AsteRx-U

User Manual

User Manual Version 1.13
Applicable to version 4.6.1 of the AsteRx-U Firmware

January 04, 2021

Thank you for choosing the AsteRx-U! This user manual provides detailed instructions on how to use AsteRx-U 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-U product family however, the particular AsteRx-U you purchased may not support functions specific to certain variants.

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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1 Introduction

1.1 User Notices

1.1.1 CE Notice

AsteRx-U receivers carry the CE mark and are as such compliant with the 2004/108/EC - EMC Directive and amendments, 2006/95/EC - Low Voltage Directive, both amended by the CE-marking directive 93/68/EC.

With regards to EMC, these devices are declared as class B, suitable for residential or business environment.

1.1.2 ROHS/WEEE Notice

The AsteRx-U 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

Statement 1: 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 provided power supply.

Statement 2: Ultimate disposal of this product should be handled according to all national laws and regulations.

Statement 3: 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.

Statement 4: The device should be installed in a restricted access area and used by skilled or instructed personel.

1.1.4 Support

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

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2 AsteRx-U overview

The AsteRx-U provides multi-frequency, multi-constellation GNSS positioning capability together with GNSS Heading, L-Band positioning and wireless communications within a rugged IP67 housing for the broadest range of applications. Use any smartphone, tablet or computer to operate the AsteRx-U without any special configuration software via the built-in webserver accessible via WiFi, Ethernet or USB connection.

2.1 AsteRx-U key features

- 544 channels for tracking all known and future signals from GPS, GLONASS, GALILEO, BEIDOU, IRNSS, QZSS and SBAS on both antennas
- Precise and robust heading calculation
- cm-level (RTK) and sub dm-level (PPP) position accuracy
- Dual L-Band channel robust against INMARSAT uplink interference
- L-band dual-beam tracking with automatic selection for increased availability of PPP corrections in difficult circumstances
- Septentrio GNSS+ algorithms for robust industrial performance
- Integrated cellular modem, Bluetooth, WiFi and optional UHF radio

2.1.1 GNSS

- 544 hardware channels for simultaneous tracking of all visible satellite signals
- Supported signals: GPS (L1, L2, L5), GLONASS (L1, L2, L3), GALILEO (E5ab, AltBoc, E6), BEIDOU (B1, B2, B3), IRNSS (L5), QZSS (L1, L2, L5) (Galileo, Beidou and IRNSS are optional features)
- All-in-view SBAS (EGNOS, WAAS, GAGAN, MSAS, SDCM) (incl. L5 tracking)
- 100 Hz Raw data output (code, carrier, navigation data) (optional feature)
- 50 Hz SBAS, DGNSS, PPP 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
- Differential GNSS (base station and rover)
- Real Time Kinematic (base and rover) (base is an optional feature)
- SECORX and VERIPOS services (optional feature, activation required)
- Moving base positioning (optional feature)
- 8 GB Internal Memory

GNSS positioning accuracy

	Horizontal	*Vertical*
Standalone	1.2 m	1.9 m
SBAS	0.6 m	0.8 m
DGPS	0.3 m	0.7 m
SECORX-D	6 cm	9 cm
SECORX-C	4 cm	6 cm
APEX	6 cm	9 cm
ULTRA	6 cm	9 cm

RTK performance

Horizontal accuracy	0.6 cm + 0.5 ppm
Vertical accuracy	1 cm + 1 ppm
Average time to fix	7 s

Velocity accuracy

0.03 m/s

Attitude accuracy

antenna separation	*Heading*	*Pitch\Roll*
1 m	0.15°	0.25°
5 m	0.03°	0.05°

Connectivity

- 3 hi-speed serial ports (RS232)
- Ethernet port (TCP/IP and UDP)
- Full speed USB (host and device)
- 2 Event markers
- xPPS output (max. 100 Hz)
- Integrated Bluetooth (2.1 + EDR/4.0)
- Integrated WiFi (802.11 b/g/n)
- Integrated UHF (406-470 MHz) (AsteRx-U UHF and MARINE variants only)
- Connector for separate L-Band antenna (AsteRx-U MARINE variant only)
- Integrated Quadband Cellular Modem (EDGE, 2G, 3G, 3.5G, 4G)

Cellular Modem Regional Operation	EU4G	NA4G
North America	-	✓
EMEA	✓	-
APAC	✓	-
Japan	-	-

Technology	EU4G	NA4G
4G LTE	1, 3, 5, 7, 8, 20	2, 4, 5, 7, 17
3G UMTS	850, 900, 1900, 2100	850, 900, 1700, 1900, 2100
2G GSM	Quad-band	Quad-band

2.1.2 Physical and Environmental

Size:	164 x 157 x 54 mm
Weight:	1.5 kg
Input voltage:	9-36 V DC
Power consumption:	8 W typical
Temperature Range:	-30 to +60 °C (operational) -40 to +75 °C (storage)
Ingress Protection:	IP67
Humidity	MIL-STD810G, Method 507.5, Procedure I
Dust	MIL-STD-810G, Method 510.5, Procedure I
Shock	MIL-STD-810G, Method 516.6, Procedure I/II
Vibration	MIL-STD-810G, Method 514.6, Procedure I

2.2 AsteRx-U variants

The AsteRx-U is available in three variants:

Variant (Part number)	**Main features**
AsteRx-U (410121)	• Integrated cellular modem (no-cell version available) • Integrated WiFi modem • Integrated Bluetooth modem
AsteRx-U UHF (410119)	• Integrated cellular modem (no-cell version available) • Integrated WiFi modem • Integrated Bluetooth modem • Integrated UHF radio with front-panel connector
AsteRx-U MARINE (410120)	• Integrated cellular modem (no-cell version available) • Integrated WiFi modem • Integrated Bluetooth modem • Integrated UHF radio with front-panel connector • Rear-panel connector for dedicated L-Band antenna • Dedicated L-Band antenna connector robust against Inmarsat and Iridium uplink interference

2.3 AsteRx-U design

2.3.1 Front panel

The front-panel layout of the AsteRx-U with attached Bluetooth/WiFi and Cellular antennas is shown in Figure 2-1.

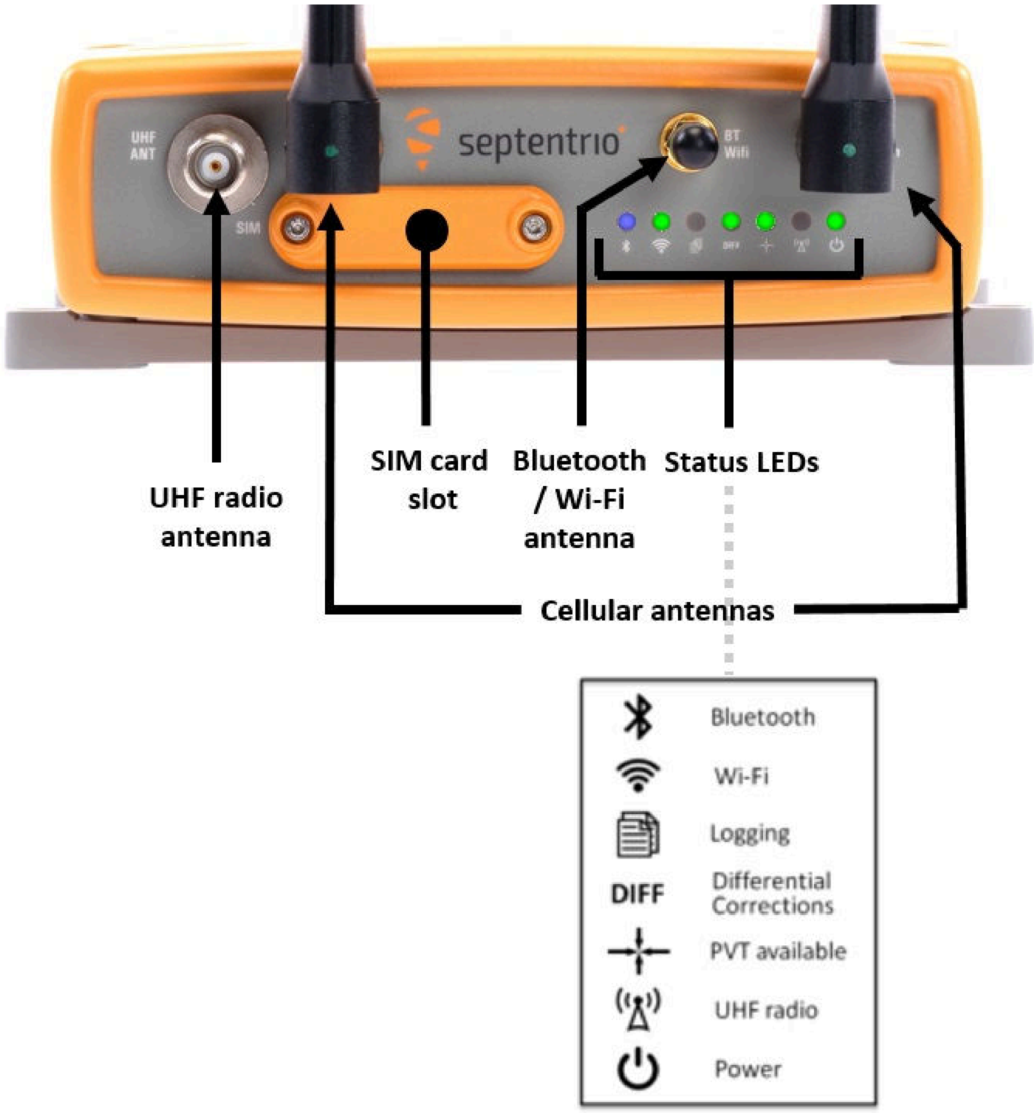


Figure 2-1: AsteRx-U front-panel layout

2.3.2 LED description

LED	Icon	Behaviour
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 **On**: UHF radio modem in search mode **Blinking slowly**: Data package sent/received **Blinking quickly**: UHF radio modem in set-up mode
green		**Off**: Receiver is powered off **On**: Receiver is powered on

2.3.3 Rear panel

Figure 2-2 shows the layout of the rear-panel connectors on the AsteRx-U. The PIN assigments for each socket can be found in the Appendix.

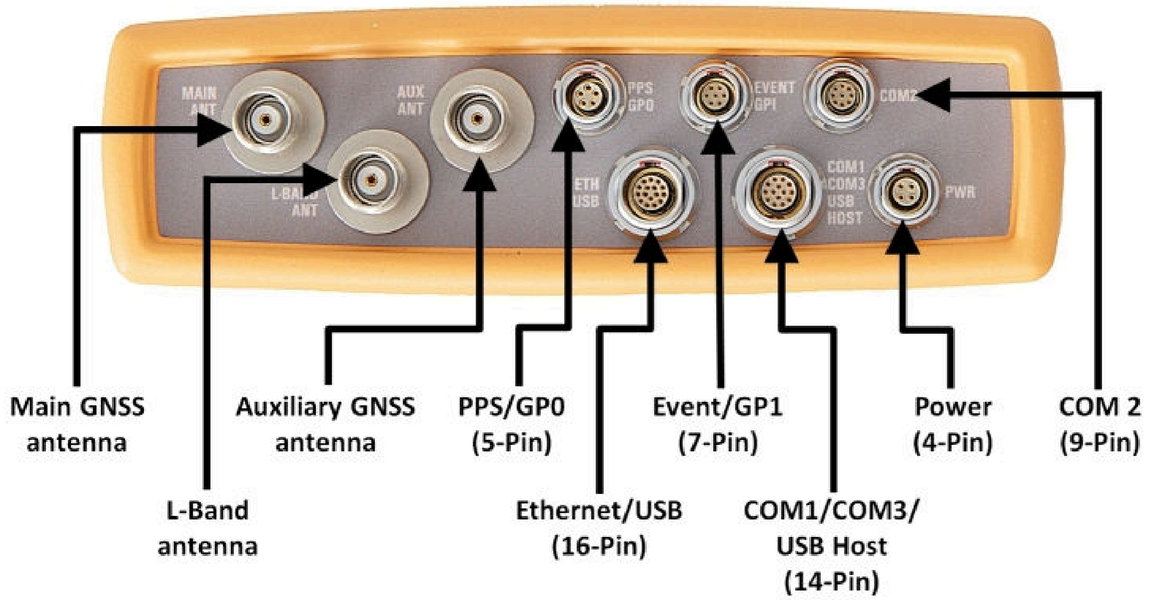


Figure 2-2: AsteRx-U rear-panel layout

2.3.4 SIM card slot

The SIM card can be inserted into the slot in the front panel of the AsteRx-U as shown in Figure 2-3.

Important: Only insert or remove the SIM card while the unit is powered down.
Note: Please take care when closing the SIM card lid again and ensure the gasket is intact and properly seated and that the SIM card door is tightened with a torque force of 1 Nm to ensure the unit's IP rating remains.

Figure 2-3: SIM card slot on the AsteRx-U

2.3.5 Mounting brackets

The AsteRx-U is supplied with mounting brackets which can be fitted to the unit as shown in Figure 2-4.

Figure 2-4: Mounting brackets fitted to the AsteRx-U

2.3.6 Internal memory

The AsteRx-U has an 8 GB Memory for internal 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 case contents

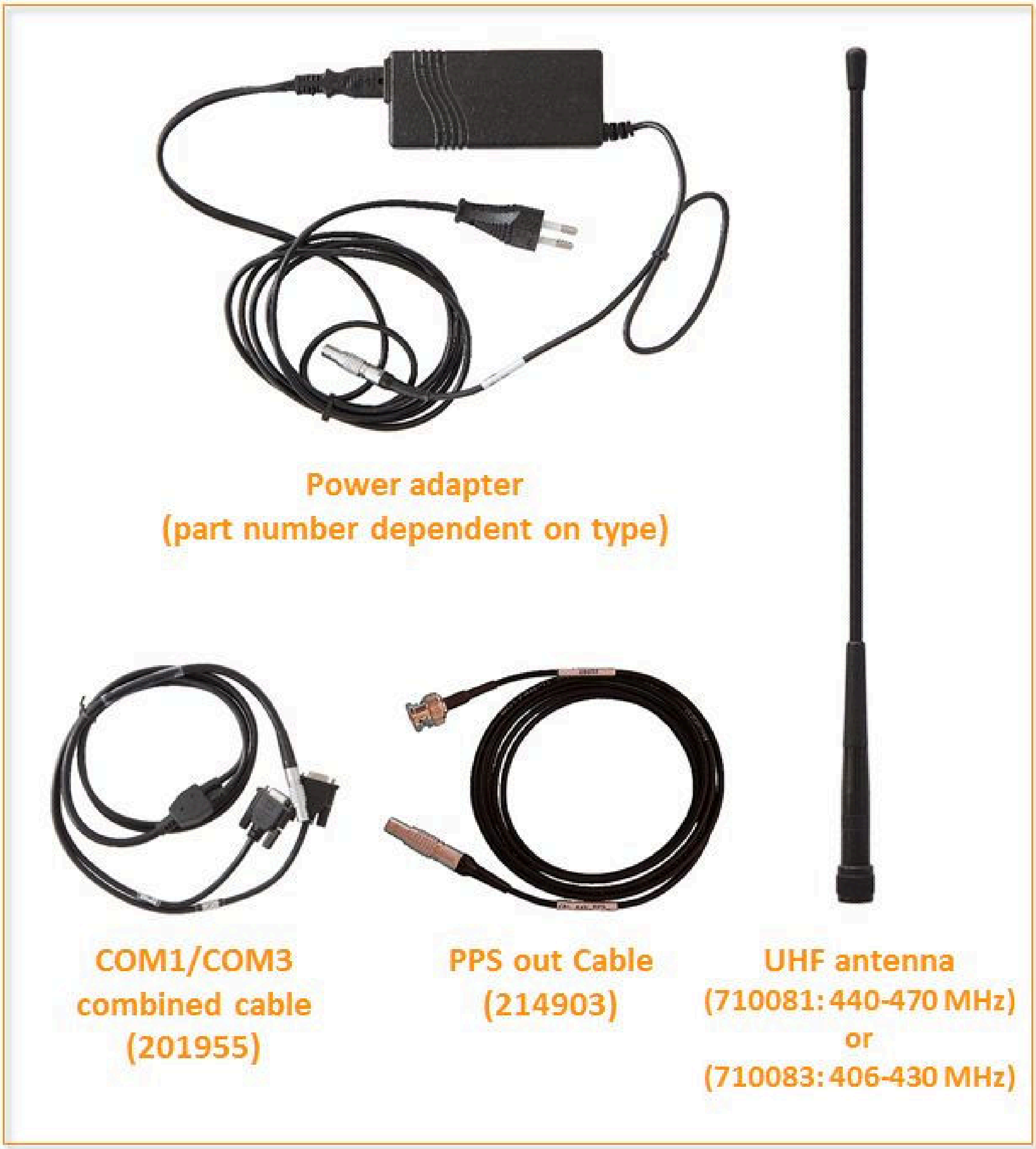
2.4.1 Supplied as standard

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

Note that there are two sets of cellular antennas included with your AsteRx-U product: one high performance antenna which is recommended to be used when operating in 4G and one standard antenna.

2.4.2 Optional items

The following items with their part numbers can be optionally purchased for use with the AsteRx-U.



3 Quick start

This section details how to power-up, connect to and communicate with the AsteRx-U. The AsteRx-U has an on-board web interface which the user can connect to in three ways: Ethernet, USB or WiFi. The AsteRx-U 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-U

Using the supplied open-ended power cable, the receiver can be powered by applying 6 to 36 V via the power-in wire. The receiver can also be powered using the power adapter (optionally available). The power socket is indicated in Figure 3-1.

Figure 3-1: Rear panel power socket

The AsteRx-U does not have a power button[1] and the unit will power up automatically when power is applied. In case the AsteRx-U is on when a power outage occurs, the unit will automatically boot up when power is restored. When the unit is powered initially, the front-panel LEDs will follow a boot sequence pattern.

[1] Older versions of the AsteRx-U do feature a power button on the front panel next to the cell antenna. It may be necessary to press this button to power up the receiver after power is applied. If the AsteRx-U loses power while the power button is on, then it will automatically boot up when power is restored.

3.2 Connecting an antenna

The rear panel of the AsteRx-U has two TNC connectors for GNSS antennas: one for the main antenna and one for an auxiliary antenna for heading applications. The AsteRx-U MARINE has an additional TNC connector for a dedicated L-Band antenna. To get started, connect an antenna via an antenna cable to the main antenna connector of the AsteRx-U indicated in Figure 3-2. An overview of the antenna's 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 antenna connector

3.3 Connecting to the AsteRx-U 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, Ethernet or WiFi. The following sections describe each of the connection methods.

3.3.1 Using the USB cable

Connect the combined USB/Ethernet cable to the connector labelled 'ETH USB' on the rear panel of the AsteRx-U and indicated in Figure 3-3.

Figure 3-3: Rear panel USB and Ethernet 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.

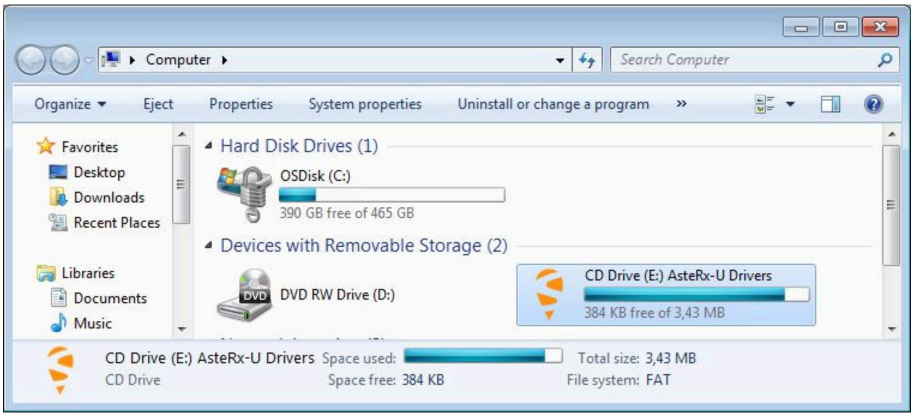


Figure 3-4: Screenshot showing USB connection after driver installation

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

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

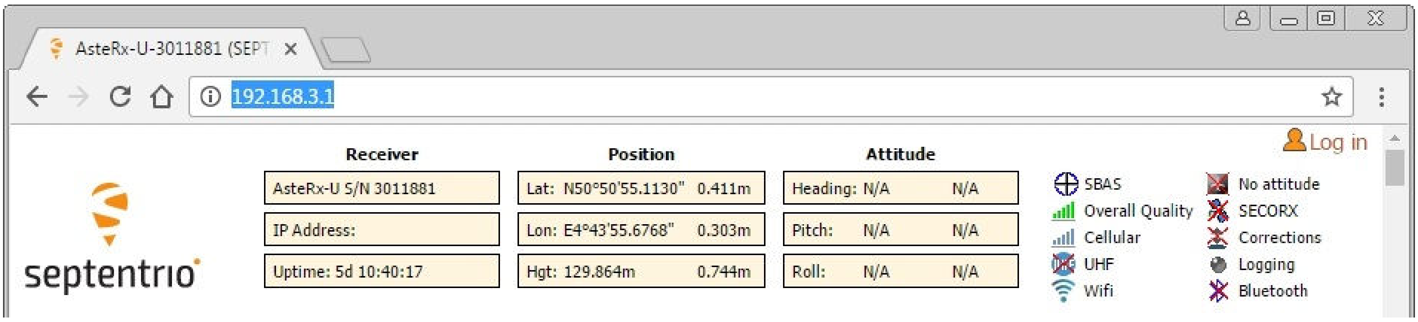


Figure 3-5: Connect to the Web Interface of the AsteRx-U over USB using the IP address **192.168.3.1** on any web browser

3.3.2 Using the Ethernet cable

Step 1: Connect the combined USB/Ethernet cable

Connect the combined USB/Ethernet cable shown in Section 2.4.1 between a LAN network and the connector labelled 'ETH USB' on the rear panel of the AsteRx-U 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-U

By default, the AsteRx-U has the hostname 'http://Asterx-U-xxxxxxx', where xxxxxxx are the last 7 digits of the AsteRx-U serial number. This hostname can be used on a local area network to connect to the AsteRx-U 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 3011881 using '**http://asterx-u-3011881**'.

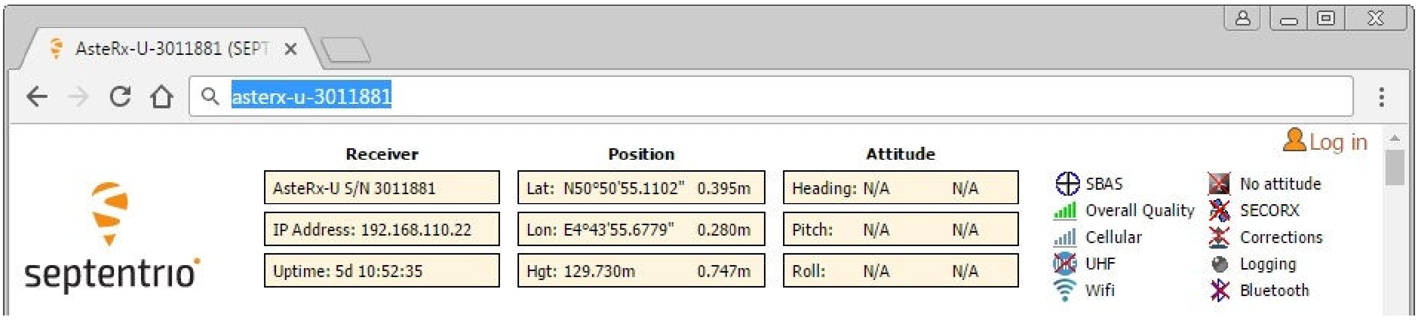


Figure 3-7: Connecting to the Web Interface via Ethernet

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-U identifies itself as a wireless access point named 'AsteRx-U-*serial number*'. The serial number of the AsteRx-U can be found on an identification sticker on the receiver housing. Select and connect to the AsteRx-U as shown in Figure 3-8.

