R&S®SMB100B
RF SIGNAL GENERATOR

Perfect combination of performance and usability in a compact size

Product Brochure
Version 04.00

ROHDE & SCHWARZ

Make ideas real

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 MHz < f ≤ 6 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 ¾ 19" width

▶ Large, state-of-the-art 5" GUI with touchscreen

BENEFITS

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.

Key facts
- ▶ 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 MHz < f ≤ 6 GHz and an offset of 30 MHz
- ▶ Very low nonharmonic signal components of < –76 dBc (spec.) at 1 GHz

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).

R&S®SMB100B standard

R&S®SMBB-B1 OCXO option

R&S®SMBB-B1H high performance OCXO option
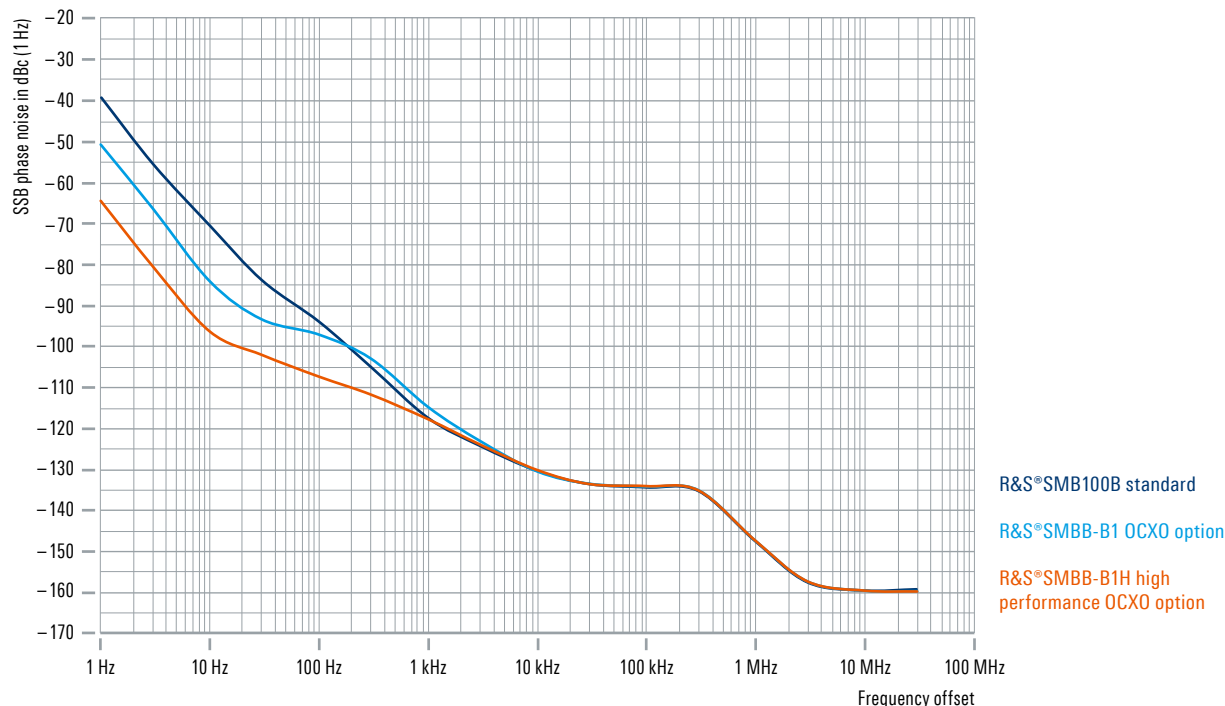
Lowest nonharmonics

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 nonharmonic components in the analog signal can lead to problems. The R&S®SMB100B excels with very low nonharmonic 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 cyan curve shows the measurement at the separate 1 GHz reference output (R&S®SMBB-B3 option).

