

# R&S® FSH-Z114

## Precision Frequency Reference

### User Manual



1321.2501.02 – 01

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# 1 Basic Safety Instructions

## **Always read through and comply with the following safety instructions!**

All plants and locations of the Rohde & Schwarz group of companies make every effort to keep the safety standards of our products up to date and to offer our customers the highest possible degree of safety. Our products and the auxiliary equipment they require are designed, built and tested in accordance with the safety standards that apply in each case. Compliance with these standards is continuously monitored by our quality assurance system. The product described here has been designed, built and tested in accordance with the attached EC Certificate of Conformity and has left the manufacturer's plant in a condition fully complying with safety standards. To maintain this condition and to ensure safe operation, you must observe all instructions and warnings provided in this manual. If you have any questions regarding these safety instructions, the Rohde & Schwarz group of companies will be happy to answer them.

Furthermore, it is your responsibility to use the product in an appropriate manner. This product is designed for use solely in industrial and laboratory environments or, if expressly permitted, also in the field and must not be used in any way that may cause personal injury or property damage. You are responsible if the product is used for any purpose other than its designated purpose or in disregard of the manufacturer's instructions. The manufacturer shall assume no responsibility for such use of the product.

The product is used for its designated purpose if it is used in accordance with its product documentation and within its performance limits (see data sheet, documentation, the following safety instructions). Using the product requires technical skills and, in some cases, a basic knowledge of English. It is therefore essential that only skilled and specialized staff or thoroughly trained personnel with the required skills be allowed to use the product. If personal safety gear is required for using Rohde & Schwarz products, this will be indicated at the appropriate place in the product documentation. Keep the basic safety instructions and the product documentation in a safe place and pass them on to the subsequent users.

Observing the safety instructions will help prevent personal injury or damage of any kind caused by dangerous situations. Therefore, carefully read through and adhere to the following safety instructions before and when using the product. It is also absolutely essential to observe the additional safety instructions on personal safety, for example, that appear in relevant parts of the product documentation. In these safety instructions, the word "product" refers to all merchandise sold and distributed by the Rohde & Schwarz group of companies, including instruments, systems and all accessories. For product-specific information, see the data sheet and the product documentation.

### Operating states and operating positions

The product may be operated only under the operating conditions and in the positions specified by the manufacturer. If the manufacturer's specifications are not observed, this can result in electric shock, fire and/or serious personal injury or death. Applicable local or national safety regulations and rules for the prevention of accidents must be observed in all work performed.

- The product is protected against dripping water and dust (IP degree 51). Unless otherwise specified, the following requirements apply to Rohde & Schwarz products: predefined operating position is always with the housing floor facing down, IP protection 2X, pollution severity 2, overvoltage category 2, use only in enclosed spaces, max. operation altitude 4600 m above sea level, max. transport altitude 12000 m above sea level. A tolerance of  $\pm 10\%$  shall apply to the nominal voltage and of  $\pm 5\%$  to the nominal frequency.
- Do not place the product on surfaces, vehicles, cabinets or tables that for reasons of weight or stability are unsuitable for this purpose. Always follow the manufacturer's installation instructions when installing the product and fastening it to objects or structures (e.g. walls and shelves). An installation that is not carried out as described in the product documentation could result in personal injury or even death.
- Do not place the product on heat-generating devices such as radiators or fan heaters. The ambient temperature must not exceed the maximum temperature specified in the product documentation or in the data sheet. Product overheating can cause electric shock, fire and/or serious personal injury or even death.

### Electrical safety

If the information on electrical safety is not observed either at all or to the extent necessary, electric shock, fire and/or serious personal injury or death may occur.

