Version 02.00

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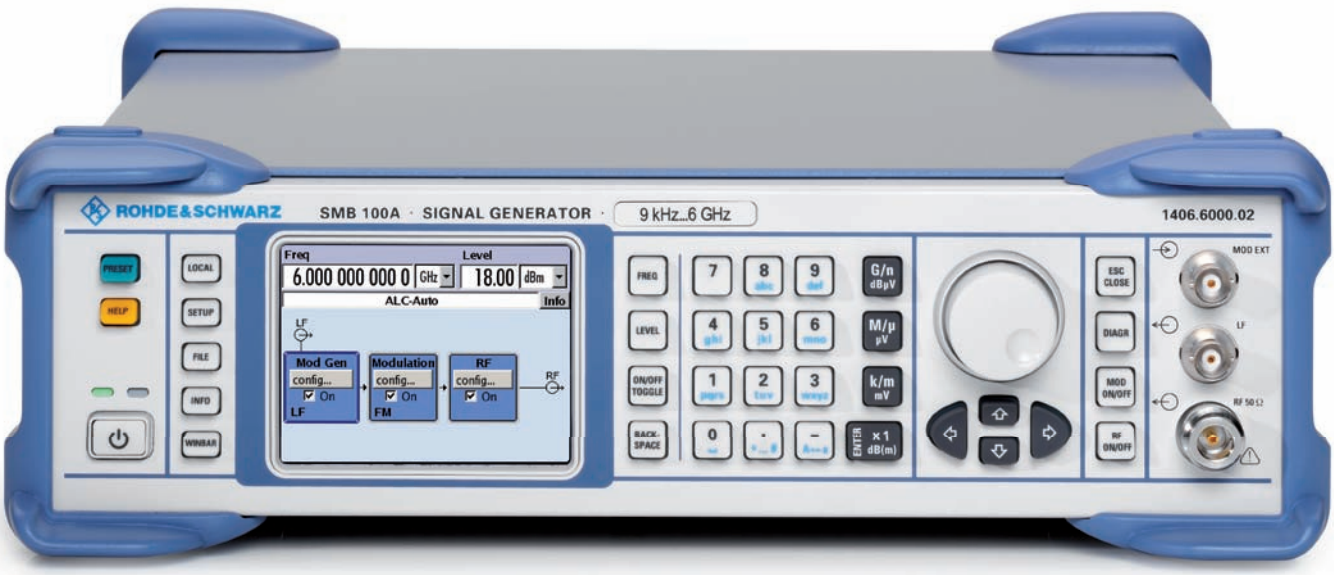
R&S®SMB100A Signal Generator

Setting standards in the mid-range

ROHDE&SCHWARZ



The technical characteristics of the R&S®SMB100A set new standards in the mid-range

Excellent signal characteristics, high flexibility, plus low cost of ownership are key criteria when it comes to selecting a signal source. The analog R&S®SMB100A signal generator superbly handles all these requirements, as a well-planned effort to fulfill them was made right from the initial stages of development. 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. Moreover, the service concept of the R&S®SMB100A enables users to perform maintenance themselves. The straightforward modular design allows servicing to be performed on-site – quickly and easily. This ensures low total cost of ownership, plus high availability in labs and production.

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

Its wide frequency range of 9 kHz to 6 GHz covers a large number of crucial RF applications. The R&S®SMB100A is thus 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. In addition to pure CW signals, it 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 modulator, allowing it to handle pulse applications.

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

The R&S®SMB100A at a glance

High output power as standard

- Specified output power of >+18 dBm over the wide frequency range of 1 MHz to 6 GHz
- Typical maximum level of +25 dBm (in overrange) over the frequency range up to 6 GHz

… provides power reserve to replace external amplifiers

Best signal quality in the mid-range

- Low SSB phase noise of typ. –128 dBc (20 kHz carrier offset, 1 GHz carrier frequency, 1 Hz measurement bandwidth)
- Very low SSB phase noise even at low output frequencies (a new DDS synthesizer from 9 kHz to 23.4375 MHz is used instead of a downconverter)
- Nonharmonics suppression of typ. –85 dBc (>10 kHz carrier offset, carrier frequency <1.5 GHz)
- Low wideband noise of typ. –152 dBc (>10 MHz carrier offset, 1 GHz carrier frequency, level >5 dBm)
- Harmonics of typ. –30 dBc at the maximum specified output power of +18 dBm