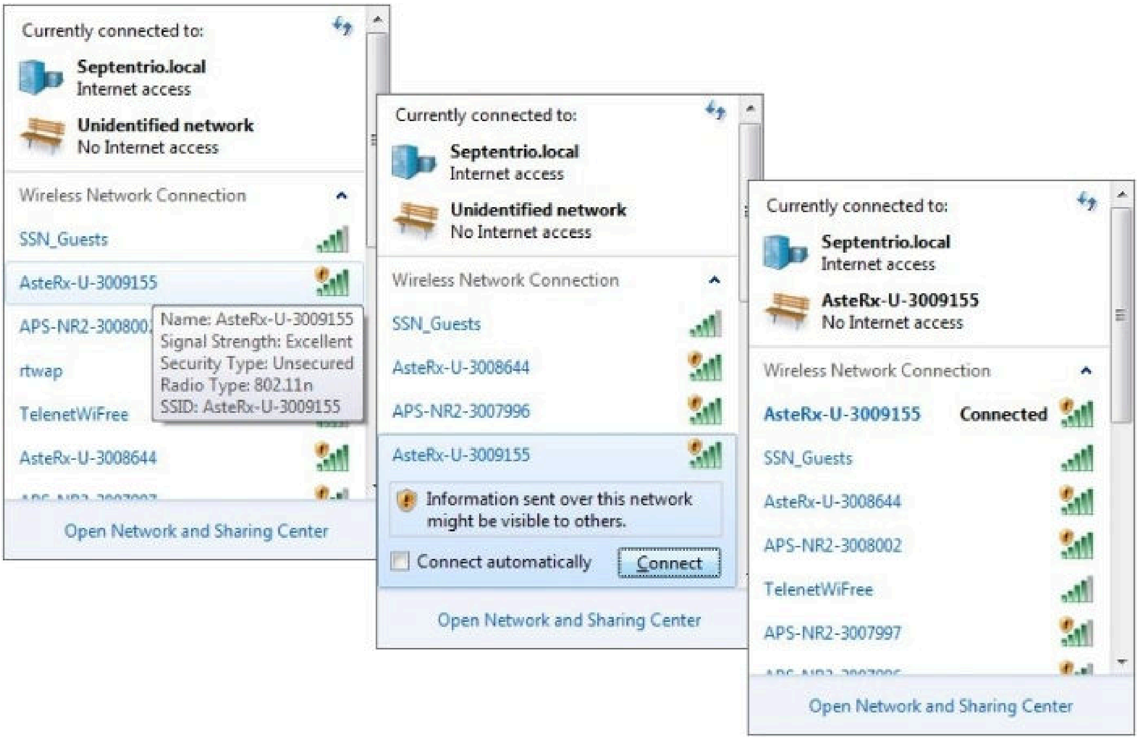


Figure 3-8: Select the AsteRx-U from the list of detected wireless signals and connect

When your PC is connected to the AsteRx-U WiFi signal, you can open a web browser using the IP address: **192.168.20.1** as shown in Figure 3-9.

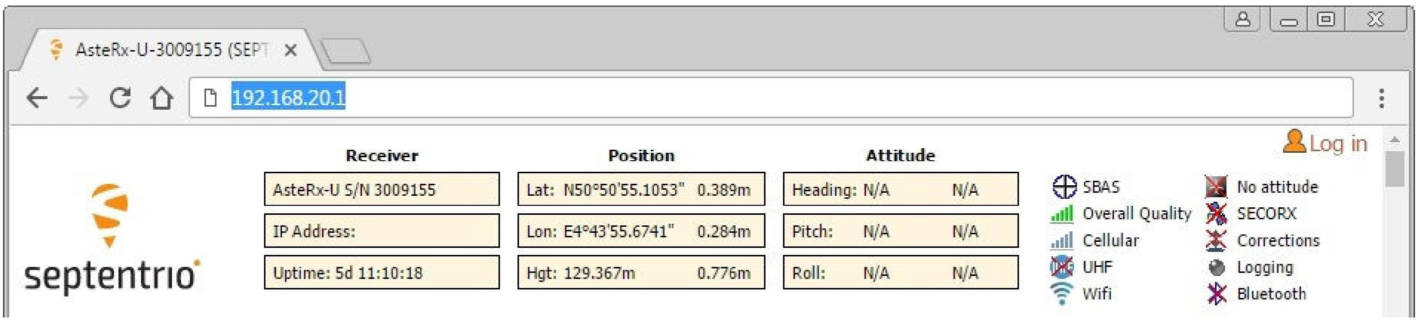


Figure 3-9: Connect to the Web Interface of the AsteRx-U over WiFi using the IP address **192.168.20.1** on any web browser

3.4 How to configure SBF and NMEA output

The AsteRx-U can output position and GNSS data in both standard NMEA format and Septentrio's proprietary compact binary format SBF. This 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-U can be connected via a serial COM cable to an RS-232 compatible secondary device[2].

Step 1: Configure the serial COM port

The COM port of the AsteRx-U 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 3-10. In this example, COM3 is set with a speed of 19200 baud.

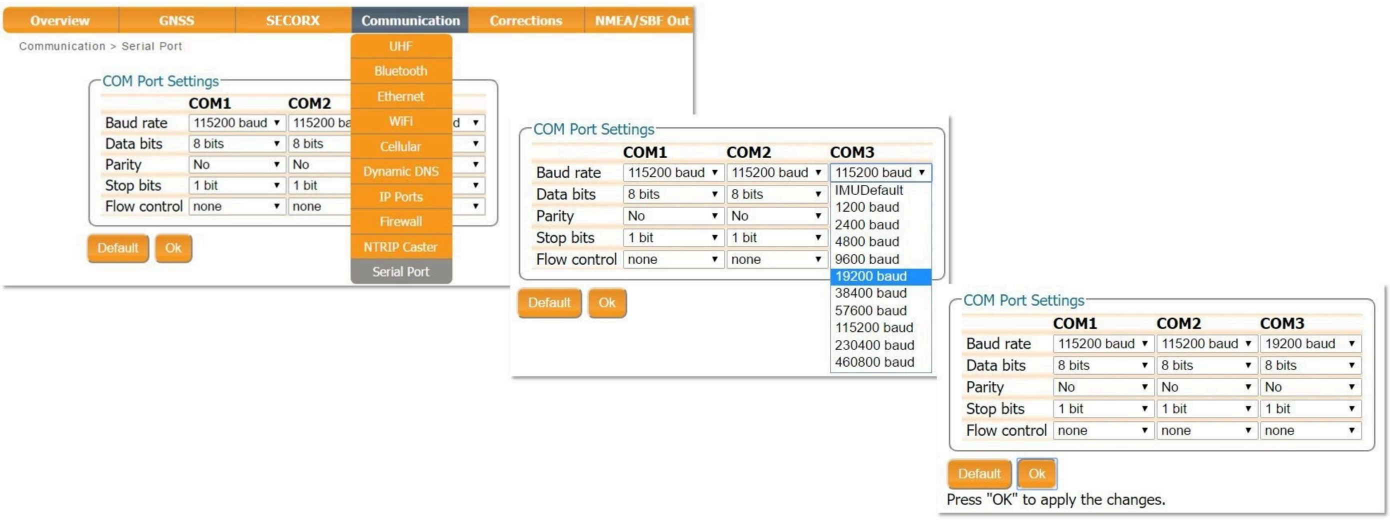


Figure 3-10: Configure the baud rate and flow control of the AsteRx-U

2 The performance at the highest setting of 460800 baud has not yet been fully validated. Users are therefore recommended not to use this setting for AsteRx-U firmware versions 4.2.0 and earlier.

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 3-11 and 3-12.

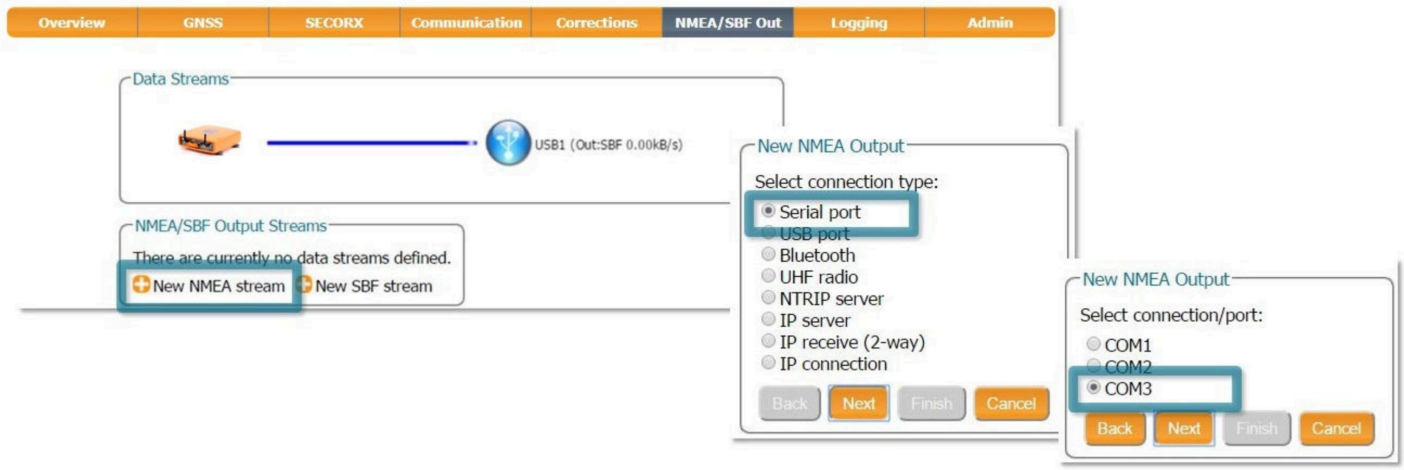


Figure 3-11: Selecting to output NMEA data on COM3

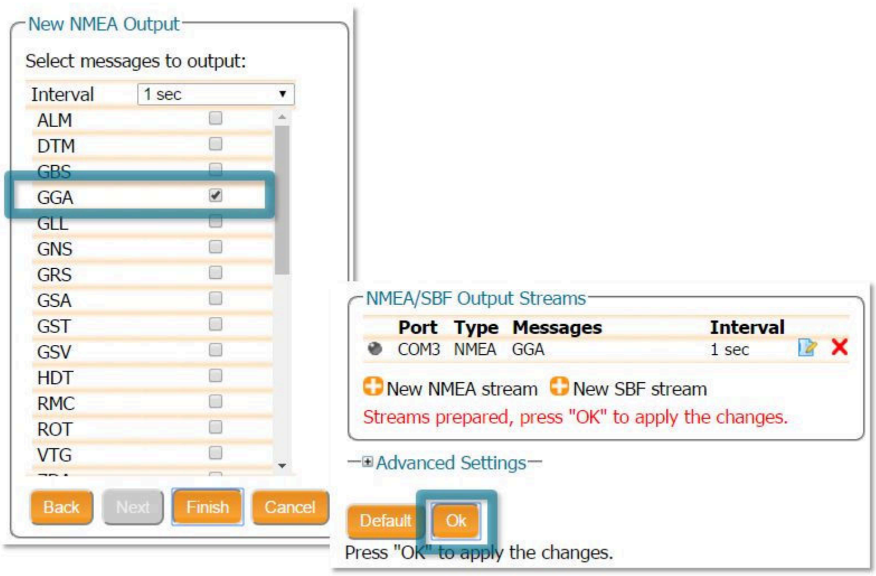


Figure 3-12: Selecting to output the GGA NMEA message every second

SBF

By clicking '**New SBF stream**', a second output stream can be configured. In the example shown in Figures 3-13 and 3-14 the PVTCartesian SBF data block will be output over COM1 once per second.

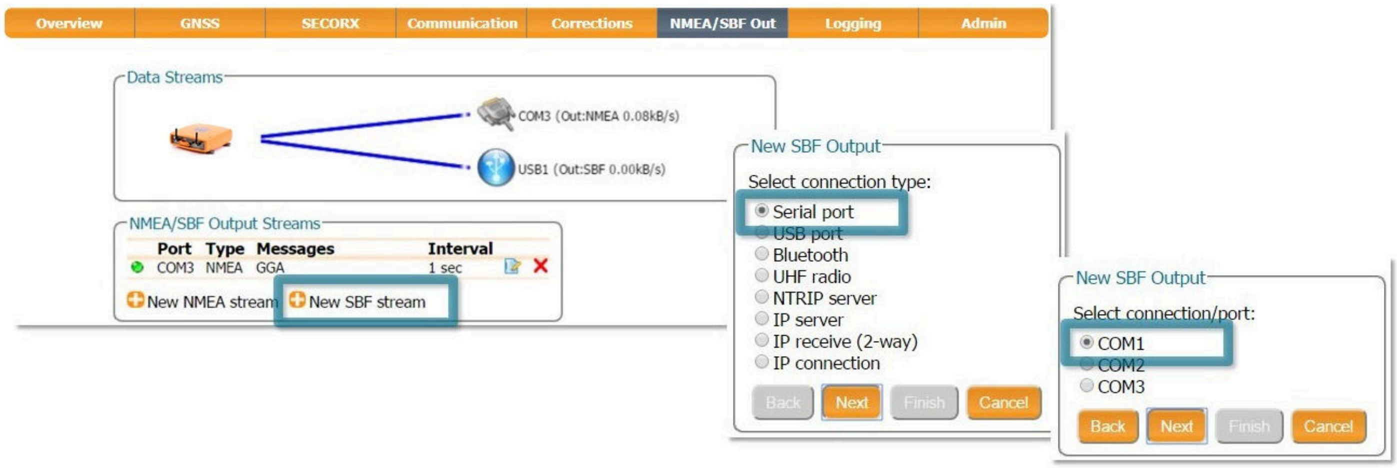


Figure 3-13: Selecting to output SBF data on COM1

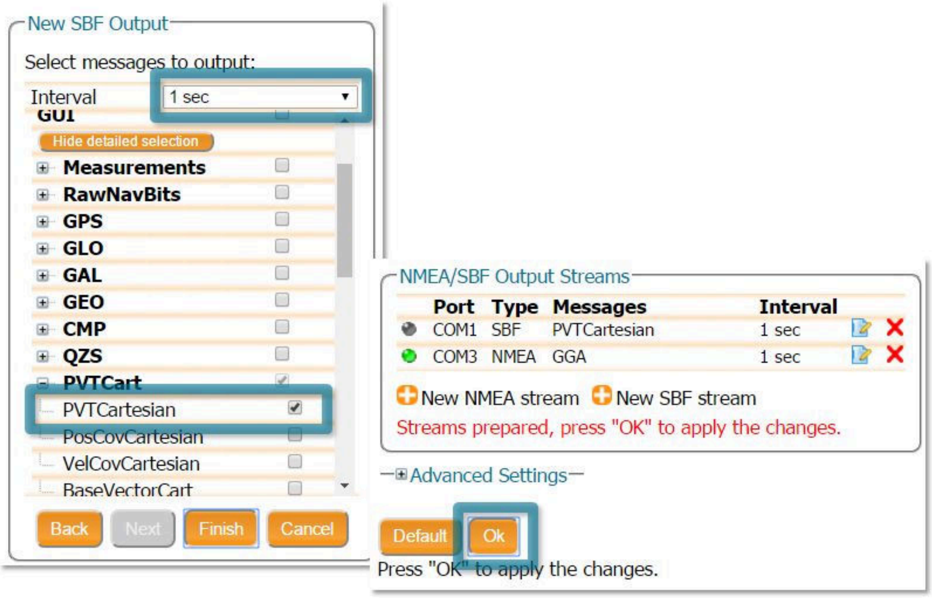


Figure 3-14: Selecting to output the PVTCartesian SBF block every second

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 3-15.

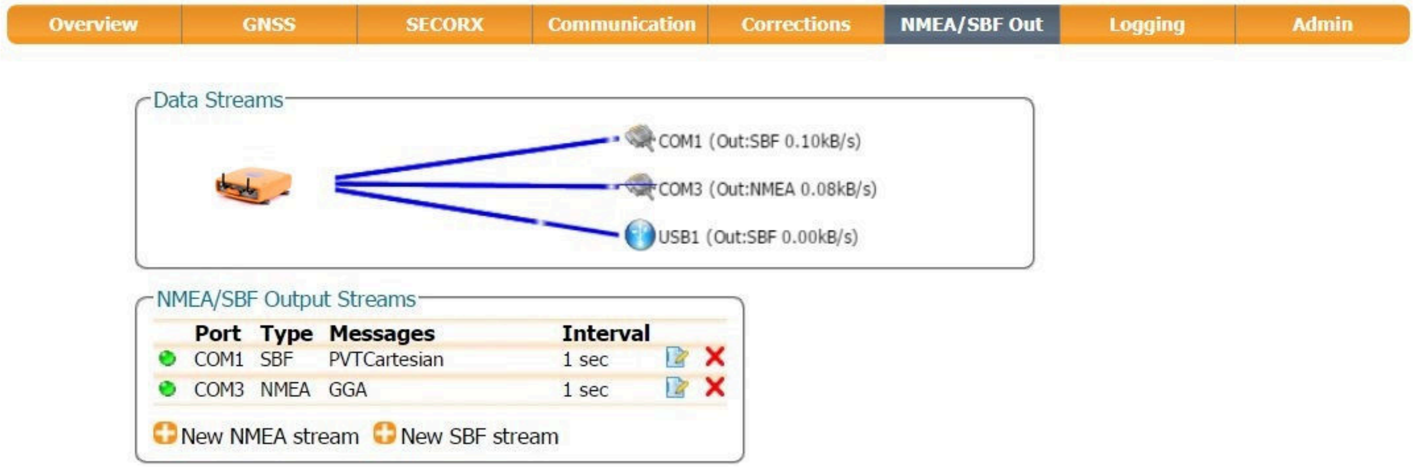


Figure 3-15: Summary of all configured data output streams

Figure 3-16 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.

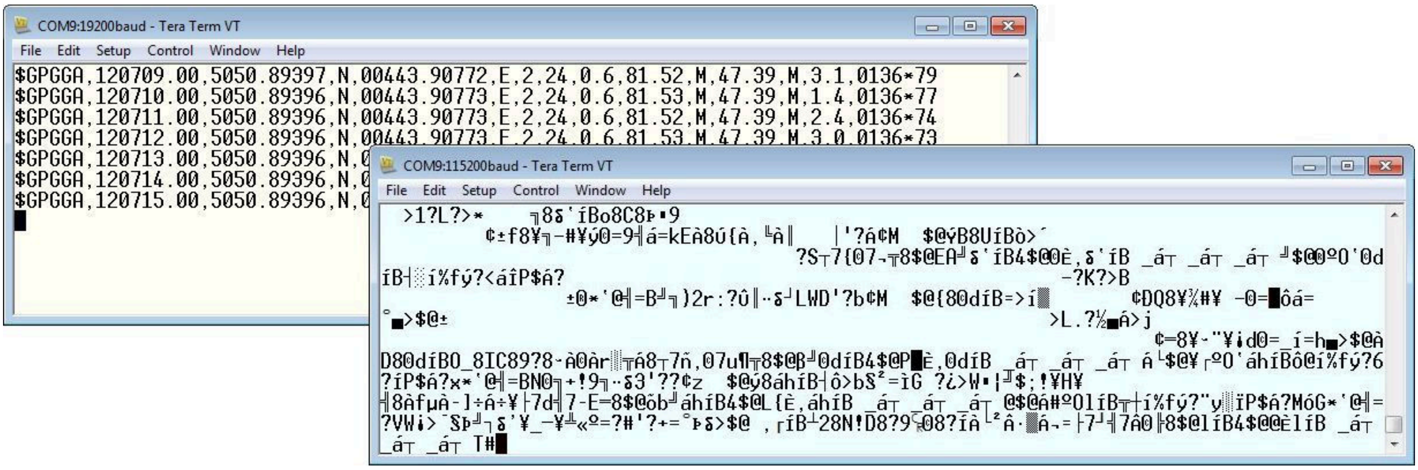


Figure 3-16: Example showing output NMEA GGA (left panel) and SBF PVTCartesian (right panel)

3.4.2 Output over Ethernet

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

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

The Ethernet port settings can be configured by selecting '**IP Ports**' from the **Communication** menu. In the example shown in Figure 3-17, 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-U for commands.

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

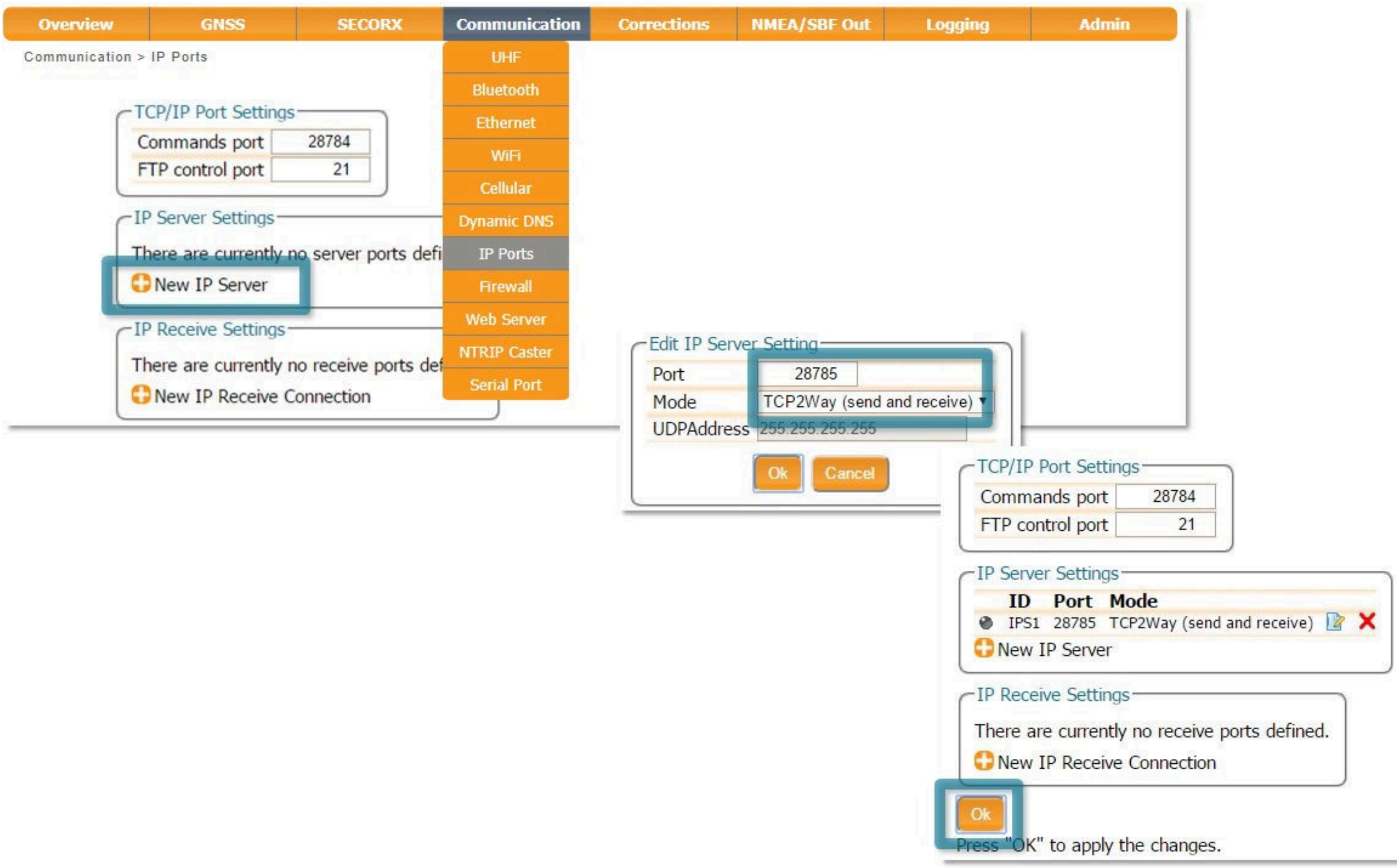


Figure 3-17: Configure the TCP/IP server port setting for data output

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 3-18, the NMEA GGA message will be output every second. Ensure that the previously configured IPS1 port is selected for output as highlighted.

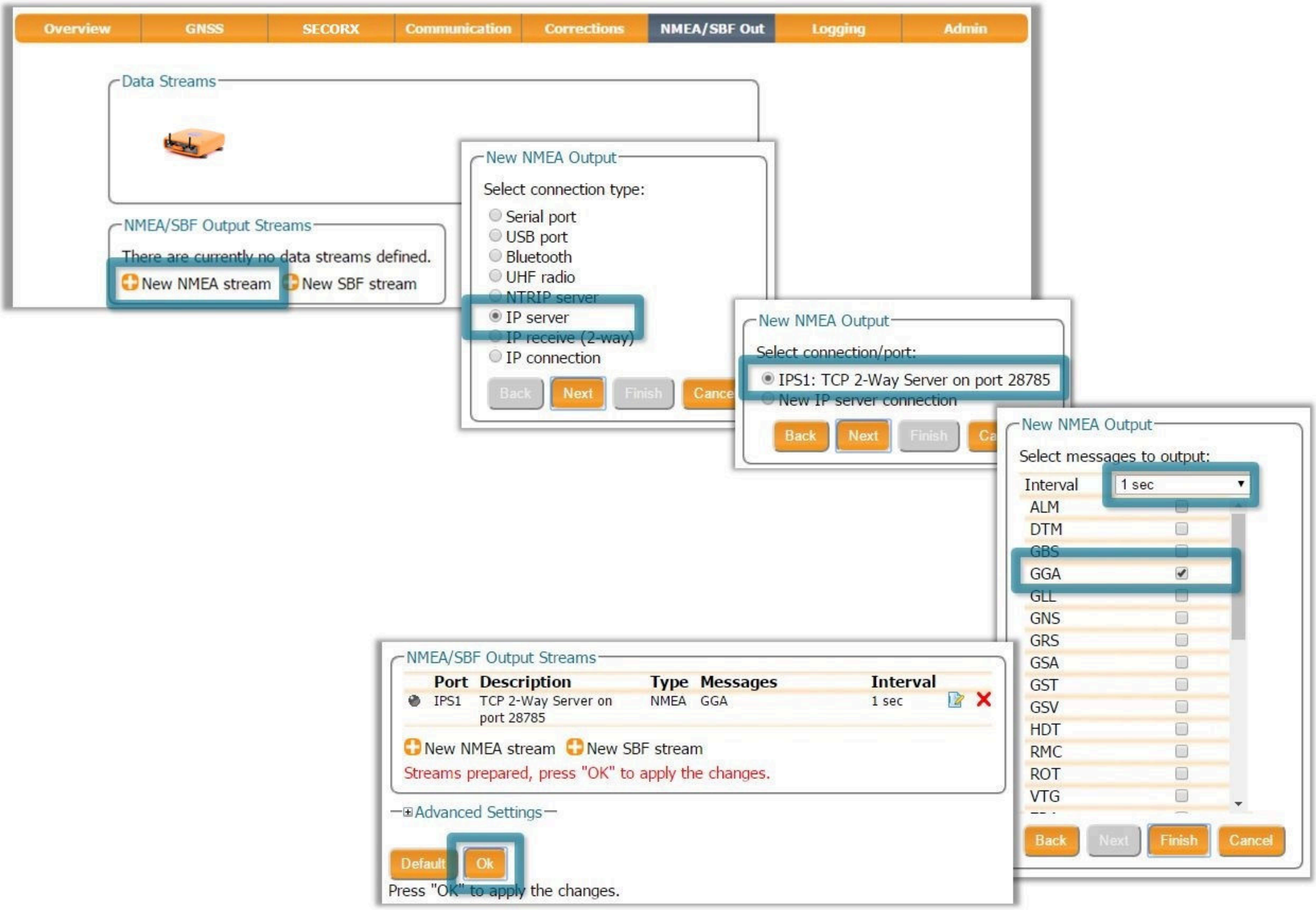


Figure 3-18: Select to output NMEA GGA over the configured IPS1 connection

Step 3: Configure Data Link to listen for NMEA output

The screenshots in Figure 3-19 show how the Septentrio GUI tool Data Link can be configured to listen for the AsteRx-U 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**'.

