

R&S® SMF100A Microwave Generator Specifications

Test & Measurement

Data Sheet | 03.01



75 Years of
Driving
Innovation


ROHDE & SCHWARZ

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 for transport up to an altitude of 4600 m above sea level.

RF characteristics

Frequency

Range	R&S®SMF-B122 with option frequency extension 100 kHz to 1 GHz R&S®SMF-B2	1 GHz to 22 GHz 100 kHz to 22 GHz
	R&S®SMF-B144 with option frequency extension 100 kHz to 1 GHz R&S®SMF-B2	1 GHz to 43.5 GHz 100 kHz to 43.5 GHz
Resolution of setting		0.001 Hz
Setting time	to within $<1 \times 10^{-7}$ for $f \geq 375$ 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	$100 \text{ kHz} \leq f < 375 \text{ MHz}$	175 MHz/ms
	$375 \text{ MHz} \leq f < 750 \text{ MHz}$	87.5 MHz/ms
	$750 \text{ MHz} \leq f < 1.5 \text{ GHz}$	175 MHz/ms
	$1.5 \text{ GHz} \leq f < 3 \text{ GHz}$	350 MHz/ms
	$3 \text{ GHz} \leq f < 11 \text{ GHz}$	700 MHz/ms
	$11 \text{ GHz} \leq f < 21 \text{ GHz}$	1400 MHz/ms
	with R&S®SMF-B122 frequency option $21 \text{ GHz} \leq f \leq 22 \text{ GHz}$	1400 MHz/ms
	with R&S®SMF-B144 frequency option $21 \text{ GHz} \leq f \leq 43.5 \text{ GHz}$	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 $\geq 1 \text{ k}\Omega$	sawtooth signal 0 V to 10 V

Reference frequency

Aging	after 30 days of uninterrupted operation	$<1 \times 10^{-8}/\text{day}$, $<1 \times 10^{-6}/\text{year}$
	with R&S [®] SMF-B1 option	$<5 \times 10^{-10}/\text{day}$, $<3 \times 10^{-8}/\text{year}$
Temperature effect	in temperature range 0 °C to +55 °C	$\pm 1 \times 10^{-6}$
	with R&S [®] SMF-B1 option	$\pm 6 \times 10^{-9}$
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. $4 \times 10^{-9}/\text{V}$ to $3 \times 10^{-8}/\text{V}$
	input voltage	-10 V to +10 V
	input impedance	typ. 10 k Ω

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

Maximum specified level with R&S [®] SMF-B122 frequency option (PEP) ¹				
	without R&S [®] SMF-B31 high output power option		with R&S [®] SMF-B31 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 \leq f < 11 GHz	+16 dBm	+14 dBm	+25 dBm	+23 dBm
11 GHz \leq f < 21 GHz	+14 dBm	+12 dBm	+23 dBm	+21 dBm
21 GHz \leq f \leq 22 GHz	+12 dBm	+10 dBm	+22 dBm	+20 dBm

Maximum specified level with options R&S [®] SMF-B122 and R&S [®] SMF-B2 (PEP) ¹				
	without R&S [®] SMF-B31 high output power option		with R&S [®] SMF-B31 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 \leq f < 300 kHz ²	typ. +13 dBm	typ. +13 dBm	typ. +13 dBm	typ. +13 dBm
300 kHz \leq f < 1 GHz ³	+16 dBm	+15 dBm	+16 dBm	+15 dBm
1 GHz \leq f < 11 GHz	+13 dBm	+11 dBm	+20 dBm	+18 dBm
11 GHz \leq f < 16 GHz	+10 dBm	+8 dBm	+19 dBm	+17 dBm
16 GHz \leq f < 21 GHz	+10 dBm	+8 dBm	+17 dBm	+15 dBm
21 GHz \leq f \leq 22 GHz	typ. +8 dBm	typ. +6 dBm	typ. +15 dBm	typ. +13 dBm

