Handheld Spectrum Analyzer R&S®FSH6

Award-winning spectrum analyzer now up to 6 GHz

The R&S®FSH6 is the world's first 6 GHz handheld spectrum analyzer that can directly measure WLAN 802.11a signals, for example. It is the follow-up to the successful 3 GHz model R&S®FSH3 [*], which won the NAB2004 Pick Hit Award (see page 63).

The latest firmware version now adds new functionality to all R&S®FSH models, including for example receiver mode and frequency tuning based on channel lists.

FIG 1 The Handheld Spectrum Analyzer R&S®FSH6 provides a frequency range of up to 6 GHz.

Ideal for numerous applications

With a frequency range of up to 6 GHz, the R&S®FSH6 (FIG 1) is ideal for installing, optimizing and servicing WLAN 802.11a networks. It is also the right tool for general lab applications in the higher frequency ranges and for measuring mobile phone local oscillator frequencies between 3.4 GHz and 3.9 GHz. The R&S®FSH6 is just as handy and robust as the R&S®FSH3. Both models also feature a straightforward operating concept, a long battery operating time of up to 4 h, an ample range of measurement functions, plus a wide choice of accessories. FIG 2 provides an overview of the R&S®FSH family.

The new spectrum analyzer is available with or without an internal tracking generator. The tracking generator covers the frequency range from 5 MHz to 6 GHz. With the generator included, the analyzer can be used for distance-to-fault (DTF) measurements, scalar and vector network analysis, and one-port cable loss measurements. A VSWR bridge of

Model	Frequency range	Tracking generator	Output power of tracking generator	Preampli-fier	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 / 0 dB selectable	●	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

FIG 2 Overview of the R&S®FSH models.

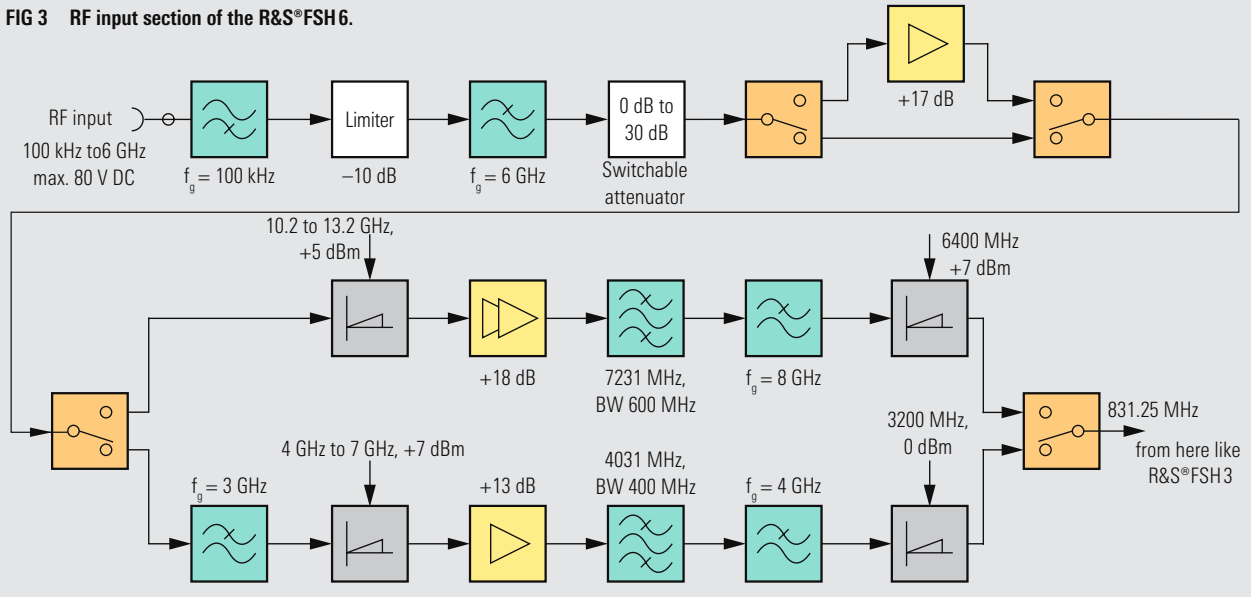
up to 3 GHz is available; a 6 GHz version is currently being developed. Both models come standard with a switchable preamplifier, making them suitable for measuring very weak signals throughout the analyzers' frequency range. With the preamplifier switched on, the displayed average noise level (DANL) of the instrument is typically –135 dBm (10 MHz to 2.2 GHz, resolution bandwidth 100 Hz). Featuring a level measurement uncertainty of <1.5 dB (typ. 0.5 dB), the R&S®FSH6 is every bit as good as the 3 GHz model, and this value is maintained even up to 6 GHz. The R&S®FSH6 stands out for its wide dynamic range of typically 80 dB up to 2.2 GHz for scalar transmission measurements. With vector transmission measurements, typically 90 dB can even be achieved, which makes the instrument suitable for critical antenna isolation measurements on base stations.

