

R&S® FPC1000

Spectrum Analyzer

Specifications



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Definitions

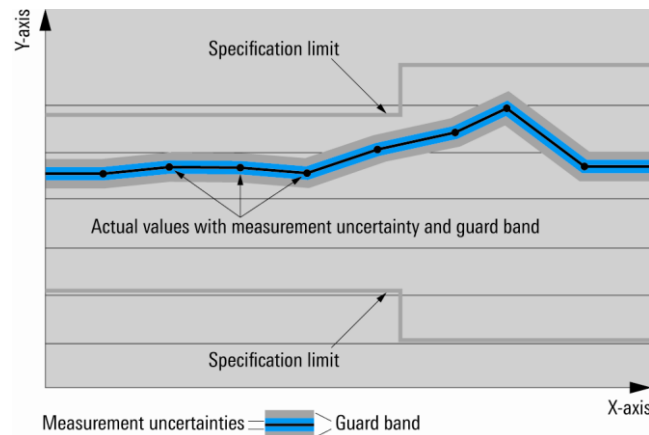
General

Product data applies under the following conditions:

- Three hours storage at ambient temperature followed by 30 minutes warm-up operation
- Specified environmental conditions met
- Recommended calibration interval adhered to
- All internal automatic adjustments performed, if applicable

Specifications with limits

Represent warranted product performance by means of a range of values for the specified parameter. These specifications are marked with limiting symbols such as $<$, $\leq$, $>$, $\geq$, $\pm$, or descriptions such as maximum, limit of, minimum. Compliance is ensured by testing or is derived from the design. Test limits are narrowed by guard bands to take into account measurement uncertainties, drift and aging, if applicable.



Specifications without limits

Represent warranted product performance for the specified parameter. These specifications are not specially marked and represent values with no or negligible deviations from the given value (e.g. dimensions or resolution of a setting parameter). Compliance is ensured by design.

Typical data (typ.)

Characterizes product performance by means of representative information for the given parameter. When marked with $<$, $>$ or as a range, it represents the performance met by approximately 80 % of the instruments at production time. Otherwise, it represents the mean value.

Nominal values (nom.)

Characterize product performance by means of a representative value for the given parameter (e.g. nominal impedance). In contrast to typical data, a statistical evaluation does not take place and the parameter is not tested during production.

Measured values (meas.)

Characterize expected product performance by means of measurement results gained from individual samples.

Uncertainties

Represent limits of measurement uncertainty for a given measurand. Uncertainty is defined with a coverage factor of 2 and has been calculated in line with the rules of the Guide to the Expression of Uncertainty in Measurement (GUM), taking into account environmental conditions, aging, wear and tear.

Device settings and GUI parameters are indicated as follows: "parameter: value".

Typical data as well as nominal and measured values are not warranted by Rohde & Schwarz.

In line with the 3GPP/3GPP2 standard, chip rates are specified in Mcps (million chips per second), whereas bit rates and symbol rates are specified in Mbps (million bits per second), kbps (thousand bits per second) or ksps (thousand symbols per second), and sample rates are specified in Msample/s (million samples per second). Mcps, kbps, ksps and Msample/s are not SI units.

Specifications

Specifications apply under the following conditions:

15 minutes warm-up time at ambient temperature, specified environmental conditions met, calibration cycle adhered to.

Data without tolerances: typical values only. Data designated as "nominal" applies to design parameters and is not tested. Data without tolerance limits is not binding.

