SSG3000X Series RF Generator

Datasheet - 2019.05

SIGLENT TECHNOLOGIES CO.,LTD

SSG3032X
SSG3021X
SSG3032X-IQE
SSG3021X-IQE

General Description

SIGLENT'S SSG3000X series of signal generators have a frequency range of 9 kHz to 2.1 GHz/3.2 GHz. They provide normal analog modulation such as AM, FM, and PM. They also provide pulse modulation and pulse train generator. In addition, when used with baseband generator such as SDG6000X, They can generate IQ modulated signals. With their high accuracy and pure outputs, the SSG3000X series are the right choice for R&D, education, and manufacturing.

Features and Benefits

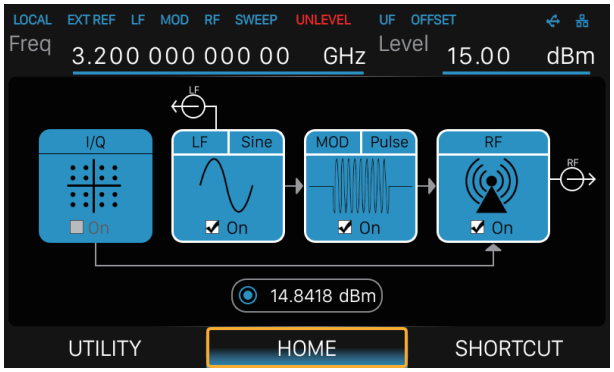
- Frequency up to 2.1 GHz/3.2 GHz
- 0.01 Hz frequency setting resolution
- Level output from -110 dBm to +13 dBm
- Maximum level up to +20 dBm (typ.)
- Phase Noise: -110 dBc/ Hz @ 1 GHz , 20 kHz offset (typ.)
- Level accuracy ≤0.7 dB (typ.)
- Provides AM, FM, &PM analog modulation with internal, external or Int+Ext source
- Pulse modulation, on/off ratio ≥70 dBc
- Pulse train generator (option)
- External IQ modulation with SDG6000X as the baseband IQ signal
- USB-power meter measurement
- 5 inch TFT capacitive touch screen, mouse and keyboard supported
- Web browser remote control on PC and mobile terminals
- Standard interface include USB Host, USB Device (USB TMC), LAN (VXI-11, Socket, Telnet). Optional interface: GPIB

Model and Main index

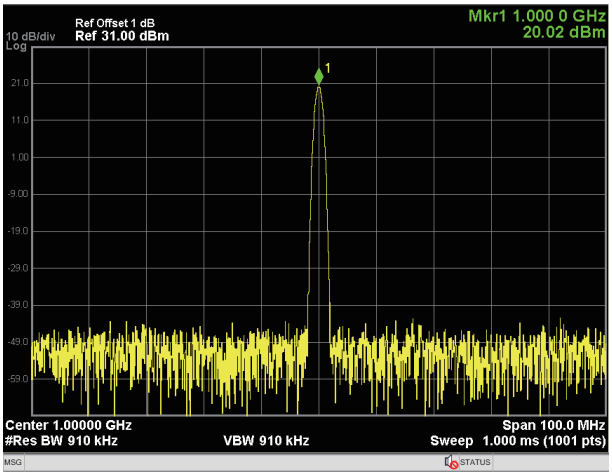
Model	SSG3032X	SSG3021X	SSG3032X-IQE	SSG3021X-IQE
Frequency Range	CW MODE 9 kHz~3.2 GHz	CW MODE 9 kHz~2.1 GHz	CW MODE 9 kHz~3.2 GHz	CW MODE 9 kHz~2.1 GHz
			IQ MODE 10 MHz~3.2 GHz	IQ MODE 10 MHz~2.1 GHz
Frequency Resolution	0.01 Hz			
Amplitude Resolution	0.01 dB			
Level accuracy	0.7 dB (typ.)			
Phase noise	-110 dBc/Hz @1 GHz ,offset 20 kHz (typ.)			
Display	5 inch capacitance touch screen, RGB (800*480)			

