



S321 Smart Antenna

User's Guide

Part No. 875-0357-D Rev. A1

Environmental

Temperature – operating -30°C to +60°C

Temperature – storage -40°C to +80°C

Humidity MIL-STD-810F Method 5-7.4

Vibration MIL-STD-810FG Method. 514.6E-1

Loose cargo MIL-STD-810F FIG. 514.5C-5

Regulatory Compliance

CE Compliance

- IEC 60950-1: 2005
- EN 301 113-1 / EN 301 113-2
- EN 301 489-1 v1.9.2
- EN301 489-3 v1.6.1
- EN301 489-7 v1.3.1
- EN 301489-17 v2.2.1
- EN301 489-24 v1.5.1
- EN55022:2010
- EN55024:2010
- EN 300440-1 v1.6.1 / EN 300440-2 v1.4.1
- EN 300 328 V1.9.1
- EN 301 511 v9.0.2
- EN 301 908-1 v6.2.1 / EN 301 908-2 v6.2.1
-

FCC Compliance

- FCC Part 15, Subpart B
- FCC Part 15, Subpart C :2015
- FCC Part 15, Subpart C :2014
- FCC Part 2
- FCC Part 22H
- FCC Part 24E

IC Compliance

- ICES-003:2012 Issue 5
- RSS-247 Issue 1
- RSS-GEN Issue 4
- RSS 132 Issue 3
- RSS 133 Issue 6

Certifications

S321 UHF

- Model: S321 UHF
- FCC ID: ZC8S321UHF
- IC: 9586A-S321UHF

S321 Non-UHF

- Model: S321 Network
- FCC ID: ZC8S321Network
- IC: 9586A-S321Network

⚠ WARNING: If your S321 is equipped with a 400 MHz radio you may be required to obtain a valid radio license for your jurisdiction.

Only set the radio to the frequency and power you are licensed to use at your location.

USA- Federal Communication Commission (FCC)

Radio frequency radiation exposure Information:

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment.

GSM Mode

- *When using the GSM to receive correction data, this equipment should be installed and operated with a minimum distance of 20 cm between the radiator and your body.*

UHF Radio Mode

- *When using the 400 MHz radio, M3-TR4 from Satel™, this equipment should be installed and operated with a minimum distance of 24 cm.*

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

Modifications not expressly approved by Hemisphere GNSS could void the user's authority to operate the equipment.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation.

This equipment generates, uses, and can radiate radio frequency energy. If not installed and used in accordance with the instructions, it may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.

If this equipment does cause harmful interference to radio or television reception, which can be determined by tuning the equipment off and on, the user is encouraged to try and correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the distance between the equipment and the receiver.
- Connect the equipment to an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Caution: Exposure to Radio Frequency Radiation.

This device must not be co-located or operating in conjunction with any other antenna or transmitter.

Canada - Industry Canada (IC)

This device complies with RSS 210 of Industry Canada. Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of this device.

L' utilisation de ce dispositif est autorisée seulement aux conditions suivantes: (1) il ne doit pas produire d'interférence et (2) l' utilisateur du dispositif doit être prêt à accepter toute interférence radioélectrique reçue, même si celle-ci est susceptible de compromettre le fonctionnement du dispositif.

Caution: Exposure to Radio Frequency Radiation.

The installer of this radio equipment must ensure that the antenna is located or pointed such that it does not emit RF field in excess of Health Canada limits for the general population; consult Safety Code 6, obtainable from Health Canada's website <http://www.hc-sc.gc.ca/rpb>.

Europe – Declaration of Conformity

This device is in compliance with the essential requirements of the R&TTE Directive 1999/5/EC.

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Hemisphere GNSS products may be covered by one or more of the following U.S. Patents:

6,111,549	6,397,147	6,469,663	6,501,346	6,539,303
6,549,091	6,631,916	6,711,501	6,744,404	6,865,465
6,876,920	7,142,956	7,162,348	7,277,792	7,292,185
7,292,186	7,373,231	7,400,956	7,400,294	7,388,539
7,429,952	7,437,230	7,460,942		

Other U.S. and foreign patents pending.

Notice to Customers

Contact your local dealer for technical assistance. To find the authorized dealer near you:

Hemisphere GNSS
8515 East Anderson Drive
Scottsdale, Arizona 85255
Phone: 480-348-6380
Fax: 480-270-6070
precision@hgnss.com
www.hgnss.com

Technical Support

If you need to contact Hemisphere GNSS Technical Support:

8515 East Anderson Drive
Scottsdale, Arizona 85255
Phone: 480-348-6380
Fax: 480-270-6070
techsupport@hgnss.com

Documentation Feedback

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Chapter 1: Introduction

Product Overview and Features

What's Included

Overview and Features

The S321 is an all-new multi-GNSS, multi-frequency smart antenna designed by and for surveyors. The S321 delivers robust performance and high precision in the field in a compact and rugged package. With multiple wireless communications ports and an open GNSS interface, the S321 can be used in a variety of operating modes in a network or crew. Use the S321 as a precise base station sending RTK or Atlas L-band corrections to your existing rover network. Turn S321 into a lightweight and easy to use rover by connecting it to your base via UHF radio or Wi-Fi network. The built-in web UI is used to control, manage, and upgrade the S321 with new firmware and activations. S321 is Athena enabled and Atlas capable.



Athena RTK

Athena RTK (Real time kinematic) technology is available on Eclipse-based GNSS receivers. Athena RTK requires the use of two separate receivers: a stationary base station (primary receiver) that broadcasts corrections over a wireless link to the rover (secondary receiver). The localized corrections are processed on the rover to achieve superior accuracy and repeatability. Performance testing has shown positioning accuracy at the centimeter level.

Athena RTK has the following benefits:

- Improved Initialization time - Performing initializations in less than 15 seconds at better than 99.9% of the time
- Robustness in difficult operating environments - Extremely high productivity under the most aggressive of geographic and landscape oriented environments
- Performance on long baselines - Industry-leading position stability for long baseline applications

Atlas L-Band

Atlas L-band corrections are available worldwide. With Atlas, the positioning accuracy does not degrade as a function of distance to a base station, as the data content is not composed of a single base station's information, but an entire network's information.

Atlas L-band is Hemisphere's industry leading correction service, which can be added as a subscription. Atlas L-Band has the following benefits:

- Positioning accuracy - Competitive positioning accuracies down to 2 cm RMS in certain applications
- Positioning sustainability - Cutting edge position quality maintenance in the absence of correction signals, using Hemisphere's patented technology
- Scalable service levels - Capable of providing virtually any accuracy, precision and repeatability level in the 2 to 100 cm range
- Convergence time - Industry-leading convergence times of 10-40 minutes

S321 is supported by our easy-to-use Atlas Portal (www.atlasgnss.com), which empowers you to update firmware and enable functionality, including Atlas subscriptions for accuracies from meter to sub-decimeter levels.

For more information about Athena RTK, see: <http://hemispheregnss.com/Technology>

For more information about Atlas L-band, see: <http://hemispheregnss.com/Atlas>

⚠ WARNING: If your S321 is equipped with a 400 MHz radio you may be required to obtain a valid radio license for your jurisdiction.

What's Included

The S321 is available as a single unit or two units (base/rover setup). Figure 1-1 shows the parts included in the single unit kit and Table 1-1 lists the parts included in both kits.



Figure 1-1: S321 single unit kit

Table 1-1: S321 parts list

Item	Item	Qty	Part Number
1a*	S321 UHF Smart Antenna	1	752-0006-0
1b*	S321 Network Smart Antenna	1	752-0007-0
2	Smart Battery	2	427-0058-0
3	Battery Charger	1	427-0059-0
4	Battery Charger Adapter	1	427-0060-0
5	5-pin LEMO to Power/Radio Cable	1	054-0172-0
6	5-pin LEMO to Power Clips (external power)	1	054-0171-0
7	7-pin LEMO Data Cable (USB and Serial)	1	051-0390-0
8	UHF External Antenna	1	150-1024-0
9	GSM/WCDMA External Antenna	1	150-1023-0
10	Quick Release 5/8" Mounting Adapter	1	699-0015-0
11	Tape Measure (not shown)	1	699-0011-0
12	Carry Case (not shown)	1	750-0183-0
13	4 GB DSD Card (not shown)	1	750-1168-0

*= The S321 kit comes as either a UHF version or a network version. Only one device is included per kit.



Chapter 2: Installation

Ports and Connections

Installing Batteries

Installing UHF and GSM Antenna

Installing on a Tribrach

Installing on a Range Pole

Connecting to a Power Source

Connecting to an External Device

Turning S321 On/Off

Inserting and Removing the SD and SIM Card

Ports and Connections

All ports and connections are located on the bottom of the unit, as shown in Figure 2-1. Table 2-1 provides additional information about each port/connection.



