

# R&S® SMB100B

## RF Signal Generator

Perfect combination of performance and usability in a compact size



# R&S®SMB100B

## RF Signal Generator

### At a glance

The new R&S®SMB100B RF signal generator is all about performance and versatility in a small footprint. Outstanding spectral purity and very high output power combined with comprehensive functionality and very simple operation are some of the impressive features of the R&S®SMB100B.

The R&S®SMB100B sets new standards in spectral purity and output power in the mid-range segment. These characteristics have been integrated into a very compact and lightweight form factor.

Even without extra options, the R&S®SMB100B delivers outstanding performance. This outstanding performance can be enhanced for a specific application. For example, the R&S®SMBB-B1 option (OCXO) reduces the aging and temperature dependency of the reference frequency and improves single sideband (SSB) phase noise. The R&S®SMBB-B1H high performance OCXO option further improves these performance parameters. Compared to the standard instrument, the aging and temperature dependency are improved by more than a power of ten.

Two optional high output power levels are available. The base unit alone provides 20 dBm of output power at 1 GHz. The R&S®SMBB-K31 high output power option provides 8 dB more output power with 28 dBm. This first "high output power" level can be activated using a keycode directly on the instrument with no added service costs. Additionally installing the R&S®SMBB-B32 ultra high output power option gives the instrument another 6 dB. The ultra high output power of 34 dBm is unique for an instrument in this class (all values are measured at 1 GHz).

The R&S®SMB100B covers a frequency range from 8 kHz to 1 GHz, 3 GHz or 6 GHz. Besides pure CW signals, the R&S®SMB100B with R&S®SMBB-K720 option can generate amplitude, frequency and phase modulated signals.

Pulse generator and pulse modulator options allow generation of high-quality pulses. With the additional R&S®SMBB-K27 pulse train option, users can generate single pulses, double pulses and configurable pulse trains.

The R&S®SMB100B is an ideal choice for a wide range of applications in R&D, production, service and maintenance where a good price/performance ratio is also a key factor.

#### Key facts

- Frequency range from 8 kHz to 1 GHz, 3 GHz or 6 GHz
- Outstanding single sideband (SSB) phase noise of  $-134$  dBc (meas.) at 1 GHz and an offset of 20 kHz
- Very low wideband noise of  $-153$  dBc (typ.) at  $15 \text{ MHz} < f \leq 6 \text{ GHz}$  and an offset of 30 MHz
- Ultra high output power of 34 dBm (meas.) at 1 GHz
- Compact form factor with 2 HU and  $\frac{3}{4}$  19" width
- Large, state-of-the-art 5" GUI with touchscreen



# R&S®SMB100B

## RF Signal Generator

### Benefits and key features

#### Perfect for signal quality

- Very low SSB phase noise of  $-134$  dBc (meas.) at 1 GHz and an offset of 20 kHz
- Very low close-in SSB phase noise of  $-94$  dBc (meas.) at 1 GHz and offset of 10 Hz
- Very low wideband noise of  $-153$  dBc (typ.) at  $15 \text{ MHz} < f \leq 6 \text{ GHz}$  and an offset of 30 MHz
- Very low nonharmonic signal components of  $< -76$  dBc (spec.) at 1 GHz

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#### Perfect for output power

- The R&S®SMBB-K31 high output power option provides 28 dBm at 1 GHz and 24 dBm at 6 GHz (measured values) – easy keycode activation
- Ultra high output power of 34 dBm at 1 GHz and 31 dBm at 6 GHz with additional R&S®SMBB-B32 ultra high output power option (measured values)

▷ [page 6](#)

#### Perfect for use

- Ergonomic operation thanks to state-of-the-art GUI with touchscreen
- Support of R&S®NRP power sensors and display of measured power on the generator display
- Easy integration into existing test environments using versatile reference frequency inputs and outputs
- Sanitizing of user data for secured areas

▷ [page 8](#)

#### R&S®LegacyPro: refresh your T&M equipment

- R&S®Legacy Pro program: replacement and emulation of obsolete signal generators using the R&S®SMB100B in an automated test environment without modifying the control software

▷ [page 11](#)

# Perfect for signal quality

In order to improve a DUT, the signal quality of the signal source has to be significantly better than the DUT's performance. Thanks to its innovative synthesizer design, the R&S®SMB100B has very low SSB phase and wideband noise and excellent suppression of nonharmonic signal components.

## Very low SSB phase noise

The R&S®SMB100B has a very low SSB phase noise of  $-134$  dBc at 1 GHz and an offset of 20 kHz (measured; 1 Hz bandwidth). The R&S®SMBB-B1 option (OCXO) and the R&S SMBB-B1H option reduce the close-in phase noise.

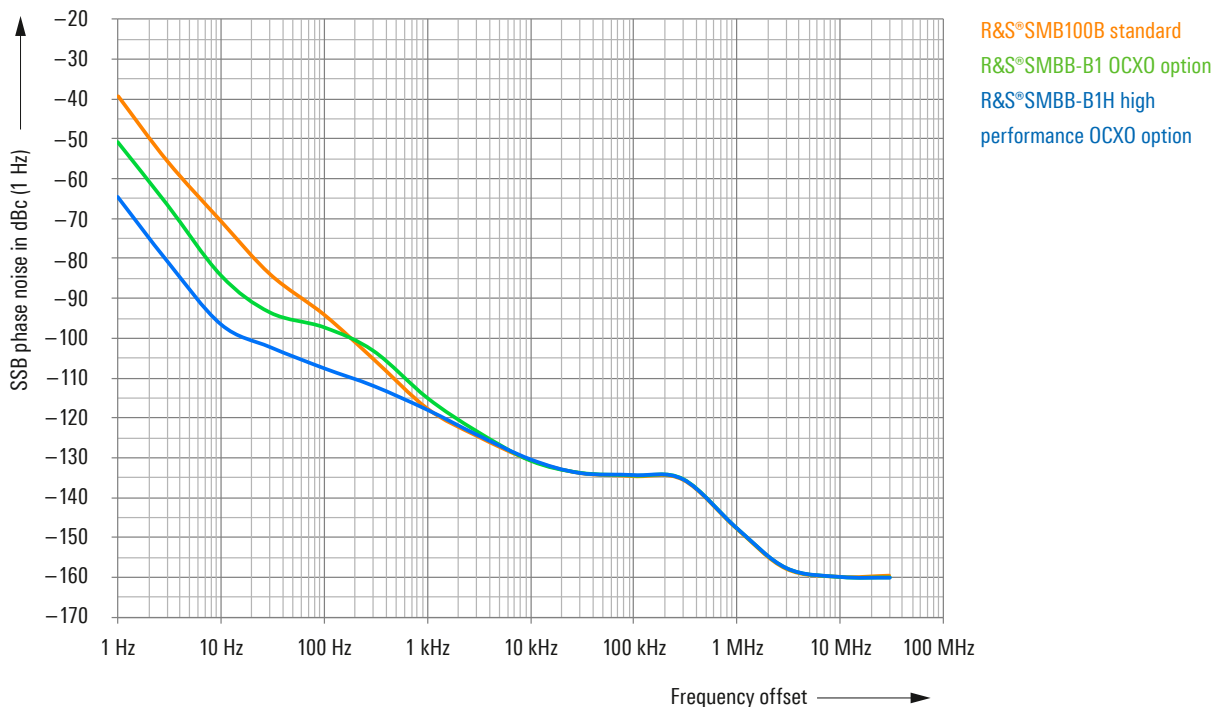
Also wideband noise is very low. The R&S®SMB100B achieves  $-153$  dB/Hz (typ.) for a 1 GHz carrier at a frequency offset of 30 MHz.

