

R&S® SMA100B

RF and Microwave

Signal Generator

Specifications



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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

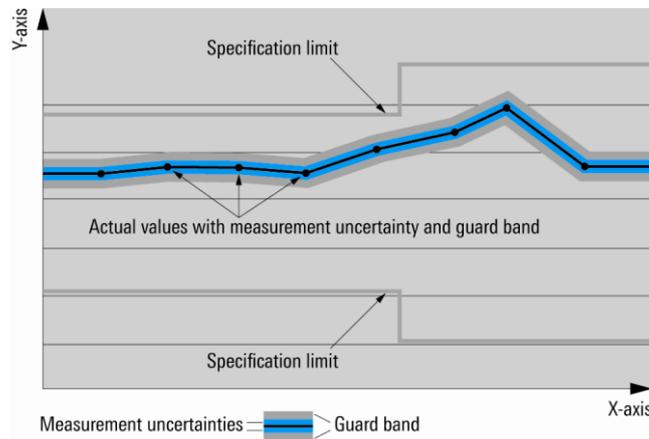
General

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 ksp/s (thousand symbols per second), and sample rates are specified in Msample/s (million samples per second). Mcps, kbps, ksp/s 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.

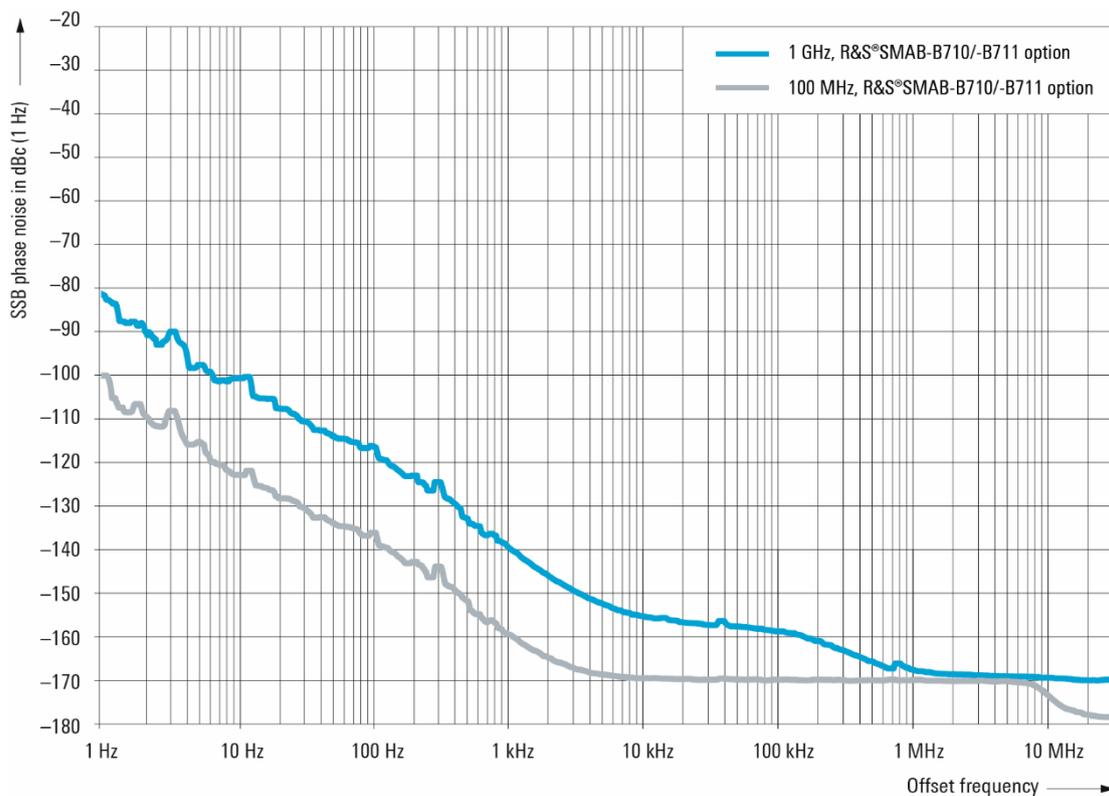
Frequency

| | | |
|------------------------------------|--|---------------------------|
| 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 |

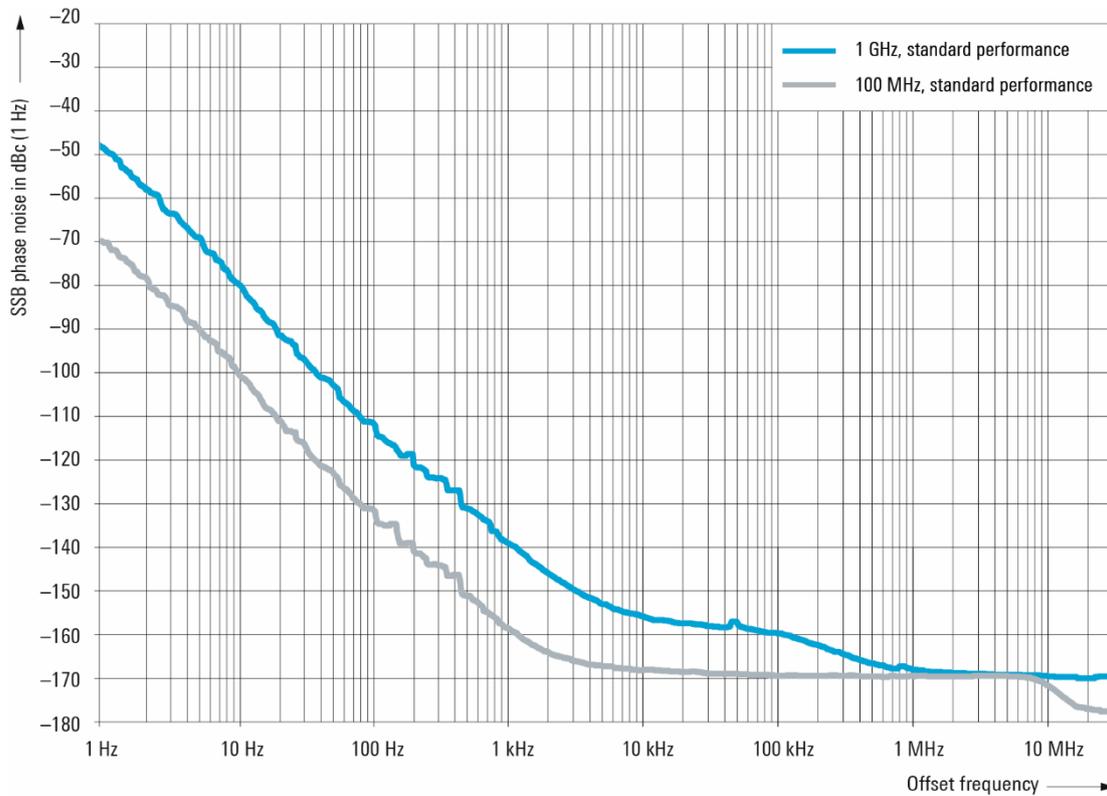
Reference frequency

| | | | |
|--|---|--|---|
| 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 | $\leq 1 \times 10^{-9}/\text{day}$ $\leq 1 \times 10^{-7}/\text{year}$ | |
| | with R&S®SMAB-B1H/-B709/-B710(N)/-B711(N) options | $\leq 5 \times 10^{-10}/\text{day}$ $\leq 3 \times 10^{-8}/\text{year}$ | |
| 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 | ≤ 10 min (nom.) | |
| Input for external reference frequency | | | |
| 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 | $\pm 0.15 \times 10^{-6}$ | |
| Output for internal reference frequency | | | |
| 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.) |
| Ultra low noise 1 GHz reference frequency (R&S®SMAB-K703 option) | | |
| 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 | | ±3 × 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.) |
| Input for electronic tuning of internal reference frequency | | |
| Connector type | external tune on rear panel | BNC female |
| Sensitivity | external tuning slope, low | 1 × 10 ⁻⁸ /V (typ.) |
| | external tuning slope, high | 5 × 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 ¹ | |
| 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 ¹ | |
| 18 GHz < f ≤ 20 GHz | -120 dBm to +24 dBm ¹ | | |

