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FIG 1 Microwave Signal Generator R&S SMR60

Microwave Signal Generators R&S SMR50 / SMR60

Allrounders up to 60 GHz

The new Microwave Signal Generators R&S SMR50 / SMR60 come with convincing features: excellent specifications at an attractive price, high reliability, optional expandability from CW generator to signal source with modulation capability and synthesized sweeper with analog ramp sweep.

Extensive functionality

Two new models, R&S SMR50 and R&S SMR60 (FIG 1), have been added to the tried and tested Microwave Signal Generator Family SMR [*]. Both have a lower cutoff frequency of 1 GHz and cover the range to 50 GHz (R&S SMR50) and 60 GHz (R&S SMR60). The lower cutoff frequency can optionally be extended down to 10 MHz. Owing to an advanced frequency synthesis concept with a fractional-N divider, both generators exhibit excellent single-sideband phase noise (FIG 2) and high spurious suppression. High-grade filters in the RF output produce optimum suppression of harmonics and subharmonics.

The higher the working frequencies in microwave test setups, the more impor-

tant is high output level of the signal source used, because attenuation in virtually all passive components of the setup increases with frequency. FIG 3 shows the typical curve of the maximally available output level of an R&S SMR50 or R&S SMR60 versus frequency when fitted with the optional RF attenuator. With the aid of this option, the lowest output level setting is -110 dBm, which is often required for measurements on receivers. Without the option, the lowest level that can be set is -20 dBm. In this case, however, the maximally available output power at 60 GHz is up to 4 dB higher (up to 3 dB at 50 GHz). A stable output level is ensured in any case by precise level control with corrected frequency response.

Like all other SMR models, the basic R&S SMR50 and R&S SMR60 feature a powerful **digital step sweep** and an interface to connect an R&S FSP or R&S FSU spectrum analyzer. This allows exact synchronization of the frequency sweeps of the SMR and the spectrum analyzer. The instruments form a tracking system for scalar network analysis that satisfies all requirements for sweep speed and dynamic range. FIG 4 shows the basic setup for determining the transmission (magnitude of S_{21}) of a twoport. A combination of SMR and FSP or FSU also allows measurements on frequency-converting twoports such as mixers, frequency multipliers or dividers, since the frequency sweep settings of both instruments can be offset. The instrument combination is easily and exclusively operated from the spectrum analyzer.

Pulse modulation is still the most important mode in the microwave range. So the basic R&S SMR50 and R&S SMR60 models come equipped with a **high-grade pulse modulator** for all the measurements usually required on radar equipment.

Flexible optioning

An additional **pulse generator** produces single and double pulses. The pulse generator can work automatically, be externally triggered or operated in external gate mode.

The optional AM/FM/Scan Modulator SMR-B5 expands the R&S SMR50 and R&S SMR60 into **signal generators with modulation capabilities**. Scan modulation (logarithmic AM) is mainly used to simulate a rotating radar antenna. In addition to the modulation circuitry, the option is equipped with a high-grade LF generator with a range from 0.1 Hz to 10 MHz. Sources fitted