Design Features

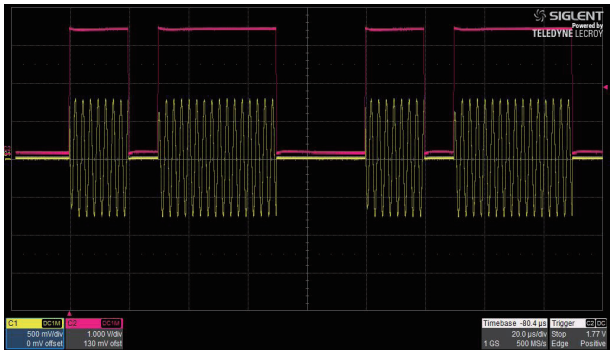
5 inch touch screen, keyboard and mouse support



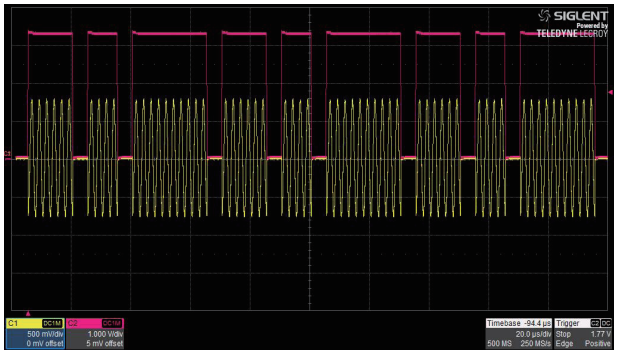
Maximum output level up to +20 dBm



Double pulse modulation



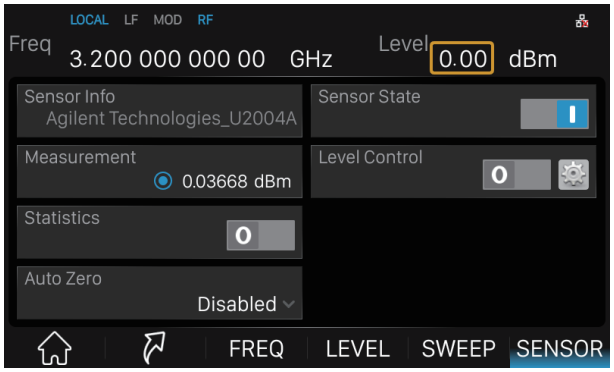
Pulse train generator



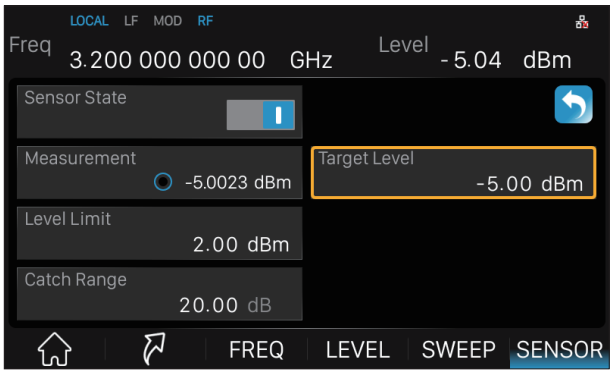
Example for auto level control

Design Features

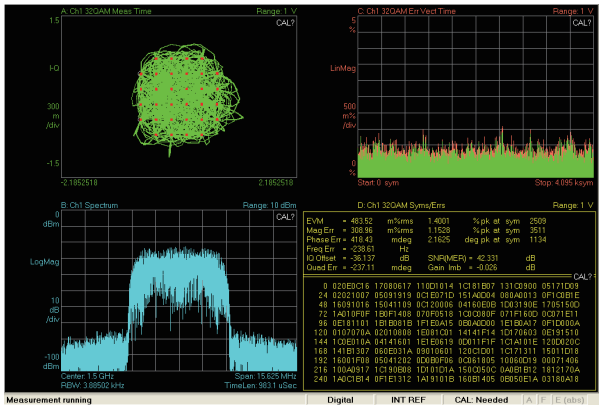
Power output display using USB power



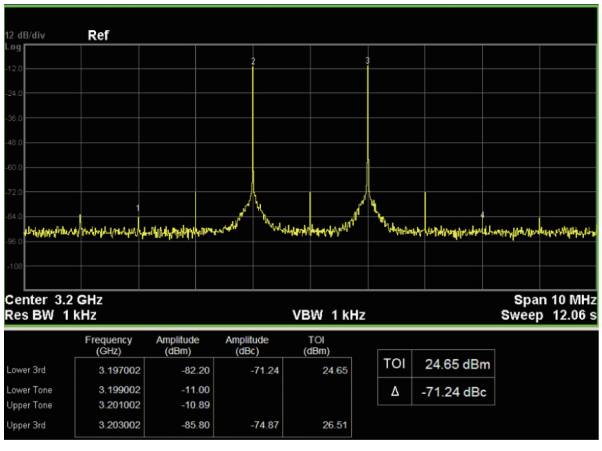
Power output control using USB power sensor



