



Datasheet

SGX1003/SGX1006 RF Signal Generator



SGX1003/SGX1006 RF Signal Generator



The SGX1003 and SGX1006 utilize a unique non-PLL (phase locked loop) design with a digital front-end and direct, proprietary back end. The design enables a distinctive combination of features and performance.

Key Features

Frequency range: 10 MHz to 6 GHz

Output power range: -70 to +20 dBm

Lightning fast - Typical switching speed:
(narrowband list mode – < 9% bandwidth) 6 μ s, settled
(wideband list mode – full bandwidth) 250 μ s, settled

Ultra-low phase noise - single sideband phase noise
-123 dBc/Hz
3 GHz, 10 kHz offset
-117 dBc/Hz
6 GHz, 10 kHz offset

Ultra-low jitter < 100 fs

AM/FM/ Θ M and pulse modulation
100 MHz reference output (10 kHz offset) -153 dBc/Hz

Excellent amplitude accuracy (as low as -70 dBm) +/-0.25 dB

Superior reliability – MTBF >200,000 hours

SGX1003/1006 RF Signal Generator – Front Panel



- 1 USB ports for peripherals
- 2 At-a-glance display of key synthesis parameters
- 3 RF output (option to move to rear panel)
- 4 Multi-touch display with intuitive user interface
- 5 Quick access to freq and amp settings and to turn RF output on/off



6 SGX100x Additional Signal Generation Capabilities (beyond CW)



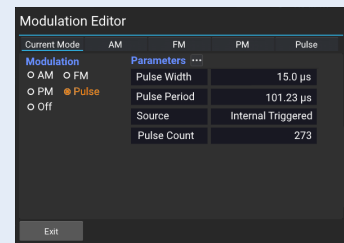
Sweep Mode

The RF output signal can be swept up or down between frequency points with a user-defined number of points and dwell time.



List Mode

Users can import a .csv file with a list of frequencies and power levels to which the instrument can be set via an external trigger or set of triggers.



Modulation

The SGX100x can be externally modulated to provide AM, FM, Θ M, or pulse modulation on its RF output. In addition, the signal generator has internal pulse modulation capability.

Specifications

| PARAMETER | MIN | TYPICAL | MAX | COMMENTS |
|-------------------------------------|---------|---------------|-----------|---|
| Frequency Range | | | | |
| Model HSM3001B | 10 MHz | | 3.072 GHz | Settable from 5 MHz to 3.072 GHz |
| Model HSM6001B | 10 MHz | | 6.400 GHz | Settable from 5 MHz to 6.720 GHz |
| Frequency Step Size | | 0.001 Hz | | |
| Phase Offset Resolution | | | | Offset Accuracy: |
| 10 MHz – 512 MHz | | 0.1 deg | | ±0.05 deg |
| 512 MHz – 1.024 GHz | | 0.2 deg | | ±0.10 deg |
| 1.024 GHz – 2.048 GHz | | 0.4 deg | | ±0.20 deg |
| 2.048 GHz – 4.096 GHz | | 0.8 deg | | ±0.40 deg |
| 4.096 GHz – 6.400 GHz | | 1.6 deg | | ±0.80 deg |
| Switching Speed (Frequency) | | | | |
| List/Step Sweep Mode (WB) | | 250 µs | 300 µs | Wideband Steps (full bandwidth) |
| List/Step Sweep Mode (NB) | | 6 µs | 100 µs | Narrowband Steps (<9% bandwidth) |
| Internal Time Base Reference | | | | |
| Oscillator Aging Rate | | ± 1 ppm/yr | | 1st year. ±0.5 ppm/yr each subsequent year |
| Temperature Effects | | ± 1 ppm | | 0° C to 55° C |
| Reference Output | | | | |
| Frequency | | 100 MHz | | |
| Amplitude | +2 dBm | | + 6 dBm | Nominal |
| External Reference Input | | | | |
| Input Frequency | | 10 or 100 MHz | | Software select 10 MHz, 100 MHz or No Ext. Ref. |
| 10MHz Lock Range | | +/- 4 ppm | +/- 1 ppm | 20 Hz Locking BW, Internal OCXO remains on |
| 10MHz External Amplitude | 0 dBm | | + 10 dBm | 20 Hz Locking BW, Internal OCXO remains on |
| 100MHz External Amplitude | + 2 dBm | | +6 dBm | Internal OCXO shuts off with 100 MHz Ext. Ref. |
| Waveform | | | | Sine |
| Digital Sweep Modes | | | | |
| Operating Modes | | | | Step sweep (linear, internal) |
| | | | | List sweep (arbitrary list of freq steps) |
| | | | | Simultaneous amplitude and frequency sweep (list) |
| Sweep Range | 10 MHz | | 3.072 GHz | SGX1003 |
| | 10 MHz | | 6.700 GHz | SGX1006 |
| Dwell Time | 100 µs | | 100 s | 1 µs increments |
| Number of Points (STEP) | 2 | | 65535 | |
| Number of Points (LIST) | 2 | | 3201 | |
| Triggering | | | | Free Run, External Trigger |

