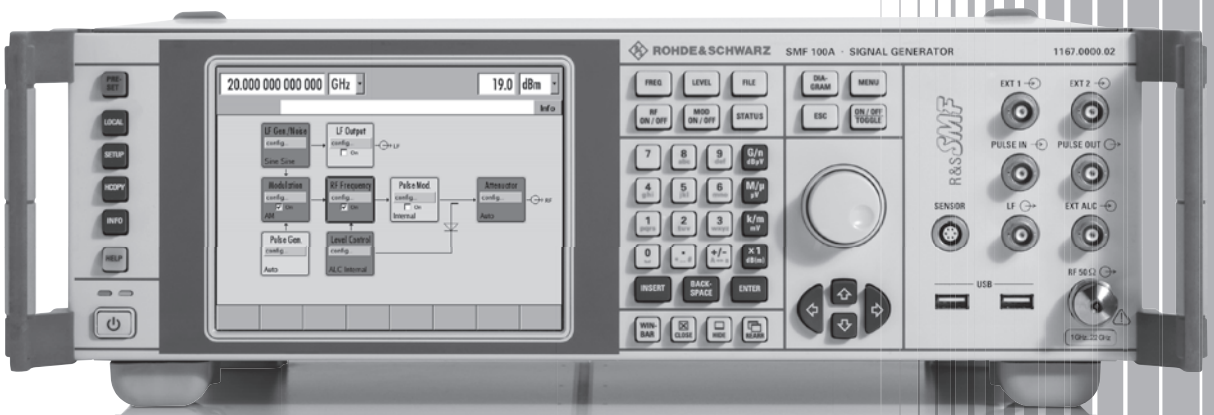
R&S®SMF100A Microwave Signal Generator

Specifications



70 Years of Driving Innovation

ROHDE&SCHWARZ

Test & Measurement

Data Sheet | 04.00

Specifications

Specifications apply under the following conditions: 30 minutes warm-up time at ambient temperature, specified environmental conditions met, calibration cycle adhered to, and all internal automatic adjustments performed. Data without tolerances: typical values only. Data designated "nominal" applies to design parameters and is not tested.

The equipment is designed for reliable operation and transport up to an altitude of 4600 m above sea level.

RF characteristics

Frequency

Range	R&S®SMF-B122	1 GHz to 22 GHz
	with R&S®SMF-B2 frequency extension option 100 kHz to 1 GHz	100 kHz to 22 GHz
	R&S®SMF-B144	1 GHz to 43.5 GHz
	with R&S®SMF-B2 frequency extension option 100 kHz to 1 GHz	100 kHz to 43.5 GHz
Resolution of setting		0.001 Hz
Setting time	to within $<1 \times 10^{-7}$ for f ≥ 375 MHz or <150 Hz for f < 375 MHz after IEC/IEEE bus delimiter	<4 ms, typ. 2 ms
Phase offset		adjustable in 0.1° steps

Frequency step sweep

Operating modes	digital sweep in discrete steps	automatic, step, single sweep, external single, external step, external start/stop, manual or external trigger, linear or logarithmic spacing
Sweep range		full frequency range
Step width	linear	full frequency range
	logarithmic	0.01 % to 100 % per step
Step time	range	2 ms to 10 s
	resolution	0.1 ms

Ramp sweep (R&S®SMF-K4 option)

Operating modes	analog frequency sweep	automatic, step, single sweep, external single, external step, external start/stop, manual or external trigger
Sweep span range		zero to full frequency range
Maximum sweep rate	100 kHz ≤ f < 375 MHz	175 MHz/ms
	375 MHz ≤ f < 750 MHz	87.5 MHz/ms
	750 MHz ≤ f < 1.5 GHz	175 MHz/ms
	1.5 GHz ≤ f < 3 GHz	350 MHz/ms
	3 GHz ≤ f < 11 GHz	700 MHz/ms
	11 GHz ≤ f < 21 GHz	1400 MHz/ms
	with R&S®SMF-B122 frequency option	
	21 GHz ≤ f ≤ 22 GHz	1400 MHz/ms
	with R&S®SMF-B144 frequency option	
	21 GHz ≤ f ≤ 43.5 GHz	2800 MHz/ms
Frequency accuracy		(0.005 % of span)/(sweep time/s)
Sweep time	range	10 ms to 10 s
	resolution	0.1 ms
Frequency markers	number of frequency markers	10
MARKER output (BNC)		TTL signal, selectable polarity
X-AXIS output (BNC)	output can drive ≥1 kΩ	sawtooth signal 0 V to 10 V

Reference frequency

Aging	after 30 days of uninterrupted operation	$<1 \times 10^{-8}$/day, $<1 \times 10^{-6}$/year
	with R&S®SMF-B1 option	$<5 \times 10^{-10}$/day, $<3 \times 10^{-8}$/year
Temperature effect	in temperature range 0 °C to +55 °C	$\pm1 \times 10^{-6}$
	with R&S®SMF-B1 option	$\pm6 \times 10^{-9}$
Warm-up time	to nominal thermostat temperature	≤10 min
Output for internal reference signal	frequency (approx. sinewave)	10 MHz or external input frequency
	level	typ. 5 dBm
	source impedance	50 Ω
Input for external reference	frequency	1 MHz to 20 MHz (in steps of 1 MHz)
	maximum deviation	3×10^{-6}
	input level, limits	≥–6 dBm, ≤19 dBm
	recommended	0 dBm to 19 dBm
	input impedance	50 Ω
Electronic tuning from input (EFC)	sensitivity	typ. 4×10^{-9}/V to 3×10^{-8}/V
	input voltage	–10 V to +10 V
	input impedance	typ. 10 kΩ

Level

Setting range	without attenuator (R&S®SMF-B26/-B27 option)	–20 dBm to +30 dBm
	with attenuator (R&S®SMF-B26/-B27 option)	–130 dBm to +30 dBm

The maximum specified level applies in the temperature range from +15 °C to +35 °C. Outside this temperature range, the maximum specified level is typical from 0 °C to +15 °C and typically degrades by less than 2 dB from +35 °C to +55 °C.

Maximum specified level with the R&S®SMF-B122 frequency option (PEP) [1]				
	without R&S®SMF-B32 high output power option		with R&S®SMF-B32 high output power option	
	without attenuator (R&S®SMF-B26 option)	with attenuator (R&S®SMF-B26 option)	without attenuator (R&S®SMF-B26 option)	with attenuator (R&S®SMF-B26 option)
1 GHz ≤ f < 11 GHz	+16 dBm	+14 dBm	+25 dBm	+23 dBm
11 GHz ≤ f < 21 GHz	+14 dBm	+12 dBm	+23 dBm	+21 dBm
21 GHz ≤ f ≤ 22 GHz	+12 dBm	+10 dBm	+22 dBm	+20 dBm

Maximum specified level with the R&S®SMF-B122 and R&S®SMF-B2 options (PEP)				
	without R&S®SMF-B34 high output power option		with R&S®SMF-B34 high output power option	
	without attenuator (R&S®SMF-B26 option)	with attenuator (R&S®SMF-B26 option)	without attenuator (R&S®SMF-B26 option)	with attenuator (R&S®SMF-B26 option)
100 kHz ≤ f < 300 kHz [2]	typ. +13 dBm	typ. +13 dBm	typ. +13 dBm	typ. +13 dBm
300 kHz ≤ f < 1 GHz [3]	+16 dBm	+15 dBm	+16 dBm	+15 dBm
1 GHz ≤ f < 11 GHz	+16 dBm	+14 dBm	+24 dBm	+22 dBm
11 GHz ≤ f < 16 GHz	+14 dBm	+12 dBm	+23 dBm	+21 dBm
16 GHz ≤ f < 21 GHz	+12 dBm	+10 dBm	+21 dBm	+19 dBm
21 GHz ≤ f ≤ 22 GHz	typ. +12 dBm	typ. +10 dBm	+20 dBm	+18 dBm

