

# R&S® SMA100B

## RF and Microwave Signal Generator Specifications

3 year  
warranty



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# Key features

## First class devices thanks to first class signals

- Purest signals
  - Excellent SSB phase noise in base unit:  $< -120$  dBc (typ.) for 10 GHz at an offset of 20 kHz
  - Outstanding SSB phase noise with option:  $< -132$  dBc (typ.) for 10 GHz at an offset of 10 kHz
  - Lowest close-in SSB phase noise:  $< -83$  dBc (typ.);  $f = 10$  GHz, offset = 10 Hz
  - Virtually no wideband noise:  $< -160$  dBc (typ.) at 10 GHz and an offset of 30 MHz
- Lowest harmonic and nonharmonic signal components
  - Very low harmonic signal components over the entire frequency range ( $< -63$  dBc) even at very high output power
  - Very low nonharmonic signal components of  $< -90$  dBc (typ.) at 10 GHz

## Very high output power without compromise

- Exceptionally high output level
  - Ultra high output power up to 38 dBm with the 6 GHz model
  - Over 30 dBm at 18 GHz and 28 dBm at 20 GHz
  - First stage high power upgrade via key code
- Excellent level accuracy and repeatability for CW signals, narrow pulses and modulated signals

## User friendly in every detail

- Flexible 2 HU or 3 HU housing
- 3 HU with larger 7" display and multiple front panel connectors
- Ergonomic operation thanks to state-of-the-art GUI with touch display

## R&S®LegacyPro: refresh your technology

- Plug and play the R&S®SMA100B in an automated test system without changing the test software
- Emulation of R&S®SMA100A, R&S®SMF100A, Keysight PSG, Keysight MXG, etc.

# Definitions

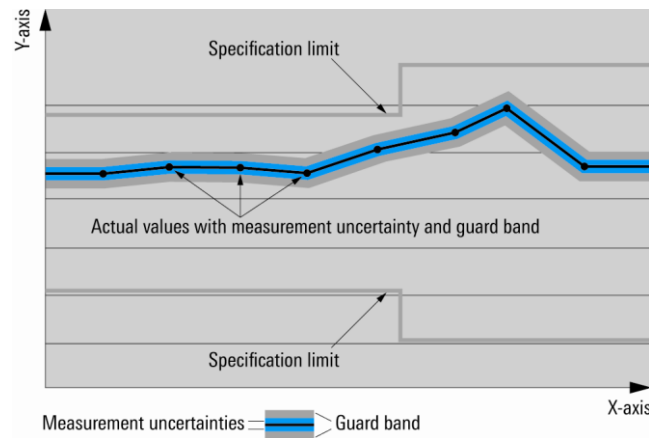
## General

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  $<$ ,  $\leq$ ,  $>$ ,  $\geq$ ,  $\pm$ , 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.

Device settings and GUI parameters are indicated as follows: "parameter: value".

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

In line with the 3GPP/3GPP2 standard, chip rates are specified in Mcps (million chips per second), whereas bit rates and symbol rates are specified in Mbps (million bits per second), kbps (thousand bits per second) or ksps (thousand symbols per second), and sample rates are specified in Msample/s (million samples per second). Mcps, kbps, ksps and Msample/s are not SI units.

## Introduction

### Frequency and platform options (mandatory options)

One of the following frequency options must be installed.

R&S®SMAB-B103	8 kHz to 3 GHz
R&S®SMAB-B106	8 kHz to 6 GHz
R&S®SMAB-B112	8 kHz to 12.75 GHz
R&S®SMAB-B120	8 kHz to 20 GHz

One of the following platform height options must be selected.

R&S®SMAB-B92	2 HU with 5" touch display
R&S®SMAB-B93	3 HU with 7" touch display

### Frequency, high power and rear panel connector options

The following table shows the frequency options and their corresponding high power, ultra high power and rear panel connector options.

Frequency option	High power option	Ultra high power option	Rear panel connector option
R&S®SMAB-B103	R&S®SMAB-K31	R&S®SMAB-B32	R&S®SMAB-B80
R&S®SMAB-B106	R&S®SMAB-K31	R&S®SMAB-B32	R&S®SMAB-B80
R&S®SMAB-B112	R&S®SMAB-K33	R&S®SMAB-B34	R&S®SMAB-B81
R&S®SMAB-B120	R&S®SMAB-K33	R&S®SMAB-B34	R&S®SMAB-B81

Note: an ultra high power option requires the corresponding high power option to be installed. For example, R&S®SMAB-K31 is a prerequisite for R&S®SMAB-B32.

## RF characteristics

Unless stated otherwise, the specifications apply within the specified level range.

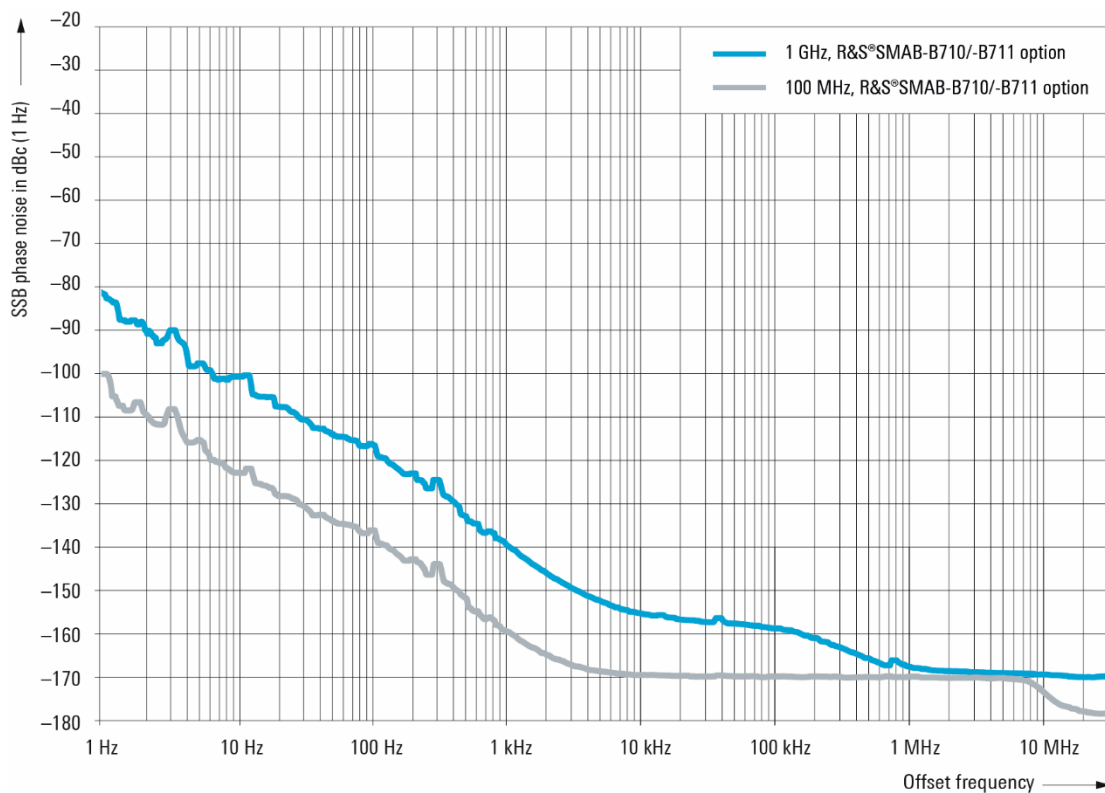
### Frequency

Range	R&S®SMAB-B103	8 kHz to 3 GHz
	R&S®SMAB-B106	8 kHz to 6 GHz
	R&S®SMAB-B112	8 kHz to 12.75 GHz
	R&S®SMAB-B120	8 kHz to 20 GHz
Resolution of setting		0.001 Hz
Resolution of synthesis	f = 1 GHz	0.053 nHz (nom.)
Setting time	to within $< 1 \times 10^{-7}$ for f > 10 MHz or < 30 Hz for f < 10 MHz, with GUI update stopped after IEC/IEEE bus delimiter with R&S®SMAB-B86 option level setting characteristic: auto	
		< 1.5 ms
	with R&S®SMAB-B711(N) option	< 4.5 ms
Resolution of phase offset setting		adjustable in 0.01° steps

### Reference frequency

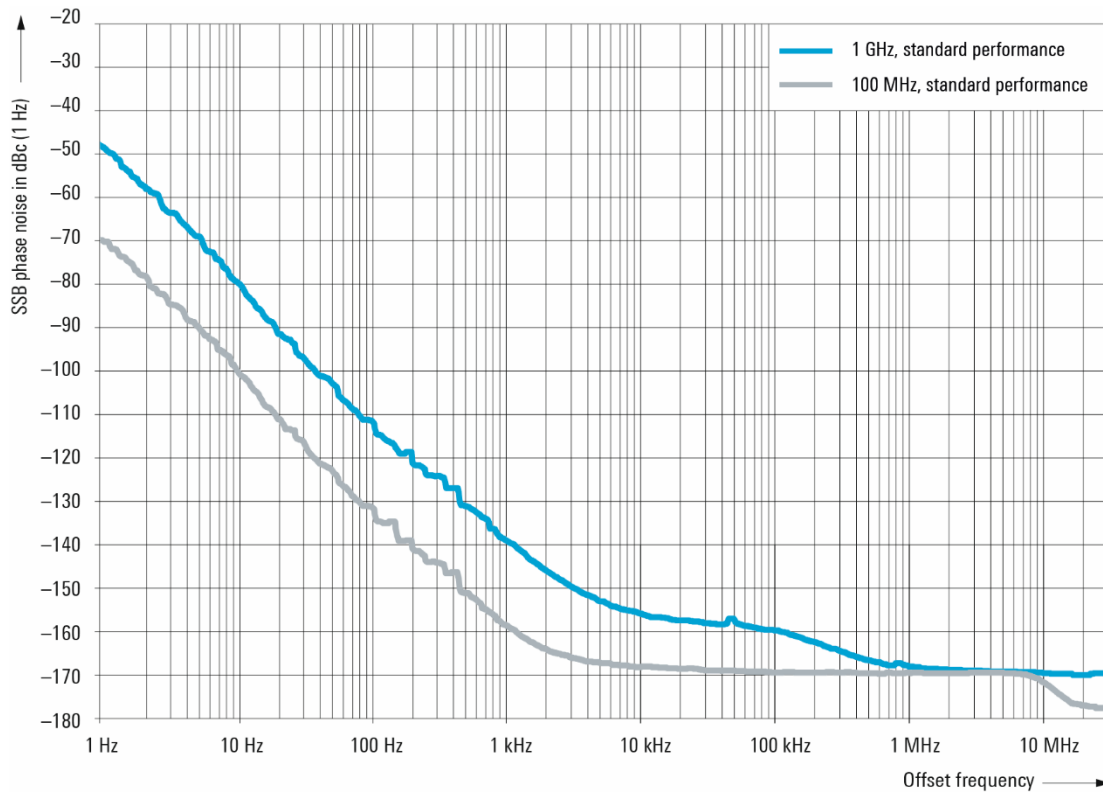
Frequency error	at time of calibration in production	
	standard or with R&S®SMAB-B1H/-B709 options	$< 1 \times 10^{-8}$
	with R&S®SMAB-B710(N)/-B711(N) options	$< 5 \times 10^{-9}$
Aging	after 30 days of uninterrupted operation	
	standard	$\leq 1 \times 10^{-9}$ /day $\leq 1 \times 10^{-7}$ /year
	with R&S®SMAB-B1H/-B709/-B710(N)/-B711(N) options	$\leq 5 \times 10^{-10}$ /day $\leq 3 \times 10^{-8}$ /year
Temperature effect	in temperature range from 0 °C to +55 °C	
	standard	$\pm 6 \times 10^{-8}$
	with R&S®SMAB-B1H/-B709 option	$\pm 6 \times 10^{-9}$
	with R&S®SMAB-B710(N)/-B711(N) options	$\pm 3 \times 10^{-9}$
Warm-up time	to nominal thermostat temperature	$\leq 10$ min (nom.)
<b>Input for external reference frequency</b>		
Connector type	REF in on rear panel	BNC female
Input frequency	standard	10 MHz
	with R&S®SMAB-K703 option	10 MHz, 100 MHz
	with R&S®SMAB-K704 option	10 MHz, 1 MHz to 100 MHz, variable
Input frequency setting resolution	with R&S®SMAB-K704 option	0.1 Hz
Input level range	level limits	0 dBm to 20 dBm
	recommended input level for optimum phase noise performance	7 dBm to 13 dBm
Input impedance		50 Ω (nom.)
Minimum frequency locking range	synchronisation bandwidth: wide	
	synchronisation bandwidth: narrow	
	standard or with R&S®SMAB-B1H/-B709 options	$\pm 0.3 \times 10^{-6}$
	with R&S®SMAB-B710(N)/-B711(N) options	$\pm 0.15 \times 10^{-6}$
<b>Output for internal reference frequency</b>		
Connector type	REF out on rear panel	BNC female
Output frequency	standard	sine wave 10 MHz
	with R&S®SMAB-K703 option	sine wave 10 MHz, 100 MHz
	with R&S®SMAB-K704 option	
	instrument set to internal reference	sine wave 10 MHz
	instrument set to external reference	sine wave 10 MHz, applied external reference frequency
Output level		7 dBm to 14 dBm
Source impedance		50 Ω (nom.)

Wideband noise	with R&S®SMAB-K703 option, 100 MHz, internal reference, carrier offset = 10 MHz, measurement bandwidth 1 Hz	< -163 dBc, -167 dBc (typ.)
<b>Ultra low noise 1 GHz reference frequency (R&amp;S®SMAB-K703 option)</b>		
Input connector type	1 GHz in on rear panel	SMA female
Input frequency		1 GHz
Input level range	level limits	≥ 6 dBm, ≤ 20 dBm
	recommended input level for optimum phase noise performance	7 dBm to 13 dBm
Input impedance		50 Ω (nom.)
Minimum frequency locking range		$\pm 3 \times 10^{-6}$
Output connector type	1 GHz out on rear panel	SMA female
Output frequency		sine wave 1 GHz
Output level		7 dBm to 13 dBm
Source impedance		50 Ω (nom.)
Wideband noise	1 GHz, internal reference, carrier offset = 10 MHz, measurement bandwidth 1 Hz	< -164 dBc, -168 dBc (typ.)
<b>Input for electronic tuning of internal reference frequency</b>		
Connector type	external tune on rear panel	BNC female
Sensitivity	external tuning slope, low	$1 \times 10^{-8}/V$ (typ.)
	external tuning slope, high	$5 \times 10^{-8}/V$ (typ.)
Input voltage range		-10 V to +10 V
Input impedance		10 kΩ (nom.)



Measured SSB phase noise of reference outputs at  $f = 100$  MHz and 1 GHz  
with the R&S®SMAB-B710(N) and R&S®SMAB-B711(N) options  
(only available with the R&S®SMAB-K703 option)





Measured SSB phase noise of reference outputs at  $f = 100$  MHz and 1 GHz with the R&S®SMAB-K703 option

### Reference frequency option concept

		Without option	With R&S®SMAB-K703 option, 1 GHz reference	With R&S®SMAB-K704 option, variable reference input
INPUT	10 MHz input frequency	•	•	•
	100 MHz input frequency	–	•	•
	1 MHz to 100 MHz input frequency	–	–	•
	1 GHz input frequency	–	•	–
OUTPUT	10 MHz output frequency	•	•	•
	100 MHz output frequency	–	•	–
	"Loop through" of input to output	–	•	•
	1 GHz output frequency	–	•	–

#### R&S®SMAB-K703 option (1 GHz reference)

When this option is installed, the user can use the 1 GHz low noise input and output for synchronization. In WIDE mode, the signal generator will use this signal directly as a reference for the synthesizer. This option should be used if a very high phase stability between multiple generators is required. The 100 MHz low noise input and output mode is only available with this option.

#### R&S®SMAB-K704 option (variable reference input)

When this option is installed, the user can set the reference input frequency in 0.1 Hz steps between 1.0 MHz and 100 MHz. The signal generator will lock its internal reference oscillator on the input frequency.