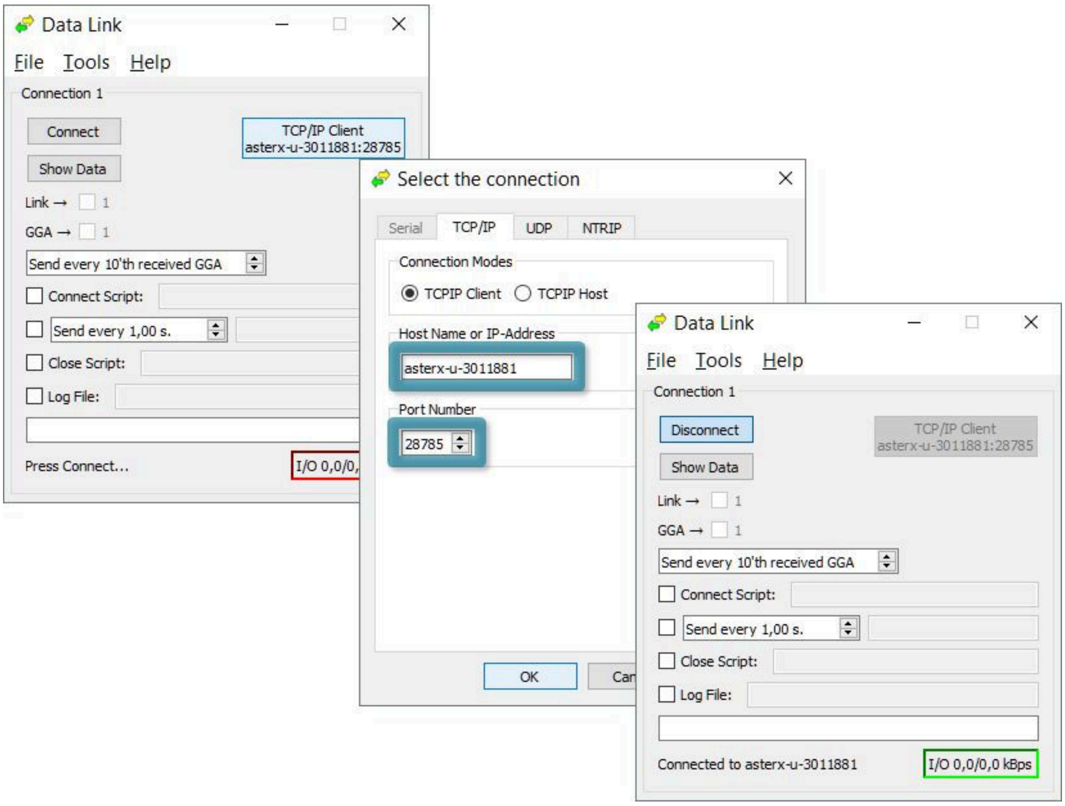


Figure 3-19: Configure the TCP/IP connection settings in Data Link

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 in Figure 3-20.

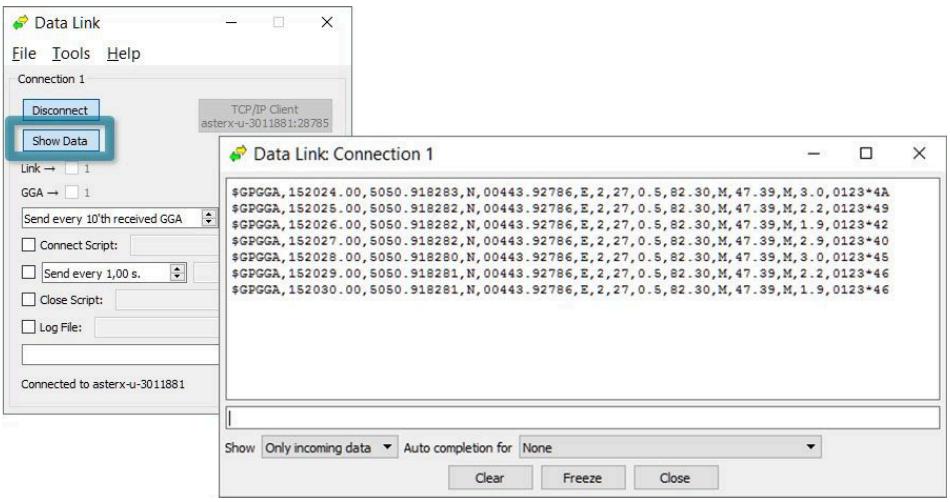


Figure 3-20: The 'Show data' window of Data Link showing GGA from the AsteRx-U

3.4.3 Output over bluetooth

Both SBF and NMEA data formats can be sent over bluetooth. This example shows how to forward NMEA data to an App called MachineryGuide on a Getac Android device.

Step 1: Configure the Bluetooth connection on the AsteRx-U

On the Overview tab of the Web Interface, you can make sure that Bluetooth has been enabled. When turned on, it may take a few moments before it is declared 'Discoverable' as shown in Figure 3-21.

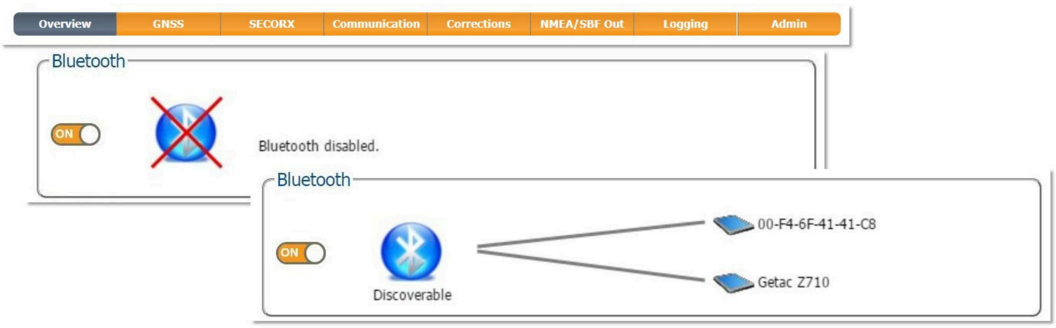


Figure 3-21: Turn on the bluetooth connection in the Overview tab

When Bluetooth is enabled, the front-panel bluetooth LED will be lit as in Figure 3-22

Figure 3-22: Indicator LED on the AsteRx-U front panel showing that Bluetooth is active

Step 2: Configure NMEA messages to output

In the **NMEA/SBF Out** window, click on **New NMEA Stream** as in Figure 3-23. This will guide you through the various steps to configure NMEA output. Select **Bluetooth** as the connection type as shown.

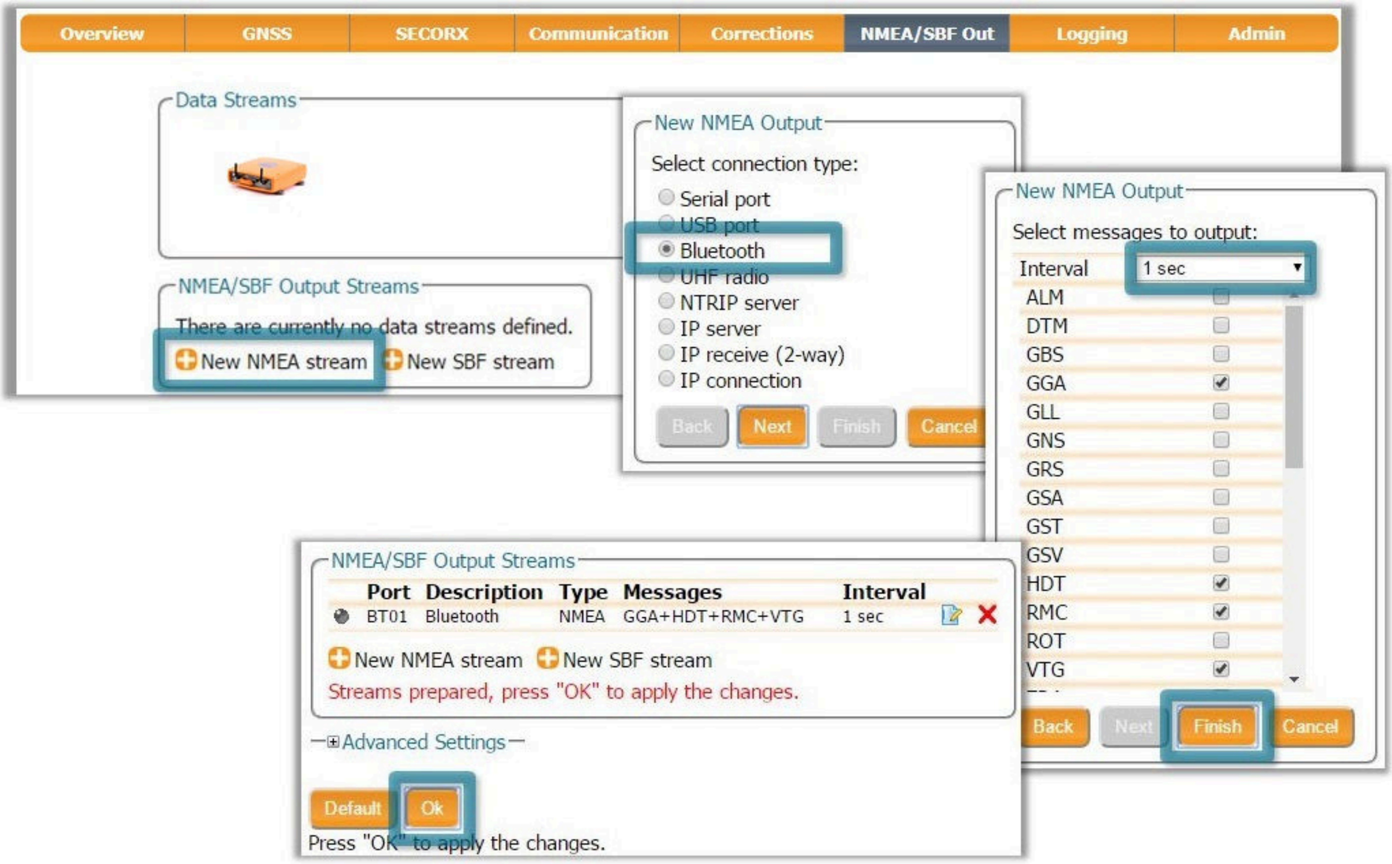


Figure 3-23: Click on **New NMEA Stream** and select the desired settings in the following windows

Step 3: Configure NMEA bluetooth data reception on secondary device

In this example, the NMEA data will be sent over bluetooth to a Getac tablet to provide positioning information for an agricultural guidance application called MachineryGuide. Figures 3-24 and 3-25 show how the MachineryGuide App can be configured to use NMEA data from the AsteRs-U over bluetooth.

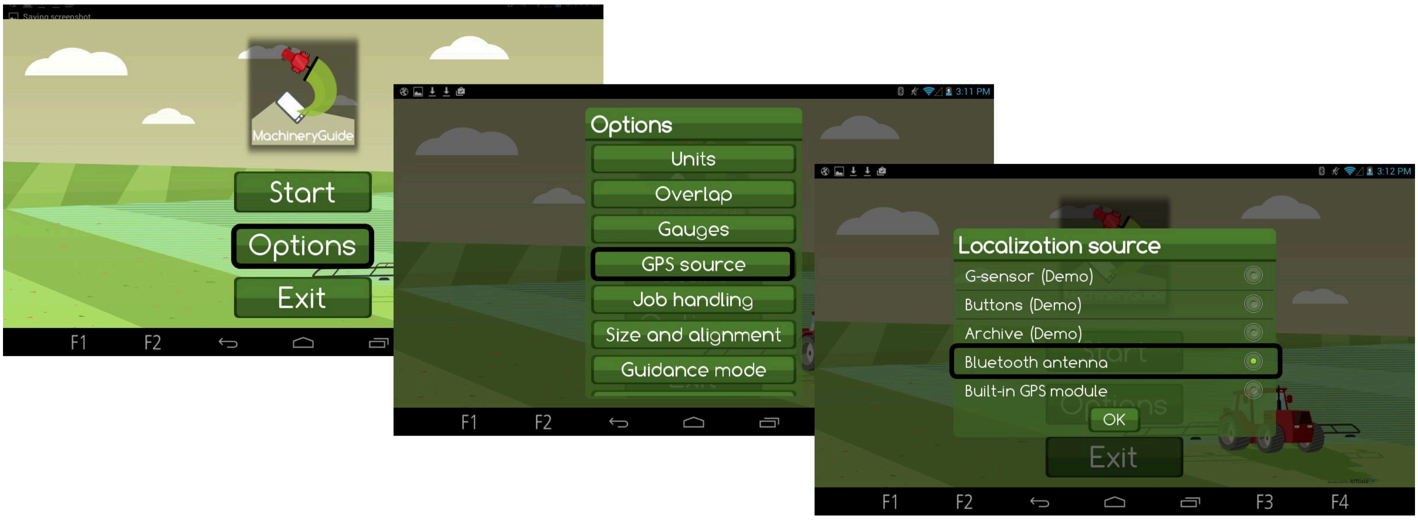


Figure 3-24: Select bluetooth for GPS positioning information

Figure 3-25: Find and pair the device to the AsteRx-U

Step 4: Verifying the configuration

When the AsteRx-U has been paired with a device and is sending data, the **NMEA/SBF Out** page will show a graphic similar to that shown in Figure 3-26.

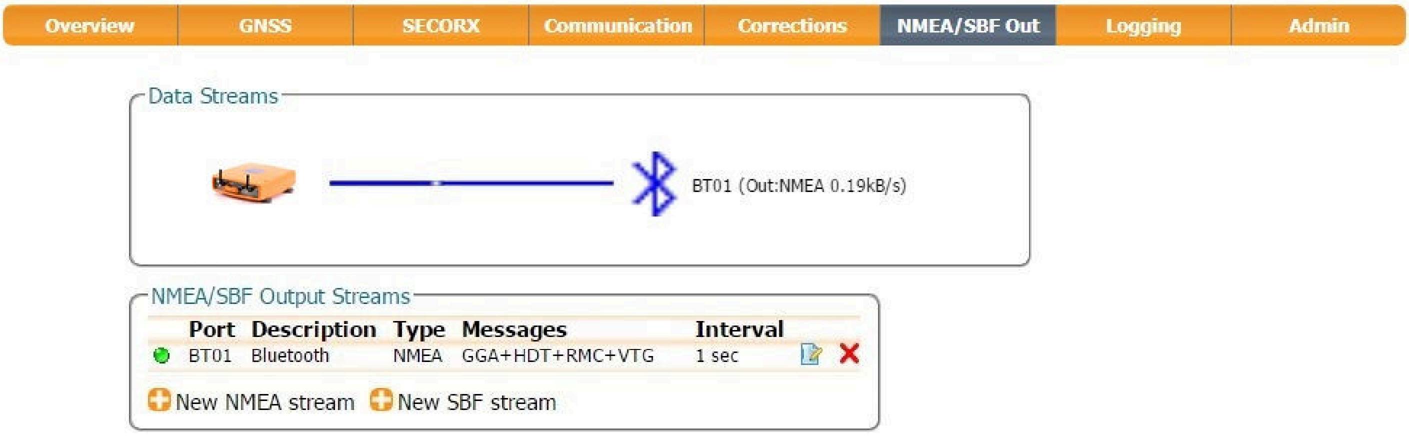


Figure 3-26: The **NMEA/SBF Out** window when the AsteRx-U is bluetooth paired to a secondary device

4 Rover operation

4.1 How to configure the AsteRx-U for RTK

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

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

When GSM/GPRS network coverage is either sparse or unreliable, RTK correction data can be transmitted over UHF radio. The AsteRx-U has build-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.

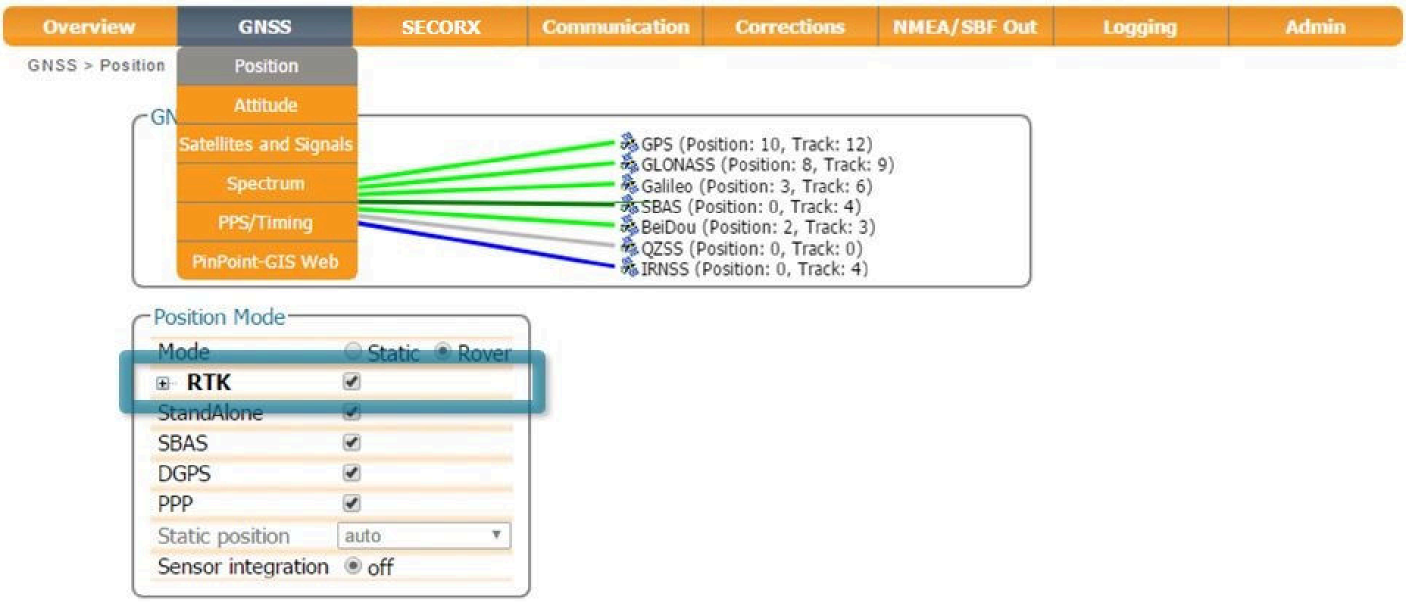


Figure 4-1: Ensure that RTK positioning mode is enabled

Step 2: Configure the UHF radio

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

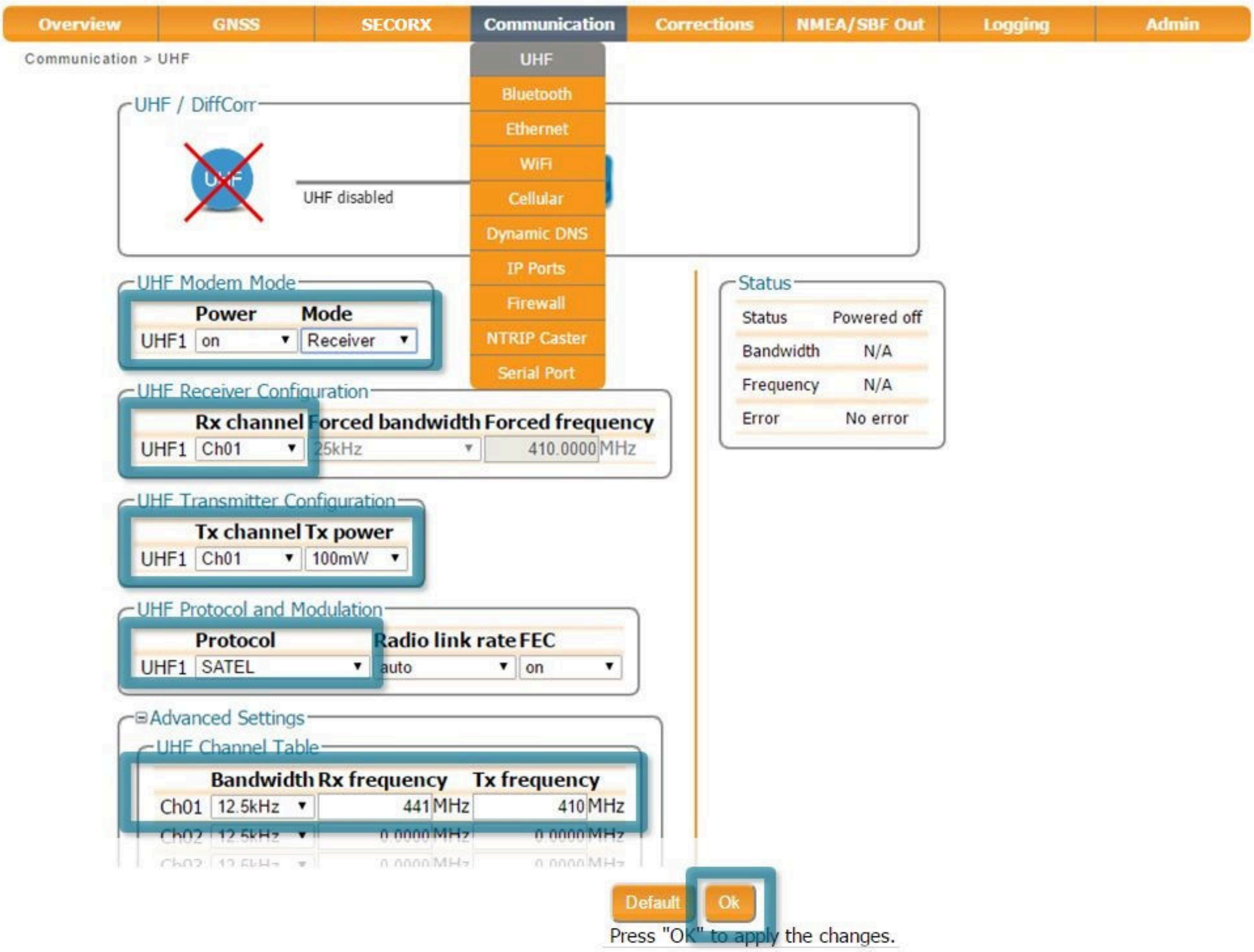


Figure 4-2: Configuring the built-in UHF radio for rover operation

After changing the settings click on **OK** to finalise 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-U 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-U has been correctly configured then you should see in the UHF/DiffCorr field, the greyed-out connection line now replaced by a 'live' green line as 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.

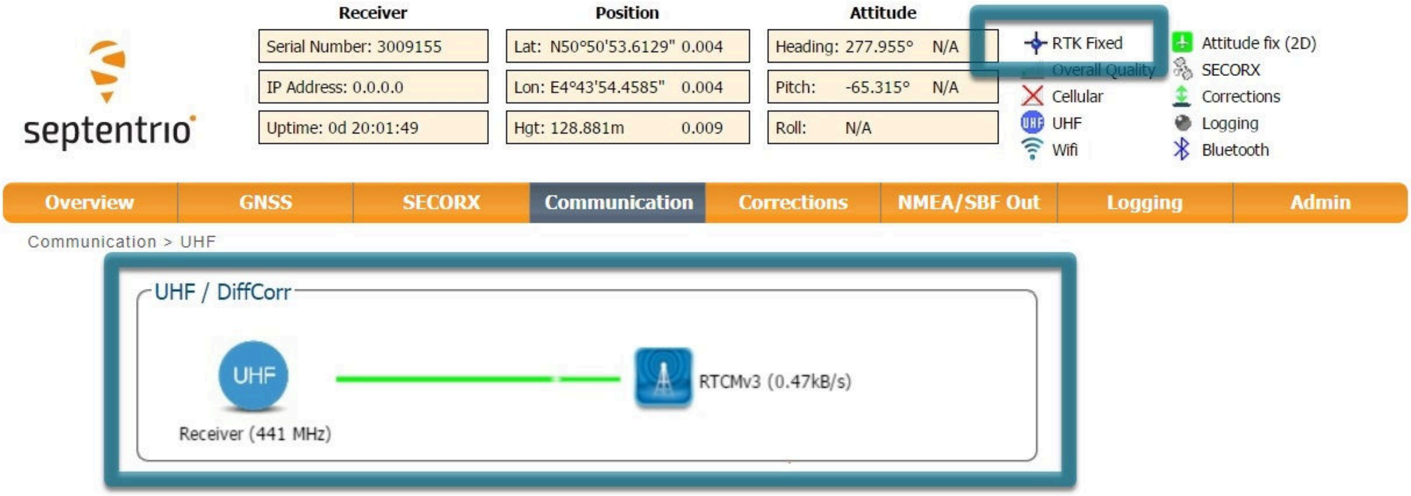


Figure 4-3: The AsteRx-U in RTK mode using differential correction data from a base station transmitting over a UHF radio connection

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

Step 1: Enable RTK mode

Ensure that RTK is be 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.

