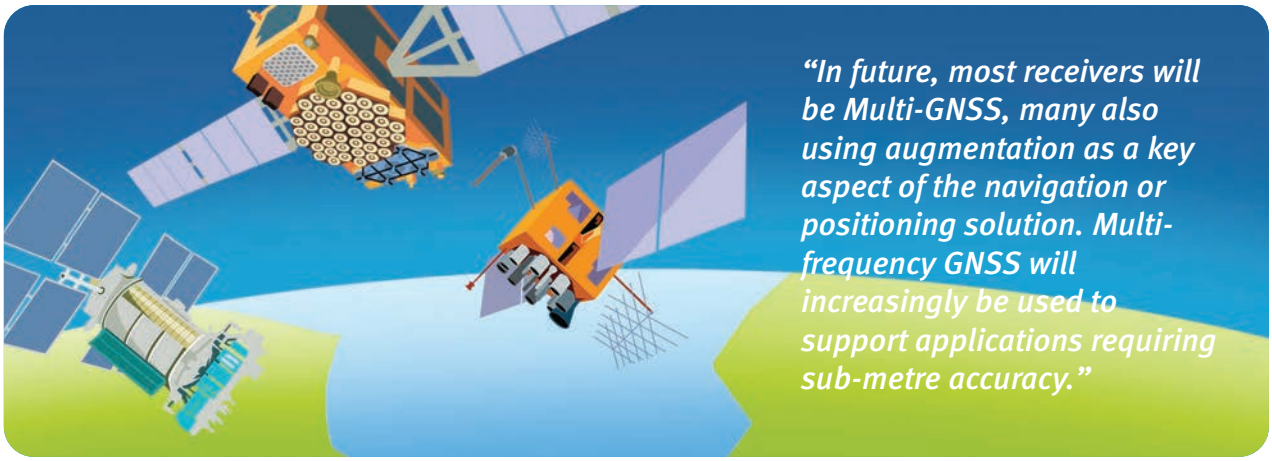
Test Solutions for:
Multi-GNSS Navigation and Positioning

Multi-GNSS

World leader in GNSS test and simulation systems SPIRENT®

Why Multi-GNSS?



"In future, most receivers will be Multi-GNSS, many also using augmentation as a key aspect of the navigation or positioning solution. Multi-frequency GNSS will increasingly be used to support applications requiring sub-metre accuracy."

Navigation and positioning technology is no longer just about GPS L1 C/A code. GPS is being modernized, the GLONASS constellation is now in place, new systems including QZSS, Galileo and Compass are underway. Multi-GNSS offers significant opportunities and challenges to GNSS technology, system and application developers.

Multi-GNSS benefits:

Availability

Percentage of time a position solution is available

- With more satellites visible, navigation becomes possible even in very challenging environments (e.g. urban canyon or pedestrian navigation).

Continuity

Performance without non-scheduled interruptions

- Three or more satellites are generally required to maintain a valid position fix. The chances of this being the case are multiplied with a receiver looking for satellites from more than one constellation.

Integrity

Level of trust in information provided

- Diversity in GNSS systems used by a receiver offers integrity benefits, for example allowing a receiver to flag anomalies or unexpected results.

Accuracy

The degree to which position data conforms to recognised true or actual position

- Accuracy over GPS alone can be improved when using Multi-GNSS in difficult environments with limited visibility. However, even then, relatively poor satellite geometry can lead to accuracy impairments compared to open sky situations with one GNSS.

Additional benefits:

- ✔ Multi-GNSS can bring improved resilience to interference effects
- ✔ Performance at high latitudes can be improved by Multi-GNSS (eg GPS plus GLONASS over GPS alone)

Augmentation systems:

Augmentation systems can also deliver benefits over autonomous GNSS approaches. The most popular augmentation approaches include Assisted-GPS (A-GPS), Space-Based Augmentation Systems (SBAS), Ground Based Augmentation Systems (GBAS) and Dead Reckoning (DR) sensors in vehicle navigation systems.

