SPIRENT

QUALITY CONTROL FOR LOCATION-ENABLED DEVICES

A guide to production testing

Spirent eBook

Challenges for the unfamiliar

The addition of location awareness to all manner of high-volume consumer products brings with it **a number of challenges** for manufacturers that are not necessarily familiar with satellite navigation technology.

And these challenges do not end once the product is designed and debugged.

When the product moves into production, the challenge becomes how to ensure that every single unit leaving the factory will perform exactly as it should. Because any malfunctioning location aware product will very quickly be found out – as soon as it gives its users an inaccurate fix on their position, or delivers navigation instructions that are patently wrong.

The dangers of failure

Manufacturers of consumer products from cars to mobile handsets have become all too aware of the power of the disgruntled user. Online forums and today's social media provide the dissatisfied customer with the means to **tell the world** that any given product does not do “exactly what it says on the tin”.

And while such media can offer valuable opportunities to improve customer interaction, recurring negative comment can do irreparable damage to any brand's reputation for reliability.

Quality control

Clearly, the only way to ensure that products released to the market are fit for purpose is through **functional testing at the end of the production line.** And in this respect, the GNSS receiver is no different from any other function of the end equipment.

The challenge then becomes how best to **integrate** functional testing of the GNSS receiver with the **other tests** performed on the product. And that means devising a test strategy that will exercise the equipment sufficiently to prove its correct (or incorrect) functionality in the minimum possible test time.

Functional testing

As with any functional testing, the operation will involve applying a known stimulus and observing the response. If the response is within acceptable bounds the product passes the test; if the response is outside those bounds the product fails.

The response to the stimulus may simply be a trigger signal or an alarm, or it may be some variable output that can be measured for the purposes of the test. But whatever the expected result, **it is essential that the stimulus is accurate and repeatable** so that the response can be gauged against a known standard.

The tests required

The exact tests required will depend entirely on the intended use of the end equipment. And while it will not be necessary to exercise all the functions of the GNSS receiver, the tests need to ensure that the receiver will function as required when it is used “in anger”.

So while static navigational accuracy may well be the simplest test to perform, **other aspects such as time to first fix (TTFF) or re-acquisition time** might well be important to the overall operation of the equipment.

Supplying the stimulus

When integrating GNSS tests with other acceptance tests, the first (and rather obvious) problem is that **the test area is not exactly a GNSS friendly environment.** The roof of the production area will almost certainly block the ingress of signals from any GNSS system, and there will inevitably be a great number of interfering RF signals being reflected around the test area.

The first of these problems is relatively easy to solve: the GNSS signals can be "captured" by an outdoor receiver and relayed to the test area. However, while relaying "live-sky" signals might seem to offer a cost-effective solution for production testing of GNSS-enabled equipment, it does have many significant limitations.

Don't be fooled

Certainly, if the only test required is for the equipment to recognise the presence of GNSS signals, then the relayed signals would be adequate for this purpose. Similarly, if the object of the test is for the equipment to determine its location from the signals supplied, then the relayed live-sky signals will suffice.

However, **the whole ethos of quality control is to determine whether the equipment produces the expected response to a known stimulus.** Certainly, the location of the test rig will not change, and so the position calculated by the GNSS receiver should always be the same.

But the nature of the “live” signals that are being relayed will be changing constantly. The relative positions of the satellites within the constellation will change; the atmospheric conditions will never be constant; and other external influences such as interference will not be consistent. So much for applying a “known” stimulus!

The reliable alternative

A GNSS simulator provides the ideal alternative to any form of “live” signals for testing any GNSS receiver. And while the simulator that would typically be used in characterising the design would need to be a fully-featured multichannel instrument capable of simulating the signals an entire constellation of satellites, **the simulator used for production testing can be a relatively simple single-channel unit.**

The important aspect here is that the simulator will produce **exactly** the same stimulus each and every time. Therefore any variation in the response of the equipment under test can easily be observed. And if the response falls outside acceptable bounds then the equipment will be rejected.

Bringing it all together

Of course, it is highly unlikely that the GNSS receiver will be the only part of the equipment that requires acceptance testing. So it is important to choose a GNSS simulator that can be integrated with other test equipment in order to create a complete functional test system for the whole equipment.

The combined test setup will speed product throughput, minimising test time and enabling complex "if-then" test scenarios that can exercise multiple functions in a single software-controlled test routine.

Reputation preserved

By integrating simulator-based GNSS receiver testing with other functional testing as part of a complete quality control procedure, manufacturers can be confident that **their location-enabled products will perform as designed,** helping maintain consumer confidence in their hard earned brand reputations.

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gnss-solutions@spirent.com

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Sales and Information

Spirent Communications

Aspen Way,

Paignton, Devon,

TQ4 7QR England

Tel: +44 1803 546325

globalsales@spirent.com

www.spirent.com/positioning

Spirent Federal Systems Inc.

22345 La Palma Avenue

Suite 105, Yorba Linda

CA 92887 USA

Tel: 1 714 692 6565

info@spirentfederal.com

www.spirentfederal.com

MCD00142 07/10

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