

R&S® FSPN Phase Noise Analyzer Getting Started



1179437002
Version 03

ROHDE & SCHWARZ
Make ideas real



This document describes the following R&S®FSPN models with firmware version 3.02 or higher:

- R&S®FSPN8 (1322.8003K06)
- R&S®FSPN8 (1322.8003K07)
- R&S®FSPN26 (1322.8003K24)
- R&S®FSPN26 (1322.8003K25)
- R&S®FSPN50 (1322.8003K49)

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1179.4370.02 | Version 03 | R&S®FSPN

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

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

The product is intended for the development, production and verification of electronic components and devices in industrial, administrative, and laboratory environments. Use the product only for its designated purpose. Observe the operating conditions and performance limits stated in the specifications document.

Target audience

Where do I find safety information?

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

- In [Chapter 1.1, "Safety instructions"](#), on page 3. The same information is provided in many languages as printed "Safety Instructions". The printed "Safety Instructions" are delivered with the product.
- Throughout the documentation, safety instructions are provided when you need to take care during setup or operation.

1.1 Safety instructions

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

Use the product only for its intended use and within its performance limits. Intended use and limits are described in the product documentation such as the 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 product is heavy. Do not move or carry the product by yourself. A single person can only carry a maximum of 18 kg safely depending on age, gender and physical condition. Look up the maximum weight in the specifications document. Use the product handles to move or carry the product. Do not lift by the accessories mounted on the product. Accessories are not designed to carry the weight of the product.

To move the product safely, you can use lifting or transporting equipment such as lift trucks and forklifts. Follow the instructions provided by the equipment manufacturer.

Choosing the operating site

Only use the product indoors. The product casing is not waterproof. Water that enters can electrically connect the casing with live parts, which can lead to electric shock, serious personal injury or death if you touch the casing.

If Rohde & Schwarz provides accessories designed for 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 and 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.

	<p>Potential hazard Read the product documentation to avoid personal injury or product damage.</p>
	<p>Heavy product Be careful when lifting, moving or carrying the product. Carrying the product requires a sufficient number of persons or transport equipment.</p>
	<p>Electrical hazard Indicates live parts. Risk of electric shock, fire, personal injury or even death.</p>
	<p>Hot surface Do not touch. Risk of skin burns. Risk of fire.</p>
	<p>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.</p>

1.2 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.

1.3 Korea certification class A



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

2 Documentation overview

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

www.rohde-schwarz.com/manual/FSPN

2.1 Getting started manual

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

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

2.2 User manuals and help

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

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

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

2.3 Service manual

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

Release notes and open source acknowledgment (OSA)

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

<https://gloris.rohde-schwarz.com>

2.4 Instrument security procedures

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

2.5 Printed safety instructions

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

2.6 Specifications and brochures

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

2.7 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.

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

2.8 Application notes, application cards, white papers, etc.

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

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

2.9 Videos

Find various videos on Rohde & Schwarz products and test and measurement topics on YouTube: <https://www.youtube.com/@RohdeundSchwarz>

3 Preparing for use

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

3.1 Lifting and carrying

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

See "[Lifting and carrying the product](#)" on page 4.

3.2 Unpacking and checking

1. Unpack the R&S FSPN carefully.
2. Retain the original packing material. Use it when transporting or shipping the R&S FSPN later.
3. Using the delivery notes, check the equipment for completeness.
4. Check the equipment for damage.

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

3.3 Choosing the operating site

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

For safety information, see "[Choosing the operating site](#)" on page 4.

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.

3.4 Setting up the R&S FSPN

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

See also:

- ["Setting up the product"](#) on page 5
- ["Intended use"](#) on page 3

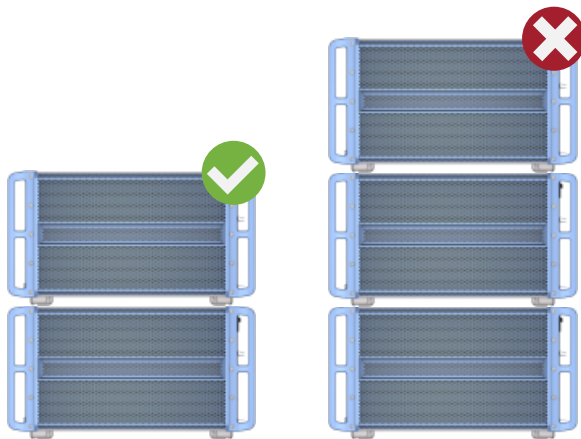
3.4.1 Placing the product on a bench top

To place the product on a bench top

1. Place the product on a stable, flat and level surface. Ensure that the surface can support the weight of the product. For information on the weight, see the specifications document.
2. **WARNING!** A stack of products can fall over and cause injury. Never stack more than two products. Otherwise, mount them in a rack.

Stack as follows:

- All products must have the same dimensions (width and length).
- Do not exceed a total load of 50 kg placed on the product at the bottom of the stack.



Left = Stacked correctly

Right = Stacked incorrectly, too many products

3. **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.

3.4.2 Mounting the R&S FSPN in a rack

To prepare the rack

1. Observe the requirements and instructions in ["Setting up the product"](#) on page 5.
2. **NOTICE!** Insufficient airflow can cause overheating and damage the product. Design and implement an efficient ventilation concept for the rack.

To mount the R&S FSPN in a rack

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

2. Lift the R&S FSPN to shelf height.
3. Grab the handles and push the R&S FSPN onto the shelf until the rack brackets fit closely to the rack.
4. Tighten all screws in the rack brackets with a tightening torque of 1.2 Nm to secure the R&S FSPN in the rack.

To unmount the R&S FSPN from a rack

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

3.5 Connecting the AC power

In the standard version, the R&S FSPN is equipped with an AC power supply connector.

The R&S FSPN can be used with different AC power voltages and adapts itself automatically to it. Refer to the specifications document for the requirements of voltage and frequency.

For safety information, see ["Connecting to power"](#) on page 5.

To connect the AC power

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



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 specifications document.

Switching the instrument on and off

For details on the connector, refer to [Chapter 4.2.2, "AC power supply connection and main power switch"](#), on page 39.

3.6 Switching the instrument on and off

Table 3-1: Overview of power states

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

To switch on the R&S FSPN

Prerequisites:

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

No RF input is connected to the instrument.

1. Set the switch on the power supply to position [I].
See [Chapter 4.2.2, "AC power supply connection and main power switch"](#), on page 39.

The LED of the Power key is orange.

See [Chapter 4.1.2, "Power key"](#), on page 30.

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

2. Press the Power key.

See [Table 3-1](#).

The LED changes to green.

The R&S FSPN boots.

After booting, the instrument is ready for operation.



Warm-up time for OCXO

When the instrument is switched on, the OCXO requires an extended warm-up time.

To shut down the product

Prerequisites:

The product is in the ready state.

Any RF input is disconnected from the instrument.

▶ Press the [Power] key.

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



If the instrument temperature exceeds the limit specified in the specifications document, the R&S FSPN automatically shuts down to protect the instrument from damage.

To disconnect from power

The R&S FSPN is in the standby state.

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

Set the switch on the power supply to position [0].

See [Chapter 4.2.2, "AC power supply connection and main power switch"](#), on page 39.

The LED of the standby key is switched off.

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

3.7 Connecting to LAN

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

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

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

Network environment

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

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

► **NOTICE!** Risk of network failure.

Consult your network administrator before performing the following tasks:

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

Errors can affect the entire network.

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

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

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



The default instrument name is <Type><variant>-<serial_number>, for example, FSPN6-123456. For information on determining the serial number, see [Chapter 4.2.12, "Device ID"](#), on page 42.

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

3.8 Connecting a keyboard

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

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

- German
- Swiss
- French
- Russian

To configure the keyboard language

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

3.9 Connecting an external monitor

You can connect an external monitor (or projector) to the "DVI" or "Display port" connector on the rear panel of the R&S FSPN (see also [Chapter 4.2.3, "Display port and DVI"](#), on page 39).

Screen resolution and format

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

The touchscreen has a screen resolution of 1280x800 pixels. Usually, the display of the external monitor is a duplicate of the instrument's monitor.

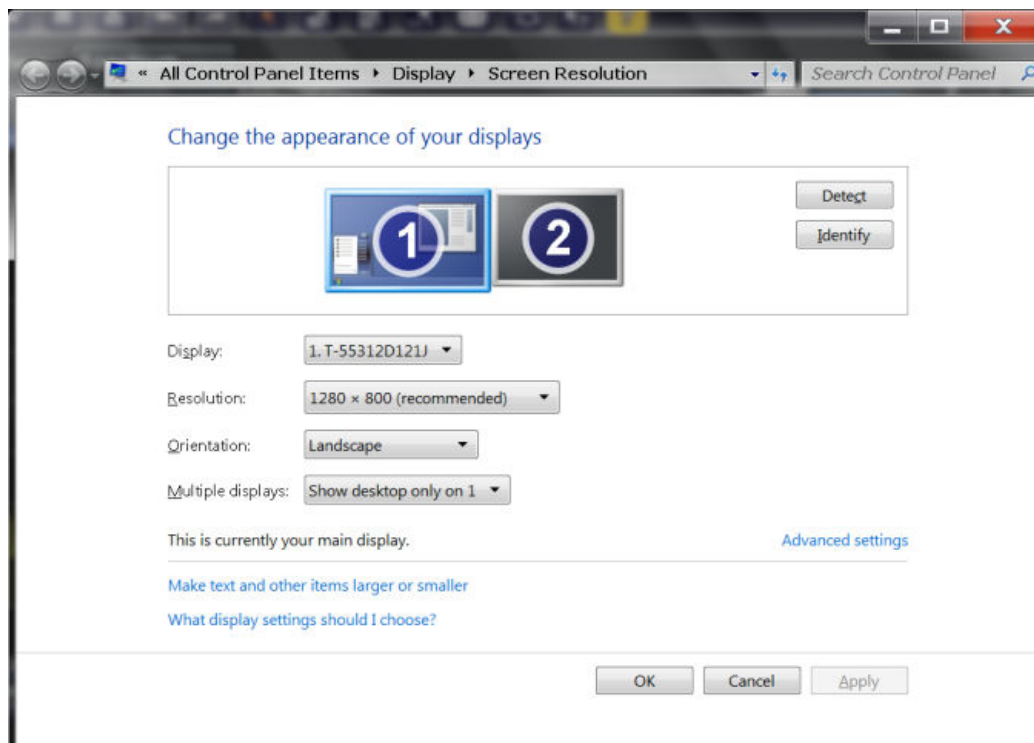
If you configure the external monitor to be used as the *only* display in the Windows configuration dialog box ("Show only on 2"), the maximum screen resolution of the monitor is used. In this case, you can maximize the R&S FSPN application window and see even more details. You cannot change the monitor's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

However, you can restore the default instrument resolution (1280x800) on the monitor using the instrument function "Setup" > "Display" > "Configure Monitor" > "Screen Resolution: Restore to default".

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

1. Connect the external monitor to the R&S FSPN.
2. Press [Setup].
3. Press "Display".
4. Select the "Configure Monitor" tab in the "Display" dialog box.

The standard Windows "Screen Resolution" dialog box is displayed.



5. Select the instrument for display:
 - "Display 1": internal monitor only
 - "Display 2": external monitor only
 - "Duplicate": both internal and external monitor
6. Tap "Apply" to try out the settings before they are accepted permanently, then you can easily return to the previous settings, if necessary.
7. Select "OK" if the settings are suitable.

3.10 Windows operating system

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

Tested software

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

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

The following program packages have been tested:

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

Service packs and updates

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

Firewall settings

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

Note that changing firewall settings requires administrator rights.

Virus protection

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

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

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

To access the "Start" menu

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

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



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



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

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

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

For required settings, refer to the Microsoft Windows documentation and to the hardware description.

3.11 Logging on

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

- **"Instrument"**: a standard user account with limited access
- **"Admin"** or **"Administrator"** (depends on firmware image): an administrator account with unrestricted access to the computer/domain

Some administrative tasks require administrator rights (e.g. adapting the auto-login function or configuring a LAN network). Refer to the description of the basic instrument Setup ([Setup] menu) to find out which functions are affected.

Passwords

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

Auto-login

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

Changing the password and use of auto-login function

Note that when you change the default password, the default auto-login function no longer works!

In this case, you must enter the new password manually to log on.

Adapting the auto-login function to a new password

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

Changing the password for auto-login requires administrator rights.

1. Select the "Windows" icon in the toolbar to access the operating system of the R&S FSPN (see also ["To access the "Start" menu"](#) on page 22).



2. Open the `C:\R_S\INSTR\USER\AUTOLOGIN.REG` file in any text editor (e.g. Notepad).
3. In the line `"DefaultPassword"="894129"`, replace the default password (894129) by the new password for automatic login.
4. Save the changes to the file.
5. In the Windows "Start" menu, select "Run".
The "Run" dialog box is displayed.

Checking the supplied options

6. Enter the command `C:\R_S\INSTR\USER\AUTOLOGIN.REG`.
7. Press [ENTER] to confirm.
The auto-login function is reactivated with the changed password. It is applied the next time you switch on the instrument.

Switching users when using the auto-login function

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

1. Select the "Windows" icon in the toolbar to access the operating system of the R&S FSPN (see also ["To access the "Start" menu"](#) on page 22).



2. Press [CTRL] + [ALT] + [DEL], then select "Sign out".
The "Login" dialog box is displayed, in which you can enter the different user account name and password.

