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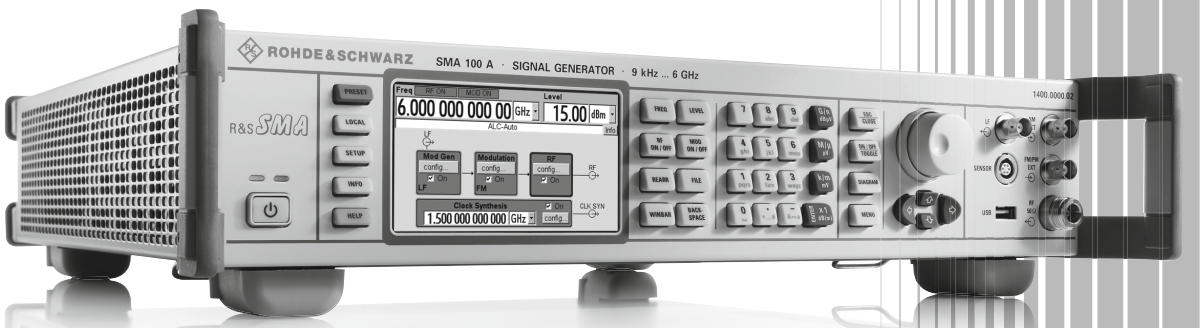
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R&S®SMA100A
Signal Generator
Specifications



ROHDE&SCHWARZ

Test & Measurement

Data Sheet | 07.00

CONTENTS

Key features **4**

Definitions **5**

Specifications **6**

RF performance 6

Frequency *6*

Frequency sweep *6*

Reference frequency *7*

Level *7*

Level sweep *9*

Spectral purity *10*

List mode *14*

Analog modulation 14

Possible modulation types *14*

Simultaneous modulation *14*

Amplitude modulation *14*

Frequency modulation (R&S®SMA-B20 or R&S®SMA-B22 option) *15*

Chirped pulses (R&S®SMA-B20 or R&S®SMA-B22 option) *16*

Phase modulation (R&S®SMA-B20 or R&S®SMA-B22 option) *17*

Pulse modulation *17*

VOR modulation (R&S®SMA-K25 option) *18*

ILS modulation (R&S®SMA-K25 option) *19*

Marker beacon (MKR BCN) (R&S®SMA-K25 option) *20*

ADF mode (R&S®SMA-K25 option) *20*

DME modulation (R&S®SMA-K26 option) *21*

Trigger and SYNC signals *22*

DME analysis (R&S®SMA-K26 option) *22*

Modulation sources 23

Internal modulation generator *23*

Multifunction generator (R&S®SMA-K24 option) *23*

LF frequency sweep *24*

Standard pulse generator *24*

High-performance pulse generator (R&S®SMA-K23 option) *24*

Pulse train (R&S®SMA-K27 option) *25*

Output for pulse generator signals *25*

Clock synthesizer (R&S®SMA-B29 option) ... 26
R&S®NRP-Z power analysis (R&S®SMA-K28 option) ... 27
Overview of power sensor functionalities ... *28*
Remote control ... 29
Connectors ... 30
Front-panel connectors ... *30*
Rear-panel connectors ... *31*
General data ... 32
Ordering information ... 33
License information ... 35

Key features

Excellent signal quality

- Very low SSB phase noise of typ. –134 dBc (20 kHz carrier offset, f = 1 GHz, 1 Hz measurement bandwidth), typ. –141 dBc with the enhanced phase noise performance option (R&S®SMA-B22)
- Wideband noise of –162 dBc (meas.) with carrier offset > 40 MHz, f = 1 GHz, level = 9 dBm, 1 Hz measurement bandwidth
- Nonharmonics of < –96 dBc (carrier offset > 10 kHz, f < 750 MHz, with the R&S®SMA-B22 option)
- High-stability reference oscillator as standard
- Very low phase noise at low frequencies due to internal division of the fundamental frequency range (750 MHz to 1500 MHz) down to 6.6 MHz

Ideal for use in production

- Very short frequency/level setting times of < 700 µs (meas.) across the entire frequency and level range, < 450 µs in List mode
- Fast Hopping mode with flexibly addressable frequency and level pairs, as fast as normal List mode
- Frequency setting time of typ. < 10 µs within a bandwidth of up to 80 MHz due to direct access to the DDS-based synthesizer (with the R&S®SMA-B20 or -B22 option; FM EXTERNAL DIGITAL mode)
- Very high level accuracy and repeatability
- High output power of up to +18 dBm, overrange up to +28 dBm
- Electronic attenuator with built-in overvoltage protection over entire frequency range
- Minimum space requirements due to compact size (only two height units)

Aerospace and defense applications

- Pulse modulator with excellent characteristics (on/off ratio of > 100 dB (meas.) for f < 5.5 GHz, rise/fall time typ. < 7 ns)
- Pulse generator integrated as standard
- Optional high-performance pulse generator with minimum pulse width of 10 ns (R&S®SMA-K23)
- Optional generation of versatile pulse sequences/pulse trains (R&S®SMA-K27)
- Optional chirp modulation (R&S®SMA-B20 or R&S®SMA-B22)
- Optional VOR/ILS modulation (R&S®SMA-K25)
- Optional DME modulation/analysis (R&S®SMA-K26)
- Optional operating altitude up to 4600 m (R&S®SMA-B46)
- Optional removable mass storage (CompactFlash™ card, R&S®SMA-B80)

All-purpose instrument

- Frequency range of 9 kHz to 3 GHz (R&S®SMA-B103/R&S®SMA-B103L) or 6 GHz (R&S®SMA-B106/R&S®SMA-B106L)
- Frequency, level and LF sweeps
- Phase-continuous frequency setting
- AM, broadband FM/φM (R&S®SMA-B20 or R&S®SMA-B22), pulse modulation
- Built-in LF generator up to 1 MHz, optional multifunction generator (R&S®SMA-K24) up to 10 MHz
- Optional low-jitter clock synthesizer up to 1.5 GHz (R&S®SMA-B29)
- Power measurement using R&S®NRP-Zxx power sensors
- Optional power analysis (R&S®SMA-K28) using R&S®NRP-Zxx power sensors for scalar network analysis or automatic pulse parameter measurement

Intuitive operating concept and versatile interfaces

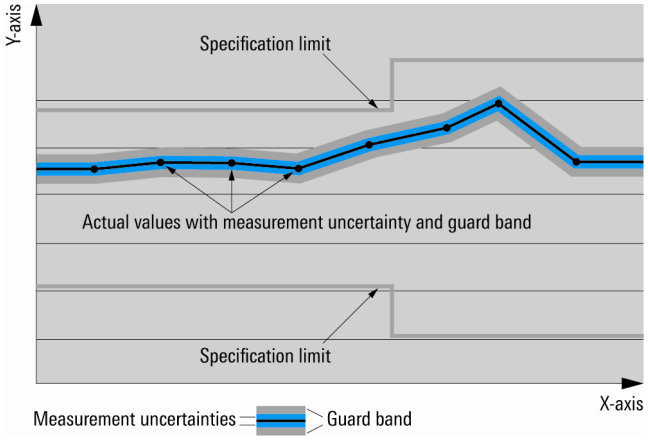
- Color display with 480 × 272 pixels
- Intuitive user interface with graphical display of signal flow (block diagram)
- Context-sensitive online help
- Remote control via GPIB, LAN or USB
- Selectable control language (SCPI or remote control emulation of various signal generators)
- Remote operation by browser (or VNC client)
- USB connectors (e.g. for keyboard, mouse, memory stick)
- Support of R&S®NRP-Zxx power sensors for precise power measurements

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
- Level within specified level range

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

Specification is only valid for instruments with serial number > 112000.

RF performance

Frequency

Range	R&S®SMA-B103/-B103L	9 kHz to 3 GHz
	R&S®SMA-B106/-B106L	9 kHz to 6 GHz
Resolution of setting		0.01 Hz
Resolution of synthesis	fundamental frequency range 750 MHz to 1500 MHz	
	standard	5 µHz (nom.)
	with R&S®SMA-B22 option	0.2 µHz (nom.)
Setting time	to within < 1 × 10^{-7} for f > 6.6 MHz or < 35 Hz for f < 6.6 MHz no relay switchover, PLL bandwdith normal	
	after IEC/IEEE bus delimiter	< 1.2 ms
	in ALC OFF S&H mode	< 5 ms
	after trigger pulse in List mode or Fast Hopping mode	< 450 µs
Resolution of phase offset setting		adjustable in 0.1° steps
Main PLL bandwith settings	with R&S®SMA-B22 option	
	f ≤ 3 GHz	normal, narrow
	f > 3 GHz	normal
Multiplier for phase-continuous frequency setting	f ≤ 6.6 MHz	rm = 1/2
	6.6 MHz < f ≤ 11.71875 MHz	rm = 1/128
	11.71875 MHz < f ≤ 23.4375 MHz	rm = 1/64
	23.4375 MHz < f ≤ 46.875 MHz	rm = 1/32
	46.875 MHz < f ≤ 93.75 MHz	rm = 1/16
	93.75 MHz < f ≤ 187.5 MHz	rm = 1/8
	187.5 MHz < f ≤ 375 MHz	rm = 1/4
	375 MHz < f ≤ 750 MHz	rm = 1/2
	750 MHz < f ≤ 1500 MHz	rm = 1
	1500 MHz < f ≤ 3 GHz	rm = 2
	f > 3 GHz	rm = 4
Phase-continuous frequency setting range		rm × 1 MHz (nom.)
	with R&S®SMA-B22 option	
	narrow mode	rm × 5 MHz
	wide mode	rm × 20 MHz
Max. phase-continuous frequency step		rm × 2 kHz (nom.)
	with R&S®SMA-B22 option	rm × 100 kHz (nom.)

