SGP Series Ultra-Low Phase Noise Microwave Signal Generator

Signal generator—can be used as a crystal oscillator

Saluki SGP series ultra-low phase noise microwave signal generator is an ultra-low phase noise, high-power microwave signal generator. The product covers frequencies from 5kHz to 3, 6, 12, 24, 40, 45 and 67GHz, with a frequency resolution of up to 0.001Hz, and has narrow pulse modulation function, with a minimum pulse width of 50ns. The product has the industry-leading ultra-low phase noise index: <-132dBc/Hz (@10GHz, 10kHz offset, typical value), suitable for applications that require extremely pure RF signals, and can excellently complete demanding component, module and system testing tasks in the fields of semiconductors, radar, quantum, satellite communications, wireless communications, etc.

The product can achieve multi-channel coherent signal output, and the frequency and power of each channel can be adjusted independently, or can be adjusted in conjunction, and can also support dual-tone signal output, which can meet the testing needs of different users and make testing simpler.

The SGP series ultra-low phase noise microwave signal source has outstanding performance in application fields that require excellent phase noise, large dynamic stable output power, and multi-channel synchronization. It is a low-noise pure microwave signal source that can be used as a crystal oscillator.

Features:

- Ultra-low phase noise: <-132dBc/Hz (@10GHz, 10kHz offset, typical value)
- Maximum output power: ≥+18dBm (@20GHz, typical value)
- Absolute level accuracy: ±0.5dB (@-20dBm~+20dBm)
- Harmonic suppression: <-60dBc (@100MHz~2GHz)
- Non-harmonic suppression: <-80dBc (@10GHz)
- With narrow pulse modulation function, minimum pulse width 50ns

Features:

- Multi-channel coherent output
- Dual-tone signal output
- Highly integrated, compact size
- Code compatible
- Simple operation

Application:

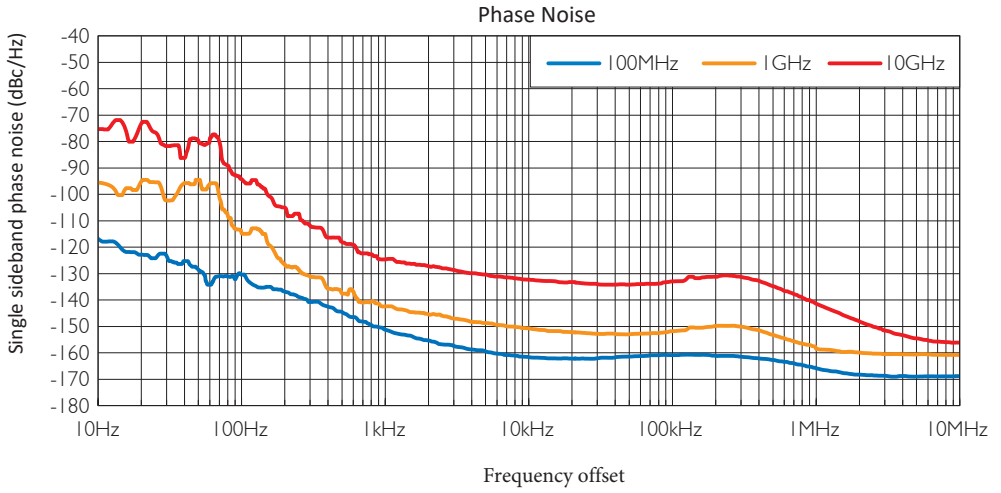
- ADC/DAC testing
- LO replacement
- Receiver testing
- ATE testing
- Base station testing
- Metrology calibration

Main Feature

Low phase noise makes the test more accurate

The SGP series ultra-low phase noise microwave signal source is the industry-leading ultra-low phase noise microwave signal source, with extremely stable RF signals, ultra-low phase noise, ultra-low harmonic and non-harmonic components, showing a pure spectrum.

- ＜-152dBc/Hz,@100MHz,1kHz offset (typical value)
- ＜-140dBc/Hz,@1GHz,1kHz offset (typical value)
- ＜-132dBc/Hz,@10GHz,10kHz offset (typical value)
- ＜-123dBc/Hz,@10GHz,1kHz offset (typical value)



Multi-channel makes testing easier

SGP series ultra-low phase noise microwave signal source can realize multi-channel coherent signal output. The frequency and power of each channel can be adjusted independently and linked. It supports dual-tone signal output to meet the testing needs of different users. The single machine supports desktop portable structure or standard rack chassis structure.

- Multi-channel coherent signal output
- Multi-channel output signals are independently adjustable and controllable
- High phase stability (phase drift between channels <±1° at 25°C for 24 hours)）

Accurate power makes the test more stable

The SGP series of ultra-low phase noise microwave signal sources have a large dynamic output power range and an absolute level accuracy of up to ±0.5dB. They can provide accurate signal output while maintaining high power stability.

- Maximum output power: ≥ + 18dBm (@20GHz)
- Minimum output power: -120dBm (@40GHz)
- Absolute level accuracy: <±0.5dB (@-20dBm～+20dBm)

Pure spectrum makes testing purer

The output signal of the SGP series ultra-low phase noise microwave signal source has extremely low broadband noise, lower harmonics, and higher non-harmonic suppression, making the test purer.

- Non-harmonic suppression: <-80dBc (@10GHz)
- Harmonic suppression: <-75dBc (@10MHz～1GHz) (measured with FSP-LFB002 harmonic suppression enhancement option)

Wide frequency, allowing wider testing

The SGP series of ultra-low phase noise microwave signal sources cover frequencies from ultra-low 5kHz to 3GHz/6GHz/12GHz/24GHz/40GHz/45GHz/67GHz ultra-high frequency outputs, with a frequency resolution as low as 0.001Hz.

