

TruPrecision SDK User Guide

V2.0

Visit us on the web:
calian.com/gnss

Document Amendment Record

Revision	Date	Comments
Draft Rev 1_0	18 Aug 2022	Draft- To review
Draft Rev 1_1	4 Jan 2023	Update for Release
Rev 1_2	30 Jan 2023	Updated Download Links
Rev 1_3	31 Jan 2023	Improved instruction clarity
Rev 1_4	3 May 2023	COM port update
Rev 1_7	March 5 2024	Calian Branding, Application vs. Service, Support for multiple Smart Antennas, Heat Map logging function

Copyright

Copyright © 2024 Calian GNSS Ltd. All Rights Reserved.

This document and the subject matter herein are proprietary items to which Calian GNSS Ltd. retains an exclusive right to reproduction, manufacture, and sale. This document is submitted in confidence, for the use of the recipient alone, or in conjunction with Calian GNSS Ltd. and its licensees, and for no other purpose whatsoever unless permission for further disclosure is expressly granted in writing. Information in this document is subject to change without notice. Calian assumes no responsibility for any errors or omissions in this document. Calian GNSS Ltd. hereby disclaims any and all warranties and liabilities of any kind.

Calian GNSS Ltd.
36 Steacie Drive
Ottawa, Ontario K2K 2A9
Tel: 613 591 3131
Fax: 613 591 3121

Table of Contents

1 Introduction 4
1.1 Key Features 4
1.2 Serial Bridge and USB 4
1.3 Included In The Kit 5
1.4 Development Tools Requirements 5
2 Hardware Setup 5
2.1 Recommended Setup Procedure 5
3 TruPrecision Status Console 7
4 Configuring the TruPrecision Application 7
4.1.1 The Mode section selects: 8
4.2 Antenna Serial Connection 11
4.3 Logging 12
5 Log Analysis 13
6  Connect Button and Status Console 16
7  NMEA Output Panel 18
8  GNSS Signal Status Panel 19
9  IMU Status Panel 20
10  Satellite Signal Strength Panel 21

1 Introduction

The TruPrecision SDK is a software development kit intended to make testing of the various Dual Band Smart GNSS Antennas, from Calian GNSS, straight forward and easy to set up. This includes configuration of the Smart GNSS Antenna, connection of supported augmentation/corrections services to the Smart GNSS Antenna (PPP-RTK and RTK Base/Rover modes) as well as ongoing monitoring and logging of the Smart GNSS Antennas received geo-location points.

1.1 Key Features

Calian Dual Band Smart GNSS Antennas typically have common elements for evaluation that the SDK can quickly exercise and observe (without coding) via the TruPrecision graphical user interface, as follows:

1. Where required, converting the Smart GNSS antenna interface connector and protocol to more generally applicable USB with an RS422 or RS232 to USB bridge device.
2. Basic Configuration (Use of corrections, baud rate, com port, logging)
3. High level status (device is communicating, fix state, correction service status etc.)
4. Detailed antenna GNSS Status (float/fixed/accuracy)
5. Multi-format Logs and presentation of logged information (Serial Data logged for map display, and (display presented on map), NMEA, RINEX, native receiver protocol, RTCM)
6. Real time received NMEA stream
7. Graphical Satellite strength representation
8. Mechanisms for testing RTK Base/Rover configurations
9. Built-in augmentation clients such as NTRIP or MQTT for receiving public RTK correction network updates
    a. Authentication facilities for RTK networks and Augmentation services.

1.2 Serial Bridge and USB

Calian Dual Band Smart GNSS Antennas can have various physical interfaces: RS422, RS232, USB, etc. USB is the generally the most widely applicable interface to evaluate the antennas, with the use of USB native versions of the antenna as choice of SDK vehicle being encouraged. If the end-use application requires one of the other interfaces (e.g. RS-422 or RS-232), an SDK for an antenna featuring the target application physical interface can be procured, and Calian bundles a 27-0095-xx Serial to USB bridge with non-USB equipped antenna SDKs to make testing from a PC easier. Calian Dual Band Smart GNSS Antennas with built in USB interfaces integrate Silicon Labs CP210x USB-UART Bridges to connect the built-in GNSS receiver to USB. If an antenna with RS-232 or RS422 needs to be adapted to USB, this same USB-UART bridge is used in the 27-0095-xx Serial Bridge, and the serial uart interface of the antenna connects to the bridge via RJ45 plug, and to the PC via

USB. Accordingly, in both instances, using the SDK requires downloading the Silicon Labs driver (see next section).

Appendix 1 – Smart GNSS Antenna vs. Serial Bridge matching shows the part number of the 27-0095-xx Serial Bridge required for the various Smart Antennas available from Calian, for separate ordering if required.

1.3 Included In The Kit

- SDK Part number referenced Calian Smart GNSS Antenna
- If non-USB antenna, 33-0095-xx Configuration Adaptor w/USB cable
- Insert with PointPerfect 60-day trial redemption code
- 10cm Ground Plane on antennas where ground plane is required (allows stand-alone precision testing)

TruPrecision application https://cs.at.calian.com/nextcloud/index.php/s/GG4PrtpDRbqow5s
  - Configure the Smart GNSS Antenna
  - Connect to the specified augmentation service
  - Monitor and display operation status

Calian uBlox Gen9 Configurator (a Calian tool that can configure more aspects of a u-blox receiver integrated into a Smart Antenna). TruPrecision does not do much configuration. The uBlox Gen9 Configurator is also available at https://cs.at.calian.com/nextcloud/index.php/s/WReKdd5rNtAj64Z

1.4 Development Tools Requirements

- Computer with Windows operating system. It is recommended to use either Windows 10 (or later) or Windows Server 2016 (or later)
- Silicon Labs USB to UART driver - CP210x Windows Drivers – https://www.silabs.com/documents/public/software/CP210x_Windows_Drivers.zip

  Note that there is a choice of 64-bit and 32-bit installers. Choose the appropriate driver for your computer. The installer must be de-compressed.

  This driver is essential for properly connecting to the Smart GNSS antenna via the 33-0095-xx serial bridge, or to any USB based Smart GNSS Antenna

2 Hardware Setup

2.1 Recommended Setup Procedure

- Install the Silicon Labs USB driver and then the TruPrecision app.
- Connect the Smart GNSS Antenna to the 33-0095-xx RJ45 port. (Figure 1)
- Connect the USB Cable from the 33-0095-xx or directly from the Smart GNSS Antenna if applicable to the PC “Type A” USB port.



Figure 1: Tallymatics 33-0095-11 + TW5390 Hardware

- Launch the Windows Device Manager to confirm detection of the two COM ports. (Figure 2) Note: The PC will dynamically assign port numbering.

Silicon Labs Dual CP2105 USB to UART Bridge: **Standard** COM Port (COMx) is a **bidirectional** port to facilitate the augmentation service.
Silicon Labs Dual CP2105 USB to UART Bridge: **Enhanced** COM Port (COMy) is a **unidirectional** port to support NMEA output monitoring.

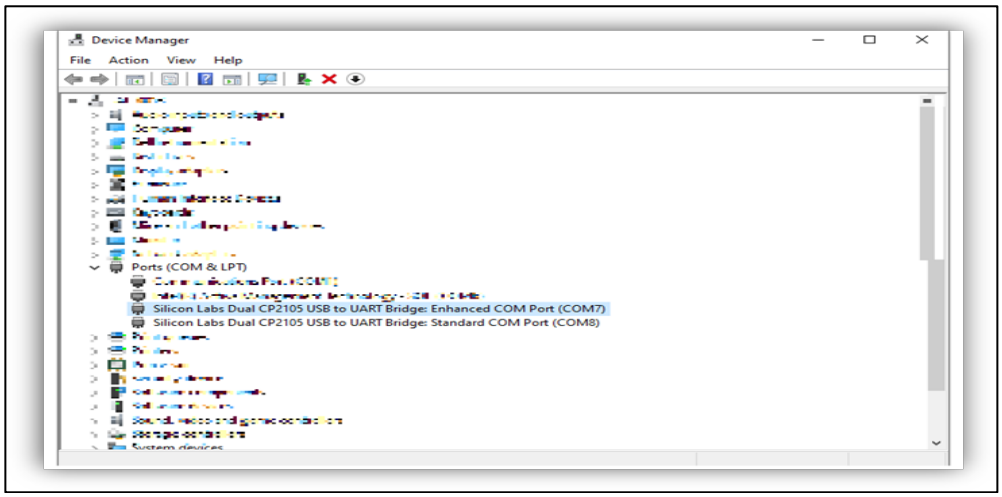


Figure 2: Device Manager (Windows) – Example Ports 7/8

Note: The TruPrecision app communicates to the Smart Antenna on the bi-directional port listed as com 8 in this example. The secondary USB port is available as a NMEA monitor for connection to any NMEA compatible application. This facilitates delivery of precise location performance to legacy applications without any need for coding updates.

Q

3 TruPrecision Status Console

Launch an instance of the application. Multiple instances of TruPrecision can run on a PC, each focused on a specific antenna. The Status Console will appear (Figure 3: Status Console).

