

Version  
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## Microwave Signal Generator R&S®SMR

High-performance, cost-effective and reliable up to 40 GHz

- ◆ Instrument family with four models
  - R&S®SMR20 (10 MHz to 20 GHz)
  - R&S®SMR27 (10 MHz to 27 GHz)
  - R&S®SMR30 (10 MHz to 30 GHz)
  - R&S®SMR40 (10 MHz to 40 GHz)
- ◆ Standard version:  
CW generator with pulse modulation and digital frequency sweep
- ◆ Easily upgradeable to AM/FM signal generator and synthesized sweep generator with analog ramp sweep owing to flexible options concept
- ◆ Optional pulse generator for radar and EMC applications
- ◆ Optional IF input for upconversion of digitally modulated IF signals
- ◆ Compact, lightweight, user-friendly: ideal in the lab and for field applications
- ◆ 3-year calibration cycle

# The allrounder – designed for future-proofness

## Ease of operation

- ◆ High-contrast LC display
- ◆ Online help including IEC/IEEE-bus commands
- ◆ Simple and self-explanatory settings
- ◆ User-assignable keys
- ◆ One-hand operation with EasyWheel

## Wide frequency range

- ◆ R&S®SMR20 (1 GHz to 20 GHz)
- ◆ R&S®SMR27 (1 GHz to 27 GHz)
- ◆ R&S®SMR30 (1 GHz to 30 GHz)
- ◆ R&S®SMR40 (1 GHz to 40 GHz)
- ◆ Optional extension of lower frequency limit to 10 MHz (R&S®SMR-B11)
- ◆ Frequency resolution 1 kHz, optional 0.1 Hz (R&S®SMR-B3)

## High output power

- ◆ R&S®SMR20 >+10 dBm (at 20 GHz)
- ◆ R&S®SMR27 >+11 dBm (at 27 GHz)
- ◆ R&S®SMR30/40 >+9 dBm (at 30/40 GHz)

## High-precision level control

- ◆ High-precision, frequency-response-compensated level control
- ◆ Setting range extendible to –130 dBm by means of the optional RF Attenuator R&S®SMR-B15/-B17

## Three instruments in one

- ◆ CW generator with pulse modulation capability (standard version)
- ◆ Signal generator with AM/FM and LF generator (option R&S®SMR-B5)
- ◆ Synthesized sweep generator with analog ramp sweep (option R&S®SMR-B4)

## Optional pulse generator (R&S®SMR-B14)

- ◆ Operating modes: single pulse, double pulse, externally triggered, gate mode
- ◆ Pulse repetition 100 ns to 85 s
- ◆ Pulse width 20 ns to 1 s

## Sweep capabilities

- ◆ Digital RF and level sweep (standard version)
- ◆ Analog ramp sweep (RF sweep, option R&S®SMR-B4)
- ◆ Max. sweep rate for ramp sweeps min. 600 MHz/ms (frequency >2 GHz)
- ◆ Digital sweep of LF generator (with option R&S®SMR-B5)
- ◆ 10 user-selectable frequency markers for RF sweep
- ◆ Operating modes: automatic, single-shot, manual, externally triggered

## Optional IF input (R&S®SMR-B23/-B24/-B25)

- ◆ Built-in upconverter for digitally modulated IF signals (R&S®SMR-B23/-B24: DC to 700 MHz, R&S®SMR-B25: 40 MHz to 6 GHz for R&S®SMR20 only)
- ◆ Ideal for use with Vector Signal Generator R&S®SMIQ and I/Q Modulation Generator R&S®AMIQ



# CW, signal or synthesized sweep generator

## Memory

- ◆ Space for 50 complete instrument setups

## The CW generator

The R&S®SMR family comprises four base models designed as CW generators with pulse modulation capability. The four models have a common lower frequency limit of 1 GHz and provide frequency coverage up to 20 GHz (R&S®SMR20), 27 GHz (R&S®SMR27), 30 GHz (R&S®SMR30) and 40 GHz (R&S®SMR40). The lower limit can be expanded to 10 MHz by the optional Frequency Extension 0.01 GHz to 1 GHz (R&S®SMR-B11).

Offering an excellent price/performance ratio, each of the four base models is ideal for the user wishing to enter the field of microwave testing at an affordable price. Should the measurement tasks become more demanding, the base models can be upgraded any time by means of options to give an AM/FM signal generator or a synthesized sweep generator featuring fast, fully synthesized, analog ramp sweep.

### Excellent spectral purity

The R&S®SMR stands out from other generators for its excellent spectral purity. Advanced frequency synthesis with fractional-N divider makes for low SSB phase noise and high spurious suppression, both of which are for example prerequisites for reliable receiver measurements. Modern microwave filters in the output path of the instrument ensure excellent harmonics suppression. This is necessary to obtain conclusive results in scalar network analysis measurements.

### High-precision output level

Microwave signal generators are frequently used for calibrating test receivers. This task calls for a highly accurate and stable output level settable with high resolution. This is ensured by a high-precision, frequency-response-compensated level control for levels higher than  $-20$  dBm. The setting range can be extended to  $-130$  dB with the optional RF Attenuator R&S®SMR-B15 or R&S®SMR-B17.

### Stable output frequency

The crystal reference built in as standard ensures an accurate, low-drift output frequency. The R&S®SMR can be fitted with the optional OCXO Reference Oscillator R&S®SMR-B1 to satisfy the most stringent requirements in terms of accuracy and aging.

### High output level saves you real cash

All microwave test setups involve high losses caused by the use of long cables, power dividers, directional couplers and RF relays. Expensive microwave amplifiers are usually the only means to remedy this. But not with the R&S®SMR: the high output power provided by all models eliminates the need for such a costly component.

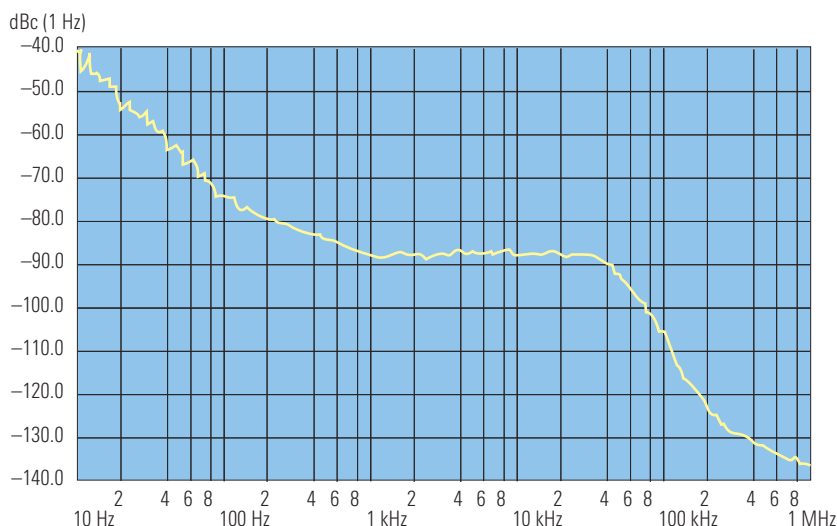
### Application-oriented frequency resolution

The standard frequency resolution of 1 kHz of the R&S®SMR offers a comfortable margin for most applications, for example frequency response measurements in the laboratory and in production and servicing. To satisfy more stringent requirements, e.g. for scientific applications and research, the R&S®SMR-B3 option is available to improve frequency resolution to 0.1 Hz.

