Hemisphere®

875-0366-0

User Guide
Revision: A2
September 14, 2017

C321
Smart Antenna

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 product complies with the essential requirements and other relevant provisions of Directive 2014/53/EU. The declaration of conformity may be consulted at https://hemispheregnss.com/About-Us/Quality-Commitment.

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U.S. Patents					Australia Patents
6111549	6876920	7400956	8000381	8214111	2002244539
6397147	7142956	7429952	8018376	8217833	2002325645
6469663	7162348	7437230	8085196	8265826	2004320401
6501346	7277792	7460942	8102325	8271194	
6539303	7292185	7689354	8138970	8307535	
6549091	7292186	7808428	8140223	8311696	
6711501	7373231	7835832	8174437	8334804	
6744404	7388539	7885745	8184050	RE41358	
6865465	7400294	7948769	8190337		

Other U.S. and foreign patents pending.

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Contact your local dealer for technical assistance. To find the authorized dealer near you:
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Scottsdale, AZ 85255 USA
Phone: (480) 348-6380
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Technical Support

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Chapter 1: Introduction

Overview and Features

What's Included

Introduction

Overview and Features

The C321 is an all-new multi-GNSS, multi-frequency smart antenna designed for the construction environment. The C321 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 C321 can be used in a variety of operating modes in a network or crew. Use the C321 as a precise base station sending RTK corrections to your existing rovers. Turn the C321 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 C321 with new firmware and activations. C321 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 (and can be added as a subscription). Atlas L-Band has the following benefits:

- **Positioning accuracy -** Competitive positioning accuracies down to 4cm 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 4 to 100 cm range
- **Convergence time -** Industry-leading convergence times of 10-40 minutes

The C321 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 and Atlas L-band, see: http://hgnss.com/Atlas

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⚠ WARNING: If your C321 is equipped with a 400 MHz radio, you may be required to obtain a valid radio license for your jurisdiction.

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 aRTK Position Aiding

aRTK is an innovative feature available in Hemisphere's C321 Smart Antenna that greatly mitigates the impact of land-based communication instability. Powered by Hemisphere's Atlas L-band system service, aRTK provides an additional layer of communication redundancy to RTK users, assuring that productivity is not impacted by intermittent data connectivity.

The C321 receives the aRTK augmentation correction data over satellite, while also receiving the land- based RTK correction data. With this, the receiver internally operates with two sources of RTK corrections, creating one additional layer of correction redundancy as compared to typical RTK systems. Once that process is established (which takes only a few seconds), the receiver can operate in the absence of either correction source, or in other words, the receiver is able to continue generating RTK positions in case the land-based RTK correction source becomes unavailable for a period of time.

Note: To use aRTK, you are required to change the RTK timeout to: 2700 s. This can be accomplished by following the Web UI directions outlined in the Setup and Configuration section of this document.

What's Included

As per Table 1.1 below, the C321 is available in a variety of kits, with supplementary products sold as "controller/option kits", "accessory kits" or simply as separate accessories. Contents can be changed without prior notice. Check the official price list to confirm contents.

Important: Charge your Li-on battery upon receipt of shipment. According to the 2017 IATA Dangerous Goods Regulations and supplemental IATA Lithium Battery Guidance, batteries must be charged to less than 30% to meet international air freight requirements.

Table 1-1: C321 Parts List

Main Kits	Part Number	940-2161-0 C321	940-2173-0 C321 (B&R)
C321 Smart Antenna	752-0009-0	1	2
S/C321 Serial Cable	051-0390-0	1	2
GSM/WCDMA External	150-1023-0	1	2
UHF External Antenna	150-1024-0	1	2
Athena RTK Bundle*	163-1045-0	1	2
Smart Battery	427-0058-0	2	4
Battery Charger Adapter	427-0060-0	1	2
Battery Charger	427-0063-0	1	2
C321 Cigarette Lighter	427-0064-0	1	2
Tape Measure	699-0006-000	1	1
Quick Release	699-0015-0	1	2
Carry Case	750-0183-1	1	1
8 GB SD Card	750-1169-0	1	2
Accessory Kits	**Part Number**	**Qty**	
C321 Power Cable	054-0171-0	1	-
C321 5-Pin Power Cable	054-0172-0	1	-
C321 5-Pin Power Cable	054-0173-0	1	-
C321 5-Pin Power Cable	054-0178-0	1	-
C321 5-Pin Power cable	054-0180-0	1	-
C321 UHF Antenna (TNC)	150-1026-0	1	-
C321 External UHF	710-0136-6	1	-
Controller/Option Kits	**Part Number**	**Qty**	
Mesa 2 Tablet Kit	940-2174-0	1	-
Hemisphere SiteMetrix Software Kit	940-2175-0	1	-
Athena RTK Bundle*	163-1045-0	1	-

* feature activation

Chapter 2: Installation

Installation

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.
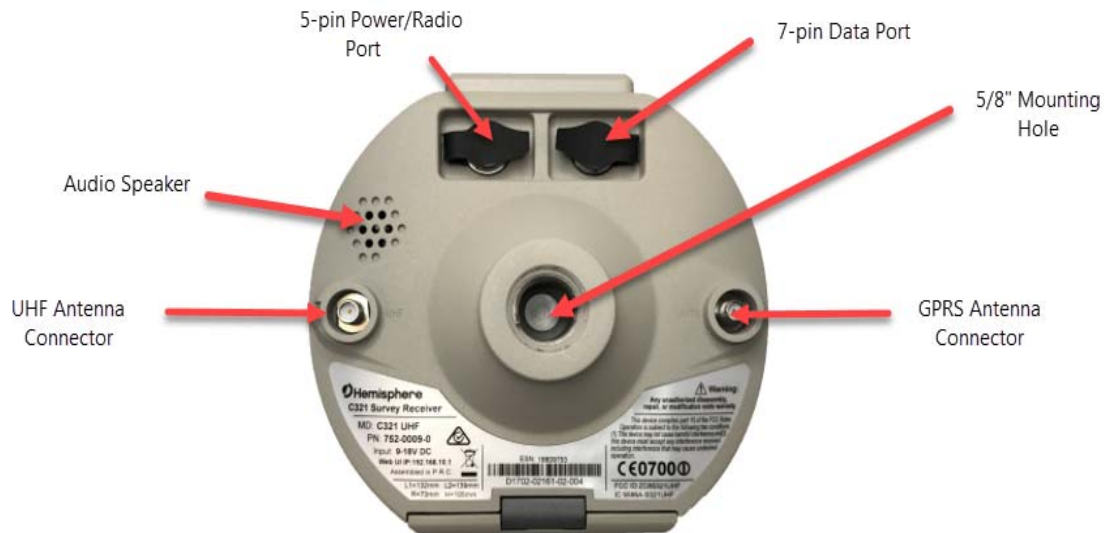

