

Version
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Measuring Receiver R&S®FSMR

All-in-one solution for the calibration of signal generators and attenuators

- ◆ Frequency range from 20 Hz to 3/26.5/50 GHz
- ◆ High level linearity of 0.005 dB deviation per 10 dB for precise calibration of level and attenuation
- ◆ Wide level measurement range from +30 dBm to -130 dBm
- ◆ Direct connection of power sensors for accurate power measurements
- ◆ Power sensor module with integrated power splitter
- ◆ Measurement of modulation depth, frequency deviation and phase deviation with <1% measurement uncertainty
- ◆ Audio analysis with automatic measurement of modulation frequency, THD and SINAD
- ◆ Display of audio signals and demodulated signals in frequency and time domain
- ◆ Audio input for calibration of modulation generators
- ◆ Fast RF frequency counter with 0.01 Hz resolution
- ◆ Control of all functions incl. power meter from front panel or via IEC/IEEE bus or LAN
- ◆ Full-featured spectrum analyzer



ROHDE & SCHWARZ

R&S®FSMR – all-in-one solution for signal generator calibration

The Measuring Receiver R&S®FSMR has been specially designed to handle the measurement tasks involved in the calibration of signal generators and fixed or adjustable attenuators.

The R&S®FSMR combines the functionality of several instruments in one:

- ◆ Highly accurate level calibrator
- ◆ Modulation analyzer
- ◆ Audio analyzer with THD and SINAD measurement functionality
- ◆ Power meter for connection of R&S®NRP power sensors
- ◆ High-performance spectrum analyzer

In particular, the R&S®FSMR features characteristics that are important in calibration labs:

- ◆ Very high level stability versus time and temperature
- ◆ Easy control of all functions
- ◆ Parameters traceable to national standards; documented calibration procedure
- ◆ 50 MHz reference source for adjustment of power sensors (not required for R&S®NRP power sensors)
- ◆ Separate audio input
- ◆ Remote control of all functions via IEC/IEEE bus

The R&S®FSMR is thus capable of calibrating all vital parameters of a signal generator:

- ◆ Output level accuracy down to -130 dBm
- ◆ Carrier frequency accuracy
- ◆ Setting accuracy of modulation depth and modulation deviation
- ◆ Modulation frequency response
- ◆ Modulation frequency
- ◆ Modulation distortion
- ◆ Spurious modulation, weighted and unweighted

The R&S®FSMR family

R&S®FSMR 3	20 Hz to 3.6 GHz
R&S®FSMR 26	20 Hz to 26.5 GHz
R&S®FSMR 50	20 Hz to 50 GHz

Plus, the R&S®FSMR offers full spectrum analyzer functionality, e.g. for measuring harmonics or phase noise. The base unit does not provide for image frequency rejection in the range above 3.6 GHz, since the YIG filters normally used for this would impair level linearity. The optional YIG preselection filter makes the R&S®FSMR a full-featured spectrum analyzer also in the microwave range. The tracking YIG filter can be switched off for accurate level calibration.