- Unless expressly permitted, never remove the cover or any part of the housing while the product is in operation. Doing so will expose circuits and components and can lead to injuries, fire or damage to the product.
- Use suitable overvoltage protection to ensure that no overvoltage (such as that caused by a bolt of lightning) can reach the product. Otherwise, the person operating the product will be exposed to the danger of an electric shock.
- Any object that is not designed to be placed in the openings of the housing must not be used for this purpose. Doing so can cause short circuits inside the product and/or electric shocks, fire or injuries.
- Unless specified otherwise, products are not liquid-proof (see also section "Operating states and operating positions", item 1). Therefore, the equipment must be protected against penetration by liquids. If the necessary precautions are not taken, the user may suffer electric shock or the product itself may be damaged, which can also lead to personal injury.
- Never use the product under conditions in which condensation has formed or can form in or on the product, e.g. if the product has been moved from a cold to a warm environment. Penetration by water increases the risk of electric shock.

## Operation

- Operating the products requires special training and intense concentration. Make sure that persons who use the products are physically, mentally and emotionally fit enough to do so; otherwise, injuries or material damage may occur. It is the responsibility of the employer/operator to select suitable personnel for operating the products.
- As with all industrially manufactured goods, the use of substances that induce an allergic reaction (allergens) such as nickel cannot be generally excluded. If you develop an allergic reaction (such as a skin rash, frequent sneezing, red eyes or respiratory difficulties) when using a Rohde & Schwarz product, consult a physician immediately to determine the cause and to prevent health problems or stress.
- Before you start processing the product mechanically and/or thermally, or before you take it apart, be sure to read and pay special attention to the section titled "Waste disposal/Environmental protection", item 1.
- Depending on the function, certain products such as RF radio equipment can produce an elevated level of electromagnetic radiation. Considering that unborn babies require increased protection, pregnant women must be protected by appropriate measures. Persons with pacemakers may also be exposed to risks from electromagnetic radiation. The employer/operator must evaluate workplaces where there is a special risk of exposure to radiation and, if necessary, take measures to avert the potential danger.
- Should a fire occur, the product may release hazardous substances (gases, fluids, etc.) that can cause health problems. Therefore, suitable measures must be taken, e.g. protective masks and protective clothing must be worn.
- EMC classes (in line with CISPR 11)  
Class A: Equipment suitable for use in all environments except residential environments and environments that are directly connected to a low-voltage supply network that supplies residential buildings.  
Class B: Equipment suitable for use in residential environments and environments that are directly connected to a low-voltage supply network that supplies residential buildings.

## Repair and service

- The product may be opened only by authorized, specially trained personnel. Before any work is performed on the product or before the product is opened, it must be disconnected from the AC supply network. Otherwise, personnel will be exposed to the risk of an electric shock.
- Adjustments, replacement of parts, maintenance and repair may be performed only by electrical experts authorized by Rohde & Schwarz. Only original parts may be used for replacing parts relevant to safety (e.g. power switches, power transformers, fuses). A safety test must always be performed after parts relevant to safety have been replaced (visual inspection, protective conductor test, insulation resistance measurement, leakage current measurement, functional test). This helps ensure the continued safety of the product.

### Transport

- If you use the product in a vehicle, it is the sole responsibility of the driver to drive the vehicle safely and properly. The manufacturer assumes no responsibility for accidents or collisions. Never use the product in a moving vehicle if doing so could distract the driver of the vehicle. Adequately secure the product in the vehicle to prevent injuries or other damage in the event of an accident.

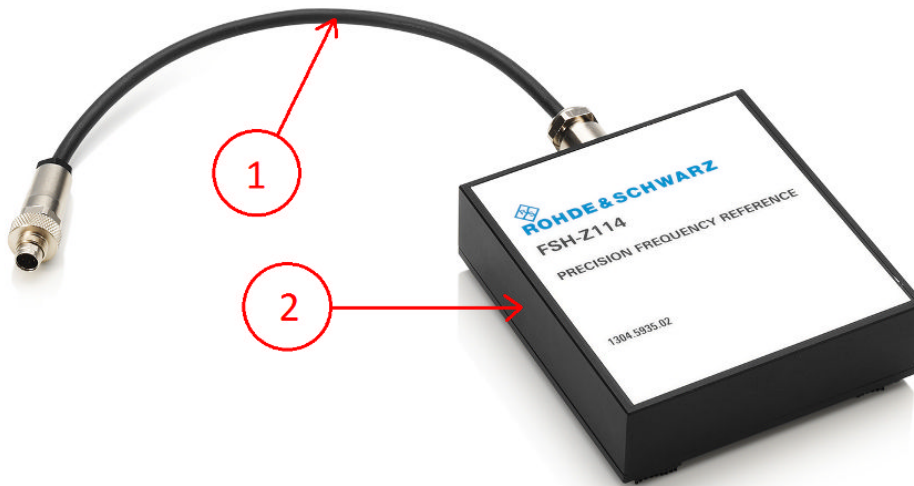
### Waste disposal / environmental protection