Other benefits of these options include significantly improved long-term stability of the reference frequency and much less temperature dependency.

## Purest 1 GHz reference output

In addition to its RF output, the R&S®SMB100B has a separate 1 GHz reference input and output. A 1 GHz reference signal provides better phase stability between the output signals of multiple coupled instruments than a 10 MHz reference signal. The SSB phase noise of this 1 GHz reference signal is shown in the diagram.

Single-sideband phase noise (1 GHz, 1 Hz bandwidth, measured)



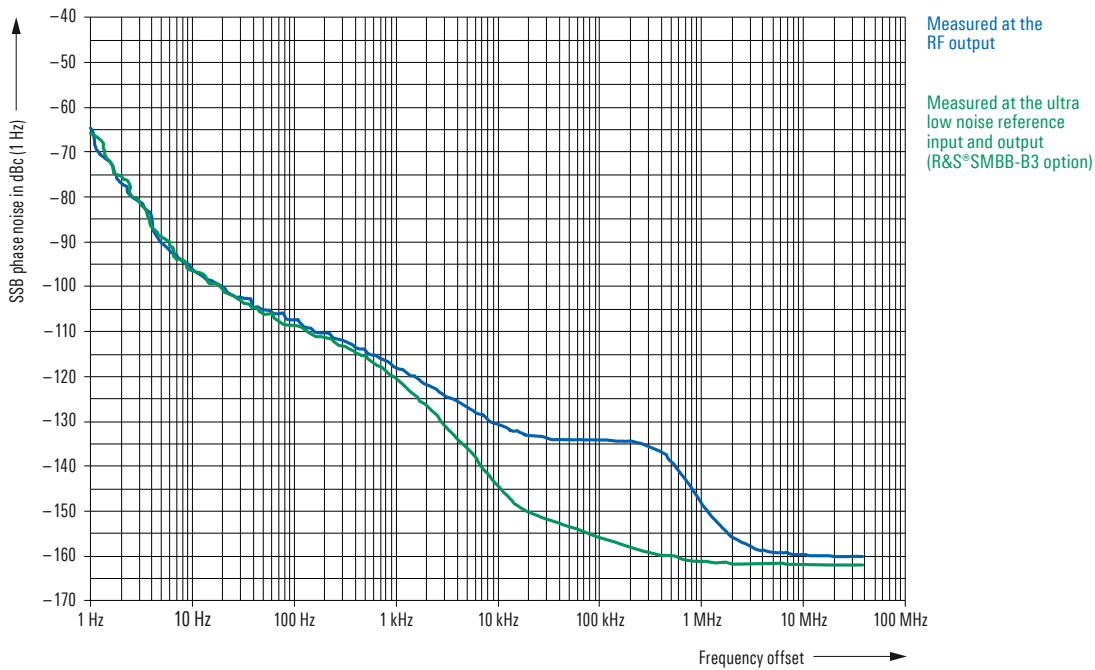
SSB phase noise of the R&S®SMB100B base unit, with the R&S®SMBB-B1 option (OCXO) and with the R&S®SMBB-B1H option (high performance OCXO).

### Lowest nonharmonics

For signal generators, the nonharmonic signal components are often considered more critical than the harmonic signal components. This is because the frequency where a nonharmonic signal component occurs cannot be predicted, making it impossible to provide appropriate filtering.

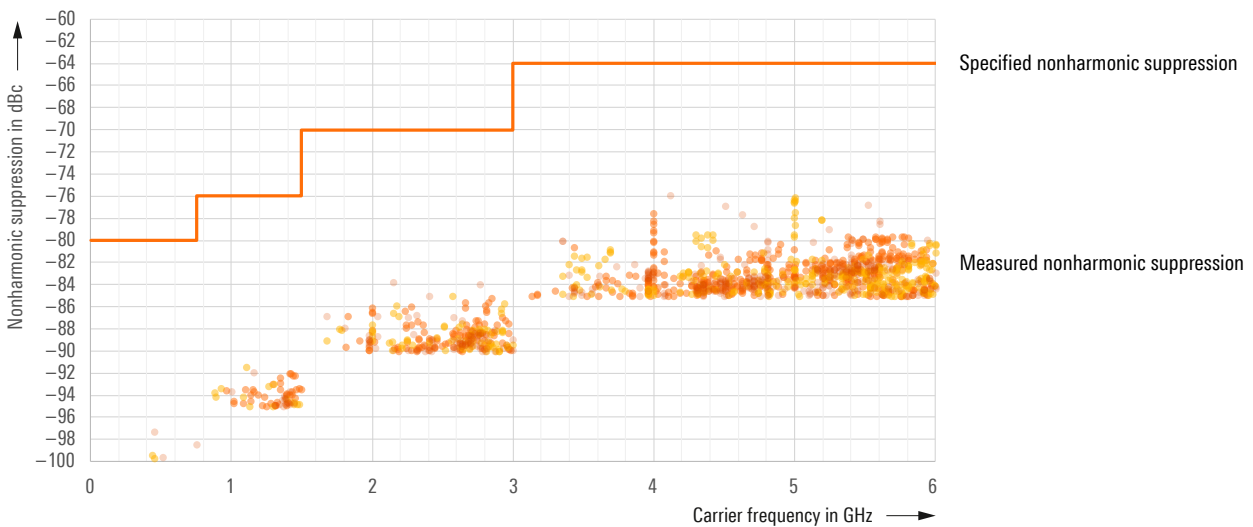
When testing ADCs, for example, excessively high non-harmonic components in the analog signal can lead to problems. The R&S®SMB100B excels with very low non-harmonic signal components of  $< -76$  dBc (specified) at 1 GHz. Measurements show significantly better results.

### Single-sideband phase noise with the R&S®SMBB-B1H option (1 GHz, 1 Hz bandwidth, measured)



Measured SSB phase noise at 1 GHz (R&S®SMB100B equipped with R&S®SMBB-B1H option). The blue curve shows the measurement at the RF output and the green curve shows the measurement at the separate 1 GHz reference output (R&S®SMBB-B3 option).

### Measured values for nonharmonics (frequency offset > 10 kHz)



Measured R&S®SMB100B nonharmonic signal components (measured on several R&S®SMB100B instruments).

