R&S®SFE
Broadcast Tester
Getting Started

ROHDE & SCHWARZ

The software contained in this product makes use of several valuable open source software packages. For information, see the "Open Source Acknowledgement" document, which is available for download from the R&S SFE product page at www.rohde-schwarz.com/product/sfe.html > "Downloads" > "Firmware".

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

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

Contents

1 Preface

This chapter provides safety related information, an overview of the user documentation and the conventions used in the documentation.

1.1 For Your Safety

The product documentation helps you to use the R&S SFE safely and efficiently. Keep the product documentation in a safe place and pass it on to the subsequent users. Use the R&S SFE only in its designated purpose as described in the product documentation. Observe the performance limits and operating conditions stated in the specifications (data sheet).

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

● In the "Basic Safety Instructions", safety issues are grouped according to subjects. For example one subject is eletrical safety. The "Basic Safety Instructions" are delivered with the R&S SFE in different media and languages: on the CD-ROM, in the printed safety brochure and in the printed getting started manual.

● Throughout the documentation, safety instructions are provided when you need to take care during setup or operation.

Always read the safety instructions carefully. Make sure to fully comply with them. Do not take risks and do not underestimate the potential danger of small details such as a damaged power cable.

1.2 Documentation Overview

Getting started

This manual is delivered with the instrument in printed form. It is an excerpt from the user manual (see below) and provides the information needed to set up the R&S SFE and start working with it. Also a sample application is described. For instructions on installation, refer to the release notes. The printed getting started manual also includes general information, e.g. the basic safety instructions. In PDF format, it is included in the user manual to allow quick access to the information needed.

User manual

This manual is delivered with the instrument on CD-ROM. It provides the necessary information to work with the instrument. For additional information on default settings and parameters, refer to the data sheet.

Help

The help is context-sensitive and provides a quick access to the complete description. To avoid crowding the screen, the screenshots are omitted.

For detailed information on how to use the help, refer to the chapter "Operating Concepts".

1.3   Conventions Used in the Documentation

The following conventions are used throughout this documentation.

Typographical conventions

Convention	Description
"Graphical user interface elements"	All names of graphical user interface elements on the screen, such as dialogs, menus, options, buttons, and softkeys are enclosed by parentheses.
KEYS	Key names are written in capital letters.
`File names, commands, program code`	File names, commands, coding samples and screen output are distinguished by their font.
Input	Input to be entered by the user is displayed in italics.
Links	Links are displayed in blue font.
"References"	References to other parts of the documentation are enclosed by parentheses.

Conventions for procedure descriptions

When describing how to operate the R&S SFE, several alternative methods may be available to perform the same task. If possible, the procedure using the front panel is described.

The terms "select" and "press" may refer to any of the described methods, i.e. using a key on the R&S SFE or on a keyboard, or a mouse pointer in the display.

2 Setting Up the R&S SFE

> ⚠ **WARNING**
>
> **Risk of injuries**
>
> To avoid injuries to yourself or others, always follow the instructions provided in the following chapters. Furthermore, observe the general safety instructions at the beginning of this manual.

2.1 Unpacking the R&S SFE

The R&S SFE is shipped together with its mandatory accessories in a cardboard box.

2.1.1 Inspecting for Shipping Damage

Check the following. If anything is damaged, immediately notify the carrier.

1. Check the shipping container and cushioning material for damage.

2. Unpack the cardboard box (see Chapter 2.1, "Unpacking the R&S SFE", on page 9) and check the housing and handle for visible damages or loose parts.

2.1.2 Unpacking the Cardboard Box

Proceed as follows:

1. Open the cardboard box.

2. Remove the accessories packed into the box.

3. Take the R&S SFE out of the packaging.

4. Remove the shock protectors attached to the R&S SFE.

> ⓘ Retain the original packing material. If the R&S SFE needs to be transported or shipped at a later date, you can use the material to prevent control elements and connectors from being damaged. Rohde & Schwarz will only accept claims of warranty if the R&S SFE is shipped with sufficient packaging.

2.1.3 Checking the Accessories

The R&S SFE comes with the following accessories:
- Power cable
- Getting started manual
- CD-ROM containing the complete user documentation and firmware

2.1.4 Warranty Conditions

For information on warranty conditions for the R&S SFE refer to the terms of the delivery documents.

2.2 Putting Up the R&S SFE

The R&S SFE is designed for interior use only. The R&S SFE can be used in stand-alone operation or can be installed in a rack.

NOTICE

Risk of material damage

Make sure that the following conditions are met at the operation site:
- The ambient temperature does not exceed the range specified in the data sheet.
- All fan openings are unobstructed and the airflow perforations are unimpeded. The minimum distance from the wall is at least 10 cm.

Failure to meet these conditions may cause damage to the R&S SFE or other devices in the test setup.

If necessary, use proper protective equipment to protect DUTs against electrostatic discharge in the event of human contact.

2.2.1 Placing the R&S SFE on a Bench Top

The R&S SFE is designed for use under general laboratory conditions.

⚠ **WARNING**

Risk of injuries

If the R&S SFE is not set up securely, you or others can be injured.

Place the R&S SFE on a stable and level surface. Do not place anything on top of the R&S SFE, if the R&S SFE is not in a level position.

Before folding out the feet at the R&S SFE bottom, read the safety instructions for instruments with fold-out feet at the beginning of this manual carefully.

2.2.2 Mounting the R&S SFE in a Rack

The R&S SFE may be installed in a 19" rack mount by using a rack adapter kit (for order no. see data sheet). Follow the installation instructions that are part of the adapter kit.

3 Interfaces and Connectors

This chapter describes the front panel and the rear panel of the R&S SFE, including all status displays and connectors. See the data sheet for information about permissible levels on the inputs and output levels on the outputs.

If you use the interfaces and connectors, take care to avoid electromagnetic interference. For details see Chapter 4.1, "Preventing Electromagnetic Interference", on page 24.

3.1 Front Panel

This chapter provides an overview of the controls and connectors on the front panel. Each control or connector is briefly described along with a reference to the chapter(s) containing detailed information about its usage.

Figure 3-1: Front panel view

1 = On/standby key
2 = Hardkeys
3 = Softkeys
4 = Keypad
5 = Rotary knob, cursor keys
6 = Display
7 = USB interfaces
8 = RF output

3.1.1 On/Standby Key

See (1) in Figure 3-1.

The on/standby key works only if the AC power switch on the back of the R&S SFE is switched on. The on/standby key switches the instrument from stand-by to on and back.

For further information see Chapter 5.1, "Instrument States", on page 28.

3.1.2 Hardkeys

See (2) in Figure 3-1.

For detailed information see the user manual or the help system.

For information on corresponding keys of an external keyboard see Table 4-1.

PRESET Hardkey

Sets a defined instrument state.

LOCAL Hardkey

Switches from remote control to manual operation.

ASSIGN Hardkey

To manage the favorites and the user fields in the info area of the display.

HELP Hardkey

Displays context-sensitive help.

FILE Hardkey

To save and reload instrument states and to manage files.

SETUP Hardkey

To perform basic instrument configurations.

HOME Hardkey

Resets tree navigation.

APPL Hardkey

To select/switch to another application (TX, BER, TSGEN,…).

3.1.3 Softkeys

See (3) in Figure 3-1.

To execute the commands displayed by the softkey labels.

For details see user manual or the help system.

3.1.4 Keypad

See (4) in Figure 3-1.

The keys on this keypad have a multiple purpose. The required characters are selected by pressing the keys an appropriate number of times.

Key	Description
Alphanumeric keys 1 to 9	To enter data.
0 ⊔	To enter the number zero. To enter a space.
. *...#	To enter a decimal point. To enter a special character.
+/- A↔a	To enter a sign. Switches between upper-case and lower-case letters.
G mV M dBμV k dBm	To enter the unit.
ESC	Cancels the input mode.
BACK	Deletes the character to the left of the cursor.
x1 ENTER	• Displays the next menu level. • Activates the editing mode for the marked numeric and alphanumeric parameters. • Completes the data entry and accepts the new value. For numeric parameters, the unit is displayed in the menu next to the value. • Switches the marked status parameters on/off (State On/Off). • Confirms (OK) and closes message windows (see user manual or the help system) • Selects Hz as the unit. Selects dB for the level offset and level step size.

