Test Solutions for:
Interference, Anti-Jam, GPS/inertial, Interference Mitigation

GNSS Vulnerability to Interference

Disruption to, or denial of, navigation service from interference sources is a major concern to GNSS technology development teams in all areas. Whether interference is intentional or unintentional, all GNSS receiver and system designs should take careful account of potential interference threats.

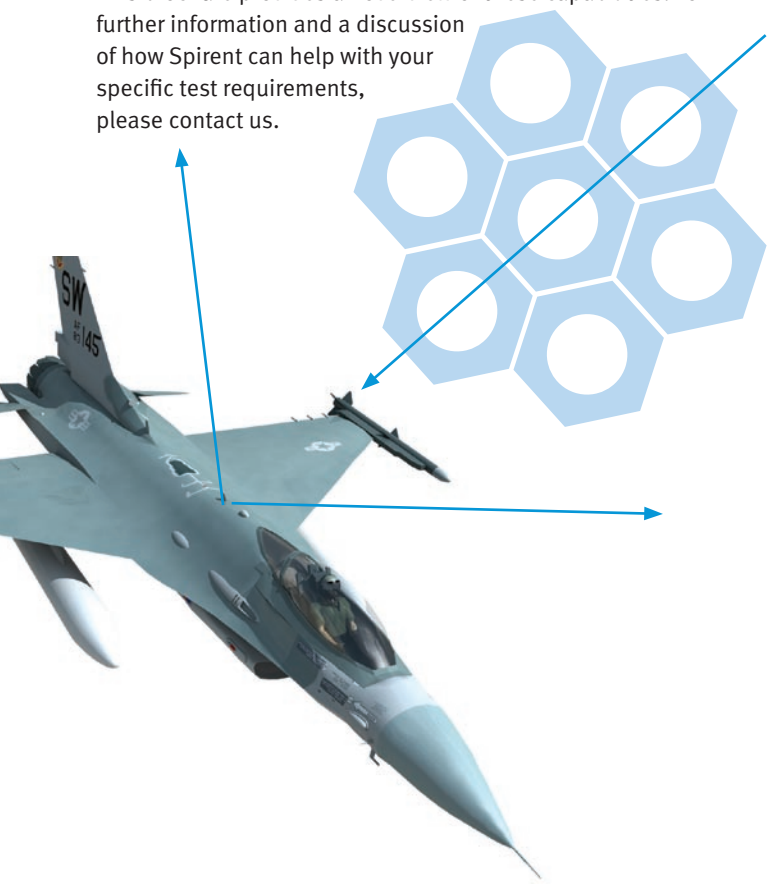
The types of potential interference will vary widely in scope and complexity depending on the application, environment and operational objectives.

Interference Mitigation

Interference mitigation techniques also vary widely, from simple approaches like directional or steerable antennas through to adaptive antenna arrays. Another commonly used technique is to combine GPS and inertial sensors. Examples here include embedded GPS/inertial (EGI) navigators and ultra-tightly coupled (UTC) GPS and inertial systems.

Spirent Test Systems

Spirent has developed a comprehensive range of test systems to enable controlled, repeatable testing under laboratory conditions. This brochure provides an overview of these capabilities. For further information and a discussion of how Spirent can help with your specific test requirements, please contact us.



Spirent Test Capability Summary

Spirent has extensive experience of test GNSS systems in the presence of interference and of related mitigation techniques.

- Industry leading GPS/GNSS simulators
  - GPS/GLONASS/Galileo
  - Augmentation systems
  - Fully-featured software and modelling capabilities
  - Detailed API for remote motion and control
  - Classified signals for authorised users
  - Leading accuracy and dynamic capabilities
- Interference signal generators, enabling multiple sources, modelled coherently with GPS simulation
- Extensions for GPS/inertial system testing
- Inertial Measurement Unit (IMU) emulation
- Software modelling enabling antenna gain and phase to be controlled to emulate directional antenna characteristics
- Multi-output GPS simulator to enable Controlled Reception Pattern Antenna (CRPA) testing

Interference Signal Generators

System GSS7765 Spirent Interference Simulation

Spirent's GSS7765 is used in combination with Spirent's GPS simulation systems to enable multiple interference sources to be generated.

Key features:

- Coherent control and set-up via Spirent's SimGEN™ software suite
- Each source capable of generating CW, swept CW, stepped CW, AM, FM, broadband and narrow band noise and pulse modulation
- Modelled mode changes interference source power and direction consistent with vehicle motion and user-defined vehicle antenna pattern
- Interactive mode enables power and modulation to be controlled in real-time
- Wide power and frequency range
- Multiple configurations supported, including multi-GNSS and multi-antenna

Application:

- Receiver testing in the presence of one or more interference source

System elements:

The GSS7765 comprises one or more interference signal generator and an interference combiner unit. These are combined at RF with the output of a Spirent GNSS signal generator. The GNSS signal generator can include classified signals such as Y-Code and M-Code for authorised users.