#### Note on choosing the proper reference synchronization bandwidth

The user has the choice to set the synchronization bandwidth either to NARROW or WIDE.

In WIDE mode, the best possible phase stability is achieved.

The phase noise performance close to the carrier depends on the phase noise of the external signal source.

In NARROW mode, the reference PLL acts as a clean-up-loop in which the phase noise is mainly determined by the signal generator's internal reference source.

This mode is recommended when using external reference sources with close-to-carrier phase noise worse than the R&S®SMA100B (i. e. rubidium standards).

Please note that due to the slow synchronization, reference locking can take up to 10 seconds.

## Level

Setting range			
R&S®SMAB-B103/-B106	standard	-145 dBm to +20 dBm	
	with R&S®SMAB-K31 option		
	f ≤ 1 MHz	-145 dBm to +30 dBm	
	f > 1 MHz	-145 dBm to +35 dBm	
	with R&S®SMAB-B32 option		
	f ≤ 1 MHz	-145 dBm to +30 dBm	
f > 1 MHz	-145 dBm to +40 dBm		
R&S®SMAB-B112/-B120	standard		
	f ≤ 13 GHz	-145 dBm to +19 dBm	
	f > 13 GHz	-145 dBm to +18 dBm	
	with R&S®SMAB-K33 option		
	f ≤ 1 MHz	-145 dBm to +30 dBm	
	f > 1 MHz	-145 dBm to +35 dBm	
	with R&S®SMAB-B34 option		
	f ≤ 1 MHz	-145 dBm to +30 dBm	
f > 1 MHz	-145 dBm to +40 dBm		
Setting resolution		0.01 dB	
Specified level range			
R&S®SMAB-B103/-B106	peak envelope power (PEP)		
	standard		
	8 kHz < f ≤ 20 kHz	-90 dBm to +8 dBm	
	20 kHz < f ≤ 100 kHz	-90 dBm to +13 dBm	
	100 kHz < f ≤ 1 MHz	-127 dBm to +13 dBm	
	1 MHz < f ≤ 6 GHz	-127 dBm to +19 dBm	
	with R&S®SMAB-K31 option		
	8 kHz < f ≤ 20 kHz	-90 dBm to +8 dBm	
	20 kHz < f ≤ 100 kHz	-90 dBm to +13 dBm	
	100 kHz < f ≤ 1 MHz	-127 dBm to +13 dBm	
	1 MHz < f ≤ 6 GHz	-127 dBm to +25 dBm	
	with R&S®SMAB-K31 and R&S®SMAB-B32 options		
	8 kHz < f ≤ 20 kHz	-90 dBm to +8 dBm	
	20 kHz < f ≤ 100 kHz	-90 dBm to +13 dBm	
	100 kHz < f ≤ 1 MHz	-127 dBm to +13 dBm	
	1 MHz < f ≤ 8 MHz	-127 dBm to +25 dBm	
	8 MHz < f ≤ 6 GHz	-127 dBm to +30 dBm	
	R&S®SMAB-B112/-B120	standard	
		8 kHz < f ≤ 20 kHz	-90 dBm to +8 dBm
		20 kHz < f ≤ 100 kHz	-90 dBm to +13 dBm
100 kHz < f ≤ 1 MHz		-127 dBm to +13 dBm	
1 MHz < f ≤ 6 GHz		-127 dBm to +18 dBm	
6 GHz < f ≤ 13 GHz		-120 dBm to +18 dBm	
13 GHz < f ≤ 20 GHz		-120 dBm to +17 dBm	
with R&S®SMAB-K33 option			
8 kHz < f ≤ 20 kHz		-90 dBm to +8 dBm	
20 kHz < f ≤ 100 kHz		-90 dBm to +13 dBm	
100 kHz < f ≤ 1 MHz		-127 dBm to +13 dBm	
1 MHz < f ≤ 6 GHz		-127 dBm to +23 dBm	
6 GHz < f ≤ 20 GHz		-120 dBm to +20 dBm <sup>1</sup>	
with R&S®SMAB-K33 and R&S®SMAB-B34 options			
8 kHz < f ≤ 20 kHz		-90 dBm to +8 dBm	
20 kHz < f ≤ 100 kHz		-90 dBm to +13 dBm	
100 kHz < f ≤ 1 MHz		-127 dBm to +13 dBm	
1 MHz < f ≤ 8 MHz		-127 dBm to +25 dBm	
8 MHz < f ≤ 6 GHz	-127 dBm to +28 dBm		
6 GHz < f ≤ 18 GHz	-120 dBm to +27 dBm <sup>1</sup>		
18 GHz < f ≤ 20 GHz	-120 dBm to +24 dBm <sup>1</sup>		

<sup>1</sup> With the R&S®SMAB-B81 rear panel connectors option, the level is reduced by (0.2 dB + 0.025 dB/GHz).

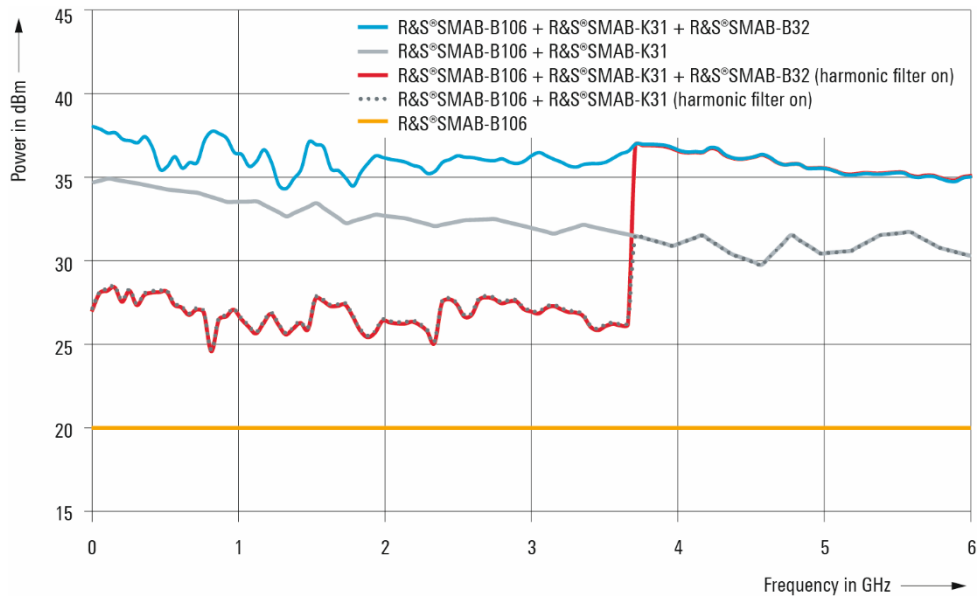
Level accuracy	CW, level setting characteristic: auto, temperature range from +18 °C to +33 °C	
	level from -90 dBm to +25 dBm	
	8 kHz < f ≤ 8 MHz	< 1.0 dB
	8 MHz < f ≤ 3 GHz	< 0.5 dB
	3 GHz < f ≤ 20 GHz	< 0.9 dB
	level > +25 dBm	
	8 MHz < f ≤ 18 GHz	< 1.0 dB
	level ≤ -90 dBm	
	100 kHz < f ≤ 8 MHz	< 1.2 dB
	8 MHz < f ≤ 3 GHz	< 0.8 dB
3 GHz < f ≤ 20 GHz	< 1.2 dB	
Additional level error	ALC state off (table)	< 0.7 dB
Interruption-free level setting range	level setting characteristic: uninterrupted level setting	> 20 dB
	with R&S®SMAB-K724 option, 52 MHz < f ≤ 20 GHz, level setting characteristic: high dynamic uninterrupted	> 60 dB, 70 dB (typ.)
Setting time	level deviation < 0.1 dB from final value, with GUI update stopped, temperature range from +18 °C to +33 °C, after IEC/IEEE bus delimiter with R&S®SMAB-B86 option	
	level setting characteristic: auto	< 1.5 ms
Level setting characteristics	predefined modes to optimize the instrument behavior for common applications	<ul style="list-style-type: none"> <li>• auto</li> <li>• uninterrupted level setting</li> <li>• strictly monotone</li> <li>• constant VSWR</li> </ul>
Automatic level control modes		auto, on, off (table), table and on

## Reverse power

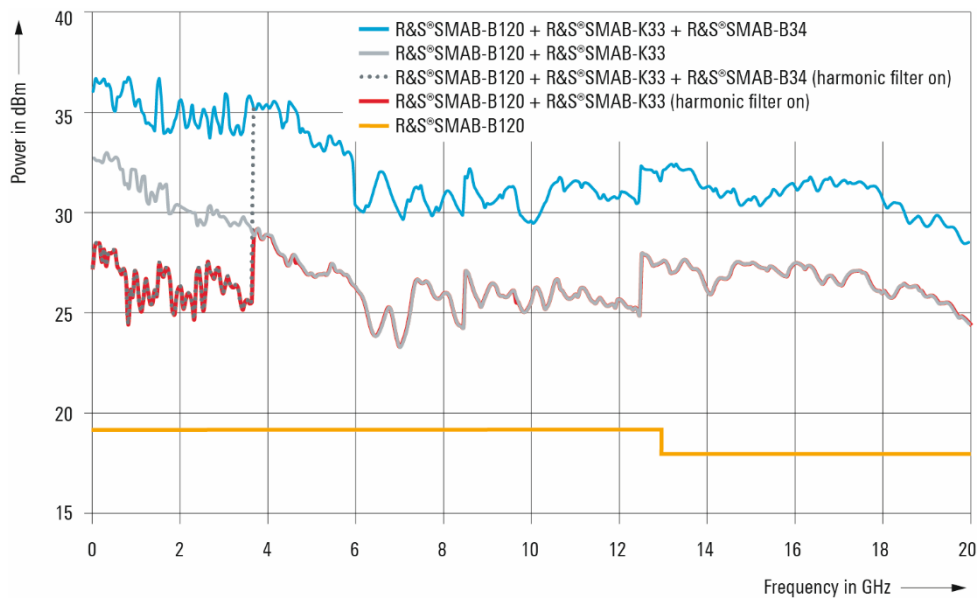
Reverse power	R&S®SMAB-B103/-B106, from 50 Ω source, maximum permissible RF power in output frequency range of RF path for f > 1 MHz; in case of too high reverse power, the RF output is switched off by a mechanical relay	
	1 MHz < f ≤ 3 GHz	50 W
	3 GHz < f < 6 GHz	10 W
	R&S®SMAB-B112/-B120, from 50 Ω source	0.5 W
Maximum permissible DC voltage	R&S®SMAB-B103/-B106	50 V
	R&S®SMAB-B112/-B120	5 V

## VSWR

Output impedance VSWR in 50 Ω system, ALC state auto	R&S®SMAB-B103/-B106	
	200 kHz < f ≤ 6 GHz	< 1.6
	R&S®SMAB-B112/-B120	
	200 kHz < f ≤ 3 GHz	< 1.9 (meas.)
	3 GHz < f ≤ 6 GHz	< 1.7 (meas.)
	6 GHz < f ≤ 20 GHz	< 1.6 (meas.)
	R&S®SMAB-B112/-B120 with R&S®SMAB-B34	
	200 kHz < f ≤ 3 GHz	< 1.9 (meas.)
	3 GHz < f ≤ 6 GHz	< 1.7 (meas.)
	6 GHz < f ≤ 20 GHz	< 1.8 (meas.)



Measured maximum available output power versus frequency



Measured maximum available output power versus frequency

## Frequency and level sweep

Operating mode		digital sweep in discrete steps
Sweep parameters		RF frequency or RF level
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		external trigger signal (INST TRIG at rear), rotary knob, touch panel, remote control
Sweep range		full specified frequency and level range
	interruption-free level sweep with attenuator mode fixed	0.01 dB to 20 dB
	high dynamic uninterrupted level sweep with R&S®SMAB-K724 option, 52 MHz < f ≤ 20 GHz	0.01 dB to 60 dB, 70 dB (typ.)
Sweep shape		sawtooth, triangle
Step size setting resolution	frequency sweep linear	0.001 Hz
	frequency sweep logarithmic	0.01 %
	level sweep	0.01 dB
Dwell time setting range	RF level sweep	3 ms to 100 s
	RF frequency sweep	3 ms to 100 s
	with R&S®SMAB-B711(N) option	5 ms to 100 s
Dwell time setting resolution		0.1 ms

## Ramp sweep (R&S®SMAB-B28 option)

Ramp sweep operation is available in the frequency range  $8 \text{ MHz} < f \leq f_{\text{max}}$ .

Operating mode		synthesized frequency sweep
Trigger modes	execute sweep continuously	auto
	execute one full sweep	single
Trigger source		external trigger signal (INST TRIG at rear), rotary knob, touchpanel, remote control
Sweep span range		Ramp sweep frequency range
Maximum sweep rate	$f \leq 375 \text{ MHz}$	500 MHz/ms
	$375 \text{ MHz} < f \leq 750 \text{ MHz}$	31.25 MHz/ms
	$750 \text{ MHz} < f \leq 1500 \text{ MHz}$	62.5 MHz/ms
	$1.5 \text{ GHz} < f \leq 3 \text{ GHz}$	125 MHz/ms
	$3 \text{ GHz} < f \leq 6 \text{ GHz}$	250 MHz/ms
	$6 \text{ GHz} < f \leq 12 \text{ GHz}$	500 MHz/ms
	$12 \text{ GHz} < f \leq 20 \text{ GHz}$	1 GHz/ms
Frequency accuracy		(0.005 % of span)/(sweep time/s)
Sweep time		
Setting range		10 ms to 100 s
Setting resolution		0.1 ms
Frequency markers	number of frequency markers	10

## List mode

Frequency and level values can be stored in a list and triggered by an internal timer or an external trigger.

Run mode		live
Operating modes	internal trigger, infinite	auto
	internal trigger, one sweep per trigger event	single
	internal trigger, one step per trigger event	step
	external trigger, one sweep per trigger event	extern single
	external trigger, one step per trigger event	extern step
Dwell time setting range	can be set individually for each step	1 ms to 100 s
Dwell time setting resolution		0.1 ms

## Spectral purity

Harmonics <sup>2</sup>	CW	
	R&S®SMAB-B103/-B106: level = 10 dBm; for instruments equipped with R&S®SMAB-K31 high power option: level = 10 dBm; for instruments equipped with R&S®SMAB-B32 ultra high power option: level = 18 dBm	
	100 kHz ≤ f ≤ 10 MHz	< -30 dBc
	10 MHz ≤ f ≤ 6 GHz	< -60 dBc
	R&S®SMAB-B112/-B120: level = 10 dBm; for instruments equipped with R&S®SMAB-K33 high power option: level = 10 dBm; for instruments equipped with R&S®SMAB-B34 ultra high power option: level = 16 dBm	
	100 kHz ≤ f ≤ 10 MHz	< -30 dBc
Nonharmonics	CW, offset > 10 kHz from carrier, level = 10 dBm	
	f ≤ 750 MHz	< -96 dBc
	750 MHz < f ≤ 1.5 GHz	< -92 dBc
	1.5 GHz < f ≤ 3 GHz	< -86 dBc
	3 GHz < f ≤ 6 GHz	< -80 dBc
	6 GHz < f ≤ 12 GHz	< -74 dBc
	12 GHz < f ≤ 20 GHz	< -68 dBc
	for instruments equipped with R&S®SMAB-B711(N) ultra low phase noise option: CW, offset > 10 kHz from carrier, level = 10 dBm	
	f ≤ 1.5 GHz	< -100 dBc
	1.5 GHz < f ≤ 3 GHz	< -94 dBc
	3 GHz < f ≤ 6 GHz	< -88 dBc
	6 GHz < f ≤ 12 GHz	< -82 dBc
12 GHz < f ≤ 20 GHz	< -76 dBc	
Subharmonics <sup>3</sup>	CW, level operating mode: auto, level = 10 dBm	
	f ≤ 5 GHz	< -85 dBc, < -95 dBc with R&S®SMAB-B711(N) option
	5 GHz < f ≤ 20 GHz	< -60 dBc
Wideband noise	level operating mode: auto, level = 10 dBm, measurement bandwidth 1 Hz, CW carrier offset 10 MHz or 10 % of carrier frequency, whichever is lower	
	f ≤ 8 MHz	< -150 dBc
	8 MHz < f ≤ 1.5 GHz	< -155 dBc
	1.5 GHz < f ≤ 3 GHz	< -153 dBc
	3 GHz < f ≤ 6.0 GHz	< -150 dBc
	carrier offset 30 MHz	
	6.0 GHz < f ≤ 12 GHz	< -150 dBc
	12 GHz < f ≤ 20 GHz	< -145 dBc
	instruments equipped with R&S®SMAB-B711(N) ultra low phase noise option carrier offset 10 MHz or 10 % of carrier frequency, whichever is lower	
	f ≤ 8 MHz	< -150 dBc
	8 MHz < f ≤ 1.5 GHz	< -157 dBc
	1.5 GHz < f ≤ 3 GHz	< -155 dBc
	3 GHz < f ≤ 6.0 GHz	< -155 dBc
	carrier offset 30 MHz	
	6.0 GHz < f ≤ 12 GHz	< -154 dBc
	12 GHz < f ≤ 16 GHz	< -152 dBc
	carrier offset 100 MHz	
	16 GHz < f ≤ 20 GHz	< -152 dBc
SSB phase noise	CW, standard performance, carrier offset 20 kHz CW, measurement bandwidth 1 Hz, level = 10 dBm	
	f = 10 MHz	< -158 dBc, -165 dBc (typ.)
	f = 100 MHz	< -154 dBc, -159 dBc (typ.)
	f = 1 GHz	< -135 dBc, -140 dBc (typ.)
	f = 2 GHz	< -129 dBc, -134 dBc (typ.)
	f = 3 GHz	< -125 dBc, -130 dBc (typ.)
	f = 4 GHz	< -123 dBc, -128 dBc (typ.)
	f = 6 GHz	< -119 dBc, -124 dBc (typ.)
	f = 10 GHz	< -115 dBc, -120 dBc (typ.)
f = 20 GHz	< -109 dBc, -114 dBc (typ.)	