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

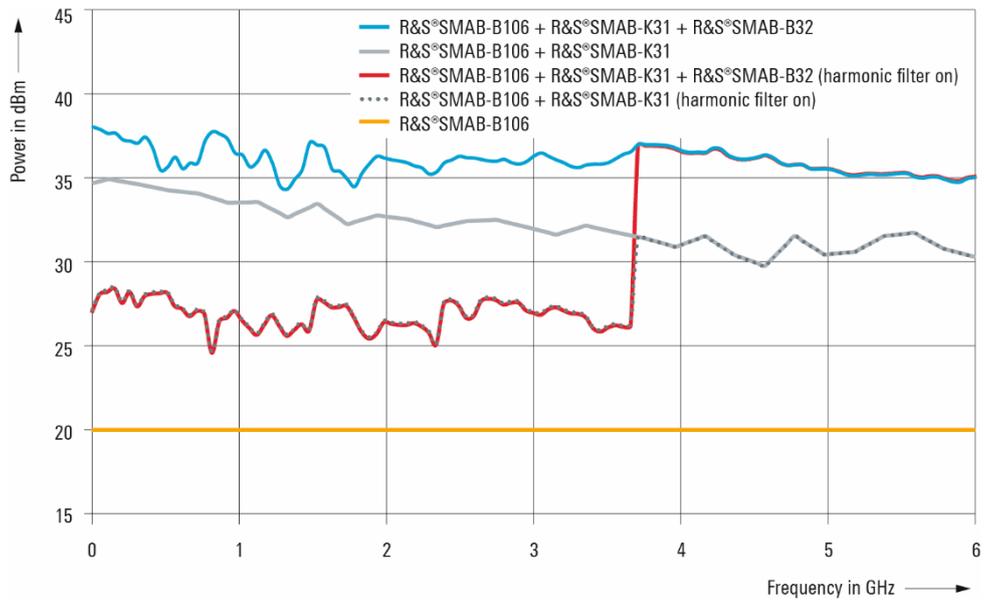
| | | |
|---------------------------------------|--|---|
| Level accuracy | CW, level setting characteristic: auto, temperature range from +18 °C to +33 °C | |
| | level from -90 dBm to +25 dBm | |
| | 8 kHz < f ≤ 8 MHz | < 1.0 dB |
| | 8 MHz < f ≤ 3 GHz | < 0.5 dB |
| | 3 GHz < f ≤ 20 GHz | < 0.9 dB |
| | 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"> • auto • uninterrupted level setting • strictly monotone • constant VSWR |
| Automatic level control modes | | auto, on, off (table), table and on |

Reverse power

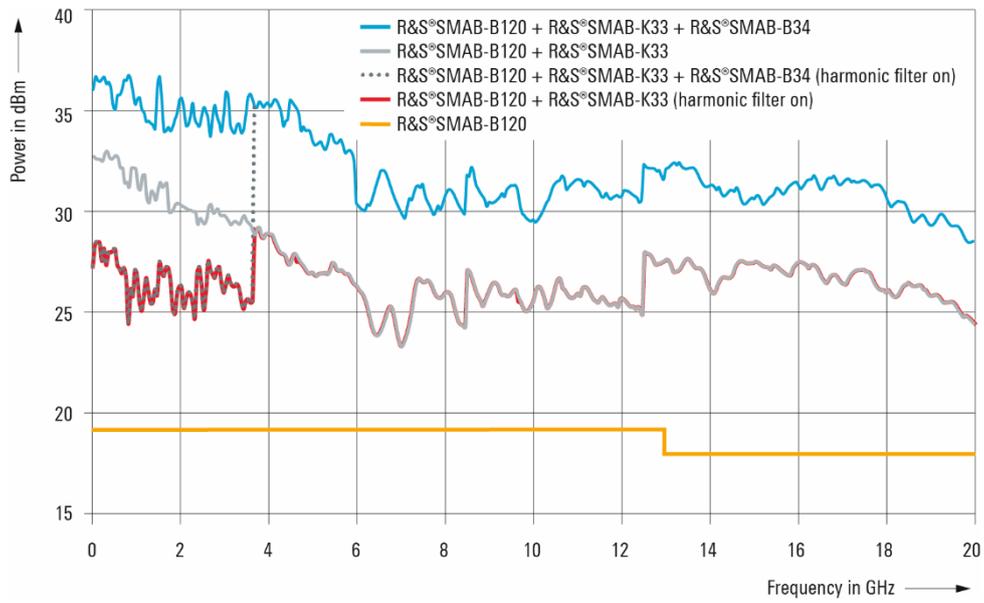
| | | |
|--------------------------------|--|-------|
| Reverse power | R&S®SMAB-B103/-B106, from 50 Ω source, maximum permissible RF power in output frequency range of RF path for f > 1 MHz; in case of too high reverse power, the RF output is switched off by a mechanical relay | |
| | 1 MHz < f ≤ 3 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 ² | 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 ³ | 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.) |

² Specifications are not valid for harmonics beyond "specified frequency range".

³ Specifications are not valid for subharmonics beyond "specified frequency range".

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

Specifications above 3 GHz only applicable for R&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.

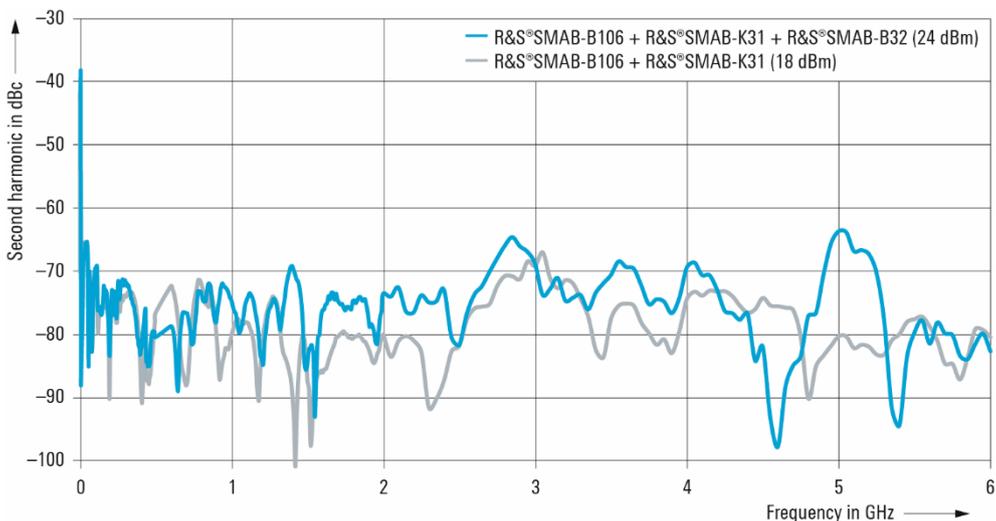
| SSB phase noise in dBc (1 Hz), CW, level = 10 dBm | | | | |
|---|--------|-------------|-------------|-------------|
| Offset frequency | 1 Hz | 10 Hz | 100 Hz | 1 kHz |
| Carrier frequency | | | | |
| f = 10 MHz | (-116) | -124 (-132) | -136 (-142) | -147 (-156) |
| f = 100 MHz | (-96) | -117 (-122) | -129 (-136) | -146 (-150) |
| f = 1 GHz | (-76) | -97 (-103) | -111 (-117) | -135 (-139) |
| f = 2 GHz | (-70) | -91 (-97) | -105 (-111) | -129 (-133) |
| f = 3 GHz | (-66) | -87 (-93) | -101 (-107) | -125 (-130) |
| f = 4 GHz | (-64) | -86 (-91) | -99 (-105) | -122 (-127) |
| f = 6 GHz | (-60) | -81 (-87) | -95 (-101) | -119 (-123) |
| f = 10 GHz | (-56) | -77 (-83) | -91 (-97) | -115 (-119) |
| f = 20 GHz | (-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 | | | | |
| f = 10 MHz | -157 (-164) | -160 (-166) | -161 (-166) | |
| f = 100 MHz | -155 (-160) | -162 (-166) | -162 (-167) | -162 (-168) |
| f = 1 GHz | -147 (-152) | -148 (-152) | -157 (-161) | -160 (-165) |
| f = 2 GHz | -142 (-146) | -142 (-146) | -151 (-157) | -159 (-164) |
| f = 3 GHz | -138 (-142) | -138 (-143) | -148 (-156) | -159 (-164) |
| f = 4 GHz | -135 (-140) | -136 (-140) | -147 (-151) | -157 (-162) |
| f = 6 GHz | -132 (-136) | -132 (-137) | -144 (-150) | -155 (-161) |
| f = 10 GHz | -128 (-132) | -128 (-133) | -140 (-145) | -156 (-160) |
| f = 20 GHz | -122 (-126) | -122 (-127) | -134 (-139) | -148 (-153) |

