

R&S® SMB100A

Microwave Signal Generator

Versatile, compact, up to 40 GHz;
170 GHz with upconverter



R&S®SMB100A Microwave Signal Generator At a glance

The compact, versatile R&S®SMB100A microwave signal generator with a frequency range up to 40 GHz provides outstanding spectral purity and high output power. In addition, it features easy operation, comprehensive functionality and low cost of ownership.

The R&S®SMB100A provides microwave characteristics that are exceptional in its class, making it an excellent general-purpose instrument. These outstanding characteristics plus its compact size and low weight make the instrument ideal for a wide range of applications. The R&S®SMB100A is optimally suited for use in development, production and service, or, to put it even simpler: wherever an analog microwave signal is required.

Its wide frequency range covers a large number of challenging applications. The R&S®SMB100A is the perfect choice for applications in the important ISM bands up to 5.7 GHz.

Furthermore, the R&S®SMB100A can be ideally used for measuring the blocking characteristic up to a CW frequency of 12.75 GHz, as specified in various telecommunications standards. When it comes to frequently changing level settings, this is the first time that a wear-free electronic step attenuator is used in this frequency range.

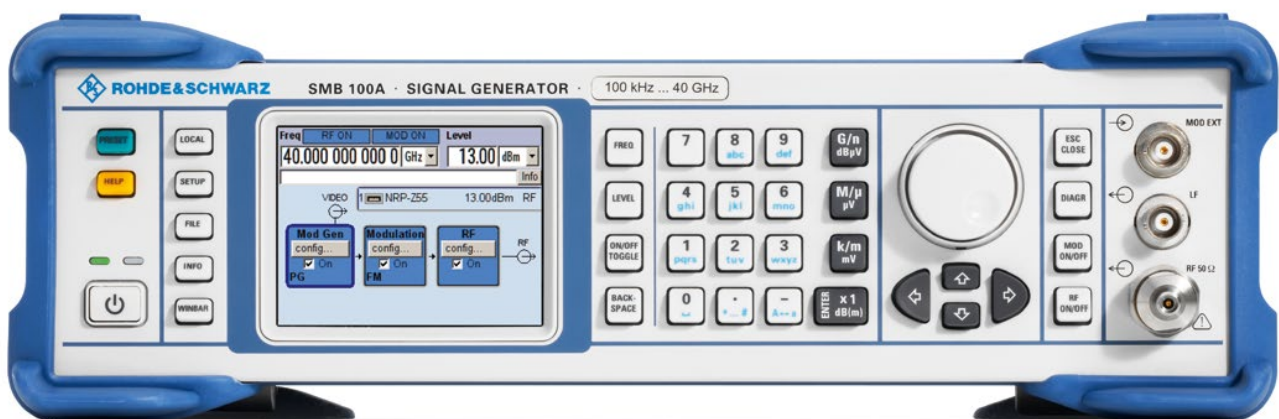
Four frequency options up to 12.75 GHz, 20 GHz, 31.8 GHz and 40 GHz are available to cover the microwave range. These options are suitable for tests on radar systems and antennas in the X and K bands, for example for wideband receiver tests.

For even higher frequencies, the frequency range of the R&S®SMB100A can be easily extended with the R&S®SMZ frequency multiplier. The R&S®SMB100A plus R&S®SMZ solution combines easy handling with precise, adjustable output levels in the frequency range from 50 GHz to 110 GHz (adjustable output levels are not possible with R&S®SMZ170).

In addition to pure CW signals, the R&S®SMB100A also provides the most common analog AM and FM/φM modulation modes as standard. Moreover, the R&S®SMB100A can be equipped with an excellent pulse generator and pulse modulator that makes it possible to generate user-programmable pulse scenarios, also referred to as pulse trains.

Key facts

- Wide frequency range from 100 kHz to 40 GHz
- Excellent signal characteristics with low SSB phase noise of typ. -128 dBc (at 1 GHz, 20 kHz offset)
- High output power of typ. up to $+27$ dBm
- All important analog modulations with AM, FM/φM and pulse modulation supported
- Compact size with only two height units and low weight



R&S®SMB100A Microwave Signal Generator Benefits and key features

All-purpose signal source

- ▮ Wide frequency range from 100 kHz to 12.75/20/31.8/40 GHz covering the main frequency bands for microwave applications
- ▮ Frequency extension from 50 GHz to 170 GHz in combination with the R&S®SMZ frequency multiplier
- ▮ All important analog modulations with AM, FM/φM and pulse modulation supported
- ▮ Support of R&S®NRP-Zxx power sensors
- ▮ Reverse power protection for high operational reliability (optionally available for the 12.75 GHz model)
- ▮ Intuitive user interface with graphical display of signal flow for easy operation
- ▮ Remote control via LAN, USB and GPIB including emulation modes for legacy instruments
- ▮ Low weight and compact design for a wide range of applications, including mobile applications

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Best signal quality in the mid-range

- ▮ Very low SSB phase noise of typ. -128 dBc at 1 GHz and typ. -108 dBc at 10 GHz carrier frequency (20 kHz carrier offset, 1 Hz measurement bandwidth)
- ▮ Optional internal low harmonic filters for the 20 GHz and 40 GHz model to lower the harmonics to less than -50 dBc for frequencies above 150 MHz
- ▮ Innovative DDS-based synthesizer concept

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High output power and wide level range

- ▮ High power over a wide frequency range
- ▮ Low level range down to -120 dBm (for instruments equipped with step attenuator) with no compromise in quality
- ▮ High harmonics suppression of < -30 dBc even at high output power

▷ [page 9](#)

Ideal for production

- ▮ Wear-free electronic attenuator up to 12.75 GHz ensuring long life even in the case of heavy use in production
- ▮ High level accuracy and repeatability for high production yield
- ▮ Closed loop power control ensures highly accurate and very stable input power to the DUT irrespective of unwanted power drifts in the test setup (e.g. caused by a power amplifier in between the signal generator and the DUT)
- ▮ Short frequency and level settling times which can be further reduced in List mode
- ▮ Low power consumption

▷ [page 11](#)

Frequency extension from 50 GHz to 170 GHz

- ▮ R&S®SMB100A signal generator (≥ 20 GHz) plus an external R&S®SMZ frequency multiplier controlled via USB
- ▮ An internal attenuator (mechanically or electronically controlled) can be integrated into the same housing as the frequency multiplier

▷ [page 13](#)

Ready for aerospace and defense applications

- ▮ Optional pulse modulator with typ. > 90 dB ON/OFF ratio and rise/fall time of typ. < 5 ns and pulse generator with minimum pulse width of 10 ns for radar system testing
- ▮ Flexible generation of pulse trains for simulating complex pulse scenarios (optional)
- ▮ Wide temperature range of 0°C to $+55^{\circ}\text{C}$ and high permissible operating altitude of 4600 m for use even under extreme conditions
- ▮ Sanitizing of user data for secured areas
- ▮ High-quality shielding

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User-defined correction of external frequency responses

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Closed loop power control

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Flexible service concept

- ▮ Servicing on-site or at a Rohde&Schwarz service center
- ▮ Built-in selftest of modules to support troubleshooting
- ▮ Complete calibration recommended only every three years

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Hardware and software option concept for the R&S®SMB100A.

The table provides an overview of the frequency ranges as well as of functionalities and options.

| Model overview | | | | |
|---|----------------------|-------------------|---------------------|-------------------|
| Frequency range | 100 kHz to 12.75 GHz | 100 kHz to 20 GHz | 100 kHz to 31.8 GHz | 100 kHz to 40 GHz |
| With electronic step attenuator | ○ | – | – | – |
| Without electronic step attenuator | ○ | – | – | – |
| With mechanical step attenuator | – | ○ | ○ | ○ |
| Without mechanical step attenuator | – | ○ | – | ○ |
| High power | ● | ○ | ○ | ○ |
| Low harmonic filter | – | ○ | ○ | ○ |
| OEXO reference oscillator ¹⁾ | ○ | ○ | ○ | ○ |
| OEXO reference oscillator, high performance ¹⁾ | ○ | ○ | ○ | ○ |
| Reverse power protection | ○ | – | – | – |
| Pulse modulator | ○ | ○ | ○ | ○ |
| Pulse generator | ○ | ○ | ○ | ○ |
| Pulse train | ○ | ○ | ○ | ○ |

The R&S®SMB100A (20 GHz, 31.8 GHz or 40 GHz model) in combination with one of the R&S®SMZ frequency multipliers below covers the frequency range from 50 GHz up to 170 GHz.

| Model overview | | | | |
|---|------------------|------------------|-------------------|--------------------|
| Frequency multiplier | R&S®SMZ75 | R&S®SMZ90 | R&S®SMZ110 | R&S®SMZ170 |
| Frequency range | 50 GHz to 75 GHz | 60 GHz to 90 GHz | 75 GHz to 110 GHz | 110 GHz to 170 GHz |
| With mechanically controlled attenuator ²⁾ | ○ | ○ | ○ | – |
| With electronically controlled attenuator ²⁾ | ○ | ○ | ○ | – |

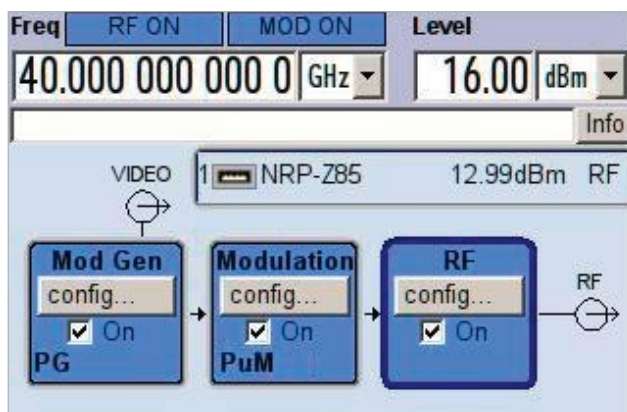
- Standard
- Optional
- Not available

¹⁾ Only one of the following options can be installed: R&S®SMB-B1 (OEXO reference oscillator) or R&S®SMB-B1H (OEXO reference oscillator, high performance).

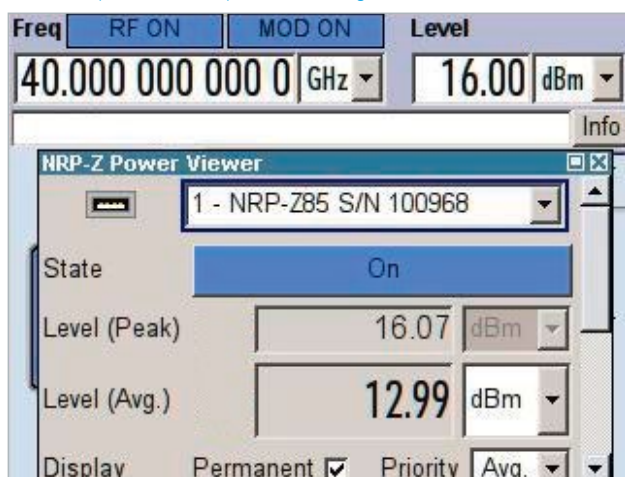
²⁾ Only one of the following options can be installed: the mechanically or the electronically controlled attenuator.

All-purpose signal source

Pulse-modulated signal measured with the R&S®NRP-Z85 wideband power sensor.



Details of the measurement with the R&S®NRP-Z85 wideband power sensor (peak and average).



Wide frequency range from 100 kHz to 40 GHz

The signal generator's wide frequency range, high output power and a wide variety of modulations make it a flexible signal source for a broad scope of applications. Its frequency option up to 12.75 GHz covers ISM bands as well as all important mobile radio bands. In addition, the frequency options up to 20 GHz and 40 GHz cover numerous microwave applications that require high spectral purity and high output power.

Frequency extension from 50 GHz to 170 GHz in combination with the R&S®SMZ frequency multiplier

In the frequency range of 50 GHz to 170 GHz the R&S®SMB100A in combination with the R&S®SMZ frequency multiplier is the ideal solution. It can be used in diverse applications, e.g. in the automotive sector with distance radars, in astronomy with sophisticated telescopes and in radar interferometry for analyzing the earth's surface.

All important analog modulations with AM, FM/φM and pulse modulation supported

The R&S®SMB100A handles the important analog AM, FM/φM modulation modes and pulse modulation with excellent characteristics. In AM and FM/φM modulation, the RF carrier is modulated with the internal LF generator or also with external signals. The two different sources of modulation can be internally added to generate two-tone-modulated signals. Due to its digital modulation processing, the R&S®SMB100A implements the modulation modes with high accuracy and minimum distortion.

Support of R&S®NRP-Zxx power sensors

The R&S®SMB100A supports a wide variety of R&S®NRP-Zxx USB power sensors. The R&S®NRP-Z92 is a power sensor that ideally complements the frequency and level range of the generator up to 6 GHz. Equipped with such a power sensor, the R&S®SMB100A fully automatically performs external level correction or precisely measures the power in the test setup. The R&S®NRP-Z55 power sensor can be used with the 12.75 GHz, 20 GHz or 40 GHz frequency option of the R&S®SMB100A for the same purpose.

Reverse power protection for high operational reliability

The reverse power protection protects the R&S®SMB100A from high external voltages and high power at the RF output. This feature shields the RF output against unwanted high reverse power and ensures a high degree of operational reliability. The R&S®SMB-B30 reverse power protection is available for the R&S®SMB-B112/R&S®SMB-B112L 12.75 GHz frequency options.

Intuitive user interface

Intuitive operation via the graphical user interface and the integrated help system facilitate the optimum use of the R&S®SMB100A for the application at hand. To support graphical operation, a mouse can be connected via USB.

Remote control via LAN, USB and GPIB including emulation modes

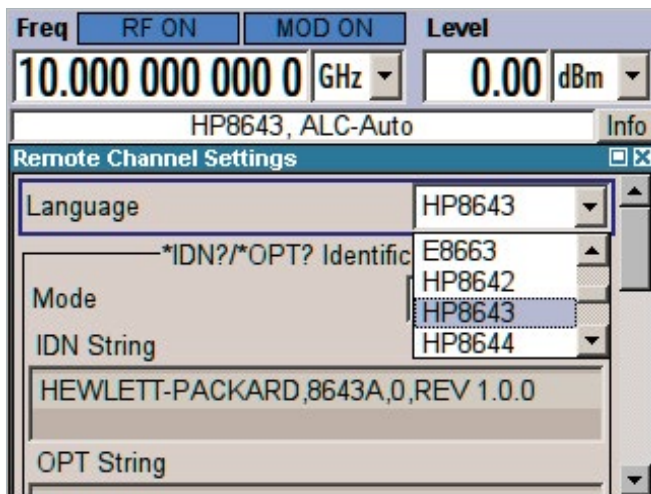
The R&S®SMB100A is also ideally equipped with regard to the remote control interface. In addition to conventional GPIB, it also supports LAN and USB as standard. This is especially advantageous in environments such as service labs where there is often no GPIB.

Signal generators are often used in automated test environments. Replacing them, e.g. due to malfunctions or standard replacement procedures, requires special care. The replacement part and the replaced part must be compatible at least in terms of electrical features and remote control features. Legacy instruments often use a proprietary remote control language. Direct replacement therefore requires language emulation capability in the software of the replacement part. To meet these requirements, the R&S®SMB100A signal generator comes with a language emulation feature. By selecting the desired language emulation, the signal generator acts as the original replaced instrument. The language list already includes a large number of emulated instruments and will be updated on a regular basis.

Low weight and compact design

The R&S®SMB100A has a compact size of only two height units and $\frac{3}{4}$ 19" width. This form factor plus its low weight of max. 6.9 kg for the 40 GHz model make it ideal for mobile use. It easily fits in any lab and service center, where space is often at a premium.

The emulation mode can be set in the remote setup menu of the R&S®SMB100A.



Best signal quality in the mid-range

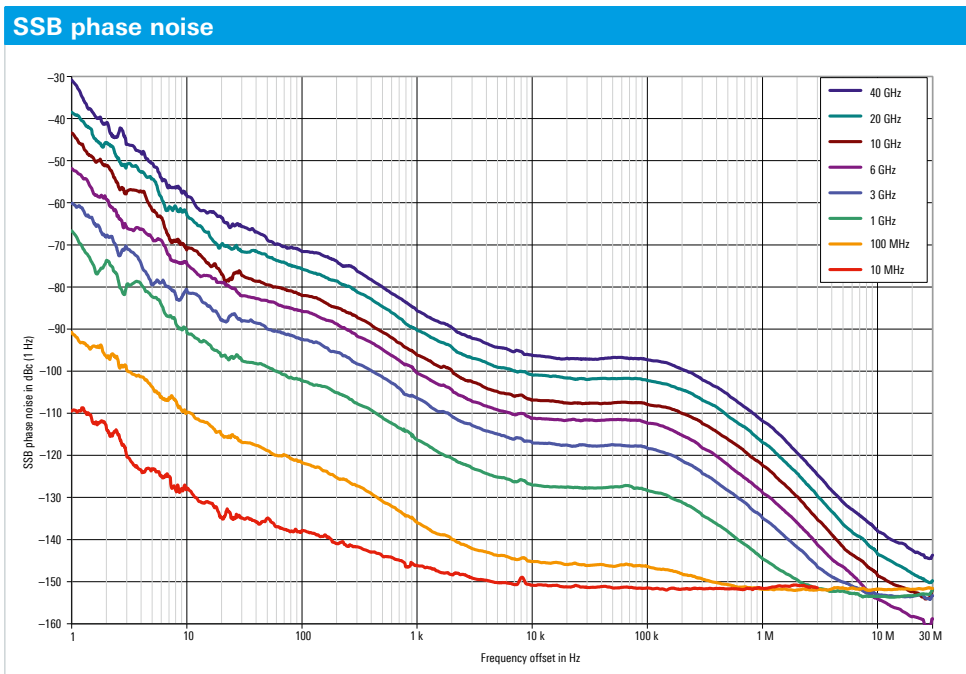
Phase noise, harmonics, nonharmonic spurious and wideband noise are key parameters when it comes to characterizing the spectral properties of analog signal generators. Many measurements focus on more than one aspect simultaneously. For example, in blocking measurements, nonharmonics together with phase noise are essential in generating the usually unwanted RFI power in the adjacent channel.

Very low SSB phase noise

When it comes to SSB phase noise performance, the R&S®SMB100A consistently achieves excellent values over the entire frequency range from from 100 kHz to 40 GHz. This is due to its remarkable concept. Below 3 GHz, the R&S®SMB100A works down to 23.3475 MHz with frequency dividers. Below this value, the integrated DDS synthesizer generates the output signal directly. In contrast to conventional designs that use a mixer range below approx. 250 MHz, the innovative Rohde&Schwarz solution leads to a much better phase noise performance at low frequencies.

