AsteRx-U3

User Manual

User Manual Version 1.6
Applicable to version 4.14.1 of the AsteRx-U3 Firmware

September 27, 2023
Thank you for choosing the AsteRx-U3! This user manual provides detailed instructions on how to use AsteRx-U3 and we recommend that you read it carefully before you start using the device.

Please note that this manual provides descriptions of all functionalities of the AsteRx-U3 product family however, the particular AsteRx-U3 you purchased may not support functions specific to certain variants.

Pictures are shown for illustration purpose only and actual product may vary due to product evolution. While we try to keep the manual as complete and up-to-date as possible, it may be that future features, functionality or other product specifications change without prior notice or obligation. The information contained in this manual is subject to change without notice. We recommend you to look for new or updated information in our Knowledge Base at https://customersupport.septentrio.com/s/topiccatalog

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Contents

1 Introduction

1.1 User Notices

1.1.1 Regulatory Notice

AsteRx-U3 receivers carry the CE mark and are as such compliant with the 2014/53/EU - Radio Equipment Directive (RED), 2011/65/EU - Restriction of Hazardous Substances (RoHS) Directive and 93/68/EC - CE-marking Directive.

With regards to EMC, the AsteRx-U3 receiver is declared as class A, suitable for residential or business environment. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

This product is not authorized to be used with a WiFi access point transmitting on the 80MHz bandwidth channels of the 5 GHz band.

1.1.2 ROHS/WEEE Notice

The AsteRx-U3 receivers are compliant with the latest WEEE, RoHS and REACH directives. For more information see www.septentrio.com/en/environmental-compliance.

1.1.3 Safety information

The power supply provided by Septentrio (if any) should not be replaced by another. If you are using the receiver with your own power supply, it must have a double isolated construction and must match the specifications of the receiver.

Ultimate disposal of this product should be handled according to all national laws and regulations.

The equipment and all the accessories included with this product may only be used according to the specifications in the delivered release note, manual or other documents delivered with the receiver.

The device should be installed in a restricted access area and used by skilled or instructed personnel.

1.1.4 Support

For first-line support please contact your AsteRx-U3 dealer. Further information can be found on our website or by contacting Septentrio Technical Support.

http://www.septentrio.com

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2 AsteRx-U3 overview

The AsteRx-U3 provides multi-frequency, multi-constellation GNSS positioning capability together with GNSS Heading and wireless communication options within a rugged IP68 housing for the broadest range of applications. AsteRx-U3 can be easily monitored and configured without any special software via the built-in web user interface accessible via WiFi, Ethernet or USB connection.

2.1 AsteRx-U3 key features

- 544 channels for full-constellation, triple-frequency satellite tracking on both antennas
- Precise and robust heading calculation
- cm-level (RTK) with high update rate and low latency
- RTK Rover or Base operation
- Septentrio GNSS+ algorithms for robust industrial performance
- Integrated cellular modem, Bluetooth, WiFi and UHF radio options

2.1.1 GNSS

- 544 hardware channels
- Up to 100 Hz Raw data output (code, carrier, navigation data)
- Up to 100 Hz SBAS, DGNSS and RTK positioning
- A Posteriori Multipath Estimator Technique (APME+), including code and phase multipath mitigation
- AIM+ interference unit mitigates against wide and narrow-band interference
- IONO+ Advanced scintillation mitigation
- RAIM Receiver Autonomous Integrity Monitoring
- Differential GNSS (base station and rover)
- Real Time Kinematic (base and rover)
- Moving base positioning
- 16 GB Internal Memory for logging

Connectivity

- 3 hi-speed serial ports (RS232/RS422)
- Ethernet port (TCP/IP and UDP)
- CAN port
- High-speed USB
- 1 Event marker
- xPPS output (max. 100 Hz)
- Integrated Bluetooth 5.2 - optional
- Integrated WiFi (802.11 a/b/g/n/ac) - optional
- Integrated UHF (410-475 MHz) - optional
- Integrated Cellular Modem (EDGE, 2G, 3G, 3.5G, 4G) - optional

2.1.2 Physical and Environmental

Size:	157 x 200 x 50 mm (not including brackets and connectors)
Size:	183 x 242 x 56 mm (including brackets and connectors)
Weight:	1.1 kg
Input voltage:	9-48 V DC
Power consumption:	8 W typical
Temperature Range:	-30 to +65 °C (operational) -40 to +75 °C (storage)
Ingress Protection:	IP68
Humidity	IEC60721-3-5, Class 5K2
Dust	MIL-STD-810H, Method 510.7, Procedure I
Shock	MIL-STD-810H, Method 516.8, Procedure I/II
Vibration	MIL-STD-810H, Method 514.8, Procedure I
Corrosion	IEC60068-2-52, Method 2

2.2 AsteRx-U3 variants

The AsteRx-U3 is available in multiple variants:

Variant (Part number)	Main features
AsteRx-U3 ANNNNR	• Dual antenna GNSS receiver
AsteRx-U3 ANNUNR	• Dual antenna GNSS receiver • Integrated UHF modem
AsteRx-U3 ANEUNR	• Dual antenna GNSS receiver for the European market • Integrated 4G Cellular modem • Integrated UHF modem
AsteRx-U3 ANEKNR	• Dual antenna GNSS receiver for the Korean market • Integrated 4G Cellular modem • Integrated UHF modem
AsteRx-U3 AWNUNR	• Dual antenna GNSS receiver • Integrated Wi-Fi modem (for European market) • Integrated Bluetooth modem • Integrated UHF modem
AsteRx-U3 AFNUNR	• Dual antenna GNSS receiver for the US market • Integrated Wi-Fi modem • Integrated Bluetooth modem • Integrated UHF modem
AsteRx-U3 AWEUNR	• Dual antenna GNSS receiver for the European market • Integrated Wi-Fi modem • Integrated Bluetooth modem • Integrated 4G Cellular modem • Integrated UHF modem

Receivers purchased with a specific regional configuration can be deployed to other regions by uploading the correct upgrade file (SUF). The following SUF files are available in the FW package of AsteRx-U3, available from Septentrio website or from Septentrio Support:

Regional configuration SUF files:

Regional_Domain_CA—v1.0.suf for Canada
Regional_Domain_ETSI—v1.0.suf for Europe
Regional_Domain_FCC—v1.0.suf for United States
Regional_Domain_JP—v1.0.suf for Japan
Regional_Domain_KR—v1.0.suf for South Korea

Figure 2-1 gives an overview of the regions where specific AsteRx-U3 configuration can be deployed. The corresponding SUF file must be loaded for combinations marked with 'SUF'.

	Can be deployed in:				
Model:	**Europe (ETSI)**	**US (FCC)**	**Canada (ISED)**	**Korea (KCC)**	**Japan (Giteki)**
AsteRx U3 (ANNNNR)	✓	✓	✓	✓	✓
AsteRx U3 UHF (ANNUNR)	✓	✓	✓	✗	✓
AsteRx U3 Cell/UHF (ANEKNR)	SUF	✗	✗	✓	SUF
AsteRx U3 Wi-Fi/UHF (AWNUNR)	✓	SUF	SUF	✗	✗
AsteRx U3 Wi-Fi/UHF (AFNUNR)	SUF	✓	SUF	✗	✗
AsteRx U3 Wi-Fi/Cell/UHF (AWEUNR)	✓	✗	✗	✗	✗
AsteRx U3 Wi-Fi/Cell/UHF (JWEUNR)	✗	✗	✗	✗	✓

Figure 2-1: AsteRx-U3 regional variants

Check with sales@septentrio.com for details on available features and regional variants of AsteRx-U3.

2.3 AsteRx-U3 design

2.3.1 Front panel

The front-panel layout of the AsteRx-U3 integrating Bluetooth/Wi-Fi and Cellular antenna connectors is shown in Figure 2-2. Depending on the configuration, some connectors may be present or not on the device.

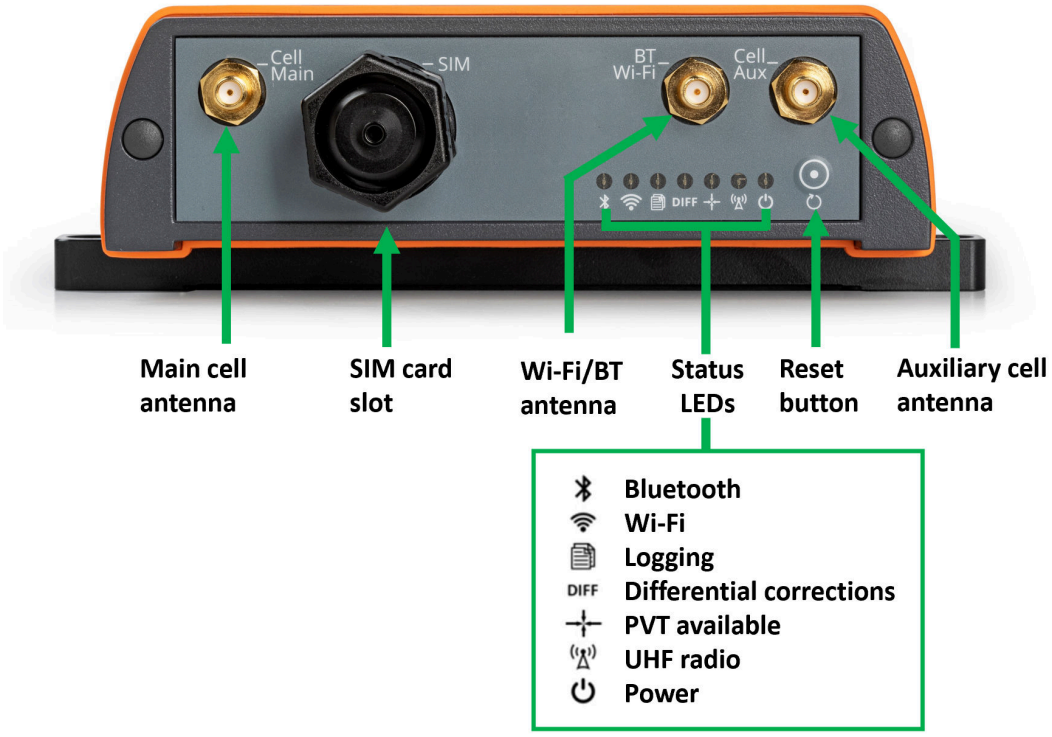

Figure 2-2: AsteRx-U3 front-panel layout

2.3.2 LED description

LED	Icon	Behavior
blue		**Off**: Bluetooth disabled **On**: Bluetooth connected **Blinking slowly**: Not connected but discoverable
green		**Off**: WiFi disabled **On**: Access-point mode or client mode **Blinking slowly**: Establishing a connection in client mode **Blinking quickly**: Error, not connected
green		**Off**: Not logging **On**: Logging active, disk is mounted **Blinking slowly**: Logging active, disk-space is low **Blinking quickly**: Disk is full or not mounted
green	DIFF	**Off**: No reception of correction data **Blinking**: Blinks on reception of correction data
green		**Off**: No PVT available **On**: PVT available
green		**Off**: UHF radio modem disabled or no data transferred **Blinking**: Data package sent/received
green		**Off**: Receiver is powered off **On**: Receiver is powered on

2.3.3 Rear panel

Figure 2-3 shows the layout of the rear-panel connectors on the AsteRx-U3.

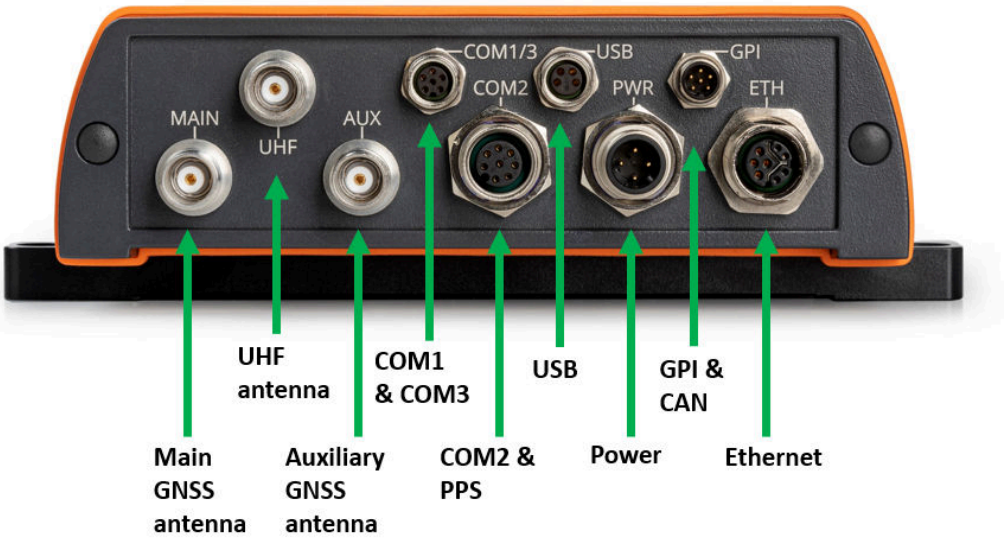

Figure 2-3: AsteRx-U3 rear-panel layout

The connectors for Ethernet, Power and COM2 are M12 type and the connectors for COM1/3, USB and GPI are M8 type. The PIN assignments for each socket can be found in the Appendix.

Important: The maximum tightening torque at the cable nut is 0.4Nm for M12 connectors and 0.2Nm for M8 connectors. These torque values should not be exceeded, to avoid damaging the connectors.
Special tools for connector tightening are recommended. For M12 connectors, use Phoenix Contact SAC BIT M12-D15 in combination with precise torque screwdriver TSD 04 SAC. For M8 connectors, use Phoenix Contact SAC BIT M8-D10 in combination with precise torque screwdriver TSD 02 SAC. If these tools are not available, the cables should be hand tightened. Other tools (pliers) should never be used to tighten cables.

Figure 2-4: Phoenix Contact TSD 04 SAC torque screwdriver, with preset torque of 0.4Nm and 4mm hexagonal drive and SAC BIT M12-D15 for use with M12 connectors

2.3.4 SIM card slot (optional)

Important: Only insert or remove the SIM card while the unit is powered down.

AsteRx-U3 accepts a nano SIM (4FF), required for the operation of the integrated cellular modem. The SIM card can be inserted into the SIM connector in the front panel of the AsteRx-U3 as shown in Figure 2-5.
Remove the SIM connector cap by unscrewing it, then insert the SIM card until it is locked in place. Close the SIM connector cap carefully, making sure it is properly fastened.

Note: Multi-carrier SIM cards are not supported.

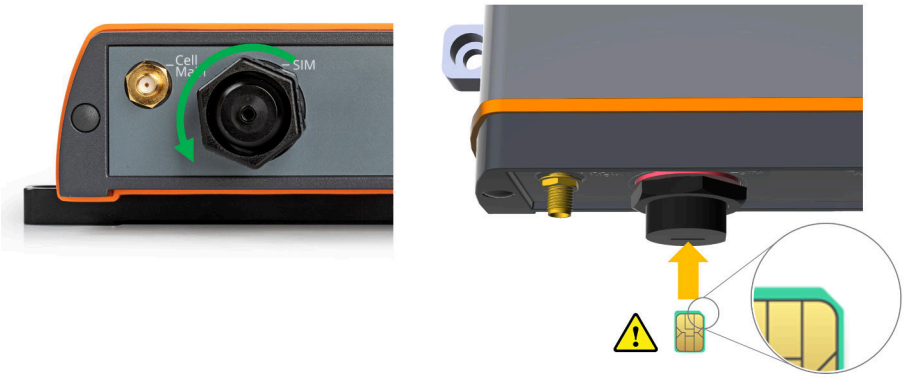

Figure 2-5: SIM card slot on the AsteRx-U3

2.3.5 Mounting instructions

The AsteRx-U3 is supplied with mounting brackets for fixing the unit using 4 bolts. The size of the fixing bolts can be M6 or smaller and the distance between the holes is shown in Figure 2-6.

Important: When selecting a mounting location for the receiver, please take into account the following precautions:

- When installed in vehicles, the unit should be properly secured to avoid injuries or damaging the receiver or nearby equipment.
- Select a mounting location that allows enough space to access the front and rear panel of the AsteRx-U3.
- Make sure the receiver and the cables will not be damaged, for example by moving parts or sharp edges.
- Make sure the conditions at the installation location never exceed the specifications of the AsteRx-U3.
- Cover all unused connectors with caps.
- If the receiver is exposed to marine atmosphere or high humidity, apply dielectric grease inside all connectors and protect them with self-amalgamating tape.

Figure 2-6: Mounting brackets fitted to the AsteRx-U3

2.3.6 Internal memory

The AsteRx-U3 has 16 GB of internal memory for data logging. Data can be logged in SBF or NMEA format and may be retrieved via the logging tab of the web interface.

2.4 Shipping box contents

2.4.1 Supplied as standard

The following items with their part numbers are supplied as standard with AsteRx-U3.

2.4.2 Optional items

The following accessories can be ordered with AsteRx-U3.

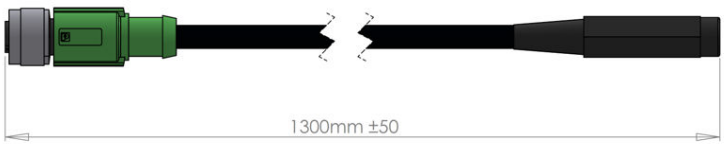

Figure 2-8: Power cable, M12 to DC jack 5.5mmx2.1mm, 1.3m (216203)

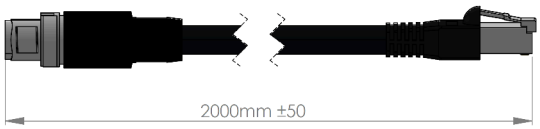

Figure 2-9: Ethernet cable, M12 to RJ45, 2m (216204)

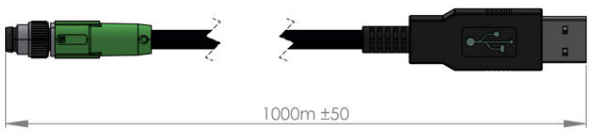

Figure 2-10: USB Cable, M8 to USB Type A, 1m (216207)

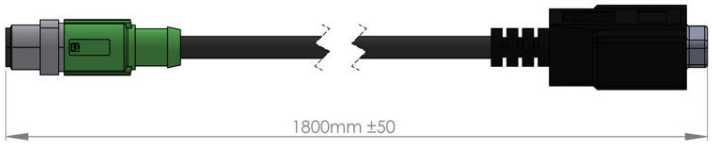

Figure 2-11: COM2 Serial Cable, M12 to DB9 female, 1.8m (216205)

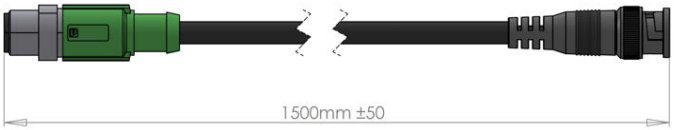

Figure 2-12: PPS Cable, M12 to 1 x BNC male, 1.5m (216206)

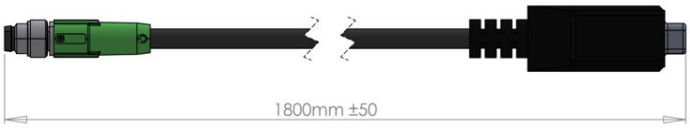

Figure 2-13: COM1 Serial Cable, M8 to DB9 female, 1.8m (216208)

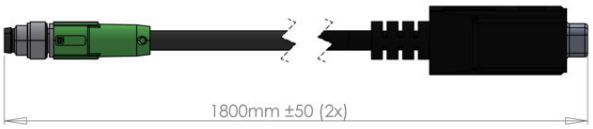

Figure 2-14: COM1 and COM3 Serial Cable, M8 to 2x DB9 female, 1.8m (216209)

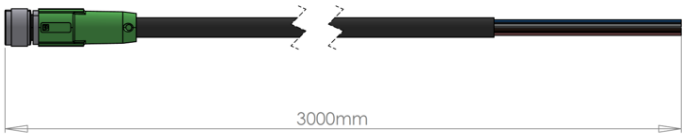

Figure 2-15: CAN and Event Cable, M8 unterminated, 3m (216210)

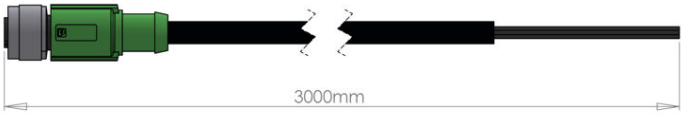

Figure 2-16: Power cable, M12 unterminated, 3m (216214)

3 Quick start

This section details how to power-up, connect to and communicate with the AsteRx-U3. The AsteRx-U3 has an on-board web interface which the user can connect to in three ways: Ethernet, USB or WiFi. The AsteRx-U3 is fully configurable using the web interface. Please note that older versions of certain browsers may not display the web interface properly.

3.1 Powering the AsteRx-U3

Using a power cable, the receiver can be powered by applying 9 to 48 V via the power-in wire. The power socket is indicated in Figure 3-1.

Figure 3-1: Rear panel power socket

The AsteRx-U3 does not have a power button and the unit will power up automatically when power is applied. When the unit is powered initially, the front-panel LEDs will follow a boot sequence pattern.

3.2 Connecting an antenna

The rear panel of the AsteRx-U3 has two TNC connectors for GNSS antennas: one for the main antenna and one for an auxiliary antenna for heading applications. To get started, connect an antenna via an antenna cable to the main antenna connector of the AsteRx-U3 indicated in Figure 3-2. An overview of the antennas which are directly compatible with the receiver can be obtained using the **lstAntennaInfo** command. For more information regarding these and other commands, please refer to the Firmware Reference Guide.

Figure 3-2: Rear-panel main and auxiliary antenna connectors

3.3 Connecting to the AsteRx-U3 via the Web Interface

You can connect to the receiver on any device that supports a web browser using the receiver's on board Web Interface. The connection can be made using either USB or Ethernet. The following sections describe each of the connection methods.

3.3.1 Using the USB cable

Connect the USB cable to the connector labeled 'USB' on the rear panel of the AsteRx-U3 and indicated in Figure 3-3.

Figure 3-3: Rear panel USB socket

The first time that the USB cable is connected to a device, you may be prompted to allow installation of drivers which can take several minutes. When the drivers have been installed, it is recommended to unplug then re-plug in the USB cable on your device to fully activate the drivers.

When the drivers have been correctly installed, the USB connection will appear as a removable storage device as shown in Figure 3-4.

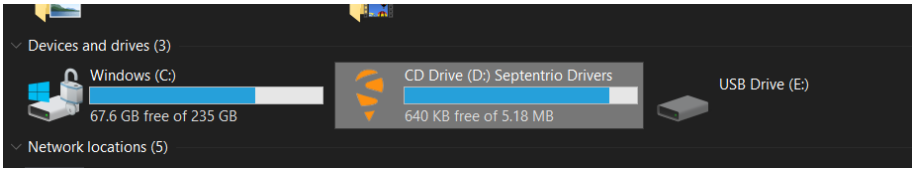

Figure 3-4: Screenshot showing USB connection after driver installation

The USB connection on the AsteRx-U3 functions as network adapter and the DHCP server running on the receiver will always assign the AsteRx-U3 the IP address 192.168.3.1.

To connect to the AsteRx-U3, you can then simply open a web browser using the IP address **192.168.3.1** as shown in Figure 3-5.

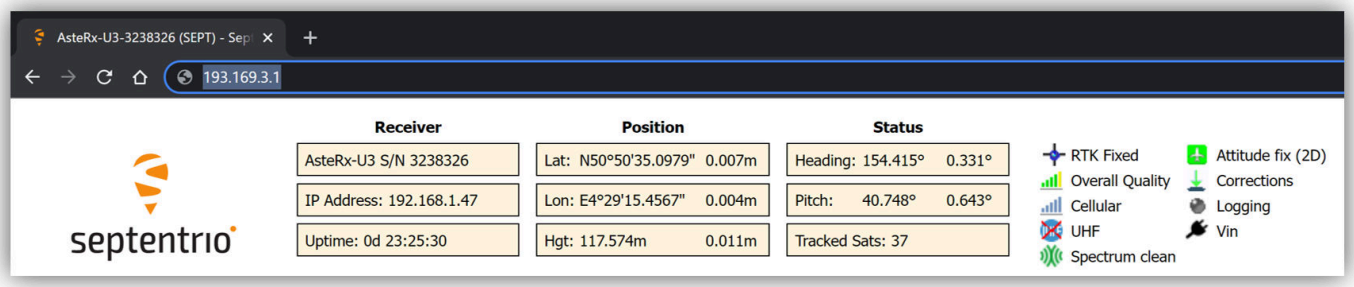

Figure 3-5: Connect to the Web Interface of the AsteRx-U3 over USB using the IP address **192.168.3.1** on any web browser

3.3.2 Using the Ethernet cable

Step 1: Connect the Ethernet cable

Connect the Ethernet cable shown in Section 2.4.1 between a LAN network and the connector labeled 'ETH' on the rear panel of the AsteRx-U3 indicated in Figure 3-6.

