R&S®ZNL Vector Network Analyzer Getting Started

ROHDE & SCHWARZ
Make ideas real

This manual applies to the following R&S®ZNL models with firmware version 1.61 and higher:

- R&S®ZNL3, 5 kHz to 3 GHz, 2 ports, N(f) connectors,
  order no. 1323.0012K03

- R&S®ZNL4, 5 kHz to 4.5 GHz, 2 ports, N(f) connectors,
  order no. 1323.0012K04

- R&S®ZNL6, 5 kHz to 6 GHz, 2 ports, N(f) connectors,
  order no. 1323.0012K06

- R&S®ZNL14, 5 kHz to 14 GHz, 2 ports, N(f) connectors,
  order no. 1323.0012K14

- R&S®ZNL20, 5 kHz to 20 GHz, 2 ports, 3.5 mm (m) connectors,
  order no. 1323.0012K20

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

Contents

1   Safety and regulatory information

The product documentation helps you use the product safely and efficiently. Follow the instructions provided here and in the following chapters.

Intended use

The product is intended for the development, production and verification of electronic components and devices in industrial, administrative, and laboratory environments. Use the product 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 of potential dangers and gives instructions on how to prevent personal injury or damage caused by dangerous situations. Safety information is provided as follows:

- In Chapter 1.1, "Safety instructions", on page 5. The same information is provided in many languages as printed "Safety Instructions". The printed "Safety Instructions" are delivered with the product.
- Throughout the documentation, safety instructions are provided when you need to take care during setup or operation.

1.1   Safety instructions

Products from the Rohde & Schwarz group of companies are manufactured according to the highest technical standards. To use the products safely, follow the instructions provided here and in the product documentation. Keep the product documentation nearby and offer it to other users.

Use the product only for its intended use and within its performance limits. Intended use and limits are described in the product documentation such as the data sheet, manuals and the printed "Safety Instructions". If you are unsure about the appropriate use, contact Rohde & Schwarz customer service.

Using the product requires specialists or specially trained personnel. These users also need sound knowledge of at least one of the languages in which the user interfaces and the product documentation are available.

Never open the casing of the product. Only service personnel authorized by Rohde & Schwarz are allowed to repair the product. If any part of the product is damaged or broken, stop using the product. Contact Rohde & Schwarz customer service at http://www.customersupport.rohde-schwarz.com.

Lifting and carrying the product

The maximum weight of the product is provided in the data sheet. To move the product safely, you can use lifting or transporting equipment such as lift trucks and forklifts. Follow the instructions provided by the equipment manufacturer.

Choosing the operating site

Only use the product indoors. The product casing is not waterproof. Water that enters can electrically connect the casing with live parts, which can lead to electric shock, serious personal injury or death if you touch the casing. If Rohde & Schwarz provides accessories designed for your product, e.g. a carrying bag, you can use the product outdoors.

Unless otherwise specified, you can operate the product up to an altitude of 2000 m above sea level. The product is suitable for pollution degree 2 environments where nonconductive contamination can occur. For more information on environmental conditions such as ambient temperature and humidity, see the data sheet.

Setting up the product

Always place the product on a stable, flat and level surface with the bottom of the product facing down. If the product is designed for different positions, secure the product so that it cannot fall over.

If the product has foldable feet, always fold the feet completely in or out to ensure stability. The feet can collapse if they are not folded out completely or if the product is moved without lifting it. The foldable feet are designed to carry the weight of the product, but not an extra load.

If stacking is possible, keep in mind that a stack of products can fall over and cause injury.

If you mount products in a rack, ensure that the rack has sufficient load capacity and stability. Observe the specifications of the rack manufacturer. Always install the products from the bottom shelf to the top shelf so that the rack stands securely. Secure the product so that it cannot fall off the rack.

Connecting to power

The product is an overvoltage category II product. Connect the product to a fixed installation used to supply energy-consuming equipment such as household appliances and similar loads. Keep in mind that electrically powered products have risks, such as electric shock, fire, personal injury or even death.

Take the following measures for your safety:

● Before switching on the product, ensure that the voltage and frequency indicated on the product match the available power source. If the power adapter does not adjust automatically, set the correct value and check the rating of the fuse.

● If a product has an exchangeable fuse, its type and characteristics are indicated next to the fuse holder. Before changing the fuse, switch off the instrument and disconnect it from the power source. How to change the fuse is described in the product documentation.

● Only use the power cable delivered with the product. It complies with country-specific safety requirements. Only insert the plug into an outlet with protective conductor terminal.

● Only use intact cables and route them carefully so that they cannot be damaged. Check the power cables regularly to ensure that they are undamaged. Also ensure that nobody can trip over loose cables.

● If the product needs an external power supply, use the power supply that is delivered with the product or that is recommended in the product documentation or a power supply that conforms to the country-specific regulations.

● Only connect the product to a power source with a fuse protection of maximum 20 A.

● Ensure that you can disconnect the product from the power source at any time. Pull the power plug to disconnect the product. The power plug must be easily accessible. If the product is integrated into a system that does not meet these requirements, provide an easily accessible circuit breaker at the system level.

Handling batteries safely

The product contains exchangeable or built-in lithium polymer or lithium ion cells or batteries. The use of the word battery in the following always means all types. Only the battery contents are potentially hazardous. As long as a battery is undamaged and the seals remain intact, there is no danger.

Impact, shock or heat can cause damage such as dents, punctures and other deformations. A damaged battery poses a risk of personal injury. Handle a damaged or leaking battery with extreme care. Immediately ventilate the area since the battery releases harmful gases. If you come into contact with the battery fluid, immediately remove all contaminated clothing. Irritation can occur if the battery fluid comes in contact with your skin or eyes. Immediately and thoroughly rinse your skin or eyes with water and seek medical aid.

For safe handling, follow these rules:

- Do not short-circuit the battery.
- Do not mechanically damage the battery. Do not open or disassemble the battery.
- Do not expose the battery to high temperatures such as open flames, hot surfaces and sunlight.
- Only use the battery with the designated Rohde & Schwarz product.
- Only use the appropriate Rohde & Schwarz charger to charge the batteries. If the batteries are improperly charged, there is a risk of explosion. For charging and discharging temperature ranges, see the product documentation.
- Replace exchangeable batteries only with the same battery type.
- Store the battery in the product or use the product packaging.
- Dispose of exchangeable batteries separately from normal household waste as specified by the local waste disposal agency.

If you disregard these rules, you risk serious personal injury or even death due to explosion, fire or hazardous chemical substances. The product documentation provides further details.

If exchangeable batteries or products with built-in batteries are defective, contact the Rohde & Schwarz customer service. Rohde & Schwarz classifies the severity of the defect. When returning batteries or Rohde & Schwarz products containing batteries, use a carrier qualified to transport dangerous goods and notify the carrier of this classification. Follow the carrier's transport stipulations in line with IATA-DGR, IMDG-Code, ADR or RID.

Connecting headphones

Take the following measures to prevent hearing damage. Before using headphones, check the volume and reduce it if necessary. If you monitor varying signal levels, take off the headphones and wait until the signal has settled. Then adjust the volume.

Cleaning the product

Use a dry, lint-free cloth to clean the product. When cleaning, keep in mind that the casing is not waterproof. Do not use liquid cleaning agents.

Meaning of safety labels

Safety labels on the product warn against potential hazards.

⚠	Potential hazard Read the product documentation to avoid personal injury or product damage.
⚡	Electrical hazard Indicates live parts. Risk of electric shock, fire, personal injury or even death.
♨	Hot surface Do not touch. Risk of skin burns. Risk of fire.
⏚	Protective conductor terminal Connect this terminal to a grounded external conductor or to protective ground. This connection protects you against electric shock if an electric problem occurs.

1.2   Labels on R&S ZNL

Labels on the casing inform about:

- Personal safety, see "Meaning of safety labels" on page 9
- Product and environment safety, see Table 1-1
- Identification of the product, see Chapter 4.2.14, "Device ID", on page 47

Table 1-1: Labels regarding R&S ZNL and environment safety

🗑	Labeling in line with EN 50419 for disposal of electrical and electronic equipment after the product has come to the end of its service life. For more information, see the product user manual, chapter "Disposal".
🗑	Labeling in line with directive 2006/66/EC for disposal of batteries after they have come to the end of their service life. For more information, see the R&S ZNL user manual, chapter "Disposal".

1.3 Warning messages in the documentation

A warning message points out a risk or danger that you need to be aware of. The signal word indicates the severity of the safety hazard and how likely it will occur if you do not follow the safety precautions.

CAUTION

Potentially hazardous situation. Could result in minor or moderate injury if not avoided.

NOTICE

Potential risks of damage. Could result in damage to the supported product or to other property.

1.4 Korea certification class A

이 기기는 업무용(A급) 전자파 적합기기로서 판매자 또는 사용자는 이 점을 주의하시기 바라며, 가정외의 지역에서 사용하는 것을 목적으로 합니다.

