

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 - Maximum switching speed:
(narrowband list mode – < 9% bandwidth) 6 μ s, settled
(wideband list mode – full bandwidth) 100 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/ΘM 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)



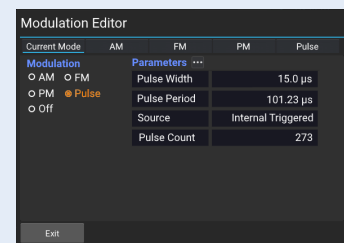
Sweep Mode

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

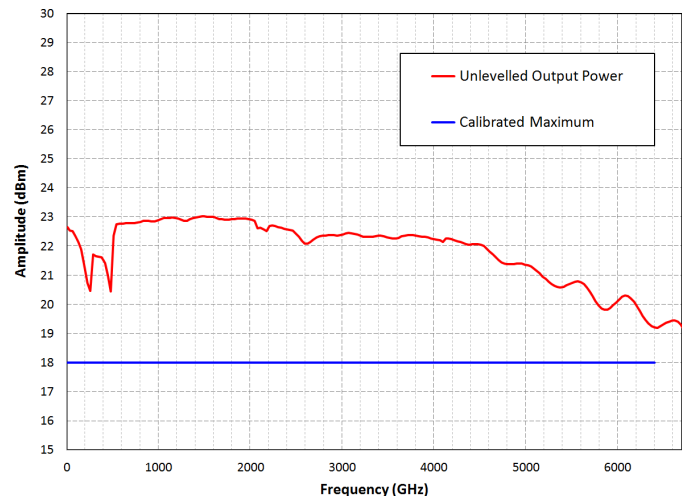
FIGURE 1:

Maximum Output Power (unleveled)

Typical Performance

10 MHz - 6.7 GHz

P_{OUT} Setting: +25 dBm



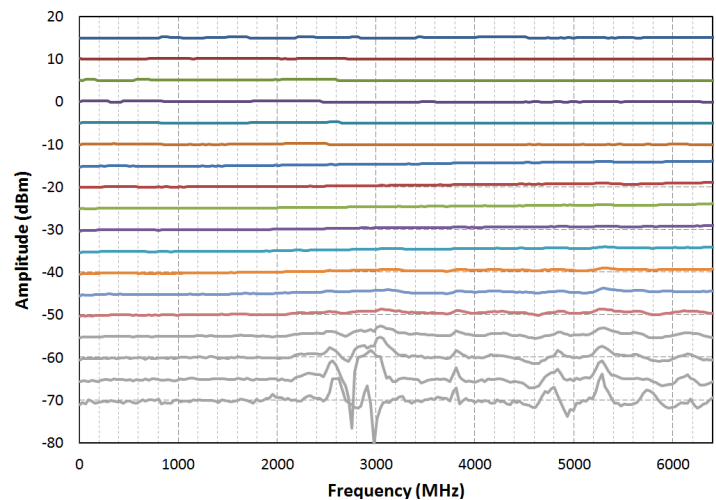
Calibrated Output Power

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:

