

## GSG-5/6 Series: 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:  $\leq 40$  dBc
- Harmonics:  $\leq 40$  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:  $\pm 1.0$  dB
- Pseudorange accuracy: 1mm
- 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 <sup>3</sup>	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.  $\pm 1.0$  dB accuracy

## External Frequency Reference Input

- Connector: BNC female
- Frequency: 10 MHz nominal
- Input signal level: 0.1 to 5Vrms
- Input impedance:  $> 1k\Omega$

## 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  $\pm 10$  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:  $< 5 \times 10^{-10}$
- Aging per year:  $< 5 \times 10^{-8}$
- Temp. variation 0...50°C:  $< 5 \times 10^{-9}$
- Short term stability (Adev @1s):  $< 5 \times 10^{-12}$

## 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
- EMC: EN 61326-1:2013, 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

### UN R144 Test suite (OPT-UNR)

This option provides scenarios and test suite for testing UN R144 in vehicle systems.

## 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

### 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
- Option L1C
- Option L2C
- Option L5
- Option L6

#### Channels/Simultaneous Frequencies <sup>2</sup>

- 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-UNR: UN R144 test suite
- OPT-ECL: eCall test suite

### 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

<sup>1</sup>Warranty period and available services may vary dependent on country.

<sup>2</sup>Option may require the unit to be returned to factory for upgrade.

## Configuration Summary

Constellation Option	Frequency Option						
	None	OPT-L1C	OPT-L2	OPT-L2C	OPT-L5	OPT-L6	
None	GPS L1C/A, SBAS L1	GPS L1C	GPS L1P, GPS L2P	GPS L2C	GPS-L5, SBAS L5		
OPT-GLO	GLO G1 C/A		GLO G2 C/A				
OPT-GAL	GAL E1				GAL E5a, E5b	GAL E6BC -Noise	
OPT-BDS	Beidou-2 B1I				Beidou-2 B2I	Beidou-2 B3I	
OPT-BDS3	Beidou-3 B1C				Beidou-3 B2a		
OPT-IRN					Navic L5		
OPT-QZ	QZSS L1C/A, QZSS L1S			QZSS L2C	QZSS L5		