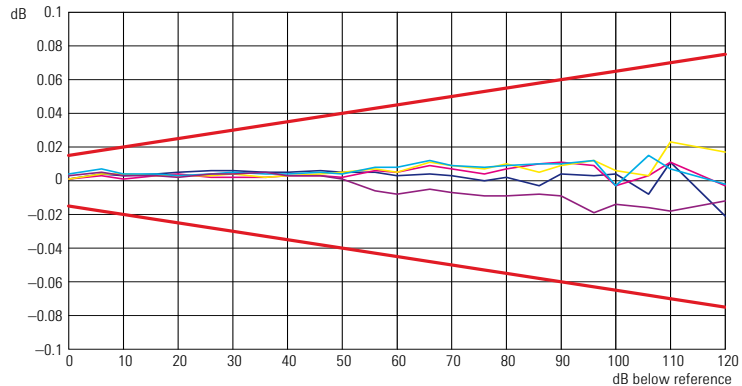
Condensed data

	R&S®FSMR 3	R&S®FSMR 26	R&S®FSMR 50
Frequency range	100 kHz to 3.6 GHz	100 kHz to 26.5 GHz	100 kHz to 50 GHz
Reference frequency	aging: 1×10^{-7} /year, optionally 2×10^{-8} /year		
Absolute power measurement	using R&S®NRP power sensor or external power meters		
Uncertainty	with R&S®NRP-Z27/37: 0.083 dB (to 4.2 GHz, 15 °C to 35 °C)		
Relative level measurement			
Measurement range	+30 dBm to -140 dBm, depending on frequency		
Linearity (+20 dBm to -140 dBm)	0.01 dB \pm 0.005 dB (per 10 dB step)		
Relative level, linearity	0.015 dB + 0.005 dB per 10 dB		
AM modulation measurements			
Modulation depth	0 % to 100 %		
Measurement uncertainty	1 % of reading, 50 Hz to 50 kHz; 0.4 % of reading, 90 Hz to 150 Hz, in range 5 % to 99 %		
Modulation frequency	50 Hz to 100 kHz		
Inherent distortion	0.3 %		
FM modulation measurements			
Frequency deviation	max. 500 kHz		
Measurement uncertainty	1 % of reading, 50 Hz to 100 kHz		
Modulation frequency	50 Hz to 200 kHz		
Inherent distortion	0.1 %		
ϕM modulation measurements			
Phase deviation	max. 10 000 rad		
Measurement uncertainty	1 % of reading, 50 Hz to 100 kHz		
Modulation frequency	50 Hz to 100 kHz		
Inherent distortion	0.1 %		
Audio measurements			
Frequency range	DC, 20 Hz to 1 MHz		
Level ranges	0.4 V, 4 V		
Measurement uncertainty	1 % of reading, 20 Hz to 100 kHz		
Spectrum analyzer			
Frequency range	20 Hz to 3.6 GHz	20 Hz to 26.5 GHz	20 Hz to 50 GHz
Resolution bandwidths	10 Hz to 50 MHz; FFT filters: 1 Hz to 30 kHz; channel filters; EMI bandwidths		
Video bandwidths	1 Hz to 10 MHz		
Displayed average noise level (RBW 10 Hz)			
1 GHz	typ. -148 dBm	typ. -146 dBm	typ. -146 dBm
26 GHz	–	typ. -141 dB	typ. -143 dBm
50 GHz	–	–	typ. -121 dBm
Trace detectors	max peak, min peak, auto peak, sample, RMS, average, quasi-peak		
Phase noise	typ. -123 dBc (1 Hz) at 10 kHz from carrier		
Sweep time			
Span >10 Hz	2.5 ms to 16 000 s		
Span 0 Hz (zero span)	1 μ s to 16 000 s		
Image frequency rejection			
f < 3.6 GHz	typ. 110 dB		
f > 3.6 GHz	–	0 dB	
f > 3.6 GHz, with option R&S®FSMR-B2	–	typ. 100 dB	

Level calibration – precise, repeatable and easy to handle

Linearity and level stability

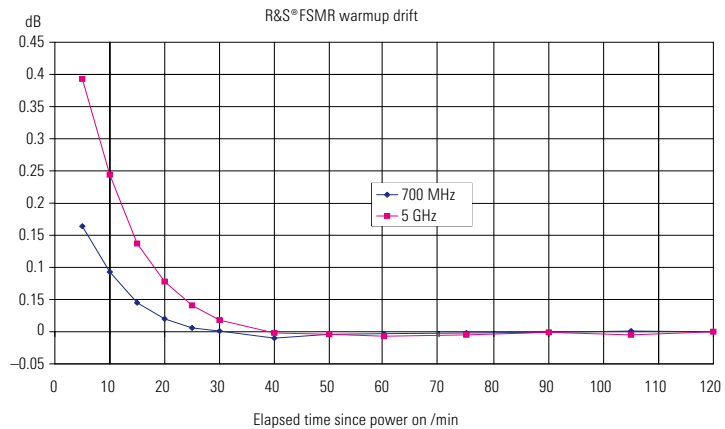
The linearity of the R&S®FSMR is almost exclusively determined by its high-quality A/D converter and the limits of traceability of calibration. Modules and components on which drift (YIG filter) or non-linear level response (crystal filter) may occur are switched off during level calibration. As a result, the R&S®FSMR features linearity values equal to or even better than those of the present industry standard.



