Operating Manual

Spectrum Analyzer R&S®FS300

Order No. 1147.0991.03

Chapter Overview

General	**Content of the Manual for Spectrum Analyzer R&S FS300**
	Data Sheet
	Safety Instructions
	Certificate of Quality
	EC Certificate of Conformity
	Customer Support
	List of Rohde & Schwarz Offices
Chapter 1	**Introduction**
Chapter 2	**Control Elements**
Chapter 3	**Putting the R&S FS300 into Operation**
Chapter 4	**Getting Started - Measurement Example**
Chapter 5	**Manual Operating Concept**
Chapter 6	**Using the R&S FS300**
Chapter 7	**Remote Control/PC Software FS300-K1**
Chapter 8	**Instrument Interfaces**
Chapter 9	**Error Messages**
Chapter 10	**Index**

Content of the Manual

Operating Manual

Introduction   This operating manual provides information about:

- Technical characteristics of the instrument
- Putting into operation
- Basic operating procedures and control elements
- Operation via menus and remote control

By way of an introduction, a typical R&S FS300 measurement is described.

The operating manual also contains information about maintenance and troubleshooting based on the warnings and error messages issued by the instrument.

Table of Contents

Data Sheet

📄 **Note**	For the R&S FS300 a calibration cycle of 1 year is recommended.

Frequency

Frequency range		9 kHz to 3 GHz
Reference frequency		
Aging		$2 \cdot 10^{-6}$/year
Temperature drift	5 to 30° C	$1 \cdot 10^{-6}$
Frequency counter		
Resolution		1 Hz, 10 Hz, 100 Hz, 1 kHz
Frequency span		1 kHz to 3 GHz, 0 Hz
Spectral purity		
SSB phase noise	10 kHz offset from carrier	< -90 dBc/(1 Hz)
Residual FM	1 kHz resolution bandwidth, 1 kHz video bandwidth	< 100 Hz, typ. 60 Hz
Sweep time		
SPAN $\geq$ 1 kHz		100 ms to 1000 s
SPAN = 0 Hz		100 µs to 20 s
Bandwidth		
Resolution bandwidths (-3 dB)	in 1, 2, 3, 5 steps	200 Hz to 1 MHz
Video bandwidths	in 1, 2, 3, 5 steps	10 Hz to 1 MHz, Off

Amplitude

Level measurement range		> 137 dB
Maximum input level		
50 MHz - 3 GHz		+33 dBm
10 MHz - 50 MHz		+26 dBm
9 kHz - 10 MHz		+20 dBm
Intermodulation-free range		
1 MHz to 100 MHz	two-tone-signal with 2 x -30 dBm at input, 0 dB RF-attenuation	$\leq$ -60 dBc
100 MHz to 3 GHz		$\leq$ -70 dBc
Harmonic distortion	-40 dBm, 0 dB RF-attenuation	$\leq$ -60 dBc
Residual spurious	input terminated, 0 dB RF-attenuation	$\leq$ -85 dBm
Other input related spurious	10 MHz to 3 GHz, -30 dBm level at 1st mixer	$\leq$ -60 dBc
Displayed average noise level	300 Hz resolution bandwidth, 10 Hz video bandwidth, 0 dB RF-attenuation	$\leq$ -110 dBm, typ. -120 dBm
1 dB compression point of 1st mixer	100 kHz to 3 GHz, 0 dB RF-attenuation	-10 dBm
Reference level range		-110 to +36 dBm
Input attenuation	in 2 dB steps, selected manually or automatically coupled to reference level	0 to 70 dB
Display range		80 dB, 40 dB, 16 dB, 8 dB, linear
Display units		
Logarithmic		dBm, dBmV, dBμV
Linear		V, W
Traces		1 active trace and 1 memory trace
Level uncertainty		< 1.5 dB

Markers		
Marker		marker and 1 delta marker
Marker functions		peak, next peak, marker to center, marker to reference
Marker displays		normal, delta, noise marker, frequency counter
Trigger		free-running, video, external, line

Inputs

RF Input		
Connector		type N female
Input impedance		50 Ω
VSWR	10 MHz to 3 GHz, RF-attenuation $\geq$ 20 dB	< 1.5
Max. input power	with 30 dB RF-attenuation	+33 dBm
Maximum permitted DC voltage		30 V
External trigger input		
Connector		BNC female
Trigger voltage		TTL-voltages
External reference input		
Connector		BNC female
Reference frequency		10 MHz $\pm$ 50 Hz
Input voltage		0.5 to 2 V into 50 Ω

Output

Reference output		
Connector		BNC female
Reference frequency		10 MHz
Output level		> 0.5 V into 50 Ω

Interfaces

USB Host		
Connector		type "A-Plug"
USB protocol		version 1.1
Command set	instrument specific command set, software driver for Windows (Windows 2000/XP™)	
USB Device		
Connector		type "B-Plug"
USB protocol		version 1.1

Power Supply

AC supply		100 to 240 V (AC), 50 to 60 Hz, autoranging
Power consumption		< 35 VA

General Data

Display		
Type		5.4" active color TFT-display
Resolution		320 x 240 pixel
Memory		
Trace storage		5
Setup storage		10
Environmental conditions		
Operating temperature range	meets DIN EN 60068-2-1/2	+5 to +45° C
Storage temperature range		-20 to +70° C
Climatic humidity	meets DIN EN 60068-2-3 (non condensing)	95 % at +40° C

Mechanical resistance		
Sinus	meets DIN EN 60068-2-6, DIN EN 61010-1 and MIL-T-28800D class 5	5 to 150 Hz, max. 2g at 55 Hz, 55 to 150 Hz, 0.5g const.
Random	meets DIN EN 60068-2-64	10 to 500 Hz, 1.9g
Shock	meets DIN EN 60068-2-27 and MIL STD 810	shock spectrum
Electromagnetic compatibility	meets EN 55011 class B and EN 61326 (EMC directive 89/336/EEC)	
Radiated susceptibility		< 10 V/m
Safety	DIN EN 61010-1/IEC61010-1 UL3111-1; CSA22.2 No:1010.1	
Dimensions (W x H x D)		219 mm x 147 mm x 350 mm (8.6 in x 5.8 in x 13.8 in)
Weight		approx. 7.4 kg

Safety Instructions
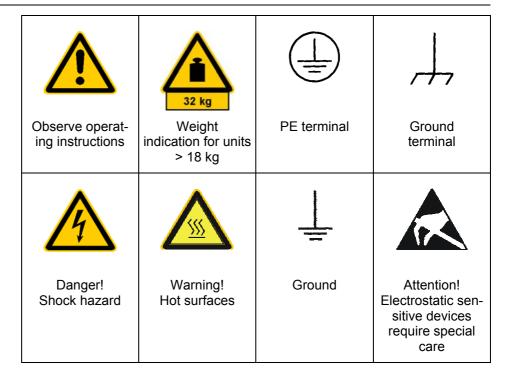
📄 **Note**	This unit has been designed and tested in accordance with the EC Certificate of Conformity and has left the manufacturer's plant in a condition fully complying with safety standards.
	To maintain this condition and to ensure safe operation, the user must observe all instructions and warnings given in this operating manual.

Safety-related symbols used on equipment and documentation from R&S

Observe operating instructions	Weight indication for units > 18 kg	PE terminal	Ground terminal
Danger! Shock hazard	Warning! Hot surfaces	Ground	Attention! Electrostatic sensitive devices require special care

Safety instructions

1. The unit may be used only in the operating conditions and positions specified by the manufacturer. Unless otherwise agreed, the following applies to R&S products:
    IP degree of protection 2X, pollution severity 2 overvoltage category 2, only for indoor use, altitude max. 2000 m.
    Unless specified otherwise in the data sheet, a tolerance of ±10 % shall apply to the nominal voltage and of ±5 % to the nominal frequency.

2. For measurements in circuits with voltages V_{rms} > 30 V, suitable measures should be taken to avoid any hazards (using, for example, appropriate measuring equipment, fusing, current limiting, electrical separation, insulation).

3. If the unit is to be permanently wired, the PE terminal of the unit must first be connected to the PE conductor on site before any other connections are made. Installation and cabling of the unit to be performed only by qualified technical personnel.

4. For permanently installed units without built-in fuses, circuit breakers or similar protective devices, the supply circuit must be fused such as to provide suitable protection for the users and equipment.

5. Prior to switching on the unit, it must be ensured that the nominal voltage set on the unit matches the nominal voltage of the AC supply network.
    If a different voltage is to be set, the power fuse of the unit may have to be changed accordingly.

6. Units of protection class I with disconnectible AC supply cable and appliance connector may be operated only from a power socket with earthing contact and with the PE conductor connected.

7. It is not permissible to interrupt the PE conductor intentionally, neither in the incoming cable nor on the unit itself as this may cause the unit to become electrically hazardous.
    Any extension lines or multiple socket outlets used must be checked for compliance with relevant safety standards at regular intervals.

8. If the unit has no power switch for disconnection from the AC supply, the plug of the connecting cable is regarded as the disconnecting device.
    In such cases it must be ensured that the power plug is easily reachable and accessible at all times (length of connecting cable approx. 2 m). Functional or electronic switches are not suitable for providing disconnection from the AC supply.
    If units without power switches are integrated in racks or systems, a disconnecting device must be provided at system level.

9. Applicable local or national safety regulations and rules for the prevention of accidents must be observed in all work performed.
    Prior to performing any work on the unit or opening the unit, the latter must be disconnected from the supply network.
    Any adjustments, replacements of parts, maintenance or repair may be carried out only by authorized R&S technical personnel.
    Only original parts may be used for replacing parts relevant to safety (e. g. power switches, power transformers, fuses). A safety test must be performed after each replacement of parts relevant to safety (visual inspection, PE conductor test, insulation-resistance, leakage-current measurement, functional test).

10. Ensure that the connections with information technology equipment comply with IEC950/EN60950.

11. Lithium batteries must not be exposed to high temperatures or fire.
Keep batteries away from children.
If the battery is replaced improperly, there is danger of explosion. Only replace the battery by R&S type (see spare part list).
Lithium batteries are suitable for environmentally-friendly disposal or specialized recycling. Dispose them into appropriate containers, only.
Do not short-circuit the battery.

12. Equipment returned or sent in for repair must be packed in the original packing or in packing with electrostatic and mechanical protection.

13. Electrostatics via the connectors may damage the equipment. For the safe handling and operation of the equipment, appropriate measures against electrostatics should be implemented.

14. The outside of the instrument is suitably cleaned using a soft, lint-free dust-cloth. Never use solvents such as thinners, acetone and similar things, as they may damage the front panel labeling or plastic parts.

15. Any additional safety instructions given in this manual are also to be observed.

Certificate of Quality

Certified Quality System

ISO 9001

DQS REG. NO 1954-04

Certificate of quality

Dear Customer,

You have decided to buy a Rohde & Schwarz product. You are thus assured of receiving a product that is manufactured using the most modern methods available. This product was developed, manufactured and tested in compliance with our quality management system standards.

The Rohde & Schwarz quality management system is certified according to ISO 9001.

ROHDE & SCHWARZ

EC Certificate of Conformity

CE

ROHDE&SCHWARZ

EC Certificate of Conformity

Certificate No.: 2002-77

This is to certify that:

Equipment type	Stock No.	Designation
FS300	**1147.0991.03**	**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 (73/23/EEC revised by 93/68/EEC)**

- **relating to electromagnetic compatibility (89/336/EEC revised by 91/263/EEC, 92/31/EEC, 93/68/EEC)**

Conformity is proven by compliance with the following standards:

EN61010-1 : 2001-12

EN55011 : 1998 + A1 : 1999, Class B

EN61326 : 1997 + A1 : 1998 + A2 : 2001

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

Affixing the EC conformity mark as from 2002

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

Munich, 2003-08-28
Central Quality Management FS-QZ/Becker

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Technical support – where and when you need it

For quick, expert help with any Rohde & Schwarz equipment, contact one of our Customer Support Centers. A team of highly qualified engineers provides telephone support and will work with you to find a solution to your query on any aspect of the operation, programming or applications of Rohde & Schwarz equipment.

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Feedback

We want to know if we are meeting your support needs. If you have any comments please email us and let us know

CustomerSupport.Feedback@rohde-schwarz.com

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1 Introduction

This chapter   Chapter 1 describes the uses of the R&S FS300 and also provides information on the storage and transportation procedures that should be adopted for the instrument. Warranty conditions are also explained.

Further information   Chapter 2 contains an overview of the R&S FS300's control elements, indicators, etc.

Chapter 3 describes how to put the R&S FS300 into operation.

1.1 Applications for the R&S FS300

Uses   RF signals are used by telecommunication systems to transmit information. The transmitted power must remain with strictly specified frequency bands, otherwise interference with other services on adjacent channels would occur.

To ensure that the stringent requirements laid down for RF communication systems are met, it is essential to have measuring equipment that can precisely measure and analyze the modulated and unmodulated signals involved.

Performance features   The Spectrum Analyzer R&S FS300 has all the performance features required to perform precise level and frequency measurements.

The key features are:

- **High-Quality RF characteristics**

- **Resolution bandwidth from 200 Hz to 1 MHz**

- **Frequency counter with 1 Hz resolution**

- **Maximum input level +33 dBm**

- **Ergonomic user interface**

Operation from keypad   All functions and measurement parameters can be set via menus using a keypad and a rotary knob.

The current trace, along with the key parameters and status indicators needed to evaluate the results, can be read at a glance from the TFT colour screen.

Remote control via PC   The R&S FS300 is equipped as standard with a USB interface so that it can communicate with a PC. All functions and parameters can be set.

1.2   Supplied Accessories

Content

1 power cord Europe

1 country specific power cord (if different from Europe)

1 manual German/English

1 USB cable

1 CD   (Content: operating manual German/English,
data sheet German/English
PC software R&S FS300-K1,
Acrobat Reader™)

1.3   Warranty

Warranty conditions

The General Terms and Conditions of Rohde & Schwarz shall apply.

Returning a defective R&S FS300

Please observe the packaging instructions (↗ 0-16). You will find the addresses of your nearest R&S representative and of the support center at the front of the manual.

Indicating claims under the warranty
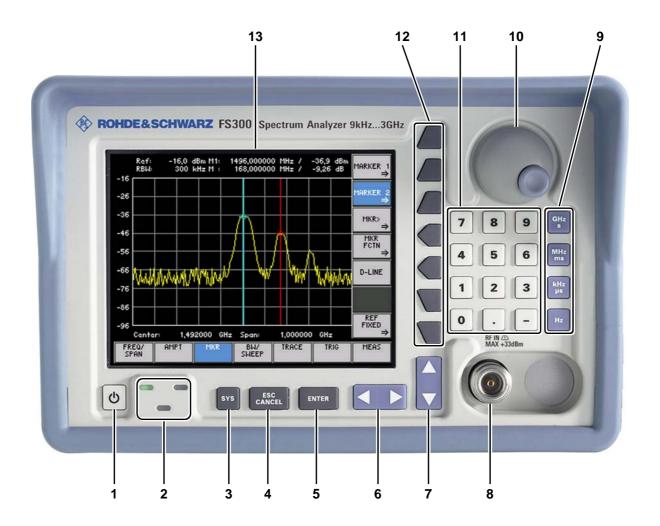
We would also ask you to state clearly if you are making a claim for repairs under warranty, preferably by including your delivery note. Repair requests that do not explicitly refer to the warranty will, in the first instance, incur charges.
If your warranty has expired, we will, of course, repair your R&S FS300 in accordance with our general installation and service conditions.
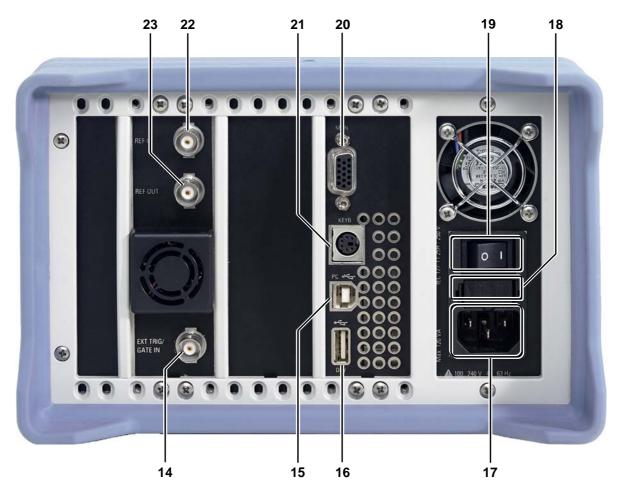
2 Control Elements

2.1 Front View

1	ON/STANDBY switch	**8**	RF IN, RF input connector
2	ON/STANDBY indicator	**9**	Unit keys
3	SYS key	**10**	Rotary knob
4	ESC/CANCEL key	**11**	Numerical keys
5	ENTER key	**12**	Function keys
6	Cursor keys ◂ / ▸	**13**	Screen
7	Cursor keys ▾ / ▴		

2.2   Rear View

14	Input connector for external trigger or external gate signal	**19**	AC line switch
15	Connector for external USB host	**20**	Connector for external monitor
16	Output connector for USB device (e. g. printer)	**21**	Connector for external keyboard
17	Power supply connector	**22**	Input for external reference (10 MHz)
18	AC line fuses	**23**	Output of internal/external reference (10 MHz)

3   Putting the R&S FS300 into Operation

This chapter   Chapter 3 describes how to put the R&S FS300 into operation.

Further   Chapter 2 contains an overview of the R&S FS300's control elements, indica-
information   tors, etc.

Chapter 4, "Getting started", takes you step-by-step through a number of simple measurements.

Chapter 8 is an in-depth description of the instrument's interfaces.

⚠ **Caution**   Before putting the R&S FS300 into operation, make the following checks:

- Ensure that the ventilation holes are free of obstructions.
- Ensure that there are no unsuitable signal voltages connected to the input.
- The R&S FS300's outputs may not be overloaded and correct polarity must be ensured.

The instrument may be damaged if the above checks are not performed.

3.1   Unpacking the R&S FS300

Recommended   When you unpack the R&S FS300, proceed as follows:
procedure

1. Remove the R&S FS300 from its packaging and check that the delivery is complete using the accessory list (↗ 1-32).
2. Carefully check the R&S FS300 for any damage.
3. If there is damage, immediately contact the carrier who delivered the instrument. Under these circumstances, it is essential to keep the box in which the R&S FS300 was transported and the packaging material (↗ 0-16).

3.2   Setting up the Instrument

⚠ **Caution**   There is a risk of injury from sharp edges and becoming wedged between the setting lever and the handle.

Setup instructions   The R&S FS300 must be assembled on a firm, level surface only. The in-
strument has a carrying handle which is also used for various setup options. This handle can be moved into any position, depending on the particular field of application.
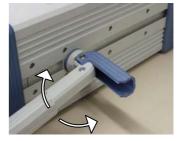
Setting the handle

1. Place the thumb and two fingers around the side-mounted setting lever and loosen it with a turning action.

2. Slide the handle lengthwise while twisting it radially in steps of about 12°.

3. Close the setting lever by pressing on the outer surface.

    Caution: There is a risk of injury from sharp edges and becoming wedged between the setting lever and the handle.

4. Remove the protective film from the screen glass if necessary.

    Caution: Use no pointed or sharp objects.

3.3   Connecting the R&S FS300 to the AC Line

⚠ **Caution**	The R&S FS300 meets the requirements for Safety Class I to DIN EN 61010-1/IEC 61010-1, e.g. all metal parts that can be touched or accessed without removing the enclosure are connected to the protective ground of the power supply network. The connection to the AC line is made via a power cord and a connector with a protective ground contact.

Automatic AC line voltage detection	When the R&S FS300 is connected to the AC line, it automatically sets itself to the correct voltage (range: AC voltage 100 V to 240 V, AC frequency 50 Hz to 60 Hz). There is no need to set the voltage manually or change the fuse.
Connecting the AC line	1. Use the supplied power cord to connect the R&S FS300 to the AC line. The power supply connector [17] is at the rear of the instrument. 2. Connect the power cord to the AC line.

3.4   Switching On the R&S FS300

⚠ **Hazard**	The AC line is still connected to the R&S FS300 when the instrument is in the standby mode.

AC line switch on the rear panel	The R&S FS300 is connected to the AC line via power supply connector [17]. AC line switch [19] which isolates the R&S FS300 from the AC line is located next to the power supply connector.
ON/STANDBY switch on the front panel	**ON operating state** After switching on the R&S FS300 by means of the AC line switch [19] at the rear panel, it is in standby mode and the yellow LED [2] comes on. If you press the ON/STANDBY switch [1], the instrument is switched on and the green LED [2] comes on. **STANDBY operating state** To switch the R&S FS300 from the operating mode to standby mode, press the ON/STANDBY switch [1] for approx. 2 seconds. After switching off the ON/STANDBY switch [1] the yellow LED [2] comes on.
Switching on the R&S FS300	1. Press the AC line switch [19] on the rear panel in the I position. 2. Press the ON/STANDBY switch [1] on the front panel. The green ON LED [2] should come on.

3.5 Function Test

⚠	**Caution**	When performing service procedures, follow the requirements of VDE 0701. Only properly qualified technicians are allowed to repair the R&S FS300. The instrument does not contain any parts the operator can repair.

Function test

After the R&S FS300 has been switched on (↗ 3-37), the green LED ON [2] on the instrument's front panel comes on. During booting, the "R&S SmartInstruments" symbol appears on a blue screen background [13]. Booting the R&S FS300 is completed when the measurement mask (↗ 5-46) and the trace appear. If the measurement trace does not appear on the screen, the sweep time (↗ 6-122) may have been too long.

In error case

If the measurement mask (↗ 5-46) does not appear and the red or the red or green LED flash alternately, switch the R&S FS300 off and on. In case the error continues, return the instrument to our service center for checking.

If the instrument shows an error message after booting, then follow the instructions in the chapter "Error messages" (↗ 9-233).

📄	**Note**	If the measurement trace does not appear on the screen shortly after booting, the sweep time may have been too long. In this case, reset the R&S FS300 by means of PRESET (↗ 6-146). If the trace still fails to appear, an error occurred and our service center must check the instrument.

3.6 EMC

EMC requirements

The R&S FS300 meets the EMC Directive 89/336/EEC (applied standards EN 55011 Class B and EN 61326).

To prevent EMI, the R&S FS300 may only be operated with its enclosure closed. Only appropriately shielded signal and control cables may be used. External units, such as keyboard, printer or monitor, that are to be connected to the R&S FS300 must comply with EMC directives.

3.7   Connecting an External Keyboard

⚠ **Caution**	Only connect the keyboard when the R&S FS300 is off or in the STANDBY mode, otherwise malfunctions may occur at a later date.
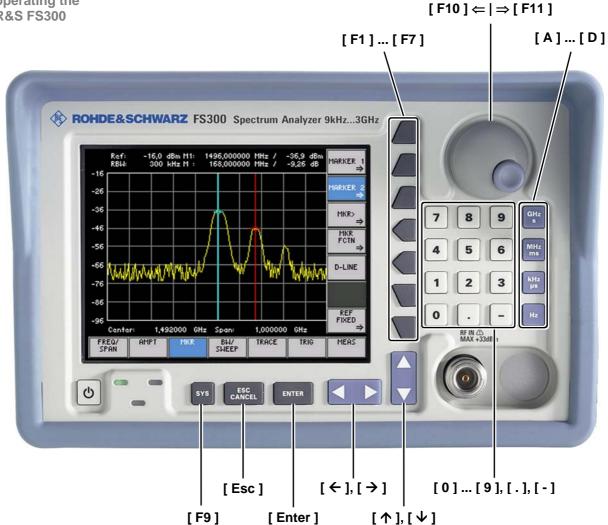
Use

You can connect an external PC keyboard via the 6-pin PS/2 KEYBOARD connector [21] on the R&S FS300's rear panel. The keyboard makes it easier to enter file names. The keyboard allows data entry as well as operation of the R&S FS300.

The keyboard is detected automatically when it is connected.

Key assignment for operating the R&S FS300

[F10] ⇐ | ⇒ [F11]

[F1] ... [F7]   [A] ... [D]

[Esc]   [⇐], [⇒]   [0] ... [9], [.], [-]

[F9]   [Enter]   [↑], [↓]

3.8   Connecting a USB Stick

⚠ **Caution**	To ensure that the USB stick is detected by the R&S FS300, the stick must be formatted in the FAT32 file system.

Use	You can connect an external USB stick to the USB device interface [16] at the rear of the R&S FS300. The USB stick is an extension of the internal memory. You can use it to save or load instrument settings, to print into a file on the USB stick or to transfer trace data to a PC.

4   Getting Started

This chapter	Chapter 4 uses a number of simple measurements to illustrate how to operate the R&S FS300.
	For the following example, the initial setting for instrument is the default setting (factory). This is set by pressing the PRESET key in the menu (↗ 6-146). The full default setup is described in chapter 6.
Further information	Chapter 5 contains an in-depth explanation of the basic operating steps, for example selecting menus and setting parameters. The layout of the screen and the information displayed on the screen are also described.
	Chapter 6 describes all the R&S FS300's menus and the associated functions in detail.

4.1   Level and Frequency Measurements

4.1.1   Measurement Task

⚠	**Caution**	The input stage of the R&S FS300 can be destroyed by overloads or DC components. If there is a possibility that the limits specified in the data sheet may be violated, the input must be protected with an attenuator and/or a DC block.

Measurement problem	Determining the level and frequency of a signal is one of the most common measurements a spectrum analyzer is used to make. Often, when making these measurements on an unknown signal, the PRESET settings (factory) are chosen as a suitable initial setup (↗ 6-146).
Solution	The center frequency (CENTER), the SPAN and the MARKER functions play a key role in level and frequency measurements.

4.1.2 Measurement Procedure

Introduction In this example, a signal with a frequency of 200 MHz and a level of -30 dBm is applied to the RF input [8]. The center frequency and the span are set manually.

Measurement steps Perform the following steps:

1. **Reset the R&S FS300.**

   • Press the SYS key.

   • Select PRESET in the bottom menu bar using the ◄ ► cursor keys.

   • Press the PRESET function key.

2. **Apply the signal.**

3. **Set the center frequency (CENTER) to 200 MHz.**

   • Select FREQ/SPAN in the bottom menu bar using the ◄ ► cursor keys.

   • Press the CENTER function key.

   • Enter **2** **0** **0** using the numerical keys. Terminate the entry by pressing the unit key MHz/ms.

4. **Reduce the SPAN to 1 MHz.**

   • Stay in the FREQ/SPAN menu.

   • Press the SPAN function key.

   • Enter **1** from the numerical keys. Terminate the entry by pressing the unit key MHz/ms.

5. **Measure the level and frequency with the marker.**

   • Select MKR in the bottom menu bar using the ◄ ► cursor keys.

   • Press the MARKER 1 ⇒ function key.

   • Press the PEAK function key in the submenu that appears. The marker jumps to the signal peak. Turn the rotary knob to change the position of the marker.

6. **Frequency measurements with the built-in frequency counter.**

   • Press the SIGNAL COUNT function key in the MARKER 1 ⇒ submenu. You can change the resolution of the frequency counter in the same submenu with the COUNT RESOL function key.

5   Manual Operating Concept

This chapter   Chapter 5 contains an overview of the R&S FS300's basic manual operating concept. This includes a description of the keypad, the screen layout, menu operation and how to set parameters. There is an overview of the menus and functions at the end of this chapter.

Further information   Chapter 4 contains a brief introduction that takes you step-by-step through some simple measurements.

Chapter 6 contains an in-depth description of the menu functions.

Chapter 7 contains note for remote control the R&S FS300 via a USB interface.

5.1   Making Entries from the Keypad

Introduction   The R&S FS300 is operated using menus in conjunction with a keypad and a rotary knob. The keypad comprises the following sections:

- Numerical keys [11]
- Unit keys [9]
- Cursor keys [6, 7]
- Function keys [12]
- Action keys [4, 5]
- SYS key [3]

5.1.1   Numerical Keys

Function   The numerical keys are used to enter numerical parameters.

[0] ... [9]   − Inserts one of the digits "0" to "9" at the cursor position.

[.]   − Inserts a decimal point "." at the cursor position.

[–]   − Inserts a minus sign "-" at the cursor position.
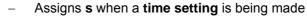
5.1.2   Unit Keys

Function   The unit keys are used to assign the appropriate unit to the number that has been entered, simultaneously terminating the entry.

[GHz / s]   − Assigns **GHz** when a **frequency setting** is being made
                           − Assigns **s** when a **time setting** is being made

[MHz / ms]   − Assigns **MHz** when a **frequency setting** is being made
                           − Assigns **ms** when a **time setting** is being made

[kHz / µs]   − Assigns **kHz** when a **frequency setting** is being made
                           − Assigns **µs** when a **time setting** is being made

[Hz]   − Assigns **Hz** when a **frequency setting** is being made

📄 **Note**   In the case of all other entries, the unit keys assume the same function as the Enter key. (↗ 5-45).

5.1.3 Rotary Knob

Function

As well as the numerical keys and the cursor keys, the rotary knob is also used to set parameters.

The rotary knob has several functions:

– **Incrementing** (turn clockwise) or **decrementing** (turn counter-clockwise) numerical instrument parameters using a specified step size.

– **Positioning** markers, limits, etc on the screen.

5.1.4 Cursor Keys

Function

As well as the numerical keys and the rotary knob, the cursor keys are also used for entering parameters and to navigate through the menus.

The cursor keys have the following functions:

– **Navigating** through menus and selection fields

– The ◄ or ► cursor keys **move** the cursor to the position you want within the numerical editing line.

– The ▼ or ▲ cursor keys **increment** or **decrement** numerical parameter entries.

5.1.5 Function Keys

Function

In the function area, various instrument functions are displayed depending on which menu has been selected.
The displayed instrument functions are assigned to the seven function keys down the right side of the screen. This means that each function key can have a variety of functions (↗ 5-48).

When a function key is pressed, various responses can be elicited:

– Immediate activation of a function or toggling between settings

– Entry of a value or selection of a setting/function

– Confirmation of a new setting and opening of a new menu item

– Branching to a submenu

5.1.6   Action Keys

Function   The action keys are for terminating menu-guided settings.

> ENTER

− This key is for **closing the entry field** or selection field after data has been entered. The **new value** is set on the R&S FS300.

          Note: Pressing a unit key will also terminate the entry of setting data.

> ESC
> CANCEL

− This key is for **closing the entry field** or selection field, but the data that has been entered is not saved - in other words the **old value** is retained.

5.1.7   SYS Key

Function

> SYS

− When you press the SYS key [3], the measuring menu is blanked out and replaced by the SYS menu. Other functions are assigned to the function keys [12] and the measurement diagram is replaced by the system parameters (↗ 6-144).

− By repeatedly pressing the SYS key [3], you can quit the SYS menu and accept the new settings.

5.2   Screen Display
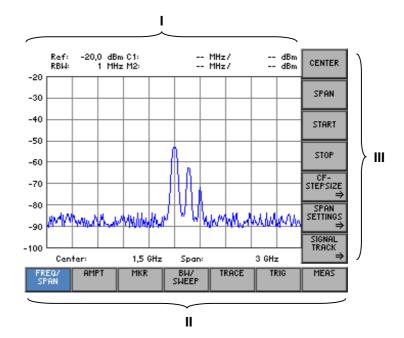
Introduction   The screen [13] provides on-going information about events and the parame-
                          ters associated with the selected measurement functions.
                          The display mode for the measurement results, the lettering of the function
                          keys and the type of menu all depend on the current settings.

Screen layout   The screen is divided into three areas:

                          I   Diagram area
                          II   Menu area
                          III Function area
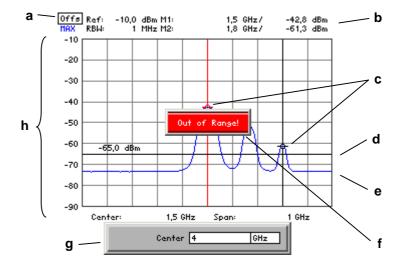
5.2.1   Diagram Area

Displays in the diagram area

The diagram area contains:

- Measurement diagrams and the associated scales (**h**) and traces (**e**)
- Measured value displays, e. g. display line (**d**) and markers (**c**)
- Parameter field (**b**) and status displays (**a**)
- Selection fields and entry fields that come up on the screen (**g**)
- Error messages that come up on the screen (**f**)

Measurement diagram

A 10 x 8 grid is superimposed on the diagram area to make it easier to analyze traces.