3.1.5 Rotary Knob

See (5) in Figure 3-1.

- To vary the input value at the cursor position. You can set and activate a fixed step size for the variation of frequency and level.
- To navigate within the tree and the work view.
- To move the cursor in the tables and drop-down lists.
- To complete your entry, press on the rotary knob (Click = ENTER). Editing mode is terminated and the value is accepted.

3.1.6 Cursor Keys

See (5) in Figure 3-1.

LEFTARROW/RIGHTARROW keys:

- In editing mode, moves the cursor in the input fields forward and back.
- In a list, table, window or dialog box, scrolls horizontally to select a parameter.

For further details see user manual or the help system.

3.1.7 Display

See (6) in Figure 3-1.

For information on the graphical user interface see the user manual or the help system.

3.1.8 RF OUT

N (50R mechanics) connector. Used to output the RF signal.

NOTICE

Do not overload the RF output

See the data sheet for the limits for the DC voltage and reverse RF power. Do not exceed these limits. Exceeding these limits can cause instrument damage.

3.1.9 USB Interfaces

See (7) in Figure 3-1.

Two USB (universal serial bus) interfaces of the type A (host USB) are provided. Use the interfaces to connect external devices like a keyboard, mouse, printer, memory stick (Chapter 4.3, "Connecting External Devices", on page 25), or to perform a firmware update.

Upper connector = port 1
Lower connector = port 3

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

● Use suitable double-shielded cables.

● Do not use USB connecting cables exceeding 1 m in length.

● Use only USB devices that remain within the permissible EMI limits.
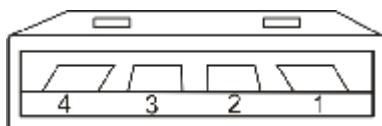
Table 3-1: Pin assignment

Pin	Abbreviation	Signal
1	PWR	+ 5 V / + 0.5 A max!
2	D-	Data -
3	D+	Data +
4	GND SHIELD	Ground

3.2 Rear Panel

This chapter provides an overview of the controls and connectors on the rear panel. Each control or connector is briefly described along with a reference to the chapter(s) containing detailed information about its usage.

3.2.1 AC Power Supply Connector and Switch

The IEC 320 / EN 60320 AC power supply connector and the AC power switch are combined (type C14).

A fuse holder is integrated.

The AC power switch is located on the right of the AC power connector.

Switch positions:
- I: Depending on the setting of the On/Standby function key on the front panel, the R&S SFE is either in standby mode or in operation.
- O: The entire instrument is disconnected from the AC power supply.

For further information:
- See Chapter 9.2, "Replacing the Fuses", on page 50
- See Chapter 4.2, "Connecting to the AC Power Supply", on page 24

- See Chapter 5, "Switching On or Off the R&S SFE", on page 28

3.2.2 BER Interfaces

These four BNC female connectors are used by the bit error rate tester application (BER R&S SFE-K60) for the serial bit error rate (BER) measurement.

For further details see user manual or the help system.

BER CLK IN/BER DATA IN

Inputs for a data stream that has a bit clock associated with it. When there are no errors, the data sequence is a standardized pseudo-random bit sequence (PRBS). If there are errors, the BER application compares the received data against the PRBS in order to detect the errors.

BER EN IN

Input to extract parts of the bit sequence on "BER DATA IN" that are not related to the PRBS. This can include synchronization and framing bits.

BER ERR OUT

Each time a bit error is detected, a pulse is output. External devices can detect and process these pulses.

3.2.3 TS1 IN / TS2 IN

BNC connector. Used to feed in a serial MPEG2 transport stream.

These inputs handle a serial signal with one of three formats:
- ASI (asynchronous serial interface)
- SMPTE 310 (Society of Motion Picture and Television Engineers)
- ETI (TS2 IN only)

To select the input, select "DIGITAL TV" menu, "INPUT SIGNAL", "INPUT". For further details see the user manual or the help system.

For the T-DMB / DAB transmission standard, TS2 IN is used as an external ETI input (ensemble transport interface). TS1 IN is not used for T-DMB/DAB. TS2 IN is conform to the ETS 300 799 specification. ETI NI (network independent) and ETI NA 5592 or ETI NA 5376 (network adaptation) signals are accepted.

3.2.4 VIDEO IN

BNC connector. Video input for the ATV transmission standards.

3.2.5 AUDIO AUX

9 pin SUB-D connector for multi purpose input.

- Audio IN
- BTSC IN
- NICAM IN

Table 3-2: Pin assignment

Pin	Description
1	Ground
2	Ground
3	AF2 - (Audio IN)
4	AF2 + (Audio IN)
5	BTSC IN
6	AF1 - (Audio IN)
7	AF1 + (Audio IN)
8	REF FREQ OUT / Trigger Out
9	NICAM IN

3.2.6 100 BASE-T

1 Gigabit LAN interface (100 Base-T).

Used to connect the R&S SFE to a local network for remote control, remote operation, printouts and data transfer. The assignment of the RJ.45 CAT5 connector supports twisted pair category 7 UTP/STP cables in a star configuration (UTP stands for "unshielded twisted pair", and STP for "shielded twisted pair").

Do not connect or disconnect the network cable until the instrument is switched off. Otherwise, the network connection cannot be reliably detected.

Electromagnetic interference (EMI) can affect the measurement results. To avoid any impact, use category 7 cables.

For further information:

- See Chapter 7, "Operating the R&S SFE in a LAN", on page 38
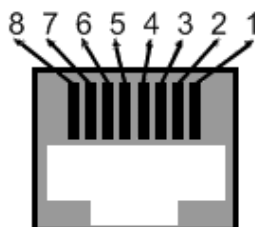- See user manual or the help system for remote control using the Ethernet

Table 3-3: Pin assignment

Pin	Abbreviation	Signal
1	TXD+	Transmit data, positive
2	TXD-	Transmit data, negative
3	RXD+	Receive data, positive
4, 5	R0	Termination, 75R
6	RXD-	Receive data, negative
7, 8	R1	Termination, 75R

3.2.7 DIG I/Q

Requires the extended I/Q input option (R&S SFE-K80). Used to receive digital I/Q signals from another R&S instrument with the same interface.

For further details see the user manual or the help system.

3.2.7.1 DIG I/Q IN
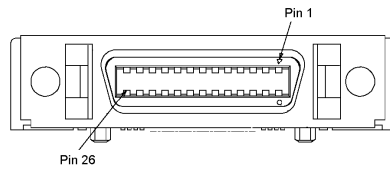
Digital I/Q input of the R&S SFE.

Table 3-4: Input pin assignment

Pin	Name	Signal
1	DIG_IQ_CLK2+	Data clock 2 (control signal)
2	GND	Ground (control signal)
3	DIG_IQ_IN_D0+	Data bit (LSB), OUT/IN 0 line (I/Q signal)
4	DIG_IQ_IN_D1+	Data bit, OUT/IN 1 line (I/Q signal)
5	DIG_IQ_IN_D2+	Data bit, OUT/IN 2 line (I/Q signal)
6	DIG_IQ_IN_CLK1+	Data clock 1 (I/Q signal)
7	DIG_IQ_IN_SCLK	Serial clock (control signal)
8	+U5V2	+5 V (control signal)
9	DIG_IQ_IN_D3+	Data bit, OUT/IN 3 line (I/Q signal)
10	DIG_IQ_IN_D4+	Data bit, OUT/IN 4 line (I/Q signal)
11	DIG_IQ_IN_D5+	Data bit, OUT/IN 5 line (I/Q signal)
12	DIG_IQ_IN_D6+	Data bit, OUT/IN 6 line (I/Q signal)
13	DIG_IQ_IN_D7+	Data bit (MSB), OUT/IN 7 line (I/Q signal)
14	DIG_IQ_CLK2-	Data clock 2 (control signal)
15	DIG_IQ_IN_D0-	Data bit (LSB), OUT/IN 0 line (I/Q signal)
16	DIG_IQ_IN_D1-	Data bit, OUT/IN 1 line (I/Q signal)
17	DIG_IQ_IN_D2-	Data bit, OUT/IN 2 line (I/Q signal)
18	DIG_IQ_IN_CLK1-	Data clock 1 (I/Q signal)
19	GND	Ground (control signal)
20	DIG_IQ_IN_SDAT	Serial data (control signal)

Pin	Name	Signal
21	DIG_IQ_IN_D3-	Data bit, OUT/IN 3 line (I/Q signal)
22	DIG_IQ_IN_D4-	Data bit, OUT/IN 4 line (I/Q signal)
23	DIG_IQ_IN_D5-	Data bit, OUT/IN 5 line (I/Q signal)
24	DIG_IQ_IN_D6-	Data bit, OUT/IN 6 line (I/Q signal)
25	DIG_IQ_IN_D7-	Data bit (MSB), OUT/IN 7 line (I/Q signal)
26	GND	Ground (control signal)

Line pairs have a name that only differs in the last character. For example, the pins 1 and 14 are a pair.

