R&S®NRT2
Power Reflection Meter
User Manual

1178555002
Version 08

ROHDE&SCHWARZ
Make ideas real

This document describes the following models and options with firmware version 02.62 and higher:

- R&S®NRT2 (1430.0509K02)
- R&S®NRT2-B8 (1430.0105K02)

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Throughout this document, R&S® is indicated as R&S.

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 sections.

Intended use

Combined with a supported R&S NRT-Zxx directional sensor, the R&S NRT2 base unit is intended for power and reflection measurements in development and for monitoring and maintenance purposes. The supported R&S NRT-Zxx directional sensors are listed in the specifications document.

Observe the operating conditions and performance limits stated in the specifications document.

Target audience

The target audience is developers and technicians. The required skills and experience in power and reflection measurements depend on the used operating concept. While manual operation is suitable for beginners, remote control requires expertise in power and reflection measurements.

Main applications are continuous monitoring of transmitter systems and power measurements with digital modulation. A profound knowledge of the intended application and test setup is recommended.

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 Section 1.1, "Safety instructions", on page 9. The same information is provided in many languages in printed format. The printed "Safety Instructions" for "Mains-Powered Products, Not Heavy" (document number 1171.1771.99) 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 specifications document, manuals and the printed "Safety Instructions" document. If you are unsure about the appropriate use, contact Rohde & Schwarz customer support.

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.

Reconfigure or adjust the product only as described in the product documentation or the specifications document. Any other modifications can affect safety and are not permitted.

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 support at https://www.rohde-schwarz.com/support.

Lifting and carrying the product

The maximum weight of the product is provided in the specifications document. You can lift or carry the product by yourself, if you can manage the weight on your own. Alternatively, you can use lifting or transporting equipment. 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 outdoor use of your product, e.g. a protective cover, you can use the product outdoors.

You can operate the product up to an altitude of 2000 m above sea level. If a higher altitude is permissible, the value is provided in the specifications document. 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 specifications document.

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 the product

Before connecting the interfaces or measuring inputs of the product to other products or electrical circuits, make sure that the other products or electrical circuits provide special protection against electric shock. This protection principle is referred to as SELV (safety extra-low voltage) and is based on a low voltage level and increased insulation. Exceptions are indicated by a measurement category on the product and given in the specifications document.

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. Replace parts that are relevant to safety only by original parts, e.g. power cables or fuses.

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.
- 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.
- 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.

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 the product

Labels on the casing inform about:

- Personal safety, see "Meaning of safety labels" on page 11
- Environment safety, see Table 1-1
- Identification of the product, see Section 3.2.2.6, "Name plate", on page 29.

Table 1-1: Labels regarding 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 "Disposing of electrical and electronic equipment" on page 201.

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.

WARNING

Potentially hazardous situation. Could result in death or serious injury if not avoided.

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 B

이 기기는 가정용(B급) 전자파 적합기기로서 주로 가정에서 사용하는 것을 목적으로 하며, 모든 지역에서 사용할 수 있습니다.

2 Welcome

This section provides an overview of the user documentation and an introduction to the R&S NRT2.

2.1 Documentation overview

This section provides an overview of the R&S NRT2 user documentation. Unless specified otherwise, you find the documents at:

www.rohde-schwarz.com/manual/NRT2

Further documents are available at:

www.rohde-schwarz.com/product/NRT2

2.1.1 Getting started manual

Introduces the R&S NRT2 and describes how to set up and start working with the product. A printed version is delivered with the instrument.

2.1.2 User manual

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

The user manual is provided on the R&S NRT2 for download under:

[System] > "Instrument Info" > "Help & Copyrights"

For further details, see Section 9.2.2, "Help & copyrights", on page 79.

2.1.3 Instrument security procedures

Deals with security issues when working with the R&S NRT2 in secure areas. It is available for download on the internet.

2.1.4 Printed safety instructions

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

2.1.5 Specifications and product brochures

The specifications document, also known as the data sheet, contains the technical specifications of the R&S NRT2. 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/NRT2

2.1.6 Release notes and open source acknowledgment (OSA)

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

The software uses several valuable open source software packages. An open source acknowledgment document provides verbatim license texts of the used open source software.

On the instrument, the open source acknowledgment document is provided under:

[System] > "Instrument Info" > "Help & Copyrights"

For further details, see Section 9.2.2, "Help & copyrights", on page 79.

See www.rohde-schwarz.com/firmware/NRT2

2.2 Key features

Directional power measurements, measuring forward and reflected power under operating conditions, are required when installing, servicing and monitoring transmitters, antennas and RF generators. The compact R&S NRT2 power reflection meter supports all the measurement functions of the R&S NRT-Zxx directional power sensors. Thanks to the wide range of measurement functions and high accuracy, you can use them in research, development and production.

The large, user-friendly touchscreen simultaneously displays the forward power and the reflected power. The base unit is exceptionally easy and intuitive to use and can be remotely controlled via LAN, GPIB (R&S NRT2-B8) or USB.

Key facts:

- Simultaneous display of forward and reflected power
- Measurement of average power, average burst power, peak power, crest factor, CCDF and mismatch
- 5" color touchscreen
- Direct operation of the R&S NRT-Zxx directional power sensors from a PC
- Frequency-range from 25 MHz to 4 GHz (sensor-dependent)

2.3 What's new?

Compared to the previous version, the documentation of firmware version FW 02.62 provides the new features listed below:

- Multiple changes of the user interface, see the release notes.

3 Getting started

3.1 Preparing for use

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

3.1.1 Lifting and carrying

For safety information, see "Lifting and carrying the product" on page 10.

The R&S NRT2 weighs below 3 kg, details are provided in the specifications document. Due to the low weight, you can move the R&S NRT2 easily.

3.1.2 Unpacking and checking

1. Unpack the product carefully.
2. Retain the original packing material. Use it when transporting or shipping the product 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.

3.1.3 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 specifications document.

For safety information, see "Choosing the operating site" on page 10.

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 specifications document.

- 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.

3.1.4 Setting up the product

For safety information, see:

- "Setting up the product" on page 10
- "Intended use" on page 9

3.1.4.1 Placing the product on a bench top

The R&S NRT2 is a small and lightweight product. You can stack the R&S NRT2 with other products, but place the R&S NRT2 on top. In the following procedure, the weight indication for stacking refers to the most common design of larger Rohde & Schwarz instruments. Verify the load suitable for your product before stacking.

To place the product on a bench top

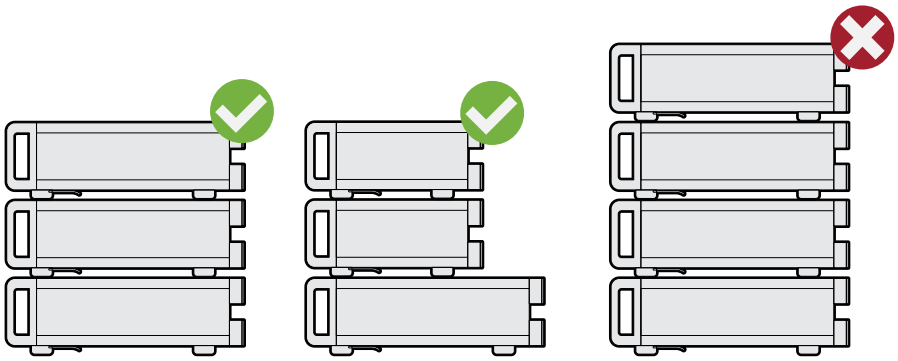
1. Place the product on a stable, flat and level surface. Ensure that the surface can support the weight of the product. For information on the weight, see the specifications document.
2. **CAUTION!** Foldable feet can collapse. For safety information, see "Setting up the product" on page 10.

   Always fold the feet completely in or out. With folded-out feet, do not place anything on top or underneath the product.
3. **WARNING!** A stack of products can fall over and cause injury. Never stack more than three products on top of each other. Instead, mount them in a rack.

   Stack as follows:

   - If the products have foldable feet, fold them in completely.
   - It is best if all products have the same dimensions (width and length). If the products have different dimensions, stack according to size and place the smallest product on top.
   - Do not exceed the permissible total load placed on the product at the bottom of the stack:

– 50 kg when stacking products of identical dimensions (left figure).
– 25 kg when stacking smaller products on top (middle figure).



Left = Stacked correctly, same dimensions
Middle = Stacked correctly, different dimensions
Right = Stacked incorrectly, too many products

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 to provide sufficient airflow and ventilation.
   - Do not place the product next to heat-generating equipment such as radiators or other products.

3.1.4.2 Mounting the product in a rack

To prepare the rack

1. Observe the requirements and instructions in "Setting up the product" on page 10.
2. **NOTICE!** Insufficient airflow can cause overheating and damage the product.
   Design and implement an efficient ventilation concept for the rack.

To mount the product in a rack

1. Use an adapter kit to prepare the product for rack mounting.
   a) Order the rack adapter kit designed for the product. For the order number, see data sheet.
   b) Mount the adapter kit. Follow the assembly instructions provided with the adapter kit.
2. Lift the product to shelf height. If the rack is high, use a safe climbing aid when placing on upper shelves.
3. Grip the product by the handles. Slide the product onto the shelf until the rack brackets fit closely to the rack.
4. Tighten all screws on the rack brackets to secure the product in the rack.

To unmount the product from a rack

1. Loosen the screws at the rack brackets.
2. Remove the product from the rack.
3. If placing the product on a bench top again, unmount the adapter kit from the product. Follow the instructions provided with the adapter kit.

3.1.5 Considerations for test setup

For safety information, see "Connecting the product" on page 11.

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.
- Do not use USB connecting cables exceeding 5 m.

Preventing electrostatic discharge (ESD)

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

► **NOTICE!** 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.

3.1.6 Connecting to power

The R&S NRT2 can be used with different AC power voltages and adapts itself automatically to them. Adjusting the R&S NRT2 to a particular AC supply voltage is therefore not required. Refer to the specifications document for the requirements of voltage and frequency.

For safety information, see "Connecting to power" on page 11.

1. Plug the AC power cable into the AC power connector on the rear panel of the product. Only use the AC power cable delivered with the product.
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.

Further information:

- Section 3.2.2.4, "AC supply and power switch", on page 28

3.1.7 Connecting to LAN

See Section 9.1.1, "Network settings", on page 65.

3.1.8 Connecting sensors

The R&S NRT2 supports the R&S NRT-Zxx sensors listed in the specifications document. You have two choices for connecting the sensors, but only one measurement at a time is possible.

3.1.8.1 NRT sensor connector

See Figure 3-2.

Communication between the R&S NRT-Zxx sensor and a base unit is only possible with a baud rate setting of 38400 Bd. This setting is the factory default that needs to be restored if the setting was changed. If the R&S NRT-Zxx sensor is not recognized by the base unit, check that the baud rate setting of the R&S NRT-Zxx sensor is 38400 Bd.

See the manual of the R&S NRT-Zxx sensor for details.

The arrow on the sensor front side shows the forward power flow.

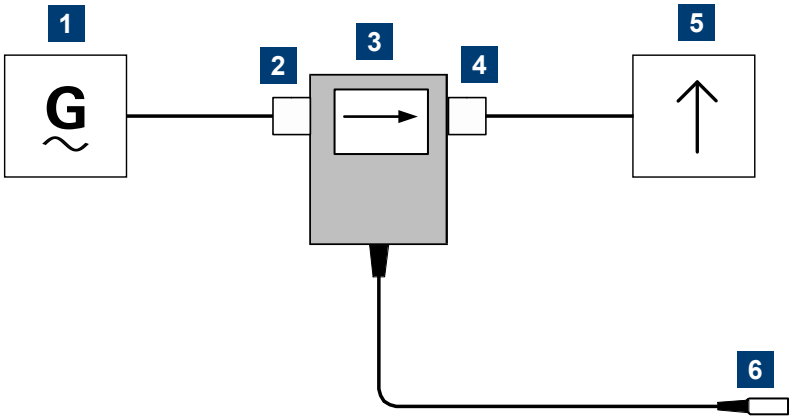


Figure 3-1: Connecting to source and load

1 = Source
2 = Port 1 (RF connector)
3 = R&S NRT-Zxx sensor
4 = Port 2 (RF connector)
5 = Load
6 = Host interface connector

To connect the R&S NRT-Zxx sensor

Connect the R&S NRT-Zxx sensor between the source and load of your test setup as follows.

1. Connect RF connector (2, port 1) to the source.
   a) Insert RF connector (2) straight into the RF connector of the source. Take care not to tilt the R&S NRT-Zxx sensor.
   b) Tighten the RF connector securely by hand.
2. Connect RF connector (4, port 2) to the load.
   a) Insert RF connector (4) straight into the RF connector of the load. Take care not to tilt the R&S NRT-Zxx sensor.
   b) Tighten the RF connector tightly by hand.
   During the measurement, the RF power flow can be high. Power leakage has the risk of electric shock and severe skin burns.
3. Connect the host interface connector of the R&S NRT-Zxx sensor (6) to the R&S NRX-B9 sensor interface for R&S NRT.

To disconnect the R&S NRT-Zxx sensor

1. **CAUTION!** Risk of electric shock and severe skin burns. During the measurement, the RF power flow can be high.
   Switch off the RF power before touching the RF connectors.
2. Unscrew the RF connectors by hand.
3. Disconnect the cable of the R&S NRT-Zxx sensor (6) from the R&S NRX-B9 sensor interface for R&S NRT.

3.1.8.2 USB 2.0 host interfaces

See Figure 3-2 and Figure 3-3.

1. Connect the R&S NRT-Z5 USB interface adapter to the R&S NRT-Zxx sensor.
2. Connect the USB connector of the adapter to the R&S NRT2.
3. Connect the R&S NRT-Zxx sensor between source and load. See Section 3.1.8.1, "NRT sensor connector", on page 21.

3.1.9 Connecting USB and external devices

Use the USB interfaces to connect USB devices. You can increase the number of connected devices by using USB hubs.

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

- Memory stick for easy transfer of data to/from a computer (e.g. firmware updates).
- Mouse if you prefer this way of operation over a touchscreen.

3.1.10 Switching on or off

Table 3-1: Overview of power states

Status	LED	Position of power switch
Off	Off	[0]
Standby	orange	[I]
Ready	green	[I]

To switch on the product

The product is off but connected to power.

1. Set the switch on the power supply to position [I]. See Section 3.2.2.4, "AC supply and power switch", on page 28.

   The LED of the [standby] key is orange. See Section 3.2.1.4, "On/standby key", on page 27.

2. Press the [standby] key.

   The LED changes to green. The product boots.
   If the previous session ended regularly, the product uses the settings from the last session.

3. If you want to return to a defined initial state, perform a preset.
   See "Preset" on page 61.

To shut down the product

The product is in the ready state.

► Press the [standby] key.

The operating system shuts down. The LED changes to orange. The product changes to standby state.

To disconnect from power

The product 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].

   The LED of the standby key is switched off.

2. Disconnect the product from the power source.

Further information:

- Section 7, "Saving and recalling settings", on page 60
- Section 3.2.1.4, "On/standby key", on page 27

3.2 Instrument tour

The meanings of the labels on the product are described in Section 1.2, "Labels on the product", on page 12.

3.2.1 Front panel tour

Figure 3-2: Front panel of the R&S NRT2

1 = NRT sensor connector, see Section 3.2.1.1, "NRT sensor", on page 24.
2 = Touchscreen, see Section 3.2.1.2, "Touchscreen", on page 25.
3, 5 = Keys, see Section 3.2.1.3, "Keys", on page 25.
4 = Cursor keys, see "Cursor keys" on page 26.
6 = On/standby key, see Section 3.2.1.4, "On/standby key", on page 27.
7 = USB host interface, see Section 3.2.1.5, "USB host interface", on page 27.

3.2.1.1 NRT sensor

See (1) in Figure 3-2.

To the left of the display, the R&S NRT2 provides the sensor interface. For supported sensors, see the product brochure.

Further information:

- Section 3.1.8, "Connecting sensors", on page 21

3.2.1.2 Touchscreen

See (2) in Figure 3-2.

The R&S NRT2 displays results in panes. Depending on the measurement mode, values are displayed digitally or graphically.

False triggers can occur

If an object (e.g. a human finger) that is charged with static electricity is brought near the touch panel, false triggers can occur.

This behavior is caused by the principle of operation of a PCAP (projected capacitive) touch panel.

Further information:

- "Using the touchscreen" on page 31

3.2.1.3 Keys

See (3, 5) in Figure 3-2.

Esc **[Esc] / Local**

If you press shortly:

- Changes to the next-higher hierarchy level.
- Escapes from the entry mode in text boxes and lists.
- Closes dialogs without losing any entries that have been made.
- Switches from remote control mode (all controls disabled) to manual operation.

If you press and hold:

- Goes to the main measurement dialog.
  See Figure 4-1.

Further information:

- "Going back to a higher hierarchy level" on page 31
- Section 4.3.2, "Returning to manual operation (LOCAL)", on page 39

Screenshot

Creates a screenshot of the current display.

See Section 4.1.5, "Creating and saving screenshots", on page 36.

Remote command:
`SYSTem:HCOPy` on page 131

1 Trig **[1Trig] / Delete**

- Controls the measurements depending on the trigger mode:
  - For all trigger modes except "Single", starts and stops the measurement.
  - For the "Single" trigger mode, enables and triggers the measurement.

Changes of the trigger state apply to all measurements.
See also "Trigger Mode" on page 52.
- Deletes numbers or text in a field so that you can enter a new value.

Enter
- Confirms entries in text fields, dialogs and selections in lists.
- Shows a frame around the control in focus. You can change the focus using the Cursor keys.

[Freq]
Sets the carrier frequency of the applied signal. This value is used for frequency response correction of the measurement result.

Remote command:
`[SENSe<Sensor>:]FREQuency[:CW]` on page 142

Favorites
Reserved for future use.

[Preset]
Opens the "Save / Recall / Preset" dialog.

See Section 7, "Saving and recalling settings", on page 60.

If you press [Preset] again, the preset function starts.

See "Preset" on page 61.

If you press the [Preset] key during booting, the R&S NRT2 starts with the factory default state.

[Zero]
Pressing [Zero] opens the "Zeroing Sensors" dialog.

If you press [Zero] again, zeroing starts.

Also displays status information:
- Zeroing status
- Sensor status

[System]
Opens the "System Overview" dialog.

See Section 9, "System settings", on page 64.

Cursor keys
See (4) in Figure 3-2.

The cursor keys are context-sensitive. The control in focus is indicated by a focus frame. Use the cursor keys as follows:
- Selecting an element in the navigation pane.
- Selecting the active pane.
- Selecting an element from a list.
- Moving the cursor in text boxes.
- Changing the value of an entry in a text box.

3.2.1.4 On/standby key

See (6) in Figure 3-2.

The on/standby key switches between standby and ready state, if the power switch is set to [I].

Further information:

- Section 3.2.2.4, "AC supply and power switch", on page 28
- Section 3.1.10, "Switching on or off", on page 23

3.2.1.5 USB host interface

See (7) in Figure 3-2.

USB 2.0 (universal serial bus) interface of the type A (host USB). Used to connect:

- R&S NRT-Zxx sensor using the R&S NRT-Z5 USB interface adapter
- External devices like a keyboard, mouse, or memory stick

Further information:

- Section 3.1.8.2, "USB 2.0 host interfaces", on page 22
- Section 3.1.9, "Connecting USB and external devices", on page 22

3.2.2 Rear panel tour

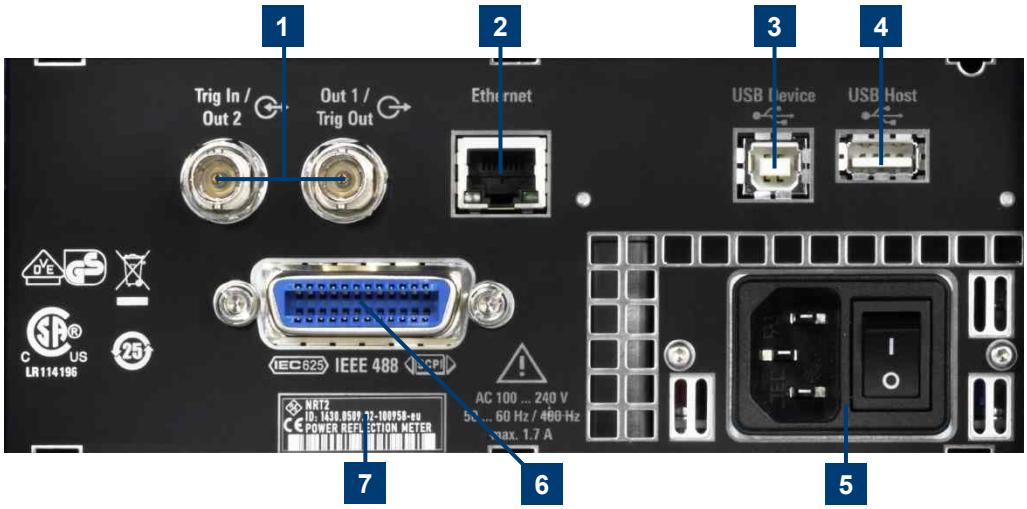


Figure 3-3: Rear panel of the R&S NRT2

1 = Trig In / Out 2 and Out 1 / Trig Out connectors, see Section 3.2.2.1, "Trig In / Out 2 and Out 1 / Trig Out connectors", on page 28.
2 = Ethernet interface, see Section 3.2.2.2, "Ethernet interface", on page 28.
3 = USB device interface, see Section 3.2.2.3, "USB device interface", on page 28.
4 = USB host interface, see Section 3.2.1.5, "USB host interface", on page 27.

5 = AC supply and power switch, see Section 3.2.2.4, "AC supply and power switch", on page 28.
6 = IEC 625/IEEE 488 interface, see Section 3.2.2.5, "IEC 625/IEEE 488 interface", on page 29.
7 = Name plate, see Section 3.2.2.6, "Name plate", on page 29

3.2.2.1 Trig In / Out 2 and Out 1 / Trig Out connectors

See (1) in Figure 3-3.

The Out 1 / Trig Out BNC connectors supply an analog signal with a voltage between 0 V and 2.5 V. It can be used to output a voltage that is proportional to the measured value (e.g. for level regulation) or a digital signal for limit monitoring.

The Trig In / Out 2 BNC connectors can be used either as an external trigger input with a switchable impedance (10 kΩ or 50 Ω) or as a second analog output.

By default, both connectors are disabled.

Further information:

- "I/O 1, I/O 2 tabs" on page 71

3.2.2.2 Ethernet interface

See (2) in Figure 3-3.

The Ethernet connector is an RJ-45 socket for remote controlling the R&S NRT2 via a network.

3.2.2.3 USB device interface

See (3) in Figure 3-3.

USB 2.0 (universal serial bus) interface of the type B (receptacle). Used to connect the R&S NRT2 to a computer for USB remote control.

3.2.2.4 AC supply and power switch

See (5) in Figure 3-3.

Observe the safety instructions in "Connecting to power" on page 11.

When the R&S NRT2 is connected to the AC supply, it automatically sets itself to the correct range for the applied voltage. The range is printed on the casing. There is no need to set the voltage manually.

The power supply does not have a replaceable fuse. If the product is connected to the mains but cannot be started, contact Rohde & Schwarz customer support for trouble-shooting help.

Further information:

- Section 3.1.6, "Connecting to power", on page 20

3.2.2.5 IEC 625/IEEE 488 interface

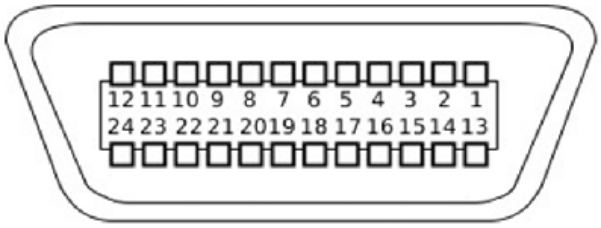
See (6) in Figure 3-3.

Requires the R&S NRT2-B8 GPIB/IEEE488 interface.

IEC bus (IEEE-488) interface for remote control of the R&S NRT2. Used to connect a controller to the remote control the R&S NRT2. Use a shielded cable for the connection.

Characteristics of the IEC bus (IEEE-488) interface:

- 8-bit parallel data transfer
- Bidirectional data transfer
- Three-wire handshake
- High data transfer rate
- Maximum length of connecting cables 15 m (single connection 2 m)



3.2.2.6 Name plate

See (7) in Figure 3-3.

Shows the type, identification and name of the R&S NRT2. The device ID consists of:

<stock number> - <serial number> - <checksum>

The framed 6 digits in Figure 3-4 are the individual serial number.

Figure 3-4: Name plate

The name plate also shows the parts of the default hostname. The default hostname consists of <type>-<serial number>.

For the R&S NRT2 with the name plate shown in Figure 3-4, the default hostname is:

NRT2-100958

Further information:

- "System Info" on page 77

- "Host Name" on page 66

4 Operating concepts

4.1 Manual operation

Using the graphical user interface of the R&S NRT2 and the keys on the front panel, you can easily configure the settings and measure in the provided measurement modes.

Using the touchscreen

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.

Select = touch the screen quickly, usually on a specific element. You can select most elements on the screen to access the settings belonging to that element (topic).

In graphs, use the following gestures:

- *Pan* = put your fingers on the touchscreen and move them while keeping contact. Thus, you can bring offscreen extensions of the graph into view.
- *Pinch* = move two fingers toward each other to change the zoom.

Going back to a higher hierarchy level

Esc The [Esc] key is the essential control element to navigate back, for example after you have opened a dialog by selecting an element.

► Press [Esc] shortly to change to the next-higher hierarchy level.

► Keep [Esc] pressed to go to the highest hierarchy level, the start dialog.

4.1.1 Main measurement dialog

From the start dialog, you can access the measurements.

To access the measurement

1. Connect a sensor to the R&S NRT2.
   See Section 3.1.8, "Connecting sensors", on page 21.
2. Boot the R&S NRT2.

   After successful booting, the R&S NRT2 displays the main measurement dialog.

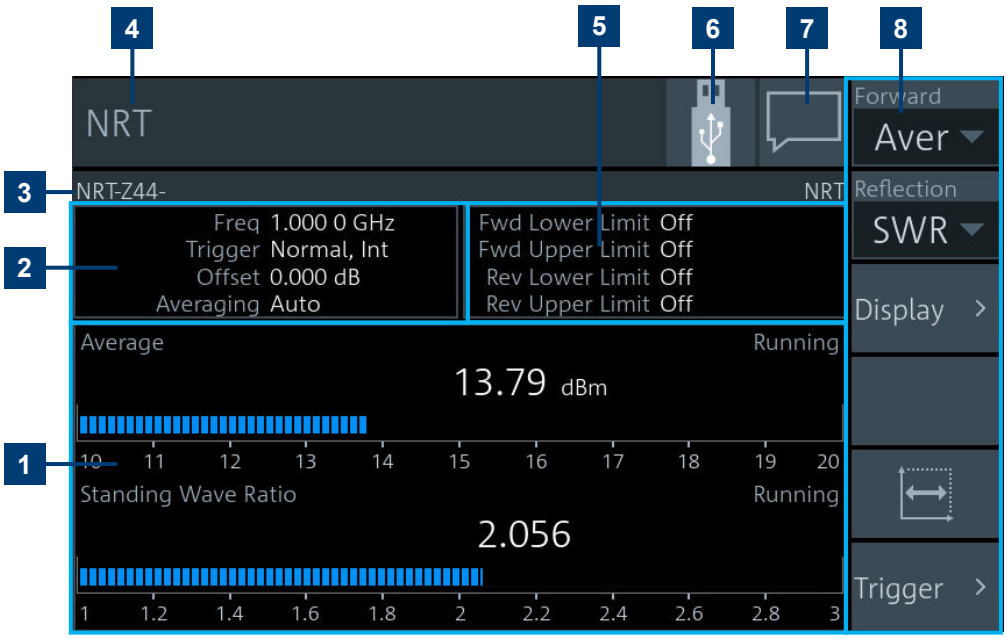


Figure 4-1: Main measurement dialog

1 = Measurement pane
2 = Measurement settings overview
3 = Connected sensor
4 = Measurement type
5 = Selected limit values
6 = Status information
7 = Notification center
8 = Navigation pane

The main measurement dialog is divided into the following four touch areas, indicated by orange frames, that lead to different settings.

Measurement pane

Displays the measurement value or graph.

► Select the area 1 in Figure 4-1.

The "Measurement Settings" dialog is displayed. There, you can change the measurement type, assign a sensor, access the sensor settings, ...
See Section 5.3, "Measurement Main Configuration dialog", on page 45.

Selecting other areas in the measurement pane can open further dialogs, but these dialogs are measurement-specific, and there is no general rule that applies to all measurements.

Measurement settings overview

► Select the area 2 in Figure 4-1.

The "Primary Sensor" dialog is displayed. There, you can configure the sensor settings.
See Section 6, "Sensor configuration", on page 54.

Selected limit values

► Select the area 5 in Figure 4-1.

The "Limit Monitor" dialog is displayed. There, you can change limit values.
See "Limit Monitor" on page 49.

Navigation pane

► Select an element in the area 8 in Figure 4-1.
You can configure either the trigger or the presentation of the measurement result or further measurement-specific settings.
See Section 5, "Measurement and display configuration", on page 40.

4.1.2 Status information

The status information is displayed in the upper right corner, left from the notification center.

See Figure 4-1.

Table 4-1: Status symbols

Symbol	Description	Further information
	Memory stick is connected and ready for operation.	Section 3.1.9, "Connecting USB and external devices", on page 22
	Memory stick is connected and initialization is in progress. When the moving green dot vanishes, the memory stick is ready for operation.	
	R&S NRT2 is in remote control.	Section 4.3.2, "Returning to manual operation (LOCAL)", on page 39
	LLO means local lockout. R&S NRT2 is in remote control. Manual operation is disabled.	
	Identification and initialization of a connected sensor is in progress.	

4.1.3 Notification center

The notification center collects all information during the operation of the R&S NRT2:

- Notices
- Warning messages
- Error messages

The notification status is displayed in the upper right corner:

- The displayed symbol belongs to the most severe message. For example, if 1 error and 5 notices are present, the symbol of the error message is displayed.
  The symbols used are explained in Table 4-2.
- The number of all messages is displayed in the color of the most severe message.

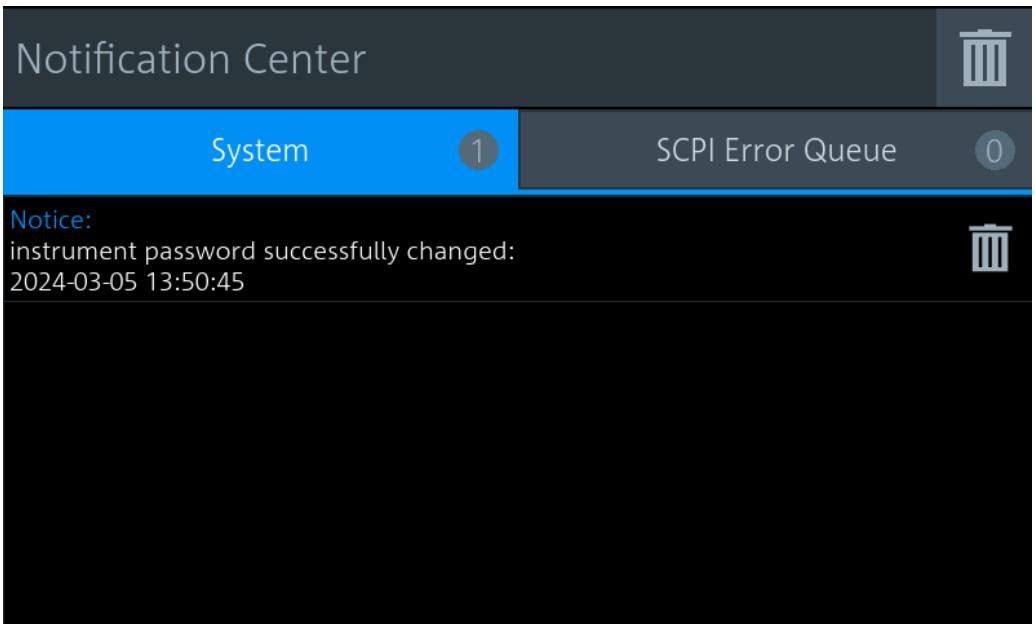
See Figure 4-1.

Table 4-2: Notification symbols

Symbol	Description
	No message is available.
	Only one or more notices are present.
	At least one warning message is present. Yellow is the assigned color.
	At least one error message is present. Red is the assigned color.

To display the messages

► Select the notification symbol in the upper left corner.



The "Notification Center" dialog has two tabs:

- "System"
  All messages concerning the instrument are listed.
- "SCPI Error Queue"
  Messages related to the remote command functionality are displayed.

To delete notices that are no longer needed

► If you want to delete a specific notice, select the bin symbol next to the notice.

► If you want to delete all notices, select the bin symbol in the right corner.

Further information:

- Section 13.2, "Notifications", on page 196

4.1.4 Editing parameters

You can make settings visible that differ from the preset value. See "Visualize Non-Preset State" on page 93.

To change a numeric or alphanumeric value

1. Select a parameter to change its value.

   Depending on the selected parameter, a numeric or an alphanumeric editor is displayed.

2. Select +− to display the value range of the parameter ("Min", "Max").

3. If "More x/x" is displayed, more units are available than displayed. Select "More x/x" to scroll through the units.

Example: "More 2/4" means, page 2 is displayed, 4 pages are available in total.

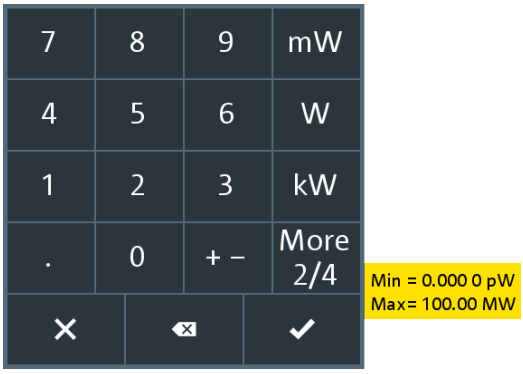


Figure 4-2: Numeric editor (example)

Use the alphanumeric editor as a standard keyboard.

Figure 4-3: Alphanumeric editor

4.1.5 Creating and saving screenshots

You can create a screenshot of the current display, for example to save graphical measurement results.

► Press the [Screenshot] key on the front panel.

The R&S NRT2 saves the screenshot in PNG format.
If a memory stick is connected, the PNG is saved on the memory stick.
Otherwise, the PNG is saved in the `volatile` directory of the FTP directory. You can download the PNG using FTP. See Section 9.3.3.1, "Data exchange using FTP", on page 83.
In the "Notification Center", a "Notice" message shows the file path and name.

Remote control:

`SYSTem:HCOPy` on page 131

Further information:

- Section 9.3.3.1, "Data exchange using FTP", on page 83
- Section 3.1.9, "Connecting USB and external devices", on page 22
- Section 3.2.1.5, "USB host interface", on page 27

4.2 Remote operation

VNC (virtual network computing) simulates the user interface of the R&S NRT2. Thus, you can operate the R&S NRT2 manually from an external computer in the same way as operating the R&S NRT2 itself. During VNC operation, local operation (manual operation, see Section 4.1, "Manual operation", on page 31) and remote operation have equal access rights. Both users see the same screen contents of the R&S NRT2 and can operate the R&S NRT2 simultaneously.

By default, VNC access is enabled. Any user in the network who knows the instrument password and IP address of the R&S NRT2 can access the R&S NRT2. To prevent access, disable the VNC server service, see Section 9.3.3, "Configuring LAN services", on page 83.

4.2.1 Setting up remote operation

Prerequisites:

- LAN interface of the external computer is configured for the network.
- R&S NRT2 and the computer are connected using a LAN network.

To set up a connection using a VNC viewer

1. On the external computer, install the VNC viewer if it is not installed already.
2. Open the VNC viewer.
3. Enter the host name or the IP address of the R&S NRT2.
   See also "Overview tab" on page 66.
4. Click "Connect".
5. Enter the instrument password.

To set up a connection using a browser

1. Open the browser.
2. Enter as web address: *http://<hostname>* or *http://<IP address>*. For example, *http://nrx-104711*.
   See also "Overview tab" on page 66.
3. Enter the instrument password.

Further information:

- Section 9.3.2.1, "Setting the instrument password", on page 81

4.2.2 Operating the front panel keys

You can operate the front panel keys using shortcuts, see also Section 3.2.1.3, "Keys", on page 25.

In the browser, you can also use the buttons below the measurement dialog that visualize the front panel keys.

