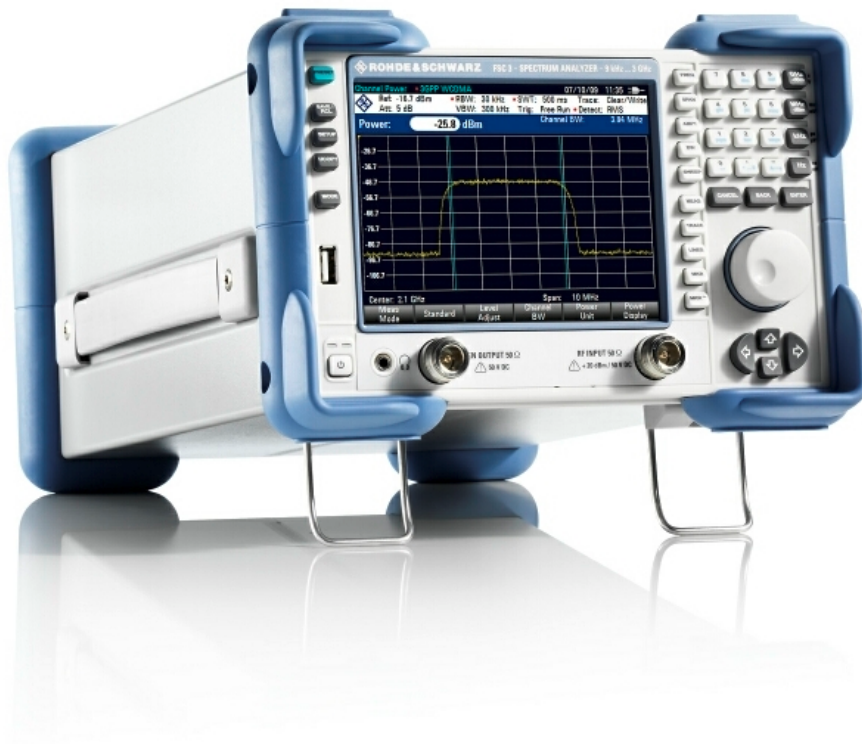


# R&S® FSC

## Spectrum Analyzer

### Quick Start Guide



1314.3493.62 – 03

The Quick Start Guide describes the following R&S®FSC models and options:

- R&S FSC3 (1314.3006K03)
- R&S FSC6 (1314.3006K06)
- R&S FSC13 (1314.3006K13)
- R&S FSC16 (1314.3006K16)
- R&S FSC-B22 (1314.3535.02)

The contents of this manual correspond to R&S®FSC firmware version 1.20 or higher.

The firmware of the instrument makes use of several valuable open source software packages. the most important of them are listed below, together with their corresponding open source license. The verbatimlicense texts are provided on the user documentation CD-ROM (included in delivery).

<b>Package</b>	<b>Link</b>	<b>License</b>
OpenSSL	<a href="http://www.openssl.org">http://www.openssl.org</a>	OpenSSL/ SSLeay
BOOST Library	<a href="http://www.boost.org">http://www.boost.org</a>	Boost Software v.1
ONC/RPC	<a href="http://www.plt.rwth-aachen.de">http://www.plt.rwth-aachen.de</a>	SUN

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

© 2010 Rohde & Schwarz GmbH & Co. KG  
Muehldorfstr. 15, 81671 Munich. Germany  
Phone: +49 89 4129-0  
Fax: +49 89 4129-12 164  
E-mail: [info@rohde-schwarz.com](mailto:info@rohde-schwarz.com)  
Internet: <http://www.rohde-schwarz.com>

81671 Munich, Germany

Printed in Germany – Subject to change – Data without tolerance limits is not binding.

R&S® is a registered trademark of Rohde & Schwarz GmbH & Co. KG.

Trade names are trademarks of the owners.

The following abbreviations are used throughout this manual:

R&S®FSC is abbreviated as R&S FSC

R&S®FSCView is abbreviated as R&SFSCView



Certificate No.: 2009-74

This is to certify that:

Equipment type	Stock No.	Designation
FSC	1314.3006.xx	SPECTRUM ANALYZER

complies with the provisions of the Directive of the Council of the European Union on the approximation of the laws of the Member States

- relating to electrical equipment for use within defined voltage limits (2006/95/EC)
- relating to electromagnetic compatibility (2004/108/EC)

Conformity is proven by compliance with the following standards:

EN 61326-1: 2006  
EN 61326-2-1: 2006  
EN 55011: 2007 + A2: 2007  
EN 61000-3-2: 2006  
EN 61000-3-3: 1995 + A1: 2001 + A2: 2005

For the assessment of electromagnetic compatibility, the limits of radio interference for Class A equipment as well as the immunity to interference for operation in industry have been used as a basis.

**ROHDE & SCHWARZ GmbH & Co. KG**  
**Mühldorfstr. 15, D-81671 München**

Munich, 2009-12-18

1314.3006.xx

Central Quality Management MF-QZ / Radde

CE

E-1

# Table of Contents

<b>1.1 Front View</b>	<b>7</b>
1.1.1 Function Keys on the Front Panel	9
1.1.2 Screen Layout	11
1.1.2.1 Hardware Settings	12
1.1.2.2 Diagram Header	12
1.1.2.3 Softkeys	12
1.1.3 Connectors on the Front Panel	13
1.1.3.1 RF Input	13
1.1.3.2 Tracking Generator Output	14
1.1.3.3 AF Output	15
1.1.3.4 USB Interfaces	15
<b>1.2 Rear View</b>	<b>16</b>
1.2.1.1 AC Power Supply Connection and Main Power Switch	17
1.2.1.2 DC Connection for External AC Power Supply	17
1.2.1.3 External Trig / External Reference	17
1.2.1.4 IF Output	18
1.2.1.5 USB Interfaces	19
1.2.1.6 LAN Connector	19
<b>2.1 Putting into Operation</b>	<b>21</b>
2.1.1 Unpacking the R&S FSC	22
2.1.2 Accessories	22
2.1.3 Placing or Mounting the R&S FSC	22
2.1.4 Connecting AC Power to the R&S FSC	23
2.1.5 Connecting DC Power to the R&S FSC	23
2.1.6 Turning the R&S FSC On and Off	24

<b>2.2 R&amp;S FSC Setup .....</b>	<b>26</b>
2.2.1 Default Settings .....	26
2.2.2 Hardware Settings .....	27
2.2.3 Audio Settings .....	28
2.2.4 Regional Settings .....	29
<b>2.3 Setting up a LAN Connection .....</b>	<b>33</b>
2.3.1 Direct Connection via LAN .....	33
2.3.2 Connection via an existing LAN network .....	37
2.3.3 Connection via USB .....	38
<b>3.1 Preparing the Installation .....</b>	<b>41</b>
<b>3.2 Performing the Firmware Update on the R&amp;S FSC .....</b>	<b>42</b>
<b>4.1 Controlling the RF Attenuator .....</b>	<b>44</b>
<b>4.2 Using a Preamplifier (Option R&amp;S FSC-B22) .....</b>	<b>46</b>
<b>4.3 Measurements on CW Signals .....</b>	<b>48</b>
4.3.1 Level Measurement .....	48
4.3.2 Setting the Reference Level .....	50
4.3.3 Frequency Measurements .....	51
4.3.4 Harmonic Measurements of a Sinewave Signal .....	52
<b>4.4 Two-Port Measurements with the Tracking Generator .....</b>	<b>53</b>
4.4.1 Calibrating the R&S FSC for Scalar Measurement of the Transmission Function .....	54
4.4.2 Measure the magnitude of the transfer function .....	54
<b>4.5 Saving and Recalling Settings and Test Results .....</b>	<b>56</b>
4.5.1 Saving Measurement Results .....	56
4.5.2 Recalling Measurement Results .....	58

# Documentation Overview

The user documentation for the R&S FSC is divided as follows:

## Quick Start Guide

The Quick Start Guide provides basic information on the instrument's functions.

It covers the following topics:

- overview of all elements of the front and rear panels
- basic information on how to set up the R&S FSC
- information on how to operate the R&S FSC in a network
- instructions on how to perform measurements

## Operating Manual

The Operating Manual provides a detailed description on the instrument's functions

It covers the following topics:

- instructions on how to set up and operate the R&S FSC in its various operating modes
- instructions on how to perform measurements with the R&S FSC
- instructions on how to work with the available software options and applications
- instructions on how to remote control the R&S FSC
- basic information on how a spectrum analyzer works

## Service Manual

The Service Manual provides information on maintenance.

It covers the following topics:

- instructions on how to perform a performance test
- instructions on how to repair the R&S FSC including a spare parts list
- mechanical drawings

## Release Notes

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

**Internet Site**

The internet site at: [R&S FSC Spectrum Analyzer](#) provides the most up to date information on the R&S FSC. The most recent manuals are available as printable PDF files in the download area.

Also provided for download are firmware updates including the associated release notes, instrument drivers, current data sheets, application notes and image versions.

# Conventions Used in the Documentation

The following conventions are used throughout the R&S R&S FSC Quick Start Guide:

## Typographical conventions

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

## Other conventions

- **Remote commands:** Remote commands may include abbreviations to simplify input. In the description of such commands, all parts that have to be entered are written in capital letters. Additional text in lower-case characters is for information only.
- **Procedure descriptions:** When describing how to operate the device, several alternative methods may be available to perform the same task. In this case, the procedure using the touchscreen is described, where available. 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 device or the on-screen keyboard is only described if it deviates from the standard operating procedures as described in the Quick Start Guide under "Basic Operations".

The terms "**select**" and "**press**" 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 device or on a keyboard.





# 1 Putting Into Operation

## 1.1 Front View

The picture below shows the front panel view of the R&S FSC. You can find a description of the numbered elements in Table 1-1. All elements are described in more detail in the subsequent sections.



**Table 1-1: Front view element overview**

Number	Description	See chapter
1	PRESET key	<a href="#">Function Keys on the Front Panel</a> (p. 9)
2	General functions keys	<a href="#">Function Keys on the Front Panel</a> (p. 9)
3	MODE key	<a href="#">Function Keys on the Front Panel</a> (p. 9)
4	USB interface	<a href="#">Connectors on the Front Panel</a> (p. 13)
5	On / Off switch	<a href="#">Function Keys on the Front Panel</a> (p. 9)
6	AF Output	<a href="#">Connectors on the Front Panel</a> (p. 13)
7	TG Output	<a href="#">Connectors on the Front Panel</a> (p. 13)
8	Display	<a href="#">Screen Layout</a> (p. 11)
9	Softkeys	<a href="#">Screen Layout</a> (p. 11)
10	RF Input	<a href="#">Connectors on the Front Panel</a> (p. 13)
11	Measurement settings and functions	<a href="#">Function Keys on the Front Panel</a> (p. 9)
12	Alphanumeric keys	<a href="#">Function Keys on the Front Panel</a> (p. 9)
13	Unit keys	<a href="#">Function Keys on the Front Panel</a> (p. 9)
14	Rotary knob	<a href="#">Function Keys on the Front Panel</a> (p. 9)
15	Cursor keys	<a href="#">Function Keys on the Front Panel</a> (p. 9)

### 1.1.1 Function Keys on the Front Panel

#### Key

#### Description



Switches the R&S FSC on and off.

