25 Years of GNSS Testing with Spirent

A Spirent eBook

SPIRENT®

Introduction

25 Years of GNSS Testing with Spirent

A lot has changed in the GNSS world over the past 25 years. Back in 1987, GPS was in its infancy and almost entirely restricted to US military use. Today, a plethora of satellite constellations fill the sky, delivering positioning data for a huge range of military, civilian and consumer applications, from space flight and aircraft navigation to precision agriculture and digital image geotagging.

Throughout the entire quarter-century, Spirent has been at the forefront of the industry, providing robust and comprehensive test solutions for public and private sector organisations developing new GNSS-based navigation and positioning equipment.

As the industry has evolved, so have our solutions. Today we offer the broadest range of test equipment available anywhere: from RF simulators for multi-GNSS testing to simulator units for Wi-Fi, sensor-based and hybrid positioning solutions. If you have a satellite or hybrid positioning device that you need to test, we have the right solution for you.

This ebook provides an introduction to GNSS testing with Spirent, and an overview of the different market sectors that we work in. It looks at how the advent of new constellations and hybrid positioning technologies is changing the industry, and how Spirent is meeting the evolving needs that result. Finally it provides an introductory guide to the full range of Spirent testing products and links to useful resources where you can find out more about GNSS testing with Spirent.

The Current GNSS Landscape

The GNSS landscape is evolving fast. Where once GPS was the only game in town, recent years have seen the arrival of the Russian GLONASS constellation and the beginnings of the European Galileo system. China's Compass/Beidou constellation is due to achieve global coverage by 2020, and then there are regional augmentation systems including Japan's QZSS, India's IRNSS and France's DORIS system.

As the signals have multiplied, so have the end-use applications. GNSS positioning and navigation is now a key feature in a huge array of military, civilian and consumer technologies, from missile guidance systems and emergency distress beacons to agricultural machinery, sports equipment, in-vehicle satnav, smartphones and digital cameras.

Location-based services, such as shops offering deals to shoppers whose smartphones indicate they are nearby, are in their infancy, but are starting to fuel a boom in new applications of GNSS positioning technology. New services that rely on pinpointing people and devices indoors and in urban canyons where GNSS signals are weak, are driving a large global market for hybrid positioning devices that augment GNSS with cellular, Wi-Fi and sensor-based data.

The Need to Test

Whatever segment you're operating in, and whatever your use of GNSS and hybrid systems, rigorous testing is vital. In some systems and applications, the performance of the GNSS receiver may literally make the difference between life and death. In others, GNSS receiver performance may be an important point of competitive differentiation. In all cases, you want to be sure that your receiver, board or device performs as promised in every conceivable condition.

That means thorough testing of the technology in a wide array of conditions and scenarios – many of which are difficult, impossible or prohibitively expensive to achieve in the real world. That's why simulation has emerged as the industry standard approach to GNSS performance testing over the past 25 years.

Why Simulation?

Simulation provides many important benefits and efficiencies over "live sky" testing with real signals, including:

1. GNSS simulators generate data for multiple scenarios and locations, compared to live sky testing, which is a single-scenario, single-location solution. For example, a simulator with 10 scenarios and six locations is equivalent to 60 individual live sky tests.

2. A GNSS simulator can repeat exactly the same scenario time-after-time, enabling test results to be accurately compared during the development process.

3. Repeatable GNSS test scenarios can be created to include failure conditions, which may only occur sporadically or randomly in the real world and are impossible to capture with live sky.

4. Only GNSS simulators can test GNSS constellations which are partially deployed or not yet deployed (e.g. Galileo) and future signals such as L5 and L2C on GPS.

5. Conducting the bulk of your testing using simulators (using live sky testing as a final verification of real world performance) saves money and time – essential when you need to bring high-performance technologies to market quickly.

Why Spirent?

