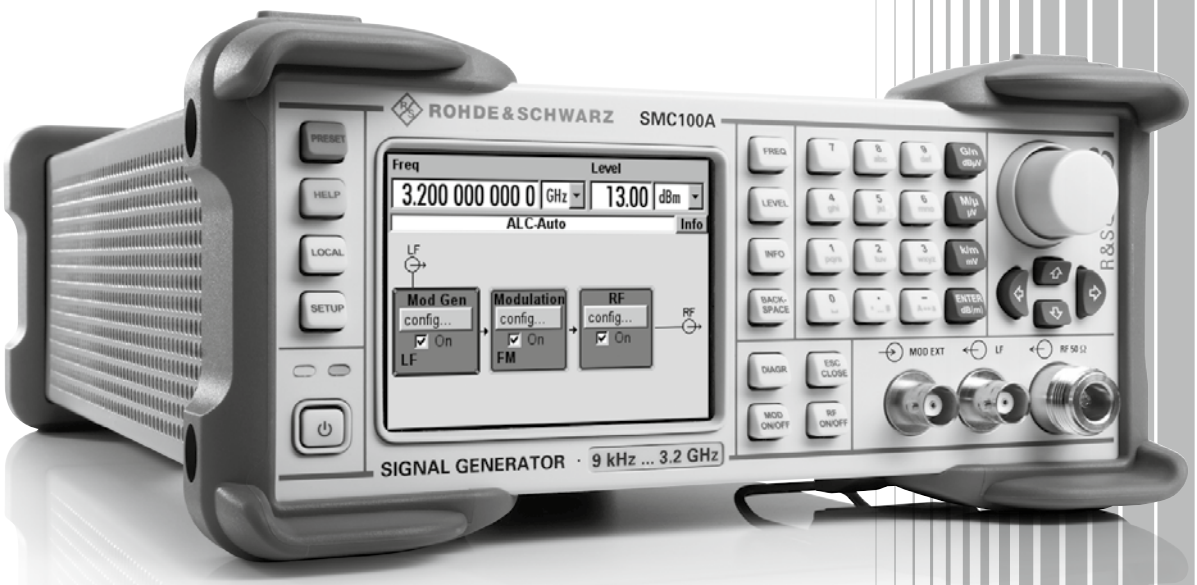
R&S®SMC100A
Signal Generator
Specifications



ROHDE&SCHWARZ

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Key features

High performance at an attractive price

- Low SSB phase noise of typ. –111 dBc (f = 1 GHz, 20 kHz carrier offset, 1 Hz measurement bandwidth)
- Wideband noise of typ. < –146 dBc (f > 1 MHz, carrier offset > 10 MHz, 1 Hz measurement bandwidth)
- Nonharmonics of typ. < –72 dBc (f ≤ 1600 MHz, carrier offset > 10 kHz)
- Level error < 0.9 dB
- Frequency and level setting times < 5 ms
- Optional high-stability reference oscillator

Flexible and universal all-purpose signal generator

- Frequency range 9 kHz to 1.1 GHz or 3.2 GHz
- Typical maximum level of > +17 dBm
- Analog modulation modes (AM/FM/φM/pulse modulation) integrated as standard
- Remote control compatibility with other signal generators
- Multiple language support (nine selectable GUI languages)
- Integrated overvoltage protection
- Wear-free electronic attenuator

Space-saving operation due to small dimensions

- Smallest signal generator in the economy class: ½ × 19", 2 height units
- Lightweight

Minimized total cost of ownership

- Attractive initial cost
- Long calibration interval
- Simplified error diagnostics through built-in selftests
- Repair by users by means of precalibrated replacement modules
- Optimization of level accuracy through level correction with R&S®NRP-Zxx sensors

Ideal tool for many application fields

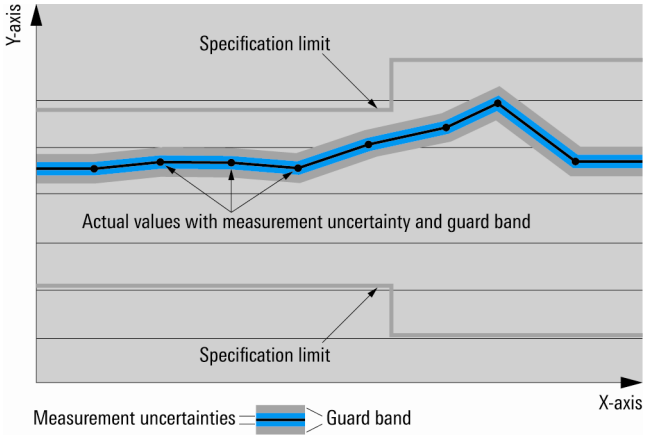
- Service and maintenance
- Research and education
- Field use
- Secure areas
- Simple production applications

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 <, ≤, >, ≥, ±, 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.

