

Spectrum Analyzer R&S®FSL

A multipurpose instrument you won't want to miss

The new Spectrum Analyzer R&S®FSL

(FIG 1) is ideal for many applications: It is versatile for laboratory use, its lightweight and portable design makes it suitable for mobile use and it is fast in production. And all this is offered at a very favorable price. Once you have started to work with it, you won't want to part with it anymore ...

Unique in its price range

A spectrum analyzer is required for many applications, e. g. to measure the level and frequency of a signal or determine unwanted signals or interference. In many cases, however, the important thing is not the dynamic range or phase noise but a solution that is as cost-efficient as possible. And this is definitely offered by the Spectrum Analyzer R&S®FSL.

Its light weight, compact size and optional battery operation make it ideal for mobile use. Due to its extensive functionality, it is nevertheless a full-featured

analyzer for general use in the laboratory, development or service. Production specialists will appreciate its high measurement speed and its high level accuracy – excellent features combined with a favorable price.

The R&S®FSL is available in four different versions as a 3 GHz and 6 GHz model (FIG 2). The instrument has a number of excellent features that are unique in its price range, e. g.:

- ◆ The large I/Q demodulation bandwidth of 20 MHz and the wide bandwidth from 1 Hz to 10 MHz.



FIG 1
The R&S®FSL has a lightweight and extremely compact design. Yet it is a full-featured spectrum analyzer offering extensive functionality and the best RF characteristics of its class.

- ◆ The high 3rd order intercept point of typ. 15 dBm yielding excellent large-signal immunity.
- ◆ Its easy and customized configuration: all options can be installed or added without having to open the analyzer.

Excellent performance

Featuring a phase noise of -103 dBc (1 Hz) at 10 kHz from the carrier, a 3rd order intercept point of typ. $+15$ dBm, a bandwidth of 10 Hz to 10 MHz (with FFT filters even from 1 Hz) and a displayed average noise level of -152 dBm (1 Hz) with preamplifier, the R&S®FSL ranks among higher-class analyzers. This makes it the ideal tool not only in production but also in service, for field applications and in the laboratory. An electronic RF attenuator settable in 5 dB steps and an optional preamplifier optimize the usable dynamic range.

For most spectrum analyzers, the frequency range of internal tracking generators is limited to approx. 3 GHz. The tracking generator of the R&S®FSL6, which operates up to 6 GHz, is therefore of special importance. For this reason, you can use the tracking generator in the full frequency range of the R&S®FSL6 to determine, for example, the frequency response of cables in the test setup or matching (with the SWR bridge).

Options for the R&S®FSL

- ◆ OCXO, aging 1×10^{-7} /year
- ◆ Additional interfaces: video out, IF out, noise source control, AUX port, R&S®NRP power sensor
- ◆ Resolution bandwidths 10 Hz to 100 Hz (1 Hz FFT)
- ◆ Gated sweep
- ◆ IEC/IEEE bus interface
- ◆ DC power supply 12 V to 28 V
- ◆ RF preamplifier
- ◆ NiMH battery pack
- ◆ Power measurement with power sensors of the Power Meter R&S®NRP

Operation similar to high-grade laboratory equipment

Handling and operation are more or less identical with that of the analyzers of the R&S®FSP and R&S®FSU families. Powerful marker functions are standard as well as the display of up to four traces and many complex measurement functions (see also FIGs 3 to 6). These functions range from preconfigured and user-configurable channel and adjacent-channel power measurements to measurement functions for burst power, user-definable limit lines and C/N to TOI

measurements and phase noise markers. The instrument comes with a full selection of detectors including RMS and quasi-peak detectors as well as a large number of settable points per trace (125 up to max. 32000).

Measurement results can be documented via a printer connected to a USB bus or can be stored as a graphics file on a USB memory stick.

This scope of functions and the excellent RF data together with an excellent price/performance ratio make the R&S®FSL an indispensable tool for any RF task like a multimeter or an oscilloscope.

Fully digital signal processing

All R&S®FSL models operate as triple converting receivers with high first IF. Frequency tuning is fully synchronous. The frequency accuracy therefore only depends on the TCXO reference and the pixel resolution of the screen.

An A/D converter directly digitizes the signal of the last IF. Signal processing from the last IF on, which means IF filtering, detection and logarithmic conversion, video filtering and signal detection, is purely digital. These functions are thus reproducible and very stable. Level errors caused by bandwidth or detector switching are negligible. The display linearity depends exclusively on the linearity of the A/D converter, whose linearity error is also negligible in practice. The level measurement uncertainty is determined mainly by the frequency response of the input device including the RF attenuator. The frequency response is (as is the case with all other analyzers from Rohde & Schwarz) stored in the device. The displayed level is corrected for any frequency and attenuator setting. This ensures a level measurement uncertainty of only 0.5 dB up to 3 GHz and 0.8 dB to 6 GHz.

FIG 2 Overview of available models.

