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R&S®SMA100A
Signal Generator
The new standard of excellence in the analog signal generator class



ROHDE&SCHWARZ

Test & Measurement

Product Brochure | 07.00

R&S®SMA100A Signal Generator

At a glance

Signal quality, speed and flexibility – these are the criteria by which signal generators are measured today. The R&S®SMA100A perfectly meets these criteria, and thus is a premium-class analog generator that sets new standards due to its outstanding characteristics.

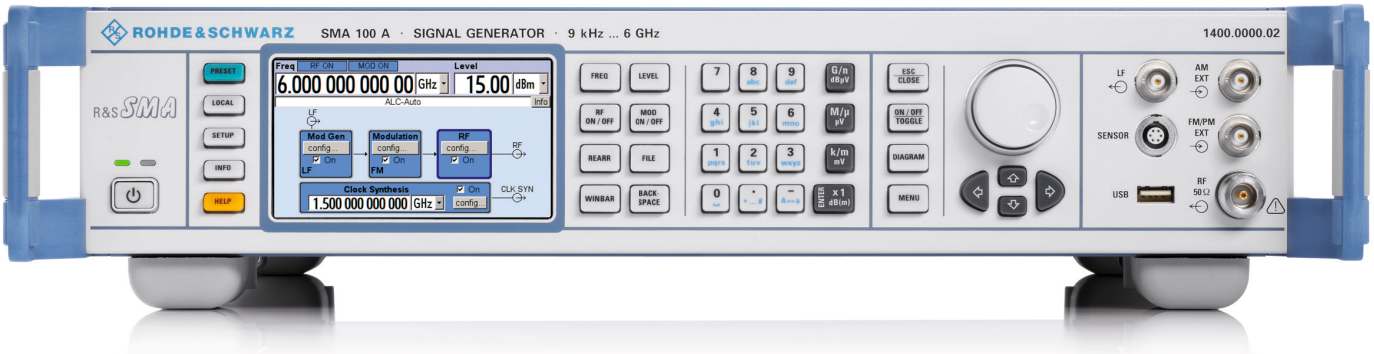
The R&S®SMA100A combines superior signal quality with very high setting speed, which makes it ideal for any task. Whether in development, production, service or maintenance, the R&S®SMA100A does an excellent job.

In the frequency range from 9 kHz to 6 GHz, it can generate CW signals as well as all common types of analog modulation (AM, FM, φM, pulse modulation). Excellent specifications and a wide range of modulation signals – these are the characteristic features of the R&S®SMA100A.

In addition, a low-jitter clock synthesizer option supplies differential clock signals of up to 1.5 GHz independently of the RF frequency. This makes the R&S®SMA100A suitable for a variety of applications – from use in phase noise test systems through to tests on mixed-signal ICs.

The R&S®SMA100A signal generator also offers a modern graphical user interface for fast and intuitive operation.

The R&S®NRP-Zxx power sensors can be connected to the R&S®SMA100A. The user can therefore perform very precise power measurements directly with the signal generator.



R&S®SMA100A Signal Generator

Benefits and key features

Excellent signal quality

- Very low SSB phase noise of typ. –134 dBc (20 kHz carrier offset, f = 1 GHz, 1 Hz measurement bandwidth), typ. –141 dBc with the R&S®SMA-B22 enhanced phase noise performance option
- Wideband noise of –162 dBc (meas.) with carrier offset > 40 MHz, f = 1 GHz, level = 9 dBm, 1 Hz measurement bandwidth
- Nonharmonics < –96 dBc (carrier offset > 10 kHz, f < 750 MHz, with the R&S®SMA-B22 option)
- High-stability reference oscillator as standard
- Very low phase noise at low frequencies due to internal division of the fundamental frequency range (750 MHz to 1500 MHz) down to 6.6 MHz

▷ page 4

Ideal for use in production

- Very short frequency/level setting times of < 700 µs (meas.) across the entire frequency and level range, < 450 µs in List mode
- Fast Hopping mode with flexibly addressable frequency and level pairs, as fast as normal List mode
- Frequency setting time of typ. 10 µs within a bandwidth of up to 80 MHz due to direct access to the DDS-based synthesizer (with the R&S®SMA-B20 or R&S®SMA-B22 option; FM EXTERNAL DIGITAL mode)
- Very high level accuracy and repeatability
- High output power of up to +18 dBm, overrange up to +28 dBm
- Electronic attenuator with built-in overvoltage protection over entire frequency range
- Minimum space requirements due to compact size (only two height units)

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All-purpose instrument

- Frequency range of 9 kHz to 3 GHz (R&S®SMA-B103/ R&S®SMA-B103L) or 6 GHz (R&S®SMA-B106/ R&S®SMA-B106L)
- Frequency, level and LF sweeps
- Phase-continuous frequency setting
- AM, broadband FM/φM (R&S®SMA-B20 or R&S®SMA-B22), pulse modulation
- Built-in LF generator up to 1 MHz, optional multifunction generator (R&S®SMA-K24) up to 10 MHz
- Optional low-jitter clock synthesizer up to 1.5 GHz (R&S®SMA-B29)
- Power measurement using R&S®NRP-Zxx power sensors
- Optional power analysis (R&S®SMA-K28) using R&S®NRP-Zxx power sensors for scalar network analysis or automatic pulse parameter measurement

