



GeoHelix[®] GPS-P2 Antenna

Slim line GPS Device Case Study

Version 1

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Document History

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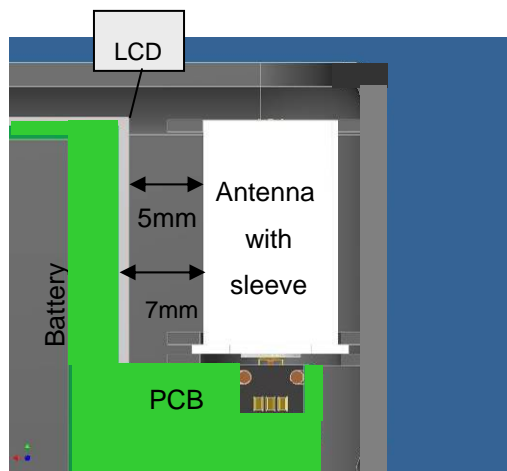
1. INTRODUCTION

This document highlights the integration of GeoHelix-P2 antenna into a GPS Slim line product. It is embedded into the device with minimal complexity, saving time and money in developing the product and hence delivering into the market on time.

Details of the mechanical integration of the antenna are also included in the document together with its electrical performance.

2.0 MECHANICAL INTEGRATION OF ANTENNA IN THE DEVICE.

The image below shows the integration of the GeoHelix-P2 into the device. It is an example of tight integration where the device not only has GPS functionality but also Bluetooth, Wi-Fi and MP3 player capabilities.