#### General functions



Resets the instrument to the default state.



Provides the functions for saving/loading instrument settings and for managing stored files.



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.)



Customizes the printout, selects and configures the printer.



Provides the selection of operating mode.

#### Measurement settings and functions



Sets the center frequency as well as the start and stop frequencies for the frequency range under consideration. This key is also used to set the frequency offset.



Sets the frequency span.



Sets the reference level, the displayed dynamic range, the RF attenuation and the unit for the level display. Also sets the level offset and the input impedance and activates the preamplifier (option RF Preamplifier, R&S FSC-B22).



Sets the resolution bandwidth and the video bandwidth.



Sets the sweep time and the number of measurement points.  
Selects continuous measurement or single measurement.



Configures the measured data acquisition and the analysis of the measurement data.

**Measurement functions**

Contains complex measurements including:

- Measurement of single multicarrier adjacent channel power (Ch Power ACLR)
- Occupied bandwidth (OBW)
- Measurement of time domain power (Time Domain Power)
- AM modulation depth (AM Mod Depth)
- Scalar two-port measurements (models with tracking generator)



Sets and positions the absolute and relative measurement markers (markers and delta markers) and controls marker functions:

- Frequency counter (Sig Count)
- Fixed reference point for relative measurement markers (Ref Fixed)
- Noise and phase noise measurements (Noise Meas)
- n dB down function
- AM/FM audio demodulation
- Peak list



Contains functions to position the marker according to certain conditions and to define marker search area.



Configures display lines and limit lines.

**Miscellaneous keys**

Alphanumeric keys



Unit keys



Cancel key



Back key



Enter key



Cursor Keys



## 1.1.2 Screen Layout

This chapter shows the general screen layout of the R&S FSC. A detailed description of the screen layout of the various operating modes and measurements is part of the operating manual.



- |   |   |    |                              |
|---|---|----|------------------------------|
| 1 | Operating mode                              | 9  | Horizontal axis labeling     |
| 2 | Date and time                               | 10 | Reference position           |
| 3 | Hardware settings                           | 11 | Currently selected menu item |
| 4 | Diagram header including marker information | 12 | Active menu item             |
| 5 | Status line                                 | 13 | Selectable menu item         |
| 6 | Invalid trace indicator                     | 14 | Vertical axis information    |
| 7 | Marker symbol                               | 15 | Softkey menu                 |
| 8 | Trace                                       |    |                              |


### 1.1.2.1 Hardware Settings



#### Customized settings

If you change any of the settings in the hardware settings manually, the R&S FSC shows a red dot in front the corresponding setting.

To indicate invalid settings, the R&S FSC shows a red star in the diagram area.

	Ref: -60.0 dBm	RBW: 100 kHz	• SWT: 20 ms	Trace: Clear/Write
	Att: 0 dB	VBW: 100 kHz	Trig: Free Run	Detect: Auto Peak

The following settings are listed:

Setting	Description
Ref	Reference level
Att	Attenuation
RBW	Resolution bandwidth
VBW	Video bandwidth
SWT	Sweep time
Trig	Trigger mode
Trace	Trace mode
Detect	Detector type

### 1.1.2.2 Diagram Header

The diagram header shows marker information, as soon as one marker is active.

	98.4992 MHz	-70.8 dBm		2.2722 MHz	-4.9 dB
---	-------------	-----------	---	------------	---------

The marker table shows the number of the marker (white) or delta marker (red) and the corresponding x-axis values and y-axis values.

In the picture above, these are the frequency values (x-axis) and the absolute power level (marker) or relative power levels (delta marker) (y-axis).

### 1.1.2.3 Softkeys

With the softkeys you can set up and perform measurements. Pressing a hardkey usually opens a softkey menu. The number of softkeys in the menu and functions of the softkeys vary according to hardkey and operating mode.

You can operate a softkey by touching the softkey on the screen.

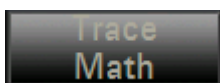
Touching a softkey

- Opens a menu to select further actions
- Opens a entry field to enter data
- Opens a dialog box
- Switches a function on or off

Softkeys can have different states:



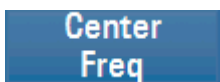
Grey color with white text means that the function the softkey triggers is available.



Grey color with grey text means that the function the softkey triggers is not available.



Green color means that the function the softkey triggers is active.



Blue color means that the menu or entry field that belongs to the softkey is currently open and the softkey is active.

If a softkey is available only with a given option, it is only displayed if that option is installed.

### 1.1.3 Connectors on the Front Panel

This section describes the front connectors and interfaces of the R&S FSC. Optional connectors and interfaces are indicated by the option name in brackets.

#### 1.1.3.1 RF Input

Connect the RF input via a cable with an N connector to the DUT. Make sure that it is not overloaded.

The maximum permissible continuous power at the RF input is 20 dBm (100 mW). It can be loaded with up to 30 dBm (1 W) for a maximum of three minutes. If the instrument is loaded with 1 W for longer, it may be destroyed. The RF input is protected from static discharges and voltage pulses by a limiting circuit.



**⚠ WARNING****Shock Hazard**

In order to avoid electrical shock the DC input voltage must never exceed the value specified on the housing.

**NOTICE****Risk of damage to the coupling capacitor, the input attenuator and the mixer**

The DC input voltage must never exceed the value specified in the data sheet.

**1.1.3.2 Tracking Generator Output**

The tracking generator output power for the different R&S FSC models is as follows:

R&S FSC3 (model 13):

Frequency: 100 kHz to 3 GHz

Tracking generator output power: 0 dBm nominal

R&S FSC6 (model 16):

Frequency: 100 kHz to 6 GHz

Tracking generator output power: 0 dBm nominal

The tracking generator output power can be reduced with an integrated step attenuator by a maximum of 40 dB in 1 dB steps in all R&S FSC models.

**NOTICE****Risk of damage to the tracking generator output**

The reverse voltage up to the voltage stated on the R&S FSC housing must not be exceeded.

### 1.1.3.3 AF Output

Headphones equipped with a miniature jack plug can be connected to the AF output female connector. The internal impedance is 10  $\Omega$ . If a plug is connected, the internal loudspeaker is automatically switched off.

---

**⚠ CAUTION****Risk of hearing damage**

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

---

### 1.1.3.4 USB Interfaces

The R&S FSC provides two USB connectors, one on the front and one on the back (see figures above).

The USB connector on the front is for connecting external devices like a memory stick or a power sensor. If you connect a power sensor, the connector is used both for the power supply and the data transfer. Note that you can perform a firmware update only through this connector.

The USB connector on the back is reserved for remote control operation of the R&S FSC. Refer to chapter 5 in the operating manual for a detailed description of remote command operation of the R&S FSC.

You cannot connect a mouse or keyboard to either of the USB ports.

## 1.2 Rear View

The picture below shows the rear panel view of the R&S FSC. You can find a description of the numbered elements in Table 1-2. All elements are described in more detail in the subsequent sections.



**Table 1-2: Elements of the rear panel**

Number	Description
1	AC connector
2	Power Switch
3	DC connector
4	Ref In / Trigger In
5	IF Out
6	USB interface
7	LAN connector

### 1.2.1.1 AC Power Supply Connection and Main Power Switch

The R&S FSC is supplied with power via an AC connection. The AC connector is located on the back of the R&S FSC.

The main power switch is located directly below the AC connector.

### 1.2.1.2 DC Connection for External AC Power Supply

The R&S FSC can also be supplied with power by an AC/DC transformer via the DC connector.

#### **NOTICE**

##### **Possible damage to the R&S FSC**

Use the DC connection only with the approved power supply.

**Model:** R&S HA-Z201

**Input:** 100-240 VAC 1.5 A 50-60 Hz

**Output:** 15 VDC 2 A

### 1.2.1.3 External Trig / External Reference

The Ext Trig / Ext Ref BNC connector can be used either as an input for an external trigger or an external reference.

Either an external trigger signal to start a measurement or a 10 MHz reference signal for frequency synchronization is fed in via the Ext Trig / Ext Ref BNC socket. The trigger threshold is similar to that of TTL signals. The level for the reference signal must be larger than 0 dBm. The necessary settings can be entered in the "Setup" menu.

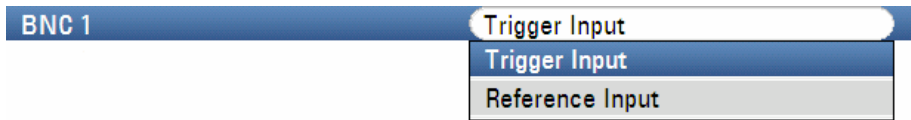
- ▶ Press the SETUP key.
- ▶ Press the "Instrument Setup" softkey.

The R&S FSC opens the corresponding dialog.

- ▶ Select the "BNC 1" menu item with the rotary knob or the cursor keys (▼ or ▲).

- Confirm with ENTER.

A dropdown menu opens.



- Select the desired function for the BNC socket with the rotary knob or the cursor keys (▼ or ▲).
- Confirm with ENTER.

### NOTICE

#### Possible damage to the R&S FSC

The BNC sockets are protected against incorrect use up to 28 V input voltage and 600 mA input current. Applying higher currents or voltages may lead to damage to the R&S FSC.

The "Ext Trig" setting is only for input configuration. The use of the external trigger must be set in the "Sweep" menu (SWEEP key, "Trigger" softkey).

If the input is configured for the external reference and if no reference signal is present at the input, a warning will appear on the screen. This is meant to prevent users from carrying out a measurement without a valid reference.

### 1.2.1.4 IF Output

The BNC socket can be used as an 21.4 MHz intermediate frequency output (IF Out).

### NOTICE

#### Possible damage to the R&S FSC

The BNC sockets are protected against incorrect use up to 28 V input voltage and 600 mA input current. Applying higher currents or voltages may lead to damage to the R&S FSC.

### 1.2.1.5 USB Interfaces

The R&S FSC provides two USB connectors, one on the front and one on the back (see figures above).

The USB connector on the back is reserved for remote control operation of the R&S FSC. Refer to chapter 5 in the operating manual for a detailed description of remote command operation of the R&S FSC.

### 1.2.1.6 LAN Connector

The LAN connector can be used for remote control operation of the R&S FSC. You can assign a fixed IP address or a dynamic IP address via DHCP. Refer to [Setting up a LAN Connection](#) on page 33 for details on how to operate the R&S FSC in a network environment.

## 2 Preparing for Use

This chapter describes all procedures to prepare the instrument for use. It starts with putting into operation, proceeds with connecting external devices, configuring the instrument and the LAN interface, and ends with information on the operating system:

---

**⚠ WARNING****Shock hazard**

Do not open the instrument casing. As a rule, operating the instrument does not require opening the casing.