… for high measurement accuracy in a wide variety of applications

On-site servicing as convenient alternative

- Flexible concept allows servicing to be performed on site or by a Rohde & Schwarz service center
- Straightforward modular instrument design with only four exchangeable modules ensures short repair times
- Calibrated replacement modules make extensive calibration and adjustment tasks unnecessary
- Built-in selftest of modules supports troubleshooting
- Verification of level accuracy and automatic level correction with a connected power sensor of the R&S®NRP-Zxx family

… ensures low cost of ownership and maximum instrument availability

All-purpose RF source

- Wide frequency range from 9 kHz to 6 GHz covers the main frequency bands for RF applications
- Integrated frequency, level, and LF sweeps
- All important analog modulations with AM, FM/φM, and pulse modulation supported
- Internal LF generator provides sinewave signals up to 1 MHz as well as squarewave signals up to 20 kHz
- Intuitive user interface with graphical display of signal flow facilitates operation
- Context-sensitive online help ensures efficient utilization of the instrument

… makes the R&S®SMB100A the ideal signal source for a wide variety of applications

Ideal for production

- Short switchover times for frequency of typ. 1.6 ms and level of typ. 1.2 ms via remote control and typ. 650 µs in the List mode allow high throughput
- High level accuracy and repeatability are the basis of high production yield
- High output power of up to +25 dBm compensates level loss on the way to the DUT
- Wearfree electronic attenuator with overvoltage protection up to 6 GHz as standard ensures long service life even in the case of heavy use in production
- Compact design with only two height units saves rack space
- Remote control via LAN, USB, and GPIB allows easy integration into the test system

… reduces production costs

Ready for aerospace and defense applications

- Optional pulse modulator (R&S®SMB-K22) offers excellent performance with typ. 90 dB on/off ratio and a rise/fall time of typ. 4 ns
- Flexible pulse generator (R&S®SMB-K23 option) with minimum pulse width of 10 ns allows the generation of various pulse signals
- Wide temperature range of 0 °C to 55 °C and maximum permissible operating altitude of 4600 m above sea level allow the instrument to be used even under extreme conditions
- Low weight of only 5.3 kg for mobile applications

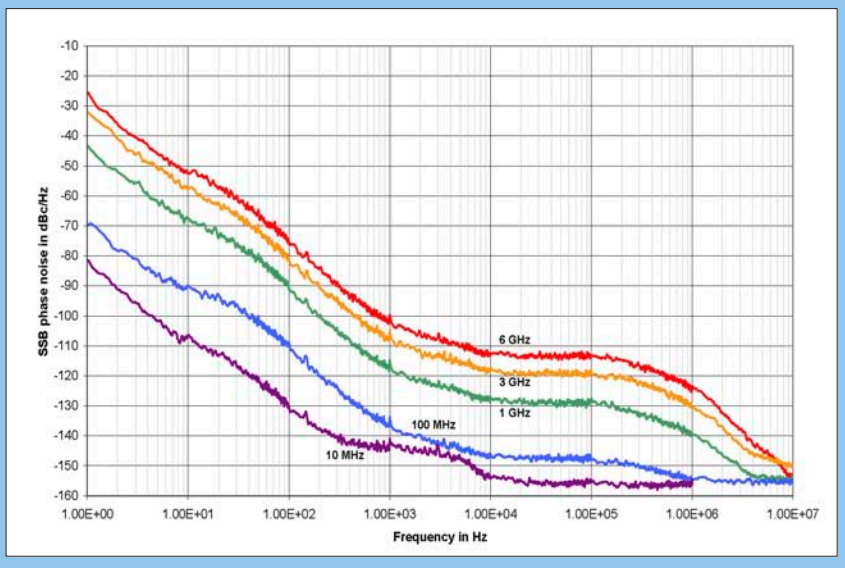
… expands the range of locations and applications for which the R&S®SMB100A can be used

