SG SERIES
PRODUCT MANUAL

USB VECTOR SIGNAL GENERATOR

SGF-60
9 kHz - 6 GHz

V1.0
26/08/2026

HAROGIC

SG Series

SGF Series Overview.

HIGH-PERFORMANCE USB VECTOR SIGNAL GENERATOR

The SGF series delivers phase noise, spurious, and harmonic performance comparable to that of benchtop analog signal generators, while incorporating a powerful baseband subsystem. It features a high-performance 16-bit DAC and up to 1 GB of high-speed onboard memory, supporting waveform playback bandwidths of up to 320 MHz and real-time IQ streaming bandwidths of up to 50 MHz. A built-in FPGA-based interpolator enables flexible, fine-grained sample rate adjustment while significantly reducing the computational load on the host. With its outstanding RF and baseband performance, the SGF series is an ideal choice for R&D, testing and other high-performance applications.

EASE OF USE AND COMPACT DESIGN

The compact form factor facilitates seamless system integration without compromising RF integrity, drastically reducing both deployment complexity and operational overhead. It is ideally positioned for footprint-sensitive and budget-conscious applications where performance cannot be sacrificed.

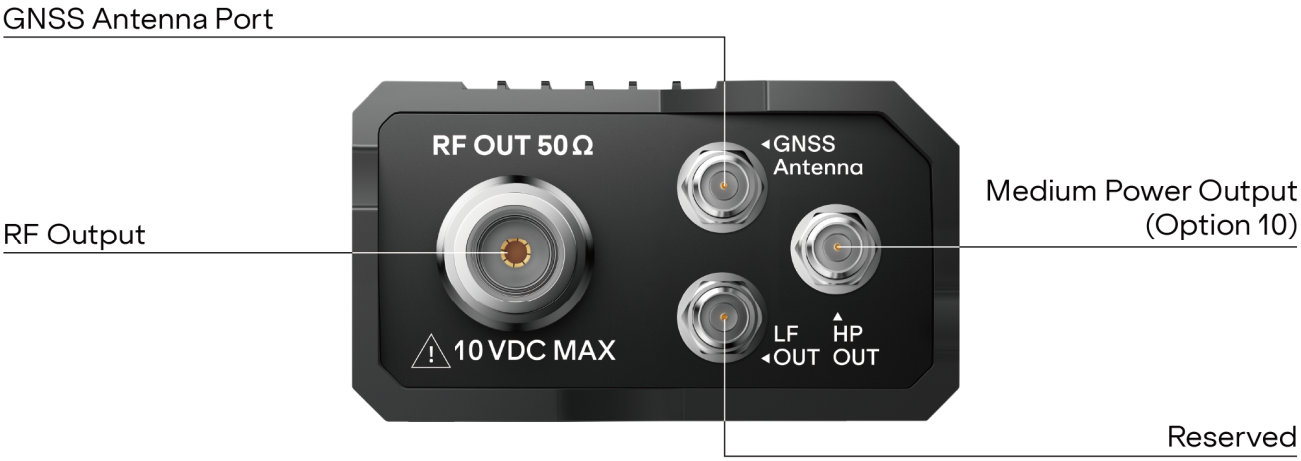
POWERFUL API AND ECOSYSTEM

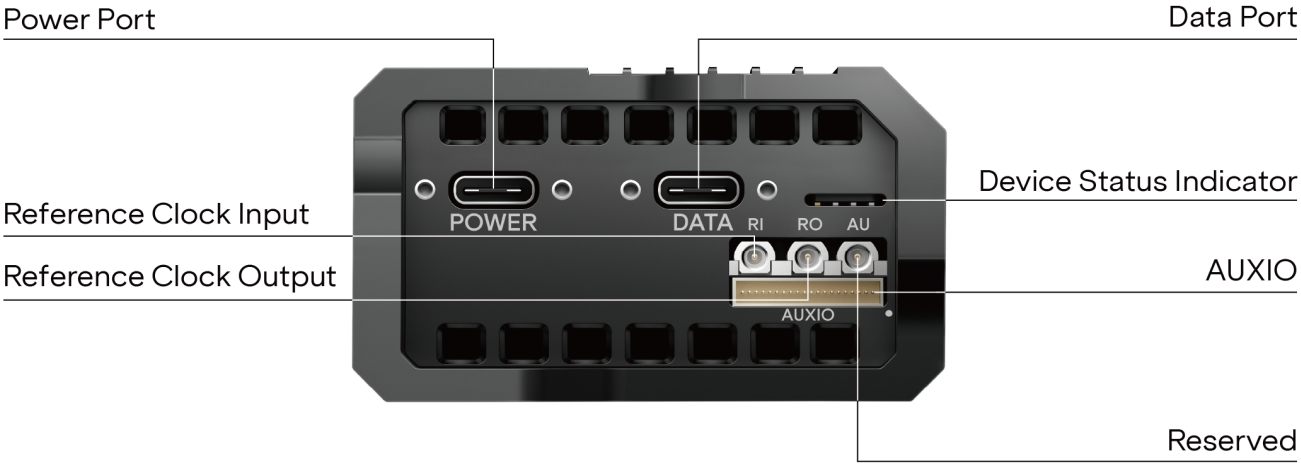
The SGF series provides an intuitive and powerful API for application development, with support for C/C++, C#, Python, MATLAB, Qt, and LabVIEW. Compatible with both Windows and Linux platforms.

