



DIFFERENTIAL GPS (DGPS) SITE OPERATIONAL ASSESSMENT

NDGPS Site: Tampa, FL DGPS Site (827)
Inspectors: ENS Ryan Quarry & CWO2 Marin Kaczmar
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REFERENCES

- (1) Broadcast Standard for the USCG DGPS Navigation Service, CIM 16577.1 (APR 1993).
- (2) Radio Technical Commission for Maritime Services (RTCM) Recommended Standards for Differential Global Navigation Satellite System (GNSS) Service, Version 2.3.
- (3) Differential Global Positioning System (DGPS) Concept of Operations, COMDTINST 16577.2 (AUG 1995).
- (4) 2014 Federal Radio Navigation Plan.

PURPOSE

- Validate advertised DGPS coverage of the Tampa DGPS site.
- Validate required RTCM message scheduling and delivery.
- Test differential correction accuracy versus a predetermined survey monument.

EQUIPMENT

Trimble SPS461 Receiver
Trimble GA 530 Antenna
Dell Latitude E3620 Laptop

TAMPA DGPS SITE PARAMETERS

Frequency	312 KHz
Forward Output Power	1500 W
Transmission Rate	200 baud
Field Strength/Range	100 μ V/m (37.5 dB μ V/m) at 389 km

SUMMARY

The Operational Assessment of the Tampa Differential Global Positioning System (DGPS) site revealed that the provided coverage is consistent with the predicted coverage area, but not the advertised range. The signal strength measurements, within the advertised range were satisfactory, with the exception of some signal attenuation to the northeast. Both northern and southern far-field signal strength readings were within the required signal strength. Additionally, a review of the output/reflected power and near-field signal strength levels was conducted and found to be satisfactory. All RTCM messages were verified, evaluated and are consistent with the requirements set forth by references (1) and (2). Finally, accuracy measurements and analysis showed that at a distance of approximately 417 km from the broadcast site, the horizontal accuracy is sub-meter and within the 10 meter accuracy requirement as set forth by Reference (3) and (4).

RESULTS

Signal Strength

A verification of the DGPS coverage area was conducted from Panama City, FL, around the Florida peninsula, and ending in Jacksonville FL. A waterborne assessment of Tampa Bay and Port Tampa was also performed to verify coverage in high vessel traffic areas. The advertised signal strength range is 389 km. Figure 1 below displays adequate signal strength throughout the predicted coverage area, but not the advertised range. Green points represent areas of signal strength above 40 dB μ V/m, whereas areas between 40 and 37.5 dB μ V/m are represented with orange points. Areas where a DGPS signal lock was unable to be obtained are represented in red. As seen in Table 1, a far-field signal strength reading was taken at a northwestern point very close to the advertised range. The northwest far field measurement was at 40 dB μ V/m signal strength on both Tampa DGPS site equipment sides.