Best signal quality in the mid-range

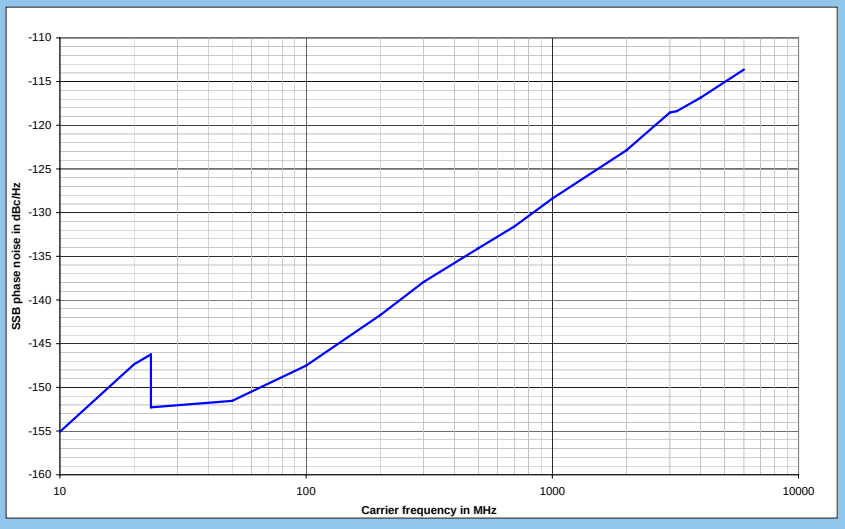
Phase noise, harmonics, and nonharmonic spurious, as well as wideband noise are key parameters when it comes to characterizing the spectral properties of analog signal generators. Many measurements focus on more than one aspect simultaneously. For example, in blocking measurements, nonharmonics together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

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.

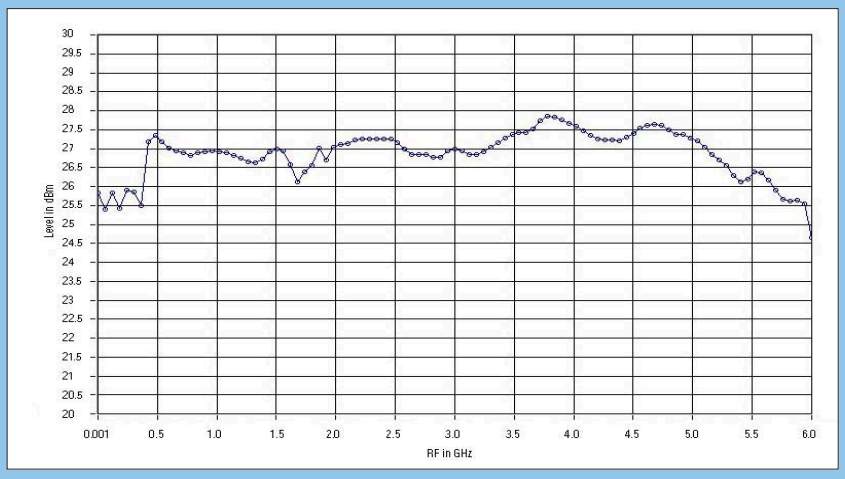
When it comes to SSB phase noise performance, the R&S®SMB100A consistently achieves excellent values over the entire frequency range from 9 kHz to 6 GHz. This is due to its remarkable concept. The R&S®SMB100A works down to 23.3475 MHz with frequency dividers. Below this value, the integrated DDS synthesizer generates the output signal directly. In contrast, conventional designs use a mixer range below approx. 250 MHz, which results in a much worse phase noise performance. The R&S®SMB100A is thus 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 thus 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.