Specifications

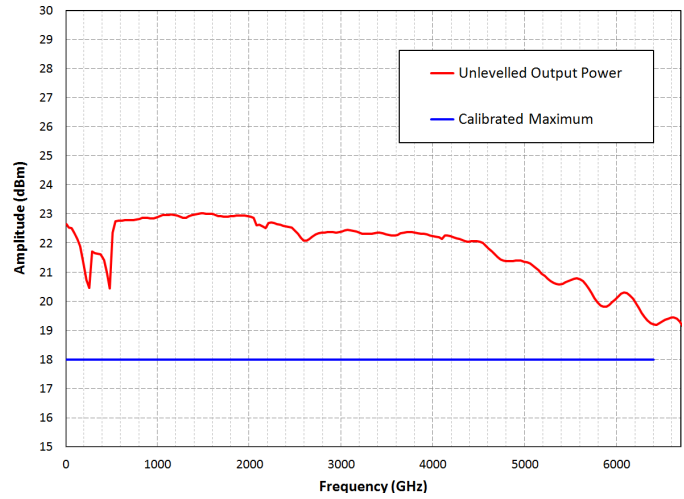
| PARAMETER | MIN | TYPICAL | MAX | COMMENTS |
|---|----------|--------------------|--------------------|--|
| Output Power (Calibrated) | - 50 dBm | | + 18 dBm | Settable from -90 dBm to +25 dBm; Refer to typical data: Page 6 |
| Resolution | | 0.01 dB | | |
| Connector | | 50 Ω | | SMA |
| SWR (return loss) | | | | |
| f < 32 MHz | | 1.4 (-15.6 dB) | 1.7 (-11.7 dB) | |
| 32 MHz < f < 1.024 GHz | | 1.15 (-23.0 dB) | 1.4 (-15.6 dB) | |
| 1.024 GHz < f < 6.4 GHz | | 1.3 (-17.7 dB) | 1.5 (-14 dB) | |
| Maximum Reverse Power | | | | |
| Max DC Voltage | | 25 VDC | | |
| > 10 MHz | | 10 mW (+16dBm) | | |
| Switching Speed (Amplitude) | | | | |
| List/Step Sweep Mode | | | 100 us | Settling to within 0.1 dB |
| Absolute Level Accuracy | | | | |
| 10 MHz < f < 6.4 GHz, +18 to -10 dBm | | ± 0.25 dB | ± 0.5 dB | 25° C to 35° C |
| 10 MHz < f < 6.4 GHz, -10 to -50 dBm | | ± 0.50 dB | ± 1.5 dB | 25° C to 35° C |
| Single Sideband Phase Noise | | | | Refer to typical data: Page 7 |
| 100 MHz, 10 kHz offset | | ≤ -153 dBc/Hz | ≤ -145 dBc/Hz | ≤ -152 dBc/Hz @ 20 kHz offset |
| 500 MHz, 10 kHz offset | | ≤ -139 dBc/Hz | ≤ -134 dBc/Hz | ≤ -140 dBc/Hz @ 20kHz offset |
| 1.0 GHz, 10 kHz offset | | ≤ -133 dBc/Hz | ≤ -128 dBc/Hz | ≤ -134 dBc/Hz @ 20 kHz offset |
| 2.0 GHz, 10 kHz offset | | ≤ -127 dBc/Hz | ≤ -122 dBc/Hz | ≤ -128 dBc/Hz @ 20 kHz offset |
| 3.0 GHz, 10 kHz offset | | ≤ -123 dBc/Hz | ≤ -117 dBc/Hz | ≤ -124 dBc/Hz @ 20 kHz offset |
| 4.0 GHz, 10 kHz offset | | ≤ -121 dBc/Hz | ≤ -115 dBc/Hz | ≤ -122 dBc/Hz @ 20 kHz offset |
| 6.0 GHz, 10 kHz offset | | ≤ -117 dBc/Hz | ≤ -111 dBc/Hz | ≤ -118 dBc/Hz @ 20 kHz offset |
| Harmonics (CW mode) | | (2nd / 3rd) | (All) | Refer to typical data: Page 8 |
| 100 MHz to 6.4 GHz | | -40 / -60 dBc | -30 dBc | @ +10 dBm |
| Sub-Harmonics (CW mode) | | (1/2 / 3/2) | (All) | Refer to typical data: Page 8 |
| 10 MHz to 1.024 GHz | | -85 / -75 dBc | -60 dBc | @ +10 dBm |
| 1.024 GHz to 4.2 GHz | | -70 / -55 dBc | -40 dBc | @ +10 dBm |
| 4.2 GHz to 6.4 GHz | | -65 / -70 dBc | -50 dBc | @ +10 dBm |
| Non-Harmonics/Spurious Broadband (CW mode) | | | | Refer to typical data: Page 8 |
| 10 MHz to 1.5 GHz | | -80 dBc | -70 dBc | @ +10 dBm |
| 1.5 GHz to 6.4 GHz | | -70 dBc | -60 dBc | @ +10 dBm |
| Jitter | | | | |
| 155 MHz | | 60 fs | | 100 Hz < BW < 1.5 MHz |
| 622 MHz | | 61 fs | | 1 kHz < BW < 5 MHz |
| 2.488 GHz | | 55 fs | | 5 kHz < BW < 20 MHz |