Measures to avoid the situation.

---

---

**NOTICE****Risk of instrument damage**

Note that the general safety instructions also contain information on operating conditions that will prevent damage to the instrument. The instrument's data sheet may contain additional operating conditions.

---

## 2.1 Putting into Operation

### NOTICE

#### Risk of instrument damage

Before switching on the instrument, make sure that the following conditions are met:

- Instrument covers are in place and all fasteners are tightened.
- 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 operated in the horizontal position on an even surface.
- 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 correctly connected and are not overloaded.

Failure to meet these conditions may cause damage to the instrument or other devices in the test setup.

### NOTICE

#### Risk of electrostatic discharge

Protect the work area against electrostatic discharge to avoid damage to electronic components in the modules and the DUT. For details, refer to the safety instructions at the beginning of this manual.



#### EMI impact on measurement results

Electromagnetic interference (EMI) can affect the measurement results. To avoid any impact, make sure that the following conditions are met:

- Use suitable double-shielded cables.
- Do not use USB connecting cables exceeding 1 m in length.

Use only USB devices that remain within the permissible EMI limits.



### 2.1.1 Unpacking the R&S FSC

To remove the instrument from its packaging and check the equipment for completeness, proceed as follows:

1. Pull off the polyethylene protection pads from the instrument's rear feet and then carefully remove the pads from the instrument handles at the front.
2. Pull off the corrugated cardboard cover that protects the rear of the instrument.
3. Check the equipment for completeness using the delivery note and the accessory lists for the various items.
4. 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**

Keep the original packing material. If the instrument needs to be transported or shipped at a later date, you can use the material to prevent control elements and connectors from being damaged.

### 2.1.2 Accessories

The R&S FSC comes with the following accessories:

- Power cable
- Quick Start Guide
- CD (R&S FSC Spectrum Analyzer User Documentation)

### 2.1.3 Placing or Mounting the R&S FSC

The R&S FSC is designed for use under laboratory conditions on a bench top whose surface should be flat. The R&S FSC should be used in a horizontal position.

## 2.1.4 Connecting AC Power to the R&S FSC

In the standard version, the R&S FSC is equipped with an AC power supply connector. For details on the connector refer to the description of the [Rear View](#) on page 16.

The R&S FSC 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.



Connect the R&S FSC 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 may only be connected to an outlet that has a ground contact.

## 2.1.5 Connecting DC Power to the R&S FSC

Alternatively, you can supply the R&S FSC with power via the DC connector.

### NOTICE

#### Using the DC input connector

When using the DC input as the power supply, make sure to use an approved power supply only (see [DC Connection for External AC Power Supply](#) on page 17)

## 2.1.6 Turning the R&S FSC On and Off

The R&S FSC has three different states.

- 'Off' state

The R&S FSC is turned off completely if the main power switch on the back of the R&S FSC is set to 'O'. In that state, the R&S FSC is not supplied with power. The LEDs above the "On/Off" key on the front are off.

After you have turned the main power supply on (position 'I'), the R&S FSC runs in standby mode.

- 'Standby' mode

The R&S FSC is switched off, but is supplied with power. The yellow LED above the "On/Off" key on the front is on.

When you press the "On/Off" key, the R&S FSC starts booting.

- 'On' state

The R&S FSC is supplied with power and ready for operation. A green LED above the "On/Off" key on the front is on.

You can turn the R&S FSC in two ways. When you turn it off with the "On/Off" key, it always goes into "Standby" mode. When you turn it off that way, it saves the current measurement and instrument settings.

You can turn it off completely by switching the main supply switch to position 'O' or by pulling the power plug.

---

### **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 may be lost.

Always press the "On/Off" key first to shut down the application properly.

---

As of R&S FSC models with serial numbers

- 100654 (R&S FSC3)
- 100643 (R&S FSC6)
- 100659 (R&S FSC13)
- 100871 (R&S FSC16)

or higher, you can customize the way the R&S FSC reacts when you turn it on.

To configure the turn-on procedure, the R&S FSC has to be in standby mode.

The default procedure is the one described above.

If you want to skip the standby mode when turning on the R&S FSC, press the "1" key for 5 seconds when it is in standby mode. If the configuration was successful, the green LED on the front panel starts to blink. As long as this mode is active, the R&S FSC skips the standby mode step when you turn it on with the main power switch. When you turn it off with the "On/Off" key, however, the R&S FSC still goes into standby mode.

If you want to restore the default configuration, press the "3" key for 5 seconds when the R&S FSC is in standby mode. If the configuration change was successful, the green LED on the front panel starts to blink.

## 2.2 R&S FSC Setup

This section describes how to setup the instrument.

### 2.2.1 Default Settings

#### Preset

The PRESET key sets the R&S FSC to the default setup. This allows a new configuration based on defined measurement parameters to be entered, without parameters from a previous setting unintentionally still being active.



Setting the instrument to default setup only affects the present mode you are working with.

- ▶ Press the PRESET key.

The R&S FSC is set to the default setup. The span depends on the model. With the R&S FSC3, it is 3 GHz; with the R&S FSC6 it is 6 GHz.

#### Reset to Factory Settings

"Reset To Factory Settings" will set the R&S FSC to factory defaults. All settings in the various menus are set to the original factory settings and all saved datasets, user defined transducer factors, limit lines, standards, channel tables and cable models will be deleted. Only the factory default files will be reinstalled.

#### NOTICE

##### Data Loss

All saved data will be lost.

- ▶ Press the SETUP key.
- ▶ Press the "Instrument Setup" softkey.

The R&S FSC opens the corresponding dialog.

Reset

Reset to Factory Settings

- ▶ Select "Reset To Factory Settings" with the rotary knob or the cursor keys (▼ or ▲).

- Confirm with ENTER.

A warning is shown.

<b>! Warning !</b>	
<b>Reset to Factory Defaults?</b>	
<b>(All saved datasets will be lost)</b>	
<b>Press YES to continue, press NO to cancel</b>	

To start the reset procedure, press the "Yes" softkey. The firmware reboots the R&S FSC and resets all settings. It shows a message box during the process.

If you want to abort the procedure, press the "No" softkey.

## 2.2.2 Hardware Settings

Set the R&S FSC to detect connected accessory automatically.

- Press the SETUP key.
- Press the "Instrument Setup" softkey.

The R&S FSC opens the corresponding dialog.

- Select "Auto Accessory Detection" below the heading "Hardware" with the rotary knob or the cursor keys (▼ or ▲).

<b>Auto Accessory Detection</b>	<b>On</b>
<b>Detected Accessory</b>	

- Confirm with ENTER.

A submenu opens in which the automatic detection of accessories is set ON or OFF.

- Turn automatic detection on or off by selecting the corresponding menu item.

If the connected accessory is detected the item is displayed in the field "Detected Accessory" below the heading "Hardware".

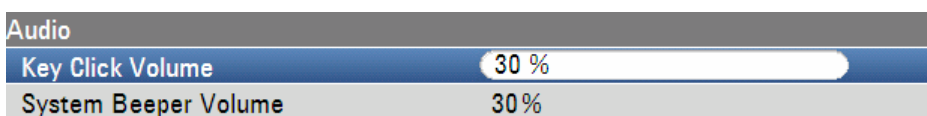
### 2.2.3 Audio Settings

Set the key click volume and the system beeper volume in the "Instrument Setup" dialog.

#### Setting the Key Click Volume

- ▶ Press the SETUP key.
- ▶ Press the "Instrument Setup" softkey.

The R&S FSC opens a list of general settings.



- ▶ Select "Key Click Volume" below the heading "Audio" with the rotary knob or the cursor keys (▼ or ▲).
- ▶ Confirm with ENTER.

An input field opens in which the current key click volume is displayed in percent.

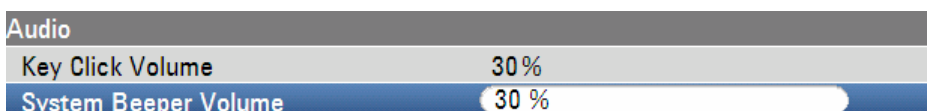
- ▶ Enter the desired volume value with the rotary knob or the cursor keys in 10 % steps or enter the value directly via the numeric keys.
- ▶ Confirm with ENTER.

The input range lies between 0 % and 100 %.

#### Setting the System Beeper Volume

- ▶ Press the SETUP key.
- ▶ Press the "Instrument Setup" softkey.

The R&S FSC opens a list of general settings.



- ▶ Select "System Beeper Volume" below the heading "Audio" with the rotary knob or the cursor keys (▼ or ▲).
- ▶ Confirm with ENTER.

An input field opens in which the current system beeper volume is displayed in percent.

- ▶ Enter the desired volume value with the rotary knob or the cursor keys in 10 % steps or enter the value directly via the numeric keys.

- ▶ Confirm with ENTER.

The input range lies between 0 % and 100 %.

## 2.2.4 Regional Settings

The regional settings allow to select a different language, date format and length unit. Set the desired regional settings in the "Instrument Setup" settings.

### Setting the Language

- ▶ Press the SETUP key.
- ▶ Press the "Instrument Setup" softkey.

The R&S FSC opens a list of general settings.

- ▶ Select "Language" below the heading "Regional" with the rotary knob or the cursor keys (▼ or ▲).
- ▶ Confirm with ENTER.

A list opens in which the supported languages are itemized.



- ▶ Select the desired language with the rotary knob or the cursor keys.
- ▶ Confirm with ENTER.



## Setting the Date Format

- ▶ Press the SETUP key.
- ▶ Press the "Instrument Setup" softkey.

The R&S FSC opens a list of general settings.

Regional	dd/mm/yyyy
Language	mm/dd/yyyy
Date Format	dd/mm/yyyy

- ▶ Select "Date Format" below the heading "Regional" with the rotary knob or the cursor keys (▼ or ▲).
  - ▶ Confirm with ENTER.
- A submenu opens.
- ▶ Select "dd/mm/yy" or "mm/dd/yy" with the rotary knob or the cursor keys (▼ or ▲).
  - ▶ Confirm with ENTER.

## Setting the Date and Time

The R&S FSC has an internal clock that can apply a date and time stamp. You can reset the date and time.

### Setting the date

- ▶ Press the SETUP key.
- ▶ Press the "Instrument Setup" softkey.

The R&S FSC opens a list of general settings.

Date and Time	
Set Date	15/12/2009
Set Time	15:44:00

- ▶ Select the "Set Date" menu item below the heading "Date And Time" with the rotary knob or the cursor keys (▼ or ▲).
- ▶ Confirm with ENTER.

An input field opens. In the input field, the date is shown in the currently selected format:

dd/mm/yyyy or mm/dd/yyyy

- ▶ Depending on the date format, change the day (dd) or month (mm) with the rotary knob, cursor keys or a numerical entry.

- Confirm with ENTER.

The cursor then automatically moves to the second field in the date (day or month, depending on the date format). Proceed with the next two fields as with the first.