# Perfect for output power

The need for very high output power often means that a signal generator must be combined with an amplifier connected to its output. The R&S®SMB100B offers a better alternative. With the R&S®SMBB-B32 ultra high output power option, it is a calibrated one-box solution that saves space and money.

## Ultra high output power

Since the R&S®SMB100B provides very high output power, no external amplifier is required downstream. This simplifies the test setup and results in high absolute level accuracy. When equipped with the appropriate options, the R&S®SMB100B delivers +34 dBm at 1 GHz and +31 dBm at 6 GHz (measured values).

## Very high dynamic range

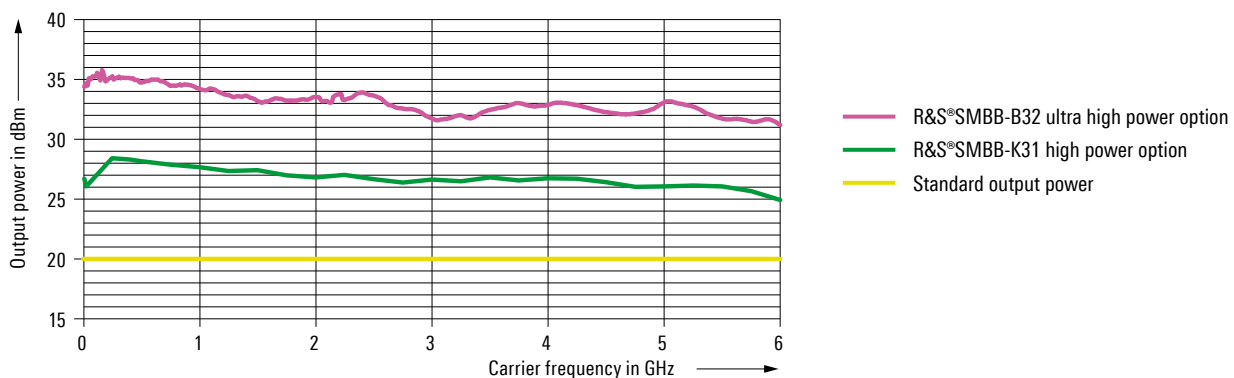
The usable dynamic range is defined by the difference between the maximum and minimum adjustable power. As soon as the lower end of the electronic setting range is reached, a switchable attenuator is activated to provide further attenuation. The R&S®SMB100B has a minimum specified power of  $-127$  dBm as standard (for  $f > 10$  MHz). With its specified maximum adjustable power of  $+26$  dBm ( $1 \text{ MHz} < f \leq 6 \text{ GHz}$ ), it has a very wide dynamic range of 153 dB.

The user always has the desired output power, regardless of whether the user is e.g. testing receiver sensitivity or needs high power levels for amplifier tests. The attenuator used in the R&S®SMB100B is fully electronic. Compared to a mechanical attenuator, it is wear-free, noiseless and changes the power level significantly faster.

## Unmatched level repeatability

Not only absolute level accuracy, but also level repeatability plays an important role. Especially for frequently repeated test sequences where the level is often changed, it is essential to be able to reproduce each individual level value during every repeated sequence. Here again the R&S®SMB100B is best in class with a level repeatability of  $\pm 0.02$  dB (1 GHz, 0 dBm, meas.).

Maximum output power (measured)



Measured output power for the base unit, with the high power option (R&S®SMBB-K31) and with the additional ultra high power option (R&S®SMBB-B32).

### High absolute level accuracy

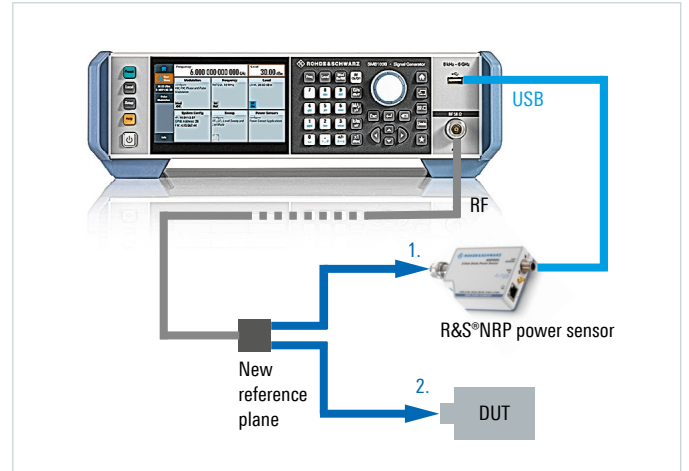
The R&S®SMB100B features excellent absolute level accuracy. The specified values of  $< 0.5 \text{ dB}$  ( $200 \text{ kHz} < f \leq 3 \text{ GHz}$ ) and  $< 0.7 \text{ dB}$  ( $f > 3 \text{ GHz}$ ) at a level of  $> -90 \text{ dBm}$  are best in class.

A DUT is rarely connected directly to the generator. There are often cables and other components between the generator and the DUT.

This shifts the reference plane from the generator's RF output to the DUT. An R&S®NRP power sensor can be connected to the R&S®SMB100B to allow extremely precise calibration (tenth of a dB) at this new reference plane. The measured power can be directly read from the generator's display. The RF output power can be adjusted until the desired power at the new reference plane is reached.

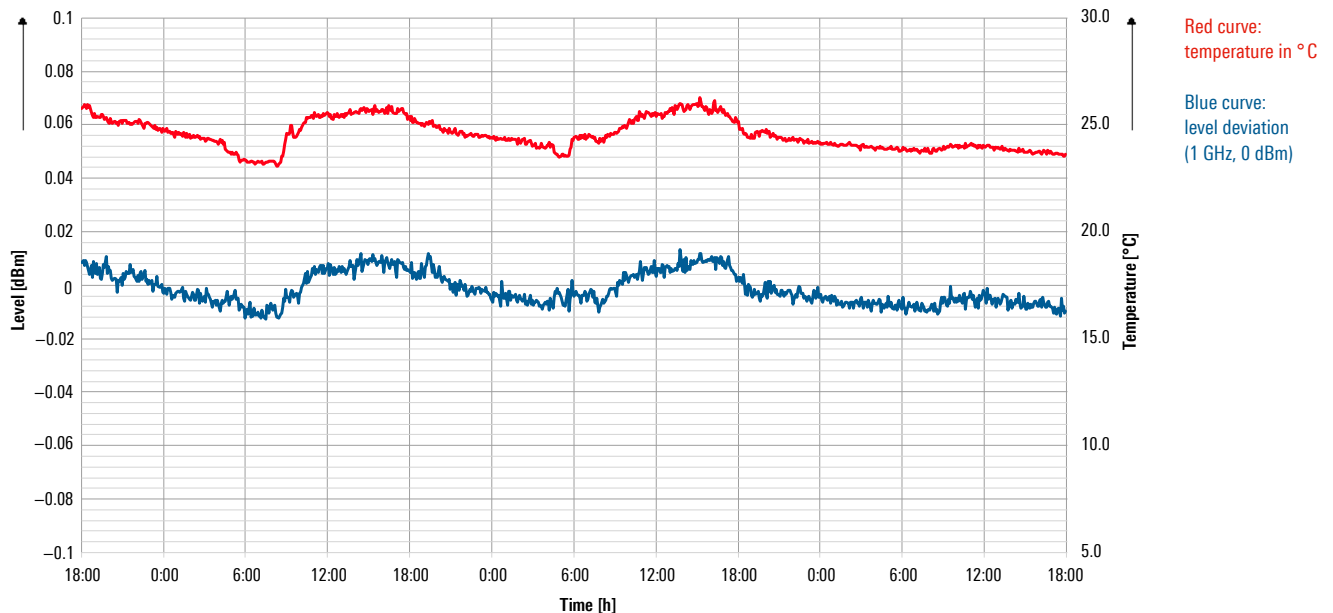


R&S®SMB100B with connected R&S®NRP power sensor (via USB).



