**TN-I0028**
**MicroStrain Technical Note**

# GPS Antenna Performance Comparison

## Relevant Products

3DM-GX3® -35 Attitude Heading Reference System (AHRS) with GPS
3DM-GX3® -45 GPS-Aided Inertial Navigation System

## Introduction

This is a "real world" test of three GPS antennas for the 3DM-GX3®. Each antenna was plugged into a 3DM-GX3® -35 and placed on wooden table outside with full sky view. Each antenna was tested for speed of acquisition of satellites, DOP data, and GPS Fix quality. In addition, each antenna was evaluated for effect on magnetometer performance.

Three antennas were tested:

- Passive "Geo Helix" antenna commonly used in hand held GPS
- Active miniature patch antenna with cable: GLYN AGG055
- Gilsson standard active patch antenna as shipped standard with MicroStrain products


*Figure 1.*
*Passive Geo Helix, Active Mini Patch, and Active Standard*

## Summary of Results

The best performing antenna, and the antenna used as a reference, was the Gilsson standard active patch antenna. This antenna ships standard with the 3DM-GX3®-35 and -45. A 3D fix using 9 satellites was acquired in under 30 seconds. The next best performing antenna was the passive Geo Helix antenna. This acquired a 3D fix using 6 satellites in under a minute. This antenna caused a slight offset in the magnetic field, causing the magnetometer to be off by several degrees. Using this antenna either directly attached to the sensor or with a short lead cable would require a field calibration of the magnetometer for best performance. The Glyn miniature patch antenna proved to have disappointing performance and took over 6 minutes to acquire a 3D fix using only 3 satellites. The resulting DOP was poor. On the other hand, this antenna appeared to have little effect on the magnetometer which presents the possibility of eliminating the need to field calibrate the magnetometer.

## Summary of Results

### Geo Helix

The Geo Helix antenna performed relatively well – it acquired satellites and a 3D Fix with 6 satellites in under one minute. GPS time was acquired within 20 seconds. DOP data was under 3 seconds. See Figure 2.

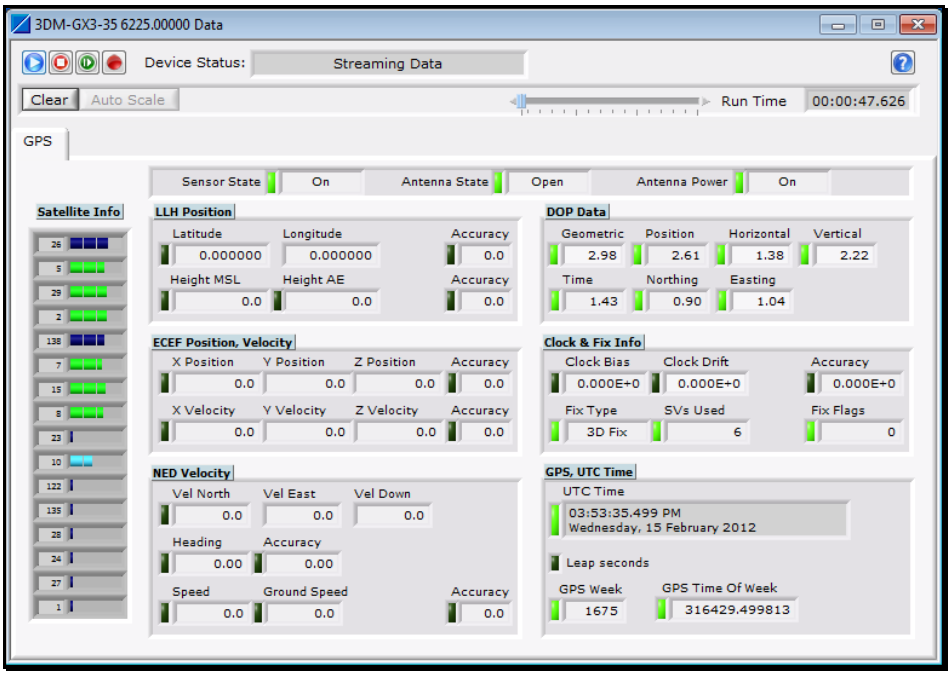


*Figure 2. Screen grab showing Geo Helix GPS data*

The magnetometer was not greatly affected with the antenna in a fixed position about 9" from the sensor. There is a slight offset of the field but no noticeable distortion. See Figure 3.