Wide compatibility, simple operation, making testing more efficient

The SGP series of ultra-low phase noise microwave signal sources are compatible with the SCPI commands of mainstream signal sources in the industry. They are code compatible and eclectic, simplifying the development process and making programming easy. They support VC++, C#, Python, MATLAB, and LabView programming and control. The operation interface is simple and easy to use, making the test more efficient.

Application

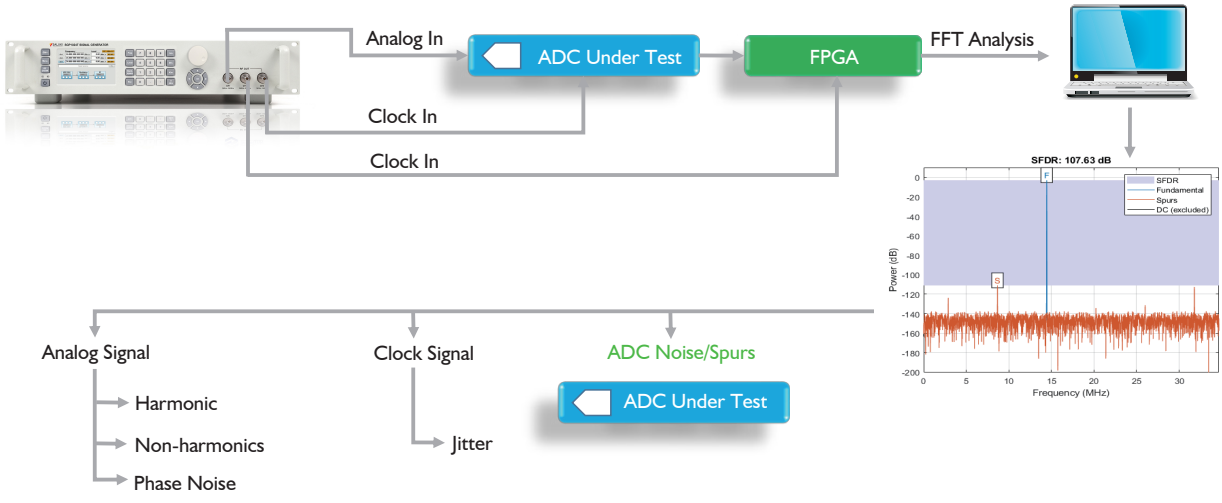
The SGP series of ultra-low phase noise microwave signal sources have outstanding ultra-low phase noise and multi-channel coherent output, and are suitable for applications that require extremely pure RF signals.

- ADC/DAC testing
- ATE testing
- Local oscillator replacement
- Base station testing
- Receiver testing
- Metrology calibration

ADC Testing

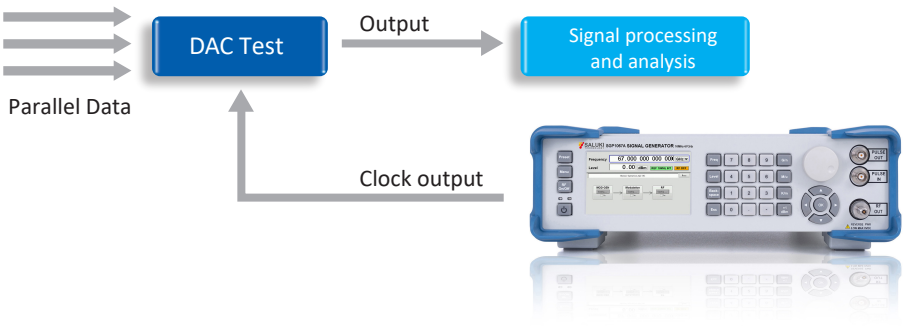
As ADCs become faster and more accurate, in order to accurately test ADC parameters such as SFDR/ENOB/SNR/THD/SINAD, there are extremely stringent requirements for the ADC input signal and reference clock signal. Only by ensuring that these two signals have extremely low phase noise and harmonics can the test results be accurate and the ADC's extreme performance be evaluated.

The SGP series ultra-low phase noise microwave signal source has ultra-low phase noise, can output very pure signals, and supports multi-channel coherent signal output. One instrument provides analog signal input and clock signal input for the ADC at the same time, and one instrument can replace multiple instruments, greatly simplifying the instrument connection and improving the measurement accuracy of ADC parameters such as SFDR/ENOB/SNR/THD/SINAD.



DAC Test

DAC is a device that converts a series of digital signals into analog signals. DAC requires a stable clock input signal when working. Saluki SGP series signal source can provide the industry-leading ultra-low phase noise and high-quality clock output signal, ensuring the accuracy of DAC verification.

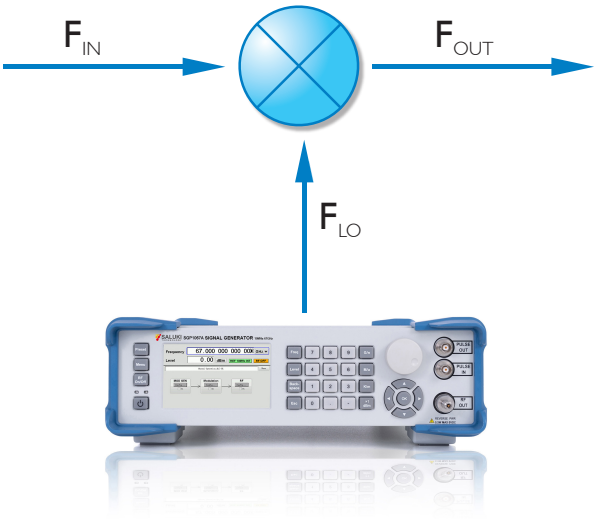


Local Oscillator Replacement

In RF transceiver systems such as radar, communication, and base stations, the local oscillator is a very critical signal. The stability of the local oscillator frequency and the quality of the signal play a vital role in the performance of the RF system. In actual RF transceiver systems, the stability of the local oscillator frequency needs to be precisely controlled within a specified range, and the short-term stability consideration index of the frequency is the phase noise. In order to ensure the performance stability and reliability of the RF system, the local oscillator should have ultra-low phase noise.