- Specially marked equipment has a battery or accumulator that must not be disposed of with unsorted municipal waste, but must be collected separately. It may only be disposed of at a suitable collection point or via a Rohde & Schwarz customer service center.
- Waste electrical and electronic equipment must not be disposed of with unsorted municipal waste, but must be collected separately.  
Rohde & Schwarz GmbH & Co. KG has developed a disposal concept and takes full responsibility for take-back obligations and disposal obligations for manufacturers within the EU. Contact your Rohde & Schwarz customer service center for environmentally responsible disposal of the product.
- If products or their components are mechanically and/or thermally processed in a manner that goes beyond their intended use, hazardous substances (heavy-metal dust such as lead, beryllium, nickel) may be released. For this reason, the product may only be disassembled by specially trained personnel. Improper disassembly may be hazardous to your health. National waste disposal regulations must be observed.
- If handling the product releases hazardous substances or fuels that must be disposed of in a special way, e.g. coolants or engine oils that must be replenished regularly, the safety instructions of the manufacturer of the hazardous substances or fuels and the applicable regional waste disposal regulations must be observed. Also observe the relevant safety instructions in the product documentation. The improper disposal of hazardous substances or fuels can cause health problems and lead to environmental damage.

For additional information about environmental protection, visit the Rohde & Schwarz website.

## 2 Front View of R&S FSH-Z114

This section describes the front view and connector details of R&S FSH-Z114.



**Fig. 2-1: Front View**

- 1 = Connector cable
- 2 = Precision Frequency Reference

## 3 Operating the R&S FSH-Z114

This section describes the basic steps to set up the R&S FSH-Z114 for the first time.

### 3.1 Unpacking the R&S FSH-Z114

The R&S FSH-Z114 is supplied in form-fit packaging consisting of an upper and lower shell. The two shells are held together by a sleeve which encloses the packaging.

The packaging contains the R&S FSH-Z114 together with the connector cable (R&S part number: 1309.7407.00).

### 3.2 Using the R&S FSH-Z114

The following section describes the steps to set up the R&S FSH-Z114 and to connect it to the R&S FSH.

#### Connecting the R&S FSH-Z114

The Precision Frequency Reference ( R&S FSH-Z114) can be attached to the backside of the R&S FSH with a velcro tape. The cable of the R&S FSH-Z114 must be connected to the "Power Sensor" interface on top of the R&S FSH. The necessary supply voltage is provided by the R&S FSH.





**Fig. 3-1: R&S FSH-Z114 with R&S FSH**

After the R&S FSH-Z114 is connected to the R&S FSH, it is detected by the R&S FSH by turning on the "Auto Accessory Detection" in the setup menu.