Figure 2-1: S321 ports and connectors

Table 2-1: S321 ports and connections

Port	What to connect
7-pin Data Port (LEMO)	Data cable for serial or USB (Item 7 in Table 1-1 on page 4)
5-pin Power/Radio Port (LEMO)	External Power and Radio devices (Item 5 and 6 in Table 1-1 on page 4)
GSM antenna connector	External GSM antenna (Item 9 in Table 1-1 on page 4)
UHF Antenna Connector	External antenna (Item 8 in Table 1-1 on page 4)
Mounting hole	Pole or tripod mount

Installing/Connecting S321

Installing Batteries

The S321 allows for one battery (11.1 V - 37.74 Wh) to be installed at a time. When installing the battery, ensure the contact points are facing up towards the “Hemisphere” logo. Slide the battery into the designated spot until the “battery tension bar” clicks into place. The projected run time of the battery is 6 hours, while running in UHF receive mode. The S321 kit provides two batteries, as noted in the “What’s Included?” portion of this user guide.



Figure 2-2: Battery installation

Installing UHF and GSM Antennas

To install the UHF portion of the S321 antenna, locate the UHF antenna (150-1024-0) from the kit list under “What’s Included.” Insert the connector end of the UHF antenna to the S321. To install the GSM portion of the S321 antenna, locate the GSM antenna (150-1023-0) from the kit list under “What’s Included.” Insert the connector end of the GPRS antenna and rotate clockwise to secure the antenna to the S321.



Figure 2-3: Installing UHF and GSM Antennas

Installing S321 on a Tribrach

The S321 mounts flush to the tribrach, by securing the 5/8" metal mounting portion of the S321 to the standard 5/8" male portion of the tribrach. Using approximately 3-4 ft./lbs. of torque, secure the S321 onto the mount in a clockwise rotation.



Figure 2-4: Installing S321 on a Tribrach

Quick Release Installation and Overview

The quick release attaches to the 5/8" bottom mounting portion of the S321. This adapter then connects to the top of a pole mount or the top of the tribrach mount. the design allows the S321 to be removed from either mounting point at the push of a button.



Figure 2-5: Quick Release Adapter

Vertical Extension for the Base

The vertical extension is a 25cm aluminum pole that mounts to the top of a tripod tribrach. This allows the S321 to have a similar height to the rover and also provides better access to the bottom of the S321 unit. Having more access to the bottom of the S321 makes for easier cable connections and adjustments to UHF or GPRS antennas.



Figure 2-6: Vertical base Extension

Installing the S321 on a Range Pole

using the standard 5/8" mount on the bottom of the S321, you can secure the unit to a field standard 5/8" range pole. the S321 should be placed carefully on the range pole, to ensure cross-threading does not occur, while rotating the unit in a clockwise direction. Apply approximately 3-4 ft./lbs. of torque to the unit.



Figure 2-7: Range Pole Installation

Connecting to a Power Source

The S321 has two main power sources. The first being an internal, removable battery which is described in the earlier portion of this chapter. The second source of power is the external power cable (054-0171-0). The 5-pin (Lemo) connector allows 9 to 24V of power into the S321. Connecting external power maybe a reasonable solution when setting up a permanent base or setting a long term base in a remote area.



Figure 2-8: External Power Connector

Connecting to an External Device

Using the web UI to enable the S321 to receive outside communications, requires setting the S321 unit to **"OEM"** mode in the web UI. This can be accomplished by, selecting **"Settings"** in the top right portion of the web UI. Using your finger or mouse, locate the **"Device Configuration"** tab at the top of the **"Settings"** screen. Under the **"Direct Link Mode"** drop down list, select the **"OEM"** mode. After making the **"OEM"** selection, press the green **"Save"** button in the bottom of the **"Settings"** screen. Once saved, the S321 is ready to communicate over the 7-pin data port external DB9 or USB cable. The S321 has a standard baud rate of 115,200 when talking in OEM mode. Please make sure to set any interface or potential programs to 115,200 when talking to the S321. Directly connecting the external device to the S321 requires the use of the 7-pin (Lemo) data port, on the bottom of the unit. The external data cable (051-0390-0) allows you to connect via a DB9 serial connection.



Figure 2-9: External Device Connector

Using the on Device FN and I Keys

The on device menu can be navigated by using the on device keys. The **FN** key allows you to scroll through each item on the device menu display. The **I** key acts as an enter key for selecting to required menu option. The **I** key also acts as a power key when the menu option of “power” is selected. (See turning the S321 on/off below).



Turning the S321 On/Off

It has powers on/off the receiver function and has a confirm function.

- **Power on receiver:** Press **I** key for 1 second, the device will beep three times.
- **Power off receiver:** Press **I** key for 0.5 seconds in order to navigate to the main menu screen. Once on the main menu screen push the **FN** key to work the menu box to the **I** icon. When the box is located over the **I** icon, press the **I** key for 0.5 seconds to turn the device off.

Note: If you hold the **I** button for longer than 0.5 seconds, the device will go into self-check mode. (See “Self-Check” below for more information).

Self-Check: It is a procedure for verifying the correct working of the instrument devices. The program is mainly to predict whether the receiver modules works normal ahead of time or not. The self-checking includes status reviews of GPS, Wi-Fi, Bluetooth, radio, network and sensor, a total of six parts?

Note: The frequency setting of the internal UHF module is set back to factory default on self-test. Please contact your local dealer to obtain the frequency information in your country.

Removing/Inserting the SD Card / SIM Card



Caution: Use electrostatic discharge (ESD) protection, such as by wearing an ESD strap that is attached to an earth ground, before inserting or removing the SIM card on the S321. If an ESD strap is not available then touch a metal object prior to accessing the SIM card holder.

The SD card and the SIM card are only accessible by first opening the battery door, where the:

- The “SIM” card slot is positioned on the left side of the battery opening
- The “SD” card slot is positioned on the right side of the battery opening.

To remove the SD card or SIM card:

1. Open the battery door.
2. Gently push the card in; it will then snap back and slightly out.
3. Remove the card.

Note: When you insert either card make sure the contacts on the card are facing upwards, towards the top of the unit and the side of the card with the notch goes in first.

To insert the SD card or SIM card:

1. Place the card in its appropriate card slot.
2. Gently push the card in until it clicks.
3. Close and secure the battery door.



Upgrading S321 Firmware via Serial Port

Using the web UI to enable the S321 to receive updated firmware for the GNSS board, requires setting the S321 unit to **“OEM”** mode. This can be accomplished by, selecting **“Settings”** in the top right portion of the web UI. Using your finger or mouse, locate the **“Device Configuration”** tab at the top of the **“Settings”** screen. Under the **“Direct Link Mode”** drop down list, select the **“OEM”** mode. After making the **“OEM”** selection, press the green **“Save”** button in the bottom of the **“Settings”** screen. Once saved, the S321 is ready to communicate over the 7-pin data port external DB9 or USB cable. The S321 has a standard baud rate of 115,200 when talking in OEM mode. Directly connecting the external device to the S321 requires the use of the 7-pin (Lemo) data port, on the bottom of the unit. The external data cable (051-0390-0) allows you to connect via a DB9 serial connection. Using Hemisphere's standard RightArm and Autloader firmware tools, the device is ready to be updated. New versions of firmware can be found at www.hgnss.com, under the Resources & Support page.

SD Card Firmware Update

Place the upgrade files under “update” folder of the MicroSD card. Version info must be place after the file name and separated by “_”. The name must follow the naming convention listed below:

Receiver firmware:

S321_update_YYMMDD.bin

YY: Year

MM: Month

DD: Day

e.g. S321_update_160202.bin

OEM board firmware:

P306_OEM_XXXXX.bin

XXXXX: version

e.g. P306_OEM_5.2Aa3.bin

Radio firmware:

SATEL_update_XXXXX.bin

XXXXX: version

e.g. SATEL_update_V07.27.2.0.8.6.bin

3G module firmware:

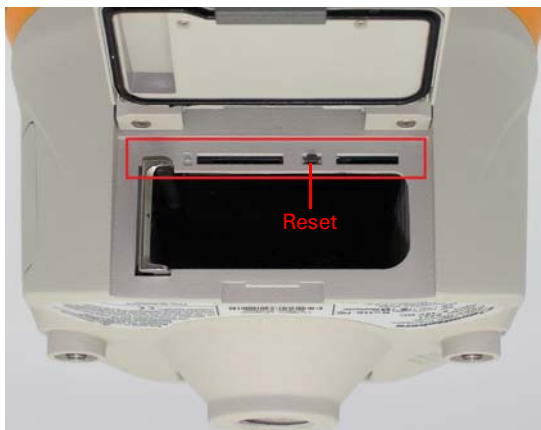
PHS_update_XXXXX.bin

XXXXX: version

e.g. PHS_update_03.001.bin

Resetting the S321

In order to reset the S321, lift the battery door and locate the “Reset” button between the SIM card and SD card slots. The reset button will turn the unit off and automatically restart the unit.





