

R&S[®] ZNLE

Vector Network Analyzer

Getting Started



1323287302

This manual applies to the following R&S®ZNLE models with firmware version 1.10 and higher:

- R&S®ZNLE3, 1 MHz to 3 GHz, 2 ports, N(f) connectors, order no. 1323.0012.53
- R&S®ZNLE6, 1 MHz to 6 GHz, 2 ports, N(f) connectors, order no. 1323.0012.56

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Throughout this manual, products from Rohde & Schwarz are indicated without the ® symbol, e.g. R&S®ZNLE is indicated as R&S ZNLE.

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1 Safety Information

The product documentation helps you use the R&S ZNLE safely and efficiently. Follow the instructions provided here and in the printed "Basic Safety Instructions". Keep the product documentation nearby and offer it to other users.

Intended use

The R&S ZNLE is intended for the development, production and verification of electronic components and devices in industrial, administrative, and laboratory environments. Use the R&S ZNLE only for its designated purpose. Observe the operating conditions and performance limits stated in the data sheet.

Where do I find safety information?

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

- The printed "Basic Safety Instructions" provide safety information in many languages and are delivered with the R&S ZNLE.
- Throughout the documentation, safety instructions are provided when you need to take care during setup or operation.

2 Preface

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

2.1 Conventions Used in the Documentation

2.1.1 Typographical Conventions

The following text markers are used throughout this documentation:

Convention	Description
"Graphical user interface elements"	All names of graphical user interface elements on the screen, such as dialog boxes, menus, options, buttons, and softkeys are enclosed by quotation marks.
[Keys]	Key and knob names are enclosed by square brackets.
Filenames, commands, program code	Filenames, commands, coding samples and screen output are distinguished by their font.
<i>Input</i>	Input to be entered by the user is displayed in italics.
Links	Links that you can click are displayed in blue font.
"References"	References to other parts of the documentation are enclosed by quotation marks.

2.1.2 Conventions for Procedure Descriptions

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

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

2.1.3 Notes on Screenshots

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

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

3 Documentation Overview

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

www.rohde-schwarz.com/manual/ZNLE

3.1 Getting Started Manual

Introduces the R&S ZNLE and describes how to set up and start working with the product. Includes basic operations, typical measurement examples, and general information, e.g. safety instructions, etc.

A printed version is delivered with the instrument. A PDF version is available for download on the Internet.

3.2 User Manuals and Help

The user manual contains the description of all instrument modes and functions. It also provides an introduction to remote control, a complete description of the remote control commands with programming examples, and information on maintenance, instrument interfaces and error messages. Includes the contents of the getting started manual.

The contents of the user manual is available as help in the R&S ZNLE. The help offers quick, context-sensitive access to the complete information for the instrument and its firmware.

The user manual is also available for download or for immediate display on the Internet.

3.3 Service Manual

Describes the performance test for checking the rated specifications, module replacement and repair, firmware update, troubleshooting and fault elimination, and contains mechanical drawings and spare part lists.

The service manual is available for registered users on the global Rohde & Schwarz information system (GLORIS):

<https://gloris.rohde-schwarz.com/irj/portal/SearchDetailView?downloadContainerID=454954>

3.4 Instrument Security Procedures

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

3.5 Basic Safety Instructions

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

3.6 Data Sheets and Brochures

The data sheet contains the technical specifications of the R&S ZNLE. It also lists the firmware applications and their order numbers, and optional accessories.

The brochure provides an overview of the instrument and deals with the specific characteristics.

See www.rohde-schwarz.com/brochure-datasheet/ZNLE

3.7 Release Notes and Open Source Acknowledgment (OSA)

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

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

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

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

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

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

3.9 Calibration Certificate

The document is available on <https://gloris.rohde-schwarz.com/calcert>. You need the device ID of your instrument, which you can find on a label on the rear panel.

4 Preparing for Use

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4.1 Putting into Operation

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

⚠ WARNING

Risk of injury due to disregarding safety information

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

- Do not open the instrument casing.
-

NOTICE

Risk of instrument damage due to inappropriate operating conditions

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

NOTICE**Instrument damage caused by electrostatic discharge**

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

If you are working in an environment where strong ESD discharges are possible, Rohde & Schwarz recommends using a broadband limiter R&S ZN-B13 (stock number 1303.7840.02) at each port of your R&S ZNLE.

NOTICE**Risk of instrument damage due to inappropriate operating conditions**

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

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

**EMI impact on measurement results**

Electromagnetic interference (EMI) may affect the measurement results.

To suppress generated electromagnetic interference (EMI):

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

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4.1.1 Unpacking and Checking the Instrument

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

**Packing material**

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

NOTICE**Risk of instrument damage during transportation and shipment**

Insufficient protection against mechanical and electrostatic effects during transportation and shipment can damage the instrument.

- Always make sure that sufficient mechanical and electrostatic protection is provided.
- When shipping an instrument, use the original packaging. If it is not available, allow for sufficient padding to prevent the instrument from moving around inside the box. Pack the instrument in antistatic wrap to protect it from electrostatic charging.
- Secure the instrument to prevent any movement and other mechanical effects during transportation.

The **carrying handles** are designed to lift or carry the instrument. Do not apply excessive external force to the handles.

4.1.2 Accessory List

The instrument comes with the following accessories:

- Power cable
- Printed Getting Started manual

4.1.3 Placing or Mounting the Instrument

The R&S ZNLE is designed for use on a bench top or in a rack.

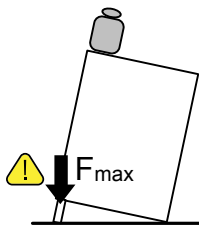
Bench Top Operation

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

⚠ CAUTION**Risk of injury if feet are folded out**

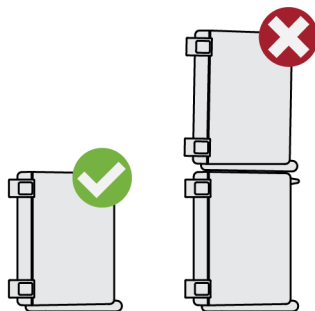
The feet can fold in if they are not folded out completely or if the instrument is shifted. This can cause damage or injury.

- Fold the feet completely in or out to ensure stability of the instrument. Never shift the instrument when the feet are folded out.
- When the feet are folded out, do not work under the instrument or place anything underneath.
- The feet can break if they are overloaded. The overall load on the folded-out feet must not exceed 200 N.

**⚠ CAUTION****Risk of injury when stacking instruments insecurely**

Never stack instruments on top of each other. The instrument's top surface area is too small to stack multiple instruments. Stacked instruments can tilt over and cause injury or damage the instrument.

If you need to stack instruments, install them in a rack.

**Rackmounting**

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

NOTICE**Risk of instrument damage due to insufficient airflow in a rack**

If you mount several instruments in a rack, you need an efficient ventilation concept to ensure that the instruments do not overheat. Insufficient airflow for a longer period can disturb the operation and even cause damage.

4.1.4 Connecting the AC Power

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

For details on the connector, refer to [Chapter 5.2.1, "AC Power Supply Connection and Main Power Switch"](#), on page 44.



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

4.1.5 Switching the Instrument On and Off

Switching on the instrument

1. Press the AC power switch on the rear panel to position "I".
2. Press the [Power] key on the front panel of the instrument.

The instrument operates on DC or AC power, whichever is supplied. After booting, the instrument is ready for operation. The green [POWER] LED indicates this.

A steady orange LED indicates the instrument is in standby mode.

Switching off the instrument

1. Press the [Power] key on the front panel.
The R&S ZNLE switches to standby mode (not in battery operation).
2. For AC power operation, set the AC power switch on the rear panel to position "O".
For DC power operation, disconnect the DC power supply cable.
The R&S ZNLE changes into off mode.

NOTICE

Risk of losing data

If you switch off the running instrument using the rear panel switch or by disconnecting the power cord, and no (charged) battery is available, the instrument loses its current settings. Furthermore, program data may be lost.

Press the Power key first to shut down the application properly.

4.2 Windows Operating System

The instrument contains the Windows operating system which has been configured according to the instrument's features and needs. Changes in the system setup are only required when peripherals like keyboard or a printer are installed or if the network configuration does not comply with the default settings. After the R&S ZNLE is started, the operating system boots and the instrument firmware is started automatically.

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

Tested software

The drivers and programs used on the instrument under Windows are adapted to the instrument. Only install update software released by Rohde & Schwarz to modify existing instrument software.

You can install additional software on the instrument, however, additional software can impair instrument function. Thus, run only programs that Rohde & Schwarz has tested for compatibility with the instrument software.

The following program packages have been tested:

- Symantec Endpoint Security – virus-protection software
- FileShredder - for reliable deletion of files on the hard disk

4.2.1 Virus Protection

Take appropriate steps to protect your instruments from infection. Use strong firewall settings and scan any removable storage device used with a Rohde & Schwarz instrument regularly. It is also recommended that you install anti-virus software on the instrument. Rohde & Schwarz does NOT recommend running anti-virus software in the background ("on-access" mode) on Windows-based instruments, due to potentially degrading instrument performance. However, Rohde & Schwarz does recommend running it during non-critical hours.

For details and recommendations, see the following Rohde & Schwarz white paper:

- [1EF96: Malware Protection Windows 10](#)

4.2.2 Service Packs and Updates

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

For details and recommendations, see the following Rohde & Schwarz white paper:

- [1EF96: Malware Protection Windows 10](#)

4.2.3 Login

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

- **"Instrument"**: a standard user account with limited access

- **"Administrator"**: an administrator account with unrestricted access to the computer/domain

Some administrative tasks require administrator rights (e.g. the configuration of a LAN network). Refer to the description of the basic instrument setup ([SETUP] menu) to find out which functions are affected.

Automatic login

For the standard instrument account, an automatic login function is active by default. If activated, login is carried out automatically in the background when the R&S ZNLE is started, without having to enter a password. This function is active until an administrator explicitly deactivates it or changes the password.

For information on how to deactivate or reactivate the automatic login, refer to [Chapter 4.2.3.1, "Automatic Login Function"](#), on page 19.

Passwords

For all default user accounts, the initial password is *894129*. Note that this password is very weak, and it is recommended that you change the password for both users after initial login. An administrator can change the password in Windows for any user at any time via "Start > Settings > Account > SignIn Options > Password > Change".



Changing the password and use of auto-login function

Note that when you change the default passwords, the default auto-login function no longer works! Reactivate it manually as described in "[Reactivating the automatic login function](#)" on page 21.

4.2.3.1 Automatic Login Function

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

Switching users when using the automatic login function

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

1. Select the "Windows" icon in the toolbar to access the operating system of the R&S ZNLE (see also [Chapter 4.2.4, "Accessing the Start Menu"](#), on page 21).



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

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

Deactivating the automatic login function

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

1. Log in to the R&S ZNLE operating system using an administrator account (see ["Switching users when using the automatic login function"](#) on page 20).
2. Select the "Windows" icon in the toolbar to access the operating system of the R&S ZNLE (see also [Chapter 4.2.4, "Accessing the Start Menu"](#), on page 21).



3. In the "Start" menu, select "Run".
The "Run" dialog box is displayed.

4. Enter the command
`C:\Users\Public\Documents\Rohde-Schwarz\ZNL\user\
NO_AUTOLOGIN.REG.`

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

Adapting the automatic login function to a new password

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

1. Open the
`C:\Users\Public\Documents\Rohde-Schwarz\ZNL\user\NO_AUTOLOGIN.REG` file in any text editor (e.g. Notepad).
2. In the line "DefaultPassword"="894129", replace the default password (894129) by the new password for automatic login.
3. Save the changes to the file.

Reactivating the automatic login function

1. Log in to the R&S ZNLE operating system using an administrator account (see ["Switching users when using the automatic login function"](#) on page 20).
2. Select the "Windows" icon in the toolbar to access the operating system of the R&S ZNLE (see also [Chapter 4.2.4, "Accessing the Start Menu"](#), on page 21).



3. In the "Start" menu, select "Run".
The "Run" dialog box is displayed.
4. Enter the command
`C:\Users\Public\Documents\Rohde-Schwarz\ZNL\user\AUTOLOGIN.REG`.
5. Press the [ENTER] key to confirm.
This command reactivates automatic login function. It is active the next time the instrument reboots.

4.2.4 Accessing the Start Menu

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

To open the "Start" menu:

- ▶ Select the "Windows" icon in the toolbar, or press the "Windows" key or the [CTRL + ESC] key combination on the (external) keyboard.



All necessary system settings can be defined in the "Start > Settings" menu.

(For required settings refer to the Windows documentation and to the hardware description).

4.2.5 Accessing the Windows Taskbar

The Windows taskbar also provides quick access to commonly used programs, for example Paint or WordPad. IECWIN, the auxiliary remote control tool provided free of charge and installed by Rohde & Schwarz, is also available from the taskbar.



4.3 Connecting USB Devices

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

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

To connect a USB device

1. Connect the device to the USB interface of the R&S ZNLE.
The operating system automatically searches for a suitable device driver.
2. If Windows does not find a suitable driver:
 - a) If the driver software is on a CD, connect a USB CD-ROM drive to the instrument.

- b) Specify a directory that contains the driver software.

To disconnect a USB device

- ▶ Remove the device from the USB interface of the R&S ZNLE.

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

4.3.1 Connecting a Keyboard

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

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

- German
- Swiss
- French
- Russian

To configure the keyboard language

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

4.3.2 Connecting a Printer

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

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

4.4 Connecting an External Monitor

You can connect an external monitor (or projector) to the "DVI" connector on the rear panel of the R&S ZNLE (see also [Chapter 5.2.5, "DVI"](#), on page 45).