Key Features

- Frequency: 9 kHz to 6 GHz
- Playback Bandwidth: 100 MHz / 320 MHz (opt.53)
- Memory depth: 128 MB / 1 GB (opt.53)
- Real-Time Bandwidth: 50 MHz
- 1 GHz phase noise: -134 dBc/Hz@10 kHz
- Typical Spurious: ≤ −85 dBc
- Maximum output power: 9 dBm to 16 dBm, 25 dBm (opt.10)
- Minimum output power: ≤ -100 dBm across full frequency range
- Harmonics: ≤ -60 dBc (0 dBm output, typical)
- 16-bit DAC for high-quality baseband waveform
- FPGA-based high-performance interpolator
- Fine sampling rate adjustment supported
- Fine reference frequency adjustment supported
- Built-in GNSS for timing, positioning, and frequency calibration
- USB 3.0 / 2.0 Type-C interface
- Supports ARM and x86_64 processor architectures
- Supports Windows and Linux systems

SGF Series Interface Description

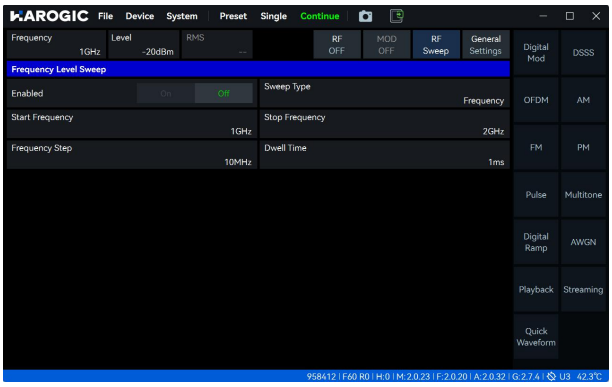




SGStudio Software Overview*

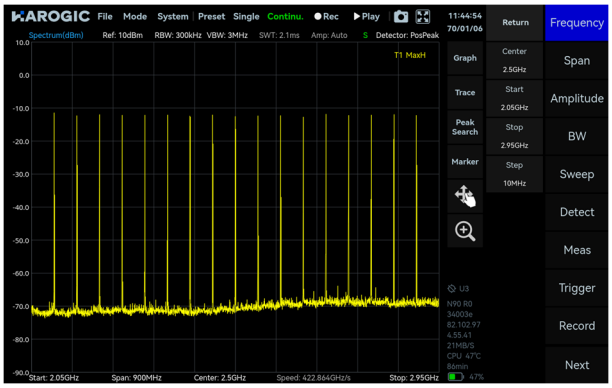
Clear and User-Friendly Interface

SGStudio features a user-friendly interface designed for ease of operation. The GUI is logically organized into five key functional areas: the Menu bar, RF parameter settings, mode selection, mode parameter settings, and status information.