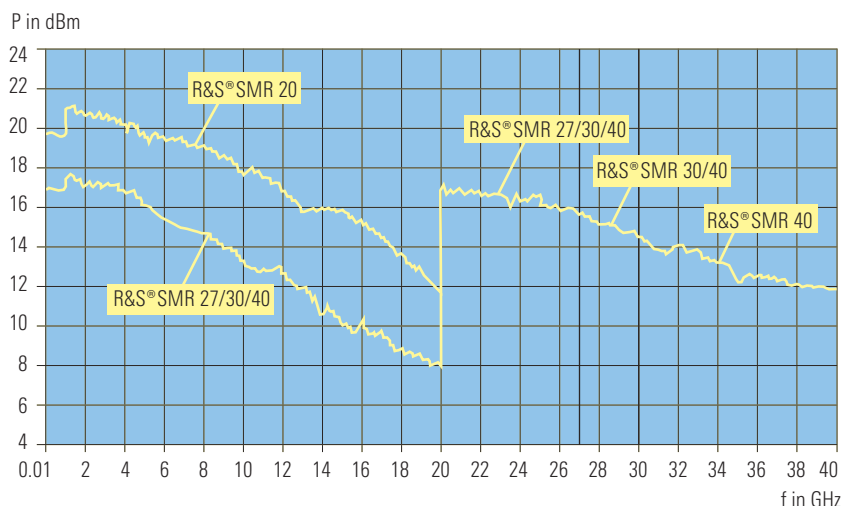
### Pulse modulator included

Pulse modulation is still the most important modulation mode for microwave applications. Each of our base units is, therefore, equipped with a high-quality pulse modulator. The on/off ratio is better than 80 dB, the rise/fall time shorter than 12 ns. Pulse widths of up to 25 ns are possible.

These guaranteed values illustrate that the R&S®SMR is the ideal generator for use in the development, production and maintenance of radar equipment.



SSB phase noise at 10 GHz



**Typical max. output level as a function of frequency (with the options R&S®SMR-B15 and R&S®SMR-B17)**

### Pulse generator option

The optional Pulse Generator R&S®SMR-B14 is an ideal complement to the pulse modulator. It generates single and double pulses with pulse frequencies up to 10 MHz. The pulse generator can also be triggered externally and operated in the external gate mode. The pulse width and delay are user-selectable over a wide range.

### Digital frequency and level sweeps

The digital frequency sweep with step times from 10 ms allows convenient frequency response measurements on microwave circuits. The start and stop frequencies are user-selectable. A trigger input enables synchronous operation with external equipment.

The 20 dB level sweep allows, for example, amplifier or mixer compression to be determined.

## The signal generator

### AM/FM/Scan modulator option

The optional AM/FM/Scan Modulator R&S®SMR-B5 added to the base models turns them into fully-fledged signal

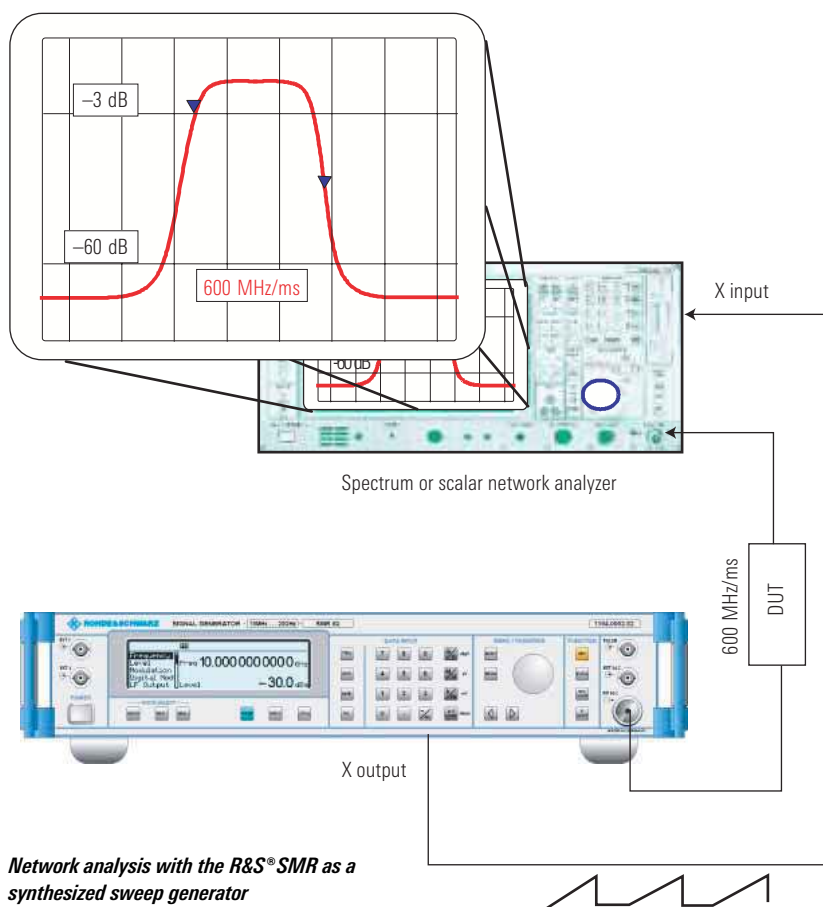
generators with AM and FM modulation capability. The option also includes an LF generator for sinewave and squarewave signals from 0.1 Hz to 10 MHz.

## FM and FSK

The FM modulator has a modulation bandwidth from DC to 5 MHz. Digital frequency shift keying (FSK) is possible with data rates from 0 Hz to 2 MHz.

## Simultaneous modulation modes

All modulation modes of the R&S®SMR can be combined. This allows the generation of complex modulation signals for modern communication and location systems. The combination of pulse modulation and FM simulates Doppler effects or chirp signals. Simultaneous AM and pulse modulation provides the types of signal occurring in pulse radar applications with rotating antenna. The combination of FM and AM can be used to check fading effects of FM receivers.