3.2.8 USB Interface

USB interface (universal serial bus) type A (host USB). For details see Chapter 3.1.9, "USB Interfaces", on page 15.

3.2.9 REF IN

BNC connector. Used to input the reference frequency.

For further details see user manual or the help system.

3.2.10 TRIG / REF OUT

BNC connector.

Output for user-programmable marker signal for triggering and controlling external devices.

Output of internal reference signal. If activated, at this output, a signal is always present.

When using an internal reference, the frequency generated by the internal reference oscillator of the R&S SFE is made available. If an external reference is activated, the

signal applied to the reference frequency input is also available here. It is buffered and filtered.
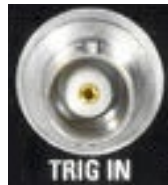

3.2.11 1PPS

BNC connector. Input for the 1 pulse per second signal used in SFN modes.

3.2.12 TRIG IN

BNC connector. Input for external triggering of digital modulations and standards and ARB.

4 Connecting the R&S SFE

This chapter describes how to connect the R&S SFE to the power supply and external devices.

4.1 Preventing Electromagnetic Interference

To prevent electromagnetic interference, the R&S SFE must be operated with all shielding covers fitted. Only suitable and shielded signal and control cables may be used.

ASI/BER/TRIGGER inputs and outputs

In particular cables that are connected to these inputs/outputs can cause EMC problems. Therefore these cables should have at least 80 dB to 1 GHz shielding. This is usually achieved by means of double-shielded cables.

USB interfaces

To connect the USB interfaces, only use peripheral equipment that does not cause limit violations. For details see Chapter 3.1.9, "USB Interfaces", on page 15.

LAN interface (100 BASE-T)

To connect the LAN interface (100 BASE-T), use a suitable cable. For details see Chapter 3.2.6, "100 BASE-T", on page 20.

4.2 Connecting to the AC Power Supply

The R&S SFE can be used with different AC power voltages and adapts itself automatically to it. Adjusting the R&S SFE to a particular AC supply voltage is therefore not required. Refer to the data sheet for the requirements of voltage and frequency.

⚠ **WARNING**

Shock hazard

Observe the basic safety instructions at the beginning of this manual, especially the instructions on electrical safety.

Take care that the AC voltage lies within the limits printed on the AC power connector of the R&S SFE and listed in the data sheet.

► Connect the R&S SFE to the AC power supply, using the power cable that is supplied. The AC power connector is located on the rear panel of the R&S SFE.

Since the R&S SFE complies with safety class EN61010-1, it should only be connected to a socket with a ground contact.

For further information see Chapter 3.2.1, "AC Power Supply Connector and Switch", on page 17.

4.3 Connecting External Devices

Using the USB interfaces, you can directly connect USB devices to the R&S SFE. This number can be increased as necessary by using USB hubs.

Due to the large number of available USB devices, there is almost no limit to the possible expansions. In the following, USB devices that can be useful are listed.

● Keyboard for entering comments, file names, etc. or for easy access to Windows XP settings. See Chapter 4.3.1, "External Keyboard", on page 25.

● Mouse for easy operation of Windows dialogs. See Chapter 4.3.2, "Mouse", on page 27.

● Memory stick for easy transfer of data to/from a computer (e.g. firmware updates). See Chapter 4.3.3, "Memory Stick", on page 27.

● CD–ROM drives for easy installation of firmware applications.

● Printer for printing out measurement results.

To install a USB device

1. Connect the USB device to the R&S SFE. You can do this during operation because all USB devices are Plug and Play.

   Windows XP automatically searches for a suitable device driver.

2. If Windows XP does not find a suitable driver, it will prompt you to specify a directory that contains the driver software. If the driver software is on a CD-ROM, connect a USB CD-ROM drive to the R&S SFE before proceeding.

To uninstall a USB device

► Disconnect the USB device from the R&S SFE. You can do this during operation.

   Windows XP immediately detects the change in the hardware configuration and deactivates the corresponding driver.

4.3.1 External Keyboard

Connect the keyboard to one of the USB interfaces (type A). The default language setting is for a UK keyboard. You can change the language and modify other settings such as the repetition rate in Windows XP.

Changing Regional and Language Settings

1. Open the "Start" menu by pressing the WINDOWS key on an external keyboard.

2. Select "Control Panel" and then "Keyboard" or "Regional and Language Options".

Table 4-1: Corresponding keys: front panel - external keyboard

Key on front panel	Corresponding key on keyboard	Function description
Rotary knob: left turn	TAB	See Chapter 3.1.5, "Rotary Knob", on page 14
Rotary knob: right turn	SHIFT+TAB	"
Rotary knob: press	SHIFT+ENTER	"
Cursor keys	LEFTARROW, RIGHTARROW, UPAR-ROW, DNARROW	See Chapter 3.1.6, "Cursor Keys", on page 15
Alphanumeric keys 1 to 9	1...9 / a...z	See Chapter 3.1.4, "Keypad", on page 14
0 ⴑ	0 SPACEBAR	"
. *...#	. *...#	"
+ - A↔a	SHIFT+"+" - Capital letters: SHIFT+"a...z"	"
CLR	DEL	"
ESC	ESC	"
BACK	BACKSPACE	"
X1 ENTER	ENTER	"
G MV	ALT+F9	"
M DBµV	ALT+F10	"
K dBm	ALT+F11	"
Softkeys	CTRL+"1...8"	See Chapter 3.1.3, "Softkeys", on page 13
PRESET	F4	See Chapter 3.1.2, "Hardkeys", on page 13
LOCAL	F3	"
ASSIGN	F2	"
HELP	F1	"
FILE	F5	"
SETUP	F6	"
HOME	F8	"
APPL	F9	"

4.3.2 Mouse

You can change settings such as the speed of the mouse cursor in Windows XP.

Changing Mouse Settings

1. Open the "Start" menu by pressing the WINDOWS key on an external keyboard.

2. Select "Control Panel" and then "Mouse".

4.3.3 Memory Stick

The R&S SFE has a disk drive. You can exchange data by using a memory stick which you plug into one of the USB interfaces. The memory stick is automatically assigned a free drive letter and you can use Windows Explorer to transfer data.

4.3.4 External Monitor

The R&S SFE does not have a connector for connecting an external monitor with an analog interface. However, you can display the screen on external monitors by using remote operation on an external computer.

For details on how to activate the power save mode see Chapter 5.2, "Switching On the R&S SFE", on page 29.

For details on remote operation see the user manual or the help system.

5 Switching On or Off the R&S SFE

⚠ **WARNING**

Shock hazard

Observe the basic safety instructions at the beginning of this manual, especially the instructions on electrical safety.

5.1 Instrument States

The following states are possible:

- Off
  The AC power switch on the back of the R&S SFE is switched off (see Chapter 3.2.1, "AC Power Supply Connector and Switch", on page 17).

- Ready
  The R&S SFE is ready for operation.
  The green LED (left LED) on the on/standby key is illuminated (see also Chapter 3.1.1, "On/Standby Key", on page 13).

- Standby
  The power supply has the operating voltage supplied to it.
  The yellow LED (right LED) on the on/standby key is illuminated.

⚠ **WARNING**

Shock hazard

In standby mode, the R&S SFE is still power-supplied.

5.2 Switching On the R&S SFE

NOTICE

Risk of instrument damage

Before switching on the R&S SFE, make sure that the following conditions are met:

- The R&S SFE is set up as described in Chapter 2, "Setting Up the R&S SFE", on page 9.
- Signal levels at the input connectors are all within the specified ranges.
- Signal outputs are correctly connected and are not overloaded. In particular, do not exceed the maximum permissible reverse power allowed at the RF output.

