

Pixhawk Compatible GNSS Receiver Comparison

Produced: April 2018



Published by: Titan Elite, Inc. (<https://shop.titaneliteinc.com>)

Prelude:

A GNSS navigation receiver isn't about giving your vehicle the ability to go from "Point A" to "Point B". It's about getting to the destination safely while dealing with interference from surroundings along the way in a stable fashion. How can you leverage the autonomous functionality of a complex vehicle and choose an economical, minimally sufficient navigation device? You can't. Not when your reputation depends on it.

There are several commonly known GNSS receivers that are compatible with the Pixhawk series, and Pixhawk based, autopilots. This document outlines some of the advertised/published capabilities of each receiver and compares this data with actual observations.

The primary goal of these findings is to compare manufacturer/reseller advertised capabilities versus actual, out-of-the-box results. While it is generally not good practice to use a GNSS receiver near structures, in real-world applications, structural or environmental interference of some type is likely to be encountered. Therefore, data was collected both in an "open" and clear baseline scenario, then under extreme multi-path interference conditions while the GNSS receivers were placed directly next to a commercial building. The data represented in this document depicts the receiver reported values given each situation.

All information presented in this document is current as of April 2018.

Disclosures:

Titan Elite, Inc. is currently a distributor and manufacturer for Zubax Robotics products.

Images, screen shots, device specifications, manufacturer and designer references discussed hereinafter have been gathered from public domain resources including published website pages and device documentation. Titan Elite, Inc. does not take ownership or credit for any logos, branding collateral, copyright material, or website content from 3D Robotics, Mayan Robotics LLC, Drotek Electronics, or Hex Technology Limited.

Executive Summary

This document outlines some of the performance differences between well-known Pixhawk autopilot compatible GNSS receivers. The Pixhawk autopilot provides autonomous functionality to unmanned vehicle systems and incorporates GNSS position estimate data in an attempt to provide stable position accuracy. GNSS receivers including the 3D Robotics GPS, Mayan Robotics NEO-M8N, Drotek NEO-M8T XL, Hex Here GNSS, and Zubax Robotics GNSS 2 have been compared.

The primary purpose of this review was to compare advertised versus actual capabilities. The secondary purpose of the test was to define the average and maximum (or minimum) observed capabilities of each receiver in a given time period.

All receivers were purchased as brand new equipment. All receivers were opened and tested in their “out of the box configuration” in a bench setup test environment. Test data was collected using the uBlox U-Center desktop program. The first test was performed for baseline testing in an “open sky”, relatively obstruction free environment. The second test was performed in an “extreme” situation whereby the GNSS receivers were placed within 1 meter of a commercial building.

The results reported that the majority of GNSS receivers observed fewer concurrent satellite constellations than advertised. The Zubax Robotics GNSS 2 and the 3D Robotics GPS receivers accurately utilized those constellations which were advertised. The Mayan Robotics, Drotek and Hex GNSS receivers did not demonstrate the ability to utilize all of the constellations advertised.

The results indicated that the Zubax Robotics GNSS 2 was able to both track and utilize the highest number of individual satellites. The Mayan Robotics and 3D Robotics receivers demonstrated the lowest number of individual satellites tracked and utilized.

No results from the first two reports can be observed regarding estimated horizontal accuracy reported by each receiver since the majority of devices did not report this data in the uBlox U-Center program by their default, out-of-the-box configuration. During the first and second tests, the estimated horizontal accuracy was only reported by the Zubax GNSS 2 while all other receivers did not publish this data.

A third and fourth bench test were performed after configuring each device to report its estimated horizontal accuracy. A minimum (best) and average value was reported. The Zubax GNSS 2 reported the most favorable values in both tests while the 3D Robotics and Mayan Robotics receivers reported the least favorable results, respectively.

GNSS Receiver Performance Review

April 2018

- 1. Purpose.** The purpose of this paper is to compare the actual versus advertised performance of several popular GNSS receivers designed for use with the Pixhawk series autopilot. The Pixhawk series autopilots are an open-source, community driven device which enables autonomous mission capabilities of various vehicle types. The GNSS receiver is arguably one of the most mission critical components of the autonomous system as the device is largely responsible for the vehicle's ability to travel from one location to another, or maintain position as commanded by the autopilot. A GNSS receiver should be reliable and provide accurate position estimation data because it is the primary guidance sensor that the autopilot relies on for autonomous or semi-autonomous functionality.

The devices reviewed in this guide have been selected due to their familiarity in the Pixhawk community. These GNSS receivers include:

Device	Manufacturer / Designer	Model
1	3D Robotics	GPS + Compass
2	mRo (Mayan Robotics)	mRo GPS uBlox Neo-M8N
3	Drotek	uBlox NEO-M8T GPS + HMC5983 Compass (XL)
4	Hex / Proficnc	HERE GNSS
5	Zubax Robotics	Zubax GNSS 2

Table 1: GNSS receivers tested during this review.

2. Test Environment & Parameters.

- A. The following test results were observed in the following environment conditions:
- Sky condition: Clear and open skies
 - Temperature: 47 degrees F (8.3 degrees C)
 - Humidity: 44%
 - Dew point: 26 degrees F (-3.3 degrees C)
- B. Results were based on observations recorded at the end of approximately a 5 minute period.
- C. Observations and testing was performed first, approximately 35 feet (10.6m) from a commercial building. Next, observations and testing were performed approximately 3 feet (0.9m) from a commercial building. The exterior of the building and visible features are constructed primarily of concrete, steel and aluminum.



Photo: Bench-test setup for initial test, approximately 35 feet (10.6m) from the nearest structure



Photo: Bench-test setup for second test, approximately 3 feet (0.9m) from the nearest structure

3. Device Reference Information.

Reference product listing page screen shots (full page):

3D Robotics GPS

The screenshot displays the product listing for the '3DR uBlox GPS with Compass kit' on the getfpu.com website. The page features a yellow header with the company logo, a search bar, and navigation links. The main content area includes a product image, a 'HOT PRODUCT' badge, a star rating, and a price of \$89.99. A 'Discontinued' label is present. Below the product details, there is a 'Description' tab, a list of included items, and a 'Features and Specifications' section. The footer contains contact information, shipping details, and social media links.

3DR uBlox GPS with Compass kit

Over 21 people looking at this item

☆☆☆☆☆ [Write a review](#)

3DR uBlox GPS with Compass kit

Discontinued

\$89.99

[Email to a Friend](#)

[Sign up to get notified when this product is back in stock](#)

[Ask a question](#)

Related Products

3DR Pithawk with GPS
\$279.99

My Cart

You have no items in your shopping cart.

GET FREE SHIPPING
on most orders over \$60

SAME DAY SHIPPING
Available on most orders.

RATED 4.9'S STARS
[Click here to view our recent reviews](#)

Description

This new design incorporates the HMC5883L digital compass, providing a convenient method of mounting the compass away from sources of interference that may be present in the confines of the vehicle. This is 3DR's best GPS module, significantly outperforming the Mediatek GPS due to the larger antenna and next-gen chipset. An excellent solution for multicopters and rovers in particular, where GPS accuracy is paramount. It features active circuitry for the ceramic patch antenna, rechargeable backup battery for warm starts, and I2C EEPROM for configuration storage. The units ship pre-configured for use with 3DR APM 2.6 autopilot; the configuration file is available in the [repository](#).

Includes

- GPS with Compass module
- Protective case
- Four-position cable (compass)
- Five-position-to-six-position cable (GPS) for APM or PX4

Pithawk users will find a six-position cable included with the Pithawk kit to connect the GPS with Compass module to Pithawk, if you need a second cable to connect the GPS with Compass to Pithawk, [please add the six-position cable here](#) to your order.

Options: Add a [GPS mast](#) to improve the performance of the GPS with compass module. [Documentation and User Guides](#)

Features and Specifications

- ublox LEA-6H module
- 5 Hz update rate
- 25 x 25 x 4 mm ceramic patch antenna
- LNA and SAW filter
- Rechargeable 3V lithium backup battery
- Low noise 3.3V regulator
- I2C EEPROM for configuration storage
- Power and fix indicator LEDs
- Protective case
- APM compatible 6-pin DF13 connector
- Exposed RX, TX, 5V and GND pad
- 38 x 38 x 8.5 mm total size, 16.6 grams.