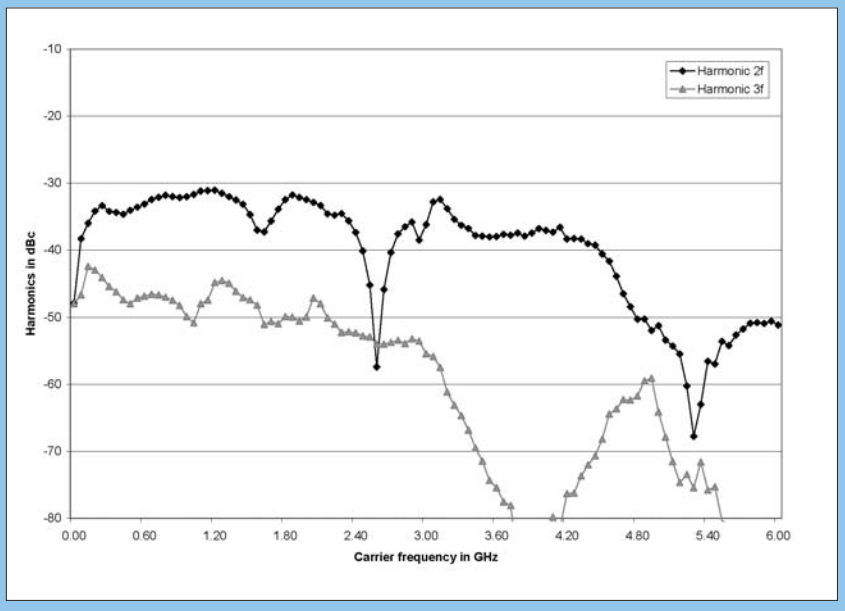
Typical SSB phase noise with internal OCXO (R&S®SMB-B1 option)



Typical SSB phase noise at 20 kHz offset versus frequency with internal OCXO (R&S®SMB-B1 option)



Measured maximum output power versus frequency



Measured harmonics at +18 dBm versus frequency

High output power as standard

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 6 GHz. The maximum available output power is typ. +25 dBm (and thus even 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. Its high output power makes the R&S®SMB100A ideal for controlling high-power devices such as high-level mixers.

What's special about the R&S®SMB100A is that harmonics are still suppressed with typ. –30 dBc even at an output power of +18 dBm.

But even in the lower level range, the R&S®SMB100A makes no compromise in quality. The RF level can be set down to –145 dBm as standard. Thus, the generator is ideally suited for sensitivity measurements on receivers.

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

On-site servicing as convenient alternative

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

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 cuts the time required for troubleshooting and repair to a minimum. Moreover, if a module has to be replaced, the R&S®SMB100A does not need to be recalibrated 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 within only 45 minutes on average.

All corrections necessary after a repair are carried out fully automatically by the instrument itself. To additionally optimize level accuracy after servicing, a new level correction can be performed in a fully automated manner by means of an R&S®NRP-Zxx power sensor that is connected to the R&S®SMB100A.

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

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

All-purpose RF source

The signal generator's wide frequency range, high output power, plus a wide variety of possible 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 6 GHz covers ISM bands as well as all important mobile radio bands.

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 only minimum distortion. For example, AM-modulated signals in the high-frequency range are generated with a total harmonic distortion of typ. only 0.1%.

The standard overvoltage protection 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.

The generator's compact size of only two height units and ¾ 19" width coupled with its low weight of only about 5 kg make it ideal for mobile use. It easily fits into any lab and service center, where space is often at a premium.

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.

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 of special advantage in environments such as service labs where there is often no GPIB.

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. 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.

Ideal for production

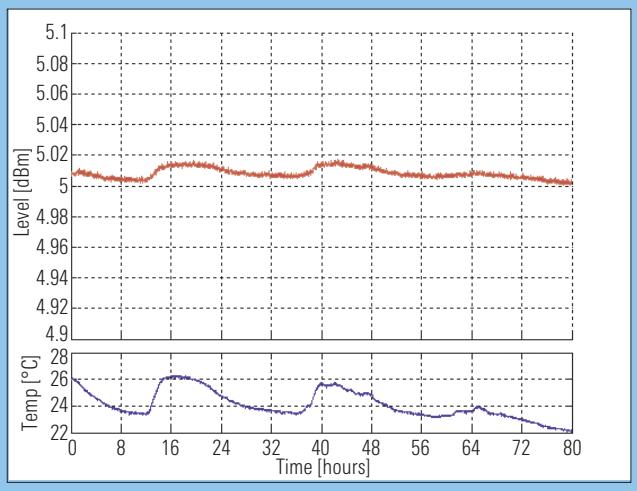
Especially in production environments, a generator's maximum output power is a key criterion when it comes to compensating for any power loss that may occur. This is where the R&S®SMB100A comes into its own, featuring >+18 dBm. Thus, it can replace external power amplifiers, saving space and reducing setup costs.