For example, in radar systems, the phase noise and spectrum purity of the local oscillator are crucial factors affecting radar performance. The phase noise will affect the radar detection capability and resolution accuracy. If the phase noise of the down-converted signal of the radar receiver system is too large, it will mask the weak signal near the main frequency, causing the radar receiver to be unable to identify moving targets.

The SGP series signal source has the industry's leading ultra-low phase noise, can output very pure and high-quality local oscillator signals, and provide stable local oscillator signals for RF transceiver systems. It is an ideal choice as a local oscillator replacement.



Technical indicators

Frequency Range

	Model	Frequency Range
Single Channel	SGP1003A	5kHz[1]≤f≤3GHz
	SGP1006A	5kHz≤f≤6GHz
	SGP1012A	5kHz≤f≤12GHz
	SGP1024A	5kHz≤f≤24GHz
	SGP1040A	5kHz≤f≤40GHz
	SGP1045A	5kHz≤f≤45GHz
	SGP1067A	5kHz≤f≤67GHz
Multi Channel	Channels	1-3
	Frequency	10MHz to 3GHz, 6GHz, 12GHz, 24GHz, 40GHz, 45GHz,67GHz (Please consult us for specific configuration)
	Channel Isolation	＞80dB
Resolution		0.001Hz

Unless otherwise specified, the 5kHz specifications in this publication are obtained with option SLF1.

Frequency Reference

Oscillator Aging Rate(2)	After 30 days <±0.1ppb/day (nominal value) <±1ppm/year (nominal value)
Calibration Accuracy	±0.01ppm (nominal value)
Temperature Effect	＜±0.05ppm,-20ºC to +70ºC

(2) The aging rate is determined by design and has a direct relationship with the OCXO.

Internal reference output

Frequency	10MHz
Power	+10±3dBm,50Ω Load

External reference input

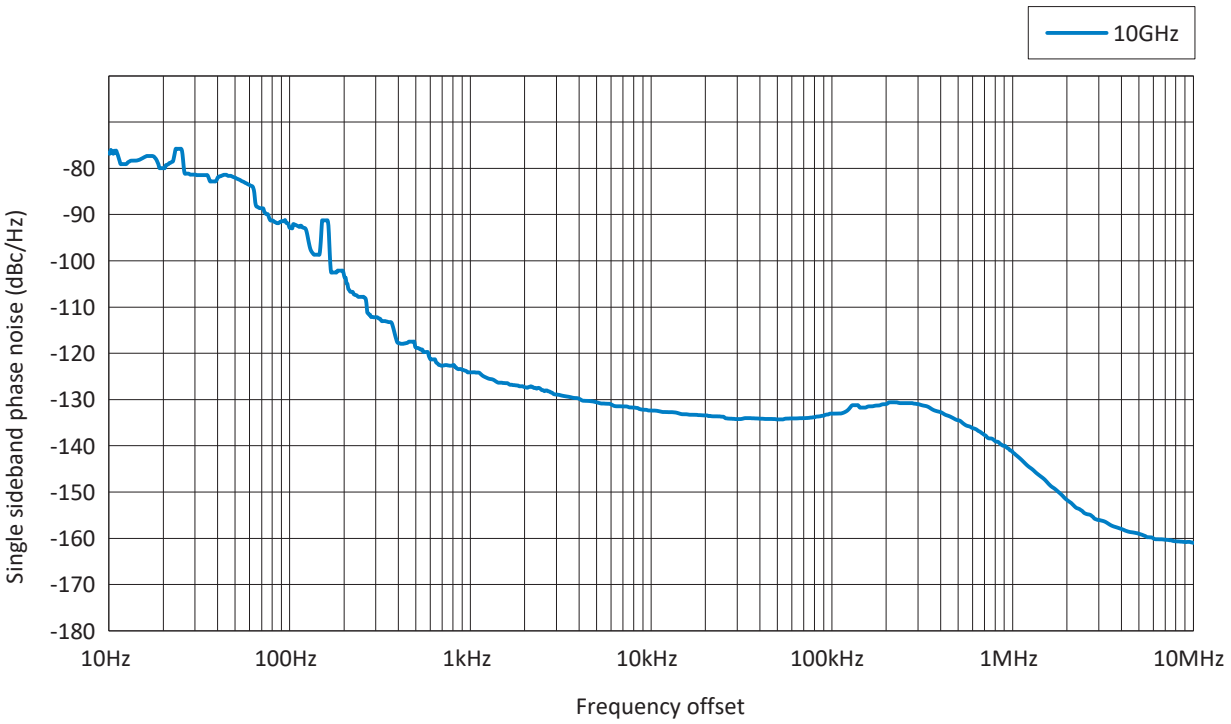
Input frequency	10MHz
Lock range	±1ppm
Power	+5±3dBm
Impedance	50Ω
Waveform	Sine wave or square wave