## Setting the Time

- Press the SETUP key.
- Press the "Instrument Setup" softkey.

The R&S FSC opens a list of general settings.

Date and Time	
Set Date	15/12/2009
Set Time	15:44:13

- Select the "Set Time" menu item below the heading "Date And Time" with the rotary knob or the cursor keys (▼ or ▲).

- Confirm with ENTER.

The currently set time appears in "hours:minutes" format in the input field.

- Change the hours with the rotary knob, the cursor keys or by numeric input.
- Confirm with ENTER.

After input, the cursor automatically moves to the minutes display. Input is identical to the procedure for setting the hour display.

After the minutes have been entered, the R&S FSC verifies the validity of the entered time. If the time is not valid, the R&S FSC sets the next valid time.

## Self Alignment

The self alignment calibrates the instrument settings for network analyzer and overrides the manufacturer's calibration stored in the instrument.

For the self alignment you need a through connection with the appropriate cable and a 50 Ohm termination.

- Press the SETUP key.
- Press the "Instrument Setup" softkey.

The R&S FSC opens a list of general settings.

Self Alignment	
Self Alignment	
Last Alignment Date	22/01/2009

- ▶ Select the SELF ALIGNMENT menu item with the rotary knob or the cursor keys (▼ or ▲).
- ▶ Confirm with ENTER.

A warning is shown:

<b>! Warning !</b>
<b>Self Alignment overwrites the factory calibration data.</b>
<b>Are you sure?</b>
<b>Press YES to continue, press NO to cancel</b>

Pressing YES will perform the self alignment.

Pressing NO discards this action. Follow the instructions displayed on the screen.

## 2.3 Setting up a LAN Connection

The powerful R&S FSCView software is available to document measuring results, create limit lines, channel tables, etc. The software is supplied with the R&S FSC. Connection to a PC is possible via either LAN or USB. The following description covers the main steps for setting up the connection between the R&S FSC and the R&S FSCView software.

The R&S FSCView software must be installed on the PC before the connection is made. To do this, place the CD-ROM supplied in the CD drive. From the autostart menu select menu item "FSCView" to install the software. Follow the instructions on the screen.



### Unsuccessful connection

If no connection can be established between the R&S FSCView software and the R&S FSC following successful configuration, please check the firewall settings on your PC.

### 2.3.1 Direct Connection via LAN

Connect the R&S FSC directly to the PC with the LAN cable supplied. The R&S FSC LAN interface is situated on the rear panel (see [Rear View](#)).

DHCP is switched on by default on the R&S FSC. DHCP on the R&S FSC must be switched off for a direct connection.

- ▶ Press the SETUP key.
- ▶ Press the "Instrument Setup" softkey.

The R&S FSC opens a list of general settings.

LAN Port	
MAC Address	00-90-b8-18-81-2d
DHCP	Off
IP Address	Off
Subnet Mask	On

- ▶ Select the "DHCP Mode" menu item below the heading "LAN Port" with the rotary knob or the cursor keys (▼ or ▲) and confirm with ENTER.

A list opens.

## Setting up a LAN Connection

- Select "Off" with the rotary knob or the cursor keys (▼ or ▲) and confirm with the ENTER key.

DHCP is now deactivated.

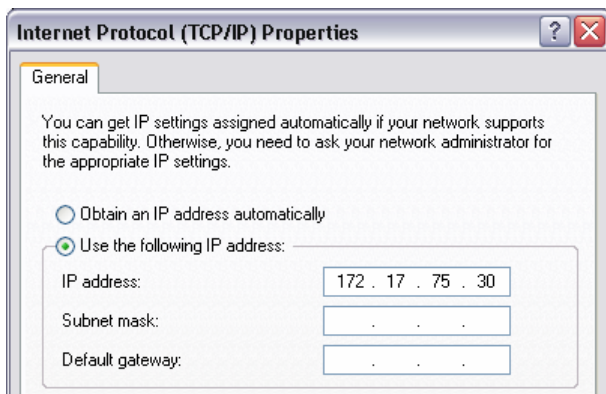
### Setting the IP Address

To establish the connection, the IP address of the PC used and that of the R&S FSC must be identical, except for the digits following the last dot.

Example:

IP address of the PC: 172.76.68.30

IP address of the R&S FSC: 172.76.68.24



**Figure 2-1: IP address of the PC**

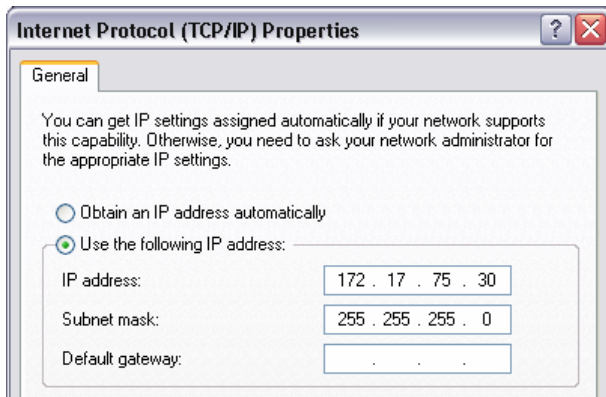
- Select the "IP Address" menu item from the list under the heading "LAN Port" with the rotary knob or the cursor keys (▼ or ▲) and confirm with ENTER.
- An input field opens. Enter the IP address of the PC (e.g. 172.76.68.24) with the numeric keys and confirm with the ENTER key.

LAN Port	
MAC Address	00-90-b8-18-81-2d
DHCP	Off
IP Address	172.17.75.1
Subnet Mask	255.255.255.0

**Figure 2-2: IP address of the R&S FSC**

## Setting the Subnet Mask

The PC's and the R&S FSC's subnet mask must also match in order to make a connection.



**Figure 2-3: Subnet Mask of the PC**

- ▶ Select the "Subnet Mask" menu item from the list below the heading "LAN Port" with the rotary knob or the cursor keys (▼ or ▲) and confirm with ENTER.
- ▶ An input field opens. Enter the subnet mask used on the PC, e.g. 255.255.255.0 with the numeric keys and confirm with the ENTER key.

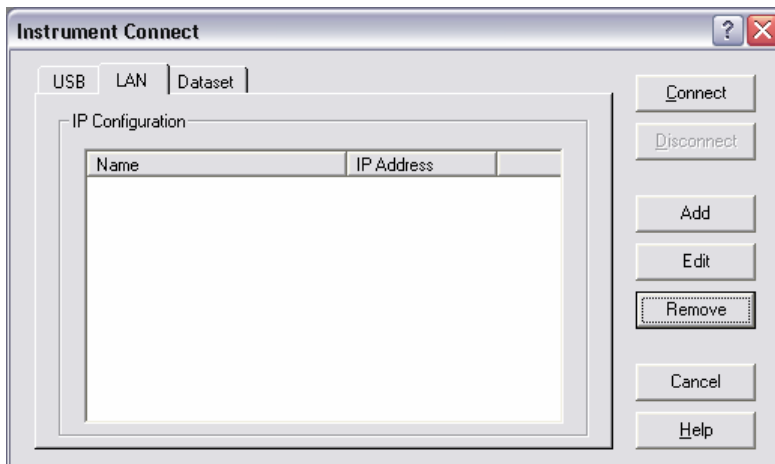
LAN Port	
MAC Address	00-90-b8-18-81-2d
DHCP	Off
IP Address	172.17.75.1
Subnet Mask	255.255.255.0

**Figure 2-4: Subnet Mask on the R&S FSC**

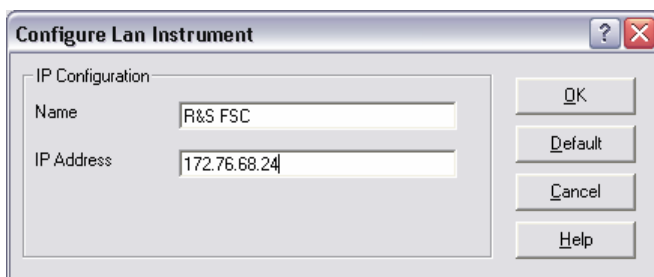
## R&S FSCView Software Configuration

- ▶ Start the R&S FSCView software on the PC.
- ▶ Select the LAN tab in the "Instrument Connect" dialog window.
- ▶ Click Add to create a new network connection.

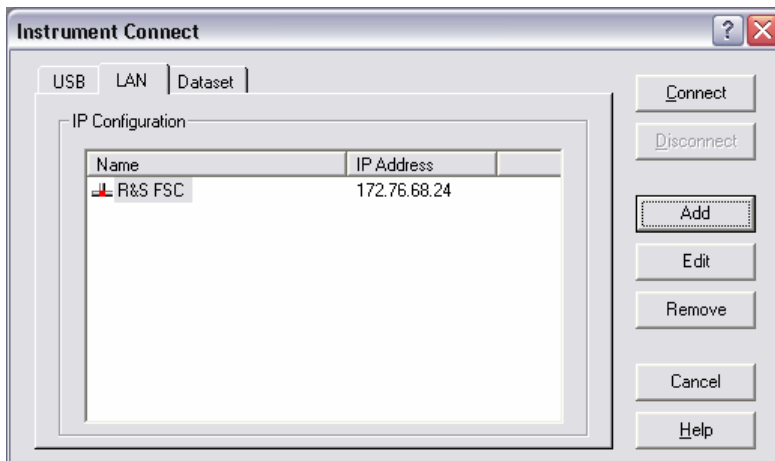
## Setting up a LAN Connection



- ▶ Enter the name for the new network connection in the open window, e.g. R&S FSC.
- ▶ Enter the IP address set for the R&S FSC in the IP Address input field, in this case 172.76.68.24, and confirm with OK.



The connection is now configured and appears in the "Instrument Connect" window.



Select the new connection named "R&S FSC" and make the connection to the R&S FSC with "Connect".

## 2.3.2 Connection via an existing LAN network

The R&S FSC's IP address can be automatically drawn from the DHCP server, or a fixed address can be defined manually. With manual allocation, a fixed IP address and subnet mask must be assigned to the R&S FSC as described in the chapter on direct LAN connection. The R&S FSCView software must then be configured as described with the assigned IP address.



### IP Address

Contact your IT system manager to obtain a free IP address.

In networks with a DHCP server, the Dynamic Host Configuration Protocol (DHCP) permits automatic allocation of the network configuration to the R&S FSC connected via LAN cable. For this purpose, DHCP must be active on the R&S FSC.

DHCP is switched on by default on the R&S FSC. If the setting has been altered, proceed as follows:

- ▶ Press the SETUP key.
- ▶ Press the "Instrument Setup" softkey.

The R&S FSC opens a list of general settings.

LAN Port	
MAC Address	00-90-b8-18-81-2d
DHCP	On
IP Address	0.0.0.0
Subnet Mask	0.0.0.0

- ▶ Select the "DHCP Mode" menu item below the heading "LAN Port" with the rotary knob or the cursor keys (▼ or ▲) and confirm with ENTER.