Typical linearity versus specified values.

High tolerance with respect to frequency drift and residual FM

The R&S®FSMR measures the signal level within the selectable measurement bandwidth. For signals within the measurement bandwidth, level measurement is not affected by frequency drift, frequency deviation or residual FM. Featuring a large, selectable measurement bandwidth from 100 Hz to 10 MHz, the R&S®FSMR is insensitive to frequency offset or residual FM of the generator to be calibrated. Very small levels are measured using the “narrow” detector, which determines the signal power within the measurement bandwidth with FFT at a reduced noise bandwidth. This yields an improved signal-to-noise ratio without increasing the effect of frequency offset or residual FM.



After warmup, the R&S®FSMR offers excellent level stability. This allows measurements to be performed with high accuracy over extended periods of time, for example during manual calibration.

Supported power meters

The absolute power and the reference power are measured with high accuracy by a power meter. The power meter can be connected to the generator output or operated in parallel with the analyzer input via a power splitter. The R&S®FSMR automatically corrects the power splitter's frequency response and insertion loss based on an internally stored correction table.

Automatic VSWR correction

If a power sensor with a power splitter is used, the analyzer's input VSWR affects the display and the measurement uncertainty of the power sensor. For this reason, the Power Sensor Modules R&S®NRP-Z27/-Z37 with built-in power splitter provide automatic VSWR correction as well as an attenuator in the signal path to the analyzer input. The automatic VSWR correction in the R&S®FSMR and the R&S®NRP-Z27/37 considerably reduces loading, allowing users to profit from the overall measurement accuracy of the thermoelectric sensors in the power sensor modules.



R&S®FSMR with Power Sensor Module R&S®NRP-Z27.

More supported power meters

The following power meters – also of other makes – are supported in addition:

- ◆ R&S®NRVS, R&S®NRVD
- ◆ ML2438A
- ◆ 438A
- ◆ 437B
- ◆ E4417A

The R&S®FSMR controls the power meter via its second IEC/IEEE bus connector. The power meter is operated from the R&S®FSMR front panel. This means that operation is just as easy for power meters of other makes as it is for power meters from Rohde & Schwarz. Remote control via the IEC/IEEE bus is still only via the R&S®FSMR. Calibration labs can thus continue to use their existing power meters.

Power sensors of the R&S®NRP series suitable for use with the Measuring Receiver R&S®FSMR

Type	Frequency range	Level range	Connector	Remarks
Recommended for use with the R&S®FSMR				
R&S®NRP-Z27	DC to 18 GHz	-24 dBm to +26 dBm	N (male)	Thermoelectric with integrated splitter
R&S®NRP-Z37	DC to 26.5 GHz	-24 dBm to +26 dBm	3.5 mm (male)	Thermoelectric with integrated splitter
R&S®NRP-Z55	DC to 40 GHz	-30 dBm to +20 dBm	2.92 mm (male)	Thermoelectric
Other power sensors				
R&S®NRP-Z11	10 MHz to 8 GHz	-67 dBm to +23 dBm	N (male)	Diode sensor
R&S®NRP-Z21	10 MHz to 18 GHz	-67 dBm to +23 dBm	N (male)	Diode sensor
R&S®NRP-Z22	10 MHz to 18 GHz	-57 dBm to +33 dBm	N (male)	Diode sensor with integrated attenuator
R&S®NRP-Z23	10 MHz to 18 GHz	-47 dBm to +42 dBm	N (male)	Diode sensor with integrated attenuator
R&S®NRP-Z24	10 MHz to 18 GHz	-42 dBm to +45 dBm	N (male)	Diode sensor with integrated attenuator
R&S®NRP-Z51	DC to 18 GHz	-30 dBm to +20 dBm	N (male)	Thermoelectric
R&S®NRP-Z91	9 kHz to 6 GHz	-67 dBm to +23 dBm	N (male)	Diode sensor