Frequency

Frequency range	R&S®FPC1000	5 kHz to 1 GHz
	with R&S®FPC-B2 option	5 kHz to 2 GHz
	with R&S®FPC-B3 option	5 kHz to 3 GHz
Frequency resolution		1 Hz

Reference frequency, internal		
Aging per year		1×10^{-6}
Temperature drift	0 °C to +30 °C	1×10^{-6}
	+30 °C to +50 °C	3×10^{-6}
Achievable initial calibration accuracy		5×10^{-7}
Total reference uncertainty		(time since last adjustment × aging rate) + temperature drift + calibration accuracy

Frequency readout		
Marker resolution		0.1 Hz
Uncertainty		$\pm(\text{marker frequency} \times \text{reference uncertainty} + 10 \% \times \text{resolution bandwidth} + \frac{1}{2} (\text{span} / (\text{sweep points} - 1)) + 1 \text{ Hz})$
Number of sweep (trace) points		1183
Marker tuning frequency step size		span/1182
Frequency counter resolution		0.1 Hz
Count uncertainty	SNR > 25 dB	$\pm(\text{frequency} \times \text{reference uncertainty} + \frac{1}{2} (\text{last digit}))$
Frequency span		0 Hz, 10 Hz to 1 GHz
	with R&S®FPC-B2 option	0 Hz, 10 Hz to 2 GHz
	with R&S®FPC-B3 option	0 Hz, 10 Hz to 3 GHz
Span uncertainty		1 % (nom.)

Spectral purity SSB phase noise		
Carrier offset	30 kHz	$f = 500 \text{ MHz}$
	100 kHz	< -88 dBc (1 Hz), -92 dBc (1 Hz) (typ.)
	1 MHz	< -98 dBc (1 Hz), -103 dBc (1 Hz) (typ.)
		< -120 dBc (1 Hz), -125 dBc (1 Hz) (typ.)

Sweep time

Sweep time	span = 0 Hz	100 µs to 100 s
	$10 \text{ Hz} \leq \text{span} \leq 600 \text{ MHz}$	10 ms to 1000 s
	span > 600 MHz	$10 \text{ ms} \times \text{span} / 600 \text{ MHz}$ to 1000 s
Uncertainty	span = 0 Hz	1 % (nom.)
	span ≥ 10 Hz	3 % (nom.)

Bandwidth

Resolution bandwidths		
Range	-3 dB bandwidth	1 Hz to 3 MHz in 1/3 sequence
Bandwidth accuracy	$1 \text{ Hz} \leq \text{RBW} \leq 300 \text{ kHz}$	< 5 % (nom.)
	$300 \text{ kHz} < \text{RBW} \leq 1 \text{ MHz}$	< 10 % (nom.)
Selectivity 60 dB:3 dB		< 5 (nom.) (Gaussian type filters)
Video filters		
Range	-3 dB bandwidth	1 Hz to 3 MHz in 1/3 sequence

Level

Display range		displayed noise floor to +30 dBm
Maximum rated input level		
DC voltage		50 V
CW RF power		33 dBm (= 2 W)
Peak RF power	duration < 3 s	36 dBm (= 4 W)
Max. pulse voltage		150 V
Max. pulse energy	pulse width 10 μ s	10 mWs
Intermodulation		
Third-order intercept (TOI)	intermodulation-free dynamic range, signal level 2×-20 dBm, RF attenuation = 0 dB, RF preamplifier = off	
	$f_{in} = 1$ GHz	+7 dBm (meas.)
	$f_{in} = 2.4$ GHz	+10 dBm (meas.)
Second harmonic intercept (SHI)	RF attenuation = 0 dB, RF preamplifier = off, signal level = -40 dBm	
	$f_{in} = 20$ MHz to 1.5 GHz	-60 dBc (nom.)
Displayed average noise level		
	0 dB RF attenuation, termination 50 Ω , RBW = 100 Hz, VBW = 10 Hz, sample detector, log scaling, normalized to 1 Hz	
	preamplifier R&S®FPC1000 = off	
	1 MHz to 10 MHz	< -127 dBm, -135 dBm (typ.)
	10 MHz to 2 GHz	< -142 dBm, -150 dBm (typ.)
	2 GHz to 3 GHz	< -138 dBm, -147 dBm (typ.)
	preamplifier R&S®FPC1000 = on (requires R&S®FPC-B22 option)	
	1 MHz to 10 MHz	< -147 dBm, -157 dBm (typ.)
	10 MHz to 2 GHz	< -158 dBm, -165 dBm (typ.)
	2 GHz to 3 GHz	< -155 dBm, -163 dBm (typ.)