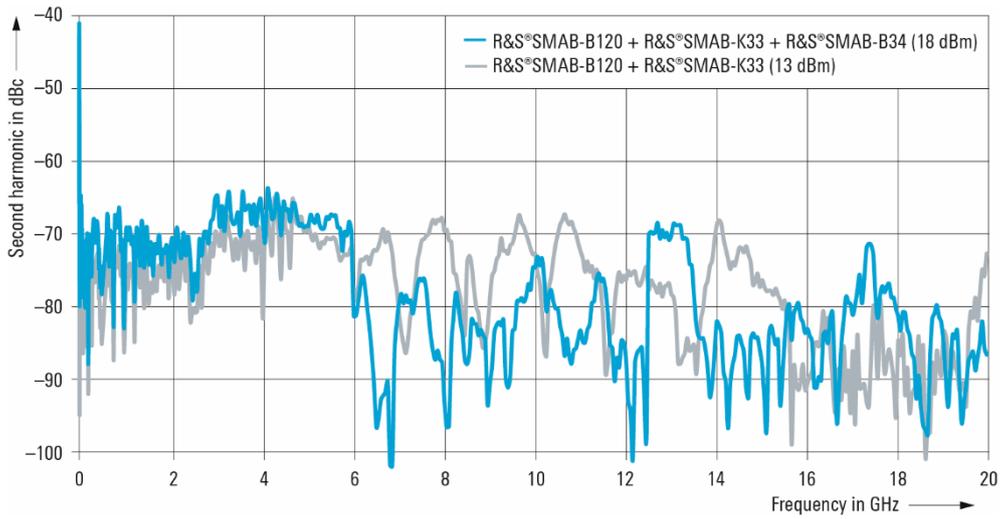
RMS jitter

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

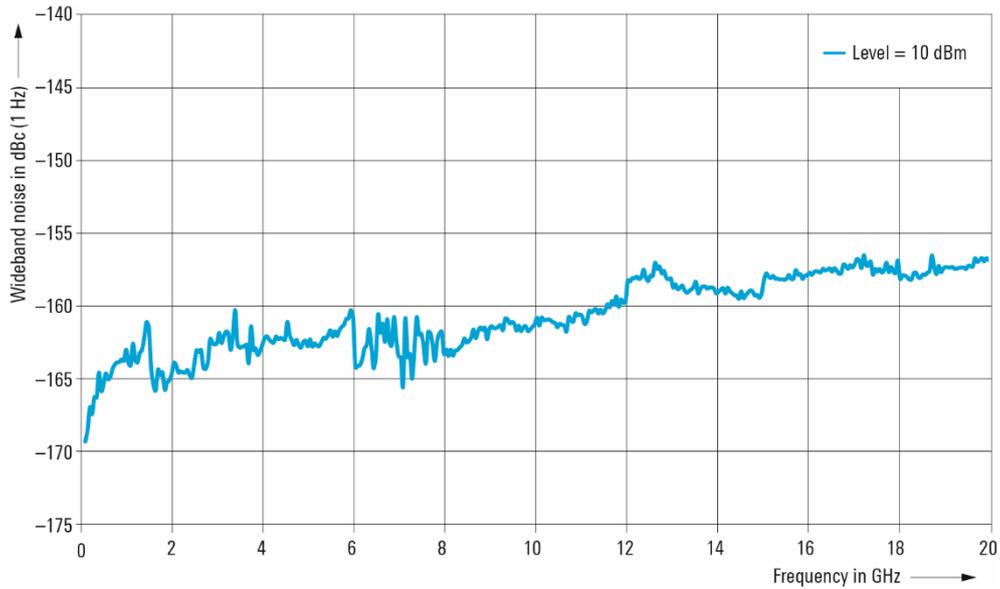
| | | |
|------------------------------|--|-----------------|
| RMS jitter | f = 155 MHz, BW 100 Hz to 1.5 MHz | 20.1 fs (meas.) |
| | f = 622 MHz, BW 1 kHz to 5 MHz | 18.7 fs (meas.) |
| | f = 1 GHz, BW 1 Hz to 10 MHz | 558 fs (meas.) |
| | f = 2.488 GHz, BW 5 kHz to 20 MHz | 18.7 fs (meas.) |
| | f = 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 % |



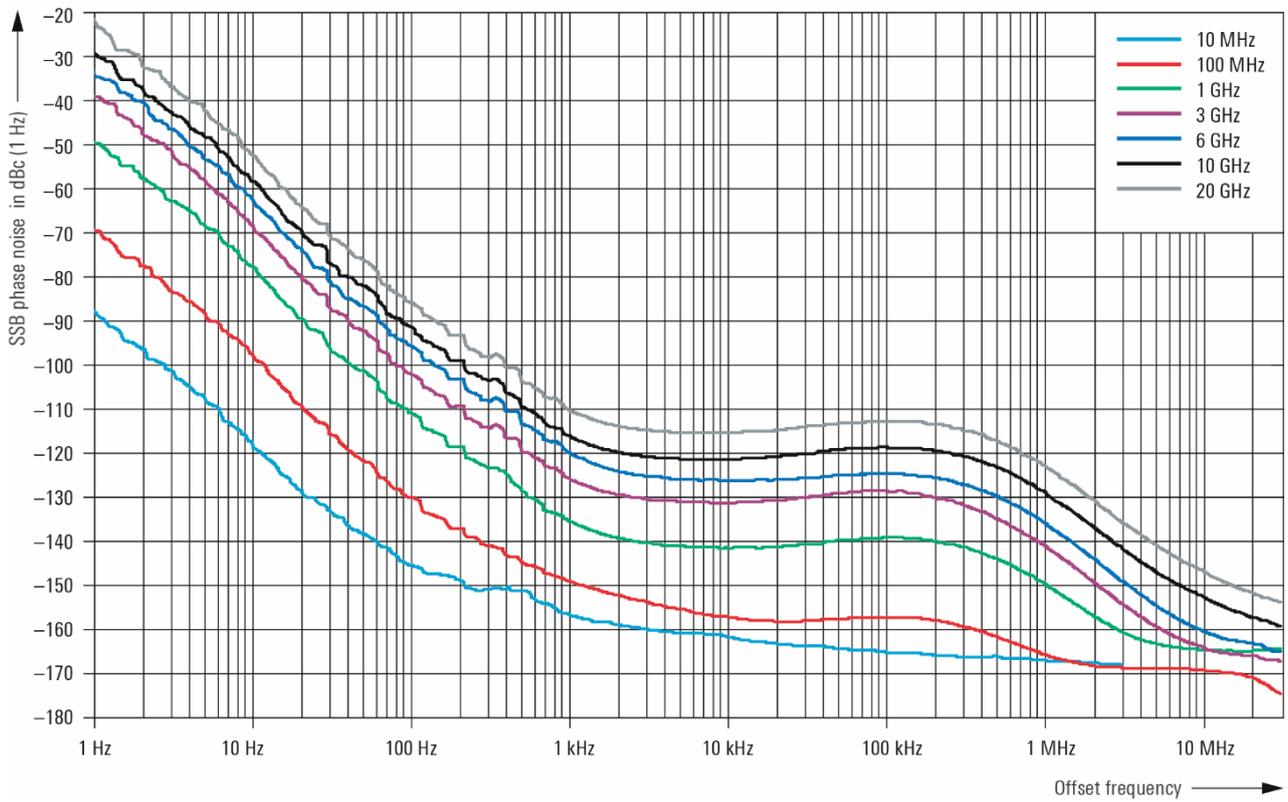
Measured harmonics versus carrier frequency with harmonic filter on for $f \leq 3.7$ GHz