2   Documentation overview

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

www.rohde-schwarz.com/manual/ZNL

2.1   Getting started manual

Introduces the R&S ZNL 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.

2.2   User manuals and help

Separate user manuals are provided for the base unit and the firmware applications:

- Base unit 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.

- Firmware application manual
  Contains the description of the specific functions of a firmware application, including remote control commands. Basic information on operating the R&S ZNL is not included.

The contents of the user manuals are available as help in the R&S ZNL. The help offers quick, context-sensitive access to the complete information for the base unit and the firmware applications.

All user manuals are also available for download or for immediate display on the Internet.

2.3 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=484937

2.4 Instrument security procedures

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

2.5 Printed safety instructions

Provides safety information in many languages. The printed document is delivered with the product.

2.6 Data sheets and brochures

The data sheet contains the technical specifications of the R&S ZNL. 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/ZNL

2.7 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/ZNL

2.8 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/ZNL

2.9 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.

3   Preparing for use

Here, you can find basic information about setting up the product for the first time.

3.1   Lifting and carrying

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

See "Lifting and carrying the product" on page 6.

3.2   Unpacking and checking

1. Unpack the R&S ZNL carefully.

2. Retain the original packing material. Use it when transporting or shipping the R&S ZNL later.

3. Using the delivery notes, check the equipment for completeness.

4. Check the equipment for damage.

   If the delivery is incomplete or equipment is damaged, contact
   Rohde & Schwarz.

3.3   Choosing the operating site

Specific operating conditions ensure proper operation and avoid damage to the
product and connected devices. For information on environmental conditions
such as ambient temperature and humidity, see the data sheet.

See also "Choosing the operating site" on page 6.

Electromagnetic compatibility classes

The electromagnetic compatibility (EMC) class indicates where you can operate
the product. The EMC class of the product is given in the data sheet under "General data".

● Class B equipment is suitable for use in:
    – Residential environments
    – Environments that are directly connected to a low-voltage supply network
      that supplies residential buildings
● Class A equipment is intended for use in industrial environments. It can cause
  radio disturbances in residential environments due to possible conducted and
  radiated disturbances. It is therefore not suitable for class B environments.
  If class A equipment causes radio disturbances, take appropriate measures to
  eliminate them.

3.4   Setting up the R&S ZNL

The R&S ZNL is designed for use either on a bench top or in a rack, or as a portable instrument (with optional battery operation) in a transport bag in the field.
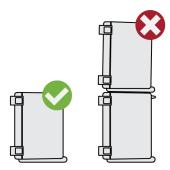
See also:
● "Setting up the product" on page 6
● "Intended use" on page 5

3.4.1   Placing the R&S ZNL on a bench top

To place the product on a bench top

1. Place the product on a stable, flat and level surface. Ensure that the surface can support the weight of the product. For information on the weight, see the data sheet.

2. **CAUTION!** Foldable feet can collapse. See "Setting up the product" on page 6.

   Always fold the feet completely in or out. With folded-out feet, do not place anything on top or underneath.

3. **CAUTION!** The product can fall over and cause injury. The top surface is too small for stacking. Never stack another product on top of the product.

   As an alternative, you can mount several products in a rack.

4. **NOTICE!** Overheating can damage the product.

   Prevent overheating as follows:
   - Keep a minimum distance of 10 cm between the fan openings of the product and any object in the vicinity.
   - Do not place the product next to heat-generating equipment such as radiators or other products.

3.4.2   Mounting the R&S ZNL in a rack

To prepare the rack

1. Observe the requirements and instructions in "Setting up the product" on page 6.

2. **NOTICE!** Insufficient airflow can cause overheating and damage the product. Design and implement an efficient ventilation concept for the rack.

To mount the R&S ZNL in a rack

1. Use an adapter kit to prepare the R&S ZNL for rack mounting.
   a) Order the rack adapter kit designed for the R&S ZNL. For the order number, see the data sheet.
   b) Mount the adapter kit. Follow the assembly instructions provided with the adapter kit.

2. Lift the R&S ZNL to shelf height.

3. Grab the handles and push the R&S ZNL onto the shelf until the rack brackets fit closely to the rack.

4. Tighten all screws in the rack brackets with a tightening torque of 1.2 Nm to secure the R&S ZNL in the rack.

To unmount the R&S ZNL from a rack

1. Loosen the screws at the rack brackets.

2. Remove the R&S ZNL from the rack.

3. If placing the R&S ZNL on a bench top again, unmount the adapter kit from the R&S ZNL. Follow the instructions provided with the adapter kit.

3.4.3　Portable operation

An optional carrying bag designed specifically for the R&S ZNL allows you to protect the instrument while working in the field. The bag includes ventilation areas at the position of the ventilation outlets in the casing to ensure air circulation. The transparent cover allows you to operate the instrument without removing it from the bag. With the help of the optional vest holster, you can carry the R&S ZNL in its bag and keep your hands free. Together with the optional battery pack (see Chapter 3.5.3, "Optional battery pack (R&S FPL1-b31)", on page 20), and packed in the dedicated carrying bag, the R&S ZNL is ideally suited for operation directly in the field, even in rough environments.

► Inspect the carrying bag for wear and tear before placing the instrument in it.

For details on optional accessories, see the R&S ZNL data sheet.

3.5   Connecting to power

There are various options to supply power to the R&S ZNL.

- The R&S ZNL is equipped with an AC power supply connector.
- The R&S ZNL can also be equipped with an optional (internal) DC power supply connector (R&S FPL1-B30).
- The R&S ZNL allows for battery operation if option R&S FPL1-B31 is installed.

3.5.1   Connecting the AC power

The R&S ZNL 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.

For safety information, see "Connecting to power" on page 7.

To connect the AC power

1. Plug the AC power cable into the AC power connector on the rear panel of the instrument. Only use the AC power cable delivered with the R&S ZNL.

2. Plug the AC power cable into a power outlet with ground contact.

   The required ratings are listed next to the AC power connector and in the data sheet.

For details on the connector, refer to Chapter 4.2.1, "AC power supply connection and main power switch", on page 42.

3.5.2   Connecting an optional DC power supply (R&S FPL1-b30)

The R&S ZNL can also be equipped with an optional DC power supply connector (R&S FPL1-B30). If installed, the R&S ZNL can be operated by a DC voltage of +12 V to +24 V. For details on the connector see Chapter 4.2.2, "Li-Ion battery packs and DC power connector", on page 43.

If you use an external power supply unit to supply safety extra-low DC voltage (SELV) to the instrument, be sure to meet the requirements for reinforced/double insulation in accordance with DIN/EN/IEC 61010 (UL 3111, CSA C22.2 No. 1010.1) or DIN/EN/IEC 60950 (UL 1950, CSA C22.2 No. 950). Provide current limitation in accordance with DIN EN 61010-1 Appendix F2.1. Use a cable no longer than 3 m.

Also see "Connecting to power" on page 7.

DC connection

► Connect the DC power connector on the rear panel of the R&S ZNL to the DC power source using a cable as described above.

3.5.3 Optional battery pack (R&S FPL1-b31)

As an alternative to the fixed AC or DC power supply, the R&S ZNL also allows for battery operation. The "Battery Pack" option R&S FPL1-B31 comprises two Li-ion batteries and an internal charger. The internal charger charges the batteries whenever the instrument is connected to AC or DC power. During operation, if neither DC nor AC power is supplied, the R&S ZNL automatically switches to battery operation.

The battery pack can be retrofitted by Rohde&Schwarz service.

(i) For models R&S ZNL14 and R&S ZNL20, hot-swapping a single Li-ion battery is possible. However, long-term operation with a single battery is not supported.

For safety information, see "Handling batteries safely" on page 7.

Charging batteries

Charge the batteries before using battery operation for the first time. Following a long storage period, it can be necessary to charge and discharge the batteries several times to reach full capacity.

For batteries from third parties, follow the instructions provided by the manufacturer. For batteries manufactured by Rohde & Schwarz, observe the following:

● If inserted in the R&S ZNL, batteries are charged via the common AC or DC power supply.

● You can also use the external battery charger R&S FSV-B34 to charge up to 4 batteries.

- Charge in a temperature range from +0 °C to +45 °C. If the temperature is above or below these values, or the temparature varies strongly, charging is interrupted. If the battery temperature rises above +53 °C, charging is stopped.

- Try not to overcharge the battery too often because overcharging reduces the service life of the battery.

65 % 🔋 When the battery is being charged in standby mode, the [Power] LED blinks. During operation, the status bar indicates that the battery is being charged.

Spare battery pack (R&S FPL1-Z4)

In addition to the internal battery pack (option R&S FPL1-B31), spare batteries are available for the R&S ZNL. The spare battery pack R&S FPL1-Z4 comprises two additional Li-ion batteries.

Outside the R&S ZNL, batteries can be charged using the external battery charger R&S FSV-B34. Even during battery operation, you can exchange the internal batteries while the R&S ZNL is running, as long as one battery remains in the instrument. However, it is not recommended to operate the R&S ZNL with only one battery for a longer period.