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	< 1×10^{-8}
	with R&S®SMA-B22 option	< 5×10^{-9}
Aging	after 10 days of uninterrupted operation	≤ 1×10^{-9}/day, ≤ 1×10^{-7}/year
	with R&S®SMA-B22 option	≤ 5×10^{-10}/day, ≤ 3×10^{-8}/year
Maximum temperature effect	in temperature range 0 °C to +50 °C	±6×10^{-8}
	with R&S®SMA-B22 option	±6×10^{-9}
Warm-up time	to nominal thermostat temperature	≤ 10 min
Reference frequnecy output		
Connector type	REF OUT on rear panel	BNC female
Output frequency	sine wave	
	instrument set to internal reference	10 MHz
	instrument set to external reference	applied external reference frequency
Output level		2 dBm to 8 dBm
		5 dBm to 7 dBm (typ.)
Source impedance		50 Ω (nom.)
Reference frequency input		
Connector type	REF IN on rear panel	BNC female
Input frequency		5 MHz, 10 MHz or 13 MHz
Min. frequency locking range		±3×10^{-6}
	with R&S®SMA-B22 option	±1.5×10^{-7}
Input level range	level limits	≥ –6 dBm, ≤ 19 dBm
	recommended input level	0 dBm to 19 dBm
Input impedance		50 Ω (nom.)
Input for electronic tuning of internal reference frequency		
Connector type	EXT TUNE on rear panel	BNC female
Sensitivity		0.5×10^{-8}/V to 3×10^{-8}/V 1×10^{-8}/V to 2×10^{-8}/V (typ.)
	with R&S®SMA-B22 option	5×10^{-9}/V to 2×10^{-8}/V 8×10^{-9}/V to 9.5×10^{-9}/V (typ.)
Input voltage		–10 V to +10 V
Input impedance		10 kΩ (nom.)
	with R&S®SMA-B22 option	5 kΩ (nom.)

Level

The R&S®SMA100A has three different modes for level setting:

NORMAL mode: In this mode, the attenuator switches without wear and tear due to the exclusive use of electronic switches. The maximum specified level depends on the set frequency (see table below).

HIGH POWER mode: In this mode, the electronic attenuator is bypassed with mechanical relays for high output power (up to typ. 28 dBm overrange). The relays are not switched over in this mode. The typical minimum level is –11 dBm.

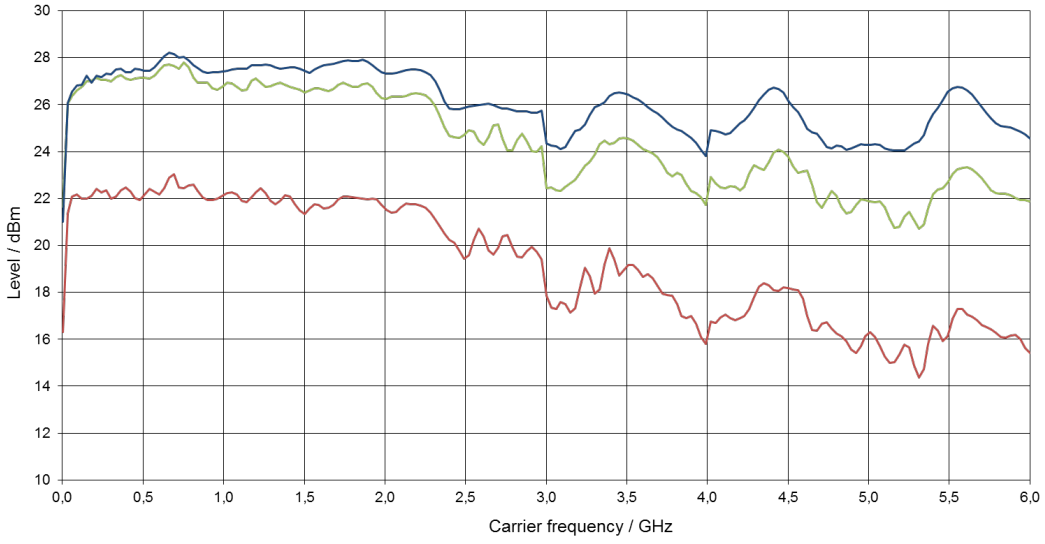
AUTO mode: In this mode, the mechanical relay bypass is switched automatically if the set level is higher than the specified max. level in the NORMAL mode. The output level is specified over the full range from –120 dBm up to +18 dBm (+15 dBm for R&S®SMA-B106).

The R&S®SMA100A is also available without attenuator (R&S®SMA-B103L and R&S®SMA-B106L) options.

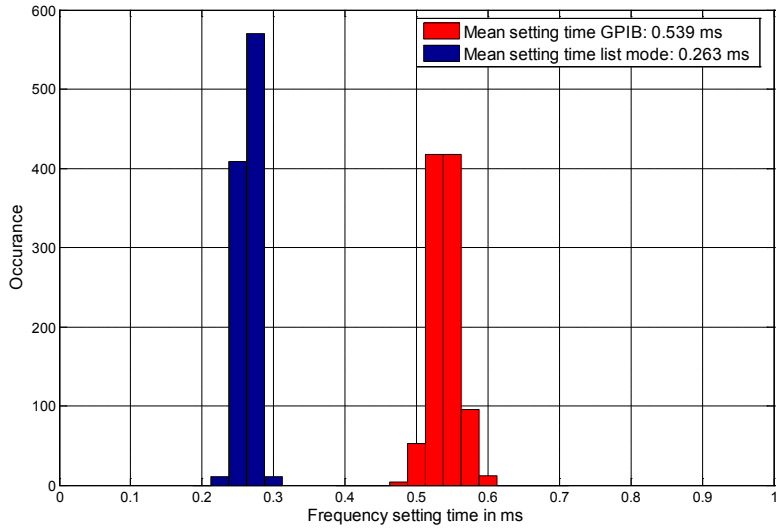
Setting range	with electronic attenuator (R&S®SMA-B103/-B106 option)	–145 dBm to +30 dBm
	without attenuator (R&S®SMA-B103L/-B106L option)	–20 dBm to +30 dBm
Specified level range with R&S®SMA-B103/-B106 frequency option	NORMAL mode	
	100 kHz < f ≤ 200 kHz	–120 dBm to +11 dBm (PEP) [1]
	200 kHz < f ≤ 3 GHz	–120 dBm to +13 dBm (PEP)
	f > 3 GHz	–120 dBm to +9 dBm (PEP)
	AUTO mode	
	100 kHz < f ≤ 30 MHz	–120 dBm to +16 dBm (PEP)
	30 MHz < f ≤ 3 GHz	–120 dBm to +18 dBm (PEP)
	f > 3 GHz	–120 dBm to +15 dBm (PEP)

[1] PEP = peak envelope power.

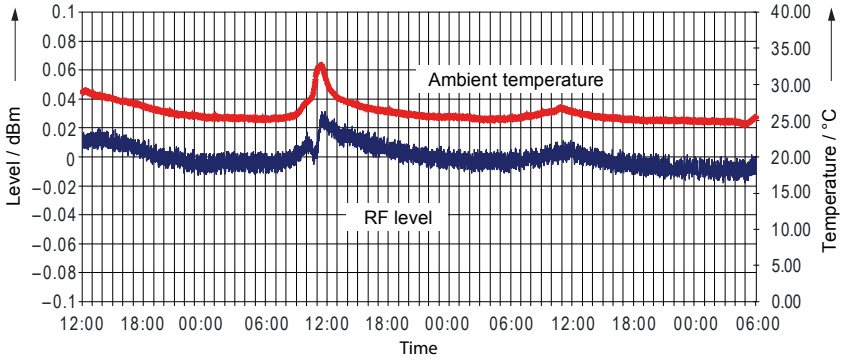
Specified level range with R&S®SMA-B103L/-B106L frequency option	AUTO mode	
	100 kHz < f ≤ 30 MHz	+12 dBm to +17 dBm (PEP)
	30 MHz < f ≤ 3 GHz	+12 dBm to +19 dBm (PEP)
	f > 3 GHz	+10 dBm to +17 dBm (PEP)
Resolution of setting		0.01 dB (nom.)
Level error	ALC state ON, attenuator mode AUTO, temperature range +18 °C to +33 °C	
	100 kHz < f ≤ 3 GHz	< 0.5 dB
	f > 3 GHz	< 0.9 dB
Additional level error with ALC OFF S&H	after “search once” and under stable temperature conditions	< 0.3 dB
Output impedance VSWR in 50 Ω system with R&S®SMA-B103/-B106 frequency option	NORMAL mode, ALC state ON	
	6.6 MHz < f ≤ 3 GHz	< 1.65
	f > 3 GHz	< 1.9
	HIGH POWER mode, ALC state ON	
	6.6 MHz < f ≤ 3 GHz	< 1.75
	f > 3 GHz	< 1.9
Output impedance VSWR in 50 Ω system with R&S®SMA-B103L/-B106L frequency option	without attenuator, ALC state ON	
	6.6 MHz < f ≤ 3 GHz	< 1.9
	f > 3 GHz	< 2.3
Setting time	with GUI update stopped, attenuator mode AUTO,temperature range +18 °C to +33 °C	
	to < 0.1 dB deviation from final value, no relay switchover	
	ALC state ON, after IEC/IEEE bus delimiter	< 1.0 ms
	ALC state OFF, after IEC/IEEE bus delimiter	< 5 ms
	in List mode or Fast Hopping mode, after trigger impulse, f > 6.6 MHz	< 450 µs
	to < 0.3 dB deviation from final value,relay switchover in attenuator mode AUTO	
	after IEC/IEEE bus delimiter	< 10 ms
Interruption-free level setting range	with attenuator mode FIXED, ALC state ON	> 20 dB
Reverse power (from 50 Ω source)	maximum permissible RF power in output frequency range of RF path for f > 1 MHz	
	with R&S®SMA-B103/-B106 option	
	1 MHz < f ≤ 3 GHz	50 W
	3 GHz < f < 6 GHz	10 W
	with R&S®SMA-B103L/-B106L option	0.05 W
Maximum permissible DC voltage	with R&S®SMA-B103/-B106 option	50 V
	with R&S®SMA-B103L/-B106L option	5 V



Maximum available power, attenuator mode NORMAL (lower trace) or HIGH POWER (center trace) and without attenuator (upper trace).



Histogram over 1000 frequency setting time measurements with GPIB remote control and List mode.