Immunity to interference, nominal values		
Image frequencies	$f_{in} - 2 \times 30.15$ MHz	< -70 dBc (nom.)
	$f_{in} - 2 \times 830.15$ MHz	< -65 dBc (nom.)
	$f_{in} - 2 \times 4042.65$ MHz	-60 dBc (nom.)
Intermediate frequencies	30.25 MHz, 830.25 MHz, 4042.65 MHz	< -70 dBc (nom.)
Other interfering signals, signal level – RF attenuation < -30 dBm	spurious at $f_{in} - 2021.325$ MHz	< -60 dBc (nom.)
Other interfering signals, related to local oscillators	$\Delta f \geq 300$ kHz	< -60 dBc (nom.)
	f = receive frequency	
Residual spurious response	input matched with 50 Ω , without input signal, RBW ≤ 30 kHz, $f \geq 3$ MHz, RF attenuation = 0 dB, Wi-Fi function disabled	< -90 dBm (nom.)
Level display		
Logarithmic level axis		1/2/5/10/20/50/100 dB, 10 divisions
Linear level axis		0 % to 100 %, 10 divisions
Number of traces		2
Trace detectors		max. peak, min. peak, auto peak, sample, RMS
Trace functions		clear/write, max. hold, min. hold, average, view
Setting range of reference level		-130 dBm to +30 dBm
Units of level axis		dBm, dBmV, dB μ V, V, W

Level measurement uncertainty		
Absolute level uncertainty at 100 MHz	+20 °C to +30 °C	< 0.3 dB
Frequency response (+20 °C to +30 °C)	$100 \text{ kHz} \leq f < 10 \text{ MHz}$	< 1.5 dB (nom.)
	$10 \text{ MHz} \leq f \leq 3 \text{ GHz}$	< 1 dB
Attenuator uncertainty		< 0.3 dB
Uncertainty of reference level setting		< 0.1 dB (nom.)
Display nonlinearity	SNR > 16 dB, 0 dB to -50 dB, logarithmic level display	< 0.3 dB
Bandwidth switching uncertainty	reference: RBW = 10 kHz	< 0.1 dB (nom.)
Total measurement uncertainty	95 % confidence level, +20 °C to +30 °C, SNR > 16 dB, 0 dB to -50 dB below reference level, RF attenuation auto	
	$10 \text{ MHz} \leq f \leq 3 \text{ GHz}$	< 1.25 dB, 0.5 dB (typ.)

Trigger functions

Trigger		
Trigger source		free run, video, external
External trigger level threshold	low → high transition	2.4 V
	high → low transition	0.7 V
	maximum	3.0 V

Inputs and outputs

RF input		
Impedance		50 Ω (nom.)
Connector		N female
VSWR	$5 \text{ kHz} \leq f \leq 1 \text{ GHz}$	< 1.5 (nom.)
	$1 \text{ GHz} < f \leq 3 \text{ GHz}$	< 2 (nom.)
Input attenuator	RF input only	0 dB to 40 dB in 5 dB steps
AF output		
AF demodulation types		AM and FM
Connector		3.5 mm mini jack
Output impedance		32 Ω (nom.)
Voltage (open circuit)		V _{RMS} adjustable from 0 V to > 100 mV
External reference, external trigger		
Connector		BNC, 50 Ω
Mode		ext. reference, ext. trigger
External reference	required level	0 dBm
	frequency	10 MHz
External trigger threshold	low → high transition	2.4 V
	high → low transition	0.7 V