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

3.12 Checking the supplied options

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

1. Press [SETUP].
2. Press "System Config".
3. Switch to the "Versions + Options" tab in the "System Configuration" dialog box.
A list with hardware and firmware information is displayed.
4. Check the availability of the hardware options as indicated in the delivery note.

3.13 Performing a self-alignment

When temperature changes occur in the environment of the R&S FSPN, or after updating the firmware, you have to perform a self-alignment to align the data to a reference source.

During self-alignment, do not connect a signal to the RF input connector. Running a self-alignment with a signal connected to the RF input can lead to false measurement results.

Performing a self-alignment

Before performing this alignment, make sure that the instrument has reached its operating temperature (for details, refer to the specifications document).

A message in the status bar ("Instrument warming up...") indicates that the operating temperature has not yet been reached.

Depending on the installation settings, an automatic self-alignment is performed after installation. A dialog box is displayed indicating how much warm-up time is still required before self-alignment can be performed.

1. Press [Setup].
2. Press "Alignment".
3. Select "Start Self Alignment" in the "Alignment" dialog box.

Once the system correction values have been calculated successfully, a message is displayed.



To display the alignment results again later

- Press [SETUP].
- Press "Alignment".

3.14 Considerations for test setup

Cable selection and electromagnetic interference (EMI)

Electromagnetic interference (EMI) can affect the measurement results.

To suppress electromagnetic radiation during operation:

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

Preventing electrostatic discharge (ESD)

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

- ▶ **NOTICE!** 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.

Signal input and output levels

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

4 Instrument tour

On the instrument tour, you can learn about the different control elements and connectors on the front and back panel of the R&S FSPN.

- [Front panel view](#).....27
- [Rear panel view](#)..... 37

4.1 Front panel view

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

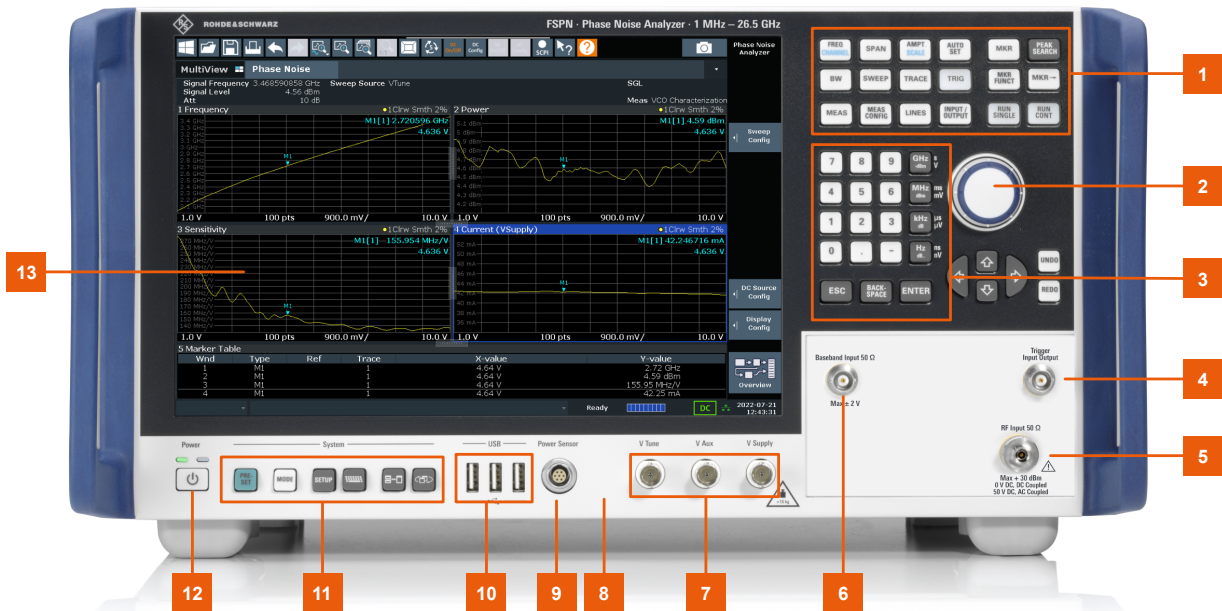


Figure 4-1: Front panel of the R&S FSPN

- 1 = Function keys
- 2 = Navigation control
- 3 = Keypad
- 4 = Trigger in- and output
- 5 = RF input
- 6 = Baseband connector
- 7 = DC power connectors
- 8 = Probe power connector
- 9 = Power sensor connector
- 10 = USB 2.0 interfaces

- 11 = System control keys
- 12 = Power key
- 13 = Display (touchscreen)

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4.1.1 Display (touchscreen)

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



- 1 = Toolbar: contains general functionality of the firmware.
- 2 = Channel tab: contains measurement channel.
- 3 = Channel bar: shows measurement settings.
- 4 = Result display: contains measurement results.
- 5 = Window title bar: contains diagram-specific (trace) information.
- 6 = Status bar: contains system messages, progress bar and date and time.
- 7 = Input field.
- 8 = Diagram footer: contains diagram-specific information.
- 9 = Softkeys: provide access to measurement functions.

A touchscreen is a screen that is touch-sensitive, i.e. it reacts in a specified way when a particular element on the screen is tapped by a finger or a pointing device, for example. Any user interface elements that can be clicked on by a mouse pointer can also be tapped on the screen to trigger the same behavior, and vice versa.

Using the touchscreen, the following tasks (among others) can be performed by the tap of your finger:

- Changing a setting
- Changing the display
- Moving a marker
- Zooming into a diagram
- Selecting a new evaluation method

- Scrolling through a result list
- Saving or printing results and settings

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

4.1.2 Power key









The power key is on the lower left corner of the front panel. It starts up and shuts down the instrument.

See also "[Connecting to power](#)" on page 5.

4.1.3 System control keys

System control keys provide access to the basic instrument configuration.

Refer to the User Manual for an extensive description of the system configuration functionality.






	Resets the instrument to its default configuration.
	Selects a particular measurement application or operating mode.
	Provides functionality to configure basic instrument characteristics, for example: <ul style="list-style-type: none"> • the LAN connection • the date and time • the display configuration • the reference frequency • firmware update and application installation • service functions • transducer configuration
	Provides access to the on-screen keyboard.
	Turns full screen mode on and off.
	Selects a window in split screen mode or browses through active windows in full screen mode.

4.1.4 The function keys

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







Refer to the user manual for an extensive description of the measurement settings and functions.

FREQ CHANNEL	Provides functionality to define frequency parameters, for example:
SPAN	
AMPT SCALE	Provides functionality to configure amplitude or level characteristics, for example:
AUTO SET	Provides functionality to automatically define various parameters like the level or frequency.
BW	Provides functionality to define various filter bandwidths.
SWEEP	Provides functionality to configure the measurement, for example:
TRACE	Provides functionality to configure data acquisition and analyze measured data, for example:
TRIG	
MKR	Provides functionality to activate and position absolute and relative markers (markers and delta markers).
PEAK SEARCH	Performs a peak search for active markers. If no marker is active, marker 1 is activated and the peak search is performed for it.
MKR FUNCT	
MKR→	Provides functionality to position and control markers, for example: <ul style="list-style-type: none"> • to configure the marker search • to configure the peak excursion
MEAS	Provides the measurement functions, for example:

	Provides functionality to configure the measurement.
	Provides functionality to control display and limit lines.
	Provides functionality to configure inputs and outputs.
	Starts a measurement in single measurement mode.
	Starts a measurement in continuous measurement mode.

4.1.5 The Keypad

The alphanumeric keys allow you to enter alphanumeric characters where necessary (for example in dialog boxes or input fields). The keypad containing the alphanumeric keys also provides keys that select a particular unit.

	Provide access to numbers and (special) characters.
...	
	
	Inserts a decimal point at the cursor position (".").
	Changes the sign of a numeric value or inserts a dash character ("-") in case of alphanumeric input.
	Select a particular unit for a numeric value. The labels on and next to the key state the units it selects.
...	
	Pressing one of the unit keys also completes the entry of a numeric value. Note that in case of level entries (dB, dBm etc.) or dimensionless values, all unit keys have the value "1" as multiplying factor and thus work like the [ENTER] key..



Provides the following functions:

In dialog boxes:

- Closes all kinds of dialog boxes if edit mode is not active.
- Quits edit mode if it is active.
- Selects the "Cancel" button when available.

In "Edit" dialog boxes:

- If data entry has been started, it retains the original value and closes the dialog box.
- If data entry has not been started or has been completed, it closes the dialog box.



Deletes the character to the left of the cursor (if an (alpha)numeric entry has been started already).



Provides the following functions:

- Completes the entry of input made with the alphanumeric keys (numeric or alphanumeric) and accepts the input.
If you enter a numeric value that has a unit, the [ENTER] key works like the [HZ/DB] key.
- Selects the default or focused element in dialog boxes.

4.1.6 Navigation Control

Navigation control consists of a rotary knob and cursor keys. These keys allow you to navigate within the display or within dialog boxes.

In addition to the rotary knob and the cursor keys, the navigation control also provides undo / redo functionality.

Rotary knob

The rotary knob allows you to do several things:

- It increases or decreases any kind of numeric value. In most cases, the rotary knob changes numeric values with a fixed step size.
Turning it to the right corresponds to an increase, turning it to the left to a decrease of a numeric value.
- It works like a cursor key in dialog boxes or lists (for example dropdown menus). In that case you can navigate to one of the items with the rotary knob. If the dialog box covers more than one screen page, it also scrolls through the dialog box.
Turning it to the right corresponds to a downward movement. Moving it to the left to an upward movement.

- It moves around markers and other graphical elements on the screen. In most cases, the step size is fix.
- Pressing the rotary knob has the same effect as pressing the [ENTER] key as it confirms an entry or selection.

Cursor keys

The cursor keys allow you to do several things:

- The up and down keys increase or decrease any kind of numeric value if an input field is active.
The cursor keys change numeric values with a fixed step size.
- The cursor keys navigate through dialog boxes or lists (for example dropdown menus).
- The left and right keys move the cursor in an input field in the corresponding direction.
- The up and down keys move markers around.
The step size is fix.
- The cursor keys allow you to navigate to a cell in a table.
- The cursor keys move a scroll bar (vertical or horizontal) in dialog boxes that have one.

Undo and redo functionality


UNDO

Reverts the software to an older state by erasing the last change you have applied.

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

REDO

Reverses an undo action or repeats the most recently performed action.

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

4.1.7 RF input 50 ohm

Provides RF input from a connected device under test (DUT) to the R&S FSPN, which is then analyzed in an RF measurement. Connect the DUT to the "RF Input" connector on the R&S FSPN *after* switching on the instrument. Disconnect the RF input before switching off the instrument.

NOTICE


Do not overload the input. For maximum allowed values, see the specifications document.

The RF input can be coupled to the DUT by alternating current (AC) or direct current (DC). AC coupling blocks any DC voltage from the input signal. This is the default setting to prevent damage to the instrument. However, some specifications require DC coupling. In this case, you must protect the instrument from damaging DC input voltages manually. For details, refer to the specifications document. For details on coupling, see the chapter on radio frequency input in the R&S FSPN user manual.

See also [Chapter 3.14, "Considerations for test setup"](#), on page 25.

4.1.8 USB ports

The three USB ports on the front panel (type A) allow you to connect devices like keyboards, mice or memory sticks.

 The R&S FSPN provides additional USB ports (including one type B port) on the rear panel.

All USB ports support standard 2.0.

4.1.9 Power sensors

The LEMOSA female connector is used to connect Rohde & Schwarz power sensors or smart noise sources to the R&S FSPN. For a detailed list of supported noise sources and power sensors, see the data sheet.

For details on configuring and using power sensors, see the R&S FSPN Spectrum Monitor User Manual.

The identification and setup procedure after connecting a smart noise source may take up to 10 seconds.

4.1.10 Probe Power Connector (3 Pins)

The Probe Power connector allows you to supply external equipment with power (for example probes or transducers).

The three-pinned probe power connector supports supply voltages from +15 V to -12.6 V and ground. The maximum permissible current is 150 mA. This probe power connector is suitable, for example, for high-impedance probes.

4.1.11 Baseband input

The "Baseband Input 50 Ω " connector is a female BNC connector that you can use to connect a DUT for baseband noise measurements. Do not overload the input. For maximum allowed values, see the data sheet.

4.1.12 Trigger input and output

The female BNC connector labeled "Trigger Input / Output" allows you to receive an external trigger signal or send a trigger signal to another device.

When you are using the connector as a trigger input, you can apply voltages in the range from 0.5 V to 3.5 V (the default value is 1.4 V). The typical input impedance is 10 k Ω .

When you are using the connector as a trigger output, the TTL compatible signal is transmitted (0 V / 5 V).

Note that you can find another connector for trigger input and output on the rear panel.

For more information about controlling and configuring trigger input and output, refer to the User Manual.

4.1.13 DC Power Supply

The female BNC connectors labeled " V_{Tune} ", " V_{Aux} " and " V_{Supply} " allow you to supply external devices, for example a DUT or an external reference oscillator, with the required voltage.

The V_{Supply} connector provides supply voltage from 0 V to +16 V, for example to provide voltage for an oscillator. The supported maximum current is 2000 mA.

The V_{Tune} connector provides tuning voltage from -10 V to +28 V. The supported maximum current is 20 mA.

The V_{Aux} connector provides DC voltage from -10 V to +10 V. The supported maximum current is 100 mA.

For more information about configuring the DC Power supply, refer to the User Manual.

