Multiple Receiver Static GPS

LAB 2

Katie Chute | REMT 3010 | October 24, 2016 | Rob Hodder

Description of Project

For this multiple receiver static global positioning system (GPS) lab the objective was to set up a base station, a base station is a station that you set up at the start of your collect and it keeps collecting until you are finished, after you have setup your base station you go and find other reference points that you can use as your points.

The location that was chosen for this lab was Berwick, the date that all this data was collected on was the 7th of October 2016. Since there are two teams doing the same lab, we got together and decided that one team would work around the North Mountain and the other team would work around the South Mountain, thus making sure the points from one team would not interfere with the other team's points.

Since there was a base station and a rover there was more equipment that had to be transported. The equipment that was used for this lab are as follows: 1 Global Positioning System (GPS), 2 Tripods, 2 Tribrach's, 2 Receivers, 4 cords (2 shorter cords and 2 longer cords), 2 Antennas, 2 Carriers, 2 Internal Batteries (plus 4 more just in case), 2 SD Cards (to store the data on and for transfer of data onto our computers), and 1 Height hook. The first setup was over the High Precision Network (HPN), the HPN was identified in class before leaving the classroom. This setup was located in an open field on the North Mountain, the monument number for this HPN is 207804. Once the HPN setup was up and running, the next step was to go and find 3 more points known as Nova Scotia Coordinate Control System (NSCCS). The first NSCCS location that was visited was on half in the ditch, but more on someone's property and that NSCCS number is 207397; then the second location was located on the edge of a famers field (the image on the cover is of this location), the NSCCS number for this location is 207411. Then finally the last location that was collected for this lab was again on the edge of a farmer's field, the NSCCS number for this location is 207368.

The collection procedures for this lab was to setup the GPS with the following configurations: static observations, every 1 second, antenna type (the antenna used in the lab was AX1203+GNSS Tripod), cut-off angle of 10°, auto store the point when stopped, include the "measured observations" in the display, and local time zone (-3:00h) and the date. The following steps are the steps that were followed to complete the processing

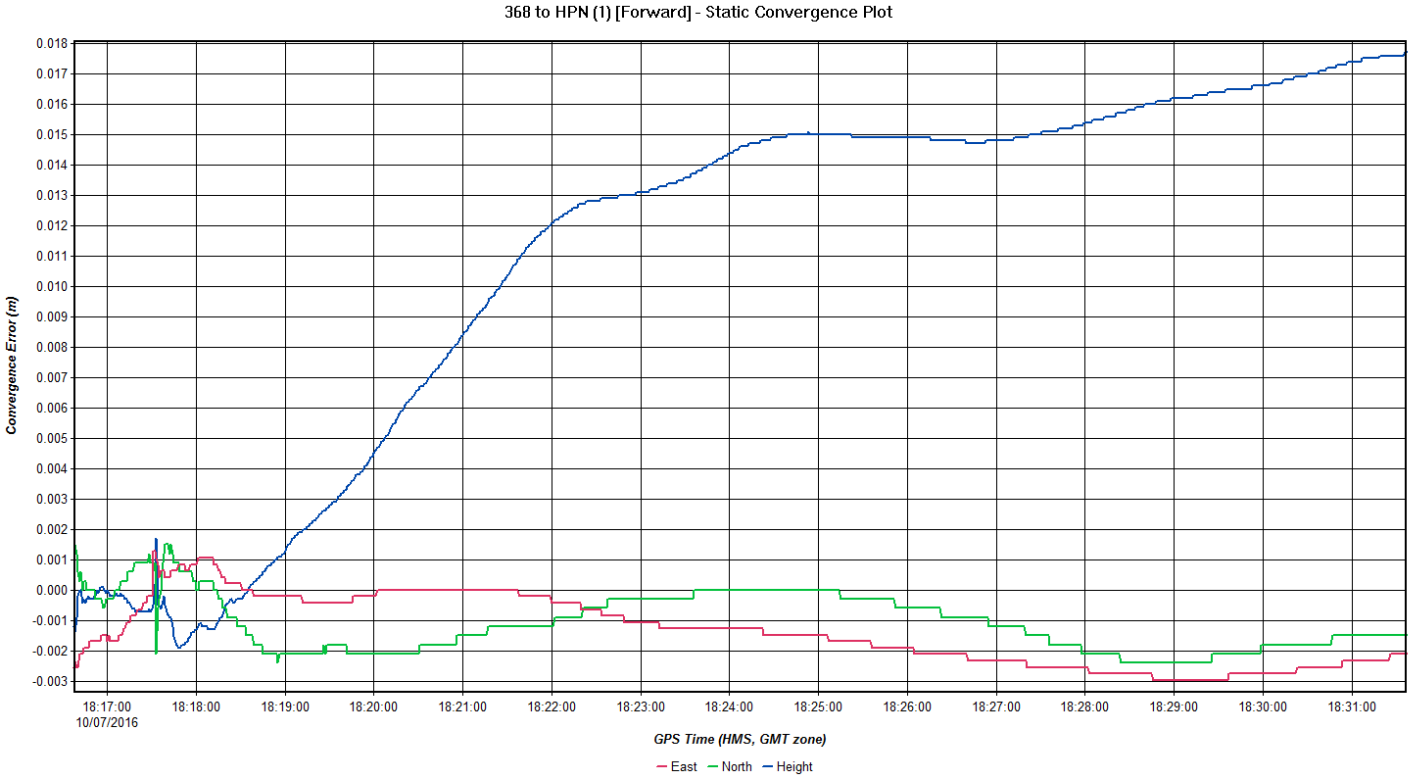
procedures. The first step was to import the base and rover observations onto our computers, then the base station had to be set as a reference. The next steps are processing the baselines, which include selecting reference and rover observations, processing parameters, reviewing results, and storing computed baselines.

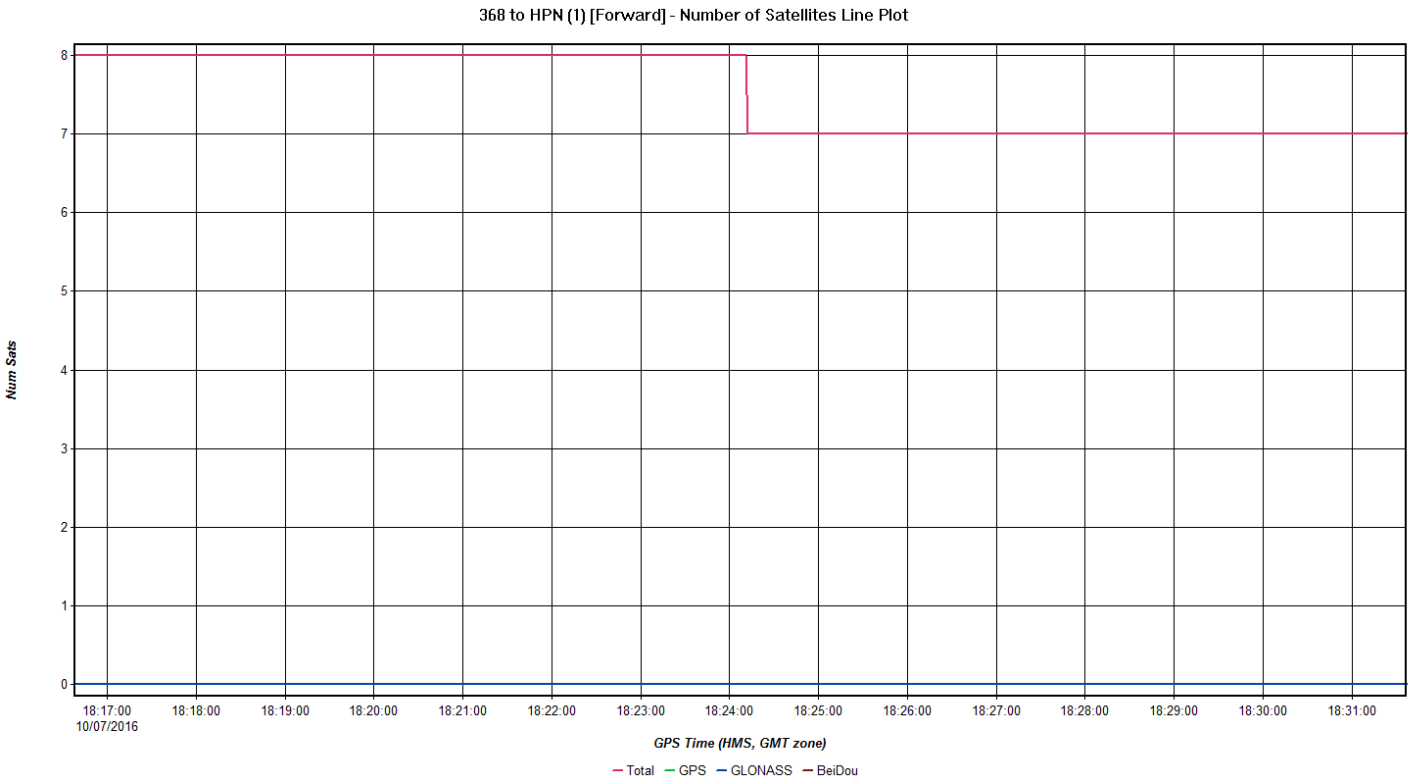
Results & Discussion

The precision, accuracy, issues and solutions, Conversion of coordinates, comparison of published and derived coordinates with supporting discussion, and gps error resolution (theory) will be discussed in this section of the report. The precision of the point data that was collected was fairly accurate, but there was one issue that I ran into, when exporting the data to view and show in Google Earth, the location for the monument number 207411 was off by a little bit (you can see the lat/long in the appendices, image number). The accuracy of the data that was collected was spot on other than the issue with monument number 207411 (second location). As far as issues that arose well completing this lab there was the issue that was mentioned above, with the coordinates being off. The other issue that arose well completing this lab was when locating the monuments, we would find the general area of where the monument should be, but there was no monument where there should be, so we could not find half of the monuments on our list (printed off a screen shot of the area that we were working in and we still had to refer to the website to find more monuments). The comparison between published and The following are steps that were taken to convert the coordinate system. The first process was to import all of the observations, once the coordinate system had been defined. Then the next process was the declare the base station as a control point. The third process was to use the post-processing tools to compute the coordinates for each monument. Then by using the UTM NAD83 coordinate system we had to convert the ellipsoidal heights into orthometric heights based upon the CGVD28 datum.

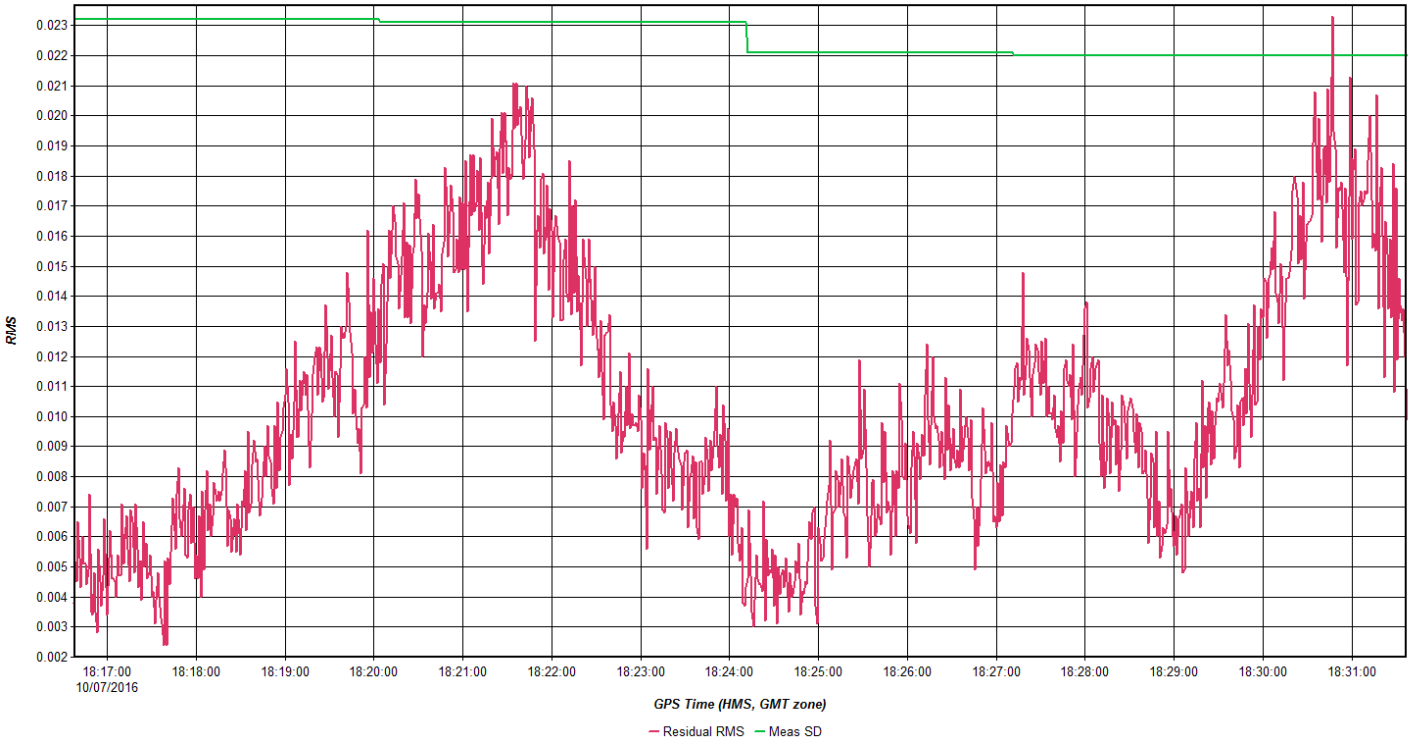
Appendices

The following screen shots are of the monumnet number 207368 to our HPN monument (number 207804).

