



GSG-2000 Series

6GHz RF Signal Generator

FEATURES

- Frequency Range : 9kHz ~ 6GHz
- Frequency Resolution : 1mHz
- Standard 10ppm Frequency Stability, 2ppm/year Aging Rate.
(Optional: 10ppb Frequency Stability with 0.1ppm/year Aging Rate)
- Amplitude Range : -140dBm ~ +20dBm
- 0.01dBm Amplitude Setting Resolution
- Amplitude Support dBm, dBμV, Vrms Unit
- Phase Noise : <-117dBc/Hz (Typical) @1GHz Output and 20kHz Offset
- Frequency/Amplitude Switching Speed : <5ms
- Built-in LF Output, Pulse Output
- Built-in in AM, FM, PM Analog Modulation
- Support IQ Modulation Output (Only for GSG-2160)
 - * Maximum 60MHz Baseband I or Q Modulation Output
 - * Maximum 120MHz RF I+Q Modulation Output
 - * Built-in ASK,PSK,APSK,QAM,FSK,MSK,User-define IQ, User-define FSK Modulation Signal
- Provide USB, LAN and GPIB (Opt.), Commands Comply with SCPI Standards

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GW INSTEK
Simply Reliable

The GSG-2000 series is a basic RF vector signal/signal generator. that covers a frequency range from 9kHz to 6GHz. It is suitable for applications in communications education, RF component testing (such as amplifiers, antennas, and filters), automotive electronic signal testing, and IoT applications. It meets the testing requirements of RF products during production and development stages. Compared to its main competitors, the GSG-2000 series offers superior specifications including a wide amplitude output range of +20dBm to -140dBm, lower phase noise of -117dBc/Hz, and high frequency accuracy with 10ppm frequency stability and 2ppm aging rate. Users have the option to enhance frequency stability and aging rate by selecting the OCXO (Oven Controlled Crystal Oscillator) option, which provides 10ppb stability and 0.1ppm aging rate.

For the signal modulation, the entire series has built-in AM, FM, and PM analog modulation, and GSG-2160 features a digital signal modulation function with a maximum bandwidth of 60MHz digital signal output, supporting ASK, PSK, APSK, QAM, FSK, MSK, User-defined IQ, User-defined FSK modulation signals.

Furthermore, the GSG-2000 series also provides LF signal and Pulse signal output. The LF signal allows users to output Sine, Square, Triangle/Ramp, Gaussian Noise signals, and the Pulse signal output can simulate pulse wave applications of various widths. In addition to the above signal outputs, GSG-2000 also provides AM/FM/digital IQ signal input, as well as independent output ports for digital I or Q signals.

GSG-2000 adopts a seven-inch TFT LCD display that can fully display the parameters and status set by the user, and the series also provides USB, LAN, GPIB (option) communications interfaces, and provides standard SCPI-compatible commands to support remote control . GSG-2000 is designed for 3U high standard rack size.

SELECTION GUIDE

Model	GSG-2160	GSG-2060
Frequency Range	9kHz~6GHz	9kHz~6GHz
Analog Modulation	AM, FM, PM	AM, FM, PM
Digital Modulation	ASK, PSK, APSK, QAM, FSK, MSK, user define IQ, user define FSK	—
LF Output	√	√
Pulse Output	√	√

A. PROVIDES MULTIFUNCTIONAL OUTPUT SIGNALS



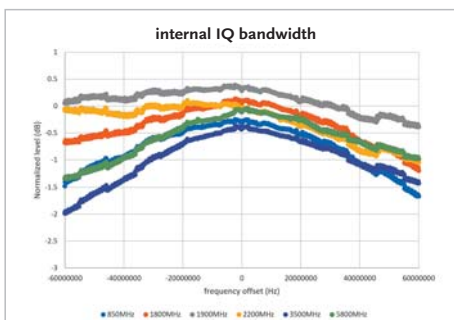
RF and LF Signal Output Ports



Pulse Signal Output Port



Digital Signal Output (GSG-2160 only)



Frequency Response Plot Generated by Internal Input IQ Signal.

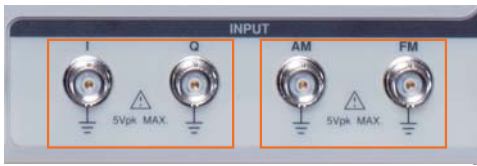
Both GSG-2160 and GSG-2060 provide RF signal output from 9kHz to 6GHz. GSG-2060 supports analog RF signal output (such as AM, FM, PM), and GSG-2160 supports analog and digital RF signal output.

