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Designed for maximum performance

Signal quality, speed, and flexibility – these are three key criteria by which modern signal generators are assessed. To launch a microwave signal generator that is in the lead in each of these disciplines was the objective in designing the

R&S®SMF100A.

Generator of the premium class

To meet these exacting development objectives, Rohde & Schwarz has devised a completely new design concept for the R&S®SMF100A. The result is impressive: The generator's excellent spectral purity, high output level, short frequency and level setting times, and intelligent option concept make the R&S®SMF100A the ideal signal source for any type of application in R&D, production, maintenance, and repair.

While offering an architecture consistently geared to maximum performance, the generator is accommodated in a relatively small box. With a height of three units, a width of 19", and a depth of 550 mm, the generator takes up minimum space on your lab bench or in the rack. And its weight is also acceptable: no more than 18 kg including all options.

High-quality CW generator

To generate premium-quality CW signals in the range 1 GHz to 22 GHz or 43.5 GHz, the R&S®SMF100A requires no more than the R&S®SMF-B122 or the R&S®SMF-B144 frequency option. In its 22 GHz generator configuration, the instrument provides output power of $>+16$ dBm between 1 GHz and 11 GHz, and $>+14$ dBm up to 21 GHz. Between 21 GHz and 22 GHz, output power as high as $>+12$ dBm is available. Higher output power can be provided by using the R&S®SMF-B31 high output power option in addition to the R&S®SMF-B122 option: The generator then supplies $+25$ dBm up to 11 GHz, $+23$ dBm up to 21 GHz, and an extraordinary $+22$ dBm up to 22 GHz. FIG 1 shows the typical maximum output level versus frequency with and without the high output power option.

The level can be set from -20 dBm to the maximum value with a resolution of 0.01 dB. A high-speed, digital level control ensures low-drift, high-accuracy level setting as well as excellent level repeatability (FIG 2). With remote control, level setting takes less than 3 ms after the IEC/IEEE bus delimiter. And setting times are even shorter in the List mode, i.e. below 700 μ s. The List mode is a programmable mode for the sequential setting of maximally 65 000 frequency and level pairs. Intended primarily for frequency hopping, it can also be used for fast frequency and level sweeps.

Levels below -20 dBm are often required, for example to test the sensitivity of communications or radar receivers. For such purposes, various test specifications define power levels between -60 dBm and -110 dBm. This poses no problem for the R&S®SMF100A: The R&S®SMF-B26 step attenuator option for the 22 GHz device and the R&S®SMF-B27 step attenuator option for the 43.5 GHz device (both extremely reliable mechanical attenuators) expand the adjustable level range to -130 dBm.

High output levels in conjunction with short setting times are definitely essential for a premium-class microwave signal generator. A feature of equal importance is spectral purity. The R&S®SMF100A offers an excellent specified single-sideband (SSB) phase noise figure of <-115 dBc, measured at a frequency of 10 GHz at 1 Hz bandwidth and 10 kHz carrier offset. Typically, the generator even attains an unparalleled value of -120 dBc. This outstanding spectral purity makes the generator an ideal reference source for all SSB phase noise measurements in the microwave range. The optional R&S®SMF-B1 OCXO

More information, brochure and data sheet at www.rohde-schwarz.com (search term: SMF100A)



Brochure



Specifications

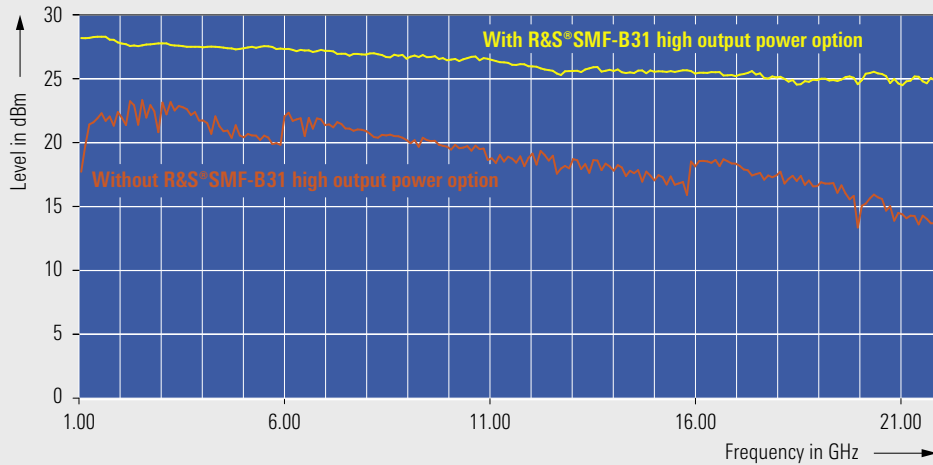


FIG 1 Maximum output power with and without high output power option.