4.2 Rear panel view

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

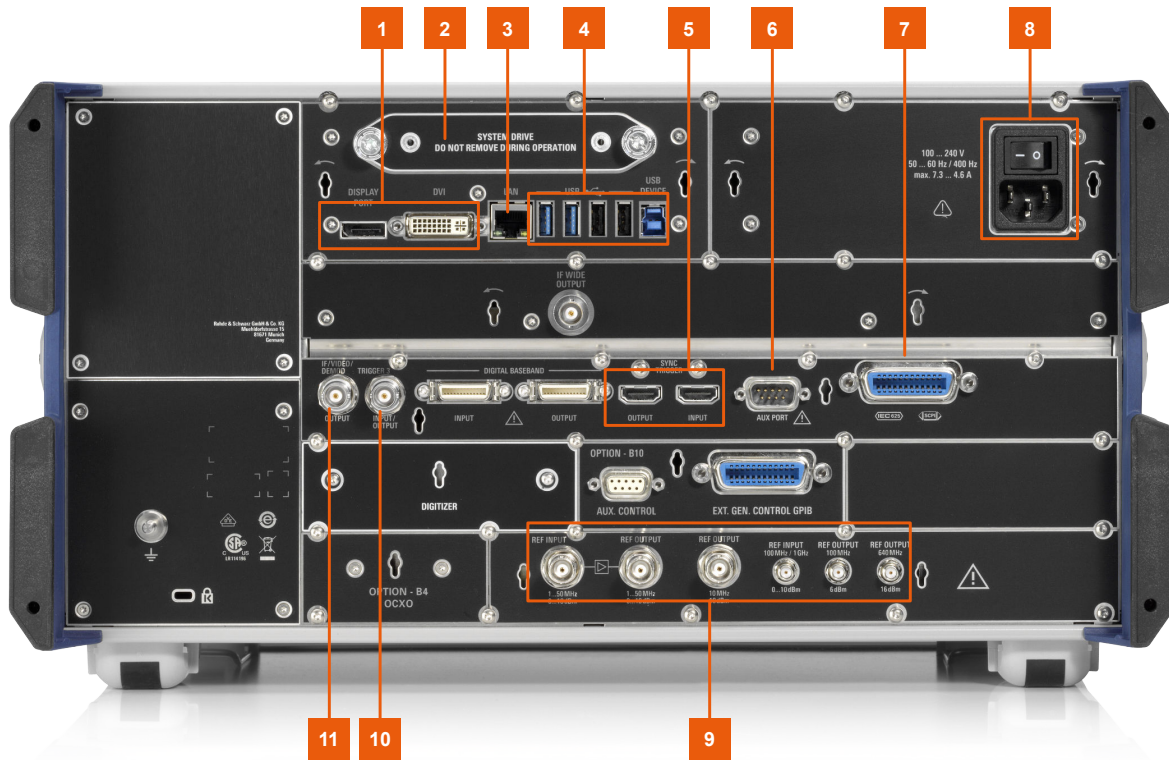


Figure 4-2: Rear panel of the R&S FSPN

- 1 = DisplayPort and DVI
- 2 = Removable hard disk
- 3 = LAN interface
- 4 = USB ports
- 5 = Sync trigger input and output
- 6 = AUX port
- 7 = GPIB interface
- 8 = AC power connector and power switch
- 9 = Ref input and output
- 10 = Trigger in- / output
- 11 = IF / Video / Demod output

For information about the trigger in- and output available on the rear panel, see [Chapter 4.1.12, "Trigger input and output"](#), on page 36.

The digital baseband in- and outputs shown in the image above are not supported by the R&S FSPN.

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4.2.1 Removable hard disk

The removable hard disk is accessible from the rear of the instrument.

In addition to the operating system and the firmware, the R&S FSPN also stores measurement data on that disk. When you remove the hard disk, you can store it and the data on it somewhere secure.

4.2.2 AC power supply connection and main power switch

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

Main power switch function:

Position 1: The instrument can be started via the Power key on the front panel.

The OCXO reference frequency is warmed up.

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

For details, refer to ["Connecting to power"](#) on page 5 and [Chapter 3.5, "Connecting the AC power"](#), on page 14.

4.2.3 Display port and DVI

You can connect an external monitor or other display device to the R&S FSPN to provide an enlarged display. Two different types of connectors are provided for this purpose:

- Display Port
- DVI (digital visual interface)

For details, see [Chapter 3.9, "Connecting an external monitor"](#), on page 18.

4.2.4 LAN

The R&S FSPN is equipped with a 1 GBit Ethernet IEEE 802.3u network interface with Auto-MDI(X) functionality. The assignment of the RJ-45 connector supports twisted-pair category 5 UTP/STP cables in a star configuration (UTP stands for *unshielded twisted pair*, and STP for *shielded twisted pair*).

For details, see the R&S FSPN user manual.

4.2.5 USB ports

The four USB ports on the rear panel (type A) allow you to connect devices like keyboards, mice or memory sticks.

The male USB connector (type B) allows you to connect the R&S FSPN to a computer and establish a remote control connection, for example.

All USB connectors support standard 2.0.

4.2.6 Sync trigger input and output

The "Sync Trigger Input / Output" connectors allow you to synchronize several devices (for example two R&S FSPNs) with respect to the trigger signal, but also the reference frequency. A 100 MHz signal can be output as a trigger or reference signal to another device, and an external trigger or reference signal can be received at the input connector by the R&S FSPN.

4.2.7 Aux. port



A 9-pole SUB-D male connector used to provide low-voltage TTL control signals (max. 5 V). The output signals can be used to control external devices.

4.2.8 GPIB interface

The GPIB interface is in compliance with IEEE488 and SCPI. A computer for remote control can be connected via this interface. To set up the connection, a shielded cable is recommended.

For more details, refer to "Setting Up Remote Control" in the R&S FSPN user manual.

4.2.9 OCXO

The OCXO generates a 10 MHz reference signal with a very precise frequency. If no external signal is used, this signal is used as an internal reference. It can also be used to synchronize other connected devices via the REF OUTPUT 10 MHz connector.

Warm-up time for OCXO

When the instrument is switched on, the OCXO requires an extended warm-up time.

4.2.10 REF INPUT / REF OUTPUT

The REF INPUT connectors are used to provide an external reference signal to the R&S FSPN.

Various connectors are provided for different reference signals:

Connector	Reference signal	Usage
REF INPUT	1...20 MHz 0...10 dBm	To provide an external reference signal on the R&S FSPN.
REF OUTPUT	1...20 MHz 0...10 dBm	To provide the same external reference signal received by the REF INPUT 1...20 MHz connector to another device, when available.
REF OUTPUT	10 MHz 10 dBm	To provide the internal reference signal from the R&S FSPN to another device continuously. Also used to provide OCXO reference signal to another device.
REF INPUT	100 MHz 0...10 dBm	To provide an external reference signal on the R&S FSPN.

Connector	Reference signal	Usage
REF OUTPUT	100 MHz 6 dBm	To provide a 100 MHz reference signal from the R&S FSPN to another device.
REF OUTPUT	640 MHz 16 dBm	To provide a 640 MHz reference signal from the R&S FSPN to another device.



SYNC TRIGGER

The SYNC TRIGGER connector can also be used to synchronize the reference frequency on several devices.

4.2.11 Labels on R&S FSPN

Labels on the casing inform about:

- Personal safety, see "[Meaning of safety labels](#)" on page 6
- Product and environment safety, see [Table 4-1](#)
- Identification of the product, see [Chapter 4.2.12, "Device ID"](#), on page 42

Table 4-1: Labels regarding R&S FSPN and environment safety

	<p>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.</p> <p>For more information, see the product user manual, chapter "Disposal".</p>
--	--

4.2.12 Device ID

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

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





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

<Type><variant>-<serial_number>

For example, FSPN6-123456.

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

5 Trying out the instrument

Overview of tutorials

Initial setup:

- ["Preparing the R&S FSPN"](#) on page 45
- ["Selecting the phase noise application"](#) on page 45
- ["Performing a preset"](#) on page 46

Measurement selection

- ["Selecting a measurement"](#) on page 46

The phase noise measurement

- ["Measuring phase noise"](#) on page 47
- ["Measuring amplitude noise"](#) on page 48
- ["Measuring spurs"](#) on page 49
- ["Measuring spot noise"](#) on page 49
- ["Measuring integrated noise"](#) on page 49

The baseband noise measurement

- ["How to measure baseband noise at the RF input"](#) on page 50

Trace smoothing

- ["How to smooth the trace by averaging the measurement data"](#) on page 52
- ["How to smooth the trace by adjusting the number of XCORR operations"](#) on page 52
- ["How to smooth the trace graphically"](#) on page 53
- ["How to remove spurs from a trace"](#) on page 53

Integration ranges

- ["How to define integration ranges"](#) on page 54

The cross-correlation gain indicator

- ["How to control the cross-correlation gain indicator \(gray area\)"](#) on page 56

Miscellaneous evaluation tools

- ["Zooming into the results"](#) on page 57
- ["Exporting measurement data"](#) on page 57

Frequency configuration

- ["How to define the measurement range"](#) on page 58
- ["How to search for signals"](#) on page 59
- ["How to define a carrier frequency manually"](#) on page 59

The half decade configuration table

- ["How to work with the half decade configuration table"](#) on page 59

DUT power supply

- ["How to supply DUTs with current or voltage"](#) on page 60

An in-depth description of all features, including remote commands, is available in the R&S FSPN user manual.

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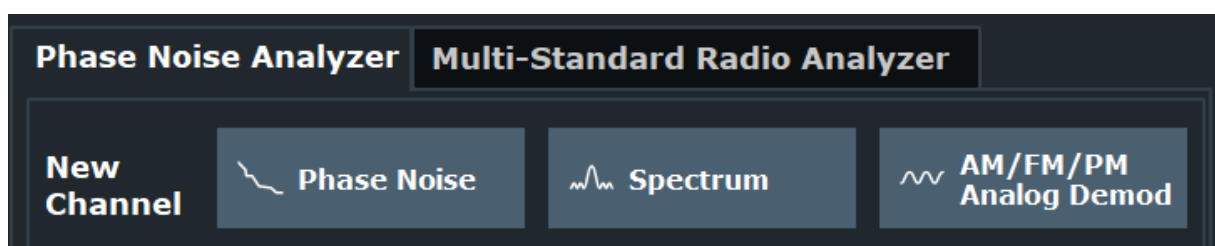
5.1 Initial setup

Preparing the R&S FSPN

1. Connect the R&S FSPN to an electrical outlet as described in [Chapter 3.5, "Connecting the AC power"](#), on page 14.
2. Turn on the R&S FSPN as described in [Chapter 3.6, "Switching the instrument on and off"](#), on page 15.

Selecting the phase noise application

1. Select the [MODE] key.
2. Select the "Phase Noise" item in the "Mode" dialog box.





There's more than one way to skin a cat

In most cases, the firmware of the R&S FSPN provides several ways to change measurement parameters. For example, the measurement range can be defined via the [FREQ] key, the "MEAS CONFIG" key or the "Overview" dialog box.

All procedures in this chapter use the "Overview" dialog box as a starting point (when possible). You can reach this dialog via the "Overview" softkey displayed at the bottom of the softkey bar on the right side of the diagram area.

Performing a preset

Before configuring and starting a new measurement, it is always recommended to perform a preset and restore the default configuration of the instrument or the measurement application.

1. Select the [PRESET] key on the front panel to restore the default state of the R&S FSPN.
2. Enter the "Overview" dialog box and select the "Preset Channel" item to restore the default state of the selected measurement channel. All other measurement channels keep their custom configuration.

5.2 Measurements

Measuring the phase noise characteristics of a DUT requires a simple measurement setup consisting of the R&S FSPN and a DUT.

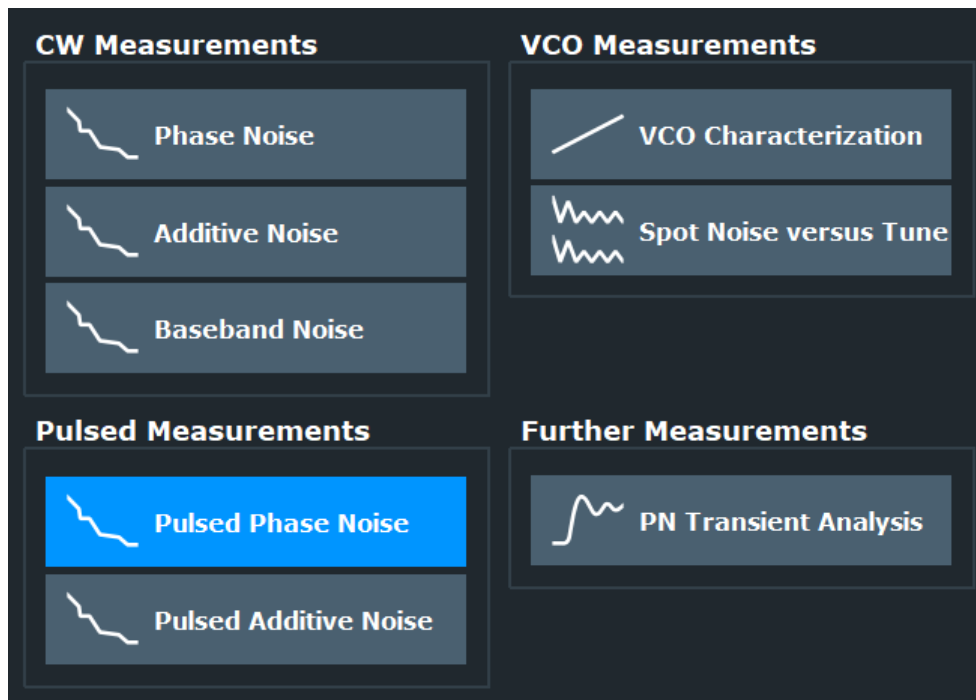
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5.2.1 Measurement selection

Selecting a measurement

- ▶ Select the [MEAS] key.