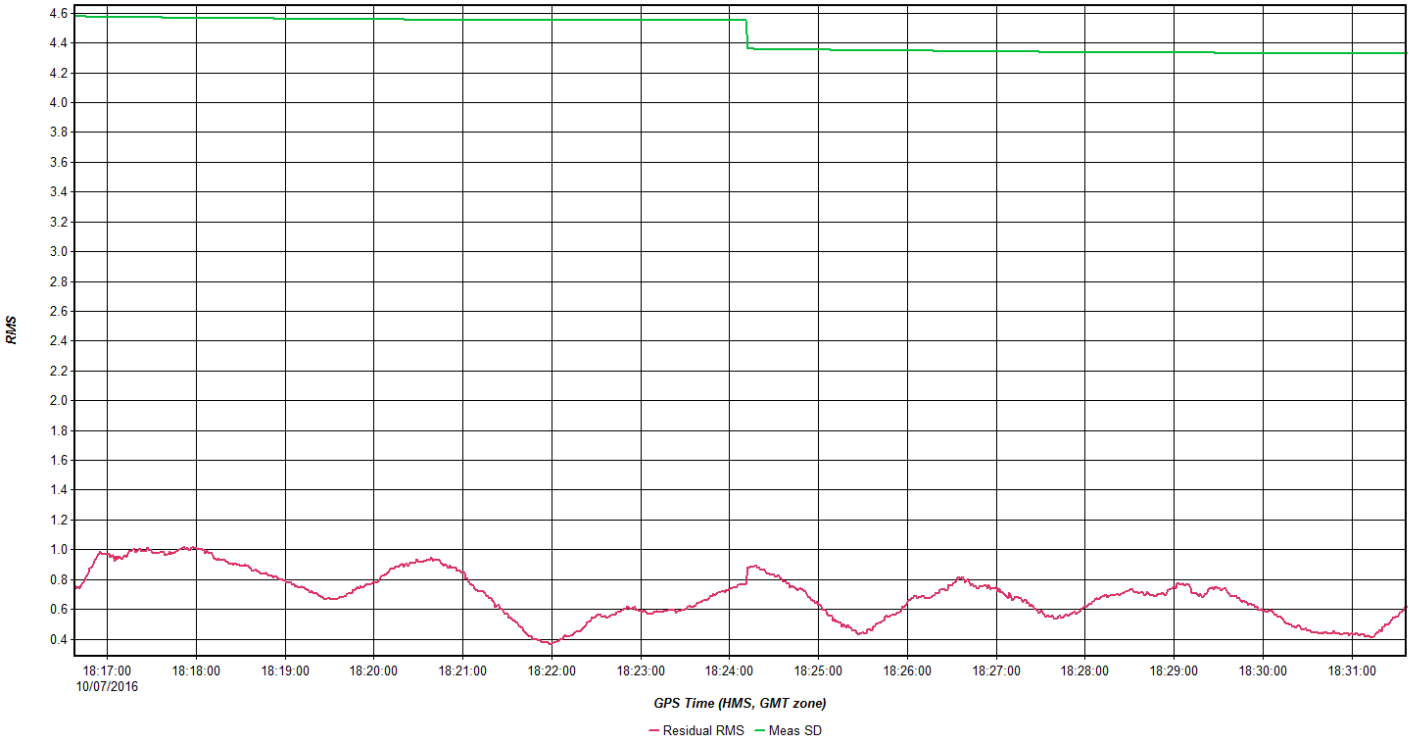




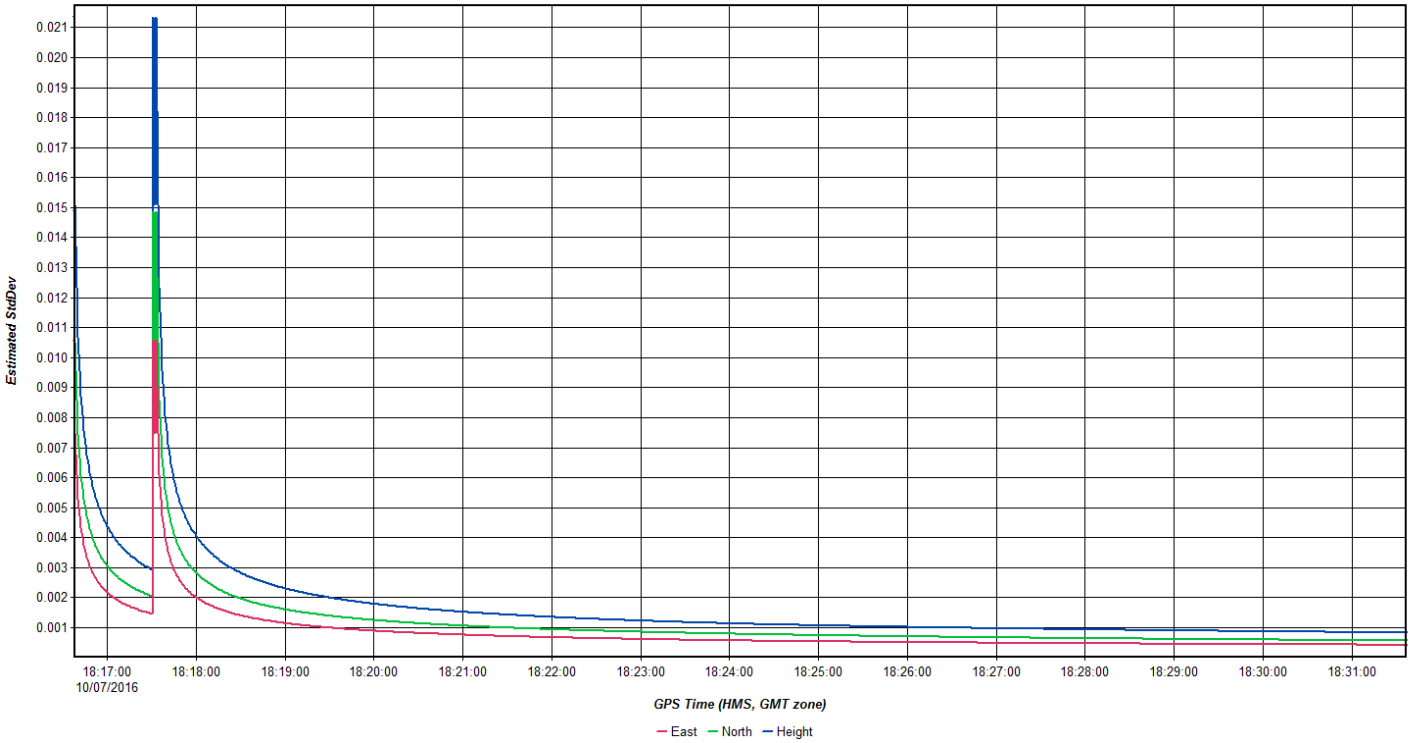
368 to HPN (1) [Forward] - Carrier Residual RMS Plot



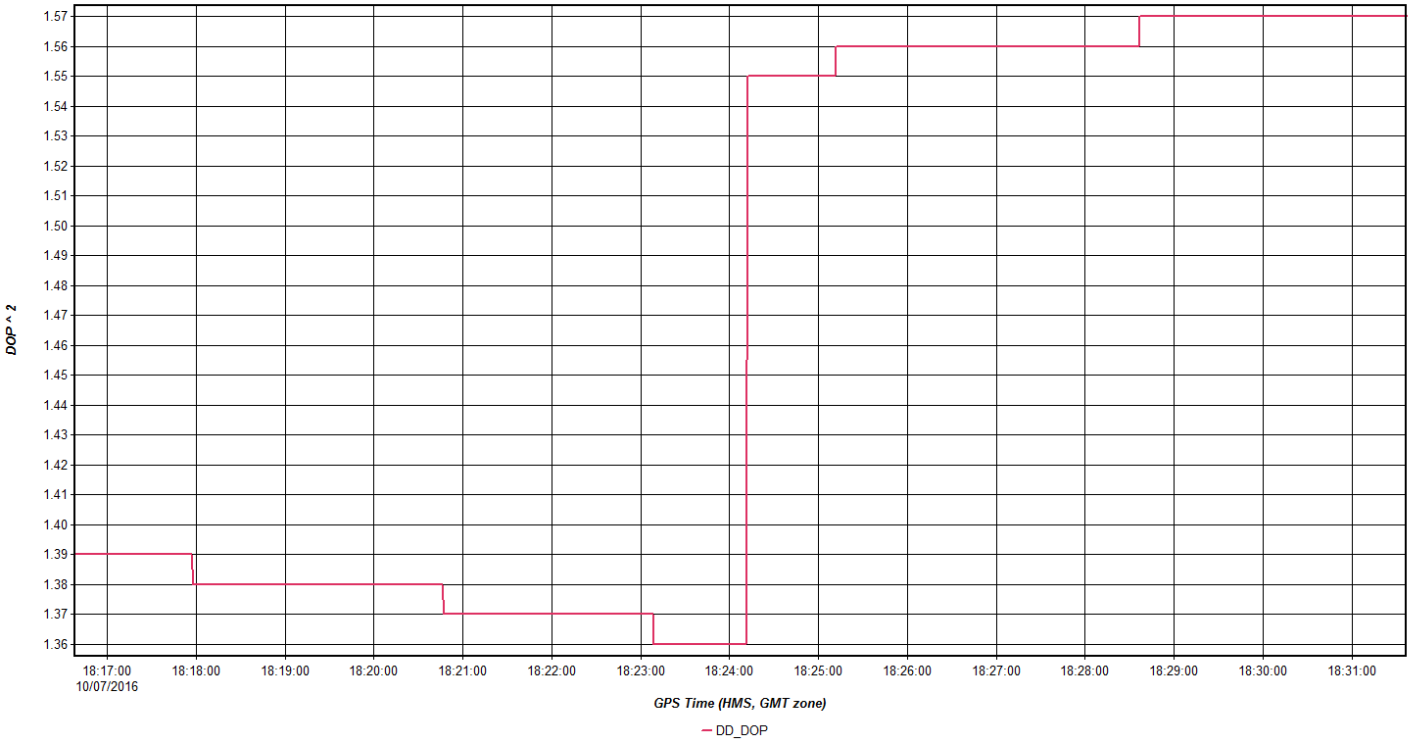
368 to HPN (1) [Forward] - C/A Code Residual RMS Plot