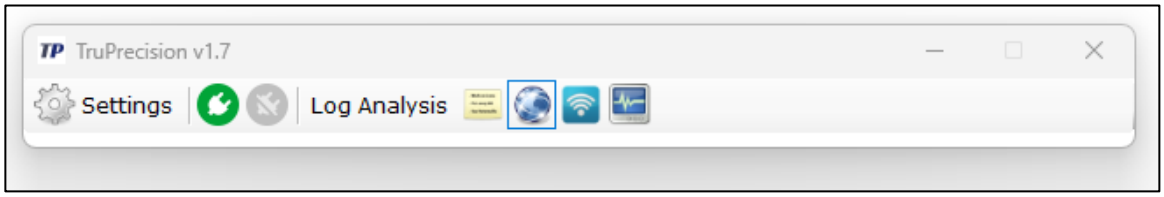
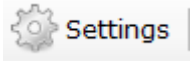
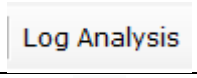


Figure 3: Status Console

This panel has several controls on it, with the following functions:

	**Settings Button**: Toggles visibility of the settings configuration panel
	**Connect Button**: Connect/disconnect from device. When green, pressing will connect to the Antenna, when red, pressing will disconnect.
	**Log Button**: Toggles visibility of the log file view panel
	**NMEA Stream Button**: Toggles the visibility of the broadcast NMEA stream
	**GNSS Status Button:** Toggles GNSS Status window
	**Satellite Strength Button**: Toggles graphical GNSS Satellite Strength view
	**IMU Status Button**: Toggles Intertial Measurement Unit (IMU) Calibration status window

4 Configuring the TruPrecision Application

- On the Status Console, click on the Settings button
- The Configuration Panel will appear (Figure 4).

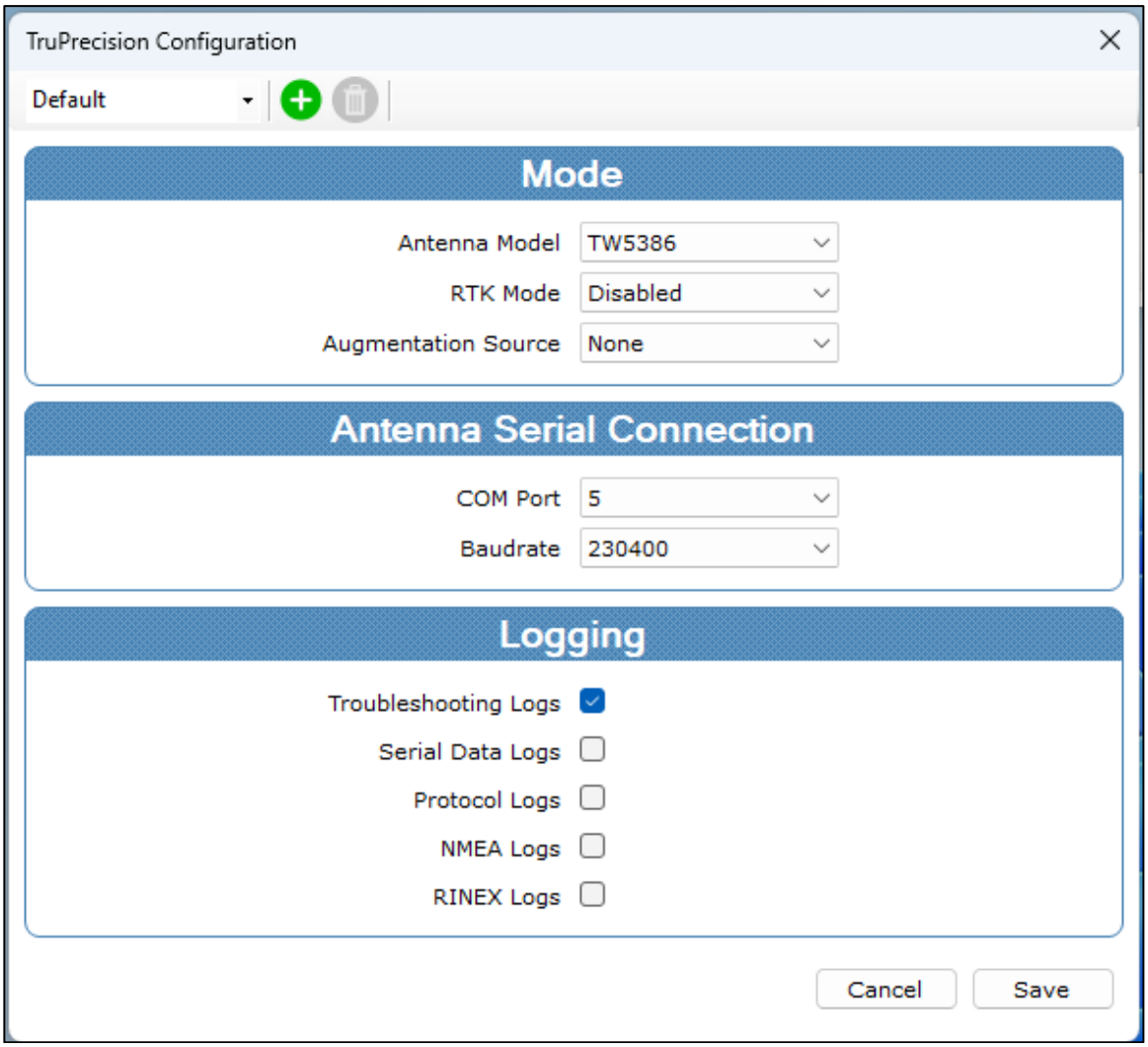
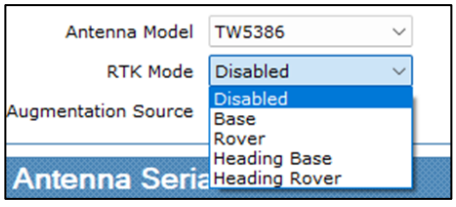


Figure 4: Basic Configuration Panel

- The Configuration Panel has a dynamic appearance, depending on the Mode being configured.
- Note that Configurations can be saved ONLY when the antenna is disconnected from the application. It must be saved while the antenna is disconnected, and is always applied to the antenna when it is connected.

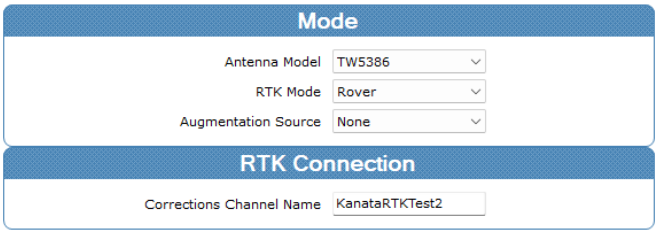
4.1.1 The Mode section selects:

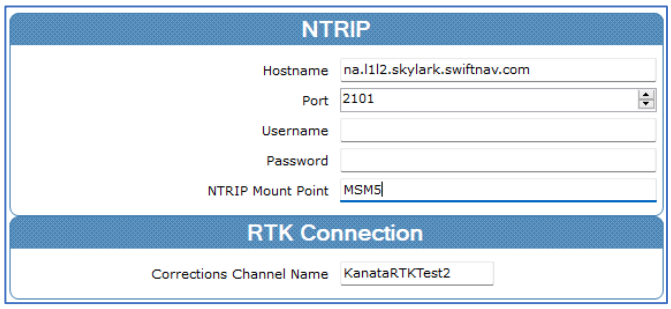
a. the antenna model being worked with.
b. RTK Mode being applied
   i. Disabled
   ii. Base



iii. Rover
iv. Heading Base (for Precise Heading Mode)
v. Heading Rover (for Precise Heading Mode)

c. Augmentation Source
   i. The Augmentation Source is dependent on the RTK Mode.
      1. If RTK mode is Rover (Ordinary Rover or Precision), there are 2 augmentation source options;

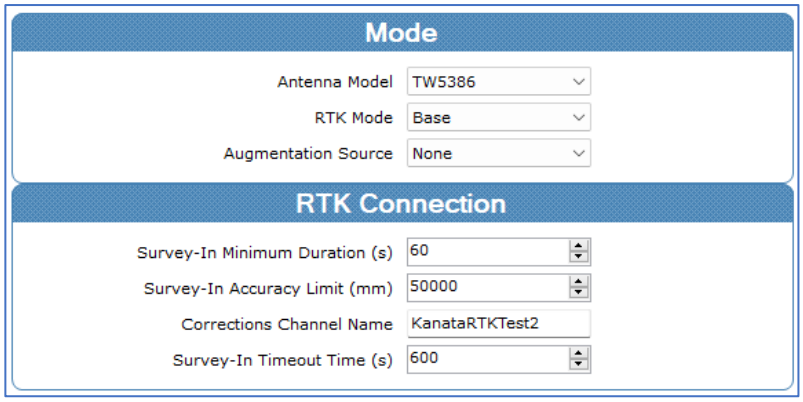




a. NONE. When "RTK Mode No Augmentation" source is selected, the RTK Connection section below it shows a field into which a Corrections Channel can be named. This refers to a cloud-based location arranged by Calian where a TruPrecision enabled base can "push" RTCM corrections, and a TruPrecision enabled rover can "get" RTCM corrections.

b. NTRIP. In this configuration, the built-in NTRIP client of the TruPrecision application is looking to have an NRTK NTRIP source configured for RTCM messages. Compatible choices of service are Swift Navigation and Point One Navigation.

