



# GSG-7

## Advanced GNSS Simulator

Safran's GSG-7 is a positioning, navigation, and timing test solution offered through Safran's family of Skydel-based simulators.

The GPU-based GSG-7 simulator delivers the highest standard of GNSS signal testing in an easy-to-use, turnkey form factor supporting the growing need for location-aware applications and systems that require navigation or timing. With a single high-quality RF output, the GSG-7 GNSS simulator covers the entire GNSS bandwidth and features high end performance with a 1000 Hz simulation iteration rate, high dynamics, real-time synchronization, and simulation of all-in-view satellite signals.

The GSG-7 is ideal for development and integration projects that require high performance and an increased number of constellation licenses and satellites in view for a single antenna or trajectory.

### Key Features:

- **700+ signals**
- **Small size – 2U Rack-Mountable or Bench Top**
- **All MF/MC Signals via Composite Port**
- **1000 Hz simulation iteration rate**
- **Available in three configurations with up to 3 SDRs**
- **Sub-nanosecond-level synchronization between RF bands**
- **On-the-fly reconfiguration of constellations and signals**
- **High-end RF quality**
- **Integrated, comprehensive automation**

**Safran Electronics & Defense is with you every step of the way, building in the intelligence that gives you a critical advantage in observation, decision-making and guidance.**

# PERFECT FOR ESSENTIAL TESTING



The GSG-7 can be used in production/receiver testing, and go/no-go testing. Integrators that need to perform essential testing of hardware components would also benefit from this platform and its ability to generate the same RF signals that are broadcast by navigation satellites to test any device or system with a GPS receiver.

The GPU-based GSG-7 simulator is an easy to use, scenario-based instrument that combines a powerful, feature-rich platform with industry-leading value and affordability for any requirement for basic GPS/GNSS testing.

The GSG-7 is an ideal instrument for essential testing since it is able to quickly and easily create simulated satellite signals and generate real RF signals by first producing I/Q data and calculating the orbits of satellites at a user-defined time, location and trajectory,

## Skydel Key Features

- All-in-view satellites simulation
- 1000Hz simulation iteration rate
- Low-latency HIL
- Live sky time synchronization
- RTK
- On-the-fly scenario reconfiguration
- Flexible licensing
- In-field software upgradability
- High-end performance (precision, resolution, ultra-high dynamic motion)
- Simulate hundreds of satellites in real-time using off-the-shelf graphics cards (GPU)
- Comprehensive and intuitive API (Python, C# and C++ open-source client)
- IQ file generation

- Scalable and highly flexible architecture using software-defined radios

## Signal Propagation and Errors Simulation

- Multipath and propagation models
- Additive pseudorange ramps
- Satellite clock error modification
- Navigation message errors
- Multiple ionospheric/tropospheric models
- Antenna pattern models
- Relativistic effects
- Pseudorange/ephemeris errors
- Basic interference



## TECHNICAL SPECIFICATIONS

Constellations & Signals	GSG-7 Interfaces
<ul style="list-style-type: none"> <li>• GPS: L1 C/A, L1C, L1 P(Y), L2 P(Y), L2C, L5</li> <li>• Galileo: E1, E5a, E5b, E5 AltBOC, E6 HAS, PRS (Restricted Signals)</li> <li>• GLONASS: G1, G2</li> <li>• BeiDou: <ul style="list-style-type: none"> <li>• BeiDou-2 (BDS-2): B1, B2</li> <li>• BeiDou-3 (BDS-3): B1C, B2a, B3I</li> </ul> </li> <li>• QZSS: L1 C/A, L1 C/B, L1S, L2C, L5, L5S</li> <li>• NavIC (IRNSS): L1, L5</li> <li>• SBAS (Satellite-Based Augmentation Systems): L1, L5</li> <li>• Xona: PULSAR XL</li> <li>• Custom Signals: User-defined signals</li> </ul>	<ul style="list-style-type: none"> <li>• RF output: N-Type</li> <li>• 10 MHz output: BNC</li> <li>• 1 PPS output: BNC</li> <li>• 10 MHz input: BNC</li> <li>• 1 PPS input: BNC</li> <li>• Antenna input: SMA</li> <li>• HDMI, USB, Ethernet ports</li> </ul> <p>Timing module:</p> <ul style="list-style-type: none"> <li>• 10 MHz clock input</li> <li>• 10 MHz clock output</li> <li>• 1 PPS input</li> <li>• 1 PPS output</li> <li>• GNSS antenna input</li> </ul>