▷ page 6

Aerospace and defense applications

- Pulse modulator with excellent characteristics (on/off ratio of > 100 dB (meas.) for f < 5.5 GHz, rise/fall time typ. < 7 ns)
- Pulse generator integrated as standard
- Optional high-performance pulse generator with minimum pulse width of 10 ns (R&S®SMA-K23)
- Optional generation of versatile pulse sequences/pulse trains (R&S®SMA-K27)
- Optional chirp modulation (R&S®SMA-B20 or R&S®SMA-B22)
- Optional VOR/ILS modulation (R&S®SMA-K25)
- Optional DME modulation/analysis (R&S®SMA-K26)
- Optional operating altitude up to 4600 m (R&S®SMA-B46)
- Optional removable mass storage (CompactFlash™ card, R&S®SMA-B80)

▷ page 8

Intuitive operating concept and versatile interfaces

- Color display with 480 × 272 pixel
- Intuitive user interface with graphical display of signal flow (block diagram)
- Context-sensitive online help
- Remote control via GPIB, LAN or USB
- Selectable control language (SCPI or remote control emulation of various signal generators)
- Remote operation by browser or VNC client
- USB connectors (e.g. for keyboard, mouse, memory stick)
- Support of R&S®NRP-Zxx power sensors for precise power measurements

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Excellent signal quality

The R&S®SMA100A is the ideal solution for measurement applications requiring high spectral purity, e.g. adjacent-channel or phase-noise measurements. It is also optimal for use as a local oscillator or quartz replacement.

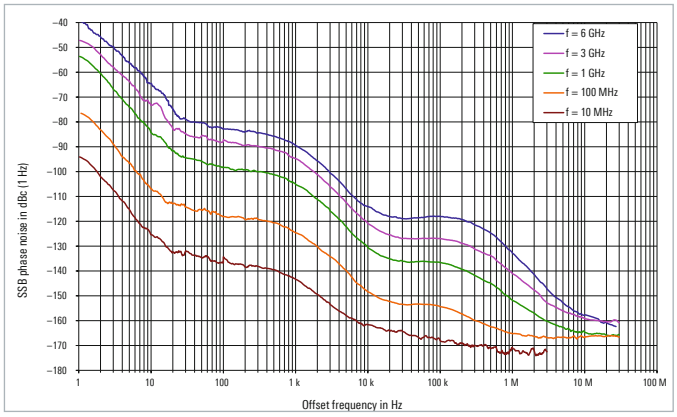
Due to an innovative synthesizer concept, the standard version of the instrument already offers excellent values in terms of broadband noise, SSB phase noise and nonharmonics suppression. The R&S®SMA-B22 enhanced phase noise performance and FM/φM modulator option even further improves SSB phase noise for frequency offsets of up to approx. 100 kHz as well as nonharmonics suppression. For frequencies below 3 GHz the PLL bandwidth can be changed in order to optimize the SSB phase noise for offset frequencies beyond 100 kHz. The R&S®SMA100A is therefore the ideal signal source for measurement tasks that place exacting requirements on spectral purity (e.g. A/D and D/A converter tests).

Frequency synthesis is implemented by division of the fundamental frequency range (750 MHz to 1500 MHz) down to 6.6 MHz. In the lower frequency range from 6.6 MHz, this yields spectral purity on par with that of high-grade crystal oscillators.

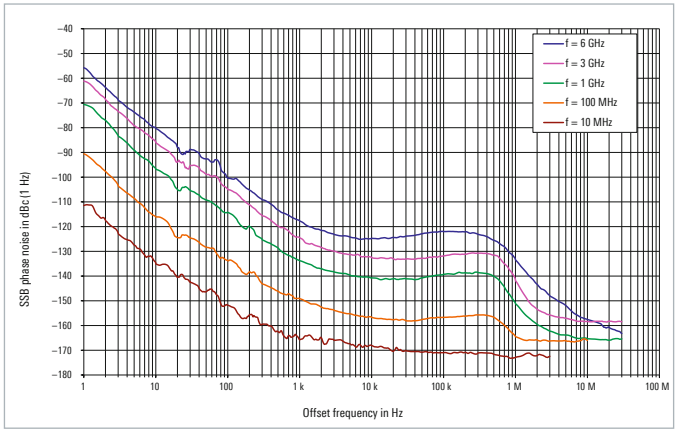
The oven-controlled crystal oscillator (OXCO) built in as standard provides very high frequency accuracy and stability. These characteristics are even further improved with the R&S®SMA-B22 option.

In summary, the R&S®SMA100A's outstanding signal quality makes it THE analog state-of-the-art signal generator for even the most exacting demands.

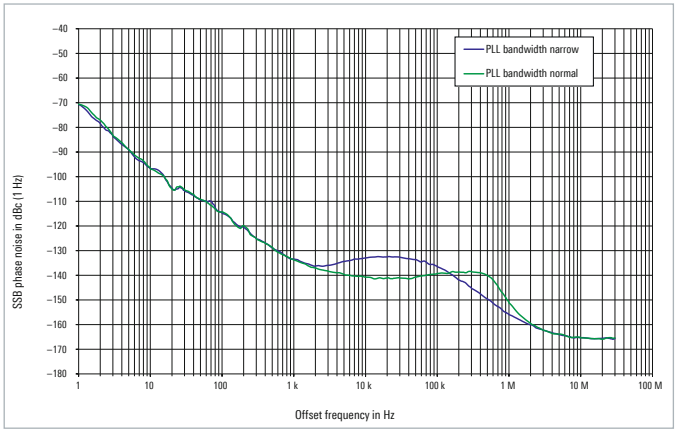
Measured SSB phase noise with internal reference oscillator (standard instrument).



