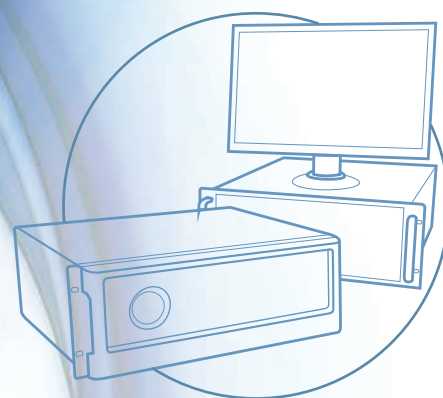


# GSS9000

## GNSS Constellation Simulator



**ULTIMATE**flexibility**SUPREME**performance**COMPREHENSIVE**capability

# GSS9000

## GNSS Constellation Simulator

The Spirent GSS9000 Multi-Frequency, Multi-GNSS RF Constellation Simulator sets a new standard of excellence in GNSS RF Simulation for R&D and performance test.

The GSS9000 produces a comprehensive range of emulated multi-GNSS, multi-frequency RF signals with ultimate class-leading flexibility, coherence, fidelity, performance, accuracy and reliability.

The GSS9000 provides numerous benefits to all those working in high-end GNSS technology and application development, including comprehensive and feature-rich simulation and full control of all aspects of the GNSS operating environment, inherent repeatability and the ability to apply systematic errors and incidents that are impossible to realise using actual satellite signals.

A GSS9000 system comprises a Spirent C50r Host running Spirent's powerful simulation software SimGEN™ and a highly-configurable signal generator able to meet all test needs. Multiple chassis can be combined to form an integrated, coherent signal generator if more signals or outputs are required. An extensive range of system extensions allows users to tailor the system to their specific needs, today and in the future.

### Ultimate Flexibility, Capability and Performance

The GSS9000 supports an extensive range of constellation configurations, from GPS L1 through to multi-GNSS, multi-frequency systems including classified/restricted signals. Configurations are available that support multi-antennas and multi-vehicles, for example differential-GNSS, attitude determination, interference/jamming and spoofing and Controlled Reception Pattern Antenna (CRPA) testing.

The GSS9000 generates all carriers, ranging codes and data streams for the GPS, GLONASS, Galileo and BeiDou GNSS systems, plus SBAS, QZSS, IRNSS and CAPS regional/augmentation systems. Additionally, data/messages for RTCM differential, GBAS/LAAS and A-GNSS are supported.

### Some of the GSS9000's Key Attributes are:

- Class-leading 1000Hz Simulation Iteration Rate (SIR) and Hardware update Rate (HUR) enabling real-time remote control and trajectory delivery with extremely low latency and simulation of ultra-high dynamic motion
- 160 channels plus 640 embedded multipath channels across 10 independent frequencies in one chassis
- Single RF version and dual RF version for differential-GNSS and multi-vehicle simulation
- 0.3mm RMS Pseudorange Accuracy, 120,000 m/s Relative Velocity
- Highly flexible configurations selectable via a 'cabinet' of licence keys
- Complete portability of Spirent SimGEN™ scenarios
- In-field upgradeability of principal GNSS functionality and capability
- On-the-fly re-configuration of constellation and signal configurations
- Fully future-proofed for all advances in GNSS technology

### Comprehensive Modelling

- Extensive multipath modelling
- Antenna gain and phase pattern
- Lever arm effects modelled
- Ionosphere and Troposphere modelling
- DGPS corrections
- Pseudorange ramps for RAIM testing
- ISCN support

### Unmatched Pedigree and Support

- Regional support centre network
- E-mail, online and telephone support
- Regular software upgrades
- Knowledge base and on-line tracking system
- Every system includes deep and comprehensive features from nearly 30 years of GNSS testing experience
- Application notes and test methodologies



## Complete Control

- Complete constellation and vehicle control
- Extensive motion and propagation models
- Highly flexible, with full defaults and error models
- Trajectory from internal vehicle models, from file or real-time external source
- Start / stop on external event trigger