Chapter 3: Setup and Configuration

Control Panel Overview

Connecting via Bluetooth

Connecting via Wi-Fi

Web UI Instructions

Setting-up the Unit

Base Setup

Rover Setup

Downloading Static Data

Control Panel Overview

You operate the S321 using the control panel shown below.

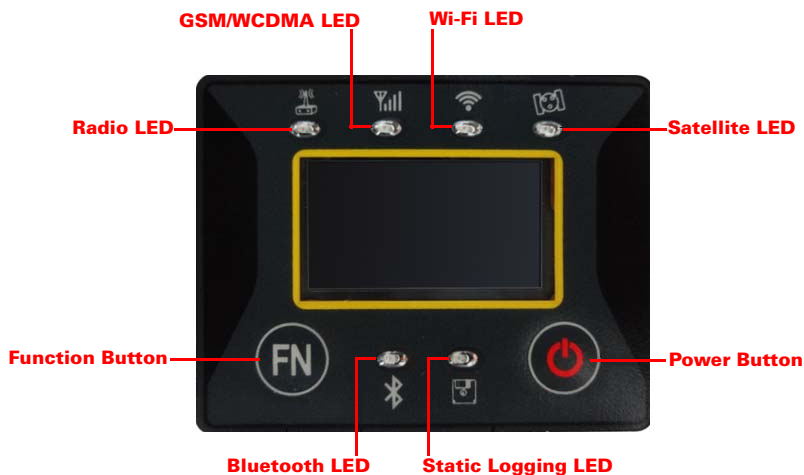


Figure 3-1: Control Panel and Display

Satellite LED (Green)

The LED illuminates and stays a solid green color to indicate a signal/satellite lock has been achieved.



Figure 3-2: Satellite LED

Static LED (Green)

It switches on if the static mode is selected and it starts to blink when the receiver is recording data, with the same frequency of the sample rate.



Figure 3-3: Static LED

Bluetooth LED (Blue)

Once you have connected the receiver with the data controller, this LED will illuminate.



Figure 3-4: Bluetooth LED

Wi-Fi LED (Green)

This indicates the S321 is emitting a Wi-Fi network and is ready to be paired with a Wi-Fi enabled controller or device. By connecting to the S321 device network, you are able to control the S321 via web UI. For more information on the web UI, please see page 21



Figure 3-5: Wi-Fi LED

External Data Link or Internal UHF Radio LED (Green)

The LED is green when the device is selected as an RTK data link, via an external data link or an internal UHF radio link. It begins blinking when the S321 is either transmitting data as a base, or receiving data as a rover.



Figure 3-6: Internal UHF Radio LED

Network LED (Green)

The light is on when the network module is selected as RTK data link. It starts to blink when receiving and transmitting data. (Download in rover mode and upload in base mode)



Figure 3-7: Network LED

Power

Includes t modes of function:

1. LED Display On: Power supply is functioning at full capacity
2. Blinking LEDs and Beeping: Very low power (below 10%)

When the power is below 10%, the LEDs will flash according to sample interval (default is 1 second) and you also hear three beeps every 60 seconds.

Bluetooth Communication

If you have a Bluetooth-enabled device, such as a data collector, you can wirelessly communicate with the S321.

When you attempt to connect the S321 to a Bluetooth-enabled device, such as a hand-held data collector, the following S321 Bluetooth information appears on the device:

S321 XXXXXX

where “XXXXXX” is the serial number

To complete the connection you must use the correct PIN/Passkey, which is 1234.

Table 3-1 describes the Bluetooth status LED options.

Table 3-1: Bluetooth LED status

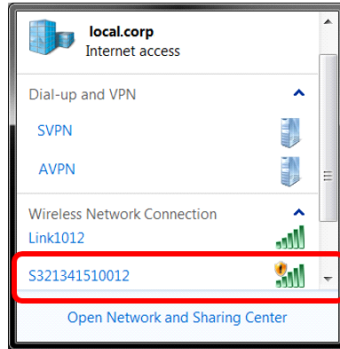
LED Colors	Meaning
 Off	Bluetooth inactive
 Blue	Active Bluetooth connection
 Blue blinking/pulsing	Active Bluetooth connection and transmitting/receiving data

Hemisphere Web UI

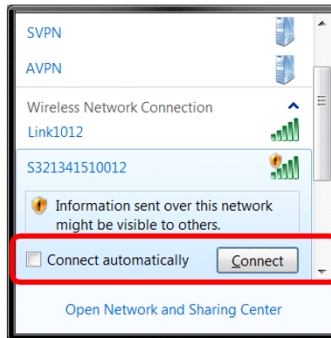
The web UI can work on any PC, Tablet, or Phone that has Wi-Fi network capabilities.

Initial Setup

Using the Windows Wi-Fi network, locate the Wireless Network Connection labeled S321XXXXXXXXXX.



If you want this network to automatically connect, select the “Connect automatically” check box before pushing the “Connect” button. If not, click on the “Connect” button.



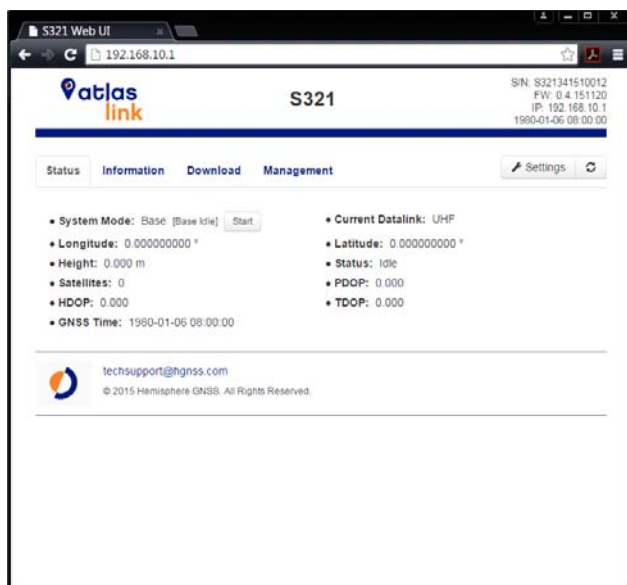
Once connected to your device. Type or copy the following IP address into your URL bar: **http://192.168.10.1/**

The web UI will prompt you for a user name and password. The default user name and password are:

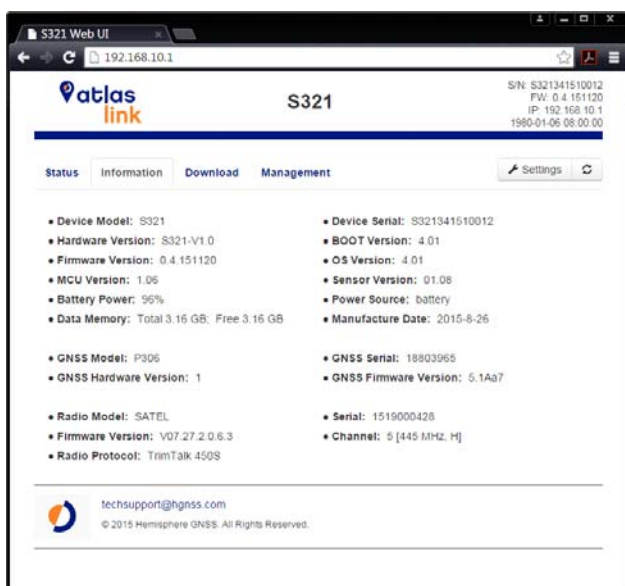
- **User Name:** admin
- **Password:** s321'

Web UI Startup

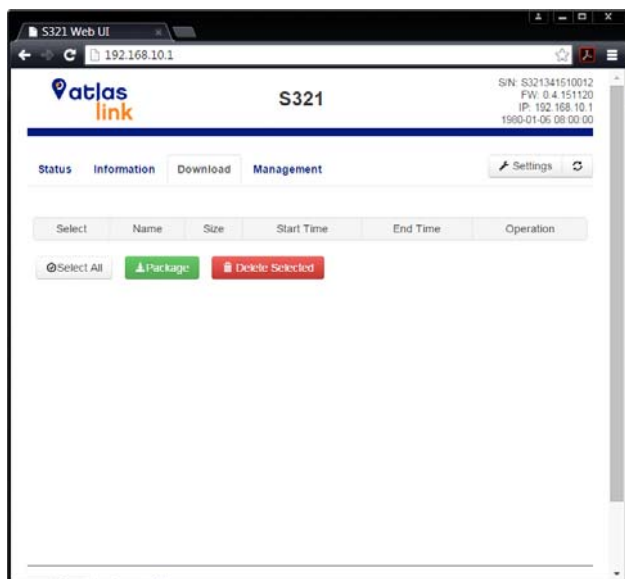
The **“Status”** tab, provides general GNSS information including System mode, Latitude, Longitude, and Height.