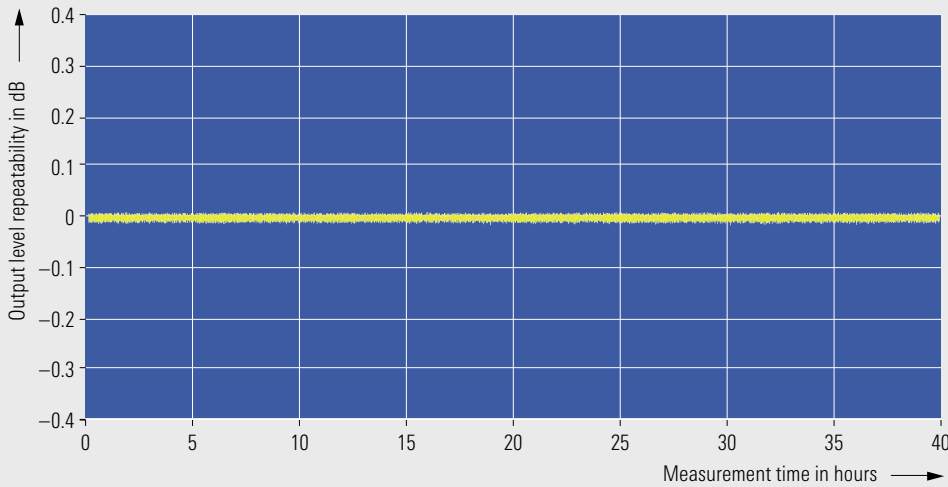


FIG 2 Level repeatability versus time (with random level and frequency changes carried out during the measurement time).

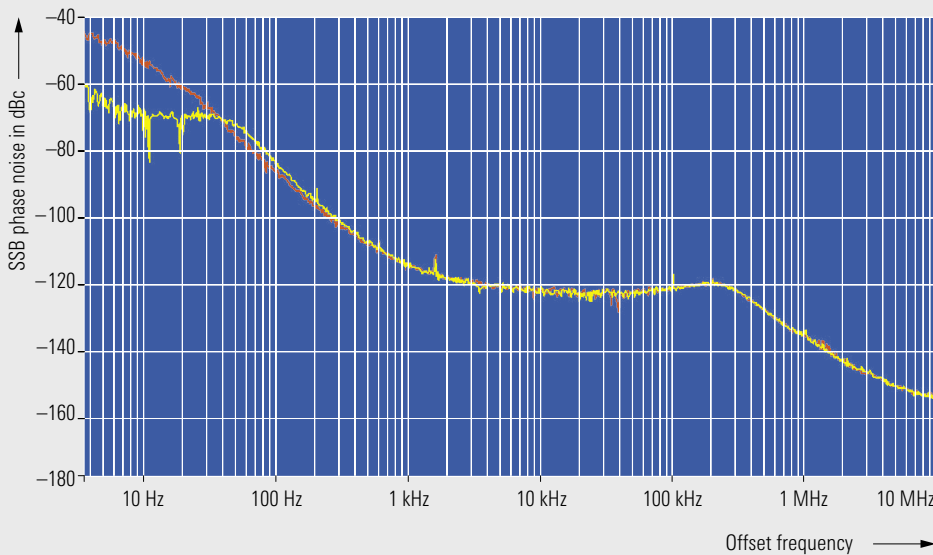


FIG 3 Typical SSB phase noise at 10 GHz (yellow: with the R&S®SMF-B1 option; red: without the R&S®SMF-B1 option).

reference oscillator further reduces phase noise close to the carrier (FIG 3).

The excellent SSB phase noise of the output signal is the result of an innovative frequency synthesis concept, which also offers other outstanding features: high frequency resolution of 0.001 Hz, extremely high accuracy, excellent stability and, last but not least, short setting times. With remote control, it takes no more than 4 ms to set any frequency within the full range of the generator to an accuracy of $<1 \times 10^{-7}$, as measured after the IEC/IEEE bus delimiter. These very short setting times are again significantly reduced in the List mode mentioned above: Use of this mode brings frequency and level setting times down to less than 700 μ s.

Highly flexible signal generator

Featuring a future-proof option concept, the R&S®SMF100A can be expanded from a CW generator to a signal generator as required. From the wide range of options, you can choose exactly what you really need:

- ◆ **R&S®SMF-K3 narrow pulse modulation** for pulse frequencies from 0 Hz to 10 MHz, featuring extremely short rise and fall times of <10 ns, an on/off ratio of >80 dB, and a minimum pulse width of <20 ns – ideal for radar and EMC measurements.
- ◆ **R&S®SMF-K23 pulse generator** for pulse periods from 20 ns to 100 s and pulse widths from 5 ns to 100 s. The option generates single and double pulses and thus ideally complements the narrow pulse modulator option.
- ◆ **R&S®SMF-B20 modulator** for AM, FM, ϕ M, and LOG AM featuring a modulation bandwidth of DC to 100 kHz for AM, DC to 10 MHz for FM, and DC to 1 MHz for ϕ M. The option also includes a noise generator, as well as two LF generators for sine-

wave, triangular, squarewave, and trapezoidal waveforms.