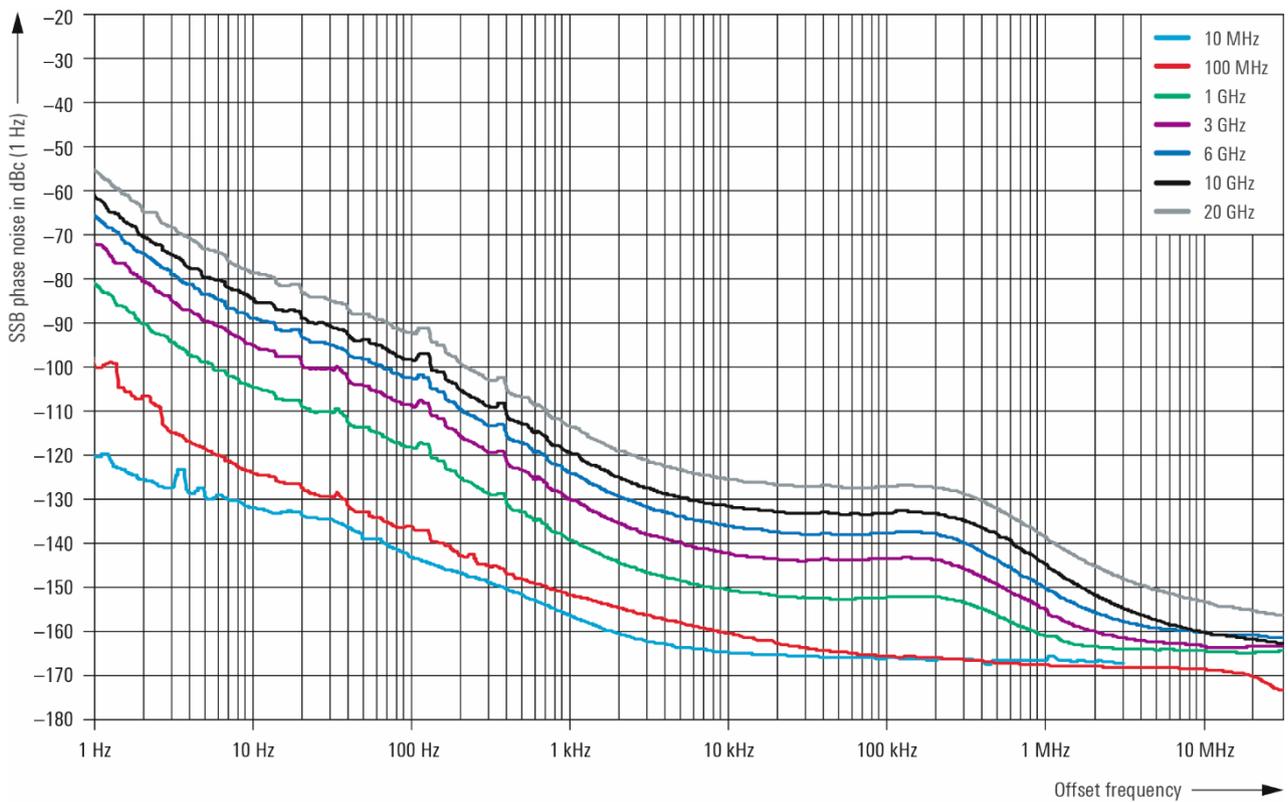
Measured harmonics versus carrier frequency with harmonic filter on for $f \leq 3.7$ GHz



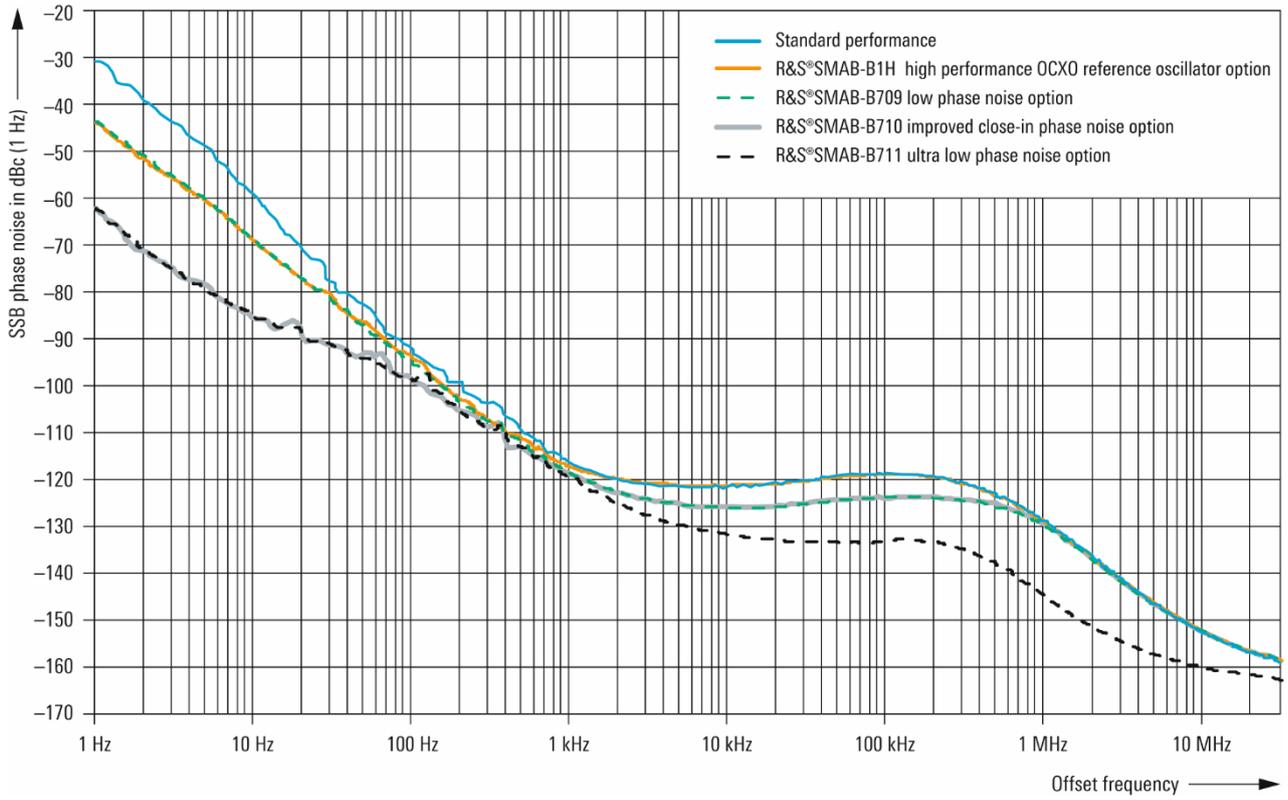
Measured wideband noise at 30 MHz offset and +10 dBm versus carrier frequency with the R&S SMAB-B120, R&S SMAB-B711 and R&S SMAB-B34 options; measured with the R&S FSWP phase noise analyzer



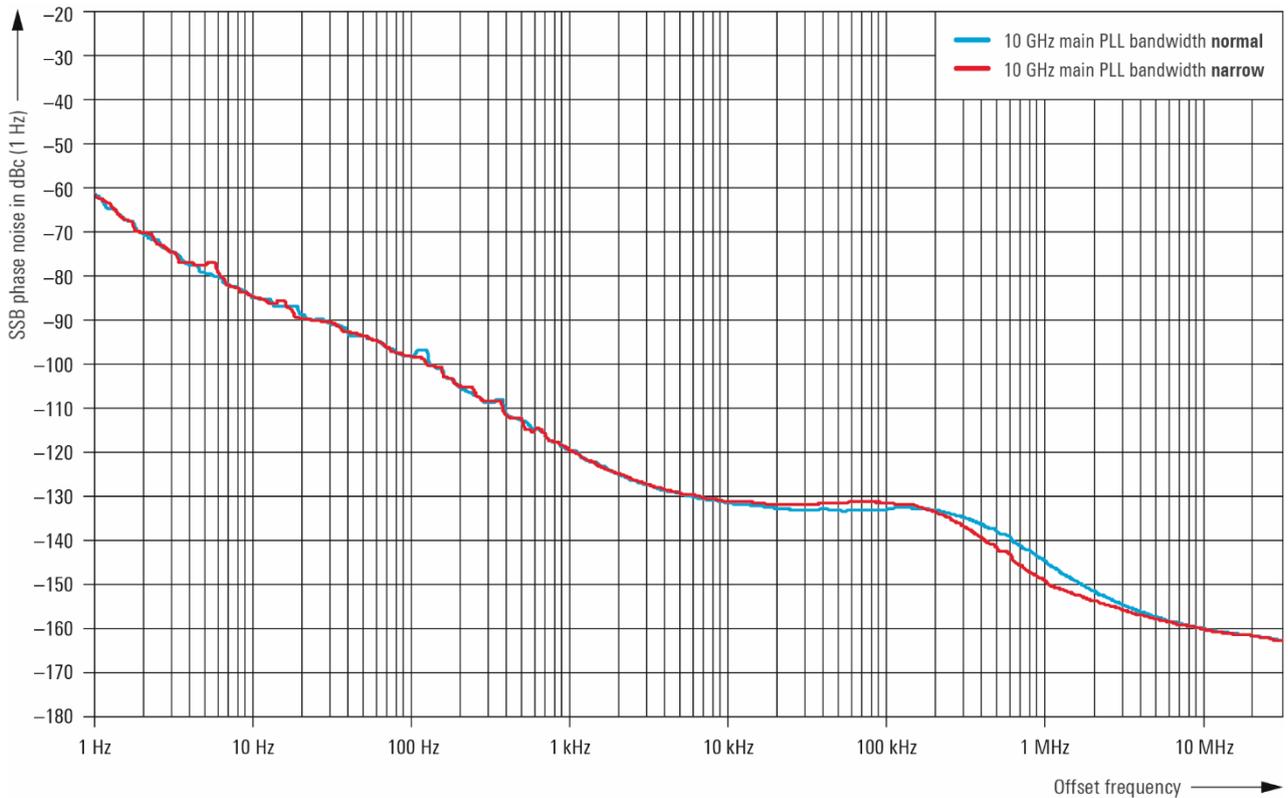
Measured SSB phase noise (standard performance)