ⓘ For models R&S ZNL14 and R&S ZNL20, hot-swapping a single Li-ion battery is possible. However, long-term operation with a single battery is not supported.

3.6   Switching on or off

Table 3-1: Overview of power states

Status	LED on Power key	Position of main power switch
Off	⚪ gray	[0]
Standby	🟠 orange	[I]
Ready	🟢 green	[I]

To switch on the R&S ZNL

The R&S ZNL is off but connected to power.

1. Set the switch on the power supply to position [I].
   See Chapter 4.2.1, "AC power supply connection and main power switch",
   on page 42.

   The LED of the Power key is orange.

   See Chapter 4.1.2, "Power key", on page 35.

   Note: If the R&S ZNL was disconnected from power before it was switched off
   regularly, it automatically switches back on when the power is reconnected.
   Using a LAN-controlled power switch, you can take advantage of this behavior
   to switch the device on and off remotely.

2. Press the Power key.

   The LED changes to green.
   The instrument operates on battery, DC, or AC power, whichever is supplied.
   The R&S ZNL boots.

   After booting, the instrument is ready for operation.

To shut down the product

The product is in the ready state.

► Press the [Power] key.

   The operating system shuts down. The LED changes to orange.

To disconnect from power

The R&S ZNL is in the standby state.

1. **NOTICE!** Risk of data loss. If you disconnect the product from power when it
   is in the ready state, you can lose settings and data. Shut it down first.

   Set the switch on the power supply to position [0].
   See Chapter 4.2.1, "AC power supply connection and main power switch",
   on page 42.

   The LED of the standby key is switched off.

2. Disconnect the R&S ZNL from the power source.

3.7 Connecting to LAN

You can connect the instrument to a LAN for remote operation via a PC.

Provided the network administrator has assigned you the appropriate rights and adapted the Windows firewall configuration, you can use the interface, for example:

- To transfer data between a controlling device and the test device, e.g. to run a remote control program
- 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

Network environment

Before connecting the product to a local area network (LAN), consider the following:

- Install the latest firmware to reduce security risks.
- For internet or remote access, use secured connections, if applicable.
- Ensure that the network settings comply with the security policies of your company. Contact your local system administrator or IT department before connecting your product to your company LAN.
- When connected to the LAN, the product may potentially be accessed from the internet, which may be a security risk. For example, attackers might misuse or damage the product. For more information about IT security and how to operate the product in a secure LAN environment, see the Rohde & Schwarz white paper 1EF96: Malware Protection Windows 10.

► **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
- Exchanging hardware

Errors can affect the entire network.

Connect the R&S ZNL to the LAN via the LAN interface on the rear panel of the instrument.

Windows automatically detects the network connection and activates the required drivers.

By default, the R&S ZNL is configured to use DHCP and no static IP address is configured.

💡 The default instrument name is <Type><variant>-<serial_number>, for example, ZNL3-123456. For information on determining the serial number, see Chapter 4.2.14, "Device ID", on page 47.

For more information on LAN configuration, see the R&S ZNL user manual.

3.8   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 ZNL:

● 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" .

3.9   Connecting an external monitor

You can connect an external monitor (or projector) to the "DVI" connector on the rear panel of the R&S ZNL (see also Chapter 4.2.13, "DVI", on page 47).
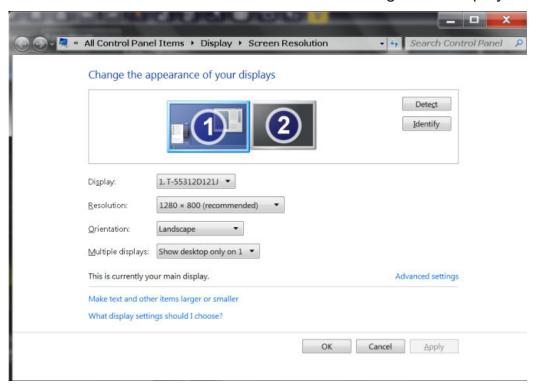
Screen resolution and format

The touchscreen of the R&S ZNL 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. Usually, the display of the external monitor is a duplicate of the instrument's monitor.

If you configure the external monitor to be used as the *only* display in the Windows configuration dialog box ("Show only on 2"), the maximum screen resolution of the monitor is used. In this case, you can maximize the R&S ZNL application window and see even more details. You cannot change the monitor's screen resolution via the standard Windows configuration dialog box.

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

1. Connect the external monitor to the R&S ZNL.

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. Consider the information in the note above.

6. Select the instrument 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 touch-screen 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.

To fix the mapping between touchscreen and display, connect an external monitor to the R&S ZNL 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.

3.10   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 a keyboard or a printer are installed or if the network configuration does not comply with the default settings. After the R&S ZNL is started, the operating system boots and the instrument firmware is started automatically.

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

Service packs and updates

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

Firewall settings

A firewall protects an instrument by preventing unauthorized users from gaining access to it through a network. Rohde & Schwarz highly recommends using the firewall on your instrument. Rohde & Schwarz instruments are shipped with the Windows firewall enabled. All ports and connections for remote control are enabled.

Note that changing firewall settings requires administrator rights.

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

To access the "Start" menu

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

► Press the "Windows" key on the front panel, or press the "Windows" key or the [CTRL + ESC] key combination on the (external) keyboard.

The "Start" menu and the Windows taskbar are displayed.

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 or "Start" menu.

For details on the IECWIN tool, see the "Network and Remote Control" chapter of the R&S ZNL user manual.

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.

3.11   Logging on

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

- **"Instrument"** : a standard user account with limited access
- **"Admin"** or **"Administrator"** (depends on firmware image): 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.

Passwords

For all default user accounts, the initial password is *894129*. Note that this password is very weak, and we strongly recommend 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".

Auto-login

When shipped, the instrument automatically logs on the default "Instrument" user to Windows using the default password. This function is active until an administrator explicitly deactivates it or changes the password.

ⓘ **Changing the password and use of auto-login function**
Note that when you change the default password, the default auto-login function no longer works!
In this case, you must enter the new password manually to log on.

Adapting the auto-login function to a new password

If you change the password that is used during auto-login, this function no longer works. Adapt the settings for the auto-login function first.

1. Select the "Windows" icon in the toolbar to access the operating system of the R&S ZNL (see also "To access the "Start" menu" on page 28).

2. Open the
   `C:\Users\Public\Documents\Rohde-Schwarz\ZNL\user\user\`
   `AUTOLOGIN.REG` file in any text editor (e.g. Notepad).

3. In the line `"DefaultPassword"="894129"`, replace the default password (`894129`) by the new password for automatic login.

4. Save the changes to the file.

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

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

7. Press the [ENTER] key to confirm.
   The auto-login function is reactivated with the changed password. It will be applied the next time the instrument is switched on.

Switching users when using the auto-login function

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

1. Select the "Windows" icon in the toolbar to access the operating system of the R&S ZNL (see also "To access the "Start" menu" on page 28).

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.

For information on deactivating and reactivating the auto-login function, see the R&S ZNL user manual.

3.12 Checking the supplied options

The instrument can be equipped with both hardware and firmware options. To check whether the installed options correspond to the options indicated on the delivery note, proceed as follows.

1. Press the [SETUP] key.

2. Press the "System Config" softkey.

3. Switch to the "Versions + Options" tab in the "System Configuration" dialog box.

   A list with hardware and firmware information is displayed.

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

3.13 Considerations for test setup

Cable selection and electromagnetic interference (EMI)

Electromagnetic interference (EMI) can affect the measurement results.

To suppress electromagnetic radiation during operation:

- Use high-quality shielded cables, for example, double-shielded RF and LAN cables.
- Always terminate open cable ends.
- Ensure that connected external devices comply with EMC regulations.

Preventing electrostatic discharge (ESD)

Electrostatic discharge is most likely to occur when you connect or disconnect a DUT.

► **NOTICE!** Risk of electrostatic discharge. Electrostatic discharge can damage the electronic components of the product and the device under test (DUT).

Ground yourself to prevent electrostatic discharge damage:

a) Use a wrist strap and cord to connect yourself to ground.
b) Use a conductive floor mat and heel strap combination.

NOTICE

Instrument damage caused by electrostatic discharge

If you are working in an environment where strong ESD discharges are possible, for additional protection Rohde & Schwarz recommends using broadband limiters R&S ZN-B13 (stock number 1303.7840.02) at each port of your R&S ZNL3|4|6.

Signal input and output levels

Information on signal levels is provided in the data sheet and on the instrument, next to the connector. Keep the signal levels within the specified ranges to avoid damage to the R&S ZNL and connected devices.

