch it gently.

● Never scratch the screen surface, for example with a finger nail.

● Never rub the screen surface strongly, for example with a dust cloth.
  For instructions on cleaning the screen, see the Maintenance chapter in the R&S FSW user manual.
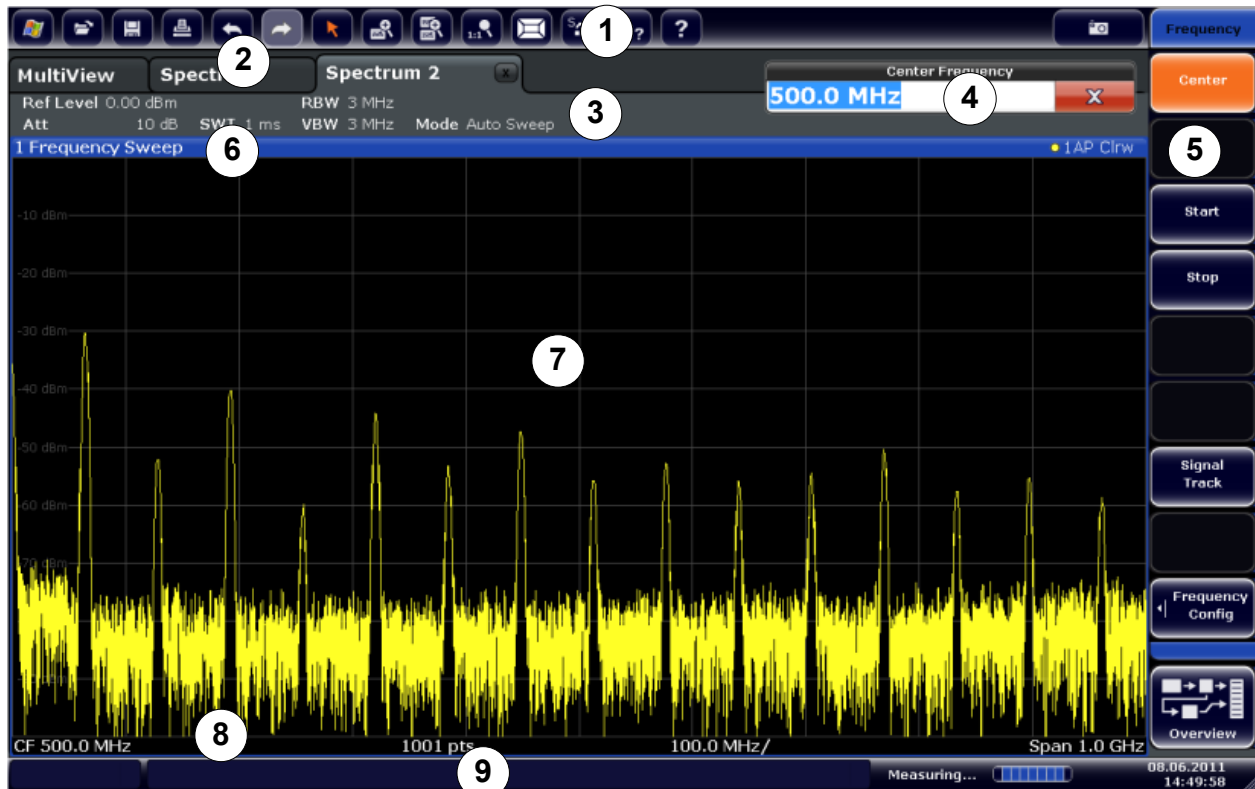
Figure 4-2: Touchscreen elements

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

A touchscreen is a screen that is touch-sensitive, that is: it reacts in a specified way when you tap a particular element on the screen with a finger or a pointing device, for example. 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 the touchscreen, you can perform the following tasks (among others) by the tap of your finger (see also Chapter 5, "Trying Out the Instrument", on page 61):

- 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.

4.1.2 POWER Key

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

See also Chapter 3.1.5, "Switching the Instrument On and Off", on page 16.

4.1.3 SYSTEM Keys

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

A detailed description of the corresponding functions is provided in the User Manual.

Table 4-1: 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.)

SYSTEM key	Assigned functions
	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.

4.1.4   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.

⚠ CAUTION

Risk of hearing damage

Before putting on the headphones, make sure that the volume setting is not too high to protect your hearing.

4.1.5   USB

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

The rear panel provides further USB connectors, including a male (USB-B) connector. See Chapter 4.2.5, "USB", on page 54.

All USB connectors support standard 2.0.

4.1.6 POWER SENSOR

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

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

4.1.7 PROBE

The R&S 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 power supply for high-impedance probes.

4.1.8 NOISE SOURCE CONTROL

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

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

4.1.9 Function Keys

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

A detailed description of the corresponding functions is provided in the User Manual.

Table 4-2: 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).
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

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

4.1.10 Keypad

The keypad is used to enter alphanumeric parameters, including the corresponding units (see also Chapter 6.4.2, "Entering Alphanumeric Parameters", on page 98). It contains the following keys:

Table 4-3: 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. In the case of 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. In the case of level entries (e.g. in dB) or dimensionless values, all units have the value "1" as multiplying factor. Thus, they have the same function as an [ENTER] key.
ESC key	Closes all kinds of dialog boxes, if the edit mode is not active. Quits the edit mode, if the edit mode is active. In dialog boxes that contain a "Cancel" button it activates that button. For "Edit" dialog boxes the following mechanism is used: ● If data entry has been started, it retains the original value and closes the dialog box. ● If data entry has not been started or has been completed, it closes the dialog box.
[BACKSPACE] key	If an alphanumeric entry has already been started, this key deletes the character to the left of the cursor.
[ENTER] key	● Concludes the entry of dimensionless entries. The new value is accepted. ● With other entries, this key can be used instead of the "Hz/dB" unit key. ● In a dialog box, selects the default or focused element.

4.1.11 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.

4.1.11.1 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: Acts like the [ENTER] key when pressed

4.1.11.2 Navigation Keys

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

Arrow Up/Arrow Down Keys

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

Arrow Left/Arrow Right Keys

The <arrow left> or <arrow right> keys do the following:
- In an alphanumeric edit dialog box, move the cursor.
- In a list, scroll forward and backward through the list entries.
- In a table, move the selection bar horizontally.

- In windows or dialog boxes with horizontal scroll bar, move the scroll bar.

4.1.12   UNDO/REDO Keys

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

- The [REDO] key repeats the previously reverted action, i.e. the most recent action is repeated.

> The [UNDO] function is not available after a [PRESET] or "RECALL" operation. When these functions are used, the history of previous actions is deleted.

4.1.13   (Analog) Baseband Input 50 Ω Connectors (Optional)

The Analog Baseband Interface option provides four "Baseband input" BNC connectors on the front panel of the R&S FSW for analog I and Q signals
(R&S 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 data sheet)

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

R&S FSW85

The R&S 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 and can receive a maximum input level of 4 V_{pp} each.

NOTICE

Risk of instrument damage

Do not overload the BASEBAND INPUT connectors. An input voltage of 4 V must never be exceeded. Noncompliance destroys the Analog Baseband Interface components.

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

For more information on the Analog Baseband Interface, see the R&S FSW I/Q Analyzer and I/Q Input User Manual.

4.1.14 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.

4.1.15   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 R&S FSW, cover the two front connectors LO OUT / IF IN and IF IN with the supplied SMA caps.

4.1.16   RF INPUT 50 Ohm

The specific connector type depends on the instrument model:

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

NOTICE

Risk of instrument damage

Do not overload the input. For maximum allowed values, see the data sheet. For AC-coupling, a DC input voltage of 50 V (1.00 mm connector: 25 V) must never be exceeded. For DC-coupling, DC voltage must not be applied at the input. In both cases, noncompliance will destroy the input mixers.

Furthermore, for **R&S FSW85** models, do not fasten the 1.00 mm RF Input connector with a torque larger than 0.23 Nm. Rohde & Schwarz offers an appropriate torque wrench (R&S®ZN-ZTW Torque 0.23 Nm; delivered with the instrument).

Connect a device under test (DUT) to the R&S FSW to provide RF input which is then analyzed. Connect the DUT to the RF Input on the R&S FSW via a cable equipped with an appropriate connector.

4.2   Rear Panel View

This figure shows the rear panel view of the R&S FSW. The individual elements are described in more detail in the subsequent sections.
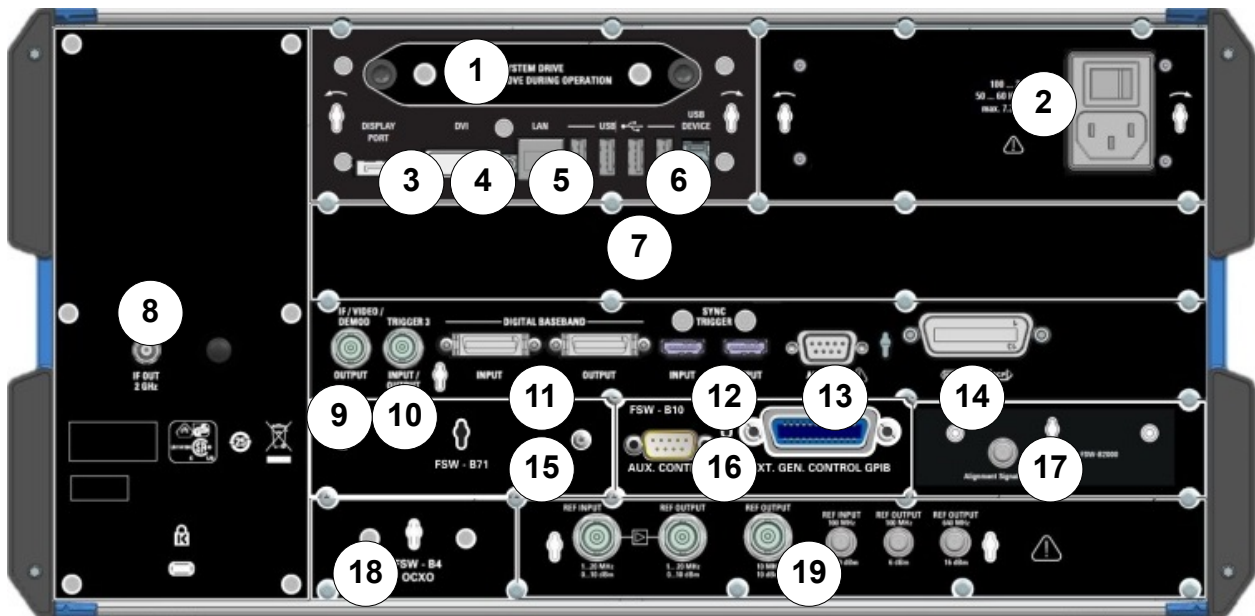
Figure 4-3: Rear panel view

1 = Removable system hard drive
2 = AC Power Supply Connection and Main Power Switch
3 = DISPLAY PORT for external display
4 = DVI connector for external display
5 = LAN connector
6 = USB (DEVICE) connectors
7 = Bandwidth Extensions and IF WIDE OUTPUT connector (160 MHz/ 320 MHz/ 512 MHz
      options), QSFP+ connector (option B517)
8 = IF OUT 2 GHz / 5 GHz connector
9 = IF/VIDEO/DEMOD connector
10 = TRIGGER 3 INPUT/OUTPUT connector
11 = DIGITAL BASEBAND INPUT/OUTPUT connectors (option B17)
12 = SYNC TRIGGER OUTPUT/INPUT
13 = AUX PORT
14 = GPIB interface
15 = Analog baseband interface (option B71)
16 = External generator control (option B10)
17 = Alignment Signal Source (option B2000)
18 = OCXO external reference (option B4)
19 = REF INPUT/OUTPUT connectors

4.2.1   Removable System Hard Drive

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

4.2.2 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 is in operation.

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

For details, refer to Chapter 3.1.4, "Connecting the AC Power", on page 16.

4.2.3 DISPLAY PORT and DVI

You can connect an external monitor or other display device to the R&S 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 Chapter 3.4, "Connecting an External Monitor", on page 26.

4.2.4 LAN

The LAN interface can be used to connect the R&S FSW to a local network for remote control, printouts or data transfer. The assignment of the RJ-45 connector supports twisted-pair category 5 UTP/STP cables in a star configuration (UTP stands for *unshielded twisted pair*, and STP for *shielded twisted pair*).

For details, see Chapter 3.5, "Setting Up a Network (LAN) Connection", on page 28.

4.2.5 USB

The rear panel provides four additional female USB (USB-A) connectors to connect devices like a keyboard, a mouse or a memory stick (see also Chapter 4.1.5, "USB", on page 43).

Furthermore, a male USB DEVICE connector (USB-B) is provided, for example to connect the R&S FSW to a PC for remote control.

All USB connectors support standard 2.0.