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

Specifications

RF characteristics

Frequency

Range	R&S®SMC-B101	9 kHz to 1.1 GHz
	R&S®SMC-B103	9 kHz to 3.2 GHz
Resolution of setting		0.001 Hz
Resolution of synthesis	f = 1 GHz	4.71 µHz (nom.)
Setting time	to within $< 1 \times 10^{-7}$ for f > 200 MHz or < 20 Hz for f ≤ 200 MHz	
	with R&S®SMC-K4 option after the IEC/IEEE bus delimiter	< 5 ms, < 2 ms (typ.)
	with R&S®SMC-K4 option after the IEC/IEEE bus delimiter in ALC OFF mode (S&H)	< 7 ms, < 3 ms (typ.)
Resolution of phase offset setting		0.1°

Frequency sweep

Operating mode		digital sweep in discrete steps
Trigger modes	execute sweep continuously with internal trigger source	auto
	execute one full sweep	single
	execute one step	step
	sweep start and stop controlled by external trigger signal	start/stop
Trigger source	internal	timer
	external	external trigger signal (INST TRIG at rear), rotary knob, remote control
Trigger slope	external trigger signal	positive, negative
Sweep range		full frequency range
Sweep shape		sawtooth, triangle
Step size	linear	full frequency range
	logarithmic	0.01 % to 100 % per step
Dwell time setting range		10 ms to 10 s
Dwell time setting resolution		0.1 ms

Reference frequency

Frequency error	at time of calibration in production	
		$< 1 \times 10^{-7}$
	with R&S®SMC-B1 option	$< 1 \times 10^{-8}$
Aging (after 30 days of uninterrupted operation)		$< 1 \times 10^{-6}$/year
	with R&S®SMC-B1 option	$< 1 \times 10^{-9}$/day, $< 1 \times 10^{-7}$/year
Temperature effect (0 °C to +55 °C)		$< 2 \times 10^{-6}$
	with R&S®SMC-B1 option	$< 1 \times 10^{-7}$
Warm-up time	to nominal thermostat temperature (only with R&S®SMC-B1 option)	≤ 10 min
Output for internal reference frequency		
Connector type	REF OUT on rear panel	BNC female
Output frequency	sine wave	10 MHz
Output level		+6 dBm to +12 dBm, 9 dBm (typ.)
Source impedance		50 Ω (nom.)
Input for external reference frequency		
Connector type	REF IN on rear panel	BNC female
Input frequency		10 MHz
Frequency locking range		$\pm 3 \times 10^{-6}$
Input level range		0 dBm to +16 dBm
Input impedance		50 Ω (nom.)

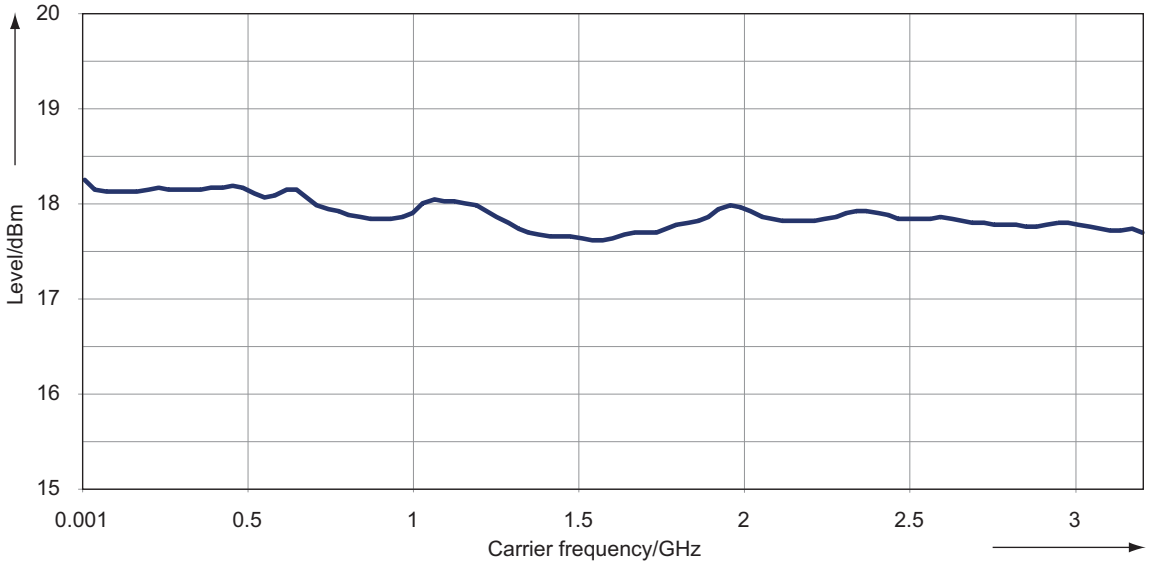
Level

The R&S®SMC100A has two different operating modes for setting the level:

AUTO MODE: The step attenuator is switched over automatically. The output level is specified over the full range from –120 dBm to +13 dBm.