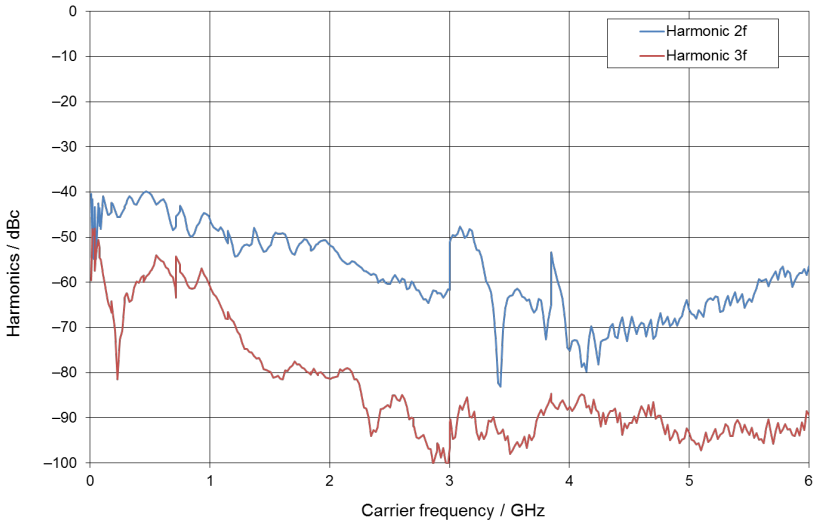
R&S®SMA100A level repeatability at 2.1 GHz, 0 dBm, ALC ON.

Level sweep

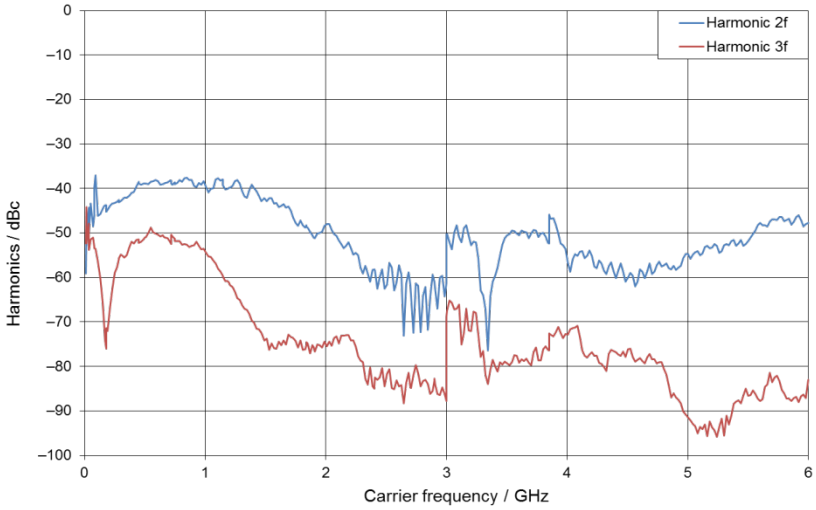
Operating mode		digital sweep in discrete steps
Trigger modes	execute sweep continuously with internal trigger source	auto
	execute one full sweep	single
	execute one step	step
	sweep start and stop controlled by external trigger signal	start/stop
Trigger source	internal	timer
	external	external trigger signal (INST TRIG at rear), rotary knob, remote control
Trigger slope	external trigger signal	positive, negative
Sweep range	with R&S®SMA-B103/-B106 option, attenuator mode AUTO The relay switching threshold (= maximum specified level of attenuator mode NORMAL) must not be exceeded during a sweep.	level range of attenuator modes NORMAL or HIGH POWER
	with R&S®SMA-B103L/-B106L option	full level range
	interruption-free level sweep with attenuator mode FIXED	0.01 dB to 30 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

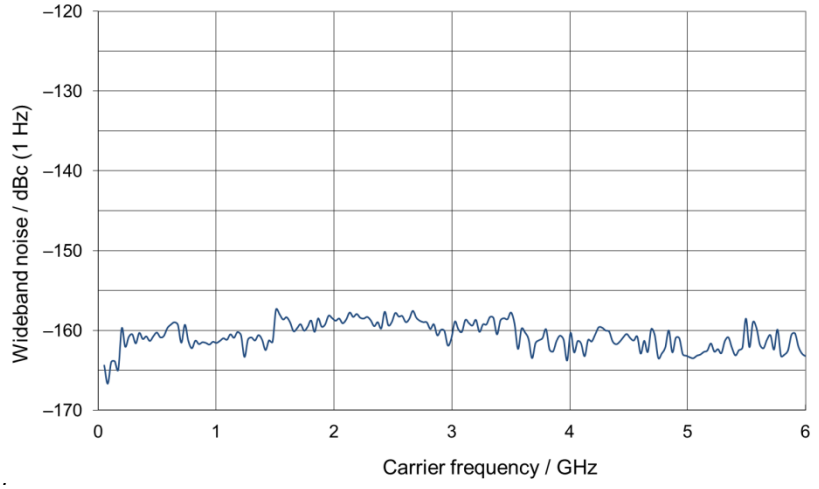
Harmonics	with R&S®SMA-B103/-B106, AUTO/NORMAL mode, CW, level ≤ 9 dBm	
	1 MHz < f ≤ 2 GHz	< –30 dBc
	f > 2 GHz	< –40 dBc
	with R&S®SMA-B103/-B106, HIGH POWER mode, CW, level ≤ 14 dBm with R&S®SMA-B103L/-B106L, CW, level ≤ 15 dBm	
	1 MHz < f ≤ 2 GHz	< –30 dBc
	f > 2 GHz	< –40 dBc
Nonharmonics	CW, level > –10 dBm (with R&S®SMA-B103/-B106), carrier offset > 10 kHz	
	f ≤ 1500 MHz	< –80 dBc
	1500 MHz < f ≤ 3 GHz	< –74 dBc
	f > 3 GHz	< –68 dBc
	CW, level > –10 dBm (with R&S®SMA-B103/-B106), carrier offset > 850 kHz	
	f ≤ 1500 MHz	< –86 dBc
	1500 MHz < f ≤ 3 GHz	< –80 dBc
	f > 3 GHz	< –74 dBc
Nonharmonics with R&S®SMA-B22 option	CW, level > –10 dBm (with R&S®SMA-B103/-B106), carrier offset > 10 kHz PLL bandwdith normal	
	f ≤ 750 MHz	< –96 dBc
	750 MHz < f ≤ 1500 MHz	< –92 dBc
	1500 MHz < f ≤ 3 GHz	< –86 dBc
	f > 3 GHz	< –80 dBc
Subharmonics	f ≤ 1500 MHz	none
	f > 1500 MHz	< –74 dBc
Wideband noise	CW, attenuator mode AUTO, carrier offset > 10 MHz, measurement bandwidth 1 Hz for level > 10 dBm with R&S®SMA-B103L/-B106L for level > 5 dBm with R&S®SMA-B103/-B106	
	9 kHz ≤ f ≤ 6.6 MHz	< –147 dBc
	6.6 MHz < f ≤ 750 MHz	< –152 dBc
	750 MHz < f ≤ 1500 MHz	< –153 dBc
	1.5 GHz < f ≤ 3 GHz	< –150 dBc
	f > 3 GHz	< –148 dBc
SSB phase noise	CW, carrier offset 20 kHz, measurement bandwidth 1 Hz	
	f ≤ 6.6 MHz	–147 dBc (meas.)
	f = 100 MHz	< –147 dBc, –153 dBc (typ.)
	f = 1 GHz	< –131 dBc, –134 dBc (typ.)
	f = 2 GHz	< –125 dBc, –128 dBc (typ.)
	f = 3 GHz	< –121 dBc, –124.5 dBc (typ.)
	f = 4 GHz	< –119 dBc, –121 dBc (typ.)
	f = 6 GHz	< –115 dBc, –118 dBc (typ.)
SSB phase noise with R&S®SMA-B22 option	CW, carrier offset 20 kHz, PLL bandwdith normal, measurement bandwidth 1 Hz	
	f ≤ 6.6 MHz	–152 dBc (meas.)
	f = 100 MHz	< –152 dBc, –157 dBc (typ.)
	f = 1 GHz	< –137 dBc, –141 dBc (typ.)
	f = 2 GHz	< –131 dBc, –134.5 dBc (typ.)
	f = 3 GHz	< –127 dBc, –133 dBc (typ.)
	f = 4 GHz	< –123 dBc, –127 dBc (typ.)
	f = 6 GHz	< –120 dBc, –124 dBc (typ.)
RMS jitter	f = 1 GHz BW = 1 Hz to 10 MHz	430 fs (430 µUI) (meas.)
	f = 155 MHz BW = 100 Hz to 1.5 MHz	60 fs (9 µUI) (meas.)
	f = 622 MHz BW = 1 kHz to 5 MHz	36 fs (22 µUI) (meas.)
	f = 2.488 GHz BW = 5 kHz to 15 MHz	22 fs (55 µUI) (meas.)
RMS jitter with R&S®SMA-B22 option	PLL bandwdith normal	
	f = 1 GHz BW = 1 Hz to 10 MHz	62 fs (62 µUI) (meas.)
	f = 155 MHz BW = 100 Hz to 1.5 MHz	22 fs (3.5 µUI) (meas.)
	f = 622 MHz BW = 1 kHz to 5 MHz	19.5 fs (12 µUI) (meas.)
	f = 2.488 GHz BW = 5 kHz to 15 MHz	18 fs (47 µUI) (meas.)
Residual FM	RMS value at f = 1 GHz	
	0.3 kHz to 3 kHz, weighted (ITU-T)	< 1 Hz
	0.03 kHz to 23 kHz	< 4 Hz
Residual AM	level = 0 dBm RMS value (0.03 kHz to 20 kHz)	< 0.02 %



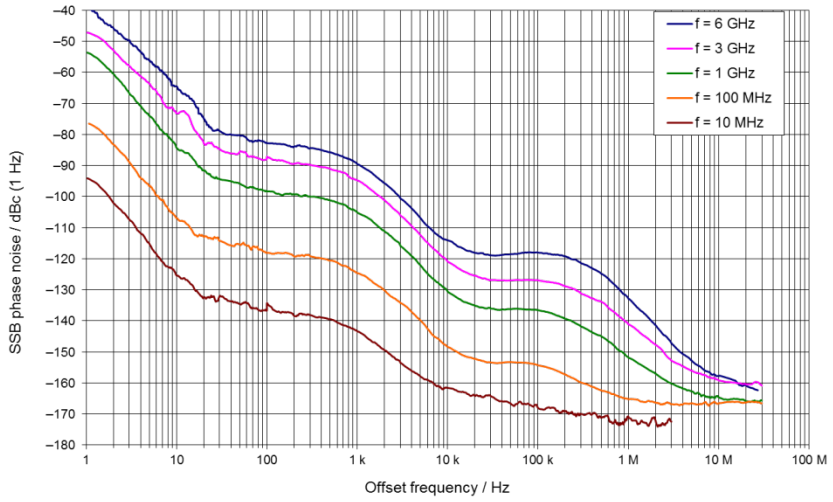
Measured harmonics at +9 dBm versus carrier frequency (level mode AUTO).