## Extensions and Options

- IMU and EGI testing: SimINERTIAL™
- Barometric aiding: SimBARO™
- Classified testing with: AES M-code\* and Non-AES M-Code via server\* to ICD-GPS-700x: SimMCODE™, Y code\*: SimSAAS™ (US), SimCLASS™ and Galileo PRS\*: SimPRST™
- Jammer and interference emulation: GSS7765
- Spoofing Vulnerability Testing: SimSAFE™
- Automotive In Vehicle Navigation System (IVNS) testing: SimAUTO™

*\*Available to authorised users only*

## SimREMOTE™ Real-Time Control and Motion API

- Comprehensive API for real-time 1000Hz remote control and trajectory delivery
- Real time, high-rate data streaming aids analysis
- Real-time, zero-effective latency hardware in the loop (HWIL) testing
- Extensive commands for precision manipulation of signal parameters such as carrier and code phase & amplitude

## GSS9000

GNSS Constellation Simulator



## The Spirent Advantage

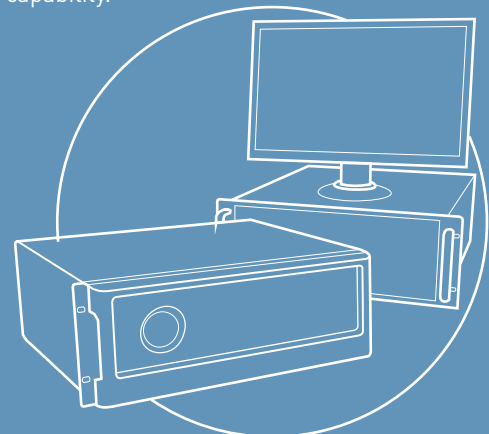
With experience amassed over nearly 30 years of supporting GNSS development, Spirent is your best choice for comprehensive performance and support.

### Spirent Offers:

- Comprehensive features as standard, built up over nearly 30 years of development
- High fidelity simulation across the full dynamic range
- Top quality systems, backed by regional support network
- An assurance of continued investment in new GNSS technologies and systems
- Most variants available as standard “COTS” commercial systems
- Tailored solutions available to support special applications and configurations

Current and future needs can be met with the highly extensible GSS9000. Invest with confidence in a changing world, knowing that your GSS9000 system can grow as your GNSS test needs evolve.

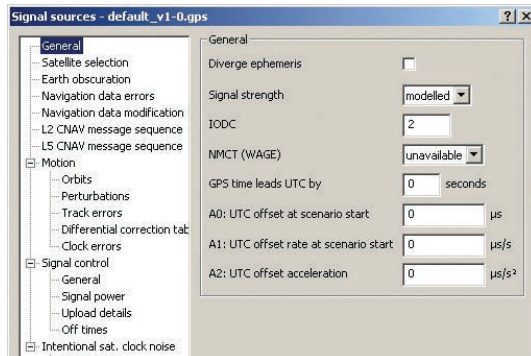
Standard features enabled by SimGEN™ include simulation of multipath reflections, terrain obscuration, antenna reception gain patterns, differential corrections, trajectory generators for land, air, sea and space vehicles and comprehensive error generation and system modelling. Also supplied as standard is a low-latency, high-rate hardware-in-the-loop capability.