Other special features

The R&S®SMF100A can be manually operated via the front panel controls, or a USB keyboard and mouse via the two USB interfaces on the front panel. The R&S®SMF-B84 option provides two extra

USB interfaces on the rear panel for remote control of the generator and for an additional USB device.

In many applications, it is desirable to transfer instrument settings from one instrument to another quickly and without errors. The solution is to use a USB memory stick: Settings can be transferred to another R&S®SMF100A rapidly by using Save and Recall.

As a special feature, this microwave generator allows you to directly connect an R&S®NRP power sensor (FIG 4). The desired power can thus be set directly on the DUT and displayed on the generator – unaffected by cable loss or any components that may be connected between the generator and the DUT. ▶

FIG 4 A feature that affords many advantages: The high-precision R&S®NRP-Zxx power sensors can be connected directly to the generator.



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- ▶ The power sensor allows the generator output power to be set with extremely high precision – a vital asset in applications that call for utmost level accuracy.

Versatile applications

FIG 5 shows a typical automatic test assembly as encountered, for example, in the production of microwave components for communications satellites. Such components usually contain n inputs and m outputs that have to be connected to the test equipment. This is done via two remotely controlled switching matrices. To stimulate the DUT, one or more of its inputs are connected to the output of the signal generator via the first switching matrix. The second switching matrix is used to connect one or more outputs of the DUT to the input of a signal analyzer. In this way, the DUT's response to a stimulus can be checked.

The level measurement accuracy offered by power meters is usually significantly higher than the accuracy provided by signal analyzers or generators. For this reason, power meters are additionally connected via the switching matrices. The power meters measure the DUT's input and output levels with high accuracy, and determine correction values for the generator settings and for the results output by the signal analyzer. The correction values increase the measurement accuracy in testing the DUT. A unique feature is that the power meters can be directly connected to the R&S®SMF 100A microwave generator, and results read from the generator's display.

Test assemblies like the one described above normally exhibit substantial insertion loss between the signal generator output and the DUT input, especially at operating frequencies above 10 GHz. Depending on the test cabling and the

design of the switching matrix, insertion loss may be as high as 10 dB. If special two-port networks such as power dividers or filters are used in addition, insertion loss may even increase to 16 dB and above. Power dividers, which may be used in conjunction with phase shifters, are required, for example, if coherent

stimulus signals are needed for the DUT. In the unlikely event that the high output power of the R&S®SMF 100A is not sufficient, an extra RF amplifier with the required output power has to be connected between the signal generator and the switching matrix.

Wilhelm Kraemer

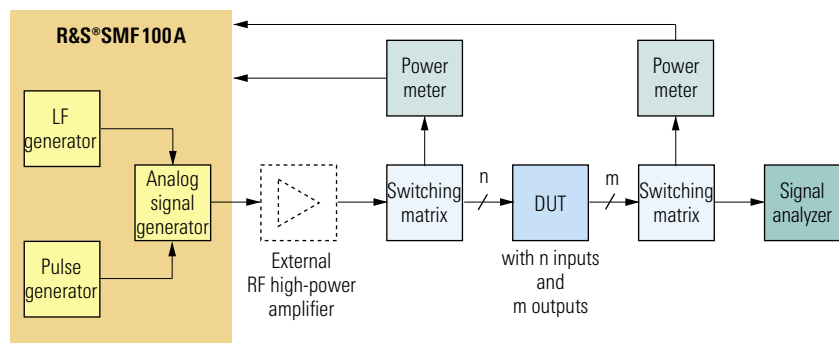


FIG 5 Typical automatic test assembly for testing microwave modules.

Condensed data of the R&S®SMF 100A

Frequency

Frequency range	1 GHz to 22 GHz
	1 GHz to 43.5 GHz
Setting time	<4 ms
Setting time in List mode	<700 μ s

Level

Setting range	-130 dBm to +30 dBm
Setting time	<3 ms
Setting time in List mode	<700 μ s

Spectral purity

SSB phase noise	
(at $f = 10$ GHz; carrier offset 10 kHz; 1 Hz measurement bandwidth)	<-115 dBc (typ. -120 dBc)
Harmonics	
(at $1 \text{ GHz} \leq f \leq 22 \text{ GHz}$)	<50 dBc, typ. <-55 dBc
Nonharmonics	
(at $1 \text{ GHz} < f \leq 11 \text{ GHz}$, carrier offset >3 kHz; +10 dBm)	<-62 dBc
Wideband noise	
(at $1 \text{ GHz} \leq f \leq 11 \text{ GHz}$; carrier offset >10 MHz; 1 Hz measurement bandwidth; +10 dBm)	typ. <-148 dBc
Modulation modes with R&S®SMF-B20 option	AM / FM / ϕ M / LOG AM

Interfaces

Standard	LAN (100BaseT), 2 \times USB
With R&S®SMF-B83 option	IEEE 488.2
With R&S®SMF-B84 option	1 \times USB, 1 \times USB slave
With R&S®SMF-B85 option	removable flash disk