Model SG6000
Signal Generator
100 kHz–6 GHz

The Model SG6000 is a light weight 2U (3.5″) high signal generator with a frequency bandwidth of 100 kHz to 6 GHz. The signal generator offers a comprehensive modulation capability and offers the convenience of control from the front panel and remote communications using either GPIB or RS-232. The signal generator has rear panel connectors for easy installation into a rack mounted system. The SG6000 provides electronic trip protection which protects the generator output against reverse power up to 50 watts.

SPECIFICATIONS

FREQUENCY

Range.....100 kHz to 6 GHz (Performance below 250 kHz unspecified)
Resolution.....0.01 Hz
Phase incrementing.....0.01° Nominal

Frequency Bands.....N is a factor to help define certain specifications in the spec sheet

Band	Frequency Range	N
1	100 kHz to < 250 MHz	0.5
2	250 MHz to < 375 MHz	0.125
3	375 MHz to < 750 MHz	0.25
4	750 MHz to <1500 MHz	0.5
5	1500 MHz to < 3000.001 MHz	1
6	3000.001 MHz to 6000 MHz	2

Switching Speed

Type	Switching Speed
SCPI mode	≤ 5 ms typical
List/Step sweep mode	≤ 5 ms typical

NOTE: *Time of receipt of SCPI command or trigger signal to within 0.1ppm of final frequency or within 100 Hz, whichever is greater, and amplitude settled to within 0.2 dB. Additional time may be required for the amplitude to settle within 0.2 dB when switching to or from frequencies < 500 kHz or amplitudes > +5 dBm.*

Accuracy.....±aging rate
±temperature effects
±line voltage effects
Internal Time base Oscillator aging rate.....≤ ±5 ppm/10 yrs, < ±1ppm/yr
Temperature effects.....±1ppm (0 to 55°C)
Line Voltage effects.....±0.1ppm Nominal
Line Voltage range.....5% to -10% Nominal

REFERENCE OUTPUT

Frequency.....10 MHz
Amplitude.....≥+4dBm Nominal (into 50Ω load)

EXTERNAL REFERENCE INPUT

Input Frequency.....10 MHz
Lock Range.....±1ppm
Amplitude.....>-3.5 to 20 dBm Nominal
Impedance.....50Ω Nominal

RF OUTPUT

Range (Specifications between 20°C and 30°C)

Frequency Range	Output Power
250 kHz to 2.5 GHz	-110 to +13 dBm
> 2.5 GHz to 3.0 GHz	-110 to +10 dBm
> 3.0 GHz to 4.5 GHz	-110 to +13 dBm
> 4.5 GHz to 5.8 GHz	-110 to +10 dBm
> 5.8 GHz to 6 GHz	-110 to +7 dBm

NOTE: *Maximum Output Power typically decreases by 0.2 dB/degree C for temperatures outside this range.*

Resolution.....0.02 dB Nominal
Step Attenuator .....0 to 130 dB in 5 dB steps

RF OUTPUT CONNECTOR.....50Ω type N connector

VSWR

≤ 1.4 GHz .....1.7:1 Typical
> 1.4 GHz to 4 GHz.....2.3:1 Typical
> 4.0 GHz to 5 GHz.....2.4:1 Typical
> 5 GHz to 6 GHz.....2.2:1 Typical

MAXIMUM REVERSE POWER

DC Voltage (max).....50 VDC Nominal
250 kHz to 6 GHz.....2 W Nominal

SWITCHING SPEED (Time from receipt of SCPI command or trigger signal to amplitude settled within 0.2 dB when switching to or from amplitudes < +5 dBm)

Type	Standard
SCPI mode	≤ 5 ms
List/Step sweep mode	≤ 5 ms

ABSOLUTE LEVEL ACCURACY (between 20°C and 30°C and the ALC on)

Frequency Range	Amplitude	
	+ 7 dBm to -60 dBm	< -60 dBm to -110 dBm
250 kHz to 1 MHz	≤0.6 dB	≤0.7 dB
> 1 MHz to 1 GHz	≤0.6 dB	≤0.7 dB
>1 GHz to 3 GHz	≤0.7 dB	≤0.9 dB
>3 GHz to 4 GHz	≤0.8 dB	≤0.9 dB
4 GHz to 6 GHz	≤0.8 dB	≤1.1 dB

ABSOLUTE LEVEL ACCURACY (For temperatures outside of 20°C and 30°C)

≤ 4.5 GHz .....0.01 dB/degree C
>4.5 GHz .....0.02 dB/degree C

FLATNESS CORRECTION

Number of Points.....1601
Number of Tables .....Dependent on available free memory

SPECTRAL PURITY .....At Single sideband phase noise (at 20 kHz offset)

500 MHz .....≤-126 dBc/Hz typical
1 GHz .....≤-121 dBc/Hz typical
2 GHz .....≤-115 dBc/Hz typical
3 GHz .....≤-110 dBc/Hz typical
4 GHz .....≤-109 dB/Hz typical
6 GHz .....≤-104 dB/Hz typical