4.2.6 Bandwidth Extension Options with IF WIDE OUTPUT Connector

You can extend the signal analysis bandwidth of the R&S FSW by a hardware option (R&S FSW-B160/-B320-B512 or R&S FSW-U160/-U320/-U512). 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)

While the extension can be activated or deactivated manually in the R&S 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.

Together with the bandwidth extension 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 data sheet. The IF WIDE OUTPUT connector is used automatically when the bandwidth extension is activated (i.e. for bandwidths > 80 MHz).

4.2.7 Digital I/Q 40G Streaming Output Connector (R&S FSW-B517)

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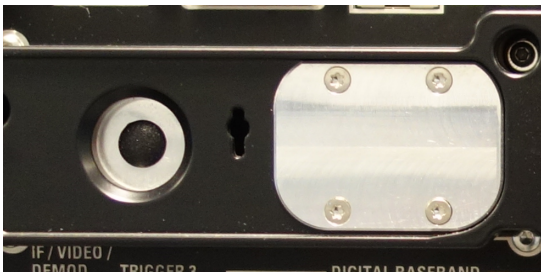
The output connector provides I/Q data streams with a sample rate of up to 600 MHz, if the R&S FSW-B517 option is installed and active.

Output is activated in the software ([INPUT/OUTPUT] key). Currently, it is only supported by the I/Q Analyzer application.

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

4.2.8   IF OUT 2 GHz / 5 GHz Connector

The female SMA connector is only available for instrument models R&S 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 R&S FSW I/Q Analyzer and I/Q Input User Manual.

4.2.9   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.

4.2.10 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).

4.2.11 Digital Baseband Interface (R&S FSW-B17) and R&S EX-IQ-BOX

The R&S FSW Digital Baseband Interface option (R&S FSW-B17) provides an online digital I/Q data interface on the rear panel of the instrument for input and output. The digital input and output can be enabled in the base unit or in one of the applications (where available).

Optionally, an R&S EX-IQ-BOX can be connected to the Digital Baseband Interface to convert signal properties and the transmission protocol of the R&S FSW into user-defined or standardized signal formats and vice versa.

Since the Digital I/Q input and the Analog Baseband input use the same digital signal path, both cannot be used simultaneously. When one is activated, established connections for the other are disconnected. When the second input is deactivated, connections to the first are re-established. This can cause a short delay in data transfer after switching the input source.

For more information on the Digital Baseband Interface (R&S FSW-B17) and typical applications, see the R&S FSW I/Q Analyzer User Manual.

4.2.12 SYNC TRIGGER OUTPUT/INPUT

Use the SYNC TRIGGER OUTPUT/INPUT connectors to synchronize several devices (e.g. two R&S FSWs) to a common trigger signal or reference frequency.

The R&S FSW can output a 100 MHz signal as a trigger or reference signal to another device. The R&S FSW can also receive an external trigger or reference signal at the input connector.

4.2.13 AUX PORT

The 9-pole SUB-D male connector provides control signals for controlling external devices. The voltage levels are of the TTL type (max. 5 V).

Pin	Signal	Description
1	+5 V / max. 250 mA	Supply voltage for external circuits
2 to 7	I/O	Control lines for user ports (see User manual)
8	GND	Ground
9	READY FOR TRIGGER	Signal indicating that the instrument is ready to receive a trigger signal (Low active = 0 V)

NOTICE

Short-circuit hazard

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

4.2.14 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 User Manual.

4.2.15 External Generator Control Option (R&S FSW-B10)

The external generator control option provides an additional GPIB and an "AUX control" connector.
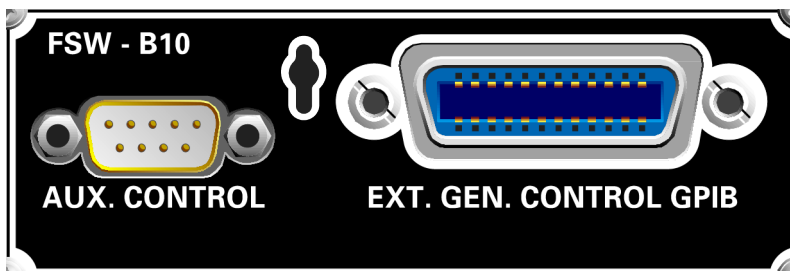
The GPIB connector can be used to connect the external generator to the R&S FSW.

The 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 R&S FSW User Manual.

4.2.16   Alignment Signal Source (Option R&S FSW-B2000)

The alignment signal source is required to align the connected oscilloscope and the oscilloscope ADC for the optional 2 GHz bandwidth extension (R&S FSW-B2000).

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

4.2.17   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 (see data sheet).

4.2.18   REF INPUT / REF OUTPUT

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

The REF OUTPUT connectors can be used to provide an external reference signal (or the optional OCXO reference signal) from the R&S 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...20 MHz 0...10 dBm	To provide an external reference signal on the R&S FSW.
REF OUTPUT	1...20 MHz 0...10 dBm	To provide the same external reference signal received by the REF INPUT 1...20 MHz connector to another device, when available.
REF OUTPUT	10 MHz 10 dBm	To provide the internal reference signal from the R&S FSW to another device continuously. Also used to provide OCXO reference signal to another device.
REF INPUT	100 MHz 0...10 dBm	To provide an external reference signal on the R&S FSW.
REF OUTPUT	100 MHz 6 dBm	To provide a 100 MHz reference signal from the R&S FSW to another device.
REF OUTPUT	640 MHz 16 dBm	To provide a 640 MHz reference signal from the R&S FSW to another device.

SYNC TRIGGER

The SYNC TRIGGER connector can also be used to synchronize the reference frequency on several devices (see Chapter 4.2.12, "SYNC TRIGGER OUTPUT/INPUT", on page 57).

5   Trying Out the Instrument

This chapter introduces the most important functions and settings of the R&S FSW step by step. The complete description of the functionality and its usage is given in the R&S FSW User Manual. Basic instrument operation is described in Chapter 6, "Operating the Instrument", on page 81.

Prerequisites

- The instrument is set up, connected to the mains system, and started up as described in Chapter 3, "Preparing for Use", on page 11.

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:

5.1   Measuring a Basic Signal

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

To display the internal 64 MHz calibration signal

1. Press the [PRESET] key to start out in a defined instrument configuration.

2. Press the [Setup] key on the front panel.

3. Tap the "Service + Support" softkey.

4. Tap the "Calibration Signal" tab.

5. Tap the "Calibration Frequency RF" option. Leave the frequency at the default 64 MHz, with a narrowband spectrum.

   The calibration signal is now sent to the RF input of the R&S 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.
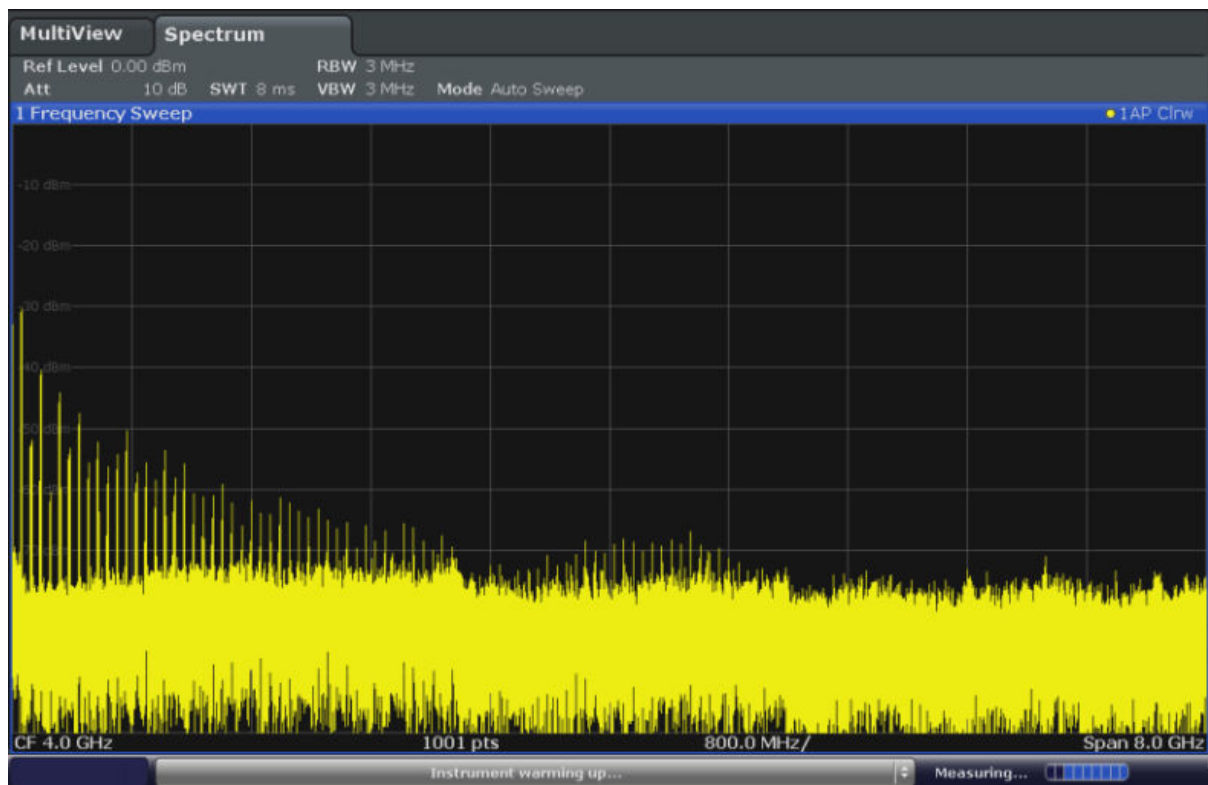
Figure 5-1: Calibration signal as RF input

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 optimize the display

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

1. Set the center frequency to the calibration frequency:

a) Tap the "Overview" softkey to display the configuration "Overview".

b) Tap the "Frequency" button.

c) In the "Center" field, enter *64* on the number pad on the front panel.

d) Press the "MHz" key next to the number pad.

2. Reduce the span to 20 MHz:

a) In the "Span" field of the "Frequency" dialog box, enter *20 MHz*.

b) Close the "Frequency" dialog box.

3. Set the reference level to -25 dBm:

a) In the configuration "Overview", tap the "Amplitude" button.

b) In the "Value" field of the "Amplitude" dialog box, enter *-25 dBm*.

The display of the calibration signal is now improved. The maximum at the center frequency (=calibration frequency) of 64 MHz becomes visible.
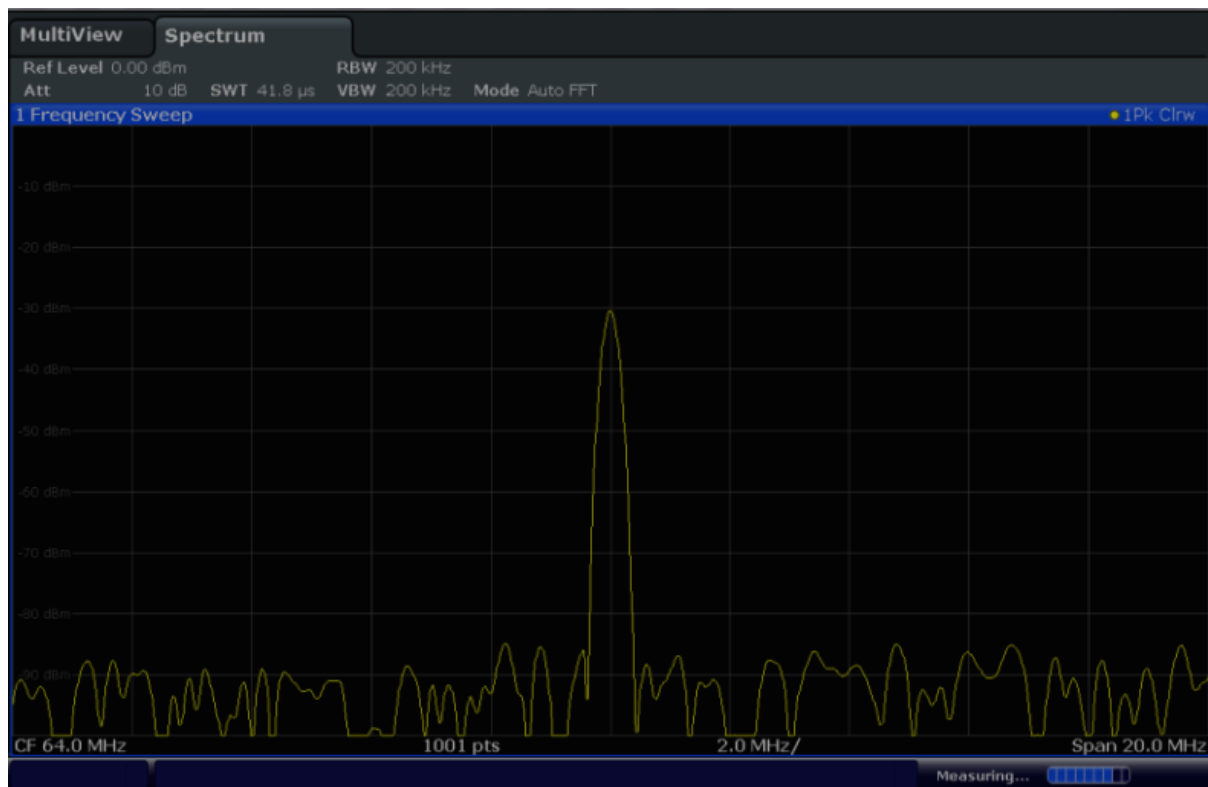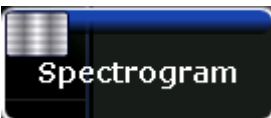
Figure 5-2: Calibration signal with optimized display settings

5.2   Displaying a Spectrogram

In addition to the standard "level versus frequency" spectrum display, the
R&S FSW also provides a spectrogram display of the measured data. A spectro-
gram shows how the spectral density of a signal varies over time. The x-axis
shows the frequency, the y-axis shows the time. A third dimension, the power
level, is indicated by different colors. Thus you can see how the strength of the
signal varies over time for different frequencies.