**Network analysis with the R&S®SMR as a synthesized sweep generator**

## The synthesized sweep generator

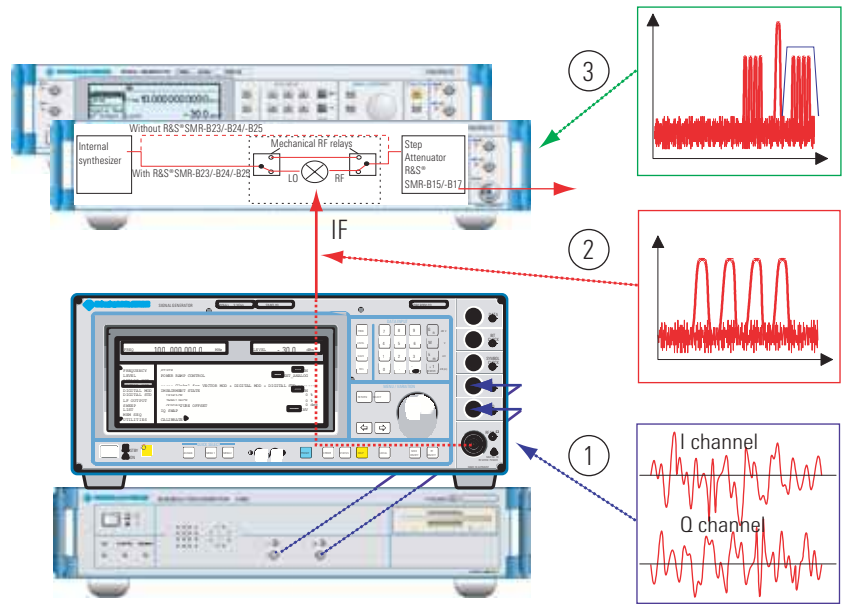
### Analog ramp sweep option

The analog ramp sweep mode corresponds to the analog sweep of classic sweep generators except that the sweep is fully synchronized over the complete range. In this way, the excellent frequency accuracy of digital step sweeps is achieved on the whole, and this at much higher sweep rates of min. 600 MHz/ms at frequencies >2 GHz.

In conjunction with scalar network analyzers or suitable spectrum analyzers, realtime adjustment of microwave filters can be performed, for example.

To mark important frequency ranges such as filter bandwidths or the position of attenuation poles, the R&S®SMR has 10 user-selectable frequency markers which can be output as pulse markers at the marker output (TTL level) or alternatively modulated on the RF level as level markers (level reduction of 1 dB).

The use of the R&S®SMR in conjunction with a scalar network or spectrum analyzer is illustrated by the figure at the bottom of page 4.



*R&S®SMR as an upconverter for digitally modulated signals*

## The R&S®SMR as an upconverter

### IF input option

Vector signal generators such as the R&S®SMIQ generate all types of digitally modulated signals up to 6.4 GHz. To generate signals up to 40 GHz, the R&S®SMR offers upconversion capability by means of the IF input option. A typical application is shown by the figure above. The I/Q Modulation Generator R&S®AMIQ supplies the I and Q signals (1) required for modulating the Vector Signal Generator R&S®SMIQ.

The modulated RF signal of the R&S®SMIQ (2) is applied directly to the IF input of the R&S®SMR. At the RF output of the R&S®SMR, the converted, digitally modulated signal of the R&S®SMIQ is brought out (3). In the example illustrated above, the selective circuits of the DUT separate the wanted signal from unwanted components generated during upconversion.

Alternatively, suitable external bandpass filters can be used.





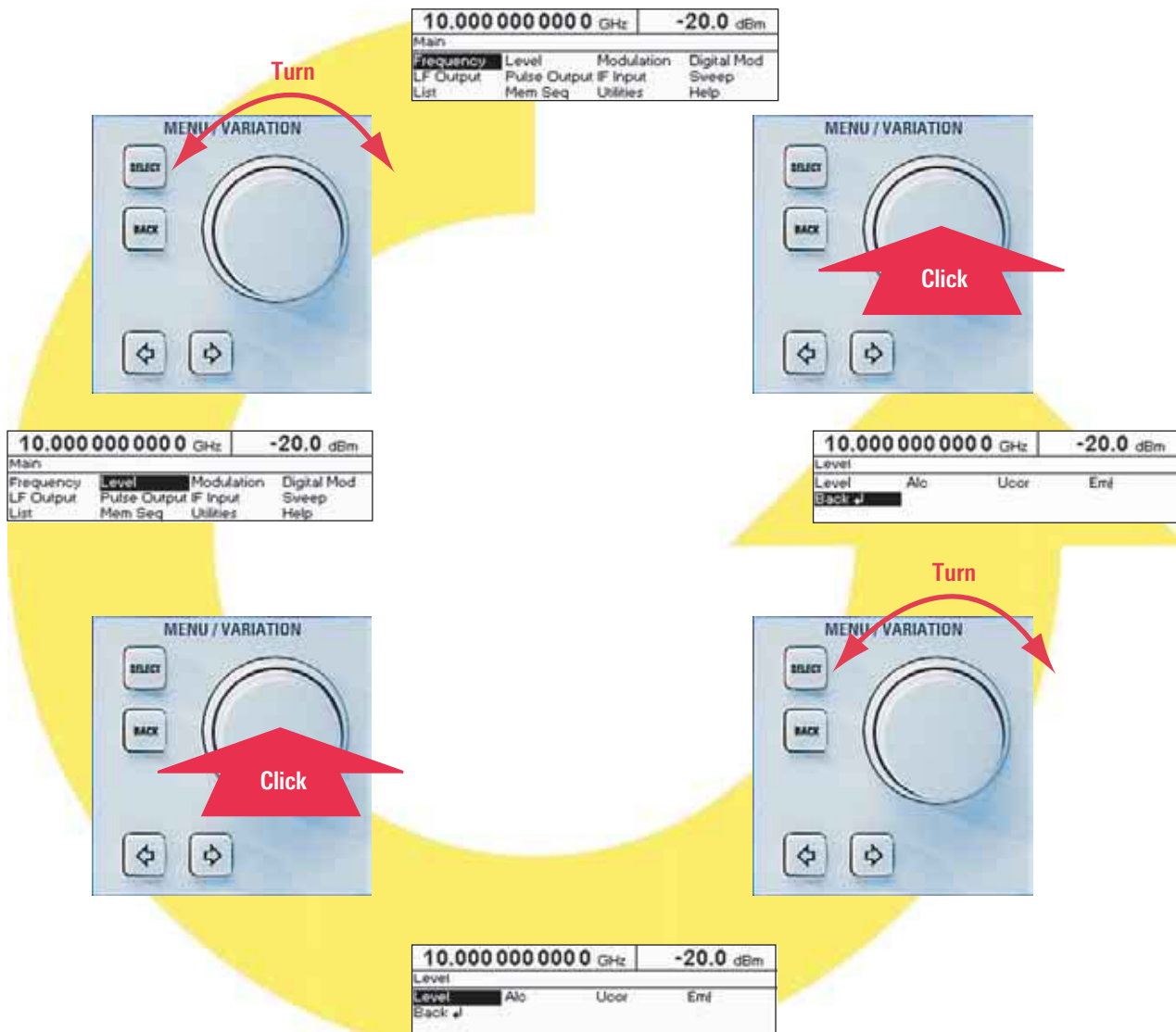
# EasyWheel – the trick with the click

## Transparent menu structure

The EasyWheel makes it extremely simple to operate the R&S®SMR user interface.

Just turn the wheel to go to the next menu item, and then press the wheel to perform the desired function.

There is no easier way to operate a measuring instrument!



## Specifications

Specifications are valid under the following conditions:  
30 minutes warm-up time, specified environmental conditions met, calibration cycle adhered to and total calibration performed.  
Data designated "nom." apply to design parameters and are not tested.  
Data designated "overrange" or "underrange" are not warranted.

