



DGPS SITE OPERATIONAL ASSESSMENT

NDGPS Site: *Wisconsin Point (830)*
Inspector(s): CWO3 William Iozzino, CWO3 Luisito Baytan
Date: 07AUG12

PURPOSE:

- Validate advertised DGPS coverage of the Wisconsin Point DGPS site.
- Validate required RTCM message delivery.
- Test differential correction accuracy versus a predetermined survey monument.

REFERENCE: (1) DGPS Concept of Operations, COMDTINST 16577.2 (AUG 1995).
(2) Broadcast Standard for the USCG DGPS Navigation Service, COMDTINST M1677.1 (APR 1993).
(3) RTCM Recommend Standards for Differential GNSS Service, Version 2.3.

EQUIPMENT: Starlink DNAV -212 DGPS Receiver
Raven MBA-2 Receive Antenna
Hemisphere R110 USB DGPS Receiver

PARAMETERS:

Frequency	296 kHz
Forward Output Power	900 W
Transmission Rate	100 baud
Field Strength/Range	75 μ V/m (37.5dB μ V/m) at 270 km

RESULTS

Signal Strength:

A verification of the Wisconsin Point Differential GPS (DGPS) coverage area was conducted from Marquette, MI to the site, then west along the southern shore of Lake Superior to Duluth, MN, and lastly north to the Canadian border along the western shore of Lake Superior. The advertised coverage area is 270 KM from the site. Figure 1 displays adequate signal strength along the west coast of Lake Superior from the Canadian border into Duluth, MN and east to Marquette, MI. Unsatisfactory coverage was observed from Upper Keweenaw south along the advertised range ring. Green points represent areas of satisfactory signal strength. Areas of unsatisfactory signal strength are represented with red points. Far-field (FF) signal strength readings were taken on the advertised range ring in the L' Anse Bay region and at the Canadian

border. Satisfactory readings were observed on the Canadian border while negative results were observed in the L' Anse Bay region (Table 1-).

