R&S®ESPI
EMI Test Receiver
Quick Start Guide

1164.6613.62 – 02

ROHDE & SCHWARZ

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

- R&S ESPI3 (1164.6407K03)
- R&S ESCI7 (1164.6407K07)

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

Package	Link	License
Xitami	http://www.xitami.com	2.5b6
PHP	http://www.php.net	PHP v 3
DOJO-AJAX	http://www.dojotoolkit.org	BSD License
BOOST Library	http://www.boost.org	Boost Software v.1
ONC/RPC	http://www.plt.rwth-aachen.de	SUN
TightVnc	http://www.tightvnc.com	GPL v.3
DemoForgeMirageDriver	http://www.demoforge.com/dfmirage.htm	GPL v.3

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®ESPI is abbreviated as R&S ESPI.

Contents

Safety Instructions
Safety Regulations for Batteries
Information on Product Disposal
Certificate of Quality
EC Certificate of Conformity
Support Center Address
List of R&S Representatives

Appendix

ROHDE&SCHWARZ
EC Certificate of Conformity

CE

Certificate No.: 2004-39

This is to certify that:

Equipment type	Stock No.	Designation
ESPI3	1164.6407.03	EMI Test Receiver
ESPI7	1164.6407.07	
ESPI-B2	1129.7498.02	Preselector
ESPI-B20	1155.1606.07	Extended Environment Specs

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

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

- relating to electromagnetic compatibility (2004/108/EC)

Conformity is proven by compliance with the following standards:

EN61010-1 : 2001-12
EN55011 : 1998 + A1:1999 + A2:2002, Class B
EN61326 : 1997 + A1:1998 + A2:2001 + A3 : 2003

For the assessment of electromagnetic compatibility, instrument class B as well as immunity to interference for operation in industry have been used as a basis.

Affixing the EC conformity mark as from 2004

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

Munich, 2008-04-02

Central Quality Management MF-QZ / Radde

Documentation Overview

The documentation of the R&S ESPI consists of base unit manuals and option manuals. All manuals are provided in PDF format on the CD-ROM delivered with the instrument. Each software option available for the instrument is described in a separate software manual.

The base unit documentation comprises the following manuals and documents:

- Quick Start Guide
- Operating Manual
- Service Manual
- Internet Site
- Release Notes

Apart from the base unit, these manuals describe the models and options of the R&S ESPI EMI Test Receiver that are listed in the documentation overview of the Operating Manual. All other options are described in separate manuals. These manuals are provided on the CD-ROM. For an overview of all options available for the R&S ESPI visit the R&S ESPI EMI Test Receiver Internet site.

Quick Start Guide

This manual is delivered with the instrument in printed form and in PDF format on the CD-ROM. It provides the information needed to set up and start working with the instrument. Basic operations and basic measurements are described. Also a brief introduction to remote control is given. More detailed descriptions are provided in the Operating Manual. The Quick Start Guide includes general information (e.g. Safety Instructions) and the following chapters:

Chapter 1	Front and Rear Panel
Chapter 2	Preparing for Use
Chapter 3	Firmware-Update and Installation of Firmware Options
Chapter 4	Basic Operation
Chapter 5	Basic Measurement Examples
Chapter 6	LAN Interface
Chapter 7	Brief Introduction to Remote Control
Appendix A	Printer Interface
Appendix B	External Generator Control

Operating Manual

This manual is a supplement to the Quick Start Guide and is available in PDF format on the CD-ROM delivered with the instrument. To retain the familiar structure that applies to all Operating Manuals of Rohde&Schwarz Test & Measurement instruments, the chapters 1 and 3 exist, but only in form of references to the corresponding Quick Start Guide chapters.

The Operating Manual is subdivided into the following chapters:

Chapter 1   Putting into Operation
                  see Quick Start Guide chapters 1 and 2.

Chapter 2   Getting Started
                  see Quick Start Guide chapter 5.

Chapter 3   Manual Operation
                  see Quick Start Guide chapter 4

Chapter 4   Instrument Functions
                  forms a reference for manual operation of the R&S ESPI and contains a detailed description of all instrument functions and their application.

Chapter 5   Remote Control - Basics
                  describes the basics for programming the R&S ESPI, command processing and the status reporting system.

Chapter 6   Remote Control - Description of Commands
                  lists all the remote-control commands defined for the instrument.

Chapter 7   Remote Control - Programming Examples
                  contains program examples for a number of typical applications of the R&S ESPI.

Chapter 8   Maintenance and Instrument Interfaces
                  describes preventive maintenance and the characteristics of the instrument's interfaces.

Chapter 9   Error Messages
                  gives a list of error messages that the R&S ESPI may generate.

Index   contains an index for the chapters 1 to 9 of the Operating Manual.

Service Manual

This manual is available in PDF format on the CD-ROM delivered with the instrument. It informs on how to check compliance with rated specifications, on instrument function, repair, troubleshooting and fault elimination. It contains all information required for repairing the R&S ESPI by the replacement of modules. The manual includes the following chapters:

Chapter 1   Performance Test

Chapter 2   Adjustment

Chapter 3   Repair

Chapter 4   Software Update / Installing Options

Chapter 5   Documents

Internet Site

The Internet site at: R&S ESPI EMI Test Receiver provides the most up to date information on the R&S ESPI. The current operating manual at a time is available as printable PDF file in the download area. Also provided for download are firmware updates including the associated release notes, instrument drivers, current data sheets and application notes.

Release Notes

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

1   Front and Rear Panel

1.1 Front View
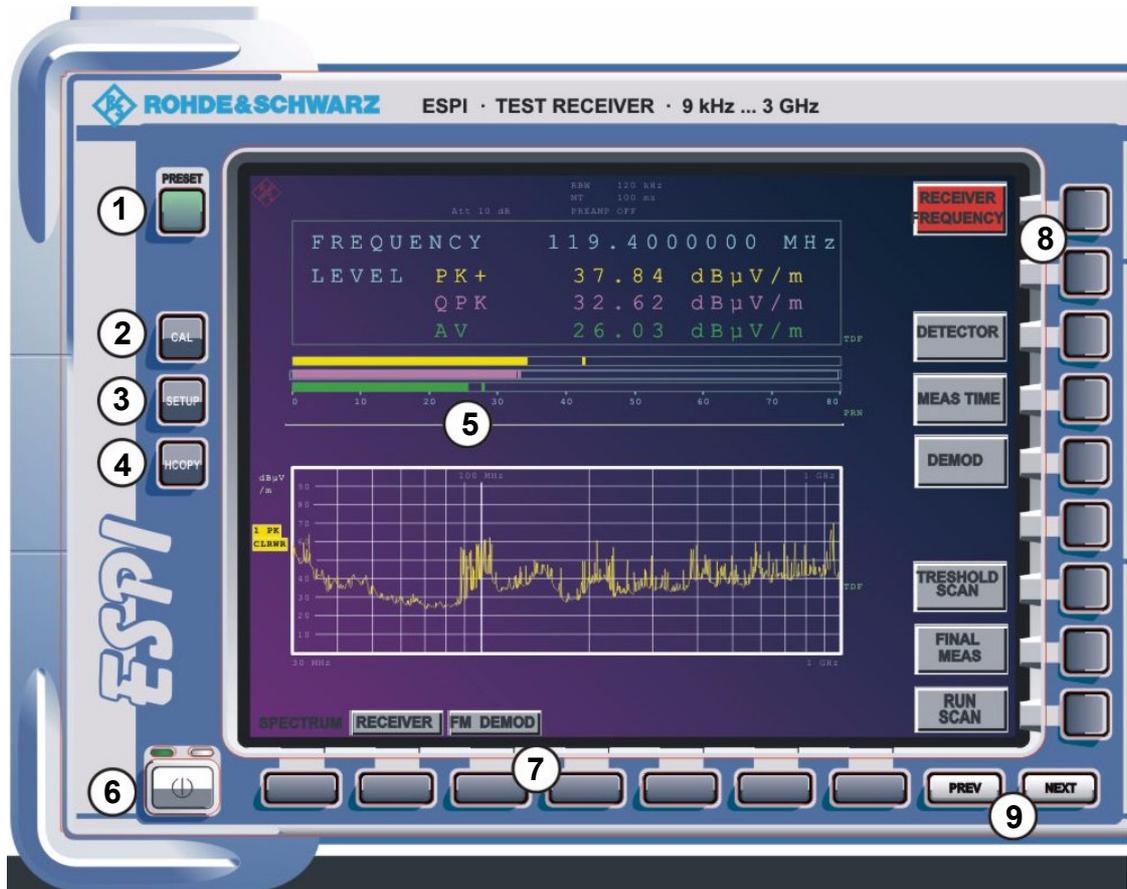
Fig. 1-1   Front view

Number in Fig. 1-1	Description
1	*PRESET* key (see " Function Keys on the Front Panel")
2	Calibration key (see " Function Keys on the Front Panel")
3	*SETUP* key (see " Function Keys on the Front Panel")
4	*HCOPY* key (see " Function Keys on the Front Panel")
5	screen
6	ON/standby switch (see " Function Keys on the Front Panel")
7	hotkeys
8	softkeys
9	*PREVIOUS* key, *NEXT* key (softkey side menus)
10	function keys for frequency, level, and markers (see " Function Keys on the Front Panel")
11	numeric keypad, units and entry keys

Number in Fig. 1-1	Description
12	*TRACE* key, *LINES* key, *DISP key*, *FILE* key (see " Function Keys on the Front Panel")
13	AF output with volume control (see page 6)
14	generator output, option R&S FSP-B9 (see page 22)
15	probe power connector - supply voltage for measurement accessories (see page 7)
16	RF input (see page 6)
17	USB interface
18	function keys for bandwidth, sweep, trigger and measurement functions (see " Function Keys on the Front Panel")
19	rotary knob with enter function and arrow keys
20	3 1/2" diskette drive; 1.44 MByte

1.2 Function Keys on the Front Panel

A detailed description of the corresponding menus and the other function keys is provided in the Operating Manual on CD-ROM.

Function key	Assigned functions
ON/STANDBY	Switches the instrument on and off.
PRESET	Resets the instrument to the default state.
FREQ	Sets the center frequency as well as the start and stop frequencies for the frequency band under consideration. This key is also used to set the frequency offset and the signal track function.
SPAN	Sets the frequency span to be analyzed.
AMPT	Sets the reference level, the displayed dynamic range, the RF attenuation and the unit for the level display. This key is also used to set the level offset and the input impedance.
MKR	Sets and positions the absolute and relative measurement markers (markers and delta markers). In addition, the following measurement functions are assigned under this key: • Frequency counter (*SIGNAL COUNT*) • Fixed reference point for relative measurement markers (*REFERENCE FIXED*) • Enlargement of the measurement area (*MARKER ZOOM*)
MKR->	Used for search functions of the measurement markers (maximum/minimum of the trace). Assigns the marker frequency to the center frequency, and the marker level to the reference level. Restricts the search area (*SEARCH LIMITS*) and characterizes the maximum points and minimum points (*PEAK EXCURSION*).
MKR FCTN	Provides additional analysis functions of the measurement markers: • Noise marker (*NOISE MEAS*) • Phase noise (*PHASE NOISE*) • n dB down function • AM/FM audio demodulation (analyzer) • Peak list
BW	Sets resolution bandwidth, video bandwidth and the two ratios "resolution bandwidth/video bandwidth" and "span/resolution bandwidth" in the case of automatic coupling.
SWEEP	Sets the scan parameters. Sets the sweep time and the number of measurement points. Selects continuous measurement or single measurement.

Function Keys on the Front Panel

Function key	Assigned functions
MEAS	Selects the measurement function (receiver mode): • Detector and the measurement time selection • AF demodulator (receiver mode) • Data reduction and peak list • Threshold scan • Final measurement functions Used to perform complex measurement functions (analyzer mode): • Measurement of time domain power (*TIME DOM POWER*) • Measurement of channel and adjacent channel power (*CHAN PWR ACP*) • Measurement of multicarrier adjacent channel power (*MULT CARR ACP*) • Occupied bandwidth (*OCCUPIED BANDWIDTH*) • Signal statistics (*SIGNAL STATISTIC*): amplitude probability distribution (APD) and cumulative complementary distribution function (CCDF) • Carrier to noise spacing (*C/N C/No*) • AM modulation depth (*MODULATION DEPTH*) • Spurious emissions (*SPURIOUS EMISSIONS*) • Third-order intercept point (*TOI*)
TRIG	Sets trigger source, trigger threshold, trigger delay, and gate configuration in the case of gated sweep.
TRACE	Configures measured data acquisition (*CLR/WRITE*; *AVERAGE*, *MAXHOLD*; *MINHOLD*, *VIEW*). Configures the analysis of the measurement data (*DETECTOR*) and the mathematical linking of traces (*TRACE MATH*).
LINES	Configures display lines and limit lines.
DISP	Configures the screen layout (one/two diagrams) and the diagram contents. This key can also be used to configure the screen colors.
FILE	Provides the functions for storing/loading instrument settings and for managing stored files.
CAL	Used to perform instrument self-calibration.
SETUP	Used to set or display the following the default settings of the instrument: • Reference frequency, noise source, preamplifier, preselector, level correction values (*TRANSDUCER*), date, time, GPIB, RS-232-C interface, LAN interface • Firmware update and enabling of options • Information about instrument configuration (*SYSTEM INFO*) incl. firmware version, module data and system error messages • Service support functions
HCOPY	Configures the screen printout, and selects and configures the printer.

1.3 Front Panel Connections

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

RF INPUT 50Ω

The RF input (20 Hz ... f_{max}) is to be connected to the DUT via a cable equipped with an appropriate connector. Be sure not to overload the input. The maximum continuous power at the RF input is +30 dBm (1 W).

NOTICE

The maximum DC voltage is 50 V, the maximum power is 1 W ($\geq$ 30 dBm) at $\geq$ 10 dB attenuation.

Tracking Generator Output (GEN OUTPUT 50Ω, Option R&S FSP-B9)

The output of the tracking generator is to be connected to the DUT via a cable equipped with a male N connector.

The female connector is available only with the tracking generator option (R&S FSP-B9).

In the case of DUTs with sensitive HF characteristics with regard to matching (VSWR) at the input, insert a 20 dB attenuator between the DUT and the tracking generator.

AF OUTPUT

A miniature headphone jack can be used at the AF OUTPUT connector to connect an external loudspeaker, a headphone set or, e.g., a LF voltmeter.

The internal impedance is 10 Ω. The output voltage can be set by using the volume control to the left of the connector. If a jack is plugged in, the internal loudspeaker will automatically be switched off.

⚠ CAUTION

Check the volume setting carefully before putting on the headphones in order to protect your hearing.

PROBE POWER

To allow the connection of probes, the R&S ESPI provides the PROBE POWER power connectors. The 3-pole connector delivers the power supply voltages +15 V and -12,6 V and ground.

The connector is also suited for powering the high-impedance probes from Hewlett Packard.
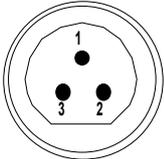
Pin	Signal
1	GND
2	-12.6 V; max. 150 mA
3	+15 V; max. 150 mA

Fig. 1-2   Pin assignments of PROBE POWER connector

USB Interfaces

The R&S ESPI provides a USB female connector at the front panel for connecting two USB devices (USB 2.0). For pin assignment see .

NOTICE

Use suitable double shielded cables.

Use only USB devices that keep the permissible EMI limits.

Disk Drive

The front panel provides a 3.5" disk drive for 1.44 MByte floppy disks.

1.4 Rear View
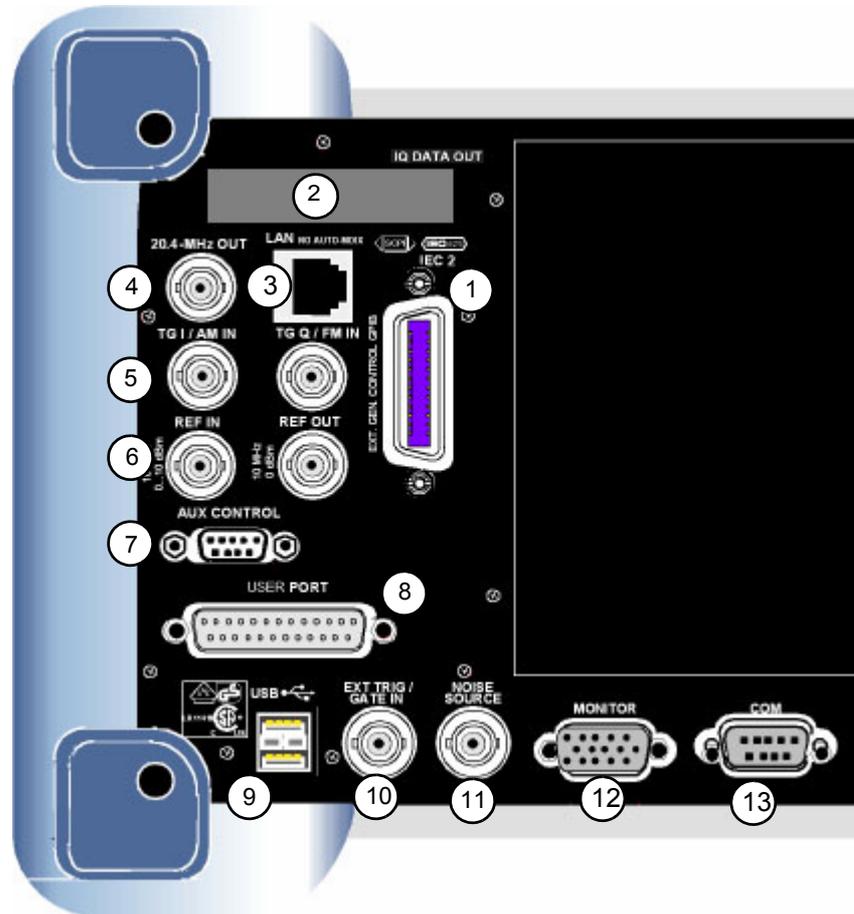
Fig. 1-3   Rear view

Number in Fig. 1-3	Description
1	second GPIB interface for external generator control, option R&S FSP-B10 (see page 14)
2	reserved for options
3	LAN interface, option R&S FSP-B16 (see page 58)
4	IF output 20.4 MHz (see page 13); with option R&S FSP-B6, this output is replaced by the switchable CCVS input/output (see page 14)
5	I/Q input for tracking generator, option R&S FSP-B9 (see page 14)
6	input/output for external/internal reference (see page 13)
7	external generator control, option R&S FSP-B10 (see page 15)
8	user port (see page 12)
9	double USB interface (see page 12)
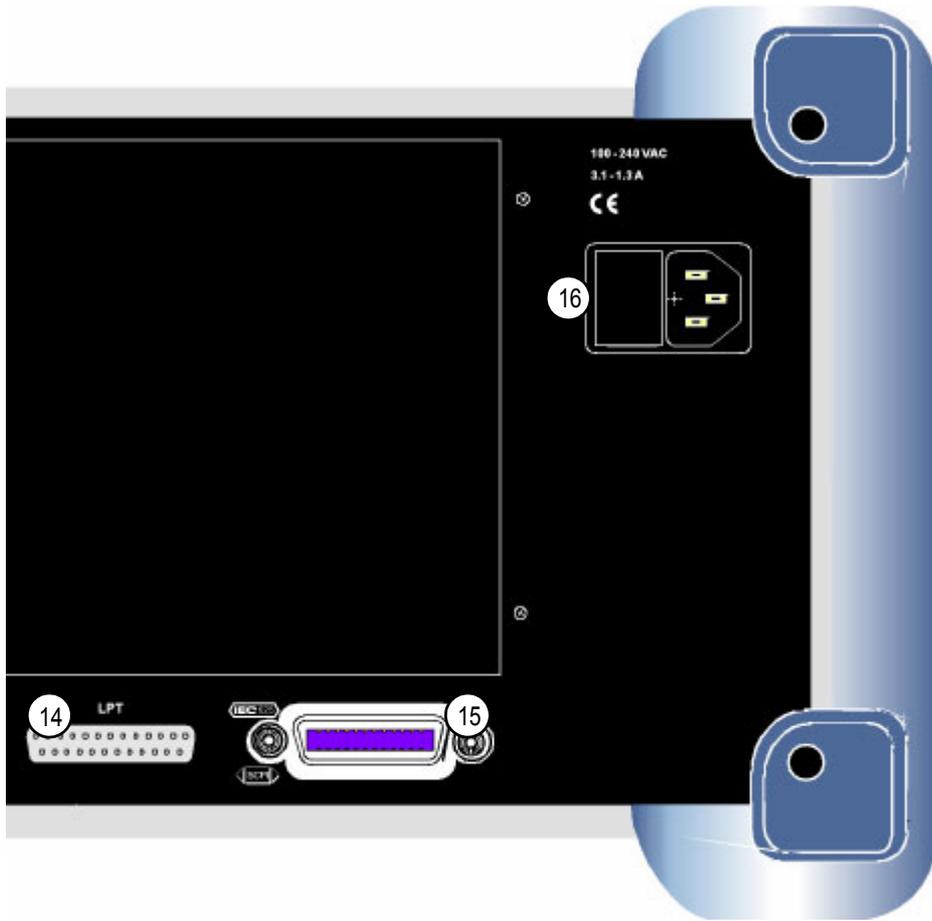
Number in Fig. 1-3	Description
10	trigger/gate interface (see page 11)
11	noise source supply voltage (see page 11)
12	VGA interface for external monitor (see page 11)
13	RS232-C interface (see page 10)
14	LPT printer interface (see page 10)
15	GPIB interface for remote control (see page 10)
16	AC power supply connector with on/off switch (see page 10)

1.5 Rear Panel Connections

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

AC Power Supply Connection and Main Power Switch

An AC power supply connector and main power switch are located in a unit on the rear panel of the instrument.

Main power switch function:

Position I   After being switched on, the instrument will be either in standby mode or in operation depending on the setting of the ON/STANDBY switch on the front panel of the instrument.

Position O   Switching the instrument off disconnects the entire instrument from the AC power supply.

> The main power switch also interrupts the power supply of the OCXO located in the instrument. When you switch the instrument back on, be sure to comply with the extended warm-up phase specified in the data sheet.

GPIB Interface

The instrument comes with a GPIB interface in compliance with IEEE488. A controller for remote control can be connected via this interface. Use a shielded cable to set up the connection. For further information refer to the Operating Manual, chapter 8.

Printer Interface (LPT)

The 25-pin female LPT connector on the rear panel of the R&S ESPI is provided for connecting a printer. The interface is compatible with the CENTRONICS interface. For further information refer to the Operating Manual, chapter 8.

RS-232-C Interface (COM)

The instrument comes with an RS-232-C interface. The interface can be manually activated and configured for remote control by defining the parameters in the *COM INTERFAC* table, which is accessed from the *SETUP - GENERAL SETUP* menu. For further information refer to the Operating Manual, chapter 8.

R&S Monitor Connection (MONITOR)

The 15-pin VGA monitor connection is used to display the screen contents on an external screen. The procedure for putting the external monitor into operation is described in the section " Connecting an External Monitor" on page 2.11.
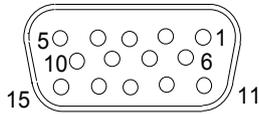
Pin	Signal	Pin	Signal
1	R	9	GND
2	G	10	GND
3	B	11	(NC)
4	(NC)	12	(NC)
5	GND	13	HSYNC
6	GND	14	VSYNC
7	GND	15	(NC)
8	GND		

Fig. 1-4   Pin assignments of the MONITOR connection

Noise Source Control (NOISE SOURCE)

Using the NOISE SOURCE connector, an external noise source can be switched on/off, in order, e.g., to measure the noise figure of (DUTs).

Usual noise sources require a +28 V signal to be turned on. At 0 V, they are turned off. These supply voltages are delivered by the connector. Maximum current is 100 mA.

Input for External Trigger (EXT TRIG/GATE IN)

The EXT TRIG/GATE IN female connector is used to control the measurement by means of an external signal.

The voltage levels are adjustable (0.5 V to 3.5 V). The typical input impedance is 10 kΩ.

USB Interface

The R&S ESPI provides a USB female connector at the rear panel for connecting two USB devices (upper connector USB 1.1, lower connector USB 2.0).

NOTICE

Use suitable double shielded cables. Passive USB connecting cables must not exceed 1 m in length.

Use only USB devices that keep the permissible EMI limits.

Pin	Signal
1	+ 5 V USB0
2	USBDATA0 -
3	USBDATA0 +
4	GND
5	+ 5 V USB1
6	USBDATA1 -
7	USBDATA1 +
8	GND
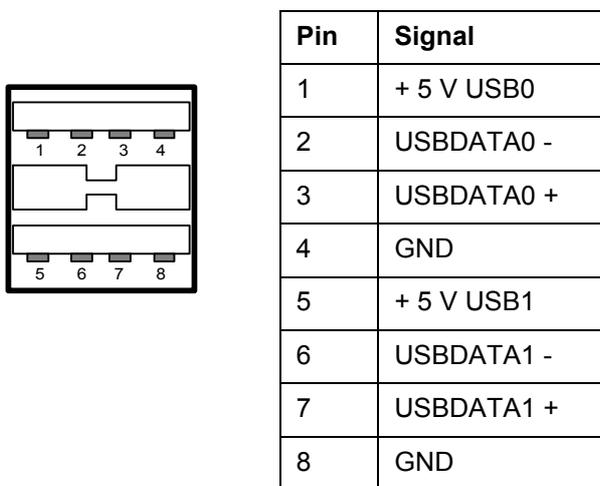
Fig. 1-5   USB connector assignment

USER PORT

The user interface is a 25 pin Cannon connector which provides access to the user port. The port is 8 bits wide (A0 - A7) and can be configured either as output or as input. The voltage levels are TTL levels (Low < 0,4 V, High > 2 V).

In addition, the internal +5 V and +12 V power supply voltages are provided. The maximum load current is 100 mA.
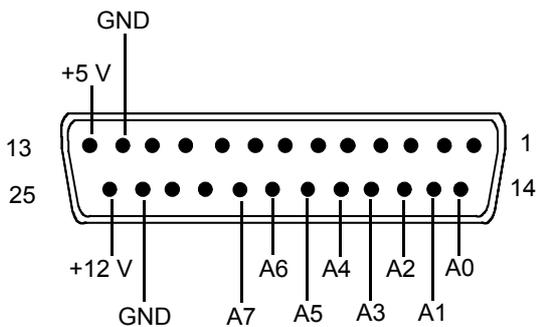
The user ports are configured in the *SETUP* menu (*SETUP* key), *GENERAL SETUP /
USER PORT* sub-menu.

Pin	Signal	Range of values
1 to 11	not used	
12	ground	
13	+5 V supply voltage	5.2 V ± 0.5 V, max. 30 mA
14 to 20	reserved	
21	ready-for-trigger output signal	HIGH: ≥ 1.4 V, LOW: ≤ 0.7 V
22 to 23	not used	
24	ground	
25	+12 V supply voltage	+12 V ± 0.5 V, max. 10 mA

Reference Input and Output (REF IN and REF OUT)

The REF IN female connector is used as an input for a 10 MHz reference signal. The required
input level is 0 to 10 dBm. The REF OUT female connector provides the internal 10 MHz
reference signal with a 0 dBm output level for other devices.

The *SETUP* menu is used to select between the internal and external references.

If an external reference is used for operation, the external reference signal from REF IN is
looped through to REF OUT.

NOTICE

Use suitable double shielded cables.

20.4 MHz IF Output (IF OUT 20.4 MHz)

The 20.4 MHz IF signal of the R&S ESPI is provided at the 20.4 MHz OUT female BNC
connector. For resolution bandwidths between 100 kHz and 10 MHz, the bandwidth
corresponds to the selected bandwidth. For bandwidths ≤100 kHz, the bandwidth of the output
is equal to 2.6 * resolution bandwidth, where the minimum value is 2.6 kHz (non-FFT). In the
analyzer mode, the level at the IF output in the case of a signal at the reference level is 0 dBm
if the resolution bandwidth is ≥100 kHz; if the resolution bandwidth is <100 kHz, the level is
-10 dBm (for mixer levels ≥ -60 dBm).

NOTICE

Use suitable double shielded cables.

> With option R&S FSP-B6, this output is replaced by the CCVS IN/ OUT connector.

CCVS Output and Input (CCVS IN/OUT, Option R&S FSP-B6)

The CCVS IN/OUT female BNC connector is a switchable CCVS input/output. If TV triggering is activated and triggering occurs in response to the internal demodulator signal (CCVS INT), the demodulated TV signal is provided for operating an CCVS monitors. If triggering occurs in response to an externally supplied CCVS signal (CCVS EXT), the female connector serves as an input.

TG I / AM IN; TG Q / FM IN (Option R&S FSU-B9)

The two female connectors TG I /AM IN and TG Q /FM IN are used to modulate the tracking generator (option R&S FSU-B9) by means of an external signal.

The input voltage range is ±0.5 V; the input impedance is 50 Ω.

LAN Interface (Option R&S FSP-B16)

The LAN interface can be used to connect to a local network. The assignment of the RJ-45 connector supports twisted-pair category 5 UTP/STP cables in a star configuration (UTP stands for "unshielded twisted pair", and STP for "shielded twisted pair").

Second GPIB Interface IEC2 (Option R&S FSP-B10)

When equipped with option R&S FSP-B10 (external generator control), the instrument provides a second GPIB interface for using external generators.
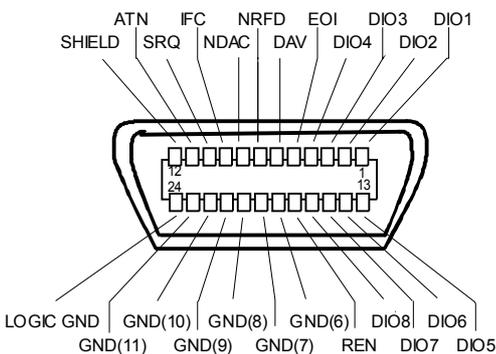
Fig. 1-6   Pin assignment of the second IEC interface

AUX CONTROL (Option R&S FSP-B10)

The optional AUX CONTROL interface is associated with the option FSP-B10 (External Generator Control). It allows fast frequency switching with the external generator control option when a Rohde & Schwarz signal generator is used.

The cable supplied is used to connect the interface to the corresponding interface of the signal generator (see also section " External Generator Control Option - FSP-B10). The voltage levels are of the TTL type (low < 0.4 V, high > 2 V).
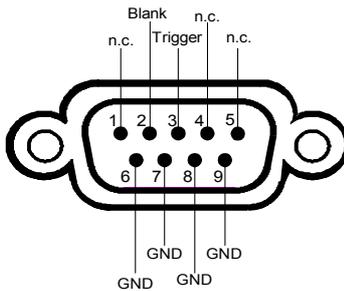
Pin	Signal	Description
1	n.c.	not connected
2	BLANK	Return signalling from the signal generator indicating that frequency setting is completed
3	TRIGGER	Trigger signal for switching to the next frequency
6...9	GND	Ground

Fig. 1-7   Pin assignment of the AUX CONTROL connector

2   Preparing for Use

2.1 Preparing for Operation

This section describes how to put the instrument into operation.

NOTICE

Before putting the instrument into operation, make sure that the following requirements have been met:

• The air vents are not blocked.

• No signal voltage levels exceeding the permitted limits are present at the inputs.

• The instrument's outputs are neither overloaded nor incorrectly connected.

Not complying with these requirements can result in damage to the instrument.

2.1.1 Unpacking the Instrument

➢ Remove the instrument from its packaging and check the equipment for completeness using the delivery note and the accessory lists for the various items.

➢ First, pull off the polyethylene protection pads from the instrument's rear feet and then carefully remove the pads from the instrument handles at the front.

➢ Pull off the corrugated cardboard cover that protects the rear of the instrument.

➢ Carefully unthread the corrugated cardboard cover at the front that protects the instrument handles and remove it.

➢ Check the instrument for any damage. If there is damage, immediately contact the carrier who delivered the instrument. In this case, make sure not to discard the box and packing material.

It is advisable to keep the original packing material in order to prevent control elements and connectors from being damaged in case the instrument is to be transported or shipped at a later date.

Protective plastic caps for the front panel and the rear panel can be ordered addditionally (order number 1096.7095.00). Please note that you need to order 2 covers for 1 instrument.

2.1.2 Setting Up the Instrument

The instrument is intended for indoor use. Note the following in this regard:

• The ambient temperature must comply with the range specified in the data sheet.

• Air inflow and outflow via the air vents on the rear panel and through the lateral perforations must not be obstructed. Clearance from walls must be at least 10 cm.

• The mounting surface must be even.

NOTICE

Risk of damaging electronic components

To avoid damage of electronic components, the operational site must be protected against electrostatic discharge (ESD).
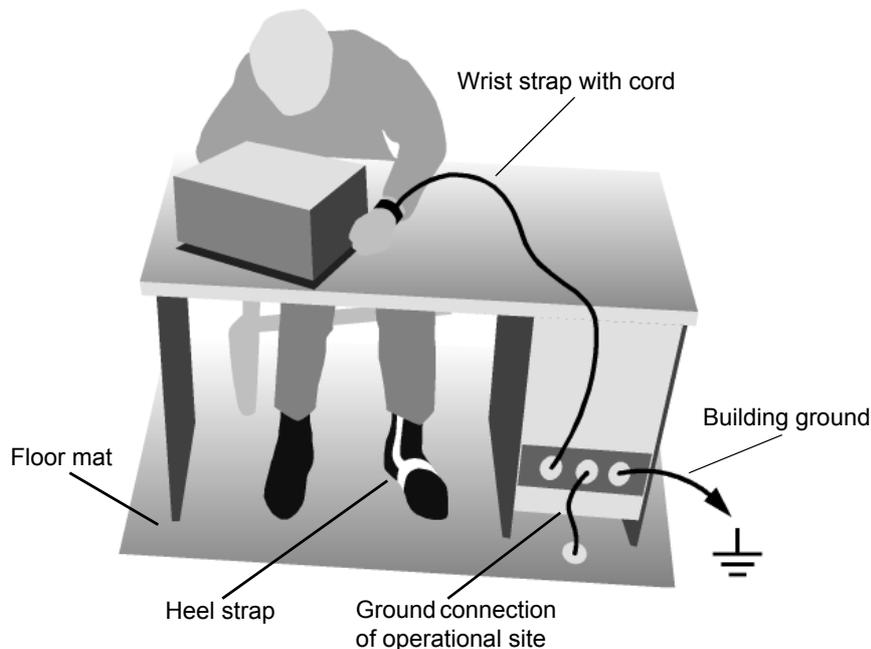
The following two methods of ESD protection may be used together or separately:

- Wrist strap with cord to ground connection
- Conductive floor mat and heel strap combination

2.1.3 Installation in a 19" Rack

The instrument can be installed in a 19" rack by using a rack adapter (see data sheet for order number). The installation instructions are included with the adapter.

NOTICE

When the instrument is installed in a rack, make sure that the vents for air inflow on the side panel and the air outlets on the rear panel are not obstructed.

2.1.4 Connecting the Instrument to the AC Power Supply

The R&S ESPI is equipped with a mechanism for detecting AC power voltage and automatically sets itself to use the available AC power voltage (range: AC voltage 100 V to 240 V; 50 Hz to 400 Hz). The AC power connector is located on the rear panel of the instrument.
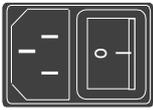
AC power
connector

➢ Connect the R&S ESPI to the AC power supply, using the power cable that is supplied.

Since the instrument is assembled in line with the specifications for safety class EN61010, it may only be connected to an outlet that has a ground contact.

2.1.5 Switching On the R&S ESPI

➢ Press the power switch on the real panel to change it to position I.

➢ Press the ON/STANDBY key on the front panel. The green LED will light up.

NOTICE

Do not switch off the instrument while it is booting.
Switching it off prematurely can lead to serious data changes on the instrument's hard disk.

After being switched on, the R&S ESPI displays the following information:

| Rohde & Schwarz GmbH & Co. KG |
| Analyzer BIOS   Vx.y |

A self test of the computer hardware will be carried out. Windows XP then starts, and the measurement screen will automatically appear with the settings that were present when the instrument was last switched off.

If you want the instrument to automatically load different settings when it is switched on, define the required configuration in the *FILE - STARTUP RECALL* menu.

2.1.6 Functional Test

The functional test should only be performed when the operating temperature is reached (approx. 15 minutes after the instrument is switched on).

➢ Call self alignment with the *CAL* key, *CAL TOTAL* softkey. Once the system correction values have been calculated successfully, the message *Calibration Passed* will appear.

➢ Start the self test with the *SETUP* key, *SERVICE – SELFTEST* softkeys. Once the instrument modules have been checked successfully, the message *Selftest Passed* will appear.

Once both steps have been completed successfully, the instrument will be ready for operation.

> The self alignment does not need to be repeated every time the instrument is switched on, because the instrument saves the values and loads them during booting automatically. A self alignment is recommended if the instrument is used at a temperature that differs considerable (more than 10°C) from the temperature present at the last self alignment.
>
> The self test also does not need to be repeated every time the instrument is switched on. It is necessary only when instrument malfunction is suspected.

2.1.7 Switching Off the R&S ESPI

➢ Press the ON/STANDBY key on the front panel.

The R&S ESPI will store the current settings on the hard disk and then shut down the software. Once the operation has been completed, the power supply unit will be switched to STANDBY and the yellow LED will come on.

⚠ WARNING

Shock hazard

In standby mode, the AC supply voltage is still present on the instrument.

➢ To completely disconnect the instrument from the AC power supply, change the power switch on the rear panel to position O.

> • The main power switch on the rear panel also interrupts the power supply of the OCXO (optional) inside the instrument. When you switch the instrument back on, be sure to adhere to the extended warm-up phase.
>
> • If you switch off the instrument by using the power switch or by disconnecting the power supply connector, it is not possible to save the current instrument settings on the hard disk. In this case, the last settings that were stored on the hard disk will be loaded when you switch the instrument back on.

2.1.8 Cleaning the Outside

The outside of the instrument is suitably cleaned using a soft, line-free dust cloth. Make sure that the air vents are not obstructed.

NOTICE

Cleaning agents contain substances that may damage the instrument, e.g. solvent-containing cleaning agents may damage the front panel labeling or plastic parts.

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

2.2 Instrument Drive Usage

The harddisk space is divided in 3 logical drives.

C:

Contains the operating system Windows XP, printer driver, network driver,…

Other user programs, applications, driver should be stored/installed on drive C:.

D:

Contains instrument's firmware and related data sets (limit lines, transducers,...)

D:\user\config is the default location for customized instrument settings

D:\R_S\instr\temp is the default directory for hardcopy files.

Other user data should be stored on drive D:.

E:

Backup storage location for Windows XP. Here a copy of the operating system is saved.

This drive is used to restore Windows XP using "Analyzer Firmware Backup" function on Power On. A copy of the currently installed update sets are located on this drive, too.

No additional data should be stored on this drive.

2.3 Connecting External Devices

2.3.1 Connecting an External Keyboard

NOTICE

Do not connect the keyboard unless the instrument is switched off (STANDBY). Otherwise, proper functioning cannot be ensured due to interactions with the firmware.

An external PC keyboard can be connected to the USB interface on the front or the rear panel of the R&S ESPI.

The keyboard simplifies instrument operation and the entry of comments, file names, etc.

Keyboards and mouse devices conform to USB Standards 1.1 or 2.0 are suitable for connection to the USB interface.

After being connected, the keyboard is automatically detected. The default keyboard language setting is US English. Special settings such as refresh rate, etc. can be made in the Windows XP Start menu by selecting *START - SETTINGS - CONTROL PANEL - KEYBOARD*.

International Keyboard Support

As of firmware version 4.3x, the following international keyboard drivers are supported.

*   French Keyboards
*   German Keyboards
*   Italian Keyboards
*   Portuguese Keyboards
*   Spanish Keyboards

These drivers are already installed on the R&S ESPI, if it is shipped with firmware version 4.3x or later. A separate installer file is available on the R&S ESPI internet site.