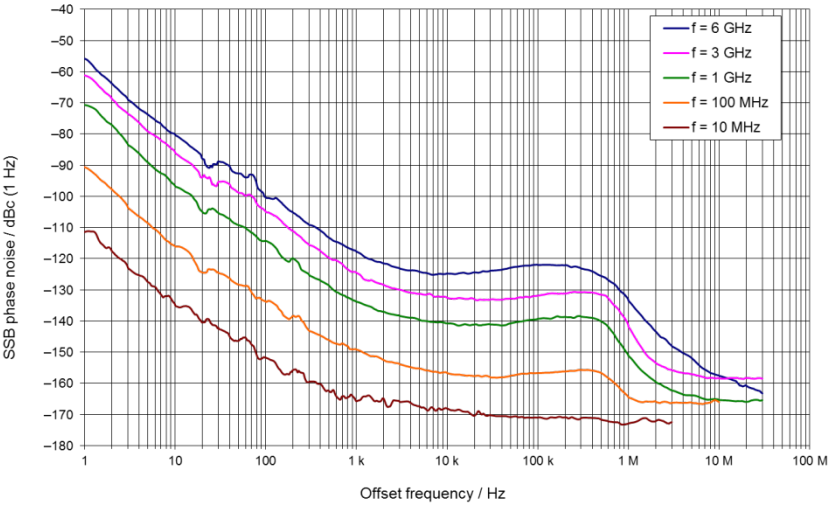
Measured harmonics at +18 dBm versus carrier frequency (level mode AUTO)



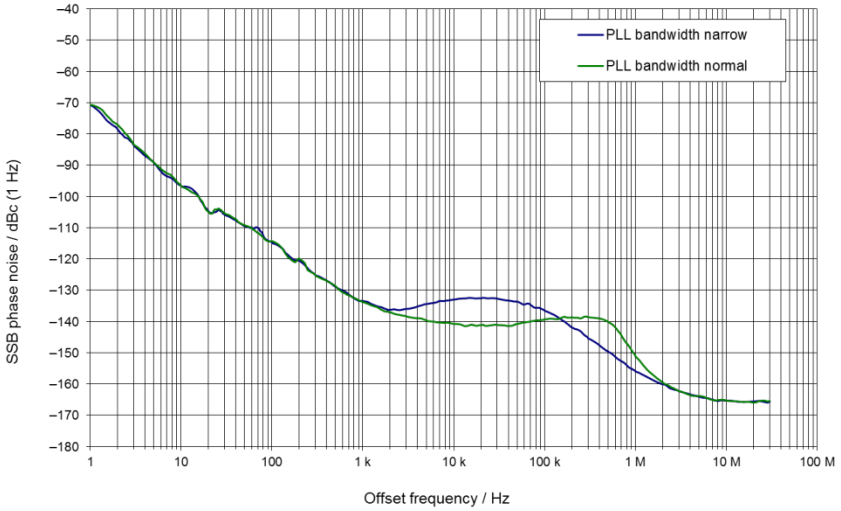
Wideband noise at 40 MHz offset and +9 dBm versus carrier frequency measured with the R&S®FSQ8 signal and spectrum analyzer.



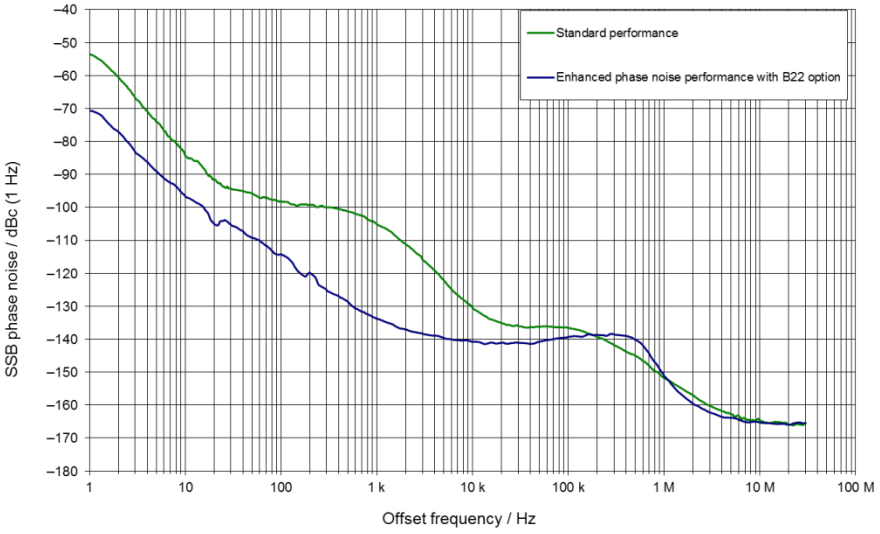
Measured SSB phase noise with internal reference oscillator (standard instrument).



Measured SSB phase noise with internal reference oscillator (with R&S®SMA-B22 enhanced phase noise performance and FM/φM modulator option).

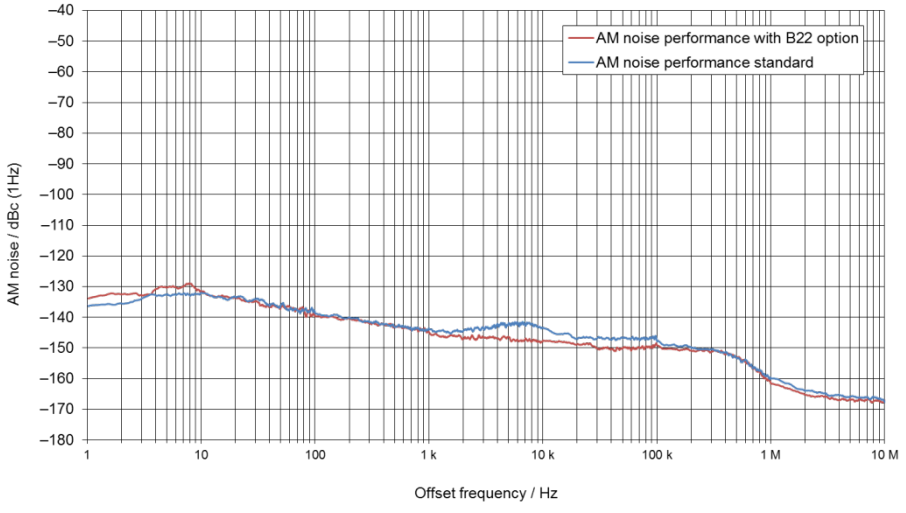


Measured SSB phase noise, f = 1 GHz (with R&S®SMA-B22 enhanced phase noise performance and FM/φM modulator option), comparison of PLL bandwidth normal and narrow (only available for f ≤ 3 GHz).



Measured SSB phase noise, f = 1 GHz, comparison of standard performance and performance with R&S®SMA-B22 option.

Carrier frequency in MHz	measured phase noise in dBc (1 Hz) with R&S®SMA-B22 option, PLL bandwdith normal frequency offset from carrier							
	1 Hz	10 Hz	100 Hz	1 kHz	10 kHz	100 kHz	1 MHz	10 MHz
0.1 to 6.6	–100	–114	–134	–145	–152	–152	–152	–
6.6 to 15.625	–106	–131	–147	–160	–167	–169	–170	–170
15.625 to 23.4375	–102	–129	–145	–160	–166	–167	–170	–170
23.4375 to 31.25	–100	–127	–143	–158	–164	–165	–168	–168
31.25 to 46.875	–96	–123	–140	–156	–163	–163	–168	–168
46.875 to 62.5	–94	–121	–138	–154	–162	–162	–166	–167
62.5 to 93.75	–90	–117	–134	–151	–160	–160	–165	–166
93.75 to 125	–88	–115	–132	–149	–156	–156	–163	–164
125 to 187.5	–84	–111	–128	–145	–153	–155	–162	–163
187.5 to 250	–82	–109	–126	–144	–151	–151	–159	–162
250 to 375	–78	–105	–122	–142	–149	–149	–158	–162
375 to 500	–76	–103	–120	–139	–145	–145	–155	–161
500 to 750	–72	–99	–116	–136	–143	–143	–153	–161
750 to 1000	–70	–97	–114	–134	–141	–139	–150	–165
1000 to 1500	–66	–93	–110	–130	–138	–137	–148	–164
1500 to 2000	–64	–91	–108	–128	–135	–134	–145	–161
2000 to 3000	–60	–87	–104	–124	–132	–131	–142	–158
3000 to 4000	–58	–85	–102	–121	–127	–124	–137	–160
4000 to 6000	–54	–81	–98	–118	–125	–122	–133	–157



Measured AM noise, f = 1 GHz, level = +14 dBm, ALC ON, comparison of standard performance and performance with R&S®SMA-B22 option.

List mode

Frequency and level values can be stored in a list and set in an extremely short amount of time.

Trigger modes	execute list continuously with internal trigger source	auto
	execute list once	single
	execute one step	step
	use of addressable frequency/level pairs (Fast Hopping mode)	
	with immediate internal trigger	external hop, direct
	with external trigger	external hop
Trigger source	internal	timer
	external	external trigger signal (INST TRIG at rear), rotary knob, remote control, fast hopping bus
Trigger slope	external trigger signal	positive, negative
Max. number of stored settings		2000
Dwell time setting range		1 ms to 1 s
Dwell time setting resolution		0.1 ms
Setting time	after external trigger	see frequency and level data

Analog modulation

Possible modulation types

Amplitude modulation, frequency modulation, phase modulation, pulse modulation, chirped pulses, avionics modulation (DME, VOR, ILS, MKR BCN, ADF).

Simultaneous modulation

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

+ = compatible, (+) = compatible with limitations, – = incompatible.

With chirped pulses and certain types of avionics modulation (VOR, ILS, MKR BCN, ADF), simultaneous modulation is not possible.

Amplitude modulation

For f ≥ 100 kHz, attenuator mode AUTO, level (PEP) [1] within specified level range.