LF Output with Built-in Function Signal - Equipped with an LF function signal (Low Frequency function generator) that can be output independently, and the series provides waveforms such as Sine, Square, Triangle, Ramp, Gaussian noise, etc. Users can use it in conjunction with other input and output functions, or it can be used alone in applications such as circuit design and electronic component testing and other related applications.

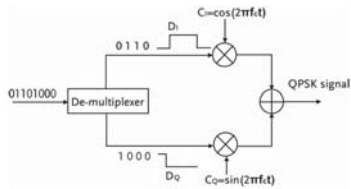
Pulse Signal Output - GSG-2000 Series has a built-in Pulse signal output. Users can adjust the Pulse duty cycle, which is often used to test digital circuits such as TTL, CMOS, ECL, etc., or to simulate changes in switching signals.

Vector signal output (GSG-2160 only) - Frequency response plot generated by internal input IQ signal.

B. SUPPORTS VARIOUS SIGNAL INPUTS



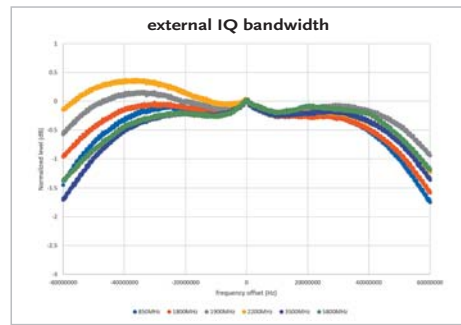
External IQ Signal & AM/FM Signal Input



I and Q input for QPSK Signal

Provides Input for External IQ Signal - Users can input I and Q data respectively, and then synthesize the required IQ vector signal through the internal RF signal output.

External AM/FM Signal Input - Users can input AM or FM signals externally for analog modulation related applications.



Frequency Response Diagram Generated by External Input IQ Signal

For example, in the QPSK signal in the diagram, after inputting the corresponding data from I and Q respectively, and selecting the QPSK function, QPSK output can be edited.

Frequency response diagram generated by external input IQ signal.

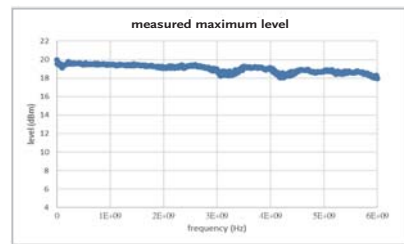
C. ACCURATELY SET RESOLUTION

FREQUENCY	AMPLITUDE
1.000000000000 GHz	-140.00 dBm

0.01dBm Setting Resolution

GSG-2000 provides a setting resolution as low as 1mHz in frequency and a setting resolution in amplitude of 0.01dBm, allowing users to process more complex signals.

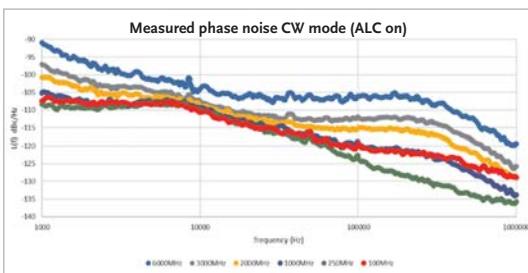
D. WIDE AMPLITUDE OUTPUT RANGE



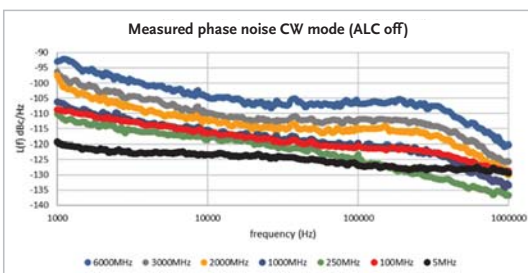
Guaranteed Specification Range

GSG-2000 provides a setting range from +20dBm ~ -140dBm, and a guaranteed specification range from +14dBm ~ -110dBm.

E. PURER SIGNAL OUTPUT



Measured Phase Noise CW mode (ALC on)



Measured Phase Noise CW mode (ALC off)

-117 dBc/Hz phase noise the output signal provided by GSG-2000 has an optimal phase noise of -117dBc/Hz, which can be applied to a wider variety of applications, such as automotive digital signals, IoT industrial applications and other fields that require pure signals.