Maximum specified level with R&S [®] SMF-B144 frequency option (PEP) ⁴				
	without R&S [®] SMF-B31 high output power option		with R&S [®] SMF-B31 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 \leq f < 11 GHz	+13 dBm	+11 dBm	+20 dBm	+18 dBm
11 GHz \leq f < 16 GHz	+10 dBm	+8 dBm	+19 dBm	+17 dBm
16 GHz \leq f < 21 GHz	+10 dBm	+8 dBm	+17 dBm	+15 dBm
21 GHz \leq f < 36 GHz	+10 dBm	+7 dBm	+10 dBm	+7 dBm
36 GHz \leq f \leq 40 GHz	+7 dBm, typ. +9 dBm	+4 dBm, typ. +7 dBm	+7 dBm, typ. +9 dBm	+4 dBm, typ. +7 dBm
40 GHz < f \leq 43.5 GHz	typ. +7 dBm	typ. +3 dBm	typ. +7 dBm	typ. +3 dBm

¹ With 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 is decreased by 2.5 dB.

³ With active pulse modulation the level is decreased by 5 dB.

⁴ With 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 options R&S [®] SMF-B144 and R&S [®] SMF-B2 (PEP) ⁵				
	without R&S [®] SMF-B31 high output power option		with R&S [®] SMF-B31 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	+13 dBm	+11 dBm	+20 dBm	+18 dBm
11 GHz ≤ f < 16 GHz	+10 dBm	+8 dBm	+19 dBm	+17 dBm
16 GHz ≤ f < 21 GHz	+10 dBm	+8 dBm	+17 dBm	+15 dBm
21 GHz ≤ f < 36 GHz	+10 dBm	+7 dBm	+10 dBm	+7 dBm
36 GHz ≤ f ≤ 40 GHz	+7 dBm, typ. +9 dBm	+4 dBm, typ. +7 dBm	+7 dBm, typ. +9 dBm	+4 dBm, typ. +7 dBm
40 GHz < f ≤ 43.5 GHz	typ. +7 dBm	typ. +3 dBm	typ. +7 dBm	typ. +3 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
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

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

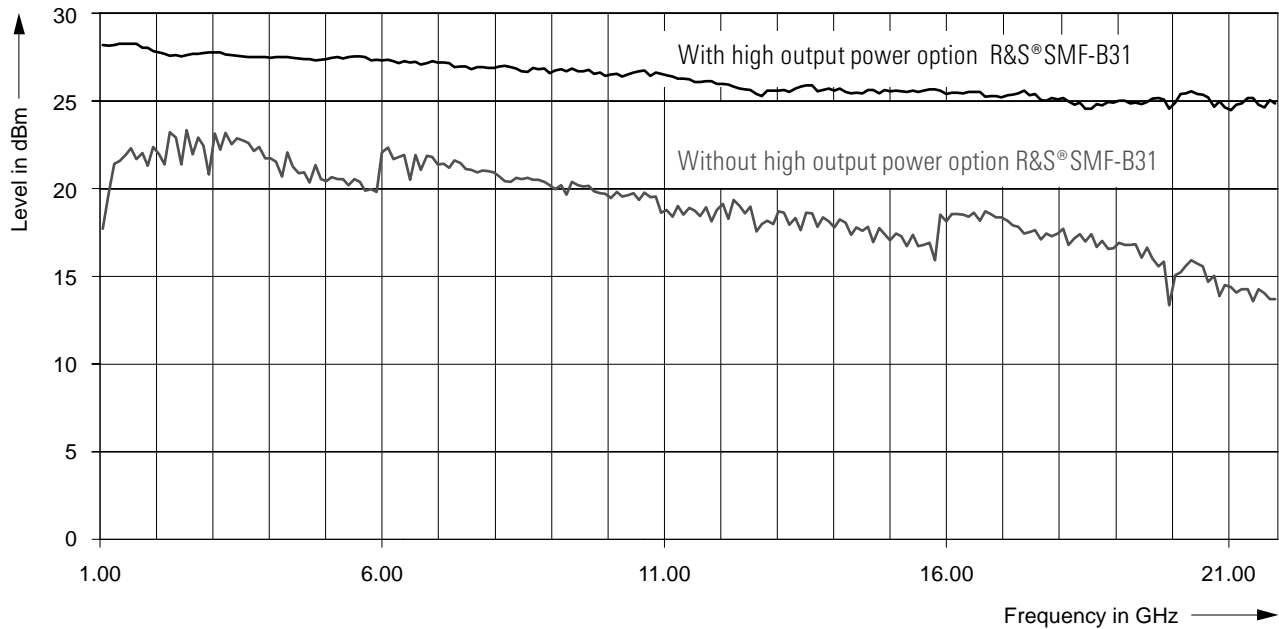
⁶ With active pulse modulation the level is decreased by 2.5 dB.