Figure 3-6: Rear panel USB and Ethernet socket

Step 2: Open a web browser and connect to the AsteRx-U3

By default, the AsteRx-U3 has the hostname 'http://AsteRx-U3-xxxxxxx', where xxxxxxx are the last 7 digits of the AsteRx-U3 serial number. This hostname can be used on a local area network to connect to the AsteRx-U3 if the IP address assigned by the DHCP server is unknown. The serial number can be found on a sticker on the corner of the outer casing of the receiver. Figure 3-7 shows a screenshot of an Ethernet connection to a receiver with serial number 3238326 using '**http://AsteRx-U3-3238326**'.

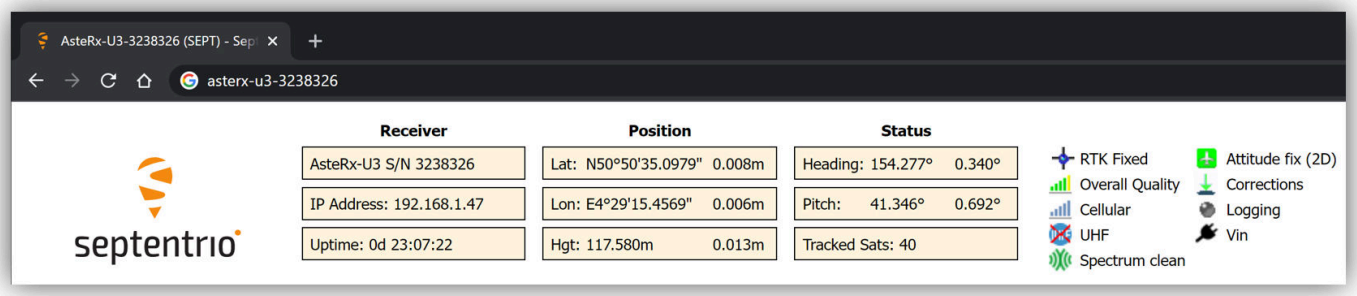

Figure 3-7: Connecting to the Web Interface via Ethernet

3.3.3 Over WiFi

The Web Interface can also be accessed over a WiFi connection. On your PC or tablet, search for visible WiFi signals: the AsteRx-U3 identifies itself as a wireless access point named 'AsteRx-U3-*serial number*'. The serial number of the AsteRx-U3 can be found on an identification sticker on the receiver housing.

When your PC is connected to the AsteRx-U3 WiFi signal, you can open a web browser using the IP address: **192.168.20.1**. AsteRx-U3 wireless access point supports up to 8 simultaneous client connections.

3.4 How to configure SBF and NMEA output

The AsteRx-U3 can output position and GNSS data in both standard NMEA format and Septentrio's proprietary compact binary format SBF. The following sections detail how to configure connections to other devices in order to send data.

3.4.1 Output over a serial COM connection

The AsteRx-U3 can be connected via a serial COM cable to an RS-232 compatible secondary device.

Step 1: Configure the serial COM port

The COM port of the AsteRx-U3 should be configured with the same baud rate and flow control setting of the coupled device. These settings can be configured via the 'Communication' tab as shown in Figure 3-8. In this example, COM3 is set with a speed of 19200 baud.

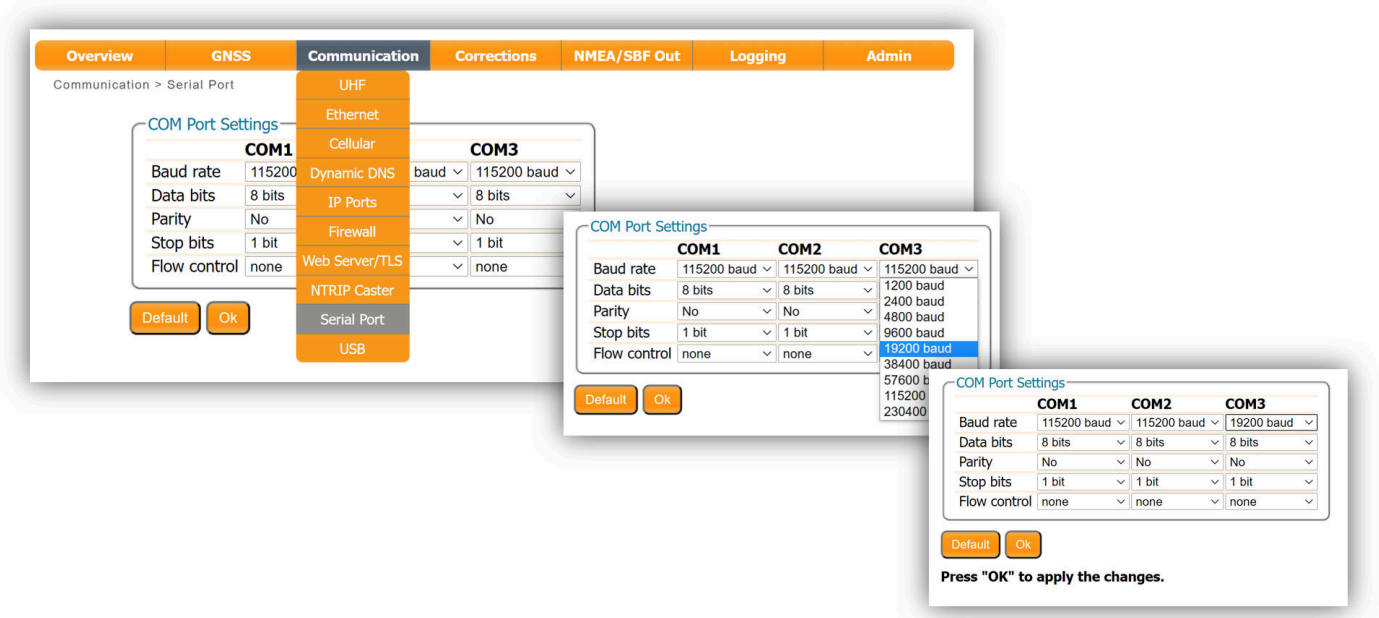

Figure 3-8: Configure the baud rate and flow control of the AsteRx-U3

Step 2: Configure data output

NMEA

In the 'NMEA/SBF Out' tab, clicking on '**New NMEA Stream**' will guide you through the steps needed to configure NMEA output as shown in Figures 3-9 and 3-10.

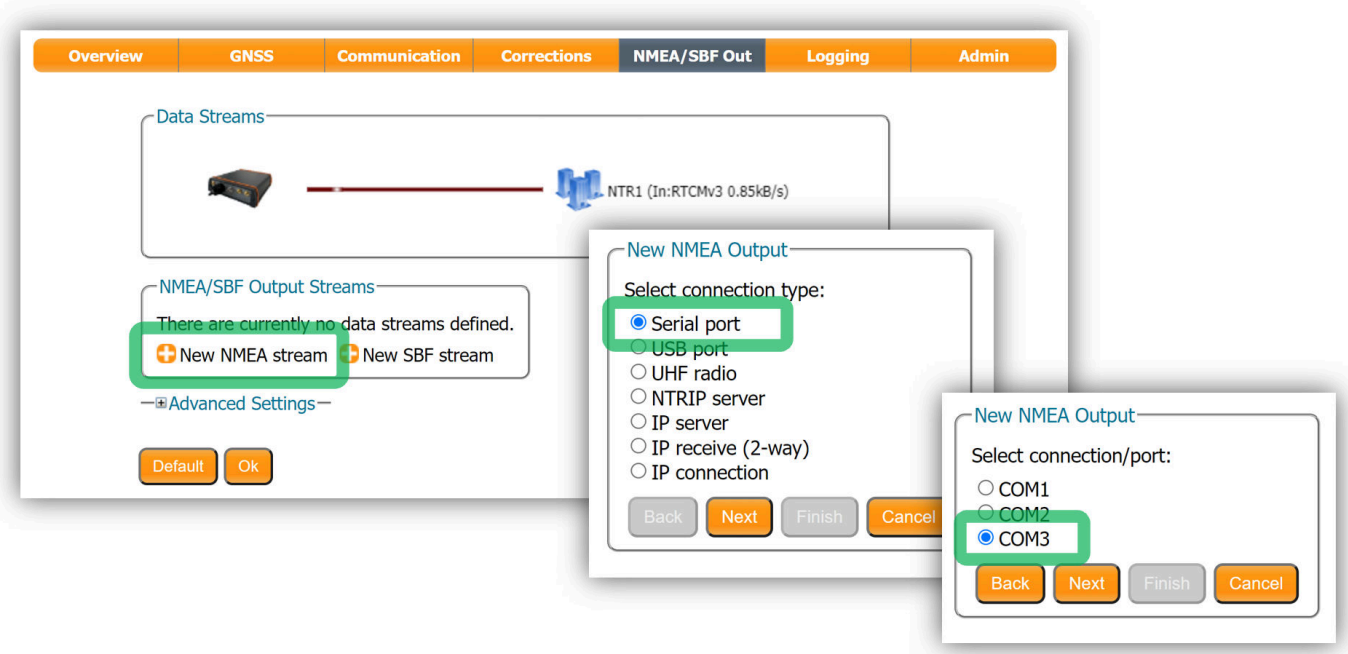

Figure 3-9: Selecting to output NMEA data on COM3

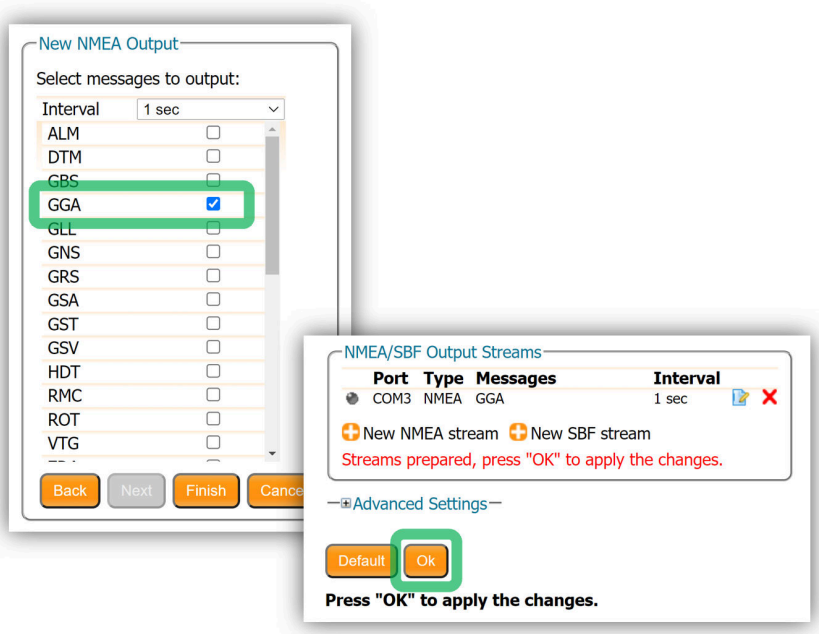

Figure 3-10: Selecting to output the GGA NMEA message every second

SBF

By clicking '**New SBF stream**', a second output stream can be configured. In the example shown in Figures 3-11 and 3-12 the PVTCartesian SBF data block will be output over COM1 once per second.

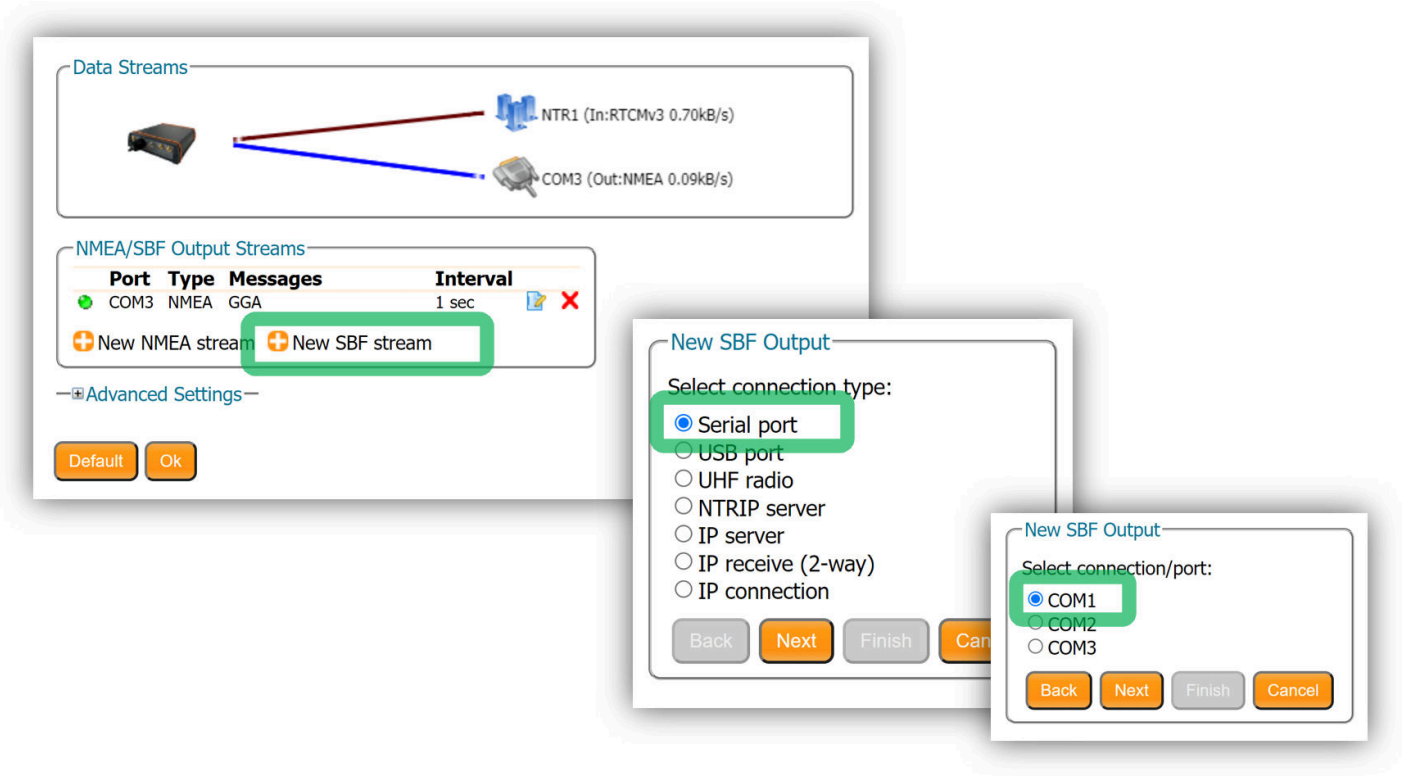

Figure 3-11: Selecting to output SBF data on COM1

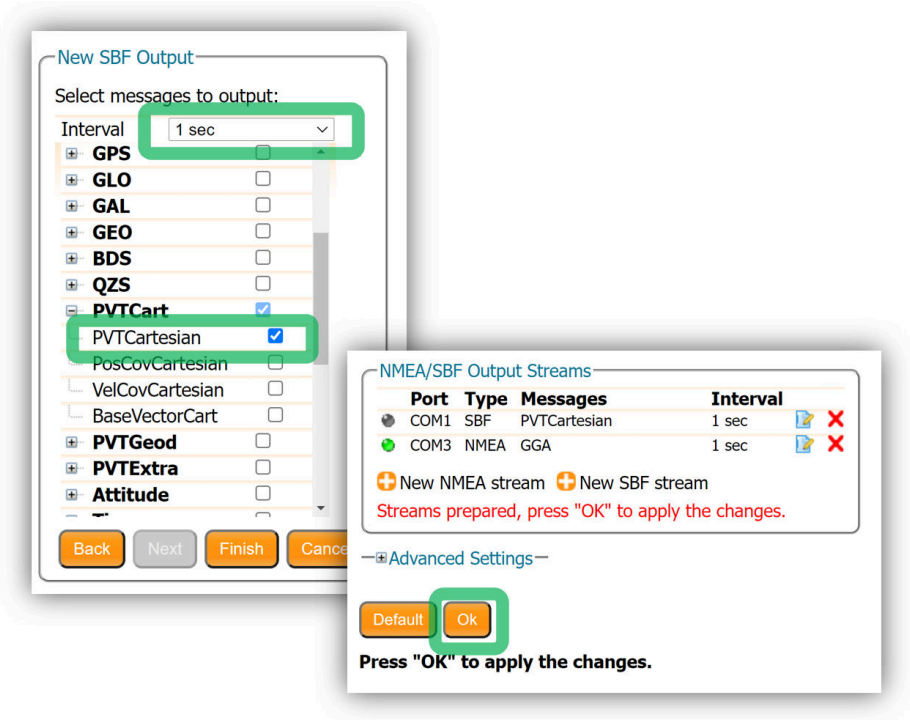

Figure 3-12: Selecting to output the PVTCartesian SBF block every second

Step 3: Verifying the configuration

Having configured data output and clicked on 'Ok' the '**NMEA/SBF Out**' page will now display a summary of all data output as shown in Figure 3-13.

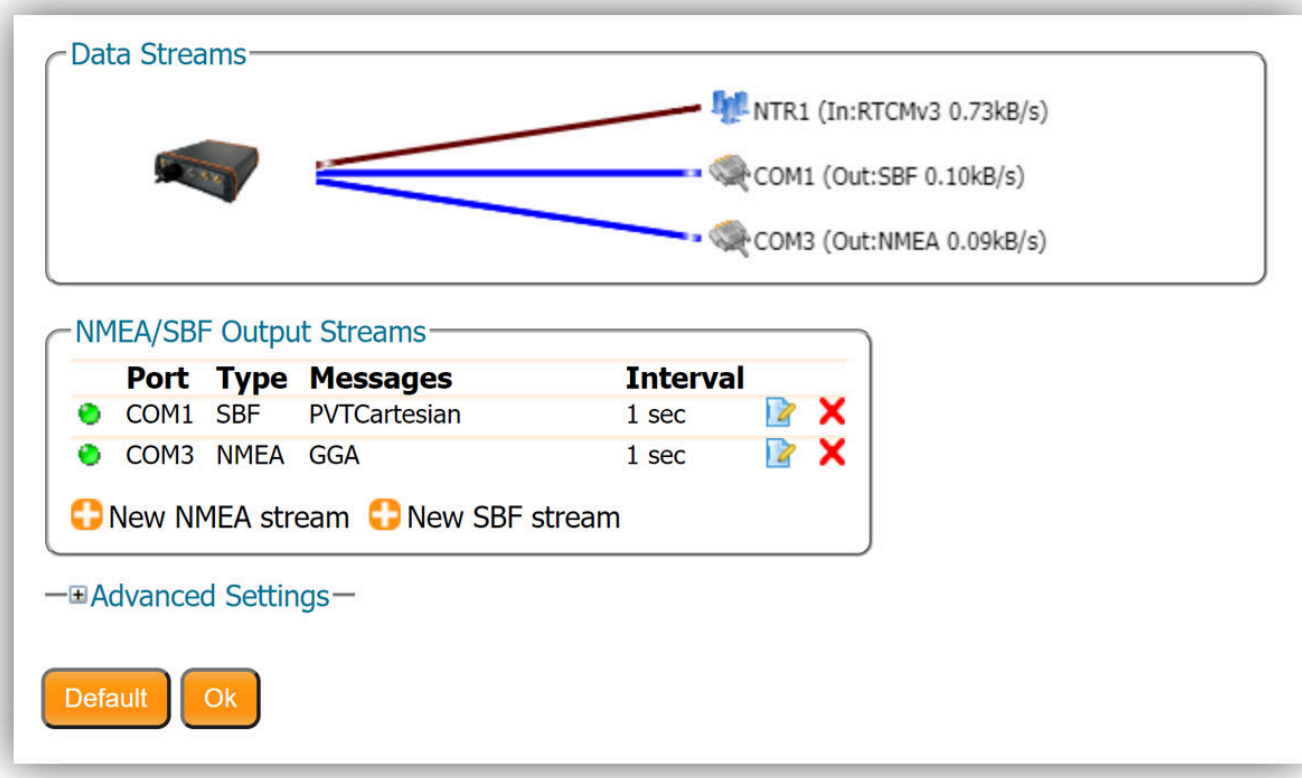

Figure 3-13: Summary of all configured data output streams

Figure 3-14 shows the actual data output. NMEA is in ASCII and is thus readable unlike SBF which is formatted in binary. In this example, the serial COM was connected to a PC via a USB adapter which maps the serial connection to a virtual COM9 of the PC.

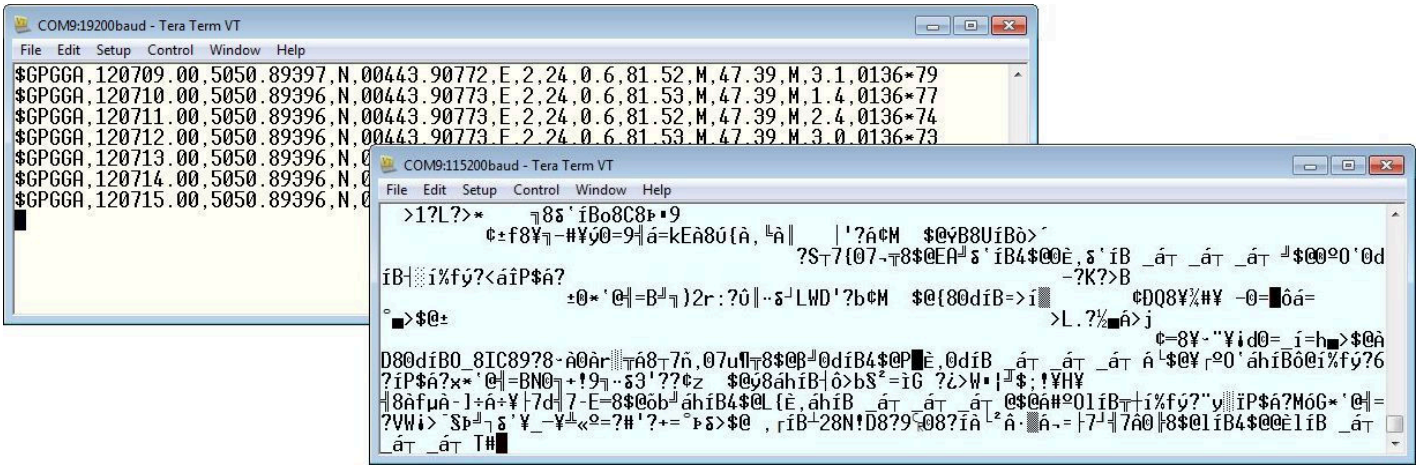

Figure 3-14: Example showing output NMEA GGA (left panel) and SBF PVTCartesian (right panel)

3.4.2 Output over Ethernet

SBF and NMEA data can be sent over an Ethernet connection to the AsteRx-U3.

Step 1: Configure an IP connection on the AsteRx-U3

The Ethernet port settings can be configured by selecting '**IP Ports**' from the **Communication** menu. In the example shown in Figure 3-15, port 28785 has been configured as connection IPS1 in **TCP2Way** mode so data can be received as well as transmitted over the connection. It is advisable to select a higher-range port to avoid those reserved for other purposes such as the webserver and FTP. Also, port 28784 is reserved by default on the AsteRx-U3 for commands.

Note that a new IP port can also be configured by following the sequence of settings for NMEA output described in ***Step 2***.

