



DIFFERENTIAL GPS (DGPS) SITE OPERATIONAL ASSESSMENT

NDGPS Site: Millers Ferry DGPS Site (865)
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REFERENCES:

- (1) DGPS Concept of Operations, COMDTINST 16577.2 (AUG 1995)
- (2) 2010 Federal Radio Navigation Plan
- (3) Broadcast Standard for the USCG DGPS Navigation Service, CIM 16577.1 (APR 1993).
- (4) RTCM Recommend Standards for Differential GNSS Service, Version 2.3.

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

MILLERS FERRY DGPS SITE PARAMETERS:

Frequency	320 KHz
Forward Output Power	900 W
Transmission Rate	200 baud
Field Strength/Range	100 μ V/m (40.0 dB μ V/m) at 241 km

RESULTS:

Signal Strength:

A verification of the Millers Ferry DGPS coverage area was conducted from Panama City Beach, FL to Pensacola, FL then north to the Hackleburg DGPS site. The advertised signal strength range is 241 km. Figure 1 below displays inadequate signal strength, throughout the advertised and predicted coverage area. Green points represent areas of satisfactory signal strength. Areas of unsatisfactory signal strength are represented with red points. Far-field (FF) signal strength readings taken at points on the northern and southern advertised range ring (Table 1 and Table 2) did not meet the required 40.0 dB μ V/m signal strength on both side A and B.

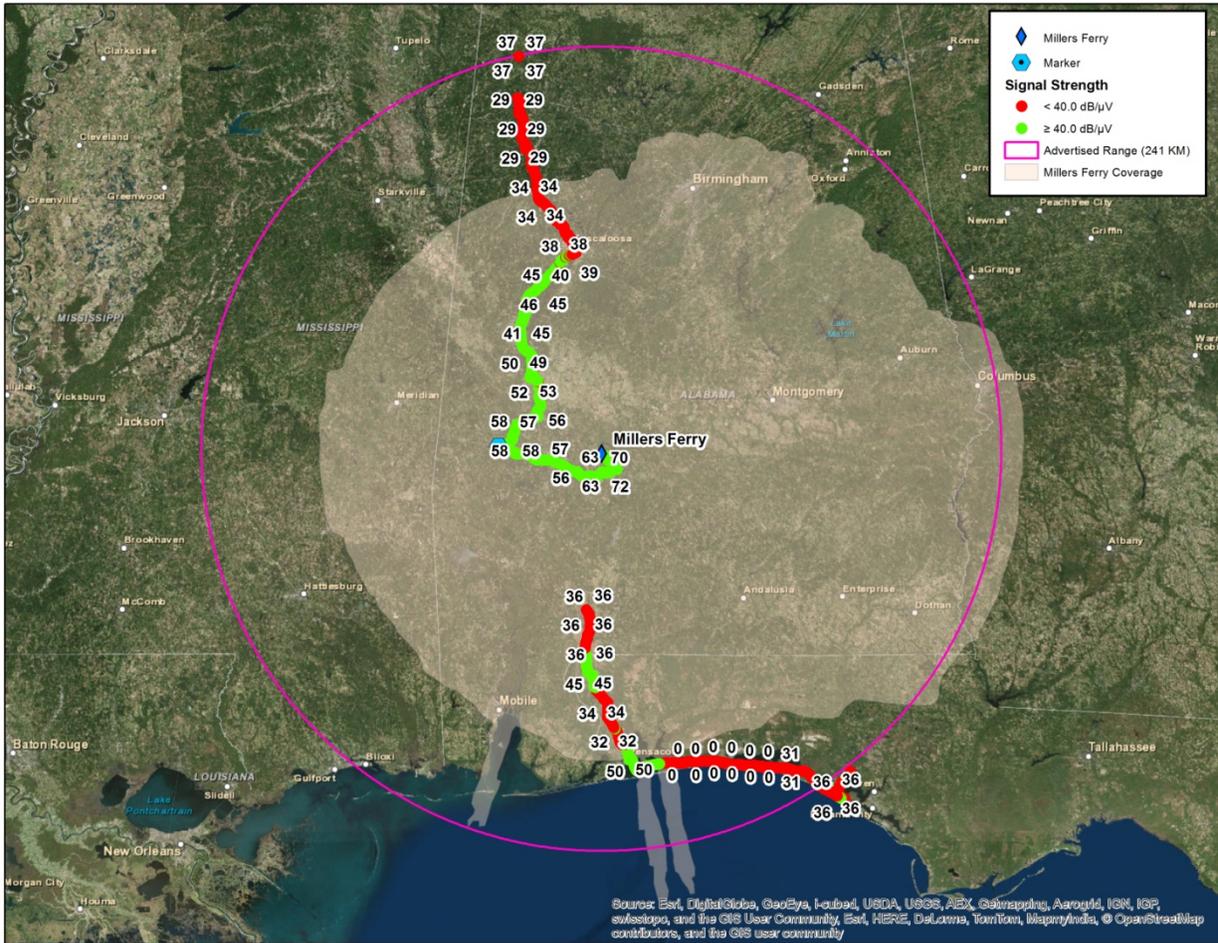


Figure 1: DNAV Signal Strength Results

Side	Signal Strength	Signal to Noise ratio	Position
A	30 dB μ V/m	03 dB μ V/m	31° 16.673845' N, 086° 0.416835' W
B	31 dB μ V/m	03 dB μ V/m	