Additional receive path of up to 6 GHz

The R&S®FSH6 features an additional receive path from 3 GHz to 6 GHz that shifts the upper frequency limit to 6 GHz. Either of the two signal paths can be used, and also switched to idle, which means that the R&S®FSH6 consumes virtually the same amount of power as the R&S®FSH3. The analyzer can thus be operated for four hours with the tracking generator switched off or 3.5 hours with the tracking generator switched on without having to recharge the battery.

FIG 3 shows the RF input section of the R&S®FSH6. A 10 dB attenuator and limiting diodes protect the RF input against power peaks and high input loads of up to approx. 36 dBm. Then, the level of the first mixer is set in accordance with the selected reference level, using an electronically switched attenuator and a preamplifier that can be bypassed. Via a switch, the 3 GHz or the 6 GHz path is activated, depending on the measurement frequency. In either signal path, the first IF is above the receive band, so

FIG 3 RF input section of the R&S®FSH6.



that only a simple input lowpass filter for image frequency rejection is required. The local oscillator frequencies for the 6 GHz path are obtained by doubling and filtering the oscillator frequencies from the base unit.

Expanded firmware provides new functionality

The new firmware version 7.0 – which can be downloaded free of charge from the Rohde&Schwarz website – adds new functionality to all models of the R&S®FSH family.

Tuning by means of channel tables

As an alternative to entering frequencies, the new firmware allows the analyzer to be tuned by means of channel numbers, as is common practice in TV and mobile radio applications. The instrument then displays the channel number instead of the center frequency (FIG 5). The channel tables are generated with the R&S®FSH View software supplied with the R&S®FSH and loaded on the analyzer (FIG 6). Up to 15 subranges with different channel spacings and channel names can be defined for each channel table, allowing frequency ranges that are of no interest – e. g. gaps in transmission systems – to be skipped, for example (FIG 4). Virtually all TV channel tables in use around the world are supplied with the R&S®FSH. If no external PC is available, channel tables can also be defined directly on the instrument by entering the first channel number with the associated frequency, number of channels and channel spacing, with the constraint that no subranges or frequency gaps can be defined in this case (FIG 6).

Receiver mode

When equipped with the R&S®FSH-K3 option, all R&S®FSH models can be operated as receivers for monitoring and precompliance EMC applications. In the receiver mode, the analyzer measures the signal level at a selected frequency or channel for a definable measurement time (FIG 7). Measurement frequencies are selected at the spacing defined in the channel tables described above.

In the scan mode, the R&S®FSH sequentially measures the level at various frequencies defined in a channel table, and displays the results in graphical form. FIG 8 shows the results of a receiver measurement on GSM mobile radio channels in the uplink band. Each vertical line represents a GSM transmission channel; the channels are spaced 200 kHz apart. The line height represents the signal level in each case. In addition, the CISPR bandwidths (6 dB) 200 Hz, 9 kHz, 120 kHz and 1 MHz are available for EMI measurements. The R&S®FSH offers peak, average, RMS and quasi-peak detectors in the receiver mode.

Optimized dynamic range

The dynamic range can be optimized as required for a specific application. You can choose between maximum sensitivity (low noise) or minimum intermodulation products (low distortion) for your measurement. In low distortion mode, the RF attenuator is set 10 dB higher than in low noise mode. The low distortion mode is important for measurements on CATV systems, for example.

User-defined PRESET settings

If you want the instrument to have default settings different from the factory settings after a preset, you can modify the preset settings. For example, you can set the R&S®FSH to operate at an input impedance of 75 Ω rather than 50 Ω after a preset. The preset settings can be defined by means of the R&S®FSH View software.

Auto save function

The R&S®FSH View software version 7.0 allows automatic saving of results at predefined intervals using various ASCII or graphics formats. This simplifies result logging over an extended period of time.

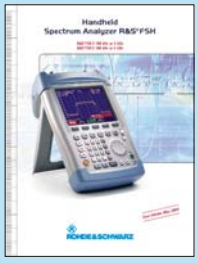
New accessories for field use

A sturdy aluminum case with edge protectors is available for field applications of the R&S®FSH. This case accommodates not only the analyzer but also all accessories (FIG 9).

The Calibration Standard R&S®FSH-Z29 has been specially designed for field use (FIG 10). It includes all calibration standards (short, open and 50 Ω load) required for network analysis and DTF measurements. Worn around the user's neck, it is always at hand when needed for calibration.

