



DIFFERENTIAL GPS (DGPS) SITE OPERATIONAL ASSESSMENT

NDGPS Site: Point Loma, CA DGPS Site (881)
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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 Point Loma 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

POINT LOMA DGPS SITE PARAMETERS

Frequency	302 KHz
Forward Output Power	400 W
Transmission Rate	100 BPS
Field Strength/Range	75 μ V/m (37.5 dB μ V/m) at 333 km

SUMMARY

The Operational Assessment of the Point Loma 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. The northern 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 277 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 Point Loma DGPS coverage area was conducted along a coastal route from San Diego, CA to Santa Maria, CA. The advertised signal strength range is 333 km. Figure 1 below displays adequate signal strength, beyond the advertised range and throughout the predicted coverage area. 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, a far-field signal strength reading was taken at northern points of the advertised range from both sides of the site. The far-field reading was above the required 37.5 dB μ V/m signal strength on both sides.

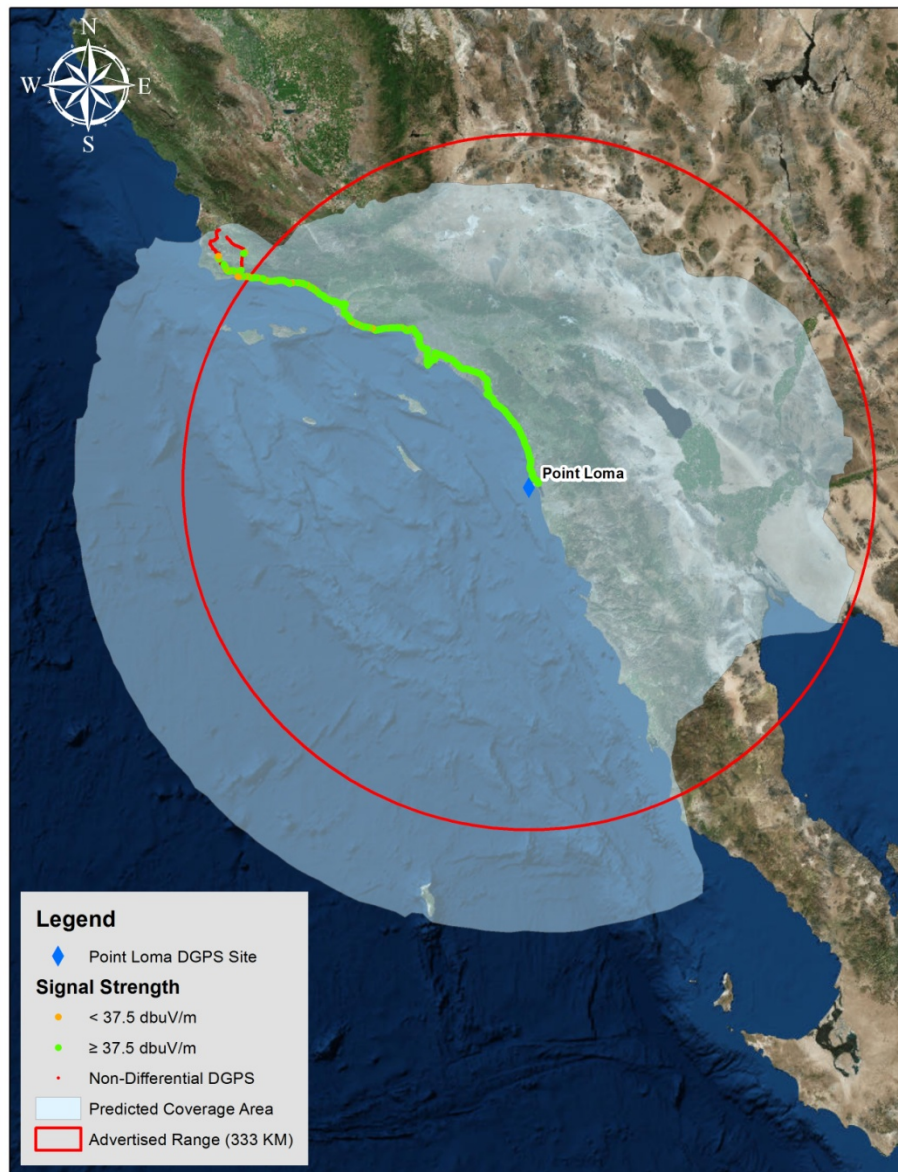


Figure 1: Signal Strength Results

Side	Signal Strength	Signal to Noise ratio	Position
A	40 dB μ V/m	12.0 dB μ V/m	34° 28' 16.45"N, 120° 13' 40.94"W
B	40 dB μ V/m	12.0 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 on 8 December 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 and 5). Side A was 0.6166 meters, bearing 312.0539° from the monument while Side B was 0.5214 meters, bearing 117.4828° 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 Point Loma 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 0.09521 meters; Side B's average deviation was 0.09513 meters. Both findings were consistent with the findings observed in the field and are within system parameters.

NGS Monument ID:	EW6804
Monument LAT:	34° 21' 20.41926"N
Monument LON:	119° 26' 30.82042"W
Distance from DGPS Site	277 km

Table 3: NGS Monument ID

Averaged LAT:	34° 21' 20.40336" N
Averaged LON:	119° 26' 30.80580" W
Averaged HDOP:	1.1
Distance from Monument:	0.6166 m (2.02296 ft)
Bearing from Monument:	312.0539°

Table 4: Side A Accuracy Check Results

Averaged LAT:	34° 21' 20.42705" N
Averaged LON:	119° 26' 30.83856" W
Averaged HDOP:	1.1
Distance from Monument:	0.5214 m (1.71062 ft)
Bearing from Monument:	117.4828°

Table 5: Side B Accuracy Check Results

<i>Antenna Location</i>	<i>GPS Satellites Tracked (PRN)</i>										
Reference Station A	10	13	15	16	18	20	21	25	26	29	
Integrity Monitor A	10	13	15	16	18	20	21	25	26	29	
Reference Station B	10	13	15	16	18	20	21	26	27	29	
Integrity Monitor B	10	13	15	16	18	20	21	26	27	29	
NGS Monument Location, Side A	10	13	15	16	18	20	21	26	29		
NGS Monument Location, Side B	10	13	15	16	18	20	21	26	29		

Table 6: GPS Satellite Comparison

RECOMMENDATION

No changes recommended.

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