<sup>2</sup> Specifications are not valid for harmonics beyond "specified frequency range".

<sup>3</sup> Specifications are not valid for subharmonics beyond "specified frequency range".

**SSB phase noise with R&S®SMAB-B709 option**Specified values in plain text, measured values in brackets ( ) and *italics*.

SSB phase noise in dBc (1 Hz), CW, level = 10 dBm				
Offset frequency \ Carrier frequency	1 Hz	10 Hz	100 Hz	1 kHz
f = 10 MHz	(-98)	-120	-136	-147
f = 100 MHz	(-79)	-103	-124	-144
f = 1 GHz	(-59)	-83	-104	-124
f = 2 GHz	(-53)	-77	-98	-118
f = 3 GHz	(-49)	-73	-94	-114
f = 4 GHz	(-47)	-71	-92	-112
f = 6 GHz	(-43)	-67	-88	-108
f = 10 GHz	(-39)	-63	-84	-104
f = 20 GHz	(-33)	-58	-78	-98

SSB phase noise in dBc (1 Hz), CW, level = 10 dBm				
Offset frequency \ Carrier frequency	10 kHz	100 kHz	1 MHz	10 MHz
f = 10 MHz	-157	-160	-161	
f = 100 MHz	-155	-155	-162	-162
f = 1 GHz	-140	-138	-145	-160
f = 2 GHz	-134	-132	-139	-159
f = 3 GHz	-130	-128	-136	-159
f = 4 GHz	-128	-126	-133	-157
f = 6 GHz	-124	-122	-131	-156
f = 10 GHz	-120	-118	-124	-148
f = 20 GHz	-114	-112	-118	-142

**SSB phase noise with R&S®SMAB-B710(N) option**Specified values in plain text, typical values in brackets ( ), measured values in brackets ( ) and *italics*.

Specifications above 3 GHz only applicable for R&amp;S®SMAB-B710 option.

SSB phase noise in dBc (1 Hz), CW, level = 10 dBm				
Offset frequency \ Carrier frequency	1 Hz	10 Hz	100 Hz	1 kHz
f = 10 MHz	(-116)	-124 (-132)	-136 (-142)	-147 (-155)
f = 100 MHz	(-96)	-117 (-122)	-129 (-136)	-144 (-150)
f = 1 GHz	(-76)	-97 (-103)	-111 (-116)	-131 (-138)
f = 2 GHz	(-70)	-91 (-97)	-105 (-110)	-125 (-131)
f = 3 GHz	(-66)	-87 (-93)	-101 (-106)	-121 (-128)
f = 4 GHz	(-64)	-86 (-90)	-99 (-104)	-119 (-125)
f = 6 GHz	(-60)	-81 (-87)	-95 (-100)	-115 (-122)
f = 10 GHz	(-56)	-77 (-82)	-91 (-96)	-111 (-118)
f = 20 GHz	(-50)	-71 (-76)	-85 (-90)	-105 (-112)

SSB phase noise in dBc (1 Hz), CW, level = 10 dBm				
Offset frequency \ Carrier frequency	10 kHz	100 kHz	1 MHz	10 MHz
f = 10 MHz	-157 (-164)	-160 (-165)	-161 (-166)	
f = 100 MHz	-155 (-160)	-155 (-160)	-162 (-166)	-162 (-168)
f = 1 GHz	-140 (-145)	-138 (-143)	-145 (-151)	-160 (-165)
f = 2 GHz	-134 (-139)	-132 (-137)	-139 (-145)	-159 (-165)
f = 3 GHz	-130 (-135)	-128 (-133)	-136 (-143)	-159 (-164)
f = 4 GHz	-128 (-133)	-126 (-131)	-133 (-139)	-157 (-161)
f = 6 GHz	-124 (-129)	-122 (-128)	-131 (-137)	-156 (-160)
f = 10 GHz	-120 (-125)	-118 (-123)	-124 (-130)	-148 (-153)
f = 20 GHz	-114 (-119)	-112 (-117)	-118 (-124)	-142 (-147)

**SSB phase noise with R&S®SMAB-B711(N) option**

Specified values in plain text, typical values in brackets ( ), measured values in brackets ( ) and *italics*.  
 Specifications above 3 GHz only applicable for R&S®SMAB-B711 option.

SSB phase noise in dBc (1 Hz), CW, level = 10 dBm				
Offset frequency	1 Hz	10 Hz	100 Hz	1 kHz
Carrier frequency				
<b>f = 10 MHz</b>	(-116)	-124 (-132)	-136 (-142)	-147 (-156)
<b>f = 100 MHz</b>	(-96)	-117 (-122)	-129 (-136)	-146 (-150)
<b>f = 1 GHz</b>	(-76)	-97 (-103)	-111 (-117)	-135 (-139)
<b>f = 2 GHz</b>	(-70)	-91 (-97)	-105 (-111)	-129 (-133)
<b>f = 3 GHz</b>	(-66)	-87 (-93)	-101 (-107)	-125 (-130)
<b>f = 4 GHz</b>	(-64)	-86 (-91)	-99 (-105)	-122 (-127)
<b>f = 6 GHz</b>	(-60)	-81 (-87)	-95 (-101)	-119 (-123)
<b>f = 10 GHz</b>	(-56)	-77 (-83)	-91 (-97)	-115 (-119)
<b>f = 20 GHz</b>	(-50)	-71 (-77)	-85 (-91)	-109 (-113)

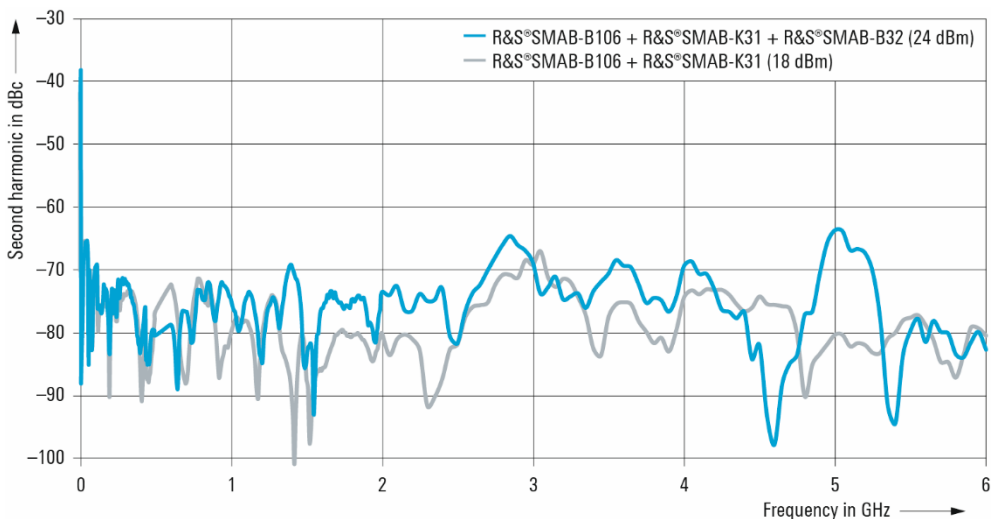
SSB phase noise in dBc (1 Hz), CW, level = 10 dBm				
Offset frequency	10 kHz	100 kHz	1 MHz	10 MHz
Carrier frequency				
<b>f = 10 MHz</b>	-157 (-164)	-160 (-166)	-161 (-166)	
<b>f = 100 MHz</b>	-155 (-160)	-162 (-166)	-162 (-167)	-162 (-168)
<b>f = 1 GHz</b>	-147 (-152)	-148 (-152)	-157 (-161)	-160 (-165)
<b>f = 2 GHz</b>	-142 (-146)	-142 (-146)	-151 (-157)	-159 (-164)
<b>f = 3 GHz</b>	-138 (-142)	-138 (-143)	-148 (-156)	-159 (-164)
<b>f = 4 GHz</b>	-135 (-140)	-136 (-140)	-147 (-151)	-157 (-162)
<b>f = 6 GHz</b>	-132 (-136)	-132 (-137)	-144 (-150)	-155 (-161)
<b>f = 10 GHz</b>	-128 (-132)	-128 (-133)	-140 (-145)	-156 (-160)
<b>f = 20 GHz</b>	-122 (-126)	-122 (-127)	-134 (-139)	-148 (-153)



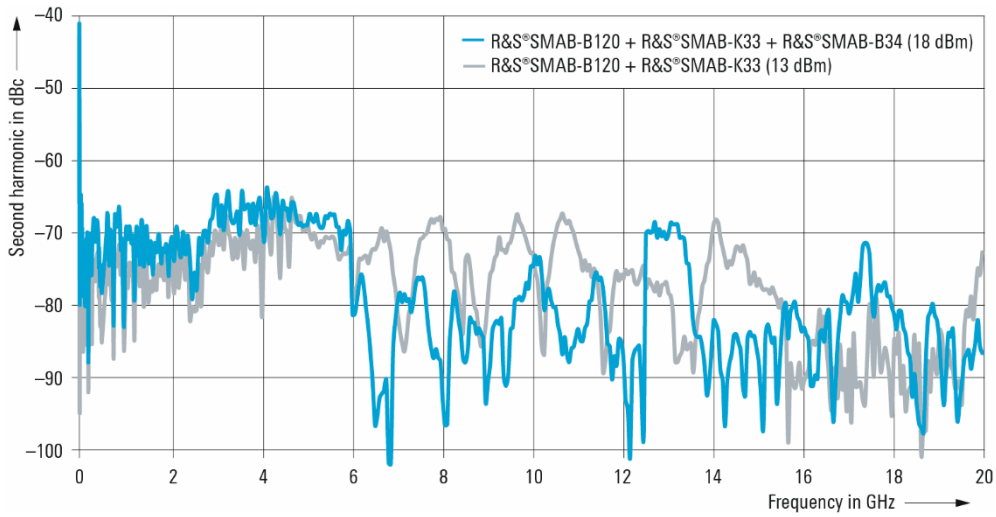
### RMS jitter

Specifications above 3 GHz not applicable for R&S®SMAB-B710N and R&S®SMAB-B711N options.

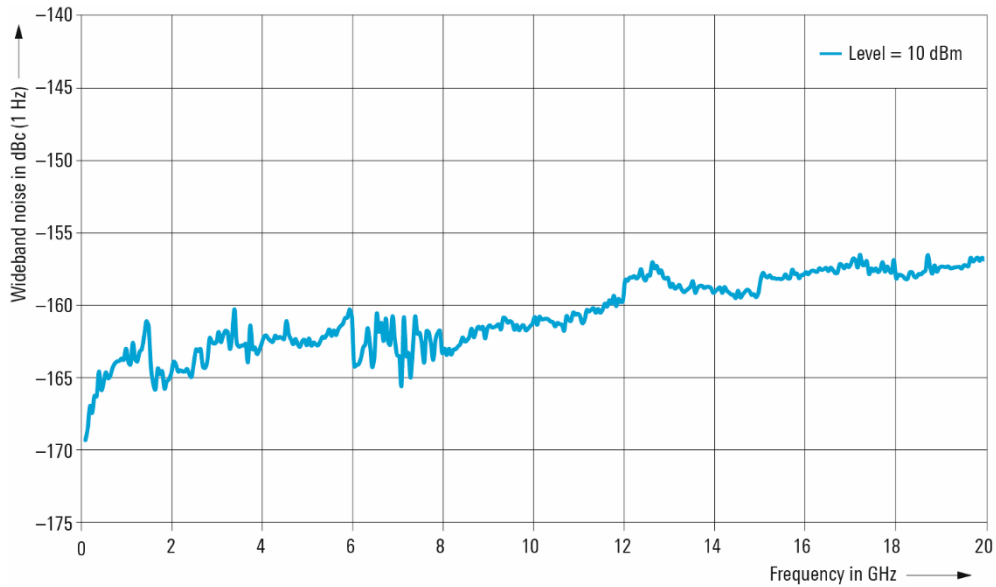
RMS jitter	f = 155 MHz, BW 100 Hz to 1.5 MHz	20.1 fs (meas.)
	f = 622 MHz, BW 1 kHz to 5 MHz	18.7 fs (meas.)
	f = 1 GHz, BW 1 Hz to 10 MHz	558 fs (meas.)
	f = 2.488 GHz, BW 5 kHz to 20 MHz	18.7 fs (meas.)
	f = 9.952 GHz, BW 10 kHz to 80 MHz	18.5 fs (meas.)
With R&S®SMAB-B1H option	f = 155 MHz, BW 100 Hz to 1.5 MHz	19.7 fs (meas.)
	f = 622 MHz, BW 1 kHz to 5 MHz	18.8 fs (meas.)
	f = 1 GHz, BW 1 Hz to 10 MHz	129 fs (meas.)
	f = 2.488 GHz, BW 5 kHz to 20 MHz	18.7 fs (meas.)
	f = 9.952 GHz, BW 10 kHz to 80 MHz	18.5 fs (meas.)
With R&S®SMAB-B709 option	f = 155 MHz, BW 100 Hz to 1.5 MHz	18.5 fs (meas.)
	f = 622 MHz, BW 1 kHz to 5 MHz	13.6 fs (meas.)
	f = 1 GHz, BW 1 Hz to 10 MHz	129 fs (meas.)
	f = 2.488 GHz, BW 5 kHz to 20 MHz	13.6 fs (meas.)
	f = 9.952 GHz, BW 10 kHz to 80 MHz	13.1 fs (meas.)
With R&S®SMAB-B710(N) option	f = 155 MHz, BW 100 Hz to 1.5 MHz	19.7 fs (meas.)
	f = 622 MHz, BW 1 kHz to 5 MHz	18.7 fs (meas.)
	f = 1 GHz, BW 1 Hz to 10 MHz	23.7 fs (meas.)
	f = 2.488 GHz, BW 5 kHz to 20 MHz	18.6 fs (meas.)
	f = 9.952 GHz, BW 10 kHz to 80 MHz	16.6 fs (meas.)
With R&S®SMAB-B711(N) option	f = 155 MHz, BW 100 Hz to 1.5 MHz	8.4 fs (meas.)
	f = 622 MHz, BW 1 kHz to 5 MHz	5.1 fs (meas.)
	f = 1 GHz, BW 1 Hz to 10 MHz	17.5 fs (meas.)
	f = 2.488 GHz, BW 5 kHz to 20 MHz	4.1 fs (meas.)
	f = 9.952 GHz, BW 10 kHz to 80 MHz	3.8 fs (meas.)
Residual FM	RMS values 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 = 8 dBm, RMS value (0.03 kHz to 20 kHz)	< 0.02 %



