

R&S®FSMR

Measuring Receiver

All-in-one calibration of signal generators and attenuators



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At a glance

The R&S®FSMR measuring receiver 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 and is therefore capable of calibrating all vital parameters of a signal generator.

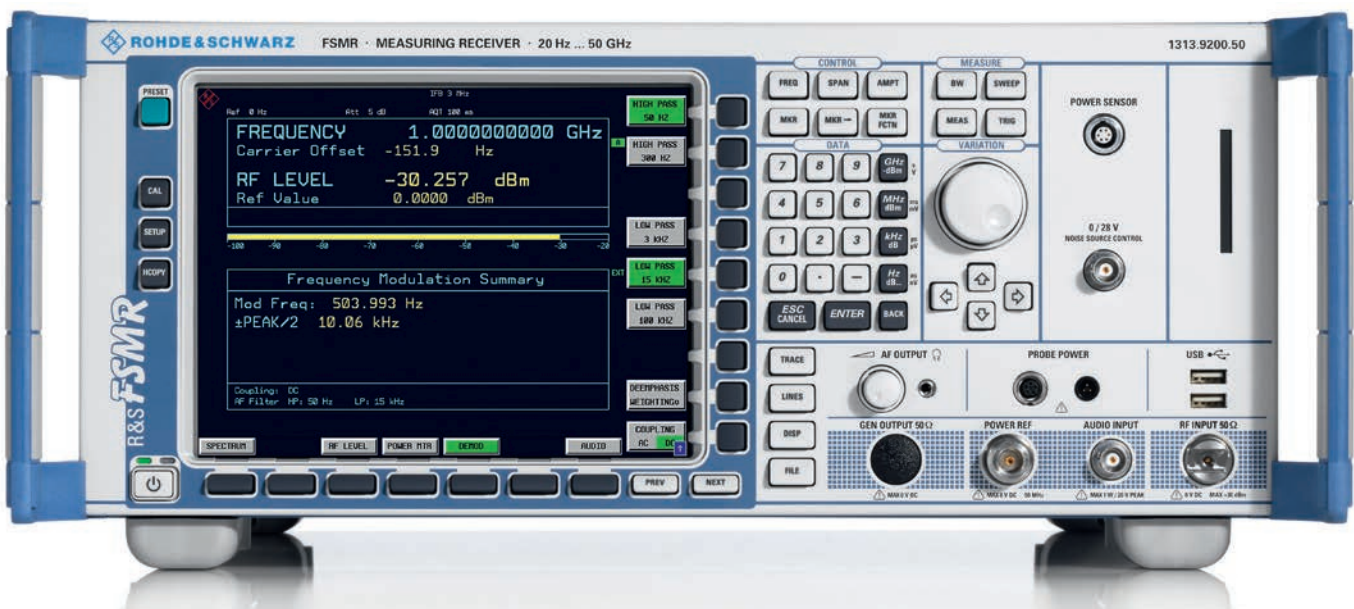
Plus, the R&S®FSMR offers full spectrum analyzer functionality, e.g. for measuring harmonics or phase noise. The base unit does not provide for image frequency rejection in the range above 3.6 GHz since the YIG filters normally used for this would impair level linearity. The optional YIG preselection 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.

Models

R&S®FSMR3: 20 Hz to 3.6 GHz
R&S®FSMR26: 20 Hz to 26.5 GHz
R&S®FSMR43: 20 Hz to 43 GHz
R&S®FSMR50: 20 Hz to 50 GHz

Key facts

- Frequency range from 20 Hz to 3/26.5/43/50 GHz
- Highly accurate level calibrator with wide level measurement range from +30 dBm to -140 dBm
- Modulation analyzer
- Audio analyzer with THD and SINAD measurement functionality
- Power meter for connection of R&S®NRP-Zxx power sensors
- High-performance spectrum analyzer