4 Instrument tour

4.1 Front panel view

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

Figure 4-1: 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 / RF input 50 Ω connector

4.1.1 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 4-2: Touchscreen elements
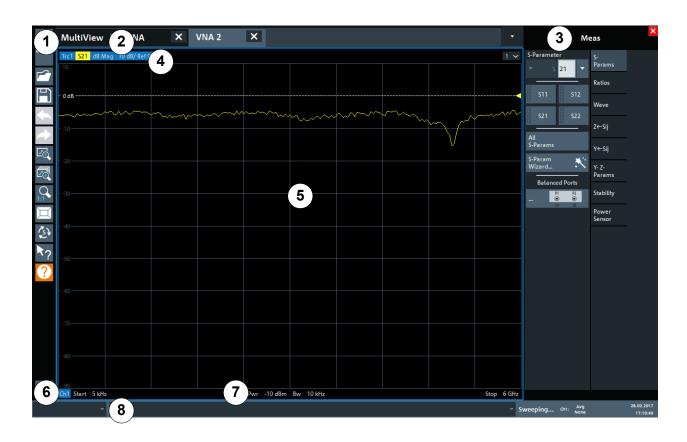
1 = Toolbar with standard application functions, e.g. print, save/open file etc.
2 = Tabs for individual channel setups
3 = Softtool panel (a.k.a. softkey bar)
4 = Window title bar with diagram-specific (trace) information
5 = Measurement results (diagram) area
6 = Channel list
7 = Diagram footer with diagram-specific information
8 = Instrument status bar for error messages and date/time display

Any user interface elements that react to a click by a mouse pointer also react to a tap on the screen, and vice versa. Using touchscreen gestures, you can perform the following tasks (among others).

(See Chapter 5, "Trying out the instrument", on page 49)

- 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 6.4, "Touchscreen gestures", on page 85.

4.1.2   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 "Connecting to power" on page 7 and Chapter 3.5, "Connecting to power", on page 18.

4.1.3   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 4.2.11, "USB", on page 47.

4.1.4   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 R&S ZNL user manual.

Table 4-1: System keys

System key	Assigned functions
[Preset]	Resets the instrument to the default state.
[Setup]	Provides basic instrument configuration functions, e.g.: • 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.) • Self-alignment (with spectrum analysis option)
[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: • At the top of the screen • At the bottom of the screen • Off

4.1.5 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 R&S ZNL user manual.

The labels indicated in *italics* (blue font color on the instrument) apply to the optional Spectrum mode only.

Table 4-2: Function keys

Function key	Assigned functions	
	VNA mode	**SA mode**
[Freq]	Defines the sweep range.	Sets the center frequency and the start and stop frequencies for the frequency range 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
[Scale] *[Ampt]*	Defines the scaling and zooming of diagrams.	Sets the reference level, the displayed dynamic range, the RF attenuation and the unit for the level display Sets the level offset and the input impedance
[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 (optional) receiver step attenuators and the IF bandwidths, and sets up averaging.	Sets the resolution bandwidth and the video bandwidth.
[Sweep]	Defines the sweep type and other sweep parameters; controls sweep execution.	Sets the sweep time and the number of measurement points Selects continuous measurement or single measurement
[Trace]	Configures the graphical analysis of measurement results.	
[Trig]	Defines how measurement sweeps are triggered.	Sets the trigger mode, the trigger threshold, the trigger delay, and the gate configuration for gated sweep
[Offset Embed]	Contains functions for deembedding/embedding the DUT from/into physical/virtual (matching) networks placed between the calibrated reference plane and the DUT.	Performs a peak search for active marker. If no marker is active, normal marker 1 is activated and the peak search is performed for it.

Function key	Assigned functions	
	VNA mode	**SA mode**
[Meas]	Selects the quantities to be measured and displayed.	
[Format] *[Config]*	Selects the trace format (dB magnitude, Smith, etc.).	Configure measurements and data input and output
[Display Lines]	Configures display lines and limit lines.	
[Cal] *[Single]*	Provides all functions related to system error calibration.	Starts and stops a single new measurement (Single Sweep Mode)
[Channel] *[Cont]*	Creates and deletes channel setups and optimize the measurement process.	Starts and stops a continuous measurement (Continuous Sweep Mode)

4.1.6   Keypad

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

Table 4-3: 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. For alphanumeric parameters, inserts a "-" at the cursor position.
Unit keys (G/n, M/µ, k/m, x1)	Adds the selected unit to the entered numeric value and complete the entry. For 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.
[ESC]	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. For "Edit" dialog boxes the following mechanism is used: ● 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]	• 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.

4.1.7 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.

4.1.7.1 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: Same effect as the Enter key when pressed

4.1.7.2 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.

4.1.8 Port 1 and port 2

Numbered RF connectors

- 3.5 mm (m) for R&S ZNL20
- N (f) for other models

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 5.1.2, "Reflection S-parameter measurement", on page 57.
- With 2 test ports, it is possible to perform full two-port measurements; see Chapter 5.1.1, "Transmission S-parameter measurement", on page 50.

> **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.

ⓘ In Spectrum mode or any other application, Port 2 is used as RF INPUT 50 ohm.

4.1.9   RF INPUT 50 ohm

Provides RF input from a connected device under test (DUT) to the R&S ZNL, which is then analyzed in an RF measurement. Connect the DUT to the "RF Input" on the R&S ZNL via a cable equipped with an appropriate connector. Do not overload the input. For maximum allowed values, see the data sheet.

See also Chapter 3.13, "Considerations for test setup", on page 31.

4.2   Rear panel view

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

Figure 4-3: Rear panel view R&S ZNL

1+2 = Removable, rechargeable Li-ion batteries
3   = DC power supply
4   = AC power supply connection and main power switch with fuse
5   = GPIB (IEC 625) interface
6   = Reference clock connectors
7   = Trigger input connector
8   = "DVI" connector for external display
9   = "LAN" connector
10   = "USB" (3.0) connectors
11   = NRP power sensor connector *)
12   = Headphones connector *)
13   = Aux. Port serving as VNA user port or SA auxiliary port *)
14   = "IF/VIDEO OUT" connector *)
15   = NOISE SOURCE CONTROL *)

*) requires the "Additional Interfaces" option R&S FPL1-B5.

ⓘ The meanings of the labels on the R&S ZNL are described in

4.2.1   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 "Connecting to power" on page 7 and Chapter 3.5, "Connecting to power", on page 18.

4.2.2   Li-Ion battery packs and DC power connector

With the Li-ion battery pack (option R&S FPL1-B31), the R&S ZNL can be operated independently of an AC or DC power supply. The instrument can house 2 Li-ion batteries which can be charged both via AC or DC power supply.

For safety information concerning batteries, see "Handling batteries safely" on page 7.

As an alternative, a DC power supply connector (option R&S FPL1-B30) is available. DC power supplies from +12 V to +24 V and from 13 A to 6.5 A can be used. Connect the connector according to the following diagram:

	Pin	Description
	1	Plus
	2	Ground
	3	Not used

If you use an external power supply unit to supply safety extra-low DC voltage (SELV) to the instrument, be sure to meet the requirements for reinforced/double insulation in accordance with DIN/EN/IEC 61010 (UL 3111, CSA C22.2 No. 1010.1) or DIN/EN/IEC 60950 (UL 1950, CSA C22.2 No. 950). Provide current limitation in accordance with DIN EN 61010-1 Appendix F2.1.

Also see "Connecting to power" on page 7.

4.2.3   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.

4.2.4 Ref. In / Ref. Out

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

The Ref. Out connectors can be used to provide a reference signal from the R&S ZNL 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 ZNL.
Ref. Out	10 MHz 10 dBm	To provide the internal reference signal from the R&S ZNL to another device continuously. For the R&S ZNL, this is also used to provide the optional OCXO reference signal to another device.

4.2.5 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 kΩ.

4.2.6 Noise Source Control

The Noise Source Control female connector is used to provide the supply voltage for an external noise source. For example, use it to measure the noise figure and gain of amplifiers and frequency converting devices.

ⓘ
- This connector is provided by the "Additional Interfaces" option R&S FPL1-B5.
- The Noise Source Control interface is only functional in Spectrum mode (option R&S ZNLxx-B1)

Conventional noise sources require a voltage of +28 V to be switched on and 0 V to be switched off. The output supports a maximum load of 100 mA.

4.2.7   IF/Video Output

The female BNC connector can be used for various outputs in the Spectrum application:

- Intermediate frequency (IF) output of approximately 20 MHz
- Video output (1V)

Which output is provided is defined in the software ("Overview" > "Output").

(i)
- This connector is provided by the "Additional Interfaces" option R&S FPL1-B5.
- The IF/Video Output interface is only functional in Spectrum mode (option R&S ZNLxx-B1)
- Interruptions in analog output can occur if you switch between a VNA and a spectrum application, due to the separate hardware. In particular, if you run a sequence of measurements including both measurement types, switching between both modes can interrupt the signal from the output connector.

For details, see the R&S ZNL Spectrum Mode user manual.

4.2.8   Aux. Port

A 25-pole D-Sub connector used as an input and output for low-voltage TTL control signals. Can either be used as VNA user port (max. 3.3 V) or SA Aux. Port (max. 5 V). In the firmware GUI, this can be set via [Setup] > "System Config" > "Add Interfaces" > "Port Configuration".

(i) This connector is provided by the "Additional Interfaces" option R&S FPL1-B5.