To change the keyboard driver language proceed as follows:

1. Start Windows Explorer
2. Start the installation procedure with double click onto the file *FsxInternationalKeyboards.msi*.
3. Reboot the analyzer.
4. Now open the windows start menu by pressing the windows key or *<CTRL> <ESC>*.
5. Select *Settings - Control Panel - Regional and Language Options - Languages*.
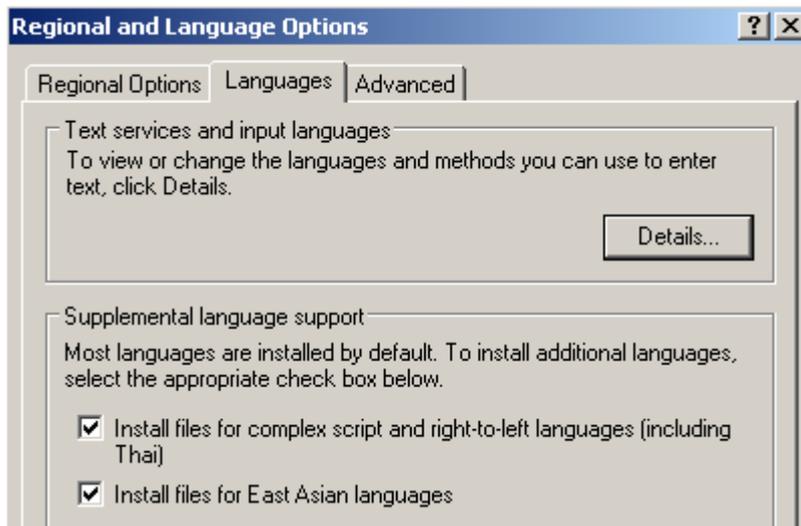
6. Select *Details*
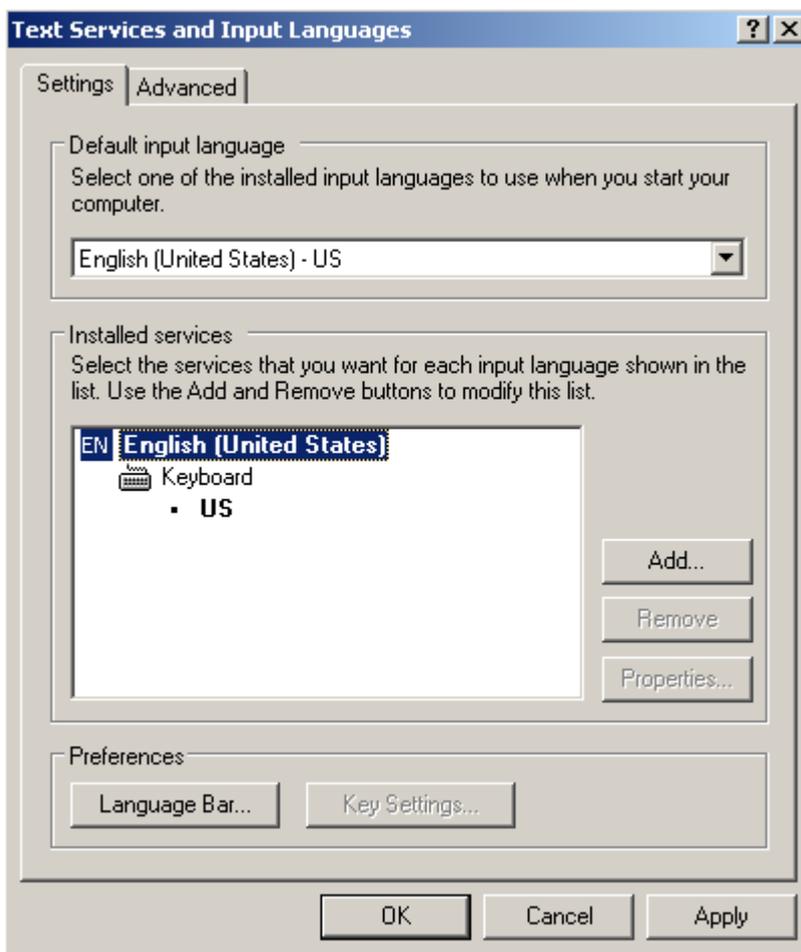
7. Select *Add* and choose one of the available languages.

   Confirm your selection with OK.
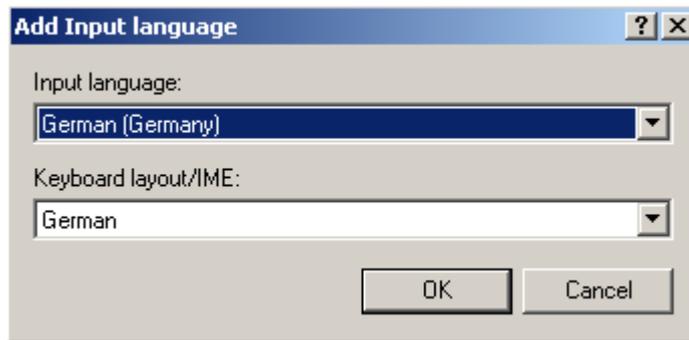
8. Change the Default input language as you like in the *Default Input Language* pane and close all open dialogs with OK.

9. Reboot the R&S ESPI

2.3.2 Connecting a Mouse

To simplify Windows XP operation, the R&S ESPI allows you to connect a mouse to one of the USB interfaces on the front or rear panel.
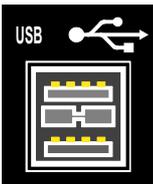
Mouse devices from Microsoft and Logitech are supported.

If you use a keyboard that contains a trackball for mouse operations, connecting an external mouse in addition may lead to malfunctions.

After being connected, the mouse is automatically detected. Special settings such as mouse cursor speed, etc. can be made in the Windows XP Start menu by selecting *START - SETTINGS - CONTROL PANEL - MOUSE*.

2.3.3 Connecting an External Monitor

NOTICE

Do not connect a monitor unless the instrument is switched off (STANDBY). Otherwise, you run the risk of damaging the monitor.

You can connect an external monitor at the MONITOR connector on the instrument's rear panel.

After connecting the external monitor, restart the instrument to detect the monitor. The measurement display will then appear on both the external screen and on the instrument. No further settings are necessary.

If the external monitor is not recognized by the instrument, you have to activate it. This requires a mouse and an external keyboard (the connection is described in sections " Connecting a Mouse" on page 2.10 and " Connecting an External Keyboard" on page 2.8).

➢ Make sure that the external monitor is connected.

➢ Press the *CTRL+ESC* key combination to display the taskbar.

➢ On the right side of the taskbar, click the monitor icon.

➢ Select *Graphics Options - Output To - Intel(R) Dual Display Clone - Monitor + Digital Display.*
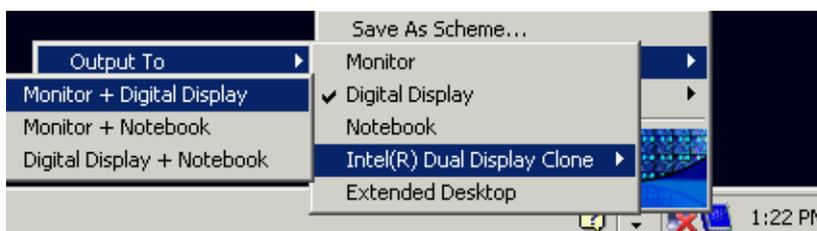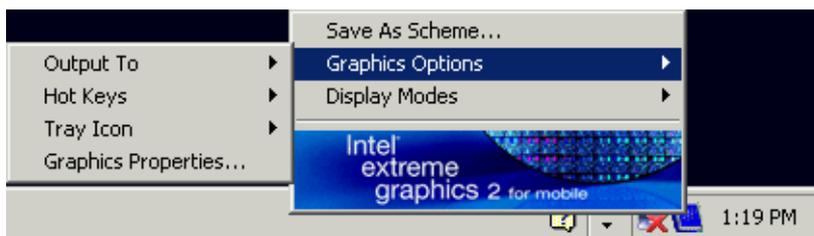
When the instrument is switched on later without a monitor, the activation of the external monitor is reset.

2.3.4 Connecting a Printer

A printer can be connected during operation.

The R&S ESPI allows you to create two different printer configurations for printing out a hardcopy of the screen and you can toggle between them by pressing a button. The *DEVICES* table in the *HCOPY* menu lists the available installed printers.

The LPT printer interface is located on the rear panel. Alternatively, one of the USB interfaces on the front or rear panel can be used.
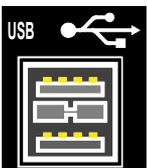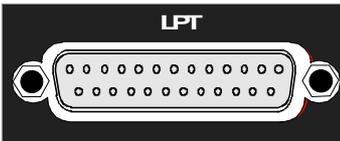
2.3.5 Connecting USB Devices (e.g. a Power Meter)

The USB interface on the front and the rear panel of the R&S ESPI allows you to connect up to 4 USB devices directly to the R&S ESPI. This number can be increased as necessary by inserting USB hubs.

Due to the large number of available USB devices, there is almost no limit to the expansions that are possible with the R&S ESPI. The following list shows various USB devices that can be useful for the R&S ESPI:

• Power sensors of the R&S NRP-Zxx series
  (require adapter cable R&S NRP-Z4)

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

• CD-ROM drives for easy installation of firmware applications

• PC keyboard for entering comments, file names, etc.

• Mouse for easy operation of Windows XP dialog boxes

• Printer for printing out measurement results

• Modem for remote control of the R&S ESPI over large distances

Installing USB devices is easy under Windows XP, because all USB devices are plug&play. All USB devices can be connected to or disconnected from the R&S ESPI during operation.

After a device is connected to the USB interface of the R&S ESPI, Windows XP automatically searches for a suitable device driver.

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, connect a USB CD-ROM drive to the R&S ESPI before proceeding.

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

Example:

Connect a memory stick to the R&S ESPI:

1. When you connect the pendrive at the USB interface, Windows XP detects the new hardware:

2. Windows XP installs the corresponding driver.

   If installation is successful, Windows XP informs you that the device is ready to use:
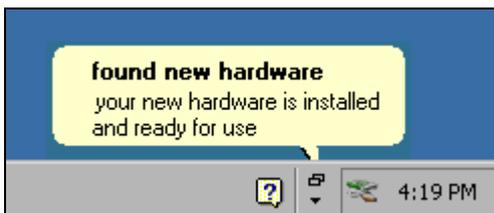
   The memory stick is made available as a new drive and is displayed in the Windows Explorer:
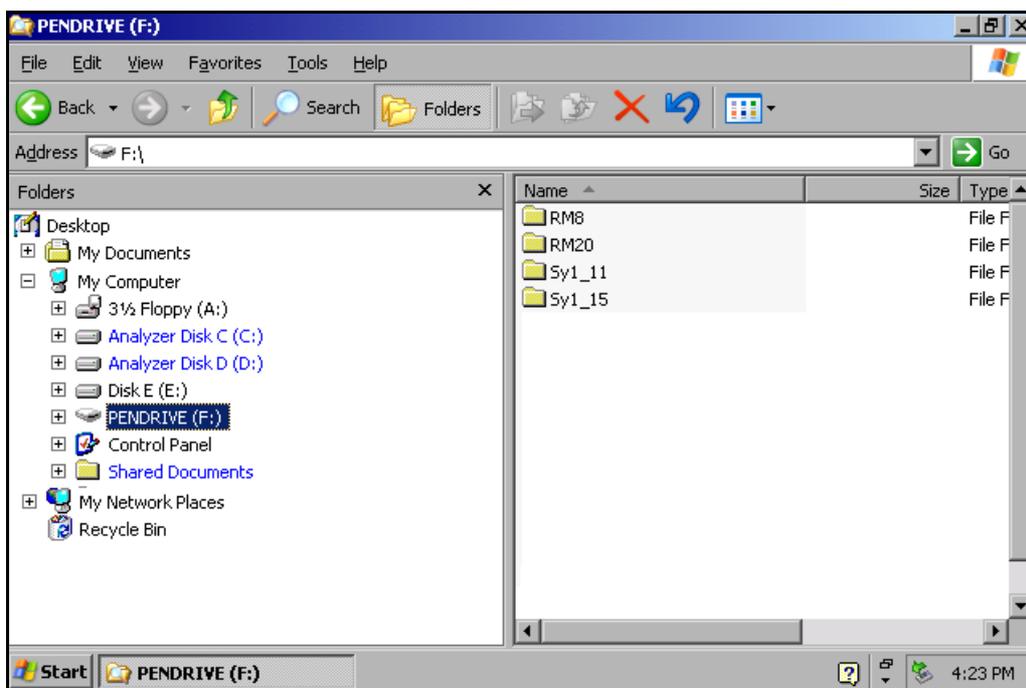
   The memory stick can be used like a normal drive to load or store data.

3. If you no longer need the memory stick or if you want to transfer files to another computer, simply disconnect the memory stick. Windows XP will automatically deactivate the driver. If the drive is still selected in Explorer, an error message will appear indicating that the drive is no longer available.

2.3.6 Connecting External Generators

The External Generator Control option (R&S FSP-B10) allows you to operate a number of commercially available generators as a tracking generator on the R&S ESPI. When suitable generators are used, the R&S ESPI thus allows scalar network analysis to be performed also outside the frequency range of the internal tracking generator. Appendix "External Generator Control" provides a list of generators supported by the option R&S FSP-B10.

The following figure shows the test setup:
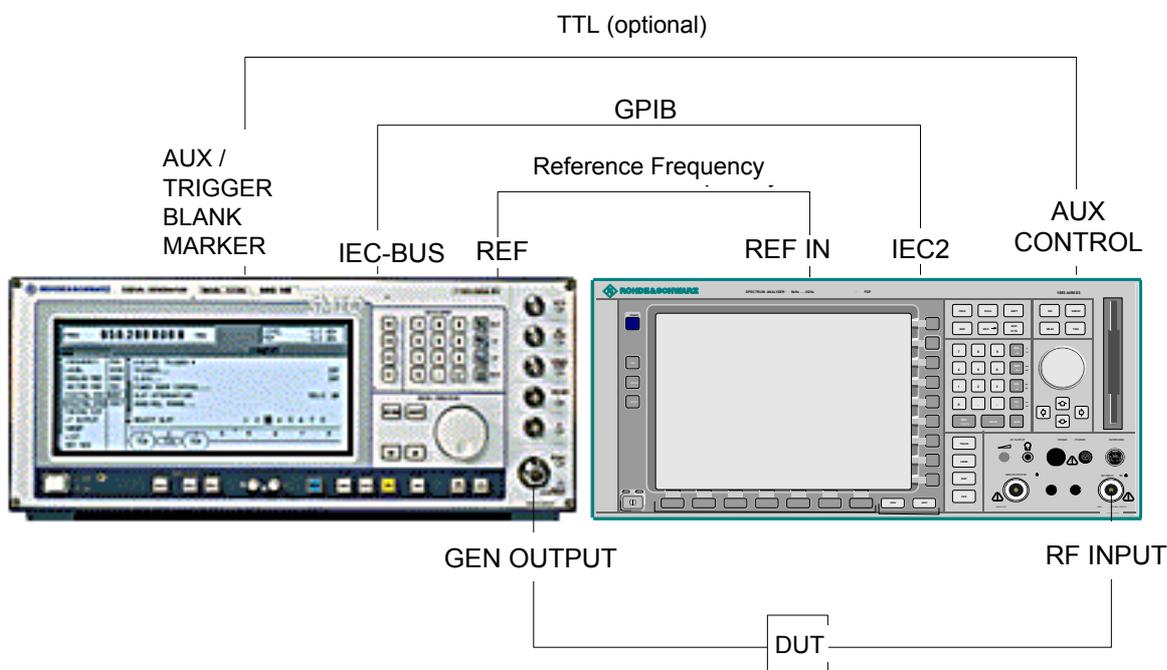
The generator is controlled via the – optional – second GPIB interface of the R&S ESPI (= IEC2, supplied together with the option). With some Rohde & Schwarz generators, it is also controlled via the TTL synchronization interface that is contained in the AUX CONTROL interface of the R&S ESPI.

- • Using the TTL interface allows you to attain significantly higher speeds than possible with a pure GPIB control, because the frequency switching mechanism of the R&S ESPI is directly coupled to the frequency switching mechanism of the generator.

- • To increase measurement accuracy, use a shared reference frequency to operate the R&S ESPI and the generator. If no independent 10 MHz reference frequency is available, connect the reference output of the generator to the reference input of the R&S ESPI and use *SETUP – REFERENCE EXT* to configure the R&S ESPI to implement the external reference.

2.3.6.1 Connecting the R&S ESPI to the Generator

To couple the frequency setting and level setting of the generator to the R&S ESPI, set up the following connections:

1. Connect the GPIB interface of the generator to the IEC2 connector on the rear panel of the R&S ESPI.

2. (Optional:) Connect the TTL interface of the generator and the R&S ESPI.

   ➢ Alternative 1 (R&S SMR, R&S SMU):
   Connect the AUX CONTROL connector of the R&S ESPI to the corresponding AUX connector on the rear panel of the generator (the connection cable is supplied together with the option R&S FSP-B10).

   ➢ Alternative 2 (R&S SME, R&S SMP, R&S SMIQ):
   Connect the AUX CONTROL connector of the R&S ESPI to the TRIGGER, MARKER and BLANK connectors on the rear panel of the generator (the connection cable is also supplied together with the option R&S FSP-B10). Note the labelling on the TRIGGER, MARKER and BLANK lines.

   ➢ Alternative 3 (R&S SML, R&S SMG/SMGU, R&S SMH/SMHU, R&S SMX/SMY, generators from other manufacturers):
   No TTL connection possible.

   The generator type determines which one of the possible connections is suitable for the generator. For more information, refer to the Operating Manual for the generator.

3. Connect the reference frequency output of the generator to the reference frequency input (*REF IN*) of the R&S ESPI.
   or
   Connect the reference frequency inputs of the two instruments to an external frequency standard.

2.3.6.2 Configuring the Generator on the R&S ESPI

To configure the generator, change into the *NETWORK* mode:

➢ Press the *SPECTRUM* hotkey to change to the analyzer mode.

➢ Press the *NETWORK* hotkey located in the hotkey bar at the lower edge of the screen.

Perform the following steps:

1. Press the *EXT SOURCE* softkey. The submenu for configuring generators will open

2. Select and configure the generator:

   ➢ Press the *SELECT GENERATOR* softkey.
   The table containing the generator settings will open. The selection bar will be located in the row *SRC 1* under the column *TYPE*.

SELECT GENERATOR								
SRC	TYPE	IFC	GPIB ADDR	MODE	F MIN	F MAX	P MIN	P MAX
1	SME03	TTL	28	REMOTE	5kHz	3GHz	-144dBm	16dBm
2	SMIQ03	GPIB	28	LOCAL	300kHz	3.3GHz	-140dBm	13dBm

   ➢ Press the *ENTER* key.
   The list of available generators will open.

   ➢ Using the rotary knob, select the desired generator and activate *ENTER* by pressing the rotary knob.
   The generator list will close, and the selected generator will then appear in the *SELECT GENERATOR* table. Simultaneously, the limits for frequency and output power which you can set on the generator will appear in the F MIN, F MAX, P MIN and P MAX fields.

   ➢ Using the ⇨ key, move the selection bar to the IFC column and press the *ENTER* key.
   The list of available control interfaces will appear.

   ➢ If the TTL interfaces from the R&S ESPI and generator are connected, select *TTL* by using the rotary knob and then activate it by pressing the rotary knob.

   ➢ If no TTL interface is provided or if the TTL interfaces are not connected, select *GPIB* by using the rotary knob and then activate it by pressing the rotary knob.

   ➢ Using the ⇨ key, move the selection bar to the GPIB ADDR column and press the ENTER key.
   The entry field for the GPIB address of the generator will open.

   ➢ Enter the GPIB address of the generator and confirm with *ENTER*.
   The specified address will be added to the table.

3. Select the reference frequency for the generator:

   ➢ If you want to operate the generator using its internal reference, change the *GEN REF* softkey to the state *INT*.

   ➢ If you want to operate the generator using an external reference, change the *GEN REF* softkey to the state *EXT*.

This concludes the procedure for defining the default setting for the generator.

> A second generator configuration can be inserted in advance by repeating the settings in the line SRC 2. This makes it easy to switch from one generator type to another.

2.3.6.3 Activating the Generator Configuration and Setting the Output Level

To select the active generator configuration, press the *FREQUENCY SWEEP* softkey. The *FREQUENCY SWEEP* table will open, and the selection bar will be located under the *STATE* column in the *SRC 1* row.

SRC	STATE	POWER[dBm]	NUM	DEN	OFFSET	RESULT

FREQUENCY SWEEP
SOURCE FREQ = REC FREQ * NUM/DEN + OFFSET

SRC	STATE	POWER[dBm]	NUM	DEN	OFFSET	RESULT
1	✓	-30dBm	1	1	0Hz	0Hz..3GHz *
2		-30dBm	1	1	0Hz	0Hz..3.2GHz

➢ If you want to use the *SRC 1* generator configuration, insert a checkmark in the field by pressing the *ENTER* key.

➢ If you want to use the *SRC 2* generator configuration, move the selection bar to the lower line of the table by using the ⬇ key. Then activate the generator configuration by pressing the *ENTER* key and set the checkmark in line 2 under the *STATE* column.

➢ Using the ➡ key, move the selection bar to the *POWER [dBm]* column and press the *ENTER* key.

➢ Enter the desired output power and confirm with the *dBm* key. The power you entered will appear in the table.

> You can also change the output power of the generator by using the *SOURCE POWER* softkey located in the *NETWORK* menu.

The remaining columns of the table are used to configure frequency-converting measurements. For more information, refer to the Operating Manual, section "External Generator Control - Option R&S FSP-B10".

This concludes the procedure for configuring the generator.

2.3.6.4 Using an External Generator as a Tracking Generator

To activate the external generator as a tracking generator, do the following:

➢ Switch on the external generator.

➢ Press the *NETWORK* hotkey on the R&S ESPI.

➢ Press the *EXT SOURCE* softkey.

Tracking generator operation using an external generator will be activated. The external generator will switch to remote control and can be used like an internal tracking generator. For more information about measurements with an external tracking generator, refer to the Operating Manual, section "External Generator Control - Option R&S FSP-B10".

Switching off the tracking generator:

➢ Press the *NETWORK* hotkey on the R&S ESPI.

➢ Press the *EXT SOURCE* softkey.

➢ Change the *EXT SRC* softkey to *OFF* by pressing it.

When you switch off tracking generator operation using an external generator, control on the IEC2 is automatically released and the generator is returned to *LOCAL* mode.

2.4 Setup

2.4.1 Selecting the Frequency Reference

You can switch the reference signal for frequency processing of the R&S ESPI between the internal reference and an external reference signal at 10 MHz as follows:

➢ Press the *SETUP* key.
The *SETUP* menu will open.

➢ Press the *REFERENCE INT/EXT* softkey until it is in the desired state.

If the reference signal is missing when switchover to the external reference occurs, *EXREF* is displayed after a few moments, indicating that synchronization has not taken place.

When switchover to an internal reference occurs, note that the external reference signal is removed in order to avoid any interactions with the internal reference signal.

IEC bus command: `ROSC:SOUR INT`

2.4.2 Setting the Date and Time

➢ Press the *SETUP* key.
The *SETUP* menu will open.

➢ Press the *GENERAL SETUP* softkey.
The submenu with general settings will open.

The *TIME+DATE* softkey activates the *TIME AND DATE* table for entering the time and date for the internal real-time clock.

```
TIME AND DATE
Time 12 : 30
Date 11 MAR 2008
```

Entering the time

Hours and minutes can be entered independently of each other in the entry field:

```
TIME
TIME   12 : 30
```

IEC bus command: `SYST:TIME 12,30`

Entering the date

The day, month and year can be entered independently of each other in the entry field:

To select the month, use the units key to open a list containing the month names. You can then select the month from the list.

IEC bus command: `SYST:DATE 2002,03,11`

2.4.3 Setting the GPIB Interface

➢ Press the *SETUP* key.
   The *SETUP* menu will open.

➢ Press the *GENERAL SETUP* softkey.
   The submenu with general settings will open.

➢ Press the *GPIB* softkey.
   The submenu for setting the parameters of the remote control interface will open.

2.4.3.1 GPIB Address

➢ Press the *GPIB ADDRESS* softkey.
   The entry field for the GPIB address will open.

The setting range is from 0 to 30. The default address is 20 if SCPI is selected as the GPIB language or 18 if an 85xx emulation is selected.

IEC bus command: `SYST:COMM:GPIB:ADDR 20`

2.4.3.2 GPIB Language

➢ Press the *GPIB LANGUAGE* softkey.
The list of available remote control languages will open.

The following languages are available:

- *SCPI*

- HP mode:

  8560E, *8561E*, *8562E*, *8563E*, *8564E*, *8565E*

  8566A, *8566B*, *8568A*, *8568A*_DC, *8568B*, *8568B*_DC, *71100C*, *71200C*, *71209A*

  8591E, *8594E*

If entries of the HP mode are selected, the command recognition uses syntax rules which are different from syntax rules of the *SCPI* mode. Correspondingly, proper detection of SCPI commands is not ensured in this mode.

For 8566A/B, 8568A/B and 8594E, command sets A and B are available. Command sets A and B differ in the rules regarding the command structure.

Selecting a language different from "SCPI" will set the GPIB address to 18 if it was 20 before.

Start / stop frequency, reference level and # of sweep points will be adapted to the selected instrument model.

8568A_DC and 8568B_DC are using DC input coupling as default if it is supported by the instrument.

The HP model 8591E is compatible to HP model 8594E, the HP models 71100C, 71200C, and 71209A are compatible to HP models 8566A/B.

71100C, 71200C, 71209A, 856xA/B, 856xE, 8591E, 8594E:

- The instrument will perform a preset.
  The following instrument settings will then be changed:

Model	# of Trace Points	Start Freq.	Stop Freq.	Ref Level	Input Coupling
8560E	601	0 Hz	2.9 GHz	0 dBm	AC
8561E	601	0 Hz	6.5 GHz	0 dBm	AC
8562E	601	0 Hz	13.2 GHz	0 dBm	AC
8563E	601	0 Hz	26.5 GHz	0 dBm	AC
8564E	601	0 Hz	40 GHz	0 dBm	AC
8565E	601	0 Hz	50 GHz	0 dBm	AC

Model	# of Trace Points	Start Freq.	Stop Freq.	Ref Level	Input Coupling
8566A/B	1001	2 GHz	22 GHz	0 dBm	AC (R&S ESPI)
8568A/B	1001	0 Hz	1.5 GHz	0 dBm	AC
8591E	401	0 Hz	3 GHz	0 dBm	AC
8594E	401	0 Hz	3 GHz	0 dBm	AC
71100C	1001	2 GHz	22 GHz	0 dBm	AC (R&S ESPI)
71200C	1001	2 GHz	22 GHz	0 dBm	AC (R&S ESPI)
71209A	1001	2 GHz	22 GHz	0 dBm	AC (R&S ESPI)

Note regarding the selection of 856x for the R&S ESPI:

- The # of trace points is not switched over until the state changes to REMOTE. In the case of switchover to manual operation (*LOCAL* key), the number of sweep points is always changed to 501.

- If necessary, the stop frequency specified in the table is restricted to the corresponding frequency range of the R&S ESPI.

IEC bus command:
```
SYST:LANG "SCPI" | "8560E" |
"8561E" | "8562E" | "8563E" |
"8564E" | "8565E" | "8566A" |
"8566B" | "8568A" | "8568A_DC" |
"8568B" | "8568B_DC" | "8591E" |
"8594E" | "71100C" | "71200C" |
"71209A"
```

2.4.3.3 ID Response String

➢ The *ID STRING FACTORY* softkey selects the default response to the command *IDN?.

   IEC bus command: --

➢ The *ID STRING USER* softkey opens the editor for entering a user-defined response to the command *IDN?. The max. length of the output string is 36 characters.

   IEC bus command: --

2.4.4 Setting the Screen Colors

➢ Press the *DISP* key.
   The *DISPLAY* menu will open.

➢ Press the *CONFIG DISPLAY* softkey.
   The submenu for configuring the screen will open.

➢ The *DEFAULT COLORS 1 and 2* softkeys set the default setting for brightness, tint and color saturation of all screen objects. The color schemes are selected in such a manner that all screen elements will be optimally visible regardless whether viewed from above or below. In the instrument's default setting, *DEFAULT COLORS 1* is active.
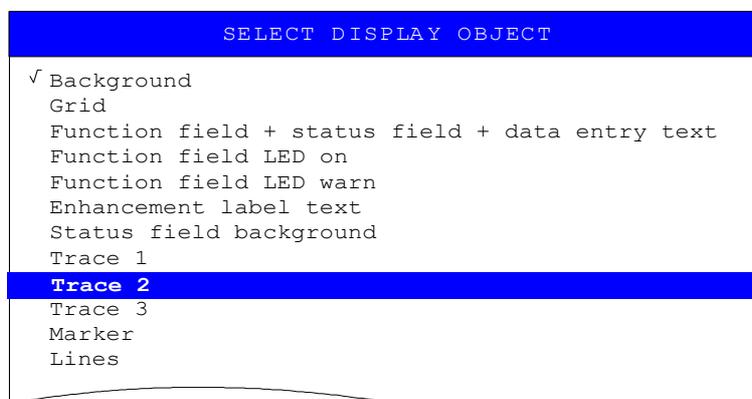
IEC bus command: `DISP:CMAP:DEF1`
                  `DISP:CMAP:DEF2`

The procedure for setting screen colors and brightness is as follows:

➢ Press the *NEXT* key.
The side menu for changing the screen colors will open.

The *SELECT OBJECT* softkey activates the selection of screen elements for which the color setting needs to be changed. Once this selection is made, the *PREDEFINED COLORS*, *BRIGHTNESS*, *TINT* and *SATURATION* softkeys can be used to change the overall color or the brightness, tint and color saturation of the selected element.

```
           SELECT DISPLAY OBJECT
 √ Background
   Grid
   Function field + status field + data entry text
   Function field LED on
   Function field LED warn
   Enhancement label text
   Status field background
   Trace 1
   Trace 2
   Trace 3
   Marker
   Lines
```

The *BRIGHTNESS* softkey activates entry of the brightness of the selected graphics element.

The entry value is between 0% and 100%.

IEC bus command: `DISP:CMAP5:HSL <hue>,<sat>,<lum>`

The *TINT* softkey activates entry of the tint for the selected graphics element. The percent value that is entered refers to a continuous color spectrum that ranges from red (0%) to blue (100%).

IEC bus command: `DISP:CMAP5:HSL <hue>,<sat>,<lum>`

The *SATURATION* softkey activates entry of the color saturation of the selected element.

The entry value is between 0% and 100%.

IEC bus command: `DISP:CMAP5:HSL <hue>,<sat>,<lum>`

The *PREDEFINED COLORS* softkey opens a list for selecting predefined colors for the screen objects:

```
          COLOR

√ BLACK
  BLUE
  BROWN
  GREEN
  CYAN
  RED
  MAGENTA
  YELLOW
```

IEC bus command: `DISP:CMAP1 ... 26:PDEF <color>`

2.4.5 Automatically Switching Off the Internal Screen

The R&S ESPI provides a feature for automatically switching off the screen after a user-defined period of time. The background lighting will be disabled if no entries are made from the front panel after the selected response time (key, softkey or hardkey and rotary knob).

To activate automatic switch-off:

➢ Press the *DISP* key.

➢ Press the *CONFIG DISPLAY* softkey.

➢ Press the *DISPLAY PWR SAVE* softkey.
  The softkey will have a color background, indicating that the power save mode
  is active. At the same time, the input window for the response time will open.

➢ Enter the desired response time in minutes and confirm the entry with the *ENTER* key.
  The screen will be disabled (turn dark) after the selected period of time.

To deactivate automatic switch-off:

➢ Press the *DISP* key.

➢ Press the *CONFIG DISPLAY* softkey.

➢ Press the *DISPLAY PWR SAVE* softkey twice.
  The color background of the softkey will disappear.
  The power save mode is now switched off.

2.4.6 File and Path Selection Using the Front Panel Keys

As of firmware version 4.3x the base system firmware supports new dialog boxes to select a folder and/or a file, e.g. for trace export.

The following section describes the usage of the instrument's front panel keys using TRACE EXPORT as an example.

➢ Press the *TRACE* key and then the *NEXT* softkey.

➢ Press the *ASCII FILE EXPORT* softkey to open the corresponding dialog box.
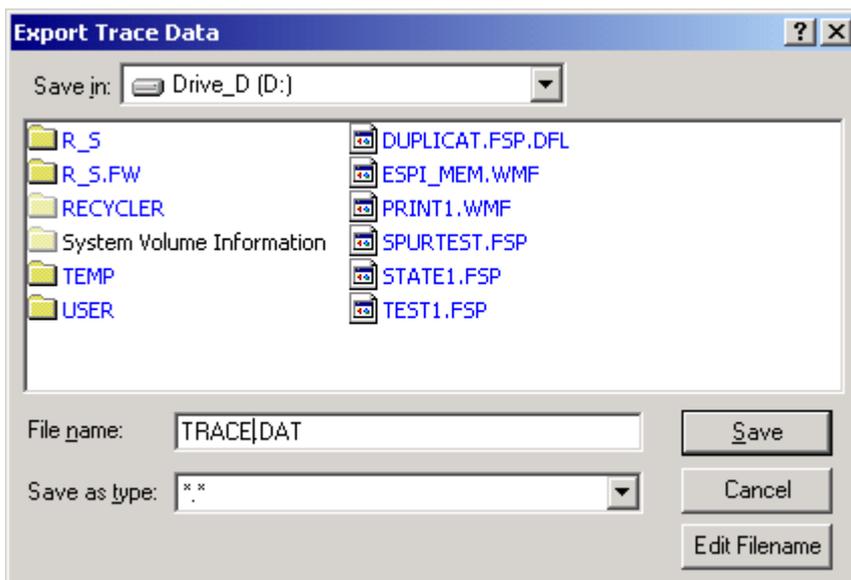
The focus is on the *File Name* field so you can directly edit the file name using the numeric keys, the cursor keys or the *BACK* key.

You can also use alphanumeric characters in the file name.

➢ To enter alphanumeric characters, select the *EDIT FILENAME* button. Confirm the selection with the ENTER key to open an online keyboard.
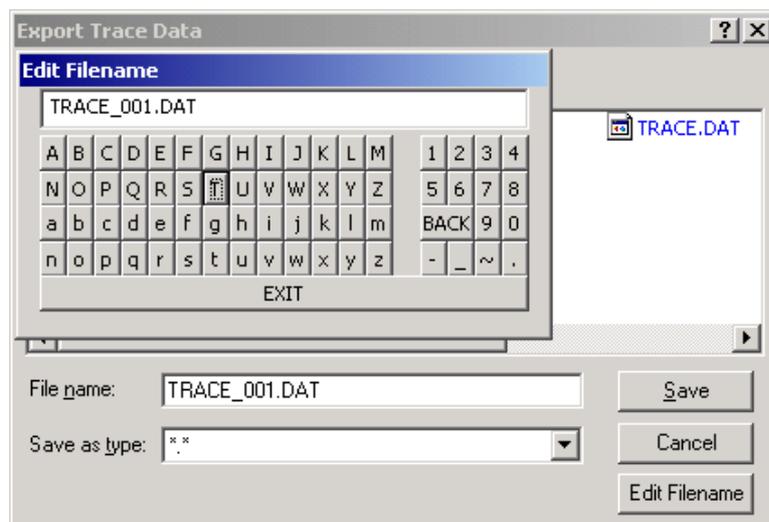
Select the characters with the rotary knob or the cursor keys and confirm with the ENTER key.

➢ Drive usage is checked according to the following rules:

- first, the R&S ESPI checks for a connected memory stick

- if a memory stick is not recognized, then the R&S ESPI uses the floppy drive

- if the R&S ESPI doesn't recognize a floppy drive or there is no floppy in the drive, the R&S ESPI uses the internal hard disk.

Note that the path and file name are reset to their default values after an instrument *PRESET*.

➢ Change the drive by moving the rotary knob until the focus is on the *Save In* field.

➢ Press the *CURSOR RIGHT* key to open the dropdown menu and select the drive you want to save the file to with the *CURSOR UP* and *CURSOR DOWN* keys. Confirm your selection by pressing the *ENTER* key.

➢ Select a subfolder by moving the rotary knob until the file / subfolder list is in focus. The selected file or subfolder in focus is framed by dotted line.
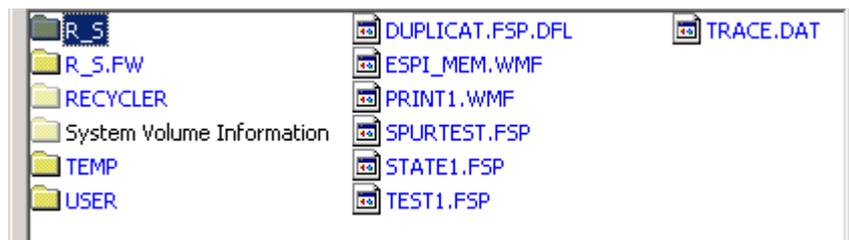

➢ Use the CURSOR UP or CURSOR DOWN keys to select a specific folder or file. To change the path or select a file, confirm your selection with the ENTER key.

Note that the R&S ESPI overwrites existing files with the new data.

2.4.7 Selecting and Configuring Printers

➢ Press the *HCOPY* key.
  The *HARDCOPY* menu will open.

➢ Press the *DEVICE SETUP* softkey.
  The dialog box for selecting the file format and printer will open:
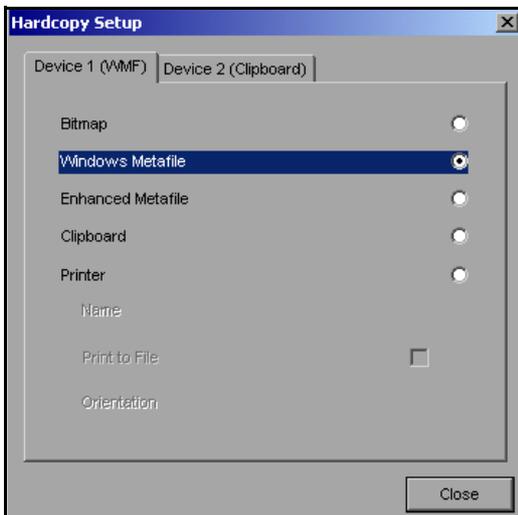
➢ You can select a connected printer (including a pre-configured network printer) by positioning the selection bar on the *Printer* entry by turning the rotary knob ⬭ and then confirming the selection by pressing the rotary knob or the *ENTER* key.

  After you confirm the selection, the entries *Name, Print to File* and *Orientation* will be made available and can also be accessed with the rotary knob.

➢ To select the printer type, open the selection list by pressing the rotary knob or the *ENTER* key after you access the *Name* field.
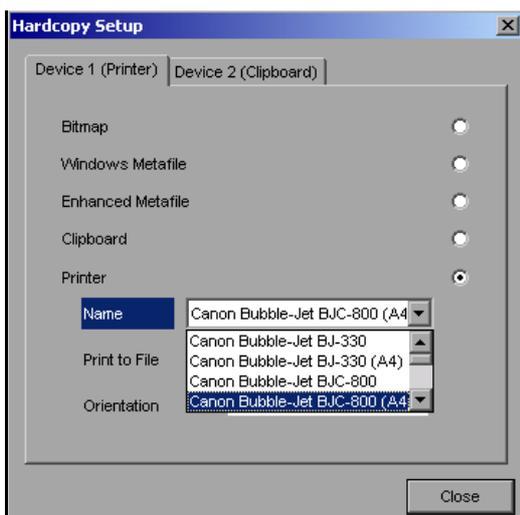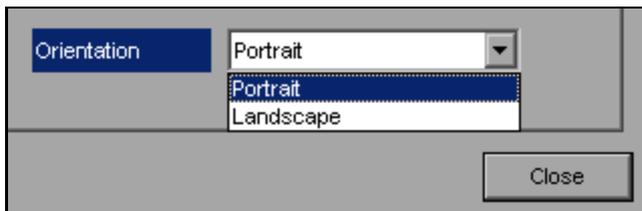

  From the selection list, you can now select the printer you want (in the example, this is *Cannon Bubble-Jet BJC800 (A4)*) by using the rotary knob again and then confirming your selection with *ENTER* or by pressing the rotary knob. The selection list will then disappear and the entry cursor will return to the *Name* field.

➢ You can also redirect the output to a file rather than to a printer. To do this, select the field *Print to File* by using the rotary knob and then mark the appropriate selection box or cancel the marking by pressing either the rotary knob or the *ENTER* key:

Print to File	☐

➢ You can select orientation for paper printout by using the *Orientation* field. To open the selection list, press the rotary knob or *ENTER*:

Orientation	Portrait ▼
	Portrait
	Landscape
	Close

From the selection list, you can now select the orientation you want (*Portrait* in the preceding figure) by using the rotary knob again and then confirm with *ENTER* or by pressing the rotary knob. The selection list will then close and the entry cursor will return to the *Orientation* field.

You can now close the dialog box by pressing the *ESC* key or by selecting and confirming the *Close* button.

2.4.7.1 Selecting Alternative Printer Configurations

The R&S ESPI can support two independent hardcopy settings. This allows you to quickly switch between output to a file and a printer.

➢ To make a selection, use the *DEVICE 1 / 2* softkey, which simultaneously shows the associated setting when the *Hardcopy Setup* dialog box is open.

IEC bus command: –

2.4.7.2 Selecting Printer Colors

➢ The *COLORS* softkey opens the submenu for selecting the colors for the printout. To make it easier for you to select colors, the selected hardcopy color combination is displayed on screen when you access the menu. When you exit the menu, the system switches back to the previous color combination.

