

Featuring a frequency range up to 18 GHz, the R&S®FSH18 follows in the footsteps of the internationally successful 3 GHz R&S®FSH3 and 6 GHz R&S®FSH6 models. It is the most lightweight handheld spectrum analyzer available on the market and is thus ideal for mobile use as well as for versatile applications in the microwave range.

R&S®FSH18 Spectrum Analyzer

The most lightweight handheld spectrum analyzer up to 18 GHz

Compact and durable

The R&S®FSH18 spectrum analyzer (FIG 1) is just as handy and robust as the R&S®FSH3 and the R&S®FSH6. Moreover, it comes with the same compact housing, which was especially designed for mobile applications. Weighing only 2.5 kg, the R&S®FSH18 is the most lightweight microwave handheld spectrum analyzer commercially available; plus, with three hours of battery power, its operating time is unparalleled in this

class of instruments. These characteristics make it ideal for use at locations that are difficult to access and wherever a lightweight and compact analyzer would considerably facilitate everyday work. Due to its extended frequency range, the R&S®FSH18 is ideally suited for performing measurements on radar stations, air traffic control and satellite systems, as well as on microwave links. Its wide scope of functions includes the determination of spurious signals as well as general-purpose lab applications. The analyzer relies on the familiar and convenient operating concept of the R&S®FSHx family, making instrument operation a breeze. What's more, the R&S®FSH18 offers a transreflective LC display, which makes for good readability even under extreme light conditions. The RF characteristics of the R&S®FSH18 are also impressive (for details, see "condensed data" on page 43). FIG 2 provides an overview of the R&S®FSHx family.

FIG 1
Low in weight for microwave applications: The R&S®FSH18 from Rohde & Schwarz is the world's most compact instrument up to 18 GHz.



New receive section up to 18 GHz

The R&S®FSH18 uses the same digital section as the R&S®FSH3, while its receive section with synthesizer is fresh out of development. Conventional analyzers covering this frequency range usually include two receive sections, i. e. one for the lower frequency range up to approximately 3 GHz, and a second receive path with a YIG filter for the upper frequency range. As the YIG filter alone consumes about 5 W power and approx. 5 cm³ of space, this solution was rejected from the start.

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► Instead, a continuous receive section from 10 MHz to 18 GHz with the first IF above the receive band was implemented in the R&S®FSH18. This new concept is highly beneficial as considerably less power and space are required. The receive section including synthesizer is located on a printed board measuring 9 cm × 13 cm and consumes about 4 W in power – not much more than the R&S®FSH6. With space at a premium, the high frequencies up to 41.85 GHz on the first local oscillator called for the use of new technologies. The microwave circuits were therefore not produced as single substrates but integrated directly on the printed board.

Highly accurate power measurement

The members of the R&S®FSH family are the only handheld spectrum analyzers worldwide that are able to perform high-precision terminating power measurements as well as directional power measurements by using external power sensors. The advantage is obvious – no additional power meters need to be brought along for applications in the field. For example, terminating power sensors will be used if the

Model	Frequency range	Tracking generator	Output power of tracking generator	Pre-amplifier	Resolution bandwidth
R&S®FSH3, model .03	100 kHz to 3 GHz	–	–	✓	100 Hz to 1 MHz
R&S®FSH3, model .13	100 kHz to 3 GHz	✓	–20 dBm	–	1 kHz to 1 MHz
R&S®FSH3, model .23	100 kHz to 3 GHz	✓	–20 dBm to 0 dBm, adjustable in 1 dB steps	✓	100 Hz to 1 MHz
R&S®FSH6, model .06	100 kHz to 6 GHz	–	–	✓	100 Hz to 1 MHz
R&S®FSH6, model .26	100 kHz to 6 GHz	✓	–10 dBm (f < 3 GHz), –20 dBm (f > 3 GHz)	✓	100 Hz to 1 MHz
new R&S®FSH18, model .18	10 MHz to 18 GHz	–	–	–	100 Hz to 1 MHz

FIG 2 The R&S®FSH x family at a glance.

transmitter output power is to be measured on a directional coupler. The analyzer displays the measured power in dBm or W (FIG 3). Power sensors up to 8 GHz or 18 GHz are available. Up to 18 GHz, the measurement uncertainty is only 0.15 dB. As with thermal power sensors – but with a considerably wider dynamic range of 90 dB – the correct RMS value of the measured signal is obtained over the entire measurement range from –67 dBm to +23 dBm irrespective of the signal waveform. Additional measurement errors can thus be prevented, in particular with modulated signals.

Directional power sensors are used whenever the output power and antenna matching of RF transmitter systems are to be measured simultaneously. For this purpose, two directional power sensors with an upper frequency limit of 1 GHz or 4 GHz are provided. The directional power sensor is connected directly between the transmitter output and the antenna. The R&S®FSH18 simultaneously displays the power emitted by the transmitter in W or dBm and the return loss or the VSWR of the antenna under operating conditions (FIG 4). Because the maximum load is 120 W, a power attenuator is usually not required.

FIG 3 Terminating power measurement with the R&S®FSH18 spectrum analyzer and the R&S®FSH-Z18 power sensor.