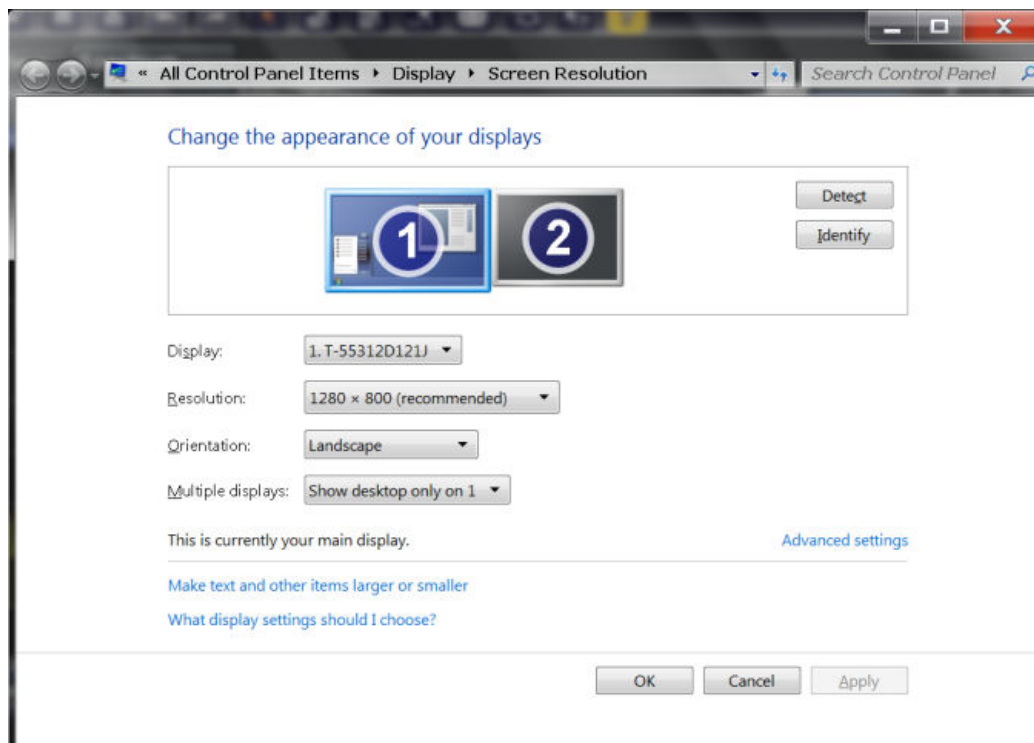
Screen resolution and format

The touchscreen of the R&S ZNLE is calibrated for a 16:10 format. If you connect a monitor or projector using a different format (e.g. 4:3), the calibration is not correct and the screen does not react to your touch actions properly.

The touchscreen has a screen resolution of 1280x800 pixels. Most external monitors have a higher screen resolution. If the screen resolution of the monitor is set higher than the instrument's resolution, the application window uses an area of 1280x800 pixels on the monitor display. For full screen display, adjust the monitor's screen resolution.

The R&S ZNLE supports a minimum resolution of 1280x768 pixels.

1. Connect the external monitor to the R&S ZNLE.
2. Press the [SETUP] key.
3. Press the "Display" softkey.
4. Select the "Configure Monitor" tab in the "Display" dialog box.
The standard Windows "Screen Resolution" dialog box is displayed.



5. If necessary, change the screen resolution to be used. Consider the information in the note above.
6. Select the instrument to be used for display:
 - "Display 1": internal monitor only
 - "Display 2": external monitor only
 - "Duplicate": both internal and external monitor
7. Tap "Apply" to try out the settings before they are accepted permanently, then you can easily return to the previous settings, if necessary.
8. Select "OK" if the settings are suitable.

Fixing a wrong touchscreen mapping

For instruments that are equipped with a system image version < 0.8, the touchscreen function is erroneously mapped to the external monitor by default. This mismatch is particularly inconvenient in extended display mode, where touch gestures on the instrument screen actually operate on the external screen. In duplicate monitor mode, touch screen operation also malfunctions if the resolutions of the internal and external display do not match.

Setting Up a Network (LAN) Connection

To fix the mapping between touchscreen and display, connect an external monitor to the R&S ZNLE and proceed as follows:

1. Select [Setup] > "Display" > "Configure Monitor" > "Display Switch" to bring up the Windows 10 "PROJECT" notification window.
Or press [Win]+[P] on a connected keyboard.
2. Select "Extend".
3. In the Windows task bar, search for "tablet" and select "Tablet PC Settings"
4. In the "Tablet PC Settings" dialog, select "Setup...". Enter the administrator password to proceed.
Observe the message "Touch this screen to identify it as the touchscreen" on the **internal** touch screen.
5. Tap on the internal touch screen.
6. Press [ENTER].
Observe the message "Touch this screen to identify it as the touchscreen" on the **external** screen.
7. If the external monitor is also a touchscreen, tap on it.
8. Press [ENTER].
Touch screen operation functions correctly now. Use the "PROJECT" flyout again to select the appropriate display mode.



Refer to the "Versions + Options" tab of the [Setup] > "System Configuration" dialog to determine the "Image" version of your instrument.

4.5 Setting Up a Network (LAN) Connection

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

The R&S ZNLE is equipped with a network interface and can be connected to an Ethernet LAN (local area network). Provided the network administrator has assigned you the appropriate rights and adapted the Windows firewall configuration, you can use the interface, for example:

Setting Up a Network (LAN) Connection

- To transfer data between a controlling device and the test device, e.g. to run a remote control program.
See chapter "Remote Control" in the R&S ZNLE user manual.
- To access or control the measurement from a remote computer using the "Remote Desktop" application (or a similar tool)
- To connect external network devices (e.g. printers)
- To transfer data from a remote computer and back, e.g. using network folders

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

- [Chapter 4.5.1, "Connecting the Instrument to the Network"](#), on page 27
- [Chapter 4.5.2, "Assigning the IP Address"](#), on page 28

**LXI**

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

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

4.5.1 Connecting the Instrument to the Network

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

- A non-dedicated network (Ethernet) connection from the instrument to an existing network made with an ordinary RJ-45 network cable. The instrument is assigned an IP address and can coexist with a computer and with other hosts on the same network.
- A dedicated network connection (Point-to-point connection) between the instrument and a single computer made with a (crossover) RJ-45 network cable. The computer must be equipped with a network adapter and is directly connected to the instrument. The use of hubs, switches, or gateways is not required, however, data transfer is still performed using the TCP/IP protocol. You must assign an IP address to the instrument and the computer, see [Chapter 4.5.2, "Assigning the IP Address"](#), on page 28.

Note: As the R&S ZNLE uses a 1 GBit LAN, a crossover cable is not necessary (due to Auto-MDI(X) functionality).

NOTICE**Risk of network failure**

Consult your network administrator before performing the following tasks:

- Connecting the instrument to the network
- Configuring the network
- Changing IP addresses

Errors can affect the entire network.

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

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

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

4.5.2 Assigning the IP Address

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

- If the network supports dynamic TCP/IP configuration using the Dynamic Host Configuration Protocol (DHCP), all address information can be assigned automatically.
- If the network does not support DHCP, or if the instrument is set to use alternate TCP/IP configuration, the addresses must be set manually.

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

NOTICE**Risk of network errors**

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

Assigning the IP address on the instrument

1. Press the [SETUP] key.
2. Press the "Network + Remote" softkey.
3. Select the "Network" tab.
4. In the "Network + Remote" dialog, toggle the "DHCP On/Off" setting to the required mode.
If DHCP is "Off", you must enter the IP address manually, as described in the following steps.
Note: When DHCP is changed from "On" to "Off", the previously set IP address and subnet mask are retrieved.
If DHCP is "On", the IP address of the DHCP server is obtained automatically. The configuration is saved, and you are prompted to restart the instrument. You can skip the remaining steps.
Note: When a DHCP server is used, a new IP address may be assigned each time the instrument is restarted. This address must first be determined on the instrument itself. Thus, when using a DHCP server, it is recommended that you use the permanent computer name, which determines the address via the DNS server
(See ["Using a DNS server to determine the IP address"](#) on page 30 and [Chapter 4.5.3, "Using Computer Names"](#), on page 31).
5. Enter the "IP Address", for example *192.0.2.0*. The IP address consists of four number blocks separated by dots. Every block contains a maximum of 3 numbers.
6. Enter the "Subnet Mask", for example *255.255.255.0*. The subnet mask consists of four number blocks separated by dots. Every block contains a maximum of 3 numbers.
7. Select "Configure Network".

Setting Up a Network (LAN) Connection

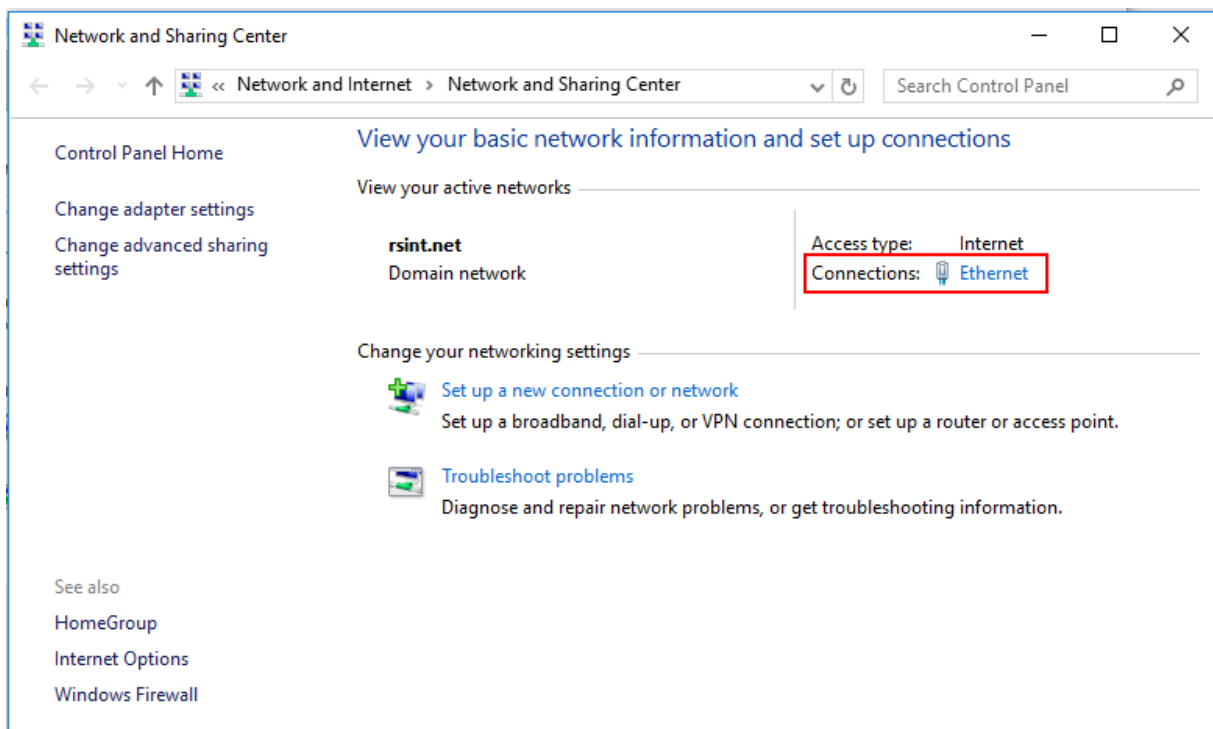
If you have entered an invalid IP address or subnet mask, the message "out of range" is displayed in the status line. If the settings are correct, the configuration is saved, and you are prompted to restart the instrument.

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

Using a DNS server to determine the IP address

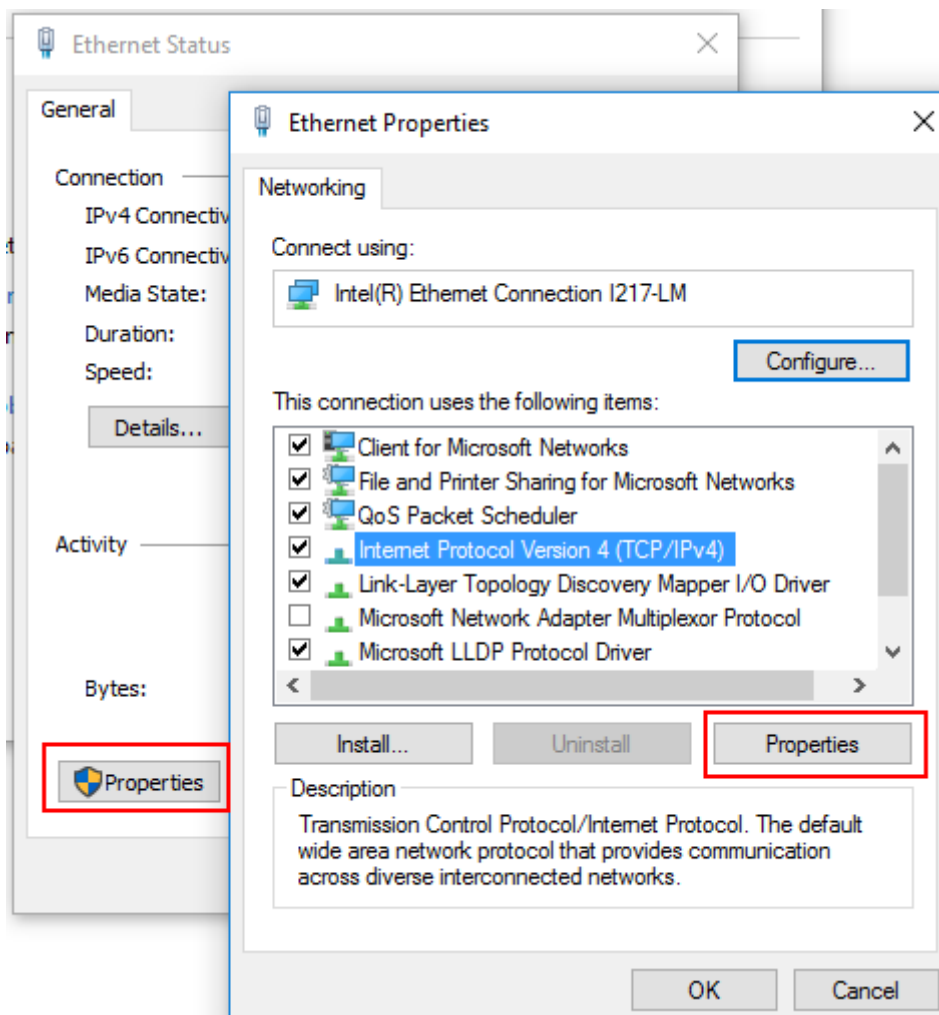
If a DNS server is configured on the R&S ZNLE, the server can determine the current IP address for the connection using the permanent computer name.