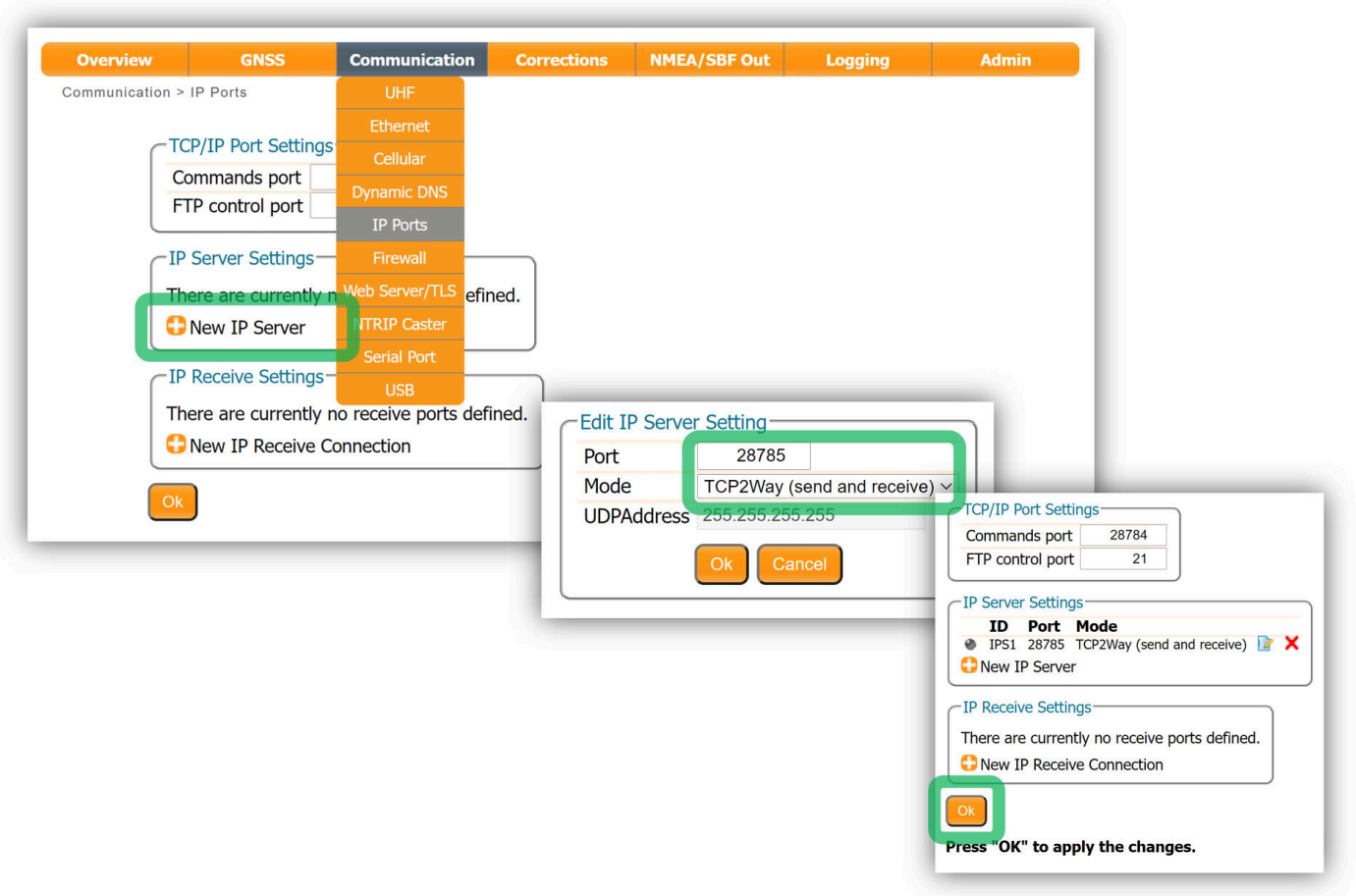

Figure 3-15: Configure the TCP/IP server port setting for data output

Step 2: Configure output of NMEA messages

In the **NMEA/SBF Out** window, click on '**New NMEA stream**' and follow the sequence of windows to configure the data you want to output. In the example shown in Figure 3-16, the NMEA GGA message will be output every second. Ensure that the previously configured IPS1 port is selected for output as highlighted.

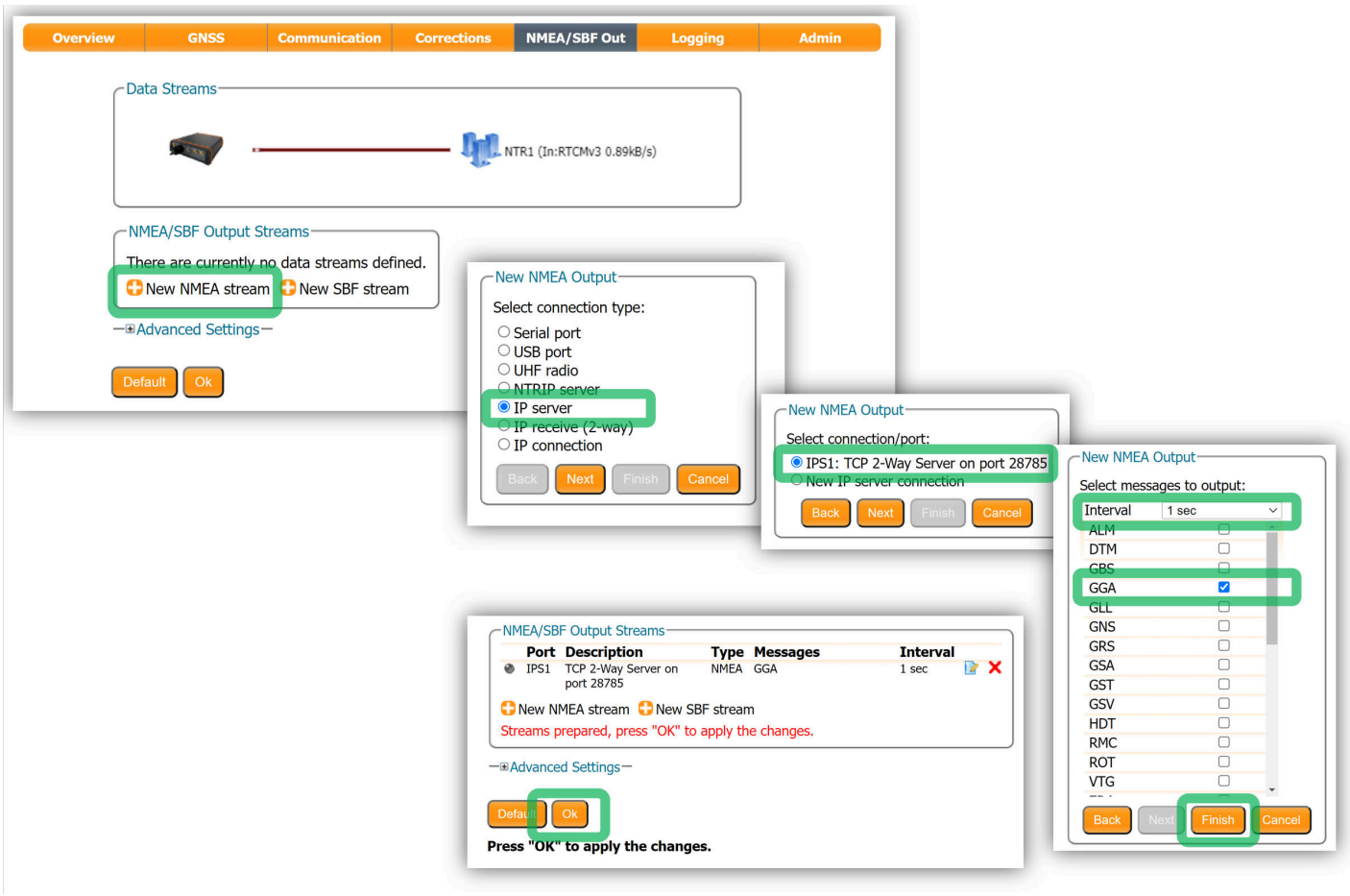

Figure 3-16: Select to output NMEA GGA over the configured IPS1 connection

Step 3: Configure Data Link to listen for NMEA output

The screenshots in Figure 3-17 show how the Septentrio GUI tool Data Link can be configured to listen for the AsteRx-U3 GGA output.

Click on the **TCP/IP Client** button to configure the connection. In the highlighted fields insert the IP address or hostname of the receiver and the port number configured in ***Step 1*** . Click on '**Connect**'.

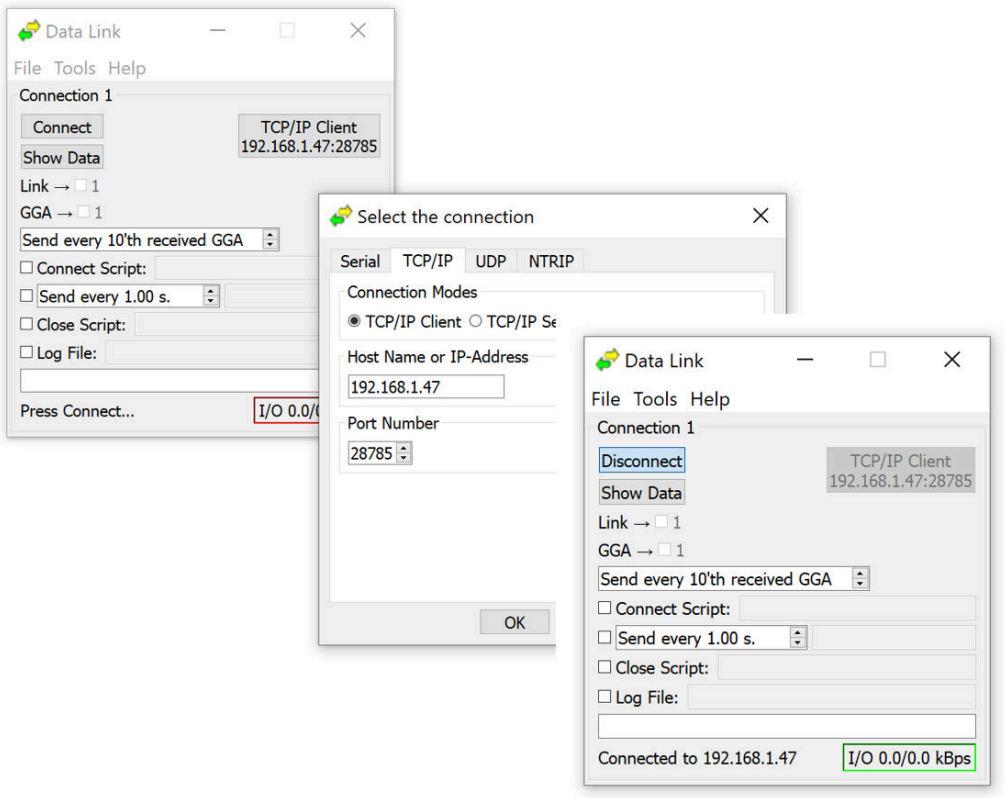

Figure 3-17: Configure the TCP/IP connection settings in Data Link

The info line at the bottom of the window should indicate that a connection has been made. Click on the '**Show Data**' button to display the GGA data from the receiver as shown in Figure 3-18.

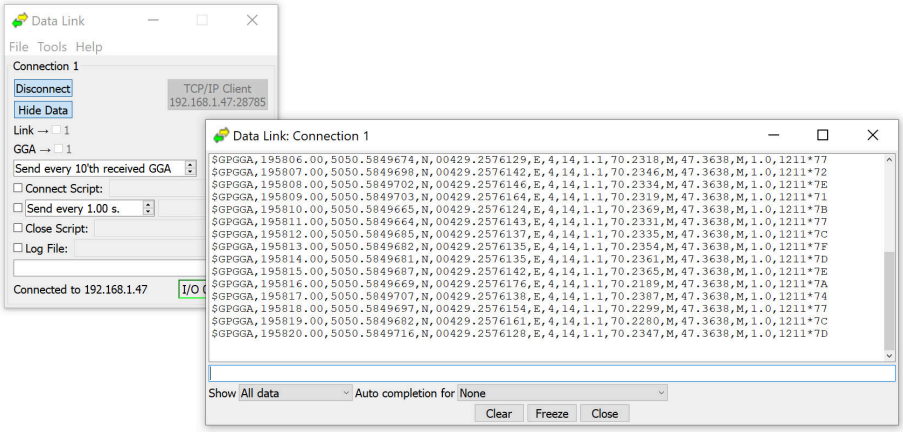

Figure 3-18: The 'Show data' window of Data Link showing GGA from the AsteRx-U3

3.5 How to configure CAN output

The CAN implementation in the AsteRx-U3 allows the transmission of several messages, as specified below. To configure CAN using the web interface, go to the Communication menu and select CAN.

By default, CAN output is turned off. By default, the Baud rate is set to 250 kbaud (as per the NMEA2000 standard) however, this can be changed.

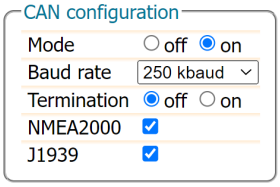

Figure 3-19: CAN configuration

The receiver can serve as a terminator on the CAN bus backbone. By default, the internal termination resistor is turned off, but if the receiver functions as one of the end points of the CAN network, the resistor can be enabled.
Finally, support for the NMEA2000 and/or J1939 standards can be turned on or off.
Every piece of equipment in the CAN network needs to have a source address. NMEA2000 uses address claiming whereby the first available address is assigned automatically to the piece of equipment on the CAN network. By default, the address from which the query for available addresses is started is zero but it can also be set to another value, as shown in Figure 3-20.

Figure 3-20: NMEA2000 start address setting

It is possible to configure up to three different NMEA2000 output streams. For each stream, a different subset of messages to be output and interval can be selected. The interval can be set to 50ms, 100ms, 200ms, 500ms or 1s. When enabled, PGN 126992, PGN 219029, PGN 129539 and PGN 129542 have a fixed interval of 1 second, regardless of the chosen interval.

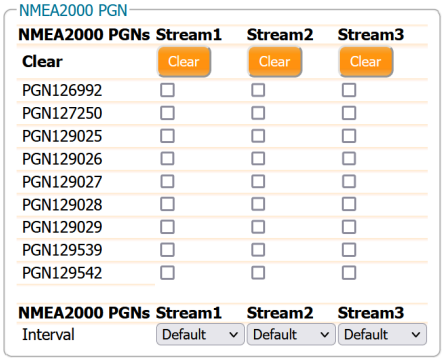

Figure 3-21: NMEA2000 PGN configuration

In a similar way, up to three streams can be configured to output the proprietary J1939 messages. Supported intervals are again 50ms, 100ms, 200ms, 500ms or 1s.

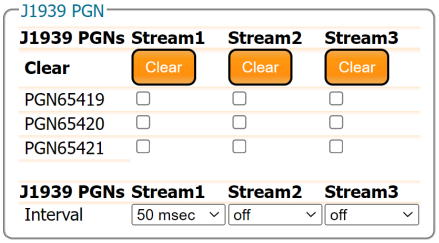

Figure 3-22: J1939 PGN configuration

3.5.1 Supported NMEA2000 and J1939 CAN messages

Septentrio receivers which support the CAN bus interface are able to output the NMEA2000 messages listed below:

PGN	*Description*	*Max. update rate*
PGN129029	NMEA2000 GNSS Position	1Hz
PGN129028	NMEA2000 Altitude Delta, High Precision Rapid Update	20Hz
PGN129027	NMEA2000 Position Delta High Precision Rapid Update	20Hz
PGN127250	NMEA2000 Vessel Heading	20Hz
PGN129539	NMEA2000 GNSS DOPs	1Hz
PGN129025	NMEA2000 GNSS Position Rapid Update	20Hz
PGN126992	NMEA2000 System Time	1Hz
PGN129026	NMEA2000 COG and SOG Rapid Update	20Hz

Detailed descriptions of the PGN messages are found in the NMEA2000 specification which can be purchased directly from the National Marine Electronics Association.
Messages PGN129028 and PGN129027 are special messages which depend on PGN129029. These messages contain delta values which can be used to calculate the current position (latitude, longitude, altitude) and time by comparing them to PGN129029. Since the maximum allowed update rate of PGN129028 and PGN129027 is much higher than that of PGN129029, this allows the user to obtain the positioning information at a higher update rate as compared to what would be possible using just PGN129029. Messages PGN129028 and PGN129027 can be related to the corresponding PGN129029 message by comparing the Sequence ID's (SID's). An example of how to calculate the current Altitude (using PGN129028 and PGN129029) and Position (using PGN129027 and PGN129029 is shown in Figure 3-23.

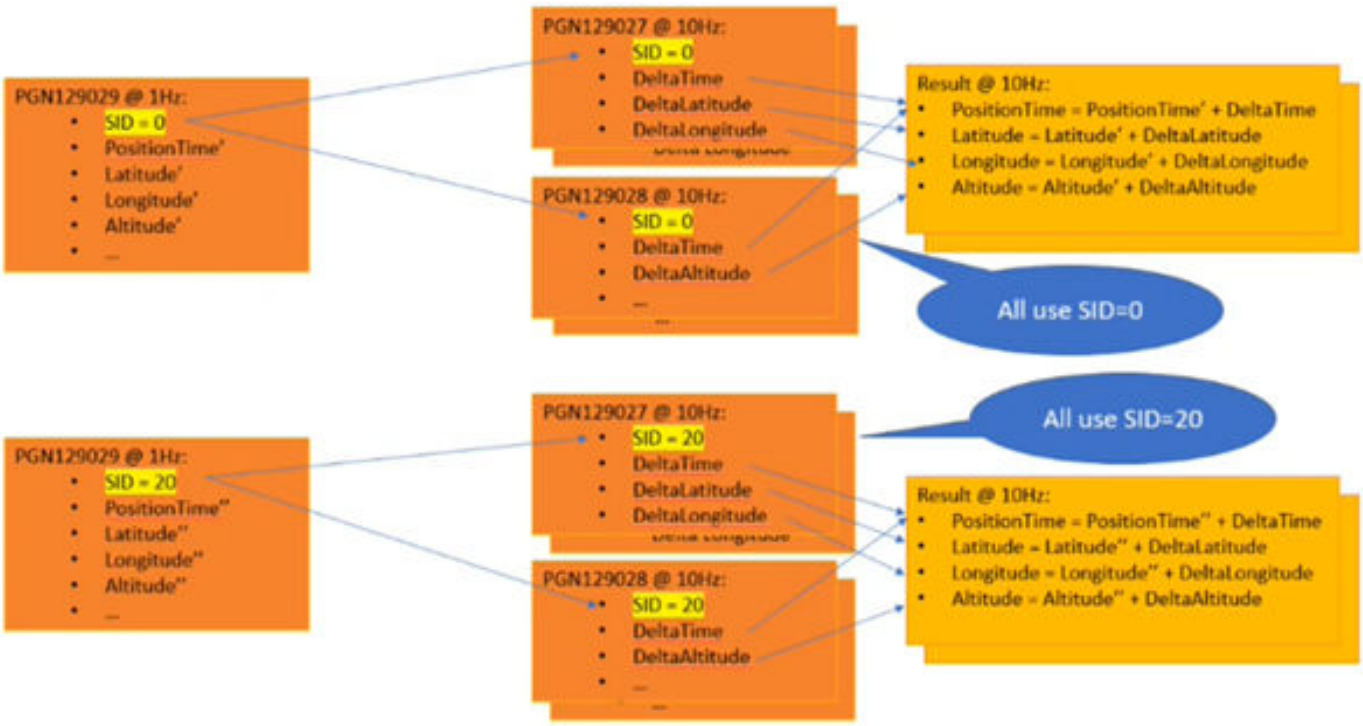

Figure 3-23: Calculating position and altitude with high update rate

Apart from the NMEA2000 messages listed earlier, the receiver also supports a number of proprietary messages. It should be noted that due to the restrictive nature of the NMEA2000 format, these messages follow the SAE J1939 standard.

Message	*Description*	*Max. update rate*
65419	Altitude	20Hz
65420	Latitude	20Hz
65421	Longitude	20Hz

4 Rover operation

4.1 How to configure the AsteRx-U3 for RTK

The AsteRx-U3 can use correction data to calculate a cm-level RTK position. The AsteRx-U3 can get this correction data in several ways: using the built-in UHF radio, over GSM or Ethernet.

4.1.1 How to configure the AsteRx-U3 in RTK rover mode using the UHF radio

When GSM network coverage is either sparse or unreliable, RTK correction data can be transmitted over UHF radio. The AsteRx-U3 has a built-in Satel radio modem that can be used to both receive and transmit data.

Step 1: Enable RTK mode

RTK should be enabled as a positioning mode. This can be done in the **GNSS, Position** window by checking the **RTK** box in the **Position Mode** field as shown in Figure 4-1. The default setting is for all positioning modes to be enabled.

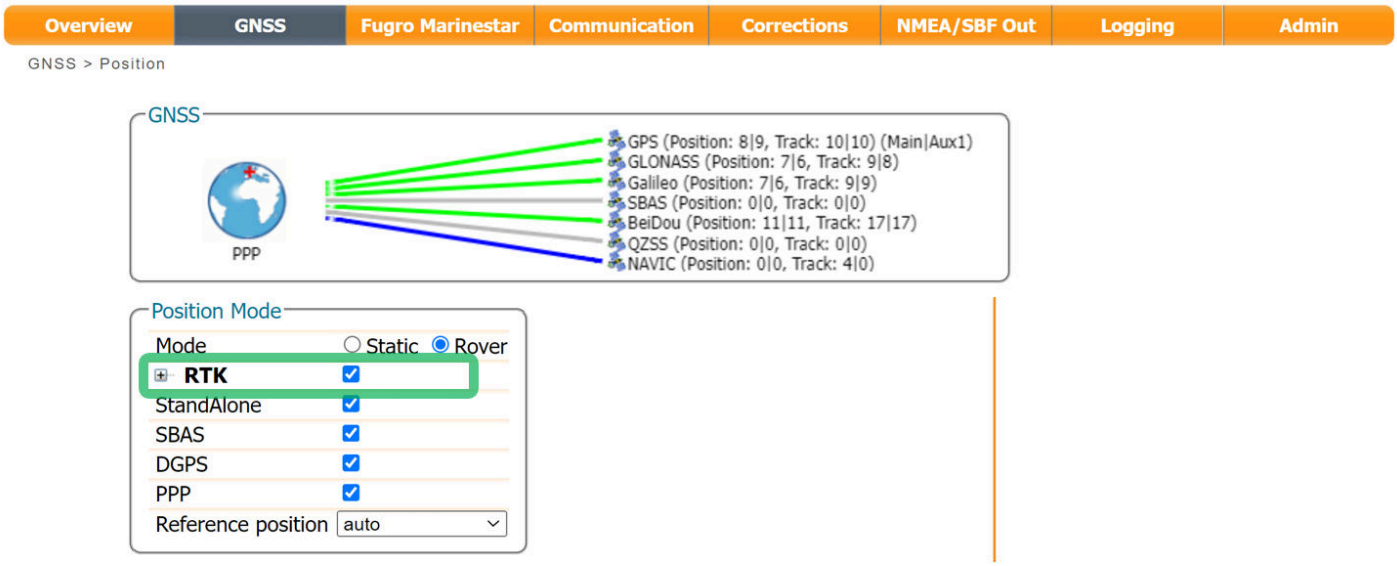

Figure 4-1: Ensure that RTK positioning mode is enabled

Step 2: Configure the UHF radio

To configure the AsteRx-U3 to receive differential correction data from a remote base station, the internal UHF radio should first be powered on as shown in Figure 4-2.