☆☆☆☆☆

0 Questions 0 Answers

[WRITE A REVIEW](#)

[ASK A QUESTION](#)

Reviews (0) Questions (0)

☆☆☆☆☆

[BE THE FIRST TO WRITE A REVIEW](#)

CONTACT INFORMATION

Address: 1060 Goodrich Ave, Sarasota, FL 34236

Phone: +1 (941) 444-0021

Email: [Technical Support](#)
[Order Support](#)

Customer Service Days/Hours: Mon - Fri / 9:00am - 6:00pm EST

SHIPPING

- ✓ Fast, world-wide shipping
- ✓ **GET FREE SHIPPING** on most orders \$60+
- ✓ Most orders \$100+ qualify for Free 2 day shipping
- ✓ Shipping Tips

CONNECT

- ✓ Newsletter Sign-Up
- ✓ Facebook
- ✓ Twitter
- ✓ YouTube
- ✓ AUVSI

LINKS

- ✓ Career Opportunities
- ✓ Dealer Catalog
- ✓ Terms & Conditions
- ✓ Privacy Policy
- ✓ Return Policy

getfpu.com

VISA PayPal DISCOVER AMERICAN EXPRESS

Copyright 2018 by getfpu LLC. All rights reserved.

4.9 ★★★★★
Google Customer Reviews

Titan Elite, Inc.

info@titaneliteinc.com – www.TitanElite.com -Tel. +1-855-848-2685

Page 7

Drotek uBlox NEO-M8T GPS (XL)

This is Google's cache of <https://drotek.com/shop/en/908-ublox-neo-m8t-gps-hmc5983-compass-xl.html>. It is a snapshot of the page as it appeared on Apr 1, 2018 15:18:45 GMT. The current page could have changed in the meantime. [Learn more](#).

Full version Text-only version View source Tip: To quickly find your search term on this page, press Ctrl+F or ⌘ (Mac) and use the find bar.

€

Sign in

Cart (empty)

Search

drotek

ELECTRONICS

STORE

PRODUCTS

SERVICES

FORUM

DOCS

NEWS

TEAM

CONTACT

Adapters

Drives


Prototyping

Sensors

IoT

Electronic boards

Home » Store » Prototyping systems » GPS » Ublox NEO-M8T GPS + HMC5983 compass (XL)



Ublox NEO-M8T GPS + HMC5983 compass (XL)

\$98.12

This product is no longer in stock

[Buy now](#)

Ublox NEO-M8T GPS + HMC5983 Magnetometer module (XL) (GPS + GLONASS + BEIDOU + Galileo)

Ref.: 9080A05

Notify me when available

[Twitter](#) [Facebook](#) [Google+](#) [Pinterest](#)

Technical informations

Reviews

Volume discounts

Warning: the magnetometer component HMC5983 is obsolete. We advise you to order our new GPS design

Ublox NEO-M8T GPS + HMC5983 Magnetometer breakout board (XL)

Board features:

- Ublox NEO-M8T
- HMC5983 magnetometer
- Patch antenna (GPS + GLONASS + BEIDOU + Galileo)
- Power supply: 3.3V or 5V
- Rechargeable battery for faster startup
- Filter on power supply lines
- EMI Shielding
- USB mini-a connector
- Default configuration: 9600baud & 1 Hz (can be changed easily with the U-center software)
- Dimensions: 80x80mm
- Hole distance: 45mm
- Weight: 23g


Package includes:

- 1 x Ublox GPS + Magnetometer
- 1 x JST-GN Cable

Download:


- [Ublox datasheet](#)
- [HMC5983 datasheet](#)
- [U-center software](#)
- [Ublox Guide](#)
- [Ublox partner](#)

Related products




Ublox NEO-6M GPS module

\$19.02




Ublox NEO-M8N GPS module

\$35.21



Ublox NEO-M8N GPS + HMC5983 compass

\$48.20



Ublox NEO-M8N GPS + HMC5983 compass (XL)

\$48.26

drotek

ELECTRONICS

"Success is not final, failure is not fatal: it is the courage to continue that counts" (Winston Churchill)

Newsletter

[Facebook](#) [Twitter](#) [Google+](#)

My account

- My orders
- My merchandise returns
- My credit slips
- My addresses
- My personal info
- My vouchers

Information

- Specials
- New products
- Terms and conditions of use

Titan Elite, Inc.

info@titaneliteinc.com – www.TitanElite.com - Tel. +1-855-848-2685

Page 8

Here GNSS



[Home](#) [Products](#) [校园计划](#) [taobao](#) [Resellers](#) [Store](#) [Download](#) [Wiki and Forum](#) [About Us](#) [Language Menu: 95](#)

Here GNSS

Categories: [accessories](#), [All](#)



SEARCH

SEARCH

PRODUCT CATEGORIES

- All (17)
- accessories (15)
- autopilot (2)

[Description](#) [Reviews \(0\)](#)

Product Description

What's inside

Here GNSS * 1

GPS1 port connector for connecting Here GNSS to PH2 * 1

Highlights

- Concurrent reception of up to 3 GNSS (GPS, Galileo, GLONASS, BeiDou)
- Industry leading -167 dBm navigation sensitivity
- Security and integrity protection
- Supports all satellite augmentation systems
- Advanced jamming and spoofing detection

Other features

- Breakaway mount
- Notification RGB LED
- HMC5983 MAG, and LIS3MDL Mag
- 6CM Ground plane

Related Products



PIXHAWK2.1 EDISON & HERE GNSS KIT

READ MORE



INTEL EDISON CARRIER BOARD

READ MORE



PIXHAWK2.1 STANDARD SET

★★★★★
\$238.00

READ MORE



DF17 CARRIER BOARD CONNECTOR

READ MORE

Room 1906, 19/F Nan Fung Centre,
298 Castle Peak Road, Tsuen
Wan, Hong Kong

info@hex.aero

(852)52342288

@Hex Technology Limited



Titan Elite, Inc.

info@titaneliteinc.com - www.TitanElite.com - Tel. +1-855-848-2685

Page 9

Page 10


[illegible]

Reference product listing page screen shots (partial page):

3D Robotics GPS

SHOP BY CATEGORIES

Home > 3DR uBlox GPS with Compass kit



3DR uBlox GPS with Compass kit

☆☆☆☆☆Write a review

3DR uBlox GPS with Compass kit

Discontinued

\$89.99

Email to a Friend

Sign up to get notified when this product is back in stock

Ask a question

♥

G f t p +

0

DescriptionAdditional

This new design incorporates the HMC5883L digital compass, providing a convenient method of mounting the compass away from sources of interference that may be present in the confines of the vehicle. This is 3DR's best GPS module, significantly outperforming the Mediatek GPS due to the larger antenna and next-gen chipset. An excellent solution for multicopters and rovers in particular, where GPS accuracy is paramount. It features active circuitry for the ceramic patch antenna, rechargeable backup battery for warm starts, and I2C EEPROM for configuration storage. The units ship pre-configured for use with **3DR APM 2.6 autopilot**; the configuration file is available in the **repository**.

Includes

- GPS with Compass module
- Protective case

Image reference: <https://getfpv.com>


Titan Elite, Inc.
info@titaneliteinc.com – www.TitanElite.com -Tel. +1-855-848-2685 Page 12

Drotek uBlox NEO-M8T GPS (XL)

[Autopilot](#) [Drones](#) [Positioning](#) [Sensors](#) [IoT](#) [Electronic boards](#)

Home > Store > Positioning systems>GPS>Ublox NEO-M8T GPS + LIS3MDL compass (XL)

NEW



Ublox NEO-M8T GPS + LIS3MDL compass (XL)

\$98.06




In stock

1 [Buy now](#)

Ublox NEO-M8T GPS + LIS3MDL Magnetometer module (XL) (GPS + GLONASS + BEIDOU + Galileo)

Ref. : 0882A05

[Tweet](#) [Share](#) [Google+](#) [Pinterest](#)



[Technical informations](#) [Reviews](#) [Volume discounts](#)

Image reference: <https://drotek.com>



[Description](#) [Reviews \(0\)](#)

Product Description

What's inside

Here GNSS * 1

GPS1 port connector for connecting Here GNSS to PH2 * 1

Highlights


- Concurrent reception of up to 3 GNSS (GPS, Galileo, GLONASS, BeiDou)
- Industry leading -167 dBm navigation sensitivity
- Security and integrity protection
- Supports all satellite augmentation systems
- Advanced jamming and spoofing detection

Other features

- Breakaway mount
- Notification RGB LED
- HMC5983 MAG, and LIS3MDL Mag
- 6CM Ground plane

Image reference: <http://hex.aero>


mRo GPS uBlox NEO-M8N

AllUAVs/Drones ▾EducationalBlog

AUTOPILOTSCABLESPATFORMSSENSORSSTARTER KITSAccessories

Home > UAVs/Drones > Sensors > GPS >

mRo GPS u-Blox Neo-M8N / 3DR SOLO Upgrade (New)



Our Price: \$49.90
Harmonized Tariff Code: 8526.91.0070
ECCN: 7A994

Quantity in Stock: 33

Availability: Usually Ships in 3 to 5 Business Days
Product Code: GP001-MR

Qty:


[Add To Cart](#)

[Add To Wishlist](#)

[Larger Photo](#)

[Twitter](#) [Facebook](#) [Google+](#) [LinkedIn](#) [Like 3](#) [Share](#)

Alternative Views:



Description

[Designed & Assembled in California]

Check our Solo Installation video tutorial [here](#).