Multi-GNSS Test Considerations

Test Objectives

Successful testing needs clearly pre-defined objectives which will vary depending on the device to be tested and the stage in the product development lifecycle. Choices made during design will impact the degree to which potential benefits are realised.

Multi-GNSS test objective examples:

Chipset development - confirm correlator function
Module development - quantify performance improvement in challenging environments
Verification testing - ensure that product objectives are met across all releases
Manufacturing test - confirmation of signal acquisition performance at defined power levels

Test Design

Test design specifies the parameters to be tested and the test conditions which will apply. It is critical to design test cases that meet the test objective. Choices made during test will determine your ability to realise and quantify success.

Typical questions to be addressed:

- How can I perform progressive testing that is time and cost effective?
- How will I demonstrate that my design objectives have been met?
- How can I ensure that my customers will get the performance that they expect?

Test Parameter examples:

Availability
- Time to First Fix and Reacquisition time
- Improvement in “Dilution of Precision”

Continuity
- SV mix change at PVT solution threshold
- Deteriorating mix versus Improving mix

Integrity
- Pseudorange ramp by constellation
- Impact of poor, irrelevant or incomplete navigation data

Accuracy
- 2d and 3d accuracy
- GNSS individually and combined

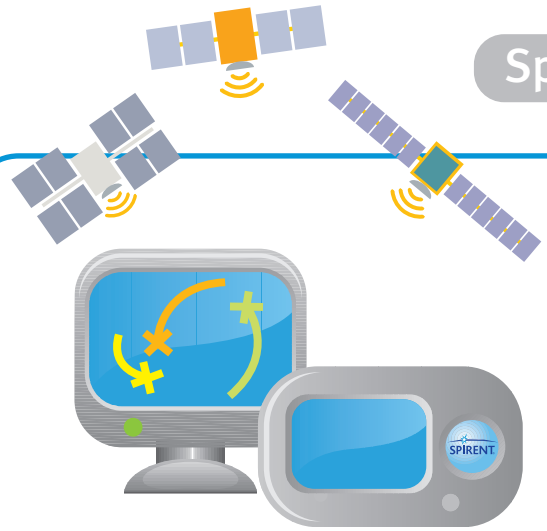
Multi-GNSS Considerations

Using satellites from more than one constellation brings special challenges and design choices for receiver design and evaluation.

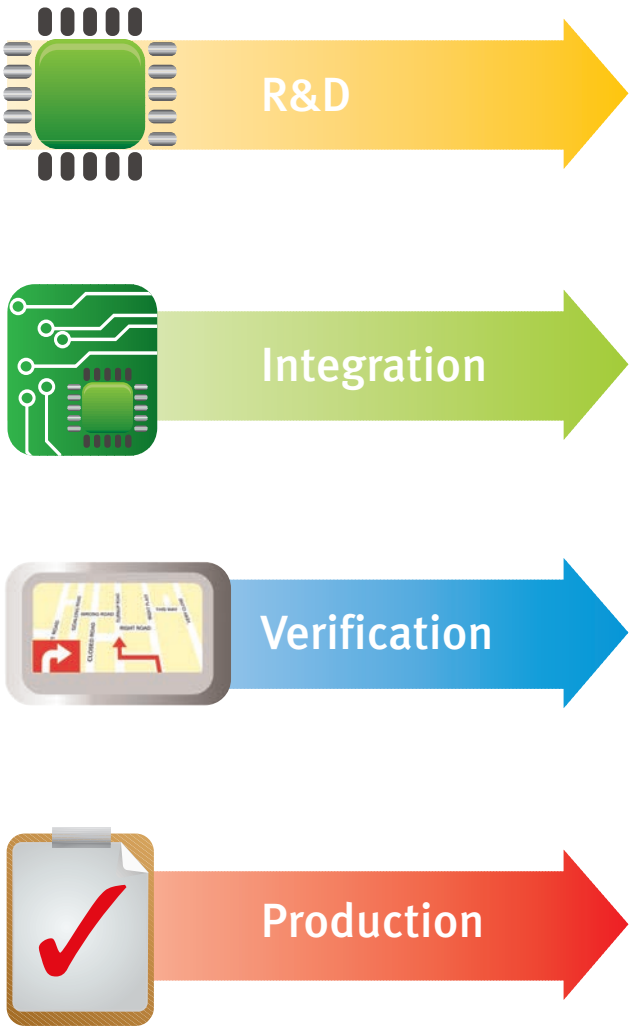
Example Multi-GNSS test design challenges:

- System specific reference frames
- System specific propagation models
- Timing offsets and rollover
- Cross systems impacts (e.g. How will unreported poor performance in one GNSS impact a blended solution?)