1. Tap the "Overview" softkey to display the general configuration dialog box.

2. Tap the "Display Config" button.

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

3.

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

Figure 5-3: 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.
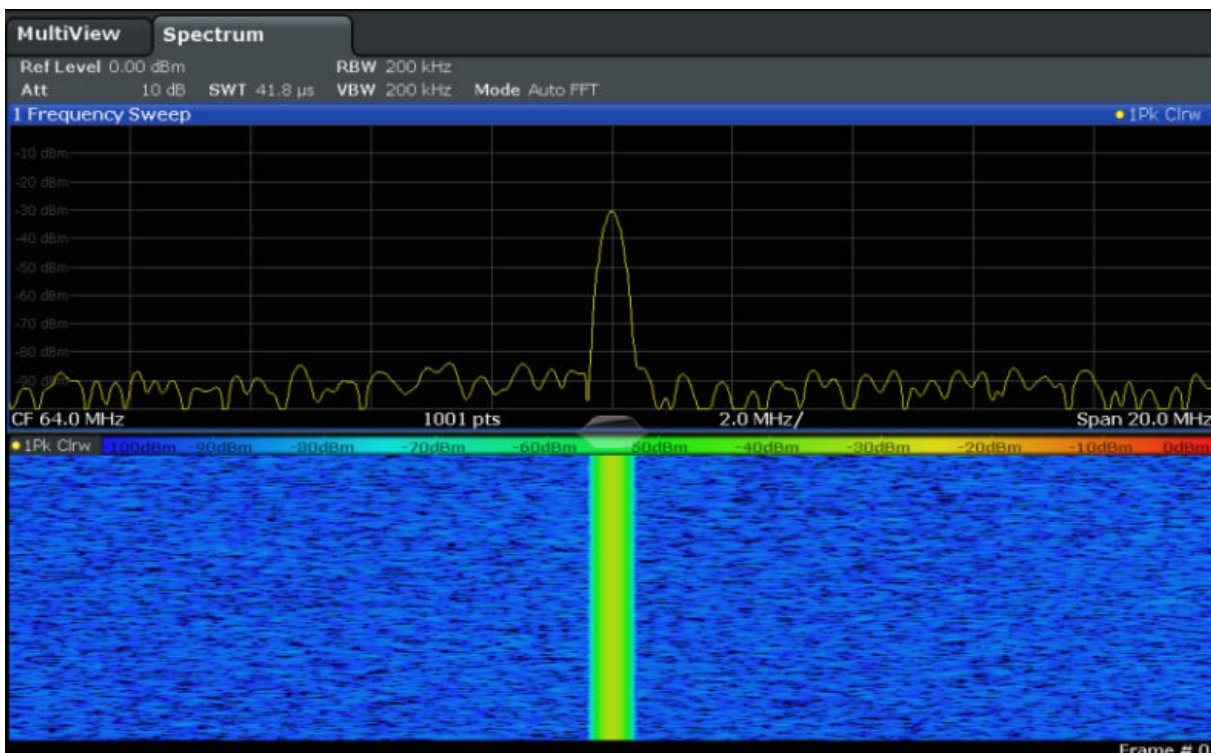
Figure 5-4: Spectrogram of the calibration signal

5.3   Activating Additional Measurement Channels

The R&S 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 the [Mode] key on the front panel.

2. On the "New Channel" tab of the "Signal + Spectrum Mode" dialog box, tap the "Spectrum" button.
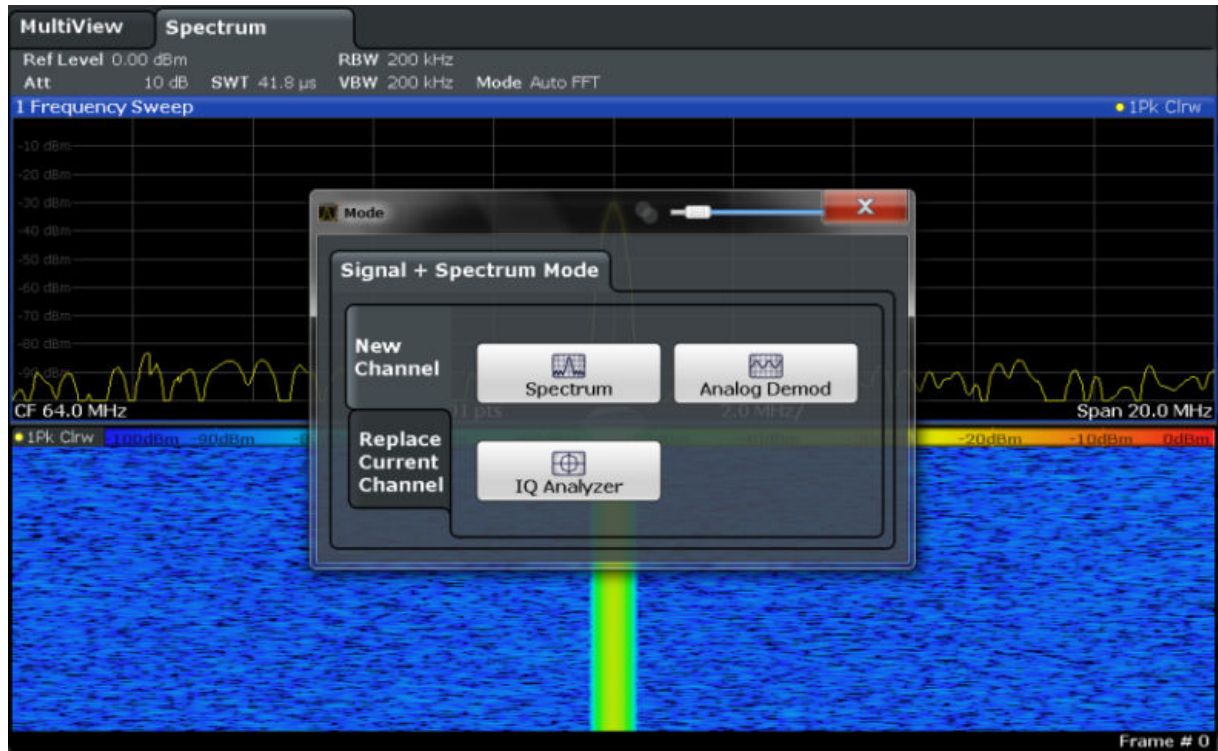
Figure 5-5: Adding a new measurement channel

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*.
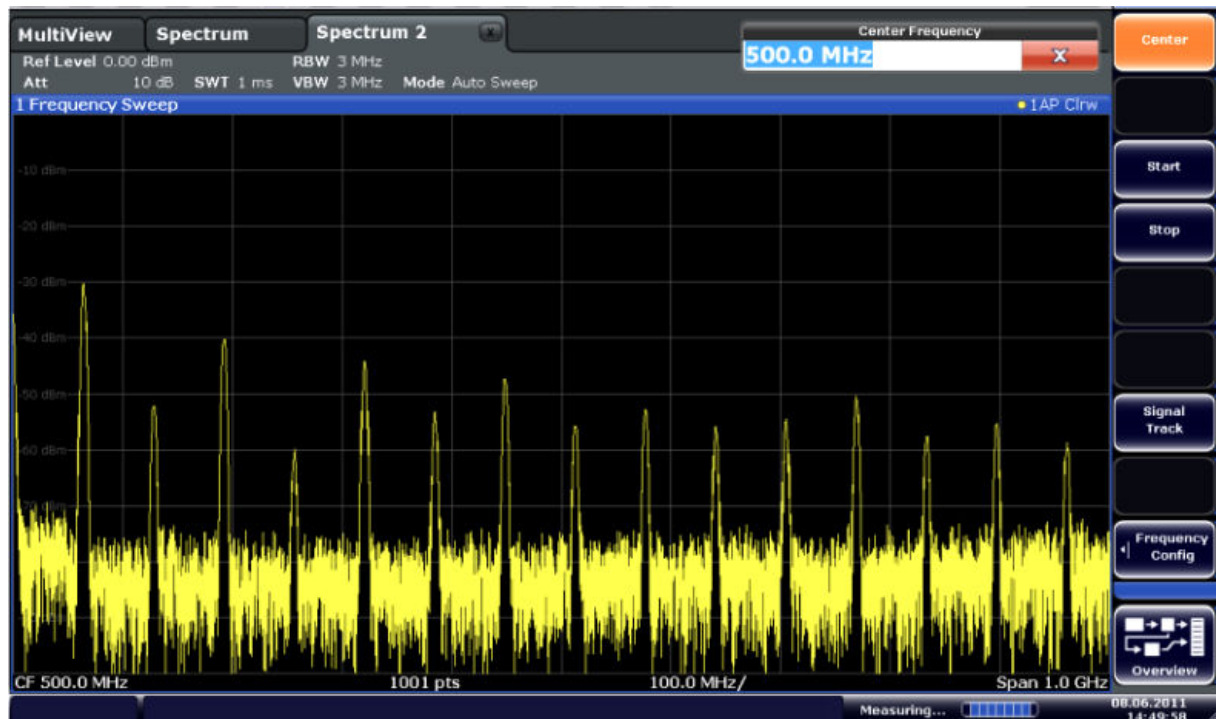
Figure 5-6: Frequency spectrum of the calibration signal with a larger span

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 dia-
    gram displays a straight line.

Figure 5-7: Time domain display of the calibration signal

5. Create a new channel for I/Q analysis:

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

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

Figure 5-8: 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 5-9: The "MultiView" tab

5.4   Performing Sequential Measurements

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

1.

   Tap the "Sequencer" icon in the toolbar.

2. Toggle the "Sequencer" softkey in the "Sequencer" menu to "On".

   A continuous sequence is started, i.e. each channel measurement is performed one after the other until the Sequencer is stopped.
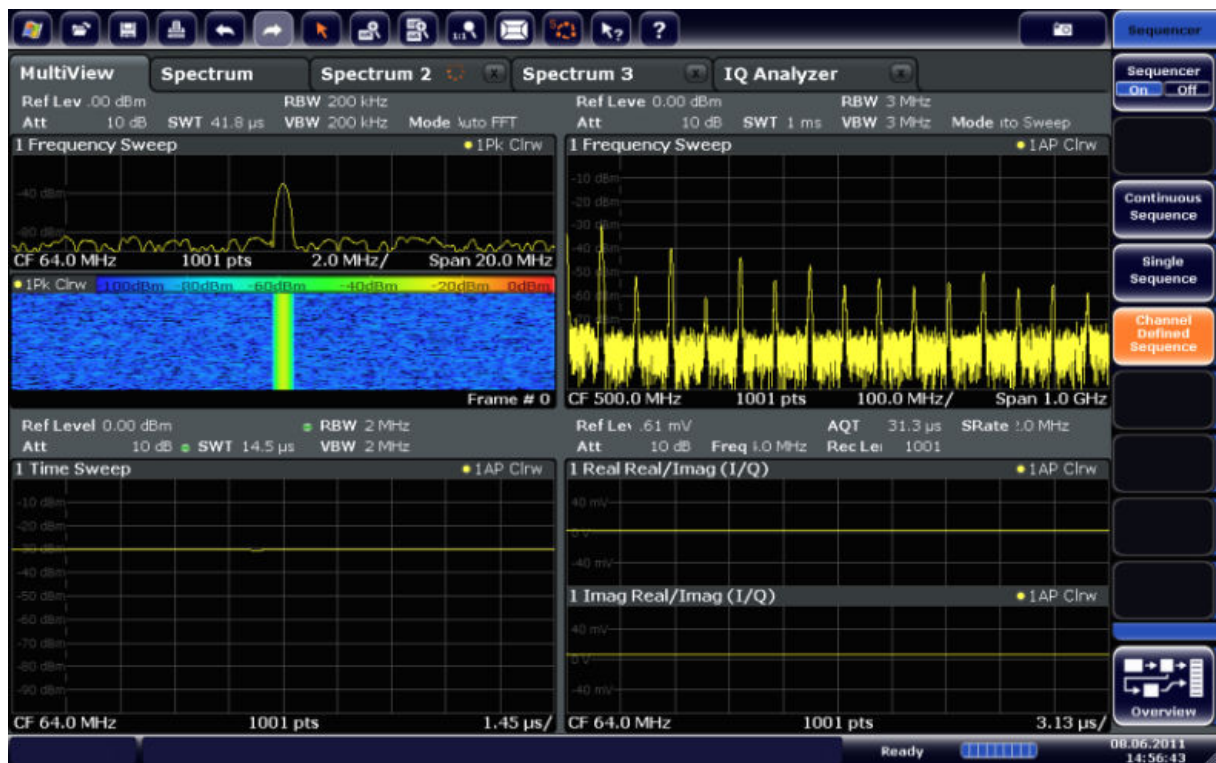
Figure 5-10: "MultiView" tab with active Sequencer

In Figure 5-10, the "Spectrum 2" measurement is currently active (indicated by the "channel active" icon in the tab label).