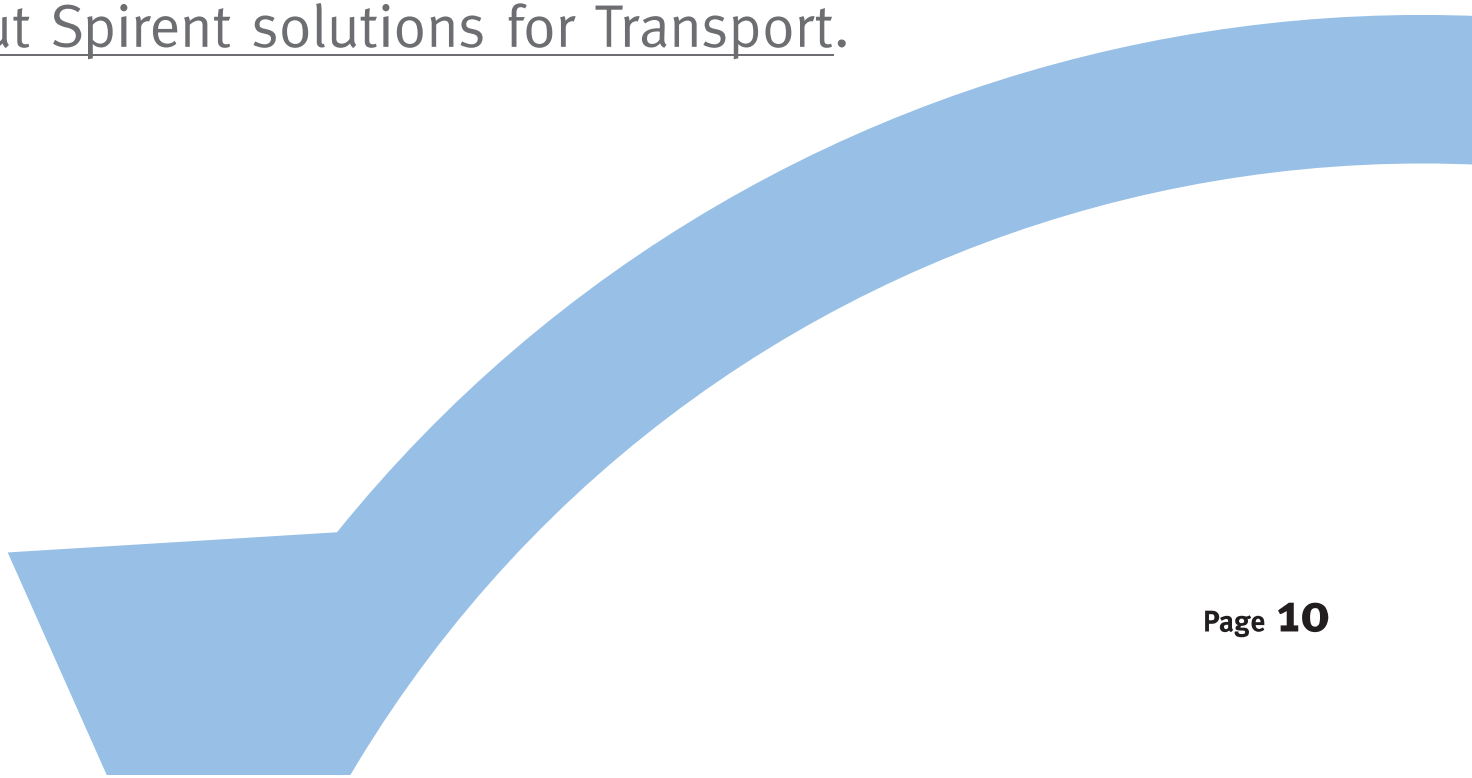
Over the past 25 years, Spirent has worked closely with every industry that relies on satellite and hybrid positioning.

Today, we offer off-the-shelf and bespoke testing solutions, including hardware, software, consultancy services and predefined test cases and scenarios, for a broad range of industries:

Military and Defence: Spirent continuously adds capabilities and features to support military GNSS simulation solutions. Whether you're involved in testing, classified signals (including GPS M-code), evaluating GPS/GNSS receiver performance, testing a new release or confirming performance meets design specification, or using test systems in the field to verify the performance of systems before deployment, Spirent can help. Find out more about Spirent solutions for Military and Defence.

Transport: GNSS satellite navigation is becoming an essential element of many transport projects, from in-vehicle navigation through to road tolling and telematics applications. Many projects in this sector are complex with safety and commercial objectives to satisfy with few standard approaches to performance definition or test approaches.

Spirent has wide experience of helping companies in this sector understand their test issues and the best approach to testing. Find out more about Spirent solutions for Transport.



Automotive: The use of simulators for GNSS telematics applications is increasing rapidly, with much focus on emissions reduction, safety and intelligent transport systems (ITS). One of the most important factors is integrity, or trust in the position information under a range of conditions.

Spirent's test solutions are being used in many development projects and we can provide help and advice to help you with your project definition, testing and overall success. Find out more about Spirent solutions for Automotive.