### **Selecting Auto Accessory Detection on the R&S FSH**

1. Press the SETUP key.
2. Select the "Auto Accessory Detection" menu item and turn it "On".

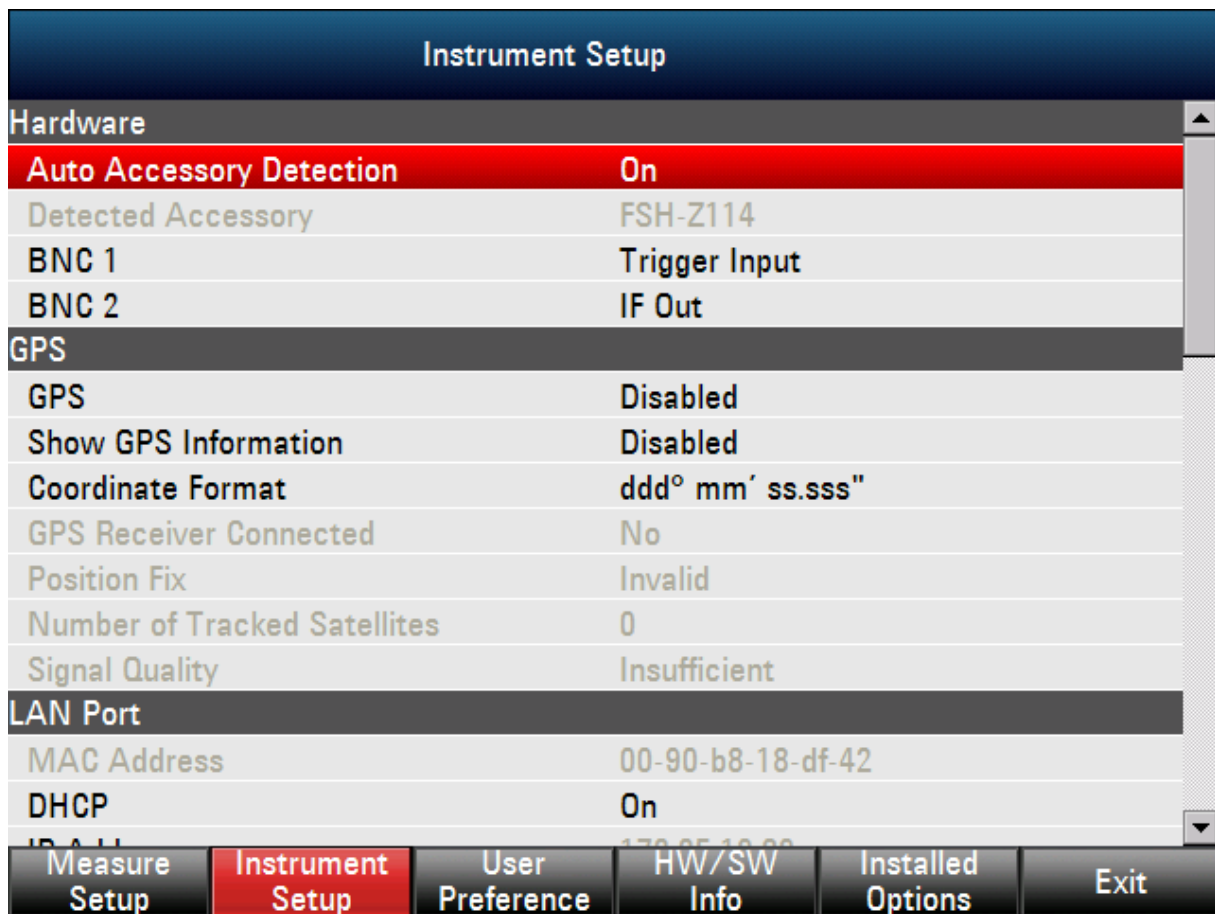


Fig. 3-2: Instrument setup for auto accessory detection

Once the R&S FSH-Z114 is detected, its name will be displayed at the top of the R&S FSH screen. The color of the label "FSH-Z114" turns green once the R&S FSH-Z114 is locked and ready to use.

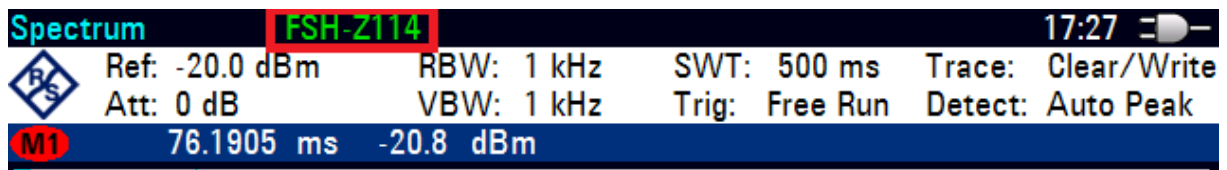


Fig. 3-3: R&S FSH-Z114's status

### Operating the R&S FSH's Frequency Counter

The frequency counter marker must be turned on to benefit from the performance of the Precision Frequency Reference.