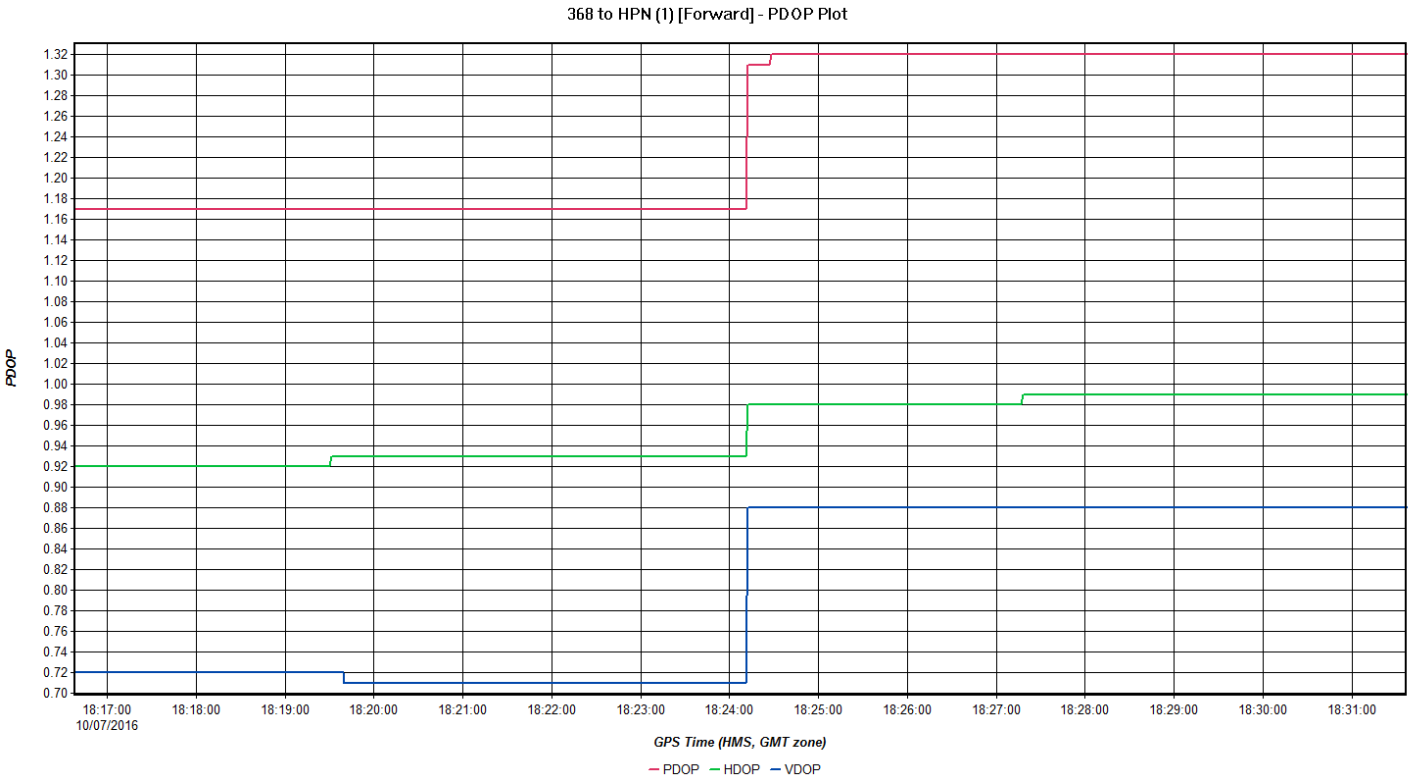


368 to HPN (1) [Forward] - Estimated Position Accuracy Plot

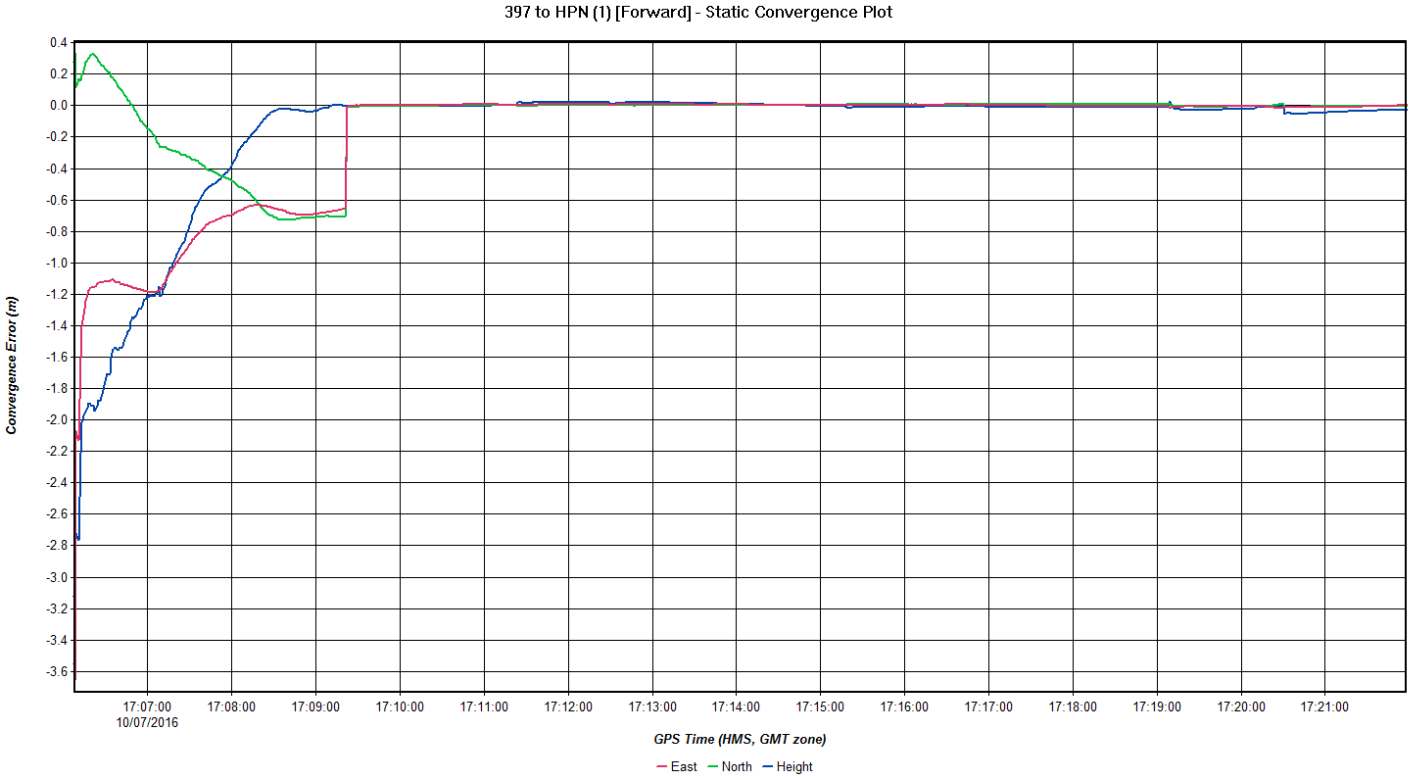


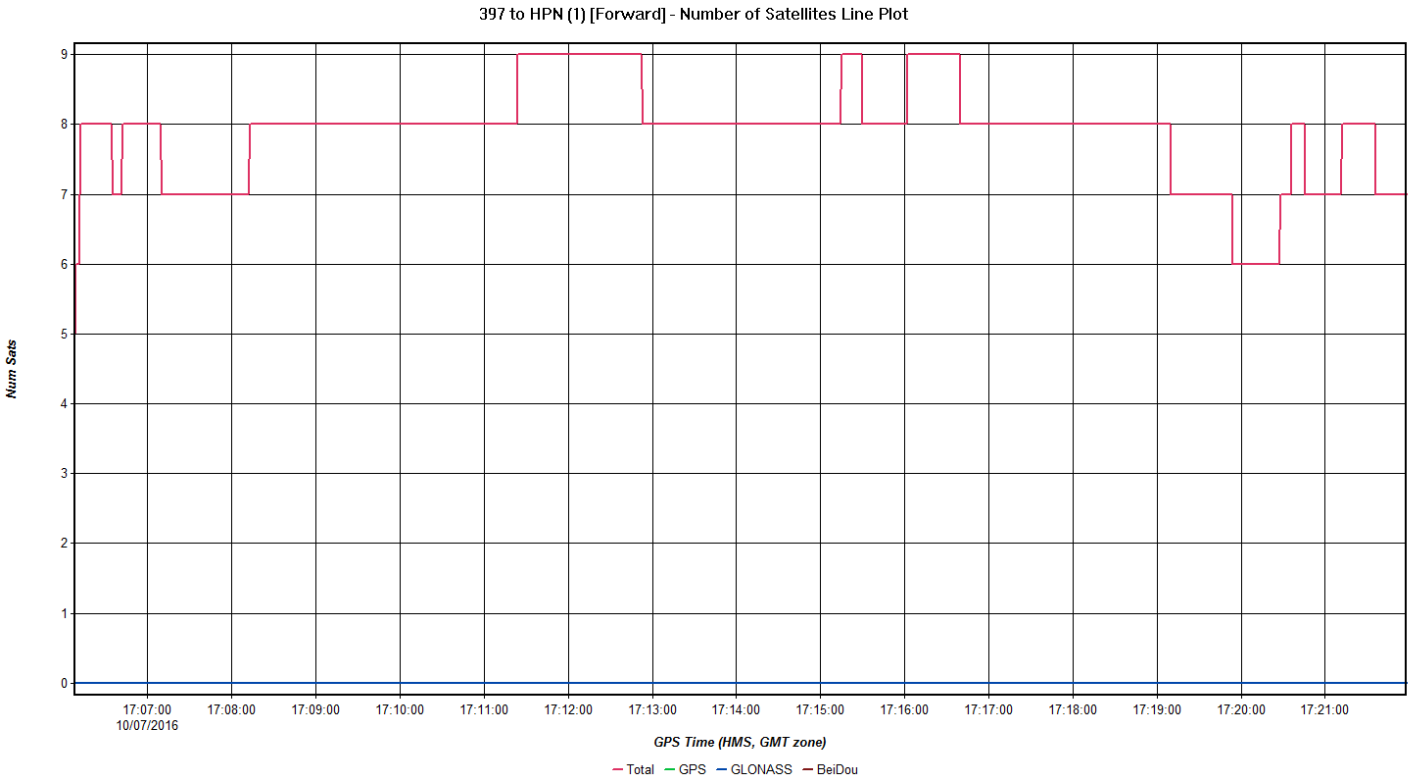
368 to HPN (1) [Forward] - Double Difference DOP