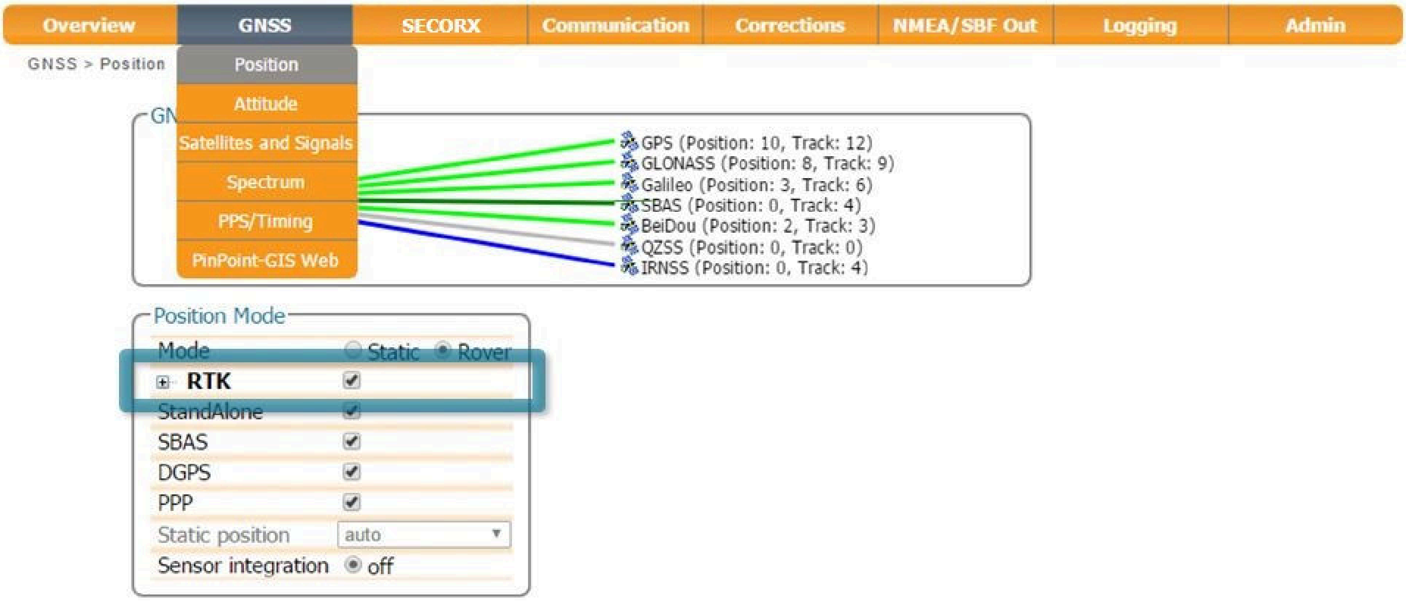


Figure 4-4: Ensure that RTK has been enabled as a positioning mode

Step 2: Configure the cellular modem

Insert a SIM card into the front-panel slot of the AsteRx-U as shown in Figure 2-3 while the unit is powered down.

The on-board cellular modem of the AsteRx-U 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.

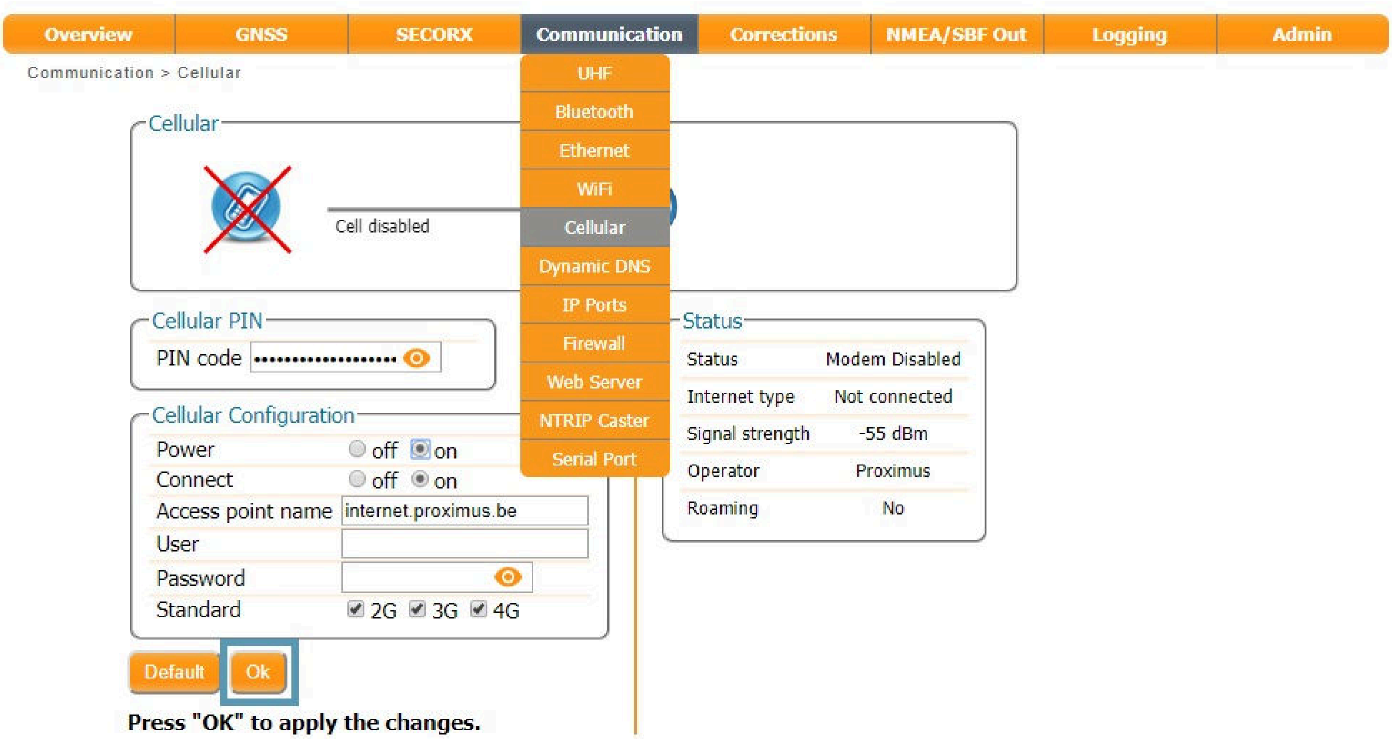


Figure 4-5: Configuring the cellular modem

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 UMTS.

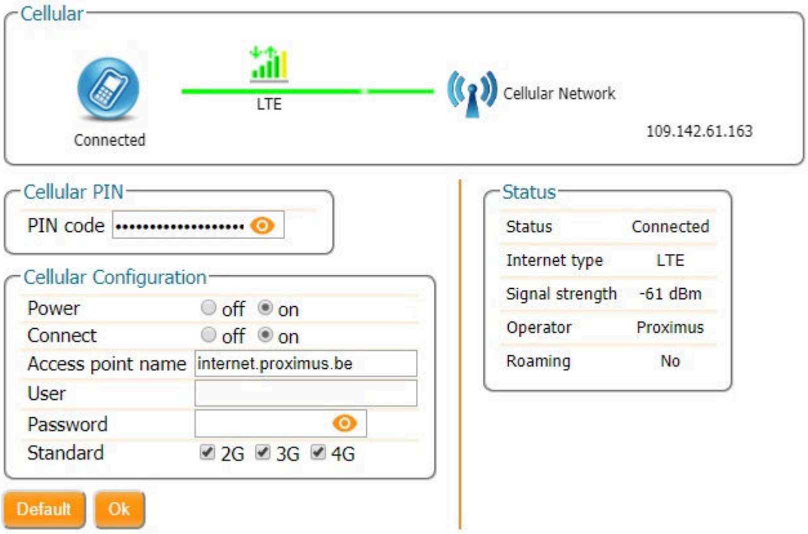


Figure 4-6: Correctly configured cellular modem

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 a NMEA GGA message. This can be configured in the '**Send GGA to caster**' drop-down list.

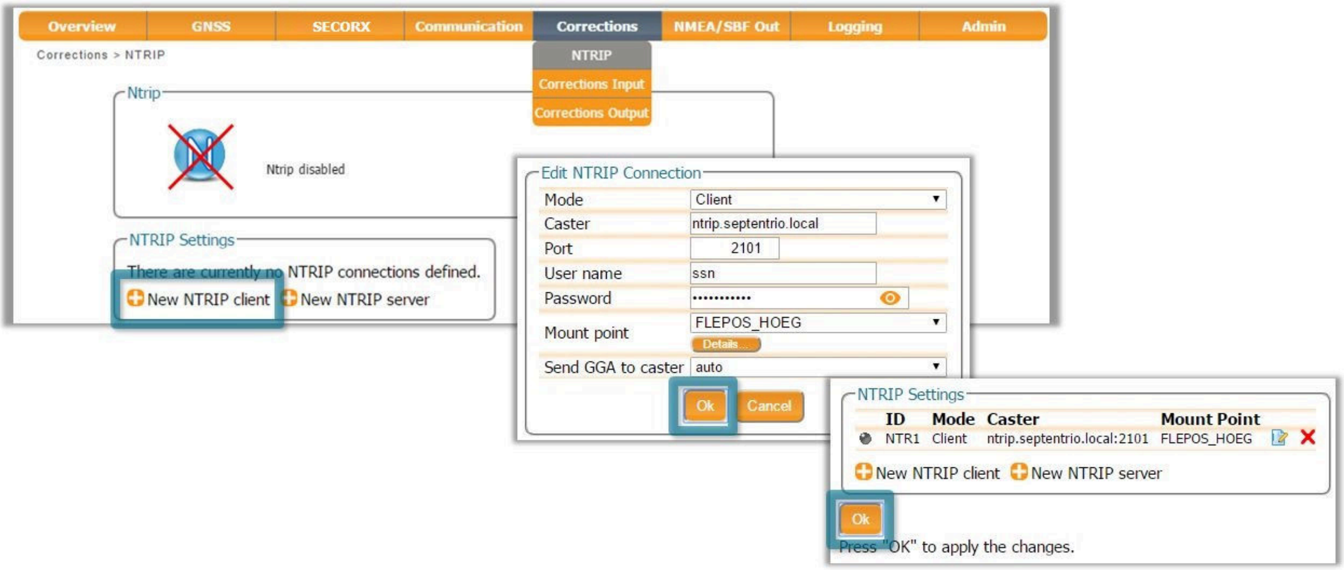


Figure 4-7: Configuring the NTRIP connection

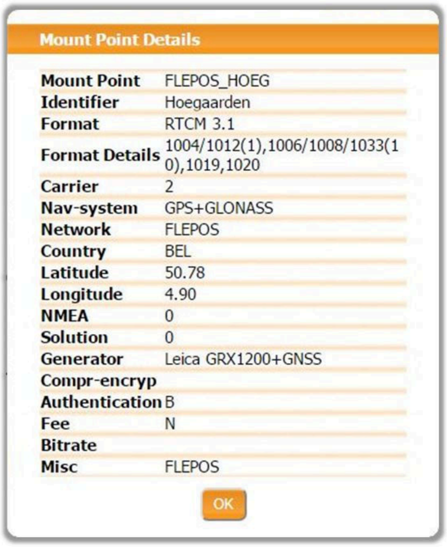


Figure 4-8: Details of the selected mount Point

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.

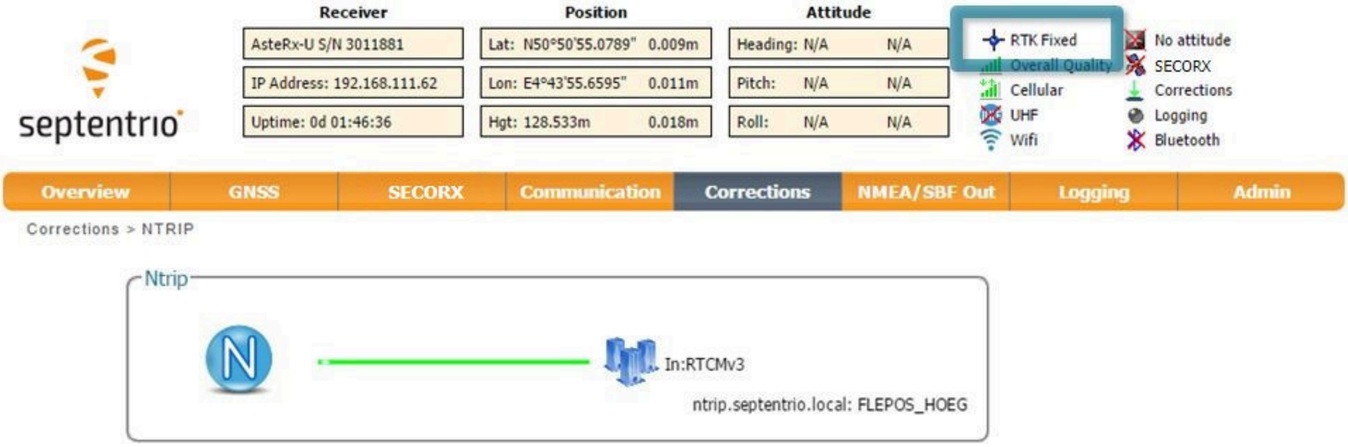


Figure 4-9: Correctly configured NTRIP connection

4.1.3 How to configure the AsteRx-U 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-U as an RTK base station.

Configure the Ethernet connection and diff corr 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 diff corr stream and Ethernet connection over which the diff corr 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.

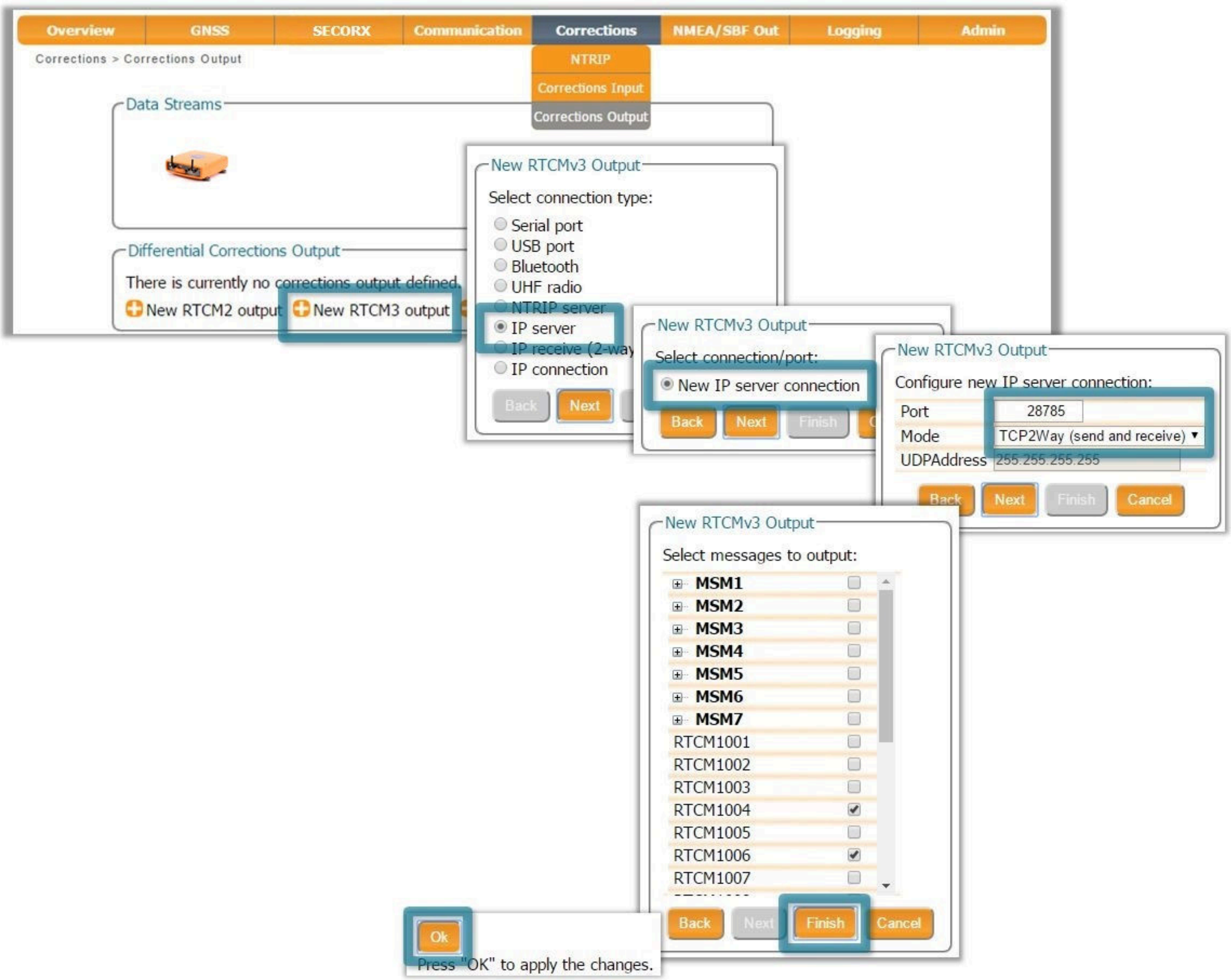


Figure 4-10: Click on **New RTCM3 output** to configure RTK diff corr output over an Ethernet connection

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.

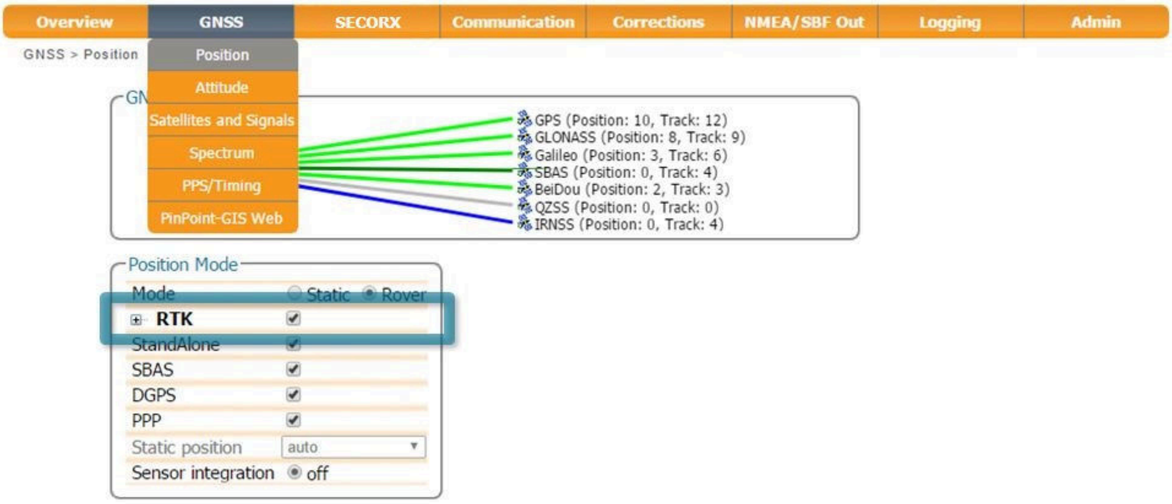


Figure 4-11: Ensure that RTK is enabled as a positioning mode

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.

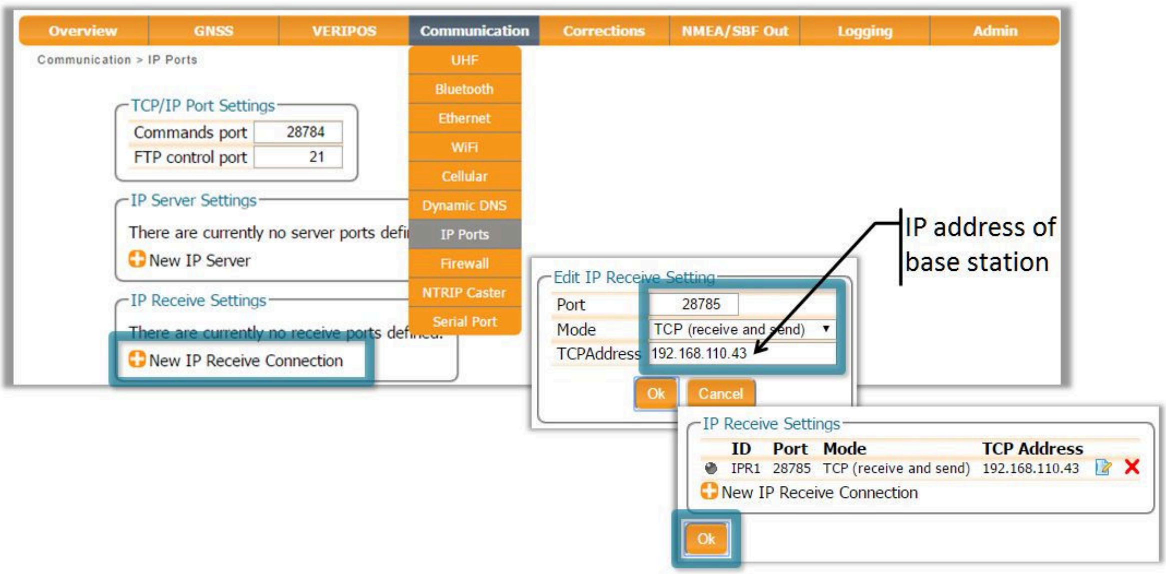


Figure 4-12: In the **IP Ports** window, click on **New IP Receive Connection** to configure the connection with the base station

Step 3: Verifying the configuration

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

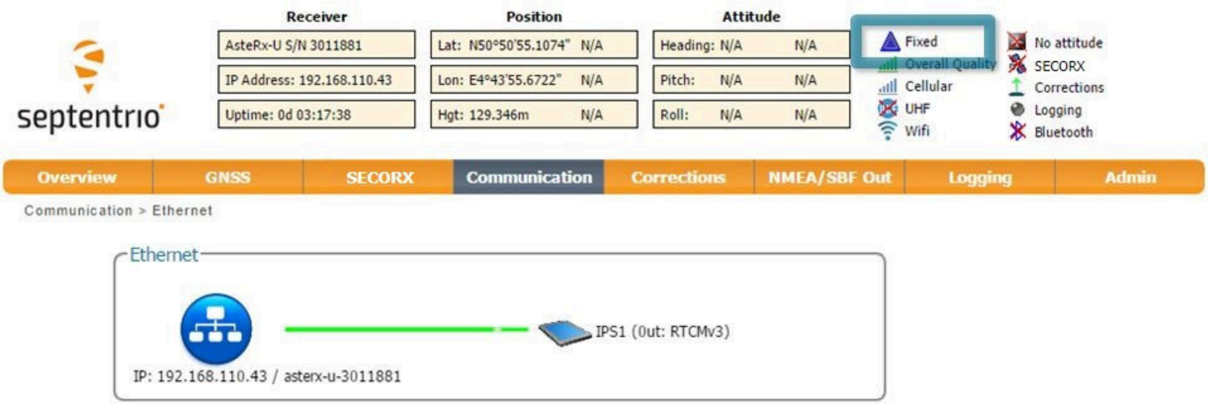


Figure 4-13: Ethernet window of the **Base station receiver** showing the position as static and an active output of RTCMv3 diff corr on server port IPS1

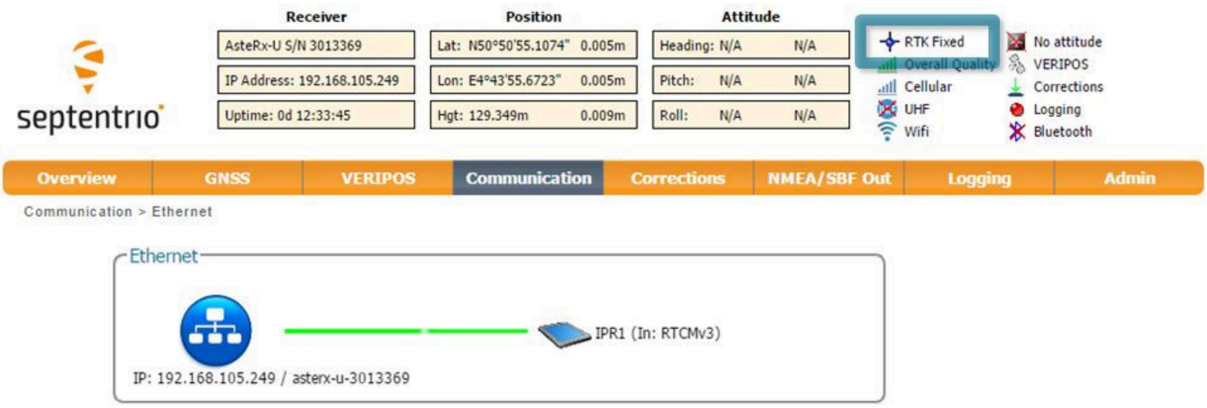


Figure 4-14: Ethernet tab of the **rover receiver** showing a fixed RTK position and reception of RTCMv3 diff corr on receiver port IPR1

4.2 Using L-band PPP correction data with the AsteRx-U

PPP (Precise Point Positioning) is high-accuracy positioning without the need for a local base station. PPP uses precise satellite clock and orbit corrections computed by a global network of reference stations and broadcast in real time by geostationary satellites transmitting in the L-band. To receive PPP correction data, your receiver will need to be connected to an L-Band capable antenna[1]. The AsteRx-U can use PPP correction data from **SECORX** (onshore) or **VERIPOS** (offshore) as described in the steps below. Additionally, the AsteRx-U also supports **SECORX-60**, a land and nearshore PPP service which provides sub-decimetre positioning for applications on land and up to 60 km offshore.