Measured at the RF output

Measured at the ultra low noise reference input and output (R&S®SMBB-B3 option)
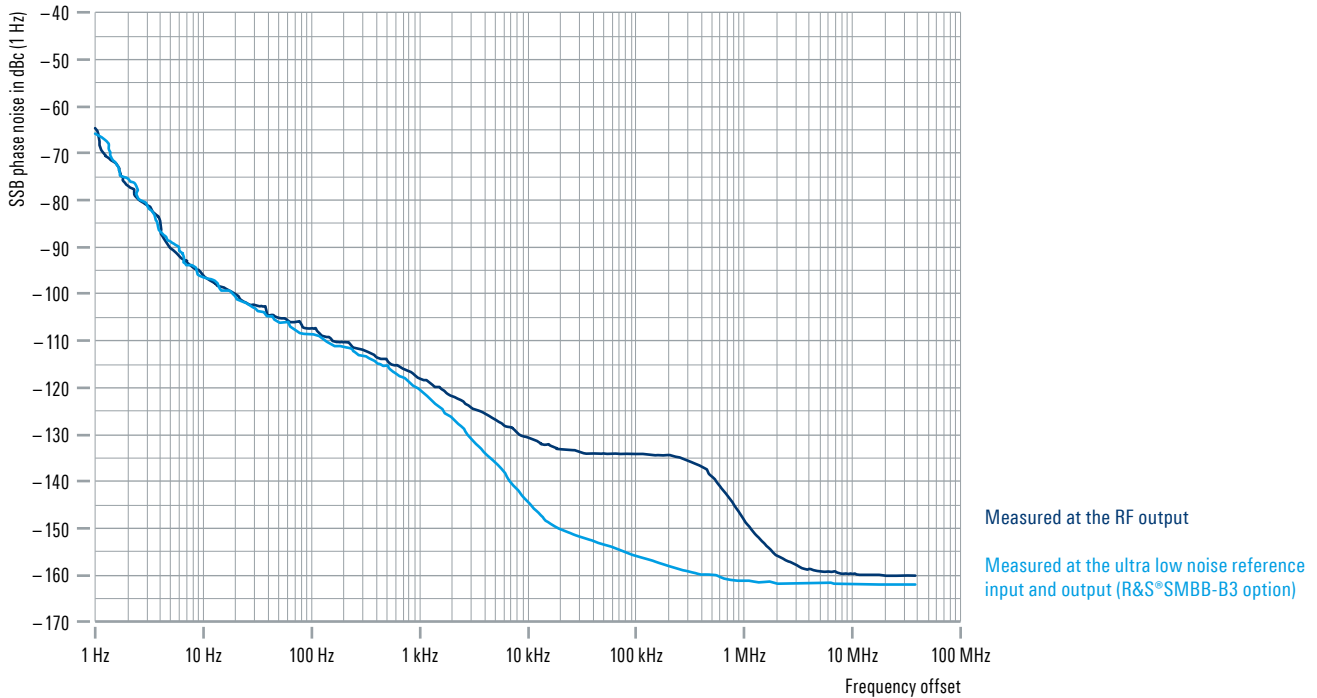
Measured values for nonharmonics (frequency offset > 10 kHz)

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

Specified nonharmonic suppression

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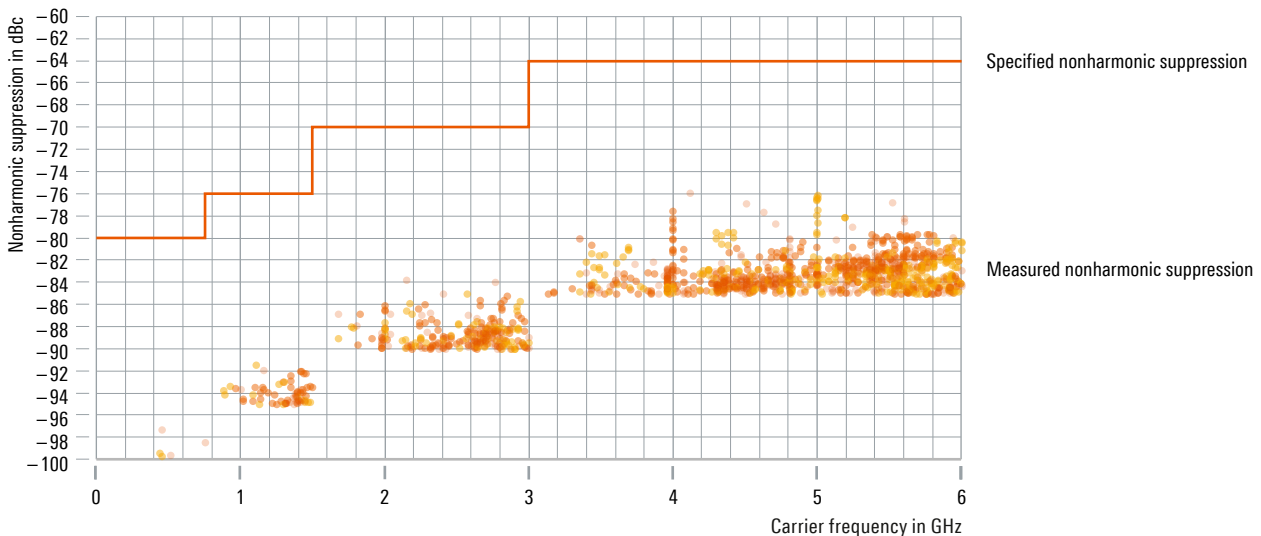
R&S®SMB100B with connected
R&S®NRP power sensor (via USB).

