



# SGA SERIES PRODUCT MANUAL



# USB VECTOR SIGNAL GENERATOR

SGA-60  
9 kHz - 6 GHz

# SGA Series Overview

## BENCHMARK USB VECTOR SIGNAL GENERATOR

The SGA series combines laboratory-grade RF performance—spanning superior phase noise to clean harmonic suppression with an accessible price. It features a high-resolution 16-bit DAC for precision signal synthesis and supports a 100 MHz playback bandwidth alongside 50 MHz real-time streaming. The integrated FPGA-based interpolator allows for granular sample rate adjustments and minimizes CPU overhead, ensuring a seamless, high-efficiency user experience for demanding test environments.

## 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 SGA series features a streamlined yet robust API designed for rapid development across diverse software environments. It offers comprehensive support for C/C++, C#, Python, and MATLAB, as well as seamless integration with industry-standard platforms like Qt, LabVIEW, and GNU Radio. Fully compatible with both Windows and Linux, the API ensures maximum flexibility for cross-platform system architecture

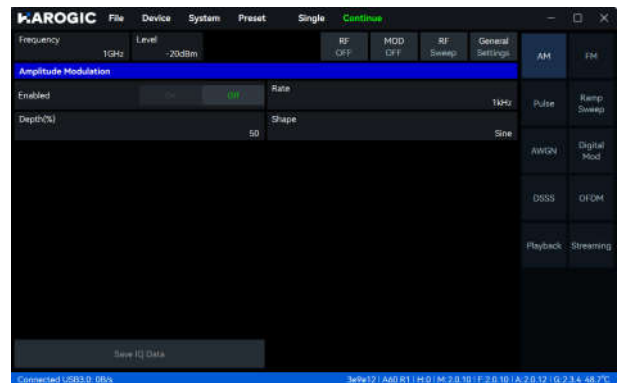
## Key Features

- Frequency: 9 kHz to 6 GHz
- Modulation Bandwidth: 100 MHz playback, 50 MHz real-time
- Memory depth: 128 MB (32M samples)
- 1 GHz phase noise: -124 dBc/Hz@10 kHz
- Maximum output power: 7 dBm to 14 dBm
- Minimum output power:  $\leq -100$  dBm across full frequency range
- Harmonics:  $\leq -50$  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
- USB3.0/2.0 Type-C interface
- Support ARM and X86 processor
- Support Windows and Linux system

# Vector Signal Generator Software SGStudio Overview

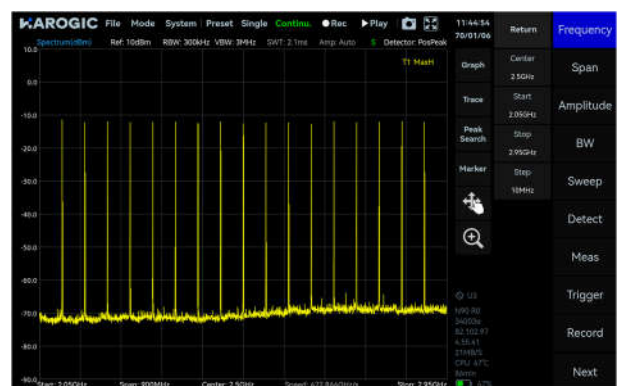
## ■ Clear and User-Friendly Interface

SGStudio features a streamlined, modular interface designed to maximize operational efficiency. The GUI is logically organized into five key functional areas: Menu Bar, RF Parameter Settings, Mode Selection, Mode Parameter Settings, and Status Information. By integrating all critical controls and real-time feedback into a unified main window, SGStudio ensures an accelerated learning curve and a seamless user experience that rivals traditional benchtop instruments.



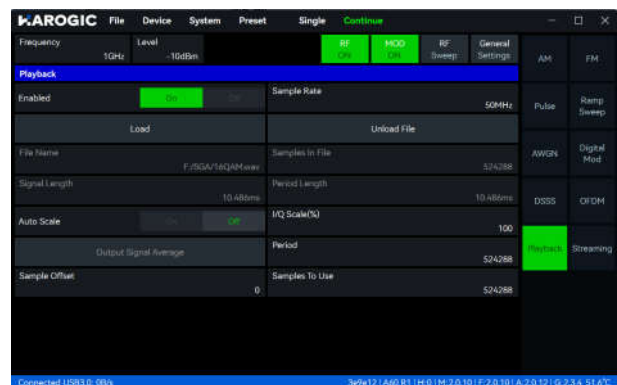
## ■ RF Frequency and Power Sweep Control

SGStudio provides comprehensive RF control, supporting single-point, 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.



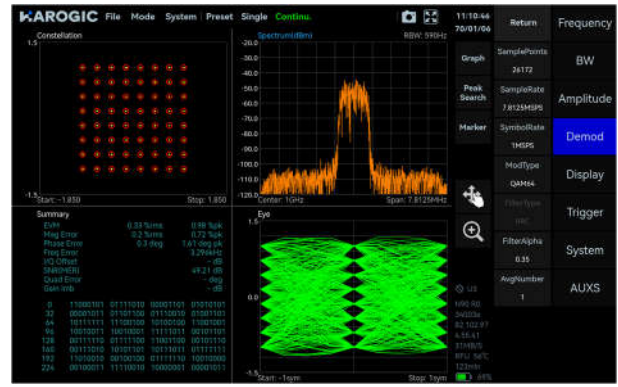
## ■ Real-Time IQ Playback

Support continuous real-time waveform streaming from the host for playback, or buffered playback using on-device memory. The playback mode offers higher signal bandwidth and operates without host intervention, fully offloading host processing. In replay mode, maximum waveform length is limited by the internal memory capacity.