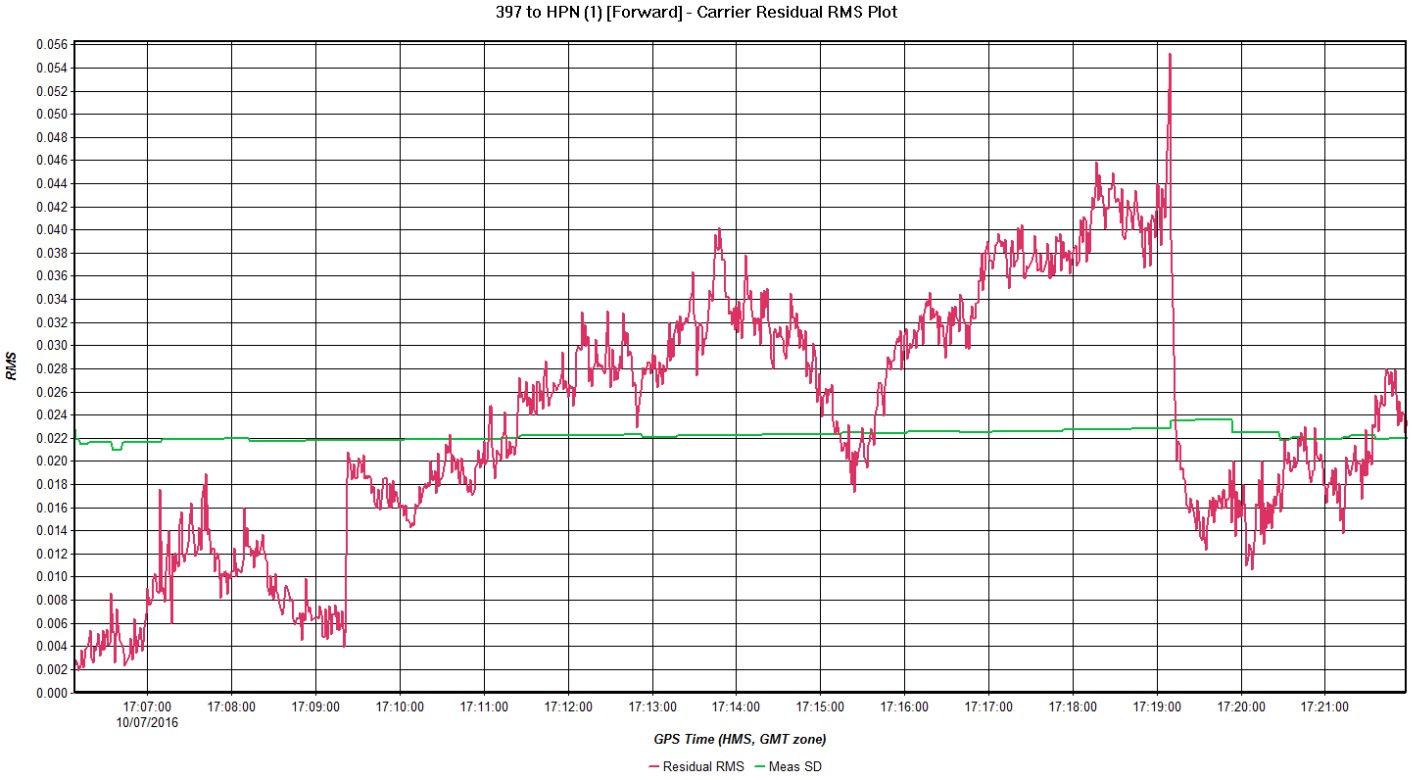




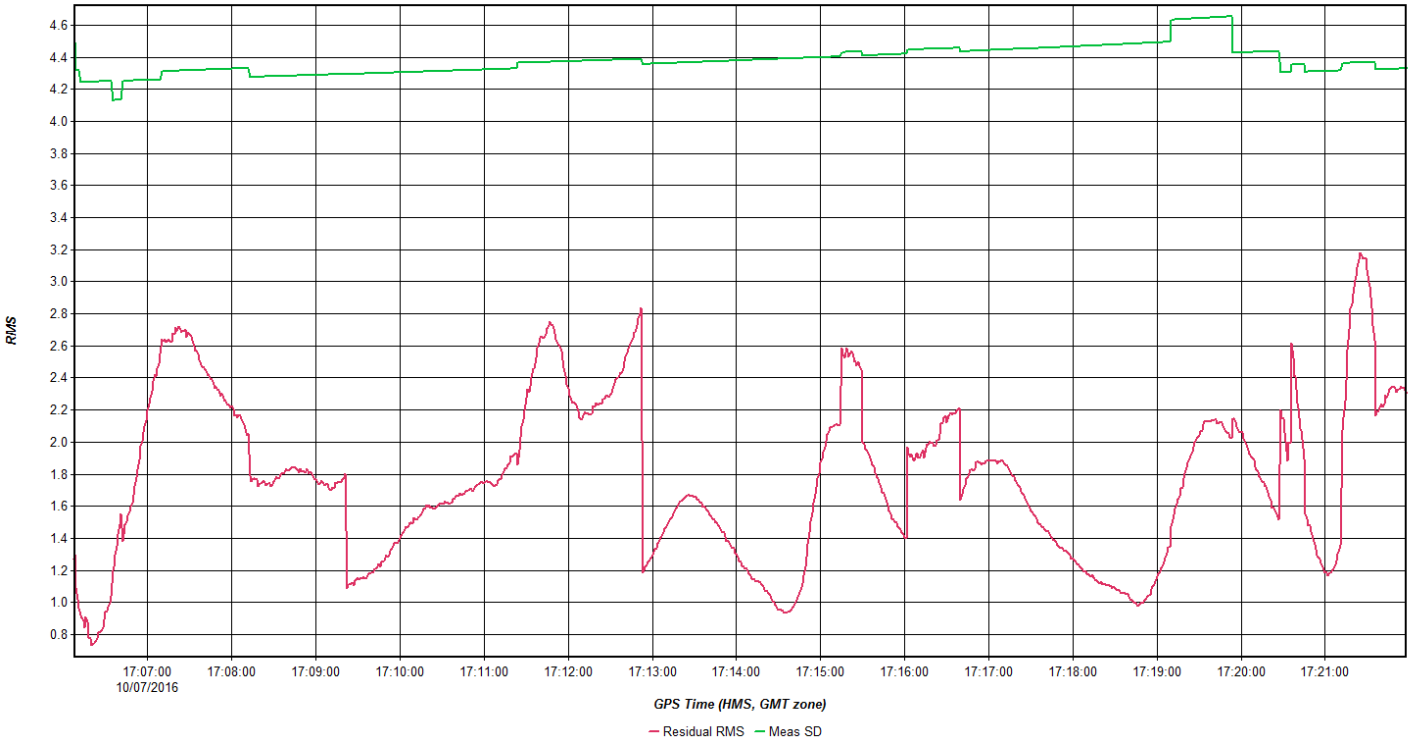
The following graphs are plots from the monument number 207397 to our HPN monument (number 207804).



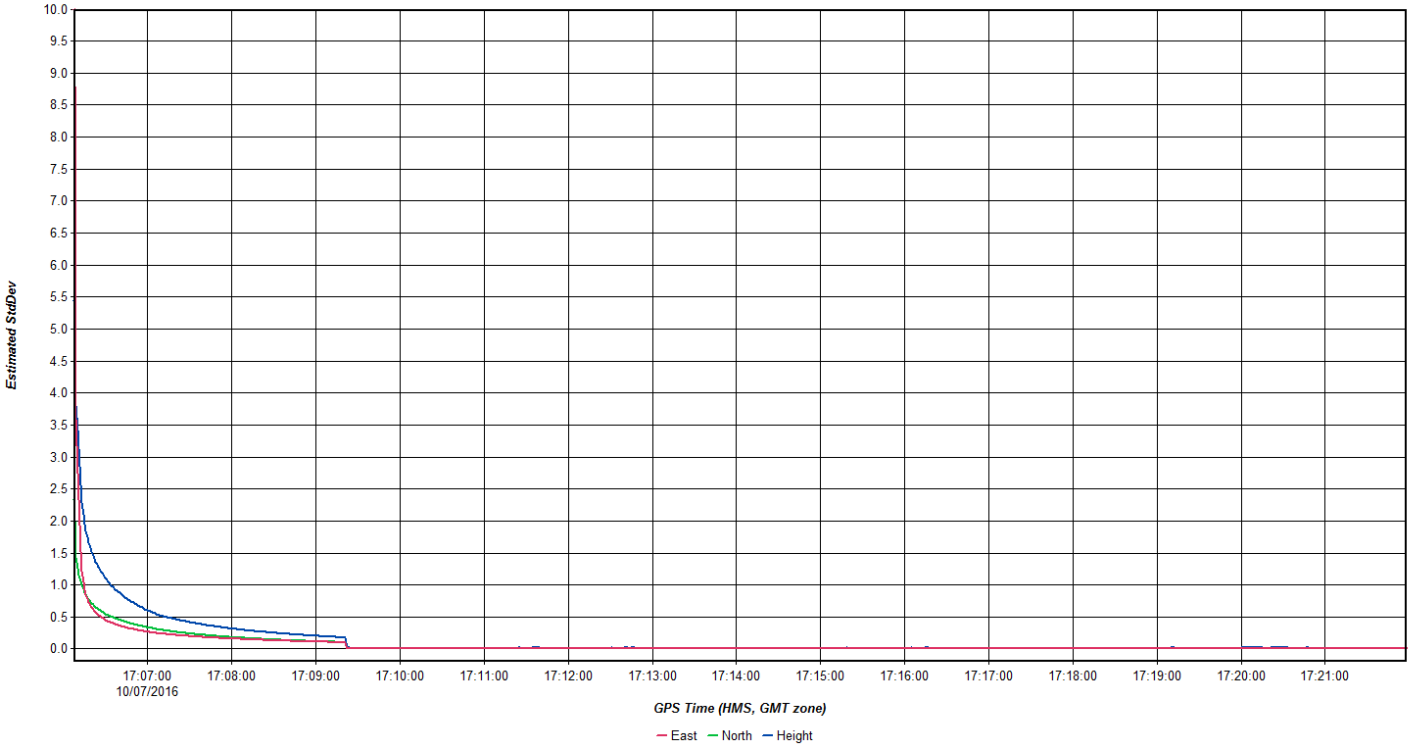

397 to HPN (1) [Forward] - Number of Satellites Line Plot
Num Sats
0
1
2
3
4
5
6
7
8
9
17:07:00
10/07/2016
17:08:00
17:09:00
17:10:00
17:11:00
17:12:00
17:13:00
17:14:00
17:15:00
17:16:00
17:17:00
17:18:00
17:19:00
17:20:00
17:21:00
GPS Time (HMS, GMT zone)
Total
GPS
GLONASS
BeiDou


397 to HPN (1) [Forward] - Carrier Residual RMS Plot
RMS
0.000
0.002
0.004
0.006
0.008
0.010
0.012
0.014
0.016
0.018
0.020
0.022
0.024
0.026
0.028
0.030
0.032
0.034
0.036
0.038
0.040
0.042
0.044
0.046
0.048
0.050
0.052
0.054
0.056
17:07:00
10/07/2016
17:08:00
17:09:00
17:10:00
17:11:00
17:12:00
17:13:00
17:14:00
17:15:00
17:16:00
17:17:00
17:18:00
17:19:00
17:20:00
17:21:00
GPS Time (HMS, GMT zone)
Residual RMS
Meas SD

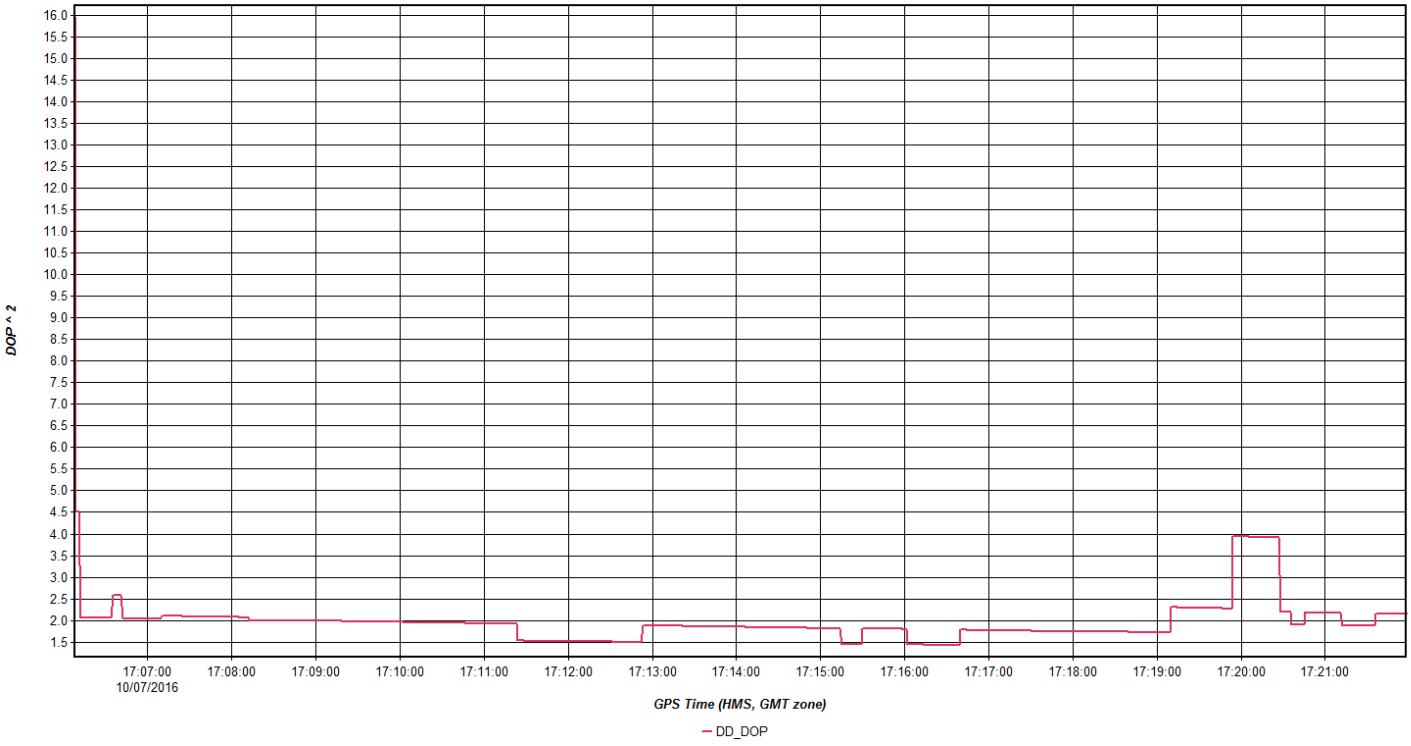
397 to HPN (1) [Forward] - C/A Code Residual RMS Plot