Modulation source		internal, external, 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		0.1 %
AM depth (m) error	f_{mod} = 1 kHz and m < 80 %	< (3 % of set AM depth + 1 %)
AM distortion	f_{mod} = 1 kHz	
	m = 30 %	< 1 %
	m = 80 %	< 2 %
Modulation frequency response	m = 60 %, up to 100 kHz	< 3 dB
Incidental φM at AM	m = 30 %, f_{mod} = 1 kHz, ±peak/2	< 0.1 rad

Frequency modulation (R&S®SMA-B20 or R&S®SMA-B22 option)

FM multiplier (rm) for different frequency ranges	f ≤ 46.875 MHz	rm = 1/2 (all modes except LOW NOISE)
	f ≤ 6.6 MHz	rm = 1/2 (only in LOW NOISE mode)
	6.6 MHz < f ≤ 11.71875 MHz	rm = 1/128 (only in LOW NOISE mode)
	11.71875 MHz < f ≤ 23.4375 MHz	rm = 1/64 (only in LOW NOISE mode)
	23.4375 MHz < f ≤ 46.875 MHz	rm = 1/32 (only in LOW NOISE mode)
	46.875 MHz < f ≤ 93.75 MHz	rm = 1/16
	93.75 MHz < f ≤ 187.5 MHz	rm = 1/8
	187.5 MHz < f ≤ 375 MHz	rm = 1/4
	375 MHz < f ≤ 750 MHz	rm = 1/2
	750 MHz < f ≤ 1500 MHz	rm = 1
	1500 MHz < f ≤ 3 GHz	rm = 2
	f > 3 GHz	rm = 4
Modulation source		internal, external, internal + external, external digital
External coupling		AC, DC
Operating modes		FM mode NORMAL
	with R&S®SMA-B22 option	FM mode NORMAL FM mode LOW NOISE
Maximum deviation	FM mode NORMAL	rm × 10 MHz
	FM mode LOW NOISE	rm × 100 kHz
Resolution of setting		< 0.02 % of set deviation min. rm × 0.1 Hz
FM deviation error	f_{mod} = 10 kHz, deviation ≤ half of max. deviation	
	internal	< (1.5 % of set deviation + 20 Hz)
	external, high input impedance	< (2 % of set deviation + 20 Hz)
FM distortion	f_{mod} = 10 kHz, deviation = rm × 1 MHz	< 0.1 %
Modulation frequency response	FM mode NORMAL (DC/AC coupling), 50 Ω input impedance	
	DC/10 Hz to 100 kHz	< 0.5 dB
	DC/10 Hz to 10 MHz	< 3 dB
	FM mode LOW NOISE (DC/AC coupling), 50 Ω input impedance	
	DC/10 Hz to 100 kHz	< 3 dB
Synchronous AM with FM	40 kHz deviation, f_{mod} = 1 kHz	
	f > 5 MHz	< 0.1 %
	f > 3 GHz	< 0.2 %
Carrier frequency offset with FM DC	after FM offset calibration	
	50 Ω input impedance	< 0.2 % of set deviation

Chirped pulses (R&S®SMA-B20 or R&S®SMA-B22 option)

The R&S®SMA100A always uses chirp modulation together with pulse modulation. When chirp modulation is activated, the ALC state of the instrument is automatically changed to ALC OFF (sample & hold). In this state, the ALC loop is opened and the output level is set directly.
In order to set the correct output level, a sample & hold measurement is performed after each frequency or level setting.

In the following cases, the nominal ON level is present for nominally 3 ms to 5 ms during a sample & hold measurement after level or frequency setting:

- No attenuator is installed (R&S®SMA-B103L/R&S®SMA-B106L frequency option)
- In HIGH POWER mode
- In AUTO mode if the level is in the high power range, i.e. the mechanical relay bypass is switched

Otherwise, the level is decreased by 30 dB during a sample & hold measurement.

Chirp bandwidth multiplier (rm) for different frequency ranges	f ≤ 46.875 MHz	rm = 1/2
	46.875 MHz < f ≤ 93.75 MHz	rm = 1/16
	93.75 MHz < f ≤ 187.5 MHz	rm = 1/8
	187.5 MHz < f ≤ 375 MHz	rm = 1/4
	375 MHz < f ≤ 750 MHz	rm = 1/2
	750 MHz < f ≤ 1500 MHz	rm = 1
	1500 MHz < f ≤ 3 GHz	rm = 2
	f > 3 GHz	rm = 4
Modulation source	pulse modulation	internal pulse generator
	frequency modulation (linear)	internal modulation generator
Trigger modes	continuous trigger with internal trigger source	auto
		externally triggered
		externally gated
Trigger slope	external trigger signal	positive, negative
Gate polarity	external gate signal	normal, inverse
Input impedance	external trigger/gate signal	50 Ω, 10 kΩ (nom.)
Chirp direction		up, down
Maximum bandwidth		rm × 20 MHz
Pulse period setting range		5 µs to 100 s
	with R&S®SMA-K23 option	1.1 µs to 100 s
Pulse width setting range		2 µs to 100 s pulse width < (pulse period – 1 µs)
	with R&S®SMA-K23 option	100 ns to 100 s pulse width < (pulse period – 1 µs)
Pulse parameter setting resolution		1 µs
	with R&S®SMA-K23 option	20 ns
Maximum chirp rate		rm × 10 MHz/µs (nom.)

Phase modulation (R&S®SMA-B20 or R&S®SMA-B22 option)

φM multiplier (rm) for different frequency ranges	f ≤ 46.875 MHz	rm = 1/2 (all modes except LOW NOISE)
	f ≤ 6.6 MHz	rm = 1/2 (only in LOW NOISE mode)
	6.6 MHz < f ≤ 11.71875 MHz	rm = 1/128 (only in LOW NOISE mode)
	11.71875 MHz < f ≤ 23.4375 MHz	rm = 1/64 (only in LOW NOISE mode)
	23.4375 MHz < f ≤ 46.875 MHz	rm = 1/32 (only in LOW NOISE mode)
	46.875 MHz < f ≤ 93.75 MHz	rm = 1/16
	93.75 MHz < f ≤ 187.5 MHz	rm = 1/8
	187.5 MHz < f ≤ 375 MHz	rm = 1/4
	375 MHz < f ≤ 750 MHz	rm = 1/2
	750 MHz < f ≤ 1500 MHz	rm = 1
	1500 MHz < f ≤ 3 GHz	rm = 2
	f > 3 GHz	rm = 4
Modulation source		internal, external, internal + external, external digital
External coupling		AC, DC
Operating modes		φM mode HIGH DEVIATION, φM mode HIGH BANDWIDTH
	with R&S®SMA-B22 option	φM mode HIGH DEVIATION, φM mode HIGH BANDWIDTH φM mode LOW NOISE
Maximum deviation	φM mode LOW NOISE	rm × 0.25 rad
	φM mode HIGH DEVIATION	rm × 20 rad
	φM mode HIGH BANDWIDTH	rm × 1 rad
Resolution of setting	φM mode LOW NOISE/HIGH DEVIATION	< 0.02 % of set deviation, min. rm × 20 µrad
	φM mode HIGH BANDWIDTH	< 0.1 % of set deviation, min. rm × 20 µrad
φM deviation error	f_{mod} = 10 kHz, deviation ≤ half of max. deviation	
	internal	< (1.5 % of set deviation + 0.003 rad)
	external, high input impedance	< (2 % of set deviation + 0.003 rad)
φM distortion	f_{mod} = 10 kHz, half of max. deviation	< 0.2 %, < 0.1 % (typ.)
Modulation frequency response	φM mode HIGH DEVIATION (DC/AC coupling), 50 Ω input impedance	
	deviation ≤ rm × 5 rad DC/10 Hz to 500 kHz	< 1 dB
	deviation > rm × 5 rad DC/10 Hz to 10 kHz	< 1 dB
	φM mode HIGH BANDWIDTH (DC/AC coupling), 50 Ω input impedance	
	DC/10 Hz to 100 kHz	< 0.5 dB
	DC/10 Hz to 10 MHz	< 3 dB
	φM mode LOW NOISE (DC/AC coupling), 50 Ω input impedance	
	DC/10 Hz to 100 kHz	< 3 dB

Pulse modulation

When pulse modulation is activated, the ALC state of the R&S®SMA100A is automatically changed to ALC OFF (sample & hold).
In this state, the ALC loop is opened and the output level is set directly.
In order to set the correct output level, a sample & hold measurement is performed after each frequency or level setting.

In the following cases, the nominal ON level is present for nominally 3 ms to 5 ms during a sample & hold measurement after level or frequency setting:

- No attenuator is installed (R&S®SMA-B103L/R&S®SMA-B106L frequency option)
- In HIGH POWER mode
- In AUTO mode if the level is in the high power range, i.e. the mechanical relay bypass is switched

Otherwise, the level is decreased by 30 dB during a sample & hold measurement.

Modulation source		external, internal
On/off ratio		> 80 dB
Rise/fall time	f > 180 MHz 10 %/90 % of RF amplitude	< 20 ns, < 7 ns (typ.)
Pulse repetition frequency		0 Hz to 10 MHz
Video crosstalk	spectral line of fundamental of 100 kHz square-wave modulation	< –30 dBc

VOR modulation (R&S®SMA-K25 option)

Attenuator mode AUTO, level (PEP) [1] within specified level range.
VOR specification valid for carrier frequency range from 108 MHz to 118 MHz.

VOR operating modes	generation of VOR signal	NORM
	30 Hz VAR tone	VAR
	9.96 kHz carrier, unmodulated	subcarrier
	9.96 kHz carrier, modulated	subcarrier + FM
Modulation tones		
Frequency error	30 Hz (VAR, REF)	< (0.005 Hz + relative deviation of reference frequency × 30 Hz)
Frequency setting range	30 Hz REF	10 Hz to 60 Hz
	9.96 kHz FM carrier	5 kHz to 15 kHz
	COM/ID tone	0.1 Hz to 20 kHz
Frequency setting resolution		0.1 Hz
FM deviation setting range	9.96 kHz FM carrier	0 Hz to 960 Hz
FM deviation setting resolution	9.96 kHz FM carrier	1 Hz
FM deviation error	9.96 kHz FM carrier at 480 Hz deviation	< 1 Hz
External AM tone	input connector	AM EXT
Modulation depth Sum of modulation depths of 30 Hz (VAR) signal, 9.96 kHz FM carrier, COM/ID and external AM signal must not exceed 100 %.		
AM depth setting range		0 % to 100 %
AM depth setting resolution		0.1 %
AM depth error	30 Hz (VAR, REF), 30 % AM depth	< 0.5 % AM depth
	9.96 kHz FM carrier, 30 % AM depth	< 0.5 % AM depth
	COM/ID, tone = 1020 Hz, depth = 10 %	< 0.5 % AM depth
External AM tone	sensitivity	0.01 V/%
Bearing angle		
Setting range		0° to 360°
	default setting	0.00°
Setting resolution		0.01°
Error		< 0.05°

ILS modulation (R&S®SMA-K25 option)

Attenuator mode AUTO, level (PEP) [1] within specified level range.
ILS-LOC specification valid for carrier frequency range from 108 MHz to 118 MHz.
ILS-GS specification valid for carrier frequency range from 329 MHz to 335 MHz.

