GSA.30

GPS Device Active Mode Radiated Receive Sensitivity Testing

Service name:

GSA.30 **GPS Device Active Mode Radiated Receive Sensitivity Testing**

Deliverables

Report

Duration:

2 Weeks

Items:

A. Measurement of conducted receive sensitivity
B. Measurement of radiated receive sensitivity
C. A high sensitivity spectrum analyzer sweep of the
D. GPS band and surrounding frequencies from the antenna
E. Comparison of radiated receive sensitivity to reference devices
F. Recommendations to maximize performance

What is the problem or concern we are addressing?

We're doing controlled, repeatable radiated receiver sensitivity measurement on a GPS device.

GPS receiver systems are unlike any other consumer radio product. These devices are more sensitive to RF energy than any other product in general consumer use. This makes them very susceptible to interference from even the smallest radio signals given off by any modern electronic device. The worst case situation is when the GPS antenna is inside a device.

It's important to clarify that simple unintentional radiator testing done as part of FCC, CE or PTCRB testing isn't sufficient. A device can easily pass those test suites and have miserable GPS performance due to interference. What FCC says is ok with them is over 100dB worse (yes, 1x1010 times worse) than what your GPS needs to perform the way you expect it to. Like any other part of a new product the GPS system implementation needs to be properly tested. Design Verification Test (DVT) for a GPS is similar to any other radio receiver except you have much weaker signals.

GPS can't be tested outside. The signal strengths of the real satellites are constantly changing as they move through the sky and it's different at every location. The goal of DVT is to directly measure the radiated receive sensitivity of the GPS receiver to ensure the product actually functions properly. This requires a repeatable and controlled test setup, including isolation from the real GPS system.

GPS DVT needs a GPS constellation simulator, anechoic chamber and a skilled and experienced RF engineer to do the testing to ensure consistent results. Taoglas has years of experience with integration of antenna and radio systems as well as the special equipment to make the measurements quickly and efficiently. We find that unless a customer is in the GPS business, these special tools can be cost prohibitive to have in-house so we offer this testing as a service to our customers.

This service offering is not intended to measure performance of the GPS antenna. Taoglas offers a separate service product for measuring the antenna performance. It is important to separate this testing to ensure each part of the system is measured and optimized in a controlled way.

The Processes

Part 1

- Taoglas will use our GPS constellation simulator and anechoic chamber to measure conducted tracking sensitivity.
- Taoglas will modify one of your devices to bring out an RF feed from your GPS antenna. We will then use a network analyzer to measure the complete closed loop path loss of the test setup.
- Taoglas will use this same modified unit, a precision low noise amplifier and spectrum analyzer to capture a high sensitivity sweep of the signals received by the GPS antenna in the GPS band and surrounding frequencies with the device fully powered and running.
- Taoglas will then use our GPS constellation simulator and anechoic chamber to measure radiated tracking sensitivity. Using the substitution principal and the measured path loss from the network analyzer measurement we can measure the signal strength at the output of the GPS antenna, which is normally the input of the GPS receiver.
- If a comparison with the development board for the GPS chip/ module is desired, Taoglas will make conducted and radiated measurements on that dev board as well if needed.
- Taoglas will compare this sensitivity data to previously measured devices, the dev board if present and the GPS solution's data sheet to compare the performance and recommend further actions as necessary.

What does Taoglas need?

Our lab will need 2 test units. These will be modified for measurement and are not suitable for sale afterwards. We also require the design files (Schematic, PCB layout, BOM, mechanical 3D model)

Your product must bring out NMEA strings to a COM port on a Windows PC. In our chamber, we have adapters for USB, Ethernet and DB9. The DB9 adapter is typically used for RS-232 or logic level UARTs. Once outside the box, the test PC has USB, Ethernet and RS-232 physical interfaces. If the device is using USB or Ethernet, you must provide any software required for the device's GPS port to show up as a logical COM port inWindows. The PC is running Windows 8 64 bit.

The device needs to be powered inside the chamber. If it's battery powered, we need a means to charge the battery. If it uses a power adapter, we will need to bring the DC power through the wall of the test chamber. Typically it's easiest if you supply a power cable.

It is critical that the GPS power up when power is applied to the device, that the host processor not talk to the GPS or take any other action that affects the GPS during testing. Testing can take several hours.

Your firmware should support delivery of GSV, GSA, GGA, GLL & ZDA NMEA messages for GPS and GLONASS if you want to test both If you want the device compared to the GPS module's development kit, you will need to provide the development kit sample. We need written instructions to tell us how to connect the cables, power the device, charge the battery, and configure the device (as required).

Part 2

From the test data, your engineers will be able to clearly see if the GPS is performing with a reasonable range compared to the comparison devices. If the GPS performance is reasonable and the GPS antenna performance (separate test) is reasonable, no further effort is required. You have verified the GPS performance of the product design.

If the GPS performance is not in an acceptable range, a mitigation effort will be required to improve performance. The data taken during this testing is necessary and sufficient to guide that mitigation effort. Testing any changes made to the device will require the same equipment used for this testing.

Taoglas will support your engineering team by rerunning the radiated sensitivity portion of this testing as needed to measure changes in performance from their mitigation efforts. There will be an additional $500 charge for each measurement-day. The results will be added as an appendix to the original report.

Deliverables

The output from this effort will be presented in a written report with major sections covering:

- The test setup
- DUT modification
- Conducted sensitivity
- Recommendations to maximize performance
- Radiated sensitivity
- Comparison of radiated receive sensitivity to reference devices
- The spectrum analyzer sweep
- Issues identified (if any)
- Suggestions on next steps to resolve identified issues (if any)