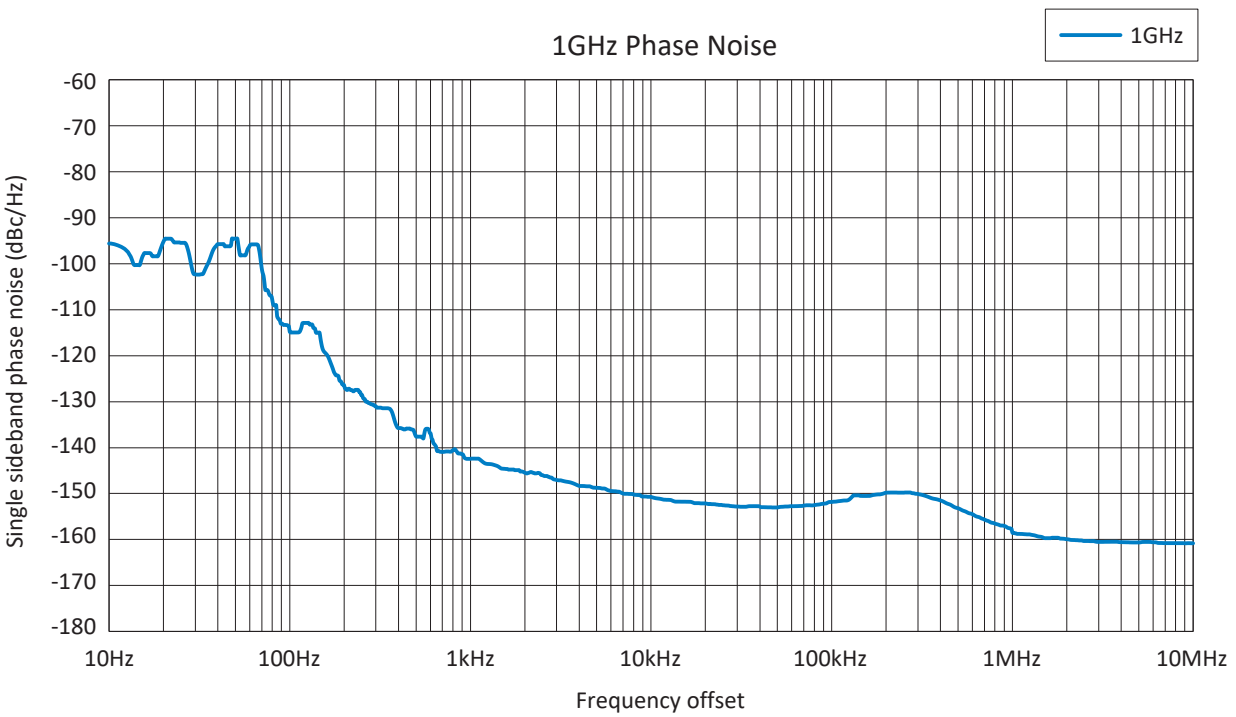
Spectral purity specifications

SSB phase noise[3](dBc/Hz) (standard)

Frequency	Offset						
	10Hz	100Hz	1kHz	10kHz	100kHz	1MHz	10MHz
100MHz	≤-110	≤-130	≤-152	≤-155	≤-155	≤-155	≤-155
200MHz	≤-106	≤-125	≤-147	≤-155	≤-155	≤-155	≤-155
1GHz	≤-92	≤-112	≤-140	≤-148	≤-148	≤-153	≤-155
10GHz	≤-72	≤-92	≤-122	≤-130	≤-130	≤-140	≤-158
20GHz	≤-66	≤-86	≤-116	≤-124	≤-124	≤-134	≤-152
40GHz	≤-60	≤-80	≤-108	≤-118	≤-118	≤-128	≤-146
67GHz	≤-55	≤-75	≤-103	≤-113	≤-113	≤-123	≤-138

(3) At room temperature, the output power is 0dBm.


10GHz
-80
-90
-100
-110
-120
-130
-140
-150
-160
-170
-180
Single sideband phase noise (dBc/Hz)
10Hz
100Hz
1kHz
10kHz
100kHz
1MHz
10MHz
Frequency offset


1GHz Phase Noise
1GHz
-60
-70
-80
-90
-100
-110
-120
-130
-140
-150
-160
-170
-180
Single sideband phase noise (dBc/Hz)
10Hz
100Hz
1kHz
10kHz
100kHz
1MHz
10MHz
Frequency offset

SSB Phase Noise[4](dBc/Hz) (Option SLN002)

Frequency	Offset						
	10Hz	100Hz	1kHz	10kHz	100kHz	1MHz	10MHz
50MHz	≤-114	≤-130	≤-155	≤-163	≤-163	≤-165	≤-165
100MHz	≤-110	≤-130	≤-152	≤-161	≤-163	≤-165	≤-165
200MHz	≤-106	≤-125	≤-147	≤-154	≤-157	≤-160	≤-160
1GHz	≤-92	≤-112	≤-140	≤-148	≤-148	≤-155	≤-160
10GHz	≤-72	≤-92	≤-122	≤-130	≤-130	≤-140	≤-158
20GHz	≤-66	≤-86	≤-116	≤-124	≤-124	≤-134	≤-152
40GHz	≤-60	≤-80	≤-108	≤-118	≤-118	≤-128	≤-146
67GHz	≤-55	≤-75	≤-103	≤-113	≤-113	≤-123	≤-138