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

5.5   Setting and Moving a Marker

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

1. In the "MultiView" tab, double-tap the "Spectrum" window (frequency sweep with spectrogram display) to return to the "Spectrum" channel.

2. Tap the spectrum display to set the focus on that window.

3.

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

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

5. Press the [MKR] key on the front panel to display the "Marker" menu.

   Marker 1 is activated and automatically set to the maximum of trace 1. The marker position and value is indicated in the diagram area as M1[1].
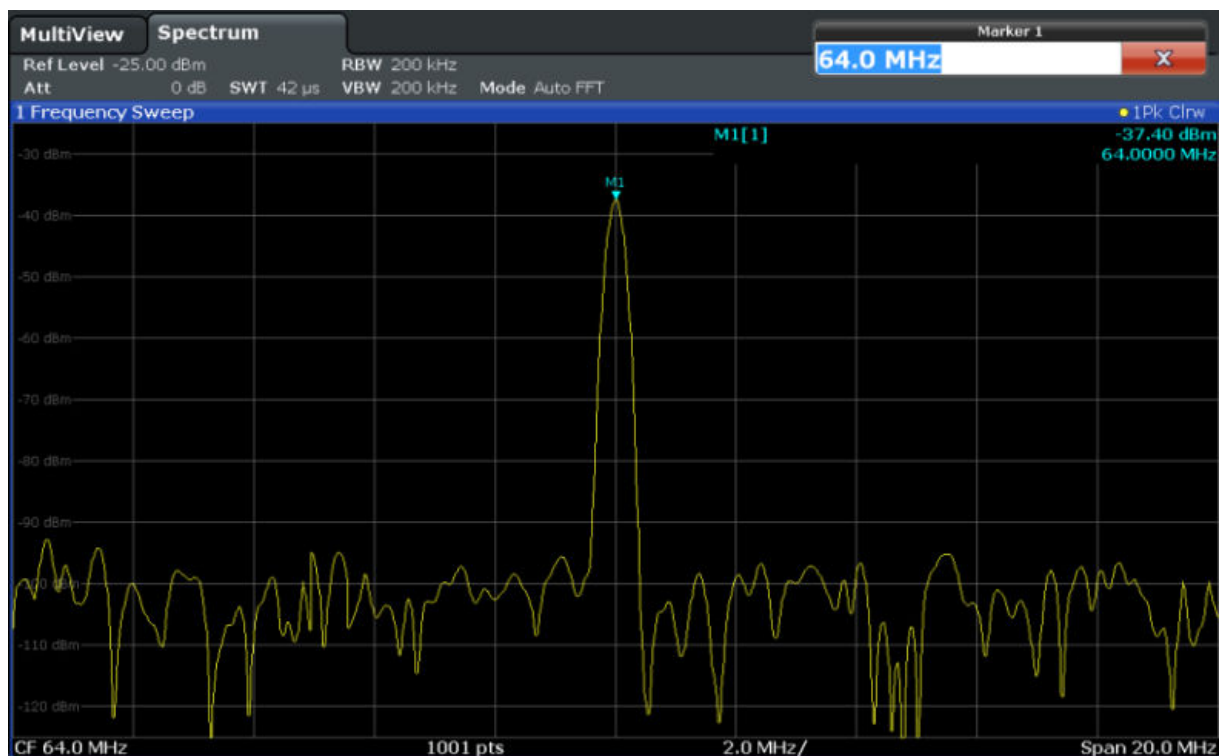
6. Now you can move the marker by tapping and dragging it to a different position. The current position is indicated by a dotted blue line. Notice how the position and value change in the marker area of the diagram.

5.6   Displaying a Marker Peak List

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

1. Tap the "Spectrum 2" tab.

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

3.

   Tap the "SmartGrid" icon in the toolbar to activate SmartGrid mode.

4. Drag the "Marker Peak List" icon from the evaluation bar to the lower half of the display to add a new window for the peak list.

5. Close the SmartGrid mode.

6. To obtain a more conclusive peak list that does not contain noise peaks, for example, define a threshold that is higher than the noise floor:

   a) Press the [MKR] key on the front panel.

b) Tap the "Marker Config" softkey in the "Marker" menu.
c) Tap the "Search" tab in the "Marker" dialog box.
d) In the "Threshold" field, enter *-68 dBm*.
e) Tap the "State" box for "Threshold" to activate its use.
   Only peaks that are larger than -68 dBm will be included in the peak list.

The marker peak list displays the determined peaks that are above the defined threshold.
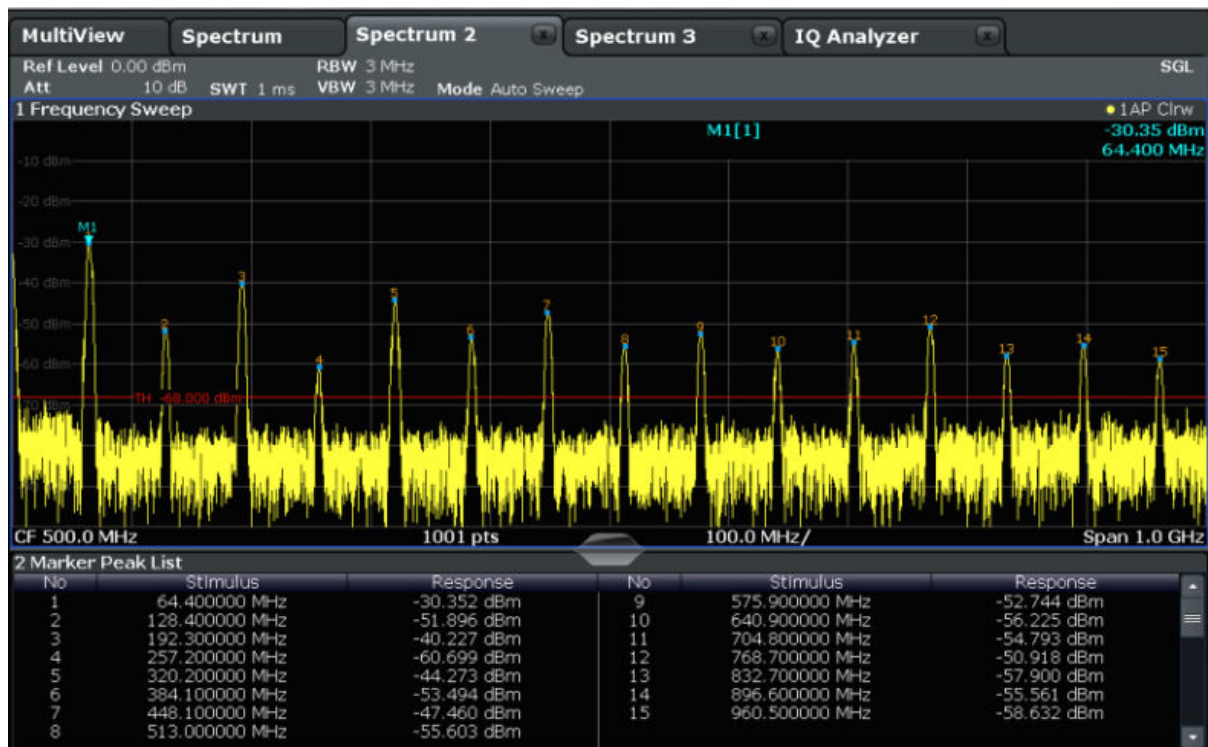
Figure 5-11: Marker Peak List

5.7   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.
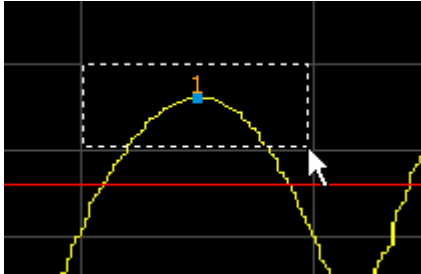
Figure 5-12: Defining the zoom area

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

Figure 5-13: Zoomed display around a peak

Zoom mode is automatically disabled, and the default selection mode is restored, indicated by the highlighted "Selection mode" icon.

3. In Figure 5-13, 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 the [Sweep] key on the front panel.
   b) Tap the "Sweep Config" softkey in the "Sweep" menu.
   c) In the "Sweep Points" field, enter *32001*.
   d) Press the RUN SINGLE key on the front panel to perform a new sweep with the increased number of sweep points.
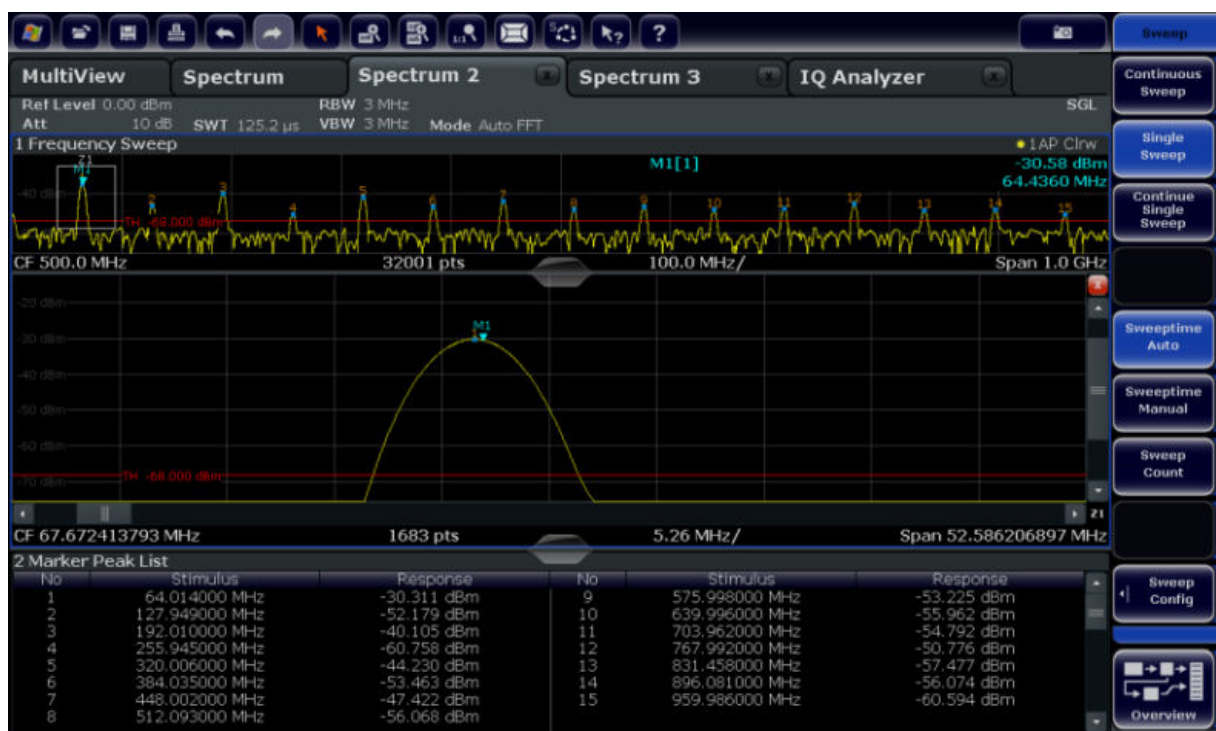
Figure 5-14: Zoomed peak with increased number of sweep points