Newer revision! We added a micro USB port that enables you to access all u-Blox features via u-Center and power the device. Please refer to this document if you have driver issues. We also added the latest Taoglas Antenna tuned for GPS + GLONASS, which provides a higher gain compared to any of its predecessors (from 1.5dBi to 5dBi).








Image reference: <https://store.mrobotics.io>


Zubax GNSS 2

[Home](#) [Accessories](#) [Android Devices](#) [PDAs & Smart Phones](#) [RFID & Barcode](#) [Software & Bundled Solutions](#) [Rugged Tablets](#) [Rugged Notebooks, Convertibles & Laptops](#)

Zubax GNSS 2 Receiver, GPS + GLONASS + Galileo with Ublox MAX M8 (M8Q) Engine








Description

Designed by: Zubax Robotics (www.Zubax.com)

Version: 2.2

Applications: Custom Embedded GIS Solutions & Autonomous UAV / Drone Position Receiver

Description: The Zubax GNSS 2 is a very high performance GPS + GLONASS + Galileo concurrent receiver with integrated Barometer and Compass. It is an open-source receiver meant for users that have sensitive position requirements (commercial users; use in semi-urban canopy environments; use in situations where the least amount of GPS drift is desired). The Zubax GNSS 2 receiver is designed for a professional user that requires RF shielding for use in systems with nearby electronics. Through the redundant CAN bus, the receiver is



Zubax GNSS 2 Receiver, GPS + GLONASS + Galileo with Ublox MAX M8 (M8Q) Engine

Brand: Zubax Robotics
Product Code: ZGNSS2
Availability: 175

\$129.00

Available Options

* Zubax Termination Plug Option
--- Please Select ---

* Zubax Cable Option
--- Please Select ---

Qty
1

[Add to Cart](#) [Shipping Estimate](#)

Image reference: <https://shop.titaneliteinc.com>

4. Results.

Results were recorded using the uBlox U-Center program (v8.27).

Link to uBlox U-Center: <https://www.u-blox.com/en/product/u-center-windows>

A. Advertised navigation satellite constellations available (as per the manufacturer / designer's website) versus actual concurrent satellite constellations used.

Device	Manufacturer / Designer	Model	Concurrent Constellations available (advertised)	Concurrent Constellations used (actual)
1	3D Robotics	3DR GPS + Compass	GPS	✓ GPS
2	mRo (Mayan Robotics)	mRo GPS uBlox Neo-M8N	GPS Galileo GLONASS	✓ GPS ✗ ✗
3	Drotek	uBlox NEO-M8T GPS + HMC5983 Compass (XL)	GPS Galileo GLONASS BeiDou	✓ GPS ✗ ✓ GLONASS ✗
4	Hex / Proficnc	HERE GNSS	GPS Galileo GLONASS BeiDou	✓ GPS ✗ ✓ GLONASS ✗
5	Zubax Robotics	Zubax GNSS 2	GPS Galileo GLONASS	✓ GPS ✓ Galileo ✓ GLONASS

Table 2: Advertised versus actual constellations utilized

B. Satellite and position data – First Test, 35 feet (10.6m) from structure

	mRo GPS uBlox Neo- M8N	Zubax GNSS 2	Drotek uBlox NEO- M8T GPS + HMC5983 compass (XL)	HERE GNSS	3DR GPS
<i>Maximum number of satellites in view (SVs tracked max.)</i>	20	74	20	24	15
<i>Actual satellite constellations observed during test</i>	GPS	GPS GLONASS Galileo	GPS GLONASS	GPS GLONASS	GPS
<i>Average Horizontal Position Accuracy Reported by Receiver (PACC H)</i>	None reported	0.516 Meters	None reported	None reported	None reported
<i>Number of satellites used for navigation AVERAGE (SVs used Avg.)</i>	6	13	9	9	8
<i>Number of satellites used for navigation MAXIMUM (SVs used Max.)</i>	7	16	10	13	10
<i>Max. observed horizontal deviation from center (estimated based on deviation graph)</i>	3.5 meters	2.5 meters	3.8 meters	3.7 meters	2.8 meters

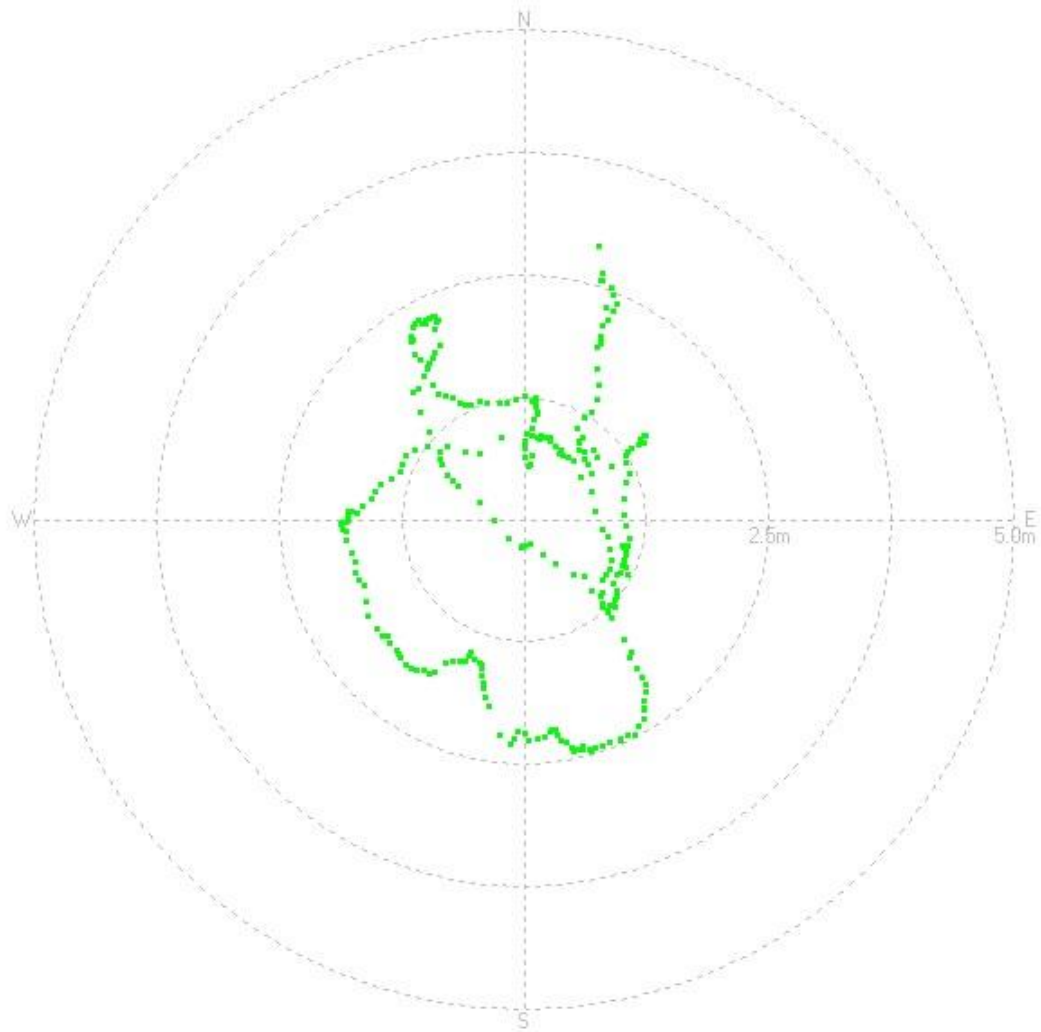
Table 3: Satellite and perceived position data – First Test

1. Deviation Graphs - First Test: 35 feet (10.6m) from structure

Note: The outer circle represents a distance of 5 meters from the “center point” of the estimated position.

3DR GPS - Baseline Test

Created with u-center
© 2017 u-blox AG
www.u-blox.com



40.77972096° -73.10426775°

Titan Elite, Inc.