Measured SSB phase noise with internal reference oscillator (with the R&S®SMA-B22 enhanced phase noise performance and FM/φM modulator option).



Measured SSB phase noise, f = 1 GHz (with R&S®SMA-B22 enhanced phase noise performance and FM/φM modulator option), comparison of PLL bandwidth normal and narrow (only available for f ≤ 3 GHz).



Ideal for use in production

In production and ATE applications, the test equipment must provide short setting times in order to ensure high throughput and low measurement costs.

The R&S®SMA100A features the very short level and frequency setting times that Rohde&Schwarz signal generators are known for and is thus an ideal choice in time-critical measurement systems. Frequency/level setting times are already shorter than 1.2 ms/1 ms in normal operation. A further significant reduction (< 450 µs) is achieved in the List mode, which uses frequency and level settings previously stored in a list.

In the Fast Hopping mode, the R&S®SMA100A features setting times as short as in the List mode. In contrast to the List mode, up to 10000 frequency and level pairs can be addressed as desired via a serial bus.

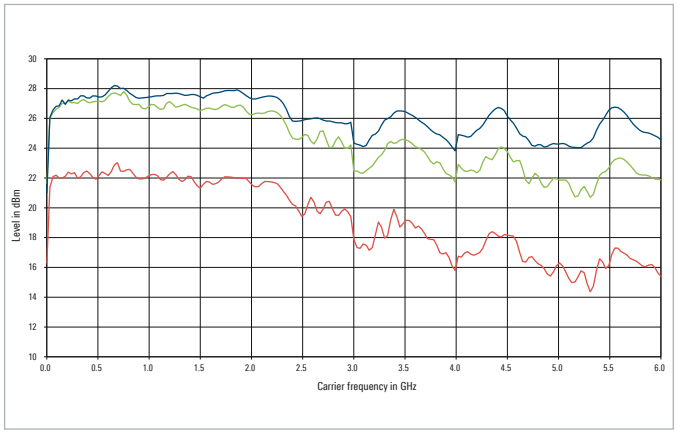
The electronic attenuator enables rapid and wear-free level setting of the generator. The level setting range is –145 dBm to +13 dBm (+20 dBm overrange) for f ≤ 3 GHz, and –145 dBm to +9 dBm (+16 dBm overrange) for f > 3 GHz. Higher output levels of +24 dBm to +28 dBm over the entire frequency range can be provided by using the relay-switched high-power bypass implemented in the R&S®SMA100A. Overvoltage protection is integrated as standard over the entire frequency range.

For applications requiring a level setting range not exceeding 30 dB, a more favorably priced solution is available in the form of a frequency option without an attenuator (R&S®SMA-B103L/R&S®SMA-B106L).

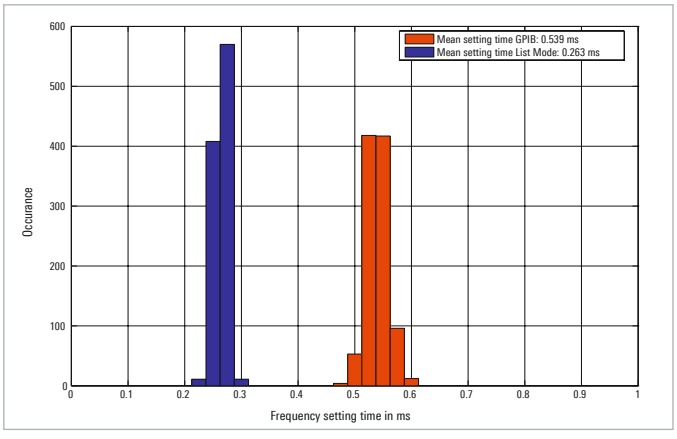
The high level accuracy and repeatability of the R&S®SMA100A help ensure results of utmost precision in series measurements.

With a compact size of only two height units, the signal generator takes up minimum space in 19" racks.

Maximum available power, attenuator mode NORMAL (lower trace) or HIGH POWER (center trace) and without attenuator (upper trace).



Histogram over 1000 frequency setting time measurements with GPIB remote control and list mode.



All-purpose instrument

The signal generator has a lower frequency limit of 9 kHz, which makes it suitable for use in EMC applications. The upper frequency limit is 3 GHz or 6 GHz.

Amplitude and pulse modulation are provided as standard; frequency and phase modulation with a bandwidth of 10 MHz can be implemented optionally (R&S®SMA-B20/R&S®SMA-B22).

