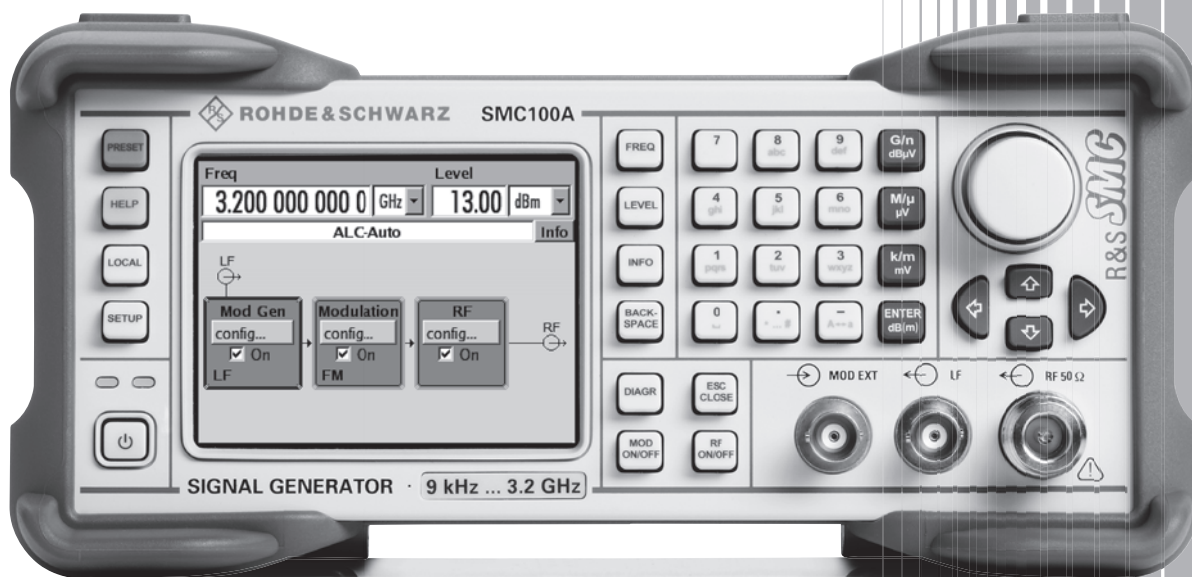


# R&S® SMC100A Signal Generator Specifications



**75** Years of  
Driving  
Innovation

  
**ROHDE & SCHWARZ**

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# Key features

## High performance at an attractive price

- Low SSB phase noise of typ.  $-111$  dBc (20 kHz carrier offset,  $f = 1$  GHz, 1 Hz measurement bandwidth)
- Wideband noise of typ.  $-148$  dBc ( $>10$  MHz carrier offset,  $f > 1$  MHz, 1 Hz measurement bandwidth)
- Nonharmonics of typ.  $-72$  dBc ( $>10$  kHz carrier offset,  $f \leq 1600$  MHz)
- Level uncertainty  $<0.9$  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/ $\phi$ M/pulse modulation) integrated as standard
- Remote control compatibility with other signal generators
- Integrated overvoltage protection
- Wear-free electronic attenuator

## Space-saving operation due to small dimensions

- Smallest signal generator in the economy class:  $\frac{1}{2} \times 19$ ", 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<sup>®</sup> NRP-Zxx sensors

## Ideal tool for many application fields

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

# 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. "Typical values" are designated with the abbreviation "typ.". These values are verified during the final test but are not assured by Rohde & Schwarz. "Nominal values" are design parameters that are not assured by Rohde & Schwarz. These values are verified during product development but are not specifically tested during production. Data without limits is not binding.