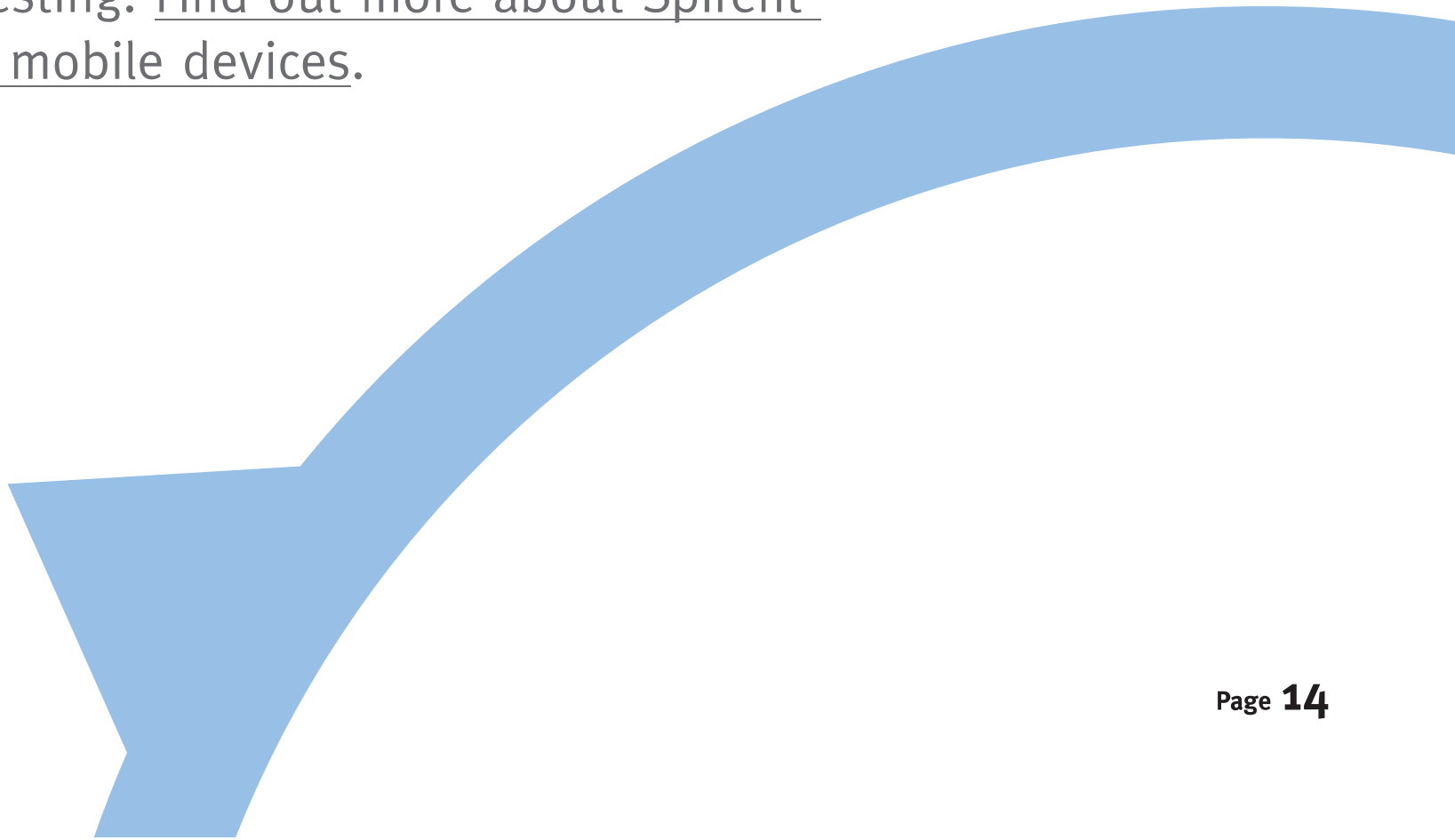
Road Tolling: The use of GPS/GNSS for road charging schemes is being considered by many government and transport authorities worldwide to help reduce traffic volumes and congestion. Potential systems need to be evaluated and their respective strengths and weaknesses compared and understood. Spirent's solutions provide the necessary repeatability and rigour to make an effective decision. Find out more about Spirent solutions for road tolling.

Rail: Many rail operators are investigating how GPS/GNSS systems could be used to reduce infrastructure costs and improve performance over traditional approaches. In a sector where there are little or no standards available that define how and what to test in a GNSS system, Spirent can help. Our experience in helping customers with GNSS systems and applications can assist you to make the right decisions. Find out more about Spirent solutions for Rail by downloading the Application Note.

Civil Aviation: Civil aviation navigation and positioning systems have specialised requirements for integrity and availability, and thorough testing and certification is essential. Spirent is widely recognised as the premier supplier of positioning and navigation simulation test systems to the civil aviation industry and is regularly used by leading aviation authorities and system developers worldwide.
Find out more about Spirent's solutions for Civil Aviation.

Space: Many space programs have come to rely on GPS as a key navigation system component for accurate positioning in space and for attitude determination. Spirent has established its high performance test systems as the product of choice for many of the world's leading space agencies and space related companies when simulating the performance of space based GPS, GLONASS and Galileo systems. Find out more about Spirent solutions for Space based applications.