1. Obtain the name of your DNS domain and the IP addresses of the DNS and WINS servers on your network.
2. Press the "Windows" key on the external keyboard or the [CTRL + ESC] key combination on your keyboard to access the operating system.
3. Select "Start > Settings > Network & Internet > Ethernet > Network and Sharing Center > Connections: Ethernet".



4. In the "Ethernet Status" dialog box, select the "Properties" button.
The items used by the LAN connection are displayed.

Setting Up a Network (LAN) Connection



5. Tap the entry named "Internet Protocol Version 4 (TCP/IPv4)" to highlight it.
6. Select the "Properties" button.
7. On the "General" tab, select "Use the following DNS server addresses" and enter your own DNS addresses.

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

4.5.3 Using Computer Names

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

Setting Up a Network (LAN) Connection

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

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

<Type><variant>-<serial_number>

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



For example, ZNLE3-123456

To change the computer name

1. Press the [Setup] key and then the "Network + Remote" softkey. The current "Computer Name" is displayed in the "Network" tab.
2. Enter the new computer name.
3. Close the dialog box.

4.5.4 Changing the Windows Firewall Settings

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

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

- [1EF96: Malware Protection Windows 10](#)

Note that changing firewall settings requires administrator rights.

4.6 Configuring the Initial Instrument Settings

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

- [Setting the User Interface Language](#)..... 33
- [Setting the Date and Time](#).....33

4.6.1 Setting the User Interface Language

The user interface to the R&S ZNLE is available in several languages.

Changing the user interface language

1. Press the [SETUP] key.
2. Press the "Language" softkey.
3. Select the required language.

All text elements of the R&S ZNLE user interface are displayed in the selected language.



Texts in standard Windows dialog boxes are displayed in the language defined in the regional settings of the Windows operating system.

4.6.2 Setting the Date and Time

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

Opening the Date and Time Properties dialog box

1. Press the [SETUP] key.
2. Press the "Display" softkey.
3. Select the "General" tab in the "Display" dialog box.
4. Press the "Set Date and Time" button to open the standard Windows "Date and Time Properties" dialog box.

Configuring the Initial Instrument Settings

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

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

5 Instrument Tour

5.1 Front Panel View

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



Figure 5-1: Front panel view

- 1 = Power key
- 2 = USB (2.0) connectors
- 3 = System keys
- 4 = Touchscreen
- 5 = Function keys
- 6 = Keypad
- 7 = Navigation controls
- 8 = Port 1
- 9 = Port 2

NOTICE**Instrument damage caused by cleaning agents**

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

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

5.1.1 Touchscreen

All measurement results are displayed on the screen on the front panel. Additionally, the screen display provides status and setting information and allows you to switch between various measurement tasks. The screen is touch-sensitive, offering an alternative means of user interaction for quick and easy handling of the instrument.

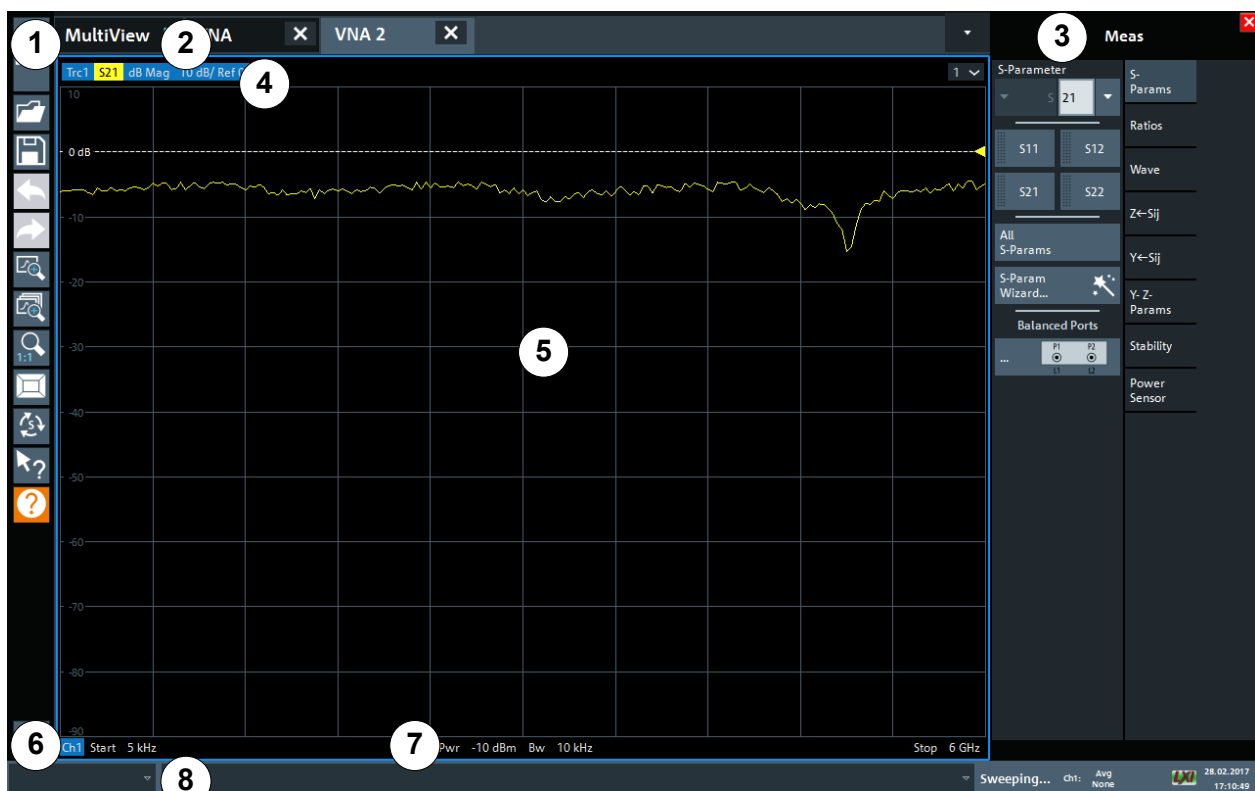


Figure 5-2: Touchscreen elements

- 1 = Toolbar with standard application functions, e.g. print, save/open file etc.
- 2 = Tabs for individual channel setups
- 3 = Softtool panel (a.k.a. softkey bar)
- 4 = Window title bar with diagram-specific (trace) information
- 5 = Measurement results (diagram) area
- 6 = Channel list
- 7 = Diagram footer with diagram-specific information
- 8 = Instrument status bar for error messages and date/time display

A touchscreen is a screen that is touch-sensitive, that is: the firmware reacts in a specified way when you move your fingers on the screen. Using touchscreen gestures, you can perform the following tasks (among others).

(See [Chapter 6, "Trying Out the Instrument"](#), on page 46)

- Changing a setting
- Changing the display
- Changing the displayed result range in a diagram
- Moving a marker
- Zooming into a diagram
- Selecting a new evaluation method
- Scrolling through a result list or table
- Saving or printing results and settings

To imitate a right-click by mouse using the touchscreen, for example to open a context-sensitive menu for a specific item, press the screen for about 1 second.

For details on touchscreen gestures see [Chapter 7.4, "Touchscreen Gestures"](#), on page 68.

5.1.2 Power Key

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

See also [Chapter 4.1.5, "Switching the Instrument On and Off"](#), on page 16.

5.1.3 USB

The front panel provides two female USB connectors (USB-A, 2.0 standard) to connect devices like a keyboard or a mouse. A memory stick can be connected to store and reload instrument settings and measurement data.




The rear panel provides further USB connectors (standard 3.0), see [Chapter 5.2.7, "USB"](#), on page 45.

5.1.4 System Keys

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

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

Table 5-1: System keys

System key	Assigned functions
[Preset]	Resets the instrument to the default state.
[Setup]	Provides basic instrument configuration functions, e.g.: <ul style="list-style-type: none"> • Reference frequency (external/internal) • Date, time, display configuration • LAN interface • Firmware update and enabling of options • Information about instrument configuration incl. firmware version and system error messages • Service support functions (self-test etc.)
[Mode]	Manages channel setups
[Print]	Provides configuration settings for the print function
[FILE]	Provides save/recall functions for instrument settings and measurement results
	Switches between the on-screen keyboard display: <ul style="list-style-type: none"> • At the top of the screen • At the bottom of the screen • Off

5.1.5 Function Keys

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

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



The labels indicated in *italics* (blue font color on the instrument) are not relevant for the R&S ZNLE.

Table 5-2: Function keys

Function key	Assigned functions
[Freq]	Defines the sweep range.
[Span]	
[Scale] <i>[Ampt]</i>	Defines the scaling and zooming of diagram(s).
[Mkr]	Defines and positions absolute and relative measurement markers (markers and delta markers). Selects special marker functions
[Mkr->]	Used for search functions of the measurement markers (maximum/minimum of the trace). Assigns the marker frequency to the center frequency, and the marker level to the reference level. Restricts the search area (Search Limits) and characterizes the maximum points and minimum points (Peak Excursion).
[Bw Avg Power]	Defines the power of the internal signal sources, selects the IF bandwidths, and sets up averaging.
[Sweep]	Defines the sweep type and other sweep parameters; controls sweep execution.
[Trace]	Configures the graphical analysis of measurement results.
[Trig]	Defines how measurement sweeps are triggered.
[Offset Embed]	Contains functions for deembedding/embedding the DUT from/into physical/virtual (matching) networks placed between the calibrated reference plane and the DUT.
[Meas]	Selects the quantities to be measured and displayed.
[Format] <i>[Config]</i>	Selects the trace format (dB magnitude, Smith, etc.).


Function key	Assigned functions
[Display Lines]	Configures display lines and limit lines.
[Cal] [Single]	Provides all functions related to system error calibration.
[Channel] [Cont]	Creates and deletes channel setups and optimize the measurement process.

5.1.6 Keypad

The keypad is used to enter numeric parameters, including the corresponding units. It contains the following keys:

Table 5-3: Keys on the keypad

Type of key	Description
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 (G/n, M/ μ , k/m, x1)	<p>Adds the selected unit to the entered numeric value and complete the entry.</p> <p>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.</p>
[ESC]	<p>Closes all kinds of dialog boxes, if the edit mode is not active. Quits the edit mode, if the edit mode is active. In dialog boxes that contain a "Cancel" button it activates that button.</p> <p>For "Edit" dialog boxes the following mechanism is used:</p> <ul style="list-style-type: none"> • If data entry has been started, it retains the original value and closes the dialog box. • If data entry has not been started or has been completed, it closes the dialog box.

Type of key	Description
 (BACKSPACE)	If an alphanumeric entry has already been started, this key deletes the character to the left of the cursor.
[ENTER]	<ul style="list-style-type: none"> • Concludes the entry of dimensionless entries. The new value is accepted. • With other entries, this key can be used instead of the "Hz/dB" unit key. • In a dialog box, selects the default or focused element.

5.1.7 Navigation Controls

The navigation controls include a rotary knob and navigation keys. They allow you to navigate within the display or within dialog boxes.



Navigating in tables

The easiest way to navigate within tables (both in result tables and configuration tables) is to scroll through the entries with your finger on the touchscreen.

5.1.7.1 Rotary Knob



The rotary knob has several functions:

- For numeric entries: increments (clockwise direction) or decrements (counterclockwise direction) the instrument parameter at a defined step width
- In lists: toggles between entries
- For markers, limit lines, and other graphical elements on the screen: moves their position
- For active scroll bars: moves the scroll bar vertically
- For dialog boxes: Acts like the [ENTER] key when pressed

5.1.7.2 Navigation Keys

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

Arrow Up/Arrow Down Keys

The <arrow up> or <arrow down> keys do the following:

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

Arrow Left/Arrow Right Keys

The <arrow left> or <arrow right> keys do the following:

- In an alphanumeric edit dialog box, move the cursor.
- In a list, scroll forward and backward through the list entries.
- In a table, move the selection bar horizontally.
- In windows or dialog boxes with horizontal scroll bar, move the scroll bar.

5.1.8 Port 1 and Port 2



Numbered type N female connectors.

The test ports serve as outputs for the RF stimulus signal and as inputs for the measured RF signals from the DUT (response signals).

- With a single test port, it is possible to generate a stimulus signal and measure the response signal in reflection. For a measurement example refer to [Chapter 6.1.2, "Reflection S-Parameter Measurement"](#), on page 54.
- With 2 test ports, it is possible to perform full two-port measurements; see [Chapter 6.1.1, "Transmission S-Parameter Measurement"](#), on page 47.