### Frequency range

|                                                                            |                                                                |
|----------------------------------------------------------------------------|----------------------------------------------------------------|
| R&S®SMR20                                                                  |                                                                |
| Without option R&S®SMR-B11                                                 | 1 GHz to 20 GHz                                                |
| With option R&S®SMR-B11                                                    | 10 MHz to 20 GHz                                               |
| R&S®SMR27                                                                  |                                                                |
| Without option R&S®SMR-B11                                                 | 1 GHz to 27 GHz                                                |
| With option R&S®SMR-B11                                                    | 10 MHz to 27 GHz                                               |
| R&S®SMR30                                                                  |                                                                |
| Without option R&S®SMR-B11                                                 | 1 GHz to 30 GHz                                                |
| With option R&S®SMR-B11                                                    | 10 MHz to 30 GHz                                               |
| R&S®SMR40                                                                  |                                                                |
| Without option R&S®SMR-B11                                                 | 1 GHz to 40 GHz                                                |
| With option R&S®SMR-B11                                                    | 10 MHz to 40 GHz                                               |
| Resolution                                                                 |                                                                |
| Without option R&S®SMR-B3                                                  | 1 kHz                                                          |
| With option R&S®SMR-B3                                                     | 0.1 Hz                                                         |
| Setting time (to within $<1 \times 10^{-6}$ ) after IEC/IEEE-bus delimiter | $<10 \text{ ms} + 2 \text{ ms/GHz}$                            |
| <b>Reference frequency</b>                                                 | <b>Standard Option R&amp;S®SMR-B1</b>                          |
| Aging (after 30 days of operation)                                         | $1 \times 10^{-6}/\text{year}$ $<1 \times 10^{-7}/\text{year}$ |
| Temperature effect (0°C to 55°C)                                           | $2 \times 10^{-6}$ $<1 \times 10^{-10}/^\circ\text{C}$         |
| Warm-up time                                                               | — 15 min                                                       |
| Output for internal reference                                              |                                                                |
| Frequency                                                                  | 10 MHz                                                         |
| Level, $V_{\text{rms}}$ (EMF, sinewave)                                    | 1 V                                                            |
| Source impedance                                                           | 50 $\Omega$                                                    |
| Input for external reference                                               |                                                                |
| Frequency                                                                  | 10 MHz                                                         |
| Permissible frequency drift                                                | $3 \times 10^{-6}$                                             |
| Input level, $V_{\text{rms}}$                                              | 0.1 V to 2 V                                                   |
| Input impedance                                                            | 50 $\Omega$                                                    |

### Spectral purity

|                                                                           |                    |
|---------------------------------------------------------------------------|--------------------|
| Spurious signals                                                          |                    |
| Harmonics <sup>1)</sup>                                                   |                    |
| 30 MHz $< f \leq 20 \text{ GHz}$ <sup>2)</sup>                            | $<-55 \text{ dBc}$ |
| $f > 20 \text{ GHz}$ <sup>3)</sup>                                        | $<-40 \text{ dBc}$ |
| Subharmonics                                                              |                    |
| $f \leq 20 \text{ GHz}$                                                   | $<-65 \text{ dBc}$ |
| $f > 20 \text{ GHz}$                                                      | $<-30 \text{ dBc}$ |
| Nonharmonics ( $>50 \text{ kHz}$ from carrier)                            |                    |
| $f \leq 20 \text{ GHz}$                                                   | $<-60 \text{ dBc}$ |
| $f > 20 \text{ GHz}$                                                      | $<-54 \text{ dBc}$ |
| SSB phase noise                                                           |                    |
| ( $f = 10 \text{ GHz}$ , 10 kHz from carrier, 1 Hz bandwidth, CW, FM off) | $<-83 \text{ dBc}$ |
| Residual FM, rms ( $f = 10 \text{ GHz}$ , FM off)                         |                    |
| 0.3 kHz to 3 kHz                                                          | $<20 \text{ Hz}$   |
| 0.03 kHz to 20 kHz                                                        | $<200 \text{ Hz}$  |

### Level

#### Maximum level without option R&S®SMR-B23/-B24/-B25<sup>4)</sup>

| Frequency range              | R&S®SMR20                  |                         | R&S®SMR27/30/40                 |                              |
|------------------------------|----------------------------|-------------------------|---------------------------------|------------------------------|
|                              | Without option R&S®SMR-B15 | With option R&S®SMR-B15 | Without option R&S®SMR-B15/-B17 | With option R&S®SMR-B15/-B17 |
| 0.01 GHz to $<1 \text{ GHz}$ | $>+13 \text{ dBm}$         |                         | $>+12 \text{ dBm}$              |                              |
| 1 GHz to $<18 \text{ GHz}$   | $>+11 \text{ dBm}$         | $>+10 \text{ dBm}$      | $>+8 \text{ dBm}$               | $>+7 \text{ dBm}$            |
| 18 GHz to 20 GHz             | $>+10 \text{ dBm}$         | $>+8 \text{ dBm}$       | $>+7 \text{ dBm}$               | $>+5 \text{ dBm}$            |
| $>20 \text{ GHz}$ to 27 GHz  | —                          | —                       | $>+11 \text{ dBm}$              | $>+9 \text{ dBm}$            |
| $>27 \text{ GHz}$ to 30 GHz  | —                          | —                       | $>+9 \text{ dBm}$               | $>+7 \text{ dBm}$            |
| $>30 \text{ GHz}$ to 40 GHz  | —                          | —                       | $>+9 \text{ dBm}$               | $>+7 \text{ dBm}$            |