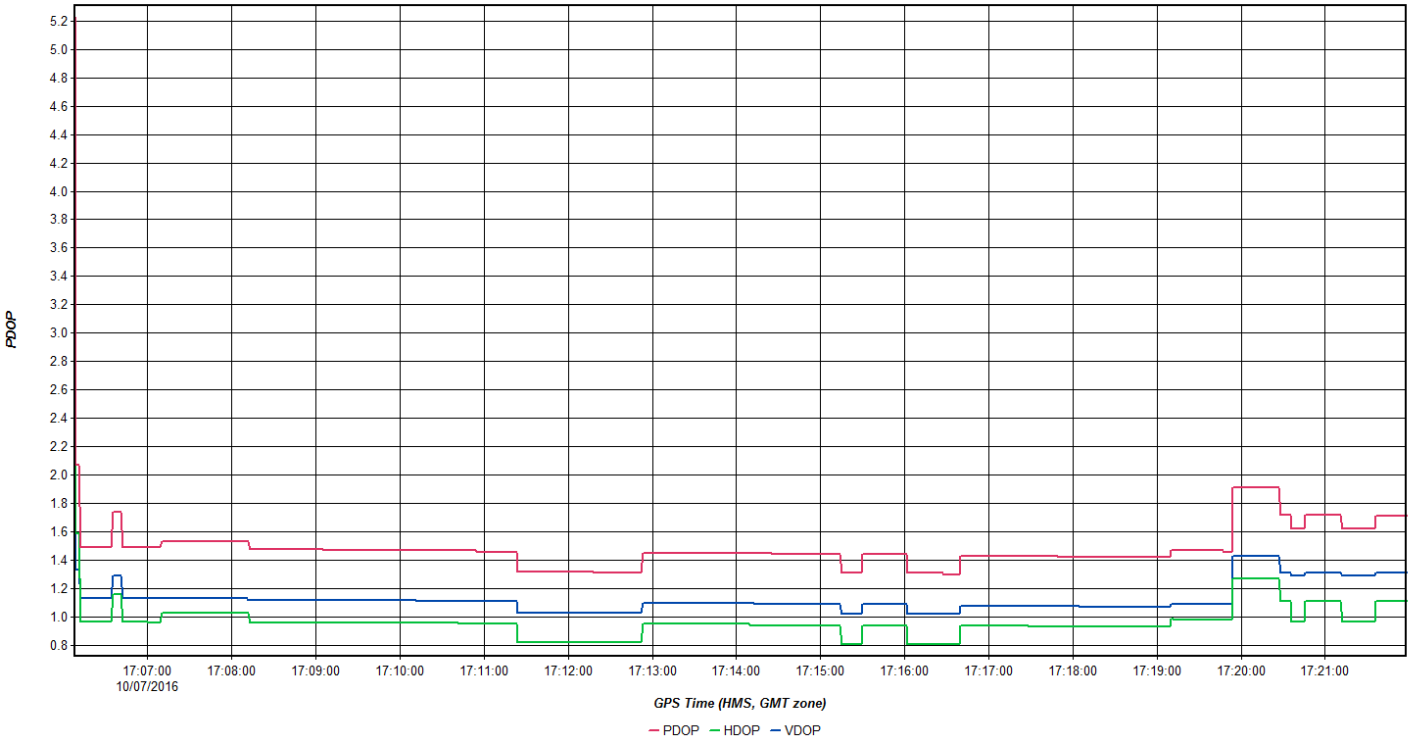
397 to HPN (1) [Forward] - Estimated Position Accuracy Plot



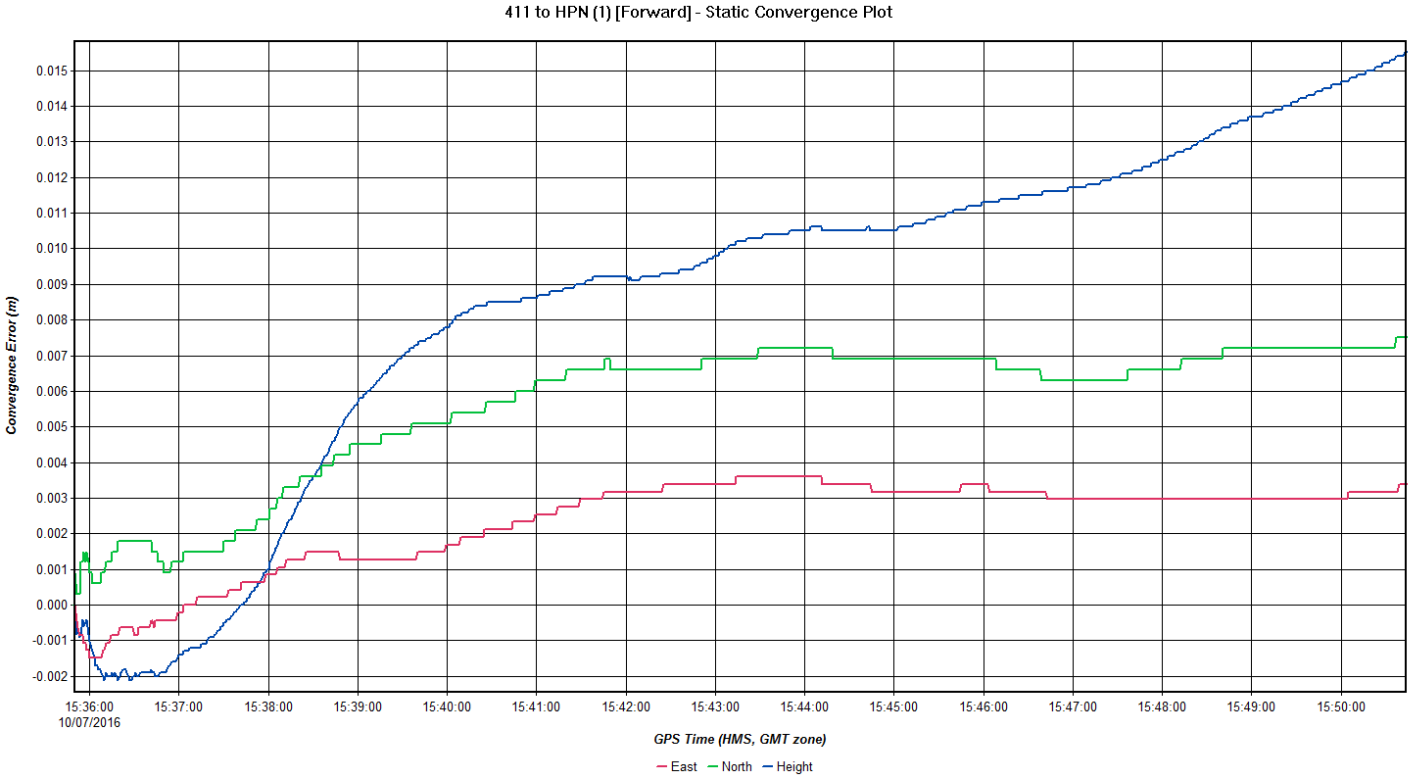
397 to HPN (1) [Forward] - Double Difference DOP

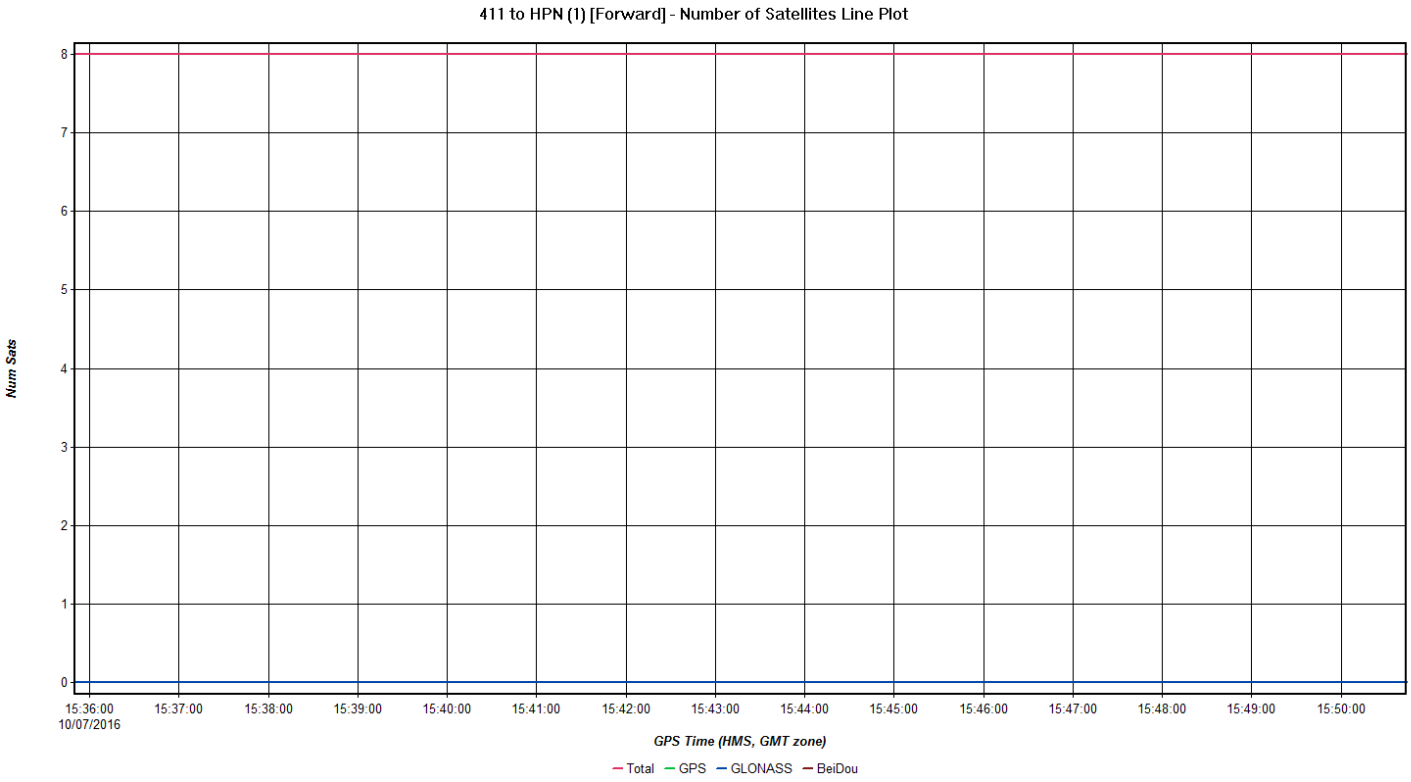


397 to HPN (1) [Forward] - PDOP Plot

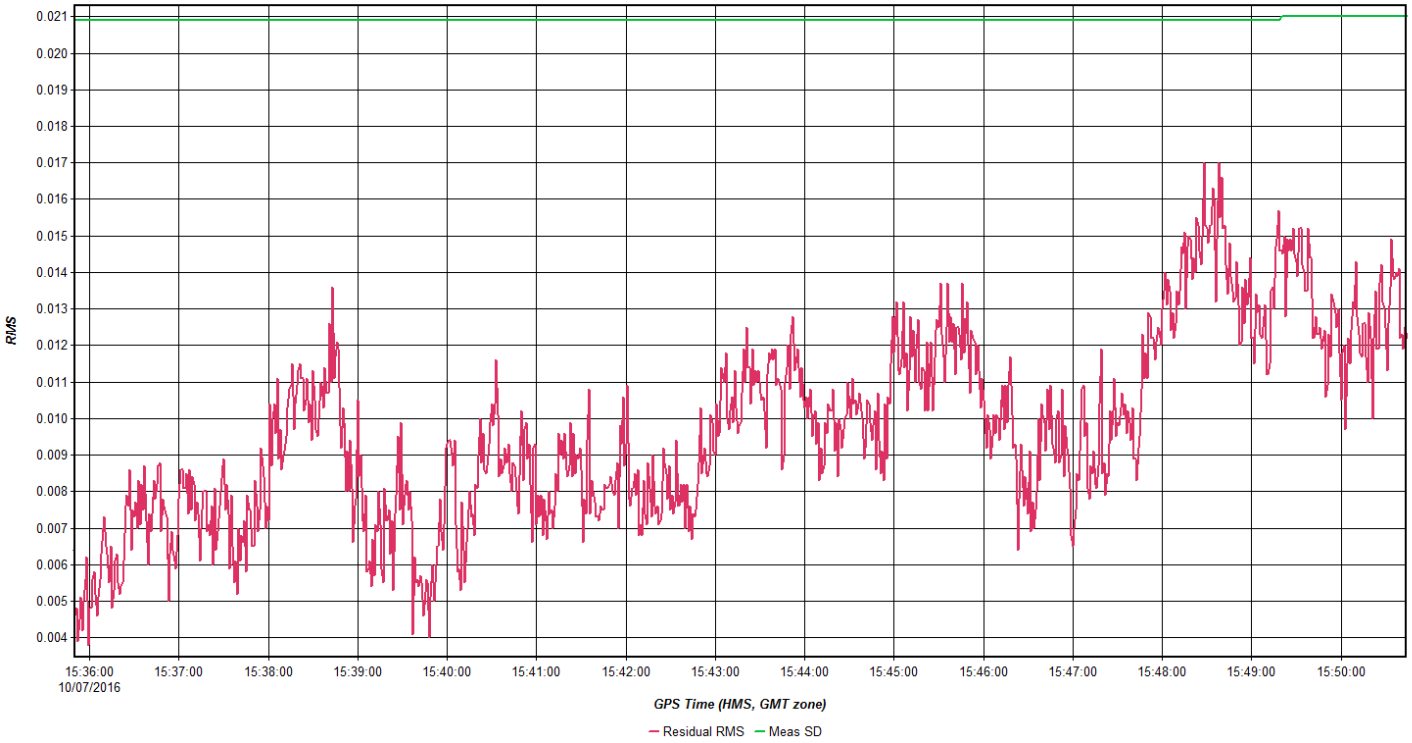


The following graphs are plots from the monument number 207411 to our HPN monument (number 207804).