Maximum specified level with the R&S®SMF-B144 frequency option (PEP) [4]				
	without R&S®SMF-B32 high output power option		with R&S®SMF-B32 high output power option	
	without attenuator (R&S®SMF-B27 option)	with attenuator (R&S®SMF-B27 option)	without attenuator (R&S®SMF-B27 option)	with attenuator (R&S®SMF-B27 option)
1 GHz ≤ f < 11 GHz	+14 dBm	+12 dBm	+25 dBm	+23 dBm
11 GHz ≤ f < 16 GHz	+11 dBm	+9 dBm	+22 dBm	+20 dBm
16 GHz ≤ f< 21 GHz	+10 dBm	+8 dBm	+19 dBm	+17 dBm
21 GHz ≤ f < 36 GHz	+11 dBm	+9 dBm	+16 dBm	+14 dBm
36 GHz ≤ f ≤ 40 GHz	+11 dBm	+9 dBm	+14 dBm	+12 dBm
40 GHz < f ≤ 43.5 GHz	typ. +8 dBm	typ. +6 dBm	typ. +12 dBm	typ. +9 dBm

[1] With the R&S®SMF-B81 rear connectors 22 GHz option, the maximum level is reduced by less than 0.1 dB/GHz.

[2] With active pulse modulation, the level decreases by 2.5 dB.

[3] With active pulse modulation, the level decreases by 5 dB.

[4] With the R&S®SMF-B82 rear connectors 43.5 GHz option, the maximum level is reduced by less than 0.1 dB/GHz.

Maximum specified level with the R&S®SMF-B144 and R&S®SMF-B2 options (PEP) [5]				
	without R&S®SMF-B34 high output power option		with R&S®SMF-B34 high output power option	
	without attenuator (R&S®SMF-B27 option)	with attenuator (R&S®SMF-B27 option)	without attenuator (R&S®SMF-B27 option)	with attenuator (R&S®SMF-B27 option)
100 kHz ≤ f < 300 kHz [6]	typ. +13 dBm	typ. +13 dBm	typ. +13 dBm	typ. +13 dBm
300 kHz ≤ f < 1 GHz [7]	+16 dBm	+15 dBm	+16 dBm	+15 dBm
1 GHz ≤ f < 11 GHz	+14 dBm	+12 dBm	+23 dBm	+21 dBm
11 GHz ≤ f < 16 GHz	+11 dBm	+9 dBm	+19 dBm	+17 dBm
16 GHz ≤ f < 21 GHz	+10 dBm	+8 dBm	+17 dBm	+15 dBm
21 GHz ≤ f < 36 GHz	+11 dBm	+9 dBm	+15 dBm	+13 dBm
36 GHz ≤ f ≤ 40 GHz	+11 dBm	+9 dBm	+14 dBm	+12 dBm
40 GHz < f ≤ 43.5 GHz	typ. +8 dBm	typ. +6 dBm	typ. +11 dBm	typ. +9 dBm

Minimum specified level (PEP)	without attenuator (R&S®SMF-B26/-B27 option)	–20 dBm
	with attenuator (R&S®SMF-B26/-B27 option)	–130 dBm
Resolution		0.01 dB
Level uncertainty	in CW mode, ALC state ON, attenuator mode AUTO, temperature range +15 °C to +35 °C, degradation outside this range typ. <0.3 dB	
	100 kHz ≤ f < 50 MHz	
	>+10 dBm	<0.6 dB
	+10 dBm to >–10 dBm	<0.6 dB
	–10 dBm to >–70 dBm	<0.9 dB
	–70 dBm to >–90 dBm	<1.0 dB
	–90 dBm to –100 dBm	<1.6 dB
	50 MHz ≤ f < 2 GHz	
	>+10 dBm	<0.6 dB
	+10 dBm to >–10 dBm	<0.6 dB
	–10 dBm to >–70 dBm	<0.7 dB
	–70 dBm to >–90 dBm	<0.8 dB
	–90 dBm to –100 dBm	<1.4 dB
	2 GHz ≤ f < 22 GHz	
	>+10 dBm	<0.8 dB
	+10 dBm to >–10 dBm	<0.8 dB
	–10 dBm to >–70 dBm	<0.9 dB
	–70 dBm to >–90 dBm	<1.0 dB
	–90 dBm to –100 dBm	<1.7 dB
	22 GHz ≤ f ≤ 40 GHz	
	>+10 dBm	<1.0 dB
	+10 dBm to >–10 dBm	<1.2 dB
	–10 dBm to >–70 dBm	<1.2 dB
	–70 dBm to >–90 dBm	<2.0 dB
	–90 dBm to –100 dBm	<3.2 dB
	40 GHz < f ≤ 43.5 GHz	
	+10 dBm to >–10 dBm	<1.0 dB
	–10 dBm to >–70 dBm	<1.5 dB
	–70 dBm to >–90 dBm	<2.5 dB
	–90 dBm to –100 dBm	<4.2 dB

[5] With the R&S®SMF-B82 rear connectors 43.5 GHz option, the maximum level is reduced by less than 0.1 dB/GHz.

[6] With active pulse modulation, the level decreases by 2.5 dB.

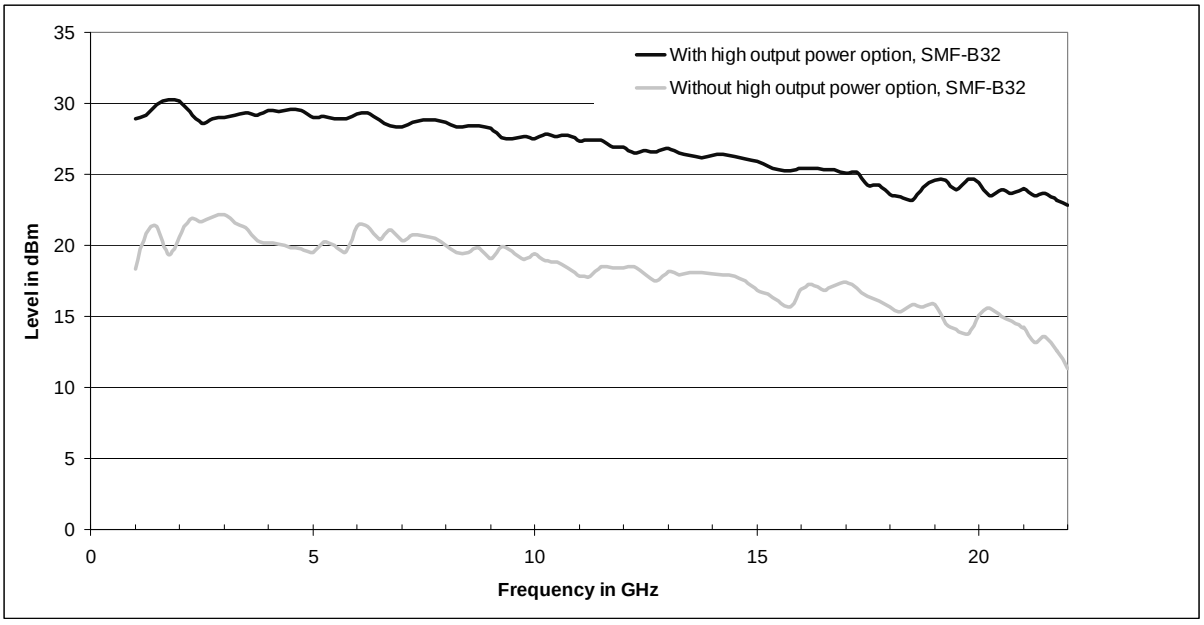
[7] With active pulse modulation, the level decreases by 5 dB.