NOTICE

Short-circuit hazard

Always observe the designated pin assignment. A short-circuit can damage the port.

4.2.9   Headphones connector

The Spectrum mode provides demodulators for AM, FM and PM signals, which can be routed to the headphone connector. With headphones or an external loud-speaker connected to the 3.5 mm headphone socket, the displayed signal can be identified acoustically.

- This connector is provided by the "Additional Interfaces" option R&S FPL1-B5.

- The headphones connector is only functional in Spectrum mode (option R&S ZNLxx-B1).
  It can **not** be used to output sounds that are generated via Windows audio APIs. To hear those sounds, connect a USB audio device to the instrument or operate it via remote desktop.

- Interruptions in analog output can occur if you switch between a VNA and a spectrum application, due to the separate hardware. In particular, if you run a sequence of measurements including both measurement types, switching between both modes can interrupt the signal from the output connector.

Note the safety information provided in "Connecting headphones" on page 8.

For details, see the R&S ZNL Spectrum mode user manual.

4.2.10   Sensor connector

The LEMOSA female connector is used to connect power sensors of the R&S NRP-Zxy family. For a detailed list of supported sensors, see the data sheet.

ⓘ This connector is provided by the "Additional Interfaces" option R&S FPL1-B5.

4.2.11 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 4.2.11, "USB", on page 47).

4.2.12 LAN

The R&S ZNL is equipped with a 1 GBit Ethernet IEEE 802.3u network interface with Auto-MDI(X) functionality. 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 the R&S ZNL user manual.

4.2.13 DVI

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

For details, see Chapter 3.13, "Considerations for test setup", on page 31.

4.2.14 Device ID

The unique device identifier is provided as a barcode sticker on the rear panel of the R&S ZNL.

It consists of the device order number and a serial number.

The serial number is used to define the **default instrument name**, which is:

<Type><variant>-<serial_number>

For example, `ZNL3-123456`.

The instrument name is required to establish a connection to the instrument in a LAN.

5   Trying out the instrument

This chapter introduces the most important functions and settings of the R&S ZNL step by step. The complete description of the functionality and its usage is given in the R&S ZNL User Manual. Basic instrument operation is described in Chapter 6, "Operating the instrument", on page 76.

Prerequisites

- The instrument is set up, connected to the mains system, and started up as described in Chapter 3, "Preparing for use", on page 14.

5.1   Performing measurements

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

ⓘ   **Prerequisite**
The instrument is set up, connected to the mains system, and started up as described in Chapter 3, "Preparing for use", on page 14.

💡   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.
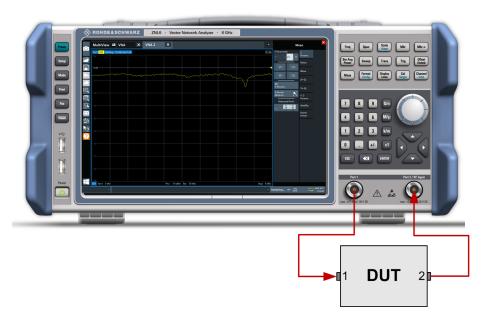
5.1.1   Transmission S-parameter measurement

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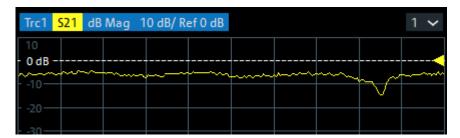
In the following example, the analyzer is set up for a two-port transmission measurement. A frequency sweep range is selected, the instrument is calibrated and the measurement result is analyzed using various display formats.

5.1.1.1   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 ZNL 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. 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.
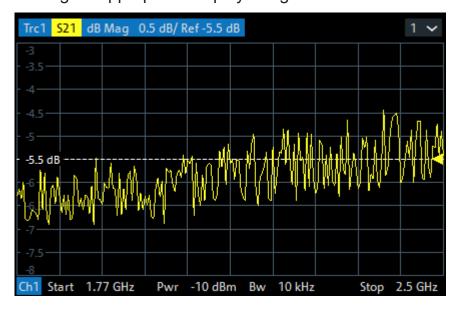
5.1.1.2 Selecting the sweep range and other parameters

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 ZNL 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 6.3, "Entering data", on page 83 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.

5.1.1.3   Calibrating the instrument
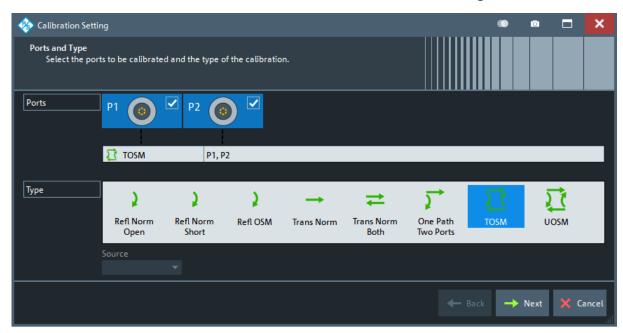
Calibration (system error correction) is the process of eliminating systematic, reproducible errors from the measurement results. E.g., in the current test setup, the connecting cables between the analyzer ports and the DUT introduce an attenuation and a phase shift of the waves. Both effects impair 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.
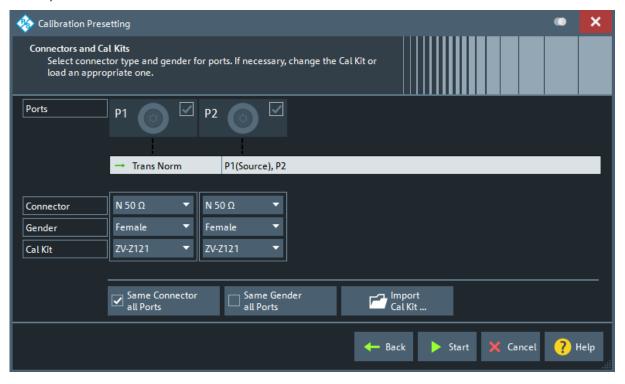
The following example requires a calibration kit with a male Through standard with known transmission characteristics for the related test port connector type and gender. With a single Through, it is possible to perform a transmission normalization, compensating for a frequency-dependent attenuation and phase shift in the signal paths.

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

1. Replace the DUT by the Through standard of your calibration kit. Make sure to disconnect all calibration units.

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).

6. Tap"Start".

7. 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 ZNL has completed the calibration sweep and calculated the correction data, the "Apply" button is enabled.

8. Select "Apply" to close the wizard.
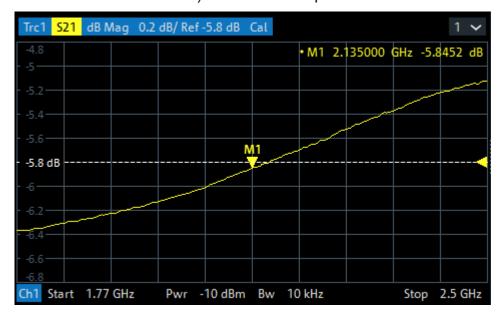
    The system error correction is calculated and applied to the current channel. A "Cal" label appears in the trace list.

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

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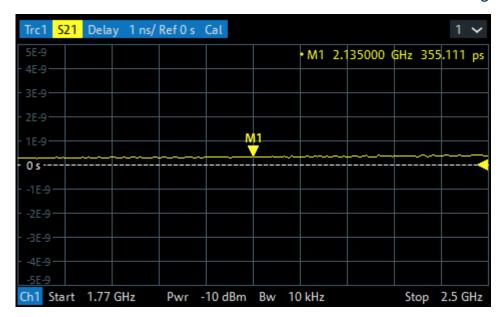
The analyzer provides various tools to optimize the display and analyze the measurement data. For instance, you can use markers to determine maxima and minima on the trace, and change the display format to obtain information about the group delay of the transmitted wave.

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.
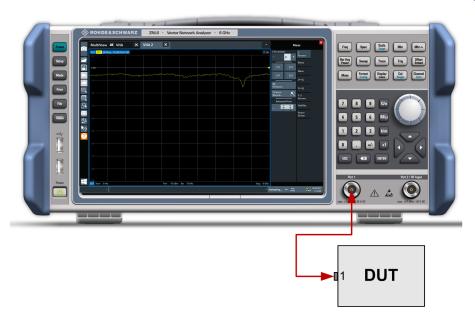
Refer to the information on trace formats in the help system or in the user manual to learn more about the diagram properties.

5.1.2   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.
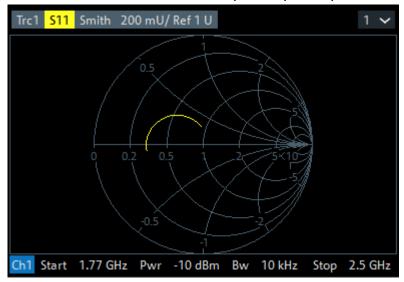
In principle, a reflection measurement involves the same steps as a transmission measurement. Note the following differences:

- 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.