The R&S®SMB100A is therefore the ideal replacement in test circuits for fixed-frequency high-end crystal oscillators that are often used as a reference signal. The R&S®SMB100A combines equal or even improved signal performance with adjustable frequency and adjustable level, which is highly beneficial as it can be ideally adapted to the DUT. Moreover, the R&S®SMB100A makes it possible to define the DUT tolerance range relative to the reference by varying these parameters.

To further improve the close-in phase noise and frequency stability, two different OCXO reference oscillators are available as options. Especially the R&S®SMB-B1H offers excellent performance that is unprecedented in this class.



Measured SSB phase noise with the R&S®SMB-B1H OCXO option for the 12.75/20/31.8/40 GHz model.

Optional internal low harmonic filters for the 20 GHz and 40 GHz model to lower the harmonics to less than -50 dBc

The harmonics of the R&S®SMB100A microwave signal generator can be significantly reduced with the optional low harmonic filters (the R&S®SMB-B25 for the 20 GHz model and the R&S®SMB-B26 for the 40 GHz model). The low harmonic filter generally improves measurement accuracy in the entire setup for frequencies higher than 150 MHz.

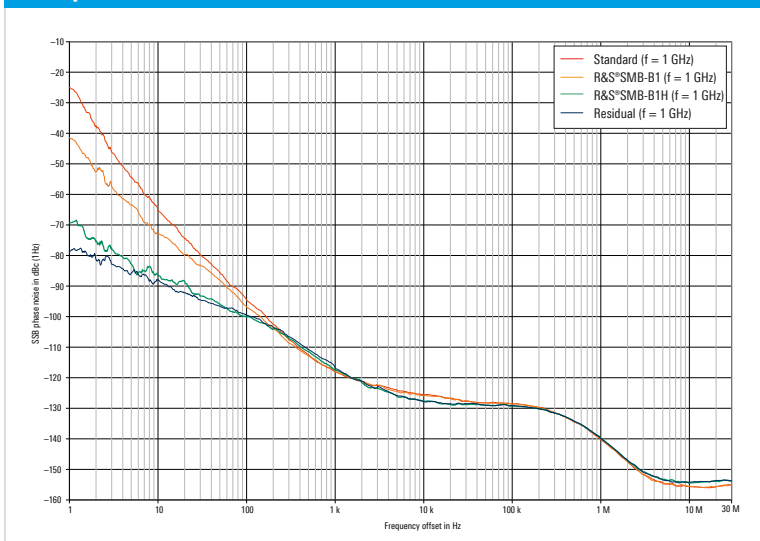
Devices which are affected by bad harmonics are, for example, wideband receivers. During blocking tests, the harmonics of the signal generator could fall into the desired band and interfere the measurement result.

Another critical application is the total harmonic distortion (THD) measurement of a power amplifier. The setup comprises a signal generator generating the input signal, the DUT and a spectrum analyzer for measuring the amplifier performance. Here, the harmonics must be low enough to ensure that the harmonic distortion of the device under test is measured and not the harmonics of the signal source. And last but not least: for scalar network analysis, good dynamic range of the overall setup is essential. Bad harmonics from the signal source will limit this, since the harmonics are unintentionally measured, too.

Innovative DDS-based synthesizer concept

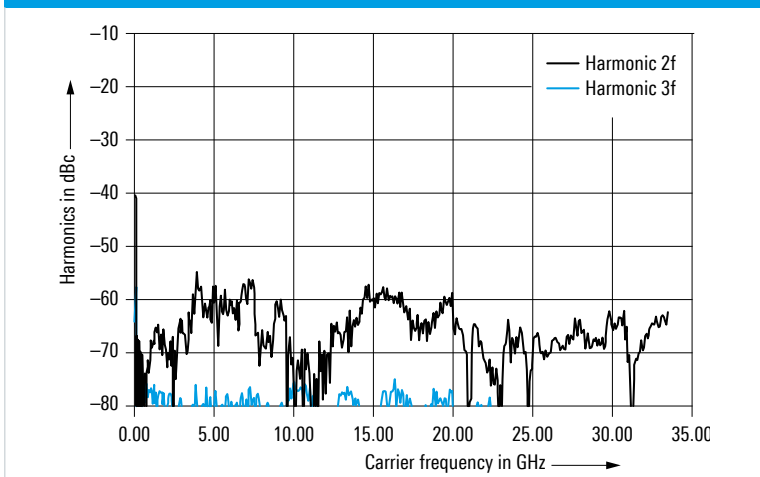
The R&S®SMB100A superbly handles high signal-quality requirements. Due to its innovative DDS-based synthesizer concept, the R&S®SMB100A yields unsurpassed values in all parameters called for in the mid-range, thereby setting new standards.

SSB phase noise



Measured SSB phase noise with standard reference, the R&S®SMB-B1 option and the R&S®SMB-B1H option.

Harmonics



Harmonics versus carrier frequency at +10 dBm output level with R&S®SMB-B140 option and R&S®SMB-B32 (meas.).

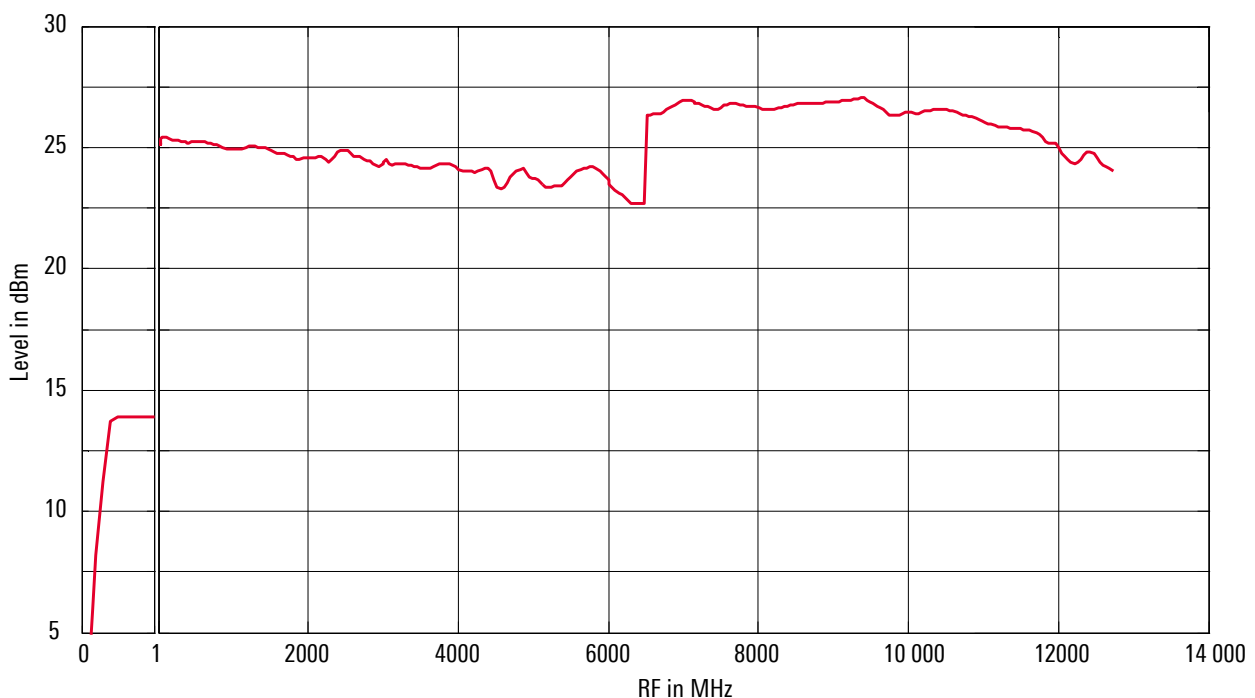
High output power and wide level range

High power over a wide frequency range

The R&S®SMB100A combines excellent signal quality with a high output power of $> +18$ dBm as standard, which is unique in this instrument class, over a wide frequency range of 1 MHz to 12.75 GHz. The maximum available output power is up to $+27$ dBm, offering sufficient power reserve to easily compensate for level loss in a test setup. The R&S®SMB-B31 high power option for the 20 GHz model delivers a specified output power of $+19$ dBm while the R&S®SMB-B32 high power option for the 40 GHz model achieves $+16$ dBm over a wide frequency range up to 20 GHz and 40 GHz, respectively. These values are even outperformed in overrange. This usually eliminates the need for an additional external amplifier, which saves space and also drastically reduces costs for a test system. In applications, users additionally benefit from the high level accuracy that the R&S®SMB100A provides – a level accuracy that is not necessarily provided if an external amplifier is used.

Measured maximum output power versus frequency of the R&S®SMB100A 12.75 GHz instrument.

Maximum output power



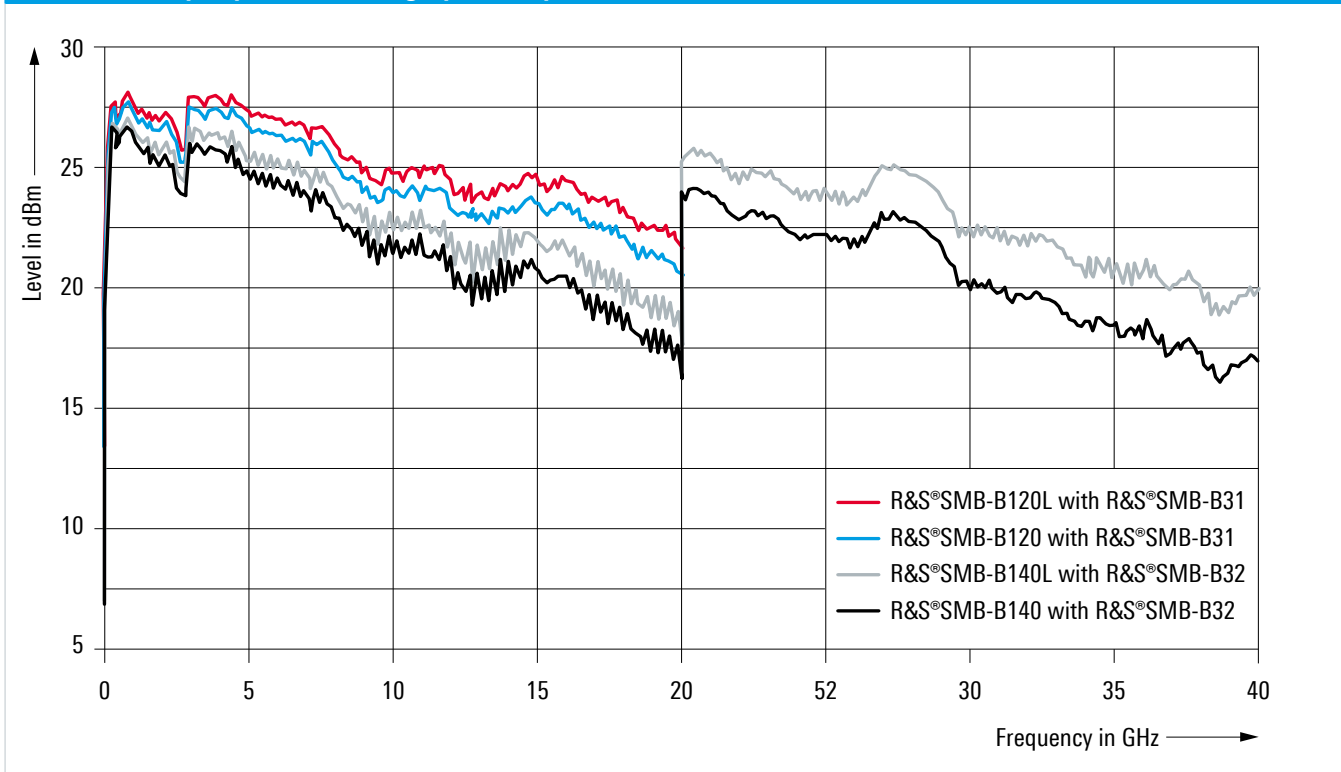
Low level range with no compromise in quality

Even in the lower level range, the R&S®SMB100A makes no compromise in quality. The RF level is specified down to -120 dBm when a step attenuator is installed. This makes the generator ideal for sensitivity measurements on receivers.

High harmonics suppression of < -30 dBc even at high output power

What is special about the R&S®SMB100A is that harmonics are still suppressed with < -30 dBc even at high output power, ideal for amplifier design applications up to 40 GHz. The nonharmonics are even suppressed by e.g. typ. < -78 dBc at 3 GHz or typ. < -66 dBc at 10 GHz.

Typical measurement of the R&S®SMB100A high-power 20 GHz and 40 GHz models, with and without optional step attenuator.

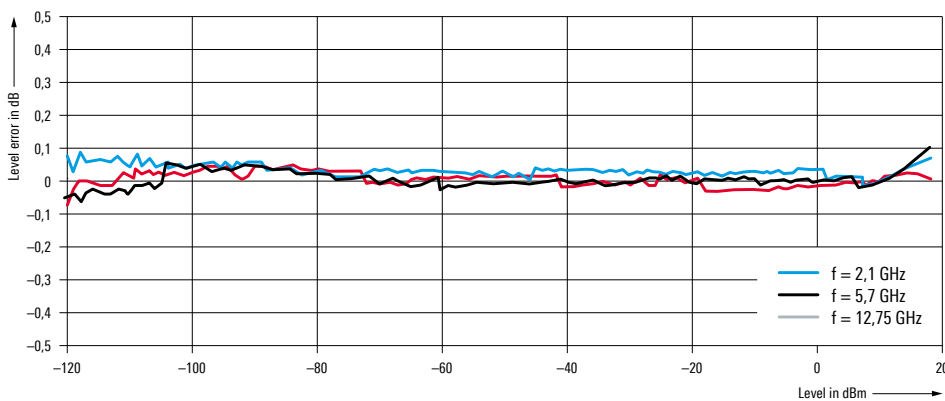
Maximum output power with high power option

Ideal for production

Wear-free electronic attenuator with reverse power protection

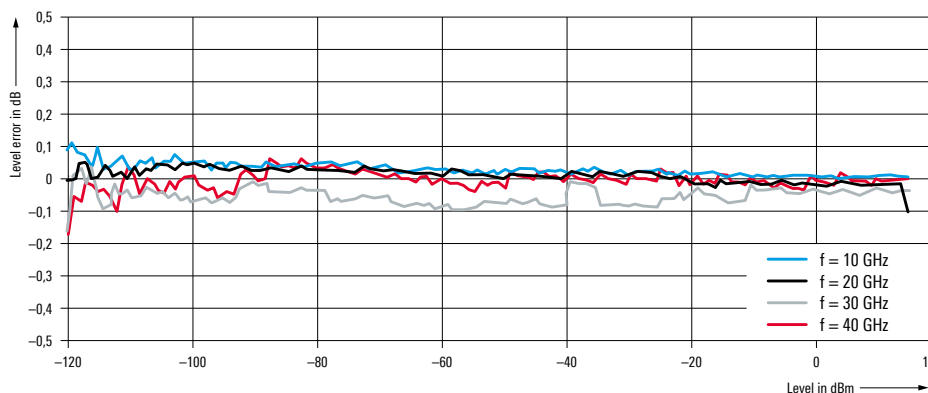
The wear-free electronic attenuator – in the frequency range up to 12.75 GHz – of the R&S®SMB100A functions reliably, even if the level values frequently change. As a result, high availability in the test system is ensured together with long service intervals even in the case of heavy use in production. Moreover, the reverse power protection (optionally available for the 12.75 GHz model) shields the R&S®SMB100A against high reverse power or DC voltage on the RF line.

Level linearity



Measured level linearity, ALC ON
(with the R&S®SMB-B112
12.75 GHz frequency option).

Level linearity



Measured level linearity, ALC ON
(with the R&S®SMB-B140
40 GHz frequency option and the
R&S®SMB-B32 high power option).

High level accuracy and repeatability for high production yield

The R&S®SMB100A offers high level accuracy and repeatability, as well as a very high level sweep range over the entire range. Measurements within narrow limits can be performed with high reproducibility, boosting production yield.

Closed loop power control

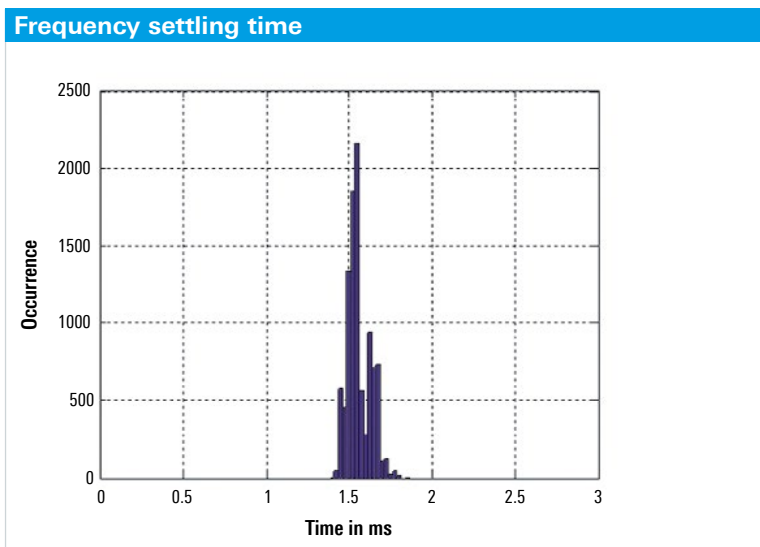
Highly accurate and stable power for testing DUTs is a very important performance requirement in many applications. The real power directly applied to the DUT is affected by cables, modules and components in between the signal generator and the DUT. By measuring the incident power to the DUT with a R&S®NRP power sensor and feeding the measurement result back to the R&S®SMB100A signal generator, the R&S®SMB100A can compensate for losses or drifts in the entire set up.

Short frequency and level settling times

Another criterion in production is the short settling time of the test instrument in order to achieve high throughput. The R&S®SMB100A meets this requirement by achieving short frequency (< 3 ms) and level (< 2.5 ms) settling times up to 40 GHz. Plus, it features the List mode as standard, which reduces the settling times to well below 1 ms. In this mode, settling parameters for the frequency and level pairs recorded in a list are precalculated and stored in order to speed up switchover.