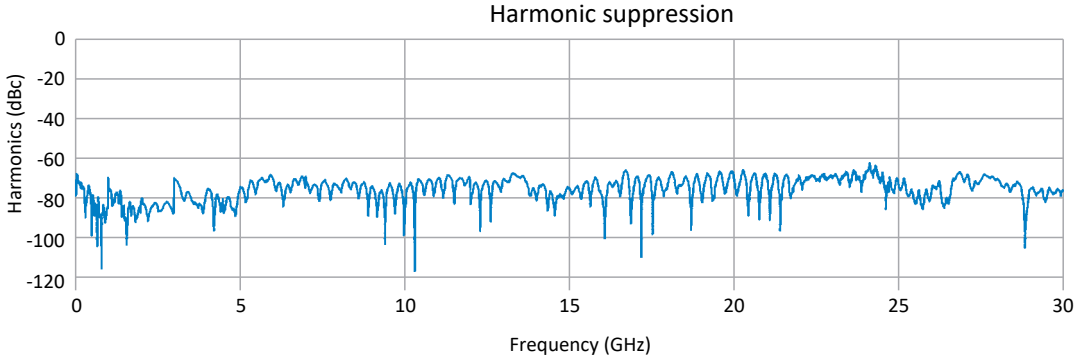
(4) Measured at room temperature, output power 0 dBm; Option SLN002 and pulse modulation option SUL001 cannot be used simultaneously; When option SLN002 is used, the minimum output power is -110 dBm

Harmonics (standard)

Frequency Range	Output power +10dBm
5kHz≤f＜10MHz	<-30dBc
10MHz≤f＜200MHz	<-40dBc
200MHz≤f＜2GHz	<-55dBc
2GHz≤f＜23GHz	<-55dBc

Harmonics (option SLFB002)

Frequency Range	Output power +10dBm
1MHz≤f＜10MHz	<-60dBc
10MHz≤f＜200MHz	<-75dBc
200MHz≤f＜1GHz	<-75dBc
1GHz≤f＜23GHz	<-55dBc



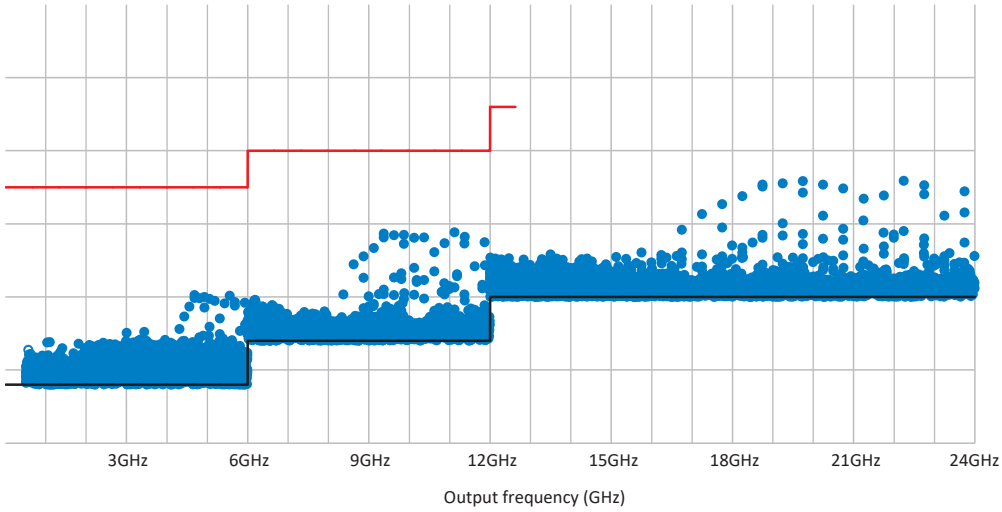
Sub-Harmonics

Frequency Range	Output power +10dBm
5kHz≤f≤12GHz	<-85dBc
12GHz＜f ≤24GHz	<-70dBc
24GHz＜f ≤40GHz	<-65dBc
40GHz＜f ≤67GHz	<-60dBc

Non-Harmonic[5]

Frequency Range	Output power 0dBm, offset >3kHz
5kHz≤f≤10MHz	<-65dBc
10MHz＜f ≤250MHz	<-85dBc
250MHz＜f ≤6GHz	<-85dBc
6GHz＜f ≤12GHz	<-81dBc
12GHz＜f ≤24GHz	<-75dBc
24GHz＜f ≤40GHz	<-70dBc
40GHz＜f ≤67GHz	<-65dBc

(5) Measured at output power 0dBm and frequency deviation > 3kHz



Power

Maximum output power (standard configuration)

	Frequency	Model							
		SGP1003A	SGP1006A	SGP1012A	SGP1024A	SGP1040A	SGP1045A	SGP1067A	Multi Channel
Maximum Output PowerdBm）	5kHz ＜ f≤10MHz	≥+15	≥+15	≥+15	≥+15	≥+15	≥+15	≥+15	≥+15
	10MHz ＜ f≤100MHz	≥+15	≥+15	≥+15	≥+15	≥+15	≥+15	≥+15	≥+15
	100MHz ＜ f≤3GHz	≥+15	≥+15	≥+15	≥+15	≥+15	≥+15	≥+15	≥+15
	3GHz ＜ f≤6GHz	-	≥+15	≥+15	≥+15	≥+15	≥+15	≥+15	≥+15
	6GHz ＜ f≤12GHz	-	-	≥+15	≥+15	≥+15	≥+15	≥+15	≥+15
	12GHz ＜ f≤20GHz	-	-	-	≥+15	≥+15	≥+15	≥+15	≥+15
	20GHz ＜ f≤24GHz	-	-	-	≥+13	≥+13	≥+13	≥+13	≥+13
	24GHz ＜ f≤36GHz	-	-	-	-	≥+13	≥+13	≥+13	≥+13
	36GHz ＜ f≤40GHz	-	-	-	-	≥+13	≥+13	≥+12	≥+13
	40GHz ＜ f≤45GHz	-	-	-	-	-	≥+10	≥+10	-
	45GHz ＜ f≤55GHz	-	-	-	-	-	-	≥+12	-
	55GHz ＜ f≤60GHz	-	-	-	-	-	-	≥+9	-
	60GHz ＜ f≤67GHz	-	-	-	-	-	-	≥+7	-
Minimum output power (dBm)		-120	-120	-120	-120	-120	-110	-90	-
Resolution		0.01dB							
Amplitude switching speed		≤20ms							
Maximum reverse power		0.5W，0 VDC							

