



## DIFFERENTIAL GPS (DGPS) SITE OPERATIONAL ASSESSMENT

**NDGPS Site:** Angleton, TX DGPS Site (828)  
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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 Angleton 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

### ANGLETON DGPS SITE PARAMETERS

Frequency	301 KHz
Forward Output Power	750 W
Transmission Rate	100 BPS
Field Strength/Range	75 $\mu$ V/m (37.5 dB $\mu$ V/m) at 275 km

### SUMMARY

The Operational Assessment of the Angleton Differential Global Positioning System (DGPS) site revealed that the provided coverage exceeds the advertised range. The signal strength measurements, within the advertised range were satisfactory. Both eastern and western 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 reference (1) and (2). Finally, accuracy measurements and analysis proved that at a distance of approximately 54 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 Angleton DGPS coverage area was conducted from New Orleans, LA, along the coast of the Gulf of Mexico, to Brownsville, TX. The advertised signal strength range is 275 km. Figure 1 below displays adequate signal strength, beyond the advertised range of 275 km from the site and throughout the predicted coverage area. Green points represent areas of signal strength above 37.5 dBμV/m, whereas areas below 37.5 dBμV/m are represented with yellow points. Areas where a DGPS fix was unable to be obtained are represented in red. The red area in the eastern portion of Figure 1 was while the team was traveling through a heavy industry area with many high-power overhead wires. The Signal to Noise Ratio on the receiver dramatically dropped/raised when entering/exiting the area. As seen in Table 1 and Table 2, far-field signal strength readings were taken at eastern and western points outside of the advertised range from both sides of the site. Both eastern and western far-field readings were above the required 37.5 dBμV/m signal strength on both sides.



Figure 1: Signal Strength Results

Side	Signal Strength	Signal to Noise ratio	Position
A	43 dB $\mu$ V/m	16 dB $\mu$ V/m	29° 58' 56.73"N, 090° 15' 38.37"W
B	42 dB $\mu$ V/m	15 dB $\mu$ V/m	

Table 1: East Far-Field Signal Strength Reading

Side	Signal Strength	Signal to Noise ratio	Position
A	49 dB $\mu$ V/m	24 dB $\mu$ V/m	25° 59' 48.41"N, 097° 09' 02.41"W
B	49 dB $\mu$ V/m	22 dB $\mu$ V/m	

Table 2: West Far-Field Signal Strength Reading

### ***Accuracy Validation***

Positional data was collected for 15 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 0.2255 meters, bearing 164.3781° from the monument while Side B was 0.1045 meters, bearing 027.5589° from the monument. As per Reference (3) and (4), both respective distances were within advertised accuracy requirements. A comparison between the GPS satellites in view at the Angleton 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 similar 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 0.09163 meters; Side B's average deviation was 0.08308 meters. Both findings were consistent with the findings observed in the field and are within system parameters.

<b>NGS Monument ID:</b>	<b>AW5664</b>
Monument LAT:	29° 33' 56.09957" N
Monument LON:	095° 01' 15.08154" W
Distance from DGPS Site	54 km

Table 3: NGS Monument ID

<b>Averaged LAT:</b>	29° 33' 56.1066" N
<b>Averaged LON:</b>	095° 01' 15.0838" W
<b>Distance from Monument:</b>	0.2255 m (0.7398 ft)
<b>Bearing from Monument:</b>	164.3781°

Table 4: Side A Accuracy Check Results

<b>Averaged LAT:</b>	29° 33' 56.1096" N
<b>Averaged LON:</b>	095 ° 01' 15.0820" W
<b>Distance from Monument:</b>	0.1045 m (0.3429 ft)
<b>Bearing from Monument:</b>	027.5589°

Table 5: Side B Accuracy Check Results

<i>Antenna Location</i>	<i>GPS Satellites Tracked (PRN)</i>										
Reference Station A	1	7	11	13	17	19	28	30			
Integrity Monitor A	1	7	11	13	17	19	28	20			
Reference Station B	3	7	8	9	11	16	23	27	28	30	
Integrity Monitor B	3	7	8	9	11	16	23	27	28	30	
NGS Monument Location, Side A	7	8	9	11	16	23	27	28	30		
NGS Monument Location, Side B	7	8	9	11	16	23	27	28	30		

Table 6: GPS Satellite Comparison

**RECOMMENDATION**

No changes recommended.

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