➢ The *COLOR ON OFF* softkey switches from color output to black-and-white printout. In this case, all background colors will be printed out in white and all color lines in black. This allows you to improve contrast on the printout. The basic setting is COLOR ON.

IEC bus command: `HCOP:DEV:COL ON`

➢ The *SCREEN COLORS* softkey selects the current screen colors for the printout.

The background will always be printed out in white and the grid in black.

IEC bus command: `HCOP:CMAP:DEF1`

➢ The *OPTIMIZED COLORS* softkey selects an optimized color setting for the printout in order to improve color clarity on the printout.

With this selection, trace 1 will be printed out in blue, trace 2 in black, trace 3 in green and the markers in turquoise.

The other colors correspond to the screen colors of the *DISP – CONFIG DISPLAY - DEFAULT COLORS 1* softkey.

> The background will always be printed out in white and the grid in black.

IEC bus command: `HCOP:CMAP:DEF2`

➢ The *USER DEFINED* softkey opens a submenu for user-defined color selection (see the *USER DEFINED COLORS* submenu).

The procedure for making the settings is similar to that for setting the screen colors.

IEC bus command: `HCOP:CMAP:DEF3`

2.4.8 Installing Plug&Play Printers

Plug&play printers can be easily installed under Windows XP:

After you connect and switch on a printer, Windows XP automatically detects the printer and installs the associated driver, provided that the driver is contained in the Windows XP installation.

If Windows XP does not find the printer driver, it will prompt you to enter a path for the associated installation files. In addition to the pre-installed drivers, a number of additional printer drivers are found in the D:\I386 directory.

You can find a detailed step-by-step procedure in Appendix A, section " Installing Non-Plug&Play Printers" on page A.6.

> When you install printer drivers that are not pre-installed on the instrument, the installation process will prompt you to specify the path containing the new driver. This can be a memory stick or USB CD-ROM drive (see the section " Connecting USB Devices (e.g. a Power Meter)" on page 2.12).

Configuring the LAN Interface (Option R&S FSP-B16 only)

2.4.9 Installing Non-Plug&Play Printers

The procedure for installing non-plug&play printers is described in appendix A, section " Installing Non-Plug&Play Printers" on page A.6.

## 2.5 Configuring the LAN Interface (Option R&S FSP-B16 only)

The instrument can be connected to an Ethernet LAN (local area network) using the LAN interface connector on the rear panel. This makes it possible to transfer data over the network and to use network printers. In addition, the instrument can be remote-controlled via the network. The network card can be operated with a 10 MHz Ethernet IEEE 802.3 or a 100 MHz Ethernet IEEE 802.3u interface.

2.5.1 Connecting the Instrument to the Network

Before connecting the instrument to the network, consult your network administrator, particularly in the case of large LAN installations. Connection errors may affect the entire network.

Connect a conventional RJ-45 cable (not supplied) to the rear panel of the instrument and a network hub of the required LAN segment. Since the RJ-45 involves star configuration rather than bus cabling, no special measures need to be taken.
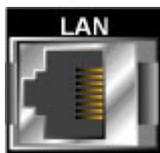
Setting up the connection does not cause any problems on the network. Likewise, disconnecting the instrument from the network does not cause any problems as long as no data traffic to and from the instrument is in progress.

2.5.2 Configuring the Network Card

2.5.2.1 Driver Installation

Under Windows XP, network card drivers do not need to be installed separately if the option R&S FSP-B16 has been factory-installed.

All you need to do is connect the network cable to the LAN-Interface connector on the instrument rear panel. Windows XP automatically detects the network connection and activates the required drivers.

2.5.2.2 Configuring the Interface

To configure the interface, do the following:

➢ Press the SETUP key.
The SETUP menu will open.

➢ Press the GENERAL SETUP softkey.
The submenu with all general settings will open.

➢ Press the *CONFIGURE NETWORK softkey*.
The dialog box with the network settings will open.
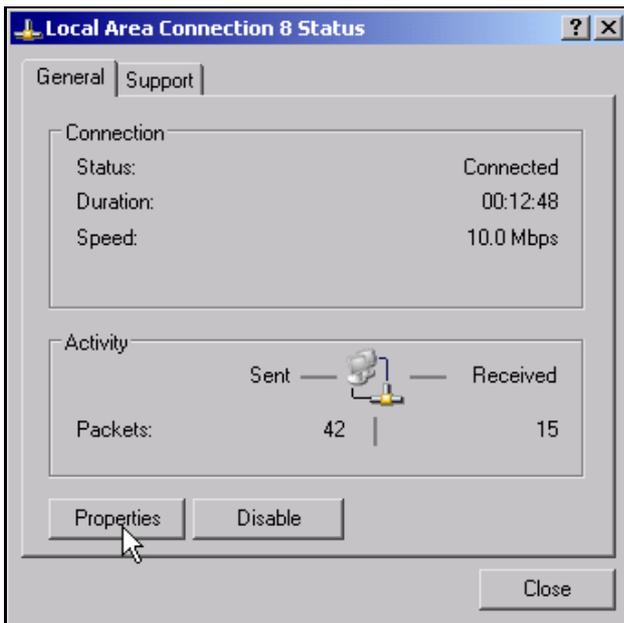
This softkey allows you to change the existing network configuration depending on the selection of the affected registration cards (see section " Configuring Existing Network Protocols (TCP/IP Protocol)" on page 2.30).

    IEC bus command: –

> Before you can configure network support, a PC keyboard with a trackball (or an additional mouse rather than a trackball) must be connected.

2.5.2.3 Configuring Existing Network Protocols (TCP/IP Protocol)

Before starting, check whether your network a DHCP server. If necessary, ask your network administrator.

• If your network has a DHCP server, the IP address is to be requested from a DHCP server automatically. This is the default setting and no change of configuration is necessary.

• If your network has no DHCP server, change the settings according to the following step-by-step instructions. Use IP addresses and subnet masks suitable for your network. If necessary, contact your network administrator.

Configuring the LAN Interface (Option R&S FSP-B16 only)

➢ Open the Windows XP Start menu by pressing the Windows key or *CTRL+ESC*.

➢ Click *Settings - Network Connections - Local Area Connection*.
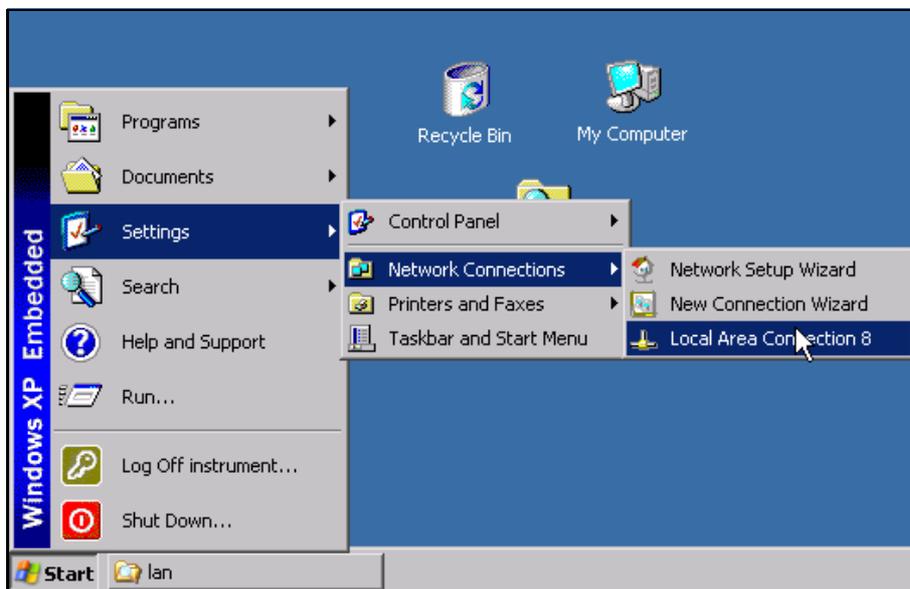
The *Local Area Connection Status* dialog box will open.
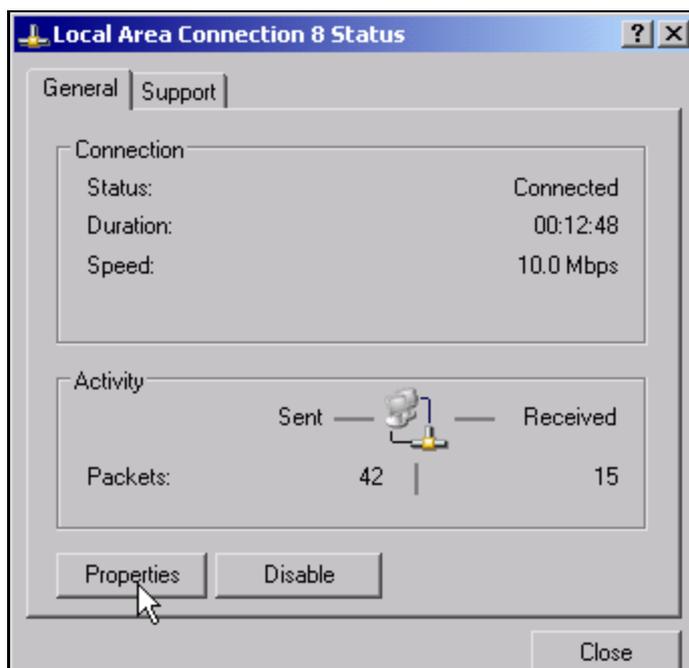
Windows XP automatically appends numbers to the name Local Area Connection Status (e.g. Local Area Connection Status 8) if the configuration is set up using the New Connection wizard. These numbers are not important in the following configuration steps and are therefore omitted.

Configuring the LAN Interface (Option R&S FSP-B16 only)

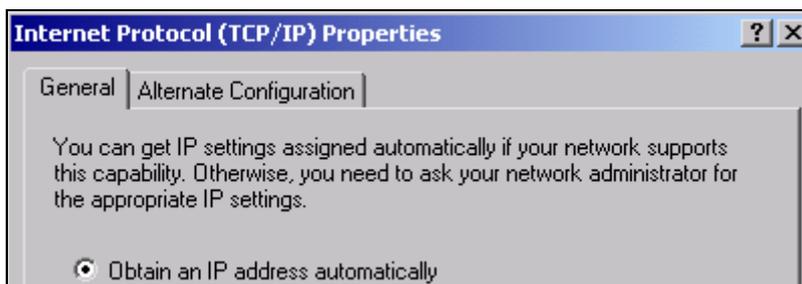➢ Click the *Properties* button.
The window with the available network protocols opens.
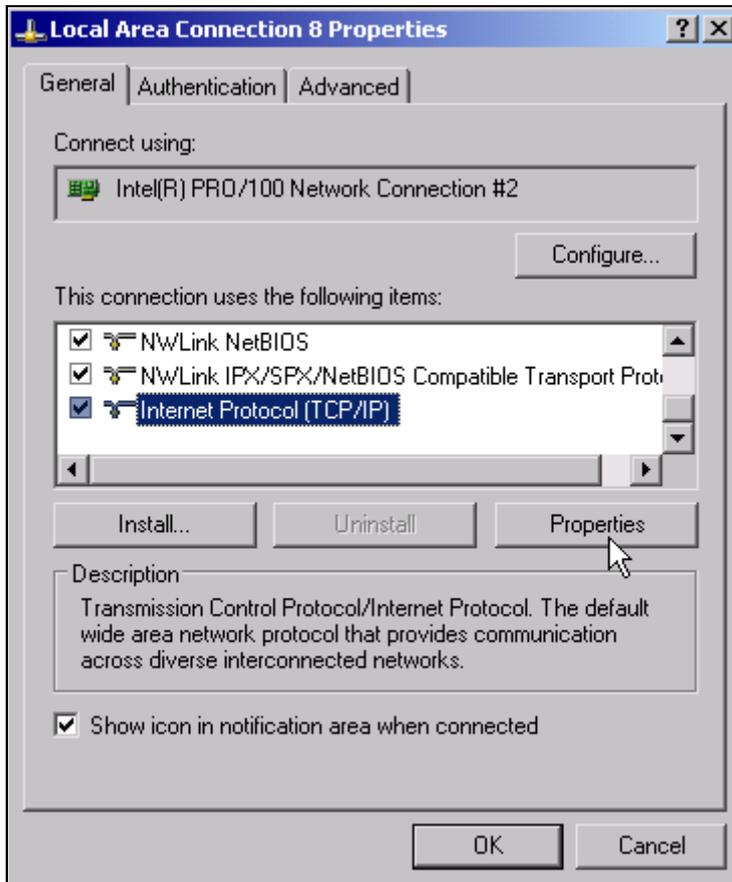
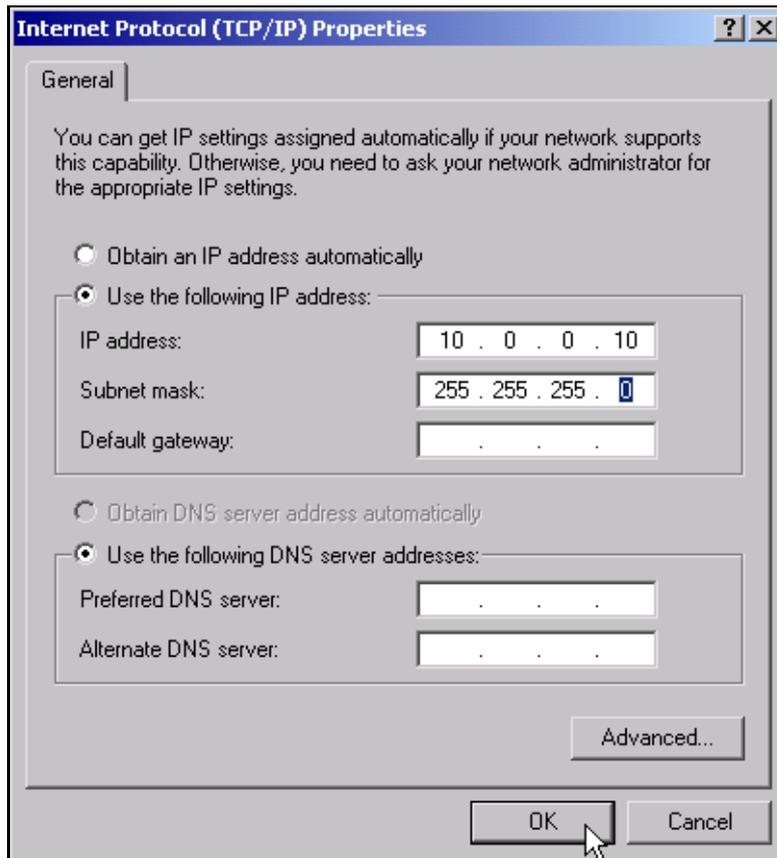➢ Click the network protocol you want (TCP/IP in the example).

➢ Click the *Properties* button.
The dialog box with the settings for the selected network protocol will open. By default, *Obtain an IP address automatically* is selected.

➢ Select *Use the following IP address* to enter a predefined IP address.

Configuring the LAN Interface (Option R&S FSP-B16 only)

➢ Select *IP address* and enter the IP address.

➢ Select *Subnet mask* and enter the required mask.

➢ Click *OK*.
Windows XP will check the entered settings for correctness and then store the configuration.

If you have entered an invalid IP address or subnet mask, an error message will appear that also asks you whether you want to enter a different address or mask:
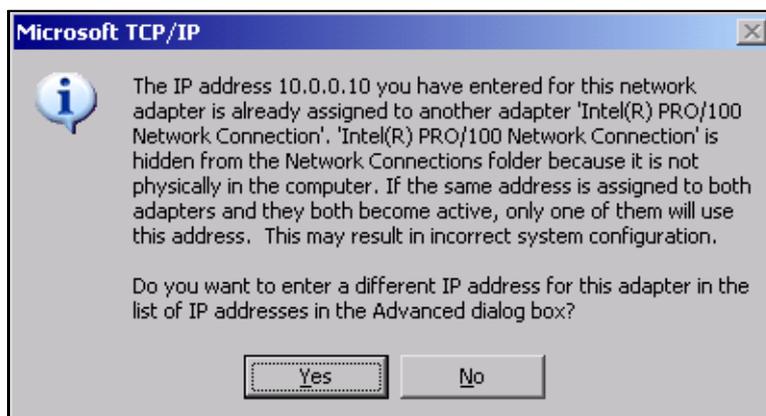
➢ Click *Yes*.
The dialog box for entering the TCP/IP parameters will open again.

If all settings are correct, you will be prompted to restart the instrument if required by the changes.
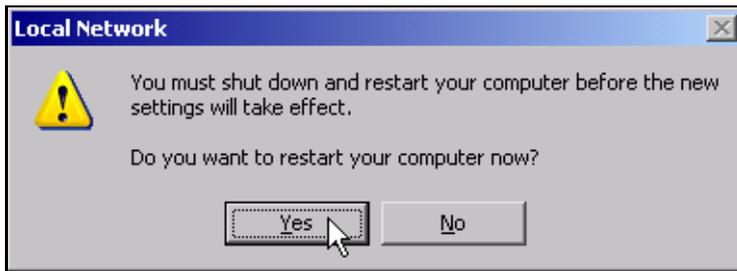
➢ Click *Yes*.
  Windows XP will restart the system.

2.5.2.4 Installing Additional Network Protocols and Services

The procedure for installing additional network protocols and services is provided in the chapter " Installing Additional Network Protocols & Services" on page 6.3.

2.5.3 Login

Windows XP requires that users identify themselves by entering a user name and password in a login window. The instrument 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* (lowercase) are set.

For information on how to deactivate the automatic login, refer to chapter " LAN Interface", section " Deactivating the Automatic Login Mechanism" on page 6.14.

2.6 Operating System Properties

2.6.1 Properties Specific to Windows XP

The instrument contains the Windows XP operating system. To ensure that the instrument software functions properly, certain rules must be adhered to when using the operating system.

NOTICE

The drivers and programs used under Windows XP have been adapted to the instrument. To avoid impairments to instrument function, use only the settings described in the Operating Manual and this manual.

Only update software approved by Rohde & Schwarz may be used to modify existing instrument software. Likewise, only programs approved by Rohde & Schwarz for use on the instrument may be run on the instrument.

Login

For details refer to section " Login" on page 2.34.

Administrator ID

The ID used by the instrument to perform auto login has administrator rights.

2.6.1.1 Windows XP Service Packs

The Windows XP operating system on the instrument is supplied with pre-installed XP service packs (SP2 and additional updates/fixes) that are necessary and suitable for operating the instrument.

NOTICE

Possible impairment of the instrument functioning

The instrument is equipped with the Windows XP operating system. It is thus possible to install commercial off-the-shelf software on the instrument. The use and installation of commercial software may impair the instrument functions. We recommend that you only execute programs tested by Rohde & Schwarz with regard to their compatibility to the instrument software. The program packages that have been tested are listed in section " Windows XP Software Approved for the Instrument".

Install only service packs approved by Rohde & Schwarz to avoid impairment of instrument functions that could lead to the necessity to repair the instrument.

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

2.6.1.2 Opening the Windows XP Start Menu

You can open the Windows XP Start menu by pressing the Windows key ( ) or the key combination *CTRL+ESC*. From the start menu, you can navigate to the submenus by using the mouse or the arrow keys. To return to the measurement screen, activate the *R&S Analyzer Interface* button in the task bar.

You can also open the Windows Start menu with the *OPEN START MENU* softkey in the SETUP menu.

2.6.1.3 Windows XP Software Approved for the Instrument

The driver software that is used and the system settings of Windows XP have been fine-tuned to support the measurement functions of the R&S ESPI. Thus, flawless instrument function is ensured only if software and hardware approved or offered by Rohde & Schwarz are used.

Using other software or hardware may cause the functions of the R&S ESPI to perform improperly or fail.

The following program packages have been successfully tested for compatibility with the measurement instrument software:

- R&S FS-K3 – Software for measuring noise factor and gain

- R&S FS-K4 – Software for measuring phase noise

- R&S Power Viewer (virtual power meter for displaying results of the power sensors of the R&S NRP-Zxx series)

- Windows XP Remote Desktop

- FileShredder – For reliable deletion of files on the hard disk

- Symantec Norton AntiVirus – Virus-protection software

- McAfee Virusscan

3   Firmware Update and Installation of Firmware Options

3.1 Firmware Update

For the latest firmware version refer to the Rohde & Schwarz internet site and download the most up-to-date firmware.

A detailed description about performing the firmware update in the intrument is given in the release note, provided on this CD. The release note is also downloadable from the Rohde & Schwarz internet site.

You can install a new firmware version by using the built-in disk drive, a memory stick, a USB CD-ROM, or LAN. The firmware update kit contains several disks whose contents must be stored in separate directories (Disk1 to Disk<n>) when a memory stick or LAN is used. Start the installation program from the *SETUP* menu.

➢ Press the *SETUP* key.
   The *SETUP* menu will open.

➢ Press the *NEXT* key.
   The side menu will open.

➢ Press the *FIRMWARE UPDATE* softkey.
   The subdirectory for installing or uninstalling new firmware versions will open.

➢ Press the *UPDATE PATH* softkey (only in the case of firmware updates via a memory stick, CD-ROM or LAN). The entry field for the path with the set of update disks will open.

➢ Enter the drive name and directory and confirm with *ENTER*.

   Example:

   The firmware update files are stored on a memory stick in the *Update* directory. They are allocated in the *Disk1* to *Disk<n>* subdirectories. After you insert the memory stick, it will be detected as drive *E:*.

   In this case, the required path specification is *E:\UPDATE*.

➢ To start the installation program, press the *FIRMWARE UPDATE* softkey in the submenu.

➢ Confirm the query *DO YOU REALLY WANT TO UPDATE THE FIRMWARE?* with *OK*.
   The installation program will then guide you through the remainder of the update procedure.
   The instrument will perform several automatic shutdowns, until the new base system firmware is installed properly.

NOTICE

Do not switch the instrument off until the update process has been finished completely.

IEC bus command: `"SYST:FIRM:UPD 'E:\UPDATE'"`

➢ To restore the previous firmware version, press the *RESTORE FIRMWARE* softkey.

IEC bus command: `--`

3.2 Activating Firmware Options

Firmware options are enabled by entering license keys via the following operating sequence:

➢ Press the *SETUP* key.
The *SETUP* menu will open.

➢ Press the *GENERAL SETUP* softkey.

➢ Press the *OPTIONS* softkey.
The *OPTIONS* menu will open. Options already available are listed in a table that is displayed when the submenu is opened.

➢ Press the *INSTALL OPTION* softkey.
The field for entering the license key for the firmware option now appears.

After you enter a valid license key, *OPTION KEY OK* will appear in the message line and the option will be entered in the *FIRMWARE OPTIONS* table.

If you enter an invalid license key, the message *OPTION KEY INVALID* will appear in the message line.

➢ The *REMOVE OPTION* softkey deletes all existing firmware options. To prevent unintentional deletion, the system asks you to confirm that you really want to perform this operation.

4   Basic Operation
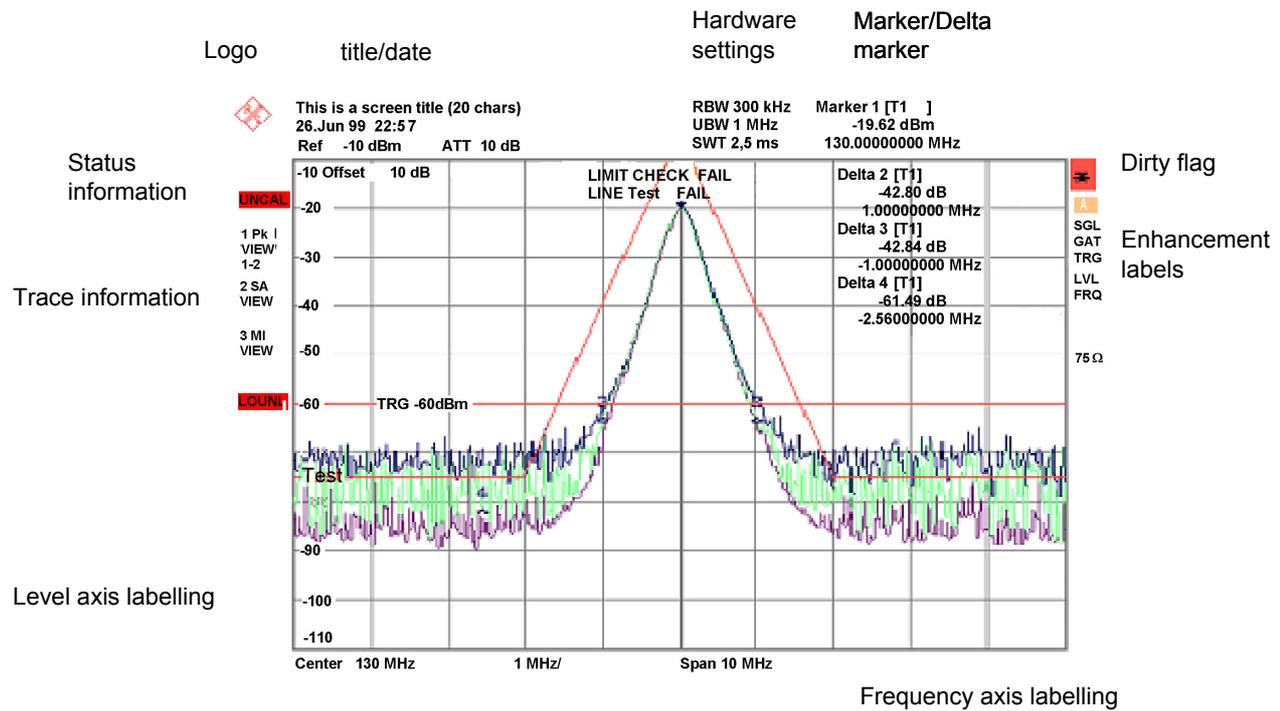
4.1 Diagram Layout

Fig. 4-1   Screen layout of the R&S ESPI during analyzer operation

4.1.1 Displays in the Diagram Area

Hardware settings

Ref Display of the reference level.

Offset Display of the reference level offset.

Att Display of the RF attenuation that has been set.

RBW Display of the resolution bandwidth that has been set.
If the bandwidth does not correspond to the value for automatic coupling, a green asterisk "*" will appear in front of the field.

MT Indication of the measurement time

PREAMP Indication of the preamplifier status

VBW Display of the video bandwidth that has been set.
If the bandwidth does not correspond to the value for automatic coupling, a green asterisk "*" will appear in front of the field.

SWT Display of the sweep time that has been set (*SWEEP TIME*).
If the sweep time does not correspond to the value for automatic coupling, an asterisk "*" will appear in front of the field. The color of the asterisk will turn to red if the sweep time is set below the value for automatic coupling. In this case, the sweep time must be increased.

Marker / Contains the x and y axis positions of the last marker or delta marker that was set
Delta as well as its index. The value in the square brackets after the index indicates the trace to which the marker is assigned as well as the active measurement function.

The measurement functions of the markers are indicated with the following abbreviations:

- FXD Reference fixed marker active

- PHN Phase noise measurement active

- CNT Frequency counter active

- TRK Signal track active

- NOI Noise measurement active

- MOD Measurement of the AM modulation depth active

- TOI measurement active

LIMIT Display of the results of the limit check.
CHECK

Status displays

The status displays on the left side of the diagram indicate any irregularities (e.g. UNCAL).

UNCAL   Indicates that one of the following conditions is present:

- Correction data has been switched off (*CAL* menu, *CAL CORR OFF*).

  – Switch on the correction *CAL CORR ON* or *PRESET*.

- No valid correction values are available. This occurs, for example, if a firmware update is performed followed by a cold start of the instrument.

  – Record the correction data (*CAL* menu, *CAL TOTAL*).

OVLD   Indicates an overload of the input mixer.

  – Increase the RF attenuation.

IFOVL   Indicates an overload of the IF signal path after the input mixer.
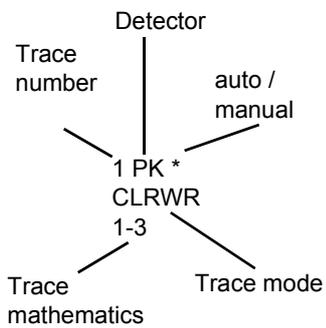
  – Increase the reference level.

LOUNL   Indicates that an error was detected in the instrument's frequency processing hardware.

EXREF   Is displayed if the instrument was set to an external reference but no signal was detected on the reference input.

OVEN   Indicates that the OCXO reference frequency (option R&S FSP-B4) has not yet reached its operating temperature. The message usually disappears a few minutes after power-on.

OVTRC   Indicates a temporary overload condition of the input mixer or IF signal path while the trace is measured with Max Hold, Min Hold or Average (Overload Trace). OVLD and IFOVL override this indication.

Trace information

```
            Detector
Trace                 auto /
number                manual
            1 PK *
            CLRWR
            1-3
Trace              Trace mode
mathematics
```

Trace #
Trace number

Detector
Selected detector:

- AP: AUTOPEAK detector

- PK: MAX PEAK detector

- MI: MIN PEAK detector

- SA: SAMPLE detector

- AV: AVERAGE detector

- RM: RMS detector

- QP: QUASIPEAK detector

auto / manual
The selected detector does not match the one for automatic coupling.

Trace Mode
Display of the sweep mode:

- CLRWR: CLEAR/WRITE

- MAXH: MAX HOLD

- MINH: MIN HOLD

- AVG: AVERAGE

- VIEW: VIEW

Trace Mathematics
Indicates that the trace difference function is activated, e.g. 1-3 in the example means that trace 3 is subtracted from trace 1.

Enhancement labels:

The enhancement labels on the right-hand side of the measurement diagram indicate that the user chose instrument settings that affect the measurement results even though this is not immediately apparent from the display of the measured values.

* (star)	The current instrument setting does not match the one during which the displayed traces were recorded. This occurs in the following cases:

- The instrument setting is changed while a measurement is in progress.
- The instrument setting is changed in the SINGLE SWEEP mode after the end of the sweep, and a new sweep is not started.
- The instrument setting is changed after a trace has been set to VIEW.

The display remains on screen until the user eliminates the cause. In some cases, this involves starting a new sweep (SINGLE SWEEP mode) or switching the affected trace to BLANK.

A/B	Designation for screen A/B. If screen A/B is activated for entering measurement parameters, the label background will be in color.
SGL	The sweep is set to SINGLE SWEEP.
GAT	The frequency sweep is controlled via the EXT TRIG/GATE connector.
TRG	Instrument triggering is not free running ($\neq$ FREE RUN).
LVL	A level offset $\neq$ 0 dB is set.
FRQ	A frequency offset $\neq$ 0 Hz is set.
TDF	A TRANSDUCER FACTOR is activated.
TDS	A TRANSDUCER SET is activated.
PRN	Printer output is active.
75 Ω	The input impedance of the instrument is set to 75 Ω.
EXT	The instrument is configured for operation with an external reference.
PA	The RF PREAMPLIFIER is switched on (option R&S ESPI-B2).
PS	The PRESELECTOR is switched on.
3DB	Gauss Filter (3 dB)
6DB	EMI Filter (6 dB)
FFT	FFT Filter
CHN	Channel Filter
RRC	RRC Filter

4.2 Setting Parameters

4.2.1 The Keypad

The keypad is used to enter numeric parameters. It contains the following keys:

• Numeric keys 0...9

• Decimal point

 Inserts a decimal point "." at the cursor position.

• Sign key

 Changes the sign of a numeric parameter.
 In the case of an alphanumeric parameter, inserts a "-" at the cursor position.

• Unit keys (*GHz/-dBm MHz/dBm, kHz/dB* and *Hz/dB*)

 These keys add the selected unit to the entered numeric value and complete the entry.

 In the case of level entries (e.g. in dB) or dimensionless values, all units have the value "1" as multiplying factor. Thus, they have the same function as an *ENTER* key. The same is true for an alphanumeric entry.

 In addition, the unit keys open and close selection fields in tables (subtables).

• *BACK* key

 – If a numeric entry has already been started, this key deletes the character to the left of the cursor.

 – If an entry has been completed or not yet started, this key toggles between the currently and previously valid value (UNDO function).

• *ESC/CANCEL* key

 – Closes the entry field if an entry has been started or has not yet been made. The original value is retained.

 – Closes the entry field if an entry has been completed.

 – Closes the *System Messages* dialog box.

• *ENTER* key

 – Concludes dimensionless entries. The new value is accepted.

> With frequency entries, the *ENTER* key corresponds to the *Hz* key. With time data, it corresponds to the µs (kHz) key.

4.2.2 The Rotary Knob and Arrow Keys

The rotary knob and arrow keys are located next to the keypad.

The rotary knob has several functions:

- Increments (clockwise direction) or decrements (counterclockwise direction) the instrument parameter at a defined step width in the case of a numeric entry.

- Shifts the selection bar horizontally or vertically within tables as long as an entry field is not open. The arrow keys are used to change the direction of motion (horizontal/vertical).

- Selects the individual letters when the alphanumeric editor is used.

- Shifts markers, limit lines, etc. on the screen.

- When it is pressed, it concludes an entry.

Within a table, the arrow keys move the selection bar to the desired position.

Within the alphanumeric editor, the ◁ or ▷ arrow keys move the cursor to the desired position.

The ⌃ or ⌄ arrow keys do the following:

- Increase or decrease the instrument parameter in the case of numeric entries.

- Switch between the editing line and the character selection in the case of alphanumeric entries.

4.2.3 Editing Numeric Parameters

Numeric values are always entered in a data entry field that automatically appears after the parameter is selected.

START FREQUENCY	——— Title line with parameter designation
10.2457535 GHz	——— Editing line with parameter value and unit
START FREQUENCY OUT OF RANGE	——— Status and error messages

The title line shows the name of the instrument parameter that was selected. The entry is performed in the editing line. After the entry field is opened, it will contain the currently valid parameter value and its unit. The optional third and fourth lines show status and error messages which always refer to the current entry.

4.2.4 Editing Alphanumeric Parameters

If an external keyboard is not available, the character selection field is automatically opened for entering alphanumeric parameters. Two models of the alphanumeric editor are available.

4.2.4.1 Alphanumeric Editor Type 1:
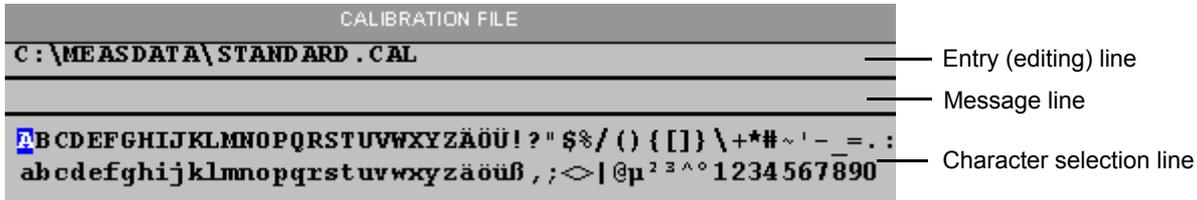
The ⬆ or ⬇ arrow keys switch between the editing line and the character selection field.

Entering the text

➢ Select the parameter.
Data entry is automatically activated after the data entry field is opened. The cursor is now located at the start of the previous entry in the editing line.

➢ Using the ⬇ arrow key, place the cursor in the character selection field.
The cursor now marks the first letter of the editor.

➢ Using the ◁ and ▷ arrow keys or the rotary knob, place the cursor on the character that you want to enter in the editing line.

➢ Press either the *ENTER* key or the rotary knob.
The character will be added to the editing line.

Correcting the entry

➢ Using the ⬆ arrow key, place the cursor in the editing line.

➢ Using the ◁ and ▷ arrow keys or the rotary knob, place the cursor after the character you want to delete.

➢ Press the *BACK* key.
The entry to the left of the cursor will be deleted.

Correcting the entry

➢ Using the ⬆ key, place the cursor in the editing line.

➢ Press one of the unit keys or the rotary knob.
The data entry field will close, and the new entry will be accepted by the instrument.

Cancelling the entry

➢ Press the *ESC* key.
The data entry field will close, and the previous entry will be retained.

4.2.4.2 Alphanumeric Editor Type 2:

A	B	C	D	E	F	G	H	I	J	K	L	M		1	2	3	4	5	6	7	8	9	0
N	O	P	Q	R	S	T	U	V	W	X	Y	Z		:	\	.	/	^	+	-	=		,
a	b	c	d	e	f	g	h	i	j	k	l	m		<	>	(	)	{	}	[	]	#	~
n	o	p	q	r	s	t	u	v	w	x	y	z		'	@	;	|	?	!	"	€	$	%
SPACE														«	»	BACK			EXIT				

The entry area consists of two parts:

- The editing line
- The character selection field

The ⇧ or arrow keys switch between the editing line and the character selection field.

Entering the text

➢ Select a parameter.
Data entry is automatically activated after the data entry field is opened. In tables, the character selection field is accessed by using the ⇩ arrow key.
The cursor is now located at the start of the existing entry in the editing line.

➢ Using the ⇩ arrow key, place the cursor in the character selection field.
The cursor now marks the first character of the editor.

➢ Using the ◁ and ▷ arrow keys or the rotary knob, place the cursor on the character that you want to enter in the editing line.

➢ Press the *ENTER* key or the rotary knob.
The character will be added to the editing line.

Correcting the entry (alternative 1)

➢ Using the rotary knob, go to the << character in the character selection field.

➢ By pressing the rotary knob on << and >>, place the cursor after the character you want to delete.

➢ Using the rotary knob, select the BACK field and press the rotary knob.
The entry to the left of the cursor in the editing line will be deleted.

Correcting the entry (alternative 2)

➢ Using the ⇧ arrow key, place the cursor in the editing line.

➢ Using the ◁ and ▷ arrow keys or the rotary knob, place the cursor after the character you want to delete.

➢ Press the *BACK* key.
The entry to the left of the cursor will be deleted.

Completing the entry (alternative 1)

➢ Using the rotary knob, select the EXIT field and then press the rotary knob.
The data entry field will close, and the new entry will be accepted by the instrument.

Completing the entry (alternative 2)

➢ Using the ⬆ arrow key, place the cursor by the editing line.

➢ Press one of the unit keys or the rotary knob.
The data entry field will close, and the new entry will be accepted by the instrument.

Cancelling the entry

➢ Press the *ESC* key.
The data entry field will close, and the previous entry will be retained.

5   Basic Measurement Examples

5.1 Introduction

This section describes a typical and simple measurement task for an EMI test receiver. Each operating step is explained with the aid of R&S ESPI for rapid familiarization of the user without the need to know all the details of the operating functions.

In the introductory example a standard measurement of level and frequency is performed with the aid of the *SCAN TABLE*. This measurement is an overview and pre-certification measurement to be performed before the final standard-conformal measurement is carried out. Each operating step is explained with the aid of R&S ESPI for rapid familiarization of the user without the need to know all the details of the operating functions.

> If unknown (RFI) signals are to be measured, it is strongly recommended to provide for at least 10 dB RF attenuation at the RF input in order to protect the input circuit.

In the following example, the R&S ESPI is set to default values in the receiver mode. The default setup is activated by pressing first the *RECEIVER* hotkey and then the *PRESET* key.

The main default parameters in receiver mode are listed in the following table:

Parameter	Setting
Receiver frequency	100 MHz
RF attenuation	Auto
Preamplifier	Off
Detector	AV
Measurement time	100 ms
RES bandwidth	120 kHz
Demodulator	Off
Trigger	Free run

5.2 Performing a Level and Frequency Measurement

Measurement

Measurement and display of RFI signal levels versus frequency is one of the most frequent tasks performed by an EMI Test Receiver. In the case of unknown signals, *PRESET* values will mostly be used for the measurement. If levels higher than +137 dBμV (10 dB RF attenuation) are expected or possible, a power attenuator has to be connected in front of the EMI Test Receiver input. Very high levels may otherwise damage or destroy the attenuator or input mixer.

Main Test Receiver Functions

The main functions required for the level and frequency measurement are setting the *SCAN TABLE* (*START FREQUENCY, STOP FREQUENCY, STEPSIZE*), selecting the resolution (IF) bandwidth (*RES BW*), setting the measurement time (*MEAS TIME*) and selecting the detectors (e.g. peak or average) and *MARKER* functions required for the analysis.

Measurement Sequence - Level and Frequency Measurement

In this example, the spectrum of the signal present at RF INPUT is recorded in the frequency range 150 kHz to 30 MHz. The *SCAN TABLE* and associated parameters are manually set. The example is generally suitable for all fast pre-compliance measurements required for measuring unknown noise spectra of DUTs in the development stage and for modifying prototypes and can be used as a basis for final tests later on.

The high speed of fully synthesized scans, the frequency and amplitude accuracy and the wide dynamic range of the R&S ESPI EMI Test Receiver are of utmost importance and very useful for these measurements.