The values are specified in the data sheet. Failure to meet these conditions may cause damage to the R&S SFE or other devices in the test setup.

To switch on the R&S SFE

1. Make sure that the R&S SFE is connected to a power supply (for details see Chapter 4.2, "Connecting to the AC Power Supply", on page 24).

2. Press the AC power switch on the rear panel into I position (for details see Chapter 3.2.1, "AC Power Supply Connector and Switch", on page 17).

3. Press the on/standby key on the front panel.

   The R&S SFE starts booting:
   - The installed BIOS version and some of the computer features are displayed on the screen for a few seconds.
   - The Windows XP Embedded operating system is booted, followed by the R&S SFE firmware.
   - A self-test is performed.

   After booting is completed, the main screen of the R&S SFE is displayed, and the R&S SFE is ready for operation.
   If the external monitor remains dark, proceed as described in Chapter 4.3.4, "External Monitor", on page 27.
   (Ready state, see Chapter 5.1, "Instrument States", on page 28.)
   The configuration settings that were active before the R&S SFE was last switched off are automatically restored.
   Use the "FILE" menu to load another instrument setting. For details see the user manual or the help system.

Activating the power save mode

Power save mode is not set by default for the R&S SFE.

If you do not need the display, you can switch off the monitor in Windows XP under "Start" – "Control Panel" – "Power Options after a particular time".

5.3 Switching Off the R&S SFE

NOTICE

Risk of losing data

If you switch off the running R&S SFE using the rear panel switch or by disconnecting the power cord before shutting it down, the R&S SFE loses its current settings. Furthermore, program data may be lost.

Always shut down the R&S SFE first.

To switch off the R&S SFE

1. Press the on/standby key on the front panel.

    The R&S SFE saves the current settings to the hard disk and shuts down the Windows operating system. During this process, the "Ending Program...Please wait" message may be displayed.
    The power supply is switched over to standby and the yellow LED on the on/standby key is illuminated.

2. If you want to completely disconnect the broadcast tester from the AC power line, set the AC switch on the rear panel to the O position, or disconnect the R&S SFE from the AC power supply.

    All LEDs on the on/standby key should go out.

You can leave the AC power switch switched on permanently. You only need to switch off the R&S SFE if you want to completely disconnect it from the AC power line.

5.4 Checking the Provided Options

The R&S SFE may be equipped with options. In order to check whether the installed options correspond to the options indicated on the delivery note, proceed as follows.

1. Press the SETUP key.

2. In the tree, select "INFO HARDWARE" to display a list showing the currently installed hardware.

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

4. In the tree, select "SOFTWARE OPTIONS" and then "ACTIVE OPTIONS" to display a short tabular overview of the enabled software options.

5. Check the availability of the software options as indicated in the delivery note.

For further details see the user manual or the help system.

For an overview of the all options available for the R&S SFE refer to the Rohde & Schwarz Homepage.

5.5 Turn-On Tests

If an error is detected, an error indication is displayed in the error/warnings line along with a brief description of the error.

► To obtain more information about the error, press the "ERROR/WARNING DETAILS" softkey.

A description of the error(s) or warning(s) is displayed.
For further details see the user manual or the help system.

Besides automatic monitoring of instrument functions, the R&S SFE also offers the following way of ensuring proper operation.

System adjustment

Use the SETUP menu to carry out an internal adjustment. This is a way of obtaining the best possible level accuracy, for example.

1. Press the SETUP key.

2. In the tree, select "ADJUSTMENT".

For further details see the user manual or the help system.

6 Sample Application

The following example involves the following main steps:

- Feed an MPEG2 transport stream to the R&S SFE using the serial interface 1 (TS1 IN, see Chapter 3.2.3, "TS1 IN / TS2 IN", on page 18) on the rear panel.

- This MPEG2 transport stream undergoes channel encoding and modulation for transmission in compliance with the DVB-C specification. To achieve this, perform the following step-by-step instructions. The involved settings are summed up in Table 6-1.

- The result is output as an RF signal on the RF output.

Table 6-1: Involved settings

Parameter	Value
Center frequency	330 MHz
Level	-20.0 dBm
Transmission standard	DVB-C
Constellation	64 QAM
Symbol rate	6.9 MS/s
Roll off	0.15

An explanation of the graphical user interface and information on how to select items, open lists and enter parameters are provided in the user manual or the help system.

Selecting the transmitter application (TX)

1. Press the APPL key.

2. Select the TX application (DVB-C transmission is a transmitter application).

3. Press the x1 ENTER key.

   The TX application is displayed.

Setting the output frequency

1. In the tree, select the "FREQUENCY" menu.

2. Press the x1 ENTER key.

   The tree is expanded and the "FREQUENCY" submenu is displayed.
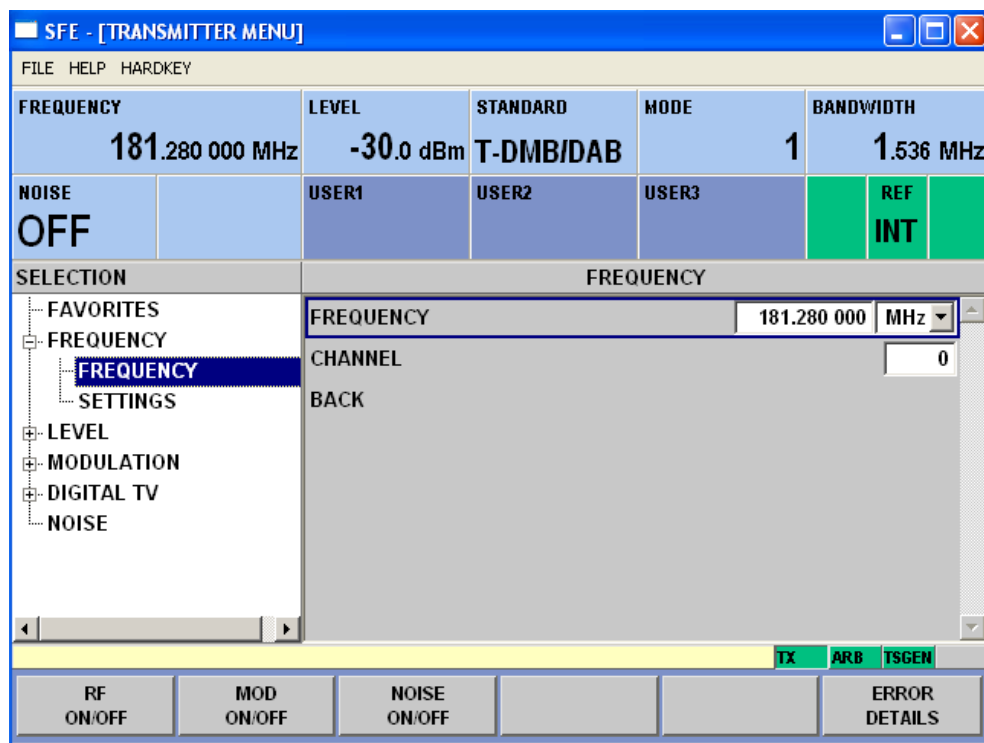
3. In the tree, select the "FREQUENCY" submenu.

4. Press the x1 ENTER key.

   The focus is set on the work view.

5. Set a frequency of 330 MHz.

   a) Select the "FREQUENCY" field.
   b) Enter *330*.
   c) Press the M dBµV unit key.

   The entered frequency is displayed in the info area.