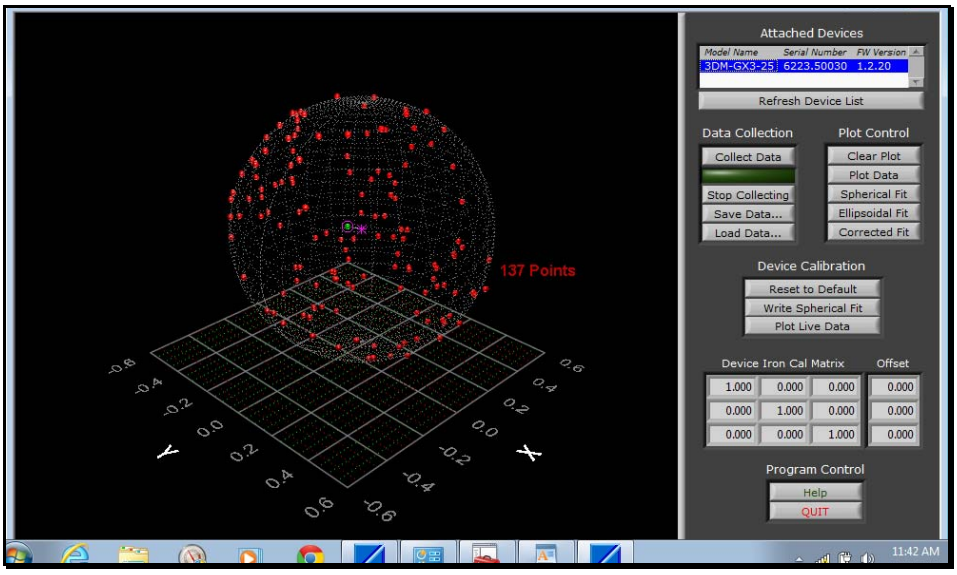


*Figure 3. Screen grab showing Geo Helix hard and soft iron calibration plot*

When the Geo Helix was attached directly to the sensor (no lead cable) the magnetometer showed a slightly larger offset in a different direction. See Figure 4.

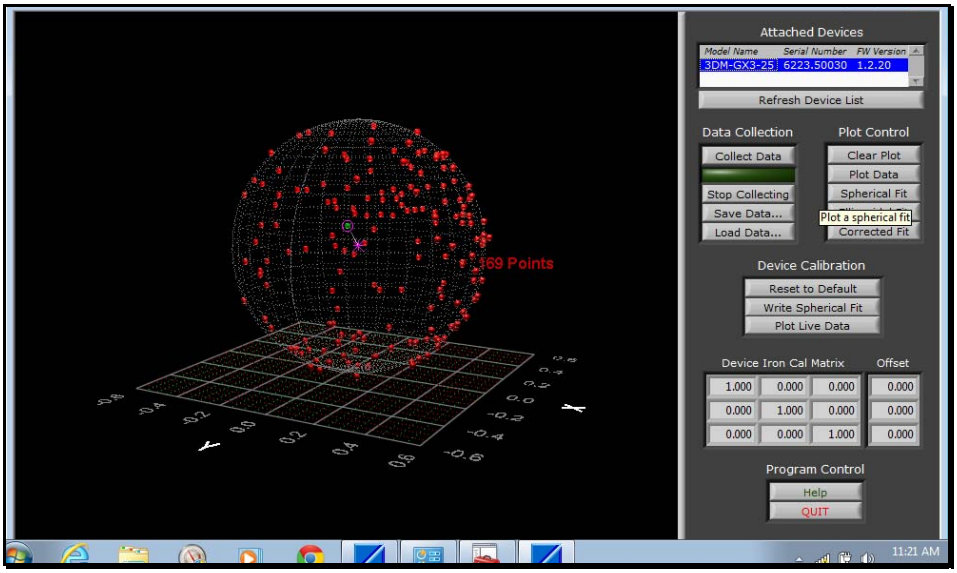


*Figure 4. Screen grab showing Geo Helix hard and soft iron calibration plot*

## GLYN AGG055 Miniature Active patch antenna

This antenna was a little disappointing, as it had trouble acquiring satellites, and did not achieve a satisfactory position fix. It took about 3 minutes before GPS time was valid and another 3 minutes before acquiring a 2D fix and another minute to acquire a 3D fix with only 4 satellites. Two antennas were tested and both provided similar results. Both were tried with and without a large ground plane and again, results were about the same. See Figure 5.