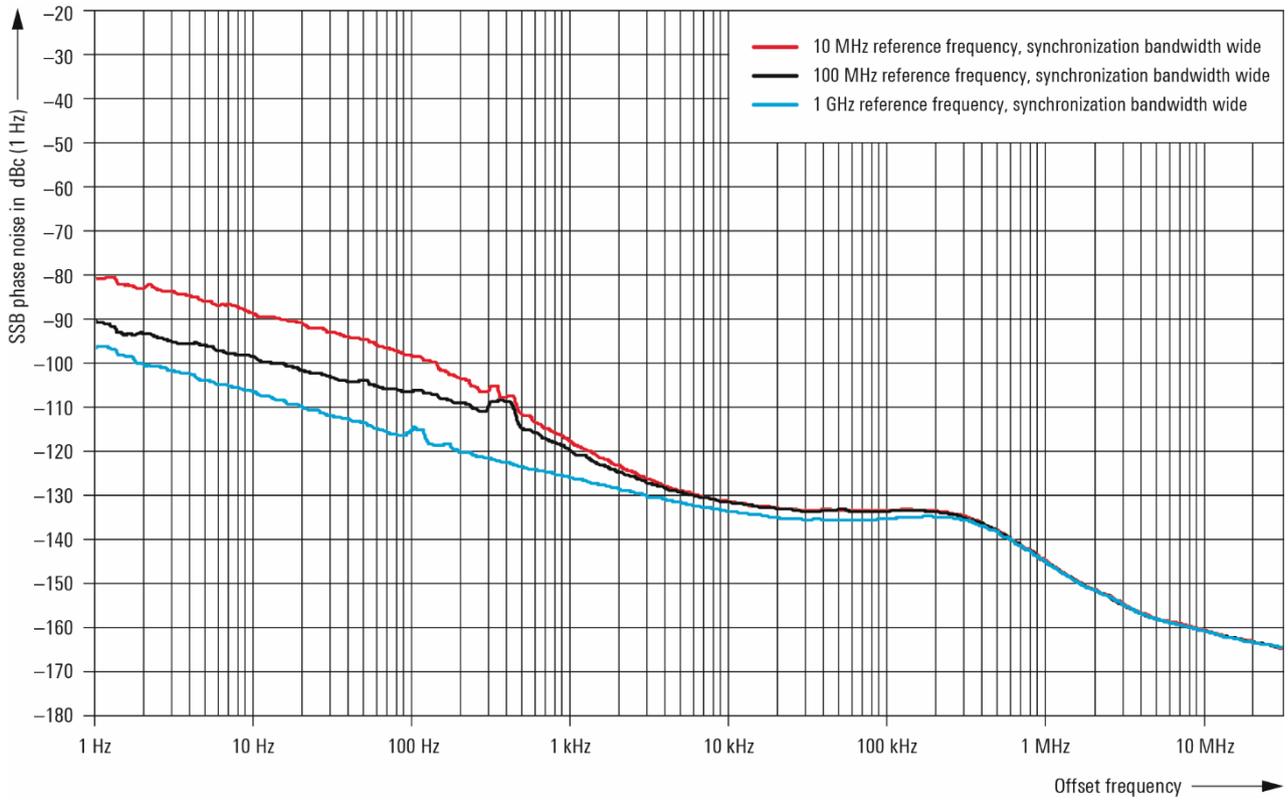
Measured SSB phase noise with the R&S[®]SMAB-B711(N) option



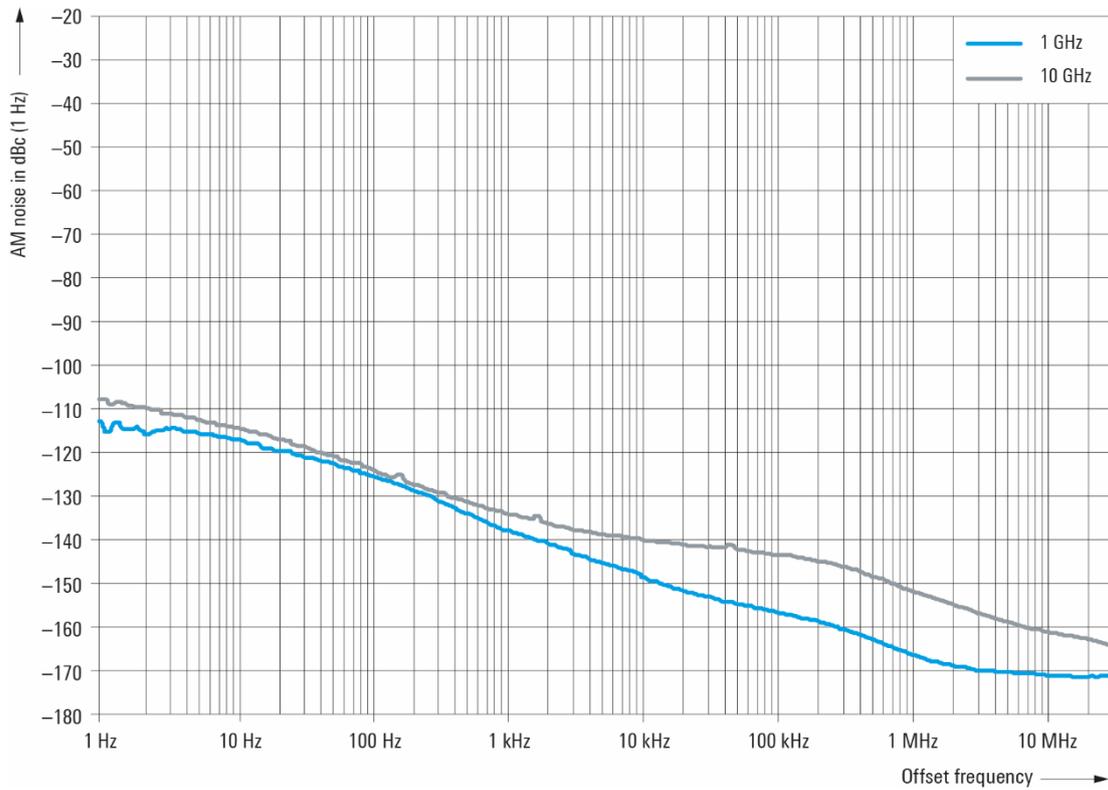
Measured SSB phase noise at $f = 10$ GHz, standard performance versus the R&S[®]SMAB-B1H, R&S[®]SMAB-B709, R&S[®]SMAB-B710 and R&S[®]SMAB-B711 options



Measured SSB phase noise at $f = 10$ GHz, comparison of PLL bandwidth normal and narrow with the R&S[®]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)⁴ = 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 Ω | |
| | DC, 10 Hz to 100 kHz | < 3 dB |
| Incidental ϕ 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 |