Model	Frequency range	Tracking generator
R&S®FSL 3, model 03	9 kHz to 3 GHz	no
R&S®FSL 3, model 13	9 kHz to 3 GHz	1 MHz to 3 GHz
R&S®FSL 6, model 06	9 kHz to 6 GHz	no
R&S®FSL 6, model 16	9 kHz to 6 GHz	1 MHz to 6 GHz

► With the R&S®FSL-K9 option, the R&S®FSL attains an even better measurement uncertainty like that offered by high-accuracy power sensors. This option supports the direct connection of all the power sensors of the Power Meter R&S®NRP. The R&S®FSL therefore replaces a power meter – which is especially interesting for mobile use.

Due to the digital implementation, the analyzer offers resolution filters of different characteristics, for instance RRC filter, channel filter or filters for EMI precompliance measurements. Digital implementation ensures not only a negligible level error when you want to switch over between different bandwidths but also a high accuracy of the set bandwidth itself. This is of vital importance for a low measurement uncertainty in the case of channel or adjacent-channel measurements (ACP).

The large bandwidth of the last IF and the high sampling rate of the A/D converter form the basis for the large bandwidth offered by the R&S®FSL.

Fast and versatile in production

The R&S®FSL is ideal for fast and easy measurement tasks in production, since often the only important thing is to measure level and frequency as quickly as possible. With its high measurement speed of >80 sweeps/s in the zero span and output of data or trace data in the remote-control mode, the R&S®FSL ensures a high throughput.

Moreover, the analyzer saves time in production, since it offers a variety of special measurement functions:

- ◆ The R&S®FSL simplifies and accelerates level calibration, which is often necessary for transmit modules, by

means of integrated complex measurement functions such as the special multisummary marker. This marker measures different levels in the time domain in a single run, eliminating return times and remote-control bus overhead.

- ◆ The R&S®FSL measures the power of modulated signals using the fast ACP function offered by channel filters. This is done for the most important mobile radio standards in the time domain at a very good repeatability and short measurement times.
- ◆ Owing to its fast frequency counter, the R&S®FSL determines the transmit frequency with a resolution of 1 Hz in less than 50 ms.
- ◆ In the list mode, the R&S®FSL operates like a selective power meter and handles up to 300 different settings with only a single remote-control command. The R&S®FSL offers a special trigger interface to enable

FIG 3 Phase noise measurement with phase noise marker
You use the phase noise marker to quickly estimate the phase noise at a certain carrier offset. For the result in dBc (1 Hz), the phase noise marker considers all necessary corrections relating to the noise bandwidth of the filters, the detectors used and averaging. The phase noise of the R&S®FSL of typ. -103 dBc (1 Hz) at 10 kHz from the carrier is sufficient for many measurement tasks on oscillators.

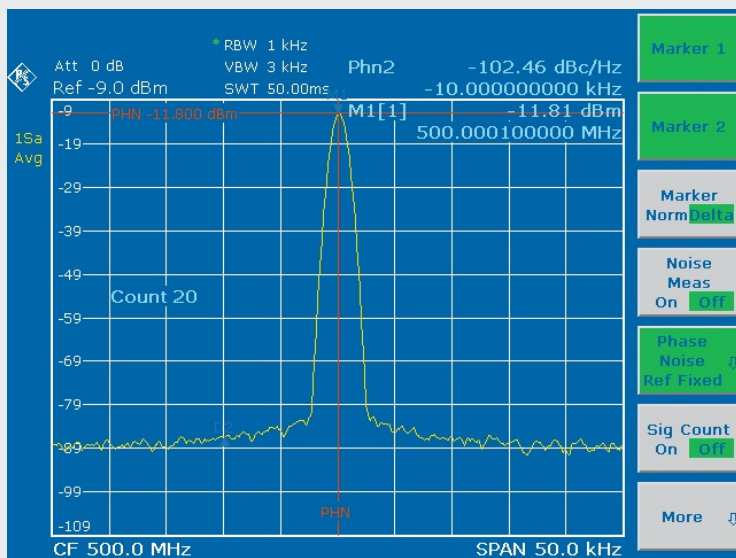
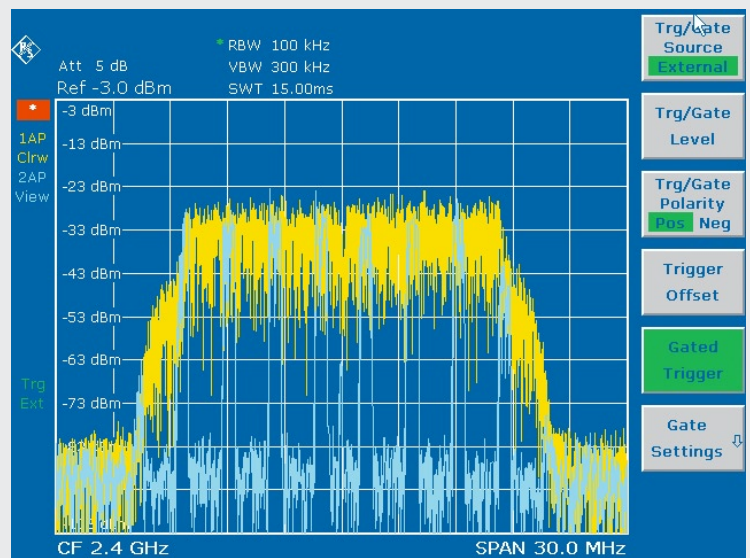