Output Power Data

The data contained in this section demonstrates the typical output power performance of the SGX1003 and SGX1006 series designs.

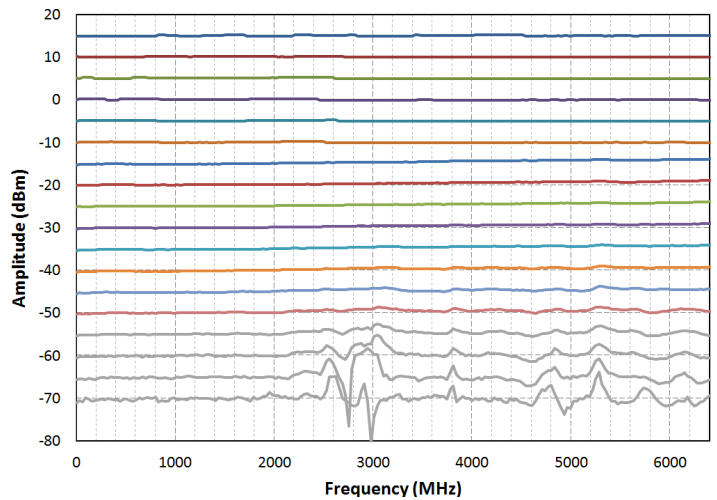
Output Power Maximum

FIGURE 1:
Maximum Output Power (unleveled)
Typical Performance
10 MHz - 6.7 GHz
 P_{OUT} Setting: +25 dBm



Calibrated Output Power

FIGURE 2:
Calibrated Output Power
+15 dBm to -50 dBm
10 MHz - 6.7 GHz

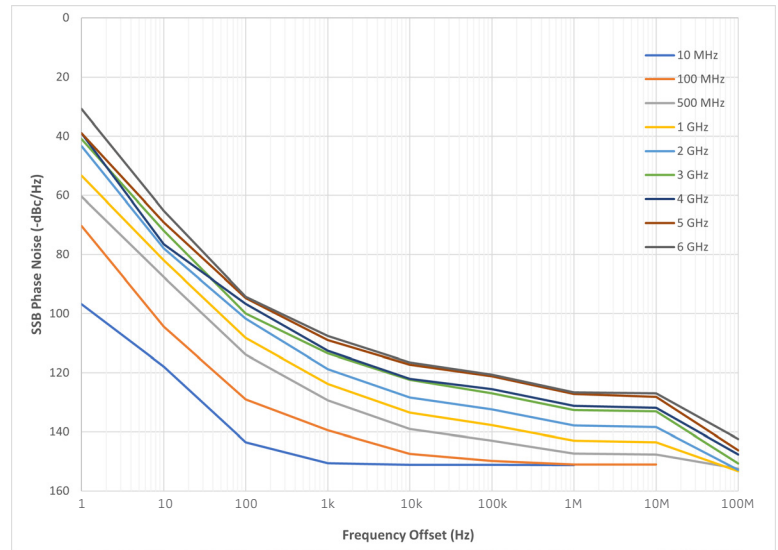


Phase Noise Data

The data contained in this section demonstrates the typical phase noise performance of the SGX1003 and SGX1006 series designs, dependent on installation of the standard OCXO.