Table 1: South Far-Field Signal Strength Reading

Side	Signal Strength	Signal to Noise ratio	Position
A	25 dB μ V/m	02 dB μ V/m	34° 12.650046' N, 087° 55.091802' W
B	25 dB μ V/m	02 dB μ V/m	

Table 2: North Far-Field Signal Strength Reading

RTCM Message Verification:

RTCM message scheduling, receipt, and content were checked during the assessment (Table 3 and 4). RTCM message scheduling on both Side A and Side B was validated with the DGPS watch and is in accordance with the Reference (3). Receipt of all RTCM messages was validated utilizing a Remote Desktop session whereby the assessment team witnessed the on-time receipt of all messages on the side B Integrity Monitor. All message content was verified and is in accordance with Reference (4) with the exception of the Eglin site location in the Type 7 message. **The position provided is .30 km greater in longitude then allowed.**

Message Type	Received	Scheduled	Content Verified/Accurate
Type 3	Y	Y	Y
Type 5 (ensure message is not being transmitted)	N	N	N/A
Type 7	Y	Y	N
Type 9	Y	Y	Y
Type 16	Y	Y	Y

Table 3: Side A RTCM Message Validation

Message Type	Received	Scheduled	Content Verified/Accurate
Type 3	Y	Y	Y
Type 5 (ensure message is not being transmitted)	N	N	N/A
Type 7	Y	Y	N
Type 9	Y	Y	Y
Type 16	Y	Y	Y

Table 4: Side B RTCM Message Validation

Accuracy Validation:

The OA team placed a Trimble GA 530 antennae atop of a National Geodetic Survey (NGS) marker and collected positional data for 10 minutes per side. Next, they post processed and compared the data to the published survey marker position in order to verify the horizontal accuracy of the broadcast correction (Table 5 and 6). Side A broadcasted a correction that was calculated to be 0.2446 meters away from the monument, bearing 298.0°. Side B’s correction was calculated to be 0.3288 meters away from the monument, bearing 205.8°. As per Reference (1) and (2), both respective distances were well within advertised accuracy requirements.

The OA team conducted a comparison (Table 7) between the GPS satellites in view at the Millers Ferry DGPS site and at the NGS monument location to identify any differences in the GPS satellite geometry used at the respective locations; any differences in geometry could lead to accuracy discrepancies. The satellites tracked by the RS and IM GPS receivers were identical at both locations.

A two dimension radial review of the same time period was completed for the integrity monitors. Side A’s average deviation was 0.12838 meters; Side B’s average deviation was 0.12331 meters. Both findings were consistent with the findings observed in the field and are well within system parameters.

NGS Monument ID:	BBBR32
Monument LAT:	32° 07’ 48.28544’’ N
Monument LON:	088° 02’ 41.68154’’ W
Distance from DGPS Site	61.7 km

Averaged LAT:	32° 07' 48.289163" N
Averaged LON:	-088° 02' 41.689795" W
Antenna Distance from Monument:	0.2446 m (0.802492 ft)
Antenna Bearing from Monument:	298.0°

Table 5: Side A Accuracy Check Results

Averaged LAT:	32° 07' 48.275858" N
Averaged LON:	-88 ° 02' 41.687019" W
Distance from Monument:	0.3288 m (1.078738 ft)
Bearing from Monument:	205.8°

Table 6: Side B Accuracy Check Results

<i>Antenna Location</i>	<i>GPS Satellites Tracked (PRN)</i>											
Reference Station A	1	3	7	8	11	13	17	19	26	28	30	
Integrity Monitor A	1	3	7	8	11	13	17	19	26	28	30	
Reference Station B	1	3	7	8	11	13	17	19	26	28	30	
Integrity Monitor B	1	3	7	8	11	13	17	19	26	28	30	
NGS Monument Location, Side A	1	3	7	8	11	13	17	19	26	28	30	
NGS Monument Location, Side B	1	3	7	8	11	13	17	19	26	28	30	

Table 7: GPS Satellite Comparison

SUMMARY:

The Operational Assessment of the Millers Ferry DGPS site revealed that the provided coverage does not meet with the predicted coverage plot or the advertised range. Far-Field signal strength readings taken at both the northern and southern range rings and were significantly lower than the requirements set in reference (3). 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 and evaluated and are consistent with the requirements set forth by reference (3) and (4) except as noted above in the Type 7 message content for the Eglin DGPS site. Finally, accuracy measurements taken at distance of 61.7 km from the broadcast site displayed sub-meter horizontal accuracy and are well within the accuracy requirements set forth by Reference (1) and (2).