R&S®FSMR

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Benefits and key features

Level calibration – precise, repeatable and easy

- Excellent linearity and level stability
- High tolerance with respect to frequency drift and residual FM
- Easy operation for level calibration over a wide level range

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Direct connection of power sensors for accurate power measurements

- Power sensor module with integrated power splitter
- Control of all functions incl. power meter from front panel or via IEC/IEEE bus or LAN
- Many supported power meters
- Automatic VSWR correction

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Modulation and audio analysis made easy

- 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

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Versatile, high-performance spectrum analysis

- Full-featured spectrum analyzer
- Full choice of detectors
- Versatile resolution filter characteristics and large bandwidth
- Full range of analysis functions

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Level calibration – precise, repeatable and easy

Excellent linearity and level stability

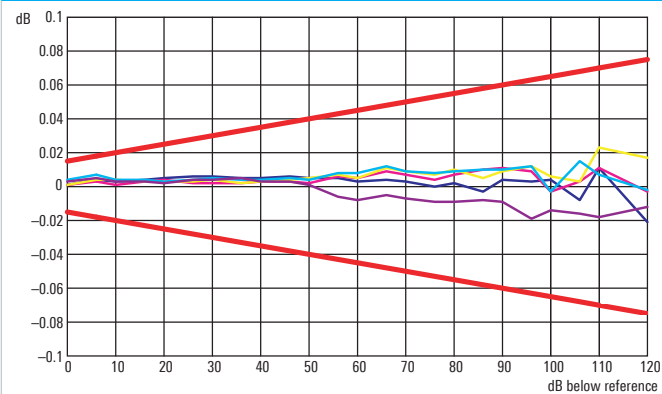
The linearity of the R&S®FSMR is almost exclusively determined by its high-quality A/D converter and the limits of traceability of calibration. Modules and components on which drift (YIG filter) or nonlinear level response (crystal filter) may occur are switched off during level calibration. As a result,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

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.

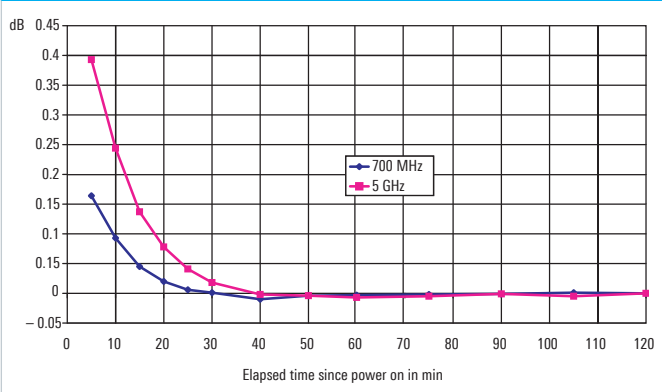
High tolerance with respect to frequency drift and residual FM

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.

Typical linearity versus specified values



Warmup drift



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. As a result, the user can benefit from the instrument's high linearity of 0.01 dB + 0.005 dB deviation per 10 dB across the entire 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 optional R&S®FSU-B25, R&S®FSU-B24, R&S®FSMR-B23 and R&S®FSMR-B223 preamplifiers expand the level range down to lower levels. In addition, they improve the measurement accuracy and measurement speed for low signal levels.

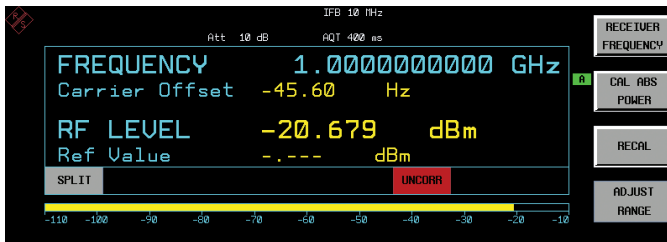
The procedure is as follows:

Step 1: Set the measurement frequency (manually or with the AUTO TUNE function). The R&S®FSMR measurement range is then automatically set to the level of the incoming signal (AUTORANGE function)

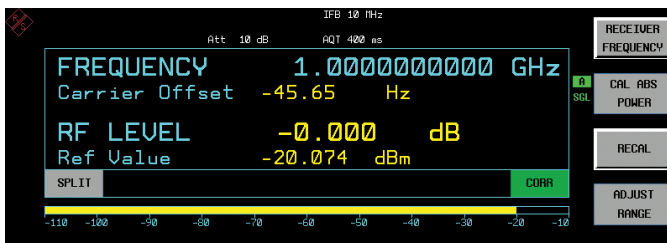
Step 2: Perform a reference measurement with the power meter by means of CAL ABS POWER. The R&S®FSMR is now ready for level calibration, which is indicated by the CAL field turning green

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

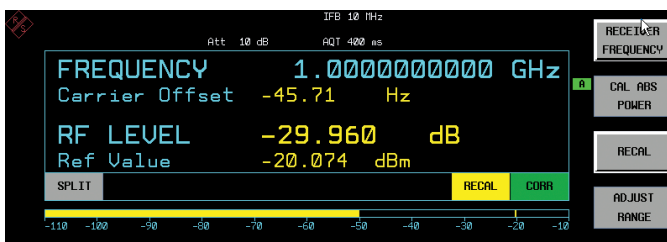
Step 4: Calibrate the adjacent range with the RECAL key. The R&S®FSMR automatically switches the measurement range



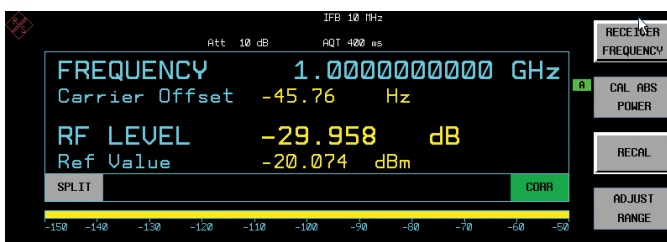
Step 1: Set the measurement frequency.



Step 2: Perform a reference measurement.



Step 3: Reduce the level of the device to be calibrated and verify the level.



Step 4: Calibrate the adjacent range with the RECAL key.

Direct connection of power sensors for accurate power measurements

Power sensor module with integrated power splitter

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.

Control of all functions incl. power meter from front panel or via IEC/IEEE bus or LAN

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 Rohde&Schwarz power meters. Remote control via the IEC/IEEE bus is still only via the R&S®FSMR. Calibration labs can therefore continue to use their existing power meters.

Many supported power meters

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

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

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 R&S®NRP-Z27/-Z37 power sensor modules 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/-Z37 considerably reduces loading, allowing users to profit from the overall measurement accuracy of the thermoelectric sensors in the power sensor modules.

Power sensors of the R&S®NRP-Zxx family suitable for use with the R&S®FSMR measuring receiver				
Type	Frequency range	Level range	Connector	Remarks
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
R&S®NRP-Z56	DC to 50 GHz	-35 dBm to +20 dBm	2.40 mm (male)	thermoelectric
R&S®NRP-Z57	DC to 67 GHz	-35 dBm to +20 dBm	1.85 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-Z52	DC to 18 GHz	-30 dBm to +20 dBm	3.5 mm (male)	thermoelectric
R&S®NRP-Z91	9 kHz to 6 GHz	-67 dBm to +23 dBm	N (male)	diode sensor

