



**ROHDE & SCHWARZ**

# Signal Generators

100 kHz to 4.32 GHz

**SMHU**

100 kHz to 2.16 GHz

**SMGU**



*Ready  
for  
the 90s*

# SPECIFICATIONS

## Frequency

Range ..... 100 kHz to 2160 MHz (SMGU)  
 100 kHz to 4320 MHz (SMHU)

## Frequency bands

If the step width is small, there is hysteresis on band switchover

Frequency range (nominal) (MHz)	Frequency range (end points with hysteresis) (MHz)
2160 to 4320	2159.000001 to 4320
1000 to 2160	1000 to 2160
500 to 1000	500 to 1000.249999
250 to 500	250 to 500.124999
125 to 250	125 to 250.062499
62.5 to 125	62.5 to 125.031249
31.25 to 62.5	31.25 to 62.515624
15.625 to 31.25	15.625 to 31.257812
0.1 to 15.625	0.1 to 15.749999
0.1 to 125	0.1 to 125.499999

Resolution ..... 0.1 Hz

Stability ..... same as reference frequency

Setting time ..... < 10 ms, < 1 ms in fast mode

(to within  $< 1 \times 10^{-6} \times f_c$  for  $f > 15.625$  MHz,  
 < 150 Hz for  $f < 15.625$  MHz,

with the special function "heterodyne band 125 MHz"  
 to within < 650 Hz for  $f < 125$  MHz)

Phase offset ..... set in 1° steps

## Reference frequency

Aging .....  $< 1 \times 10^{-9}$ /day after 100 h operation

Temperature variation .....  $< 2 \times 10^{-9}/^{\circ}\text{C}$

Output ( $V_{\text{rms}}$ ) ..... 0.5 V into 50 Ω

Frequency ..... 5 or 10 MHz, selectable by means of special function

Input ( $V_{\text{rms}}$ ) ..... 0.1 to 2 V

Frequency ..... 5 or 10 MHz  $\pm 3 \times 10^{-6}$

## Spectral purity

### Spurious signal

Harmonics ..... < -30 dBc

### Subharmonics

$f < 2160$  MHz ..... none

$f > 2160$  MHz ..... < -60 dBc<sup>1)</sup>

### Nonharmonics

> 10 kHz from carrier<sup>1)</sup>

$f \leq 1000$  MHz ..... < -100 dBc<sup>2)</sup>

$f > 1000$  MHz ..... < -94 dBc

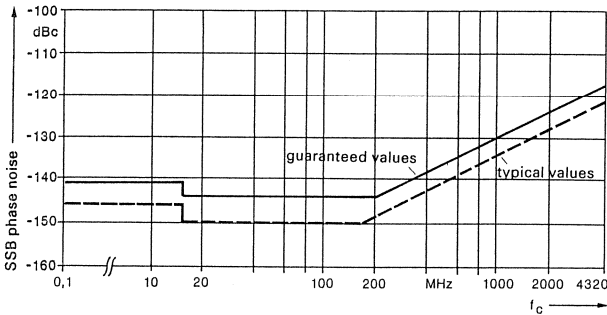
$f > 2160$  MHz ..... < -88 dBc

### Wideband noise for CW<sup>1)</sup>

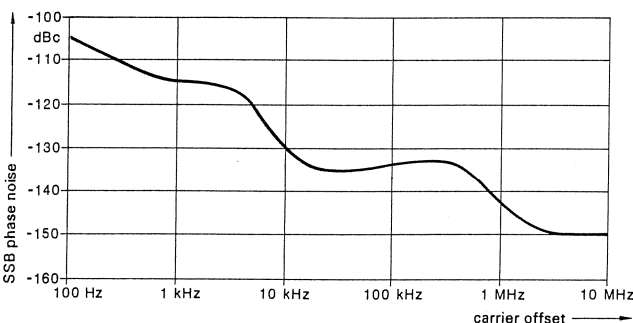
(offset from carrier > 2 MHz;

> 5 MHz for  $f > 2.16$  GHz,

1 Hz bandwidth) ..... typ. < -145 dBc



Single-sideband phase noise 20 kHz from carrier at a bandwidth of 1 Hz (FM/φM deviation < 2% of maximum deviation)<sup>2)</sup>



Typical single-sideband phase noise at 1000 MHz

Residual FM, rms (FM/φM deviation < 2% of maximum deviation)

Frequency range (MHz)	Weighting bandwidth	
	0.3 to 3 kHz (CCITT) (Hz)	0.03 to 20 kHz (Hz)
0.1 to 500	< 0.5	< 1
500 to 1000	< 1	< 2
1000 to 2160	< 2	< 4
2160 to 4320	< 4	< 8

## Residual AM, rms

(0.3 to 3 kHz) ..... < 0.01 %

## Level

Range ..... -140 to +13 dBm

Overrange not to specifications ..... to 16 dBm (SMGU)

to 19 dBm (SMHU)