Figure 2-1: C321 Ports and Connectors

Table 2-1: C321 Ports and Connections

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

Installing/Connecting C321

Installing Batteries

The C321 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 C321 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 C321 antenna, locate the UHF antenna (150-1024-0) from the kit list under "What's Included". Insert the connector end of the UHF antenna and rotate clockwise to secure the antenna to the C321. To install the GSM portion of the C321 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 C321.

Figure 2-3: Installing UHF and GSM Antennas

Note: Only one antenna (UHF or GSM) can be connected to the C321 at a time.

Installing C321 on a Tribach

The C321 mounts flush to the tribrach, by securing the 5/8-11 female metal mounting portion of the C321 to the standard 5/8-11 male portion of the tribrach. Hand-tighten (35-40 in-lbs. of torque) to secure the C321 onto the mount in a clockwise rotation.

Figure 2-4: Installing C321 on a Tribach

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 C321 to have a similar height to the rover and provides better access to the bottom of the C321 unit. Access to the bottom of the C321 makes for easier cable connections and adjustments to UHF or GPRS antennas.

Figure 2-5 Vertical Base Extension

Installing the C321 on a Range Pole

Using the standard 5/8-11 mount on the bottom of the C321, you can secure the unit to a field standard 5/8-11 range pole. the C321 should be placed carefully on the range pole, to ensure cross- threading does not occur, while rotating the unit in a clockwise direction. Hand-tighten (35-40 in-lbs. of torque) to secure to the unit.

Figure 2-6: Range Pole Installation

Connecting to a Power Source

The C321 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 C321.

Figure 2-7: External Power Connector

Connecting to an External Device

The 7-pin connector is available for troubleshooting, debugging, and USB log downloads.

Figure 2-8: 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 powering the C321 on/off below).

Figure 2-9: C321 On-Device Menu

Powering the C321 On/Off

The C321 has a power-on/off the receiver 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 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 goes into self- check mode. (See "Self-Check" below for more information).

Self-Check: Self Check 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.

Inserting and Removing the Micro 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 C321. If an ESD strap is not available then touch a metal object prior to accessing the SIM card holder.

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

To insert the Micro 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.

Figure 2-10: Micro SD/SIM Card Slots

Resetting the C321

To reset the C321, lift the battery door and locate the "Reset" button between the SIM card and SD card slots. The reset button will power the unit off and automatically restart the unit.

Figure 2-11: C321 Reset button

Chapter 3: Setup and Configuration

Setup and Configuration

Control Panel Overview

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)

The Static LED illuminates 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)

After you have connected the receiver with the data controller, this LED illuminates.

Figure 3-4: Bluetooth LED

Wi-Fi LED (Green)

This indicates the C321 is emitting a Wi-Fi network and is ready to be paired with a Wi-Fi enabled controller or device. By connecting to the C321 device network, you can control the C321 via Web UI. For more information on the Web UI, please see section Web UI.

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 C321 is either transmitting data as a base, or receiving data as a rover.

Figure 3-6: Internal UHF 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 two 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 hear three beeps every 60 seconds.

Table 3.1: Definition of Icons on the C321 Menu

| Type	icons	Explanation
Operating mode		Rover mode
		Base mode
		Static mode
Power status		Full battery power or external power supply
		Battery power remaining ¾
		Battery power remaining 2/4
		Battery power remaining ¼
		The battery needs to be replaced
Date status		The Rover station is receiving differential
		The base station is transmitting differential
Date link		UHF, number in right corner indicating the channel
		GPRS module
		External Data Link
		Bluetooth data link
Difference type		RTCM3.2
		RTCM 3.0
		RTCM 2.3
		CMR
		DGPS

C321 Menu Structure and Information

Home Page
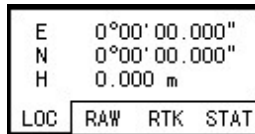
Coordinate Information

Current Data Link Status
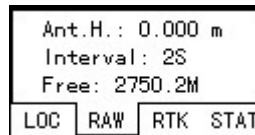
File Information

Device Status

Operating Mode Settings

Switch Operating Modes

Operating Mode Settings (continued)

Switch Data Link

General Settings

Wi-Fi

Backlight

Language

Setting up the C321

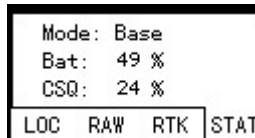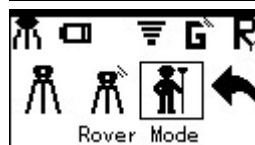The following figure shows a typical setup for both a base station unit and a rover unit (tripod and pole mount not included, data collect is optional).

The antenna 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 the receiver to the 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 the 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 set the instruments.