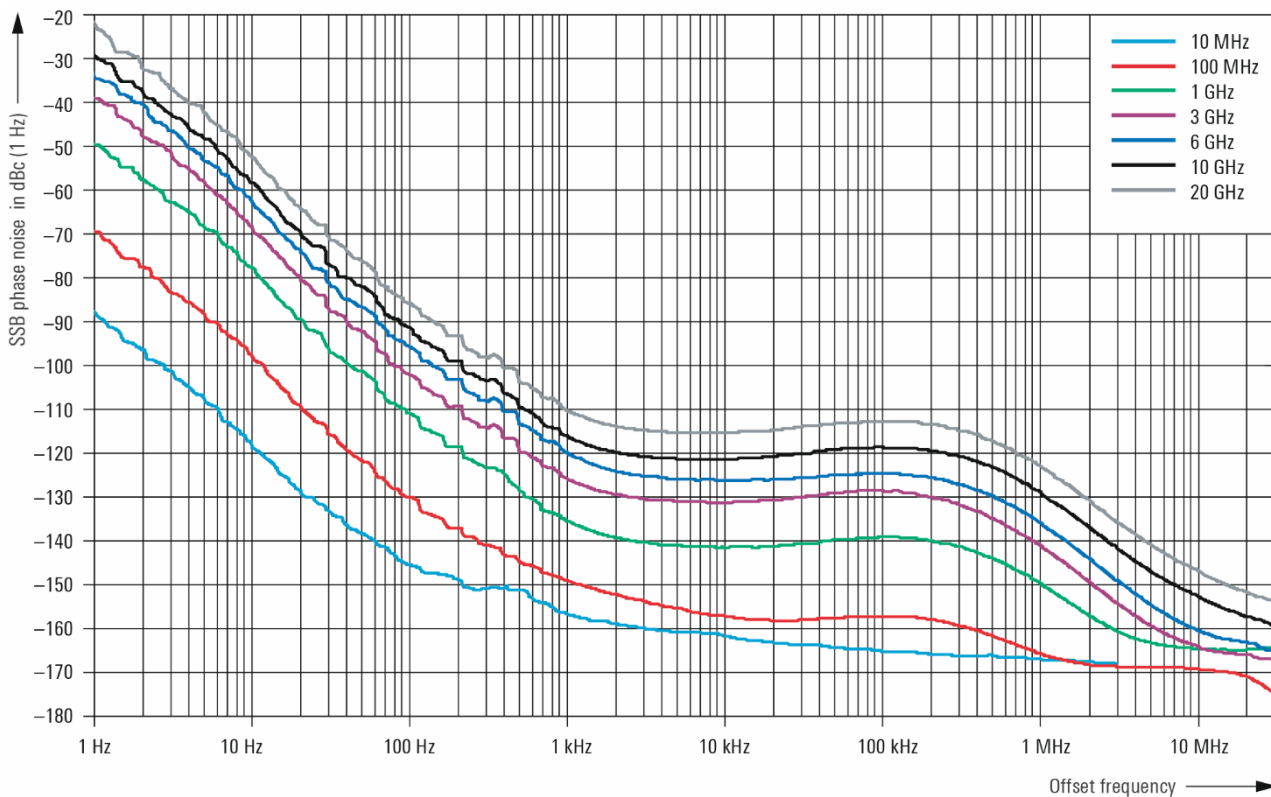
Measured harmonics versus carrier frequency with harmonic filter on for  $f \leq 3.7$  GHz



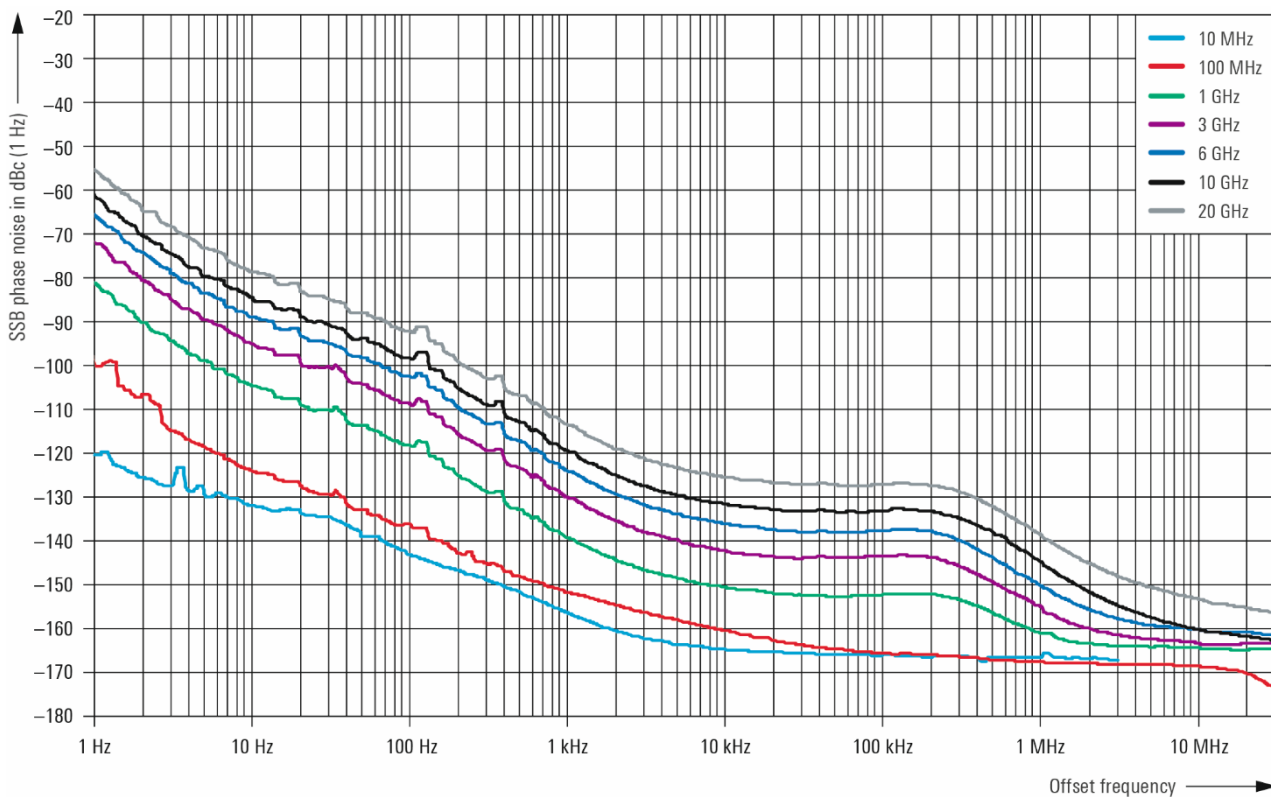
*Measured harmonics versus carrier frequency with harmonic filter on for  $f \leq 3.7$  GHz*



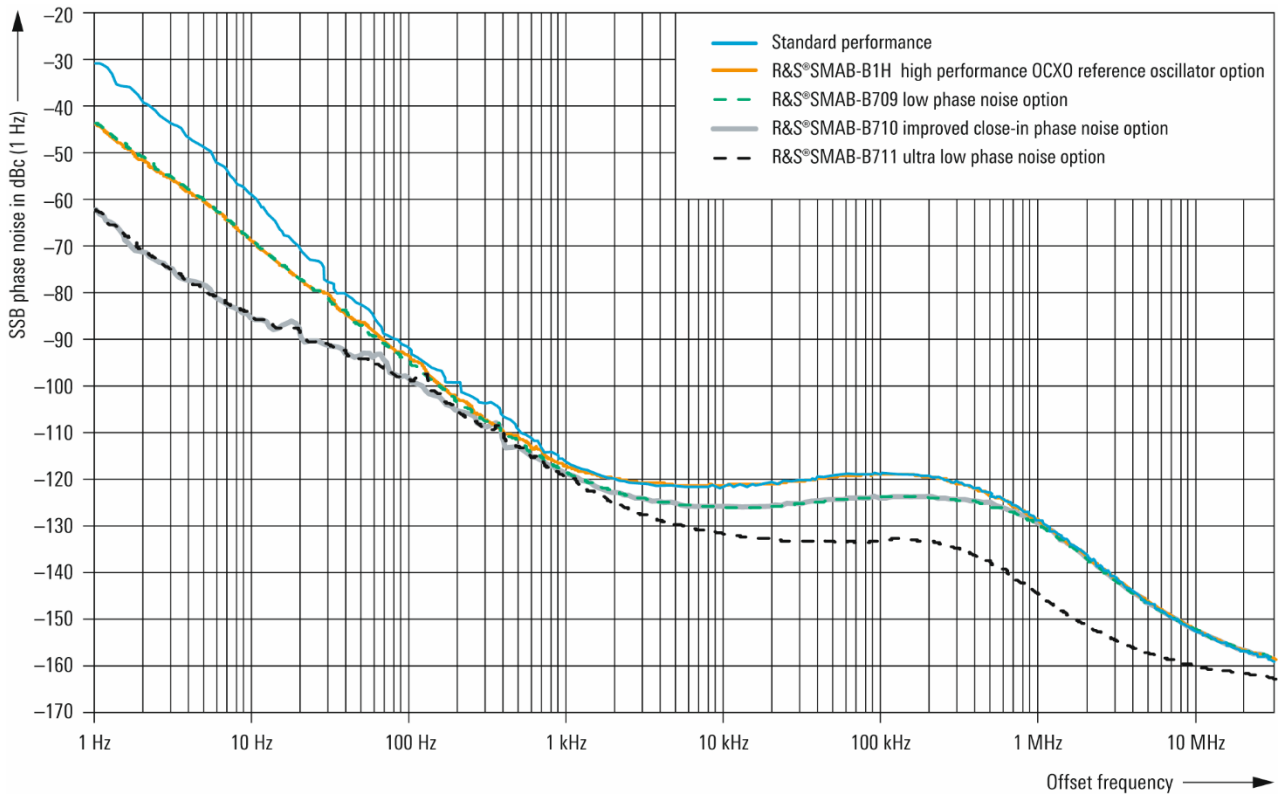
*Measured wideband noise at 30 MHz offset and +10 dBm versus carrier frequency with the R&S®SMAB-B120, R&S®SMAB-B711 and R&S®SMAB-B34 options; measured with the R&S®FSWP phase noise analyzer*



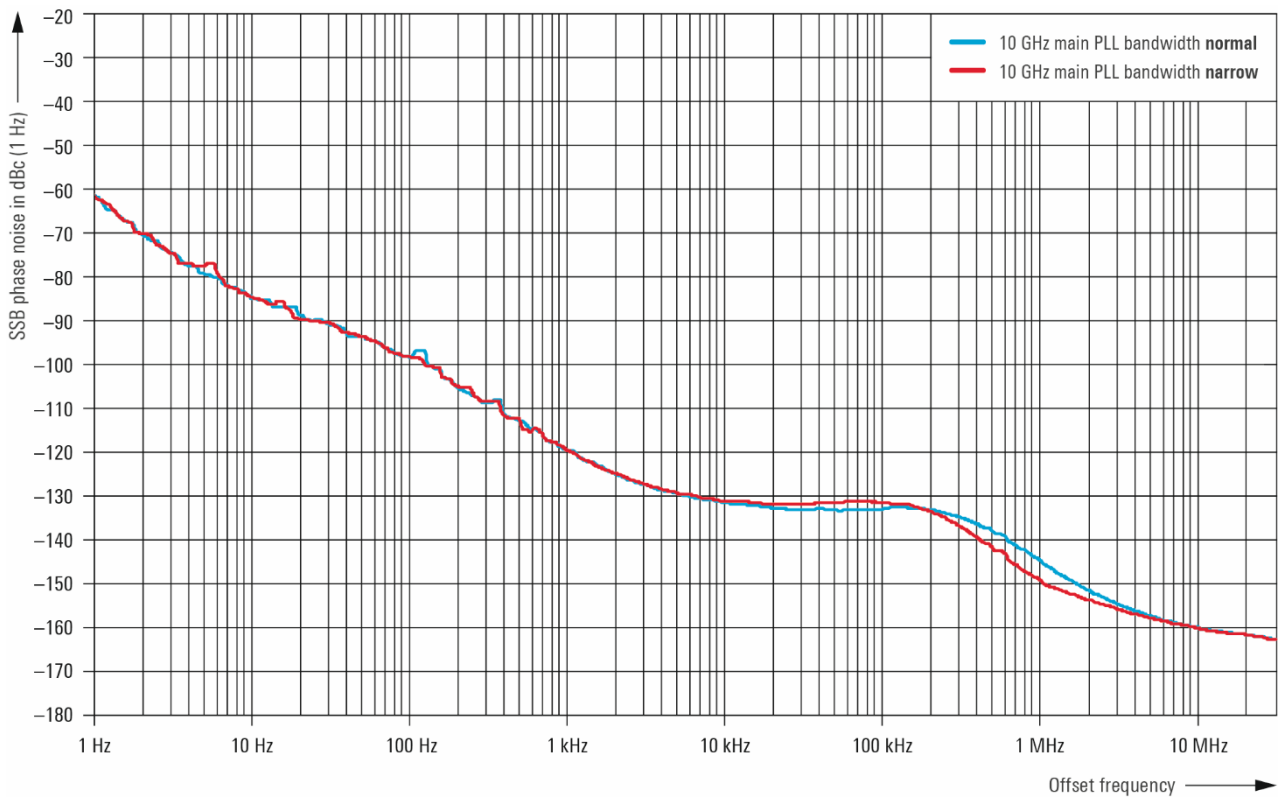
Measured SSB phase noise (standard performance)



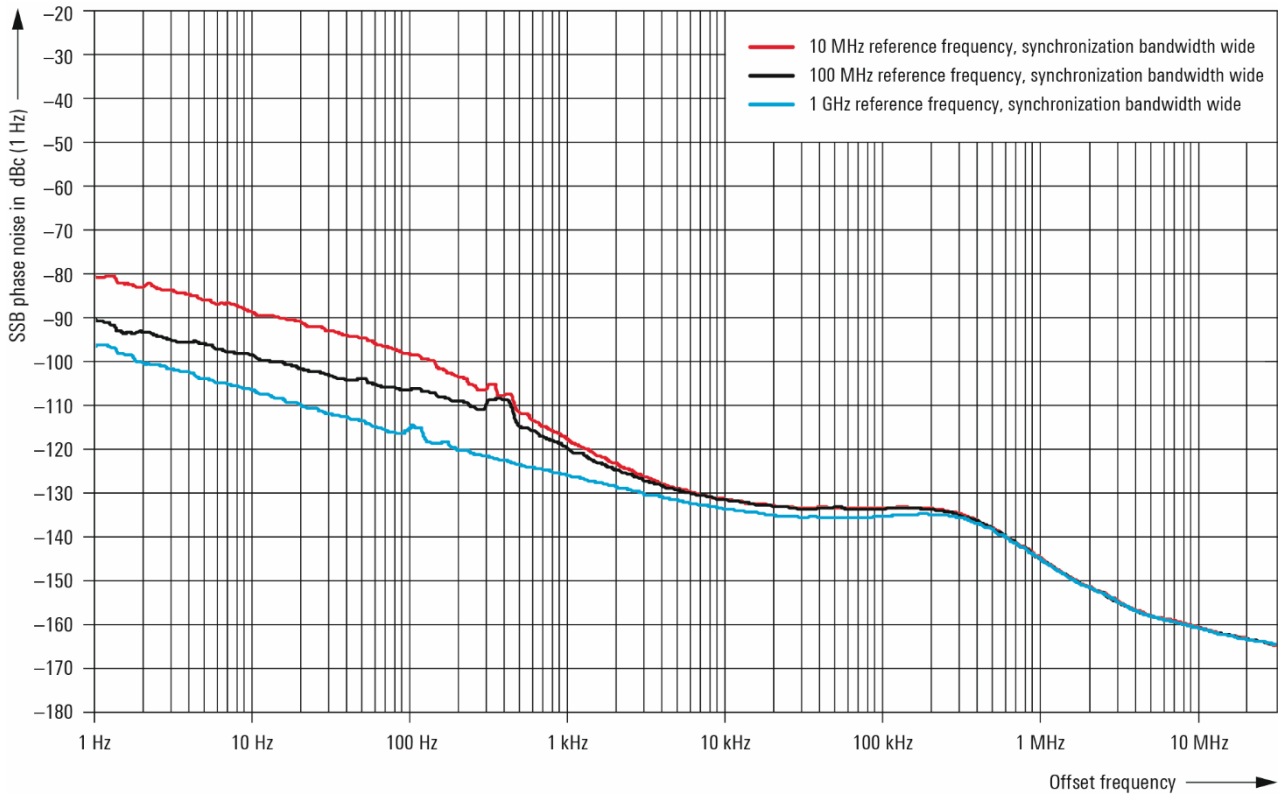
Measured SSB phase noise with the R&S<sup>®</sup>SMAB-B711(N) option