Step 1: Check you have PPP permissions on your AsteRx-U

The use of PPP services is permission-file controlled on the AsteRx-U. You can make sure that you have PPP permissions enabled on the **About** page selected from the **Admin** menu. Click on **Permitted Capabilities** and scroll down the list of permissions: **PPP** and **Augmented Data Svc** should appear as permitted as shown in Figure 4-15.

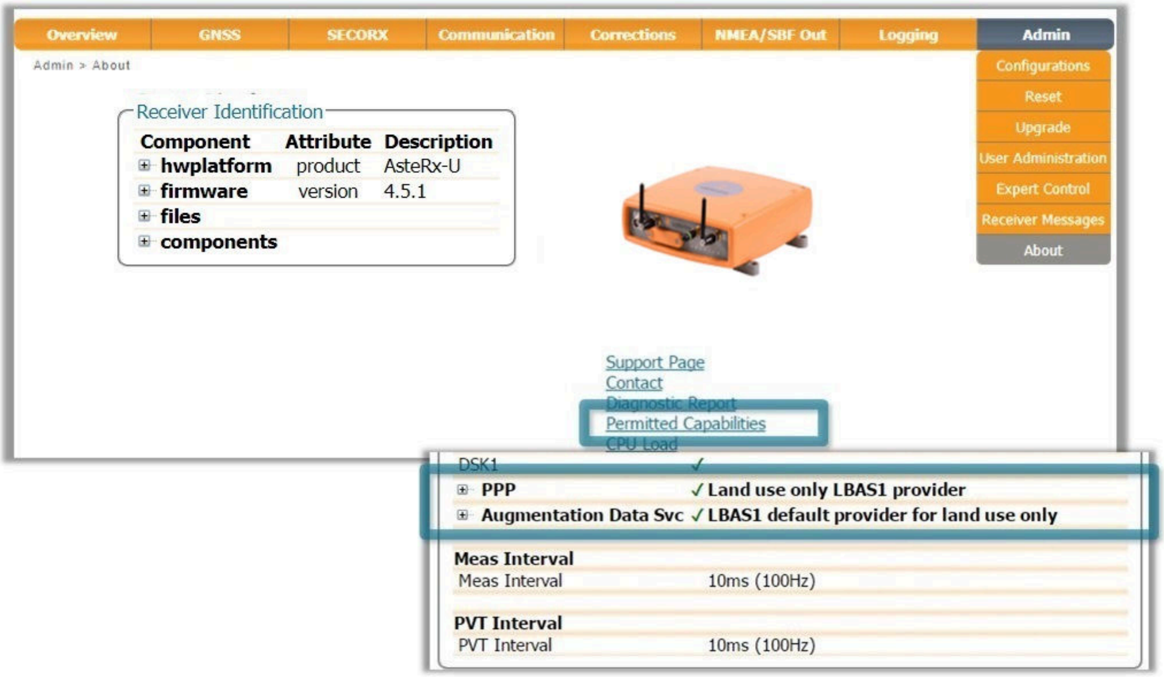


Figure 4-15: Check that PPP is enabled in the AsteRx-U permission file

If you don't have PPP permissions on your AsteRx-U, you can purchase this option from the Septentrio sales department: sales@septentrio.com.

The SECORX-60 PPP service is not linked to a new permission but can be subscribed to by existing customers.

[1] Please note that PPP correction data is also available over an Ethernet connection using NTRIP and for this, an L-Band antenna is not required

Step 2: Activating a SECORX or VERIPOS PPP service

SECORX is a PPP service aimed at on-shore applications and VERIPOS for off-shore.

SECORX activation

To be able to get PPP correction data from SECORX, you will also have to have a SECORX subscription which can be purchased from your AsteRx-U dealer or from Septentrio sales department: sales@septentrio.com. To activate SECORX you will need to provide the **Product Activation Code** (PAC) of the receiver. The PAC can be found in the **SECORX** window as shown in Figure 4-16.

Figure 4-16: The Product Activation Code (PAC) required for SECORX activation

VERIPOS activation

You can find out more about VERIPOS services via the link: www.veripos.com/services.html. To activate the VERIPOS service, you will be asked to provide the **Augmentation User ID** of the AsteRx-U which can be found in the **SECORX** window and is shown highlighted in Figure 4-17.

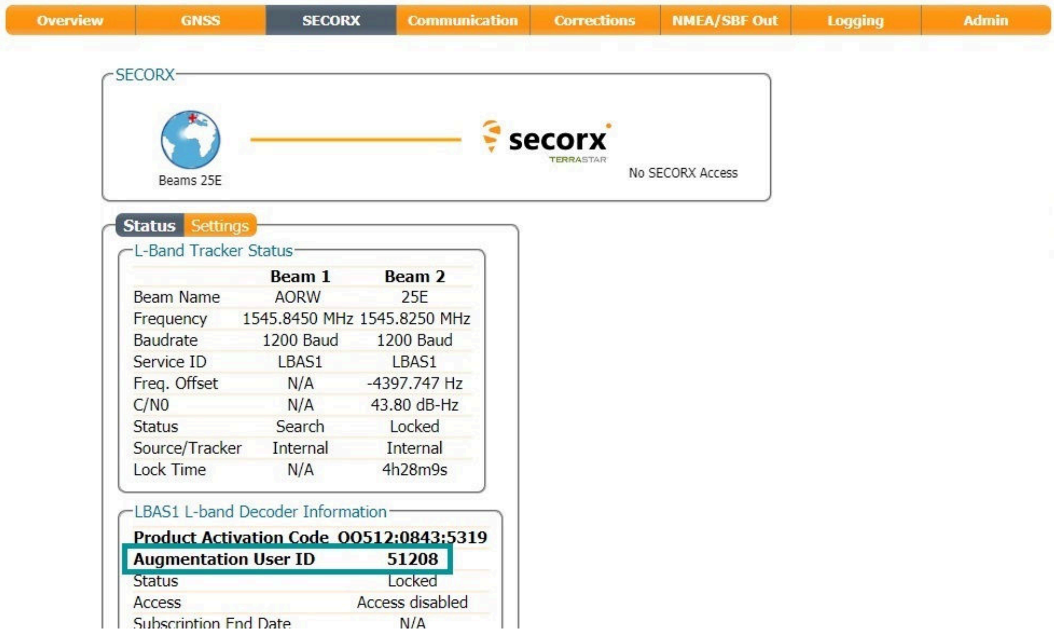


Figure 4-17: Augmentation User ID required for VERIPOS service activation

Both SECORX and VERIPOS services are activated over the air at a scheduled activation time. The AsteRx-U will therefore have to be powered on with an antenna connected and tracking L-Band satellites (see Steps 3 and 4) in a clear sky view, starting just before the scheduled activation time, in order to compute GPS time and receive the activation signal. In case the receiver was not set up in time to receive the activation signal, please keep the receiver running for a minimum of 4 more hours in order to activate the service as activations are sent out every 3.5 hours. To guarantee successful activation, the L-Band signal should be received with a carrier-to-noise ratio of 36 dB-Hz or higher. In case of any issues, please contact the Septentrio Support department: support@septentrio.com.

Step 3: Connect an L-Band antenna

Ensure that you have an L-band capable antenna connected to the main antenna rear-panel connector. The AsteRx-U MARINE variant offers an additional connector for a dedicated L-band antenna as shown in Figure 4-18.

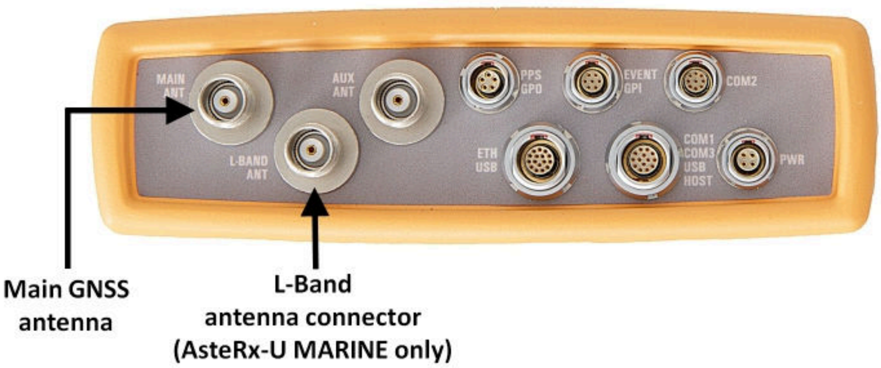


Figure 4-18: Rear panel antenna connectors

Step 4: Select PPP positioning

Ensure that PPP is selected as a positioning mode in the GNSS Position tab as shown in Figure 4-19.

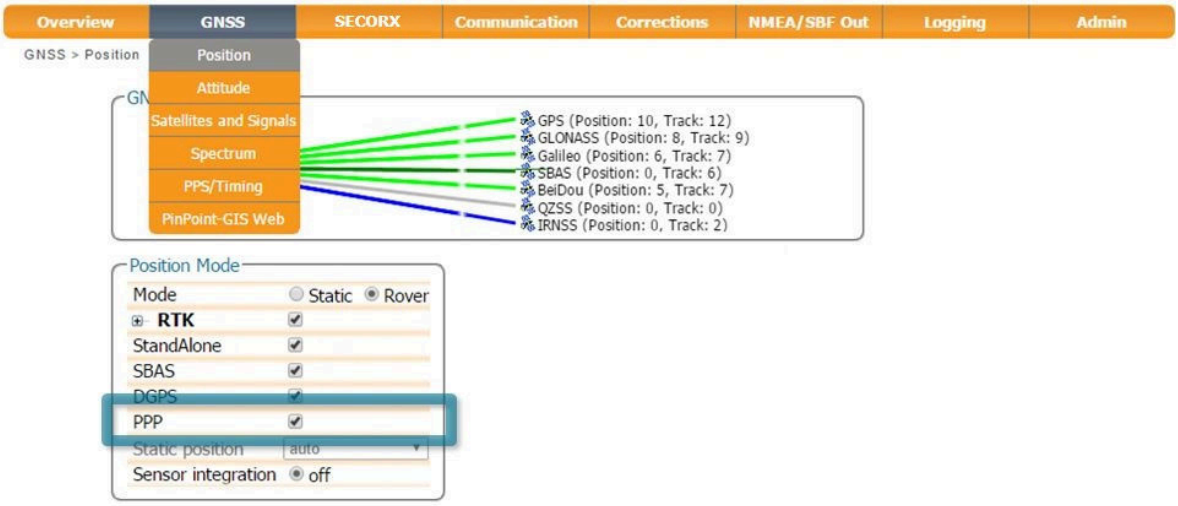


Figure 4-19: Enable PPP positioning mode

Step 5: Beam Selection Mode and Service

For SECORX configuration, select the tab named **SECORX** on the web interface. For VERIPOS, the L-Band configuration window is named **VERIPOS** as shown in Figure 4-20.

The AsteRx-U can track two L-band beams simultaneously (Multibeam tracking). For increased ease of use, the default L-band beam selection mode is **auto** as shown in Figure 4-20. In this mode, the demodulator will try to lock on to two visible beams, preferring beams to which access has been granted.

In **manual** mode, the demodulator will attempt to lock on to the beams selected from the 'Manual beam selection' and 'Second beam selection' drop-down lists ignoring all other beams. The beams in these lists can be pre-set in the 'Advanced Settings' expandable field. A beam is characterized by a frequency and data rate.

Users of the VERIPOS corrections, will have purchased either ULTRA or APEX services which should be selected as the **PPP correction type** as shown.

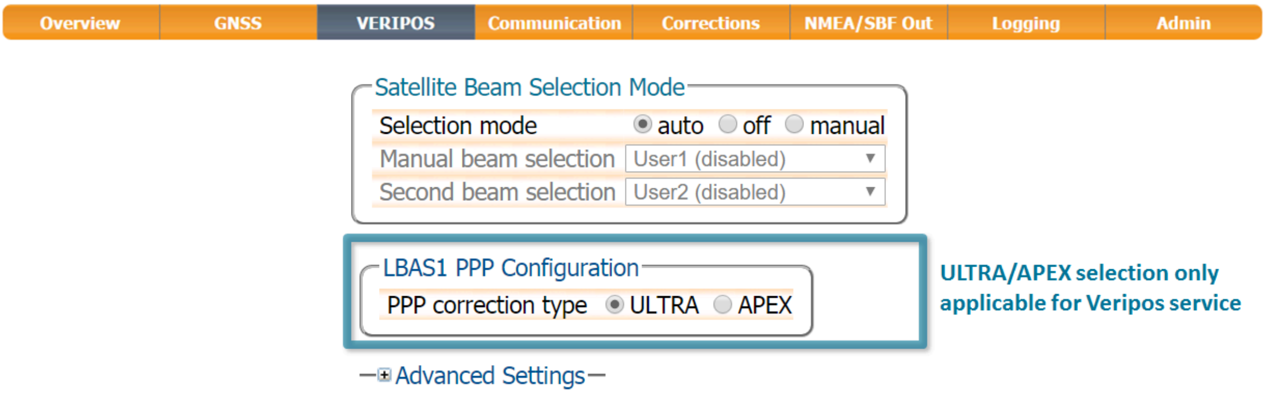


Figure 4-20: Select L-Band beam and APEX/ULTRA correction type (only applicable for VERIPOS service)

Without a SECORX or VERIPOS subscription, the AsteRx-U will still be able track visible L-Band signals. Figure 4-21 shows the L-Band Tracker Status field when the AsteRx-U is locked onto signals from the AORE satellite which transmits at 1539.9825 Mz. After purchasing a subscription you will need to track one of the beams for activation over the air.

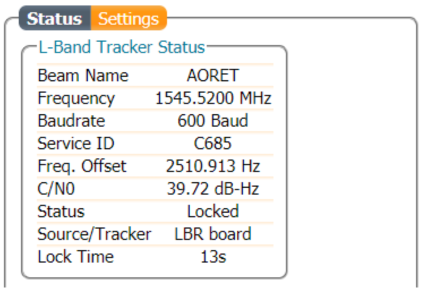


Figure 4-21: L-Band Tracker Status field when locked on to an L-Band signal

Step 6: Verifying the configuration

With a valid SECORX or VERIPOS subscription, the AsteRx-U will be able to decode PPP correction data. The **Access** line in the **L-band decoder Information** field should show **Access Enabled** as in Figure 4-22.

After a few moments, the AsteRx-U positioning mode should change to PPP as indicated by the highlighted icon in the upper status field.

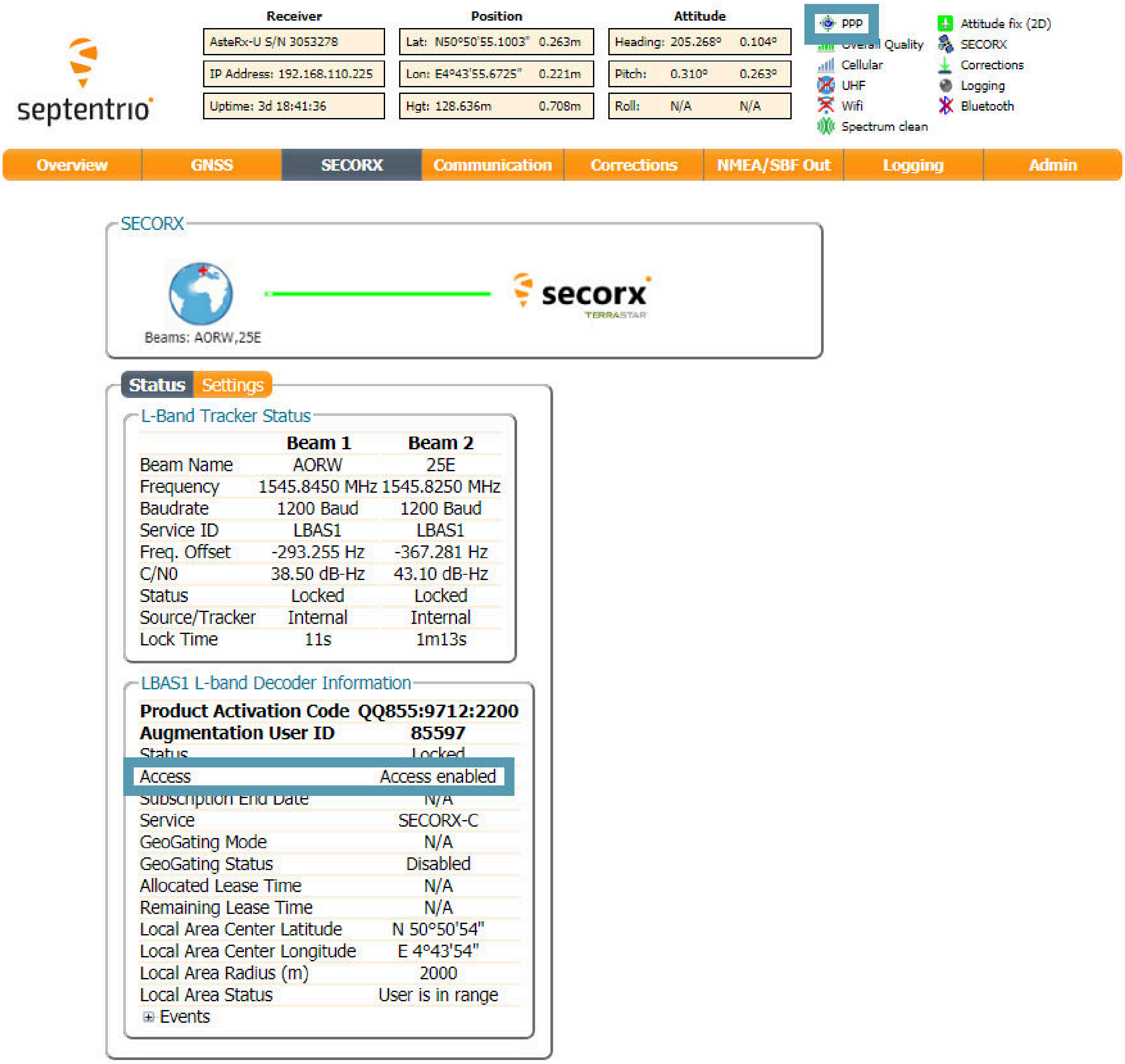


Figure 4-22: L-Band decoder Information field showing that SECORX decoding is enabled

Step 6: Additional optional settings: RTK seeding

The AsteRx-U can use an RTK or DGPS position to reduce the PPP convergence time: a process known as seeding. The configuration fields for seeding can be found in the **GNSS, Position** window as shown in Figure 4-23.

RTK positions are typically expressed in a regional datum which depends on the local RTK provider whereas SECORX and VERIPOS PPP positions relate to the global ITRF2008 reference frame. To avoid coordinate jumps each time the PVT engine switches between RTK and PPP modes and to ensure accurate seeding of the PPP engine from RTK, the regional datum used by your RTK provider must be provided to the receiver. This can be done in the **Geodetic Datum** field using the drop-down datum list. Alternatively, the datum shift can be removed in the **PPP Datum Offset** field. The dx, dy and dz values will be subtracted from all PPP coordinates.

Figure 4-23: Configuration fields of RTK/DGPS seeding

4.3 How to configure the AsteRx-U for Attitude

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

Step 1: Connect a second antenna

Connect a second antenna to the rear-panel connector labelled **AUX ANT** and indicated in Figure 4-24.

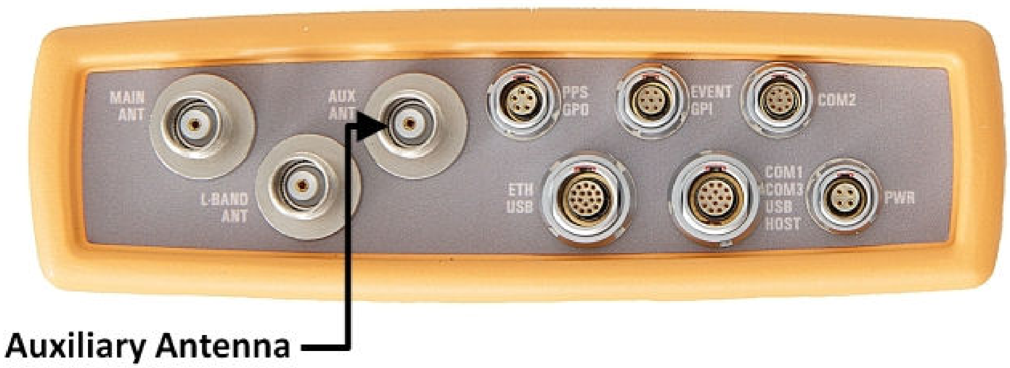


Figure 4-24: Auxiliary antenna connector on rear panel

Step 2: Configure attitude settings

The attitude settings of the AsteRx-U can be configured in the **GNSS, Attitude** window as shown in Figure 4-25.

Figure 4-25: 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-U 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 4-25 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 4-26 shows.

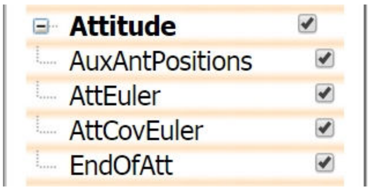


Figure 4-26: SBF blocks containing attitude information

NMEA

You can output the attitude information from the AsteRx-U in NMEA format by selecting the standard NMEA HDT sentence or the Septentrio proprietary HRP sentence as shown in Figure 4-27.

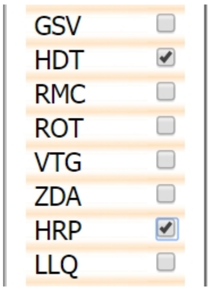


Figure 4-27: NMEA sentences containing attitude information

4.4 How to output a PPS signal

The AsteRx-U can output a PPS (Pulse-per-Second) signal that can be used for example, to synchronise 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 4-28.

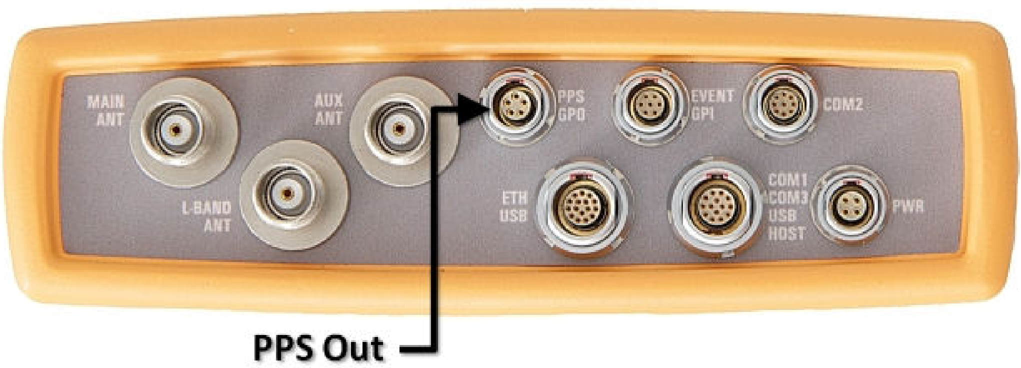


Figure 4-28: PPS connector on rear panel

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 4-29.

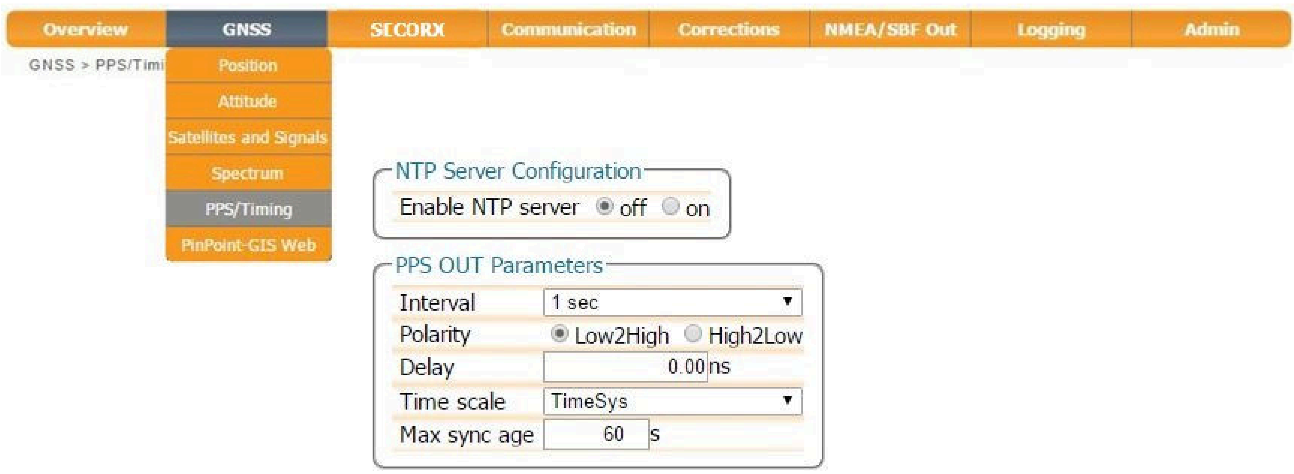


Figure 4-29: The **GNSS, PPS/Timing** window

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, 20 nsec. If Delay is left unchanged, the PPS pulse will come 20 ns too late. To re-synchronize the PPS pulse, Delay should be increased by 20 ns.