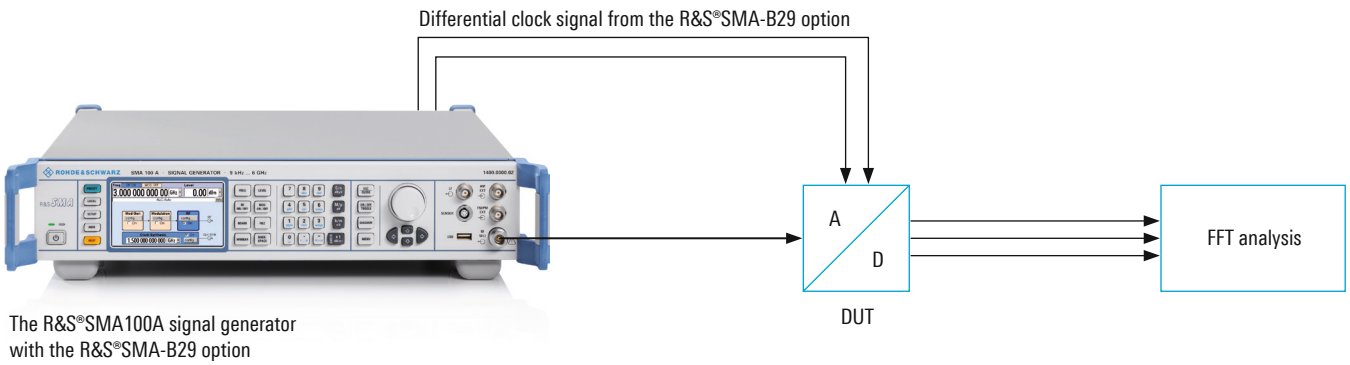
The R&S®SMA-B22 enhanced phase noise performance and FM/φM modulator option offers different setting modes in which the user can optimally set the modulation bandwidth and SSB phase noise.

These characteristics make the R&S®SMA100A suitable for phase noise measurements on free-running VCOs, eliminating the need for complex delay-line measurements.

Tests on integrated RF circuits frequently require a pure clock signal in addition to the RF signal. In the past, an extra signal generator was usually necessary in this case. The R&S®SMA100A delivers a low-jitter clock signal (R&S®SMA-B29 clock synthesizer option), which can be set independently of the RF output signal. The clock signal is available as a differential signal in the frequency range from 100 kHz to 1.5 GHz at two separate connectors. It enables, for example, A/D converter tests using only a single signal generator.

The application note "Selecting a Signal Generator for Testing A/D Converters" (1GP66) can be downloaded from the Rohde&Schwarz website (Application Notes download area).

Application example: A/D converter test with the R&S®SMA100A



The R&S®SMA100A signal generator with the R&S®SMA-B29 option

The RF signal can be internally modulated by means of the built-in LF generator or the optional multifunction generator (R&S®SMA-K24). The multifunction generator supplies various waveforms including sine wave, square wave, user-programmable trapezoidal waveforms or noise with selectable bandwidth. Modulation signals can be added together, with different weighting applied to the individual signals. The modulation signals for AM/FM/φM and for the LF output can be set independently of one another. Based on this concept, the new signal generator offers a level of modulation flexibility previously unknown in analog signal generators. For example, all types of two-tone modulation can be implemented; the user can add together two internal modulation signals or one external and one internal signal.

Using noise as a modulation signal, the R&S®SMA100A generates defined and adjustable phase or FM noise to simulate, for example, a VCO or an interference signal of variable spectral purity for receiver tests.

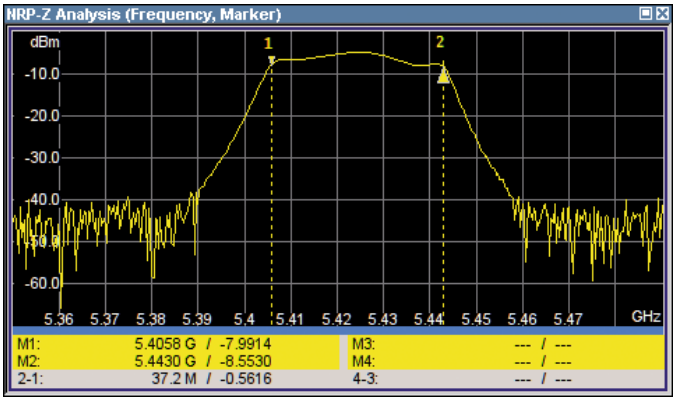
Moreover, the R&S®SMA-B20 and R&S®SMA-B22 FM/φM modulator options can be used to implement extremely fast frequency changes (across a limited frequency range). Direct access to the DDS-based synthesizer yields frequency setting times of nominally 10 µs across a range of max. 80 MHz. This allows fast frequency-hopping transmitters to be simulated, for example.

The R&S®SMA-K28 power analysis option makes it possible to use the R&S®NRP-Zxx power sensors to measure and display power versus frequency, power and time. The user does not need any additional equipment to quickly and simply carry out sophisticated power analysis.

Power analysis applications

Measurement of level versus	Application
Frequency	▪ Scalar network analysis ▪ VSWR measurement (with directional coupler)
Power	▪ Measurement of amplifier characteristics/compression points
Time	▪ Automatic analysis of pulse parameters ▪ Gated power measurements

Scalar network analysis: characterization of a bandpass filter.