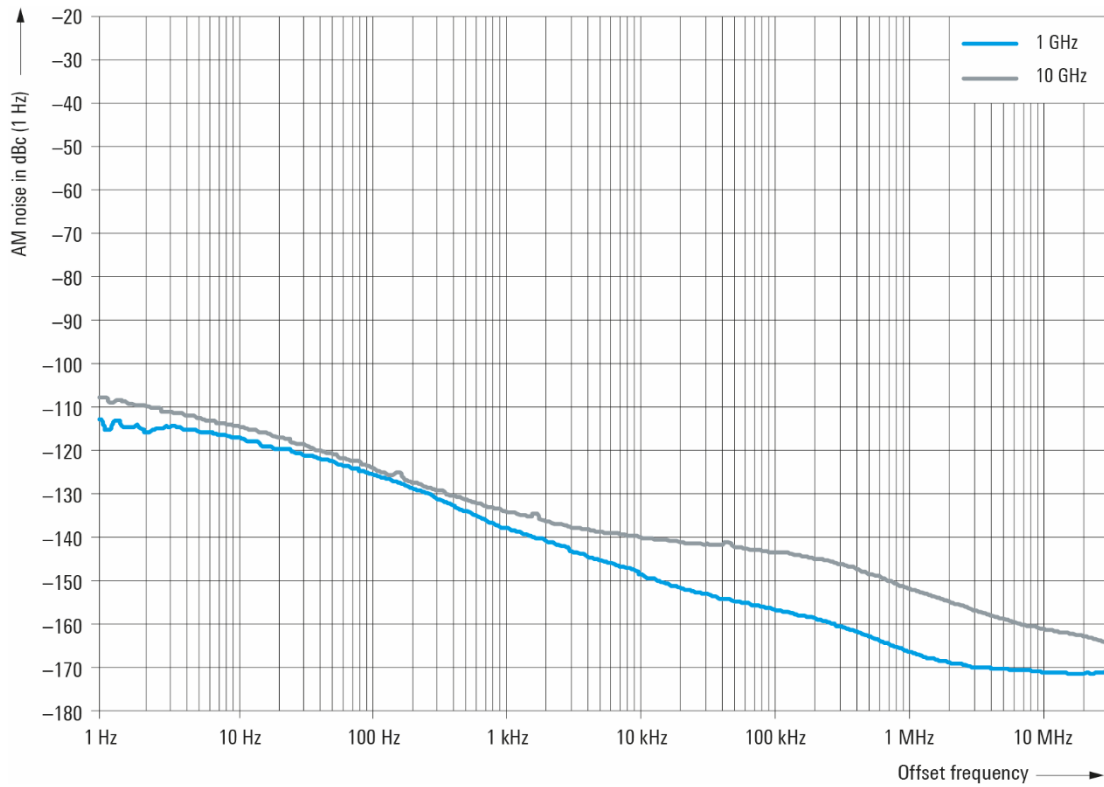
Measured SSB phase noise at  $f = 10$  GHz, standard performance versus the R&S<sup>®</sup>SMAB-B1H, R&S<sup>®</sup>SMAB-B709, R&S<sup>®</sup>SMAB-B710 and R&S<sup>®</sup>SMAB-B711 options



Measured SSB phase noise at  $f = 10$  GHz, comparison of PLL bandwidth normal and narrow with the R&S<sup>®</sup>SMAB-B711 option



Measured residual SSB phase noise at  $f = 10$  GHz with the R&S®SMAB-B711 option, comparison of different reference frequencies



Measured AM noise at  $f = 1$  GHz and 10 GHz with the R&S®SMAB-B711 option

# Analog modulation

## Simultaneous modulation

	Amplitude modulation	Scan AM	Frequency modulation	Phase modulation	Pulse modulation
Amplitude modulation		–	•	•	•
Scan AM	–		•	•	•
Frequency modulation	•	•		–	•
Phase modulation	•	•	–		•
Pulse modulation	•	•	•	•	

• = compatible, – = incompatible, ◦ = compatible with limitations

With certain types of avionics modulation (VOR, ILS, ADF), simultaneous modulation is not possible.

## Amplitude modulation (R&S®SMAB-K720 option)

For  $f \geq 100$  kHz, attenuator mode: auto, level (PEP)<sup>4</sup> = 10 dBm or level = 15 dBm for instruments equipped with R&S®SMAB-B32/-B34 ultra high power option. At high levels, modulation is clipped when the maximum PEP is reached.

Modulation source		internal, external, internal + external
External coupling		AC, DC
AM type		linear, exponential
Linear AM depth		
Setting range	internal modulation source	0 % to 100 %
	external modulation source	0 %/V to 100 %/V
Setting resolution		0.01 %/(V)
AM depth (m) error	$f_{\text{mod}} = 1$ kHz and $m < 80$ %	< (3 % of reading + 1 %)
Exponential AM depth		
Setting range	internal modulation source	0 dB to 30 dB
	external modulation source	0 dB/V to 30 dB/V
Setting resolution		0.01 dB/(V)
AM distortion	$f_{\text{mod}} = 1$ kHz	
	$m = 30$ %	< 1 %
	$m = 80$ %	< 2 %
Modulation frequency response	$m = 60$ %, coupling: DC/AC, input impedance: 50 $\Omega$	
	DC, 10 Hz to 100 kHz	< 3 dB
Incidental $\phi$ M at AM	$m = 30$ %, $f_{\text{mod}} = 1$ kHz, $\pm$ peak/2	
	$f \leq 15$ GHz	< 0.15 rad
	$f > 15$ GHz	< 0.2 rad

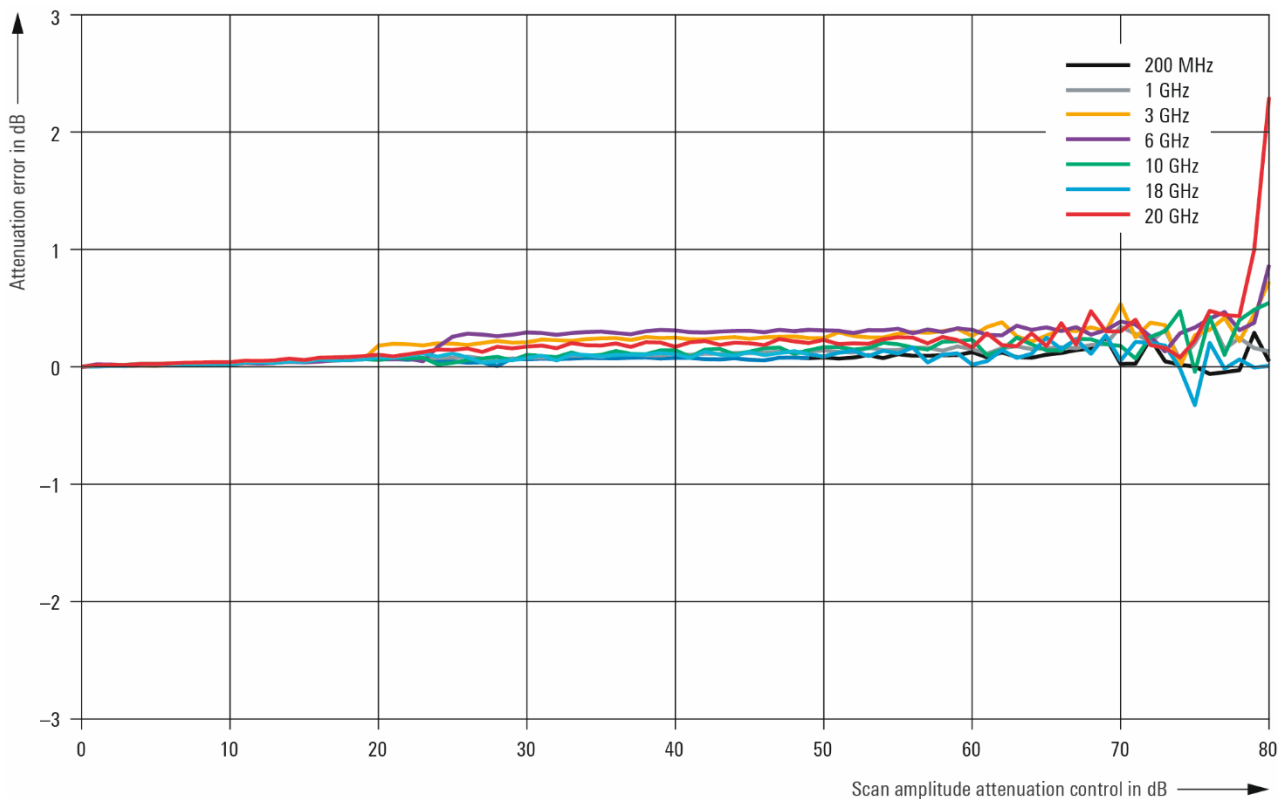
## Scan AM (R&S®SMAB-K721 option)

Level (PEP)<sup>4</sup> = 10 dBm or Level = 15 dBm for instruments equipped with R&S®SMAB-B32/-B34 ultra high power option. Scan AM is available for 52 MHz <  $f \leq 20$  GHz.

Prerequisite: R&S®SMAB-K720 option must be installed.

Modulation source		internal, external, internal + external
External coupling		DC
Scan AM depth		
Setting range	internal modulation source	0 dB to 100 dB
	external modulation source	0 to 100 dB/V
Resolution of setting		0.01 dB
Maximum attenuation		> 60 dB, 70 dB (typ.)
Attenuation error	level setting characteristic: auto, temperature range from +18 °C to +33 °C	
	0 dB < $m \leq 10$ dB	< 0.25 dB
	10 dB < $m \leq 20$ dB	< 1 dB
	20 dB < $m \leq 40$ dB	< 2 dB (typ.)
	40 dB < $m \leq 50$ dB	< 3 dB (typ.)
	50 dB < $m \leq 60$ dB	< 4 dB (typ.)
Rise/fall time	transition time: 10 % to 90 % (log) for RF amplitude step of 60 dB	< 10 $\mu$ s (meas.)

<sup>4</sup> PEP = peak envelope power.



Measured Scan AM attenuation error with the R&S<sup>®</sup>SMAB-K721 option

## Frequency bands for frequency modulation and phase modulation

Multiplier N is used to define FM and φM specifications within this document.

Multiplier (N) for different frequency ranges	FM mode: low noise, φM mode: low noise	
		f ≤ 8 MHz
	8 MHz < f ≤ 11.71875 MHz	1/128
	11.71875 MHz < f ≤ 23.4375 MHz	1/64
	23.4375 MHz < f ≤ 46.875 MHz	1/32
	46.875 MHz < f ≤ 93.75 MHz	1/16
	93.75 MHz < f ≤ 187.5 MHz	1/8
	187.5 MHz < f ≤ 375 MHz	1/4
	375 MHz < f ≤ 750 MHz	1/2
	750 MHz < f ≤ 1.5 GHz	1
	1.5 GHz < f ≤ 3 GHz	2
	3 GHz < f ≤ 6 GHz	4
	6 GHz < f ≤ 12 GHz	8
	12 GHz < f ≤ 20 GHz	16
	FM mode: high bandwidth, φM mode: high bandwidth, high deviation	
	f ≤ 350 MHz	1/2
	350 MHz < f ≤ 375 MHz	1/4
	375 MHz < f ≤ 750 MHz	1/2
	750 MHz < f ≤ 1.5 GHz	1
	1.5 GHz < f ≤ 3 GHz	2
	3 GHz < f ≤ 6 GHz	4
	6 GHz < f ≤ 12 GHz	8
	12 GHz < f ≤ 20 GHz	16

## Frequency modulation (R&S®SMAB-K720 option)

Specifications only valid for main PLL bandwidth normal.

Modulation source		internal, external, internal + external
External coupling		AC, DC
FM modes		high bandwidth, low noise
Maximum deviation	FM mode: high bandwidth	$N \times 10$ MHz
	FM mode: low noise	$N \times 100$ kHz
Resolution of setting		< 0.02 % of set deviation or $N \times 0.1$ Hz, whichever is greater, min. 0.01 Hz
FM deviation error	$f_{\text{mod}} = 10$ kHz, deviation $\leq$ half of max. deviation or 10 MHz, whichever is lower	
	source: internal	< (1.5 % of reading + 20 Hz)
	source: external, input impedance: high	< (2 % of reading + 20 Hz)
FM distortion	$f_{\text{mod}} = 10$ kHz, deviation = $N \times 1$ MHz	< 0.1 %
Modulation frequency response	FM mode: high bandwidth, coupling: DC/AC, input impedance: 50 $\Omega$	
	DC, 10 Hz to 100 kHz	< 0.5 dB
	$f > 350$ MHz	
	DC, 10 Hz to 10 MHz	< 3 dB
	$f \leq 350$ MHz	
	DC, 10 Hz to 5 MHz	< 3 dB
	FM mode: low noise, coupling: DC/AC, input impedance: 50 $\Omega$	
	DC, 10 Hz to 100 kHz	< 3 dB
Synchronous AM with FM	FM mode: high bandwidth, 40 kHz deviation, $f_{\text{mod}} = 1$ kHz	
	8 MHz < $f \leq 3$ GHz	< 0.1 %
	$f > 3$ GHz	< 0.2 %
Carrier frequency offset with FM DC	after FM offset calibration, FM source external, input impedance 50 $\Omega$	< 0.2 % of set deviation

## Phase modulation (R&S®SMAB-K720 option)

Specifications only valid for main PLL bandwidth normal.