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.
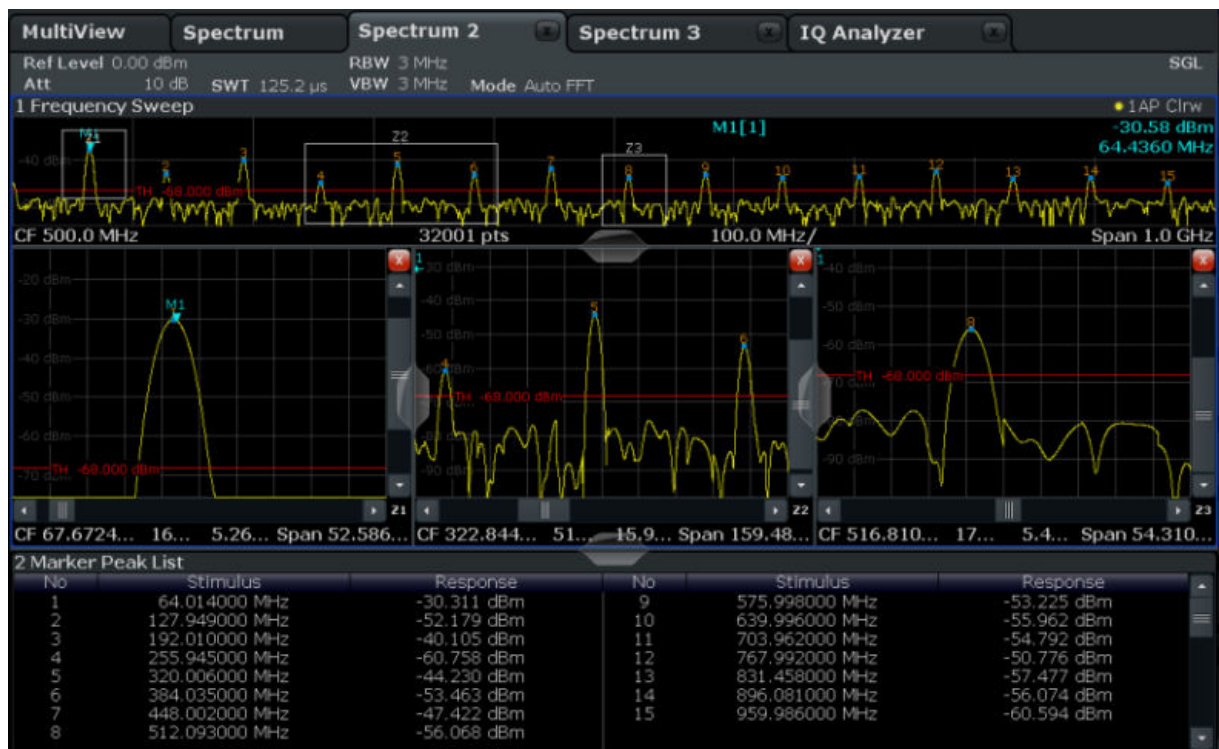
Figure 5-15: Multiple zoom windows

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.
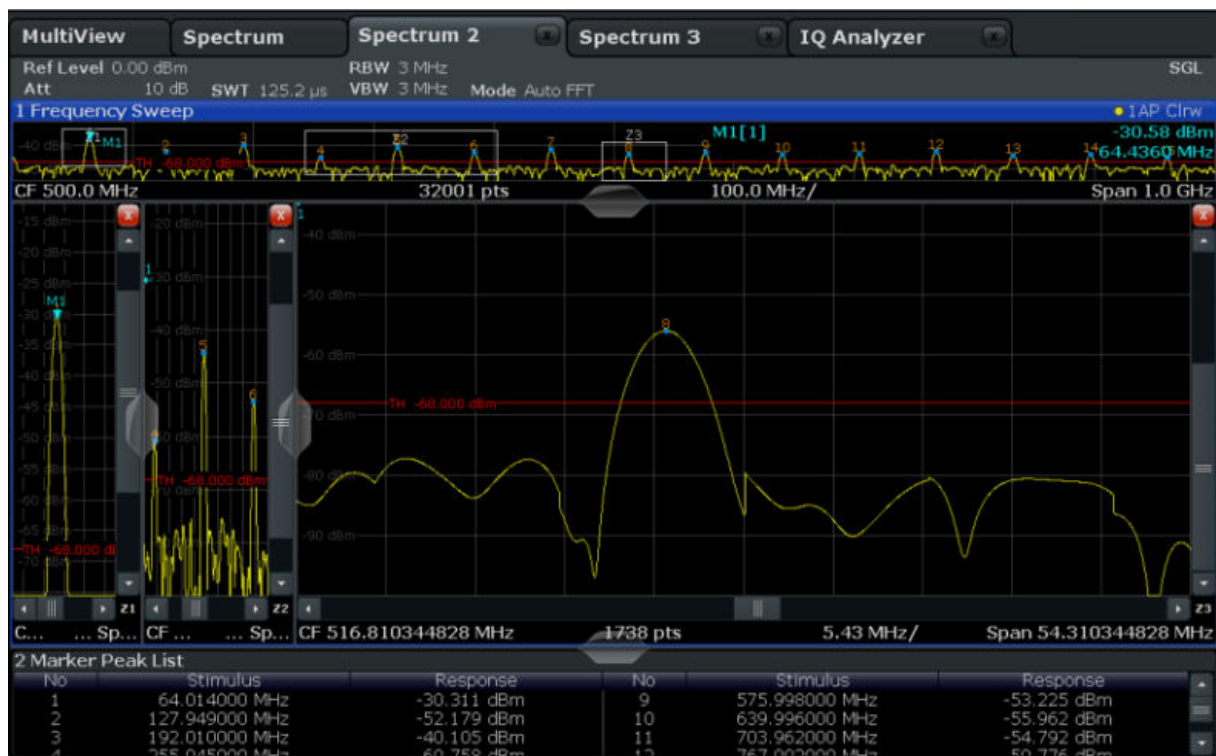
Figure 5-16: Enlarged zoom window

5.8   Saving Settings

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

To save the instrument settings to a file

1.

    Tap the "Save" icon in the toolbar.

2.

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

3. In the "Save" dialog box, tap the "File Name" field and enter *MyMultiView-Setup* using the keyboard.

Keep the default "File Type" setting "Instrument with all Channels" to store the configuration of all channels.
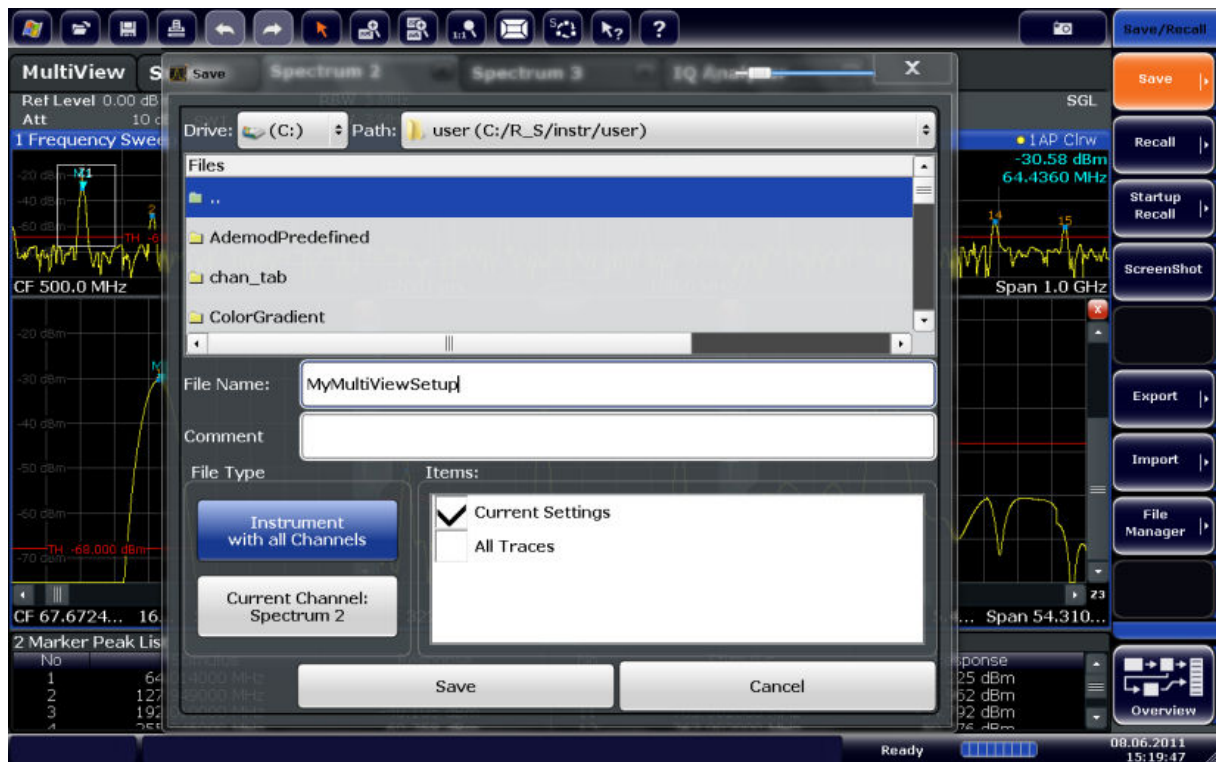
Figure 5-17: Saving the instrument settings to a file

4. Tap the "Save" button.

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

To load stored instrument settings

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

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

2.

   Tap the "Load" icon in the toolbar.

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

4. Tap the "Load" button.

All instrument settings are restored and the display should resemble Figure 5-16, which shows the instrument display right before the settings were stored.

5.9   Printing and Saving Results

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

To export the trace data

1. Press the [TRACE] key on the front panel.

2. Tap the "Trace Config" softkey.

3. Tap the "Trace Export" tab.

4. Tap the "Export Trace to ASCII File" button.

5. Enter the file name *MyMultiViewResults*.

The trace data is stored to `MyMultiViewResults.DAT`

To create a screenshot of the display

1.

Tap the "Print immediately" icon in the toolbar.

A screenshot of the current display is created. Note that the colors on the screen are inverted in the screenshot to improve printout results.

2. In the "Save Hardcopy as Portable Network Graphics (PNG)" dialog box, enter a file name, e.g. *MyMultiViewDisplay*.

The screenshot is stored to `MyMultiViewDisplay.png`.

6   Operating the Instrument

This chapter provides an overview on how to work with the R&S FSW. It describes:

- What kind of information is displayed in the diagram area
- How to operate the R&S FSW via the front panel keys and other interaction methods
- How to use the Online Help

NOTICE

Risk of touchscreen damage

Inappropriate tools or excessive force can damage the touchscreen.

Observe the following instructions when operating the touchscreen:

- Never touch the screen with ball point pens or other sharp objects, use your fingers instead.
  As an alternative, you can use a stylus pen with a smooth soft tip.
- Never apply excessive force to the screen. Touch it gently.
- Never scratch the screen surface, for example with a finger nail.
- Never rub the screen surface strongly, for example with a dust cloth.
  For instructions on cleaning the screen, see the Maintenance chapter in the R&S FSW User Manual.

6.1   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.
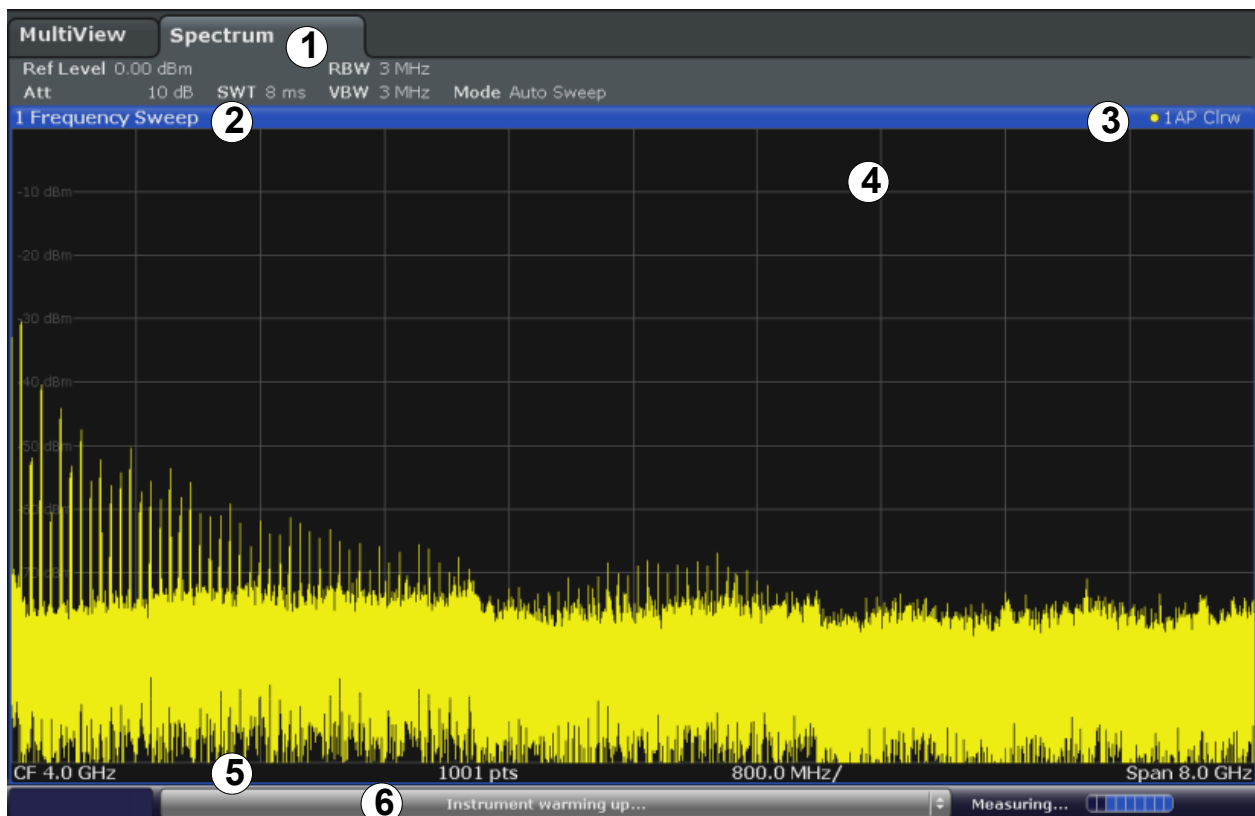
1   = Channel bar for firmware and measurement settings
2+3 = Window title bar with diagram-specific (trace) information
4   = Diagram area with marker information
5   = Diagram footer with diagram-specific information, depending on measurement application
6   = Instrument status bar with error messages, progress bar and date/time display