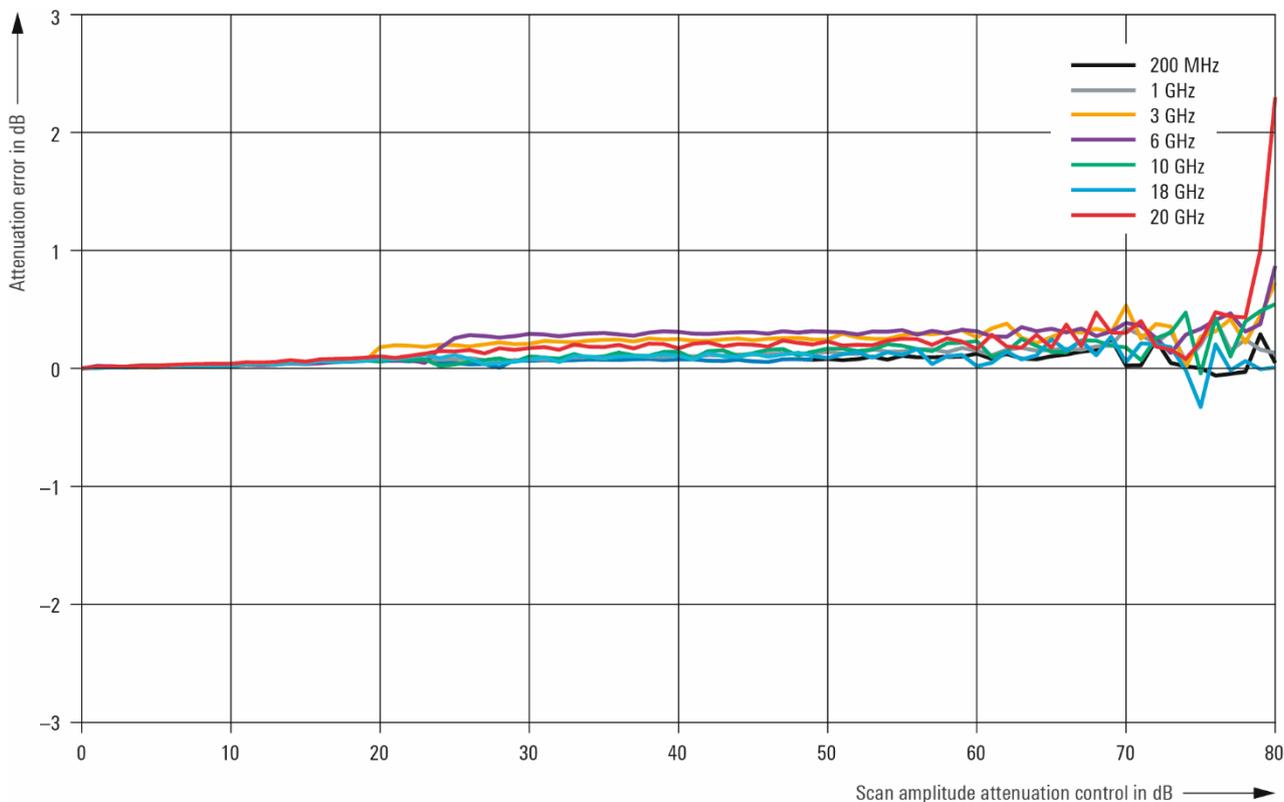
Scan AM (R&S®SMAB-K721 option)

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

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 μ s (meas.) |

⁴ PEP = peak envelope power.



Measured Scan AM attenuation error with the R&S[®]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 Ω | |
| | 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 Ω | |
| | 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 Ω | < 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 |
| ϕ M modes | | high deviation, high bandwidth, low noise |
| Maximum deviation | ϕ M mode: high deviation | $N \times 20$ rad |
| | ϕ M mode: high bandwidth | $N \times 1$ rad |
| | ϕ M mode: low noise | $N \times 0.25$ rad |
| Resolution of setting | ϕ M modes: high deviation, low noise | < 0.02 % of set deviation or $N \times 20$ μ rad, whichever is greater, min. 1 μ rad |
| | ϕ M mode: high bandwidth | < 0.1 % of set deviation, min. $N \times 20$ μ rad |
| ϕ 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) |
| ϕ M distortion | $f_{\text{mod}} = 10$ kHz, deviation = half of max. deviation | < 0.2 %, < 0.1 % (typ.) |
| Modulation frequency response | ϕ M mode: high deviation, coupling: DC/AC, input impedance: 50 Ω | |
| | 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 | |
| | ϕ M mode: high bandwidth, coupling: DC/AC, input impedance: 50 Ω | |
| | 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 |
| | ϕ M mode: low noise, coupling: DC/AC, input impedance: 50 Ω | |
| | 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)⁵ 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) | < (0.001 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 |
| 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° |

⁵ PEP = peak envelope power.

ILS modulation (R&S®SMAB-K25 option)

Attenuator mode AUTO, level (PEP) ⁶ 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 | Ext 1 |
| 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®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.

| | | |
|--|-----------------------------|---|
| Marker beacon modulation tones | | |
| 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 |
| Marker beacon 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 | < 4 % AM depth |
| | COM/ID, tone = 1020 Hz | < 0.5 % AM depth |

⁶ 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, ϕ 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 Ω (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 ≥ 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)

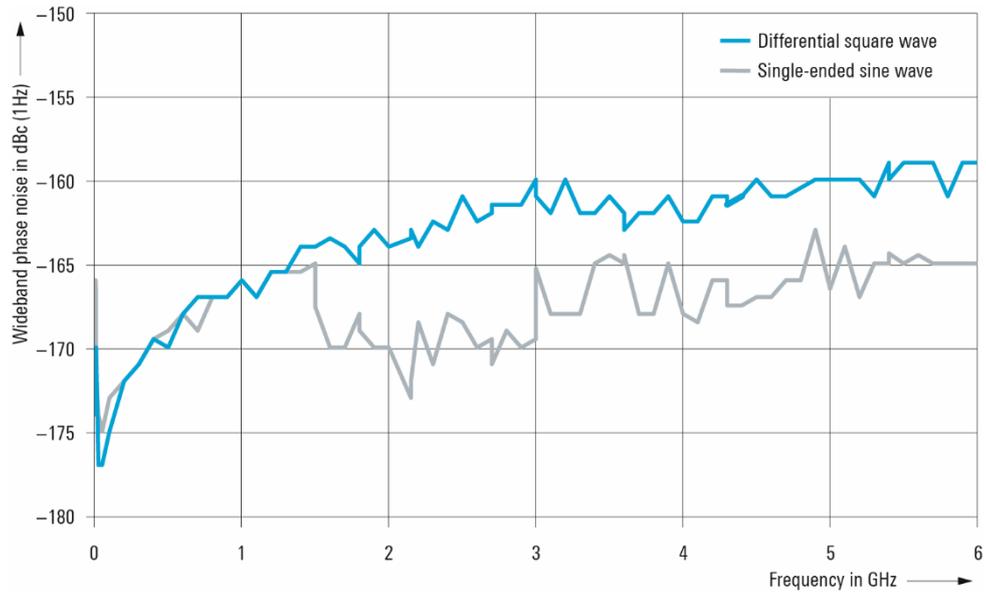
The R&S®SMAB-B29 option provides a differential or single-ended clock signal with selectable waveform and DC offset up to 3 GHz or up to 6 GHz with the R&S®SMAB-K722 option.

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.

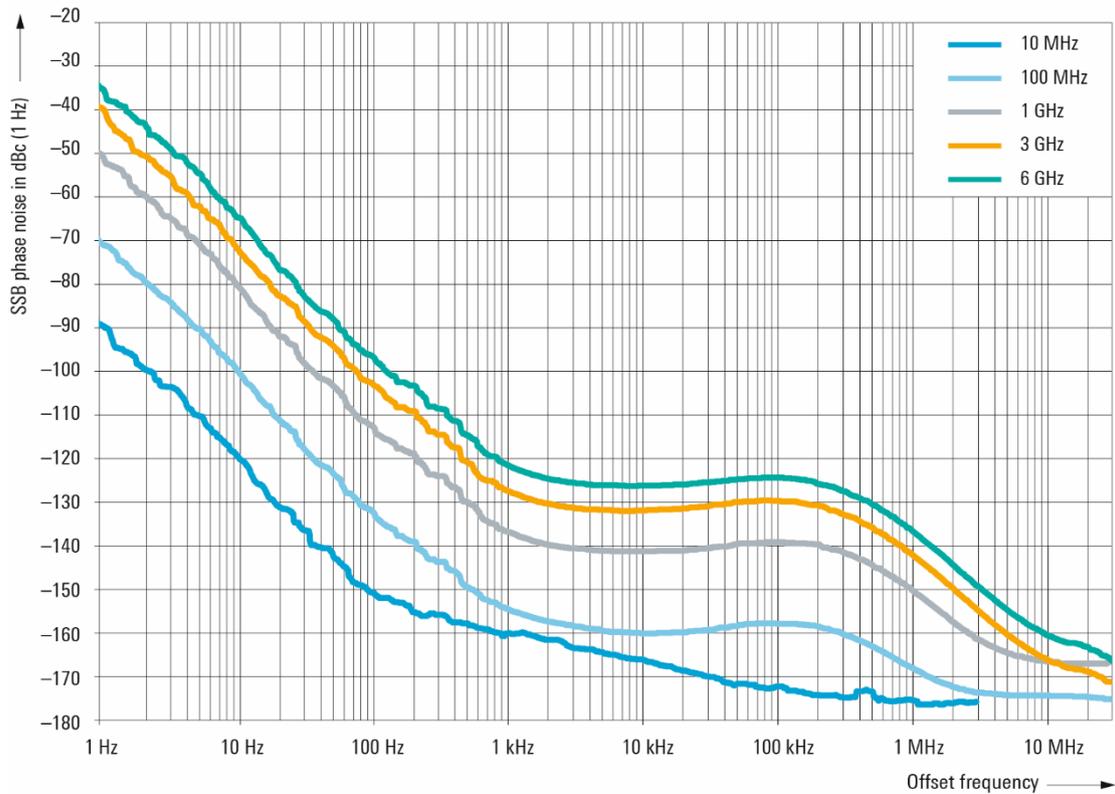
Specifications above 3 GHz are only valid for instruments equipped with the R&S®SMAB-K722 option.