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

Bluetooth Communication

If you have a Bluetooth-enabled device, such as a data collector, you can wirelessly communicate with the C321. When you attempt to connect the C321 to a Bluetooth-enabled device, such as a hand-held data collector, the following C321 Bluetooth information appears on the device:

C321 XXXXXX
where "XXXXXX" is the serial number

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 C321XXXXXXXXX.
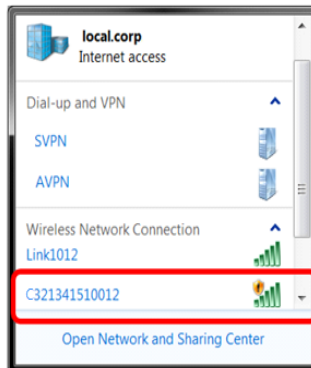
If you want this network to automatically connect, select the "**Connect automatically**" check box before pushing the "Connect" button. If not, click on the "**Connect**" button.
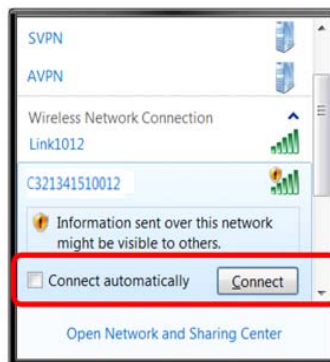
Once connected to your device. Type or copy the following IP address into your URL bar:
http://192.168.10.1/

The Web UI will prompt you for a user name and password. The default user name and password are:
User Name: admin
Password: C321

Web UI Start Up

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 to properly secure your device.
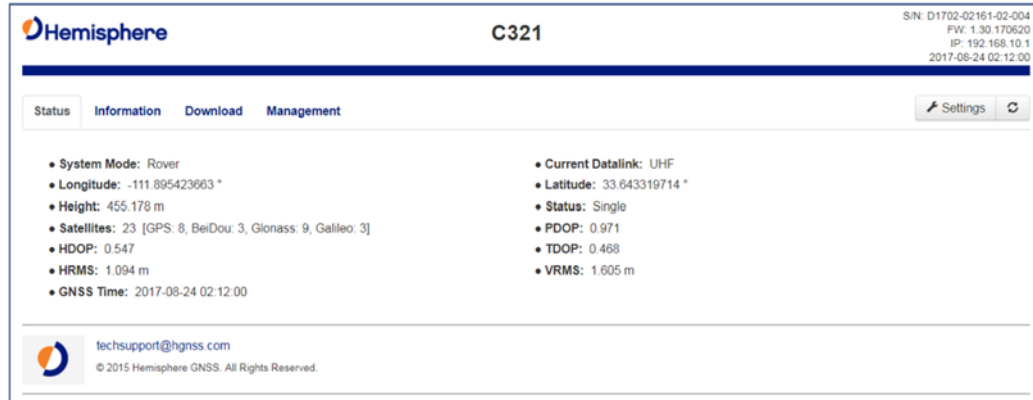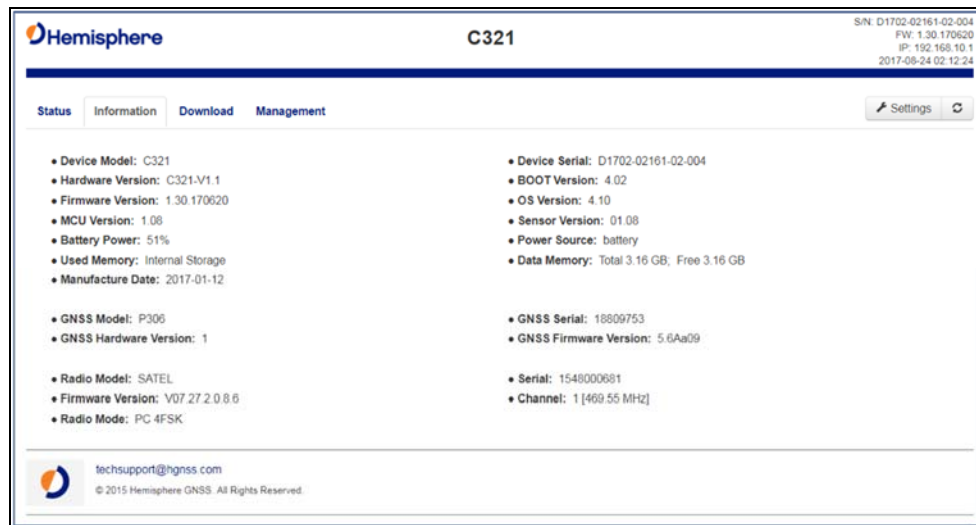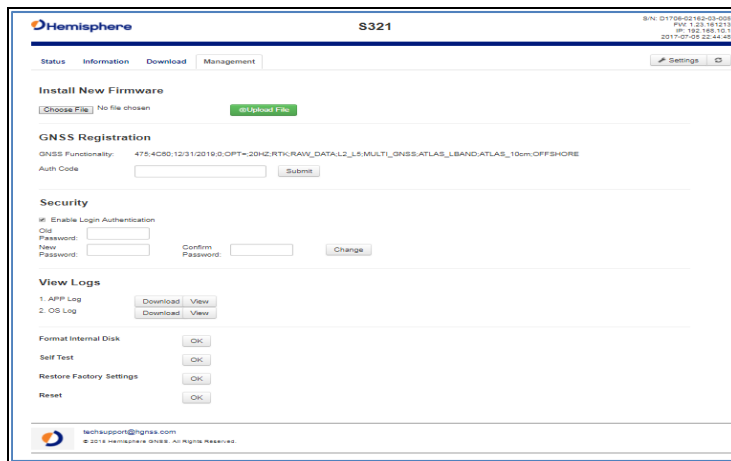

Install New Firmware

This feature allows you to update the menu application software. Once the correct software is selected under the **Choose File** browser, the **Upload File** button initiates the update procedure and re-starts the C321 device.

GNSS Registration

This displays the expiration date of different features which have been subscribed to the C321. The Atlas expiration date will be displayed under this field. In addition, the ability to update the C321 with new subscriptions is available under the "AuthCode" field. Type 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 can 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 allows you to reformat the internal hard drive in the C321.
Self-test provides an application review to ensure the device functioning properly (See self-check for more information).

Restore Factory Settings: returns the C321 to all default settings and perform a full power cycle.

Reset initiates a complete device shut down, creating a hard reset to the device and stopping any application activity. (See Resetting the C321 for more information).

Web UI Settings

Working Mode: UHF

When using a UHF datalink, channel tables must be configured by a certified Hemisphere GNSS dealer, or by uploading a channel table file provided by a dealer.