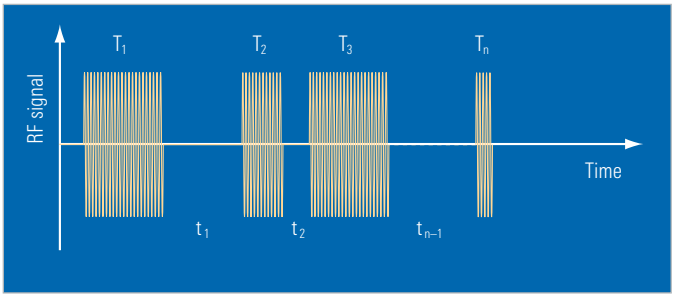
Aerospace and defense applications

For pulse modulation, the R&S®SMA100A includes as standard a high-quality pulse modulator with an on/off ratio of > 80 dB and a rise/fall time of typ. 7 ns as well as a basic pulse generator. Optionally, a high-performance pulse generator with a minimum pulse width of 10 ns, a resolution of 5 ns and a variety of setting options is available (R&S®SMA-K23).

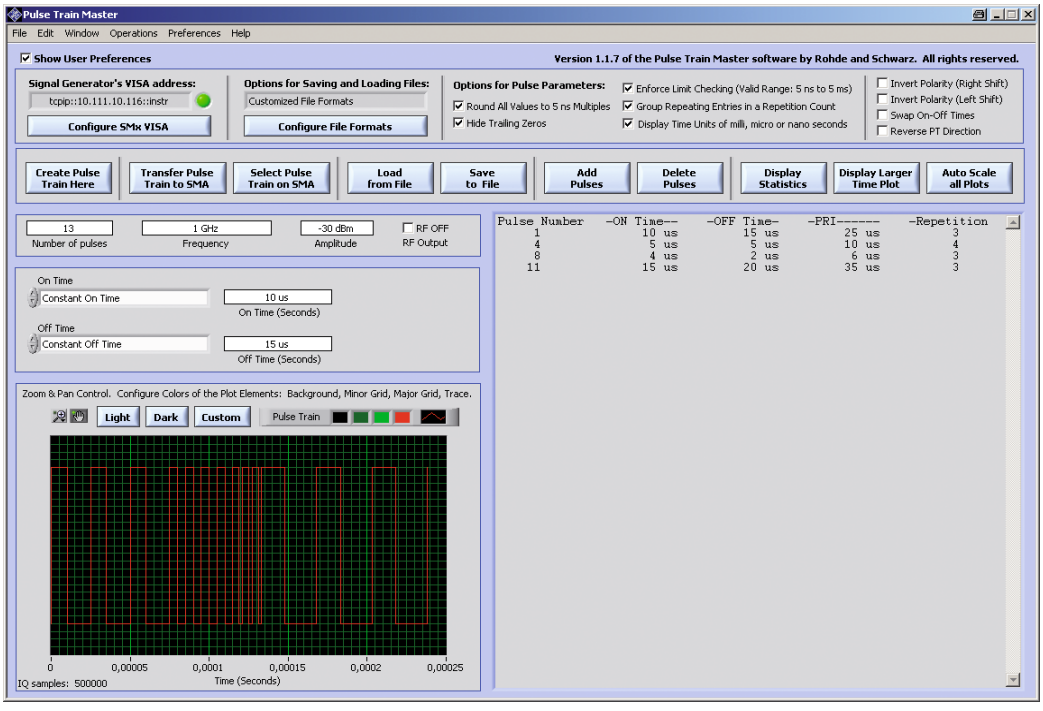
An optional feature of the built-in pulse generator is the generation of pulse trains (R&S®SMA-K27 option), which are commonly used for radar applications. An example of a pulse train is shown in the figure on the left. In contrast to single or double pulses, pulse trains are a combination of different pulses, which can be a periodical or non-periodical set of pulses.

The application note "Pulse Train Master for the R&S®SMF and R&S®SMA Signal Generators" (1MA148, available from the Application Notes download area on the Rohde&Schwarz website) comes with a software that enables the user to easily create and transfer pulse trains between a PC and an R&S®SMA100A signal generator.

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



Simple creation and transfer of pulse trains with the Pulse Train Master application software.



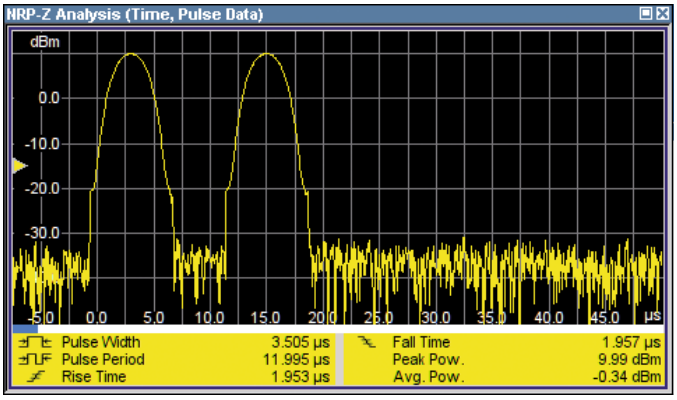
The R&S®SMA100A offers internal (linear) chirp generation up to an 80 MHz chirp bandwidth without the need for external synchronization. Frequency and pulse modulation are synchronized internally. This feature can be used in radar applications, for example.

When equipped with the R&S®SMA-K25 option, the R&S®SMA100A can generate avionics signals (VOR/ILS) in accordance with ICAO standards. Due to its low modulation error and very high level accuracy, the R&S®SMA100A is the optimal high-precision VOR/ILS signal source for testing avionics receivers.