The phase noise at each frequency under ALC On and ALC Off.

The signal purity of its Harmonic and Spur is also close to the entry-level indicators of major European and American manufacturers.



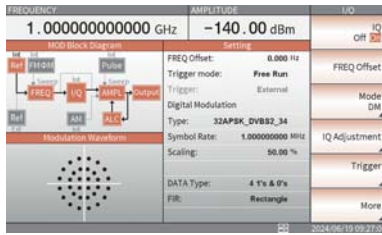
Harmonics <-35dBc

Phase Noise @ 20kHz offset (dBc/Hz)			
	MHz	ALC On	ALC Off
Frequency Range	5	-	-122
	100	-112	-115
	250	-112	-117
	1000	-112	-117
	2000	-108	-112
	6000	-102	-105

Harmonics	
Range	Level \leq 4dBm
$9k \leq \text{Freq.} < 6000M$	$< -35dBc$

Non-Harmonics		
Level $> -10dBm$, offset $> 10kHz$	$< -65dBc$	$1M \leq \text{Freq.} < 5M$
	$< -70dBc$	$5M \leq \text{Freq.} < 187.5M$
	$< -75dBc$	$187.5M \leq \text{Freq.} < 750M$
	$< -72dBc$	$750M \leq \text{Freq.} < 1500M$
	$< -64dBc$	$1500M \leq \text{Freq.} < 3000M$
	$< -58dBc$	$3000M \leq \text{Freq.} < 6000M$

F. GRAPHIC DISPLAY DESIGN



GSG-2000 utilizes a 7-inch large-size LCD display. All setting parameters, measurement results and current function information can be directly displayed, allowing users to quickly understand the current setting information.

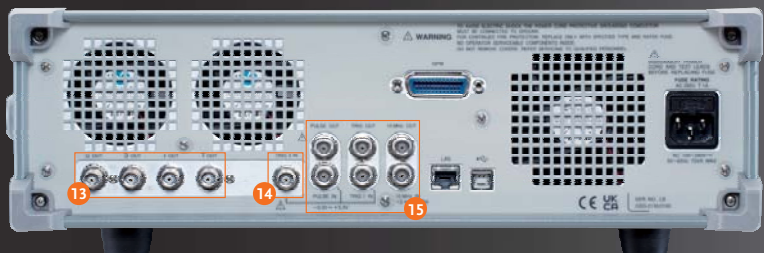
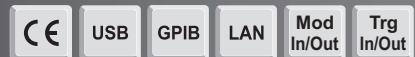
For the first innovation, icons and arrow connections are displayed directly on the screen, allowing users to understand the path of signal generation at a glance. For example, the PSK and QAM signal output in the picture above directly displays the block diagram, modulation signal pattern and corresponding parameters on the screen, allowing the user to set related parameters.

G. RICH COMMUNICATIONS INTERFACES



GSG-2000 provides standard interface LAN and USBTMC output, and optional GPIB interface to meet the user's connection needs under various interfaces. The command supports the standard SCPI IEEE488.2 standard command set.

PANEL INTRODUCTION



1. Frequency, Amplitude, Sweep Setting Keys
2. Numeric Input Keys
3. Unit Selection Keys
4. F1-F5 Function Keys
5. Return Key
6. AM/FM/PM/Pulse Setting Keys
7. Trigger/LF/IQ Setting Keys
8. File/Save/Recall/Default/User Default/Utility Setting Buttons
9. LF On/Off; RF On/Off
10. I/Q Input Port
11. AM/FM Input Port
12. LF/RF Output Port
13. I/Q Output Port
14. Trigger 2 In
15. Pulse In/Out; Trigger 1 In/Trigger Out; 10MHz In/Out