A dropdown menu opens.

- ▶ Select ON with the rotary knob or the cursor keys (▼ or ▲) and confirm with ENTER.

DHCP is now active.

The R&S FSC is now allocated an IP address and the subnet mask by the DHCP server. This can take several seconds. The values then appear under "IP Address" and "Subnet Mask" under the "LAN Port" heading.



**Example:**

IP Address: 172.17.75.1  
Subnet Mask: 255.255.255.0

The R&S FSCView software must then be configured as described in the chapter on direct LAN connection.

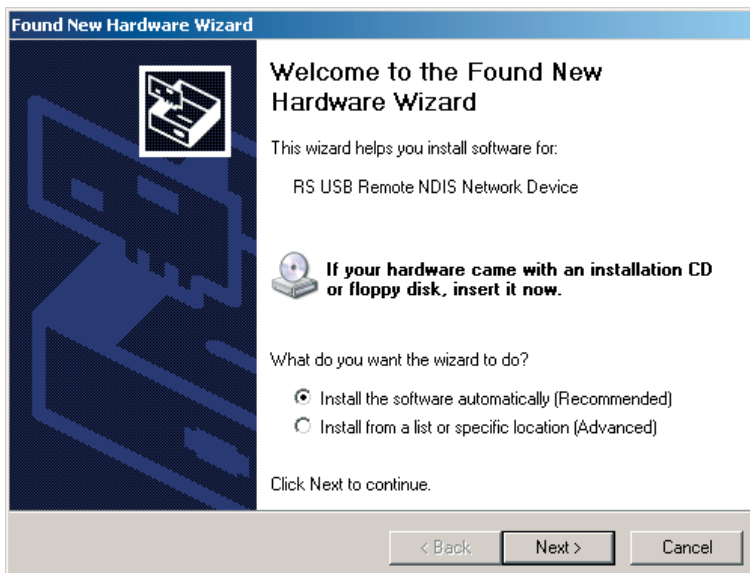
**IP adress and subnet mask usage**

The IP address and subnet mask assigned by the DHCP server must then be used to create a new LAN connection.

### 2.3.3 Connection via USB

- ▶ Switch on the R&S FSC.
- ▶ Connect the R&S FSC directly to the PC with the USB cable supplied. The R&S FSC USB interface is situated on the left side under a protective cap (see also the chapter on spectrum analyzer connections).

When connected for the first time, the wizard for finding new hardware appears on the PC screen.



- ▶ Select "Install The Software Automatically (Recommended)".
- ▶ Confirm with NEXT.

**Install R&S FSCView**

The R&S FSCView software must be installed on the PC. Only then can the hardware wizard find the necessary drivers for the USB connection.

After a few seconds, the wizard reports that the software for the new hardware has been installed.

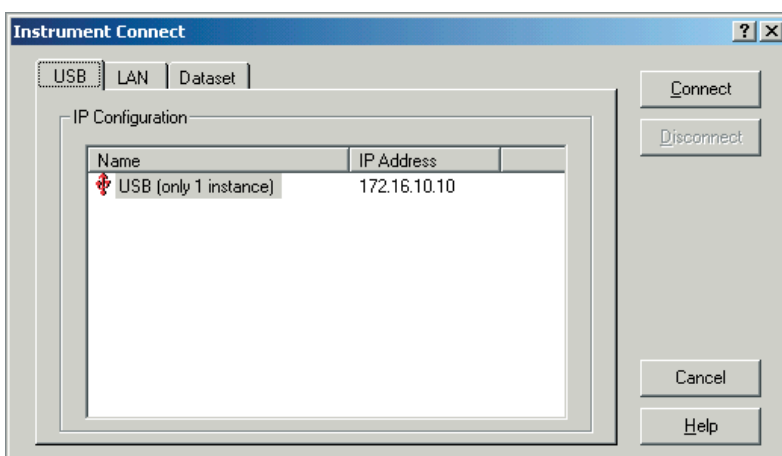


- Click "Finish" to finish the installation.

The connection is now set up.

- Open the R&S FSCView software on the PC.

The "Instrument Connect" dialog opens.



- Select the "USB" tab in the "Instrument Connect" dialog.

## Setting up a LAN Connection

- ▶ Select the R&S FSC connection.
- ▶ Click "Connect".

**Fixed IP address**

The R&S FSC internally emulates a LAN connection. The IP address displayed by R&S FSCView for the USB connection is for information only. It is fixed to 172.16.10.10 and cannot be changed in R&S FSCView or the instrument.

## 3 Firmware Update

The firmware update file for the R&S FSC is one file with the name FSC\_V1\_xx.EXE from the Rohde & Schwarz web page.

### 3.1 Preparing the Installation

In order to update the R&S FSC after downloading the FSC\_V1\_xx.EXE installation file, a memory stick is required.

#### Make a backup of datasets, screenshots and modified files

Before you start the firmware update, make sure that you make a backup with R&S FSCView of all datasets and screenshots that you previously stored on the R&S FSC. The same holds true for all channel tables, standards, limit lines, transducer factors and cable models which you created or modified. The factory preset necessary to complete the firmware update procedure will otherwise erase or overwrite the files.

#### Preparing the installation files

1. Connect the memory stick to your PC via the USB interface and wait until Windows has identified the memory stick as a new volume (e.g. D:)
2. Copy FSC\_V1\_xx.EXE into the root directory of the memory stick, e.g. D:\R&S\_FSC
3. Execute FSC\_V1\_xx.EXE. The self-extracting .ZIP file will be unpacked.

The memory stick should now contain the following files:

- bootloader\_FSC\_V1\_xx.bin
- osimage\_FSC\_V1\_xx.bin
- updater\_FSC\_V1\_xx.bin
- splashscreen\_FSC.bmp
- FSC\_V1\_xx.EXE



#### Using a memory stick

Make sure that only one file version is present on the memory stick. The update mechanism rejects the memory stick if it detects two versions of the same file. (e.g. bootloader\_FSC\_V1\_01.bin and bootloader\_FSC\_V1\_20.bin) in the root directory and will abort the update at a later point.

**Prepare the instrument**

1. Switch the instrument OFF.
2. Connect the memory stick to the USB interface of the R&S FSC.

## 3.2 Performing the Firmware Update on the R&S FSC

The firmware update process is performed by the following steps:

1. Press the keys PRESET and 8 on the numeric keypad simultaneously.
2. Switch the instrument on and keep PRESET and 8 pressed for at least 5 seconds after the startup screen has appeared on the screen.
3. Release the keys PRESET and 8.
4. The R&S FSC will continue its boot process and after a couple of seconds the following information will appear on the screen:

---

**Instrument Firmware Update**

Searching for storage device ... OK

Searching for updater \*.bin ... Found updater \_FSC\_V1\_xx.bin

Checking updater \_FSC\_V1\_xx.bin: ... OK

Update instrument to software version V1.xx

Press [ENTER] to update the firmware.

Press [CANCEL] to abort firmware updating.

---

5. Press ENTER to start the firmware update process.

The instrument will perform the firmware update. This will take about 5 minutes. The progress of the update will be displayed in a sequence of messages on the screen.

---

**NOTICE****Possible data loss**

Do not switch the instrument off during the update process in order to avoid data corruption of the internal flash memory!

---

## Performing the Firmware Update on the R&amp;S FSC

As soon as the firmware update is completed, the R&S FSC will display the following message at the bottom of the screen:

---

Firmware updating is successfully completed.

Please switch off the instrument.

---

6. Switch the instrument off and on again.

The R&S FSC will boot with the new firmware version.

7. After the boot process is completed, press the SETUP key and enter the instrument setup dialog with the "Instrument Setup" softkey. Select "Reset To Factory Settings" by moving the cursor down the list with the cursor keys or the rotary knob. Confirm the selection with ENTER, and reconfirm with "Yes" when prompted.

Be patient: the subsequent reset and reboot process will take about a minute to complete.

**Updating channel tables, cable models and transducer factors**

Restoring the factory settings is necessary to update the pre-installed channel tables, cable models and transducer factors. If this step is omitted, bugfixes and updates to these pre-installed files will not be installed.

## 4 Getting Started

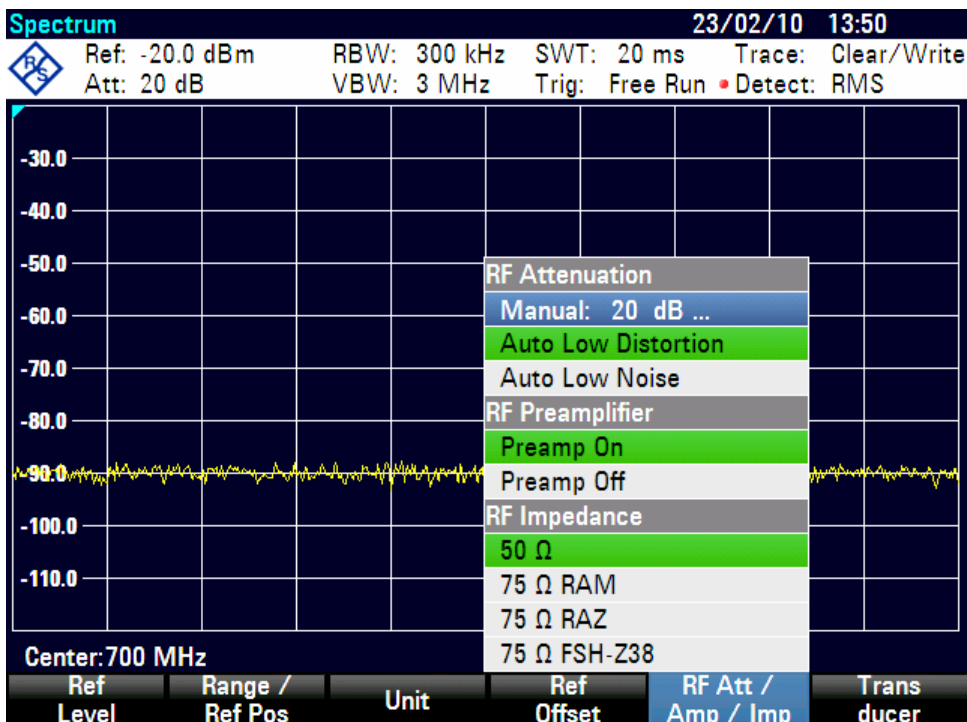
This section explains the basic operation of the Handheld Spectrum Analyzer R&S FSC using some simple measurements as examples. A more detailed description of operation and functions, such as selecting menus and setting measurement parameters, is given in section 4 of the manual on the CD-ROM.

### 4.1 Controlling the RF Attenuator

Depending on the selected reference level, the R&S FSC sets the attenuator on the RF input to a suitable value. It offers two modes: one for the highest possible sensitivity (auto low noise) and one for the lowest possible intermodulation products (auto low distortion). The difference between the two modes is that the attenuation that the R&S FSC sets for the RF attenuator is 5 to 10 dB higher for auto low distortion than for auto low noise. The default setting is auto low distortion.