## RF characteristics

### Frequency

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

### Frequency sweep

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

### Reference frequency

Aging	after 30 days of uninterrupted operation	<math>< 1 \times 10^{-6}</math>/year
	with R&S <sup>®</sup> SMC-B1 option	<math>< 1 \times 10^{-9}</math>/day, <math>< 1 \times 10^{-7}</math>/year
Temperature effect	0 °C to +55 °C	<math>< 2 \times 10^{-6}</math>
	with R&S <sup>®</sup> SMC-B1 option	<math>< 1 \times 10^{-7}</math>
Warm-up time	to nominal thermostat temperature (only with R&S <sup>®</sup> SMC-B1 option)	≤10 min
Output for internal reference signal	frequency (waveform: sine)	10 MHz
	level	typ. +9 dBm
	source impedance	nominal 50 Ω
External reference input	frequency	10 MHz
	maximum deviation	$3 \times 10^{-6}$
	limits of input level	≥0 dBm, ≤+16 dBm
	input impedance	nominal 50 Ω

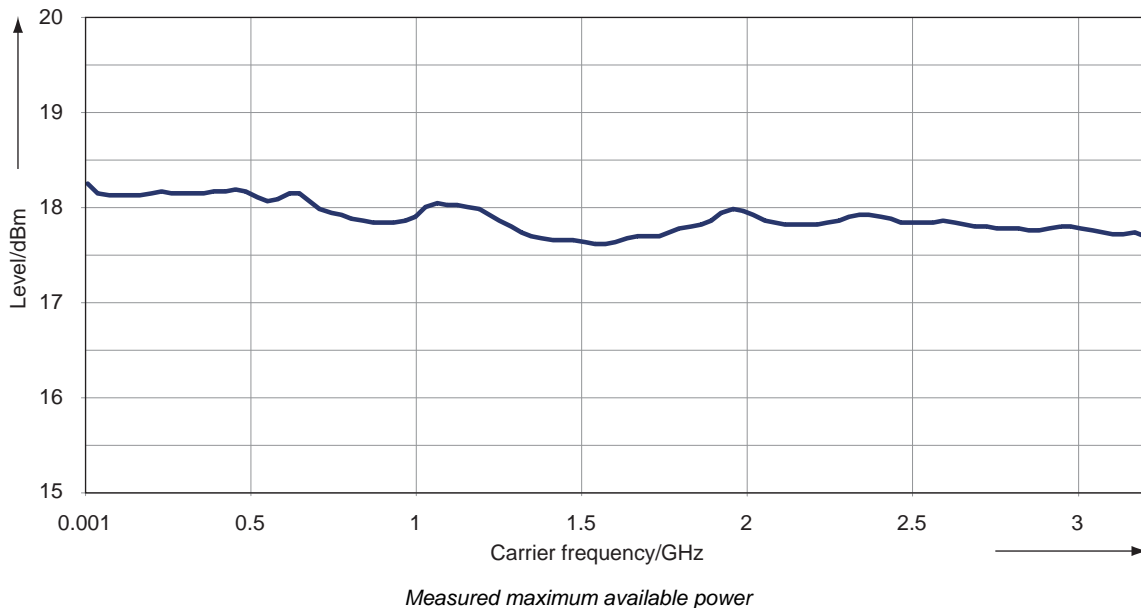
## Level

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

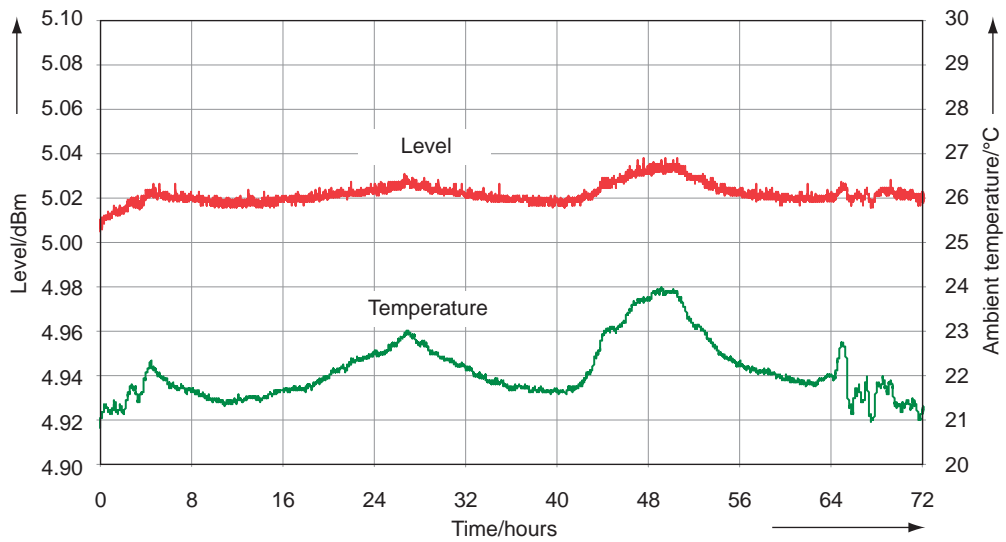
**AUTO MODE:** The step attenuator is switched over automatically. The output level is specified over the full range from -120 dBm to +13 dBm.