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.

Key facts
▶ 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)

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 MHz < f ≤ 6 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.

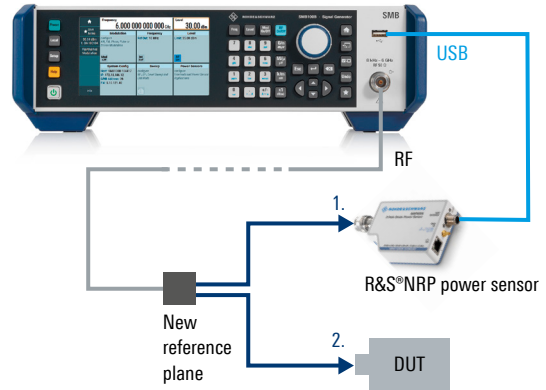## Unmatched level repeatability
Not only absolute level accuracy, but also level repeatability plays an important role. Especially for frequently repeated test sequences where the level is often changed, it is essential to be able to reproduce each individual level value during every repeated sequence.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

High absolute level accuracy

The R&S®SMB100B features excellent absolute level accuracy. The specified values of < 0.5 dB (200 kHz < f ≤ 3 GHz) and < 0.7 dB (f > 3 GHz) at a level of > –90 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 external devices

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


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).

R&S®SMBB-B32 ultra high power option

R&S®SMBB-K31 high power option

Standard output power
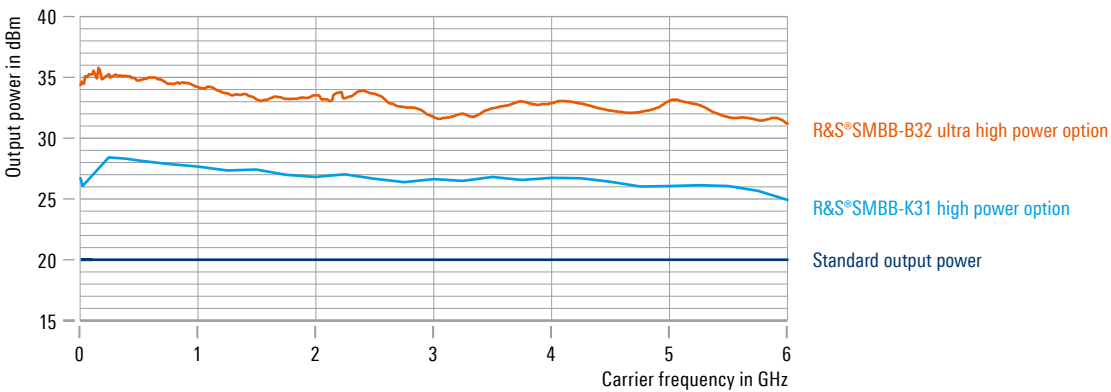
Measured level repeatability

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).