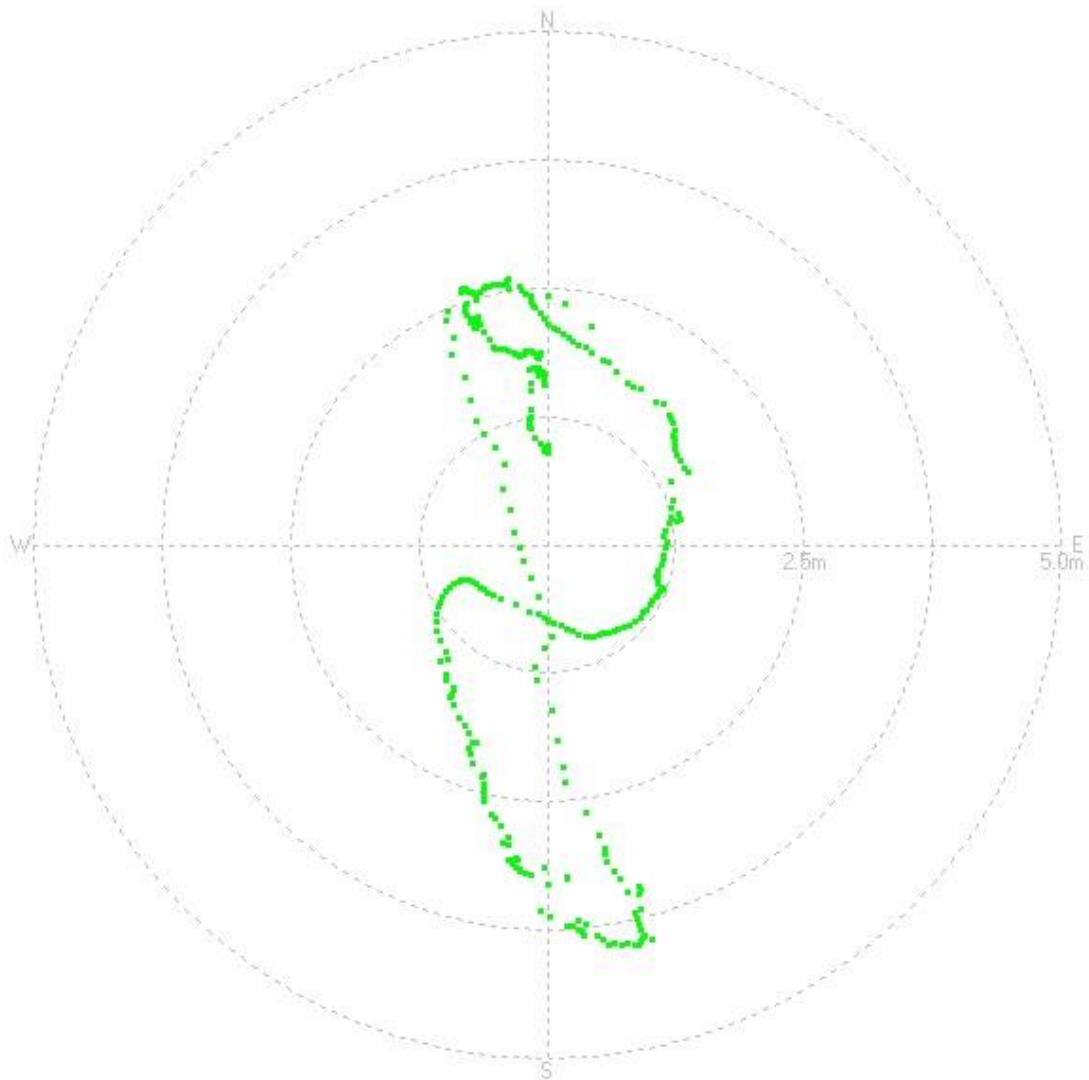
info@titaneliteinc.com – www.TitanElite.com -Tel. +1-855-848-2685

Page 19

Drotek Ublox NEO-M8T (XL) - Baseline Test



Created with u-center
© 2017 u-blox AG
www.u-blox.com



40.77972795° -73.10428720°

Titan Elite, Inc.

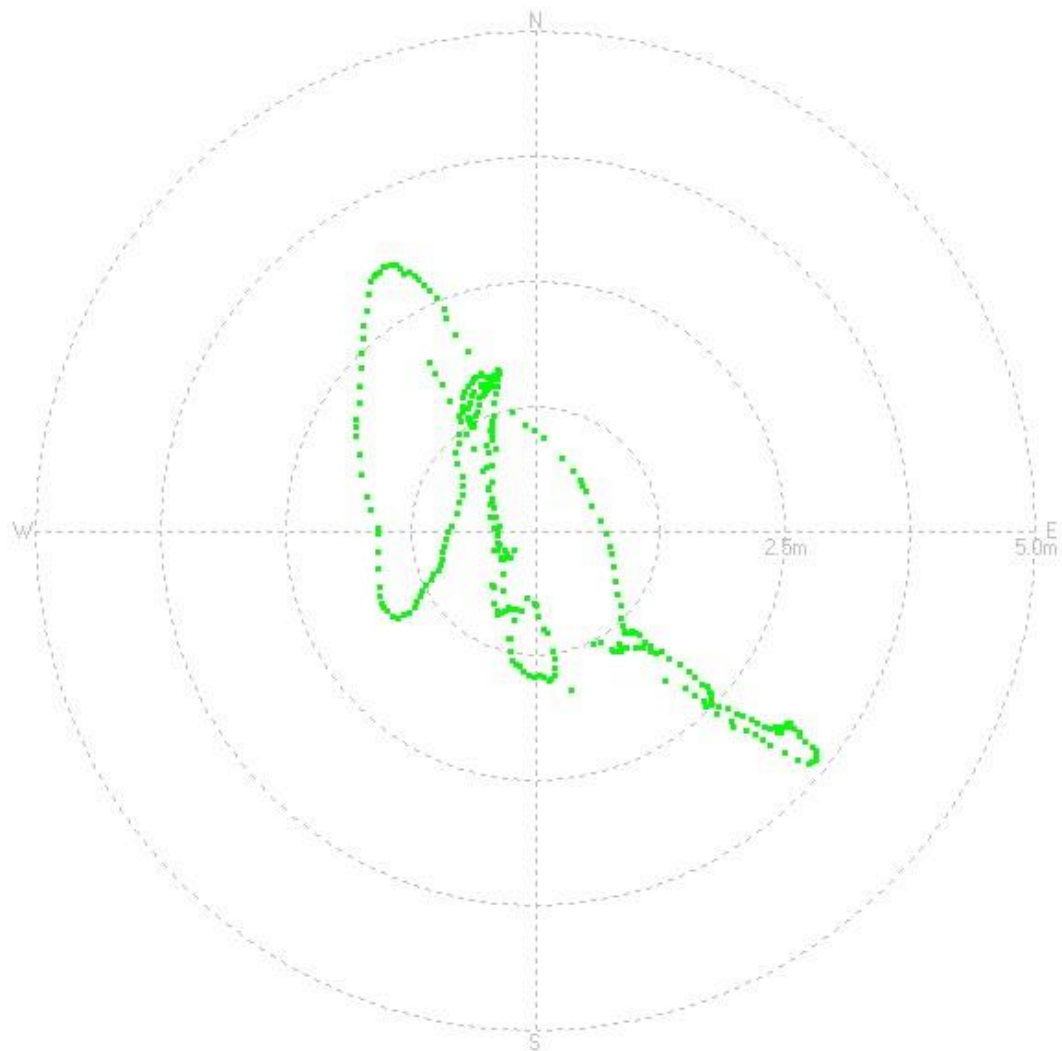
info@titaneliteinc.com – www.TitanElite.com -Tel. +1-855-848-2685

Page 20

Here GPS - Baseline Test



Created with u-center
© 2017 u-blox AG
www.u-blox.com



40.77969166° -73.10424673°

Titan Elite, Inc.