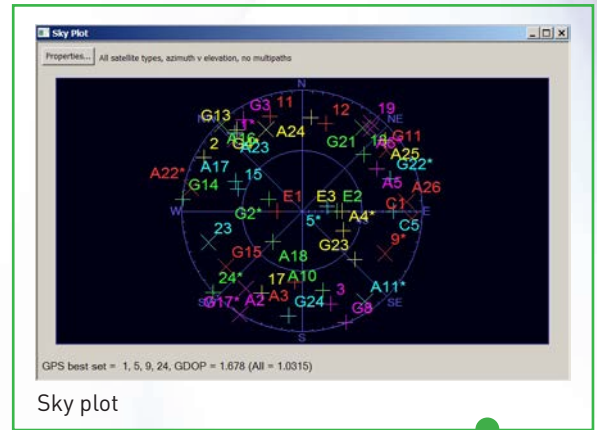


# GSS9000

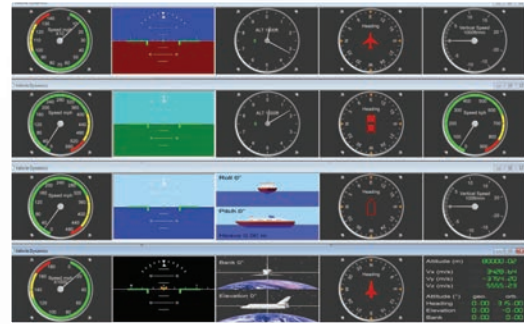
## GNSS Constellation Simulator



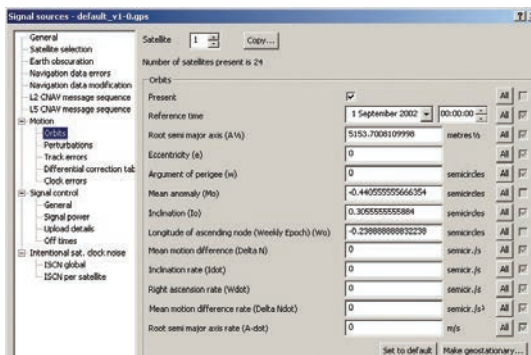
Comprehensive constellation editor



Sky plot



Flexible vehicle models



Import or define orbits



Real-time remote 6-DOF trajectory and simulation control



## Comprehensive Modelling

Standard capabilities enabled through SimGEN™ include simulation of atmospheric effects, multipath reflections, terrain obscuration, antenna reception gain and phase patterns, differential corrections, trajectory generation for land, air, sea and space vehicles and comprehensive error generation.

An easy to use Graphical User Interface (GUI) allows modification of a wide range of variables from pre-set defaults, enabling the user to focus their time on the areas of test important to them.

Complete scenarios are readily shared between systems, supporting collaborative activities and speeding the R&D cycle.

## Complete Control

SimGEN™ works in real-time, compiling the required data stream that drives the RF signal generator and on-screen displays.

During scenario run, the user has extensive, interactive access allowing changes to predefined conditions. These 'User Actions' are recorded to a script file to aid post-run analysis or to allow the same actions to be replayed in subsequent runs of this or other simulations.

Data generated during scenario run-time may be displayed or saved to a file for subsequent analysis.

Also incorporated as standard is a low-latency, high-rate remote control capability permitting the use of external sources for trajectory, enabling testing within control loops.



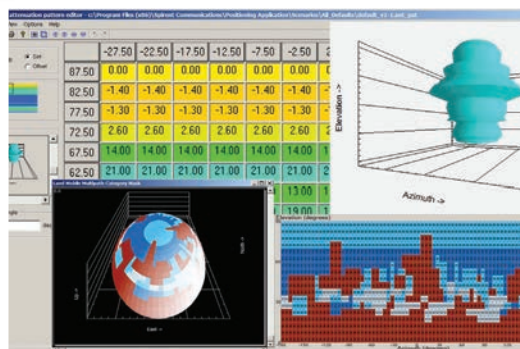
**Antenna Signal Types**

Simulated signal types:

GPS L1	<input checked="" type="checkbox"/>	L2	<input checked="" type="checkbox"/>	L5	<input checked="" type="checkbox"/>
GALILEO E1	<input checked="" type="checkbox"/>	E5	<input checked="" type="checkbox"/>	E6	<input checked="" type="checkbox"/>
GLONASS L1	<input checked="" type="checkbox"/>	L2	<input checked="" type="checkbox"/>		
WAAS L1	<input checked="" type="checkbox"/>	L5	<input checked="" type="checkbox"/>		
EGNOS L1	<input checked="" type="checkbox"/>	L5	<input checked="" type="checkbox"/>		
MSAS L1	<input checked="" type="checkbox"/>	L5	<input checked="" type="checkbox"/>		
Quasi-Zenith L1	<input checked="" type="checkbox"/>	L2	<input checked="" type="checkbox"/>	L5	<input checked="" type="checkbox"/>
IRNSS S	<input checked="" type="checkbox"/>	L5	<input checked="" type="checkbox"/>		
BeiDou B1	<input checked="" type="checkbox"/>	B2	<input checked="" type="checkbox"/>	B3	<input checked="" type="checkbox"/>
Interference	<input checked="" type="checkbox"/>				
LAAS	<input checked="" type="checkbox"/>				
GTx GPS L1	<input checked="" type="checkbox"/>	L2	<input checked="" type="checkbox"/>		
GTx GLONASS L1	<input checked="" type="checkbox"/>	L2	<input checked="" type="checkbox"/>		
CAPS C1	<input checked="" type="checkbox"/>	C2	<input checked="" type="checkbox"/>	C3	<input checked="" type="checkbox"/>

OK Help No RF Cancel

Simple signal selection



Antenna pattern and multipath mask e



## Multiple Signals Combined

Whether testing with multiple signals from a single constellation or testing hybrid systems with signals from multiple constellations, the GSS9000's modular design and flexibility means it is easily user-reconfigurable to meet all your needs.