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



<sup>1</sup> PEP = peak envelope power.



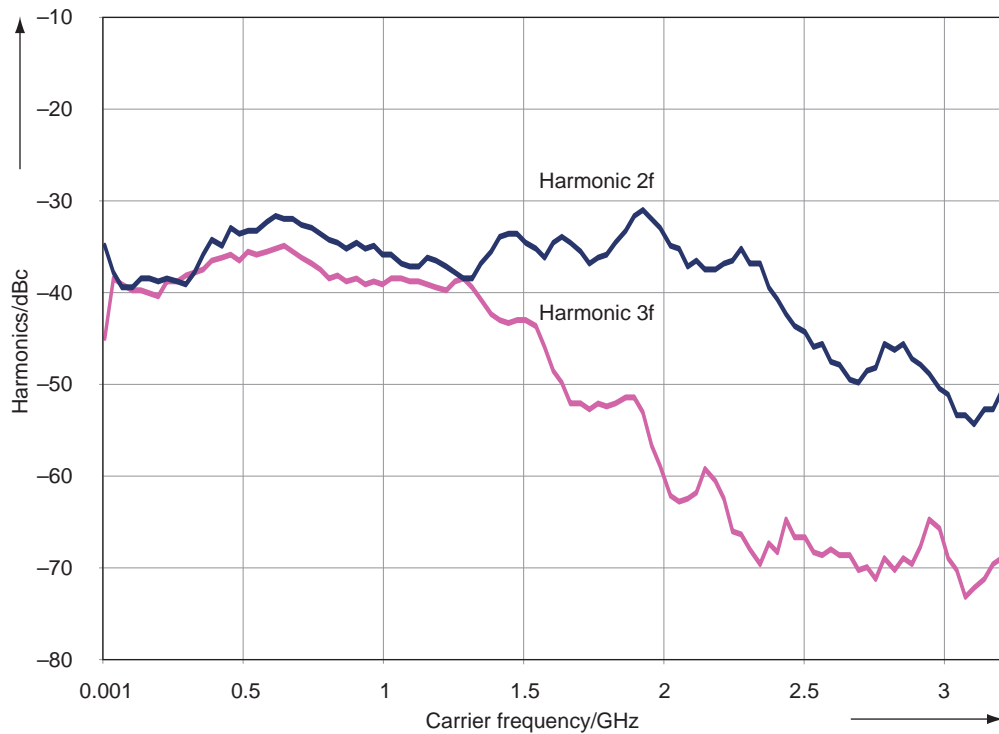
Measured level repeatability at 3 GHz, +5 dBm, ALC ON