Table 4-3: Shortcuts for the front panel keys

Front panel key	Remote operation replacement
1 Trig	Backspace
Esc	ESC
★	Ctrl + C
Freq	Ctrl + F
📷	Ctrl + Y
Preset	Ctrl + P
System	Ctrl + E
Zero	Ctrl + N

4.3 Remote control

The R&S NRT2 is equipped with various interfaces for connecting it to a controller for remote control:

- IEC/IEEE bus interface (standard equipment) in line with the standards IEC 60625.1 (IEEE 488.1) and IEC 60625.2 (IEEE 488.2)
- Gigabit Ethernet interface
- USB 2.0 interface for remote control and firmware update

Connectors are installed at the rear of the R&S NRT2. See Section 3.2, "Instrument tour", on page 24.

The interfaces support the SCPI (standard commands for programmable instruments) standard, version 1999.0 of May 1999. The SCPI standard is based on the IEEE 488.2 standard. It defines a standardized command language for controlling measuring and instruments with functions beyond the scope of the IEEE 488.2 standard.

For a detailed description of the remote commands, see Section 11, "Remote control commands", on page 101.

4.3.1 Switching to remote control (REMOTE)

Prerequisites

- A link is established between the controller and the R&S NRT2.
- The R&S NRT2 is configured correctly.

After power-up, the R&S NRT2 is always in manual control mode "LOCAL". When the R&S NRT2 receives a SCPI command, it switches to remote control irrespective of the selected interface.

4.3.2 Returning to manual operation (LOCAL)

If the R&S NRT2 is in remote control, you can display settings using the front panel keys and the touchscreen, but you cannot change settings. To do that, you have to return to manual operation.

The R&S NRT2 remains in remote control until you perform one of the following actions. Make sure that the R&S NRT2 is free for you to use.

► Press the [Esc/Local] key. See "[Esc] / Local" on page 25.
If the manual operation was disabled by the `&LLO` command (local lockout) and the [Esc/Local] key does not work, switch the R&S NRT2 off and on again.

► Send the `&GTL` command (go to local).

► Select the symbol on the touchscreen.
See Section 4.1.2, "Status information", on page 33.

5 Measurement and display configuration

The R&S NRT2 performs power reflection measurements with the R&S NRT-Zxx directional power sensor.

The R&S NRT-Zxx directional sensor measures the forward and reverse power. The forward power is the power flux from the source to the load.

The ratio of forward and reverse power is a measure of the matching of the load which can be measured as standing wave ratio (SWR), return loss or reflection coefficient.

To observe during the power reflection measurement

► **CAUTION!** Risk of electric shock and severe skin burns. During the measurement, the RF power flow can be high.

After switching on the RF power, do not touch the RF ports.

Never exceed the permissible continuous power that is shown in the diagram on the back of the sensor.

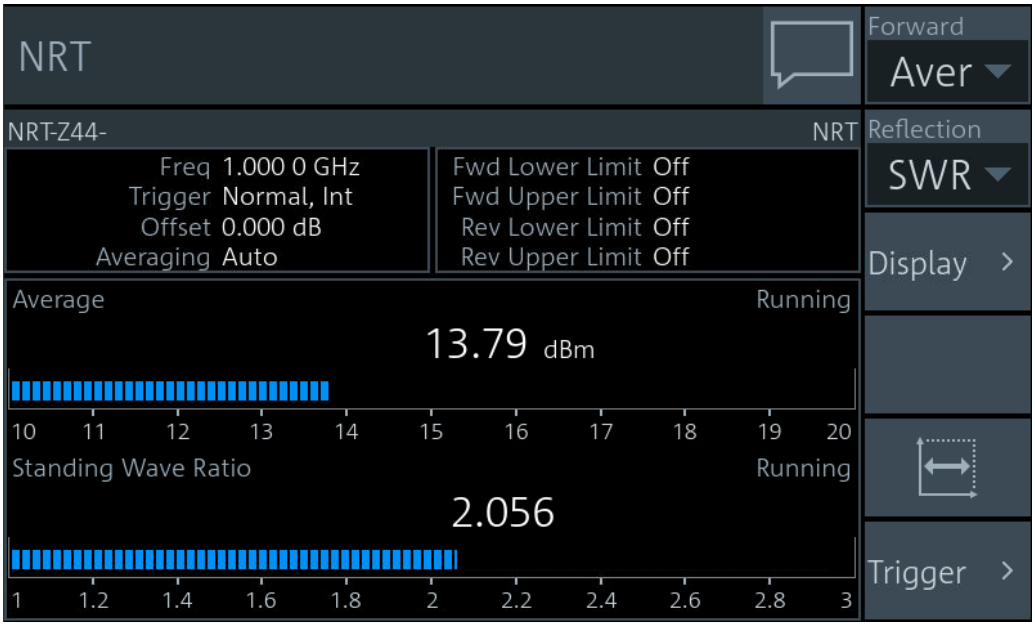
Further information:

- Section 6, "Sensor configuration", on page 54
- Setup see Section 3.1.8.1, "NRT sensor connector", on page 21.

5.1 NRT result display

After successful booting, the R&S NRT2 displays the main measurement dialog. See also Figure 4-1.

The R&S NRT2 displays the forward and reflected power simultaneously.



Displays two scalar values. One for the selected Forward measurement and one for the Reflection measurement.

In this example, Average and Return Loss are selected.

5.2 NRT settings

Access: main measurement dialog

Forward
Opens a dialog to measure power, power differences and envelope parameters.

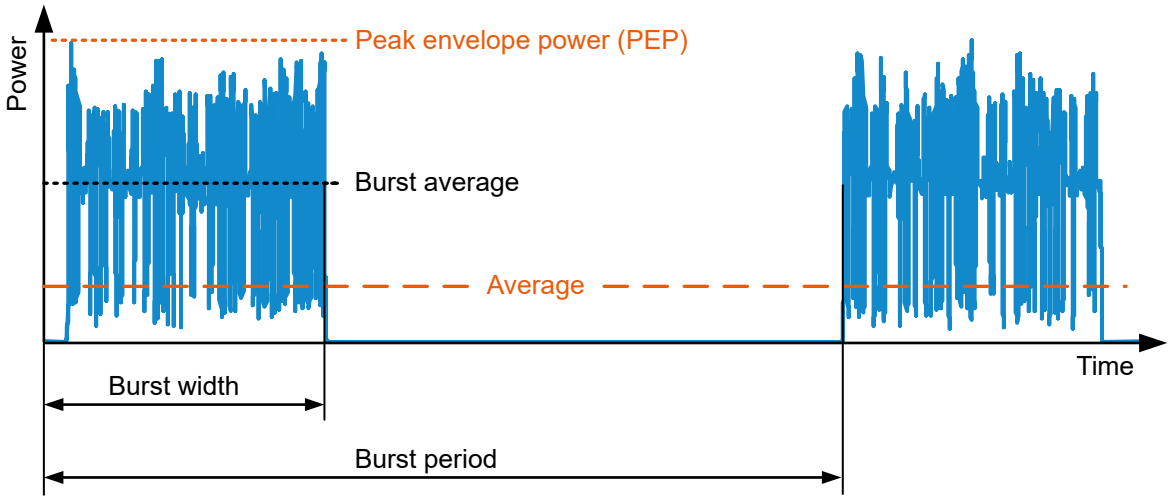


Figure 5-1: Forward power measurement parameters

Average ← Forward
Average power

Remote command:
CALCulate<Measurement>[:CHANnel<Channel>]:FEED<Channel>
"POWer:FORWard:AVERage"

CCDF ← Forward
Complementary cumulative distribution function. Probability that the envelope power is higher than the threshold set under "CCDF Threshold" on page 56.

Suitable for assessing the power distribution of spread spectrum signals, for example CDMA.

Remote command:
CALCulate<Measurement>[:CHANnel<Channel>]:FEED<Channel>
"POWer:FORWard:CCDFunction"

Peak Envelope Power (PEP) ← Forward
Peak power of an amplitude-modulated signal. Depending on the selected Video Bandwidth, this parameter allows detecting short-time overshoots at the beginning of a burst.

The peak envelope power (PEP) is an important parameter for describing the modulation characteristics of transmitter output stages.

Remote command:
CALCulate<Measurement>[:CHANnel<Channel>]:FEED<Channel>
"POWer:FORWard:PEP"

Absorption Average ← Forward
Absorbed average power. Difference between the forward and reverse average measurement.

This parameter measures the effective power transmitted to the load. With good matching, the difference between forward power and net power is less than one percent.

Remote command:
CALCulate<Measurement>[:CHANnel<Channel>]:FEED<Channel>
"POWer:ABSorption:AVERage"

Crest Factor (CF) ← Forward
Level difference between the peak envelope power and the average power in dB.

$$\text{Crest factor} = 10\ \text{dB} \times \log \frac{\text{Peak envelope power}}{\text{Average power}}$$

Allows recognizing larger modulation distortions quickly.

Remote command:
CALCulate<Measurement>[:CHANnel<Channel>]:FEED<Channel>
"POWer:CFACtor"

Absorption PEP ← Forward
Absorbed peak envelope power (PEP). Difference of peak envelope power between forward and reflected power measurement.

Remote command:
CALCulate<Measurement>[:CHANnel<Channel>]:FEED<Channel>
"POWer:ABSorption:PEP"

Burst Average ← Forward
Average power within a burst. The R&S NRT2 determines the average burst power by multiplying the average power with the ratio of burst period to burst width:

$$\text{Burst average} = \text{Average} \frac{\text{Burst period}}{\text{Burst width}}$$

Burst period and burst width are derived depending on the setting of "Burst Mode" on page 55.

For pulsed RF signals, the burst average defines the average carrier power within the burst. If the burst is unmodulated and has no overshoots, the average burst is equal to the peak envelope power.

Remote command:
CALCulate<Measurement>[:CHANnel<Channel>]:FEED<Channel>
"POWer:FORWard:AVERage:BURSt"

Absorption Burst ← Forward
Absorbed burst average. Difference of bust average between forward and reflected power measurement.

Remote command:
CALCulate<Measurement>[:CHANnel<Channel>]:FEED<Channel>
"POWer:ABSorption:AVERage:BURSt"

Reflection
Opens a dialog to measure reflection parameters.

The ratio of forward and reflected power is a measure for the matching of the load that can be expressed as standing wave ratio (SWR), return loss or reflection coefficient.

Off ← Reflection
Disabled.

Remote command:
CALCulate<Measurement>[:CHANnel<Channel>]:FEED<Channel>
"POWer:OFF"

Reverse Power ← Reflection
Reflected power in W or dBm.

Remote command:
CALCulate<Measurement>[:CHANnel<Channel>]:FEED<Channel>
"POWer:REVerse"

Standing Wave Ratio (SWR) ← Reflection

$$\text{Standing wave ratio} = \frac{1 + \text{Reflection coefficient}}{1 - \text{Reflection coefficient}}$$

See also "Reflection Coefficient" on page 44.

Remote command:
CALCulate<Measurement>[:CHANnel<Channel>]:FEED<Channel>
"POWer:SWRatio"
UNIT<Measurement>:POWer:REFLection

Return Loss ← Reflection

$$\text{Return loss} = 10 \times \log \frac{\text{Forward power}}{\text{Reverse power}}$$

Remote command:
CALCulate<Measurement>[:CHANnel<Channel>]:FEED<Channel>
"POWer:RLOSs"
UNIT<Measurement>:POWer:REFLection

Reflection Coefficient ← Reflection

$$\text{Reflection coefficient} = \sqrt{\frac{\text{Reverse power}}{\text{Forward power}}}$$

Remote command:
CALCulate<Measurement>[:CHANnel<Channel>]:FEED<Channel>
"POWer:RCOefficient"
UNIT<Measurement>:POWer:REFLection

Reflection Ratio ← Reflection

$$\text{Reflection ratio} = 100\,\frac{\text{Reverse power}}{\text{Forward power}}$$

Remote command:
CALCulate<Measurement>[:CHANnel<Channel>]:FEED<Channel>
"POWer:RFRatio"
UNIT<Measurement>:POWer:REFLection

Display
Opens the "Display" dialog. See Section 5.4, "Display settings", on page 46.

Autoscale
Adapts the scaling of the graphical display.

Remote command:
[SENSe<Sensor>:]POWer:REFLection:RANGe:AUTO
[SENSe<Sensor>:]POWer[:POWer]:RANGe:AUTO

Trigger
Opens the "Measurement Trigger Configuration" dialog:
- "Trigger Mode" on page 52
- "Trigger Source" on page 53

5.3 Measurement Main Configuration dialog

Access: In the "NRT" dialog, select the *displayed graph*.

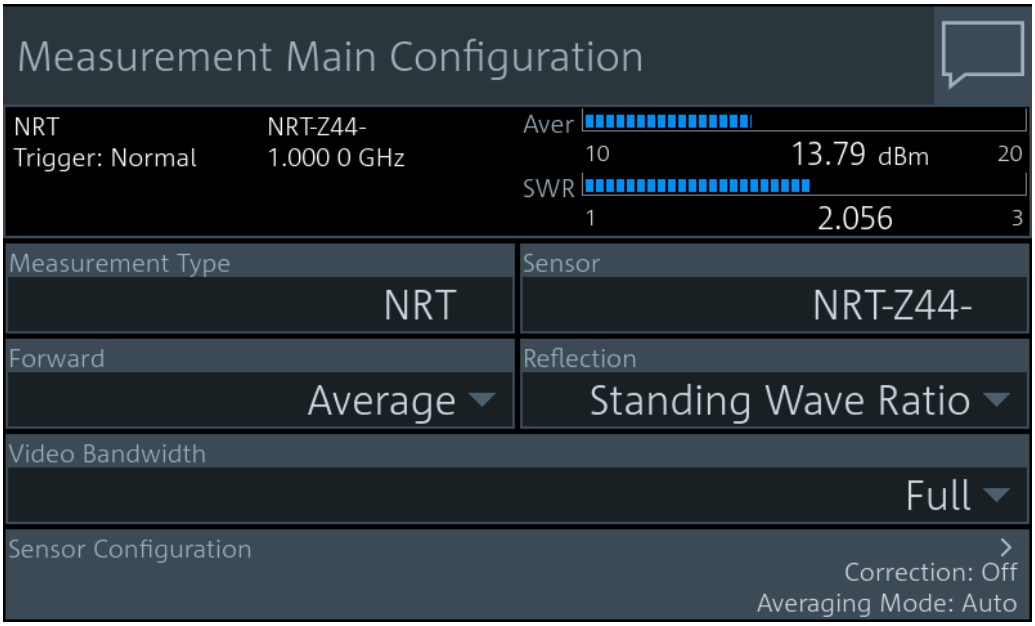


Figure 5-2: Measurement Main Configuration dialog

Measurement Type
Fixed setting.

Sensor
Assigns the sensor to the measurement.

Forward
See "Forward" on page 42.

Reflection
See "Reflection" on page 44.

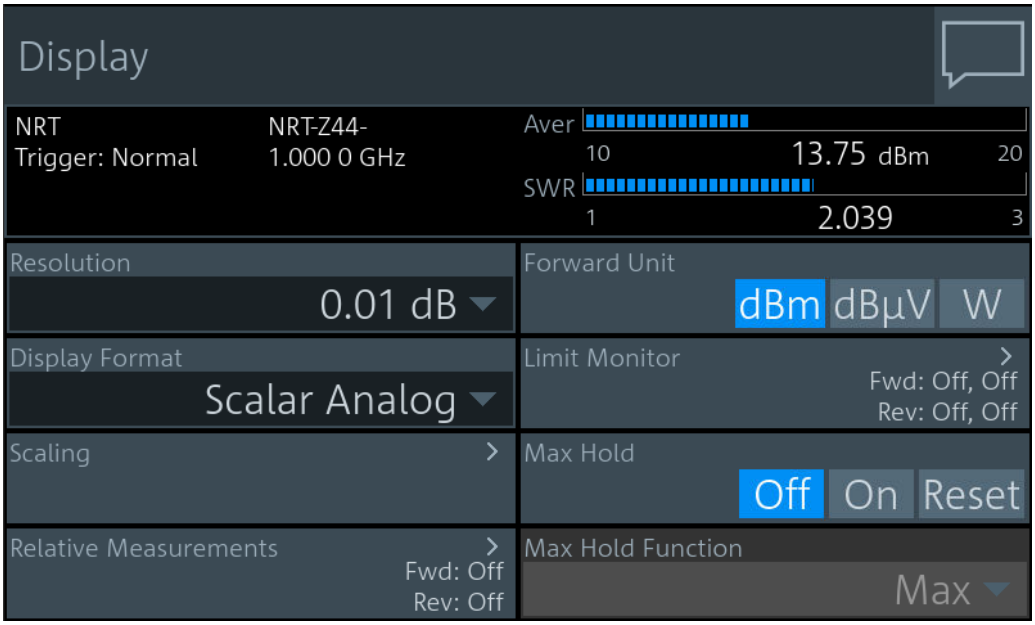
Video Bandwidth
See "Video Bandwidth" on page 59.

Sensor Configuration
Opens the "Channel Configuration" dialog.

See Section 6, "Sensor configuration", on page 54.

5.4 Display settings

Access: Main measurement dialog > "Display"



Resolution
Configures the resolution of the measurement. For logarithmic power values (dB, dBm or dBµV), the number of decimal places is set directly. For linear power values (W, Δ%, 1), the number of decimal places depends on the selected resolution and the magnitude of the result.

"1 dB | 0.1 dB | 0.01 dB | 0.001 dB"
Sets the resolution to the specified value.

Remote command:
`CALCulate<Measurement>:RESolution`
`[SENSe<Sensor>:]RRESolution`

Display Format
Sets the display format of the measured values.

"Scalar Digital" Numeric format

"Scalar Analog" Numeric format with bar chart

Remote command:
CALCulate<Measurement>:DMODe on page 111

Scaling
Opens the "Scaling" dialog to configure the display scaling.

Forward Scale Lower Limit, Reflection Scale Lower Limit ← Scaling
Defines the lower limit of the bargraph display.

Remote command:
CALCulate<Measurement>:METer<DirectionalChannel>:LOWer[:DATA]:CCDF
CALCulate<Measurement>:METer<DirectionalChannel>:LOWer[:DATA]:RATio:RCOefficient
CALCulate<Measurement>:METer<DirectionalChannel>:LOWer[:DATA]:RATio:RFRatio
CALCulate<Measurement>:METer<DirectionalChannel>:LOWer[:DATA]:RATio:RLOSs
CALCulate<Measurement>:METer<DirectionalChannel>:LOWer[:DATA]:RATio:SWR
CALCulate<Measurement>:METer<DirectionalChannel>:LOWer[:DATA]:RATio[:VALue]
CALCulate<Measurement>:METer<DirectionalChannel>:LOWer[:DATA][:POWer]

Forward Scale Upper Limit, Reflection Scale Upper Limit ← Scaling
Defines the upper limit of the bargraph display.

Remote command:
CALCulate<Measurement>:METer<DirectionalChannel>:UPPer[:DATA]:CCDF
CALCulate<Measurement>:METer<DirectionalChannel>:UPPer[:DATA]:RATio:RCOefficient
CALCulate<Measurement>:METer<DirectionalChannel>:UPPer[:DATA]:RATio:RFRatio
CALCulate<Measurement>:METer<DirectionalChannel>:UPPer[:DATA]:RATio:RLOSs
CALCulate<Measurement>:METer<DirectionalChannel>:UPPer[:DATA]:RATio:SWR
CALCulate<Measurement>:METer<DirectionalChannel>:UPPer[:DATA]:RATio[:VALue]
CALCulate<Measurement>:METer<DirectionalChannel>:UPPer[:DATA][:POWer]

Relative Measurements
Opens the dialog that groups the settings for relative measurements.

Forward Reference Value, Reflection Reference Value ← Relative Measurements
Available if Forward Relative State, Reflection Relative State is set to "On" or "Set".

Sets the reference value.

Remote command:
```
CALCulate<Measurement>:RELative<DirectionalChannel>:CCDF
CALCulate<Measurement>:RELative<DirectionalChannel>:POWer[:MAGNitude]
CALCulate<Measurement>:RELative<DirectionalChannel>:RATio:RCOefficient
CALCulate<Measurement>:RELative<DirectionalChannel>:RATio:RFRatio
CALCulate<Measurement>:RELative<DirectionalChannel>:RATio:RLOSs
CALCulate<Measurement>:RELative<DirectionalChannel>:RATio:SWR
CALCulate<Measurement>:RELative<DirectionalChannel>:RATio[:MAGNitude]
[SENSe<Sensor>:]POWer:REFerence
```

Forward Relative State, Reflection Relative State ← Relative Measurements
Allows you to relate measured power to a reference value.

Off	Displays the absolute power or power ratio.
On	Displays the relative power or power ratio. As a reference value, the value specified under Relative Measurements is used.
Set	Assigns the current measurement result as a reference value and displays the relative power.

Remote command:
```
CALCulate<Measurement>:RELative<DirectionalChannel>:STATe
```

Forward Unit
Sets the unit of the forward power measurement.

"dBm"	Power in dBm
"dBµV"	Power in dBµV
"W"	Power in W

Remote command:
```
UNIT<Measurement>:POWer[:VALue]
UNIT<Measurement>:POWer:RATio
```

Limit Monitor
Opens the "Limit Monitor" dialog that groups the limit settings.

You can set an upper and a lower limit for the forward and reflection measurement.

Forward Lower Limit State, Reflection Lower Limit State ← Limit Monitor
Enables or disables the monitoring function for the lower limit.

Remote command:
```
CALCulate<Measurement>:LIMit<DirectionalChannel>:LOWer:STATe
```

Forward Lower Limit, Reflection Lower Limit ← Limit Monitor
Defines a lower limit.

Remote command:
```
CALCulate<Measurement>:LIMit<DirectionalChannel>:LOWer[:DATA]:
CCDF
CALCulate<Measurement>:LIMit<DirectionalChannel>:LOWer[:DATA]:
POWer
CALCulate<Measurement>:LIMit<DirectionalChannel>:LOWer[:DATA]:
RATio:RCOefficient
CALCulate<Measurement>:LIMit<DirectionalChannel>:LOWer[:DATA]:
RATio:RFRatio
CALCulate<Measurement>:LIMit<DirectionalChannel>:LOWer[:DATA]:
RATio:RLOSs
CALCulate<Measurement>:LIMit<DirectionalChannel>:LOWer[:DATA]:
RATio:SWR
CALCulate<Measurement>:LIMit<DirectionalChannel>:LOWer[:DATA]:
RATio[:VALue]
```

Forward Upper Limit State, Reflection Upper Limit State ← Limit Monitor
Enables or disables the monitoring function for the upper limit.

Remote command:
```
CALCulate<Measurement>:LIMit<DirectionalChannel>:UPPer:STATe
```

Forward Upper Limit, Reflection Upper Limit ← Limit Monitor
Defines an upper limit.

Remote command:
```
CALCulate<Measurement>:LIMit<DirectionalChannel>:UPPer[:DATA]:
CCDF
CALCulate<Measurement>:LIMit<DirectionalChannel>:UPPer[:DATA]:
POWer
CALCulate<Measurement>:LIMit<DirectionalChannel>:UPPer[:DATA]:
RATio:RCOefficient
CALCulate<Measurement>:LIMit<DirectionalChannel>:UPPer[:DATA]:
RATio:RFRatio
CALCulate<Measurement>:LIMit<DirectionalChannel>:UPPer[:DATA]:
RATio:RLOSs
CALCulate<Measurement>:LIMit<DirectionalChannel>:UPPer[:DATA]:
RATio:SWR
CALCulate<Measurement>:LIMit<DirectionalChannel>:UPPer[:DATA]:
RATio[:VALue]
```

Max Hold
If enabled, displays the highest value measured for each point (pixel) of the selected display type.

Remote command:
```
CALCulate<Measurement>:HOLD[:STATe]
```

Max Hold Function
For all measurement functions, the R&S NRT2 stores the maximum and minimum values and the calculated differences between these values.

The selected setting applies to both power and reflection indication. You can change at any time.

"Max" Maximum value

"Min" Minimum value

"Max − Min" Difference between maximum and minimum value

Remote command:
`CALCulate<Measurement>:HOLD:FUNCtion`

5.5 Controlling the measurement

The sensor offers a bunch of possibilities to control the measurement:

- Do you want to start the measurement immediately after the initiate command or do you want to wait for a trigger event?
- Do you want to start a single measurement cycle or a sequence of measurement cycles?
- Do you want to output each new average value as a measurement result or do you want to bundle more measured values into one result?

Further information:

- Section 5.6, "Triggering", on page 51

5.6 Triggering

In a basic continuous measurement, the measurement is started immediately after the initiate command. However, sometimes you want that the measurement starts only if a specific condition is fulfilled. For example, if a signal level is exceeded, or in certain time intervals. For these cases, you can define a trigger for the measurement.

5.6.1 Trigger states

The sensor has trigger states to define the exact start and stop time of a measurement and the sequence of a measurement cycle. The following states are defined:

- Idle
  The sensor performs no measurement. After powering on, the sensor is in the idle state.
- Waiting for trigger
  The sensor waits for a trigger event that is defined by the trigger source. When the trigger event occurs, the sensor enters the measuring state.
- Measuring

The sensor is measuring data. It remains in this state during the measurement. When the measurement is completed, it exits this state immediately.

5.6.2 Trigger sources

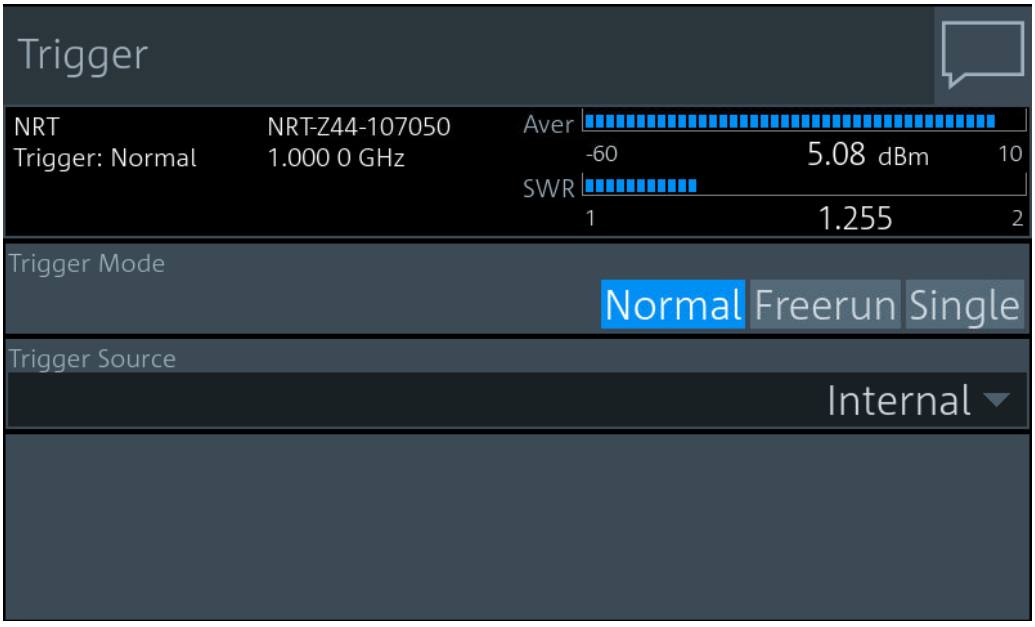
The possible trigger conditions and the execution of a trigger depend on the selected trigger mode and trigger source.

If the signal power exceeds or falls below a reference level set by the trigger level, the measurement is started after the defined delay time. Waiting for a trigger event can be skipped.

Trigger source	Description	Remote commands to initiate the measurement
"Internal"	Uses the input signal as the trigger signal.	`TRIGger<Measurement>[:IMMediate]`
"External"	Uses the external trigger signal that is supplied at the Trig In / Out 2 connector. See Section 3.2.2.1, "Trig In / Out 2 and Out 1 / Trig Out connectors", on page 28.	`TRIGger<Measurement>[:IMMediate]`

5.6.3 Trigger settings

Access: Main measurement dialog > "Trigger"



Trigger Mode
Controls the trigger execution depending on the settings under "Trigger Source" on page 53.

"Normal"	Continuous triggering with regular trigger events.
"Freerun"	Enables a continuous measurement. The sensor executes one measurement cycle after the other.
"Single"	Disables continuous triggering so that only one trigger event at a time is executed. To enable triggering again, press [1Trig].

Remote command:
`TRIGger<Measurement>:MODE`

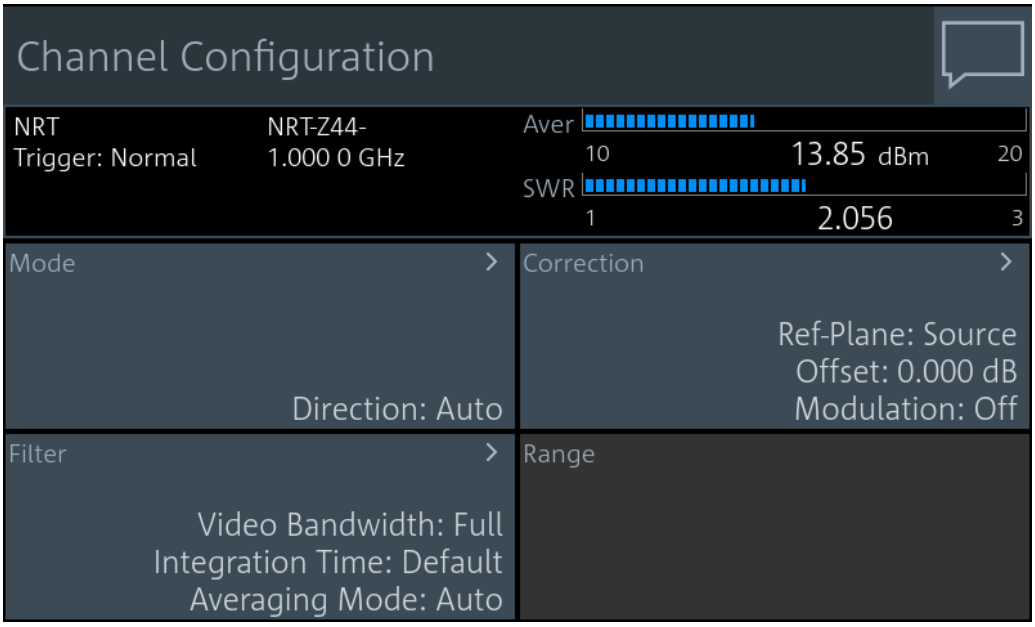
Trigger Source
Sets the source for the trigger event. See Section 5.6.2, "Trigger sources", on page 52.

Remote command:
`TRIGger<Measurement>[:CHANnel<Channel>]:SOURce`

6 Sensor configuration

Access: "Measurement Main Configuration" > "Sensor Configuration"

The "Channel Configuration" dialog offers access to all sensor-related settings.



An R&S NRT-Zxx directional power sensor has two measurement channels, one channel for forward power and one channel for reflected power.

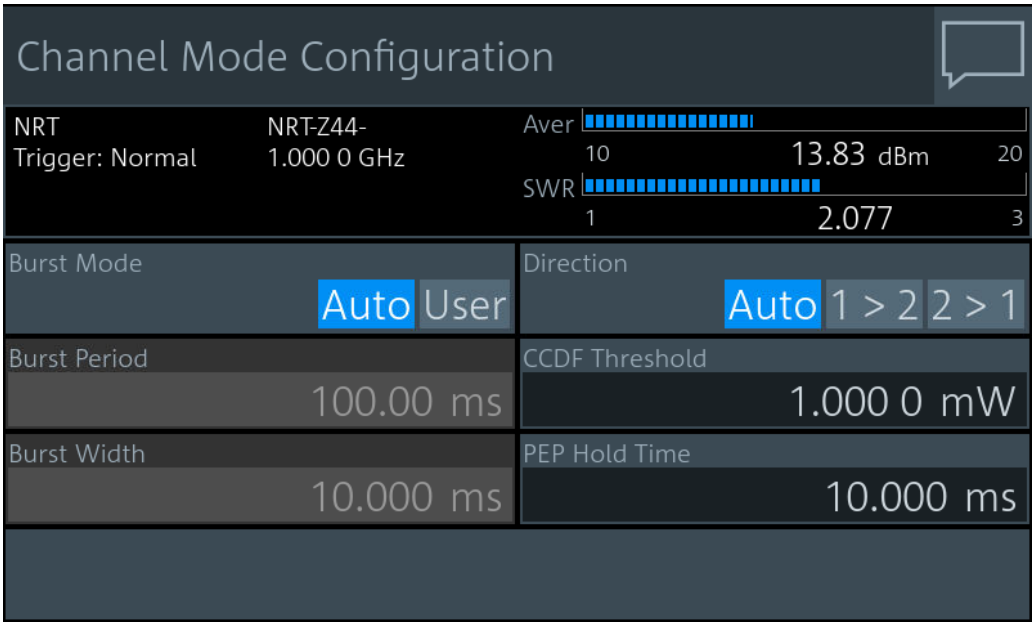
Further information:

- Figure 4-1

The "Channel Configuration" dialog provides access to:

6.1 Channel mode settings

Access: "Measurement Main Configuration" > "Sensor Configuration" > "Mode"



Burst Mode
Defines how the average burst power is determined.

"Auto" Not supported by all sensors.
The sensor automatically recognizes the duty cycle of the burst series and calculates the average burst power from this duty cycle and the average power. Set an appropriate Video Bandwidth.

"User" Define the duty cycle by:
- Burst Period
- Burst Width

The R&S NRT2 calculates the average burst power from these values.

Remote command:
`CALCulate<Measurement>[:CHANnel<Channel>]:NRT:BURSt:MODE`

Burst Period
Available if "User" is set under "Burst Mode" on page 55.

Sets the burst period.

Remote command:
`CALCulate<Measurement>[:CHANnel<Channel>]:NRT:BURSt:PERiod`

Burst Width
Available if "User" is set under "Burst Mode" on page 55.

Sets the burst width.

Remote command:
`CALCulate<Measurement>[:CHANnel<Channel>]:NRT:BURSt:WIDTh`

Direction
Defines how the forward power is determined.

"Auto" Determines the power flow direction automatically. The greater value of two measured values is automatically assigned as forward power.

"1 > 2", "2 > 1" Sets a fixed direction of the forward power, either from port 1 to port 2, or from port 2 to port 1.
The two ports are indicated on the directional power sensor.

Remote command:
`CALCulate<Measurement>[:CHANnel<Channel>]:NRT:DIRection`
`INPut<Sensor>:PORT:SOURce:AUTO`
`INPut<Sensor>:PORT:SOURce[:VALue]`

CCDF Threshold
Sets the threshold for the complementary cumulative distribution function. See also "CCDF" on page 42.

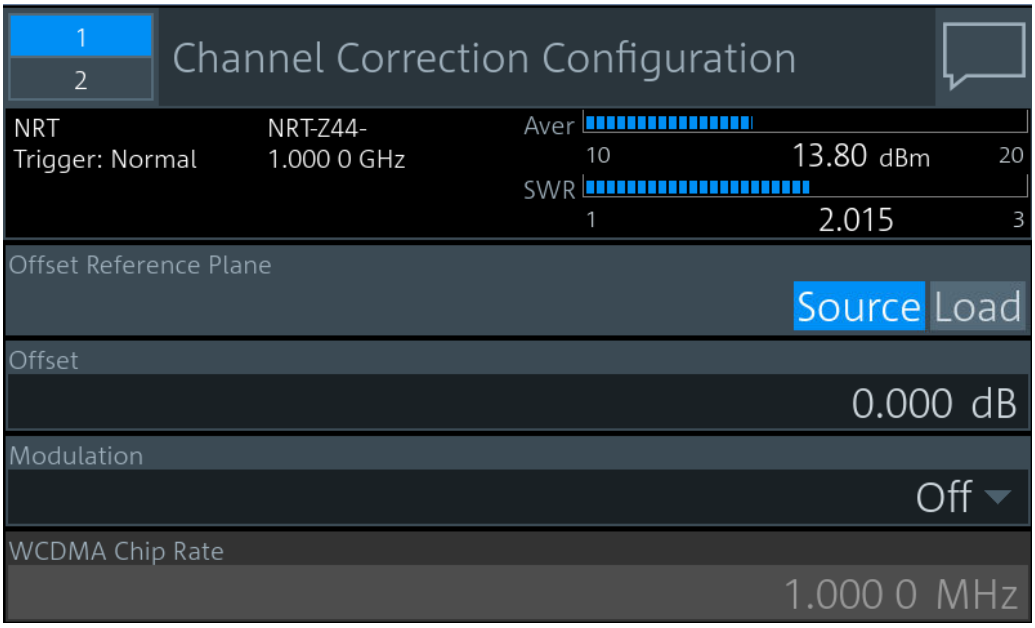
Remote command:
`CALCulate<Measurement>[:CHANnel<Channel>]:NRT:CCDF:THReshold`

PEP Hold Time
Sets the hold time of the peak hold circuit of the sensor. See also "Peak Envelope Power (PEP)" on page 42.

Remote command:
`CALCulate<Measurement>[:CHANnel<Channel>]:NRT:PEP:HOLD:TIME`

6.2 Channel correction settings

Access: "Measurement Main Configuration" > "Sensor Configuration" > "Correction"



Offset Reference Plane
Selects the sensor port to which the measurement results are referred to.