GSS9000 systems are configurable to meet your requirements from combinations of the following signals:

### Key Signal Capabilities:

Constellation	Carrier	Standard Signal Types	Optional Signal Types
GPS	L1	C/A, L1c Data/Pilot, P, M Noise, Pseudo Y	Y*, AES-M* and Non-AES-M-Code via data server*
	L2	L2c, P, Pseudo Y, M Noise	Y*, AES-M* and Non-AES-M-Code via data server*
	L5	I, Q	
Galileo	E1	PRS Noise, OS Data/Pilot	PRS*
	E6	PRS Noise, CS Data/Pilot (without encryption)	PRS*, CS Data/Pilot (with encryption)*
	E5ab	E5a Data/Pilot, E5b Data/Pilot	
GLONASS	L1	C/A, P (Chan No. -7 thru +6)	
	L2	C/A, P (Chan No. -7 thru +6)	
SBAS	L1	C/A	
	L5	I	
BeiDou	B1	B1I	
	B2	As B1I	
QZSS	L1	SAIF, C/A, L1c	
	L2	L2c	
	L5	I, Q	

Your GSS9000 can be subsequently field upgraded to meet your evolving test needs.

## Extensions and Options

Increasingly, GNSS receivers and sensors do not operate in isolation. If development and verification testing of integrated systems is required then it is essential that other sensors are emulated and other signals are reproduced coherent with the GNSS signals.

The GSS9000 has been designed to operate with all of Spirent's extensive range of options and system extensions. For example: Inertial sensors can be emulated by SimINERTIAL™. Wheel tick sensors and VSS signals are reproduced by SimAUTO™. Noise and channel interference can be reproduced by the GSS7765.

In all cases, coherent control is achieved via Spirent's SimGEN™ software suite.

**SimINERTIAL™**: Operational performance of an Integrated GPS/Inertial (IGI) system can be established in the laboratory using real-time emulation of the inertial sensor outputs along with a GSS9000 constellation simulator. All signals are coherently generated to exactly match the simulated vehicle trajectory. Typical inertial sensor performance can be represented by a sensor error model driven by the simulated motion, with appropriate coefficients entered by the user.

**SimMCODE™**: The GSS9000 series supports AES M-Code testing with SimMCODE™ and server-based Non-AES M-Code testing via an extension to SimMCODE™.

**SimCLASS™ / SimSAAS™**: Provides SA/A-S simulation for testing of SAASM equipment with Y code.

**SimAUTO™**: SimAUTO™ provides a turnkey solution to testing integrated vehicle navigation systems comprising GPS and Dead Reckoning (DR) sensors such as gyros or wheel ticks. SimAUTO™ allows parameters such as vehicle geometry and odometer pulse rate to be set and saved to a vehicle personality file for future use.