Alexander Roth; Rainer Wagner

More information and data sheet at www.rohde-schwarz.com (search term: FSH6)



REFERENCE

[*] Handheld Spectrum Analyzer R&S®FSH3: New mobility in spectrum analysis. News from Rohde&Schwarz (2002) No. 175, pp 20–25

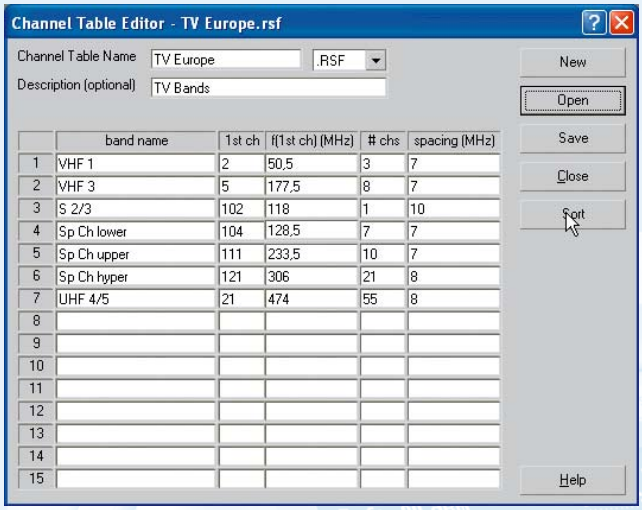


FIG 4 Channel tables with up to 15 subranges can be generated with the R&S®FSH View software.

Condensed data of the R&S®FSH6

Frequency range		100 kHz to 6 GHz
Resolution bandwidths	(3 dB)	100 Hz to 1 MHz
	(6 dB), optional	200 Hz, 9 kHz, 120 kHz and 1 MHz
Video bandwidths		10 Hz to 1 MHz
SSB phase noise		<–100 dBc at 100 kHz from carrier
Displayed average noise level (DANL)		typ. –135 dBm (100 Hz)
Detectors		sample, max/min peak, auto peak, RMS optional: average, quasi-peak
Level measurement uncertainty		<1.5 dB, typ. 0.5 dB, up to 6 GHz
Tracking generator (model 26 only)		5 MHz to 6 GHz

FIG 9 Transit Case R&S®FSH-Z26.

FIG 10 Calibration Standard R&S®FSH-Z29 designed for field use.

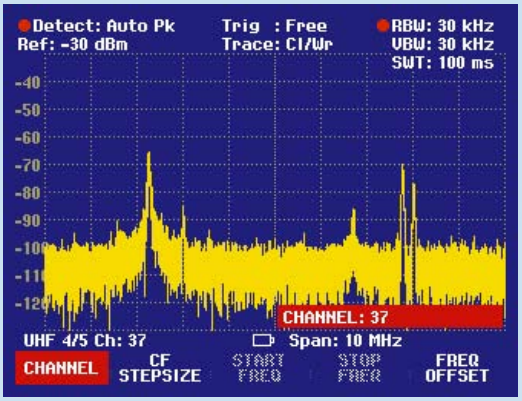


FIG 5 Spectrum measurement of a TV signal with frequency tuning based on a channel table.

FIG 6 Up to 15 channel tables can be loaded on the R&S®FSH.

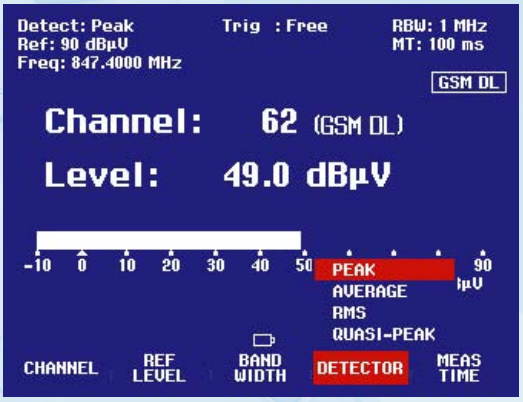


FIG 7 Level measurement at a selected channel in the receiver mode.

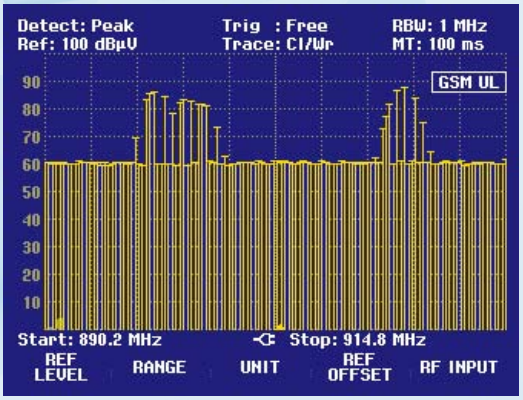


FIG 8 Receiver measurement in scan mode in the GSM uplink band.