Short form

1. Reset the instrument.
2. Select the receiver mode.
3. Program a SCAN TABLE.
4. Select the detectors.
5. Apply the signal.
6. Start the scan.
7. Analyze the level in frequency domain.
   – Analyze the level in frequency domain using the marker functions.
   – Analyze the level in frequency domain using the peak search functions.
8. Set the SPLIT SCREEN function.
9. Tune the receiver frequency and obtain final test results using the QUASIPEAK detector.
10. From overview to standard-conformal measurement

11. Store the test results, tables or diagrams.

Detailed procedure

1. Reset the instrument.

➢ Press the *PRESET* key.

2. Select the receiver mode.

➢ Press the *RECEIVER* hotkey.

The receiver mode is set. The main receiver menu is displayed:
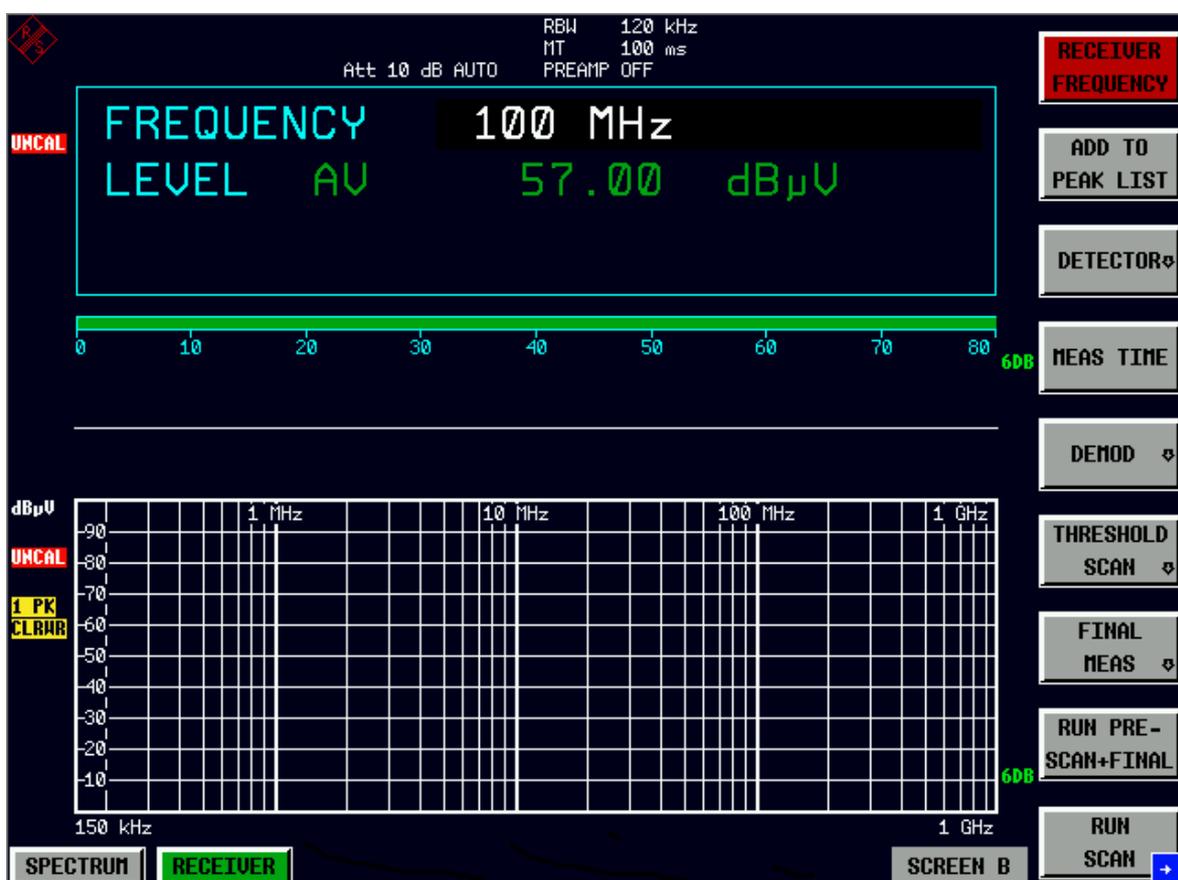
Fig. 5-1   Display after selecting the default setup in receiver mode

3. Program a SCAN TABLE.

➢ Press the *SWEEP* key.

➢ Press the *USE SCAN TABLE* softkey.

A dialog box is displayed where the whole display range can be defined and divided into scan subranges.
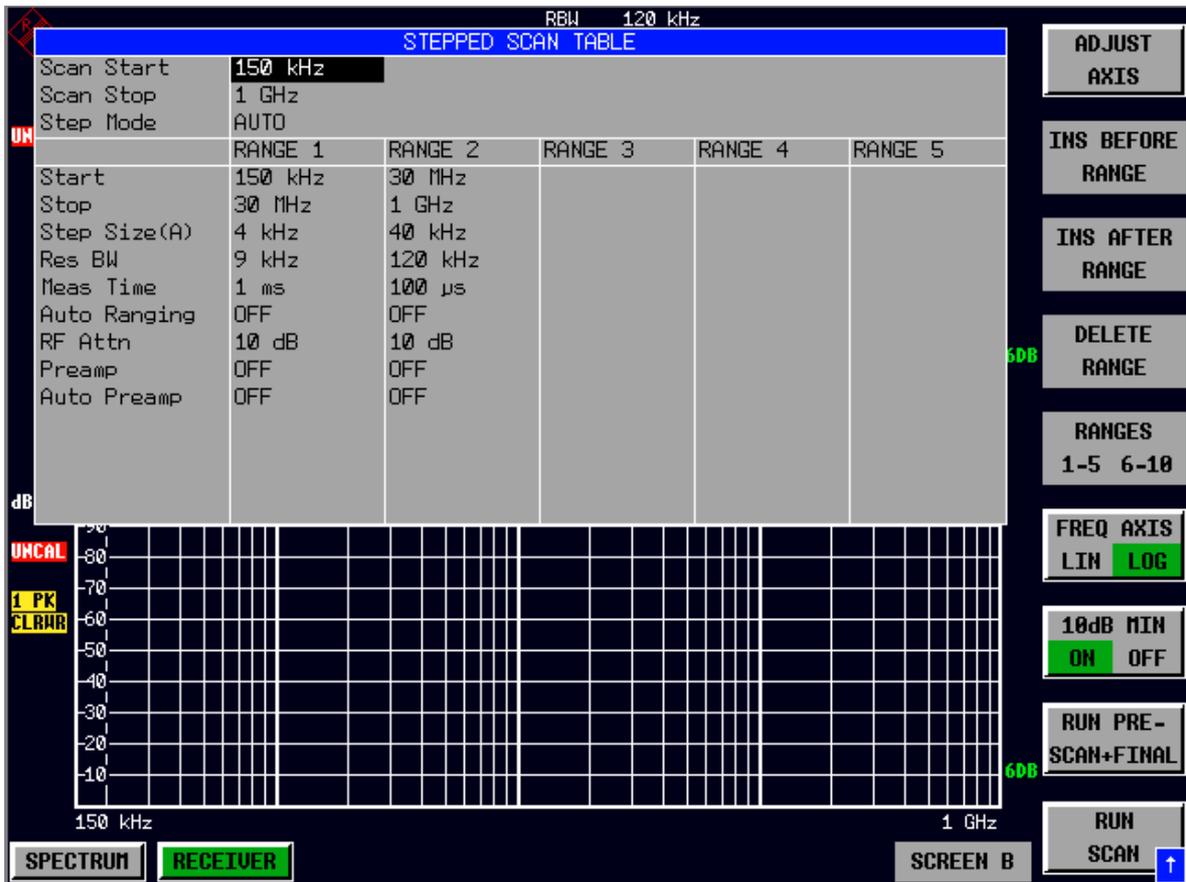
Fig. 5-2   Scan range after selecting default setup with PRESET

After *PRESET* a scan range of 150 kHz to 1 GHz is set on the frequency axis. The stop frequency is set to 30 MHz.

➢ Press the ⬇ arrow key repeatedly until a line is marked in the *SCAN TABLE*.

➢ Press the ➡ arrow key field.

An entry in the *RANGE 2* column is marked.

➢ Press the *DELETE RANGE* softkey.

All entries in the *RANGE 2* column are cleared. The following *SCAN TABLE* is displayed:
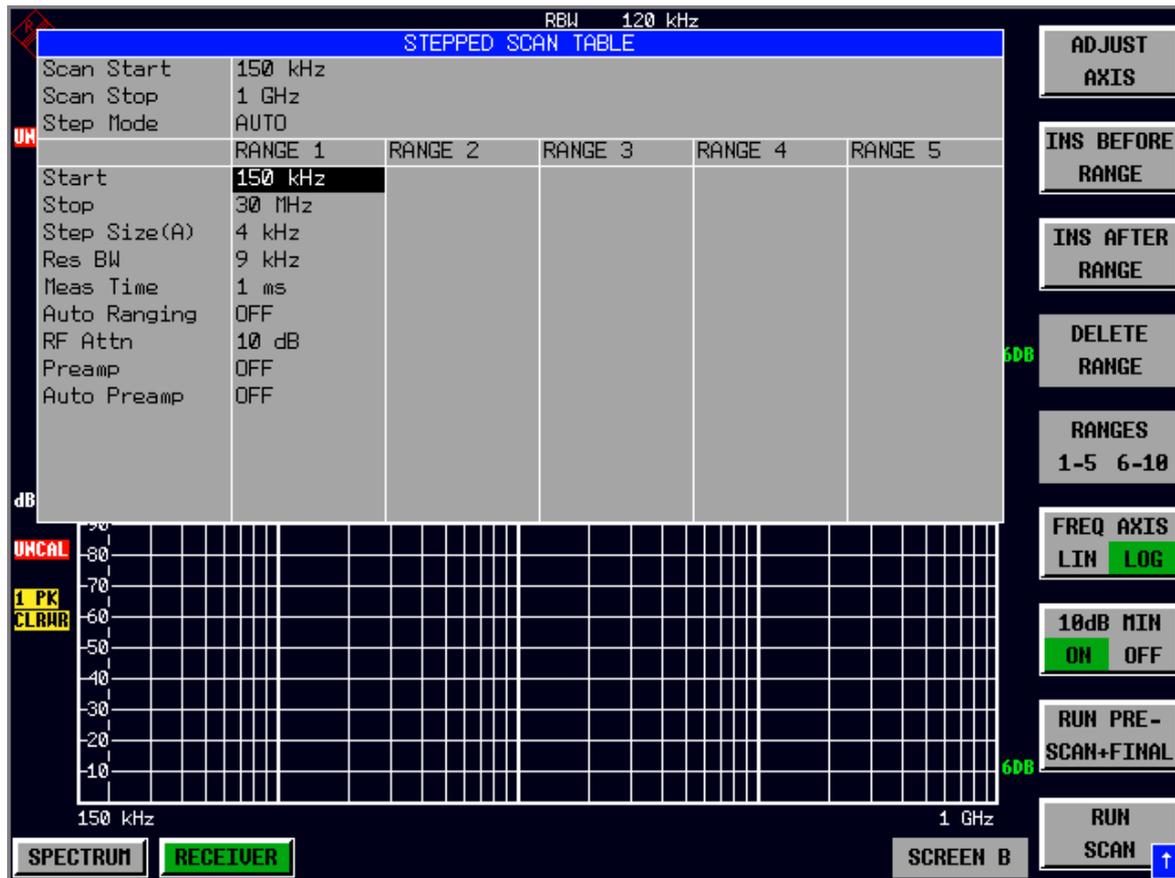
Fig. 5-3   Modified *SCAN TABLE* for preparing a scan

After editing the scan subrange, the frequency display has to be adapted to the new settings. The lowest start frequency of the range 1 scan and the highest stop frequency of the subsequently defined subranges are used for defining the start and stop frequencies of the graphics display. In the example, the limit frequencies of *SCAN RANGE 1* are therefore also the limits of the graphics display.

➢ Press the *ADJUST AXIS* softkey.

The respective frequency values in the table are transferred to adapt the display.

➢ Press the menu change key *PREV*.

The *USE SCAN TABLE* submenu is closed.

4. Select the detectors.

Up to three detectors can be connected in parallel to simultaneously display the amplitude at every frequency as a function of detector weighting. When a parallel detector is selected, the slowest detector (in the sense of a calibrated measurement) determines the speed or the total measurement time required for the scan. The fastest scan is performed when the peak detector is used as the sole detector.

In the example, the peak detector (trace 1) and the average detector (trace 2; default) are used in an overview measurement.

➢ Press the *TRACE* key.

   The *TRACE* menu is displayed.

➢ Press the *SELECT TRACE* softkey.

   A data input field is displayed.

➢ Enter *1* as trace number and confirm with the *ENTER* key.

➢ Press the *DETECTOR* softkey.

   The *DETECTOR* menu is displayed.

➢ Press the *MAX PEAK* softkey to select the detector.

   The peak detector is selected for trace 1.

➢ Press the *TRACE* key again.

➢ Press the *SELECT TRACE* softkey again.

➢ Enter *2* as trace number and confirm with the *ENTER* key.

➢ Press the *CLEAR / WRITE* softkey.

   In the *DETECTOR* menu, select the *AVERAGE* detector.

5. Apply the signal.

➢ Connect the RF cable to the RF input.

6. Start the scan.

➢ Press the *SWEEP* key.

   The *SWEEP/SCAN* menu is displayed.

➢ Press the *RUN SCAN* softkey.

   The *HOLD SCAN* and *STOP SCAN* softkeys are displayed.

   The measurement with the selected *PEAK* and *AVERAGE* detectors is continuously repeated because the default setting *CONTINUOUS SCAN* remains unchanged.

➢ Press the *STOP SCAN* softkey.

The measurement is aborted.

Peak and average results (see Fig. 5-4) should be further analyzed with the aid of the built-in marker functions.

Depending on the DUT, diverse trace forms are obtained. For this reason the diagram below should be regarded as an example.

The scaling of the y-axis can be adjusted in the *AMPT* menu by means of softkey *GRID RANGE LOG MANUAL* if necessary.
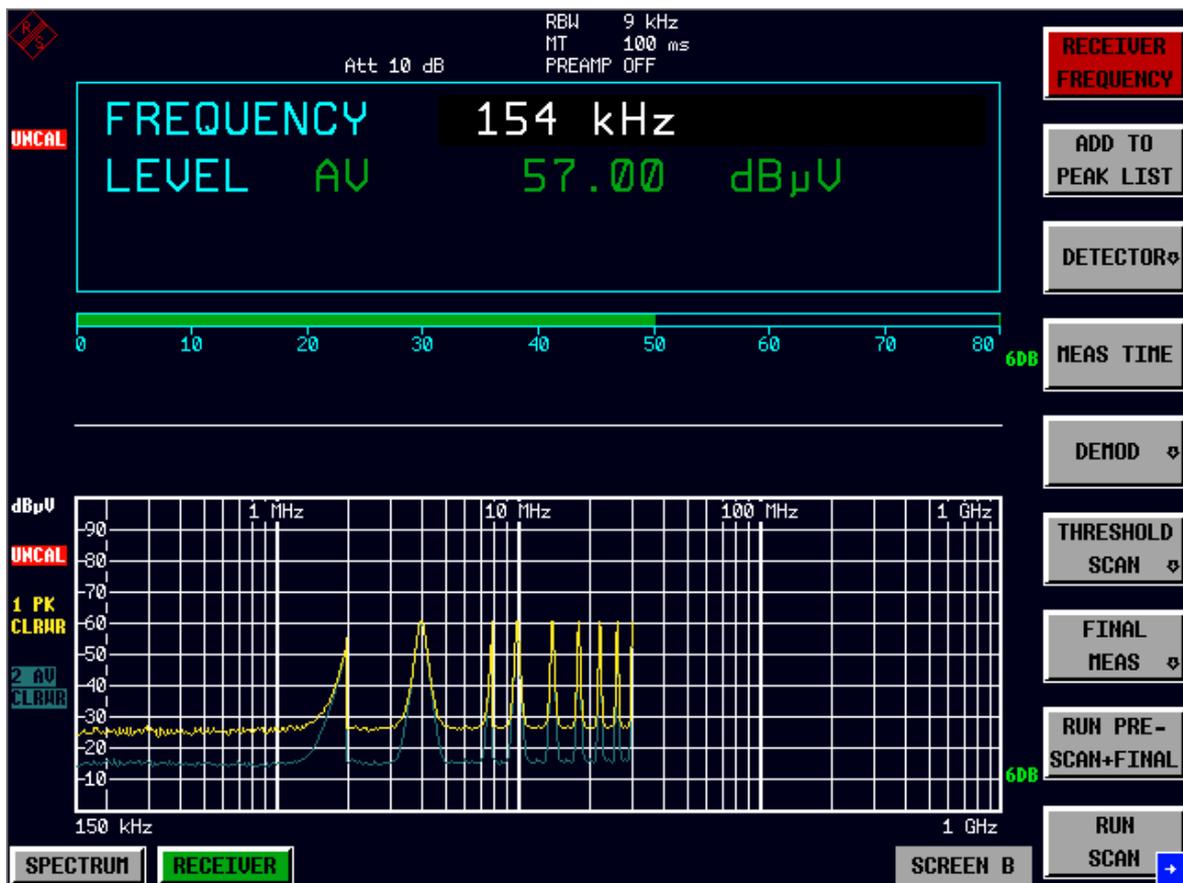
Fig. 5-4   Result display of standard pre-compliance measurement using peak/average detector

7. *Analyze the level in frequency domain using the marker functions.*

Alternatively, you can use the peak search functions (see step 8).

➢ Press the *MRK* key.

The marker jumps to the largest signal peak shown on the display screen.

> When the marker is switched on for the first time, it automatically performs the PEAK SEARCH function as demonstrated in this example.
>
> If a marker was already active, the *PEAK* softkey in the MRK-> menu must be pressed in order to set the currently active marker to the displayed signal maximum.

The level and frequency measured by the marker can be read in the marker field at the upper edge of the display screen.

➢ Move the marker on the trace with the aid of the rotary knob.

The respective level and frequency values are displayed in the marker field.

8. *Analyze the level in frequency domain using the peak search functions.*

Alternatively, you can use the marker functions (see step 7).

➢ Press the Press the *MKR–>* key.

The *MKR–>* menu is displayed.

➢ Press the *PEAK* softkey.

The marker is positioned at the maximum level in the display.

➢ Press the menu change key *NEXT*.

➢ Press the *NEXT MIN* softkey.

The marker moves to the next lower level in the spectrum irrespective of whether the frequency is higher or lower than that of the previously measured *PEAK* value.

➢ Press the menu change key *PREV*.

➢ Press the *NEXT PEAK RIGHT* softkey.

The marker is displayed on the next peak level at a higher frequency (see Fig. 5-5).

The displayed spectrum can be further analyzed with the aid of up to 4 markers. The markers can be assigned to different traces.

➢ Press the *DISP* key.

The *DISPLAY* menu is displayed.

➢ Press the *FULL SCREEN* softkey.

One window is displayed on the screen
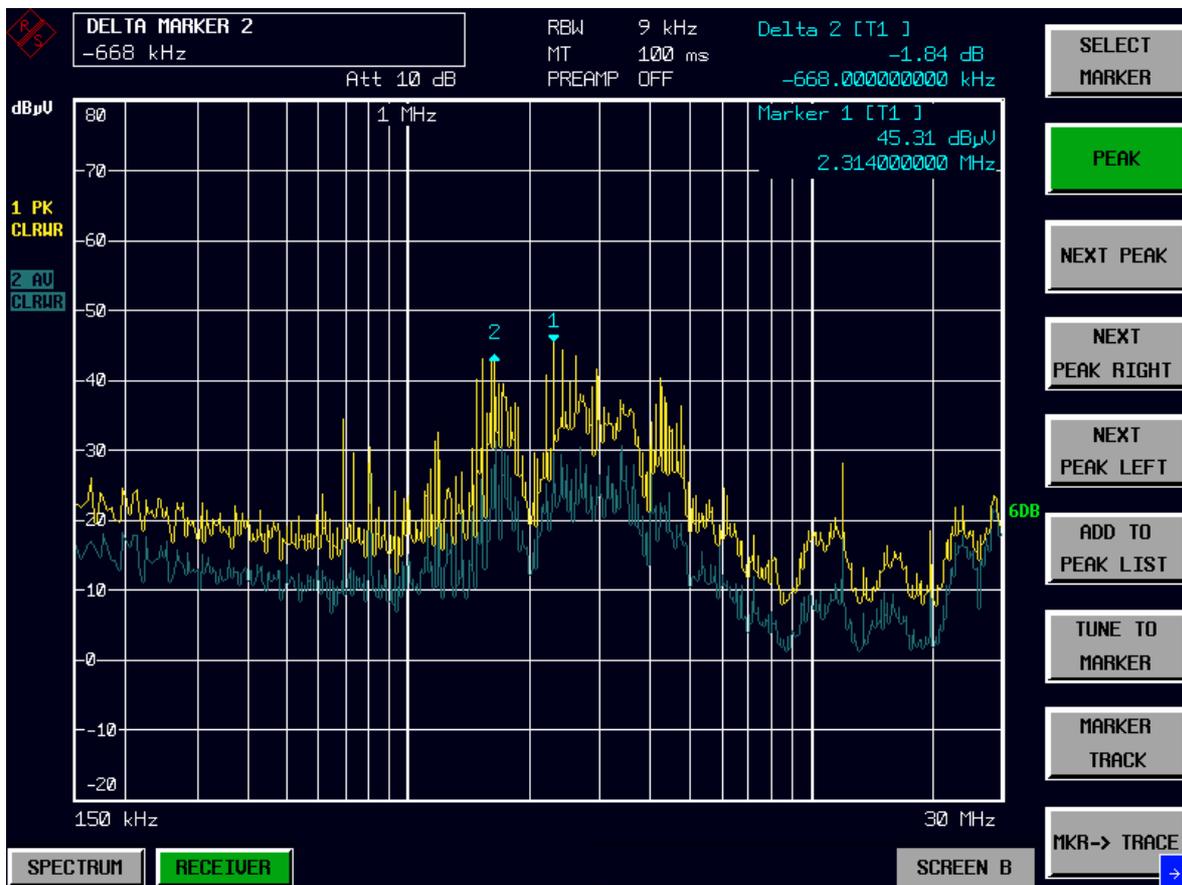
Fig. 5-5   Screen display with marker

9. *Set the SPLIT SCREEN function.*

The *SPLIT SCREEN* function simplifies the analysis of measured data, particularly at critical frequencies. In the split-screen mode, the frequency, e.g. that of the active marker, and the level of the active detectors are displayed in the upper half of the screen numerically and on a bar graph.

➢ Press the *DISP* key.

The *DISPLAY* menu is displayed.

➢ Press the *SPLIT SCREEN* softkey.

Two windows are displayed on the screen.

Performing a Level and Frequency Measurement

10.Tune the receiver frequency and obtain final test results using the QUASIPEAK detector.

The currently measured frequency can be rapidly changed e.g. with the *TUNE TO MARKER* softkey in the *MKR→* menu. Other or additional detectors can be switched on at this receive frequency and an overview of levels of all active detectors is given. For measurements to standard, the measurement time must first be set to 1 s.

➢ Press the *MKR* key.

Marker 1 is displayed.

Frequency and level values can be read in the marker field at the top left of the screen.

➢ Press the *MKR→* key.

The *MKR→* menu is displayed.

➢ Press the *TUNE TO MARKER* softkey.

The current receive frequency is tuned to the marker frequency.

A measurement time of 1 s must be set for measurements to standard.

➢ Press the *RECEIVER* hotkey.

The *RECEIVER* menu is displayed.

➢ Press the *MEAS TIME* softkey.

The window with the currently set measurement time is displayed (1 ms in the example).

➢ Enter *1* on the numeric keypad and terminate by pressing s.

The new measurement time is displayed.

The quasi peak detector should now be switched on in addition.

➢ Press the *DETECTOR* softkey.

The *DETECTOR* menu is displayed. The peak and average detectors of the pre-compliance measurement are active.

➢ Press the *QUASIPEAK* and the *MAX PEAK* softkey.

The level at the current receive frequency is displayed for three detectors numerically and on three bar graphs (see Fig. 5-6).

Fig. 5-6   Analysis of single frequencies with standard measurement time and several detectors

11. From overview to standard-conformal measurement

➢ Data reduction and automatic routines for final measurement

The R&S ESPI offers several data reduction methods for interactive or automatic final measurements. For details refer to the Operating Manual, chapter 4.

➢ Limit lines

A final measurement to standard can be performed when active limit lines are displayed in the diagram during the described analysis and measurements are repeated at all critical frequencies using the standard measurement time and a corresponding detector. For details refer to the Operating Manual, chapter 4.

➢ Transducer

Care should be taken that the correction values or transducer factors available in tabular form are considered in the measurement result when accessories with frequency-dependent characteristics are used. Several correction tables can be combined to form a transducer set. For details refer to the Operating Manual, chapter 4.

Performing a Level and Frequency Measurement

12.Store the test results, tables or diagrams.

In the example, test results are stored on a memory stick. Measured data are output in WMF format for use in other applications.

DEVICE1 and output in WMF format is automatically selected with *PRESET*.

➢ Press the *HCOPY* key.

The *HCOPY SETTINGS* menu is displayed where the output of measurement and device data can be configured and started.

➢ Connect a memory stick to the USB port.

➢ Press the *PRINT SCREEN* softkey.

The output is started. A window to enter file name and path.

➢ Enter file name and path using the built-in auxiliary line editor or the external keyboard, e.g. *F:\ display.wmf* and confirm the entry with the *ENTER* key.

➢ Press the *ENTER* key.

The screen content is stored on the disk under the specified file name.

During storing the softkeys are blanked. Operation in the menus can be continued when the softkeys are displayed again.

The file can be used in other Windows applications, i.e. it can be linked.

Fig. 5-7 gives an example of a stored display. In the example, two limit lines are active and 4 markers positioned in the spectrum.
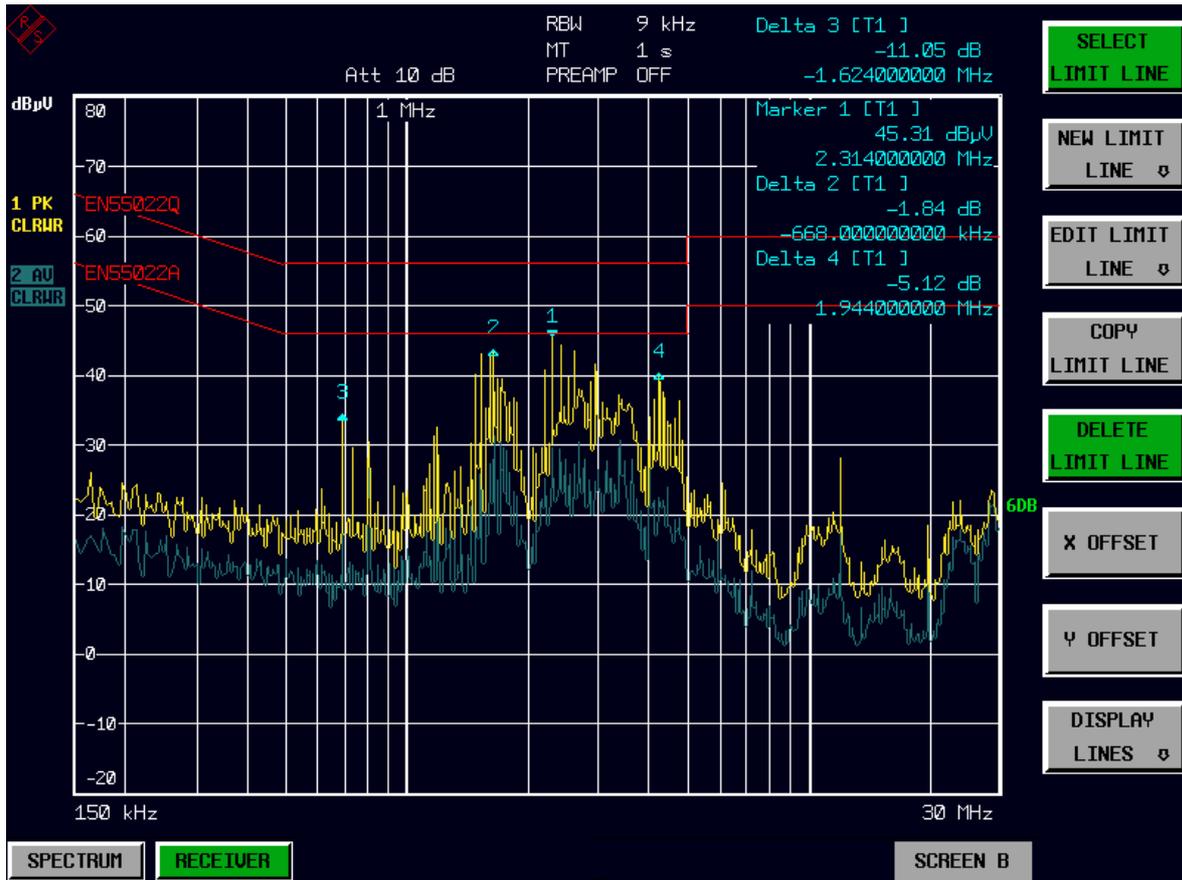
Fig. 5-7   Result display stored in a file in WMF format

A detailed description of the file management for complete EMI Test Receiver setups, data records for traces (traces 1-3), limit lines and transducer is given in the Operating Manual, chapter 4, section "Operating Concept of File Managers".

6   LAN Interface

In some of the following step-by-step instructions, user names and passwords must be entered. This requires a mouse and an external keyboard is (the connection is described in sections " Connecting a Mouse" and " Connecting an External Keyboard" on page 2.8).

6.1 Installing Additional Network Protocols & Services

> Your network administrator knows which protocols are necessary. In the case of the RSIB protocol and VXI11 support, TCP/IP must always be installed. In the following example, the support for Novell Network will also be installed..

➢ Press the *SETUP* key.
The *SETUP* menu will open.

➢ Press the *GENERAL SETUP* softkey.
The *GENERAL SETUP* menu will open.

➢ Press the *CONFIGURE NETWORK* softkey.
The *Local Area Connection Status* dialog box will open.
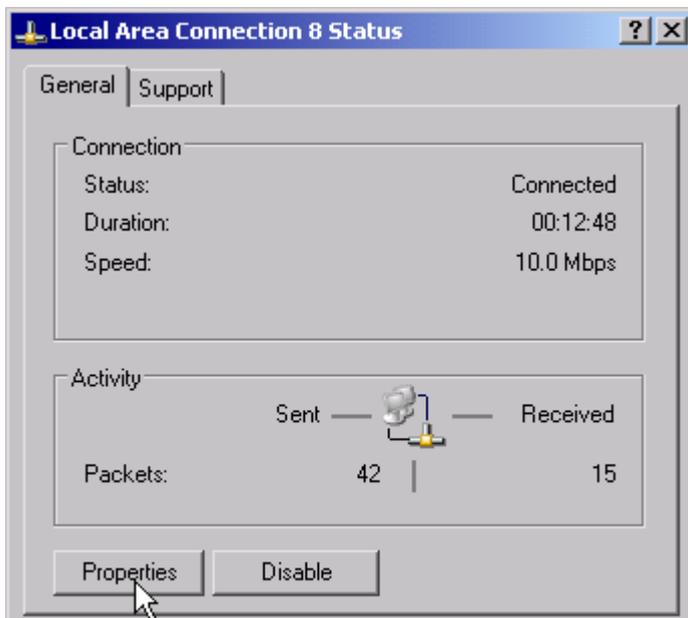
> • Windows XP automatically appends numbers to the name Local Area Connection Status (e.g. Local Area Connection Status 8) if the configuration is created using the New Connection wizard. Since these numbers are unimportant in the following configuration steps, they are omitted in the description.
>
> • Alternatively it is possible to access the dialog using a connected external keyboard. Proceed as follows:
> Open the Windows XP Start menu with the Windows key or *CTRL+ESC*. Select *Settings - Network Connections - Local Area Connection*.
> The Local Area Connection Status dialog box will open.

➢ Click the *Properties* button.
The dialog box containing the available network protocols will open.
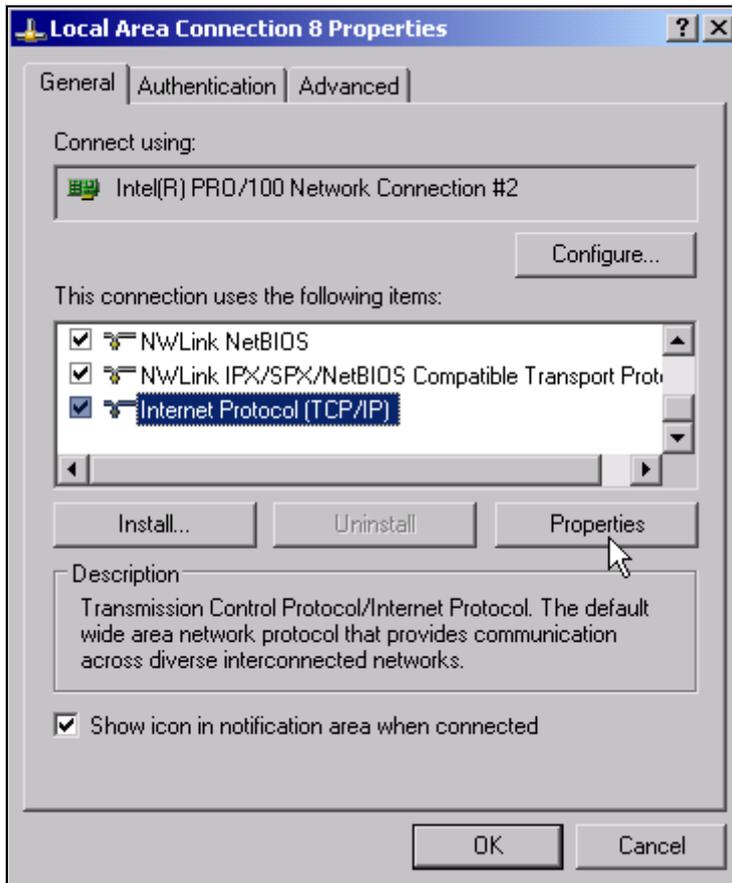
➢ Click the *Install* button.
The list of available network components will open.
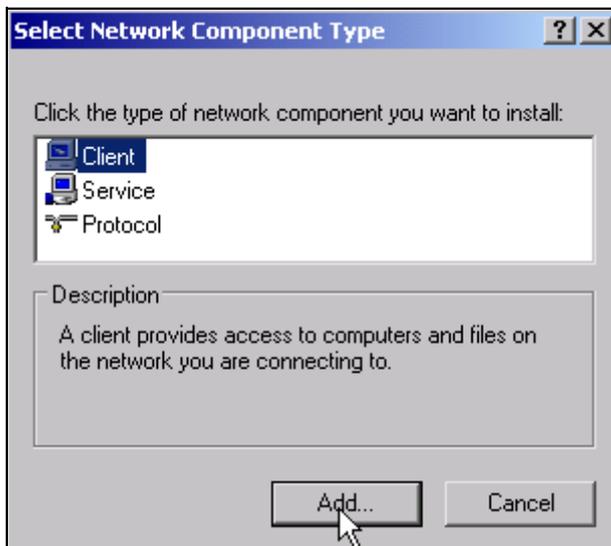
➢ Select *Client*.

➢ Click the *Add...* button.
The list of available network protocols will open.
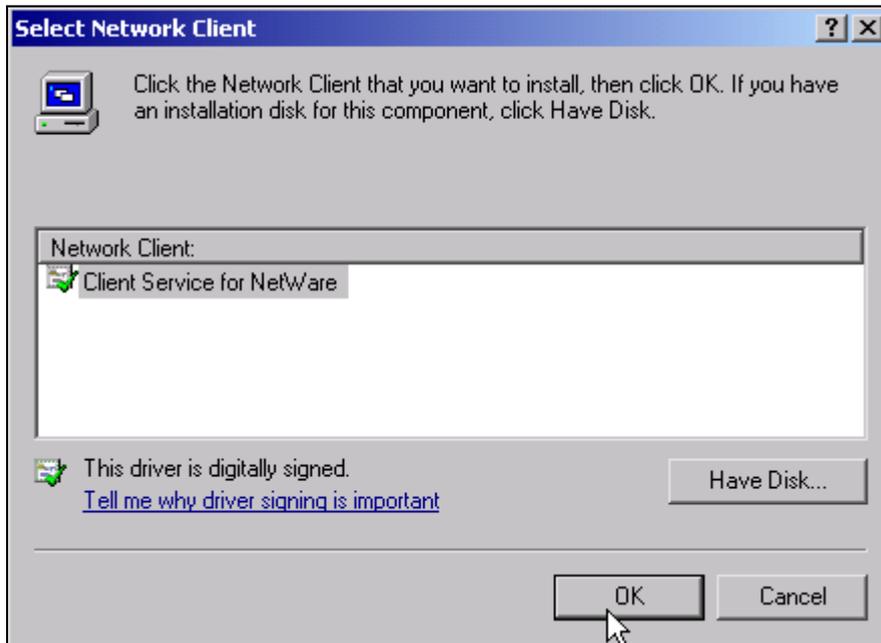
➢ Select *Client Service for NetWare*.

➢ Click the *OK* button.
The network driver for Novell Netware will be installed.

- Your network administrator knows which clients, services and protocols must be installed for your network.

- If network components are not included in *D:\I386* they have to be installed e.g. using a disk containing the drivers (or a CD that is replayed via a USB CD-ROM drive).
In this case, click the *Have Disk* button and specify the path with the corresponding drivers.

-

After you complete the installation, you will be prompted to restart the instrument.
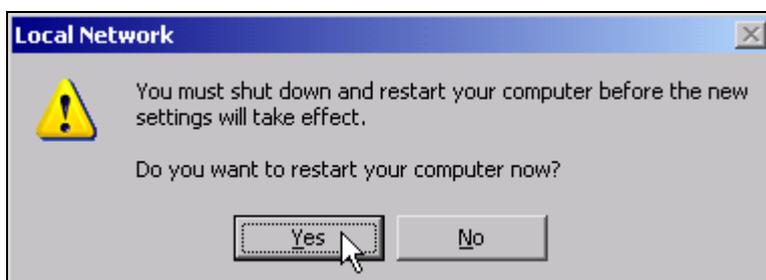
➢ Click the Yes button.
Windows will restart the system.

6.2 Configuration Examples

Network	Protocols	Services	Comments
NOVELL Netware	NWLink IPX/SPX compatible transport	Client service for NetWare	The frame type used in the network must be set under *Protocols - Properties*.
IP Networks (FTP, TELNET, WWW, GOPHER, etc.)	TCP/IP	Simple TCP/IP services	An IP address that is unique in the network must be set under *Protocols - Properties.*
MICROSOFT Network	TCP/IP	Workstation server	A name that is unique in the network must be set under *Identification - Computer Name*.

6.3 Subsequent Changes to the Network Configuration

This chapter describes changes to the network configuration like the computer name, the doman or the workgroup.

After completing the installation, you can modify the computer name as follows:

➢ Press the Windows key or *CTRL+ESC*.
   The Windows Start menu will open.
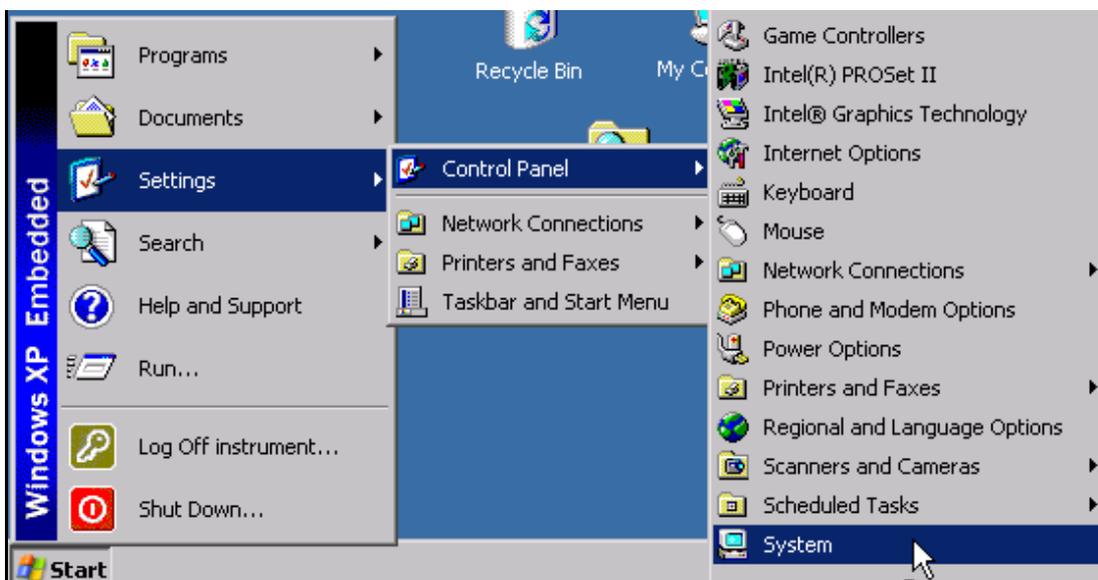
➢ Select Settings - Control Panel - System.
   The *System Properties* dialog will open.
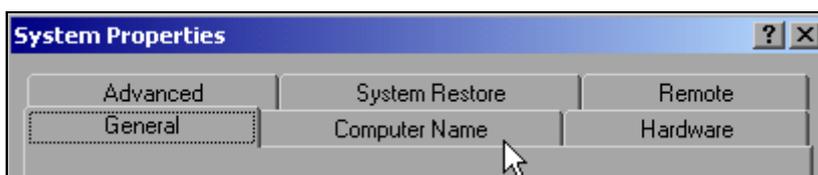
➢ Select the *Computer Name*.