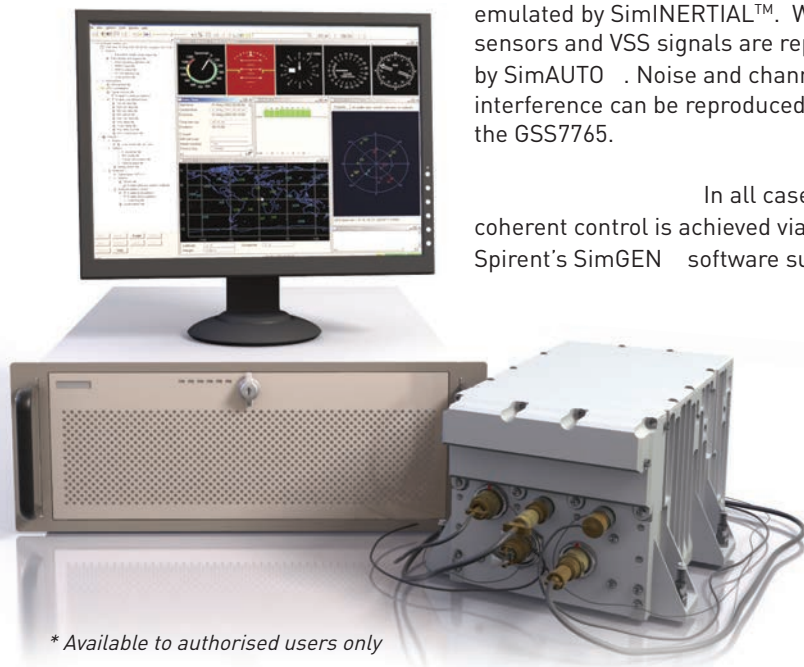
**GSS7765**: The GSS7765 offers a very broad range of interfering signal options, which may be used to represent a varied array of threat sources. The GSS7765 also supports noise generation with variable bandwidth and can be configured to support multiple fully independent interference sources.

**SimREMOTE™**: Extends the GSS9000's comprehensive native remote control facility to include GPIB and SCRAMNet in addition to Ethernet.

**SimSAFE™**: The vulnerability of GNSS to spoofing attacks is a key consideration across many GNSS applications. SimSAFE™ is used with the GSS9000 to evaluate the vulnerability of a receiver under test to deliberate "spoofing" or "meaconing" attacks and to assess the effectiveness of mitigation techniques and strategies. SimSAFE™ can be used in R&D applications and in certification or vendor selection applications.

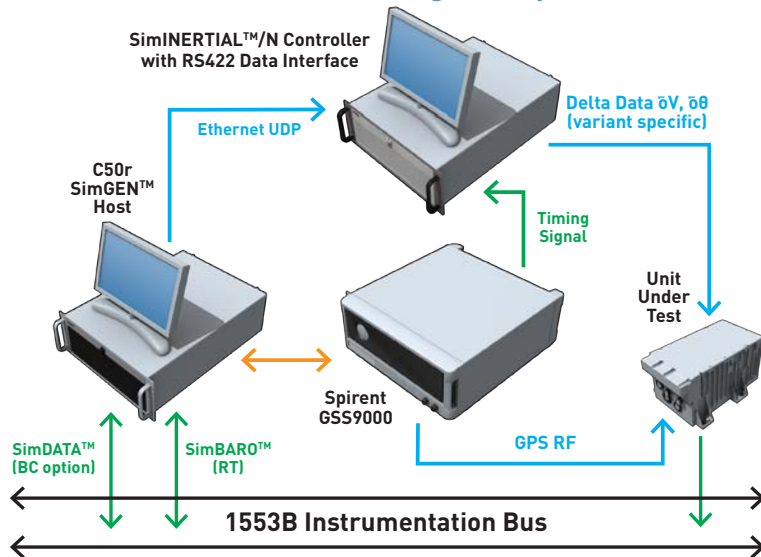
## Flexibility and Connectivity

The GSS9000 is designed for the real-world testing environment with a wide range of interfaces both analogue and digital. Low level RF outputs are supplemented by high level RF inputs and outputs for monitoring and signal injection purposes; a range of digital interfaces include IEEE-488, Ethernet, SCRAMNet+ and SCRAMNet GT; extensive timing, trigger and control access.