NOTICE**Maximum input levels**

The maximum input levels at all test ports according to the front panel labeling or the data sheet must not be exceeded.

In addition, the maximum input voltages of the other input connectors at the rear panel must not be exceeded.



It is recommended that you use a torque wrench when screwing RF cables on the test port connectors.

5.2 Rear Panel View

This figure shows the rear panel view of the R&S ZNLE. The individual elements are described in more detail in the subsequent sections.

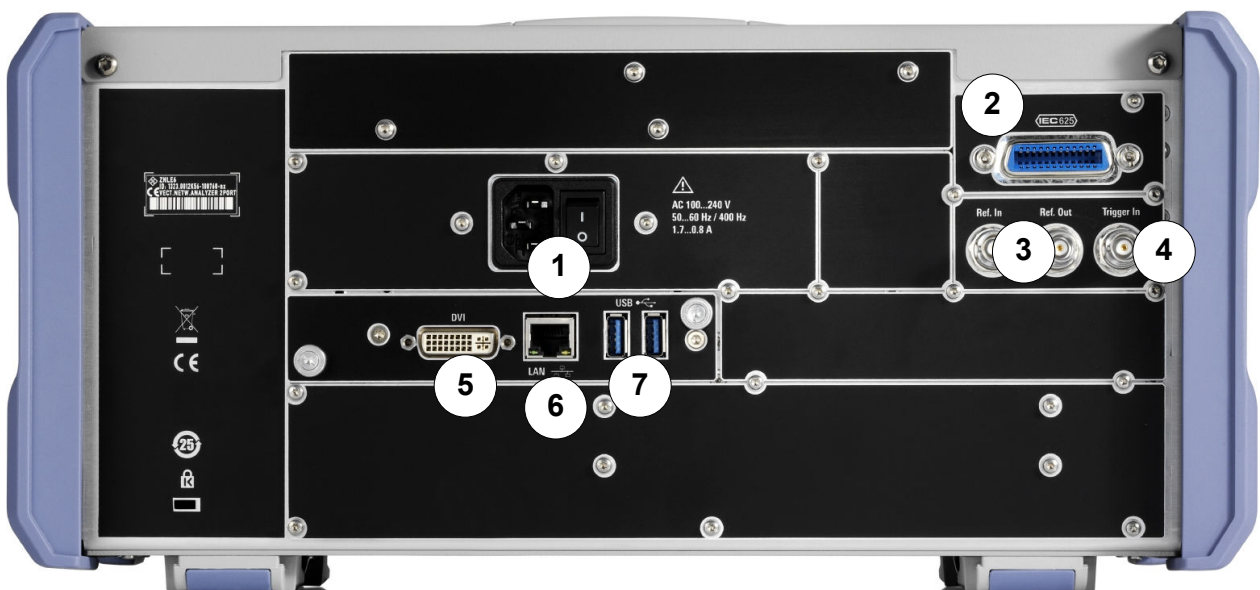


Figure 5-3: Rear panel view

- 1 = AC Power Supply Connection and Main Power Switch
- 2 = GPIB ("IEC") interface
- 3 = Reference clock connectors
- 4 = Trigger input connector

5 = "DVI" connector for external display

6 = "LAN" connector

7 = "USB" (3.0) connectors

5.2.1 AC Power Supply Connection and Main Power Switch

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

Main power switch function:

Position 1: The instrument is in operation.

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

For details, refer to [Chapter 4.1.4, "Connecting the AC Power"](#), on page 16.

5.2.2 GPIB Interface

The optional GPIB interface (R&S FPL1-B10) is in compliance with IEEE488 and SCPI. A computer for remote control can be connected via this interface. To set up the connection, a shielded cable is recommended.

5.2.3 Ref. In / Ref. Out

The Ref. In connectors are used to provide an external reference signal to the R&S ZNLE.

The Ref. Out connectors can be used to provide a reference signal from the R&S ZNLE to other devices that are connected to this instrument.

Various connectors are provided for different reference signals:

Connector	Reference signal	Usage
Ref. In	10 MHz 10 dBm	To provide an external reference signal on the R&S ZNLE.
Ref. Out	10 MHz 10 dBm	To provide the internal reference signal from the R&S ZNLE to another device continuously.

5.2.4 Trigger In

Use the female Trigger In connector to input an external trigger or gate data. Thus, you can control the measurement using an external signal. The voltage level is 1.4 V. The typical input impedance is 10 k Ω .

5.2.5 DVI

You can connect an external monitor or other display device to the R&S ZNLE via the DVI (Digital visual interface) connector to provide an enlarged display.

For details, see [Chapter 4.4, "Connecting an External Monitor"](#), on page 24.

5.2.6 LAN

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

For details, see [Chapter 4.5, "Setting Up a Network \(LAN\) Connection"](#), on page 26.

5.2.7 USB

The rear panel provides two additional female USB (3.0 standard) connectors to connect devices like a keyboard, a mouse or a memory stick (see also [Chapter 5.2.7, "USB"](#), on page 45).

6 Trying Out the Instrument

This chapter introduces the most important functions and settings of the R&S ZNLE step by step. The complete description of the functionality and its usage is given in the R&S ZNLE User Manual. Basic instrument operation is described in [Chapter 7, "Operating the Instrument"](#), on page 61.

Prerequisites

- The instrument is set up, connected to the mains system, and started up as described in [Chapter 4, "Preparing for Use"](#), on page 11.
- [Performing Measurements](#)..... 46
- [Zooming into the Display](#)..... 56
- [Saving Settings](#)..... 57
- [Printing and Saving Results](#)..... 59

6.1 Performing Measurements

This chapter takes you through a sample session with a R&S ZNLE network analyzer and describes basic operation tasks.

CAUTION

Safety considerations

Before starting any measurement on your network analyzer, please note the instructions given in [Chapter 4.1, "Putting into Operation"](#), on page 11.



Use the "S-Parameter Wizard" accessible via [Meas] > "S-Params" > "S-Param Wizard..." to measure S-parameters in a straightforward way. The wizard provides a series of dialogs where you can select the test setup, screen configuration and measurement parameters, configure the essential channel settings and perform a guided calibration.

Measurement stages in the wizard

The individual dialogs of the "S-Parameter Wizard" correspond to the typical stages of any measurement:

1. Select the test setup.
2. Define port impedances.
3. Select the measurement parameters and the diagrams.
4. Define the sweep range.
5. Adjust the receiver and source settings (measurement bandwidth, source power).
6. Perform a calibration.

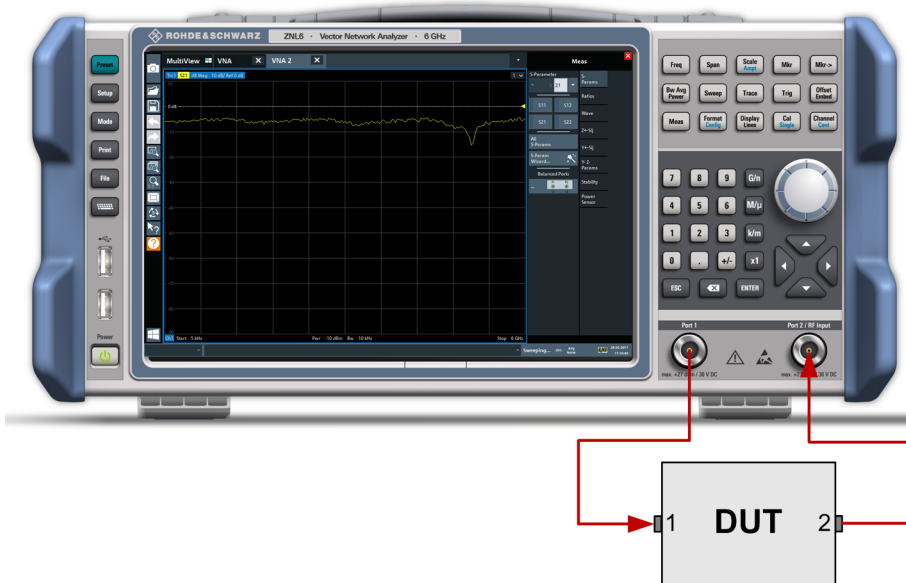
6.1.1 Transmission S-Parameter Measurement

In a transmission measurement, the analyzer transmits a stimulus signal to the input port of the device under test (DUT) and measures the transmitted wave at the DUT's output port. The trace settings allow you to select the measured quantities and display formats, depending on what you want to learn from the data. A minimum of two analyzer test ports are required for transmission measurements.

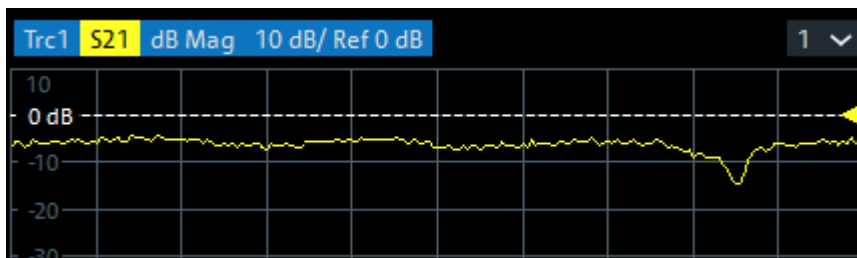
In the following example, the analyzer is set up for a two-port transmission measurement. A frequency sweep range is selected, the instrument is calibrated and the measurement result is analyzed using various display formats.

6.1.1.1 Connecting the Instrument for Transmission Measurements

To prepare a transmission measurement, you have to connect your DUT (which for simplicity we assume to have appropriate connectors) in-between a pair of analyzer test ports. It is recommended that you preset the R&S ZNLE to start from a well-defined instrument state.



1. Connect the DUT between test ports 1 and 2 of the network analyzer as shown above.
2. Switch on the instrument and start the VNA application. Proceed as described in [Chapter 4.1.5, "Switching the Instrument On and Off"](#), on page 16.
3. Use the [Preset] key to restore a well-defined instrument state. The analyzer is now set to its default state. The default measured quantity is the transmission S-parameter S_{21} .



Select [Trace] and use the control elements in the "Traces" softtool tab if you wish to create additional traces and diagrams.

6.1.1.2 Selecting the Sweep Range and Other Parameters

After a system preset the display shows a diagram with a dB magnitude scale, and the S-parameter S_{21} is selected as a measured quantity. This S-parameter is

the forward transmission coefficient of the DUT. It is defined as the ratio of the transmitted wave at the DUT's output port (port no. 2) to the incident wave at the DUT's input port (port no. 1).

The R&S ZNLE automatically adjusts its internal source and receiver to the selected measured quantities: For an S_{21} measurement, a stimulus signal (termed a_1) is transmitted at the analyzer port no. 1; the transmitted wave (termed b_2) is measured at port 2. The stimulus signal from the analyzer port no. 2 is not needed except for some calibration types.

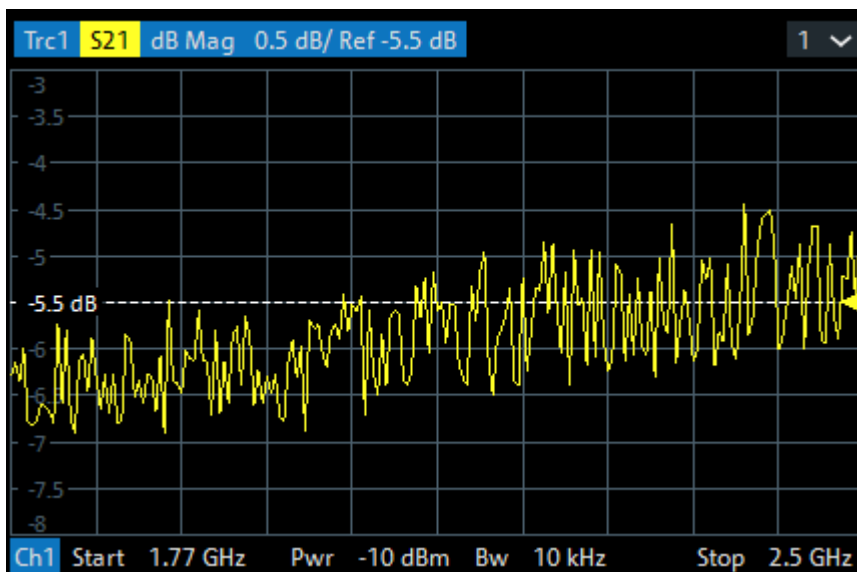
By default the sweep range is set to the frequency range of the analyzer, which can be unsuitable for your DUT. The following procedure shows you how to configure a smaller sweep range.

1. Select [Freq] and set the "Start Frequency" to the lowest frequency you want to measure (e.g. 1.77 GHz). For convenient data entry, double-tap/click the input field to open the "Numeric Editor".

Tip: If you use the keypad at the front panel for data entry, type [1][.][7][7] and terminate the entry with the [G/n] key.

Refer to [Chapter 7.3, "Entering Data"](#), on page 66 to learn more about entering numeric values and characters.

2. In the "Stop Frequency" input field, enter the highest frequency you want to measure (e.g. 2.5 GHz).
3. Select [Scale] > "Scale Values" and activate the "Auto Scale Trace" function. The analyzer adjusts the scale of the diagram to fit in the entire S_{21} trace, leaving an appropriate display margin.