5.2   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.
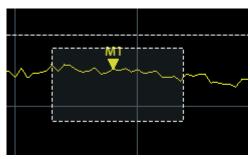
Figure 5-1: Defining the zoom area

When you remove your finger, the zoom area is enlarged in a second (sub-)window.
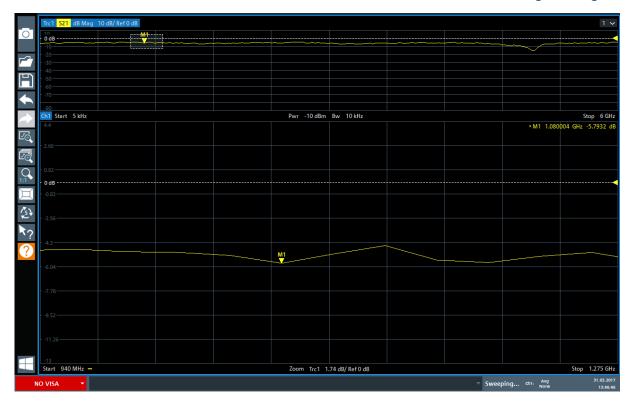
Figure 5-2: Zoomed display around a peak

5.3   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.
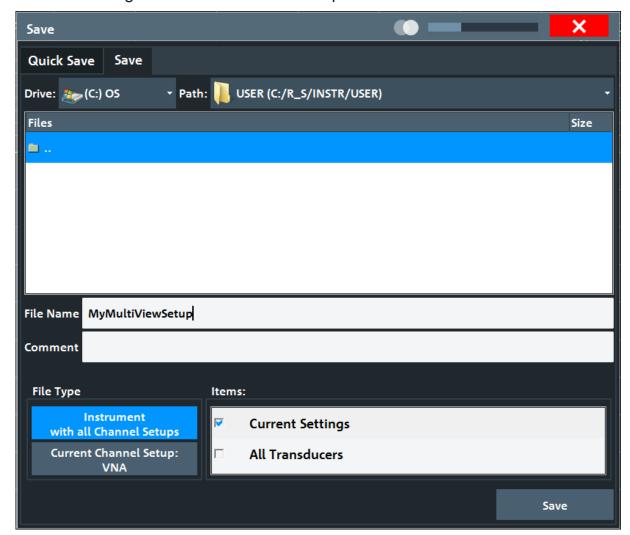
Figure 5-3: Saving the instrument settings to a file

4. Tap the "Save" button.

   The file `MyMultiViewSetup.dfl` is stored in the default directory `C:\ProgramData\Rohde-Schwarz\ZNL-FPL\Save`.

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:\ProgramData\Rohde-Schwarz\ZNL-FPL\Save`.

4. Tap the "Load" button.

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

5.4   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.
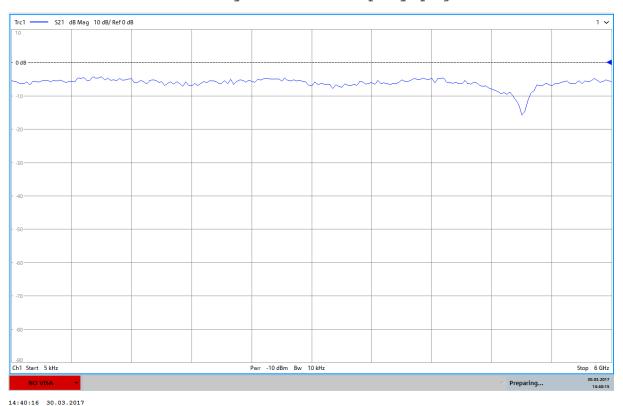
   A screenshot of the current display is created. Note that the colors on the screen are inverted in the screenshot to improve printout results.

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`.

5.5 Activating additional channel setups

The R&S ZNL features multiple channel setups, i.e. you can define several measurement configurations in parallel and then switch between the channel setups automatically to perform the measurements sequentially. We will demonstrate this feature by activating additional channel setups for a different frequency range, a Spectrum measurement, and an I/Q analysis (note that the latter two measurements are only available if the optional Spectrum mode is installed).

To activate additional channel setups

1. Press the [Mode] key on the front panel.

2. On the "New Channel Setup" tab of the "Mode" dialog box, tap the "VNA" button.

3. Change the frequency range for this measurement:
   Set the **center frequency** to *500 MHz* and the **span** to *1 GHz*.

4. Press the [Mode] key on the front panel.

5. On the "New Channel Setup" tab of the "Mode" dialog box, tap the "Spectrum" button.
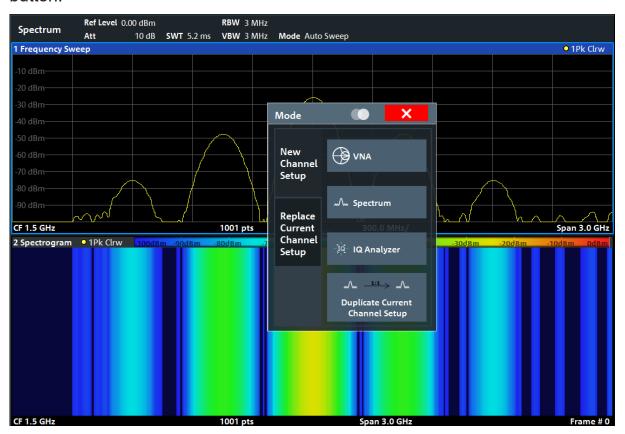
Figure 5-4: Adding a new channel setup

6. Create a new channel setup for I/Q analysis:
   a) Press the [Mode] key.
   b) Tap the "IQ Analyzer" button to activate a channel setup for the I/Q Analyzer application.
   c) Tap the "Display Config" softkey to activate the SmartGrid mode.

d) Drag the "Real/Imag (I/Q)" icon from the evaluation bar to the SmartGrid.
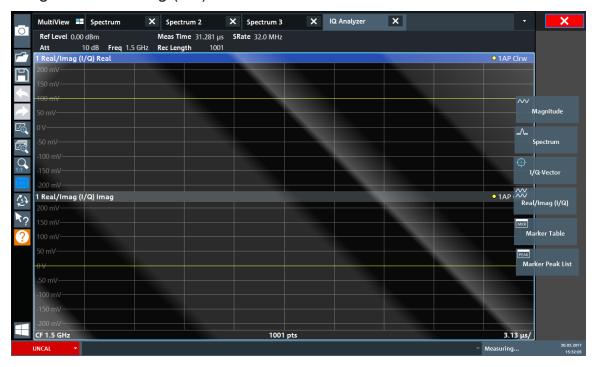
Figure 5-5: Inserting a Real/Imag diagram for I/Q analysis

e) Close the SmartGrid mode.

The "IQ Analyzer" channel setup displays the real and imaginary signal parts in separate windows.

To display the MultiView tab

An overview of all active channel setups is provided in the "MultiView" tab. This tab is always displayed if more than one channel setup is active and cannot be closed.

► Tap the "MultiView" tab.
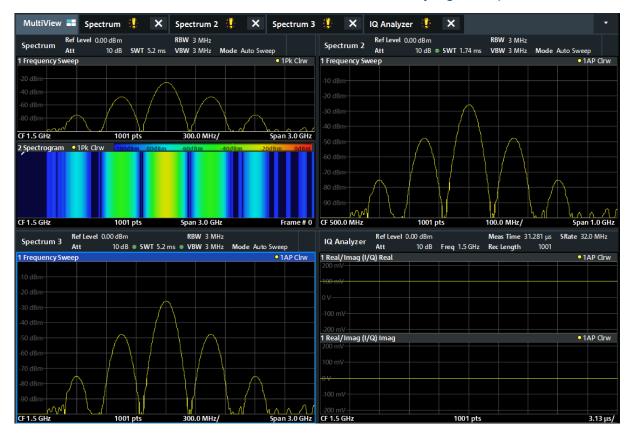
Figure 5-6: The "MultiView" tab

5.6 Trying out spectrum mode

If the spectrum analysis option R&S ZNLxx-B1 is installed, you can use the instrument for Spectrum measurements. The following chapters describe some basic tasks in spectrum mode.

(i) For instruments R&S ZNL14 and R&S ZNL20 with serial numbers below 101200, the B1 option and other dependent options are **not available**.

5.6.1   Measuring a basic signal

We will start out by measuring a simple sinus wave, using the internal calibration signal as the input.