| | | |
|----------------------------------|--|--|
| Output types | | differential square wave, differential sine wave, single-ended sine wave, differential CMOS |
| Frequency | | |
| 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 |
| Level | | |
| 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 |
| Output connectors | | |
| 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 |
| Reverse power | | |
| 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) |
| DC offset | | |
| Setting range | not available in CMOS mode | -5 V to +5 V |
| Setting resolution | | 1 mV |
| DC offset source impedance | | 50 Ω (nom.) |
| Spectral purity | | |
| 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 |

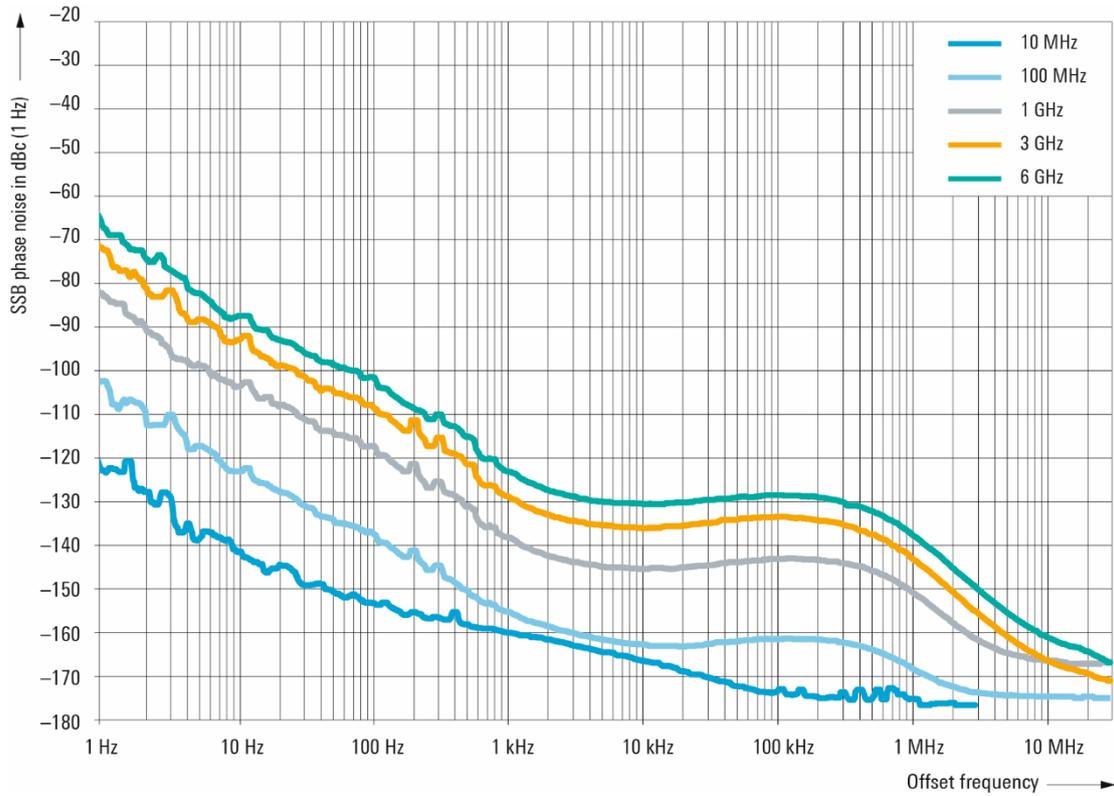
| | | | |
|---|--|--|-----------------------------|
| Wideband noise | maximum output level, sine wave, carrier offset 10 MHz, measurement bandwidth 1 Hz carrier offset 10 MHz or 10 % of carrier frequency, whichever is lower | | |
| | $f \leq 8 \text{ MHz}$ | < -150 dBc | |
| | $8 \text{ MHz} < f \leq 1.5 \text{ GHz}$ | < -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.) | |



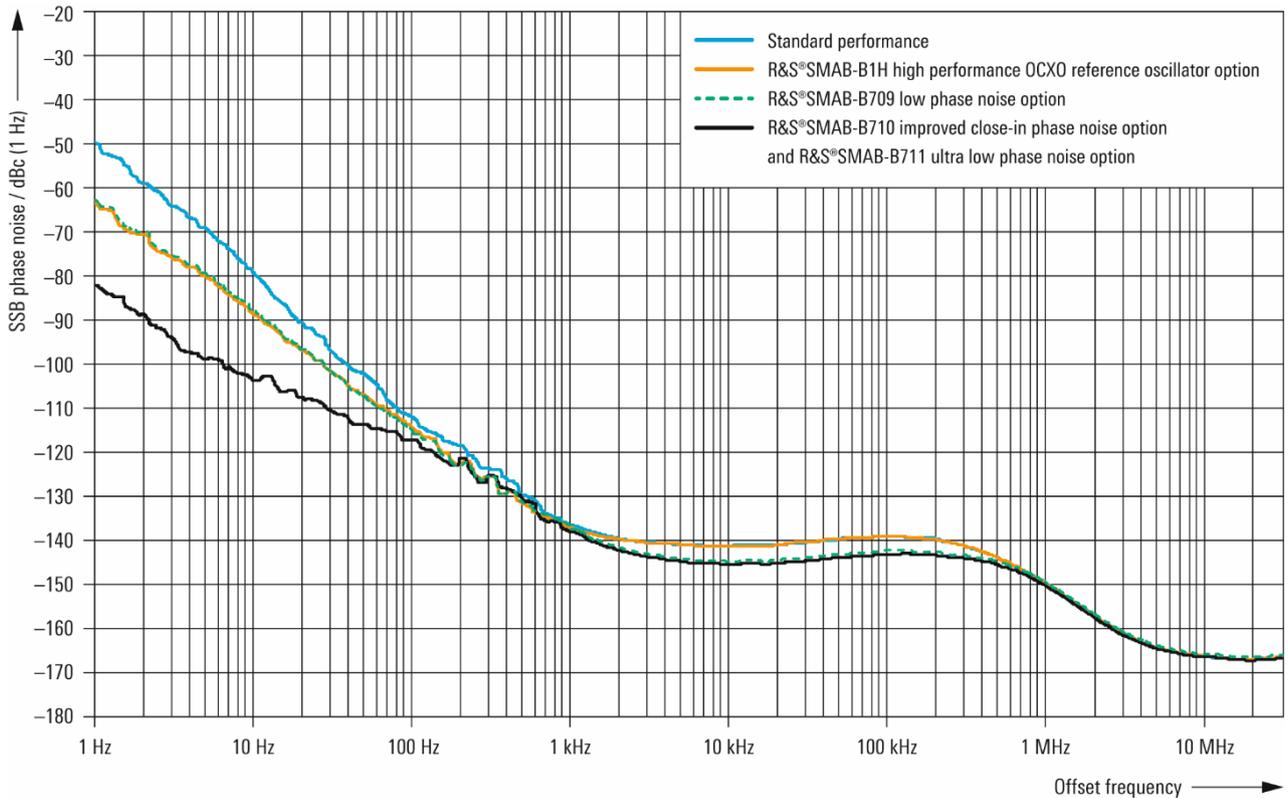
Measured wideband noise of clock synthesizer output at maximum output power versus carrier frequency with the R&S[®]SMAB-B29 and R&S[®]SMAB-K722 options; measured with the R&S[®]F5WP phase noise analyzer