6.1.1.3 Calibrating the Instrument

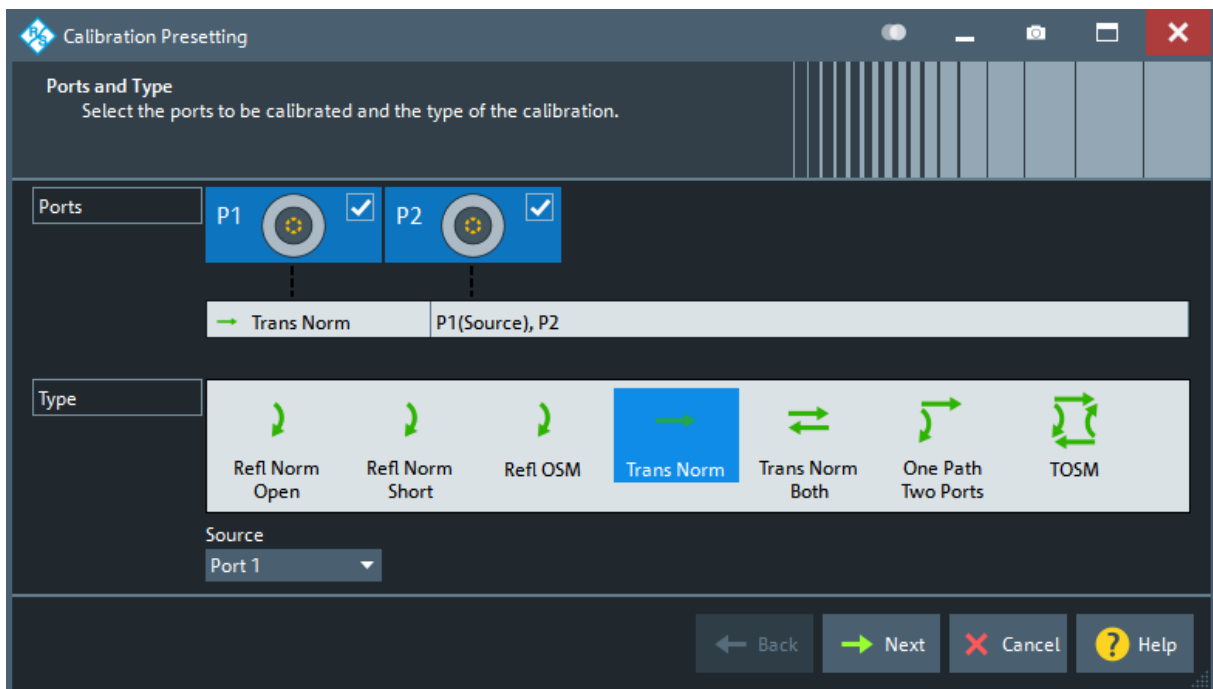
Calibration (system error correction) is the process of eliminating systematic, reproducible errors from the measurement results. E.g., in the current test setup, the connecting cables between the analyzer ports and the DUT introduce an attenuation and a phase shift of the waves. Both effects impair the accuracy of the S-parameter measurement.

The analyzer provides a wide range of sophisticated calibration methods for all types of measurements. The calibration method to select depends on the expected system errors, the accuracy requirements of the measurement, on the test setup and on the types of calibration standards available.

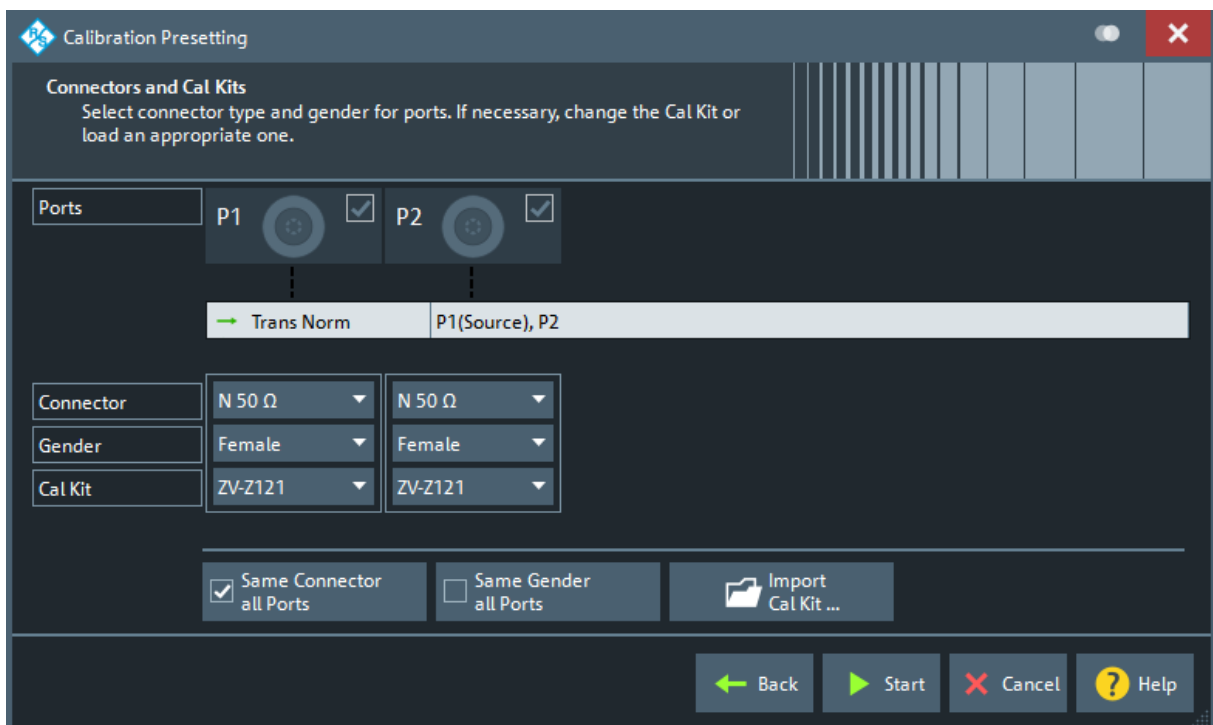
The following example requires a calibration kit with a male Through standard with known transmission characteristics for the related test port connector type and gender. With a single Through, it is possible to perform a transmission normalization, compensating for a frequency-dependent attenuation and phase shift in the signal paths.

Due to the R&S ZNLE's calibration wizard, calibration is a straightforward, guided process.

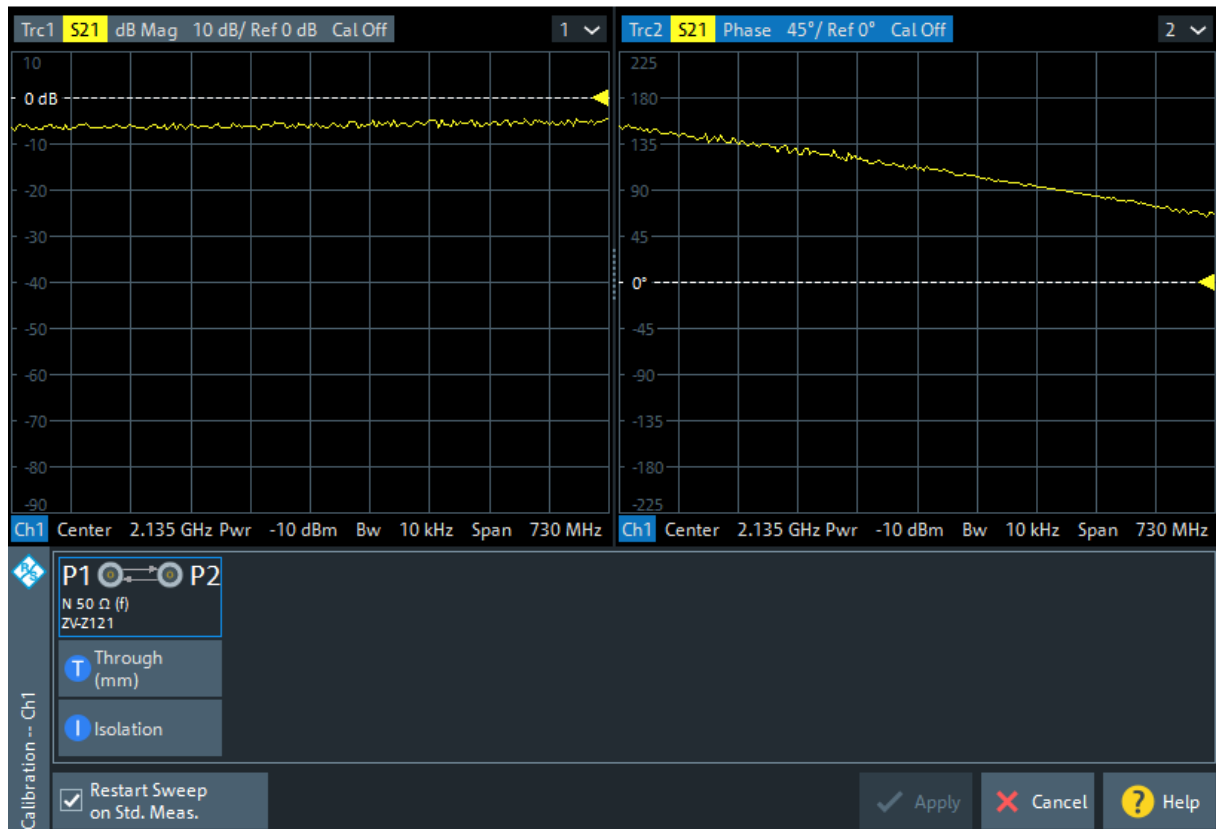
1. Replace the DUT by the Through standard of your calibration kit.
2. Select [Cal] > "Start... (Manual)" to open the "Calibration Setting" wizard.
3. Select the port combination Port 1 (P1) and Port 2 (P2) and the calibration type "Trans Norm". Make sure to define port 1 as the source port.



4. Select "Next" to proceed to the next page of the "Calibration Setting" wizard.
5. Select the test port connector type and gender (here: N 50 Ω , female, corresponding to a male Through standard) and the calibration kit (here: R&S ZV-Z121), then click "Start".



6. The "Calibration" dock widget indicates the standard measurements that make up a "Trans Norm" calibration. Select "Through (mm)" to initiate the measurement of the connected Through standard. Measuring the isolation between ports 1 and 2 is optional. Skip it for now.



The analyzer performs a calibration sweep for the measured quantity S_{21} . The magnitude and phase of the result is displayed in two diagrams, together with the expected typical result for a Through standard. The similarity of real and expected traces indicates that the Through standard has been properly connected. After the R&S ZNLE has completed the calibration sweep and calculated the correction data, the "Apply" button is enabled.

7. Select "Apply" to close the wizard and apply the system error correction to the current channel.

A "Cal" label appears in the trace list.

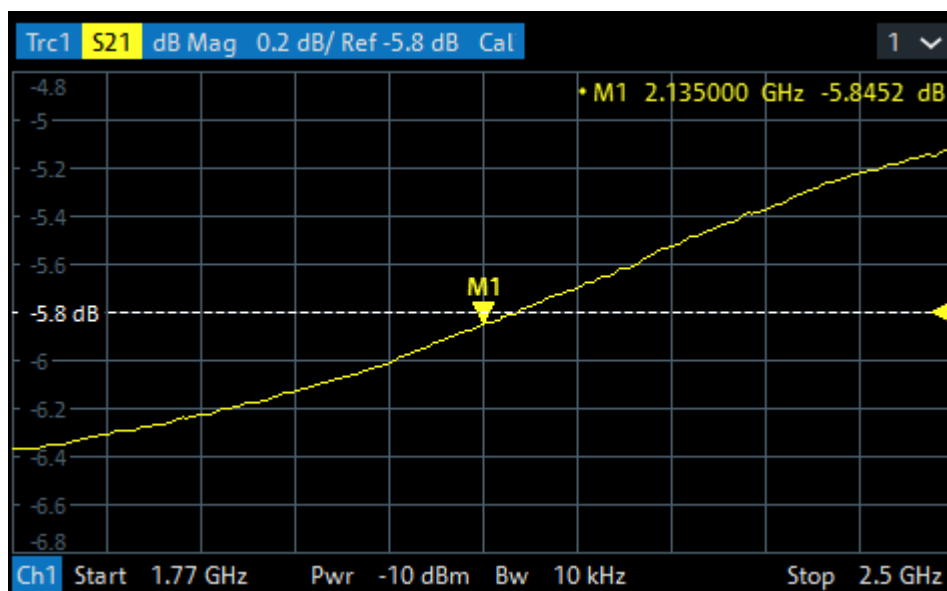
To proceed with the measurement, remove the Through standard and connect the DUT again.

6.1.1.4 Evaluating Data

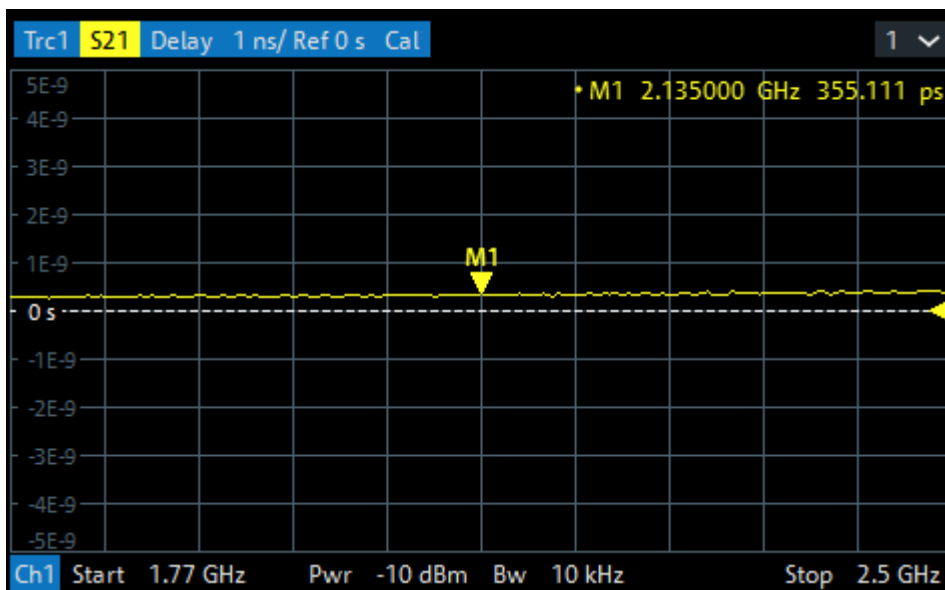
The analyzer provides various tools to optimize the display and analyze the measurement data. For instance, you can use markers to determine maxima and minima on the trace, and change the display format to obtain information about the group delay of the transmitted wave.