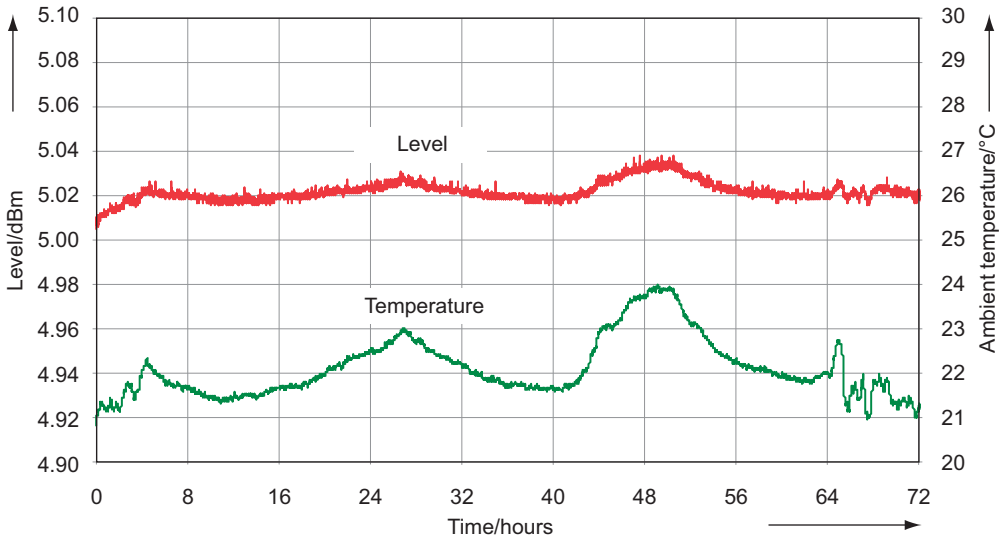
FIXED MODE: The level is set without changing the step attenuator. The step attenuator is thus fixed to the current setting. If ALC is ON, level changes are performed without interruption. The maximum interruption-free setting range is limited. If this range is exceeded, the spectral purity of the output signal decreases.

Setting range		–120 dBm to +19 dBm
Specified level range	200 kHz ≤ f ≤ 3.2 GHz	–120 dBm to +13 dBm (PEP) [1]
Resolution		0.01 dB
Level error	ALC ON, AUTO mode, temperature range +18 °C to +33 °C in specified level range	< 0.9 dB
	additional level error with ALC OFF S&H	< 0.5 dB
Output impedance VSWR in 50 Ω system	in specified level range	< 1.8
Setting time	to < 0.1 dB deviation from final value	
	with R&S®SMC-K4 option after the IEC/IEEE bus delimiter	< 5 ms, < 2 ms (typ.)
	with R&S®SMC-K4 option after the IEC/IEEE bus delimiter in ALC OFF mode (S&H)	< 7 ms, < 3 ms (typ.)
Interruption-free level setting	FIXED MODE, ALC ON	
	setting range	0 dB to 20 dB
Reverse power from 50 Ω source at R&S®SMC-B101, R&S®SMC-B103	maximum permissible RF power in output frequency range of RF path for f ≥ 1 MHz	
	1 MHz ≤ f ≤ 1 GHz	50 W
	1 GHz < f ≤ 2 GHz	25 W
	2 GHz < f ≤ 3.2 GHz	10 W
Maximum permissible DC voltage		50 V



Maximum available level (meas.)

[1] PEP = peak envelope power.