Benefits:

- Enables controlled and repeatable interference signal generation
- Optimise performance in the presence of a wide range of signal types
- Know how your device will perform under on-design and extreme conditions
- Test under static and realistic dynamic (including high dynamic) conditions

Embedded Jamming Signal Generation GSS8700

Spirent's GSS8700 GPS Simulator, part of the GSS8000 GNSS Simulator Series, enables the generation of in-band interference sources at L1 and/or L2. Up to 61dB interference-to-signal power is supported and the interference sources are configured and located using SimGEN™ software.

Application:

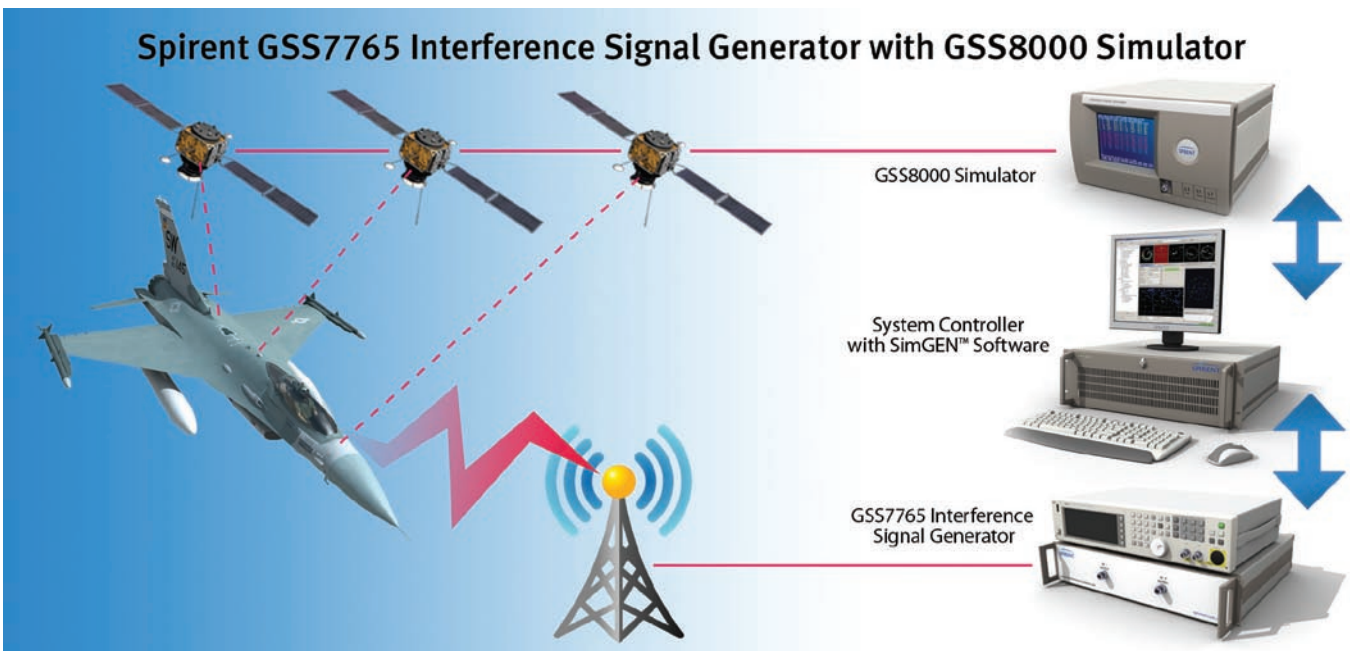
- Coherent CW or BPSK interference signal generation up to 61dB interference-to-signal power

System elements:

- GSS8700 GPS Simulation System with appropriate hardware and operating mode

Benefits:

- Designed for advanced testing in the presence of multiple in-band interference sources



Specialist Products for Controlled Reception Pattern Antenna (CRPA) Testing

Testing and development of CRPA systems is a specialist area where Spirent has developed and deployed various systems. The following descriptions are intended to be indicative of the approaches that are supported and where Spirent has experience and systems available. Because of the complex nature of CRPA testing, Spirent recommends a dialogue is established at an early stage to ensure that all aspects have been fully considered prior to any decisions on a test approach being taken.

Laboratory Approach: Spirent GSS8000 CRPA Test System

Spirent's GSS8000 system generates both GPS and interference signals. Multiple GSS8000 systems may be combined to enable CRPA testing. Both null-steering and space/time adaptive CRPA testing are supported by this approach.

Key features:

- Up to seven antenna elements coherently controlled by SimGEN™ software
- GPS L1/L2 with LI/L2 interference sources
- Proven alignment and calibration to enable accurate and representative testing