Easy operation for level calibration over a wide level range

To perform measurements over the full level range of conventional RF generators, e.g. from -130 dBm to $+10$ dBm, it is necessary to switch the R&S®FSMR's built-in RF attenuator or the IF gain as required. The R&S®FSMR eliminates any level errors that may occur as a result of range switching by calibrating the adjacent range prior to switchover. The user can thus benefit from the instrument's high linearity of 0.015 dB + 0.005 dB deviation per 10 dB

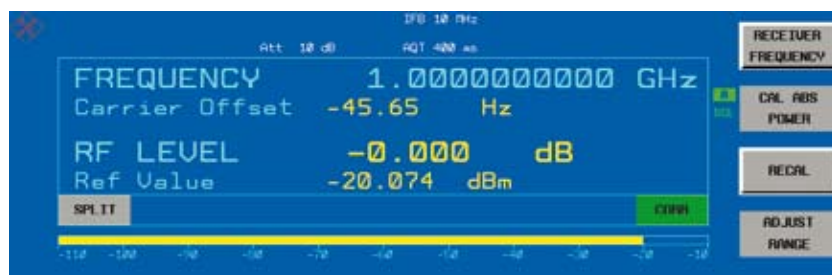
across the complete level range. Level calibration is carried out in just a few steps. The complete setup, including the power meter connected to the measuring receiver, is operated via the R&S®FSMR front panel.

The procedure is as follows:

- ◆ Step 1: Set the measurement frequency. The R&S®FSMR measurement range is then automatically set to the level of the incoming signal (AUTORANGE function)
- ◆ Step 2: Perform a reference measurement with the power meter by means of CAL ABS POWER. The R&S®FSMR is now ready for level calibration, which is indicated by the CAL field turning green
- ◆ Step 3: Reduce the level of the device to be calibrated in the required steps and verify the level. If the test signal is outside the usable measurement range of the R&S®FSMR, a prompt is issued to calibrate the adjacent range
- ◆ Step 4: Calibrate the adjacent range with the RECAL key. The R&S®FSMR automatically switches the measurement range



Step 1



Step 2



Step 3



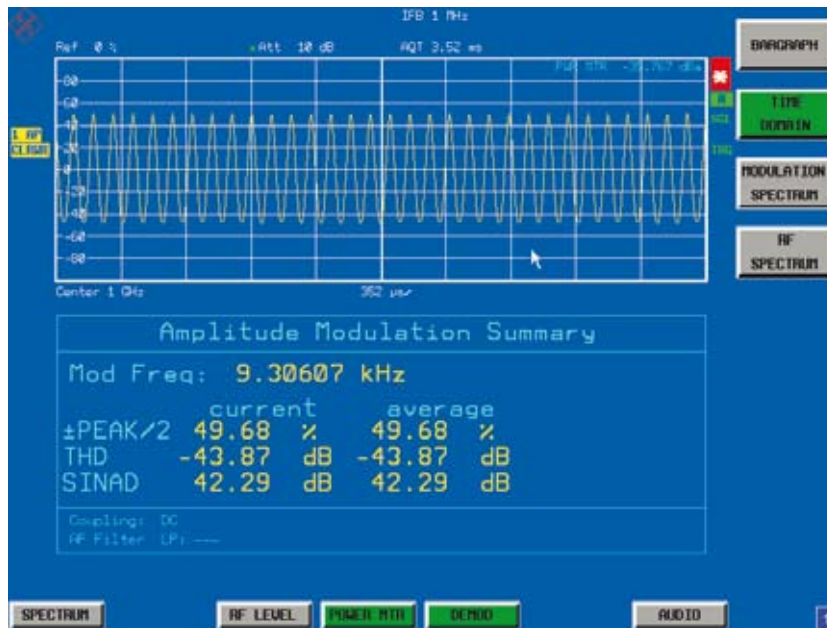
Step 4

Modulation and audio analysis made easy

The R&S®FSMR features a complete, integrated modulation and audio analyzer for the AM, FM and ϕ M analog modulation modes. Audio parameters are measured either on the demodulated signal or on the signal applied to the audio input.