1. Select [Mkr] > [Mkr] > "Mkr 1".

This places marker "M1" to its default position (center of the sweep range). A marker symbol (triangle) appears on the trace, a marker info field in the upper right corner of the diagram. The marker info field displays the stimulus value (frequency) and response value (magnitude of the transmission coefficient converted to a dB value) at the marker position.



2. Open the [Mkr->] > "Peak" softtool tab and activate "Min" search.
The marker jumps to the absolute minimum of the curve in the entire sweep range. The marker info field shows the coordinates of the new marker position.
3. Select [Format] and choose the "Delay" of the transmission coefficient as displayed quantity.
The group delay represents the propagation time of the wave through the DUT; it is displayed in a Cartesian diagram. The marker info field shows the frequency and group delay at the marker position.



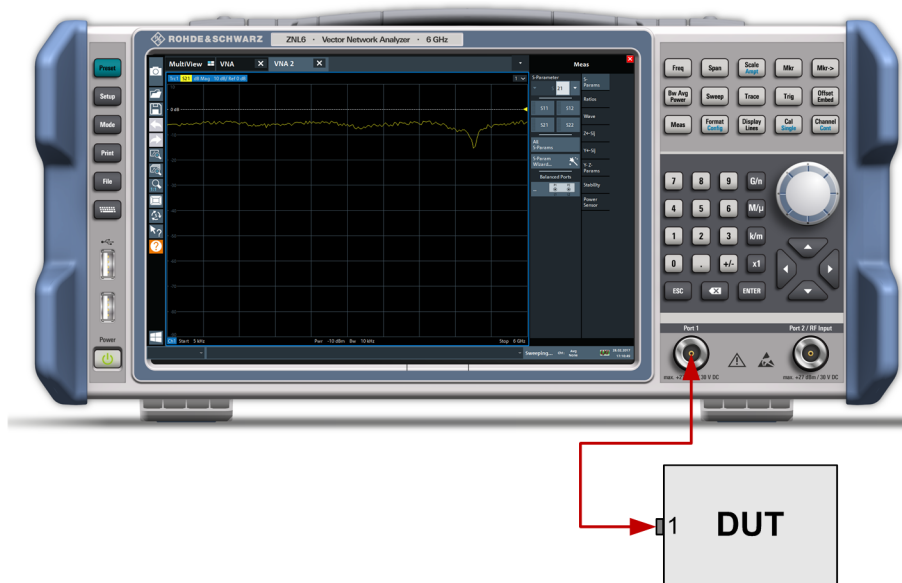
Refer to section "Trace Formats" in the help system or in the user manual to learn more about the diagram properties.

6.1.2 Reflection S-Parameter Measurement

In a reflection measurement, the analyzer transmits a stimulus signal to the input port of the device under test (DUT) and measures the reflected wave. Different trace formats allow you to express and display the results, depending on what you want to learn from the data. Only one analyzer test port is required for reflection measurements.

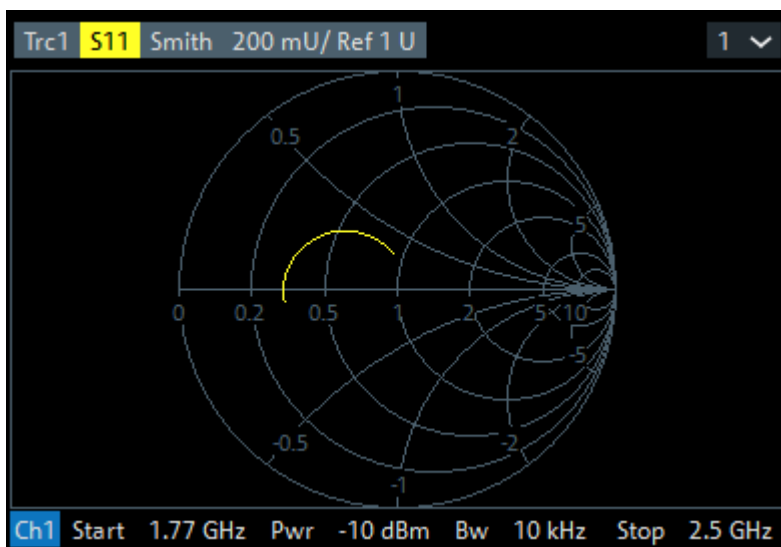
In principle, a reflection measurement involves the same steps as a transmission measurement. Note the following differences:

- The basic test setup for reflection measurements involves a single DUT and analyzer port. For instance, you can connect the input of your DUT to port 1 of the analyzer as shown below.



You can also use the basic transmission test setup, e.g. if you want to measure reflection and transmission parameters in parallel.

- The analyzer provides special calibration types for reflection measurements. Use the calibration wizard and select an appropriate type. The full 2-port calibration TOSM corrects the system errors for all transmission and reflection S-parameters.
- Some of the trace formats are particularly suited for reflection measurements. For instance, you can display the measured reflection coefficient S_{11} in a Smith chart to obtain the complex input impedance at port 1.



6.2 Zooming into the Display

To analyze the areas around the peak levels in more detail, we will zoom into a peak.

1. Tap the "Multiple Zoom" icon in the toolbar.



The icon is highlighted to indicate that zoom mode is active.

2. Tap the diagram near the peak and drag your finger to the opposite corner of the zoom area. A white rectangle is displayed from the point where you tapped to the current position.

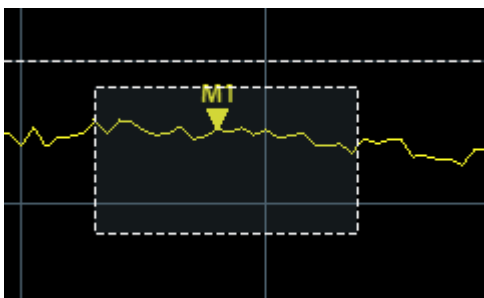


Figure 6-1: Defining the zoom area

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

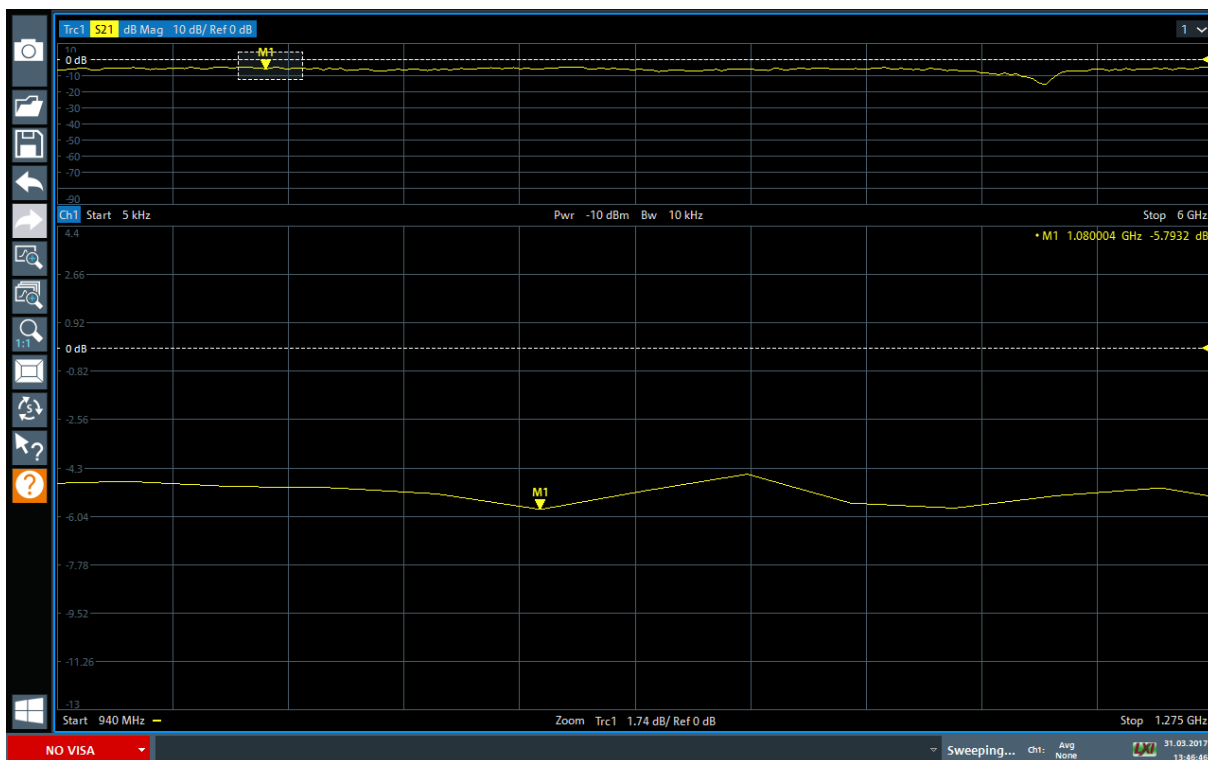


Figure 6-2: Zoomed display around a peak

6.3 Saving Settings

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

To save the instrument settings to a file

1. Tap the "Save" icon in the toolbar.



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



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

Keep the default "File Type" setting "Instrument with all Channel Setups" to store the configuration of all channel setups.

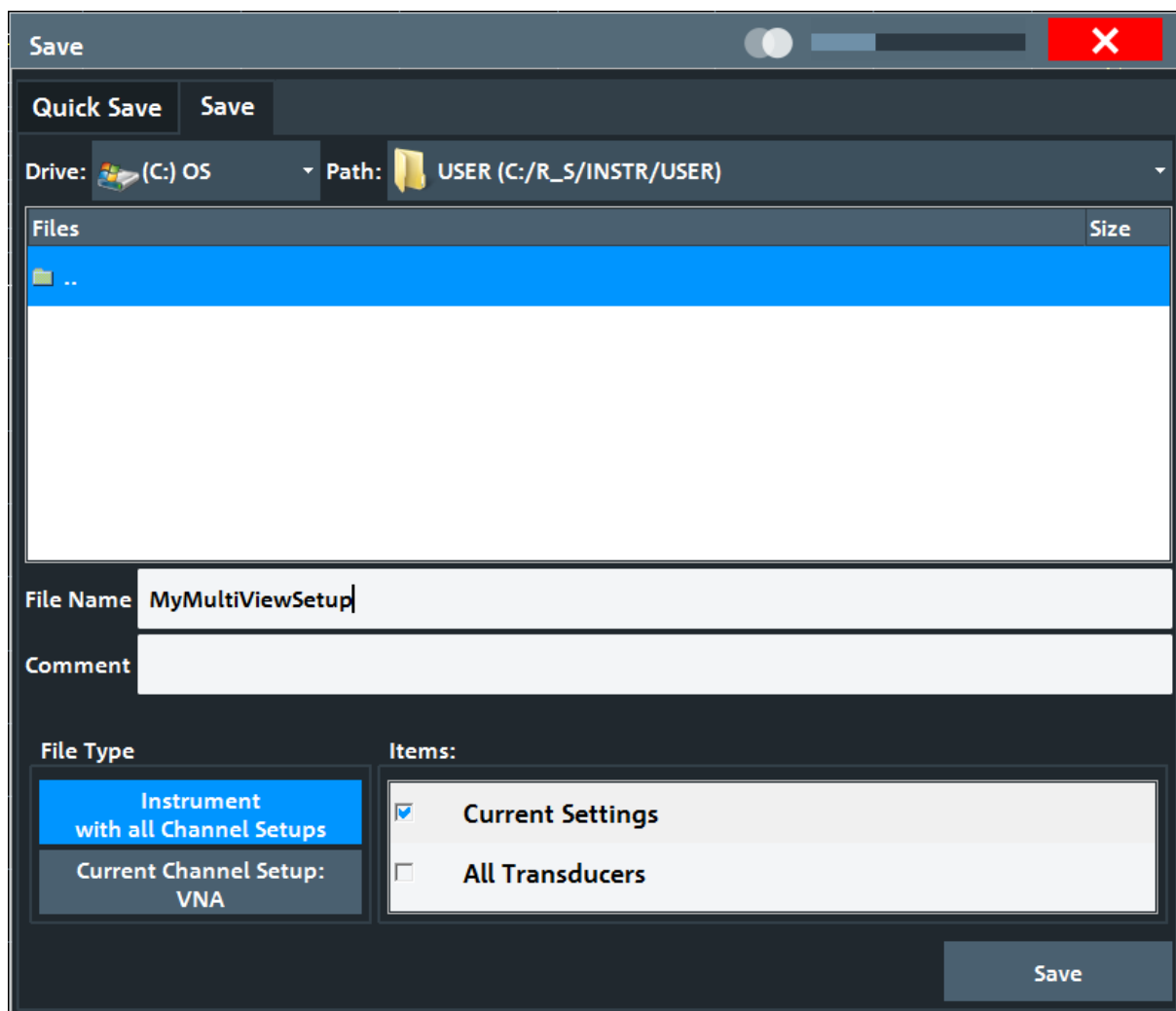


Figure 6-3: Saving the instrument settings to a file

4. Tap the "Save" button.

The file `MyMultiViewSetup.dfl` is stored in the default directory `C:\Users\Public\Documents\Rohde-Schwarz\ZNL\user`.