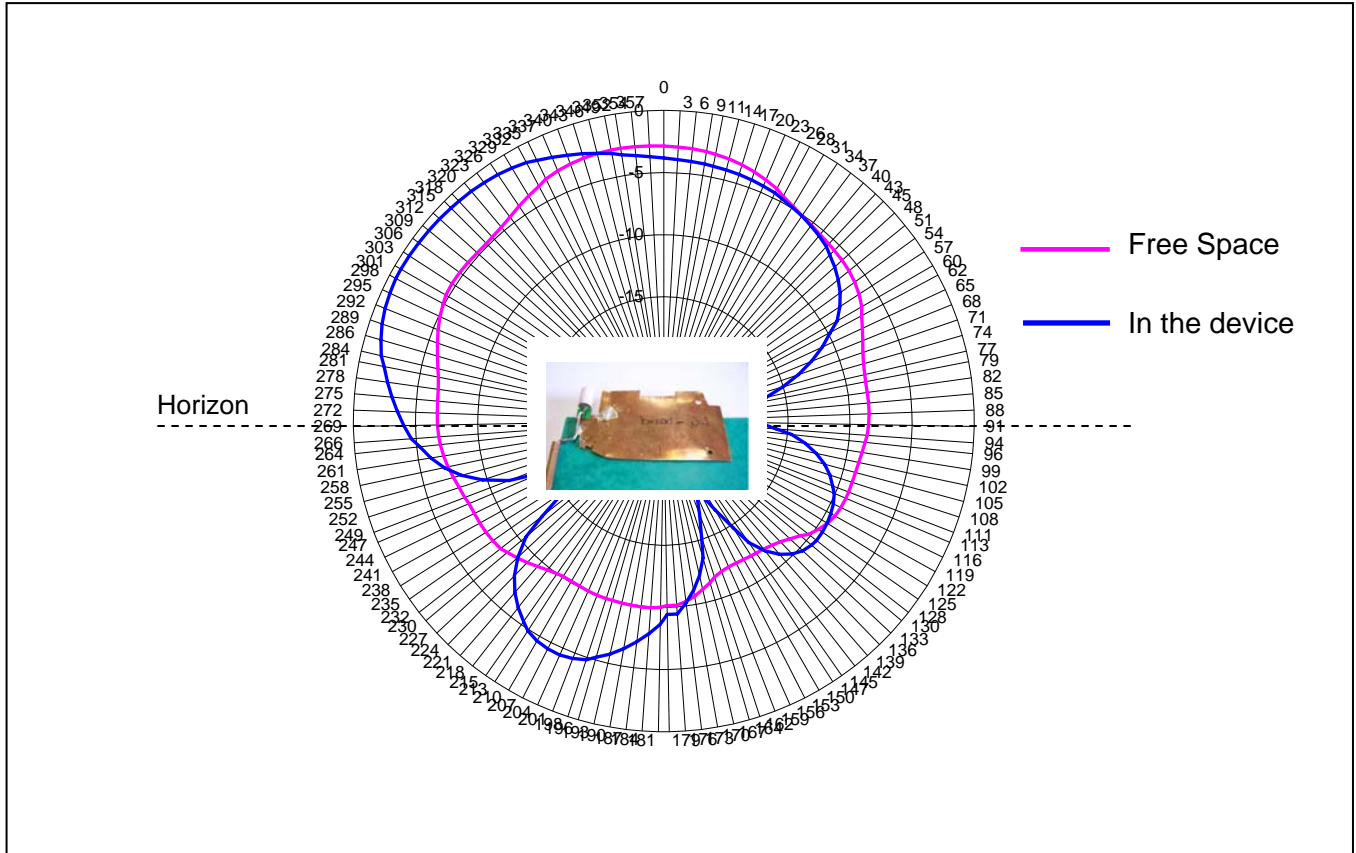


GeoHelix-P2 integrated into the device with separation from the LCD and PCB also highlighted.

The antenna has been supported in the device by the use of ribs in the housing, together with the 'flange' feature at the bottom of the sleeve. Further details with regards to the mechanical integration of the GeoHelix-P2 can be requested through Sarantel applications group.

3.0 RADIATION PATTERN OF P2 IN FREE SPACE AND EMBEDDED IN THE DEVICE

Radiation patterns of the antenna in Free Space and in the device are given in Figure 1 below. The picture within the radiation pattern demonstrates the orientation of the antenna in the device and its proximity to the PCB.



Radiation pattern summary:

Measurement	Peak Gain(dBic)	Average Gain Above Horizon(dBic)
Free Space	-2.87	-5.14
In the device	-0.58	-5.29

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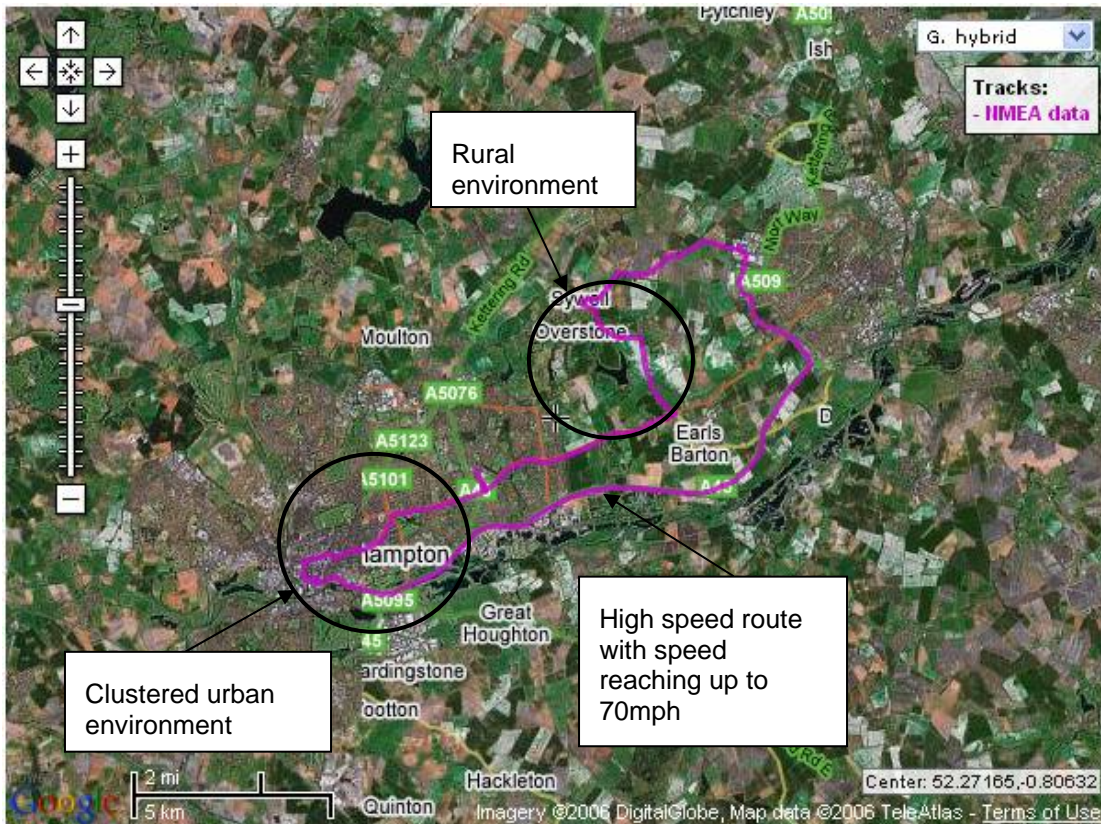
In comparison to the Free Space measurement, the peak gain of the antenna increases by approximately 2dB in the device. The pattern has skewed slightly to the left due to the proximity of the PCB and energy being reflected back from it. Furthermore, the average gain of the antenna in Free Space and in the device is very similar and therefore its GPS performance is not expected to degrade.