The R&S FSPN opens a dialog box to select the measurement.



5.2.2 Phase noise measurement

Test setup

Connect the DUT via cable to the RF input of the R&S FSPN as shown in the illustration.

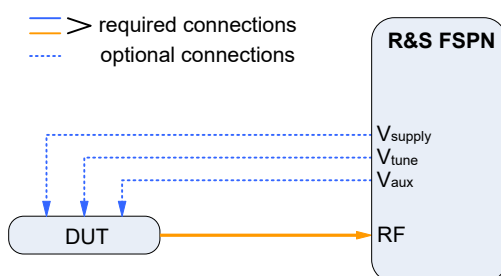


Figure 5-1: Typical test setup for basic noise measurements

Measuring phase noise

1. Perform a [PRESET].

The application automatically starts a continuous measurement.

First, it searches for a carrier signal (see [How to search for signals](#)). When one has been found, it measures the noise characteristics of the DUT in the default measurement (or frequency offset) range.

If no carrier could be found, a corresponding error message is displayed in the status bar below the diagram.

- You can stop the measurement (to analyze the measurement data in detail) with the [RUN SGL] or [RUN CONT] key; [RUN SGL] performs one more measurement, then stops, [RUN CONT] stops immediately.
By default, two traces are displayed: the first trace shows the smoothed data without spurs, the second trace the raw data including spurs.

Measuring amplitude noise

The test setup is the same as shown above.

The default phase noise trace shows the phase noise characteristics of the DUT. In addition, you can also display the amplitude noise characteristics (or both together).

- Enter the "Overview" dialog box and, from there, enter the "Analysis" dialog box.
- Select the vertical "Trace" tab, and then the horizontal "Traces" tab.
- For any trace, select "AM Noise" from the "Result" dropdown menu.

	Traces		Export / Import	Copy Trace	Trace Math	Trace Label	Smoothing		Spurious		Trace Offset		Persistence	
	Mode	Result	State/Value	Thresh	Hide	State/Offset	State/Decay							
Markers	Trace 1	Clear Write	Phase Noise	<input checked="" type="checkbox"/>	1 %	6.0 dB	<input checked="" type="checkbox"/>	<input type="checkbox"/>	0.0 dB	<input type="checkbox"/>	0 s			
	Trace 2	Clear Write	Phase Noise	<input type="checkbox"/>	1 %	6.0 dB	<input type="checkbox"/>	<input type="checkbox"/>	0.0 dB	<input type="checkbox"/>	0 s			
Limit Lines	Trace 3	Blank	Phase Noise	<input type="checkbox"/>	1 %	6.0 dB	<input type="checkbox"/>	<input type="checkbox"/>	0.0 dB	<input type="checkbox"/>	0 s			
	Trace 4	Blank	Phase Noise	<input type="checkbox"/>	1 %	6.0 dB	<input type="checkbox"/>	<input type="checkbox"/>	0.0 dB	<input type="checkbox"/>	0 s			

- Start a new measurement to determine the AM noise of the DUT. (The "Phase + AM Noise" menu item displays the sum of phase and amplitude noise.)

Tip: If you'd like to view both results separately at the same time, open two phase noise diagrams, one that shows the phase noise, the other showing the AM noise and perform a measurement.

In addition to the graphical representation of the phase noise characteristics, the application also provides several tables that show specific phase noise characteristics.

Measuring spurs

In addition to the graphical display of spurs in the diagram (spikes on the trace), the application also features a result display that contains a list of all detected spurs.

- ▶ Open the SmartGrid (☐) and drag the "Spurious List" item from the evaluation bar into the display.



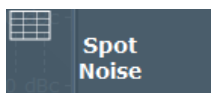
The spurious list contains all detected spurs (including their characteristics) on all traces and all windows.

For more information see the R&S FSPN user manual.

Measuring spot noise

Spot noise is the phase noise or AM noise at a specific offset frequency (for example the phase noise at 500 kHz).

- ▶ Open the SmartGrid (☐) and drag the "Spot Noise" item from the evaluation bar into the display.



The table contains a list of spot noise values for selected frequency offsets (in the default state, these are the decade edges) on each active trace.

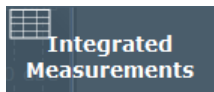
For more information on the table contents see the R&S FSPN user manual.

Tip: You can define custom spot noise frequencies in the "Spot Noise" tab of the "Noise Config" dialog box.

Measuring integrated noise

Integrated measurements show various noise characteristics, like the residual noise, integrated over a certain offset frequency range.

- ▶ Open the SmartGrid (☐) and drag the "Integrated Measurements" item from the evaluation bar into the display.



The table contains a list of integrated measurement results.

For more information on the table contents see the R&S FSPN user manual.

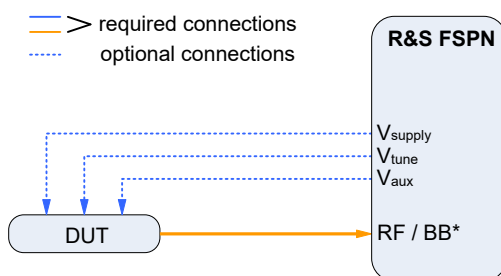
Tip: You can define [custom integration ranges](#) in the "Integration Ranges" tab of the "Noise Config" dialog box.

5.2.3 Baseband noise measurement

Baseband Noise measurements measure the noise characteristics of a DUT over an absolute frequency span (not relative to carrier).

You can use either the RF input for these measurements, or the baseband input. The baseband input is DC coupled and extend the lower frequency range to 1 mHz (the lowest supported frequency on the RF input is 1 MHz). Using the baseband input, you can, for example, test the voltage supply of DC sources.

Test setup



* = See text below for instructions on how to use the baseband input.

How to measure baseband noise at the RF input

For baseband noise measurements on the RF input, proceed as follows.

1. Connect the DUT to the RF input.
2. Perform a [PRESET].

The application automatically starts a continuous measurement and measures the noise characteristics of the DUT in the default frequency range.

3. Select the "Baseband Noise" measurement via the [MEAS] key.

4. You can stop the measurement (to analyze the measurement data in detail) with the [RUN SGL] or [RUN CONT] key; [RUN SGL] performs one more measurement, then stops, [RUN CONT] stops immediately.
By default, two traces are displayed: the first trace shows the smoothed data without spurs, the second trace the raw data including spurs.
Tip: Integrated measurement results. Note that the "PM", "FM" and "Jitter" results are always "0" for baseband noise measurements.

5.2.4 Adding another measurement channel

Measuring the noise characteristics in two different measurement channels allows you, for example, to capture and analyze two different data streams with different measurement configurations.

Adding another measurement channel

1. Select the [MODE] key.
2. Select the "Phase Noise" item in the "Mode" dialog box.
The firmware adds a second instance of the phase noise application which is independent of the first one.

5.3 Result evaluation

The phase noise application provides several tools to control the data displayed in the various result displays. Some tools have an effect on the graphical result displays, other on the numerical results and still others on both graphical and numerical (for example in case the numerical results are based on the graphical results).

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- [Miscellaneous evaluation tools](#)..... 57

5.3.1 Trace smoothing

How to smooth the trace by averaging the measurement data

When you average the trace, the application measures the data several times and builds an average over all measurements when it is done. Averaging measurement data yields a smoother trace.

Trace averaging is applied to all traces.

1. Enter the "Overview" dialog box, and from there, enter the "Noise Config" dialog box.
2. Define the number of measurements to be performed in the "Sweep / Average Count" input field, for example "10".



3. Start the measurement.
 - In case of a single measurement, the application performs x measurements over the frequency range you have defined. An average count of "10", for example, would result in 10 measurements.
 - In case of continuous measurements, the application performs a moving average over the average count.

How to smooth the trace by adjusting the number of XCORR operations

When you apply cross-correlation operations, the application is able to determine the phase noise characteristics at a certain frequency offset more precisely.

The number of cross-correlation operations applied in each half decade depends on a cross-correlation factor that you can define arbitrarily.

Cross-correlation operations are applied to all traces.

1. Enter the "Overview" dialog box, and from there, enter the "Noise Config" dialog box.
2. Define the cross-correlation factor as required in the "XCORR Factor" input field.



The application calculates the number of cross-correlations for each half decade based on this factor. You can see the resulting operations in the table of the "Noise Config" dialog box.

The number of operations calculated for each half decade targets a similar measurement time for all half decades, so that the measurement is done at roughly the same time in each half decade.

You can also see the resulting number of operations in the green bar at the bottom of the diagram area.

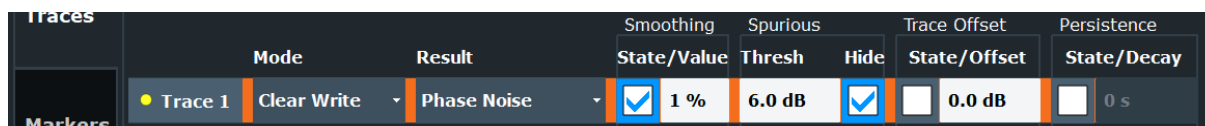
For more information on how cross-correlation works refer to the R&S FSPN user manual.

How to smooth the trace graphically

When you apply trace smoothing, the existing data remains the same. The trace is smoothed by applying mathematical operations

Trace smoothing is applied to each trace individually.

1. Enter the "Overview" dialog box, and from there, enter the "Analysis" dialog box.
2. Select the vertical "Trace" tab, and then the horizontal "Traces" tab.
3. For any trace, turn on "Smoothing" and define the amount by which the trace should be smoothed (in %) in the corresponding input field.



Trace smoothing is applied immediately after you have applied it to a trace. For more information on how this is done, refer to the R&S FSPN user manual.

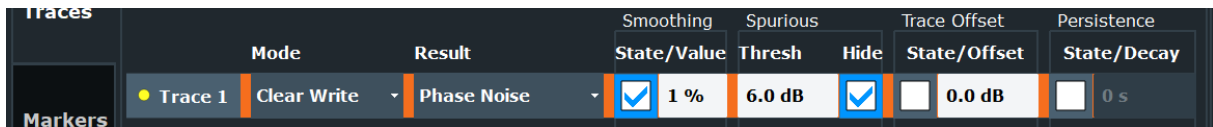
How to remove spurs from a trace

By default, the application already shows a trace without spurs (the yellow one). However, you can decide for each trace individually whether it shows spurs or not.

Spur removal is done after traces have been smoothed in any way.

1. Enter the "Overview" dialog box, and from there, enter the "Analysis" dialog box.
2. Select the vertical "Trace" tab, and then the horizontal "Traces" tab.

- For any trace, remove or display spurs individually. You can also enter a threshold that defines a level from which a spur is recognized as a spur.



The application removes all signals that are above the threshold from the trace spur removal is applied to. Signals with levels below the threshold are not regarded as spurs and are still displayed.

For more information about spur removal, refer to the R&S FSPN user manual.

Note: Note that the threshold is always taken into account in the spur table, regardless of whether spur removal is on or off.

5.3.2 Integration ranges

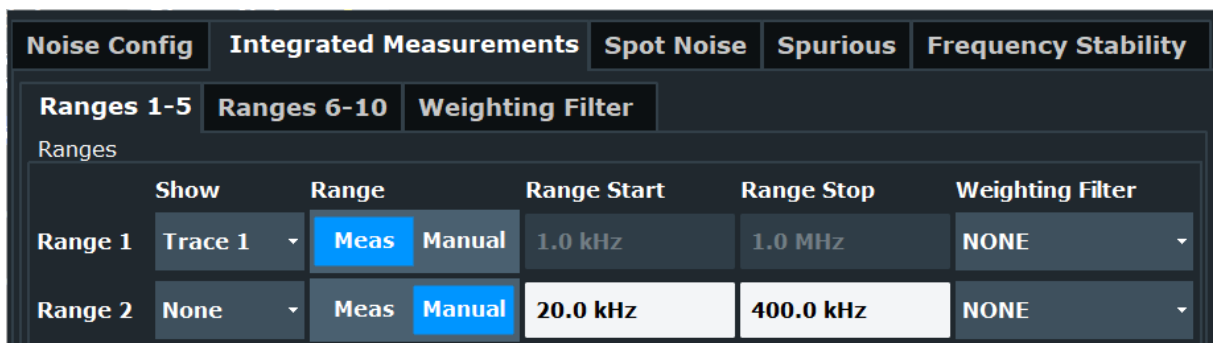
How to define integration ranges

For the integrated measurements (residual AM, FM and PM and jitter), you can define custom integration ranges.

By default, the integration range corresponds to the measurement range defined by the frequency offsets. Custom integration ranges can have any range you desire.

Integration is done after traces have been smoothed in any way.

- Enter the "Overview" dialog box and, from there, enter the "Noise Config" dialog box.
- Select the "Integrated Measurements" tab.



3. Select the "Trace" whose data you would like to integrate from the "Show" dropdown menu.

Tip: If you select a trace that is currently not displayed in the diagram, no integrated measurement results will be displayed for the corresponding range.

4. Select "Manual" integration ranges.
5. Define the frequency ranges ("Range Start" and "Range Stop") over which you would like to integrate.