Resolution ..... 0.1 dB

Total error for levels  $> -127$  dBm<sup>1)</sup>

$f \leq 2160$  MHz .....  $\pm 1.5$  dB

$f > 2160$  MHz .....  $\pm 2.5$  dB

Flatness at 0 dBm<sup>1)</sup>

$f \leq 2160$  MHz ..... < 1 dB

$f > 2160$  MHz ..... < 1.5 dB

Output impedance ..... 50 Ω

VSWR ..... < 1.5 for levels  $\leq 0$  dBm (SMGU)<sup>1)</sup>

< 1.8 for levels  $> 0$  dBm (SMGU)<sup>1)</sup>

< 1.8 for  $f \leq 3000$  MHz (SMHU)

< 2.5 for  $f > 3000$  MHz (SMHU)

Setting time ..... < 25 ms (< 10 ms for transient-free level settings)

Transient-free level settings ..... 0 to -20 dB, from any level

## Reverse power protection

(protects the set from externally applied RF power (50-Ω source) and DC voltages)

Max. RF power ..... 50 W (SMGU)

30 W (SMHU)

Max. DC ..... 35 V

## Modulation generator

### AF synthesizer

#### Frequency range

Sine ..... 1 Hz to 100 kHz

Sawtooth, squarewave ..... 1 Hz to 2 kHz

Resolution ..... 1 Hz

Display ..... 4 digits, floating point

Frequency error .....  $< 4 \times 10^{-5}$

#### Output level ( $V_a$ )

AF INT connector ..... 0.2 mV to 2 V

Resolution up to 200 mV ..... 0.2 mV

Resolution above 200 mV ..... 2 mV

Level error at 1 kHz .....  $< 1\% + 0.5$  mV

#### Frequency response flatness

up to 20 kHz .....  $\pm 2.5\%$

up to 100 kHz .....  $\pm 3.5\%$

Distortion (level  $> 0.5$  V) ..... < 0.1 %

#### Setting time for phase-continuous

frequency changes ..... < 5 ms

AF fixed-frequency generator ..... 409.6 Hz, 1024 Hz

## Amplitude modulation

Operating modes ..... INT, EXT AC, EXT DC, two tone

Modulation depth ..... 0 to 100 %

(modulation depths that meet the AM specifications decrease linearly between 7 and 13 dBm; a status message is output if the modulation depth is too great.)

Resolution ..... 0.1 %

Setting error at 1 kHz

and  $m < 80\%$ <sup>1)</sup>

$f < 2160$  MHz ..... < (4% of reading + 1 %)

$f > 2160$  MHz ..... < (6% of reading + 1 %)

AM distortion at 1 kHz<sup>1)</sup>

and  $m = 60\%$  ..... < 2 %

Modulation frequency (3 dB bandwidth)

AM EXT AC (DC) ..... 10 Hz (DC) to 50 kHz

AM INT ..... 1 Hz to 50 kHz

Modulation frequency response<sup>1)</sup>

10 Hz (DC) to 20 kHz ..... < 1 dB

Incidental φM, AM (30%),  $f_{\text{mod}} = 1$  kHz

$f < 2000$  MHz ..... < 0.2 rad

$f > 2000$  MHz ..... < 0.4 rad

#### Modulation input AM EXT

Input impedance ..... 100 kΩ, link selectable to 600 Ω

Input voltage for the set modulation depth ( $V_p$ ) ..... 1 V (high/low display at  $\pm 3\%$ )

## AM square (AM-SQU)

Dynamic range<sup>1)</sup> ..... typ. 30 dB

Rise/fall time ..... typ. 2 μs

Modulation signal (AM EXT) ..... logic signal (low < 1 V/high

> 3.5 V),

polarity selectable via special function

### Frequency modulation

Operating modes ..... INT, EXT AC, EXT DC, two tone, preemphasis

Carrier (MHz)	Max. dev. (kHz)	Max. dev. (kHz) with preemphasis
2160 to 4320	3200	800
1000 to 2160	1600	400
500 to 1000	800	200
250 to 500	400	100
125 to 250	200	50
62.5 to 125	100	25
31.25 to 62.5	50	12.5
15.625 to 31.25	25	6.25
0.1 to 15.625	200	50
0.1 to 125*)	800	200

\*) With the "125 MHz heterodyne band"

Resolution ..... < 1%, min. 10 Hz

Setting error at

$f_{mod} = 1$  kHz ..... < 3% of reading + 20 Hz

with preemphasis ..... < 5% of reading + 20 Hz

FM distortion at 1 kHz

and half max. deviation ..... < 0.2% (< 1% with preemphasis)