Spirent Multi-GNSS Test Systems



Spirent offers a wide range of test systems and capabilities to meet your Multi-GNSS test needs. Whether you are undertaking R&D performance testing or assessing manufacture of Multi-GNSS devices, Spirent has a Multi-GNSS test system available to match your needs.



Our UK verification office suite enables us to replicate your test environment and helps us to help you quickly and effectively.

Multi-GNSS FAQ's

Why do I need Multi-GNSS Now?
Improved performance is available now by using GPS and GLONASS. During the lifetime of any product in development today there will be competition from Multi-GNSS alternatives.

What about further developments in the future such as Compass?
Spirent has always kept up to date with modernisation and other developments in GNSS and will continue to do so.

What if I only want GPS now but I know I'll need GLONASS in the future?
Spirent Multi-GNSS systems are designed with future development in mind and are expandable to address tomorrow's requirements as well as today's.

I already have a GPS simulator. Will I need a new system?
Many Spirent systems can be upgraded to add second constellations. Otherwise trade-in is offered. Contact Spirent for details of your route to Multi-GNSS.

Can I just test the constellations independently?
Limited independent testing may be possible depending on receiver design. Independent testing will not explore Multi-GNSS integration issues or Multi-GNSS benefits.

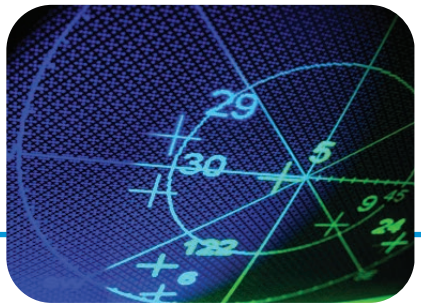
Surely combining signals is easy?
Tight integration is required between the constellation signal generators to allow combined PVT solutions. Spirent systems provide coherent signals with well controlled synchronisation and reference frame offsets.

What if I need classified codes?
The GSS8000 product family provides classified codes for authorised users.

Can you simulate multi-frequency Multi-GNSS?
Yes. *The GSS8000 family supports all current GNSS frequency bands and signals.*

Can I share my test scenario with collaborators and partners?
Yes. *Portability of scenarios allows results to be obtained under identical controlled conditions in different labs and at different times, impossible with live-sky testing.*

What if I don't want to write my own scenario?
Spirent can provide standard scenarios or develop custom scenarios to meet your specific needs.



Documentation and Reference Table

Product, Option or Document	Document Type	Document Reference
GSS8000	Brochure Datasheet	MCD00152 MS3057/MS3008
GSS6700	Brochure Datasheet	MCD00153 MS3066/7/8
GSS6300	Brochure Datasheet	MCD00154 MS3063
Testing GNSS Systems for Automotive Applications	Application Note	DAN001
Testing GNSS System Errors	Application Note	DAN002
Fundamental GNSS Receiver Characterisation	Application Note	DAN003
Testing GNSS for Railway Applications	Application Note	DAN011
Land Vehicle City Environment Scenario Set	Datasheet	MS3065
Test Solutions for: Interference, Anti-Jam, GPS/Inertial, Integration Mitigation	Solutions Brochure	MCD00162

Brochures & Application Notes available on our website - www.spirent.com/positioning

It's no longer just about GPS.

If you're not working on Multi-GNSS yet, you probably will be soon.

Spirent's Multi-GNSS test systems are available now. GPS/SBAS, GLONASS, Galileo & QZSS are all supported today.

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

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

AP/UK/04/HS/077

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