The application calculates the measurement results as defined. Result in the integrated measurements result table are adjusted accordingly (see "[Measuring integrated noise](#)" on page 49 for a description on how to view that table).

1 Integrated Measurements	
	Range 1
Trace	1
Start Offset	1.000 kHz
Stop Offset	1.000 MHz
Weighting	
Int Noise	-72.21 dBc
PM	19.86 m°/346.70 μrad
FM / AM	173.170 Hz
Jitter	13.795 fs

Figure 5-2: Custom integration range results (frequency range from 3 kHz to 500 kHz, applied to trace 2)

Note that the integration ranges are displayed graphically in the noise diagram.

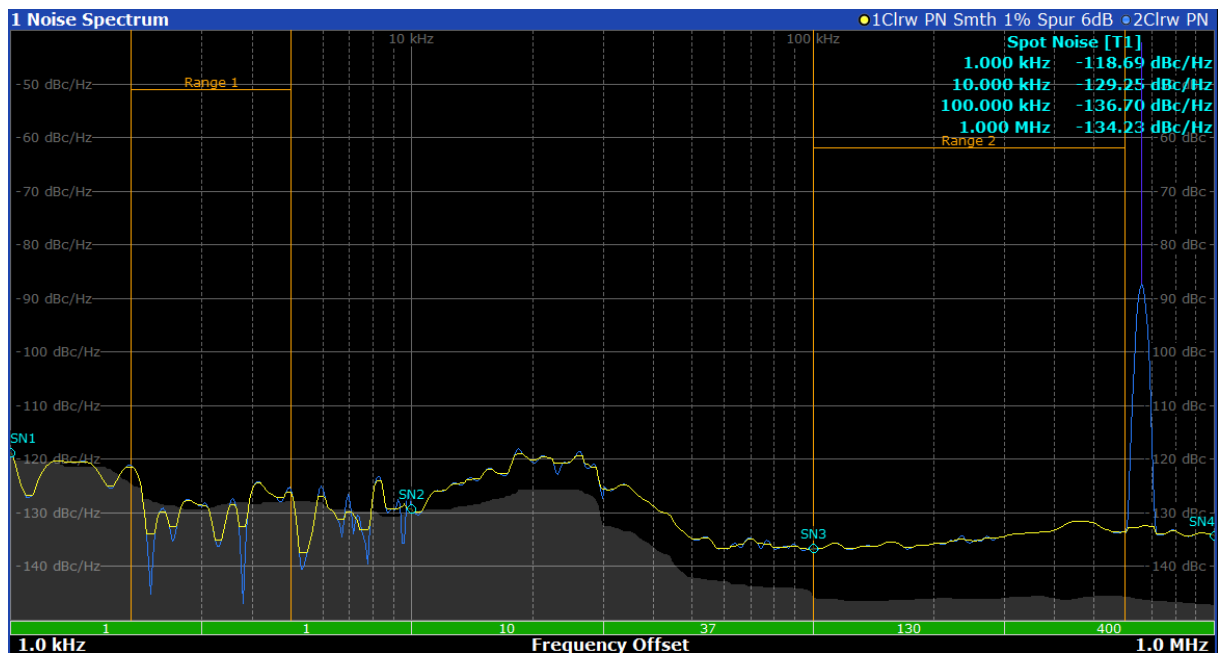


Figure 5-3: Custom integration ranges are represented in the diagram as colored lines

For more information on integrated measurement result calculation refer to the R&S FSPN user manual.

5.3.3 Cross-Correlation gain indicator

How to control the cross-correlation gain indicator (gray area)

The gray trace, or cross-correlation gain indicator, indicates the ideal position of the measurement trace for the current number of cross-correlation operations. Thus, the position of this area depends on the number of cross-correlations that are currently applied in each half decade.

This in turn indicates that measurement traces that are close to the gray area (even if only in places) can be improved by increasing the cross-correlation operations. On the other hand, when the measurement trace lies above the gray area throughout (about 10 dB), it is not possible to improve the results any more.

1. Enter the "Overview" dialog box, and from there, enter the "Noise Config" dialog box.
2. Select the "Noise Config" tab.
3. Change the "XCORR Factor", run a single measurement, and see how the position of the gray area changes.

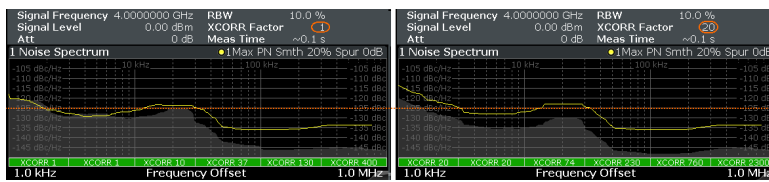


Figure 5-4: Increasing XCORR operations changes shape of gray area

- If required, you can turn this area on and off as required with the "XCORR Gain Indicator" feature.

5.3.4 Miscellaneous evaluation tools

Zooming into the results

The zoom tool is useful if you want to see parts of the results in more detail.

- Select the "Zoom" icon in the toolbar (🔍).
- In the diagram, select the area you want to zoom in to (while doing this, the area is marked by a dotted line).
- You can return to the full display any time with the "Unzoom" icon in the toolbar (🔍).

Exporting measurement data

Exporting measurement data to a .dat file allows you to archive that data in external programs like a spreadsheet.

- Enter the "Overview" dialog box and, from there, enter the "Analysis" dialog box.
- Select the vertical "Traces" tab and the horizontal "Trace / Data Export" tab.
- Select the data types as required (trace data only or together with numerical results and / or measurement settings).
- Select the "Export PN to ASCII File" button and select the destination where you want to save that data.
- View the .dat file that has been created with your preferred program.

5.4 Measurement configuration

The Phase Noise application provides several tools that make the measurement process easier to handle or allow you to customize the measurement configuration according to your needs.

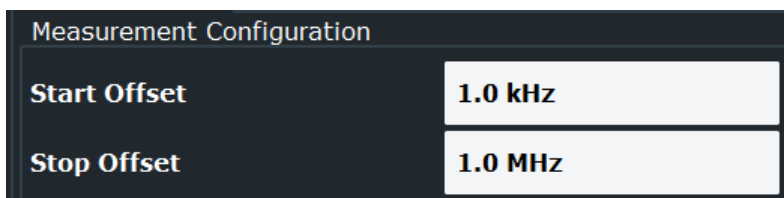
- [Frequency configuration](#).....58
- [Half decade configuration table](#).....59
- [DUT power supply](#).....60

5.4.1 Frequency configuration

How to define the measurement range

The measurement range defines the carrier frequency offset over which the phase noise measurement takes place.

1. Enter the "Overview" dialog box, and from there, enter the "Noise Config" dialog box.
2. Select the "Noise Config" tab.
3. Define the measurement range with the "Start Offset" and "Stop Offset" properties.



The application adjusts the measurement range. You can see this change, for example, in the noise diagram result display.

Note: In case of baseband measurements, the measurement range is defined by an absolute start and stop frequency instead of offsets.

For more information on the measurement range, refer to the R&S FSPN user manual.

How to search for signals

The application allows you to search for a carrier signal, instead of defining the carrier frequency manually.

1. Enter the "Overview" dialog box, and from there, enter the "Frequency" dialog box.
2. Turn on the "Auto Search" feature (it is on by default).
3. Define the frequency range in which the search should take place ("Start" and "Stop"). By default the search is done in the maximum frequency range supported by the hardware.
4. Define a "Threshold" for the search. Signals below the threshold are ignored during the search.

When the application finds a signal with appropriate characteristics, it starts a phase noise measurement in the [measurement range](#) you have defined.

Note: Automatic signal search is only available in phase noise measurements.

How to define a carrier frequency manually

When you already know the frequency of the carrier signal, you can define it manually and reduce the measurement time.

1. Enter the "Overview" dialog box, and from there, enter the "Frequency" dialog box.
2. Turn off the "Auto Search" feature.
3. Define the "Signal Frequency".

The application performs the measurement on the defined frequency.

5.4.2 Half decade configuration table

How to work with the half decade configuration table

The half decade configuration table contains the measurement configuration for each half decade that is analyzed during a measurement.

You can either enter the values for the measurement bandwidth and number of cross-correlation operations directly. Or you can let the application calculate ideal values for each half decade.

1. Enter the "Overview" dialog box, and from there, enter the "Noise Config" dialog box.
2. Select automatic or manual configuration mode with the "Half Decade Config" feature.
3. In case of an **automatic configuration**, define an "RBW" factor and an "XCORR Factor".

From these values, the application calculates the best and least time-consuming absolute resolution bandwidth and cross-correlation operations for each half decade.

4. In case of a **manual configuration**, define the resolution bandwidth and number of cross-correlations for each half decade directly in the half decade configuration table as absolute values.
The relative "RBW" factor and "XCORR Factor" are ignored.

5.4.3 DUT power supply

How to supply DUTs with current or voltage

Some measurement setups or DUTs require you to supply them with either voltage or current.

The R&S FSPN can provide both, when you set it up that way.

1. Enter the "Overview" dialog box and, from there, enter the "Output" dialog box.
2. Select the "DC Config" tab.

There you have the following options:

- Turn each of the three DC outputs on or off.
- Define the supplied voltage (or current in case of the V_{supply} output).
- Define limits for the outputs. When you define limits, the supplied voltage will not go below or above these.

For more information on configuring DC outputs, refer to the R&S FSPN user manual.

3. Turn on the output of voltage or current with the "DC Power" feature.

Tip: You can turn the output on and off easily with the "DC On / Off" button in the toolbar. The "DC Config" button provides access to a softkey menu that lets you define the signal characteristics without entering a dialog box.

6 Operating the instrument

The following topics provide an overview on how to work with the R&S FSPN. They describe what kind of information is displayed in the diagram area, how to operate the R&S FSPN via the front panel keys and other interaction methods, and how to use the Online Help.

- [Understanding the display information](#)..... 62
- [Accessing functions](#)..... 72
- [Changing the focus](#)..... 76
- [Entering data](#)..... 77
- [Touchscreen gestures](#)..... 80
- [Displaying results](#)..... 83
- [Remote control](#)..... 91

6.1 Understanding the display information

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

Understanding the display information



- 1 = Toolbar: contains general functionality of the firmware.
- 2 = Channel tab: contains measurement channel.
- 3 = Channel bar: shows measurement settings.
- 4 = Result display: contains measurement results.
- 5 = Window title bar: contains diagram-specific (trace) information.
- 6 = Status bar: contains system messages, progress bar and date and time.
- 7 = Input field.
- 8 = Diagram footer: contains diagram-specific information.
- 9 = Softkeys: provide access to measurement functions.

Hiding elements in the display

You can hide some of the elements in the display, for example the status bar or channel bar, in order to enlarge the display area for the measurement results ("Setup > Display > Displayed Items").

For details see the R&S FSPN User Manual.

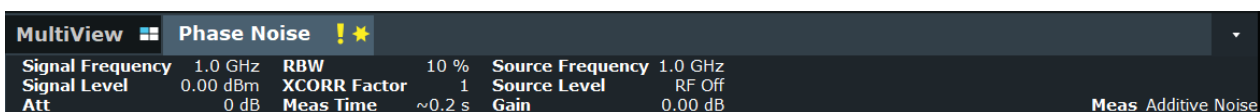
- Channel bar..... 64
- Window title bar..... 66
- Marker information..... 67
- Spot noise information..... 68
- Measurement progress information..... 68

Understanding the display information

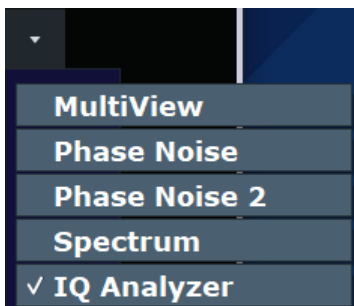
- [Frequency information in diagram footer](#)..... 69
- [Instrument and status information](#)..... 70
- [Error information](#)..... 71

6.1.1 Channel bar

Using the R&S FSPN you can handle several different measurement tasks (channels) at the same time (although they can only be performed asynchronously). For each channel, a separate tab is displayed on the screen. In order to switch from one channel display to another, simply select the corresponding tab.

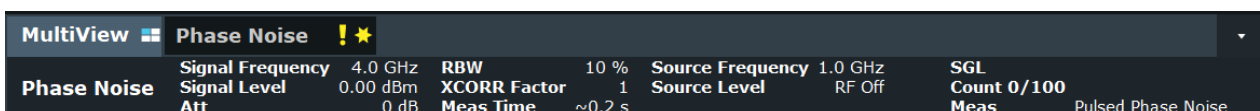


Alternatively, if many tabs are displayed, select the tab selection list icon at the right end of the channel bar and select the channel you want to switch to from the list.



MultiView tab

An additional tab labelled "MultiView" provides an overview of all active channels at a glance. In the "MultiView" tab, each individual window contains its own channel bar with an additional button. Tap this button to switch to the corresponding channel display quickly.





Icons in the channel bar

The star icon (★) on the tab label indicates that the displayed trace no longer matches the current instrument settings. This may be the case, for example, if a

Understanding the display information

trace is frozen and the instrument settings are changed. As soon as a new measurement is performed, the icon disappears.

The exclamation mark ("!" or ) icon indicates that an error or warning is available for that measurement channel. This is particularly useful if the MultiView tab is displayed.

The  icon indicates the currently active channel during an automatic measurement sequence (**Sequencer** functionality).

Beneath the channel name, information on channel-specific settings for the measurement are displayed in the **channel bar**. Channel information varies depending on the active application.