R&S®SMB100B with external devices: R&S®NRP power sensor (via USB); setup for setting the target power at the new reference plane.

### Measured level repeatability



Measured level repeatability at different temperatures over a very long time period of three days. The graph shows the accuracy with which a 0 dBm level at 1 GHz is repeated (another level is always selected between two 0 dBm settings).

# Perfect for use

The user friendliness of the R&S®SMB100B is evident in many ways. The RF signal generator is simple to operate, supports working with a connected R&S®NRP power sensor and can emulate legacy instruments.

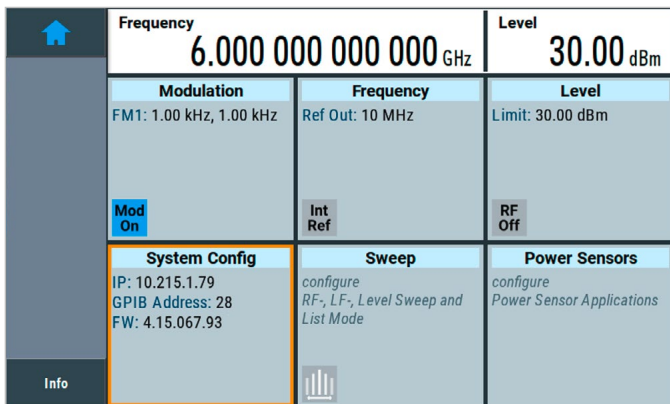
## Ergonomic operation thanks to state-of-the-art GUI with touchscreen

The graphical user interface with high-resolution touchscreen makes the R&S®SMB100B very easy to use. The main screen clearly displays all important parameters and information to save the user time when looking for functions.

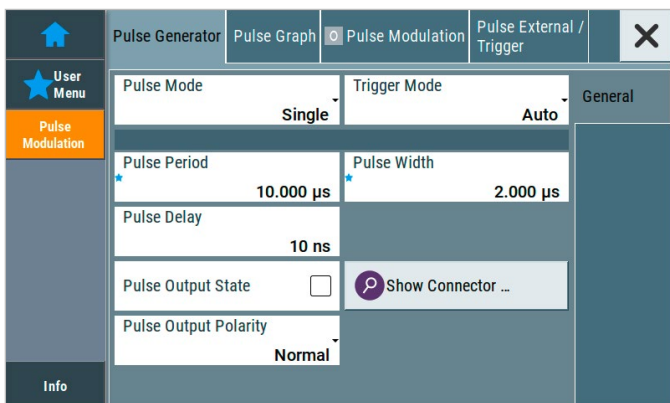
The ability to save a user menu on the R&S®SMB100B simplifies working with the instrument. Frequently used menu items can be added to the user menu so that the user can quickly and directly access all needed settings from a single menu.

Context-sensitive online help provides comprehensive information. It describes each parameter and setup menu in detail, states the setting range and shows the associated remote control command. Users can also search for specific parameters in the user manual installed on the instrument.

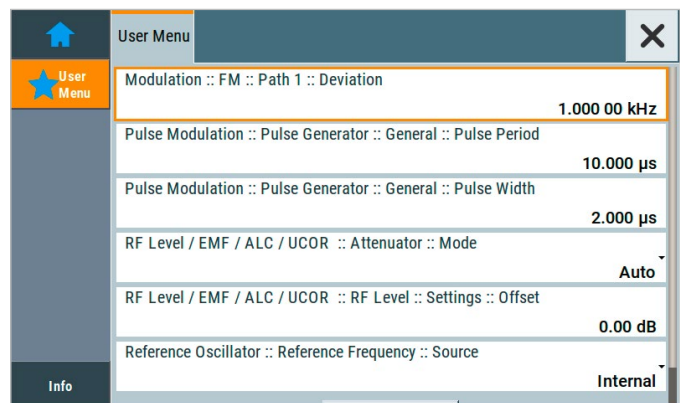
The R&S®SMB100B helps users quickly and correctly create remote control programs. The instrument's built-in SCPI macro recorder with code generator can automatically record all manual settings and create an executable MATLAB® script.



The main screen with all important parameters and information.

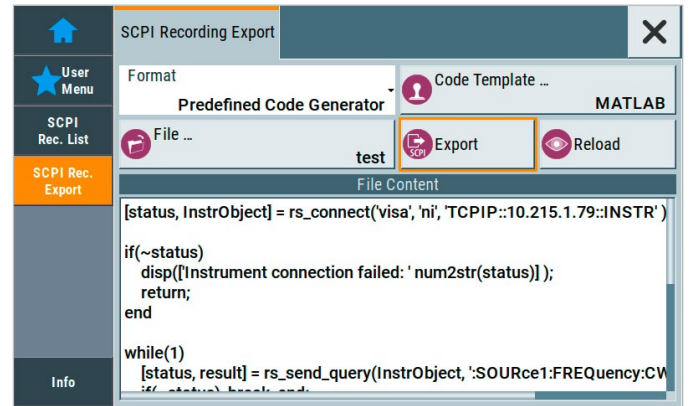
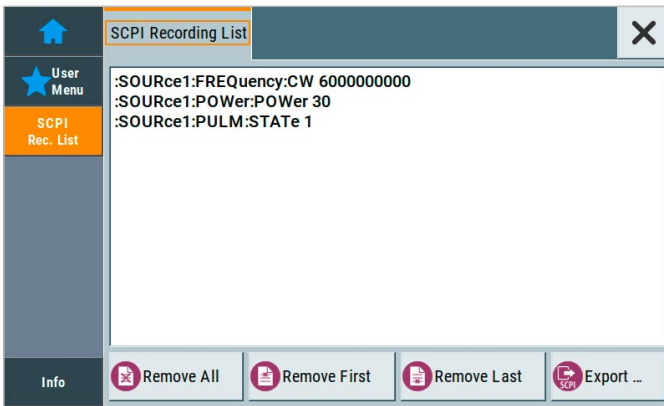


Individual menu items can be added to the user menu. Added items are marked with a blue star.



Example of a user menu. The individually composed parameters can be directly set in this menu.