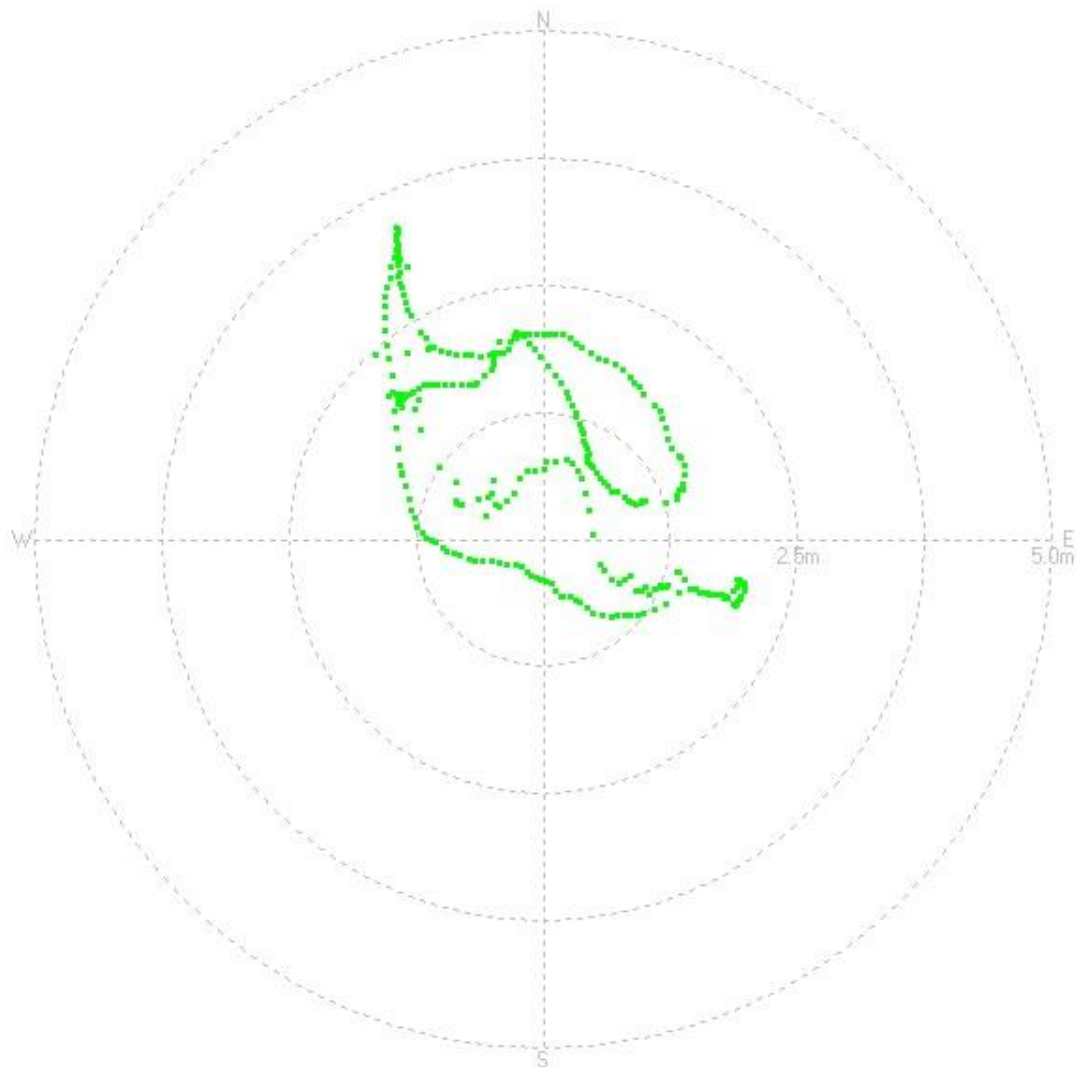
info@titaneliteinc.com – www.TitanElite.com -Tel. +1-855-848-2685

Page 21

mRo U-Blox NEO-M8N - Baseline Test



Created with u-center
© 2017 u-blox AG
www.u-blox.com



40.77972148° -73.10424122°

Titan Elite, Inc.

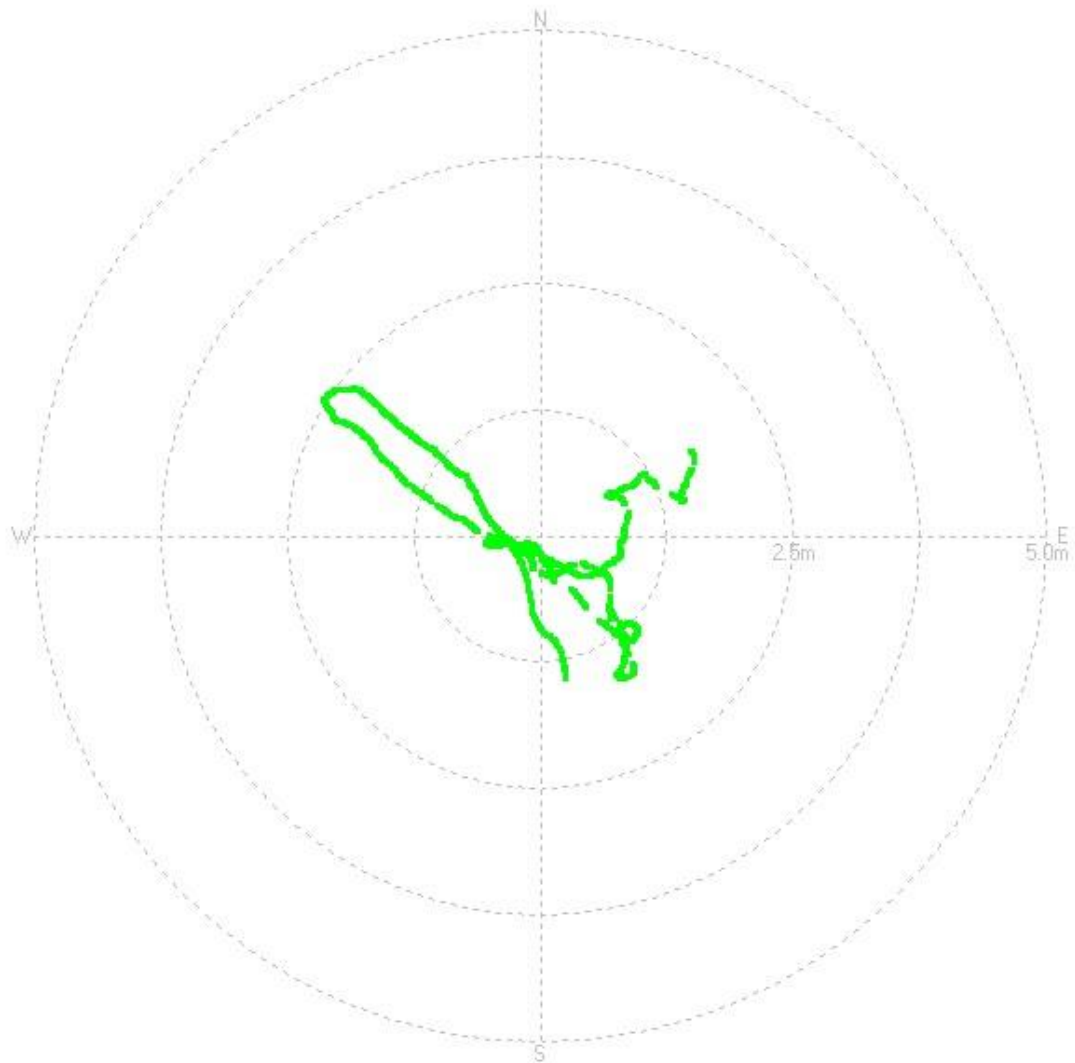
info@titaneliteinc.com – www.TitanElite.com -Tel. +1-855-848-2685

Page 22

Zubax GNSS 2 - Baseline Test



Created with u-center
© 2017 u-blox AG
www.u-blox.com



40.77970792° -73.10425725°

Titan Elite, Inc.

info@titaneliteinc.com – www.TitanElite.com -Tel. +1-855-848-2685

Page 23

C. Satellite and position data – Second Test, 3 feet (0.9m) from structure

	mRo GPS uBlox Neo- M8N	Zubax GNSS 2	Drotek uBlox NEO- M8T GPS + HMC5983 compass (XL)	HERE GNSS	3DR GPS
<i>Maximum number of satellites in view (SVs tracked max.)</i>	10	72	17	23	12
<i>Actual satellite constellations observed during test</i>	GPS	GPS GLONASS Galileo	GPS GLONASS	GPS GLONASS	GPS
<i>Average Horizontal Position Accuracy Reported by Receiver (PACC H)</i>	None reported	1.002 Meters	None reported	None reported	None reported
<i>Number of satellites used for navigation AVERAGE (SVs used Avg.)</i>	6	14	9	11	8
<i>Number of satellites used for navigation MAXIMUM (SVs used Max.)</i>	7	16	11	14	16
<i>Max. observed horizontal deviation from center (estimated based on deviation graph)</i>	31 meters	33 meters	35 meters	31 meters	24 meters