To configure the remaining settings, you will need to know the following four parameters from the base station transmitter:

- bandwidth (sometimes referred to as channel spacing) of the transmitter
- frequency of the transmitted signal
- protocol of the transmitted data
- error correction method (FEC) of the transmitted data

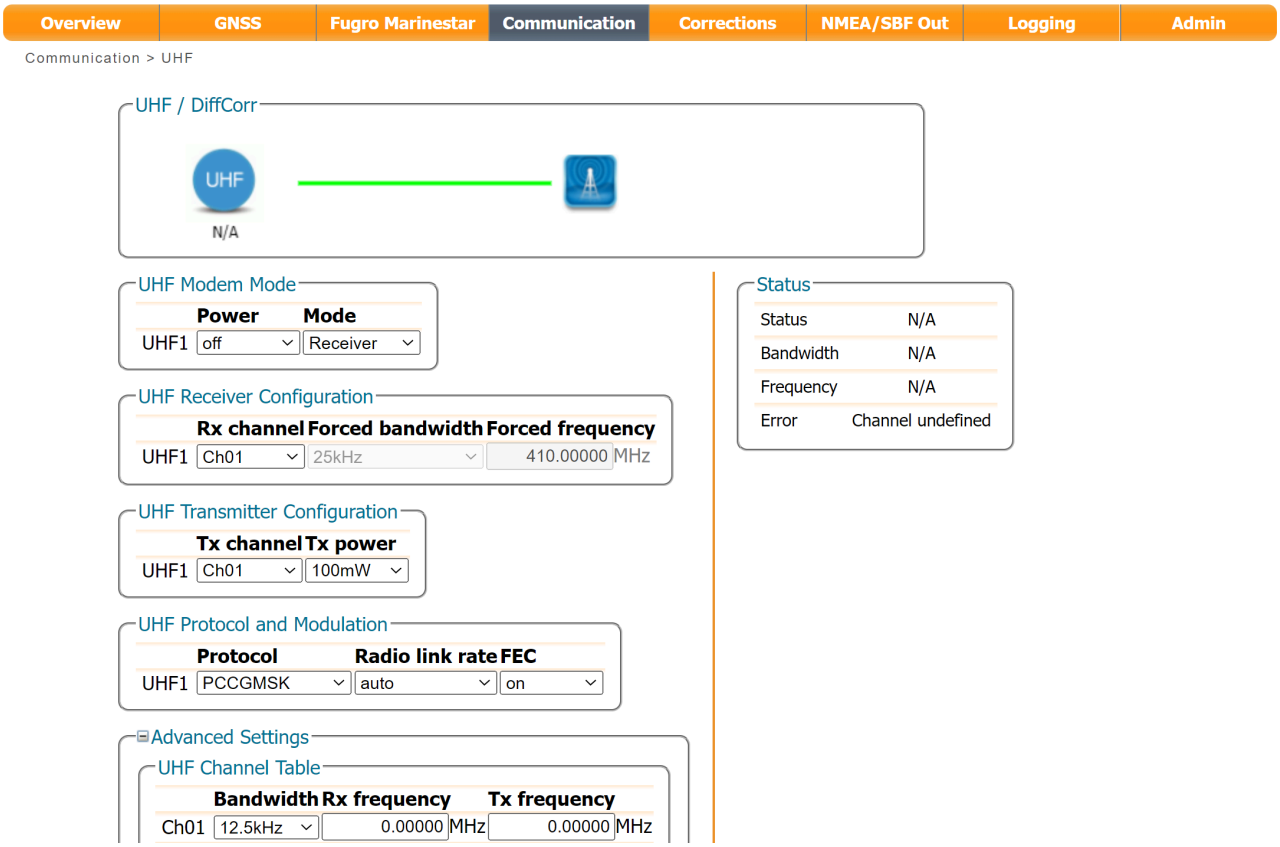

Figure 4-2: Configuring the built-in UHF radio for rover operation

After changing the settings click on **OK** to finalize the settings. Each time the configuration is changed, a pop-up in the lower right-hand corner will prompt you to save the new configuration as the boot configuration. Clicking on 'Save' will cause the AsteRx-U3 to boot with the new configuration after a power cycle.

The frequency and bandwidth are configured via the **Advanced Settings** menu. Note that, the baud rate of the connection depends on the **Protocol** and **Bandwidth** settings as given in Appendix 9.2.

Step 3: Verifying the configuration

If the UHF radio of the AsteRx-U3 has been correctly configured then you should see in the UHF/DiffCorr field, the grayed-out connection line is now replaced by a 'live' green line as shown in Figure 4-3. The message format of the differential corrections will appear next to the right-hand base station icon: RTCMv3 in this example. All being well, the positioning mode icon in the upper status field should also indicate 'RTK Fixed' after a few seconds.

Figure 4-3: The AsteRx-U3 in RTK mode using differential correction data from a base station transmitting over a UHF radio connection

4.1.2 How to configure the AsteRx-U3 in RTK rover mode using the cellular modem and NTRIP

Step 1: Enable RTK mode

Ensure that RTK is enabled as a positioning mode. This can be done in the **GNSS, Position** tab by checking the 'RTK' box in the 'Position Mode' field as shown in Figure 4-4.

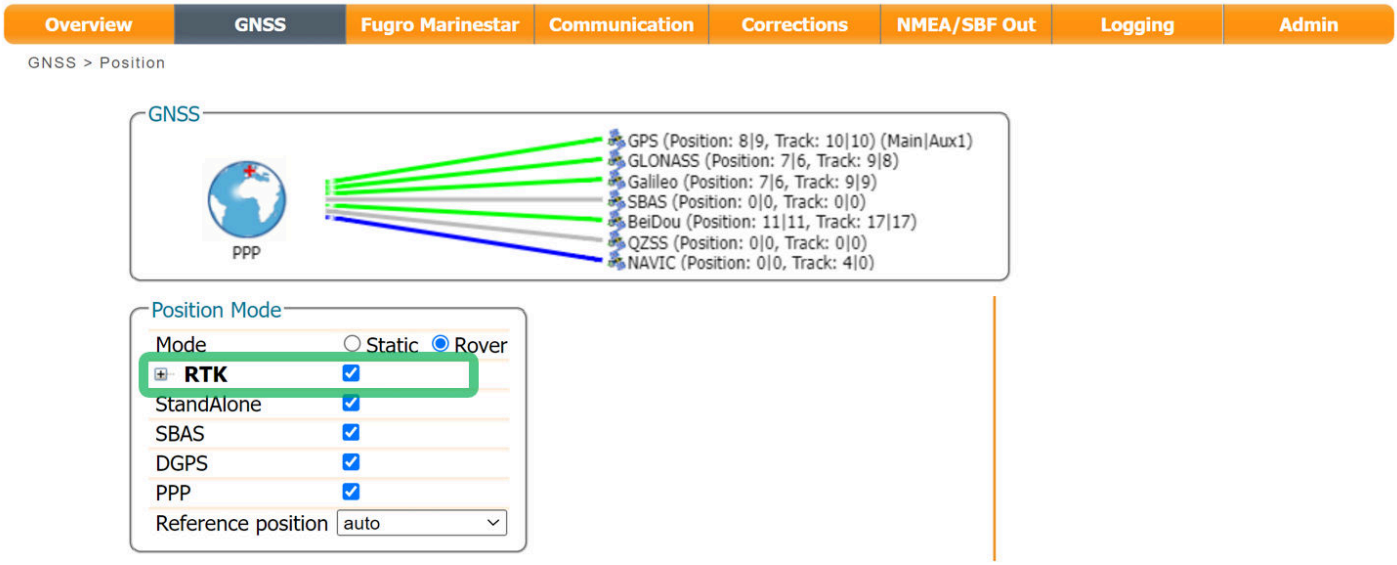

Figure 4-4: Ensure that RTK has been enabled as a positioning mode

Step 2: Configure the cellular modem

Insert a SIM card into the front-panel slot of the AsteRx-U3 as shown in Figure 2-5 while the unit is powered down.

The on-board cellular modem of the AsteRx-U3 can be configured in the **Communication, Cellular** window as shown in Figure 4-5. A PIN number may or may not be required depending on the SIM configuration. In the **Cellular Configuration** field, the Access Point Name (APN) should be inserted with other fields being optional.

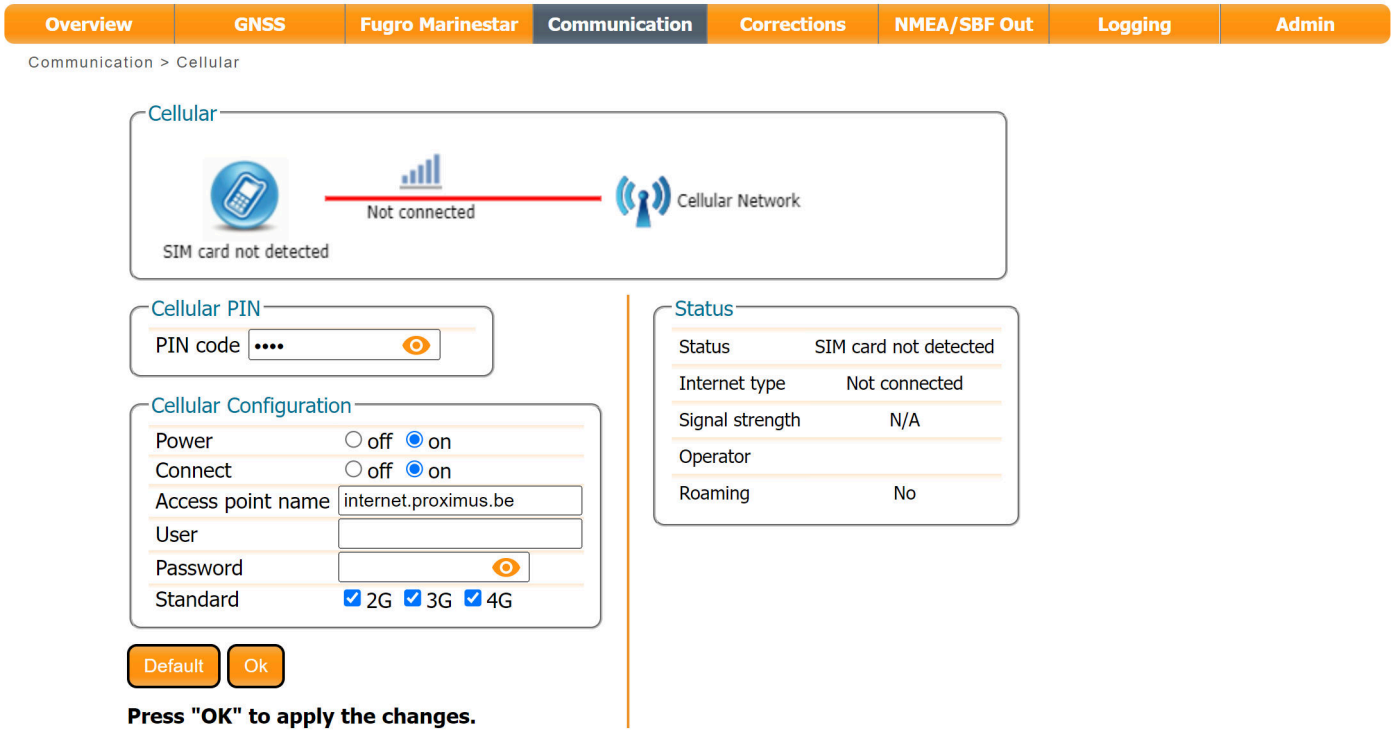

Figure 4-5: Configuring the cellular modem

Click on Ok and if the settings are correct, the cellular graphic should appear as shown in Figure 4-6. The connection type may appear as HSUPA, HSPA or in this example LTE.

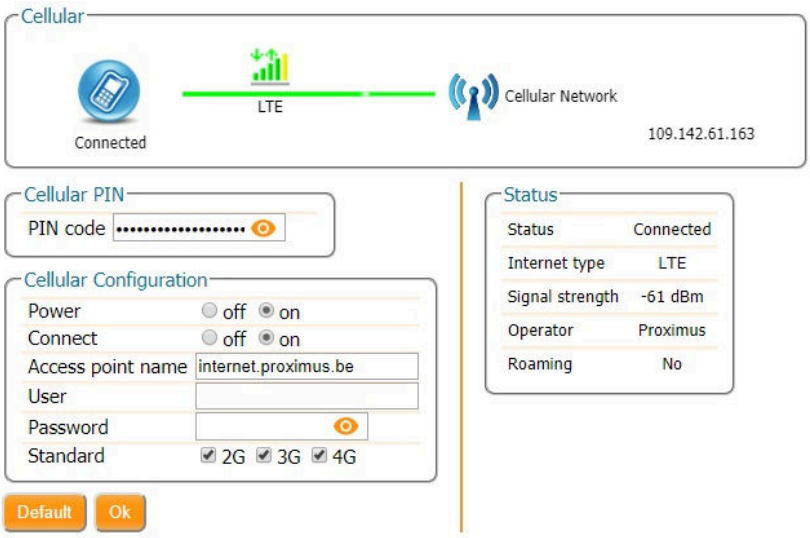

Figure 4-6: Correctly configured cellular modem

Step 3: Configure the NTRIP connection

Using a cellular connection, you can get RTK correction data from an NTRIP service. Figure 4-7 shows the settings required to retrieve correction data from the Septentrio NTRIP Caster. Select 'Client' from the drop-down **Mode** menu. The Caster, Port, User Name and Password should be provided by the NTRIP service. NTRIP Casters typically provide multiple correction data streams known as **Mount Points**. When a connection has been made to the Caster, the 'Mount Point' drop-down list will become active. In this example, the FLEPOS_HOEG stream has been selected, the details of which are shown in Figure 4-8.

When using correction data from a virtual base station it is often necessary to provide your position to the NTRIP Caster in the form of an NMEA GGA message. This can be configured in the '**Send GGA to caster**' drop-down list.

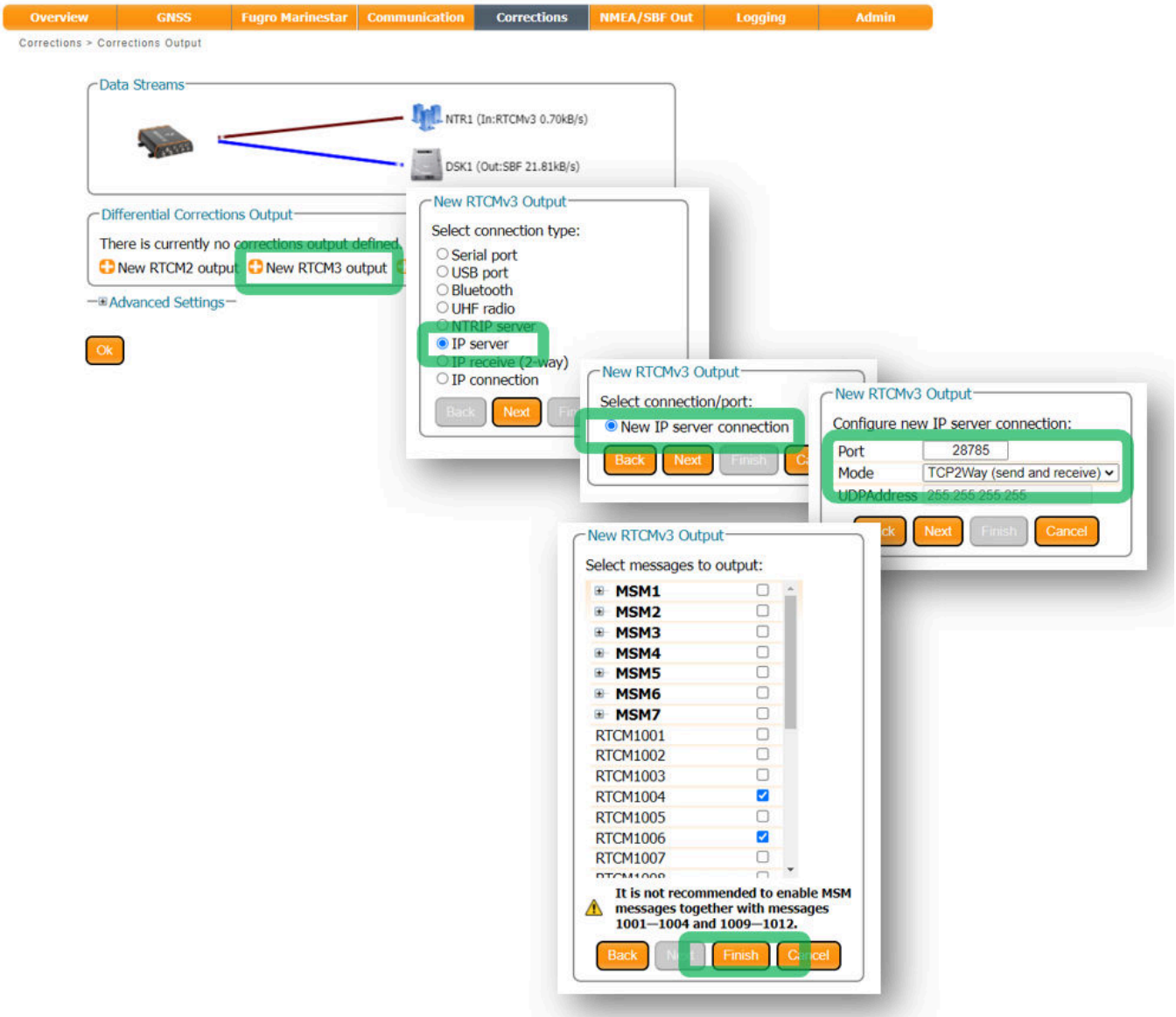

Figure 4-7: Configuring the NTRIP connection

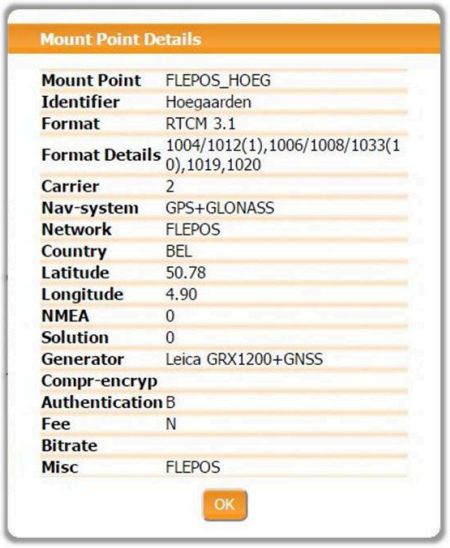

Figure 4-8: Details of the selected mount Point

Step 4: Verifying the configuration

When both the cellular modem and NTRIP connection have been correctly configured, the Ntrip figure in Corrections NTRIP window will indicate differential correction reception as shown in Figure 4-9 with the positioning mode icon indicating RTK fixed.

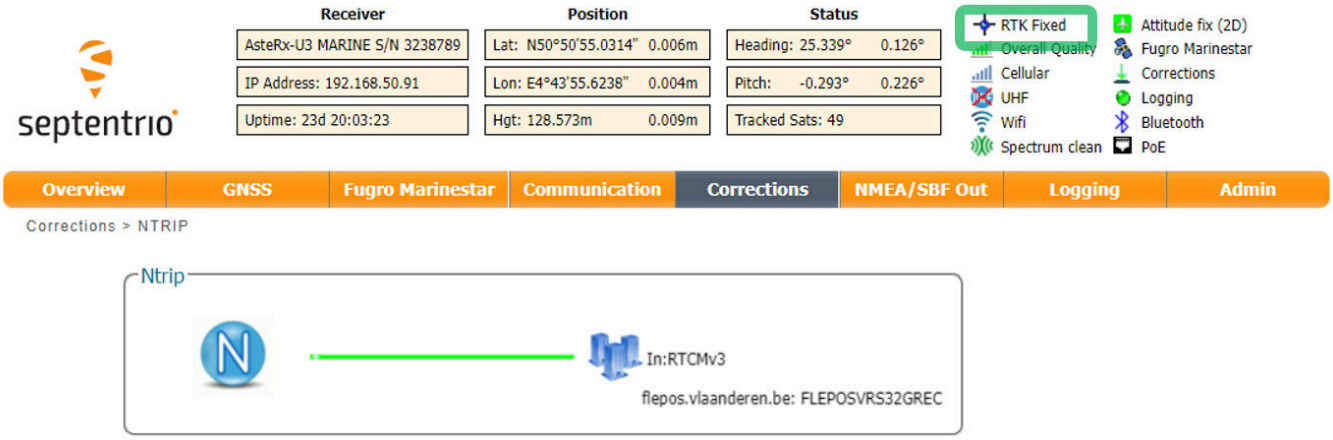

Figure 4-9: Correctly configured NTRIP connection

4.1.3 How to configure the AsteRx-U3 in RTK rover mode using TCP/IP in a closed network

Step 1: Configure the Base station receiver

Set the Base station position as static

Section 5.1 describes how to configure the AsteRx-U3 as an RTK base station.

Configure the Ethernet connection and differential corrections output from the Base station receiver

In the **Corrections Output** window click on **New RTCM3 output** to start the sequence of steps to configure the RTK differential corrections stream and Ethernet connection over which the differential corrections will be sent. In the example shown in Figure 4-10, RTCMv3 correction data are sent out over port 28785. The RTCMv3 messages necessary for RTK positioning are selected by default.

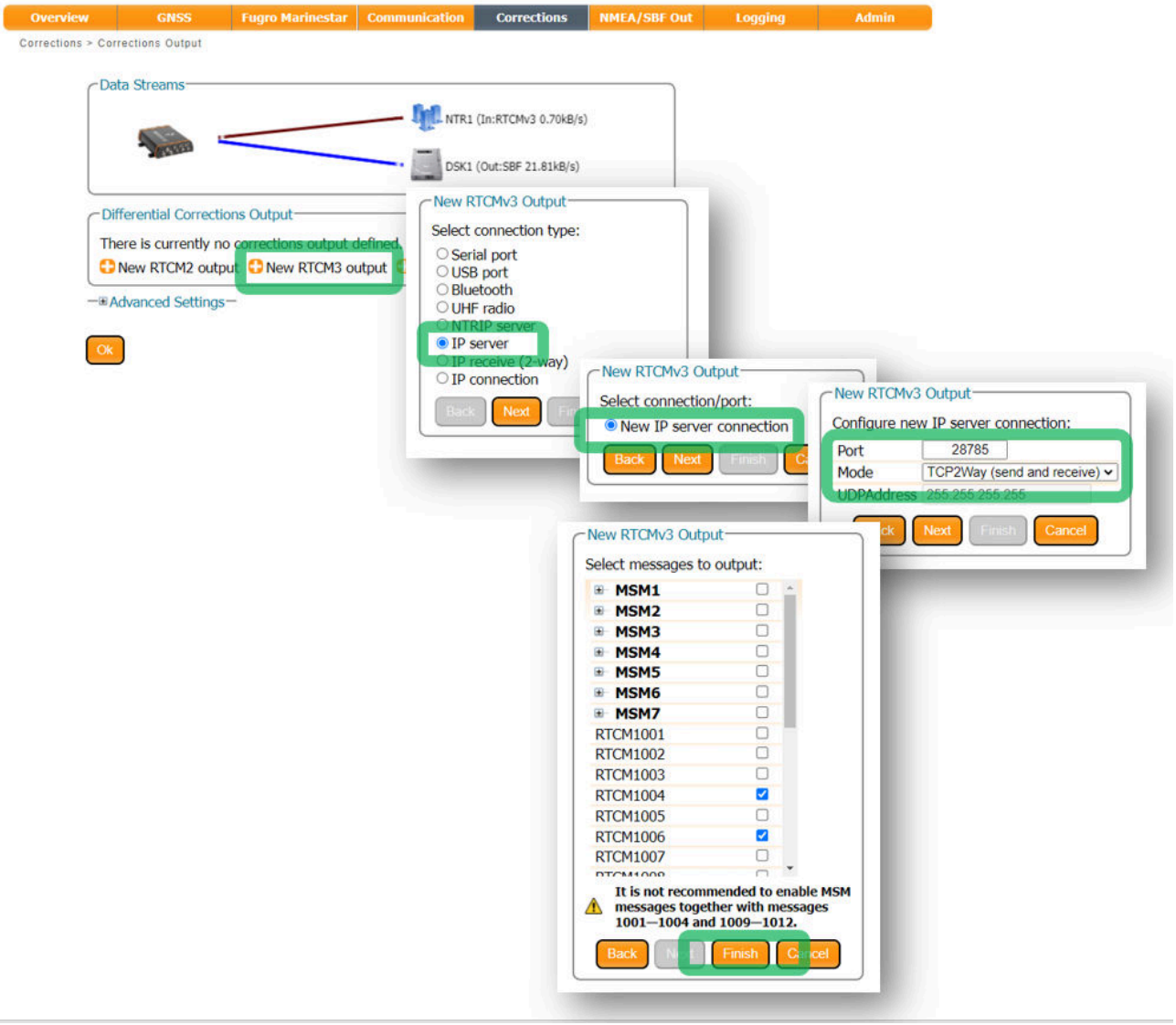

Figure 4-10: Configuring RTK differential corrections output over an Ethernet connection

Step 2: Configure the Rover receiver

Enable RTK positioning mode on the rover receiver

Ensure that RTK is enabled as a positioning mode. This can be done in the GNSS Position tab by checking the 'RTK' box in the 'Position Mode' field as shown in Figure 4-11.