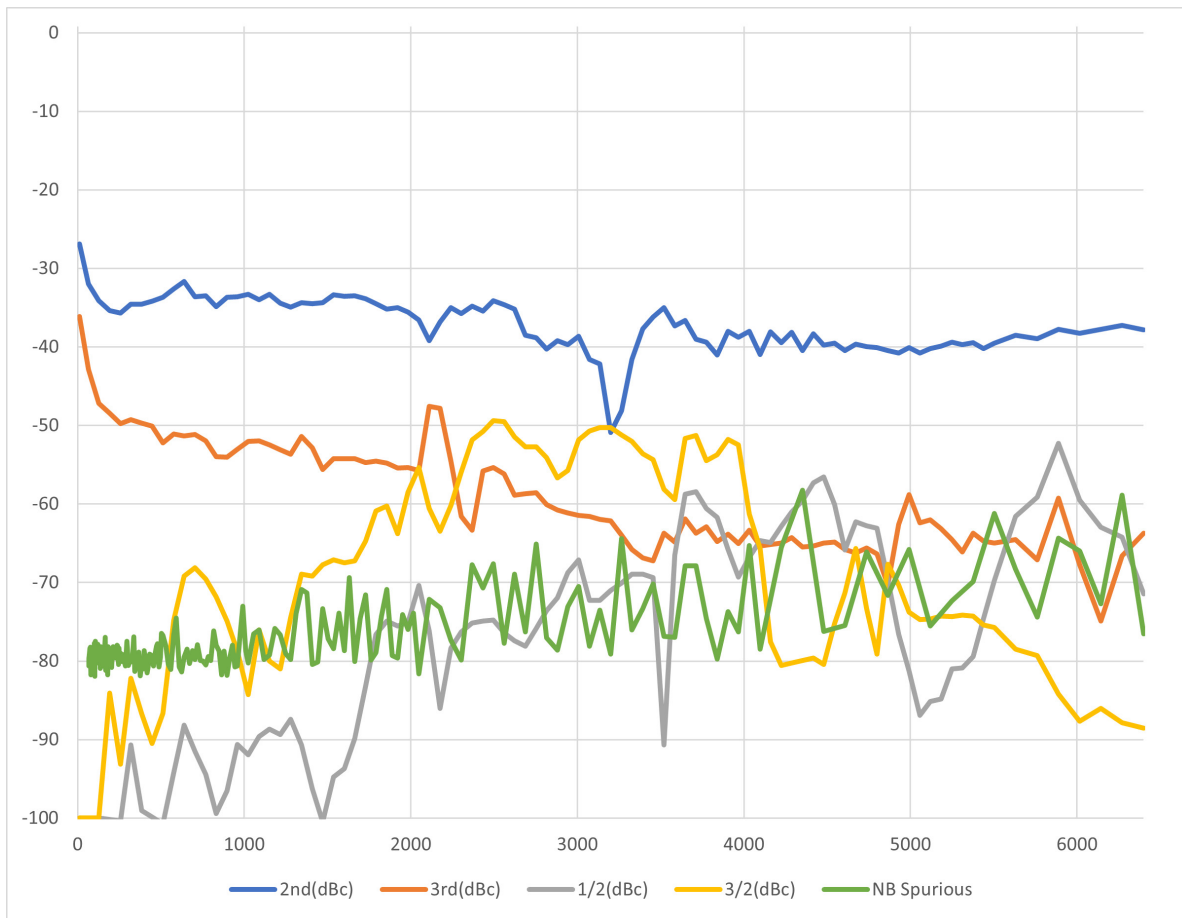
Standard OCXO

FIGURE 3:
Phase Noise
Performance
Standard OCXO
500 MHz - 6 GHz
 P_{OUT} Setting: +10 dBm
Offset: 10 Hz - 100 MHz



Spectral Purity Data

The data contained in this section demonstrates the typical spectral purity performance of the SGX1003 and SGX1006 series designs.