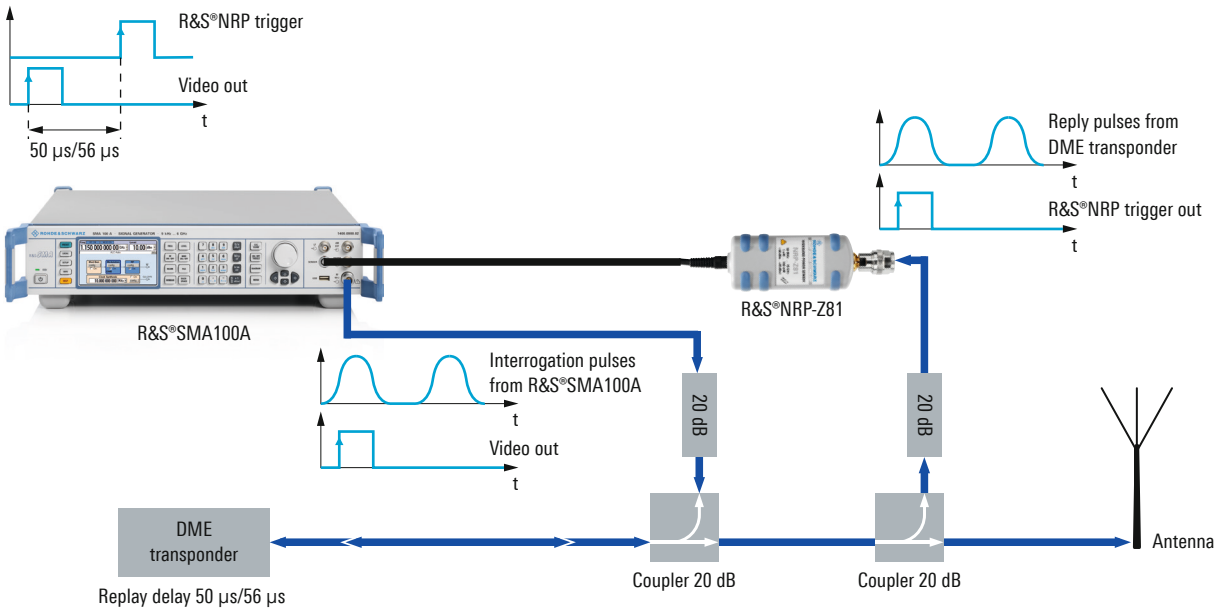
The R&S®SMA100A signal generator, together with the R&S®SMA-K26 DME modulation option, lets the user create standard-compliant distance measurement equipment (DME) signals. The user can easily create the DME interrogation signal (simulation of an airplane interrogator) or the ground station's response signal and test the components or DME receiver in a flexible manner.

The R&S®NRP-Z81 wideband power sensor can also be connected directly to the R&S®SMA100A signal generator to analyze DME signals. This provides a convenient way to measure the reply delay and reply efficiency of the ground station or the DME average peak power and pulse repetition rate.

Automatic DME pulse measurement with the R&S®SMA-K28 pulse analysis option.



Test setup for DME analysis



If the R&S®SMA100A signal generator is equipped with the R&S®SMA-K28 power analysis option, the DME double pulse parameters can be simply displayed and automatically measured. This eliminates the need for other measurement equipment such as oscilloscopes and RF detectors.

The application note “Test of DME Transponders” (1GP74) can be downloaded from the Rohde&Schwarz website (Application Notes download area).

For areas where security is an issue, an ejector option (R&S®SMA-B80) is available, by means of which the mass storage medium (CompactFlash™ card containing all stored settings) can be removed from the instrument.

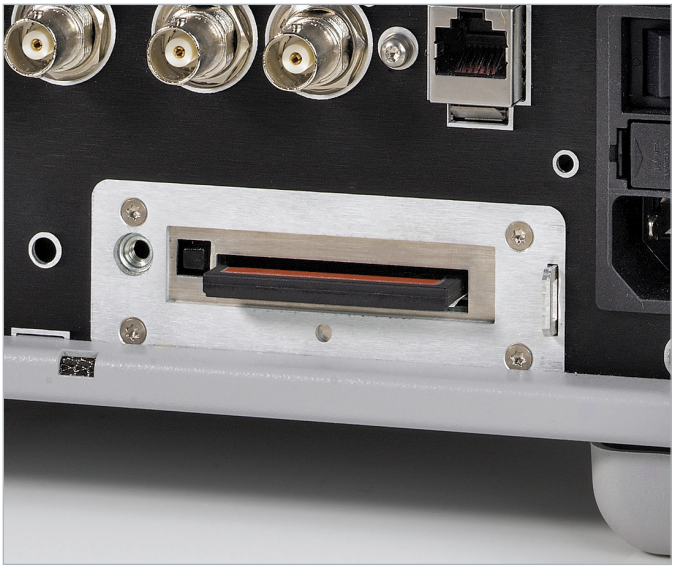
A sanitizing procedure for the R&S®SMA100A is also available.

Furthermore, the USB and LAN interfaces can be disabled.

For further security-related details, please refer to the “Instrument Security Procedures”, which can be downloaded from the Rohde&Schwarz website (R&S®SMA100A > Downloads > Security).

