BROCHURE

GSS7000 GNSS Simulator

Flexible, high performance PNT testing

spirent™

BROCHURE

Ultimate Flexibility. Unrivalled Control.

Your Trusted PNT Partner

Delivering reliable results faster with Spirent's GSS7000 simulation solution

Getting successful products to market demands precise, reliable, and flexible test capabilities. The GSS7000 offers exceptional accuracy, fidelity, and authentic GNSS signal emulation, ensuring true performance at every test stage.

Precision multi-frequency, multi-GNSS simulation: purpose-built hardware including PNT-specific software-defined radios delivers high precision simulation across all current and planned GNSS and SBAS signals

Flexible and powerful architecture: built on Spirent's proven architecture for realistic testing and easy upgrade and calibration in the field

Advanced features: embedded multipath, interference and spoofing capabilities deliver comprehensive vulnerabilities testing

spirent™

From smartphones to autonomous vehicles, modern applications are demanding greater accuracy and robustness in positioning, navigation, and timing than ever before. The GSS7000 is the ultimate tool for developers of GNSS-enabled consumer products, delivering the flexibility required for comprehensive testing and the true performance needed for reliable results.

Proven Architecture

Employing state-of-the-art SDR technology, refined over five decades of leading the industry, the GSS7000 has been designed and built for PNT testing. This dedicated architecture enables the GSS7000 to maintain the precision specifications for accuracy, synchronization and latency needed to truthfully represent the constellation and operating environment under the full range of specified dynamics.

Uncompromising Signal Generation

Spirent have patented Direct Digital Synthesis (DDS) techniques for generating signals that are 100% representative of the 'truth data'. With the GSS7000, you can be sure that the results you see represent the true performance of the device under test.

Ultimate Flexibility

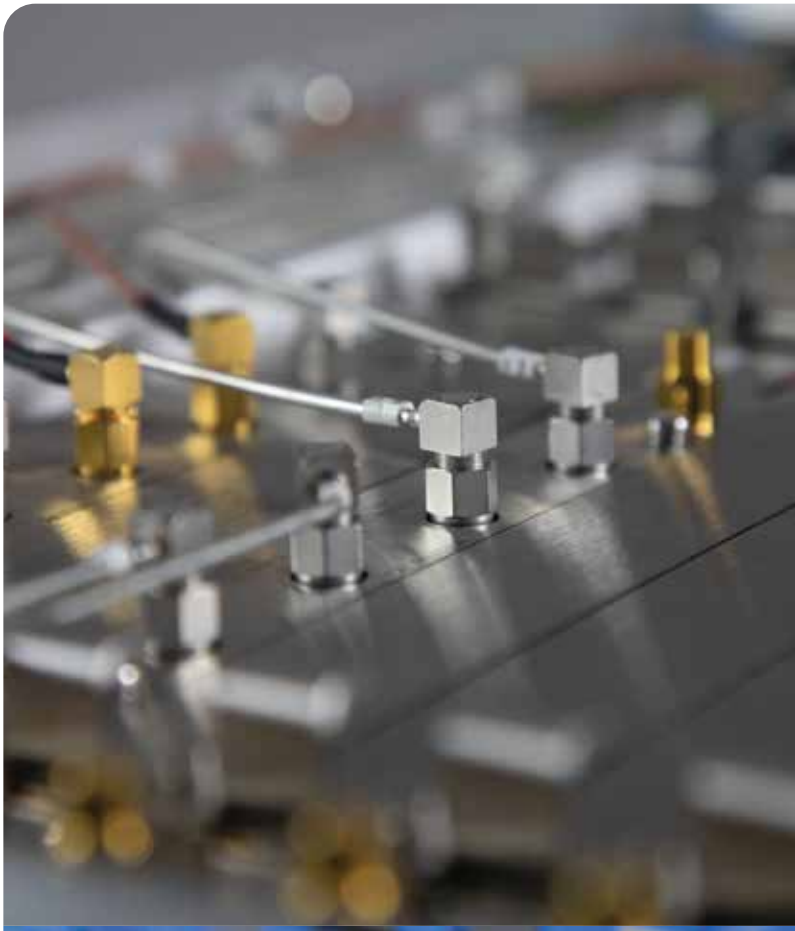
A highly digital architecture enables real-time configuration of signals generated and in-field upgrades of both hardware and software. In addition, the GSS7000 is designed to integrate seamlessly with a broad range of Spirent and third party tools, giving you the flexibility to grow and vary your test capabilities.

Unrivalled Control

Spirent's industry-leading Positioning Application software family enables adjustment of virtually every parameter imaginable — from signal control to bit-level manipulation of the navigation message, to adjustment of models such as orbital parameters and atmospheric errors.

Verified Performance

Spirent signal ICD implementations and performance specifications are verified by leading external entities.



Features and Capabilities

Embedded Interference

Embedded interference generation capability enables realistic and precise reproduction of in-band interference signals in test lab. It allows users to set transmitter locations, trajectories, and antenna patterns, also enables the customer defined interference signal parameters such as centre frequency, signal modulation and power level:

- Simulation of multiple interference transmitters
- Maximum power level -47 dBm
- User defined interference transmitter trajectory and antenna patterns

Embedded Spoofing

Spoofing is a growing concern for any safety- or mission-critical application. Without any additional hardware required, the GSS7000 is capable of simulating real-world spoofing test cases such as meaconing attacks, trajectory spoofing, base station spoofing, and satellite navigation data spoofing.