Output impedance VSWR in 50 Ω system	ALC state ON	
	100 kHz ≤ f ≤ 2 GHz	typ. <1.4
	2 GHz < f ≤ 22 GHz	typ. <1.6
	22 GHz < f ≤ 43.5 GHz	typ. <1.8
Setting time	without attenuator (R&S®SMF-B26/-B27 option), after IEC/IEEE bus delimiter	<3 ms
	with attenuator (R&S®SMF-B26/-B27 option), attenuator mode AUTO	<25 ms

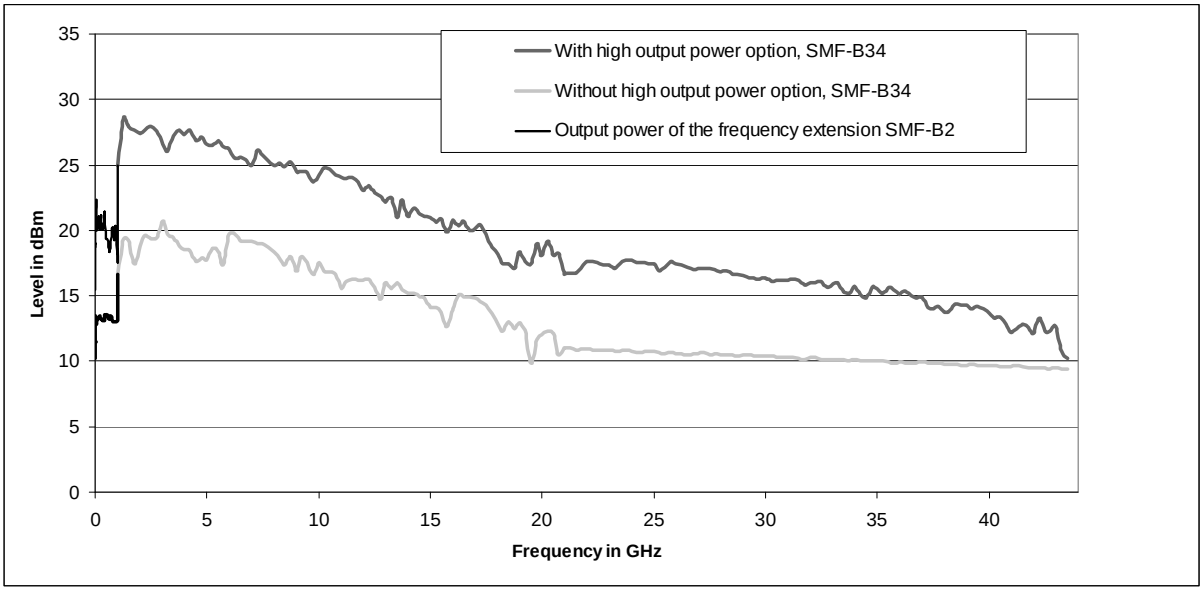
Back-feed (from ≥50 Ω source)	1 GHz ≤ f ≤ 43.5 GHz	
	maximum permissible RF power in output	0.5 W
	maximum permissible DC voltage	0 V

Level sweep

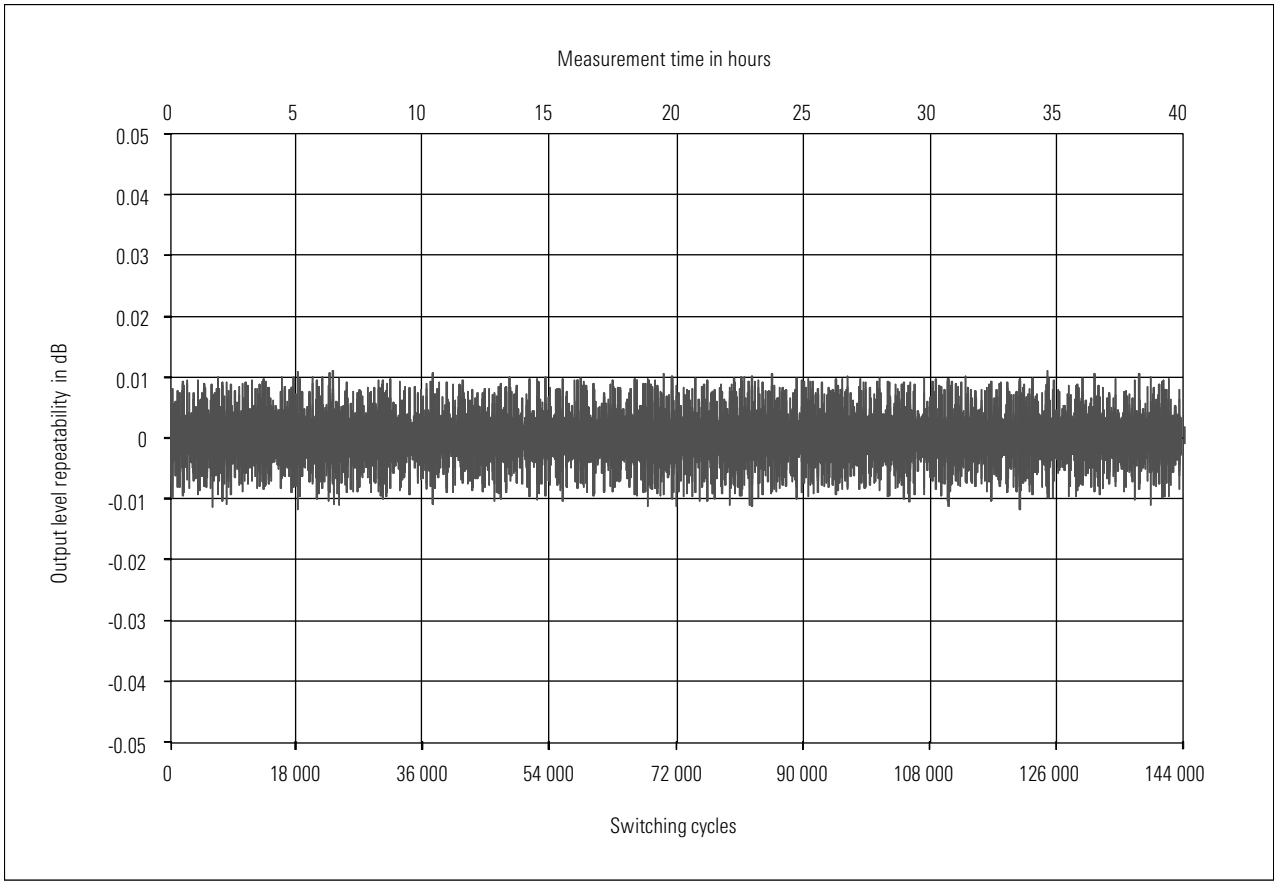
Digital sweep in discrete steps	operating modes	automatic, step, single sweep, external single, external step, external start/stop, manual or external trigger, linear spacing
	sweep range	full level range
	step width	0.01 dB to full level range in dB per step



Maximum output power with and without the R&S®SMF-B32 high output power option in the frequency range 1 GHz to 22 GHz (R&S®SMF-B122, in both cases with the R&S®SMF-B26 step attenuator option).



Maximum output power with and without the R&S®SMF-B34 high output power option in the frequency range 100 kHz to 43.5 GHz (R&S®SMF-B144 and SMF-B2, with the R&S®SMF-B27 step attenuator option); the lower curve in the frequency range 100 kHz to 1 GHz is with activated pulse modulator of the R&S®SMF-B2 frequency extension.



Level repeatability over time (with random frequency and level changes between measurements).