General data

Power supply		
AC supply	input specifications	100 V to 240 V AC, 50 Hz to 60 Hz, 0.6 A to 0.4 A
Power consumption		14 W (nom.)
Safety		IEC 61010-1, EN 61010-1, UL 61010-1, CAN/CSA-C22.2 No. 61010.1
Test mark		VDE, GS, CSA
Manual operation		
Languages		Chinese, English, French, German, Italian, Hungarian, Japanese, Korean, Portuguese, Russian, Spanish
Remote control		
Command set		SCPI 1997.0
LAN interface		10/100BASE-T, RJ-45
USB		type B plug, version 2.0
Display		
Size		10.1"
Resolution		1366 × 768 pixel
Pixel errors		< 2 pixel
Audio		
Speaker		internal
USB interface		type A plug, version 2.0
	number of interfaces	2
Mass memory		
Mass memory		memory stick (not supplied), size ≤ 4 Gbyte, USB version 1.1 or 2.0
Data storage	internal	> 256 instrument settings and traces
	on memory stick, ≥ 1 Gbyte	> 5000 instrument settings and traces
Environmental conditions		
Temperature	operating temperature range	+10 °C to +40 °C
	storage temperature range	–20 °C to +70 °C
Climatic loading	relative humidity	+25 °/+40 °C at 85 % relative humidity in line with EN 60068-2-30
Mechanical resistance		
Vibration	sinusoidal	EN 60068-2-6
	random	EN 60068-2-64
Shock		40 g shock spectrum, in line with MIL-STD-810F, method 516.4 procedure 1, EN 60068-2-27
EMC		in line with European EMC Directive 2004/108/EC including CISPR 11/EN 55011/group 1 class A (emission) EN 61326 table 2 (immunity, industrial)
Dimensions (W × H × D)	without feet	396 mm × 178 mm × 147 mm (15.6 in × 7 in × 5.8 in)
	including feet	396 mm × 185 mm × 156 mm (15.6 in × 7.3 in × 6.1 in)
Weight		3 kg (6.61 lb)
Recommended calibration interval		1 year

Options

R&S®FPC-K7 modulation analysis

The specifications below apply to the R&S®FPC1000. They are based on the data sheet specifications of the R&S®FPC1000, have not been checked separately and are not verified during instrument calibration.

Measurement of analog modulation signals		
Center frequency		10 MHz to 3 GHz
Demodulation bandwidth		2 MHz, 1 MHz, 500 kHz, 300 kHz, 200 kHz, 100 kHz, 50 kHz, 30 kHz, 20 kHz, 10 kHz (nom.)
Bandwidth accuracy		< ± 5% (nom.)
Display	AM	carrier power, carrier frequency offset, AM modulation depth, modulation frequency, THD, SINAD
	FM	carrier power, carrier frequency offset, FM deviation, modulation frequency, THD, SINAD

Carrier power		
Carrier power measurement accuracy		add 0.2 dB, see section Level measurement uncertainty
Display resolution		0.1 dB

AF (modulation frequency) ¹		
Range	AM	20 Hz to 100 kHz (nom.)
	FM	20 Hz to 200 kHz (nom.)
Resolution		1 Hz
Measurement uncertainty	1 kHz ≤ AF ≤ 200 kHz	±(1 % of measured value) (nom.)
	20 Hz ≤ AF < 1 kHz	± 1 Hz (nom.)
AF filters		
Lowpass	audio decimation	bypass, 1/10, 1/30, 1/100 (nom.)
Deemphasis	FM demodulation and demodulation bandwidth 200 kHz and 300 kHz	off, 50 μs, 75 μs (nom.)

AM demodulation ²		
Measurement range	modulation depth	5 % to 95 % (nom.)
Modulation depth uncertainty		±(4 %) (nom.)

FM demodulation ³		
Measurement range	frequency deviation	10 kHz to 400 kHz (nom.), max. 0.4 × demodulation bandwidth
Deviation uncertainty		±(0.04 × (AF + deviation)) (nom.)