When the R&S®SMA-B46 operating altitude option is installed, the R&S®SMA100A can even be used up to an altitude of 4600 m.

CompactFlash™ card ejector on instrument rear panel.



Intuitive operating concept and versatile interfaces

Intuitive operating concept

The signal flow is shown by a straightforward block diagram on the R&S®SMA100A color display (480 × 272 pixel). Thus, the user can immediately see the activated and deactivated generator blocks as well as where settings can be made.

The entire operating manual for the R&S®SMA100A signal generator is integrated into the instrument's help system. At the press of a button, the user can access details about the function currently being used. For example, it is very easy to display the associated remote-control command.

To make settings, the rotary knob, the cursor and function keys or a USB mouse and/or keyboard can be used.

The above features combine to make operation of the R&S®SMA100A easy and intuitive.

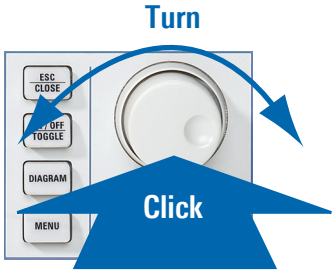
Connectors

The R&S®SMA100A can be remote-controlled via GPIB or LAN and also manually operated from an external PC using remote desktop control (VNC).

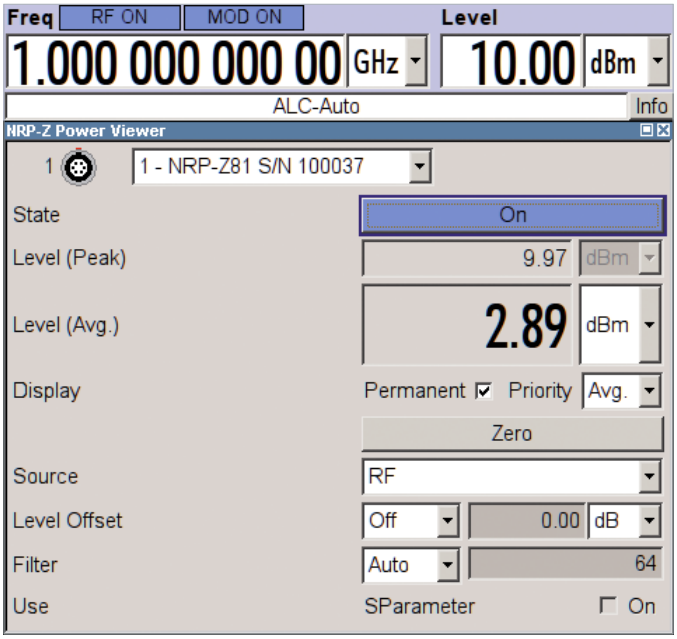
Two USB connectors on the front and the rear panel allow the use of USB devices such as a mouse or a memory stick.

The R&S®NRP-Zxx USB power sensors can also be connected directly to the R&S®SMA100A. The user can then easily carry out highly precise power measurements in the existing test setup without requiring an additional power meter base unit.

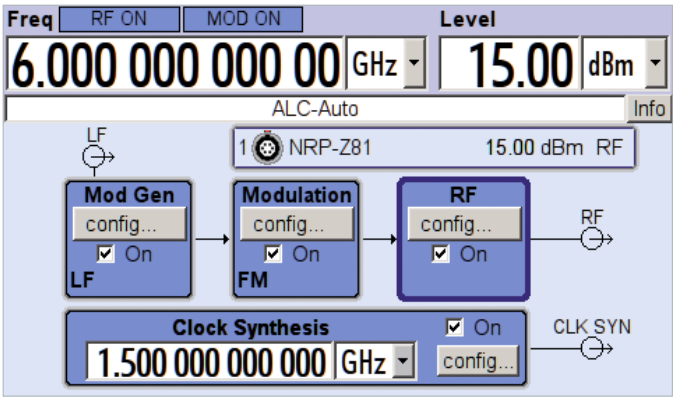
Rotary knob for menu navigation



Power measurement dialog on the R&S®SMA100A.



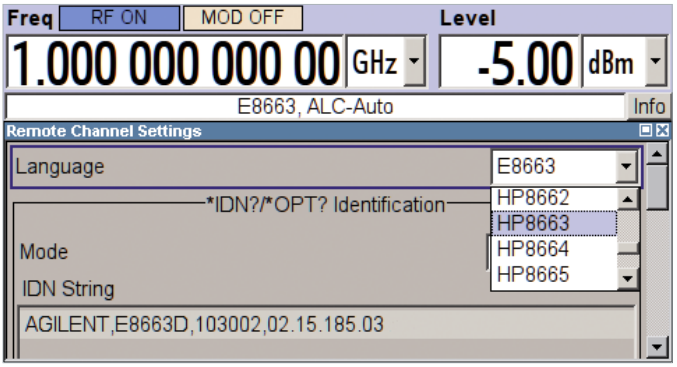
Block diagram of the R&S®SMA100A with power measurement display.



Selectable control language

In addition to the standard SCPI remote-control command set, the R&S®SMA100A offers emulations of common analog signal generators. If these generators are no longer manufactured or if they can no longer be repaired, the user can easily replace them with the R&S®SMA100A. This eliminates the time- and budget-consuming task of rewriting the remote-control software. A list of all supported emulations of analog signal generators can be found in the data sheet (order number PD 5213.6412.22).