### Frequency counter selection on the R&S FSH

1. Press the MARKER key.  
The marker menu opens.
2. Select the "Frequency Count" menu item using the rotary knob or the cursor keys.
3. Press the ENTER key.



**Fig. 3-4: Frequency Counter Selection**

The Label "M" at the upper left hand corner of the measurement diagram changes to "C" to indicate that the frequency counter has been switched on. The resolution of the frequency readout is 0.1 Hz independent of other settings. After the oscillator of the frequency reference is locked (green "FSH-Z114" indicator), the frequency counter result will be updated approximately every 15 seconds.



**Fig. 3-5: Frequency Counter Display**



- The datasheet indicates two values for the total frequency accuracy achievable with the Precision Frequency Reference: a nominal accuracy reached 30 seconds after the "FSH-Z114" indicator has turned to green, and a specified accuracy reached after 2 minutes. Refer to the datasheet for more details on the differences between these values.
- To update the frequency counter results, the R&S FSH must be set to "Continuous Sweep" mode. In "Single Sweep" operation the frequency counter will not be updated, if the R&S FSH-Z114 is connected to the instrument.
- To make sure that the frequency counter works correctly, the frequency span should not be wider than  $(630 * \text{resolution bandwidth})$ .

## Using remote control

In remote control operation with the R&S FSH-Z114 option connected, the command `CALCulate:MARKer:COUNT:FREQuency?` will only return valid results if the instrument is in continuous sweep mode.

### Programming example:

The following command sequence can be used to set the marker to the highest signal in the current frequency range and measure its frequency using the frequency counter:

```
//Select continuous sweep mode
INIT:CONT ON
//Position the marker to the signal peak in the current frequency range
CALC:MARK:MAX
//Turn on the frequency counter
CALC:MARK:COUN ON
//wait for 30 s to obtain a result with nominal frequency accuracy
//or
//wait for 120 s to obtain the specified frequency accuracy
```

```
//Query the frequency counter results
CALC:MARK:COUN:FREQ?
```

Note that changing an instrument setting (frequency, span, bandwidth etc.) or starting a new sweep via the commands `INIT` or `*TRG` will reset the frequency counter. To obtain the desired frequency accuracy the settling times mentioned in the programming example should be taken care of.

- 30 s for results with nominal frequency accuracy.
- 120 s for results with the specified frequency accuracy.

### Software Requirement

The R&S FSH-Z114 requires firmware version 2.12 or higher.

### Supported Instrument Models

Designation	Type	Order No.
Spectrum Analyzer, 9 kHz to 3.6 GHz, with preamplifier	R&S®FSH4	1309.6000.04
Spectrum Analyzer, 9 kHz to 3.6 GHz, with preamplifier and tracking generator	R&S®FSH4	1309.6000.14
Spectrum Analyzer, 100 kHz to 3.6 GHz, with preamplifier, tracking generator and internal VSWR bridge	R&S®FSH4	1309.6000.24
Spectrum Analyzer, 9 kHz to 8 GHz, with preamplifier	R&S®FSH8	1309.6000.08
Spectrum Analyzer, 9 kHz to 8 GHz, with preamplifier and tracking generator	R&S®FSH8	1309.6000.18
Spectrum Analyzer, 100 kHz to 8 GHz, with preamplifier, tracking generator and internal VSWR bridge	R&S®FSH8	1309.6000.28



Option R&S FSH-Z114 is only supported by instruments with serial numbers >105000

## 4 About Rohde & Schwarz

Rohde & Schwarz is an independent group of companies specializing in electronics. It is a leading supplier of solutions in the fields of test and measurement, broadcasting, radiomonitoring and radiolocation, as well as secure communications. Rohde & Schwarz has a global presence and a dedicated service network in over 70 countries. Company headquarters are in Munich, Germany.

Certified Quality System  
**ISO 9001**

### Environmental commitment

- Energy-efficient products
- Continuous improvement in environmental sustainability
- ISO 14001-certified environmental management system

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The following abbreviations are used throughout this manual: R&S®FSH-Z114 is abbreviated to R&S FSH-Z114.