Low power consumption

The R&S®SMB100A combines very low power consumption and effective heat dissipation. Its power consumption of only 140 W (40 GHz model) reduces expenditures for cooling in a production line rack. The efficient design of the R&S®SMB100A also has a positive impact on the MTBF.



Measured frequency settling time statistics for remote control over 10000 settings (with the R&S®SMB-B112 frequency option).

Frequency extension from 50 GHz to 170 GHz

Frequencies in the range from 50 GHz to 170 GHz can be easily generated with the R&S®SMB100A signal generator (20 GHz, 31.8 GHz or 40 GHz model) plus an external R&S®SMZ frequency multiplier. The frequency multiplier family consists of the models R&S®SMZ75 (from 50 GHz to 75 GHz), R&S®SMZ90 (from 60 GHz to 90 GHz), R&S®SMZ110 (from 75 GHz to 110 GHz) and the R&S®SMZ170 (from 110 GHz to 170 GHz). In order to change the output power of the frequency multiplier, an additional attenuator is necessary (not available for R&S®SMZ170). For simpler handling, the attenuator is integrated into the same housing as the frequency multiplier.

The R&S®SMB100A signal generator directly controls the R&S®SMZ frequency multiplier via USB. This combination operates as a single unit, allowing users to enter the wanted frequency and the target level at the R&S®SMZ output directly on the R&S®SMB100A.

Compared with conventional setups, this one-box solution significantly simplifies setup and operation. The R&S®SMB100A receives all necessary data from the connected R&S®SMZ, such as the configuration, the multiplication factor and in particular the precalibrated frequency response. The R&S®SMB100A is able to perform automatic correction, which ensures that the frequency and level values set on the R&S®SMB100A will actually be available at the R&S®SMZ output. Costly, error-prone and time-consuming level measurement using level detectors or power sensors, which is common for conventional setups, is no longer required.

Signals in the frequency range from 50 GHz to 170 GHz are used in both the civil sector and in aerospace & defense applications. Here, the R&S®SMB100A microwave signal generator in combination with the R&S®SMZ frequency multiplier is mainly used as a local oscillator (LO). An ideal CW signal with high spectral purity and an accurate level is required. The easiest way to obtain this signal is to use the R&S®SMB100A plus the R&S®SMZ frequency multiplier with built-in electronically controlled attenuator: The frequency and the level are set on the R&S®SMB100A and measurement can begin immediately.

Test setup containing the R&S®SMB100A microwave signal generator (20 GHz or 40 GHz model) and the R&S®SMZ110 frequency multiplier with built-in electronically controlled attenuator.

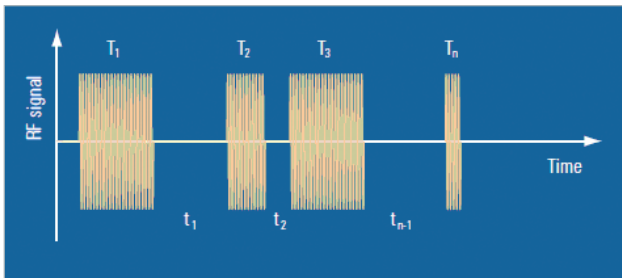


Ready for aerospace and defense applications

Optional high-performance pulse modulator and pulse generator

Pulsed signals are frequently required in aerospace and defense applications to test radar systems. To meet this need, the R&S®SMB100A can be equipped with an integrated pulse modulator (R&S®SMB-K21) and a pulse generator (R&S®SMB-K23) with superb characteristics such as a minimum pulse width of 10 ns for radar system testing. The pulse modulator, for example, makes it possible to perform radar tests with a high ON/OFF ratio of > 80 dB and very short rise/fall times of typ. < 5 ns. The pulse modulator is either controlled by an external pulse signal or it is supplied with single or double pulses or pulse trains as modulation signals by the internal pulse generator.

Pulse train: combination of pulses with different pulse widths and pulse pauses.



Editing pulse train data.

Editing pulse train data interface showing parameters:

- Freq: 10.000 000 000 0 GHz
- RF ON
- MOD ON
- Level: 0.00 dBm
- ALC-Auto

| | ON-Time/μs | OFF-Time/μs | Count |
|---|------------|-------------|-------|
| 1 | 10.000 | 10.000 | 1 |
| 2 | 40.000 | 5.000 | 1 |
| 3 | 5.000 | 30.000 | 1 |
| 4 | 10.000 | 10.000 | 3 |
| 5 | 10.000 | 100.000 | 1 |

Buttons: Goto, Edit, Save

Diagram of the pulse train.

Diagram of the pulse train interface showing parameters:

- Freq: 10.000 000 000 0 GHz
- RF ON
- MOD ON
- Level: 5.00 dBm
- ALC-Auto

Pulse Train Dialog - pulsetrain

Edit Pulse Train Data... Edit

Zoom Position: 0.000 μs

Buttons: Zoom In, Zoom Out

Versatile pulse trains

An optional feature of the built-in pulse generator is the possibility to generate pulse trains (R&S®SMB-K27 option), which are commonly used for radar applications. An example of a pulse train is shown in the figure on the left. In contrast to a single or double pulse, a pulse train is a combination of different pulses, which can be a periodical or non-periodical set of pulses. Pulse width and pulse pause can be set independently and separately for each pulse. This makes it possible to generate staggered pulses or to apply jitter to pulse width and pulse pause. Up to 2047 different pulses with a repetition of 1 to max. 65 535 are possible. This yields very long pulse train sequences for testing.

Wide temperature range and high permissible operating altitude

The R&S®SMB100A functions reliably under extreme conditions owing to its wide temperature range of 0°C to +55°C and a maximum permissible operating altitude of 4600 m above sea level.

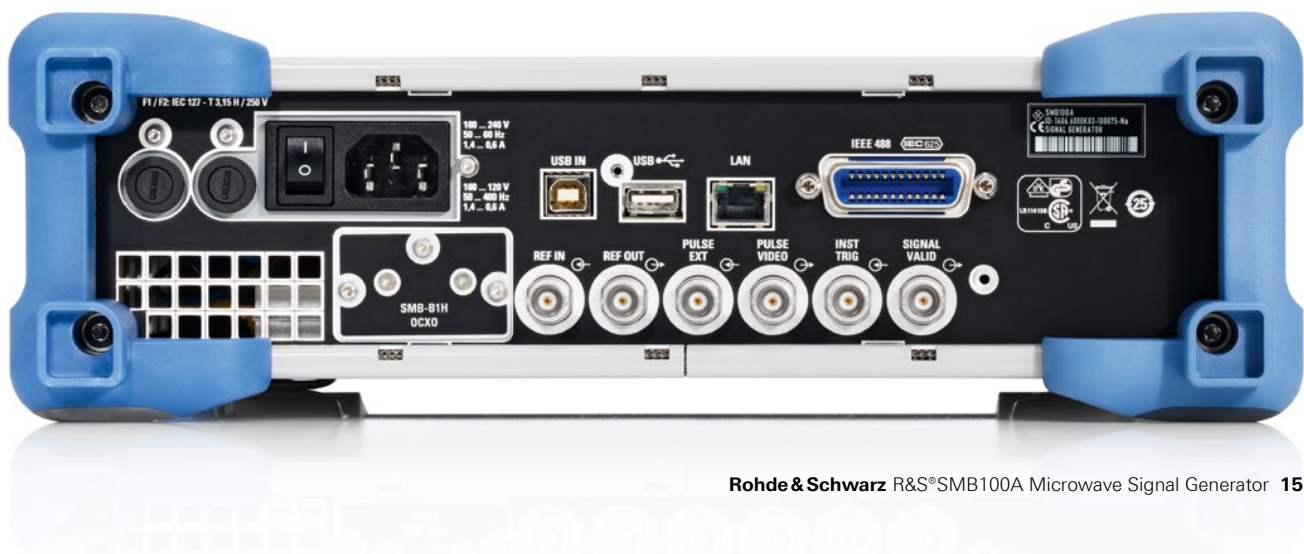
Sanitizing of user data for secured areas

To meet requirements for secured areas, an erase and sanitize procedure has been developed that reliably erases user data from the instrument. This ensures that no sensitive data will leave the secured area. Moreover, LAN and USB ports can be disabled by means of a security password and the display can be disabled as well.

High-quality shielding

Sensitivity measurements on low-noise satellite receivers can only be made with RF-leakage-proof signal sources. The comprehensive shielding of the R&S®SMB100A based on sophisticated technologies ensures low RF leakage exactly for this purpose.

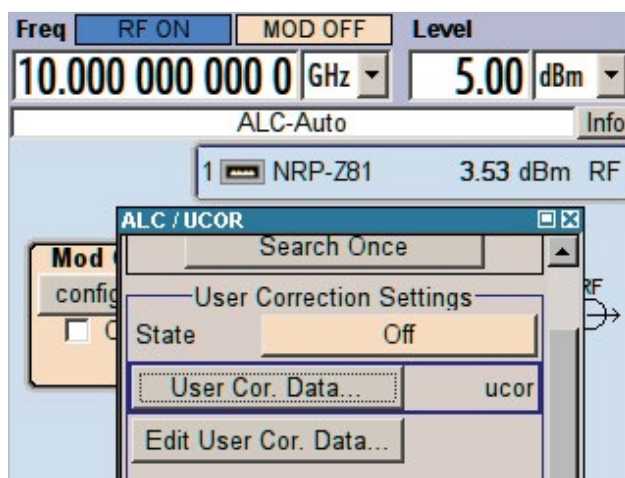
Rear view of the R&S®SMB100A.



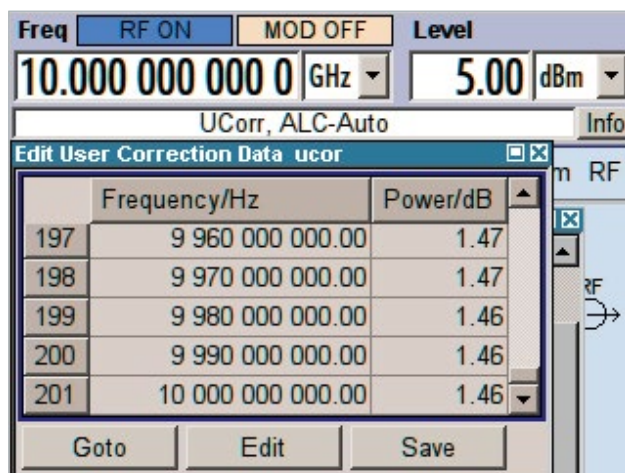
User-defined correction of external frequency responses

Test setups including cables, power amplifiers or filters always have frequency responses. The signal generator can compensate for the frequency response. The R&S®SMB100A features the User Correction function for

Without frequency response correction of the RF cable, the level error (measured with the R&S®NRP-Z81 power sensor) amounts to approx. 1.5 dB at 10 GHz (nominal value: 5 dBm).



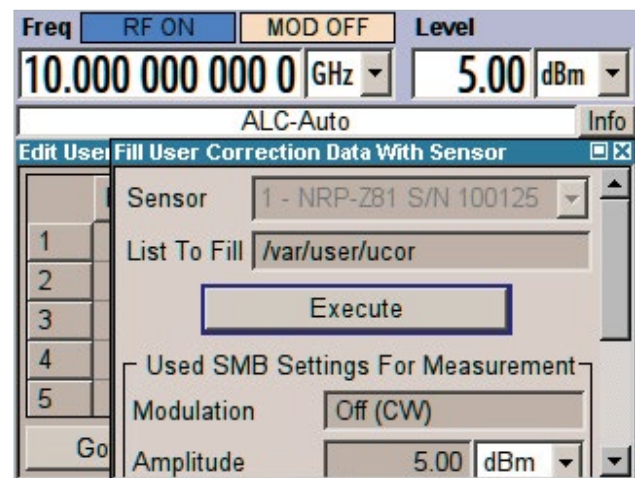
The measured level correction values are stored in a table together with the user-selected frequencies.



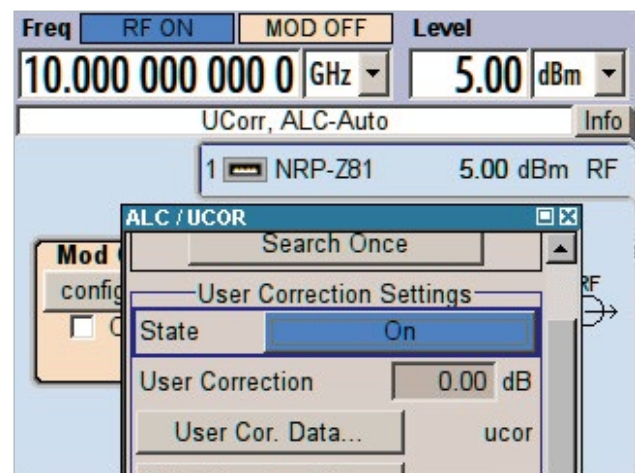
precisely this purpose. For a known frequency response that needs to be corrected, the user can enter the level correction values as a function of the frequency. Automatic interpolation of the correction values is performed between these frequency points. To simplify this, the R&S®SMB100A can also automatically include the level correction values at the press of a button by using a directly connected R&S®NRP-Zxx power sensor.

The screenshots show the frequency response correction for an RF cable in the range from 8 GHz to 10 GHz. Without frequency response correction, the level error (measured with the R&S®NRP-Z81) amounts to approx. 1.5 dB at 10 GHz due to cable loss. After the correction values in the range from 8 GHz to 10 GHz have been automatically measured and stored with the R&S®NRP-Z81, the level error will be automatically compensated for when the User Correction function is activated.

The connected R&S®NRP-Z81 power sensor automatically measures and stores the frequency response of the RF cable.



After the User Correction table has been activated, the R&S®SMB100A adapts its output power in order to compensate for the frequency response of the RF cable.



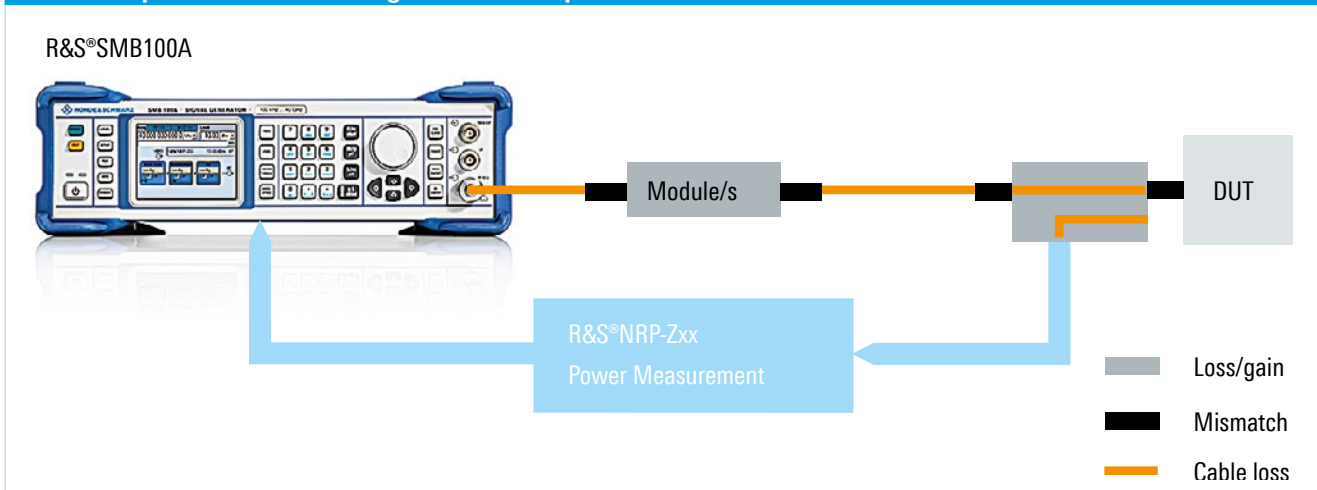
Closed loop power control

One important performance requirement in many applications is the generation of highly accurate and stable power for testing DUTs (e.g. power amplifiers). This is not a trivial task since the real power directly applied to the DUT is affected by the level accuracy of the signal generator, the losses due to cables, the losses due to modules or components and, last but not least, by mismatching. In addition, the frequency response of an amplifier in the setup might show an unwanted temperature dependency.

The best solution to this problem is "closed loop power control" in realtime – a standard feature of the R&S®SMB100A. In the setup below, it ensures highly accurate and very stable input power to the DUT, irrespective of unwanted power drifts or changes in the setup.

For measuring the DUT input power, a directional coupler plus the R&S®NRP-Zxx power sensor connected to the directional coupler can be used. An attractive alternative to the directional coupler plus the R&S®NRP-Zxx power sensor is the R&S®NRP-Z28 level control sensor. The measurement result from the R&S®NRP-Zxx or the R&S®NRP-Z28 is fed back to the R&S®SMB100A, which immediately adjusts its output power to compensate for the discrepancy between wanted and measured level.

Closed loop power control ensures highly accurate and stable input power to the DUT irrespective of unwanted power drifts or changes in the setup



Closed loop power control with directional coupler plus R&S®NRP-Zxx power sensor.



Closed loop power control with R&S®NRP-Z28 level control sensor.



Flexible service concept

Servicing on-site or at a Rohde&Schwarz service center

The R&S®SMB100A is designed for maximum reliability and easy servicing to maximize uptime in all application fields and significantly reduce cost of ownership. Customers can choose between calling on a certified Rohde&Schwarz service center as usual or servicing the instrument themselves.

Built-in selftest of modules to support troubleshooting

A built-in selftest carries out an operational check of the instrument and serves as a troubleshooting aid during servicing. The simple and straightforward architecture with very few modules cuts the time required for troubleshooting and repair to a minimum. A simple function check is usually sufficient to ensure the outstanding specifications of the R&S®SMB100A. Do-it-yourself servicing can be completed in just 45 minutes on average.

Complete calibration only every three years

A complete calibration is recommended for the R&S®SMB100A only every three years and can, of course, also be performed on-site.