Parameter field and status display

The following are displayed in the parameter field:

Ref: - upper diagram limit (reference level)
RBW: - current resolution bandwidth
M1:   - marker 1 plus marker position and level
M2:   - marker 2 plus marker position and level

The status display provides the following information:

Offs   - level offset is on
MAX   - current trace display mode, e. g. max hold

5.2.2   Menu Area

Menu display

Menus for setting the measurement parameters and the measurement functions are displayed in the menu area. The selected menu is highlighted, e. g. FREQ/SPAN menu:
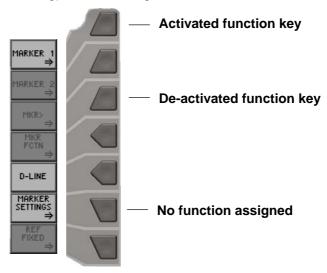
5.2.3   Function Area

Displaying the current assignment for the function keys

When a menu is selected, the associated instrument functions are displayed in the function area.

The displayed instrument functions are assigned to the seven function keys down the right-hand side of the screen. If a key in the function area does not have any lettering, the key has not been assigned a function in the menu in question. If a key has lettering, but not in full brightness, the key has temporarily (current setting) not been assigned a function.

5.3   Calling and Changing Menus

Introduction   Operating the R&S FS300 is menu-guided. All the menus used to set the measurement parameters and measurement functions are displayed in the menu area. The instrument functions associated with any menu you select are displayed in the function area.

Pressing a function key has one of the following effects:
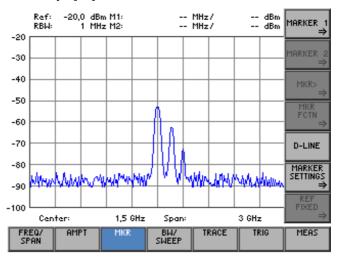
- Direct execution of an instrument function
- Opening of entry or selection windows
- Opening of submenus

The ◀ or ▶ cursor keys [6] are used for menu navigation.

Calling or   **1.** Select a **menu,** e. g. | MKR |, with the ◀ or ▶ [6] **cursor keys**.
changing menus

The menu name is highlighted and the appropriate function is assigned to the function keys [12].
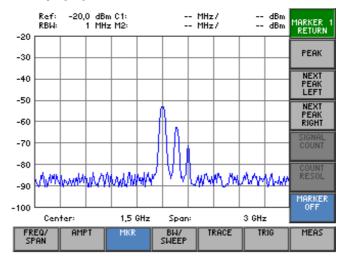
📄 **Note**   A double arrow ⇒ pointing to a function key, e. g. |MARKER 1 ⇒|, tells you that pressing this key will call a submenu.

Calling/quitting submenus

2. Press the `MARKER 1 ⇒` **function key** in the `MKR` **menu**.

The MARKER 1 submenu opens and the new functions are assigned to the function keys [12].

3. Press the `MARKER 1 RETURN` **function key** in the `MARKER 1 ⇒` **submenu**.

The submenu is closed and the previous functions remain assigned to the function keys [12].

5.4   Setting Parameters

There is a choice of methods

Parameters can be set in a number of ways:

- Direct selection of an instrument function (function key)
- Selecting settings from selection fields
- Entering numerical parameters in entry fields

The numerical keys [11], the unit keys [9], the rotary knob [10], the cursor keys [6, 7] and the action keys [4, 5] can all be used to select and enter instrument parameters.

5.4.1   Direct Selection of Instrument Functions

Introduction
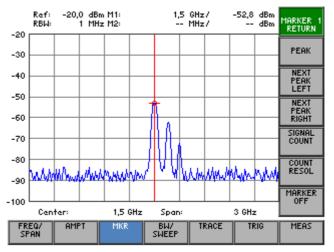
When you select a menu, various instrument functions are displayed in the function area. Some instrument functions can be set directly by pressing a function key.

The function key you select is highlighted.

e.g. :
Displaying marker 1
(↗ 6-92)

1.   Press the [PEAK] **function key** in the [MARKER 1 ⇒] **submenu.**

   Marker 1 is turned on and placed on the trace maximum. The M1 marker values are displayed in the parameter field.

2.   Press the [MARKER OFF] f**unction key** in the [MARKER 1 ⇒] **submenu.**

   Marker 1 disappears from the diagram area and the M1 marker values are blanked out.

5.4.2 Selecting Settings

Introduction
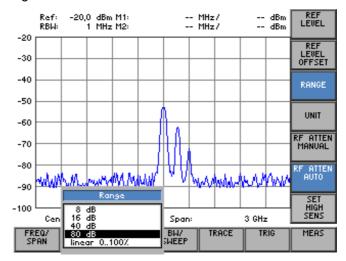
When you select a menu, a number of instrument functions are displayed in the function area. If certain function keys are then pressed, a selection field is displayed in the diagram area. You can then choose and activate any of the settings offered for selection.

The function key you select is highlighted.

**e.g. :
Setting the level
display range
(↗ 6-83)**

1. Press the RANGE **function key** in the AMPT **menu.**

   A selection field containing the available settings is displayed. The default setting is "80 dB".

2. Select a level display range with **rotary knob** [10].

3. Press the **ENTER key** [5] to close the selection field.

   The new setting is saved.

   If you want to keep the old setting, close the entry field with the **ESC/CANCEL key** [4].

📄 **Note**

If there are more than five options, a scroll bar is displayed on the right next to the selection field. At any one time, only five options are displayed on the screen.

5.4.3   Entering Numerical Parameters

Introduction   When you select a menu, a number of instrument functions will be displayed in the function area. If you press certain function keys, an entry field will be displayed in the diagram area.
The function key you select is highlighted.

There are two ways of entering numerical parameters:

▪ **Entry** of a number with the **numerical keys**

▪ **Entry** of a number with the **cursor keys** and **rotary knob**
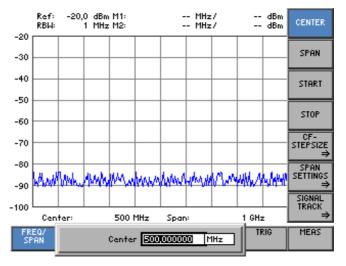
The entry with the cursor keys and rotary knob is useful if you only have a rough idea of what the measurement parameters should be. As the screen is continuously updated as the value is varied, a search is possible.

5.4.3.1   Entry with the Numerical Keys

**e.g. :
Setting the
center frequency
(↗ 6-70)**

1. Press the   CENTER   **function key** in the   FREQ/ SPAN   **menu**.

An entry field containing the current setting is displayed.

**Entering
a new value**

2. Overwrite the old value, e.g. **1.5 GHz,** with the **numerical keys** [11].
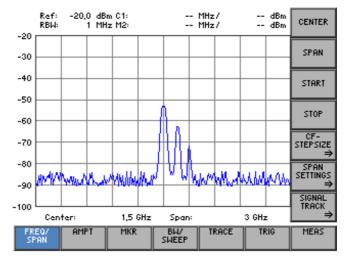
Note: If a numerical key is pressed after the entry field is brought up on the screen, the old value will be erased. However, a complete new value must now be entered using the numerical keys.

Terminating entries
3a. Press a **unit key** [9], e.g. **GHz,** to terminate the entry.

The R&S FS300 sets the value that has been set numerically using the **new unit**. The entry window is closed.

3b. Press the **ENTER key** [5] to terminate the entry.

The R&S FS300 sets the value that has been set numerically, but with the **old unit**. The entry window is closed.

Note: If a parameter is unitless or always has the same unit, you can terminate the entry with the ENTER key or one of the unit keys.

3c. Press the **ESC/CANCEL key** [4] to abort the entry.

The **old value** is retained. The entry window is closed.

Invalid parameter entry
If an invalid parameter is entered, the new value is rejected by the R&S FS300 and an error message is issued:

Out of Range!

- Acknowledge the error message with the **ENTER key** [5] and repeat the entry with the correct value.
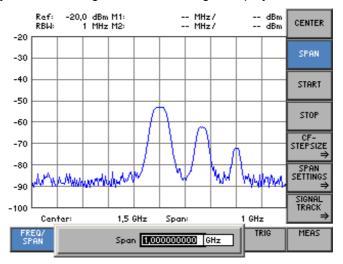
Note
When numbers are displayed, only the digit sequences 1 to 999 appear before the decimal point. In other words, if the digit sequence <5000> and the unit <kHz> are entered, <5 MHz> appears in the display. Trailing zeros will be eliminated in the display area.

5.4.3.2   Entry using the Cursor Keys and the Rotary Knob

e.g. :
Setting the span
(↗ 6-70)

1. Press the SPAN **function key** in the FREQ/SPAN **menu.**

   An entry field containing the current setting is displayed.

Entering
a new value,
e.g. 1.6

2. Using the **cursor keys** ◀ and ▶ [6], position the cursor on a decimal place in the entry field.

   1 × ▶   ⇨   Span 1,000000000 GHz

3a. Press the ▼ or ▲ **cursor key** [7] until you obtain the value you want.

   Pressing the ▲ cursor key once increments the value by one; pressing the ▼ cursor key once decrements the value by one.

   6 × ▲   ⇨   Span 1,600000000 GHz

3b. Turn the **rotary knob** [10] until you obtain the value you want.

   Turning clockwise increases the value; turning counter-clockwise reduces the value.

   6 × 🖲   ⇨   Span 1,600000000 GHz

   Note: In both cases, there are carries associated with incrementation or decrementation. In other words, if a 9 digit is incremented or a 0 digit decremented, a carry is added to or subtracted from next highest digit.

📄 **Note**   When you enter the center frequency, you can specify the step width of the rotary knob. (↗ 6-72). In this case, the value is incremented or decremented in accordance with the specified step width, with the cursor always moving to the highest value, irrespective of its earlier position.

Terminating entries

4a. Press a **unit key** [9], e. g. **MHz,** to terminate the entry.

The R&S FS300 sets the value that has been entered using the **new unit**. The entry window is closed.

4b. Press the **ENTER key** [5] to terminate the entry.

The R&S FS300 sets the value that has been set numerically but with the **old unit**. The entry window is closed.

Note: If a parameter is unitless or always has the same unit, you can terminate the entry with the ENTER key or one of the unit keys.

4c. Press the **ESC/CANCEL key** [4] to abort the entry.

The **old value** is retained. The entry window is closed.

Invalid parameter entry

If the limit value is reached, the numeric value in the entry window remains the same and is neither increased nor decreased. No error message is issued.

📄 **Note**

When numbers are displayed, only the digit sequences 1 to 999 appear before the decimal point. In other words, if the digit sequence <5000> and the unit <kHz> are entered, <5 MHz> appears in the display. Trailing zeros will be eliminated in the display area.

5.5   Overview of all Menus and Functions

5.5.1   Spectrum Analyzer

5.5.1.1   FREQ/SPAN Menu

**Function key
assignment**

CENTER	Entering the center frequency	(↗ 6-70)
SPAN	Entering the span	(↗ 6-70)
START	Entering the start frequency	(↗ 6-71)
STOP	Entering the stop frequency	(↗ 6-71)
CF-STEPSIZE →	**Open submenu:** Entering the step width of the center frequency	

CF-STEPSIZE RETURN	Quitting the submenu	
MANUAL	Setting the step size manually	(↗ 6-73)
AUTO	Setting the step size automatically	(↗ 6-73)
=CENTER	Setting the step size to the center frequency	(↗ 6-73)
=MARKER	Setting the step size to the marker frequency	(↗ 6-73)

SPAN SETTINGS →	**Open submenu:** Display modes for the frequency axis	

SPAN SETTINGS RETURN	Quitting the submenu	
FULL SPAN	Displaying the whole frequency range	(↗ 6-75)
ZERO SPAN	Switching over to the ZERO SPAN	(↗ 6-76)
LAST SPAN	Restoring the previous setting	(↗ 6-76)
ZOOM IN	Reducing the span	(↗ 6-77)
ZOOM OUT	Increasing the span	(↗ 6-77)
FULL SCREEN	Expanding the diagram area to fill the whole screen	(↗ 6-77)

SIGNAL TRACK →	**Open submenu:** Signal tracking	

SIGNAL TRACK RETURN	Quitting the submenu	
TRACK ON	Activating signal tracking	(↗ 6-79)
TRACK OFF	De-activating signal tracking	(↗ 6-79)

5.5.1.2 AMPT Menu

Function key assignment

REF LEVEL	Entering the reference level	(↗ 6-81)
REF LEVEL OFFSET	Entering a level offset	(↗ 6-82)
RANGE	Selecting the level display range	(↗ 6-83)
UNIT	Selecting a unit for the level display	(↗ 6-84)
RF ATTEN MANUAL	Setting the RF input attenuation manually	(↗ 6-86)
RF ATTEN AUTO	Setting the RF input attenuation automatically	(↗ 6-87)
SET HIGH SENS	Selecting the setting High Sensitivity	(↗ 6-89)

5.5.1.3   MKR Menu

Function key assignment

MARKER 1 ⇒	**Open submenu:** Activate marker 1		

MARKER 1 RETURN	Quitting the submenu	
PEAK	Place marker 1 on the trace maximum	(↗ 6-92)
NEXT PEAK LEFT	Place marker 1 on the next trace maximum to the left	(↗ 6-92)
NEXT PEAK RIGHT	Place marker 1 on the next trace maximum to the right	(↗ 6-92)
SIGNAL COUNT	Measure the signal frequency: Start measurement	(↗ 6-94)
COUNT RESOL	Measure signal frequency: Set resolution	(↗ 6-94)
MARKER OFF	De-activate marker 1	(↗ 6-92)

MARKER 2 ⇒	**Open submenu:** Activate marker 2		

MARKER 2 RETURN	Quitting the submenu	
PEAK	Place marker 2 on the trace maximum	(↗ 6-96)
NEXT PEAK LEFT	Place marker 2 on the next trace maximum to the left	(↗ 6-96)
NEXT PEAK RIGHT	Place marker 2 on the next trace maximum to the right	(↗ 6-96)
MARKER NORM	Set marker 2 as a normal marker (NORM)	(↗ 6-97)
MARKER DELTA	Set marker 2 as a delta marker (DELTA)	(↗ 6-97)
MARKER OFF	De-activate marker 2	(↗ 6-96)

MKR> ⇒	**Open submenu:** Accepting marker values as settings		

MKR> RETURN	Quitting the submenu	
CENTER = MKR FREQ	Set the center frequency to the marker frequency	(↗ 6-99)
REF LVL = MKR LVL	Set the marker level as a reference level	(↗ 6-99)
MKR -> CF STEPSIZE	Set the step size for entering the center frequency to the marker frequency	(↗ 6-101)

MKR FCTN ⇒	**Open submenu:** Marker measurement functions	
	MKR FCTN RETURN — Quitting the submenu	
	NOISE MARKER — Measuring noise power density	(↗ 6-103)
	N dB DOWN — Measuring signal bandwidth	(↗ 6-104)
D-LINE	Bring display line up on screen	(↗ 6-106)
MARKER SETTINGS ⇒	**Open submenu:** Search criterion of functions NEXT PEAK LEFT/RIGHT	
	MARKER SETTINGS RETURN — Quitting the submenu	
	PEAK EXCURS — Entering the peak excursion	(↗ 6-108)
REF FIXED ⇒	**Open submenu:** Reference points for measuring level differences	
	REF FIXED RETURN — Quitting the submenu	
	REF FIXED ON — Activating the entry of arbitrary reference points	(↗ 6-111)
	REF FIXED OFF — Using M1 marker values as a reference point	(↗ 6-111)
	REF POINT LEVEL — Entering the reference-point level	(↗ 6-111)
	REF POINT FREQ — Entering the reference-point frequency	(↗ 6-111)
	REF POINT TIME — Entering the reference-point time	(↗ 6-111)

5.5.1.4   BW/SWEEP Menu

**Function key
assignment**

RES BW MANUAL	Setting the resolution bandwidth manually	(↗ 6-115)
RES BW AUTO	Activating automatic resolution bandwidth setting	(↗ 6-115)
VIDEO BW MANUAL	Setting the video bandwidth manually	(↗ 6-116)
VIDEO BW AUTO	Activating automatic video bandwidth setting	(↗ 6-116)
COUPL RATIO →	**Open submenu:** Setting the RBW/VBW coupling ratio	

	COUPL RATIO RETURN	Quitting the submenu	
	RBW/VBW MANUAL	Setting the coupling ratio RBW/VBW manually	(↗ 6-118)
	RBW/VBW AUTO	Activating the default setting for the coupling ratio RBW/VBW	(↗ 6-118)
	RBW/SPAN LOW NOISE	Switching over the coupling RBW/SPAN to low noise	(↗ 6-119)

SWEEP →	**Open submenu:** Setting the sweep time	

	SWEEP RETURN	Quitting the submenu	
	CONT SWEEP	Starting a continuous frequency sweep	(↗ 6-121)
	SINGLE SWEEP	Performing an n-times sweep	(↗ 6-121)
	NO. OF SWEEPS	Setting the number of sweeps	(↗ 6-121)
	REPEAT SGL SWEEP	Repeating n-times sweeps	(↗ 6-122)
	SWEEP TIME MANUAL	Setting the sweep time manually	(↗ 6-122)
	SWEEP TIME AUTO	Activating automatic sweep-time setting	(↗ 6-122)
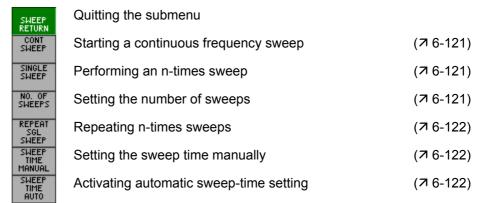
5.5.1.5   TRACE Menu

Function key assignment

Open submenu: Selecting the active trace		
	Quitting the submenu	
	Turning on and activating Trace 1	(↗ 6-125)
	Turning on and activating Trace 2	(↗ 6-125)
	Trace display mode: Overwrite mode	(↗ 6-127)
	Trace display mode: Min./Max. hold	(↗ 6-127)
	Trace display mode: Averaging	(↗ 6-127)
	Freezing the trace	(↗ 6-127)
	Blanking out the trace	(↗ 6-127)
	Open submenu: Trace difference	
	Quitting the submenu	
	Turning on the trace-difference mode	(↗ 6-131)
	Repositioning Trace 1 (result)	(↗ 6-131)
	Turning off the trace-difference mode	(↗ 6-131)
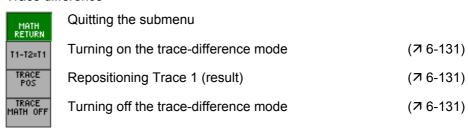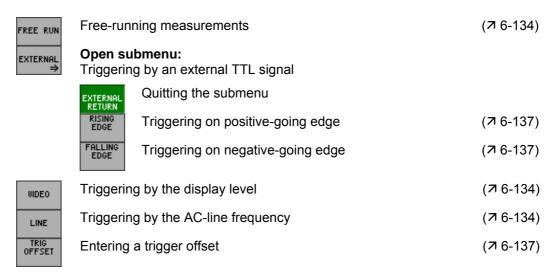
5.5.1.6   TRIG Menu

Function key assignment

FREE RUN	Free-running measurements	(↗ 6-134)
EXTERNAL ⇒	**Open submenu:** Triggering by an external TTL signal	
	EXTERNAL RETURN — Quitting the submenu	
	RISING EDGE — Triggering on positive-going edge	(↗ 6-137)
	FALLING EDGE — Triggering on negative-going edge	(↗ 6-137)
VIDEO	Triggering by the display level	(↗ 6-134)
LINE	Triggering by the AC-line frequency	(↗ 6-134)
TRIG OFFSET	Entering a trigger offset	(↗ 6-137)

5.5.1.7   MEAS Menu

**Function key
assignment**

TIME DO-MAIN PWR ⇒	**Open submenu:** Measure the power in the time domain (ZERO SPAN)	
TIME DO-MAIN PWR RETURN	Quitting the submenu	
PEAK	Output the peak value within the section	(↗ 6-140)
MEAN	Output the mean value within the section	(↗ 6-140)
START LIMIT	Insert a vertical line to limit the lower (left) part of a section	(↗ 6-140)
STOP LIMIT	Insert a vertical line to limit the upper (right) part of a section	(↗ 6-140)
OFF	Switch off the power measurement	(↗ 6-140)
TOI	Measure the third-order intercept point	(↗ 6-143)

5.5.2   SYSTEM Functions

5.5.2.1   PRESET Menu

**Function key
assignment**

| | PRESET | Calls an instrument default setting | (↗ 6-147) |
| | PRESET SETTINGS | Selects an instrument default setting | (↗ 6-147) |

5.5.2.2   STATUS Menu

**Function key
assignment**

| | ANALYZER | Displaying the current instrument setting | (↗ 6-148) |

5.5.2.3   FILE Menu

**Function key
assignment**

	SAVE	Saves a user-defined setting	(↗ 6-150)
	RECALL	Loads a user-defined setting	(↗ 6-150)
	PRINT	Prints out a screenshot	(↗ 6-150)

5.5.2.4   CONFIG Menu

**Function key
assignment**

	DATE/TIME	Sets the date and time	(↗ 6-157)
	REF	Selects an internal or external reference source	(↗ 6-159)
	INTERFACE	Configures the instrument interfaces	(↗ 6-160)
	SCREEN SAVER	Sets the screen saver mode	(↗ 6-162)
	MONITOR	Selects an internal or external monitor	(↗ 6-164)

5.5.2.5   SERVICE Menu

**Function key
assignment**

| | SELFTEST | Performs a selftest | (↗ 6-165) |

5.5.2.6   INFO Menu

**Function key
assignment**

HARDWARE INFO	Displays module data	(↗ 6-167)
STATISTICS	Displays instrument statistics	(↗ 6-167)
SYSTEM MESSAGES	Displays system messages	(↗ 6-168)

6   Using the R&S FS300

This chapter

All the spectrum analyzer functions and their uses are fully described in chapter 6. The order in which the menus are described follows that of the procedures for configuring and starting measurements:

- ▪ R&S FS300 default settings
- ▪ Setting measurement parameters
- ▪ Selecting and configuring measurement functions

Further information

The operating concept is explained in chapter 5, which also contains an overview of the menus and functions.

The index at the end of this manual will also help you find the information you want.

6.1   R&S FS300 Factory Settings

Switching on for the first time

When you switch on the R&S FS300 (↗ 3-37), the settings you were using when the instrument was last switched off are restored.

When you switch on for the first time, the factory default settings are activated:

	Parameter	Setting
Frequency axis	Center frequency (CENTER)	1.5 GHz
	Frequency span (SPAN)	3 GHz
	Step size for center frequency	150 MHz
Level axis	Reference level (REF LEVEL)	-20 dBm
	Level offset (REF LEVEL OFFSET)	0 dB
	Level range (RANGE)	80 dB
	Level unit (UNIT)	dBm
RF input	Input attenuation (RF ATTEN)	AUTO (NORMAL)
Bandwidth	Sweep time (SWEEP TIME)	AUTO
	Resolution bandwidth (RES BW)	AUTO (1 MHz)
	Video bandwidth (VIDEO BW)	AUTO (1 MHz)
Frequency sweep	Sweep	CONT SWEEP
Trace	Trace	CLEAR/WRITE
Trigger	Trigger	FREE RUN
Markers	Marker 1 and marker 2	OFF

📄 **Note**

The factory default setting is stored in non-volatile memory in the R&S FS300 and can be reloaded at any time (↗ 6-146).
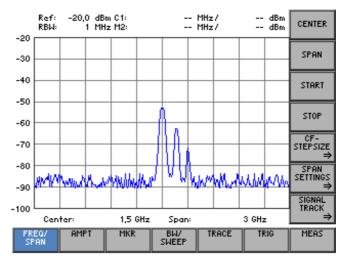
6.2   Spectrum Analyzer

Introduction

The R&S FS300 measures signal spectra over the selected frequency range using the selected resolution bandwidth and sweep. The time characteristic of the amplitude at the set frequency is displayed in zero span.

User interface

When the R&S FS300 is switched on and the selftest passed, the spectrum analyzer's user interface is activated. The following is displayed on the screen [13]:

Menus for configuring and starting measurements

The menus used to set the spectrum analyzer are displayed in the menu area. The order of the menus mirrors that of the procedure for configuring and starting measurements:

FREQ/SPAN	Selecting the frequency span (setting the x axis in the diagram area)	(↗ 6-69)
AMPT	Setting the level axis and the RF input (setting the y axis in the diagram area)	(↗ 6-80)
MKR	Signal analysis with marker functions	(↗ 6-89)
BW/SWEEP	Setting the bandwidths and the sweep time	(↗ 6-114)
TRACE	Displaying the trace	(↗ 6-123)
TRIG	Triggering the measurement	(↗ 6-133)
MEAS	Measurement functions	(↗ 6-138)

6.2.1   Selecting the Frequency Span (FREQ/SPAN Menu)
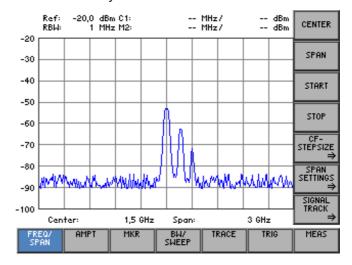
What the settings are for

Use the FREQ/SPAN menu to specify the frequency range.

Selecting the FREQ/SPAN menu

- Select the [FREQ/ SPAN] **menu** using the ◀ or ▶ **cursor key** [6].

  The menu name is highlighted and the appropriate functions are as-signed to the function keys.
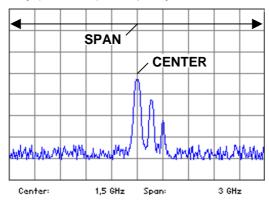
Function key assignment

[CENTER] , [SPAN]	**1st variant:** Setting the frequency range Enter the center frequency (CENTER) and the SPAN	(↗ 6-70)
[START] , [STOP]	**2nd variant:** Setting the frequency range Enter the START and STOP frequencies	(↗ 6-71)
[CF-STEPSIZE ⇒]	**Open submenu:** Entering the step width of the center frequency	(↗ 6-72)
[SPAN SETTINGS ⇒]	**Open submenu:** Frequency axis display modes	(↗ 6-74)
[SIGNAL TRACK ⇒]	**Open submenu:** Signal tracking	(↗ 6-78)

6.2.1.1   Entering the Center Frequency and the Span

Use

If you know the frequency of the signal you want to measure, you can set the x axis of the diagram area accordingly. Enter the signal frequency as the center frequency (CENTER) and specify a SPAN.

Entering the center frequency

1. Press the ⎡CENTER⎤ **function key** in the ⎡FREQ/SPAN⎤ **menu.**

   An entry field containing the current setting is displayed:

   Center ⎡1.500000000⎤ GHz

2. Enter the new value (↗ 5-53).
   The entry range for the center frequency is:

   500 Hz ≤ Center ≤ 2.9999995 GHz

Setting the span

3. Press the ⎡SPAN⎤ **function key** in the ⎡FREQ/SPAN⎤ **menu.**

   An entry field containing the current setting is displayed:

   Span ⎡1.000000000⎤ GHz

4. Enter the new value (↗ 5-53).
   The span entry range is:

   1 kHz ≤ Span ≤ 3 GHz

   The new setting is saved and displayed in the diagram area. The grid lines associated with the frequency axis represent 1/10 of the current span.

📄 **Note**
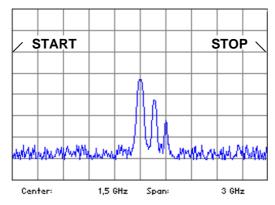
The effect of pressing the ⎡CENTER⎤ or ⎡SPAN⎤ function key is to switch the frequency axis lettering in the diagram area to the display showing the current center frequency and the span.

6.2.1.2 Entering the Start Frequency and the Stop Frequency

Use

If you want to analyze a specific frequency range, you can enter a start frequency and a stop frequency. The frequency range is shown along the x axis of the diagram area.

Entering a start frequency

1. Press the START **function key** in the FREQ/SPAN . **menu.**

   An entry field containing the current setting is displayed:

2. Enter the new value (↗ 5-53).

   The entry range for the start frequency is:

   0 ≤ Start ≤ 2.999999 GHz

Entering a stop frequency

3. Press the STOP **function key** in the FREQ/SPAN **menu.**

   An entry field containing the current setting is displayed:

4. Enter the new value (↗ 5-53).

   The entry range for the stop frequency is:

   1 kHz ≤ Stop ≤ 3 GHz

   The new setting is saved and displayed in the diagram area. The grid lines associated with the frequency axis represent 1/10 of the current span.

📄 **Note**

The effect of pressing the START or the STOP function key is to switch the lettering of the frequency axis in the diagram area to the display showing the current start and stop frequencies.

6.2.1.3 Entering the Step Width of the Center Frequency

What the settings are for

Using the CF STEP SIZE submenu, you can set any step size of the rotary knob you want or have the R&S FS300 set a step size that is a function of the measurement parameters.
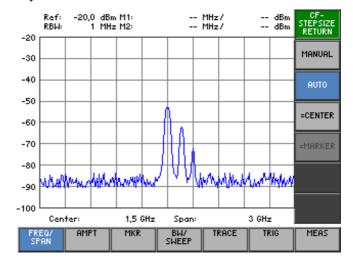
Selecting the CF STEP SIZE submenu

- Press the [CF-STEPSIZE ⇒] **function key** in the [FREQ/SPAN] **menu**.

  The submenu opens and the appropriate functions are assigned to the function keys.

Function key assignment

|		
[CF-STEPSIZE RETURN]	Quitting the submenu	
[MANUAL]	Setting the step size manually	(↗ 6-73)
[AUTO]	Setting the step size automatically	(↗ 6-73)
[=CENTER]	Setting the step size to the center frequency	(↗ 6-73)
[=MARKER]	Setting the step size to the marker frequency	(↗ 6-73)

📄 **Note**

The [MANUAL] and [AUTO] function keys are selection keys. In other words, only one setting can be activated at any one time. The function key in question is highlighted.
The AUTO function is the default setting.

The [=MARKER] function key is available only when marker 1 is turned on.

6.2.1.3.1   Setting the Step Size

Setting the step size manually

If you want to examine the frequency spectrum at certain intervals, you can enter the value of your choice for the step size of the rotary knob.

1. Press the | MANUAL | **function key** in the | CF- STEPSIZE ⇒ | **submenu.**

An entry field containing the current setting is displayed:

| StepSize **1**   Hz |

2. Enter the new value (↗ 5-53).

The entry range for the step size is:

1 Hz ≤ Step Size ≤ 2.999999 GHz

Setting the step size automatically

If you want to change the center frequency using steps that are small compared with the span, select the automatic setting mode.

• Press the | AUTO | **function key** in the | CF- STEPSIZE ⇒ | **submenu.**

The step size is set to a tenth of the current span.

Setting the step size to the center frequency

If you make the step size equal to the center frequency (or an integer multiple of the center frequency), it is easy to find harmonics which are multiples of the center frequency.

• Press the | =CENTER | **function key** in the | CF- STEPSIZE ⇒ | **submenu**.

The step size is made equal to the current center frequency.

Setting the step size to the marker frequency

If you make the step size equal the marker frequency, you can search through the frequency spectrum and quickly jump back to the frequency at which you started.

• Press the | =MARKER | **function key** in the | CF- STEPSIZE ⇒ | **submenu**.

The step size is made equal to the current marker frequency (↗ 6-89).

6.2.1.4 Frequency-Axis Display Modes

What the settings are for
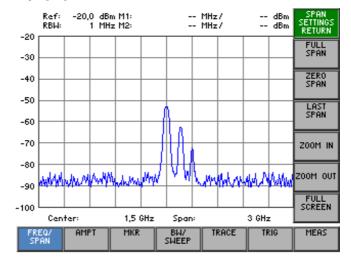
The frequency axis (x axis) can be displayed in a number of ways. Using the SPAN SETTINGS submenu, you can display the whole frequency range, zoom in on subranges of the frequency axis or project the diagram area onto the whole of the screen, if and when you require.