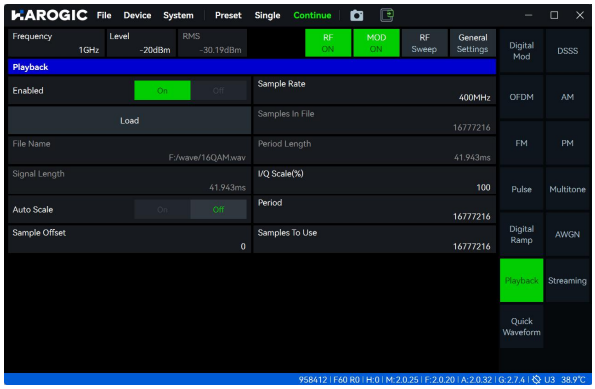
RF Frequency and Power Sweep Control

SGStudio provides comprehensive RF control, supporting single tone, frequency sweep, and power sweep modes. It simplifies complex characterization tasks, enabling users to perform automated frequency response and compression point testing directly through the GUI—eliminating the need for custom programming.



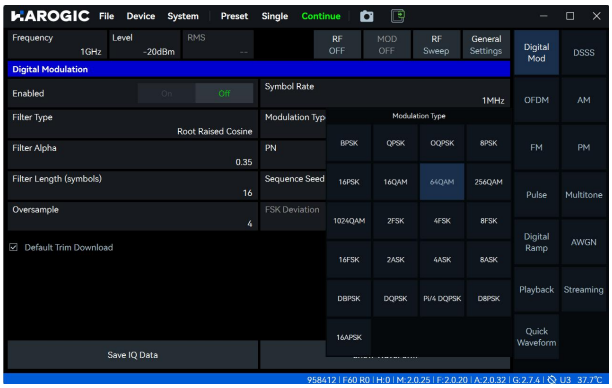
IQ Streaming and Playback

SGStudio supports continuous real-time waveform streaming from the host for playback, as well as waveform buffering in the device's internal memory for subsequent playback. Buffered playback supports wider signal bandwidth and requires no host intervention during playback, thereby fully freeing host processing resources. In buffered playback mode, the maximum waveform length is limited by the capacity of the device's internal memory.



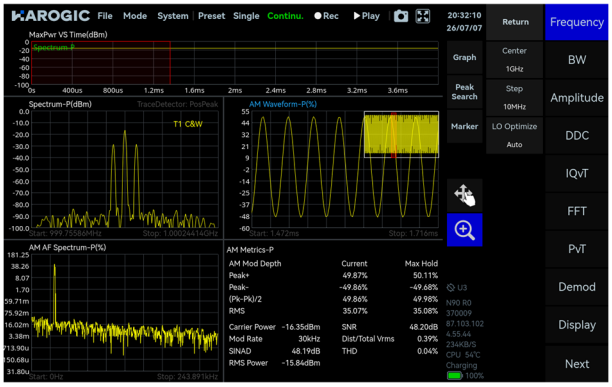
Digital Modulation Signal Output

Engineered for versatility, the SGF series supports an extensive library of modulation schemes, ranging from fundamental ASK, FSK, and PSK to high-order 1024QAM. The architecture is specifically optimized for modern wireless standards, with support for DSSS and OFDM to facilitate advanced signal generation for both field testing and R&D verification.



Basic AM/FM/PM Signal Output

SGStudio supports analog modulation formats, including AM, FM, and PM. Each of the three modulation types supports a variety of modulation signal formats, with configurable parameters including modulation rate, modulation index, frequency deviation, phase deviation, and initial phase, accommodating routine analog modulation signal generation and RF testing requirements.

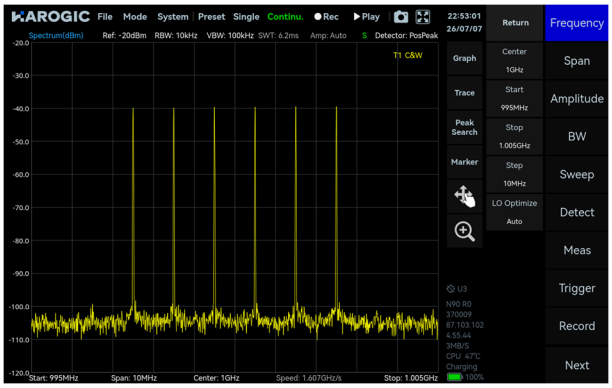


Basic Pulse Signal Output

SGStudio supports basic pulse signal output with configurable pulse repetition period, duty cycle, and pulse width.

