

# Signal generators

## Signal generator SG 1000; 1 ms switching time, 15 $\mu$ s



- Frequency range 9 kHz to 1000 MHz
- AM, FM, PhM
- Pulse modulation
- Output level - 137 dBm ... + 13 dBm
- Level offset - 10 dB ... + 10 dB
- Level corrections can be saved
- Fast frequency switching
- Digital sweeping
- Frequency hopping
- High spectral purity
- Unwanted swing < 0.1 Hz
- High signal-to-spurious noise ratio
- Precise OCXO as internal reference
- RS 232 interface; IEEE bus
- Pager (POCSAG encoder)
- LF generators 0 Hz to 100 kHz
- 100 memory positions for all instrument settings

Two models of the signal generator SG 1000 are available; these differ essentially in the time taken to change the frequency. The SG 1000 (order no. 86204.000) requires less than 1 ms for the full slew to a new carrier frequency. The signal generator SG 1000 (order no. 86204.001) takes only 1  $\mu$ s for frequency steps of less than 1 MHz and only 15  $\mu$ s for frequency steps from 1 MHz. In case of frequency changes below 1 MHz, the carrier signal change is made with continuous phase.

The carrier frequency on the signal generators SG 1000 can be adjusted in the range between 9 kHz and 1000 MHz (can be used from 1 kHz with uncalibrated output level). All settings are made using numeric keys or using the handwheel. The increment used for switching can be selected as required. All parameters set are clearly displayed on a high-contrast LCD display with 4-level backlighting.

The signal generators SG 1000 can be amplitude, frequency, phase and pulse modulated. It is possible to combine individual modulation types. The internal LF generator, an external signal or both can be used for the modulation. The frequency of the internal LF generator can be adjusted in the range from 0 to 32 kHz (up to 100 kHz as option) in 0.01-Hz steps. Depending on the application, the LF generator supplies sinusoidal, square, triangular or saw tooth wave shapes. The generation of POCSAG for checking pagers in audio only, numeric and alphanumeric modes is available as an option. In the alphanumeric operating mode it is possible to generate all ASCII characters.

The fast switching version of the signal generator SG 1000 has a programmable and directly addressable memory bank as an option. Frequency settings can be saved at each address in the memory bank to generate the hopping sequence required.

The execution of the hopping program is sequentially controlled either internally or by an external clock. The individual memory addresses can also be accessed directly. To generate a sweep signal, only the start and stop frequencies are defined as required and the increment set.

To compensate for the attenuation in connecting cables or other losses, it is possible to add a corresponding correction to the output level.

Up to 100 full SG 1000 settings can be saved in non-volatile memory and retrieved as required.