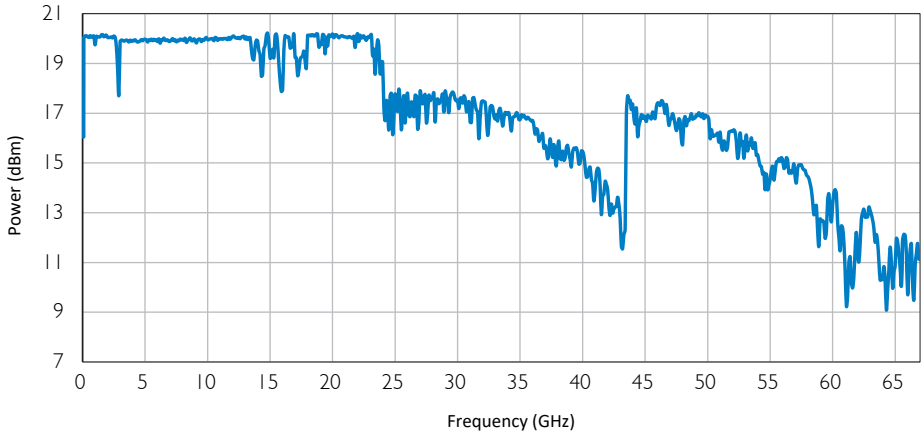
(6) The minimum output power of SGP1003A, SSGP1006A, SGP1012A, SGP1024A, SGP1040A is -120dBm; when option SLN002 is selected, the minimum power is -110dBm

Maximum output power (option SHP002)

	Frequency	Model							
		SGP1003A	SGP1006A	SGP1012A	SGP1024A	SGP1040A	SGP1045A	SGP1067A	Multi Channel
Maximum Output PowerdBm）	5kHz ＜ f≤10MHz	≥+15	≥+1	≥+15	≥+15	≥+15	≥+15	≥+15	≥+15
	10MHz ＜ f≤100MHz	≥+15	≥+15	≥+15	≥+15	≥+15	≥+15	≥+15	≥+15
	100MHz ＜ f≤3GHz	≥+15	≥+15	≥+15	≥+15	≥+15	≥+15	≥+15	≥+15
	3GHz ＜ f≤6GHz	-	≥+18	≥+18	≥+18	≥+18	≥+18	≥+16	≥+18
	6GHz ＜ f≤12GHz	-	-	≥+18	≥+18	≥+18	≥+18	≥+16	≥+18
	12GHz ＜ f≤20GHz	-	-	-	≥+18	≥+18	≥+18	≥+16	≥+18
	20GHz ＜ f≤24GHz	-	-	-	≥+18	≥+18	≥+18	≥+14	≥+17
	24GHz ＜ f≤36GHz	-	-	-	-	≥+18	≥+18	≥+14	≥+15
	36GHz ＜ f≤40GHz	-	-	-	-	≥+17	≥+18	≥+12	≥+13
	40GHz ＜ f≤45GHz	-	-	-	-	-	≥+17	≥+10	-
	45GHz ＜ f≤55GHz	-	-	-	-	-	-	≥+12	-
	55GHz ＜ f≤60GHz	-	-	-	-	-	-	≥+9	-
	60GHz ＜ f≤67GHz	-	-	-	-	-	-	≥+7	-
Minimum output power (dBm)		-120	-120	-120	-120	-120	-110	-90	-
Resolution		0.01dB							
Amplitude switching speed		≤20ms							
Maximum reverse power		0.5W，0 VDC							

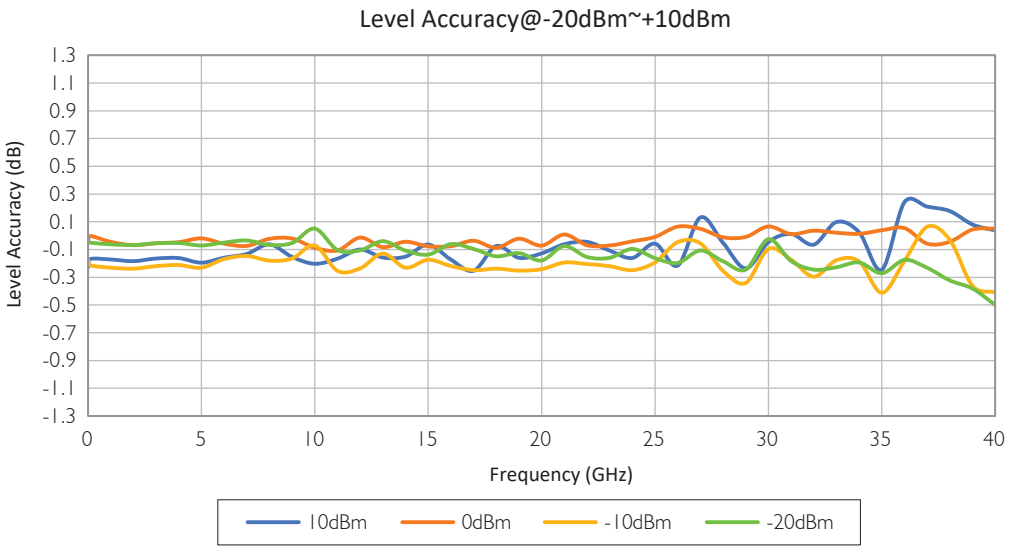
(7) The minimum output power of SGP1003A, SGP1006A, SGP1012A, SGP1024A, SGP1040A is -120dBm; when option SLN002 is selected, the minimum power is -110dBm