Modulation source		internal, external, internal + external
External coupling		AC, DC
$\phi$ M modes		high deviation, high bandwidth, low noise
Maximum deviation	$\phi$ M mode: high deviation	$N \times 20$ rad
	$\phi$ M mode: high bandwidth	$N \times 1$ rad
	$\phi$ M mode: low noise	$N \times 0.25$ rad
Resolution of setting	$\phi$ M modes: high deviation, low noise	< 0.02 % of set deviation or $N \times 20$ $\mu$ rad, whichever is greater, min. 1 $\mu$ rad
	$\phi$ M mode: high bandwidth	< 0.1 % of set deviation, min. $N \times 20$ $\mu$ rad
$\phi$ M deviation error	$f_{\text{mod}} = 10$ kHz, deviation $\leq$ half of max. deviation	
	source: internal	< (1.5 % of reading + 0.003 rad)
	source: external, input impedance: high	< (2 % of reading + 0.003 rad)
$\phi$ M distortion	$f_{\text{mod}} = 10$ kHz, deviation = half of max. deviation	< 0.2 %, < 0.1 % (typ.)
Modulation frequency response	$\phi$ M mode: high deviation, coupling: DC/AC, input impedance: 50 $\Omega$	
	deviation $\leq N \times 5$ rad	< 1 dB
	DC, 10 Hz to 500 kHz	
	deviation > $N \times 5$ rad	< 1 dB
	DC, 10 Hz to 10 kHz	
	$\phi$ M mode: high bandwidth, coupling: DC/AC, input impedance: 50 $\Omega$	
	DC, 10 Hz to 100 kHz	< 1 dB
	$f > 350$ MHz	
	DC, 10 Hz to 10 MHz	< 3 dB
	$f \leq 350$ MHz	
	DC, 10 Hz to 5 MHz	< 3 dB
	$\phi$ M mode: low noise, coupling: DC/AC, input impedance: 50 $\Omega$	
	DC, 10 Hz to 100 kHz	< 3 dB



## Pulse modulation (R&S®SMAB-K22 option)

Modulation source		external
	with R&S®SMAB-K23 option	external, internal
On/off ratio		> 80 dB
Rise/fall time	f > 700 MHz	
	10 % to 90 % of RF amplitude	< 10 ns, 5 ns (typ.)
Minimum pulse width	f > 700 MHz	
	50 % / 50 % of RF amplitude	< 20 ns
Pulse repetition frequency		0 Hz to 25 MHz
Video feedthrough	level < 10 dBm	
	f ≤ 3 GHz	< 10 % of RF
	f > 3 GHz	< 10 % of RF, < 2 mV (peak-to-peak)
Pulse overshoot		< 10 %
Pulse delay	pulse external trigger to RF	50 ns (nom.)
Pulse external trigger input		
Input impedance		10 kΩ or 50 Ω (nom.)
Threshold voltage		0 V to 2.0 V (nom.)
Input polarity		normal, inverse

## VOR modulation (R&S®SMAB-K25 option)

Attenuator mode AUTO, level (PEP)<sup>5</sup> 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
<b>Modulation tones</b>		
Frequency error	30 Hz (VAR, REF)	< (0.001 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	Ext 1
<b>Modulation depth</b>		
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/%
<b>Bearing angle</b>		
Setting range		0° to 360°
	default setting	0.00°
Setting resolution		0.01°
Error		< 0.05°

<sup>5</sup> PEP = peak envelope power.

## ILS modulation (R&S®SMAB-K25 option)

Attenuator mode AUTO, level (PEP) <sup>6</sup> 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
<b>ILS modulation tones</b>		
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	Ext 1
<b>Modulation depth</b>		
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/%
<b>Difference in depth of modulation (DDM)</b>		
Setting range		0 to ±SDM
Setting resolution		0.0001
Error		< 0.0003 + 2 % of set DDM
<b>ILS phase</b>		
Setting range		0° to 120°
Setting resolution		0.01°
Error		< 0.05°

## Marker beacon (MKR BCN) (R&S®SMAB-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.

<b>Marker beacon modulation tones</b>		
Frequency error		< (0.001 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
<b>Marker beacon modulation depth</b>		
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	< 4 % AM depth
	COM/ID, tone = 1020 Hz	< 0.5 % AM depth

<sup>6</sup> PEP = peak envelope power.

## ADF mode (R&S®SMAB-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	< (0.001 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 %

## Sources for analog modulation

### Internal modulation generator

Signal types		sine
Frequency setting range		0.1 Hz to 1 MHz
Frequency setting resolution		0.01 Hz
Frequency error		< (0.001 Hz + relative deviation of reference frequency × modulation frequency)
Frequency response	up to 1 MHz	< 0.3 dB
Distortion	f < 100 kHz, at $R_L \geq 50 \Omega$ , level ( $V_{EMF}$ ) < 1 V	< 0.1 %

### Multifunction generator (R&S® SMAB-K24 option)

Signal types	LF generator 1	sine, pulse, triangle, trapezoid
	LF generator 2	sine, pulse, triangle, trapezoid
	noise generator (noise amplitude distribution)	Gaussian, equal
Frequency range	sine	0.1 Hz to 10 MHz
	pulse, triangle, trapezoid	0.01 Hz to 1 MHz (displayed value)
	noise bandwidth	100 kHz to 10 MHz
Resolution of setting	sine	0.01 Hz
	pulse, triangle, trapezoid	10 ns
	noise bandwidth	100 kHz
Frequency error		< (0.001 Hz + relative deviation of reference frequency × modulation frequency)
Frequency response	sine, up to 1 MHz	< 0.3 dB
	sine, up to 10 MHz	< 1 dB
Distortion	f < 100 kHz, at $R_L \geq 50 \Omega$ , level ( $V_{EMF}$ ) 1 V	< 0.1 %

### 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		external trigger signal (INST TRIG at rear), rotary knob, touch panel, remote control
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		3 ms to 100 s
Dwell time setting resolution		0.1 ms

### LF output

Monitoring of resulting modulation signal for		AM, FM, $\phi$ M
Source		LF generator 1, LF generator 2, noise generator, external 1, external 2
Output voltage	$V_{peak}$ at LF connector, open-circuit voltage EMF	
Setting range		1 mV to 4 V
Setting resolution		1 mV
Setting error	f = 1 kHz, $R_L > 50 \text{ k}\Omega$	< (1 % of reading + 1 mV)
Output impedance		50 $\Omega$ (nom.)

## Pulse generator (R&S®SMAB-K23 option)

Pulse modes		single pulse, double pulse
Trigger modes	free run, internally triggered	auto
		external trigger
		external gate
Pulse period		
Setting range		20 ns to 100 s
Setting resolution		5 ns
Pulse width	pulse widths of double pulses can be set independently	
Setting range		5 ns to 100 s
Setting resolution		5 ns
Pulse delay		
Setting range		0 s to 100 s
Setting resolution		5 ns
Double-pulse spacing		
Setting range		10 ns to 100 s
Setting resolution		5 ns
External trigger		
Delay	trigger to video output	40 ns (nom.)
Jitter		< 5 ns (nom.)

## Pulse train (R&S®SMAB-K27 option)

The R&S®SMAB-K27 option extends the functionality of the pulse generator (R&S®SMAB-K23 option). With this option, pulses and sequences of pulses can be user-defined in order to generate jittered or staggered pulse scenarios widely used in radar applications.

Prerequisite: R&S®SMAB-K23 option must be installed.

Pulse mode	user-settable pulse width, pulse spacing and pulse sequences	train
Trigger modes	free run, internally triggered	auto
		external trigger
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

## Pulse generator outputs

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

## Additional performance options

### Differential clock synthesizer (R&S®SMAB-B29 option)

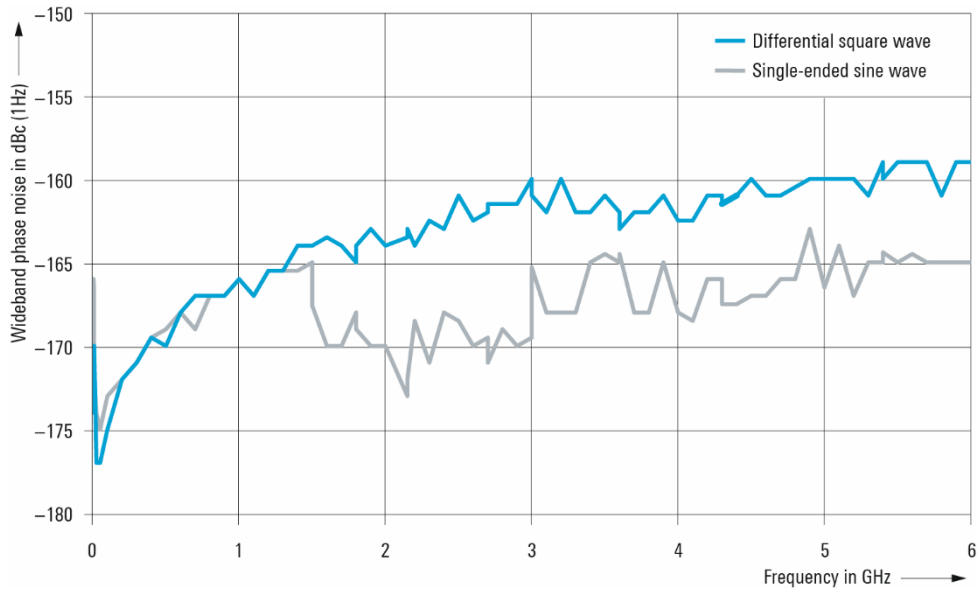
The R&S®SMAB-B29 option provides a differential or single-ended clock signal with selectable waveform and DC offset up to 3 GHz or up to 6 GHz with the R&S®SMAB-K722 option.

The R&S®SMAB-K722 option is not available for instruments equipped with the 3 GHz R&S®SMAB-B103 RF frequency option. The frequency of the clock synthesizer (R&S®SMAB-B29 option) can be set independently of the RF frequency of the R&S®SMAB100A.

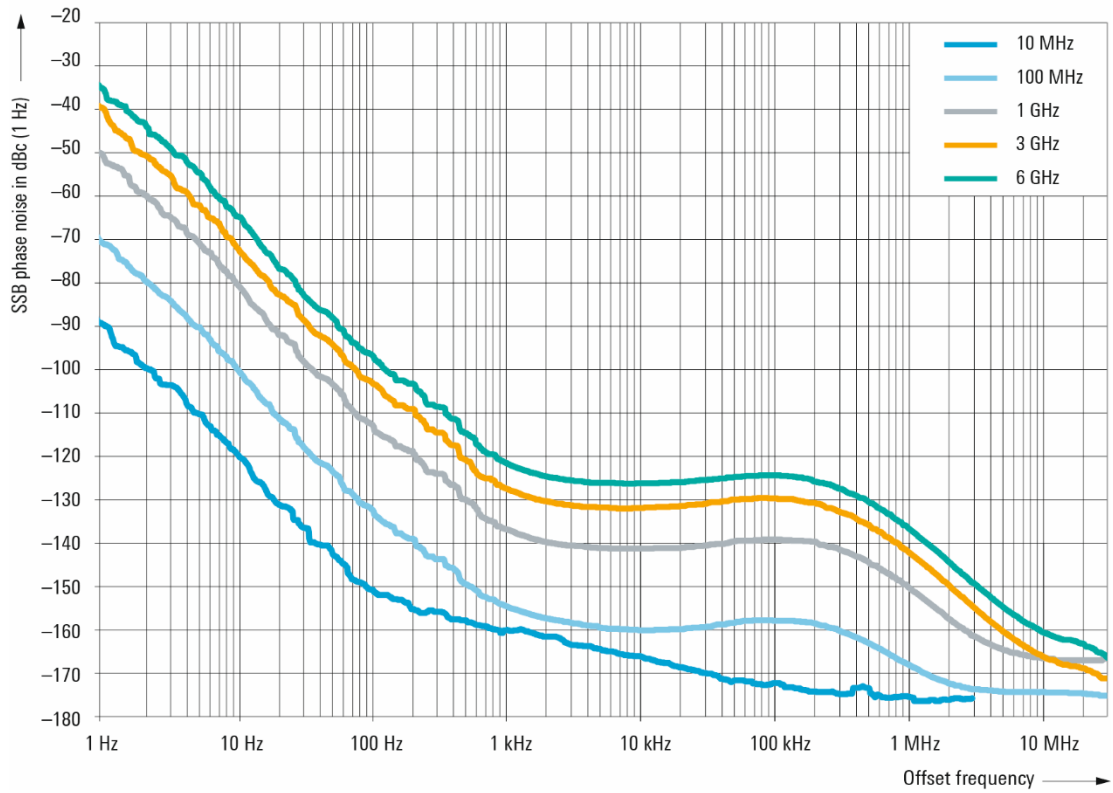
Specifications above 3 GHz are only valid for instruments equipped with the R&S®SMAB-K722 option.

<b>Output types</b>		differential square wave, differential sine wave, single-ended sine wave, differential CMOS
<b>Frequency</b>		
Frequency range	differential square wave, single-ended sine wave	100 kHz to 3 GHz
	differential sine wave	10 MHz to 3 GHz
	with R&S®SMAB-K722 option	10 MHz to 6 GHz
	differential square wave, single-ended sine wave	100 kHz to 6 GHz
	differential sine wave	10 MHz to 6 GHz
	CMOS output	100 kHz to 200 MHz
Resolution of setting		0.001 Hz
Resolution of synthesis	f = 1 GHz	0.053 nHz (nom.)
Frequency setting time	to within $<1 \times 10^{-7}$ for f > 10 MHz, with GUI update stopped after IEC/IEEE bus delimiter with R&S®SMAB-B86 option	< 1.5 ms
<b>Level</b>		
Level setting range	sine wave, differential and single-ended	-24 dBm to 20 dBm
	differential square wave	fixed
	differential CMOS	0.8 V to 2.7 V
<b>Output connectors</b>		
Connector type	CLK SYN, CLK SYN_N outputs	SMA female
	with R&S®SMAB-B93 option (3 HU)	front panel
	with R&S®SMAB-B92 option (2 HU) or with R&S®SMAB-B93 option (3 HU) and R&S®SMAB-B80/-B81 rear panel connector options	rear panel
<b>Reverse power</b>		
Reverse power (from 50 Ω source)	maximum permissible RF power	0.05 W
Maximum permissible DC voltage	sine wave and square wave, DC offset disabled	±5 V
	any output type with DC offset enabled	0 V (short-circuit-proof)
	differential CMOS	0 V (short-circuit-proof)
<b>DC offset</b>		
Setting range	not available in CMOS mode	-5 V to +5 V
Setting resolution		1 mV
DC offset source impedance		50 Ω (nom.)
<b>Spectral purity</b>		
Nonharmonics	offset > 10 kHz from carrier, level = 10 dBm, sine wave	
	f ≤ 10 MHz	< -90 dBc
	10 MHz < f ≤ 750 MHz	< -96 dBc
	750 MHz < f ≤ 1.5 GHz	< -92 dBc
	1.5 GHz < f ≤ 3 GHz	< -86 dBc
	3 GHz < f ≤ 6 GHz	< -80 dBc
	instruments equipped with R&S®SMAB-B709/-B710(N)/-B711(N)	
	f ≤ 1.5 GHz	< -100 dBc
	1.5 GHz < f ≤ 3 GHz	< -94 dBc
	3 GHz < f ≤ 6 GHz	< -88 dBc

Wideband noise	maximum output level, sine wave, carrier offset 10 MHz, measurement bandwidth 1 Hz carrier offset 10 MHz or 10 % of carrier frequency, whichever is lower		
	$f \leq 8 \text{ MHz}$	< -150 dBc	
	$8 \text{ MHz} < f \leq 1.5 \text{ GHz}$	< -155 dBc	
	$1.5 \text{ GHz} < f \leq 3 \text{ GHz}$	< -153 dBc	
	carrier offset 30 MHz		
	$3 \text{ GHz} < f \leq 6.0 \text{ GHz}$	< -150 dBc	
	instruments equipped with R&S®SMAB-B711(N) ultra low phase noise option carrier offset 10 MHz or 10 % of carrier frequency, whichever is lower		
	$f \leq 8 \text{ MHz}$	< -150 dBc	
	$8 \text{ MHz} < f \leq 1.5 \text{ GHz}$	< -157 dBc	
	$1.5 \text{ GHz} < f \leq 3 \text{ GHz}$	< -155 dBc	
	carrier offset 30 MHz		
	$3 \text{ GHz} < f \leq 6.0 \text{ GHz}$	< -155 dBc	
	SSB phase noise	single-ended and differential sine wave or differential square wave; carrier offset 20 kHz, measurement bandwidth 1 Hz	
		$f = 10 \text{ MHz}$	< -163 dBc, -168 dBc (typ.)
$f = 100 \text{ MHz}$		< -155 dBc, -161 dBc (typ.)	
$f = 1 \text{ GHz}$		< -135 dBc, -140 dBc (typ.)	
$f = 2 \text{ GHz}$		< -129 dBc, -134 dBc (typ.)	
$f = 3 \text{ GHz}$		< -125 dBc, -130 dBc (typ.)	
$f = 4 \text{ GHz}$		< -123 dBc, -128 dBc (typ.)	
$f = 6 \text{ GHz}$		< -119 dBc, -124 dBc (typ.)	
instruments equipped with R&S®SMAB-B709/-B710(N)/-B711(N)			
$f = 10 \text{ MHz}$		< -163 dBc, -168 dBc (typ.)	
$f = 100 \text{ MHz}$		< -158 dBc, -163 dBc (typ.)	
$f = 1 \text{ GHz}$		< -141 dBc, -145 dBc (typ.)	
$f = 2 \text{ GHz}$		< -135 dBc, -139 dBc (typ.)	
$f = 3 \text{ GHz}$		< -131 dBc, -135 dBc (typ.)	
$f = 4 \text{ GHz}$		< -129 dBc, -133 dBc (typ.)	
$f = 6 \text{ GHz}$		< -125 dBc, -129 dBc (typ.)	
RMS jitter		single-ended and differential sine wave or differential square wave	
		$f = 155 \text{ MHz}$ , BW = 100 Hz to 1.5 MHz	18.3 fs (meas.)
	$f = 622 \text{ MHz}$ , BW = 1 kHz to 5 MHz	18.0 fs (meas.)	
	$f = 1 \text{ GHz}$ , BW = 1 Hz to 10 MHz	558 fs (meas.)	
	$f = 2.488 \text{ GHz}$ , BW = 5 kHz to 20 MHz	18.0 fs (meas.)	
With R&S®SMAB-B709 option	$f = 155 \text{ MHz}$ , BW = 100 Hz to 1.5 MHz	13.6 fs (meas.)	
	$f = 622 \text{ MHz}$ , BW = 1 kHz to 5 MHz	13.7 fs (meas.)	
	$f = 1 \text{ GHz}$ , BW = 1 Hz to 10 MHz	129 fs (meas.)	
	$f = 2.488 \text{ GHz}$ , BW = 5 kHz to 20 MHz	13.6 fs (meas.)	
With R&S®SMAB-B710(N) or R&S®SMAB-B711(N) option	$f = 155 \text{ MHz}$ , BW = 100 Hz to 1.5 MHz	13.6 fs (meas.)	
	$f = 622 \text{ MHz}$ , BW = 1 kHz to 5 MHz	13.7 fs (meas.)	
	$f = 1 \text{ GHz}$ , BW = 1 Hz to 10 MHz	21.6 fs (meas.)	
	$f = 2.488 \text{ GHz}$ , BW = 5 kHz to 20 MHz	13.7 fs (meas.)	