Refer to the operating manual for a table that shows the setting for the RF attenuator as a function of the reference level.


- ▶ Press the AMPT key.
- ▶ Press the "Rf Att/Amp/Imp" softkey.



## Controlling the RF Attenuator

- ▶ Select either "Auto Low Noise" or "Auto Low Distortion" with the rotary knob or the cursor keys.
- ▶ Confirm with ENTER or the "Rf Att/Amp/Imp" softkey.

The current attenuation value for the RF attenuator is displayed in the status bar (Att: caption).



Ref: -10.0 dBm	RBW: 300 kHz	SWT: 100 ms	Trace: Clear/Write
• Att: 0 dB	VBW: 300 kHz	Trig: Free Run	Detect: RMS

To set the attenuator manually, proceed as follows:

- ▶ Press the AMPT key.
- ▶ Press the "Rf Att/Amp/Imp" softkey.
- ▶ Select the "Manual: xx dB" menu item with the rotary knob or the cursor keys.
- ▶ Confirm with ENTER.

The current attenuation value of the attenuator is displayed in the input field. This value can be changed with the rotary knob or the cursor keys in 5 B steps within the 0 dB to 40 dB range. The desired value can also be entered directly via the numeric keypad.

- ▶ Confirm the input of the attenuation value with ENTER.

The attenuation you have set is displayed in the status bar. A red dot is placed at the "Att:" caption in the status bar to indicate that the attenuation has been set manually.

To reactivate automatic attenuator setting as described, select either "Auto Low Noise" or "Auto Low Distortion".



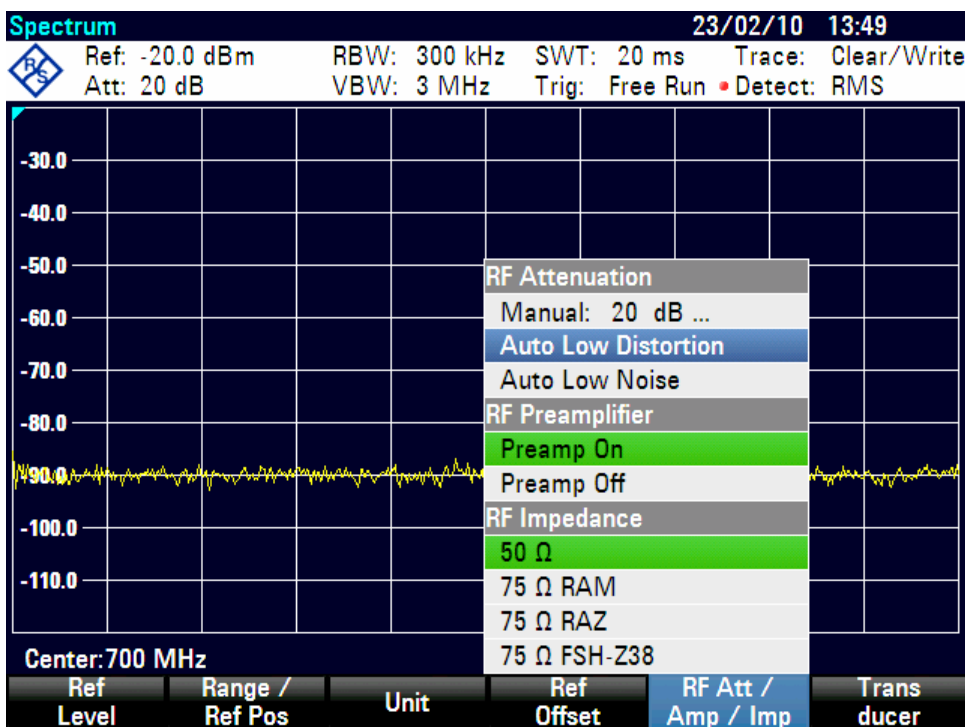
## 4.2 Using a Preamplifier (Option R&S FSC-B22)

The R&S FSC-B22 is a preamplifier for increasing sensitivity. Depending on the frequency, this amplifier has 15 dB to 20 dB gain and increases sensitivity by 10 dB to 15 dB.

- ▶ Press the AMPT key.
- ▶ Press the "Rf Att/Amp/Imp" softkey.

The R&S FSC changes to the submenu for configuring the preamplifier. The green selection bar displays the current setting.

- ▶ Select the desired setting in the "Rf Preamplifier" submenu with the rotary knob or the cursor keys (Preamp On or Preamp Off).



- ▶ Confirm with ENTER or the "Rf Att/Amp/Imp" softkey.

If the preamplifier is switched on, its use is coupled to the reference level, thus ensuring the optimum dynamic range of the R&S FSC at all times. The table below shows the positions of the RF attenuator and the preamplifier as a function of the reference level.

## Using a Preamplifier (Option R&amp;S FSC-B22)

Reference Level	Preamplifier OFF		Preamplifier ON	
	RF attenuation		RF attenuation	
	Low Noise	Low Distortion	Low Noise	Low Distortion
≤ -30 dBm	0 dB	0 dB	0 dB	0 dB
-29 bis -25 dBm	0 dB	0 dB	0 dB	5 dB
-24 bis -20 dBm	0 dB	0 dB	0 dB	10 dB
-19 bis -15 dBm	0 dB	5 dB	5 dB	15 dB
-14 bis -10 dBm	0 dB	10 dB	10 dB	20 dB
-9 bis -5 dBm	5 dB	15 dB	15 dB	25 dB
-4 bis 0 dBm	10 dB	20 dB	20 dB	30 dB
1 bis 5 dBm	15 dB	25 dB	25 dB	35 dB
6 bis 10 dBm	20 dB	30 dB	30 dB	40 dB
11 bis 15 dBm	25 dB	35 dB	35 dB	40 dB
16 bis 20 dBm	30 dB	40 dB	40 dB	40 dB
21 bis 25 dBm	35 dB	40 dB	40 dB	40 dB
26 bis 30 dBm	40 dB	40 dB	40 dB	40 dB

## 4.3 Measurements on CW Signals

A basic task performed by spectrum analyzers is measuring the level and frequency of sinewave signals. The following examples illustrate the most effective way of performing these measurements with the R&S FSC.

A signal generator is used as a signal source, e.g. the Signal Generator R&S SMC

### Measurement setup

- Connect the RF output of the signal generator to the RF input of the R&S FSC.

Signal generator settings:

Frequency: 700 MHz

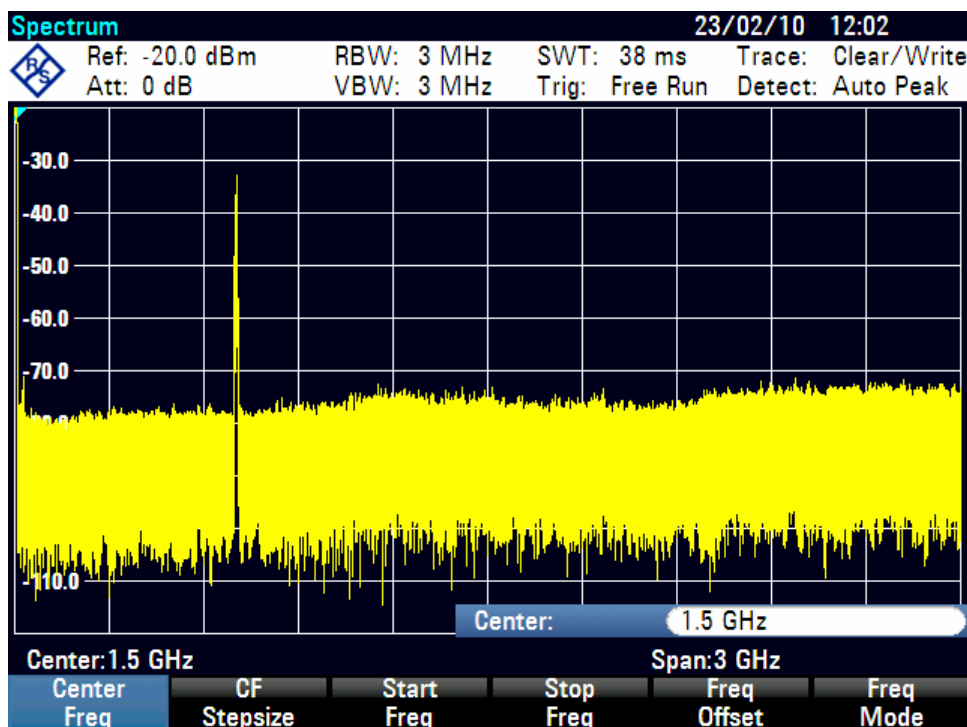
Level: -30 dBm

### 4.3.1 Level Measurement

First, set the R&S FSC to its default settings to show all the operating steps that are required.

- Press the PRESET key.

The analyzer displays the frequency spectrum over the R&S FSC's maximum frequency span. At 700 MHz, the generator signal is displayed as a vertical line.

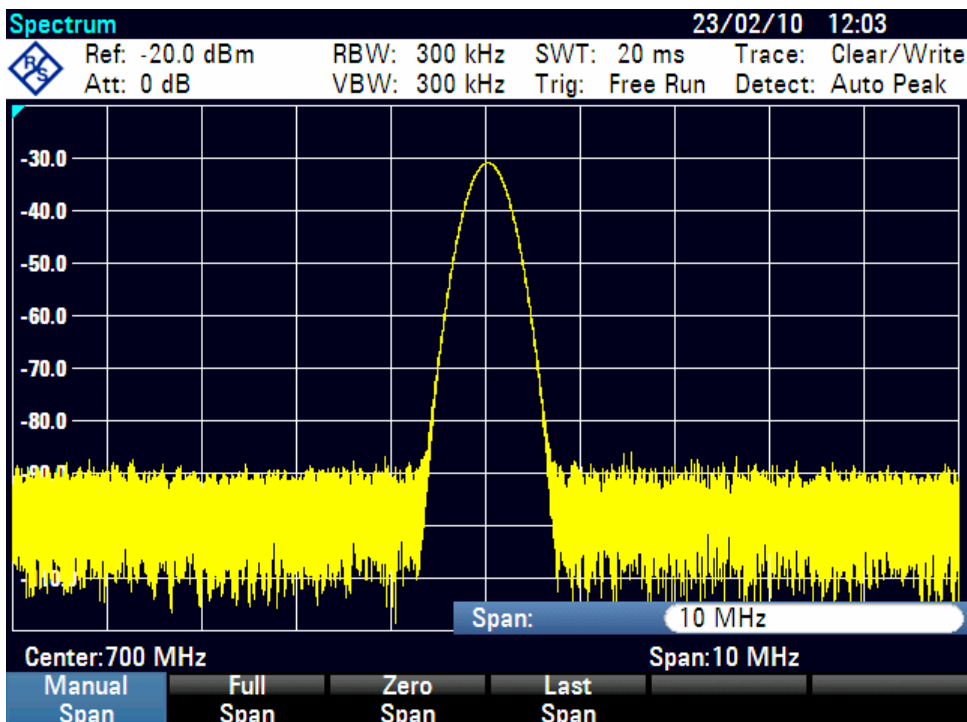


## Measurements on CW Signals

To analyze the generator signal at 700 MHz in more detail, reduce the frequency span. Set the R&S FSC's center frequency to 700 MHz and reduce the span to 10 MHz.

