R&S®SMB100A
Signal Generator
Setting standards in the mid-range

ROHDE&SCHWARZ

Test&Measurement

Product Brochure | 03.03

R&S®SMB100A Signal Generator

At a glance

The analog R&S®SMB100A signal generator delivers excellent signal characteristics and high flexibility at low cost of ownership, perfectly matching the key criteria for a signal source. The technical characteristics of the R&S®SMB100A set new standards in the mid-range, especially the generator's high output power and signal purity.

The R&S®SMB100A provides RF characteristics that are exceptional in its class, making it an excellent general-purpose instrument. These outstanding RF 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 RF signal is required.

Its wide frequency range covers a large number of critical RF applications. The R&S®SMB100A is the perfect choice for applications in the important ISM bands up to 5.7 GHz as well as for EMC applications because of its lower frequency limit of 9 kHz. 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 and tear free electronic step attenuator is used in this frequency range. In addition to pure CW signals, the R&S®SMB100A also provides the most common analog AM and FM/φM modulation modes as standard.

The R&S®SMB100A is outstanding for its comprehensive standard equipment and hardly needs any additional options.

Key facts

- Wide frequency range from 9 kHz to 6 GHz or from 100 kHz to 12.75 GHz
- Excellent signal characteristics with low SSB phase noise of typ. –128 dBc (at 1 GHz, 20 kHz offset)
- High output power of up to +25 dBm
- All important analog modulations with AM, FM/φM and pulse modulation supported
- Compact size with only two height units and low weight of 5.6 kg for a fully equipped 12.75 GHz instrument

R&S®SMB100A Signal Generator

Benefits and key features

All-purpose RF source

- Wide frequency range from 9 kHz to 1.1/2.2/3.2/6 GHz or from 100 kHz to 12.75 GHz covers the main frequency bands for RF applications
- Overvoltage protection for high operational reliability
- Support for power sensors of the R&S®NRP-Zxx family
- All important analog modulations with AM, FM/φM and pulse modulation supported
- Intuitive user interface with graphical display of signal flow facilitates operation
- Remote control via LAN, USB and GPIB allows easy integration into the test system
- Low weight and compact design for a wide range of applications, including mobile applications

▷ page 4

Best signal quality in the mid-range

- Innovative DDS-based synthesizer concept
- Very low SSB phase noise of typ. –128 dBc (20 kHz carrier offset, 1 GHz carrier frequency, 1 Hz measurement bandwidth)

▷ page 6

High output power as standard

- Maximum specified output power of +18 dBm over the wide frequency range from 1 MHz to 12.75 GHz with excellent signal quality
- Low level range down to –120 dBm with no compromise in quality (in underrange down to –145 dBm)
- High harmonics suppression of typ. < –30 dBc even at high output power of +15 dBm

▷ page 8

Ideal for production

- Wear free electronic attenuator up to 12.75 GHz ensures long service life even in the case of heavy use in production
- High level accuracy and repeatability are the basis of high production yield
- Short setting times for frequency (< 3 ms) and level (< 2.5 ms) via remote control and < 1 ms in the List mode allow high throughput

▷ page 9

Testing of FM stereo and RDS receivers

- Optional stereo/RDS coder provides full coverage of the frequency range in question
- Automatic synchronization of measurement results with the R&S®UPV or R&S®UPP audio analyzer
- Up to five different RDS sequences with up to 64 000 characters each
- Internal LF generator delivers sinusoidal signals at fixed or swept LF frequencies

▷ page 10

Ready for aerospace and defense applications

- Optional pulse modulator with typ. > 90 dB ON/OFF ratio (up to 11 GHz) 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 tests on pulse receivers (optional)
- Wide temperature range of 0 °C to +55 °C and high permissible operating altitude of 4600 m for use even under extreme conditions
- Reliable erasure of user data for secured areas

▷ page 11

Flexible service concept

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

▷ page 12

All-purpose RF source

Wide frequency range from 9 kHz to 6 GHz or from 100 kHz to 12.75 GHz

The signal generator's wide frequency range, high output power plus a wide variety of modulations make it a flexible signal source for a broad scope of applications. Its minimum frequency of 9 kHz permits applications in EMC measurements. Its maximum frequency of 12.75 GHz covers ISM bands as well as all important mobile radio bands.