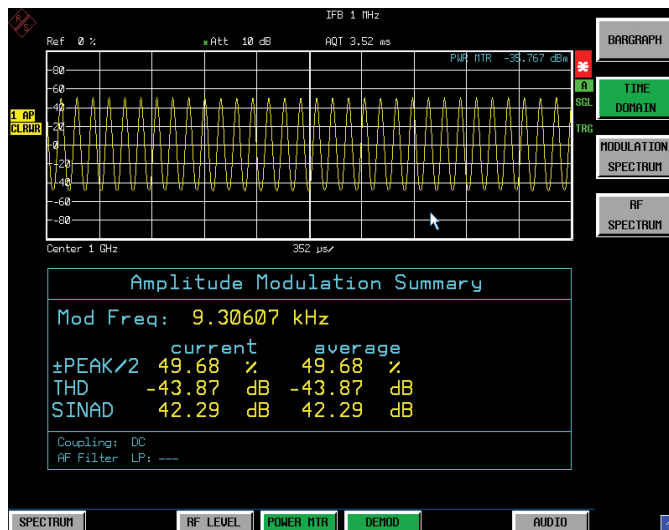
Modulation and audio analysis made easy

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.

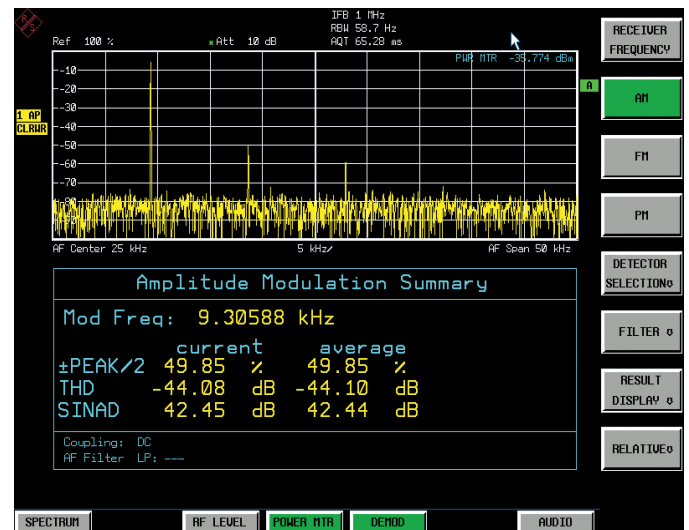
This means that no extra instrument is required for calibrating modulation settings and the modulation generator.

Various audio filters, deemphasis functions 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 additionally weights noise and nonharmonic spurious.



Versatile, high-performance spectrum analysis

Full-featured spectrum analyzer

Calibration labs handle a variety of measurement tasks. These tasks often require a spectrum analyzer featuring a wide range of functions and excellent allround 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 R&S®FSU spectrum analyzer.

Full choice of detectors

For adaptation of the R&S®FSMR to a wide range of signal types, a full choice of detectors is included:

- RMS
- Auto Peak
- Max Peak
- Min Peak
- Sample
- Average
- QPK (Quasi Peak)

Versatile resolution filter characteristics and large bandwidth

The R&S®FSMR 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 (R&S®FSMR43: max. 10 MHz)
- FFT filters from 1 Hz to 30 kHz
- 39 channel filters with bandwidths from 100 Hz to 5 MHz
- RRC filters for NADC and TETRA
- EMI filters: 200 Hz, 9 kHz, 120 kHz

Full range of analysis functions

In addition, the R&S®FSMR 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-featured channel power meter
- TOI marker
- Noise/phase noise marker
- Versatile channel/adjacent-channel power measurement functions with wide user-configurable selection of standards
- CCDF measurement function
- Split-screen mode with selectable settings
- Peak list marker for fast search of all peaks within the set frequency range (search for spurious)

Attenuation calibration kit

The R&S®FSMR-Z2 attenuation calibration kit 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 manual. 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 with case.