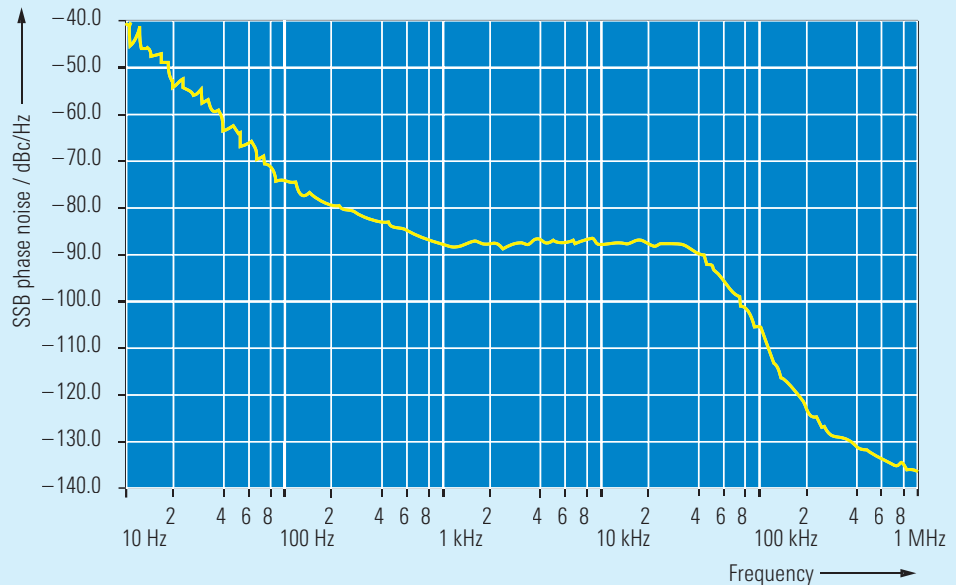


FIG 2 Single-sideband phase noise at 10 GHz

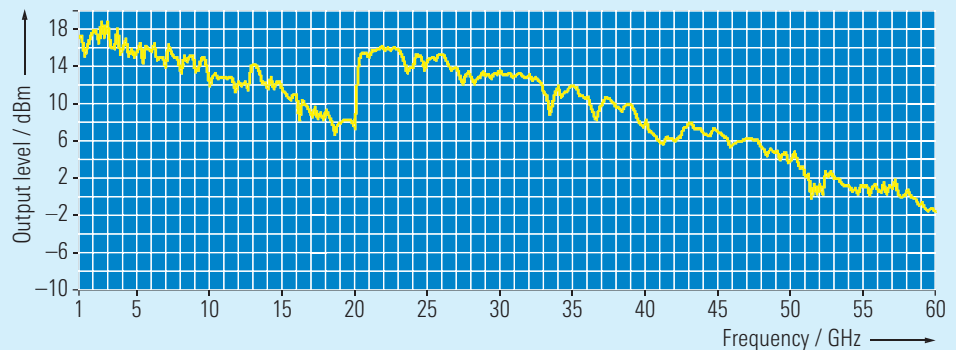


FIG 3 Typical maximum output level versus frequency (with optional RF attenuator)