Modulation distortion ^{1, 2, 3}		
Measurement functions		THD, SINAD
Measurement range		–50 dB to 0 dB (THD)
		0 dB to 50 dB (SINAD, AM)
		0 dB to 40 dB (SINAD, FM)
Display resolution		0.1 dB
Measurement uncertainty		1 dB (nom.)
AF frequency range		20 Hz to 100 kHz (nom.)

¹ Min. and max. detectable audio frequency and harmonics depend on the demodulation bandwidth and audio filter settings.

² Modulation frequency 1 kHz sine, AM modulation depth 50 %, carrier level 0 dBm, center frequency = 499 MHz, reference level 6 dBm, demodulation bandwidth = 20 kHz, SNR > 60 dB, audio filter = bypass.

³ Modulation frequency 1 kHz sine, FM-deviation = 75 kHz, carrier level 0 dBm, center frequency = 499 MHz, reference level 6 dBm, demodulation BW = 300 kHz, SNR > 60 dB, audio filter = 1/10, deemphasis = off.

Measurement of digital modulation signals (ASK, FSK)		
Center frequency		10 MHz to 4 GHz
Demodulation bandwidth		400 Hz to 2 MHz auto-set corresponding to signal and demodulation bandwidth requirements
Display	ASK diagram	eye diagram, symbols, modulation depth, modulation error
	ASK numerical results	carrier power, carrier frequency error, modulation depth and index, modulation error
	FSK diagram	eye diagram, symbols, modulation deviation, modulation error
	FSK numerical results	carrier power, carrier frequency error, frequency deviation, modulation error, magnitude error

Demodulation parameters		
Modulation and demodulation filters	transmit filter	root raised cosine (RRC)
		raised cosine (RC)
		Gaussian (GAUSS)
		unfiltered ⁵
		(measurement and reference filters are internally adapted to signal parameters)
Points/symbol		4, 8, 16 internally adapted to signal parameters
Filter length		internally adapted to signal parameters
Demodulation length		20 symbols to max. 1000 symbols (at 4 points/symbol)

Carrier power		
Carrier power measurement accuracy		add 0.2 dB, see section Level measurement uncertainty
Carrier power range		–30 dBm to +20 dBm (nom.)
Display resolution		0.1 dB

ASK demodulation ⁶		
Measurement range	symbol rate	1 kHz to 100 kHz (nom.)
	modulation depth	5 % to 95 % (nom.)
Modulation depth uncertainty		±(4 %) (nom.)
Display resolution		0.1 %

FSK demodulation ⁷		
Measurement range	symbol rate	1 kHz to 100 kHz (nom.)
	frequency deviation	1 kHz to 400 kHz (nom.)
	symbol rate	
	1 kHz to 20 kHz	$1 \leq \beta^9 \leq 20$
	> 20 kHz to 50 kHz	$1 \leq \beta \leq 8$
	> 50 kHz to 100 kHz	$1 \leq \beta \leq 4$
Accuracy		± (4 %) (nom.)
Display resolution		0.1 Hz

⁵ Reference signal is generated with a Gauss filter, BT = 3.

⁶ ASK modulation index 50 %, symbol rate = 100 kHz, Gauss BT = 1.0, modulation signal PSBS.

⁷ FSK modulation deviation 100 kHz, symbol rate = 100 kHz, Gauss BT = 1.0, modulation signal PRBS.

⁹ Beta is the ratio of frequency deviation to symbol rate.

R&S®FPC-K43 receiver mode

The specifications below apply to the R&S®FPC1000. They are based on the data sheet specifications of the R&S®FPC1000, have not been checked separately and are not verified during instrument calibration.