RF/GNSS Signal	Specifications
Power	<ul style="list-style-type: none"> <li>• GNSS maximum carrier level : -30 dBm *</li> <li>• GNSS minimum carrier level : -135dBm **</li> <li>• GNSS carrier level resolution : 0.1dB</li> <li>• Linearity &lt; 0.5dB (from -100dBm to -20dBm)</li> <li>• Absolute Accuracy : <math>\pm 0.5</math> dB</li> <li>• Run to run repeatability: <math>\pm 0.1</math>dB</li> </ul>
GNSS Bands	Simultaneous bands: 1 (GSG-711) 2(GSG-721) 3 (GSG-731) simultaneous 100MHz bands
Compatible Bands	L5,L2, E6, L1, S-band
Signal Purity	<ul style="list-style-type: none"> <li>• Spurious transmission &lt; -65 dBc</li> <li>• Harmonics &lt; -45 dBc</li> <li>• Phase noise: &lt; 0.003 rad RMS***</li> </ul>
Signal Pseudorange Accuracy in RMS	$\pm 1$ mm RMS
Pseudorange Bias	0mm RMS

Time Alignment	<ul style="list-style-type: none"> <li>1PPS output to RF output alignment bias <math>&lt;\pm 1.2</math> ns</li> <li>Typical 1PPS output to RF output alignment deviation <math>&lt; 30</math> ps</li> <li>Inter Frequency signal Alignment (as inter-SDR alignment) <math>&lt; 1</math> ns</li> <li>Inter-signal alignment bias in the same band : 0s</li> </ul>
Sampling Rate	Configurable, up to 125 Msps

\* The indicated power refers to the power measured at the output of the unit (via the output RF connector). You can increase or decrease this power level using attenuators (included in the ancillary kit) or an LNA (not included). Please note that active electronics, such as amplifiers, may affect signal purity, power linearity, and accuracy.

\*\* As a result of the simulated GNSS signal from Skydel, which ranges from -175 to -100 dBm in IQ data, and RF output power amplification of +40 to +70 dB.

\*\*\* Nominal Value, which can vary based on several factors such as temperature fluctuations and power supply stability.

Scenarios	Type of Data
Number of Signals	700 signals
Iteration Rate	1000 Hz
Dynamics	<ul style="list-style-type: none"> <li>Relative velocity : 1 500 000 m/s</li> <li>Relative acceleration : no limits</li> <li>Relative jerk: no limits</li> <li>Angular rate (in rad/s) : <ul style="list-style-type: none"> <li>15pi (at lever arm of 1.5m)</li> <li>60pi (at lever arm of 0.05m)</li> </ul> </li> </ul>
HIL Latency	<ul style="list-style-type: none"> <li>10 ms</li> <li>Zero effective latency</li> </ul>
Scenario Duration	No limits

### Available Plugins for the GSG-7

- SKY-PLG-IMU – Inertial sensors emulation.
- SKY-PLG-RTK – RTCM message generation via virtual basestation.
- SKY-PLG-SDK – Plugin SDK allows the creation and integration of custom plugins for Skydel.

### Optional Features for the GSG-7

- SKY-HIL – Hardware-in-the-loop mode allows input of vehicle trajectory information in real-time.
- SKY-IQFILE – IQ File, allows saving of generated IQ data to file
- SKY-CSI – Custom signal injections, allows real-time simulation of user-defined GNSS signals (custom modulation and navigation message).

Ext Warranty – Extends Hardware warranty over 3-years

SKY-SSUP – Extends Software support

[safran-navigation-timing.com](http://safran-navigation-timing.com)