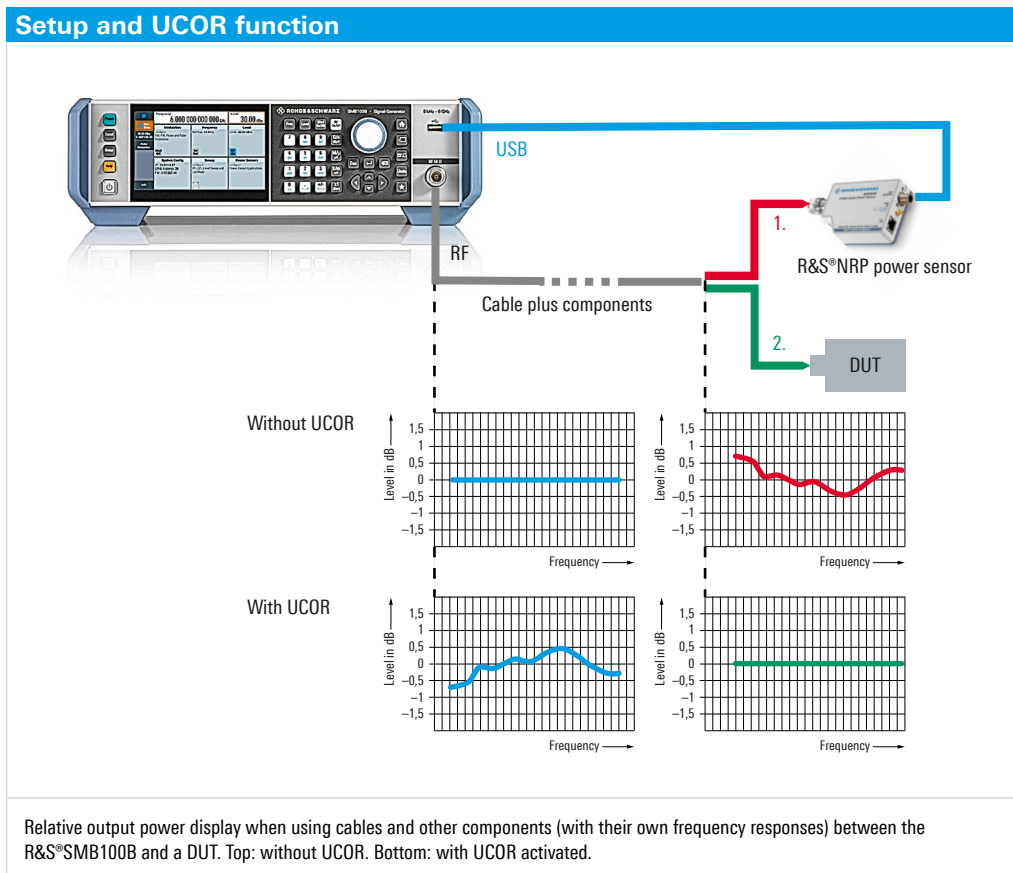


The built-in SCPI macro recorder and code generator supports fast, easy generation of SCPI program sequences.

### Support of R&S®NRP power sensors

DUTs are often connected to the signal generator via long cables or other frequency-dependent components. It is therefore very important to compensate the frequency response. The R&S®SMB100B provides a user correction (UCOR) function for this purpose. If the frequency response of external components is known, level correction values for different frequencies can be entered in the R&S®SMB100B. The correction values between these frequency points are automatically interpolated.

The R&S®NRP power sensor offers a much more user-friendly solution than manual entry. The power sensor is connected as shown in the figure. At the push of a button, the level correction values are automatically determined and saved in the UCOR table. When UCOR is activated, a frequency response compensated RF signal is available at the new reference plane for the DUT.



### Variable reference frequency inputs/outputs

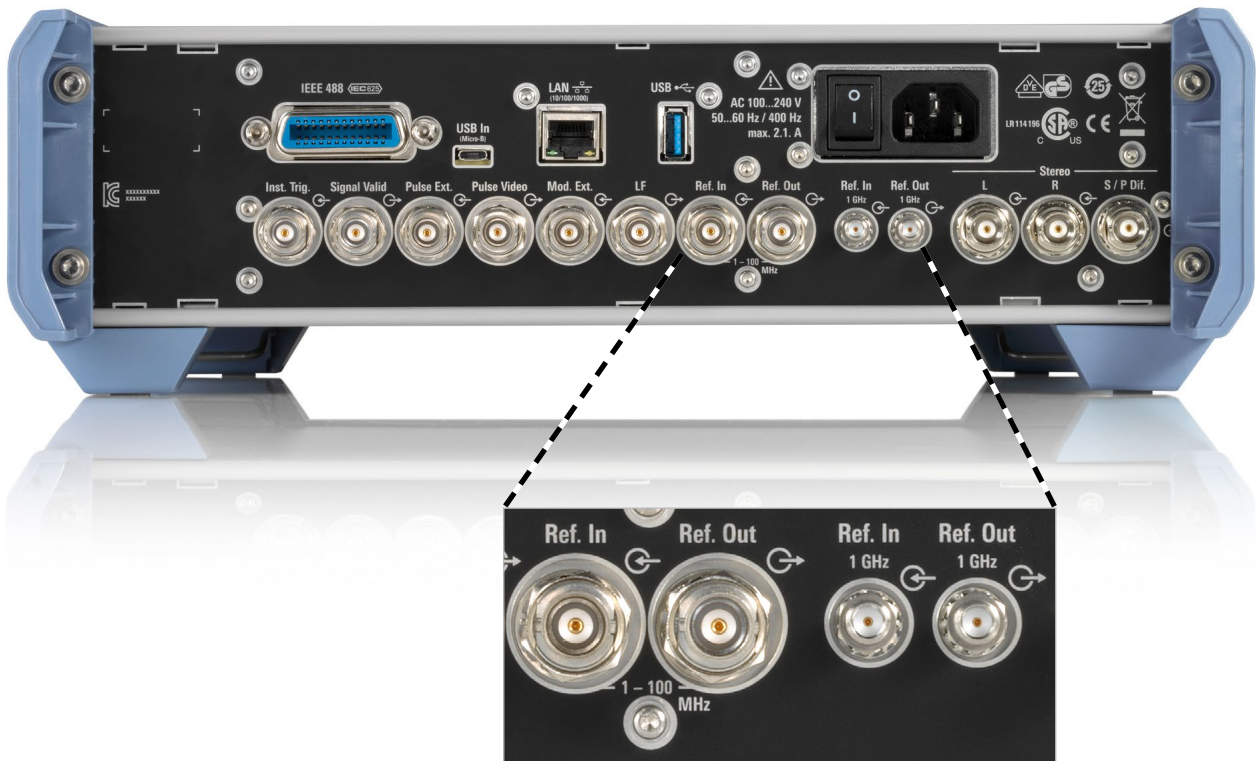
The R&S®SMB100B provides various ways to output (or input) reference signals. The 1 MHz to 100 MHz variable external reference frequency input (R&S®SMBB-K704 option) allows the R&S®SMB100B to be easily integrated into existing test environments. The received reference frequency can also be output to a separate reference output.