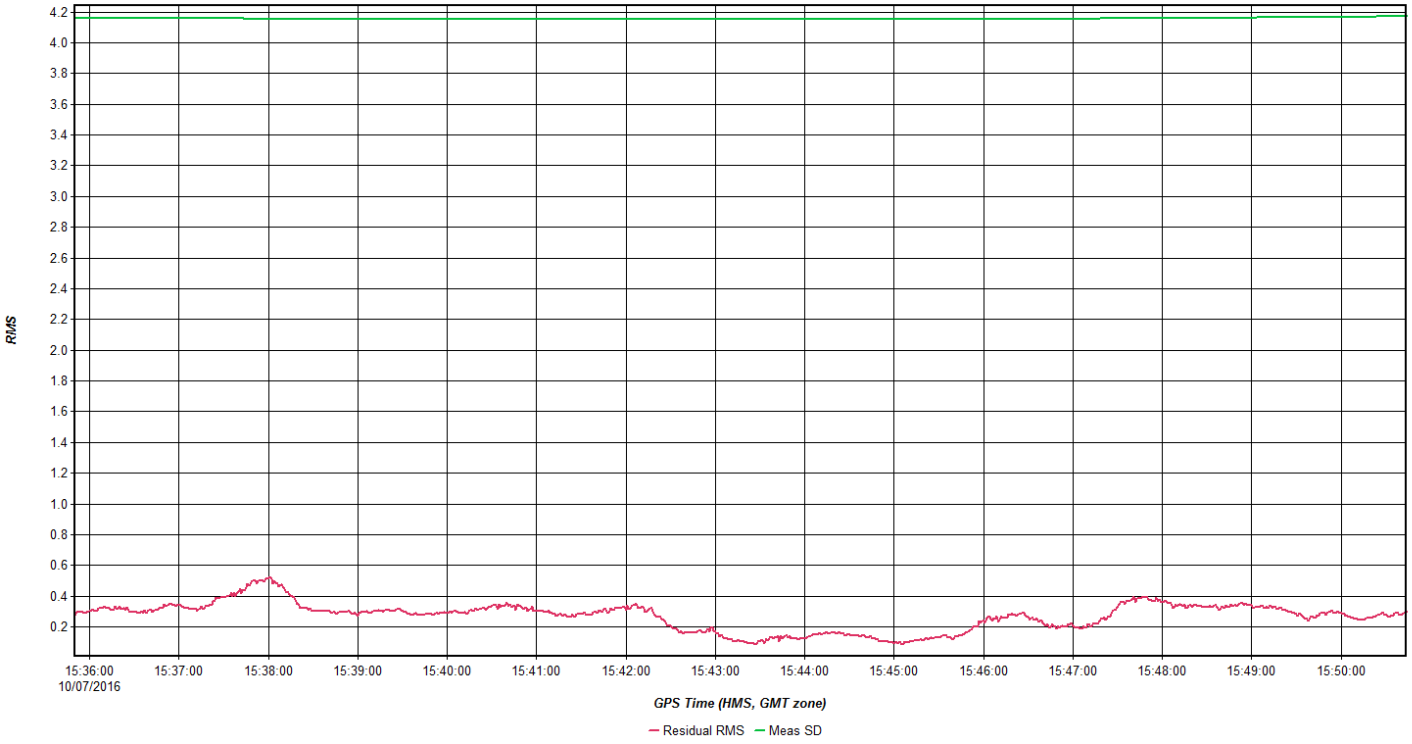




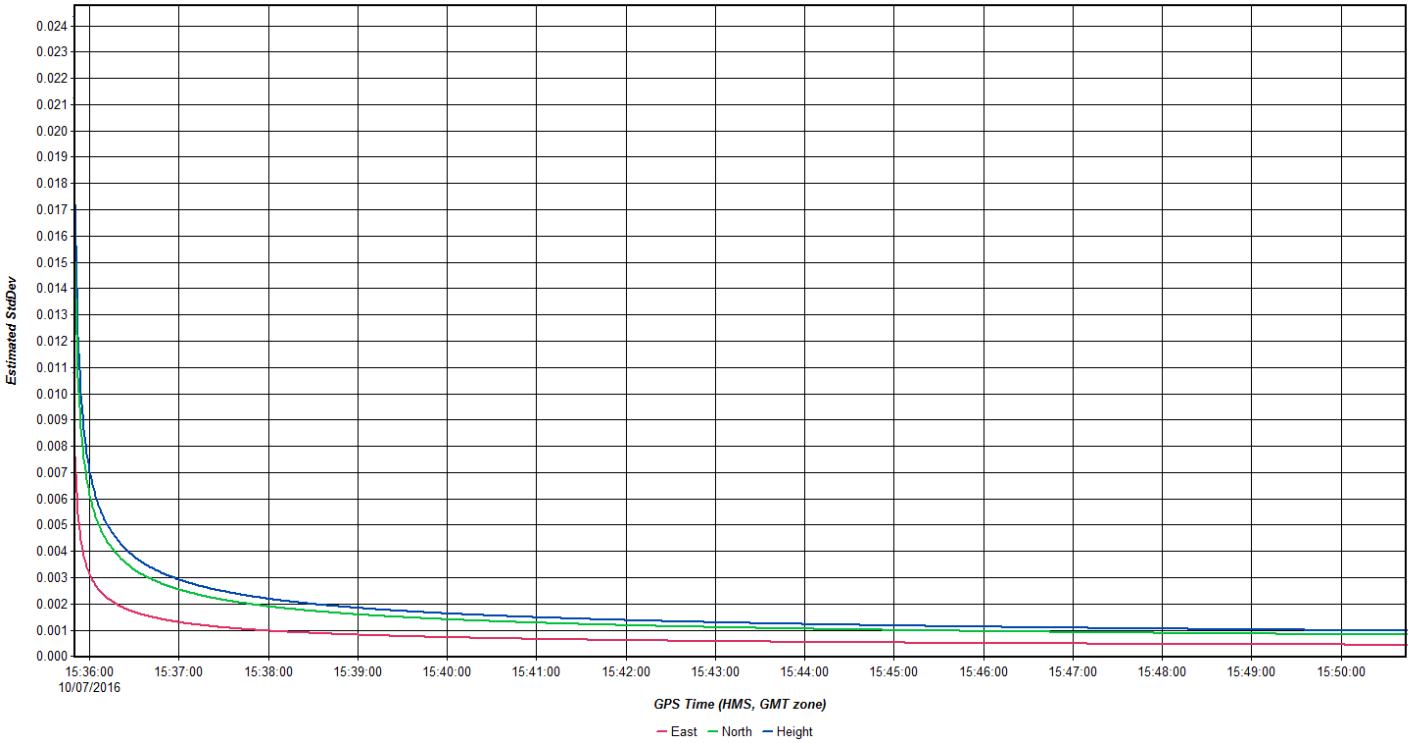
411 to HPN (1) [Forward] - Carrier Residual RMS Plot



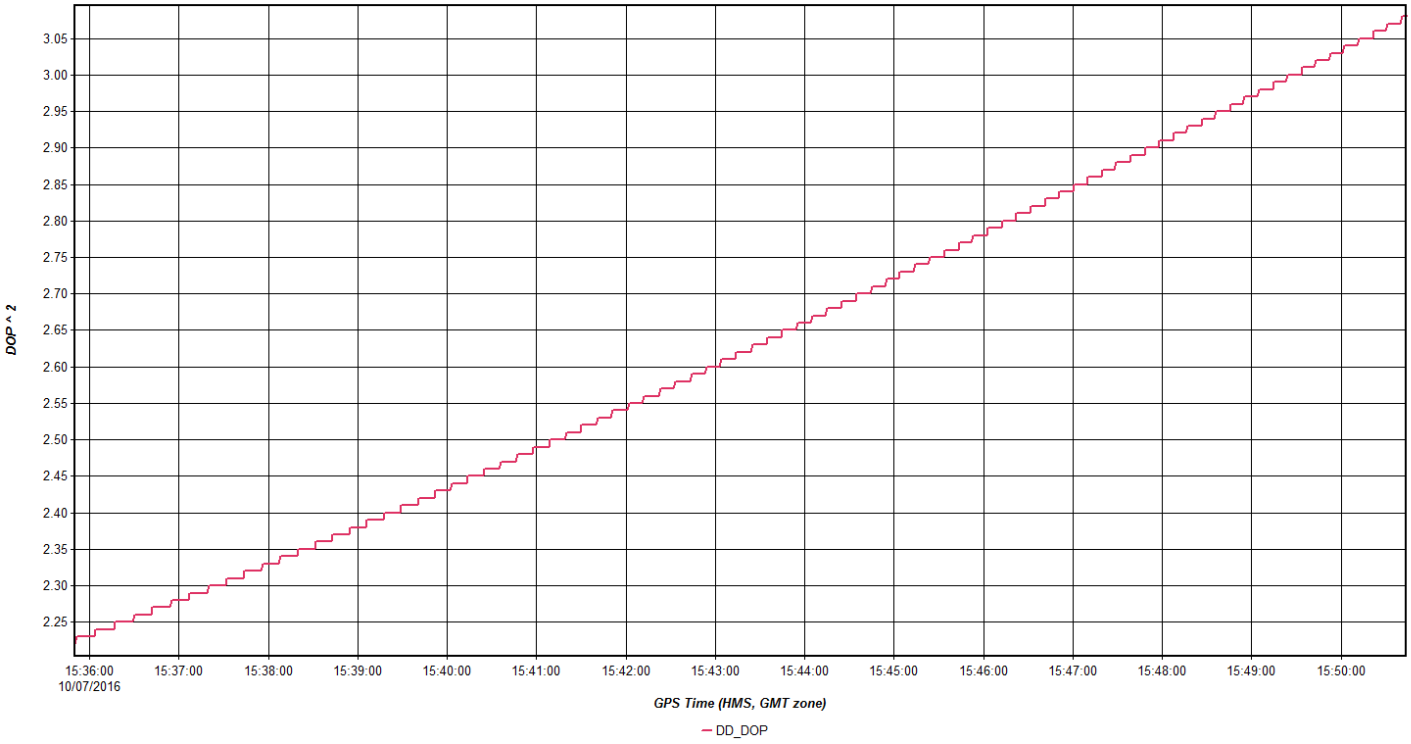
411 to HPN (1) [Forward] - C/A Code Residual RMS Plot