The **“Information”** tab, contains device and module information, in addition to current software and firmware versions.



The **“Download”** tab, allows you to log and review multiple data files from the on-board memory of the device.



The **“Management”** tab, provides access to the firmware update tools, a terminal to register authorization codes, and password customization in order to properly secure your device moving forward.

Install New Firmware:

This feature allows you to update the menu application software. Once the correct software is selected under the “choose file” browser, the “Upload” button initiates the update procedure and restarts the S321 device.

Registration:

This displays the expiration date of different features which have been subscribed to the S321. More specifically, if the S321 has been activated for Atlas, the appropriate Atlas expiration date will be displayed under this field. In addition, the ability to update the S321 with new subscriptions is available under the “AuthCode” field. Enter the new Atlas code and the device will automatically update.

Security:

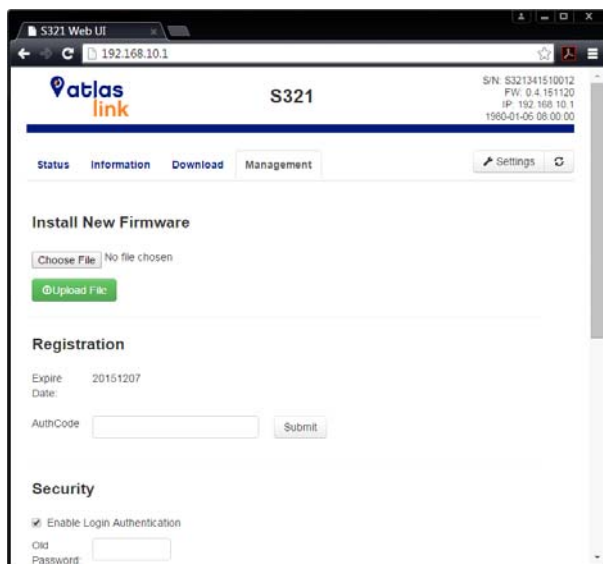
The security field allows the user to enable or disable login requirements. The user is able to reset or customize a new password for their device. By filling in the required fields to change the password, Old Password, New Password and Confirm Password.

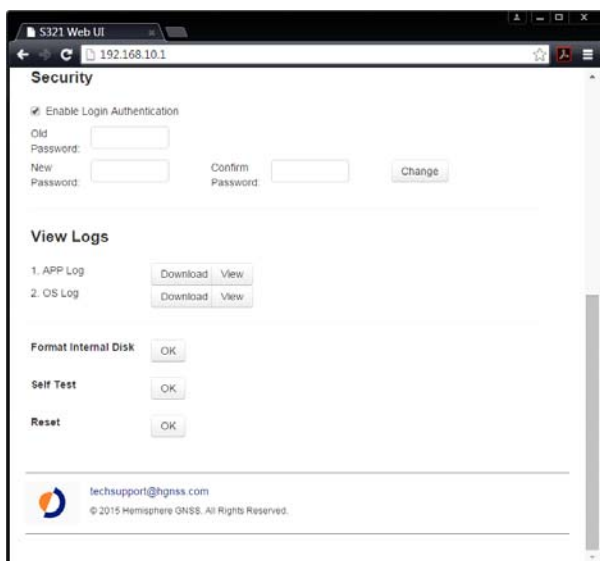
View Logs:

The view logs field allows you to track any activity at the application and OS level. This is important when troubleshooting any issues.

Formatting / Self Test / Reset:

The Format internal disk button allow you to reformat the internal hard drive in the S321. Self test, provides an application review to ensure the device functioning properly (See self-check for more information). Reset, initiates a complete device shut down. Creating a hard reset to the device and stopping any application activity. (See resetting the S321 for more information).

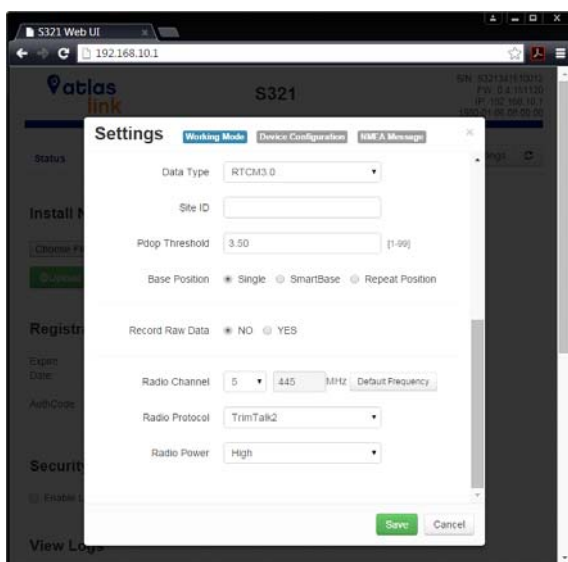
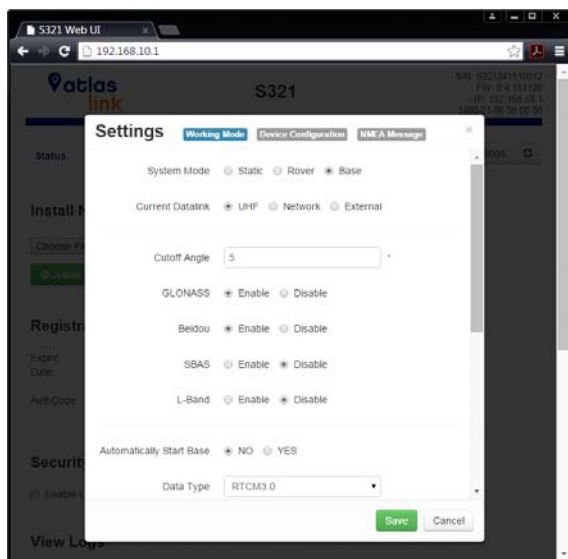




Web UI Settings

Working Modes:

Base/UHF



Base/Network

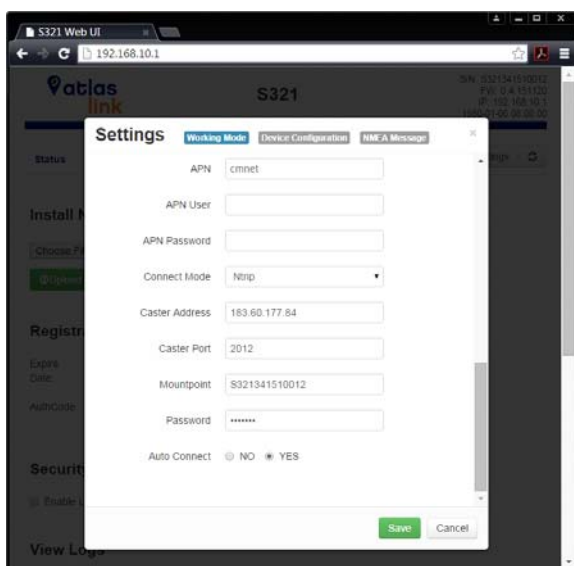
The image displays two screenshots of the S321 Web UI, showing the Settings dialog box. The top screenshot shows the 'Working Mode' tab, and the bottom screenshot shows the 'Device Configuration' tab.

Working Mode Settings:

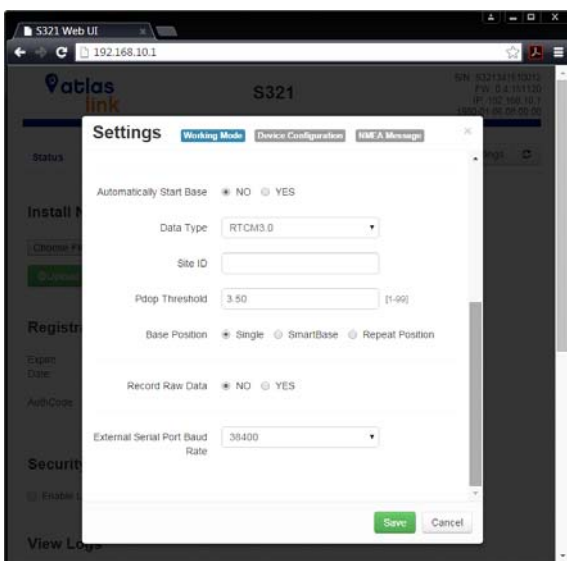
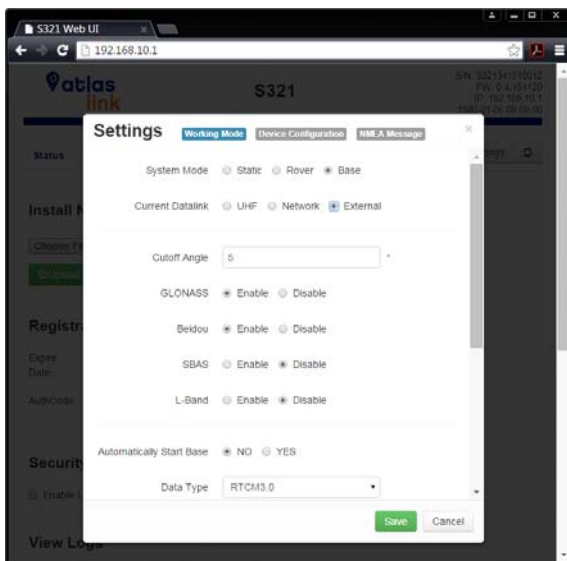
- Data Type: RTCM3.0
- Site ID: [Empty]
- Pdp Threshold: 3.50 [1-99]
- Base Position: ☒ Single ☐ SmartBase ☐ Repeat Position
- Record Raw Data: ☒ NO ☐ YES
- Radio Channel: 5 [445 MHz Default Frequency]
- Radio Protocol: TrimTalk2
- Radio Power: High