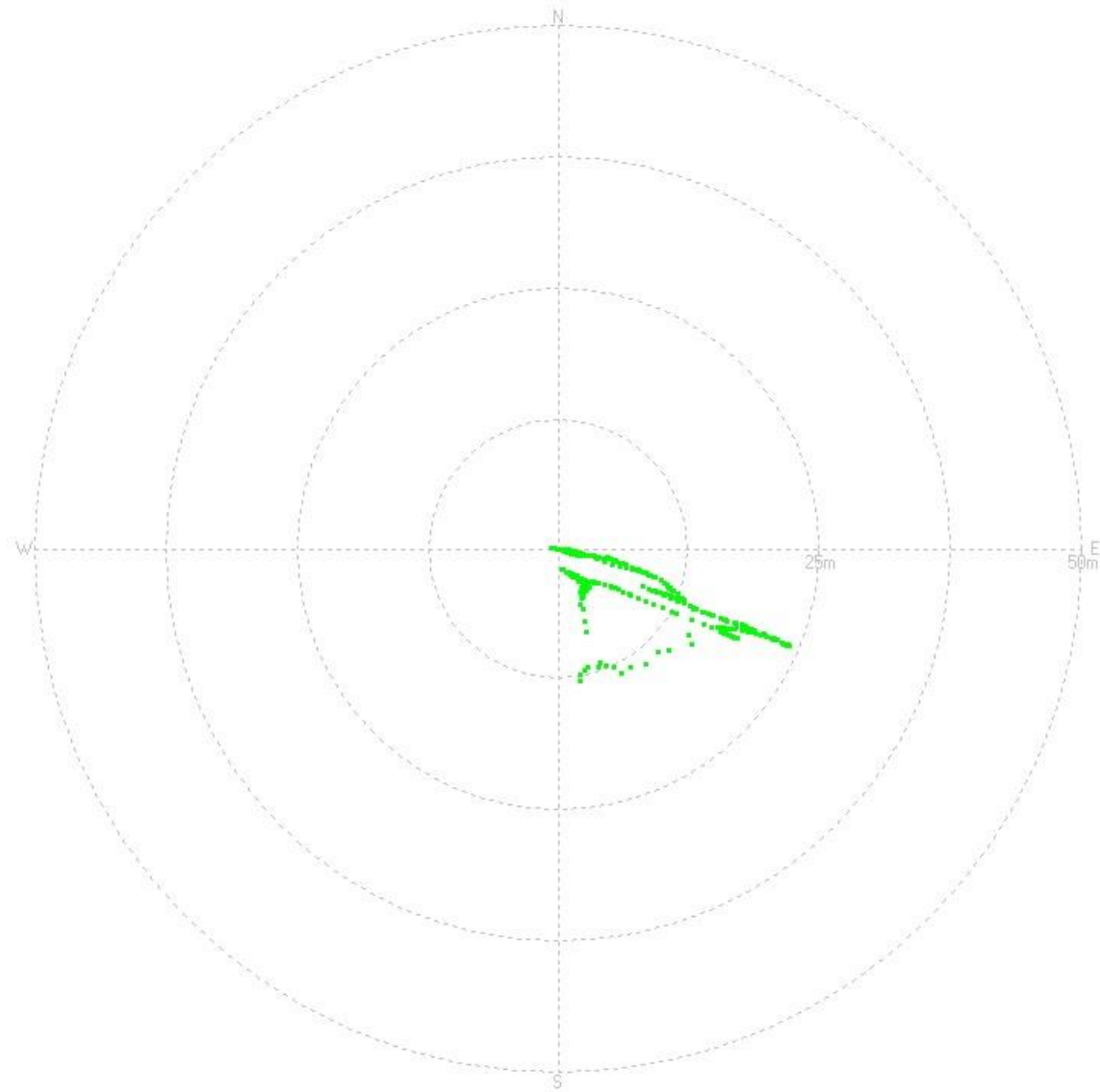
Table 4: Satellite and perceived position data – Second Test

1. Deviation Graphs - Second Test: 3 feet (0.9m) from structure

Note: The outer circle represents a distance of 50 meters from the “center point” of the estimated position.

3DR GPS - Close Proximity Test

Created with u-center
© 2017 u-blox AG
www.u-blox.com

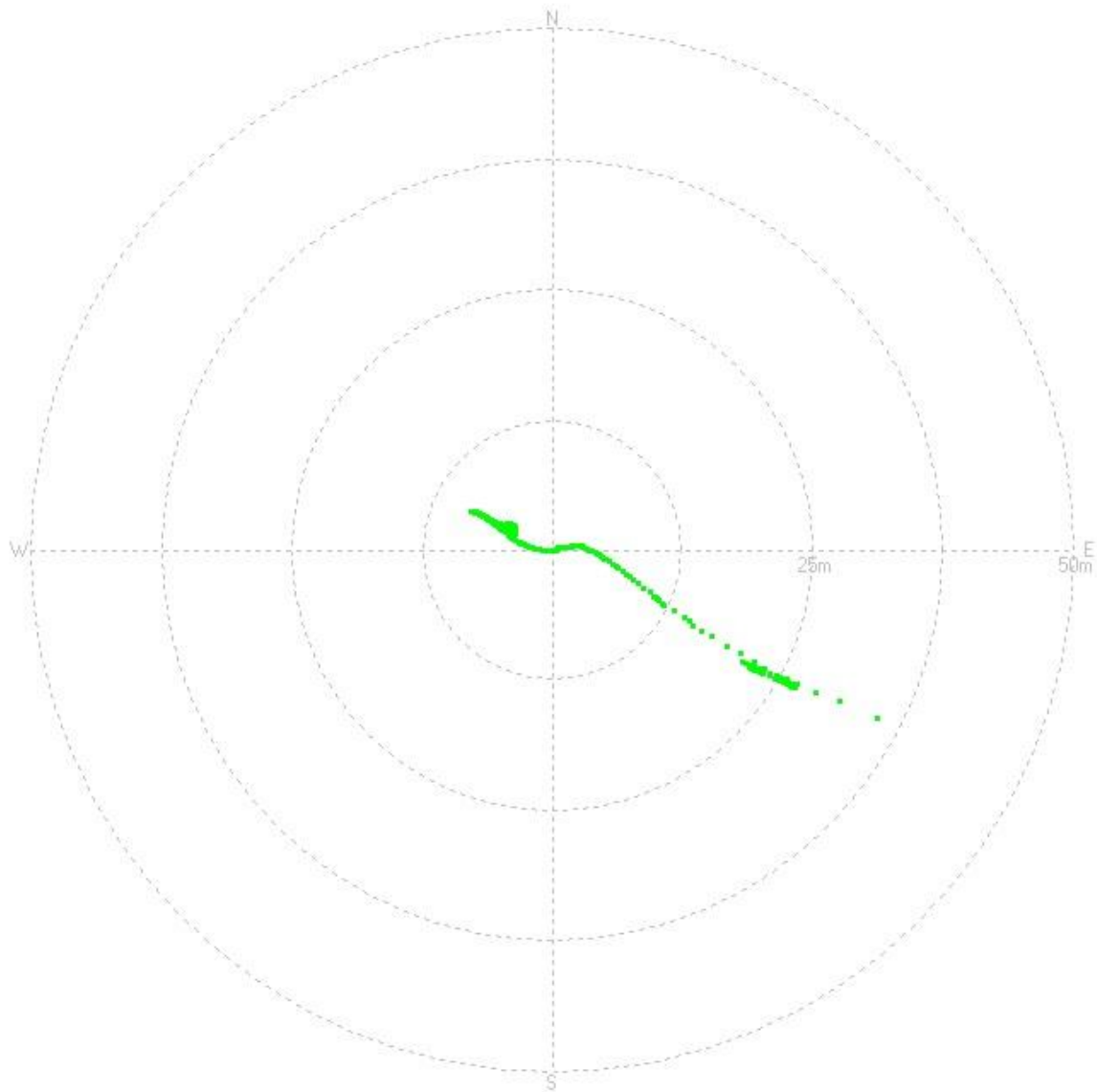


40.77967896° -73.10425904°

Drotek NEO-M8T (XL) - Close Proximity Test



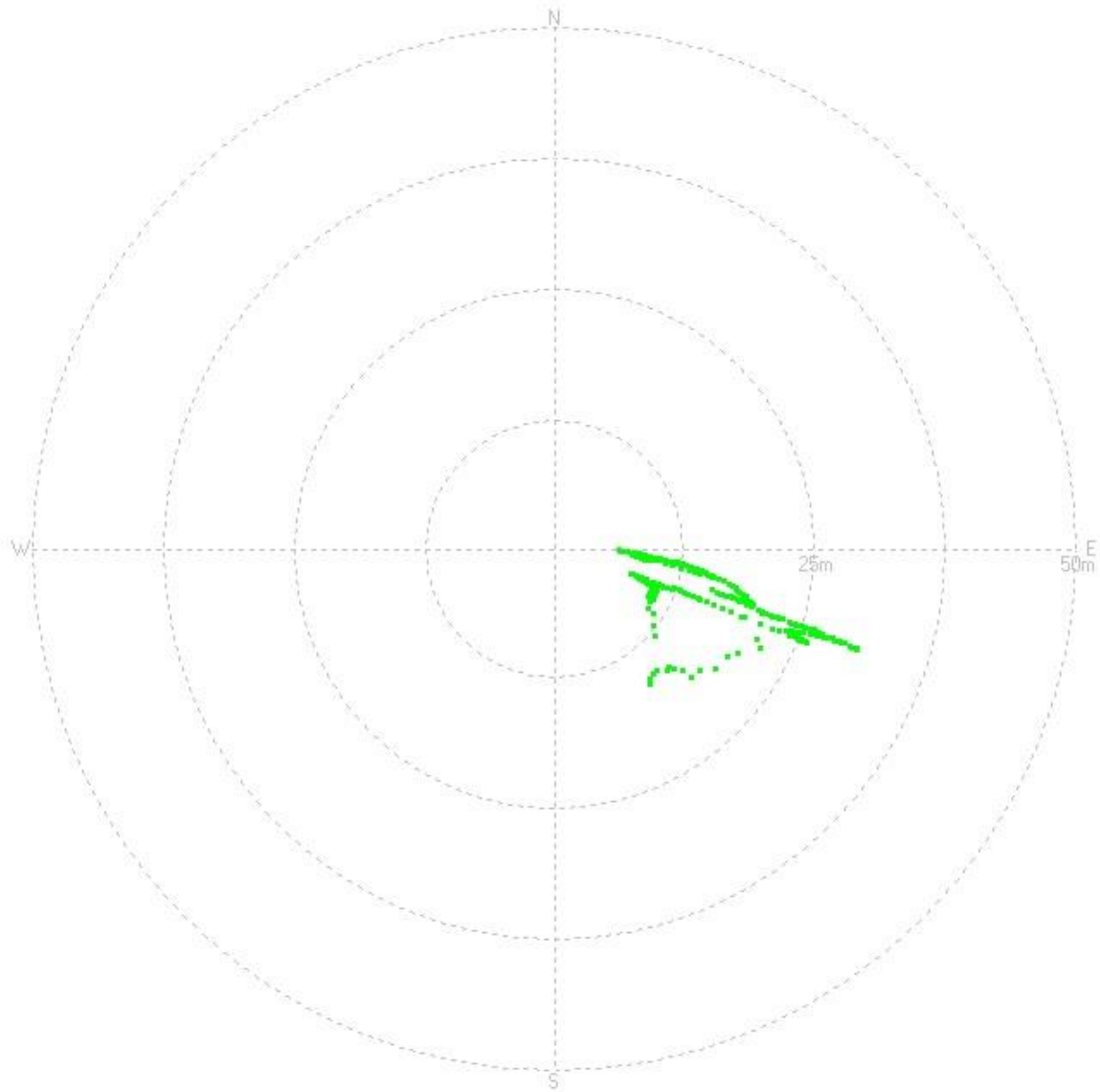
Created with u-center
© 2017 u-blox AG
www.u-blox.com