"Source" Source connector of the R&S NRT-Zxx directional sensor

"Load" Load connector of the R&S NRT-Zxx directional sensor

Remote command:
`CALCulate<Measurement>[:CHANnel<Channel>]:CORRection:OFFSet:RPLane`
`INPut<Sensor>:PORT:POSition`

Offset
Considers the transmission loss in a cable that connects the desired measurement point, set by Offset Reference Plane, and the sensor.

Remote command:
`CALCulate<Measurement>[:CHANnel<Channel>]:CORRection:OFFSet:STATe`
`CALCulate<Measurement>[:CHANnel<Channel>]:CORRection:OFFSet[:MAGNitude]`
`INPut<Sensor>:PORT:OFFSet`

Modulation
Sets a communication standard for the modulation correction to reduce systematic deviations occurring in power measurements.

"Off" Disabled.

"IS95" IS- 95 CDMA standard for base stations.

"WCDMA" WCDMA standard for base stations.

"DVBT" DVB-T standard for terrestrial DVB TV transmitters.

"DAB" DAB standard for radio transmitters.

Remote command:

```
CALCulate<Measurement>[:CHANnel<Channel>]:NRT:DMODulation[:VALue]
[SENSe<Sensor>:]DM:STATe
[SENSe<Sensor>:]DM:STANdard
```

WCDMA Chip Rate

Available if "WCDMA" is set under Modulation.

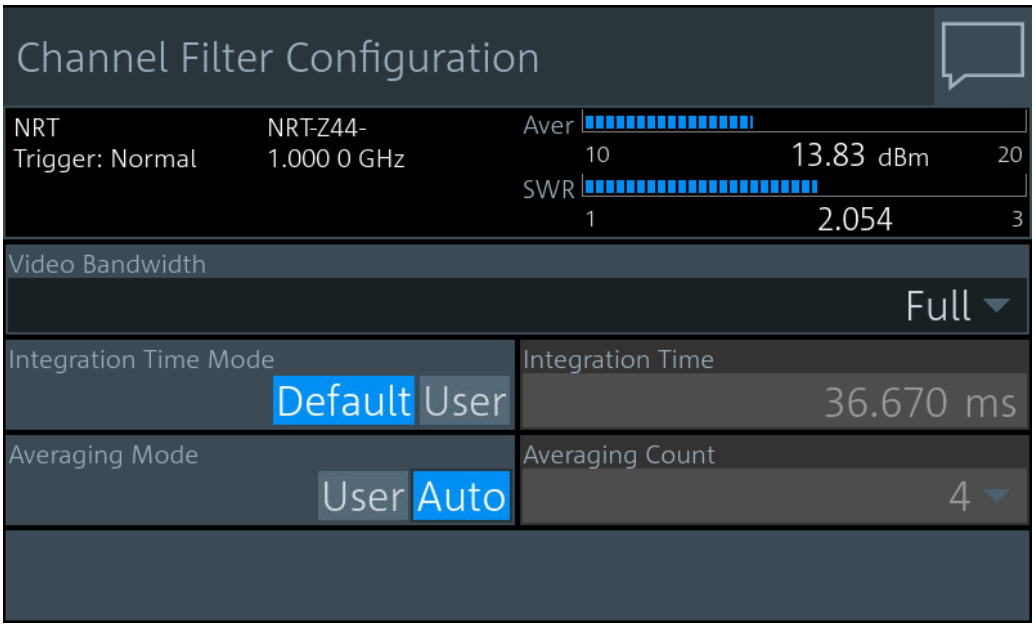
Sets the chip rate for the WCDMA communication standard.

Remote command:

```
CALCulate<Measurement>[:CHANnel<Channel>]:NRT:DMODulation:WCDMa:CRATe
```

6.3 Channel filter settings

Access: "Measurement Main Configuration" > "Sensor Configuration" > "Filter"



Video Bandwidth
For measuring the peak envelope power, specify the video bandwidth that the sensor uses for measuring the detected RF signal.

"4 kHz" | "200 kHz" | "Full"
"Full" means that the maximum bandwidth of the sensor is used.

Remote command:
```
CALCulate<Measurement>[:CHANnel<Channel>]:NRT:VBWidth[:VALue]
[SENSe<Sensor>:]BANDwidth:VIDeo:FNUMber
[SENSe<Sensor>:]BWIDth:VIDeo:FNUMber
```

Integration Time Mode
Specifies which integration time is used for a single measurement.

"Default" Uses the default settings.

"User" Define a value under Integration Time.

Remote command:
```
CALCulate<Measurement>[:CHANnel<Channel>]:NRT:APERture:MODE
```

Integration Time
Available if Integration Time Mode is set to "User".

Defines the integration time for a single measurement.

Remote command:
```
CALCulate<Measurement>[:CHANnel<Channel>]:NRT:APERture[:VALue]
```

Averaging Mode
Sets the averaging mode.

"User" Define the value under Averaging Count.

"Auto" Determines the average count automatically from the level of the input signal.

Remote command:
```
CALCulate<Measurement>[:CHANnel<Channel>]:AVERage:COUNt:AUTO[:
STATe]
```

Averaging Count
Available if Averaging Mode is set to "User".

Sets the number of readings that are averaged for one measured value. The higher the count, the lower the noise, and the longer it takes to obtain a measured value.

Remote command:
```
CALCulate<Measurement>[:CHANnel<Channel>]:AVERage:COUNt[:VALue]
```

7 Saving and recalling settings

When shutting down, the R&S NRT2 saves the measurement settings. When booting the next time, the R&S NRT2 uses the settings from the last session. See also Section 3.1.10, "Switching on or off", on page 23.

If you want to return to a defined initial state, perform a preset. See "Preset" on page 61.

If you want to save specific measurement settings to reuse at another time, save the setup in a file. The R&S NRT2 offers 20 setup files for this purpose.

Access: [Preset] > "Save / Recall / Preset" dialog

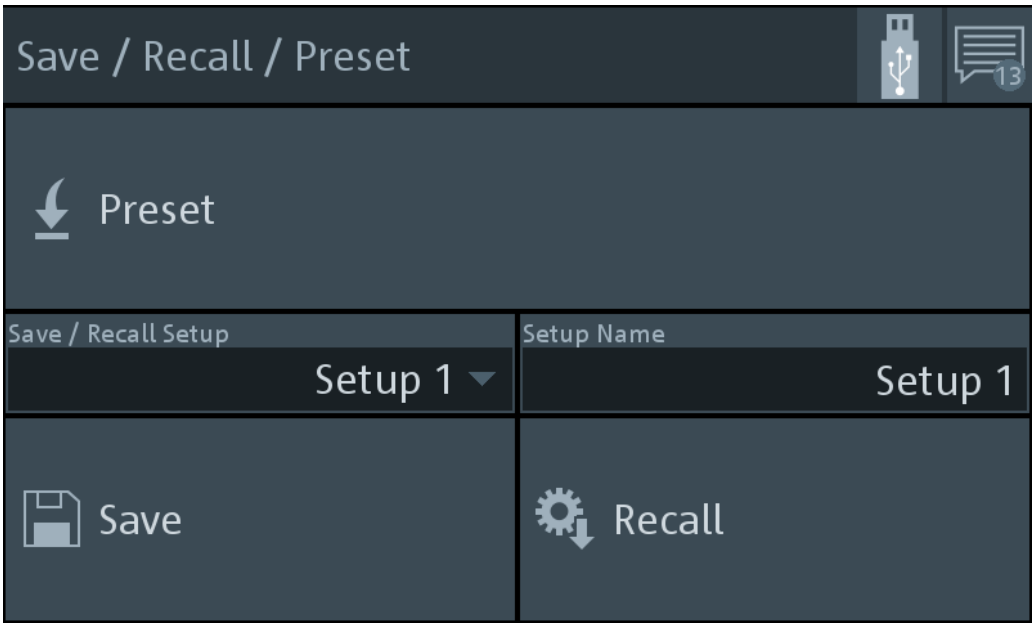


Figure 7-1: Save / Recall / Preset dialog

To save settings

1. Press [Preset].
2. Under "Save / Recall Setup", select a setup, for example "Setup 2".
3. If you want to give the setup a meaningful name, enter a new name under "Setup Name".
4. Select "Save".

To recall settings

1. Press [Preset].
2. Under "Save / Recall Setup", select the setup you want to load, for example "Setup 2".

3. Select "Recall".

Preset
Sets the R&S NRT2 and the connected sensors to a defined initial state. Thus, you can change parameter values from a well defined starting point.

For details on sensor settings, see the user manual of the sensor.

Remote command:
`SYSTem:PRESet`
`*RST`

Save / Recall Setup
Selects the setup file in which the instrument settings are saved.

Save
Saves the current instrument settings in the selected setup file.

Remote command:
`*SAV`

Setup Name
Selects the setup file from which to load the instrument settings.

Recall
Restores the selected instrument settings.

Remote command:
`*RCL`

8 Zeroing sensors

Zeroing removes offset voltages from the analog circuitry of the sensors, so that there are only low powers displayed when there is no power applied.

Zeroing is recommended if:

- The temperature has varied by more than 5 K.
- The sensor has been replaced.
- No zeroing was performed in the last 24 hours.
- Signals of very low power are to be measured, for instance, if the expected measured value is less than 10 dB above the lower measurement range limit.

Access: [Zero] > "Zeroing Sensors" dialog

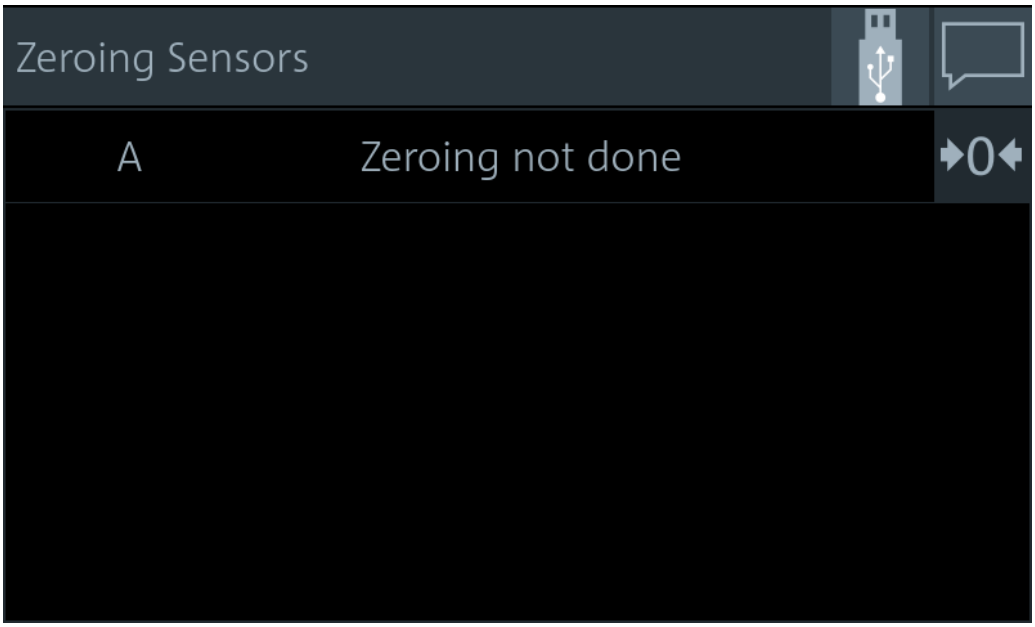


Figure 8-1: Zeroing Sensors dialog

Shows the zeroing status for sensor A: not done, in progress or successful.

Sensors zeroed successful are also checked: ✔

To zero sensors

1. Disconnect the sensors that you want to zero from all power sources. Any signals present at the RF input of a sensor is taken into account. You can either switch off the RF output of a DUT or disconnect the sensor physically from any power source.

   Note: An active test signal during zeroing causes an error.

2. Press [Zero].
3. Select 0.

   The status changes from in progress to successful.

Remote command:

- See Section 11.6, "Zeroing", on page 161.

9 System settings

The system settings do not affect the measurements directly.

Access: [System]

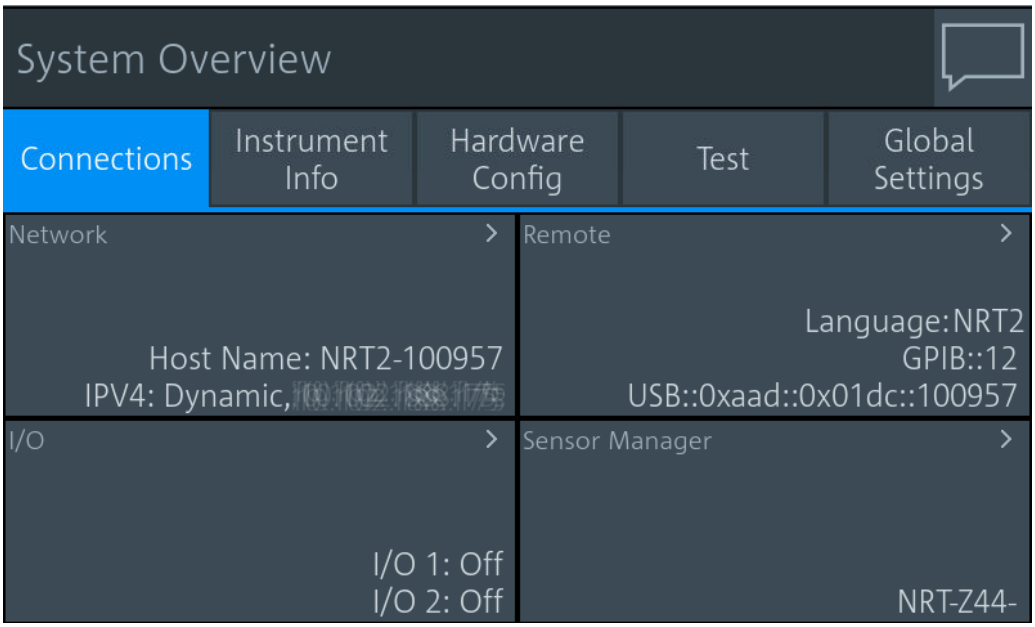


Figure 9-1: System Overview dialog

The "System Overview" dialog provides access to:

- Connections configuration....64
- Instrument information....76
- Instrument security management....80
- Option management....89
- User interface tests....91
- Global settings....92

9.1 Connections configuration

Access: [System] > "Connections"

See Figure 9-1.

On this tab, you can display and configure the following settings:

- Network settings....65
- Remote settings....68
- Input/output settings (I/O)....71
- Sensor management....73

9.1.1 Network settings

Access: [System] > "Connections" > "Network"

Contains the settings for integrating the R&S NRT2 in a network. There are two methods to establish a network connection between R&S NRT2 and computer:

► Connect both to a common network (infrastructure network).

► Connect R&S NRT2 and computer only over the switch (peer-to-peer network).

In this case, the use of a static IP address is recommended.

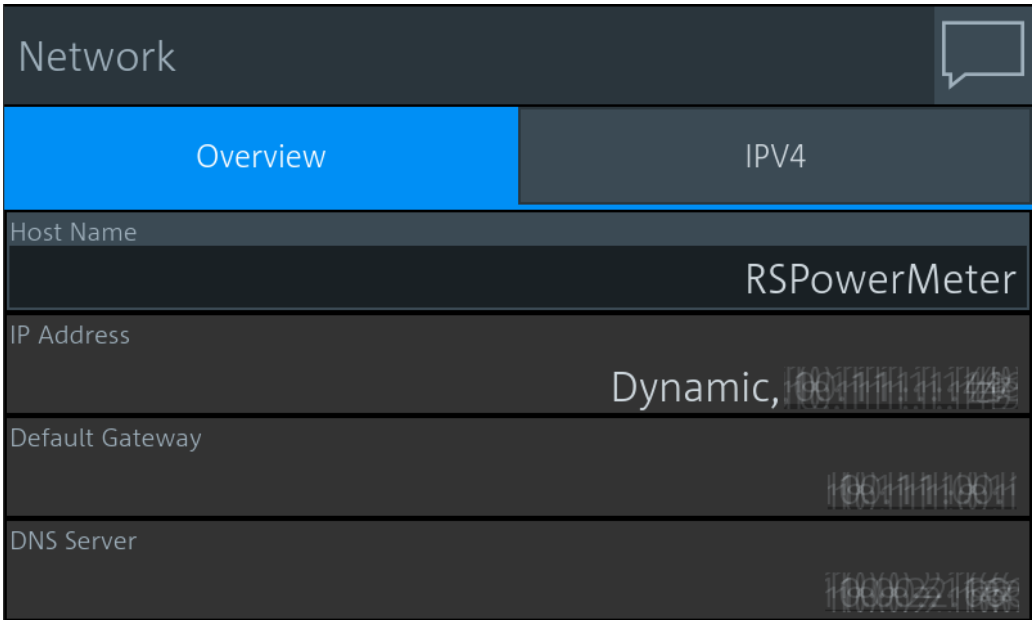
Connection errors can affect the entire network. If your network does not support DHCP, or if you choose to disable dynamic TCP/IP configuration, assign a valid address information before connecting the R&S NRT2 to the LAN. Contact your network administrator to obtain valid IP addresses.

After integrating the R&S NRT2 into a network, you can set up the following connections:

- Remote control connection to control the R&S NRT2 using SCPI commands.
  See Section 4.3, "Remote control", on page 38.
- Remote desktop connection for remote operation or file transfer.
  See Section 4.2, "Remote operation", on page 37.

The "Network" dialog is divided into the following tabs:

Overview tab



Apart from the Host Name, the other parameters are only displayed here. Configure them on the "IPv4 tab" on page 67.

Host Name ← Overview tab
Sets the individual hostname of the R&S NRT2.

In a LAN that uses a domain name system server (DNS server), you can access each connected instrument using a unique hostname instead of its IP address. The DNS server translates the hostname to the IP address. Using a hostname is especially useful if a DHCP server is used, as a new IP address can be assigned each time the R&S NRT2 is restarted.

For the default hostname, see Section 3.2.2.6, "Name plate", on page 29.

When you change the hostname, the R&S NRT2 restarts its connection to the network, which can take several seconds. During this time, you cannot address the R&S NRT2. After the restart, you can only address the R&S NRT2 using the newly set hostname.

Note: It is recommended that you do not change the default hostname to avoid problems with the network connection. However, if you change the hostname, be sure to use a unique name.

Remote command:
`SYSTem:COMMunicate:NETWork[:COMMon]:HOSTname`

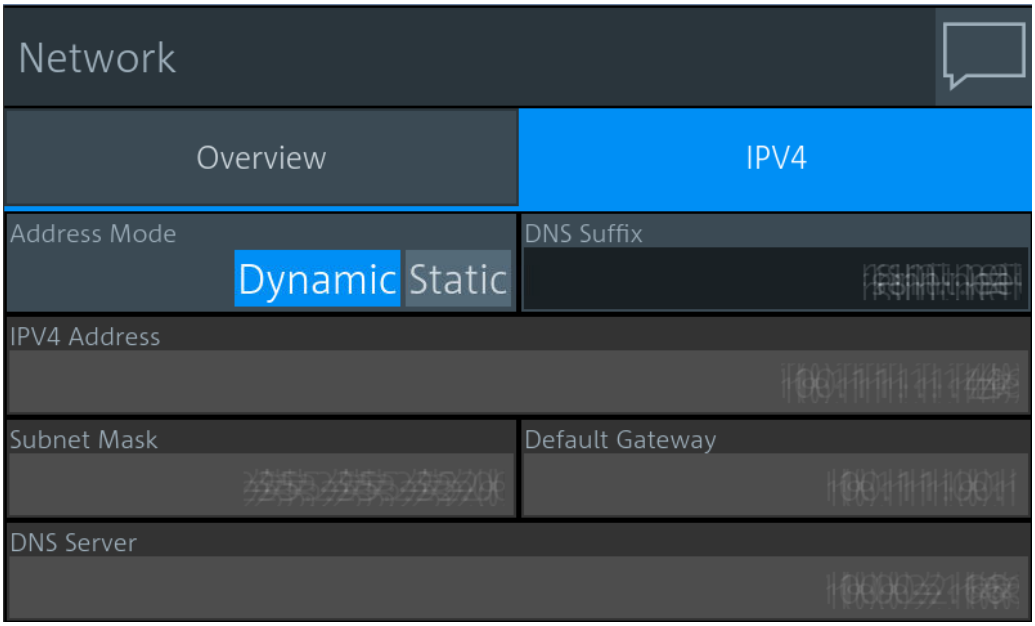
IP Address ← Overview tab
Displays the IP address, and whether it is static or dynamic.

Set the parameters under:
- "Address Mode" on page 67
- "IPv4 Address" on page 68

Default Gateway ← Overview tab
Displays the IP address of the default gateway of the local subnet. Set the parameter under "Default Gateway" on page 68.

DNS Server ← Overview tab
Displays the IP address of the DNS server of the local subnet. Set the parameter under "DNS Server" on page 68.

IPv4 tab



Addresses consist of 4 number blocks separated by dots. In maximum, each block contains 3 digits, for example *100.100.100.100*. Fewer digits in a block are also allowed.

Address Mode ← IPv4 tab
Sets how the IP address is assigned.

"Dynamic" Assigns the IP address automatically, provided the network supports the dynamic host configuration protocol (DHCP).

"Static" Enables assigning the IP address manually.

Remote command:
`SYSTem:COMMunicate:NETWork[:IPADdress]:MODE`
`SYSTem:COMMunicate:INET[:SELF]:MODE`

DNS Suffix ← IPv4 tab
Sets the primary DNS suffix that means the domain name. DNS uses the suffix for registration and name resolution to identify the R&S NRT2 uniquely in the entire network.

Remote command:
`SYSTem:COMMunicate:NETWork[:COMMon]:DOMain`
`SYSTem:COMMunicate:INET[:SELF]:DNS:SUFFix`

IPv4 Address ← IPv4 tab
Available if "Static" is set under Address Mode.

Sets the IP address of the R&S NRT2.

Remote command:
```
SYSTem:COMMunicate:NETWork[:IPADdress][:ADDRess]
SYSTem:COMMunicate:INET[:SELF]:ADDRess
```

Subnet Mask ← IPv4 tab
Available if "Static" is set under Address Mode.

Sets the subnet mask of your local subnet.

Remote command:
```
SYSTem:COMMunicate:NETWork[:IPADdress]:SUBNet:MASK
SYSTem:COMMunicate:INET[:SELF]:SUBNetmask:ADDRess
```

Default Gateway ← IPv4 tab
Available if "Static" is set under Address Mode.

Sets the IP address of the default gateway.

Remote command:
```
SYSTem:COMMunicate:NETWork[:IPADdress]:GATeway
SYSTem:COMMunicate:INET[:SELF]:GATeway:ADDRess
```

DNS Server ← IPv4 tab
Available if "Static" is set under Address Mode.

Sets the DNS server address of your local subnet.

Remote command:
```
SYSTem:COMMunicate:NETWork[:IPADdress]:DNS
SYSTem:COMMunicate:INET[:SELF]:DNS:ADDRess
```

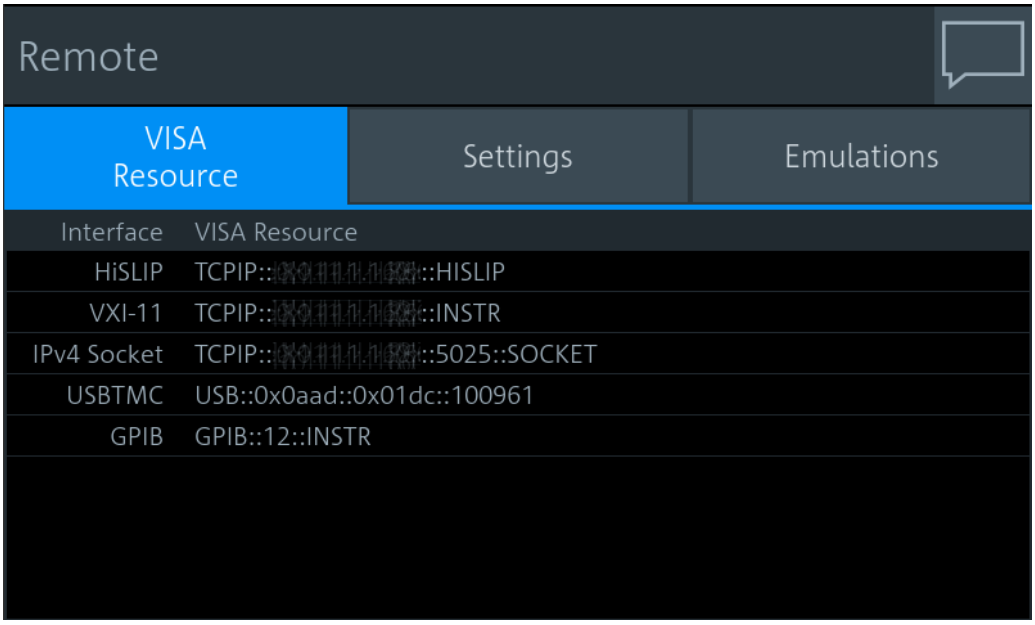
9.1.2 Remote settings

Access: [System] > "Connections" > "Remote"

Contains the settings for remote control.

The "Remote" dialog is divided into the following tabs:

VISA Resource tab

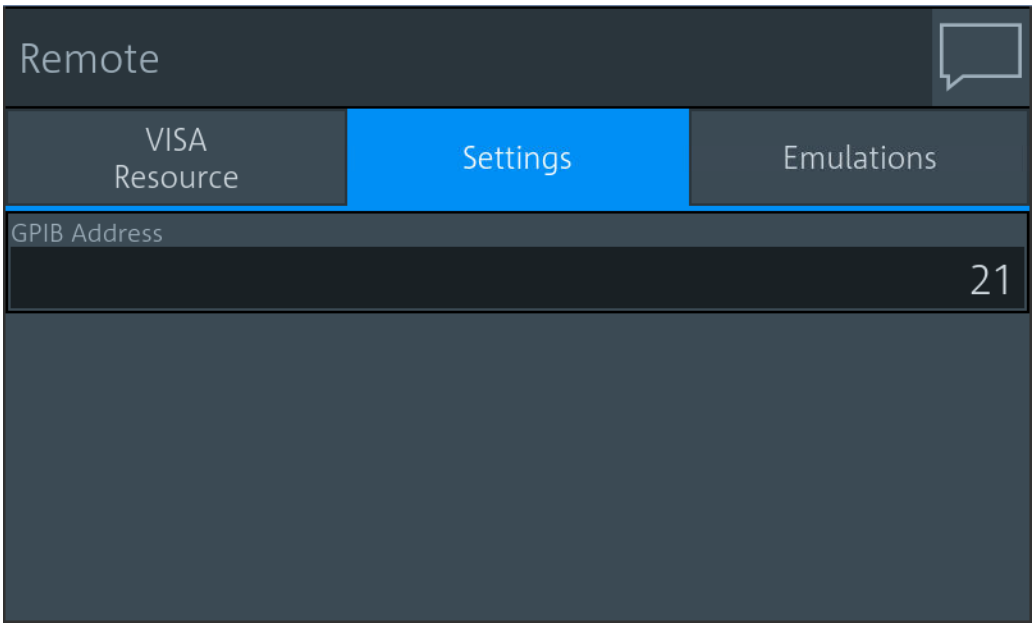


Interface - VISA Resource table ← VISA Resource tab
Displays the VISA resource strings of the interfaces available for remote control.

In a LAN, the VISA resource string is required to establish a communication session between the controller and the R&S NRT2. The resource string is a unique identifier, composed of the specific IP address of the instrument and some network and VISA-specific keywords. The resource string depends on the interface used for remote control.

For details on the strings, see Table 12-1.

Settings tab



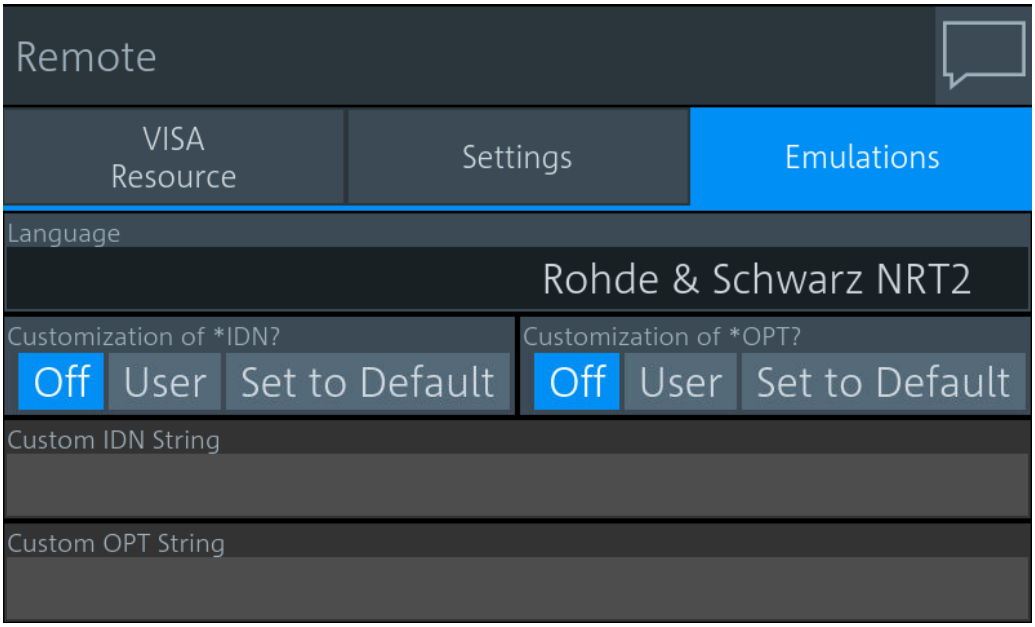
GPIB Address ← Settings tab
Sets the GPIB address.

See also Section 12.1.3, "GPIB interface", on page 190.

"1" to "30" Channel address

Remote command:
`SYSTem:COMMunicate:GPIB[:SELF]:ADDRess`

Emulations tab



Language ← Emulations tab
Fixed value.

"Rohde & Schwarz NRT2"
Native remote command set of the R&S NRT2, based on the standard commands for programmable instruments (SCPI-99).

Remote command:
`SYSTem:LANGuage`

Customization of *IDN? ← Emulations tab
Sets which identification string is used.

"Off" Default identification string

"User" Customized identification string. Enter the customized instrument identification string under Custom IDN String.

"Set to Default" Sets the content of Custom IDN String to the default identification string.

Remote command:
`SYSTem:IDN:MODE`
`SYSTem:IDN:AUTO`

Customization of *OPT? ← Emulations tab
Sets which option string is used.

"Off"	Default option string
"User"	Customized option string. Enter the customized option string under Custom OPT String.
"Set to Default"	Sets the content of Custom OPT String to the default identification string.

Remote command:
`SYSTem:OPT:MODE`
`SYSTem:OPT:AUTO`

Custom IDN String ← Emulations tab
Available if Customization of *IDN? is set to "User".

Sets the customized instrument identification string so that you can identify each R&S NRT2 individually.

Remote command:
`SYSTem:IDN:ANSWer`

Custom OPT String ← Emulations tab
Available if Customization of *OPT? is set to "User".

Sets the customized option identification string.

Remote command:
`SYSTem:OPT:ANSWer`

9.1.3 Input/output settings (I/O)

Access: [System] > "Connections" > "I/O"

The "I/O" dialog is divided into the following tabs:

I/O 1, I/O 2 tabs
Configures the two multifunctional BNC connectors at the rear of the R&S NRT2, see Section 3.2.2.1, "Trig In / Out 2 and Out 1 / Trig Out connectors", on page 28.
- Use the "I/O 1" tab for Out 1 / Trig Out connector.
- Use the "I/O 2" tab for Trig In / Out 2 connector.

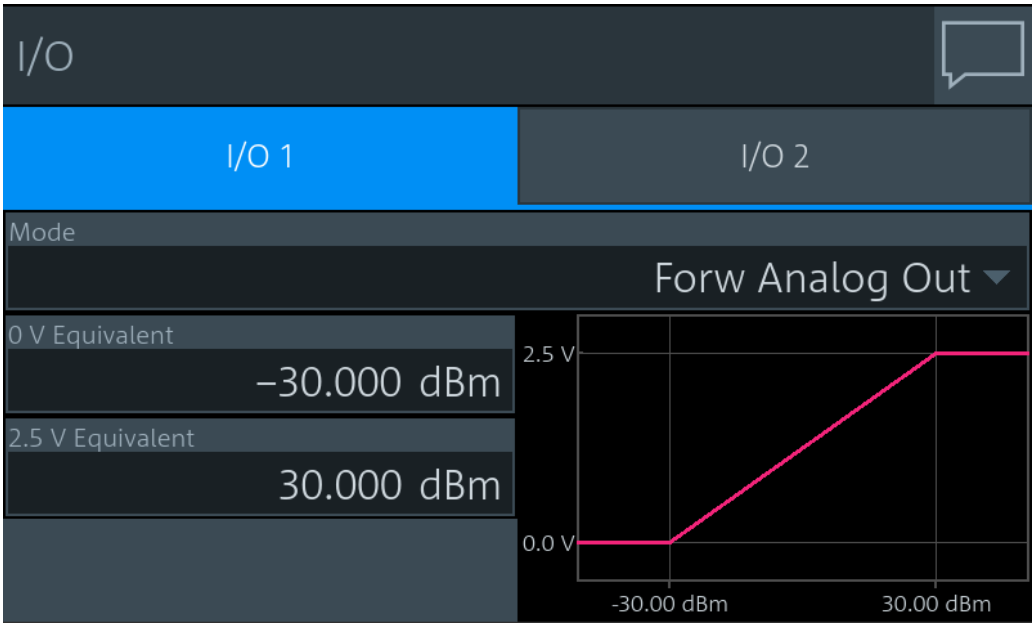


Figure 9-2: Example

Mode ← I/O 1, I/O 2 tabs
Sets the functionality of the Out 1 / Trig Out and Trig In / Out 2 connectors.

"Off" Disables the connector.

"Forw Analog Out", "Refl Analog Out"
Provides an analog voltage that is proportional to the displayed value.

"Forw Limit Violation" (only for Out 1 / Trig Out on "I/O 1" tab)
Sets the fail voltage that is output if a value of the forward measurement causes a limit violation.

"Refl Limit Violation" (only for Out 1 / Trig Out on "I/O 1" tab)
Sets the fail voltage that is output if a value of the reflection measurement causes a limit violation.

Remote command:
`[SENSe<Sensor>:]POWer:REFLection:RANGe:LIMit[:STATe]`
`[SENSe<Sensor>:]POWer[:POWer]:RANGe:LIMit[:STATe]`
`OUTPut:MODE<output>`

0 V Equivalent ← I/O 1, I/O 2 tabs
Available if Mode is set to:
- "Forw Analog Out"
- "Refl Analog Out"

Enter the measurement value that corresponds to 0 V output voltage.

Remote command:
`OUTPut:RECorder<output>:LIMit:LOWer:CCDF`
`OUTPut:RECorder<output>:LIMit:LOWer:POWer`
`OUTPut:RECorder<output>:LIMit:LOWer:RATio:RCOefficient`
`OUTPut:RECorder<output>:LIMit:LOWer:RATio:RFRatio`

```
OUTPut:RECorder<output>:LIMit:LOWer:RATio:RLOSs
OUTPut:RECorder<output>:LIMit:LOWer:RATio:SWR
OUTPut:RECorder<output>:LIMit:LOWer:RATio[:VALue]
```

2.5 V Equivalent ← I/O 1, I/O 2 tabs
Available if Mode is set to:
- "Forw Analog Out"
- "Refl Analog Out"

Enter the measurement value that corresponds to 2.5 V output voltage.

Remote command:

```
OUTPut:RECorder<output>:LIMit:UPPer:CCDF
OUTPut:RECorder<output>:LIMit:UPPer:POWer
OUTPut:RECorder<output>:LIMit:UPPer:RATio:RCOefficient
OUTPut:RECorder<output>:LIMit:UPPer:RATio:RFRatio
OUTPut:RECorder<output>:LIMit:UPPer:RATio:RLOSs
OUTPut:RECorder<output>:LIMit:UPPer:RATio:SWR
OUTPut:RECorder<output>:LIMit:UPPer:RATio[:VALue]
```

Fail Voltage ← I/O 1, I/O 2 tabs
Available if Mode is set to:
- "Forw Limit Violation"
- "Refl Limit Violation"

Sets the fail voltage that is output if a measured value causes a limit violation.