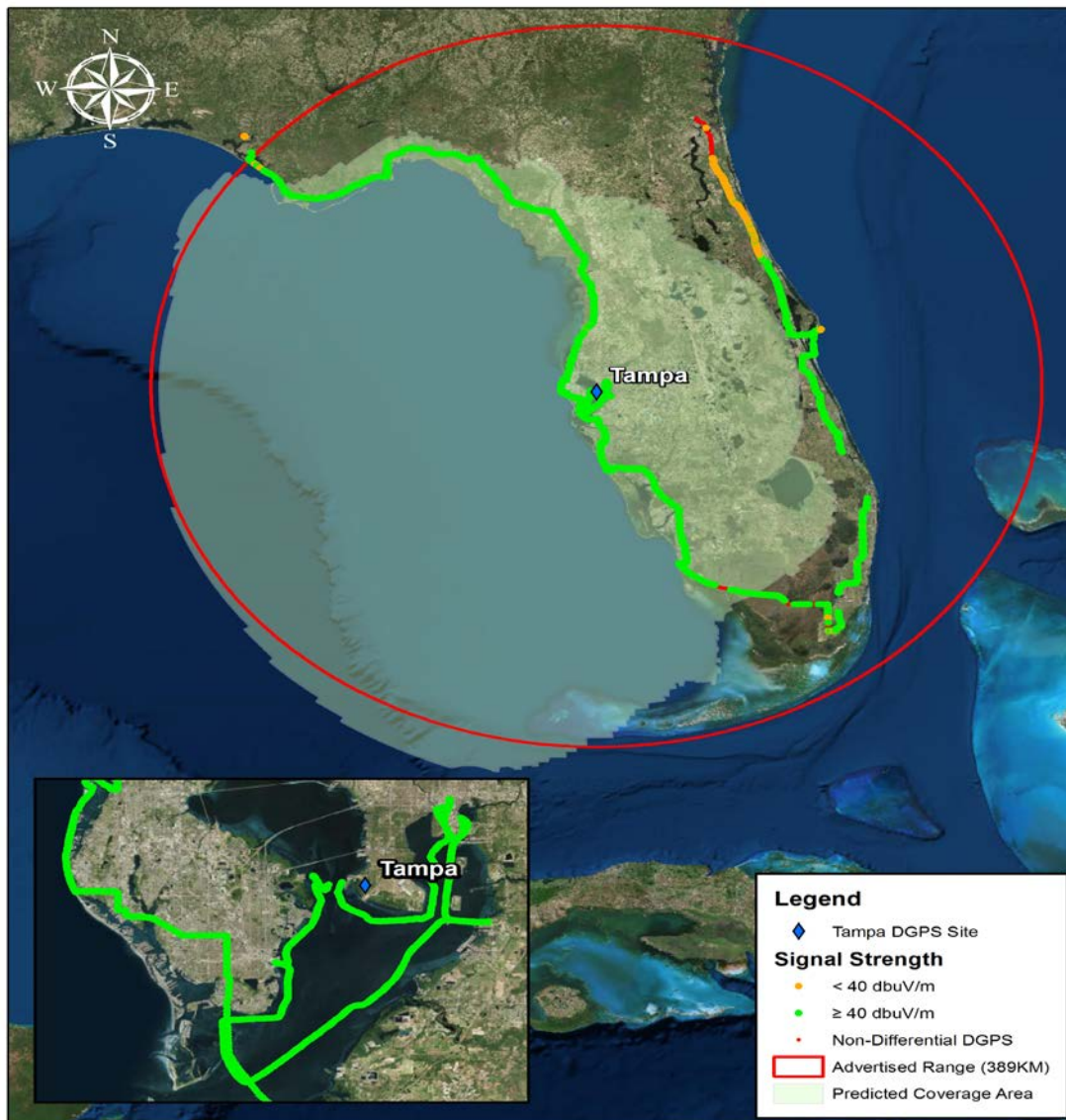


Figure 1: Signal Strength Results

Side	Signal Strength	Signal to Noise ratio	Position
A	37.5 dB μ V/m	16 dB μ V/m	30° 19' 43.32203''N, 85° 45' 46.18020''W
B	37.5 dB μ V/m	15 dB μ V/m	

Table 1: North Far-Field Signal Strength Reading

Accuracy Validation

Positional data was collected for 10 minutes per side using the Trimble SPS461. The data was then post processed and compared to a National Geodetic Survey (NGS) marker to verify the horizontal accuracy of the broadcast correction (Table 4 and 5). Side A was 0.5261 meters, bearing 102.83333° from the monument while Side B was 0.1889 meters, bearing 2.896667° from the monument. As per references (3) and (4), both respective distances were within advertised accuracy requirements. A comparison between the GPS satellites in view at the Tampa DGPS site and at the NGS monument location was conducted (Table 6) to identify any differences in the GPS satellite geometry used at the respective locations; any differences in geometry could lead to accuracy discrepancies. In this case, the satellites being tracked by the Reference Station and Integrity Monitor GPS receivers at the site were almost identical to those tracked at the NGS monument location. A two dimension radial review of the same time period was completed for the integrity monitors. Side A's average deviation was 0.06346 meters; Side B's average deviation was 0.06616 meters. Both findings were consistent with the findings observed in the field and are within system parameters.

NGS Monument ID:	BE2980
Monument LAT:	30° 19' 43.32303'' N
Monument LON:	85° 45' 46.18020'' W
Distance from DGPS Site	417.7 km

Table 3: NGS Monument ID

Averaged LAT:	30° 19' 43.319377'' N
Averaged LON:	085° 45' 46.160924'' W
Distance from Monument:	0.5261 m (1.726046 ft)
Bearing from Monument:	102.83333°

Table 4: Side A Accuracy Check Results

Averaged LAT:	30° 19' 43.329137'' N
Averaged LON:	85 ° 45' 46.179842'' W
Distance from Monument:	0.1889 m (0.619749 ft)
Bearing from Monument:	2.896667°

Table 5: Side B Accuracy Check Results

<i>Antenna Location</i>	<i>GPS Satellites Tracked (PRN)</i>										
Reference Station A	2	3	6	17	19	24	28				
Integrity Monitor A	2	3	6	17	19	24	28				
Reference Station B	2	3	6	12	17	19	24	28			
Integrity Monitor B	2	3	6	12	17	19	24	28			
NGS Monument Location, Side A	2	6	17	19	24	28					
NGS Monument Location, Side B	2	3	6	17	19	24	28				

Table 6: GPS Satellite Comparison

RECOMMENDATION

No changes recommended

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