Setting the output level

1. In the tree, select the "LEVEL" menu.

2. Press the x1 ENTER key.

   The tree is expanded and the "LEVEL" submenu is displayed.
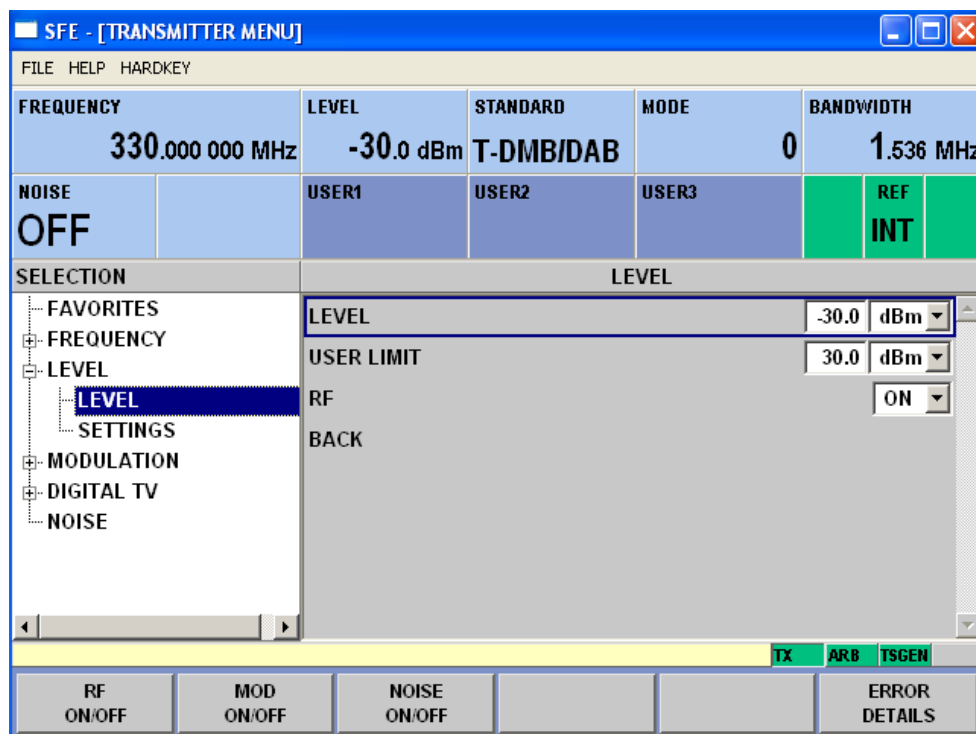
3. In the tree, select the "LEVEL" submenu.

4. Press the x1 ENTER key.

    The focus is set on the work view.

5. Set a level of -20 dBm.

    a) Select the "LEVEL" field.
    b) Enter *-20*.
    c) Press the M dBµV unit key.
    d) If you want to enter the level in a different unit, change the unit in the "LEVEL" menu, under "SETTINGS" / "LEVEL UNIT" first (see user manual or help system).

    The entered level is displayed in the info area.

Setting the modulation parameters and selecting the transmission standard

1. In the tree, select the "MODULATION" menu.

2. Press the x1 ENTER key.

    The tree is expanded and the "MODULATION" submenu is displayed.
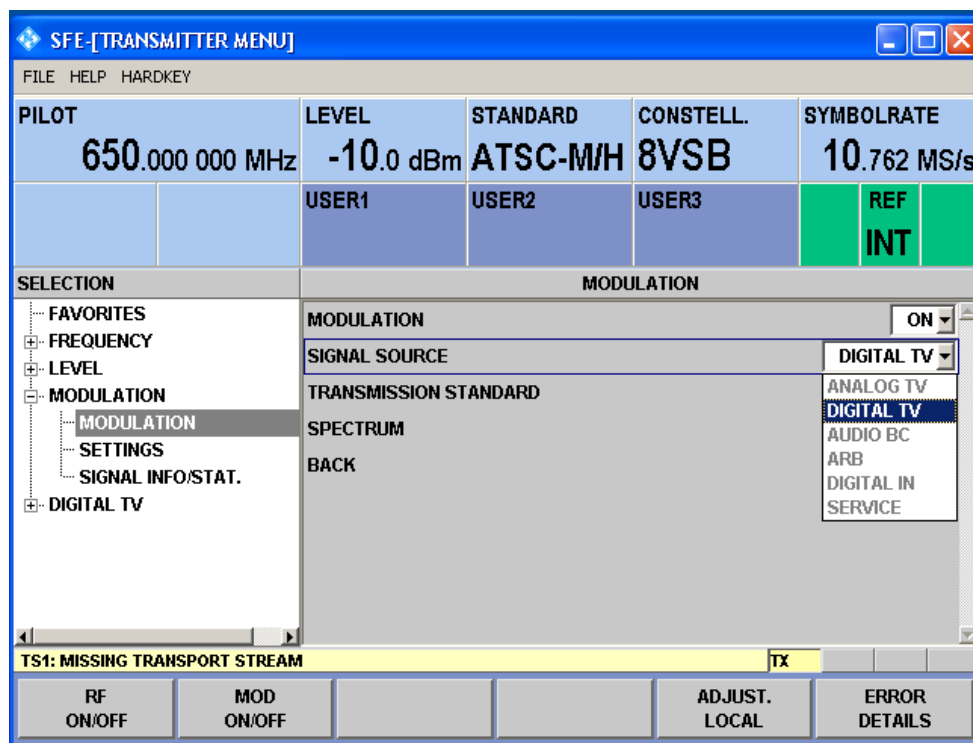
3. In the tree, select the "MODULATION" submenu.

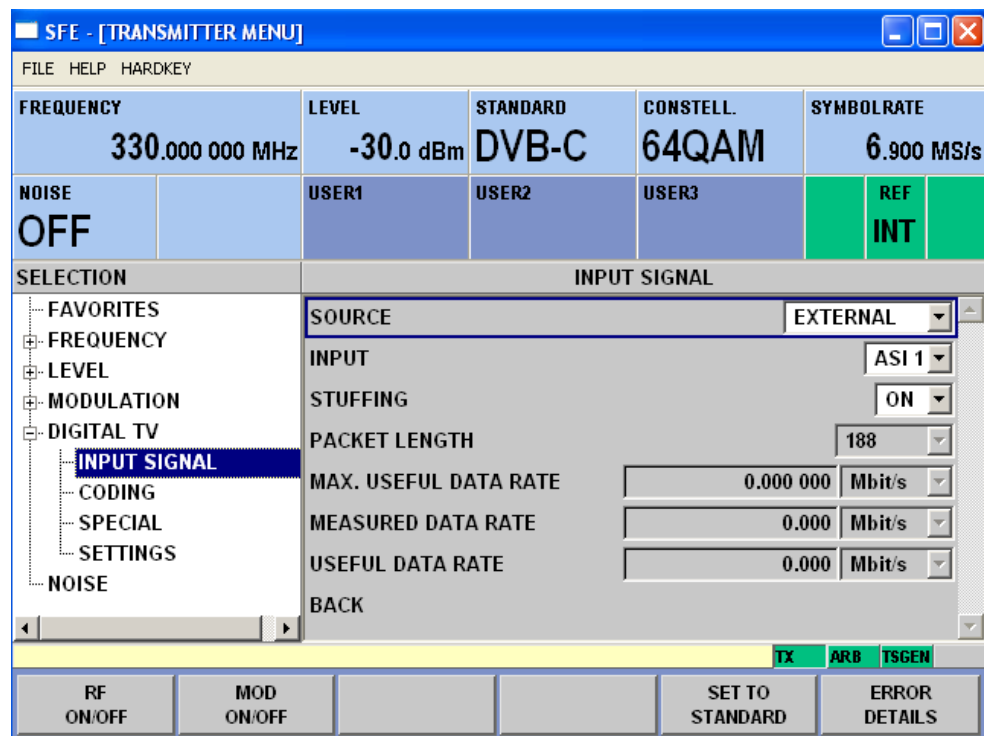4. Press the x1 ENTER key.

    The focus is set on the work view.

5. Activate the modulation.

    a) Select the "MODULATION" field.
    b) Press the x1 ENTER key to display the list.
    c) Select "ON".
    d) Press the x1 ENTER key to confirm the selection.

6. Select the "DIGITAL TV" signal source.

    a) Select the "SIGNAL SOURCE" field.
    b) Press the x1 ENTER key to display the list.
    c) Select "DIGITAL TV".
    d) Press the x1 ENTER key to confirm the selection.

7. Select the "DVB-C" transmission standard.

    a) Select the "TRANSMISSION STANDARD" field.
    b) Press the x1 ENTER key to display the list.
    c) Select "DVB-C".
    d) Press the x1 ENTER key to confirm the selection.

    The selected standard is displayed in the info area.

    The I/Q modulation is switched on, the internal coder is selected as the signal source, and the DVB-C transmission standard is set.

Selecting the transport stream input and setting the DVB-C transmission parameters

1. In the tree, select the "DIGITAL TV" menu.

2. Press the x1 ENTER key.

   The tree is expanded and the "DIGITAL TV" submenu is displayed.
   (See Figure 6-1.)