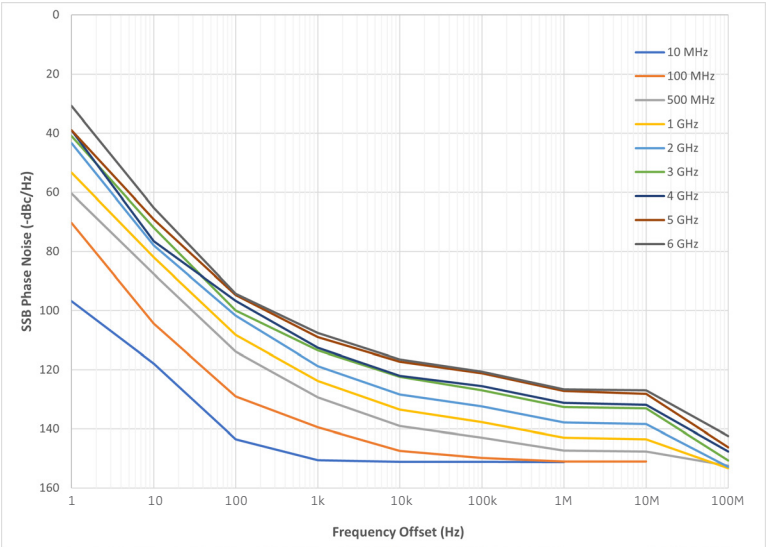
Phase Noise
Performance

Standard OCXO

500 MHz - 6 GHz

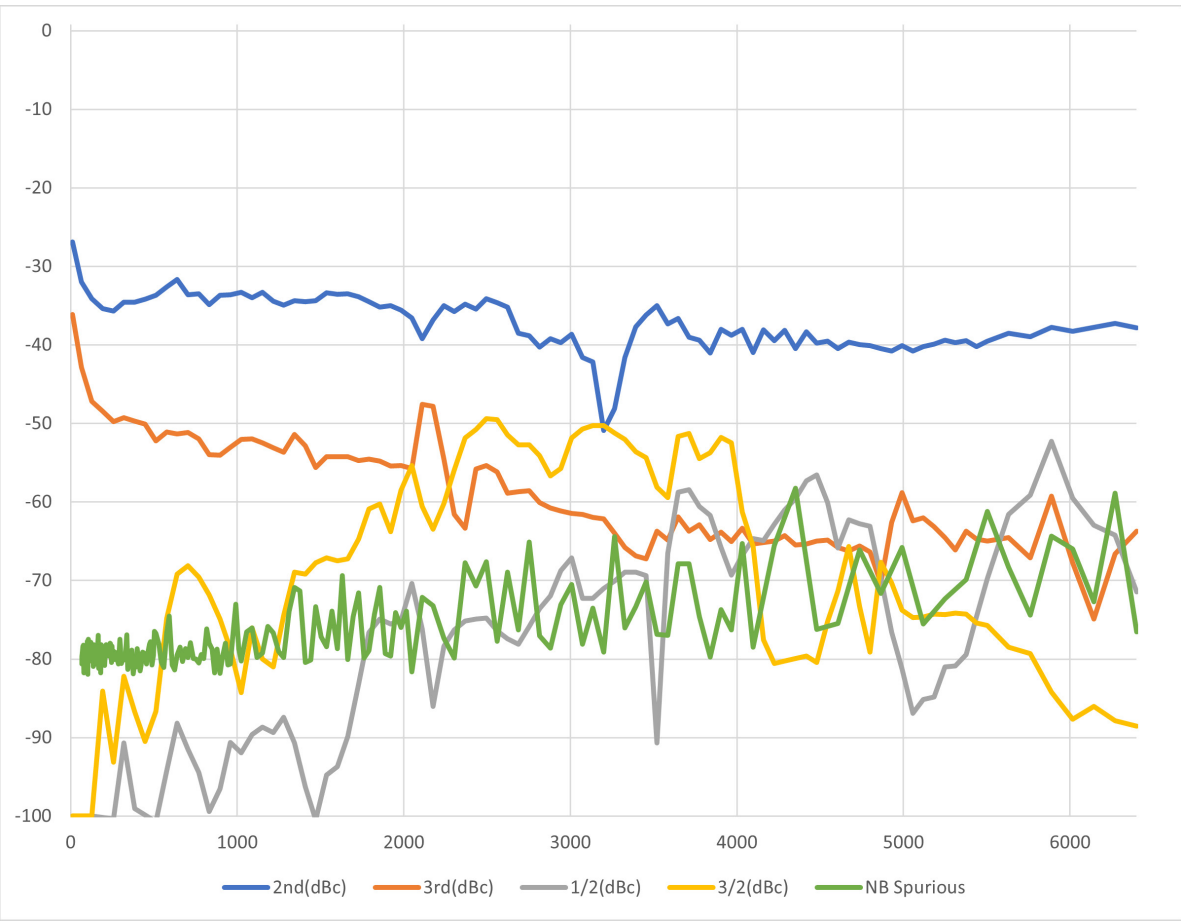
P_{OUT} Setting: +10 dBm

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

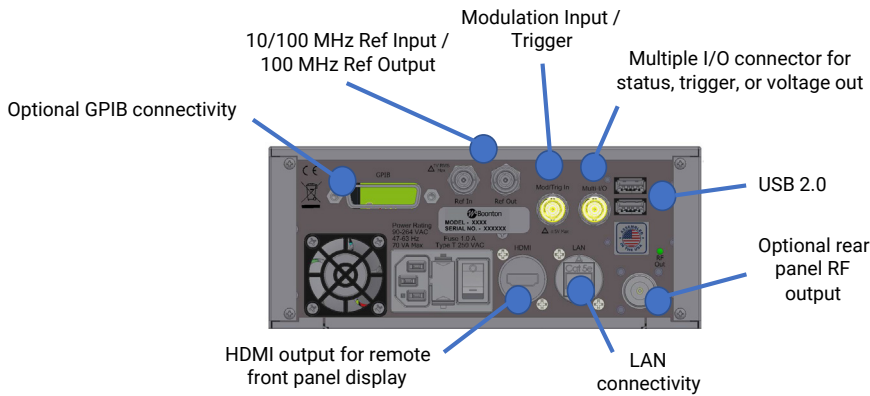
P_{OUT} Setting: +10 dBm

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
	GPIO (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 $^{\circ}\text{C}$ (32 to 122 $^{\circ}\text{F}$)
Storage Temperature		-40 to +70 $^{\circ}\text{C}$ (-40 to 158 $^{\circ}\text{F}$)
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	± 1V peak into 50Ω	+ 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	± 1V peak into 50Ω	+ 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	± 1V peak for indicated Depth (into 50Ω)	+ 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