HARMONICS

2nd Harmonic
3rd Harmonic

Harmonics Performance

10 MHz – 6.7 GHz

P_{OUT} Setting: +10 dBm

RBW: 3 kHz

VBW: 3 kHz

SUB-HARMONICS

$1/2$ Sub-Harmonic
 $3/2$ Sub-Harmonic

Sub-Harmonic Performance

10 MHz – 6.7 GHz

P_{OUT} Setting: +10 dBm

RBW: 3 kHz

VBW: 3 kHz

NARROWBAND NON-HARMONICS / SPURIOUS

Maximum Spurious
Response

Narrowband Maximum
Spurious Performance

10 MHz – 6.4 GHz

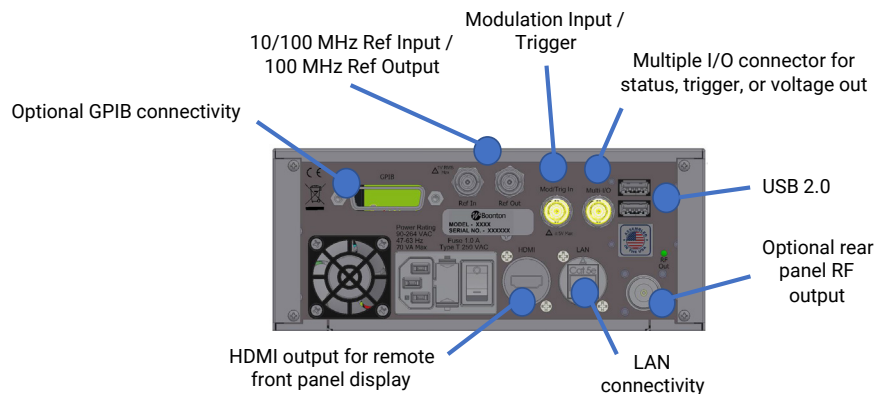
P_{OUT} Setting: +10 dBm

RBW: 3 kHz

VBW: 3 kHz

Specifications, Continued

| | | |
|-----------------------------------|-----------------|---|
| Inputs/Outputs (front panel) | USB | 2 ports USB2.0: Type A receptacle |
| RF Output | | 50 Ω, N-type (f) |
| Inputs/Outputs (rear panel) | LAN | RJ-45 modular socket |
| | USB | 2 ports USB2.0: Type A receptacle |
| RF Output (optional) | | 50 Ω, N-type (f) |
| Multi I/O Connector | | 50 Ω, BNC(f); DC-coupled |
| | User Selectable | Status, trigger, or voltage output |
| | Range | 0 to 10 V (Analog unipolar) |
| | | -10 V to +10 V (Analog bipolar) |
| | | 0 or 5 V (Logic) |
| | Accuracy | ±200 mV (±100 mV typical) |
| | Linearity | 0.1% typical |
| Modulation Input / Trigger | | +/- 5V max; 50 Ω, BNC(f); DC-coupled |
| Reference Input | | 1V RMS max; 50 Ω, BNC(f); AC-coupled |
| Reference Output | | 100 MHz; 50 Ω, BNC(f); AC-coupled |
| HDMI | | |
| Remote Control | Command Set | SCPI-1999.0 |
| | LAN | Ethernet:10/100/1000 BaseT; HISLIP |
| | GPIB (optional) | |
| Regulatory Compliance | | CE compliance with the following European Union directives |
| | | Low Voltage Directive 2014/35/EU |
| | | Electromagnetic Compatibility Directive (EMC) 2014/30/EU |
| | | RoHS Directive 2011/65/EU, WEEE Directive 2012/19/EU |
| | | Environmental MIL-PRF-28800F, Class 3 |
| Dimensions (excluding connectors) | H x W x D | 3.5x8.3x11.2 (in), 89x211x284 (mm) |
| Weight | | 7 lbs, 3.2 kg |
| Power Requirements | | 90 to 260 VAC, 47 to 60 Hz; 90 to 135 VAC, 47 to 400 Hz; 30 W (35 VA) max |
| Operating Temperature | | 0 to 50 °C (32 to 122 °F) |
| Storage Temperature | | -40 to +70 °C (-40 to 158 °F) |
| Humidity | | 95% maximum, non-condensing |
| Altitude | | Operation up to 15,000 feet (4575 m) |
| Shock | | Withstands ±30 G, 11 ms impulse in X, Y, and Z axes |
| Vibration | | Withstands 2 G sine, 5 to 55 Hz; 2 G random, 5 to 500 Hz |
| Warranty | | 3 years |



Specification — Modulation (External Stimulus)

| PARAMETER | PERFORMANCE | COMMENTS |
|--------------------------------------|---|---|
| FREQUENCY MODULATION (Analog) | | |
| Max Deviation | 100 kHz | |
| Resolution | 0.01% or 1mHz, whichever is greater | |
| Modulation Freq. Response | DC to 20 kHz (-3dB) | DC Coupled |
| Sensitivity when using Ext. Input | $\pm 1V$ peak into 50 Ω | + 1V: Maximum Positive Deviation 0V: Zero Deviation from Carrier - 1V: Maximum Negative Deviation |
| PHASE MODULATION (Analog) | | |
| Modulation Deviation | ± 1.6 deg to ± 180 deg | |
| Frequency Response | DC to 20 kHz (-3dB) | DC Coupled |
| Resolution | Frequency Dependent | See Phase Offset Specification |
| Sensitivity when using Ext. Input | $\pm 1V$ peak into 50 Ω | + 1V; Maximum Negative Deviation 0V: Zero Deviation from Carrier - 1V: Maximum Negative Deviation |
| AMPLITUDE MODULATION (Analog) | | |
| AM Depth Type | Linear | |
| Depth | | |
| Maximum | 5% to 75% | 0.45 dB to 12 dB |
| Resolution | <3% of Maximum Depth | |
| Depth Accuracy | 5% of Maximum Depth | |
| Modulation Rate | DC to 10 kHz (-3dB) | DC Coupled |
| Sensitivity when using Ext. Input | $\pm 1V$ peak for indicated Depth (into 50 Ω) | + 1V: Maximum Positive Deviation 0V: Zero Deviation from Carrier - 1V: Maximum Negative Deviation |
| PULSE MODULATION (Analog) | | |
| Rise time (T_r) | <50 ns | |
| Fall time (T_f) | <50 ns | |
| On/Off Ratio | > 70dB | |
| Minimum Pulse Width | <100 ns | |
| ALC Loop Deviation (ALC disabled) | 1dB difference from ALC enabled | |
| External Trigger Threshold | +1.2 V | +/- 5% into 50 Ω |