Hiding elements in the display

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

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

6.1.1   Channel Bar

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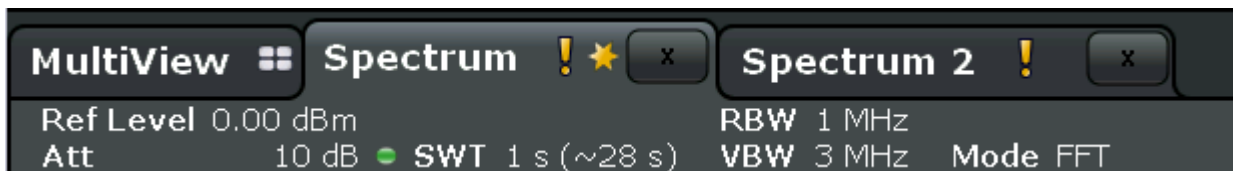
If many tabs are displayed, select the tab selection list icon at the right end of the channel bar. Select the channel you want to switch to from the list.
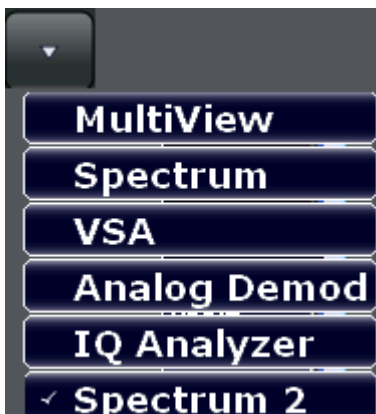
MultiView tab

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.
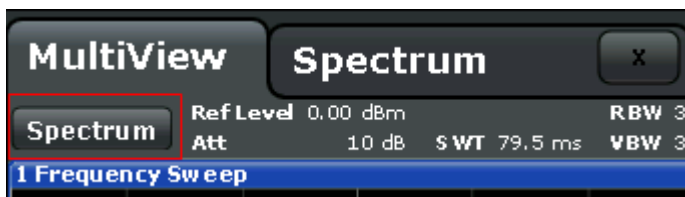
Icons in the channel bar

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. Thiscan happen, for example, when you change the measurement bandwidth, but the displayed trace is still based on the old bandwidth. As soon as a new measurement is performed or the display is updated, the icon disappears.

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

An orange "IQ" (in MSRA mode only) indicates that the results displayed in the MSRA slave application(s) no longer match the data captured by the MSRA Master. The "IQ" disappears after the results in the slave application(s) are refreshed.

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

Channel-specific settings

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

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

Table 6-1: Channel settings displayed in the channel bar in the Spectrum application

Ref Level	Reference level
m.+el.Att	Mechanical and electronic RF attenuation that has been set.
Ref Offset	Reference level offset
SWT	Sweep time that has been set.
	If the sweep time does not correspond to the value for automatic coupling, a bullet is displayed in front of the field. The color of the bullet turns red if the sweep time is set below the value for automatic coupling. In addition, the UNCAL flag is shown. In this case, the sweep time must be increased.
	For FFT sweeps, an estimated duration for data capture *and processing* is indicated behind the sweep time in the channel bar.

Meas Time/AQT	Measurement (acquisition) time, calculated from analysis bandwidth and number of samples (for statistics measurements)
RBW	Resolution bandwidth that has been set.
	If the bandwidth does not correspond to the value for automatic coupling, a green bullet appears in front of the field.
VBW	Video bandwidth that has been set.
	If the bandwidth does not correspond to the value for automatic coupling, a green bullet is displayed in front of the field.
AnBW	Analysis bandwidth (for statistics measurements)
Compatible	Compatible device mode (FSP, FSU, default; default not displayed)
Mode	Indicates which sweep mode type is selected: • "Auto FFT": automatically selected FFT sweep mode • "Auto sweep": automatically selected swept sweep mode • "Sweep": manually selected frequency sweep mode • "FFT": manually selected FFT sweep mode

Icons for individual settings

A bullet next to the setting indicates that user-defined settings are used, not automatic settings. A green bullet indicates this setting is valid and the measurement is correct. A red bullet indicates an invalid setting that does not provide useful results.

Common settings

The channel bar above the diagram not only displays the channel-specific settings. It also displays information on instrument settings that affect the measurement results even though it is not immediately apparent from the display of the measured values. This information is displayed in gray font and only when applicable for the current measurement, as opposed to the channel-specific settings that are always displayed.
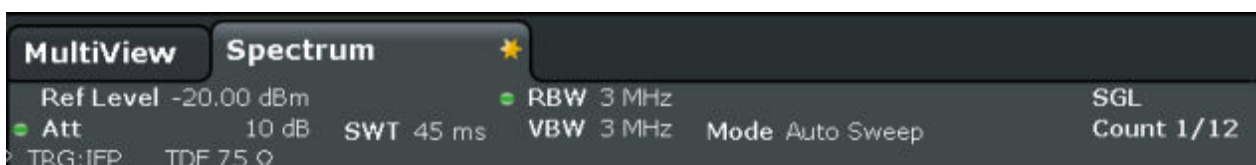
The following types of information are displayed, if applicable.

Table 6-2: 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.
"YIG Bypass"	The YIG filter is deactivated.
"GAT"	The frequency sweep is controlled via the TRIGGER INPUT connector.
"TDF"	A 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

<"NOR" | "APR">	The R&S FSW is controlling an external generator (requires option R&S FSW-B10).
"Ext. Gen"	**NOR**: the measurements are normalized with the results of the external generator calibration
	APR (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.
	For details, see the "External Generator Control" section in the R&S FSW User Manual.
"LVL"	A level offset is applied to the external generator signal (only if external generator control is active).

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

6.1.2   Window Title Bar

Each channel in the R&S 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 Chapter 6.6, "Displaying Results", on page 102). The window title bar indicates which type of evaluation is displayed.

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

See also Chapter 6.6.4, "Switching Between a Split and Maximized Window Display", on page 109.

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.

6.1.3   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

6.1.4   Frequency and Span Information in Diagram Footer

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

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

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

6.1.5   Instrument and Status Information

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

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

The following information is displayed:

Instrument status

	The instrument is configured for operation with an external reference.
	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 R&S FSW I/Q Analyzer User Manual.
	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 R&S FSW I/Q Analyzer User Manual.
	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 R&S 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.

6.1.6   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 6-3: 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 dis-
   plays the information for the currently selected measurement only.

For a description of possible errors, see the R&S FSW User Manual.

6.2   Accessing the Functionality

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

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

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

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

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

6.2.1   Toolbar

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

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

The following functions are available:

Table 6-4: Standard Application Functions in the Toolbar

Icon	Description
	Windows: displays the Windows "Start" menu and task bar
	Open: opens a file from the instrument ("Save/Recall" menu)
	Store: stores data on the instrument ("Save/Recall" menu)
	Print: defines print settings ("Print" menu)
	Undo: reverts last operation
	Redo: repeats previously reverted operation
	Selection mode: the cursor can be used to select (and move) markers in a 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.
	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
	Zoom off: displays the diagram in its original size
	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.
	SmartGrid: activates "SmartGrid" mode to configure the screen layout

Icon	Description
	Sequencer: opens the "Sequencer" menu to perform consecutive measurements
	Help (+ Select): allows you to select an object for which context-specific help is displayed
AL	Analysis line (MSRA mode only): opens a dialog box to display and position an analysis line in MSRA measurements (see R&S FSW MSRA User Manual)
	Help: displays context-sensitive help topic for currently selected element
	Print immediately: prints the current display (screenshot) as configured
In "SmartGrid" mode only:	
	Exit "SmartGrid" mode

6.2.2   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.

6.2.3 Context Menus

Several items in the diagram area have context menus (for example markers, traces or the channel bar). If you right-click on one of these items (or tap it for about 1 second), a menu is displayed which contains the same functions as the corresponding softkey. This is useful, for example, when the softkey display is hidden.
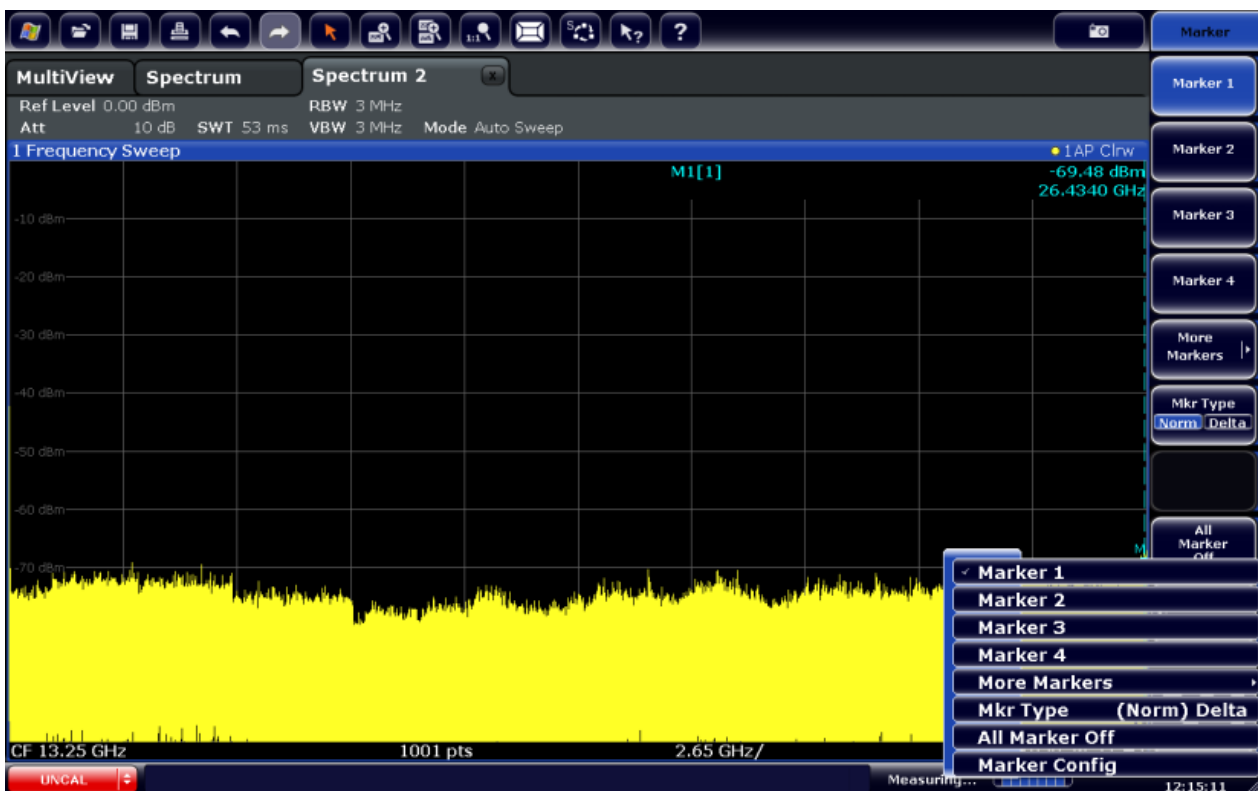
6.2.4 On-screen Keyboard

The on-screen keyboard is an additional means of interacting with the instrument without having to connect an external keyboard.
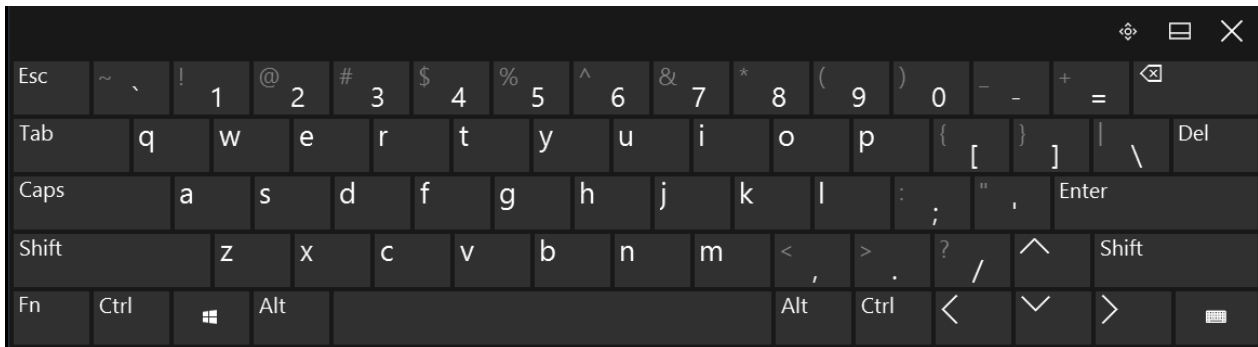
The on-screen keyboard display can be switched on and off as desired using the "On-Screen Keyboard" function key beneath the screen.