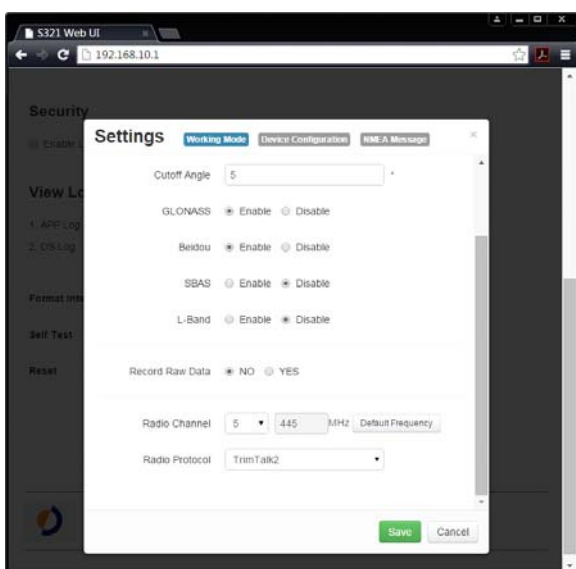
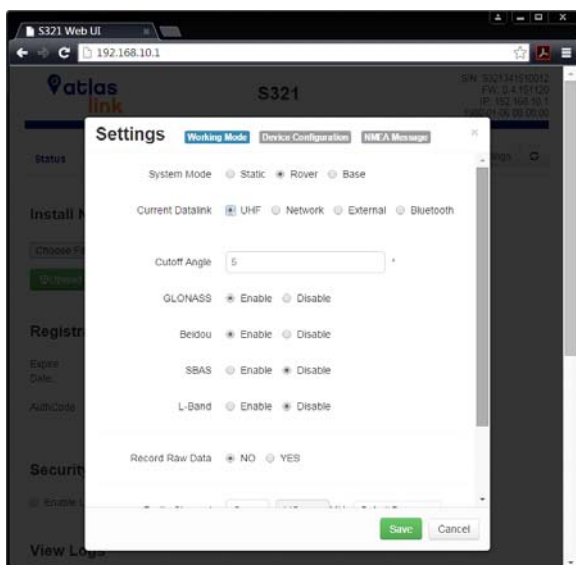
Device Configuration Settings:

- APN: cmnet
- APN User: [Empty]
- APN Password: [Empty]
- Connect Mode: Ntrip

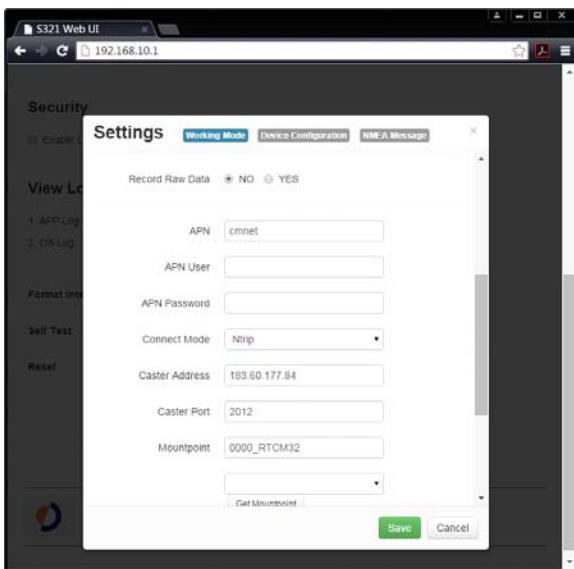
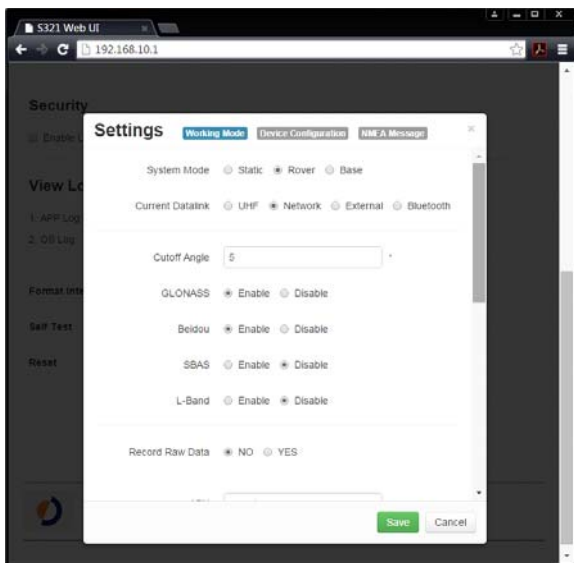


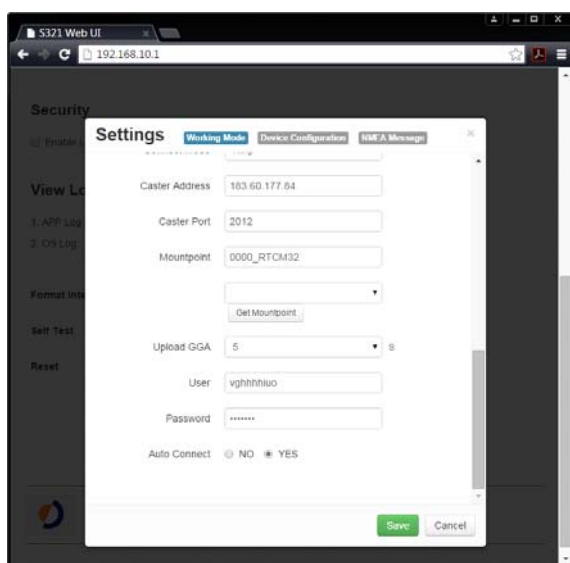
Base/External



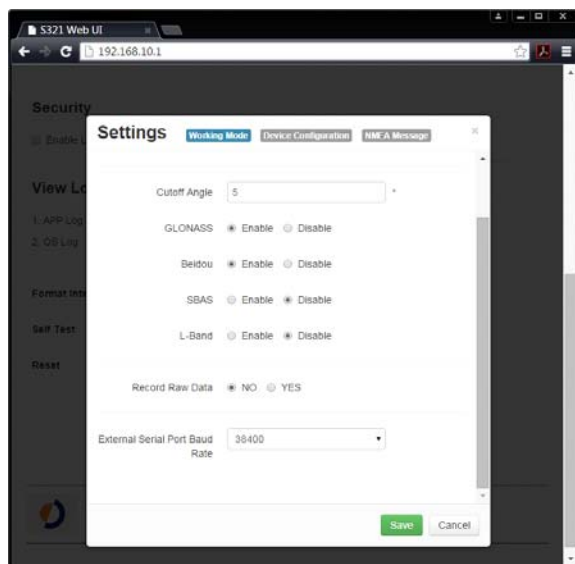
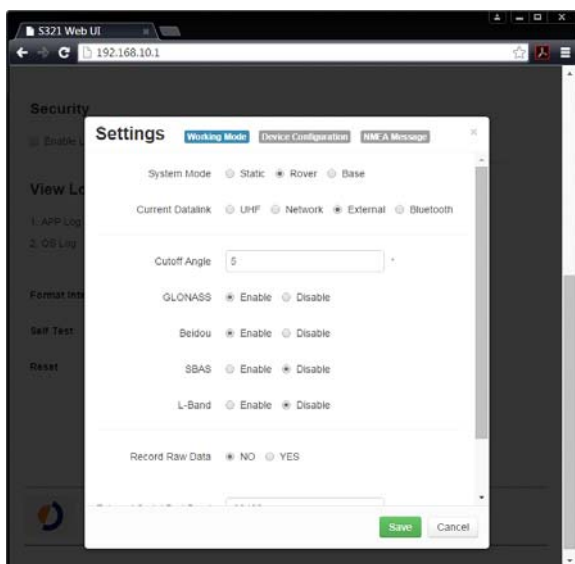
Rover/UHF