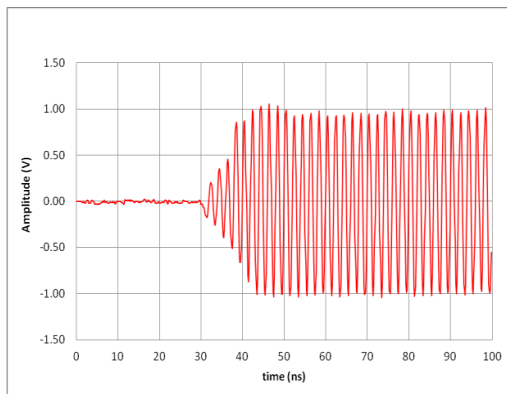


Figure 1a: Pulse Mod Rise Time, $f_c = 500$ MHz

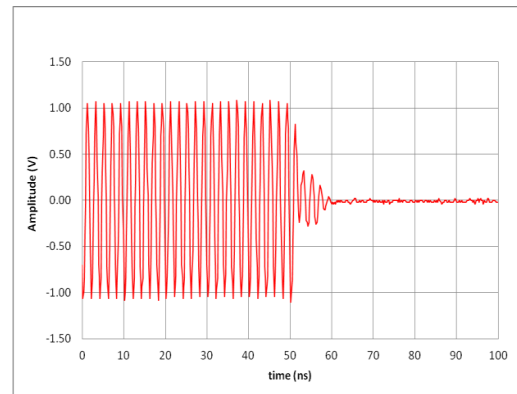


Figure 1b: Pulse Mod Fall Time, $f_c = 500$ MHz

Specification — Modulation (External Stimulus), Continued

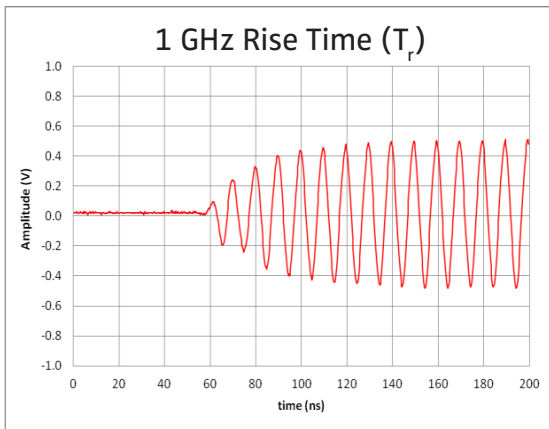


Figure 2a: Pulse Mod Rise Time, $f_c = 1$ GHz

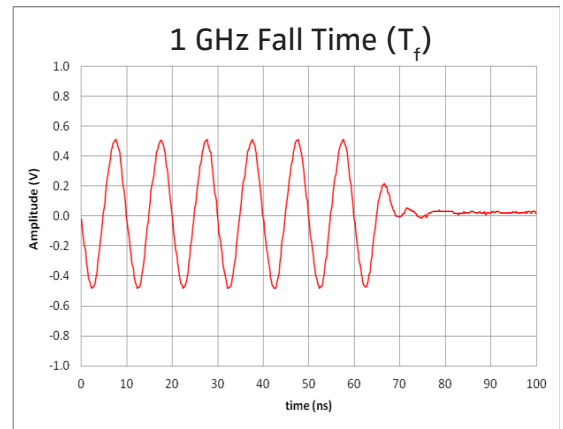


Figure 2b: Pulse Mod Fall Time, $f_c = 1$ GHz

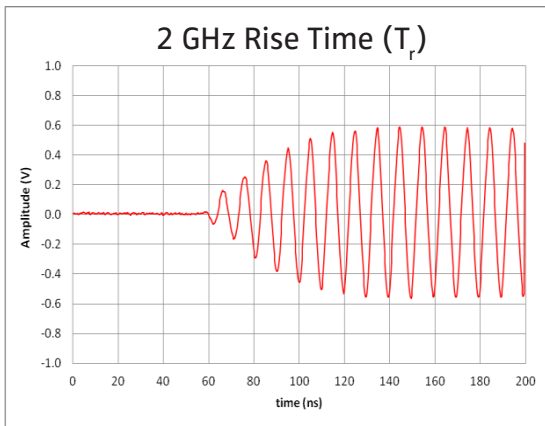


Figure 3a: Pulse Mod Rise Time, $f_c = 2$ GHz

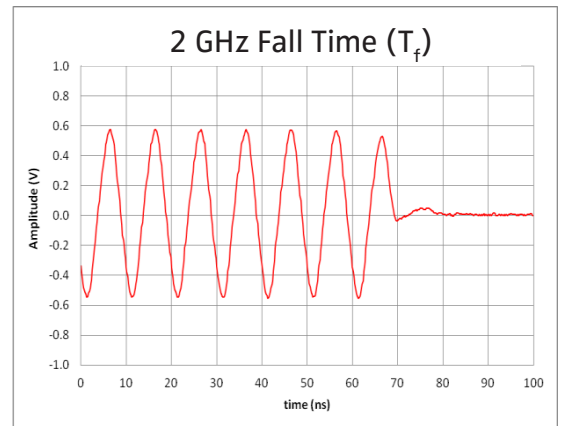


Figure 3b: Pulse Mod Fall Time, $f_c = 2$ GHz

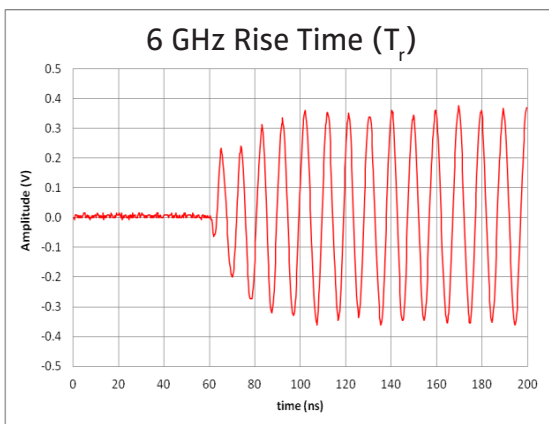


Figure 4a: Pulse Mod Rise Time, $f_c = 6$ GHz

