The Global Leader in Resilient PNT

GSG-5/6 Series: Advanced GNSS Simulators

Easy to Use

- Pre-defined or user-defined test scenarios
- Full control over all test parameters
- Front panel interface/stand-alone operation
- Windows-based scenario builder software including Google Maps

Flexible

- Remote operation by Ethernet, GPIB, USB
- Built-in or downloadable navigation files
- Full control over trajectories and other dynamics

Powerful

- Up to 64 simultaneous signals
- All GNSS constellations and frequencies
- Accurate, adjustable power levels
- Synchronization features to external devices or other simulators

Test Solutions

- Position/navigation accuracy
- Dynamic range/sensitivity
- Simulate movements/trajectories any way on or above earth
- Susceptibility to noise
- Sensitivity to GPS impairments: loss of satellites, multi-path, atmospheric conditions, interference, jamming and spoofing
- Conducted or over-the-air RF
- GPS time transfer accuracy
- Effect of leap second transition
- Multiple constellation testing
- Modernization signals/ frequencies
- Keyless military SAASM and dual-frequency and survey-grade receiver testing
- Controlled radiation pattern antennas (CRPA)
- Hardware-in-the-loop integration

Simulation is simply the best way to test and verify proper operation of devices, systems and software reliant on global navigation satellite signals. Orolia GSG-5/6 series simulators are easy to use, feature-rich and affordable to offer the best value compared to alternative testing tools or the limitations of testing from “live sky” signals.

Basic Principle

GSG-5/6 simulators can generate any combination of GPS, GLONASS, Galileo, BeiDou, QZSS, SBAS satellite signals under any condition simultaneously through a single RF output (type N connector). Configurations with higher channel counts generate new, modernized, signals on any of the navigation frequencies, including IRNSS, even those currently under development. Based on a test scenario that includes date, time and power levels, the generated signals correspond to any position on, or above, the earth (below the satellite orbits at approximately 20,000 km). It is easy to test dynamic conditions by defining a trajectory of the receiver under test. The simulator manages all the dynamics including relativistic effects.

Simple Set-up and Operation

Even the most inexperienced operator can configure scenarios on the fly without the need for an external PC and pre-compilation phase. Via the front panel, the user can swiftly modify parameters. Each unit comes with a license for GSG StudioView™ Windows software to graphically create, modify, and upload scenarios. A Google Maps interface makes trajectory creation easy. Trajectories can also be defined by recorded or generated NMEA formats.

Connectivity Extends Ease-of-use and Flexibility

GSG simulators can be controlled via an Ethernet network connection, USB or GPIB. A built-in web interface allows complete operation of the instrument through front panel controls. It also allows for file transfers. Connectivity also supports the integration of GNSS simulation into a wide range of other applications. There is an option to control signal generation in real-time through a simple command set. It can synchronize to external systems in many other ways based on its precision timing capabilities and the ability to automatically download ephemeris and almanac data via RINEX files.

Input/Output

RF GNSS Signal Generation

- Connector: Type N female
- DC blocking: Internal, up to 7 VDC; 470 Ω nominal load
- Frequency bands:
  - L1/E1/B1/SAR: 1539 to 1627 MHz
  - L2/L2C: 1192 to 1280 MHz
  - L5/E5/B2: 1148 to 1236 MHz
  - E6/B3:1224 to 1312 MHz
- Output channels:
  - 1 (GSG-51); 4, 8, 16 (GSG-5); 32 (GSG-62), 48, (GSG-63), 64 (GSG-64)
  - Any channel can generate any constellation or a derivative signal (multipath, interference, jamming)
  - Any set of 16 channels can generate within a frequency band
- Constellations: GPS, GLONASS, Galileo, BeiDou, QZSS, IRNSS
- Modulations: BPSK, QPSK, BOC (all)
- SBAS: WAAS, EGNOS, GAGAN, MSAS, SAIF (included)
- Spurious transmission: ≤40 dBc
- Harmonics: ≤40 dBc
- Output signal level: -65 to -160 dBm; 0.1 dB resolution down to -150 dBm; 0.3 dB down to -160 dBm
- Power accuracy: ±1.0 dB
- Pseudorange accuracy: Within any one frequency band:1 mm; Across different frequency bands: 30 cm
- Inter-channel bias: Zero
- Inter-channel range: >54 dB

• Limits	Standard	Extended
Altitude	18,240 m (60,000 feet)	20,200,000 m (66,273,000 feet)
Acceleration	4.0 g	No limits
Velocity	515 m/s (1000 knots)	20,000 m/s (38,874 knots)
Jerk	20 m/s^3	No limit