      2. If RTK mode is Base (Ordinary or Precision), there are three Augmentation sources:



a. NONE: In this mode the Base is achieving its fix by purely standalone methods (No augmentation). Note that only BASE capable antennas should use this mode (e.g. TW5x84, TW5x94, TW5388). The RTK Connection section requires a Survey-in Minimum duration in seconds, a Survey-in Accuracy Limit in mm, the Corrections Channel Name, and a Survey-In Timeout Time maximum. This determines the minimum accuracy and time to fix of the BASE fix.

b. PointPerfect. In this mode, the Base antenna can get augmentation from the PointPerfect augmentation service, enhancing the location

precision of the Base itself (**Error! Reference s ource not found.**). The PointPerfect authentication information must be populated (see Appendix 2 – U-Blox Point Perfect PPP-RTK Service).

i. Note that if the Antenna is capable, the choice of augmentation network can either be network IP or L-Band (mutually exclusive choices). The operational region must also be selected. The current options

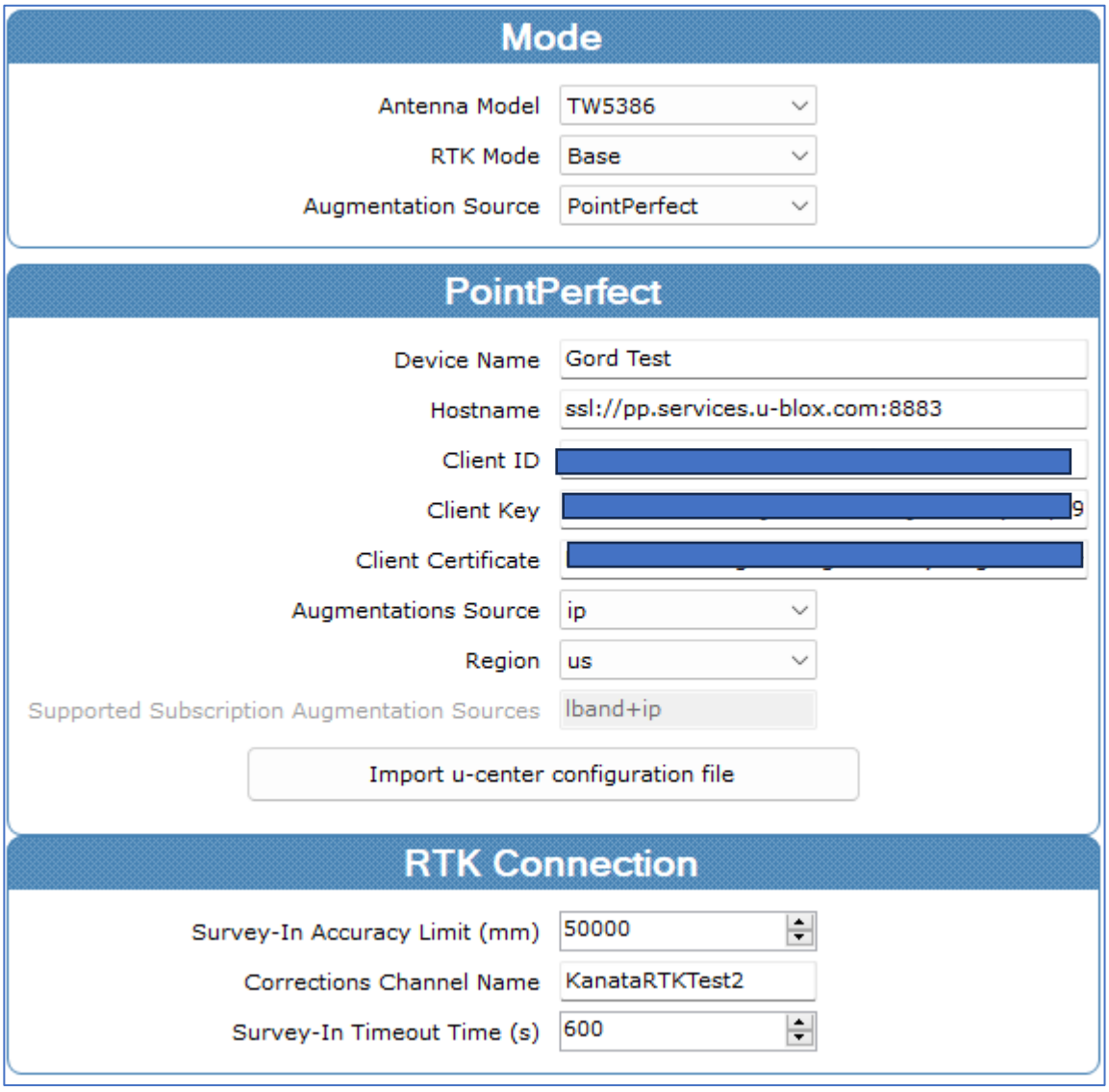


Figure 5: PointPerfect Configuration

are: US; EU; KR(Korea); AU(Australia)

c. NTRIP. This mode is used for the Skylark NRTK service or Point One Polaris. (Figure 6), and

received RTCM messages from these services can also be used to enhance the survey-in time and accuracy of the BASE antenna

3. If RTK mode is disabled, and there is no Augmentation source, then the Antenna is in Standalone mode
4. If RTK mode is Rover, the choice of correction RTCM is either the Corrections Channel supported by Calian for SDK evaluation purposes, or NTRIP client for NRTK sources.

4.2 Antenna Serial Connection

This section (Figure 7) should perhaps be the first configuration detail to pay attention to, as this is where the COM Port information obtained in the Recommended Setup Procedure section from the Device Manager should be applied. Default baud rates are 230400 from the factory, however, multiple baud rates choices are available here in case the factory setting has been changed (via ublox ucentre or Calian ublox Gen9 Configurator)

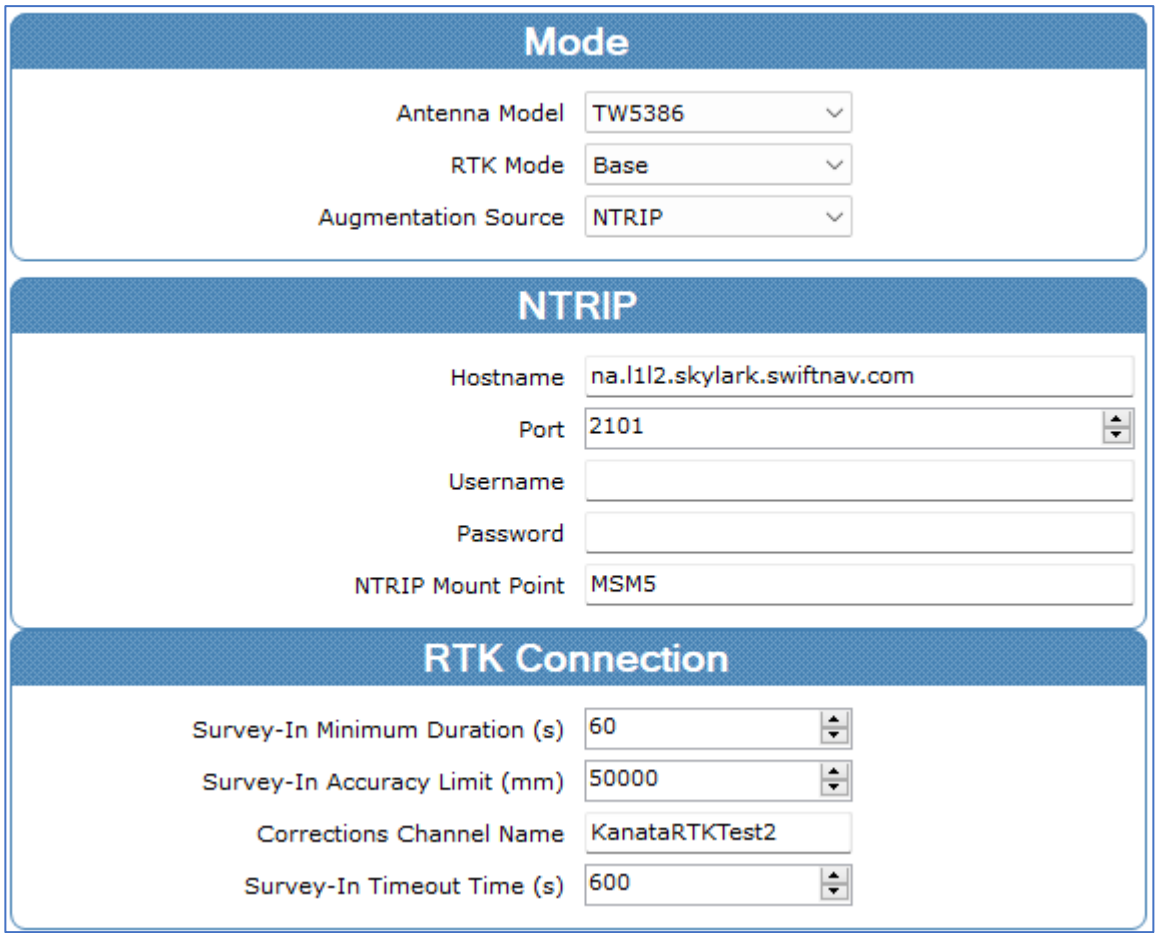


Figure 6: NTRIP Configuration

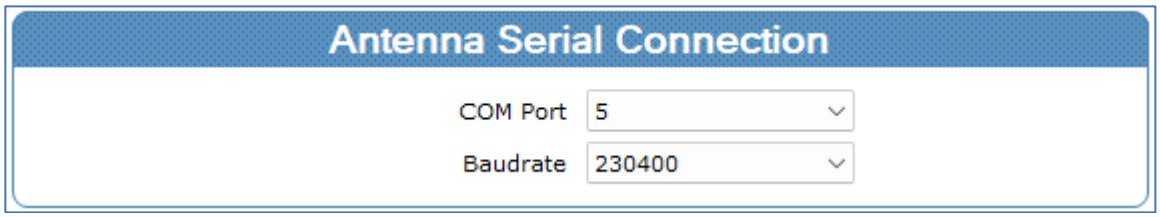


Figure 7: Antenna Serial Connection

4.3 Logging

The Logging section allows logs to be saved whenever the antenna is connected to TruPrecision. Logs can be found at:

c:\ProgramData\Tallysman\TruPrecision\Logs.