4.0 PRODUCT LIVE TESTING

4.1 DRIVE TEST

The product in discussion was placed on a dashboard of a car and an in vehicle drive test was carried out. The route covered both urban and rural areas to determine how the product deals with dense foliage and urban clustered environments.

NMEA data was logged during the drive test and then plotted on 'Google Earth' using a GPS data plotting software, known as 'GPSVisualizer'. Map of the route covered during the drive test is shown below:

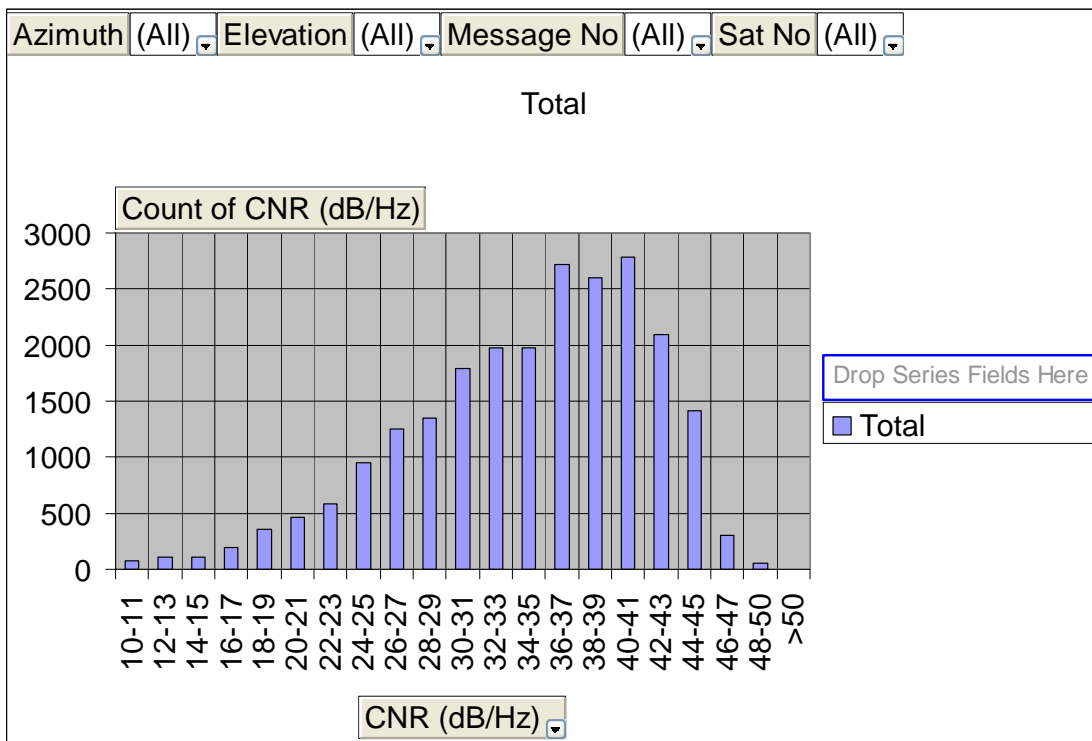


4.2 DRIVE TEST RESULTS

The results were plotted in the categories below:

- Carrier to Noise Ratio of all satellites
- Number of Satellites in View and HDOP(Horizontal Dilution of Precision)