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.

4.4.1 Time synchronisation using the PPS signal

The PPS signal is an electronic pulse synchronised with GPS time clock ticks, it doesn't itself specify time. To synchronise a device with GPS time, the AsteRx-U 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-U as an RTK base station using the UHF radio

The AsteRx-U 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-U base station position

Set the position as static

To work as a base station, the position of the AsteRx-U should be set to static. If not, the AsteRx-U 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.

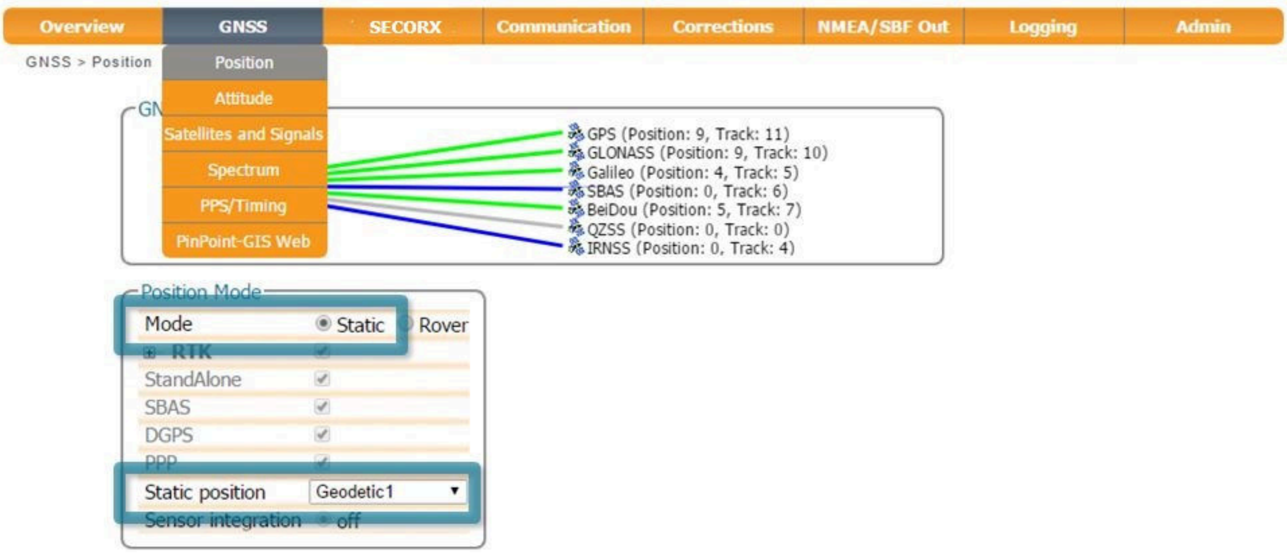


Figure 5-1: Setting the AsteRx-U base station position to static

Set the correct position

An accurate position of the antenna that is connected to the AsteRx-U 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.

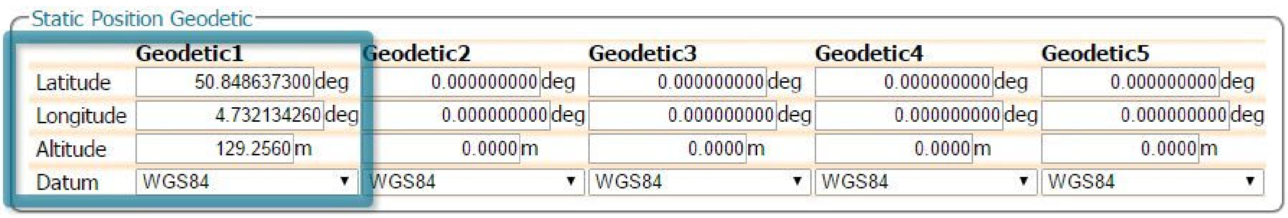


Figure 5-2: Setting the static position to the pre-set 'Geodetic1' position

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.

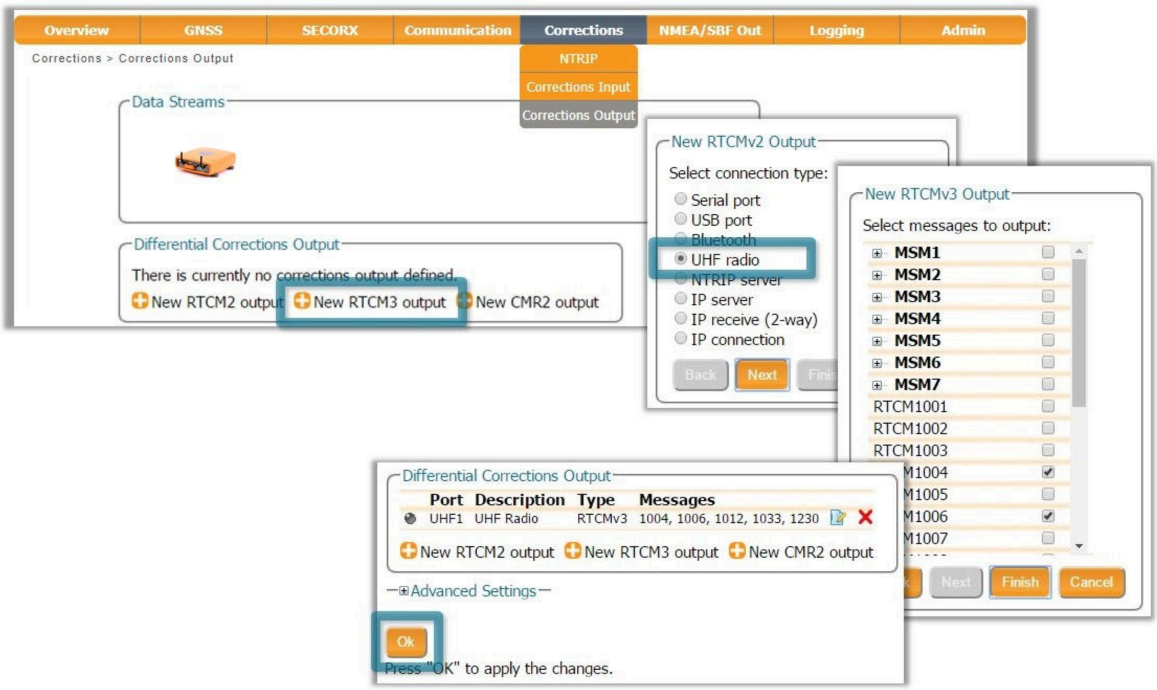


Figure 5-3: Selecting to output RTCM3 RTK corrections over the UHF radio

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.

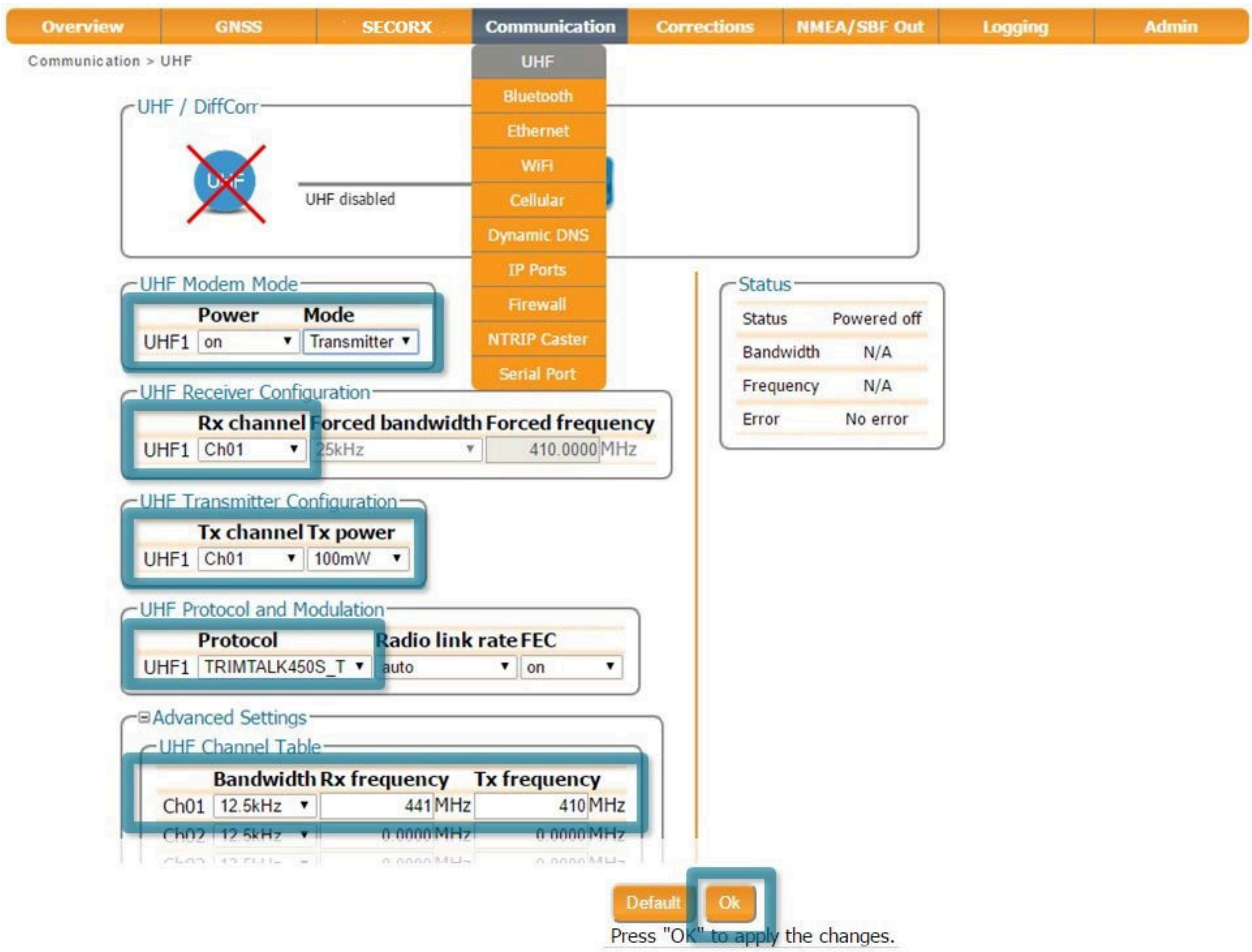


Figure 5-4: Configuring the UHF radio

[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.

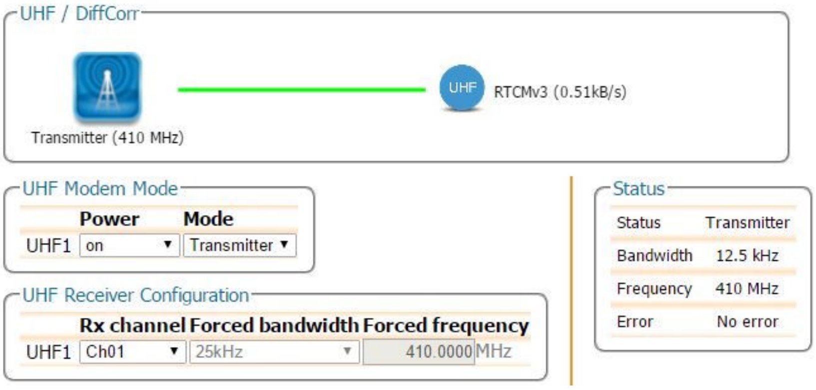


Figure 5-5: The UHF radio configured to transmit RTCMv3 diff corr at 410 MHz

5.2 Configuring the AsteRx-U NTRIP Caster

The AsteRx-U includes a built-in NTRIP Caster that makes correction data from the AsteRx-U 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-U NTRIP Caster can be configured on 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-U, select '**No**' in the 'Allow external server' field[2].

Click on the '**Local Server ...**' button to enable the local NTRIP server of the AsteRx-U 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.

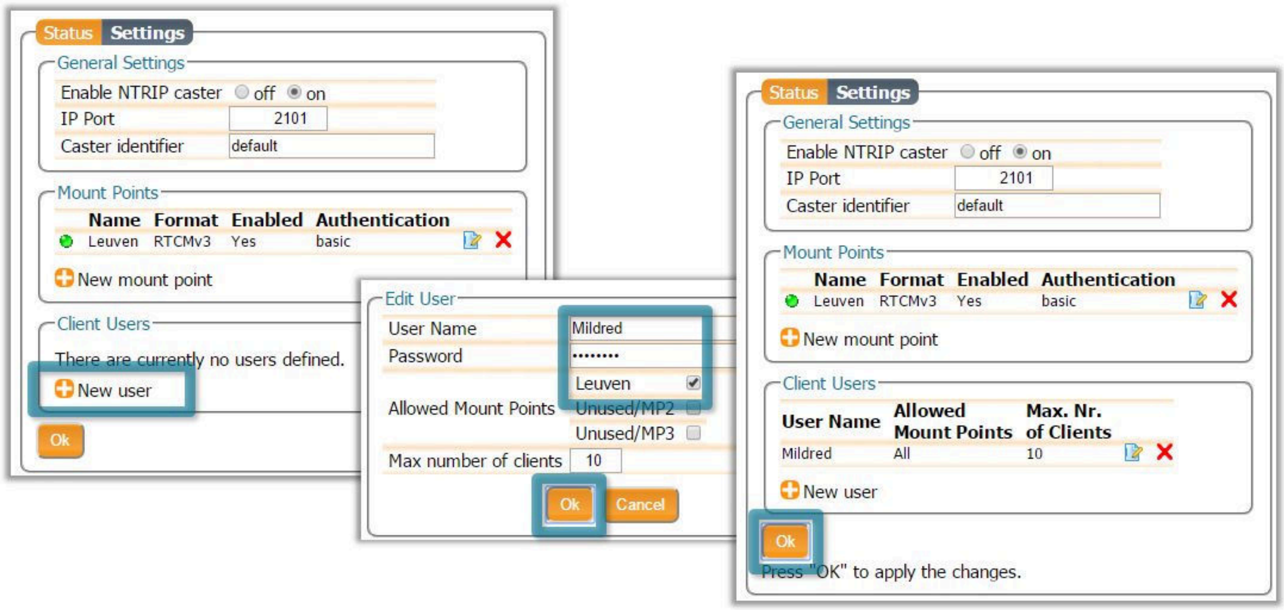


Figure 5-7: Configuring the login credentials for a user

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

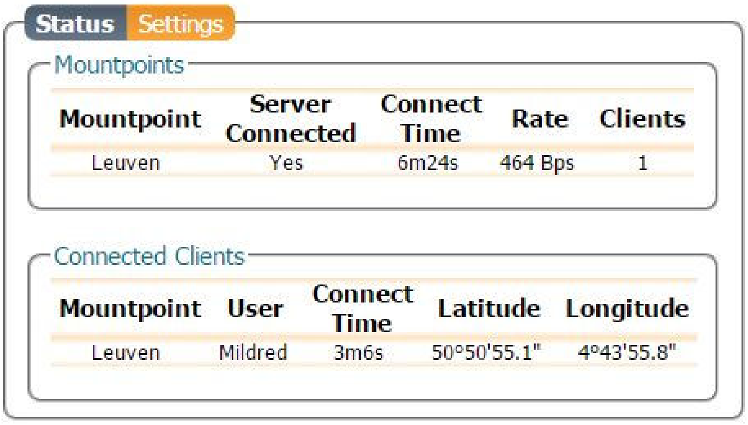


Figure 5-8: Connecting as a client to the AsteRx-U NTRIP Caster

On the NTRIP Client side

Rover receivers can connect to the NTRIP Caster by 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.

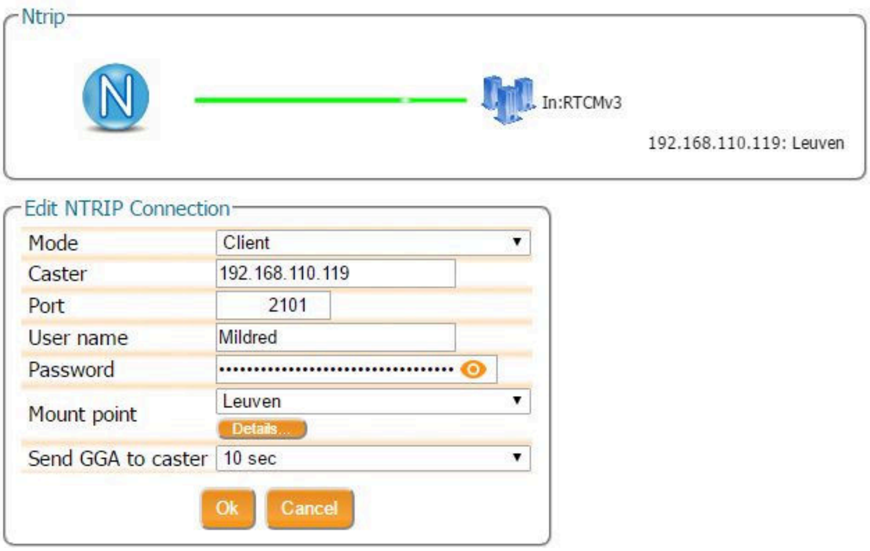


Figure 5-9: Connecting as a client to the AsteRx-U NTRIP Caster

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-U’s operational status.

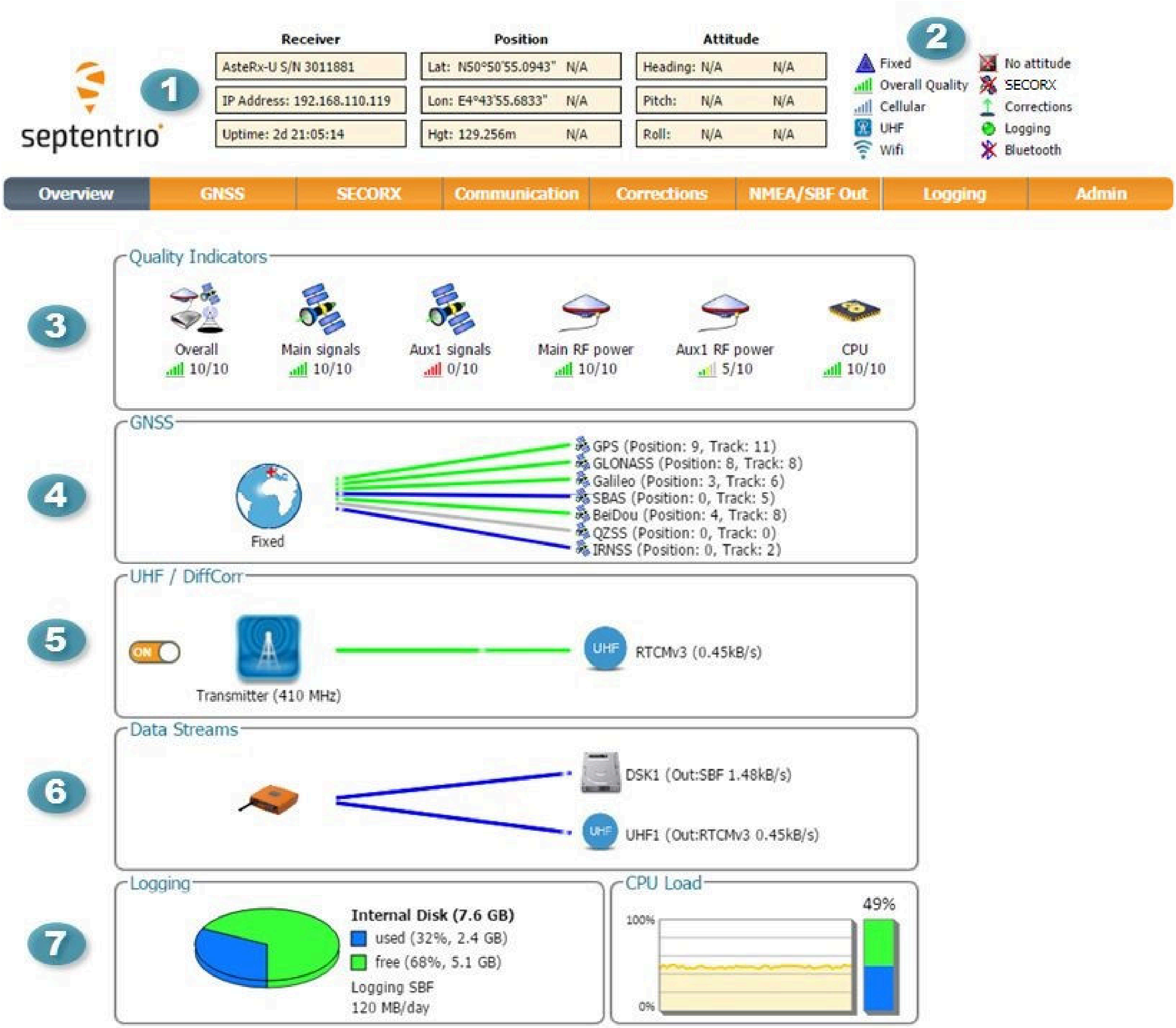


Figure 6-1: Overview page of the web interface

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 perfomance (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 summarises 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 analyser to detect and mitigate interference

The AsteRx-U 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.

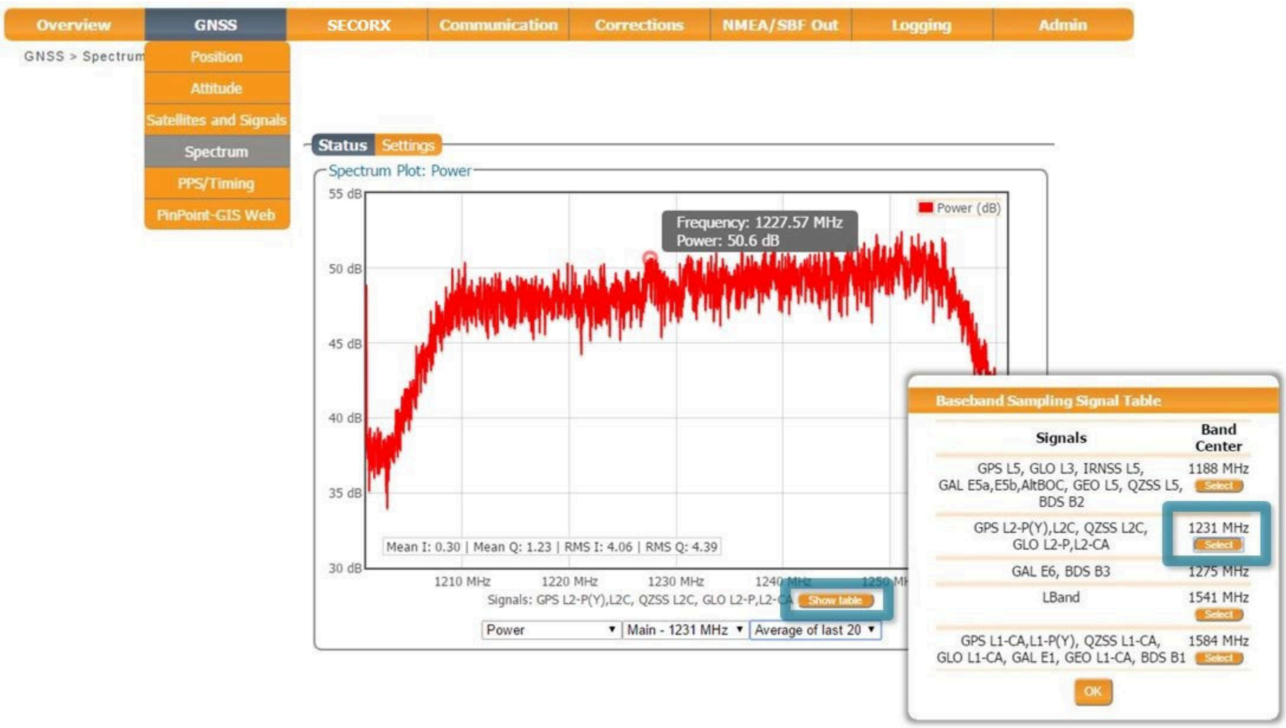


Figure 6-2: The RF spectrum of the L2 Band

6.2.1 Narrowband interference mitigation

Configuring the notch filters

In the default auto mode of the notch filters, 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 centre frequency and a bandwidth which is effectively blanked by the notch filter.