3. In the tree, select the "INPUT SIGNAL" submenu.

4. Press the x1 ENTER key.

   The focus is set on the work view.

Figure 6-1: DIGITAL TV menu

5. Select the "EXTERNAL" signal source.

   a) Select the "SOURCE" field.
   b) Press the x1 ENTER key to display the list.
   c) Select "EXTERNAL".
   d) Press the x1 ENTER key to confirm the selection.

6. Select the "ASI 1" input.

   a) Select the "INPUT" field.
   b) Press the x1 ENTER key to display the list.
   c) Select "ASI 1".
   d) Press the x1 ENTER key to confirm the selection.

7. Make sure that the "STUFFING" field in the work view is set to "ON".
   This ensures that the incoming transport stream will be adapted to the proper data rate of the coder. The data rate of the coder will depend on the transmission parameters. The data stream is padded with null packets to allow adaptation to the transmission parameters.

   a) Select the "STUFFING" field.
   b) Press the x1 ENTER key to display the list.
   c) Select "ON".
   d) Press the x1 ENTER key to confirm the selection.

8. Select "BACK" and press the x1 ENTER key.

   The focus is set to the tree.

9. In the tree, select the "CODING" submenu.

10. Press the x1 ENTER key.

   The focus is set on the work view.

11. Select a symbol rate of 6.9 .MS/s.

   a) Select the "SYMBOL RATE" field.
   b) Enter *6.9*.
   c) If the units field to the right shows "MS/s", press the x1 ENTER key.
   d) If the units field indicates another unit, select this field. Press the x1 ENTER key, and select the "MS/s" unit. Press the x1 ENTER key twice to confirm the unit and the symbol rate.

   The selected symbol rate is displayed in the info area.

12. Select the "64 QAM" constellation.

   a) Select the "CONSTELLATION" field.
   b) Press the x1 ENTER key to display the list.
   c) Select "64 QAM".
   d) Press the x1 ENTER key to confirm the selection.

   The selected constellation is displayed in the info area.

7 Operating the R&S SFE in a LAN

The R&S SFE is equipped with a network interface and can be connected to an Ethernet LAN (local area network). The network card operates with 100 MBit Ethernet IEEE 802.3u. The TCP/IP network protocol and the associated network services are preconfigured.

To be able to exchange data within a local area network (LAN), every computer or instrument that is connected must have a unique IP address or a unique computer name. Access between different users is managed with access authorizations.

Provided the appropriate rights have been assigned and the Window XP firewall configuration is adapted accordingly, the interface can be used e.g. for transferring data, printing on network printers, operating the R&S SFE from a remote computer.

To use network resources, access must be granted. To share files on the R&S SFE with other network users, access to instrument resources, e.g. the hard drives, must also be granted. All these administration tasks are normally performed by a network administrator using the Windows XP Start menu (for details refer to the Windows XP help system). Contact your network administrator for access authorizations.

User name and password of the R&S SFE are factory-set. The user name is used for auto login, access authorization and remote operation.

For further information:

- See Chapter 8.1.1, "Login", on page 42
- See Chapter 3.2.6, "100 BASE-T", on page 20
- See the user manual or help system for details on remote operation.

7.1 Connecting the R&S SFE to the Network

NOTICE

Risk of network failure/virus infection

Before connecting the R&S SFE to the network or configuring the network, do the following:

- Consult your network administrator.
- If your network does not support DHCP or if you choose to disable dynamic TCP/IP configuration, you must assign valid address information before connecting the R&S SFE to the LAN.

Errors may affect the entire network.

Efficient virus protection is a prerequisite for secure operation in the network. Never connect the R&S SFE to a network without proper protection against a virus infection, as doing so may cause damage to the instrument software.

To connect the R&S SFE to the network

1. Fulfill all prerequisites mentioned above.

2. Make sure that the R&S SFE is switched off. This is the only way to ensure that the network connection is reliably detected and any disruptions during the operation of the R&S SFE are avoided.

3. Connect the R&S SFE to the network using a CAT-5 RJ-45 cable.

4. Switch on the R&S SFE.

To disconnect the R&S SFE from the network

1. Make sure that the R&S SFE is switched off.

2. Disconnect the R&S SFE from the network.

7.2 Establishing a Point-to-Point Connection

To set up a single network (a LAN connection between an R&S SFE and a single computer without integration into a larger network), an IP address needs to be assigned to the R&S SFE and the computer. The IP addresses 192.168.xxx.yyy are available for use here. xxx and yyy can assume values of 1 to 254, and the value for the subnet mask is 255.255.255.0.

► Connect the R&S SFE and the computer with a standard RJ-45 cross-over cable.

7.3 Zero Configuration Networking

This service is available in firmware version V02.60 and later.

The R&S mDNS Service is installed with the firmware. Using this service, you can connect to a network automatically. You do not need to set up services, such as dynamic host configuration protocol (DHCP) and domain name system (DNS), or configure the network settings manually (see Chapter 7.4, "Configuring the Network Card", on page 40).

7.4 Configuring the Network Card

Under Windows XP, network card drivers do not need to be installed separately. If the R&S SFE is connected to the LAN, Windows XP automatically detects the network connection and activates the required drivers.

The configuration tasks depend on whether your network has a DHCP server or not. If necessary, ask your network administrator.

> If you use the R&S mDNS Service, you do not need to configure at all. For details see Chapter 7.3, "Zero Configuration Networking", on page 39.

Networks with DHCP Server

The R&S SFE is preconfigured for networks using the dynamic host configuration protocol (DHCP). In such networks, the instrument is automatically assigned a free IP address. Identification in the network is based on the use of a unique computer name.

Every instrument is assigned an individual computer name at the factory. It is displayed as part of the window title of the application.

If necessary, you can change the computer name using the firmware or the Windows XP Start menu (for details refer to the Windows XP help system).

Querying the computer name using the firmware

1. If the R&S SFE has a default computer name, the computer name is displayed as part of the window title of the application.
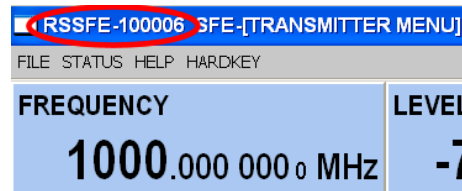
2. If no default computer name is displayed, do the following.
   a) Press the SETUP key.
   b) In the tree, select "COMMUNICATION".
   c) Read out the computer name from the "FULL COMPUTER NAME" field.

Networks without DHCP Server

In networks that assign fixed IP addresses, the network administrator usually configures the network card. Contact your network administrator. The IP address is set using the firmware or the Windows XP Start menu (for details refer to the Windows XP help system).

Entering the IP address using the firmware

1. Press the SETUP key.

2. In the tree, select "COMMUNICATION".

3. Enter the IP address in the "TCP/IP ADDRESS" field.

7.5 Firewall Settings

By default, the Windows Firewall is activated to protect the R&S SFE from an attack of hostile users and programs. The Windows Firewall suppresses all network communication which is not initialized by the R&S SFE itself or which is not defined as an exception.

To enable data transfer or to allow access to the R&S SFE, define exceptions using the Windows XP Start menu. For details refer to the Windows XP help system or contact your network administrator for support.

8 Installed Software

The firmware and the operating system are already installed on the R&S SFE.

For further information:

- Performing a firmware update: see the release notes.
- Installing software options: see the user manual or the help system.

8.1 Operating System

The R&S SFE is equipped with the Windows XP Embedded operating system. When the R&S SFE is delivered, the operating system is configured for optimum operation. Changes to the system settings are required only if you install peripherals such as a keyboard and printer or if you configure the network and the settings do not conform to the default settings.

NOTICE

Risk of causing instrument unusability

To prevent malfunctions and to avoid instrument repair, only install service packs approved by Rohde & Schwarz.

In particular, do not use service packs for Windows XP Home Edition or Professional Edition.

8.1.1 Login

Windows XP requires that you identify yourself by entering a user name and password in a login window. The R&S SFE provides a factory–installed auto login function, i.e. login is carried out automatically in the background. The ID used for auto login has administrator rights.

As user name and password, *instrument* are factory-set.

If the R&S SFE is connected to a network and if the user name and the password are identical under Windows XP and on the network, you log on to operating system and the network at the same time.