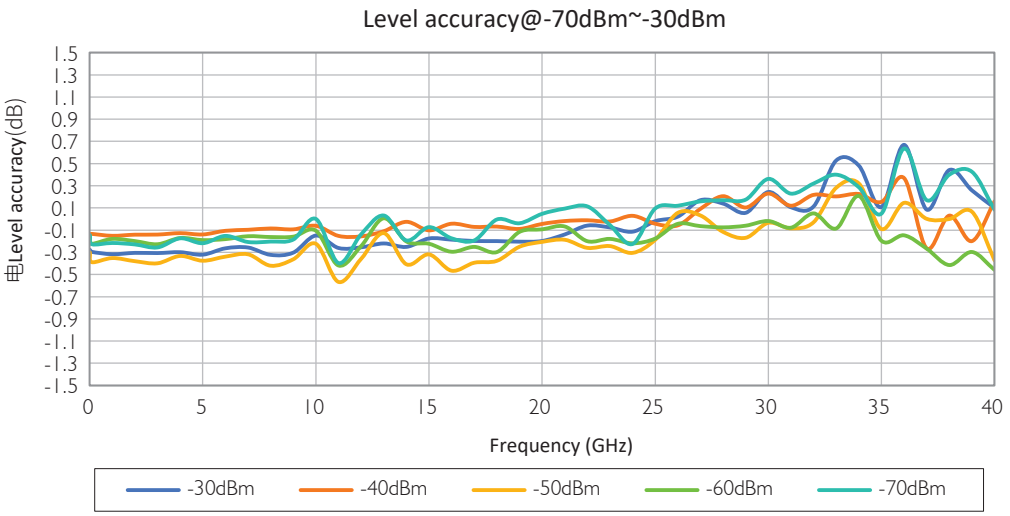
SGP1067A maximum output power

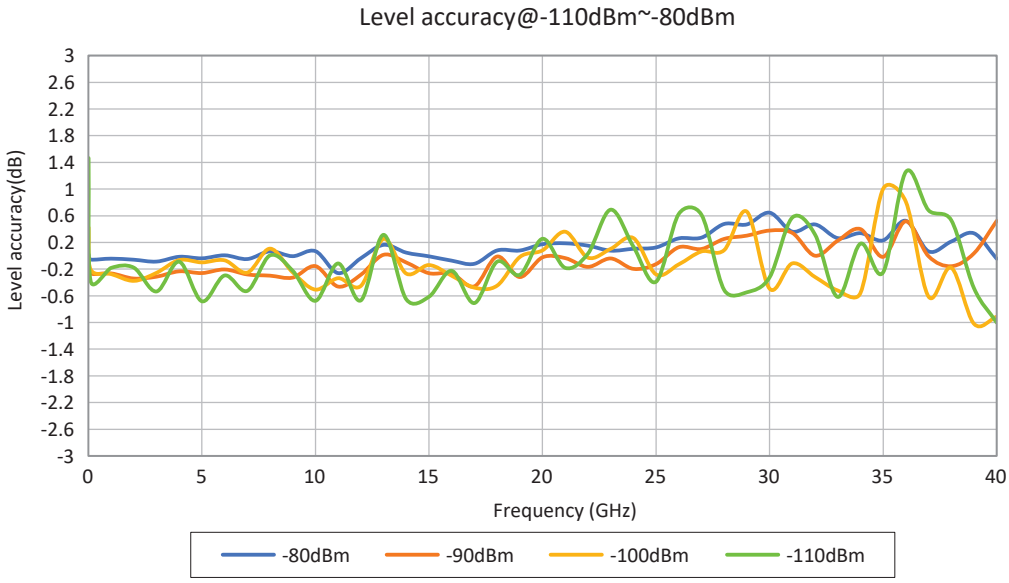


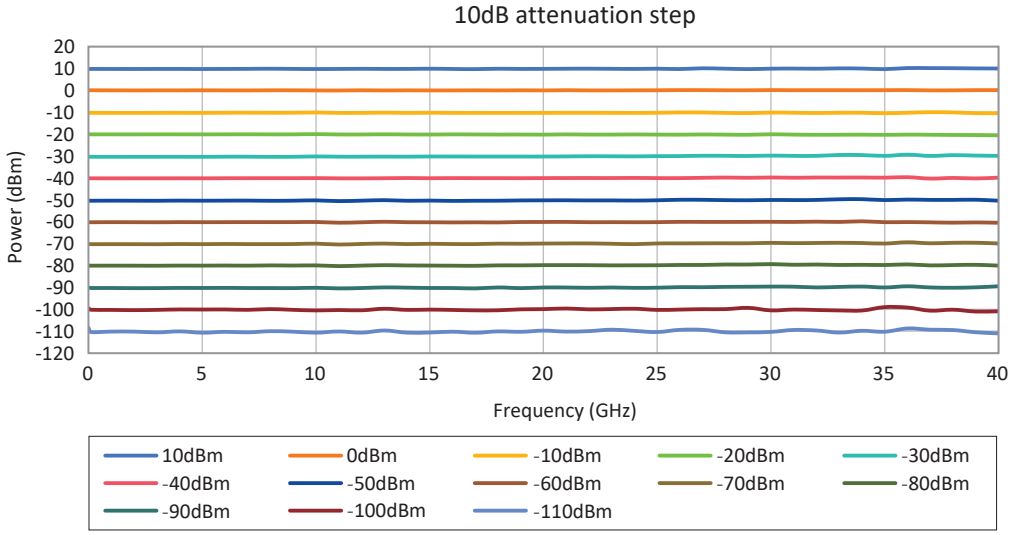
Absolute level accuracy

Frequency	Output Power		
	＞-20dBm	-70dBm<P≤-20dBm	≤-70dBm
5kHz＜f ≤10MHz	≤±1.2dB	≤±1.3dB	≤±2.0dB
10MHz＜f ≤3GHz	≤±0.5dB	≤±0.7dB	≤±2.0dB
3GHz＜f ≤20GHz	≤±0.5dB	≤±0.9dB	≤±2.5dB
20GHz＜f ≤40GHz	≤±1.0dB	≤±1.3dB	≤±3.0dB
40GHz＜f ≤50GHz	≤±1.3dB	≤±1.5dB	≤±3.0dB
50GHz＜f ≤67GHz	≤±1.8dB	≤±2.0dB	≤±3.0dB









SWR

Frequency	Attenuator status: 10dB
≤2GHz	＜1.40:1
2GHz＜f ≤24GHz	＜1.50:1
24GHz＜f ≤40GHz	＜1.60:1
40GHz＜f ≤67GHz	＜2.0:1

Pulse Modulation

General Features

On-off ratio	＞80dB
Minimum pulse width	50ns
Minimum cycle	100ns

External pulse input

input impedance	DC coupled, high impedance
Level Logic (CMOS)	3.3V

Internal pulse generator

Square wave rate	0.1Hz to 25MHz
Pulse period	100ns to 10s
Pulse Width	50ns to 10s
Resolution	5ns
Adjustable trigger delay	5ns to 10s
Level Logic (CMOS)	3.3V

Scanning characteristics

Operating mode	Step sweep (frequency steps at the same interval), list sweep, power sweep
Scan range	Within the instrument's specification range
Dwell time	20ms to 10s
Time resolution	100us
Frequency switching speed	≤20ms

General technical indicators

Power Requirements		85~264VAC, 50～60Hz,100W
range of working temperature		0 to 50ºC
Weight (excluding protective pads)	Single Channel	≤10kg
	Multi Channel	Dual Channel≤16kg Three channels≤20kg
Dimensions (excluding protective pads)	Single Channel	2U: 88mm high * 320mm wide * 400mm deep
	Multi Channel	2U: 88mm high * 483mm wide * 559mm deep (dual or three-channel, each channel is below 24GHz) 3U: 134mm high * 483mm wide * 559mm deep (three-channel, output above 24GHz)
Recommended calibration cycle		12 months
ISO compliant		The instrument is manufactured in an ISO-9001 certified factory and complies with SALUKI's internal quality standards.

Instrument Port

Programmable port

LAN	RJ45 connector, LAN connector provides remote control function
RS422	DB9 connector, serial communication interface, provides remote control function