Rover/Network

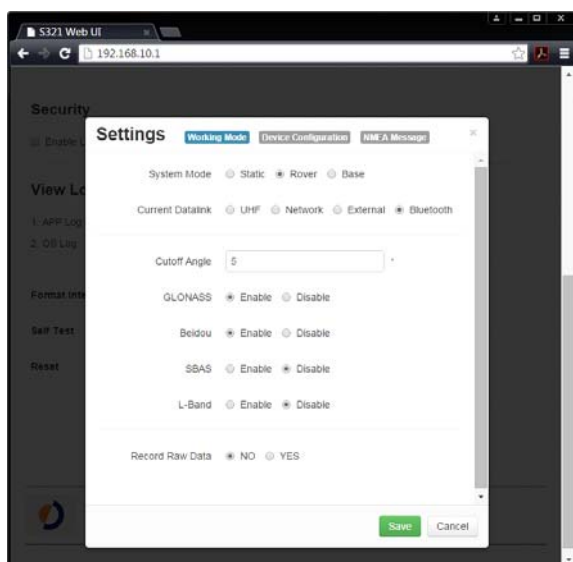




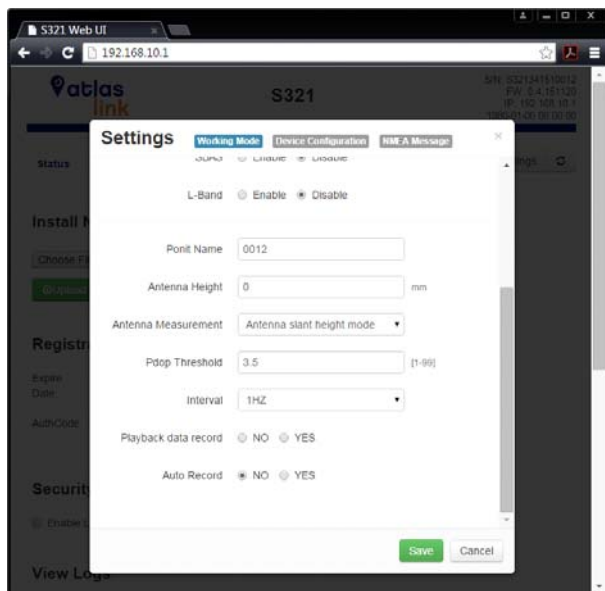
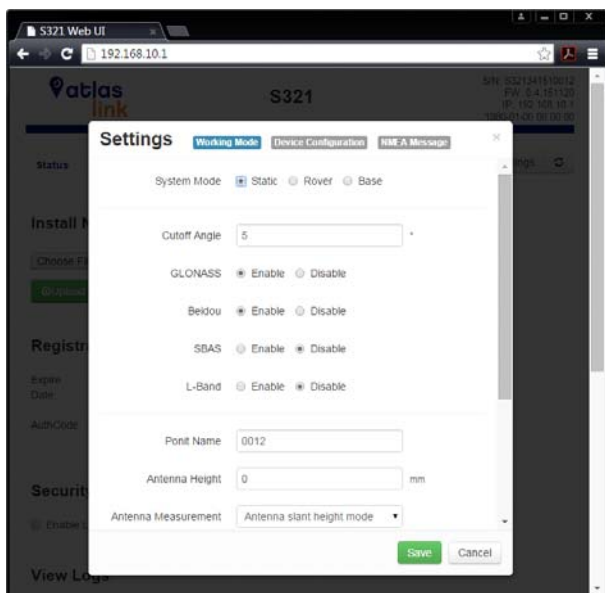
Rover/External



Rover/Bluetooth



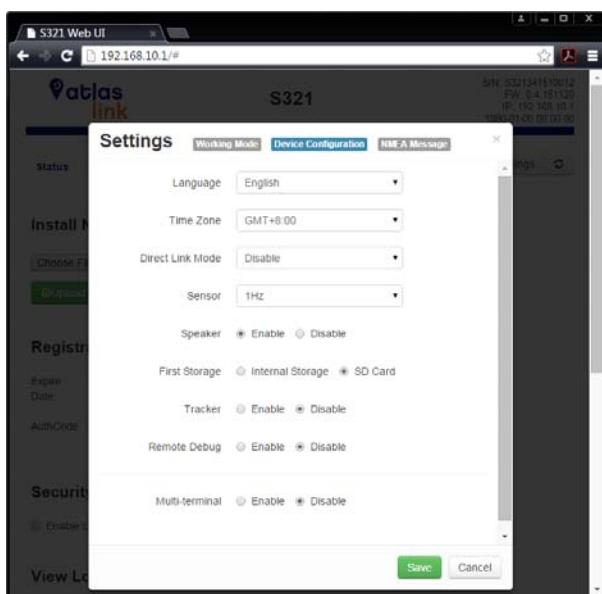
Static



Device Configuration

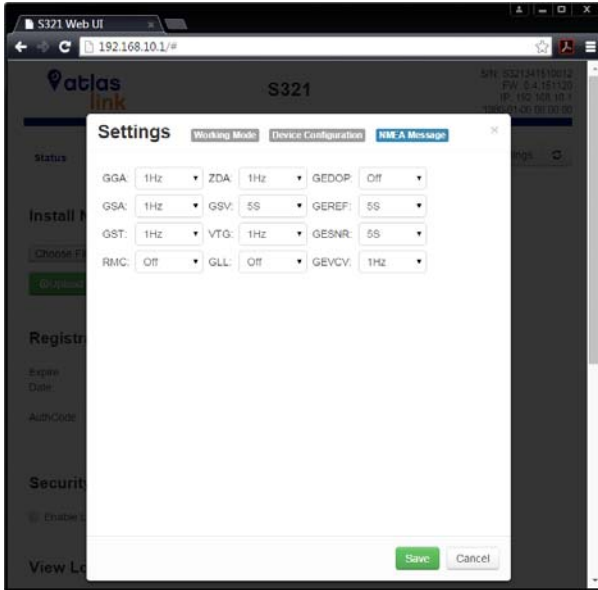
The device configuration tab allows for custom settings in terms of language, time zones, storage, and a number of other options.

Some of the most important portions of the device configuration is the ability to select your Direct Link Mode, giving you the option to connect via external serial devices (OEM), radio (UHF), and TTS. In addition, the easy to use radio buttons allow you to use tracker, remote debug, and select which mode of data logging storage you wish to use, SD or Internal.



NMEA Message

NMEA Message



GSM / NTRIP Functionality

This section provides advanced GSM information that requires connecting to the web UI. Using the web UI, press the “Settings” button in the top right portion of the screen. Then navigate to the “Working Mode” tab and select the “Network” radio button to put the device in Network mode. By selecting the Network button, the screen has been altered to accept GSM or NTRIP information. See Base/Network or Rover/Network in the web UI walk-through below.

This section covers the following topics:

- GSM overview
- GSM modes
- Configuring GSM for NTRIP
- SMS messaging

GSM Overview

Global System for Mobile Communications (GSM) is a network technology for mobile phone communications. The GSM modem in the S321 is what allows you to connect to a GSM carrier.

The Access Point Name (APN) is a protocol that allows the S321 to access the internet using the mobile phone network. It is a configurable network identifier used when connecting to a GSM carrier. The default APNCFG value is “internet.com”. The specific APN required by the S321 depends on your mobile carrier. Check with your mobile provider for details.

GSM Modes

The GSM module operates in four modes:

- IDLE - Default mode for the module. In this state, the GSM module only attempts to register on the network.
- DIRECT IP - For users who have direct access to a server providing differential corrections.
- LINK - For users to establish a link between two S321 modules directly, where the BASE has a dynamic IP address. You should only use this mode on the rover in a base station / rover setup (use IDLE mode for the base station).
 - The dynamic IP address is available when PPP is selected under the base configuration. Allowing the cell modem to reach the secondary device and report the IP address.
- NTRIP - Used to provide differential correction information to the GNSS receiver.

Configuring GSM for NTRIP

NTRIP (Networked Transport of RTCM via Internet Protocol) is the protocol for transmitting GNSS data over the internet.

Note: To configure NTRIP you must connect the S321 to the web UI.

To configure NTRIP fill in the following fields under the “Network” screen in the web UI. For instructions to access the web UI see page 23.

- Remote host name - server name (such as www.igs-ip.net) or an IP address
- Mount point name - caster stream name from NTRIP Caster Source Table (you can download a sample source table from <http://www.igs-ip.net:2101/>). If you leave this field blank, the S321 will fetch the caster source table and select the mount point closest to its current position.
- User name and password - authentication with a user name and password is required for most NTRIP casters. You can leave both blank to specify that no authentication is required. The user name and password are case sensitive.

Setting Up the S321

The following figure shows a typical setup for both a base station unit and a rover unit (tripod and pole mount not included, data collector optional).

The antenna in is connected to the bottom of the unit; you have the option of attaching the antenna to the antenna bracket so the antenna faces upward.