40.77970642° -73.10439985°

Here GNSS - Close Proximity Test

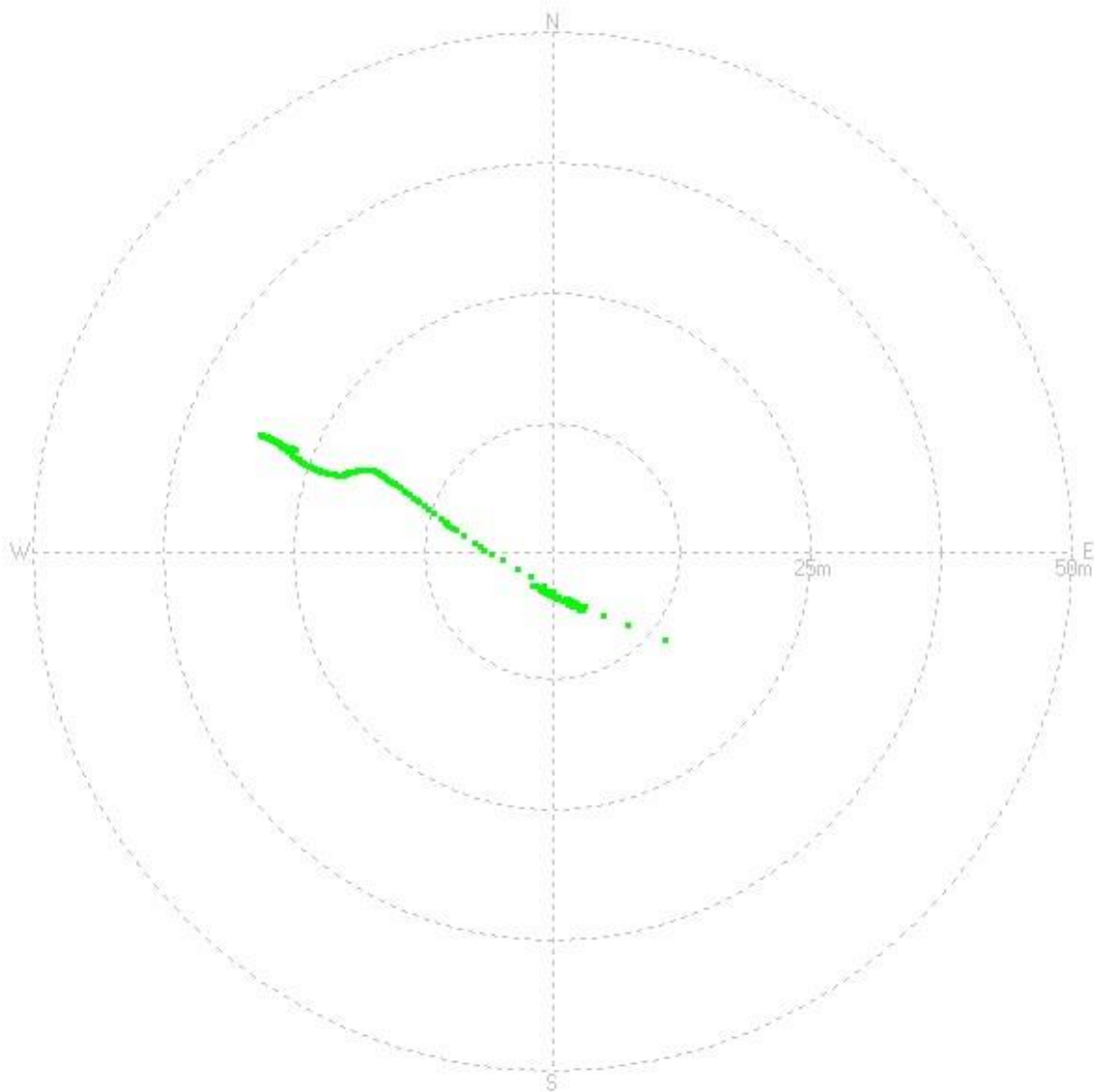
Created with u-center
© 2017 u-blox AG
www.u-blox.com



40.77968227° -73.10434189°

mRo NEO-M8N - Close Proximity Test

Created with u-center
© 2017 u-blox AG
www.u-blox.com



40.77963933° -73.10415920°

Titan Elite, Inc.

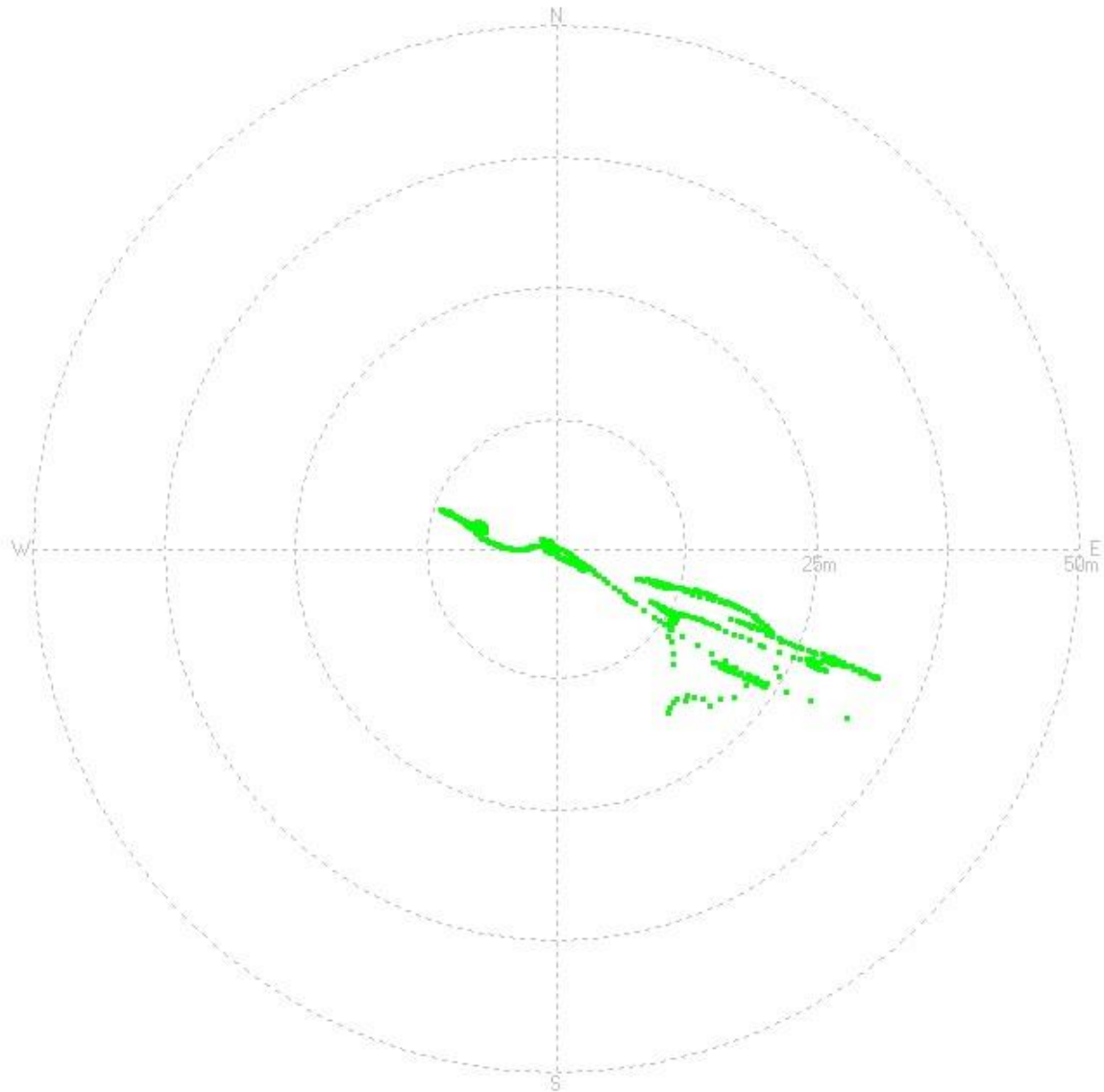
info@titaneliteinc.com – www.TitanElite.com -Tel. +1-855-848-2685