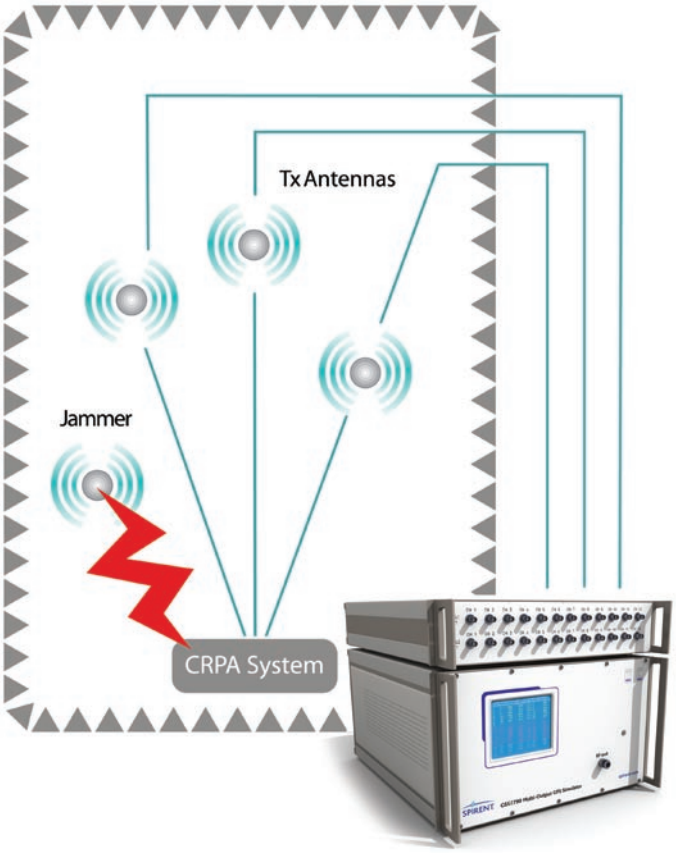
Spirent GSS8000 7 element CRPA test system

Benefits:

- Tests processing algorithms of CRPA electronics unit in a wide variety of controlled and repeatable conditions

Anechoic Chamber Approach: Spirent GSS7790 Multi-Output GPS Simulation System

Spirent's GSS7790 allows the signal from each satellite to be mapped to a separate RF output. These signals can then be fed to individual transmit antennas which, when suitably deployed in an anechoic chamber, replicate the spatial diversity of satellite and jammer signals incident on the receive antenna.



Key features:

- Up to 12 GPS L1 + 12 GPS L2 channels
- One RF output per channel
- Higher power outputs to compensate for transmission path losses

Application:

- Enables testing of the CRPA antenna element under diverse conditions

System elements:

- Spirent GSS7790 Multi-Output GPS Simulation System, anechoic chamber, interference signal generator, associated antennas and cabling to suit application

Benefits:

- The only controlled approach to testing that enables the CRPA antenna element to be included

Interference Mitigation Testing

The SimINERTIAL packages enable simulation of the inertial test inputs of integrated GPS/inertial navigators (IGIs or EGIs). Variants are also available which emulate the output of an Inertial Measurement Unit (IMU).

Key features:

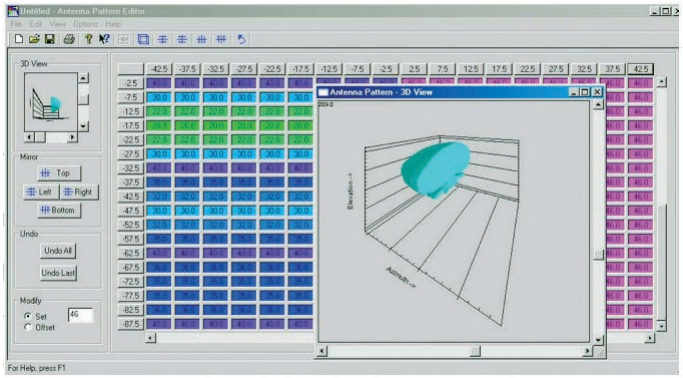
- Enables IGIs to be dynamically tested in the laboratory (EGI variants)
- Enables GPS receivers to be tested while being aided or assisted by data from an emulated IMU (IMU variants)
- Honeywell, Northrop Grumman, AMRAAM and NATO STANAG 4572 EGI and IMU variants supported
- Altitude reference and data capture / control packages also available

System elements:

- SimINERTIAL, GSS8000 GNSS Constellation Simulator running SimGEN™ software, optional SimBARO, SimDATA

Benefits:

- Enables controlled test approach to EGI and GPS/IMU aided system development
- Dramatically reduced test costs compared to live flight testing



SimGEN™ antenna pattern gain and phase editor example

Antenna Pattern Modelling

Spirent's SimGEN™ software supports modelling of the reception pattern of the GPS antenna in terms of amplitude and phase.

Key features:

- Resolution of up to 1° in azimuth and elevation
- Antenna lever-arm offset from vehicle centre of motion reference
- May be defined via SimGEN™ user interface or CSV file

Documentation and Reference Table

Related Product, Option or System Extension	Brochure Title	Data-sheet /Specification Ref.
GSS8000 GNSS Simulation System	Datasheet	MS3057
GSS8700 Advanced GPS Simulator Specification	Datasheet	MS3058
SimGEN™	Datasheet	MS3008
GSS7790 Multi-output Simulation System	Datasheet	MS3025
SimINERTIAL package	Datasheet	MS3030
GSS7765	Datasheet	MS3018

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ISO 9001:2008 Reg. No. 059 — UKAS QUALITY MANAGEMENT
9001:2008 - AJA99/1371

ISO 14001:2004 Reg. No. 059 — UKAS ENVIRONMENTAL MANAGEMENT
14001:2004 - AJA04/7994

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