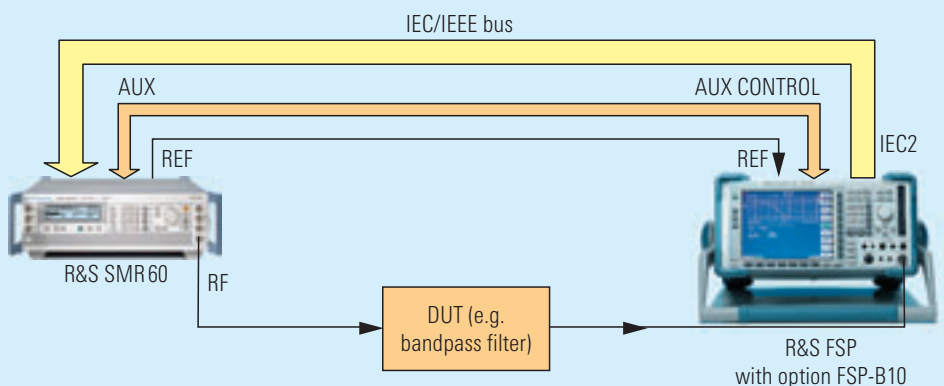


FIG 4 Transmission measurement with R&S SMR60 and Spectrum Analyzer R&S FSP

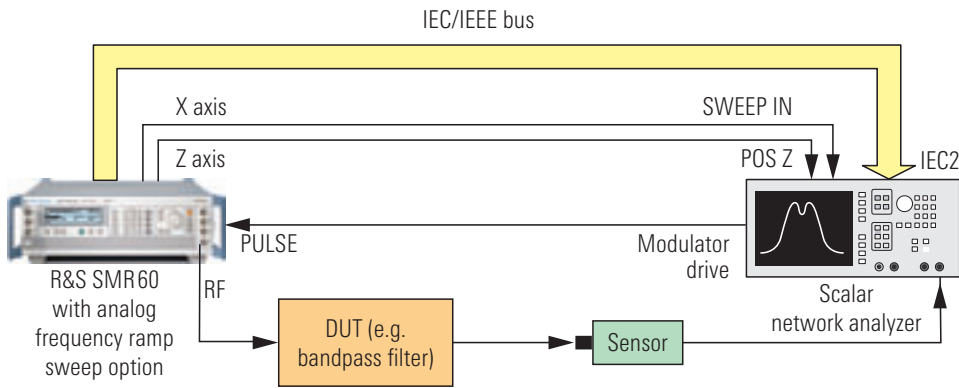


FIG 5 Transmission measurement with R&S SMR 60 and scalar network analyzer

▶ with this option can produce signals from 0.1 Hz right through to 60 GHz.

The **analog ramp sweep option** adds a function to the microwave generators of the R&S SMR family which corresponds to the analog frequency sweep of traditional sweep generators. In this way, ten complete sweeps per second are easily achieved, which is a necessity for operation with conventional scalar network analyzers. Large use is made of such

network analyzers with diode sensors in the upper microwave region because they are a low-cost alternative to vector network analyzers or systems with tracking receivers. Due to the broadband nature of diode sensors however, strict requirements are made for harmonic, subharmonic and spurious suppression of the synthesized sweepers that are used in order to limit measurement error. The R&S SMR 50, R&S SMR 60 and all other members of the SMR family optimally fulfil these requirements.

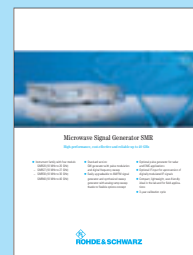
FIG 5 shows a setup for transmission measurement (S_{21}) on a twoport. While the generator in the R&S SMR / spectrum analyzer combination in FIG 4 is controlled by the analyzer, here it is the other way round. All major parameters such as start and stop frequency, frequency markers, sweep time and RF level are now set on the signal source, which – after each new setting – first of all sends both the start and the stop frequency to the scalar network analyzer, which then displays the values. In a next step, the generator controls the entire sweep. The analyzer concentrates on measurement and display. Scalar network analyzers can usually be operated in DC or AC mode. Maximum sensitivity in DC mode is limited to approx. -55 dBm, depending on the sensor used, while in AC mode it may be better by 3 dB to 4 dB. FIG 5 shows the AC mode. Operation in DC mode can dispense with the connecting line between the PULSE input of the generator and the modulator drive output of the scalar network analyzer.

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Condensed data of R&S SMR 50 / SMR 60

Frequency range R&S SMR 50 / SMR 60	10 MHz to 50 GHz / 10 MHz to 60 GHz
Resolution	1 kHz (0.1 Hz with option SMR-B3)
Harmonics	
≤ 0.03 GHz / > 0.03 GHz to 20 GHz / > 20 GHz	< -50 dBc / < -55 dBc / < -40 dBc
Subharmonics ≤ 20 GHz / > 20 GHz	< -65 dBc / < -30 dBc
Spurious	
≤ 20 GHz / > 20 GHz to 40 GHz / > 40 GHz	< -60 dBc / < -54 dBc / < -52 dBc
SSB phase noise	
(at 10 GHz, 10 kHz from carrier)	< -83 dBc
Level R&S SMR 50 (at 50 GHz)	$> +3$ dBm (without option SMR-B18)
R&S SMR 60 (at 60 GHz)	> 0 dBm (without option SMR-B18)
AM / FM / scan AM	with option SMR-B5
Pulse modulation on/off ratio	> 80 dB
Minimum pulse width	25 ns (ALC off) / 500 ns (ALC on)
LF generator (option SMR-B5)	0.1 Hz to 10 MHz, sinewave, rectangular
Pulse generator (option SMR-B14)	100 ns to 85 s
Digital frequency sweep/level sweep	10 ms/1 ms to 5 s per step
Analog frequency ramp sweep (option SMR-B4)	10 ms to 100 s

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



Data sheet R&S SMR

REFERENCES

[*] Microwave Signal Generator SMR – Microwave in handy size. News from Rohde & Schwarz (1999) No. 162, pp 4–6