Specifications in brief

| Specifications in brief | | |
|--|---|---|
| Frequency | | |
| Frequency range | R&S®SMB-B112/-B112L | 100 kHz to 12.75 GHz |
| | R&S®SMB-B120/-B120L | 100 kHz to 20 GHz |
| | R&S®SMB-B131 | 100 kHz to 31.8 GHz |
| | R&S®SMB-B140/-B140L/-B140N | 100 kHz to 40 GHz |
| Settling time | SCPI mode | < 3 ms |
| | List mode | < 1 ms |
| Level | | |
| Maximum specified output power (PEP) | R&S®SMB-B112/-B112L, 1 MHz < f ≤ 12.75 GHz | +18 dBm |
| | R&S®SMB-B120 with R&S®SMB-B31, 50 MHz < f ≤ 20 GHz | +16 dBm |
| | R&S®SMB-B120L with R&S®SMB-B31, 100 MHz < f ≤ 20 GHz | +19 dBm |
| | R&S®SMB-B131/-B140/-B140N with R&S®SMB-B32, 50 MHz < f ≤ 40 GHz | +13 dBm |
| | R&S®SMB-B140L with R&S®SMB-B32, 50 MHz < f ≤ 40 GHz | +16 dBm |
| Minimum specified output power | R&S®SMB-B112/-B120/-B131/-B140/-B140N | -120 dBm |
| | R&S®SMB-B112L | -5 dBm |
| | R&S®SMB-B120L/-B140L | 0 dBm |
| Settling time (without switching of the mechanical attenuator) | SCPI mode | < 2.5 ms |
| | List mode | < 1 ms |
| Spectral purity | | |
| SSB phase noise | f = 1 GHz, carrier offset = 20 kHz, 1 Hz measurement bandwidth | < -122 dBc, typ. -128 dBc |
| | f = 10 GHz, carrier offset = 20 kHz, 1 Hz measurement bandwidth | < -102 dBc, typ. -108 dBc |
| Harmonics | | |
| R&S®SMB-B112/-B112L | 1 MHz < f ≤ 6 GHz; level ≤ 13 dBm ¹⁾ , f > 6 GHz; level ≤ 10 dBm ¹⁾ | < -30 dBc |
| R&S®SMB-B120/-B120L/-B131/-B140/-B140N/-B140L | standard; level ≤ 8 dBm ¹⁾ | |
| | f > 1 MHz | < -30 dBc |
| | with R&S®SMB-B25/-B26 low harmonic option, low harmonic filter on, level ≤ 10 dBm ¹⁾ | |
| | 1 MHz < f ≤ 150 MHz | < -30 dBc |
| | 150 MHz < f ≤ 3 GHz | < -58 dBc |
| | 3 GHz < f ≤ 20 GHz | < -50 dBc |
| | f > 20 GHz | < -60 dBc (meas.) |
| Supported modulation modes | | |
| AM | | standard |
| AM depth | | 0% to 100% |
| FM/φM | | standard |
| Maximum FM deviation | f = 10 GHz | 32 MHz |
| Maximum φM deviation | f = 10 GHz | 320 rad |
| Pulse | R&S®SMB-K21/-K22 pulse modulator | |
| Rise/fall time | | < 20 ns, typ. < 5 ns |
| ON/OFF ratio | | > 80 dB |
| Minimum pulse width of pulse generator output | | 10 ns |
| Connectivity | | |
| Remote control | | GPIO IEEE-488.2, Ethernet (TCP/IP), USB |
| Peripherals | | USB |

¹⁾ Or maximum specified output power, whichever is lower.

Ordering information

| Designation | Type | Order No. |
|---|---------------|--------------|
| Base unit | | |
| Microwave signal Generator ¹⁾ | R&S®SMB100A | 1406.6000.02 |
| Including power cable, quick start guide and CD-ROM (with operating and service manual) | | |
| Options | | |
| RF path/frequency option | | |
| 100 kHz to 12.75 GHz, with electronic step attenuator | R&S®SMB-B112 | 1407.2109.02 |
| 100 kHz to 12.75 GHz, without step attenuator | R&S®SMB-B112L | 1407.2150.02 |
| 100 kHz to 20 GHz, with mechanical step attenuator | R&S®SMB-B120 | 1407.2209.02 |
| 100 kHz to 20 GHz, without step attenuator | R&S®SMB-B120L | 1407.2250.02 |
| 100 kHz to 31.8 GHz, with mechanical step attenuator | R&S®SMB-B131 | 1407.2280.02 |
| 100 kHz to 40 GHz, with mechanical step attenuator | R&S®SMB-B140 | 1407.2309.02 |
| 100 kHz to 40 GHz, with mechanical step attenuator, minimum pulse width limited | R&S®SMB-B140N | 1407.2380.02 |
| 100 kHz to 40 GHz, without step attenuator | R&S®SMB-B140L | 1407.2350.02 |
| OEXO reference oscillator ²⁾ | R&S®SMB-B1 | 1407.3005.02 |
| OEXO reference oscillator, high performance ²⁾ | R&S®SMB-B1H | 1407.3070.02 |
| Harmonic filter option | | |
| 150 MHz to 20 GHz (only available with R&S®SMB-B120/-B120L) | R&S®SMB-B25 | 1407.1660.02 |
| 150 MHz to 40 GHz (only available with R&S®SMB-B131/-B140/-B140N/-B140L) | R&S®SMB-B26 | 1407.1760.02 |
| Reverse power protection (only available with R&S®SMB-B112/-B112L) | R&S®SMB-B30 | 1407.1160.02 |
| High power option | | |
| 50 MHz to 20 GHz (only available with R&S®SMB-B120/-B120L) | R&S®SMB-B31 | 1407.1260.02 |
| 50 MHz to 40 GHz (only available with R&S®SMB-B131/-B140/-B140N/-B140L) | R&S®SMB-B32 | 1407.1360.02 |
| Pulse modulator for R&S®SMB-B112/-B112L/-B120/-B120L/-B131/-B141/-B140/-B140N/-B140L | R&S®SMB-K21 | 1407.3811.02 |
| Pulse generator | R&S®SMB-K23 | 1407.3786.02 |
| Pulse train ³⁾ | R&S®SMB-K27 | 1407.3828.02 |

¹⁾ The base unit must be ordered together with an R&S®SMB-B112/-B112L/-B120/-B120L/-B131/-B140/-B140N/-B140L frequency option.

²⁾ Only one of the R&S®SMB-B1 or R&S®SMB-B1H options can be installed.

³⁾ Requires the R&S®SMB-K23 option; only available for instruments with serial number > 102400.

| Designation | Type | Order No. |
|---|-----------------------------|--------------|
| Recommended extras | | |
| 19" rack adapter | R&S®ZZA-S234 | 1109.4493.00 |
| Power sensor, 9 kHz to 6 GHz, for levels up to 33 dBm; incl. USB adapter cable | R&S®NRP-Z92 | 1171.7005.42 |
| Power sensor, DC to 40 GHz, for levels up to 20 dBm | R&S®NRP-Z55 | 1138.2008.03 |
| Power sensor, 10 MHz to 18 GHz, for levels up to 33 dBm | R&S®NRP-Z22 | 1137.7506.02 |
| Keyboard with USB interface (US character set) | R&S®PSL-Z2 | 1157.6870.04 |
| Mouse with USB interface, optical | R&S®PSL-Z10 | 1157.7060.03 |
| USB adapter for R&S®NRP-Zxx power sensors | R&S®NRP-Z4 | 1146.8001.02 |
| USB serial adapter for RS-232 remote control | R&S®TS-USB1 | 6124.2531.00 |
| Adapters for instruments with an R&S®SMB-B112/-B112L/-B120/-B120L frequency option | | |
| Test port adapter, PC 3.5 mm female | | 1021.0512.00 |
| Test port adapter, PC 3.5 mm male | | 1021.0529.00 |
| Test port adapter, N female | | 1021.0535.00 |
| Test port adapter, N male | | 1021.0541.00 |
| Adapters for instruments with an R&S®SMB-B131/-B140/-B140N/-B140L 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 |
| Frequency multipliers | | |
| Frequency multiplier, 50 GHz to 75 GHz | R&S®SMZ75 | 1417.4004.02 |
| Frequency multiplier, 60 GHz to 90 GHz | R&S®SMZ90 | 1417.4504.02 |
| Frequency multiplier, 75 GHz to 110 GHz | R&S®SMZ110 | 1417.5000.02 |
| Frequency multiplier, 110 GHz to 170 GHz | R&S®SMZ170 | 1417.5500.02 |
| Including waveguide-to-waveguide adapter, DC power adapter, USB cable, hex ball driver 3/32, operating manual, CD-ROM with operating manual | | |
| Options | | |
| Mechanically controlled attenuator for the R&S®SMZ75 | R&S®SMZ-B75M ¹⁾ | 1417.6007.02 |
| Electronically controlled attenuator for the R&S®SMZ75 | R&S®SMZ-B75E ¹⁾ | 1417.6107.02 |
| Mechanically controlled attenuator for the R&S®SMZ90 | R&S®SMZ-B90M ¹⁾ | 1417.6507.02 |
| Electronically controlled attenuator for the R&S®SMZ90 | R&S®SMZ-B90E ¹⁾ | 1417.6607.02 |
| Mechanically controlled Attenuator for the R&S®SMZ110 | R&S®SMZ-B110M ¹⁾ | 1417.7003.02 |
| Electronically controlled attenuator for the R&S®SMZ110 | R&S®SMZ-B110E ¹⁾ | 1417.7103.02 |
| Documentation | | |
| Documentation of calibration values | R&S®DCV-2 | 0240.2193.18 |
| Accredited calibration | R&S®ACASMB100A | 3596.9508.03 |

¹⁾ Option factory fitted (only mechanically or electronically controlled attenuators can be fitted).

| Warranty | | |
|--|---------|---|
| Base unit | | 3 years |
| All other items | | 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 | |

For data sheet, see PD 5213.8396.22 and www.rohde-schwarz.com

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R&S®SMB100A Microwave Signal Generator
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5213839612

R&S® SMB100A MICROWAVE SIGNAL GENERATOR

Specifications



Data Sheet
Version 02.00

ROHDE & SCHWARZ

Make ideas real



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Definitions

Phased-out articles and replacements

- The R&S®SMB100A-B101/-B103/-B104/-B106/-B5 are phased out from July 1, 2019.
- The successor unit is the R&S®SMB100B (-B101/-B103/-B104/-B106/-B5).
- The R&S®SMB100A (> 6 GHz) will be not phased out.

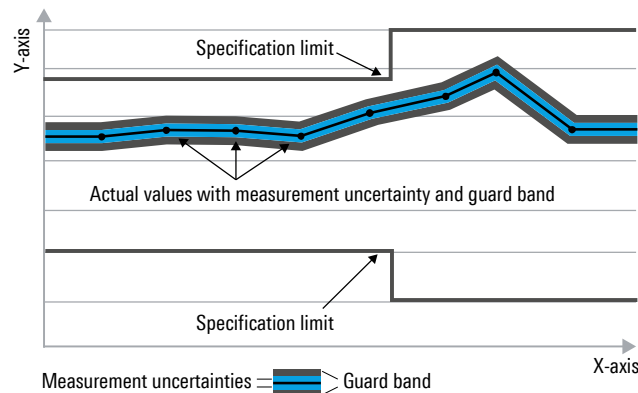
General

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 designated with the format "parameter: value".

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

Specifications

Hardware and software option concept

Available frequency ranges and the corresponding hardware and software options:

| | 100 kHz to 12.75 GHz | 100 kHz to 20 GHz | 100 kHz to 31.8 GHz | 100 kHz to 40 GHz |
|---|----------------------|-------------------|---------------------|-----------------------------|
| With electronic step attenuator | R&S®SMB-B112 | – | – | – |
| With mechanical step attenuator | – | R&S®SMB-B120 | R&S®SMB-B131 | R&S®SMB-B140, R&S®SMB-B140N |
| Without step attenuator | R&S®SMB-B112L | R&S®SMB-B120L | – | R&S®SMB-B140L |
| High power | standard | R&S®SMB-B31 | R&S®SMB-B32 | R&S®SMB-B32 |
| Low harmonic filter | – | R&S®SMB-B25 | R&S®SMB-B26 | R&S®SMB-B26 |
| OCXO reference oscillator | R&S®SMB-B1 | | | |
| OCXO reference oscillator, high performance | R&S®SMB-B1H | | | |
| Reverse power protection | R&S®SMB-B30 | – | | |
| Pulse modulator | R&S®SMB-K21 | | | |
| Pulse generator | R&S®SMB-K23 | | | |
| Pulse train | R&S®SMB-K27 | | | |

RF performance

Frequency

| | | |
|------------------------------------|--|----------------------------|
| Frequency ranges | R&S®SMB-B112, R&S®SMB-B112L | 100 kHz to 12.75 GHz |
| | R&S®SMB-B120, R&S®SMB-B120L | 100 kHz to 20 GHz |
| | R&S®SMB-B131 | 100 kHz to 31.8 GHz |
| | R&S®SMB-B140, R&S®SMB-B140L, R&S®SMB-B140N | 100 kHz to 40 GHz |
| Resolution of setting | | 0.001 Hz |
| Resolution of synthesis | $f = 1 \text{ GHz}$ | 0.44 μHz (nom.) |
| Setting time | to within $< 1 \times 10^{-7}$ for $f > 200 \text{ MHz}$ or $< 20 \text{ Hz}$ for $f \leq 200 \text{ MHz}$; specification does not apply when frequency crosses 20 GHz; specification does not apply to instruments equipped with R&S®SMB-B120/-B131/-B140 when frequency crosses 200 kHz | |
| | after IEC/IEEE bus delimiter | |
| | ALC state on | < 3.5 ms |
| | ALC state S&H, $f \leq 20 \text{ GHz}$ | < 7 ms |
| | ALC state S&H, $f > 20 \text{ GHz}$ | < 10 ms |
| | after trigger pulse in list mode | < 1 ms |
| Resolution of phase offset setting | | 0.1° |

Frequency sweep

| | | |
|-----------------------|-----------------------|--|
| Operating mode | | digital sweep in discrete steps |
| Trigger mode | free run | automatic |
| | full sweep | single |
| | execute one step | step |
| | external trigger only | start/stop |
| Trigger source | | keyboard, external trigger, remote control |
| Trigger slope | | positive, negative |
| Sweep range | | full frequency range |
| Sweep shape | | triangle, sawtooth |
| Step spacing | | linear, logarithmic |
| Step size | linear | full frequency range, min. 0.001 Hz |
| | logarithmic | 0.01 % to 100 % |
| Dwell time range | | 10 ms to 100 s |
| Dwell time resolution | | 0.1 ms |

Reference frequency

| | | |
|---|--|--|
| Frequency error | at time of calibration in production | $< 1 \times 10^{-7}$ |
| | with R&S®SMB-B1/R&S®SMB-B1H option | $< 1 \times 10^{-8}$ |
| Aging (after 10 days of uninterrupted operation) | standard | $< 1 \times 10^{-6}/\text{year}$ |
| | with R&S®SMB-B1 option | $< 1 \times 10^{-9}/\text{day}, < 1 \times 10^{-7}/\text{year}$ |
| | with R&S®SMB-B1H option | $< 5 \times 10^{-10}/\text{day}, < 3 \times 10^{-8}/\text{year}$ |
| Temperature effect (0 °C to +50 °C) | standard | $< 2 \times 10^{-6}$ |
| | with R&S®SMB-B1 option | $< 1 \times 10^{-7}$ |
| | with R&S®SMB-B1H option | $< 1 \times 10^{-8}$ |
| Warm-up time | to nominal thermostat temperature with R&S®SMB-B1/R&S®SMB-B1H option | $\leq 10 \text{ min}$ |
| Reference frequency output | | |
| Connector type | REF OUT on rear panel | BNC female |
| Output frequency | sine wave | |
| | instrument set to internal reference | 10 MHz |
| | instrument set to external reference | applied external reference frequency |
| Output level | | +7 dBm to +13 dBm, +10 dBm (typ.) |
| Source impedance | | 50 Ω (nom.) |
| Reference frequency input | | |
| Connector type | REF IN on rear panel | BNC female |
| Input frequency | | 5 MHz, 10 MHz |
| Frequency locking range | | $\pm 3 \times 10^{-6}$ |
| Input level range | | 0 dBm to +16 dBm |
| Input impedance | | 50 Ω (nom.) |

Level

General explanations

Instruments equipped with R&S®SMB-B112 frequency options include an electronic step attenuator with step ranges of 5 dB (6 dB with R&S®SMB-B112). Instruments equipped with R&S®SMB-B120/-B131/-B140 frequency options include a mechanical step attenuator. Instruments equipped with R&S®SMB-B112L/-B120L/-B140L frequency options do not include a step attenuator. These instruments have a limited level setting range and a limited specified level range.

Level setting modes

The R&S®SMB100A offers two different operating modes for level setting:

- Auto mode: The step attenuator is switched automatically
- Fixed mode: The level is set without switching the step attenuator. The step attenuator is fixed to the current setting. If ALC is on, level changes are performed without interruption. The maximum interruption-free setting range is limited

ALC modes

The R&S®SMB100A offers different ALC modes:

- ALC state auto: The best suited ALC mode is set automatically
- ALC state on: The level control loop is closed. This mode is suitable for CW, AM, FM and ϕ M
- ALC state sample & hold (S&H): At every frequency and level change, the level control loop is closed for about 1 ms and the level control voltage is sampled. The level control voltage is then clamped. This mode is used internally while in ALC state auto for pulse modulation

During an S&H measurement the level is decreased by 30 dB for instruments with electronic step attenuator. For instruments with mechanical attenuator or without step attenuator, the set on level is present for approximately 2 ms during an S&H procedure after level or frequency setting or after switching RF on.