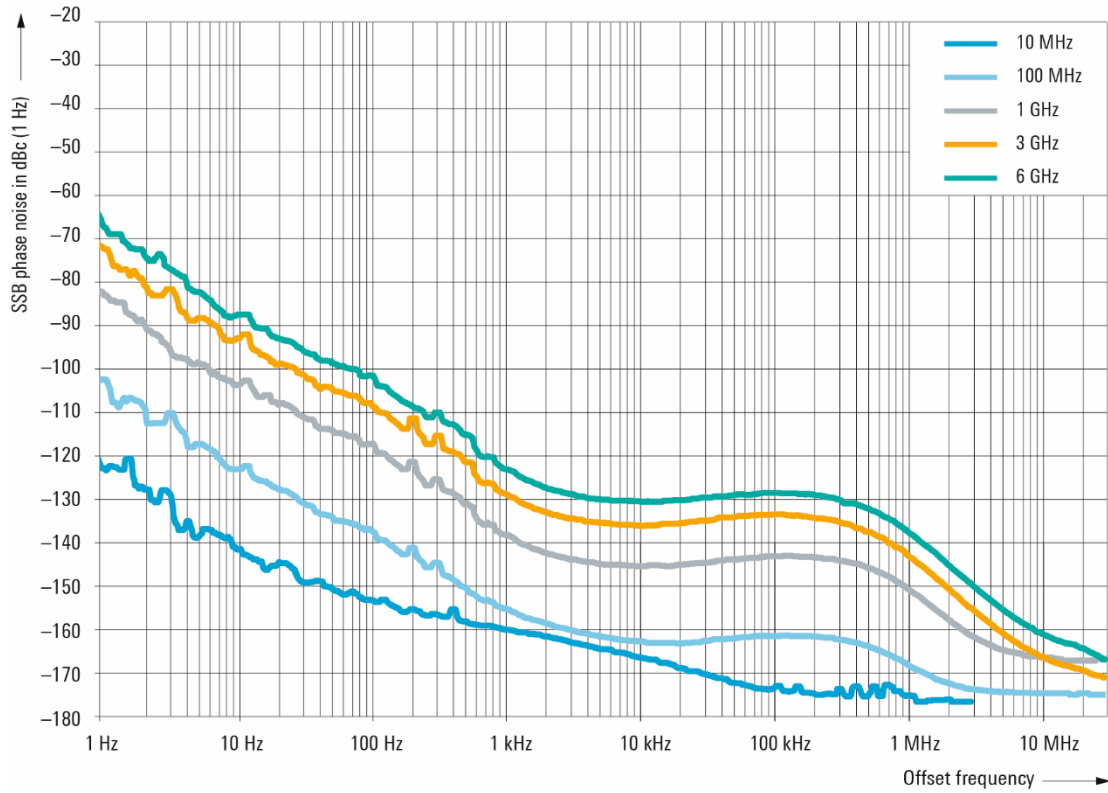


Measured wideband noise of clock synthesizer output at maximum output power versus carrier frequency with the R&S<sup>®</sup>SMAB-B29 and R&S<sup>®</sup>SMAB-K722 options; measured with the R&S<sup>®</sup>F5WP phase noise analyzer

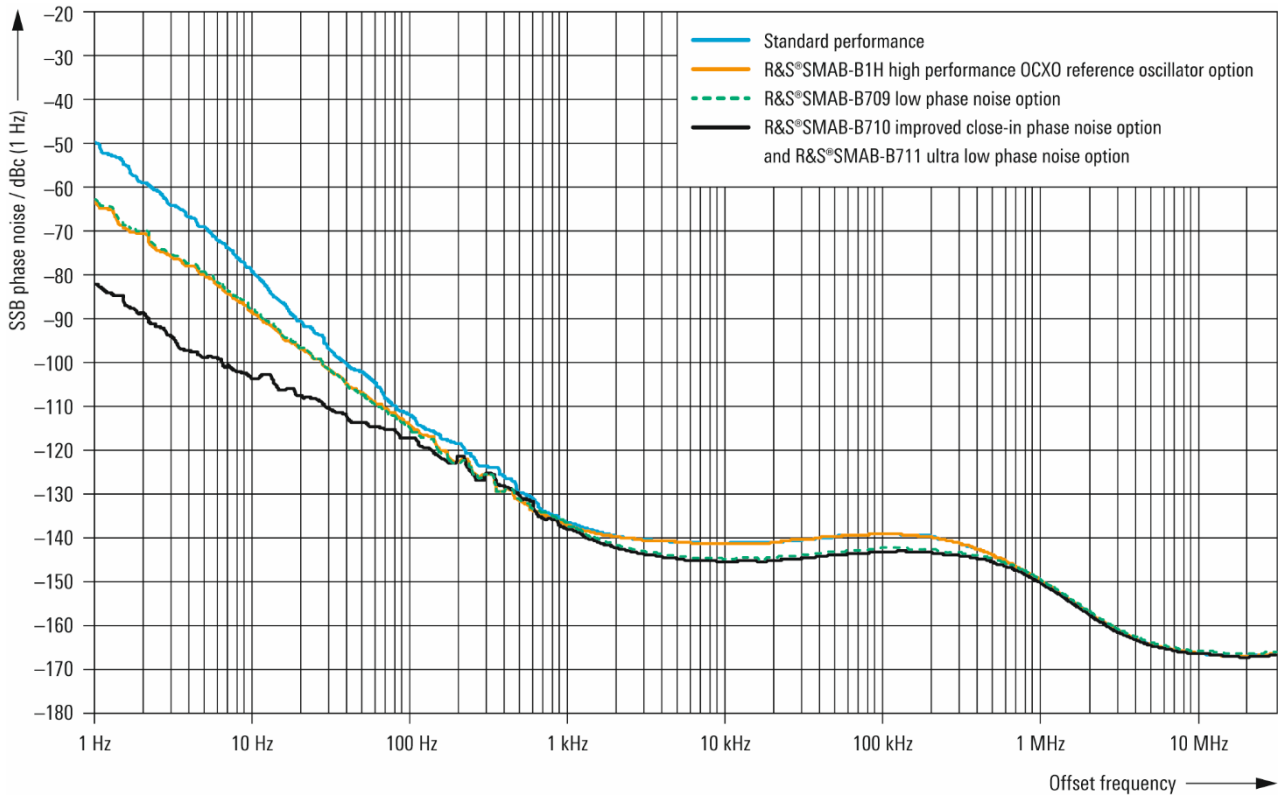


Measured SSB phase noise of clock synthesizer (standard performance) with the R&S<sup>®</sup>SMAB-B29 and R&S<sup>®</sup>SMAB-K722 options

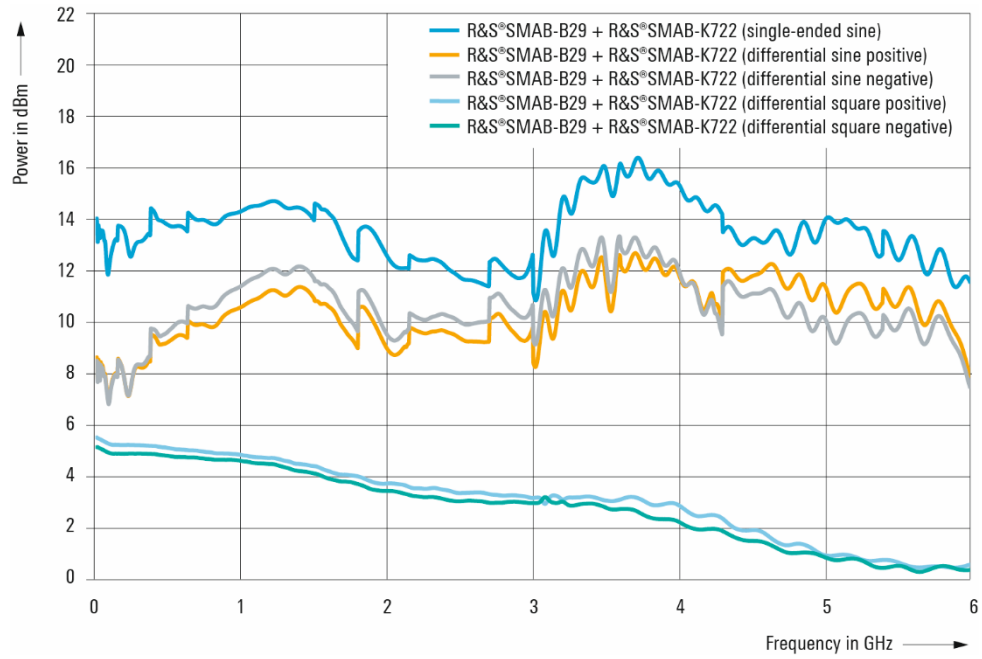




Measured SSB phase noise of clock synthesizer with the R&S®SMAB-B29, R&S®SMAB-B711(N) and R&S®SMAB-K722 options



Measured SSB phase noise of clock synthesizer at  $f = 1$  GHz, standard performance versus the R&S®SMAB-B1H, R&S®SMAB-B709, R&S®SMAB-B710(N) and R&S®SMAB-B711(N) options



*Measured maximum available output power versus frequency  
for the R&S®SMAB-B29 and R&S®SMAB-K722 options*

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

### Overview of supported power sensor and 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-Z81/-Z85/-Z86	•	•	•

• = supported, – = not supported.

Modes		<ul style="list-style-type: none"> <li>power vs. frequency</li> <li>power vs. power</li> <li>power vs. time (trace mode)</li> </ul>
<b>General settings</b>		
Number of points per sweep (= steps)		10 to 1000
Frequency range	depending on R&S®NRP-Zxx power sensor and R&S®SMA100B frequency option	full frequency range of signal generator or power sensor (whichever is lower); support of frequency-converting DUTs
Y-axis setting range		–200 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		<ul style="list-style-type: none"> <li>single</li> <li>continuous</li> </ul>
Number of traces	used for sensor data or as reference trace	4
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	800 × 480 pixel (size of screen)
<b>Power vs. frequency mode</b>		
Spacing		linear, logarithmic
Timing mode		fast, normal
Sweep time	depends on timing mode, number of steps and power sensor e.g. R&S®NRP-Z81 timing mode FAST, 200 steps	set automatically  approx. 2.5 s
<b>Power vs. power mode</b>		
Spacing		dB steps
Timing mode		fast, normal
Sweep time	depends on timing mode, steps and power sensor e.g. R&S®NRP-Z81 timing mode FAST, 200 steps	set automatically  approx. 2.5 s
<b>Power vs. time mode (trace mode)</b>		
Spacing		linear
Sweep time	R&S®NRP-Z81/-Z85/-Z86	
	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 externally triggered R&S®NRP-Z3 required	auto, free run, internal 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

<b>Available measurements in time mode</b>		
Gate function		
Number of gates	user-selectable	2
Power measurements		peak power, average power
Pulse data measurement, only with R&S®NRP-Z81/-Z85/-Z86		
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 %

## Remote control

Interfaces/systems	standard with R&S®SMAB-B86 option	Ethernet/LAN 10/100/1000BASE-T IEC 60625 (GPIB IEEE-488.2), USB 2.0 (according to VISA USB-TMC), serial (RS-232) <sup>7</sup>
Command set		SCPI 1999.5 or compatible command sets
Compatible command sets	<p>These command sets can be selected in order to emulate another instrument. A subset of common commands is supported.</p> <p>For each emulated instrument, the *IDN? and *OPT? strings can be configured to meet the specific requirements. This is particularly useful for the Aeroflex/IFR/Marconi instruments since the manufacturer ID changed over time and for the Hewlett-Packard/Agilent instruments to adapt to a specific suffix and configuration.</p>	<p><b>Hewlett Packard</b></p> <ul style="list-style-type: none"> <li>• HP 8340, HP 8341</li> <li>• HP 8360</li> <li>• HP 83620, HP 83622, HP 83623, HP 83624</li> <li>• HP 83630, HP 83640, HP 83650</li> <li>• HP 8373</li> <li>• HP 83711, HP 83712</li> <li>• HP 83731, HP 83732</li> <li>• HP 8642, HP 8643, HP 8644, HP 8645</li> <li>• HP 8647, HP 8648</li> <li>• HP 8656, HP 8657</li> <li>• HP 8662, HP 8663, HP 8664, HP 8665</li> <li>• HP 8673</li> </ul> <p><b>Agilent/Keysight Technologies</b></p> <ul style="list-style-type: none"> <li>• E4421, E4422, E4428</li> <li>• E8257, E8663</li> <li>• N5161, N5181, N5183</li> </ul> <p><b>Aeroflex (IFR/Marconi)</b></p> <ul style="list-style-type: none"> <li>• 2023, 2024</li> <li>• 2030, 2031, 2032</li> <li>• 2040, 2041, 2042</li> </ul> <p><b>Anritsu</b></p> <ul style="list-style-type: none"> <li>• 68017, 68037</li> </ul> <p><b>Panasonic</b></p> <ul style="list-style-type: none"> <li>• VP-8303A</li> </ul> <p><b>Racal Dana</b></p> <ul style="list-style-type: none"> <li>• 3102, 9087</li> </ul> <p><b>Rohde &amp; Schwarz</b></p> <ul style="list-style-type: none"> <li>• R&amp;S®SMA100A</li> <li>• R&amp;S®SME02/03/06</li> <li>• R&amp;S®SMF100A</li> <li>• R&amp;S®SMG/SMH</li> <li>• R&amp;S®SMGU/SMHU</li> <li>• R&amp;S®SML01/02/03</li> <li>• R&amp;S®SMP02/03/04</li> <li>• R&amp;S®SMR20/27/30/40</li> <li>• R&amp;S®SMT02/03/06</li> <li>• R&amp;S®SMY01/02</li> </ul>
IEC/IEEE bus address		0 to 30
Ethernet/LAN protocols and services		<ul style="list-style-type: none"> <li>• VISA VXI-11 (remote control)</li> <li>• Telnet/RawEthernet (remote control)</li> <li>• VNC (remote operation with web browser)</li> <li>• FTP (file transfer protocol)</li> <li>• SMB (mapping parts of the instrument to a host file system)</li> </ul>
Ethernet/LAN addressing		DHCP, static; support of ZeroConf and M-DNS to facilitate direct connection to a system controller

<sup>7</sup> Requires recommended extra R&S®TS-USB1.