Extremely good phase stability between multiple R&S®SMB100B instruments can be achieved with the optional 1 GHz reference frequency input and output (R&S®SMBB-B3 option).

### Sanitizing of user data for secured areas

To meet requirements for secured areas, the R&S®SMB100B can be configured to prevent user data from being saved to the instrument's internal nonvolatile memory. An easy-to-use erasure and sanitization procedure is available to remove user data from the instrument. As an additional precaution, a dedicated password can be used to disable the LAN and USB ports. The display can also be disabled. This ensures that no sensitive data will leave the secured area.

### Rear panel reference frequency inputs and outputs



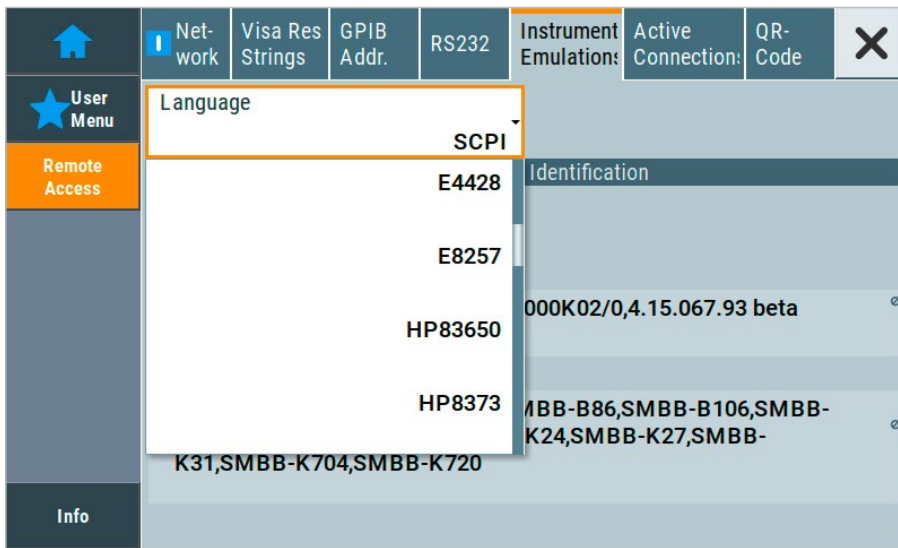
# R&S® LegacyPro: refresh your T&M equipment

## Replace your legacy signal generator

For older test systems, obsolescence is a common topic. When individual pieces of equipment become obsolete before the entire ATE system does, regular calibration and repair of obsolete equipment is an expensive, time-consuming and challenging task. Replacing obsolete test equipment with equivalent state-of-the-art instruments should be straightforward and require minimal hardware and software changes.

The R&S®SMB100B with R&S®LegacyPro code emulation fulfills these requirements, reducing the workload and eliminating risks. R&S®LegacyPro enables the R&S®SMB100B to reliably emulate a wide range of legacy generators from vendors such as Keysight, Agilent, HP, Anritsu and Rohde&Schwarz. As a result, the R&S®SMB100B can be deployed in legacy ATE systems without major software changes, effectively increasing uptime, lowering the cost of ownership and extending the test system's useful life.

Enjoy plug&play replacement of your legacy signal generator with the R&S®LegacyPro program and the R&S®SMB100B.



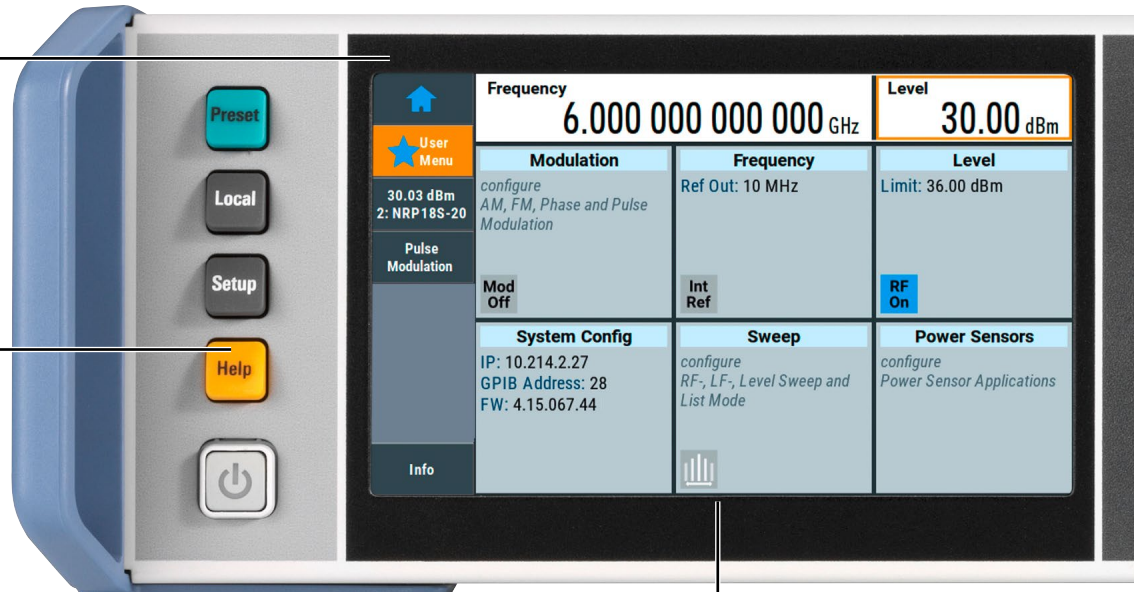
Emulation of legacy generators from Rohde & Schwarz and other vendors.

# Front and rear panel overview

High-resolution touchscreen with easy-to-use graphical user interface

Context-sensitive help system and comprehensive user manual

The main screen clearly displays modulation, frequency and level settings as well as the system configuration, the sweep mode and power sensor related parameters



Remote control via LAN (GPIB and USB with R&S®SMBB-B86 option)

Input for external pulse modulation signal (R&S®SMBB-K22 option)

Variable LF output (R&S®SMBB-K24 option)





Standard USB connector for the R&S®NRP power sensors

RF output connector (N female)

Favorite key for simplified and fast operation via customizable user menu



FM stereo connectors (R&S®SMBB-B5 option)

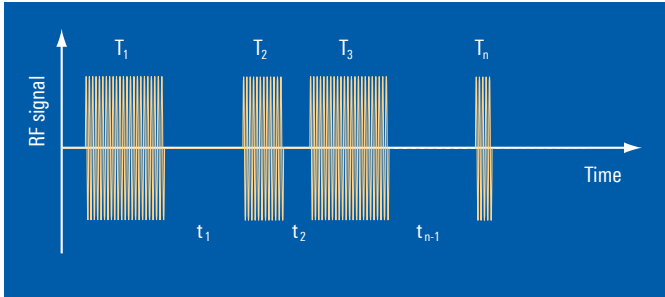
1 GHz reference input/output (R&S®SMBB-B3 option)