Level settings

| Setting ranges | | |
|--|---------------------------------|--|
| R&S®SMB-B112 | 100 kHz \leq f \leq 200 kHz | -145 dBm to +1 dBm |
| | 200 kHz < f \leq 300 kHz | -145 dBm to +6 dBm |
| | 300 kHz < f \leq 1 MHz | -145 dBm to +9 dBm |
| | 1 MHz < f \leq 12.75 GHz | -145 dBm to +30 dBm |
| R&S®SMB-B112L | 100 kHz \leq f \leq 200 kHz | -20 dBm to +5 dBm |
| | 200 kHz < f \leq 300 kHz | -20 dBm to +10 dBm |
| | 300 kHz < f \leq 1 MHz | -20 dBm to +13 dBm |
| | 1 MHz < f \leq 12.75 GHz | -20 dBm to +30 dBm |
| R&S®SMB-B120/R&S®SMB-B131, R&S®SMB-B140/R&S®SMB-B140N | standard | |
| | 100 kHz \leq f \leq 200 kHz | -145 dBm to +4 dBm |
| | 200 kHz < f \leq 300 kHz | -145 dBm to +9 dBm |
| | 300 kHz < f \leq 1 MHz | -145 dBm to +12 dBm |
| | 1 MHz < f \leq 40 GHz | -145 dBm to 3 dB above max. specified output power |
| | with R&S®SMB-B31/-B32 | |
| | 100 kHz \leq f \leq 300 kHz | -145 dBm to +10 dBm |
| | 300 kHz < f \leq 50 MHz | -145 dBm to +12 dBm |
| | 50 MHz < f \leq 100 MHz | -145 dBm to +17 dBm |
| | 100 MHz < f \leq 200 MHz | -145 dBm to +20 dBm |
| | 200 MHz < f \leq 400 MHz | -145 dBm to +22 dBm |
| | 400 MHz < f \leq 40 GHz | -145 dBm to +30 dBm |
| R&S®SMB-B120L/R&S®SMB-B140L | standard | |
| | 100 kHz \leq f \leq 200 kHz | -20 dBm to +4 dBm |
| | 200 kHz < f \leq 300 kHz | -20 dBm to +9 dBm |
| | 300 kHz < f \leq 1 MHz | -20 dBm to +12 dBm |
| | 1 MHz < f \leq 40 GHz | -20 dBm to 3 dB above max. specified output power |
| | with R&S®SMB-B31/-B32 | |
| | 100 kHz \leq f \leq 300 kHz | -20 dBm to +10 dBm |
| | 300 kHz < f \leq 50 MHz | -20 dBm to +12 dBm |
| | 50 MHz < f \leq 100 MHz | -20 dBm to +17 dBm |
| | 100 MHz < f \leq 200 MHz | -20 dBm to +20 dBm |
| | 200 MHz < f \leq 400 MHz | -20 dBm to +22 dBm |
| | 400 MHz < f \leq 40 GHz | -20 dBm to +30 dBm |
| Resolution of setting | | 0.01 dB |
| Interruption-free level setting range | fixed mode, ALC state on | 0 dB to +20 dB |

Level performance

| Specified level range, peak envelope power (PEP) | | |
|--|--------------------------------------|---------------------|
| R&S®SMB-B112 | standard | |
| | 200 kHz < f ≤ 1 MHz | -120 dBm to +6 dBm |
| | 1 MHz < f ≤ 12.75 GHz | -120 dBm to +18 dBm |
| | with R&S®SMB-B30 option | |
| | 200 kHz < f ≤ 1 MHz | -120 dBm to +5 dBm |
| R&S®SMB-B112L | standard | |
| | 200 kHz < f ≤ 1 MHz | -5 dBm to +10 dBm |
| | 1 MHz < f ≤ 12.75 GHz | -5 dBm to +18 dBm |
| | with R&S®SMB-B30 option | |
| | 200 kHz < f ≤ 1 MHz | -5 dBm to +9 dBm |
| R&S®SMB-B120 | standard | |
| | 200 kHz < f ≤ 10 MHz | -120 dBm to +5 dBm |
| | 10 MHz < f ≤ 50 MHz | -120 dBm to +10 dBm |
| | 50 MHz < f ≤ 20 GHz | -120 dBm to +11 dBm |
| | with R&S®SMB-B31 option ¹ | |
| | 200 kHz < f ≤ 10 MHz | -120 dBm to +5 dBm |
| | 10 MHz < f ≤ 50 MHz | -120 dBm to +10 dBm |
| R&S®SMB-B120L | standard | |
| | 200 kHz < f ≤ 10 MHz | 0 dBm to +5 dBm |
| | 10 MHz < f ≤ 50 MHz | 0 dBm to +10 dBm |
| | 50 MHz < f ≤ 20 GHz | 0 dBm to +14 dBm |
| | with R&S®SMB-B31 option ¹ | |
| | 200 kHz < f ≤ 10 MHz | 0 dBm to +5 dBm |
| | 10 MHz < f ≤ 50 MHz | 0 dBm to +10 dBm |
| R&S®SMB-B131 | standard | |
| | 200 kHz < f ≤ 10 MHz | -120 dBm to +5 dBm |
| | 10 MHz < f ≤ 31.8 GHz | -120 dBm to +8 dBm |
| | with R&S®SMB-B32 option ¹ | |
| | 200 kHz < f ≤ 10 MHz | -120 dBm to +5 dBm |
| | 10 MHz < f ≤ 50 MHz | -120 dBm to +9 dBm |
| R&S®SMB-B140, R&S®SMB-B140N | standard | |
| | 200 kHz < f ≤ 10 MHz | -120 dBm to +5 dBm |
| | 10 MHz < f ≤ 40 GHz | -120 dBm to +8 dBm |
| | with R&S®SMB-B32 option ¹ | |
| | 200 kHz < f ≤ 10 MHz | -120 dBm to +5 dBm |
| R&S®SMB-B140L | standard | |
| | 200 kHz < f ≤ 10 MHz | 0 dBm to +5 dBm |
| | 10 MHz < f ≤ 50 MHz | 0 dBm to +9 dBm |
| | 50 MHz < f ≤ 40 GHz | 0 dBm to +11 dBm |
| | with R&S®SMB-B32 option ¹ | |
| | 200 kHz < f ≤ 10 MHz | 0 dBm to +5 dBm |
| | 10 MHz < f ≤ 50 MHz | 0 dBm to +9 dBm |
| 50 MHz < f ≤ 40 GHz | 0 dBm to +16 dBm | |

¹ For instruments equipped with R&S®SMB-B25 or R&S®SMB-B26 option, the specification is valid with low harmonic filter off.
With low harmonic filter on, the standard level range is valid.

| | | |
|--|---|-----------|
| Level error | ALC state on, temperature range: +18 °C to +33 °C | |
| R&S®SMB-B112 | 9 kHz ≤ f ≤ 200 kHz | < 1.0 dB |
| | 200 kHz < f ≤ 3 GHz | < 0.5 dB |
| | f > 3 GHz | < 0.9 dB |
| R&S®SMB-B112L | 200 kHz < f ≤ 3 GHz | < 0.7 dB |
| | f > 3 GHz | < 1.1 dB |
| R&S®SMB-B120L/-B140L | 200 kHz < f ≤ 3 GHz | < 0.7 dB |
| | 3 GHz < f ≤ 20 GHz | < 1.1 dB |
| | 20 GHz < f ≤ 40 GHz | < 1.2 dB |
| R&S®SMB-B120/-B131, R&S®SMB-B140/-B140N | level > -90 dBm | |
| | 200 kHz < f ≤ 3 GHz | < 0.5 dB |
| | 3 GHz < f ≤ 20 GHz | < 0.9 dB |
| | 20 GHz < f ≤ 40 GHz | < 1.0 dB |
| | level ≤ -90 dBm | |
| | 200 kHz < f ≤ 3 GHz | < 0.5 dB |
| | 3 GHz < f ≤ 20 GHz | < 1.2 dB |
| 20 GHz < f ≤ 40 GHz | < 1.5 dB | |
| Additional level error | ALC state S&H | < 0.25 dB |

Level setting times

| | | |
|--------------|--|---------|
| Setting time | level deviation < 0.1 dB ² from final value, with GUI update stopped, temperature range: +18 °C to +33 °C, without switching of the mechanical step attenuator after IEC/IEEE bus delimiter | |
| | ALC state on | < 3 ms |
| | ALC state S&H, f ≤ 20 GHz | < 7 ms |
| | ALC state S&H, f > 20 GHz | < 10 ms |
| | in list mode after trigger pulse | < 1 ms |
| | with switching of the mechanical step attenuator | |
| | ALC state on | < 25 ms |
| | ALC state S&H | < 30 ms |

Reverse power

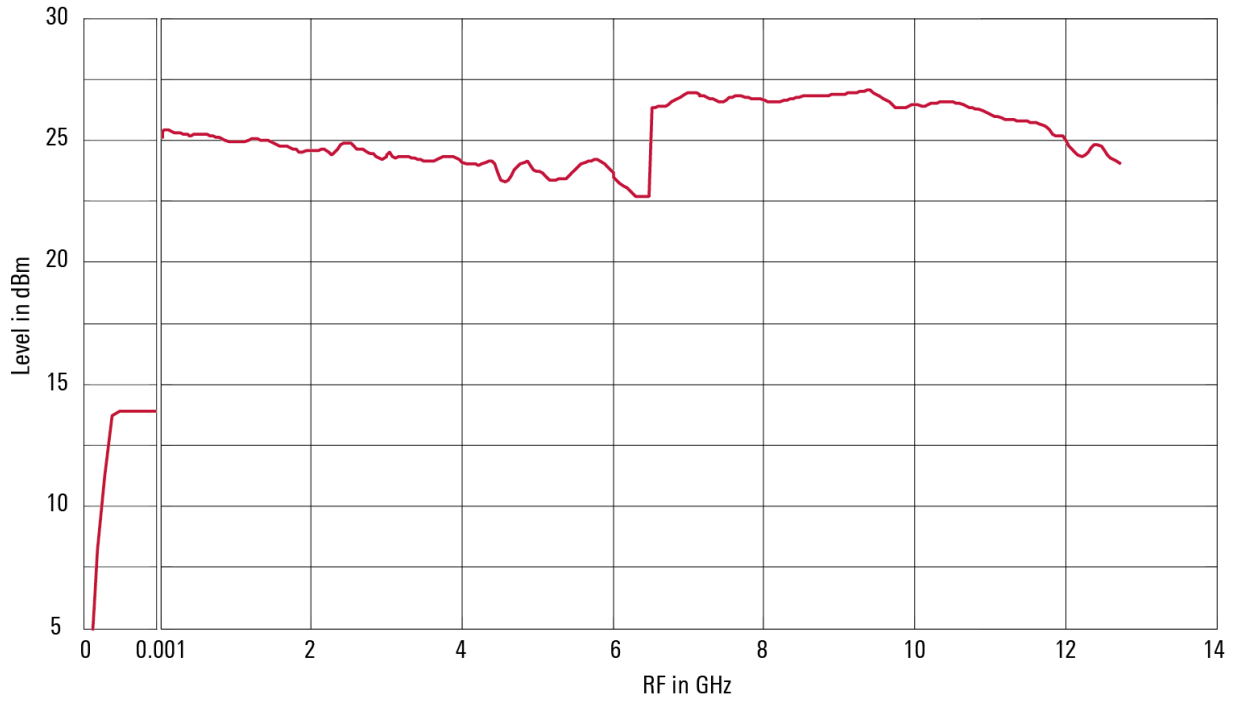
If the R&S®SMB100A is equipped with the R&S®SMB-B112 or R&S®SMB-B112L frequency option, a reverse power protection option (R&S®SMB-B30) is available.

| | | |
|---|---|-------|
| Maximum permissible RF power in output frequency range of RF path for f > 1 MHz, from source ≥ 50 Ω | | |
| Instruments with reverse power protection | | |
| Reverse power | 1 MHz < f ≤ 1 GHz | 50 W |
| | 1 GHz < f ≤ 2 GHz | 25 W |
| | 2 GHz < f ≤ 12.75 GHz | 10 W |
| Maximum permissible DC voltage | | 35 V |
| Instruments without reverse power protection | | |
| Reverse power | | 0.5 W |
| Maximum permissible DC voltage | R&S®SMB-B112/-B112L | 35 V |
| | R&S®SMB-B120/-B120L, R&S®SMB-B131, R&S®SMB-B140/-B140L/-B140N | 0 V |

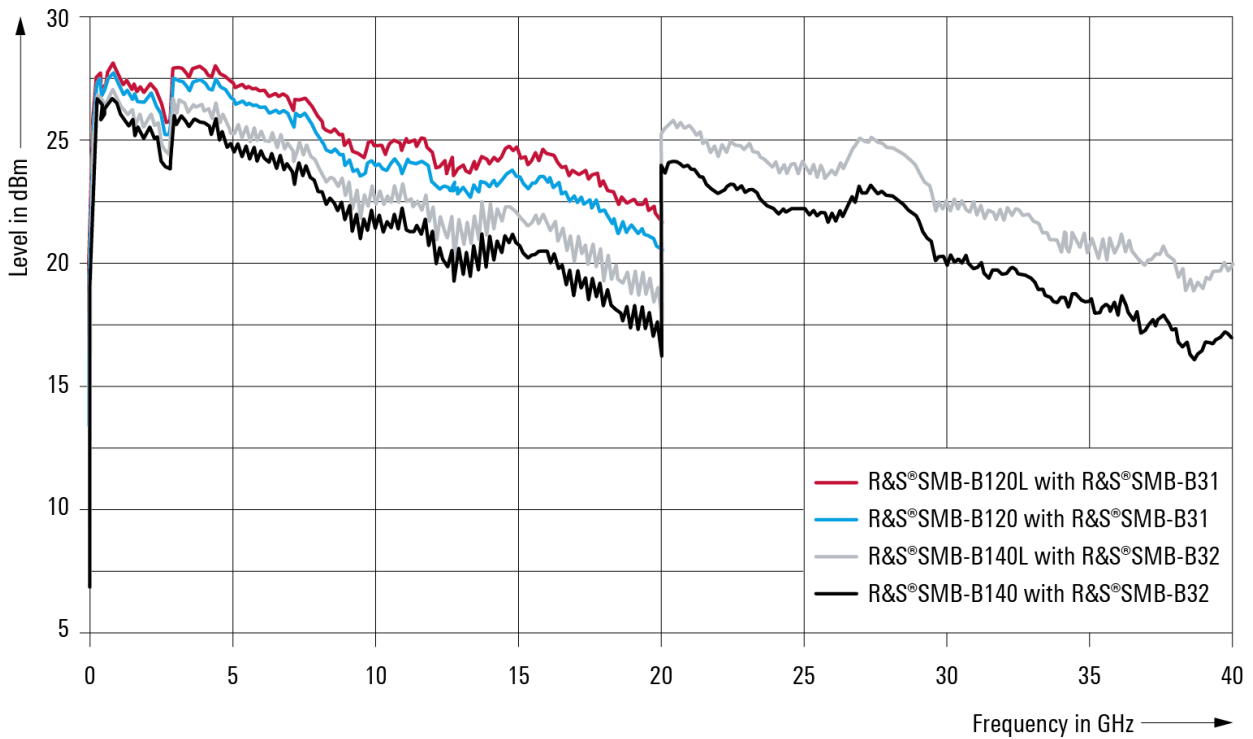
VSWR

| | | |
|--|---------------------|---------------|
| Output impedance VSWR in 50 Ω system, ALC state on | | |
| R&S®SMB-B112 | f > 200 kHz | < 1.8 |
| R&S®SMB-B112L/-B30 | f > 200 kHz | < 2.0 |
| R&S®SMB-B120/-B131, R&S®SMB-B140/-B140N | 1 MHz < f ≤ 20 GHz | < 1.6 (meas.) |
| | 20 GHz < f ≤ 40 GHz | < 1.8 (meas.) |

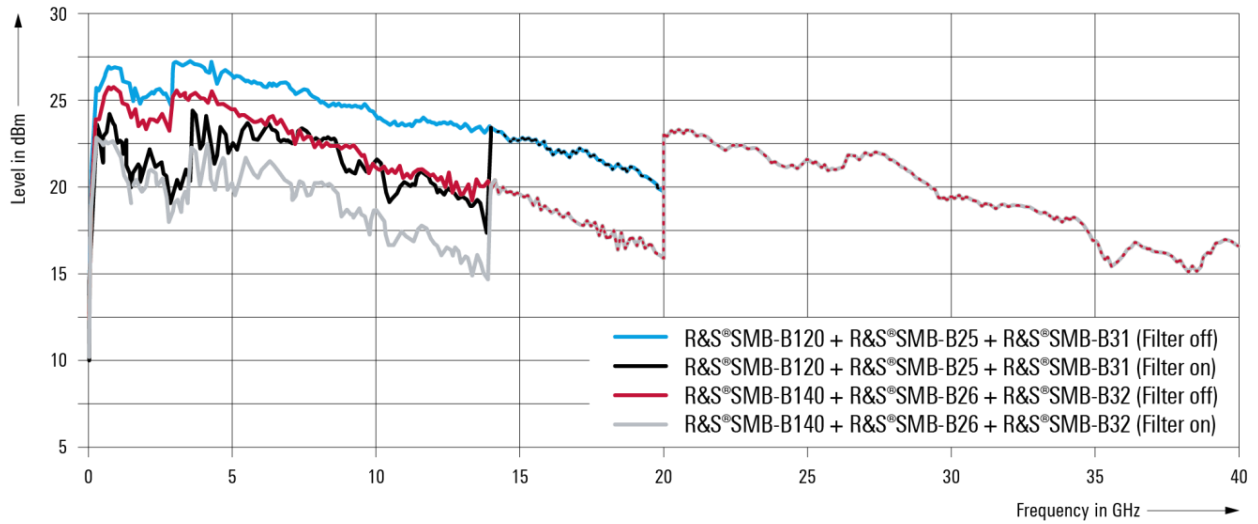
² Level deviation < 0.25 dB for f ≤ 23.4375 MHz for instruments equipped with an R&S®SMB-B112/-B112L/-B120/-B120L/-B131/-B140/-B140L/-B140N option.



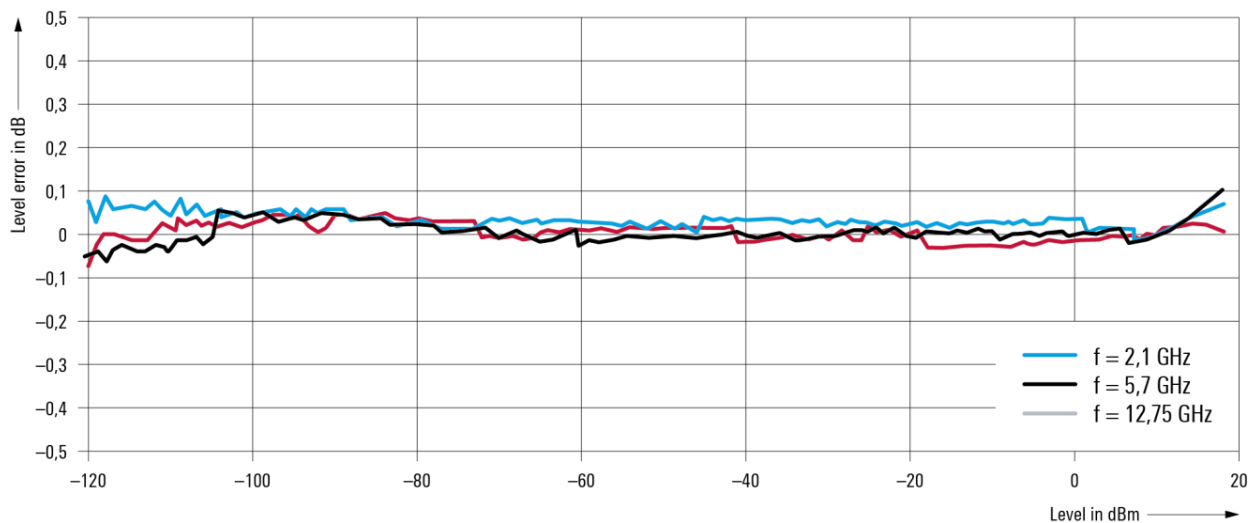
Maximum available output level versus frequency (meas.) for instruments equipped with R&S[®]SMB-B112 option.



