The Model SG6000 is a lightweight 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

<table>
<thead>
<tr>
<th>Band</th>
<th>Frequency Range</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>100 kHz to &lt; 250 MHz</td>
<td>0.5</td>
</tr>
<tr>
<td>2</td>
<td>250 MHz to &lt; 375 MHz</td>
<td>0.125</td>
</tr>
<tr>
<td>3</td>
<td>375 MHz to &lt; 750 MHz</td>
<td>0.25</td>
</tr>
<tr>
<td>4</td>
<td>750 MHz to &lt; 1500 MHz</td>
<td>0.5</td>
</tr>
<tr>
<td>5</td>
<td>1500 MHz to &lt; 3000.001 MHz</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>3000.001 MHz to 6000 MHz</td>
<td>2</td>
</tr>
</tbody>
</table>

**Switching Speed**

- SCPI mode: \( \leq 5 \text{ ms typical} \)
- List/Step sweep mode: \( \leq 5 \text{ ms typical} \)

**NOTE:** Time of receipt of SCPI command or trigger signal to within 0.1 ppm 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**

- Internal Time base Oscillator aging rate: \( \leq 5 \text{ ppm/10 yrs, } < 1 \text{ ppm/yr} \)
- Temperature effects: \( \pm 1 \text{ ppm (0 to 55°C)} \)
- Line Voltage effects: \( \pm 0.1 \text{ ppm Nominal} \)
- Line Voltage range: \( 5\% \text{ to } 10\% \text{ Nominal} \)

**REFERENCE OUTPUT**

- Frequency: 10 MHz
- Amplitude: \( \geq +4 \text{ dBm Nominal (into 50\Omega load)} \)

**EXTERNAL REFERENCE INPUT**

- Input Frequency: 10 MHz
- Lock Range: \( \pm 1 \text{ ppm} \)
- Amplitude: \( >-3.5 \text{ to 20 dBm Nominal} \)
- Impedance: \( 50\Omega \text{ Nominal} \)
RF OUTPUT

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

<table>
<thead>
<tr>
<th>Frequency Range</th>
<th>Output Power</th>
</tr>
</thead>
<tbody>
<tr>
<td>250 kHz to 2.5 GHz</td>
<td>-110 to +13 dBm</td>
</tr>
<tr>
<td>&gt; 2.5 GHz to 3.0 GHz</td>
<td>-110 to +10 dBm</td>
</tr>
<tr>
<td>&gt; 3.0 GHz to 4.5 GHz</td>
<td>-110 to +13 dBm</td>
</tr>
<tr>
<td>&gt; 4.5 GHz to 5.8 GHz</td>
<td>-110 to +10 dBm</td>
</tr>
<tr>
<td>&gt; 5.8 GHz to 6 GHz</td>
<td>-110 to +7 dBm</td>
</tr>
</tbody>
</table>

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)

<table>
<thead>
<tr>
<th>Type</th>
<th>Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCPI mode</td>
<td>≤ 5 ms</td>
</tr>
<tr>
<td>List/Step sweep mode</td>
<td>≤ 5 ms</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Frequency Range</th>
<th>Amplitude</th>
</tr>
</thead>
<tbody>
<tr>
<td>+ 7 dBm to -60 dBm</td>
<td>&lt; -60 dBm to -110 dBm</td>
</tr>
<tr>
<td>250 kHz to 1 MHz</td>
<td>≤ 0.6 dB</td>
</tr>
<tr>
<td>&gt; 1 MHz to 1 GHz</td>
<td>≤ 0.6 dB</td>
</tr>
<tr>
<td>&gt; 1 GHz to 3 GHz</td>
<td>≤ 0.7 dB</td>
</tr>
<tr>
<td>&gt; 3 GHz to 4 GHz</td>
<td>≤ 0.8 dB</td>
</tr>
<tr>
<td>4 GHz to 6 GHz</td>
<td>≤ 0.8 dB</td>
</tr>
</tbody>
</table>

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 dBc/Hz typical
6 GHz .............................................................. ≤ -104 dBc/Hz typical

HARMONICS (CW mode, output level <4 dBm)
≤ 3 GHz .............................................................. < -30 dBc
> 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

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

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 ........................................ 1 mHz
- 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 ........................................... –3.99 μs to 3.97 μs
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)

<table>
<thead>
<tr>
<th></th>
<th>1 dB Bandwidth</th>
<th>3 dB Bandwidth</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC Coupled</td>
<td>DC to 3 MHz nominal</td>
<td>DC to 7 MHz nominal</td>
</tr>
<tr>
<td>AC Coupled</td>
<td>5 Hz to 3 MHz nominal</td>
<td>5 Hz to 7 MHz nominal</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th></th>
<th>Max deviation</th>
<th>3 dB Bandwidth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal BW</td>
<td>N x 10 radians nominal</td>
<td>DC to 1 MHz nominal</td>
</tr>
<tr>
<td>High BW</td>
<td>N x 1 radian nominal</td>
<td>DC to 4 MHz nominal</td>
</tr>
<tr>
<td>Resolution</td>
<td>0.1% of deviation nominal</td>
<td></td>
</tr>
</tbody>
</table>

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
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 2kΩ. Damage levels are ±15V.

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.