Overvoltage protection for high operational reliability

The standard overvoltage protection for instruments up to 6 GHz protects the R&S®SMB100A from high external voltages and high power applied at the RF output. This feature shields the RF output from unwanted high reverse power and ensures a high degree of operational reliability. An optional R&S®SMB-B30 overvoltage protection is available for the R&S®SMB-B112 or R&S®SMB-B112L 12.75 GHz frequency option.

Support for power sensors of the R&S®NRP-Zxx family

Of course, the R&S®SMB100A also supports the power sensors of the R&S®NRP-Zxx family. 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 power sensor R&S®NRP-Z55 can be used for the 12.75 GHz option of the R&S®SMB100A for the same purpose.

The R&S®SMB100A with connected R&S®NRP-Z92 power sensor performs automatic level correction.

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 in the range up to 1 MHz, or also with externally applied signals. Of course, 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.

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.

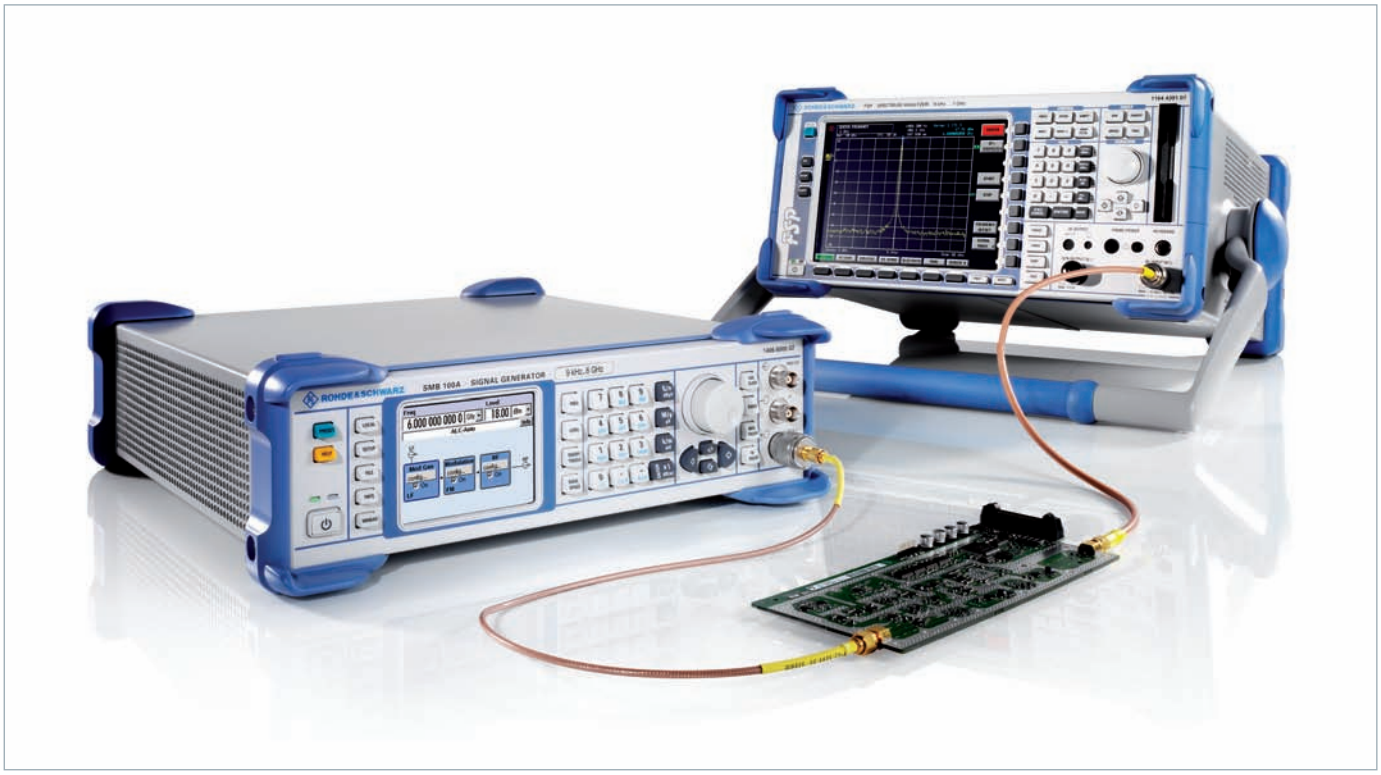
Remote control via LAN, USB and GPIB

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.