If you switchover to the time domain (ZERO SPAN), you can display the amplitude of the carrier signal as functions of time.

Selecting the SPAN SETTINGS submenu

• Press the SPAN SETTINGS ⇒ **function key** in the FREQ/SPAN **menu**.

The submenu opens and the appropriate functions are assigned to the function keys [12].

Function key assignment

SPAN SETTINGS RETURN	Quitting the submenu	
FULL SPAN	Displaying the whole frequency range	(↗ 6-75)
ZERO SPAN	Switching over to the ZERO SPAN	(↗ 6-76)
LAST SPAN	Restoring the previous setting	(↗ 6-76)
ZOOM IN	Zoom function: Reducing the span	(↗ 6-77)
ZOOM OUT	Zoom function: Increasing the span	(↗ 6-77)
FULL SCREEN	Zoom function: Filling the whole screen with the diagram area	(↗ 6-77)

6.2.1.4.1   **Displaying the Whole Frequency Range**

Use
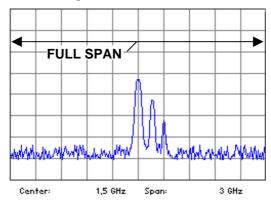
If you do not know the frequency of the signal to be investigated, you can display the R&S FS300's whole frequency range along the x axis of the diagram area. You can then systematically reduce the span to the appropriate size (↗ 6-70).

The whole frequency range display can also be used to swap backwards and forwards between an overview measurement (FULL SPAN) and a detailed measurement (LAST SPAN, e. g. center frequency and span set manually).

Displaying the whole frequency range

1.   Press the [FULL SPAN] **function key** in the [SPAN SETTINGS ⇒] **menu.**
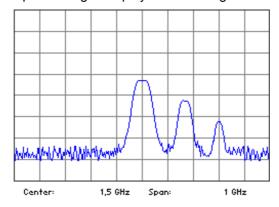
The old setting is saved and the R&S FS300's whole frequency range is displayed in the diagram area.

Displaying the last span

2.   Press the [LAST SPAN] **function key** in the [SPAN SETTINGS ⇒] **menu.**

The last span setting is displayed in the diagram area, e. g. 1 GHz:

📄 **Note**

The last span is restored if and only if the span is > 0, in other words, the time domain (ZERO SPAN) will not be selected automatically.

6.2.1.4.2   Switching over to the ZERO SPAN

Use

The amplitude of a particular signal component in the frequency spectrum can be displayed as a function of time. To activate this mode, enter the frequency of the signal component as the center frequency. You can then define the x axis to be the time axis.

Specifying the signal component

1. Press the CENTER **function key** in the FREQ/ SPAN menu**.**

   An entry field containing the current setting is displayed:

   Center 1.500000000 GHz

2. Enter the frequency of the signal component you want to display in the time domain (↗ 6-70).

Switching over to the ZERO SPAN

3. Press the ZERO SPAN **function key** in the SPAN SETTINGS ⇒ **submenu.**
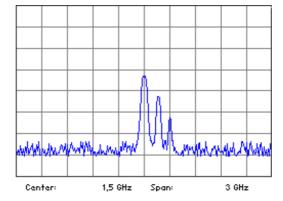
   The x axis becomes the time axis and the signal amplitude at the current center frequency is displayed as a function of time (current sweep time). The grid line spacing represents 1/10 of the current sweep time (↗ 6-119).

Center: 1,5 GHz   Time: 1 s/div

Switching over to the frequency domain

4. Press the LAST SPAN **function key** in the SPAN SETTINGS ⇒ **submenu.**

   The last span is displayed in the diagram area.

Center: 1,5 GHz   Span: 3 GHz

6.2.1.4.3 ZOOM Functions

Use
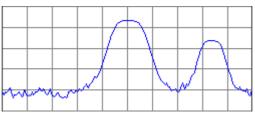
If you want to increase or decrease the size of the screen window to analyze traces, you can zoom onto sections of the span or fill the whole screen with the current screen window.

Reducing the span

- Press the ZOOM IN **function key** in the SPAN SETTINGS ⇒ **submenu.**
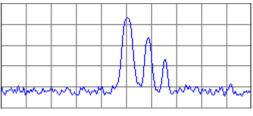
   The span is reduced by a factor of two. The center frequency remains the same.

Increasing the span

- Press the ZOOM OUT **function key** in the SPAN SETTINGS ⇒ **submenu.**
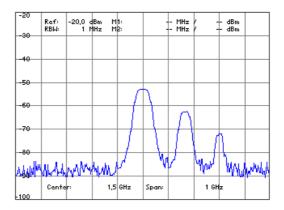
   The span is increased by a factor of two. The center frequency remains the same. The center frequency will be adapted if the new display frequency range exceeds the maximum permissible start or stop frequency.

Whole screen

1. Press the FULL SCREEN **function key** in the SPAN SETTINGS ⇒ **submenu.**

   The menu area, the function area and the parameter field are blanked out on the screen [13]. The diagram area then fills the whole screen. The scale lettering and all key parameters are displayed within the diagram area.

2. Press any key to return to the normal display mode.

6.2.1.5 Signal Tracking
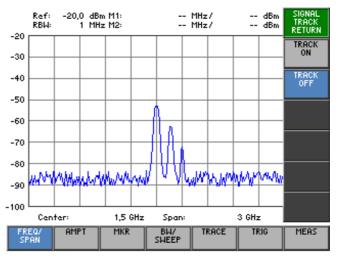
What the settings are for

When signal tracking is selected, the center frequency of the R&S FS300 is continually set to the frequency of the signal with most power. This means that a signal whose frequency is changing slowly in comparison with the sweep time can be kept in the center of the screen. The capture range of the function is $\pm$ span/5 referring to the center frequency. The spectrum analyzer's center frequency is adjusted after each sweep.

Selecting the SIGNAL TRACK submenu

- Press the **SIGNAL TRACK ⇒** **function key** in the **FREQ/ SPAN** **menu.**

  The submenu opens and the appropriate functions are assigned to the function keys [12].

Function key assignment

SIGNAL TRACK RETURN	Quitting the submenu	
TRACK ON	Activating signal tracking	(↗ 6-79)
TRACK OFF	De-activating signal tracking	(↗ 6-79)
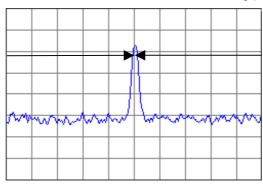
6.2.1.5.1   Activating Signal Tracking

Use   If the frequency of the signal being analyzed is continually varying, you can
                           use this function to obtain a display that appears to be stationary. The power
                           of signals of this kind can then be measured over long periods.

Activating signal   • Press the [TRACK ON] **function key** in the [SIGNAL TRACK ⇒] **submenu.**
tracking
                           The center frequency is constantly adjusted so that the signal peak is al-
                           ways in the middle of the screen. The latest center frequency to be set is
                           displayed. The peak will continue to be tracked provided it remains within
                           the span referring to the center frequency.

De-activating   • Press the [TRACK OFF] **function key** in the [SIGNAL TRACK ⇒] **submenu.**
signal tracking
                           The center frequency ceases to be tracked and remains at its last value.

6.2.2 Setting the Level Axis and the RF Input (AMPT Menu)

What the settings are for
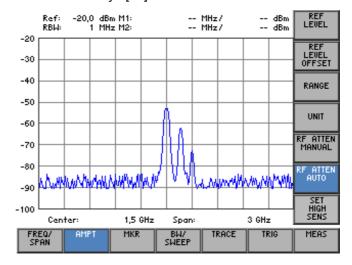
From the AMPT menu, you can define the y axis of the measurement diagram as the level axis. You can also specify the attenuation of the RF input.

Selecting the AMPT menu

- Select the [AMPT] **menu** with the ◄ or ► **cursor key** [6].

  The menu name is highlighted and the appropriate functions are assigned to the function keys [12].

Function key assignment

[REF LEVEL]	Entering the reference level	(↗ 6-81)
[REF LEVEL OFFSET]	Entering a level offset	(↗ 6-82)
[RANGE]	Selecting the level display range	(↗ 6-83)
[UNIT]	Selecting the level display unit	(↗ 6-84)
[RF ATTEN MANUAL]	Setting the RF input attenuation manually	(↗ 6-86)
[RF ATTEN AUTO]	Setting the RF input attenuation automatically	(↗ 6-87)
[SET HIGH SENS]	Selecting the setting High Sensitivity	(↗ 6-89)

📄 **Note**
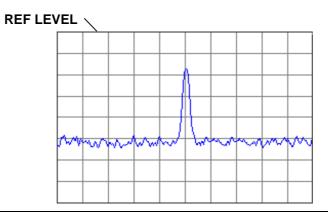
The [RF ATTEN MANUAL] and [RF ATTEN AUTO] function keys are selection keys. In other words, only one setting can be activated at any one time. The function key in question is highlighted.
The RF ATTEN AUTO function is the default setting.

6.2.2.1   Entering the Reference Level

Use   The upper diagram limit is specified with the reference level.

REF LEVEL

📄 **Note**   The currently activated unit is used as the unit for reference level entries (↗ 6-84). The default setting is "dBm".

Entering the
reference level   1.   Press the | REF LEVEL | **function key** in the | AMPT | **menu**.

An entry field containing the current setting is displayed. The default setting is -20 dBm.

2.   Enter a new value in 0.1 dB steps (↗ 5-53).
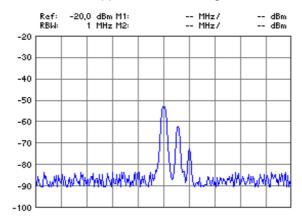
The entry range for the reference level is:

-110 [dBm] ≤ Reference ≤ +36 [dBm]

The new setting is saved and displayed in the diagram area. The reference level defines the upper limit of the diagram.
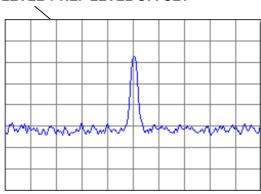
6.2.2.2   Entering a Level Offset

Use   If you have connected external attenuators or amplifiers between the DUT and the RF input, you can enter a level offset to adjust the level display. The level offset is added to the reference level.

REF LEVEL + REF LEVEL OFFSET

Entering a   **1.** Press the `REF LEVEL OFFSET` **function key** in the `AMPT` **menu**.
level offset
An entry field containing the current setting is displayed. The default setting is 0 dB.

`Ref Lvl Offset 0.0        dB`

2. Enter a new value in 0.1 dB steps (↗ 5-53).
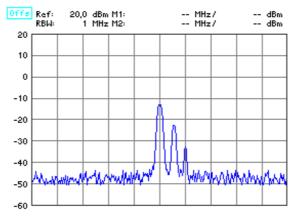
The entry range for the level offset is:

-100 [dB] ≤ Ref Lvl Offset ≤ +50 [dB]

The new setting is saved and displayed in the diagram area. The text "Offs" is also displayed in the top left of the diagram.

The level offset is always entered in dB no matter what unit is used for the reference level. If the units mV or mW are used, the offset is automatically converted so that the reference level is displayed correctly:
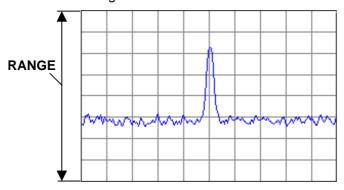
REF LEVEL$_{Display}$ = REF LEVEL   + REF LEVEL OFFSET
e. g.   = -20 dBm   + 40 dB   = 20 dBm

6.2.2.3 Selecting the Level Display Range

Use

Use the level display range to define the "visible" level range and set the measurement diagram scale.

RANGE

Levels can be displayed using either logarithmic or linear scales. The lettering of the grid lines is automatically adapted.

- **8 dB**
  1 dB/div.

- **16 dB**
  2 dB/div.

- **40 dB**
  5 dB/div.

- **80 dB**
  10 dB/div.

- **LINEAR**
  12.5 %/div., linear scale, 100 % corresponds to the reference level, 0 % to 0 V or 0 W

Entering the level display range
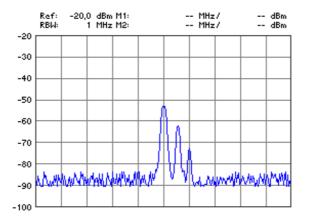
1. Press the RANGE **function key** in the AMPT **menu**.

   A selection field containing the available settings is displayed. The default setting is 80 dB.

2. Select a level display range with **rotary knob** [10].

3. Press the **ENTER key** [5] to close the selection field.

   The new setting is saved and displayed in inverse video in the diagram area. The level display range is referred to the reference level. This determines how the grid lines are lettered, for example, for REF LEVEL = -20 dBm and RANGE = 80 dB, the first grid line is at -20 dBm and the second at -30 dBm, and so on.

| 📄 Note | The level display range uses the currently activated unit (↗ 6-84). |

6.2.2.4 Selecting the Level Display Unit
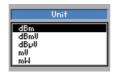
Use

To make it easier to analyze results, you can display levels in **dBm**, **dBmV**, **dBµV**, **mV** and **mW**.

Selecting the unit for the level display

1. Press the [UNIT] **function key** in the [AMPT] **menu**.

   A selection field containing the available settings is displayed. The default setting is dBm.
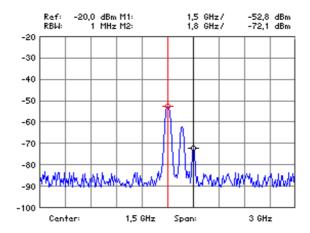
2. Select a unit for the level display with **rotary knob** [10].

3. Press the **ENTER key** [5] to close the selection field.

   The new setting is saved and displayed in the diagram area.

How RANGE and UNIT are related
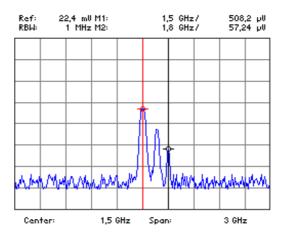
Log display/RANGE in dBx (The letter x is a wildcard character for the letters m, mV or µV.)

If a dB display has been selected for RANGE (↗ 6-83) and a dBx display for UNIT, the vertical-scale unit is dB. The values indicated by the level markers and the relevant level entries are in dBx.
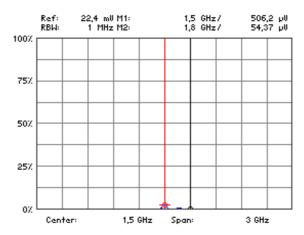
Log display/RANGE in xV or xW (The letter x is a wildcard character for the letters m, mV or μV.)

If a mV or mW has been selected for UNIT, only the reference level is displayed in the selected unit. There is no grid lettering. The values shown by the level markers and the relevant level entries are in the selected unit.

Linear display/RANGE in xV or xW (The letter x is a wildcard character for the letters m, mV or μV.)

If the linear scale is selected for RANGE, the scale lettering indicates percent, e.g. 0 %, 25 %, 50 %, 75 % and 100 %. The values indicated by the level markers and the relevant level entries are in the selected unit.

6.2.2.5   Setting the RF Input Attenuation Manually

Use
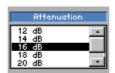
In the default setting, the input attenuation is coupled to the reference level. In most cases, this is the setting that will be used because it prevents the input stages from being overdriven and so, consequently, any incorrect measurements.

In exceptional cases, it may be necessary to adjust the input attenuation manually with input attenuations from **0** to **70 dB**.

Setting the input attenuation manually

1. Press the [RF ATTEN MANUAL] **function key** in the [AMPT] **menu**.

    A selection field containing the available settings is displayed. The default setting is 16 dB.

Attenuation
12 dB
14 dB
16 dB
18 dB
20 dB

2. Select an input attenuation for the RF input with **rotary knob** [10].

3. Press the **ENTER key** [5] to close the selection field.

    The new setting is saved and the RF input is re-configured.

Invalid parameter entry

If the reference level you have specified cannot be set for the input attenuation that has been entered, (↗ 6-81), it is automatically adjusted.
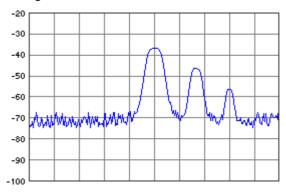
6.2.2.6   Setting the RF Input Attenuation Automatically

Use

The input attenuation should be set automatically to prevent the R&S FS300's input mixer from being overloaded. There are three RF input modes you can choose from (coupling between reference level and input attenuation) to optimize measurements:
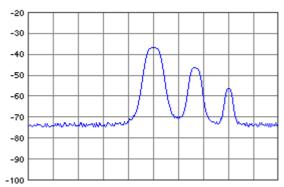
- **NORMAL**
  Normal setting for measurements.
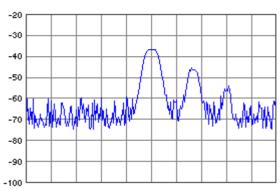
- **LOW NOISE**
  Settings for measurements with low displayed average noise level of the analyzer.

- **LOW DISTORTION**
  Setting for measurements with low inherent distortion of the analyzer.

Activating the auto-matic input attenuation setting mode

1. Press the | RF ATTEN AUTO | **function key** in the | AMPT | **menu**.

   A selection field containing the available settings is displayed. The de-fault setting is NORMAL.

2. Using the **rotary knob** [10] select a criterion for autosetting the input attenuation.

3. Press the **ENTER key** [5] to close the selection field.

   The new setting is saved and the RF input is configured automatically according to the setting.

6.2.2.7   Selecting the Setting High Sensitivity

Use
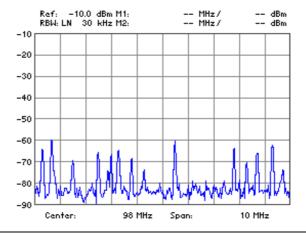
By setting SET HIGH SENS, you can change several settings in the device in order to increase the input and measurement sensitivity of the analyzer in comparison to the normal setting. This function is helpful when you want to measure weak antenna signals with the analyzer.

SET HIGH SENS influences the following settings in the R&S FS300:

▪ Sets the **reference level** (REF LEVEL, ↗ 6-81) to -10 dBm (if RF ATTEN was set to AUTO, the analyzer switches to MANUAL).

▪ Sets the **input attenuation** (RF ATTEN, ↗ 6-86) to 0 dB (if RES BW was set to MANUAL, the analyzer switches to AUTO).

▪ Activates the **coupling** (RBW/SPAN LOW NOISE, ↗ 6-119)

Selecting the Setting High Sensitivity

● Press the [SET HIGH SENS] **function key** in the [AMPT] **menu**.

The setting RBW/SPAN LOW NOISE is indicated by the letters LN next to the RBW display.

```
Ref:  -10.0 dBm M1:      -- MHz/      -- dBm
RBW: LN  30 kHz M2:      -- MHz/      -- dBm
-10
-20
-30
-40
-50
-60
-70
-80
-90
     Center:      98 MHz   Span:      10 MHz
```

📄 **Note**

You can switch the input attenuation of the analyzer to 0 dB by means of SET HIGH SENS. To ensure that the R&S FS300 is not overdriven, the level at the analyzer input must not exceed the reference level that has been set. (↗ 6-81).

6.2.3 Signal Analysis using Marker Functions (MKR Menu)

What the settings are for
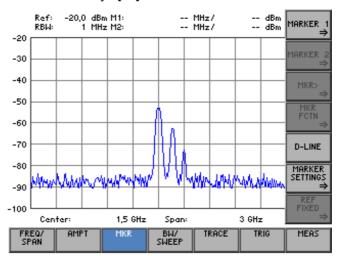
Using the MKR menu, you can position markers on any point on the trace to read off any levels or level differences of interest. The measured values indicated by the markers (marker values) are displayed in the parameter field (↗ 5-47).

A scrollable display line can also be shown on-screen.

Selecting the MKR menu

- Select the [MKR] **menu** with the ◄ or ► **cursor key** [6].

   The menu name is highlighted and the appropriate functions are assigned to the function keys [12].

Function key assignment

[MARKER 1 ⇒]	**Open submenu:** Activate marker 1	(↗ 6-91)
[MARKER 2 ⇒]	**Open submenu:** Activate marker 2	(↗ 6-95)
[MKR> ⇒]	**Open submenu:** Accepting marker values as settings	(↗ 6-98)
[MKR FCTN ⇒]	**Open submenu:** Marker measurement functions	(↗ 6-102)
[D-LINE]	Show display line	(↗ 6-106)
[MARKER SETTINGS ⇒]	**Open submenu:** Search criterion of functions NEXT PEAK LEFT/RIGHT	(↗ 6-107)
[REF FIXED ⇒]	**Open submenu:** Reference points for level-difference measurements	(↗ 6-110)

📄 **Note**

The [MARKER 1 ⇒] and [MARKER 2 ⇒] function keys are selection keys.

The [MARKER 2 ⇒] function key is available only when marker 1 is turned on.

The [MKR> ⇒], [MKR FCTN ⇒] and [REF FIXED ⇒] function keys are available only when marker 1 is turned on.

6.2.3.1   Activating Marker 1

What the settings are for

From the MARKER 1 submenu, you can activate a marker and position it on the trace. All the current level and frequency values (marker values) are displayed.
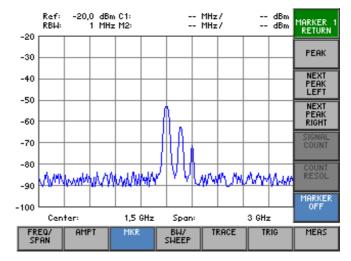
The frequency indicated by the marker can be measured more accurately with the FREQ COUNT function.

Selecting the MARKER 1 submenu

- Press the MARKER 1 ⇒ **function key** in the MKR **menu**.

  The submenu is opened and the appropriate functions are assigned to the function keys [12].

Function key assignment

MARKER 1 RETURN	Quitting the submenu
PEAK	Activate marker 1 and place it on the trace maximum (↗ 6-92)
NEXT PEAK LEFT	Place marker 1 on the next peak to the left (↗ 6-92)
NEXT PEAK RIGHT	Place marker 1 on the next peak to the right (↗ 6-92)
SIGNAL COUNT	Measure the signal frequency: Start the measurement (↗ 6-94)
COUNT RESOL	Measure the signal frequency: Set the resolution (↗ 6-94)
MARKER OFF	De-activate marker 1 (↗ 6-92)

📄 **Note**   The SIGNAL COUNT and COUNT RESOL function keys are available only when marker 1 has been activated.

6.2.3.1.1 Reading off Measured Values with Marker 1
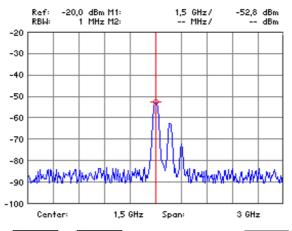
Use

You can position marker 1 on the trace to read off specific levels and frequencies (marker values).

Activating marker 1 and placing it on the trace maximum

1. Press the PEAK **function key** in the MARKER 1 **submenu**.
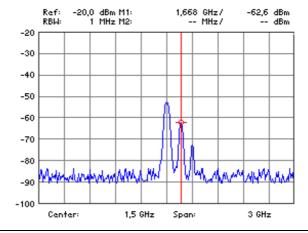
   Marker 1 is activated and placed on the current trace maximum. M1 marker values are displayed in the parameter field.

Placing marker 1 on the next trace maximum

2. Press the NEXT PEAK RIGHT or NEXT PEAK LEFT **function key** in the MARKER 1 **submenu.**

   Marker 1 is positioned on the next trace maximum to the right (or left). The new M1 marker values are displayed in the parameter field.
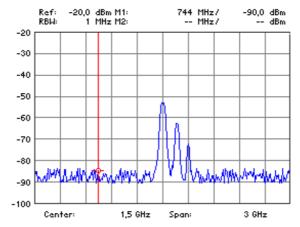
📄 **Note**

The search criterion of functions NEXT PEAK LEFT/RIGHT can be changed by using the funktion key PEAK EXCURS (↗ 6-108).

Scrolling
marker 1

3.   Change the marker position with **rotary knob** [10].

The current M1 marker values are displayed in the parameter field.

De-activating
marker 1

•   Press the [MARKER OFF] **function key** in the [MARKER 1 ⇒] **submenu**.

Marker 1 (and marker 2, if activated) disappears from the diagram area and the M1 (M2) marker values are blanked out.

📄 **Note**   The [NEXT PEAK RIGHT] and [NEXT PEAK LEFT] function keys can also be used to activate marker 1.

6.2.3.1.2 Frequency Measurements using the Frequency Counter

Use

The normal marker indicates the frequency represented by the pixel on which it is placed. The measurement uncertainty is relatively large because the number of pixels is limited to 250.

When a measurement is made with the frequency counter, the sweep is stopped at the frequency indicated by marker 1, the frequency is counted using the required resolution (**1 KHz**, **100 Hz**, **10 Hz**, **1 Hz**) and then the sweep is restarted. There must be a periodic signal at the marker position if the measurement is to be successful.

Setting the resolution

1. Position marker 1 on the trace (↗ 6-91).

The current M1 marker values are displayed in the parameter field.

2. Press the | COUNT RESOL | **function key** in the | MARKER 1 ⇒ | **submenu.**

A selection field containing the available settings is displayed. The default setting is 100 Hz.

```
Counter Resolution
1 kHz
100 Hz
10 Hz
1 Hz
```
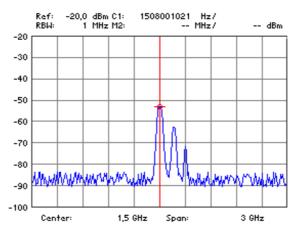
3. Select a resolution for the internal frequency counter with **rotary knob** [10], e. g. 1 Hz.

The new setting is saved.

Measuring the signal frequency

4. Press the | SIGNAL COUNT | **function key** in the | MARKER 1 ⇒ | **submenu.**

The frequency is counted with the internal counter. The result is displayed in the parameter field instead of the marker frequency (M1).

De-activating the measurement

• Press the | SIGNAL COUNT | **function key** in the | MARKER 1 ⇒ | **submenu.**

The internal counter is turned off. The current M1 marker values are again displayed in the parameter field.

📄 **Note**

The absolute accuracy of the frequency measurement depends on the frequency stability of the reference-oscillator. When the internal reference is used, the accuracy is given according to the values specified in the data sheet. (↗ 0-11).

6.2.3.2   Activating Marker 2

What the settings are for

From the MARKER 2 submenu, you can activate a second marker and position it on the trace.

Marker 2 can be used either as a normal marker (NORM) or as a delta marker (DELTA). The delta marker function expands the R&S FS300's analysis capability and can be used as a basis for a variety of measurement techniques (↗ 6-138).
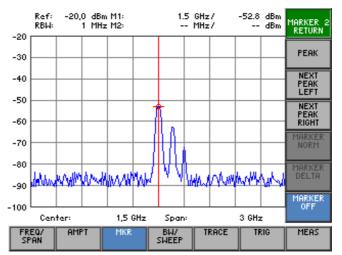
📄 **Note**

Marker 2 can only be activated if marker 1 has been activated.

Selecting the MARKER 2 submenu

• Press the **MARKER 2 ⇒** **function key** in the **MKR** **menu.**

The submenu is opened and the appropriate functions are assigned to the function keys [12].

Function key assignment

MARKER 2 RETURN	Quitting the submenu
PEAK	Activate marker 2 and position it on the trace maximum (↗ 6-96)
NEXT PEAK LEFT	Place marker 2 on the next peak to the left (↗ 6-96)
NEXT PEAK RIGHT	Place marker 2 on the next peak to the right (↗ 6-96)
MARKER NORM	Set marker 2 as a normal marker (NORM) (↗ 6-97)
MARKER DELTA	Set marker 2 as a delta marker (DELTA) (↗ 6-97)
MARKER OFF	De-activate marker 2 (↗ 6-96)

📄 **Note**

The **MARKER NORM** and **MARKER DELTA** function keys are selection keys. In other words, only one setting can be activated at any one time. The function key in question is highlighted. The MARKER NORM function is the default setting.

6.2.3.2.1 Reading off Measured Values with Marker 2

Use

To read off specific levels, you can activate marker 2 as a normal marker (in addition to marker 1) and position it on the trace. The current level and frequency can be displayed in this way (M2 marker values).
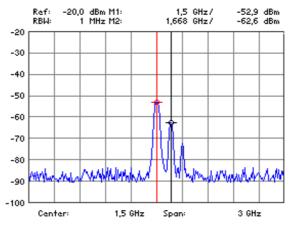
Activating marker 2 as a normal marker (NORM)

1. Press the PEAK **function key** in the MARKER 2 ⇒ **submenu.**

   Marker 2 is activated and placed on the trace maximum.

2. Press the MARKER NORM **function key** in the MARKER 2 ⇒ **submenu.**

   Marker 2 is defined as a normal marker. The M2 absolute marker values are displayed in the parameter field.

3. Position marker 2 on the trace (↗ 6-92).

   The current M2 marker values are displayed in the parameter field.

De-activating marker 2

• Press the MARKER OFF **function key** in the MARKER 2 ⇒ **submenu.**

   Marker 2 disappears from the diagram area and the M2 marker values are blanked out.

📄 **Note**

The NEXT PEAK RIGHT and NEXT PEAK LEFT function keys can also be used to activate marker 2.
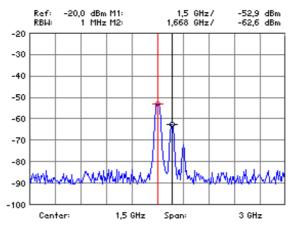
6.2.3.2.2   Reading off Level Differences

Use   You can define marker 2 as a delta marker to read off level differences from the trace. The level difference between marker 2 and a reference point is displayed. Marker 1 (↗ 6-91) or reference values that have been set manually (↗ 6-110) can be used as reference points.

Activating marker 2

1. Press the | PEAK | **function key** in the | MARKER 2 ⇒ | **submenu.**
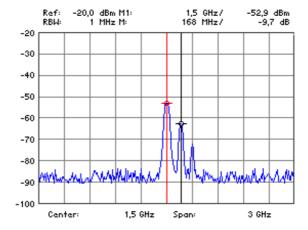
2. Position marker 2 on the trace (↗ 6-95).

   The current M2 marker values are displayed in the parameter field.

Defining marker 2 as a delta marker (DELTA)

3. Press the | MARKER DELTA | **function key** in the | MARKER 2 ⇒ | **submenu.**

   Marker 2 is defined as a delta marker. The relative delta marker values (M), which represent the level difference between marker 2 and a reference point, e.g. marker 1, are displayed in the parameter field.

6.2.3.3 Accepting Marker Values as Settings

What the settings are for

From the MKR> submenu, you can accept the marker values of the active marker as settings for level, frequency or frequency steps.

The step size used to enter the center frequency with the help of the rotary knob can also be the marker frequency.

📄 **Note**
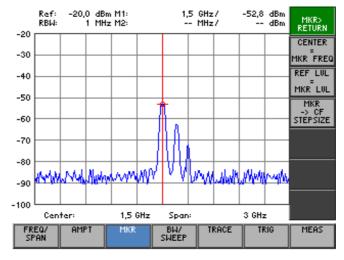
The [MKR>⇒] function key is only available when the markers are activated.

Selecting the MKR> submenu

- Press the [MKR>⇒] **function key** in the [MKR] **menu.**

  The submenu is opened and the appropriate functions are assigned to the function keys [12].

Function key assignment

[MKR> RETURN]   Quitting the submenu

[CENTER = MKR FREQ]   Set the center frequency (CENTER) to the marker frequency
Moving the trace in the diagram area (x axis)   (↗ 6-99)

[REF LVL = MKR LVL]   Set the reference level (REF LEVEL) to the marker level
Moving the trace in the diagram area (y axis)   (↗ 6-99)

[MKR -> CF STEPSIZE]   Set the step size for entering the center frequency to the marker frequency
                                                          (↗ 6-101)

📄 **Note**

In the time-domain mode (ZERO SPAN), the [CENTER = MKR FREQ] function key is not available.

6.2.3.3.1   **Moving Trace Sections in the Measurement Diagram**

Use

If you want to analyze a section of the trace more closely, you can change ist location within the measurement diagram using the active marker. The marker frequency becomes the center frequency and the marker level becomes the upper diagram boundary.
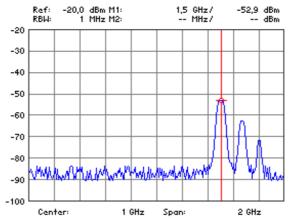
You can then analyze the trace section using a smaller span (↗ 6-70).