Subsequent Changes to the Network Configuration

> You can change the other settings after you select the other tabs.
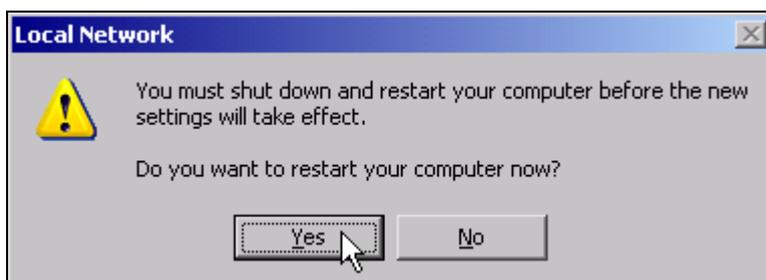> Before doing so, however, be sure to check with your network
> administrator.

> To use the Network Identification Wizard to join a domain and create a local user account, click Network ID.
>
> [Network ID]
>
> To rename this computer or join a domain, click Change.
>
> [Change...]
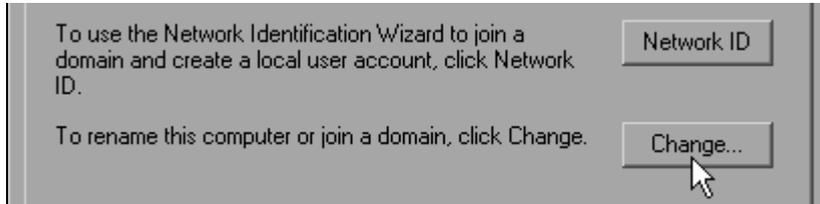
➢ Click the *Change* button.
  The dialog box for changing the computer name, domain and workgroup will open.

Computer Name Changes

You can change the name and the membership of this computer. Changes may affect access to network resources.

Computer name:
ANALYZER

Full computer name:
ANALYZER.

[More...]

Member of
○ Domain:

⦿ Workgroup:
WORKGROUP

[OK] [Cancel]

➢ Enter a new computer name.

➢ If necessary, enter a *Domain* or *Workgroup*.

➢ Confirm changes with *OK*.

  You are prompted to restart the instrument:

Local Network

You must shut down and restart your computer before the new settings will take effect.

Do you want to restart your computer now?

[Yes] [No]

➢ Click the *Yes* button.
  Windows will restart the system.

6.4 Configuring the Windows XP Firewall

The Windows XP Firewall blocks all network communication which is not initialized by the controller itself or which is defined as unwanted. It protects the controller from an attack of hostile users and programs. On the instrument, the Internet Connection Firewall (ICF) is activated for all network connections by default to enhance protection of the instrument.

The default configuration of the firewall enables data transfer with other controllers in a local network, file and printer sharing and remote control via LAN. To change these settings for security reasons, perform the following steps:

➢ Using the Windows key or the key combination *CTRL+ESC*, call the Windows XP Start menu.

➢ Click *Settings* and then *Control Panel* and *Windows Firewall*.
   The *Windows Firewall* dialog box is displayed.
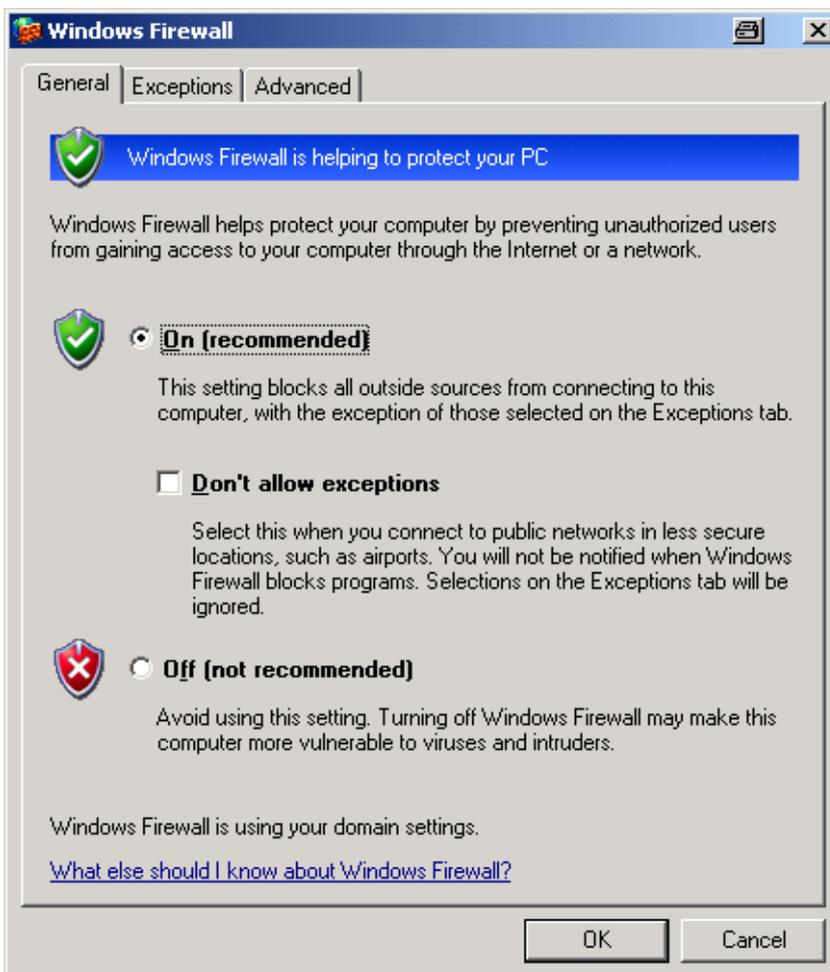
6.5 Operating the Instrument without a Network

If you want to operate the instrument either temporarily or permanently without a network connection, no special measures are necessary in contrast to Windows NT. Windows XP automatically detects the interruption of the network connection and does not set up the connection when the instrument is switched on.

If you are not prompted to enter the user name and password, proceed as described in the section " Reactivating the Automatic Login Mechanism" on page 6.14.

6.6 Operating the Instrument in a Network

After network support has been installed, data can be exchanged between the instrument and other computers, and network printers can be used.

Network operation is possible only if you are authorized to use network resources. Typical resources are file directories of other computers or even central printers.

Authorization is assigned by the network or server administrator. This requires having the network names of the resources and the corresponding authorizations.

6.6.1 Creating Users

After the software for the network has been installed, the instrument will issue an error message the next time it is switched on, because there is no user named *instrument* (= user ID for Windows XP automatic login) in the network. Thus, a matching user must be created in Windows XP and in the network, the password must be adapted to the network password, and the automatic login mechanism must then be deactivated.

The network administrator is responsible for creating new users in the network. A new user can be created on the instrument by using the User Account wizard:

➢ Using the Windows key or the key combination *CTRL+ESC*, call the Windows XP Start menu.
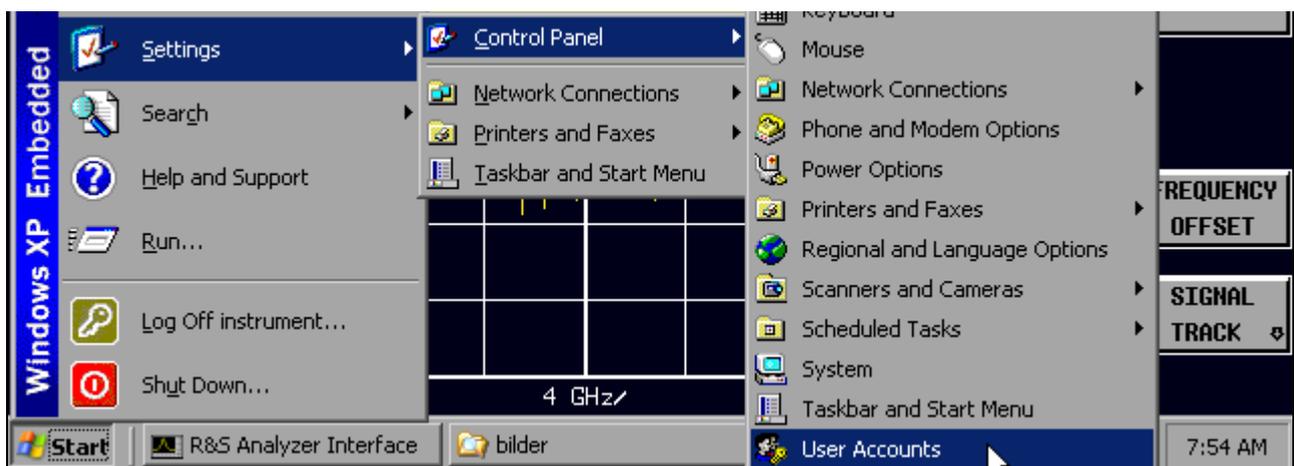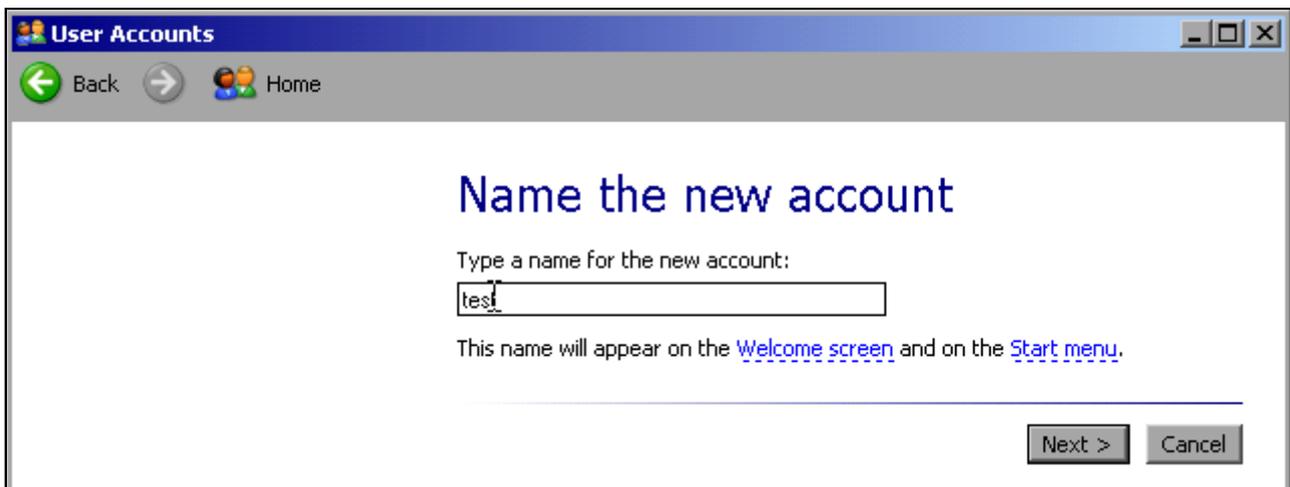

➢ Click *Settings* and then *Control Panel* and *User Accounts*.
The wizard for managing the user will open with the *Pick a task...* dialog box.

➢ Select *Create a new account*.
  The dialog box for entering a new computer name will open.

➢ Enter the name of the new user in the text field and confirm with *Next* ->. The *Pick an account type* dialog box for defining the user's rights will open.

➢ Select *Computer administrator*.

Proper firmware function requires administrator rights.

➢ Conclude the creation of the new user by clicking the *Create Account* button.
   The new user has now been created.

6.6.2 Changing the User Password

After the new user has been created on the instrument, the password must be adapted to the network password. This is also done by using the User Account wizard.

➢ Using the Windows key or the key combination *CTRL+ESC*, call the Windows XP Start menu.

➢ Click *Settings* and then *Control Panel* and *User Accounts*.
   The wizard for managing the users will open with the *Pick a task...* dialog box.
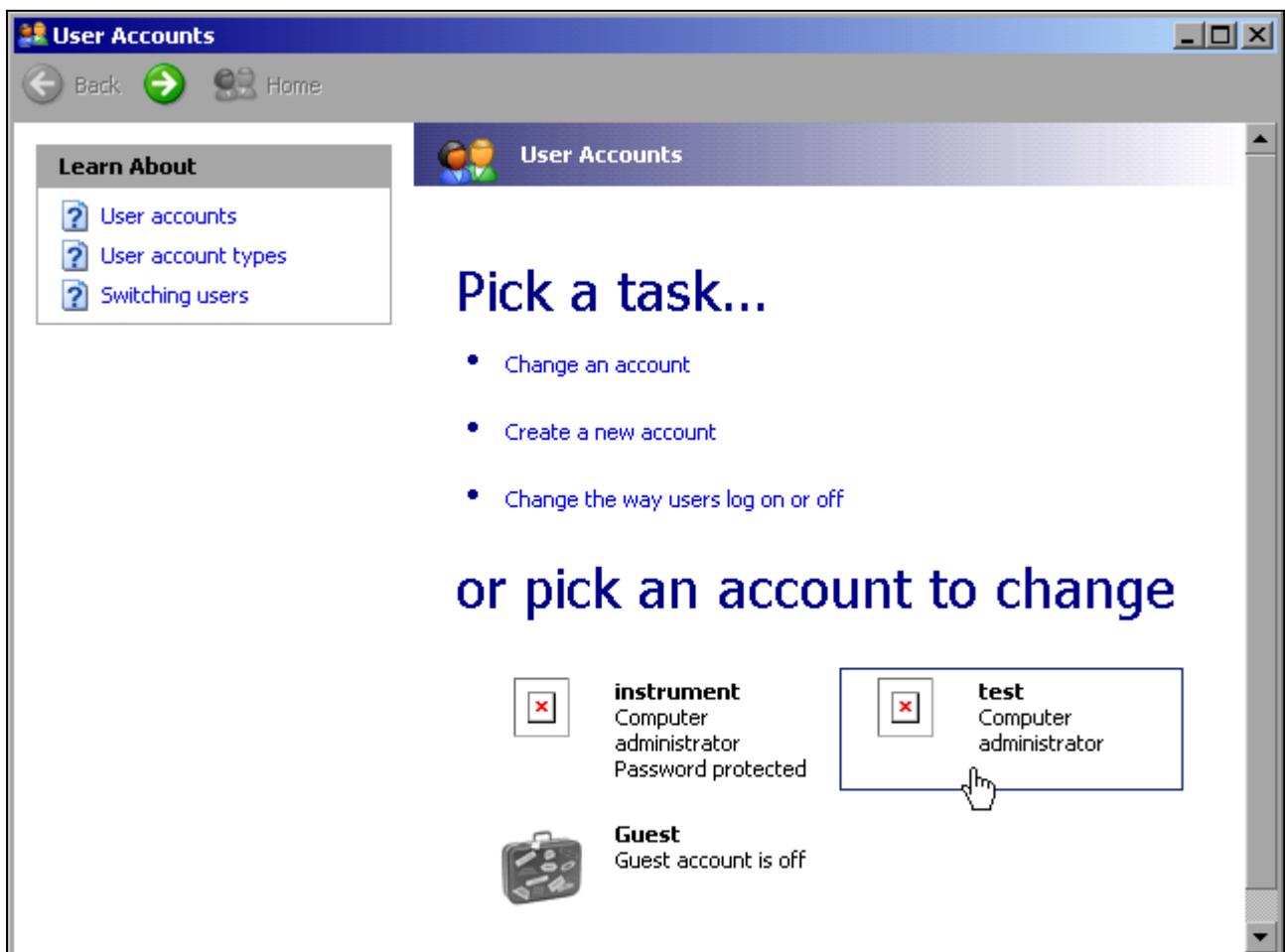
➢ Click the desired user account (in the example: user *Test*).
   The dialog box for selecting the desired action will open.
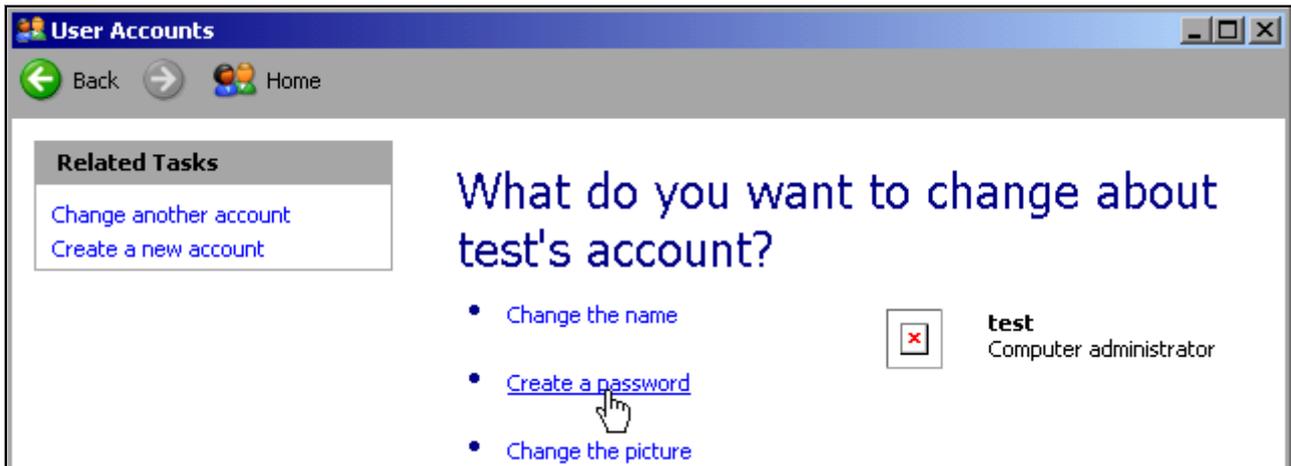
➢ Click *Create a password*.
  The dialog box for entering a new password will open.
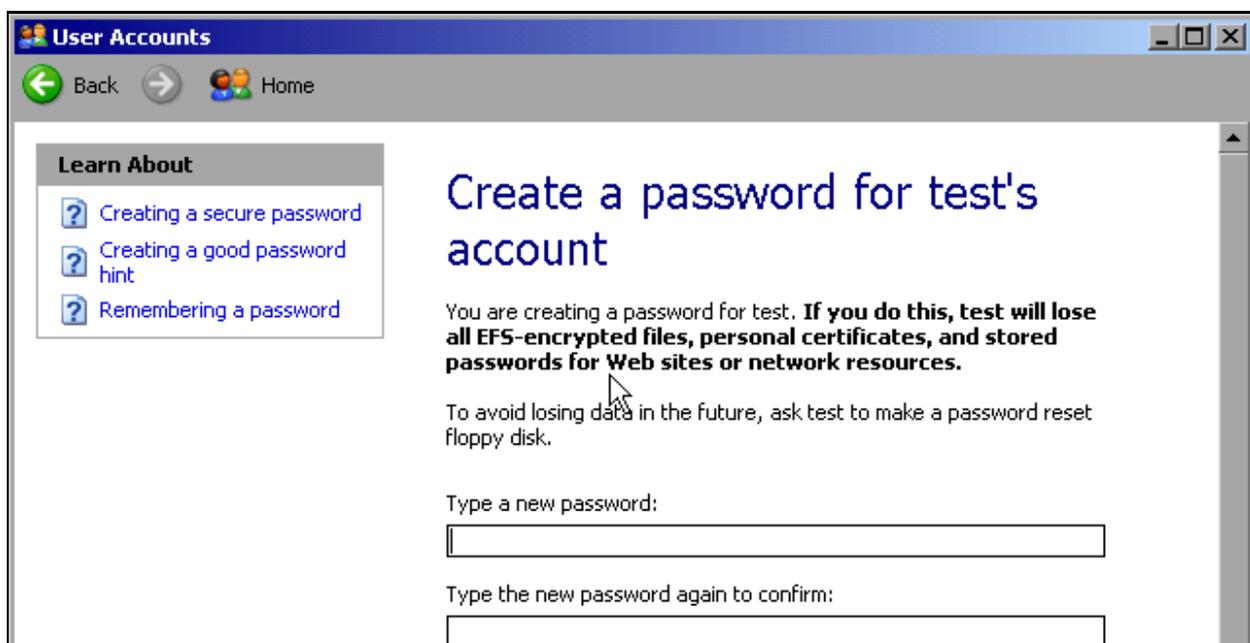
➢ Enter the new password in the upper text line and repeat it in the following line.

➢ Scroll the screen contents down.

➢ Conclude the entry with the *Create Password* button.
  The new password is now active.

6.6.3 NOVELL Network only: Configure NOVELL Client

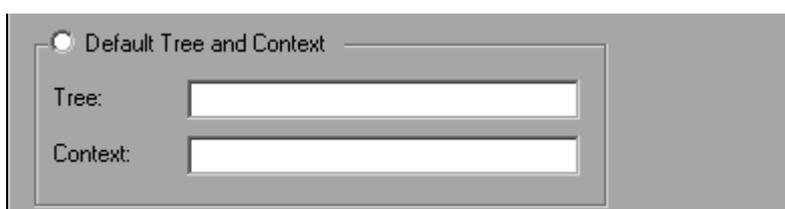➢ Using the Windows key or the key combination *CTRL+ESC*, call the Windows XP Start menu.
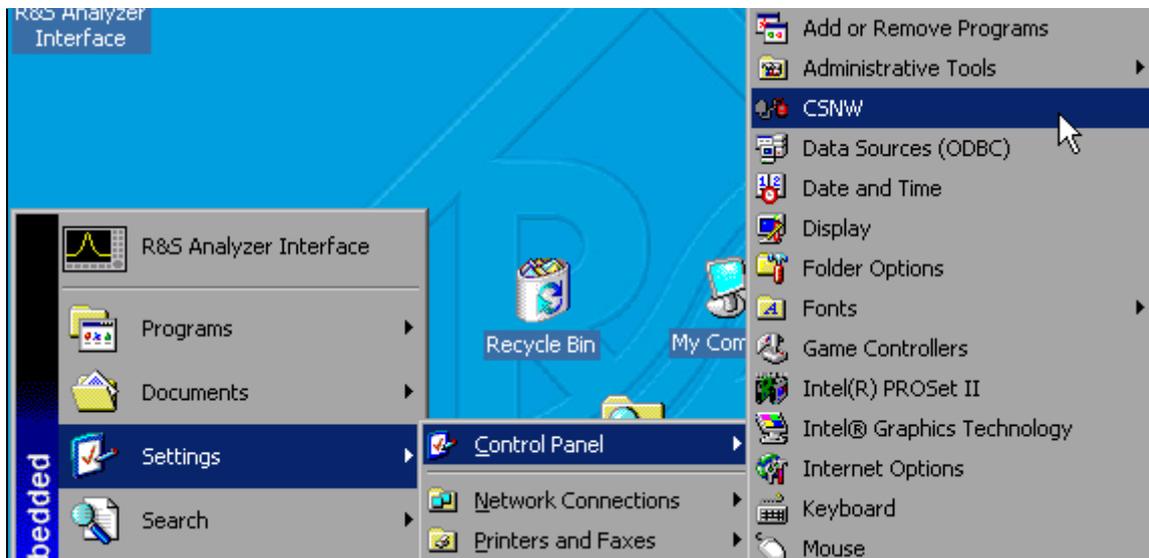
➢ Click *Settings* and then *Control Panel* and *CSNW*.

Bindary Login (NOVELL 3.x)

➢ Click *Default Tree and Context*.

➢ Under *Select Preferred Server*, select the NOVELL server on which the user has been created.

NDS Login (newer NOVELL versions)

➢ Click *Default Tree* and *Context*.

➢ Under *Tree*, enter the NDS Tree and, under *Context*, the hierarchical path on which the user has been created.

➢ If desired, click the *Run Login Script* entry.

You can obtain this information from your network administrator.

➢ Conclude the login configuration with *OK*.

6.6.4 Logging On to the Network

Network login occurs at the same time you log on to the operating system. For this to be possible, the user name and the password must be identical under Windows XP and on the network.

6.6.5 Deactivating the Automatic Login Mechanism

When shipped, the instrument is already configured to automatically log on under Windows XP. To deactivate the automatic login mechanism, perform the following steps:

➢ Open the Windows XP Start menu with *CTRL+ESC*.

➢ Select *RUN* from the menu.
   An entry field will open.

➢ Enter the command *D:\USER\NOAUTOLOGIN.REG* in the entry field and confirm it with *ENTER*.

The automatic login mechanism will be deactivated. The next time you switch on the instrument, you will be prompted to enter your user name and password before the firmware is started.

6.6.6 Reactivating the Automatic Login Mechanism

To reactivate the automatic login mechanism, do the following:

➢ Open the Windows XP Start menu with *CTRL+ESC*.

➢ Select *RUN* from the menu. The entry field will open.

➢ Enter the command *D:\USER\AUTOLOGIN.REG* in the entry field and confirm it with *ENTER*.

The automatic login mechanism will be reactivated,. It will be applied the next time the instrument is switched on.
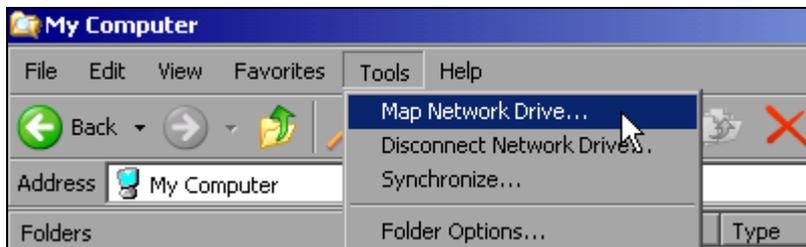
6.6.7 Using Network Drives

➢ Using the Windows key or the key combination *CTRL+ESC*, call the Windows XP Start menu.

➢ Click *Programs*, and then *Accessories* and *Windows Explorer.*

➢ Under Desktop, click *My Network Places* and *Entire Network*
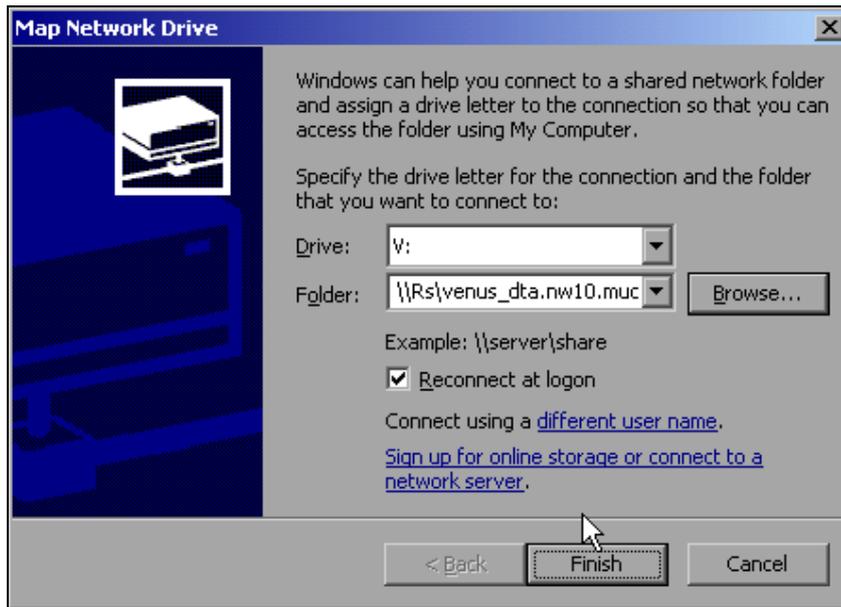All available network drives will be displayed.
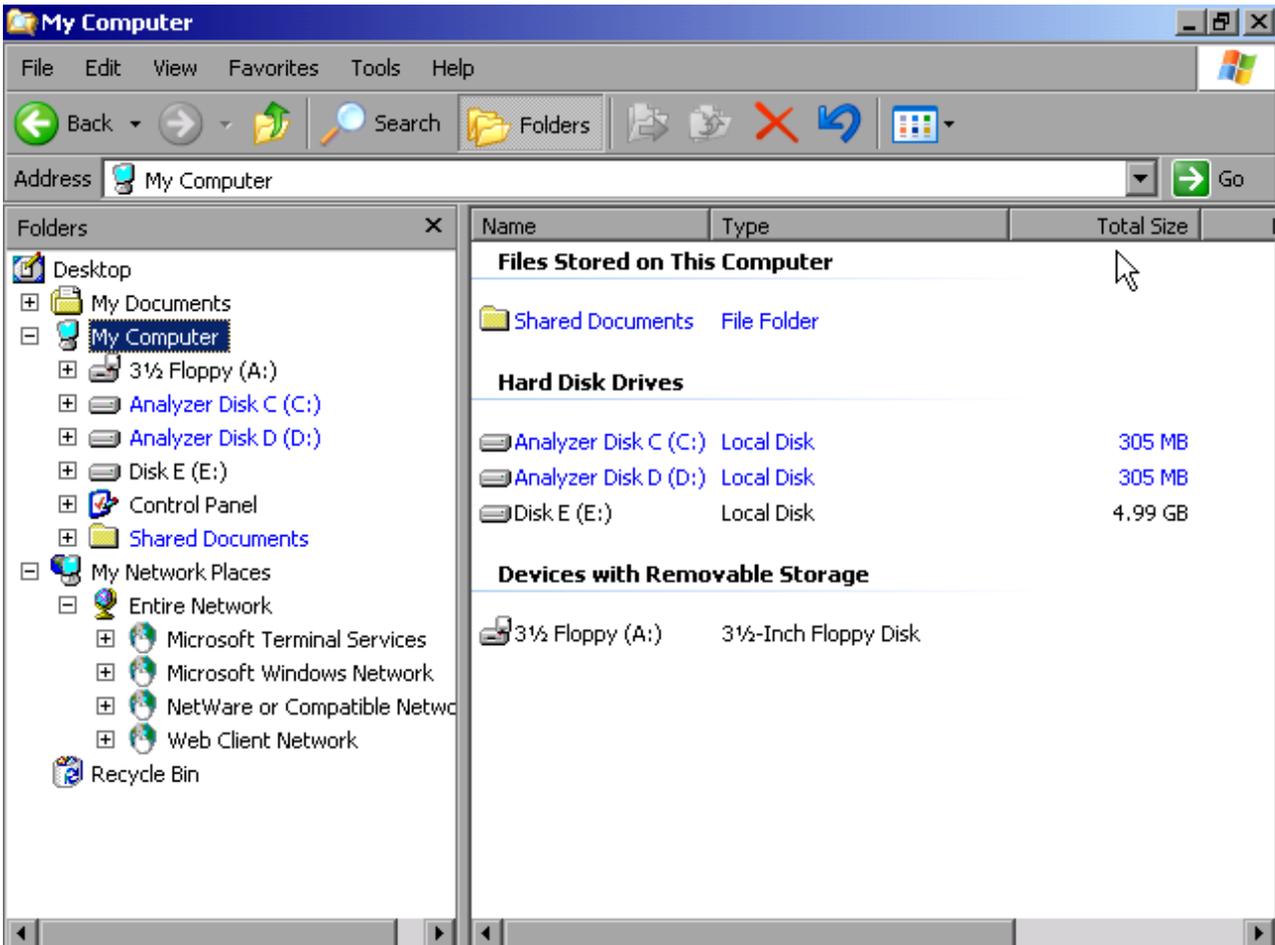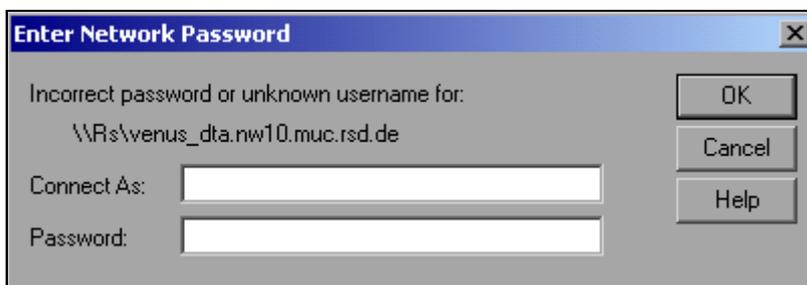

➢ Click *Tools* and then *Map Network Drive*.

The *Map Network Drive* dialog will open:

➢ Under *Drive*: click the drive.

➢ Using *Browse*, open the list of network paths available in the network.

➢ Mark the desired network path.

➢ Activate *Reconnect at Logon:* if you want the connection to be set up automatically each time the instrument is started.

➢ Click *Finish* to connect the network path with the selected drive.
You will be now prompted to enter your user name and password.

The drive will then appear under *All Directories* in Explorer.

Only networks authorized in the network will be connected.

Terminate the connection

➢ In Windows Explorer, click *Tools* and then Disconnect Network Drive.

➢ Under *Drive:*, select the drive whose connection is to be terminated.

➢ Click *OK* to terminate the connection. You will need to confirm this step with *Yes*.
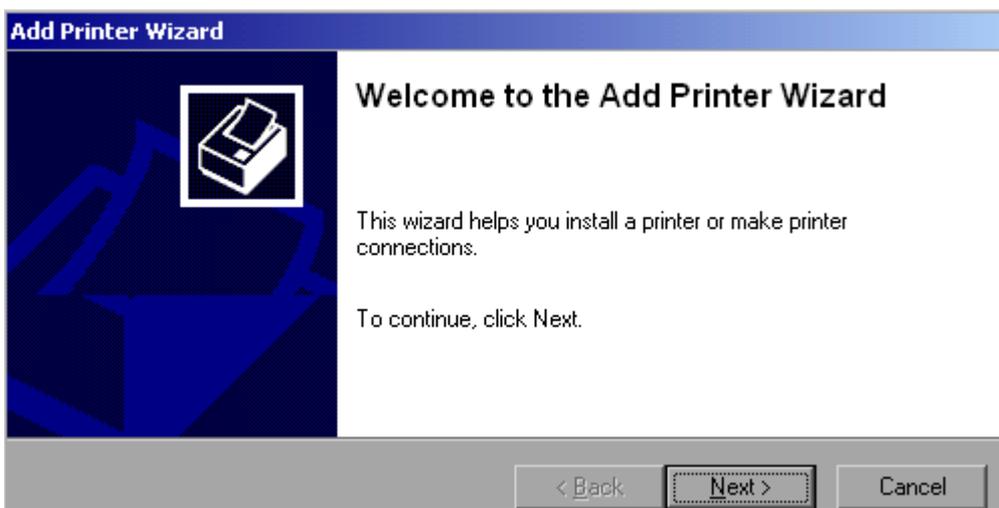
6.6.8 Installing a Network Printer

A new printer is installed using the *INSTALL PRINTER* softkey in the *HCOPY* menu.

➢ Click the *HCOPY* key.
  The *HCOPY* menu will open.

➢ Click the *NEXT* key to go to the side menu.

➢ Using *INSTALL PRINTER*, open the *Printers and Faxes* dialog box
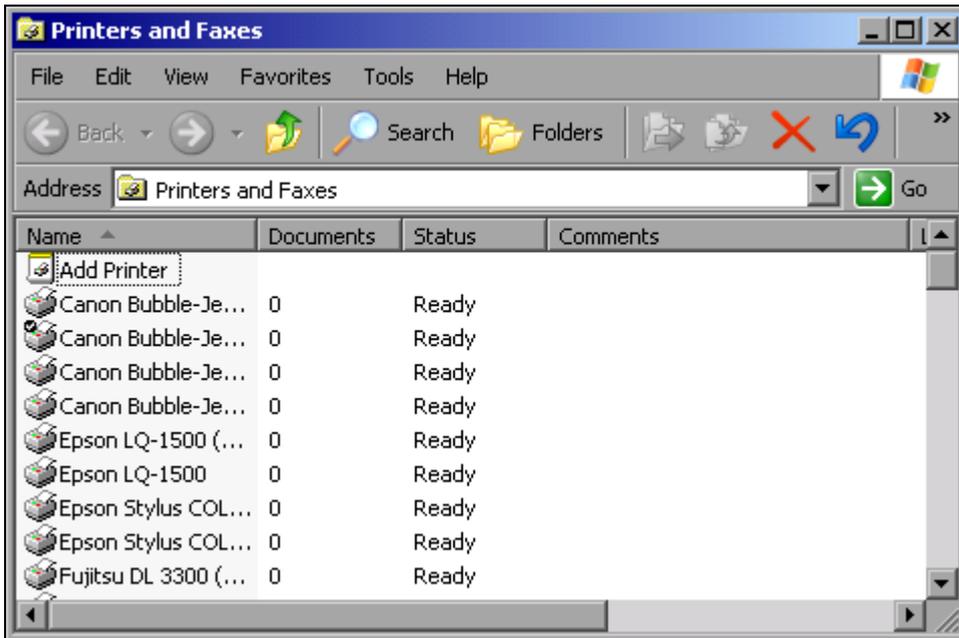
➢ Using the rotary knob, go to Add Printer in the selection list.

➢ Using right arrow key, mark the entry and then confirm by pressing *ENTER* or the rotary knob.
 The *Add Printer Wizard* will now appear.

➢ Select *Next* with the rotary knob and then press the rotary knob to confirm.
  The *Local or Network Printer* selection will appear.

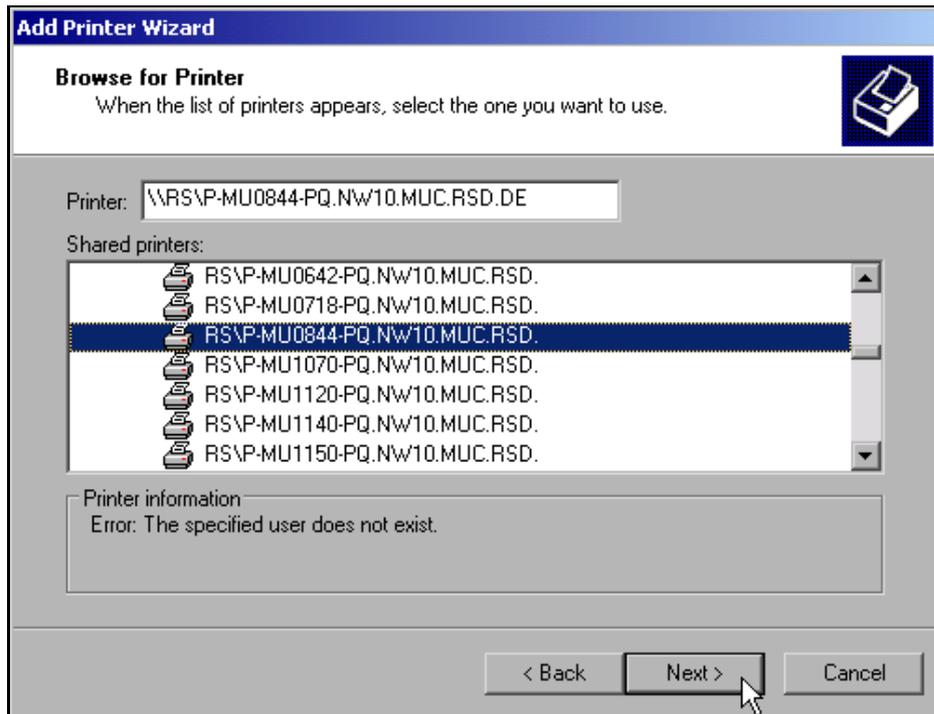In this example, an HP Laserjet 5 printer is installed as a network printer.
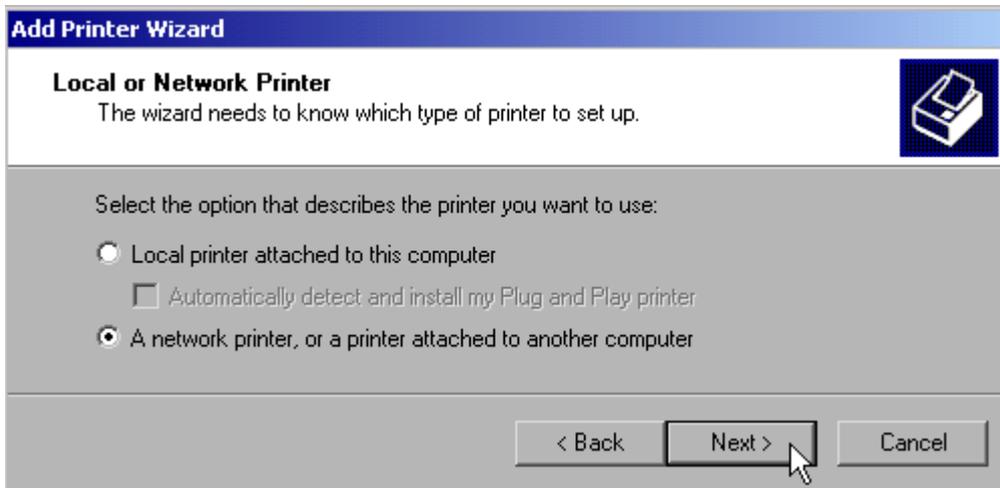
➢ To select a network printer, activate *A network printer or a printer attached to another computer*.

