



DIFFERENTIAL GPS (DGPS) SITE OPERATIONAL ASSESSMENT

NDGPS Site: Whidbey Island, WA DGPS Site (888)
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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 Whidbey Island 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

WHIDBEY ISLAND DGPS SITE PARAMETERS

Frequency	302 KHz
Forward Output Power	250 W
Transmission Rate	100 BPS
Field Strength/Range	75 μ V/m (37.5 dB μ V/m) at 166 km

SUMMARY

The Operational Assessment of the Whidbey Island Differential Global Positioning System (DGPS) site revealed that the provided coverage is consistent with the advertised range. The signal strength measurements, within the advertised range were satisfactory, though there was some terrestrial masking to the southwest. Both northern 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 24 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 Whidbey Island DGPS coverage area was conducted via a circuitous route around Puget Sound. The advertised signal strength range is 166 km. Figure 1 below displays adequate signal strength on and around the Puget Sound, with terrestrial masking limiting the signal strength to the southwestern region of the route. Green points represent areas of signal strength above 37.5 dB μ V/m, whereas areas below 37.5 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 western points of the advertised range from both sides of the site. Both northern and western far-field readings were above the required 37.5 dB μ V/m signal strength on both sides.



Figure 1: Signal Strength Results

Side	Signal Strength	Signal to Noise ratio	Position
A	55 dB μ V/m	31 dB μ V/m	48° 59' 26.60"N, 122° 46' 20.99" W
B	55 dB μ V/m	34 dB μ V/m	

Table 1: North Far-Field Signal Strength Reading

Side	Signal Strength	Signal to Noise ratio	Position
A	54 dB μ V/m	26 dB μ V/m	48° 21' 32.47"N, 124° 33' 19.19"W
B	53 dB μ V/m	28 dB μ V/m	

Table 2: West 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 0.1083 meters, bearing 061.1808° from the monument while Side B was 0.22339 meters, bearing 117.6611° 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 Whidbey Island 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 0.08901 meters; Side B's average deviation was 0.09437 meters. Both findings were consistent with the findings observed in the field and are within system parameters.

NGS Monument ID:	BBBG19
Monument LAT:	48° 06' 21.41299" N
Monument LON:	122° 46' 43.94540" W
Distance from DGPS Site	24 km

Table 3: NGS Monument ID

Averaged LAT:	48° 06' 21.4113" N
Averaged LON:	122° 46' 43.9500" W
Distance from Monument:	0.1083 m (0.3553 ft)
Bearing from Monument:	061.1808°

Table 4: Side A Accuracy Check Results

Averaged LAT:	48° 06' 21.4146" N
Averaged LON:	122° 46' 43.9500" W
Distance from Monument:	0.1071 m (0.3514 ft)
Bearing from Monument:	117.6611°

Table 5: Side B Accuracy Check Results

<i>Antenna Location</i>	<i>GPS Satellites Tracked (PRN)</i>										
Reference Station A	2	6	12	14	17	19	24	25	29		
Integrity Monitor A	2	6	12	14	17	19	24	25	29		
Reference Station B	2	6	12	17	19	24	25	29			
Integrity Monitor B	2	6	12	17	19	24	25	29			
NGS Monument Location, Side A	2	6	12	17	19	24	25	29			
NGS Monument Location, Side B	2	6	12	19	24	25	29				

Table 6: GPS Satellite Comparison

RECOMMENDATION

No changes recommended.

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