Figure 3-8: Base and Rover Setup

Installation of Base

1. Put a tripod on a location with known coordinates or unknown coordinates, attach receiver to tribrach.
2. Attach the transmitting radio antenna into the port “UHF”: using the 40cm supporting pole is better, since increases the height of the antenna.
3. Switch on the receiver and select the base working mode.

Installation of Rover

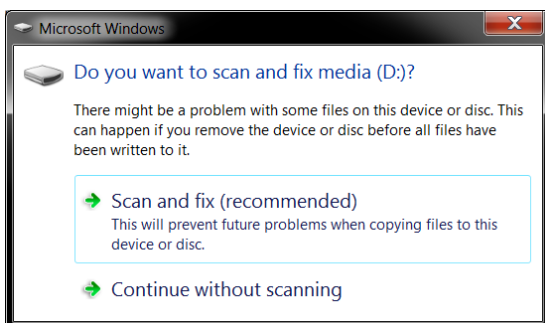
1. Fix the bracket on the pole, fix the hand-held to the bracket, put the rover on the pole and attach receiving antenna into the port “UHF”
2. Power on the receiver and select the rover working mode.
3. Open the hand-held and start the software, then you can do the setting of the instruments.

If you want to take very accurate measures (few cm), we recommend you to use a tripod and put the rover on it.

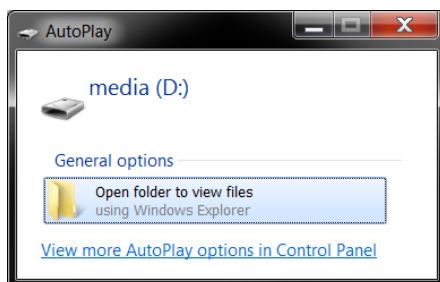
How to download Static Data

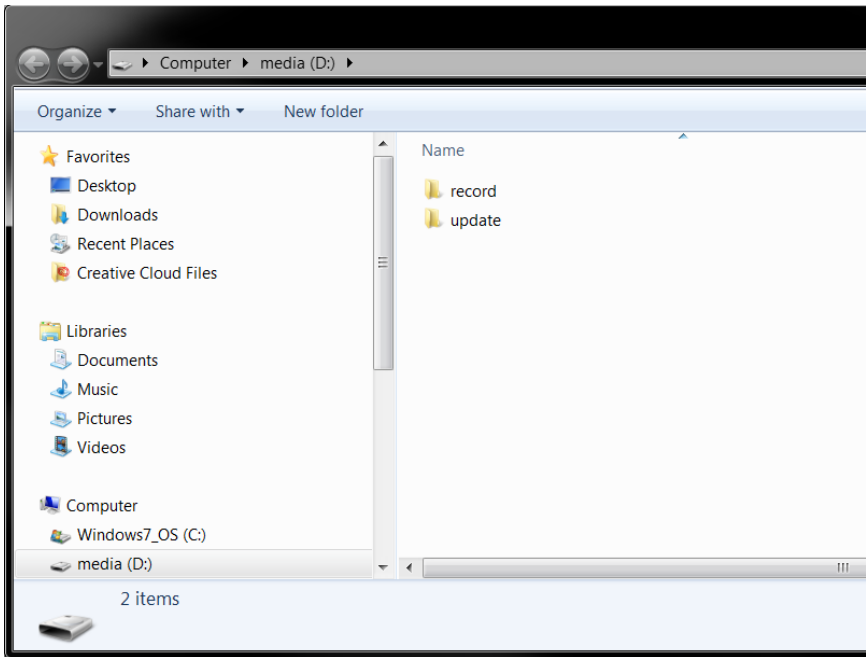
You can download static data by web UI “Download” tab and by USB. For a correct connection between receiver and PC, follow the procedure described below.

At first turn off the receiver, then connect the cable to the communication interface of the receiver (7-pin Lemo) port, then insert the USB port in the PC. Turn the S321 back on and the following task-bar will show as follows:



The PC considers the receiver as a “media disk”, so open the “media disk”, and then you can get the data files in the memory.







Appendix A: Troubleshooting

Table A-1 provides troubleshooting tips for the S321.

Table A-1: S321 troubleshooting

Issue	Possible Resolution
Receiver fails to power	• External power is low • Check charge on external battery and the fuse on the power cable, if applicable • Internal power: Check charge on internal battery • Check all power cables and pins • Try other batteries or cables • Make sure to hold the power button down for a minimum of one full second to turn on • Ensure batteries are installed with contacts pointed in the correct direction
No data logged 1. No communication 2. No valid data	• (1) Check receiver power status • (2) Verify it is locked to a valid DGPS signal • (2) Verify that it is locked to 4 or more GPS satellites • (2) Check integrity and connectivity of power and data cable connections • Verify that the baud rate settings match in external device mode • If trying to connect over Bluetooth, ensure Bluetooth module is powered ON and device is paired prior to opening the port
Random data from web UI or S321 Direct Link mode	• Verify the messages selected in the output messages in the web UI match what you desire. • Verify the baud rate settings match • Potentially, the volume of data requested to be output could be higher than the current baud rate supports. Try using a higher baud rate for communications.
No GNSS position	• Verify the antenna's view of the sky, especially toward SBAS satellites, south in the northern hemisphere • Ensure there is SBAS coverage in your area
No DGPS position in external RTCM mode	• Verify the baud rate of the RTCM input port matches the baud rate of the external source • Verify the pin-out between the RTCM source and the RTCM input port (the "ground" pin and pin-out must be connected, and the "transmit" from the source must connect to the "receiver" of the RTCM input port)



Appendix B: Technical Specifications

The following tables provide information on the technical specifications of the S321.

Table B-1: GNSS receiver specifications

Item	Specification
Receiver type	Multi Frequency GNSS
Channels	372
Positioning modes	RTK, L-band DGNSS, SBAS, External RTCM, Autonomous
RTK formats	RTCM3.0, CMR, CMR+, RTCM3.2, ROX
L-band formats	Atlas H100, Atlas H30, and Atlas H10
Update rate / recording interval	Selectable from 1, 2, 4, 5, 10, 20 Hz

Table B-2: Performance Specifications

Mode	Specification	
	Horizontal	Vertical
RTK Performance	10mm + 1 ppm	20mm + 1 ppm
Static Performance (long occupation)	3mm + 0.1 ppm	3.5mm + 0.4 ppm
Static Performance (rapid occupation)	3mm + 0.5 ppm	5mm + 0.5 ppm
L-band Performance ³	0.08 m	0.16m
SBAS Performance ¹	0.3 m	0.6 m
Autonomous, no SA ²	1.2 m	2.4 m

Table B-3: Satellite Tracking

Satellites	
GPS	L1C/A, L1P, L2P, L2C
GLONASS	L1C/A, L2C/A
BeiDou	B1, B2, B3
QZSS	With future firmware upgrade
Galileo	With future firmware upgrade

Table B-3: Satellite Tracking (continued)

Satellites	
SBAS	MSAS, WAAS, EGNOS, GAGAN

Table B-4: Communication and port specifications

Item	Description
Connectors I/O	5-pin Lemo connector for external power supply and external radio devices 7-pin Lemo connector for USB OTG connection and a serial port interface 1 antenna connector for internal radio 1 antenna connector for modem module
Web UI	To upgrade the software, manage the status and settings, data download, via smart phone, tablet or other electronic device
TTS	Smart voice broadcast system. "Speaking" receiver
Reference Outputs	RTCM2.1, RTCM2.3, RTCM3.0, RTCM3.1, RTCM3.2 including MSM

Table B-5: Radio specifications

Item	Specification
Frequency Range	410 - 470 MHz
Channel Spacing	12.5 KHz / 25 KHz
Emitting Power	0.5 / 1w

Table B-6: Wireless specifications

Item	Specification
Wi-Fi	Integrated module with internal Wi-Fi antenna 802.11 bgn.
Bluetooth	Bluetooth 2.1 + EDR Integrated Bluetooth (BT) communication module with internal BT antenna

Table B-7: Cellular specifications

Item	Description
Type	UMTS/HSPA+/GSM/GPRS/EDGE
Supported Frequencies	GSM/GPRS/EDGE (850, 900, 1800, and 1900MHz) WCDMA/HSDPA (850/800, 900, 1800, and 1900MHz)

Table B-8: Power specifications

Item	Specification
Battery	Rechargeable 11.1 V - 37.74 Wh
Battery Life	6 hours with one battery and UHF radio in Rx mode
Voltage	9 to 22V DC external power input with over-voltage protection
Charge Time	Typically 7 hours

Table B-9: Memory specifications

item	Specification
SIM Card	Accessible SIM card slot
Memory	Internal 4GB. Accessible through USB and Wi-Fi External Micro SD card slot supports up to 64 GB.