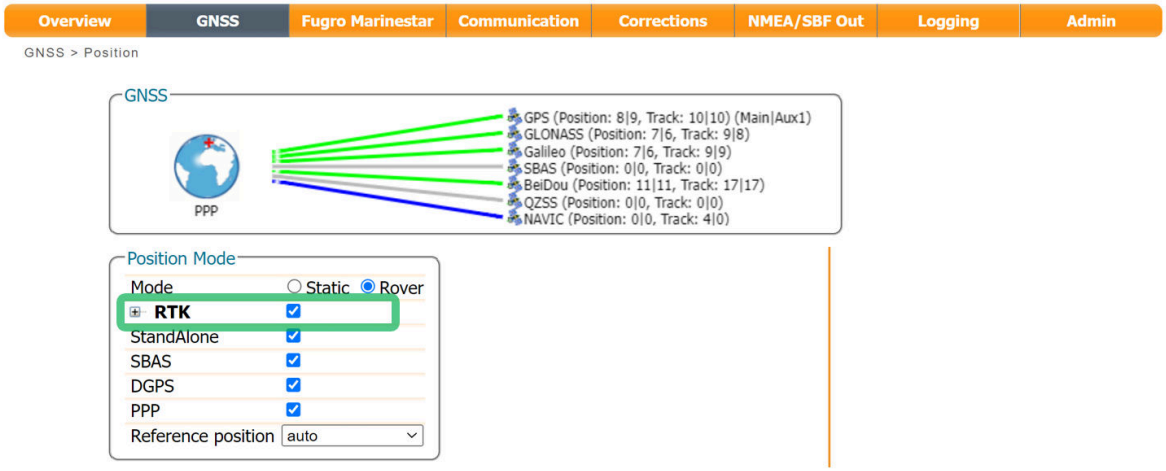

Figure 4-11: Ensure that RTK is enabled as a positioning mode

Configure the Ethernet connection of the rover receiver

On the **IP Ports** window of the rover receiver, click on **New IP Receive Connection** as shown in Figure 4-12 to start configuration sequence. The **Port** and **TCPAddress** should match the port and IP address of the Base station receiver.

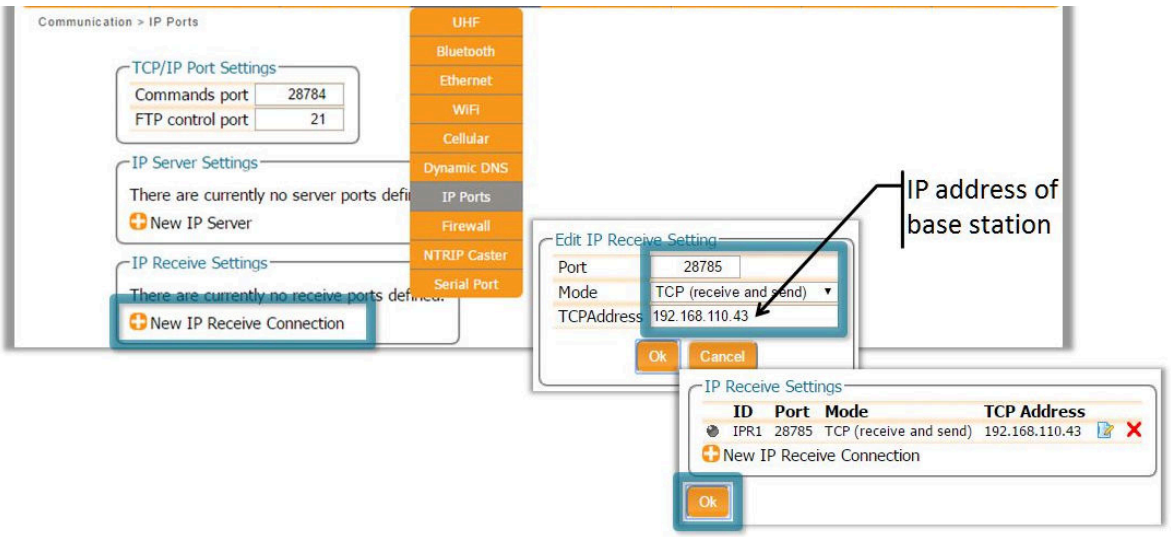

Figure 4-12: In the **IP Ports** window, click on **New IP Receive Connection** to configure the connection with the base station

Step 3: Verifying the configuration

If the Base station and rover receivers have been configured correctly then connections in the Communication Ethernet windows should appear similar to those shown in Figures 4-13 and 4-14.

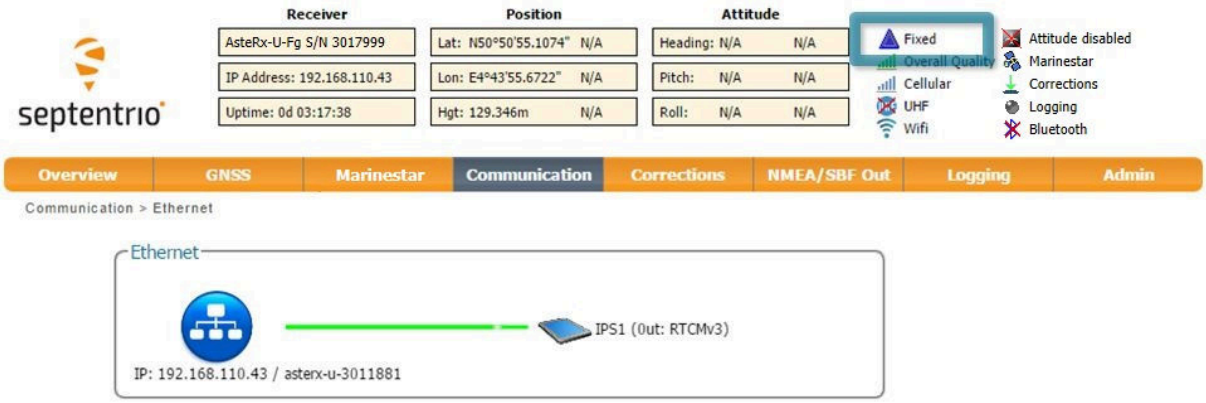

Figure 4-13: Ethernet window of the **Base station receiver** showing the position as static and an active output of RTCMv3 differential corrections on server port IPS1

Figure 4-14: Ethernet tab of the **rover receiver** showing a fixed RTK position and reception of RTCMv3 differential corrections on receiver port IPR1

4.2 How to configure the AsteRx-U3 for Attitude

With two antennas connected to the AsteRx-U3, the receiver can calculate Heading and either Pitch or Roll. This section details how to configure the AsteRx-U3 in a two-antenna setup.

Step 1: Connect a second antenna

Connect a second antenna to the rear-panel connector labeled **AUX ANT** and indicated in Figure 4-15.
Note: It is recommended to keep the net gain difference between MAIN and AUX antennas to maximum 10dB.

Figure 4-15: Auxiliary antenna connector on rear panel

Step 2: Configure attitude settings

The attitude settings of the AsteRx-U3 can be configured in the **GNSS, Attitude** window as shown in Figure 4-16.

Figure 4-16: GNSS Attitude window when two antennas are connected

GNSS Attitude field

The recommended settings for a Heading setup are **MultiAntenna** mode with attitude calculated using **Fixed** ambiguities as shown. These setting are configured by default.

Antenna Location and Antenna Offset

The AsteRx-U3 assumes that the main and auxiliary antennas are placed along the longitudinal axis of the vehicle with the auxiliary in front of the main antenna. If the antennas cannot be placed in such a configuration, the reported heading and pitch may be biased. The default settings in the **Antenna Offset** and **Antenna Location** fields shown in Figures 4-16 can be altered to compensate for these biases.

Step 3: Attitude information in SBF and NMEA data

Details on how to output SBF and NMEA data can be found in Section 3.4.

SBF

Attitude information is contained in the SBF blocks *AuxAntPositions*, *AttEuler*, *AttCovEuler* and *EndOfAtt*. These blocks are selected automatically when checking the 'Attitude' box when configuring SBF output via the **NMEA/SBF Out** window as Figure 4-17 shows.

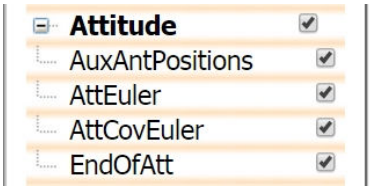

Figure 4-17: SBF blocks containing attitude information

NMEA

You can output the attitude information from the AsteRx-U3 in NMEA format by selecting the standard NMEA HDT sentence or the Septentrio proprietary HRP sentence as shown in Figure 4-18.

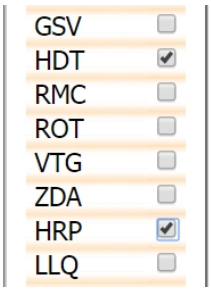

Figure 4-18: NMEA sentences containing attitude information

4.3 How to output a PPS signal

The AsteRx-U3 can output a PPS (Pulse-per-Second) signal that can be used for example, to synchronize a secondary device to UTC time.

Step 1: Connect the PPS cable

Connect the PPS_OUT cable to the rear-panel connector labelled 'PPS GPO' and indicated in Figure 4-19.

Figure 4-19: PPS connector on rear panel

Step 2: Configure the PPS settings

You can configure the PPS settings on the **PPS/Timing** window on the **GNSS** menu as shown in Figure 4-20.

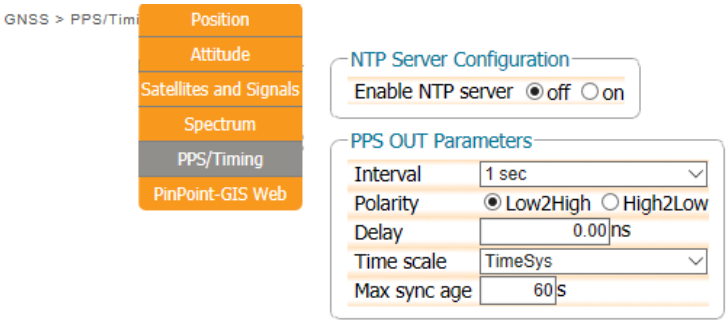

Figure 4-20: The **GNSS, PPS/Timing** window

The **Interval** is the time interval between successive timing pulses and is selectable between 10ms and 10s. The default **Polarity** of the PPS signal is a low-to-high transition which can be alternatively configured as high-to-low.

The **Delay** argument can be used to compensate for signal delays in the system (including antenna, antenna cable and PPS cable). For example, if the antenna cable is replaced by a longer one, the overall signal delay could be increased by say, 20ns. If Delay is left unchanged, the PPS pulse will come 20ns too late. To re-synchronize the PPS pulse, Delay should be increased by 20ns.

By default, PPS pulses are aligned with the satellite time system (TimeSys) as shown in the **Time Scale** field. PPS signals can alternatively be aligned with UTC, local receiver time (RxClock) or GLONASS time.

When Time Scale is set to anything other than RxClock, the accuracy of the time of the PPS pulse depends on the age of the last PVT computation. During PVT outages, the PPS generation time, which is extrapolated from the last available PVT information, may start to drift. To avoid large biases, the receiver stops outputting the PPS pulse when the last available PVT is older than the specified **MaxSyncAge**. The MaxSyncAge is ignored when TimeScale is set to RxClock.

4.3.1 Time synchronization using the PPS signal

The PPS signal is an electronic pulse synchronized with GPS time clock ticks, it doesn't itself specify time. To synchronize a device with GPS time, the AsteRx-U3 can be configured to output both a PPS signal and an NMEA ZDA sentence which contains the time. The PPS signal arrives first followed by the ZDA whose reported time corresponds to the leading edge of the PPS signal.

5 Base station operation

5.1 How to configure the AsteRx-U3 as an RTK base station using the UHF radio

The AsteRx-U3 can itself also be configured to work as a base station and provide differential correction data to one or more rover receivers.

Step 1: Setting the AsteRx-U3 base station position

Set the position as static

To work as a base station, the position of the AsteRx-U3 should be set to static. If not, the AsteRx-U3 will still work as a base station however the position of the rover may show more variation. The 'Static' position mode can be selected in the '**Position**' window of the '**GNSS**' menu as shown in Figure 5-1.

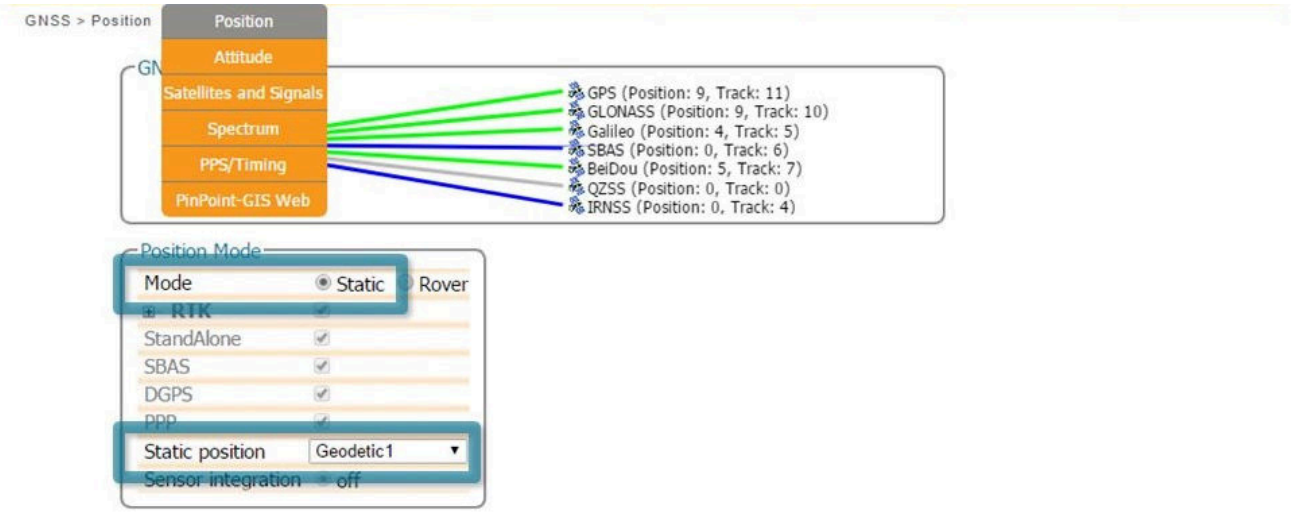

Figure 5-1: Setting the AsteRx-U3 base station position to static

Set the correct position

An accurate position of the antenna that is connected to the AsteRx-U3 should also be set. The default setting of 'auto' can be used for demonstrations however, for most other purposes, a properly surveyed position is advisable. In the example shown in Figure 5-2, the position stored under 'Geodetic1' is used. The stored positions can be entered via the '**Advanced Settings**' menu on the same page. Pre-set positions can be entered in either Geodetic or Cartesian coordinates as shown.

Select the Datum of the antenna position

In the **Datum** field, you can select the datum to which the antenna coordinates refer. The selected value is stored in the Datum field of position-related SBF blocks (e.g. `PVTCartesian`) and also in any output differential corrections. Please note that the **Datum** setting does not apply any datum transformation to the antenna position coordinates.

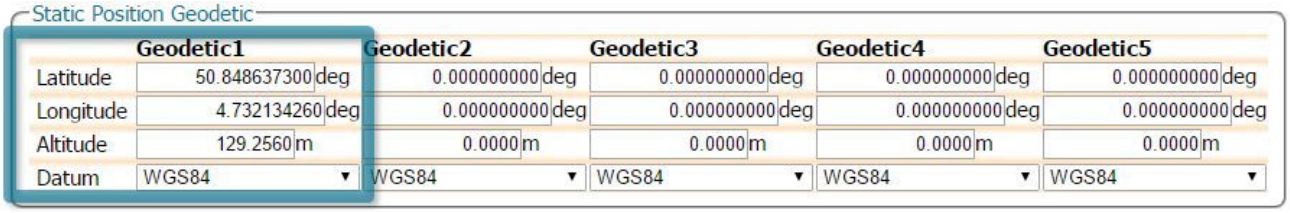

Figure 5-2: Setting the static position to the pre-set 'Geodetic1' position

Click '**OK**' to apply the new settings

Step 2: Configure output of differential corrections

Selecting the correction format and connection type

Output of differential corrections can be configured in the **Corrections Output** window as Figure 5-3 shows. Click on **New RTCM3 output** to start the sequence of configuration steps. The messages needed for RTK are selected by default.

RTCMv3 is the most compact and robust correction format. It is recommended to use this format wherever possible.

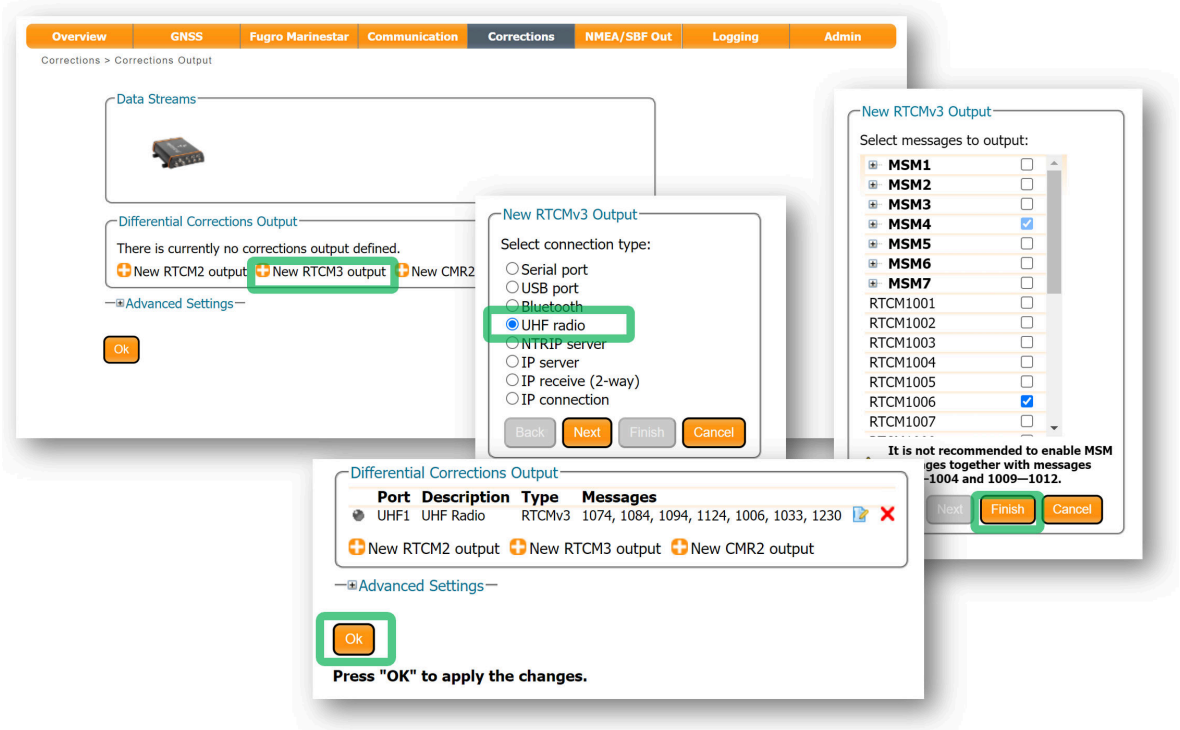

Figure 5-3: Selecting to output RTCM3 RTK corrections over the UHF radio

Step 3: Configuring the UHF radio

The UHF radio can be configured in the '**UHF**' window. In the example show in Figure 5-4, the radio will transmit at a frequency of 410 MHz, channel spacing of 12.5 kHz and at a power of 100 mW[1]. The transmission protocol and error method can also be selected on this page as shown.

The frequency and bandwidth are configured via the **Advanced Settings** menu. Note that, the baud rate of the connection depends on the **Protocol** and **Bandwidth** settings as given in Appendix 9.2.

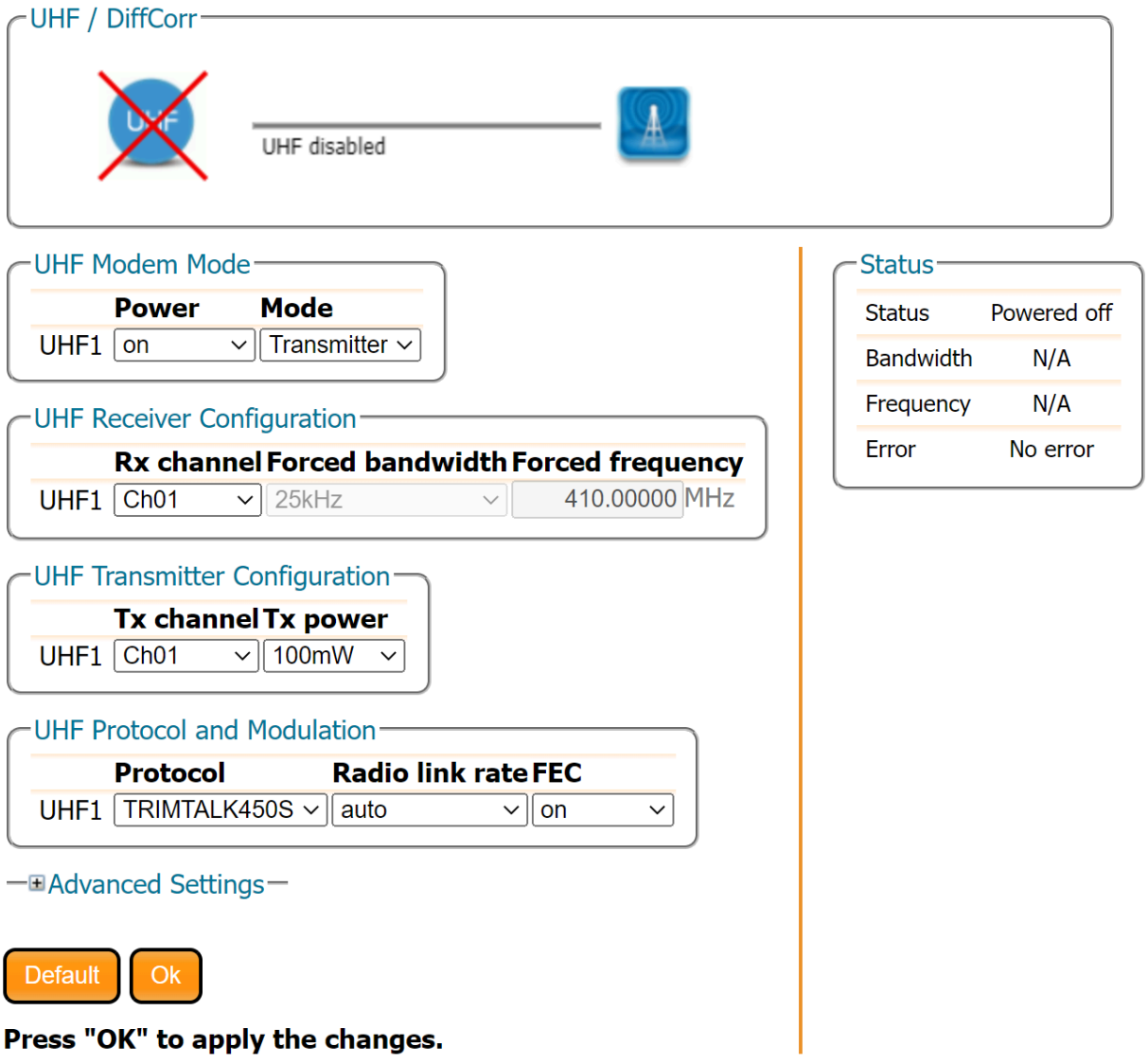

Figure 5-4: Configuring the UHF radio

[1] Please note that, depending on your location, you may be prohibited from transmitting on certain frequencies or at certain power levels.