Low weight and compact design

The generator's compact size of only two height units and ¾ 19" width coupled with its low weight of max. 5.6 kg make it ideal for mobile use. It easily fits in any lab and service center, where space is often at a premium.

Wide frequency range, high output power and a variety of modulations make the R&S®SMB100A a flexible signal source for a broad scope of applications.



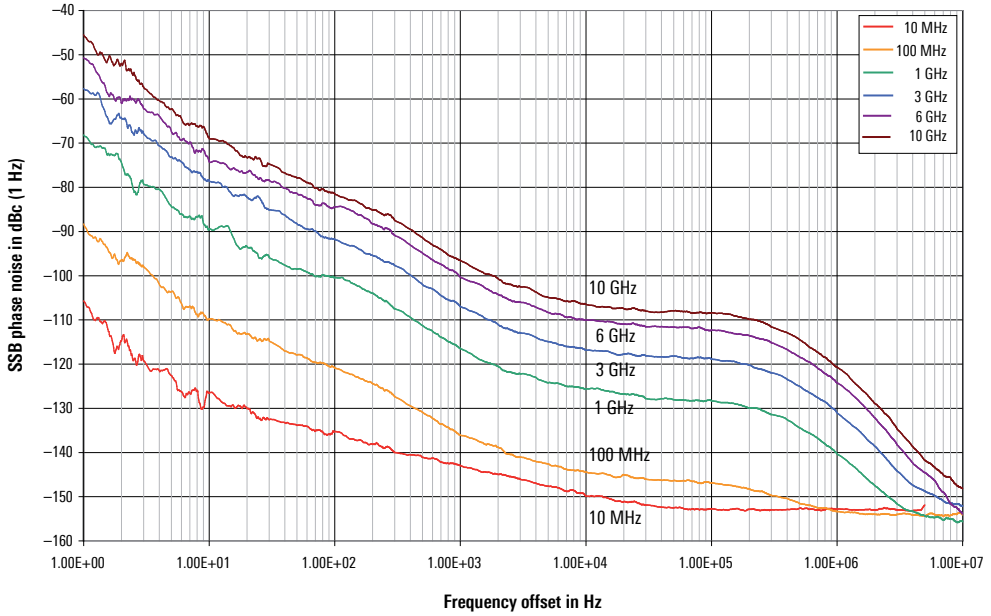
Best signal quality in the mid-range

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.

Innovative DDS-based synthesizer concept

The R&S®SMB100A superbly handles these 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, thus setting new standards.

SSB phase noise



Measured SSB phase noise with the R&S®SMB-B1H OCXO option.