Important options

Measurement applications/ technology	Measurement functions	Spectrum measurements	Miscellaneous	Special features
R&S®FS-K15 I VOR/ILS measurements	ILS measurement functions: I DDM I SDM I Modulation depth and frequency VOR measurement functions: I VOR phase I Modulation depth and frequency for 30 Hz subcarrier identifier I 9.96 kHz subcarrier deviation I Modulation depth and frequency of subcarrier	I ILS: THD I VOR: THD – phase between 90 Hz and 150 Hz signal	I VOR phase measurement range: 0° to 360°, 0.1° resolution I VOR phase measurement uncertainty: 0.003°	
R&S®FSMR-B73 vector signal analysis for: I BPSK, QPSK, OQPSK I $\pi/4$ DQPSK I 8PSK, D8PSK, $3\pi/8$ 8PSK I (G)MSK I 2, 4, (G)FSK I 16/32/64/128/256 (D)QAM I 2FSK, 4FSK I 8VSB	I In-phase and quadrature signals versus time I Magnitude and phase versus time I Eye diagram I Vector diagram I Constellation diagram I Demodulated bit stream I Statistical evaluation of modulation parameters	I Spectral evaluation I Amplifier distortion measurements	I Trigger modes: external, burst, IF power	I 25 MHz symbol rate I 28 MHz I/Q demodulation bandwidth
R&S®FS-K40 I phase noise measurement	I SSB phase noise versus carrier offset	–	I Determination of residual FM and jitter from a phase noise trace within a selectable offset range	

Specifications in brief

	R&S®FSMR3	R&S®FSMR26	R&S®FSMR43	R&S®FSMR50
Frequency range	20 Hz to 3.6 GHz	20 Hz to 26.5 GHz	20 Hz to 43 GHz	20 Hz to 50 GHz
Reference frequency	aging: 1×10^{-7} /year, optionally 2×10^{-8} /year			
Absolute power measurement	using R&S®NRP-Zxx power sensor or external power meters			
Uncertainty	with R&S®NRP-Z27/-Z37: 0.083 dB (up 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 ± 0.005 dB per 10 dB step			
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 from 5% to 99%			
Modulation frequency	10 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	10 Hz to 200 kHz			
Inherent distortion	0.1%			
ϕM modulation measurements				
Phase deviation	max. 10000 rad			
Measurement uncertainty	1% of reading, 50 Hz to 100 kHz			
Modulation frequency	10 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 43 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 1 Hz)				
1 GHz	typ. -158 dBm	typ. -156 dBm	typ. -156 dBm	typ. -156 dBm
26 GHz	-	typ. -151 dB	typ. -151 dBm	typ. -151 dBm
43 GHz	-	-	typ. -140 dBm	typ. -140 dBm
50 GHz	-	-	-	typ. -133 dBm
Trace detectors	Max Peak, Min Peak, Auto Peak, Sample, RMS, Average, Quasi Peak			
Phase noise	typ. -133 dBc (1 Hz) at 10 kHz from carrier, 640 MHz carrier frequency			
Sweep time				
Span > 10 Hz	2.5 ms to 16000 s			
Span 0 Hz (zero span)	1 μ s to 16000 s			
Image frequency rejection				
f < 3.6 GHz	typ. 110 dB			
f > 3.6 GHz	-	0 dB	-	-
f > 3.6 GHz, with R&S®FSMR-B2 option	-	typ. 100 dB	-	-