Selection of GPIB command set.



Rear view of the R&S®SMA100A and its versatile interfaces.



Specifications in brief

Base unit	
Frequency	
Frequency range	9 kHz to 3 GHz/6 GHz
Setting time	< 1.2 ms
Level	
Range	–145 dBm to +18 dBm (up to +28 dBm overrange)
Setting time	< 1.0 ms
Setting time in List mode/Fast Hopping mode	< 450 µs
Spectral purity (at f = 1 GHz)	
Nonharmonics (carrier offset > 10 kHz, f ≤ 1500 MHz)	< –80 dBc < –92 dBc with the R&S®SMA-B22 option
SSB phase noise (20 kHz carrier offset, 1 Hz measurement bandwidth)	< –131 dBc (–134 dBc typ.) < –137 dBc (–141 dBc typ.) with the R&S®SMA-B22 option
Wideband noise (carrier offset > 10 MHz, 1 Hz measurement bandwidth, 750 MHz < f ≤ 1500 MHz)	< –153 dBc (–160 dBc, meas.)
Supported modulation modes	
AM	standard
FM/φM	optional (with the R&S®SMA-B20/R&S®SMA-B22 options)
Pulse	standard
Chirped pulses	optional (with the R&S®SMA-B20/R&S®SMA-B22 options)
VOR/ILS	optional (with the R&S®SMA-K25 option)
DME	optional (with the R&S®SMA-K26 option)
Clock synthesis	
Frequency range	100 kHz to 1.5 GHz (with the R&S®SMA-B29 option)
Interfaces	IEEE 488.2, LAN (10/100BaseT), 2 × USB, 1 × USB slave

Ordering information

Designation	Type	Order No.
Signal Generator [1] including power cable, Quick Start Guide and CD-ROM (with operating and service manual)	R&S®SMA100A	1400.0000.02
Options		
RF Path		
9 kHz to 3 GHz, with electronic attenuator	R&S®SMA-B103	1405.0209.02
9 kHz to 6 GHz, with electronic attenuator	R&S®SMA-B106	1405.0809.02
9 kHz to 3 GHz, without attenuator	R&S®SMA-B103L	1405.0609.02
9 kHz to 6 GHz, without attenuator	R&S®SMA-B106L	1405.1005.02
FM/φM Modulator	R&S®SMA-B20	1405.1605.02
Enhanced Phase Noise Performance and FM/φM Modulator	R&S®SMA-B22	1405.1805.02
Clock Synthesizer	R&S®SMA-B29	1400.2503.02
Operating Altitude up to 4600 m	R&S®SMA-B46	1405.1305.02
Removable Mass Storage (CompactFlash™ card)	R&S®SMA-B80	1405.2001.03
Rear Connectors	R&S®SMA-B81	1405.2401.02
High-Performance Pulse Generator	R&S®SMA-K23	1405.2801.02
Multifunction Generator	R&S®SMA-K24	1405.2901.02
VOR/ILS Modulation	R&S®SMA-K25	1405.3008.02
DME Modulation [2]	R&S®SMA-K26	1405.3408.02
Pulse Train [3] [4]	R&S®SMA-K27	1405.3908.02
Power Analysis	R&S®SMA-K28	1405.3959.02
Calibration		
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®SMA-DKD	1161.3571.00
Recommended extras		
Spare CompactFlash™ Card (R&S®SMA-B80 required)	R&S®SMA-Z10	1405.4004.02
19" Rack Adapter	R&S®ZZA-211	1096.3260.00
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
External USB DVD Drive	R&S®PSP-B6	1134.8201.22
Wideband Power Sensor (for R&S®SMA-K26 DME modulation and R&S®SMA-K28 power analysis)	R&S®NRP-Z81	1137.9009.02
Power Sensor, 9 kHz to 6 GHz, 33 dBm	R&S®NRP-Z92	1171.7005.02
USB Adapter for R&S®NRP-Zxx power sensors	R&S®NRP-Z4	1146.8001.02
USB Serial Adapter for RS-232-C remote control	R&S®TS-USB1	6124.2531.00

[1] The base unit must be ordered together with an R&S®SMA-B103/R&S®SMA-B103L or R&S®SMA-B106/R&S®SMA-B106L frequency option.
[2] The R&S®SMA-K26 option can be installed in an R&S®SMA100A with serial number 101500 or higher.
[3] Requires the R&S®SMA-K23 high-performance pulse generator option.
[4] The R&S®SMA-K27 option can be installed in an R&S®SMA100A with serial number 101500 or higher.

Service options		
Two-Year Calibration Service	R&S®CO2SMA100A	Please contact your local Rohde&Schwarz sales office.
Three-Year Calibration Service	R&S®CO3SMA100A	
Five-Year Calibration Service	R&S®CO5SMA100A	
One-Year Repair Service following the warranty period	R&S®RO2SMA100A	
Two-Year Repair Service following the warranty period	R&S®RO3SMA100A	
Four-Year Repair Service following the warranty period	R&S®RO5SMA100A	

For data sheet, see PD 5213.6412.22 and www.rohde-schwarz.com

Your local Rohde&Schwarz expert will help you determine the optimum solution for your requirements.
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R&S®SMA100A Signal Generator

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