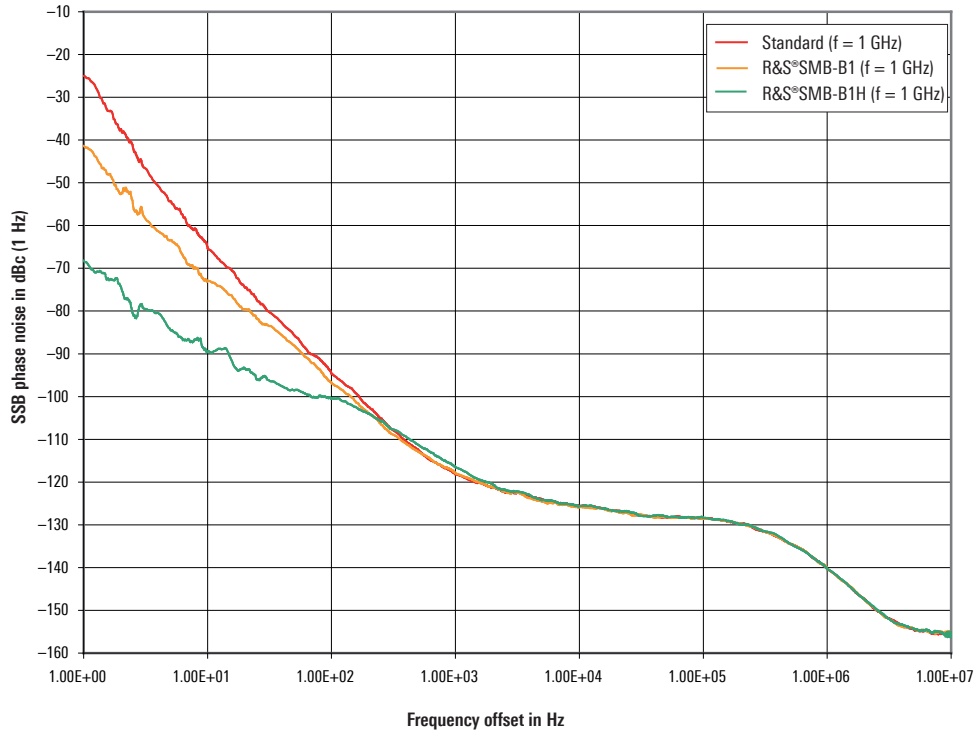
Very low SSB phase noise

When it comes to SSB phase noise performance, the R&S®SMB100A consistently achieves excellent values over the entire frequency range from 9 kHz to 6 GHz or from 100 kHz to 12.75 GHz. This is due to its remarkable concept. 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, conventional designs use a mixer range below approx. 250 MHz, which results in much poorer phase noise performance.

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.

SSB phase noise



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

High output power as standard

High power over a wide frequency range

The R&S®SMB100A combines excellent signal quality with a high output power of > +18 dBm, 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 +25 dBm (significantly higher), offering sufficient power reserve to easily compensate for level loss in a test setup. This usually eliminates the need for an additional external amplifier, thus saving space and also drastically reducing 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.

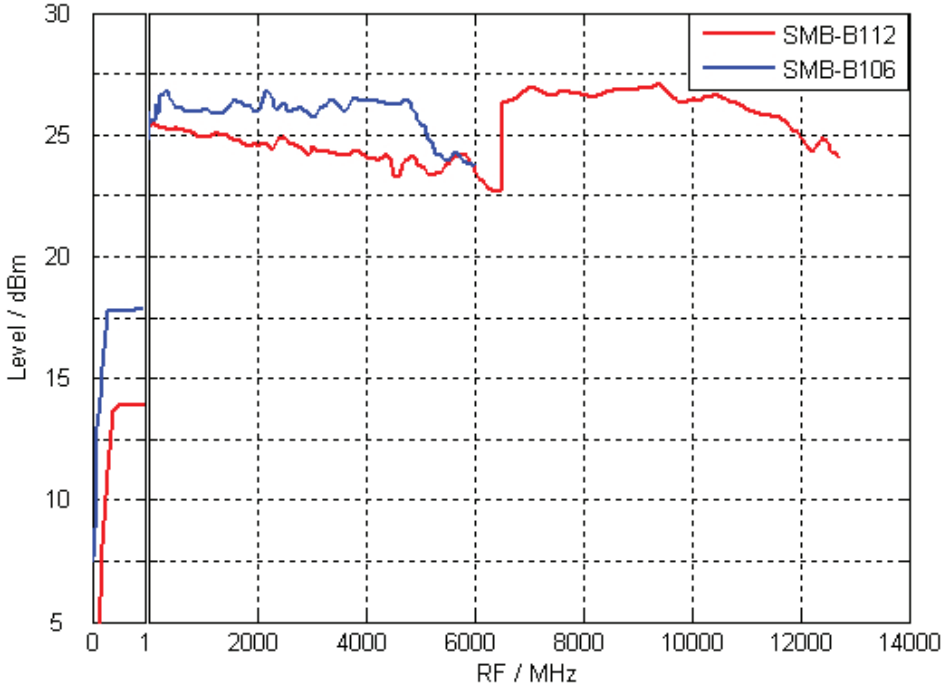
Low level range with no compromise in quality

Even in the lower level range, the R&S®SMB100A makes no compromise in quality. The RF level is specified to –120 dBm as standard (settable down to –145 dBm in underrange). Thus, the generator is ideally suited for sensitivity measurements on receivers.

High harmonics suppression of typ. < –30 dBc even at high output power of +15 dBm

What is special about the R&S®SMB100A is that harmonics are still suppressed with typ. < –30 dBc even at an output power of +15 dBm, ideal for local oscillator applications up to 12.75 GHz. The nonharmonics are even suppressed by e.g. typ. < –78 dBc at 3 GHz or < –66 dBc at 10 GHz.

Maximum output power



Measured maximum output power versus frequency.

Ideal for production

Wearfree electronic attenuator with overvoltage protection

The wear free and tear free electronic attenuator – unique 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 overvoltage protection (optional for the 12.75 GHz model) shields the R&S®SMB100A against high reverse power or DC voltage on the RF line.