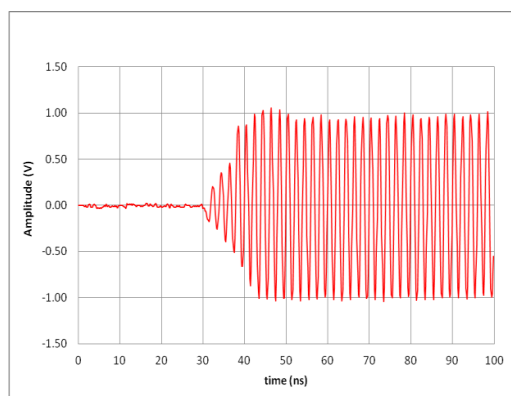


Figure 1a: Pulse Mod Rise Time, $f_c = 500$ MHz

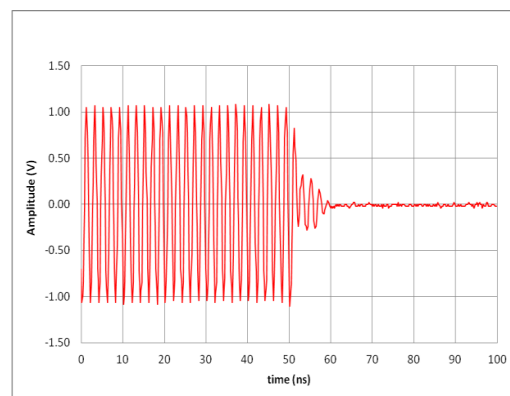


Figure 1b: Pulse Mod Fall Time, $f_c = 500$ MHz

Specification — Modulation (External Stimulus), Continued

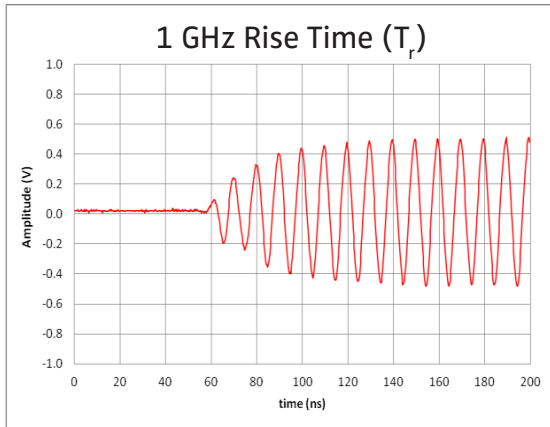


Figure 2a: Pulse Mod Rise Time, $f_c = 1$ GHz

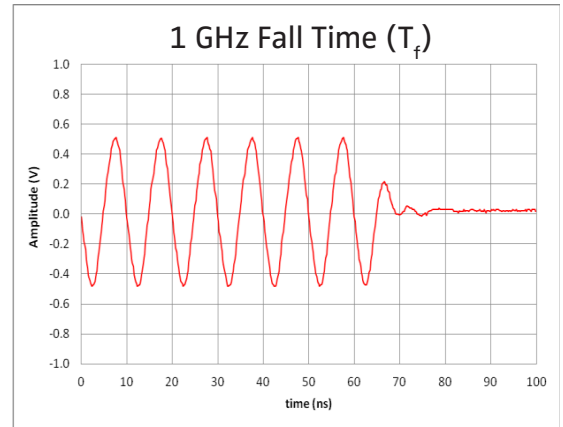


Figure 2b: Pulse Mod Fall Time, $f_c = 1$ GHz

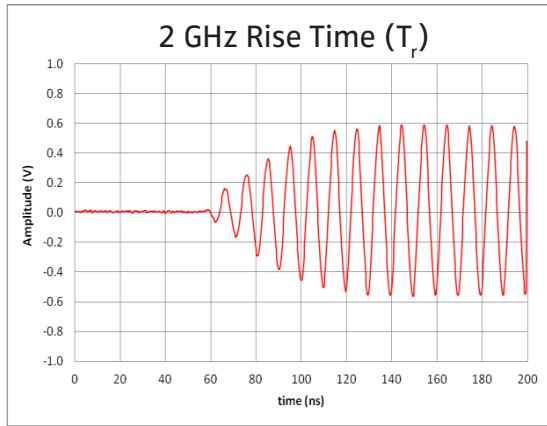


Figure 3a: Pulse Mod Rise Time, $f_c = 2$ GHz