### Level sweep

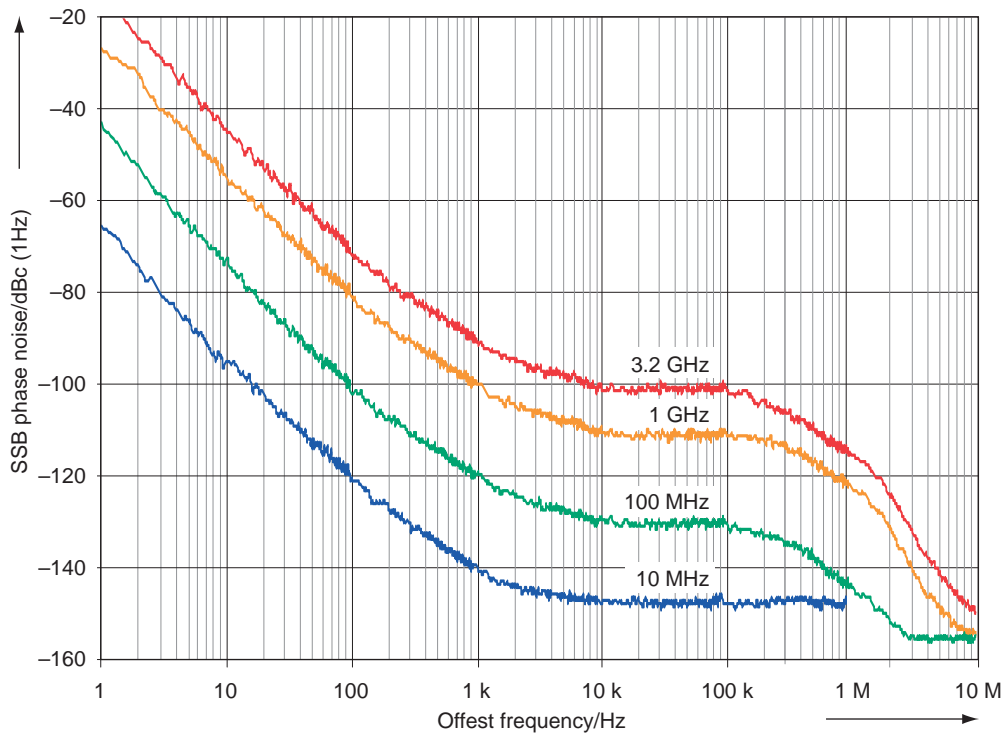
Operating modes	digital sweep in discrete steps	automatic, single sweep, step, manual or external trigger, linear in dB
Sweep range	interruption-free	full level range
Step size		+0.01 dB to +20 dB
		full level range

## Spectral purity

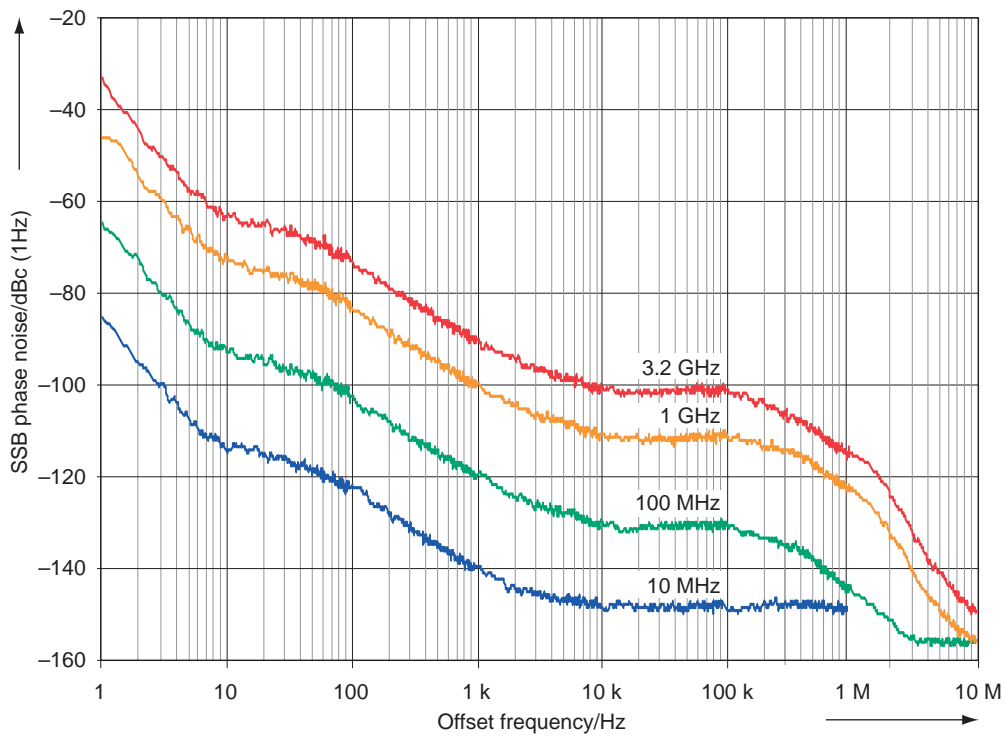
Harmonics	f > 1 MHz, level ≤ 8 dBm	<-30 dBc
Nonharmonics	CW, level > -10 dBm, offset > 10 kHz from carrier	
	f ≤ 1600 MHz	<-60 dBc (typ. -72 dBc)
	1600 MHz < f ≤ 3200 MHz	<-54 dBc
Wideband noise	f > 1 MHz, carrier offset > 10 MHz, level > 5 dBm, measurement bandwidth 1 Hz, CW	<-138 dBc (typ. -148 dBc)
SSB phase noise	carrier offset 20 kHz, measurement bandwidth 1 Hz	
	f = 1 GHz	<-105 dBc (typ. -111 dBc)
	f = 2 GHz	<-99 dBc (typ. -105 dBc)
	f = 3.2 GHz	<-95 dBc (typ. -101 dBc)
Residual FM	RMS value at f = 1 GHz, CW	
	0.3 kHz to 3 kHz	typ. 1 Hz
	0.03 kHz to 20 kHz	typ. 9 Hz
Residual AM	RMS value (0.03 kHz to 20 kHz)	typ. <0.02 %



