G1-m1™ GNSS Mobile System Field Testing - Mobile Case

Figure 1: G1-m1™ Mobile System on a Pole over a GCP

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October 2013

Purpose: This document is for the G1 GNSS system users. It shows the achieved accuracy of the G1-m1™ system data in mobile stop-n-go mode. For instructions on how to acquire the GNSS data, refer to the G1 receiver quick guide. For instructions on how to process the acquired data, refer to the Horus™ software guide.

Requirements: This document presumes that you have at least one G1 GNSS receiver (the rover). Optionally, users can collect correction data on a known base station (the base). Or, you can request to download the correction data from the closest Continuously Operating Reference Station (CORS), as described in the Horus™ software guide.

Note: By GNSS data, we mean raw ranges between the G1 receiver and the respective GPS/GLONASS satellites in the form of C/A code and carrier phase observations. The raw ranges are readily available on a uSD card in the form of a binary data file after a successful data acquisition mission using the G1 receive.

Test Objective

The G1-m1™ receiver has an L1-only GNSS engine. It is capable of acquiring data in static and kinematic positioning modes. This test is to show the achievable positioning accuracy of the G1-m1™ receiver in mobile stop-n-Go mode, i.e. when the receiver roves between survey points with short stops on each of them. The G1-m1™ system used is configured for 1-s interval and GPS-only mode. The antenna used is a G1-A311™ patch with a 3.75" ground plane.

Test Site

The test was conducted in June 2013 at the parking lot of the Santa Fe Community College in Gainesville, FL. The site was chosen because of its relative openness and its suitable satellite visibility, see Figure 2.

Figure 2: Test Site of 70+ GCPs
GCP Marking =>

Reference Ground Control Points (GCPs)

A mesh of 70+ control stations were marked with PK nails and black and white washers on the parking lot asphalt as depicted in Figure 2. They were then surveyed with geodetic-grade receivers by a licensed surveyor. The reference GCPs provide benchmark solution accurate to a few millimeters both horizontally and vertically. *For the purpose of this evaluation,* we shall consider the reference GCPs to be fixed (errorless).

Test Procedures

The G1-m1TM receiver was setup on a 67" survey pole to rove between the GCPs with short stops on each GCP. EVTs were used to identify the GCPs in the G1-m1TM acquired data set. The whole survey was recorded in one session; the test path along with the EVTs at the GCPs are shown in Figure 3. The green color indicates quality 1 solution where the amber color indicates quality 2 solution; the GCPs are marked with their respective numbers.

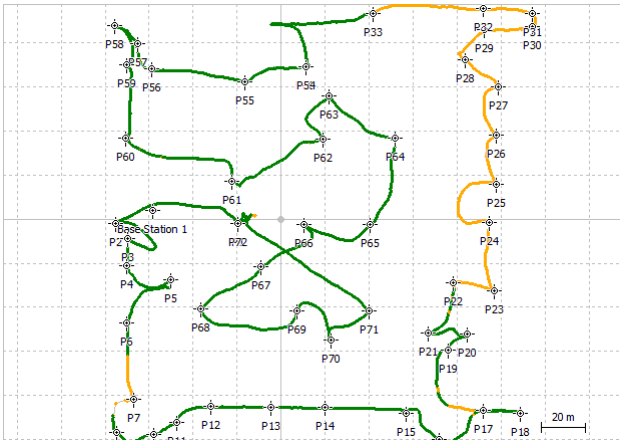

Figure 3: Mobile Test Path

Test Results

Horus™ GNSIS post-mission processing software is used to process the acquired data against the SFe base station data. The coordinates of the 72 GCPs were extracted from the EVT report and compared to the surveyed point values.

Figure 4 shows the individual errors at each GCP, while Table 1 provides a collective error measure for the whole survey. GCPs P22 to P33, the east leg of the survey trajectory (depicted in amber color in Figure 3), have positional quality 2 as estimated by Horus™. This is also confirmed in the calculated actual error in Figure 4; the same repeats at P7, P18, and P59 spikes confirming the reliability of the Horus™ software positional estimates.

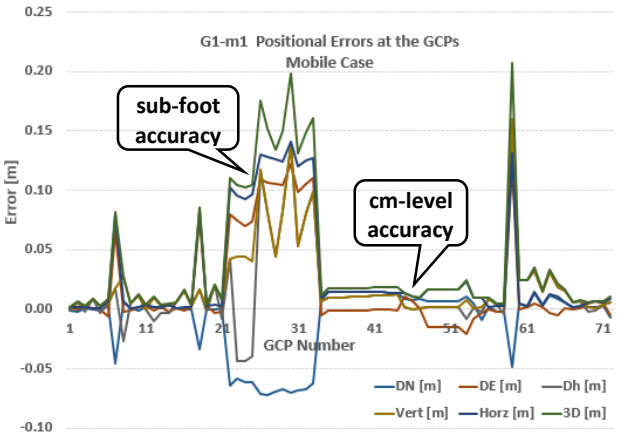

Figure 4: Positional Errors of the G1-m1™ Mobile System

As shown in Table 1, the overall rmse of the 72 GCPs is 0.055 m horizontally and 0.069 m vertically. The maximum recorded error is 0.14 m horizontally and 0.16 vertically, corresponding to about ½ foot.

					Vert	Horz	3D
avg	0.00	-0.010	0.020	0.017	0.023	0.022	0.028
std	0.00	0.029	0.042	0.037	0.033	0.051	0.063
rmse	0.00	**0.031**	**0.046**	**0.040**	**0.040**	**0.055**	**0.069**
pos max		0.014	0.122	0.160	0.160	0.140	0.207
neg max		-0.072	-0.021	-0.044	0.000	0.001	0.002

Table 1: Summary Statistics of the Mobile Test Data Showing cm-level rmse

Conclusion

The results of this test show that cm-level horizontal and vertical positioning accuracy is achievable with the G1-m1™ receiver in mobile mode over short baseline. The test also reveals the system sub-foot positional accuracy potential in the instantaneous (real time) positioning case (e.g. RTK).

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