➢ Click *Next* to continue. The *Specify a Printer* dialog will open.
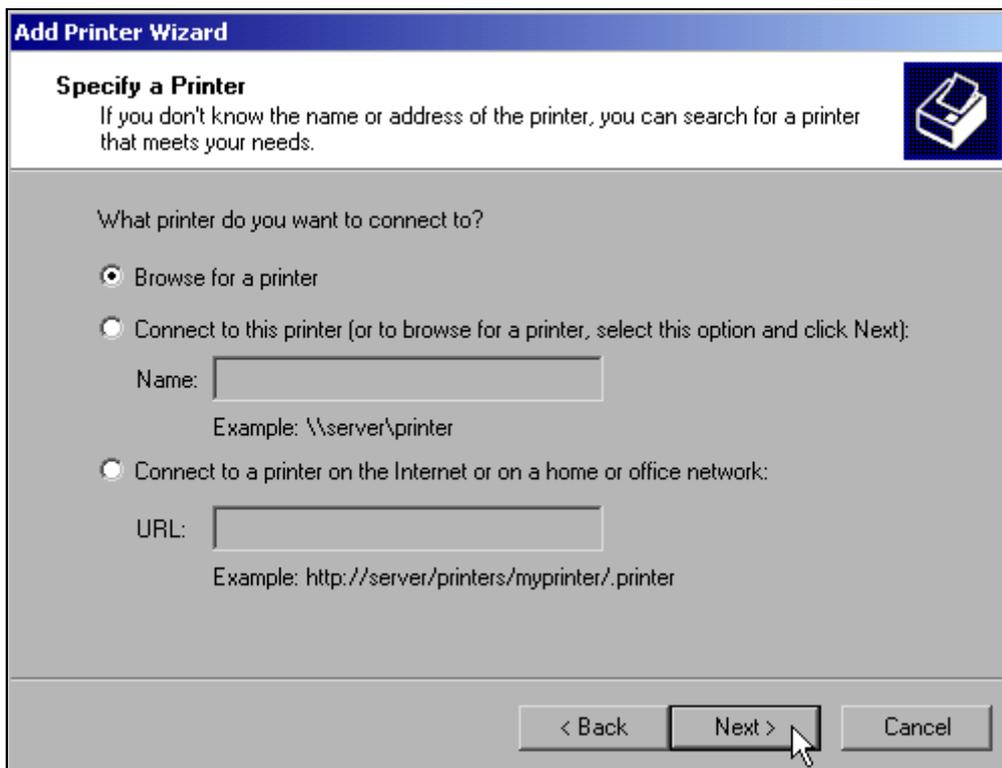
➢ Click *Browse for a printer* and then *Next*.
  The selection of enabled printers will appear.

➢ Mark a printer and confirm with *OK*.

➢ When you are prompted to confirm the installation of a suitable printer driver, click *OK*.
The selection of printer drivers will appear.
The left-hand pane will list the manufacturers and the right-hand pane the available printer drivers.
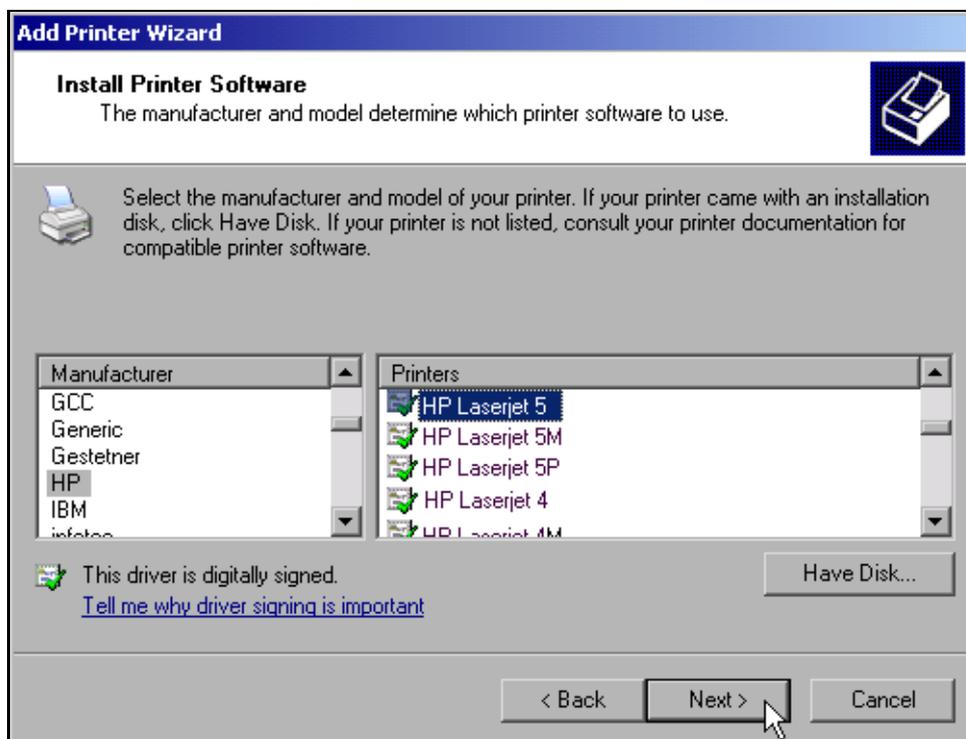
➢ Select the appropriate manufacturer under *Manufacturers* and then the appropriate printer driver under *Printers*.
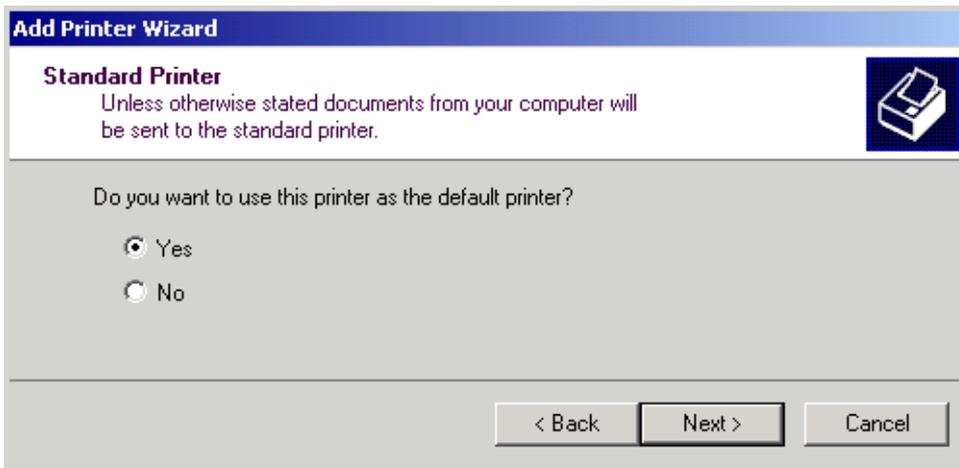
> If the printer you need does not appear in the list, the driver has not yet been installed on the instrument. In this case, click the *Have Disk* button. You will then be prompted to insert a disk containing the required driver. Then press *OK* and select the printer driver.
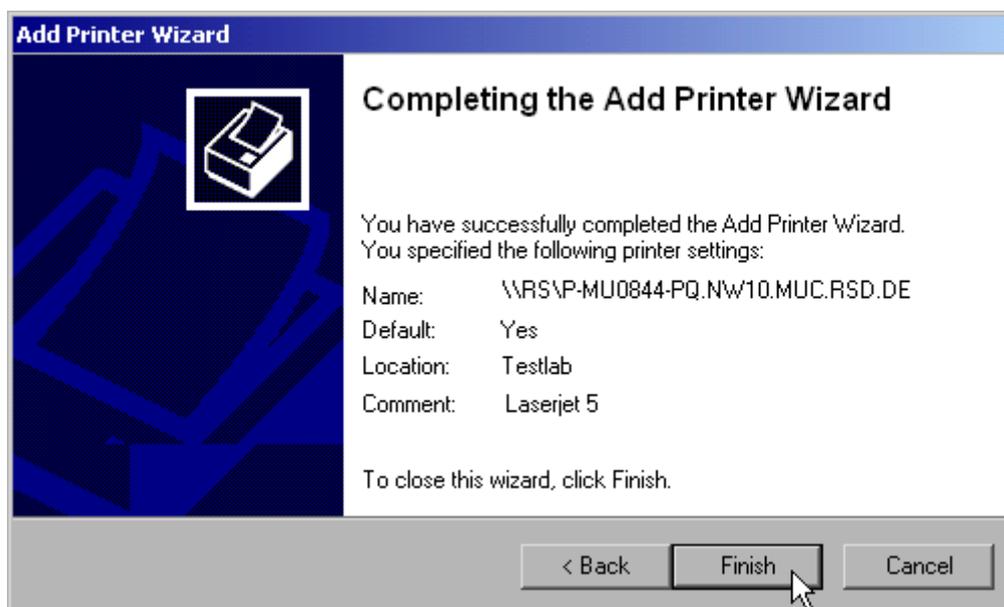
➢ Click *Next*.

The default printer selection dialog is opened.

Add Printer Wizard

Standard Printer
Unless otherwise stated documents from your computer will be sent to the standard printer.

Do you want to use this printer as the default printer?

⦿ Yes

○ No

[< Back] [Next >] [Cancel]

If one or more printers have already been installed, you will now be asked whether you want to use the printer you just installed as the default printer for Windows XP applications. The default response is *No*.

➢ After selecting the default printer, click *Next*. The final message of the installation wizard is displayed.

Add Printer Wizard

Completing the Add Printer Wizard

You have successfully completed the Add Printer Wizard. You specified the following printer settings:

Name: \\RS\P-MU0844-PQ.NW10.MUC.RSD.DE
Default: Yes
Location: Testlab
Comment: Laserjet 5

To close this wizard, click Finish.

[< Back] [Finish] [Cancel]

➢ Click the *Finish* button to start installation of the printer driver.

➢ Configure the R&S ESPI for printout with this printer using the *DEVICE SETUP* and *DEVICE 1/2* softkeys in the hardcopy main menu (see section " Selecting and Configuring Printers" on page 2.26).

6.6.9 Sharing Directories (only with Microsoft Networks)

Sharing directories makes data on the device available for use on other computers. This is possible only in Microsoft networks.
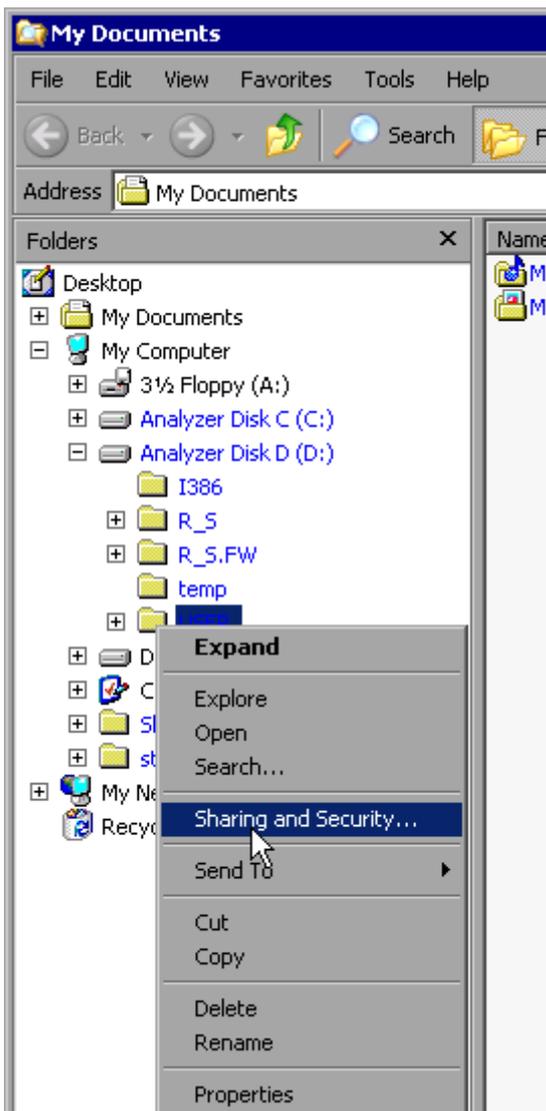
Sharing is a property of a file or directory. The procedure for applying sharing is as follows:

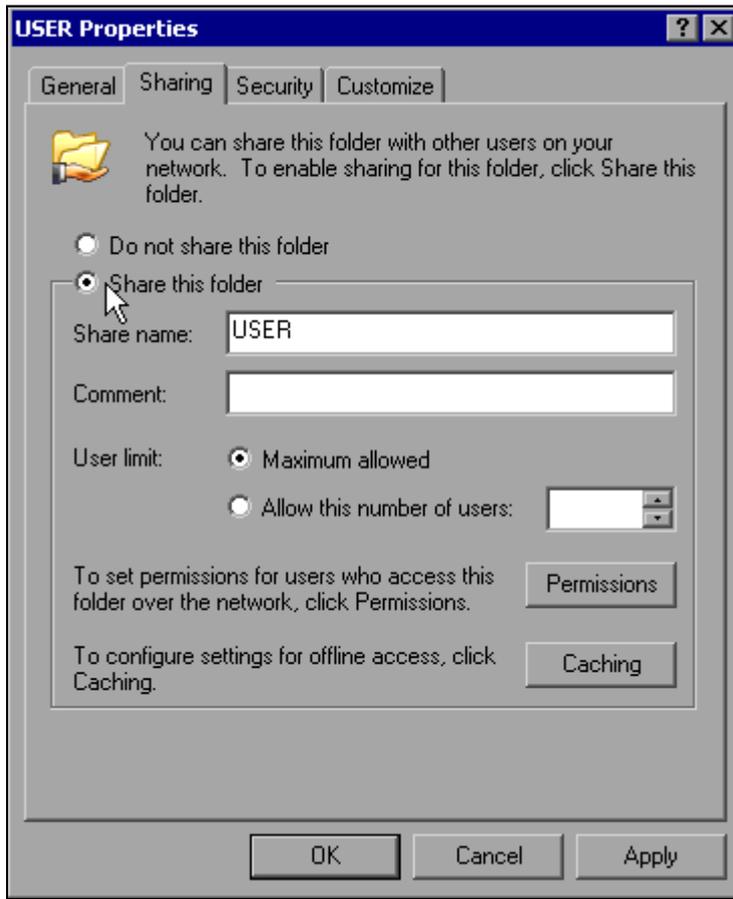➢ Open the Windows Start menu with the Windows key or *CTRL+ESC*.
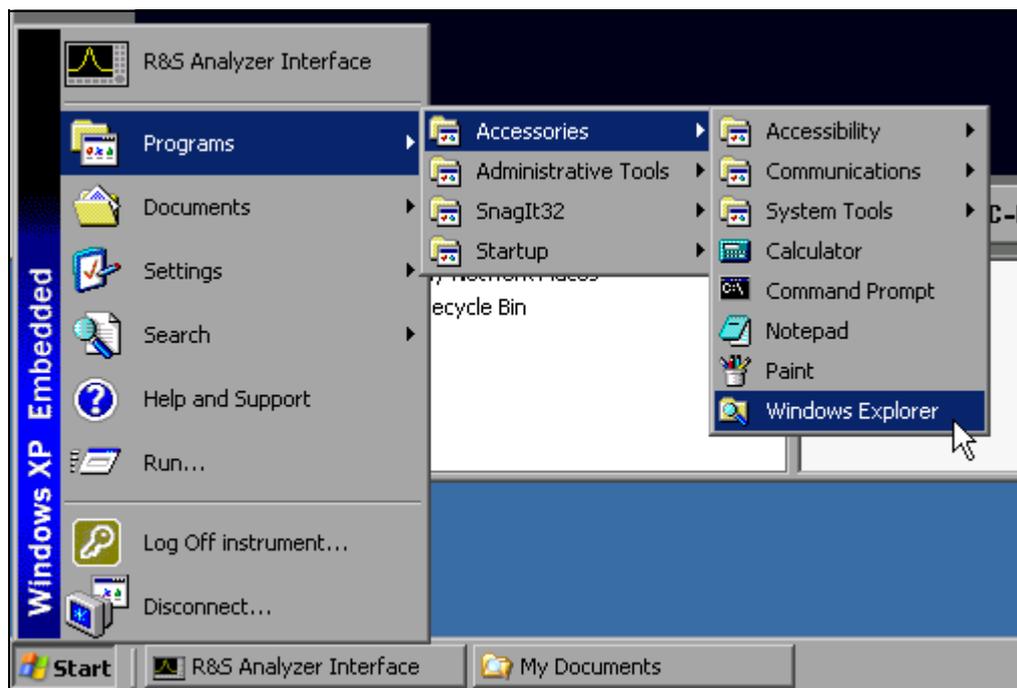
➢ Click *Programs - Accessories - Windows Explorer* to open Windows Explorer.

➢ Click the desired folder with the right mouse button.

➢ Click *Sharing and Security*.
The dialog for sharing the directory will open.

➢ Click *Share this folder*.

➢ You can change the following settings as necessary:

    Share name: Name under which the directory appears in Explorer

    Comment: Comments regarding the shared directory

    User Limit: Maximum number of users who can access the directory simultaneously

    Permissions: The user access rights (read only, read and write, all)

    Caching: Local buffering of the directory contents for quicker access

➢ Confirm the settings with *OK*.
The drive will be shared and marked with a hand under the directory symbol in Explorer:

6.7 Manual Operation of the R&S ESPI with XP Remote Desktop

6.7.1 Introduction

In production test and measurement, a common requirement is central monitoring of the T&M instruments for remote maintenance and remote diagnostics. Equipped with the Remote Desktop software of Windows XP, the R&S ESPI ideally meets requirements for use in production:

• Access to the control functions via a virtual front panel *(soft front panel)*

• Printout of measurement results directly from the controller

• Storage of measured data on the controller's hard disk

The R&S ESPI is connected via a LAN, in which case Windows XP also supports a connection via a modem. This section describes the configuration of the R&S ESPI and Remote Desktop Client of the control PC. Details on how to set up a modem connection are described in the Window XP documentation.

6.7.2 Configuring the R&S ESPI for Use of XP Remote Desktop

To enable an external computer to access the Remote Desktop software of the R&S ESPI, proceed as follows:
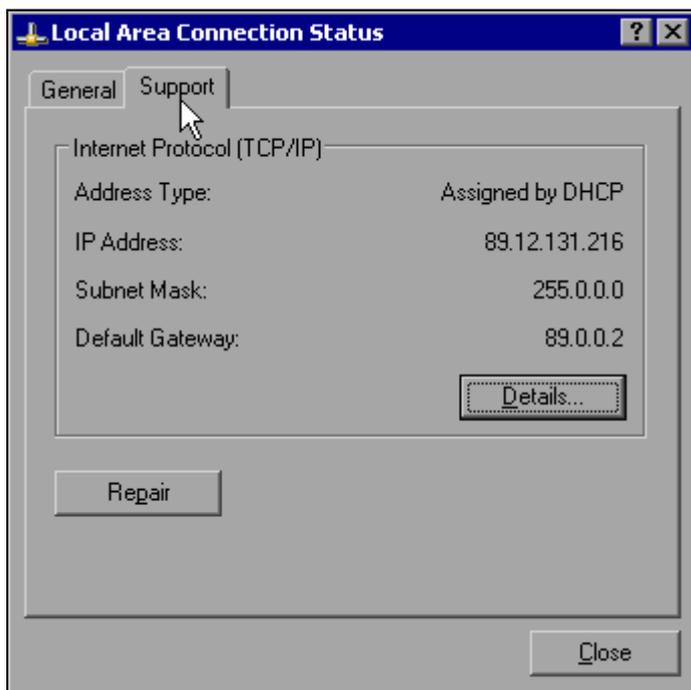
1. Determine the IP configuration of the network connection:

➢ Open the Windows XP Start menu with the Windows key or the *CTRL+ESC* key combination.
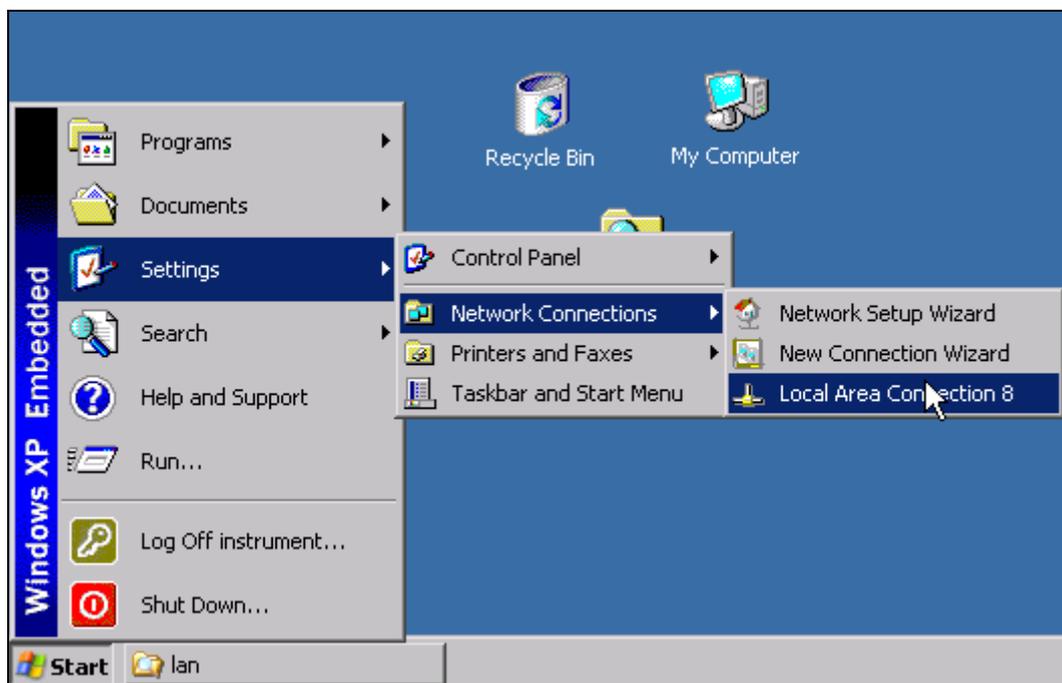
➢ Click *Settings - Network Connections - Local Area Connection*.
The *Local Area Connection Status* dialog box will open.

Manual Operation of the R&S ESPI with XP Remote Desktop

➢ Click the *Support* tab.
The current TCP/IP configuration will be displayed.

If *Assigned by DHCP* appears in the *Address Type* field, go to step 2 (Create a fixed IP address...). Otherwise, simply note the IP address and go to step 3 (Enable the R&S ESPI...).

2. Create a fixed IP address for the TCP/IP protocol as described in the section
*" Configuring Existing Network Protocols (TCP/IP Protocol)" on page 2.30*

> To avoid problems, use a fixed IP address.
> When a DHCP server is used, a new IP address is assigned each time the instrument is restarted. This address must first be determined on the instrument itself. Thus, using a DHCP server is not suitable for remote operation of the R&S ESPI.
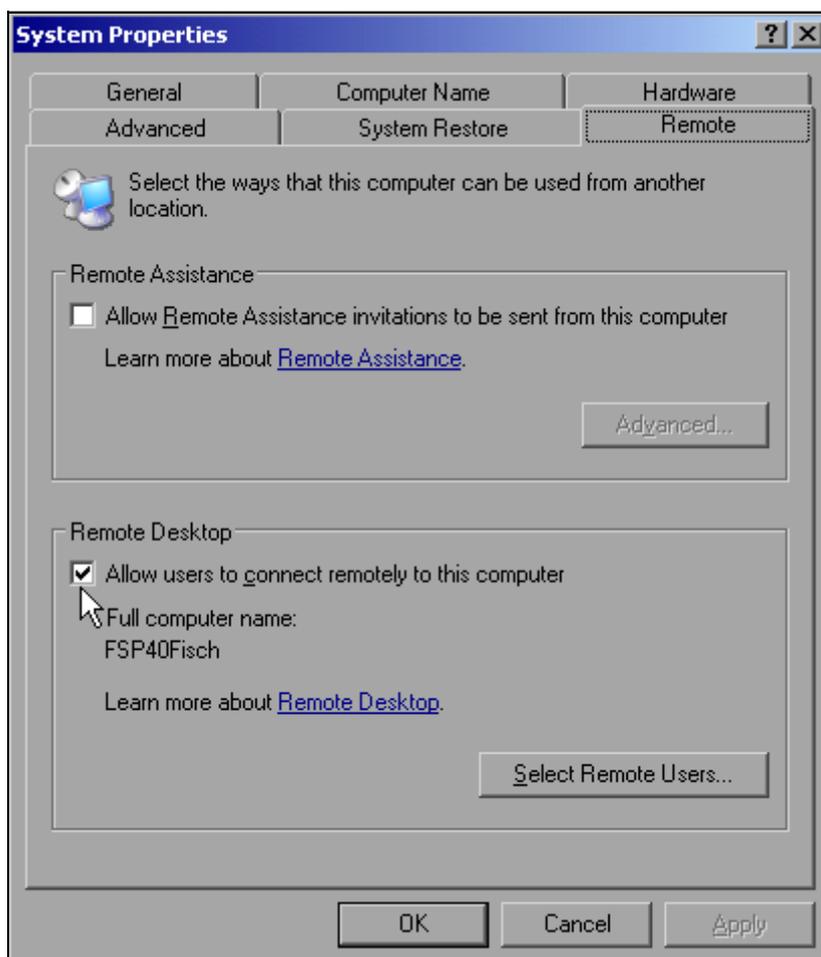
3. Enable the R&S ESPI for operation with Remote Desktop

➢ Press the Windows key or *CTRL+ESC*.
The Windows Start menu will open.

Manual Operation of the R&S ESPI with XP Remote Desktop
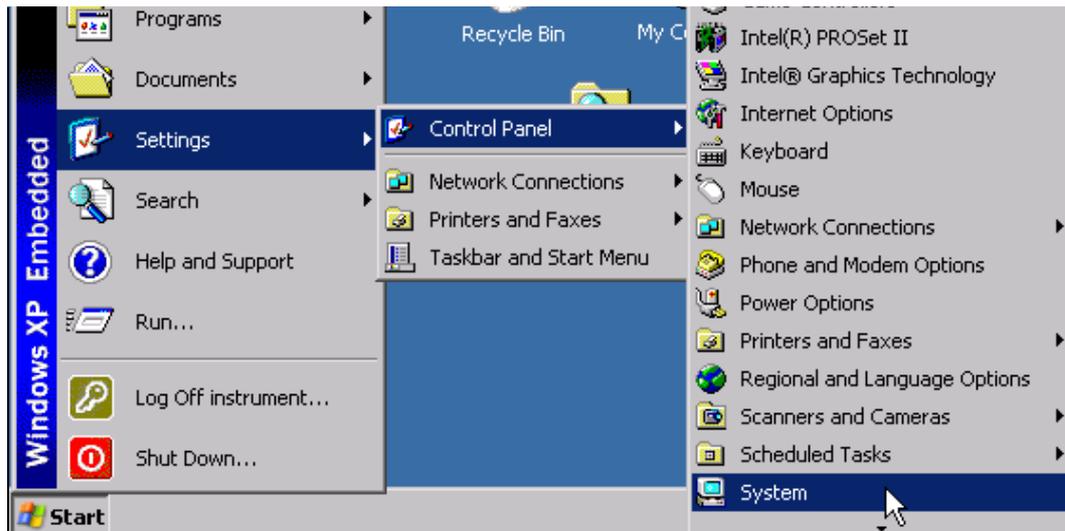
➢ Select *Settings - Control Panel - System*.

➢ Select the *Remote* tab.

➢ In the *Remote Desktop* panel, select the check box in front of *Allow users to connect remotely to this computer*.

Manual Operation of the R&S ESPI with XP Remote Desktop

➢ If necessary, click *Select Remote Users...* and select users created on the R&S ESPI who are to be given access to the R&S ESPI also via Remote Desktop.

> The user account under which configuration is carried out is automatically enabled for Remote Desktop.

➢ Confirm the setting with *OK*.

The R&S ESPI is now ready for connection setup with the Remote Desktop program of the controller.

6.7.3 Configuring the Controller

Before Remote Desktop can be operated, the TCP/IP protocol must be created on the controller and Remote Desktop Client must be installed.

> With Windows XP, Remote Desktop Client is part of the operating system and can be accessed via *Start - Programs - Accessories - Communications - Remote Desktop Connection*.
>
> For other versions of Windows, Microsoft offers the Remote Desktop Client as an add-on.

The settings on the Remote Desktop Client of the controller must be made before the connection with the R&S ESPI is set up. The procedure is as follows:

➢ Press the Windows key or *CTRL+ESC*.
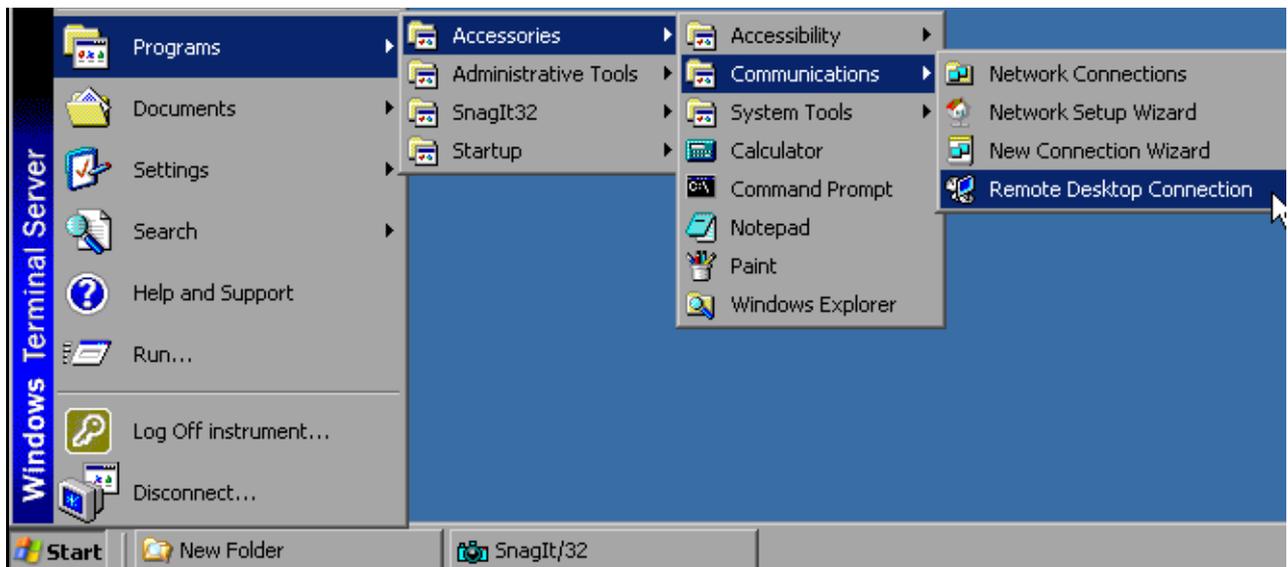
➢ Select *Programs - Accessories -* Communications - Remote Desktop Connection.
The Remote Desktop login screen will appear.

Manual Operation of the R&S ESPI with XP Remote Desktop
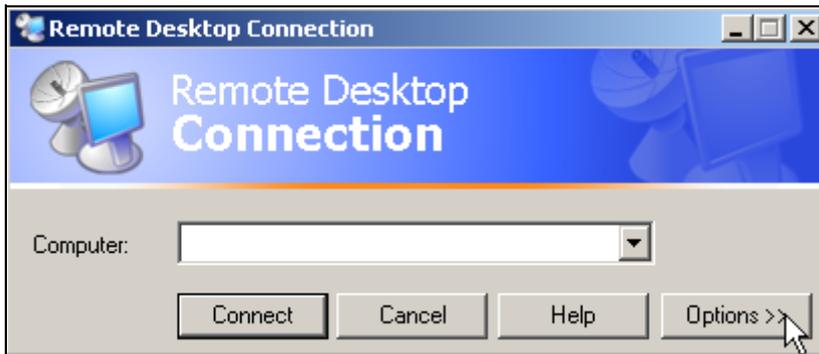
➢ Select the *Options >>* button.
The table with the configuration data will appear.

➢ Select the *Experience* tab.
These settings are used to select and optimize the connection speed.

➢ Click the selection list under *Choose your connection speed to optimize performance*.
The list of available configurations will appear.
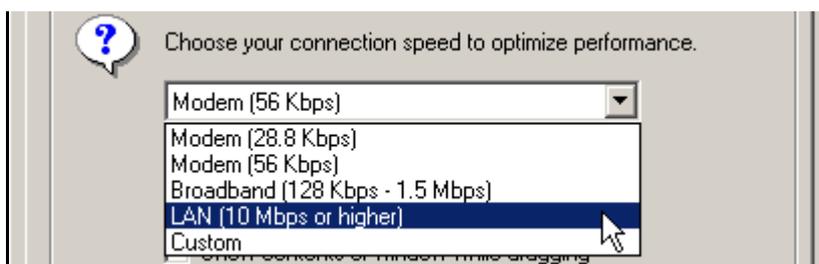
➢ Select the appropriate connection (for example: LAN (10 Mbps or higher)).
Depending on your selection, various checkboxes will be activated in the list located below
(also depends on how powerful the connection is).

➢ To improve performance, you can deactivate *Desktop background*, *Show Contents of
Window while dragging* and *Menu and Window animation*.

➢ Click the *Local Resources* tab.
The tab for enabling printers, local drives and serial interfaces will appear.
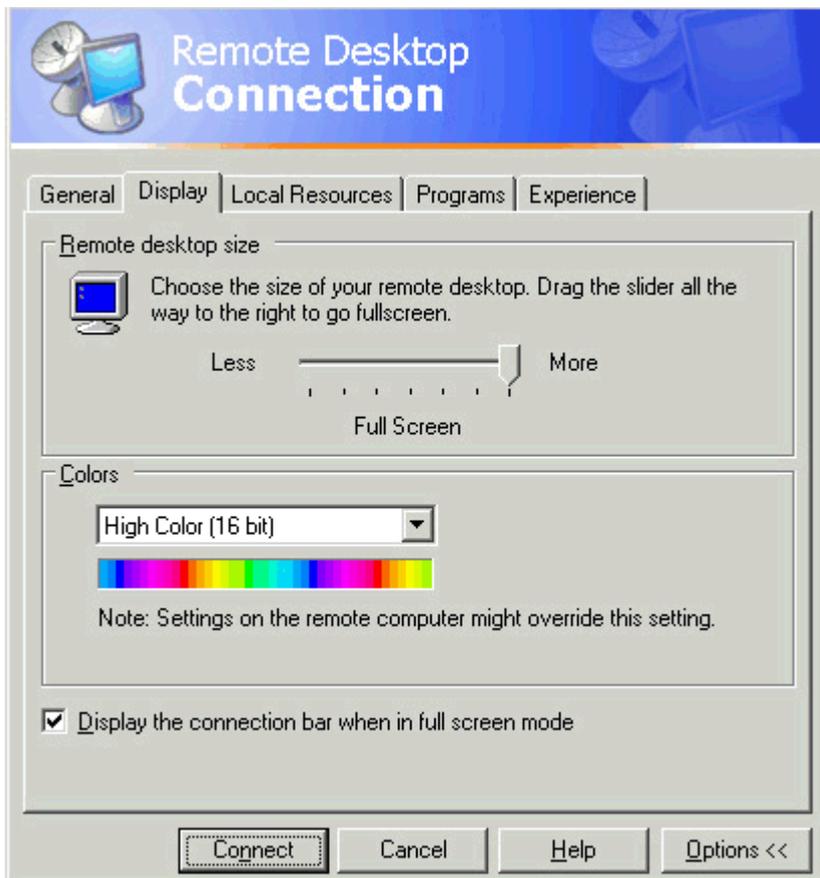
Manual Operation of the R&S ESPI with XP Remote Desktop

➢ Click the check box in front of *Disk drives* if you will need to access drives of the controller from the R&S ESPI (e.g. in order to store settings or to copy files from the controller to the R&S ESPI):

Windows XP will then map drives of the controller to the R&S ESPI like network drives.

➢ Click the check box in front of *Printers* if you want to use printers connected to the controller by accessing them from the R&S ESPI.

➢ Do not change the remaining settings.

➢ Click the *Display* tab.
The options for configuring the R&S ESPI screen display will appear.

➢ You can set the size of the R&S ESPI window on the desktop of the controller by positioning the pointer in the *Remote desktop size* panel. The default setting is Full Screen.

➢ Do not change the *Colors* setting.

➢ Display the connection bar when in full screen mode:

If this option is enabled, a bar showing the network address of the R&S ESPI will appear at the top edge of the screen. You can use this bar to reduce, minimize or close the window.

If this option is disabled, the only way you can return to the controller desktop from the R&S ESPI screen in full screen mode is to select *Disconnect* from the Start menu:
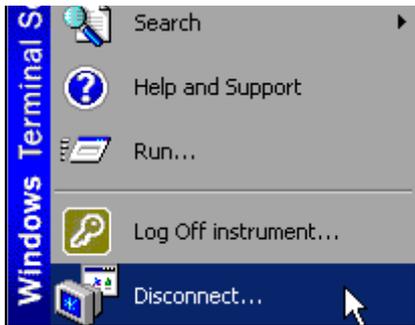
6.7.4 Connection Setup with the R&S ESPI

After you configure the Remote Desktop Client, you need to set up the connection to the R&S ESPI.

➢ Click the *General* tab. You can now enter the connection information.
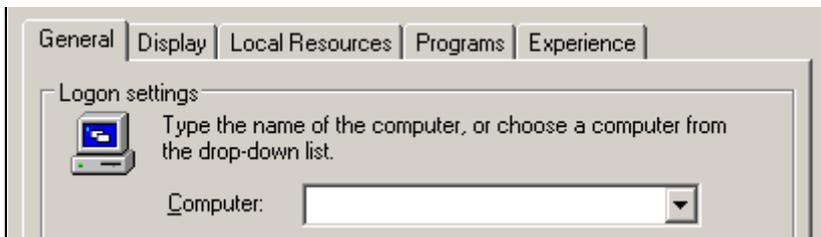
➢ Enter the IP address of the R&S ESPI in the *Computer* field.

➢ You can save the connection information for later use by clicking the *Save As...*button. You can use the *Open...* button to load an existing connection configuration.
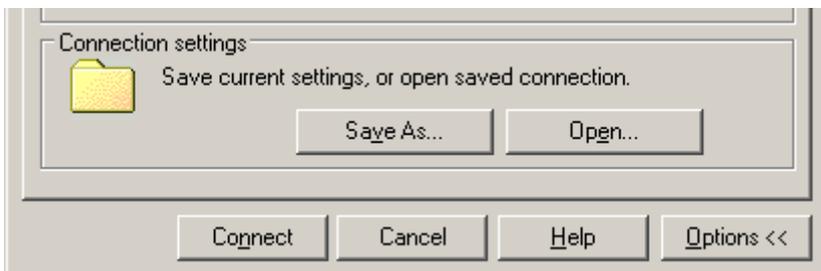
➢ Press the *Connect* button.
The connection will be set up.

➢ If the entry *Disk Drives* is enabled on the *Local Resources* tab, a warning will appear indicating that the drives are enabled for access from the R&S ESPI:

Manual Operation of the R&S ESPI with XP Remote Desktop

➢ Confirm the warning with *OK*.
Connection setup will be resumed.

After a few moments, the screen of the R&S ESPI will appear on the controller's screen with the prompt for you to log on. To enable remote control of the R&S ESPI, do the following:

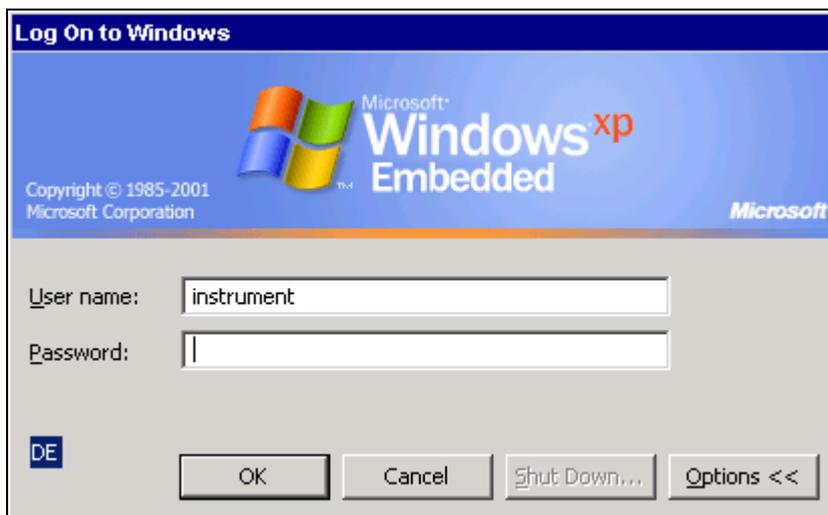➢ Enter "instrument" as the *user name* and "123456" as the *password*.
After a few moments, the R&S ESPI screen will appear.