"Low" 0 V

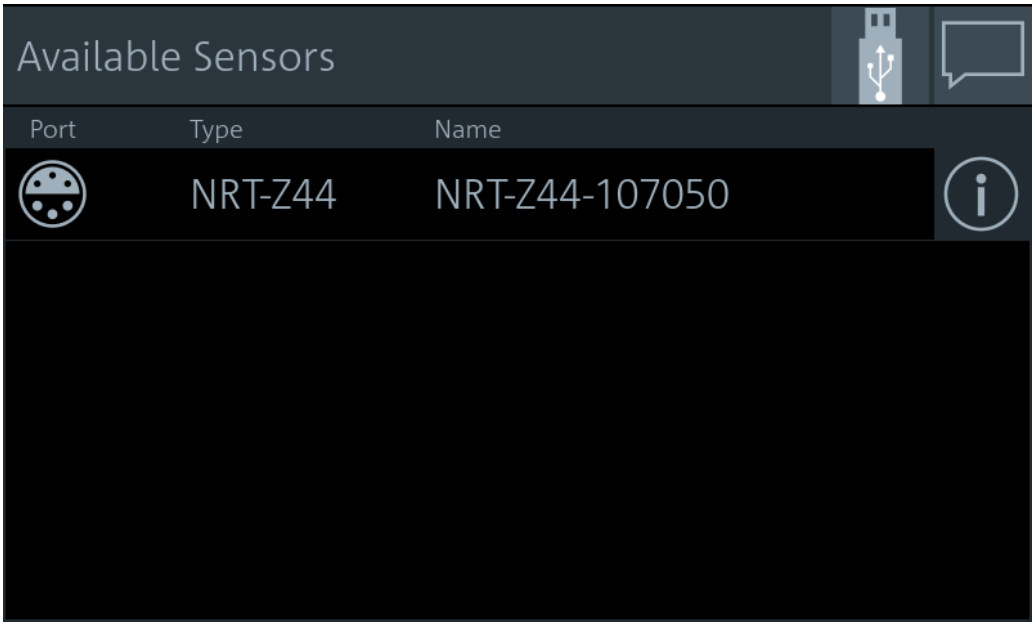
"High" 3.3 V

Remote command:

```
[SENSe<Sensor>:]POWer:REFLection:RANGe:AUTO
[SENSe<Sensor>:]POWer[:POWer]:RANGe:LIMit:DETect
OUTPut:LIMit:FAIL
```

9.1.4 Sensor management

Access: [System] > "Connections" > "Sensor Manager"



The R&S NRT2 displays the recognized sensors.

Table 9-1: Information given in the Available Sensors dialog

Column	Description
"Type"	Sensor type
"Name"	Hostname of the sensor
	Info icon Select to open the "Sensor Info" dialog, see "Sensor Info" on page 74.

To display information about a sensor

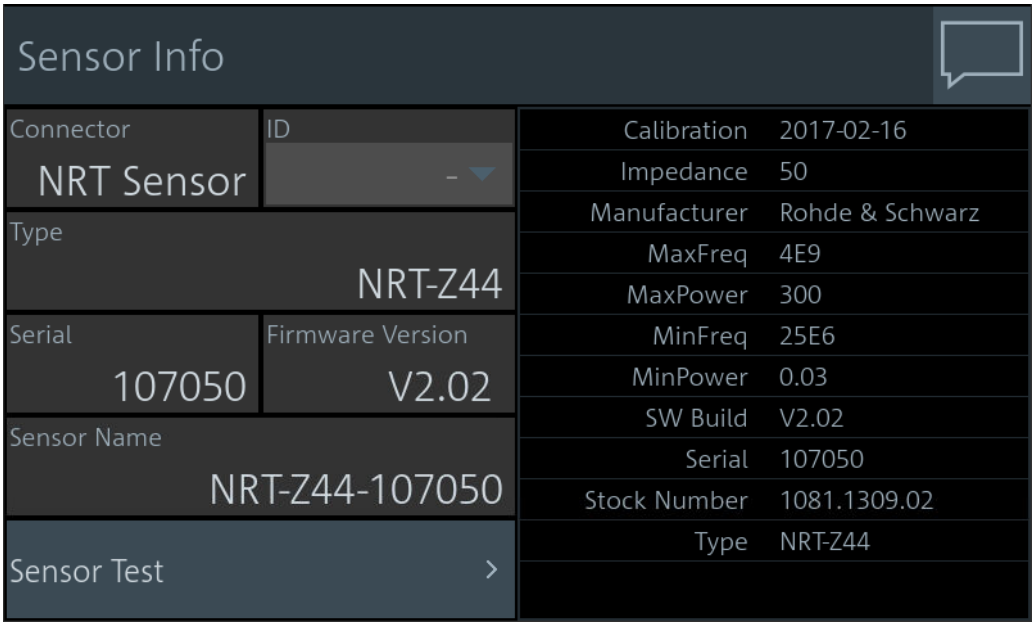
► In the "Available Sensors" dialog, select ⓘ of the sensor of interest.
The "Sensor Info" dialog is displayed, see "Sensor Info" on page 74.

To perform an internal self-test of a sensor

1. In the "Available Sensors" dialog, select ⓘ of the sensor of interest.
2. In the "Sensor Info" dialog, select "Sensor Test".
The "Sensor Test" dialog is displayed, see "Sensor Test" on page 75.

The sensor manager gives access to:

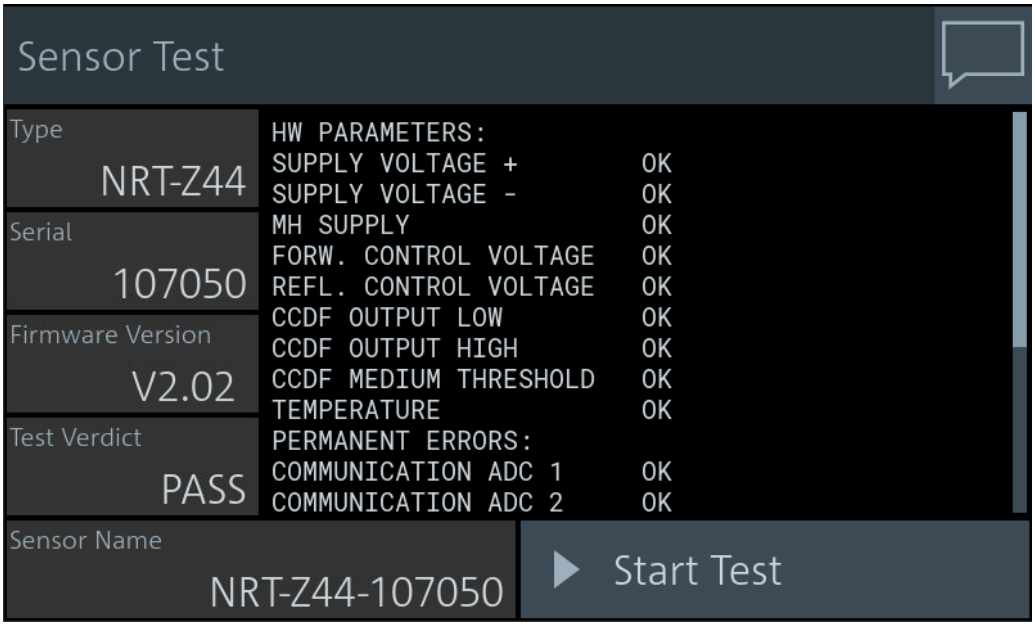
Sensor Info
Access: [System] > "Connections" > "Sensor Manager" > ⓘ
Displays information about the selected sensor, including calibration data.



Remote command:
`[SENSe<Sensor>:]INFormation?`

Sensor Test ← Sensor Info
Access: [System] > "Connections" > "Sensor Manager" > ⓘ > "Sensor Test"

When started, performs an internal self-test of the connected sensor. The internal self-test provides detailed information that you can use for troubleshooting. Do not apply a signal during the internal self-test.



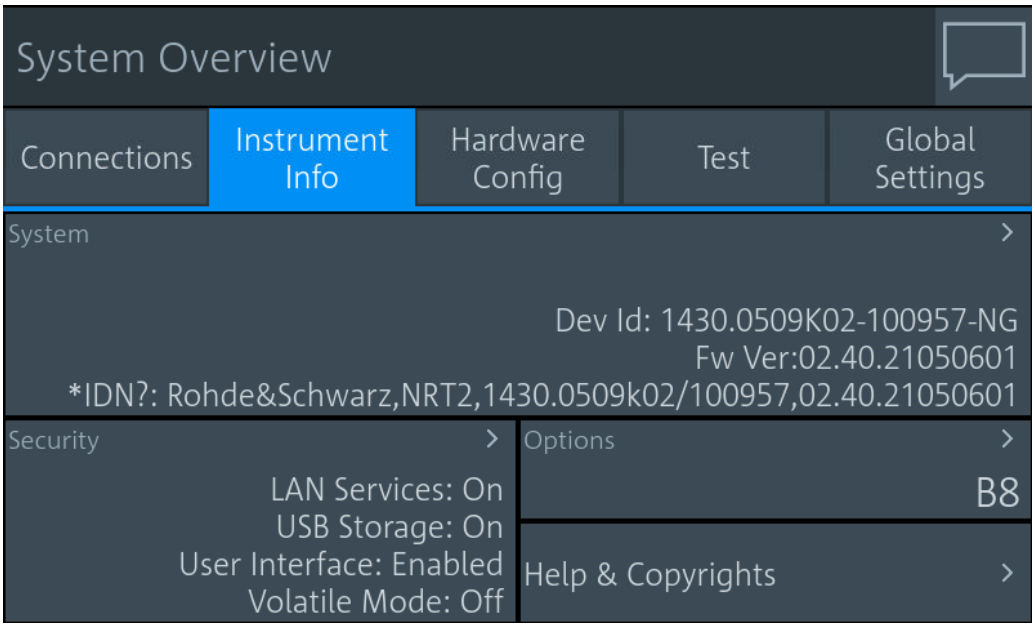
"Test Verdict" Shows the status of the self-test.

Remote command:
`TEST:SENSor<Sensor>?`

9.2 Instrument information

Access: [System] > "Instrument Info"

For displaying information on a connected sensor, see "Sensor Info" on page 74.

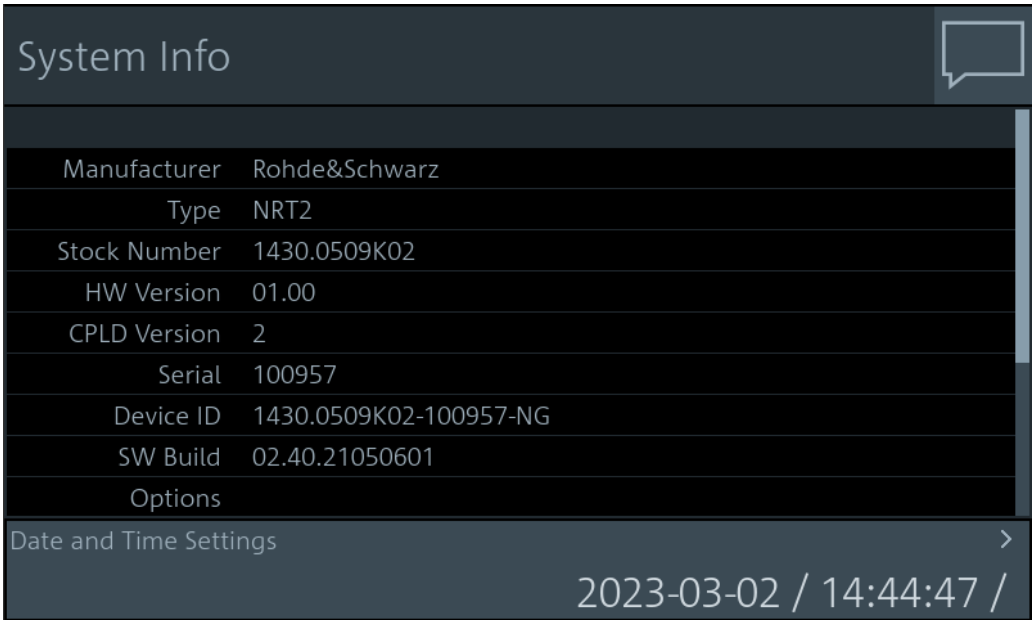


On this tab, you can display and configure the following settings:

9.2.1 System information

Access: [System] > "Instrument Info" > "System"

Displays a list of instrument-specific parameters.



System Info
Displays the information on the R&S NRT2:

- "Manufacturer"
- "Type"
- "Stock Number"
  See Section 3.2.2.6, "Name plate", on page 29.
- "HW Version"
- "CPLD Version"
  Complex programmable logic device (CPLD) version
- "Serial"
- "Device ID"
  See Section 3.2.2.6, "Name plate", on page 29.
- "SW Build"
  Version of software build
- "Options"
  Short names of the installed options
- "MAC Address"
  Ethernet hardware address
- "Hostname"
  See "Host Name" on page 66.
- "IP Address"
  See "IP Address" on page 66.
- "*IDN?"

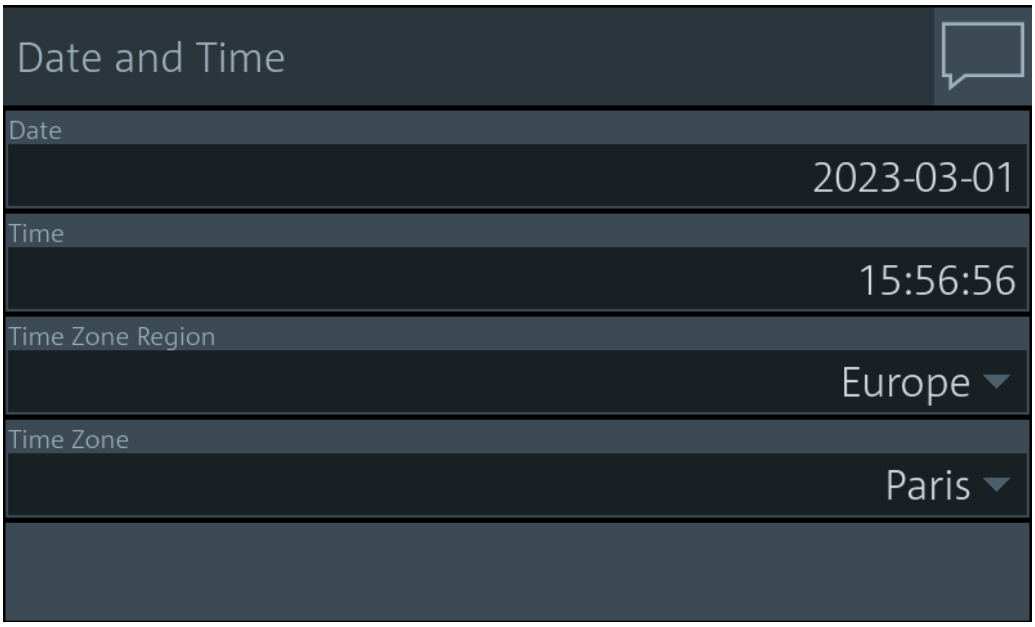
Instrument identification string: <manufacturer>,NRT2,<serial number>,<firmware version>

- "*OPT?"
  Option identification string; lists the installed options: <option 1>, <option 2>,....
- "Uptime"
  Operating time of the R&S NRT2

Remote command:

```
SYSTem:INFO[:INFO]?
SYSTem:DID?
SYSTem:DEVice:ID?
```

Date and Time Settings
Opens the "Date and Time" dialog.



Date ← Date and Time Settings
Sets the date in the format YYYY-MM-DD.

Remote command:

```
SYSTem:DATE
SYSTem:DATE:UTC
SYSTem:DATE:LOCal
```

Time ← Date and Time Settings
Sets the time in the format HH:MM:SS.

Remote command:

```
SYSTem:TIME
SYSTem:TIME:UTC
SYSTem:TIME:LOCal
```

Time Zone Region ← Date and Time Settings
Sets the time zone region.

Remote command:
SYSTem:TIME:DSTime:RULE
SYSTem:TIME:DSTime:RULE:CATalog?

Time Zone ← Date and Time Settings
Sets the time zone.

Remote command:
SYSTem:TIME:DSTime:RULE
SYSTem:TIME:DSTime:RULE:CATalog?

9.2.2 Help & copyrights

Access: [System] > "Instrument Info" > "Help & Copyrights"

Gives access to the user manual, open source acknowledgment and license information.

Export User Documentation to USB Stick
Downloads the user manual to a connected USB flash drive. If no USB flash drive is connected, the file is saved to the volatile directory of the FTP directory. Information to the download is displayed in the "Notification Center". See also Section 4.1.3, "Notification center", on page 34.

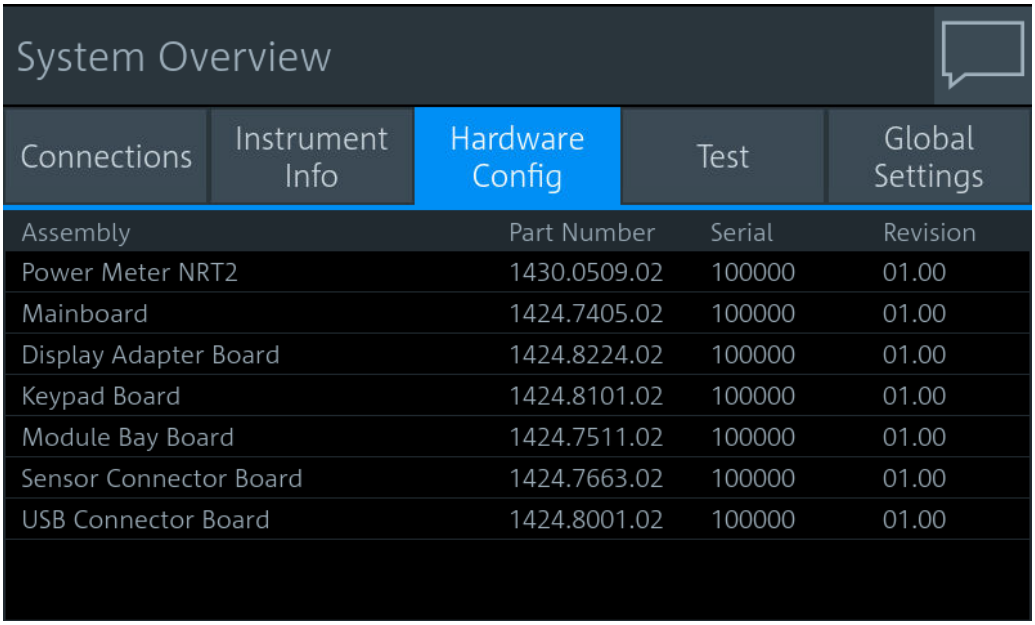
Open Source Achnowledgement
Displays the open source acknowledgment.

Open Source Licenses
Displays the license texts of open source software packages used in the R&S NRT2 software. Under "Component", select the open source software package you want to display the license text of.

LucasFonts RsCorpid EULA
Displays the end user license agreement (EULA) of LucasFonts.

9.2.3 Hardware configuration

Access: [System] > "Hardware Config"



Lists the hardware details of the R&S NRT2 assemblies. This tab can be useful for looking up the revision of hardware, for example when troubleshooting.

9.3 Instrument security management

The individual settings are described in Section 9.3.5, "Security settings", on page 84.

9.3.1 Protecting security-relevant settings

All security settings are protected by the security password. Before you can change a security setting, you have to unlock the security settings by entering the security password. When you leave the "Security" dialog, the settings are locked automatically.

The preconfigured security password is *123456*.

We recommend that you change the preconfigured security password before connecting the R&S NRT2 to a network.

To unlock the security settings for editing

1. Select [System] > "Instrument Info" > "Security" > "General".
2. Enter the security password.

   All settings in the "Security" dialog are enabled for editing.

To change the security password

1. Unlock the security settings. See "To unlock the security settings for editing" on page 81.
2. Change to the "Security password" tab.
3. Enter the new security password.
4. Select "Change Password" to assign the new password.

9.3.2 Managing instrument access

The R&S NRT2 offers the several possibilities to prevent unauthorized access.

9.3.2.1 Setting the instrument password

The instrument password is required for logon and accessing the R&S NRT2, for example by VNC, browser or FTP.

The preconfigured instrument password is *instrument*.

We recommend that you change the preconfigured instrument password before connecting the R&S NRT2 to a network.

To change the instrument password

1. Unlock the security settings. See "To unlock the security settings for editing" on page 81.
2. Change to the "Instrument password" tab.
3. Enter the new instrument password.
4. Select "Change Password" to confirm the new password.

9.3.2.2 Managing storage devices

USB storage

You can allow saving and reading files from USB storage, or you can restrict saving and reading files to the internal memory.

To disable file transfer using USB storage

1. Unlock the security settings. See "To unlock the security settings for editing" on page 81.
2. Select "Off".

Non-volatile and volatile memory

For saving changed settings, you can select between the non-volatile and the volatile memory.

- Volatile memory: Deleted after reboot. Use the volatile mode if you want to reboot with a defined configuration for a measurement setup, regardless of any settings made manually or by remote control.
- Non-volatile memory: Remains unaffected by a reboot.

To save changed settings in the volatile memory

1. Unlock the security settings. See "To unlock the security settings for editing" on page 81.
2. Select "On".
3. Reboot the R&S NRT2.

   If you change into the volatile mode or back, a reboot is required.

Sanitizing the internal memory

If you have confidential data on the R&S NRT2, you can sanitize the internal memory before removing the R&S NRT2 from your secure environment. For details, see the Section 2.1.3, "Instrument security procedures", on page 14.

9.3.2.3 Restricting manual and remote operation

For security measures, you can restrict the manual and remote operation allowed at the R&S NRT2.

To restrict manual and remote operation

1. Unlock the security settings. See "To unlock the security settings for editing" on page 81.
2. Under "User Interface", select the restriction. Restrictions of various degrees are available, see "User Interface" on page 86.

If you use the R&S NRT2 in a remote operation session, you can set "Display Only" or "Disabled" to make sure that only authorized persons can interrupt the remote session.

To lift the restrictions

Restrictions are indicated by 🔒.

1. Select the touchscreen or any control.
2. Enter the security password.

   The R&S NRT2 sets "User Interface" to "Enabled".

9.3.3 Configuring LAN services

You can enable or disable the LAN services together or individually.

To disable all LAN services together

1. Unlock the security settings. See "To unlock the security settings for editing" on page 81.
2. Change to the "LAN Settings" tab.
3. Under "LAN Services", select "Disabled".

To configure a LAN service individually

1. Unlock the security settings. See "To unlock the security settings for editing" on page 81.
2. Change to the "LAN Settings" tab.
3. Enable or disable the LAN service. Available services see "LAN Settings tab" on page 86.

9.3.3.1 Data exchange using FTP

You can transfer files from and to the R&S NRT2 using FTP (file transfer protocol).

The following directories on the R&S NRT2 are available by FTP:

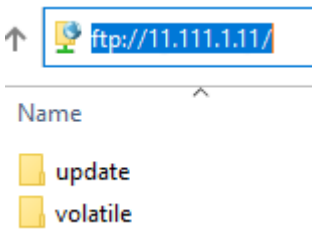
- `update` directory
  Used for firmware update files. See also Section 10.2.4.2, "Using FTP", on page 99.
- `volatile` directory
  Here, the screenshots are saved. You can copy the screenshots to a computer. See also Section 4.1.5, "Creating and saving screenshots", on page 36.

By default, FTP file transfer is enabled. Any user in the network who knows the password and IP address of the R&S NRT2 can access the R&S NRT2 directories.

To exchange data using FTP

1. Establish a network connection between R&S NRT2 and computer. See Section 9.1.1, "Network settings", on page 65.
2. On the computer, start the Windows Explorer.
3. In the address field, enter one of the following:
   - *ftp://<IP address of the instrument>*, for example *ftp://11.111.1.11*
   - *ftp://<host name of the instrument>*

   A logon dialog opens and requests authentication.
4. Enter the user identification and password.
5. Access the directory of your choice.



9.3.4 Securing the firmware update

New firmware packages have an R&S signature. Old firmware packages remain unsigned. By default, the R&S NRT2 allows you to install only firmware packages with a valid R&S signature. Firmware packages with an invalid signature or no signature are rejected. If you want to install an older firmware package that is unsigned, change the setting as follows.

To install unsigned firmware packages

1. Unlock the security settings. See "To unlock the security settings for editing" on page 81.
2. Under "Secure Update Policy", select "All Packages".

After the firmware installation, set "R&S Signed Packages" again.

9.3.5 Security settings

Access: [System] > "Instrument Info" > "Security"

Contains the settings for access rights, LAN security and passwords.

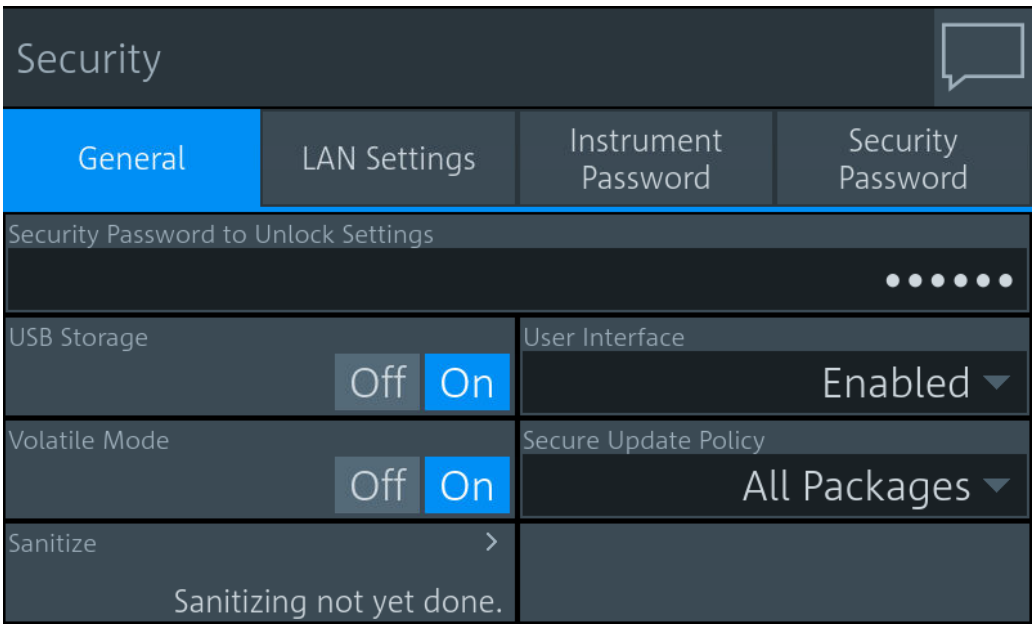
Further information:

- Section 9.3, "Instrument security management", on page 80

The "Security" dialog is divided into the following tabs:

General tab

Configures the access rights for storage devices and restrictions for the user interface.



Security Password to Unlock Settings ← General tab
Enter the password that is required to enable the settings protected by a security password. See also Section 9.3.1, "Protecting security-relevant settings", on page 80.

USB Storage ← General tab
Enables or disables the file transfer using USB storage. See also "USB storage" on page 82.

Volatile Mode ← General tab
If enabled, the R&S NRT2 saves changed settings in the volatile memory. See also "Non-volatile and volatile memory" on page 82.

Sanitize ← General tab
Sanitizes the internal memory. Sanitization requires the security password. For details, see the Section 2.1.3, "Instrument security procedures", on page 14.

User Interface ← General tab
Opens a dialog to restrict the manual and remote operation allowed at the R&S NRT2. See also Section 9.3.2.3, "Restricting manual and remote operation", on page 82.

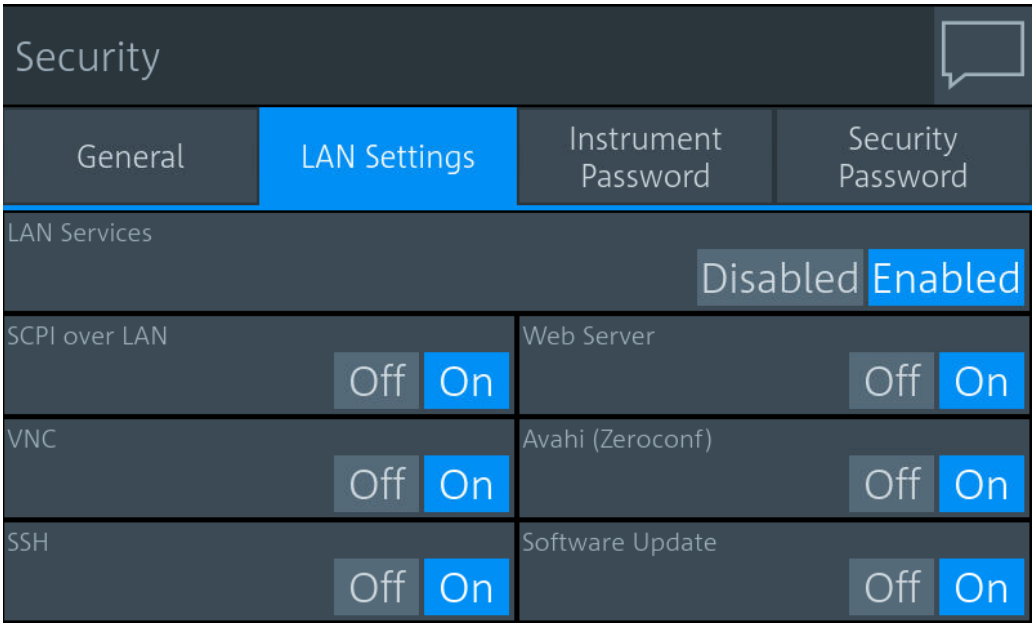
"Enabled"	Enables manual operation. The screen and all manual controls are working. Remote operation is also enabled.
"VNC Only"	Disables manual operation. Remote operation remains enabled. The screen remains on. Anyone at the R&S NRT2 can read the screen contents.
"Display Only"	Disables manual and remote operation. Both remain blocked until you enter the security password. The screen remains on. Anyone at the R&S NRT2 can read the screen contents.
"Disabled"	Disables manual and remote operation. Both remain blocked until you enter the security password. The screen only displays a padlock symbol 🔒, thus preventing unauthorized reading.

Remote command:
See Section 11.8.5, "Locking", on page 166.

Secure Update Policy ← General tab
Allows you to configure the automatic signature verification that is performed before firmware installation. See also Section 9.3.4, "Securing the firmware update", on page 84.

"All Packages"	You can install firmware packages with a valid R&S signature and firmware packages without a signature.
"R&S Signed Packages"	You can install only firmware packages with a valid R&S signature.

LAN Settings tab
Configures the LAN services together or individually. See also Section 9.3.3, "Configuring LAN services", on page 83.



LAN Services ← LAN Settings tab
Enables or disables the LAN services together. If enabled, it provides remote access via all unlocked services.

SCPI over LAN ← LAN Settings tab
Enables or disables the access over LAN to control the R&S NRT2 remotely by using SCPI (standard commands for programmable instruments) commands. See also Section 4.3, "Remote control", on page 38.

VNC ← LAN Settings tab
Enables or disables access using a virtual network computing (VNC) interface, a graphical desktop sharing system that uses RFB protocol to control the R&S NRT2 remotely. See also Section 4.2, "Remote operation", on page 37.

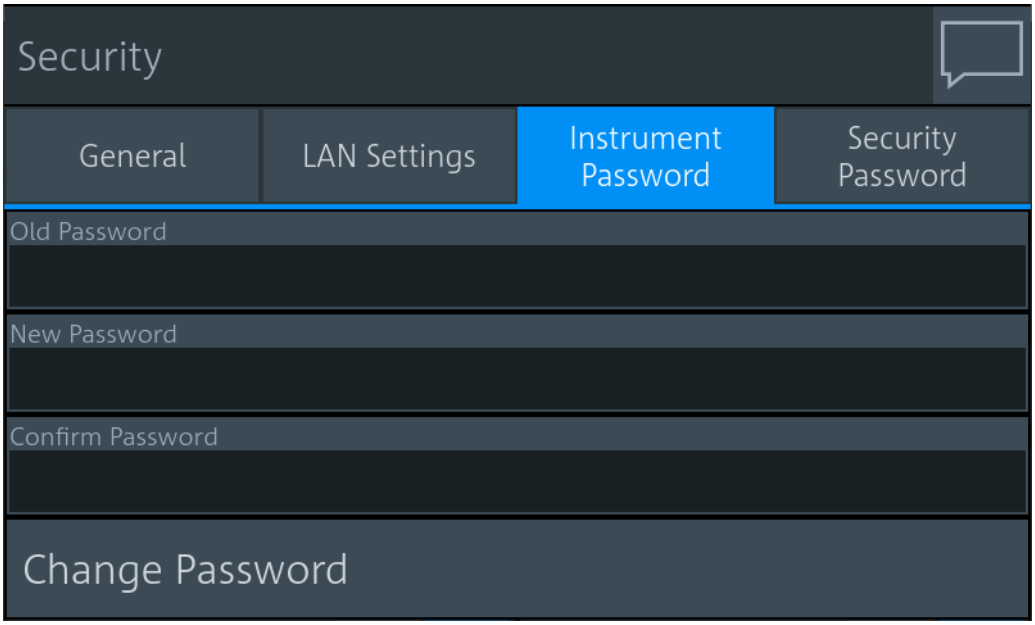
SSH ← LAN Settings tab
Enables or disables copying files using system and communications protections (SCP). Usually, these files are screenshots that you retrieve from the R&S NRT2. An interactive shell access using a secure shell (SSH) is not supported.

Web Server ← LAN Settings tab
Enables or disables a web server that is required to access using a web application. See also "To set up a connection using a browser" on page 37.

Avahi (Zeroconf) ← LAN Settings tab
Enables or disables Avahi, a service for automatic configuration of the R&S NRT2 in a network environment.

Software Update ← LAN Settings tab
Enables or disables the firmware update over LAN. See also Section 10, "Firmware update", on page 95.

Instrument Password tab
Used to change the instrument password. See also Section 9.3.2.1, "Setting the instrument password", on page 81.



Old Password ← Instrument Password tab
Currently used instrument password.

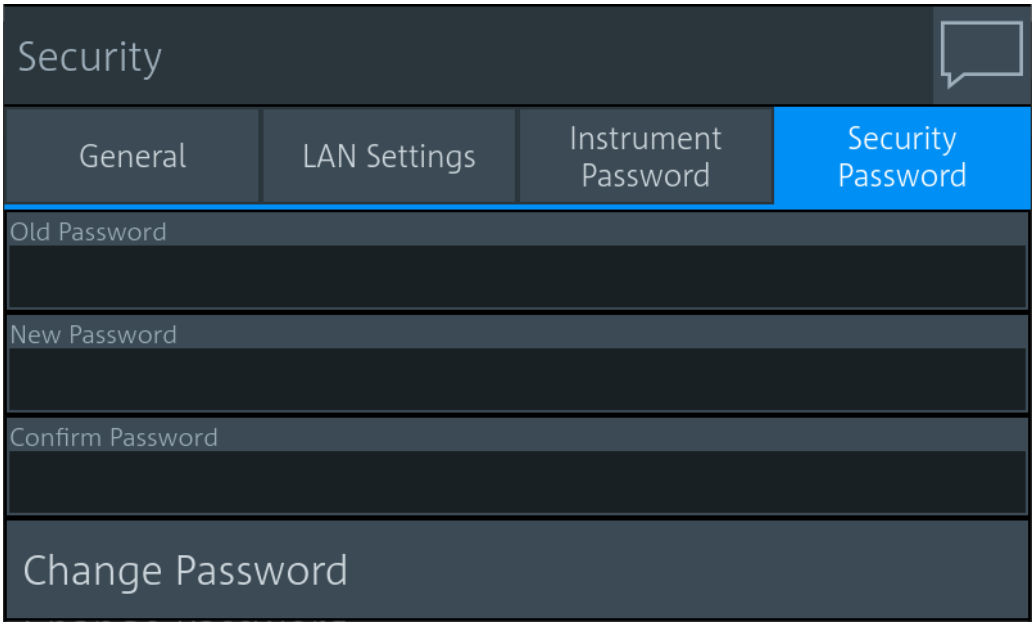
New Password ← Instrument Password tab
New instrument password.

Confirm Password ← Instrument Password tab
New instrument password for confirmation.

Change Password ← Instrument Password tab
Sets the new password as the instrument password.

Remote command:
`SYSTem:SECurity:PASSword:USER` on page 165

Security Password tab
Used to change the security password. The security password is required for changing security settings in the "Security" dialog. See also Section 9.3.1, "Protecting security-relevant settings", on page 80.



Old Password ← Security Password tab
Currently used security password.

New Password ← Security Password tab
New security password.

Confirm Password ← Security Password tab
New security password for confirmation.

Change Password ← Security Password tab
Sets the new password as a security password.