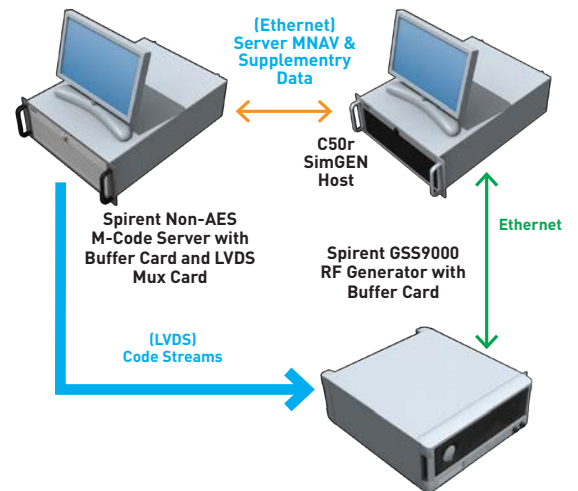


\* Available to authorised users only

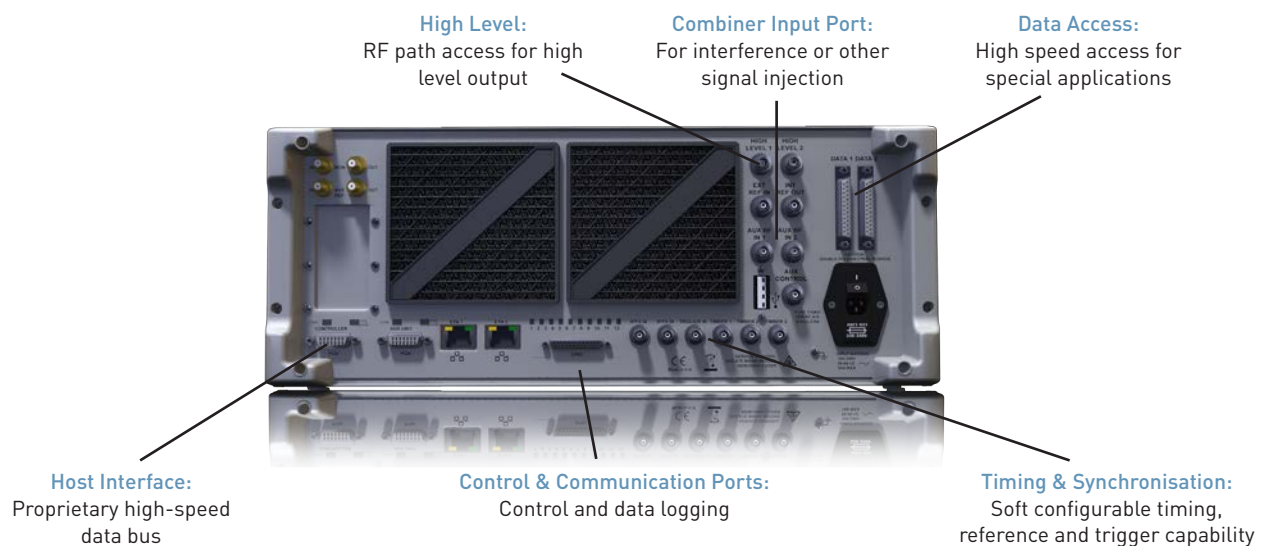
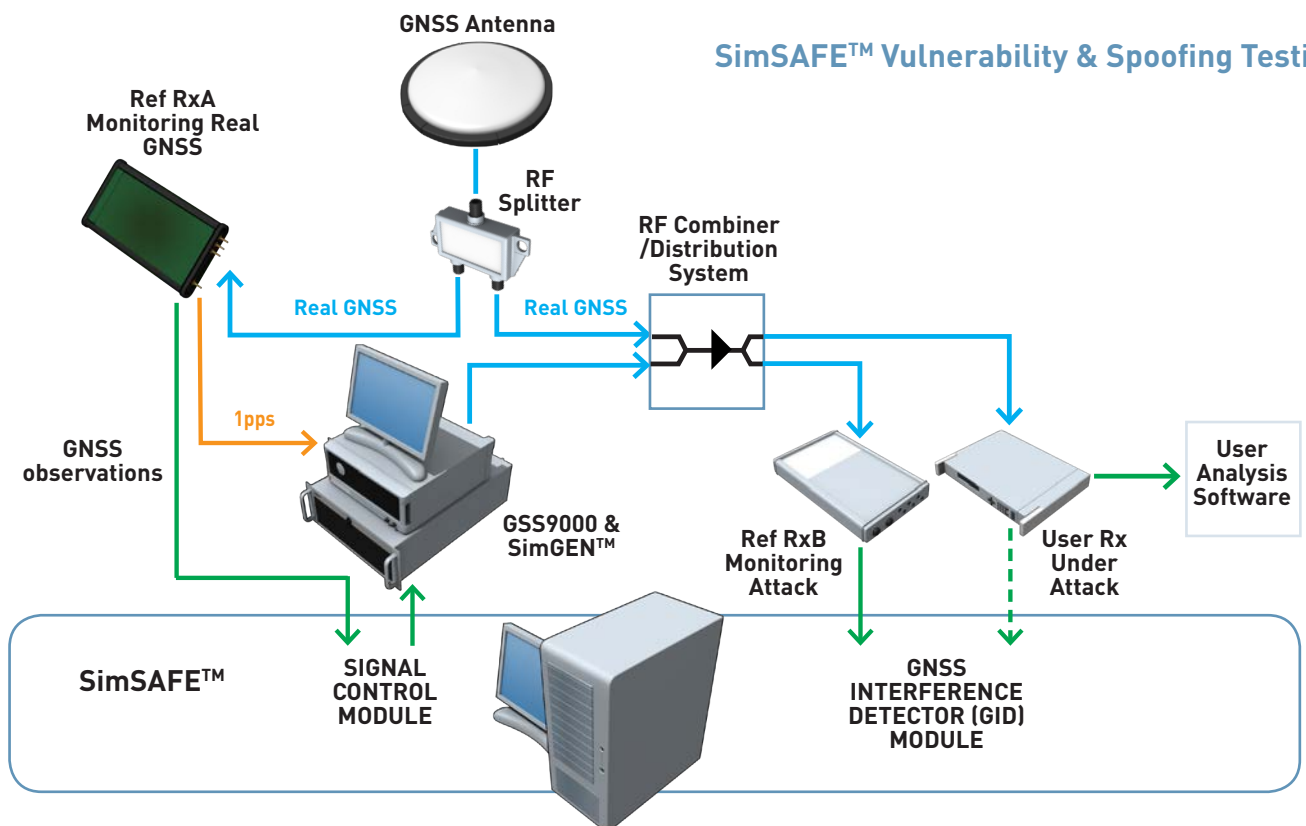
## GPS + Inertial Testing Example