⁷ With active pulse modulation the level is decreased by 5 dB.

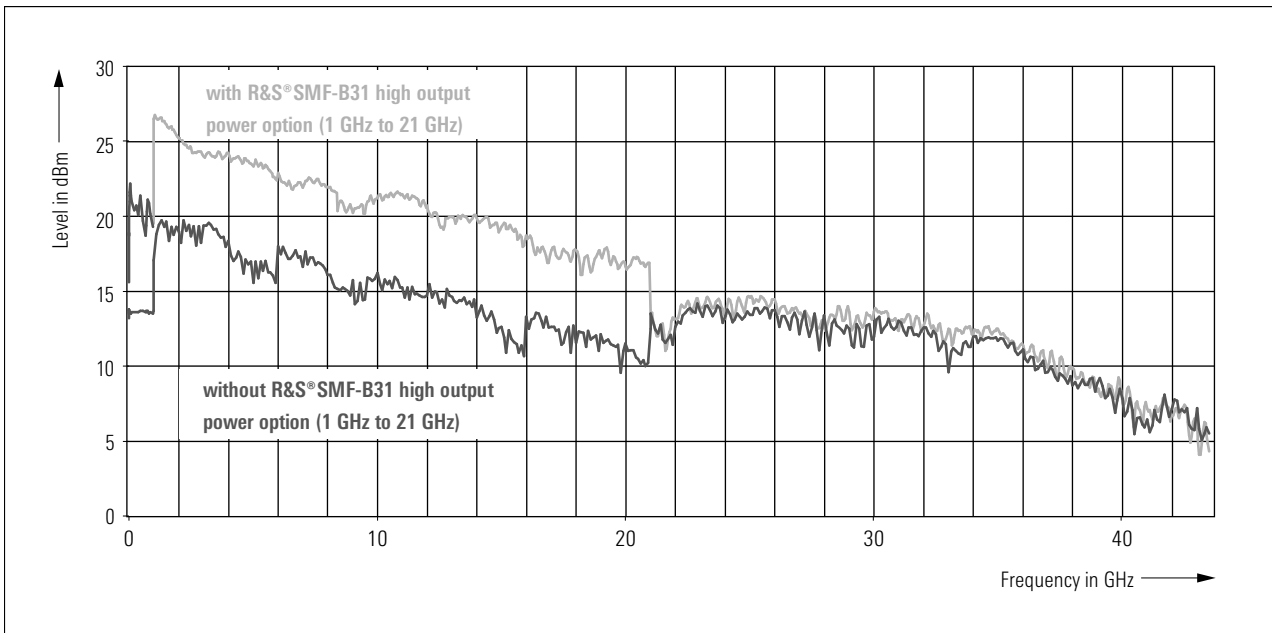
Back-feed (from $\geq 50 \Omega$ source)	1 GHz $\leq f \leq$ 43.5 GHz	
	maximum permissible RF power in output	0.5 W
	maximum permissible DC voltage	0 V