Logs cannot be accessed if the Antenna is connected to TruPrecision. All logs are saved in a folder named for the type of mode configuration. For example, if the RTK mode is Base, and no augmentation source is specified, the folder is called "Base" and all log files with that RTK configuration will be in that folder. If the RTK mode is Disabled and the Augmentation source is PointPerfect, the log files for that

configuration will be in a folder called “Disabled PointPerfect” In each folder, the logged files are named for the log type and the date, for instance “Serial 20240315”. All logging on one date will be added to the same file, unless the Serial file for the date-stamp is renamed manually (e.g. useful for quickly identifying individual trips). The next connection to the antenna will see a daily file of the default naming nomenclature started again.

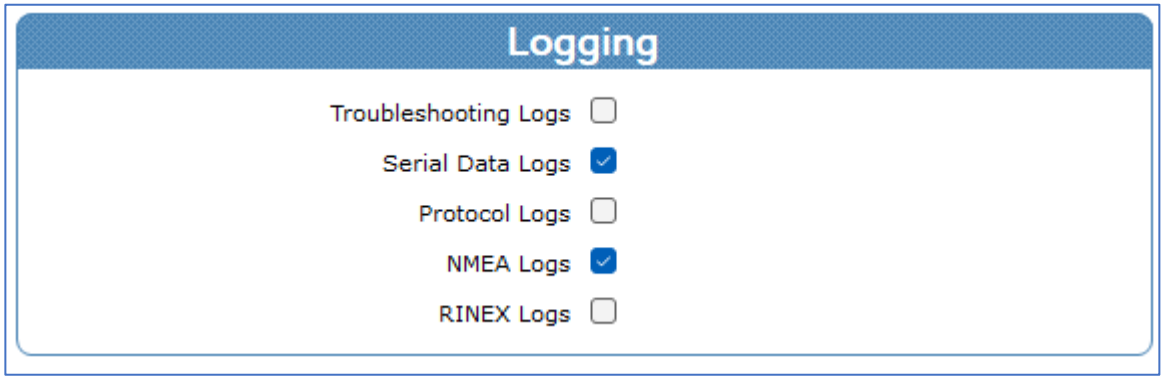


Figure 8: Log File section

Log files are readable text, but serial logs can be viewed on a map using the Log Analysis feature. The table below shows the naming nomenclature for each type of log file and Figure 11 shows an example directory for a set of log files belonging to a specific RTK Mode Correction configuration.

Log Type	File Name
Troubleshooting Logs	“Application_YYYYMMDD”
Serial Data Logs	“Serial_YYYYMMDD”
Protocol Logs	“UBX_YYYYMMDD” and “RTCM_YYYMMDD” (RTCM only available in Base mode
NMEA Logs	“NMEA_YYYYMMDD”
RINEX Logs	“Rinex_YYYYMMDD”

When **changing** RTK Correction modes, the TruPrecision application must be quit and restarted to ensure log files are directed into the correct folder e.g. Base vs. Serial.

5 Log Analysis

To use the Log Analysis feature TruPrecision must be disconnected from the antenna (Figure 9). The purpose of this mode is to view the geo-location data on a map.

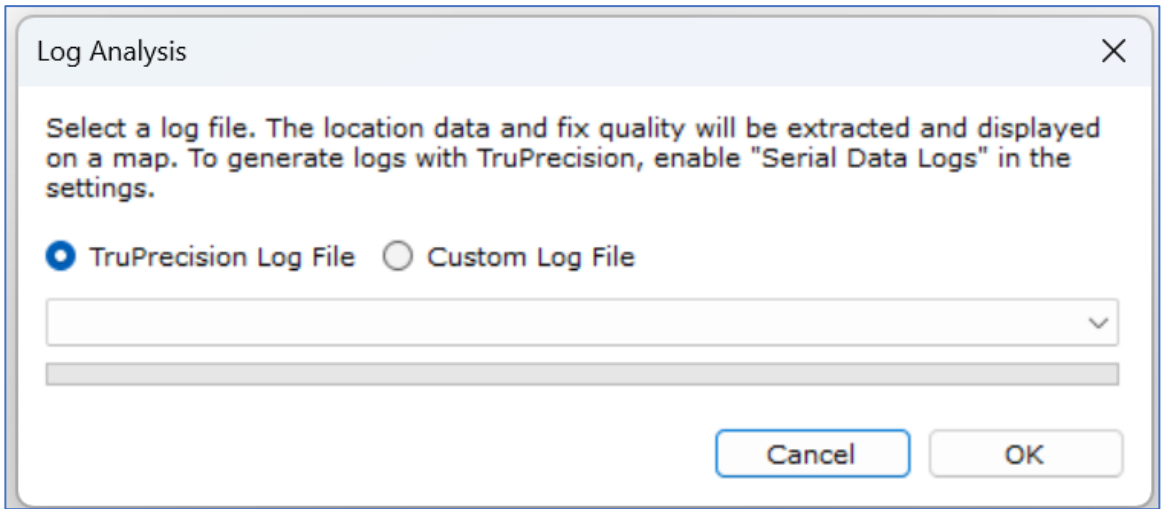


Figure 9: Log Analysis Panel

There are 2 types of files that can be viewed: a TruPrecision **Serial** Log (with the naming conventions previously discussed), or the same type of file with a custom name. If a TruPrecision Log file is selected, a list of the files available in the folder for the current RTK mode configuration will be displayed in a pulldown (Figure 10). When selected, the geo-location data will be viewed in the system default browser on a map.

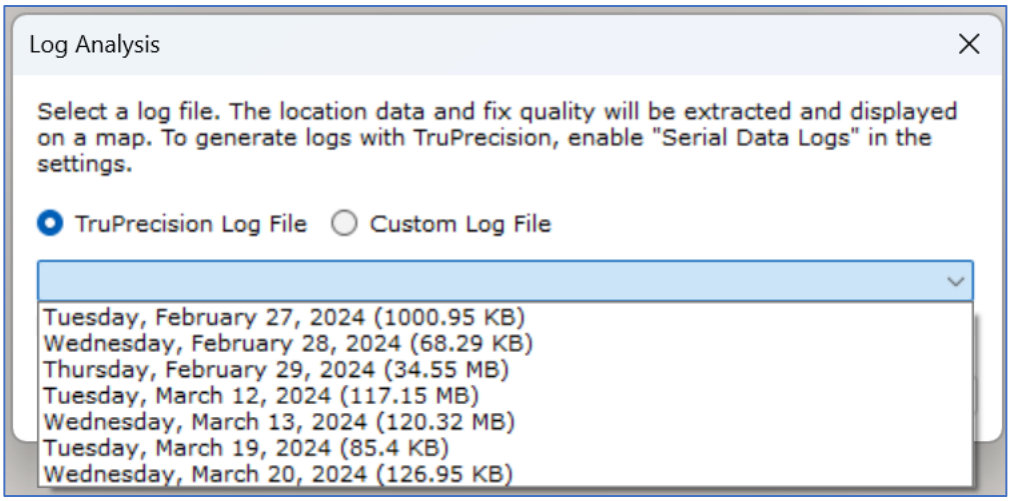


Figure 10: Pull down menu of TruPrecision logs

If the serial files are renamed, or in a folder other than the current "RTK Correction Mode" folder then they can be found using the custom log button. These can be found using the "…" button which will open the file browser window to look for the files.