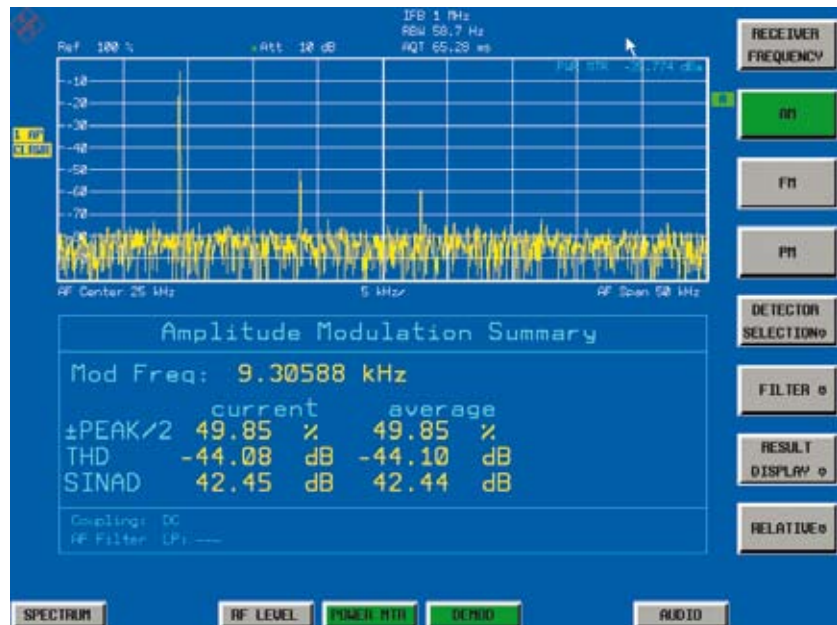
This means that no extra instrument is required for calibrating modulation settings and the modulation generator.

Various audio filters, deemphases and detectors are available for audio analysis. This makes it easy to perform residual FM measurements, for example.



Measurement of modulation depth of an amplitude-modulated signal: The R&S®FSMR measures the modulation depth and modulation frequency, and optionally also indicates the averaged modulation values. The demodulated audio signal is displayed in the time domain.

The R&S®FSMR not only displays the demodulated or the audio signal in the time domain, but also as an RF spectrum generated by means of an FFT, with harmonics and any spurious modulation such as hum displayed selectively. For THD and SINAD measurements, the instrument is automatically tuned to the fundamental. The THD function selectively measures all harmonics within the FFT spectrum. The SINAD function in addition weights noise and nonharmonic spurious.



Versatile, high-performance spectrum analysis

Calibration labs handle a variety of measurement tasks. These tasks often require a spectrum analyzer featuring a wide range of functions and excellent all-round performance. The R&S®FSMR includes as standard a spectrum analyzer that meets these requirements and, with the YIG filter option fitted, provides image frequency rejection up into the microwave range. The R&S®FSMR's built-in spectrum analyzer offers functionality and performance equivalent to that of the Spectrum Analyzer R&S®FSU.

This includes a full choice of detectors for adaptation to a wide range of signal types (Fig. 1):