ILS modulation	generation of ILS localizer signal, COM/ID tone possible	ILS-LOC
	generation of ILS glideslope signal	ILS-GS
ILS operating modes	NORM	90 Hz + 150 Hz + COM/ID tone (ILS-LOC)
	90 Hz	suppression of 150 Hz modulation tone
	150 Hz	suppression of 90 Hz modulation tone
ILS modulation tones If the frequency of the 90 Hz or 150 Hz tone is varied, the other tone is automatically changed in proportion.		
Frequency error		< (0.02 Hz + relative deviation of reference frequency × ILS tone frequency)
Frequency setting range	90 Hz tone	60 Hz to 120 Hz
	150 Hz tone	100 Hz to 200 Hz
	COM/ID tone	0.1 Hz to 20 kHz
Frequency setting resolution	90 Hz tone	0.3 Hz
	150 Hz tone	0.5 Hz
	COM/ID tone	0.1 Hz
External AM tone	input connector	AM EXT
Modulation depth Sum of modulation depths of 90 Hz, 150 Hz, COM/ID and external AM signal must not exceed 100 %.		
Setting range	SDM of 90 Hz, 150 Hz, COM/ID tone	0 % to 100 %
	ILS-LOC default setting	40 %
	ILS-GS default setting	80 %
Setting resolution	SDM and COM/ID depth	0.1 %
AM depth error	SDM = 40 %	< 0.8 % AM depth
	SDM = 80 %	< 1.6 % AM depth
	COM/ID, tone = 1020 Hz, depth = 10 %	< 0.5 % AM depth
External AM tone	sensitivity	0.01 V/%
Difference in depth of modulation (DDM)		
Setting range		0 to ±SDM
Setting resolution		0.0001
Error		< 0.0003 + 2 % of set DDM
ILS phase		
Setting range		0° to 120°
Setting resolution		0.01°
Error		< 0.05°

Marker beacon (MKR BCN) (R&S®SMA-K25 option)

Attenuator mode AUTO, level (PEP) within specified level range.
MKR-BCN specification valid for carrier frequency range from 74 MHz to 76 MHz.

Modulation tones		
Frequency error		< (0.005 Hz + relative deviation of reference frequency × marker frequency)
Marker frequencies		400 Hz, 1300 Hz and 3000 Hz
COM/ID tone frequency setting range		0.1 Hz to 20 kHz
COM/ID tone frequency setting resolution		0.1 Hz
Modulation depth Sum of modulation depths of marker tone and COM/ID signal must not exceed 100 %.		
AM depth setting range		0 % to 100 %
	marker tone default setting	95 %
AM depth setting resolution		0.1 %
AM depth error	marker tone, depth = 95 %	< 4 % AM depth
	COM/ID, tone = 1020 Hz, depth = 5 %	< 0.5 % AM depth

ADF mode (R&S®SMA-K25 option)

The ADF mode provides a carrier frequency of 190 kHz with 30 % AM depth at 1 kHz modulation rate.

Frequency error	ADF tone	< (0.005 Hz + relative deviation of reference frequency × ADF frequency)
ADF frequency setting range		0.1 Hz to 20 kHz
ADF setting resolution		0.1 Hz
AM depth setting range		0 % to 100 %
AM depth setting resolution		0.1 %
	ADF tone default setting	30 %

DME modulation (R&S®SMA-K26 option)

Specifications valid for carrier frequency range from 960 MHz to 1215 MHz, attenuator mode AUTO, ALC state AUTO, level (PEP) within specified level range and DME default settings.

When DME modulation is activated, the ALC state of the R&S®SMA100A is automatically changed to sample & hold. In this state, the ALC loop is opened and the output level is set directly.
In order to set the correct output level, a sample & hold measurement is executed after each frequency or level setting.
In the following cases, the nominal ON level is present for typ. 3 ms to 5 ms after level or frequency setting:

- No attenuator is installed (R&S®SMA-B103L/R&S®SMA-B106L frequency option)
- In HIGH POWER mode
- In AUTO mode if the level is in the high power range, i.e. the mechanical relay bypass is switched

Otherwise, the level is decreased by 30 dB during a sample & hold measurement.

DME operating modes	DME/N	DME interrogation DME reply
DME channel		X, Y
Single pulse	generation of a single pulse instead of a pulse pair	ON, OFF
Squitter pulses	randomly distributed pulse repetition rate in line with EUROCAE ED-54	ON, OFF
Level error	attenuator mode AUTO, temperature range +18 °C to +33 °C	
	pulse peak power error	< 0.8 dB
	pulse-to-pulse level difference	< 0.2 dB, < 0.1 dB (typ.)
On/off ratio		> 80 dB
Pulse shaping	cos² shape for rising and falling edge	cos²
	cos shape for rising edge; cos² shape for falling edge	cos cos²
	linear shape for rising and falling edge	linear
Pulse rise/fall time setting range	10 %/90 % of RF amplitude	0.5 µs to 20 µs
Pulse width setting range	50 %/50 % of RF amplitude	1 µs to 100 µs
Pulse spacing setting range	50 %/50 % of RF amplitude	1 µs to 100 µs
Pulse parameter setting resolution	rise/fall time, pulse width, pulse spacing	20 ns
Rise/fall time error	rise/fall time = 2 µs	< 150 ns, < 70 ns (typ.)
Pulse width error	pulse width = 3.5 µs	< 150 ns, < 70 ns (typ.)
Pulse spacing error	pulse spacing = 12 µs or 36 µs	< 100 ns, < 40 ns (typ.)
Pulse repetition rate setting range	squitter OFF	10 pp/s to 6000 pp/s [2]
	squitter ON (mean pulse repetition rate)	10 pp/s to 6000 pp/s (nom.)
Pulse repetition rate setting resolution	squitter OFF	1 pp/s
	squitter ON	100 pp/s
Reply efficiency setting range		0 to 100 %
Reply efficiency setting resolution		1 %
Range distance setting range		–3 NM to 400 NM
Range distance setting resolution		0.01 NM
Identification pulses, only in DME reply mode		
ID code		user-selectable four-character code
ID rate setting range		100 pp/s to 10000 pp/s
ID period setting range		10 s to 120 s
ID dot, dash, symbol space and letter space length setting range		50 ms to 500 ms
Monitor output		The DME modulation signal is available at the LF output.

[2] pp/s = pulse pairs per second. Due to the internal timing resolution of 20 ns, the pulse repetition rate indicator is rounded to the nearest integer value.

Trigger and SYNC signals

Trigger		
Trigger modes	continuous trigger with internal trigger source, only in DME interrogation mode	auto
		externally triggered
	only in DME reply mode and with R&S®NRP-Z81 connected to sensor connector	external power sensor
External trigger input	externally triggered	BNC (PULSE EXT at rear) see “Rear-panel connectors” for details
	external power sensor	R&S®NRP-Z81 connected to sensor connector
External trigger delay setting range		4 µs to 4.99 ms
External trigger delay resolution		20 ns
Jitter of external trigger delay		< 10 ns
SYNC output, outputs a synchronizing pulse at the start of the first DME pulse		
Connector type		BNC (PULSE SYNC at rear)
SYNC output level	R_L ≥ 50 Ω	digital signal 0 V/3.3 V (nom.)
SYNC pulse width		70 ns (nom.)
VIDEO output, outputs a signal between 50 % voltage point of rising and falling edge of first DME RF pulse		
Connector type		BNC (PULSE VIDEO at rear)
VIDEO output level	R_L ≥ 50 Ω	digital signal 0 V/3.3 V (nom.)
VIDEO pulse width		equal to set DME pulse width

DME analysis (R&S®SMA-K26 option)

The R&S®SMA100A is able to analyze DME pulses transmitted from a DME transponder if a R&S®NRP-Z81 wideband power sensor is connected to the instrument.

Peak level range		–10 dBm to 20 dBm
Reply delay range		0 µs to 100 µs
Reply efficiency range		0 % to 100 %
Pulse repetition rate range		2 Hz to 10 kHz

Modulation sources

Internal modulation generator

Waveform		sine
Frequency setting range		0.1 Hz to 1 MHz
Resolution of frequency setting		0.01 Hz
Frequency error		< (0.005 Hz + relative deviation of reference frequency × modulation frequency)
Frequency setting time	to within < 1 × 10^{-7}, after IEC/IEEE bus delimiter	< 3 ms
Frequency response	100 Hz to 1 MHz	< 0.3 dB
Distortion	f < 100 kHz at R_L > 50 Ω, level (V_{EMF}) < 1 V	< 0.1 %
Output voltage setting range	V_{peak} at LF connector, open circuit voltage EMF	1 mV to 4 V
Output voltage setting resolution		1 mV
Output voltage setting error	f = 1 kHz, R_L > 50 kΩ	< (1 % of set output voltage + 1 mV)
Output impedance		50 Ω (nom.)

Multifunction generator (R&S®SMA-K24 option)

The multifunction generator option (R&S®SMA-K24) consists of three function generators that can be set independently. Two of the three signal sources can be added with different weighting. The total voltage is limited by the maximum output voltage.

Waveforms	LF generator 1	sine
	LF generator 2	sine, square, triangle user-programmable trapeze ΔT = 20 ns
	noise generator noise amplitude distribution	Gaussian, equal
Frequency range	sine wave	0.1 Hz to 10 MHz
	triangle, square	0.1 Hz to 1 MHz
	noise bandwidth	100 kHz to 10 MHz
Resolution of frequency setting	sine, triangle, square	0.01 Hz
Resolution of ramp parameter settings	rise, fall, low and high time	20 ns
Frequency error		< (0.005 Hz + relative deviation of reference frequency × modulation frequency)
Frequency setting time	to within < 1 × 10^{-7}, after IEC/IEEE bus delimiter	< 3 ms
Frequency response	sine wave	
	100 Hz to 1 MHz	< 0.3 dB
	100 Hz to 10 MHz	< 1 dB
Distortion	f < 100 kHz at R_L > 50 Ω, level (V_{EMF}) < 1 V	< 0.1 %
Output voltage setting range	V_{peak} at LF connector, open circuit voltage EMF	1 mV to 4 V
Output voltage setting resolution		1 mV
Output voltage setting error	f = 1 kHz, R_L > 50 kΩ	< (1 % of set output voltage + 1 mV)
Output impedance		50 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 (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

Standard pulse generator

The pulse generator is fully digital; the clock is directly derived from the instrument's reference frequency.