Positioning markers on the trace

1. Activate the markers (↗ 6-91, 6-95).

2. Press the MARKER 1 ⇒ or MARKER 2 ⇒ **function key** in the MKR **menu.**

   The selected marker is activated. All further marker settings are for the active marker, e. g. marker 1.

3. Position the active marker on the trace (↗ 6-92, 6-96).
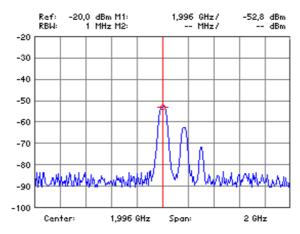
Setting the center frequency to the marker frequency

4. Press the CENTER = MKR FREQ **function key** in the MKR> ⇒ **menu.**

   The marker frequency is made the current center frequency (↗ 6-70). The trace is shifted horizontally to bring marker 1 into the center of the measurement diagram.

   The span remains unchanged provided the limits of 9 kHz or 3 GHz are not reached. Otherwise the span is reduced symmetrically about the center frequency. The lower limit for the span is 1 kHz.
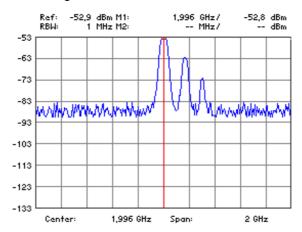
📄 **Note**	In the time-domain mode (ZERO SPAN), the [CENTER = MKR FREQ] function key is not available.

Setting the reference level to the marker level

5. Press the [REF LVL = MKR LVL] **function key** in the [MKR> ⇒] **submenu.**

The current marker level is set as the reference level (↗ 6-81). The trace is shifted vertically until the marker level forms the upper limit of the measurement diagram. The minimum value that can be set is -110 dBm.

6.2.3.3.2   Setting the Step Size to the Marker Frequency

Use
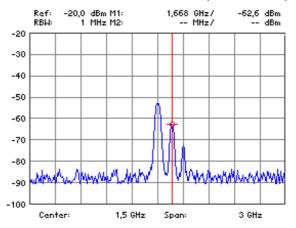
If you set the step size to the marker frequency, you will find that you can quickly jump back to the start frequency when you are stepping through the frequency spectrum with the help of the rotary knob.

Positioning markers on the trace

1. Turn on the markers (↗ 6-91, 6-95).

2. Press the MARKER 1 or MARKER 2 **function key** in the MKR **menu.**

    The selected marker is activated. All further marker settings are for the active marker, e. g. marker 1.

3. Position the activated marker on the trace (↗ 6-92, 6-96).

4. Press the =MARKER **function key** in the MKR -> CF STEPSIZE **submenu.**

    The step size is set to the current marker frequency.

📄 **Note**

"Setting the step size to the marker frequency" has the same function as the setting "step size for entering the center frequency" (↗ 6-72).

6.2.3.4   Marker Measurement Functions

What the settings are for

From the MKR FCTN submenu, using the markers, you can select certain spectral components of the input signal to measure the noise power density and the signal bandwidth.

📄 **Note**
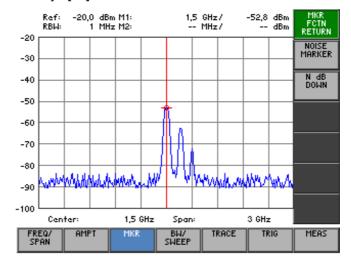
The [MKR FCTN ⇒] function key is available only when the markers are turned on.

Selecting the submenu MKR FCTN

- Press the [MKR FCTN ⇒] **function key** in the [MKR] **menu.**

   The submenu is opened and the appropriate functions are assigned to the function keys [12].

Function key assignment

[MKR FCTN RETURN]	Quitting the submenu	
[NOISE MARKER]	Measuring the noise power density	(↗ 6-103)
[N dB DOWN]	Measuring the signal bandwidth	(↗ 6-104)
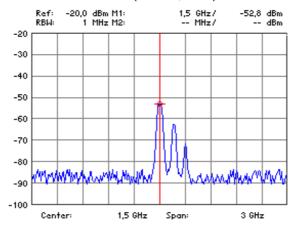
6.2.3.4.1 Measuring the Noise Power Density

Use

The R&S FS300 allows you to measure the noise power density at the active marker position.

Measuring noise power density

1. Turn on the markers (↗ 6-91, 6-95).
2. Position the activated marker (↗ 6-92, 6-96) as desired.

3. Press the NOISE MARKER **function key** in the MKR FCTN ⇒ **submenu.**

   The noise power density measurement is started at the frequency indicated by a marker. If marker 1 is the only marker that has been turned on, the measurement is made at its position. If marker 2 has also been turned on, the measurement is made at its position.

   Two points in the frequency domain (one to the right and one to left of the marker) and two points in the time domain (one to the right and one to the left of the marker) are used in the calculation to obtain a stable measurement result.

   The values measured with the noise marker represent the current value of the amplitude of the noise signal and can fluctuate relatively strongly. To obtain a stable measurement result, the video bandwidth must be set to 1/100 of the set resolution bandwidth.

   The noise power density is displayed in the marker field of the appropriate marker.

   The noise power density display mode depends on the activated unit:

   ▪ **dBm/Hz, W/Hz** for powers
   ▪ **dBμV/ $\sqrt{\text{Hz}}$, mV/ $\sqrt{\text{Hz}}$** for voltages

De-activating the measurement
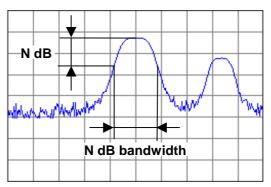
• Press the NOISE MARKER **function key** in the MKR FCTN ⇒ **submenu.**

   The noise power measurement is terminated. The marker used for the measurement reverts to being a normal marker. Marker values are again displayed in the parameter field.

6.2.3.4.2 Measuring the Filter or Signal Bandwidth
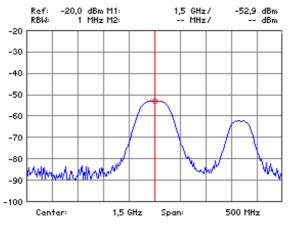
Use

If you want to measure the bandwidth of a certain signal spectrum shown in the measurement diagram, you can do this with the N dB DOWN function. Two lines one of which is n dB down on the active reference marker are displayed on the screen [13]. The difference between the measured frequencies is displayed on the screen as the bandwidth.

Selecting the signal spectrum

1. Position marker 1 on the trace maximum which is to form the reference for the bandwidth measurement (↗ 6-91).

Measuring the signal bandwidth

2. Press the [N dB DOWN] **function key** in the [MKR FCTN ⇒] **submenu.**

   An entry field containing the current attenuation setting of N dB is displayed. The default setting is 3 dB.

3. Enter a new value (↗ 5-53).
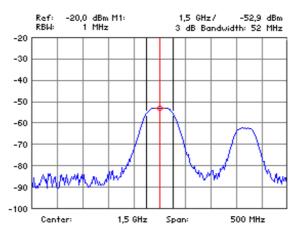
   The entry range for the attenuation N is:

   $$0 \leq \textbf{down} \leq \textbf{100 dB}$$

4. Press the **ENTER key** [5] to close the entry field.

   The new setting is saved and the temporary markers T1 and T2 which are positioned to the right and left of marker 1 on the trace are activated. The levels at markers T1 and T2 are N dB less than the level at marker 1. The frequency difference between the markers T1 and T2 (N dB bandwidth) is displayed in the parameter field instead of the M2 marker values.

Ref: -20,0 dBm M1:   1,5 GHz/   -52,9 dBm
RBW: 1 MHz   3 dB Bandwidth: 52 MHz

Center: 1,5 GHz   Span: 500 MHz

Terminating the measurement

- Press the [N dB DOWN] **function key** in the [MKR FCTN ⇒] **submenu.**

  The signal or filter bandwidth measurement is terminated and the temporary markers T1 and T2 disappear from the screen. The M2 marker values are again displayed in the parameter field.

6.2.3.5   Activating a Display Line

Use

If you want to observe whether a signal exceeds or falls below a certain level you can activate a horizontal display line in the measurement diagram and adjust its position.

Activating the display line

1. Press the | D-LINE | **function key** in the | MKR | **menu**.

    A selection field containing the available settings is displayed.

    > **DLine**
    > Scroll
    > off
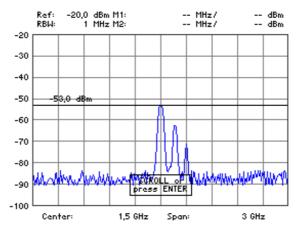
2. Select the **SCROLL** setting with **rotary knob** [10].

3. Press the **ENTER key** [5] to close the selection field.

    The display line appears at the top edge of the diagram area (REF LEVEL). The lettering "SCROLL or press ENTER" is displayed and indicates that the display line can be moved "up" or "down".

Moving the display line

4. Change the position of the display line with **rotary knob** [10].

    The current level is displayed on the left above the display line.

5. Press the **ENTER key** [5] to terminate the scroll mode.

    The text SCROLL disappears, and the display line is now in its new position.

De-activating the display line

1. Press the | D-LINE | **function key** in the | MKR | **menu**.

    A selection field containing the available settings is displayed.

    > **DLine**
    > Scroll
    > off

2. Select **OFF** with **rotary knob** [10].

3. Press the **ENTER key** [5] to close the selection field.

    The display line disappears from the diagram area.

6.2.3.6 Setting the Search Criterion of Functions NEXT PEAK LEFT/RIGHT
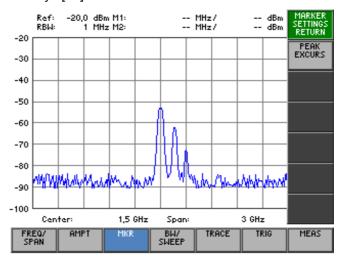
What the settings are for

From the MARKER SETTINGS submenu, you can set the search criterion of functions NEXT PEAK LEFT/RIGHT. The PEAK EXCURSION softkey enables – for level measurements – the entry of a minimum level value by which a signal must fall so that it will be identified as a maximum by the NEXT PEAK LEFT and NEXT NEXT PEAK RIGHT search functions.

Selecting the MARKER SETTINGS submenu

- Press the [MARKER SETTINGS ⇒] **function key** in the [MKR] **menu.**

  The submenu is opened and the appropriate functions are assigned to the function keys [12].

Function key assignment

[MARKER SETTINGS RETURN]   Quitting the submenu

[PEAK EXCURS]   Entering the peak excursion   (↗ 6-108)

6.2.3.6.1 Entering the Peak Excursion

Use

If NEXT PEAK LEFT or NEXT PEAK RIGHT is selected, these functions search for the next relative maximum left or right of the current marker position irrespective of the current signal amplitude. When the signal level decreases for a difinite amount, the peak excursion, to either side of the maximum a relative maximum is given.

Entering the peak excursion

1. Press the PEAK EXCURS **function key** in the MARKER SETTINGS ⇒ **submenu.**

   An entry field containing the current setting is displayed. The default setting is 6 dB.

   Peak Excursion [6] dB

2. Enter a new value in 0.1 dB steps (↗ 5-53).
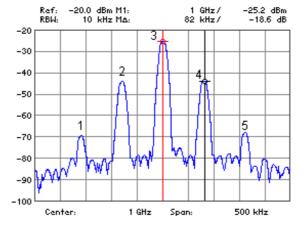
   The entry range for the reference-point level is:

   0 ≤ Peak Excursion ≤ 80 dB

   The new setting is saved and it is the current search criterion when you use the functions NEXT PEAK LEFT/RIGHT (↗ 6-92).

Examples of level measurement with different settings of PEAK EXCURSION

The following example illustrates the effect of different settings of the PEAK EXCURSION.

The following table lists the signals as indicated by numbers in the measuring diagram above, as well as the minimum of the amplitude decrease to both sides of the signal:

Signal #	Min. amplitude decrease to both sides of the signal
1	10 dB
2	35 dB
3	48 dB
4	35 dB
5	10 dB

50 dB peak excursion	With this setting, NEXT PEAK LEFT and NEXT PEAK RIGHT will not find any signal, as the signal level does not decrease by more than 48 dB to either side of any signal.

Order of signals detected:
PEAK: signal 3
NEXT PEAK LEFT: signal 3 (no further signal detected)
NEXT PEAK RIGHT: signal 3 (no further signal detected)

30 dB peak excursion	With this setting, NEXT PEAK LEFT and NEXT PEAK RIGHT will also detect signals 2 and 4, as the signal level decreases at least by 35 dB to either side of this signal, which is now greater than the peak excursion.

Order of signals detected:
PEAK: signal 3
NEXT PEAK LEFT: signal 2
NEXT PEAK LEFT: signal 2 (no further signal detected)
NEXT PEAK RIGHT: signal 3
NEXT PEAK RIGHT: signal 4
NEXT PEAK RIGHT: signal 4 (no further signal detected)

6 dB peak excursion	With this setting, all signals will be detected with NEXT PEAK RIGHT or NEXT PEAK LEFT.

Order of signals detected:
PEAK: signal 3
NEXT PEAK LEFT: signal 2
NEXT PEAK LEFT: signal 1
NEXT PEAK LEFT: signal 1 (no further signal detected)
NEXT PEAK RIGHT: signal 2
NEXT PEAK RIGHT: signal 3
NEXT PEAK RIGHT: signal 4
NEXT PEAK RIGHT: signal 5
NEXT PEAK RIGHT: signal 5 (no further signal detected)

6.2.3.7 Setting Reference Points for Level-Difference Measurements

What the settings are for

From the REF FIXED submenu, you can define any reference point within the R&S FS300's measurement range. You can use this point as a fixed reference for level-difference measurements using the delta marker (↗ 6-97).
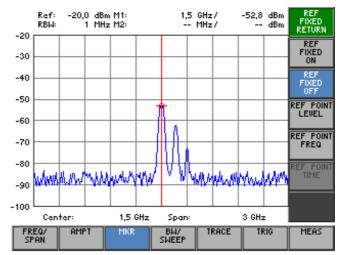
📄 **Note**

The [REF FIXED ⇒] function keys are available only when the markers are turned on.

Selecting the REF FIXED submenu

- Press the [REF FIXED ⇒] **function key** in the [MKR] **menu.**

  The submenu is opened and the appropriate functions are assigned to the function keys [12].

Function key assignment

[REF FIXED RETURN]   Quitting the submenu

[REF FIXED ON]   Activate reference point entry   (↗ 6-111)

[REF FIXED OFF]   Activate the M1 marker values as a reference point   (↗ 6-111)

[REF POINT LEVEL]   Enter the reference point level   (↗ 6-111)

[REF POINT FREQ]   Enter the reference point frequency   (↗ 6-111)

[REF POINT TIME]   Enter the reference point time   (↗ 6-111)

📄 **Note**

The [REF FIXED ON] and [REF FIXED OFF] function keys are selection keys. In other words, only one setting can be activated at any one time. The function key in question is highlighted.

The [REF POINT FREQ] function key is available only in the frequency domain (SPAN > 0). The [REF POINT TIME] function key is available only in the time domain (ZERO SPAN).

6.2.3.7.1   Manual Entry of Reference Points

Use

There are two methods you can use to find level differences from the trace. The first method is to define a reference point on the trace using marker 1 (↗ 6-91).
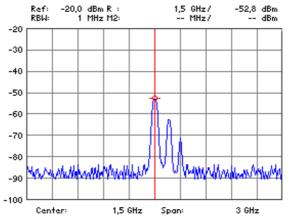
The second approach is entering arbitrary reference points inside and outside the measurement diagram.

When you enter arbitrary reference points the M1 marker values are frozen. Instead, the R reference values are displayed in the parameter field. The M2 marker values indicate the level difference referred to the reference point.

Activating entry of arbitrary reference points

1. Press the [REF FIXED ON] **function key** in the [REF FIXED ⇒] **submenu.**

    It is now not possible to move marker 1. The M1 marker values are frozen and are used as fixed reference values R.

Entering reference point levels

2. Press the [REF POINT LEVEL] **function key** in the [REF FIXED ⇒] **submenu.**

    An entry field containing the current setting (frozen marker level) is displayed.

3. Enter a new value in 0.1 dB steps (↗ 5-53).

    The entry range for the reference-point level is:

    -200 [dBm] ≤ Ref point level ≤ +200 [dBm]

    The new setting is saved and displayed in the diagram area. The value is not displayed if it is outside the diagram area.

Entering a reference point frequency

4a) Frequency-domain display mode (SPAN > 0, ↗ 6-69)**:**

- Press the [REF POINT FREQ] **function key** in the [REF FIXED ⇒] **submenu.**

An entry field containing the current setting (frozen marker frequency)is displayed.

> Ref point freq `1.500000000` GHz

- Enter a new value (↗ 5-53).
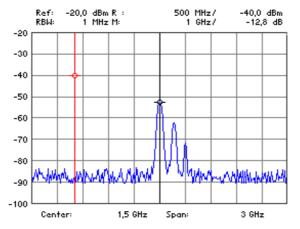
The entry range for the reference point frequency is:

0 ≤ Ref point freq ≤ 3 GHz

The new setting is saved and displayed in the diagram area. The value is not displayed if it is outside the diagram area.

The level and the frequency at the reference point form the fixed reference point for level-difference measurements with the delta marker in the frequency domain (↗ 6-97).

Entering a reference point time

4b) Time-domain display mode (ZERO SPAN, ↗ 6-76)**:**

- Press the [REF POINT TIME] **function key** in the [REF FIXED ⇒] **submenu.**

An entry field containing the current setting (frozen marker time) is displayed.

> Ref point time `5.0` ms

- Enter a new value (↗ 5-53).
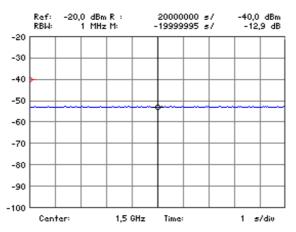
The entry range for the reference-point time is:

0 s ≤ Ref point time ≤ t_{SWEEP}

where t_{SWEEP} - current SWEEP time (↗ 6-122)

The new setting is saved and displayed in the diagram area. If the value is outside the diagram area, it is not displayed.
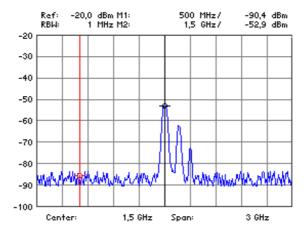
The reference point level and time form a fixed reference point for level difference measurements with the delta marker in the time domain (↗ 6-97).

```
Ref:   -20,0 dBm R :        20000000 s/      -40,0 dBm
RBW:      1 MHz M:         -19999995 s/      -12,9 dB
```

Activating M1 marker values as reference points

- Press the [REF FIXED OFF] **function key** in the [REF FIXED ⇒] **submenu.**

  The reference values (R) disappear from the screen and the M1 marker values are again activated. Marker 1 is positioned on the last reference point frequency on the trace and can again be moved, e. g. in the frequency-domain display mode.

```
Ref:   -20,0 dBm M1:        500 MHz/      -90,4 dBm
RBW:      1 MHz M2:         1,5 GHz/      -52,9 dBm
```

6.2.4   Setting the Bandwidths and the Sweep Time (BW/SWEEP Menu)

What the settings are for
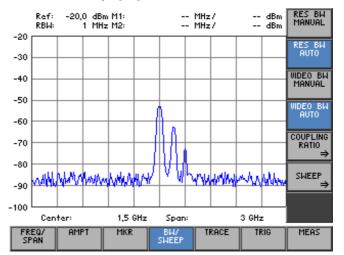
You can set the resolution bandwidth (RBW), the video bandwidth (VBW) and the sweep time using the BW/SWEEP menu.

The parameters determine the measurement procedure and can be coupled as a function of the SPAN or set independently.

Selecting the BW/SWEEP menu

• Select the | BW/ SWEEP | **menu** with the ◀ or ▶ **cursor key** [6].

The menu name is highlighted and the appropriate functions are assigned to the function keys [12].

Function key assignment

| RES BW MANUAL | Setting the resolution bandwidth manually | (↗ 6-115) |

| RES BW AUTO | Activating automatic resolution bandwidth setting | (↗ 6-115) |

| VIDEO BW MANUAL | Setting the video bandwidth manually | (↗ 6-116) |

| VIDEO BW AUTO | Activating automatic video bandwidth setting | (↗ 6-116) |

| COUPL RATIO ⇒ | **Open submenu:** Setting the RBW/VBW coupling ratio | (↗ 6-117) |

| SWEEP ⇒ | **Open submenu:** Setting the sweep time | (↗ 6-120) |

📄 **Note**

The | RES BW MANUAL |, | RES BW AUTO | function keys and the | VIDEO BW MANUAL |, | VIDEO BW AUTO | function keys are selection keys. In other words, only one setting can be activated at any one time. The function key in question is highlighted.
The RES BW AUTO and VIDEO BW AUTO functions are the default settings.

The | RES BW AUTO | function key is not available in the time-domain display mode (ZERO SPAN).

6.2.4.1 Setting the Resolution Bandwidth
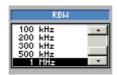
Use

The span and the resolution bandwidth can be set independently. In the default setting, however, these two parameters are coupled to make operating the instrument easier. This setting is recommended for many applications because operating errors are prevented. To make certain measurements, it may be necessary to set the resolution bandwidth and the span independently. With the R&S FS300, you can manually set resolution bandwidths from 200 Hz to 1 MHz in a 1, 2, 3, 5, 10 sequence.

Setting the resolution bandwidth manually

1. Press the | RES BW MANUAL | **function key** in the | BW/ SWEEP | **menu**.

    A selection field containing the available settings is displayed. The default setting is 1 MHz.

2. Select a resolution bandwidth with **rotary knob** [10].

3. Press the **ENTER key** [5] to close the selection field.

    The new setting is saved and the resolution filter is configured.

Activating automatic resolution bandwidth setting

• Press the | RES BW AUTO | **function key** in the | BW/ SWEEP | **menu**.

    The resolution bandwidth is set to $^1/_{50}$ of the span. If the span is changed, the resolution bandwidth is adjusted automatically.

📄 **Note**

The | RES BW AUTO | function key is not available in the time-domain display mode (ZERO SPAN).

6.2.4.2 Setting the Video Bandwidth

Use

You can set a variety of video bandwidths to smooth the trace. You can set video bandwidths from 10 Hz to 1 MHz in a 1, 2, 3, 5, 10 sequence on the R&S FS300.

Setting the video bandwidth manually

1. Press the [RES BW MANUAL] **function key** in the [BW/ SWEEP] **menu**.

   A selection field containing the available settings is displayed. The default setting is 1 MHz.

2. Select a video bandwidth with **rotary knob** [10].

3. Press the **ENTER** key [5] to close the selection field.

   The new setting is saved and the selected video bandwidth is set.

Activating automatic video bandwidth setting

- Press the [VIDEO BW AUTO] **function key** in the [BW/ SWEEP] **menu**.

   The R&S FS300's video bandwidth is set to three times the resolution bandwidth. If the resolution bandwidth is changed, the video bandwidth is adjusted automatically.
   Within the permissible setting range, the video bandwidth is set to the value that is closest to three times the value of the resolution bandwidth.

   The coupling ratio can be changed (↗ 6-117).
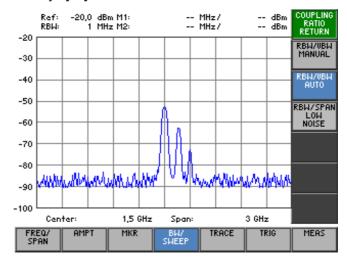
6.2.4.3   RBW, VBW and SPAN Coupling Ratio

What the settings are for

You can set the coupling ratio between the video bandwidth, the resolution bandwidth and the frequency display span using the COUPLING RATIO sub-menu.

Selecting the COUPLING RATIO submenu

- Press the ⬚ **COUPL RATIO** ⇒ **function key** in the ⬚ **BW/ SWEEP** **menu**.

   The submenu is opened and the appropriate functions are assigned to the function keys [12].

Function key assignment

COUPL RATIO RETURN	Quitting the submenu	
RBW/VBW MANUAL	Setting the coupling ratio RBW/VBW manually	(↗ 6-118)
RBW/VBW AUTO	Activating the default setting for the coupling ratio RBW/VBW	(↗ 6-118)
RBW/SPAN LOW NOISE	Switching over the coupling RBW/SPAN to low noise	(↗ 6-119)

📄 **Note**

The **RBW/VBW MANUAL** and **RBW/VBW AUTO** function keys are selection keys. In other words, only one setting can be activated at any one time. The function key in question is highlighted.
The RBW/VBW AUTO function is the default setting.

6.2.4.3.1   Changing the Coupling Ratio RBW/VBW

Use

You can change the automatic coupling between resolution bandwidth (RBW) and the video bandwidth (VBW) by means of the RBW/VBW MANUAL function. This makes it possible to increase the display accuracy of the analyzer in comparison to the default setting (RBW/VBW AUTO).

Setting the coupling ratio manually

1. Press the RBW/VBW MANUAL **function key** in the COUPL RATIO⇒ **submenu**.

   An entry field containing the current setting is displayed. The default setting is 1.

   RBW/VBW [1.0000]

2. Enter a new value (↗ 5-53).

   The entry range for the coupling ratio is:

   $$0.001 \leq RBW/VBW \leq 1000$$

   The new setting is saved and the VBW/RBW coupling ratio is set. If the resolution bandwidth is changed, the video bandwidth is adjusted automatically.

Activating the default setting for the coupling ratio

• Press the RBW/VBW AUTO **function key** in the COUPL RATIO⇒ **submenu**.

   The R&S FS300's video bandwidth is set to three times the resolution bandwidth.

6.2.4.3.2   Switching Over the Coupling RBW/SPAN to Low Noise

Use

You can change the automatic coupling between frequency display span (SPAN) and resolution bandwidth (RBW) by means of the RBW/SPAN LOW NOISE function. This makes it possible to increase the measurement sensitivity of the analyzer in comparison to the normal setting.

If the span is < 1 GHz in the Low Noise setting, the setting for the resolution bandwidth is as shown in the following table:
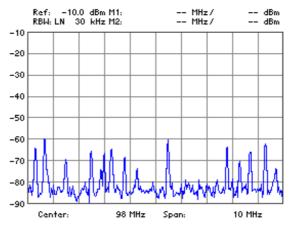
SPAN	RBW
SPAN > 1 GHz	1 MHz
1 GHz ≥ SPAN > 50 MHz	300 kHz
50 MHz ≥ SPAN > 10 MHz	100 kHz
10 MHz ≥ SPAN > 5 MHz	30 kHz
5 MHz ≥ SPAN > 1 MHz	10 kHz
1 MHz≥ SPAN > 200 kHz	3 kHz
200 kHz ≥ SPAN > 100 kHz	1 kHz
100 kHz ≥ SPAN > 50 kHz	500 Hz
50 kHz ≥ SPAN > 20 kHz	300 Hz
20 kHz ≥ SPAN > 1 kHz	200 Hz

Switching on the coupling RBW/SPAN LOW NOISE

• Press the [RBW/SPAN LOW NOISE] **function key** in the [COUPL RATIO ⇒] **submenu**.

The ratio between frequency display span (SPAN) and resolution bandwidth (RBW) is set consequently.

The setting is indicated by the letters LN next to the RBW display.

Switching off the coupling RBW/SPAN LOW NOISE

• Press the [RBW/SPAN LOW NOISE] **function key** in the [COUPL RATIO ⇒] **submenu**.

The ratio between frequency display span (SPAN) and resolution bandwidth (RBW) is set normally and provides the shortest possible sweep times for a set SPAN.

The letters LN next to the RBW display are blanked out.

6.2.4.4 Setting the Sweep

What the settings are for

You can select the type of sweep and the sweep time from the SWEEP submenu.
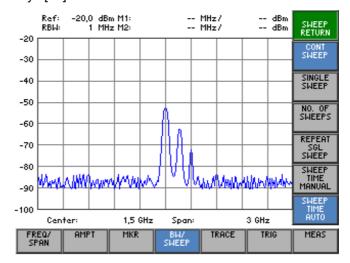
Selecting the SWEEP submenu

- Press the `SWEEP →` **function key** in the `BW/ SWEEP` **menu**.

  The submenu opens and the appropriate functions are assigned to the function keys [12].

Function key assignment

`SWEEP RETURN`	Quitting the submenu	
`CONT SWEEP`	Starting the continuous sweep	(↗ 6-121)
`SINGLE SWEEP`	Performing an n-times sweep	(↗ 6-121)
`NO. OF SWEEPS`	Setting the number of sweeps	(↗ 6-121)
`REPEAT SGL SWEEP`	Repeating an n-times sweep	(↗ 6-122)
`SWEEP TIME MANUAL`	Setting the sweep time manually	(↗ 6-122)
`SWEEP TIME AUTO`	Activating automatic sweep time setting	(↗ 6-122)

📄 **Note**

The `CONT SWEEP`, `SINGLE SWEEP` function keys and the `SWEEP TIME MANUAL`, `SWEEP TIME AUTO` function keys are selection keys. In other words, only one setting is activated at any one time. The function key in question is highlighted.
The COUNT SWEEP and SWEEP TIME AUTO functions are the default settings.

The `RES BW AUTO` function key is not available in the time-domain display mode (ZERO SPAN).

6.2.4.4.1   Selecting the Frequency Sweep

Use
: Frequency sweep is the process where the resolution filter covers a defined frequency range.
Sweeps may be performed continuously (CONT SWEEP) or once (SIN-GLE SWEEP).

Starting a
continuous sweep
: • Press the [CONT SWEEP] **function key** in the [SWEEP⇒] **submenu**.

  The sweep repeats continuously when the trigger event is detected (↗ 6-133).

Performing an
n-times sweep
: 1. Press the [SINGLE SWEEP] **function key** in the [SWEEP⇒] **submenu**.

  An n-times sweep is started when the trigger event is detected. The number of sweeps is specified with the NO. OF SWEEPS setting (↗ below).

  When you repeatedly press the [SINGLE SWEEP] function key, the previous trace is cleared and a new frequency sweep (n times) is started.

Setting the
number of sweeps
: 2. Press the [NO. OF SWEEPS] **function key** in the [SWEEP⇒] **submenu**.

  An entry field containing the current setting is displayed. The default setting is 0 (endless sweeps).

  Cycle Count [0   ]

  3. Enter a new value (↗ 5-53).

  The entry range for the number of sweeps is:

  0 ≤ Cycle Count ≤ 32767

  The new setting is saved and when a single sweep has been started, the sweep is repeated n times.

Repeating an
n-times sweep
: 4. Press the [REPEAT SGL SWEEP] **function key** in the [SWEEP⇒] **submenu**.

  An n-times sweep is started when the trigger event is detected. The trace is not cleared on completion of the sweep as would be the case with the single-sweep function.

  This is most relevant in relation to the TRACE AVERAGE and HOLD functions if measured values that have already been recorded have to be taken into account for averaging and finding the minimum/maximum.

6.2.4.4.2 Setting the Sweep Time

Use

The sweep time is the time taken by the resolution filter set to a specific bandwidth (RBW) to sweep a particular frequency range or span.

In the default setting, the sweep time is coupled to the span (SPAN), the resolution bandwidth (RBW) and the video filter (VBW).

Setting the sweep time manually

1. Press the [SWEEP TIME MANUAL] **function key** in the [SWEEP⇒] **submenu**.

   An entry field containing the current setting is displayed. The default setting is 15.5 ms. The default setting is at SPAN = 1 GHz and

   - RBW = 300 kHz: 137.833 ms
   - RBW = 1 MHz: 24.825 ms

   Sweep Time [10.0000] ms

2. Enter a new value (↗ 5-53).

   The entry range for the sweep time is:

   0 ms ≤ Sweep Time ≤ 10 ms

3. Press the **ENTER key** [5] to close the entry field.

   The new setting is saved and the new sweep time activated.

Activating automatic sweep time setting

- Press the [SWEEP TIME AUTO] **function key** in the [SWEEP⇒] **submenu**.