HARMONICS (CW mode, output level <4 dBm)

≤3 GHz .....< -30dBc
>3 GHz .....< -44 dBc typical

NON-HARMONICS (CW mode) > 10 kHz offset

250 kHz to 250 MHz.....< -54 dBc
>250 MHz to 375 MHz.....< -61 dBc
>375 MHz to 750 MHz.....< -55 dBc
>750 MHz to 1.5 GHz.....< -48 dBc
>1.5 GHz to 3 GHz.....< -48 dBc
>3 GHz to 6 GHz.....≤ -42 dBc

SUB-HARMONICS (CW mode)

≤4 GHz .....< -76 dBc
>4 GHz to 5 GHz.....< -64 dBc
>5 GHz to 5.5 GHz.....< -50 dBc
>5.5 GHz to 6 GHz.....< -46 dBc

JITTER

Carrier Frequency	SONET/SDH Data Rate	Rms jitter BW	uUI rms	Femtoseconds
155 MHz	155 MB/s	100 Hz to 1.5 MHz	84	537
622 MHz	155 MB/s	1 kHz to 5 MHz	47	75
2488 MHz	2488 MB/s	5 kHz to 20 MHz	178	72

NOTE: Calculated from the phase noise performance in CW mode at +10 dBm.

DIGITAL SWEEP MODES (for Frequency)

Step Sweep
List Sweep
Simultaneous frequency/amplitude sweeping
Sweep Range .....within instrument frequency range
Dwell time .....100 us to 100 sec
Number of Points .....2 to 65535 (step sweep) / 1 to 1601 (list sweep)
Step Change.....Linear or logarithmic (frequency)

DIGITAL SWEEP MODES (for Amplitude)

Sweep Range .....within instrument amplitude range
Dwell time .....100 us to 100 sec
Number of Points .....2 to 65535 (step sweep) / 1 to 1601 (list sweep)
Step Change.....Linear (amplitude)
Triggering .....Free Run, Trigger Key, External, Timer, bus (GPIB, LAN, USB)

MODULATION MODES.....All modulation types (FM, AM, ΦM and pulse modulation) may be simultaneously enabled: except FM and phase modulation can not be combined; two modulation types can be simultaneously generated using the same modulation source. For example, AM and FM can run concurrently and will modulate the output RF. This is useful for simulating signal impairments.

INTERNAL MODULATION SOURCE

Waveform.....Sine wave
Rate Range .....100 mHz to 2 MHz
Resolution.....1mHz
Frequency Accuracy.....Same as RF reference source Nominal

EXTERNAL MODULATION INPUTS

Modulation types.....AM, FM, ΦM, and Pulse modulation
Input Impedance .....50Ω nominal

AMPLITUDE MODULATION

AM depth type.....Linear or exponential
Depth maximum 90%
Depth Resolution.....0.1% nominal
Depth Accuracy (1 kHz rate).....< ±4% of setting +1% typical

MODULATION RATE (3 DB BANDWIDTH)

DC Coupled .....0 to 10 kHz typical
AC Coupled.....5 Hz to 10 kHz typical

DISTORTION (1 kHz rate).....< 2% typical

SENSITIVITY (when using external input).....+1Vp for indicated depth nominal

NOTE: AM is specified at carrier frequencies from 500 kHz to 3 GHz, power levels ≤ ±4 dBm, and depths ≤ 90%

PULSE MODULATION (Pulse specifications apply to frequencies > 10 MHz)

ON/OFF Ratio .....> 80 dB typical
Rise Time .....< 50 ns typical
Fall Time.....< 50 ns typical
Minimum width (ALC ON) .....≥ 2µs typical
Minimum width (ALC OFF).....≥ 500 ns
Resolution.....20 ns nominal
Pulse Repetition Frequency (ALC ON).....DC to 500 kHz
Pulse Repetition Frequency (ALC OFF) .....DC to 2 MHz

Resolution ..... 20 ns nominal
Level accuracy ..... < 1 dB typical
Relative to CW, ALC On and Off
Video feedthrough ..... < 0.5V typical
Pulse overshoot ..... < 15% typical
Pulse compression ..... 15 ns typical
Internal Pulse delay ..... 50 ns nominal
External Pulse delay ..... 100 ns nominal
External Input Impedance ..... 50 Ω nominal
External Input Level ..... + 1Vp = ON nominal
Internal Pulse generator modes ..... Free-run, square, triggered, adjustable doublet, trigger doublet, gated, and external pulse.
Square wave rate ..... 0.1 Hz to 10 MHz, 0.1 Hz resolution nominal
Pulse period ..... 500 ns to 42 seconds nominal
Pulse width ..... 500 ns to pulse period – 10 ns nominal
Resolution ..... 20 ns nominal
Adjustable trigger delay ..... -pulse period + 10 ns to pulse period
to pulse width – 10 ns
Free run Settable delay ..... -3.99µs to 3.97µs
Triggered Settable delay ..... 0 to 40 s
Resolution ..... 10 ns nominal
Delay, Width, Period
Pulse doublets (1st pulse delay) ..... 0 to 42 s – pulse width – 10 ns
Relative to sync out
Pulse doublets (1st pulse width) ..... 500 ns to 42 s – delay – 10 ns
Pulse doublets (2nd pulse delay) ..... 0 to 42 ns – (delay1 + width2) – 10 ns
Relative to pulse 1
Pulse doublets (2nd pulse width) ..... 20 ns to 42 s – (delay1 + delay2) – 10 ns