Spectral purity

Harmonics [8] with R&S®SMF-B122 frequency option, level +10 dBm (with R&S®SMF-B2: level +6 dBm for f ≥ 1 GHz)		
	without R&S®SMF-B32/-B34 high output power option	with R&S®SMF-B32/-B34 high output power option
100 kHz ≤ f < 300 kHz	typ. <–25 dBc	typ. <–25 dBc
300 kHz ≤ f < 10 MHz	<–30 dBc	<–30 dBc
10 MHz ≤ f < 200 MHz	<–40 dBc, typ. <–45 dBc	<–40 dBc, typ. <–45 dBc
200 MHz ≤ f < 1 GHz	<–50 dBc, typ. <–55 dBc	<–50 dBc, typ. <–55 dBc
1 GHz ≤ f ≤ 22 GHz	<–50 dBc, typ. <–55 dBc	<–30 dBc

Harmonics [8] with R&S®SMF-B144 frequency option, level +10 dBm (with R&S®SMF-B2: level +6 dBm for f ≥ 1 GHz) or maximum specified level, whichever is lower		
	without R&S®SMF-B32/-B34 high output power option	with R&S®SMF-B32/-B34 high output power option
100 kHz ≤ f < 300 kHz	typ. <–25 dBc	typ. <–25 dBc
300 kHz ≤ f < 10 MHz	<–30 dBc	<–30 dBc
10 MHz ≤ f < 200 MHz	<–40 dBc, typ. <–45 dBc	<–40 dBc, typ. <–45 dBc
200 MHz ≤ f < 1 GHz	<–50 dBc, typ. <–55 dBc	<–50 dBc, typ. <–55 dBc
1 GHz ≤ f < 21 GHz	<–50 dBc, typ. <–55 dBc	<–30 dBc
21 GHz ≤ f ≤ 43.5 GHz	<–40 dBc	<–40 dBc

Nonharmonics [9]	CW, level +10 dBm or maximum specified level, whichever is lower, carrier offset > 3 kHz	
	100 kHz ≤ f < 300 kHz	typ. <–67 dBc
	300 kHz ≤ f < 40 MHz	<–67 dBc
	40 MHz ≤ f < 375 MHz	<–55 dBc
	375 MHz ≤ f < 1 GHz	<–75 dBc
	1 GHz ≤ f < 3 GHz	<–68 dBc
	3 GHz ≤ f < 11 GHz	<–62 dBc
	11 GHz ≤ f < 21 GHz	<–56 dBc
	with R&S®SMF-B122 frequency option	
	21 GHz ≤ f ≤ 22 GHz	<–56 dBc
	with R&S®SMF-B144 frequency option	
	21 GHz ≤ f ≤ 43.5 GHz	<–50 dBc
Power-supply-related nonharmonics	f = 10 GHz	
	50 Hz to 3 kHz from carrier	<–50 dBc, typ. –70 dBc

Subharmonics [10] with R&S®SMF-B122 frequency option, level +10 dBm		
	without R&S®SMF-B32/-B34 high output power option	with R&S®SMF-B32/-B34 high output power option
f < 11 GHz	none	none
11 GHz ≤ f ≤ 22 GHz	<–55 dBc	<–50 dBc

Subharmonics [10] with R&S®SMF-B144 frequency option, level +10 dBm or maximum specified level, whichever is lower		
	without R&S®SMF-B32/-B34 high output power option	with R&S®SMF-B32/-B34 high output power option
f < 11 GHz	none	none
11 GHz ≤ f < 36 GHz	<–50 dBc	<–50 dBc
36 GHz ≤ f ≤ 43.5 GHz	<–30 dBc	<–30 dBc

Wideband noise with R&S®SMF-B122 frequency option, level +10 dBm, carrier offset > 10 MHz, measurement bandwidth 1 Hz, CW		
	without R&S®SMF-B32/-B34 high output power option	with R&S®SMF-B32/-B34 high output power option
3 GHz ≤ f < 11 GHz	typ. <–148 dBc	typ. <–140 dBc
11 GHz ≤ f ≤ 22 GHz	typ. <–145 dBc	typ. <–140 dBc

[8] Specifications are typical for harmonics beyond specified frequency range.

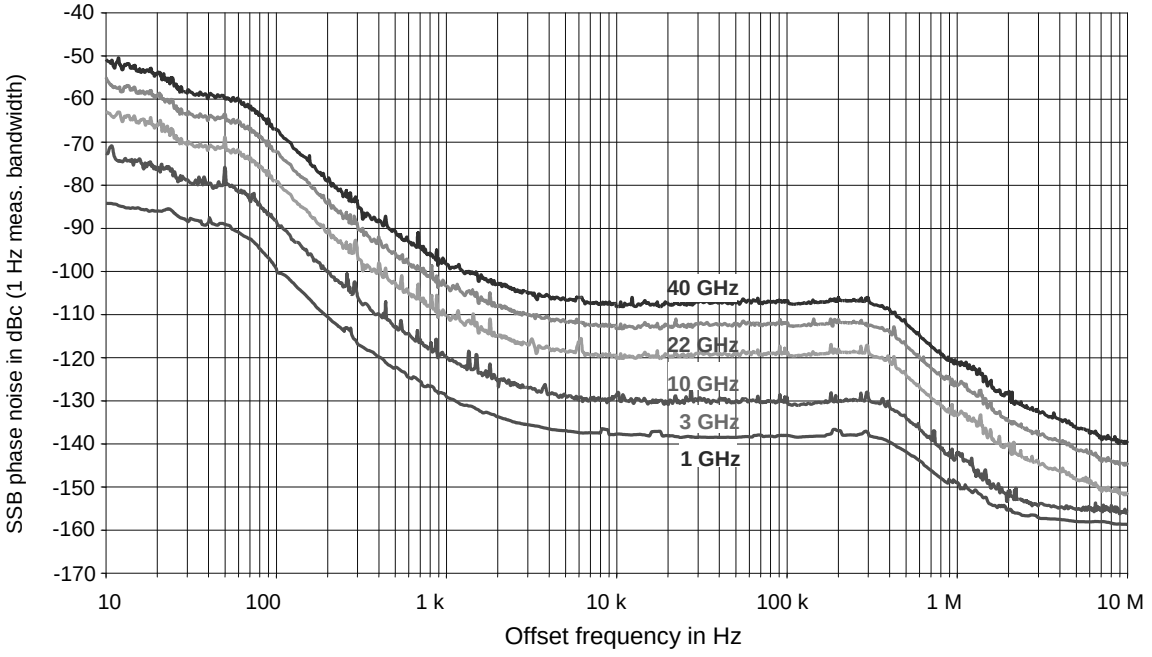
[9] Specifications are typical for nonharmonics beyond specified frequency range.

[10] Specifications are typical for subharmonics beyond specified frequency range.