## Connectors

All digital inputs and outputs are CMOS 3.3 V unless otherwise noted. The input damage level is  $-0.5\text{ V}/+5\text{ V}$ .

### Front or rear panel connectors

These connectors are located either on the front or the rear panel of the instrument, depending on the option configuration.

Instrument with 2 HU (equipped with the R&S®SMAB-B92 option): RF 50  $\Omega$ , USB, SENSOR, SD card on the front panel, all others on the rear panel.

Instrument with 3 HU (equipped with the R&S®SMAB-B93 option): all connectors on front panel.

Instrument with 2 or 3 HU and equipped with an R&S®SMAB-B80/-B81 rear panel connector option: all except USB on the rear panel.

RF 50 $\Omega$	RF output	
	R&S®SMAB-B103, R&S®SMAB-B106	N female
	R&S®SMAB-B112, R&S®SMAB-B120	test port adapter, PC 2.92 mm female (interchangeable port connector system)
LF	LF generator output	BNC female
Ext 1, Ext 2	input for external analog modulation (AM, FM, $\phi$ M, Scan AM)	BNC female
Input impedance		100 k $\Omega$ ; 600 $\Omega$ or 50 $\Omega$ (nom.)
Input sensitivity	AM, FM, $\phi$ M: peak value for set deviation	1 V (nom.)
Input voltage range	Scan AM	
	Ext 1	$-6\text{ V}$ to $0\text{ V}$
	Ext 2	$-1\text{ V}$ to $0\text{ V}$
Input damage voltage	50 $\Omega$ input impedance	$\pm 7\text{ V}$
	600 $\Omega$ and 100 k $\Omega$ input impedance	$\pm 10\text{ V}$
Pulse Ext	input for external pulse modulation, external trigger input for pulse generator, external gate input for pulse generator	BNC female/digital signal
Input impedance	selectable	10 k $\Omega$ or 50 $\Omega$ (nom.)
Input voltage	TTL, CMOS compatible	
	threshold voltage	$0\text{ V}$ to $2.0\text{ V}$ (nom.)
Input damage voltage		$-0.5\text{ V}/+5\text{ V}$
Input polarity	selectable	normal, inverse
Pulse Video	pulse generator output, video output for external pulse modulation	BNC female/digital signal
Pulse Sync	synchronizing output for pulse generator	BNC female/digital signal
SENSOR	connector for R&S®NRP power sensor	6 pol. ODU mini-snap series B
USB	USB 2.0 connector for external USB devices such as mouse, keyboard, R&S®NRP power sensors (with R&S®NRP-Z4 adapter cable), memory stick for software update and data exchange or USB serial adapter for RS-232 remote control	USB type A
SD	with R&S®SMAB-B85 option for removable mass storage	SD card slot
Clk Sync	clock synthesizer output	SMA female
Clk Sync_N	clock synthesizer inverted output	SMA female

### Rear panel connectors

Ref. In	external reference frequency input	BNC female
Input damage level		$> 20\text{ dBm}$
Ref. Out	reference frequency output	BNC female
Ref. In 1 GHz	external 1 GHz reference frequency input	SMA female
Input damage level		$> 20\text{ dBm}$
Ref. Out 1 GHz	ultra low noise 1 GHz reference frequency output	SMA female
Ext. Tune	input for electronic tuning of internal reference frequency	BNC female
Inst. Trig.	trigger input for sweep and list mode	BNC female/digital signal
Signal Valid	output for triggering external devices, low state indicates that the instrument has settled to its final value	BNC female/digital signal

V/GHz X-Axis	with R&S®SMAB-B28 option, delivers voltage level proportional to absolute sweep frequency or sweep progress	BNC female
Load impedance		≥ 1 kΩ
Z-Axis	with R&S®SMAB-B28 option, delivers pulses with different levels to indicate frequency markers and blanking signals	BNC female
Load impedance		≥ 10 kΩ
Stop	with R&S®SMAB-B28 option, bidirectional signal to indicate halted sweep or to stop sweep by external device	BNC female/digital signal
Input polarity		Low active
Marker User 1	with R&S®SMAB-B28 option, pulse output to mark selected frequencies	BNC female/digital signal
Input polarity	selectable	normal, inverse
LAN	provides remote control functionality and other services, see section "Remote control"	RJ-45
USB	USB 2.0 connector for external USB devices such as mouse, keyboard, R&S®NRP power sensors (with adapter cable R&S®NRP-Z4), memory stick for software update and data exchange or USB serial adapter for RS-232 remote control	USB type A
USB In	with R&S®SMAB-B86 option, USB 2.0, remote control of instrument	USB type micro-B
IEEE 488	with R&S®SMAB-B86 option, remote control of instrument via GPIB	24-pin Amphenol series 57 female

## General data

<b>Power rating</b>		
Rated voltage		100 V to 240 V AC ( $\pm 10\%$ )
Rated frequency		50 Hz to 60 Hz ( $\pm 5\%$ ), 400 Hz ( $\pm 5\%$ )
Rated current	instrument with 2 HU (R&S®SMAB-B92 option)	3.5 A to 1.6 A (50 Hz to 60 Hz), 3.5 A to 2.9 A (400 Hz)
	instrument with 3 HU (R&S®SMAB-B93 option)	7.3 A to 4.6 A (50 Hz to 60 Hz/400 Hz)
Rated power	instrument with 2 HU (R&S®SMAB-B92 option), when fully equipped	300 W (meas.)
	instrument with 3 HU (R&S®SMAB-B93 option), when fully equipped	300 W (meas.)
Power factor correction		in line with EN 61000-3-2
<b>Product conformity</b>		
Electromagnetic compatibility	EU: in line with EMC Directive 2004/108/EC	applied harmonized standards: <ul style="list-style-type: none"> <li>• EN 61326-1 (industrial environment)</li> <li>• EN 61326-2-1</li> <li>• EN 55011 class A</li> <li>• EN 61000-3-2</li> <li>• EN 61000-3-3</li> </ul>
Electrical safety	EU: in line with Low Voltage Directive 2006/95/EC	applied harmonized standard: EN 61010-1
	USA	UL 61010-1
	Canada	CAN/CSA-C22.2 No. 61010-1
International safety approvals	VDE – Association for Electrical, Electronic and Information Technologies	GS mark 40045930
	CSA – Canadian Standards Association	CSA <sub>UL</sub> mark 70108101
<b>Mechanical resistance</b>		
Vibration	sinusoidal	5 Hz to 55 Hz, 0.15 mm amplitude const., 55 Hz to 150 Hz, 0.5 g const., 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 516.4, procedure I
<b>Environmental conditions</b>		
Temperature range	operation	0 °C to +55 °C
	storage	-40 °C to +71 °C
Damp heat		+40 °C, 90 % rel. humidity, steady state, in line with EN 60068-2-78
Altitude	operating, linear derating of max. ambient temperature to +45 °C starting at altitude = 3000 m	4600 m (15000 ft)
	transport	4600 m (15000 ft)
<b>Weight and dimensions</b>		
Dimensions (L x W x H)	instrument with 2 HU (R&S®SMAB-B92 option), without front handles and instrument feet, for use with extra R&S®ZZA-xxx	472 mm x 445 mm x 108 mm (18.58 in x 17.52 in x 4.25 in) 428 mm x 425 mm x 88 mm (16.83 in x 16.73 in x 3.47 in)
	instrument with 3 HU (R&S®SMAB-B93 option), without front handles and instrument feet, for use with extra R&S®ZZA-xxx	472 mm x 445 mm x 152 mm (18.58 in x 17.52 in x 5.98 in) 428 mm x 425 mm x 133 mm (16.83 in x 16.73 in x 5.22 in)
Weight	2 HU instrument (R&S®SMAB-B92 option), when fully equipped	14.4 kg (31.7 lb)
	3 HU instrument (R&S®SMAB-B93 option), when fully equipped	19.0 kg (41.9 lb)



<b>Display</b>		
Resolution		800 x 480 pixel
Size	2 HU instrument	5" touch display
	3 HU instrument	7" touch display
<b>Calibration interval</b>		
Recommended calibration interval	operation 40 h/week in the full range of the specified environmental conditions	3 years

# Ordering information

R&amp;S®SMAB-Bxxx = hardware option

R&amp;S®SMAB-Kxxx = software/keycode option

Designation	Type	Order No.
<b>Signal Generator</b> <sup>8</sup> including power cable and quick start guide	R&S®SMA100B	1419.8888.02
<b>Options</b>		
Frequency options		
8 kHz to 3 GHz	R&S®SMAB-B103	1420.8488.02
8 kHz to 6 GHz	R&S®SMAB-B106	1420.8588.02
8 kHz to 12.75 GHz	R&S®SMAB-B112	1420.8688.02
8 kHz to 20 GHz	R&S®SMAB-B120	1420.8788.02
Platform height options		
2 HU with 5" touch display	R&S®SMAB-B92	1420.8288.02
3 HU with 7" touch display	R&S®SMAB-B93	1420.8388.02
Phase noise performance and reference oscillator options		
High performance OCXO reference oscillator <sup>9</sup>	R&S®SMAB-B1H	1420.8188.02
Low phase noise <sup>9</sup>	R&S®SMAB-B709	1420.9849.02
Improved close-in phase noise performance for R&S®SMAB-B106/-B112/-B120 <sup>9</sup>	R&S®SMAB-B710	1420.8007.02
Improved close-in phase noise performance for R&S®SMAB-B103 <sup>9</sup>	R&S®SMAB-B710N	1420.8107.02
Ultra low phase noise for R&S®SMAB-B106/-B112/-B120 <sup>9</sup>	R&S®SMAB-B711	1420.8020.02
Ultra low phase noise for R&S®SMAB-B103 <sup>9</sup>	R&S®SMAB-B711N	1420.8120.02
100 MHz, 1 GHz ultra low noise reference input/output	R&S®SMAB-K703	1420.9761.02
Flexible reference input from 1 MHz to 100 MHz	R&S®SMAB-K704	1420.9778.02
Output power options		
High output power 3 GHz/6 GHz	R&S®SMAB-K31	1420.7100.02
Ultra high output power 3 GHz/6 GHz <sup>10</sup>	R&S®SMAB-B32	1420.7200.02
High output power 12.75 GHz/20 GHz	R&S®SMAB-K33	1420.7300.02
Ultra high output power 12.75 GHz/20 GHz <sup>11</sup>	R&S®SMAB-B34	1420.7400.02
Analog modulation options		
High performance pulse modulator	R&S®SMAB-K22	1420.9710.02
Pulse generator	R&S®SMAB-K23	1420.9726.02
Multifunction generator	R&S®SMAB-K24	1420.9732.02
VOR/ILS	R&S®SMAB-K25	1420.9855.02
Pulse train <sup>12</sup>	R&S®SMAB-K27	1420.9749.02
AM/FM/φM	R&S®SMAB-K720	1420.9790.02
Scan AM <sup>13 14</sup>	R&S®SMAB-K721	1420.9784.02
Additional performance options		
Ramp sweep	R&S®SMAB-B28	1420.6579.02
High dynamic uninterrupted level sweep <sup>14</sup>	R&S®SMAB-K724	1420.9832.02
Differential clock synthesizer 3 GHz	R&S®SMAB-B29	1420.8088.02
Clock synthesizer frequency extension to 6 GHz (only for instruments equipped with R&S®SMAB-B106/-B112/-B120)	R&S®SMAB-K722	1420.9810.02
Power analysis	R&S®SMAB-K28	1420.9755.02
Other options		
Rear panel connectors (3 GHz/6 GHz)	R&S®SMAB-B80	1420.6504.02
Rear panel connectors (12.75 GHz/20 GHz)	R&S®SMAB-B81	1420.6510.02
Removable mass storage	R&S®SMAB-B85	1420.6556.02
Remote control GPIB and USB	R&S®SMAB-B86	1420.6562.02

<sup>8</sup> The base unit can only be ordered with an R&S®SMAB-B1xx frequency option and an R&S®SMAB-B92 or R&S®SMAB-B93 platform height option.

<sup>9</sup> Only one of the following six options can be installed: R&S®SMAB-B1H, R&S®SMAB-B709, R&S®SMAB-B710, R&S®SMAB-B710N, R&S®SMAB-B711, R&S®SMAB-B711N.

<sup>10</sup> R&S®SMAB-B32 can only be ordered with R&S®SMAB-K31.

<sup>11</sup> R&S®SMAB-B34 can only be ordered with R&S®SMAB-K33.

<sup>12</sup> Requires R&S®SMAB-K23 pulse generator option.

<sup>13</sup> Requires R&S®SMAB-K720 AM/FM/φM option.

<sup>14</sup> For instruments with serial number < 102000, please contact the Rohde & Schwarz service department.

Designation	Type	Order No.
<b>Recommended extras</b>		
19" rack adapter for 2 HU model	R&S®ZZA-KNA21	1177.8026.00
19" rack adapter for 3 HU model	R&S®ZZA-KNA31	1177.8032.00
USB serial adapter for RS-232 remote control	R&S®TS-USB1	6124.2531.00
Spare SD card	R&S®SMAB-Z10	1420.6662.02
Adapters for instruments with an R&S®SMAB-B112/-B120 frequency option		
Test port adapter, 2.4 mm female		1088.1627.02
Test port adapter, 2.92 mm female		1036.4790.00
Test port adapter, 2.92 mm male		1036.4802.00
Test port adapter, N female		1036.4777.00
Test port adapter, N male		1036.4783.00
<b>Documentation</b>		
Documentation of calibration values	R&S®DCV-2	0240.2193.18
R&S®SMA100B accredited calibration	R&S®SMA100B-ACA	1420.6740.02

<b>Warranty</b>		
Base unit		3 years
All other items <sup>15</sup>		1 year
Options		
Extended warranty, one year	R&S®WE1	Please contact your local Rohde & Schwarz sales office.
Extended warranty, two years	R&S®WE2	
Extended warranty with calibration coverage, one year	R&S®CW1	
Extended warranty with calibration coverage, two years	R&S®CW2	
Extended warranty with accredited calibration coverage, one year	R&S®AW1	
Extended warranty with accredited calibration coverage, two years	R&S®AW2	

#### Extended warranty with a term of one and two years (WE1 and WE2)

Repairs carried out during the contract term are free of charge <sup>16</sup>. Necessary calibration and adjustments carried out during repairs are also covered.

#### Extended warranty with calibration coverage (CW1 and CW2)

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 <sup>16</sup> and calibration at the recommended intervals as well as any calibration carried out during repairs or option upgrades.

#### Extended warranty with accredited calibration (AW1 and AW2)

Enhance your extended warranty by adding accredited calibration coverage at a package price. This package ensures that your Rohde & Schwarz product is regularly calibrated under accreditation, inspected and maintained during the term of the contract. It includes all repairs <sup>16</sup> and accredited calibration at the recommended intervals as well as any accredited calibration carried out during repairs or option upgrades.

<sup>15</sup> For options that are installed, the remaining base unit warranty applies if longer than 1 year. Exception: all batteries have a 1 year warranty.

<sup>16</sup> Excluding defects caused by incorrect operation or handling and force majeure. Wear-and-tear parts are not included.

## Service that adds value

- | Worldwide
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- | Uncompromising quality
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## Rohde & Schwarz

The Rohde & Schwarz electronics group offers innovative solutions in the following business fields: test and measurement, broadcast and media, secure communications, cybersecurity, monitoring and network testing. Founded more than 80 years ago, the independent company which is headquartered in Munich, Germany, has an extensive sales and service network with locations in more than 70 countries.

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## Rohde & Schwarz training

[www.training.rohde-schwarz.com](http://www.training.rohde-schwarz.com)

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