- ▶ Press the FREQ key.
- ▶ Enter '700' using the numeric keypad and confirm the entry with the MHz key.
- ▶ Press the SPAN key.
- ▶ Enter '10' using the numeric keypad and confirm the entry with the MHz key.

The R&S FSC now displays the generator signal with a higher resolution.



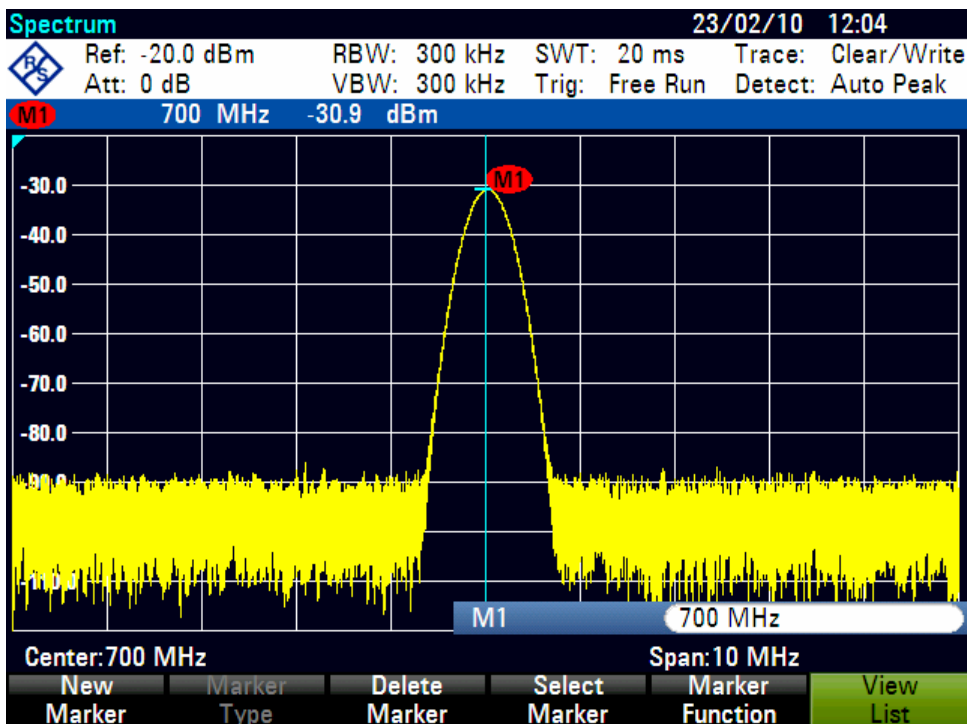
The R&S FSC has markers for reading off signal levels and frequencies. Markers are always positioned on the trace. Both the level and frequency at their current positions are displayed on the screen.

- ▶ Press the marker key.

The marker is activated and is automatically positioned on the trace maximum. A vertical line on the measurement diagram indicates the marker frequency. A short horizontal line on the trace indicates the level.

The R&S FSC displays the level and the frequency of the marker position numerically above the measuring screen.

## Measurements on CW Signals



### 4.3.2 Setting the Reference Level

The level shown by spectrum analyzers at the top of the measurement diagram is called the reference level. To obtain the best dynamic range from a spectrum analyzer, its full level range should be used. This means that the maximum spectrum level should be at or close to the top of the measurement diagram (= reference level). The reference level is the maximum level on the level axis (y axis).

Reduce the reference level by 10 dB to increase the dynamic range.

- Press the AMPT key.

The softkeys for the AMPT menu are displayed and the "Ref Level" softkey label is highlighted in red, i.e. it is enabled for value entry. The red value entry box at the bottom right-hand corner of the measurement diagram displays the current reference level.

- Enter '30' using the numeric keypad and confirm the entry with the '-dBm' key.

The reference level is now set to -30 dBm. The maximum trace value is close to the maximum scale value of the measurement diagram. The increase in the displayed noise floor is minimal. The difference between the signal maximum and the displayed noise (i.e. the dynamic range) has, however, been increased.

Using markers is also an effective way to shift the trace maximum so that it coincides with the top of the measurement diagram. If the marker is positioned on the trace maximum (as in the example), the reference level can be set to the marker level by entering the following keystrokes:

- ▶ Press the MARKER-> key.
- ▶ Press the "Center=Mkr/Level" softkey.
- ▶ Select "Level=Marker Level" in the selection box by using the rotary knob or the cursor keys (▼ or ▲).
- ▶ Press the ENTER key.

The reference level is then set to the measured level indicated by the marker. Only a few keystrokes are needed to set the optimal reference level.

### 4.3.3 Frequency Measurements

The R&S FSC's trace displays 631 measurement points (frequency points). The marker is always positioned on one of these measurement points. The R&S FSC calculates the marker frequency from the measurement point frequency, and the center frequency and frequency span that have been set. The measurement-point resolution, and consequently the accuracy of the marker frequency readout, therefore depend on the frequency span that has been selected.

The R&S FSC has a frequency counter to increase the accuracy of the marker-frequency readout. It stops the sweep at the marker position, counts the frequency and then continues the sweep.

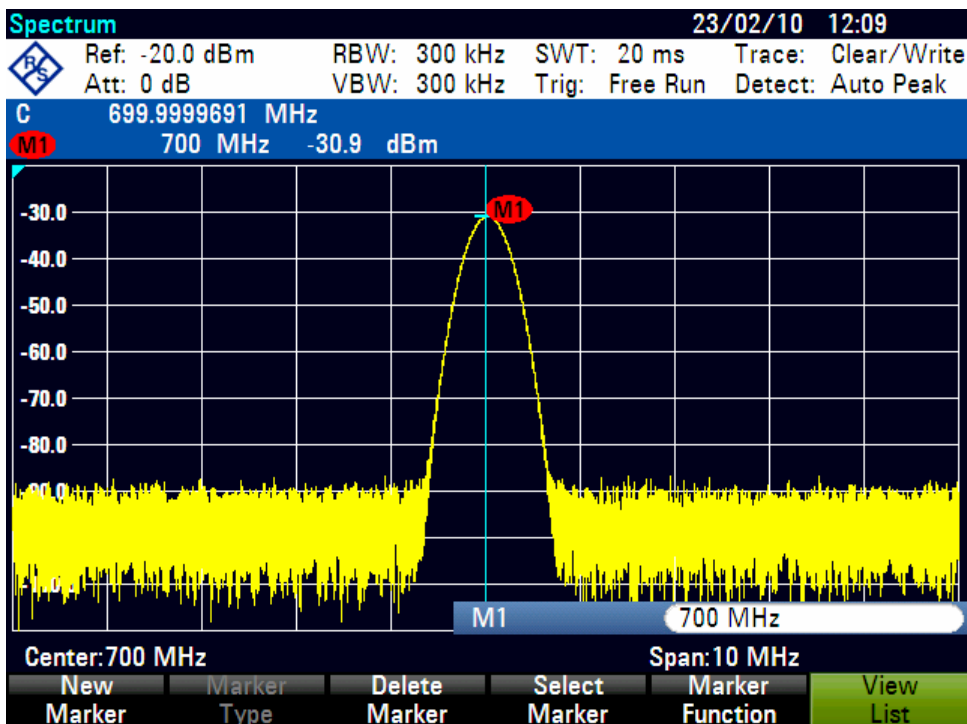
The following measurement example is based on the previous example.

- ▶ Press the "Marker Function" softkey in the marker menu.
- ▶ Select the "Frequency Count" menu item with the rotary knob or the cursor keys (▼ or ▲)
- ▶ Press the ENTER key.

The label 'M:' at the upper left-hand corner of the measurement diagram changes to 'C:' to tell you that the frequency counter has been switched on. The resolution of the frequency readout is now 1 Hz no matter what span has been set.

- ▶ The accuracy is determined by the R&S FSC's internal reference frequency. It is far higher than that of pixel-oriented, marker-frequency readout.

## Measurements on CW Signals



#### 4.3.4 Harmonic Measurements of a Sinewave Signal

Since a spectrum analyzer can resolve different signals in the frequency domain, it is ideal for measuring harmonic levels or harmonic ratios. To speed up these operations, the R&S FSC has marker functions that deliver fast results with only a few keystrokes.

As above, a signal generator with a 100 MHz output frequency and an output level of -20 dBm is used in the following measurement example.

First, the R&S FSC is set to its default settings to show all measurement steps that are needed.

- Press the PRESET key.

The analyzer displays the frequency spectrum from the largest available span. At 100 MHz, the generator signal is displayed as a line. The generator harmonics are displayed as lines at frequencies that are multiples of 100 MHz.

To measure the second harmonic ratio, set the start and stop frequency as follows:

- Press the FREQ key.  
The softkey menu opens entering the frequency.
- Press the "Start Freq" softkey.
- Enter '50' using the numeric keypad and confirm the entry with the MHz key.

## Two-Port Measurements with the Tracking Generator

- ▶ Press the "Stop Freq" softkey.
- ▶ Enter '250' using the numeric keypad and confirm the entry with the MHz key.

The R&S FSC now displays the spectrum from 50 MHz to 250 MHz and thus the signal at 100 MHz and its second harmonic at 200 MHz.

To measure the harmonic ratio, set the marker on the fundamental and the delta marker on the second harmonic.

- ▶ Press the MARKER key.

The softkey menu opens for marker entry and automatically positions the main marker on the trace maximum.

- ▶ Press the "New Marker" softkey.

The delta marker is activated (vertical dotted line) and is automatically placed on the next trace maximum (= second harmonic). The harmonic ratio in dB is displayed at the top of the screen.

## 4.4 Two-Port Measurements with the Tracking Generator

For measurements of the gain or attenuation of four-port devices, the R&S FSC (models .13 and .16) provides a tracking generator which generates a sinewave signal exactly at the receive frequency of the R&S FSC.

- ▶ Press the MODE key.
- ▶ Press the "Network Analyzer" softkey.

The R&S FSC changes to network analyzer mode and switches on the tracking generator. Since no calibration is performed, (Uncal) is displayed at the top.

Before calibration, the span you want should be set because calibration is valid only for the calibrated span.

- ▶ Press the FREQ key.

Using the numeric keys, enter the center frequency.

- ▶ Press the SPAN key.
- ▶ Using the numeric keys, enter the span.