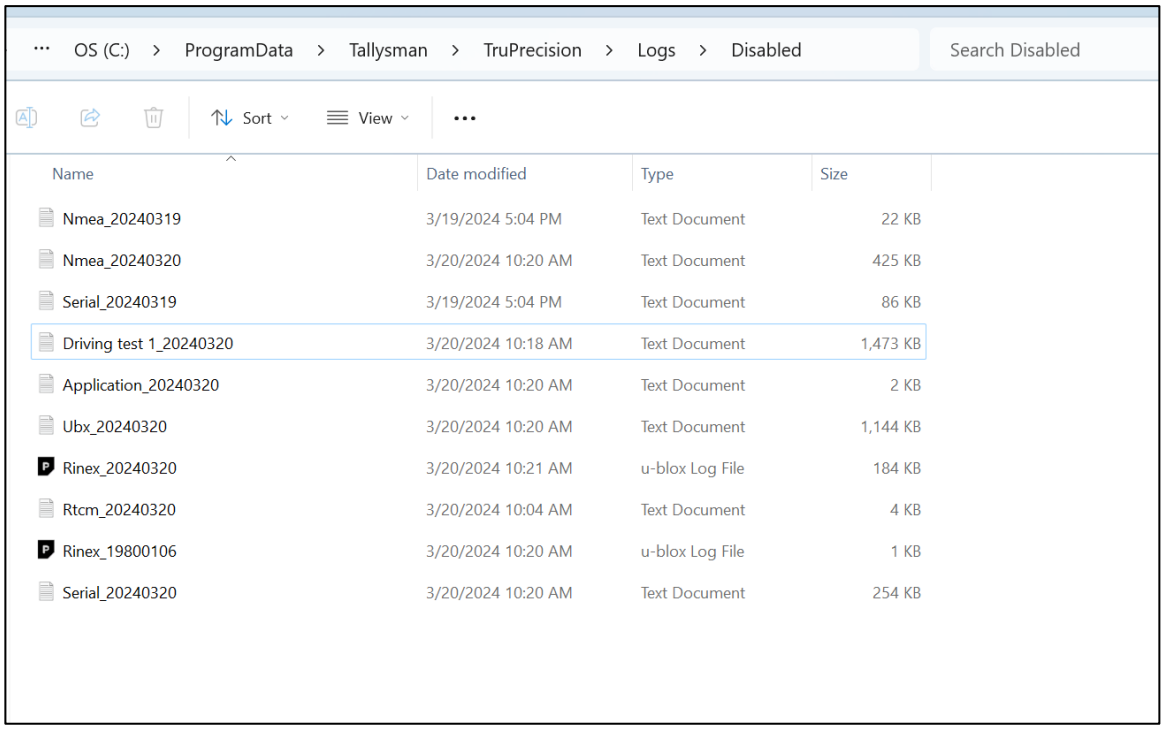


Figure 11: Directory with Log files

Once selected, the default system browser is opened showing a “heatmap” of the location and fix status of the antenna as logged in the Serial Log file selected. Figure 12 shows such a heat map. The legend show the various fix states, including GDR (Dead Reckoning Sensor-Fusion from an IMU).

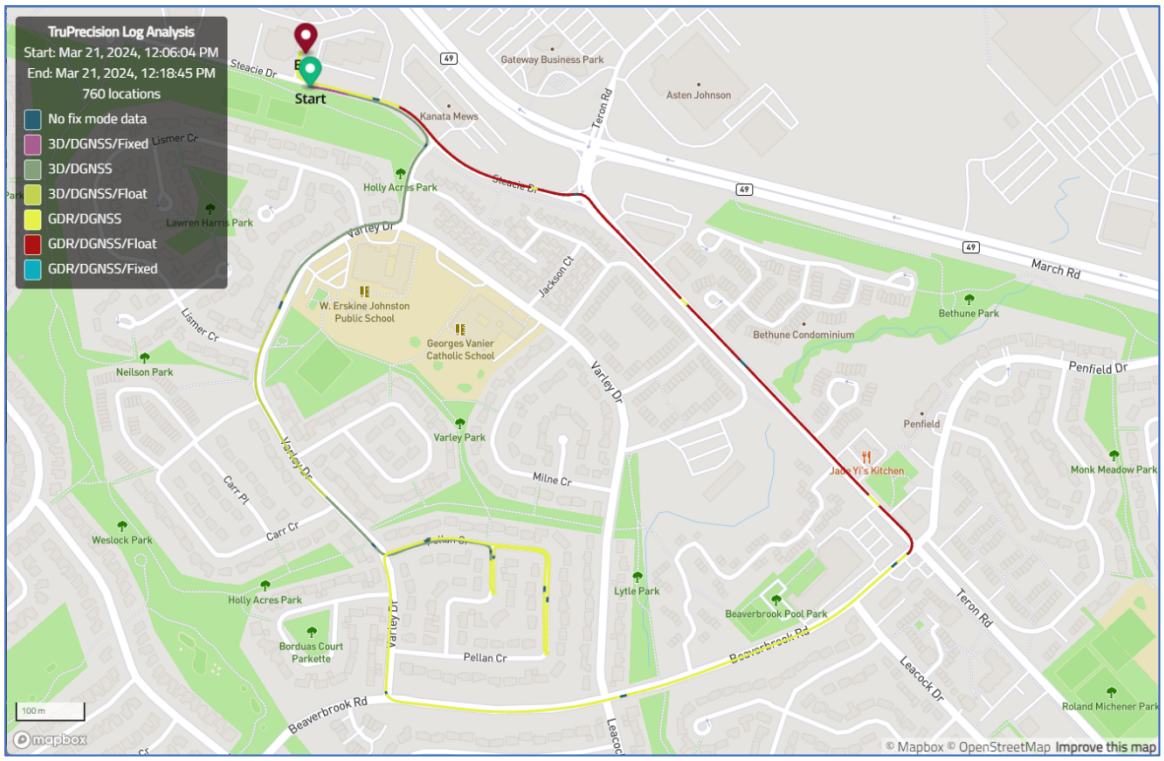


Figure 12: Heat Map of Serial Data Log information

6 Connect Button and Status Console

The Connect Button connects TruPrecision to the antenna. When the icon is green, the antenna is NOT connected (it is inviting you to connect) and the TruPrecision Console displays NO status information. When the Connect Button is selected, TruPrecision connects to the antenna if the correct COM port has been specified in the configuration panel (Figure 4). Status Console then displays meaningful information about the COM Port, the Antenna and the connection to augmentation services or RTK corrections.

The following service status information is available, depending on the RTK Correction and Augmentation Service configuration

- Bi-directional connection to Smart Antenna (Active/Fail)
- GNSS Fix and augmentation message status (Active/Fail)
- RTK Base/Rover status
- Connection Status to Augmentation IP gateway service (Active/Fail)

Figure 13 shows the Status Console properly connected to an Antenna with a Valid GNSS fix.

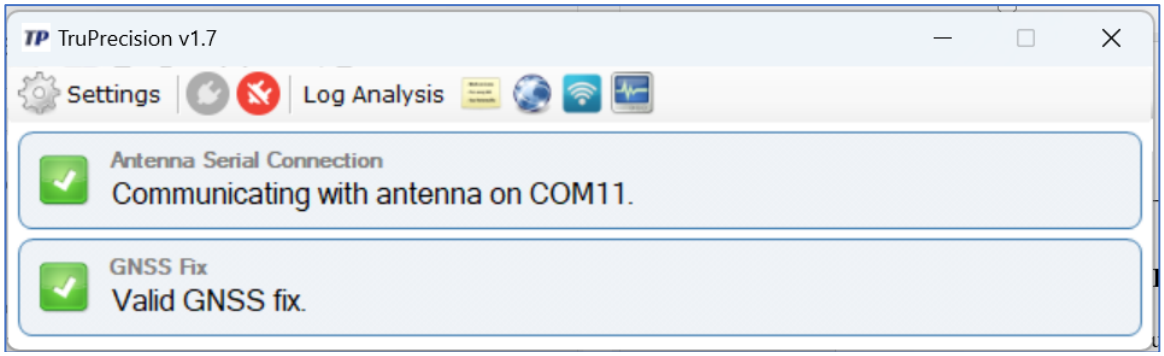


Figure 13: Status Console with No RTK Corrections Mode or Augmentation

Figure 14 shows the status for an antenna in Base mode with no Augmentation service. The Survey Mode prerequisite conditions are set in the Configuration Panel.

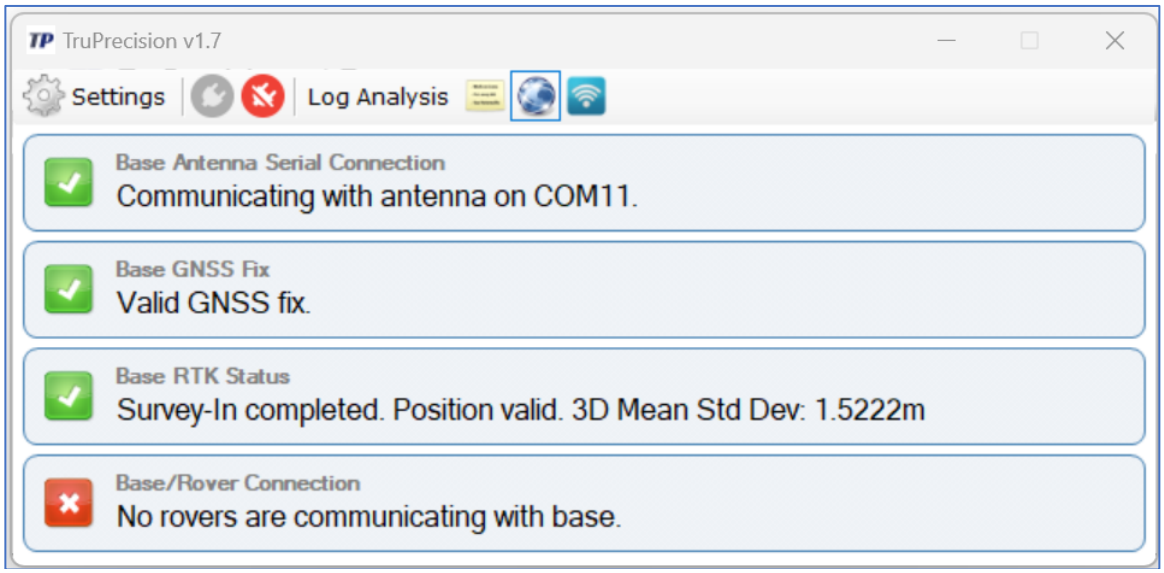


Figure 14: Status Console for Base no Augmentation

Figure 15 shows an antenna with no RTK Correction specified, but PointPerfect Augmentation enabled.