> By default, the username is "instrument" and the password is "123456".
>
> Prior to firmware version 4.4, the username and password both were "instrument".

If the R&S ESPI application appears on screen immediately after connection setup, shutdown and restart are not necessary.

If a dark screen appears or a dark square appears in the upper left-hand corner of the screen, you must restart the R&S ESPI in order to see the modified screen resolution:

Manual Operation of the R&S ESPI with XP Remote Desktop
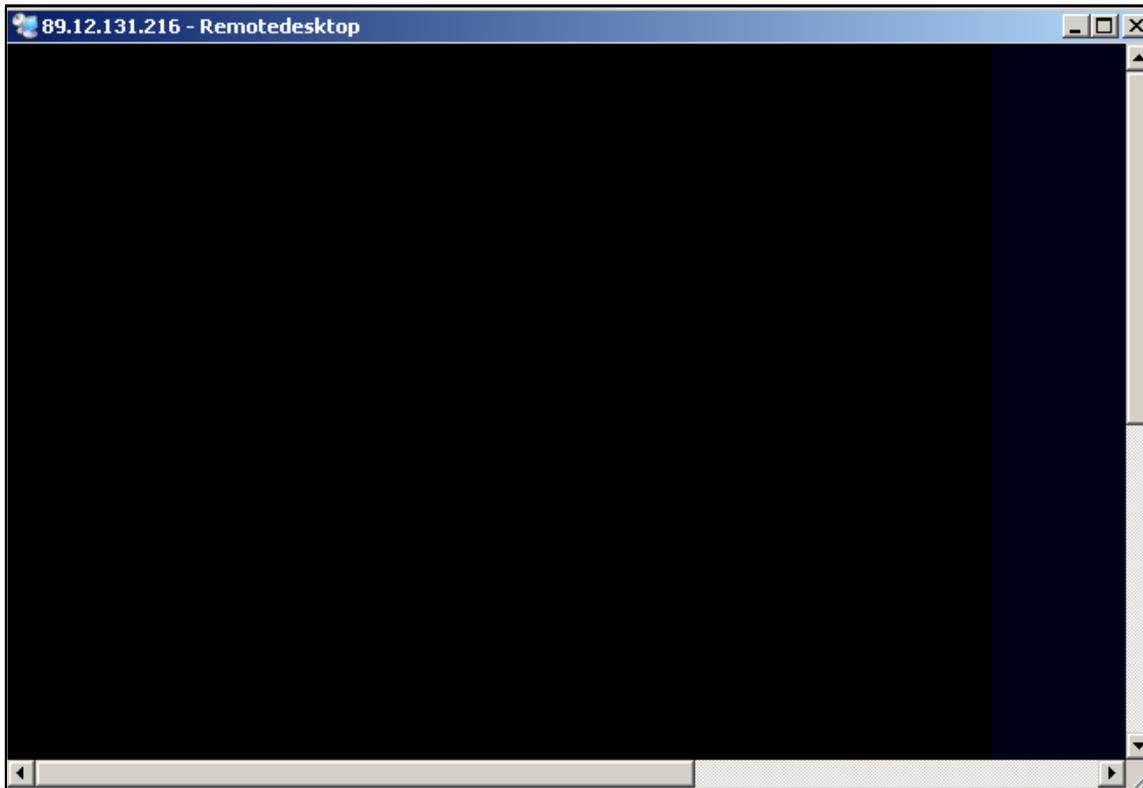
In this case, do the following:

➢ Press *ALT+F4*.
   The R&S ESPI firmware will be shut down, which may take a few seconds.
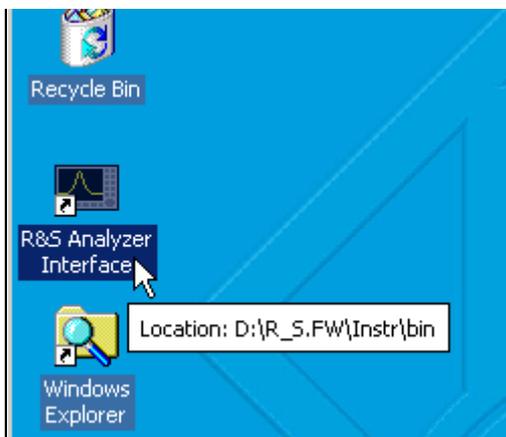
➢ Double-click *R&S Analyzer Interface*.
   The firmware will restart and then automatically open the *Soft Front Panel*, i.e. the user interface on which all front panel controls and the rotary knob are mapped to buttons.

   After the connection is established the R&S ESPI screen is displayed in the Remote Desktop application window.
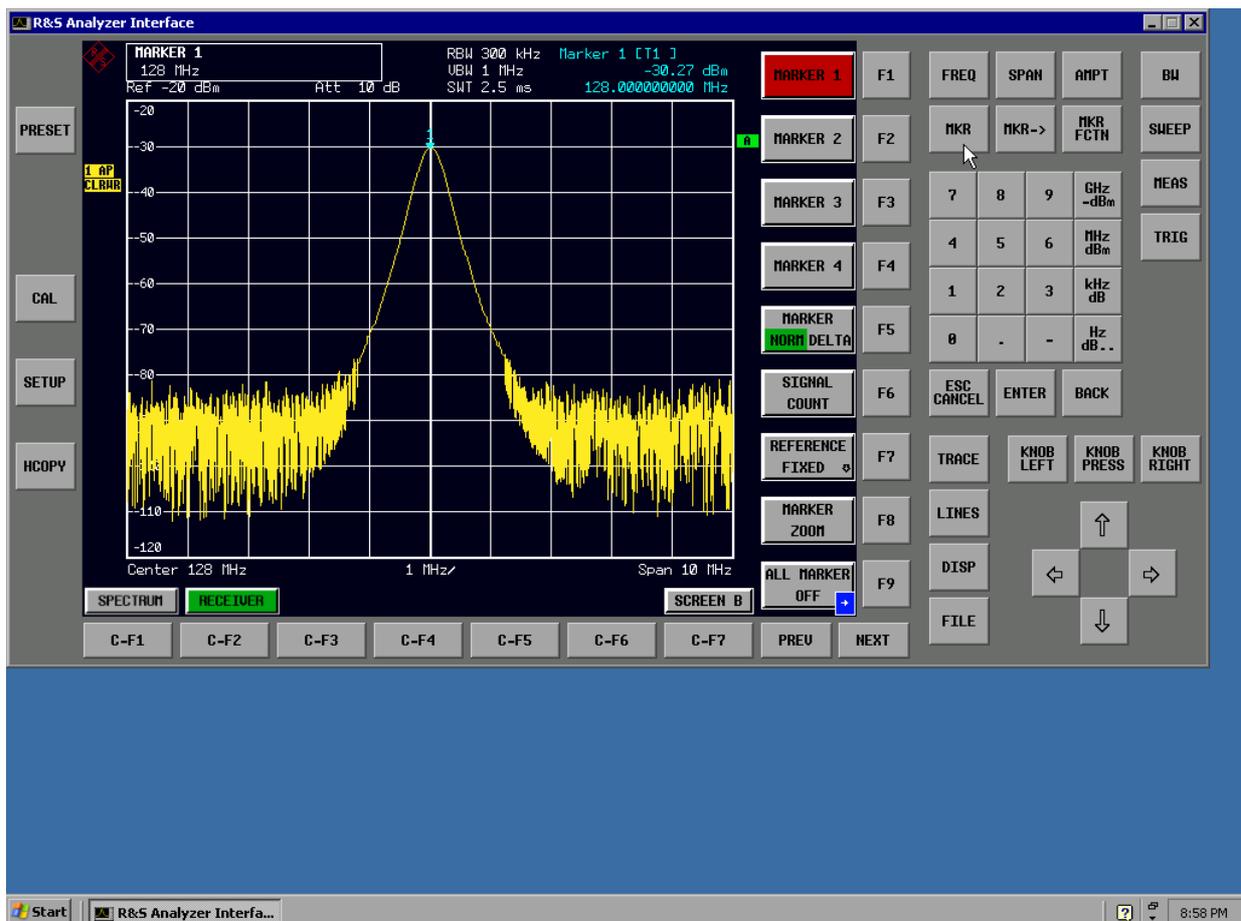
You can operate all hardkeys, softkeys and hotkeys by using the mouse.

The rotary knob is simulated by means of the *KNOB LEFT, KNOB RIGHT* and *KNOB PRESS* buttons.

The Windows XP Start menu can be made available by expanding the Remote Desktop window to Full Size.

6.7.5 Interrupting and Restoring the Remote Desktop Connection with the R&S ESPI

The connection to the R&S ESPI can be interrupted at any time by closing the Remote Desktop window on the controller.

To restore the connection with the R&S ESPI, merely follow the instructions provided in the section" Connection Setup with the R&S ESPI" on page 6.30. If the connection is interrupted and then restored, the R&S ESPI remains in the same state.

During the connection with the controller, the login entry will appear on the R&S ESPI screen. If the login procedure is completed successfully on the instrument, a message will appear on the controller display indicating that another user has assumed control of the instrument and that the connection was terminated as a result.

Manual Operation of the R&S ESPI with XP Remote Desktop

6.7.6 Deactivating the R&S ESPI from the Controller

The R&S ESPI can be deactivated via remote control. To do so, proceed as follows:

1. Click the R&S ESPI soft front panel and close the application with *ALT+F4*.

2. Click the desktop and press *ALT+F4*.
   A safety query will appear that warns you that the instrument cannot be reactivated via remote control and asks you whether you want to continue the shutdown process.

3. Respond to the safety query with YES.
   The connection with the controller will then be terminated and the R&S ESPI will be deactivated.

7   Brief Introduction to Remote Control

Basic Steps in Programming using the VISA Interface

The instrument can be remote controlled via the GPIB interface. For details on setting the GPIB interface see chapter 2, section " Setting the GPIB Interface" on page 2.19.

Remote control via network (LAN interface) is provided with option R&S FSP-B16 only. For details on configuring the LAN interface see chapter 2, section " Configuring the LAN Interface (Option R&S FSP-B16 only)" on page 2.29.

The following programming examples are hierarchical in structure, i.e. the later examples are based on the preceding ones. This makes it possible to easily assemble a well-functioning program by using the modules of the program examples. More complex examples are provided in the Operating Manual, chapter 7.

The chapter is divided into the following sections:

• " Basic Steps in Programming using the VISA Interface" on page 7.3

• " Detailed Programming Examples" on page 7.9

7.1 Basic Steps in Programming using the VISA Interface

The following examples explain how to program the instrument and can be used as a basis for solving enhanced programming tasks.

Visual Basic was used as the programming language. However, the programs can be implemented in other languages as well.

> In progamming languages as C, C++ or programmes as MATLAB, NI Interactive Control, a backslash starts an escape sequence (e.g. "\n" is used to start a new line). In these progamming languages and programms, two backslashes instead of one must be used in remote commands, e.g. in " Storing Instrument Settings" on page 7.19:
> instead of `MMEM:STOR:STAT 1,'D:\USER\DATA\TEST1'`
> use `MMEM:STOR:STAT 1,'D:\\USER\\DATA\\TEST1'`

7.1.1 Linking the VISA Library for Visual Basic

7.1.1.1 Programming notes:

Outputting texts by using the "Print" function

The following programming examples are based on the assumption that all subroutines are created as part of a form (file extension .FRM). In this case, the following notation is permitted:

```
Print "Text"
```

However, if the subroutines are created as a module (file extension .BAS), the name of the form that contains the required print method must be placed in front of the print instruction. Thus, if a form is named "Main", the print instruction will be as follows:

```
Main.Print "Text".
```

Accessing the functions of the VISA32.DLL

To enable users to create Visual Basic control applications, the file dynamic link library VISA32.DLL has to be added to the project using the *References* command in the *Project* menu. In addition, the file VISA32.BAS is being added to the project. This file contains constants and definitions for error handling, time-out values, etc.

Declaring the DLL functions as procedures

All functions return a status variable that is defined as `Long`. Thus, all functions are declared in the file VISA32.BAS as follows:

```
Declare Function xxx Lib "visa32.dll" ( ... ) As Long
```

Creating a response buffer

Since the DLL returns zero-terminated strings in responses, a string of sufficient length must be created before the `viRead()` function is called, because Visual Basic inserts a length specification in front of the strings and this specification is not updated by the DLL. The following two means of creating the length specification for a string are provided:

```
Dim Rd as String * 100
Dim Rd as String
Rd = Space$(100)
```

7.1.2 Initialization and Default State

At the beginning of each program, the VISA resource manager has to be initialized. It opens a connection to the VISA driver itself, which controls the interaction with all instruments.

7.1.2.1 Creating Global Variables

In Visual Basic, global variables are stored in modules (data extension .BAS). Thus, at least one module (e.g. GLOBALS.BAS) must be created that contains the variables used by all subroutines, e.g. the variables for device handlers used by the VISA layer.

For all example programs shown below, the file must contain the following instructions:

```
Global analyzer As ViSession
Global defaultRM As ViSession
Const analyzerString = "GPIB0::20::INSTR"
Const analyzerTimeout = 10000
```

The constant analyzerString, specifies the instrument. "GPIB0" specifies the control, whereas "20" specifies a certain instrument connected to the controller. Assuming the instrument was connected via a LAN cable and assigned the IP address 192.168.1.1, the corresponding string would read as:

```
Const analyzerString = "TCPIP::192.168.1.1::INSTR"
```

7.1.2.2 Initializing the Controller

This procedure first establishes a connection to the VISA layer and then to the instrument specified by the analyzerString.

```
REM ------------ Initializing the controller ------------------------------
Public SUB InitController()
Dim status As ViStatus
status = viOpenDefaultRM(defaultRM)
status = viOpen(defaultRM, analyzerString, VI_NULL, VI_NULL, analyzer)
     'Opens connection to Default Resource Manager and returns a handle to it
END SUB
REM ***********************************************************************
```

7.1.2.3 Initializing the Instrument

The instrument is set to its default settings and the status register is cleared.

```
REM ------------ Initializing the instrument ------------------------------
Public SUB InitDevice()
Dim status As ViStatus
Dim retCnt As Long
status = viWrite(analyzer, "*CLS", 4, retCnt)
     'Reset status register
status = viWrite(analyzer, "*RST", 4, retCnt)
     'Reset instrument
status = viWrite(analyzer, "INST:SEL SAN", 12, retCnt)  'Change into analyzer mode
END SUB
REM***********************************************************************
```

7.1.2.4 Switching the Screen Display On and Off

In the default setting, all remote control commands are carried out with the screen display switched off in order to attain optimum measurement speed. During the development phase of remote control programs, however, the screen display is required in order to visually check both the programming of the settings and the measurement results.

The following examples show functions that switch the screen display on or off during remote control.

```
REM ------------ Switching on the screen display -------------------------
Public SUB DisplayOn()
Dim status As ViStatus
Dim retCnt As Long
status = viWrite(analyzer, "SYST:DISP:UPD ON", 16, retCnt)
     'Switch on screen display
END SUB
REM***********************************************************************
REM ------------ Switching off the screen display ------------------------
Public SUB DisplayOff()
Dim status As ViStatus
Dim retCnt As Long
```

```
status = viWrite(analyzer, "SYST:DISP:UPD OFF", 17, retCnt)
     'Switch off screen display
END SUB
REM****************************************************************************
```

7.1.2.5 Configuring the Power Save Function for the Display

During remote operation, it is often unnecessary to display the measurement results on screen. Although the `SYSTem:DISPlay:UPDate OFF` command switches off the display of the measurement results, thus significantly improving speed during remote control, the display itself and the background lighting in particular remain switched on.

If you also want to switch off the display itself, you must use the Power Save function by setting the response time in minutes prior to activation.

> The display will be immediately reactivated if you press a key on the instrument's front panel.

```
REM -------- Switching on Power Save function ----------------------------
Public SUB PowerSave()
Dim status As ViStatus
Dim retCnt As Long
status = viWrite(analyzer, "DISP:PSAV:HOLD 1", 16, retCnt)
     'Set response time to 1 minute
status = viWrite(analyzer, "DISP:PSAV ON", 12, retCnt)
     'Switch on Power Save function
END SUB
REM****************************************************************************
```

7.1.3 Sending Simple Instrument Setting Commands

This example shows how the center frequency, span and reference level of the instrument are set.

```
REM -------- Instrument setting commands ---------------------------------
PUBLIC SUB SimpleSettings()
Dim status As ViStatus
Dim retCnt As Long
status = viWrite(analyzer, "FREQENCY:CENTER 128MHz", 22, retCnt)
     'Center frequency 128 MHz
status = viWrite(analyzer, "DISPLAY:TRACE:Y:RLEVEL -10dBm", 29, retCnt)
     'Set reference level to -10dBm
END SUB
REM ********************************************************************
```

7.1.4 Reading Out Instrument Settings

The settings made above can now be read out. To do so, the abbreviated commands are used.

```
REM --------- Reading out instrument settings ----------------------------
PUBLIC SUB ReadSettings()
Dim status As ViStatus
Dim retCnt As Long
CFfrequenz$ = Space$(20)
     'Provide text variable (20 characters)
status = viWrite(analyzer, "FREQ:CENT?", 10, retCnt)
     'Request center frequency
status = viRead(analyzer, CFfrequenz$, 20, retCnt)
     'Read in value
CFspan$ = Space$(20)
     'Provide text variable (20 characters)
status = viWrite(analyzer, "FREQ:SPAN?", 10, retCnt)
     'Request span
status = viRead(analyzer, CFspan$, 20, retCnt)
     'Read in value
RLpegel$ = Space$(20)
     'Provide text variable (20 characters)
status = viWrite(analyzer, "DISP:TRAC:Y:RLEV?", 17, retCnt)
     'Request ref level setting
status = viRead(analyzer, RLpegel$, 20, retCnt)
     'Read in value
REM -------- Displaying values on the screen ----------------------------
Print "Center frequency: "; CFfrequenz$,
Print "Span:             "; CFspan$,
Print "Reference level:  "; RLpegel$,
END SUB
REM*************************************************************************
```

7.1.5 Marker Positioning and Readout

```
REM -------- Example of marker function ---------------------------------
PUBLIC SUB ReadMarker()
status = viWrite(analyzer, "CALC:MARKER ON;MARKER:MAX", 25, retCnt)
     'Activate marker 1 and search for peak
MKmark$ = Space$(30)
     'Provide text variable (30 characters)
status = viWrite(analyzer, "CALC:MARK:X?;Y?", 15, retCnt)
status = viRead(analyzer, MKmark$, 30, retCnt)
     'Query frequency and level and read in value
REM -------- Displaying values on the screen ----------------------------
Print "Marker frequency/level "; MKmark$,
END SUB
REM *************************************************************************
```

7.1.6 Command Synchronization

The synchronization methods used in the following example are described in the Operating Manual, chapter 5, section "Command Sequence and Command Synchronization".

Service requests are only supported by GPIB and VXI instruments.

```
REM -------- Commands for command synchronization -----------------------
PUBLIC SUB SweepSync()
Dim status As ViStatus
Dim retCnt As Long
Dim etype As ViEventType
Dim eevent As ViEvent
Dim stat As Integer
Rem The command INITiate[:IMMediate] starts a single sweep if the
Rem command INIT:CONT OFF has already been sent. The next command
Rem must not be carried out until a full sweep has been completed.
status = viWrite(analyzer, "INIT:CONT OFF", 13, retCnt)
REM -------- First method: Using *WAI ------------------------------------
status = viWrite(analyzer, "ABOR;INIT:IMM;*WAI", 18, retCnt)
REM -------- Second method: Using *OPC? ----------------------------------
OpcOk$ = Space$(2)
status = viWrite(analyzer, "ABOR;INIT:IMM; *OPC?", 20, retCnt)
     'Provide space for *OPC? response
REM In this case, the controller can use other instruments:
status = viRead(analyzer, OpcOk$, 2, retCnt)
     'Wait for "1" from *OPC?
REM -------- Third method: Using *OPC ------------------------------------
Rem In order for the Service Request function to be used with a GPIB
Rem driver from National Instruments, the setting
Rem "Disable Auto Serial Poll" must be set to "yes" with IBCONF!
status = viWrite(analyzer, "*SRE 32", 7, retCnt)
     'Enable Service Request for ESR
status = viWrite(analyzer, "*ESE 1", 6, retCnt)
     'Set event enable bit for operation complete bit
status = viEnableEvent(analyzer, VI_EVENT_SERVICE_REQ, VI_QUEUE, VI_NULL)
     'Enable SRQ event
status = viWrite(analyzer, "ABOR;INIT:IMM;*OPC", 18, retCnt)
     'Start sweep with synchronization to OPC
status = viWaitOnEvent(analyzer, VI_EVENT_SERVICE_REQ, 10000, etype, eevent)
     'Wait for Service Request
status = viReadSTB(analyzer, stat)
status = viClose(eevent)
     'Close event handler
status = viDisableEvent(analyzer, VI_EVENT_SERVICE_REQ, VI_QUEUE)
     'Disable SRQ Event
REM Resume main program here.
```

```
END SUB
REM **********************************************************************
```

7.1.6.1 Reading Output Buffers

```
REM -------- Subroutine for the individual STB bits ----------------------
Public SUB Outputqueue()
     'Reading the output queue
Dim status As ViStatus
Dim retCnt As Long
result$ = Space$(100)
     'Create space for response
status = viRead(analyzer, result$, 100, retCnt)
Print "Contents of Output Queue : "; result$
END SUB
REM ***********************************************************************
```

7.1.6.2 Reading Error Messages

```
REM ------- Subroutine for evaluating the error queue --------------------
Public SUB ErrorQueueHandler()
Dim status As ViStatus
Dim retCnt As Long
sError$ = Space$(100)
     'Subroutine for evaluating the error queue
status = viWrite(analyzer, "SYSTEM:ERROR?", 13, retCnt)
status = viRead(analyzer, sError$, 100, retCnt)
Print "Error Description : "; sError$
END SUB
REM ***********************************************************************
```

7.2 Detailed Programming Examples

7.2.1 Default Settings of the R&S ESPI

The following settings provide typical examples of how to change the default settings of the R&S ESPI.

Note that only some of the settings are necessary depending on the application example. In many cases, it is not necessary to set resolution bandwidth, video bandwidth and sweep time since these parameters are automatically calculated in the default setting when the span is changed. Likewise, the input attenuation is automatically calculated in the default setting as a function of the reference level. Last of all, the level detectors are linked to the selected trace mode in the default setting.

The settings automatically calculated in the default setting are indicated with an asterisk (*) in the following program example.

7.2.1.1 Setting the IEC Bus Status Registers

```
REM ************************************************************************
Public Sub SetupStatusReg()
Dim status As ViStatus
Dim retCnt As Long
REM ------ IEEE 488.2 status register -------------------------------------
status = viWrite(analyzer, "*CLS", 4, retCnt)
     'Reset status registers
status = viWrite(analyzer, "*SRE 168", 8, retCnt)
     'Enable Service Request for STAT:OPER-, STAT:QUES- and ESR-Register
status = viWrite(analyzer, "*ESE 61", 7, retCnt)
     'Set event enable bit for: operation complete command-, execution-,device
     'dependent- and query error
REM ------ SCPI status register -------------------------------------------
status = viWrite(analyzer, "STAT:OPER:ENAB 0", 16, retCnt)
     'Disable OPERation Status Register
status = viWrite(analyzer, "STAT:QUES:ENAB 0", 16, retCnt)
     'Disable QUEStionable Status Register
End Sub
REM ************************************************************************
```

7.2.1.2 Default Settings for Measurements

```
REM ************************************************************************
Public Sub SetupInstrument()
Dim status As ViStatus
Dim retCnt As Long
REM ------ Default setting of the R&S ESPI ---------------------------------
Call SetupStatusReg
     'Configure status registers
status = viWrite(analyzer, "*RST", 4, retCnt)
     'Reset instrument
status = viWrite(analyzer, "INST:SEL SAN", 12, retCnt)
     'Change into analyzer mode.
status = viWrite(analyzer, "SYST:DISP:UPD ON", 16, retCnt)
     'ON: screen display on, OFF: off(improved performance)
status = viWrite(analyzer, "DISP:FORM SINGle", 16, retCnt)
     'Full screen display
status = viWrite(analyzer, "DISP:WIND1:SEL", 14, retCnt)
     'Active Screen A
status = viWrite(analyzer, "INIT:CONT OFF", 13, retCnt)
     'Single sweep mode
REM ------ Frequency setting ----------------------------------------------
status = viWrite(analyzer, "FREQ:SPAN 1 MHz", 15, retCnt)
     'Span
REM ------ Level setting --------------------------------------------------
status = viWrite(analyzer, "DISP:WIND:TRAC:Y:RLEV -20dBm", 28, retCnt)
     'Reference level
```

```
status = viWrite(analyzer, "INP:ATT 10dB", 12, retCnt)
     'Input attenuation  (*)
REM ------ Level scaling -----------------------------------------------
status = viWrite(analyzer, "DISP:WIND:TRAC:Y:SPAC LOG", 25, retCnt)
     'Log level axis
status = viWrite(analyzer, "DISP:WIND:TRAC:Y:SCAL 100dB", 27, retCnt)
     'Level range
status = viWrite(analyzer, "DISP:WIND:TRAC:Y:SCAL:MODE ABS", 30, retCnt)
     'Absolute scaling
status = viWrite(analyzer, "CALC:UNIT:POW DBM", 17, retCnt)
     'y meas. unit
REM ------ Trace and detector setting ------------------------------------
status = viWrite(analyzer, "DISP:WIND:TRAC1:MODE AVER", 25, retCnt)
     'Trace1 average
status = viWrite(analyzer, "AVER:TYPE VID", 13, retCnt)
     'Average mode video; "VID" for video
status = viWrite(analyzer, "SWE:COUN 10", 11, retCnt)
     'Sweep count
status = viWrite(analyzer, "DISP:WIND:TRAC2:STAT OFF", 24, retCnt)
     'Trace2 blank
status = viWrite(analyzer, "DISP:WIND:TRAC3:STAT OFF", 24, retCnt)
     'Trace3 blank
status = viWrite(analyzer, "CALC:MATH:STAT OFF", 18, retCnt)
     'Trace difference off
status = viWrite(analyzer, "DETECTOR1 RMS", 13, retCnt)
     'Detector Trace1   (*)
status = viWrite(analyzer, "DET2:AUTO ON", 12, retCnt)
     'Detector Trace2   (*)
status = viWrite(analyzer, "DET3:AUTO ON", 12, retCnt)
     'Detector Trace3   (*)
REM ------ Bandwidths and sweep time ----------------------------------------
status = viWrite(analyzer, "BAND:RES 100KHz", 15, retCnt) 'Resolution bandwidth (*)
status = viWrite(analyzer, "BAND:VID 1MHz", 13, retCnt)  'Video bandwidth   (*)
status = viWrite(analyzer, "SWE:TIME 100ms", 14, retCnt) 'Sweep time        (*)
END SUB
REM ***********************************************************************
```

7.2.2 Using Markers and Delta Markers

7.2.2.1 Marker Search Functions, Restricting the Search Range

The following example is based on an AM-modulated signal at 100 MHz that has the following characteristics:

- Carrier signal level: –30 dBm

- AF frequency: 100 kHz

- Modulation depth: 50%

Marker 1 and then delta marker 2 are set to the largest maximum points on the trace. The frequency and level are then read. In the following measurements, the instrument's default setting can be used for measurements (SetupInstrument).

```
REM ************************************************************************
Public Sub MarkerSearch()
Dim status As ViStatus
Dim retCnt As Long
result$ = Space$(100)
Call SetupInstrument
     'Default Setting
REM ------ Peak search without search range limits-------------------------
status = viWrite(analyzer, "INIT:CONT OFF", 13, retCnt)
     'Switch to single sweep
status = viWrite(analyzer, "CALC:MARK:PEXC 6DB", 18, retCnt)
     'Define peak excursion
status = viWrite(analyzer, "CALC:MARK:STAT ON", 17, retCnt)
     'Enable marker 1
status = viWrite(analyzer, "CALC:MARK:TRAC 1", 16, retCnt)
     'Set marker 1 to trace 1
status = viWrite(analyzer, "INIT;*WAI", 9, retCnt)
     'Perform sweep with sync
status = viWrite(analyzer, "CALC:MARK:MAX;X?;Y?", 19, retCnt)
     'Marker to peak; read frequency and level
status = viRead(analyzer, result$, 100, retCnt)
Print "Marker 1: "; result$
status = viWrite(analyzer, "CALC:DELT2:STAT ON;MAX;MAX:LEFT", 31, retCnt)
     'Activate delta marker 2, set to peak and then to next peak left
status = viWrite(analyzer, "CALC:DELT2:X?;Y?", 16, retCnt)
     'Read delta marker 2 frequency and level
status = viRead(analyzer, result$, 100, retCnt)
Print "Delta 2: "; result$
REM ------ Peak search with search range limit in x direction -------------
status = viWrite(analyzer, "CALC:MARK:X:SLIM:STAT ON;LEFT 0Hz;RIGHt 100.05MHz", 49,
retCnt)
     'Activate search limit and set at right below AF
status = viWrite(analyzer, "CALC:DELT3:STAT ON;MAX;MAX:RIGHt", 32, retCnt)
     'Activate delta marker 3, 'set to peak and then to next peak right
status = viWrite(analyzer, "CALC:DELT3:X:REL?;:CALC:DELT3:Y?", 32, retCnt)
```

```
     'Read delta marker 3 frequency and level; both must have a value of 0
status = viRead(analyzer, result$, 100, retCnt)
Print "Delta 3: "; result$
```

REM ------ Peak search with search range limit in y direction --------------

```
status = viWrite(analyzer, "CALC:THR:STAT ON", 16, retCnt)
status = viWrite(analyzer, "CALC:THR -35DBM", 15, retCnt)
     'Activate threshold and set it above the AF
status = viWrite(analyzer, "CALC:DELT3:STAT ON;MAX;MAX:NEXT", 31, retCnt)
     'Activate delta marker 3, set to peak and then to next peak => is not found
status = viWrite(analyzer, "CALC:DELT3:X:REL?;:CALC:DELT3:Y?", 32, retCnt)
     'Query and read delta marker 3 frequency and level; both must have a value of 0
status = viRead(analyzer, result$, 100, retCnt)
Print "Delta 3: "; result$
```

REM - Setting center frequency and reference level with markers -----------

```
status = viWrite(analyzer, "CALC:MARK2:FUNC:CENT", 20, retCnt)
     'Delta marker 2 -> marker and center frequency = marker 2
status = viWrite(analyzer, "CALC:MARK2:FUNC:REF", 19, retCnt)
     'Ref level = marker 2
status = viWrite(analyzer, "INIT;*WAI", 9, retCnt)
     'Sweep with sync
```

END SUB

**REM **

7.2.2.2 Frequency Counting

The following example is based on a signal at 100 MHz with a level of –30 dBm. Also in this measurement, the instrument's default setting can be used (SetupInstrument). The purpose of frequency counting is to determine the exact frequency of the signal at 100 MHz.

**REM **

Public Sub MarkerCount()
```
Dim status As ViStatus
Dim retCnt As Long
result$ = Space$(100)
Call SetupInstrument
     'Default setting
```
REM ------ Defining signal frequency with frequency counter ---------------
```
status = viWrite(analyzer, "INIT:CONT OFF", 13, retCnt)
     'Switch to single sweep
status = viWrite(analyzer, "CALC:MARK:PEXC 6DB", 18, retCnt)
     'Define peak excursion
status = viWrite(analyzer, "CALC:MARK:STAT ON", 17, retCnt)
     'Activate marker 1
status = viWrite(analyzer, "CALC:MARK:TRAC 1", 16, retCnt)
     'Set marker 1 to trace 1
status = viWrite(analyzer, "CALC:MARK:X 100MHz", 18, retCnt)
     'Set marker 1 to 100 MHz
status = viWrite(analyzer, "CALC:MARK:COUNT:RES 1HZ", 23, retCnt)
     'Set count resolution to 1 Hz
```

```
status = viWrite(analyzer, "CALC:MARK:COUNT ON", 18, retCnt)
     'Activate frequency counter
status = viWrite(analyzer, "INIT;*WAI", 9, retCnt)
     'Perform sweep with sync
status = viWrite(analyzer, "CALC:MARK:COUNT:FREQ?", 21, retCnt)
     'Query and read measured frequency
status = viRead(analyzer, result$, 100, retCnt)
Print "Marker Count Freq: "; result$
END SUB
REM ***********************************************************************
```

7.2.2.3 Working with a Fixed Reference Point (Reference Fixed)

The following example is based on a signal at 100 MHz with a level of -20 dBm. Thus, the harmonics of the signal are located at 200 MHz, 300 MHz, etc. In the case of high-quality signal sources, these harmonics may be located outside the dynamic range of the R&S ESPI. Nevertheless, to measure the harmonic suppression, the level setting must be changed to higher sensitivity when measuring the harmonics, in which case it may be necessary to suppress the carrier by using a notch filter in order to prevent the RF input of the R&S ESPI from being overloaded.

Thus, two measurements with different level settings are performed in the following example. First, a high reference level is used on the carrier frequency, and then a low reference level is used on the frequency of the third harmonic.

The default setting of the R&S ESPI for measurements (SetupInstrument) is also used as a starting point here, after which adaptations for the measurement are carried out.

```
REM ***********************************************************************
Public Sub RefFixed()
Dim status As ViStatus
Dim retCnt As Long
result$ = Space$(100)
Call SetupInstrument
     'Default setting
REM ------ Measuring the reference point -------------------------------
status = viWrite(analyzer, "INIT:CONT OFF", 13, retCnt)
     'Switch to single sweep
status = viWrite(analyzer, "CALC:MARK:PEXC 6DB", 18, retCnt)
     'Define peak excursion
status = viWrite(analyzer, "CALC:MARK:STAT ON", 17, retCnt)
     'Activate marker 1
status = viWrite(analyzer, "CALC:MARK:TRAC 1", 16, retCnt)
     'Set marker 1 to trace 1
status = viWrite(analyzer, "INIT;*WAI", 9, retCnt)
     'Perform sweep with sync
status = viWrite(analyzer, "CALC:MARK:MAX", 13, retCnt)
     'Set marker 1 to 100 MHz
status = viWrite(analyzer, "CALC:DELT:FUNC:FIX ON", 21, retCnt)
     'Define reference
```

```
REM -- Setting frequency, level and bandwidth for measuring harmonics -----
status = viWrite(analyzer, "FREQ:CENT 400MHz;Span 1MHz", 26, retCnt)
     'Set freq of 3rd harmonic
status = viWrite(analyzer, "BAND:RES 1kHz", 13, retCnt)
     'Set suitable RBW
status = viWrite(analyzer, "SWEEP:TIME:AUTO ON", 18, retCnt)
     'Couple sweep time
status = viWrite(analyzer, "INP:ATT:AUTO ON", 15, retCnt)
status = viWrite(analyzer, "DISP:WIND:TRAC:Y:RLEV -50dBm", 28, retCnt)
     'Select more sensitive level setting
status = viWrite(analyzer, "INIT;*WAI", 9, retCnt)
     'Perform sweep with sync
status = viWrite(analyzer, "CALC:DELT:MAX;X:REL?;Y?", 23, retCnt)
     'Read delta marker
status = viRead(analyzer, result$, 100, retCnt)
      'Read frequency and level
Print "Deltamarker 1: "; result$
END SUB
REM ************************************************************************
```

7.2.2.4 Measuring Noise and Phase Noise

When phase noise is measured, the noise power related to a bandwidth of 1 Hz is set in relation to the power of an adjacent carrier signal. A commonly used offset between the measured frequency and the carrier frequency is 10 kHz.

When noise is measured, the measured absolute level is related to a bandwidth of 1 Hz.

The following example is also based on a signal at 100 MHz with a level of -30 dBm. Two markers are used to determine both the noise and the phase noise at a 10 kHz offset from the carrier signal.

```
REM ************************************************************************
Public Sub Noise()
Dim status As ViStatus
Dim retCnt As Long
result$ = Space$(100)
REM ------ Default setting of the R&S ESPI --------------------------------
Call SetupStatusReg
     'Configure status register
status = viWrite(analyzer, "*RST", 4, retCnt)
     'Reset instrument
status = viWrite(analyzer, "INST:SEL SAN", 12, retCnt)
     'Change into analyzer mode.
status = viWrite(analyzer, "INIT:CONT OFF", 13, retCnt)'Single sweep mode
REM ------ Setting the frequency ------------------------------------------
status = viWrite(analyzer, "FREQUENCY:CENTER 100MHz", 23, retCnt)
     'Center frequency
status = viWrite(analyzer, "FREQ:SPAN 100 kHz", 17, retCnt)
     'Span
```

```
REM ------ Setting the level -----------------------------------------------
status = viWrite(analyzer, "DISP:WIND:TRAC:Y:RLEV -20dBm", 28, retCnt)
     'Reference level
status = viWrite(analyzer, "INIT;*WAI", 9, retCnt)
     'Perform sweep with sync
REM ------ Setting the reference point -------------------------------------
status = viWrite(analyzer, "CALC:MARK:PEXC 6DB", 18, retCnt)
     'Define peak excursion
status = viWrite(analyzer, "CALC:MARK:STAT ON", 17, retCnt)
     'Activate marker 1
status = viWrite(analyzer, "CALC:MARK:TRAC 1", 16, retCnt)
     'Set marker 1 to trace 1
status = viWrite(analyzer, "CALC:MARK:MAX", 13, retCnt)
     'Set marker 1 to 100 MHz
status = viWrite(analyzer, "CALC:DELT:FUNC:PNO ON", 21, retCnt)
     'Define reference point for phase noise
REM ------ Measuring the phase noise ---------------------------------------
status = viWrite(analyzer, "CALC:DELT:X 10kHz", 17, retCnt)
     'Position delta marker
status = viWrite(analyzer, "CALC:DELT:FUNC:PNO:RES?", 23, retCnt)
     'Query phase noise result
status = viRead(analyzer, result$, 100, retCnt)
Print "Phase Noise [dBc/Hz]: "; result$
REM ------ Measuring the noise ---------------------------------------------
status = viWrite(analyzer, "CALC:MARK:X 99.96MHz", 20, retCnt)
     'Position marker 1
status = viWrite(analyzer, "CALC:MARK:FUNC:NOIS:RES?", 24, retCnt)
     'Query and output result
status = viRead(analyzer, result$, 100, retCnt)
Print "Noise [dBm/Hz]: "; result$
END SUB
REM *********************************************************************
```

7.2.3 Reading Out Trace Data

In the following example, the trace data obtained with the default setting is read from the instrument and displayed in a list on screen. Readout occurs first in binary format and then in ASCII format, once with the span > 0 and once with the span = 0.

In binary format, the header of the message with the length specification is evaluated and used to calculate the x axis values.

In ASCII format, merely the list of level values is output.

Binary data is read out in three steps:

1. The number of digits in the length specification is read out.

2. The length specification itself is read out.

3. The trace data itself is read out.

The procedure is required in the case of programming languages that only support structures with data types of the same type (arrays) (such as with Visual Basic), because the data types of the header and data sections are different in binary data.