Temperature in ° C

Level deviation (1 GHz, 0 dBm)
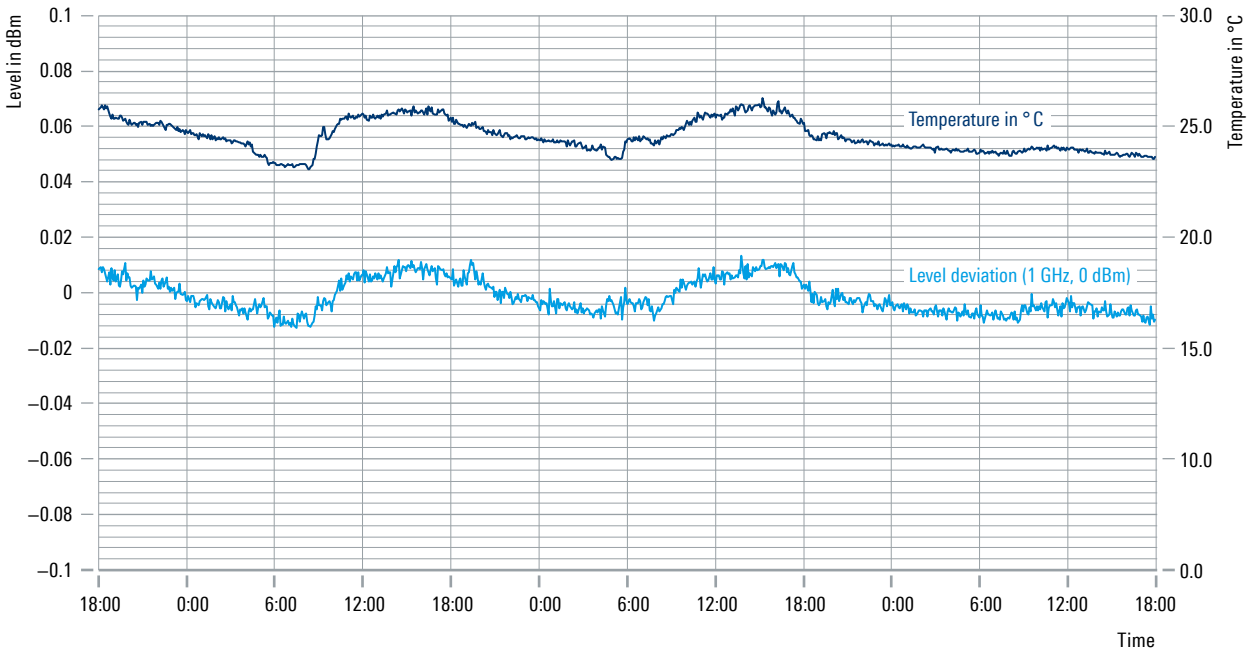
PERFECT FOR USE

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.

Key facts
► 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
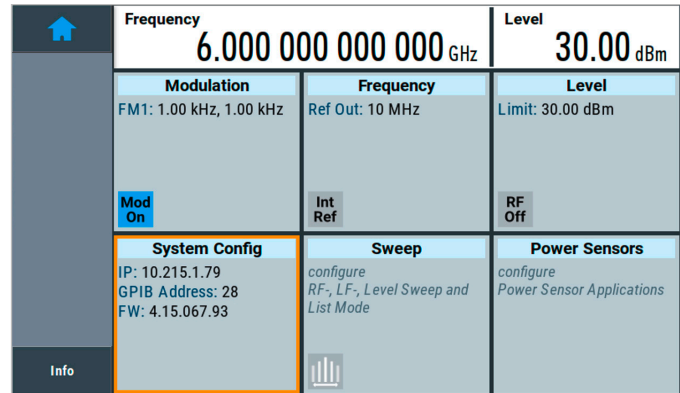
The main screen with all important parameters and information.

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.