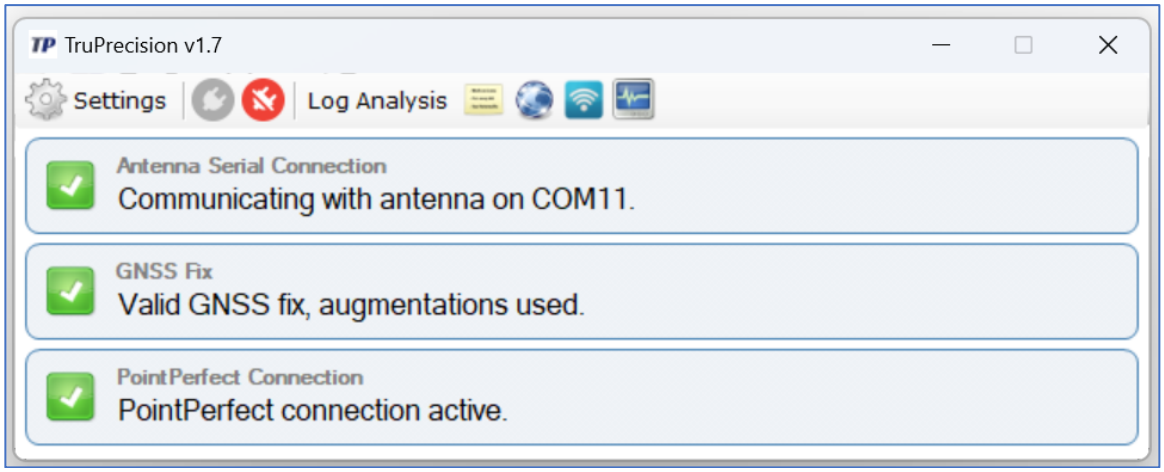


Figure 15: Status Console for Antenna with no RTK, but PointPerfect Augmentation enabled

Figure 16 shows an antenna with no RTK Corrections specified, but PointPerfect Augmentation enabled over L-Band. As an aside, a Smart GNSS antenna using PointPerfect PPP-RTK over L-Band must refresh its encryption keys by reporting over a network connection at least once per 30 days.

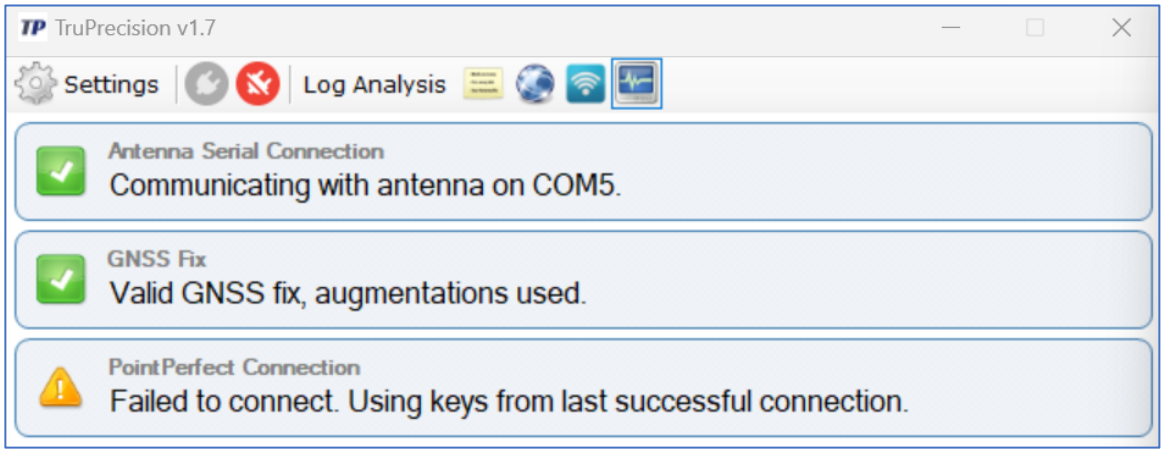
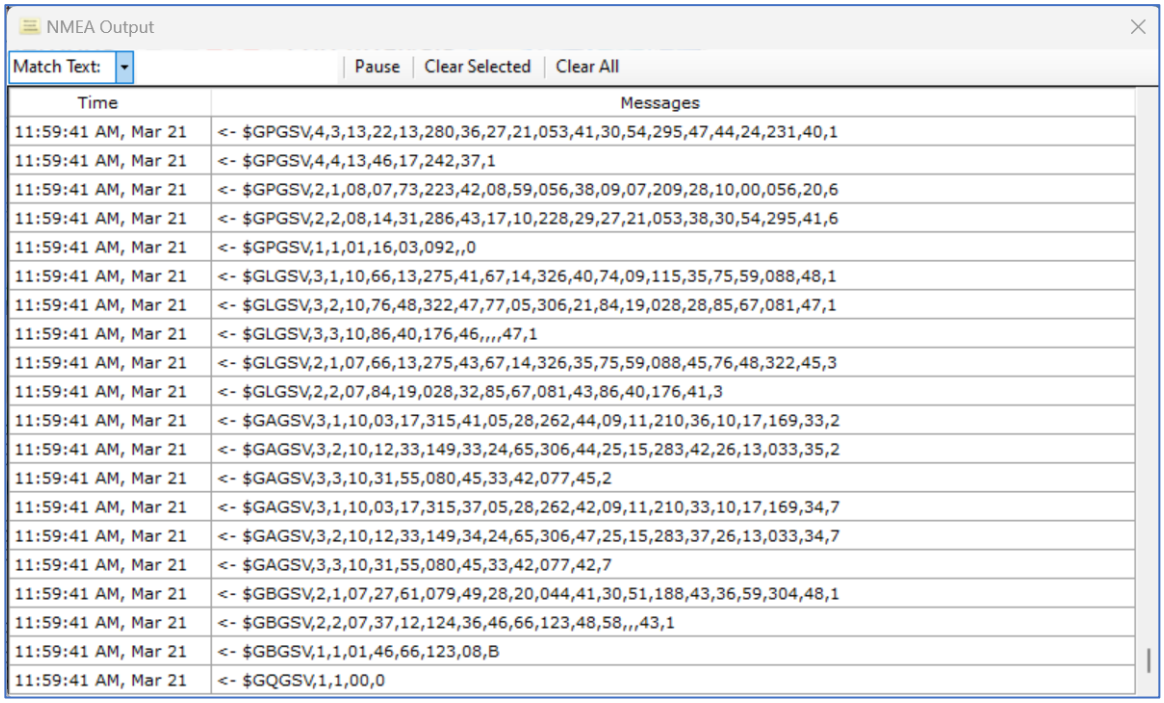


Figure 16: Status Console for Antenna with no RTK but PointPerfect Augmentation over L-Band enabled

7 NMEA Output Panel

If the NMEA Output Panel is selected, then a real time text terminal panel is of the NMEA output from the antenna is displayed (Figure 17)



Time	Messages
11:59:41 AM, Mar 21	<- $GPGSV,4,3,13,22,13,280,36,27,21,053,41,30,54,295,47,44,24,231,40,1
11:59:41 AM, Mar 21	<- $GPGSV,4,4,13,46,17,242,37,1
11:59:41 AM, Mar 21	<- $GPGSV,2,1,08,07,73,223,42,08,59,056,38,09,07,209,28,10,00,056,20,6
11:59:41 AM, Mar 21	<- $GPGSV,2,2,08,14,31,286,43,17,10,228,29,27,21,053,38,30,54,295,41,6
11:59:41 AM, Mar 21	<- $GPGSV,1,1,01,16,03,092,,0
11:59:41 AM, Mar 21	<- $GLGSV,3,1,10,66,13,275,41,67,14,326,40,74,09,115,35,75,59,088,48,1
11:59:41 AM, Mar 21	<- $GLGSV,3,2,10,76,48,322,47,77,05,306,21,84,19,028,28,85,67,081,47,1
11:59:41 AM, Mar 21	<- $GLGSV,3,3,10,86,40,176,46,,,,47,1
11:59:41 AM, Mar 21	<- $GLGSV,2,1,07,66,13,275,43,67,14,326,35,75,59,088,45,76,48,322,45,3
11:59:41 AM, Mar 21	<- $GLGSV,2,2,07,84,19,028,32,85,67,081,43,86,40,176,41,3
11:59:41 AM, Mar 21	<- $GAGSV,3,1,10,03,17,315,41,05,28,262,44,09,11,210,36,10,17,169,33,2
11:59:41 AM, Mar 21	<- $GAGSV,3,2,10,12,33,149,33,24,65,306,44,25,15,283,42,26,13,033,35,2
11:59:41 AM, Mar 21	<- $GAGSV,3,3,10,31,55,080,45,33,42,077,45,2
11:59:41 AM, Mar 21	<- $GAGSV,3,1,10,03,17,315,37,05,28,262,42,09,11,210,33,10,17,169,34,7
11:59:41 AM, Mar 21	<- $GAGSV,3,2,10,12,33,149,34,24,65,306,47,25,15,283,37,26,13,033,34,7
11:59:41 AM, Mar 21	<- $GAGSV,3,3,10,31,55,080,45,33,42,077,42,7
11:59:41 AM, Mar 21	<- $GBGSV,2,1,07,27,61,079,49,28,20,044,41,30,51,188,43,36,59,304,48,1
11:59:41 AM, Mar 21	<- $GBGSV,2,2,07,37,12,124,36,46,66,123,48,58,,,43,1
11:59:41 AM, Mar 21	<- $GBGSV,1,1,01,46,66,123,08,B
11:59:41 AM, Mar 21	<- $GQGSV,1,1,00,0

Figure 17: NMEA Output Panel

8 GNSS Signal Status Panel

The GNSS Signal Status toggle activates a convenient monitor (Figure 18) for the position state and reported accuracy estimate.