GPIB interface (optional)	Standard GPIB interface, providing remote control function

Input and Output

Debug interface DEBUG	DB15 connector, power calibration and firmware update functions are available through dedicated connector
External trigger input TRIG IN	BNC-K connector, sweep or modulation trigger input interface, 3.3V-COMS logic level, input high impedance
Internal trigger output TRIG OUT	BNC-K connector, synchronous pulse trigger output
External 10MHz reference input REF 10MHz IN	BNC-K connector, receives 10MHz reference signal, used for frequency locking internal time base, rated input power is +2 to +8dBm, impedance is 50Ω, sine wave or square wave
Internal 10MHz reference output REF 10MHz OUT	BNC-K connector, output 10MHz reference signal. Output power is +10±1dBm, output impedance is 50Ω
RF OUT	3.5mm (SGP1012A/SGP1024A), output impedance 50Ω
	2.92mm (SGP1040A), output impedance 50Ω
	2.4mm (SGP1045A), output impedance 50Ω
	1.85mm (SGP1067A), output impedance 50Ω
PULSE IN	BNC-K connector, external modulation pulse input port, 3.3V-COMS logic level, input high impedance
PULSE OUT	BNC-K connector, output internally generated pulse signal, 3.3V-COMS logic level, output impedance is low resistance

Ordering Information

Main Machine

Model	Description
SGP1003A	10MHz-3GHz Single Channel
SGP1006A	10MHz-6GHz Single Channel
SGP1012A	10MHz-12GHz Single Channel
SGP1024A	10MHz-24GHz Single Channel
SGP1040A	10MHz-40GHz Single Channel
SGP1045A	10MHz-45GHz Single Channel
SGP1067A	10MHz-67GHz Single Channel
SGP1024D SGP10420D SGP1040D	Dual Channel
SGP1024T SGP104220T SGP104420T SGP1040T	Three channels

Options

Model	Description
SLF1	5kHz-10MHz low frequency output
SLF2	1MHz-10MHz low frequency output
SLN002(8)	Low phase noise option(Please consult our company for specific configuration)
SHP002	High power output option
SLFB002	Enhanced harmonic suppression option
SP001(9)	Pulse modulation option

(8) The minimum power when using option SLN002 is -110dBm
(9) Option SLN002 and option SP001 cannot be used at the same time