Pulse mode		single pulse
Trigger mode	continuous trigger with internal trigger source	auto
Pulse period setting range		5 µs to 100 s
Pulse period setting resolution		1 µs
Pulse width setting range		2 µs to 100 s
Pulse width setting resolution		1 µs

High-performance pulse generator (R&S®SMA-K23 option)

The pulse generator is fully digital; the clock is directly derived from the instrument's reference frequency.

Pulse modes		single pulse, double pulse
Trigger modes	continuous trigger with internal trigger source	auto
		externally triggered
		externally gated
Pulse period setting range		20 ns to 100 s
Pulse period setting resolution		5 ns
Pulse width setting range	The pulse width of double pulses can be set independently.	5 ns to 100 s
Pulse width setting resolution		5 ns
Pulse delay setting range	with external trigger	10 ns to 100 s
Pulse delay setting resolution	with external trigger	5 ns
Double-pulse spacing setting range		10 ns to 100 s
Double-pulse spacing setting resolution		5 ns
External trigger delay		50 ns (nom.)
Jitter of external trigger delay		< 5 ns (nom.)

Pulse train (R&S®SMA-K27 option)

High-performance pulse generator (R&S®SMA-K23 option) required.

The R&S®SMA-K27 option extends the functionality of the high-performance pulse generator (R&S®SMA-K23 option). It enables the user to define pulses and sequences of pulses in order to generate jittered or staggered pulse scenarios widely used in radar applications.

Pulse mode	user-selectable pulse width, pulse spacing and pulse sequences	train
Trigger mode	continuous trigger with internal trigger source	auto
		externally triggered
Number of bursts		1 to 2047
Number of identical pulses per burst		1 to 65535
Pulse on time setting range		0 ns to 5 ms
Pulse off time setting range		5 ns to 5 ms
Pulse on and off time setting resolution		5 ns

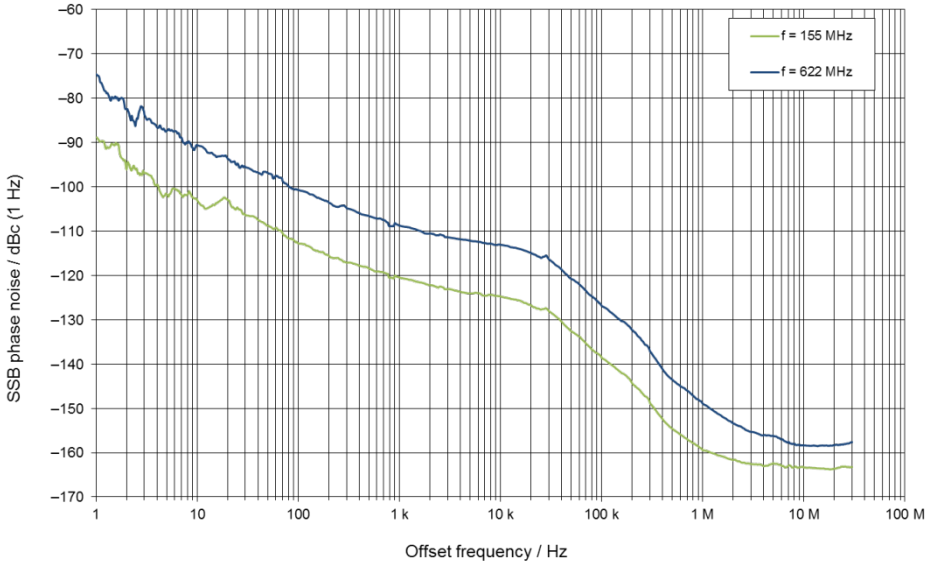
Output for pulse generator signals

SYNC output, output of synchronizing pulse at pulse start or start of pulse sequence		
Connector type		BNC (PULSE SYNC at rear)
SYNC output level	$R_L \geq 50\ \Omega$	digital signal 0 V/3.3 V (nom.)
SYNC pulse width	pulse period < 100 ns	10 ns (nom.)
	pulse period ≥ 100 ns or externally triggered	50 ns (nom.)
VIDEO output, output of pulse generator signal		
Connector type		BNC (PULSE VIDEO at rear)
VIDEO output level	$R_L \geq 50\ \Omega$	digital signal 0 V/3.3 V (nom.)
PULSE VIDEO output	$R_L \geq 50\ \Omega$	digital signal 0 V/3.3 V (nom.)

Clock synthesizer (R&S®SMA-B29 option)

The frequency of the clock synthesizer (R&S®SMA-B29 option) can be set independently of the RF frequency of the R&S®SMA100A. It provides a differential clock signal (AC-coupled, symmetric square) on the rear panel of the R&S®SMA100A.

Frequency range			100 kHz to 1.5 GHz
Resolution of setting			0.01 Hz
Resolution of synthesis			< 100 µHz
Frequency setting time	to within < 1 × 10^{-7}, after IEC/IEEE bus delimiter		< 30 ms
Output voltage (CLK SYN, CLK SYN_N)	into 50 Ω, peak to peak, f = 10 MHz		> 0.4 V, > 0.6 V (typ.)
DC offset voltage setting range			–5 V to +5 V
DC offset voltage resolution			10 mV
DC offset source impedance			2 kΩ (nom.)
Frequency response	100 kHz to 1.5 GHz, both outputs terminated with 50 Ω		< 6 dB, < 4.5 dB (typ.)
Reverse power (from 50 Ω source)	maximum permissible RF power in output frequency range of CLKSYN for f > 1 MHz		0.05 W
Maximum permissible DC voltage			3 V
Spectral purity			
Nonharmonics	carrier offset > 10 kHz		
	f ≤ 325 MHz		< –82 dBc
	325 MHz < f ≤ 650 MHz		< –76 dBc
	650 MHz < f ≤ 1300 MHz		< –70 dBc
	1300 MHz < f ≤ 1500 MHz		< –64 dBc
Wideband noise	carrier offset > 10 MHz, measurement bandwidth 1 Hz		
	30 MHz < f ≤ 1000 MHz		< –150 dBc, < –153 dBc (typ.)
	1000 MHz < f ≤ 1500 MHz		< –147 dBc, < –151 dBc (typ.)
SSB phase noise	carrier offset 20 kHz, measurement bandwidth 1 Hz		
	f = 100 MHz		< –123 dBc, –130.5 dBc (typ.)
	f = 250 MHz		< –113 dBc, –122 dBc (typ.)
	f = 500 MHz		< –109 dBc, –115 dBc (typ.)
	f = 1000 MHz		< –103 dBc, –110 dBc (typ.)
SSB phase noise with R&S®SMA-B22 option	carrier offset 20 kHz, measurement bandwidth 1 Hz		
	f = 100 MHz		< –125 dBc, –131.5 dBc (typ.)
	f = 250 MHz		< –115 dBc, –124.5 dBc (typ.)
	f = 500 MHz		< –111 dBc, –118 dBc (typ.)
	f = 1000 MHz		< –105 dBc, –112 dBc (typ.)
RMS jitter	f = 100 MHz	BW = 1 Hz to 10 MHz	300 fs (30 µUI) (meas.)
	f = 155 MHz	BW = 100 Hz to 1.5 MHz	220 fs (34 µUI) (meas.)
	f = 622 MHz	BW = 1 kHz to 5 MHz	190 fs (118 µUI) (meas.)
RMS jitter with R&S®SMA-B22 option	f = 100 MHz	BW = 1 Hz to 10 MHz	220 fs (22 µUI) (meas.)
	f = 155 MHz	BW = 100 Hz to 1.5 MHz	160 fs (25 µUI) (meas.)
	f = 622 MHz	BW = 1 kHz to 5 MHz	140 fs (87 µUI) (meas.)



Clock synthesizer (R&S®SMA-B29 option): SSB phase noise measured with R&S®SMA-B22 option.

R&S®NRP-Z power analysis (R&S®SMA-K28 option)

Modes		power vs. frequency
		power vs. power
		power vs. time (trace mode)
General settings		
Number of points per sweep (= steps)		10 to 1000
Frequency range	depending on R&S®NRP-Zxx power sensor and R&S®SMA100A frequency option	full frequency range of signal generator or power sensor (whichever is lower); support of frequency-converting DUTs
Y-axis setting range		–100 dBm to +100 dBm
Uncertainty of measured power	determined by power sensor used and timing mode (noise)	see R&S®NRP-Zxx data sheet
Sweep mode		single continuous
Number of traces	used for sensor data or as reference trace	3
Number of markers		4
Trace data export	supported file formats	JPG, BMP, XPM, PNG, CSV
Resolution of saved graphic file	for JPG, BMP, XPM and PNG file format	320 × 240, 640 × 480, 800 × 600 or 1024 × 768
Power vs. frequency mode		
Spacing		linear, logarithmic
Timing mode		fast, normal
Sweep time	depends on timing mode, number of steps and power sensor	set automatically
	e.g. R&S®NRP-Z21 timing mode FAST, 200 steps	approx. 2.5 s
Power vs. power mode		
Spacing		dB steps
Timing mode		fast, normal
Sweep time	depends on timing mode, steps and power sensor	set automatically
	e.g. R&S®NRP-Z21 timing mode FAST, 200 steps	approx. 2.5 s
Power vs. time mode (trace mode)		
Spacing		linear
Sweep time	R&S®NRP-Z11/-Z21/-Z22/-Z23/-Z24, R&S®NRP-Z28, R&S®NRP-Z31	
	setting range	100 µs to 300 ms
	resolution	10 µs
	R&S®NRP-Z81/-Z85	
	setting range	100 ns to 1 s
	resolution (sweep time/steps) ≥ 12.5 ns	12.5 ns
	resolution (sweep time/steps) < 12.5 ns periodic signals trigger mode internally triggered	2 ns
Trace offset	with reference to trigger event	positive, negative
Average		1 to 1024
Trigger modes	internally triggered	auto, free run
	externally triggered R&S®NRP-Z3 required	external
Trigger level setting range	depends on power sensor used	see R&S®NRP-Zxx data sheet
Trigger hysteresis setting range		0 dB to 10 dB
Trigger dropout time setting range		0 ns to 10 s

Available measurements in time mode		
Gate function		
Number of gates	user-selectable	2
Power measurements		peak power, average power
Pulse data measurement, only with R&S®NRP-Z81/-Z85		
Timing measurements		duty cycle, pulse width, pulse period, pulse off time, rise time, pulse start time, overshoot, fall time, pulse stop time
Power measurements		peak power, average power, minimal power, top power, base power, distal power, mesial power, proximal power
Setting range for distal, mesial and proximal threshold	voltage or power-related	0 % to 100 %

Overview of power sensor functionalities

Latest power sensor firmware version is recommended

Power sensor	Power vs. frequency and power vs. power	Power vs. time	Pulse data measurement
R&S®NRP-Z11/-Z21/-Z22/ -Z23/-Z24/-Z31	+	+	–
R&S®NRP-Z28	+	+	–
R&S®NRP-Z51/-Z52/-Z55/ -Z56/-Z57	+	–	–
R&S®NRP-Z81/-Z85	+	+	+
R&S®NRP-Z91/-Z92	+	–	–
R&S®NRP-Z98	+	–	–

+ = supported, – = not supported.