SPECIFICATIONS			
FREQUENCY RANGE			
Frequency Range	9kHz ~ 6GHz	GSG-2160, GSG-2060	
Frequency Resolution	1mHz		
Frequency Bands	Band	Frequency Range	N
	1	9kHz to 5MHz	digital synthesis
	1	<5MHz to 187.5MHz	1
	2	<187.5MHz to 375MHz	0.25
	3	<375MHz to 750MHz	0.5
	4	<750MHz to 1500MHz	1
5	<1500MHz to 3000MHz	2	
6	<3000MHz to 6000MHz	4	
Frequency Switching	≤ 5ms		
SSB PHASE NOISE, CW at 20kHz OFFSET(dBc/Hz)			
Frequency (MHz)		ALC on	ALC off
	5	-	-122
	100	-112	-115
	250	-112	-117
	1000	-112	-117
	2000	-108	-112
	3000	-107	-110
6000	-102	-105	
Residual FM (0.3kHz ~ 3kHz)(1GHz CW)	<2Hz		
NON HARMONICS			
Non Harmonics	Level > -10dBm, Offset > 10kHz	<65dBc	1M ≤ freq. ≤ 5M
		<66dBc,-70dBc(typ)	5M < freq. ≤ 187.5M
		<75dBc	187.5M < freq. < 750M
		<70dBc,-74dBc(typ)	750M ≤ freq. < 1500M
		<62dBc,-66dBc(typ)	1500M ≤ freq. < 3000M
		<58dBc,-60dBc(typ)	3000M ≤ freq. < 6000M
HARMONICS			
Range	Level < 4dBm		
9k ≤ Freq < 6000M	<35dBc		
FREQUENCY REFERENCE			
Frequency Reference	10MHz		
Temperature Stability	<10ppm, Standard		<10ppb, OCXO Option
Aging	2ppm/year, Standard		0.1ppm/year, OCXO Option
Output	1Vpp, 50 Ohm Load		
Input	-3 ~ 20dBm, 50 Ohm Load		
Input Deviation	Standard: 3ppm		OCXO Option: 0.5ppm
AMPLITUDE SPECIFICATIONS			
AMPLITUDE			
Setting Range	20dBm ~ -140dBm		
Resolution	0.01dB		
Amplitude Unit	dBm, dBμV, Vrms		
AMPLITUDE ACCURACY			
Absolute Level Accuracy in CW Mode (ALC On)		14dBm to -60dBm	-60dBm to -90dBm
	9k < freq. < 3GHz	±0.6dB	±0.8dB (±0.6dB typical)
	3GHz < freq. < 6GHz	±0.8dB	±1dB (±0.6dB typical)
Addition Level Accuracy in CW Mode (ALC Off, Power Search Run, Relative to ALC On)		0.15dB	
VSWR (5M ~ 3GHz)	<1.8 (output ≤ -66dBm)		
Amplitude Switching (ALC on, CW)	≤ 5ms		
SWEEP SPECIFICATIONS			
SWEEP			
Mode	Frequency, amplitude, list		
Dwell Time	100μs ~ 100s		
Number of Points (Step)	2 ~ 65,535		
Number of Points (List)	1 ~ 4,096		
Triggering	Free, trigger key, external, timer		
ANALOG MODULATION SPECIFICATIONS			
FM			
Source	Internal, external		
Max. Deviation	N*1MHz		
Rate	freq ≥ 10MHz	0.1Hz ~ 1MHz	
	freq < 10MHz	0.1Hz ~ 100kHz	
Resolution	1mHz		
Accuracy (1kHz rate, N*50kHz deviation)	2% setting + 20Hz		
Distortion (1kHz rate, N*50kHz deviation)	0.40%		
PM			
Source	Internal,external		
Max. Devaition	N* 1MHz/rate or 5N rad		
Rate	freq ≥ 10MHz	0.1Hz ~ 1MHz	
	freq < 10MHz	0.1Hz ~ 100kHz	
Resolution	0.001rad		
Accuracy (1kHz rate)	1% of setting+0.1rad		
Distortion (1kHz rate, max deviation)	0.20%		
Response	0.1Hz ~ 1MHz		
AM			
Source	internal, external		
Resolution	0.01%		
Depth	0 ~ 100%		
Accurcay (1kHz, 0dBm)	<5MHz	1.5% setting +1%	
	5M ~ 4GHz	3% of setting+1%	
	4GHz ~ 6GHz	5% of setting + 1%	
Distortion (1kHz, 80%, <8dBm)	<5MHz	1.50%	
	5M ~ 4GHz	2%	
	4GHz ~ 6GHz	3%	
Response	0.1Hz ~ 20kHz		