To load stored instrument settings

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

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

2. Tap the "Load" icon in the toolbar.



3. In the "Load" dialog box, select the `MyMultiViewSetup.dfl` file in the default directory `C:\Users\Public\Documents\Rohde-Schwarz\ZNL\user`.
4. Tap the "Load" button.

All instrument settings are restored and the display should resemble the instrument display right before the settings were stored.

6.4 Printing and Saving Results

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

To export the trace data

1. Press the [TRACE] key on the front panel.
2. Tap the Trace softkey.
3. Tap the "Trace / Data Export" tab.
4. Tap the "Export Trace to ASCII File" button.
5. Enter the file name *MyMultiViewResults*.

The trace data is stored to `MyMultiViewResults.DAT`

To create a screenshot of the display

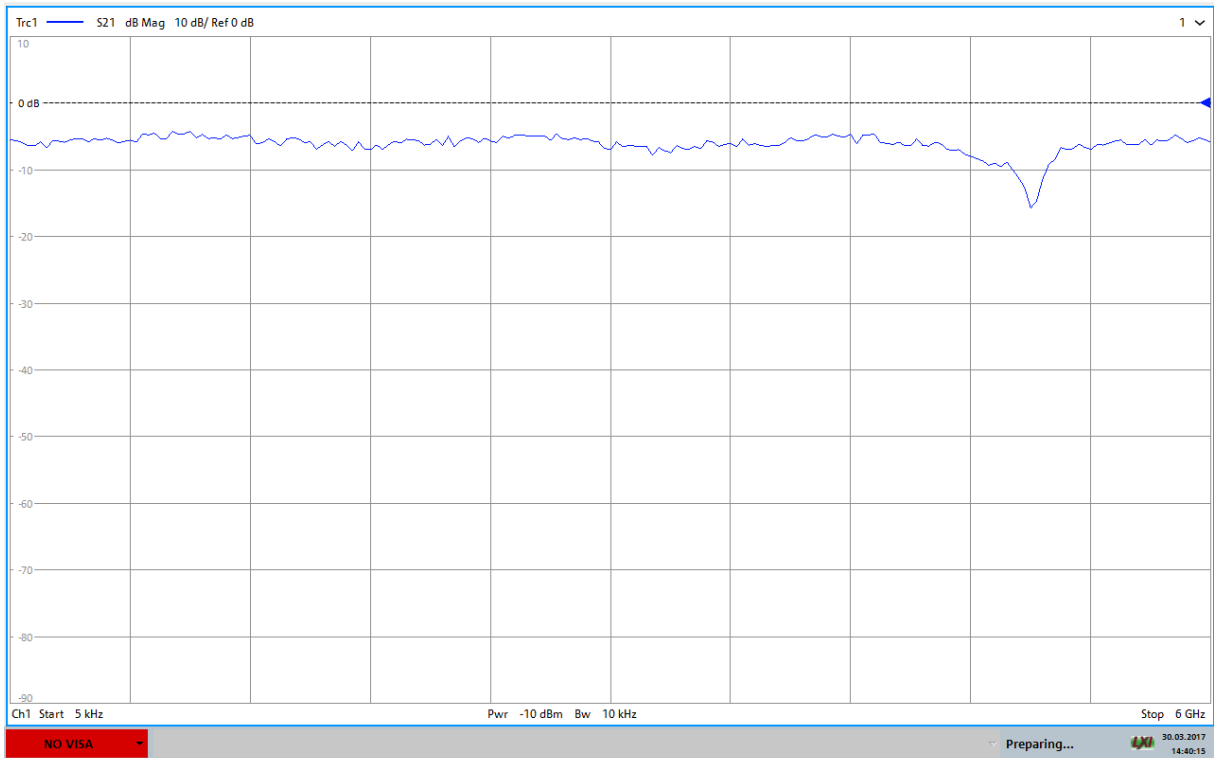
1. Tap the "Print immediately" icon in the toolbar.



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

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

The screenshot is stored to MyMultiViewDisplay.png.



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7 Operating the Instrument

This chapter provides an overview on how to work with the R&S ZNLE.

NOTICE

Risk of touchscreen damage

Inappropriate tools or excessive force can damage the touchscreen.

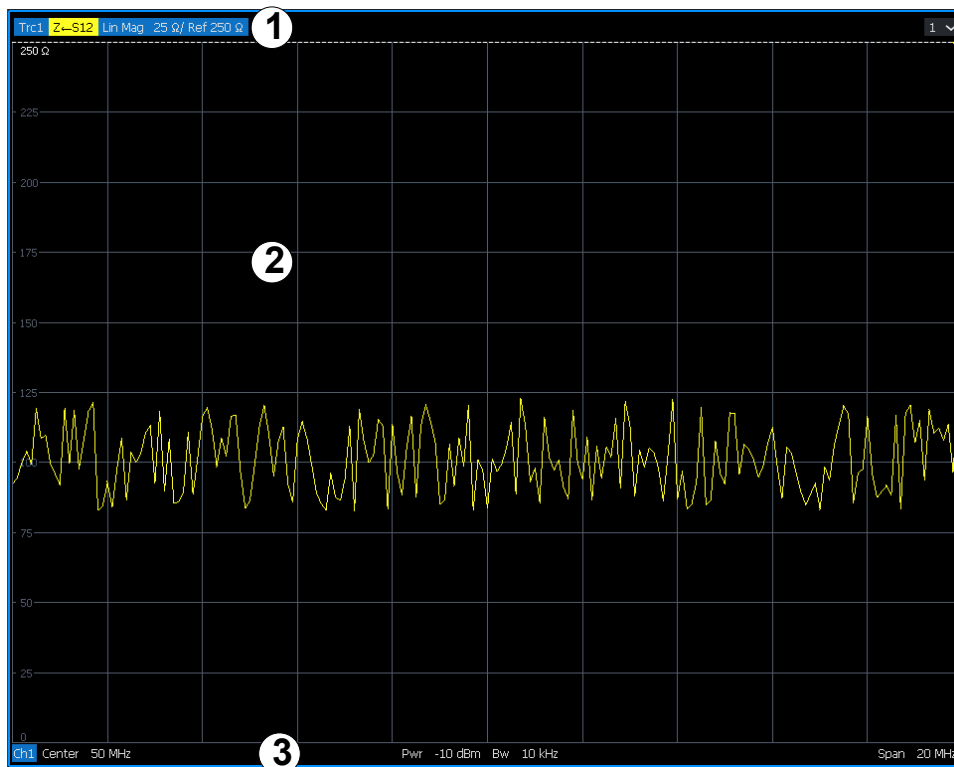
Observe the following instructions when operating the touchscreen:

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

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7.1 Understanding the Display Information

The following figure shows a measurement diagram. All different information areas are labeled. They are explained in more detail in the following sections.



- 1 = Window title bar with measurement-specific (trace) information
- 2 = Diagram area with marker information
- 3 = Diagram footer with diagram-specific information

Window title bar

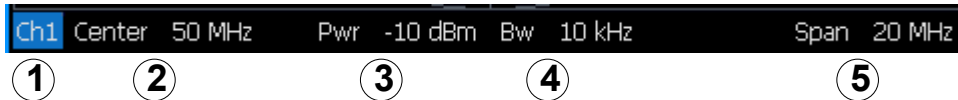
For each parameter diagram, a window is displayed with the following information in the title bar:



- 1 = Trace name
- 2 = Measured parameter
- 3 = Trace format
- 4 = Scale per division
- 5 = Reference value

Diagram footer

For each parameter diagram, a window is displayed with the following information in the footer:



- 1 = Channel
- 2 = Center frequency
- 3 = Power level
- 4 = Measurement bandwidth
- 5 = Span

7.2 Accessing the Functionality

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

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

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

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

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

7.2.1 Toolbar

Standard functions can be performed via the icons in the toolbar on the left side of the screen.



You can hide the toolbar display, e.g. when using remote control, to enlarge the display area for the measurement results ("Setup" > "Display" > "Displayed Items").

See the R&S ZNLE User Manual.

7.2.2 Softtools

Softtools display groups of related settings as a tabbed panel. They can be opened via function keys on the (virtual) front panel, or via context menu items.

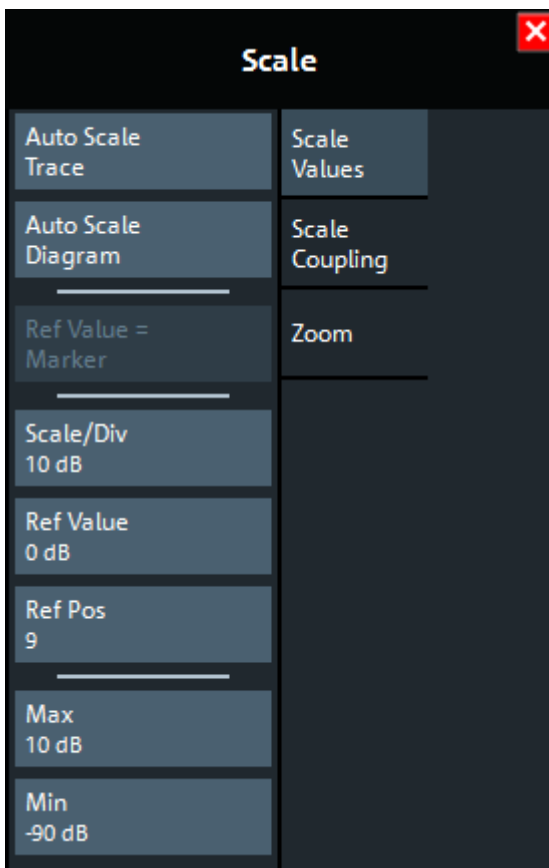


Figure 7-1: Scale softtool

The softtools are displayed in the softkey bar of the instrument. The title area of the softkey bar displays the name of the currently opened softtool.

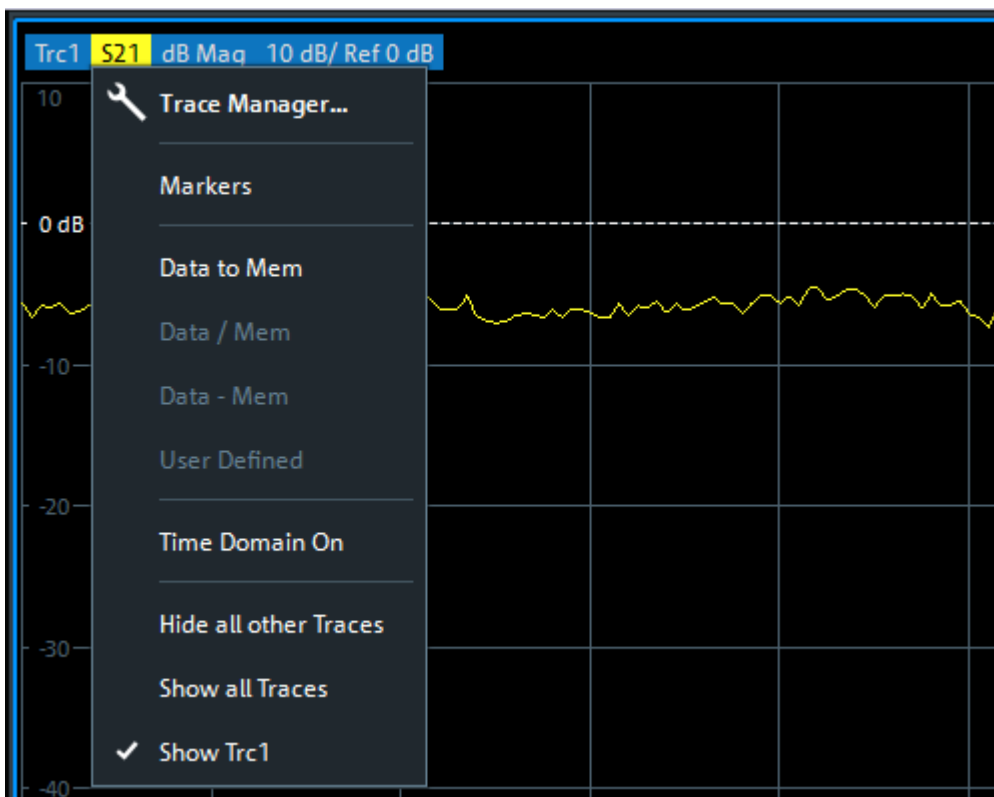


If you close the softkey bar using its close icon, it is automatically reopened the next time a function key is pressed. You can change this behavior in the "User Interface" tab of the "VNA Setup" dialog.

Some controls on the softtool tabs allow you to read and modify settings (e.g. "Ref Value" in the screenshot above), some perform actions (e.g. "Auto Scale Trace"), while others open additional dialogs (button label ends with "...").