For data sheet, see PD 0758.2319.22 and www.rohde-schwarz.com

Ordering information

Designation	Type	Order No.	Retrofit- table	Remarks
Measuring Receiver, 20 Hz to 3.6 GHz	R&S®FSMR3	1313.9200.03		
Measuring Receiver, 20 Hz to 26.5 GHz	R&S®FSMR26	1313.9200.26		
Measuring Receiver, 20 Hz to 43 GHz	R&S®FSMR43	1313.9200.43		
Measuring Receiver, 20 Hz to 50 GHz	R&S®FSMR50	1313.9200.50		
Hardware options				
YIG Preselection, 3.6 GHz to 26.5 GHz	R&S®FSMR-B2	1157.1903.26	no	not with R&S®FSMR-B23 and R&S®FSMR-B223, for R&S®FSMR26
YIG Preselection, 3.6 GHz to 26.5 GHz	R&S®FSMR-B2	1157.1903.43	no	not with R&S®FSMR-B23 and R&S®FSMR-B223, for R&S®FSMR26
YIG Preselection with 20 dB Preamplifier, 3.6 GHz to 26.5 GHz	R&S®FSMR-B223	1157.1955.26	no	not with R&S®FSMR-B23 and R&S®FSMR-B2, for R&S®FSMR26
YIG Preselection, 3.6 GHz to 50 GHz	R&S®FSMR-B2	1157.1903.50	no	for R&S®FSMR50 only
Low-Aging OXCO	R&S®FSU-B4	1144.9000.02	yes	
Tracking Generator, 100 kHz to 3.6 GHz	R&S®FSU-B9	1142.8994.02	yes	
Attenuator for Tracking Generator	R&S®FSU-B12	1142.9349.02	yes	
Removable Hard Disk	R&S®FSMR-B18	1303.0400.14	no	
Second Hard Disk	R&S®FSMR-B19	1303.0600.04		requires R&S®FSMR-B18
RF Preamplifier, 3.6 GHz to 26 GHz	R&S®FSMR-B23	1157.0907.05	no	requires R&S®FSU-B25, not with R&S®FSMR-B2 and R&S®FSMR-B223, for R&S®FSMR26 only
Vector Signal Analyzer	R&S®FSMR-B73	1169.5696.02		
20 dB RF Preamplifier and Electronic Attenuator, 100 kHz to 3.6 GHz	R&S®FSU-B24	1157.2100.50	yes	excludes R&S®FSU-B25, not with R&S®FSMR-B25 and R&S®FSMR-B223, not for R&S®FSMR3
20 dB RF Preamplifier and Electronic Attenuator, 100 kHz to 3.6 GHz	R&S®FSU-B25	1144.9298.02	yes	
Attenuation Calibration Kit	R&S®FSMR-Z2	1169.4954.02	yes	
N-Type Adapter for R&S®RT-Zx Probes	R&S®RT-ZA9	1417.0909.02	yes	
Software options				
VOR/ILS Measurement Demodulator	R&S®FS-K15	1302.0936.02		
Application Firmware for Noise Figure and Gain Measurements	R&S®FS-K30	1300.6508.02		retrofitable only for serial 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/NodeB FDD Application Firmware	R&S®FS-K72	1154.7000.02		
3GPP UE FDD Application Firmware	R&S®FS-K73	1154.7252.02		
3GPP HSDPA BTS Application Firmware	R&S®FS-K74	1300.7156.02		requires R&S®FS-K72
3GPP TD-SCDMA BTS Application Firmware	R&S®FS-K76	1300.7291.02		
3GPP 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		