In addition to the channel-specific settings, the channel bar above the diagram also displays information on instrument settings that affect the measurement results even though this is not immediately apparent from the display of the measured values. This information is displayed only when applicable for the current measurement.

The following table contains all labels that might be displayed in the Spectrum and Receiver applications.

Table 6-1: Channel settings displayed in the channel bar

Label	Information
Signal Frequency	Current carrier frequency of the applied signal.
Signal Level	Currently level measured on the carrier frequency.
Att	Current RF attenuation.
RBW	Current Resolution bandwidth (RBW). The RBW is a function of the start offset frequency of each half decade included in the measurement.
XCORR Factor	Current cross-correlation factor. The cross-correlation factor defines the number of cross-correlations are done in each half decade included in the measurement.
Meas Time (estimated)	Current estimated measurement time. The measurement time depends, among other things, on the offset frequency, the resolution bandwidth or the number of averages / cross-correlations that you have defined.
SGL	Current number of measurements performed in a single sweep. Only displayed if you are in single sweep measurement mode.
Count	The current signal count for measurement tasks that involve a specific number of subsequent sweeps.
Meas	Currently selected measurement

Icons for individual settings

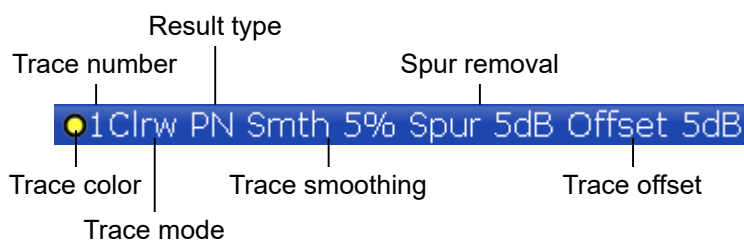
A bullet next to the setting indicates that user-defined settings are used, not automatic settings. A green bullet indicates this setting is valid and the measurement is correct. A red bullet indicates an invalid setting that does not provide useful results.

6.1.2 Window title bar

Each channel in the R&S FSPN display may contain several windows. Each window can display either a graph or a table as a result of the channel measurement. Which type of result evaluation is displayed in which window is defined in the display configuration (see [Chapter 6.6, "Displaying results"](#), on page 83). The window's title bar indicates which type of evaluation is displayed.

Trace Information in Window Title Bar

Information on the displayed traces is indicated in the window title bar.



Trace color Color of trace display in diagram

Trace number Number of the trace (1 to 6)

Trace Mode Abbreviation of the trace mode:

- Clrw
Clear Write trace
- Max
Max Hold trace
- Min
Min Hold trace
- Avg
Average trace
- View
Frozen trace
- WrH
Write Hold trace

Understanding the display information

Result type	Type of result the trace represents. <ul style="list-style-type: none"> • PN • AM • PN + AM
Trace smoothing	Trace smoothing characteristics. Only displayed if trace smoothing has been turned on for a trace.
Spur removal	Spur removal characteristics. Only displayed if spur removal has been turned on for a trace.
Trace offset	Trace offset characteristics. Only displayed if an offset has been defined for a trace.

6.1.3 Marker information

Marker information is provided either in the diagram grid or in separate marker tables, depending on the configuration.

Marker information in diagram grid

Within the diagram, the x-axis and y-axis positions of the last 2 markers or delta markers that were set are displayed, if available, as well as their index. The value in the square brackets after the index indicates the trace to which the marker is assigned. (Example: M2[1] defines marker 2 on trace 1.) For more than 2 markers, a separate marker table is displayed beneath the diagram by default.

Marker information in marker table

In addition to the marker information displayed within the diagram grid, separate marker tables may be added to the display. These tables provide the following information for all active markers:

Table 6-2: Regular marker table

Label	Information
Wnd	Window type the marker is positioned in. (Only if there is more than one window containing a phase noise diagram.)
Type	Marker type: N (normal), D (delta), T (temporary, internal)
Ref	Reference (for delta markers)
Trc	Trace to which the marker is assigned

Label	Information
X-value	x-value of the marker
Y-value	y-value of the marker

6.1.4 Spot noise information

Spot noise information in diagram grid

The diagram contains information about all spot noise positions [T<x>]. Spot noise information is made up out of the position of the spot noise measurement on the x-axis and the y-axis. The value in the square brackets after the index indicates the trace to which the spot noise calculation is assigned (Example: [T1] indicates trace 1). Note that you can also display spot noise information in a separate table.

Spot noise information in spot noise table

The R&S FSPN also provides a numerical result table for the spot noise measurement. The spot noise table has to be added deliberately. Note that the spot noise table only contains information when the calculation of spot noise has been turned on.

Table 6-3: Spot noise information result table

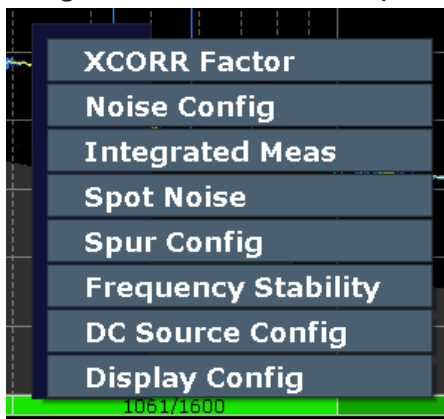
Label	Information
Wnd	Measurement window that the spot noise has been calculated for. (Only if there is more than one window containing a phase noise diagram.)
Offset	Offset frequency or spot noise position on the x-axis of the Phase Noise diagram.
Noise [T<x>]	Measured noise on the spot noise position for each active trace.

6.1.5 Measurement progress information

The Phase Noise result display shows the progress of the measurement in a series of green bars at the bottom of the diagram area. For each half decade in the measurement, the R&S FSPN adds a bar that spans the frequency range of the corresponding half decade.

The bar has several features.

- Measurement times less than 1 s
The numbers within the green bar indicate the number of cross-correlation operations applied to the corresponding half decade.
- Measurement times greater than 1 s
The numbers within the green bar show the progress of the cross-correlation operations in the half decade the application currently works on. The first number is the current, the second number the total count of cross-correlations for that half decade. The bars of half decades in which a measurement is still running has a lighter tone of green than bars of half decades in which the measurement has already finished (see image below).
- A double-click on the bar opens the "Noise Config" dialog box to define the cross-correlation factor for that half decade.
- A right-click on the bar opens a context menu.



The context menu provides easy access to various parameters to set up the measurement.

6.1.6 Frequency information in diagram footer

Graphical result displays contain information in the diagram footer. The information (beneath the diagram) depends on the result display.

The contents depend on the application and the result display.

Label	Information
Start offset	Start offset frequency
Stop offset	Stop offset frequency

6.1.7 Instrument and status information

Global instrument settings and functions, the instrument status and any irregularities are indicated in the status bar beneath the diagram.



In the MultiView tab the status bar always displays the information for the currently selected measurement.

The following information is displayed:

Instrument status



The state of the DC Power features.

- white label = DC Power has been turned off
- green label = DC Power has been turned on and is within the defined limits
- red label = DC Power has been turned on and violates the defined limits



The R&S FSPN is configured for operation with an external reference.

Progress

The status of the current operation is displayed in the status bar. This includes the remaining measurement time for measurements that last longer than 1 second.

Display of the remaining measurement time is supported by the following measurements:

- Phase noise
- Baseband noise



In the MultiView tab, the progress bar indicates the status of the currently selected measurement, not the measurement currently being performed by a Sequencer, for example.

Date and time

The date and time settings of the instrument are displayed in the status bar.

16.10.2020
10:43:58

Error messages and warnings

If errors or irregularities are detected, a keyword and an error message, if available, are displayed in the status bar.

6.1.8 Error information

If errors or irregularities are detected, a keyword and an error message, if available, are displayed in the status bar.

UNCAL

Depending on the type of message, the status message is indicated in varying colors.

Table 6-4: Status bar information - color coding

Color	Type	Description
red	Error	An error occurred at the start or during a measurement, e.g. due to missing data or wrong settings, so that the measurement cannot be started or completed correctly.
orange	Warning	An irregular situation occurred during measurement, e.g. the settings no longer match the displayed results, or the connection to an external device was interrupted temporarily.
gray	Information	Information on the status of individual processing steps.
no color	No errors	No message displayed - normal operation.
green	Measurement successful	Some applications visualize that the measurement was successful by showing a message.


 If any error information is available for a measurement channel, an exclamation mark is displayed next to the channel name (❗). This is particularly useful when the MultiView tab is displayed, as the status bar in the MultiView tab always displays the information for the currently selected measurement only.

Table 6-5: Keywords in the status bar

Message	Meaning
IF OVLD	Overload of the IF signal path in the A/D converter or in the digital IF. Increase attenuation or remove the signal from the RF input.
LOUNL	Error in the instrument's frequency processing hardware was detected.
NO REF	Instrument was set to an external reference but no signal was detected on the reference input.
OVEN	The OCXO reference frequency has not yet reached its operating temperature. The message usually disappears a few minutes after power has been switched on.
RF OVLD	Overload of the input mixer or of the analog IF path. Reduce the input level.
UNCAL	One of the following conditions applies: <ul style="list-style-type: none"> • Correction data has been switched off. • No correction values are available, for example after a firmware update. • Record the correction data by performing a self alignment
WRONG_FW	The firmware version is out-of-date and does not support the currently installed hardware. Until the firmware version is updated, this error message is displayed and self-alignment fails. (For details refer to the R&S FSPN User Manual).

6.2 Accessing functions

All tasks necessary to operate the instrument can be performed using the user interface. Apart from instrument specific keys, all other keys that correspond to an external keyboard (for example arrow keys, [Enter] key) operate conform to Microsoft.

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

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

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

- System and function keys on the front panel of the instrument
- Softkeys on the touchscreen
- Context menus for specific elements on the touchscreen

- Icons on the tool bar in the touchscreen
- Displayed setting on the touchscreen
- [Toolbar](#)..... 73
- [Softkeys](#)..... 74
- [Context menus](#)..... 75
- [On-screen keyboard](#)..... 76

6.2.1 Toolbar

The icons in the toolbar provide access to general functions.



You can hide the toolbar display, for example when using remote control, in order to enlarge the display area for the measurement results ("Setup > Display > Displayed Items"). See the R&S FSPN User Manual for details.



Windows: opens the Windows "Start" menu and task bar.



Open: opens a file from the instrument or an external device ("Save/Recall" menu).



Store: stores data on the instrument or an external device ("Save/Recall" menu).



Print: defines print settings ("Print" menu).



Undo: reverts last operation



Redo: repeats previously reverted operation



Select: the cursor can be used to select (and move) elements in the display (markers, lines etc.).



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



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



Zoom off: displays the diagram in its original size.



SmartGrid: activates "SmartGrid" mode to configure the screen layout.



Sequencer: opens the "Sequencer" menu to perform consecutive measurements.



DC Power: turns the DC power output on and off.



DC Configuration: provides quick access to configure the main parameters for DC power supply.



Help (+ Select): allows you to select an element for which context-specific help is displayed.



Help: displays context-sensitive help topic for currently selected element.



Print immediately: prints the current display (screenshot) as configured.

In "SmartGrid" mode only:



Close: Exit "SmartGrid" mode.

6.2.2 Softkeys

Softkeys are virtual keys provided by the software. Thus, more functions can be provided than those that can be accessed directly via the function keys on the instrument. Softkeys are dynamic: depending on the selected function key, a different list of softkeys is displayed on the right side of the screen.

A list of softkeys for a certain function key is also called a menu. Softkeys can either perform a specific function or open a dialog box.

Recognizing the softkey status by color

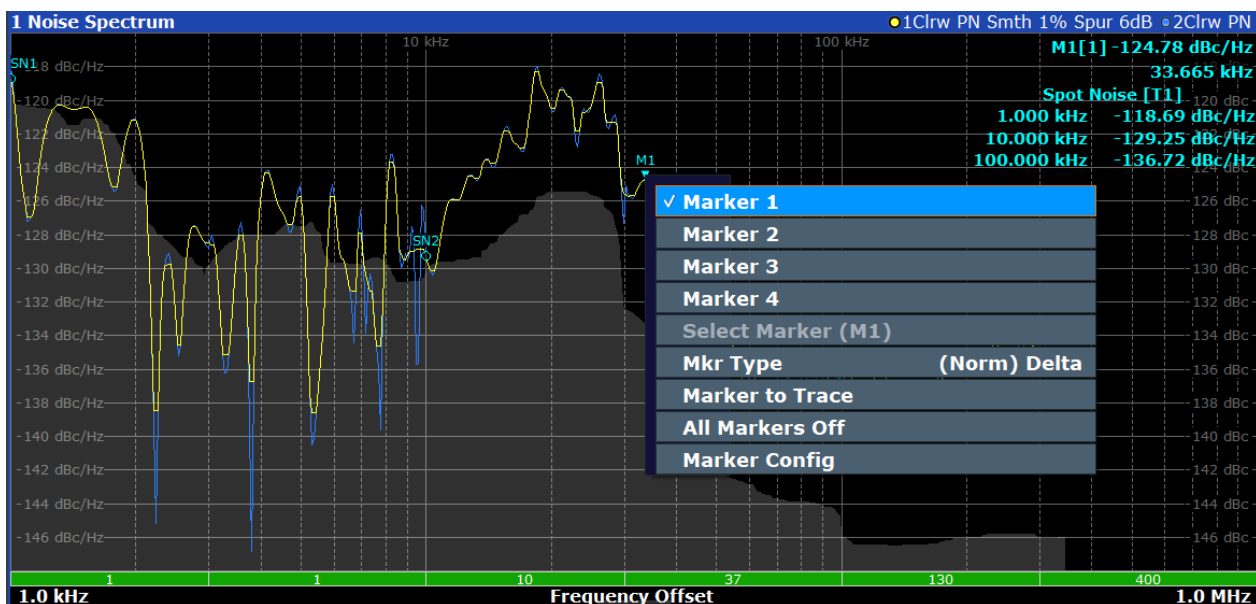
Color	Meaning
orange	associated dialog box is open
blue	associated function is active; for toggle keys: currently active state
gray	instrument function is temporarily not available due to a specific setting or missing option



You can hide the softkey display, e.g. when using remote control, in order to enlarge the display area for the measurement results ("Setup > Display > Displayed Items"). See the User Manual for details.