Modulation frequency

FM INT ..... 10 Hz to 100 kHz

FM EXT AC (DC) ..... 10 Hz (DC) to 100 kHz,

10 Hz (DC) to 1 MHz (with deviation < 10% of maximum deviation)

Modulation frequency response

20 Hz to 100 kHz ..... < 0.5 dB

Preemphasis ..... 50  $\mu$ s, 75  $\mu$ s

Incidental AM at  $f_{mod} = 1$  kHz,

deviation = 40 kHz ( $f > 1$  MHz) ..... < 0.1%

Carrier frequency deviation

at FM AC

$f > 15.625$  MHz ..... <  $1 \times 10^{-7} \times f_c$

$f < 15.625$  MHz ..... < 15 Hz

With the "125 MHz heterodyne band" special function for

$f < 125$  MHz ..... < 65 Hz

at FM DC ..... same as FM AC + 1% of deviation

Modulation input FM/ $\phi$ M EXT

Input impedance ..... 100 k $\Omega$ , link selectable to 600  $\Omega$

Input voltage for

deviation set ( $V_p$ ) ..... 1 V (high/low display at  $\pm 3\%$ )

### FSK modulation

The deviation is the same as for FM.

Frequency accuracy ..... same as for FM AC + 4% of deviation

Rise/fall time ..... 10  $\mu$ s

Modulation signal (FM/ $\phi$ M EXT) ..... logic signal (low < 1 V/  
high > 3.5 V),  
polarity selectable with special function

### Phase modulation

Operating modes ..... INT, EXT AC, dual tone

$\phi$ M deviation

Carrier (MHz)	Max. dev. (rad)
2160 to 4320	320
1000 to 2160	160
500 to 1000	80
250 to 500	40
125 to 250	20
62.5 to 125	10
31.25 to 62.5	5
15.625 to 31.25	2.5
0.1 to 15.625	20
0.1 to 125*)	80

\*) With the "heterodyne band 125 MHz" special function

Resolution ..... < 1%, min. 0.001 rad

Setting error at  $f_{mod} = 1$  kHz ..... < 5% of reading + 0.01 rad

$\phi$ M distortion at  $f = 1$  kHz

and half max. deviation ..... < 0.5%

Modulation frequency ..... 10 Hz to 10 kHz

Modulation frequency response

10 Hz to 10 kHz ..... < 1 dB

Modulation input FM/ $\phi$ M EXT

Input impedance ..... 100 k $\Omega$ , link selectable 600  $\Omega$

Input voltage for the

deviation set ( $V_p$ ) ..... 1 V (high/low display at  $\pm 3\%$ )

### Pulse modulation

Operating mode ..... external

On/off ratio ..... > 80 dB

Rise/fall time ..... < 20 ns ( $f > 125$  MHz)

Modulation signal ..... HCT signal, selectable polarity  
by means of a special function

### Sweep

Operating modes ..... automatic, single shot or manual

	RF sweep	AF sweep	RF level sweep	Memory sweep
Sweep range	user select.	user select.	0.1 to 20 dB	user select.
Step width (lin)	user select.	user select.	—	1
Step width (log)	0.01 to 50%	0.01 to 50%	0.1 to 20 dB	—
Time for step	10 ms to 1 s	10 ms to 1 s	10 ms to 1 s	50 ms to 60 s 1 ms to 60 s*)
Marker	user select.	user select.	user select.	—

\*) in fast mode

X output ..... 0 to 10 V

Z output ..... 0/5 V logic signal, polarity,  
selection via special function

### Remote control

System ..... IEC 625-1 (IEEE 488)

Connector type ..... Amphenol 24-contact

Remote controllable functions ..... all, except those of spinwheel and power switch

IEC-bus address ..... set via the keypad (0 to 30)

Interface functions ..... SH1, AH1, T6, L4, SR1, RL1, PPO  
DC1, DT0, C0

### General data

Rated temperature range ..... 0 to 50 °C

Storage temperature range ..... -40 to +75 °C

RF leakage ..... to VDE 0871 and MIL STD 461 B

(Method. CE 03 and RE 02), radiated and conducted interference; also meets VDE 0875 (RFI class K)

Mechanical shock ..... Shock tested to DIN 40046, part 7 (30 g, 11 ms) and vibration tested to DIN 40046, part 8

(5 to 55 Hz, 2 g); corresponds to IEC Publications 68-2-27 and 68-2-6

Power supply ..... 100/120/220/240 V  $\pm 10\%$

47 to 63 Hz (max. 270 VA)

safety class I to VDE 0411 (IEC 348)

Dimensions (W x H x D) ..... 435 mm x 192 mm x 460 mm

Weight ..... 25 kg

### Ordering information

Order designation ..... ► Signal Generator SMGU

819.0010.52

► Signal Generator SMHU

835.8011.52

Supplied accessories ..... power cable

### Recommended extras

Rear-panel connectors for RF

and AF ..... SMGU-Z9 ..... 820.4415.02

19" Rack Adapter ..... ZZA-94 ..... 396.4905.00

Service Kit ..... SMGU-Z2 ..... 820.4515.02

1) does not apply to special function "transient-free level settings".

2) does not apply to special function "125 MHz heterodyne band".

3) does not apply to special function "AGC off".