The wearfree electronic attenuator 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. Moreover, the standard overvoltage protection shields the R&S®SMB100A against high reverse power or DC voltage on the RF line.

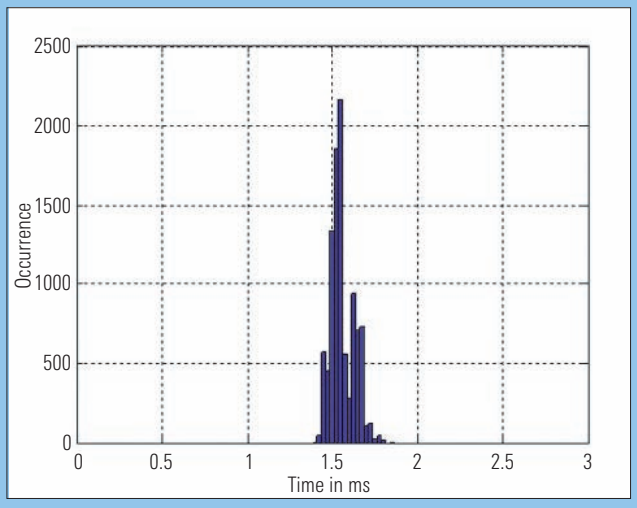
The R&S®SMB100A offers a very high level sweep range of typ. –145 dBm to +25 dBm as standard, as well as high level accuracy and repeatability over the entire range. Measurements within narrow limits can thus be performed with high reproducibility, boosting production yield.

Another criterion in production is short setting time of the test instrument in order to achieve high throughput. The R&S®SMB100A meets this requirement by achieving short frequency (typ. 1.6 ms) and level (typ. 1.2 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.

The extremely compact design of the R&S®SMB100A with only two height units makes it easy to integrate the instrument into any test system, thus saving precious rack space.



Measured level repeatability at 3 GHz, 5 dBm, ALC ON



Measured frequency setting time statistics for remote control over 10000 settings

Ready for aerospace and defense applications

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-K22) and pulse generator (R&S®SMB-K23) with superb characteristics. The pulse modulator, for example, makes it possible to perform radar tests with a high on/off ratio of typ. 90 dB and very short rise/fall times of typ. 4 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.

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.

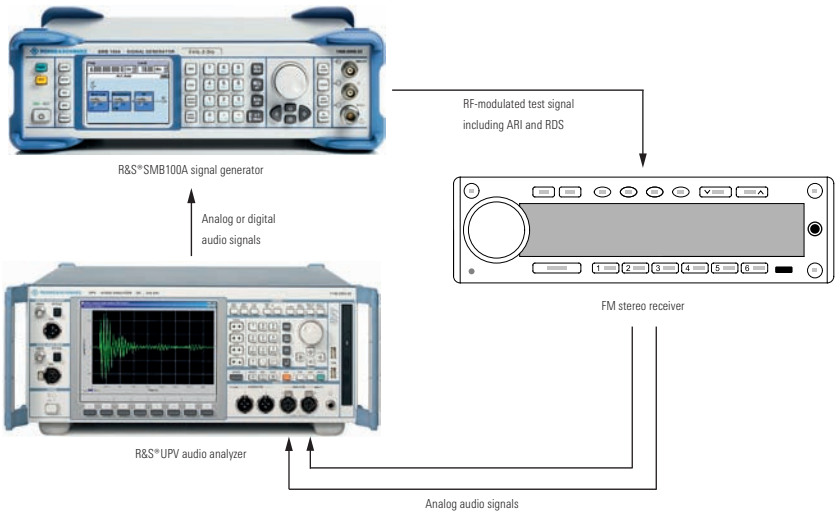
To meet requirements for secured areas, an erase and sanitize procedure is being developed that reliably erases user data. This ensures that no sensitive data will leave the secured area. Moreover, LAN and USB ports can be disabled by means of a security password.

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.

The optional stereo/RDS coder (R&S®SMB-B5) 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.

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, thus allowing basic functional tests to be carried out without an external signal.