To display the internal 50 MHz calibration signal

1. Press the [Preset] key to start out in a defined instrument configuration.

2. Press

3. Press the [Setup] key.

4. Tap the "Service + Support" softkey.

5. Tap the "Calibration Signal" tab.

6. Tap the "Calibration Frequency RF" option. Leave the frequency at the default 50 MHz.

7. Close the dialog box.

    The calibration signal is now sent to the RF input of the R&S ZNL. By default, a continuous frequency sweep is performed, so that the spectrum of the calibration signal is now displayed in the standard level versus frequency diagram.
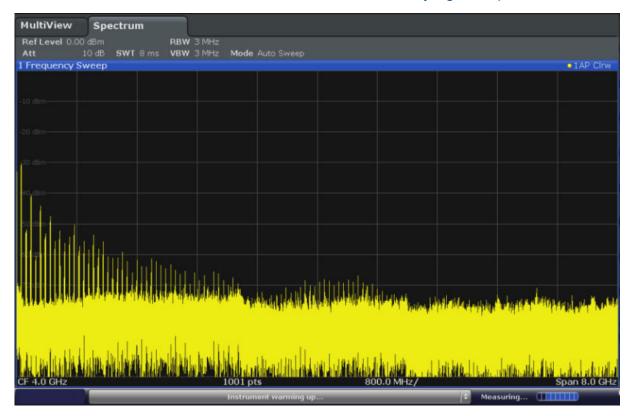
Figure 5-7: Calibration signal as RF input

(i) **Instrument warmup time**

Note that the instrument requires an initial warmup time after switching it on. A message in the status bar ("Instrument warming up...") indicates that the operating temperature has not yet been reached. Wait until this message is no longer displayed before you start a measurement.

To optimize the display

To optimize the display for the calibration signal, we will adjust the main measurement settings.

1. Set the center frequency to the calibration frequency:

    a) Tap the "Overview" softkey to display the configuration "Overview".
    b) Tap the "Frequency" button.
    c) In the "Center" field, enter *50* on the number pad on the front panel.
    d) Press the "MHz" key next to the number pad.

2. Reduce the span to 20 MHz:

    a) In the "Span" field of the "Frequency" dialog box, enter *20 MHz*.

b) Close the "Frequency" dialog box.

3. Set the reference level to -25 dBm:

a) In the configuration "Overview", tap the "Amplitude" button.

b) In the "Value" field of the "Amplitude" dialog box, enter *-25 dBm*.

The display of the calibration signal is now improved. The maximum at the center frequency (=calibration frequency) of 50 MHz becomes visible.
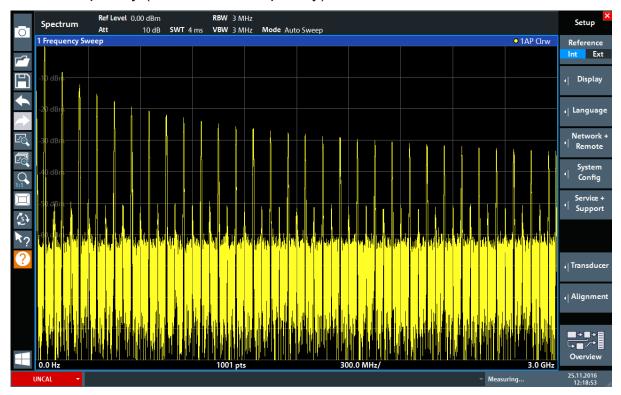
Figure 5-8: Calibration signal with optimized display settings

5.6.2   Displaying a spectrogram

In addition to the standard "level versus frequency" spectrum display, the R&S ZNL also provides a spectrogram display of the measured data. A spectrogram shows how the spectral density of a signal varies over time. The x-axis shows the frequency, the y-axis shows the time. A third dimension, the power level, is indicated by different colors. Thus you can see how the strength of the signal varies over time for different frequencies.

1. Tap the "Overview" softkey to display the general configuration dialog box.

2. Tap the "Display Config" button.

The SmartGrid mode is activated, and the evaluation bar with the available evaluation methods is displayed.

3.

Spectrogram

Drag the "Spectrogram" icon from the evaluation bar to the diagram area. The blue area indicates that the new diagram would replace the previous spectrum display. Since we do not want to replace the spectrum, drag the icon to the lower half of the display to add a window instead.
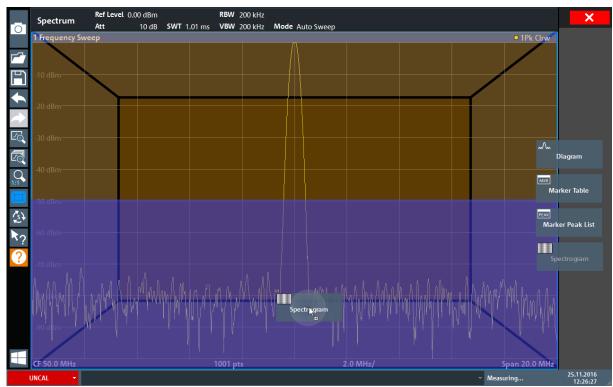
Figure 5-9: Adding a Spectrogram to the display

Drop the icon.

4. Close the SmartGrid mode by tapping the "Close" icon at the top right corner of the toolbar.

You see the spectrogram compared to the standard spectrum display. Since the calibration signal does not change over time, the color of the frequency levels does not change over time, i.e. vertically. The legend at the top of the spectrogram window describes the power levels the colors represent.
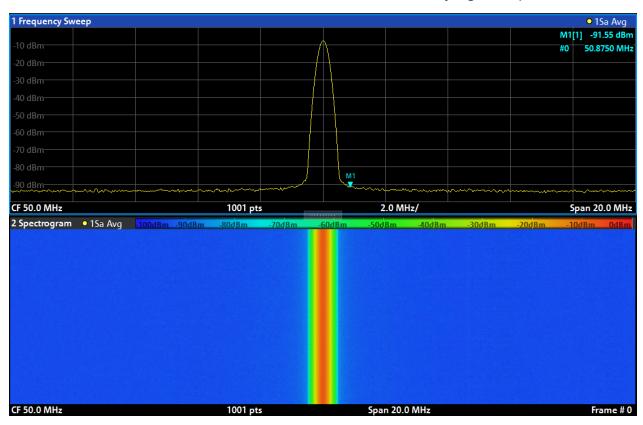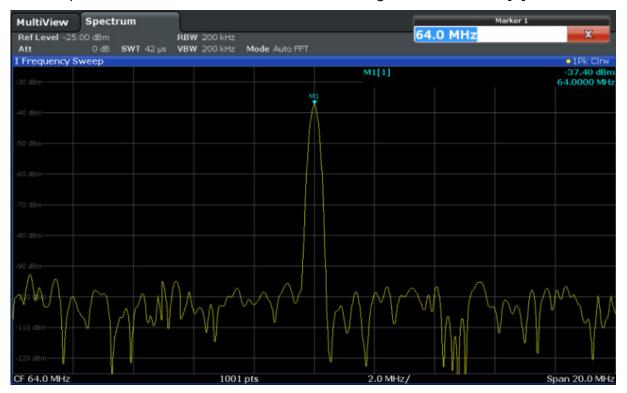
Figure 5-10: Spectrogram of the calibration signal

5.6.3 Setting and moving a marker

Markers are useful to determine the position of particular effects in the trace. The most common use is to determine a peak, which is the default setting when you activate a marker. We will set a marker on the peak in our first Spectrum measurement.
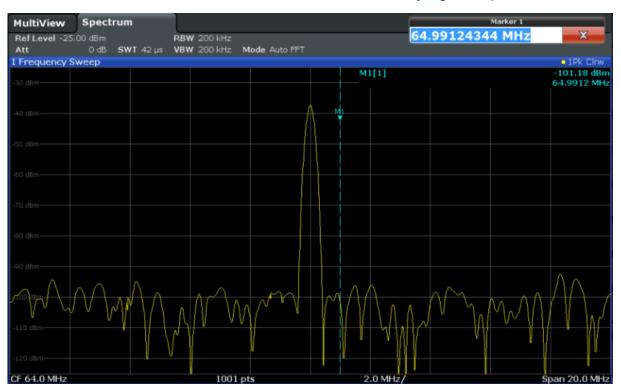
1. In the "MultiView" tab, double-tap the "Spectrum" window (frequency sweep with spectrogram display) to return to the "Spectrum" channel setup.

2. Tap the spectrum display to set the focus on that window.

3. Double-tap the spectrum window to maximize it, as we currently do not need the spectrogram display.

4. Press the "RUN SINGLE" key on the front panel to perform a single sweep so we have a fixed trace to set a marker on.

5. Press the [MKR] key on the front panel to display the "Marker" menu.

Marker 1 is activated and automatically set to the maximum of trace 1. The marker position and value is indicated in the diagram area as M1[1].

6. Now you can move the marker by tapping and dragging it to a different position. The current position is indicated by a dotted blue line. Notice how the position and value change in the marker area of the diagram.

5.6.4   Displaying a marker peak list

The marker peak list determines the frequencies and levels of peaks in the spectrum automatically. We will display a marker peak list for the Spectrum 2 channel setup.

1. Tap the "Spectrum 2" tab.

2. Press the "RUN SINGLE" key on the front panel to perform a single sweep for which we will determine the peaks.

3. Tap the "SmartGrid" icon in the toolbar to activate SmartGrid mode.

4. Drag the "Marker Peak List" icon from the evaluation bar to the lower half of the display to add a new window for the peak list.