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
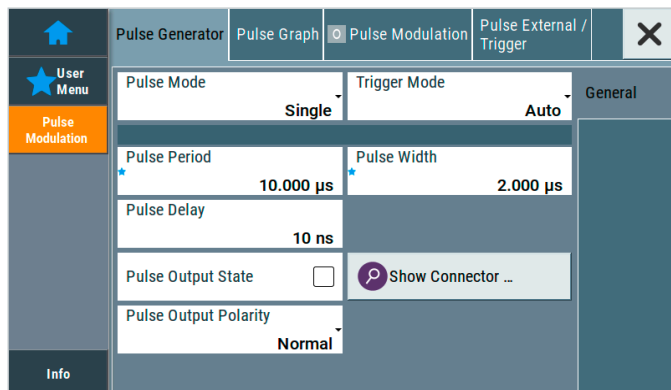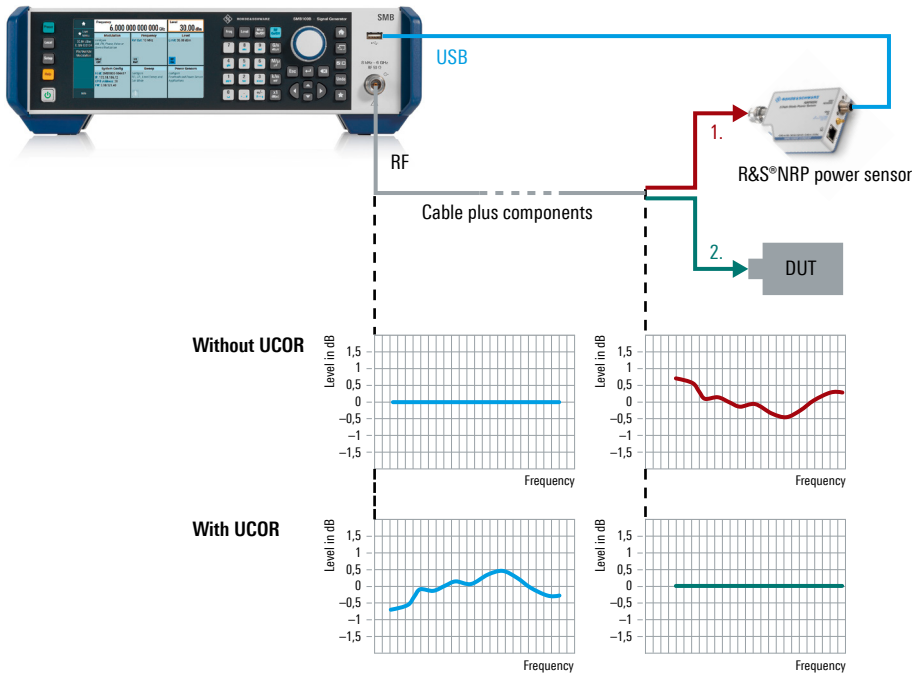

Individual menu items can be added to the user menu. Added items are marked with a blue star.
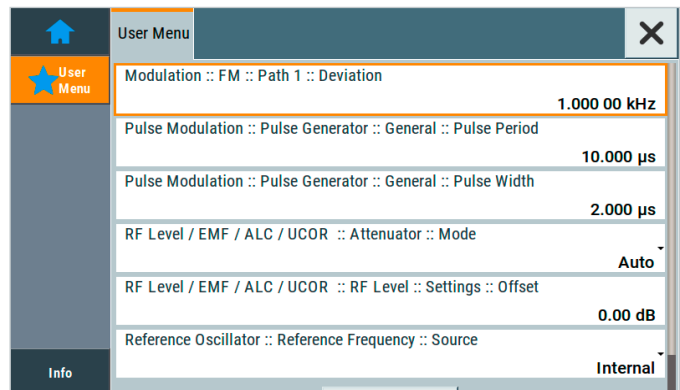
Example of a user menu. The individually composed parameters can be directly set in this menu.

Setup and UCOR function

Relative output power display when using cables and other components (with their own frequency responses) between the R&S®SMB100B and a DUT. Top: without UCOR. Bottom: with UCOR activated.

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.
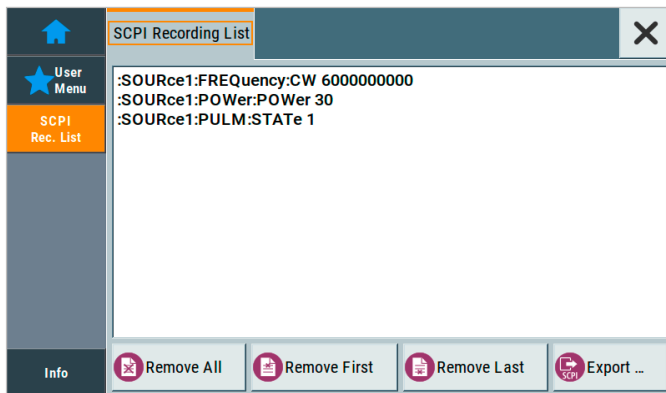
The built-in SCPI macro recorder and code generator supports fast, easy generation of SCPI program sequences.
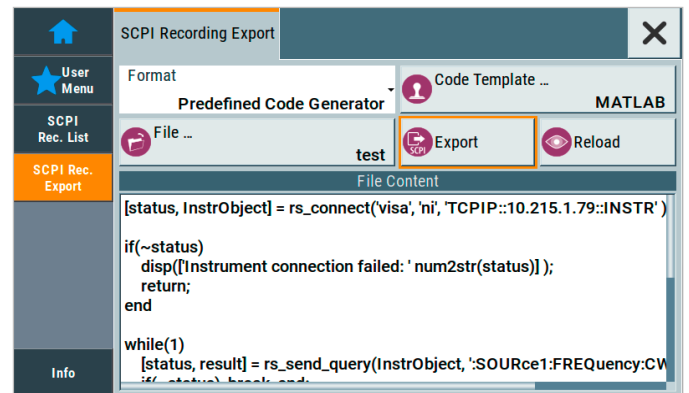
An SCPI program sequence generated with the built-in SCPI macro recorder.