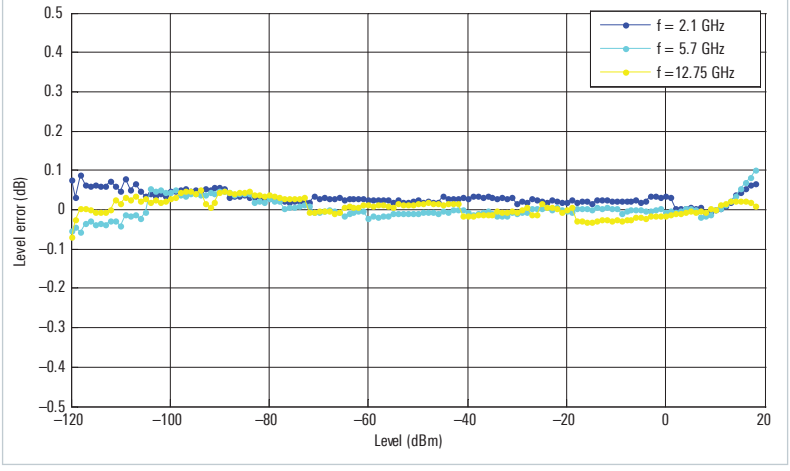
High level accuracy and repeatability are the basis of high production yield

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.

Short setting times for frequency and level

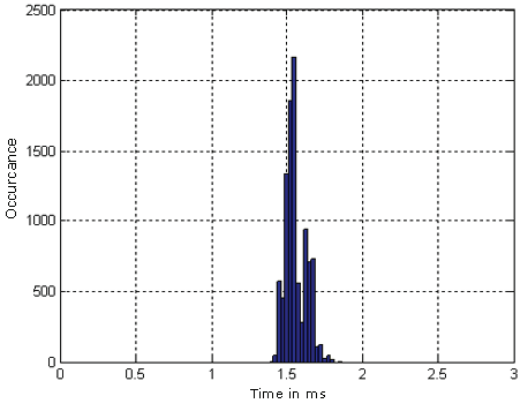
Another criterion in production is the short setting time of the test instrument in order to achieve high throughput. The R&S®SMB100A meets this requirement by achieving short frequency (< 3 ms) and level (< 2.5 ms) setting times in the regular operating mode. Plus, it features the List mode as standard, which reduces the setting times to well below 1 ms using frequency and level settings previously stored in a list.

Level linearity



Measured level linearity, ALC ON.

Frequency setting time



Measured frequency setting time statistics for remote control over 10000 settings.

Testing of FM stereo and RDS receivers

FM stereo is still the major audio broadcasting medium – especially in the automobile 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) established in many countries for a long time.

Optional stereo/RDS coder

The optional stereo/RDS coder (R&S®SMB-B5, available for instruments up to 6 GHz) meets all the above requirements. Built into the R&S®SMB100A, the solution is based on equipment that features an excellent price/performance ratio as well as top-class specifications and provides full coverage of the frequency range in question.

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®SMB100A signal generator and the R&S®UPV or the 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®SMB100A as a modulator, and measured in the analyzer section of the R&S®UPV or the R&S®UPP. Since generation and analysis are optimally timed, measurement times are considerably shorter than with separately operating instruments.