Important: The **Advanced UHF Settings** can only be accessed by Hemisphere GNSS or certified Hemisphere GNSS dealers.
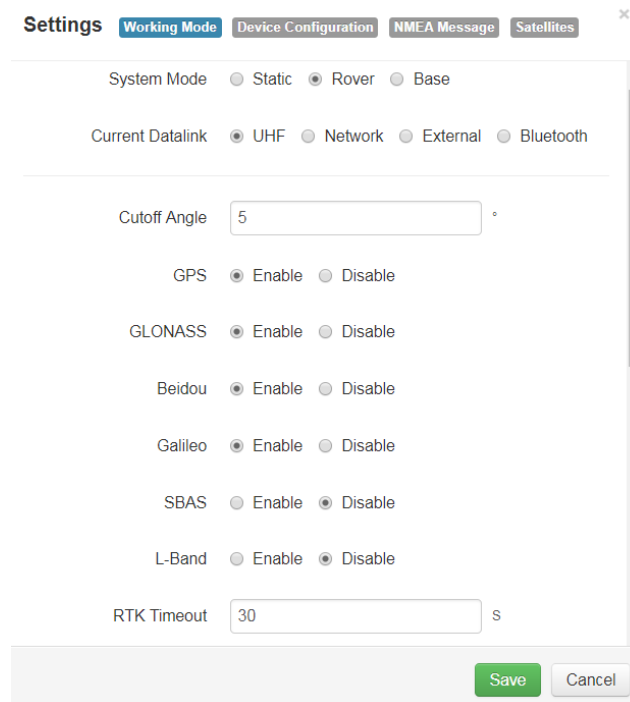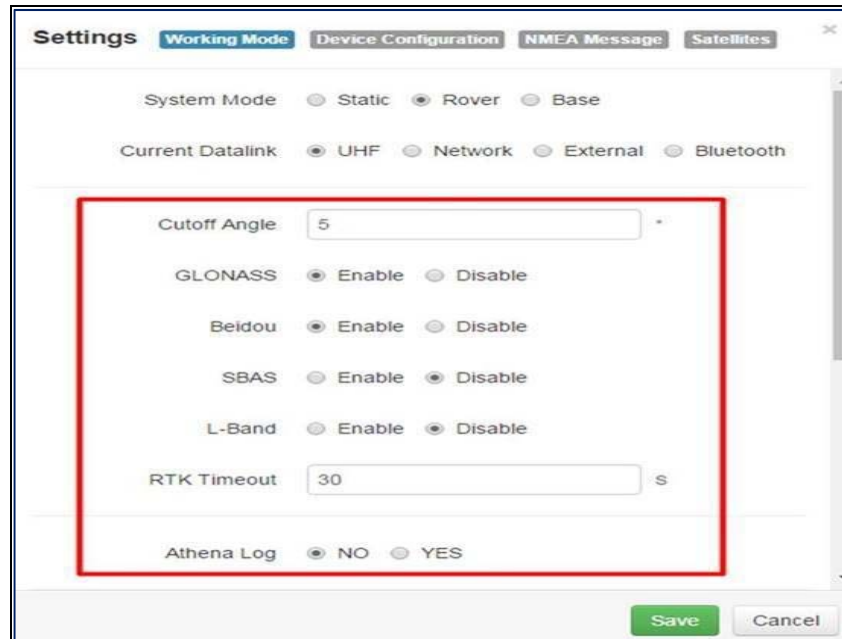
- **Cutoff Angle**: satellites at a lower angle to the horizon than "5" are not used in the GNSS solution
- **GLONASS**: Enable or Disable the use of GLONASS satellites
- **Beidou**: Enable or Disable the use of Beidou satellites
- **Galileo**: Enable or Disable the use of Galileo satellites
- **SBAS**: Enable or Disable the use of SBAS for DGNSS corrections
- **L-Band**: Enable to use Atlas corrections or aRTK
- **RTK Timeout**: this field indicates the amount of time an RTK correction will continue to be used after RTK corrections are lost. (**Note:** If using aRTK, the L-Band needs to be set to Enable and RTK
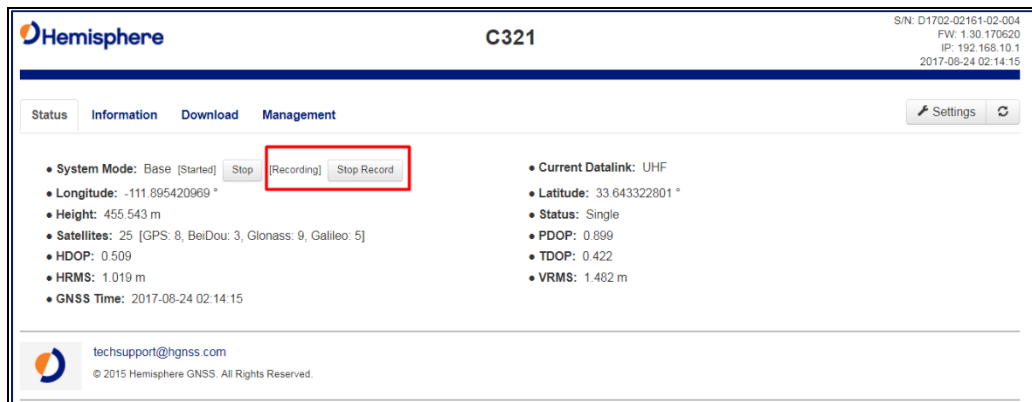
Timeout should be set to 2700.)
- **Athena Log**: Record raw data for converting to **Rinex** and post-processing. If "**Yes**" is selected, the following dialogue will display: Access the Rinex converter using the following hyperlink: https://hemispheregnss.com/Resources-Support/Software

- **Point Name:** choose a name for the point that is occupied
- **Antenna Height:** type the height of the antenna in meters (**Note:** older versions of firmware required millimeters (mm) as seen in the image. Please refer to the unit listed to the right-hand side of the field.)
- **Pdop Threshold:** data will not be logged if the Pdop of the receiver exceeds the user defined value (3.5 is the default value, but this can be changed.)
- **Interval:** log data at intervals of 30s, 15s, 5s, 1Hz, 2Hz, 5Hz, or 10Hz

While the receiver is logging data, the WebUI will display **[Recording]** next to **System Mode** under the **Status** tab. To stop recording, click **Stop Record**.

To download the log, click the **Download** tab.