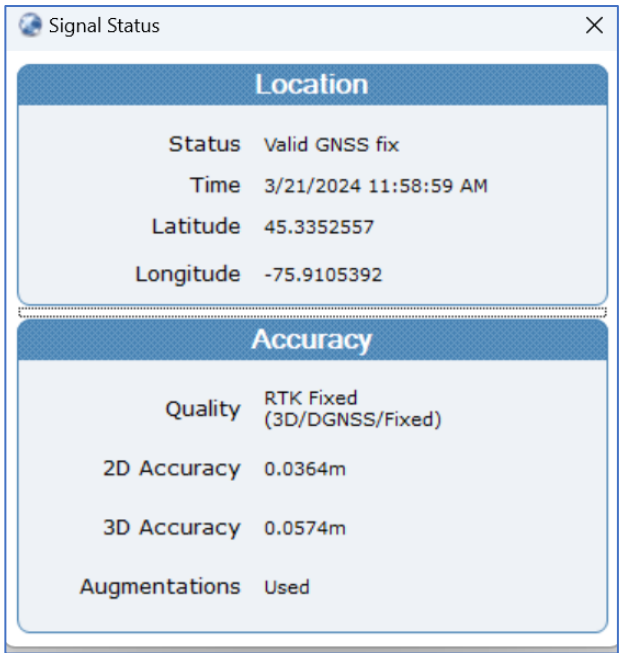


Figure 18: GNSS Status Panel

- Reported accuracy with Fix quality. (Example states)
  - NoFix
  - AutonomousGnssFix (3D)
  - DifferentialGnssFix (3D/DGNSS)
  - RTKFloat (carrier-phase w/ floating ambiguities)
  - RTKFixed (carrier-phase w/ fixed ambiguities)

9 IMU Status Panel

The IMU Status Panel (Figure 19) shows the state of the IMU (if enabled and if the antenna incorporates an IMU … e.g. TW5384 and TW5394 do not have built-in IMU's).

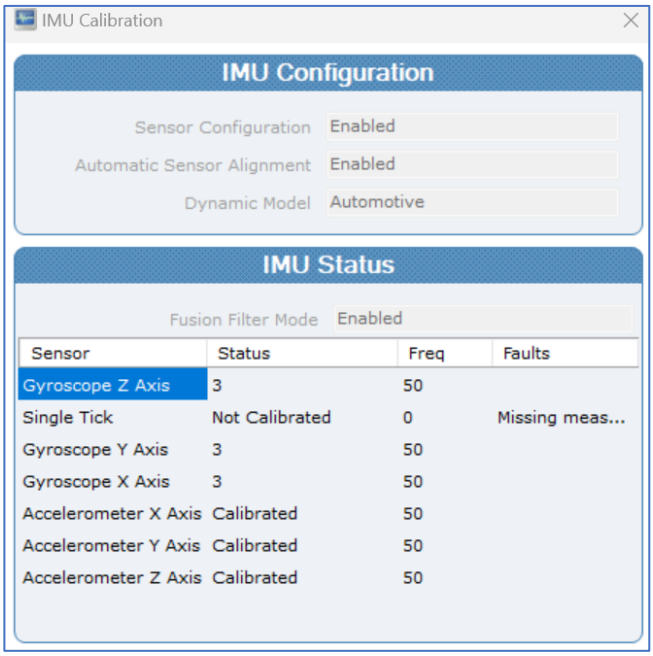


Figure 19: IMU Status Panel

Note: The inertial sensors must complete a calibration process prior to the activation of Sensor Fusion mode and addition of the inertial augmentation to the position solution. This is best accomplished by a short drive with multiple stops and turns.
Note: IMU Sensor Fusion for u-blox ZED-F9R receivers is supported by a limited number of Dynamic Models. (including "Automotive") Please refer to the u-blox ZED-F9R Interface Manual for detailed information.

9.1 U-blox F9 Dynamic Model

TruPrecision does program the dynamic model for ublox based antennas (TruPrecision configuration is non-persistent). The TW5384 Smart Antenna is shipped from the factory with Standard dynamic model, but other antennas are shipped with the Automotive as the dynamic model. Changing the dynamic model of

a u-blox based antenna should be via the u-blox u-centre or Calian u-blox Gen 9 configurator.

10 Satellite Signal Strength Panel

The Satellite Signal Strength Panel (Figure 20) is a graphic representation of the satellites reported by the Smart GNSS Antenna receiver.

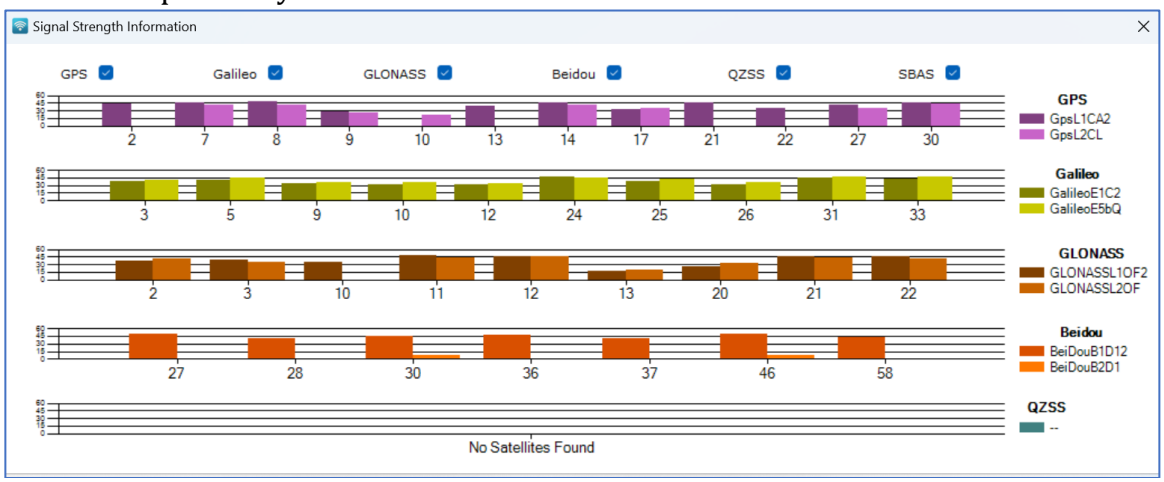


Figure 20: Satellite Signal Strength Panel

Appendix 1 – Smart GNSS Antenna vs. Serial Bridge matching

Voltage	Model	Data/Timepulse I?F	Bridge
5V to 36V	33-5252-7	RS232/NA	
5V to 36V	33-5262-7	RS232/NA	
5V to 36V	33-5350-7	RS232/RS422	33-0095-3
5V to 36V	33-5351-7	RS232/RS422	33-0095-3
5V to 36V	33-5354-7	RS422/RS422	33-0095-10
5V to 36V	53-5342-7/33-5352-7	RS232/RS232	33-0095-4
5V to 36V	33-5362-7	RS232/RS232	33-0095-4
5V to 36V	33-5365-7	RS422/RS232	33-0095-5
5V to 36V	33-5382-07	RS422/RS422	33-0095-10
5V to 36V	33-5384-07	RS422/RS422	33-0095-10
5V to 36V	33-5384-27	RS232/RS422	33-0095-13
5V to 36V	33-5386-07	RS422/RS422	33-0095-10
5V to 36V	33-5386-27	RS232/RS422	33-0095-13
5V	33-5390-09	RS422/RS422	33-0095-11
5V	33-5390-29	RS232/RS422	33-0095-13
5V	33-5790-19	USB	
5V	33-5790-29	RS232/RS232	33-0095-13
5V	33-5394-09	RS422/RS422	33-0095-11
5V	33-5394-29	RS232/RS422	33-0095-13
5V	33-5794-19	USB	
5V	33-5794-29	RS232/RS232	33-0095-13
5V	HCS885XF-29	RS232	33-0095-13
5V	HCS885XF-49	CMOS	33-0095-7
5V	HCS885EXF-29	RS232	33-0095-13
5V	HCS885EXF-49	CMOS	33-0095-7

Appendix 2 – U-Blox Point Perfect PPP-RTK Service

A2.1 u-blox Service Platform Registration

u-blox Thingstream® is a service delivery platform providing a management console for enabling and managing the entire suite of u-blox IoT Location-as-a-Service products. New users must register and create an account. An email address must be provided, and a Thingstream domain name created/provided. Once registered, the Thingstream dashboard will be visible.

https://portal.thingstream.io/register (Figure 3)

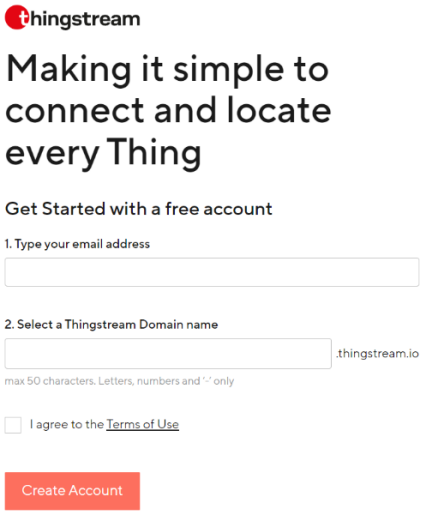


Figure 21: u-blox Thingstream - Registration

A2.2 Creating PointPerfect Location Things

Before a device can use the augmentation service, a user must create a "**Thing**" that represents the device within the location service.