Page 28

Zubax GNSS 2 - Close Proximity Test



Created with u-center
© 2017 u-blox AG
www.u-blox.com



40.77970663° -73.10436103°

- 5. Log files.** The log files from each test period may be downloaded and opened using the uBlox U-Center program.

Device	Manufacturer / Designer	Model	Log File Download Link (First Test)	Log File Download Link (Second Test)
1	3D Robotics	3DR GPS + Compass	http://titaneliteinc.com/share/public/c70e43	http://titaneliteinc.com/share/public/3e6073
2	mRo (Mayan Robotics)	mRo GPS uBlox Neo-M8N	http://titaneliteinc.com/share/public/13e81c	http://titaneliteinc.com/share/public/fa94fe
3	Drotek	uBlox NEO-M8T GPS + HMC5983 Compass (XL)	http://titaneliteinc.com/share/public/543c8e	http://titaneliteinc.com/share/public/f6e5b1
4	Hex / Proficnc	HERE GNSS	http://titaneliteinc.com/share/public/0be50d	http://titaneliteinc.com/share/public/e82dfb
5	Zubax Robotics	Zubax GNSS 2	http://titaneliteinc.com/share/public/a0da4b	http://titaneliteinc.com/share/public/9a04d1

Table 5: uBlox U-Center Log Files

6. Publicly advertised information. The following specifications are reported based upon data found on the designer or manufacturer's website.

	3DR GPS	mRo GPS uBlox Neo-M8N	Drotek uBlox NEO-M8T GPS + HMC5983 compass (XL)	HERE GNSS	Zubax GNSS 2
<i>Link</i>	https://www.getfpv.com/3dr-ublox-gps-with-compass-kit.html	https://store.mrobotics.io/mRo-GPS-u-Blox-Neo-M8N-HMC5983-Compass-p/mro-gps004-mr.htm	https://drotek.com/shop/en/ublox/808-ublox-neo-m8t-gps-hmc5983-compass-xl.html	http://www.helix.aero/?product=here-gnss	https://shop.titaneliteinc.com/index.php?route=product/product&product_id=987
<i>GPS Chipset</i>	uBlox Lea 6H	uBlox NEO-M8N	uBlox NEO-M8T	uBlox M8N	uBlox MAX-M8Q
<i>Communication Type</i>	Serial (I2C for compass and barometer)	Serial	Serial	Serial	Redundant CAN bus; UART; USB
<i>Integrated Barometer?</i>	Yes	No	No	No	Yes
<i>Redundant Communication</i>	No	No	No	No	Yes
<i>Advertised Data Refresh Rate</i>	5Hz	Unknown	1Hz (default)	Up to 10Hz	Up to 15Hz
<i>Retail Cost (US Dollars)</i>	\$89.99	69.90	\$94.51	\$48.00	\$129.00

Table 6: Publicly reported GNSS receiver reference information

7. Additional Testing.

The primary purpose of this paper is to illustrate the out-of-the box, manufacturer configured device performance. Two additional tests were performed after configuring each GNSS receiver to record perceived horizontal position accuracy, as labeled in the uBlox U-Center program as “PACC H”. Similar to the previous test setup mentioned in this paper, the first test consisted of an “open sky”, relatively obstruction free bench test. Following this was an extreme, close proximity test where the GNSS receivers were bench tested next to a commercial building.

A. Test Environment & Parameters.

1. The following test results were observed in the following environment conditions:
 - a. Sky condition: Overcast
 - b. Temperature: 50 degrees F (10 degrees C)
 - c. Humidity: 58%
 - d. Dew point: 36 degrees F (2.2 degrees C)
2. Results were based on observations recorded after at least a 5 minute period.
3. Observations and testing was performed first, approximately 35 feet (10.6m) from a commercial building. Next, observations and testing were performed approximately 3 feet (0.9m) from a commercial building. The exterior of the building and visible features are constructed primarily of concrete, steel and aluminum.

B. Results.

	mRo GPS uBlox Neo- M8N	Zubax GNSS 2	Drotek uBlox NEO- M8T GPS + HMC5983 compass (XL)	HERE GNSS	3DR GPS
<i>Average Horizontal Position Accuracy Reported by Receiver (PACC H) - Meters</i>	1.20	0.65	Not available	1.05	0.95
<i>Minimum Horizontal Position Accuracy Reported by Receiver (PACC H) - Meters</i>	1.10	0.53	1.04	0.96	0.71

Table 7: Estimated Horizontal Position Accuracy Reported – Far from obstructions

	mRo GPS uBlox Neo- M8N	Zubax GNSS 2	Drotek uBlox NEO- M8T GPS + HMC5983 compass (XL)	HERE GNSS	3DR GPS
<i>Average Horizontal Position Accuracy Reported by Receiver (PACC H) - Meters</i>	3.39	1.98	2.58	3.33	4.57
<i>Minimum Horizontal Position Accuracy Reported by Receiver (PACC H) - Meters</i>	2.77	1.62	2.19	2.73	4.11

Table 8: Estimated Horizontal Position Accuracy Reported – Extremely close to building

C. Log files. The log files from each test period may be downloaded and opened using the uBlox U-Center program.

Device	Manufacturer / Designer	Model	Log File Download Link (Relatively Obstruction Free)	Log File Download Link (Extreme Building Proximity)
1	3D Robotics	3DR GPS + Compass	http://titaneliteinc.com/share/public/7a7240	http://titaneliteinc.com/share/public/fdfb7a
2	mRo (Mayan Robotics)	mRo GPS uBlox Neo-M8N	http://titaneliteinc.com/share/public/93146c	http://titaneliteinc.com/share/public/377872
3	Drotek	uBlox NEO-M8T GPS + HMC5983 Compass (XL)	http://titaneliteinc.com/share/public/1d577c	http://titaneliteinc.com/share/public/f3289d
4	Hex / Proficnc	HERE GNSS	http://titaneliteinc.com/share/public/4adf99	http://titaneliteinc.com/share/public/9ea49b
5	Zubax Robotics	Zubax GNSS 2	http://titaneliteinc.com/share/public/fcb9b5	http://titaneliteinc.com/share/public/6f7121

Table 9: uBlox U-Center Log Files

4. Conclusion.

It appears that the majority of devices tested do not perform as stated by the designer/manufacturer in a bench test environment. The largest discrepancy of “advertised specifications” versus “actual observation” involves the use of GNSS constellations enabled and used. This is important to note because a higher number of satellites observed and used could lead to a better position estimate.

When choosing a GNSS receiver for your autopilot, mission critical applications could also benefit from factors including:

- data communication type
- redundant communication capability
- actual real-world performance (i.e. how the device reports position data when subjected to structural or environmental interference)
- how the device performs given EMI produced by neighboring equipment
- data refresh rate
- additional sensors that improve the accuracy of data being processed by the autopilot (i.e. barometric pressure sensor or magnetometer)

It appears that each manufacturer’s published product data focuses on the uBlox chipset installed on the receiver, however the capabilities of the particular chipset must be realized in design and configuration (i.e. if a uBlox chipset states that it can concurrently track 3 satellite constellations, the manufacturer/designer should actually enable those constellations for the benefit of the end user).

Since this document is not a comprehensive analysis, it is important to validate these observations in your actual working environment and consider the maximum limitation of each device before use. When selecting the best receiver for your application, if a trial-and-error approach is impractical, consider the observations from this report when purchasing a select receiver (or receivers). Environmental conditions and related hardware in your end-product ecosystem will impact the actual performance of each GNSS receiver. The observations made in this document have been acquired either from public-facing manufacturer/designer resources or from uBlox U-Center log reports (available to download in *Table 5 and 9*).