All logs stored on the C321 internal hard drive will display. Click **Delete** to delete the log.

Multiple logs can be downloaded or deleted at one time by selecting the box next to each of the logs and clicking **Package** or **Delete Selected**.
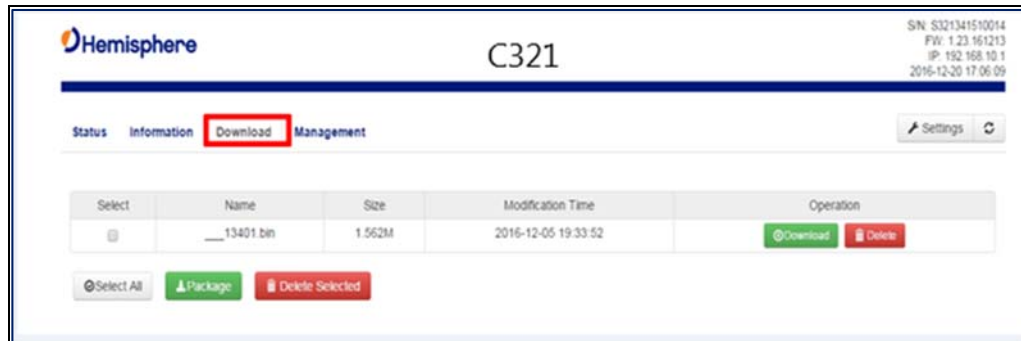
System Modes

The C321 can be configured as a Survey Rover, Base Station, or run a Static Observation.
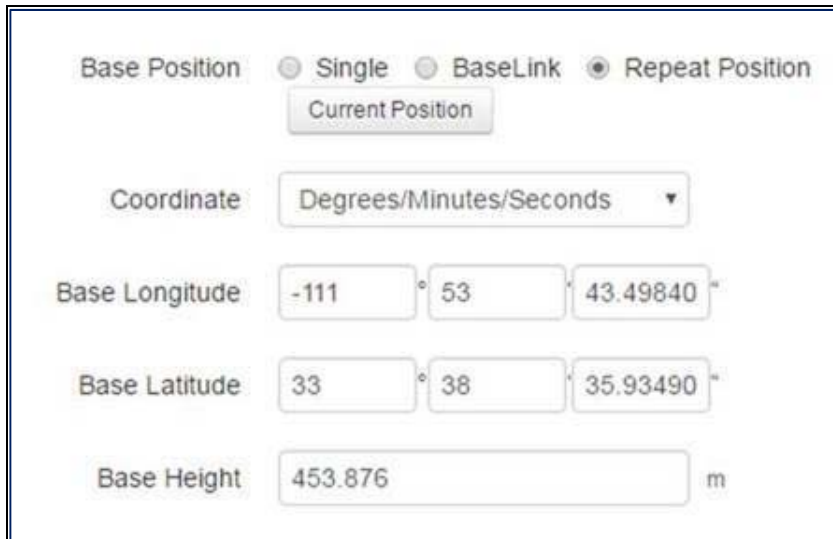
The Base Position must be configured. Select **Base**, under System Mode, the following dialogue appears:

- **Automatically Start Base**: Set to **Yes** if the C321 should automatically begin broadcasting RTK upon startup. If set to **No**, you must manually start the base every time the unit is powered on.
- **Data Type**: Broadcast RTK via RTCM 2.3 (DGNSS), RTCM 3.0, RTCM 3.2, CMR, CMR+, or ROX (Hemisphere proprietary message format).
- **Site ID**: Base station ID
- **Pdop Threshold**: Only transmit RTK if the PDOP of the base station is less than this value.

To set the base location select one of the following:

- **Single:** Upon startup, the C321 will average its position, and use that position for the base position
- **Repeat Position:** is used to input a permanent base station position into the C321. You may type in a latitude, longitude, and altitude, or click "**Current Position**" to automatically populate the field with the current GNSS position

Data Links

The C321 supports the sending and receiving of RTK via the Internal UHF radio, external devices (such as an external radio) via serial, TCP/IP, NTRIP, and Bluetooth (rover only).

Internal UHF

Your C321 comes without a channel table loaded. Only Hemisphere GNSS or a Hemisphere GNSS certified dealer can create the file to upload a channel table.

A channel table can be created through the WebUI by a certified Hemisphere GNSS dealer by clicking on **Advanced UHF Settings** and typing a password.
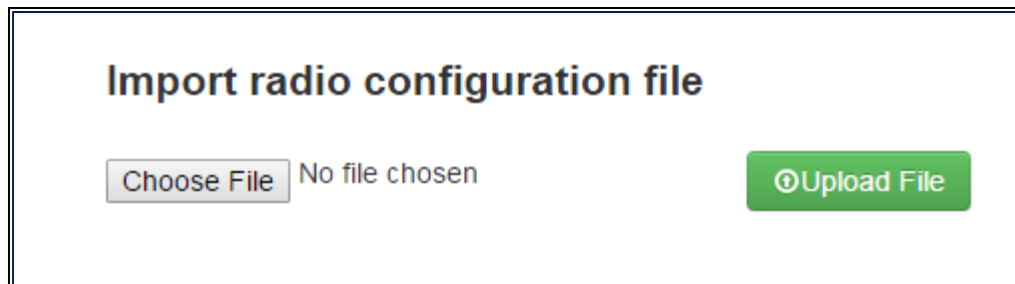
You can also upload by clicking **Import** next to **Radio Configuration File** and uploading a channel table file (.ucf) provided by your dealer.

Note: The radio frequency should match the transmitting base.