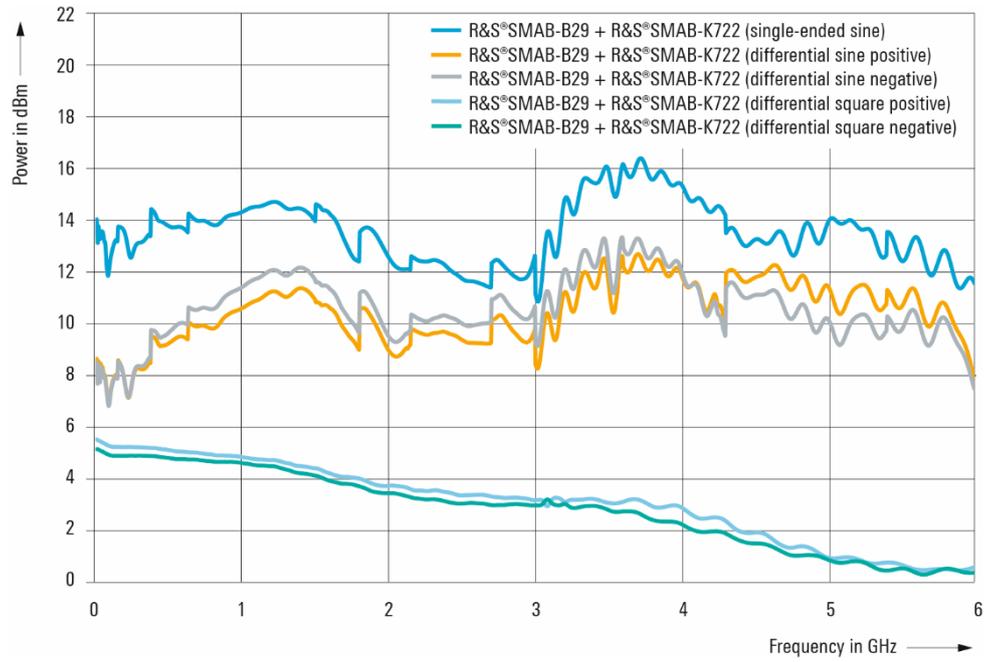
Measured SSB phase noise of clock synthesizer (standard performance) with the R&S[®]SMAB-B29 and R&S[®]SMAB-K722 options



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"> • 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®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"> • single • continuous |
| 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) |
| Power vs. frequency mode | | |
| 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 |
| Power vs. power mode | | |
| 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 |
| Power vs. time mode (trace mode) | | |
| 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 |

| 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/-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) ⁷ |
| 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>Hewlett Packard</p> <ul style="list-style-type: none"> • HP 8340, HP 8341 • HP 8360 • HP 83620, HP 83622, HP 83623, HP 83624 • HP 83630, HP 83640, HP 83650 • HP 8373 • HP 83711, HP 83712 • HP 83731, HP 83732 • HP 8642, HP 8643, HP 8644, HP 8645 • HP 8647, HP 8648 • HP 8656, HP 8657 • HP 8662, HP 8663, HP 8664, HP 8665 • HP 8673 <p>Agilent/Keysight Technologies</p> <ul style="list-style-type: none"> • E4421, E4422, E4428 • E8257, E8663 • N5161, N5181, N5183 <p>Aeroflex (IFR/Marconi)</p> <ul style="list-style-type: none"> • 2023, 2024 • 2030, 2031, 2032 • 2040, 2041, 2042 <p>Anritsu</p> <ul style="list-style-type: none"> • 68017, 68037 <p>Panasonic</p> <ul style="list-style-type: none"> • VP-8303A <p>Racal Dana</p> <ul style="list-style-type: none"> • 3102, 9087 <p>Rohde & Schwarz</p> <ul style="list-style-type: none"> • R&S®SMA100A • R&S®SME02/03/06 • R&S®SMF100A • R&S®SMG/SMH • R&S®SMGU/SMHU • R&S®SML01/02/03 • R&S®SMP02/03/04 • R&S®SMR20/27/30/40 • R&S®SMT02/03/06 • R&S®SMY01/02 |
| IEC/IEEE bus address | | 0 to 30 |
| Ethernet/LAN protocols and services | | <ul style="list-style-type: none"> • 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 facilitate direct connection to a system controller |

⁷ 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 Ω , 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 Ω | 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, ϕ M, Scan AM) | BNC female |
| Input impedance | | 100 k Ω ; 600 Ω or 50 Ω (nom.) |
| Input sensitivity | AM, FM, ϕ M: peak value for set deviation | 1 V (nom.) |
| Input voltage range | Scan AM | |
| | Ext 1 | -6 V to 0 V |
| | Ext 2 | -1 V to 0 V |
| Input damage voltage | 50 Ω input impedance | $\pm 7\text{ V}$ |
| | 600 Ω and 100 k Ω 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 Ω or 50 Ω (nom.) |
| Input voltage | TTL, CMOS compatible | |
| | threshold voltage | 0 V to 2.0 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

| Power rating | | |
|---------------------------------|--|--|
| 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 |
| Product conformity | | |
| Electromagnetic compatibility | EU: in line with EMC Directive 2004/108/EC | applied harmonized standards: <ul style="list-style-type: none"> • EN 61326-1 (industrial environment) • EN 61326-2-1 • EN 55011 class A • EN 61000-3-2 • EN 61000-3-3 |
| 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 _{UL} mark 70108101 |
| Mechanical resistance | | |
| 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 |
| Environmental conditions | | |
| 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) |
| Weight and dimensions | | |
| 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) |

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

Ordering information

R&S®SMAB-Bxxx = hardware option

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

| Designation | Type | Order No. |
|--|----------------|--------------|
| Signal Generator ⁸ including power cable and quick start guide | R&S®SMA100B | 1419.8888.02 |
| Options | | |
| 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 ⁹ | R&S®SMAB-B1H | 1420.8188.02 |
| Low phase noise ⁹ | R&S®SMAB-B709 | 1420.9849.02 |
| Improved close-in phase noise performance for R&S®SMAB-B106/-B112/-B120 ⁹ | R&S®SMAB-B710 | 1420.8007.02 |
| Improved close-in phase noise performance for R&S®SMAB-B103 ⁹ | R&S®SMAB-B710N | 1420.8107.02 |
| Ultra low phase noise for R&S®SMAB-B106/-B112/-B120 ⁹ | R&S®SMAB-B711 | 1420.8020.02 |
| Ultra low phase noise for R&S®SMAB-B103 ⁹ | 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 ¹⁰ | 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 ¹¹ | 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 ¹² | R&S®SMAB-K27 | 1420.9749.02 |
| AM/FM/φM | R&S®SMAB-K720 | 1420.9790.02 |
| Scan AM ^{13 14} | R&S®SMAB-K721 | 1420.9784.02 |
| Additional performance options | | |
| Ramp sweep | R&S®SMAB-B28 | 1420.6579.02 |
| High dynamic uninterrupted level sweep ¹⁴ | 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 |

⁸ 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.

⁹ 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.

¹⁰ R&S®SMAB-B32 can only be ordered with R&S®SMAB-K31.

¹¹ R&S®SMAB-B34 can only be ordered with R&S®SMAB-K33.

¹² Requires R&S®SMAB-K23 pulse generator option.

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

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

| Designation | Type | Order No. |
|---|-----------------|--------------|
| Recommended extras | | |
| 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 |
| Documentation | | |
| Documentation of calibration values | R&S®DCV-2 | 0240.2193.18 |
| R&S®SMA100B accredited calibration | R&S®SMA100B-ACA | 1420.6740.02 |

| | | |
|---|---------|---|
| Warranty | | |
| Base unit | | 3 years |
| All other items ¹⁵ | | 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 ¹⁶. 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 ¹⁶ 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 ¹⁶ and accredited calibration at the recommended intervals as well as any accredited calibration carried out during repairs or option upgrades.

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

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

Service that adds value

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- | Long-term dependability

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- | Longevity and optimized total cost of ownership

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ISO 14001

Rohde & Schwarz training

www.training.rohde-schwarz.com

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R&S®SMA100B RF and Microwave Signal Generator

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