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.

6.3   Changing the Focus

Any selected function is always performed on the currently focused element in the display, e.g. a dialog field, diagram, or table row. Which element is focused is indicated by a blue frame (diagram, window, table) or is otherwise highlighted (softkey, marker etc.). Moving the focus is most easily done by tapping on the element on the touchscreen. Alternatively, use the "Tab" key on the on-screen keyboard or the rotary knob to move the focus from one element to the next on the display.

 To move the focus between any displayed diagrams or tables in a window, press the "Change focus" key 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.

6.4   Entering Data

Data can be entered in dialog boxes using one of the following methods:

- Using the touchscreen, via the online 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, use the slider at the top of the dialog box.

(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.

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

6.4.2   Entering Alphanumeric Parameters

If a field requires alphanumeric input, you can use the on-screen keyboard to enter numbers and (special) characters (see Chapter 6.2.4, "On-screen Keyboard", on page 95).

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 6-5.

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 6-5.

5. To change from capital to small letters and vice versa, press the sign key (-).

6. When you have chosen the desired value, wait for 2 seconds (to use the same key again), or start the next entry by pressing another key.

To enter a blank

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

To correct an entry

1. Using the arrow keys, move the cursor to the right of the entry you want to delete.

2. Press the [BACKSPACE] key.

    The entry to the left of the cursor is deleted.

3. Enter your correction.

To complete the entry

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

To abort the entry

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

Table 6-5: 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 Æ Å Ç
9	D E F 9 É
4	G H I 4
5	J K L 5
6	M N O 6 Ñ 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\>

6.5   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.
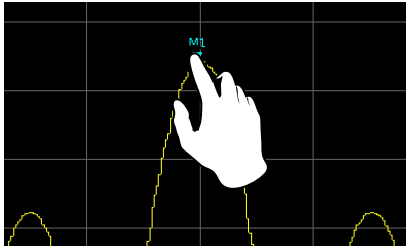
Figure 6-1: Tapping

Double-tapping

Tap the screen twice, in quick succession.

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

Double-tap a diagram to add a peak marker. The next available (delta) marker is set to the peak near the x-axis position you tapped. This function is not available in spectrograms.

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.
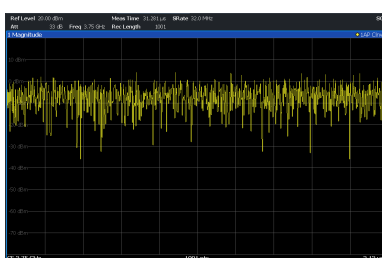
Figure 6-2: Dragging

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).

For example:

- Dragging horizontally in a spectrum display changes the center frequency.

- Dragging vertically in a power vs frequency (spectrum) or power vs. time display changes the reference level (for absolute scaling) or the min and max power values (for relative scaling).

- Dragging horizontally in a time domain display changes the trigger offset value (if available, not in free run).

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 6-6: Correlation of mouse and touch actions

Mouse operation	Touch operation
Click	Tap
Double-click	Double-tap
Click and hold	Touch and hold
Right-click	Touch, hold for 1 second and release
Drag-&-drop (= click and hold, then drag and release)	Touch, then drag and release
Mouse wheel to scroll up or down	Swipe
Dragging scrollbars to scroll up or down, left or right	Swipe

In (graphical) Zoom mode only: dragging the borders of the displayed rectangle to change its size	Touch, then drag and release

Example:

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

6.6 Displaying Results

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

6.6.1 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.
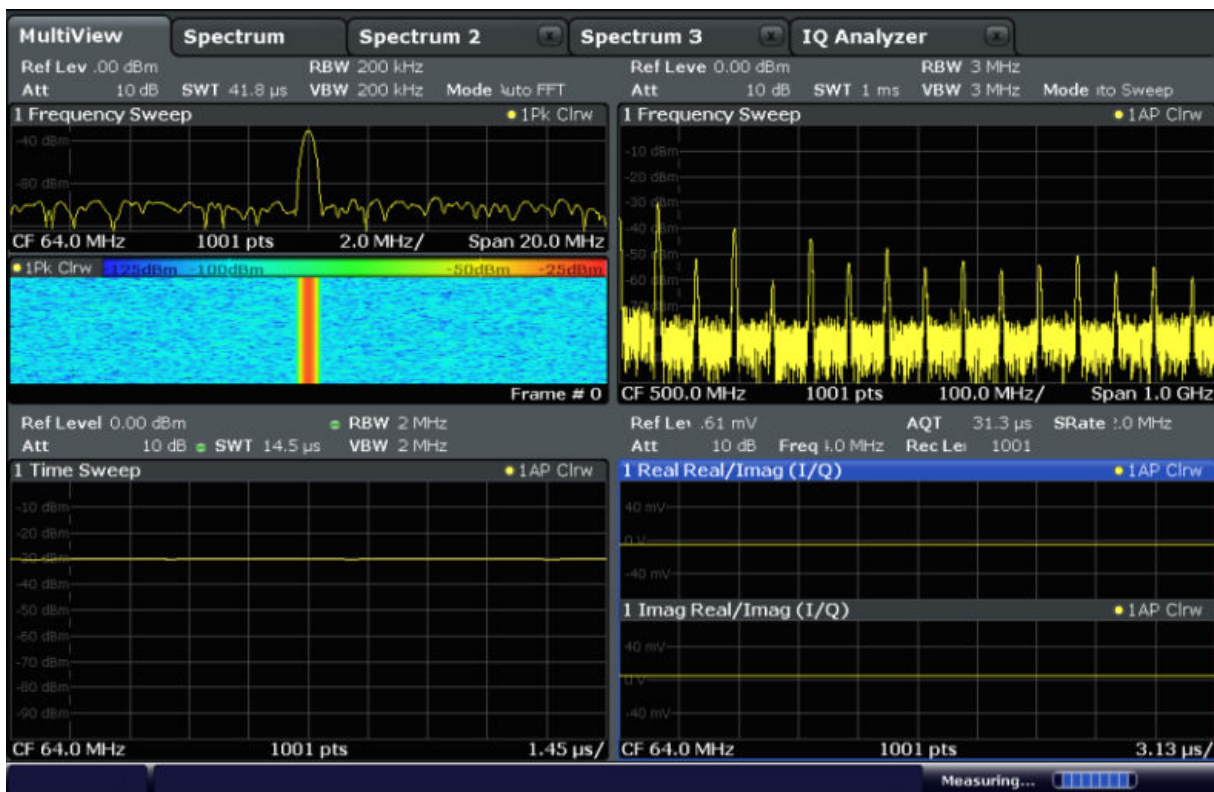
To start a new channel

1. Select the [Mode] key.

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

To change the application in an active channel

1. Select the tab of the channel you want to change.

2. Select the [Mode] key.

3. In the "Mode" dialog box, select the new application to be displayed on the "Replace Current Channel" tab.
   The selected application is displayed in the current channel.

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.

6.6.2   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.

6.6.2.1   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 Smart-Grid where you drop the window determines its position on the screen.
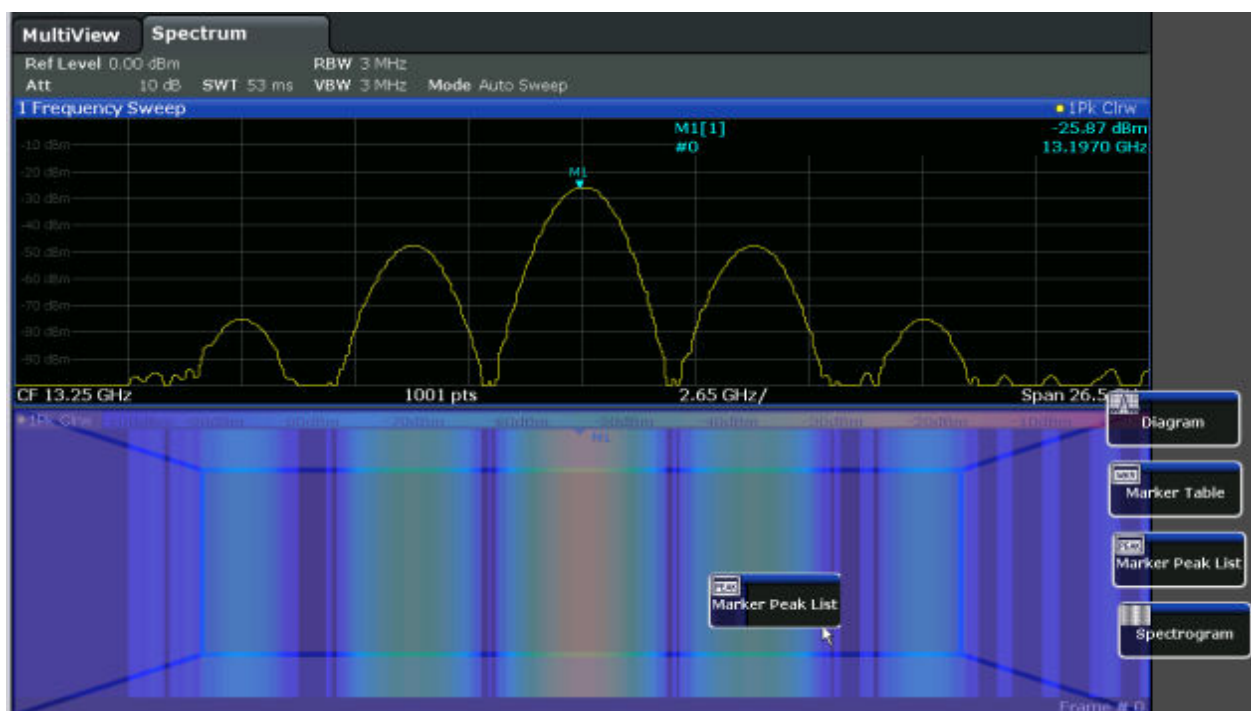
Figure 6-3: Moving a window in SmartGrid mode

The brown area indicates the possible "drop area" for the window, i.e. the area in which the window can be placed. A blue area indicates the (approximate) layout of the window as it would be if the icon were dropped at the current position. The frames indicate the possible destinations of the new window with respect to the existing windows: above/below, right/left or replacement (as illustrated in Figure 6-4). 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 Smart-Grid. 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).
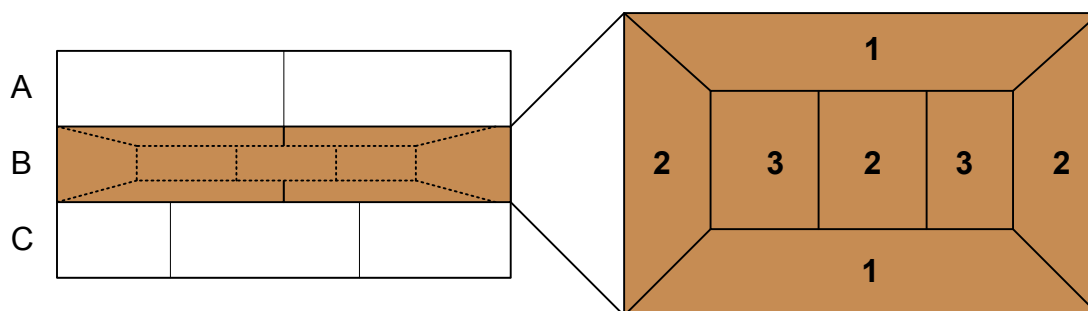
Figure 6-4: SmartGrid window positions

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.