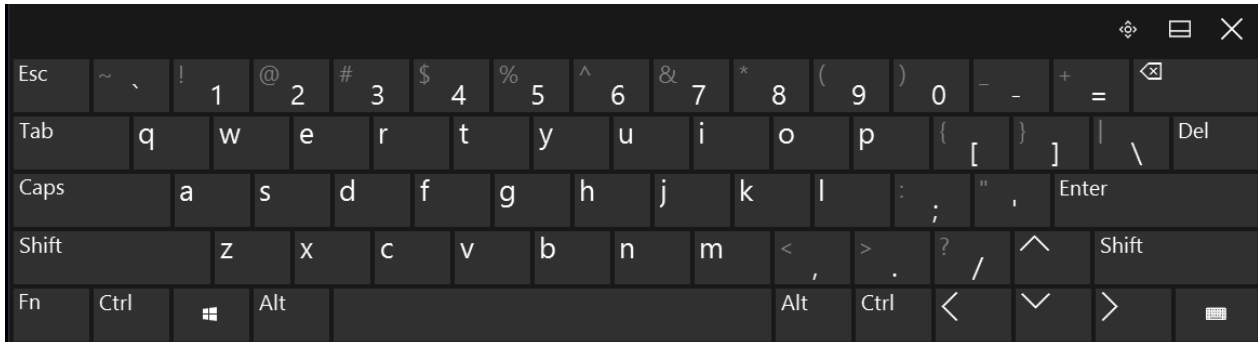
7.2.3 Context Menus

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



7.2.4 On-screen Keyboard

The on-screen keyboard is an additional means of interacting with the instrument without having to connect an external keyboard.



The on-screen keyboard display can be switched on and off as desired using the "On-Screen Keyboard" function key beneath the screen.



When you press this key, the display switches between the following options:

- Keyboard displayed at the top of the screen
- Keyboard displayed at the bottom of the screen
- No keyboard displayed



You can use the TAB key on the on-screen keyboard to move the focus from one field to another in dialog boxes.

7.3 Entering Data

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

- Using the touchscreen, via the online keyboard
- Using other elements provided by the front panel, e.g. the keypad, rotary knob, or navigation keys
The rotary knob acts like the [ENTER] key when it is pressed.
- Using a connected external keyboard



Transparent dialog boxes

You can change the transparency of the dialog boxes to see the results in the windows behind the dialog box. Thus, you can see the effects that the changes you make to the settings have on the results immediately.

To change the transparency, select the transparency icon at the top of the dialog box. A slider is displayed. To hide the slider, select the transparency icon again.



(The title bar of the dialog box is always slightly transparent and is not affected by the slider.)



Particularities in Windows dialog boxes

In some cases, e.g. if you want to install a printer, original Windows dialog boxes are used. In these dialog boxes, the rotary knob and function keys do not work. Use the touchscreen instead.

Entering Numeric Parameters

If a field requires numeric input, the keypad provides only numbers.

1. Enter the parameter value using the keypad, or change the currently used parameter value by using the rotary knob (small steps) or the [UP] or [DOWN] keys (large steps).
2. After entering the numeric value via keypad, press the corresponding unit key. The unit is added to the entry.
3. If the parameter does not require a unit, confirm the entered value by pressing the [ENTER] key or any of the unit keys. The editing line is highlighted to confirm the entry.

Entering Alphanumeric Parameters

If a field requires alphanumeric input, you can use the on-screen keyboard to enter numbers and (special) characters (see [Chapter 7.2.4, "On-screen Keyboard"](#), on page 66).

Correcting an entry

1. Using the arrow keys, move the cursor to the right of the entry you want to delete.
2. Press the [BACKSPACE] key.
The entry to the left of the cursor is deleted.
3. Enter your correction.

Completing the entry

- ▶ Press the [ENTER] key or the rotary knob.

Aborting the entry

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

7.4 Touchscreen Gestures

A touchscreen allows you to interact with the software using various finger gestures on the screen. The basic gestures supported by the software and most applications are described here. Further actions using the same gestures may be possible.



Tapping

Touch the screen quickly, usually on a specific element.

You can tap most elements on the screen; in particular, any elements you can also click on with a mouse pointer.

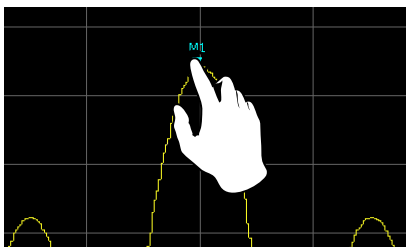


Figure 7-2: Tapping

Double-tapping

Tap the screen twice, in quick succession.

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



Dragging

Move your finger from one position to another on the display, keeping your finger on the display the whole time.

By dragging your finger over a table or diagram you can pan the displayed area of the table or diagram to show results that were previously out of view.

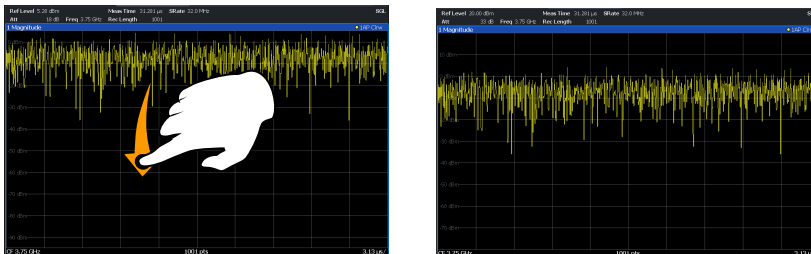


Figure 7-3: Dragging



Pinching and spreading two fingers

Move two fingers together on the display (pinch) or move two fingers apart on the display (spread).

When you pinch two fingers in the display, you decrease the size of the currently displayed area, showing the surrounding areas previously out of view.

When you spread two fingers in the display, you increase the size of the currently displayed area, showing more details.

You can pinch or spread your fingers vertically, horizontally, or diagonally. The direction in which you move your fingers determines which dimension of the display is changed.

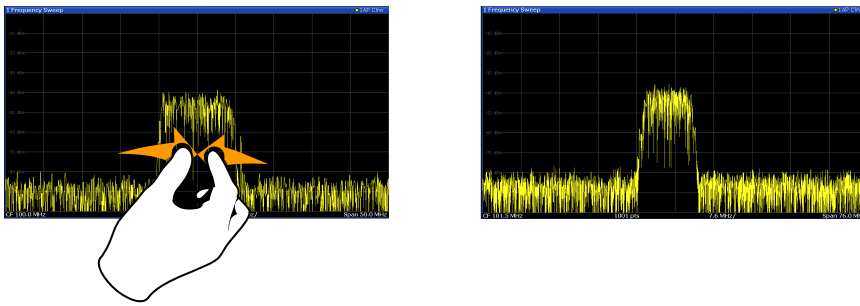


Figure 7-4: Pinching

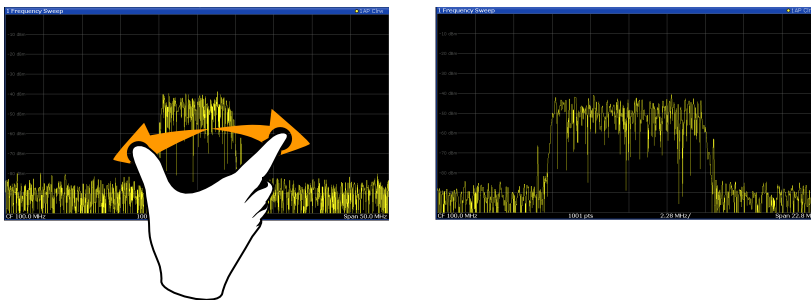


Figure 7-5: Spreading



Touch gestures in diagrams change measurement settings

When you change the display using touch gestures, the corresponding measurement settings are adapted. This is different to selecting an area on the screen in zoom mode, where merely the resolution of the displayed trace points is changed temporarily (graphical zoom).

Mouse vs. touch actions

Any user interface elements that react to actions by a mouse pointer also react to finger gestures on the screen, and vice versa. The following touch actions correspond to mouse actions:

Table 7-1: Correlation of mouse and touch actions

Mouse operation	Touch operation
Click	Tap
Double-click	Double-tap
Click and hold	Touch and hold
Right-click	Touch, hold for 1 second and release

Mouse operation	Touch operation
Drag-&-drop (= click and hold, then drag and release)	Touch, then drag and release
Mouse wheel to scroll up or down	Swipe
Dragging scrollbars to scroll up or down, left or right	Swipe
In (graphical) Zoom mode only: dragging the borders of the displayed rectangle to change its size	Touch, then drag and release

Example:

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

7.5 Getting Help

If any questions or problems concerning the R&S ZNLE arise, an extensive online help system is provided on the instrument and can be consulted at any time. The help system is context-sensitive and provides information specifically for the current operation or setting to be performed. In addition, general topics provide an overview on complete tasks or function groups as well as background information.

7.5.1 Calling Up Help

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

Calling context-sensitive help

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



The "Help" dialog box "View" tab is displayed. A topic containing information about the focused screen element is displayed.

If no context-specific help topic is available, a more general topic or the "Content" tab is displayed.



For standard Windows dialog boxes (e.g. File Properties, Print dialog etc.), no context-sensitive help is available.

- ▶ To display a help topic for a screen element not currently focused:

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



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

b) Select the screen element to change the focus.

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

7.5.2 Using the Help Window

The Help window contains several tabs:

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



The Help toolbar provides some buttons:

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



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

To search for a topic in the index

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

1. Switch to the "Index" tab.
2. Select the "Keyboard" icon besides the entry field.
3. Enter the first characters of the keyword you are interested in.
The entries containing these characters are displayed.
4. Double-tap the suitable index entry.
The "View" tab with the corresponding help topic is displayed.

To search topics for a text string

1. Switch to the "Search" tab.
2. Select the "Keyboard" icon besides the entry field.
3. Enter the string you want to find.
If you enter several strings with blanks between, topics containing all words are found (same as AND operator).

For advanced search, consider the following:

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

To close the Help window

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

7.6 Remote Control

In addition to working with the R&S ZNLE interactively, located directly at the instrument, it is also possible to operate and control it from a remote PC. Various methods for remote control are supported:

- Connecting the instrument to a (LAN) network (see [Chapter 4.5, "Setting Up a Network \(LAN\) Connection"](#), on page 26)
- Using the LXI browser interface in a LAN network
- Using the Windows Remote Desktop application in a LAN network
- Connecting a PC via the GPIB interface

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



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

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

7.6.1 Using the LXI Browser Interface in a LAN

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

Via the LXI browser interface to the R&S ZNLE you can control the instrument remotely from another PC. Manual instrument controls are available via the front panel simulation. File upload and download between the instrument and the remote PC is also available. Using this feature, several users can access *and operate* the R&S ZNLE simultaneously. This is useful for troubleshooting or training purposes. If necessary, this feature can be deactivated.

7.6.2 Remote Desktop Connection

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

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

7.6.3 Connecting a PC via the GPIB Interface

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

A GPIB interface is available on the rear panel of the R&S ZNLE if the option R&S FPL1-B10 is installed.

8 Collecting Information for Support

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

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

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

- **Windows Event Log Files**

Windows records important actions of applications and the operating system in event logs. You can create event log files to summarize and save the existing event logs (see ["To create Windows event log files"](#) on page 77).

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

An .xml file with information on the system configuration ("Device Footprint") can be created automatically (using the `DIAGnostic:SERvice:SIInfo` command or as described in ["To collect the support information"](#) on page 76).

- **Error Log:** The `RSError.log` file (in the `C:\Program Files\Rohde-Schwarz\Vector Network Analyzer\ZNL\log` directory) contains a chronological record of errors.
- **Support file:** a *.zip file with important support information can be created automatically (in the `C:\Program Files\Rohde-Schwarz\Vector Network Analyzer\ZNL\user` directory). The *.zip file contains the system configuration information ("Device Footprint"), the current eeprom data and a screenshot of the screen display.

To collect the support information

1. Press the [SETUP] key.
2. Select "Service" > "R&S Support" and then "Create R&S Support Information".

The file is stored as

```
C:\Program Files\Rohde-Schwarz\Vector Network Analyzer\ZNL\
user\
```

For example

```
C:\Program Files\Rohde-Schwarz\Vector Network Analyzer\ZNL\
user\ZNL3__20160803_145113.zip
```

To create Windows event log files

1. Select the "Windows Start Button" in the bottom left corner.



2. Type in *Event Viewer* and select "Enter".
3. Select and expand "Windows Logs" in the "Console Tree".
4. Right-click on each subsection and select "Save All Events As...".

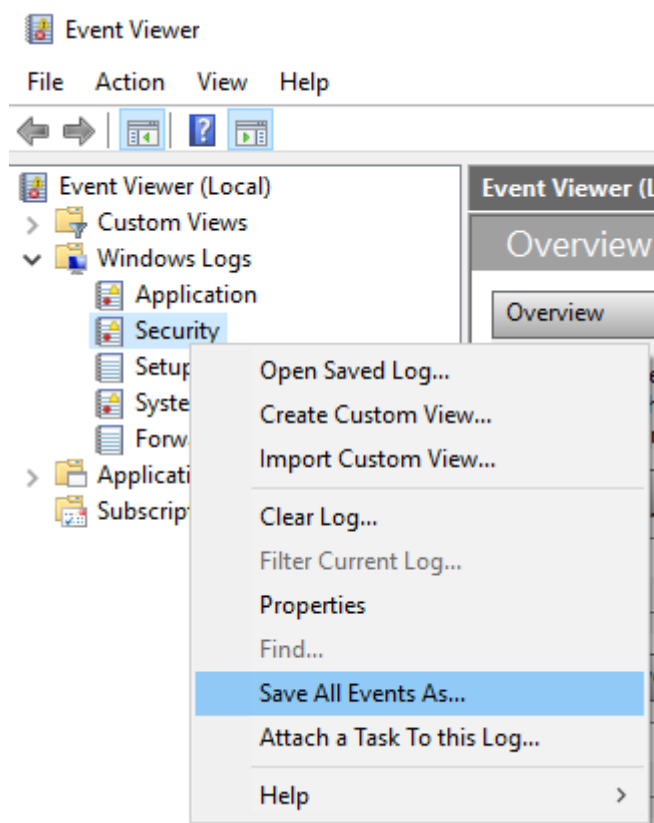


Figure 8-1: Event Viewer

5. Enter a file name and select "Save"

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

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