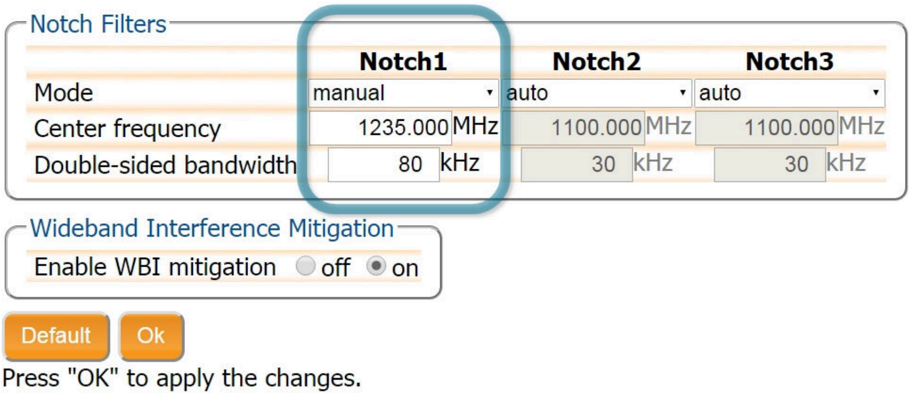


Figure 6-3: Configuring the first notch filter Notch1 at 1235 MHz

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.

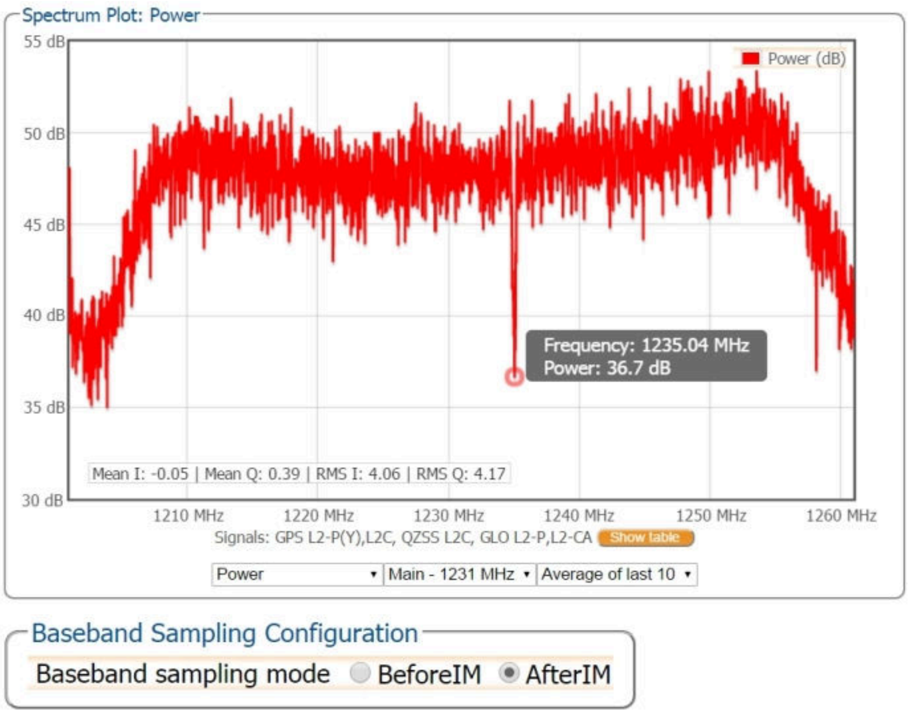


Figure 6-4: The RF spectrum of the L2 Band after applying the notch filter at 1235 MHz

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-U 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.

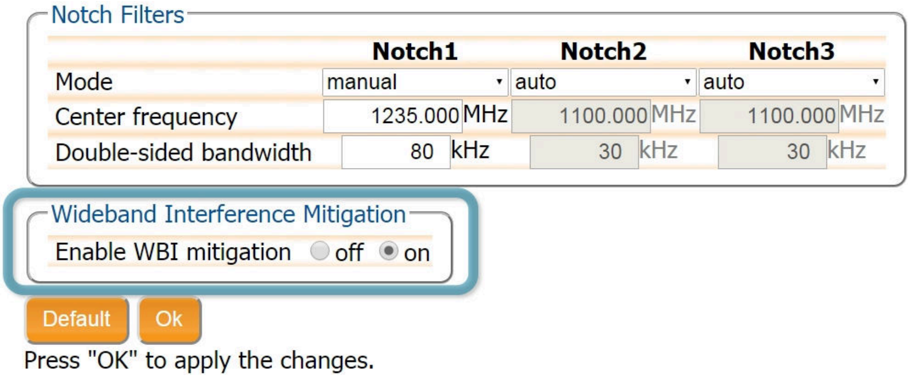


Figure 6-5: Select 'on' to enable wideband interference mitigation then 'OK' to apply the new setting.

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.

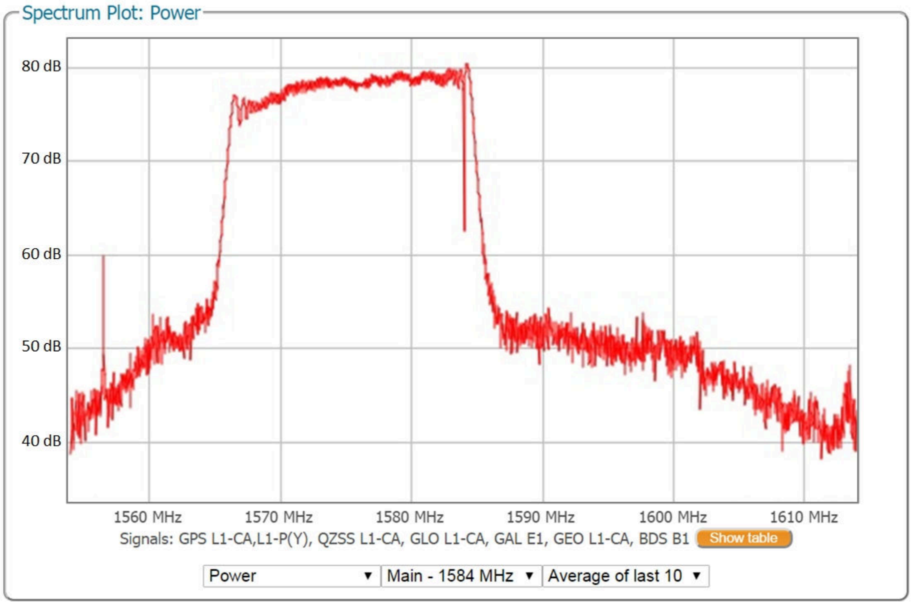


Figure 6-6: Simulated wideband interference in the GPS L1 band using an in-car chirp jammer.

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.

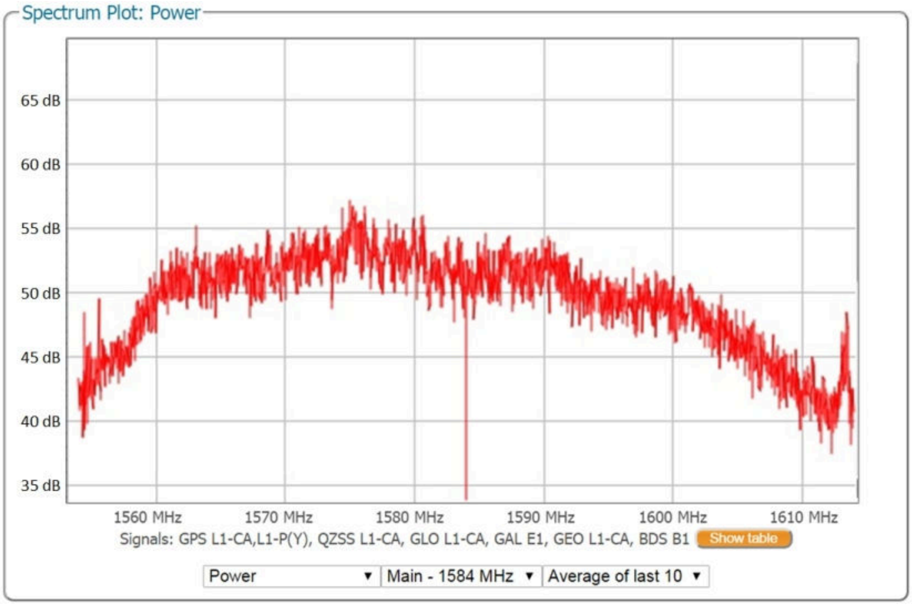


Figure 6-7: Enabling WBI interference mitigation greatly reduces the effect of the interference caused by the chirp jammer.

6.3 How to log data for problem diagnosis

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

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.

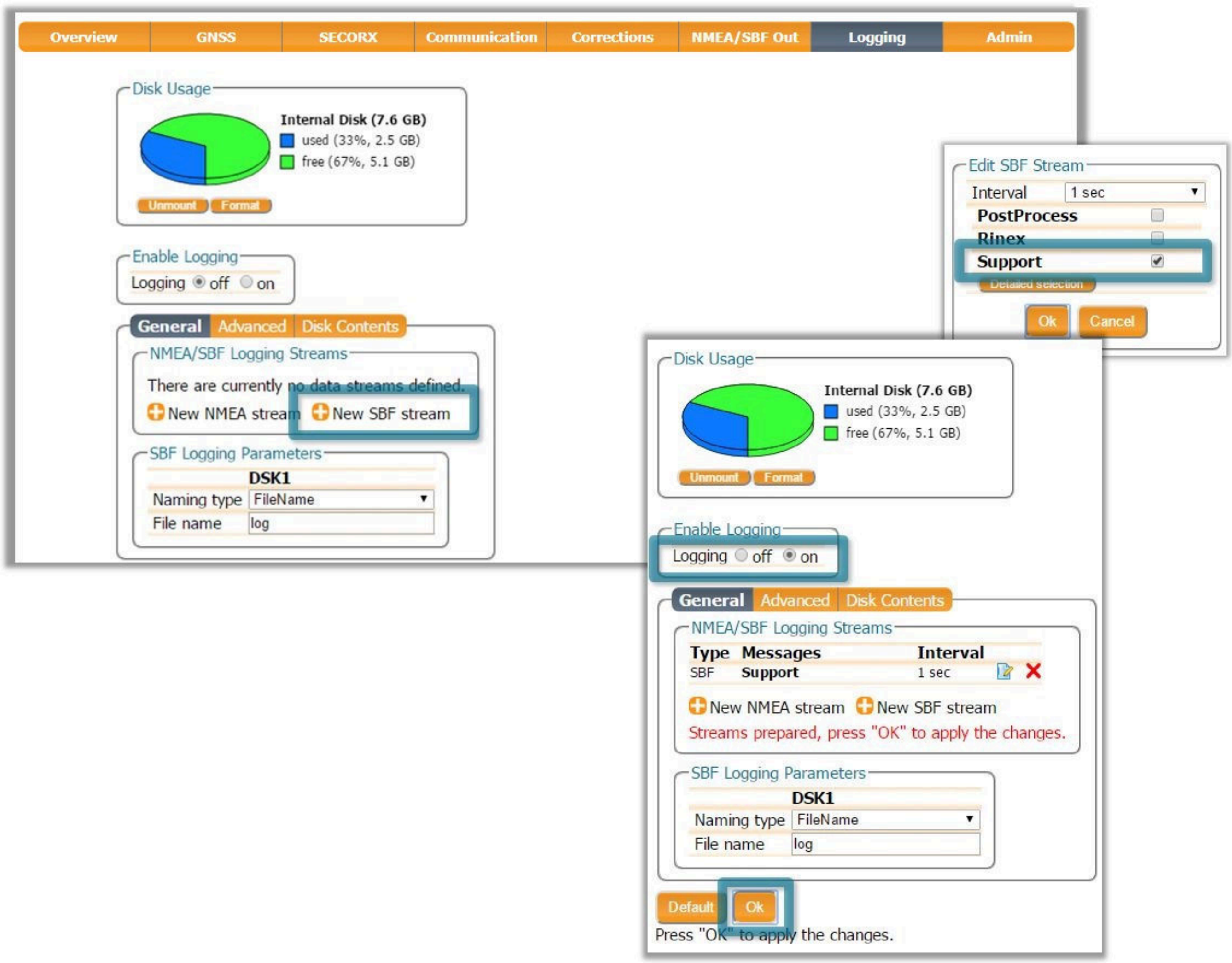


Figure 6-8: Click on **New SBF stream** and select **Support**

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.

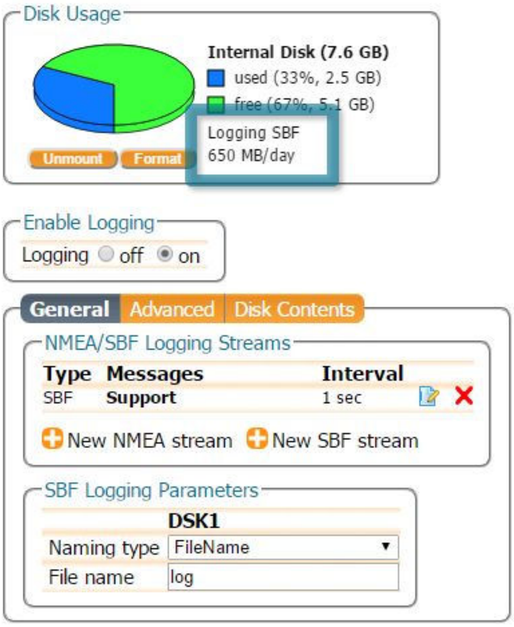


Figure 6-9: The **Logging** window showing an active logging session

Step 2: Downloading the logged SBF file

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

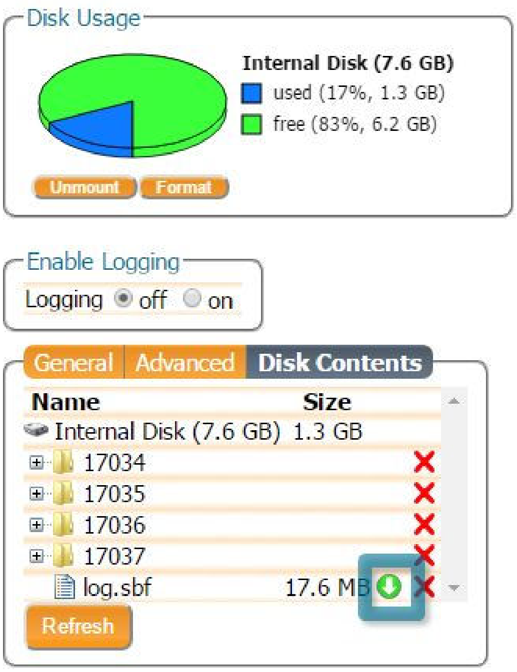


Figure 6-10: Click the icon next to the file you want to download

6.5 Activity logging

The AsteRx-U 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.

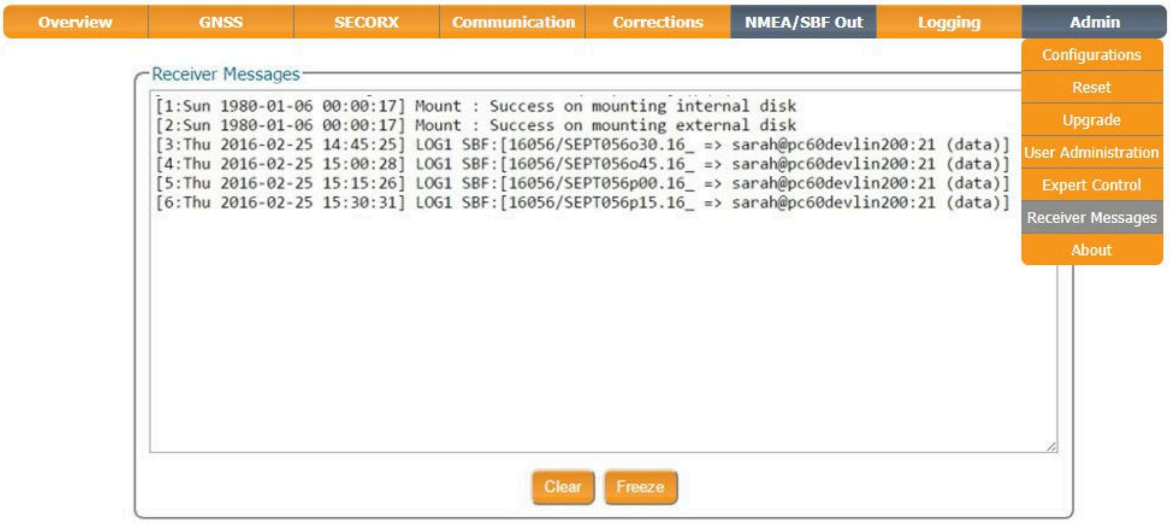


Figure 6-11: Events reported by the AsteRx-U in the **Receiver Messages** window

7 Receiver Administration Operations

7.1 How to change IP settings of the AsteRx-U

The IP settings of the AsteRx-U can be configured on the **Ethernet** window of the Web Interface. By default, the AsteRx-U 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.

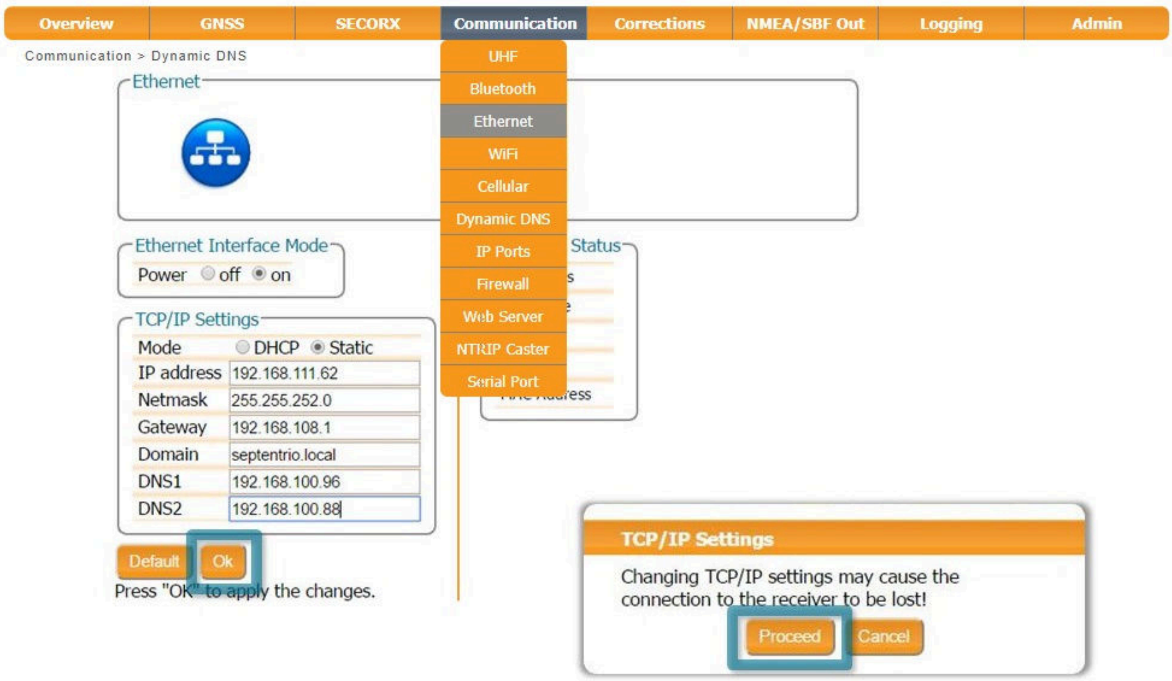


Figure 7-1: Configuring a static IP address

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

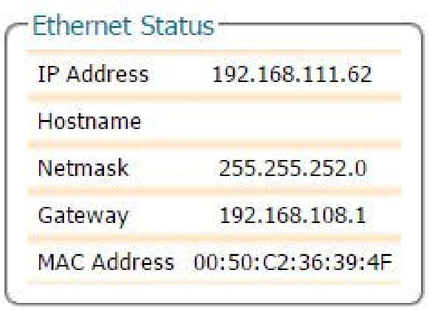


Figure 7-2: TCP/IP settings

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-U 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-U, 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.

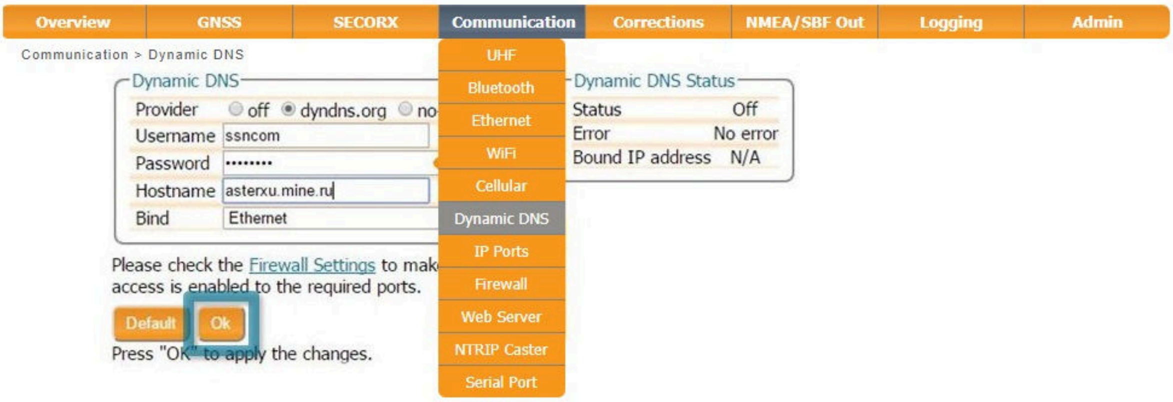


Figure 7-3: Configuring Dynamic DNS

7.3 How to control access using the AsteRx-U Firewall

You can control access to the AsteRx-U 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.

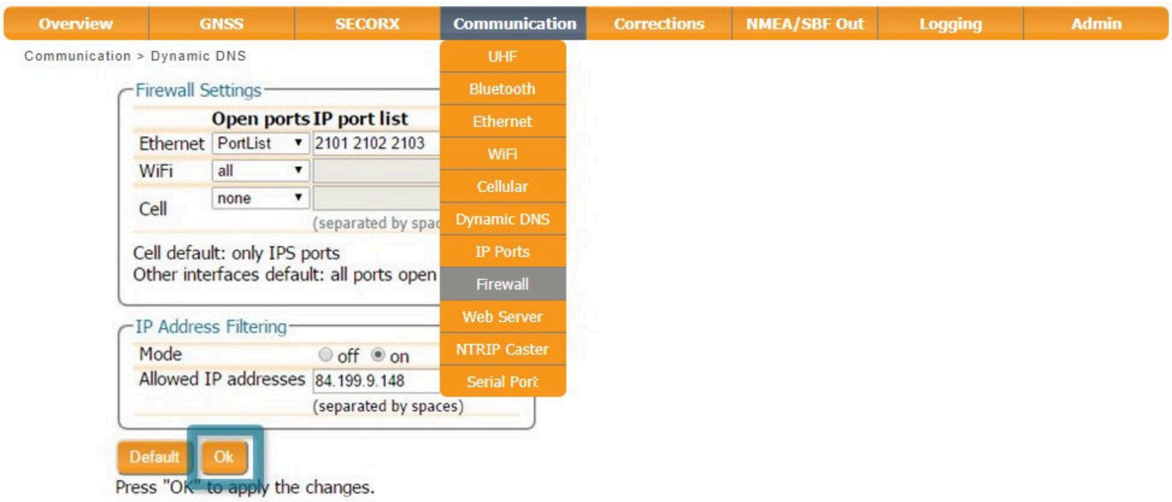


Figure 7-4: Configuring the Firewall of the AsteRx-U

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

The AsteRx-U firmware and permission files both have the extension .suf (Septentrio Upgrade Format) and can be uploaded to the AsteRx-U as shown in the steps below. Firmware upgrades can be downloaded from the Septentrio website and are free for the lifetime of the receiver. Permission files enable additional features on the AsteRx-U and can be purchased via our sales department.

Step 1: Select the .suf file and 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-U 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 .

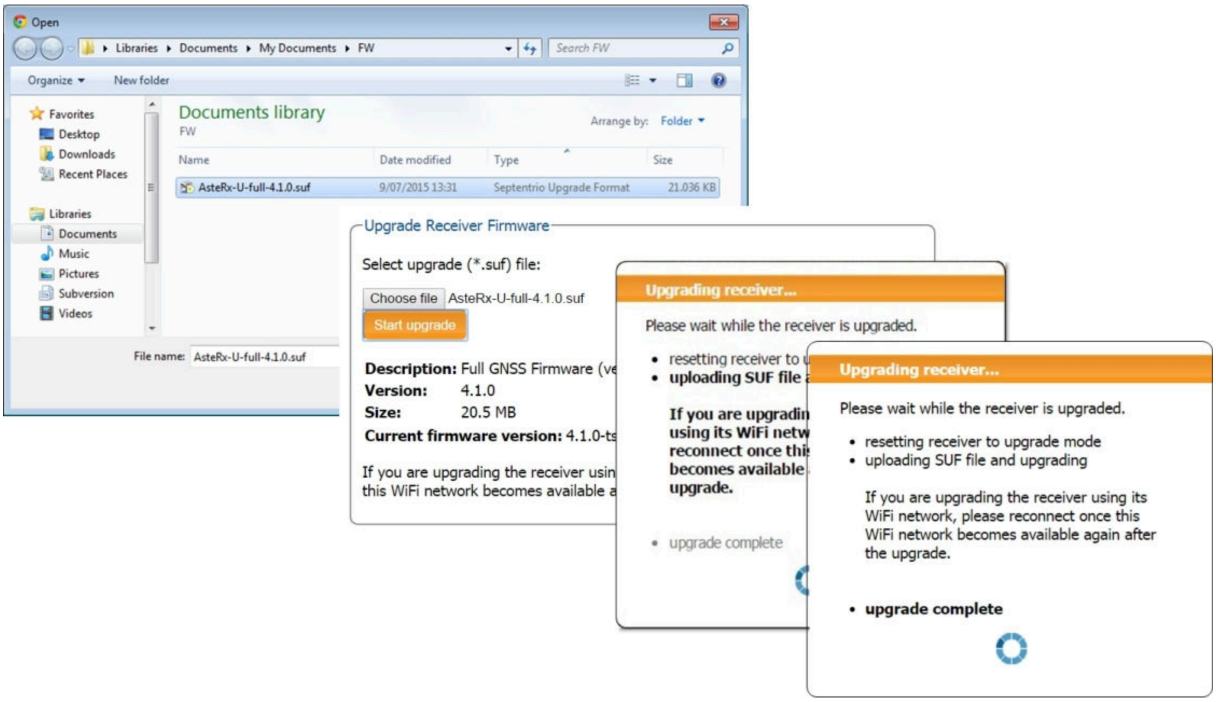


Figure 7-6: The AsteRx-U upgrade window

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-U firmware or permission file has correct, new version as indicated in Figure 7-7.