#### Maximum level with option R&S®SMR-B23/-B24/-B25, normal mode (IF input off)<sup>4)</sup>

| Frequency range                                            | R&S®SMR20                                          |                         | R&S®SMR27/30/40                 |                              |
|------------------------------------------------------------|----------------------------------------------------|-------------------------|---------------------------------|------------------------------|
|                                                            | Without option R&S®SMR-B15                         | With option R&S®SMR-B15 | Without option R&S®SMR-B15/-B17 | With option R&S®SMR-B15/-B17 |
| 0.01 GHz to $<1 \text{ GHz}$                               | $>+13 \text{ dBm}$                                 |                         | $>+12 \text{ dBm}$              |                              |
| 1 GHz to $<18 \text{ GHz}$                                 | $>+10 \text{ dBm}$                                 | $>+9 \text{ dBm}$       | $>+7 \text{ dBm}$               | $>+6 \text{ dBm}$            |
| 18 GHz to 20 GHz                                           | $>+8 \text{ dBm}$                                  | $>+6 \text{ dBm}$       | $>+5 \text{ dBm}$               | $>+3 \text{ dBm}$            |
| $>20 \text{ GHz}$ to 27 GHz                                | —                                                  | —                       | $>+8 \text{ dBm}$               | $>+6 \text{ dBm}$            |
| $>27 \text{ GHz}$ to 30 GHz                                | —                                                  | —                       | $>+6 \text{ dBm}$               | $>+4 \text{ dBm}$            |
| $>30 \text{ GHz}$ to 40 GHz                                | —                                                  | —                       | $>+6 \text{ dBm}$               | $>+4 \text{ dBm}$            |
| Minimum level of all models                                |                                                    |                         |                                 |                              |
| Without option R&S®SMR-B15/-B17                            | $-20 \text{ dBm}$ (underrange $<-20 \text{ dBm}$ ) |                         |                                 |                              |
| With option R&S®SMR-B15/-B17                               | $-130 \text{ dBm}$                                 |                         |                                 |                              |
| Resolution                                                 | 0.1 dB or 0.01 dB, selectable                      |                         |                                 |                              |
| Total deviation (level = 0 dBm)                            |                                                    |                         |                                 |                              |
| $f \leq 20 \text{ GHz}$ <sup>5)</sup>                      | $<1 \text{ dB}$                                    |                         |                                 |                              |
| $f > 20 \text{ GHz}$                                       | $<1.4 \text{ dB}$                                  |                         |                                 |                              |
| Frequency response (level = 0 dBm)                         |                                                    |                         |                                 |                              |
| $f \leq 20 \text{ GHz}$ <sup>6)</sup>                      | $<0.5 \text{ dB}$ , typ. $<0.3 \text{ dB}$         |                         |                                 |                              |
| $f > 20 \text{ GHz}$                                       | $<0.7 \text{ dB}$ , typ. $<0.4 \text{ dB}$         |                         |                                 |                              |
| Impedance                                                  | 50 $\Omega$                                        |                         |                                 |                              |
| SWR                                                        | $<2$                                               |                         |                                 |                              |
| Setting time after IEC/IEEE-bus delimiter                  | $<10 \text{ ms}$                                   |                         |                                 |                              |
| With option R&S®SMR-B15/-B17, with switching in attenuator | $<25 \text{ ms}$                                   |                         |                                 |                              |
| Range for non-interrupting level setting                   | 20 dB (overrange $>20 \text{ dB}$ )                |                         |                                 |                              |
| Residual level <sup>7)</sup> with switchoff via RF OFF     |                                                    |                         |                                 |                              |
| Without option R&S®SMR-B15/-B17                            | nom. $<-70 \text{ dBm}$                            |                         |                                 |                              |
| With option R&S®SMR-B15/-B17                               | nom. $<-140 \text{ dBm}$                           |                         |                                 |                              |

#### Linear amplitude modulation with option R&S®SMR-B5

|                                                                                            |                                                            |
|--------------------------------------------------------------------------------------------|------------------------------------------------------------|
| Operating modes                                                                            | internal, external AC/DC                                   |
| Modulation depth <sup>8)</sup>                                                             | 0% to 100%                                                 |
| Resolution                                                                                 | 0.1%                                                       |
| Setting accuracy ( $\text{AF} = 1 \text{ kHz}$ , $m < 80\%$ ) <sup>9)</sup>                | $<4\%$ of reading + 1%                                     |
| AM distortion <sup>9)</sup>                                                                |                                                            |
| ( $f > 50 \text{ MHz}$ , $\text{AF} = 1 \text{ kHz}$ , $m = 60\%$ )                        |                                                            |
| $f < 1 \text{ GHz}$                                                                        | $<3\%$                                                     |
| $f \geq 1 \text{ GHz}$                                                                     | $<1\%$                                                     |
| Modulation frequency response ( $m = 60\%$ ) <sup>9)</sup>                                 |                                                            |
| $f < 1 \text{ GHz}$                                                                        |                                                            |
| DC to 50 kHz                                                                               | $<3 \text{ dB}$                                            |
| $f \geq 1 \text{ GHz}$                                                                     |                                                            |
| 20 Hz to 20 kHz                                                                            | $<1 \text{ dB}$                                            |
| DC to 50 kHz                                                                               | $<3 \text{ dB}$                                            |
| Incidental $\phi\text{M}$ with AM, peak value ( $\text{AF} = 1 \text{ kHz}$ , $m = 30\%$ ) | $<0.4 \text{ rad}$                                         |
| EXT1, EXT2 modulation input                                                                |                                                            |
| Input impedance                                                                            | 50 $\Omega$ /600 $\Omega$ <sup>10)</sup> or 100 k $\Omega$ |
| Input voltage $V_p$ for selected modulation depth                                          | 1 V (high/low indication for inaccuracy $>3\%$ )           |

#### Logarithmic amplitude modulation with option R&S®SMR-B5 (SCAN AM)

|                             |                                                            |
|-----------------------------|------------------------------------------------------------|
| Operating modes             | internal, external                                         |
| Dynamic range               | 30 dB (overrange $>30 \text{ dB}$ )                        |
| Sensitivity                 | $\pm 0.1 \text{ dB/V}$ to $\pm 10 \text{ dB/V}$            |
| Resolution                  | 0.01 dB                                                    |
| Rise/fall time (10%/90%)    | $<10 \mu\text{s}$                                          |
| EXT1, EXT2 modulation input |                                                            |
| Input impedance             | 50 $\Omega$ /600 $\Omega$ <sup>10)</sup> or 100 k $\Omega$ |
| Input voltage range         | $-6 \text{ V}$ to $+6 \text{ V}$                           |

### Frequency modulation with option R&S®SMR-B5

|                                                     |                                              |
|-----------------------------------------------------|----------------------------------------------|
| Operating modes                                     | internal, external AC/DC                     |
| Maximum deviation                                   |                                              |
| ≤15.625 MHz                                         | 39.0625 kHz                                  |
| >15.625 MHz to 31.25 MHz                            | 78.125 kHz                                   |
| >31.25 MHz to 62.5 MHz                              | 156.25 kHz                                   |
| >62.5 MHz to 125 MHz                                | 312.5 kHz                                    |
| >125 MHz to 250 MHz                                 | 625 kHz                                      |
| >250 MHz to 500 MHz                                 | 1.25 MHz                                     |
| >500 MHz to <1 GHz                                  | 2.5 MHz                                      |
| 1 GHz to <2 GHz                                     | 5 MHz                                        |
| 2 GHz to 10 GHz                                     | 10 MHz                                       |
| >10 GHz to 20 GHz                                   | 20 MHz                                       |
| >20 GHz                                             | 40 MHz                                       |
| Resolution                                          | <1%, min. 10 Hz                              |
| Setting accuracy (AF = 1 kHz)                       | <5% of reading + 20 Hz                       |
| FM distortion (AF = 1 kHz, half max. deviation)     | <0.5%                                        |
| Modulation frequency range                          | DC to 5 MHz                                  |
| Modulation frequency response                       | <3 dB                                        |
| Carrier frequency offset with FM                    |                                              |
| ≤15.625 MHz                                         | 0.39063 Hz + 1% of deviation                 |
| >15.625 MHz to 31.25 MHz                            | 0.78125 Hz + 1% of deviation                 |
| >31.25 MHz to 62.5 MHz                              | 1.5625 Hz + 1% of deviation                  |
| >62.5 MHz to 125 MHz                                | 3.125 Hz + 1% of deviation                   |
| >125 MHz to 250 MHz                                 | 6.25 Hz + 1% of deviation                    |
| >250 MHz to 500 MHz                                 | 12.5 Hz + 1% of deviation                    |
| >500 MHz to <1 GHz                                  | 25 Hz + 1% of deviation                      |
| 1 GHz to <2 GHz                                     | 50 Hz + 1% of deviation                      |
| 2 GHz to 10 GHz                                     | 100 Hz + 1% of deviation                     |
| >10 GHz to 20 GHz                                   | 200 Hz + 1% of deviation                     |
| >20 GHz                                             | 400 Hz + 1% of deviation                     |
| EXT1, EXT2 modulation input                         |                                              |
| Input impedance                                     | 50 Ω/600 Ω <sup>10)</sup> or 100 kΩ          |
| Input voltage V <sub>p</sub> for selected deviation | 1 V (high/low indication for inaccuracy >3%) |