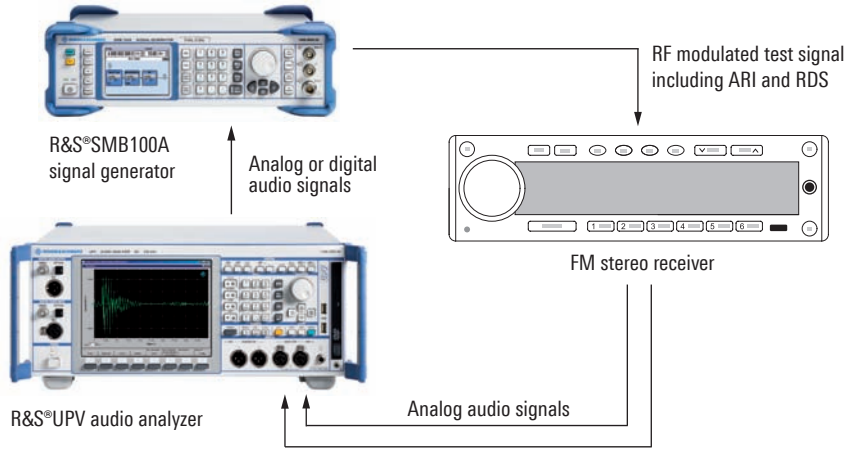
Up to five different RDS sequences

The R&S®SMB100A with the R&S®SMB-B5 option generates stereo multiplex signals, including ARI and RDS information, and outputs the signals on the RF. It is possible to choose between traffic announcement identification and standardized area identification A to F. The RDS traffic program or RDS traffic announcement can be switched on and off. Up to five different RDS sequences can be loaded. Due to a length of up to 64 000 characters per sequence, longer RDS applications such as radio text can be tested as well.

Flexible internal LF generator

The internal LF generator, which is suitable for general receiver tests, is part of the basic configuration of the R&S®SMB100A. It generates sinusoidal signals at fixed or swept LF frequencies, allowing basic functional tests to be carried out without an external signal.

Typical test setup with the R&S®UPV audio analyzer



Typical test setup with the R&S®SMB100A and the R&S®UPV audio analyzer (the R&S®UPP can be used alternatively).

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 or R&S®SMB-K22) and a pulse generator (R&S®SMB-K23) with superb characteristics such as e.g. 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 typ. > 90 dB (up to 11 GHz) and very short rise/fall times of typ. < 5 ns. The pulse modulator is either controlled by an external video signal or it is supplied with single or double pulses as a modulation signal by the internal pulse generator.

Versatile pulse train

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. In contrast to single or double pulses, pulse trains are a combination of different pulses, which can be a periodical or non-periodical set of pulses. Up to 2047 different pulses with a repetition of 1 to maximum 65 535 are possible. This yields very long pulse train sequences for testing.

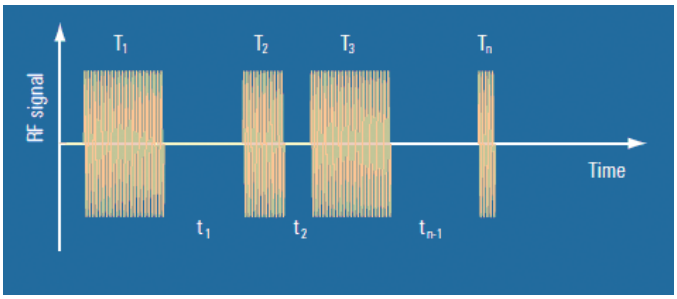
Wide temperature range and high permissible operating altitude

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.

Reliable erasure of user data for secured areas

To meet requirements for secured areas, an erase and sanitize procedure is being developed that reliably erases user data. 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.

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



Rear view of the R&S®SMB100A signal generator.