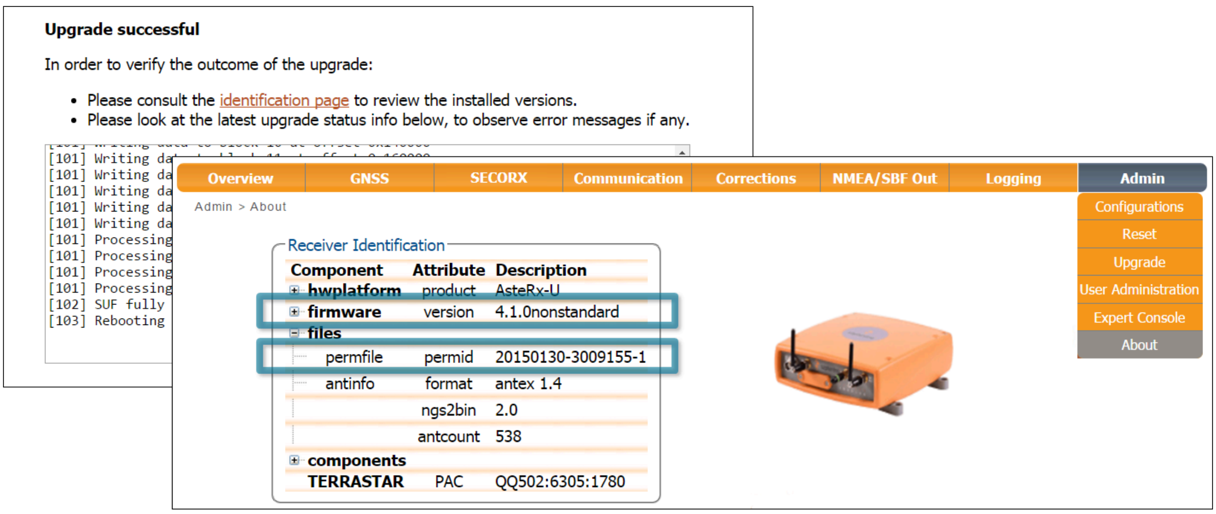


Figure 7-7: Checking the firmware and permission file versions

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

You can set the AsteRx-U 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.

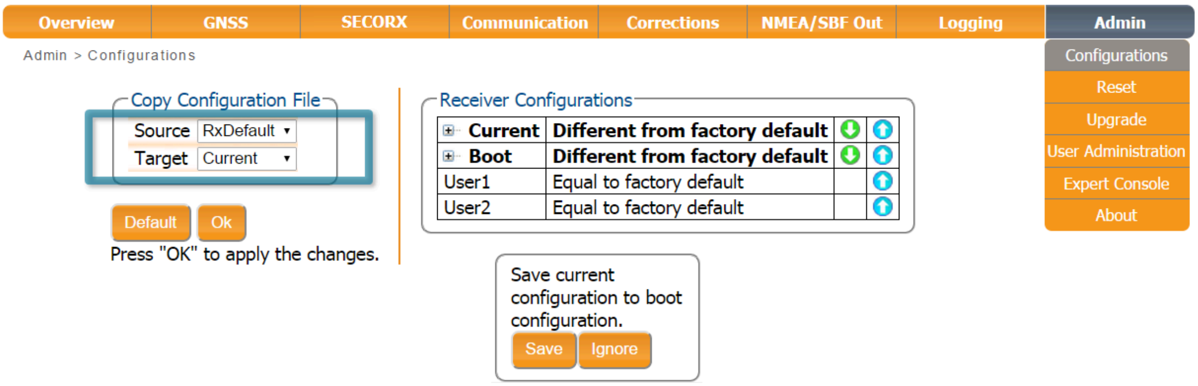


Figure 7-8: Setting the AsteRx-U to the default configuration

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-U

If the AsteRx-U is not operating as expected, a simple reset may resolve matters. The AsteRx-U can be fully power-cycled using the front-panel power button however, 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-U to boot up with its current configuration while a 'hard' reset will use the configuration stored in the boot file.

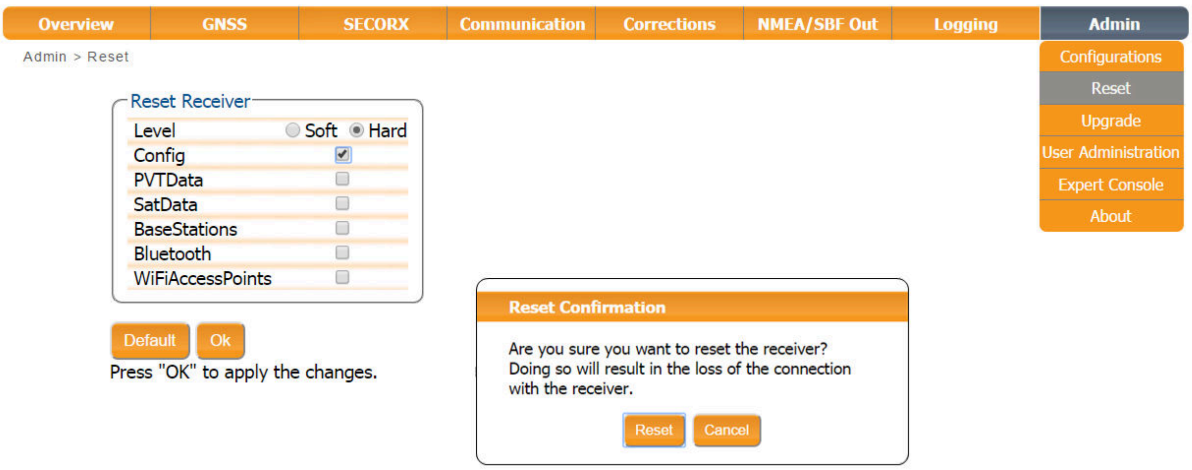


Figure 7-9: Resetting the AsteRx-U configuration to its boot configuration

7.7 How to copy the configuration from one receiver to another

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

Step 1: Downloading the configuration from an AsteRx-U

Click the green download arrow next the configuration you wish to download as shown in Figure 7-10. The configuration will be saved as a .txt file in the same downloads location used by the internet browser.

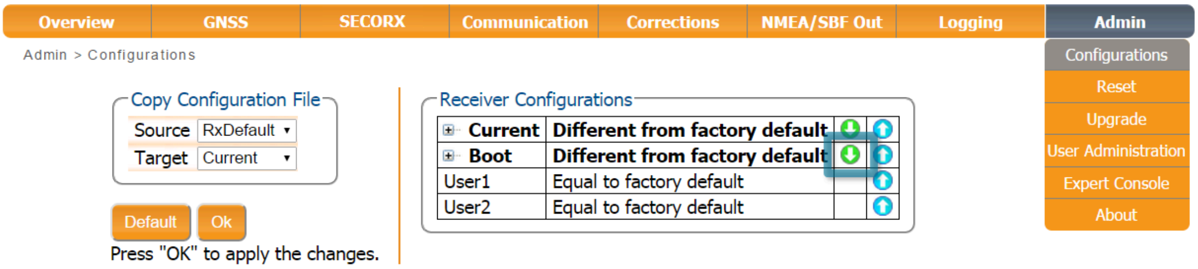


Figure 7-10: Downloading a configuration from an AsteRx-U

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

Click on the blue upload arrow, as indicated in Figure 7-11, to upload a configuration file stored on you PC. In this example, the saved file will be uploaded as the Boot configuration.

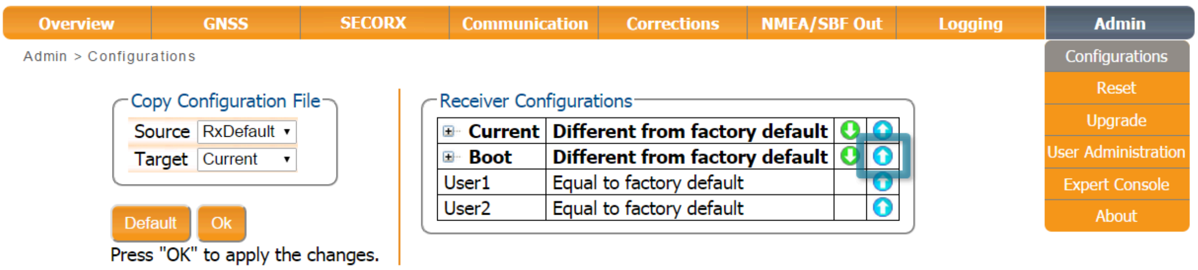


Figure 7-11: Uploading a configuration to an AsteRx-U

Select the configuration file to be uploaded then click on OK on the status pop-up as shown in Figure 7-12.

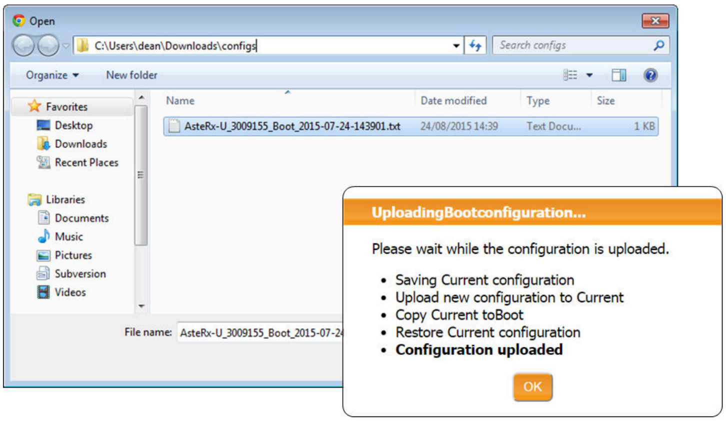


Figure 7-12: Select the configuration file to upload

8 Security

8.1 Default access to the AsteRx-U

You can manage the access that users have to the AsteRx-U 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.

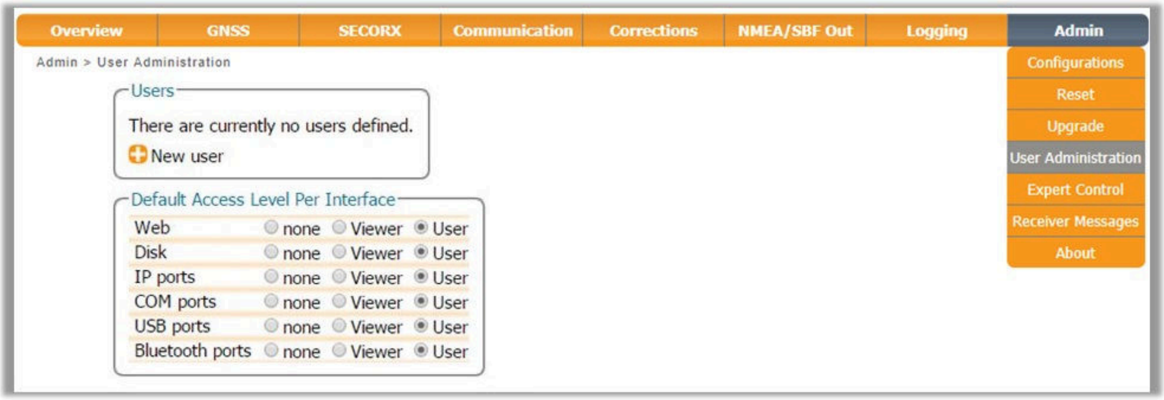


Figure 8-1: The default access levels of the AsteRx-U

8.2 Defining user access to the AsteRx-U

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.

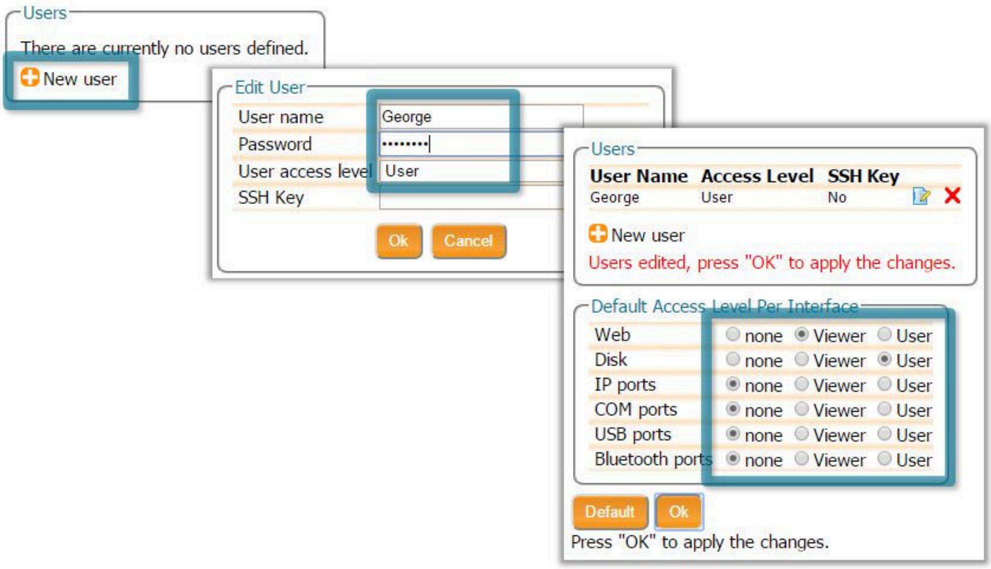


Figure 8-2: Click on '**New user**' and fill in the user details and the default access when not logged in

8.3 User access: an example

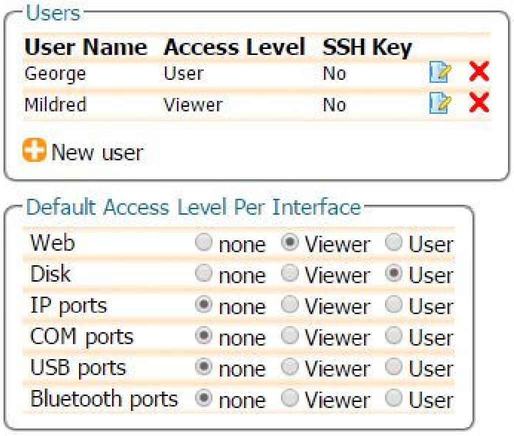


Figure 8-3: An example with two defined users

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.

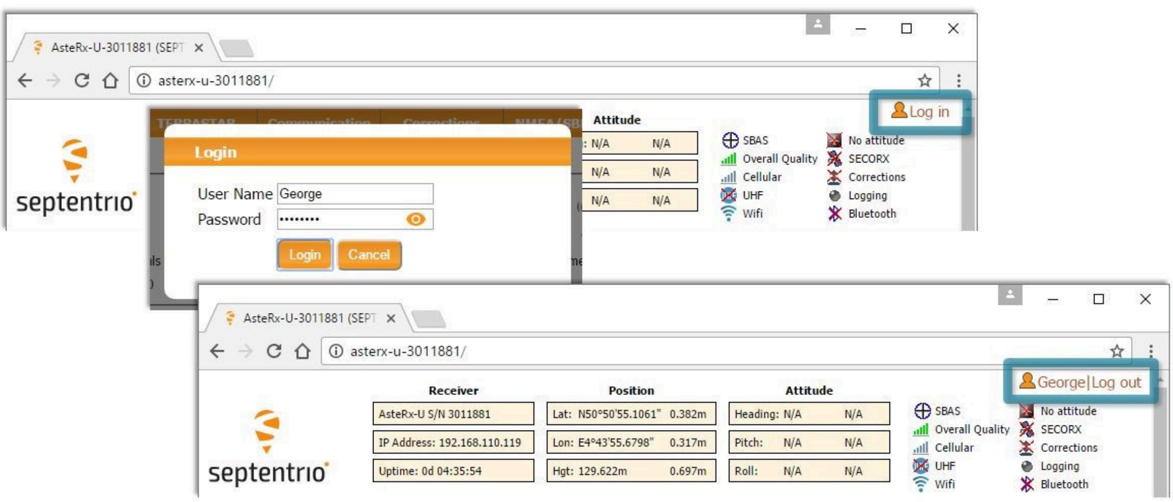


Figure 8-4: Logging in to the AsteRx-U web interface

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-U. 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.

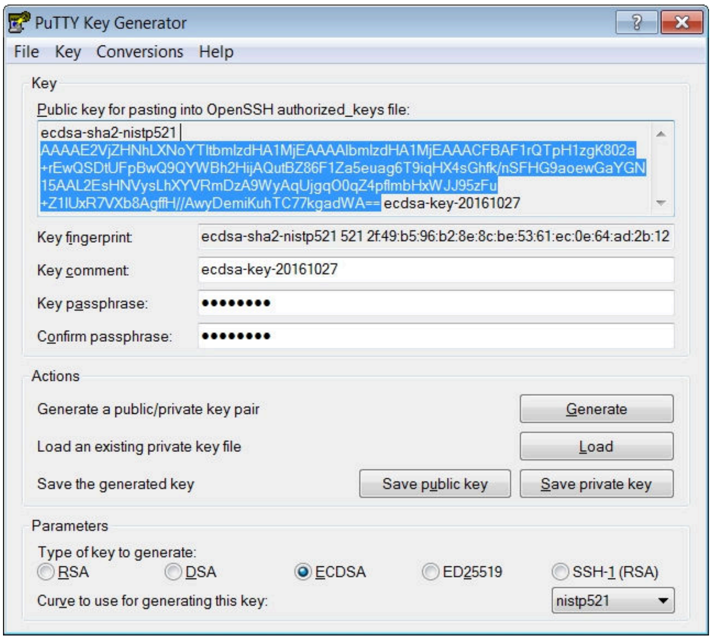


Figure 8-5: Generating SSH keys using the PuTTY Key Generator. The public key is highlighted.

The generated public key is the highlighted text that can be pasted directly into the **SSH Key** field of the AsteRx-U 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 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.

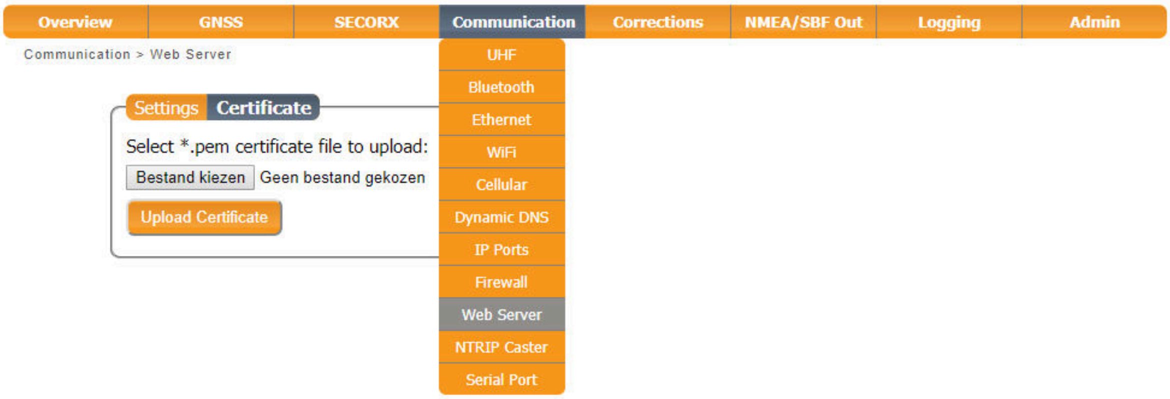


Figure 8-7: Uploading a certificate to the receiver

9 Appendix

9.1 Rear-panel port descriptions

9.1.1 PWR

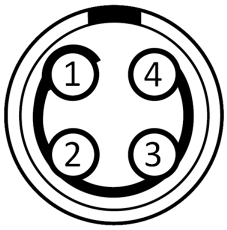


Figure 9-1: 4-pin female socket pin-numbering guide as viewed end on. Start counting at pin indicated by bold semi-circle and follow the line in an anti-clockwise direction. This socket can be paired with a LEMO multipole male connector of type 0B.

PIN #	Name	Comment
1	Power_IN	power input, 9 to 36 VDC. Single power input with
2	Power_IN	PINs 1 and 2 shorted together internally.
3	Ground	
4	Ground	

9.1.2 PPS/GPO

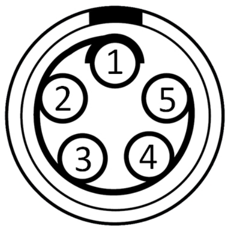


Figure 9-2: 5-pin female socket pin-numbering guide as viewed end on. Start counting at pin indicated by bold semi-circle and follow the line in an anti-clockwise direction. This socket can be paired with a LEMO multipole male connector of type 0B.

PIN #	Name	Comment
1	Ground	
2	PPS	5V, Zout = 50Ω, 50mA. The pulse duration is 1.2ms.
3	Ground	
4	GPO	reserved
5	Ground	

9.1.3 Event/GP1

Figure 9-3: 7-pin female socket pin-numbering guide as viewed end on. Start counting at pin indicated by bold semi-circle and follow the line in an anti-clockwise direction. This socket can be paired with a LEMO multipole male connector of type 0B.

PIN #	Name	Comment
1	GPI 1	reserved
2	Event A	First EVENT input (Max. V_{IL} = 1V, Min. V_{IH} = 2V, Max. V_{IH} = 24V, 15 KΩ pull-down)
3	Event B	Second EVENT input (Max. V_{IL} = 1V, Min. V_{IH} = 2V, Max. V_{IH} = 24V, 15 KΩ pull-down)
4	Ground	
5	nRST_IN	Reset signal 3.3V-LVTTL, 5V TTL input. System is reset if the line is pulled low (<0.6 V)
6	GPI 2	reserved
7	Ground	

9.1.4 COM2

Figure 9-4: 9-pin female socket pin-numbering guide as viewed end on. Start counting at pin indicated by bold semi-circle and follow the line in an anti-clockwise direction. This socket can be paired with a LEMO multipole male connector of type 0B.

PIN #	Name	Comment
1	RTS2	Serial COM 2 RTS line
2	Ground	
3	5V output	5V DC output (500 mA max.)
4	RS232	reserved for future RS422 selection
5	Not connected	
6	Rx2	Serial COM 2 receive line
7	Tx2	Serial COM 2 transmit line
8	CTS2	Serial COM 2 CTS line
9	Ground	

9.1.5 COM1/COM3/Host USB

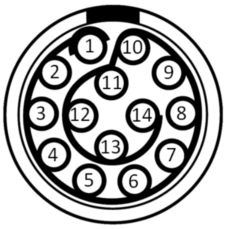


Figure 9-5: 14-pin female socket pin-numbering guide as viewed end on. Start counting at pin indicated by bold semi-circle and follow the line in an anti-clockwise direction. This socket can be paired with a LEMO multipole male connector of type 1B.

The USB Host feature will only become fully functional in later firmware versions.

PIN #	Name	Comment
1	USBH_VB	reserved
2	USBH_DP	reserved
3	USBH_DM	reserved
4	not connected	
5	Tx3	Serial COM 3 transmit line
6	Rx3	Serial COM 3 receive line
7	not connected	
8	Rx1	Serial COM 1 receive line
9	not connected	
10	Tx1	Serial COM 1 transmit line
11	Ground	
12	not connected	
13	not connected	
14	Ground	

9.1.6 Ethernet/USB

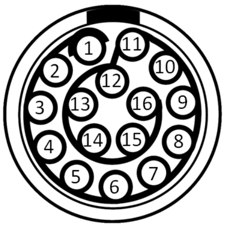


Figure 9-6: 16-pin female socket pin-numbering guide as viewed end on. Start counting at pin indicated by bold semi-circle and follow the line in an anti-clockwise direction. This socket can be paired with a LEMO multipole male connector of type 1B.

PIN #	Name	Comment
1	Ground	
2	RXP	Ethernet 10/100 RX+
3	RXN	Ethernet 10/100 RX-
4	TXP	Ethernet 10/100 TX+
5	TXN	Ethernet 10/100 TX-
6	USB_DP	USB 2.0 data signal positive D+
7	USB_DM	USB 2.0 data signal positive D-
8	USB_VBUS	USB Power. Cannot be used to power the receiver.
9	reserved	
10	reserved	
11	not connected	
12	Ground	
13	Ground	
14	Ground	
15	Ground	
16	Ground	

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_P	GMSK	always on	4800 bps	9600 bps
TRIMTALK450S_T	GMSK	always on	4800 bps	9600 bps