Wideband noise with R&S®SMF-B144 frequency option, level +10 dBm or maximum specified level, whichever is lower, carrier offset > 10 MHz, measurement bandtwidth 1 Hz, CW		
	without R&S®SMF-B32/-B34 high output power option	with R&S®SMF-B32/-B34 high output power option
3 GHz ≤ f < 11 GHz	typ. <–148 dBc	typ. <–140 dBc
11 GHz ≤ f < 21 GHz	typ. <–145 dBc	typ. <–140 dBc
21 GHz ≤ f ≤ 43.5 GHz	typ. <–138 dBc	typ. <–138 dBc

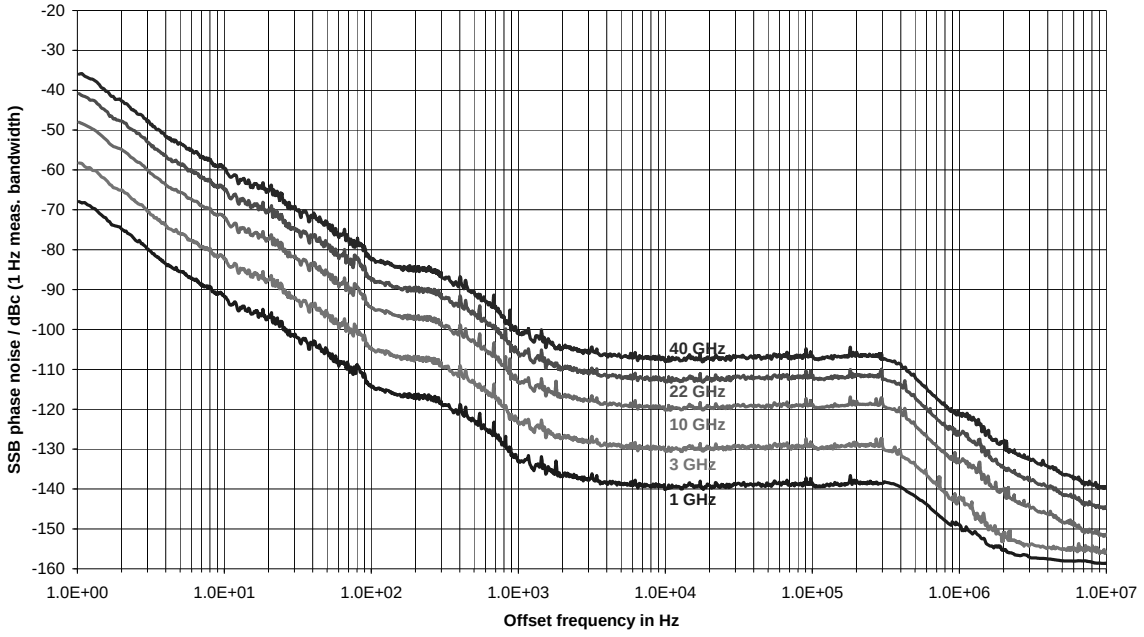
SSB phase noise	carrier offset 100 Hz, measurement bandwidth 1 Hz, CW	
	f = 250 MHz	<–90 dBc
	f = 1 GHz	<–95 dBc
	f = 2 GHz	<–89 dBc
	f = 4 GHz	<–83 dBc
	f = 10 GHz	<–75 dBc
	f = 20 GHz	<–69 dBc
	f = 40 GHz	<–63 dBc
	carrier offset 20 kHz, measurement bandwidth 1 Hz, CW	
	f = 250 MHz	<–126 dBc
	f = 1 GHz	<–132 dBc
	f = 2 GHz	<–128 dBc
	f = 4 GHz	<–122 dBc
	f = 10 GHz	<–115 dBc
	f = 20 GHz	<–109 dBc
	f = 40 GHz	<–103 dBc

Carrier frequency	SSB phase noise with R&S®SMF-B1 option, measurement bandwidth 1 Hz, CW				
	frequency offset from carrier				
	10 Hz	100 Hz	1 kHz	10 kHz	100 kHz
250 MHz	<–72 dBc	<–90 dBc	<–115 dBc	<–126 dBc	<–128 dBc
1 GHz	<–77 dBc	<–95 dBc	<–120 dBc	<–132 dBc	<–133 dBc
2 GHz	<–71 dBc	<–89 dBc	<–114 dBc	<–128 dBc	<–127 dBc
4 GHz	<–65 dBc	<–83 dBc	<–108 dBc	<–122 dBc	<–121 dBc
10 GHz	<–57 dBc	<–75 dBc	<–100 dBc	<–115 dBc	<–113 dBc
20 GHz	<–51 dBc	<–69 dBc	<–94 dBc	<–109 dBc	<–107 dBc
40 GHz	<–45 dBc	<–63 dBc	<–88 dBc	<–103 dBc	<–101 dBc



Single sideband phase noise for various frequencies (each with the R&S®SMF-B1 OCXO reference oscillator option).

Carrier frequency	SSB phase noise with R&S®SMF-B22 option, measurement bandwidth 1 Hz, CW					
	frequency offset from carrier					
	1 Hz	10 Hz	100 Hz	1 kHz	10 kHz	100 kHz
250 MHz	<–52 dBc	<–80 dBc	<–97 dBc	<–116 dBc	<–126 dBc	<–128 dBc
1 GHz	<–57 dBc	<–85 dBc	<–101 dBc	<–121 dBc	<–132 dBc	<–133 dBc
2 GHz	<–51 dBc	<–79 dBc	<–96 dBc	<–115 dBc	<–128 dBc	<–127 dBc
4 GHz	<–45 dBc	<–73 dBc	<–89 dBc	<–109 dBc	<–122 dBc	<–121 dBc
10 GHz	<–37 dBc	<–65 dBc	<–81 dBc	<–101 dBc	<–115 dBc	<–113 dBc
20 GHz	<–31 dBc	<–59 dBc	<–75 dBc	<–95 dBc	<–109 dBc	<–107 dBc
40 GHz	<–25 dBc	<–53 dBc	<–69 dBc	<–89 dBc	<–103 dBc	<–101 dBc



Single sideband phase noise for various frequencies with the R&S®SMF-B22 enhanced phase noise performance option.

LIST mode

Frequency and level values can be stored in a list and set in an extremely short amount of time		
Operating modes		automatic, step, single sweep, external single, external step, manual or external trigger
Max. number of stored settings		2000
Dwell time		0.7 ms to 10 s
	resolution	0.1 ms
Setting time	after external trigger	
	to within <1 × 10^{-6} for f ≥ 375 MHz or <150 Hz for f < 375 MHz	typ. <0.75 ms
	to within <1 × 10^{-6} for f = 3.001 GHz to f = 10.999 GHz	<1.1 ms

Analog modulation

Possible modulation types

Amplitude modulation (AM), amplitude shift keying (ASK), logarithmic AM (LOG AM), frequency modulation (FM), frequency shift keying (FSK), phase modulation (φM), phase shift keying (PSK), pulse modulation (PM)

Simultaneous modulation

	FM	φM	AM	LOG AM	PM	FSK	PSK	ASK
FM	+	–	+	+	+	–	–	+
φM	–	+	+	+	+	–	–	+
AM	+	+	+	–	*	+	+	–
LOG AM	+	+	–	+	*	+	+	–
Pulse mod.	+	+	*	*		+	+	*
FSK	–	–	+	+	+		–	+
PSK	–	–	+	+	+	–		+
ASK	+	+	–	–	*	+	+	

+ = possible with no restrictions * = possible with restrictions – = not feasible

Amplitude modulation (R&S®SMF-B20 option)

Attenuator mode AUTO

Operating modes		EXT1-AC/EXT1-DC EXT2-AC/EXT2-DC LF1/LF2/noise
Modulation depth	At high levels, modulation is clipped when the maximum PEP is reached.	0 % to 100 %
Resolution		0.1 %
Setting uncertainty	f_{mod} = 1 kHz, m < 80 %	<(5 % of reading + 1 %)
AM distortion [11]	f_{mod} = 1 kHz, m = 60 %	
	100 kHz ≤ f < 1 MHz	typ. <5 %
	1 MHz ≤ f < 10 MHz	<2.5 %
	10 MHz ≤ f < 1 GHz	<1 %
	1 GHz ≤ f ≤ 43.5 GHz	<1.5 %
Modulation frequency response [11]	10 MHz ≤ f ≤ 43.5 GHz, m = 60 %	
	DC/10 Hz to 20 kHz	<1 dB
	DC/10 Hz to 100 kHz	<3 dB

[11] For level up to maximum specified level.