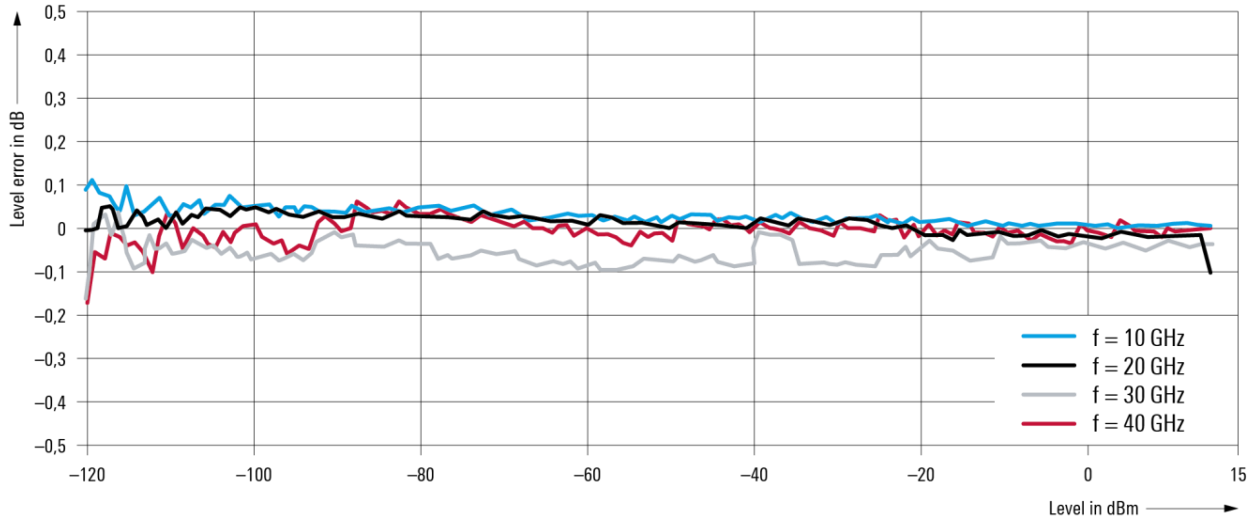
Maximum available output level versus frequency (meas.).



Maximum available output level versus frequency, low harmonic filter off and on (meas.).



Level linearity with R&S SMB-B112 option, ALC on (meas.).



Level linearity with R&S®SMB-B140 and R&S®SMB-B32 options, ALC on (meas.).

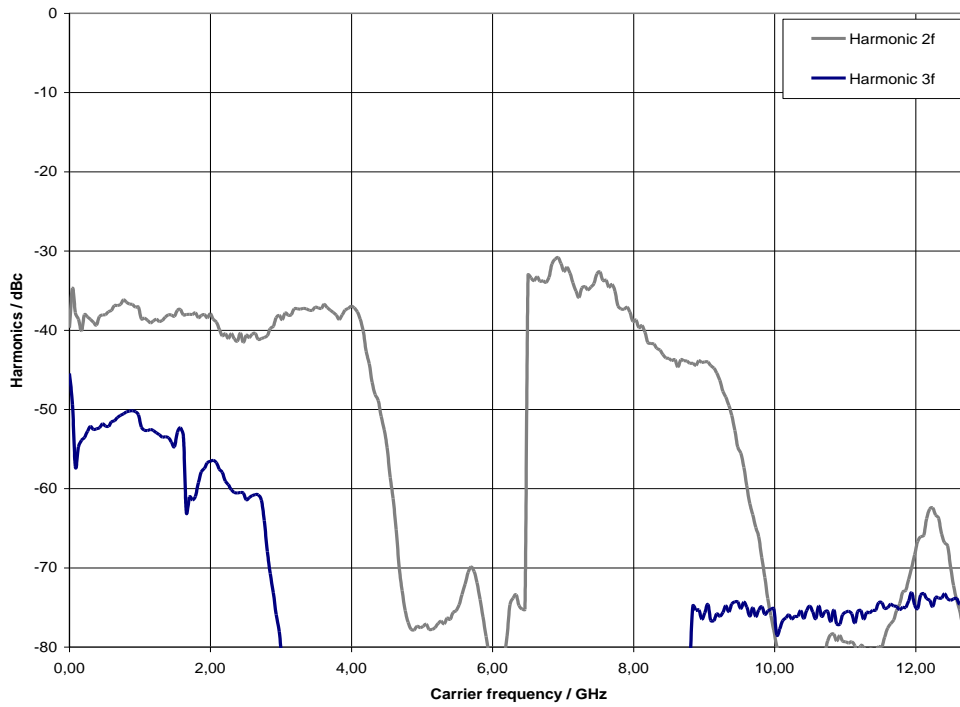
Level sweep

| | | |
|-------------------------------|-----------------------|--|
| Operating mode | | digital sweep in discrete steps |
| Trigger mode | free run | automatic |
| | full sweep | single |
| | execute one step | step |
| | external trigger only | start/stop |
| Trigger source | | keyboard, external connector, remote control |
| Trigger slope | with external trigger | positive, negative |
| Sweep range | | full specified level range |
| | interruption-free | -20 dB to +20 dB |
| Sweep shape | | triangle, sawtooth |
| Step spacing | | logarithmic |
| Step size setting resolution | | 0.01 dB |
| Dwell time setting range | | 10 ms to 100 s |
| Dwell time setting resolution | | 0.1 ms |

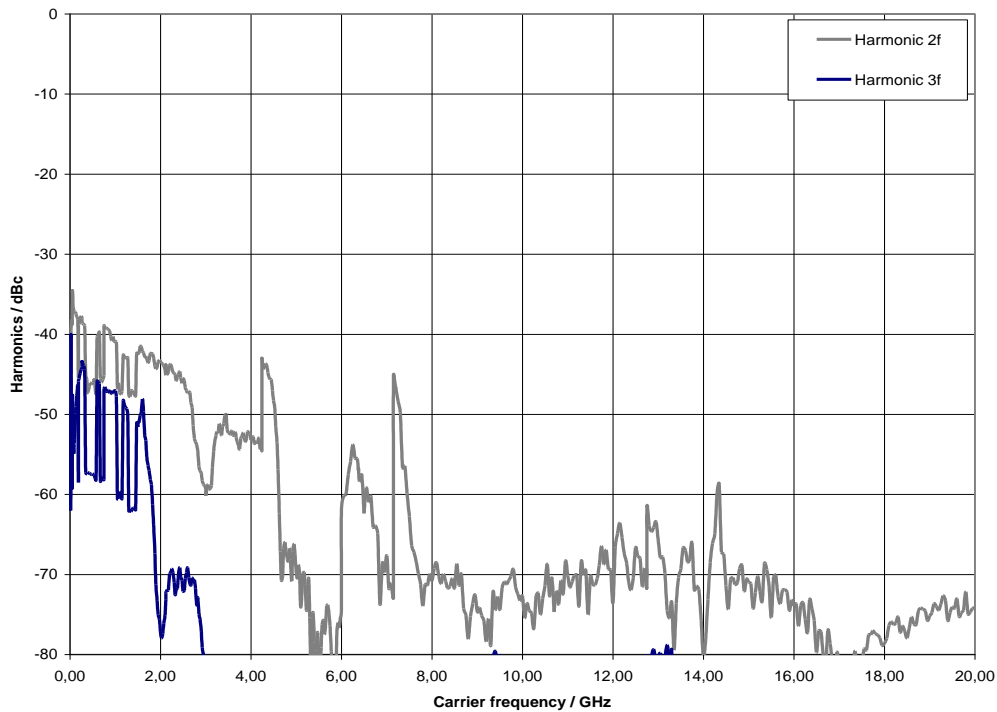
Spectral purity

| | | |
|--|---|-----------------------------|
| Harmonics | | |
| R&S®SMB-B112/-B112L | 1 MHz < f ≤ 6 GHz, level ≤ 13 dBm ³ | < -30 dBc |
| | f > 6 GHz, level ≤ 10 dBm ³ | < -30 dBc |
| R&S®SMB-B120/-B120L/-B131, R&S®SMB-B140/-B140L/-B140N | standard, level ≤ 8 dBm ³ | |
| | f > 1 MHz | < -30 dBc |
| | with R&S®SMB-B25, R&S®SMB-B26 low harmonic option, low harmonic filter on, level ≤ 10 dBm ³ | |
| | 1 MHz < f ≤ 150 MHz | < -30 dBc |
| | 150 MHz < f ≤ 3 GHz | < -58 dBc |
| | 3 GHz < f ≤ 20 GHz | < -50 dBc |
| | f > 20 GHz | < -60 dBc (meas.) |
| Nonharmonics | | |
| CW, level > -10 dBm (level > 0 dBm for instruments without step attenuator), offset > 10 kHz from carrier | | |
| | f ≤ 23.4375 MHz | < -70 dBc |
| | 23.4375 MHz < f ≤ 1500 MHz | < -70 dBc, < -84 dBc (typ.) |
| | 1500 MHz < f ≤ 3 GHz | < -64 dBc, < -78 dBc (typ.) |
| | 3 GHz < f ≤ 6.375 GHz | < -58 dBc, < -72 dBc (typ.) |
| | 6.375 GHz < f ≤ 12.75 GHz | < -52 dBc, < -66 dBc (typ.) |
| | 12.75 GHz < f ≤ 25.5 GHz | < -46 dBc, < -60 dBc (typ.) |
| | 25.5 GHz < f ≤ 40 GHz | < -40 dBc, < -54 dBc (typ.) |
| Subharmonics | | |
| level > -10 dBm (level > 0 dBm for instruments without step attenuator) | | |
| | f < 6.375 GHz | none |
| | 6.375 GHz < f ≤ 20 GHz | < -55 dBc |
| | 20 GHz < f ≤ 40 GHz | < -50 dBc |
| Wideband noise | | |
| level operating mode: auto, level > 10 dBm ³ , measurement bandwidth 1 Hz, CW | | |
| carrier offset: 10 MHz | | |
| | 15 MHz < f ≤ 6.375 GHz | < -142 dBc |
| carrier offset: 30 MHz | | |
| | 6.375 GHz < f ≤ 12.75 GHz | < -138 dBc |
| | 12.75 GHz < f ≤ 20 GHz | < -135 dBc |
| | 20 GHz < f ≤ 40 GHz | < -132 dBc |
| SSB phase noise | | |
| carrier offset: 20 kHz, measurement bandwidth: 1 Hz, CW | | |
| | f = 100 MHz, level = 10 dBm | < -141 dBc, -145 dBc (typ.) |
| | f = 1 GHz | < -122 dBc, -128 dBc (typ.) |
| | f = 2 GHz | < -116 dBc, -122 dBc (typ.) |
| | f = 3 GHz | < -112 dBc, -118 dBc (typ.) |
| | f = 4 GHz | < -110 dBc, -116 dBc (typ.) |
| | f = 6 GHz | < -106 dBc, -112 dBc (typ.) |
| | f = 10 GHz | < -102 dBc, -108 dBc (typ.) |
| | f = 20 GHz | < -96 dBc, -102 dBc (typ.) |
| | f = 30 GHz | < -92 dBc, -98 dBc (typ.) |
| | f = 40 GHz | < -90 dBc, -96 dBc (typ.) |
| RMS jitter | | |
| f = 1 GHz, bandwidth: 1 Hz to 10 MHz, CW | | |
| | standard | 7.2 ps (meas.), (7.2 mUI) |
| | with R&S®SMB-B1 option | 1.3 ps (meas.), (1.3 mUI) |
| | with R&S®SMB-B1H option | 105 fs (meas.), (105 μUI) |
| | f = 155 MHz, bandwidth: 100 Hz to 1.5 MHz, CW | 83 fs (meas.), (12.9 μUI) |
| | f = 622 MHz, bandwidth: 1 kHz to 5 MHz, CW | 63 fs (meas.), (39.2 μUI) |
| | f = 2.488 GHz, bandwidth: 5 kHz to 15 MHz, CW | 55 fs (meas.), (137 μUI) |
| Residual FM | | |
| RMS value at f = 1 GHz, CW | | |
| | 0.3 kHz to 3 kHz, weighted (ITU-T) | < 4 Hz, 0.22 Hz (typ.) |
| | 0.03 kHz to 23 kHz | < 10 Hz, 1.35 Hz (typ.) |
| Residual AM | | |
| | RMS value (0.03 kHz to 20 kHz), CW, level: 8 dBm | < 0.02 % |

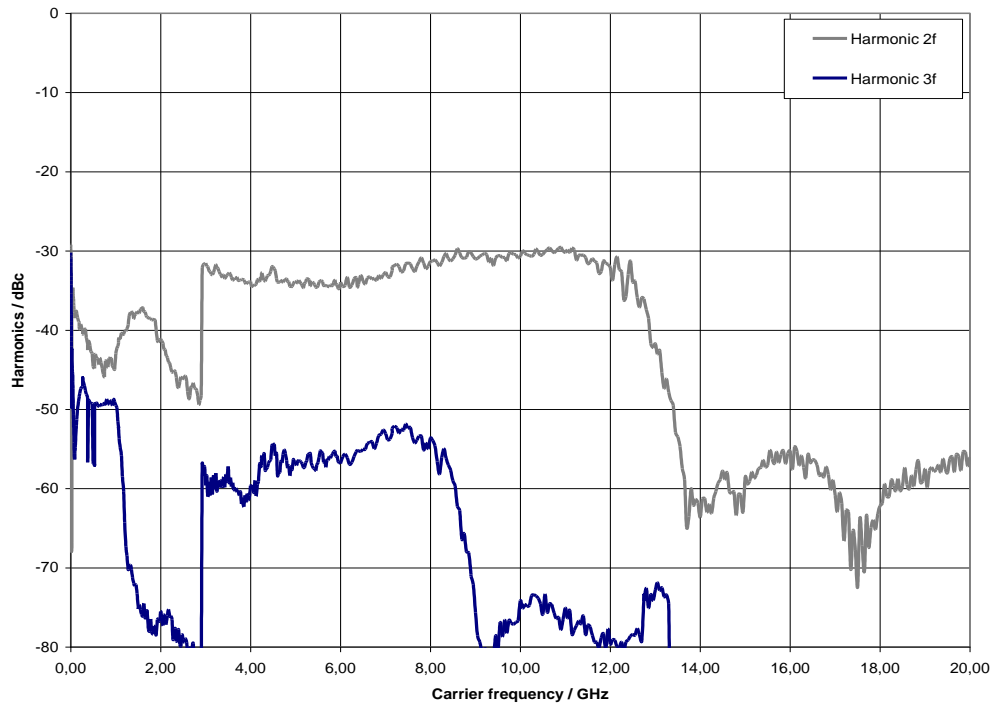
³ Or maximum specified output power, whichever is lower.



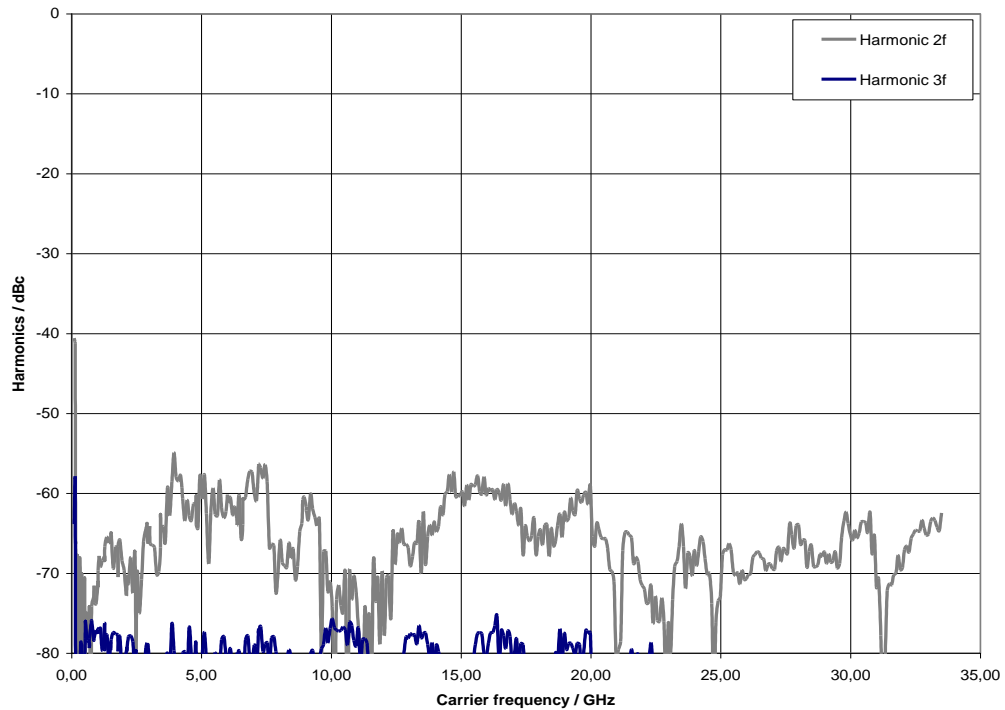
Harmonics versus carrier frequency at +15 dBm output level, with R&S®SMB-B112 option (meas.).