Note that the function viRead32 is not declared in VISA32.BAS and therefore needs to be defined separately:

```
Declare Function viRead32 Lib "Visa32" Alias "viRead" (ByVal vi As Long, Values As
Any, ByVal count As Long, retCount As Long) As Long
```

> The arrays for the measured data are dimensioned in such a way that they provide sufficient space for trace data of the R&S ESPI (501 measurement points).

```
REM ***********************************************************************
Public Sub ReadTrace()
Dim status As ViStatus
Dim retCnt As Long
REM ------ Creating variables ---------------------------------------------
Dim traceData(1250) As Single
     'Buffer for floating point binary data
Dim digits As Byte
     'Number of characters in length specification
Dim traceBytes As Integer
     'Len. of trace data in bytes
Dim traceValues As Integer
     'No. of meas. values in buff.
asciiResult$ = Space$(25000)
     'Buffer for ASCII trace data
result$ = Space$(100)
     'Buffer for simple results
startFreq$ = Space$(100)
     'Buffer for start frequency
span$ = Space$(100)
     'Buffer for span
REM ------ Default setting of the R&S ESPI --------------------------------
Call SetupInstrument
     'Default setting
status = viWrite(analyzer, "INIT:CONT OFF", 13, retCnt)
     'Switch to single sweep
status = viWrite(analyzer, "INIT;*WAI", 9, retCnt)
     'Perform sweep with sync
REM ------ Defining the frequency range for output ------------------------
status = viWrite(analyzer, "FREQ:STARt?", 11, retCnt)
     'Read start frequency
status = viRead(analyzer, startFreq$, 100, retCnt)
startFreq = Val(startFreq$)
status = viWrite(analyzer, "FREQ:SPAN?", 10, retCnt)
```

```
     'Read span
status = viRead(analyzer, span$, 100, retCnt)
span = Val(span$)
REM ------ Reading out in binary format -----------------------------------
status = viWrite(analyzer, "FORMAT REAL,32", 14, retCnt)
     'Set binary format
status = viWrite(analyzer, "TRAC1? TRACE1", 13, retCnt)
     'Read trace 1
status = viRead(analyzer, result$, 2, retCnt)
     'Read and store length spec. for number of
digits = Val(Mid$(result$, 2, 1))'characters
result$ = Space$(100)
     'Reinitialize buffer
status = viRead(analyzer, result$, digits, retCnt)
     'Read and store length specification
traceBytes = Val(Left$(result$, digits))
status = viRead32(analyzer, traceData(0), traceBytes, retCnt)
     'Read trace data into buffer
status = viRead(analyzer, result$, 1, retCnt)
     'Read in delimiter <NL>
REM ------ Outputting binary data as frequency/level pairs ----------------
traceValues = traceBytes / 4
     'Single precision = 4 bytes
stepsize = span / traceValues
     'Calculate frequency step size
For i = 0 To traceValues - 1
Print "Value["; i; "] = "; startFreq + stepsize * i; ", "; traceData(i)
Next i
REM ------ Default setting of the time domain -----------------------------
status = viWrite(analyzer, "FREQ:SPAN 0Hz", 13, retCnt)
     'Switch to time domain
status = viWrite(analyzer, "INIT;*WAI", 9, retCnt)
     'Perform sweep with sync
REM ------ Reading out in ASCII format ------------------------------------
status = viWrite(analyzer, "FORMAT ASCII", 12, retCnt)
     'Set ASCII format
status = viWrite(analyzer, "TRAC1? TRACE1", 13, retCnt)
     'Read and output
status = viRead(analyzer, asciiResult$, 25000, retCnt)
Print "Contents of Trace1: ", asciiResult$ 'trace 1
END SUB
REM **********************************************************************
```

7.2.4 Storing and Loading Instrument Settings

7.2.4.1 Storing Instrument Settings

In the following example, the settings/measured data to be stored are initially defined, in which case only the hardware settings are stored. However, the selection commands for the other settings are specified with the state "OFF" for the sake of completeness.

```
REM ************************************************************************
Public Sub StoreSettings()
Dim status As ViStatus
Dim retCnt As Long
     'This subroutine selects the settings to be stored and creates the
     'data record "TEST1" in the directory D:\USER\DATA. It uses the default
     'setting and resets the instrument after the setting is stored.
REM ------ Default settings of the R&S ESPI -------------------------------
Call SetupInstrument
status = viWrite(analyzer, "INIT:CONT OFF", 13, retCnt)
     'Change to single sweep
status = viWrite(analyzer, "INIT;*WAI", 9, retCnt)
     'Perform sweep with sync
REM ------ Selection of settings to be stored -----------------------------
status = viWrite(analyzer, "MMEM:SEL:HWS ON", 15, retCnt)
     'Store hardware settings
status = viWrite(analyzer, "MMEM:SEL:TRAC OFF", 17, retCnt)
     'Do not store any traces
status = viWrite(analyzer, "MMEM:SEL:LIN:ALL OFF", 20, retCnt)
     'Store only the activated limit lines
REM ------ Entering comments ----------------------------------------------
status = viWrite(analyzer, "MMEM:COMM 'Test Setup'", 22, retCnt)
REM ------ Storing on the instrument --------------------------------------
status = viWrite(analyzer, "MMEM:STOR:STAT 1,'D:\USER\DATA\TEST1'", 37, retCnt)
REM ------ Resetting the instrument ---------------------------------------
status = viWrite(analyzer, "*RST", 4, retCnt)
END SUB
REM ************************************************************************
```

7.2.4.2 Loading Instrument Settings

In the following example, the *TEST1* data record stored under *D:\USER\DATA* is reloaded into the instrument:

```
REM ************************************************************************
Public Sub LoadSettings()
Dim status As ViStatus
Dim retCnt As Long
     'This subroutine loads the TEST1 data record in the directory D:\USER\DATA.
REM ------ Default setting of the status register -------------------------
Call SetupStatusReg
     'Configure status register
```

```
'--------- Loading the data record ----------------------------------------
status = viWrite(analyzer, "MMEM:LOAD:STAT 1,'D:\USER\DATA\TEST1'", 37, retCnt)
REM ------ Performing measurement using loaded data record ----------------
status = viWrite(analyzer, "DISP:TRAC1:MODE WRITE", 21, retCnt)
     'Set trace to Clr/Write
status = viWrite(analyzer, "INIT;*WAI", 9, retCnt)
     'Start sweep
END SUB
REM ***********************************************************************
```

7.2.4.3 Setting the Data Record for Startup Recall

In the following example, the first step is to change the R&S ESPI to the default state. In the next step, the *TEST1* data record stored under *D:\USER\DATA* is selected for the STARTUP RECALL function, i.e. the data record is then set after each *RST, PRESET and each time the instrument is started. For demonstration purposes, the command *RST is carried out again.

```
REM ***********************************************************************
Public Sub StartupRecallSettings()
Dim status As ViStatus
Dim retCnt As Long
REM ------ Resetting the R&S ESPI -----------------------------------------
status = viWrite(analyzer, "*RST", 4, retCnt)
status = viWrite(analyzer, "INST:SEL SAN", 12, retCnt)
     'Change into analyzer mode.
REM ------ Default setting of the status register -------------------------
Call SetupStatusReg
     'Configure status register
REM ------ Selecting the startup recall data record -----------------------
status = viWrite(analyzer, "MMEM:LOAD:AUTO 1,'D:\USER\DATA\TEST1'", 37, retCnt)
REM ------ Activating the startup recall data record ----------------------
status = viWrite(analyzer, "*RST", 4, retCnt)
END SUB
REM ***********************************************************************
```

7.2.5 Configuring and Starting a Printout

The following example shows how to configure the output format and output device for printing out a measurement screen.

The procedure is as follows:

1. Set the measurement you want for the printout.

2. Check which output devices are available on the instrument.

3. Select an output device.

4. Select the output interface.

5. Configure the output format.

6. Start the printout with synchronization to the end.

It is assumed that the desired setting is a signal at 100 MHz with a power of –20 dBm. It is also assumed that the sixth printer out of the available printers that are listed is the one you want. The printout is first output to the selected printer and then to a file.

```
REM *************************************************************************
Public Sub HCopy()
Dim status As ViStatus
Dim retCnt As Long
Dim Devices(100) As String
     'Create buffer for printer name
For i = 0 To 49
     Devices$(i) = Space$(50)
     'Preallocate buffer for printer name
Next i
REM ------ Default setting of the R&S ESPI --------------------------------
Call SetupStatusReg
     'Configure status register
status = viWrite(analyzer, "*RST", 4, retCnt)
     'Reset instrument
status = viWrite(analyzer, "INST:SEL SAN", 12, retCnt)
     'Change into analyzer mode
status = viWrite(analyzer, "INIT:CONT OFF", 13, retCnt)
     'Single sweep mode
status = viWrite(analyzer, "SYST:DISP:UPD ON", 16, retCnt)
     'Screen display on
REM ------ Measurement settings -------------------------------------------
status = viWrite(analyzer, "FREQ:CENT 100MHz;SPAN 10MHz", 27, retCnt)
     'Frequency setting
status = viWrite(analyzer, "DISP:WIND:TRAC:Y:RLEV -10dBm", 28, retCnt)
     'Reference Level
status = viWrite(analyzer, "INIT;*WAI", 10, retCnt)
     'Perform measurement
REM ------ Querying the available output devices --------------------------
status = viWrite(analyzer, "SYST:COMM:PRIN:ENUM:FIRSt?", 26, retCnt)
     'Read out and display first output device
status = viRead(analyzer, Devices$(0), 100, retCnt)
Print "Printer 0: " + Devices$(0)
For i = 1 To 99
     status = viWrite(analyzer, "SYST:COMM:PRIN:ENUM:NEXT?", 24, retCnt)
     'Read out next printer name
     status = viRead(analyzer, Devices$(i), 100, retCnt)
     If Left$(Devices$(i), 2) = "''" Then GoTo SelectDevice
     'Stop at end of list
     Print "Printer" + Str$(i) + ": "; Devices$(i)
     'Display printer name
Next i
SelectDevice:
REM - Selection of output device, printer language and output interface ----
```

```
status = viWrite(analyzer, "SYST:COMM:PRIN:SEL " + Devices(6), 19 + Len(Devices(6)),
retCnt)
     'Printer selection #6
status = viWrite(analyzer, "HCOP:DEST 'SYST:COMM:PRIN'", 26, retCnt)
     'Configuration: "Printout to printer interface"
status = viWrite(analyzer, "HCOP:DEV:LANG GDI", 17, retCnt)
     'Printers require printer language 'GDI'
REM -- Selection of orientation (portrait/landscape) and color/BW ---------
status = viWrite(analyzer, "HCOP:PAGE:ORI PORTrait", 22, retCnt)
     'Portrait orientation
status = viWrite(analyzer, "HCOP:DEV:COL OFF", 16, retCnt)
     'Black-and-white printout
REM -- Configuring and starting the printout -----------------------------
status = viWrite(analyzer, "HCOP:ITEM:ALL", 13, retCnt)
     'All screen contents
status = viWrite(analyzer, "*CLS", 4, retCnt)
     'Reset status administration
status = viWrite(analyzer, "HCOP:IMMediate;*OPC?", 19, retCnt)
     'Start printout
status = viRead(analyzer, result$, 100, retCnt)
REM - Printout in WMF format (BMP format) to file -------------------------
status = viWrite(analyzer, "HCOP:DEST 'MMEM'", 16, retCnt)
     'Configuration: "Printout to file"
status = viWrite(analyzer, "HCOP:DEV:LANG WMF", 17, retCnt)
     'WMF file format
'status = viWrite(analyzer, "HCOP:DEV:LANG BMP", 17, retCnt)
     'BMP file format
status = viWrite(analyzer, "MMEM:NAME 'D:\USER\DATA\PRINT1.WMF'", 35, retCnt)
     'Define file name
status = viWrite(analyzer, "*CLS", 4, retCnt)
     'Reset Status administration
status = viWrite(analyzer, "HCOP:IMMediate;*OPC?", 19, retCnt)
     'Start printout
status = viRead(analyzer, result$, 100, retCnt)
END SUB
REM ********************************************************************************
```

Appendix

Appendix A: Printer Interface

This appendix describes the installation procedure for local printers. You can either use a plug&play printer (e.g. via USB) or a non-plug&play printer (e.g. via the LPT port).

> To install printer drivers that are not preinstalled on the instrument, you can use one of the following external devices: LAN, USB device (e.g. memory stick or CD-ROM).

You can install a local printer via manual or remote control. In the following step-by-step instructions, the iinstallation process is described via remote desktop. Alternatively, you can connect a mouse and keyboard for the installation instead of using the front panel. Also read the documentation of your printer on how to install the printer.

After installation, the instrument must be configured for printing with a printer. Refer to " Selecting and Configuring Printers" for more information on how to select and configure printers directly on the instrument.

A detailed description for installing network printers is provided in chapter " Installing a Network Printer".

A.1 Installing USB Printers

➢ If you use a USB device for driver installation, install the USB device on the instrument and connect it to the instrument before starting the installation.

➢ If you use a LAN connection for driver installation, the corresponding network drives must be mounted before starting the installation.

➢ Connect the printer via the USB connector on the front panel to the R&S ESPI. The first page of the *Found New Hardware Wizard* dialog box is displayed.

➢ Select the *No, not this time* option to skip the Windows update via internet.

You can also perform a Windows update by selecting one of the other options. However, note that the R&S ESPI

– has limited disk space, so make sure that there's enough disk space available or save the update on an external medium, e.g. a USB stick.

– has to be connected to the internet to perform an update.

➢ Click *Next* to get to the second *Found New Hardware Wizard* dialog box.

➢ Select the *Install the software automatically* option.

The installation process runs automatically and a dialog box is displayed after the installation is completed. Proceed with step 15.

If the driver software cannot be found, an error message is displayed.

➢ Deactivate the *Don't prompt me again* to install this software option.

➢ Click *Finish*.

  The first page of the wizard is displayed again.

➢ Select the *Install from a list or specific location* option.

➢ Click *Next*.

  The third page of the wizard is displayed.

Found New Hardware Wizard

Please choose your search and installation options.

     ⦿ Search for the best driver in these locations.

         Use the check boxes below to limit or expand the default search, which includes local paths and removable media. The best driver found will be installed.

         ☐ Search removable media (floppy, CD-ROM...)

         ☑ Include this location in the search:

            `C:\WINNT\SYSTEM32\DRIVERS` ▼   [Browse]

     ◯ Don't search. I will choose the driver to install.

         Choose this option to select the device driver from a list. Windows does not guarantee that the driver you choose will be the best match for your hardware.

                        [< Back]   [Next >]   [Cancel]

➢ Connect the USB device containing the driver to the R&S ESPI (e.g. the CD-ROM drive or a memory stick)

➢ Activate the *Include this location* in the search option.

➢ Click the *Browse* button.

  The dialog box to browse for a folder is displayed.

➢ On the USB device, select the folder containing the printer drivers.

➢ Click *OK*. This button is only active, if the selected folder contains drivers.

  The third page of the wizard is displayed again.

➢ Click *Next*.

The selected folder is searched for the printer driver and the printer driver files are copied to C:. After the installation is finished, a dialog box is displayed.

Found New Hardware Wizard

Completing the Found New Hardware Wizard

The wizard has finished installing the software for:

Lexmark 7100 Series

Click Finish to close the wizard.

< Back   Finish   Cancel
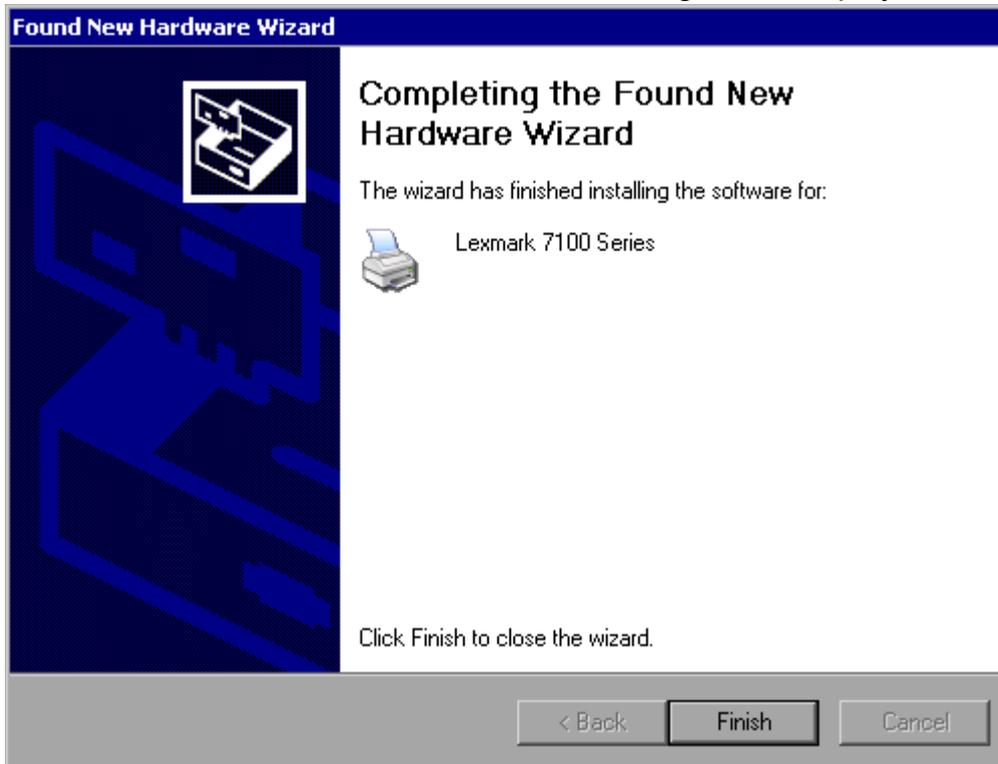
A.2 Installing Non-Plug&Play Printers

The following dialog boxes can be operated either from the front panel or via a mouse and keyboard (see sections " Connecting a Mouse" and " Connecting an External Keyboard" on page 2.8).

A new printer is installed using *HCOPY - NEXT - INSTALL PRINTER*.

A.2.1 Local Printer
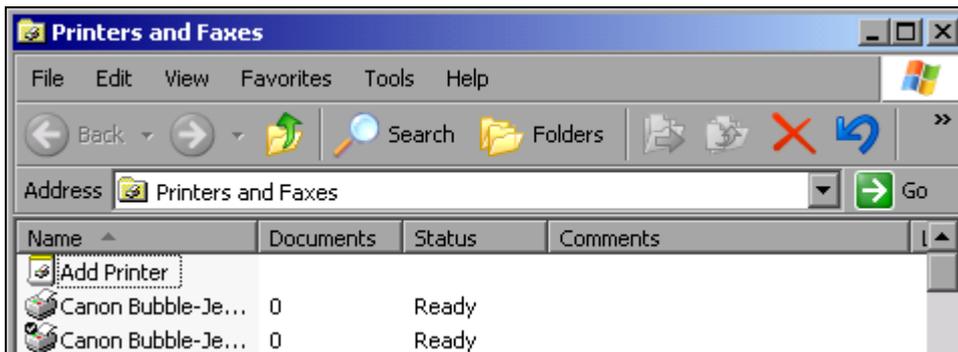
➢ Using the rotary knob, select *Add Printer* from the list.

➢ Mark the selected item with the right arrow key, and press *ENTER* or the rotary knob to confirm the selection.
The *Add Printer Wizard* will appear.
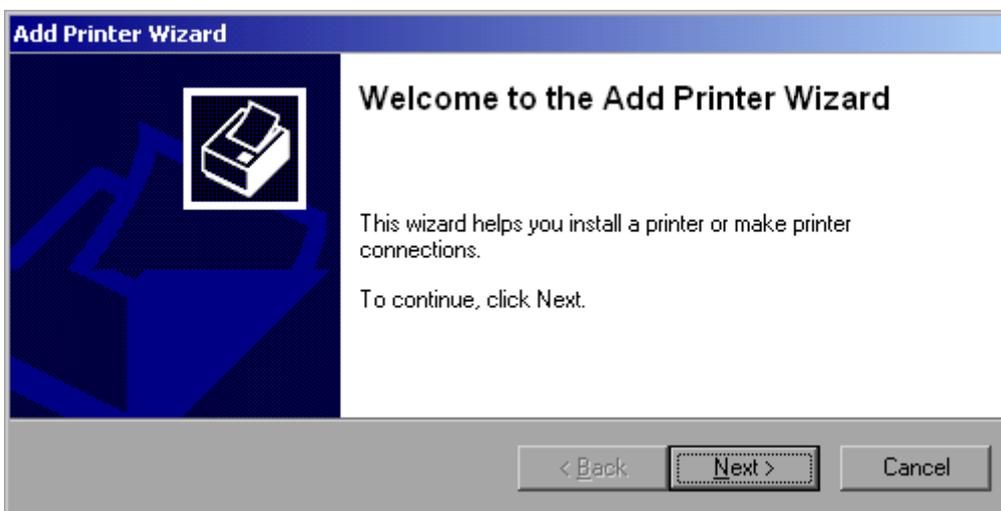
➢ Using the rotary knob, select *NEXT* and confirm by pressing the rotary knob.
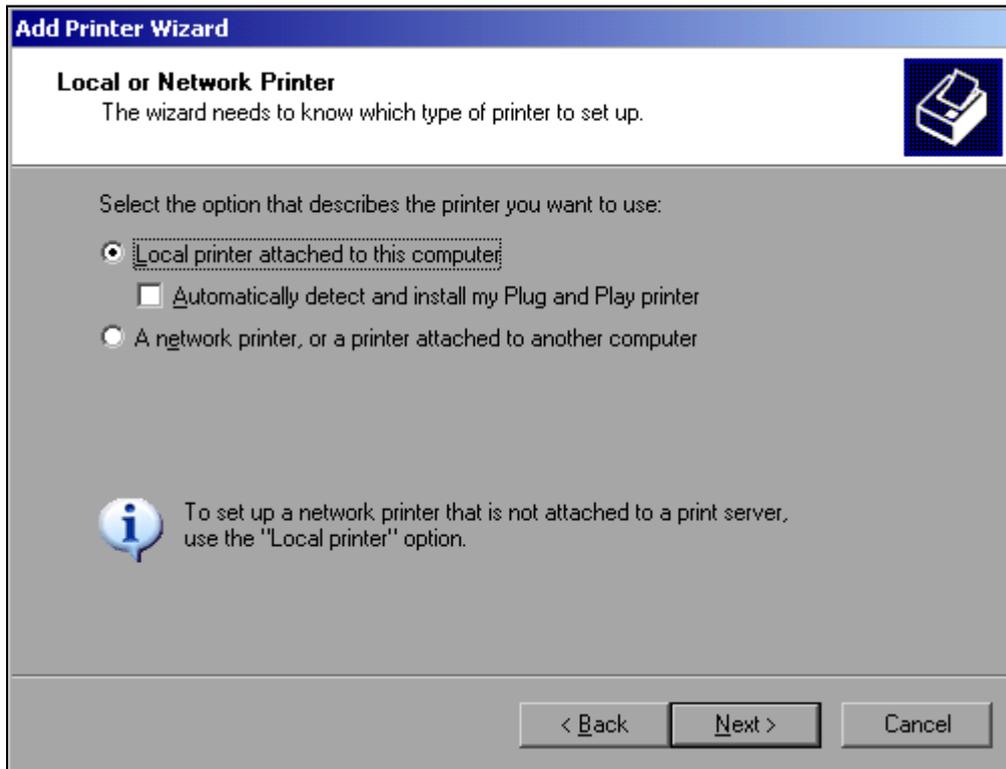
➢ To install a local printer, select *Local printer attached to this computer* with the rotary knob, confirm by pressing the rotary knob and continue to the next step.

➢ To install a network printer, select *A network printer or a printer attached to another computer*, confirm by pressing the rotary knob and continue to the next step.
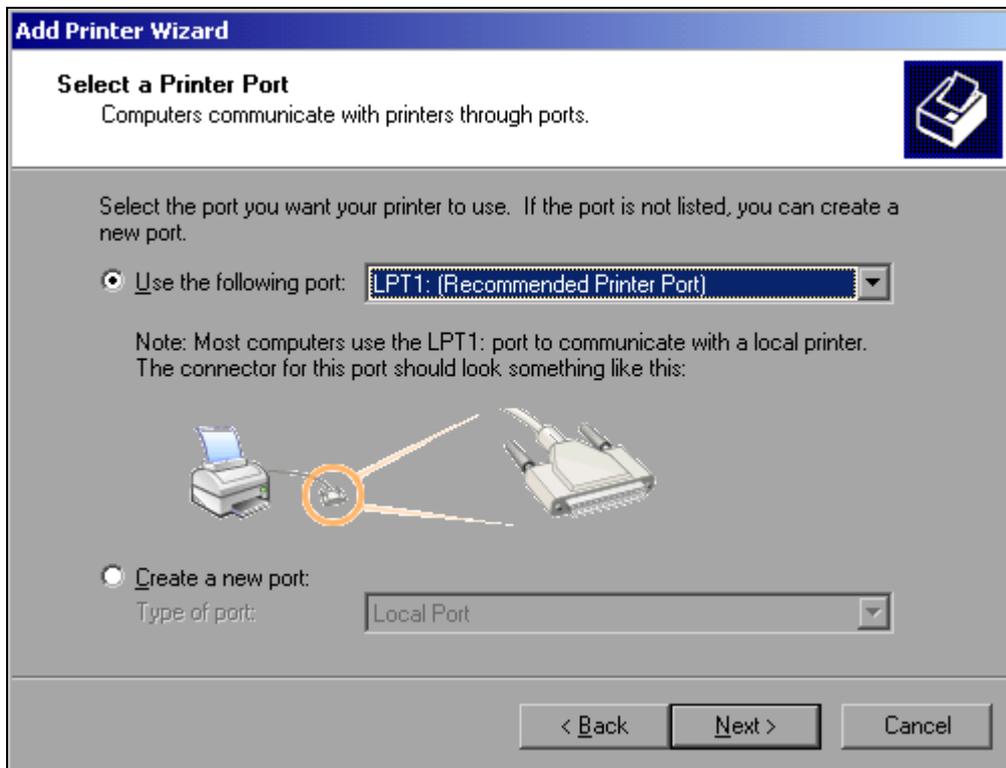
Installing Non-Plug&Play Printers

In the following example, a local printer of type Star LC24 is installed.

➢ To select a USB connection, open the list of available ports by pressing the rotary knob. Using the arrow keys or rotary knob, select a printer port and confirm by pressing the rotary knob.

➢ To select an LPT connection, you do need not to open the selection list.

➢ Using the rotary knob, move the focus to the *Next* button and confirm by pressing the rotary knob.
The *Install Printer Software* dialog panel will open.

Add Printer Wizard

Install Printer Software
The manufacturer and model determine which printer software to use.

Select the manufacturer and model of your printer. If your printer came with an installation disk, click Have Disk. If your printer is not listed, consult your printer documentation for compatible printer software.

Manufacturer	Printers
Seiko	Star LC24-20
Seikosha	Star LC24-20 II
Sharp	Star LC24-200
Shinko	Star LC24-200 Colour
Star	Star LC24-30 Colour
Tally	

This driver is digitally signed.
Tell me why driver signing is important

Have Disk...

< Back   Next >   Cancel

➢ Using the arrow up/down keys, select the required manufacturer (*Star*) from the *Manufacturers* table.

➢ Using the rotary move, go to the *Printers* table.

➢ Using the arrow up/down keys, select the desired printer type (*Star LC24-200 Colour*) and confirm with *ENTER*.

> If the desired printer type is not in the list, its driver has not yet been installed. In this case, click the *Have Disk* button with the mouse. You will be prompted to insert a disk containing the corresponding printer driver. Press OK and select the desired printer driver.

Installing Non-Plug&Play Printers

Add Printer Wizard

Name Your Printer
You must assign a name to this printer.

Type a name for this printer. Because some programs do not support printer and server name combinations of more than 31 characters, it is best to keep the name as short as possible.

Printer name:

Star LC24-300 Colour

Do you want to use this printer as the default printer?

○ Yes
⦿ No

< Back | Next > | Cancel
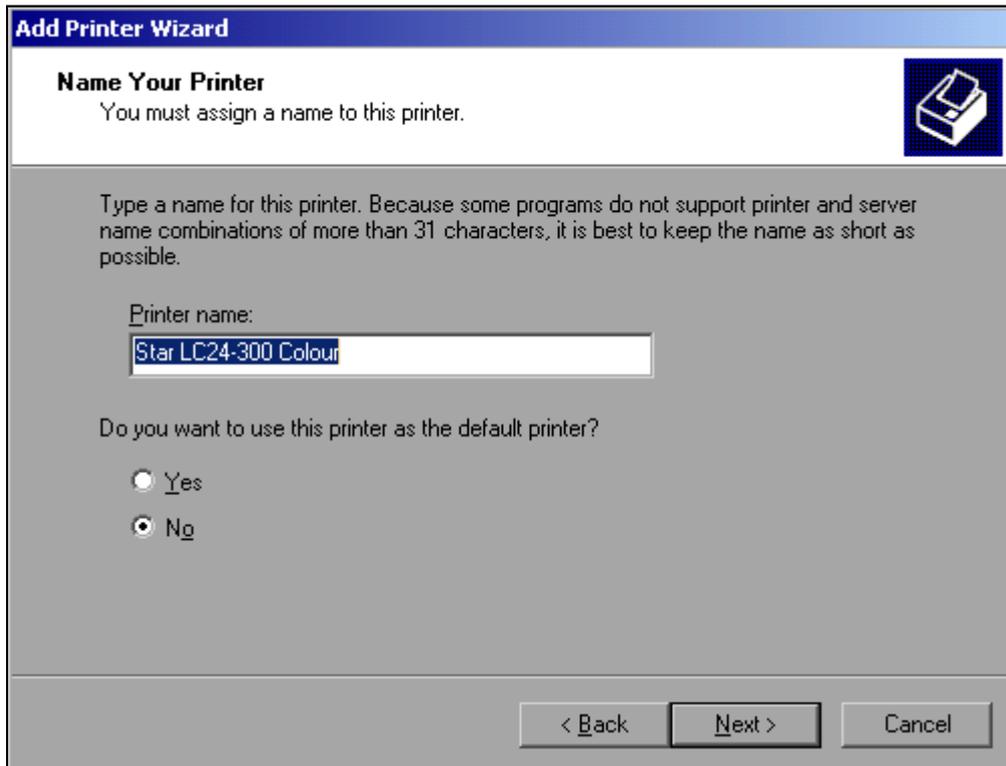
➢ You can change the printer name in the *Printer Name* field to any name you want (max. 60 characters). However, this requires using a PC keyboard.

➢ Using the rotary knob, select *Default Printer yes / no*.

➢ Using the arrow up/down keys, select the desired status.

➢ Confirm the entry with *ENTER*.
The *Printer Sharing* dialog panel will open.

➢ Confirm the entry with *ENTER*.
The *Printer Sharing* dialog panel will open.

➢ Exit the dialog panel by pressing *ENTER*.
The *Completing the Add Printer Wizard* dialog panel will open.
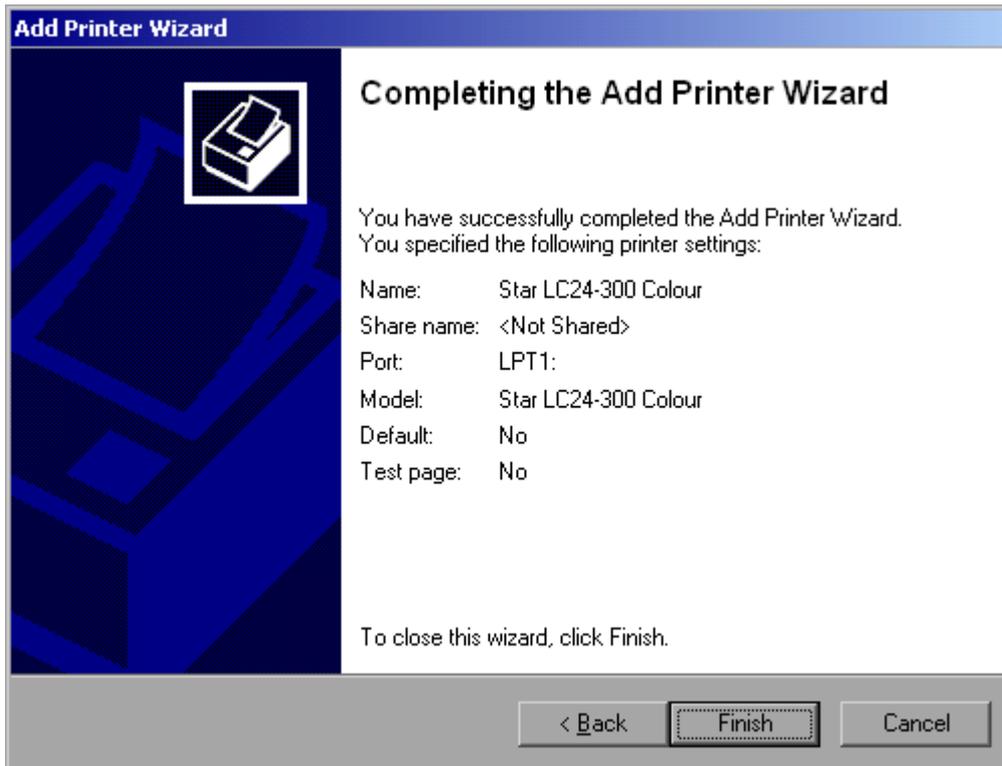
➢ Check the displayed settings and exit the dialog panel with *ENTER*.
The printer will be installed. If Windows finds the required driver files, the installation will be completed without any further queries.

If Windows cannot find the required driver files, the dialog box for entering the path for files will open.
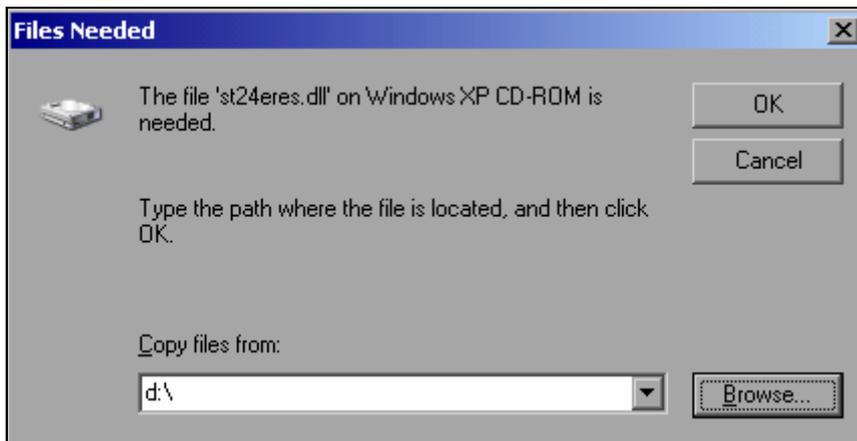
➢ Using the rotary knob, select the *Browse* button and confirm by pressing the rotary knob.
The *Locate File* dialog box will open.

➢ Select the path D:\I386 by turning the rotary knob and then pressing it.
If the background of the selection bar is not blue, the selection must be marked with the arrow up/down keys before the entry can be selected by pressing the rotary knob.
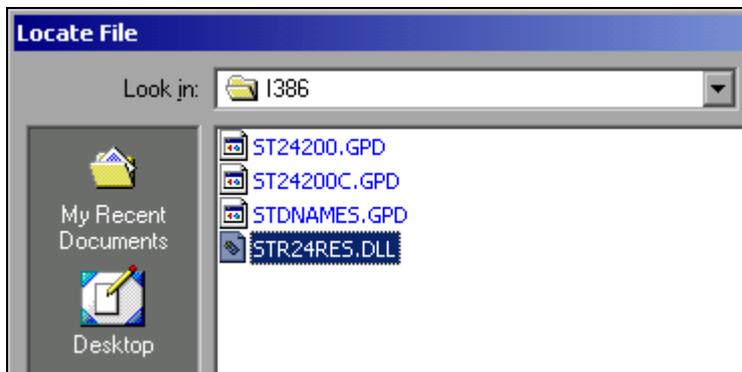
➢ Using the rotary knob, select a driver file and confirm by pressing the rotary knob.
The file will be added to the *Files Needed* dialog box.

If the file is not available in the D:\I386 directory, you will need a disk containing the driver file. In this case, exit the dialog box with ESC and repeat the selection starting with the *Files needed* dialog box.
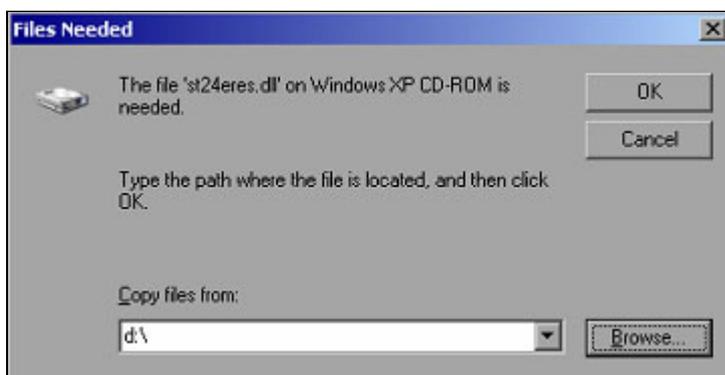
➢ Using the rotary knob, select *OK* and confirm by pressing the rotary knob.
The installation will be completed.

The instrument must then be configured for printout with this printer using the DEVICE SETUP and DEVICE 1/2 softkeys in the hardcopy main menu (see section " Selecting and Configuring Printers" on page 2.26).

A.2.2 Network Printer

Network printer installation is described in chapter 6, section " Installing a Network Printer" on page 6.17.

Appendix B: External Generator Control

B.1 List of Generator Types Supported by the R&S ESPI

Generator	Interface Type	Generator Min. Freq.	Generator Max. Freq.	Generator Min. Power dBm	Generator Max. Power dBm
SMA100A[1]	TTL	9 kHz	6.0 GHz	-145	+30
SMB100A[1]	TTL	9 kHz	6.0 GHz	-145	+30
SMBV100A[1]	TTL	9 kHz	6.0 GHz	-145	+30
SMC100A[1]	GPIB	9 kHz	3.2 GHz	-120	+19
SME02	TTL	5 kHz	1.5 GHz	-144	+16
SME03	TTL	5 kHz	3 GHz	-144	+16
SME06	TTL	5 kHz	6 GHz	-144	+16
SMF100A[1]	TTL	100 kHz	43.5 GHz	-130	+30
SMG	GPIB	100 kHz	1.0 GHz	-137	+13
SMGL	GPIB	9 kHz	1.0 GHz	-118	+30
SMGU	GPIB	100 kHz	2.16 GHz	-140	+13
SMH	GPIB	100 kHz	2.0 GHz	-140	+13
SMHU	GPIB	100 kHz	4.32 GHz	-140	+13
SMIQ02B	TTL	300 kHz	2.2 GHz	-144	+13
SMIQ02E	GPIB	300 kHz	2.2 GHz	-144	+13
SMIQ03B	TTL	300 kHz	3.3 GHz	-144	+13
SMIQ03E	GPIB	300 kHz	3.3 GHz	-144	+13
SMIQ04B	TTL	300 kHz	4.4 GHz	-144	+10
SMIQ06B	TTL	300 kHz	6.4 GHz	-144	+10
SMJ03	TTL	100 kHz	3 GHz	-145	+13
SMJ06	TTL	100 kHz	6 GHz	-145	+13
SML01	GPIB	9 kHz	3.3 GHz	-140	+13
SML02	GPIB	9 kHz	3.3 GHz	-140	+13
SML03	GPIB	9 kHz	3.3 GHz	-140	+13
SMP02	TTL	10 MHz	20 GHz	-130	+17
SMP03	TTL	10 MHz	27 GHz	-130	+13
SMP04	TTL	10 MHz	40 GHz	-130	+12
SMP22	TTL	10 MHz	10 GHz	-130	+20

List of Generator Types Supported by the R&S ESPI

Generator	Interface Type	Generator Min. Freq.	Generator Max. Freq.	Generator Min. Power dBm	Generator Max. Power dBm
SMR[2]	TTL	10 MHz	60 GHz	-130	+13
SMT02	GPIB	5.0 kHz	1.5 GHz	-144	+13
SMT03	GPIB	5.0 kHz	3.0 GHz	-144	+13
SMT06	GPIB	5.0 kHz	6.0 GHz	-144	+13
SMU200A[3]	TTL	100 kHz	6.0 GHz	-145	+19
SMV03	GPIB	9 kHz	3.3 GHz	-140	+13
SMX	GPIB	100 kHz	1.0 GHz	-137	+13
SMY01	GPIB	9 kHz	1.04 GHz	-140	+13
SMY02	GPIB	9 kHz	2.08 GHz	-140	+13
HP8254A	GPIB	250 kHz	4 GHz	-135	+25
HP8257D	GPIB	250 kHz	7 GHz	-135	+25
HP8340A	GPIB	10 MHz	26.5 GHz	-110	+10
HP8648	GPIB	9 kHz	4 GHz	-136	+10
HP ESG-A Series 1000A, 2000A, 3000A, 4000A	GPIB	250 kHz	4 GHz	-136	+20
HP ESG-D SERIES E4432B	GPIB	250 kHz	3 GHz	-136	+10

[1] The upper frequency limit depends on the frequency option the generator is fitted with.

In the dialog box that selects the generator, the upper frequency is indicated by the extension of the generator type (e.g. generator type SMBV100A6 means an SMBV100A with an upper frequency of 6 GHz).

The respective frequency is indicated by the name of the generator as shown by the dialog on the R&S ESPI, e.g. the SMBV100A6 means an upper frequency limit of 6 GHz.

[2] The upper frequency limit, minimum and maximum power depends on the model of the R&S SMR. In addition, the minimum and maximum power depends on whether options R&S SMR-B15/-B17 is installed or not. The lower frequency limit depends on whether option R&S SMR-B11 is installed or not.

Refer to the data sheet of the R&S SMR for more information.

[3] The upper frequency limit, minimum and maximum power depend on which RF Path option R&S SMU-B10x is installed and on whether option R&S SMU-B31 is installed or not.

Refer to the data sheet of the R&S SMU for more information.

Index

Symbols

Numerics

A

B

C

D