   The sweep time is coupled to the span, the resolution bandwidth (RBW) and the video bandwidth (VBW). The sweep time is automatically adjusted if either the span, the RBW or the VBW are changed.

   The R&S FS300 always selects the shortest possible sweep time consistent with valid results. The maximum level error trade-off for a longer sweep time is < 0.1 dB. If you do not want the additional bandwidth and level error, set the sweep time manually to three times the suggested value (↗ above).

6.2.5   Measured-Value Display (TRACE Menu)

What the settings are for

Using the TRACE menu, you can apply various display modes to the input-signal results. Two traces (Trace 1, Trace 2) are provided for this purpose.
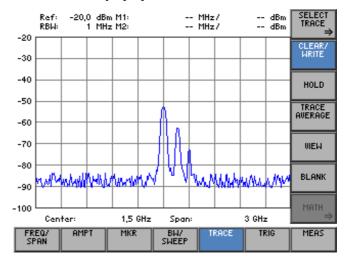
Selecting the TRACE menu

- Select the `TRACE` **menu** with the ◂ or ▸ **cursor key** [6].

    The menu name is highlighted and the appropriate functions are assigned to the function keys [12].

Function key assignments

SELECT TRACE ⇒	**Open submenu:** Selecting the active trace	(↗ 6-124)
CLEAR/ WRITE	Trace display mode: Overwrite mode	(↗ 6-127)
HOLD	Trace display mode: Min/Max Hold	(↗ 6-127)
TRACE AVERAGE	Trace display mode: Averaging	(↗ 6-127)
VIEW	Freezing the trace	(↗ 6-127)
BLANK	Blanking out the trace	(↗ 6-127)
MATH ⇒	**Open submenu:** Trace difference function	(↗ 6-130)

📄 **Note**

The function keys `CLEAR/ WRITE`, `HOLD`, `TRACE AVERAGE`, `VIEW` or `BLANK` are selection keys. In other words, only one setting can be active at any one time. The function key in question is highlighted.
The CLEAR/WRITE function is the default setting.

The `MATH ⇒` function key is only available when both traces are on (↗ 6-124).
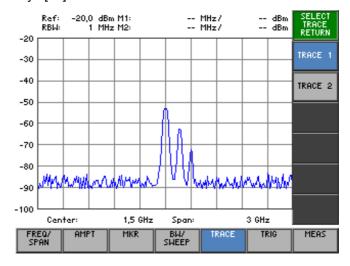
6.2.5.1 Selecting the Active Trace

What the settings are for

Via the SELECT TRACE submenu, you can activate a second trace and select the current trace (Trace 1, Trace 2) to which all the following settings will be applied.

Selecting the SELECT TRACE submenu

- Press the [SELECT TRACE ⇒] **function key** in the [TRACE] **menu**.

  The submenu opens and the appropriate functions are assigned to the function keys [12].

Function key assignment

[SELECT TRACE RETURN] Quitting the submenu

[TRACE 1] Turn on and activate Trace 1   (↗ 6-125)

[TRACE 2] Turn on and activate Trace 2   (↗ 6-125)

📄 **Note**

The function keys [TRACE 1] and [TRACE 2] are selection keys. In other words, only one setting can be active at any one time. The function key in question is highlighted.
The TRACE 1 function is the default setting.

6.2.5.1.1   Activating Traces

Use

The measured values for the input signal can be displayed using two different traces (Trace 1 and Trace 2). However, only one trace is active and can be used at any one time. The other trace is frozen and displayed. This means that the two traces can be compared.

Activating Trace 1
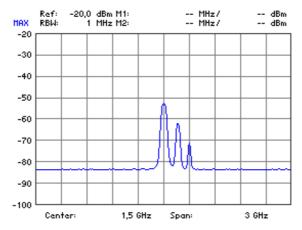
When you switch on the R&S FS300, Trace 1 is automatically turned on and activated. Trace 2 is turned off. All the settings are for Trace 1.

- In the [SELECT TRACE ⇒] **submenu,** press the [TRACE 1] **function key** if Trace 2 is turned on and active.

  Trace 1 becomes the active trace. All the following settings are for this trace. The current display mode, e.g.   MAX HOLD (MAX, ↗ 6-127), is displayed in the top left of the diagram area in the trace colour:
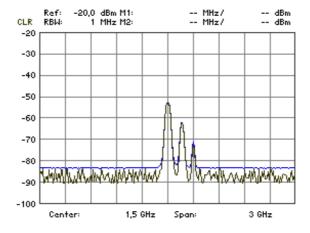
Turning on and activating Trace 2

When the R&S FS300 is turned on, Trace 2 is turned off. When the trace is called for the first time, the CLEAR/WRITE display mode is set.

- Press the [TRACE 2] **function key** in the [SELECT TRACE ⇒] **submenu.**

  Trace 2 becomes the active trace. All subsequent settings are for this trace. In the top left of the diagram area, the current display mode is shown in the trace colour, e.g. CLEAR/WRITE (CLR, ↗ 6-127):

**Turning off
Trace 2**

1. Press the TRACE 2 **function key** in the SELECT TRACE ⇒ **submenu**.

Trace 2 is now active.

2. Press the BLANK **function key** in the TRACE **menu**.

Trace 2 is blanked out.

3. Press the TRACE 1 **function key** in the SELECT TRACE ⇒ **submenu**.

Trace 1 is activated and Trace 2 is turned off.

📄 **Note**   The current values are displayed in the trace colour. This means that you can quickly tell which trace has been activated.

6.2.5.2   Displaying the Active Trace

Use   You can select the following settings for displaying the active trace:

- **CLEAR/WRITE**
  Overwrites the trace on every frequency sweep.

- **HOLD**
  Displays the minimum/maximum over several sweeps.

  This function is used to find the minimum/maximum value of a signal over several frequency sweeps (↗ CONT. SWEEP, 6-121). This is particularly useful in the case of modulated or pulse-like signals. On every sweep, more data is added to the signal spectrum until all the signal components are displayed using a type of "envelope curve".

- **AVERAGE**
  Displays the average over several frequency sweeps.

  This function is used to display the signal average over several frequency sweeps. This function is most useful for sine signals which have been degraded by noise. Essentially, noise can be eliminated by averaging the samples over several frequency sweeps.

  After a measurement has been performed, the trace can be frozen (**VIEW**) or blanked out (**BLANK**).
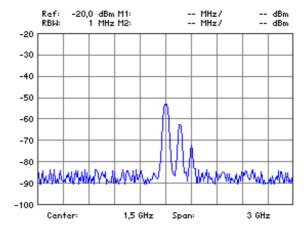
Displaying   When the R&S FS300 is switched on, Trace 1 is active and is displayed in
current   the CLEAR/WRITE display mode.
measured values

- Press the [CLEAR/ WRITE] **function key** in the [TRACE] **menu.**

  The overwrite mode is set. This means that the trace is overwritten on every frequency sweep.

Displaying signal minimum/maximum
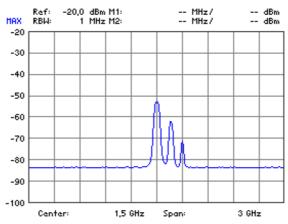
1. Press the HOLD **function key** in the TRACE **menu.**

   A selection field containing the available settings is displayed. The default setting is Min Hold.

2. Select a settings for displaying the active trace with **rotary knob** [10].

3. Press the **ENTER key** [5] to close the selection field.

   The MIN/MAX function is activated. This means that, after every sweep, the R&S FS300 only transfers the new measured value to the measured value memory if it is smaller/greater than the previous value. The current display mode , e. g. MAX , is displayed in the top left of the diagram area.

Displaying average values

1. Press the TRACE AVERAGE **function key** in the TRACE **menu.**

   Averaging is activated. The average is taken over several frequency sweeps.

   An entry field for entering the number of frequency sweeps is displayed. The default setting is 0.

2. Enter a new value (↗ 5-53).

   The entry range for the number of frequency sweeps is:

   0 ≤ Sweep Count ≤ 100

   where:

Sweep Count = 0	Continuous averaging
Sweep Count = 1	No averaging
Sweep Count > 1	Averaging over the specified number of frequency sweeps
	If the continuous sweep mode (↗ CONT. SWEEP, 6-121) has been selected, continuous averaging is automatically activated when the specified number of sweeps has been performed.
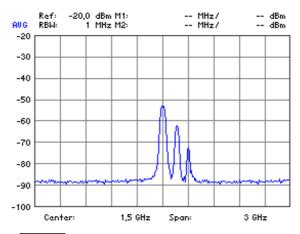
3. Press **ENTER key** [5] to close the entry field.

The new setting is saved. Averaging is started and the result is displayed. The current display mode AVG is shown in the top left of the diagram area.

Freezing traces

1. Press the [VIEW] **function key** in the [TRACE] **menu**.

The current trace is frozen and displayed.

2. Press the [CLEAR/ WRITE], [HOLD] or [TRACE AVERAGE] **function key** in the [TRACE] **menu** when you want to update the trace.

Blanking traces

• Press the [BLANK] **function key** in the [TRACE] **menu**.

The trace is blanked out of the measurement diagram.

If the trace has been frozen previously at some time, it can be returned to the display by pressing the [VIEW] function key. Otherwise, the trace is deleted.

6.2.5.3 Trace Difference Function

📄 **Note** The MATH⇒ function key is available only if both traces are turned on (↗ 6-124).
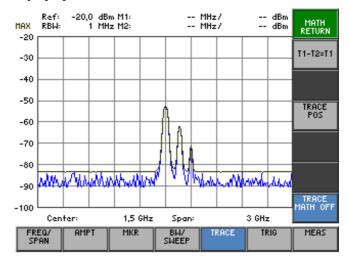
What the settings are for

You can activate the difference function for two traces (Trace 1, Trace 2) from the MATH submenu and use this function to analyze the input signal.

Selecting the MATH submenu

• Press the MATH⇒ **function key** in the TRACE **menu.**

The submenu opens and the appropriate functions are assigned to the function keys [12].

Function key assignment

MATH RETURN   Quitting the submenu

T1-T2=T1   Activating the trace difference function (↗ 6-131)

TRACE POS   Repositioning Trace 1 (result) (↗ 6-131)

TRACE MATH OFF   Turning off the trace difference function (↗ 6-131)

6.2.5.3.1   Activating the Trace Difference Function
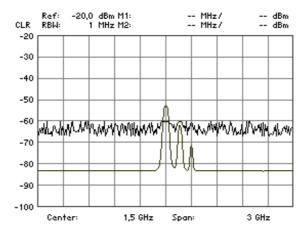
Use   You can use the R&S FS300's MATH function to directly determine differ-
                          ences between signals by forming the difference of two traces. The new ref-
                          erence for the difference trace is in the center of the measurement diagram
                          (50 %). The difference trace can be moved within the measurement diagram
                          by changing the reference.

Turning on the   **1.**   Press the T1-T2=T1 **function key** in the MATH⇒ **submenu.**
difference
function   The new trace, Trace 1, is the difference of the old traces, e. g. T1 = T1 -
                          T2. Each measured value represented by Trace 2 is subtracted from the
                          corresponding measured value represented by Trace 1.
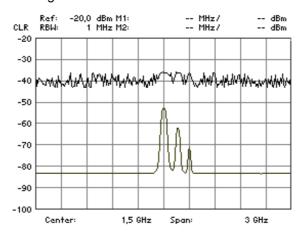
**Repositioning
Trace 1 (result)**

2. Press the TRACE POS **function key** in the MATH⇒ **submenu.**

A reference line is displayed in the middle of the current diagram area. The text "SCROLL or press ENTER" is displayed to tell you that the trace can be moved up or down.

3. Change the position of the reference line with **rotary knob** [10].

The current position in % is displayed on the left above the reference line.

4. Press the **ENTER key** [5] to terminate scrolling.

The text "SCROLL" disappears and Trace 1 is now in its new position. The new setting is saved.

You can then display (↗ 6-127) and analyze (↗ 6-89) Trace 1 in any way you want.

**Turning off the trace
difference function**

• Press the TRACE MATH OFF **function key** in the MATH⇒ **submenu**.

The difference function for the two traces (T1=T1-T2) is turned off and the two traces are again displayed independently.

📄 **Note**   While a math function is being performed on both traces, it is not possible to change the active trace.

6.2.6   Triggering Measurements (TRIG Menu)

What the settings are for
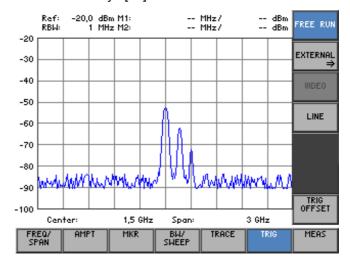
From the TRIG menu, you can select a variety of trigger sources. You can set the trigger edge and the measurement time for external trigger signals (TTL).

Selecting the TRIG menu

- Select the [TRIG] **menu** with the ◀ or ▶ **cursor key** [6].

  The menu name is highlighted and the appropriate functions are assigned to the function keys [12].

Function key assignment

[FREE RUN]	Free-running measurement. No explicit triggering of the start of measurement (↗ 6-134)
[EXTERNAL ⇒]	**Open submenu:** Triggering by an external TTL signal (↗ 6-136)
[VIDEO]	Triggering by the display level (↗ 6-134)
[LINE]	Triggering related to the zero crossings of the AC line voltage (↗ 6-134)
[TRIG OFFSET]	Enter trigger offset (↗ 6-137)

📄 **Note**

The [FREE RUN], [EXTERNAL ⇒], [VIDEO] and [LINE] functions keys are selection keys. In other words, only one setting can be activated at any one time. The function key in question is highlighted.
The FREE RUN function is the default setting.

The [VIDEO] function key is available only in the time-domain display mode (ZERO SPAN).

6.2.6.1   Internal Trigger Sources

Use

Depending on the measurement, you can use a variety of criteria for triggering measurements in the frequency domain (SPAN > 0) or in the time domain (ZERO SPAN).

- Free-running triggering
- Triggering by the display level (only in the time domain, ZERO SPAN)
- Triggering by the AC line frequency

Free-running triggering

Suitable for measurements on stationary signals where a time reference is not necessary.

- Press the FREE RUN **function key** in the TRIG **menu.**

    There is no explicit triggering of the start of measurements. When one measurement has been completed, another is started immediately.

Triggering by display level (only available in time domain, ZERO SPAN)

If the video trigger is used, triggering on signals whose carrier amplitude is a function of time is possible. This means that measurements can be made on bursts which are often encountered in mobile radio applications.

1. Press the VIDEO **function key** in the TRIG **menu.**

    A horizontal trigger line is displayed in the diagram area. The associated trigger level is displayed above the trigger line on the left.

    An entry field for entering the trigger level is also displayed. The trigger level can be set to between 0 % and 100 % of the diagram height. The default setting is 50 % corresponding to e. g. -60.0 dBm.

    Trig. Video [50] %

2. Enter a new value (↗ 5-53).
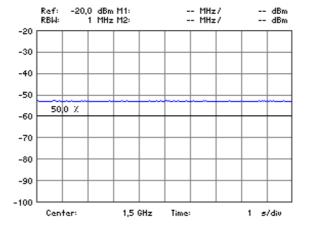
    The entry range for the trigger level is:

    0 % ≤ Trigger Video ≤ 100 %

3. Press the **ENTER key** [5] to close the entry field.

    The trigger line is in its new position and the current trigger level indicates how large the input level must be to start the next measurement.

Triggering by the AC line frequency

This makes it possible to perform synchronized measurements on video signals, for example, which can even be triggered using the frequency of the AC line.

- Press the [LINE] **function key** in the [TRIG] **menu.**

  The measurement is triggered by referencing the AC line.

6.2.6.2 External Trigger Sources

What the settings are for

From the EXTERNAL submenu, you can activate an external TTL signal and specify the trigger edge for triggering measurements.
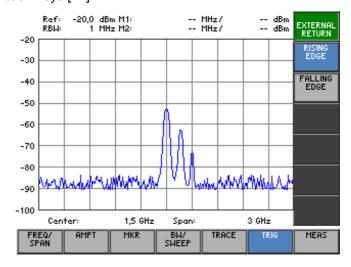
Selecting the EXTERNAL submenu

- Press the EXTERNAL **function key** in the TRIG **menu.**

  The submenu is opened and the appropriate functions are assigned to the function keys [12].

Function key assignment

EXTERNAL RETURN   Quitting the submenu

RISING EDGE   Triggering on the rising edge of the external TTL signal   (↗ 6-137)

FALLING EDGE   Triggering on the falling edge of the external TTL signal   (↗ 6-137)

📄 **Note**

The RISING EDGE and FALLING EDGE function keys are selection keys. In other words, only one setting can be selected at any one time. The function key in question is highlighted.
The RISING EDGE function is the default setting.

6.2.6.2.1   Setting the Trigger Edge for External TTL Signals

Use

For certain measurements, you can use an external TTL signal (squarewave signal) as a trigger. The trigger period is user-selectable. The R&S FS300 allows you to set triggering on a rising or on a falling edge of the squarewave.

1. Connect the external signal source to the R&S FS300's input connector [14].

Rising trigger edge

2. **a)** Press the `RISING EDGE` **function key** in the `EXTERNAL ⇒` **submenu.**

    The measurement is started on every positive-going edge of the trigger signal.

Falling trigger edge

   b) Press the `FALLING EDGE` **function key** in the `EXTERNAL ⇒` **submenu.**

    The measurement is started on every negative-going edge of the trigger signal.

6.2.6.3   Setting a Trigger Offset

Use

If the time difference between the signal to be measured and the trigger event is too great ($t > t_{Sweep}$), you can enter a time (trigger offset) by which the trigger point will be advanced or delayed.

Entering a trigger offset

1. Press the `TRIG OFFSET` **function key** in the `TRIG` **menu.**

    An entry field containing the current setting is displayed. The default setting is 0.000 ms.

    Trigger Delay `0.000` ms

2. Enter a new value (↗ 5-53).

    The entry range for the trigger offset is:

$$0\ s \leq \textbf{Trigger Delay} \leq \textbf{100 ms} \qquad \textbf{(SPAN > 0)}$$

$$\textbf{-Sweep Time} \leq \textbf{Trigger Delay} \leq \textbf{100 ms} \quad \textbf{(ZERO SPAN)}$$

3. Press the **ENTER key** [5] to close the entry field.

    The new setting is saved and the trigger offset is added to the trigger point.

6.2.7 Measurement Functions (MEAS Menu)

What the settings are for
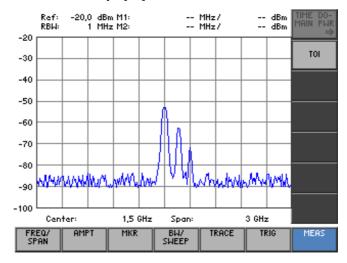
From the MEAS menu, you can measure the power in the time domain (ZERO SPAN) as well as the third-order intercept point.

Selecting the MEAS menu

- Select the MEAS **menu** with the ◀ or ▶ **cursor key** [6].

  The menu name is highlighted and the appropriate functions are assigned to the function keys [12].

Function key assignment

TIME DO-MAIN PWR ⇒	**Open submenu:** Measure the power in the time domain (ZERO SPAN)	(↗ 6-139)
TOI	Measure the third-order intercept point	(↗ 6-143)

📄 **Note**

The TIME DO-MAIN PWR ⇒ function key is only available in the time domain (ZERO SPAN).

6.2.7.1   Measuring the Power in the Time Domain

What the settings are for
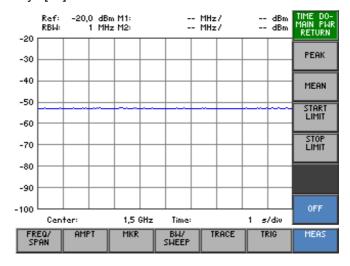
From the TIME DOMAIN PWR submenu, you can determine the trace section for which the power measurement is to be performed. You can measure either the mean power (MEAN) or the peak power (PEAK).

Selecting the TIME DOMAIN PWR submenu

- Press the TIME DO-MAIN PWR ⇒ **function key** in the MEAS **menu.**

    The submenu opens and the appropriate functions are assigned to the function keys [12].

Function key assignment
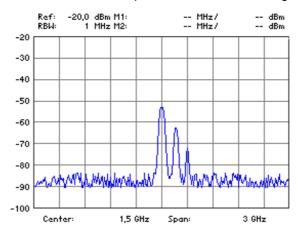
TIME DO-MAIN PWR RETURN	Quitting the submenu	
PEAK	Output the peak value within the section	(↗ 6-140)
MEAN	Output the mean value within the section	(↗ 6-140)
START LIMIT	Insert a vertical line to limit the lower (left) part of a section	(↗ 6-140)
STOP LIMIT	Insert a vertical line to limit the upper (right) part of a section	(↗ 6-140)
OFF	Switch off the power measurement	(↗ 6-140)

6.2.7.1.1 Measuring the Power

Use
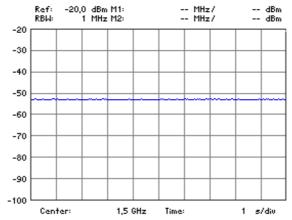
By using the "Time Domain Power" measurement function, the R&S FS300 determines in the time domain (ZERO SPAN) the power of the signal by integrating the pixels within the selected section. This allows you to measure the power of TDMA signals, for example, during the transmission phase or during the mute phase. You can measure either the mean power (MEAN) or the peak power (PEAK).

If both the switch-on and the switch-off phase of a burst signal are displayed, you can limit the measurement range to the transmission phase or the mute phase by means of the vertical lines. Since both phases are measured separately, you can determine the S/N power ratio of a TDMA signal, for example.

Activating the time domain mode
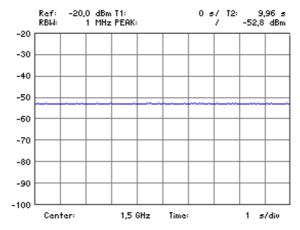
1. Switch the R&S FS300 to the time domain mode (ZERO SPAN, ↗ 6-76).

Activating the
measurement
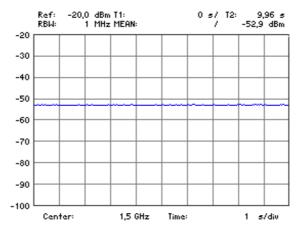
2. Press the [PEAK] **function key** in the [TIME DO-MAIN PWR ⇒] **submenu.**

The maximum power is measured within the limit lines T1 and T2 and displayed in the parameter field (PEAK:). In the default setting, these are the left (T1) and the right (T2) limit lines of the measurement diagram.

```
Ref:   -20,0 dBm T1:           0 s/ T2:     9,96 s
RBW:      1 MHz PEAK:            /       -52,8 dBm
-20
-30
-40
-50
-60
-70
-80
-90
-100
     Center:        1,5 GHz   Time:       1  s/div
```

3. Press the [MEAN] **function key** in the [TIME DO-MAIN PWR ⇒] **submenu.**

The mean power is measured within the limit lines T1 and T2 and displayed in the parameter field (MEAN:). In the default setting, these are the left and the right limit lines of the measurement diagram.

```
Ref:   -20,0 dBm T1:           0 s/ T2:     9,96 s
RBW:      1 MHz MEAN:            /       -52,9 dBm
-20
-30
-40
-50
-60
-70
-80
-90
-100
     Center:        1,5 GHz   Time:       1  s/div
```
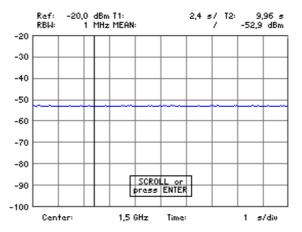
Changing the measurement range (limit lines)

1. Press the [START LIMIT] **function key** in the [TIME DO-MAIN PWR ⇒] **submenu.**

    A limit line is inserted at the left side of the diagram. The "SCROLL or press ENTER" display shows you that the limit lines can be scrolled to the left or to the right.

2. Use the **rotary knob** [10] to change the position of the limit line.

    The current position T1 of the left limit line and the new measured parameter are displayed in the parameter field.
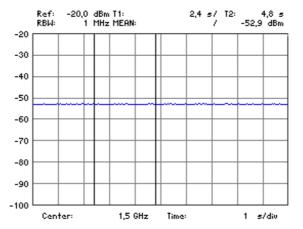
3. Press the **ENTER key** [5] to terminate scrolling.

    The SCROLL inscription disappears and the limit line is repositioned.

4. Press the [STOP LIMIT] **function key** in the [TIME DO-MAIN PWR ⇒] **submenu.**

    A limit line is inserted at the right end of the diagram.

5. Repeat steps 2 to 5 to position the right limit line.

    The current position T2 of the right limit line and the new measured parameter are displayed in the parameter field.

Deactivating the measurement

- Press the [OFF] **function key** in the [TIME DO-MAIN PWR ⇒] **submenu.**

    The "Time Domain Power" measurement function is deactivated.

6.2.7.2   Measuring the Third-Order Intercept Point

Use

If two signals with different frequencies are applied to a DUT with non-linear characteristic, intermodulation products occur at the output. Third-order mixture products are of particular importance since they are close to the useful signals.

The frequencies of the noise products f_{s1} and f_{s2} are located above and below the frequencies of the input signals f_{n1} and f_{n2}:

$$F_{s1} = 2 \times f_{n1} - f_{n2}$$

$$F_{s2} = 2 \times f_{n2} - f_{n1}$$
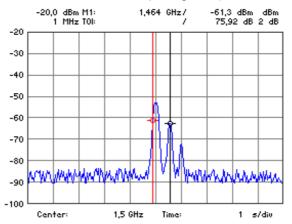
A third-order intercept point can be easily calculated with the input signals at the same level P_n plus the measured value of an intermodulation product:

$$IP3 = a_{d3}/2 + P_n$$

When the TOI function is set and the markers are set to the input signals, the R&S FS300 automatically measures the intermodulation products and displays the value calculated for the intercept point.

Setting the markers to the input signals

1. Set markers 1 and 2 to the two input signals (↗ 6-91, 6-95).

Activating the measurement

2. Press the [TOI] **function key** in the [MEAS] **submenu.**

   The TOI measurement is activated and the function key is highlighted.
   The value calculated for the TOI is displayed in the parameter field.

Deactivating the measurement

• Press the [TOI] **function key** in the [MEAS] **submenu.**

   The TOI measurement is deactivated and the function key is no longer highlighted.

6.3   SYSTEM Functions (SYS Key)

Introduction
The R&S FS300 has system and service functions as well as measurement functions.
All current settings can be called so that they can be viewed at a glance, and saved for use at a later date, a selftest can be run on the R&S FS300 and the system settings configured. Furthermore, the R&S FS300 switched over from remote control to local mode.
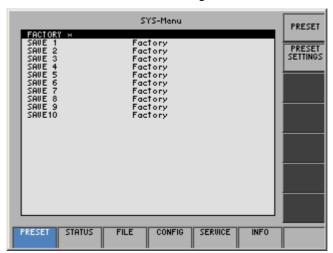
Switching over the user interface
When the R&S FS300 has been switched on and the selftest has run without detecting any faults, the spectrum analyzer's user interface is activated.

1. Press the **SYS key** [3].

    The measurement diagram and the parameter field are blanked out. The menus for the system and service functions are brought up on the screen in the menu area and the appropriate functions are assigned to the function keys [12]. Depending on the function key assignment, the associated parameters are listed as tables in the diagram area.

2. Press the **SYS key** [3].

    The **new** settings are saved and the spectrum analyzer's user interface is activated again.

    Press the **ESC/CANCEL key** [4].

    The **old** settings are retained and the spectrum analyzer's user interface is activated again.

**Menus for
system and
service functions**

PRESET	Selects and calls the instrument's default setting	(↗ 6-146)
STATUS	Displays the current instrument settings	(↗ 6-148)
FILE	Saves and loads user-defined settings	(↗ 6-149)
CONFIG	System settings	(↗ 6-156)
SERVICE	Service functions	(↗ 6-165)
INFO	System information	(↗ 6-166)

6.3.1   Instrument Default Setting (Menu PRESET)

What the settings are for

From the PRESET menu, you can specify a user-defined instrument setting as the instrument default setting and directly call it.
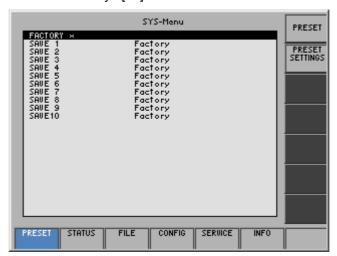
Selecting the PRESET menu

1. Press the **SYS key** [3].

2. Select the **menu** PRESET with the ◄ or ► **cursor key** [6].

   The menu name is highlighted and the appropriate functions are assigned to the function keys [12].

Function key assignment

PRESET	Calls an instrument default setting	(↗ 6-147)
PRESET SETTINGS	Selects an instrument default setting	(↗ 6-147)

6.3.1.1   Selecting and Calling the Instrument Default Setting

Use
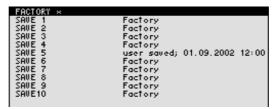
When you switch on the R&S FS300, those settings that were valid when the R&S FS300 was last switched off are restored.

The R&S FS300 also lets you save and call user-defined instrument settings. If you frequently use one of these settings and want to load it quickly, you can define this setting to be the PRESET (default setting) and call it directly at any time.

Selecting user-defined settings

1. Save the user-defined settings (↗ 6-150).

2. Select the **menu** PRESET with the ◂ or ▸ **cursor key** [6].
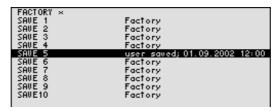
    A table containing the available settings is displayed. The current setting is marked with the sign x.

    ```
    FACTORY  ×
    SAVE  1          Factory
    SAVE  2          Factory
    SAVE  3          Factory
    SAVE  4          Factory
    SAVE  5          user saved; 01.09.2002 12:00
    SAVE  6          Factory
    SAVE  7          Factory
    SAVE  8          Factory
    SAVE  9          Factory
    SAVE10          Factory
    ```

3. Select a setting with the ▴ or ▾ **cursor key** [7].

    The selected option is highlighted.
    The PRESET memory location FACTORY contains the factory setting (↗ 6-67).

    ```
    FACTORY  ×
    SAVE  1          Factory
    SAVE  2          Factory
    SAVE  3          Factory
    SAVE  4          Factory
    SAVE  5          user saved; 01.09.2002 12:00
    SAVE  6          Factory
    SAVE  7          Factory
    SAVE  8          Factory
    SAVE  9          Factory
    SAVE10          Factory
    ```

4. Press the **function key** PRESET SETTINGS.

    The setting is defined to be the instrument default setting and is marked with the sign x.

Activating the instrument default setting

5. Press the PRESET **function key** in the PRESET **menu**.

    The current instrument default setting is loaded and the SYS menu is leaved. The spectrum analyzer's user interface is activated again.

📄 **Note**

If no user-defined settings have been defined, the PRESET function key PRESET is assigned the FACTORY PRESET, e.g. the factory default setting (↗ 6-67).

6.3.2   Displaying the Current Instrument Setting (STATUS Menu)

What the settings are for

From the STATUS menu, you can display an overview of the principal current instrument settings.
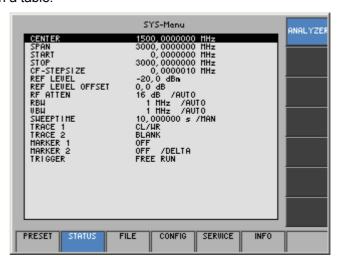
Selecting the STATUS menu

1.   Press the **SYS key** [3].

2.   Select the ⌈STATUS⌉ **menu** with the ◀ or ▶ **cursor key** [6].

The principal spectrum-analyzer parameters and the current settings are listed in a table.