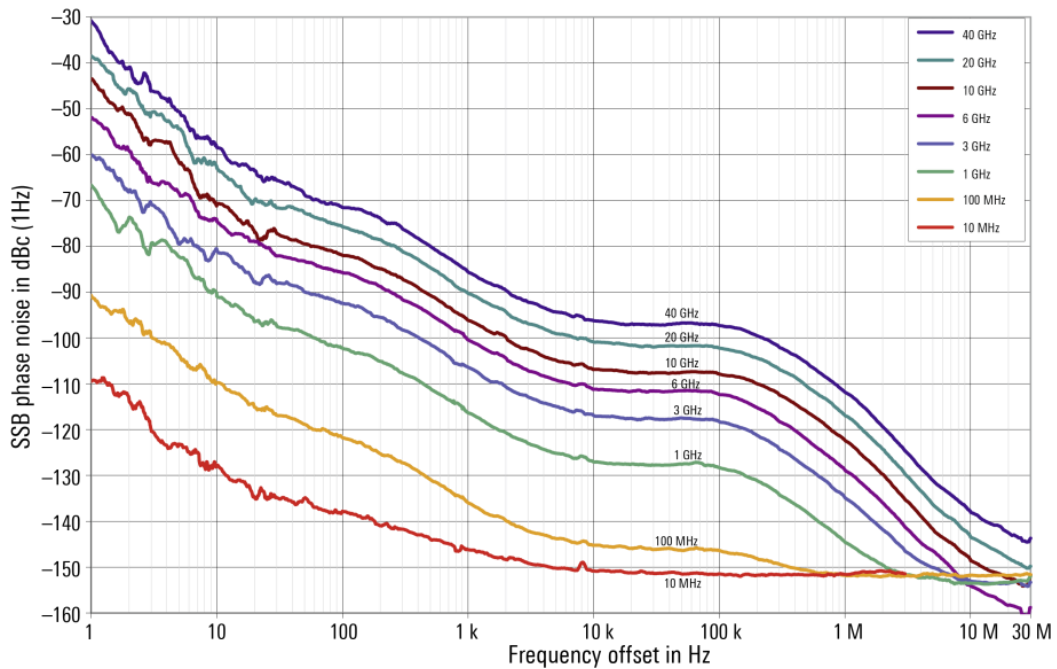
Harmonics versus carrier frequency at +8 dBm output level, with R&S®SMB-B140 option (meas.).



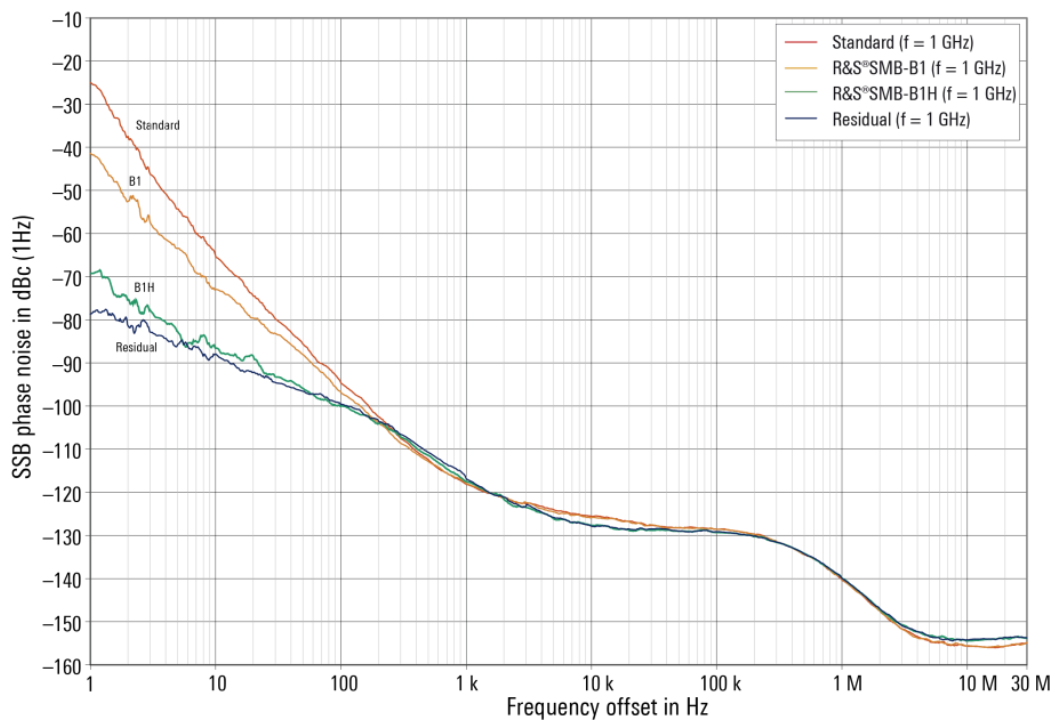
Harmonics versus carrier frequency at +13 dBm output level, with R&S®SMB-B140 and R&S®SMB-B32 options (meas.).



Harmonics versus carrier frequency at +10 dBm output level, with R&S®SMB-B140, R&S®SMB-B32 and R&S®SMB-B26 options, low harmonic filter on (meas.).



Measured SSB phase noise with R&S®SMB-B1H OCXO option, for the 12.75/20/40 GHz model.



Measured SSB phase noise, $f = 1$ GHz, comparison with standard internal reference, R&S®SMB-B1 OCXO option, R&S®SMB-B1H OCXO option and residual phase noise.

List mode settings

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

| | | |
|-----------------------------------|------------------------|--|
| Trigger mode | free run | automatic |
| | full sweep | single |
| | execute one step | step |
| Trigger source | | keyboard, external trigger, remote control |
| Maximum number of stored settings | | 2000 |
| Dwell time setting range | | 1 ms to 100 s |
| Dwell time setting resolution | | 0.1 ms |
| Setting time | after external trigger | see frequency and level data |

Analog modulation

Simultaneous modulation

| | Amplitude modulation | Frequency modulation | Phase modulation | Pulse modulation |
|----------------------|----------------------|----------------------|------------------|------------------|
| Amplitude modulation | | ● | ● | (●) |
| Frequency modulation | ● | | ○ | ● |
| Phase modulation | ● | ○ | | ● |
| Pulse modulation | (●) | ● | ● | |

● = compatible

○ = incompatible

(●) = compatible with limitations: No specification applies to AM distortion, AM depth error and on/off ratio with pulse modulation.

Amplitude modulation

For $f \geq 200$ kHz, level setting mode: auto, AM envelope within specified level range.

| | | | |
|-------------------------------|---|--|------------|
| Modulation source | | internal, external, internal and external | |
| External coupling | | AC, DC | |
| AM depth setting range | at high levels; modulation is clipped when the maximum PEP is reached | 0 % to 100 % | |
| Resolution of setting | | 0.1 % | |
| AM depth (m) error | $f_{\text{mod}} = 1$ kHz and $m < 80$ % | R&S®SMB-B112/-B112L/-B120/-B120L/-B131/-B140/-B140L/-B140N | |
| | $f > 1$ MHz, PEP ≤ 15 dBm ^{4,5} | < (4 % of setting + 1 %) | |
| AM distortion | $f_{\text{mod}} = 1$ kHz | $m = 30$ % | $m = 80$ % |
| | R&S®SMB-B112/-B112L/-B120/-B120L | | |
| | $f > 5$ MHz, PEP ≤ 15 dBm ⁴ | < 1.5 % | < 3 % |
| | R&S®SMB-B131/-B140/-B140L/-B140N | | |
| | 5 MHz < $f \leq 20$ GHz, PEP ≤ 13 dBm ⁴ | < 1.5 % | < 3 % |
| | 20 GHz < $f \leq 40$ GHz, PEP ≤ 10 dBm ^{4,5} | < 2 % | < 4 % |
| Modulation frequency response | $m = 60$ %, DC coupling: 0 Hz to 50 kHz, AC coupling: 10 Hz to 50 kHz | < 3 dB | |
| Synchronous ϕ M at AM | $m = 30$ %, $f_{\text{mod}} = 1$ kHz, \pm peak/2 | | |
| | $f \leq 20$ GHz | < 0.2 rad | |
| | 20 GHz < $f \leq 40$ GHz | < 0.4 rad | |

Frequency bands for frequency and phase modulation

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

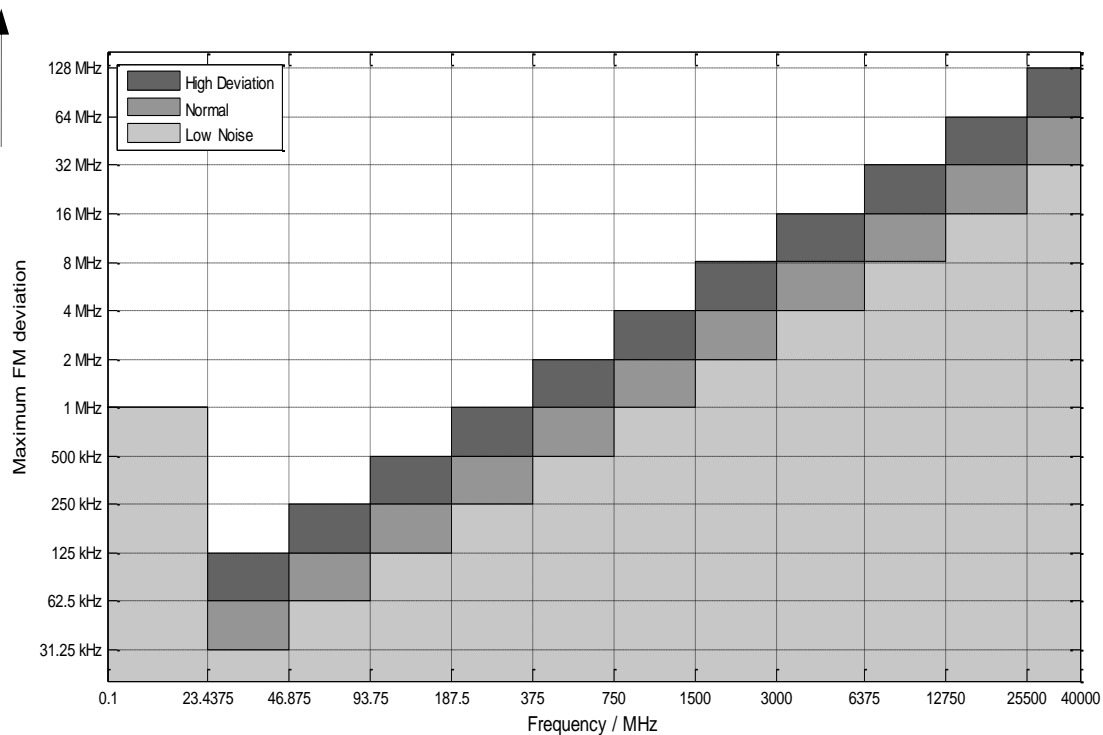
| | | |
|---|-----------------------------------|------|
| Multiplier N for different frequency ranges | $f \leq 23.4375$ MHz | 1/4 |
| | 23.4375 MHz < $f \leq 46.875$ MHz | 1/32 |
| | 46.875 MHz < $f \leq 93.75$ MHz | 1/16 |
| | 93.75 MHz < $f \leq 187.5$ MHz | 1/8 |
| | 187.5 MHz < $f \leq 375$ MHz | 1/4 |
| | 375 MHz < $f \leq 750$ MHz | 1/2 |
| | 750 MHz < $f \leq 1500$ MHz | 1 |
| | 1500 MHz < $f \leq 3$ GHz | 2 |
| | 3 GHz < $f \leq 6.375$ GHz | 4 |
| | 6.375 GHz < $f \leq 12.75$ GHz | 8 |
| | 12.75 GHz < $f \leq 25.5$ GHz | 16 |
| | 25.5 GHz < $f \leq 40$ GHz | 32 |

⁴ Or maximum specified output power, whichever is lower.

⁵ Temperature range: 0 °C to +33 °C for $f > 20$ GHz.

Frequency modulation

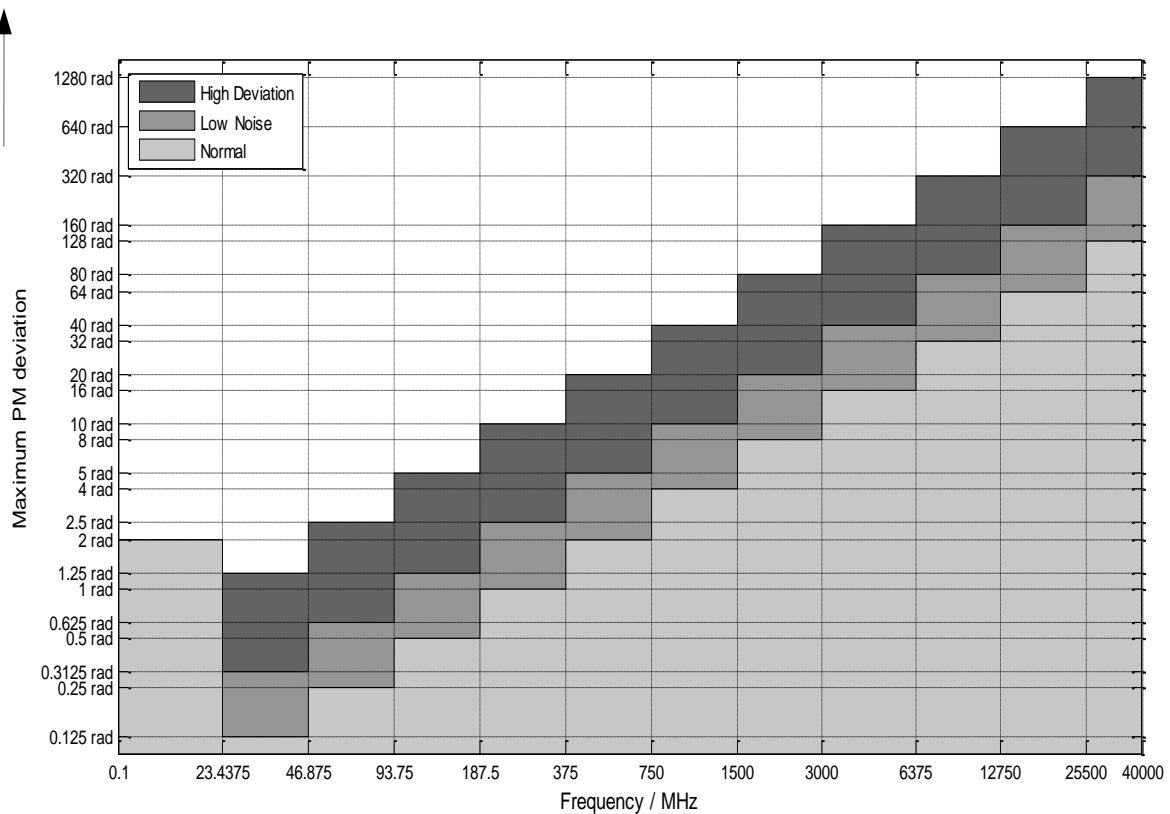
| | | |
|-------------------------------------|--|--|
| Modulation source | | internal, external, internal and external |
| External coupling | | AC, DC |
| Operating modes | | <ul style="list-style-type: none"> • FM mode: low noise • FM mode: normal • FM mode: high deviation |
| Maximum deviation | $f \leq 23.4375$ MHz | 1 MHz |
| | $f > 23.4375$ MHz | |
| | FM mode: normal | $N \times 2$ MHz |
| | FM mode: low noise | $N \times 1$ MHz |
| | FM mode: high deviation | $N \times 4$ MHz |
| Resolution | | $< 0.02\%$ of set deviation, min. $N \times 0.1$ Hz |
| FM deviation error | $f_{\text{mod}} = 1$ kHz, deviation $\leq N \times 1$ MHz | |
| | internal | $< (2\% \text{ of setting} + 20 \text{ Hz})$ |
| | external | $< (3\% \text{ of setting} + 20 \text{ Hz})$ |
| FM distortion | $f_{\text{mod}} = 2$ kHz, deviation = $N \times 1$ MHz | $< 0.2\%$ |
| Modulation frequency response | FM modes: low noise and high deviation | |
| | DC coupling: 0 Hz to 100 kHz, AC coupling: 10 Hz to 100 kHz | < 3 dB |
| | FM mode: normal | |
| | DC coupling: 0 Hz to 500 kHz, AC coupling: 10 Hz to 500 kHz | < 3 dB |
| Synchronous AM with FM | 40 kHz deviation, $f_{\text{mod}} = 1$ kHz, $f > 10$ MHz | $< 0.2\%$ |
| Carrier frequency offset with FM DC | after FM offset adjustment | $< 0.2\%$ of set deviation |



FM deviation versus frequency and operating mode.

Phase modulation

| | | |
|-------------------------------|--|--|
| Modulation source | | internal, external, internal and external |
| External coupling | | AC, DC |
| Operating modes | φM modes: low noise/normal/high deviation | |
| Maximum deviation | $f \leq 23.4375$ MHz | 2 rad |
| | $f > 23.4375$ MHz | |
| | φM mode: normal | $N \times 4$ rad |
| | φM mode: low noise | $N \times 10$ rad |
| Resolution | φM mode: high deviation | $N \times 40$ rad |
| | | < 0.02 % of set deviation, min. $N \times 20 \mu$ rad |
| φM deviation error | $f_{mod} = 1$ kHz, deviation \leq half of maximum deviation | |
| | internal | < (2 % of setting + 0.003 rad) |
| | external | < (3 % of setting + 0.003 rad) |
| φM distortion | $f_{mod} = 10$ kHz, half of maximum deviation | < 0.2 % |
| Modulation frequency response | φM modes: low noise and high deviation | |
| | DC coupling: 0 Hz to 100 kHz, AC coupling: 10 Hz to 100 kHz | < 3 dB |
| | φM mode: normal | |
| | DC coupling: 0 Hz to 500 kHz, AC coupling: 10 Hz to 500 kHz | < 3 dB |



φM deviation versus frequency and operating mode.

Pulse modulation (R&S®SMB-K21 or R&S®SMB-K22 option)

When pulse modulation is activated, the R&S®SMB100A automatically switches to ALC state S&H. In this case, the ALC loop is opened and the output level is set directly. In order to set the correct level, a S&H measurement is performed prior to each frequency or level setting or after switching RF on.

In the following cases, the nominal on level is present for approximately 2 ms during a S&H measurement after level or frequency setting or after switching RF on:

- No attenuator installed (R&S®SMB-B112L/-B120L/-B140L frequency option)
- A mechanical step attenuator installed (R&S®SMB-B120/-B131/-B140/-B140N frequency option)

For instruments with electronic step attenuator (R&S®SMB-B112 frequency option), the level during a sample and hold measurement is decreased by 30 dB.