### ASK modulation with option R&S®SMR-B5

|                          |                                     |
|--------------------------|-------------------------------------|
| Operating modes          | external                            |
| Maximum modulation depth | 90%                                 |
| Resolution               | 0.1%                                |
| Data rate                | 0 Hz to 200 kHz                     |
| Rise/fall time (10%/90%) | <10 μs                              |
| EXT1 modulation input    |                                     |
| Input impedance          | 50 Ω/600 Ω <sup>10)</sup> or 100 kΩ |
| Input level              | TTL/HCT signal, selectable polarity |

### FSK modulation with option R&S®SMR-B5

|                          |                                     |
|--------------------------|-------------------------------------|
| Operating modes          | external                            |
| Maximum deviation        |                                     |
| ≤15.625 MHz              | 39.0625 kHz                         |
| >15.625 MHz to 31.25 MHz | 78.125 kHz                          |
| >31.25 MHz to 62.5 MHz   | 156.25 kHz                          |
| >62.5 MHz to 125 MHz     | 312.5 kHz                           |
| >125 MHz to 250 MHz      | 625 kHz                             |
| >250 MHz to 500 MHz      | 1.25 MHz                            |
| >500 MHz to <1 GHz       | 2.5 MHz                             |
| 1 GHz to <2 GHz          | 5 MHz                               |
| 2 GHz to 10 GHz          | 10 MHz                              |
| >10 GHz to 20 GHz        | 20 MHz                              |
| >20 GHz                  | 40 MHz                              |
| Data rate                | 0 Hz to 2 MHz                       |
| Rise/fall time (10%/90%) | <10 μs                              |
| EXT1 modulation input    |                                     |
| Input impedance          | 50 Ω/600 Ω <sup>10)</sup> or 100 kΩ |
| Input level              | TTL/HCT signal, selectable polarity |

### Pulse modulation

|                                    |                                                                       |
|------------------------------------|-----------------------------------------------------------------------|
| Operating modes                    | external, internal with option R&S®SMR-B14                            |
| On/off ratio <sup>9)</sup>         | >80 dB                                                                |
| Rise/fall time (10%/90%)           |                                                                       |
| 62.5 MHz to 125 MHz <sup>11)</sup> | <50 ns <sup>12)</sup>                                                 |
| >125 MHz to 450 MHz                | <20 ns <sup>12)</sup>                                                 |
| >450 MHz                           | <12 ns <sup>12)</sup>                                                 |
| Minimum pulse width                |                                                                       |
| With level control on (ALC ON)     | 500 ns                                                                |
| With level control off (ALC OFF)   | 25 ns                                                                 |
| Maximum pulse pause                |                                                                       |
| With level control on (ALC ON)     | 40 ms                                                                 |
| With level control off (ALC OFF)   | any                                                                   |
| Minimum pulse/pause ratio          |                                                                       |
| With level control on (ALC ON)     | 1/100                                                                 |
| With level control off (ALC OFF)   | any                                                                   |
| Maximum pulse repetition frequency |                                                                       |
| 62.5 MHz to 125 MHz                | 1 MHz                                                                 |
| >125 MHz to 450 MHz                | 2 MHz                                                                 |
| >450 MHz                           | 10 MHz                                                                |
| Pulse delay                        | typ. 50 ns                                                            |
| Video feedthrough V <sub>pp</sub>  | <20 mV                                                                |
| PULSE modulation input             |                                                                       |
| Input level                        | TTL/HCT signal or selectable switching thresholds at +0.5 V or -2.5 V |
| Input impedance                    | 50 Ω (max. 2 W, overload protection) or 10 kΩ                         |

### Simultaneous modulation

FM (FSK) is independent of AM (SCAN AM, ASK) and pulse modulation. Reduced AM bandwidth for simultaneous AM (SCAN AM, ASK) and pulse modulation.

### R&S®SMR-B23/-B24/-B25 IF input option

|                                             | R&S®SMR-B23     | R&S®SMR-B24       | R&S®SMR-B25     |
|---------------------------------------------|-----------------|-------------------|-----------------|
| IF input                                    |                 |                   |                 |
| Frequency range                             | DC to 700 MHz   | DC to 700 MHz     | 40 MHz to 6 GHz |
| Level                                       | <0 dBm          | <0 dBm            | <0 dBm          |
| Frequency response                          | typ. <5 dB      | typ. <7 dB        | typ. <7 dB      |
| SWR                                         | <2              | <2                | <2              |
| RF output                                   |                 |                   |                 |
| Frequency range                             | 1 GHz to 20 GHz | 2 to 27/30/40 GHz | 1 GHz to 20 GHz |
| LO level                                    | <-6 dBm         | <-3 dBm           | <0 dBm          |
| SWR                                         | <2              | <2                | <2              |
| Conversion loss (IF input/RF output)        |                 |                   |                 |
| With option R&S SMR-B15/-B17 <sup>13)</sup> | 3 dB to 18 dB   | 3 dB to 23 dB     | 3 dB to 23 dB   |
| Without option R&S®SMR-B15/-B17             | 3 dB to 16 dB   | 3 dB to 19 dB     | 3 dB to 19 dB   |

### LF generator with option R&S®SMR-B5

|                                                       |                                              |
|-------------------------------------------------------|----------------------------------------------|
| Frequency range                                       | 0.1 Hz to 10 MHz                             |
| Resolution                                            | 0.1 Hz                                       |
| Waveforms                                             | sinewave, squarewave                         |
| Frequency drift                                       | <1 × 10 <sup>-4</sup>                        |
| Frequency response (up to 500 kHz)                    | <0.5 dB                                      |
| Distortion (up to 100 kHz)                            | <0.5% (R <sub>L</sub> >200 Ω, level = 0.5 V) |
| Open-circuit voltage V <sub>p</sub> (LF connector)    | 40 mV to 4 V                                 |
| Resolution                                            | 1 mV                                         |
| Setting accuracy (at 1 kHz, V <sub>p</sub> = 1 V)     | 1.5%                                         |
| Output impedance                                      | approx. 10 Ω                                 |
| Frequency setting time (after IEC/IEEE-bus delimiter) | <10 ms                                       |