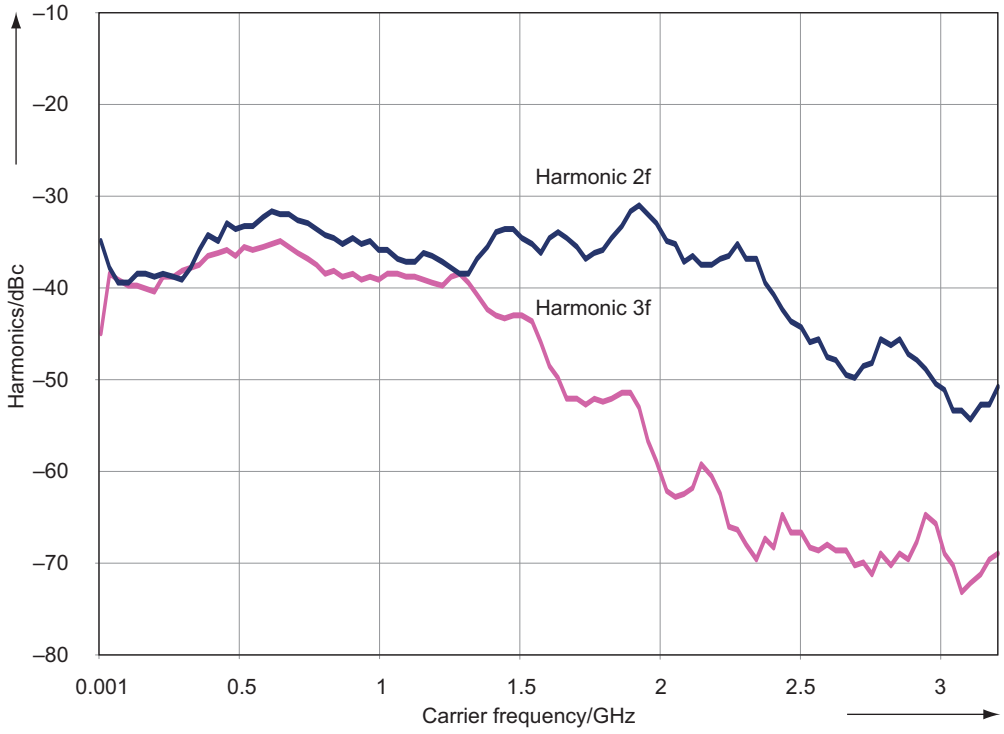
Level repeatability at 3 GHz, +5 dBm, ALC ON (meas.)

Level sweep

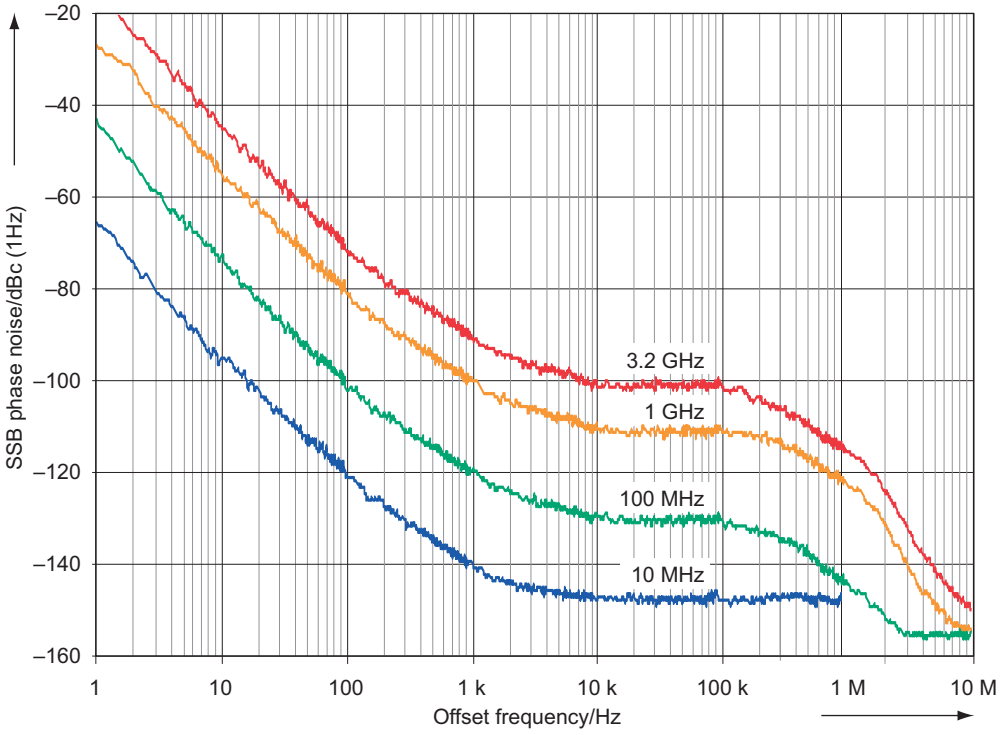
Operating mode		digital sweep in discrete steps
Trigger modes	execute sweep continuously with internal trigger source	auto
	execute one full sweep	single
	execute one step	step
	sweep start and stop controlled by external trigger signal	start/stop
Trigger source	internal	timer
	external	external trigger signal, rotary knob, remote control
Trigger slope	external trigger signal	positive, negative
Sweep range		full specified level range
	interruption-free level sweep with attenuator mode FIXED	+0.01 dB to +20 dB
Sweep shape		sawtooth, triangle
Step size setting resolution		0.01 dB
Dwell time setting range		10 ms to 10 s
Dwell time setting resolution		0.1 ms