External IQ modulation using the SDG6000X as the baseband source



Provides double-tone signal with IQ modulation, easily do TOI testing



SPECIFICATIONS

Specifications are valid under the following condition: The instrument is within the calibration period, has been stored between 0 and 50℃ for at least 2 hours prior to use, and has been powered on and warmed up for at least 40 minutes. The specifications include the measurement uncertainty, unless otherwise noted.

Specifications: All products are guaranteed to meet published specifications when operating temperatures from 5 to 45℃, unless otherwise noted.

Typical(typ.): Performance deemed typical implies that 80 percent of the measurement results will meet the typical published performance with a 95th percentile confidence level at room temperature (approximately 25℃). Typical performance is not warranted and does not include measurement uncertainty.

Nominal(nom.): This value indicate the expected mean or average performance, or an attribute whose performance is by design, such as the 50 ohm connector.

Frequency characteristics

Frequency

Frequency range	SSG3032X	CW MODE 9 kHz~3.2 GHz	
	SSG3021X	CW MODE 9 kHz~2.1 GHz	
	SSG3032X-IQE	CW MODE 9 kHz~3.2 GHz	IQ MODE 10 MHz~3.2 GHz
	SSG3021X-IQE	CW MODE 9 kHz~2.1 GHz	IQ MODE 10 MHz~2.1 GHz
Frequency resolution	0.01 Hz		
Setting time	<5 ms (typ.), ALC ON <10 ms (typ.), ALC OFF (S&H)		
Resolution of phase offset setting	0.1°		

Frequency Band [1]

Band	Frequency range	N
1	9 kHz≤f≤1 MHz	0.25
2	1 MHz<f≤250 MHz	0.5
3	250 MHz<f≤500 MHz	0.125
4	500 MHz<f<1000 MHz	0.25
5	1000 MHz≤f<2000 MHz	0.5
6	2000 MHz≤f≤3200 MHz	1

[1] N is a factor used to help define certain specifications with the document

Frequency Reference

Reference frequency	10.000000 MHz	
Initial calibration accuracy	<0.2 ppm	
Temperature stability	<1 ppm/year, 0℃ ~50℃	
Frequency aging rate	<0.5 ppm/first year, 3.0 ppm/20 years	

Frequency sweep

Sweep type	frequency step (linear or logarithmic step) arbitrary list	
Sweep range	full frequency range	
Sweep sheep	triangle, saw-tooth	
Sweep mode	single, continuous	
Step spacing	linear, logarithmic	
Number of points	step sweep	2~65535
	list sweep	2~500
Dwell time range	10 ms~100 s	
Dwell time setting resolution	0.1 ms	
Trigger source	auto, keyboard, external connector, bus	
Trig slop	positive, negative when trigger source is external	

Level characteristics

ALC modes

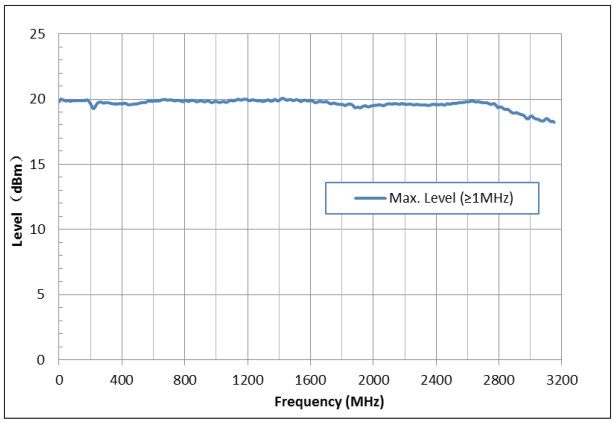
The SSG3000X series offer three ALC modes:

ALC STATE AUTO : The best suited ALC mode is set automatically.