| <b>R&amp;S®SMR-B14 pulse generator option</b>                                                    |                                                                                                                                                                          |
|--------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Operating modes                                                                                  | single or double pulse (automatically or externally triggered), delayed pulse (externally triggered), gate mode (external)                                               |
| Active trigger edge                                                                              | positive or negative                                                                                                                                                     |
| Pulse repetition period<br>Resolution<br>Accuracy                                                | 100 ns to 85 s<br>5 digits, min. 20 ns<br>$<1 \times 10^{-4}$                                                                                                            |
| Pulse width<br>Resolution<br>Accuracy                                                            | 20 ns to 1 s<br>4 digits, min. 20 ns<br>$<1 \times 10^{-4} + 3$ ns                                                                                                       |
| Pulse delay<br>Resolution<br>Accuracy                                                            | 20 ns to 1 s<br>4 digits, min. 20 ns<br>$<1 \times 10^{-4} + 3$ ns                                                                                                       |
| Double pulse<br>Resolution<br>Accuracy                                                           | 60 ns to 1 s<br>4 digits, min. 20 ns<br>$<1 \times 10^{-4} + 3$ ns                                                                                                       |
| Trigger delay<br>Jitter                                                                          | typ. 50 ns<br><10 ns                                                                                                                                                     |
| PULSE modulation input<br>Input level<br><br>Input impedance                                     | TTL/HCT signal or selectable switching thresholds at +0.5 V or -2.5 V<br>50 $\Omega$ (max. 2 W, overload protection) or 10 k $\Omega$                                    |
| SYNC output                                                                                      | TTL/ACT signal, ( $R_L \geq 50 \Omega$ ), 40 ns pulse width                                                                                                              |
| PULSE/VIDEO output                                                                               | TTL/ACT signal ( $R_L \geq 50 \Omega$ )                                                                                                                                  |
| <b>Digital sweep, sweep in discrete steps</b>                                                    |                                                                                                                                                                          |
| RF sweep, AF sweep<br>Operating modes<br><br>Sweep range<br>Step width (lin)<br>Step width (log) | automatic, single-shot, manual or externally triggered, linear or logarithmic user-selectable user-selectable 0.01% to 100%                                              |
| Level sweep<br>Operating modes<br><br>Sweep range<br>Step width                                  | automatic, single-shot, manual or externally triggered, logarithmic 0 dB to 20 dB 0.01 dB to 20 dB                                                                       |
| Step time<br>Frequency sweep<br>Level sweep<br>Resolution                                        | 10 ms to 5 s<br>1 ms to 5 s<br>0.1 ms                                                                                                                                    |
| Markers                                                                                          | 10, user-selectable                                                                                                                                                      |
| MARKER output signal                                                                             | TTL level, selectable polarity                                                                                                                                           |
| X output                                                                                         | 0 V to 10 V                                                                                                                                                              |
| BLANK output signal                                                                              | TTL level, selectable polarity                                                                                                                                           |
| <b>R&amp;S®SMR-B4 ramp sweep option</b>                                                          |                                                                                                                                                                          |
| RF sweep <sup>14)</sup><br>Operating modes<br><br>Sweep range<br>Resolution<br>Accuracy          | automatic, single-shot, manual or externally triggered; start/stop, center frequency/span user-selectable 1 kHz (0.005% (of deviation)/ (sweep time/s) + reference error |

| Sweep time                                                                                                                                                                                                                                                   | 10 ms to 100 s (switchover time $\leq 30$ ms at 1 GHz, 2 GHz, 10 GHz and 20 GHz)                                                                                    |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Max. sweep rate<br>$\leq 15.625$ MHz<br>>15.625 MHz to 31.25 MHz<br>>31.25 MHz to 62.5 MHz<br>>62.5 MHz to 125 MHz<br>>125 MHz to 250 MHz<br>>250 MHz to 500 MHz<br>>500 MHz to <1 GHz<br>1 GHz to <2 GHz<br>2 GHz to 10 GHz<br>>10 GHz to 20 GHz<br>>20 GHz | 2.34375 MHz/ms<br>4.6875 MHz/ms<br>9.375 MHz/ms<br>18.75 MHz/ms<br>37.5 MHz/ms<br>75 MHz/ms<br>150 MHz/ms<br>300 MHz/ms<br>600 MHz/ms<br>1200 MHz/ms<br>2400 MHz/ms |
| MARKER output signal                                                                                                                                                                                                                                         | TTL level, selectable polarity                                                                                                                                      |
| X output                                                                                                                                                                                                                                                     | 0 V to 10 V                                                                                                                                                         |
| BLANK output signal                                                                                                                                                                                                                                          | TTL level, selectable polarity                                                                                                                                      |
| <b>List mode</b>                                                                                                                                                                                                                                             | frequency and level values can be stored in a list and will be set fast                                                                                             |
| Permissible level variation                                                                                                                                                                                                                                  | 20 dB                                                                                                                                                               |
| Operating modes                                                                                                                                                                                                                                              | auto, single-shot, manual or externally triggered                                                                                                                   |
| Maximum number of channels                                                                                                                                                                                                                                   | 2003                                                                                                                                                                |
| Step time<br>Resolution                                                                                                                                                                                                                                      | 10 ms to 5 s<br>0.1 ms                                                                                                                                              |
| <b>Memory for instrument setups</b>                                                                                                                                                                                                                          |                                                                                                                                                                     |
| Storable setups                                                                                                                                                                                                                                              | 50                                                                                                                                                                  |
| <b>Remote control</b>                                                                                                                                                                                                                                        |                                                                                                                                                                     |
| System                                                                                                                                                                                                                                                       | IEC60625 (IEEE488) Rev. 2003                                                                                                                                        |
| Command set                                                                                                                                                                                                                                                  | SCPI 1995.0                                                                                                                                                         |
| Connector                                                                                                                                                                                                                                                    | 24-contact Amphenol                                                                                                                                                 |
| IEC/IEEE-bus address                                                                                                                                                                                                                                         | 0 to 30                                                                                                                                                             |
| Interface functions                                                                                                                                                                                                                                          | SH1, AH1, T6, L4, SR1, RL1, PP1, DC1, DT1, C0                                                                                                                       |

- <sup>1)</sup> R&S®SMR20: level  $<+5$  dBm without or  $<+3$  dBm with option R&S®SMR-B23 or R&S®SMR-B25; R&S®SMR27/30/40: level  $<+2$  dBm without or  $<+0$  dBm with option R&S®SMR-B24.
- <sup>2)</sup> 10 MHz  $\leq f \leq 30$  MHz: typ.  $<-50$  dBc.
- <sup>3)</sup> Specifications for harmonics above 20 GHz (R&S®SMR20), 27 GHz (R&S®SMR27), 30 GHz (R&S®SMR30) and 40 GHz (R&S®SMR40) only typical.
- <sup>4)</sup> With option R&S®SMR-B19/-B20 the maximum level is likely to be reduced by up to 0.1 dB/GHz. The maximum level is reduced by up to -2 dB in the temperature range 35 °C to 55 °C.
- <sup>5)</sup> From 10 MHz to 50 MHz, the specified total deviation is only valid in the temperature range 15 °C to 35 °C. The deviation outside this temperature range is likely to be higher by max. 0.7 dB.
- <sup>6)</sup> From 10 MHz to 50 MHz, the specified frequency response is only valid in the temperature range 15 °C to 35 °C.
- <sup>7)</sup> Residual level at set RF.
- <sup>8)</sup> The modulation depth adjustable with adherence to the AM specifications continuously decreases from 6 dB below the maximum level up to the maximum level.
- <sup>9)</sup> This specification does not apply
  - a) to non-interrupting level setting (ATTENUATOR MODE FIXED) if option R&S®SMR-B15/-B17 is used,
  - b) to levels below -7 dBm without option R&S®SMR-B15/-B17,
  - c) to external level control mode (EXT ALC).
- <sup>10)</sup> 50  $\Omega$  or 600  $\Omega$  selectable by means of internal jumpers.
- <sup>11)</sup> Pulse modulation not specified for frequencies  $<62.5$  MHz.
- <sup>12)</sup> Only valid if level control set to OFF (ALC OFF).
- <sup>13)</sup> Option R&S®SMR-B15/-B17 in 0 dB position. The conversion loss can be increased by 10 dB to 110 dB in 10 dB steps using option R&S®SMR-B15/-B17. With option R&S®SMR-B19/-B20, the conversion loss increases by up to 0.1 dB/GHz.
- <sup>14)</sup> Cannot be combined with frequency modulation. Pulse modulation possible, but not specified.