The user can define, amongst other parameters, the number of spoofer transmitters and their location (absolute or vehicle relative), the spoofer power levels, the false vehicle position (spoofed position) and the spoofing signal content, including navigation data and errors

The resulting spoofer RF signal will be automatically calculated based on user scenario settings, with the correct spoofer signal arrival angle and spoofer signal content.

Realistic 3D test environments: Assess the impact of multipath and obscuration effects on GNSS signals based on a virtual 3D local environment.

Hardware-in-the-loop testing: The GSS7000's open and rich interface enables seamless integration into hardware-in-the-loop (HIL) test configurations.

Interference testing: The GSS7000 offers a broad range of high-power interfering signal options and can be configured to support multiple fully independent interference sources. It also supports noise generation with variable bandwidth.

Route-matched trajectories: The GSS7000 interfaces with the most popular free mapping tools, enabling real-world routes to be scheduled and tested.

GNSS/inertial testing: The GSS7000 enables users to test the operational performance of integrated GNSS/inertial systems and IMUs by emulating sensor outputs to match the simulated vehicle trajectory.

Live sky synchronization: The GSS7000 has the capability to synchronize with live sky GNSS signals, enabling highly realistic spoofing testing.

Single Channel Utility (SCU): The GSS7000's SCU enables generation of a single signal for each licensed constellation and frequency. SCU is validated to support test tools such as Qualcomm's QDART.

Remote control: In addition to its native Ethernet remote control facility, the GSS7000 can take advantage of comprehensive APIs for Labview, C++ and other common programming languages and test environments.

Multi-antenna, multi-vehicle simulation: 6-DOF trajectories from one or two independent RF outputs.

Correction support: streaming of RTCM data over RS232 or via in-built NTRIP server interface.

> We needed a new approach to R&D testing that combined best-in-class components. By working with Spirent's experts, we have created a system that will help to bring connected cars to market faster.
>
> Antonio Casu
> *Chief Technical Officer, Italdesign*

Simulation Control

Multipath and obscuration: including embedded models, or seamless integration with Spirent's advanced 3D environment modelling tool — Sim3D

Ionospheric and tropospheric effects: multiple configurable models available

Satellite orbital editing: enabling complete control over orbital parameters and induced errors

Satellite clock error and navigation data errors: adding declared and undeclared errors to create a comprehensive test methodology – including recreation of real-world events

Satellite transmit antenna pattern control: unique capability to model gain and phase patterns for different transmission frequencies

Receiver antenna modelling: reception gain and phase pattern control for flexible conducted testing

Remote control: remote control and integration with automation tools via native SimREMOTE API

Signal Generation

Generating signals from first principles is the only way a simulator can generate truthful signals with the control developers and integrators need. The GSS7000 generates signals via bit-by-bit generation of the navigation message by full implementation of the relevant SIS-ICD. All the orbital data and ephemerides are calculated to create the perfect truth data that downloaded observed datasets with potential decoding and SIS errors cannot provide.

Available Signals

GPS	L1 C/A, L2 C/A, L5 I/Q
GLONASS	L1OF, L2OF, L1OC, L2OC, L3OC
Galileo	E1 OS, E5 A/B, E6
BeiDou-2	B1I, B2I
BeiDou-3	B1C, B2a, B2b, B3I
QZSS	L1, L2, L5, L6
IRNSS	L5

Signal Characteristics

A test instrument must be many times more accurate than the device it is testing. Without this, the performance of the instrument can have a significant and unwanted effect on results. The GSS7000 uses advanced SDR technology to accurately represent signals without Introducing artificial phase noise and spurious signal effects to the test, enabling complete confidence and powerful analysis.

Rate

- Simulation iteration rate 100 Hz
- Signal Accuracy
- Pseudorange ±0.003 m
- Pseudorange range ±0.001 m/s
- Interchannel bias zero

All signal accuracy specifications are achieved under the highest dynamics and maximum simulation iteration rate.

Signal Dynamics

- Relative velocity ±30,000 m/s
- Relative acceleration ±2000 m/s2
- Relative jerk ±22,000 m/s^2

Signal Quality

- Spurious (Max) -182 dBW
- Harmonics (Max) -40 dBc
- Phase Noise (Max) 0.02 rad RMS
- Frequency stability ±5 x 10-10

Signal Control

- Level control range +15 dB to -40 dB
- Level control resolution 0.1 dB
- Level control accuracy ±0.5 dB

“Spirent has world-class products and services, which provide good support for our scientific research and talent training.”

Professor Mingquan Lu
Department of Electronic Engineering, Tsinghua University

Americas Europe Asia

About Spirent Positioning Technology

Spirent enables innovation and development in the GNSS (global navigation satellite system) and additional PNT (positioning, navigation and timing) technologies that are increasingly influencing our lives.

Our clients promise superior performance to their customers. By providing comprehensive and tailored test and assurance solutions, Spirent assures that our clients fulfil that promise.

Why Spirent?

Over five decades Spirent has brought unrivalled power, control and precision to positioning, navigation and timing technology. Spirent is trusted by the leading developers across all segments to consult and deliver on innovative solutions, using the highest quality dedicated hardware and the most flexible and intuitive software on the market.

Spirent delivers

- Ground-breaking features proven to perform
- Flexible and customisable SDR technology for future-proofed test capabilities
- World-leading innovation, redefining industry expectations
- First-to-market with new signals and ICDs
- Signals built from first principles — giving the reliable and precise truth data you need
- Unrivalled investment in customer-focused R&D
- A global customer support network with established experts

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