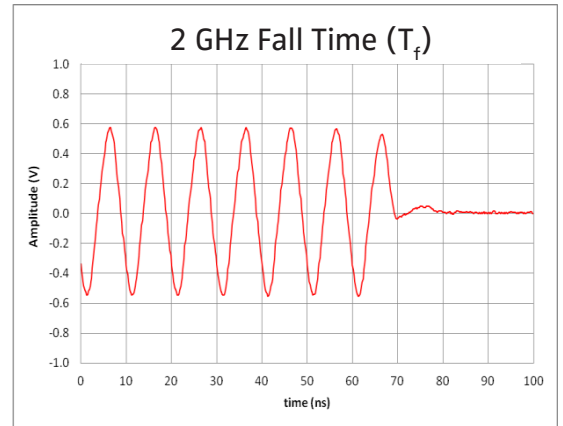


Figure 3b: Pulse Mod Fall Time, $f_c = 2$ GHz

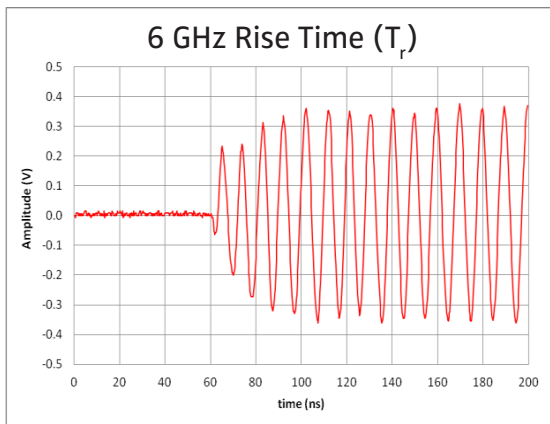


Figure 4a: Pulse Mod Rise Time, $f_c = 6$ GHz

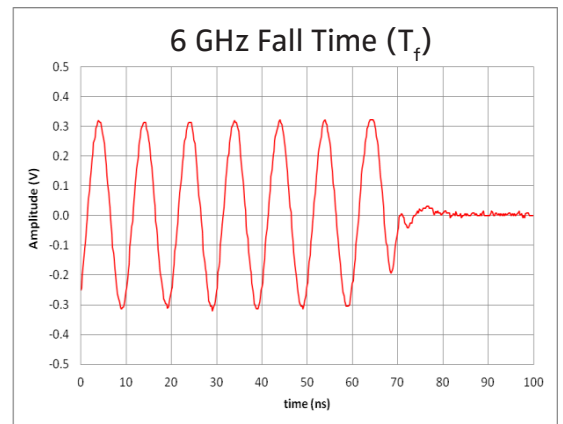


Figure 4b: Pulse Mod Fall Time, $f_c = 6$ GHz

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	

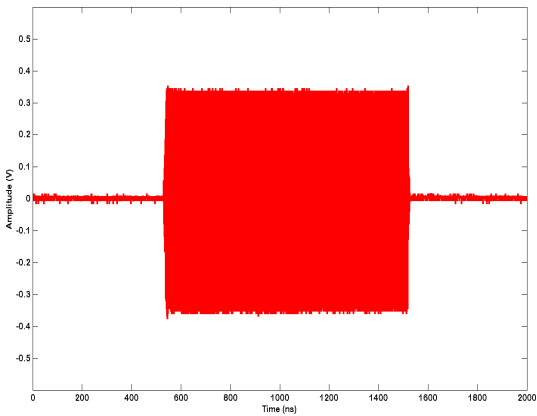


Figure 1: Self Pulse Mod $f_c = 500\text{ MHz}$, 1 μs Pulse1

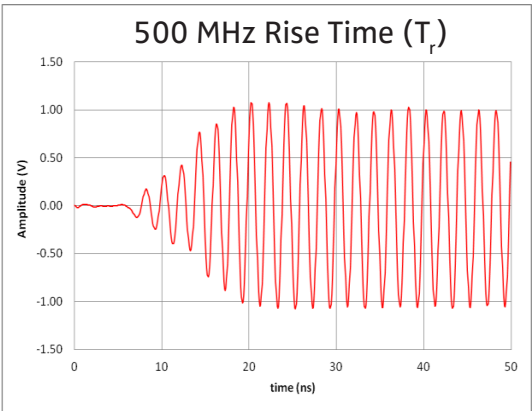