Variable reference input/output from 1 MHz to 100 MHz (R&S®SMBB-K704 option)

# Radar pulse generation

## 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®SMB100B can be equipped with an R&S®SMBB-K22 integrated pulse modulator and an



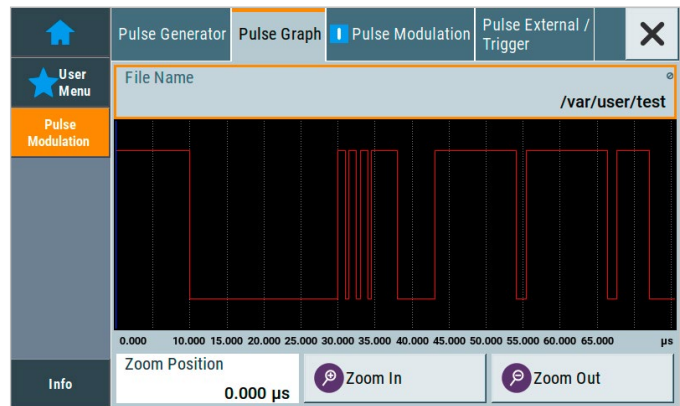
Pulse train.

R&S®SMBB-K23 pulse generator with superb characteristics such as a minimum pulse width of 20 ns (for radar system testing). The pulse modulator makes it possible, for example, to perform radar tests with a high on/off ratio of > 80 dB and very short rise/fall times of meas. < 5 ns. The pulse modulator is either controlled by an external pulse signal or it is supplied by the internal pulse generator as modulation signals with single or double pulses or pulse trains.

## Versatile pulse trains for complex test cases

An optional feature of the built-in pulse generator is the ability to generate pulse trains (R&S®SMBB-K27 option), which are commonly used for radar applications. An example of a pulse train is shown in the figure below. Unlike a single or double pulse, a pulse train is a combination of different pulses. It 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 the pulse width and pulse pause. Up to 2047 different pulses with a repetition of 1 to 65535 are possible. This yields very long pulse train sequences for testing.

Edit Pulse Train Data			
test			
User Menu	ON-Time/ $\mu$ s	OFF-Time/ $\mu$ s	Count
Pulse Modulation	10.00	20.00	1
Edit Pulse Train Data	1.00	0.50	3
	3.50	5.10	1
	11.00	1.30	2
	4.36	3.40	1



Pulse train tables and their graphical representation.

# Testing of FM stereo and RDS receivers

FM stereo is still a major audio broadcasting medium – especially in the automotive sector where millions of car radios are produced every year. For testing FM stereo receivers, audio test signals are modulated onto an RF carrier and measured after demodulation by the DUT. Test signals are also needed for the radio data system (RDS) that has been established in many countries for a long time.

## Optional stereo/RDS coder

The optional stereo/RDS coder (R&S®SMBB-B5) meets all the above requirements. Built into the R&S®SMB100B, the solution is based on equipment that features an excellent price/performance ratio as well as top-class specifications and fully covers the required frequency range.

## Automatic synchronization of measurement results

The stereo/RDS coder also works with external signals applied to its analog (left and right) or digital (S/P DIF) modulation inputs. Combining the R&S®SMB100B signal generator with the R&S®UPV or R&S®UPP audio analyzer creates

a general-purpose test system for FM receivers. The great advantage is the automatic synchronization of measurement results. As in other audio measurements, the test signals are produced in the generator section of the audio analyzer, routed to the DUT through the R&S®SMB100B as a modulator and measured in the analyzer section of the R&S®UPV or R&S®UPP. Since generation and analysis are optimally timed, measurement times are considerably shorter than with separately operating instruments.

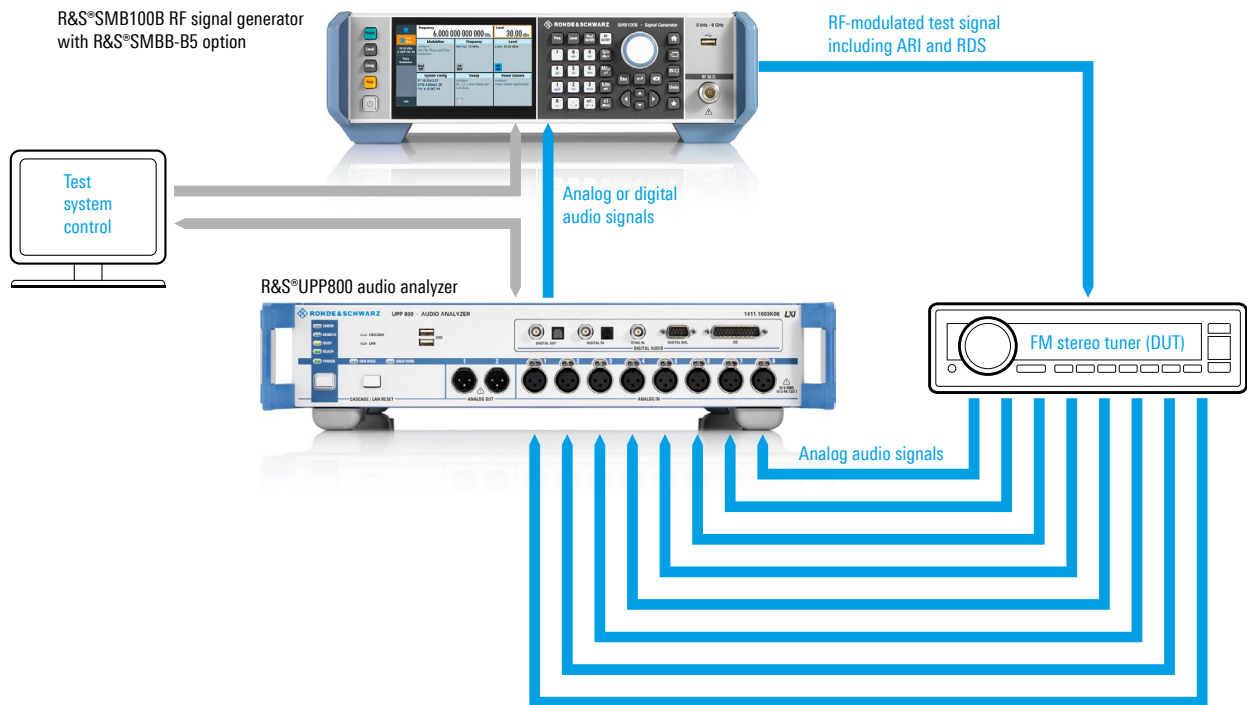
## Up to five different RDS sequences

The R&S®SMB100B with the R&S®SMBB-B5 option generates stereo multiplex signals, including ARI and RDS information, and outputs the signals at the RF output. It is possible to choose between traffic announcement identification and standardized area identification A to F. The RDS traffic program and RDS traffic announcement can be switched on and off. Up to five different RDS sequences can be loaded. With a length of up to 64 000 characters per sequence, longer RDS applications such as radio text can also be tested.