Step 4: Verifying the configuration

If the UHF radio has been correctly configured, the transmission line in the top-panel should change to green as shown in Figure 5-5. The format of the corrections stream should also be correctly identified along with the data rate.

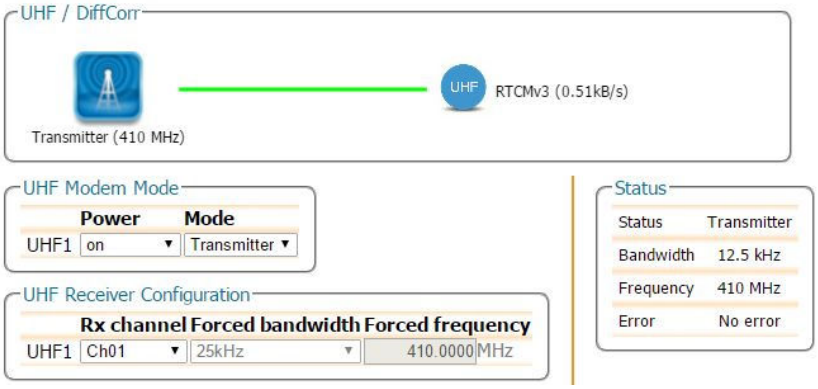

Figure 5-5: The UHF radio configured to transmit RTCMv3 diff corr at 410 MHz

5.2 Configuring the AsteRx-U3 NTRIP Caster

The AsteRx-U3 includes a built-in NTRIP Caster that makes correction data from the AsteRx-U3 available to up to 10 NTRIP clients (or rovers) over the internet. The caster supports up to three mount points and can also broadcast correction data from a remote NTRIP server.

All settings relating to the AsteRx-U3 NTRIP Caster can be configured in the **NTRIP Caster** window from the **Communication** menu.

Step 1: Define a new mount point

Figure 5-6: The configuration sequence for defining a new mount point

In the NTRIP Caster window, click on the **Settings** tab.

In the General Settings field, enable the NTRIP Caster and select the IP port over which you wish to send correction data: the default port is 2101.

Click on **New mount point** as indicated in Figure 5-6. Select '**Yes**' to enable the mount point and give it a name. This is the name that will appear in the caster source table. Up to 3 mount points can be defined each with a different name. You can also select the type of

Client authentication for the mount point: **none** - any client can connect without logging in or, **basic** - clients have to login with a username and password.

To select a correction stream from the NTRIP server of the AsteRx-U3, select '**No**' in the 'Allow external server' field[2].

Click on the '**Local Server ...**' button to enable the local NTRIP server of the AsteRx-U3 and to select the individual messages you want to broadcast. By default, correction messages necessary for RTK are pre-selected. Click **Ok** to apply the settings.

Step 2: Define a new user

If you selected **basic** client authentication when configuring the mount point in the previous step, you will need to define at least one user. The user name and password are the credentials needed for the NTRIP client (rover) to access the correction stream.

In the 'Client Users' section, click on **New User** as shown in Figure 5-7. Enter a User Name and Password for the user and select the mount points that they will have access to. Up to 10 NTRIP clients can log in as a particular user. Click **Ok** to apply the settings.

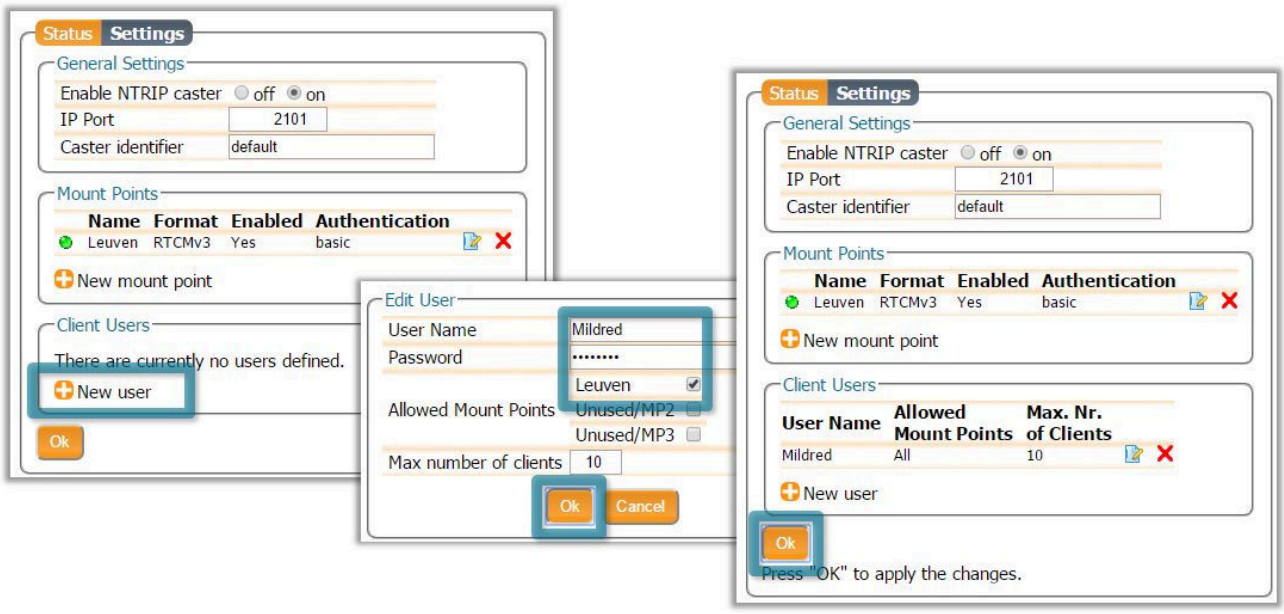

Figure 5-7: Configuring the login credentials for a user

Step 3: Is the NTRIP Caster working?

In the '**Status**' tab of the NTRIP Caster window, you can see a summary of the NTRIP Caster to make sure that it has been properly configured. In the example shown in Figure 5-8, a rover client is connected to the mount point named **Leuven** as user **Mildred**.

If the client rover receivers are configured to send a GGA message to the caster (as was the case in Figure 5-9), then their position will also be visible.

[2] By setting **Allow external server** to **Yes** the mount point can receive a stream from a remote NTRIP server

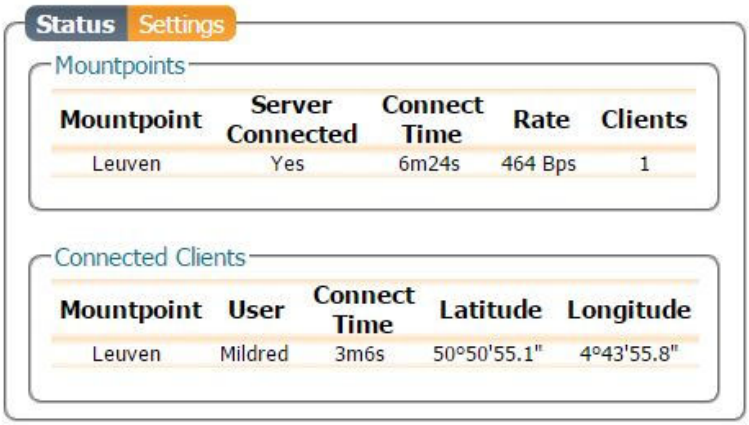

Figure 5-8: Connecting as a client to the AsteRx-U3 NTRIP Caster

On the NTRIP Client side

Rover receivers can connect to the NTRIP Caster by going to '**Corrections > NTRIP**' clicking **New NTRIP client** and entering its IP address and Port as shown in Figure 5-9. After clicking 'Ok', the mount point source table will be filled and a mount point can be selected. The user name and password can then be entered and within a few seconds, the rover receiver should report an RTK fixed position.

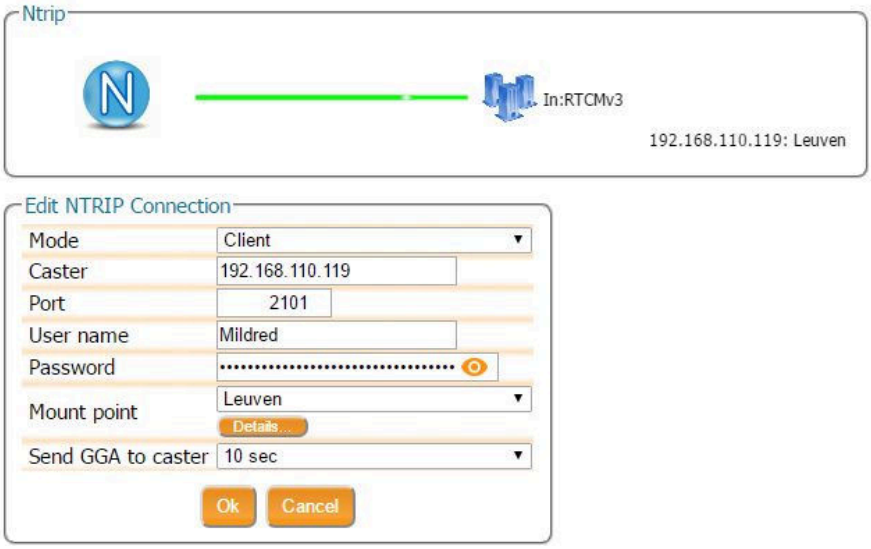

Figure 5-9: Connecting as a client to the AsteRx-U3 NTRIP Caster

6 Receiver Monitoring

6.1 Basic operational monitoring

The 'Overview' page of the web interface in Figure 6-1 shows at a glance a summary of the AsteRx-U3's operational status.

Figure 6-1: Overview page of the web interface

1 The main information bar at the top of the window gives some basic receiver information: receiver type, serial number and position. The length of time since the last power cycle (Uptime) and the attitude when a second antenna is connected, are also given.

2. The icons to the right of the information bar show that, in this example, the position of the receiver is fixed, the overall performance (signal quality and CPU) is Excellent (5 out of 5 bars) and the receiver is logging to the internal disk. The Corrections icon indicates that differential corrections are being sent out to a rover receiver. The active UHF and WiFi icons show that the on-board UHF and WiFi modems are turned on.

3. The Quality indicators give a simple overview of signal quality, RF antenna power and CPU load of the receiver.

4. The GNSS field details how many satellites for each constellation are being tracked and used in the position solution (PVT). A green line indicates that at least one satellite in the constellation is being used in the PVT, a blue line indicates that satellites are being tracked but not used and a grey line that there are no satellites from that particular constellation in tracking. More information can found in the **Satellites and Signals** page on the **GNSS** menu.

5. The **UHF/DiffCorr** field shows the differential correction format being transmitted or received via the UHF radio.

6. The **Data Streams** field gives an overview of the data streams into (green lines) and out from (blue lines) the receiver. In this example, the receiver is logging SBF data to the internal memory (DSK1) and sending out RTCMv3 differential correction data over the UHF radio.

7. The Logging field summarizes the current logging sessions and disk capacities. The complete logging information and configuration windows can be found via the **Logging** menu.

6.2 AIM+: Using the spectrum analyzer to detect and mitigate interference

The AsteRx-U3 is equipped with a sophisticated RF interference monitoring and mitigation system (AIM+). To mitigate the effects of narrow-band interference, 3 notch filters can be configured either in auto or manual mode. These notch filters effectively remove a narrow part of the RF spectrum around the interfering signal. The L2 band being open for use by radio amateurs is particularly vulnerable to this type of interference. The effects of wideband interference both intentional and unintentional can be mitigated by turning on the WBI mitigation system. The WBI system also reduces, more effectively than traditionally used pulse-blanking methods, the effects of pulsed interferers.

The spectrum view plot

In the Spectrum window of the GNSS menu, you can monitor the RF spectrum and configure three separate notch filters to cancel out narrowband interference. Figure 6-2 shows the L2 frequency band with the GPS L2P signal at 1227.60 indicated. Different bands can be viewed by clicking on the 'Show table' button as shown. The spectrum is computed from baseband samples taken at the output of the receiver's analog to digital converters.

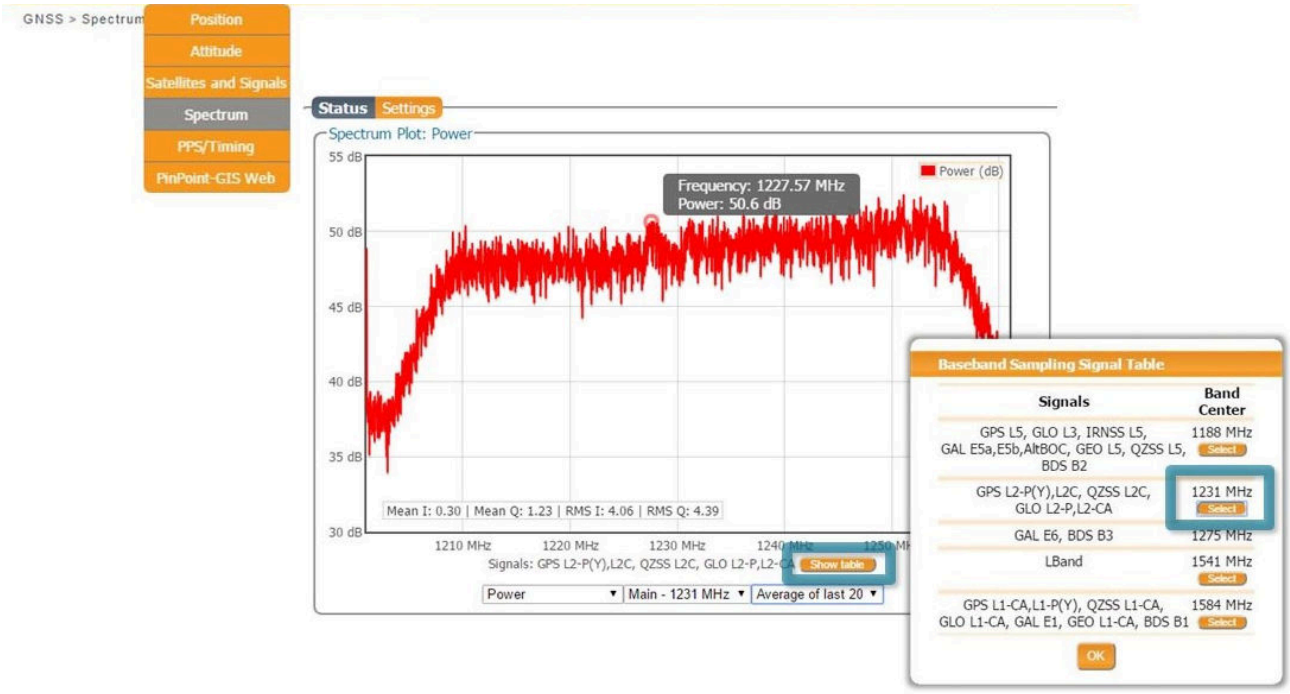

Figure 6-2: The RF spectrum of the L2 Band

6.2.1 Narrowband interference mitigation

Configuring the notch filters

When the notch filters are set to their default auto mode, the receiver performs automatic interference mitigation of the region of the spectrum affected by interference. In manual mode, as shown configured for Notch1 in Figure 6-3, the region of the affected spectrum is specified by a center frequency and a bandwidth which is effectively blanked by the notch filter.

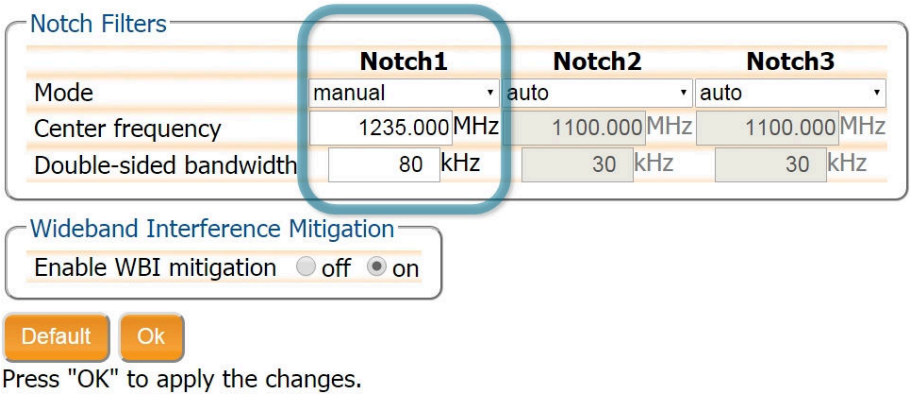

Figure 6-3: Configuring the first notch filter Notch1 at 1235 MHz

With the Notch1 settings as shown in Figure 6-3, the L2-band after the notch filter (After IM) is shown in Figure 6-4 with the blanked section clearly visible.

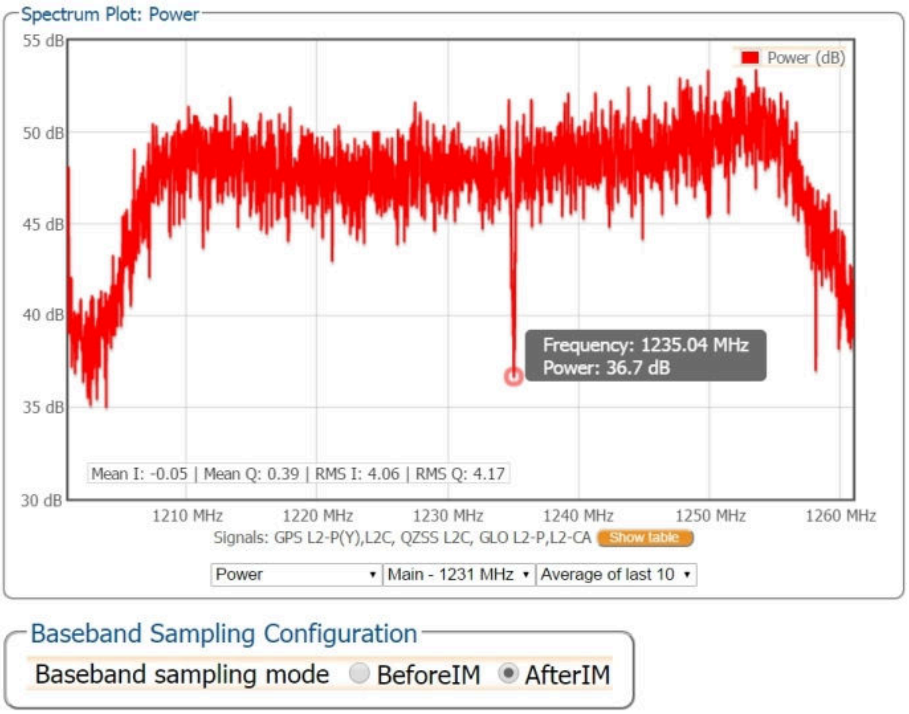

Figure 6-4: The RF spectrum of the L2 Band after applying the notch filter at 1235 MHz

6.2.2 Wideband interference mitigation

Wideband interference of GNSS signals can be caused unintentionally by military and civilian ranging and communication devices. There are also intentional sources of interference from devices such as chirp jammers. The wideband interference mitigation system (WBI) of the AsteRx-U3 can reduce the effect of both types of interference on GNSS signals.

Configuring WBI mitigation

The wideband interference mitigation system (WBI) can be enabled by selecting 'on' as shown in Figure 6-5.

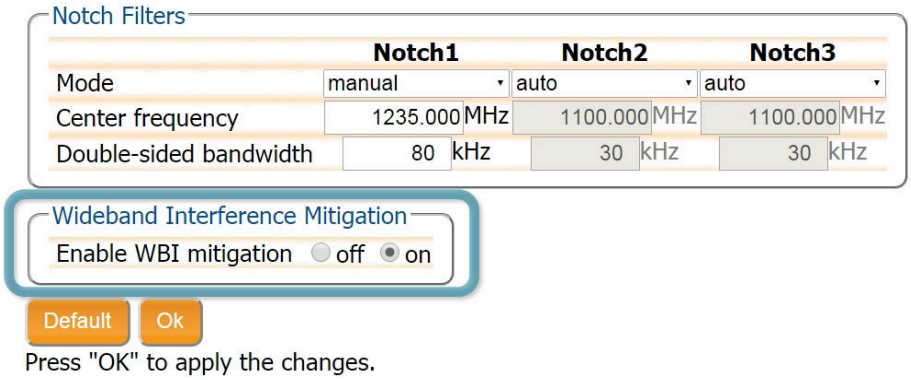

Figure 6-5: Select 'on' to enable wideband interference mitigation then 'OK' to apply the new setting.

WBI mitigation in action

The GPS L1 band interference shown in Figure 6-6 is produced by combining the GNSS antenna signal with the output from an in-car GPS chirp jammer.

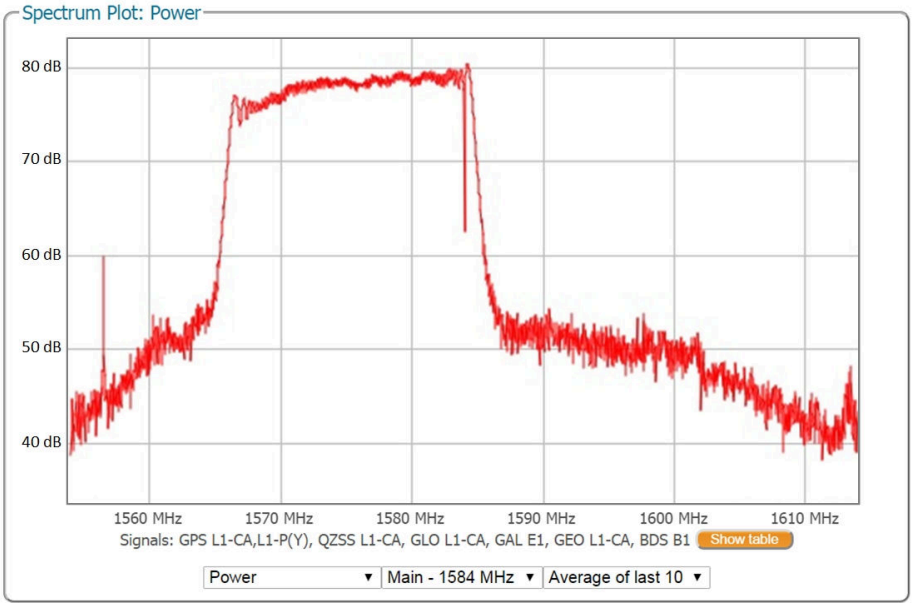

Figure 6-6: Simulated wideband interference in the GPS L1 band using an in-car chirp jammer.

When WBI mitigation is enabled, the effect of the interference is dramatically reduced to the extent that, the small signal bump at the GPS L1 central frequency of 1575 MHz is clearly visible as Figure 6-7 shows.

In this particular test, the interference signal caused the receiver to fall back to the less precise DGNSS or standalone positioning modes. With WBI mitigation enabled however, the receiver was able to maintain an RTK fix position throughout.

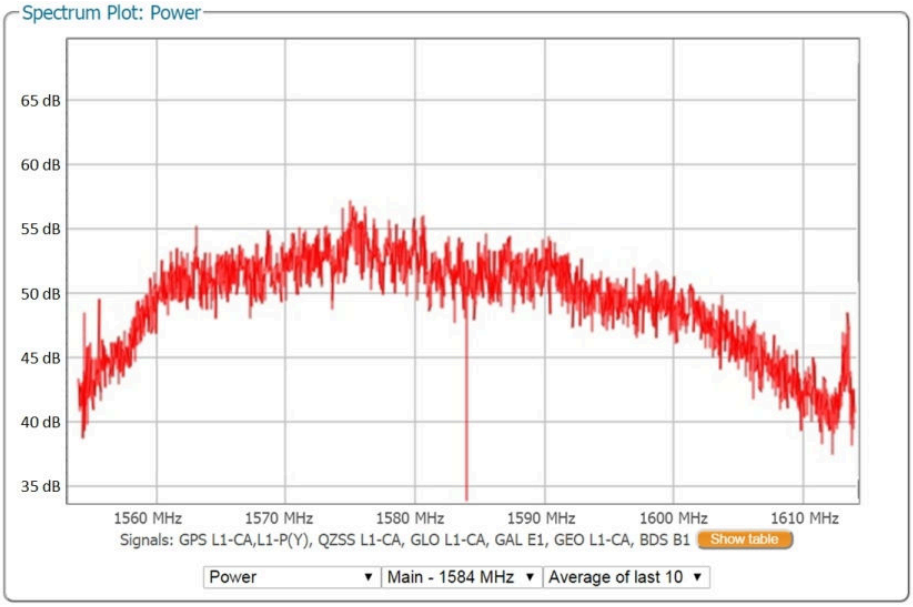

Figure 6-7: Enabling WBI interference mitigation greatly reduces the effect of the interference caused by the chirp jammer.