The following dialogue appears:

Radio Configuration File   Import

Import radio configuration file

Choose File   No file chosen   ⊕Upload File

Next to **Data Link** select **UHF.** The following dialogue appears at the bottom of the page.
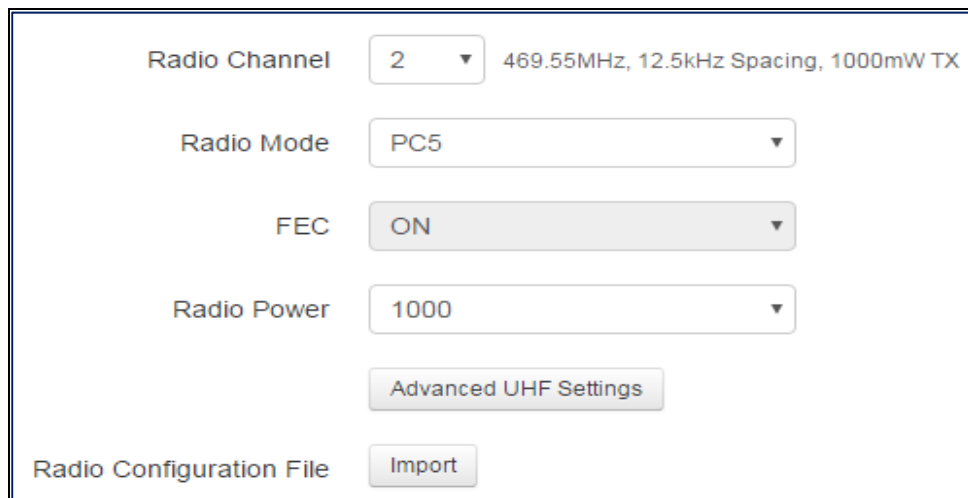
Radio Channel	2 ▼	469.55MHz, 12.5kHz Spacing, 1000mW TX
Radio Mode	PC5 ▼	
FEC	ON ▼	
Radio Power	1000 ▼	
	Advanced UHF Settings	
Radio Configuration File	Import	

- **Radio Channel:** Select a channel from the channel table provided by your dealer. The frequency, bandwidth, and transmit power (base only) is shown next to the channel
- **Radio Mode:** The C321 supports PacCrest protocols (GMSK and 4-FSK modulation), Satel protocols, and Trimtalk protocols. For a full list of protocols, with descriptions (FEC, Scrambling, over the air link rate, and modulation), please refer to Appendix C.
- **FEC:** Forward Error Corrections
- **Radio Power**: Transmit RTK corrections at 100mW, 200mW, 500mW, or 1W (dependent upon the radio settings and restrictions provided by your dealer). This feature is only displayed when running as a base.

External

If you wish to send RTK corrections out of the serial port (such as to an external UHF radio) instead of to the Internal UHF radio, as explained above, select **External** next to "Current Datalink."

Select the **baud rate** of the external device, and plug that device into 5-pin serial port. (Baud rates range from 4800 bps – 115200 bps.)

External Serial Port Baud Rate	38400 ▾

The part numbers for the 5-pin cable are as follows:

Table 3-1: C321 5-pin cables

5-pin Cable	Part Number
S/C321 Power Cable (Alligator Clips)*	054-0171-0
S/C321 Power Cable (PacCrest/Rcvr)	054-0172-0
S/C321 Power Cable (Satel/Rcvr)	054-0173-0
S/C321 Power Cable (Serial/Rcvr)**	054-0179-0

*The above cables come with unterminated power and communication. The alligator clips cable connects to the other cables. Three variations of the cable exist: one variation has a connector (serial) to plug into Pacific Crest radios. The second variation has a connector to plug into Satel radios. The third variation has a standard DB9 connector. Please see a certified Hemisphere GNSS dealer to ensure that the pinout of these connectors matches the pinout of your radio.

**Most radios may require a null-modem adapter.
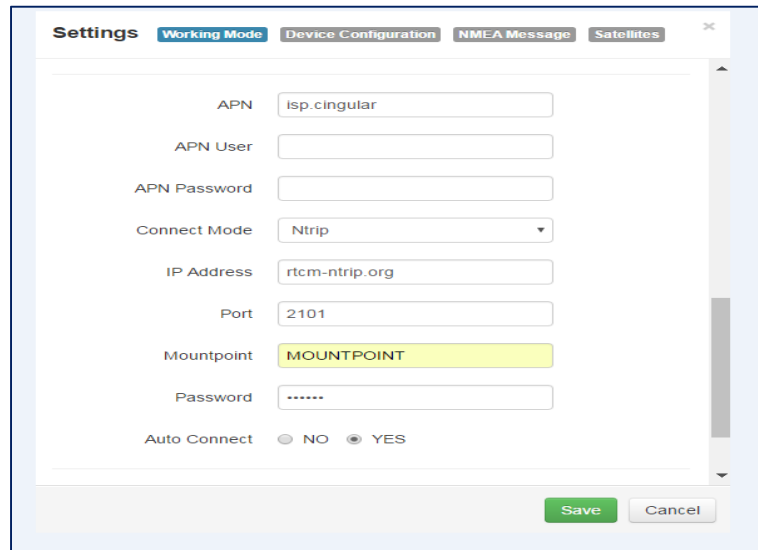
Network

The C321 supports TCP/IP connections for direct connection between base and rovers via cellular as well as NTRIP.

NTRIP

NTRIP requires a specific IP address, username and password. When used as a base, the C321 is an NTRIP caster.

Type your **APN User name**, **APN Password**, **IP address**, **Port**, and **Mountpoint**. If a username and password is not required for your APN, you can leave those fields blank. The configuration of NTRIP for a Base is shown below:
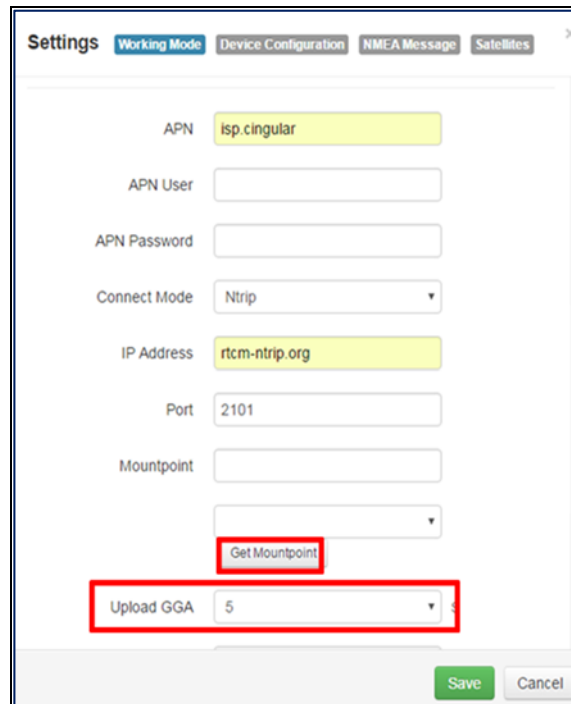
If configuring NTRIP for a Rover, click **Get Mountpoint** to generate a list of available mount points.