FIG 4 Gated sweep
The R&S®FSL uses the gated sweep function for measurements on burst signals and can thus display the spectrum of WLAN packets, for example, and exactly measure their power. The traces indicate the comparison between a measurement with (yellow) and without (blue) the gate function. The IF power trigger supports the measurement in cases where no external trigger signal is available.



fast synchronization or triggering in this mode. This interface is offered by the optional Additional Interfaces R&S®FSL-B5.

The standard remote-control interface is 10/100BaseT, which is much faster than the IEC/IEEE bus in transmitting large volumes of data. An IEC/IEEE bus interface can be installed as an option.

The standard electronic RF attenuator setting ensures utmost reliability. Problems occurring with mechanically switched attenuators during high switching cycles are unknown to the R&S®FSL.

Easy extendibility

The R&S®FSL has a unique concept for retrofitting options using plug & play: All options can be retrofitted without

having to open the unit. This concept offers a variety of advantages:

- ◆ No additional adjustment after installation
- ◆ No recalibration
- ◆ No need to send the instrument in and thus no downtimes
- ◆ No installation costs
- ◆ Easy extendability for additional tasks

Herbert Schmitt

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

Condensed data of the R&S®FSL

Frequency range	depending on model: 9 kHz to 3 GHz or 6 GHz 1 kHz at 1 GHz, optional 100 Hz at 1 GHz
Frequency uncertainty	
Resolution bandwidth	
Standard	300 Hz to 3 MHz in 1/3 sequence
With option R&S®FSL-B7	10 Hz to 10 MHz in 1/3 sequence, add. 1 Hz (FFT filter)
Video bandwidths	1 Hz to 10 MHz
I/Q demodulation bandwidth	20 MHz
Phase noise	typ. -103 dBc (1 Hz), at 10 kHz from carrier, 1 GHz
Displayed average noise floor	
At 1 kHz RBW, 50 MHz < f < 3 GHz	-110 dBm
At 10 Hz RBW and with preamplifier (options R&S®FSL-B7/22), 50 MHz < f < 3 GHz	-142 dBm
TOI	10 dBm, typ. 15 dBm
Detectors	Pos/Neg Peak / Auto Peak, RMS, QuasiPeak, Average, Sample
Level measurement uncertainty	<0.5 dB for f < 3 GHz, 0.8 dB for 3 GHz < f < 6 GHz

FIG 5 Scalar network analyzer

The R&S®FSL uses the tracking generator of models 13 and 16 to quickly and easily perform frequency response, filter and attenuator measurements. The n-dB down marker determines, for example the 3 dB bandwidth of a bandpass filter at a keystroke. The analyzer uses an external measurement bridge to measure the analyzer return loss or matching. Through, Short and Open calibration increases the accuracy.

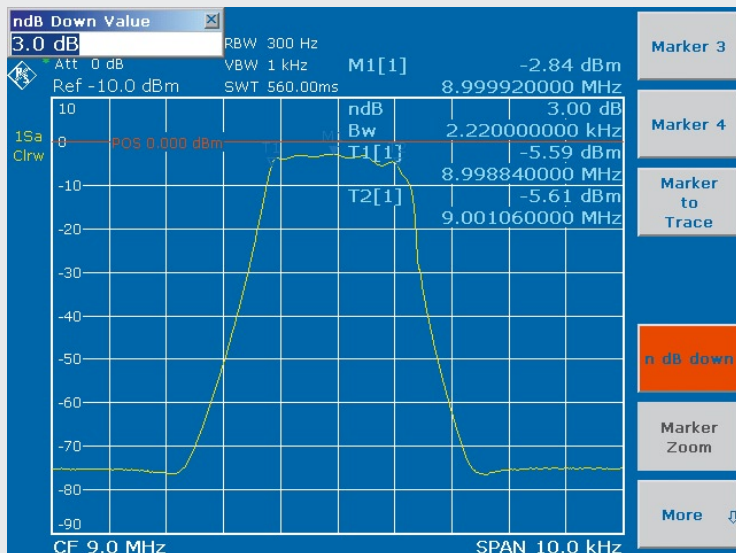


FIG 6 Adjacent-channel measurement

The ACP measurement function determines the adjacent-channel power in absolute values or with reference to the useful carrier. In addition to many predefined settings offered by the R&S®FSL for many transmission standards, this measurement is largely user-definable: you can enter different channel widths and channel spacings for up to 12 useful and three adjacent channels.