- Click on the "**Location Services**" item in the navigation bar on the left of the page, then click on the **"Location Things"** selection option. (Figure 4)

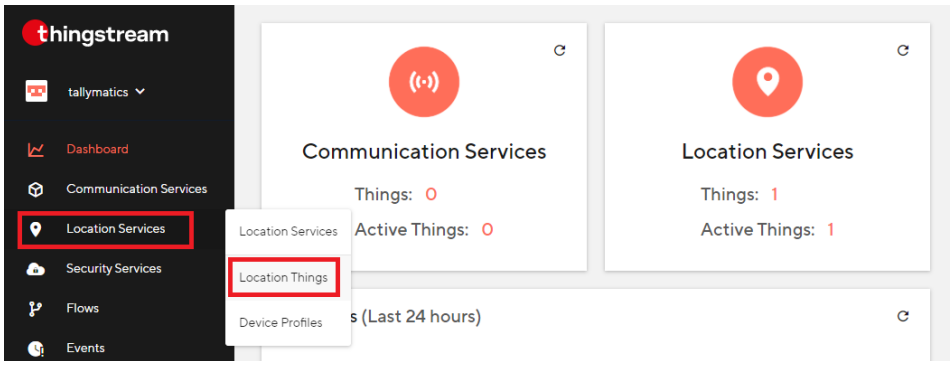


Figure 22: u-blox Thingstream - Creating PointPerfect Things - Location Services

- Click on the "**Add Location Thing"** button at the top right. (Figure 5)

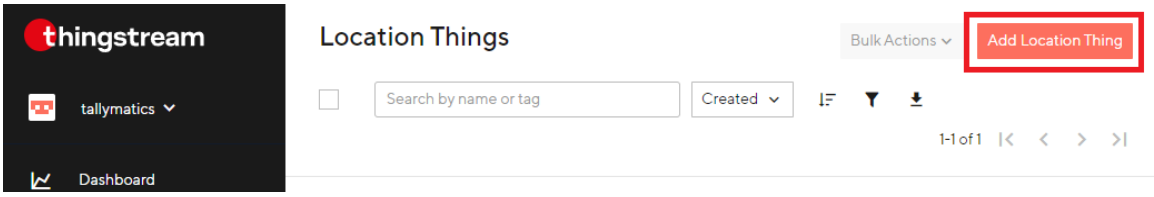


Figure 5: u-blox Thingstream - Creating PointPerfect Things - Location Things

- Select the "**Use a code**" tab and then "**Redeem your Thing**" (Figure 6)

Note: Do not click on "PointPerfect" unless you do not intend to use the 60-day trial included in the 33-TP5390SDK-0.

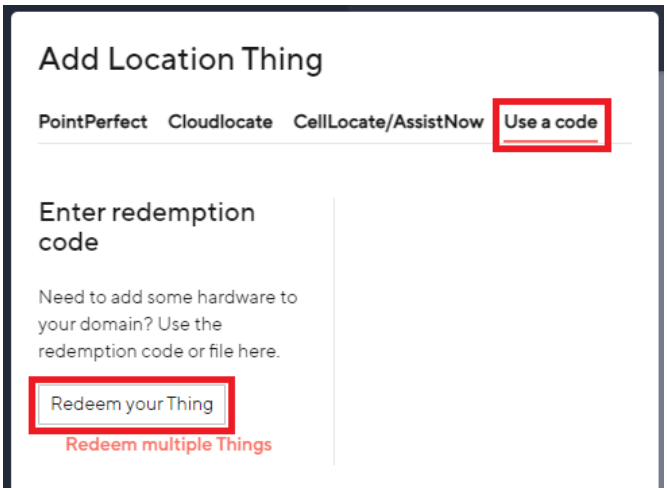


Figure 6: u-blox Thingstream - Creating PointPerfect Things – Redeem Code

- Enter the code (Figure7) on the card found inside the 33-TP5390SDK-0 package, then click on the "**Next"** button. You will be prompted to enter a friendly name for the Thing to be associated with the code.

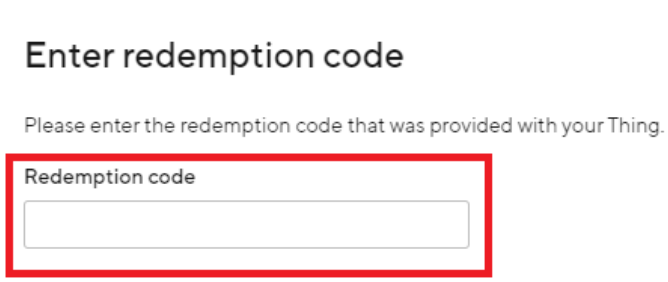


Figure 7: u-blox Thingstream - Creating PointPerfect Things – Redemption Code

- Thingstream will respond showing information about the newly created "**Thing",** which may then be added by clicking the "**Add Thing**" button. Select "**View Details**" to proceed to the "**Thing details**" page. (Fig. 8)

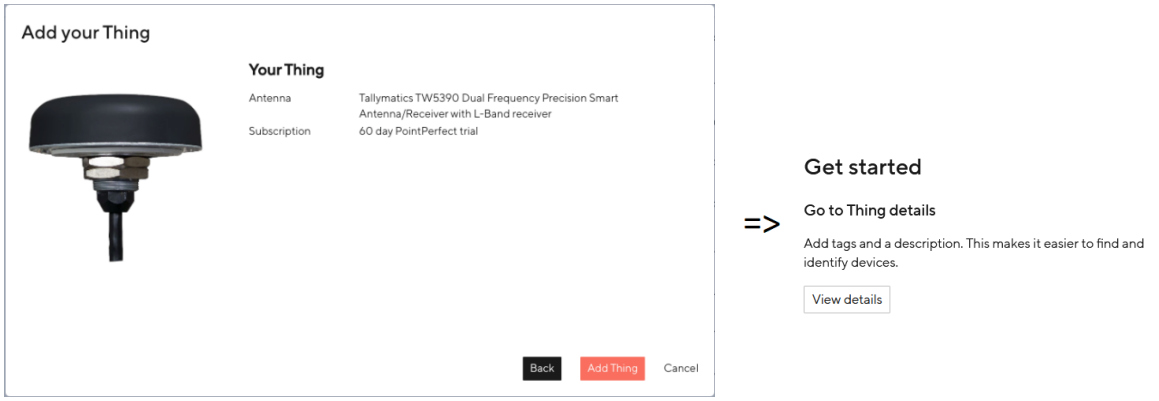


Figure 8: u-blox Thingstream - Creating PointPerfect Things – Add Thing

Thingstream will return to the Things list with the newly created Thing selected and the details highlighted.

A2.3 Downloading the PointPerfect Client Key and Certificate

The TruPrecision Application requires a PointPerfect Client Key and Certificate to authenticate and subscribe to the Thingstream PointPerfect augmentation service. To download the key and the certificate go to the "**Thing details**" and click on the "**Credentials**" tab. Select the download action adjacent to the "**u-center Config**" (Figure 9)

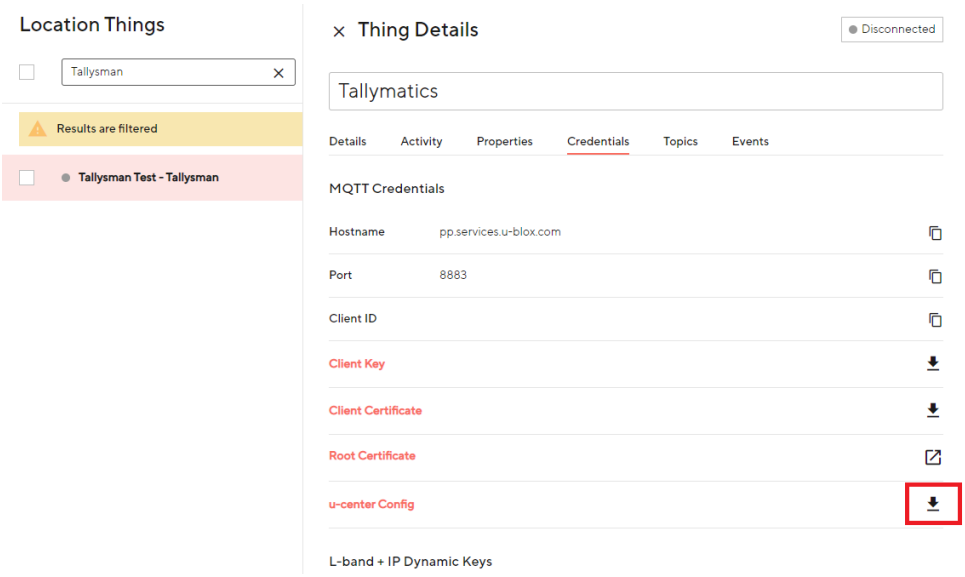


Figure 9: u-blox Thingstream - Device Provisioning - Credentials

Appendix 3 - Swift Navigation SkyLark Precise Positioning Service

A3.1

Appendix 4 – Point One Navigation Polaris RTK