SPECIFICATIONS		
PULSE SPECIFICATIONS		
PULSE		
Mode	Free-run, square, triggered, adjustable doublet, trigger doublet, gated, pulse train, and external pulse	
Source	Internal, external	
Pulse Input	-0.5V ~ 5V, $V_{IH}=V_{IL}=1.5V$ (typ)	
Edge Time	<20ns	
On/Off Ratio	70dB, 5M ~ 3GHz 45dB, 3G ~ 6GHz	
Repetition Rate	0.1Hz ~ 10MHz	
Pulse Period	100ns ~ 42s	
Resolution	10ns	
Width	50ns ~ period-10ns	
Pulse Train Number of Patterns	2047	
LF SPECIFICATIONS		
LF		
Waveform	Sine, square, triangle, ramp, gaussian noise	
Frequency Range	Sine	0.1Hz ~ 10MHz
	Square, Triangle, Ramp	0.1Hz ~ 1MHz
	Gaussian Noise	10MHz BW
Resolution	1mHz	
Output	2mVpp ~ 6Vpp	
Impedance	50 Ohm	
VECTOR MODULATION SPECIFICATIONS		
VECTOR MODULATION (GSG-2160 only)		
Source	Internal, external	
Bandwidth (baseband)	60MHz	
Bandwidth (RF)	120MHz	
Carrier Frequency	<5MHz ~ 6,000MHz	
Carrier Suppression	25±5°C >50dBc	
Sideband Suppression	25±5°C >50dBc	
Modulation Mode	ASK, PSK, APSK, QAM, FSK, MSK, user define IQ, user define FSK	
ASK	2ASK(0 ~ 100%), 4ASK, 8ASK, 16ASK, 32ASK	
PSK	BPSK, QPSK, DQPSK, OQPSK, $\pi/4$ DQPSK, 8PSK, D8PSK, 16PSK	
APSK	16APSK, 32APSK	
QAM	16QAM, 32QAM, 64QAM, 128QAM, 256QAM	
FSK	2FSK, 4FSK, 8FSK, 16FSK	
Internal Modulation EVM (16QAM, RRC filter, $\alpha=0.25$, 4Msps, level $\leq 4dBm$, ALC off)	0.8%, 10MHz < freq < 3GHz 1.2%, 3GHz < freq < 5GHz	
IQ GENERATOR		
Resolution	16bit	
Sample Rate	10kHz ~ 180MHz	
Baseband Bandwidth	60MHz	
ARB Memory	Waveform Length Storage Capacity	
	16Msa 16GB	
Trigger Type	Free, single, gated, trigger and run	
Trigger Source	External, trigger key	
INTERNAL IQ ADJUSTMENT		
IQ Offset	±10%	
IQ Gain	±6dB	
IQ Skew	max 30ps ~ 100ps	
EXTERNAL IQ OUTPUT		
Impedance	50Ohm per output	
Maximum per Output	0.5Vpk	
Bandwidth	60MHz	
Common Mode Offset	±1.25V	
Differential Mode Offset	±50mV	
EXTERNAL IQ INPUT		
Bandwidth	60MHz	
Full Scale	±1V into 50Ohm	
IQ Offset	±10% full scale	
IQ Gain	±6dB	
SIMULTANEOUS MODULATION		
All modulation types (I/Q, FM, AM, ΦM , and pulse modulation) may be simultaneously enabled except: FM and phase modulation		
GENERAL SPECIFICATIONS		
Power Source	AC 100 ~ 240V, 50 ~ 60Hz	
Power Consumption	90VA Maximum	
Display	7 inch TFT LCD, 1024(RGB)*600	
Interface	GPIO (option), USB, LAN	
Operating Temperature	0 ~ 50°C	
Storage Temperature	-10 ~ 70°C	
Humidity	85% at 40°C	
Altitude	Up to 2000m	
Dimensions (W x H x D) & Weight	430(W) x 140(H) x 540(D)mm ; Approx. 13 kg	

Specifications subject to change without notice. GSG-2000_E_ID1BH

ORDERING INFORMATION

GSG-2160 6GHz RF Signal Generator with Digital IQ Modulation
GSG-2060 6GHz RF Signal Generator

ACCESSORIES

CD (User Manual) x1, Power Cord x1

OPTIONAL ACCESSORIES

ADP-001 N(M)-BNC(F) Adapter GTL-301 N(M)-N(M) RF Cable
ADP-002 N(M)-SMA(F) Adapter GTL-303 SMA(M)-SMA(M) RF Cable
GRA-447 Rack Mount Kit. 19", 3U Size

OPTION

OCXO clock reference source

* GPIB and OCXO options can only be installed prior to the shipment. Please select these options while placing an order.



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