4.2.1 CARRIER TO NOISE RATIO OF ALL SATELLITES:

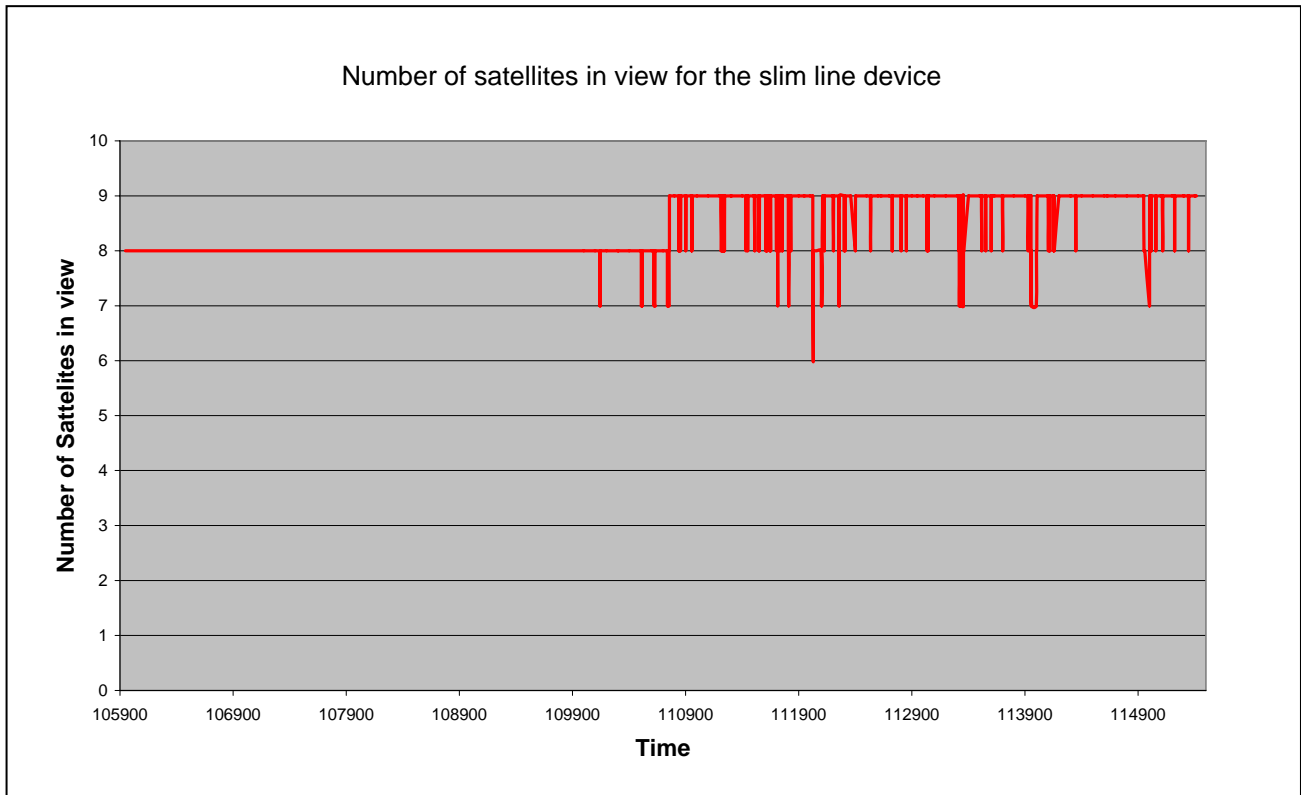


The distribution above shows that the unit performs very well during the drive test and on some satellites, the peak C/N ratio is 50. In addition, 95% of the time, C/N ratio of the device is above 20dBHz which highlights the GPS performance of the device is very consistent.

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4.2.2 NUMBER OF SATELLITES IN VIEW AND HDOP:

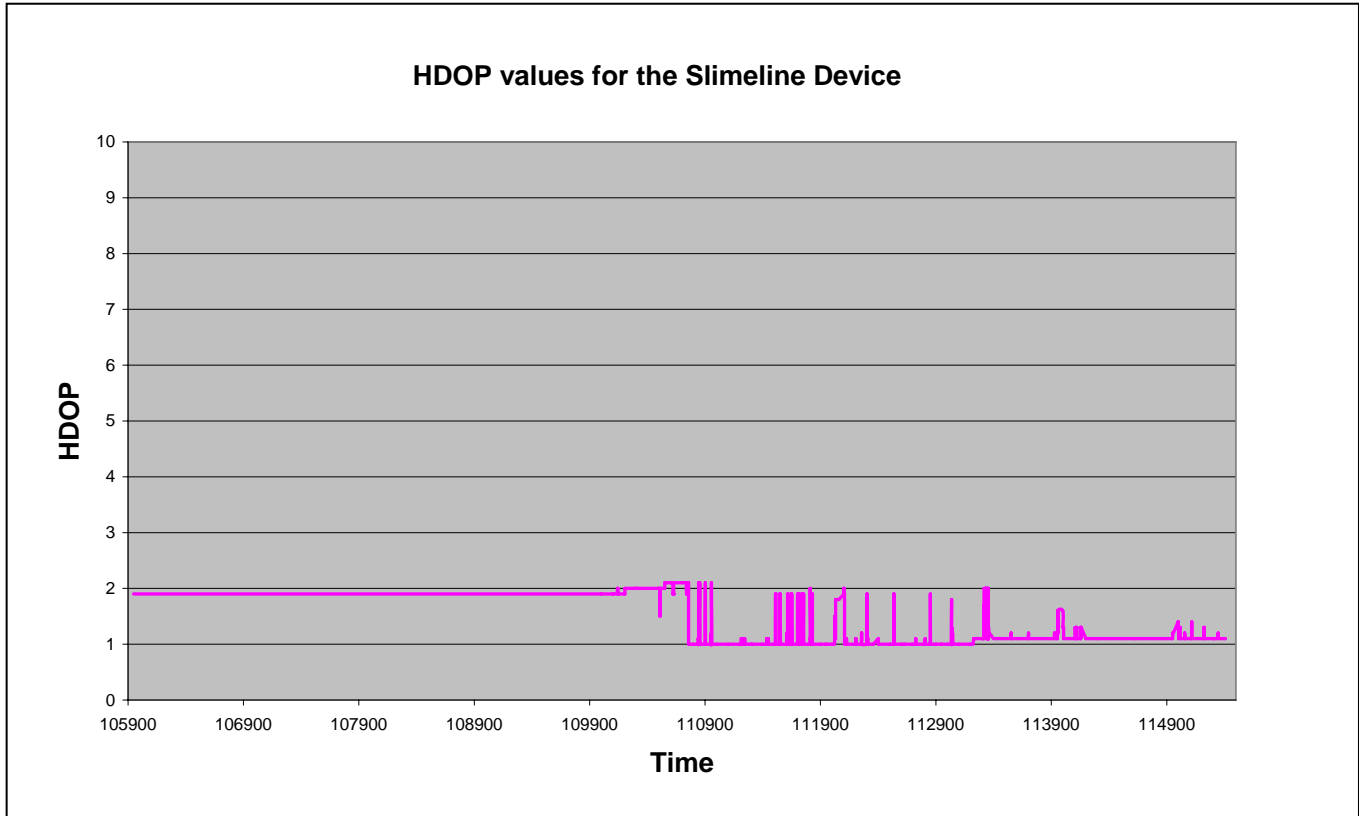
Number of satellites in view:



The device consistently receives good number of satellites even in urban canyons. This is because the GeoHelix antenna has a large 3dB beamwidth and a good azimuth pattern at low elevation – this is particularly important in clustered environments where visibility of the sky is limited.

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HDOP(Horizontal Dilution of Precision)



The above plot shows that the device has a very good positional accuracy during the whole duration of the drive test. Positional accuracy is determined by the number of satellites being used in the solution and in particular, satellites at low elevation play a significant role in improving positional accuracy. The GeoHelix antenna has a very large 3dB beamwidth and a uniform azimuth plane pattern at low elevation; both of these combinations help to pick up more satellites near the horizon.

5.0 CONCLUSIONS

The integration of GeoHelix-P2 embedded in a Slim line GPS device has been highlighted in this document. Live tests were carried out to determine the performance of the GeoHelix-P2 tightly embedded in the device. Key characteristics to highlight are:

- The Carrier to Noise ratio of the device was consistent throughout the duration of the test with peaks reaching up to 50dBHz.
- The radiation pattern of the GeoHelix-P2 was influenced slightly in the device, but the overall pattern provided very acceptable performance.
- The positional accuracy(HDOP) of the device was continually below 2, even in urban canyons and under dense foliage. This is due to the fact that the GeoHelix-P2 has a large 3dB beamwidth and since the antenna is omni-directional, it has a uniform gain in the azimuth plane.
- They were consistently large number of satellites in view even in clustered urban environments due to the large 3dB beamwidth of the antenna and its omni-directional characteristic.

Overall, the GeoHelix-P2 performed very well embedded in a Slim line GPS device. The device was an example of tight integration since as well as GPS, it had Bluetooth and Wi-fi capabilities. The GeoHelix-P2 allows Slim line GPS devices to be manufactured, providing leading GPS performance.