8.1.2   Windows XP Start Menu

The Windows XP Start menu provides access to the Windows XP functionality and installed programs. Under "Control Panel", the system settings are grouped. For details refer to the Windows XP help system.

To access to the operating system, connect an external keyboard. If you want more convenient access to Windows XP, connect a mouse. To change to the user interface of the R&S SFE, in the taskbar, double-click the R&S SFE entry.

For details on connecting external devices see Chapter 4.3, "Connecting External Devices", on page 25.

8.2   Additional Software

NOTICE

Risk of causing instrument unusability

The instrument is equipped with the Windows XP operating system. Additional software can therefore be installed on the instrument. The use and installation of additional software may impair instrument function. Thus, run only programs that Rohde & Schwarz has tested for compatibility with the instrument software.

The drivers and programs used on the instrument under Windows XP have been adapted to the instrument. Existing instrument software must always be modified using only update software released by Rohde & Schwarz.

8.3   Windows XP Recovery and Backup Partition

The R&S SFE provides a backup and recovery partition. A backup of the factory system partition (C:\) is stored per default and can be recovered in case of a system crash.

In addition, backups of up to 5 firmware versions can be stored on this partition. For example, it is possible to backup the current system partition prior to a firmware update or to provide different system configurations for different environments. When recovered, the system partition (C:/) is deleted, formatted and written newly. The data partition (D:\) is not affected.

8.3.1   Windows XP Embedded Recovery and Backup Partition Dialog

To display the Windows XP Embedded Recovery and Backup Partition dialog

1. Connect a keyboard and a mouse to the USB interfaces.

2. Switch the R&S SFE off and on again.

   The boot screen is displayed with the default selection "Firmware". If you do not perform step step 3 within 4 seconds, the dialog vanishes and the booting process continues.

3. Select "Backup/Recovery" and press ENTER.
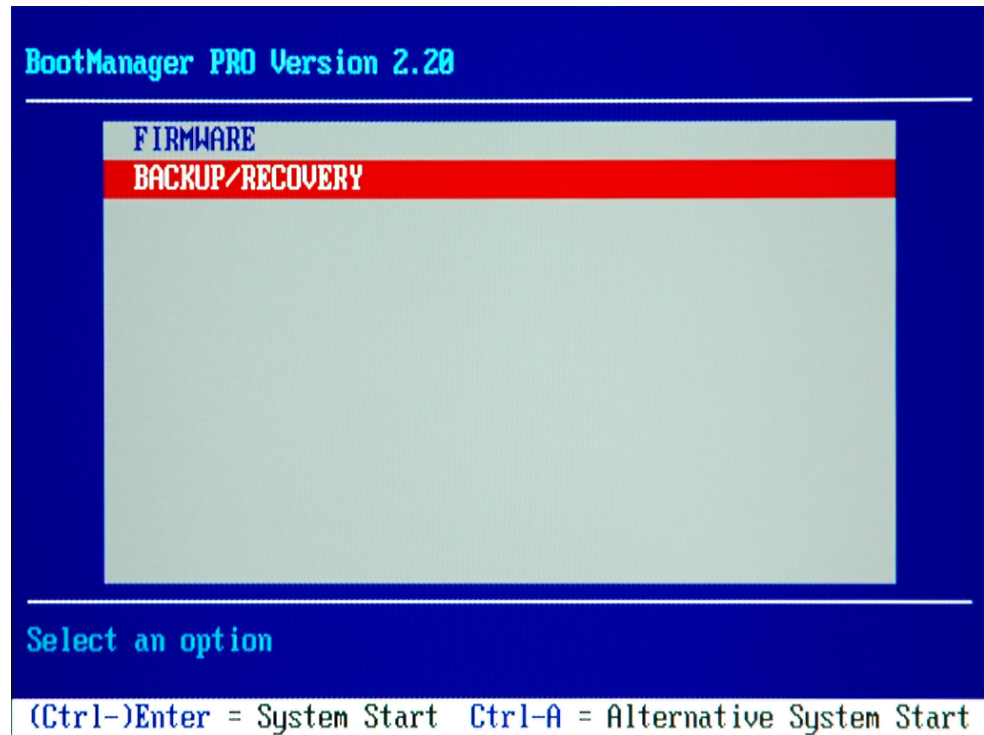
   The "Windows XP Recovery and Backup Embedded Partition" dialog is displayed. It shows the available selections for the recovery and backup partition.
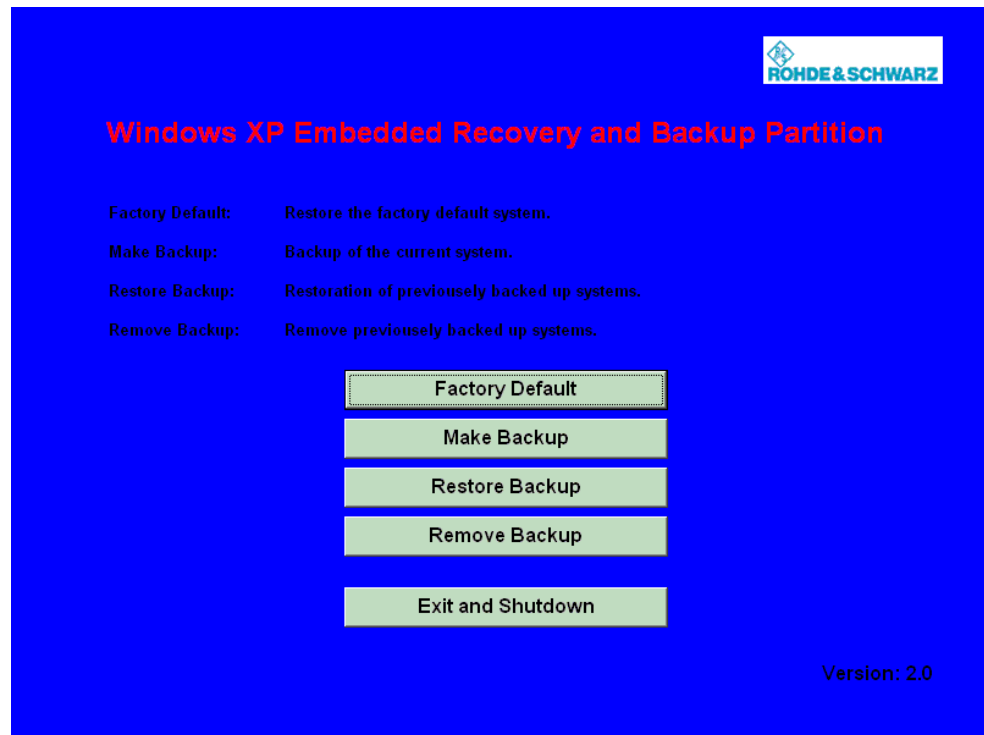
Figure 8-1: Windows XP Recovery and Backup Embedded Partition dialog

To continue see one of the following chapters:

- The Chapter 8.3.1.1, "Backing Up Current System Partition", on page 45
- The Chapter 8.3.1.2, "Recovering the Selected Version of System Partition", on page 46
- The Chapter 8.3.1.3, "Recovering the Factory Default", on page 47
- The Chapter 8.3.1.4, "Deleting Backups", on page 47

8.3.1.1 Backing Up Current System Partition

1. In the "Windows XP Embedded Recovery and Backup Partition" dialog (see "To display the Windows XP Embedded Recovery and Backup Partition dialog" on page 43), click "Make Backup".

   The "Make Backup" dialog is displayed. It shows the current versions of the firmware and the software platform.
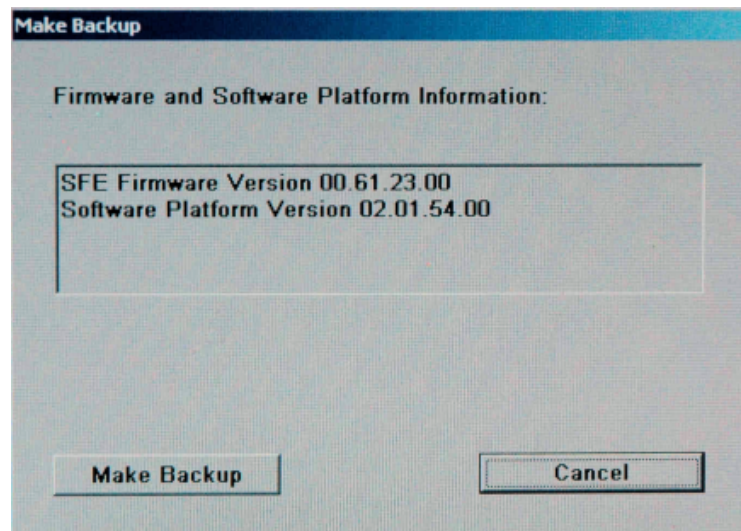
2. Click "Make Backup".