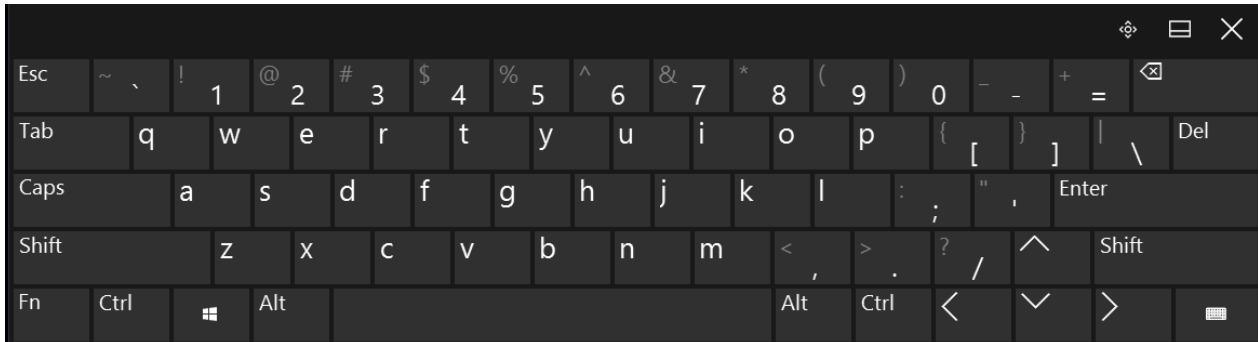
6.2.3 Context menus

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



6.2.4 On-screen keyboard

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



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



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

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



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

6.3 Changing the focus

Any interaction using the keypad, scrollbar or knobs always affects the currently focused element in the display, e.g. a dialog field, diagram, or table row. The currently focused element is indicated by a blue frame (diagram, window, table) or is otherwise highlighted (softkey, marker etc.). To move the focus, select the element on the touchscreen.

6.4 Entering data

You can enter data in dialog boxes using any of the following methods:

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

Transparent dialog boxes

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

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



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

Particularities in Windows dialog boxes

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

6.4.1 Entering numeric parameters

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

1. Enter the parameter value using the keypad, or change the currently used parameter value by using the rotary knob (small steps) or the [UP] or [DOWN] keys (large steps).
2. After entering the numeric value via keypad, press the corresponding unit key. The unit is added to the entry.

3. If the parameter does not require a unit, confirm the entered value by pressing [ENTER] or any of the unit keys.
The editing line is highlighted to confirm the entry.

6.4.2 Entering alphanumeric parameters

If a field requires alphanumeric input, you can use the on-screen keyboard to enter numbers and (special) characters (see [Chapter 6.2.4, "On-screen keyboard"](#), on page 76).

Alternatively, you can use the keypad. Every alphanumeric key represents several characters and one number. The decimal point key (.) represents special characters, and the sign key (-) toggles between capital and small letters. For the assignment, refer to [Table 6-6](#).



You can change the default behavior of the keypad for text input. This is useful if you frequently enter numeric values in text fields, for example to define file names consisting of numbers.

For details, see "System Configuration Settings" in the R&S FSPN base unit user manual.

To enter numbers and (special) characters via the keypad

1. Press the key once to enter the first possible value.
2. All characters available via this key are displayed.
3. To choose another value provided by this key, press the key again, until your desired value is displayed.
4. With every key stroke, the next possible value of this key is displayed. If all possible values have been displayed, the series starts with the first value again. For information on the series, refer to [Table 6-6](#).
5. To change from capital to small letters and vice versa, press the sign key (-).
6. When you have chosen the desired value, wait for 2 seconds (to use the same key again), or start the next entry by pressing another key.

To enter a blank

- ▶ Press the "Space" bar, or press "0" and wait 2 seconds.

To correct an entry

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

To complete the entry

- ▶ Press [ENTER] or the rotary knob.

To abort the entry

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

Table 6-6: Keys for alphanumeric parameters

Key name (upper inscription)	Series of (special) characters and number provided
7	7 μ Ω ° € ¥ \$ ¢
8	A B C 8 Ä Å Ç
9	D E F 9 É
4	G H I 4
5	J K L 5
6	M N O 6 Ñ Ö
1	P Q R S 1
2	T U V 2 Ü
3	W X Y Z 3
0	<blank> 0 – @ + / \ < > = % &
.	. * : _ , ; " ' ? () #
–	<toggles between capital and small letters>

6.5 Touchscreen gestures

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



Tapping

Touch the screen quickly, usually on a specific element.

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

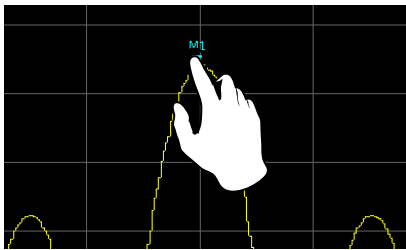


Figure 6-1: Tapping

Double-tapping

Tap the screen twice, in quick succession.

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



Dragging

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

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

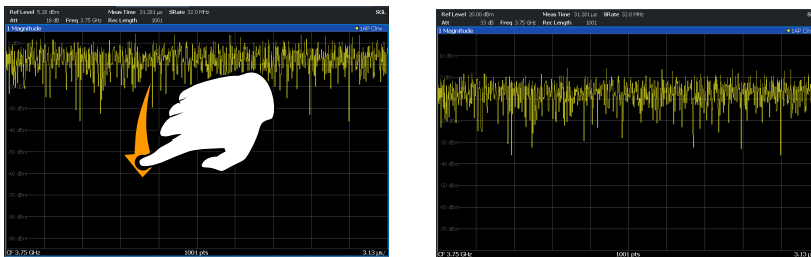


Figure 6-2: Dragging



Pinching and spreading two fingers

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

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

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

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

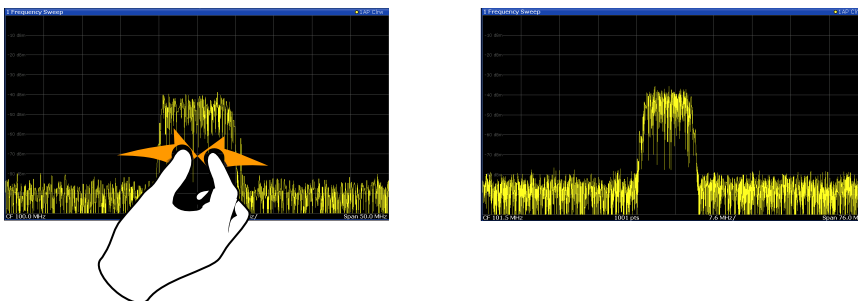


Figure 6-3: Pinching

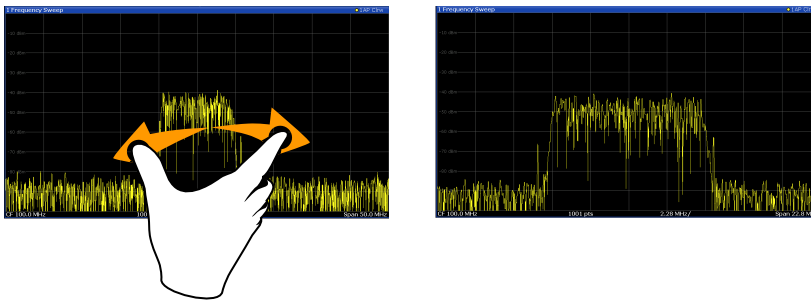


Figure 6-4: Spreading

i Touch gestures in diagrams change measurement settings

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

Mouse vs. touch actions

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

Table 6-7: Correlation of mouse and touch actions

Mouse operation	Touch operation
Click	Tap
Double-click	Double-tap
Click and hold	Touch and hold
Right-click	Touch, hold for 1 second and release
Drag-&-drop (= click and hold, then drag and release)	Touch, then drag and release
Mouse wheel to scroll up or down	Swipe
Dragging scrollbars to scroll up or down, left or right	Swipe
In (graphical) Zoom mode only: dragging the borders of the displayed rectangle to change its size	Touch, then drag and release

Example:

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

6.6 Displaying results

The results of a measurement channel can be evaluated in many different ways, both graphically and numerically. For each evaluation method the results are displayed in a separate window in the tab.

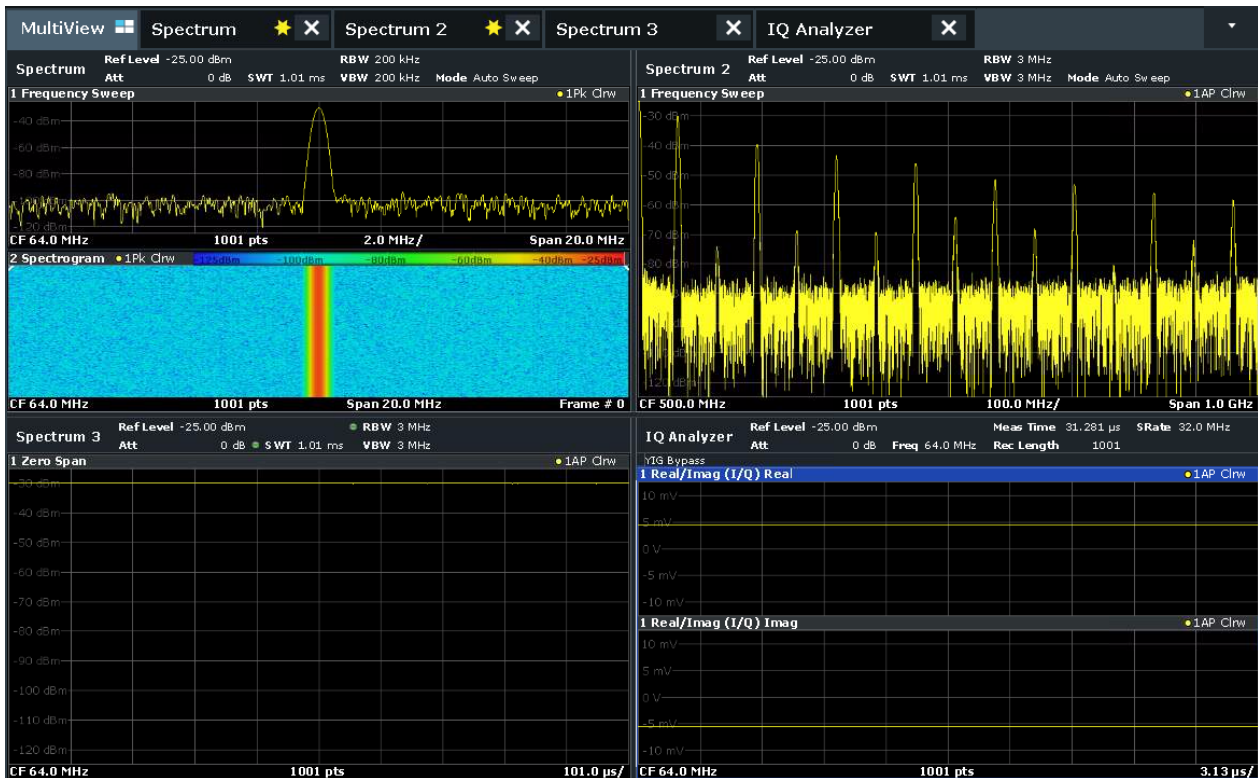
The R&S FSPN allows you to configure the display to suit your specific requirements and optimize analysis.

6.6.1 Activating and deactivating channels

When you activate an application, a new measurement channel is created which determines the measurement settings for that application. The same application can be activated with different measurement settings by creating several channels for the same application. Whenever you switch channels, the corresponding measurement settings are restored. Each channel is displayed in a separate tab on the screen.

An additional tab ("MultiView") provides an overview of all currently active channels at once.

Only one measurement can be performed at any time, namely the one in the currently active channel. However, in order to perform the configured measurements consecutively, a Sequencer function is provided.



To start a new channel

1. Select [Mode].
2. In the "Mode" dialog box, select the required application on the "New Channel" tab.
A new tab is displayed for the new channel.

To change the application in an active channel

1. Select the tab of the channel you want to change.
2. Select [Mode].
3. In the "Mode" dialog box, select the new application to be displayed on the "Replace Current Channel" tab.
The selected application is displayed in the current channel.

To close a measurement channel



Select the "Close" icon on the tab of the measurement channel.

The tab is closed, any running measurements are aborted, and all results for that channel are deleted.

6.6.2 Laying out the result display with the smartgrid

Measurement results can be evaluated in many different ways, for example graphically, as summary tables, statistical evaluations etc. Each type of evaluation is displayed in a separate window in the channel tab. Up to 16 individual windows can be displayed per channel (i.e. per tab). To arrange the diagrams and tables on the screen, the Rohde & Schwarz SmartGrid function helps you find the target position simply and quickly.