Remote command:
`SYSTem:SECurity:PASSword:SECurity` on page 165

9.4 Option management

For detailed information on available options, see the specifications document or visit:

www.rohde-schwarz.com/brochure-datasheet/NRX

9.4.1 Option settings

Access: [System] > "Instrument Info" > "Options"

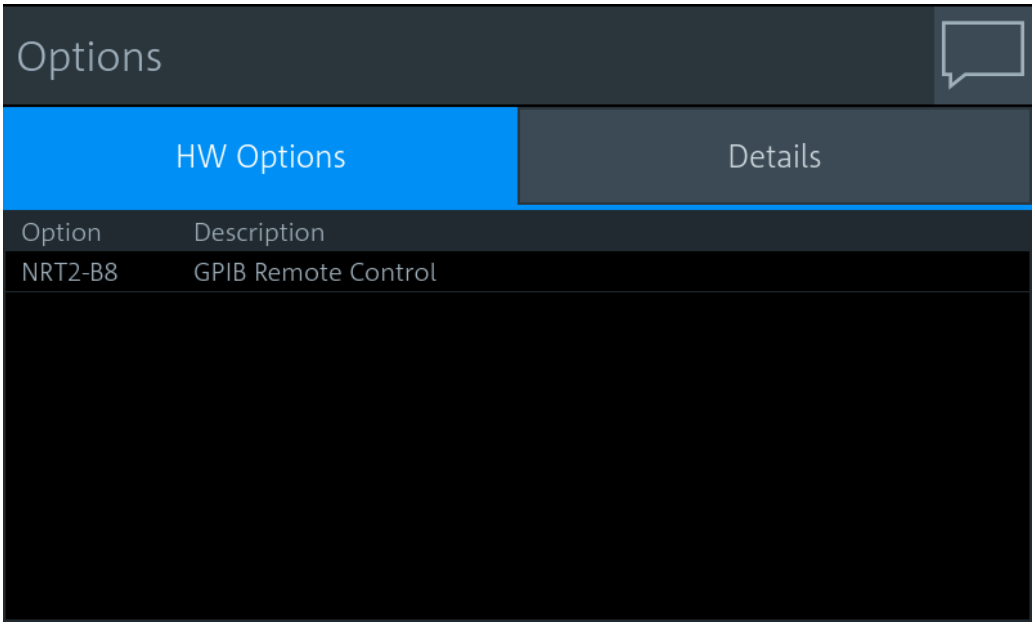
Displays the installed hardware options.

Further information:

- Section 9.2.3, "Hardware configuration", on page 80

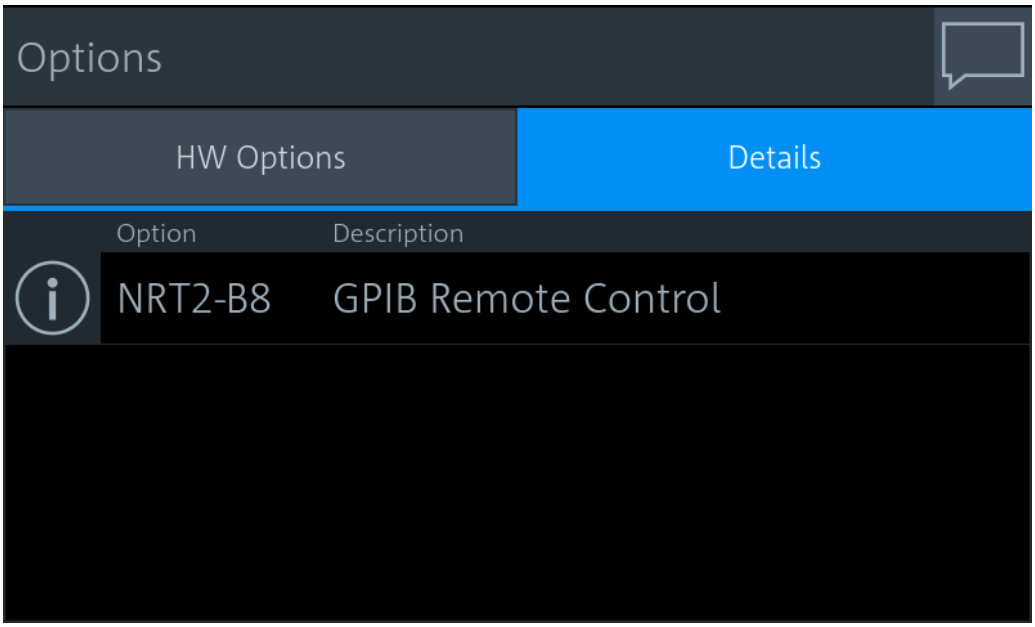
The "Options" dialog contains the following parameters:

HW Options tab
Displays the installed hardware options.

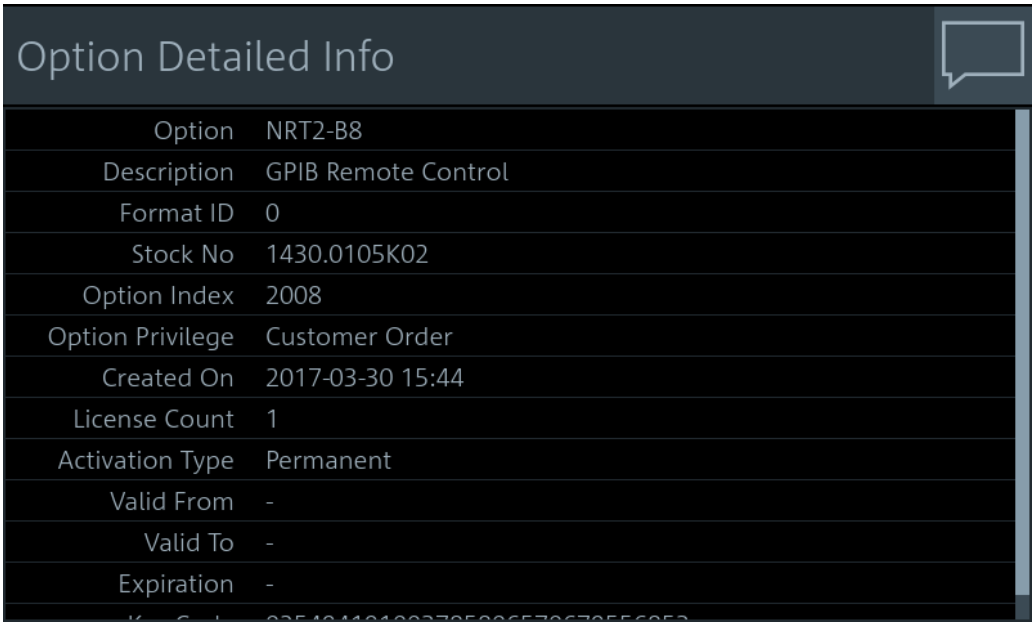


Remote command:
`*OPT?` on page 107

Details tab
Displays the installed hardware options.

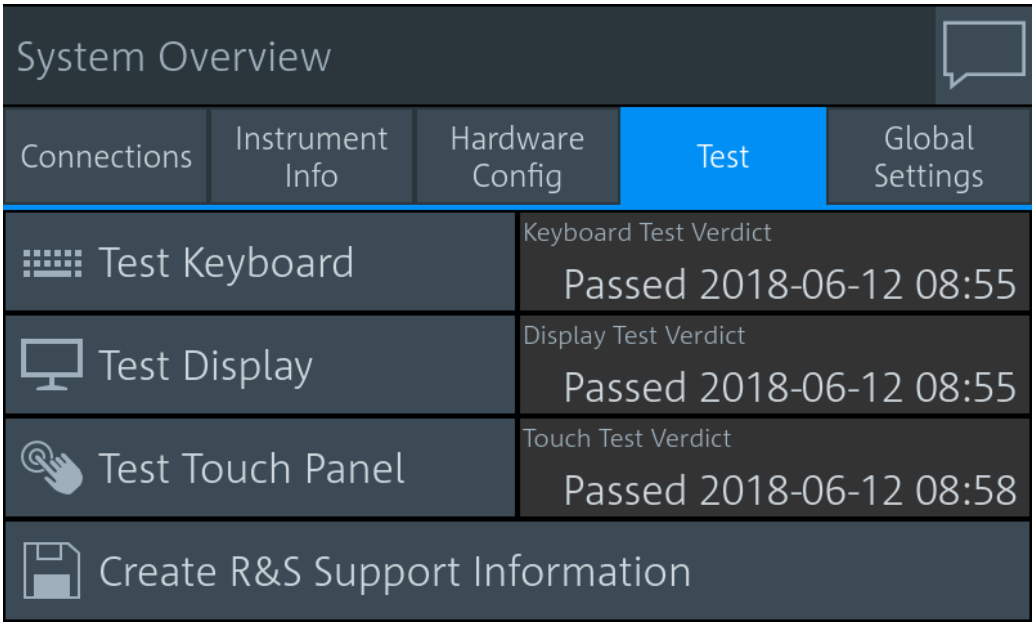


If you want to see more information on a specific option, select ⓘ.



9.5 User interface tests

Access: [System] > "Test"



On this tab, you can test whether the user interfaces are in working order and create information useful for troubleshooting.

For testing a connected sensor, see "Sensor Test" on page 75.

Testing the user interfaces

1. Select the test that you want to perform.

   A dialog with detailed test instructions is displayed.

2. Read and follow the instructions.

3. Exit the test.

   Note: "Exit with PASS" only becomes available when the test is finished successfully.

   The results, passed or failed, are displayed for each test.

Remote command:

Creating information for troubleshooting

You can save information for troubleshooting on a memory stick.

1. Connect a memory stick to one of the USB interfaces.

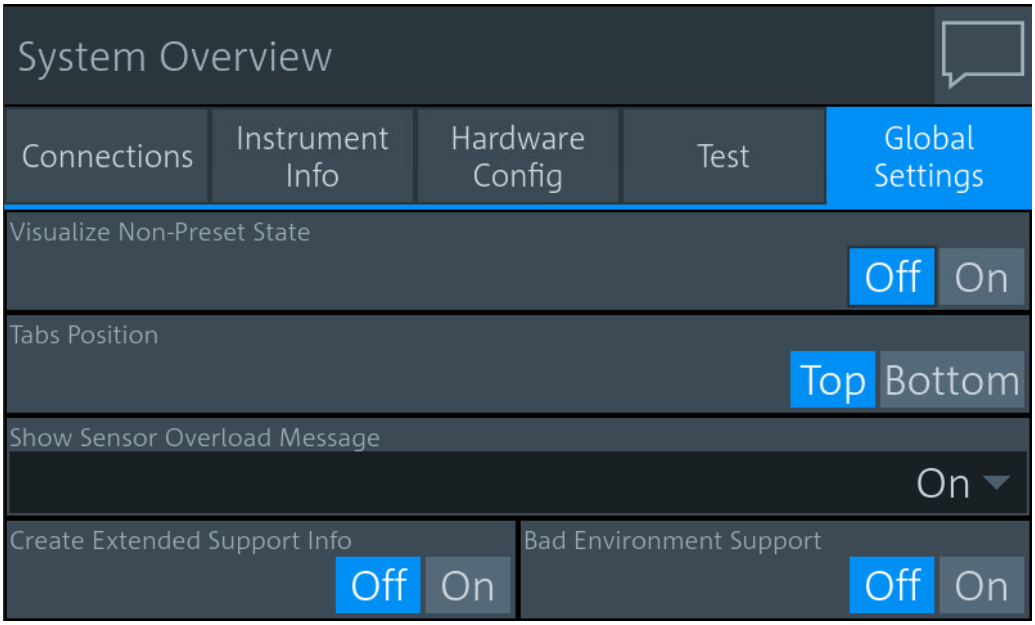
2. Select "Create R&S Support Information".

   The created archive file (`*.tar.gz`) contains the following information:
   - Software errors
   - Hardware status
   - Current device footprint
   - Current device settings
   - Log files, if available. To create them, enable Create Extended Support Info.

   If a memory stick is connected and USB storage is allowed, the archive file is saved there. See also "USB Storage" on page 86.

9.6 Global settings

Access: [System] > "Global Settings"



On this tab, you configure the following settings:

Visualize Non-Preset State
If enabled, a setting that differs from the preset value is indicated by a pencil symbol.

The control elements in the hierarchies above that are leading to this setting are marked, too. Thus, you can find the setting easily if you want to use a preset value.

Tabs Position
Specifies the position of the tabs in dialogs, top or bottom.

Show Sensor Overload Message
If enabled, shows the sensor overload message. Overload can damage the sensor, depending on the amount of power and the duration of the overload condition. The maximum power is specified in the specifications document of the sensor.

You can also query the maximum power using `[SENSe<Sensor>:]INFormation?`.

Remote command:
`DISPlay:OVERload[:STATe]` on page 113

Create Extended Support Info
If enabled, the R&S NRT2 creates log files that are saved onto the flash memory. The logging process can slow down the R&S NRT2.

The saved log files are used as support information for troubleshooting. See "Creating information for troubleshooting" on page 92.

Bad Enviroment Support
If enabled, reduces the data rate to the sensor to the basic data rate defined by USB 1.0, 12 Mbit/s. The reduction of the data rate makes the USB connection more stable. We recommend that you enable this feature only after you discussed your problem with our customer support. See also Section 13.5, "Contacting customer support", on page 199.

10 Firmware update

This section describes installing or updating the firmware on the R&S NRT2.

10.1 Downloading the firmware update file

Firmware update files of R&S power meters generally have an RSU extension, RSU meaning Rohde & Schwarz update.

To download the RSU file

1. Download the most recent firmware version from the Rohde & Schwarz homepage on the internet. The latest firmware update files are available at: www.rohde-schwarz.com/firmware/NRT2
2. Save the RSU file on the computer.
3. If the RSU file is packed in a `*.zip` archive, extract it.

10.2 Firmware update using a PC

In this procedure, you use a PC connected to the R&S NRT2 by USB or Ethernet.

Use the Firmware Update program to load new firmware to the R&S NRT2. It is part of the R&S NRP-Toolkit.

10.2.1 Hardware requirements

Hardware requirements when using a USB connection:

- PC has a free USB port.
- USB cable (USB-A plug to USB-B plug).

Hardware requirements when using an Ethernet connection:

- PC and instrument are connected to an Ethernet network.
- Ethernet cable.

10.2.2 Software requirements

Make sure that your PC meets the following software requirements:

- Operating system Microsoft Windows 7, Microsoft Windows 8 or Microsoft Windows 10
- R&S NRP-Toolkit software is installed on your PC. It includes the Firmware Update program.

- *Recent VISA software is installed on your PC.* You can perform a firmware update using the Firmware Update program only if the R&S NRT2 is recognized as a VISA device.
- Rohde & Schwarz update file (`*.rsu`) for the R&S NRT2 is available.

10.2.3 Preparing an update

To prepare an update using a USB connection

1. Check the emulation settings to make sure that the R&S NRT2 is recognized.

   The following settings are required:
   - Native remote command set of the R&S NRT2
   - Default identification string
   - Default option string

   For details and corresponding remote commands, see "Emulations tab" on page 70.

2. Connect the R&S NRT2 to the PC using a USB cable. If the instrument is off, switch it on.

   The PC identifies the new USB hardware shortly afterwards.
   If no recent VISA software is installed, Windows tries in vain to find a USB driver for the R&S NRT2. Accordingly, in the Windows device manager, the R&S NRT2 is highlighted by a yellow exclamation mark. Abort the installation process and install a recent VISA software.

To prepare an update using a network connection

1. Connect the R&S NRT2 to the network. If the instrument is off, switch it on.
   Check that the instrument has an IP address assigned:

   a) Press the [System] hardkey on the front panel.
   b) On the "Connections" tab under "Network", check the "IPV4" status.

   See Figure 9-1.

2. If the instrument has no IP address assigned, do the following:

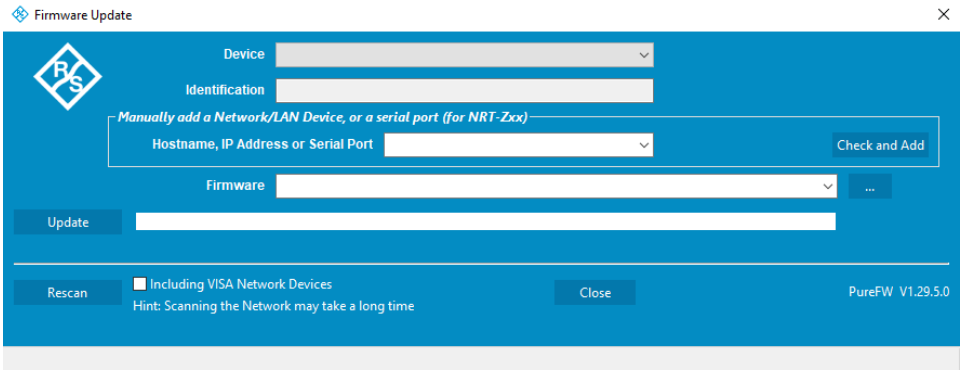
   a) In the "Network" dialog, check whether the network settings are correct.
   b) Check the cable used to connect the instrument to the network.

3. Register the instrument as a VISA device. Refer to the documentation of your VISA software for details.

10.2.4 Updating the firmware

10.2.4.1 Using the Firmware Update program

1. Start the Firmware Update program via "Start menu" > "NRP-Toolkit" > "Firmware Update".



   The program automatically scans for R&S power sensors and meters *connected by USB*. When the scan is completed, all recognized instruments are listed in the "Device" list.

2. If the instrument that you want to update is not listed but connected by USB, select "Rescan" to search for R&S power sensors and meters connected by USB.

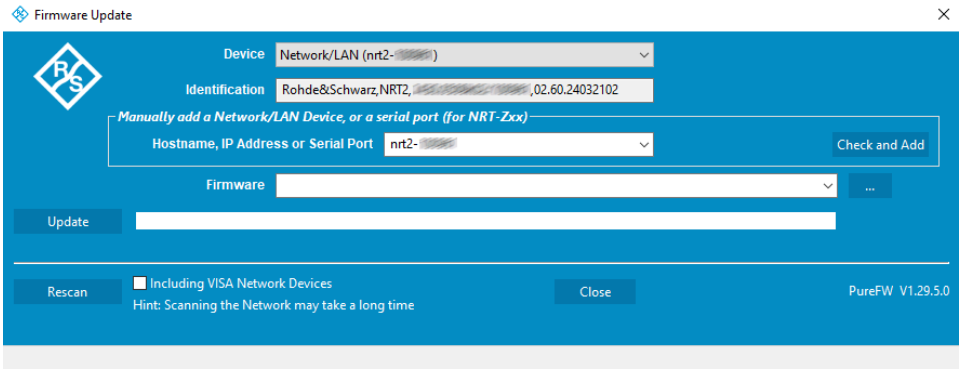
3. If the instrument is connected to a network, perform the following actions under "Manually add a Raw SCPI Device":

   a) Enter the host name or the IP address of the instrument.
   b) Select "Check and Add".

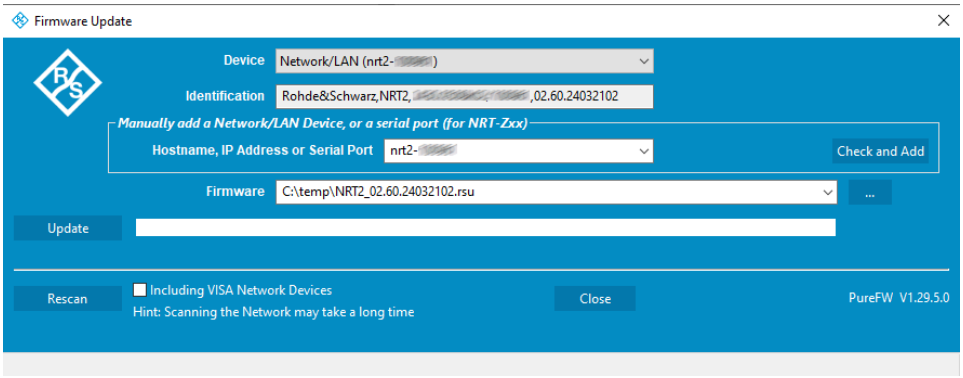
   The program searches for the specified instrument on the network and adds it to the "Device" list.

4. If the instrument is still not listed, see "Troubleshooting: Instrument is not recognized" on page 98.

5. In the "Device" list, select the instrument that you want to update.



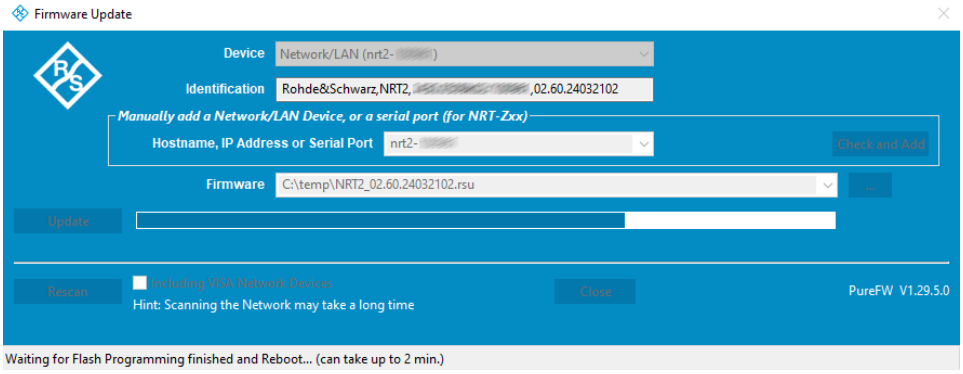
6. Under "Firmware", do one of the following:
   - Enter the full path and filename of the update file.
   - Select the "..." button to browse the file system for it.



7. **NOTICE!** Do not disconnect the power supply while an update is in progress. Interrupting the power supply during the firmware update will most likely lead to an unusable device which needs to be sent in for maintenance.

   Select "Update".

   The new firmware is downloaded and installed on the instrument.



   During the update process, the progress is shown. The update sequence can take a couple of minutes.

8. Check if the update was successful. If that is the case, the firmware version under "Identification" is the same as the one displayed under "Firmware".

Troubleshooting: Instrument is not recognized

► Scan for VISA network devices automatically. This procedure can be more time-consuming than adding the device manually.

a) Enable "Including VISA Network Devices".
b) Select "Rescan".

► Check whether a VISA library is installed on the computer.
If no VISA library is installed on the computer, no VISA instrument is accessible.

► If a network connection is used, check whether the instrument is registered as a VISA device.

10.2.4.2 Using FTP

Prerequisite:

- The R&S NRT2 and the computer are connected by a LAN connection. See also "To prepare an update using a network connection" on page 96.

1. Access the R&S NRT2 using FTP. See the user manual, section "Data exchange using FTP", for details.
2. Copy the firmware update file (`*.rsu`) into the `update` directory.

   When the copying process is completed, the firmware update starts automatically.

10.3 Firmware update using a memory stick

In this procedure, you use a memory stick to install or update the firmware on the R&S NRT2.

The R&S NRT2 supports this update method from version 02.xx of the installed firmware. With version 01.xx installed, perform an update to version 02.xx or later with the method described in section Section 10.2, "Firmware update using a PC", on page 95 first.

10.3.1 Hardware and software requirements

Make sure to meet the system requirements when performing a firmware update using a memory stick:

- PC or mobile device with a free USB port running any operating system and software that supports copying files to the memory stick.
- Memory stick (USB 2.0 or 3.0, with USB-A plug, FAT32 file system, and sufficient space for the firmware file)
- Rohde & Schwarz update file (`*.rsu`) for the R&S NRT2 must be available.

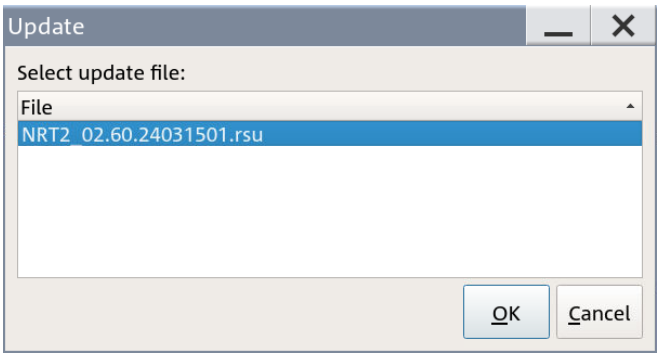
10.3.2 Preparing an update

1. Copy the Rohde & Schwarz update file to the root directory of the memory stick.
2. Disconnect the memory stick from the PC or mobile device. If the instrument is off, switch it on.

10.3.3 Updating the firmware

1. Connect the memory stick to the front or rear USB host port of the R&S NRT2.

   Shortly afterwards, the instrument identifies the memory stick. A dialog displays the Rohde & Schwarz update file stored on the memory stick.



2. If there are more than one available Rohde & Schwarz update files, select the file you want to use for the update.

   The latest version is displayed on top of the list.

3. **NOTICE!** Do not disconnect the power supply while an update is in progress. Interrupting the power supply during the firmware update will most likely lead to an unusable device which needs to be sent in for maintenance.

   Select "OK" to start the update process.

   After copying the Rohde & Schwarz update file to internal memory, a dialog asks you to remove the installation medium (memory stick).

4. Remove the memory stick.
   If you do not remove the memory stick, the firmware update process will start anew after the reboot. In this case, interrupt the second installation by selecting "Cancel" when the "Update" dialog appears.

5. Select "OK" to reboot the instrument.

11 Remote control commands

11.1 Conventions used in SCPI command descriptions

The following conventions are used in the remote command descriptions:

- *Command usage*
  If not specified otherwise, commands can be used both for setting and for querying parameters.
  If a command can be used for setting or querying only, or if it initiates an event, the usage is stated explicitly.
- *Parameter usage*
  If not specified otherwise, a parameter can be used to set a value, and it is the result of a query.
  Parameters required only for setting are indicated as "Setting parameters".
  Parameters required only to refine a query are indicated as "Query parameters".
  Parameters that are only returned as the result of a query are indicated as "Return values".
- *Conformity*
  Commands that are taken from the SCPI standard are indicated as "SCPI confirmed". All commands used by the R&S NRT2 follow the SCPI syntax rules.
- *Asynchronous commands*
  A command which does not automatically finish executing before the next command starts executing (overlapping command) is indicated as an "Asynchronous command".
- *Reset values (*RST)*
  Default parameter values that are used directly after resetting the instrument (`*RST` command) are indicated as "*RST" values, if available.
- *Default unit*
  The default unit is used for numeric values if no other unit is provided with the parameter.

Units

Units and prefixes, as defined by the international system of units (SI), are allowed and recognized. If you need decimal multiples and submultiples of a unit, you can use SCPI prefixes. Because SCPI uses only capital letters, it cannot distinguish between upper and lower case characters. Therefore, if SI prefixes use the same letter in upper and lower case, SCPI defines the meaning. An example is milli (m) and mega (M). In SCPI, M means milli for all units except Hz and Ohm - `MHZ` means mega Hz, 10^6 Hz.

Table 11-1: SCPI prefixes

Factor	SI name	SI symbol	SCPI prefix
10^3	kilo	k	K
10^6	mega	M	MA; also allowed are MOHM and MHZ

Factor	SI name	SI symbol	SCPI prefix
10^{9}	giga	G	G
10^{12}	tera	T	T
10^{-3}	milli	m	M Exception: Hz and Ohm
10^{-6}	micro	µ	U
10^{-9}	nano	n	N
10^{-12}	pico	p	P

11.2 Common commands

The common commands are taken from the IEEE 488.2 (IEC 625–2) standard. The headers of these commands consist of an asterisk * followed by three letters.

&ABO

Device clear

Usage: Event

&DFC

Disable flow control

Usage: Event

&GET

Group execute trigger

Usage: Event

&GTL

Go to local

Usage: Event

&GTM

Go to local with remote state

Usage: Event

&GTR

Go to remote

Usage: Event

&HFC

Hardware flow control

Usage: Event

&LLO

Local lockout

Usage: Event

&NREN

Not remote enabled (go to local)

Usage: Event

***CLS**

Clear status. Resets the following:

- Status byte (`STB`)
- Standard event register (`ESR`)
- `EVENt` part of the `QUEStionable` and the `OPERation` register
- Error/event queue

The command does not change the `ENABle` and `TRANsition` parts of the registers.

Usage: Event

***DEV** [<instrument_no>]

Fixed value.

Parameters:
<instrument_no> 0

***DMC** <Label>, <Macro>
***DMC?** <Label>

Defines a macro command.

Parameters:
<Macro>

Parameters for setting and query:
<Label>

***EMC** <Enable>

Enables a macro command.

Parameters:
<Enable>

***ESE** <register>

Event status enable

Sets the event status enable register to the specified value. The query returns the contents of the event status enable register in decimal form.

Parameters:

<register>	Range:	0 to 255
	*RST:	0

***ESR?**

Event status read

Returns the contents of the event status register in decimal form (0 to 255) and then sets the register to zero.

Usage: Query only

***GCLS**

Clears all status information in all internal "instruments".

Usage: Event

***GMC?** <Label>

Get macro content.

Query parameters:
<Label>

Return values:

<Macro>	<dblock>

Usage: Query only

***GOPC?**

Analog of `*OPC?` for all instruments in multichannel device.

Return values:

<gopc>	`1` is return if all pending operations in all internal instruments are finished.

Usage: Query only

***GWAI**

Waits for all pending operations in all internal "instruments".

Usage: Event

***IDN?**

Identification

Returns a string containing information on the identity of the sensor (device identification code). In addition, the version number of the installed firmware is indicated.

Usage: Query only

***IST?**

Individual status

Returns the current value of the IST flag in decimal form. The IST flag is the status bit which is sent during a parallel poll.

Usage: Query only

***LMC?**

List macro commands.

Return values:
<Label>

Usage: Query only

***OPC**

Operation complete

Sets bit 0 in the event status register when all preceding commands have been executed. Send this command at the end of a program message. It is important that the read timeout is set sufficiently long.

The query always returns `1` because the query waits until all previous commands are executed.

`*OPC?` basically functions like `*WAI`, but also returns a response. The response is an advantage, because you can query the execution of commands from a controller program before sending new commands. Thus preventing overflow of the input queue when too many commands are sent that cannot be executed.

***OPT?**

Option identification

Returns a comma-separated list of installed options.

Usage: Query only

Manual operation: See "HW Options tab" on page 90

***PMC**

Purge macro command.

Usage: Event

***PRE** <register>

Parallel poll register enable

Sets the parallel poll enable register to the specified value or queries the current value.

Parameters:

<register> Range: 0 to 255
*RST: 0

***PSC** <psc>

Writes/reads the power on status clear flag (PSC).

Parameters:

<psc> Power on status clear flag.

***RCL** <num>

ReCaLl

Recalls the instrument settings from the specified intermediate memory.

Setting parameters:

<number> Number of the intermediate memory
Range: 0 to 19
*RST: 0

Usage: Setting only

Manual operation: See "Recall" on page 61

***RMC** <Label>

Remove macro content.

Setting parameters:
<Label>

Usage: Setting only

***RST**

Sets the instrument to a defined initial state, a so-called reset. The default settings are indicated in the description of commands as *RST value.

The command corresponds to `SYSTem:PRESet`.

Usage: Event

Manual operation: See "Preset" on page 61

***SAV** <num>

SAVe

Saves the current instrument settings in the specified intermediate memory.

Setting parameters:
<number> Number of the intermediate memory
Range: 0 to 19
*RST: 0

Usage: Setting only

Manual operation: See "Save" on page 61

***SRE** <register>

Service request enable

Sets the service request enable register to the specified value. This command determines under which conditions a service request is triggered.

Parameters:
<register> Range: 0 to 255
*RST: 0

***SRQ?** [<timeout>]

A generic `srq wait` command to be used without `srq event transport`. It is read from the interface.

Query parameters:
<timeout>

Return values:
<srq>

Usage: Query only

***STB?**

Status byte

Returns the contents of the status byte in decimal form.

Usage: Query only

***TRG**

Trigger

Triggers a measurement if the following conditions are met:

- Sensor is in the waiting for trigger state.
- Trigger source is set to `BUS`.

See `TRIGger<Measurement>[:CHANnel<Channel>]:SOURce` on page 132

Usage: Event

***TST?**

Self-test

Triggers a self-test of the sensor and outputs the result. `0` indicates that no errors have occurred.

Usage: Query only

***WAI**

Wait to continue

Prevents the execution of the subsequent commands until all preceding commands have been executed and all signals have settled.

Usage: Event

***XESE** <xese>

Specifies the standard event status enable register (ESE). This register determines which events from the standard event status register (ESR) are summarized in bit 5 (the event summary bit ESB) of the status byte.

Parameters:
<xese> <expr>

***XESR?**

Reads and clears the standard event status register (ESR).

Return values:
<xesr> <expr>

Usage: Query only

***XPRE** <xpre>

Reads or writes the parallel PLL enable register (PRE).

Parameters:
<xpre> <expr>
Parallel poll enable register.

***XSRE** <xsre>

Reads or writes the service request enable register. Used to enable service requests.

Parameters:
<xsre> <expr>
Service request enable register (SRE).

***XSTB?**

Reads the status byte.

Return values:
<xstb> <expr>
Status byte (STB).

Usage: Query only

11.3 Measurement settings and results

Example: Running a measurement

```
::
:: <…various settings…>
::
TRIG:MODE FREerun
::
TRIGger
SENSe:DATA?
::
TRIGger
SENSe:DATA?
::
```

Further information:

- Section 5, "Measurement and display configuration", on page 40

11.3.1 Configuring display and results

Further information:

- Section 5.4, "Display settings", on page 46

11.3.1.1 General settings

CALCulate<Measurement>:DMODe <mode>

Specifies the display format of the measured values.

Suffix:
<Measurement> 1
Measurement

Parameters:
<mode> SDIGital | SANalog

SDIGital | SANalog
For continuous average, burst average, NRT measurements
Numeric format without/with bar chart

*RST: SANalog

Manual operation: See "Display Format" on page 47

CALCulate<Measurement>:HOLD:FUNCtion <function>

For all measurement functions, the R&S NRT2 stores the maximum and minimum values and the calculated differences between these values.

The selected setting applies to both power and reflection indication. You can change at any time.

Alias: `CALCulate<Measurement>:LIMit<undef>:TYPE`

Suffix:
<Measurement> 1
Measurement

Parameters:
<function> MAX | MIN | DIFFerence

MAXimum
Maximum value

MINimum
Minimum value

DIFFerence
Difference between maximum and minimum value

*RST: MAX

Manual operation: See "Max Hold Function" on page 51

CALCulate<Measurement>:HOLD[:STATe] <state>

If enabled, displays the highest value measured for each point (pixel) of the selected display type.

Alias: `CALCulate<Measurement>:LIMit<undef>[:STATe]`

Suffix:
<Measurement> 1
Measurement

Parameters:
<state> OFF | ON | RESet

*RST: OFF

Manual operation: See "Max Hold" on page 50

CALCulate<Measurement>:LIMit<undef>:TYPE <type>

Alias for `CALCulate<Measurement>:HOLD:FUNCtion` on page 111.

Suffix:
<Measurement> 1
Measurement

<undef> 1 to n
No suffix required.

Parameters:
<type> MAX | MIN | DIFFerence

*RST: MAX

CALCulate<Measurement>:LIMit<undef>[:STATe] <state>

Alias for `CALCulate<Measurement>:HOLD[:STATe]`.

Suffix:
<Measurement> 1
Measurement

<undef> 1 to n
No suffix required.

Parameters:
<state> OFF | ON
*RST: OFF

CALCulate<Measurement>:RESolution <resolution>

Configures the resolution of the measurement.

Suffix:
<Measurement> 1
Measurement

Parameters:
<resolution> I | OI | OOI | OOOI

I
No decimal places, e.g. 1 dBm

OI
1 decimal place, e.g. 0.1 dBm

OOI
2 decimal places, e.g. 0.01 dBm

OOOI
3 decimal places, e.g. 0.001 dBm

*RST: OOI

Manual operation: See "Resolution" on page 47

DISPlay:BRIGthness <brightness>

Enables or disables the display backlight.

Parameters:
<brightness> Range: 0.0 to 1.0
*RST: 1.0

DISPlay:OVERload[:STATe] <state>

If enabled, hides the sensor overload message. But keep in mind that overload can damage the sensor, depending on the amount of power and the duration of the overload condition.

You can look up the allowed maximum power in the specifications document of the sensor.

Parameters:
<state> OFF | ON | NEVer
*RST: ON; but does not apply if NEVer is set.

Manual operation: See "Show Sensor Overload Message" on page 93

[SENSe<Sensor>:]DATA? [<function>]

Queries the measurement result of all active functions or of the specified measurement function. If you restrict the query to a specific measurement function, use the strings listed in `CALCulate<Measurement>[:CHANnel<Channel>]:FEED<Channel>` on page 132.

Suffix:
<Sensor> 1
Configured sensor

Query parameters:
<function>

Usage: Query only

SYSTem:SPEed <mode>

Changes the data processing speed.

Parameters:
<mode> NORMal | FAST | SLOW | FREeze
FAST
The display is switched off and the measured values are no longer displayed, since the continuous update of the screen content requires computation time.
*RST: NORMal

11.3.1.2 Scaling

CALCulate<Measurement>:METer<DirectionalChannel>:LOWer[:DATA]:CCDF <value>

Sets the lower limit for the CCDF bargraph display.