## General data

|                                                       |                                                                                                                                                         |
|-------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|
| Temperature resistance<br>Operating temperature range | 0 °C to +55 °C; meets<br>DIN EN 60068-2-1 Rev. 1998 and<br>DIN EN 60068-2-2 Rev. 1998                                                                   |
| Storage temperature range                             | –40 °C to +70 °C                                                                                                                                        |
| Climatic resistance<br>Damp heat                      | 95% relative humidity, cyclic test<br>at +25 °C/+40 °C, meets<br>DIN EN 60068-2-30 Rev. 1998                                                            |
| Mechanical resistance<br>Vibration, sinusoidal        | 5 Hz to 150 Hz, max. 2 g at 55 Hz,<br>55 Hz to 150 Hz, 0.5 g const.;<br>meets DIN EN 60068-2-6<br>Rev. 1998, DIN EN 61010-1 and<br>MIL-T-28800D class 5 |
| Vibration, random                                     | 10 Hz to 300 Hz, acceleration<br>1.2 g (rms)                                                                                                            |
| Shock                                                 | 40 g shock spectrum, meets<br>MIL-STD-810E, MIL-T-28800D,<br>class 3/5                                                                                  |
| Electromagnetic compatibility                         | meets EN 61326-1 Rev. 1997 +<br>A1 Rev. 1998 and<br>EN 55011 Rev. 1998 + A1 Rev.<br>1999 (EMC directive of EU)                                          |
| Leakage (carrier frequency <1 GHz)                    | <0.1 µV (induced in a two-turn<br>coil 25 mm in diameter at a<br>distance of 25 mm from any<br>surface of the enclosure)                                |
| Radiated susceptibility                               | 10 V/m                                                                                                                                                  |
| Power supply                                          | 100 V to 120 V (AC), 50 to 400 Hz<br>200 V to 240 V (AC), 50 to 60 Hz,<br>autoranging,<br>max. 200 VA                                                   |
| Safety standards                                      | DIN EN 61010-1 Rev. 1994,<br>IEC 61010-1 Rev. 1995,<br>UL 3111-1, CAN/CSA-C22.2<br>No. 1010.1-B97                                                       |
| Conformity marks                                      | VDE-GS, CSA, NRTL/C                                                                                                                                     |
| Dimensions (W × H × D)                                | 427 mm × 88 mm × 450 mm                                                                                                                                 |
| Weight                                                | <12 kg when fully equipped                                                                                                                              |

More information at  
[www.rohde-schwarz.com](http://www.rohde-schwarz.com)  
(search term: SMR)



## Ordering information

| Designation                                                   | Type            | Order No.    |
|---------------------------------------------------------------|-----------------|--------------|
| Microwave Signal Generator                                    |                 |              |
| 1 GHz to 20 GHz                                               | R&S®SMR20       | 1104.0002.20 |
| 1 GHz to 27 GHz                                               | R&S®SMR27       | 1104.0002.27 |
| 1 GHz to 30 GHz                                               | R&S®SMR30       | 1104.0002.30 |
| 1 GHz to 40 GHz                                               | R&S®SMR40       | 1104.0002.40 |
| <b>Accessories supplied</b>                                   |                 |              |
| Power cable, operating manual,<br>adapter                     |                 |              |
| 3.5 mm, female                                                | R&S®SMR20       |              |
| 2.9 mm, female                                                | R&S®SMR27/30/40 |              |
| <b>Options</b>                                                |                 |              |
| OCXO Reference Oscillator                                     | R&S®SMR-B1      | 1104.5485.02 |
| Frequency Resolution 0.1 Hz                                   | R&S®SMR-B3      | 1104.5585.02 |
| Ramp Sweep                                                    | R&S®SMR-B4      | 1104.5685.02 |
| AM/FM/Scan Modulator                                          | R&S®SMR-B5      | 1104.3501.02 |
| Frequency Extension<br>0.01 GHz to 1 GHz <sup>1)</sup>        | R&S®SMR-B11     | 1104.4250.02 |
| Pulse Generator                                               | R&S®SMR-B14     | 1104.3982.02 |
| RF Attenuator for R&S®SMR20/27 <sup>1)</sup>                  | R&S®SMR-B15     | 1104.4989.02 |
| RF Attenuator for R&S®SMR30/40 <sup>1)</sup>                  | R&S®SMR-B17     | 1104.5233.02 |
| Rear Connectors for RF, AF<br>(R&S®SMR20) <sup>1)</sup>       | R&S®SMR-B19     | 1104.6281.02 |
| Rear Connectors for RF, AF<br>(R&S®SMR27/30/40) <sup>1)</sup> | R&S®SMR-B20     | 1104.6381.02 |
| IF Input DC to 700 MHz<br>(R&S®SMR20) <sup>1)</sup>           | R&S®SMR-B23     | 1104.5804.02 |
| IF Input DC to 700 MHz<br>(R&S®SMR27/30/40) <sup>1)</sup>     | R&S®SMR-B24     | 1104.6100.02 |
| IF Input 0.04 GHz to 6 GHz<br>(R&S®SMR20) <sup>1)</sup>       | R&S®SMR-B25     | 1135.1998.02 |
| Low Leakage                                                   | R&S®SMR-B31     | 1164.7910.02 |
| <b>Recommended extras</b>                                     |                 |              |
| Service Kit                                                   | R&S®SMR-Z1      | 1103.9506.02 |
| Cable for Network Analyzers                                   | R&S®SMR-Z3      | 1134.9772.02 |
| 19" Rack Adapter                                              | R&S®ZZA-211     | 1096.3260.00 |
| Adapter (R&S®SMR20)                                           |                 |              |
| 3.5 mm, female                                                |                 | 1021.0512.00 |
| 3.5 mm, male                                                  |                 | 1021.0529.00 |
| N, female                                                     |                 | 1021.0535.00 |
| N, male                                                       |                 | 1021.0541.00 |
| Adapter (R&S®SMR27/30/40)                                     |                 |              |
| 2.9 mm, female                                                |                 | 1036.4790.00 |
| 2.9 mm, male                                                  |                 | 1036.4802.00 |
| N, female                                                     |                 | 1036.4777.00 |
| N, male                                                       |                 | 1036.4783.00 |

<sup>1)</sup> Factory-fitted option.



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