CLEARLY STRUCURED USER INTERFACE

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

Context-sensitive help system
And comprehensive user manual

Main screen
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)

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

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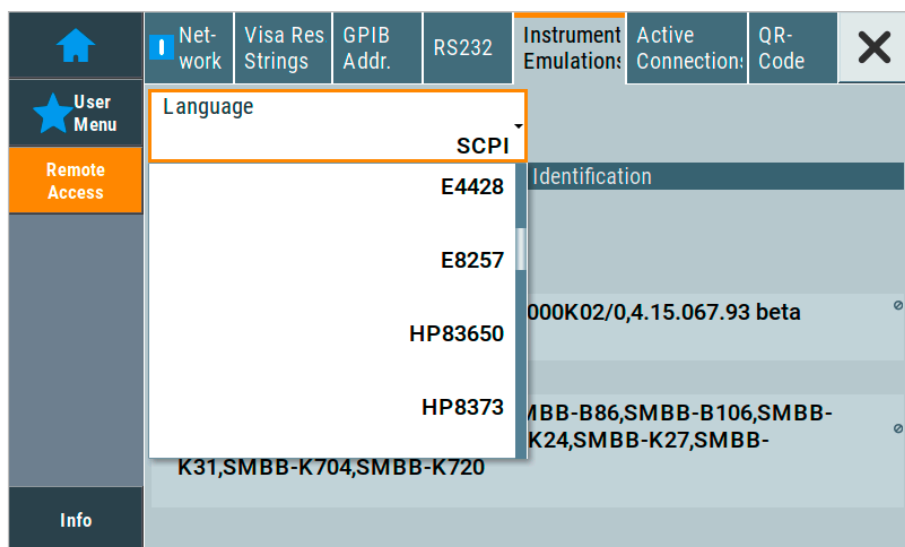
Emulation of legacy generators from Rohde & Schwarz and other vendors.

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 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.

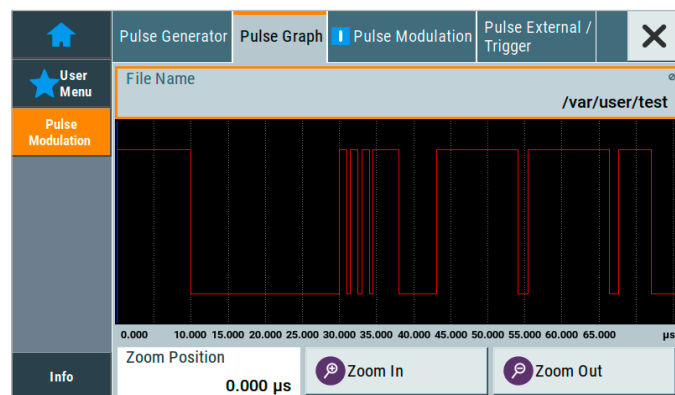## Versatile pulse trains for complex test cases

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 65 535 are possible. This yields very long pulse train sequences for testing.

Pulse train
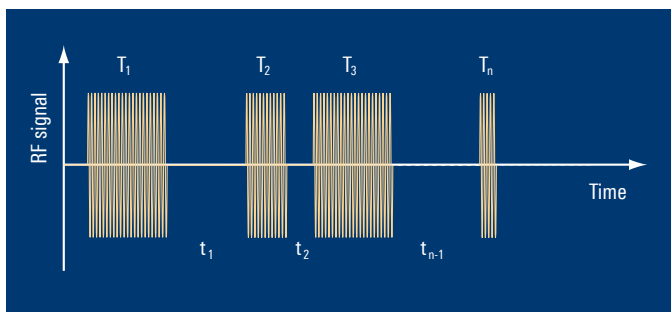
Pulse train tables.

Graphical representation of pulse train tables.

SPECIFICATIONS IN BRIEF

Specifications in brief			
Frequency range	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	
Level			
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	
Spectral purity			
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	
Modulation	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	
Compatible command sets	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 specifications)	