Figure 2a: Self Pulse Mod Rise Time, $f_c = 500\text{ MHz}$

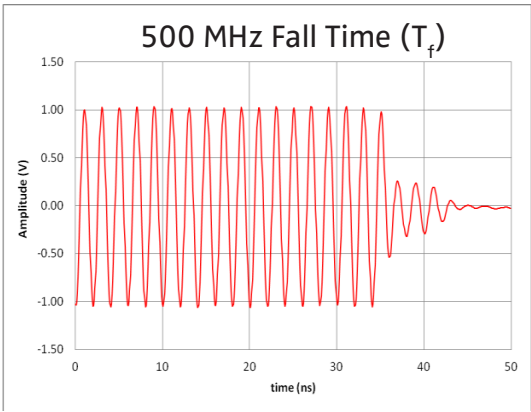


Figure 2b: Self Pulse Mod Fall Time, $f_c = 500\text{ MHz}$

Specification – Modulation (Self Pulse Modulation), Continued

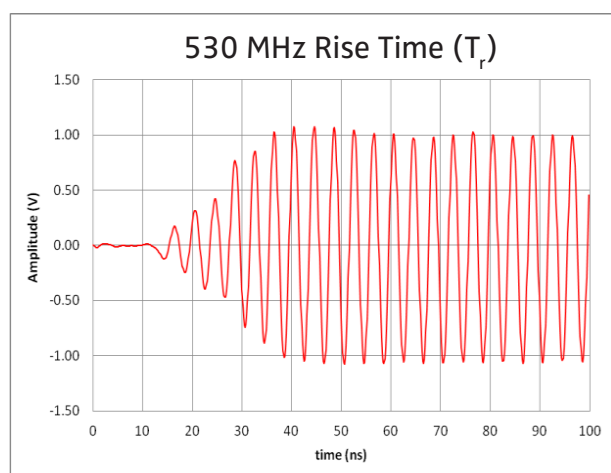


Figure 3a: Self Pulse Mod Rise Time, $f_c = 530$ MHz

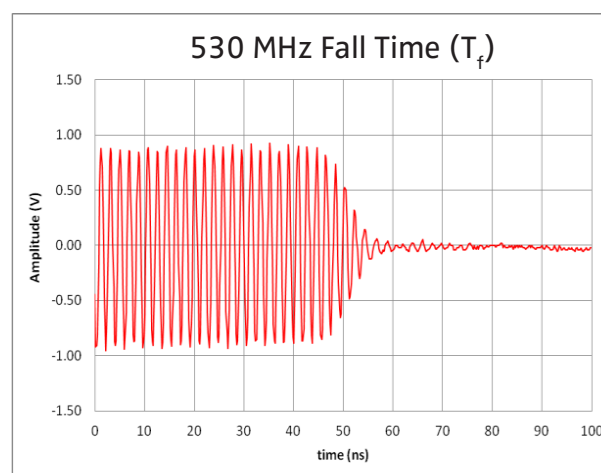


Figure 3b: Self Pulse Mod Fall Time, $f_c = 530$ MHz

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

SGX-RMK	19" Rack Mount Kit
SGX-TCASE	Transit case