Logarithmic amplitude modulation (R&S®SMF-B20 option)

Attenuator mode AUTO

Operating modes		EXT1-AC/EXT1-DC EXT2-AC/EXT2-DC LF1/LF2/noise
Dynamic range		30 dB
Sensitivity		–10 dB/V to +10 dB/V
Resolution		0.01 dB/V
Rise/fall time (10 %/90 %) [11]	10 MHz ≤ f ≤ 43.5 GHz	<10 µs

Frequency modulation (R&S®SMF-B20 option)

Operating modes		EXT1-AC/EXT1-DC EXT2-AC/EXT2-DC/ LF1/LF2/noise
FM multiplier for different frequency ranges	100 kHz ≤ f < 375 MHz	n = ½
	375 MHz ≤ f < 750 MHz	n = ⅛
	750 MHz ≤ f < 1.5 GHz	n = ¼
	1.5 GHz ≤ f < 3 GHz	n = ½
	3 GHz ≤ f < 11 GHz	n = 1
	11 GHz ≤ f < 21 GHz	n = 2
	with R&S®SMF-B122 frequency option	
	21 GHz ≤ f ≤ 22 GHz	n = 2
	with R&S®SMF-B144 frequency option	
	21 GHz ≤ f ≤ 43.5 GHz	n = 4
Maximum deviation		n × 10 MHz
Resolution		<1 %, min. 10 Hz
Setting uncertainty	10 MHz ≤ f ≤ 43.5 GHz	
	f_{mod} = 1 kHz, deviation = 100 kHz	<(3 % of reading + 20 Hz)
	f_{mod} = 1 MHz, deviation = 100 kHz	<(10 % of reading + 20 Hz)
FM distortion	10 MHz ≤ f ≤ 43.5 GHz	
	f_{mod} ≤ 50 kHz, deviation = 500 kHz	<0.5 %
Modulation frequency response	deviation = 100 kHz, DC/10 Hz to 10 MHz	
	10 MHz ≤ f < 1 GHz, DC/10 Hz to 3 MHz	<3 dB
	1 GHz ≤ f ≤ 43.5 GHz, DC/10 Hz to 10 MHz	<3 dB
Carrier frequency offset		<0.2 % of set deviation

Phase modulation (R&S®SMF-B20 option)

Operating modes		EXT1-AC/EXT1-DC EXT2-AC/EXT2-DC/ LF1/LF2/noise
φM multiplier for different frequency ranges	100 kHz ≤ f < 375 MHz	n = ½
	375 MHz ≤ f < 750 MHz	n = ⅛
	750 MHz ≤ f < 1.5 GHz	n = ¼
	1.5 GHz ≤ f < 3 GHz	n = ½
	3 GHz ≤ f < 11 GHz	n = 1
	11 GHz ≤ f < 21 GHz	n = 2
	with R&S®SMF-B122 frequency option	
	21 GHz ≤ f ≤ 22 GHz	n = 2
	with R&S®SMF-B144 frequency option	
	21 GHz ≤ f ≤ 43.5 GHz	n = 4
Maximum deviation		n × 160 rad
Resolution		<1 %
Setting uncertainty	10 MHz ≤ f ≤ 43.5 GHz	
	f_{mod} = 1 kHz, deviation = 80 rad	<5 %
	f_{mod} = 10 kHz, deviation = 80 rad	<10 %
Distortion	10 MHz ≤ f ≤ 43.5 GHz	
	f_{mod} ≤ 50 kHz, deviation = 80 rad	<0.5 %
Modulation frequency response	10 MHz ≤ f ≤ 43.5 GHz	
	DC/10 Hz to 1 MHz	<3 dB

ASK modulation (R&S®SMF-B20 option)

Attenuator mode AUTO

Operating modes		EXT1 EXT2 pulse generator random (noise generator)
Modulation depth	At high levels, modulation is clipped when the maximum PEP is reached.	0 % to 100 %
Resolution		0.1 %
Data rate		0 bit to 200 kbit/s
Rise/fall time (10 %/90 %) [12]	10 MHz ≤ f ≤ 43.5 GHz	<10 µs

FSK modulation (R&S®SMF-B20 option)

Operating modes		EXT1 EXT2 pulse generator random (noise generator)
FSK multiplier for different frequency ranges	100 kHz ≤ f < 375 MHz	n = ½
	375 MHz ≤ f < 750 MHz	n = ⅛
	750 MHz ≤ f < 1.5 GHz	n = ¼
	1.5 GHz ≤ f < 3 GHz	n = ½
	3 GHz ≤ f < 11 GHz	n = 1
	11 GHz ≤ f < 21 GHz	n = 2
	with R&S®SMF-B122 frequency option	
	21 GHz ≤ f ≤ 22 GHz	n = 2
	with R&S®SMF-B144 frequency option	
	21 GHz ≤ f ≤ 43.5 GHz	n = 4
Maximum deviation		n × 10 MHz
Resolution		<1 %, min. 10 Hz
Data rate	10 MHz ≤ f ≤ 43.5 GHz	0 bit/s to 2 Mbit/s

PSK modulation (R&S®SMF-B20 option)

Operating modes		EXT1 EXT2 pulse generator random (noise generator)
PSK multiplier for different frequency ranges	100 kHz ≤ f < 375 MHz	n = ½
	375 MHz ≤ f < 750 MHz	n = ⅛
	750 MHz ≤ f < 1.5 GHz	n = ¼
	1.5 GHz ≤ f < 3 GHz	n = ½
	3 GHz ≤ f < 11 GHz	n = 1
	11 GHz ≤ f < 21 GHz	n = 2
	with R&S®SMF-B122 frequency option	
	21 GHz ≤ f ≤ 22 GHz	n = 2
	with R&S®SMF-B144 frequency option	
	21 GHz ≤ f ≤ 43.5 GHz	n = 4
Maximum deviation		n × 160 rad
Resolution		<1 %
Data rate	10 MHz ≤ f ≤ 43.5 GHz	0 bit/s to 500 kbit/s

[12] For level up to maximum specified level.

Narrow pulse modulation (R&S®SMF-K3 option)

Operating modes		external, internal with R&S®SMF-K23 option
ON/OFF ratio		>80 dB
Rise/fall time	10 %/90 % of RF amplitude	
	10 MHz ≤ f < 1 GHz	<20 ns
	1 GHz ≤ f ≤ 43.5 GHz	<10 ns
Pulse repetition frequency		0 Hz to 10 MHz
Minimum pulse width	with ALC state ON	
	10 MHz ≤ f < 1 GHz	50 ns
	1 GHz ≤ f ≤ 43.5 GHz	500 ns [13]
	with ALC state OFF	
	10 MHz ≤ f < 1 GHz	50 ns
	1 GHz ≤ f ≤ 43.5 GHz	20 ns
Pulse overshoot		typ. <10 %
RF delay	video output pulse to RF pulse	typ. 35 ns
Video crosstalk	10 MHz ≤ f < 1 GHz	<150 mV (peak-to-peak value)
	1 GHz ≤ f < 3 GHz	
	without R&S®SMF-B32/-B34 option	<75 mV (peak-to-peak value)
	with R&S®SMF-B32/-B34 option	<150 mV (peak-to-peak value)
	3 GHz ≤ f ≤ 43.5 GHz	
	without R&S®SMF-B32/-B34 option	<5 mV (peak-to-peak value)
	with R&S®SMF-B32/-B34 option	<10 mV (peak-to-peak value)

Chirped pulses (R&S®SMF-B20 option, in combination with the R&S®SMF-K3 and R&S®SMF-K23 options)