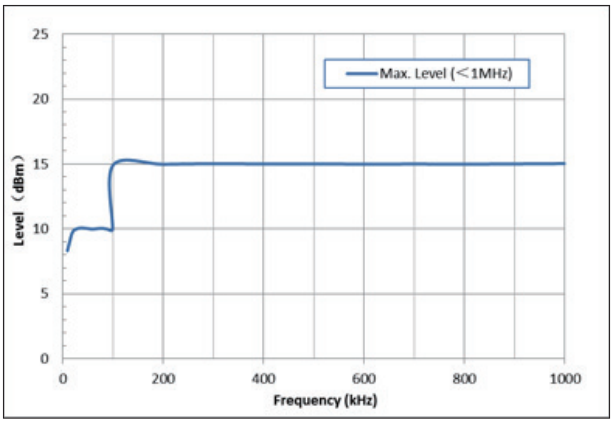
ALC STATE ON: The level control loop is closed. This mode is suitable for CW, FM and PM.

ALC STATE SAMPLE & HOLD (S&H) : At every frequency and level change, The level control loop is closed about 3 ms and the level control voltage is sampled. The level control voltage is the clamped. This mode is used internally while in ALC state AUTO for pulse modulation, AM modulation.

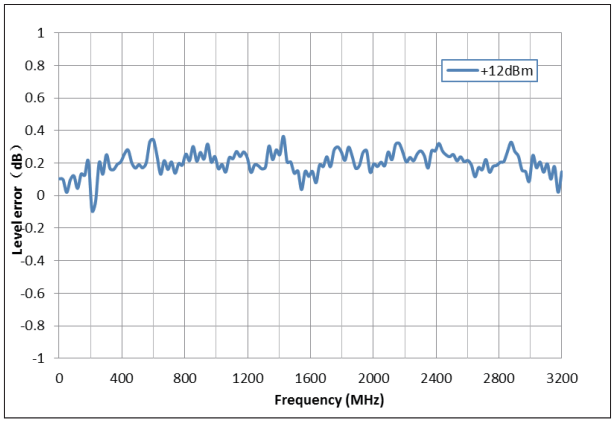
Level characteristics			
Level setting			
Level setting range	9 kHz≤f<100 kHz	-110 dBm~+9 dBm	
	100 kHz≤f<1 MHz	-110 dBm~+15 dBm	
	1 MHz≤f≤3.2 GHz	-110 dBm~+20 dBm	
Resolution of setting	0.01 dB		
Level of performance range			
	9 kHz≤f<100 kHz	-110 dBm~+7 dBm	
	100 kHz≤f<1 MHz	-110 dBm~+10 dBm	
	1 MHz≤f≤3.2 GHz	-110 dBm~+13 dBm	
Level error (ALC on, temperature is 20 ℃ ~30 ℃)			
	+13 dBm~-50 dBm	-50 dBm~-90 dBm	-90 dBm~-110 dBm
9 kHz≤f<100 kHz	≤0.9 dB ≤0.7 dB (typ.)	≤1.1 dB ≤0.7 dB (typ.)	≤1.1 dB ≤0.7 dB (typ.)
100 kHz≤f≤3.2 GHz	≤0.7 dB ≤0.5 dB (typ.)	≤0.7 dB ≤0.5 dB (typ.)	≤1.1 dB ≤0.7 dB (typ.)
Additional level error	ALC State Off (S&H)	<0.2 dB	
VSWR			
level ≤0 dBm, ALC State ON			
VSWR	1 MHz≤f≤3.2 GHz	≤1.8 (nom.)	
Level setting			
Level setting time	Level deviation <0.1 dB from final value, with GUI update stopped, temperature range from 20 ℃ ~30 ℃		<5 ms
	ALC state ON		<5 ms
	ALC state S&H		<10 ms
Reverse power			
Maximum permissible DC voltage	50 V		
Maximum reverse input power	1 MHz≤f≤3.2 GHz		+30 dBm
Level step sweep			
Sweep type	amplitude step (linear or logarithmic step), arbitrary list		
	full specified level range		
Sweep shape	triangle, saw-tooth		
Sweep range	the device output range		
Trigger mode	free run, single		
Step spacing	linear		
Sweep points	step sweep		2~65535
	list sweep		1~500
Dwell time setting range	10 ms~100 s		
Dwell time setting resolution	0.1 ms		
Trigger source	auto, keyboard, external connector, bus		
Trigger Slop	positive, negative		