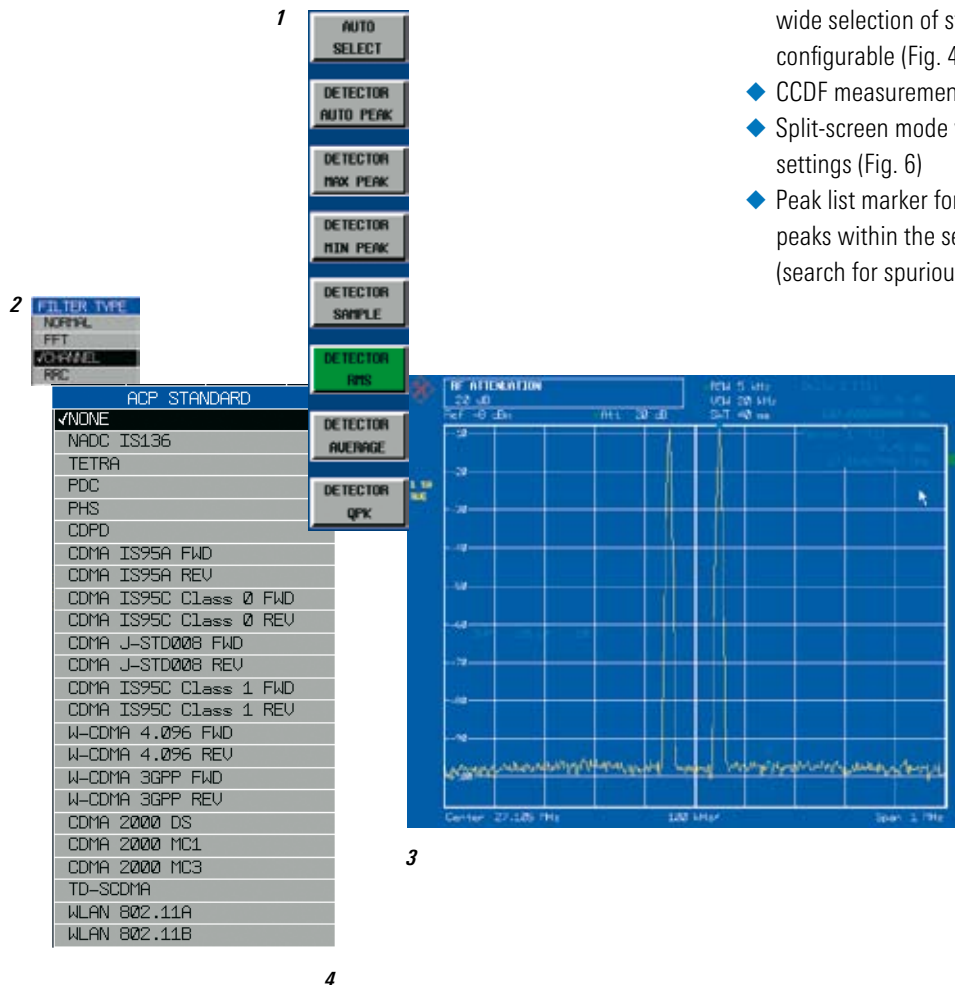
- ◆ RMS
- ◆ Auto peak
- ◆ Max peak
- ◆ Min peak
- ◆ Sample
- ◆ Average
- ◆ QPK (quasi-peak)

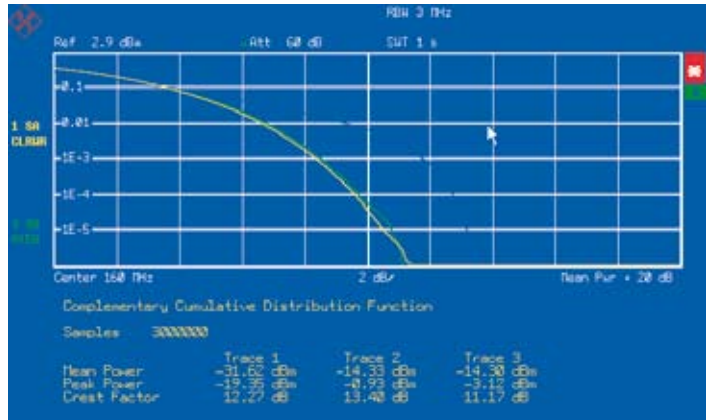
It also offers the most versatile resolution filter characteristics and largest bandwidth found in a spectrum analyzer:

- ◆ Standard resolution filters from 10 Hz to 50 MHz in steps of 1, 2, 3, 5
- ◆ FFT filters from 1 Hz to 30 kHz
- ◆ 39 channel filters with bandwidths from 100 Hz to 5 MHz (Fig. 2)
- ◆ RRC filters for NADC and TETRA
- ◆ EMI filters: 200 Hz, 9 kHz, 120 kHz