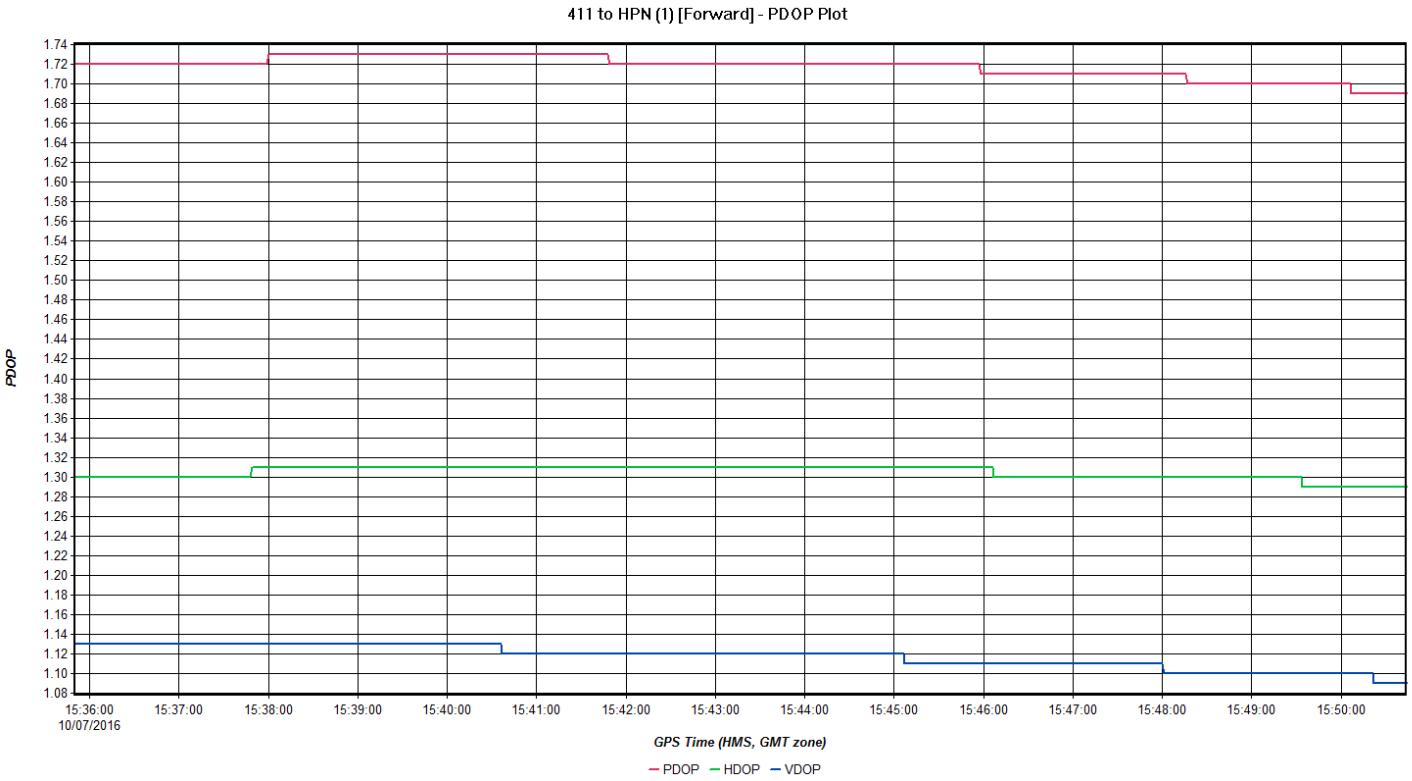


411 to HPN (1) [Forward] - Estimated Position Accuracy Plot



411 to HPN (1) [Forward] - Double Difference DOP





The graph that you see below is the comparison of coordinates using a MTM, ATS77, and WGS77 datum. This graph shows the changes between the coordinate systems.

Monument Number	MTM		ATS77 (Geographic)		WGS84		Orthometric (CGVD28)
	Lat	Long	Northing	Easting	Lat	Long	Orthometric Height
207397	4993284.273	5481917.865	45 04 45.55710	64 45 46.82113	45 04 45.70420	64 43 46.73694	38.734
207411	4993854.234	5480082.515	45 05 03.84447	64 45 10.82481	45 05 03.93528	65 45 11.0665	54.59
207368	4992465.040	5476553.215	45 04 18.45044	64 57 51.98360	45 04 18.59380	64 47 51.86548	70.592

The Configurations that were used in completing this lab are as follows. The static observations were set to collect every 1 second. The antenna type was set to whatever antenna you happen to be using that day and in this case we were using AX1203+GNSS tripod. The cut-off angle was set for 10 degrees, which means nothing below 10 degrees would be collected throughout this lab. An auto store was set up; this allows you to store the point as soon as the GPS has stopped collecting that point. The display was set up to show the measured observations, on the screen that you see well the GPS is collecting the data. The final configuration that was done for this lab was setting the local time zone to -3:00 hours and also set the date to the day that you are collecting your data on.

The following scans are of my GPS Static/Kinematic Baseline Log sheets. The first two scans (pages 14 &15) are those of the first NSCCS that was collected. The following two scans (pages 16&17) are that of the second NSCCS point that was collected. Then the following two scans (on pages 18&19) are that of the third NSCCS point that was collected during the day. Finally, the last two scans (on page 20&21) are that of the HPN (or our base station) that was collecting the whole time well the other three points were collecting. You can that on the second page of every baseline log sheet there is a visual (very rough) of where the monument can be located.

Katie Clute Job1-07397
Station Name = 397

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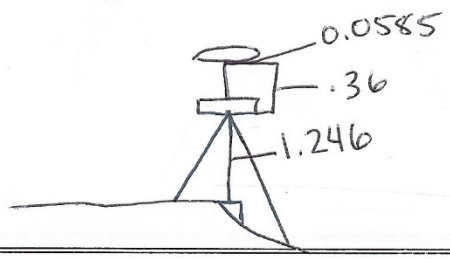
GPS Static/Kinematic Baseline Log

PROJECT NAME: Lab2 (Job1-07397)	PROJECT SECTION OR CREW: TDK
Receiver Model: RX1210	SESSION IDENTIFIER:
Receiver Serial No.: 55-04099	**Station Number/Name:** 207397
Receiver Software:	Observation Date: Oct 7th/16
Antenna Model: AX1202 or AX1203+	Julian Day: 281
Antenna Serial No.: 55-04099	Operator(s): KC
Antenna Cable Length: 4m	Receiver File Name:

Lat/Long/ht	**Antenna Height Drawing (show your measurements)**
Recording Interval 1 Seconds	
Start Time (UT) 12:24	
Stop Time (UT) 12:39	
Elev. Mask / PDOP 10° Degrees	
Observation Method ***STATIC/FAST*** ***STATIC***	



Antenna Height *(3 measurements equally spaced around the antenna, taken at the beginning of the session and again at the end of the session.)*

Correction from Antenna Reference Point(ARP) to L1 Phase Centre 0.0648 (AX1202) m or 0.0585 (for AX1203+GNSS)

Correction from Antenna Reference Point(ARP) to L2 Phase Centre 0.0622(AX1202) m or 0.0555 (for AX1203+GNSS)

Height Hook Method		**Vertical Method**	
Antenna Height		**Antenna Height**	
Before	After	Before	After
1.246 m	1.246 m	m	m
m	m	m	m
m	m	m	m
Uncorrected Slant Meas to: m		Uncorrected Vertical measurement toARP m	
Radius N/A m			
Corrected to Antenna Bottom (ARP). Add 0.360 m 1.606 m			
Correction to APC 0.0585 m		Correction to APC	
Final H.I. to APC (L1) 1.6645 m		Final H.I. to APC	

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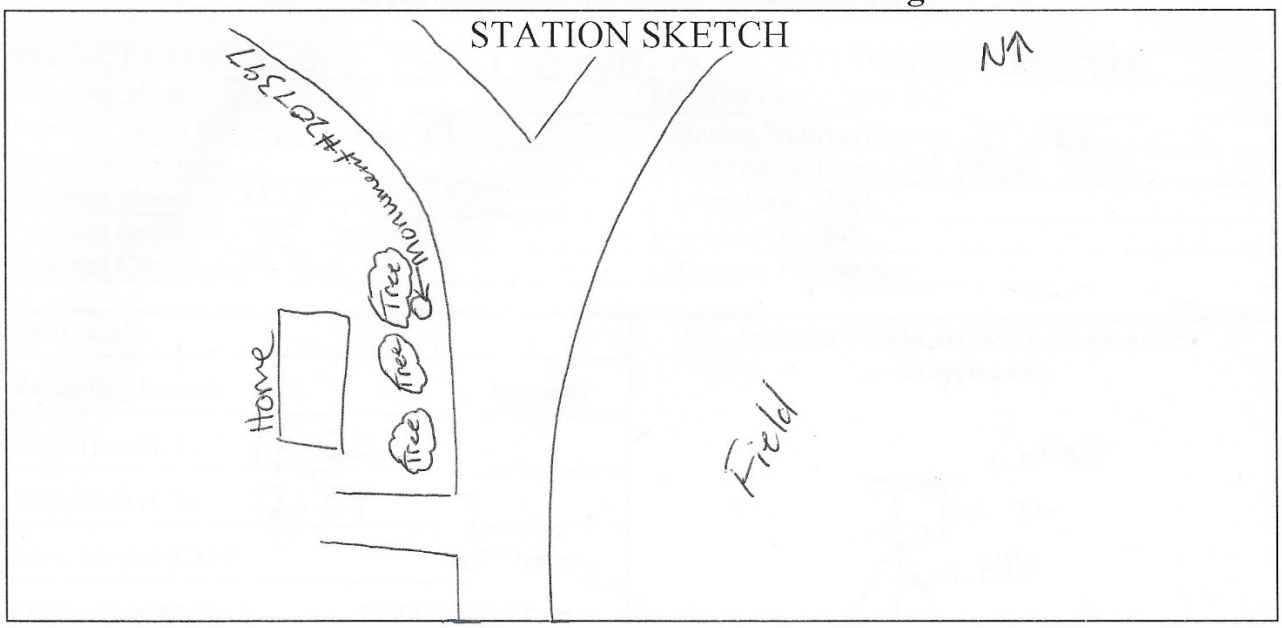
GPS Static/Kinematic Baseline Log

STATION SKETCH



Station Number	Station Name	Date
Obstruction/ Source(s)	**Bearing(Mag.)**	**Comments**

GENERAL AND WEATHER OBSERVATIONS	
Time (UT)	Comments
12:24	Sunny + Clear (Start time)
12:39	Sunny + Clear (End time

Katie Clute Job2-411 (Station Name)

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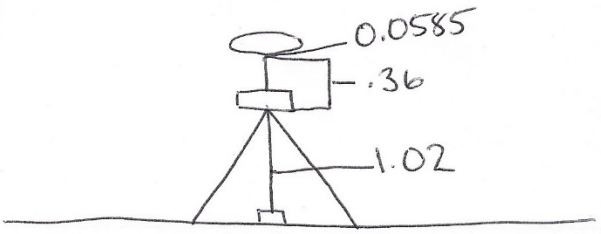
GPS Static/Kinematic Baseline Log

PROJECT NAME: Lab2 (Job2-411)	PROJECT SECTION OR CREW: TDK
Receiver Model: Rx1210T	SESSION IDENTIFIER:
Receiver Serial No.: 55-04099	**Station Number/Name:** 207411
Receiver Software:	Observation Date: Oct 7th
Antenna Model: AX1202 or (AX1203+)	Julian Day: 281
Antenna Serial No.: 55-04099	Operator(s): KC
Antenna Cable Length: 4m	Receiver File Name:

Lat/Long/ht	**Antenna Height Drawing (show your measurements)**
Recording Interval 1 Seconds	
Start Time (UT) 2:05	
Stop Time (UT) 2:20	
Elev. Mask / PDOP 10° Degrees	
Observation Method ***STATIC/FAST STATIC***	



Antenna Height ***(3 measurements equally spaced around the antenna, taken at the beginning of the session and again at the end of the session.)***

Correction from Antenna Reference Point(ARP) to L1 Phase Centre 0.0648 (AX1202) m or 0.0585 (for AX1203+GNSS)

Correction from Antenna Reference Point(ARP) to L2 Phase Centre 0.0622(AX1202) m or 0.0555 (for AX1203+GNSS)

Height Hook Method		**Vertical Method**	
Antenna Height		**Antenna Height**	
Before	After	Before	After
1.02 m	1.02 m	m	m
m	m	m	m
m	m	m	m
Uncorrected Slant Meas to: m		Uncorrected Vertical measurement toARP m	
Radius N/A m			
Corrected to Antenna Bottom (ARP). Add 0.360 m 1.38 m			
Correction to APC 0.0585 m		Correction to APC	
Final H.I. to APC (L1) 1.41385 m		Final H.I. to APC	