Measured harmonics at +13 dBm versus carrier frequency (level mode AUTO)

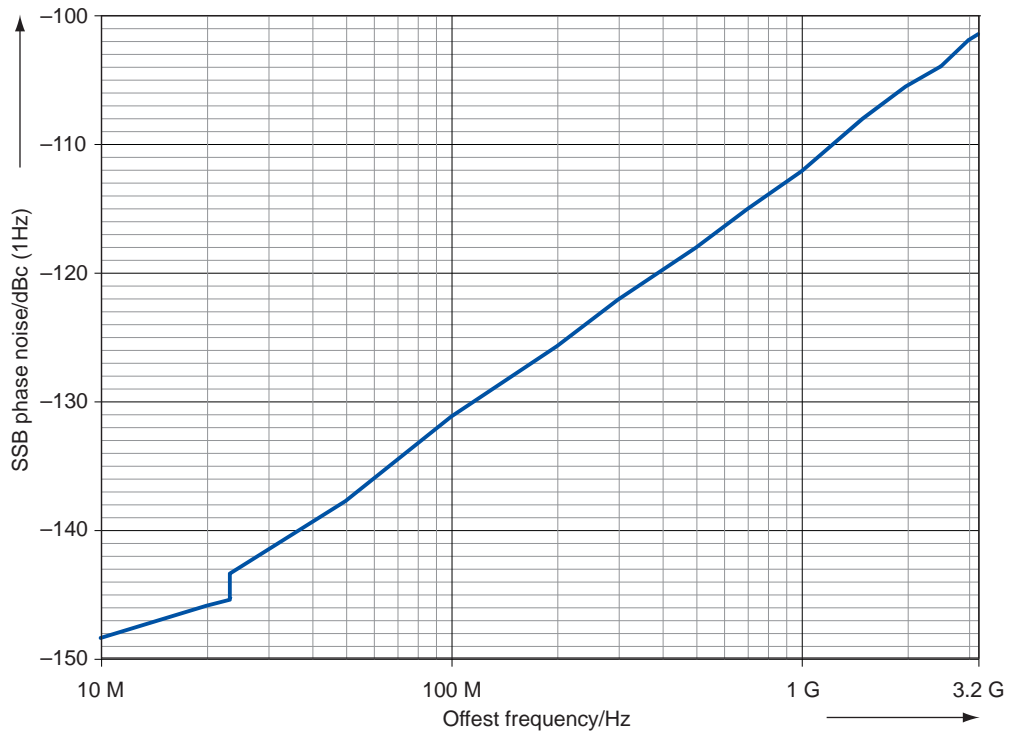


Measured SSB phase noise with internal reference oscillator



Measured SSB phase noise with internal OCXO R&S<sup>®</sup>SMC-B1





Measured SSB phase noise at 20 kHz offset versus frequency

# 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

## Amplitude modulation

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

Operating modes	AM	internal, external, AC/DC
Modulation factor	at high levels, modulation is clipped when the maximum PEP is reached	0 % to 100 %
Resolution		1 %
AM depth error	at $f_{\text{mod}} = 1$ kHz and $m < 80$ % $f \leq 23.4375$ MHz $f > 23.4375$ MHz	<(1 % of setting + 1 %) <(4 % of setting + 1 %)
AM distortion	at $f_{\text{mod}} = 1$ kHz $m = 30$ %, $f \leq 23.4375$ MHz $m = 30$ %, $f > 23.4375$ MHz	<1 % <3 %
Modulation frequency response	$m = 60$ %, DC/10 Hz to 50 kHz	<3 dB
Synchronous $\phi$ M at AM	$m = 30$ %, $f_{\text{mod}} = 1$ kHz, peak	typ. <0.2 rad