Flexible service concept

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

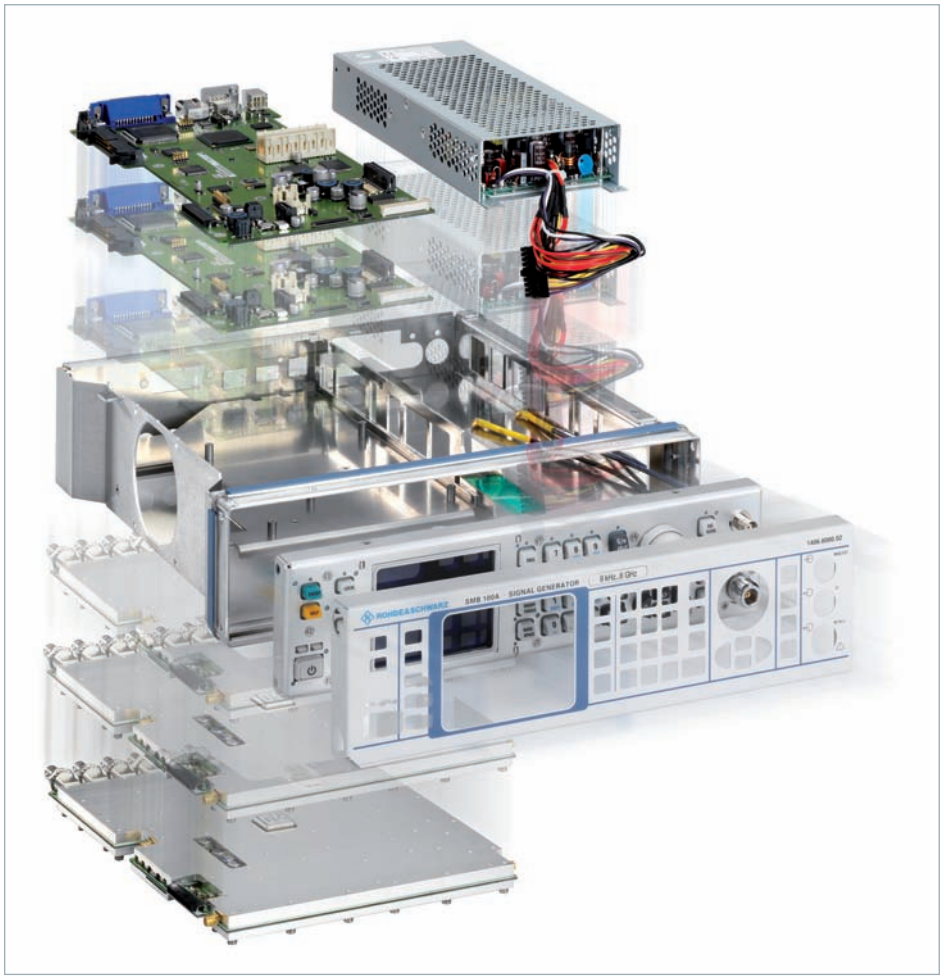
The R&S®SMB100A is designed for maximum reliability and easy servicing to maximize uptime in all application fields and significantly reduce cost of ownership. Customers can choose between calling on a certified Rohde&Schwarz service center as usual or servicing the instrument themselves.

Built-in selftest of modules supports 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 only four modules, respectively five modules with the R&S®SMB-B112 option, cuts the time required for troubleshooting and repair to a minimum. Moreover, for all instruments up to 6 GHz, the R&S®SMB100A does not need to be recalibrated if a module has to be replaced as all replacement modules come fully adjusted. 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 min 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.

A minimum of modules in the R&S®SMB100A means high reliability and easy servicing.



From pre-sale to service. At your doorstep.

The Rohde&Schwarz network in over 70 countries ensures optimum on-site support by highly qualified experts. The user risks are reduced to a minimum at all stages of the project:

- Solution finding/purchase
- Technical start-up/application development/integration
- Training
- Operation/calibration/repair

Specifications in brief

R&S®SMB100A signal generator		
Frequency		
Frequency range	R&S®SMB-B101	9 kHz to 1.1 GHz
	R&S®SMB-B102	9 kHz to 2.2 GHz
	R&S®SMB-B103	9 kHz to 3.2 GHz
	R&S®SMB-B106	9 kHz to 6 GHz
	R&S®SMB-B112/R&S®SMB-B112L	100 kHz to 12.75 GHz
Setting time	SCPI mode	< 3 ms
	List mode	< 1 ms
Level		
Maximum output power	1 MHz ≤ f < 12.75 GHz	> +18 dBm
Minimum specified output power	R&S®SMB-B101/-B102/-B103/-B106/-B112	–120 dBm
	R&S®SMB-B112L	–5 dBm
Level uncertainty	R&S®SMB-B101/-B102/-B103/-B106/-B112	
	200 kHz < f < 3 GHz	< 0.5 dB
	f > 3 GHz	< 0.9 dB
Setting time	SCPI mode	< 2.5 ms
	List mode	< 1 ms
Reverse power protection [1]	1 MHz ≤ f < 1 GHz	50 W/35 V
	1 GHz ≤ f < 2 GHz	25 W/35 V
	2 GHz ≤ f < 12.75 GHz	10 W/35 V
Spectral purity		
Harmonics	1 MHz < f ≤ 6 GHz, level ≤ 13 dBm f > 6 GHz, level ≤ 10 dBm	< –30 dBc
Nonharmonics	carrier offset > 10 kHz, 23.4375 MHz < f ≤ 1500 MHz	< –70 dBc (typ. < –84 dBc)
SSB phase noise	f = 1 GHz, carrier offset = 20 kHz, 1 Hz measurement bandwidth	< –122 dBc (typ. –128 dBc)
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	optional	R&S®SMB-K21 or R&S®SMB-K22 pulse modulator
Rise/fall time		< 20 ns, typ. < 5 ns
ON/OFF ratio		> 80 dB
Connectivity		
Remote control		IEC/IEEE bus, Ethernet (TCP/IP), USB
Peripherals		USB

[1] Optional for the R&S®SMB-B112/-B112L.