5. Close the SmartGrid mode.

6. To obtain a more conclusive peak list that does not contain noise peaks, for example, define a threshold that is higher than the noise floor:

   a) Press the [MKR] key on the front panel.

    b) Tap the "Marker Config" softkey in the "Marker" menu.

    c) Tap the "Search" tab in the "Marker" dialog box.

    d) In the "Threshold" field, enter *-68 dBm*.

    e) Tap the "State" box for "Threshold" to activate its use.
       Only peaks that are larger than -68 dBm will be included in the peak list.

The marker peak list displays the determined peaks that are above the defined threshold.
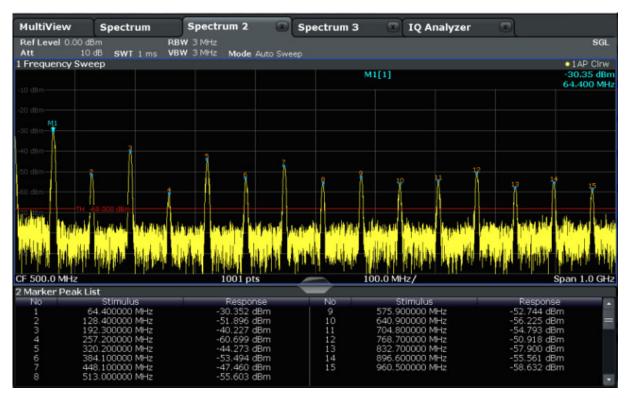
Figure 5-11: Marker Peak List

5.7 Performing sequential measurements

Although only one measurement can be performed at any one time, the measurements configured in the active channel setups can be performed sequentially, that means: one after the other, automatically, either once or continuously.

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

2. Toggle the "Sequencer" softkey in the "Sequencer" menu to "On".

A continuous sequence is started, i.e. each channel setup measurement is performed one after the other until the Sequencer is stopped.
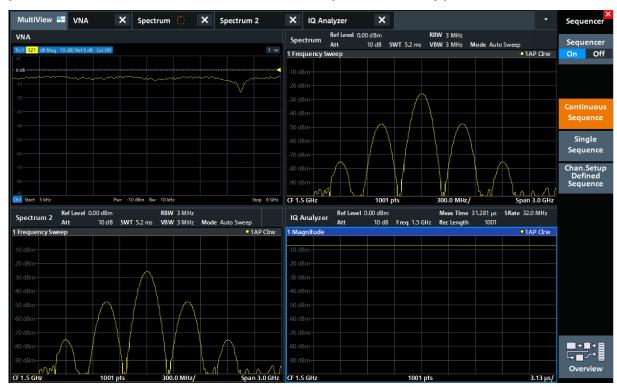
Figure 5-12: "MultiView" tab with active Sequencer

In Figure 5-12, the "Spectrum 2" measurement is currently active (indicated by the "channel active" icon in the tab label).

3. Stop the Sequencer by tapping the "Sequencer" softkey again.

6   Operating the instrument

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

> ℹ️ **Remote control**
>
> In addition to working with the R&S ZNL 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
> - Using the web 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 R&S ZNL user manual.
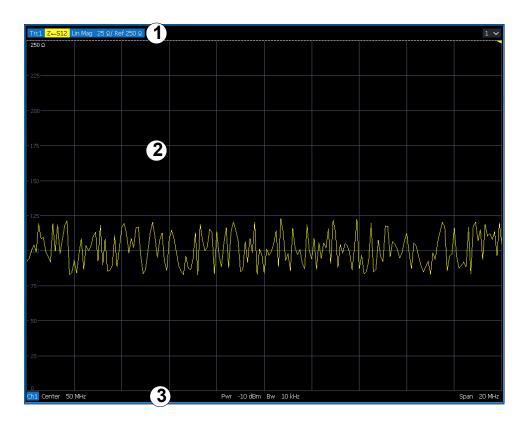
6.1   Understanding the Display Information (VNA Mode)

The following figure shows a measurement diagram in VNA mode. 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:

Ch1 Center 50 MHz   Pwr -10 dBm Bw 10 kHz   Span 20 MHz
①   ②   ③   ④   ⑤

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

6.2   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

6.2.1   Toolbar functions

Standard functions can be performed via the icons in the toolbar at the top 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 ZNL User Manual.

Print immediately
Prints the current display (screenshot) as configured.

Open
Opens a file from the instrument ("Save/Recall" menu).

Save
Stores data on the instrument ("Save/Recall" menu).

Undo
Reverts last operation, i.e. the status before the previous action is retrieved.

The undo function is useful, for example, if you are performing a zero span measurement with several markers and a limit line defined and accidentally select a different measurement. In this case, many settings would be lost. However, if you press [UNDO] immediately afterwards, the previous status is retrieved, i.e. the zero span measurement and all settings.

Note: The [UNDO] function is not available after a [PRESET] or "Recall" operation. When these functions are used, the history of previous actions is deleted.

Redo
Repeats previously reverted operation

Zoom mode
Displays a dotted rectangle in the diagram that can be expanded to define the zoom area.

Multiple zoom mode
Multiple zoom areas can be defined for the same diagram.

Zoom off
Displays the diagram in its original size.

SmartGrid
Activates "SmartGrid" mode to configure the screen layout.

Sequencer
Opens the "Sequencer" menu to perform consecutive measurements.

Help (+ Select)
Allows you to select an object for which context-specific help is displayed
See Chapter 6.5, "Getting help", on page 88

Help
Displays context-sensitive help topic for the most recently selected element

See Chapter 6.5, "Getting help", on page 88

Windows
Displays the Windows "Start" menu and task bar.

See "To access the "Start" menu" on page 28.

6.2.2 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.
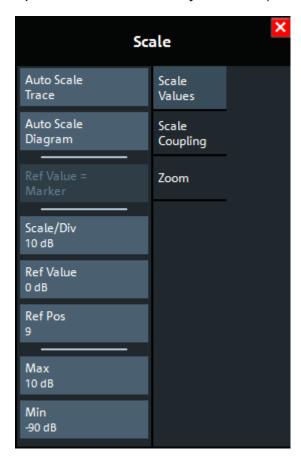
Figure 6-1: Scale softtool

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 "...").

6.2.3   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.

6.2.4   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.

6.3   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
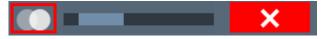
💡 **Transparent dialog boxes**

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 6.2.4, "On-screen keyboard", on page 82).

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.

6.4   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 6-2: Tapping
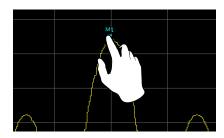
Double-tapping

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.
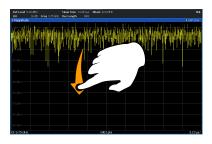
Dragging

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.
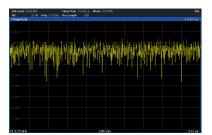
Figure 6-3: Dragging

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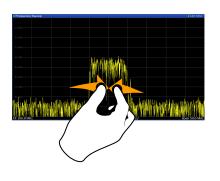
Move two fingers together on the display (pinch) or move two fingers apart on the display (spread).

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.
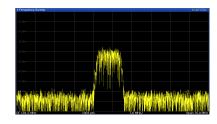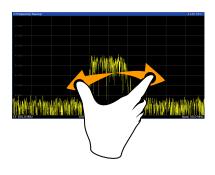
Figure 6-4: Pinching
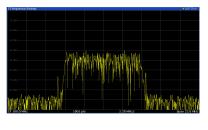
Figure 6-5: Spreading

ⓘ **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 6-1: 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
n.a. (Change hardware settings)	Spread and pinch two fingers
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.

6.5   Getting help

If any questions or problems concerning the R&S ZNL 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.

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.

To call 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.

(i) 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

1. Select the "Help pointer" icon on the toolbar.

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

2. Select the screen element to change the focus.

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

7   Customer support

7.1   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 ZNL. 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 91).

- **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:SINFo` command or as described in "To collect the support information" on page 91).

- **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 Informa-
    tion" .

    The file is stored as
    ```
    C:\Program Files\Rohde-Schwarz\Vector Network Analyzer\ZNL\
    user\<inst_model>_<serial-no>_<date_and_time>.zip
    ```
    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. Enter *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...".
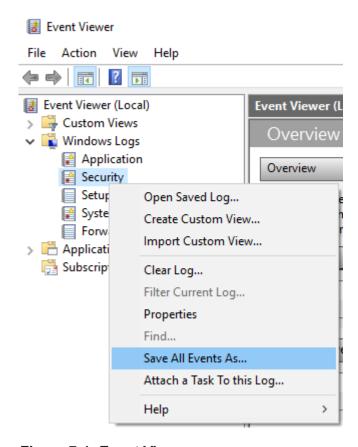
Figure 7-1: Event Viewer

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 in Chapter 7.2, "Contacting customer support", on page 92.

7.2   Contacting customer support

Technical support – where and when you need it

For quick, expert help with any Rohde & Schwarz product, contact our customer support center. A team of highly qualified engineers provides support and works with you to find a solution to your query on any aspect of the operation, programming or applications of Rohde & Schwarz products.

Contact information

Contact our customer support center at www.rohde-schwarz.com/support, or follow this QR code:

Figure 7-2: QR code to the Rohde & Schwarz support page

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