Suffix:
<Measurement> 1
Measurement

<DirectionalChannel> 1 to 2
1 = forward, 2 = reflection (reverse) or 1 = forward, 2 = reflection (reverse)

Parameters:
<value> Range: 0.0 pct to 100.0 pct
*RST: 0.0 pct
Default unit: pct

Manual operation: See "Forward Scale Lower Limit, Reflection Scale Lower Limit" on page 48

CALCulate<Measurement>:METer<DirectionalChannel>:LOWer[:DATA]:RATio:RCOefficient <value>

Sets the lower limit for the reflection coefficient bargraph display.

Suffix:
<Measurement> 1
Measurement

<DirectionalChannel> 1 to 2
1 = forward, 2 = reflection (reverse) or 1 = forward, 2 = reflection (reverse)

Parameters:
<value> Range: -1e18 to 1e18
*RST: 1.0
Default unit: -

Manual operation: See "Forward Scale Lower Limit, Reflection Scale Lower Limit" on page 48

CALCulate<Measurement>:METer<DirectionalChannel>:LOWer[:DATA]:RATio:RFRatio <value>

Sets the lower limit for the ratio of the forward/reverse power bargraph display.

Suffix:
<Measurement> 1
Measurement

<DirectionalChannel> 1 to 2
1 = forward, 2 = reflection (reverse) or 1 = forward, 2 = reflection (reverse)

Parameters:

<value> Range: 0.0 pct to 100.0 pct
*RST: 0.0 pct
Default unit: pct

Manual operation: See "Forward Scale Lower Limit, Reflection Scale Lower Limit" on page 48

CALCulate<Measurement>:METer<DirectionalChannel>:LOWer[:DATA]:RATio:RLOSs <value>

Sets the lower limit for the return loss bargraph display.

Suffix:

<Measurement> 1
Measurement

<DirectionalChannel> 1 to 2
1 = forward, 2 = reflection (reverse) or 1 = forward, 2 = reflection (reverse)

Parameters:

<value> Range: -200.0 dB to 200.0 dB
*RST: -200.0 dB
Default unit: dB

Manual operation: See "Forward Scale Lower Limit, Reflection Scale Lower Limit" on page 48

CALCulate<Measurement>:METer<DirectionalChannel>:LOWer[:DATA]:RATio:SWR <value>

Sets the lower limit for the standing wave ratio (SWR) bargraph display.

Suffix:

<Measurement> 1
Measurement

<DirectionalChannel> 1 to 2
1 = forward, 2 = reflection (reverse) or 1 = forward, 2 = reflection (reverse)

Parameters:

<value> Range: 0.0 to 1e18
*RST: 1.0
Default unit: -

Manual operation: See "Forward Scale Lower Limit, Reflection Scale Lower Limit" on page 48

CALCulate<Measurement>:METer<DirectionalChannel>:LOWer[:DATA]:RATio[:VALue] <value>

Sets the lower limit for the power ratio bargraph display.

If you enter a value without unit, the unit is defined by `UNIT<Measurement>:POWer:RATio`. For further information, see Section 11.3.1.3, "Units", on page 120.

Suffix:
<Measurement> 1
Measurement

<DirectionalChannel> 1 to 2
1 = forward, 2 = reflection (reverse) or 1 = forward, 2 = reflection (reverse)

Parameters:
<value> Range: -180.0 dB to +180.0 dB
*RST: -20.0 dB
Default unit: dB

Manual operation: See "Forward Scale Lower Limit, Reflection Scale Lower Limit" on page 48

CALCulate<Measurement>:METer<DirectionalChannel>:LOWer[:DATA][:POWer] <value>

Sets the lower limit for the power value bargraph display.

If you enter a value without unit, the unit is defined by `UNIT<Measurement>:POWer[:VALue]`. For further information, see Section 11.3.1.3, "Units", on page 120.

Suffix:
<Measurement> 1
Measurement

<DirectionalChannel> 1 to 2
1 = forward, 2 = reflection (reverse) or 1 = forward, 2 = reflection (reverse)

Parameters:
<value> Range: -120.0 dBm to +150.0 dBm
*RST: -60.0 dBm
Default unit: dBm

Manual operation: See "Forward Scale Lower Limit, Reflection Scale Lower Limit" on page 48

CALCulate<Measurement>:METer<DirectionalChannel>:UPPer[:DATA]:CCDF <value>

Sets the upper limit for the CCDF bargraph display.

Suffix:
<Measurement> 1
Measurement

<DirectionalChannel> 1 to 2
1 = forward, 2 = reflection (reverse) or 1 = forward, 2 = reflection (reverse)

Parameters:
<value> Range: 0.0 pct to 100.0 pct
*RST: 100.0 pct
Default unit: pct

Manual operation: See "Forward Scale Upper Limit, Reflection Scale Upper Limit" on page 48

CALCulate<Measurement>:METer<DirectionalChannel>:UPPer[:DATA]:RATio:RCOefficient <value>

Sets the upper limit for the reflection coefficient bargraph display.

Suffix:
<Measurement> 1
Measurement

<DirectionalChannel> 1 to 2
1 = forward, 2 = reflection (reverse) or 1 = forward, 2 = reflection (reverse)

Parameters:
<value> Range: -1e18 to 1e18
*RST: 5.0
Default unit: -

Manual operation: See "Forward Scale Upper Limit, Reflection Scale Upper Limit" on page 48

CALCulate<Measurement>:METer<DirectionalChannel>:UPPer[:DATA]:RATio:RFRatio <value>

Sets the upper limit for the ratio of the forward/reverse power bargraph display.

Suffix:
<Measurement> 1
Measurement

<DirectionalChannel> 1 to 2
1 = forward, 2 = reflection (reverse) or

Parameters:
<value> Range: 0.0 pct to 100.0 pct
*RST: 100.0 pct
Default unit: pct

Manual operation: See "Forward Scale Upper Limit, Reflection Scale Upper Limit" on page 48

CALCulate<Measurement>:METer<DirectionalChannel>:UPPer[:DATA]:RATio:RLOSs <value>

Sets the upper limit for the return loss bargraph display.

Suffix:
<Measurement> 1
Measurement

<DirectionalChannel> 1 to 2
1 = forward, 2 = reflection (reverse) or 1 = forward, 2 = reflection (reverse)

Parameters:
<value> Range: -200.0 dB to 200.0 dB
*RST: 200.0 dB
Default unit: dB

Manual operation: See "Forward Scale Upper Limit, Reflection Scale Upper Limit" on page 48

CALCulate<Measurement>:METer<DirectionalChannel>:UPPer[:DATA]:RATio:SWR <value>

Sets the upper limit for the standing wave ratio (SWR) bargraph display.

Suffix:
<Measurement> 1
Measurement

<DirectionalChannel> 1 to 2
1 = forward, 2 = reflection (reverse) or 1 = forward, 2 = reflection (reverse)

Parameters:
<value> Range: 0.0 to 1e18
*RST: 2.0
Default unit: -

Manual operation: See "Forward Scale Upper Limit, Reflection Scale Upper Limit" on page 48

CALCulate<Measurement>:METer<DirectionalChannel>:UPPer[:DATA]:RATio[:VALue] <value>

Sets the upper limit for the power ratio bargraph display.

If you enter a value without unit, the unit is defined by `UNIT<Measurement>:POWer:RATio`. For further information, see Section 11.3.1.3, "Units", on page 120.

Suffix:
<Measurement> 1
Measurement

<DirectionalChannel> 1 to 2
1 = forward, 2 = reflection (reverse) or 1 = forward, 2 = reflection (reverse)

Parameters:
<value> Range: -180.0 dB to +180.0 dB
*RST: +20.0 dB
Default unit: dB

Manual operation: See "Forward Scale Upper Limit, Reflection Scale Upper Limit" on page 48

CALCulate<Measurement>:METer<DirectionalChannel>:UPPer[:DATA][:POWer]
<value>

Sets the upper limit for the power value bargraph display.

If you enter a value without unit, the unit is defined by `UNIT<Measurement>:POWer[:VALue]`. For further information, see Section 11.3.1.3, "Units", on page 120.

Suffix:
<Measurement> 1
Measurement

<DirectionalChannel> 1 to 2
1 = forward, 2 = reflection (reverse) or 1 = forward, 2 = reflection (reverse)

Parameters:
<value> Range: -120.0 dBm to +150.0 dBm
*RST: +10.0 dBm
Default unit: dBm

Manual operation: See "Forward Scale Upper Limit, Reflection Scale Upper Limit" on page 48

11.3.1.3 Units

If you enter a value that is expressed in a certain unit, for example Hz, you can omit the unit. Then, the default unit provided in the remote command description is used. If you need decimal multiples and submultiples of a unit, you can use SCPI prefixes, see "Units" on page 101.

If you enter a power value or power ratio that can be expressed in more than one unit, you can enter the value together with the unit, and the unit is recognized. If you enter a value without unit, the unit defined by one of the following commands is used:

- `UNIT<Measurement>:POWer[:VALue]`
- `UNIT<Measurement>:POWer:RATio`

After a reset, the default unit is used.

SENSe<Sensor>:UNIT:POWer[:VALue] <unit>

Sets the unit for power-related `SENSe` parameters if you enter a value without unit.

Information whether this command applies is given in the description of the affected command.

Suffix:
<Sensor> 1
Configured sensor

Parameters:
<unit> DBM | DBUV | W
Available units.
If the R&S NRP2 emulation is enabled using `SYSTem:LANGuage`, the unit is fixed to W.
*RST: DBM

UNIT<Measurement>:POWer:RATio <unit>

Sets the unit of the relative forward power measurement.

Suffix:
<Measurement> 1
Measurement

Parameters:
<unit> DB | DPCT | O
The character `O` stands for One (x1).
*RST: DB

Manual operation: See "Forward Unit" on page 49

UNIT<Measurement>:POWer:REFLection <unit>

Effective if `CALCulate<Measurement>[:CHANnel<Channel>]:FEED<Channel>` `"POWer:REVerse"` is set.

Sets how the ratio of forward and reflected power is expressed.

Suffix:
<Measurement> 1
Measurement

Parameters:
<unit> RCO | RL | SWR | RFR

RCO
Reflection coefficient; 0 to 1, no unit

RL
Return loss in dB

SWR
Standing wave ratio; 1 to ∞, no unit

RFR
Ratio between forward and reflected power; 0 % to 100 %

*RST: SWR

Manual operation: See "Standing Wave Ratio (SWR)" on page 44
See "Return Loss" on page 44
See "Reflection Coefficient" on page 44
See "Reflection Ratio" on page 45

UNIT<Measurement>:POWer:RELative:STATe <state>

Alias for `CALCulate<Measurement>:RELative<DirectionalChannel>:STATe` on page 137.

`ON` corresponds to `ON` and `SET`.

Suffix:
<Measurement> 1
Measurement

Parameters:
<state> OFF | ON

*RST: 0

UNIT<Measurement>:POWer[:VALue] <unit>

Sets the unit of the absolute forward power measurement.

Suffix:
<Measurement> 1
Measurement

Parameters:
<unit> DBM | DBUV | W

*RST: DBM

Manual operation: See "Forward Unit" on page 49

11.3.1.4 Limits

CALCulate<Measurement>:LIMit<DirectionalChannel>:LOWer[:DATA] <value>

Sets the lower limit for the measured values.

Suffix:
<Measurement> 1
Measurement

<DirectionalChannel> 1 to 2
1 = forward, 2 = reflection (reverse)

Parameters:
<value>

CALCulate<Measurement>:LIMit<DirectionalChannel>:LOWer[:DATA]:CCDF
<value>

Sets the lower limit for the complementary cumulative distribution function (CCDF).

Suffix:
<Measurement> 1
Measurement

<DirectionalChannel> 1 to 2
1 = forward, 2 = reflection (reverse) or 1 = forward, 2 = reflection (reverse)

Parameters:
<value> Range: 0.0 pct to 100.0 pct
*RST: 0.0 pct
Default unit: pct

Manual operation: See "Forward Lower Limit, Reflection Lower Limit" on page 50

CALCulate<Measurement>:LIMit<DirectionalChannel>:LOWer[:DATA]:RATio:RCOefficient <value>

Sets the lower limit for the reflection coefficient.

Suffix:
<Measurement> 1
Measurement

<DirectionalChannel> 1 to 2
1 = forward, 2 = reflection (reverse) or 1 = forward, 2 = reflection (reverse)

Parameters:
<value> Range: -1e18 to 1e18
*RST: 1.0
Default unit: -

Manual operation: See "Forward Lower Limit, Reflection Lower Limit" on page 50

CALCulate<Measurement>:LIMit<DirectionalChannel>:LOWer[:DATA]:RATio:RFRatio <value>

Sets the lower limit for the ratio of forward/reverse power.

Suffix:
<Measurement> 1
Measurement

<DirectionalChannel> 1 to 2
1 = forward, 2 = reflection (reverse) or 1 = forward, 2 = reflection (reverse)

Parameters:
<value> Range: 0.0 pct to 100.0 pct
*RST: 0.0 pct
Default unit: pct

Manual operation: See "Forward Lower Limit, Reflection Lower Limit" on page 50

CALCulate<Measurement>:LIMit<DirectionalChannel>:LOWer[:DATA]:RATio:RLOSs <value>

Sets the lower limit for the return loss.

Suffix:
<Measurement> 1
Measurement

<DirectionalChannel> 1 to 2
1 = forward, 2 = reflection (reverse) or 1 = forward, 2 = reflection (reverse)

Parameters:
<value> Range: -200.0 dB to 200.0 dB
*RST: -200.0 dB
Default unit: dB

Manual operation: See "Forward Lower Limit, Reflection Lower Limit" on page 50

CALCulate<Measurement>:LIMit<DirectionalChannel>:LOWer[:DATA]:RATio:SWR <value>

Sets the lower limit for the standing wave ratio (SWR).

Suffix:
<Measurement> 1
Measurement

<DirectionalChannel> 1 to 2
1 = forward, 2 = reflection (reverse) or 1 = forward, 2 = reflection (reverse)

Parameters:
<value> Range: 0.0 to 1e18
*RST: 1.0
Default unit: -

Manual operation: See "Forward Lower Limit, Reflection Lower Limit" on page 50

CALCulate<Measurement>:LIMit<DirectionalChannel>:LOWer[:DATA]:RATio[:VALue] <value>

Sets the lower limit for the measured power ratios.

If you enter a value without unit, the unit is defined by `UNIT<Measurement>:POWer:RATio`. For further information, see Section 11.3.1.3, "Units", on page 120.

Suffix:
<Measurement> 1
Measurement

<DirectionalChannel> 1 to 2
1 = forward, 2 = reflection (reverse) or 1 = forward, 2 = reflection (reverse)

Parameters:
<value> Range: -180.0 dB to +180.0 dB
*RST: -20.0 dB
Default unit: dB

Manual operation: See "Forward Lower Limit, Reflection Lower Limit" on page 50

CALCulate<Measurement>:LIMit<DirectionalChannel>:LOWer[:DATA]:POWer <value>

Sets the lower limit for the measured power values.

If you enter a value without unit, the unit is defined by `UNIT<Measurement>:POWer[:VALue]`. For further information, see Section 11.3.1.3, "Units", on page 120.

Suffix:
<Measurement> 1
Measurement

<DirectionalChannel> 1 to 2
1 = forward, 2 = reflection (reverse) or 1 = forward, 2 = reflection (reverse)

Parameters:
<value> Range: -120.0 dBm to +150.0 dBm
*RST: -60.0 dBm
Default unit: dBm

Manual operation: See "Forward Lower Limit, Reflection Lower Limit" on page 50

CALCulate<Measurement>:LIMit<DirectionalChannel>:LOWer:STATe <state>

Enables or disables the monitoring function for the lower limit.

Suffix:
<Measurement> 1
Measurement

<DirectionalChannel> 1 to 2
1 = forward, 2 = reflection (reverse) or 1 = forward, 2 = reflection (reverse)

Parameters:
<state> *RST: OFF

Manual operation: See "Forward Lower Limit State, Reflection Lower Limit State" on page 49

CALCulate<Measurement>:LIMit<DirectionalChannel>:UPPer[:DATA] <value>

Sets the upper limit for the measured values.

Suffix:
<Measurement> 1
Measurement

<DirectionalChannel> 1 to 2
1 = forward, 2 = reflection (reverse)

Parameters:
<value>

CALCulate<Measurement>:LIMit<DirectionalChannel>:UPPer[:DATA]:CCDF <value>

Sets the upper limit for the complementary cumulative distribution function (CCDF).

Suffix:
<Measurement> 1
Measurement

<DirectionalChannel> 1 to 2
1 = forward, 2 = reflection (reverse) or 1 = forward, 2 = reflection (reverse)

Parameters:
<value> Range: 0.0 pct to 100.0 pct
*RST: 100.0 pct
Default unit: pct

Manual operation: See "Forward Upper Limit, Reflection Upper Limit" on page 50

CALCulate<Measurement>:LIMit<DirectionalChannel>:UPPer[:DATA]:RATio:RCOefficient <value>

Sets the upper limit for the reflection coefficient.

Suffix:
<Measurement> 1
Measurement

<DirectionalChannel> 1 to 2
1 = forward, 2 = reflection (reverse) or 1 = forward, 2 = reflection (reverse)

Parameters:
<value> Range: -1e18 to 1e18
*RST: 5.0
Default unit: -

Manual operation: See "Forward Upper Limit, Reflection Upper Limit" on page 50

CALCulate<Measurement>:LIMit<DirectionalChannel>:UPPer[:DATA]:RATio:RFRatio <value>

Sets the upper limit for the ratio of forward/reverse power.

Suffix:
<Measurement> 1
Measurement

<DirectionalChannel> 1 to 2
1 = forward, 2 = reflection (reverse) or 1 = forward, 2 = reflection (reverse)

Parameters:

<value> Range: 0.0 pct to 100.0 pct
*RST: 100.0 pct
Default unit: pct

Manual operation: See "Forward Upper Limit, Reflection Upper Limit" on page 50

CALCulate<Measurement>:LIMit<DirectionalChannel>:UPPer[:DATA]:RATio:RLOSs <value>

Sets the upper limit for the return loss.

Suffix:

<Measurement> 1
Measurement

<DirectionalChannel> 1 to 2
1 = forward, 2 = reflection (reverse) or 1 = forward, 2 = reflection (reverse)

Parameters:

<value> Range: -200.0 dB to 200.0 dB
*RST: 200.0 dB
Default unit: dB

Manual operation: See "Forward Upper Limit, Reflection Upper Limit" on page 50

CALCulate<Measurement>:LIMit<DirectionalChannel>:UPPer[:DATA]:RATio:SWR <value>

Sets the upper limit for the standing wave ratio (SWR).

Suffix:

<Measurement> 1
Measurement

<DirectionalChannel> 1 to 2
1 = forward, 2 = reflection (reverse) or 1 = forward, 2 = reflection (reverse)

Parameters:

<value> Range: 0.0 to 1e18
*RST: 2.0
Default unit: -

Manual operation: See "Forward Upper Limit, Reflection Upper Limit" on page 50

CALCulate<Measurement>:LIMit<DirectionalChannel>:UPPer[:DATA]:RATio[:VALue] <value>

Sets the upper limit for the measured power ratios.

If you enter a value without unit, the unit is defined by `UNIT<Measurement>:POWer:RATio`. For further information, see Section 11.3.1.3, "Units", on page 120.

Suffix:
<Measurement> 1
Measurement

<DirectionalChannel> 1 to 2
1 = forward, 2 = reflection (reverse) or 1 = forward, 2 = reflection (reverse)

Parameters:
<value> Range: -180.0 dB to +180.0 dB
*RST: +20.0 dB
Default unit: dB

Manual operation: See "Forward Upper Limit, Reflection Upper Limit" on page 50

CALCulate<Measurement>:LIMit<DirectionalChannel>:UPPer[:DATA]:POWer <value>

Sets the upper limit for the measured power values.

If you enter a value without unit, the unit is defined by `UNIT<Measurement>:POWer[:VALue]`. For further information, see Section 11.3.1.3, "Units", on page 120.

Suffix:
<Measurement> 1
Measurement

<DirectionalChannel> 1 to 2
1 = forward, 2 = reflection (reverse) or 1 = forward, 2 = reflection (reverse)

Parameters:
<value> Range: -120.0 dBm to +150.0 dBm
*RST: +10.0 dBm
Default unit: dBm

Manual operation: See "Forward Upper Limit, Reflection Upper Limit" on page 50

CALCulate<Measurement>:LIMit<DirectionalChannel>:UPPer:STATe <state>

Enables or disables the monitoring function for the upper limit.

Suffix:
<Measurement> 1
Measurement

<DirectionalChannel> 1 to 2
1 = forward, 2 = reflection (reverse) or

Parameters:
<state> *RST: OFF

Manual operation: See "Forward Upper Limit State, Reflection Upper Limit State" on page 50

11.3.1.5 Result formats and screenshots

FORMat:SREGister <sregister>

Specifies the format that is used for the return value of `*STB?`.

Parameters:

<sregister> ASCii | BINary | HEXadecimal | OCTal

*RST: ASCii

FORMat[:READings][:DATA] [<data,length>, <arg1>]

Specifies how the controller expects numeric data from the R&S NRT2.

Parameters:

<data,length> <REAL,32 | 64>

Floating point numbers as standardized in IEEE 754, 32-bit or 64-bit. If you omit the length, the R&S NRT2 uses the last used length.
Example for `REAL,32` format:
`#14....<binary float value>....`
Example for `REAL,64` format:
`#18....<binary float value>....`

<arg1> <ASCii[,0 to 12]>

Readable value. The digit defines the number of decimal places. If more values are output, they are separated by commas.
Example: -2.279610E+01

*RST: ASCii,0
The reset value 0 does not restrict the number of decimal places.

FORMat[:READings]:BORDer <border>

Selects the order of bytes in 64-bit binary data.

Parameters:

<border> NORMal | SWAPped

NORMal
The 1st byte is the least significant byte, the 4th/8th byte the most significant byte.
Fulfills the Little Endian (little end comes first) convention, used by x86/x64 CPUs, for example.

SWAPped
The 1st byte is the most significant byte, the 4th/8th byte the least significant byte.
Fulfills the Big Endian (big end comes first) convention.

*RST: NORMal

Example: `FORM:BORD NORM`

SYSTem:HCOPy [<filename>]

Creates a screenshot of the current display. If you supply a filename with the command, this filename is used for the target file. Otherwise, an internal name is generated that you can query using this command.

See also Section 4.1.5, "Creating and saving screenshots", on page 36.

Parameters:
<filename>

Manual operation: See "Screenshot" on page 25

11.3.2 Configuring the trigger

Further information:

- Section 5.6, "Triggering", on page 51

TRIGger<Measurement>:MODE <mode>

Controls the trigger execution depending on the setting of the trigger source, see `TRIGger<Measurement>[:CHANnel<Channel>]:SOURce`.

Suffix:
<Measurement> 1
Measurement

Parameters:
<mode> NORMal | FREerun | SINGle

NORMal
Continuous triggering with regular trigger events.

FREerun
Enables a continuous measurement. The sensor executes one measurement cycle after the other.

SINGle
Disables continuous triggering so that only one trigger event at a time is executed.

*RST: NORMal

Manual operation: See "Trigger Mode" on page 52

TRIGger<Measurement>[:CHANnel<Channel>]:SOURce <source>

Sets the source for the trigger event. See Section 5.6.2, "Trigger sources", on page 52.

The command is not fully R&S NRP2 compatible. If port 1 is assigned to measurement 1, and so on, the command works. If port 1 is assigned to measurement 2, for example, enable the R&S NRP2 emulation by using `SYSTem:LANGuage "NRP2"`.

Suffix:
<Measurement> 1
Measurement

<Channel> 1 to 2
1 = forward, 2 = reflection (reverse)

Parameters:
<source> INTernal | EXTernal

See Section 5.6.2, "Trigger sources", on page 52.

*RST: INTernal

Manual operation: See "Trigger Source" on page 53

TRIGger<Measurement>[:IMMediate]

Starts a measurement.

Suffix:
<Measurement> 1
Measurement

Usage: Event

11.3.3 Selecting the measurement

Before starting a measurement, select the measurement type.

CALCulate<Measurement>[:CHANnel<Channel>]:FEED<Channel> "<string>"

Determines the data that are processed. The parameters depend on the measurement type.

The sensor averages every measured value using a series of samples. If a `RANDom` feed is selected, the sensor takes a random value from the samples and forwards it to the R&S NRT2 as a measured value. `PEAK` is the maximum of all samples in the measurement interval.

Table 11-2: Parameter to measurement assignment

Measurement type	"<string>"	Measured value
Absolute Forward direction	POWer:FORWard:AVERage	Average power
	POWer:FORWard:PEP	Peak power of an amplitude-modulated signal
	POWer:ABSorption:AVERage	Absorbed average power
	POWer:ABSorption:PEP	Absorbed peak envelope power (PEP)
	POWer:FORWard:AVERage:BURSt	Average power within a burst
	POWer:ABSorption:AVERage:BURSt	Absorbed burst average
Absolute Reverse direction	POWer:OFF	Reflected power disabled
	POWer:REVerse	Reflected power
Relative Forward direction	POWer:FORWard:CCDFunction	Complementary cumulative distribution function
	POWer:CFACtor	Crest factor
Relative Reverse direction	POWer:SWRatio	Standing wave ratio
	POWer:RLOSs	Return loss
	POWer:RCOefficient	Reflection coefficient
	POWer:RFRatio	Reflection ratio

Suffix:

<Measurement> 1
Measurement

<Channel> 1 to 2
1 = forward, 2 = reflection (reverse) or 1 = forward, 2 = reflection (reverse)

<Channel> 1 to 2
1 = forward, 2 = reflection (reverse)

Parameters:

"<string>" The availability depends on the measurement type, see Table 11-2.

*RST: POWer:FORWard:AVERage

Manual operation:

See "Average" on page 42
See "CCDF" on page 42
See "Peak Envelope Power (PEP)" on page 42
See "Absorption Average" on page 43
See "Crest Factor (CF)" on page 43
See "Absorption PEP" on page 43
See "Burst Average" on page 43
See "Absorption Burst" on page 43
See "Off" on page 44
See "Reverse Power" on page 44
See "Standing Wave Ratio (SWR)" on page 44
See "Return Loss" on page 44
See "Reflection Coefficient" on page 44
See "Reflection Ratio" on page 45

11.3.4 Selecting the sensor

Further information:

- Section 5.3, "Measurement Main Configuration dialog", on page 45

[SENSe<Sensor>:]CATalog?

Returns a list of all connected sensors together with the suffix of the port where the sensor is connected.

Suffix:

<Sensor> 1
Configured sensor

Example: `CAT?`
Query
`"1:NRT-Z44-107050"`
Response

Usage: Query only

11.3.5 Configuring the measurement

Further information:

- Section 5.2, "NRT settings", on page 41

CALCulate<Measurement>:RELative<DirectionalChannel>:CCDF <value>

Sets the reference value for the cumulative distribution function (CCDF).

Suffix:
<Measurement> 1
Measurement

<DirectionalChannel> 1 to 2
1 = forward, 2 = reflection (reverse) or 1 = forward, 2 = reflection (reverse)

Parameters:
<value> Range: 0.0 pct to 100.0 pct
*RST: 50.0 pct
Default unit: pct

Manual operation: See "Forward Reference Value, Reflection Reference Value" on page 49

CALCulate<Measurement>:RELative<DirectionalChannel>:POWer[:MAGNitude] <value>

Sets the reference value for relative ratio measurements.

If you enter a value without unit, the unit is defined by `UNIT<Measurement>:POWer[:VALue]`. For further information, see Section 11.3.1.3, "Units", on page 120.

Suffix:
<Measurement> 1
Measurement

<DirectionalChannel> 1 to 2
1 = forward, 2 = reflection (reverse) or 1 = forward, 2 = reflection (reverse)

Parameters:
<value> Range: -180.0 dBm to -180.0 dBm
*RST: -180.0 dBm
Default unit: dBm

Manual operation: See "Forward Reference Value, Reflection Reference Value" on page 49

CALCulate<Measurement>:RELative<DirectionalChannel>:RATio:RCOefficient <value>

Sets the reference value for the reflection coefficient.

Suffix:
<Measurement> 1
Measurement

<DirectionalChannel> 1 to 2
1 = forward, 2 = reflection (reverse) or 1 = forward, 2 = reflection (reverse)

Parameters:
<value> Range: 0.0 to 1.0
*RST: 0.5
Default unit: -

Manual operation: See "Forward Reference Value, Reflection Reference Value" on page 49

CALCulate<Measurement>:RELative<DirectionalChannel>:RATio:RFRatio <value>

Sets the reference value for the ratio of forward/reverse power.

Suffix:
<Measurement> 1
Measurement

<DirectionalChannel> 1 to 2
1 = forward, 2 = reflection (reverse) or 1 = forward, 2 = reflection (reverse)

Parameters:
<value> Range: 0.0 pct to 100.0 pct
*RST: 50.0 pct
Default unit: pct

Manual operation: See "Forward Reference Value, Reflection Reference Value" on page 49

CALCulate<Measurement>:RELative<DirectionalChannel>:RATio:RLOSs <value>

Sets the reference value for the return loss.

Suffix:
<Measurement> 1
Measurement

<DirectionalChannel> 1 to 2
1 = forward, 2 = reflection (reverse) or 1 = forward, 2 = reflection (reverse)

Parameters:
<value> Range: -200.0 dB to 200.0 dB
*RST: 0.0 dB
Default unit: dB

Manual operation: See "Forward Reference Value, Reflection Reference Value" on page 49

CALCulate<Measurement>:RELative<DirectionalChannel>:RATio:SWR <value>

Sets the reference value for the standing wave ratio (SWR).

Suffix:
<Measurement> 1
Measurement

<DirectionalChannel> 1 to 2
1 = forward, 2 = reflection (reverse) or 1 = forward, 2 = reflection (reverse)

Parameters:
<value> Range: 0.0 to 1.0
*RST: 0.5
Default unit: -

Manual operation: See "Forward Reference Value, Reflection Reference Value" on page 49

CALCulate<Measurement>:RELative<DirectionalChannel>:RATio[:MAGNitude] <value>

Sets the reference value for relative ratio measurements.

Suffix:
<Measurement> 1
Measurement

<DirectionalChannel> 1 to 2
1 to 2

Parameters:
<value> Default unit: pct

Manual operation: See "Forward Reference Value, Reflection Reference Value" on page 49

CALCulate<Measurement>:RELative<DirectionalChannel>:STATe <state>

Allows you to relate a measured power or a power ratio to a reference value. Whether the power is measured by one sensor or whether it is a combined value measured by two sensors, is set by:

`CALCulate<Measurement>[:CHANnel<Channel>]:FEED<Channel>` on page 132

Alias:

`UNIT<Measurement>:POWer:RELative:STATe`

Suffix:
<Measurement> 1
Measurement

<DirectionalChannel> 1 to 2
1 = forward, 2 = reflection (reverse) or 1 = forward, 2 = reflection (reverse)

Parameters:
<state> OFF | ON | SET

OFF
Absolute power or power ratio

ON
Relative power or power ratio, using the specified reference value.

SET
Uses the current measurement value as the reference value and enables the relative measurement.

*RST: OFF

Manual operation: See "Forward Relative State, Reflection Relative State" on page 49

[SENSe<Sensor>:]FUNCtion:CONCurrent <concurrent>

Enables or disables the usage of several measurement functions simultaneously.

Suffix:
<Sensor> 1
Configured sensor

Parameters:
<concurrent> **ON**
Two measurement functions can be enabled simultaneously.

OFF
Only a single function can be enabled. If a new measurement function is enabled, the previously active function is disabled automatically.

*RST: ON

[SENSe<Sensor>:]FUNCtion:OFF:ALL<Channel>

Disables all measurement functions for the specified channel.

Suffix:
<Sensor> 1
Configured sensor

<Channel> 1 to 2
1 = forward, 2 = reflection (reverse)

Usage: Event

[SENSe<Sensor>:]FUNCtion:OFF[:FUNC] <function>

Disables the specified measurement function.

The query returns all disabled measurement functions.

Suffix:
<Sensor> 1
Configured sensor

Setting parameters:
<function> See `CALCulate<Measurement>[:CHANnel<Channel>]:FEED<Channel>` on page 132.

Usage: Setting only

[SENSe<Sensor>:]FUNCtion:STATe? <function>

Queries whether the measurement function is enabled or disabled.

Suffix:
<Sensor> 1
Configured sensor

Query parameters:
<function> See `CALCulate<Measurement>[:CHANnel<Channel>]:FEED<Channel>` on page 132.

Usage: Query only

[SENSe<Sensor>:]POWer:REFerence <ref>

Sets the reference value for the relative power indication.

If you enter a value without unit, the unit is defined by `UNIT<Measurement>:POWer:RATio`. For further information, see Section 11.3.1.3, "Units", on page 120.

Suffix:
<Sensor> 1
Configured sensor

Parameters:
<ref> Range: -290.0 dBm to +110.0 dBm
*RST: +30.0 dBm
Default unit: dBm

Manual operation: See "Forward Reference Value, Reflection Reference Value" on page 49

[SENSe<Sensor>:]POWer:REFLection:RANGe:AUTO <state>
[SENSe<Sensor>:]POWer[:POWer]:RANGe:AUTO <state>

If enabled, adapts the scaling of the graphical display once.

Suffix:
<Sensor> 1
Configured sensor

Parameters:
<state> ON | OFF
*RST: ON

Manual operation: See "Autoscale" on page 45

[SENSe<Sensor>:]POWer:REFLection:RANGe:LIMit:DETect <value>
[SENSe<Sensor>:]POWer[:POWer]:RANGe:LIMit:DETect <value>

Effective if the Out 1 / Trig Out connector is configured as a monitoring output for the power indication, for example using `[SENSe<Sensor>:]POWer[:POWer]:RANGe:LIMit[:STATe] ON`.

Defines when a logic high level (> 2.7 V) is output at the Out 1 / Trig Out connector.

Suffix:
<Sensor> 1
Configured sensor

Parameters:
<value> INBound | OUTBound | HIGH

INBound
Measured power is within the range specified.

OUTBound
Measured power is out of the range defined.

HIGH
Measured power exceeds the upper scale limit.

*RST: HIGH

Manual operation: See "Fail Voltage" on page 73

[SENSe<Sensor>:]POWer:REFLection:RANGe:LIMit[:STATe] <state>
[SENSe<Sensor>:]POWer[:POWer]:RANGe:LIMit[:STATe] <state>

Enables or disables the Out 1 / Trig Out connector as a monitoring output for the power indication.

If enabled, you cannot use the connector for any other purpose.

Suffix:
<Sensor> 1
Configured sensor

Parameters:
<state> *RST: OFF

Manual operation: See "Mode" on page 72

[SENSe<Sensor>:]POWer:REFLection:RANGe:LOWer <lower>
[SENSe<Sensor>:]POWer[:POWer]:RANGe:LOWer <lower>

Effective if `[SENSe<Sensor>:]POWer:REFLection:RANGe:AUTO` is disabled.

Sets the lower scale limit for the power indication.

The entry has no unit. The unit corresponds to the output unit selected by `UNIT<Measurement>:POWer[:VALue]` or `UNIT<Measurement>:POWer:RATio`. If you change the unit, the entered value remains the same.

Suffix:
<Sensor> 1
Configured sensor

Parameters:
<lower> Range: -1999.0 to 1999.0
*RST: 0.0

[SENSe<Sensor>:]POWer:REFLection:RANGe[:UPPer] <upper>
[SENSe<Sensor>:]POWer[:POWer]:RANGe[:UPPer] <upper>

Effective if `[SENSe<Sensor>:]POWer:REFLection:RANGe:AUTO` is disabled.

Sets the lower scale limit for the power indication. For further details, see `[SENSe<Sensor>:]POWer[:POWer]:RANGe:LOWer` on page 141.

Suffix:
<Sensor> 1
Configured sensor

Parameters:
<upper> Range: -1999.0 to 1999.0
*RST: 1.0

[SENSe<Sensor>:]RRESolution <rres>

Configures the resolution of the measurement.

Suffix:
<Sensor> 1
Configured sensor

Parameters:
<rres> LOW | HIGH

HIGH
Equals `CALCulate<Measurement>:RESolution OOOI`.

LOW
All other settings.
*RST: LOW

Manual operation: See "Resolution" on page 47

11.4 Configuring sensors

11.4.1 Setting the frequency

[SENSe<Sensor>:]FREQuency:FIXed <frequency>
[SENSe<Sensor>:]FREQuency[:CW] <frequency>

Sets the carrier frequency of the applied signal. This value is used for frequency response correction of the measurement result.

Suffix:
<Sensor> 1
Configured sensor

Parameters:
<frequency> Range: Depends on sensor.
*RST: Depends on sensor.
Default unit: Hz

Manual operation: See "[Freq]" on page 26

11.4.2 Channel mode settings

Further information:

- Section 6.1, "Channel mode settings", on page 54

CALCulate<Measurement>[:CHANnel<Channel>]:NRT:BURSt:MODE <mode>

Defines how the average burst power is determined.