Chirp bandwidth multiplier for different frequency ranges	100 kHz ≤ f < 375 MHz	n = ½
	375 MHz ≤ f < 750 MHz	n = ⅛
	750 MHz ≤ f < 1.5 GHz	n = ¼
	1.5 GHz ≤ f < 3 GHz	n = ½
	3 GHz ≤ f < 11 GHz	n = 1
	11 GHz ≤ f < 21 GHz	n = 2
	with R&S®SMF-B122 frequency option	
	21 GHz ≤ f ≤ 22 GHz	n = 2
	with R&S®SMF-B144 frequency option	
	21 GHz ≤ f ≤ 43.5 GHz	n = 4
Operating modes		AUTO, EXTERNAL TRIGGER, EXTERNAL GATE
Chirp direction		up, down
Maximum bandwidth		n × 20 MHz
Pulse period		≥200 ns
Pulse width		≥100 ns
Maximum chirp rate		n × 10 MHz/µs, nominal

Inputs for external modulation signals

Modulation inputs EXT1 and EXT2 for FM, φM, AM, LOG AM, FSK, PSK and ASK	input voltage for FM, φM and AM (peak value for selected modulation depth or deviation)	1 V
	input voltage range for LOG AM	–6 V to + 6 V
	input level for FSK, PSK and ASK	TTL-compatible signal
	input impedance	50 Ω, 600 Ω or 100 kΩ
	polarity for FSK, PSK and ASK	selectable
	modulation input bandwidth for FM, φM, AM and LOG AM	200 kHz or 10 MHz
Modulation input PULSE IN	input level	threshold TTL, 0.5 V or –2.5 V
	input impedance	50 Ω or 10 kΩ
	polarity	selectable

[13] With attenuator (R&S®SMF-B26/-B27 option), Attenuator mode AUTO.
Without attenuator (R&S®SMF-B26/-B27 option), level ≥ 0 dBm.

Modulation sources

Internal modulation generators (LF generator 1, LF generator 2, noise generator) (R&S®SMF-B20 option)

Waveforms	LF generator 1, LF generator 2	sine, pulse, triangle, trapezoid, user-programmable ramp ΔT = 20 ms
	noise generator	noise amplitude distribution: Gaussian, equal
Sine	frequency range	0.1 Hz to 10 MHz
	frequency uncertainty	<0.003 Hz + relative deviation of reference frequency
	resolution of setting	0.1 Hz
	setting time to within $<1 \times 10^{-7}$, after IEC/IEEE bus delimiter	<3 ms
	distortion at f < 100 kHz, R_L > 50 Ω, level (V_p) 0.5 V	<0.5 %
Pulse	period	1 µs to 100 s
	width	1 µs to 100 s
	resolution of setting	20 µs
Triangle	period	1 µs to 100 s
	rise time	1 µs to 100 s
	resolution of setting	20 ns
Trapezoid	period	1 µs to 100 s
	rise time	1 µs to 100 s
	high time	1 µs to 100 s
	fall time	1 µs to 100 s
	resolution of setting	20 ns
Noise generator	noise amplitude distribution	Gaussian, equal
	noise bandwidth	100 kHz to 10 MHz
Frequency response	f ≤ 500 kHz	<0.5 dB
	f ≤ 10 MHz	<3 dB
Output voltage	V_p at LF connector, open circuit voltage	1 mV to 6 V
	EMF resolution	1 mV
	EMF setting accuracy at 1 kHz, level (V_p) 1 V	<11 mV
Output impedance		50 Ω
Sweep	digital sweep in discrete steps	
	operating modes	automatic, step, single sweep, external single, external step, external start/stop, manual or external trigger, linear or logarithmic spacing
	sweep range	full frequency range
	step width (lin)	full frequency range
	step width (log)	0.01 % to 100 % per step

Pulse generator (R&S®SMF-K23 option)

Operating modes		automatic, external trigger, external gate, single pulse, double pulse, delayed pulse (external trigger)
Active trigger edge		positive or negative
Pulse period		20 ns to 100 s
Resolution		5 ns
Uncertainty		relative deviation of reference frequency
Pulse width	Pulse width of double pulses can be set independently.	5 ns to 100 s
Resolution		5 ns
Uncertainty	Pulse width of double pulses can be set independently.	relative deviation of reference frequency
Pulse delay		10 ns to 100 s
Resolution		5 ns
Uncertainty		relative deviation of reference frequency

Double-pulse delay		10 ns to 100 s
Resolution		5 ns
Uncertainty		relative deviation of reference frequency
External trigger		
Delay	external input pulse to SYNC output pulse	typ. 55 ns
Jitter		<5 ns
Generator output PULSE OUT		LVC signal ($R_L \geq 50\ \Omega$)

Pulse train (R&S®SMF-K27 option)

Operating mode	additional mode for pulse generator (R&S®SMF-K23 option) to define sequences of pulses
Number of pulses	2 to 1023
ON/OFF times	5 ns to 5 ms

Power analysis (R&S®SMF-K28 option)

Modes	power vs. frequency (frequency response) power vs. power (power sweep, AM/AM) power vs. time (Trace mode)	
General settings	number of points per sweep (= steps)	10 to 1000 (default: 200)
	frequency range	depending on sensor and R&S®SMF frequency options, support of frequency converting DUTs
	settable Y-axis range	–80 dBm to + 40 dBm
	timing	fast normal
	uncertainty of measured power	determined by power sensor used (e.g. <0.1 dB at –40 dBm, Fast mode using the R&S®NRP-Z21)
	run mode	single continuous
	display modes	small (block diagram still visible, markers not visible) full screen marker (maximum size with markers) full screen (maximum size, markers not visible)
	number of traces	3 (to be used for sensor data or as reference trace)
	markers	4
	save	traces can be stored to file (formats: JPG, BMP, XPM, PNG) and in CSV format
	resolution of saved graphics	320 × 240, 640 × 480, 800 × 600 or 1024 × 768
Power vs. frequency (frequency response)	supported power sensors	R&S®NRP-Z11, R&S®NRP-Z21, R&S®NRP-Z22, R&S®NRP-Z23, R&S®NRP-Z24 R&S®NRP-Z51, R&S®NRP-Z52, R&S®NRP-Z55 R&S®NRP-Z91, R&S®NRP-Z92 required firmware version: V4.01 or later (V4.10 recommended) R&S®NRP-Z81 required firmware version: V1.20 or later
	spacing	linear logarithmic
	sweep time	depending on timing, steps and sensor, typ. 2 s at 200 steps, Fast mode

Power vs. power (power sweep, AM/AM)	supported power sensors	R&S®NRP-Z11, R&S®NRP-Z21, R&S®NRP-Z22, R&S®NRP-Z23, R&S®NRP-Z24 R&S®NRP-Z51, R&S®NRP-Z52, R&S®NRP-Z55 R&S®NRP-Z91, R&S®NRP-Z92 required firmware version: V4.01 or later (V4.10 recommended) R&S®NRP-Z81 required firmware version: V1.20 or later
	sweep time	depending on timing, steps and sensor, typ. 2 s at 200 steps, Fast mode
Power vs. time (Trace mode)	supported power sensors	R&S®NRP-Z11, R&S®NRP-Z21, R&S®NRP-Z22, R&S®NRP-Z23, R&S®NRP-Z24 required firmware version: V4.10 or later R&S®NRP-Z81 required firmware version: V1.20 or later
	sweep time	
	R&S®NRP-Z11, R&S®NRP-Z21, R&S®NRP-Z22, R&S®NRP-Z23, R&S®NRP-Z24	100 µs to 300 ms
	R&S®NRP-Z81	100 ns to 1 s
	trigger modes	free run auto
	trigger level	settable by value, cursor or automatically
	other trigger parameters	hysteresis, drop-out time, positive or negative trigger offset