## Frequency modulation

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

## Phase modulation

Operating modes	$\phi$ M	internal, external, AC/DC
Maximum deviation	$f \leq 23.4375$ MHz	5 rad
	$23.4375$ MHz < $f \leq 25$ MHz	0.3125 rad
	$25$ MHz < $f \leq 50$ MHz	0.625 rad
	$50$ MHz < $f \leq 100$ MHz	1.25 rad
	$100$ MHz < $f \leq 200$ MHz	2.5 rad
	$200$ MHz < $f \leq 400$ MHz	5 rad
	$400$ MHz < $f \leq 800$ MHz	10 rad
	$800$ MHz < $f \leq 1.6$ GHz	20 rad
	$1.6$ GHz < $f \leq 3.2$ GHz	40 rad
Resolution		<1 % of maximum deviation, minimum 0.001 rad
Setting error	$f_{\text{mod}} = 1$ kHz	<(4 % of setting + 0.01 rad)
$\phi$ M distortion	at $f_{\text{mod}} = 10$ kHz and half the maximum deviation	<0.2 %
Modulation frequency response	DC/10 Hz to 100 kHz	<3 dB

## Pulse modulation

When pulse modulation is activated, the R&S<sup>®</sup>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.

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

## Input for external modulation signals

Modulation input AM/FM/ $\phi$ M EXT	input impedance	nominal 220 k $\Omega$ or 600 $\Omega$
	input sensitivity (peak value for set modulation factor or deviation)	nominal 1 V
	maximum permissible input voltage	$\pm 10$ V
Modulation input PULSE	nominal input level	
	threshold Low	nominal 0.5 V
	threshold High	nominal 1.5 V
	maximum permissible input voltage	$\pm 10$ V
	input impedance	nominal > 5 k $\Omega$
	polarity	selectable

## Modulation sources

### Internal modulation generator

Waveform		sine wave
Frequency range		0.1 Hz to 100 kHz
Resolution of setting		0.1 Hz
Frequency error		<(0.005 Hz + relative deviation of reference frequency × modulation frequency)
Frequency response	≤ 10 kHz	<0.1 dB
	≤ 100 kHz	<1 dB
Distortion	f ≤ 10 kHz at R <sub>L</sub> = 50 Ω, V <sub>p</sub> = 1 V	<1 %
Output voltage amplitude	V <sub>p</sub> at LF connector at R <sub>L</sub> ≥ 50 Ω	10 mV to 2.55 V
	resolution	10 mV
	setting error at 1 kHz, R <sub>L</sub> ≥ 1 kΩ	<(2 % of setting + 10 mV)
Output impedance		nominal 1 Ω
Frequency setting time	to within <1 × 10 <sup>-7</sup>	typ. <5 ms
Sweep	digital sweep in discrete steps	
	operating modes	automatic, single sweep, step, 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 %

### Pulse generator

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

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

## General data

### Remote control

Systems	IEC/IEEE bus, IEC 60625 (IEEE 488) (R&S® SMC-K4 option)	
	Ethernet (TCP/IP)	
	USB	
Command set	SCPI 1999.5 or compatible command sets	
Compatible command sets	supports a subset of common commands	Agilent/HP 8643A
		Agilent/HP 8644A/B
		Agilent/HP 8647A
		Agilent/HP 8648A/B/C/D
		Agilent/HP 8656A/B
Interface	IEC/IEEE bus	24-contact Amphenol
	Ethernet	Western
	USB host	USB type A
	USB device	USB type B
IEC/IEEE bus address	0 to 30	
IEC interface functions	SH1, AH1, T6, L4, SR1, RL1, PP1, DC1, DT1, C0	
LAN interface	10/100BaseT	