## Digital Modulation Signal Output

Engineered for versatility, the SGA 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, featuring native support for DSSS and OFDM to facilitate advanced signal generation for both field testing and R&D verification



## Basic AM/FM Signal Output

SGA series provides robust support for classic analog modulation, including AM and FM signal generation. Users benefit from high-precision control over all modulation parameters—including modulation frequency, depth, and frequency deviation—ensuring accurate simulation for traditional receiver testing and analog system verification.



## Basic Pulse Signal Output

The SGA series includes integrated pulse signal generation, providing precise control for timing-sensitive applications. Users can fully configure critical parameters—including pulse repetition period, duty cycle, and pulse width—allowing for the accurate simulation of pulsed RF environments and radar signal characteristics.



## Specifications\*

### FREQUENCY

<b>Frequency range</b>	9 kHz to 6 GHz	
<b>Frequency resolution</b>	0.1 Hz analog tuning, $\leq 1$ uHz digital tuning	
<b>LO switching time</b>	$\leq 100$ us pre-programmed; $\leq 50$ ms software controlled	
<b>Reference clock</b>	Internal or external, manual correction or GNSS calibration is available	
<b>Frequency accuracy</b>	TCXO (std.)	$< 0.5$ ppm, manual correction is available
	OCXO (opt.01)	$< 0.2$ ppm, manual correction is available
	OCXO frequency correction via GNSS	$\leq 0.05$ ppm, when GNSS is locked
<b>Aging and temperature stability</b>	TCXO (std.)	$\leq 1$ ppm/year, $\leq 1$ ppm
	OCXO (opt.01)	$\leq 1$ ppm/year, $\leq 0.15$ ppm
<b>Built-in GNSS 1PPS accuracy</b>	$\pm 100$ ns	

### SPECTRUM PURITY

#### SSB phase noise (dBc/Hz)

Carrier frequency	1 GHz	3 GHz	6 GHz
1 kHz	-115	-105	-98
10 kHz	-124	-114	-108
100 kHz	-126	-116	-110
1 MHz	-138	-128	-122

<b>Harmonics CW, 0 dBm</b>	100 MHz	$\leq -45$ dBc
	1 GHz	$\leq -50$ dBc
	3 GHz	$\leq -60$ dBc
	6 GHz	$\leq -75$ dBc

<b>Non-harmonic spurious</b>	1 MHz steps size and 20 MHz observation bandwidth	
	Spurious levels are $\leq -80$ dBc for approximately 98% of frequency points Worst-case spurious $\leq -55$ dBc	

<b>EVM (Typical)</b>	1 GHz	$\leq 0.3\%$ 1MSPS QAM 16, Alpha = 0.35 $\leq 0.5\%$ 10MSPS QAM 64, Alpha = 0.35
	6 GHz	$\leq 0.5\%$ 1MSPS QAM 16, Alpha = 0.35 $\leq 1.0\%$ 10MSPS QAM 64, Alpha = 0.35

## AMPLITUDE

	9kHz	100 MHz	1 GHz	3 GHz	6 GHz
Max. output power (dBm)	≥0	≥7	≥14	≥14	≥7
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, Frequency sweep, Power sweep, IQ playback, Real-Time IQ playback
Modulation bandwidth	100 MHz RAM playback, 50 MHz continuous streaming
Built-in memory depth	128 MB (32 M samples)
IQ sampling rate	195.3125 kHz to 125 MHz, step size ≤10 Hz
Basic modulation signal generation	APSK: 16APSK ASK: 2ASK, 4ASK, 8ASK FSK: 2FSK, 4FSK, 8FSK, 16FSK QAM: 16 QAM, 64 QAM, 256 QAM, 1024 QAM 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, USB3.0 (USB2.0 bandwidth limited) Requires 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 330 Ω
Reference clock output	MMCX(F), Output impedance 50 Ω, 100 MHz
External trigger input	3.3 V CMOS, Input high impedance
External trigger output	3.3 V CMOS
GNSS antenna input	SMA (F)
Power consumption	≤16 W
Overall/core weight	≤360 g/≤120 g

<b>Overall/core dimensions (L x W x H)</b>	≤163 x 66 x 37 mm/≤63 x 60 x 15 mm	
<b>System requirements</b>	Linux	aarch64, x64
	Windows	x64
<b>Operating/storage temperature (Ambient)</b>	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
<b>Packaging accessories</b>	Flash disk * 1, USB 3.0 data cable * 1, USB power cable * 1, Power adapter * 1	

\*Specification applies 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

01	Built-in OCXO reference clock	built-in hardware
05	Built-in high precise GNSS	built-in hardware
40	T1 temperature class	built-in hardware
41	T2 temperature class, only available for core	built-in hardware

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