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

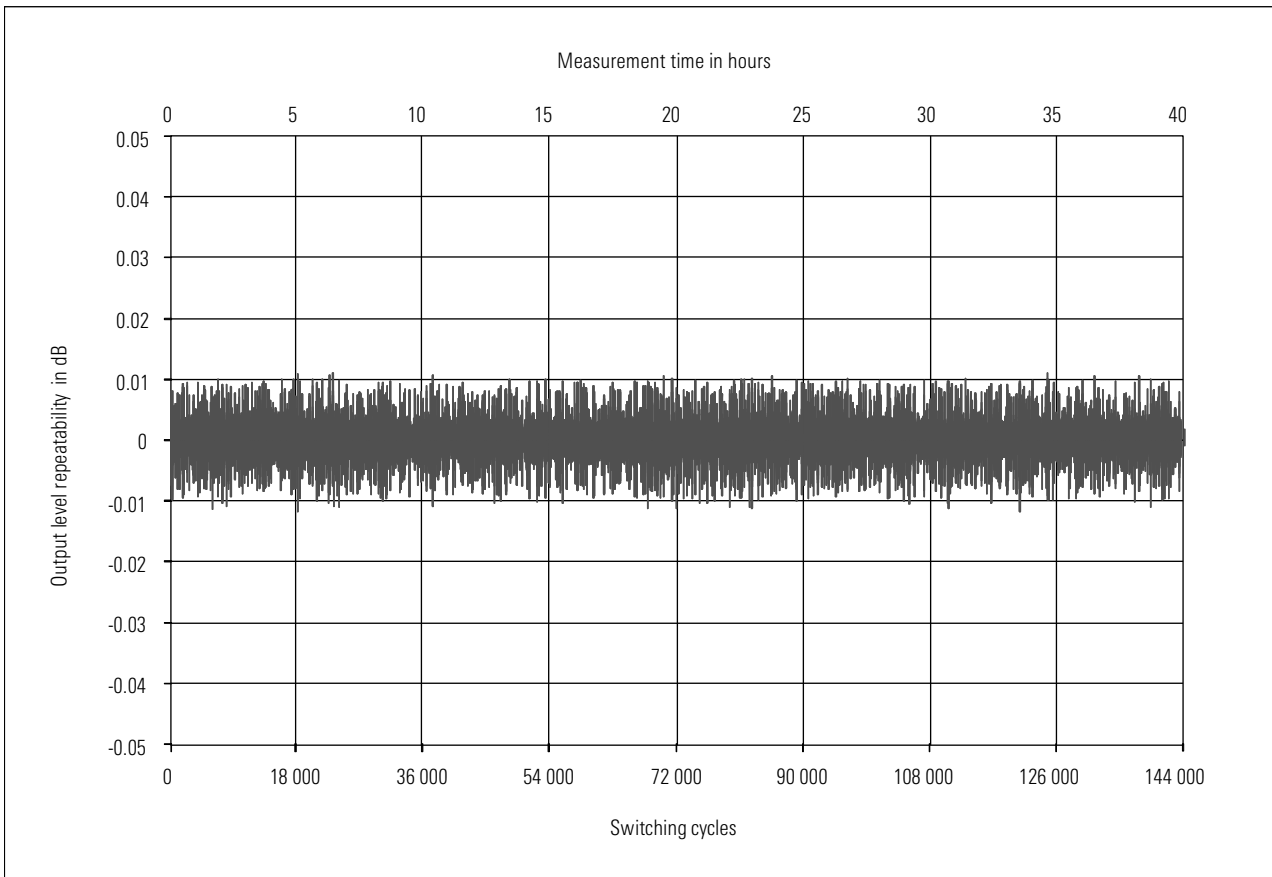


Maximum output power with and without the high output power option in the frequency range 1 GHz to 22 GHz (in both cases with the R&S®SMF-B26 step attenuator option)



Maximum output power with and without the high output power option in the frequency range 100 kHz to 43.5 GHz
 (with 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 frequency extension R&S[®]SMF-B2



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 $f \geq 1$ GHz)		
	without R&S [®] SMF-B31 high output power option	with R&S [®] SMF-B31 high output power option
$100 \text{ kHz} \leq f < 300 \text{ kHz}$	typ. $< -25 \text{ dBc}$	typ. $< -25 \text{ dBc}$
$300 \text{ kHz} \leq f < 10 \text{ MHz}$	$< -30 \text{ dBc}$	$< -30 \text{ dBc}$
$10 \text{ MHz} \leq f < 200 \text{ MHz}$	$< -40 \text{ dBc}$, typ. $< -45 \text{ dBc}$	$< -40 \text{ dBc}$, typ. $< -45 \text{ dBc}$
$200 \text{ MHz} \leq f < 1 \text{ GHz}$	$< -50 \text{ dBc}$, typ. $< -55 \text{ dBc}$	$< -50 \text{ dBc}$, typ. $< -55 \text{ dBc}$
$1 \text{ GHz} \leq f \leq 22 \text{ GHz}$	$< -50 \text{ dBc}$, typ. $< -55 \text{ dBc}$	$< -30 \text{ dBc}$