6.6.2.2 How to Activate SmartGrid Mode

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

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

-

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

The SmartGrid functions and the evaluation bar are displayed.

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

6.6.2.3   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 Chapter 6.6.2.5, "How to Arrange the Result Windows", on page 108 for more information on positioning the window).

6.6.2.4   How to Close a Result Window

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

6.6.2.5   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.

6.6.3   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.
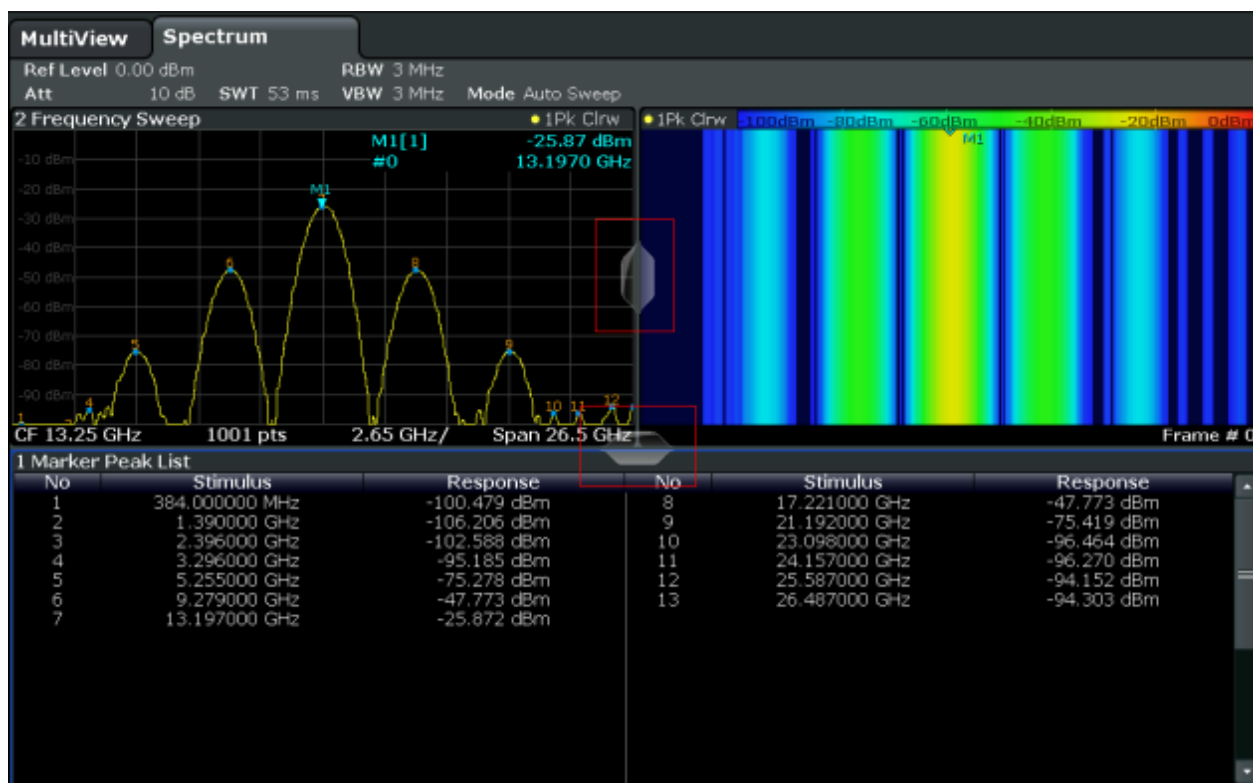
> The splitters are not available in SmartGrid mode.

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

6.6.4 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 the [SPLIT/MAXIMIZE] key on the front panel. In maximized display, the currently focused window is maximized. In split display, all active windows are displayed.

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

6.6.5   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

6.7   Getting Help

If any questions or problems concerning the R&S 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.

6.7.1   Calling Up Help

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

Calling context-sensitive help

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

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

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

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

  b) Select the screen element to change the focus.

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

6.7.2 Using the Help Window

The Help window contains several tabs:

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

The Help toolbar provides some buttons:

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

To navigate the Help, use the touchscreen. Alternatively, you can also use the navigation keys on the front panel.

To search for a topic in the index

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

1. Switch to the "Index" tab.

2. Select the "Keyboard" icon besides the entry field.

3. Enter the first characters of the keyword you are interested in.
   The entries containing these characters are displayed.

4. Double-tap the suitable index entry.
   The "View" tab with the corresponding help topic is displayed.

To search topics for a text string

1. Switch to the "Search" tab.

2. Select the "Keyboard" icon besides the entry field.

3. Enter the string you want to find.
   If you enter several strings with blanks between, topics containing all words are found (same as AND operator).

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

To close the Help window

► Select the "Close" icon in the upper right corner of the help window.
   Or: Press the [ESC] key.

6.8   Remote Control

In addition to working with the R&S 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 (see Chapter 3.5, "Setting Up a Network (LAN) Connection", on page 28)

● Using the LXI browser interface in a LAN network

● Using the Windows Remote Desktop application in a LAN network

● Connecting a PC via the GPIB interface

How to configure the remote control interfaces is described in the User Manual.

The R&S FSW is delivered with *IECWIN* installed, the auxiliary remote control tool provided free of charge by R&S.

For details on the IECWIN tool, see the "Network and Remote Control" chapter of the R&S FSW User Manual.

6.8.1   Using the LXI Browser Interface in a LAN

LAN eXtensions for Instrumentation (LXI) is an instrumentation platform for measuring instruments and test systems that is based on standard Ethernet technology. LXI is intended to be the LAN-based successor to GPIB, combining the advantages of Ethernet with the simplicity and familiarity of GPIB. The LXI browser interface allows for easy configuration of the LAN and remote control of the R&S FSW without additional installation requirements.

Restrictions

Only user accounts with administrator rights can make use of the LXI functionality.

For details see Chapter 3.2.3, "Login", on page 20.

Via the LXI browser interface to the R&S FSW you can control the instrument remotely from another PC. Manual instrument controls are available via the front panel simulation. File upload and download between the instrument and the remote PC is also available. Using this feature, several users can access *and*

operate the R&S FSW simultaneously. This is useful for troubleshooting or train-
ing purposes. If necessary, this feature can be deactivated.

For details see the R&S FSW User Manual.
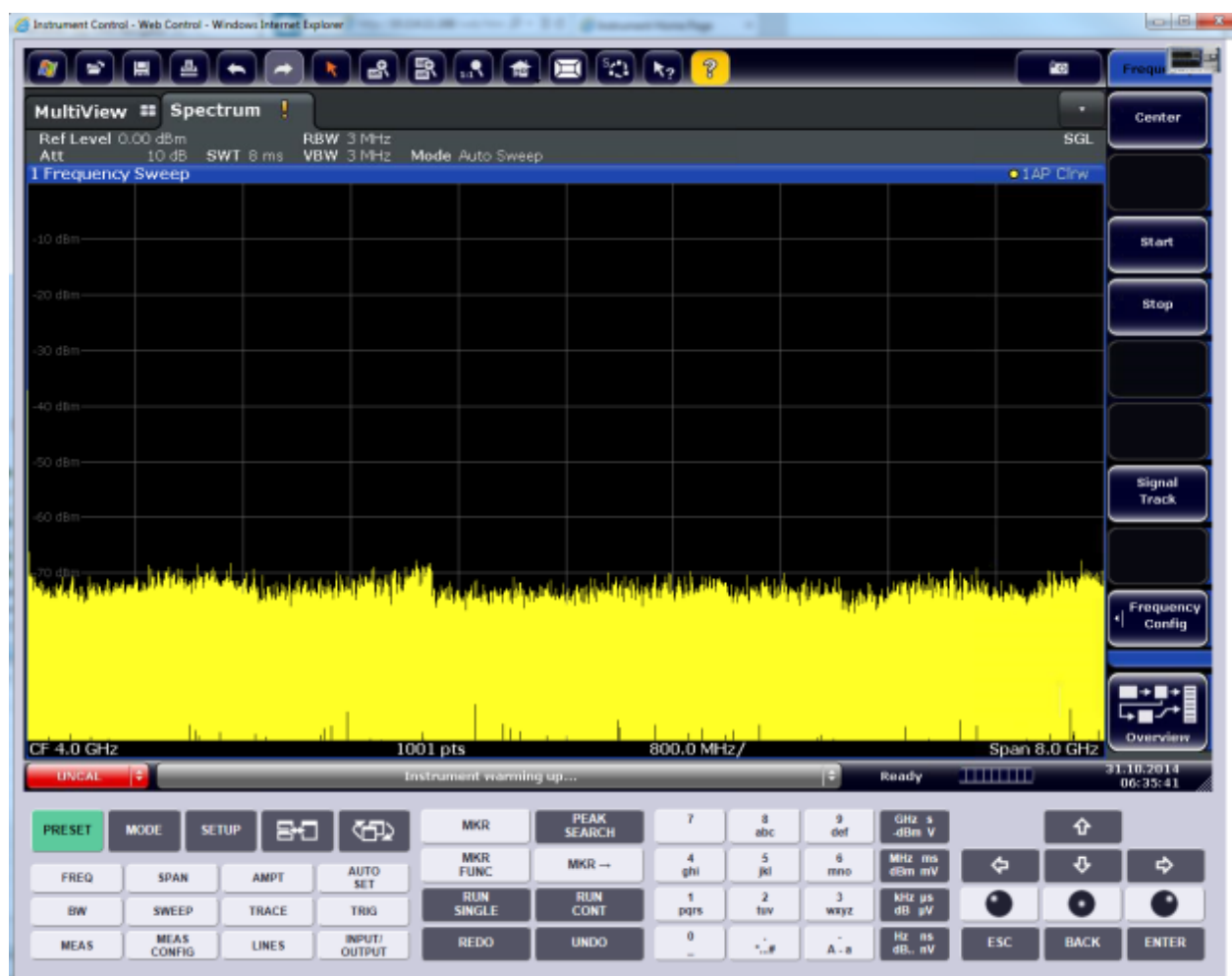
6.8.2   Remote Desktop Connection

Remote Desktop is a Windows application which can be used to access and con-
trol the instrument from a remote computer through a LAN connection. While the
instrument is in operation, the instrument screen contents are displayed on the
remote computer. Remote Desktop provides access to all of the applications,
files, and network resources of the instrument. Thus, remote operation of the
instrument is possible.

The Remote Desktop Client is part of the installed Windows operating system. For other versions of Windows, Microsoft offers the Remote Desktop Client as an add-on.

6.8.3   Connecting a PC via the GPIB Interface

You can connect a PC to the R&S FSW via the GPIB interface to send remote commands to control and operate the instrument. You can configure the GPIB address and the ID response string. The GPIB language is set as SCPI by default but can be changed to emulate other instruments.

A GPIB interface is integrated on the rear panel of the instrument.

7   Collecting Information for Technical Support

If problems occur, the instrument generates error messages which in most cases will be sufficient for you to detect the cause of an error and find a remedy.

Error messages are described in the "Troubleshooting" section of the user manuals.

In addition, our customer support centers are there to assist you in solving any problems that you may encounter with your R&S FSW. We will find solutions more quickly and efficiently if you provide us with the information listed below.

- **System Configuration:** The "System Configuration" dialog box (in the "Setup" menu) provides information on:
  - **Hardware Info:** hardware assemblies
  - **Versions and Options:** the status of all software and hardware options installed on your instrument
  - **System Messages:** messages on any errors that may have occurred

  An .xml file with information on the system configuration ("Device Footprint") can be created automatically (using the `DIAGnostic:SERVice:SINFo` command or as described in "To collect the support information" on page 116).

- **Error Log:** The `RSError.log` file (in the `C:\Program Files (x86)\Rohde-Schwarz\FSW\<version>\log` directory) contains a chronological record of errors.

- **Support file:** a *.zip file with important support information can be created automatically (in the `C:\Program Files (x86)\Rohde-Schwarz\FSW\<version>\user` directory). The *.zip file contains the system configuration information ("Device Footprint"), the current eeprom data and a screenshot of the screen display.

To collect the support information

1. Press the [SETUP] key.

2. Select "Service" > "R&S Support" and then "Create R&S Support Information" .

The file is stored as

```
C:\Program Files (x86)\Rohde-Schwarz\FSW\<version>\user\
<inst_model>_<serial-no>_<date_and_time>.zip
```

For example

```
C:\Program Files (x86)\Rohde-Schwarz\FSW\<version>\user\
FSW-26_1312.8000K26-100005-xx_20150420_113652.zip
```

Collect the error information and attach it to an email in which you describe the problem. Send the email to the customer support address for your region as listed on the Internet (http://www.customersupport.rohde-schwarz.com).

Packing and transporting the instrument

If the instrument needs to be transported or shipped, observe the notes described in Chapter 3.1.1, "Unpacking and Checking the Instrument", on page 13.

Index