Explanation of parameters

CENTER	Center frequency	(↗ 6-70)
SPAN	Frequency span	(↗ 6-70)
START	Start frequency for span	(↗ 6-71)
STOP	Stop frequency for span	(↗ 6-71)
CF-STEPSIZE	Entering the step width of the center frequency	(↗ 6-72)
REF LEVEL	Reference level	(↗ 6-81)
REF LEVEL OFFSET	Reference level offset	(↗ 6-82)
RF ATTEN	RF input attenuation	(↗ 6-86)
RBW	Resolution bandwidth	(↗ 6-115)
VBW	Video bandwidth	(↗ 6-116)
SWEEPTIME	Sweep time	(↗ 6-119)
TRACE 1	Display mode for Trace 1	(↗ 6-124)
TRACE 2	Display mode for Trace 2	(↗ 6-124)
MARKER 1	Marker 1 display	(↗ 6-91)
MARKER 2	Marker 2 display	(↗ 6-95)
TRIGGER	Trigger source	(↗ 6-133)

6.3.3   User-Defined Settings (FILE Menu)

What the settings are for
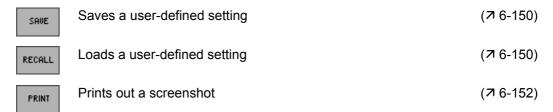
You can save user-defined settings and load them when required from the FILE menu. You can also print out a screenshot.

Selecting the FILE menu

1. Press the **SYS key** [3].

2. Select the FILE **menu** with the ◄ or ► **cursor key** [6].

The menu name is highlighted and the appropriate functions are assigned to the function keys [12].

Function key assignment

SAVE	Saves a user-defined setting	(↗ 6-150)
RECALL	Loads a user-defined setting	(↗ 6-150)
PRINT	Prints out a screenshot	(↗ 6-152)

6.3.3.1 Saving and Loading User-Defined Settings

Use
When you switch on the R&S FS300, those settings that were valid when the R&S FS300 was last switched off are restored.
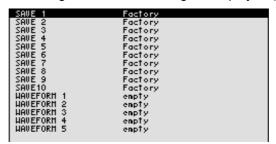
The R&S FS300 also lets you save and load user-defined settings.

You can save 10 different settings (SAVE 1 to 10) and 5 traces (WAVE 1 to 5). When the R&S FS300 is delivered, the factory settings are loaded in the SAVE memory locations. The WAVE memory locations are empty.

Saving user-defined settings

1. Set up the R&S FS300 for the measurement you want to perform (↗ 6-67).

2. Press the ⌷ SAVE ⌷ **function key** in the ⌷ FILE ⌷ **menu**.

   A table containing the available settings is displayed (memory locations).

   ```
   SAVE  1          Factory
   SAVE  2          Factory
   SAVE  3          Factory
   SAVE  4          Factory
   SAVE  5          Factory
   SAVE  6          Factory
   SAVE  7          Factory
   SAVE  8          Factory
   SAVE  9          Factory
   SAVE 10          Factory
   WAVEFORM 1       empty
   WAVEFORM 2       empty
   WAVEFORM 3       empty
   WAVEFORM 4       empty
   WAVEFORM 5       empty
   ```

3. Select a setting with the ▲ or ▼ **cursor key** [7].
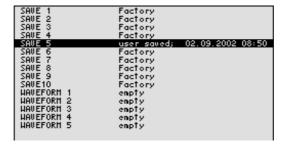
   The selected option is highlighted.

4. Press the **ENTER key** [5].

   An entry field for entering a file name is displayed. The default setting is "user saved" or "empty".

   ```
   SAVE 5           user saved
   ```
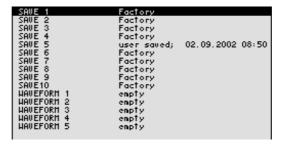
5. Enter a new file name from the **numerical keys** [11] or from an external keyboard (↗ 3-39).

6. Press the **ENTER key** [5].

   The current setting is saved and the text "Factory" is replaced by the file name, the date and time.

   ```
   SAVE  1          Factory
   SAVE  2          Factory
   SAVE  3          Factory
   SAVE  4          Factory
   SAVE  5          user saved;  02.09.2002 08:50
   SAVE  6          Factory
   SAVE  7          Factory
   SAVE  8          Factory
   SAVE  9          Factory
   SAVE 10          Factory
   WAVEFORM 1       empty
   WAVEFORM 2       empty
   WAVEFORM 3       empty
   WAVEFORM 4       empty
   WAVEFORM 5       empty
   ```

Loading user-defined settings

1. Press the RECALL **function key** in the FILE **menu**.

   A table containing the available settings is displayed (memory locations).

2. Select a setting with the ▲ or ▼ **cursor key** [7].

   The FACTORY memory location contains the factory setting (↗ 6-67).

3. Press the **ENTER key** [5].

   The following message is displayed.

4. Press the **ENTER key** [5].

   The setting you have selected is loaded and the SYS menu is leaved. The spectrum analyzer's user interface is activated again.

📄 **Note**   If you frequently use one of the saved settings and want to load it quickly, you can define this setting to be the PRESET (default setting) and call it directly at any time. (↗ 6-147).

6.3.3.2   **Printing out a Screenshot**

Use
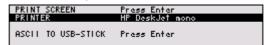
The R&S FS300 prints out (printer) or saves (USB stick) a current screenshot when you press the SYS key and an overview of the principal current instrument settings. A printer with a USB device connector or a USB stick is required.

Selecting an output unit

1.   Press the [PRINT] **function key** in the [FILE] **menu**.

   A table containing the available parameters is displayed.

2.   Select the **PRINTER** parameter with the ▲ or ▼ **cursor key** [7].

PRINT SCREEN	Press Enter
PRINTER	HP DeskJet mono
ASCII TO USB-STICK	Press Enter

3.   Press the **ENTER key** [5].

   A selection field containing the available settings is displayed. The default setting is "HP DeskJet mono".
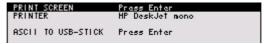
PRINTER
HP DeskJet mono
HP DeskJet color
HP LaserJet III
HP LaserJet IV
HP LaserJet V
USB Stick

4.   Select a setting with the **rotary knob** [10].

5.   Press the **ENTER key** [5] to close the selection field.

   The setting is saved and the printer driver is loaded.

Printing out a screenshot

1. Connect a printer to the **USB device connector** [16].

2. Select a printer for the output unit (↗ 6-152).

3. Press the **PRINT** **function key** in the **FILE** **menu**.

   A table containing the available parameters is displayed.

4. Select the **PRINT SCREEN** parameter with the ▲ or ▼ **cursor key** [7].

   ```
   PRINT SCREEN        Press Enter
   PRINTER             HP DeskJet mono

   ASCII TO USB-STICK  Press Enter
   ```

5. Press the **ENTER key** [5].

   The following message is displayed.

   Printing
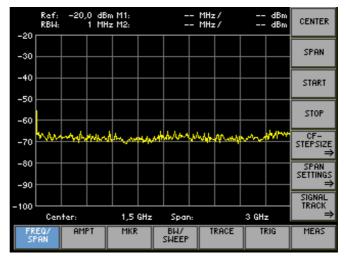
   A current screenshot and an overview of the principal current instrument settings (↗ 6-148) is printed out, e.g.:

Saving the screen-shot as a bitmap (.bmp) in the USB stick

1. Connect the USB stick to the **USB device connector** [16].

2. Select the USB stick for the output unit (↗ 6-152).

3. Press the PRINT **function key** in the FILE **menu**.

   A table containing the available parameters is displayed.

4. Select the **PRINT SCREEN** parameter with the ▲ or ▼ **cursor key** [7].

   ```
   PRINT SCREEN      Press Enter
   PRINTER           HP DeskJet mono

   ASCII TO USB-STICK   Press Enter
   ```

5. Press the **ENTER key** [5].

   An entry field for entering a file name is displayed. The default setting is "FS_Date_Time".

   ```
   file name       FS300_040206_1108
   ```

   Note: If you wish you can enter a new file name from the **numerical keys** [11] or from an external keyboard (↗ 3-39).

6. Press the **ENTER key** [5].

   The current screenshot before you press the SYS button is saved as a bitmap (.bmp) in the USB stick.

📄 **Note**

When the USB stick is not connected the following message is displayed:

```
No Stick!
Please plug usb stick on device.
Confirm Message with ENTER
```

- Connect the USB stick to the **USB device connector** [16] and confirm the message by pressing the **ENTER key** [5].

Saving the wave-form data as an ASCII file (.asc) in the USB stick

1. Connect the USB stick to the **USB device connector** [16].

2. Press the | PRINT | **function key** in the | FILE | **menu**.

   A table containing the available parameters is displayed.

3. Select the **ASCII TO USB-STICK** parameter with the ▲ or ▼ **cursor key** [7].

   ```
   PRINT SCREEN        Press Enter
   PRINTER             HP DeskJet mono

   ASCII TO USB-STICK  Press Enter
   ```

4. Press the **ENTER key** [5].

   An entry field for entering a file name is displayed. The default setting is "FS_Date_Time".

   ```
   file name    FS300_040206_1108
   ```

   Note: If you wish you can enter a new file name from the **numerical keys** [11] or from an external keyboard (↗ 3-39).

5. Press the **ENTER key** [5].

   The current screenshot before you press the SYS button is saved as an ASCII file (.asc) in the USB stick.

📄 **Note**   When the USB stick is not connected the following message is displayed:

```
No Stick!

Please plug usb stick on device.

Confirm Message with ENTER
```

• Connect the USB stick to the **USB device connector** [16] and confirm the message by pressing the **ENTER key** [5].

6.3.4   System Settings (CONFIG Menu)

What the settings are for

You can configure the general system parameters for time/date, reference source, instrument interface and screen saver from the CONFIG menu.
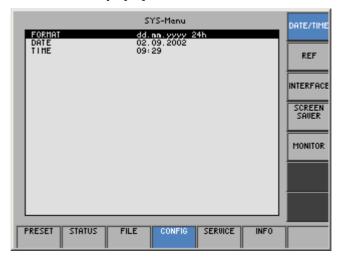
Selecting the CONFIG menu

1. Press the **SYS key** [3].

2. Select the ⬚ CONFIG **menu** with the ◀ or ▶ **cursor key** [6].

    The menu name is highlighted and the appropriate functions are assigned to the function keys [12].

```
                    SYS-Menu                        DATE/TIME
    FORMAT          dd.nn.yyyy 24h
    DATE            02.09.2002
    TIME            09:29                            REF

                                                   INTERFACE

                                                    SCREEN
                                                    SAVER

                                                    MONITOR



    PRESET  STATUS   FILE   CONFIG  SERVICE  INFO
```

Function key assignment

DATE/TIME	Sets the date and time	(↗ 6-157)
REF	Selects an internal or external reference source	(↗ 6-159)
INTERFACE	Configures the instrument interfaces	(↗ 6-160)
SCREEN SAVER	Sets the screen saver mode	(↗ 6-162)
MONITOR	Selects an internal or external monitor	(↗ 6-164)

6.3.4.1   Setting the Date and Time of Day

Use

When you save a setting, it is time-stamped using the time provided by the internal real-time clock (↗ 6-150).

When you set the internal real-time clock, you can choose between two date and time display format options and modify the parameters.

- **dd.mm.yyyy   24 h clock**
- **mm/dd/yyyy   12 h clock**

     where: d   - day
                  m   - month
                  y   - year
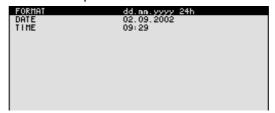
Selecting the display format

1. Press the DATE/TIME **functions key** in the CONFIG **menu**.

    A table containing the available parameters is displayed.

2. Select the **FORMAT** parameter with the ▲ or ▼ **cursor key** [7].

    ```
    FORMAT            dd.nn.yyyy  24h
    DATE              02.09.2002
    TIME              09:29
    ```

3. Press the **ENTER key** [5].

    A selection field containing the available settings is displayed. The default setting is "dd.mm.yyyy".

    ```
    FORMAT
    dd.nn.yyyy  24h
    nn/dd/yyyy  12h
    ```

4. Select a setting with the **rotary knob** [10].
5. Press the **ENTER key** [5] to close the selection field.

    The setting is saved and the display format updated.

Setting the date

1. Press the `DATE/TIME` **function key** in the `CONFIG` **menu**.

   A table containing the available parameters is displayed.

2. Select the **DATE** parameter with the ▲ or ▼ **cursor key** [7].

   ```
   FORMAT        dd.nn.yyyy  24h
   DATE          02.09.2002
   TIME          09:31
   ```

3. Press the **ENTER key** [5].

   An entry field containing the current setting is displayed.

   ```
   Date  02.09.2002
   ```

4. Enter a new value (↗ 5-53).

5. Press the **ENTER key** [5].
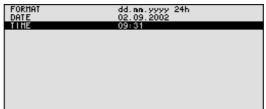
   The setting is saved and displayed.

Setting the time

1. Press the `DATE/TIME` **function key** in the `CONFIG` **menu**.

   A table listing the available parameters is displayed.

2. Select the **TIME** parameter with the ▲ or ▼ **cursor key** [7].

   ```
   FORMAT        dd.nn.yyyy  24h
   DATE          02.09.2002
   TIME          09:31
   ```

3. Press the **ENTER key** [5].

   An entry field containing the current setting is displayed.

   ```
   Time  09:33
   ```

4. Enter a new value (↗ 5-53).

5. Press the **ENTER key** [5].

   The setting is saved and displayed.

6.3.4.2   Selecting an Internal or External Reference Source

Use

The R&S FS300 acting as the frequency standard for all internal oscillators can use the internal reference source (**internal**) or an external reference source (**external**). A 10 MHz crystal oscillator is used as the internal reference source. When the default setting is activated (internal reference), a 10 MHz frequency is output at the REF OUT rear-panel connector [23] to synchronize other devices to the R&S FS300 reference frequency, for example.

When the "REFERENCE external" setting is activated, the REF IN connector [22] is used as the input for an external frequency standard. All the R&S FS300's internal oscillators are synchronized to this external reference frequency (also 10 MHz).

Selecting the reference source
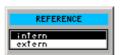
1. When required, connect the external reference source to the REF IN connector [22].

2. Press the | REF | **function key** in the | CONFIG | **menu**.

    The current reference source setting is displayed.

    REFERENCE   extern

3. Press the **ENTER key** [5].

    A selection field containing the available settings is displayed. The default setting is "internal".

    REFERENCE
    intern
    extern

4. Select a reference source with **rotary knob** [10].

5. Press the **ENTER key** [5].

    The setting is saved and the R&S FS300 frequency standard is taken from a new source.

📄 **Note**
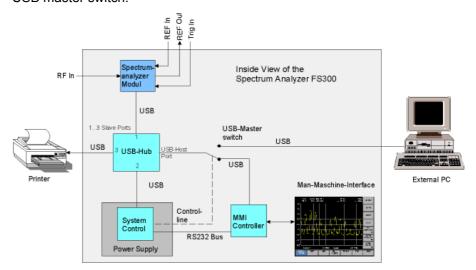
If there is no reference signal when you switch over to an external reference, the message PLL UNLOCK is output after a short delay to indicate that there is no sync.

6.3.4.3 Configuring the Instrument Interfaces

Use

The R&S FS300 can be remote-controlled via the existing USB host interface [15]. The R&S FS300 automatically detects an existing connection to a PC and also automatically switches to remote control in the default setting (AUTO).

Switchover between internal USB master (local control on the instrument) and external USB master (remote control via PC) is effected by means of a USB master switch.

The behaviour of the USB master switch can be controlled via the following settings:

- **AUTO**
  The AUTO setting is the standard configuration of the USB master switch and allows flexible switching between the local control mode on the R&S FS300 and remote control via PC. This setting allows the instrument to automatically find a connected PC and switch immediately to "remote control". Under Windows™, the R&S FS300 is recognized as a new USB device, and is thus available for software applications on the PC.

  When you press the SYS key [3], the R&S FS300 can be switched to "local mode" at any time. The PC and the R&S FS300 are thus physically disconnected. Reactivate the AUTO setting to switch the R&S FS300 again to "remote control".

- **INSTRUMENT**
  The INSTRUMENT setting is required if the R&S FS300 is to be controlled only via the front panel (local control), irrespective of a PC connection. This setting avoids automatic switchover to "remote control".

  When you switch the INSTRUMENT setting to AUTO, an existing PC is recognized, and the R&S FS300 automatically switches to "remote control".

■ **EXTERN**
If EXTERNAL is set, the USB master switch is in the "remote control" mode and the R&S FS300 can only be controlled via a PC.

When you press the SYS key [3], the R&S FS300 can be switched again to "local mode" at any time, for example for changing settings. Reactivate the EXTERNAL setting to switch the R&S FS300 again to "remote control".

Setting the USB master selector

1. Press the INTERFACE **function key** in the CONFIG **menu.**

   The current USB master setting is displayed.

   ```
   USB MASTER          AUTO
   ```

2. Press the **ENTER key** [5].

   A selection field containing the available settings is displayed. The default setting is AUTO.

   ```
   USB MASTER
   AUTO
   INSTRUMENT
   EXTERN
   ```

3. Select a setting with **rotary knob** [10].

4. Press the **ENTER key** [5] to close the selection field.

   The setting is saved.

📄 **Note** With remote control, the local control mode of the R&S FS300 is deactivated and can only be reactivated by pressing the SYS key [3] on the front panel. Switching between remote control and local control takes approx. 2 s.

6.3.4.4 Setting the Screen Saver Mode

Use

The R&S FS300 has a screen-saver function that turns off the screen [13] after a certain time. There are a number of timing options for screen turn-off:

- **none**
  The screen is always on.

- **5 min**
  The screen is turned off after 5 minutes.

- **30 min**
  The screen is turned off after 30 minutes.

If the instrument is in remote-control mode and the results are being displayed on the controller (PC monitor) the screen can be switched off.

- **picture**
  The screen displays when the instrument is in remote-control mode.

- **black**
  The screen is switched off.

Activating the screen saver

1. Press the SCREEN SAVER **function key** in the CONFIG **menu.**

   A table listing the available parameters is displayed.

2. Select the **SREEN SAVER** parameter with the ▲ or ▼ **cursor key** [7].

   ```
   SCREEN SAVER    none
   REMOTE          picture
   ```

3. Press the **ENTER key** [5].

   A selection field containing the available settings is displayed. The default setting is "none".

   ```
   SCREEN SAVER
   none
   5 min
   30 min
   ```

4. Select a setting with **rotary knob** [10].

5. Press the **ENTER key** [5].

   The setting is saved and the screen saver is activated or de-activated.

**Activating the
Screen saver in
remote-control
mode**

1. Press the [SCREEN SAVER] **function key** in the [CONFIG] **menu.**

   A table listing the available parameters is displayed.

2. Select the **REMOTE** parameter with the ▲ or ▼ **cursor key** [7].

   SCREEN SAVER   none
   REMOTE   picture

3. Press the **ENTER key** [5].

   A selection field containing the available settings is displayed. The de-fault setting is "black".

   REMOTE
   black
   picture

4. Select a setting with **rotary knob** [10].

5. Press the **ENTER key** [5].
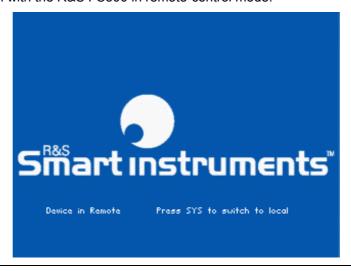
   The setting is saved and the screen disconnection in the remote-control mode is activated or de-activated.

   With the "black" setting, the screen is, of course, black, and only the green LED [2] indicates that the R&S FS300 is in remote-control mode.

   With the "picture" setting, the following message is displayed on the screen with the R&S FS300 in remote-control mode:

📄 **Note**   With remote control, the local control mode of the R&S FS300 is deactivated and can only be reactivated by pressing the SYS key [3] on the front panel. Switching between remote control and local control takes approx. 2 s.

6.3.4.5   Selecting an Internal or External Monitor

Use   Screen display is possible via the internal monitor or an external monitor.

- **intern**
  Screen display is via the built-in colour TFT display.

- **extern**
  Screen display is via the connected monitor.

Selecting   1. If required, connect a monitor to the MONITOR connector [20].
the monitor

2. Press the MONITOR **function key** in the CONFIG **menu.**

   The current screen setting is displayed.

MONITOR	extern

3. Press the **ENTER key** [5].

   A selection field containing the available settings is displayed. The default setting is "intern".

MONITOR
intern
extern

4. Select a setting with **rotary knob** [10].

5. Press the **ENTER key** [5].

   The setting is saved.
   If the "external" setting is selected, the connected screen shows the active user interface. The internal monitor is switched off.

6.3.5   Service Functions (SERVICE Menu)
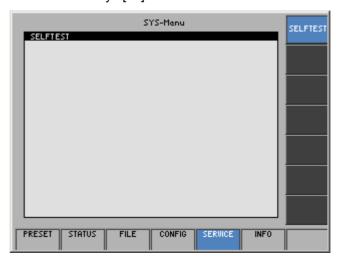
What the settings are for

You can call a number of auxiliary functions to be used for servicing or troubleshooting from the SERVICE menu. These functions are not required for normal measurements with the R&S FS300.

Selecting the SERVICE menu

1. Press the **SYS key** [3].

2. Select the `SERVICE` **menu** with the ◀ or ▶ **cursor key** [6].

    The menu name is highlighted and the appropriate functions are assigned to the function keys [12].

Function key assignment

`SELFTEST`   Performs a selftest   (↗ 6-165)

6.3.5.1   Performing Selftests

Use

The R&S FS300 can perform a module selftest. If there is a fault, the R&S FS300 itself is capable of localizing the defective module.

Starting selftests

1. Press the `SELFTEST` **function key** in the `SERVICE` **menu**.

    The text SELFTEST is displayed (↗ below).

2. Press the **ENTER key** [5].

    The selftest starts. All modules are checked one after the other and the result, "passed" or "failed", is output.

6.3.6 System Information (INFO Menu)

What the settings are for

You can obtain information such as module data, instrument statistics and system messages from the INFO menu.

Selecting the INFO menu

1. Press the **SYS key** [3].

2. Select the [INFO] **menu** with the ◀ or ▶ **cursor key** [6].

   The menu name is highlighted and the appropriate functions are assigned the function keys [12].

Function key assignment

HARDWARE INFO	Displays module data	(↗ 6-167)
STATISTICS	Displays instrument statistics	(↗ 6-167)
SYSTEM MESSAGES	Displays system messages	(↗ 6-168)

6.3.6.1 Displaying Module Data
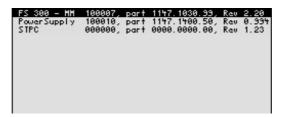
Use   You can display the serial number of the modules installed in the R&S FS300.

Calling module data
- Press the [HARDWARE INFO] **function key** in the [INFO] **menu**.

    A table listing the current modules and the serial number is displayed.

```
FS 300 - MM   100007, part 1147.1030.99, Rev 2.20
PowerSupply   100010, part 1147.1400.50, Rev 0.994
STPC          000000, part 0000.0000.00, Rev 1.23
```

6.3.6.2 Displaying Instrument Statistics
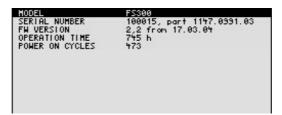
Use   You can display the following R&S FS300 statistics:

- **MODEL**   - model designation
- **SERIAL NUMBER**   - serial number
- **FW VERSION**   - firmware version
- **OPERATION TIME**   - operating hours
- **POWER ON CYCLES**   - on/off cycles

Direct selection
- Press the [STATISTICS] **function key** in the [INFO] **menu**.

    A table listing the current data is displayed.

```
MODEL           FS300
SERIAL NUMBER   100015, part 1147.0391.03
FW VERSION      2,2 from 17.03.04
OPERATION TIME  745 h
POWER ON CYCLES 473
```

6.3.6.3 Displaying System Messages

Use
You can display the most recent R&S FS300 system messages in their order of occurrence. Operating errors are neither saved nor displayed.
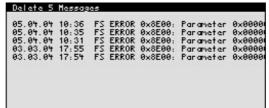
System messages help the service personnel to analyze the instrument and handle errors, and should therefore only be deleted by them.

Displaying system messages
1. Press the SYSTEM MESSAGES **function key** in the INFO **menu**.

   A table listing the current system messages is displayed.

2. Select a system message with the ▲ or ▼ **cursor key** [7].

```
Delete 5 Messages

05.04.04 10:36  FS ERROR 0x8E00: Parameter 0x0000
05.04.04 10:35  FS ERROR 0x8E00: Parameter 0x0000
05.04.04 10:31  FS ERROR 0x8E00: Parameter 0x0000
03.03.04 17:55  FS ERROR 0x8E00: Parameter 0x0000
03.03.04 17:54  FS ERROR 0x8E00: Parameter 0x0000
```

3. Press the **ENTER key** [5].

   The current system message is clearly displayed with the date and time of their occurrence and the error code.

```
                        MESSAGE

Date:     05.04.04
Time:     10:35
Message:  FS ERROR 0x8E00

          Parameter 0x00000010 and 0x0000
```

4. Press the **ENTER key** [5] for closing the display.

Deleting system messages (only for service

1. Press the SYSTEM MESSAGES **function key** in the INFO **menu**.

   The table of current system messages is displayed.

2. Select the first line with the ▲ or ▼ **cursor key** [7].

   Delete 5 Messages

3. Press the **ENTER key** [5].

   The field for the input of the password is displayed.

   Enter Password

4. Enter the right password and confirm with the **ENTER key** [5].

   The error messages are deleted.

Invalid password

If the password is invalid, the following message is displayed:

PASSWORD ERROR
Password failed
confirm with ENTER

- Confirm the error message with the **ENTER key** [5].

  The deleting of the error messages is breaked off.

7   Remote Control/PC Software FS300-K1

📄 **Note**   The latest remote control commands and software drivers for the USB-interface of the R&S FS300 can be downloaded from the R&S Smart Instruments internet site:

www.smart-instruments.de

7.1   Applications of PC Software

Performance features

The PC Software R&S FS300-K1 allows convenient operation of the R&S FS300 by remote control via a PC. All the functions of the spectrum analyzer are supported. In addition, you can create test reports on your PC. Highlights of the software features are:

- Fast and simple transfer of measurements between the R&S FS300 and the PC

- Permanent analysis of ongoing sweeps to the PC with evaluation capabilities (Marker, Zoom, etc.)

- Practically unlimited memory capacity for storing traces and measurement information (comparison of current and previous information)

- Extended range of functions (Limit Lines, Log File)

- Export of trace values (700 points) in .txt format for import into Microsoft Excel™

- Export of displayed data (screenshots) in JPEG format

- Printing the working window by standard Windows™ printer

Remote control using the keyboard and the mouse

All functions and measuring parameters can be set with the keyboard and the mouse using menus, toolbars or short keys.

Large display on the PC monitor

The current trace as well as parameters and status fields required for measuring result analysis are displayed clearly arranged on the monitor.

7.2 Installation and Configuration

System requirements   The PC software runs on Windows™ 2000 and XP operating systems with USB interface.

7.2.1 Installing the PC Software

📄 **Note**   To install the PC software, you must have administrator rights on your PC. (↗ Windows™ help).

Introduction   The PC software is installed in two steps. Firstly the remote control program for the R&S FS300 is installed. The R&S FS300 must not be connected at this time. Secondly the drivers are installed; at this time the instrument has to be connected.
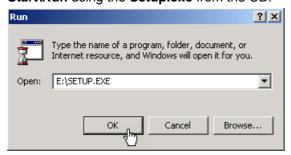
7.2.1.1 Installing the Program

📄 **Note**   The <Back> button enables the user to go back one step during installation. Installation can be interrupted by pressing <Cancel>.

Installation steps   **1.** Place the CD ROM, which came with the product, in your installation drive. The autorun function automatically initiates installation. Alternatively you may also initiate the installation in the start menu of Windows™ **Start\Run** using the **Setup.exe** from the CD.

The installation is prepared and the installation wizard appears.
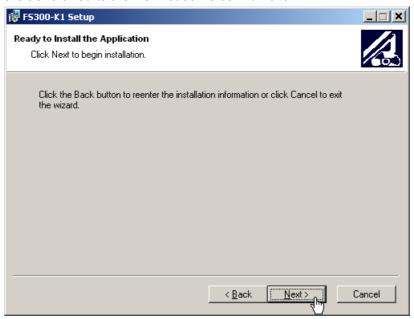
2. Click **<Next>** to continue the installation.

3. Click **<Browse>** to assign a new directory if you wish to install the program in another directory than proposed. Click **<Next>** to continue the installation.
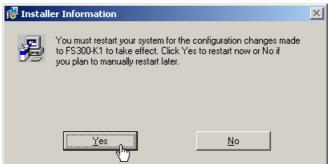
4. Click **<Next>** to continue the installation. Installation begins and the data are transferred to the PC.Please wait a moment.
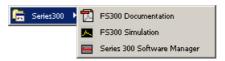
5. Click **<Finish>** to successfully complete the installation.

6. Click **<Yes>** to restart the computer.

All new settings are now effective and the following appears in the Windows™ **Start\Programs\Rohde&Schwarz\Series300** start-up menu:
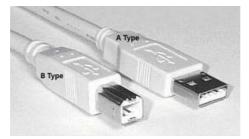
7. Install the device driver now (↗ next section).

7.2.1.2 Installing the Device Drivers

7.2.1.2.1 Installing Steps for Windows™ 2000

Connecting R&S FS300 to the PC

R&S FS300 is connected to the PC via the USB interface. The connection cable has two plug types. Plug A is connected to the computer (↗ computer manual) and plug B is connected to the R&S FS300 (↗ 2-34).

The CD ROM must be in the installation drive in order to install the driver.

1. Switch on the R&S FS300 and the PC.

2. Connect the instrument to the PC with the USB cable. The PC (Windows™) recognizes the connected instrument and reports new hardware. This message appears only when an R&S FS300 is installed for the first time.

If the R&S FS300 is not automatically recognized, check that the USB master switch of the R&S FS300 is at **AUTO** (↗ 6-160).
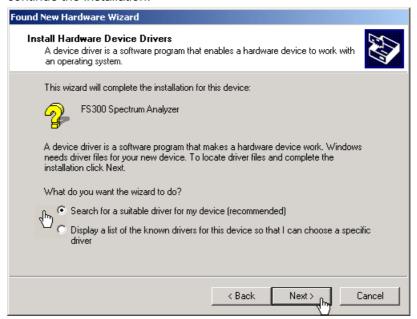
Installing device drivers
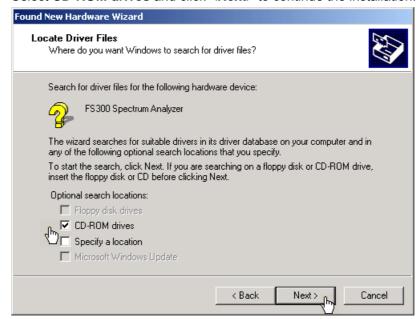
3. Click **<Next>** to continue the installation.

4. Select **Search for a suitable driver for my device** and click **<Next>** to continue the installation.
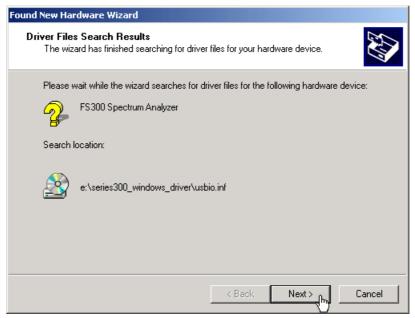
5. Select **CD-ROM drives** and click **<Next>** to continue the installation.

Then the search results for the driver data are displayed.

6. Click **<Next>** to continue the installation.
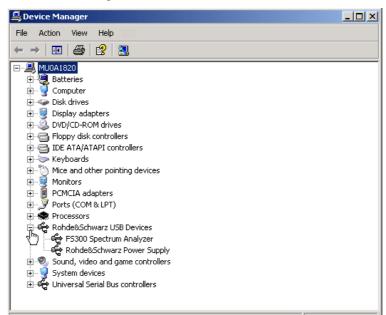
7. Click **<Finish>** to complete the installation.

This is followed by the installation of the device driver for the **Rohde & Schwarz Power Supply**. Windows generally "remembers" all the necessary information when installing the Spectrum Analyzer R&S FS300 and installs the Rohde & Schwarz Power Supply without a query. However, depending on the system, the installation assistant might be activated.

In this case, repeat instructions 3. to 7. to successfully complete the installation.
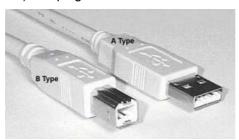
The drivers are now correctly installed and this can be checked using the device manager.