Harmonics ⁸ with R&S [®] SMF-B144 frequency option level +10 dBm (with R&S [®] SMF-B2 level +6 dBm for $f \geq 1$ GHz) or maximum specified level, whichever is lower		
	without R&S [®] SMF-B31 high output power option	with R&S [®] SMF-B31 high output power option
$100 \text{ kHz} \leq f < 300 \text{ kHz}$	typ. $< -25 \text{ dBc}$	typ. $< -25 \text{ dBc}$
$300 \text{ kHz} \leq f < 10 \text{ MHz}$	$< -30 \text{ dBc}$	$< -30 \text{ dBc}$
$10 \text{ MHz} \leq f < 200 \text{ MHz}$	$< -40 \text{ dBc}$, typ. $< -45 \text{ dBc}$	$< -40 \text{ dBc}$, typ. $< -45 \text{ dBc}$
$200 \text{ MHz} \leq f < 1 \text{ GHz}$	$< -50 \text{ dBc}$, typ. $< -55 \text{ dBc}$	$< -50 \text{ dBc}$, typ. $< -55 \text{ dBc}$
$1 \text{ GHz} \leq f < 21 \text{ GHz}$	$< -50 \text{ dBc}$, typ. $< -55 \text{ dBc}$	$< -30 \text{ dBc}$
$21 \text{ GHz} \leq f \leq 43.5 \text{ GHz}$	$< -40 \text{ dBc}$	$< -40 \text{ dBc}$

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

Subharmonics ¹⁰ with R&S [®] SMF-B122 frequency option, level +10 dBm		
	without R&S [®] SMF-B31 high output power option	with R&S [®] SMF-B31 high output power option
$f < 11 \text{ GHz}$	none	none
$11 \text{ GHz} \leq f \leq 22 \text{ GHz}$	$< -55 \text{ dBc}$	$< -50 \text{ dBc}$

Subharmonics ¹⁰ with R&S [®] SMF-B144 frequency option, level +10 dBm or maximum specified level, whichever is lower		
	without R&S [®] SMF-B31 high output power option	with R&S [®] SMF-B31 high output power option
$f < 11 \text{ GHz}$	none	none
$11 \text{ GHz} \leq f < 36 \text{ GHz}$	$< -50 \text{ dBc}$	$< -50 \text{ dBc}$
$36 \text{ GHz} \leq f \leq 43.5 \text{ GHz}$	$< -30 \text{ dBc}$	$< -30 \text{ dBc}$

Wideband noise with R&S [®] SMF-B122 frequency option, level +10 dBm, carrier offset $> 10 \text{ MHz}$, measurement bandwidth 1 Hz, CW		
	without R&S [®] SMF-B31 high output power option	with R&S [®] SMF-B31 high output power option
$3 \text{ GHz} \leq f < 11 \text{ GHz}$	typ. $< -148 \text{ dBc}$	typ. $< -140 \text{ dBc}$
$11 \text{ GHz} \leq f \leq 22 \text{ GHz}$	typ. $< -145 \text{ dBc}$	typ. $< -140 \text{ dBc}$

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 at maximum specified level, whichever is lower, carrier offset >10 MHz, measurement bandwidth 1 Hz, CW

	without R&S®SMF-B31 high output power option	with R&S®SMF-B31 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

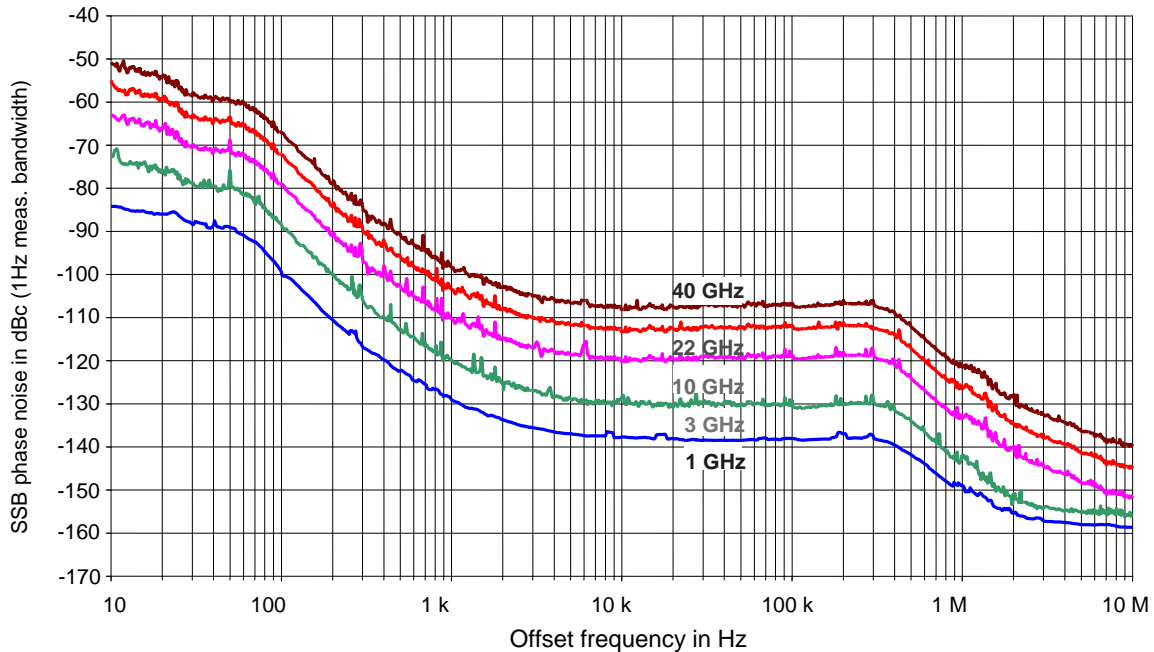
carrier offset 100 Hz, measurement bandwidth 1 Hz, CW