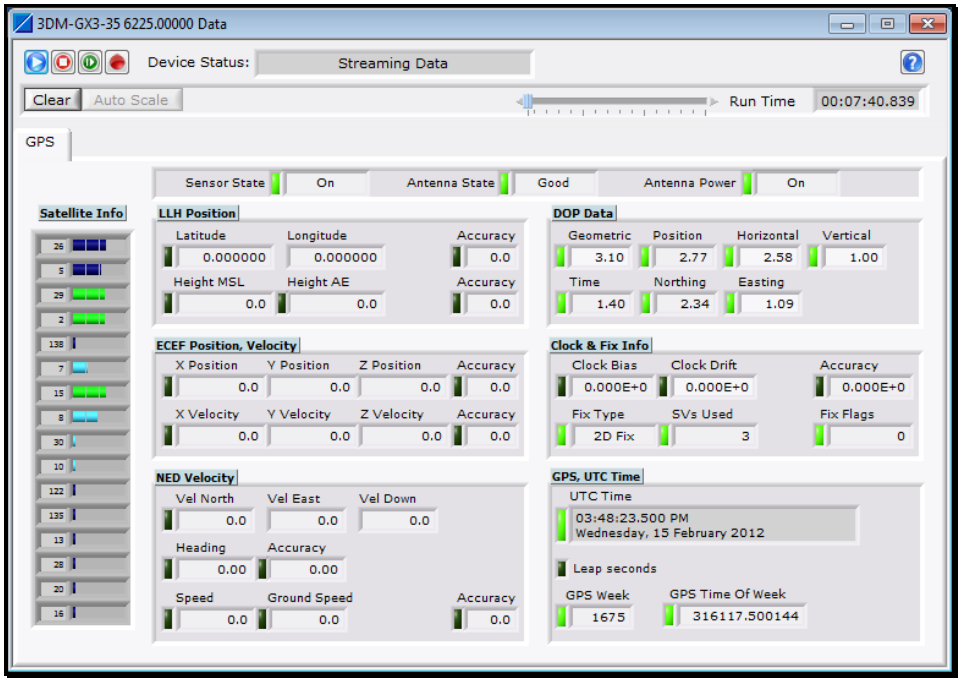


*Figure 5. Screen grab showing GLYN AGG055 GPS data*

On the plus side, these antennas did not seem to affect the magnetometer output noticeably when in a fixed position approximately 4" from the sensor. See Figure 6.

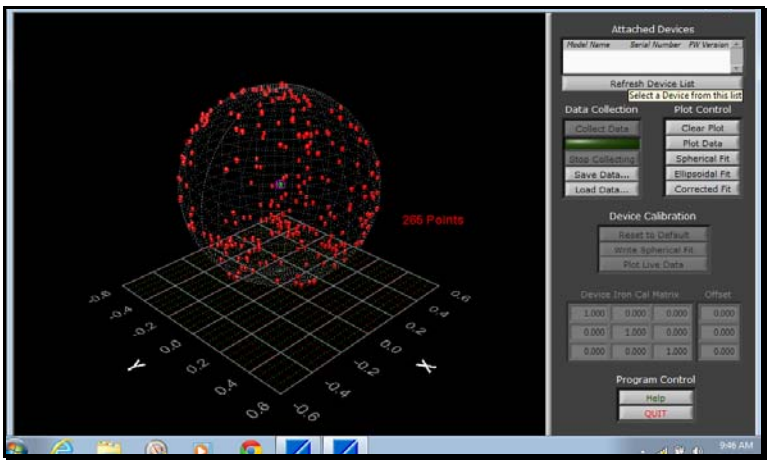


*Figure 6. Screen grab showing GLYN AGG055 hard and soft iron calibration plot*

## Gilsson standard active patch antenna

Not surprisingly, the Gilsson provided the best performance, achieving a 3D fix in under 30 seconds with 9 satellites and DOP close to 1. See Figure 7.

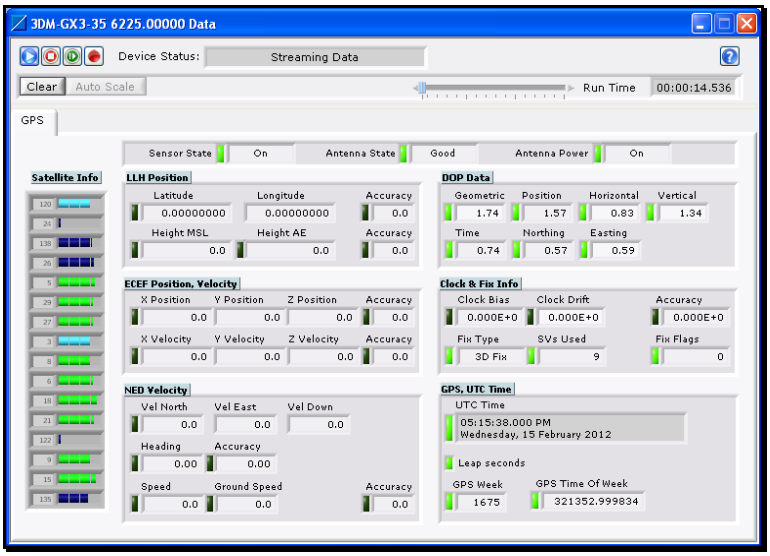


*Figure 7. Screen grab showing Gilsson GPS data*

Magnetometer performance was not evaluated as the Gilsson has a nine foot (3meter) lead cable which allows positioning of the antenna for very little impact on the magnetometer. The lead cable provided with the 3DM-GX3® is non magnetic.

MicroStrain®
MicroStrain, Inc.
459 Hurricane Lane, Unit 102
Williston, VT 05495 USA
www.microstrain.com
ph: 800-449-3878
fax: 802-863-4093
support@microstrain.com


Copyright © 2012 MicroStrain, Inc.

MicroStrain® and 3DM-GX3® are trademarks of MicroStrain, Inc.