## Technical data SG 1000

Reference oscillator		Tolerance (m < 80 %, LF = 1 kHz):	≤ ± 5 % of m
Frequency/type:	10 MHz/OCXO	Distortion factor (m < 30 %, 1 kHz):	≤ 1 %
Temperature effect (+ 5 °C ... + 45 °C):	≤ 3 x 10 <sup>-8</sup>	(m < 80 %, 1 kHz):	≤ 2 %
Ageing:	≤ 2 x 10 <sup>-8</sup> /month	Mod. frequency response:	(0 ... 75 kHz, m = 30 %):
Reference frequency output:	10 MHz; + 10 dBm		≤ ± 1 dB
Reference frequency input:	10 MHz ± 2 x 10 <sup>-7</sup>		
Input level:	0 dBm ... + 8 dBm		
		Frequency modulation	
Carrier frequency:		Modulation frequency range:	0 ... 100 kHz
Frequency range:	9 kHz ... 999.999 999 8 MHz	Frequency swing (f < 500 MHz):	0 ... 500.0 kHz
Resolution (f < 500 MHz):	0.1 Hz	Ranges:	0 ... 610 Hz; 2.4 kHz; 9.8 kHz; 39.1 kHz
(f ≥ 500 MHz):	0.2 Hz		156.25 kHz; 500.0 kHz
Frequency error:	≤ 10 mHz+ reference error	Resolution:	Approx. 0.05 % of input
Slew time to a new frequency:	1 ms	Frequency swing (f ≥ 500 MHz):	0 ... 999.9 kHz
Switching time using IEEE bus, fast mode	≤ 10 ms	Ranges:	0 ... 1.22 kHz; 4.8 kHz; 19.6 kHz; 78.2 kHz
			312.5 kHz; 999.9 kHz
		Resolution:	Approx. 0.05 % of input
Spectral purity		Tolerance (LF = 1 kHz):	≤ ± 3 % + 20 Hz
Harmonic (P ≤ + 13 dBm):	≤ - 30 dBc	Distortion factor (swing > 2.5 kHz, LF = 1 kHz):	≤ 0.1 %
Sub-harmonic (f ≥ 500 MHz):	≤ - 65 dBc	Mod. freq. response: (0 ... 75 kHz, 50 kHz swing):	≤ ± 1 d
(f < 500 MHz):	None		
Non-harmonic (f < 500 MHz):	≤ - 72 dBc	Phase modulation	
(f ≥ 500 MHz):	≤ - 65 dBc	Modulation frequency range:	0 ... 100 kHz
FM interference (CCITT, eff.):	≤ 0.1 Hz	Phase swing (f < 500 MHz):	0 ... 49.99 rad
SSB noise (10 kHz offset): f < 500 MHz:	≤ - 126 dBc/Hz	Ranges:	0 ... 0.8 rad; 3.14 rad; 12.6 rad; 49.9 rad
f ≥ 500 MHz:	≤ - 120 dBc/Hz	Resolution:	Approx. 0.05 % of input
Background noise (f < 500 MHz):	≤ - 126 dBc/Hz	Phase swing (f ≥ 500 MHz):	0 ... 99.99 rad
(f ≥ 500 MHz):	≤ - 120 dBc/Hz	Ranges:	0 ... 1.6 rad; 6.28 rad; 25.2 rad; 99.8 rad
		Resolution:	Approx. 0.05 % of input
		Tolerance (LF = 1 kHz):	≤ ± 3 %
<b>Output level</b>		Pulse modulation	
Unmodulated, FM, PhM:	- 137 dBm ... + 13 dBm	Carrier frequency range:	9 kHz ... 999.999 999 9 MHz
AM:	- 137 dBm ... + 7 dBm	Control:	Ext. pulse, TTL pos. logic
Resolution:	0.1 dB	On/off ratio: 10 kHz < f < 10 MHz:	≥ 70 dB
Tolerance (- 40 dBm ... + 13 dBm):	≤ ± 0.5 dB	10 MHz < f < 700 MHz:	≥ 60 dB
(- 137 dBm ... - 40 dBm):	≤ ± 1.5 dB	700 MHz < f < 1000 MHz:	≥ 45 dB
Continuously variable (unmod., FM, PhM):	20 dB	Rise/fall time (10/90 %):	£ 5 ns
AM:	14 dB	Repetition frequency:	0 ... 20 MHz
Output level can be adjusted in:	dBm, dBµV, µV, mV, V		
Internal resistance:	50 W	<b>External modulation:</b>	
VSWR (P < + 8 dBm):	≤ 1.5	Input resistance:	1 MW
Level offset (0.1 dB-steps):	± 10 dB	Nominal input voltage:	1 Vpp
Connection:	N socket	Max. input voltage:	5 Vpp
Modulation		Connection:	BNC socket
Modulation types AC/DC coupling:	AM, FM, PhM, AM + FM, AM+PhM, pulse	<b>LF generator</b>	
Modulation sources:	internal, external, external + internal	Frequency range:	0 ... 32 kHz
		Frequency range (Option):	0 ... 99.999 9 kHz
Amplitude modulation		Frequency resolution::	0.01 Hz
Modulation frequency range:	0 ... 100 kHz	Frequency error:	≤ ± 2,3 mHz + Ref.
Modulation depth m:	0 ... 99.99 %	Output voltage (EMK):	1 mVeff ... 4.095 Veff
Resolution:	0.025 %		