6.3 How to log data for problem diagnosis

If the AsteRx-U3 does not behave as expected and you need to contact Septentrio's Support Department, it is often useful to send a short SBF data file that captures the anomalous behavior.

6.4 Support SBF file

Step 1: Log the Support SBF data blocks

On the **Logging** page, click on **New SBF stream**. In the next window, you can select the SBF blocks you wish to log. By selecting **Support** as shown in Figure 6-8 the most useful SBF blocks for problem diagnosis will be automatically selected. Click **OK** then turn **on** logging. Again click **OK** to start data logging.

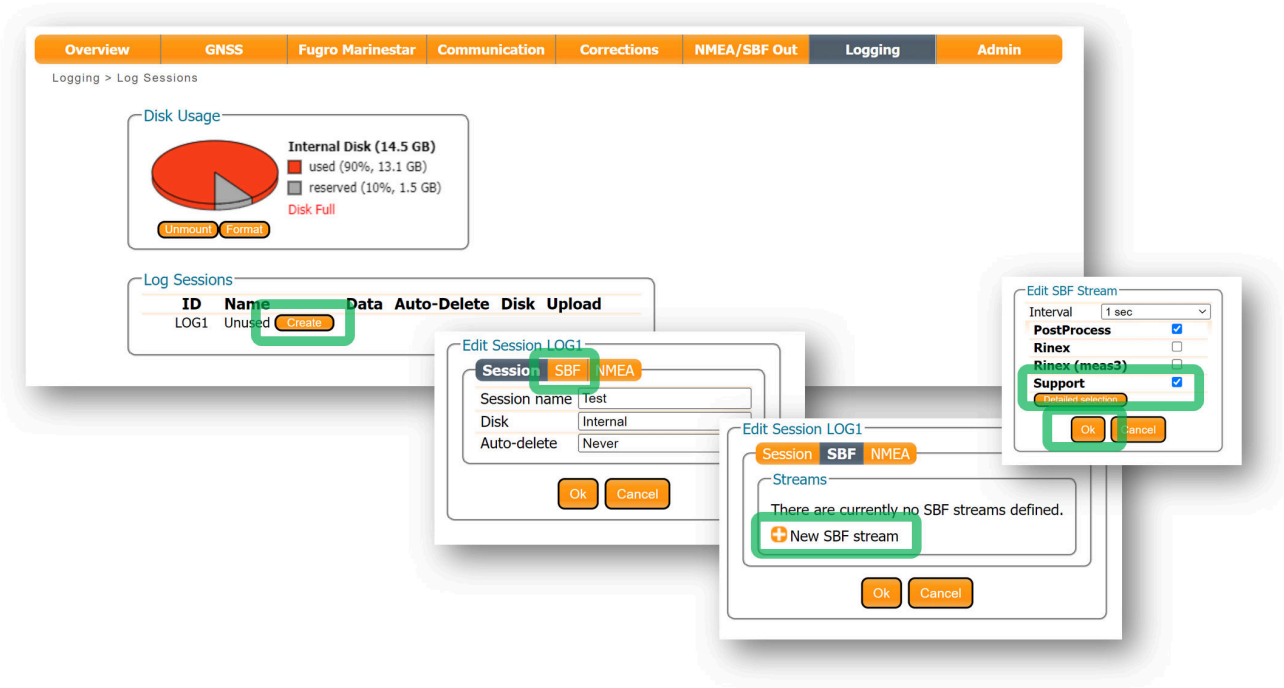

Figure 6-8: Click on **New SBF stream** and select **Support**

Please note that logging the **Support** data blocks requires a large throughput of data that may not be compatible with other CPU-intensive tasks such as data output at higher rates.

When data logging has been correctly configured, the **Logging** window will show the newly defined session as active as indicated in Figure 6-9.

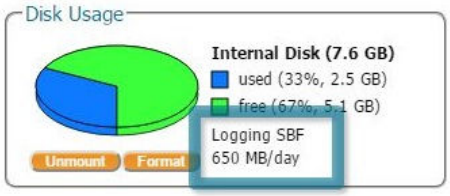

Figure 6-9: The **Logging** window showing an active logging session

Step 2: Downloading the logged SBF file

To download a data file logged on the AsteRx-U3, click the download icon next to the filename on the **Disk Contents** tab as shown in Figure 6-10

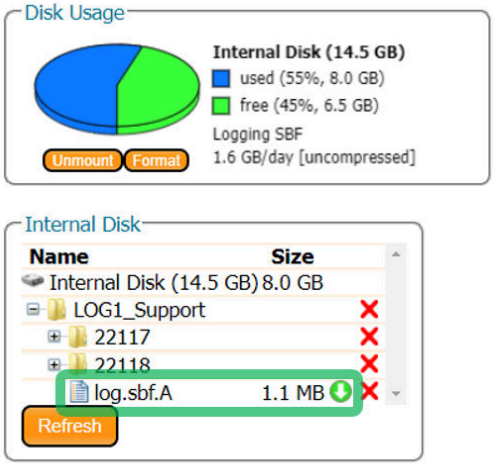

Figure 6-10: Click the icon next to the file you want to download

6.5 Activity logging

The AsteRx-U3 reports various events in the **Receiver Messages** window of the **Admin** menu that can be used to check receiver operations. The example in Figure 6-11 shows that four, 15 minute SBF files have been successfully FTP pushed to a remote location.

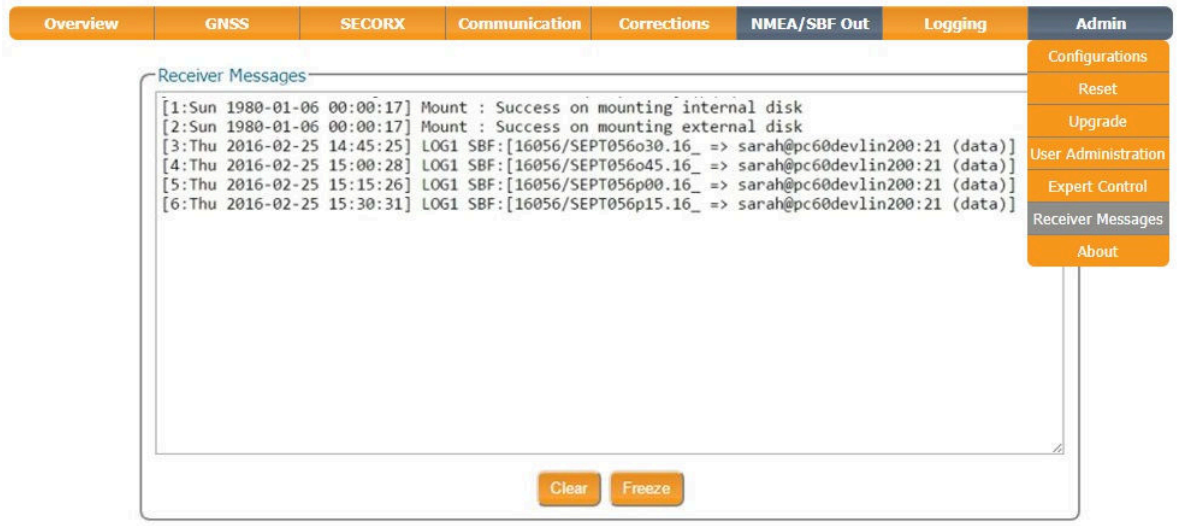

Figure 6-11: Events reported by the AsteRx-U3 in the **Receiver Messages** window

7 Receiver Administration Operations

7.1 How to change IP settings of the AsteRx-U3

The IP settings of the AsteRx-U3 can be configured in the **Ethernet** window of the Web Interface. By default, the AsteRx-U3 is configured to use DHCP to obtain an IP address but, a static IP address can also be configured as shown in Figure 7-1.

In Static mode, the receiver will not attempt to request an address via DHCP but will use the specified IP address, netmask, gateway, domain name and DNS. DNS1 is the primary DNS, and DNS2 is the backup DNS. In DHCP mode, the arguments IP, Netmask, Gateway, Domain, DNS1, and DNS2 are ignored.

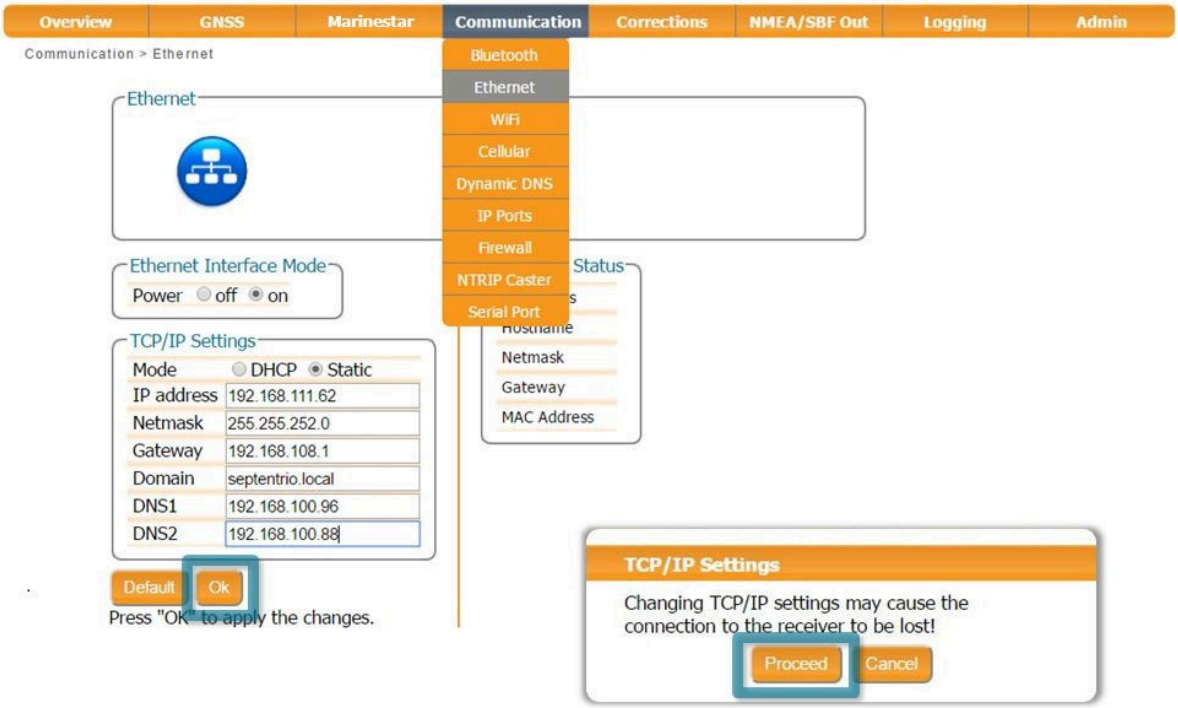

Figure 7-1: Configuring a static IP address

The new IP address should now appear in the **Ethernet Status** field as shown in Figure 7-2.

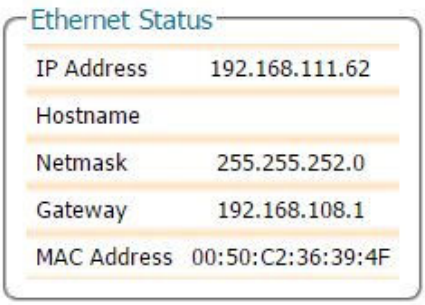

Figure 7-2: TCP/IP settings

Note that the IP settings will keep their value after a power cycle and even after a reset to factory default in order to avoid accidentally losing an Ethernet connection to the receiver.

7.2 How to configure Dynamic DNS

Dynamic DNS allows remote contact with the AsteRx-U3 using a hostname.

When devices are connected to the internet, they are assigned an IP address by an internet service provider (ISP). If the IP address is *dynamic* then it may change over time resulting in a loss of connection. Dynamic DNS (DynDNS or DDNS) is a service that addresses this problem by linking a user-defined hostname for the device to whichever IP address is currently assigned to it.

To make use of this feature on the AsteRx-U3, you should first create an account with a Dynamic DNS provider (**dyndns.org** or **no-ip.org**) to register a hostname for your receiver. In the example shown in Figure 7-3, the hostname *asterxu.mine.nu* has been registered with dyndns.org. The **Bind** option, selected in this case, tells the Dynamic DNS provider only to update IP addresses assigned over an Ethernet LAN connection.

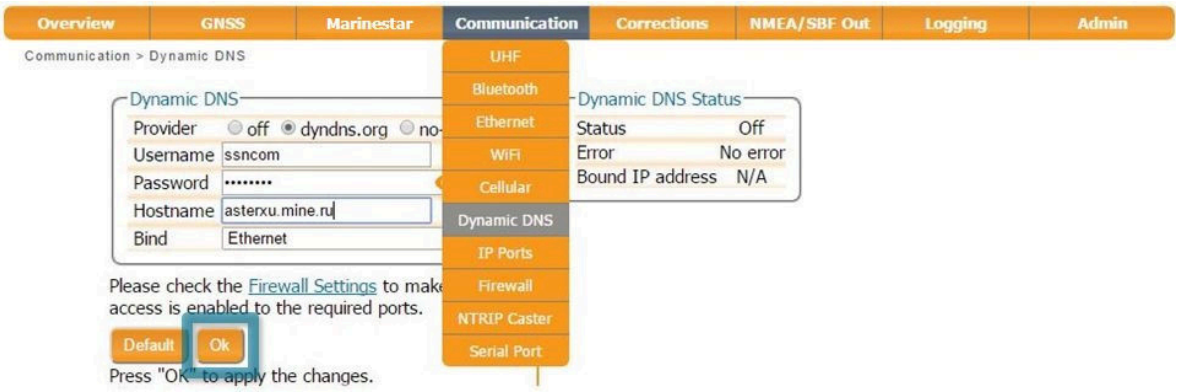

Figure 7-3: Configuring Dynamic DNS

7.3 How to control access using the AsteRx-U3 Firewall

You can control access to the AsteRx-U3 using the receiver's firewall in the **Firewall** window. By default, all Ethernet and WiFi ports are open as are the cellular IPS ports (i.e. those defined on the **IP Ports** menu).

In the example shown in Figure 7-4, Ethernet ports 2101, 2102 and 2103 are accessible but only from devices with the IP address 84.199.9.148. Similarly, all WiFi ports are open but only those from IP 84.199.9.148. No access is possible via cellular ports.

Please note that the firewall settings do not apply when connecting to the web interface using USB. In the case of WiFi, firewall settings only apply when the receiver is in WiFi client mode.

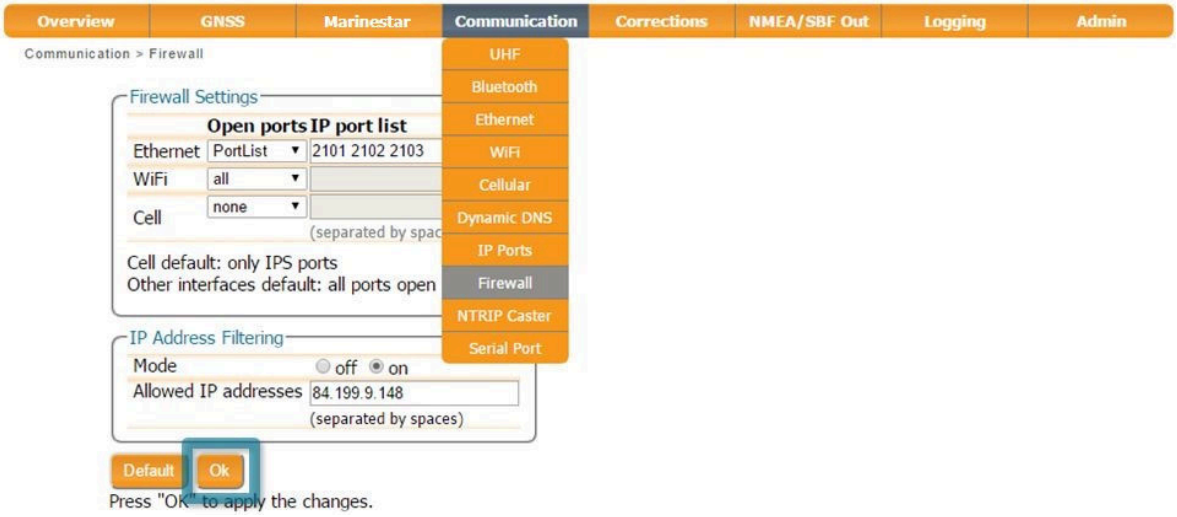

Figure 7-4: Configuring the Firewall of the AsteRx-U3

7.4 How to upgrade the firmware or upload a new permission file

The AsteRx-U3 firmware and permission files both have the extension .suf (Septentrio Upgrade Format) and can be uploaded to the AsteRx-U3 as shown in the steps below. Firmware upgrades can be downloaded from the Septentrio website and are free for the lifetime of the receiver.

Step 1: Select the .suf file and start upgrade

The upgrade procedure is started by clicking on Choose file in the Admin Upgrade tab as shown in Figure 7-5.

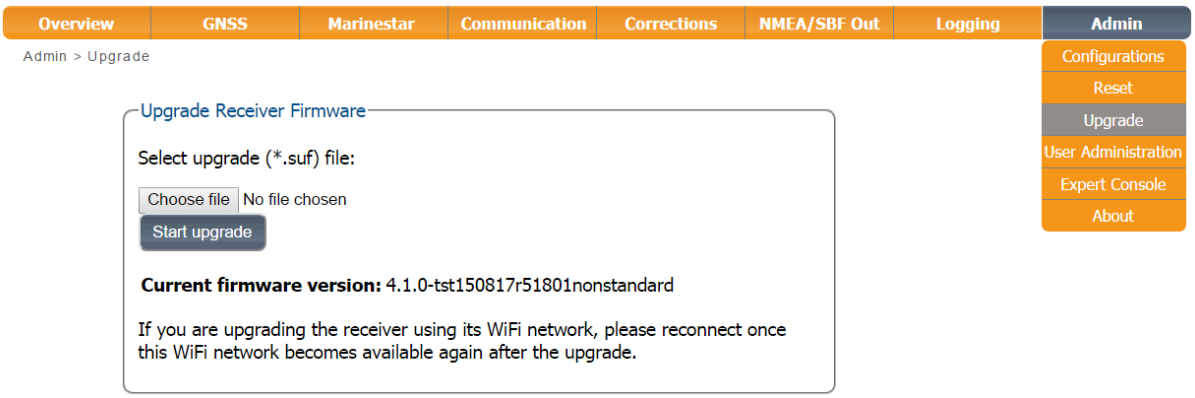

Figure 7-5: The AsteRx-U3 upgrade window

After saving the .suf file to your PC, you can then select this file, start the upgrade and follow its progress as shown in Figure 7-6 .

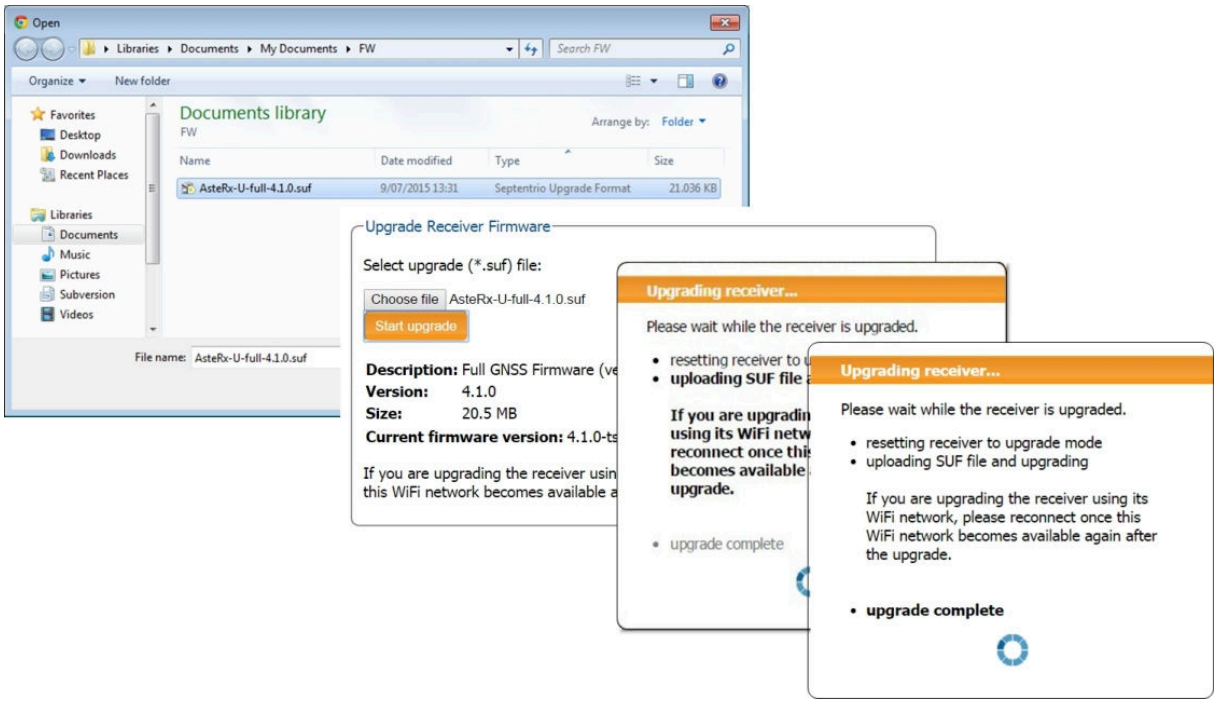

Figure 7-6: The AsteRx-U3 upgrade window

Step 2: Verifying the upgrade

If there were no problems with the upgrade the message 'Upgrade successful' will appear. You can then check on the Admin About tab that the AsteRx-U3 firmware or permission file has correctly been updated to the new version as indicated in Figure 7-7.

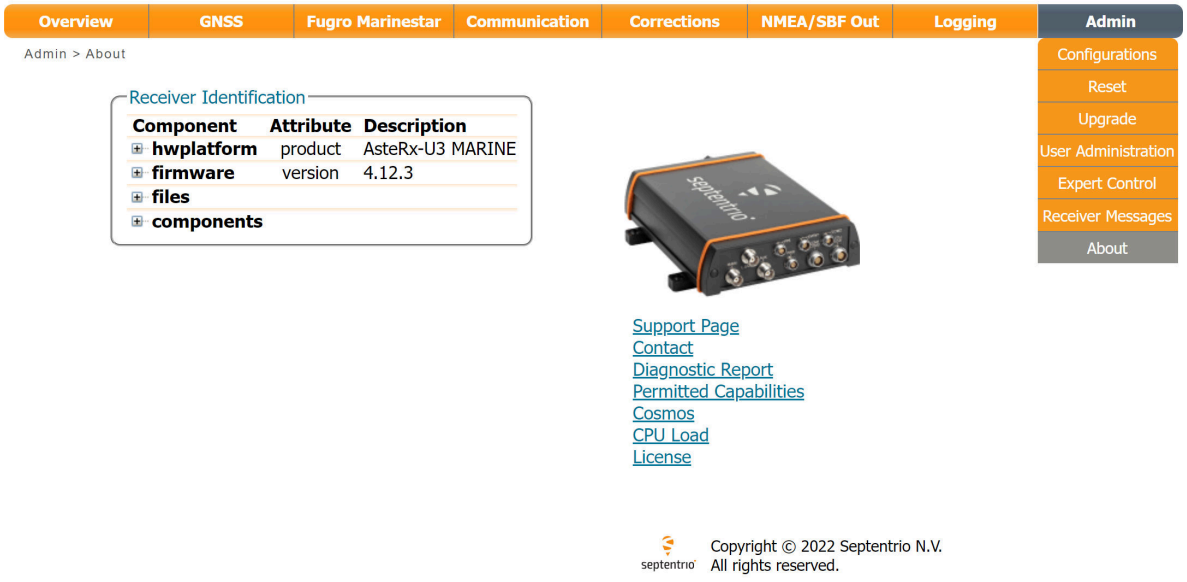

Figure 7-7: Checking the firmware and permission file versions

7.5 How to set the AsteRx-U3 to its default configuration

You can set the AsteRx-U3 configuration to its default settings via the Admin Configurations tab as shown in Figure 7-8. Select 'RxDefault' from the 'Source' drop-down list and either 'Current' or 'Boot' in the 'Target' menu. You will then be prompted to Save or Ignore the new current configuration as the boot configuration.