Measurements	fixed frequency	•
	frequency scan	•
	channel scan	•
	user defined channel list	•
	EMI precompliance	•
	CISPR bandwidths	•
	CISPR detectors	•

Frequency range		see basic instrument
Measurement modes		fixed frequency, frequency scan, channel scan
Frequency scan step size		
Scan step size		100 Hz to max. frequency
Max. number of steps		10000
Channel scan		
Channel spacing		user-definable
Max. number of channels		10000
Resolution bandwidths		
Range	–3 dB bandwidth	1 Hz to 3 MHz in 1/3 sequence
Detectors	CISPR bandwidths (–6 dB)	200 Hz, 9 kHz, 120 kHz, 1 MHz
		max. peak, average, RMS, quasi-peak
Level		see basic instrument

R&S®FPC-K55 advanced measurements

Measurements	spectrogram	•
	channel power	•
	occupied bandwidth	•

R&S®FPC-B200 Wi-Fi connection support

Interface		Wireless LAN 802.11 b/g/n, 2.4 GHz
Operating modes		client mode
Certifications		CE13, ETSI 9113, FCC, IC, Japan approval, Korea certification

Ordering information

Designation	Type	Order No.
Spectrum Analyzer, 5 kHz to 1 GHz	R&S®FPC1000	1328.6660.02
Accessories supplied		
Power cable, USB cable for connection to PC		

Options

Designation	Type	Order No.
Spectrum Analyzer Frequency Upgrade to 2 GHz	R&S®FPC-B2	1328.6677.02
Spectrum Analyzer Frequency Upgrade to 3 GHz	R&S®FPC-B3	1328.6683.02
Spectrum Analyzer Preamplifier	R&S®FPC-B22	1328.6690.02
Modulation Analysis for AM, FM, ASK, FSK	R&S®FPC-K7	1328.6748.02
Receiver Mode	R&S®FPC-K43	1328.6754.02
Advanced Measurements	R&S®FPC-K55	1328.6760.02
Wi-Fi-Support	R&S®FPC-B200	1328.6990.02

Accessories

Designation	Type	Order No.
19" Rackmount Kit	R&S®ZZA-FPC1	1328.7080.02
Soft Carrying Bag	R&S®RTM-Z3	1305.0289.02
Carrying Case	R&S®RTB-Z3	1333.1734.02

Service options

Warranty		
Base unit		3 years
All other items ¹⁰		1 year
Options		
Extended Warranty, one year	R&S®WE1	Please contact your local Rohde & Schwarz sales office.
Extended Warranty, two years	R&S®WE2	
Extended Warranty with Calibration Coverage, one year	R&S®CW1	
Extended Warranty with Calibration Coverage, two years	R&S®CW2	

Extended warranty with a term of one and two years (WE1 and WE2)

Repairs carried out during the contract term are free of charge ¹¹. Necessary calibration and adjustments carried out during repairs are also covered.

Extended warranty with calibration coverage (CW1 and CW2)

Enhance your extended warranty by adding calibration coverage at a package price. This package ensures that your Rohde & Schwarz product is regularly calibrated, inspected and maintained during the term of the contract. It includes all repairs ¹¹ and calibration at the recommended intervals as well as any calibration carried out during repairs or option upgrades.

For product brochure, see PD 5214.7112.12 and www.rohde-schwarz.com

¹⁰ For options that are installed, the remaining base unit warranty applies if longer than 1 year. Exception: all batteries have a 1 year warranty.

¹¹ Excluding defects caused by incorrect operation or handling and force majeure. Wear-and-tear parts are not included.

Service that adds value

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

Rohde & Schwarz

The Rohde & Schwarz electronics group offers innovative solutions in the following business fields: test and measurement, broadcast and media, secure communications, cybersecurity, monitoring and network testing. Founded more than 80 years ago, the independent company which is headquartered in Munich, Germany, has an extensive sales and service network with locations in more than 70 countries.

Sustainable product design

- ▮ Environmental compatibility and eco-footprint
- ▮ Energy efficiency and low emissions
- ▮ Longevity and optimized total cost of ownership

Certified Quality Management

ISO 9001

Certified Environmental Management

ISO 14001

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