Spectral purity

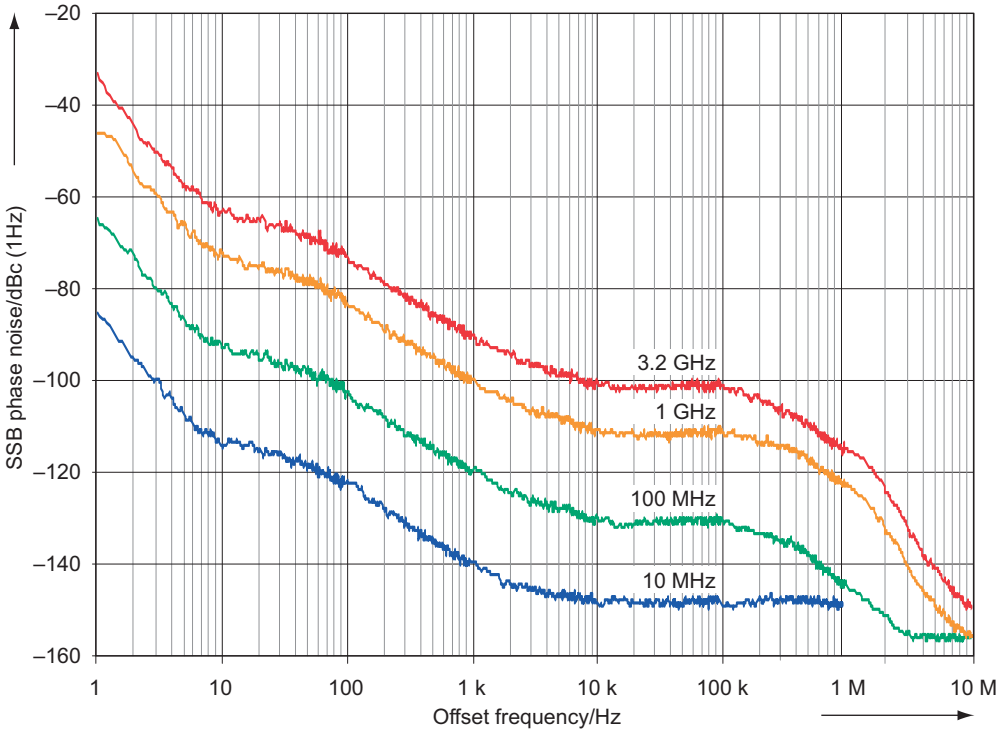
Harmonics	f > 1 MHz, level ≤ 8 dBm	< –30 dBc
Nonharmonics	CW, level > –10 dBm, offset > 10 kHz from carrier	
	f ≤ 1600 MHz	< –60 dBc, < –72 dBc (typ.)
	1600 MHz < f ≤ 3200 MHz	< –54 dBc
Wideband noise	f > 1 MHz, carrier offset > 10 MHz, level > 5 dBm, measurement bandwidth 1 Hz, CW	< –138 dBc, < –146 dBc (typ.)
SSB phase noise	carrier offset 20 kHz, measurement bandwidth 1 Hz	
	f = 1 GHz	< –105 dBc, –111 dBc (typ.)
	f = 2 GHz	< –99 dBc, –105 dBc (typ.)
	f = 3.2 GHz	< –95 dBc, –101 dBc (typ.)
Residual FM	RMS value at f = 1 GHz, CW	
	0.3 kHz to 3 kHz	< 5 Hz, 1 Hz (typ.)
	0.03 kHz to 23 kHz	< 30 Hz, 8 Hz (typ.)
Residual AM	RMS value (0.03 kHz to 20 kHz) level = 8 dBm	< 0.02 %, < 0.005 % (typ.)