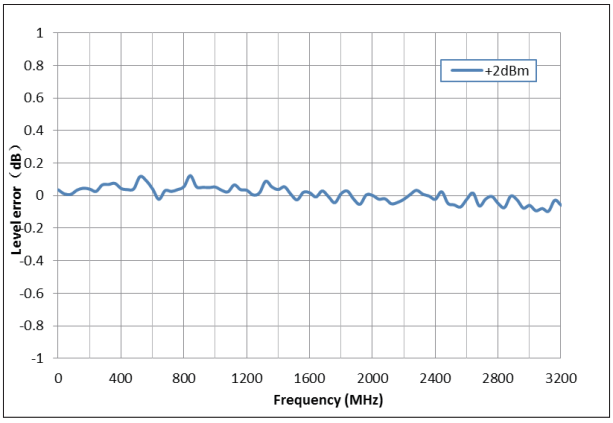
Maximum output power versus frequency, f ≥1 MHz



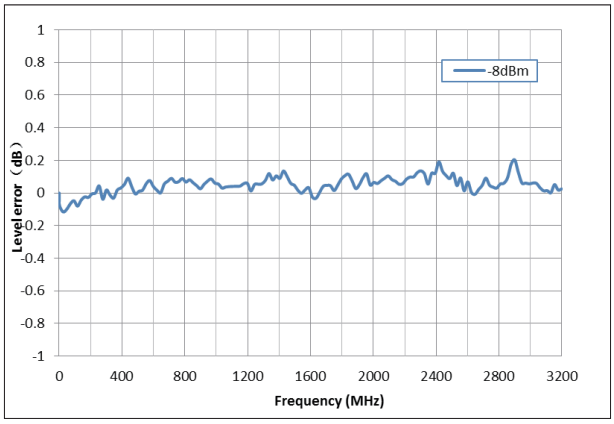
Maximum output power versus frequency, f <1 MHz



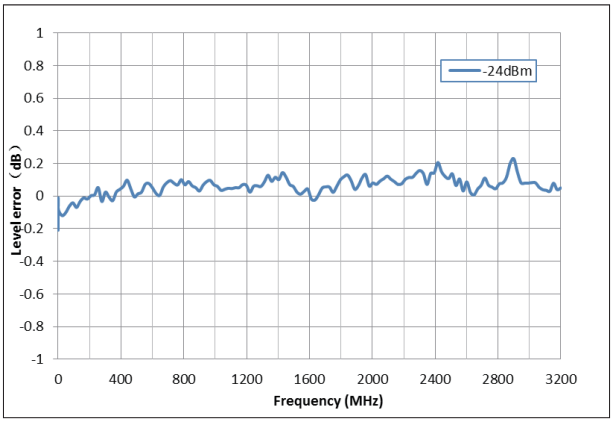
Measured level error versus frequency, Level = +12 dBm



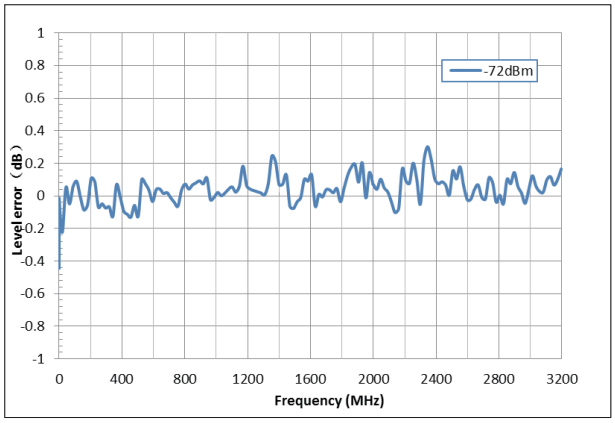
Measured level error versus frequency, Level = +2 dBm