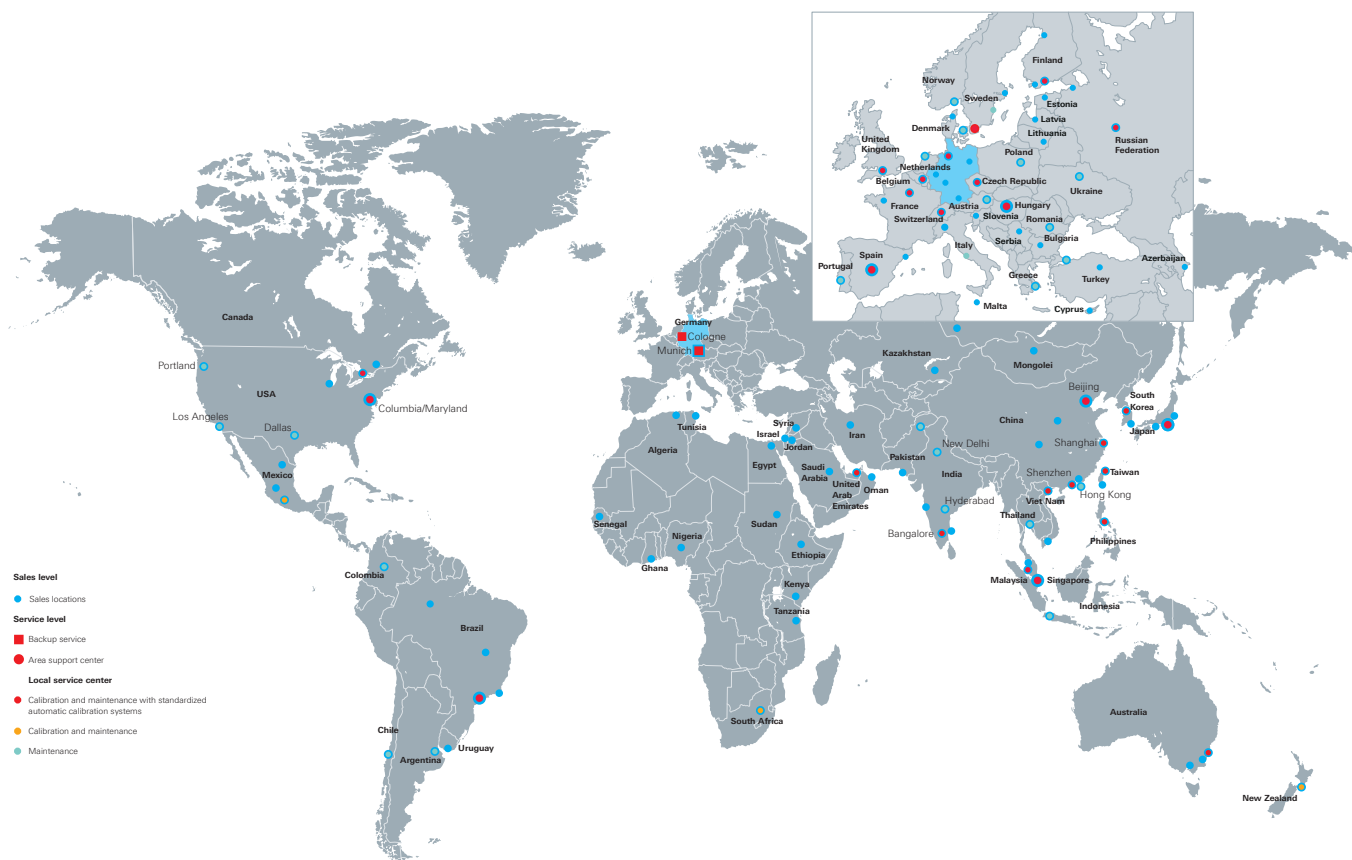
Service options				
Two-Year Calibration Service	R&S®CO2FSMR			Please contact your local Rohde & Schwarz sales office.
Three-Year Calibration Service	R&S®CO3FSMR			
Five-Year Calibration Service	R&S®CO5FSMR			
One-Year Repair Service following the warranty period	R&S®RO2FSMR			
Two-Year Repair Service following the warranty period	R&S®RO3FSMR			
Four-Year Repair Service following the warranty period	R&S®RO5FSMR			

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From pre-sale to service. At your doorstep.

The Rohde&Schwarz network in over 70 countries ensures optimum on-site support by highly qualified experts. The user risks are reduced to a minimum at all stages of the project:

- ▮ Solution finding/purchase
- ▮ Technical start-up/application development/integration
- ▮ Training
- ▮ Operation/calibration/repair



Service you can rely on

- | Worldwide
- | Local and personalized
- | Customized and flexible
- | Uncompromising quality
- | Long-term dependability

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. Established more than 75 years ago, Rohde & Schwarz has a global presence and a dedicated service network in over 70 countries. Company headquarters are in Munich, Germany.

Environmental commitment

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

Certified Quality System
ISO 9001

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