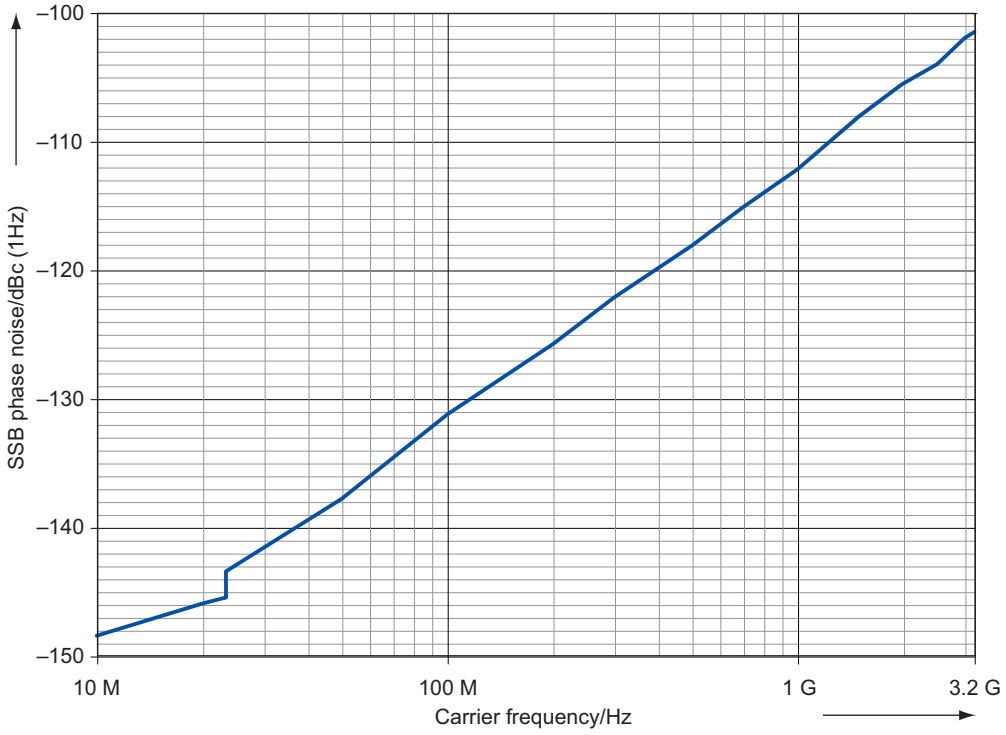
Harmonics versus carrier frequency at +13 dBm output level (level mode AUTO) (meas.)



SSB phase noise with internal reference oscillator (meas.)



SSB phase noise with internal OCXO R&S®SMC-B1 (meas.)



SSB phase noise at 20 kHz offset versus frequency (meas.)

Analog modulation

Simultaneous modulation

	Amplitude modulation	Frequency modulation	Phase modulation	Pulse modulation
Amplitude modulation		+	+	(+)
Frequency modulation	+		–	+
Phase modulation	+	–		+
Pulse modulation	(+)	+	+	

+ = compatible
– = incompatible
(+) = compatible with limitations: no specification applies for AM distortion, AM depth error and pulse ON/OFF ratio

Amplitude modulation

For f > 100 kHz, attenuator mode AUTO, level (PEP) ≤ +8 dBm

Modulation source		internal, external
External coupling		AC, DC
AM depth setting range	at high levels, modulation is clipped when the maximum PEP is reached	0 % to 100 %
Resolution of setting		1 %
AM depth error	at f_{mod} = 1 kHz and m < 80 %	
	f ≤ 23.4375 MHz	< (1 % of setting + 1 %)
	f > 23.4375 MHz	< (4 % of setting + 1 %)
AM distortion	at f_{mod} = 1 kHz and m = 30 %	
	f ≤ 23.4375 MHz	< 1 %
	f > 23.4375 MHz	< 3 %
Modulation frequency response	m = 60 %, DC/10 Hz to 50 kHz	< 3 dB
Synchronous φM at AM	m = 30 %, f_{mod} = 1 kHz, peak	< 0.3 rad

Frequency modulation

Modulation source		internal, external
External coupling		AC, DC
Maximum deviation	f ≤ 23.4375 MHz	500 kHz
	23.4375 MHz < f ≤ 25 MHz	31.25 kHz
	25 MHz < f ≤ 50 MHz	62.5 kHz
	50 MHz < f ≤ 100 MHz	125 kHz
	100 MHz < f ≤ 200 MHz	250 kHz
	200 MHz < f ≤ 400 MHz	500 kHz
	400 MHz < f ≤ 800 MHz	1 MHz
	800 MHz < f ≤ 1.6 GHz	2 MHz
	1.6 GHz < f ≤ 3.2 GHz	4 MHz
Resolution		< 1 % of maximum deviation, minimum 10 Hz
FM deviation error	f_{mod} = 1 kHz	< (4 % of setting + 20 Hz)
FM distortion	at f_{mod} = 2 kHz and half the max. deviation	< 0.2 %
Modulation frequency response	DC/10 Hz to 100 kHz	< 3 dB
Synchronous AM at FM	40 kHz deviation, f_{mod} = 1 kHz, f > 10 MHz	< 0.2 %
Carrier frequency offset with FM DC	after FM offset adjustment	< 0.4 % of deviation setting

Phase modulation

Modulation source		internal, external
External coupling		AC, DC
Maximum deviation	f ≤ 23.4375 MHz	5 rad
	23.4375 MHz < f ≤ 25 MHz	0.3125 rad
	25 MHz < f ≤ 50 MHz	0.625 rad
	50 MHz < f ≤ 100 MHz	1.25 rad
	100 MHz < f ≤ 200 MHz	2.5 rad
	200 MHz < f ≤ 400 MHz	5 rad
	400 MHz < f ≤ 800 MHz	10 rad
	800 MHz < f ≤ 1.6 GHz	20 rad
	1.6 GHz < f ≤ 3.2 GHz	40 rad
Resolution		< 1 % of maximum deviation, minimum 0.001 rad
φM deviation error	f_{mod} = 1 kHz	< (4 % of setting + 0.01 rad)
φM distortion	at f_{mod} = 10 kHz and half of max. deviation	< 0.2 %
Modulation frequency response	DC/10 Hz to 100 kHz	< 3 dB