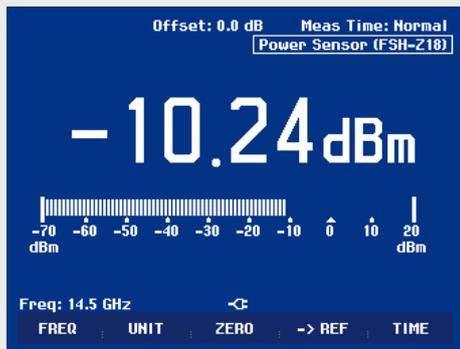


FIG 4 Simultaneous measurement of power and antenna matching using the R&S®FSH-Z44 directional power sensor.

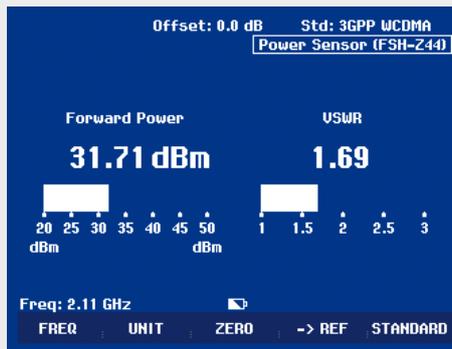
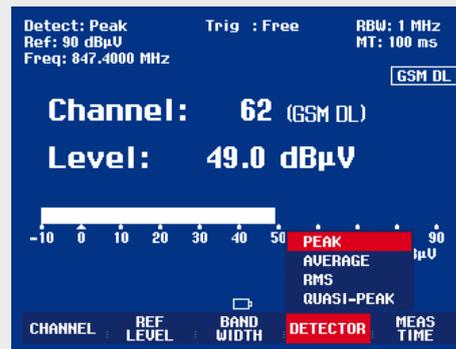


FIG 5 Level measurement on a specified channel in receiver mode.





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FIG 6 The R&S®FSH 18 with the R&S®TS-EMF isotropic antenna.

Monitoring and precompliance EMC applications

Equipped with the R&S®FSH-K3 option, the spectrum analyzer can be operated as a receiver for monitoring and pre-compliance EMC applications. In this mode, the analyzer measures the signal level at a selected frequency or channel for a definable measurement time (FIG 5). Frequency is tuned via user-definable tables for channel spacing. In the scan mode, the R&S®FSH 18 sequentially measures the level at various frequencies that are defined in a channel table, and displays the results in graphical form. For EMI emission measurements, the CISPR bandwidths of 200 Hz, 9 kHz, 120 kHz, and 1 MHz are available (–6 dB). Peak, average, RMS, and quasi-peak detectors can be selected in the receiver mode.

Field-strength measurements

When measuring electric field strength, the R&S®FSH 18 takes into account the specific antenna factors of the connected antenna and displays the field strength directly in dB μ V/m. If W/m² is selected, the analyzer calculates and displays the power flux density. Using the R&S®TS-EMF isotropic antenna (FIG 6),

the spectrum analyzer is able to determine the direction-independent resultant field strength, which is not possible when a directional antenna is used. The antenna includes three orthogonally arranged antenna elements for measuring the resultant field strength. The R&S®FSH 18 successively triggers each of the antenna elements and calculates the resultant field strength from the individual results. The calculation takes into account the antenna factors for each antenna element as well as the cable loss of the connecting cable.

Convenient documentation of measurement results

Like all R&S®FSH models, the R&S®FSH 18 comes with the R&S®FSHView software as standard. R&S®FSHView allows the measurement result data that is stored in the analyzer to be conveniently transferred to a PC. The results can then be exported in various graphics formats or in ASCII format. The software additionally offers the following functions:

- ◆ Automatic storage of measurement results at selectable intervals

- ◆ Continuous transfer of the trace to the PC
- ◆ Printout of all relevant data
- ◆ Microsoft® Word macro for easy documentation of measurement results
- ◆ Subsequent setting or shifting of markers
- ◆ Editor for generating limit lines, channel tables, and antenna factors

Summary

The R&S®FSH 18 is a powerful handheld spectrum analyzer up to 18 GHz that provides a wide range of functions. R&S®FSH 18 users are sure to appreciate its low weight, ruggedness, ease of operation, and its long operating time on battery power in their daily work.

Rainer Wagner; Alexander Roth

More information, data sheet, and product brochure at www.rohde-schwarz.com (search term: FSH18)

Condensed data of the R&S®FSH 18

Frequency range	10 MHz to 18 GHz
Resolution bandwidths	–3 dB –6 dB, optional
Video bandwidths	100 Hz to 1 MHz
SSB phase noise	200 Hz, 9 kHz, 120 kHz, 1 MHz
Displayed average noise level (at 100 Hz resolution bandwidth)	10 Hz to 1 MHz <–90 dBc at 100 kHz carrier offset
Detectors	<–120 dBm, 50 MHz to 6 GHz <–118 dBm, 6 GHz to 8 GHz <–115 dBm, 8 GHz to 12 GHz <–110 dBm, 12 GHz to 16 GHz <–100 dBm, 16 GHz to 18 GHz Sample, Max/Min Peak, Auto Peak, RMS optional: Average, Quasi-Peak
Level measurement uncertainty	<1.5 dB up to 6 GHz <2.5 dB up to 14 GHz <3.0 dB up to 18 GHz
Standard measurement functions	channel power, TDMA power, occupied bandwidth (OBW), carrier/noise (C/N), electric field strength, noise marker, frequency counter, AM / FM audio demodulator
Battery operating time	typ. 3 h
Weight	2.5 kg