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	<-130 dBc
f = 1 GHz	<-135 dBc
f = 2 GHz	<-129 dBc
f = 4 GHz	<-123 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	<-128 dBc	<-128 dBc
1 GHz	<-77 dBc	<-95 dBc	<-120 dBc	<-133 dBc	<-133 dBc
2 GHz	<-71 dBc	<-89 dBc	<-114 dBc	<-129 dBc	<-127 dBc
4 GHz	<-65 dBc	<-83 dBc	<-108 dBc	<-123 dBc	<-121 dBc
10 GHz	<-57 dBc	<-75 dBc	<-100 dBc	<-115 dBc	<-113 dBc
20 GHz	<-51 dBc	<-69 dBc	<-94 dBc	<-111 dBc	<-107 dBc
40 GHz	<-45 dBc	<-63 dBc	<-88 dBc	<-105 dBc	<-101 dBc



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

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 (ϕ M), phase shift keying (PSK), pulse modulation

Simultaneous modulation

	FM	ϕ M	AM	LOG AM	Pulse mod.	FSK	PSK	ASK
FM	+	-	+	+	+	-	-	+
ϕ M	-	+	+	+	+	-	-	+
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	$f_{mod} = 1 \text{ kHz}$, $m < 80 \%$	<(5 % of reading + 1 %)
AM distortion ¹¹	$f_{mod} = 1 \text{ kHz}$, $m = 60 \%$	
	$100 \text{ kHz} \leq f < 1 \text{ MHz}$	typ. <5 %
	$1 \text{ MHz} \leq f < 10 \text{ MHz}$	<2.5 %
	$10 \text{ MHz} \leq f < 1 \text{ GHz}$	<1 %
Modulation frequency response ¹¹	$1 \text{ GHz} \leq f \leq 43.5 \text{ GHz}$	<1.5 %
	$10 \text{ MHz} \leq f \leq 43.5 \text{ GHz}$, $m = 60 \%$	
	DC/10 Hz to 20 kHz	<1 dB
	DC/10 Hz to 100 kHz	<3 dB

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	$10 \text{ MHz} \leq f \leq 43.5 \text{ GHz}$	<10 μ s

¹¹ For level up to maximum specified level.

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 = ⅙
	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 = ⅙
	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 kBit to 200 kBit/s
Rise/fall time (10 %/90 %) ¹²	10 MHz ≤ f ≤ 43.5 GHz	<10 μs

¹² For level up to maximum specified level.