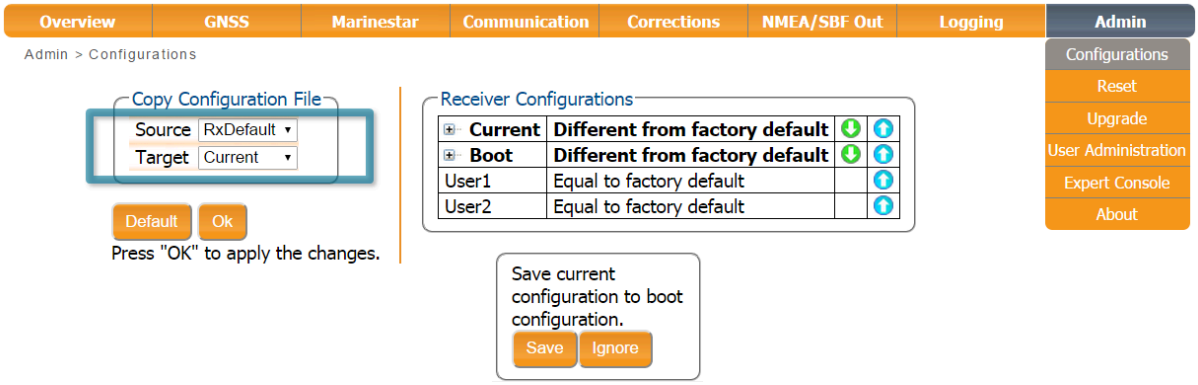

Figure 7-8: Setting the AsteRx-U3 to the default configuration

Please note that this procedure will not erase the IP settings of the receiver. This can only be done on the **Ethernet** page of the **Communication** menu.

7.6 How to reset the AsteRx-U3

If the AsteRx-U3 is not operating as expected, a simple reset may resolve matters. Via the Admin > Reset tab as shown in Figure 7-9, different functionalities can be individually reset. A 'Soft' level reset will cause the AsteRx-U3 to boot up with its current configuration while a 'hard' reset will use the configuration stored in the boot file.

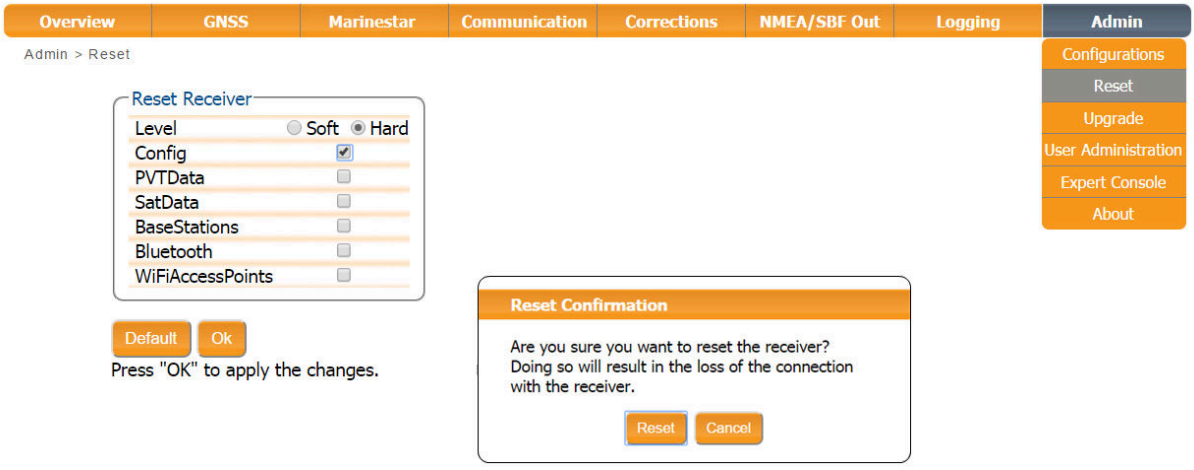

Figure 7-9: Resetting the AsteRx-U3 configuration to its boot configuration

A ‘Hard’ reset can also be triggered by pressing the reset button on the front panel of the receiver for more than 3 seconds.

Figure 7-10: Front pannel button for resetting the AsteRx-U3

7.7 How to copy the configuration from one receiver to another

In the Admin > Configurations tab, the configuration of an AsteRx-U3 can be easily saved to a PC as a text file. A saved configuration can also be uploaded to an AsteRx-U3.

Step 1: Downloading the configuration from an AsteRx-U3

Click the green download arrow next the configuration you wish to download as shown in Figure 7-11. The configuration will be saved as a .txt file in the same downloads location used by the internet browser.

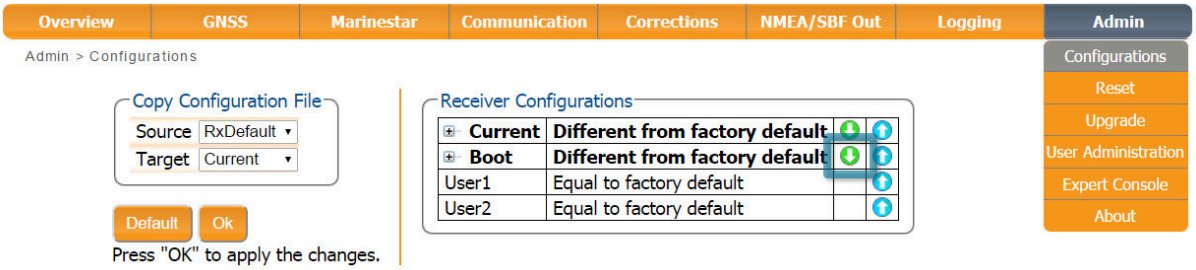

Figure 7-11: Downloading a configuration from an AsteRx-U3

Step 2: Uploading the configuration to a second AsteRx-U3

Click on the blue upload arrow, as indicated in Figure 7-12, to upload a configuration file stored on you PC. In this example, the saved file will be uploaded as the Boot configuration.

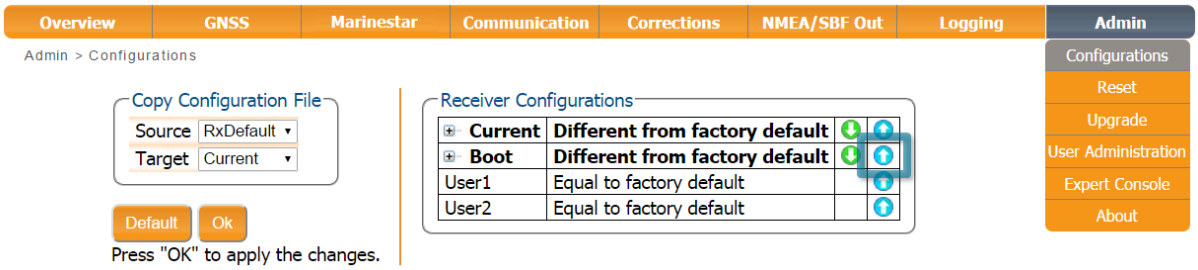

Figure 7-12: Uploading a configuration to an AsteRx-U3

Select the configuration file to be uploaded then click on OK on the status pop-up as shown in Figure 7-13.

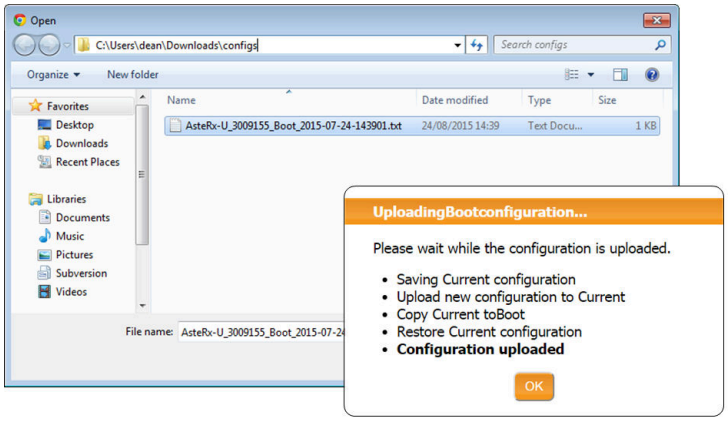

Figure 7-13: Select the configuration file to upload

8 Security

8.1 Default access to the AsteRx-U3

You can manage the access that users have to the AsteRx-U3 in the '**User Administration**' window of the '**Admin**' menu.

By default, all communications are assigned User-level access as shown in Figure 8-1. 'User' level allows full control of the receiver while 'Viewer' level only allows monitoring the receiver and viewing its configuration.

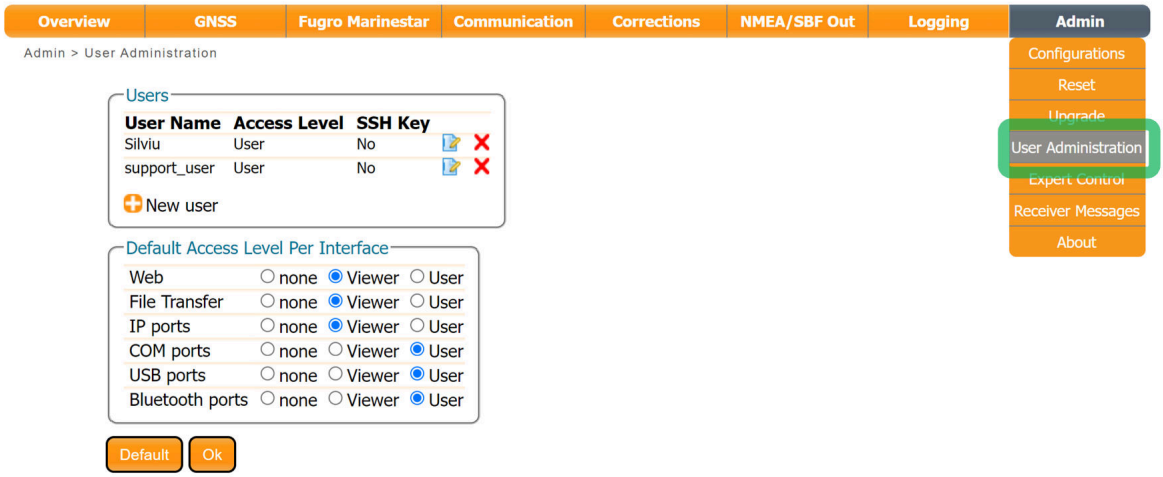

Figure 8-1: The default access levels of the AsteRx-U3

8.2 Defining user access to the AsteRx-U3

You can add users and define their access levels by clicking on the '**New user**' button as shown in Figure 8-2. You can also define the default access when not logged in.

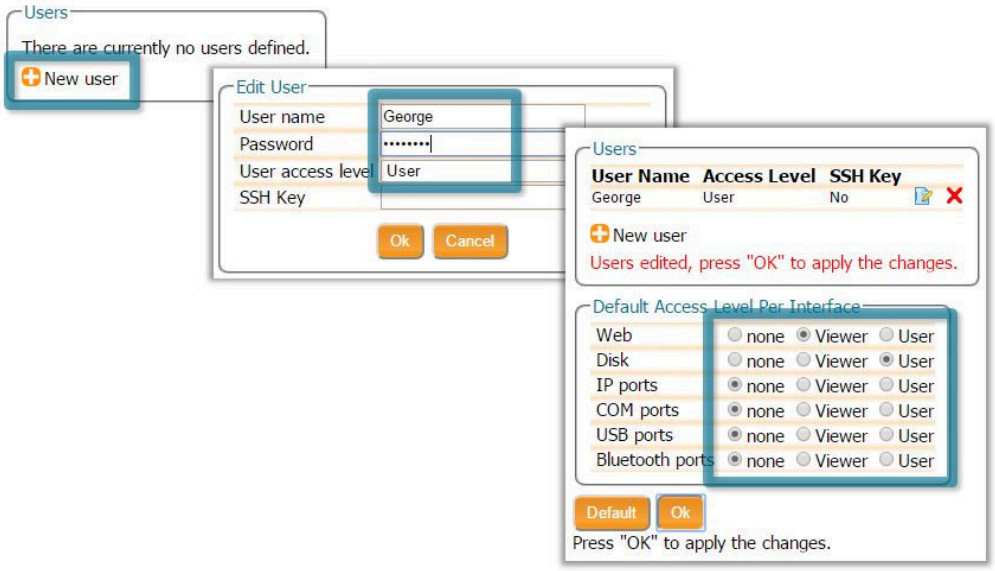

Figure 8-2: Click on '**New user**' and fill in the user details and the default access when not logged in

8.3 User access: an example

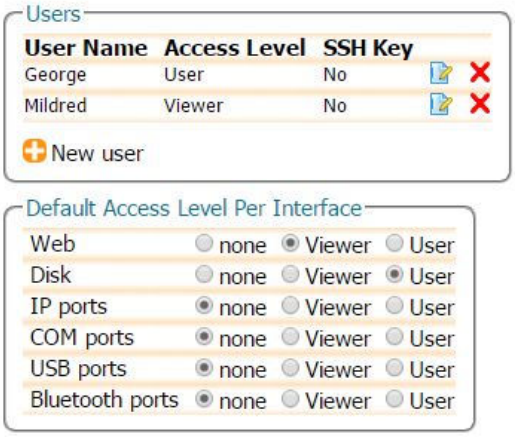

Figure 8-3: An example with two defined users

In the example shown in Figure 8-3:

Web Interface: Anonymous users (without password) can connect to the receiver via the web interface as Viewers. They can browse the various windows but cannot change any of the settings. Only George, who has User access, can change receiver settings via the web interface.

FTP: Anonymous users have full access to the disk over FTP so can download and delete logged data files.

IP, COM, USB and Bluetooth Ports: Only George has User access to the IP, COM, USB and Bluetooth ports so can change receiver settings over these connections. Mildred has only viewer access to the IP, COM and USB ports so can only send commands to show the

configuration. Anonymous users can neither change or view the receiver configuration over these connections.

After defining the Users/Viewers and their access levels, they can login on the web interface by clicking on **Log in** on the upper-right corner as shown in Figure 8-4.

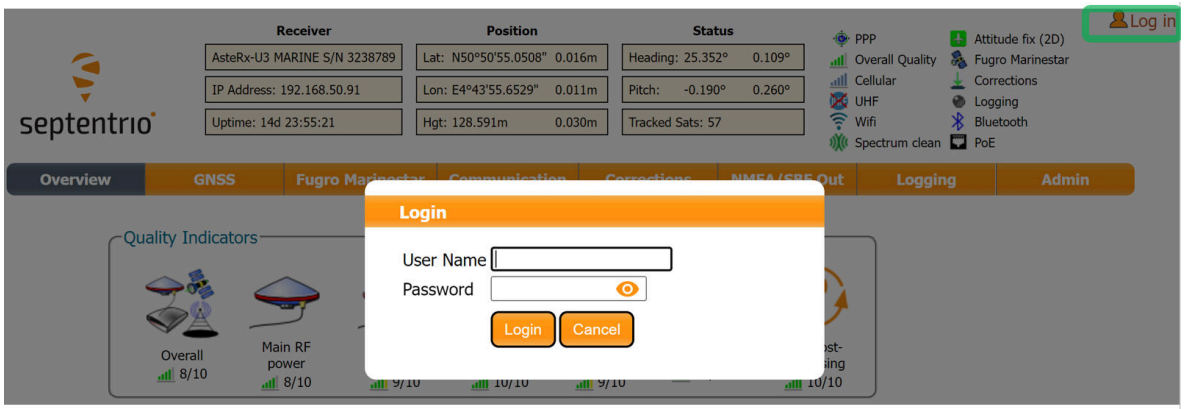

Figure 8-4: Logging in to the AsteRx-U3 web interface

8.3.1 Using SSH key authentication

By default, anonymous users have full access over FTP, SFTP and rsync to the files logged on the AsteRx-U3. FTP, SFTP and rsync access can be limited by configuring user access, as described in Section 8.1. For added security, user authentication for SFTP and rsync access can be configured using an SSH public key. When an SSH key is defined, the configured user can download files using SFTP or rsync without entering a password provided of course, that the matching private key is known by the key agent running on the same PC.

You can generate public and private keys using for example, **PuTTY Key Generator** as shown in Figure 8-5.

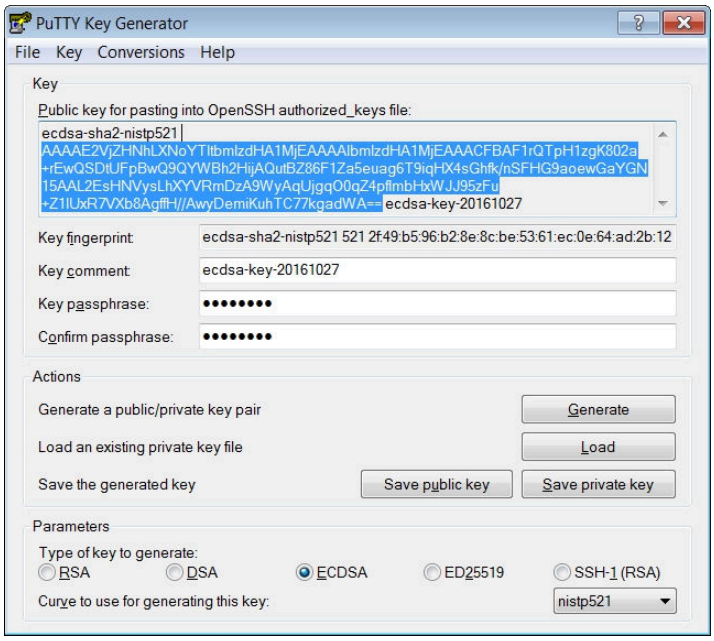

Figure 8-5: Generating SSH keys using the PuTTY Key Generator. The public key is highlighted.

The generated public key is the highlighted text that can be pasted directly into the **SSH Key** field of the AsteRx-U3 Web Interface as shown in Figure 8-6.

Figure 8-6: Using an SSH Key

521-bit ECSDA keys offer the best security however, ECSDA 256 and 384-bit keys can also be used. Alternatively, RSA 512 and 1024 key encryption is also supported.

8.4 HTTP/HTTPS

By default, both http and https are enabled, however, http and/or https access to the receiver can be disabled through the web interface by going to the Communication/Web Server page or using the **setHttpsSetting** command. Secure http access requires the user to provide a certificate to the receiver which can be done by again navigating to the Communication/Web Server page of the web interface as shown in Figure 8-7, and uploading a .pem file containing the certificate. By default, if no user-provided certificate is available, the receiver will use a self-signed certificate instead.

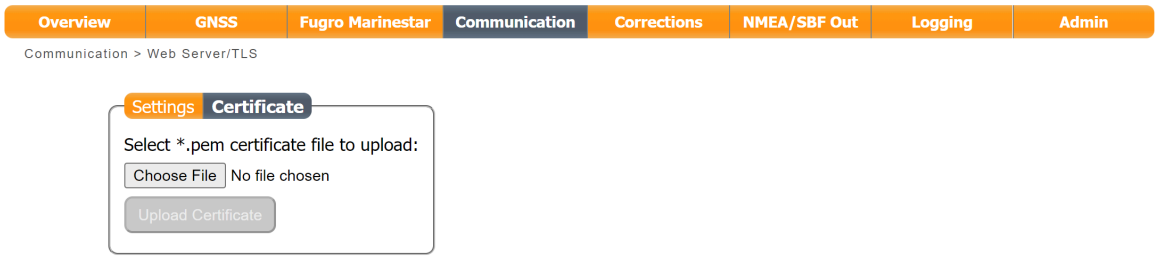

Figure 8-7: Uploading a certificate to the receiver

9 Appendix

9.1 Rear-panel port descriptions

9.1.1 Power (PWR)

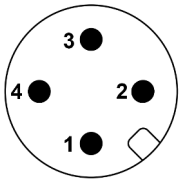

Figure 9-1: 4-pin male socket pin-numbering guide as viewed end on.

PIN #	Name	Comment
1	Power_IN	Power input, 9 to 48 VDC
2	Power_IN	PINs 1 and 2 shorted together internally
3	Ground	
4	Ground	PINs 3 and 4 shorted together internally

9.1.2 Ethernet (ETH)

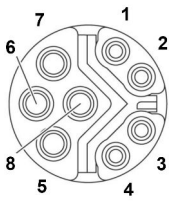

Figure 9-2: 8-pin female socket pin-numbering guide as viewed end on.

PIN #	Name	Comment
1	TxD+	Ethernet 10/100 TX+
2	TxD-	Ethernet 10/100 TX-
3	RxD+	Ethernet 10/100 RX+
4	RxD-	Ethernet 10/100 RX-
5	Power_IN	
6	Power_IN	PINs 5 and 6 shorted together internally
7	Ground	
8	Ground	PINs 7 and 8 shorted together internally

9.1.3 USB

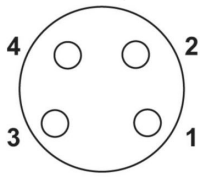

Figure 9-3: 4-pin female socket pin-numbering guide as viewed end on.

PIN #	Name	Comment
1	USB D+	USB 2.0 data signal positive D+
2	USB V	USB Power. Cannot be used to power the receiver
3	USB D-	USB 2.0 data signal positive D-
4	Ground	

9.1.4 General Purpose Interface (GPI)

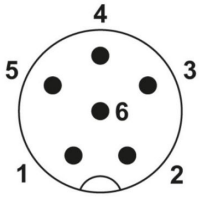

Figure 9-4: 6-pin female socket pin-numbering guide as viewed end on.

PIN #	Name	Comment
1	CAN H	CAN high
2	CAN L	CAN low
3	Reserved	
4	Reserved	
5	Reserved	
6	Ground	

9.1.5 Serial (COM1/3)

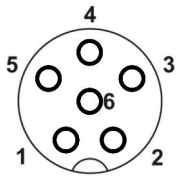

Figure 9-5: 6-pin female socket pin-numbering guide as viewed end on.

PIN #	RS232 mode	RS422 mode	Comment
1	RX1	RX1-	
2	RX3	RX1+	
3	TX1	TX1-	
4	TX3	TX1+	
5	Reserved	Reserved	
6	Ground	Ground	

The COM port protocol can be changed from RS232 (default) to RS422 by going to Admin > Expert Control > Control Panel > Communications > COM Port Settings.

9.1.6 Serial (COM2)

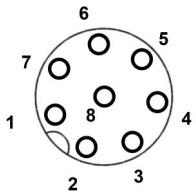

Figure 9-6: 8-pin female socket pin-numbering guide as viewed end on.

PIN #	RS232 mode	RS422 mode	Comment
1	RTS2	TX2+	
2	RX2	RX2-	
3	CTS2	RX2+	
4	5V Out	5V Out	
5	PPS Out	PPS Out	
6	Ground	Ground	
7	TX2	TX2-	
8	Ground	Ground	

The COM port protocol can be changed from RS232 (default) to RS422 by going to Admin > Expert Control > Control Panel > Communications > COM Port Settings.

9.2 UHF radio baud rates

The receiver automatically adapts the baud rate according to the UHF channel bandwidth (12.5 or 25 kHz). The parameters associated with the different protocols are given in the table below.

When sending correction data for multiple constellations and frequencies at rates of 1 Hz and greater, the lowest baud rate configurations (9600 and 4800 baud) may not be sufficient and you should select a protocol/bandwidth combination for 19200 baud. For diff corr rates of 0.5 Hz and less, a 9600 baud setting is sufficient.

Protocol	Modulation	Forward Error Correction	Default baud rate 12.5kHz	Default baud rate 25kHz
PCCGMSK	GMSK	always on	4800 bps	9600 bps
PCC4FSK	4FSK	always on	9600 bps	19200 bps
PCCFST	4FSK	always on	9600 bps	19200 bps
SATEL	4FSK	configurable	9600 bps	19200 bps
TRIMTALK450S	GMSK	always on	4800 bps	9600 bps