8. Create now the program version for specific instrument (↗ 7-182).

7.2.1.2.2 Installing Steps for Windows™ XP

Connecting R&S FS300 to the PC

R&S FS300 is connected to the PC via the USB interface. The connection cable has two plug types. Plug A is connected to the computer (↗ computer manual) and plug B is connected to the R&S FS300 (↗ 2-34).

The CD ROM must be in the installation drive in order to install the driver.

1. Switch on the R&S FS300 and the PC.

2. Connect the instrument to the PC with the USB cable. The PC (Windows™) recognizes the instrument when it is connected and reports new hardware. This message appears only when an R&S FS300 is installed for the first time.

If the R&S FS300 is not automatically recognized, check that the USB master switch of the R&S FS300 is at **AUTO** (↗ 6-160).

Installing device drivers
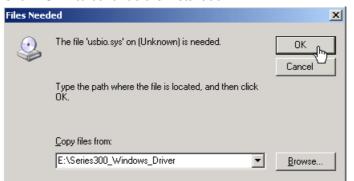
3. Select **Install the software automatically** and click **<Next>** to continue the installation.
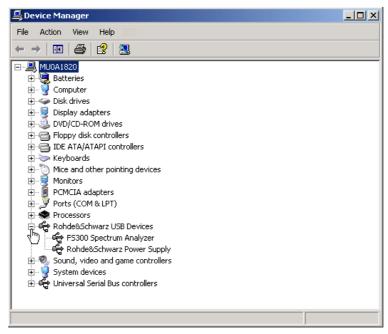
4. Click **<OK>** to continue the installation.

5. Click **<Finish>** to successfully complete the installation.

This is followed by the installation of the device driver for the **Rohde & Schwarz Power Supply**. Windows generally "remembers" all the necessary information when installing the Spectrum Analyzer R&S FS300 and installs the Rohde & Schwarz Power Supply without a query. However, depending on the system, the installation assistant might be activated.

In this case, repeat instructions 3. to 5. to successfully complete the installation.

The drivers are now correctly installed and this can be checked using the device manager.

6.   Create now the program version for specific instrument (↗7-182).

7.2.2 Connecting the PC-Software with the R&S FS300

Introduction   Due to the USB-Technology which is used in the R&S FS300, more than one instrument in the 300 Series can be connected with a PC at the same time. For each instrument a connection with the respective software which allows the opening and remote controlling of the specific instrument has to be created.

The creation of an instrument-specific connection of the Software R&S FS300-K1 by using the provided Series 300 Software Manager is explained in the following section. Before this process can be started, the R&S FS300-K1 Software needs to be installed on your PC (↗ 7-171) and one or more instruments have to be connected to the PC via USB-cable (↗ 7-187).

📄 **Note**   No Authorization (Key Code) is required for the provided R&S FS300-K1 Software Version 2.5.
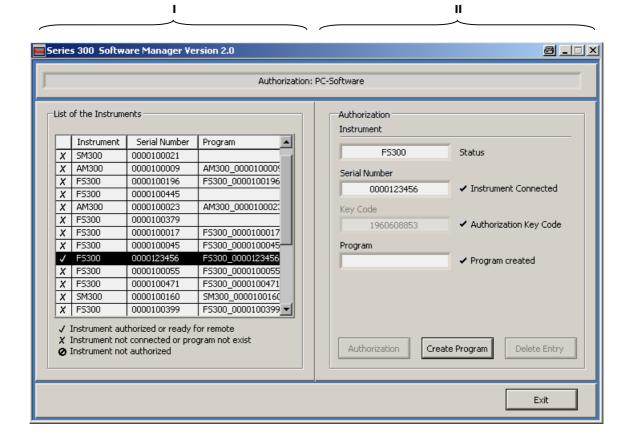
7.2.2.1 Starting the Series 300 Software Manager

Starting the service program   • In the Windows™ start-up directory select:
Start\Programs\Rohde&Schwarz\Series300\Series 300 Software Manager

The service program initializes. The program interface is divided into two areas:
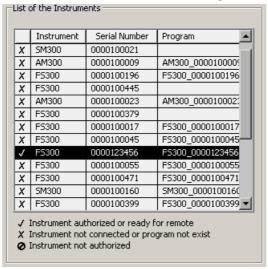
I   A list of all previously connected Smart instruments
II Information, status fields and command buttons for authorization

7.2.2.2   Creating the Program Version

**Selecting
the instrument**

1. In **I** click on the instrument for which you create a link.

	Instrument	Serial Number	Program	
X	SM300	0000100021		
X	AM300	0000100009	AM300_0000100009	
X	FS300	0000100196	FS300_0000100196	
X	FS300	0000100445		
X	AM300	0000100023	AM300_0000100023	
X	FS300	0000100379		
X	FS300	0000100017	FS300_0000100017	
X	FS300	0000100045	FS300_0000100045	
√	FS300	0000123456	FS300_0000123456	
X	FS300	0000100055	FS300_0000100055	
X	FS300	0000100471	FS300_0000100471	
X	SM300	0000100160	SM300_0000100160	
X	FS300	0000100399	FS300_0000100399	

√ Instrument authorized or ready for remote
X Instrument not connected or program not exist
Ø Instrument not authorized

**Creating the pro-
gram version for
specific instrument**

2. Click **<Create Program>**. A program version for specific instrument is created and displayed in **II** with the status (✔). The program number is created from the instrument name (**FS300**) and the serial number (**0000xxxxxx**).

Program
FS300_0000123456.exe	✔ Create Program

3. In **II** click **<Exit>** to close the service program. After correctly creating the program version, the option **FS300 0000xxxxxx** is available in the Win-dows™ start-up menu
Start\Programs\Rohde & Schwarz\Series300.

Series300 ▶	Series 300 Software Manager
	FS300 Documentation
	FS300 0000123456
	FS300 Simulation

Now the program **FS300 0000xxxxxx** can be started (↗ 7-188)

7.2.3   Uninstalling the PC Software

Installation steps for Windows™ 2000

1. Place the CD ROM, which came with the product, in the installation drive. The autorun function automatically initiates installation. Alternatively you may also initiate the installation in the start menu of Windows™ **Start\Run** using the **Setup.exe** from the CD. The uninstallation is prepared and the uninstallation assistant appears.

2. Click **<Next>** to continue the uninstallation.

3. Click **<Finish>** to complete the uninstallation.

📄 **Note**   The PC software can also be uninstalled using the Windows™ control panel.

7.2.4   Update PC Software

Introduction   Old versions of the PC-Software can be updated with the Series 300 Software Manager. Therefore the old version has to be uninstalled (↗ 7-184). The new version can then be installed from the CD-ROM (↗ 7-171). After that, the links which already existing to the listed instruments have to be updated manually.

Starting the service program
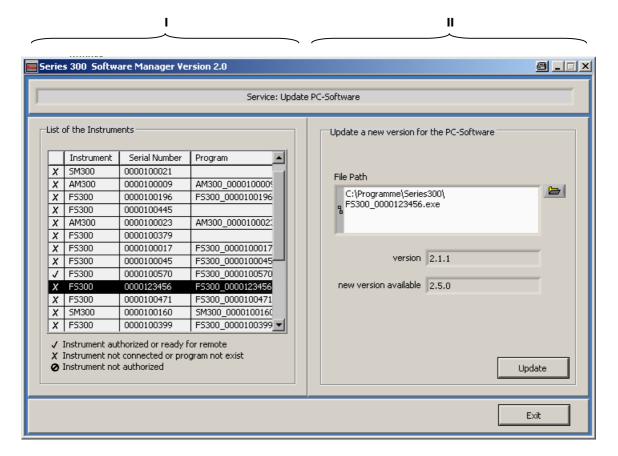
1. Start the Series 300 Software Manager (↗ 7-182).

    The service program initializes and the window „Authorization: PC-Software" is displayed.

2. Click on the top bar **Authorization: PC-Software** and choose "Service: Update PC-Software" from the menu.
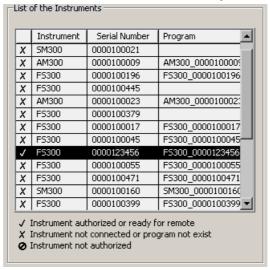
    The "Update PC-Software" window is displayed and has the following two partitions:

    I   List of all Smart-Instruments that have been previously connected
    II   Display of the current version of the program and the available version

Selecting the instrument

3. In **I** click on the instrument for which you wish to update a link.

	Instrument	Serial Number	Program
✗	SM300	0000100021	
✗	AM300	0000100009	AM300_0000100009
✗	FS300	0000100196	FS300_0000100196
✗	FS300	0000100445	
✗	AM300	0000100023	AM300_0000100023
✗	FS300	0000100379	
✗	FS300	0000100017	FS300_0000100017
✗	FS300	0000100045	FS300_0000100045
✓	FS300	0000123456	FS300_0000123456
✗	FS300	0000100055	FS300_0000100055
✗	FS300	0000100471	FS300_0000100471
✗	SM300	0000100160	SM300_0000100160
✗	FS300	0000100399	FS300_0000100399

List of the Instruments

✓ Instrument authorized or ready for remote
✗ Instrument not connected or program not exist
⊘ Instrument not authorized

Updating the link

4. Click in **II** on **<Update>**, to update the displayed link.

5. Click in **II** on **<Exit>**, to shut down the service program. The updated connection **FS300 0000xxxxxx** is displayed in the Windows™ Start Menu **Start\Programme\Rohde & Schwarz\Series300**.

Series300 ▶
- Series 300 Software Manager
- FS300 Documentation
- FS300 0000123456
- FS300 Simulation

Now the program **FS300 0000xxxxxx** can be started (↗ 7-188).

7.3   Starting the Remote Control

7.3.1   Connecting the Instrument to the PC
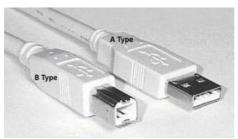
📄 **Note**   PC software R&S FS300-K1 must be installed before you can connect the R&S FS300 to the PC (↗ 7-171).

Introduction   R&S FS300 is connected to the PC via the USB interface. The connection cable has two plug types. Plug A is connected to the computer (↗ computer manual) and plug B is connected to the R&S FS300 (↗ 2-34).

Prepare remote con-   **1.** Switch on the R&S FS300 and the computer.
trol

Connect instrument   **2.** Connect the instrument to the computer with the USB cable. The com-
to PC   puter recognizes the attached instrument and sets up a connection. The
                                following message appears on the monitor of the R&S FS300:

                            If the R&S FS300 is not automatically recognized, please check that the
                            USB master switch of the R&S FS300 is at position **AUTO** (↗ 6-160).

📄 **Note**   In remote control mode, control of the R&S FS300 is deactivated and can only be reactivated by pressing the SYS key at the front panel of the instrument. Switching from remote to local control takes approximately 5 seconds.

7.3.2 Starting the Program

Starting the program   **1.**   In the Windows™ start-up directory click on:
Start\Programs\Rohde&Schwarz\Series300\FS300 0000xxxxxx
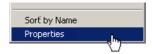
If the link is not avail-   2.   If the program does not start, then click with the right mouse button in the
able   Windows™ start-up directory on:
Start\Programs\Rohde&Schwarz\Series300\FS300 0000xxxxxx

Click **Properties**.
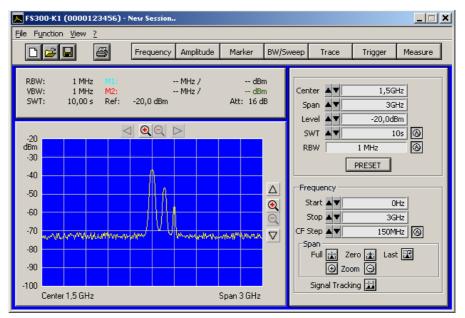
Click **<OK>** to create a link between the programm and start-up direc-
tory.

Start the program again (↗ above, instruction 1.)

Program interface   The program starts up and you may begin using the R&S FS300 remote control.

Loading the current instrument settings   A new session opens automatically when you start the program. The current R&S FS300 settings are loaded. The following settings are display and evaluation functions and are not transferred to the PC software:

- Marker functions (↗ 7-209)
- Scale of measuring diagram (Range, Unit)
- Trace functions (↗ 7-212)
- Measure functions (↗ 7-213)

📄 **Note**   If the message **Device not connected** appears on the program interface, you need to check the connection to the instrument (↗ 7-187).
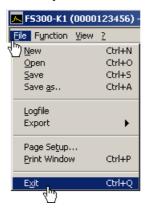
7.3.3 Closing the Remote Control

Closing the program

1. In Windows™ click on the close symbol **x**.

You may also select the option **Exit** in the pull-down menu **File**.

Closing the remote control

2. Remove the USB cable from one side or press the SYS key at the front panel of the R&S FS300.

    Switching between remote and local control takes approximately 5 seconds.

7.4 Getting Started

7.4.1 Level and Frequency Measurement

7.4.1.1 Measuring Task

⚠ **Caution**	The input stage of the R&S FS300 can be destroyed by overloads or DC components. If there is a possibility that the limits specified in the data sheet may be violated, the input must be protected with an attenuator and/or a DC block.
Measurement problem	Determining the level and frequency of a signal is one of the most common measuring tasks which can be solved with a spectrum analyzer. When measuring an unknown signal the PRESET (factory) setting (↗ 6-67) is used as a start-up setting.
Solution	Important functions for the level and frequency measurement are setting the center frequency (CENTER) and the frequency display span (SPAN) as well as the MARKER functions.

7.4.1.2   Measuring Sequence

Introduction

In this example, a signal with a frequency of 200 MHz and a level of –30 dBm is applied to the HF input of the R&S FS300. The center frequency and the frequency display span are set manually. Carry out the following steps:

- Reset the R&S FS300
- Apply a signal to the R&S FS300
- Set the center frequency (Center) to 200 MHz
- Reduce frequency display span (Span) to 1 MHz
- Measure the level and frequency with the marker
- Measure the frequency with the built-in frequency counter

Resetting the R&S FS300

1.   Start the PC software (FS300 0000123456.EXE) on your PC.

Alternatively you may also open a new session when the PC software is already started. To do so, press **<Ctrl+N>**. The default settings are now active (↗ 6-67).

Applying a signal to the R&S FS300

2.   Apply the measuring signal to the HF input socket.

Setting the center frequency (Center) to 200 MHz

3.   Press **<Ctrl+Shift+C>**. The input window **Center** is activ.

4.   Enter the value **<200M>** with the numeric keys. Complete the input by pressing **<Enter>**.

Reducing the frequency display span (Span) to 1 MHz

5.   Press **<Ctrl+Shift+S>**. The input window **Span** is active.
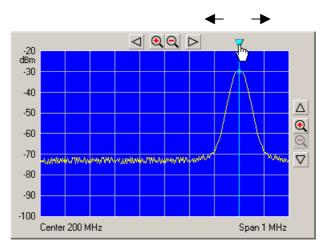
6.   Enter the value **<1M>** with the numeric keys. Complete the input by pressing **<Enter>**.

<table>
<tr><td>**Measuring the level and frequency with the marker**</td><td>**7.** Press **<Ctrl+Shift+M>**. The marker jumps to the signal peak. An arrow appears above of the diagram at the position of the marker.</td></tr>
</table>

8. You can change the position of the marker by moving the arrow with the left **<Mouse Button>**. The parameter field above shows the marker values M1.

RBW:	20 kHz	M1:	200 MHz /	-30,0 dBm
VBW:	50 kHz	M2:	-- MHz /	-- dBm
SWT:	10,00 s	Ref: -20,0 dBm		Att: 16 dB

Measuring the frequency with the built-in frequency counter

9. In the **Function** display **Marker** click on **<Counter>** with the left **<Mouse Button>**

10. Set the resolution of the frequency counter in the selection window **<Res>**.

The exact frequency value C1 can be seen in the parameter field above.

RBW:	20 kHz	M1:	200002730 Hz /	
VBW:	50 kHz	M2:	-- MHz /	-- dBm
SWT:	10,00 s	Ref: -20,0 dBm		Att: 16 dB

7.5   Control Concept

7.5.1   PC Monitor Display
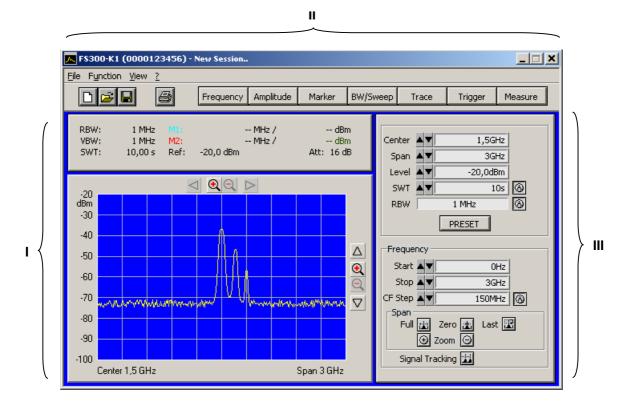
Introduction

The PC monitor provides continuous information about the results and parameters of the selected measuring functions. The display format for the measuring results and the insertion of the function displays depend on the current settings.

Structure of the program interface

The program interface is divided into three areas:

I   Diagram
II   Menus
III   Functions
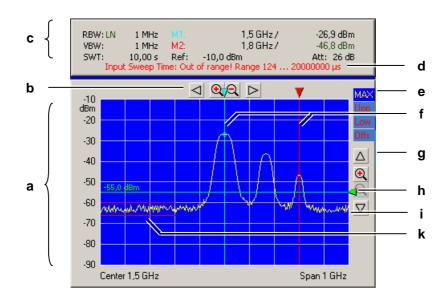
7.5.1.1 Diagram

Diagram displays

The diagram area contains:

- Measuring diagram with scale (**a**) and traces (**i**)
- Measuring value displays, e.g., display lines (**h**) and markers (**f**)
- Limit lines (**k**)
- Parameter field (**c**) and status displays (**e**)
- Pop-up error messages (**d**)

Measuring diagram

A 10 x 8 grid is superimposed on the diagram to facilitate traces analysis.

Parameter field and status display

The following values are displayed in the parameter field:

RBW: - current resolution bandwidth (**LN** for max. sensitivity)
VBW: - current video bandwidth
SWT: - current sweep time
M1: - marker 1 with marker position and level value
M2: - marker 2 with marker position and level value
Ref: - current reference level
Att: - current input attenuation

The status display provides information about:

MAX - current trace display, e.g., maximum value
Upp - limit line Upp is switched on
Low - limit line Low is switched on
Offs - level offset is switched on

📄 **Note**

Error messages are closed after several seconds.

Further system messages and warnings in illegal modes of operation are described in detail in chapter 9.

7.5.1.2 **Menus**

**Calling up and dis-
playing menus**   Different pull-down menus can be accessed in the menu area.

In addition, Windows™-typical menu items can be called up via a toolbar (icons).

Menus for setting the measuring parameters and functions are also available as a toolbar and can be selected directly.

📄 **Note**   The ▸ arrow after a menu option in the pull-down menu indicates that a sub-menu will appear after opening, e.g., .
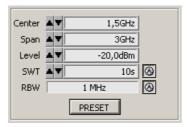
7.5.1.3 Functions

Main functions display

The **main functions** of the R&S FS300 are always displayed in the top part of the function display. These are:
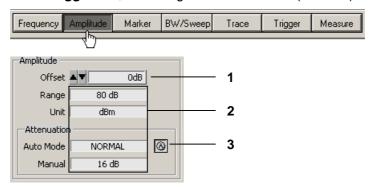
- Center frequency (Center)
- Frequency display span (Span)
- Reference level (Level)
- Sweep time (SWT)
- Resolution band width (RBW)
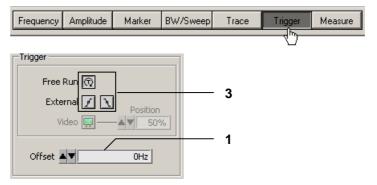
These may be changed at any time.

Inserting specific functions

In the lower part of the function display, different function displays with input fields (1), selection fields (2) and control buttons (3) are displayed e.g., **Amplitude** or **Trigger** etc., according to menu selection (↗ 7-201).

Note: If a selection is not highlighted, it has currently no function (current setting).

7.5.2 Input via Keyboard and Mouse

Introduction   The R&S FS300 is remote controlled via PC keyboard and mouse with the help of menus. The most important keys are:

- Numeric keys   0 ... 9
- Arrow keys   ◄ / ► / ▼ / ▲
- Function keys   F5 ... F11
- Action keys   Enter, Esc
- Tab key   Tab
- Space bar   Space
- Mouse buttons   left, right

7.5.2.1 Numeric Keys

Function   The numeric keys are used to enter numerical parameters.

0 ... 9 −   At cursor, insert numbers **<0>** ... **<9>**

Level ▲▼ [20 |dBm]

, −   At cursor, insert decimal separating sign **<,>** oder **<.>** dependence on PC system settings

Level ▲▼ [20, |dBm]

- −   At cursor, insert minus sign **<->**

Level ▲▼ [- |20,0dBm]
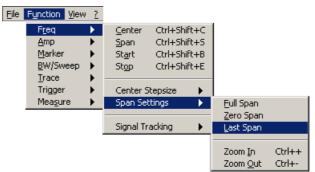
7.5.2.2 Arrow Keys

Function   In addition to numeric keys, the arrow keys are used to enter parameters. They can also be used to navigate through the menus.

◄ / ► / ▼ / ▲   The arrow keys have the following functions:

- **Navigating the pull-down menus** with all arrow keys
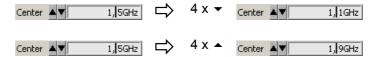
     −   **Navigating** the selection fields with the ⯆ / ⯅ arrow keys

       | Hz |
       | **kHz** |
       | MHz |
       | ✓ GHz |

     −   **Positioning** the cursor in the input fields with the ◀ / ▶ arrow keys

       Center ▲▼   1,5GHz

     −   **Increasing** or **decreasing** numerical parameter inputs with the ⯆ / ⯅ arrow keys

       Center ▲▼   1,5GHz   ⇨   4 x ⯆   Center ▲▼   1,1GHz

       Center ▲▼   1,5GHz   ⇨   4 x ⯅   Center ▲▼   1,9GHz

7.5.2.3   Function Keys

Function   Function keys open the menus to set the measuring parameters and measuring functions and insert the corresponding function display.

F5	−	Inserts the **Frequency** function display	(↗ 7-207)
F6	−	Inserts the **Amplitude** function display	(↗ 7-208)
F7	−	Inserts the **Marker** function display	(↗ 7-209)
F8	−	Inserts the **BW/Sweep** function display	(↗ 7-211)
F9	−	Inserts the **Trace** function display	(↗ 7-212)
F10	−	Inserts the **Trigger** function display	(↗ 7-213)
F11	−	Inserts the **Measure** function display	(↗ 7-213)

7.5.2.4   Action Keys (Enter, Esc)

Function   The action keys complete the menu-operated settings.

     Enter key   –   This key **closes the input or selection**. The **new value** now applies.

       Esc key   –   This key **closes the selection**. The **old value** is preserved.
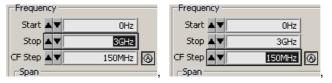
7.5.2.5   Tab Key

Function   The tab key activates the input fields, the selection fields and the buttons within a function display.

       Tab key   –   Jumps from one control element to another in a function display

     Note: The tab key can be only used to make selections when an input field, a selection field or a control button has been selected in the function display via a menu ($\nearrow$ 7-201) or with the mouse ($\nearrow$ 7-200).
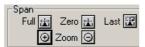
7.5.2.6   Space Key

Function   After selecting an input field, a selection field or a control button with the tab key, different actions are initiated by pressing the space key:

     Space key   –   Immediate function **execution** of the function e.g., Zoom +
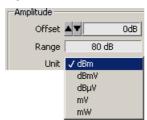
                   –   **Toggle** a setting, e.g., switch on/off signal tracking

                   –   **Open** selection fields, e.g., set the measuring unit for Amplitude
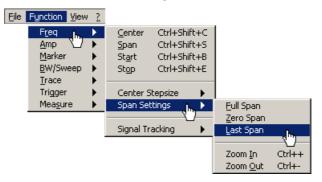
7.5.2.7   Mouse Buttons

Function

Placing the mouse pointer over and clicking on any program interface item will allow for different actions.

Left mouse button

− Pull-down menus can be **opened** with the mouse

− The contents of input fields can be **highlighted** with mouse button pressed and held

− The cursor can be **positioned** in the input fields by clicking the mouse button

− Selection fields can be **opened** and settings can be **selected** with mouse button pressed and held
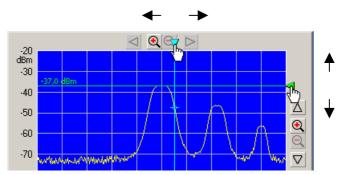
− Immediate **execution** of any function by clicking the mouse button

− **Toggling** a setting with multiple mouse clicks

− **Moving** markers and limits, also in the diagram area, with mouse button pressed and held
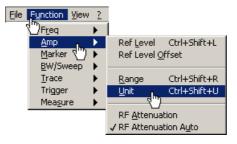
7.5.3   Calling up and Changing the Menus

Various methods are possible

The R&S FS300 is remote controlled via a menu. The keyboard and the mouse can be used to select a menu (↗ 7-197).

Instrument parameters (and program functions) can be selected in different ways on the PC interface, e.g., unit for the level display:
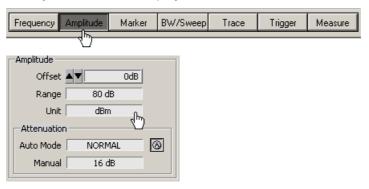
- **Selecting with the pull-down menu**

- **Selecting with short keys**

  Unit   Ctrl+Shift+U

- **Selecting with the toolbar menu** and **selecting the selection field** directly in the function display

---

📄 **Note**

The ▸ arrow after a menu option in the pull-down menu indicates that a sub-menu will appear after opening, e.g. Amp   ▸ .

7.5.4   Setting the Parameters

Introduction   Parameters can be set in different ways:

- Selecting an instrument function directly (command button)
- Selecting settings in the selection fields
- Inputting numerical parameters in the input fields
- Moving markers

The keyboard and mouse can be used for the settings (↗ 7-197).
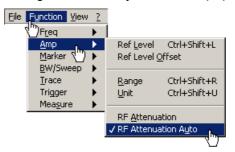
7.5.4.1   Direct Selection of a Instrument Function

Various methods are possible   Some instrument functions are executed immediately after selection, e.g., automatic setting of the HF input attenuator.
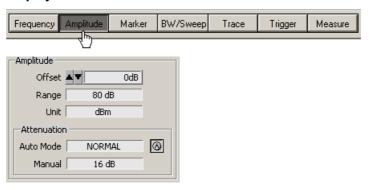
Instrument parameters (control buttons) can be selected in different ways:

- **Selecting and switching on using a pull-down menu**. The current setting is indicated by a tick mark (✔).

- **Selecting using a toolbar menu** and **switching on in the function display**
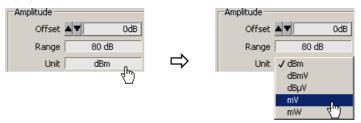
7.5.4.2   Selecting the Settings

Setting the instrument functions in selection windows

Several settings are available for certain instrument functions, e.g., level display unit.

The selection window can be **reached** in a number of different ways (↗ 7-201), e.g., selection using the toolbar menu.

Opening the selection window and **selecting the instrument functions** takes place in the **function** display. The current setting is indicated by a tick mark (✔).

7.5.4.3   Inputting the Numerical Parameters

Setting instrument functions in the input window

Two methods are available for entering the numerical parameters, e.g., inputting the frequency display range:

- **Inputting** a value with **numeric keys**
- **Inputting** a value with **arrow keys**

You should use the arrow keys for inputting if the value to be measured cannot be determined accurately beforehand. Given that the screen is constantly updated while the values are changing, browsing is possible.

Selecting input window

The input fields can be selected in a number of different ways (↗ 7-201), e.g., using short keys:

Inputting with numeric keys

Inputting using the numeric keys can be done in a number of different ways:

- Highlighting and **overwriting numbers**

- Selecting a decimal point and **inserting numbers**
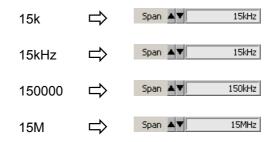
Selecting the unit
The entry is made in the active measurement unit, which is indicated after the numeric value in the entry field and can be changed. Make sure that there are no spaces between the numeric figure and the measurement unit.
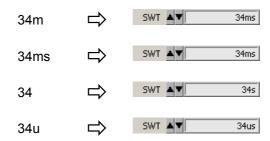
You may omit the base unit (e.g. Hz, s, dBm). However, you must specify the unit size (valid values: G, M, k, m, u, n, p).

Input examples
▪ **Span:**

15k ⇨ Span ▲▼ 15kHz

15kHz ⇨ Span ▲▼ 15kHz

150000 ⇨ Span ▲▼ 150kHz

15M ⇨ Span ▲▼ 15MHz

▪ **Sweep Time:**

34m ⇨ SWT ▲▼ 34ms

34ms ⇨ SWT ▲▼ 34ms

34 ⇨ SWT ▲▼ 34s

34u ⇨ SWT ▲▼ 34us
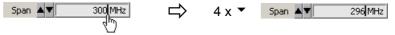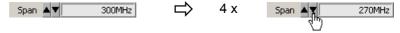
Inputting with arrow keys
Inputting using the arrow keys can be done in a number of different ways:

▪ Selecting a decimal point and incrementation or decrementation **with the ▼ / ▲ arrow keys on the keyboard**

Span ▲▼ 300 MHz ⇨ 4 x ▼ Span ▲▼ 296 MHz

▪ Incrementing or decrementing **with the arrow keys on the user interface**

Span ▲▼ 300MHz ⇨ 4 x Span ▲▼ 270MHz

Note: When entering the center frequency, increment size can be set on the rotary knob (↗ 6-72). The value is then incremented or decremented according to this set value.

Invalid parameter entry
If a parameter entry is invalid, the value will automatically be limited, and an error message indicating the valid value range will appear in the parameter field, e.g.:

SWT: 124,0 µs   Ref: -20,0 dBm   Att: 16 dB
Input Sweep Time: Out of range! Range 124 ... 20000000 µs
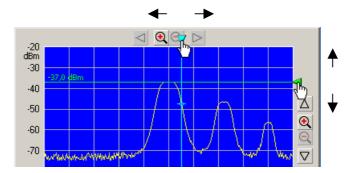
• Acknowledge the error message with the mouse or the Enter key and repeat the entry with the correct value.
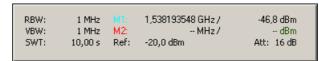
7.5.4.4   Moving the Markers

Introduction   In the diagram area, lines (markers, limits, etc.) can be inserted to analyze the trace. In addition, an arrow is displayed at the edge of the diagram at the position of the corresponding line. The position of the line can be changed by moving the arrow with the left mouse button.

The marker values can be read in the parameter fields above.

RBW:	1 MHz	M1:	1,538193548 GHz /	-46,8 dBm
VBW:	1 MHz	M2:	-- MHz /	-- dBm
SWT:	10,00 s	Ref:	-20,0 dBm	Att: 16 dB

7.6   Overview of all Menus and Functions (Shortcuts)

7.6.1   File

Menus to prepare for a Session   The following options are available in the pull-down menu **File:** open, save and close a session; create a log file; export data; print screen.

New	Ctrl+N	Begin new session	(↗ 7-215)
Open	Ctrl+O	Open saved session	(↗ 7-216)
Save	Ctrl+S	Save current session	(↗ 7-216)
Save as..	Ctrl+A	Save current session as	(↗ 7-216)
Logfile		Create a log file for the current session	(↗ 7-221)
Export	▶	Export data	(↗ 7-224)
Page Setup…		Page setup for printing	(↗ 7-226)
Print Window	Ctrl+P	Print current window	(↗ 7-226)
Exit	Ctrl+Q	Exit program	(↗ 7-190)

7.6.2   Function
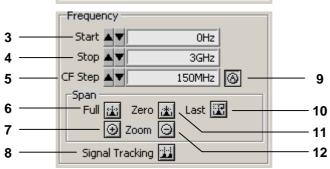
📄 **Note**	Instrument functions are accurately described in chapter 6 of the R&S FS300 manual.

Menus for configuring and starting measurements

The menus used to set the spectrum analyzer are displayed in the pull down menu **Functions** or in the toolbar menu. The order of the menus mirrors that of the procedure for configuring and starting measurements.