Remote control

Interfaces		IEC 60625 (GPIB IEEE 488.2) Ethernet/LAN USB 2.0 (in line with VISA USBTMC) serial (RS-232-C) [3]
Command set		SCPI 1999.5 or compatible command sets
Compatible command sets	These command sets can be selected in order to emulate another instrument. A subset of common commands is supported.	Agilent/HP 8642A/B Agilent/HP 8643A, 8644A/B, 8645A Agilent/HP 8647A, 8648A/B/C/D Agilent/HP 8662A, 8663A Agilent/HP 8664A, 8665B Agilent E4428C Agilent E8663B/D Agilent N5161A, 5181A (MXG analog) Aeroflex/IFR/Marconi 2023, 2024 Aeroflex/IFR/Marconi 2030 series Aeroflex/IFR/Marconi 2040 series Racal 3102, 9087 R&S®SMGU/SMHU R&S®SMT/SME/SMY/SML Panasonic PA8303
IEC/IEEE bus address		0 to 30
Ethernet/LAN protocols and services		VISA VXI-11 (remote control) Telnet/RawEthernet (remote control) VNC (remote operation with web browser) FTP (file transfer protocol) SMB (mapping parts of the instrument to a host file system)
Ethernet/LAN addressing		DHCP, Static support of ZeroConf and M-DNS to simplify the direct connection to a system controller

[3] Requires R&S®TS-USB1 USB serial adapter.

Connectors

Front-panel connectors

The following connectors are located on the front panel of the instrument as standard. Using the R&S®SMA-B81 rear connector option the connectors can be moved to the rear panel of the instrument.

RF 50Ω	RF output	N female
LF	modulation generator output	BNC female
AM EXT	input for external amplitude modulation	BNC female
Input impedance		> 100 kΩ
Input sensitivity	peak value for set modulation depth	1 V (nom.)
Maximum input voltage		1 V (nom.)
Input damage voltage		±6 V
FM/PM EXT	input for external frequency or phase modulation (only with R&S®SMA-B20/-B22 option)	BNC female
Input impedance		> 100 kΩ or 50 Ω (nom.)
Input sensitivity	peak value for set deviation	1 V (nom.)
Maximum input voltage		1 V (nom.)
Input damage voltage		±10 V
SENSOR	connector for R&S®NRP-Zxx power sensor	6-pin ODU mini-snap series B
USB	USB 1.1 connector for external USB devices such as mouse, keyboard, R&S®NRP-Zxx power sensors (with R&S®NRP-Z4 adapter cable), memory stick for software update and data exchange, or USB serial adapter for RS-232-C remote control	USB type A

Rear-panel connectors

REF IN	external reference frequency input	BNC female
REF OUT	reference frequency output	BNC female
CLK SYN	clock synthesizer output	SMA female
CLK SYN_N	clock synthesizer inverted output	SMA female
PULSE EXT	input for external pulse modulation external trigger input for pulse generator external gate input for pulse generator external trigger input for DME modulation	BNC female
Input impedance	selectable	10 kΩ or 50 Ω (nom.)
Input voltage	TTL, CMOS compatible	
	threshold low	0.7 V (nom.)
	threshold high	0.9 V (nom.)
Input damage voltage		±10 V
Input polarity	selectable	normal, inverse
PULSE VIDEO	pulse generator output video output for external pulse modulation and DME modulation	BNC female
PULSE SYNC	synchronizing output for pulse generator and DME generator	BNC female
INST TRIG	trigger input for sweep and List mode input signal range	BNC female 0 V to 3.3 V (nom.)
BLANK	output for triggering external devices; a low state indicates that the instrument has settled to its final value; output voltage without load	BNC female digital signal 0 V/3.3 V (nom.)
EXT TUNE	input for electronic tuning of internal reference frequency	BNC female
AUX I/O	input for digital FM/φM data signals input for Fast Hopping mode control signals input signal range	26-pin Mini D Ribbon (MDR 26) 0 V to 3.3 V (nom.)
USB IN	USB 1.1 remote control of instrument	USB type B
USB	USB 1.1 connector for external USB devices such as mouse, keyboard, R&S®NRP-Zxx power sensors (with R&S®NRP-Z4 adapter cable), memory stick for software update and data exchange, or USB serial adapter for RS-232-C remote control	USB type A
LAN	provides remote control functionality and other services, see “Remote control”	RJ-45
IEEE 488	remote control of instrument via GPIB	24-pin Amphenol series 57, female

General data

Power supply		
AC input voltage range		100 V to 240 V ± 10 %
AC supply frequency		50 Hz to 400 Hz ± 10 %
Power consumption	when fully equipped	130 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	emissions	in line with EN 55011 class B
	immunity to interfering field strength	in line with EN 61326-1 (industrial environment) in line with EN 61326-2-1
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 MIL-STD-810E method no. 516.4 procedure 1
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 3000 m
	with R&S®SMA-B46 option	up to 4600 m
	storage	up to 4600 m
Weight and dimensions		
Weight	when fully equipped	10 kg (22 lb)
Dimensions (W × H × D)		465 mm × 108 mm × 495 mm (18.31 in × 4.25 in × 19.49 in)
	without front handles and instrument feet for use with R&S®ZZA-211	427 mm × 92.5 mm × 450 mm (16.81 in × 3.46 in × 17.72 in)
Calibration interval		
Recommended calibration interval	operation 40 h/week in full range of specified environmental conditions	3 years

Ordering information

Designation	Type	Order No.
Signal Generator [4]	R&S®SMA100A	1400.0000.02
Including power cable, Quick Start Guide and CD-ROM (with operating and service manual)		
Options		
RF Path		
9 kHz to 3 GHz with electronic attenuator	R&S®SMA-B103	1405.0209.02
9 kHz to 6 GHz with electronic attenuator	R&S®SMA-B106	1405.0809.02
9 kHz to 3 GHz without attenuator	R&S®SMA-B103L	1405.0609.02
9 kHz to 6 GHz without attenuator	R&S®SMA-B106L	1405.1005.02
FM/φM Modulator	R&S®SMA-B20	1405.1605.02
Enhanced Phase Noise Performance and FM/φM Modulator	R&S®SMA-B22	1405.1805.02
Clock Synthesizer	R&S®SMA-B29	1400.2503.02
Operating Altitude up to 4600 m	R&S®SMA-B46	1405.1305.02
Removable Mass Storage (CompactFlash™ card)	R&S®SMA-B80	1405.2001.03
Rear Connectors	R&S®SMA-B81	1405.2401.02
High-Performance Pulse Generator	R&S®SMA-K23	1405.2801.02
Multifunction Generator	R&S®SMA-K24	1405.2901.02
VOR/ILS Modulation	R&S®SMA-K25	1405.3008.02
DME Modulation [5]	R&S®SMA-K26	1405.3408.02
Pulse Train [6, 7]	R&S®SMA-K27	1405.3908.02
Power Analysis	R&S®SMA-K28	1405.3950.02
Calibration		
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 instrument)	R&S®SMA-DKD	1161.3571.00
Recommended extras		
Spare CompactFlash™ Card (R&S®SMA-B80 required)	R&S®SMA-Z10	1405.4004.02
19" Rack Adapter	R&S®ZZA-211	1096.3260.00
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
Wideband Power Sensor (for R&S®SMA-K26 DME modulation and R&S®SMA-K28 power analysis)	R&S®NRP-Z81	1137.9009.02
Power Sensor 9 kHz to 6 GHz, 33 dBm	R&S®NRP-Z92	1171.7005.02
USB Adapter for R&S®NRP-Zxx power sensors	R&S®NRP-Z4	1146.8001.02
USB Serial Adapter for RS-232-C remote control	R&S®TS-USB1	6124.2531.00

[4] The base unit must be ordered together with an R&S®SMA-B103/R&S®SMA-B106 or R&S®SMA-B103L/R&S®SMA-B106L frequency option.

[5] The R&S®SMA-K26 option can be installed in an R&S®SMA100A with serial number 101500 or higher.

[6] Requires the R&S®SMA-K23 high-performance pulse generator option.

[7] The R&S®SMA-K27 option can be installed in an R&S®SMA100A with serial number 101500 or higher.

Service options		
Extended Warranty, one year	R&S®WE1SMA100A	Please contact your local Rohde & Schwarz sales office.
Extended Warranty, two years	R&S®WE2SMA100A	
Extended Warranty, three years	R&S®WE3SMA100A	
Extended Warranty, four years	R&S®WE4SMA100A	
Extended Warranty with Calibration Coverage, one year	R&S®CW1SMA100A	
Extended Warranty with Calibration Coverage, two years	R&S®CW2SMA100A	
Extended Warranty with Calibration Coverage, three years	R&S®CW3SMA100A	
Extended Warranty with Calibration Coverage, four years	R&S®CW4SMA100A	

Extended warranty with a term of one to four years (WE1 to WE4)
Repairs carried out during the contract term are free of charge [8]. Necessary calibration and adjustments carried out during repairs are also covered. Simply contact the forwarding agent we name; your product will be picked up free of charge and returned to you in top condition a couple of days later.

Extended warranty with calibration (CW1 to CW4)
Enhance your extended warranty by adding calibration coverage at a package price. This package ensures that your Rohde & Schwarz product is regularly calibrated, inspected and maintained during the term of the contract. It includes all repairs [8] and calibration at the recommended intervals as well as any calibration carried out during repairs or option upgrades.

For product brochure, see PD 5213.6412.12 and www.rohde-schwarz.com

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

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.

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