The R&S®SMB-K21 option is available for R&S®SMB-B112/-B112L/-B120/-B120L/-B131/-B140/-B140L/-B140N.

| | | |
|---|--|------------------------|
| Modulation source | | external, internal |
| On/off ratio | level > 0 dBm for instruments without step attenuator | > 80 dB |
| Rise/fall time | 10 % to 90 % of RF amplitude | |
| | 23.4375 MHz < f ≤ 20 GHz | < 15 ns, < 5 ns (typ.) |
| | f > 20 GHz | < 15 ns, < 9 ns (typ.) |
| Minimum pulse width | 50 %/50 % of RF amplitude | |
| | with R&S®SMB-B112, R&S®SMB-B112L, R&S®SMB-B120, R&S®SMB-B120L, R&S®SMB-B131, R&S®SMB-B140, R&S®SMB-B140L frequency options | 20 ns |
| | with R&S®SMB-B140N frequency option | |
| | f ≤ 20.0 GHz | 20 ns |
| | f > 20.0 GHz | 30 ns |
| Pulse repetition frequency | | 0 Hz to 25 MHz |
| Video crosstalk for R&S®SMB-B112/-B112L/-B120/-B120L/ -B140/-B140L/-B140N | spectral line of fundamental of 100 kHz pulse repetition frequency | < -30 dBc |

Input for external modulation signals

| | | |
|-----------------------------------|---|------------------------|
| Modulation input EXT for AM/FM/φM | | |
| Connector type | MOD EXT | BNC female |
| Input impedance | selectable | 220 kΩ or 600 Ω (nom.) |
| Input sensitivity | peak value for set modulation factor or deviation | 1 V (nom.) |
| Maximum input voltage | | 1 V (nom.) |
| Input damage voltage | | ±10 V |
| Modulation input PULSE EXT | | |
| Connector type | PULSE EXT on rear panel | BNC female |
| Input impedance | selectable | 10 kΩ or 50 Ω (nom.) |
| Input voltage | TTL, CMOS compatible, threshold low | 0.5 V (nom.) |
| | TTL, CMOS compatible, threshold high | 1.5 V (nom.) |
| Input damage voltage | | ± 5 V |
| Input polarity | selectable | normal, inverse |

Modulation sources

Internal modulation generator (LF)

| | | |
|--------------------------------------|---|------------------------------------|
| Waveforms | | sine wave, square wave, sawtooth |
| Frequency range | sine wave | 0.1 Hz to 1 MHz |
| | square wave, sawtooth | 0.1 Hz to 20 kHz |
| Resolution of frequency setting | | 0.1 Hz |
| Frequency error | < (0.005 Hz + relative error of reference frequency × modulation frequency) | |
| Frequency response | sine wave, 0.1 Hz to 1 MHz | < 1 dB |
| Frequency setting time | to within $< 1 \times 10^{-7}$, after IEC/IEEE bus delimiter | < 5 ms (meas.) |
| Distortion | sine wave, $f \leq 100$ kHz at $R_L > 200 \Omega$, $V_p = 1$ V | < 0.1 % |
| Output voltage range | V_p at LF connector, open circuit voltage | 1 mV to 3 V |
| Resolution of output voltage setting | | 1 mV |
| Output voltage setting error | at 1 kHz, $R_L \geq 10$ k Ω | < (1 % of setting + 1 mV) |
| Output impedance | selectable | 10 Ω or 600 Ω (nom.) |

LF frequency sweep

| | | |
|-------------------------------|-----------------------|--|
| Operating mode | | digital sweep in discrete steps |
| Trigger mode | free run | automatic |
| | full sweep | single |
| | execute one step | step |
| | external trigger only | start/stop |
| Trigger source | | keyboard, external trigger, remote control |
| Trigger slope | | positive, negative |
| Sweep range | | full frequency range, min. 0.1 Hz |
| Sweep shape | | triangle, sawtooth |
| Step spacing | | linear, logarithmic |
| Step size setting resolution | linear | 0.1 Hz |
| | logarithmic | 0.01 % |
| Dwell time setting range | | 10 ms to 100 s |
| Dwell time setting resolution | | 0.1 ms |

Pulse generator (R&S®SMB-K23 option)

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

| | | |
|---|--|--|
| Pulse mode | | single pulse, double pulse |
| Trigger modes | free run, internally triggered | automatic |
| | | externally triggered, externally gated |
| Active trigger edge | | positive or negative |
| Pulse period setting range | | 40 ns to 100 s |
| Pulse period setting resolution | | 10 ns |
| Pulse width setting range | pulse widths of double pulses can be set independently | 10 ns to 100 s |
| Pulse width setting resolution | | 10 ns |
| Pulse delay setting range | with external trigger | 10 ns to 100 s |
| Pulse delay setting resolution | with external trigger | 10 ns |
| Double-pulse spacing setting range | | 20 ns to 100 s |
| Double-pulse spacing setting resolution | | 10 ns |
| External trigger delay | | 50 ns (meas.) |
| External trigger jitter of delay | | < 10 ns |
| Pulse video output signal | without load | digital signal 0 V/3.3 V (nom.) |

Pulse train (R&S®SMB-K27 option)

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

| | | |
|--|---|--|
| Pulse modes | setting of pulse width, pulse spacing and pulse sequences | user-programmable |
| Trigger modes | | automatic (free run) externally triggered |
| Active trigger edge | | positive or negative |
| Number of pulses | | 1 to 2047 |
| Number of repetitions per pulse | | 1 to 65535 |
| Pulse width and pulse spacing setting range | | 10 ns to 5 ms |
| Pulse width and pulse spacing setting resolution | | 10 ns |

Remote control

| | | | |
|--|--|--|---|
| Interfaces | remote control | IEC 60625 (GPIB IEEE-488.2) | |
| | Ethernet/LAN | 10/100BASE-T | |
| | USB | 2.0 (high speed) | |
| | serial | RS-232 ⁶ | |
| Command set | | SCPI 1999.5 or compatible command sets | |
| Compatible command sets | These command sets can be selected in order to emulate another instrument. | Agilent/Keysight/HP E442x | |
| | | Agilent/Keysight/HP E443x | |
| Agilent/Keysight/HP E8663 | | | |
| Agilent/Keysight/HP E8257/67 | | | |
| Agilent/Keysight/HP N51xx Analog Parts | | | |
| Agilent/Keysight/HP 8642 | | | |
| Agilent/Keysight/HP 8643A | | | |
| Agilent/Keysight/HP 8644A/B | | | |
| Agilent/Keysight/HP 8645 | | | |
| Agilent/Keysight/HP 8647A | | | |
| Agilent/Keysight/HP 8648A/B/C/D | | | |
| Agilent/Keysight/HP 8656A/B | | | |
| Agilent/Keysight/HP 8657A/B | | | |
| Agilent/Keysight/HP 8664/65 | | | |
| Agilent/Keysight N5161A, 5181A (MXG analog) | | | |
| Aeroflex/IFR 2023/2024 | | | |
| Aeroflex/IFR 203x, 204x, 205x | | | |
| Panasonic PA8303 | | | |
| R&S [®] SML | | | |
| R&S [®] SMT | | | |
| R&S [®] SMY | | | |
| additional command sets for instruments equipped with R&S [®] SMB-B112/B112L, R&S [®] SMB-B120/-B120L/-B131, R&S [®] SMB-B140/-B140L/-B140N | Anritsu 68017/37 | | |
| | Agilent/Keysight/HP 834x | | |
| | Agilent/Keysight/HP 8360 | | |
| | Agilent/Keysight/HP 8362x | | |
| | Agilent/Keysight/HP 83630 | | |
| | Agilent/Keysight/HP 8371x | | |
| | Agilent/Keysight/HP 8373x | | |
| | Agilent/Keysight/HP 8662/63 | | |
| | Agilent/Keysight/HP 8673 | | |
| | Agilent/Keysight N5183A (MXG microwave) | | |
| | Agilent/Keysight E8257D; 8663 B/D (PSG analog) | | |
| | R&S [®] SMR | | |
| | IEC/IEEE bus address | | 0 to 30 |
| | Ethernet/LAN protocols and services | | VISA VXI-11 (remote control) |
| | | | Telnet/RawEthernet (remote control) |
| | | | VNC (remote operation with web browser) |
| | | | FTP (file transfer protocol) |
| | | SMB (mapping parts of the instrument to a host file system) | |
| Ethernet/LAN addressing | | DHCP, static, support of ZeroConf and M-DNS to ease the direct connection to a system controller | |
| USB protocol | | VISA USB-TMC | |

⁶ Requires the R&S[®]TS-USB1 serial adapter (recommended extra).

Connectors

Front panel connectors

| | | |
|----------------|--------------------------------------|--|
| RF 50 Ω | RF output | |
| | R&S®SMB-B112/-B112L/-B120/-B120L | test port adapter, PC 3.5 mm female (interchangeable port connector system) |
| | R&S®SMB-B131/-B140/-B140L/-B140N | test port adapter, PC 2.92 mm female (interchangeable port connector system) |
| LF | modulation generator output | BNC female |
| MOD EXT | input for external analog modulation | BNC female |

Rear panel connectors

| | | |
|--------------|--|----------------------------------|
| REF IN | reference frequency input | BNC female |
| REF OUT | reference frequency output | BNC female |
| PULSE EXT | input for external pulse modulation | BNC female |
| PULSE VIDEO | pulse generator output | BNC female |
| INST TRIG | trigger input, TTL 5 V compatible | BNC female |
| SIGNAL VALID | output for triggering external devices; function 1: low state indicates that the instrument has settled to its final value; function 2 ⁷ : If the pulse generator is active and pulse sync is enabled, a pulse sync signal is provided at the beginning of a pulse sequence (e.g. pulse train). Pulse sync is not available for a pulse sequence < 100 ns. | BNC female |
| USB IN | USB 2.0 (high speed), remote control of instrument (USB-TMC) | USB type B |
| USB | USB 2.0 (high speed), connector for external USB devices, <ul style="list-style-type: none"> mouse and keyboard for enhanced operation R&S®NRP-Zxx power sensors (with R&S®NRP-Z4 adapter cable) for external power measurements and level adjustment of instrument memory stick for software update and data exchange USB serial adapter for RS-232 remote control | USB type A |
| LAN | provides remote control functionality and remote operation via VNC and file transfer via FTP | RJ-45 |
| IEEE 488 | remote control of instrument via GPIB | 24-pin Amphenol series 57 female |

⁷ Requires the R&S®SMB-K23 option; only available for instruments with serial number > 102400.

General data

| Power supply | | |
|--|---|--|
| AC input voltage range | | 90 V to 264 V |
| AC supply frequency | 100 V to 240 V | 45 Hz to 66 Hz |
| | 100 V to 120 V | 380 Hz to 440 Hz |
| Maximum input current | | 1.4 A (100 V) to 0.6 A (240 V) |
| | instruments with options | |
| | R&S®SMB-B112 | 80 W (meas.) |
| | R&S®SMB-B120 and R&S®SMB-B31 | 90 W (meas.) |
| | R&S®SMB-B120, R&S®SMB-B25 and R&S®SMB-B31 | 105 W (meas.) |
| | R&S®SMB-B131/-B140/-B140N and R&S®SMB-B32 | 125 W (meas.) |
| R&S®SMB-B131/-B140/-B140N, R&S®SMB-B26 and R&S®SMB-B32 | 140 W (meas.) | |
| Product conformity | | |
| Electromagnetic compatibility | EU: in line with EMC directive 2014/30/EU | applied harmonized standards: <ul style="list-style-type: none"> • EN 61326-1 (for use in industrial environment) • EN 61326-2-1 • EN 55011 (class B) • EN 61000-3-2 • EN 61000-3-3 |
| Electrical safety | EU: in line with low voltage directive 2014/35/EU | applied harmonized standard: EN 61010-1 |
| | USA | UL 61010-1 |
| | Canada | CAN/CSA-C22.2 No. 61010-1 |
| RoHS | EU: in line with directive 2011/65/EU | EN IEC 63000 |
| International certification | VDE – Association for Electrical, Electronic and Information Technologies | VDE mark 40021972 |
| | CSA – Canadian Standard Association | cCSA _{US} |
| Mechanical resistance | | |
| Vibration | sinusoidal | 5 Hz to 150 Hz, max. 2 g at 55 Hz, const. 0.5 g at 55 Hz to 150 Hz, in line with EN 60068-2-6 |
| | random | 10 Hz to 300 Hz, acceleration: 1.2 g (RMS), in line with EN 60068-2-64 |
| Shock | | 40 g shock spectrum, in line with MIL-STD-810E, method no. 516.4, procedure I |
| Environmental conditions | | |
| Temperature range | operating | 0 °C to +55 °C, in line with DIN EN 60068-2-1, DIN EN 60068-2-2 |
| | storage | -40 °C to +71 °C |
| Climatic resistance | +40 °C, 95 % relative humidity | in line with DIN EN 60068-2-78 |
| Altitude | operating, maximum ambient temperature: +45 °C | up to 4600 m (15000 ft) |
| | storage | up to 4600 m (15000 ft) |
| Calibration interval | | |
| Recommended calibration interval | when operated 40 h/week in the full range of the specified environmental conditions | 3 years |
| Dimensions and weight | | |
| Dimensions | instruments with R&S®SMB-B112/-B112L/-B120/-B120L/-B131/-B140/-B140L/-B140N option | 344 mm × 112 mm × 418 mm (13.5 in × 4.4 in × 16.5 in) |
| Weight | when fully equipped | |
| | instruments with R&S®SMB-B112 option | 5.6 kg (12.3 lb) |
| | instruments with R&S®SMB-B120/-B120L/-B131/-B140/-B140L/-B140N option | 6.9 kg (15.2 lb) |

Ordering information

| Designation | Type | Order No. |
|---|----------------------------|--------------|
| Base unit | | |
| RF and microwave signal generator ⁸ | R&S [®] SMB100A | 1406.6000.02 |
| Including power cable, quick start guide and CD-ROM (with operating and service manual) | | |
| Options | | |
| RF path/frequency option | | |
| 100 kHz to 12.75 GHz, with electronic step attenuator | R&S [®] SMB-B112 | 1407.2109.02 |
| 100 kHz to 12.75 GHz, without step attenuator | R&S [®] SMB-B112L | 1407.2150.02 |
| 100 kHz to 20 GHz, with mechanical step attenuator | R&S [®] SMB-B120 | 1407.2209.02 |
| 100 kHz to 20 GHz, without step attenuator | R&S [®] SMB-B120L | 1407.2250.02 |
| 100 kHz to 31.8 GHz, with mechanical step attenuator | R&S [®] SMB-B131 | 1407.2280.02 |
| 100 kHz to 40 GHz, with mechanical step attenuator | R&S [®] SMB-B140 | 1407.2309.02 |
| 100 kHz to 40 GHz, without step attenuator | R&S [®] SMB-B140L | 1407.2350.02 |
| 100 kHz to 40 GHz, with mechanical step attenuator, minimum pulse width limited | R&S [®] SMB-B140N | 1407.2380.02 |
| OCXO reference oscillator ⁹ | R&S [®] SMB-B1 | 1407.3005.02 |
| OCXO reference oscillator, high performance ⁹ | R&S [®] SMB-B1H | 1407.3070.02 |
| Harmonic filter option | | |
| 150 MHz to 20 GHz (only available with R&S [®] SMB-B120/-B120L) | R&S [®] SMB-B25 | 1407.1660.02 |
| 150 MHz to 40 GHz (only available with R&S [®] SMB-B131/-B140/-B140L/-B140N) | R&S [®] SMB-B26 | 1407.1760.02 |
| Reverse power protection (only available with R&S [®] SMB-B112, R&S [®] SMB-B112L) | R&S [®] SMB-B30 | 1407.1160.02 |
| High-power option | | |
| 50 MHz to 20 GHz (only available with R&S [®] SMB-B120/-B120L) | R&S [®] SMB-B31 | 1407.1260.02 |
| 50 MHz to 40 GHz (only available with R&S [®] SMB-B131/-B140/-B140L/-B140N) | R&S [®] SMB-B32 | 1407.1360.02 |
| Pulse modulator, for R&S [®] SMB-B112/-B112L/-B120/-B120L/-B131/ -B140/-B140L/-B140N | R&S [®] SMB-K21 | 1407.3811.02 |
| Pulse generator | R&S [®] SMB-K23 | 1407.3786.02 |
| Pulse train ¹⁰ | R&S [®] SMB-K27 | 1407.3828.02 |
| Recommended extras | | |
| 19" rack adapter | R&S [®] ZZA-S234 | 1109.4493.00 |
| Power sensor, 9 kHz to 6 GHz, for levels up to 33 dBm, incl. USB adapter cable | R&S [®] NRP-Z92 | 1171.7005.42 |
| Power sensor, DC to 40 GHz, for levels up to 20 dBm | R&S [®] NRP-Z55 | 1138.2008.03 |
| Power sensor, 10 MHz to 18 GHz, for levels up to 33 dBm | R&S [®] NRP-Z22 | 1137.7506.02 |
| USB adapter for R&S [®] NRP-Zxx power sensors | R&S [®] NRP-Z4 | 1146.8001.02 |
| USB serial adapter for RS-232 remote control | R&S [®] TS-USB1 | 6124.2531.00 |
| Adapters for instruments with an R&S [®] SMB-B112/-B112L/-B120/-B120L frequency option | | |
| Test port adapter, PC 3.5 mm female | | 1021.0512.00 |
| Test port adapter, PC 3.5 mm male | | 1021.0529.00 |
| Test port adapter, N female | | 1021.0535.00 |
| Test port adapter, N male | | 1021.0541.00 |
| Adapters for instruments with an R&S [®] SMB-B131/-B140/-B140L/-B140N 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 |
| DKD (ISO 17025) calibration including ISO 9000 calibration | R&S [®] SMB-DKD | 1161.3607.02 |

⁸ The base unit must be ordered together with an R&S[®]SMB B112/-B112L/-B120/-B120L/-B131/-B140/-B140L/-B140N frequency option.

⁹ Only one of the R&S[®]SMB-B1 or R&S[®]SMB-B1H option can be installed.

¹⁰ Requires the R&S[®]SMB-K23 option; only available for instruments with serial number > 102400.

| Warranty | | |
|---|---------|---|
| Base unit | | 3 years |
| All other items ¹¹ | | 1 year |
| Service 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 ¹². 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 ¹² 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 ¹² and accredited calibration at the recommended intervals as well as any accredited calibration carried out during repairs or option upgrades.

Phased-out articles and replacements

- The R&S®SMB100A -B101/-B103/-B104/-B106/-B5 are phased out from July 1, 2019.
- The successor unit is the R&S®SMB100B (-B101/-B103/-B104/-B106/-B5).
- The R&S®SMB100A (> 6 GHz) will be not phased out.

For product brochure, see PD 5213.8396.12 and www.rohde-schwarz.com

¹¹ For options installed, the remaining base unit warranty applies if longer than 1 year. Exception: all batteries have a 1 year warranty.

¹² Excluding defects caused by incorrect operation or handling and force majeure. Wear-and-tear parts are not included.

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- Customized and flexible
- Uncompromising quality
- Long-term dependability

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