Suffix:
<Measurement> 1
Measurement

<Channel> 1 to 2
1 = forward, 2 = reflection (reverse) or 1 = forward, 2 = reflection (reverse)

Parameters:
<mode> AUTO | USER

AUTO
Not supported by all sensors.
The sensor automatically recognizes the duty cycle of the burst series and calculates the average burst power from this duty cycle and the average power. Set an appropriate video bandwidth using `CALCulate<Measurement>[:CHANnel<Channel>]:NRT:VBWidth[:VALue]`.

USER
Define the duty cycle by:
`CALCulate<Measurement>[:CHANnel<Channel>]:NRT:BURSt:PERiod`
`CALCulate<Measurement>[:CHANnel<Channel>]:NRT:BURSt:WIDTh`
The R&S NRT2 calculates the average burst power from these values.

*RST: USER

Manual operation: See "Burst Mode" on page 55

CALCulate<Measurement>[:CHANnel<Channel>]:NRT:BURSt:PERiod <value>

Effective if `CALCulate<Measurement>[:CHANnel<Channel>]:NRT:BURSt:MODE USER` is set.

Sets the burst period.

Suffix:
<Measurement> 1
Measurement

<Channel> 1 to 2
1 = forward, 2 = reflection (reverse) or 1 = forward, 2 = reflection (reverse)

Parameters:
<value> Range: 0.0 s to 1.0 s
*RST: 1.0e-2 s
Default unit: s

Manual operation: See "Burst Period" on page 55

CALCulate<Measurement>[:CHANnel<Channel>]:NRT:BURSt:WIDTh <value>

Effective if `CALCulate<Measurement>[:CHANnel<Channel>]:NRT:BURSt:MODE USER` is set.

Sets the burst width.

Suffix:
<Measurement> 1
Measurement

<Channel> 1 to 2
1 = forward, 2 = reflection (reverse) or 1 = forward, 2 = reflection (reverse)

Parameters:
<value> Range: 0.0 s to 1.0 s
*RST: 1.0e-3 s
Default unit: s

Manual operation: See "Burst Width" on page 55

CALCulate<Measurement>[:CHANnel<Channel>]:NRT:CCDF:THReshold <value>

Sets the threshold for the complementary cumulative distribution function (CCDF).

If you enter a value without unit, the unit is defined by `UNIT<Measurement>:POWer[:VALue]`. For further information, see Section 11.3.1.3, "Units", on page 120.

Suffix:
<Measurement> 1
Measurement

<Channel> 1 to 2
1 = forward, 2 = reflection (reverse) or 1 = forward, 2 = reflection (reverse)

Parameters:
<value> Range: -290.0 dBm to +110.0 dBm
*RST: +0.0 dBm
Default unit: dBm

Manual operation: See "CCDF Threshold" on page 56

CALCulate<Measurement>[:CHANnel<Channel>]:NRT:DIRection <direction>

Defines how the forward power is determined.

Suffix:
<Measurement> 1
Measurement

<Channel> 1 to 2
1 = forward, 2 = reflection (reverse) or 1 = forward, 2 = reflection (reverse)

Parameters:

<direction> AUTO | FORWard | REVerse

AUTO
Determines the power flow direction automatically. The greater value of two measured values is automatically assigned as forward power.

FORWard | REVerse
Sets a fixed direction of the forward power, either from port 1 to port 2 (`FORWard`), or from port 2 to port 1(`REVerse`).

*RST: AUTO

Manual operation: See "Direction" on page 56

CALCulate<Measurement>[:CHANnel<Channel>]:NRT:PEP:HOLD:TIME <value>

Sets the hold time of the peak hold circuit of the sensor.

Suffix:

<Measurement> 1
Measurement

<Channel> 1 to 2
1 = forward, 2 = reflection (reverse) or 1 = forward, 2 = reflection (reverse)

Parameters:

<value> Range: 1.0e-3 s to 1.0e-1 s
*RST: 6.0e-2 s
Default unit: s

Manual operation: See "PEP Hold Time" on page 56

INPut<Sensor>:PORT:SOURce:AUTO <auto>

Enables or disables the automatic assignment of the forward direction.

Suffix:

<Sensor> 1
Configured sensor

Parameters:

<auto> **ON**
The direction, in which the greater power flows, is taken as the forward direction.

OFF
The forward direction is defined by `INPut<Sensor>:PORT:SOURce[:VALue]`.

*RST: ON

Manual operation: See "Direction" on page 56

INPut<Sensor>:PORT:SOURce[:VALue] <val>

Effective if `INPut<Sensor>:PORT:SOURce:AUTO OFF` is set.

Sets a fixed direction of the forward power.

Suffix:
<Sensor> 1
Configured sensor

Parameters:
<val> **1**
Port 1 to port 2

2
Port 2 to port 1

Range: 1 to 2
*RST: 1

Manual operation: See "Direction" on page 56

11.4.3 Channel correction settings

Further information:

- Section 6.2, "Channel correction settings", on page 56

[SENSe<Sensor>:]DM:STATe <state>

Enables or disables the modulation correction. To set the communication standard, use `[SENSe<Sensor>:]DM:STANdard`.

Suffix:
<Sensor> 1
Configured sensor

Parameters:
<state> OFF | ON
*RST: 0

Manual operation: See "Modulation" on page 57

[SENSe<Sensor>:]DM:STANdard <standard>

Sets a communication standard for the modulation correction to reduce systematic deviations occurring in power measurements.

Suffix:
<Sensor> 1
Configured sensor

Parameters:
<standard> IS95 | WCDMa | DVBT | DAB | EDGE | TETRa

IS95
IS-95 CDMA standard for base stations

WCDMa
WCDMA standard for base stations

DVBT
DVB-T standard for terrestrial DVB TV transmitters

DAB
DAB standard for radio transmitters.

EDGE
Mobile communication standard

TETRa
Terrestrial trunked radio standard

*RST: EDGE

Manual operation: See "Modulation" on page 57

CALCulate<Measurement>[:CHANnel<Channel>]:CORRection:OFFSet:RPLane <plane>

Selects the sensor port to which the measurement results refer.

Suffix:
<Measurement> 1
Measurement

<Channel> 1 to 2
1 = forward, 2 = reflection (reverse) or 1 = forward, 2 = reflection (reverse)

Parameters:
<plane> SOURce | LOAD

*RST: LOAD

Manual operation: See "Offset Reference Plane" on page 57

CALCulate<Measurement>[:CHANnel<Channel>]:CORRection:OFFSet:STATe <state>

Enables or disables the offset correction.

Suffix:
<Measurement> 1
Measurement

<Channel> 1 to 2
1 = forward, 2 = reflection (reverse) or 1 = forward, 2 = reflection (reverse)

Parameters:
<state> ON | OFF
*RST: OFF

Manual operation: See "Offset" on page 57

CALCulate<Measurement>[:CHANnel<Channel>]:CORRection:OFFSet[:MAGNitude] <value>

Effective if `CALCulate<Measurement>[:CHANnel<Channel>]:CORRection:OFFSet:STATe ON` is set.

Considers the transmission loss in a cable that connects the desired measurement point, set by `INPut<Sensor>:PORT:POSition`, and the sensor.

Suffix:
<Measurement> 1
Measurement

<Channel> 1 to 2
1 = forward, 2 = reflection (reverse) or 1 = forward, 2 = reflection (reverse)

Parameters:
<value> Range: -200.0 dB to 200.0 dB
*RST: 0.0 dB
Default unit: dB

Manual operation: See "Offset" on page 57

CALCulate<Measurement>[:CHANnel<Channel>]:NRT:DMODulation[:VALue] <modulation>

Sets a communication standard for the modulation correction to reduce systematic deviations occurring in power measurements.

Suffix:
<Measurement> 1
Measurement

<Channel> 1 to 2
1 = forward, 2 = reflection (reverse) or 1 = forward, 2 = reflection (reverse)

Parameters:
<modulation> OFF | IS95 | WCDMa | DVBT | DAB | EDGE | TETRa

IS95
IS-95 CDMA standard for base stations

WCDMa
WCDMA standard for base stations

DVBT
DVB-T standard for terrestrial DVB TV transmitters

DAB
DAB standard for radio transmitters.

EDGE
Mobile communication standard

TETRa
Terrestrial trunked radio standard

*RST: OFF

Manual operation: See "Modulation" on page 57

CALCulate<Measurement>[:CHANnel<Channel>]:NRT:DMODulation:WCDMa:CRATe <value>

Effective if `CALCulate<Measurement>[:CHANnel<Channel>]:NRT:DMODulation[:VALue] WCDMa` is set.

Sets the chip rate for the WCDMA communication standard.

Suffix:
<Measurement> 1
Measurement

<Channel> 1 to 2
1 = forward, 2 = reflection (reverse) or 1 = forward, 2 = reflection (reverse)

Parameters:
<value> Range: 0.0 Hz to 8.2e6 Hz
Default unit: Hz

Manual operation: See "WCDMA Chip Rate" on page 58

INPut<Sensor>:PORT:OFFSet <offs>

Considers the transmission loss in a cable that connects the desired measurement point, set by `INPut<Sensor>:PORT:POSition`, and the sensor.

Suffix:
<Sensor> 1
Configured sensor

Parameters:
<offs> Range: 0.0 dB to 100.0 dB
*RST: 0.0 dB
Default unit: dB

Manual operation: See "Offset" on page 57

INPut<Sensor>:PORT:POSition <pos>

Selects the sensor port to which the measurement results refer.

Suffix:
<Sensor> 1
Configured sensor

Parameters:
<pos> SOURce | LOAD
*RST: LOAD

Manual operation: See "Offset Reference Plane" on page 57

11.4.4 Channel filter settings

Further information:

- Section 6.3, "Channel filter settings", on page 58

CALCulate<Measurement>[:CHANnel<Channel>]:AVERage:COUNt:AUTO[:STATe] <state>

Sets the averaging mode.

Suffix:
<Measurement> 1
Measurement

<Channel> 1 to 2
1 = forward, 2 = reflection (reverse)

Parameters:
<state> **OFF**
Uses the value set by `CALCulate<Measurement>[:CHANnel<Channel>]:AVERage:COUNt[:VALue]`

ON
Determines the average count automatically from the level of the input signal.

ONCE
Automatically adapts the average count once.

*RST: ON

Manual operation: See "Averaging Mode" on page 59

CALCulate<Measurement>[:CHANnel<Channel>]:AVERage:COUNt[:VALue] <value>

Effective if `CALCulate<Measurement>[:CHANnel<Channel>]:AVERage:COUNt:AUTO[:STATe] OFF` is set.

Sets the number of readings that are averaged for one measured value. The higher the count, the lower the noise, and the longer it takes to obtain a measured value.

Suffix:
<Measurement> 1
Measurement

<Channel> 1 to 2
1 = forward, 2 = reflection (reverse)

Parameters:
<value> Range: 1 to 256
*RST: 1

Manual operation: See "Averaging Count" on page 59

CALCulate<Measurement>[:CHANnel<Channel>]:NRT:APERture:MODE <mode>

Specifies which integration time is used for a single measurement.

Suffix:
<Measurement> 1
Measurement

<Channel> 1 to 2
1 = forward, 2 = reflection (reverse) or 1 = forward, 2 = reflection (reverse)

Parameters:
<mode> DEFault | USER

DEFault
Default setting

USER
Value defined by `CALCulate<Measurement>[:CHANnel<Channel>]:NRT:APERture[:VALue]`.

*RST: USER

Manual operation: See "Integration Time Mode" on page 59

CALCulate<Measurement>[:CHANnel<Channel>]:NRT:APERture[:VALue] <value>

Effective if `CALCulate<Measurement>[:CHANnel<Channel>]:NRT:APERture:MODE USER` is set.

Defines the integration time for a single measurement.

Suffix:
<Measurement> 1
Measurement

<Channel> 1 to 2
1 = forward, 2 = reflection (reverse)

Parameters:
<value> Range: 0.005 s to 0.111 s
*RST: 0.037 s
Default unit: s

Manual operation: See "Integration Time" on page 59

CALCulate<Measurement>[:CHANnel<Channel>]:NRT:VBWidth[:VALue] <value>

For measuring the peak envelope power, specify the video bandwidth that the sensor uses for measuring the detected RF signal.

Suffix:
<Measurement> 1
Measurement

<Channel> 1 to 2
1 = forward, 2 = reflection (reverse) or 1 = forward, 2 = reflection (reverse)

Parameters:
<value> **0**
4 kHz

1
200 kHz

2
Maximum bandwidth of the sensor

Range: 0 to 2
*RST: 1

Manual operation: See "Video Bandwidth" on page 59

[SENSe<Sensor>:]BWIDth:VIDeo:FNUMber <fnum>
[SENSe<Sensor>:]BANDwidth:VIDeo:FNUMber <fnum>

Sets the video bandwidth for the rectified RF. The setting mainly influences the measurement of the following:

- Peak envelope power (PEP)
- Crest factor (CF)
- Average burst power
- Complementary cumulative distribution function (CCDF)

Suffix:
<Sensor> 1
Configured sensor

Parameters:
<numeric_value> **0**
4 kHz

1
200 kHz

2
The full bandwidth depends on the sensor:
R&S NRT-Z14: 600 kHz
R&S NRT-Z43, R&S NRT-Z44: 4 MHz

Range: 0 to 2
*RST: 1

Manual operation: See "Video Bandwidth" on page 59

11.5 Configuring the analog signal output and the trigger input/output

Configures the two multifunctional BNC connectors at the rear of the R&S NRT2.

Further information:

- Section 3.2.2.1, "Trig In / Out 2 and Out 1 / Trig Out connectors", on page 28
- "I/O 1, I/O 2 tabs" on page 71

INPut<undef>:TRIGger:IMPedance <impedance>

Effective if `OUTPut:MODE<output> TIN` is set.

Sets the termination resistance of the external trigger signal that is supplied at the Trig In / Out 2 connector. Choose a setting that fits the impedance of the trigger source to minimize reflections on the trigger signals.

Suffix:
<undef> 1 to n
No suffix required.

Parameters:
<impedance> HIGH | LOW
*RST: HIGH

OUTPut:LIMit:FAIL <mode>

Effective if `OUTPut:MODE<output>` is set to:

`FLIMit` or `RLIMit`

Sets the fail voltage that is output if a measured value causes a limit violation.

Parameters:
<mode> LOW | HIGH

HIGH
Output voltage of 5 V.

LOW
Output voltage of 0 V.

*RST: LOW

Manual operation: See "Fail Voltage" on page 73

OUTPut:MODE<output> <mode>

Sets the functionality of the Out 1 / Trig Out and Trig In / Out 2 connectors.

Suffix:
<output> 1 to 2
BNC connectors at the rear; 1 = Out 1 / Trig Out,
2 = Trig In / Out 2

Parameters:
<mode> OFF | RECorder | FRECorder | RRECorder | LIMit | FLIMit | RLIMit | TOUT | TIN | OFF | FRECorder | RRECorder | FLIMit | RLIMit | TIN

OFF
Disabled

FRECorder
Forward analog output

RRECorder
Reflection analog output

FLIMit
Forward limit violation

RLIMit
Reflection limit violation

TIN
Trigger input

*RST: OFF

Manual operation: See "Mode" on page 72

OUTPut:RECorder<output>:LIMit:LOWer:CCDF <value>

Effective if `OUTPut:MODE<output>` is set to:

`FREC` or `RREC`

Sets the CCDF measurement value that corresponds to 0 V output voltage.

Suffix:
<output> 1 to 2
BNC connectors at the rear; 1 = Out 1 / Trig Out,
2 = Trig In / Out 2

Parameters:
<value> Range: 0.0 pct to 100.0 pct
*RST: 0.0 pct
Default unit: pct

Manual operation: See "0 V Equivalent" on page 72

OUTPut:RECorder<output>:LIMit:LOWer[:VALue] <value>

Effective if `OUTPut:MODE<output>` is set to `REC`, `FREC` or `RREC`.

Sets the measurement value that corresponds to 0 V output voltage.

If you enter a value without unit, the unit is defined by `UNIT<Measurement>:POWer[:VALue]`. For further information, see Section 11.3.1.3, "Units", on page 120.

Suffix:
<output> 1 to 2
BNC connectors at the rear; 1 = Out 1 / Trig Out,
2 = Trig In / Out 2

Parameters:
<value> The range depends on the measurement.

OUTPut:RECorder<output>:LIMit:LOWer:POWer <value>

Effective if `OUTPut:MODE<output>` is set to:

FREC or RREC

Sets the power measurement value that corresponds to 0 V output voltage.

If you enter a value without unit, the unit is defined by UNIT<Measurement>:POWer[:VALue]. For further information, see Section 11.3.1.3, "Units", on page 120.

Suffix:
<output> 1 to 2
BNC connectors at the rear; 1 = Out 1 / Trig Out,
2 = Trig In / Out 2

Parameters:
<value> Range: -120.0 dBm to +210.0 dBm
*RST: -30.0 dBm
Default unit: dBm

Manual operation: See "0 V Equivalent" on page 72

OUTPut:RECorder<output>:LIMit:LOWer:RATio:RCOefficient <value>

Effective if OUTPut:MODE<output> is set to:

FREC or RREC

Sets the reflection coefficient measurement value that corresponds to 0 V output voltage.

Suffix:
<output> 1 to 2
BNC connectors at the rear; 1 = Out 1 / Trig Out,
2 = Trig In / Out 2

Parameters:
<value> Range: -1e18 to 1e18
*RST: 0.0
Default unit: -

Manual operation: See "0 V Equivalent" on page 72

OUTPut:RECorder<output>:LIMit:LOWer:RATio:RFRatio <value>

Effective if OUTPut:MODE<output> is set to:

FREC or RREC

Sets the ratio of forward/reverse power that corresponds to 0 V output voltage.

Suffix:
<output> 1 to 2
BNC connectors at the rear; 1 = Out 1 / Trig Out,
2 = Trig In / Out 2

Parameters:

<value>
Range: 0.0 pct to 100.0 pct
*RST: 0.0 pct
Default unit: pct

Manual operation: See "0 V Equivalent" on page 72

OUTPut:RECorder<output>:LIMit:LOWer:RATio:RLOSs <value>

Effective if `OUTPut:MODE<output>` is set to:

`FREC` or `RREC`

Sets the return loss measurement value that corresponds to 0 V output voltage.

Suffix:

<output>
1 to 2
BNC connectors at the rear; 1 = Out 1 / Trig Out,
2 = Trig In / Out 2

Parameters:

<value>
Range: -180.0 dB to 180.0 dB
*RST: 0.0 dB
Default unit: dB

Manual operation: See "0 V Equivalent" on page 72

OUTPut:RECorder<output>:LIMit:LOWer:RATio:SWR <value>

Effective if `OUTPut:MODE<output>` is set to:

`FREC` or `RREC`

Sets the standing wave ration (SWR) measurement value that corresponds to 0 V output voltage.

Suffix:

<output>
1 to 2
BNC connectors at the rear; 1 = Out 1 / Trig Out,
2 = Trig In / Out 2

Parameters:

<value>
Range: -1e18 to 1e18
*RST: 1.0
Default unit: -

Manual operation: See "0 V Equivalent" on page 72

OUTPut:RECorder<output>:LIMit:LOWer:RATio[:VALue] <value>

Effective if `OUTPut:MODE<output>` is set to:

`FREC` or `RREC`

Sets the power ratio measurement value that corresponds to 0 V output voltage.

If you enter a value without unit, the unit is defined by `UNIT<Measurement>:POWer:RATio`. For further information, see Section 11.3.1.3, "Units", on page 120.

Suffix:
<output> 1 to 2
BNC connectors at the rear; 1 = Out 1 / Trig Out,
2 = Trig In / Out 2

Parameters:
<value> Range: -180.0 dB to +180.0 dB
*RST: +0.0 dB
Default unit: dB

Manual operation: See "0 V Equivalent" on page 72

OUTPut:RECorder<output>:LIMit:UPPer:CCDF <value>

Effective if `OUTPut:MODE<output>` is set to:

`FREC` or `RREC`

Sets the CCDF measurement value that corresponds to 2.5 V output voltage.

Suffix:
<output> 1 to 2
BNC connectors at the rear; 1 = Out 1 / Trig Out,
2 = Trig In / Out 2

Parameters:
<value> Range: 0.0 pct to 100.0 pct
*RST: 1.0 pct
Default unit: pct

Manual operation: See "2.5 V Equivalent" on page 73

OUTPut:RECorder<output>:LIMit:UPPer[:VALue] <value>

Effective if `OUTPut:MODE<output>` is set to `REC`, `FREC` or `RREC`.

Sets the measurement value that corresponds to 2.5 V output voltage.

If you enter a value without unit, the unit is defined by `UNIT<Measurement>:POWer[:VALue]`. For further information, see Section 11.3.1.3, "Units", on page 120.

Suffix:
<output> 1 to 2
BNC connectors at the rear; 1 = Out 1 / Trig Out,
2 = Trig In / Out 2

Parameters:
<value> The range depends on the measurement.

OUTPut:RECorder<output>:LIMit:UPPer:POWer <value>

Effective if `OUTPut:MODE<output>` is set to:

`FREC` or `RREC`

Sets the power measurement value that corresponds to 2.5 V output voltage.

If you enter a value without unit, the unit is defined by `UNIT<Measurement>:POWer[:VALue]`. For further information, see Section 11.3.1.3, "Units", on page 120.

Suffix:
<output> 1 to 2
BNC connectors at the rear; 1 = Out 1 / Trig Out,
2 = Trig In / Out 2

Parameters:
<value> Range: -120.0 dBm to +210.0 dBm
*RST: +30.0 dBm
Default unit: dBm

Manual operation: See "2.5 V Equivalent" on page 73

OUTPut:RECorder<output>:LIMit:UPPer:RATio:RCOefficient <value>

Effective if `OUTPut:MODE<output>` is set to:

`FREC` or `RREC`

Sets the reflection coefficient measurement value that corresponds to 2.5 V output voltage.

Suffix:
<output> 1 to 2
BNC connectors at the rear; 1 = Out 1 / Trig Out,
2 = Trig In / Out 2

Parameters:
<value> Range: -1e18 to 1e18
*RST: 1.0
Default unit: -

Manual operation: See "2.5 V Equivalent" on page 73

OUTPut:RECorder<output>:LIMit:UPPer:RATio:RFRatio <value>

Effective if `OUTPut:MODE<output>` is set to:

`FREC` or `RREC`

Sets the ratio of forward/reverse power that corresponds to 2.5 V output voltage.

Suffix:
<output> 1 to 2
BNC connectors at the rear; 1 = Out 1 / Trig Out,
2 = Trig In / Out 2

Parameters:
<value> Range: 0.0 pct to 100.0 pct
*RST: 100.0 pct
Default unit: pct

Manual operation: See "2.5 V Equivalent" on page 73

OUTPut:RECorder<output>:LIMit:UPPer:RATio:RLOSs <value>

Effective if `OUTPut:MODE<output>` is set to:

`FREC` or `RREC`

Sets the return loss measurement value that corresponds to 2.5 V output voltage.

Suffix:
<output> 1 to 2
BNC connectors at the rear; 1 = Out 1 / Trig Out,
2 = Trig In / Out 2

Parameters:
<value> Range: -180.0 dB to 180.0 dB
*RST: 10.0 dB
Default unit: dB

Manual operation: See "2.5 V Equivalent" on page 73

OUTPut:RECorder<output>:LIMit:UPPer:RATio:SWR <value>

Effective if `OUTPut:MODE<output>` is set to:

`FREC` or `RREC`

Sets the standing wave ratio (SWR) measurement value that corresponds to 2.5 V output voltage.

Suffix:
<output> 1 to 2
BNC connectors at the rear; 1 = Out 1 / Trig Out,
2 = Trig In / Out 2

Parameters:
<value> Range: -1e18 to 1e18
*RST: 10.0
Default unit: -

Manual operation: See "2.5 V Equivalent" on page 73

OUTPut:RECorder<output>:LIMit:UPPer:RATio[:VALue] <value>

Effective if `OUTPut:MODE<output>` is set to:

`FREC` or `RREC`

Sets the power ratio measurement value that corresponds to 2.5 V output voltage.

If you enter a value without unit, the unit is defined by `UNIT<Measurement>:POWer:RATio`. For further information, see Section 11.3.1.3, "Units", on page 120.

Suffix:
<output> 1 to 2
BNC connectors at the rear; 1 = Out 1 / Trig Out,
2 = Trig In / Out 2

Parameters:
<value> Range: -180.0 dB to +180.0 dB
*RST: +10.0 dB
Default unit: dB

Manual operation: See "2.5 V Equivalent" on page 73

11.6 Zeroing

Further information:

- Section 8, "Zeroing sensors", on page 62

CALibration<Sensor>:ZERO [<auto>]

Performs zeroing for the sensor that is connected to the selected port.

Turn off all test signals before zeroing. An active test signal during zeroing causes an error.

While zero calibration is in progress, no queries or other setting commands are allowed, since the command is synchronous. Any communication attempt can run into a timeout. Use `*WAI` to recognize the end of a zeroing procedure.

Suffix:
<Sensor> 1
Configured sensor

Parameters:
<auto> ON | OFF | ONCE | LFR | UFR

ON
Return value if a calibration is in progress.

OFF
Return value if no calibration is in progress.

ONCE
Starts zeroing.

LFR | UFR
Starts zeroing in a lower frequency range (LRF) or upper frequency range (UFR), thus reducing the required time by half. Not accepted by all sensors. Consult the manual of the sensor concerned.

11.7 Running self-tests

Used for testing the connected sensors and the R&S NRT2.

Further information:

- Section 9.5, "User interface tests", on page 91

DIAGnostic:INFO:OTIMe?

Queries the count of the built-in elapsed-time meter. The count is always output in hours [h] and cannot be changed.

Usage: Query only

TEST:SENSor<Sensor>? [<argument>]

Starts a self-test of the selected sensor and returns the result. In contrast to `*TST?`, this command returns detailed information that you can use for troubleshooting.

The response is sensor-dependent. It always contains an identification string for the sensor with the type name and the firmware version number. If an error has occurred, the response also contains the error message in plain text.

Suffix:
<Sensor> 1
Configured sensor

Query parameters:
<argument> Specifies a part of the self-test. If you add this string, the sensor performs only the specified part of the self-test. The string is sensor-specific.

Usage: Query only

Manual operation: See "Sensor Test" on page 75

11.8 System information and configuration

The SYSTem subsystem contains a series of commands for general functions that do not directly affect the measurement.

Further information:

- Section 9, "System settings", on page 64

11.8.1 Preset

SYSTem:PRESet

Sets the R&S NRT2 to a defined initial state. The default settings are indicated in the description of commands as *RST value.

The command corresponds to *RST.

Usage: Event

Manual operation: See "Preset" on page 61

11.8.2 Shutdown and reboot

SYSTem:REBoot

Reboots the R&S NRT2.

Usage: Event

SYSTem:SHUTdown

Shuts down the R&S NRT2.

Usage: Event

11.8.3 Firmware update

You can integrate a firmware update function in an application.

Example: Integrating a firmware update of the R&S NRT2

You want to update your R&S NRT2 with the NRT2_18.01.22.02.rsu file. This file has a size of 10242884 bytes.

To send the file to the R&S NRT2 for updating the firmware, your application has to assemble a memory block containing:

```
SYST:FWUP <block_data>
```

The <block_data> are definite length arbitrary block data as described in SYSTem:FWUPdate on page 164.

The size of the file is 10242884. This number has 8 digits. Thus, the <block_data> consist of the following:

- #
- 8
  How many digits follow to specify the file size.
- 10242884
  Number that specifies the file size.
- <file_contents>
  Contents of the *.rsu file, byte-by-byte
- 0x0a
  Delimiter

In this example, you write exactly 10242905 bytes to the R&S NRT2, for example by using a 'viWrite()' function.

The 10242905 bytes result from the values of the list above:

9 + 1 + 1 + 1 + 8 + 10242884 + 1

In a (pseudo) string notation, the memory block looks as follows:

```
SYST:FWUP #810242884<file_contents>0x0a,
```

11.8.3.1 Updating the R&S NRT2

SYSTem:FWUPdate <fwudata>>

Loads new operating firmware into the R&S NRT2. Rohde & Schwarz provides the update file. For further details, see Section 10, "Firmware update", on page 95.

If you want to integrate a firmware update function in an application, see the example given in Section 11.8.3, "Firmware update", on page 163.

Setting parameters:

<<fwudata>> <block_data>

Definite length arbitrary block data containing the direct copy of the binary *.rsu file in the following format:
#
Single digit indicating how many digits follow to specify the size of the binary file.
Number that specifies the size of the binary file.

Binary data
0x0a as appended delimiter for line feed

Usage: Setting only

SYSTem:FWUPdate:STATus?

Queries the result of the firmware update, returned as a readable string.

Further information.

- `SYSTem:FWUPdate` on page 164
- Section 10, "Firmware update", on page 95

Example: `SYST:FWUP:STAT?`
Query
`"Success"`
Response

Usage: Query only

11.8.4 Password management

See also Section 9.3, "Instrument security management", on page 80.

SYSTem:SECurity:PASSword:SECurity <pwd1>, <pwd2>

Sets a new security password.

The command is restricted to remote control over the USB interface (USBTMC).

Setting parameters:

<pwd1> Old security password, entered as a string.

<pwd2> New security password, entered as a string.

Example: `SYST:SEC:PASS:SEC "100095","100096"`

Usage: Setting only

Manual operation: See "Change Password" on page 89

SYSTem:SECurity:PASSword:USER <pwd1>, <pwd2>

Sets a new user password, also called instrument password.

The command is restricted to remote control over the USB interface (USBTMC).

Setting parameters:

<pwd1> Old user password, entered as a string.

<pwd2> New user password, entered as a string.

Example: `SYST:SEC:PASS:USER "instrument", "rohdeandschwarz"`

Usage: Setting only

Manual operation: See "Change Password" on page 88

11.8.5 Locking

SYSTem:KLOCk <klock>

Disables or enables the front panel keyboard of the instrument including the [LOCAL] key.

Parameters:
<klock> OFF | ON

SYSTem:LOCK:SHARed:STRing?

Queries the lock string assigned to the locking group if shared locking is enabled.

Writes an error in the error queue if shared locking is not enabled.

Return values:
<result>

Usage: Query only

SYSTem:LOCK:TIMeout <timeout>

When processing a command, sets the maximum time to wait before the command is discarded and an error is written to the error queue if the following applies:

- Instrument is locked.
- Sender of the command is not the owner of the lock.

Setting parameters:
<timeout> **<integer>**
Waiting time in milliseconds

INFinite
No timeout

Return values:
<result>

11.8.6 Network settings

SYSTem:COMMunicate:INET[:SELF]:ADDRess <address>
SYSTem:COMMunicate:NETWork[:IPADdress][:ADDRess] <IPaddress>

Effective if `SYSTem:COMMunicate:NETWork[:IPADdress]:MODE STATic` is set.

Sets the IP address of the R&S NRT2

Parameters:

<IPaddress> Consists of four blocks separated by dots, consisting of up to 3 digits. Example: 108.0.0.255

Range: 0 to 255 for each block

Manual operation: See "IPv4 Address" on page 68

SYSTem:COMMunicate:INET[:SELF]:DNS:ADDRess <server>
SYSTem:COMMunicate:NETWork[:IPADdress]:DNS <DNS>

Effective if `SYSTem:COMMunicate:NETWork[:IPADdress]:MODE STATic` is set.

Sets the DNS server address of your local subnet.

Parameters:

<DNS> Consists of four blocks separated by dots, consisting of up to 3 digits. Example: 123.456.0.1

Range: 0 to 255 for each block

Manual operation: See "DNS Server" on page 68

SYSTem:COMMunicate:INET[:SELF]:DNS:SUFFix <suffix>
SYSTem:COMMunicate:NETWork[:COMMon]:DOMain <Domain>

Sets the primary DNS suffix that means the domain name. DNS uses the suffix for registration and name resolution to identify the R&S NRT2 uniquely in the entire network.

Parameters:
<Domain>

Manual operation: See "DNS Suffix" on page 67

SYSTem:COMMunicate:INET[:SELF]:GATeway:ADDRess <gateway>
SYSTem:COMMunicate:NETWork[:IPADdress]:GATeway <Gateway>

Effective if `SYSTem:COMMunicate:NETWork[:IPADdress]:MODE STATic` is set.

Sets the IP address of the default gateway.

Parameters:
<Gateway> Consists of four blocks separated by dots, consisting of up to 3 digits. Example: 192.168.10.254

Range: 0 to 255 for each block

Manual operation: See "Default Gateway" on page 68

SYSTem:COMMunicate:INET[:SELF]:MODE <state>
SYSTem:COMMunicate:NETWork[:IPADdress]:MODE <mode>

Sets how the IP address is assigned.

Parameters:
<mode> AUTO | STATic

AUTO
Assigns the IP address automatically, provided the network supports the dynamic host configuration protocol (DHCP).

STATic
Enables assigning the IP address manually.

*RST: AUTO

Manual operation: See "Address Mode" on page 67

SYSTem:COMMunicate:INET[:SELF]:SUBNetmask:ADDRess <netmask>
SYSTem:COMMunicate:NETWork[:IPADdress]:SUBNet:MASK <Mask>

Effective if `SYSTem:COMMunicate:NETWork[:IPADdress]:MODE STATic` is set.

Sets the subnet mask of your local subnet.

Parameters:
<Mask> Consists of four blocks separated by dots, consisting of up to 3 digits. Example: 255.255.255.0

Range: 0 to 255 for each block

Manual operation: See "Subnet Mask" on page 68

SYSTem:COMMunicate:NETWork[:COMMon]:HOSTname <Hostname>

Sets the individual hostname of the R&S NRT2.

It is recommended that you do not change the default hostname to avoid problems with the network connection. However, if you change the hostname, be sure to use a unique name.

Parameters:
<Hostname>

Manual operation: See "Host Name" on page 66

SYSTem:COMMunicate:NETWork[:COMMon]:WORKgroup <Workgroup>

Sets an individual workgroup name for the R&S NRT2.

Parameters:
<Workgroup>

SYSTem:COMMunicate:NETWork:MACaddress?

Queries the MAC address of the network adapter.

Usage: Query only

SYSTem:COMMunicate:NETWork:RESTart

Restarts the network connection to the R&S NRT2, i.e. terminates the connection and sets it up again.

Usage: Event

SYSTem:COMMunicate:NETWork:STATus?

Queries the network configuration state.

Usage: Query only

11.8.7 Remote settings

SYSTem:COMMunicate:GPIB[:SELF]:ADDRess <address>

Sets the GPIB address.

Parameters:
<address> Range: 1 to 30
*RST: 12

Manual operation: See "GPIB Address" on page 70

SYSTem:HELP:HEADers? [<Parser>]

Returns a list of all SCPI commands supported by the R&S NRT2.

Query parameters:
<Parser>

Return values:
<Headers> <dblock>

Usage: Query only

SYSTem:HELP:SYNTax? <Header>

Returns the relevant parameter information for the specified SCPI command.

Query parameters:
<Header> Long or short form of the SCPI command.

Return values:
<Syntax> <dblock>

Example: `SYST:HELP:SYNT? "SYST:KLOC"`
Query
`"SYSTem:KLOCk[?] <boolean>"`
Response

Usage: Query only

SYSTem:HELP:SYNTax:ALL?

Queries the implemented SCPI commands and their parameters. Returns the result as block data.

Return values:
<Syntax> <dblock>

Usage: Query only

SYSTem:IDN:ANSWer <string>

Effective if `SYSTem:IDN:MODE USER` is set.

Sets the customized instrument identification string so that you can identify each R&S NRT2 individually.

You can query the defined string using `*IDN?`.

Parameters:

<string> Identification string. Maximum string length is 128 characters.

Manual operation: See "Custom IDN String" on page 71

SYSTem:IDN:AUTO <status>

Enables or disables the automatic instrument identification for `*IDN?`.

Parameters:

<status> ON | OFF

*RST: 1

Manual operation: See "Customization of *IDN?" on page 70

SYSTem:IDN:MODE <mode>

Sets which identification string is used.

Parameters:

<mode> AUTO | USER

AUTO
Automatic instrument identification.

USER
Customized identification string. Define the string using `SYSTem:IDN:ANSWer`.

*RST: AUTO

Manual operation: See "Customization of *IDN?" on page 70

SYSTem:LANGuage <language>

Fixed value.

Setting parameters:

<language> String

SCPI
Native remote command set of the R&S NRT2.

Query parameters:
<language> String
SCPI
*RST: SCPI

Manual operation: See "Language" on page 70

SYSTem:OPT:ANSWer <string>

Effective if `SYSTem:OPT:MODE USER` is set.

Sets the customized option identification string.

You can query the defined string using `*OPT?`.

Parameters:
<string> Option string. Maximum string length is 128 characters.

Manual operation: See "Custom OPT String" on page 71

SYSTem:OPT:AUTO <status>

Enables or disables the automatic instrument identification for `*OPT?`.