- White noise signal level: -50 to -160 dBm; 0.1 dB resolution down to -150 dBm; 0.3 dB down to -160 dBm. ±1.0 dB accuracy

External Frequency Reference Input

- Connector: BNC female
- Frequency: 10 MHz nominal
- Input signal level: 0.1 to 5Vrms
- Input impedance: >1kΩ

Frequency Reference Output

- Connector: BNC female
- Frequency: 10 MHz sine
- Output signal level: 1Vrms in to 50 Ω load

External Trigger Input

- Connector: BNC female
- Level: TTL level, 1.4V nominal

XPPS Output

- Connector: BNC female
- Rate: 1, 10, 100, 1000 PPS (configurable)
- Pulse ratio: 1/10 (1 high, 9 low)
- Output signal level: Approx. 0V to +2.0V in 50 Ω load
- Accuracy: Calibrated to ±10 nSec of RF timing mark output (option to reduce by a factor of ten with a characterization of offsets)

Built-in Timebase

Internal Timebase – High Stability OCXO

- Aging per 24 h: <5x10^{-10}
- Aging per year: <5x10^{-8}
- Temp. variation 0...50°C: <5x10^{-9}
- Short term stability (Adev @1s): <5x10^{-12}

Auxiliary Functions

Interface

- GPIB (IEEE-488.2), USB 1.X or 2.X (SBTMC-488), Ethernet (100/10 Mbps)

Settings

- Predefined scenarios: User can change date, time, position, trajectory, number of satellites, satellite power level and atmospheric model
- User defined scenarios: Unlimited
- Trajectory data: NMEA format (GGA or RMC messages, or both), convert from other formats with GSG StudioView™ (see separate datasheet)

General Specifications

Certifications

- Safety: Designed and tested for Measurement Category I, Pollution Degree 2, in accordance with EN/IEC 61010-1:2001 and CAN/ CSA-C22.2 No. 61010-1-04 (incl. approval)
- EMC: EN 61326-1:2006, increased test levels per EN 61000-6-3:2001 and EN 61000-6-2:2005

Dimensions

- WxHxD: 210 x 90 x 395 mm (8.25" x 3.6" x 15.6")
- Weight: approx. 2.7 kg (approx. 5.8 lb)

Optional Antenna

- Frequency: 1000 to 2600 MHz
- Impedance: 50 Ω
- VSWR: <2:1 (typ)
- Connector: SMA male
- Dimensions: 15 mm diameter x 36 mm length

Environmental

- Class: MIL-PRF-28800F, Class 3
- Temperature: 0°C to +50°C (operating); -40°C to +70°C non-condensing @ <12,000 m (storage)

Humidity:

- 5-95 % @ 10 to 30°C
- 5-75 % @ 30 to 40°C
- 5-45 % @ 40 to 50°C

Power

- Line Voltage: 100-240 VAC, 50/60/400 Hz
- Power Consumption: 40 W max.

Optional Features

Record and Playback (OPT-RP)

This option provides the easiest way to create a complex scenario by recording satellite signals on a route. It includes a recording receiver and software to automatically generate a simulation scenario that can be modified to ask 'what if' questions.

- True life constellation replication
- Automatic scenario generation
- Ability to modify signal parameters
- Compatible with any recording that includes NMEA 0183 RMC, GGA, and GSV sentences

Real-time Scenario Generator (OPT-RSG)

This option supports generation of 6DOF trajectory information via position, velocity, acceleration, or heading commands as the input for GPS RF generation. Vehicle attitude and attitude rate changes, as well as satellite power levels, are also controllable via real-time commands.

- Control trajectories using 6DOF
- Low fixed latency from command input to RF output
- Hardware-in-the-loop applications
- Includes sensor simulation option

RTK/DGNSS Virtual Reference Station (OPT-RTK)

This option supports generation of RTCM correction data messages for testing an RTK/Differential-GNSS receiver.

- Generates RTCM 3.x correction data via 1002, 1004, 1006, 1010, 1012, and 1033 messages
- User settable base station location
- Support for GNSS RTK receivers using serial interfaces

High Velocity Option (OPT-HV)

This option extends the limits for simulated trajectories. As of August 2014, the extended limits are no longer USA export controlled. (See Limits chart under Input/Output specifications.)

Jamming Simulation (OPT-JAM)

This option extends the capability of the standard interference simulation feature. Set noise or sweep types of interference and create a location-based jammer to test your system's susceptibility.

- Adjustable bandwidth and amplitude interference
- Location-based jamming
- Swept-frequency jamming

eCall Scenarios (OPT-ECL)

This option provides scenarios for testing eCall in vehicle systems per Regulation (EU) 2017/79.