Freq ▶	Selecting the frequency span (setting the x axis in the diagram area)
Amp ▶	Setting the level axis and the RF input (setting the y axis in the diagram area)
Marker ▶	Signal analysis with marker functions
BW/Sweep ▶	Setting the bandwidths and the sweep time
Trace ▶	Displaying the trace
Trigger ▶	Triggering the measurement
Measure ▶	Measurement functions

7.6.2.1   FREQ Menu

Main function dis-
play (always visible)

1 ——— Center ▲▼ [1,5GHz]
2 ——— Span ▲▼ [3GHz]
Level ▲▼ [-20,0dBm]
SWT ▲▼ [10s] ⊛
RBW [1 MHz   ] ⊛
[PRESET]

Function display
(insert with F5 key)

Frequency

3 ——— Start ▲▼ [0Hz]
4 ——— Stop ▲▼ [3GHz]
5 ——— CF Step ▲▼ [150MHz] ⊛ ——— 9

Span
6 ——— Full 📷 Zero 📷 Last 📷 ——— 10
7 ——— ⊕ Zoom ⊝ ——— 11
8 ——— Signal Tracking 📷 ——— 12

Function and
shortcut

Center Ctrl+Shift+C	Entering the center frequency		**(1)**
Span Ctrl+Shift+S	Entering the span		**(2)**
Start Ctrl+Shift+B	Entering the start frequency		**(3)**
Stop Ctrl+Shift+E	Entering the stop frequency		**(4)**

Center Stepsize   ▶   **Open submenu:**
Entering the step width of the center frequency

manual	Setting the step size manually	**(5)**
auto	Setting the step size automatically	**(9)**
= Centerfrequency	Setting the step size to the center frequency	
= Markerfrequency	Setting the step size to the marker frequency	

Span Settings   ▶   **Open submenu:**
Display modes for the frequency axis

Full Span	Displaying the whole frequency range	**(6)**
Zero Span	Switching over to the ZERO SPAN	**(11)**
Last Span	Restoring the previous setting	**(10)**
Zoom In Ctrl++	Reducing the span	**(7)**
Zoom Out Ctrl+-	Increasing the span	**(12)**

Signal Tracking   ▶   **Open submenu:**
Signal tracking

on	Activating signal tracking	**(8)**
off	De-activating signal tracking	**(8)**

7.6.2.2   Amp Menu

**Main function dis-
play (always visible)**

1

**Function display
(insert with F6 key)**

2
3
4

8

5   7
6

**Function and
shortcut**
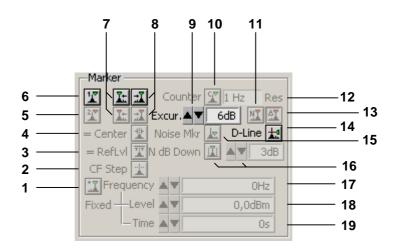
Ref Level Ctrl+Shift+L	Entering the reference level	**(1)**
Ref Level Offset	Entering a level offset	**(2)**
Range Ctrl+Shift+R	Selecting the level display range	**(3)**
Unit Ctrl+Shift+U	Selecting a unit for the level display	**(4)**
RF Attenuation	Setting the RF input attenuation manually	**(6)**
RF Attenuation Auto	Setting the RF input attenuation automatically	**(5), (7)**
Set High Sense	Setting the high sensitivity automatically	**(8)**

7.6.2.3   Marker Menu
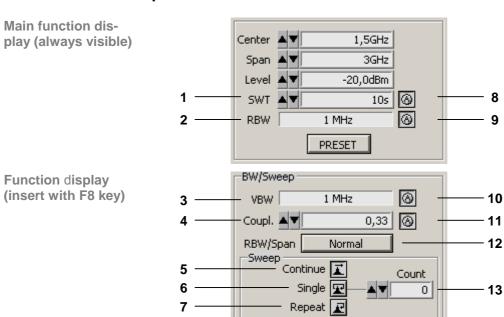
**Function display
(insert with F7 key)**

**Function and
shortcut**
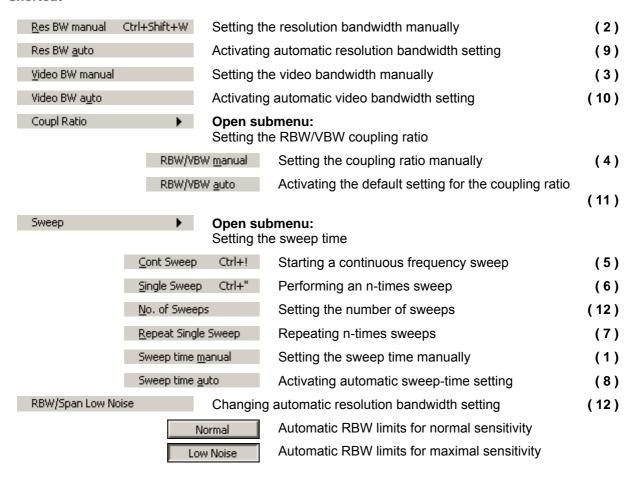
Marker 1 ▶	**Open submenu:** Activate marker 1	
Peak Ctrl+Shift+M	Place marker 1 on the trace maximum	**(6)**
next Peak left	Place marker 1 on the next trace maximum to the left	**(7)**
next Peak right	Place marker 1 on the next trace maximum to the right	**(8)**
Signal Count	Measure the signal frequency: Start measurement	**(10)**
Signal Count Resolution	Measure signal frequency: Set resolution	**(12)**
off	De-activate marker 1	**(6)**
Marker 2 ▶	**Open submenu:** Activate marker 2	
Peak	Place marker 2 on the trace maximum	**(5)**
next Peak left	Place marker 2 on the next trace maximum to the left	**(7)**
next Peak right	Place marker 2 on the next trace maximum to the right	**(8)**
Marker norm	Set marker 2 as a normal marker (NORM)	**(11)**
Marker delta	Set marker 2 as a delta marker (DELTA)	**(13)**
off	De-activate marker 2	**(5)**
Marker > ▶	**Open submenu:** Accepting marker values as settings	
Center = Marker Freq	Set the center frequency to the marker frequency	**(4)**
Ref Level = Marker Level	Set the marker level as a reference level	**(3)**
Center Stepsize = Marker Freq	Set the step size for entering the center frequency to the marker frequency	**(2)**

Marker Functions ▶	**Open submenu:** Marker measurement functions		
Noise Marker	Measuring noise power density	**(15)**	
n dB down	Measuring signal bandwidth	**(16)**	
D-Line　Ctrl+Shift+D	Bring display line up on screen	**(14)**	
Limit Line	Bring limit line up on screen	(↗ 7-218)	
Ref fixed ▶	**Open submenu:** Reference points for measuring level differences		
on	Activating the entry of arbitrary reference points	**(1)**	
off	Using M1 marker values as a reference point	**(1)**	
Ref Point Level	Entering the reference-point level	**(18)**	
Ref Point Freq	Entering the reference-point frequency	**(17)**	
Ref Point Time	Entering the reference-point time	**(19)**	
Marker Settings ▶	**Open submenu:** Search criterion of functions NEXT PEAK LEFT/RIGHT		
Peak Excursion	Entering the peak excursion	**(9)**	

7.6.2.4   BW/Sweep Menu

Main function display (always visible)

Function display (insert with F8 key)

Function and shortcut

Res BW manual Ctrl+Shift+W	Setting the resolution bandwidth manually	**(2)**
Res BW auto	Activating automatic resolution bandwidth setting	**(9)**
Video BW manual	Setting the video bandwidth manually	**(3)**
Video BW auto	Activating automatic video bandwidth setting	**(10)**
Coupl Ratio ▶	**Open submenu:** Setting the RBW/VBW coupling ratio	
RBW/VBW manual	Setting the coupling ratio manually	**(4)**
RBW/VBW auto	Activating the default setting for the coupling ratio	**(11)**
Sweep ▶	**Open submenu:** Setting the sweep time	
Cont Sweep Ctrl+!	Starting a continuous frequency sweep	**(5)**
Single Sweep Ctrl+"	Performing an n-times sweep	**(6)**
No. of Sweeps	Setting the number of sweeps	**(12)**
Repeat Single Sweep	Repeating n-times sweeps	**(7)**
Sweep time manual	Setting the sweep time manually	**(1)**
Sweep time auto	Activating automatic sweep-time setting	**(8)**
RBW/Span Low Noise	Changing automatic resolution bandwidth setting	**(12)**
Normal	Automatic RBW limits for normal sensitivity	
Low Noise	Automatic RBW limits for maximal sensitivity	

7.6.2.5   Trace Menu

**Function display
(insert with F9 key)**

1	Trace
2	Clear/Write
3	Hold Max Min Sweeps
4	Average 0
5	View
6	Blank
7	T1-T2 = T1 Trace Pos 0%

1 ——— Trace   8
9
4
10

**Function and
shortcut**
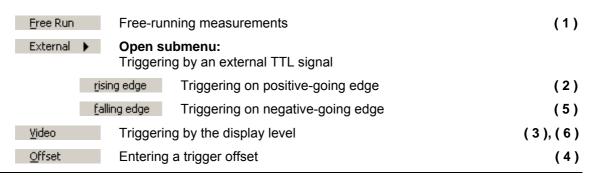
Select Trace ▶	**Open submenu:** Selecting the active trace	
Trace 1	Turning on and activating Trace 1	(1)
Trace 2	Turning on and activating Trace 2	(8)
Clear/Write	Trace display mode: Overwrite mode	(2)
Max Hold	Trace display mode: Max. hold	(3)
Min Hold	Trace display mode: Min. hold	(9)
Trace Average	Trace display mode: Averaging	(4)
View	Freezing the trace	(5)
Blank	Blanking out the trace	(6)
Math ▶	**Open submenu:** Trace difference	
T1-T2=>T1	Turning on the trace-difference mode	(7)
Trace Pos	Repositioning Trace 1 (result)	(10)
off	Turning off the trace-difference mode	(7)

7.6.2.6　Trigger Menu

**Function display
(insert with F10 key)**

**Function and
shortcut**

Free Run	Free-running measurements	**(1)**
External ▶	**Open submenu:** Triggering by an external TTL signal	
rising edge	Triggering on positive-going edge	**(2)**
falling edge	Triggering on negative-going edge	**(5)**
Video	Triggering by the display level	**(3), (6)**
Offset	Entering a trigger offset	**(4)**
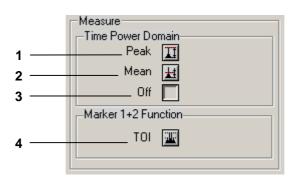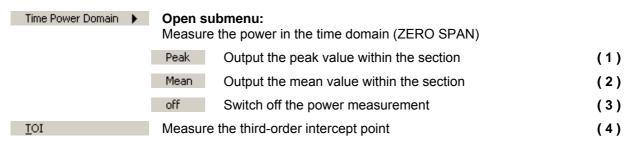
📄 **Note**　　　The trigger function **LINE** (triggering by the AC-line frequency) is not supported.

7.6.2.7　Measure Menu

**Function display
(insert with F11 key)**

**Function and
shortcut**

Time Power Domain ▶	**Open submenu:** Measure the power in the time domain (ZERO SPAN)	
Peak	Output the peak value within the section	**(1)**
Mean	Output the mean value within the section	**(2)**
off	Switch off the power measurement	**(3)**
TOI	Measure the third-order intercept point	**(4)**

7.6.3   View

Menus for configuring the program interface

Menus for resizing the window and setting screen colors are available in the pull-down menu **View**.

large Window	Ctrl+W	Switch on/off large window	(↗ 7-227)
Color	Ctrl+L	Set screen color	(↗ 7-228)

7.6.4   ? Help
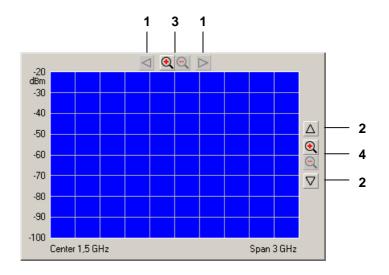
Help menus

Menus for opening the help function and displaying the program information are available in the pull-down menu **Help**.

Help		Start help function	(↗ 7-229)
Info	Ctrl+I	Display program information	(↗ 7-229)

7.6.5   Zoom Functions

Diagram area (always visible)

Functions

Zoom   Zoom the screen window

(1)   Move screen window in X direction (one grid unit)

(2)   Move screen window in Y direction (one grid unit)

(3)   Zoom screen window in/out in X direction

(4)   Zoom screen window in/out in Y direction

📄 **Note**   Zoom function **(3)** corresponds to the Zoom In/Out functions (↗ 7-207). Zoom function **(4)** corresponds to the Range functions (↗ 7-208).

7.7 Saving/Exporting Data (File)

7.7.1 Opening the Session

Application
A new session is opened automatically when the program is started (↗ 7-188). The current R&S FS300 settings are loaded. The following settings are display and evaluation functions and are not transferred to the PC software:

- Marker functions (↗ 7-209)
- Scale of measuring diagram (Range, Unit)
- Trace functions (↗ 7-212)
- Measure functions (↗ 7-213)

However, you may also open a new session while in remote control mode. Default settings are automatically loaded (↗ 6-67).

You can save and load specific instrument settings if you plan to work with these on a regular basis.

7.7.1.1 Beginning New Measurement
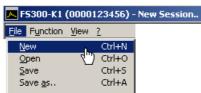
Beginning the measurement with current instrument setting
- Start the PC software on your PC.

Beginning the measurement with factory setting
- Select menu item: **New**.

7.7.1.2   Loading the Saved Settings
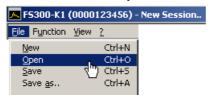
📄 **Note**	If you drag and drop an *.fs file (saved instrument settings) to the FS300-K1.exe icon while the program is closed, the program will open using the settings from this *.fs file.
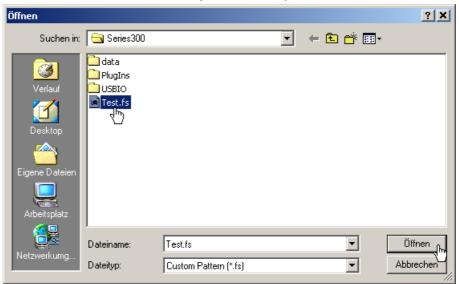
Beginning the measurement with saved instrument settings

1. Select menu item: **Open**.

2. Select a file from the directory and click **<Open>**.

Resetting the instrument settings

- To load the instrument settings that were last loaded or the factory settings, press **<Preset>** in the main function display.

7.7.2   Saving the Session

Application

You can save specific instrument settings if you plan to work with them on a regular basis (Save Session).
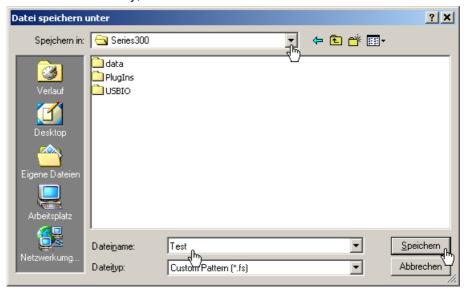
You may also change a previously saved instrument setting and save it under a different file name (Save Session as..).

Saving instrument settings

1.   Select menu item: **Save** or **Save as..**.

2.   Select a directory, enter a file name and click **<Save>**.

7.7.3   Monitoring the Measuring Values
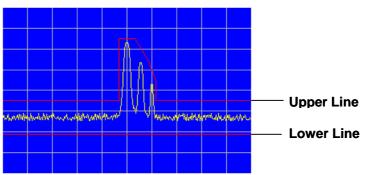
Introduction   If you wish to monitor deviation of measuring values you may set limit lines (Limit Lines) to monitor them. A logfile is created which can be opened with any text editor or with Microsoft Excel™.

7.7.3.1   Inserting the Limit Lines

Application   Measuring values which **overshoot** the limit lines are monitored with an **Upper Line** and measuring values which undershoot the limit lines are monitored with a **Lower Line**. The shape of the limit lines are entered into a table in value pairs (frequency, amplitude), they may then be inserted into the measuring diagram.
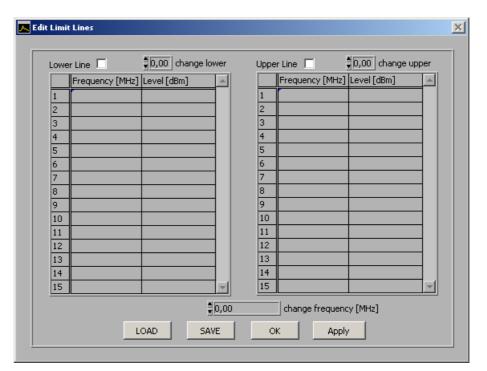
You can create limit lines with up to 50 value pairs, these may be saved and loaded for later use.

Entering limit lines   **1.**   Select menu item: **Limit Line**.
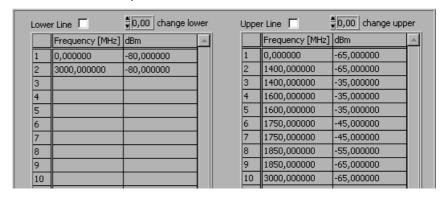
Edit Limit Lines window opens.
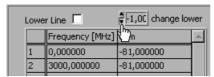
2. Use the left-hand table to enter the frequency and amplitude values for the lower lines and use the right-hand table to enter the upper lines.

Each row in the table describes a reference point on the limit line. At least 2 value pairs (reference points) per line must be entered, e.g., lower line: -80 dB for full span.

Note: You may increase and decrease the amplitude values of a limit line for all value pairs with the input fields: **change lower**/**change upper**.

You may increase and decrease the frequency values of a limit line for all value pairs with the input fields: **change frequency [MHz]**.
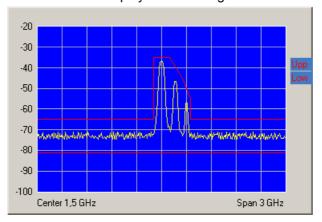
Inserting limit lines   1. Tick the check boxes for **Lower Line** and/or **Upper Line** to activate the limit line(s).

2. Click **<APPLY>** to activate the limit line(s). The status information **Upp** and/or **Low** are displayed in the diagram.

Saving and loading   1. Press **<SAVE>** if you plan to use the current settings again.
limit lines

The **Save File as** window opens.

2. Select a directory, enter a file name and click **<Save>**. The current settings are saved.

3. Press **<LOAD>** if you wish to use the saved settings again.

The **File open** window opens.

4. Select the (**.lim**) file from your directory and click **<Open>**. The saved settings (frequency and amplitude values) are loaded.

Closing the window   • Press **<OK>** to close the **Edit Limit Lines** window. The current settings remain active in the diagram.
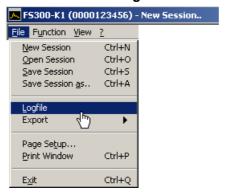
7.7.3.2   Monitoring

Aim   A logfile is created during the monitoring process, which documents over- and undershooting of a limit line. This allows random events to be captured.

Creating the logfile   **1.**   Select menu item: **Logfile**.
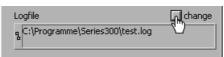
The **Logfile** window opens.

2.   Click **<change>** if a logfile has not yet been created.

The **Save File as** window opens. Select a directory, enter a file name and click **<Save>**. The current logfile path is displayed.
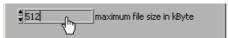
3.   Click in the **Comment** window to enter a logfile comment.

Starting the monitoring

1. Enter the maximum logfile memory size in KB. The default setting is "512 KB".

2. Click **<Enable recording>** to start the monitoring process. The button lights up red.

If an over- or undershoot of a limit is detected, the corresponding status information **Upp** and/or **Low** flashes in the diagram. The measuring values are monitored 10x per second and each over- or undershoot of a limit line is recorded.

Stopping the monitoring

1. Click **<Enable recording>** to finish the monitoring process. The button no longer lights up red.

2. Click **<OK>** to close the **Logfile** window.

7.7.3.3 Analyzing the Logfile
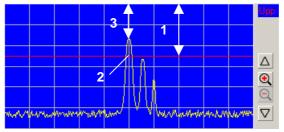
Logfile content

The logfile contains the measuring data, which were recorded during the monitoring process. A record is created from the following parameters when a limit line has been over- or undershot.

- **Date** - event date
- **Time** - event time
- **MinLimit** **(1)** - limit line level Upp
- **MaxLimit** - limit line level Low
- **EventFreq** **(2)** - event frequency value
- **EventLevel** **(3)** - event maximum level
- **Center** - center frequency
- **Span** - span
- **RBW** - resolution bandwidth
- **Ref Level** - reference level
- **Leveloffset** - level offset
- **SweepTime** - sweep time

Analyzing the logfile

If the logfile (.log) is saved as a text file (.txt) the data can be opened and analyzed in Microsoft Excel™.

7.7.4   Exporting the Measuring Data
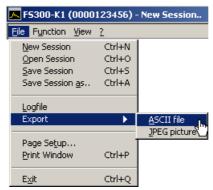
Application   To record the measurements, you can save the current diagram with the most important parameter settings in ASCII code or you can save a screenshot of the current window as a JPEG.

7.7.4.1   Creating the ASCII File

Creating the ASCII file

1. Select menu item: **ASCII file**.

The **Export ASCII** window opens.

2. Click in the **Please change comment** window to enter a logfile comment and click **<OK>**.
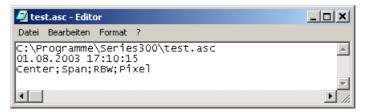
The **Save File as** window opens.

3. Select a directory, enter a file name and click **<Save>**.

ASCII File contents   The ASCII file contains the following parameters:

- **Center**   - center frequency
- **Span**   - span
- **RBW**   - resolution bandwidth
- **Pixel**   - level values of the trace
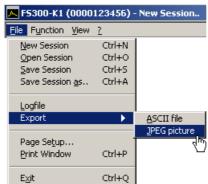
📄 **Note**   The number of exported level values (pixels) depends on the setting for the size of the window. (↗ 7-227, small window: 310 pixels, large window: 700 pixels)

7.7.4.2 Creating the Screenshot

Creating the screen-shot   1. Select menu item: **JPEG picture**.

The **Save File as** window opens.

2. Select a directory, enter a file name and click **<Save>**.
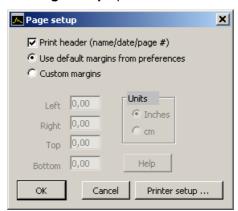
7.7.5   Printing the Window

Page setup   **1.** Select menu item: **Page setup**.

The **Page setup** opens.

2. Check the **<Print header>** box (✔) to print a header with the file name, date and page number.

3. Check **<Use default margins from preferences>** to print page with the presettings.

You may also check **<Custom margins>** to print page with user-defined settings. You may then adjust the page margins: **<Left>**, **<Right>**, **<Top>** and **<Bottom>**.

4. Click **<Printer setup>** to select your printer settings.

5. Click **<OK>** to close the **Page setup** window.

Printing the window   **6.** Select menu item: **Print Window** from the **File** pull-down menu to print the current program window.

7.8   Customizing the Working Window (View)
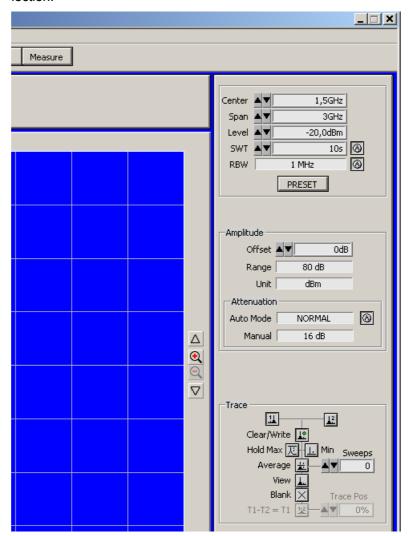
7.8.1   Adjusting the Window Size

Adjusting the win-
dow size

1.   Select menu item: **Large Window** to enlarge the program window.

The diagram is enlarged by a factor of 2. In addition to the **Main Set-
tings**, two function displays appear in the function display area. The first
function display (e.g., **Amplitude**) refers to the current menu selection
and the second function display (e.g., **Trace**) refers to the last menu se-
lection.

2.   Select the **Large Window** menu item again to reduce the window size.
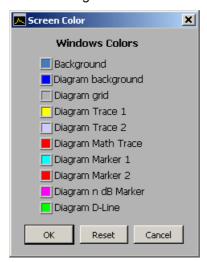
7.8.2   Changing the Window Color

Changing the win-dow color
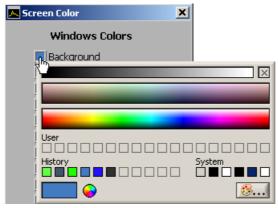
1. Select menu item: **Color**.

The **Screen Color** window opens. Colors for the listed window elements can be changed.

2. Click on a color field to change the color for the corresponding windows element. A color scheme opens.

3. Move the mouse over the color bars and click on your preferred color. The color scheme closes and the new color appears in the color field of the window element.

4. Click **<OK>** to close the **Screen Color** window and to activate the new window colors.

You may also click **<Reset>** and **<OK>** to revert to the default color settings.

7.9   Getting Help (?)

7.9.1   Starting the Help

Starting the help   • Select menu item: **Help** to start the Windows™ Help for program **FS300 0000xxxxxx**.

Acrobat Reader™ (↗ CD-ROM) starts up and the English R&S FS300 operating manual opens.

7.9.2   Displaying the Program Version

Opening/closing the   **1.** Select menu item: **Info** for information about the **FS300 0000xxxxxx**
program version   program.

An information field opens.

2. Click in the information field with the mouse to close.

You may also wait approximately 10 seconds for the information field to close automatically.
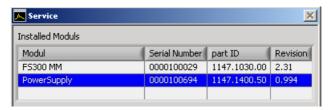
7.9.3   Displaying Module Data

Displaying module data

1. Select menu item: **Service** to obtain information about the individual modules.
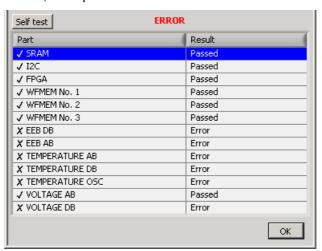
The modules of the R&S FS300 will be output and displayed.

Starting self-diagnostics

2. Click the line **<FS300>** to select the generator module.

3. Click **<Self test>** to start self-diagnostics.

All modules are checked one after the other and the result, "Passed" or "Error", is output.

4. Click **<OK>** to close the Service window.

8 Instrument Interfaces

This chapter   The chapter 8 contains a description of the R&S FS300's interfaces.

Further information   The address of our Support Center and a list of Rohde & Schwarz service centers will be found at the front of this manual.

8.1 Keyboard Connector (KEYB)

Connector   There is a 6-pin PS/2 connector KEYBOARD [21] on the R&S FS300's rear panel for an external keyboard.

Pin assignment

Pin	Signal
1	KEYBOARDDATA
2	MOUSEDATA
3	GND
4	5 V, KEYBOARD
5	KEYBOARDCLK
6	MOUSECLK

8.2 Monitor Connector (MON)

Connector   There is connector MONITOR [20] on the rear panel of the R&S FS300 for an external monitor.

Pin assignment

Pin	Signal
1	R
2	G
3	B
4	(NC)
5	GND
6	GND
7	GND
8	GND
9	GND
10	GND
11	(NC)
12	(NC)
13	HSYNC
14	VSYNC
15	(NC)

8.3   Input for External Trigger (EXT TRIG/GATE IN)

Specification   The connector EXT TRIG/GATE IN [14] is for an external signal which is used to control measurements.

The signal has TTL levels (low < 0.7 V, high > 1.4 V), and the typical impedance is 10 kΩ.

Instrument setting   The TRIG menu ($\nearrow$ 6-136) allows you to make the appropriate settings when an external signal is used to trigger measurements.

8.4   Reference Input and Output (REF IN and REF OUT)

External reference   If an external reference is used, the internal reference oscillator is synchronized to the 10 MHz reference signal at connector REF IN [22]. The input level must be 0.5 to 2 V.

Internal reference   The 10 MHz signal from the internal reference oscillator is available at the REF OUT connector [23] so that other devices can be synchronized to the R&S FS300. The output level is 0 dBm.

Instrument setting   You can switch over between the internal and external reference in the CONFIG menu ($\nearrow$ 6-159).

8.5   USB Interface (PC, DEV)

Connector   The USB-Host [15] and USB-Device [16] connectors on the rear panel of the R&S FS300 are for a USB device.

Pin assignment

Pin	Signal
1	Vbus (Vcc)
2	D-
3	D+
4	GND
Shell	Shield

9   Error Messages

This chapter   Refer to chapter 9 for a detailed description of errors that may occur in the R&S FS300. You will also find notes on troubleshooting.

The R&S FS300 displays detected errors and warnings on the screen. The various types of messages are described in the following:

- System messages
- Warnings indicating impermissible operating states

Further information   Chapter 6 describes all the R&S FS300's menus and the associated functions in detail.

9.1   System Messages

System messages   System messages inform you of internally detected errors. The following informs are displayed, e. g.:

- Type of error (**x**)
- Four-digit error number (**y**)
- Request for closing the system messages (**z**)

The error number allows the service shop to determine the type of error. In the event of an system message, please write down the error number and proceed according to the following steps.

Device Error "Error number"   A system error was detected in the instrument.

1. Please write down the error number and the corresponding instrument settings.
2. Contact your nearest Rohde & Schwarz representative (0-22). The instrument may have to be checked in the service shop.

Overtemperature Error "Error number"   An impermissibly high temperature was detected in the instrument. The internal fans are switched to full power for approx. 30 seconds, and then the R&S FS300 is automatically switched off to prevent further overheating.

The overtemperature could be caused by too high an ambient temperature and/or reduced air circulation.

1. Let the instrument cool off for a while and remove any obstructions that could hinder air circulation.
2. If this doesn't eliminate the overtemperature, have the instrument checked by the service shop.

📄 **Note**   Some errors can cause the instrument or parts of the instrument to be switched off immediately in order to avoid destruction of components. Whenever an system message occurs, an entry is made under SYSTEM MESSAGES (↗ 6-168).

9.2　　Warnings Indicating Impermissible Operating States

Warnings

Red labels at the upper left corner of the measurement grid tell the user that the measurement results may be incorrect. This can be caused by excessively high signal levels at the input or by incorrect settings on the instrument. The warning remains on the screen until the problem has been eliminated.

There are three types of messages that can be displayed on the screen:

OVERLOAD

A level above 13 dBm is detected at the R&S FS300 input and the current input attenuation setting is less than 20 dB. In this case, the instrument automatically increases the input attenuation by 20 dB to prevent the subsequent stages from being overdriven. The displayed signal level decreases by 20 dB as a result of the additional attenuation, without the display being corrected.

1. To obtain a correct level display, the reference level must be increased (↗ 6-81) until the message disappears.

2. If the message does not disappear, it is possible that the input attenuation is set to Manual. Raise the input attenuation above 20 dB (↗ 6-86), or switch to automatic setting of the input attenuation (↗ 6-87).

Note: This display will appear even if the signal is outside the currently selected span. In FULL SPAN mode (↗ 6-75), check whether a signal exceeds the permissible value and reduce the level if necessary.

PLL unlock

The control loop, which is used to set the frequency of the internal reference oscillator with crystal accuracy, does not lock. This causes a frequency error, and the spectrum analyzer no longer operates according to specifications. The cause for this may be an internal instrument error or the absence of the 10 MHz reference signal at the external input REF IN. The absence of the reference signal, however, is not indicated unless the reference has been switched to "external".

1. If the missing external reference signal is the cause of this error message, connect a 10 MHz signal to the REF IN [22] input or switch the reference to "internal" (↗ 6-159).

2. If the missing external reference signal is not the cause of this error message, an internal instrument error has occurred. In this case, switch the instrument off and on again. If the error message is still present, the instrument must be sent to the service shop to be checked.

ADC overload

the level of the input signal is approx. 20 dB above the set reference level. In this case, the analog/digital converter is being overdriven, causing intermodulation products and distortions in the spectrum.

• This can be remedied by increasing the value for the reference level in the instrument (↗ 6-81).

10   Index