Ordering information

Designation	Type	Order No.
Base unit		
Signal Generator 1)	R&S®SMB100A	1406.6000.02
Options		
RF Path		
9 kHz to 1.1 GHz	R&S®SMB-B101	1407.2509.02
9 kHz to 2.2 GHz	R&S®SMB-B102	1407.2609.02
9 kHz to 3.2 GHz	R&S®SMB-B103	1407.2709.02
9 kHz to 6 GHz	R&S®SMB-B106	1407.2909.02
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
OCXO Reference Oscillator 2)	R&S®SMB-B1	1407.3005.02
OCXO High Performance Reference Oscillator 2)	R&S®SMB-B1H	1407.3070.02
Stereo/RDS Coder 3)	R&S®SMB-B5	1407.3205.02
Reverse Power Protection, 100 kHz to 12.75 GHz 4)	R&S®SMB-B30	1407.1160.02
Pulse Modulator 4)	R&S®SMB-K21	1407.3811.02
Pulse Modulator 5)	R&S®SMB-K22	1407.3770.02
Pulse Generator	R&S®SMB-K23	1407.3786.02
Pulse Train 6)	R&S®SMB-K27	1407.3828.02
Recommended extras		
Hardcopy manuals (in English, UK)		1407.0806.32
Hardcopy manuals (in English, US)		1407.0806.39
19" Rack Adapter	R&S®ZZA-S234	1109.4493.00
Power Sensor 9 kHz to 6 GHz	R&S®NRP-Z92	1171.7005.42
Power Sensor 10 MHz to 18 GHz	R&S®NRP-Z22	1137.7506.02
Power Sensor 0 Hz to 40 GHz (for levels up to 20 dBm)	R&S®NRP-Z55	1138.2008.02
Keyboard with USB Interface (US character set)	R&S®PSL-Z2	1157.6870.04
Optical mouse with USB Interface	R&S®PSL-Z10	1157.7060.03
Service options		
Two-Year Calibration Service	R&S®CO2SMB100A	Please contact your local Rohde&Schwarz sales office.
Three-Year Calibration Service	R&S®CO3SMB100A	
Five-Year Calibration Service	R&S®CO5SMB100A	
One-Year Repair Service following the warranty period	R&S®RO2SMB100A	
Two-Year Repair Service following the warranty period	R&S®RO3SMB100A	
Four-Year Repair Service following the warranty period	R&S®RO5SMB100A	
Documentation of Calibration Values	R&S®DCV-2	0240.2193.18
DKD (ISO 17025) Calibration including ISO 9000 calibration (can only be ordered with the instrument)	R&S®SMB-DKD	1161.3607.02

1) The base unit must be ordered together with an R&S®SMB-B101/-B102/-B103/-B106/-B112/-B112L frequency option.
2) Only one of the options R&S®SMB-B1 or R&S®SMB-B1H can be installed.
3) Only applicable with the R&S®SMB-B101/-B102/-B103/-B106 frequency option.
4) Only applicable with the R&S®SMB-B112/112L frequency option.
5) Only applicable with the R&S®SMB-B101/-B102/-B103/-B106 frequency option.
6) Requires an R&S®SMB-K23 option, only available for instruments with serial number > 102400.

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

Your local Rohde&Schwarz expert will help you determine the optimum solution for your requirements and will be glad to provide you with a customized quotation.

To find your nearest Rohde&Schwarz representative, visit www.sales.rohde-schwarz.com.

Service you can rely on

- Worldwide
- Local and personalized
- Customized and flexible
- Uncompromising quality
- Long-term dependability

About Rohde&Schwarz

Rohde&Schwarz is an independent group of companies specializing in electronics. It is a leading supplier of solutions in the fields of test and measurement, broadcasting, radiomonitoring and radiolocation, as well as secure communications. Established more than 75 years ago, Rohde&Schwarz has a global presence and a dedicated service network in over 70 countries. Company headquarters are in Munich, Germany.

Environmental commitment

- Energy-efficient products
- Continuous improvement in environmental sustainability
- ISO 14001-certified environmental management system

Certified Quality System
ISO 9001

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