Mobile Devices: GPS, GLONASS, Sensors and Wi-Fi Positioning are combining to make location-aware technology in mobile devices a must-have feature. Spirent is the leading provider of test systems for characterisation and evaluation of performance in mobile devices, at every stage in the value chain – from initial R&D through to production testing. Find out more about Spirent solutions for mobile devices.



World-Class Testing Throughout the Product Value Chain

R&D

As the GNSS environment becomes more complex, developing new positioning equipment is becoming increasingly challenging. You need to know that your receiver or antenna will work as desired in every scenario, whether it relies on GPS, GLONASS, Galileo or Compass signals, regional augmentation systems, on-board sensors, Wi-Fi or cellular trilateration, or a combination of these.

The complexity of today's signal environment means that live sky testing is simply no longer an option. You need simulators to create (and more importantly, recreate) all of the possible combinations of signals, errors and interference that will influence the performance of your product.

Spirent is the leading vendor of RF simulation equipment to R&D labs in the academic, public and commercial sectors. With Spirent's solutions you can develop test cases and scenarios, model existing signals and signals that have not yet come on-stream, and ensure complete repeatability for every test you undertake. As a result, you can test faster, more accurately and more cost-effectively than ever before. Find out more about Spirent's solutions for R&D applications.

Integration

As more and more devices incorporate a GNSS receiver and antenna, GNSS performance testing is becoming an increasingly important part of the integration process. Whether the end-application is a GPS-enabled smartphone or a navigation device for precision agriculture, integrators need to know that the GNSS component functions as planned when incorporated into the overall device design.

Spirent works with integrators across the globe to provide market-leading test equipment and software for GNSS-enabled devices. Find out more about Spirent solutions for integrators by downloading the eBook.

Verification

Many GNSS-enabled devices have to conform to industry quality standards and regulatory requirements. To ensure compliance, you need a GPS/GNSS Verification Testing environment that lets you reproduce GNSS quality and performance tests consistently in a repeatable and controlled manner; analyse the results; manage Quality Assurance processes and handle any issues with traceability, calibration records, fault rate analysis or field support.

Spirent's tried and trusted Verification-focused GNSS testing solutions can help to ensure a smooth product transition from R&D through to the production stage, and so accelerate time-to-market. Find out more about Spirent solutions for verification and compliance.

Production Testing

Every device that offers positioning capabilities as part of its specification must be tested in production to ensure it performs as promised. For manufacturers, that means testing every product as it rolls off the production line – an increasingly complex task with the advent of multi-GNSS receivers and devices with hybrid positioning capabilities.

Spirent offers a range of GNSS and Wi-Fi simulators that enable rapid, effective and accurate production testing for a wide range of devices. Designed specifically for the testing needs of production houses, our solutions are used by manufacturers across the globe to ensure product quality. Find out more about Spirent solutions for production testing.

Our Hardware

Spirent GSS8000 Multi-GNSS Simulator: A comprehensive, highly adaptable tool, designed to meet the simulation requirements of the world's most demanding and pioneering research and development teams.

Spirent GSS6700 Multi-GNSS Simulator: A powerful, flexible platform for Multi-GNSS development, integration and verification testing.

Spirent GSS6400 Record and Playback System: a complete, standalone system for capturing live GNSS RF data in the field and replaying it with optimal fidelity and performance back in the lab.

Spirent GSS6300 Multi-GNSS Signal Generator: The ideal solution for high volume, Multi-GNSS manufacturing environments.

Spirent GSS5700 Wi-Fi Simulator: a practical, intuitive instrument for testing Wi-Fi positioning technology in the lab – either as a standalone solution, or in tandem with Spirent's Multi-GNSS simulation systems.

SimREPLAY: Play and replay pre-defined scenarios for fast, accurate comparative measurements.

SimREPLAYPlus: As above, with the additional option to generate scenarios locally, edit the time, date and position and to define vehicle motion remotely or using a file in the required format.

SimGEN™: A fully flexible software suite designed for R&D use. SimGEN™ offers complete, flexible scenario generation capability including control of the constellations, propagation, terrain obscuration, antenna patterns, multipath, vehicle trajectory and a range of error models.

TestDrive-GNSS: An integrated test solution to set up and run pre-defined test sequences, and process and store the results.

Where Next?

If you found this eBook of interest, you may now like to do one of the following:

- Visit our Resources page to browse our other eBooks and Application Notes on relevant topics.
- Read the Spirent GNSS Blog to keep up with news and insights on the latest GNSS developments.
- Email us for more information at gnss-solutions@spirent.com

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About Spirent

Spirent has been the global leader in GNSS testing for 25 years. Spirent delivers navigation and positioning test equipment and services to governmental agencies, major manufacturers, integrators, test facilities and space agencies worldwide.

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