Table B-10: Environmental specifications

Item	Specification
Operating Temperature	-30°C to 60°C (-22°F to 140°F)
Storage Temperature	-40°C to 80°C (-22°F to 176°F)
Water / Dust Proof	IP67
Shock Resistance	MIL-STD-810G, method 516.6
Vibration	MIL-STD-810G, method 514.6E-I
Humidity	Up to 100%

Table B-11: Mechanical specifications

Item	Specification
Size	14.1 D x 14.0 H (cm) 5.5 D x 5.5 H (in)
Weight	<1.38 kg (<3.05 lbs)
Mounting	5/8"x11, 55 ° thread angle, stainless steel insert
Phase Center Offset	GPS L1 and L2 offset below 2.5mm

¹ Depends on multi-path environment, number of satellites in view, satellite geometry, and ionospheric activity

² Depends also on baseline length

³ Requires a subscription from Hemisphere GNSS

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14. **LICENSEE REMEDIES.** In all cases which involve a failure of the Software to conform in any material respect to the documentation during the Warranty Period or a breach of a warranty, Hemisphere's sole obligation and liability, and Licensee's sole and exclusive remedy, is for Hemisphere, at Hemisphere's option, to (a) repair the Software, (b) replace the Software with software conforming to the documentation, or (c) if Hemisphere is unable, on a reasonable commercial basis, to repair the Software or to replace the Software with conforming software within ninety (90) days, to terminate this Agreement and thereafter Licensee shall cease using the Software. Hemisphere will also issue a refund for the price paid by Licensee less an amount on account of amortization, calculated on a straight-line basis over a deemed useful life of three (3) years.
15. **LIMITATION OF LIABILITY.** IN NO EVENT WILL HEMISPHERE BE LIABLE TO LICENSEE FOR ANY INCIDENTAL, CONSEQUENTIAL, SPECIAL OR INDIRECT DAMAGES INCLUDING ARISING IN RELATION TO ANY LOSS OF DATA, INCOME, REVENUE, GOODWILL OR ANTICIPATED SAVINGS EVEN IF HEMISPHERE HAS BEEN INFORMED OF THE POSSIBILITY OF SUCH LOSS OR DAMAGE. FURTHER, IN NO EVENT WILL HEMISPHERE'S TOTAL CUMULATIVE LIABILITY HEREUNDER, FROM ALL CAUSES OF ACTION OF ANY KIND, EXCEED THE TOTAL AMOUNT PAID BY LICENSEE TO HEMISPHERE TO PURCHASE THE PRODUCT. THIS LIMITATION AND EXCLUSION APPLIES IRRESPECTIVE OF THE CAUSE OF ACTION, INCLUDING BUT NOT LIMITED TO BREACH OF CONTRACT, NEGLIGENCE, STRICT LIABILITY, TORT, BREACH OF WARRANTY, MISREPRESENTATION OR ANY OTHER LEGAL THEORY AND WILL SURVIVE A FUNDAMENTAL BREACH.
16. **LIMITS ON LIMITATION OF LIABILITY.** Some jurisdictions do not allow for the limitation or exclusion of liability for incidental or consequential damages, so the above limitation or exclusion may not apply to Licensee and Licensee may also have other legal rights which may vary from jurisdiction to jurisdiction.
17. **BASIS OF BARGAIN.** Licensee agrees and acknowledges that Hemisphere has set its prices and the parties have entered into this Agreement in reliance on the limited warranties, warranty disclaimers and limitations of liability set forth herein, that the same reflect an agreed-to allocation of risk between the parties (including the risk that a remedy may fail of its essential purpose and cause consequential loss), and that the same forms an essential basis of the bargain between the parties. Licensee agrees and acknowledges that Hemisphere would not have been able to sell the Product at the amount charged on an economic basis without such limitations.
18. **PROPRIETARY RIGHTS INDEMNITY.** Hemisphere shall indemnify, defend and hold harmless Licensee from and against any and all actions, claims, demands, proceedings, liabilities, direct damages, judgments, settlements, fines, penalties, costs and expenses, including royalties and attorneys' fees and related costs, in connection with or arising out of any actual infringement of any third party patent, copyright or other intellectual property right by the Software or by its use, in accordance with this Agreement and documentation, PROVIDED THAT: (a) Hemisphere has the right to assume full control over any action, claim, demand or proceeding, (b) Licensee shall promptly notify Hemisphere of any such action, claim, demand, or proceeding, and (c) Licensee shall give Hemisphere such reasonable assistance and tangible material as is reasonably available to Licensee for the defense of the action, claim, demand or proceeding. Licensee shall not settle or compromise any of same for which Hemisphere has agreed to assume responsibility without Hemisphere's prior written consent. Licensee may, at its sole cost and expense, retain separate counsel from the counsel utilized or retained by Hemisphere.
19. **INFRINGEMENT.** If use of the Software may be enjoined due to a claim of infringement by a third party then, at its sole discretion and expense, Hemisphere may do one of the following: (a) negotiate a license or other agreement so that the Product is no longer subject to such a potential claim, (b) modify the Product so that it becomes non-infringing, provided such modification can be accomplished without materially affecting the performance and functionality of the Product, (c) replace the Software, or the Product, with non-infringing software, or product, of equal or better performance and quality, or (d) if none of the foregoing can be done on a commercially reasonable basis, terminate this license and Licensee shall stop using the Product and Hemisphere shall refund the price paid by Licensee less an amount on account of amortization, calculated on a straight-line basis over a deemed useful life of three (3) years.

The foregoing sets out the entire liability of Hemisphere and the sole obligations of Hemisphere to Licensee in respect of any claim that the Software or its use infringes any third party rights.
20. **INDEMNIFICATION.** Except in relation to an infringement action, Licensee shall indemnify and hold Hemisphere harmless from any and all claims, damages, losses, liabilities, costs and expenses (including reasonable fees of lawyers and other professionals) arising out of or in connection with Licensee's use of the Product, whether direct or indirect, including without limiting the foregoing, loss of data, loss of profit or business interruption.

21. **TERMINATION.** Licensee may terminate this Agreement at any time without cause. Hemisphere may terminate this Agreement on 30 days notice to Licensee if Licensee fails to materially comply with each provision of this Agreement unless such default is cured within the 30 days. Any such termination by a party shall be in addition to and without prejudice to such rights and remedies as may be available, including injunction and other equitable remedies. Upon receipt by Licensee of written notice of termination from Hemisphere or termination by Licensee, Licensee shall at the end of any notice period (a) cease using the Software; and (b) return to Hemisphere (or destroy and provide a certificate of a Senior Officer attesting to such destruction) the Software and all related material and any magnetic or optical media provided to Licensee. The provisions of Sections 6), 7), 8), 9), 10), 15), 21), 26) and 27) herein shall survive the expiration or termination of this Agreement for any reason.
22. **EXPORT RESTRICTIONS.** Licensee agrees that Licensee will comply with all export control legislation of Canada, the United States, Australia and any other applicable country's laws and regulations, whether under the Arms Export Control Act, the International Traffic in Arms Regulations, the Export Administration Regulations, the regulations of the United States Departments of Commerce, State, and Treasury, or otherwise as well as the export control legislation of all other countries.
23. **PRODUCT COMPONENTS.** The Product may contain third party components. Those third party components may be subject to additional terms and conditions. Licensee is required to agree to those terms and conditions in order to use the Product.
24. **FORCE MAJEURE EVENT.** Neither party will have the right to claim damages as a result of the other's inability to perform or any delay in performance due to unforeseeable circumstances beyond its reasonable control, such as labor disputes, strikes, lockouts, war, riot, insurrection, epidemic, Internet virus attack, Internet failure, supplier failure, act of God, or governmental action not the fault of the non-performing party.
25. **FORUM FOR DISPUTES.** The parties agree that the courts located in Calgary, Alberta, Canada and the courts of appeal there from will have exclusive jurisdiction to resolve any disputes between Licensee and Hemisphere concerning this Agreement or Licensee's use or inability to use the Software and the parties hereby irrevocably agree to attorn to the jurisdiction of those courts. Notwithstanding the foregoing, either party may apply to any court of competent jurisdiction for injunctive relief.
26. **APPLICABLE LAW.** This Agreement shall be governed by the laws of the Province of Alberta, Canada, exclusive of any of its choice of law and conflicts of law jurisprudence.
27. **CISG.** The United Nations Convention on Contracts for the International Sale of Goods will not apply to this Agreement or any transaction hereunder.
28. **GENERAL.** This is the entire agreement between Licensee and Hemisphere relating to the Product and Licensee's use of the same, and supersedes all prior, collateral or contemporaneous oral or written representations, warranties or agreements regarding the same. No amendment to or modification of this Agreement will be binding unless in writing and signed by duly authorized representatives of the parties. Any and all terms and conditions set out in any correspondence between the parties or set out in a purchase order which are different from or in addition to the terms and conditions set forth herein, shall have no application and no written notice of same shall be required. In the event that one or more of the provisions of this Agreement is found to be illegal or unenforceable, this Agreement shall not be rendered inoperative but the remaining provisions shall continue in full force and effect.



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