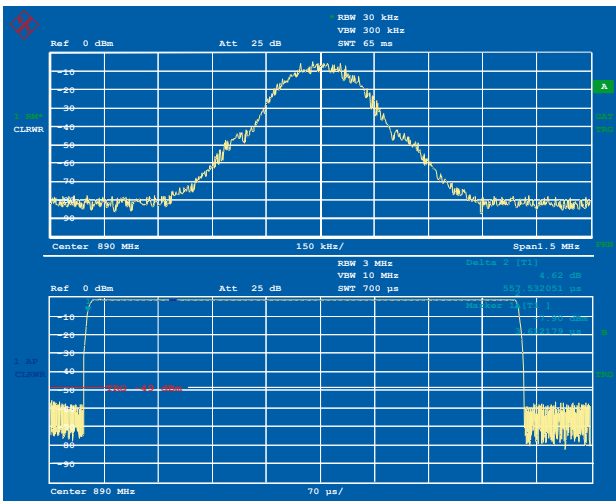
In addition it provides a full range of analysis functions:

- ◆ Time-domain power in conjunction with channel or RRC filters turn the R&S®FSMR into a full-fledged channel power meter
- ◆ TOI marker (Fig. 3)
- ◆ Noise/phase-noise marker
- ◆ Versatile channel/adjacent-channel power measurement functions with wide selection of standards, user-configurable (Fig. 4)
- ◆ CCDF measurement function (Fig. 5)
- ◆ Split-screen mode with selectable settings (Fig. 6)
- ◆ Peak list marker for fast search of all peaks within the set frequency range (search for spurious)





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Wealth of functions

Highly selective digital filters from 10 Hz to 100 kHz	PC-compatible screenshots on diskette, hard disk or USB stick
Fast FFT filters from 1 Hz to 30 kHz	Up to 80 measurements/s in manual mode
Channel filters from 100 Hz to 5 MHz	Up to 70 measurements/s on GPIB interface
RRC filters	SCPI-compatible GPIB command set
Resolution bandwidth from 1 Hz to 50 MHz	R&S® FSE/R&S® FSQ-compatible GPIB command set
QP detector and EMI bandwidths 200 Hz, 9 kHz, 120 kHz	8566A/B/859x-compatible GPIB command set
2.5 ms sweep time in frequency domain	Fast ACP measurement in time domain
1 μs sweep time in time domain	Statistical signal analysis with CCDF function
Number of measurement points/trace selectable between 155 and 10001	RMS detector of 100 dB dynamic range
Time-selective spectrum analysis with gating function	Transducer factors for correcting antenna or cable frequency responses
GPIB interface, IEEE 488.2	Limit lines with PASS/FAIL evaluation
RS-232-C serial interface, 9-pin D-Sub	Peak list function for fast spurious measurement
VGA output, 15-pin D-Sub	External reference from 1 MHz to 20 MHz in 1 Hz steps

Attenuation calibration kit

The Attenuation Calibration Kit R&S®FSMR-Z2 is used to calibrate the level linearity of the R&S®FSMR as described in the R&S®FSMR performance test. The performance test description is included in the R&S®FSMR manual as standard. The attenuation calibration kit enables calibration laboratories to recalibrate the R&S®FSMR's level linearity themselves. The kit is PTB-calibrated and consists of the following

- ◆ 3 × 6 dB attenuators
- ◆ 2 × 10 dB attenuators
- ◆ 2 × 20 dB attenuators
- ◆ PTB calibration certificate



Attenuation calibration kit for verifying the R&S®FSMR linearity.



Attenuation calibration kit.