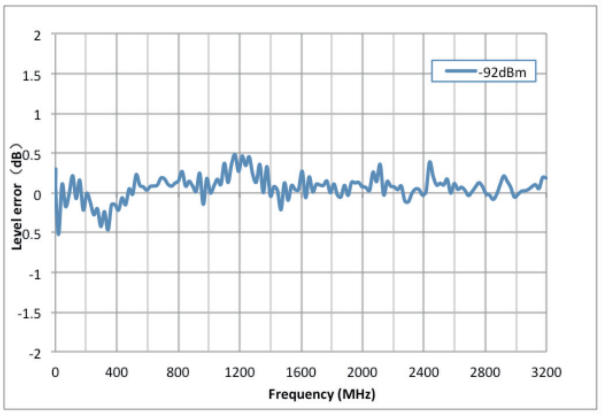
Measured level error versus frequency, Level = -8 dBm



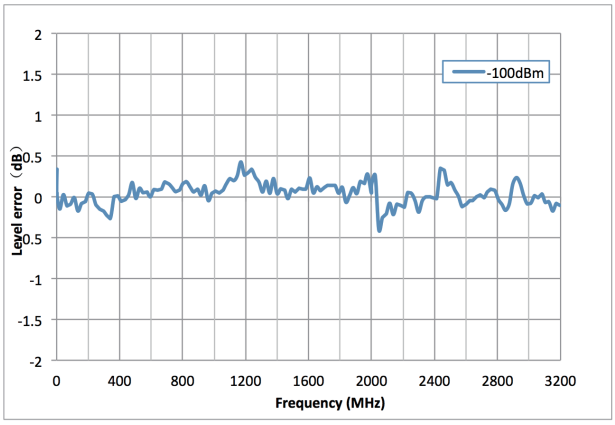
Measured level error versus frequency, Level = -24 dBm



Measured level error versus frequency, Level = -72 dBm



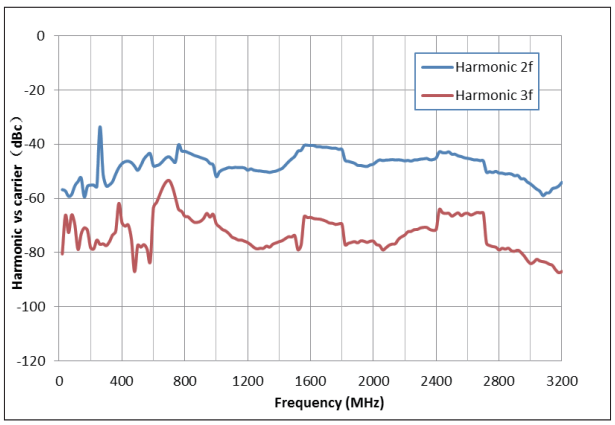
Measured level error versus frequency, Level = -92 dBm



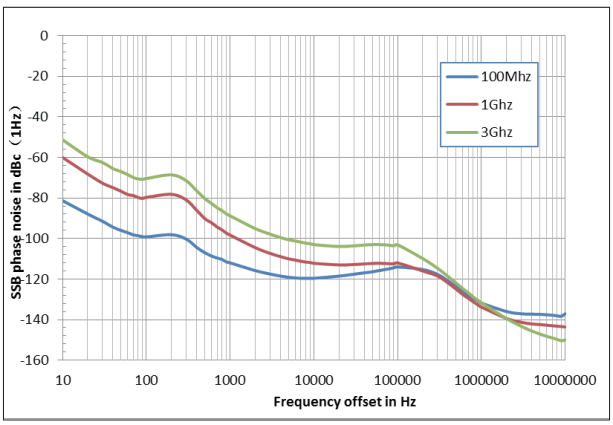
Measured level error versus frequency, Level = -100 dBm

Spectral purity

Harmonics	CW mod, 1 MHz<f≤3.2 GHz, Level ≤ +13 dBm	<-30 dBc
Sub harmonics	CW mod, 1 MHz<f≤3.2 GHz, offset >10 kHz Level ≤ +13 dBm	<-45 dBc
Non-harmonics	CW mod, offset>10 kHz, Level ≤ +13 dBm 1 MHz<f≤1.5 GHz	<-65 dBc
	CW mod, offset>10 kHz, Level ≤ +13 dBm 1.5 GHz≤f≤3.2 GHz	<-75 dBc
SSB Phase noise	CW mod, offset=20 KHz, 1 Hz measure bandwidth	
	f=100 MHz	<-118 dBc/Hz (typ.)
	f=1 GHz	<-110 dBc/Hz (typ.)
	f=3 GHz	<-105 dBc/Hz (typ.)