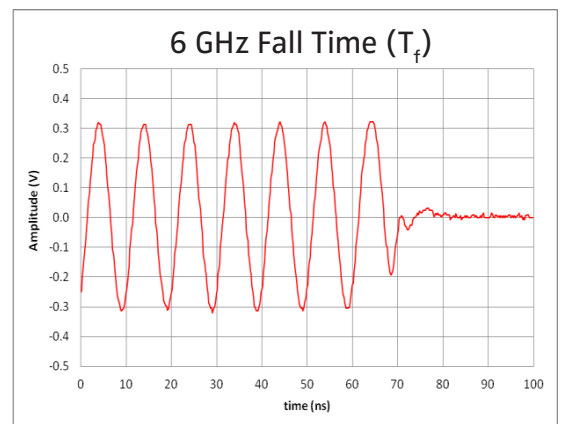


Figure 4b: Pulse Mod Fall Time, $f_c = 6$ GHz

Specification – Modulation (Self Pulse Modulation)

| PARAMETER | PERFORMANCE | COMMENTS |
|-----------------------------------|---------------------------------|----------|
| PULSE MODULATION (Analog) | | |
| Rise time (T_r) | | |
| $f_c < 512\text{MHz}$ | 10 ns (typical) | |
| $f_c > 512\text{MHz}$ | 35 ns (typical) | |
| Fall time (T_f) | | |
| $f_c < 512\text{MHz}$ | 8 ns (typical) | |
| $f_c > 512\text{MHz}$ | 10 ns (typical) | |
| On/Off Ratio | > 70dB | |
| Minimum Pulse Width | 50 ns | |
| ALC Loop Deviation (ALC disabled) | 1dB difference from ALC enabled | |