## Non-AES M-Code Via Server Testing



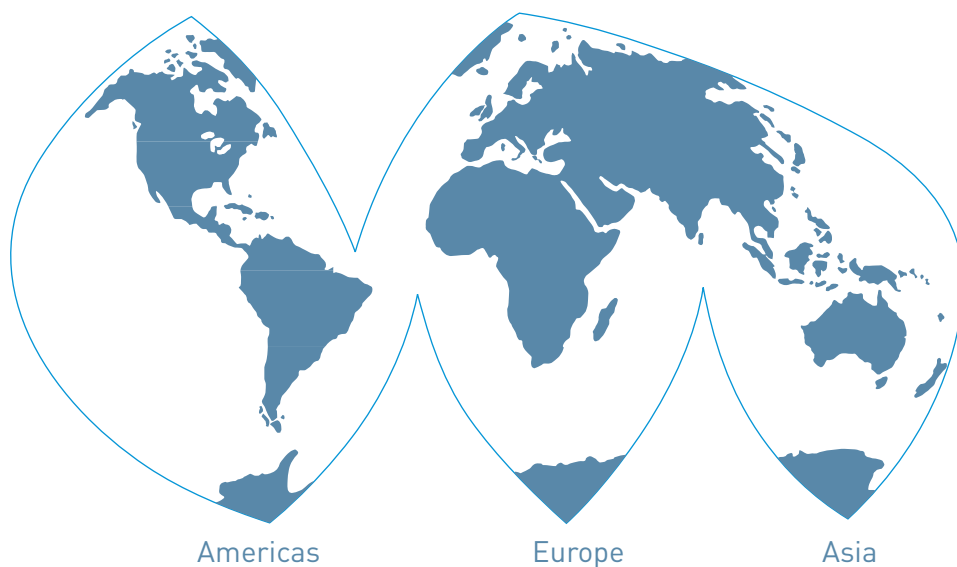
## SimSAFE™ Vulnerability & Spoofing Testing



## Documentation and Reference Table

Related Product, Option or System Extension	Data-sheet / Specification Ref.
GSS9000	MS9000
SimGEN™	MS3008
SimINERTIAL™	MS3030
SimBARO™	MS3056
SimAUTO™	MS3023
SimDATA™	MS3034
SimPRS™	MS9042
SimCLASS™	MS9020
SimMCODE™	MS9018
SimREMOTE™	MS3015
GSS7765	MS3055
SimSAFE™	MS3092

### Global coverage



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