Pulse modulation

When pulse modulation is activated, the R&S®SMC100A automatically switches to the ALC mode S&H. In this case, the ALC loop is opened and the output level is set directly. In order to set the correct level, a Sample & Hold measurement is performed prior to each frequency and level setting.

Modulation source		internal, external
On/off ratio		> 80 dB
Rise/fall time	10 % to 90 % of RF amplitude	< 500 ns, < 100 ns (typ.)
Pulse repetition frequency		0 Hz to 500 kHz
Video crosstalk	spectral line of fundamental at 100 kHz (square wave signal)	< –30 dBc

Input for external modulation signals

Modulation input AM/FM/φM EXT		
Connector type	MOD EXT on front panel	BNC female
Input impedance	selectable	220 kΩ or 600 Ω (nom.)
Input sensitivity	peak value for set modulation factor or deviation	1 V (nom.)
Maximum input voltage	for linear operation	1 V (nom.)
Input damage voltage		±10 V
Modulation input PULSE		
Connector type	PULSE EXT/INST TRIG on rear panel	BNC female
Input impedance		8 kΩ (nom.)
Input voltage	TTL, CMOS compatible	
	threshold low	0.5 V (nom.)
	threshold high	1.5 V (nom.)
Input damage voltage		±10 V
Input polarity	selectable	normal, inverse

Modulation sources

Internal modulation generator

Waveform		sine wave
Frequency range		0.1 Hz to 100 kHz
Resolution of frequency setting		0.1 Hz
Frequency error		< (0.005 Hz + relative error of reference frequency × modulation frequency)
Frequency response	f ≤ 10 kHz	< 0.1 dB
	f ≤ 100 kHz	< 1 dB
Distortion	f ≤ 10 kHz at RL = 50 Ω, U_{peak} = 1 V	< 1 %
Output voltage range	U_{peak} at LF connector at RL ≥ 50 Ω	10 mV to 2.55 V
Resolution of output voltage setting		10 mV
Output voltage setting error	at 1 kHz, RL ≥ 1 kΩ	< (2 % of setting + 10 mV)
Output impedance		1 Ω (nom.)

LF frequency sweep

Operating mode		digital sweep in discrete steps
Trigger modes	execute sweep continuously with internal trigger source	auto
	execute one full sweep	single
	execute one step	step
	sweep start and stop controlled by external trigger signal	start/stop
Trigger source	internal	timer
	external	external trigger signal, rotary knob, remote control
Trigger slope	external trigger signal	positive, negative
Sweep range		full frequency range
Sweep shape		sawtooth, triangle
Step size	linear	full frequency range
	logarithmic	0.01 % to 100 % per step
Dwell time setting range		10 ms to 10 s
Dwell time setting resolution		0.1 ms

Pulse generator

The pulse generator is fully digitally implemented, the clock is directly derived from the instrument's reference frequency.

Pulse modes		single pulse, double pulse
Trigger mode	pulse generation of single pulses can be delayed additionally with external triggering	automatic (free run)
		external triggered
		external gated
Active trigger edge		positive or negative
Pulse period setting range		2 µs to 85 s
Pulse period setting resolution		100 ns
Pulse width setting range	The pulse widths of double pulses can be set independently.	1 µs to 1 s
Pulse width setting resolution		100 ns
Pulse delay setting range	with external trigger	100 ns to 1 s
Pulse delay setting resolution	with external trigger	100 ns
Double-pulse spacing setting range		1 µs to 1 s
Double-pulse spacing setting resolution		100 ns
External trigger delay		50 ns (meas.)
External trigger jitter of delay		< 20 ns (nom.)
PULSE/VIDEO output signal	without load	digital signal 0 V/3.3 V (nom.)
PULSE/VIDEO output impedance		50 Ω (nom.)