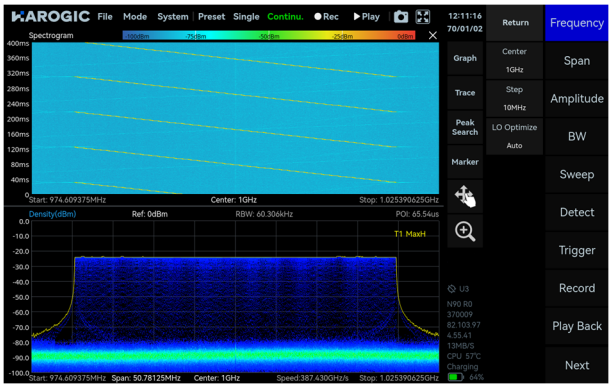
Multitone Signal Output

The SGF series supports the generation of multi-tone RF signals composed of multiple discrete tones. Users can configure the number of tones, tone spacing, and phase mode. In-band notches can also be configured relative to the RF center frequency, making this function suitable for dynamic range, intermodulation distortion, and frequency-response flatness testing.



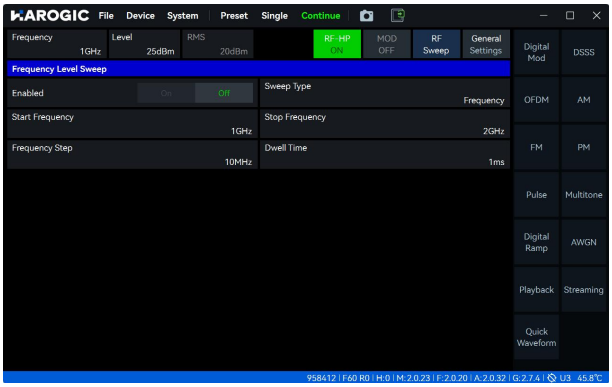
■ Digital Ramp Sweep

SGStudio supports linear digital ramp frequency sweeps with configurable sweep span, sweep time, and sweep period. This function is suitable for radar signal simulation, wideband excitation, and frequency-response testing.



■ Medium Power Output (opt.10)

The SGF series offers an optional medium-power RF output port, delivering up to 25 dBm of output power over the 10 MHz to 6 GHz frequency range. This option is ideal for applications requiring higher excitation levels, such as device testing and system integration.



*Some spectrum and waveform illustrations are shown using measurement screens from spectrum analyzer software.

Specifications*

FREQUENCY

Frequency range	9 kHz to 6 GHz	
Frequency resolution	Output frequency < 500 MHz	1 Hz
	500 MHz ≤ Output frequency ≤ 6 GHz	0.1 Hz
LO switching time	≤ 100 us pre-programmed; ≤ 50 ms software controlled	
Reference clock	Internal or external, manual correction or GNSS calibration is available	
Frequency accuracy	≤ 0.1 ppm Supports GNSS correction	≤ 0.05 ppm After GNSS-based frequency correction
Aging and temperature stability	≤ 0.3 ppm/year, ≤ 0.05 ppm	
Built-in GNSS 1PPS accuracy	≤ 100 ns / ≤ 20 ns (opt.05), under clear-sky conditions	

SPECTRUM PURITY

SSB phase noise (dBc/Hz) (Guaranteed / Typical)			
Carrier frequency	1 GHz	3 GHz	6 GHz
1 kHz	-125 / -128	-118 / -121	-112 / -115
10 kHz	-132 / -134	-124 / -126	-118 / -120
100 kHz	-131 / -133	-123 / -125	-117 / -119
1 MHz	-141 / -143	-131 / -133	-125 / -127
Harmonics CW, 0 dBm	100 MHz	≤ -45 dBc	
	1 GHz	≤ -60 dBc	
	3 GHz	≤ -60 dBc	
	6 GHz	≤ -70 dBc	
Non-harmonic spurious	1 MHz step size and 20 MHz observation bandwidth Spurious levels are ≤ -85 dBc for approximately 99% of frequency points Worst-case spurious ≤ -65 dBc		
EVM (Typical)	1 GHz	≤ 0.3% 1MSPS QAM 16, Alpha = 0.35 ≤ 0.5% 10MSPS QAM 64, Alpha = 0.35	
	6 GHz	≤ 0.5% 1MSPS QAM 16, Alpha = 0.35 ≤ 1.0% 10MSPS QAM 64, Alpha = 0.35	