Distortion factor (f ≤ 20 kHz): ≤ 0.1 %  
 (f > 20 kHz): ≤ 1 %  
 Wave shapes: Sinusoidal  
 f ≤ 18 kHz: saw tooth +, saw tooth -, triangular, square  
 wave Internal resistance: 600 W  
 Connection: BNC socket

### POCSAG encoder (option)

(Free access to carrier frequency, RF level, swing)

Audio only: Tones (A, B, C, D)  
 Numeric: Tone II, tone III, 0 ... 20 characters  
 Alphanumeric: Tone II, tone III, 00 ... 80 characters  
 (Text can be edited as required)

### General

LCD graphic display: 240 x 64 dots  
 Backlighting: LEDs, 4 brightness levels  
 Internal memory: 100 full settings  
 Interfaces (options): RS 232, IEEE bus  
 Power supply: 115 V/125 V, 230 V/250 V ± 10 %;  
 47 Hz ... 63 Hz; 100 VA (stand-by 10 VA)

Electrical safety: EN 61010

EMC: CE marking  
 Operating temperature: + 5 °C ... + 45 °C  
 Dimensions (W x H x D): 447 mm x 88 mm x 450 mm  
 Weight: Approx. 13 kg

### Accessories supplied

1 Power cable  
 1 Operating manual  
 1 set Fuses

### Order codes

Signal generator SG 1000,  
 1 ms switching time Order no. 86204.000

### Options

IEEE bus Order no. 86204.201  
 RS 232 interface Order no. 86204.206  
 LF generator 100 kHz Order no. 86204.204  
 POCSAG Order no. 86204.205

### Accessories

19" adapter Order no. 86302.10

## Supplement to technical data SG 1000 15 µs switching time

Carrier frequency  
 Frequency range: 9 kHz ... 999.999 999 8 kHz  
 Resolution (f < 500 MHz): 0.1 kHz  
 (f < 500 MHz): 0.2 kHz  
 Frequency error: ≤ 10 mHz + error  
 on the reference oscillator

Slew time to a new frequency:  
 Frequency step < ± 500 kHz ≤ 1 µs  
 Frequency step ≥ ± 500 kHz ≤ 15 µs  
 Switching time using memory bank:  
 Frequency step < ± 500 kHz ≤ 2 µs  
 Frequency step ≥ ± 500 kHz ≤ 20 µs  
 Switching time using IEEE bus, fast mode ≤ 10 ms

### Sweep and hopping (option)

Sweep mode: Digital sweep with discrete steps  
 Operating modes: Single measurement; multiple  
 measurement (repetitive)  
 Range: Start, stop and step frequency  
 can be selected as required  
 Number of steps: Max. 8,192  
 Step time: Adjustable 100 µs ... 10 s  
 Pen-up: Adjustable 100 µs ... 10 s  
 Plotter outputs: X output; 0 ... 10 V; BCN socket  
 Z output; TTL level; BCN socket

### Hopping mode

Operating modes: Single measurement,  
 multiple measurement (repetitive)  
 Triggered manually or by external TTL clock signal  
 Addresses/frequencies can be edited using  
 keypad/IEEE bus

Saved in non-volatile memory: 1,000  
 Saved via IEEE bus in additional RAM 15,384  
 Step times - internal operation (adjustable): 100 µs ... 10s  
 Step times - ext. clock control: Step < ± 500 kHz ≥ 20 µs  
 Step ≥ ± 500 kHz ≥ 20 µs  
 Interface: 50-pin socket, Sub-D

### Order codes

Signal generator SG 1000,  
 15 µs switching time Order no. 86204.001

### Options

IEEE bus Order no. 86204.201  
 RS 232 interface Order no. 86204.206  
 Sweep and hopping Order no. 86204.203  
 LF generator 100 kHz Order no. 86204.204  
 POCSAG Order no. 86204.205

### Accessories

19" adapter Order no. 86302.101