Parameters:
<status> ON | OFF
*RST: 1

Manual operation: See "Customization of *OPT?" on page 71

SYSTem:OPT:MODE <mode>

Sets which option string is used.

Parameters:
<mode> AUTO | USER
AUTO
Automatic option identification string.
USER
Customized option string. Define the string using `SYSTem:OPT:ANSWer`.
*RST: AUTO

Manual operation: See "Customization of *OPT?" on page 71

SYSTem:VERSion?

Queries the SCPI version that the command set of the R&S NRT2 complies with.

Return values:
<version>

Usage: Query only

11.8.8 Sensor management

[SENSe<Sensor>:]INFormation? [<argument>]

Queries information about the sensor used for the measurement.

Suffix:
<Sensor> 1
Configured sensor

Query parameters:
<argument>

Example: `INF?`
Query
`"ID:ID:ROHDE & SCHWARZ NRT-Z44","ID:SER 107050"`
Response

Usage: Query only

Manual operation: See "Sensor Info" on page 74

11.8.9 Instrument information

SYSTem:DID?
SYSTem:DEVice:ID?

Queries the Rohde & Schwarz instrument ID.

Return values:
<DeviceID>

Usage: Query only

Manual operation: See "System Info" on page 77

SYSTem:DFPRint [<Path>]

Generates the device footprint.

Setting parameters:
<Path>

Return values:
<XMLDeviceFootprint><dblock>

SYSTem:DFPRint:HISTory:COUNt?

Queries the number of device footprints in the history.

Return values:
<Count>

Usage: Query only

SYSTem:DFPRint:HISTory:ENTRy? <index>

Queries a device footprint from the history.

Query parameters:
<index> **0**
Most recent device footprint

Return values:
<XmlDeviceFootprint><dblock>

Usage: Query only

SYSTem:INFO:TERMchar <termination>

Selects the termination characters for information returned by:

- `SYSTem:INFO[:INFO]?`.
- `[SENSe<Sensor>:]CATalog?`
- `[SENSe<Sensor>:]INFormation?`

Parameters:
<termination> CR | LF | CRLF | STRS
*RST: CRLF

SYSTem:INFO[:INFO]? [<argument>]

Queries information on the R&S NRT2. See "System Info" on page 77.

If queried without parameters, the command returns all available information in the form of a list of strings separated by commas.

If you want to query specific information, add the query parameter:

```
SYST:INFO? "<string>"
```

Query parameters:

<argument> 'Manufacturer', 'Type', 'Stock Number', 'Serial', 'SW Build', 'MAC Address', 'Hostname', 'IP Address', 'Domain', 'Subnetmask', 'Gateway', 'Mode', 'Status', 'Sensor Name', 'Technology', 'Function', 'MinPower', 'MaxPower', 'MinFreq', 'MaxFreq', 'Impedance', 'Coupling', 'Uptime', 'Cal. Misc.', 'Cal. Abs.', 'Cal. Refl.', 'Cal. Temp.', ' Cal. Lin.', 'Cal. S-Para.', 'Cal. S-Para. (User)', 'SPD Mnemonic', 'Cal. Due Date', 'Certificate No', 'Limit', 'TestLimit', 'TestLimit pd'

Usage: Query only

Manual operation: See "System Info" on page 77

11.8.10 Date and time settings

SYSTem:DATE <year>, <month>, <day>
SYSTem:DATE:UTC <year>, <month>, <day>

Sets the date in coordinated universal time (UTC).

`SYSTem:DATE:LOCal` is changed accordingly.

Parameters:

<year> YYYY

<month> Range: 1 to 12

<day> Range: 1 to 31

Manual operation: See "Date" on page 78

SYSTem:DATE:LOCal <year>, <month>, <day>

Sets the local date.

`SYSTem:DATE:UTC` is changed accordingly.

Parameters:

<year> YYYY

<month> Range: 1 to 12

<day> Range: 1 to 31

Manual operation: See "Date" on page 78

SYSTem:TIME <hour>, <min>, <sec>
SYSTem:TIME:UTC <hour>, <minute>, <second>

Sets the time in the coordinated universal time (UTC).

`SYSTem:TIME:LOCal` is changed accordingly.

Parameters:
<hour> hh

<minute> mm

<second> ss

Manual operation: See "Time" on page 78

SYSTem:TIME:LOCal <hour>, <minute>, <second>

Sets the local time.

`SYSTem:TIME:UTC` is changed accordingly.

Parameters:
<hour> hh

<minute> mm

<second> ss

Manual operation: See "Time" on page 78

SYSTem:TIME:DSTime:MODE <dst>

Enables or disables the automatic clock adjustment for daylight saving time (DST). The automatic clock adjustment depends on the configured time zone, see `SYSTem:TIME:DSTime:RULE` on page 176.

If disabled, the local time is calculated as:

Local time = UTC + time zone offset

Parameters:
<dst> OFF | ON

SYSTem:TIME:DSTime:RULE <rule>

Sets the time zone. You can query the list of the available time zones with `SYSTem:TIME:DSTime:RULE:CATalog?`.

Parameters:
<rule>

Manual operation: See "Time Zone Region" on page 78
See "Time Zone" on page 79

SYSTem:TIME:DSTime:RULE:CATalog?

Queries the list of available time zones.

Return values:
<cat>

Usage: Query only

Manual operation: See "Time Zone Region" on page 78
See "Time Zone" on page 79

SYSTem:TIME:HRTimer:ABSolute:SET

Sets the start time for an absolute timer.

Return values:
<year> YYYY
<month> MM
<day> DD
<hour> hh
<min> mm
<sec> ss
<msec>

SYSTem:TZONe <hour>, <minute>

Sets the offset of the local time to the UTC time, due to the time zone. There can be an additional offset due to daylight saving time (DST).

Parameters:
<hour> Range: -12 to 15
<minute> Range: -59 to 59

11.8.11 Notifications and errors

The R&S NRT2 handles events and errors in 2 different queues, depending on their context:

- System event queue
  `SYSTem:SERRor` commands
- SCPI communication error queue
  `SYSTem:ERRor` commands

In the following, the expressions "error number" and "error code" are used synonymously.

11.8.11.1 System event queue

This system list contains notices, warnings and static errors that happen in setup.

A static error remains in the queue until you solve it. It prevents the execution of normal measurements. For example, if a sensor overload occurs, you need to lower the input power to the sensor. When you have done that, the static error disappears.

Warnings and static errors, you can remove from the queue using `SYSTem:SERRor:REMove`.

For further information, see Section 13.2.1, "Interpreting notifications and their number", on page 196.

Currently, the event type is not included in the description of the event.

SYSTem:SERRor[:ALL]?

Queries all events from the system event queue.

Returns a comma-separated list of unique event numbers.

Usage: Query only

SYSTem:SERRor:REMove <num>

Removes a notice or warning from the system event queue. You identify it by its unique number. To find out the unique number of an event, use `SYSTem:SERRor[:ALL]?`.

Setting parameters:

<num> Unique number of the event

*RST: 0

Example: `SYST:SERR:REM 2007`
This number belongs to a static error: #2007 - sensor overload
You cannot remove a static error from the queue, thus a "Parameter not allowed" error condition occurs. See also Section 11.8.11.1, "System event queue", on page 178.

Usage: Setting only

11.8.11.2 Changes in the system event queue

This SCPI list shows changes in the system event queue. An entry is created when an event is reported or removed. Thus, deleting an event using `SYSTem:SERRor:REMove` also causes an entry in this list.

SYSTem:SERRor:LIST:ALL?

Queries all changes in the system event queue that have not been read yet and removes them from the queue.

Usage: Query only

SYSTem:SERRor:LIST:NEXT?

Queries the list of system event changes for the oldest entry and removes it from the queue.

Returns an error number and a short description of the error. `0` means that no errors have occurred since the error queue was last read out.

Usage: Query only

11.8.11.3 SCPI communication error queue

This list contains errors in SCPI communication, for example, unknown commands or syntax errors. Generally, a single parameter or setting is affected.

SYSTem:ERRor:ALL?

Queries all errors in SCPI communication that have not been read yet and removes them from the queue.

Returns a comma-separated list of error numbers and a short error description in the first-in first-out order.

Return values:

<ErrorNumber> **<n>**
Number as defined in the SCPI standard

0
No errors have occurred since the error queue was last read out.

<ErrorText> Short error description

Usage: Query only

SYSTem:ERRor:CODE:ALL?

Queries all errors in SCPI communication that have not been read yet and removes them from the queue.

Returns a comma-separated list of error numbers, but no error description.

Return values:

<ErrorCode> **<n>**
Number as defined in the SCPI standard

0
No errors have occurred since the error queue was last read out.

Usage: Query only

SYSTem:ERRor:CODE[:NEXT]?

Queries the SCPI communication error queue for the oldest entry and removes it from the queue.

Returns the error number, but no error description.

Return values:

<Error> **<n>**
Number as defined in the SCPI standard

0
No errors have occurred since the error queue was last read out.

Usage: Query only

SYSTem:ERRor:COUNt?

Queries the number of entries in the SCPI communication error queue.

Return values:

<ErrorCount> Total number of entries

Example: `SYST:ERR:COUNt?`
Queries the number of entries in the error queue.
`1`
Response: One error has occurred since the error queue was last read out.

Usage: Query only

SYSTem:ERRor[:NEXT]?

Queries the SCPI communication error queue for the oldest entry and removes it from the queue.

Returns an error number and a short description of the error.

Return values:

<ErrorCode> **<n>**
Number as defined in the SCPI standard
0
No errors have occurred since the error queue was last read out.

<ErrorDescription> Short error description

Usage: Query only

11.9 Using the status register

Further information:

- Section 12.2, "Status reporting system", on page 190

11.9.1 General status register commands

STATus:PRESet

Resets the edge detectors and `ENABle` parts of all registers to a defined value.

Usage: Event

STATus:QUEue[:NEXT]?

Queries the most recent error queue entry and deletes it.

Return values:

<ErrorCode> Numeric value

<positive error number>
Sensor-specific error

<negative error number>
SCPI error message

0
Error queue is empty.

<ErrorDescription> String describing the error, example:
"No error"
Error queue is empty.

Usage: Query only

11.9.2 Reading the CONDition part

STATus:OPERation:BIT<bitno>:CONDition?
STATus:OPERation:CONDition?
STATus:QUEStionable:BIT<bitno>:CONDition?
STATus:QUEStionable:CONDition?
Return values:
<RegisterValue>

Usage: Query only

11.9.3 Reading the EVENt part

STATus:OPERation[:EVENt]?
STATus:OPERation:BIT<bitno>[:EVENt]?
STATus:QUEStionable[:EVENt]?
STATus:QUEStionable:BIT<bitno>[:EVENt]?
Suffix:
<bitno> 9 to 12
Bit

Return values:
<RegisterBit>

Usage: Query only

11.9.4 Controlling the ENABle part

STATus:OPERation:BIT<bitno>:ENABle <RegisterBit>
STATus:OPERation:ENABle <RegisterValue>
STATus:QUEStionable:BIT<bitno>:ENABle <RegisterBit>
STATus:QUEStionable:ENABle <RegisterValue>
Parameters:
<RegisterValue>

11.9.5 Controlling the negative transition part

STATus:OPERation:BIT<bitno>:NTRansition <RegisterBit>
STATus:OPERation:NTRansition <RegisterValue>

STATus:QUEStionable:BIT<bitno>:NTRansition <RegisterBit>
STATus:QUEStionable:NTRansition <RegisterValue>
Parameters:
<RegisterValue>

11.9.6 Controlling the positive transition part

STATus:OPERation:BIT<bitno>:PTRansition <RegisterBit>
STATus:OPERation:PTRansition <RegisterValue>
STATus:QUEStionable:BIT<bitno>:PTRansition <RegisterBit>
STATus:QUEStionable:PTRansition <RegisterValue>
Parameters:
<RegisterValue>

11.10 R&S NRT compatibility

This section describes all R&S NRT remote commands that are still functional but not recommended to use if you start afresh. If you want to reuse the programming of the R&S NRT, you can use these commands. But if you start with the R&S NRT2 without inherited liabilities, only use the commands recommended for the R&S NRT2.

11.10.1 SENSe commands

[SENSe<Sensor>:][POWer:][AVG:]APERture[:VALue] <integration_time>

Available for compatibility. Recommended sensor command:

`CALCulate<Measurement>[:CHANnel<Channel>]:NRT:APERture[:VALue]`

Suffix:
<Sensor> 1
Configured sensor

Parameters:
<integration_time> Range: 10.0e-6 s to 2.00 s
*RST: 0.03667 s
Default unit: s

[SENSe<Sensor>:]AVERage:COUNt:AUTO[:STATe] <state>

Available for compatibility. Recommended sensor command:

`CALCulate<Measurement>[:CHANnel<Channel>]:AVERage:COUNt:AUTO[:STATe]`

Suffix:
<Sensor> 1
Configured sensor

Parameters:
<state> | OFF | ON

[SENSe<Sensor>:]AVERage:COUNt[:VALue] <count>

Available for compatibility. Recommended sensor command:

`CALCulate<Measurement>[:CHANnel<Channel>]:AVERage:COUNt[:VALue]`

Suffix:
<Sensor> 1
Configured sensor

Parameters:
<count> Range: 1 to 256
*RST: 1

[SENSe<Sensor>:]DM:WCDMa:CRATe <value>

Available for compatibility. Recommended sensor command:

`CALCulate<Measurement>[:CHANnel<Channel>]:NRT:DMODulation:WCDMa:CRATe`

Suffix:
<Sensor> 1
Configured sensor

Parameters:
<value> Range: 0.0 Hz to 8.2e6 Hz
Default unit: Hz

[SENSe<Sensor>:]FUNCtion[:ON] <function>

Available for compatibility. Recommended sensor command:

`CALCulate<Measurement>[:CHANnel<Channel>]:FEED<Channel>`

Suffix:
<Sensor> 1
Configured sensor

Parameters:
<function> *RST: POWer:AVG

[SENSe<Sensor>:]POWer:CCDFunction:REFerence <ref>

Available for compatibility. Recommended sensor command:

`CALCulate<Measurement>[:CHANnel<Channel>]:NRT:CCDF:THReshold` on page 144

If you enter a value without unit, the unit is defined by `UNIT<Measurement>:POWer[:VALue]` on page 122. For further information, see Section 11.3.1.3, "Units", on page 120.

Suffix:
<Sensor> 1
Configured sensor

Parameters:
<ref> Range: -290.0 dBm to +110.0 dBm
*RST: +0.0 dBm
Default unit: dBm

[SENSe<Sensor>:]POWer:PEP:HOLD <time>

Available for compatibility. Recommended sensor command:

`CALCulate<Measurement>[:CHANnel<Channel>]:NRT:PEP:HOLD:TIME`

Suffix:
<Sensor> 1
Configured sensor

Parameters:
<time> Range: 1.0e-3 s to 1.0e-1 s
*RST: 6.0e-2 s
Default unit: s

11.10.2 TEST commands

TEST:ALL?

Available for R&S NRT compatibility, but the command has no functionality in the R&S NRT2.

Usage: Query only

TEST:DIRect <sensor_command>

Available for R&S NRT compatibility, but the command has no functionality in the R&S NRT2.

Parameters:
<sensor_command> *RST: -

TEST:FRAM?

Available for R&S NRT compatibility, but the command has no functionality in the R&S NRT2.

Usage: Query only

TEST:RAM?

Available for R&S NRT compatibility, but the command has no functionality in the R&S NRT2.

Usage: Query only

TEST:ROM?

Available for R&S NRT compatibility, but the command has no functionality in the R&S NRT2.

Usage: Query only

11.10.3 UNIT commands

UNIT<Measurement>:POWer:RELative[:VALue] <unit>

Available for compatibility. Recommended sensor command:

`UNIT<Measurement>:POWer:RATio`

Suffix:
<Measurement> 1
Configured sensor

Parameters:
<unit> PCT | DB
*RST: PCT

12 Remote control basics

For general information on remote control of Rohde & Schwarz products via SCPI, refer to www.rohde-schwarz.com/rc-via-scpi.

12.1 Remote control interfaces and protocols

For remote control, communication between the R&S NRT2 and the controlling host is established based on the following interfaces and protocols.

Table 12-1: Supported interfaces and protocols

Interface	Protocol	VISA*) address string	Library
USB	USBTMC	USB::<vendor ID>::<product ID>::<serial number>[::INSTR]	VISA
Ethernet	VXI-11	TCPIP::host address[::LAN device name][::INSTR]	VISA
	HiSLIP High-speed LAN instrument protocol (IVI-6.1)	TCPIP::host address::hislip0[::INSTR]	VISA
	Socket communication (SCPI raw)	TCPIP::host address[::LAN device name]::<port>::SOCKET	
GPIB/ IEEE-488 interface (R&S NRT 2-B8)	GPIB/IEEE 488	GPIB::<primary address>::INSTR	
	*) VISA is a standardized software interface library providing input and output functions to communicate with instruments. A VISA installation on the controller is a prerequisite for remote control over LAN (when using VXI-11 or HiSLIP protocol) and USBTMC interfaces. See also Section 12.1.2.1, "VISA resource strings", on page 189.		

12.1.1 USB interface

Computer requirements

- VISA library
  A USB connection requires the VISA library to be installed. VISA detects and configures the R&S NRT2 automatically when the USB connection is established.
- USBTMC driver
  Apart from the USBTMC driver, which comes with the installation of the R&S NRP-Toolkit, you do not have to install a separate driver.

Setup

► Connect the host interface of the R&S NRT2 and the USB interface of the computer.

USBTMC protocol

USB Test & Measurement Class Specification (USBTMC) is a protocol that is built on top of USB for communication with USB devices from the test & measurement category. It defines a dedicated class code that identifies a device's functionality.
R&S NRT2 also uses this class code to identify itself as a member of the test & measurement class. Using a VISA library, such devices support service request, trigger and other operations that are commonly found in GPIB devices.

USB resource string

The VISA resource string for USBTMC device communication represents an addressing scheme that is used to establish a communication session with the sensor. It is based on the sensor address and some sensor- and vendor-specific information. The syntax of the used USB resource string is:

USB::<vendor ID>::<product ID>::<serial number>[::INSTR]

- <*vendor ID*> is the vendor ID for Rohde & Schwarz.
- <*product ID*> is the product ID for the R&S NRT2.
- <*serial number*> is the individual serial number of the R&S NRT2, printed on the casing.

Example:

```
USB::0x0AAD::0x01DC::100001
```

0x0AAD is the vendor ID for Rohde & Schwarz.

0x01DC is the product ID for the R&S NRT2.

100001 is the serial number of the particular R&S NRT2.

12.1.2 Ethernet interface

The Ethernet interface of the R&S NRT2 allows you to integrate it in a local area network (LAN).

Requirements

- TCP/IP network protocol
  The local area network must support the TCP/IP network protocol.
  The TCP/IP network protocol and the associated network services are preconfigured on the R&S NRT2.
- VISA library
  Installed on the computer.
- Software for device control
  Installed on the computer.

Setup

► Using the Ethernet interface, connect the computer and the R&S NRT2 to a local area network.

12.1.2.1 VISA resource strings

The VISA resource string is required to establish a communication session between the controller and the sensor in a LAN. The resource string is a unique identifier, composed of the specific IP address of the sensor and some network and VISA-specific keywords.

TCPIP::<IP address or hostname>[::<LAN device name>][::INSTR]

- *TCPIP* designates the network protocol used.
- *<IP address or hostname>* is the IP address or host name of the device.
- *[::<LAN device name>]* defines the protocol and the instance number of a subinstrument.
- *[::INSTR]* indicates the sensor resource class (optional).

The IP address or host name is used by the programs to identify and control the sensor. While the host name is determined by settings in the sensor, the IP address is assigned by a DHCP server when the sensor requests one. Alternatively the IP address is determined with a procedure called zeroconf.

You can also assign a *LAN device name* which defines the protocol characteristics of the connection. See the description of the VISA resource string below for the corresponding interface protocols. The string of the *LAN device name* is emphasized in italics.

HiSLIP

TCPIP::<IP address or hostname>*::hislip0*[::INSTR]

- *hislip0* is the HiSLIP device name, designates that the interface protocol HiSLIP is used (mandatory)

hislip0 is composed of [::HiSLIP device name[,HiSLIP port]] and must be assigned.

VXI-11

TCPIP::<IP address or hostname>*[::inst0]*[::INSTR]

- *inst0* is the LAN device name, indicating that the VXI-11 protocol is used (optional)

inst0 currently selects the VXI-11 protocol by default and can be omitted.

Socket communication

TCPIP::<IP address or hostname>*::port::SOCKET*

- *Port* determines the used port number
- *SOCKET* indicates the raw network socket resource class

Socket communication requires the specification of the port (commonly referred to as port number) and of "SOCKET" to complete the VISA resource string with the associated protocol used.

The default port for socket communication is port 5025.

Example:

A sensor has the IP address *10.111.11.20*; the valid resource string using the VXI-11 protocol is:

TCPIP::10.111.11.20::INSTR

The DNS host name is *nt2-100001*; the valid resource string is:

TCPIP::nt2-100001::hislip0 (HiSLIP)

TCPIP::nt2-100001::inst0 (VXI-11)

A raw socket connection can be established using:

TCPIP::10.111.11.20::5025::SOCKET

TCPIP::nt2-100001::5025::SOCKET

12.1.3 GPIB interface

Connect the R&S NRT2 and the controller using a GPIB bus cable. Address the R&S NRT2 by its GPIB address.

Controller prerequisites

- GPIB bus card
- Card drivers
- Program libraries for the programming language

12.2 Status reporting system

The status reporting system stores all information on the current operating state of the instrument, and on errors which have occurred. This information is stored in the status registers and in the error queue. You can query both with the commands of the `STATus` subsystem.

12.2.1 Overview

Figure 12-1 shows the hierarchical structure of information in the status registers.

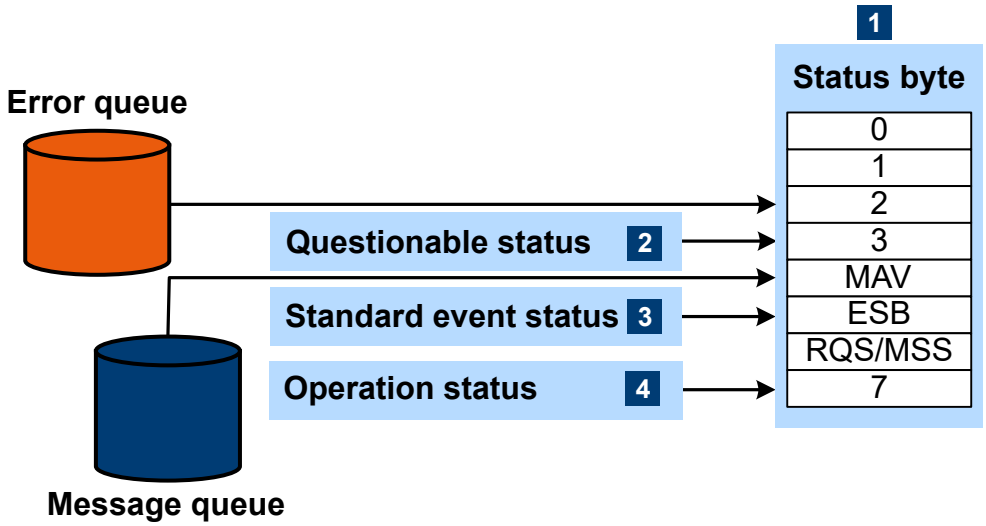


Figure 12-1: Status registers overview

1 = Status byte, see Table 12-2
2 = Section 12.2.2, "Questionable status register", on page 192
3 = Section 12.2.3, "Standard event status and enable register (ESR, ESE)", on page 193
4 = Section 12.2.4, "Operation status register", on page 194

The highest level is formed by the status byte register (STB) and the associated service request enable (SRE) register.

The status byte register (STB) receives its information from:

- Standard event status register (ESR)
- Associated standard event status enable register (ESE)
- SCPI-defined operation status register
- Questionable status register, which contains detailed information on the device.
- Device status register

Table 12-2: Used status byte bits and their meaning

Bit no.	Short description	Bit is set if
2	Error queue not empty	The error queue has an entry. If this bit is enabled by the service request enable register, each entry of the error queue generates a service request. An error can thus be recognized and specified in detail by querying the error queue. The query yields a conclusive error message. This procedure is recommended since it considerably reduces the problems of IEC/IEEE bus control.
3	Questionable status register summary	An `EVENt` bit is set in the `QUEStionable` status register and the associated `ENABLe` bit is set to 1. A set bit denotes a questionable device status which can be specified in greater detail by querying the questionable status register. Section 12.2.2, "Questionable status register", on page 192
4	MAV Message available	A readable message is in the message queue. This bit can be used to read data automatically from the instrument into the controller.

Bit no.	Short description	Bit is set if
5	ESB Standard event status register summary	One of the bits in the standard event status register is set and enabled in the event status enable register. Setting this bit denotes a serious error which can be specified in greater detail by querying the standard event status register. Section 12.2.3, "Standard event status and enable register (ESR, ESE)", on page 193.
6	RQS/MSS Primary status summary	The instrument triggers a service request. The service request happens if one of the other bits of this register is set together with its enable bit in the service request enable register (SRE).
7	Operation status register summary	An `EVENt` bit is set in the operation status register and the associated `ENABLe` bit is set to 1. A set bit denotes that an action is being performed by the instrument. Information on the type of action can be obtained by querying the operation status register. Section 12.2.4, "Operation status register", on page 194

Further information:

- See Figure 12-1.
- Set and read the service request enable register using `*SRE`.

12.2.2 Questionable status register

Contains information on questionable instrument states that occur if the instrument is not operated in compliance with its specifications.

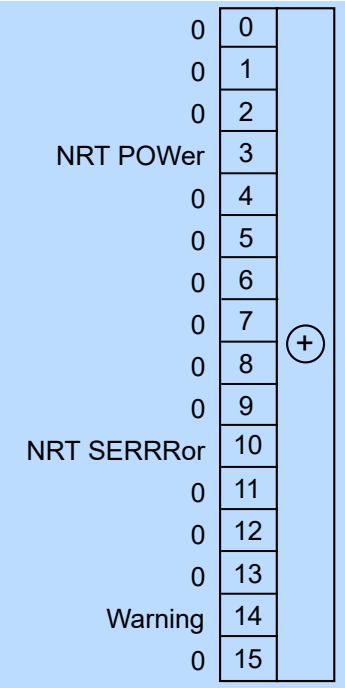


Figure 12-2: Questionable status register

Querying the register:

- `STATus:QUEStionable:CONDition?`
- `STATus:QUEStionable[:EVENt]?`

Table 12-3: Used questionable status bits and their meaning

Bit no.	Short description	Bit is set if
3	NRT POWer	• Sensor is overloaded. The forward or reflected power exceeds the maximum value specified for the sensor. • The measured values for power or matching exceed the limit values. • The central supply voltage for sensor and R&S NRT2 exceeds or falls below the allowed limits.
10	NRT SERRRor	Static error of the R&S NRT-Zxx sensor occurred.
14	Warning	

12.2.3 Standard event status and enable register (ESR, ESE)

The `ESR` is already defined in the IEEE 488.2 standard. It is comparable to the `EVENt` register of a SCPI register. The standard event status register can be read out by `*ESR?`.

The `ESE` forms the associated `ENABle` register. It can be set and read by `*ESE`.

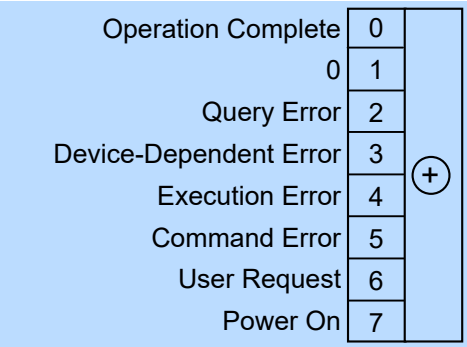


Figure 12-3: Standard event status register (ESR)

Table 12-4: Used standard event status bits and their meaning

Bit no.	Short description	Bit is set if
0	Operation complete	All previous commands have been executed and `*OPC` is received.
2	Query error	The controller wants to read data from the instrument but has not sent a query, or it sends new commands to the instrument before it retrieves existing requested data. A frequent cause is a faulty query which cannot be executed.
3	Device-dependent error	An instrument-dependent error occurs. An error message with a number between -300 and -399 or a positive error number denoting the error in greater detail is entered in the error queue.
4	Execution error	The syntax of a received command is correct but the command cannot be executed due to various marginal conditions. An error message with a number between -200 and -300 denoting the error in greater detail is entered in the error queue.
5	Command error	An undefined command or a command with incorrect syntax is received. An error message with a number between -100 and -200 denoting the error in greater detail is entered in the error queue.
6	User request	The instrument is switched over to manual control.
7	Power on	The instrument is switched on.

12.2.4 Operation status register

Contains information on current operations in the `CONDition` register. Or operations performed since the last query in the `EVENt` register.

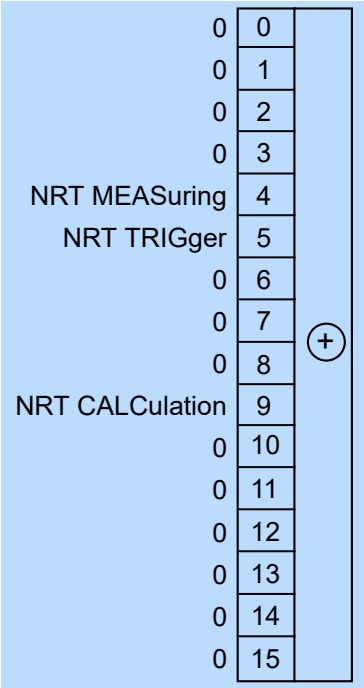


Figure 12-4: Operation status register

Querying the register:

- `STATus:OPERation:CONDition?`
- `STATus:OPERation[:EVENt]?`

Table 12-5: Used operation status bits and their meaning

Bit no.	Short description	Bit is set if
4	NRT MEASuring	R&S NRT2 is measuring.
5	NRT TRIGger	R&S NRT2 is waiting for trigger event.
9	NRT CALCulation	R&S NRT2 performs a limit check.

13 Troubleshooting

13.1 Displaying information

Status information

Status information is displayed in the title bar of the graphical user interface. See Section 4, "Operating concepts", on page 31.

In remote control, the status reporting system stores all information on the current operating state and occurred errors. See:

- Section 11.9, "Using the status register", on page 181
- Section 12.2, "Status reporting system", on page 190

Instrument information

Instrument information, including the installed hardware and software options, is described in Section 9.2, "Instrument information", on page 76.

Sensor information

You can display information about one of the connected sensors. See "Sensor Info" on page 74.

13.2 Notifications

The graphical user interface has a notification center where all information, warning and error messages are collected. See Section 4.1.3, "Notification center", on page 34.

13.2.1 Interpreting notifications and their number

In the following, important notifications and their meaning are explained. For all other notifications, perform tests to find out whether it is a hardware or software problem, and report the problem to the R&S customer support. See Section 13.3, "Performing tests", on page 198.

In remote control, notifications and errors are associated with a unique number. Positive numbers are instrument-dependent. Negative numbers are reserved by the SCPI standard.

The notification types are grouped in number ranges. In the following description, both the number used in remote control and the description is given to help identify the problem.

13.2.1.1 System notifications

Number range: 1000 to 1999. Described notifications:

1004 - firmware update error
Firmware update failed.

Possible reasons:
- You have used a `*.rsu` file that is not designated for the R&S NRT2. The name of a suitable `*.rsu` file starts with "NRT2".
- The firmware update was interrupted or otherwise faulty.

Solution: Perform the firmware update again. See Section 10, "Firmware update", on page 95.

1005 - settings conflict
Settings conflict of the R&S NRT2 occurred.

Reason: Contradictory settings are allowed so that you are not hampered in your workflow.

Solution: Solve the setting conflict before starting a measurement.

1007 - target descriptor error
Servicing required. You cannot resolve the problem yourself.

Solution: Contact customer support. See Section 13.5, "Contacting customer support", on page 199.

1008 - temperature alert
R&S NRT2 is overheated. Overheating can damage the R&S NRT2.

Possible reasons:
- Insufficient airflow. Follow the instructions in Section 3.1.4, "Setting up the product", on page 18.
- The environmental temperature exceeds the suitable temperature range given in the specifications document under environmental conditions.
- The fan does not work properly. See Section 13.5, "Contacting customer support", on page 199.

1009 - fan failure alert
The fan does not work. Overheating can damage the R&S NRT2.

Solution: Switch off the R&S NRT2, and contact customer support. See Section 13.5, "Contacting customer support", on page 199.

13.2.1.2 Sensor notifications

Number range: 2000 to 2999.

The sensors report their error states to the R&S NRT2. The error states depend on the sensor type.

2007 - sensor overload
The RF input power exceeds the measurement range by far.

Solution: Immediately disconnect the sensor from the RF source to avoid damage. Use an attenuator or another sensor that is suitable for the input level.

13.2.1.3 License key notifications

Number range: 4000 to 4999.

For all notifications not described here, collect information for technical support. See Section 13.4, "Collecting information for technical support", on page 199. Described notifications:

4001 - license key management warning
Usually caused by:
- Problems with the system time. See "Date and Time Settings" on page 78.
- Wrong license key for a software option.

13.2.1.4 Queue handling notifications

Number range starts from 9000.

9001 - static error queue overflow
The queue of events has reached its maximum number of 1000 notices, warnings and errors. No more entries are created.

Solution: Solve the errors before continuing.

13.3 Performing tests

Using the graphical user interface, you can test the following:
- User interface of the R&S NRT2. See Section 9.5, "User interface tests", on page 91.
- Connected sensors, see "Sensor Test" on page 75.

13.4 Collecting information for technical support

If you encounter problems that you cannot solve yourself, contact your Rohde & Schwarz support center, see Section 13.5, "Contacting customer support", on page 199. Our support center staff is optimally trained to assist you in solving problems.

The support center finds solutions more quickly and efficiently if you provide them with information on the instrument and an error description.

Obtaining information from the R&S NRT2 firmware

1. Select [System] > "Test".
2. Create and save the information for troubleshooting. See "Creating information for troubleshooting" on page 92.

Attach the archive file to an email in which you describe the problem.

If you need to transport or ship the product, see Section 14, "Transporting", on page 200.

13.5 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 13-1: QR code to the Rohde & Schwarz support page

14 Transporting

Lifting and carrying

See:

- "Lifting and carrying the product" on page 10
- Section 3.1.1, "Lifting and carrying", on page 17

Packing

Use the original packaging material. It consists of antistatic wrap for electrostatic protection and packing material designed for the product.

If you do not have the original packaging, use similar materials that provide the same level of protection. You can also contact your local Rohde & Schwarz service center for advice.

Securing

When moving the product in a vehicle or using transporting equipment, make sure that the product is properly secured. Only use items intended for securing objects.

Transport altitude

The maximum transport altitude without pressure compensation is specified in the specifications document.

15 Maintenance, storage and disposal

The product does not require regular maintenance. It only requires occasional cleaning. It is however advisable to check the nominal data from time to time.

15.1 Cleaning

How to clean the product is described in "Cleaning the product" on page 11.

Do not use any liquids for cleaning. Cleaning agents, solvents, acids and bases can damage the front panel labeling, plastic parts and display.

15.2 Storage

Protect the product against dust. Ensure that the environmental conditions, e.g. temperature range and climatic load, meet the values specified in the specifications document.

15.3 Disposal

Rohde & Schwarz is committed to making careful, ecologically sound use of natural resources and minimizing the environmental footprint of our products. Help us by disposing of waste in a way that causes minimum environmental impact.

Disposing of electrical and electronic equipment

A product that is labeled as follows cannot be disposed of in normal household waste after it has come to the end of its life. Even disposal via the municipal collection points for waste electrical and electronic equipment is not permitted.

Figure 15-1: Labeling in line with EU directive WEEE

Rohde & Schwarz has developed a disposal concept for the eco-friendly disposal or recycling of waste material. As a manufacturer, Rohde & Schwarz completely fulfills its obligation to take back and dispose of electrical and electronic waste. Contact your local service representative to dispose of the product.

Glossary: List of abbreviations

A

AVG: Average

C

CCDF: Complementary cumulative distribution function

CDMA: Code division multiple access

D

DHCP: Dynamic host control protocol

DNS: Domain name system

E

EMC: Electromagnetic compatibility

EMI: Electromagnetic interference

F

FTP: File transfer protocol

G

GPIB: General purpose interface bus

H

HiSLIP: High-speed LAN instrument protocol

I

IDN: Instrument identification string

IP: Internet protocol

L

LAN: Local area network

O

OPT: Option identification string

OSA: Open source acknowledgment

P

PEP: Peak envelope power

S

SCP: System and communications protections

SCPI: Standard commands for programmable instruments

SSH: Secure shell

SWR: Standing wave ratio

U

USB: Universal serial bus

V

VISA: Virtual instrument software architecture

VNC: Virtual network computing

W

WCDMA: Wideband code division multiple access

List of commands

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