(For details on evaluation methods see the User Manual.)

Principally, the layout of the windows on the screen is based on an underlying grid, the SmartGrid. However, the SmartGrid is dynamic and flexible, allowing for many different layout possibilities. The SmartGrid functionality provides the following basic features:

- Windows can be arranged in columns or in rows, or in a combination of both.
- Windows can be arranged in up to four rows and four columns.
- Windows are moved simply by dragging them to a new position on the screen, possibly changing the layout of the other windows, as well.
- All evaluation methods available for the currently selected measurement are displayed as icons in the evaluation bar. If the evaluation bar contains more icons than can be displayed at once on the screen, it can be scrolled vertically. The same evaluation method can be displayed in multiple windows simultaneously.
- New windows are added by dragging an evaluation icon from the evaluation bar to the screen. The position of each new window depends on where you drop the evaluation icon in relation to the existing windows.
- All display configuration actions are only possible in SmartGrid mode. When SmartGrid mode is activated, the evaluation bar replaces the current softkey menu display. When the SmartGrid mode is deactivated again, the previous softkey menu display is restored.

- [Background information: the smartgrid principle](#)..... 86
- [How to activate smartgrid mode](#)..... 87
- [How to add a new result window](#)..... 88
- [How to close a result window](#)..... 88
- [How to arrange the result windows](#)..... 89

6.6.2.1 Background information: the smartgrid principle

SmartGrid display

During any positioning action, the underlying SmartGrid is displayed. Different colors and frames indicate the possible new positions. The position in the Smart-Grid where you drop the window determines its position on the screen.

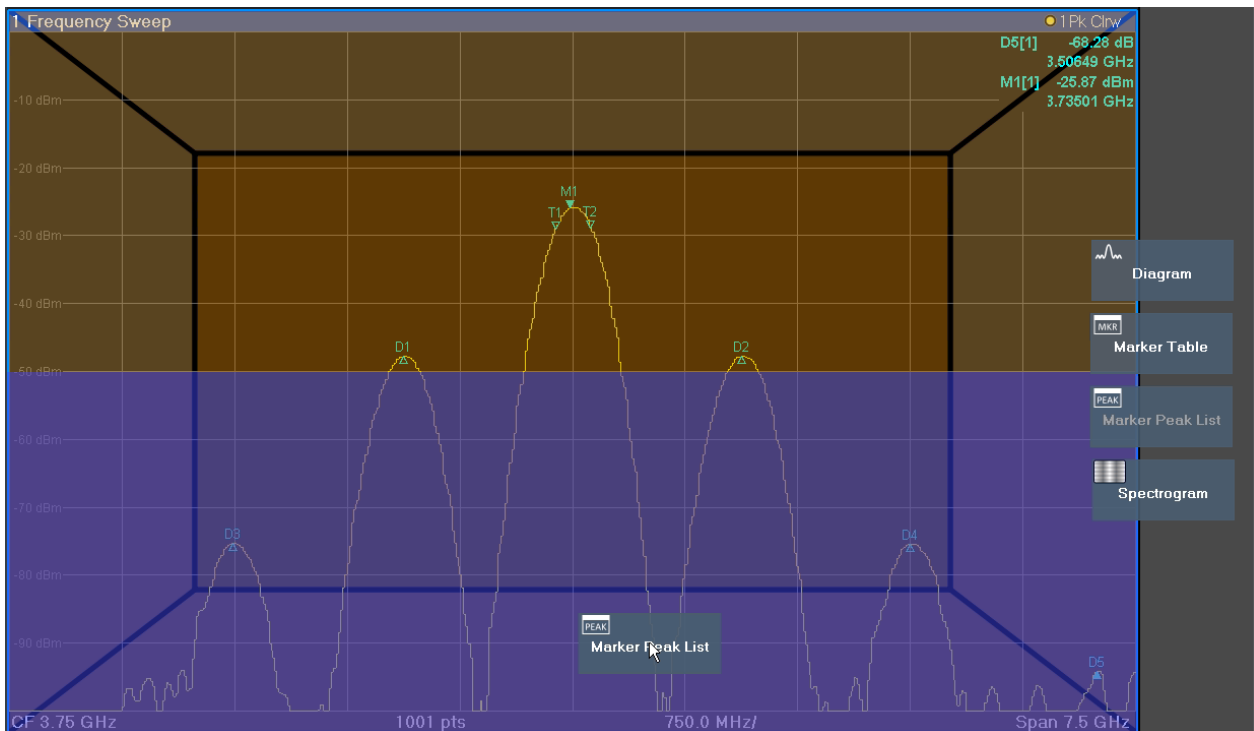


Figure 6-5: Moving a window in SmartGrid mode

The brown area indicates the possible "drop area" for the window, i.e. the area in which the window can be placed. A blue area indicates the (approximate) layout of the window as it would be if the icon were dropped at the current position. The frames indicate the possible destinations of the new window with respect to the existing windows: above/below, right/left or replacement (as illustrated in [Fig-](#)

ure 6-6). If an existing window would be replaced, the drop area is highlighted in a darker color shade.

Positioning the window

The screen can be divided into up to four rows. Each row can be split into up to four columns, where each row can have a different number of columns. However, rows always span the entire width of the screen and may not be interrupted by a column. A single row is available as the drop area for the window in the Smart-Grid. The row can be split into columns, or a new row can be inserted above or below the existing row (if the maximum of 4 has not yet been reached).

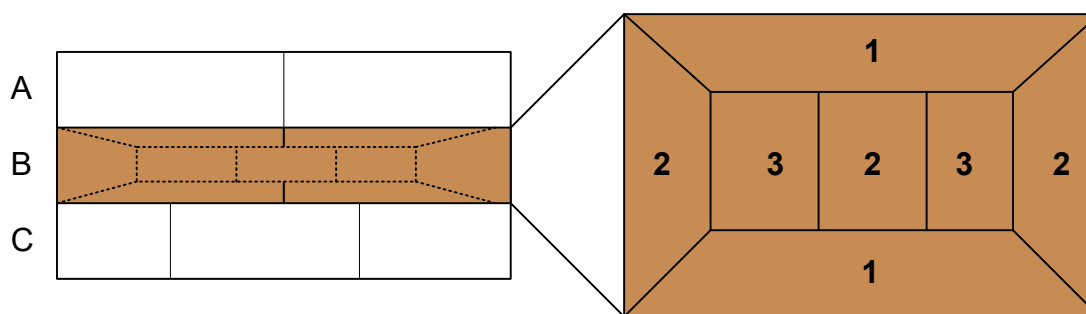


Figure 6-6: SmartGrid window positions

- 1 = Insert row above or below the existing row
- 2 = Create a new column in the existing row
- 3 = Replace a window in the existing row

SmartGrid functions

Once the evaluation icon has been dropped, icons in each window provide delete and move functions.



The "Move" icon allows you to move the position of the window, possibly changing the size and position of the other displayed windows.



The "Delete" icon allows you to close the window, enlarging the display of the remaining windows.

6.6.2.2 How to activate smartgrid mode

All display configuration actions are only possible in SmartGrid mode. In Smart-Grid mode the evaluation bar replaces the current softkey menu display. When

the SmartGrid mode is deactivated again, the previous softkey menu display is restored.

► To activate SmartGrid mode, do one of the following:



Select the "SmartGrid" icon from the toolbar.

- Select "Display Config" in the configuration "Overview".
- Select "Display Config" from the [Meas Config] menu.

The SmartGrid functions and the evaluation bar are displayed.



To close the SmartGrid mode and restore the previous softkey menu, select the "Close" icon, or press any key.

6.6.2.3 How to add a new result window

Each type of evaluation is displayed in a separate window. Up to 16 individual windows can be displayed per channel (i.e. per tab).

1. Activate SmartGrid mode.

All evaluation methods available for the currently selected measurement are displayed as icons in the evaluation bar.

2. Select the icon for the required evaluation method from the evaluation bar.

3. Drag the required icon from the evaluation bar to the SmartGrid, which is displayed in the diagram area, and drop it at the required position. (See [Chapter 6.6.2.5, "How to arrange the result windows"](#), on page 89 for more information on positioning the window).

6.6.2.4 How to close a result window

► To close a window, activate SmartGrid mode and select the "Delete" icon for the window.



6.6.2.5 How to arrange the result windows

1. Select an icon from the evaluation bar or the "Move" icon for an existing evaluation window.

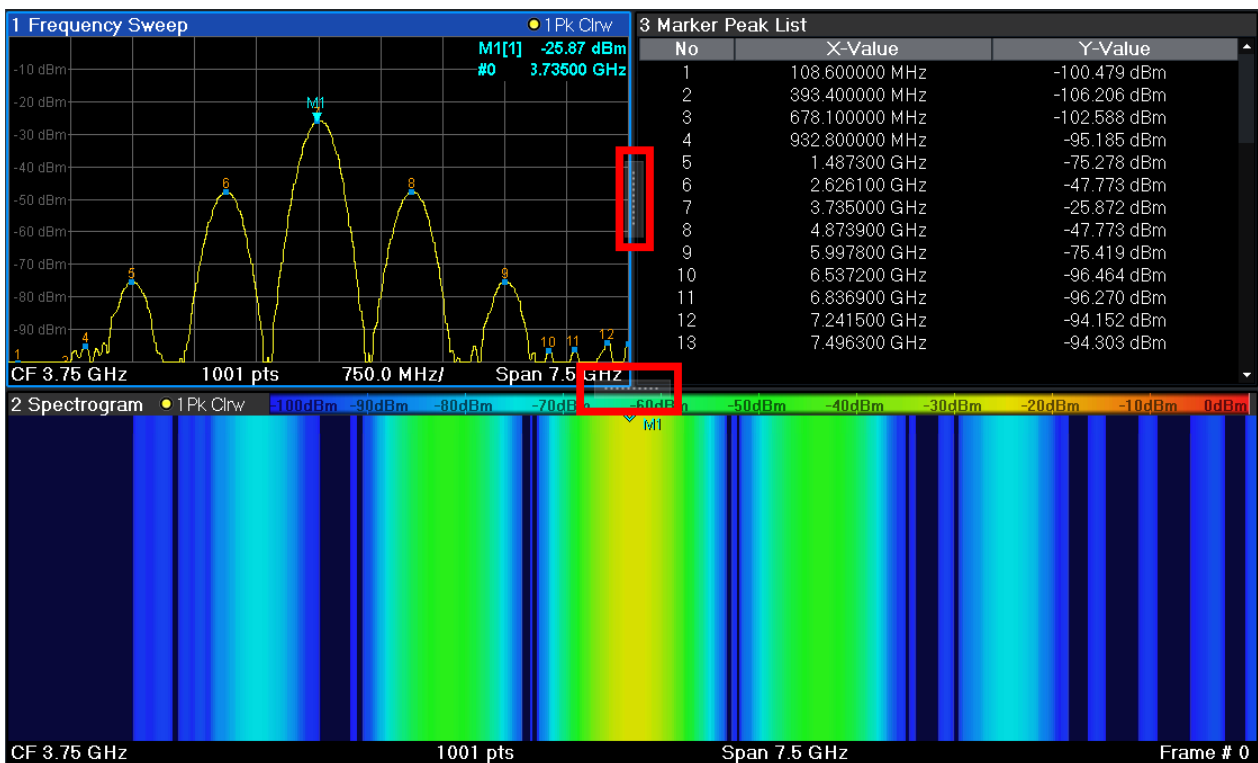


2. Drag the evaluation over the SmartGrid.
A blue area shows where the window will be placed.
3. Move the window until a suitable area is indicated in blue.
4. Drop the window in the target area.
The windows are rearranged to the selected layout, and "Delete" and "Move" icons are displayed in each window.
5. To close a window, select the corresponding "Delete" icon.



6.6.3 Changing the size of windows

Each channel tab may contain several windows to evaluate the measurement results using different methods. A "splitter" allows you to change the size of neighboring windows.



The splitters are not available in SmartGrid mode.

- To change the size of two neighboring windows, drag the splitter between the windows in either direction.

6.6.4 Switching between a split and maximized window display

To get an overview of the results, displaying several windows at the same time may be helpful. However, the individual windows may become rather small. In this case it is useful to maximize an individual window to the entire screen temporarily in order to analyze the results in more detail.



To switch between a split and a maximized display without having to close and re-open windows, press [SPLIT/MAXIMIZE] on the front panel. In maximized display, the currently focused window is maximized. In split display, all active windows are displayed.

Alternatively, double-tap the title bar of a window to maximize it.

6.6.5 Changing the display

The display can be optimized for your individual needs. The following display functions are available and are described in detail in the User Manual.

- Displaying a simulation of the entire front panel of the instrument on the screen ("Front Panel")
- Displaying the main function hardkeys in a separate window on the screen ("Mini Front Panel")
- Hiding or showing various screen elements
- Selecting a display theme and colors
- Changing the display update rate
- Activating or deactivating the touch-sensitivity of the screen
- Zooming into the diagram

6.7 Remote control

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

- Connecting the instrument to a (LAN) network
(See the R&S FSPN user manual.)
- Using the Windows Remote Desktop application in a LAN network
- Connecting a PC via the GPIB interface

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



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

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

6.7.1 Remote desktop connection

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

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

6.7.2 Connecting a PC via the GPIB interface

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

A GPIB interface is integrated on the rear panel of the instrument.

7 Contacting customer support

Technical support – where and when you need it

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

Contact information

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



Figure 7-1: QR code to the Rohde & Schwarz support page