



DIFFERENTIAL GPS (DGPS) SITE OPERATIONAL ASSESSMENT

NDGPS Site: Millers Ferry, AL DGPS Site (865)
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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 Millers Ferry 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

MILLERS FERRY DGPS SITE PARAMETERS

Frequency	320 KHz
Forward Output Power	900 W
Transmission Rate	200 BPS
Field Strength/Range	100 μ V/m (40 dB μ V/m) at 241 km

SUMMARY

The Operational Assessment of the Millers Ferry Differential Global Positioning System (DGPS) site revealed that the provided coverage is not consistent with the advertised range. The signal strength measurements, within the advertised range were not satisfactory. The northern far-field signal strength reading was below the required signal strength, while the southern far-field signal strength reading was 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 Reference (1) and (2). Finally, accuracy measurements and analysis proved that at a distance of approximately 103 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 Millers Ferry DGPS coverage area was conducted from New Orleans, LA to Mobile Bay, AL, then turning north along the Alabama River ending in Birmingham, AL. The advertised signal strength range is 241 km. Figure 1 below displays inadequate signal strength, short of the advertised range of 241 km from the site and throughout the predicted coverage area. Green points represent areas of signal strength above 40 dB μ V/m, whereas areas below 40 dB μ V/m are represented in yellow. Areas where a DGPS fix was unable to be obtained are represented in red. As seen in Table 1 and Table 2, far-field signal strength readings were taken at northern and southern points of the advertised range from both sides of the site. The northern far-field readings were below the required 40 dB μ V/m, while southern far-field readings were at the required 40 dB μ V/m signal strength on both sides.

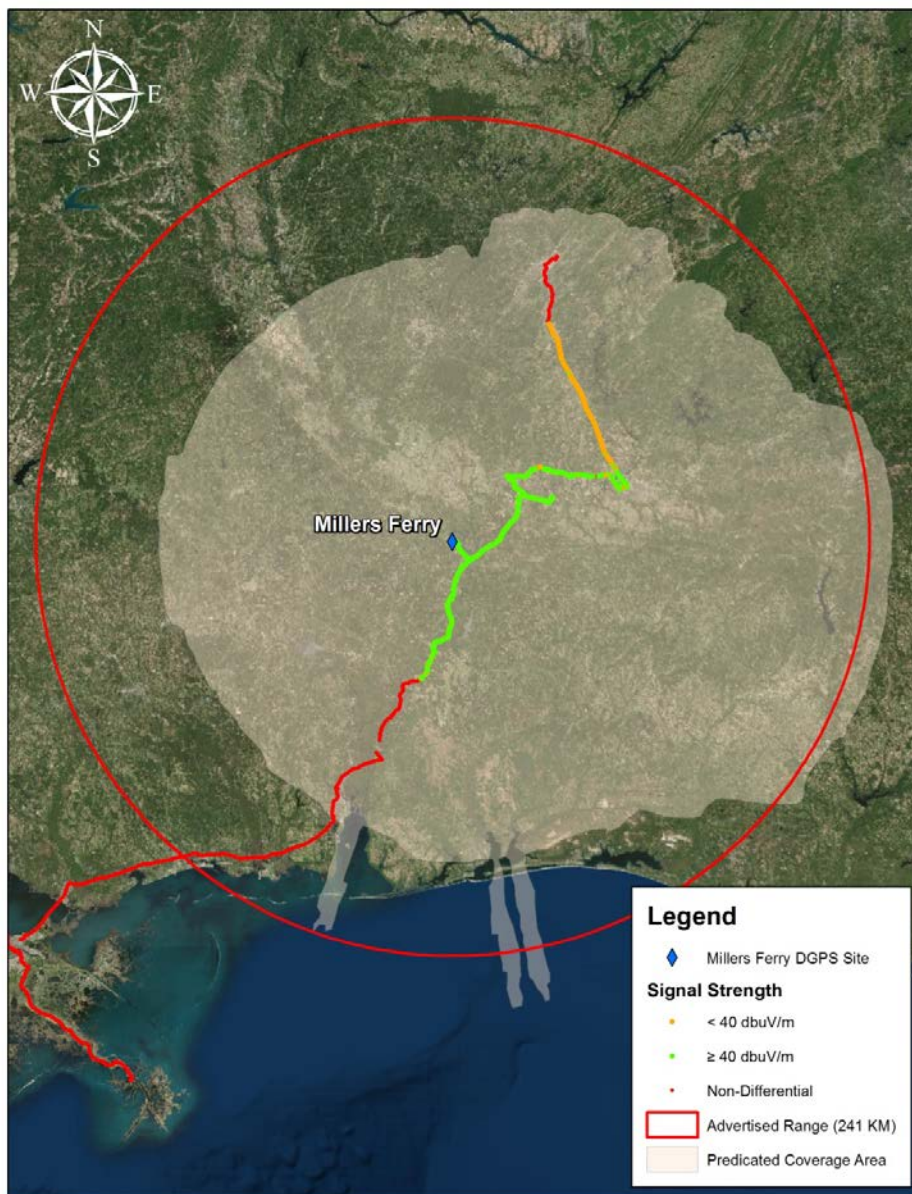


Figure 1: Signal Strength Results

Side	Signal Strength	Signal to Noise ratio	Position
A	31 dB μ V/m	3 dB μ V/m	33° 32' 35.58"N, 086° 45' 36.73"W
B			

Table 1: North Far-Field Signal Strength Reading

Side	Signal Strength	Signal to Noise ratio	Position
A	40 dB μ V/m	9 dB μ V/m	31° 22' 58.80"N, 087° 34' 39.60"W
B			

Table 2: South Far-Field Signal Strength Reading

Accuracy Validation

Positional data was collected for 15 minutes using the Trimble SPS461 on 11 November 2016. 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). Side A was 0.348 meters, bearing 143.9725° from the monument. As per Reference (3) and (4), this distance is within advertised accuracy requirements. A comparison between the GPS satellites in view at the Millers Ferry DGPS site and at the NGS monument location was conducted (Table 5) 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 included 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 0.13061 meters; which is consistent with the findings observed in the field and are within system parameters.

NGS Monument ID:	BBCZ87
Monument LAT:	32° 22' 52.67183" N
Monument LON:	086° 21' 15.62494" W
Distance from DGPS Site	103 km

Table 3: NGS Monument ID

Averaged LAT:	32° 22' 52.6683" N
Averaged LON:	086° 21' 15.6219" W
Averaged HDOP:	2.1
Distance from Monument:	0.1348 m (0.4423 ft)
Bearing from Monument:	143.9725°

Table 4: Side A Accuracy Check Results

<i>Antenna Location</i>	<i>GPS Satellites Tracked (PRN)</i>										
Reference Station A	2	5	6	9	12	17	19	25			
Integrity Monitor A	2	5	6	9	12	17	19	24	25		
Reference Station B											
Integrity Monitor B											
NGS Monument Location, Side A	2	5	12	17	19						
NGS Monument Location, Side B											

Table 5: GPS Satellite Comparison

Discrepancies

Due to time constraints the NGS Monument used for the Accuracy Validation was not an ideal site; the eastern sky was partially blocked by a building. This resulted in the limited satellites for comparison and HDOP of 2.1. Due to a Reference Station B failure, data was only able to be collected for side A.

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