## Versatile internal LF generator

The internal LF generator, which is suitable for general receiver tests, is part of the basic R&S®SMB100B configuration. It generates sinusoidal signals at fixed or swept LF frequencies, allowing basic functional tests to be carried out without an external signal.

## Typical production test setup to measure FM car radios with eight audio channels



The R&S®UPP800 audio analyzer generates all required audio test signals and transfers them to the R&S®SMB100B, which adds the ARI and RDS test signals and modulates the entire test signal onto the RF carrier. The DUT demodulates the received test signal and outputs the audio signals on all amplifier channels. Measuring these signals with the R&S®UPP800 closes the loop and makes it possible to analyze the overall sound quality of the car radio under test.

# Specifications in brief

Specifications in brief		
<b>Frequency range</b>	R&S®SMBB-B101	8 kHz to 1 GHz
	R&S®SMBB-B103	8 kHz to 3 GHz
	R&S®SMBB-B106	8 kHz to 6 GHz
<b>Level</b>		
Maximum specified output power (PEP)	R&S®SMBB-B101/-B103/-B106	
	standard	
	200 kHz < f ≤ 1 MHz	-110 dBm to +13 dBm
	1 MHz < f ≤ 10 MHz	-110 dBm to +18 dBm
	10 MHz < f ≤ 6 GHz	-127 dBm to +18 dBm
	with R&S®SMBB-K31 option	
	200 kHz < f ≤ 1 MHz	-110 dBm to +13 dBm
	1 MHz < f ≤ 10 MHz	-110 dBm to +21 dBm
	10 MHz < f ≤ 4 GHz	-127 dBm to +21 dBm
	4 GHz < f ≤ 6 GHz	-127 dBm to +20 dBm
	with R&S®SMBB-B32 and R&S®SMBB-K31 options	
200 kHz < f ≤ 10 MHz	-110 dBm to +21 dBm	
10 MHz < f ≤ 6 GHz	-127 dBm to +26 dBm	
<b>Spectral purity</b>		
SSB phase noise	f = 1 GHz, 20 kHz offset, 1 Hz measurement bandwidth	< -126 dBc, -132 dBc (typ.)
Harmonics	1 MHz < f ≤ 6 GHz; level ≤ 13 dBm	< -30 dBc
Nonharmonics	CW, level > +10 dBm; offset > 10 kHz from carrier	
	f ≤ 750 MHz	< -80 dBc
	750 MHz < f ≤ 1500 MHz	< -76 dBc
	1500 MHz < f ≤ 3 GHz	< -70 dBc
	3 GHz < f ≤ 6 GHz	< -64 dBc
<b>Modulation</b>	with R&S®SMBB-K720 option	AM, FM, φM
	with R&S®SMBB-K22 option	pulse modulation
	rise/fall time	10% to 90% of RF amplitude, f > 80 MHz
	transition type: fast	< 15 ns, 5 ns (meas.)
	on/off ratio	> 80 dB
	minimum pulse width	50%/50% of RF amplitude,
	transition type: fast	< 20 ns
<b>Compatible command sets</b>	command sets can be used to emulate another instrument; a subset of common commands is supported	Aeroflex (IFR/Marconi), Agilent/Keysight Technologies, Hewlett Packard, Anritsu, Panasonic, Racal Dana (more details in the data sheet)

## Always up-to-date

The firmware can be updated using an USB storage device or the LAN port.

Free firmware updates are downloadable from the Internet at [www.rohde-schwarz.com](http://www.rohde-schwarz.com).



# Ordering information

Designation	Type	Order No.
R&S®SMBB-Bxxx = hardware option		
R&S®SMBB-Kxxx = software/keycode option		
<b>Base unit</b>		
Signal Generator, including power cable and quick start guide	R&S®SMB100B	1422.1000.02
<b>Frequency options <sup>1)</sup></b>		
8 kHz to 1 GHz	R&S®SMBB-B101	1422.5005.02
8 kHz to 3 GHz	R&S®SMBB-B103	1422.5105.02
8 kHz to 6 GHz	R&S®SMBB-B106	1422.5205.02
<b>Reference oscillator options</b>		
OCXO Reference Oscillator <sup>2)</sup>	R&S®SMBB-B1	1422.5305.02
High Performance OCXO Reference Oscillator <sup>2)</sup>	R&S®SMBB-B1H	1422.5405.02
100 MHz, 1 GHz Ultra Low Noise Reference Input and Output	R&S®SMBB-B3	1422.5505.02
Variable Reference Input from 1 MHz to 100 MHz	R&S®SMBB-K704	1422.6301.02
<b>Output power options</b>		
High Output Power, 1/3/6 GHz	R&S®SMBB-K31	1422.5705.02
Ultra High Output Power 1/3/6 GHz <sup>3)</sup>	R&S®SMBB-B32	1422.5740.02
<b>Analog modulation options</b>		
High Performance Pulse Modulator	R&S®SMBB-K22	1422.5905.02
Pulse Generator	R&S®SMBB-K23	1422.6001.02
Multifunction Generator	R&S®SMBB-K24	1422.6053.02
Pulse Train <sup>4)</sup>	R&S®SMBB-K27	1422.6101.02
AM/FM/φM	R&S®SMBB-K720	1422.6201.02
Stereo/RDS Coder <sup>5)</sup>	R&S®SMBB-B5	1422.5605.02
<b>Other options</b>		
Remote Control Interface (GPIB and USB)	R&S®SMBB-B86	1422.5805.02
<b>Recommended extras</b>		
19" Rackmount Kit	R&S®ZZA-KNA23	1177.8084.00
Power Sensor, 10 MHz to 18 GHz, for levels up to 15 W	R&S®NRP18S-20	1424.6738.02
USB Interface Cable for R&S®NRPS18-20	R&S®NRP-ZKU	1419.0658.02
USB Serial Adapter for RS-232 remote control	R&S®TS-USB1	6124.2531.00
<b>Documentation</b>		
Documentation of Calibration Values	R&S®DCV-2	0240.2193.18
R&S®SMB100B Accredited Calibration	R&S®SMBB-ACA	1422.6147.02

Warranty		
<b>Base unit</b>		3 years
All other items <sup>6)</sup>		1 year
<b>Options</b>		
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	

<sup>1)</sup> The base unit must be ordered together with an R&S®SMBB-B101, R&S®SMBB-B103 or R&S®SMBB-B106 frequency option.

<sup>2)</sup> Only one of the R&S®SMBB-B1 or R&S®SMBB-B1H options can be installed.

<sup>3)</sup> Requires the R&S®SMBB-K31 option.

<sup>4)</sup> Requires the R&S®SMBB-K23 option.

<sup>5)</sup> Requires the R&S®SMBB-K720 option.

<sup>6)</sup> For options that are installed, the remaining base unit warranty applies if longer than 1 year. Exception: all batteries have a 1 year warranty.