Measured harmonics versus carrier frequency at level ≤ +13 dBm



Measured phase noise

Internal modulation generator (LF)		
Waveforms	sine wave, square wave, saw-tooth, triangle, DC	
Frequency range	sine wave	0.1 Hz~1 MHz[2]
	square wave, triangle, saw-tooth	0.1 Hz~20 kHz
Resolution of frequency setting	0.01 Hz	
Frequency error	similar with RF source	
Frequency response	sine wave <0.3 dB	
Level Offset	setting range	min (2.5 V- $\frac{1}{2}$LEVEL, 2 V)
	offset resolution	0.01 V
Output voltage range[3]	Vp at connector	1 mVpp~3 Vpp
	resolution of amplitude setting	1 mv
Output impedance	50 Ω (nom.)	

[2]When use modulation and LF simultaneously, the LF frequency range and wave type will be restricted.
[3] The connector's load is 50 Ω.

LF frequency sweep	
Operating mode	digital sweep in discrete steps
Step spacing	linear, logarithmic
Sweep shape	saw-tooth, triangle
Sweep direction	up, down
Sweep range	0.01 Hz~1 MHz
Trigger mode	auto, keyboard, external connector, bus
Trigger slope	positive, negative
Dwell time setting range	1 ms~ 500 s
Dwell time setting resolution	0.1 ms

Analog modulation				
Simultaneous modulation				
	Amplitude modulation	Frequency modulation	Phase modulation	Pulse modulation
Amplitude modulation		●	●	(●)
Frequency modulation	●		×	●
Phase modulation	●	×		●
Pulse modulation	(●)	●	●	
●=compatible, ×=incompatible, (●)=compatible limitations; NO specification Applies to AM distortion				
Amplitude modulation				
Modulation source	internal, external, internal+external			
AM depth setting range	0%~100%			
Resolution of setting	0.1%			
AM depth error	f-mod=1 kHz,m<80%,Level<=13dBm		<4% of setting+1%	
AM distortion	f-mod=1 kHz, m<30%, level<0 dBm		<3% (typ.)	
Modulation frequency response	m<80%, 10 Hz~100 kHz		<3 dB (nom.)	

Frequency modulation		
Modulation source	internal, external, internal +external	
Maximum deviation	N*1 MHz (typ.)	
Resolution	0.1% of set deviation or 1 Hz, whichever is larger	
FM deviation error	Fmod=1 kHz, internal	<(2% of setting + 20 Hz)
FM distortion	Fmod =1 kHz, deviation=N*1 MHz	<0.5% (nom.)
Modulation frequency response	10 Hz~100 kHz	<3 dB (nom.)
Phase modulation		
Modulation source	internal, external, internal + external	
Maximum deviation	N*5 rad	
Resolution	0.1% of set deviation or 0.01 rad, whichever is larger	
ΦM deviation error	Fmod=1 kHz, internal, deviation≤ N*5 rad	<(2% of setting + 0.05 rad)
ΦM distortion	Fmod=1 kHz, deviation≤ N*5 rad	<0.5% (nom.)
Modulation frequency response	10 Hz~100 kHz	<3 dB (nom.)
Pulse modulation		
Modulation source	internal, external	
On/off ration	1 MHz <f<3.2 GHz	>70 dBc
Raise/fall time (10% / 90%)	10% to 90% of RF amplitude	<50 ns
Pulse repetition time	setting range	40 ns~300 s
Pulse generator		
Pulse modes	single pulse, double pulse	
Pulse source	internal, external	
Pulse polarity	normal, inverse	
Pulse period	setting range	40 ns~300 s
	resolution of setting	10 ns
Pulse width	setting range	20 ns~300 s
	resolution of setting	10 ns
Double pulse Delay	setting range	20 ns~300 s
	resolution of setting	10 ns
#2 Width	setting range	20 ns~300 s
	resolution of setting	10 ns
Trigger modes	auto, keyboard, external trigger, external gate trigger, bus	
Trig polarity	normal, inverse (used in external gate trigger mode)	
Trigger Slop	positive, negative (used in external trigger mode)	
External trigger delay	140 ns~300 s	
External trigger delay resolution of setting	10 ns	
Pulse train generator (SSG3000X-PT)		
Number of pulses	1~2047	
Number of repetitions per pulse	1 to 65535	
Pulse on time and off time setting range	20 ns~300 s	
Pulse on time and off time setting resolution	10 ns	