FREQUENCY MODULATION

Max Deviation ..... N times 10 MHz nominal
Resolution ..... 0.1% of deviation or 1 Hz, which ever is greater nominal
Deviation accuracy ..... < ±2% + 20 Hz
(1 kHz rate, deviation is N x 100kHz)
Modulation frequency response (at 100 kHz deviation)

	1 dB Bandwidth	3 dB Bandwidth
DC Coupled	DC to 3 MHz nominal	DC to 7 MHz nominal
AC Coupled	5 Hz to 3 MHz nominal	5 Hz to 7 MHz nominal

Carrier frequency accuracy ..... < ±0.2% of set deviation + (N x 1 Hz)
Relative to CW in DCFM
NOTE: Specification valid for temperature changes < 5°C since last DCFM calibration
Distortion (1 kHz rate, deviation is N x 100 kHz) ..... < 0.4%
Sensitivity (External input) ..... +1Vp for indicated deviation nominal

PHASE MODULATION

Maximum Deviation and frequency response

	Max deviation	3 dB Bandwidth
Normal BW	N x 10 radians nominal	DC to 1 MHz nominal
High BW	N x 1 radian nominal	DC to 4 MHz nominal
Resolution	0.1% of deviation nominal	

Deviation accuracy ..... < +0.5% + 0.01 radians typical
(1 kHz rate, deviation normal BW mode)
Sensitivity (External Input) ..... +1Vp for indicated deviation nominal
Distortion ..... <3%@10 radians@1kHz modulation rate

GENERAL

GPIB Communications ..... IEEE 488.2
USB ..... Version 2.0
LAN ..... 100BaseT LAN interface, LXI class C compliant
SCPI ..... Version 1997.0

AC Input ..... 100 to 120 VAC, 50 to 60 Hz
220 to 240 VAC, 50 to 60 Hz

250 W maximum

Dimensions (HxWxD).....103x426x432 mm (4.07x16.8x17 in)
Weight.....≤12.5 kg (27.5 lb)
Operating Temperature.....0 to 55° C
Storage Temperature.....-40 to 70° C
Operating and storage Altitude.....(15,000 ft)
Recommended Calibration Cycle .....24 months

REAR PANEL CONNECTORS

RF Output .....Type N female connector
Sweep Output .....BNC connector
0 to +10V when signal generator is sweeping.
The output can also be programmed to indicate when the source is settled or output pulse video and is TTL and CMOS compatible in this mode. Output Impedance < 1Ω, can drive 2k Ω. Damage levels are ±15 V.
External AM Input.....BNC
Damage Levels are ±5 V and has an input impedance of 50Ω.
External FM Input .....BNC
Damage Levels are ±5 V and has an input impedance of 50Ω.
External Pulse Input .....BNC
A TTL and CMOS compatible input. Logic Low levels are 0 V and Logic high level is +1V with a nominal input impedance of 50Ω. Input damage levels are ≤ -0.3V and ≥ +5.3V.
Trigger In.....BNC
Accepts TTL and CMOS level signals for triggering point-to-point in sweep mode. Damage levels are ≤ -0.3V and ≥ +5.3V.

Trigger Out.....BNC
Outputs TTL and CMOS level signal for use with sweep mode. The signal is high at start of dwell, or when waiting for point trigger in manual sweep mode; low when dwell is over or point trigger is received. This output can also be programmed to indicate when the source is settled, pulse synchronization, or pulse video. Nominal output impedance 50Ω. Input damage levels are ≤ -0.3V and ≥ +5.3V.
Reference Input .....BNC
Accepts a 10 MHz reference signal used to frequency lock the internal time base. Nominal Input impedance 50Ω with -3.5 to +20 dBm.
10 MHz Output.....BNC
Outputs 10 MHz reference signal used by internal time base. Level nominally +3.9 dBm. Nominal output impedance 50Ω. Input damage level is +16 dBm.

USB 2.0.....The USB connector provides remote programming functions via SCPI
LAN (100 BaseT).....The LAN connector provides the same SCPI remote programming. This functions the same as the GPIB. The LAN supports DHCP, sockets SCPI, VXI-11 SCPI, and LXI class C compliant.

GPIB.....Provides remote programming functionality via SCPI.