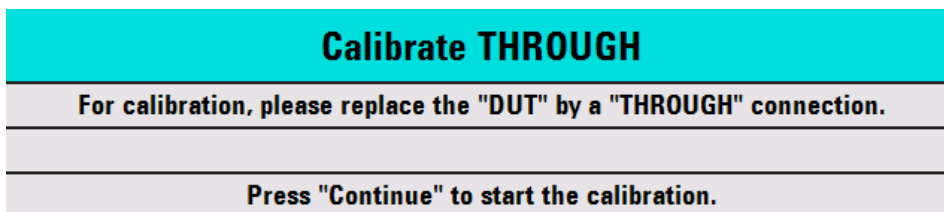
Alternately, the start and stop frequencies can be entered using the "Start Freq" and "Stop Freq" softkeys in the frequency menu.



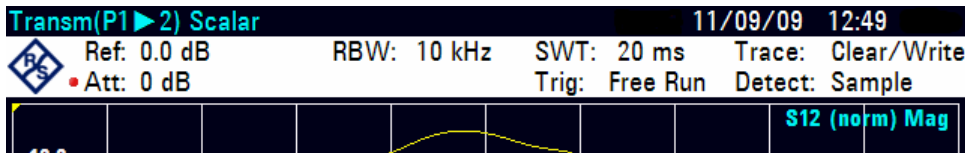
#### 4.4.1 Calibrating the R&S FSC for Scalar Measurement of the Transmission Function

The following example shows a scalar measurement of the transmission function.

- ▶ Press the MEAS key.
- ▶ Press the "Calibrate" softkey in the main menu for the network analyzer.  
The R&S FSC requests that the RF input be connected to the tracking generator output for directional calibration.
- ▶ Connect the GEN Output port to the RF Input port directly with a measuring cable without a device under test.
- ▶ Press "Continue" to start the calibration.



After the calibration is finished, the R&S FSC displays S12 (norm) in the status line.

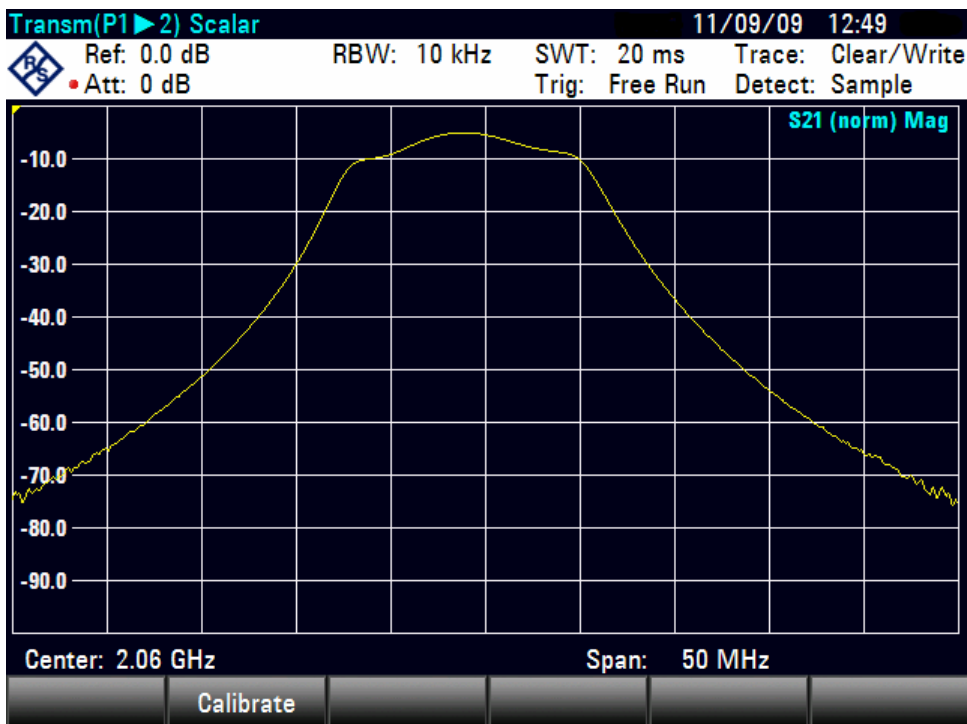


#### 4.4.2 Measure the magnitude of the transfer function

Connect the DUT between the RF input and the generator's output.

The R&S FSC displays the magnitude of the transfer function. You can read out values with the markers, for example.

## Two-Port Measurements with the Tracking Generator



The calibration for the transmission measurement is not lost if the start, stop frequency, the center frequency and the span are subsequently changed within the calibrated frequency domain. In this case, the R&S FSC interpolates the correction data between the reference points of the calibration. In this case, the R&S FSC displays (Interp) in the status line and indicates the possibly increased measurement error. If the modified frequency domain lies outside the calibrated frequency range, the calibration becomes invalid and (Uncal) is displayed in the status line. To restore the last valid calibration, proceed as follows:

- ▶ Press the "Calibrate" softkey in the main menu for the network analyzer.
- ▶ Select "Restore Calibration Settings" with the rotary knob or the cursor keys (▼ or ▲).

The R&S FSC restores all instrument settings which were used at the time of the last calibration. The calibration is reactivated and (Cal) is displayed at top left.

When a data record for scalar transmission measurement in calibrated state is saved, the R&S FSC also discards the calibration data with the remaining settings. This means that it is possible to measure without first having to recalibrate after the settings have been restored.

## 4.5 Saving and Recalling Settings and Test Results

The R&S FSC can store measuring results and settings in the internal memory or on a memory stick. Results and settings are always stored together, allowing them to be interpreted in context when recalled. The R&S FSC can store at least 100 data records in the internal memory which are differentiated by their names. A memory stick can be used as a memory extension via the USB connection or for data transfer to a PC without a direct LAN or USB connection.

### 4.5.1 Saving Measurement Results

- ▶ Press the SAVE / RCL key.
- ▶ Press the Save softkey.

You are prompted to enter a name for the data set to be saved. The name for the most recently stored data set is suggested in the 'Save as:' entry box, which is highlighted in blue. When you press the ENTER key or the SAVE softkey a second time, the data set is saved under the suggested name.

- ▶ Press the "Internal/USB" softkey to switch between saving data on the internal memory or a memory stick.

Save Dataset		15/12/09 14:06		
Stat	Name	Size	Date	Time
◀	\Public\Datasets\..			
	Dataset001.set	47 kB	15/12/2009	14:06
	Dataset002.set	47 kB	15/12/2009	14:06
	Dataset003.set	47 kB	15/12/2009	14:06

Save as:	Dataset004	Free: 15 MB
Save	Sort/ Show	Internal/ USB
		Exit

## Saving and Recalling Settings and Test Results

An existing data record can be selected from the list using the rotary knob or the cursor keys (▼ or ▲). This data record is transferred to the input field by pressing the ENTER key. This can then either be overwritten with the current data or saved under a modified name.

A new name can be entered via the alphanumeric keypad. Enter the letter above the key by pressing the key the appropriate number of times. The number of free memory locations (Free) is also displayed.

- ▶ Enter a name for the data set using the numeric keypad.
- ▶ Confirm with ENTER.

The data record is stored under the name specified in the internal R&S FSC CMOS-RAM or on a memory stick.

The name of an existing data set can be edited with the cursor keys. It is therefore not necessary to fully enter the name of a new data set.

- ▶ Press the "Save" softkey.

The R&S FSC suggests a name for the data set to be saved.

- ▶ Press a cursor key (▼ or ▲).

A vertical cursor is positioned at the end of the name for the data set.

Save Dataset			15/12/09 14:08	
Stat	Name	Size	Date	Time
⏏	\Public\Datasets\..			
	Dataset001.set	47 kB	15/12/2009	14:06
	Dataset002.set	47 kB	15/12/2009	14:06
	Dataset003.set	47 kB	15/12/2009	14:06
	Dataset004.set	47 kB	15/12/2009	14:07

Save as:	Dataset005	Free: 15 MB
Save	Sort/ Show	Internal/ USB
		Exit

- ▶ Use the '◀' key to move the cursor to the left.
- ▶ Use the '▶' key to move the cursor to the right.

## Saving and Recalling Settings and Test Results

- ▶ Insert a new letter or number at the cursor position using the alphanumeric keypad.
- ▶ Press the BACK key to delete the letter or digit to the left of the cursor.

## 4.5.2 Recalling Measurement Results

Use the R&S FSC's recall function to review previously saved measurement results and settings.

- ▶ Press the SAVE / RCL key.
- ▶ Press the "Recall" softkey.

A list of all saved data sets opens. If you'd like to load a measuring result from a memory stick, press the "Internal/USB" softkey. All data records on the memory stick are displayed.

- ▶ Select a data set from the list using the rotary knob or the cursor keys (▼ or ▲).  
Confirm your selection by pressing the "Recall" softkey.

Recall Dataset			15/12/09 14:08	
Stat	Name	Size	Date	Time
⏏	\Public\Datasets\..			
	Dataset001.set	47 kB	15/12/2009	14:06
	Dataset002.set	47 kB	15/12/2009	14:06
	Dataset003.set	47 kB	15/12/2009	14:06
	Dataset004.set	47 kB	15/12/2009	14:07
Free: 15 MB				
View	Recall	Sort/ Show	Internal/ USB	Exit

# Index

AC Connection.....	23	Hcopy Key.....	9
AC Power Supply.....	17	IF Output.....	18
Accessories.....	22	IP Address.....	34
AF Output.....	15	Key Click Volume.....	28
Alphanumeric Keys.....	10	LAN Connection.....	19, 33
Ampt Key.....	9	Language.....	29
Audio Settings.....	28	Lines Key.....	10
Back Key.....	10	Meas Key.....	10
BW Key.....	9	Mkr Key.....	10
Cancel Key.....	10	Mode Key.....	9
Connectors		On Off Key.....	9
AC Power Supply.....	17, 23	Power Switch.....	17
AF Output.....	15	Preamplifier.....	46
DC Connection.....	17, 23	Preset Key.....	9, 26
External Reference.....	17	Rear View.....	16
External Trigger.....	17	Recalling Results.....	58
Front Panel.....	13	Regional Settings.....	29
IF Output.....	18	Reset.....	26
LAN Connection.....	19, 33	RF Input.....	13
RF Input.....	13	Save / Recall Key.....	9, 56
Tracking Generator Output.....	14	Saving Results.....	56
USB Interface.....	15, 19, 38	Scalar Measurements.....	53
Video Out.....	18	Screen Layout.....	11
Conventions.....	5	Self Alignment.....	31
Cursor Keys.....	10	Setup Key.....	9
Date.....	30	Softkey States.....	13
Date Format.....	30	Softkeys.....	12
DC Connection.....	17, 23	Span Key.....	9
Diagram Header.....	12	Subnet Mask.....	35
Enter Key.....	10	Sweep Key.....	9
External Reference.....	17	System beeper Volume.....	28
External Trigger.....	17	Time.....	31
Factory Reset.....	26	Trace Key.....	9
Firmware Update.....	41	Tracking Generator.....	53
Freq Key.....	9	Tracking Generator Output.....	14
Front View.....	7	Unit Keys.....	10
Function Keys.....	9	USB Interface.....	15, 19, 38
Hardware Settings.....	12, 27	Video Out.....	18