Recommended configurations

Frequency range	20 Hz to 3.6 GHz	20 Hz to 26 GHz	20 Hz to 50 GHz
Base unit	R&S®FSMR3	R&S®FSMR26	R&S®FSMR50
Power Sensor Modules	R&S®NRP-Z27	R&S®NRP-Z37	R&S®NRP-Z37, R&S®NRP-Z55
Other options			
Preamplifier up to 3.6 GHz	R&S®FSU-B25	R&S®FSU-B25	R&S®FSU-B25
YIG Preselection included (for f > 3.6 GHz) without preamplifier	Not available	R&S®FSMR-B2	R&S®FSMR-B2
Preamplifier and YIG preselection	Not available	R&S®FSU-B25, R&S®FSMR-B223 (preamplifier up to 26 GHz)	R&S®FSU-B25, R&S®FSMR-B2 (preamplifier up to 3.6 GHz)

Ordering information

Order designation	Type	Order No.	Remarks
Measuring Receiver 20 Hz to 3.6 GHz	R&S®FSMR 3	1166.3311.03	
Measuring Receiver 20 Hz to 26.5 GHz	R&S®FSMR 26	1166.3311.26	
Measuring Receiver 20 Hz to 50 GHz	R&S®FSMR 50	1166.3311.50	
Options			
YIG Preselection 3.6 GHz to 26.5 GHz	R&S®FSMR-B2	1157.1903.26	Not for retrofit, excludes R&S®FSMR-B23 and R&S®FSMR-B223, for R&S®FSMR 26
YIG Preselection with 20 dB Preamplifier, 3.6 GHz to 26.5 GHz	R&S®FSMR-B223	1157.1955.26	Not for retrofit, excludes R&S®FSMR-B23 and R&S®FSMR-B2, for R&S®FSMR 26
YIG Preselection 3.6 GHz to 50 GHz	R&S®FSMR-B2	1157.1903.50	Not for retrofit, for R&S®FSMR 50 only
Low-Aging OXCO	R&S®FSU-B4	1144.9000.02	
Tracking Generator 100 kHz to 3.6 GHz	R&S®FSU-B9	1142.8994.02	
Attenuator for Tracking Generator	R&S®FSU-B12	1142.9349.02	
Removable Hard Disk	R&S®FSMR-B18	1145.0242.06	Not for retrofit
Second Hard Disk for R&S®FSMR-B18	R&S®FSMR-B19	1145.0394.06	R&S®FSMR-B18 required
RF Preamplifier 3.6 GHz to 26 GHz	R&S®FSMR-B23	1157.0907.05	Not for retrofit, R&S®FSU-B25 required, excludes R&S®FSMR-B2 and R&S®FSMR-B223, for R&S®FSMR 26 only
20 dB RF Preamplifier and Electronic Attenuator, 100 kHz to 3.6 GHz	R&S®FSU-B25	1144.9298.02	
Attenuation Calibration Kit	R&S®FSMR-Z2	1169.4954.02	
Firmware/Software			
Application Firmware for Noise Figure and Gain Measurements	R&S®FS-K30	1300.6508.02	Retrofittable only for ser. no. >200000; preamplifier (e.g. R&S®FSU-B25) recommended
Application Firmware for Phase Noise Measurement	R&S®FS-K40	1161.8138.02	
GSM/EDGE Application Firmware	R&S®FS-K5	1141.1496.02	
3GPP BTS/Node B FDD Application Firmware	R&S®FS-K72	1154.7000.02	
3GPP UE FDD Application Firmware	R&S®FS-K73	1154.7252.02	
3 GPP HSDPA BTS Application Firmware	R&S®FS-K74	1300.7156.02	R&S®FS-K72 required
3 GPP TD-SCDMA BTS Application Firmware	R&S®FS-K76	1300.7291.02	
3 GPP TD-SCDMA UE Application Firmware	R&S®FS-K77	1300.8100.02	
CDMA2000® BTS Application Firmware	R&S®FS-K82	1157.2316.02	
CDMA2000® MS Application Firmware (incl. 1xEV-DV)	R&S®FS-K83	1157.2416.02	
CDMA2000® 1xEV-DO BTS Application Firmware	R&S®FS-K84	1157.2851.02	
CDMA2000® 1xEV-DO MS Application Firmware	R&S®FS-K85	1300.6689.02	

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For specifications, see PD 0758.2319.22
and www.rohde-schwarz.com
(search term: FSMR)



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