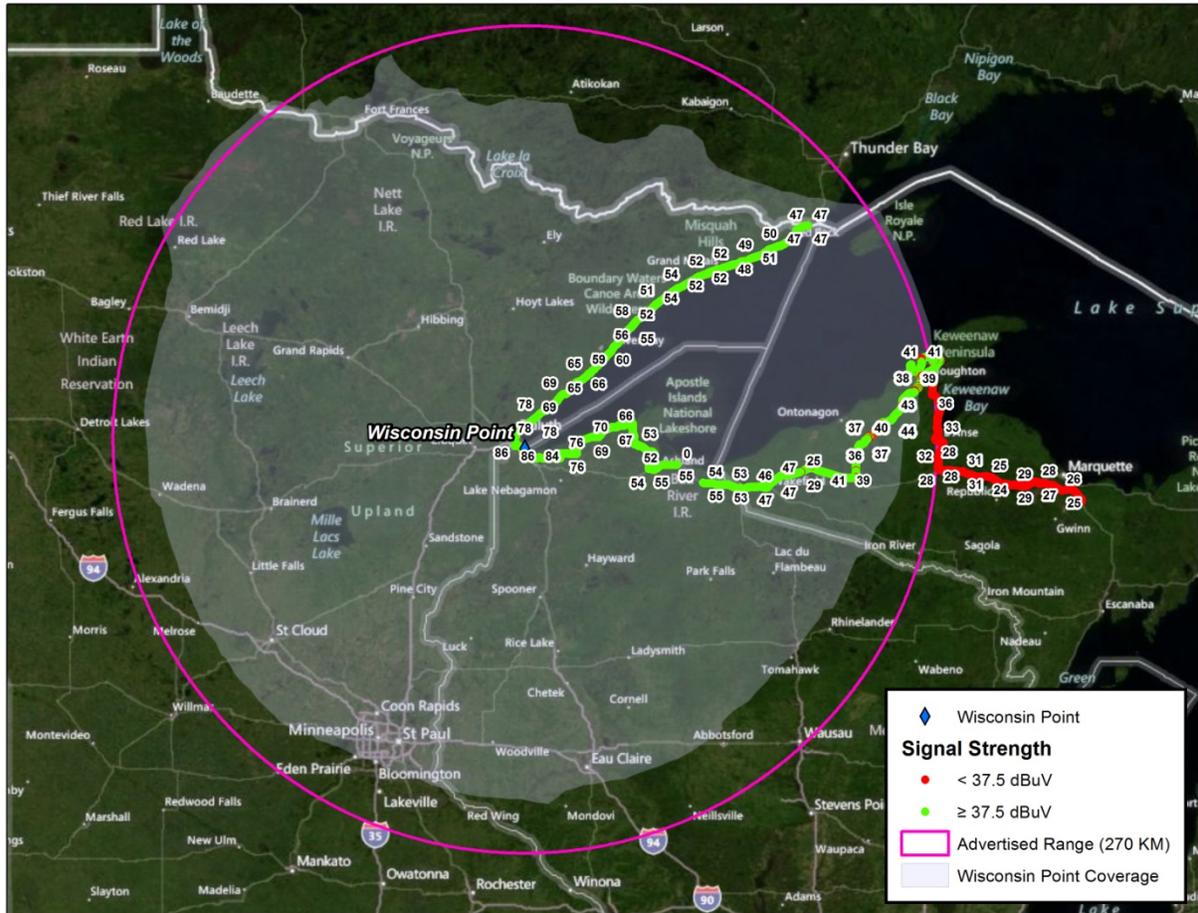


Figure 1: DNAV Measurements for Wisconsin Point

Table 1: L' Anse Bay region Far-Field Signal Strength Reading

Position:	46° 53.108'N, 088° 28.823'W
Side A	SS: 33 dB μ V/m SNR: 04
Side B	SS: 32 dB μ V/m SNR: 03

Table 2: Canadian border Lake Superior Far-Field Signal Strength Reading

Position:	47° 59.99'N, 089° 35.38'W
Side A	SS: 47 dB μ V/m SNR: 16
Side B	SS: 47 dB μ V/m SNR: 17

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 Reference (2). Receipt of all RTCM messages was validated utilizing a Remote Desktop Session where the assessment team witnessed the on-time receipt of all messages on the active and standby Integrity Monitor Computer. All message content was verified and is in accordance with Reference (3).

Table 3: Side A

Message Type	Received	Scheduled	Content Verified/Accurate
Type 3	Y	Y	Y
Type 7	Y	Y	Y
Type 9	Y	Y	Y
Type 16	Y	Y	Y

Table 4: Side B

Message Type	Received	Scheduled	Content Verified/Accurate
Type 3	Y	Y	Y
Type 7	Y	Y	Y
Type 9	Y	Y	Y
Type 16	Y	Y	Y

Accuracy Validation:

Positional data was collected for 10 minutes per side using the Hemisphere R110 DGPS Receiver. The data was then post processed and compared to National Geodetic Survey (NGS) marker to verify the horizontal accuracy of the broadcast correction (Table 5 and 6). Side A was 0.56 meters, bearing 071.6°, away from the monument while Side B was 0.60 meters, bearing 146.5° away from the monument. Both respective distances were well within advertised accuracy requirements. A two dimension radial review of the same time period was completed for the integrity monitor. Side A's average deviation was 0.13524 meters; Side B's average deviation was 0.14256.

NGS Monument ID:	RM0072
Monument LAT:	46° 28.625474' N
Monument LON:	090° 10.067236' W

Table 5: Side A

Averaged LAT:	46° 28.62556690' N
Averaged LON:	090° 10.06682191' N
Distance from DGPS Site:	143.3km
Distance from Monument:	0.56m (1.83 feet)
Bearing from Monument:	071.6°

Table 6: Side B

Averaged LAT:	46° 28.62569457' N
Averaged LON:	90° 10.06689346' N
Distance from DGPS Site:	143.3 km
Distance from Monument:	0.60 m (1.97 feet)
Bearing from Monument:	046.5°

SUMMARY:

Analysis of coverage area finds that the coast lines and the immediate area around Lake Superior have sufficient coverage while the coverage south from Upper Keweenaw along the range ring was unsatisfactory. Both of these findings are consistent with the COAST predicted coverage area. 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 in Reference (2) and (3). Finally, accuracy measurements and analysis proved that at a distance of 143 KM from the broadcast site, the horizontal accuracy is well within the requirements set forth in Reference (1) and (2).