Remote control

Systems	with R&S®SMC-K4 option	IEC 60625 (GPIB IEEE-488.2)
		Ethernet (TCP/IP) 10/100 BaseT
		USB 2.0
Command set		SCPI 1999.5 or compatible command sets
Compatible command sets	supports a subset of common commands	Agilent/HP E4428C Agilent/HP E4438C Agilent/HP E8663 Agilent/HP E8257/67 Agilent/HP N51xx Analog Parts Agilent/HP 8642 Agilent/HP 8643 Agilent/HP 8644 Agilent/HP 8645 Agilent/HP 8647 Agilent/HP 8648 Agilent/HP 8656 Agilent/HP 8657 Agilent/HP 8664/65 Aeroflex/IFR 2023/2024 Aeroflex/IFR 203x, 204x, 205x R&S®SML01, R&S®SML02, R&S®SML03 R&S®SMT02, R&S®SMT03
IEC/IEEE bus address		0 to 30

Connectors

Front panel connectors

RF 50 Ω	RF output	type-N female
LF	modulation generator output	BNC female
MOD EXT	input for external analog modulation	BNC female

Rear panel connectors

REF IN	reference frequency input	BNC female
REF OUT	reference frequency output	BNC female
PULSE EXT/INST TRIG	input for external pulse modulation/ trigger input	BNC female
PULSE VIDEO	pulse generator output	BNC female
USB IN	remote control of instrument	USB type B
USB	connector for external USB devices, mouse and keyboard for graphical support of operation, R&S®NRP power sensors for external power measurements and level adjustment of instrument, memory stick for software update and data exchange	USB type A
LAN	provides remote control functionality and remote operation via VNC file transfer via FTP	RJ-45
IEEE488	remote control of instrument via GPIB	24-pin Amphenol female

General data

Power supply		
AC input voltage range		100 V to 240 V ±10 %
AC supply frequency		50 Hz to 60 Hz, –5 %/+10 %
Max. input current		1.2 A (100 V) to 0.4 A (240 V)
Power consumption	fully equipped, 230 V AC	45 W (meas.)
Power factor correction		in line with EN 61000-3-2
Electrical safety		
Compliance		in line with IEC 61010-1, EN 61010-1, CAN/CSA-C22.2 No. 61010-1-04, UL 61010-1
Test mark		VDE-GS, $_{C}$CSA$_{US}$
EMC		
Electromagnetic compatibility		in line with EN 55011 class B, EN 61326
Immunity to interfering field strength		up to 10 V/m
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
	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
Environmental conditions		
Temperature range	operating	0 °C to +55 °C in line with EN 60068-2-1, EN 60068-2-2
	storage	–40 °C to +71 °C
Climatic resistance	test: +40 °C/95 % rel. humidity	in line with EN 60068-2-78
Altitude	operating	up to 4600 m
	storage	up to 4600 m
Weight and dimensions		
Weight	when fully equipped	3.9 kg (8.6 lb)
Dimensions	width × height × depth	236 mm × 112 mm × 368 mm (9.3 in × 4.4 in × 14.5 in)
Calibration interval		
Recommended calibration interval	operation 40 h/week in the full range of the specified environmental conditions	3 years

Ordering information

Designation	Type	Order No.
Signal Generator [2], including power cable, Quick Start Guide and CD-ROM (with operating and service manual)	R&S®SMC100A	1411.4002.02
Options		
RF Path		
9 kHz to 1.1 GHz	R&S®SMC-B101	1411.6505.02
9 kHz to 3.2 GHz	R&S®SMC-B103	1411.6605.02
Reference Oscillator OCXO	R&S®SMC-B1	1411.6705.02
GPIB/IEEE488 Interface	R&S®SMC-K4	1411.3506.02
Documentation of Calibration Values	R&S®DCV-2	0240.2193.18
DKD (ISO 17025) Calibration including ISO 9000 calibration (can only be ordered with the device)	R&S®SMC-DKD	1415.7512.02

Recommended extras		
19” Rack Adapter (for two 2-HU instruments next to each other) Suitable for installation of two R&S®SMC100A instruments	R&S®ZZA-T35	1109.4506.00
19” Rack Adapter (for one 2-HU instruments + spacing module)	R&S®ZZA-T36	1109.4512.00
Power Sensor 9 kHz to 6 GHz, +23 dBm	R&S®NRP-Z91	1168.8004.02
Power Sensor 9 kHz to 6 GHz, +33 dBm	R&S®NRP-Z92	1171.7005.02
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

Service options		
Two-Year Calibration Service	R&S®CO2SMC100A	Please contact your local Rohde & Schwarz sales office.
Three-Year Calibration Service	R&S®CO3SMC100A	
Five-Year Calibration Service	R&S®CO5SMC100A	
One-Year Repair Service following the warranty period	R&S®RO2SMC100A	
Two-Year Repair Service following the warranty period	R&S®RO3SMC100A	
Four-Year Repair Service following the warranty period	R&S®RO5SMC100A	

For product brochure, see PD 5214.1143.12 and www.rohde-schwarz.com

License information

The firmware of this device contains open source software. Details as well as license agreements can be found in release notes and operating manual.

[2] The base unit must be ordered together with an R&S®SMC-B101/R&S®SMC-B103 frequency option.

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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