Sensor Simulation (OPT-SEN)

This option generates sensor data in response to a query according to the trajectory of the GPS RF simulation in real-time. See technical note for more details.

- Simultaneously test GPS plus other sensor inputs to your nav system
- Simulate data for accelerometers, gravimeters, gyroscopes and odometers

Ordering Information

Base Configurations

- GSG-51: Single channel GPS L1 generator (contact the factory for alternative constellations and upgrades to multi-channel and/or frequencies)
- GSG-5: 4-channel GPS L1 simulator. Software options increase output channels to 8 or 16, and adds GLONASS, BeiDou (B1), Galileo (E1), or QZSS constellations. Factory upgradable to GSG-62 to add more channel and/or frequencies)
- GSG-62: 32-channels and up to 2 simultaneous frequency bands. Software options adds GLONASS, BeiDou, Galileo, QZSS or IRNSS constellations; and adds signals on other frequencies (P-code, L2, L2C, Galileo E5a/b, BeiDou B2)
- GSG-63: 48-channels and up to 3 simultaneous frequency bands. Same software options as GSG-62
- GSG-64: 64-channels and up to 4 simultaneous frequency bands. Same software options as GSG-62

Included with instrument

- User manual and GSG StudioView software (one license per unit) on CD
- RF cable, 1.5 m
- SMA to Type N adapter
- USB cable
- Certificate of calibration
- 3-year warranty[1]

Optional Accessories

- Option 01/71: Passive GNSS antenna
- Option 22/90: Rack-mount kit
- Option 27H: Heavy-duty hard transport case
- OM-54: User manual (printed)
- Additional StudioView licenses are available

Optional Upgrades

Constellations

- OPT-GLO: GLONASS Constellation
- OPT-GAL: Galileo Constellation
- OPT-BDS: BeiDou Constellation
- OPT-QZ: QZSS Constellation
- OPT-IRN: IRNSS Constellation (requires at least GSG-62 and OPT-L5)

Frequencies (requires at least GSG-62; non-GPS signals are enabled when constellation option is installed)

- Option L2: Enables GPS L1P, GPS L2P, GLO L2 C/A
- Option L2C: Enables GPS L2C
- Option L5: Enables GPS L5, Galileo E5a/b, BeiDou B2, IRNSS L5
- Option L6: Enables Galileo E6b/c

Channels/Simultaneous Frequencies[2]

- Option 8: 4-channel to 8-channel upgrade
- Option 16: 8-channel to 16-channel upgrade
- Option 32/2: 16-channel to 32-channel, dual frequency upgrade
- Option 48/3: 32-channel to 48-channel, three frequency upgrade
- Option 64/4: 48-channel to 64-channel, four frequency upgrade

Application Packages (typical requirement for 16 channel min)

- OPT-RSG: Real-time scenario generator
- OPT-HV: High velocity upgrade to extended limits
- OPT-RP: Record and playback package
- OPT-JAM: Jamming package
- OPT-RTK: RTK virtual base station scenarios
- OPT-SEN: Sensor simulation data via protocol (included with OPT RSG)
- OPT-ECL: eCall scenarios

Optional Services

- Calibration/GSG: GSG Calibration Service
- Option 95/05: Extended warranty to 5 years
- GSG-ASP: GSG Annual Service Plan
- GSG-INST: User Training and Installation
- OPT-TIM: Timing Calibration Service

[1]Warranty period and available services may vary dependent on country.

[2]Option may require the unit to be returned to factory for upgrade.

Configuration Summary

Models	Channels	# of Sim. Freq.	Upgrade to next higher model	Upgrade type	Constellations and Signal Types	Frequency Bands
GSG-51	1	1	OPT-4	Software	**GPS L1 C/A included** **Others if constellation is ordered:** • GLONASS L1 C/A • QZSS L1 • Galileo E1 • BeiDou B1	1539-1627 MHz (L1)
GSG-5	4	1	OPT-8	Software		
	8		OPT-16	Software		
	16		OPT-32/2	Factory		
GSG-62	32	2	OPT-48/3	Factory	**Same as above** **Options if constellation and frequency are ordered:** • GPS L1P, L2P, GLONASS L2 C/A (OPT L2) • GPS L2C (OPT L2C) • GPS L5, IRNSS L5, Galileo E5a/b, BeiDou B2 (OPT L5)	**Same as above and 3 other ranges** • 1192-1280 MHz (L2) • 1148-1236 MHz (L5) • 1224-1312 MHz (E6/B3)
GSG-63	48	3	OPT 64/4	Factory		
GSG-64	64	4	–	–		

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Specifications subject to change or improvement without notice.

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