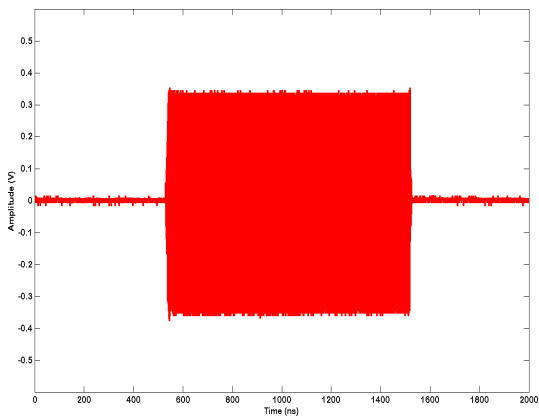


Figure 1: Self Pulse Mod $f_c = 500\text{ MHz}$, $1\ \mu\text{s}$ Pulse1

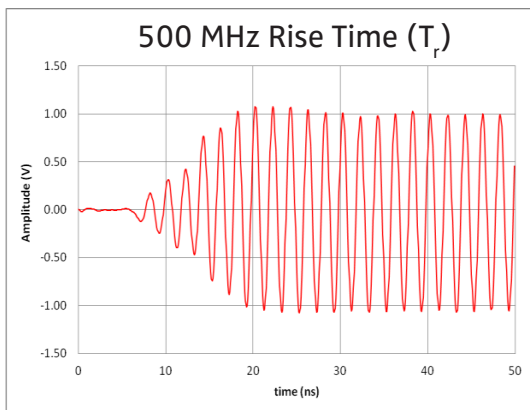


Figure 2a: Self Pulse Mod Rise Time, $f_c = 500\text{ MHz}$

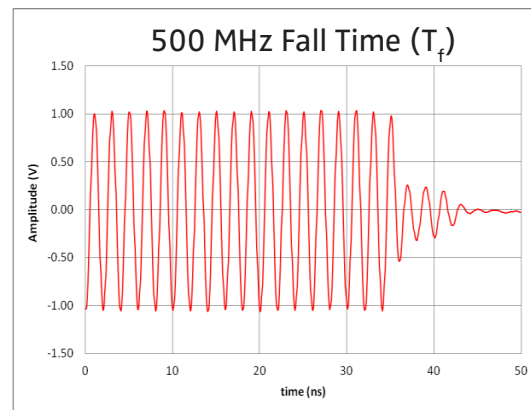


Figure 2b: Self Pulse Mod Fall Time, $f_c = 500\text{ MHz}$

Specification – Modulation (Self Pulse Modulation), Continued

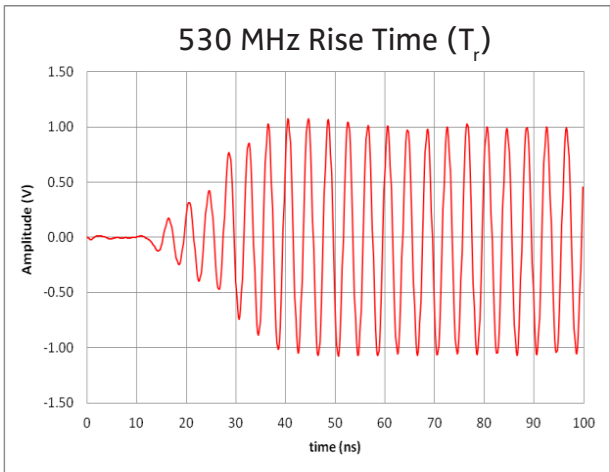


Figure 3a: Self Pulse Mod Rise Time, $f_c = 530$ MHz

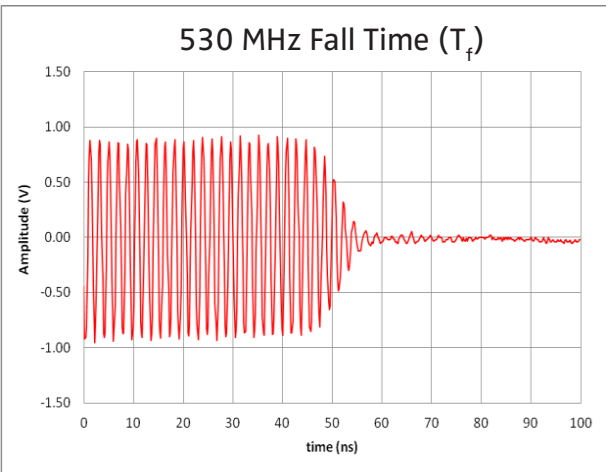


Figure 3b: Self Pulse Mod Fall Time, $f_c = 530$ MHz

Ordering Information

| | |
|---------|---------------------------------------|
| SGX1003 | RF Signal Generator (10 MHz to 3 GHz) |
| SGX1006 | RF Signal Generator (10 MHz to 6 GHz) |

Options

| | |
|----------|-------------------------------------|
| SGX-GPIB | GPIB Control (internally installed) |
| SGX-RRF | Moves RF output the rear panel |

Included Accessories

Information Card (provides information on where to find latest manual versions)

Optional Accessories

| | |
|-------------|--------------------|
| PMX40-RMK | 19" Rack Mount Kit |
| PMX40-TCASE | Transit case |