   After the backup, the "Windows XP Embedded Recovery and Backup Partition" dialog is displayed again.

3. Click "Exit and Shutdown".

4. Turn off/on the R&S SFE manually.

8.3.1.2 Recovering the Selected Version of System Partition

1. In the "Windows XP Embedded Recovery and Backup Partition" dialog (see "To display the Windows XP Embedded Recovery and Backup Partition dialog" on page 43), click "Restore Backup" to recover a selected version of the system partition.

   The "Restore Backup" dialog is displayed. It shows the versions of the firmware and the software platform of the backup displayed under "Select Backup".
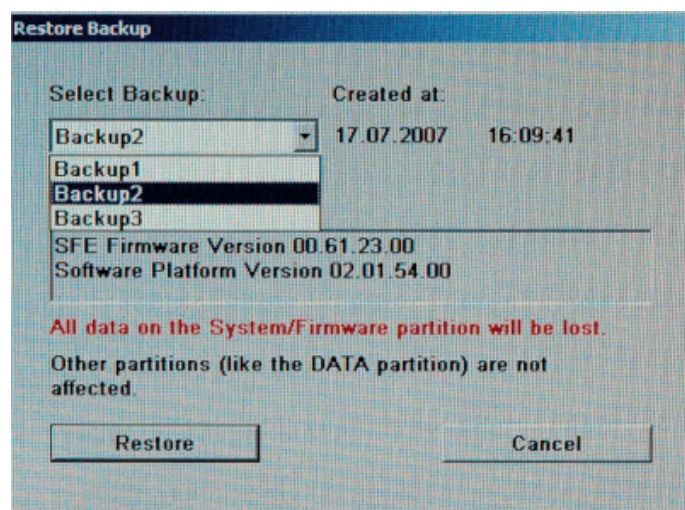
2. Under "Select Backup", select the backup to be restored.

3. Click "Restore" and follow the instructions.

4. After the recovery, turn off/on the R&S SFE manually.

8.3.1.3 Recovering the Factory Default

1. In the "Windows XP Embedded Recovery and Backup Partition" dialog (see "To display the Windows XP Embedded Recovery and Backup Partition dialog" on page 43), click "Factory Default" to recover the factory version of the system partition.

    The "Factory Default" dialog is displayed. It shows the versions of the firmware and the software platform on delivery.
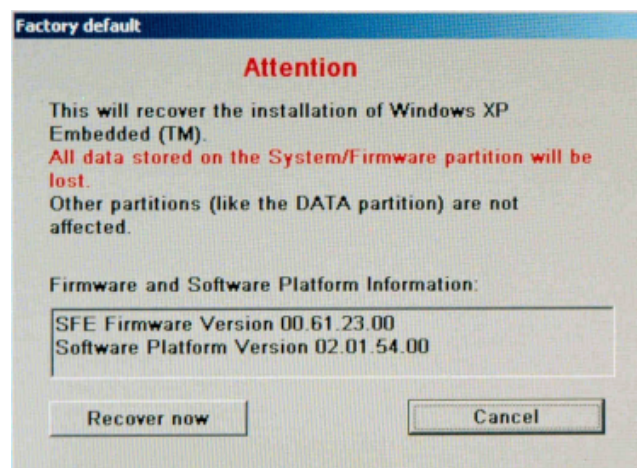
2. Click "Recover now" and follow the instructions.

3. After the recovery, turn off/on the R&S SFE manually.

8.3.1.4 Deleting Backups

On the recovery partition, you can store up to five backups in addition to the factory default. To provide space for new backups, you may need to remove older backups. The factory default cannot be deleted.

1. In the "Windows XP Embedded Recovery and Backup Partition" dialog (see "To display the Windows XP Embedded Recovery and Backup Partition dialog" on page 43), click "Remove Backup" to delete a selected backup.

    The "Remove Backup" dialog is displayed. It shows the versions of the firmware and the software platform of the selected backup.
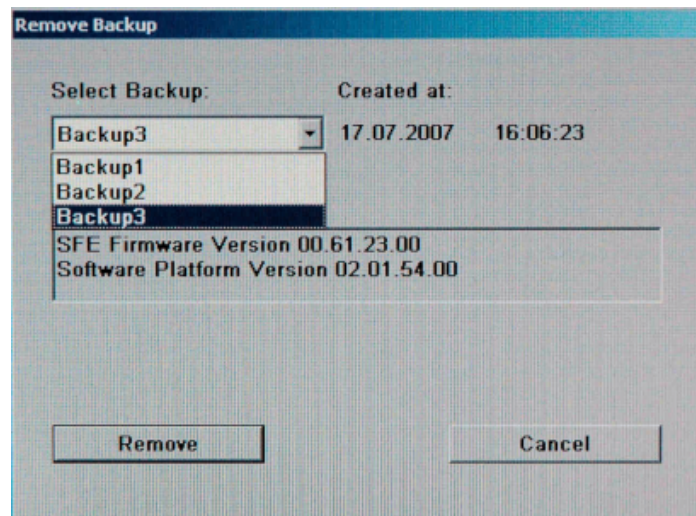
2. Under "Select Backup", select the backup to be deleted.

3. Click "Remove".

   After the deletion, the R&S SFE returns to the "Remove Backup" dialog as long as backups are still available. If the last backup is deleted, the "Windows XP Embedded Recovery and Backup Partition" dialog is displayed again.

4. Click "Cancel" to return the "Windows XP Embedded Recovery and Backup Partition" dialog.

5. Click "Exit and Shutdown".

6. After the recovery, turn off/on the R&S SFE manually.

9 Maintenance

The R&S SFE does not need a periodic maintenance unless it is operated in dusty areas.

NOTICE

Risk of instrument damage

If the R&S SFE is operated in dusty areas, the fans may become obstructed by dust or other particles in the process of time. Make sure to check and, if necessary, clean the fans regularly to ensure they operate properly at all times. If the R&S SFE is run with obstructed fans for a longer period, it may become overheated which may cause damage.

Clean the outside of the instrument when necessary and check the rated data from time to time.

If any problem arises, contact one of our customer support centers. The addresses of our customer support centers are provided at the beginning of this manual.

9.1 Cleaning the Instrument

⚠ WARNING

Shock hazard

Before cleaning the R&S SFE, make sure that the R&S SFE is switched off and disconnected from all power supplies.

1. Clean the outside of the R&S SFE using a soft, lint-free dust cloth.

2. Make sure that vents are not obstructed.

NOTICE

Instrument damage caused by cleaning agents

Cleaning agents contain substances that may damage the R&S SFE, e.g. cleaning agents that contain a solvent may damage the front panel labeling or plastic parts.

Never use cleaning agents such as solvents (thinners, acetone, etc), acids, bases, or other substances.

9.2 Replacing the Fuses

The R&S SFE is protected by two fuses (F1/F2: IEC127-T2.0H/250 V) located on the rear panel next to the AC power switch.

⚠ **WARNING**

Shock hazard

Before replacing a fuse, make sure that the R&S SFE is switched off and disconnected from all power supplies.

Always use fuses supplied by Rohde & Schwarz as spare parts, or fuses of the same type and rating.

To replace the fuses

1. Open the lid of the AC power connector.

2. Lift the fuse holder out of its slot.

3. Exchange the two fuses.

4. Put the fuse holder back in its slot and close the lid.

9.3 Storing the Instrument

The storage temperature range of the R&S SFE is given in the data sheet. If the R&S SFE is to be stored for a longer period of time, it must be protected against dust.

Repack the R&S SFE as it was originally packed when transporting or shipping. The two protective foam plastic parts prevent the control elements and connectors from being damaged. The antistatic packing foil avoids any undesired electrostatic charging to occur.

If you do not use the original packaging, provide for sufficient padding to prevent the R&S SFE from slipping inside the package. Wrap antistatic packing foil around the R&S SFE to protect it from electrostatic charging.

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