Some networks require a GNSS position prior to sending RTK. To send GNSS positions to the network, click the dropdown menu next to "**Upload GGA**" and select a rate.

Note: The **Auto Connect** identifies that the receiver connects to the network when powered up.

WARNING: If the C321 has not yet established an internet connection via the Internal GSM modem, the **Get Mountpoint** button will not work. You can configure the APN settings while using TCP/IP so that an internet connection is established.

After establishing an internet connection, change **Connect Mode** back to **NTRIP** and proceed with the configuration.

TCP/IP
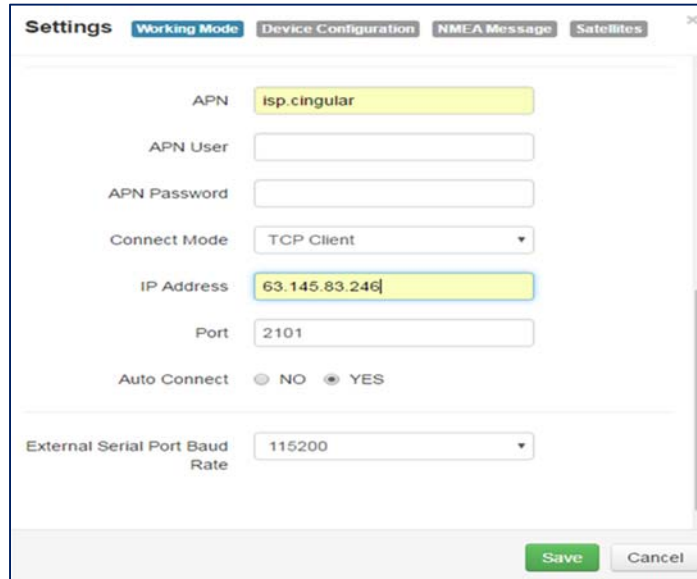
If running as a base station, select **TCP Server** and type in a **Port**.

The TCP Server requires that the SIM card provide a public IP address. The public IP address can be found in the "**Information"** tab on the C321 WebUI.

Note: The **Auto Connect** identifies that the receiver connects to the network when powered up.

If the C321 is running as a rover, select **TCP Client** and type in the **IP address** and **Port** of the base.

Note: The IP address and Port of the base can be found under the **Information** tab of the base station.
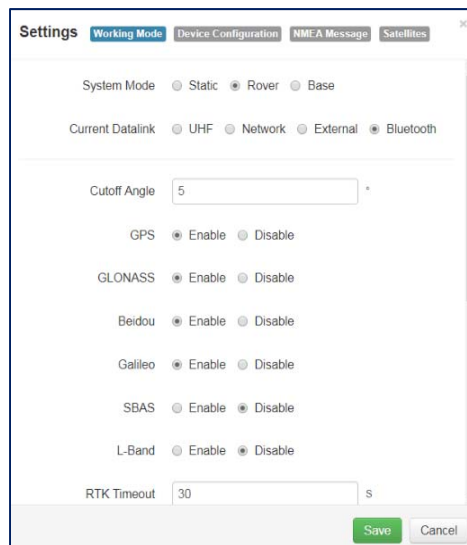
Rover/Bluetooth

The Rover/Bluetooth is typically used with SiteMetrix or other capable third-party software when streaming network corrections to the data collector internet and then sending them to the C321 via the Bluetooth communication port.
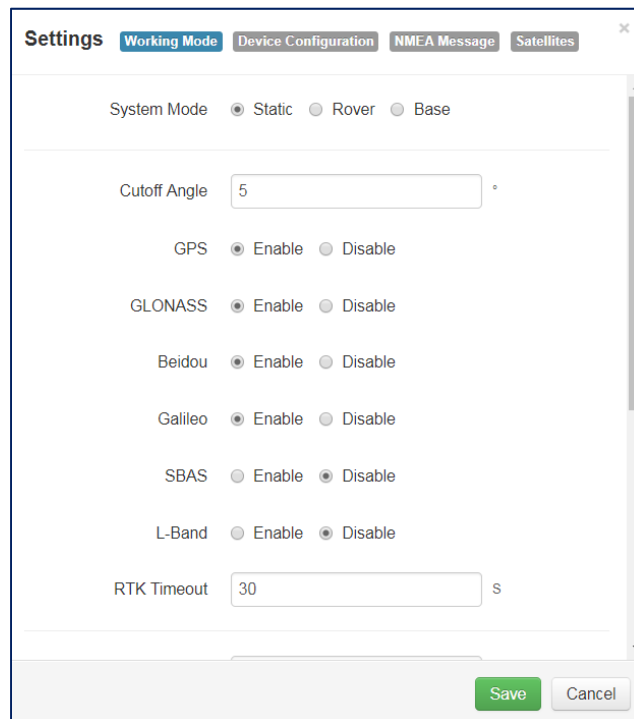
Static

Use Static mode to take a static observation of a point, and stop logging (for both base and rover) if the position moves.