General data

Remote control

Systems	IEC/IEEE bus in line with IEC 60625 (IEEE 488) with R&S®SMF-B83 option Ethernet, TCP/IP
Command set	SCPI 1999.5
Connector	
IEC	24-contact Amphenol (with R&S®SMF-B83 option)
Ethernet	Western
USB	with R&S®SMF-B84 option
IEC/IEEE bus address	0 to 30
Interface functions IEC	SH1, AH1, T6, L4, SR1, RL1, PP1, DC1, DT1, C0
LAN interface	10/100BaseT

Operating data

Power supply	input voltage range	
	50 Hz to 60 Hz, –5 %/+10 %	100 V to 240 V (AC) ±10 %
	50 Hz to 400 Hz, –5 %/+10 %	100 V to 120 V (AC) ±10 %
	power consumption	250 VA
Power factor correction		in line with EN 61000-3-2
EMC		in line with EMC directive of EU (2004/108/EC), applied standard EN 61326 (immunity for industrial environment; class A emissions) [14]
Immunity to interfering field strength		up to 10 V/m
Environmental conditions	operating temperature range	0 °C to +55 °C in line with EN 60068-2-1, EN 60068-2-2
	maximum operating altitude	4600 m
	storage temperature range	–40 °C to +75 °C
	climatic resistance, +40 °C/95 % rel. humidity	in line with EN 60068-2-3
Mechanical resistance	vibration, sinusoidal	5 Hz to 150 Hz, max. 2 g at 55 Hz, max. 0.5 g at 55 Hz to 150 Hz, in line with EN 60068-2-6
	vibration, random	10 Hz to 300 Hz, acceleration 1.2 g (rms) in line with EN 60068-2-64
	shock	40 g shock spectrum, in line with EN 60068-2-27, MIL-STD-810E
Electrical safety		in line with IEC 61010-1, EN 61010-1, CAN/CSA-C22.2 No. 61010-1-04, UL 61010-1
Approvals		VDE-GS, $_{C}$CSA$_{US}$
Dimensions	(W × H × D)	427 mm × 132 mm × 550 mm (16.8 in × 5.2 in × 21.7 in)
Weight	when fully equipped	18 kg (39.7 lb)
Recommended calibration interval		3 years

[14] The instrument complies with the emission requirements stipulated by EN 55011 class A. This means that the instrument is suitable for use in industrial environments. In line with EN 61000-6-4, operation in residential, commercial and business areas or in small-size companies is not covered. Thus, the instrument may not be operated in residential, commercial and business areas or in small-size companies, unless additional measures are taken to ensure that EN 61000-6-3 is complied with.

Ordering information

Designation	Type	Order No.
Microwave Signal Generator [15]	R&S®SMF100A	1167.0000.02
Including power cable, quick start guide and CD-ROM (with operating and service manual)		
Options		
Frequency Range 1 GHz to 22 GHz [16] (adapter for 3.5 mm female included)	R&S®SMF-B122	1167.7004.03
Frequency Range 1 GHz to 43.5 GHz [16] (adapter for 2.4 mm female + 2.9 mm female included)	R&S®SMF-B144	1167.7204.03
OCXO Reference Oscillator [17, 18]	R&S®SMF-B1	1167.9159.02
Frequency Extension 100 kHz to 1 GHz [17]	R&S®SMF-B2	1167.4005.02
AM/FM/φM/LOG AM Modulator [17]	R&S®SMF-B20	1167.9594.02
Enhanced Phase Noise Performance [17]	R&S®SMF-B22	1415.2204.02
Step Attenuator 100 kHz to 22 GHz [17]	R&S®SMF-B26	1167.5553.02
Step Attenuator 100 kHz to 43.5 GHz [17]	R&S®SMF-B27	1167.5776.02
High Output Power (not in combination with R&S® SMF-B2) [17]	R&S®SMF-B32	1415.2304.02
High Output Power (in combination with R&S® SMF-B2) [17]	R&S®SMF-B34	1415.2404.02
Rear Connectors 22 GHz [17]	R&S®SMF-B81	1167.5999.02
Rear Connectors 43.5 GHz [17]	R&S®SMF-B82	1167.6208.02
Removable GPIB [19]	R&S®SMF-B83	1167.6408.02
Removable USB [19]	R&S®SMF-B84	1167.6608.02
Removable Flash Disk [17, 19]	R&S®SMF-B85	1167.6808.02
Narrow Pulse Modulation	R&S®SMF-K3	1167.7804.02
Ramp Sweep	R&S®SMF-K4	1167.7604.02
Pulse Generator	R&S®SMF-K23	1167.7704.02
Pulse Train [20]	R&S®SMF-K27	1415.2004.02
Power Analysis	R&S®SMF-K28	1415.2104.02
Service options		
Two-Year Calibration Service	R&S®CO2SMF100A	Please contact your local sales office.
Three-Year Calibration Service	R&S®CO3SMF100A	
Five-Year Calibration Service	R&S®CO5SMF100A	
One-Year Repair Service following the warranty period	R&S®RO2SMF100A	
Two-Year Repair Service following the warranty period	R&S®RO3SMF100A	
Four-Year Repair Service following the warranty period	R&S®RO5SMF100A	
Documentation of Calibration Values	R&S®DCV-2	0240.2193.19
DKD (ISO 17025) Calibration including ISO 9000 calibration (can only be ordered with the device)	R&S®SMF22-DKD	1161.3594.00
	R&S®SMF44-DKD	1161.3620.00

[15] The base unit can only be ordered together with an R&S®SMF-B122 or R&S®SMF-B144 frequency option.

[16] Option fitted by factory.

[17] Option fitted by factory or especially equipped Rohde & Schwarz service department.

[18] Option cannot be installed with an R&S®SMF-B22 enhanced phase noise performance option (not required).

[19] Only two of the three R&S®SMF-B83/84/85 options can be installed simultaneously.

[20] Requires R&S®SMF-K23 pulse generator option.

Recommended extras		
Wideband Power Sensor (for use with R&S®SMF-K28)	R&S®NRP-Z81	1137.9009.02
Hardcopy manuals (in English, UK)		1167.2319.32
Hardcopy manuals (in English, US)		1167.2319.39
Spare Compact Flash Card (R&S®SMF-B85 required)	R&S®SMF-Z10	1167.8100.02
19“ Rack Adapter	R&S®ZZA-311	1096.3277.00
Keyboard with USB Interface (US character set)	R&S®PSL-Z2	1157.6870.04
Mouse with USB Interface, optical	R&S®PSL-Z10	1157.7060.03
External USB DVD Drive	R&S®PSP-B6	1134.8201.22
Adapters for the R&S®SMF100A with the R&S®SMF-B122 frequency option		
3.5 mm female		1021.0512.00
3.5 mm male		1021.0529.00
N female		1021.0535.00
N male		1021.0541.00
Adapters for the R&S®SMF100A with the R&S®SMF-B144 frequency option		
2.4 mm female		1088.1627.02
2.9 mm female		1036.4790.00
2.9 mm male		1036.4802.00
N female		1036.4777.00
N male		1036.4783.00

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Regional contact

Europe, Africa, Middle East
+49 1805 12 42 42* or +49 89 4129 137 74
customersupport@rohde-schwarz.com
North America
1 888 TEST RSA (1 888 837 87 72)
customer.support@rsa.rohde-schwarz.com
Latin America
+1 410 910 79 88
customersupport.la@rohde-schwarz.com
Asia/Pacific
+65 65 13 04 88
customersupport.asia@rohde-schwarz.com

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ISO 9001
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ISO 14001
DQS REG. NO 1954 UM

For product brochure,
see PD 5213.7660.12
and www.rohde-schwarz.com

Rohde&Schwarz GmbH&Co. KG
Mühldorfstraße 15 | 81671 München
Phone +49 89 41 290 | Fax +49 89 41 29 121 64

www.rohde-schwarz.com

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Subject to change

*0.14 €/min within German wireline network; rates may vary in other networks (wireline and mobile) and countries.