AMPLITUDE

	9 kHz	100 MHz	1 GHz	3 GHz	6 GHz
Max. output power (dBm)	≥ 0	≥ 10	≥ 16	≥ 16	≥ 9
Min. output power (dBm)	≤ -100	≤ -100	≤ -100	≤ -100	≤ -100
Power accuracy (Guaranteed / Typical)	Output power: ≥ -45 dBm			± 1.2 dB / 0.7 dB	
	Output power: -80 dBm to -45 dBm			± 1.5 dB / 1.2 dB	
	Output power: -100 dBm to -80 dBm			± 2.0 dB / 1.8 dB	
Power setting step size	0.1 dB				

SIGNAL PROCESSING

Standard function	Single tone, multitone, frequency sweep, power sweep, AM, FM, PM, pulse modulation, digital ramp sweep Gaussian white noise, IQ playback, Real-Time IQ playback
Modulation bandwidth	Real-Time IQ Streaming: 50 MHz Playback: 100 MHz / 320 MHz (opt.53)
Built-in memory depth	128 MB (32 M samples), 1 GB (opt.53, 256 M samples)
IQ sampling rate	195.3125 kHz to 125 MHz or 312.5 kHz to 200 MHz, 300 MHz to 400 MHz fixed sample rates (opt.53) step size ≤ 10 Hz
Basic modulation signal generation	APSK: 16APSK ASK: 2ASK, 4ASK, 8ASK FSK: 2FSK, 4FSK, 8FSK, 16FSK QAM: 16QAM, 64QAM, 256QAM, 1024QAM PSK: BPSK, QPSK, 8PSK, 16PSK, DBPSK, DQPSK, D8PSK, Pi/4 DQPSK

GENERAL

Input and output	
Power	Type-C, PD protocol (12 V / 3 A std.) Voltage range 9 to 12 V, Ripple < 200 mVpp
Data	Type-C, USB 3.0 (USB 2.0 bandwidth limited) Recommend 5 V / 1 A power supply
RF output	N(F), Output impedance 50 Ω
External reference clock input	MMCX(F), Amplitude ≥ 1.5 Vpp, Input impedance 200 Ω
Reference clock output	MMCX(F), Output impedance 50 Ω, 100 MHz
External trigger input	Integrated into AUXIO, 3.3 V CMOS; Input: High Impedance
External trigger output	Integrated into AUXIO, 3.3 V CMOS
GNSS antenna input	SMA(F)

Power consumption	≤ 22 W	
Overall / core weight	≤ 390 g / ≤ 125 g	
Overall / core dimensions (L × W × H)	≤ 163 × 66 × 37 mm / ≤ 63 × 60 × 15 mm	
System requirements	Linux	aarch64, x64
	Windows	x64
Operating / storage temperature (Ambient)	T0 class (std.)	0 to 50 °C / -20 to 70 °C
	T1 class (opt.40)	-20 to 65 °C / -40 to 85 °C
	T2 class (opt.41), only core	-40 to 65 °C / -40 to 85 °C
Packaging accessories	Flash disk * 1, USB 3.0 data cable * 1, USB power cable * 1, Power adapter * 1	

Medium Power Output (opt.10)		
Frequency range	10 MHz to 6 GHz	
Max. output power	≥ 25 dBm (typ.)	
Min. output power	≤ -80 dBm (typ.)	
Power accuracy (Guaranteed / Typical)	Output power: ≥ -20 dBm	± 1.2 dB / 0.7 dB
	Output power: -60 dBm to -20 dBm	± 1.5 dB / 0.7 dB
	Output power: -80 dBm to -60 dBm	± 2.5 dB / 1.2 dB
Harmonics CW, 0 dBm	100 MHz	≤ -55 dBc
	1 GHz	≤ -50 dBc
	3 GHz	≤ -42 dBc
	6 GHz	≤ -46 dBc

*Typical specifications apply under the following conditions:

(1) 10 min warm-up after power-on

(2) Ambient temperature: 25 °C (instrument temperature: 50 °C)

(3) With adequate cooling ensuring both ambient and core temperatures remain within the rated range

OPTIONS

Code		
05	Internal high precision GNSS	built-in hardware
10	Medium power output	built-in hardware
20	AUXIO IO expansion board	external hardware
40	T1 temperature class	built-in hardware
41	T2 temperature class, only available for core	built-in hardware
53	320 MHz bandwidth, 1 GB RAM	built-in hardware
80	4-Year Warranty	service
81	5-Year Warranty	service

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