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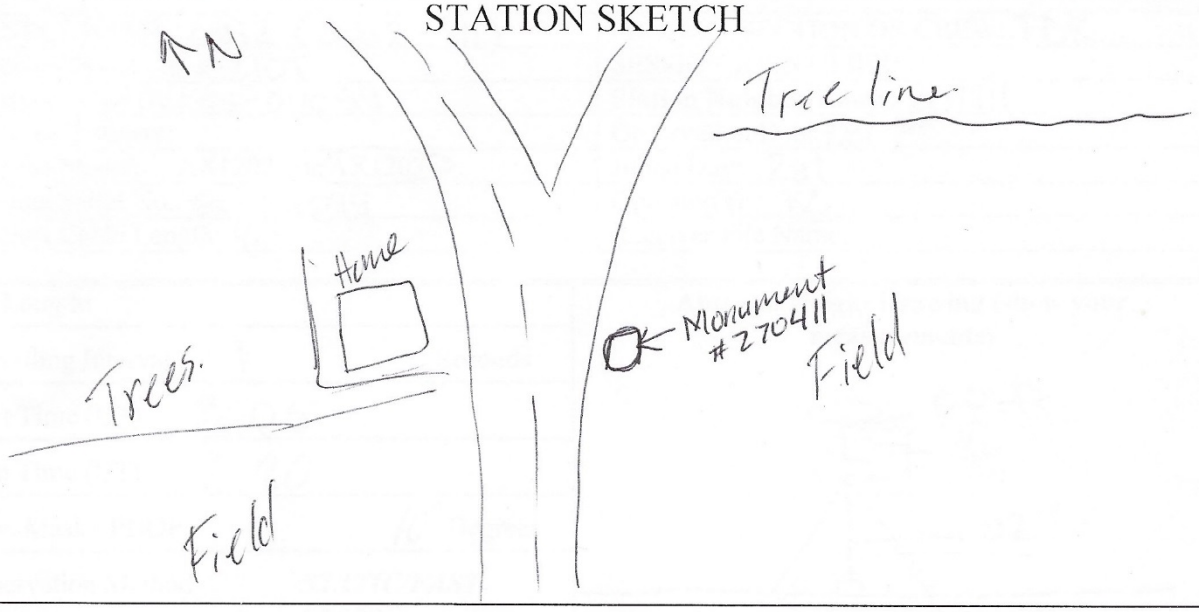
GPS Static/Kinematic Baseline Log

STATION SKETCH



Station Number	Station Name	Date
Obstruction/ Source(s)	**Bearing(Mag.)**	**Comments**

GENERAL AND WEATHER OBSERVATIONS	
Time (UT)	Comments
2:05	Sunny + Clear (start time)
2:20	Sunny + Clear (End time)

Katie Clute Station Name: 368

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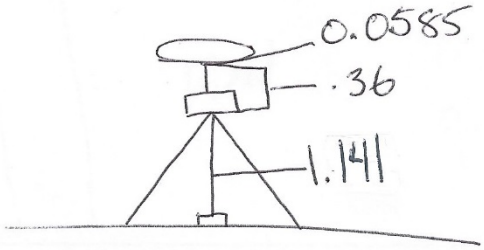
GPS Static/Kinematic Baseline Log

PROJECT NAME: Lab2 (Job 3-368)	PROJECT SECTION OR CREW: TDK
Receiver Model: RX1210T	SESSION IDENTIFIER:
Receiver Serial No.: 55-04099	**Station Number/Name:** 207368
Receiver Software:	Observation Date: Oct 7th, 2016
Antenna Model: AX1202 or (AX1203+)	Julian Day: 281
Antenna Serial No.: 55-04099	Operator(s): KC
Antenna Cable Length: 4m	Receiver File Name:

Lat/Long/ht	**Antenna Height Drawing (show your measurements)**
Recording Interval 1 Seconds	
Start Time (UT) 3:35	
Stop Time (UT) 3:50	
Elev. Mask / PDOP 10° Degrees	
Observation Method ***STATIC/FAST STATIC***	

Antenna Height ***(3 measurements equally spaced around the antenna, taken at the beginning of the session and again at the end of the session.)***

Correction from Antenna Reference Point(ARP) to L1 Phase Centre 0.0648 (AX1202) m or 0.0585 (for AX1203+GNSS)

Correction from Antenna Reference Point(ARP) to L2 Phase Centre 0.0622(AX1202) m or 0.0555 (for AX1203+GNSS)

Height Hook Method		**Vertical Method**	
Antenna Height		**Antenna Height**	
Before	After	Before	After
1.141 m	1.141 m	m	m
m	m	m	m
m	m	m	m
Uncorrected Slant Meas to: m		Uncorrected Vertical measurement toARP m	
Radius N/A m			
Corrected to Antenna Bottom (ARP). Add 0.360 m 1.501 m			
Correction to APC 0.0585 m		Correction to APC	
Final H.I. to APC (L1) 1.5595 m		Final H.I. to APC	

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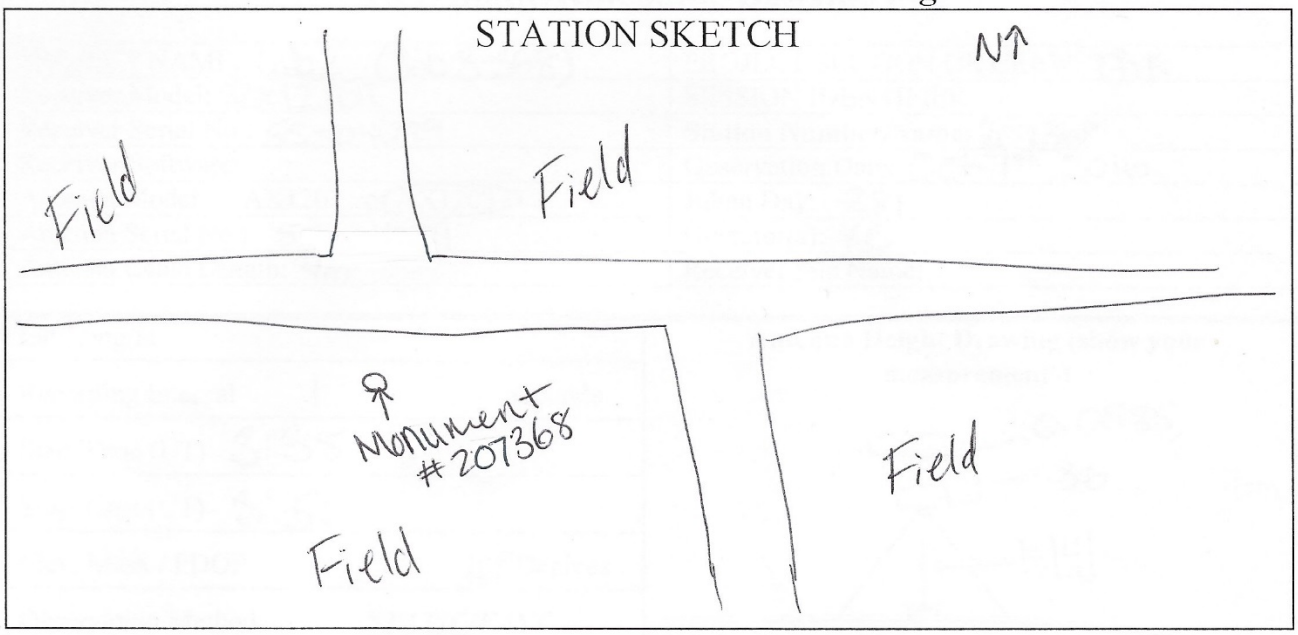
GPS Static/Kinematic Baseline Log

STATION SKETCH



Station Number	Station Name	Date
Obstruction/ Source(s)	**Bearing(Mag.)**	**Comments**

GENERAL AND WEATHER OBSERVATIONS	
Time (UT)	Comments
3:35	Sunny + Clear (start time)
3:50	Sunny + Clear (End time)

Katie Chute

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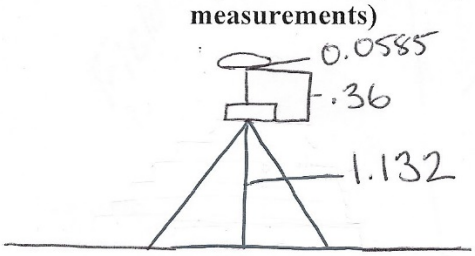
GPS Static/Kinematic Baseline Log

PROJECT NAME: Lab 2 (HPN)	PROJECT SECTION OR CREW: TDK
Receiver Model: RX1210T	SESSION IDENTIFIER:
Receiver Serial No.: 55-04099	**Station Number/Name:** 2078O4
Receiver Software:	Observation Date: Oct 7th /16
Antenna Model: AX1202 or (AX1203+)	Julian Day: 281
Antenna Serial No.: 55-04099	Operator(s): KC
Antenna Cable Length: 4m	Receiver File Name:

Lat/Long/ht	**Antenna Height Drawing (show your measurements)**
Recording Interval 1 Seconds	
Start Time (UT) 10:39	
Stop Time (UT) 4:39	
Elev. Mask / PDOP 10° Degrees	
Observation Method ***STATIC/FAST*** (***STATIC***)	

Antenna Height ***(3 measurements equally spaced around the antenna, taken at the beginning of the session and again at the end of the session.)***

Correction from Antenna Reference Point(ARP) to L1 Phase Centre 0.0648 (AX1202) m or 0.0585 (for AX1203+GNSS)

Correction from Antenna Reference Point(ARP) to L2 Phase Centre 0.0622(AX1202) m or 0.0555 (for AX1203+GNSS)

Height Hook Method		**Vertical Method**	
Antenna Height		**Antenna Height**	
Before	After	Before	After
1.132 m	1.132 m	m	m
m	m	m	m
m	m	m	m
Uncorrected Slant Meas to: m		Uncorrected Vertical measurement toARP m	
Radius N/A m			
Corrected to Antenna Bottom (ARP). Add 0.360 m 1.492 m			
Correction to APC 0.0585 m		Correction to APC	
Final H.I. to APC (L1) 1.5505 m		Final H.I. to APC	

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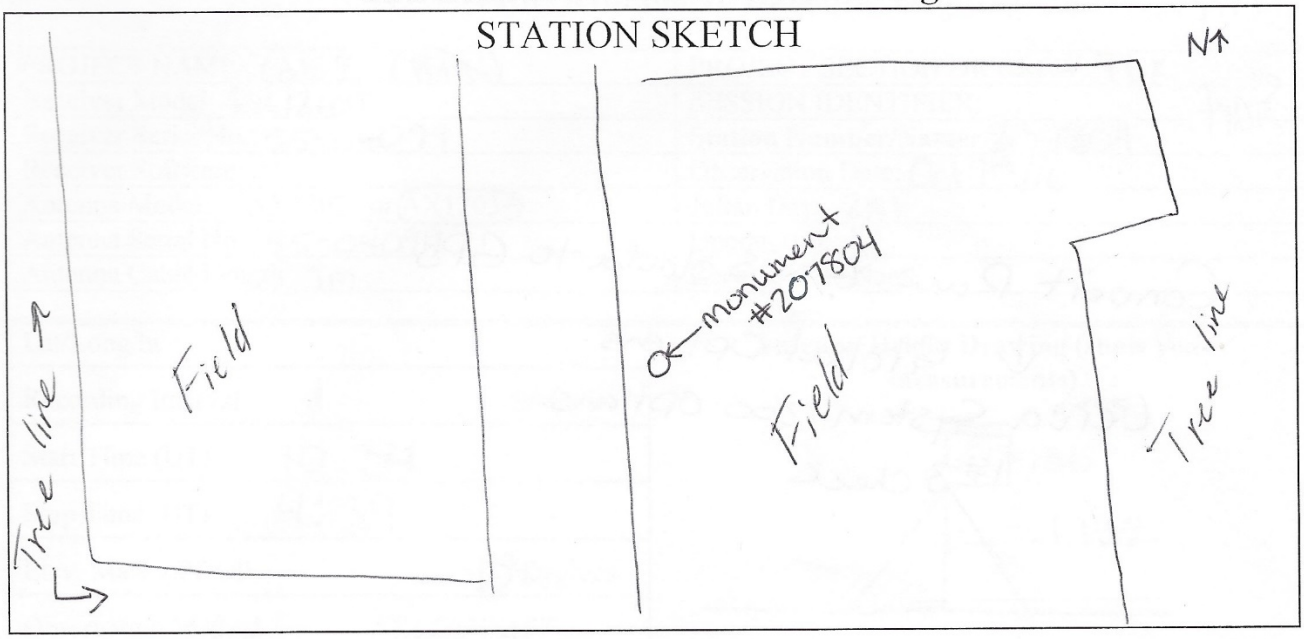
STATION SKETCH



Station Number	Station Name	Date
Obstruction/ Source(s)	**Bearing(Mag.)**	**Comments**

GENERAL AND WEATHER OBSERVATIONS	
Time (UT)	Comments
10:39	Sunny + Clear (Start time)
4:39	Sunny + Clear (End time)