### Operating data

Power supply	input voltage range, AC, nominal	100 V to 240 V (AC) $\pm 10\%$
	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 factor correction	in line with EN 61000-3-2
Electromagnetic compatibility	in line with EN 55011 class B, EN 61326	
Immunity to interfering field strength	up to 10 V/m	
Environmental conditions	operating temperature range	0 °C to +55 °C in line with: DIN EN 60068-2-1, DIN EN 60068-2-2
	storage temperature range	-40 °C to +71 °C
	climatic resistance, test: +40 °C/95 % rel. humidity	in line with DIN EN 60068-2-78
	operating altitude	up to 4600 m
Mechanical resistance	sinusoidal vibration	5 Hz to 150 Hz, max. 2 g at 55 Hz, max. 0.5 g at 55 Hz to 150 Hz, in line with DIN EN 60068-2-6
	random	10 Hz to 300 Hz, acceleration 1.2 g (rms) in line with DIN EN 60068-2-64
	shock	40 g shock spectrum in line with DIN 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 <sub>US</sub>	
Dimensions	width x height x depth	236 mm x 112 mm x 368 mm
Weight	when fully equipped	nominal 3.9 kg
Recommended calibration interval	3 years	

# Ordering information

Designation	Type	Order No.
Signal Generator <sup>2</sup>	R&S <sup>®</sup> SMC100A	1411.4002.02
Including power cable, Quick Start Guide and CD-ROM (with operating and service manual)		
<b>Options</b>		
RF Path		
9 kHz to 1.1 GHz	R&S <sup>®</sup> SMC-B101	1411.6505.02
9 kHz to 3.2 GHz	R&S <sup>®</sup> SMC-B103	1411.6605.02
Reference Oscillator OCXO	R&S <sup>®</sup> SMC-B1	1411.6705.02
GPIO/IEEE488 Interface	R&S <sup>®</sup> SMC-K4	1411.3506.02
<b>Service options</b>		
Two-Year Calibration Service	R&S <sup>®</sup> CO2SMC100A	please contact your local sales office
Three-Year Calibration Service	R&S <sup>®</sup> CO3SMC100A	please contact your local sales office
Five-Year Calibration Service	R&S <sup>®</sup> CO5SMC100A	please contact your local sales office
One-Year Repair Service following the warranty period	R&S <sup>®</sup> RO2SMC100A	please contact your local sales office
Two-Year Repair Service following the warranty period	R&S <sup>®</sup> RO3SMC100A	please contact your local sales office
Four-Year Repair Service following the warranty period	R&S <sup>®</sup> RO5SMC100A	please contact your local sales office
Documentation of calibration values	R&S <sup>®</sup> DCV-2	0240.2193.18
DKD (ISO 17025) calibration including ISO 9000 calibration (can only be ordered with the device)	R&S <sup>®</sup> SMC-DKD	1415.7512.02
<b>Recommended extras</b>		
Hardcopy manuals (in English, UK)		1411.4060.32
Hardcopy manuals (in English, US)		1411.4060.39
19" Rack Adapter (for two 2-HU instruments next to each other) Suitable for installation of two R&S <sup>®</sup> SMC100A instruments	R&S <sup>®</sup> ZZA-T35	1109.4506.00
19" Rack Adapter (for one 2-HU instruments + spacing module)	R&S <sup>®</sup> ZZA-T36	1109.4512.00
Power Sensor 9 kHz to 6 GHz, +23 dBm	R&S <sup>®</sup> NRP-Z91	1168.8004.02
Power Sensor 9 kHz to 6 GHz, +33 dBm	R&S <sup>®</sup> NRP-Z92	1171.7005.02
Keyboard with USB Interface (US character set)	R&S <sup>®</sup> PSL-Z2	1157.6870.04
Mouse with USB Interface, optical	R&S <sup>®</sup> PSL-Z10	1157.7060.03

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



## Service you can rely on

- | In 70 countries
- | Person-to-person
- | Customized and flexible
- | Quality with a warranty
- | No hidden terms

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

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For product brochure,  
see PD 5214.1143.12  
and [www.rohde-schwarz.com](http://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.