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 = ⅙	
	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 MBit/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 = ⅙	
	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 kBit/s to 500 kBit/s	

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
	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	
	1 GHz ≤ f < 3 GHz	
	without R&S®SMF-B31 option	<75 mV (peak-to-peak value)
	with R&S®SMF-B31 option	<150 mV (peak-to-peak value)
	3 GHz ≤ f ≤ 43.5 GHz	
	without R&S®SMF-B31 option	<5 mV (peak-to-peak value)
with R&S®SMF-B31 option	<10 mV (peak-to-peak value)	

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

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 $\Delta T = 20$ 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	$f \leq 500$ kHz	<0.5 dB
	$f \leq 10$ 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)

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 recommended below 18 GHz: R&S® NRP-Z21 recommended above 18 GHz: R&S® NRP-Z55 required firmware version: V4.01 or later
Modes	power vs. frequency (frequency response) power vs. power (power sweep, AM/AM)
Number of points per sweep (= steps)	10 to 1000 (default 500)
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 (2 ms averaging time/step) normal (20 ms averaging time/step)
Spacing	linear logarithmic
Uncertainty	<0.1 dB at -40 dBm, mode fast using R&S® NRP-Z21
Sweep time	depending of timing, steps and sensor typ. 2 s at 300 steps, mode fast
Number of sensors	1
Markers	2
Hardcopy	trace can be stored to file (formats: JPG, BMP, XPM, PNG)

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) ¹³
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, cCSA _{US}
Dimensions (W × H × D)		427 mm × 132 mm × 550 mm (16.81 in × 5.2 in × 21.65 in)
Weight	when fully equipped	18 kg (39.68 lb)
Recommended calibration interval		3 years

¹³ 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 is not covered in residential, commercial, and business areas nor in small-size companies. Thus, the instrument must not be operated in residential, commercial, and business areas nor in small-size companies, unless additional measures are taken to ensure that EN 61000-6-3 is met.

Ordering information

Designation	Type	Order No.
Microwave Signal Generator ¹⁴	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 ¹⁵ (Adapter 3.5 mm female included)	R&S [®] SMF-B122	1167.7004.02
Frequency Range 1 GHz to 43.5 GHz ¹⁵ (Adapter 2.4 mm female + 2.9 mm female included)	R&S [®] SMF-B144	1167.7204.02
OCXO Reference Oscillator ¹⁶	R&S [®] SMF-B1	1167.9159.02
Frequency Extension 100 kHz to 1 GHz ¹⁶	R&S [®] SMF-B2	1167.4005.02
AM/FM/ϕM/LOG AM Modulator ¹⁶	R&S [®] SMF-B20	1167.9594.02
Step Attenuator 100 kHz to 22 GHz ¹⁶	R&S [®] SMF-B26	1167.5553.02
Step Attenuator 100 kHz to 43.5 GHz ¹⁶	R&S [®] SMF-B27	1167.5776.02
High Output Power 1 GHz to 22 GHz ^{16, 17}	R&S [®] SMF-B31	1167.7404.02
Rear Connectors 22 GHz ¹⁶	R&S [®] SMF-B81	1167.5999.02
Rear Connectors 43.5 GHz ¹⁶	R&S [®] SMF-B82	1167.6208.02
Removable GPIB ¹⁸	R&S [®] SMF-B83	1167.6408.02
Removable USB ¹⁸	R&S [®] SMF-B84	1167.6608.02
Removable Flash Disk ^{16, 18}	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	R&S [®] SMF-K27	1415.2004.02
Power Analysis	R&S [®] SMF-K28	1415.2104.02
Service options		
Calibration Option 2 years	R&S [®] CO2SMF100A	1167.0000S15
Calibration Option 3 years	R&S [®] CO3SMF100A	1167.0000S11
Calibration Option 5 years	R&S [®] CO5SMF100A	1167.0000S13
Repair Option 2 years	R&S [®] RO2SMF100A	1167.0000S16
Repair Option 3 years	R&S [®] RO3SMF100A	1167.0000S12
Repair Option 5 years	R&S [®] RO5SMF100A	1167.0000S14
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
Recommended extras		
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 R&S [®] SMF100A with 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 R&S [®] SMF100A with 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

¹⁴ The base unit can only be ordered together with frequency option R&S[®]SMF-B122 or R&S[®]SMF-B144.

¹⁵ Option fitted by factory.

¹⁶ Option fitted by factory or especially equipped Rohde & Schwarz service department.

¹⁷ If ordered with frequency option R&S[®]SMF-B144 high output power option R&S[®]SMF-B31 works from 1 GHz to 21 GHz only.

¹⁸ Only two of the three options R&S[®]SMF-B83/84/85 can be installed simultaneously.

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For product brochure,
see PD 5213.7660.12
and www.rohde-schwarz.com
(search term: SMF100A)

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