Typical test setup with R&S® UPV audio analyzer

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 audio analyzer creates a general-purpose test system for FM receivers. The great advantage is the automatic synchronization of measurement results. Just 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. Since generation and analysis are optimally timed, measurement times are considerably shorter than with separately operating instruments.

The R&S®SMB100A with the R&S®SMB-B5 option generates the stereo multiplex signal, 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 64000 characters per sequence, longer RDS applications such as radio text can be tested as well.

Summary of benefits

Best signal quality in the mid-range expands the instrument's scope of use and ensure high measurement accuracy in the diverse applications of the R&S®SMB100A. The high signal quality and repeatability of the R&S®SMB100A make for narrow measurement limits which are essential in increasing production yield.

High output power as standard offers sufficient level for high-power DUTs or compensates for attenuation in the signal flow toward the DUT. The R&S®SMB100A makes external amplifiers superfluous, thus streamlining the test setup.

On-site servicing as convenient alternative enables users to perform servicing themselves. On-site servicing improves maximum instrument availability and optimizes cost of ownership due to cost-efficient and convenient maintenance. Customers can, of course, also call on a certified Rohde&Schwarz service center to handle the job.

The excellent R&S®SMB100A offers a unique price/performance ratio and sets new standards in the mid-range.

Specifications in brief

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
Setting time	SCPI mode List mode	<3 ms, typ. 1.6 ms <1 ms
Level		
Maximum output power	f = 1 MHz to 6 GHz	>+18 dBm up to +25 dBm in Overrange mode
Level uncertainty	f = 200 kHz to 3 GHz	<0.5 dB
Setting time	SCPI mode List mode	<2.5 ms, typ. 1.2 ms <1 ms
Back-feed	f = 1 MHz to 1 GHz f = 1 GHz to 2 GHz f = 2 GHz to 6 GHz	50 W / 50 V 25 W / 50 V 10 W / 50 V
Spectral purity		
Harmonics	level ≤8 dBm, f > 1 MHz	<–30 dBc
Nonharmonics	carrier offset >10 kHz, f ≤ 1500 MHz	<–70 dBc (typ. –85 dBc)
SSB phase noise	f = 1 GHz carrier offset = 20 kHz 1 Hz measurement bandwidth	<–122 dBc (typ. –128 dBc)
Wideband noise	level > 5 dBm carrier offset >10 MHz 1 Hz measurement bandwidth	<–142 dBc (typ. –152 dBc)
Supported modulation modes		
AM		standard
AM depth		0 to 100 %
FM/φM		standard
Maximum FM deviation	f > 3 GHz	16 MHz
Maximum φM deviation	f > 3 GHz	160 rad
Pulse		optional (R&S®SMB-K22 pulse modulator)
Rise/fall time		<20 ns, typ. 4 ns
Minimum pulse width	using the optional pulse generator (R&S®SMB-K23)	10 ns
On/off ratio		>80 dB
Connectivity		
Remote control		IEC/IEEE bus Ethernet (TCP/IP) USB
Peripherals		USB

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
Reference Oscillator OCXO	R&S®SMB-B1	1407.3005.02
Stereo/RDS Coder	R&S®SMB-B5	1407.3205.02
Pulse Modulator	R&S®SMB-K22	1407.3770.02
Pulse Generator	R&S®SMB-K23	1407.3786.02
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
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
Service options		
Two-Year Calibration Service	R&S®CO2SMB100A	please contact your local 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 device)	R&S®SMB-DKD	1161.3607.02

[1] The base unit must be ordered together with an R&S®SMB-B101/R&S®SMB-B102/R&S®SMB-B103/R&S®SMB-B106 frequency option.

Certified Quality System
ISO 9001
DQS REG. NO 1954 QM

Certified Environmental System
ISO 14001
DQS REG. NO 1954 UM

For data sheet, see 5213.8396.22
and www.rohde-schwarz.com
(search term: SMB100A)

ROHDE&SCHWARZ

www.rohde-schwarz.com
Europe, Latin America, Africa, Middle East Tel. +49 1805 124242* or +49 89 4129 13774 customersupport@rohde-schwarz.com
North America +1-888-837-8772 customersupport@rohde-schwarz.com
Asia | Pacific +65 65 130 488 customersupport@rohde-schwarz.com