IQ modulation feature (SSG3000X-IQE)	
Modulate source[5]	External
Bandwidth	Base Band I or Q <100 MHz (typ.) RF (I+Q) <200 MHz (typ.)
Full-scale input	$\sqrt{I^2+Q^2}$=0.5 Vrms
EVM	16QAM[5], root cosine filler (a=0.22), 5 MSps, level≤0 dBm
	10 MHz<f≤1.5 GHz, EVM≤0.7% (nom.) 1.5 GHz<f≤3.2 GHz, EVM≤1.2% (nom.)
	QPSK, root cosine filler (a=0.22), 5 MSps, level≤0 dBm
	10 MHz<f≤1.5 GHz, EVM≤0.7% (nom.) 1.5 GHz<f≤3.2 GHz, EVM≤1% (nom.)

[5] In this test , the baseband IQ come from SDG6000X series .

Connectors

Front panel connectors		
RF output	impedance	50 Ω
	connector	N female
Modulation generator output (LF)	impedance	50 Ω
	connector	BNC female
Rear panel connectors		
TRIG IN / OUT	impedance	100 kΩ
	connector	BNC female
	active trigger voltage	5 V TTL
EXT MOD INPUT	impedance	50 Ω
	connector	BNC female
PULSE IN / OUT	impedance	100 kΩ
	connector	BNC
	input/output voltage	CMOS 3.3 V
10 MHz IN	impedance	50 Ω
	connector	BNC-female
	input power range	-5 dBm~ +10 dBm
10 MHz OUT	impedance	50 Ω
	connector	BNC-female
	input power range	>0 dBm
SIGNAL VALID	impedance	50 Ω
	connector	BNC-female
	output voltage range	CMOS 3.3 V
I INPUT	impedance	50 Ω
	connector	BNC-female
Q INPUT	impedance	50 Ω
	connector	BNC-female
Communication Interface		
USB host	USB-A 2.0	
USB device	USB-B 2.0	
LAN	LAN (VXI11, 10/100Base, RJ-45)	

General Specification	
Display	TFT LCD, RGB (800*480), 5 inch capacitive touch screen
Storage	internal (Flash) 256 M Byte ,external (USB storage device)
Source	input voltage range (AC) 100 V~240 V (±10%) AC frequency supply 100 V to 240 V, 50/60 Hz; supply 100V to 120 V, 400 Hz power consumption 35 W with all function working
Temperature	Working temperature 0 ℃ to 50 ℃ , Storage temperature -20 ℃ to 70 ℃
Humidity	0 ℃ to 30 ℃ , ≤95% relative humidity; 30 ℃ to 50 ℃ , ≤75% relative humidity
Dimensions	W×H×D=338×113×369 mm
Weight without package	contain IQ modulator board 4.84 kg
Electromagnetic Compatibility and Safety	
EMC	EN 61326-1:2013
Electrical safety	EN 61010-1:2010

Ordering Information

Product Description	SSG3000X Signal Generator	Order Number
Product code	Signal Generator 9 kHz~3.2 GHz	SSG3032X
		SSG3032X-IQE
	Signal Generator 9 kHz~2.1 GHz	SSG3021X
		SSG3021X-IQE
Standard configurations	quick start, an USB cable, calibration certificate, power cord	
option	pulse train generator	SSG3000X-PT
	rack mount kit	SSG-RMK
	USB-GPIB adapter	USB-GPIB
	Upgrade 2.1 GHz to 3.2 GHz	SSG3000X-21BW32
	Upgrade 2.1 GHz to 3.2 GHz (with external IQ)	SSG3000X-IQE-21BW32

SSG3000X Series RF Generator

About SIGLENT

SIGLENT is an international high-tech company, concentrating on R&D, sales, production and services of electronic test & measurement instruments.

SIGLENT first began developing digital oscilloscopes independently in 2002. After more than a decade of continuous development, SIGLENT has extended its product line to include digital oscilloscopes, function/arbitrary waveform generators, digital multimeters, DC power supplies, spectrum analyzers, isolated handheld oscilloscopes and other general purpose test instrumentation. Since its first oscilloscope, the ADS7000 series, was launched in 2005, SIGLENT has become the fastest growing manufacturer of digital oscilloscopes. We firmly believe that today SIGLENT is the best value in electronic test & measurement.

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