Select **Static** next to **System Mode** and configure the log file (to configure a file, refer to Working Mode for instructions).
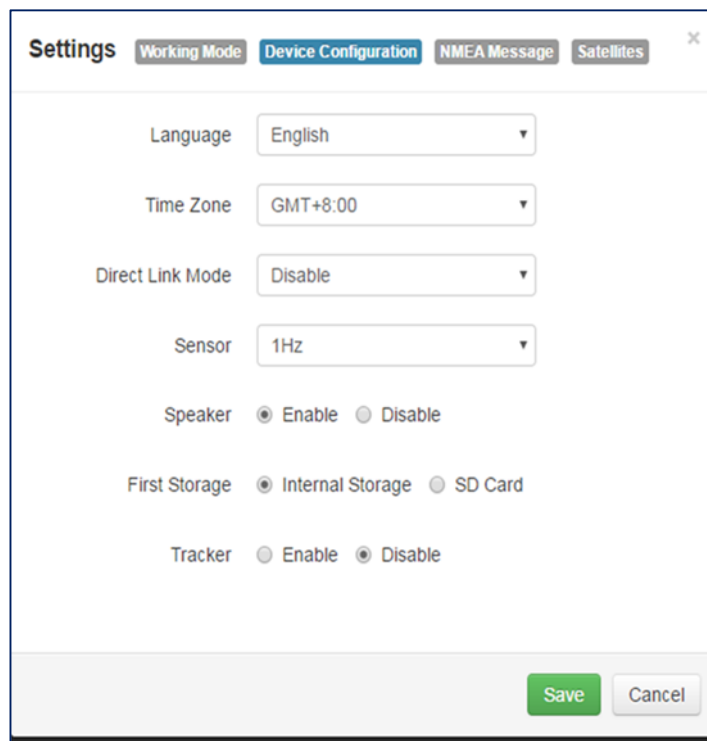
Device Configuration

The **Device Configuration** tab allows for custom settings in terms of language, time zones, storage, and several other options.

When enabling the speaker, the C321 relays the status of the positioning via voice updates. Specifically, the C321 will audibly indicate when the receiver is in **Base** or **Rover** mode. Voice indication covers, logging data, and declaring when the C321 has achieved RTK float and RTK fix. This is important when working in a low visibility environment.

Direct Link Mode enables certain troubleshooting features for Hemisphere GNSS and certified Hemisphere GNSS dealers. In addition, the easy-to-use radio buttons allow you to use tracker and select which mode of data logging storage you wish to use, SD or Internal.

NMEA

Enable the NMEA messages.

Note: This function is only available if you have hardware version C321-v1.1 (see "**Information**" tab) or higher, these messages will come out of the 5-pin serial port at the same baud rate as the External Serial Port Baud Rate (as shown above). This function cannot be used if you are using an external device for RTK.

Satellites
If you wish to exclude a specific satellite, select the **Don't track** checkbox next to that satellite in the list.

Firmware Update

Updating Firmware via Web UI

Using the "**Management**" tab under the Web UI, select the "**Choose File**" button to find the appropriate firmware of application software for the C321 device.
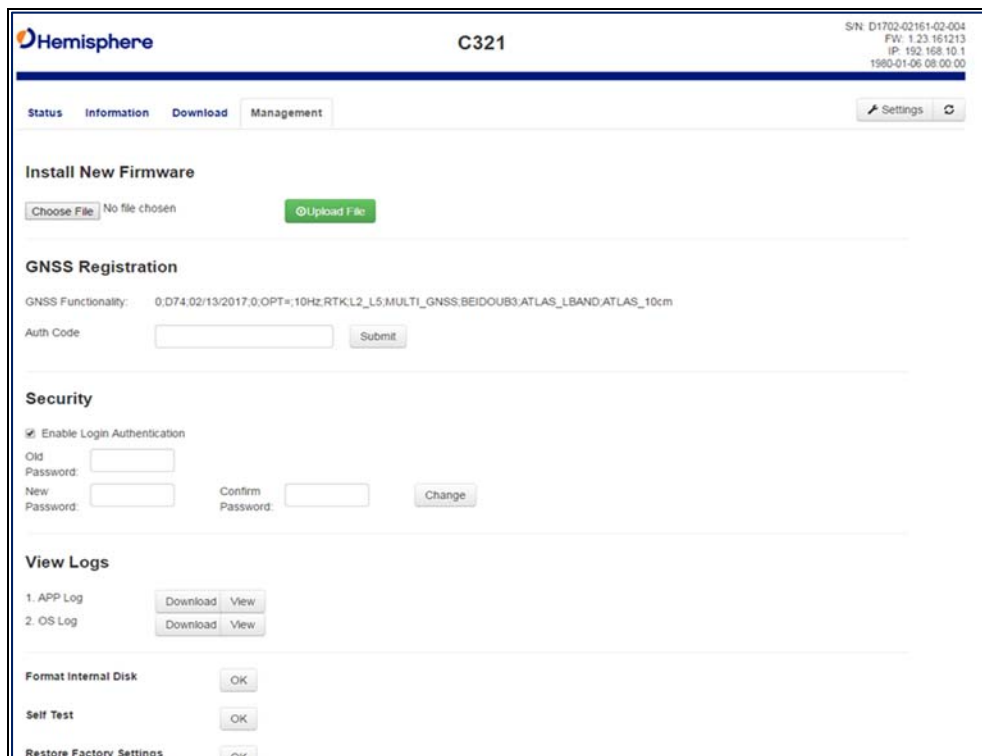
After selecting the correct firmware/software file, click the green "**Upload File**" button.

When the file is uploaded, be sure to check the current firmware version versus the new firmware version. When you have ensured the correct files are in place, click "**OK**" button.
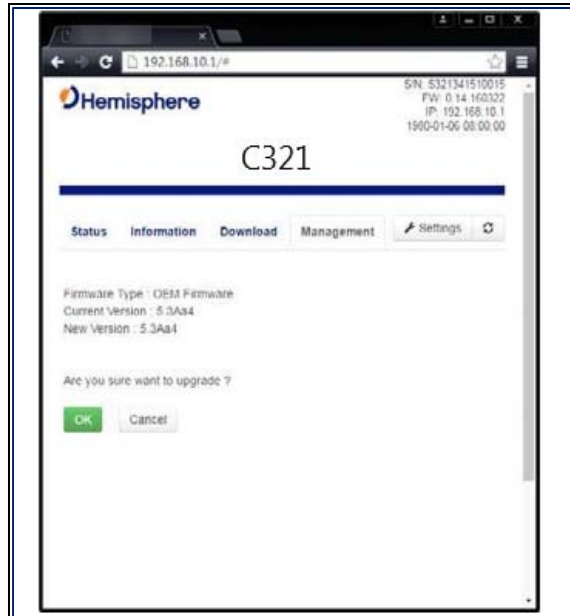
A status bar indicates the level of progress for the updating firmware/software.
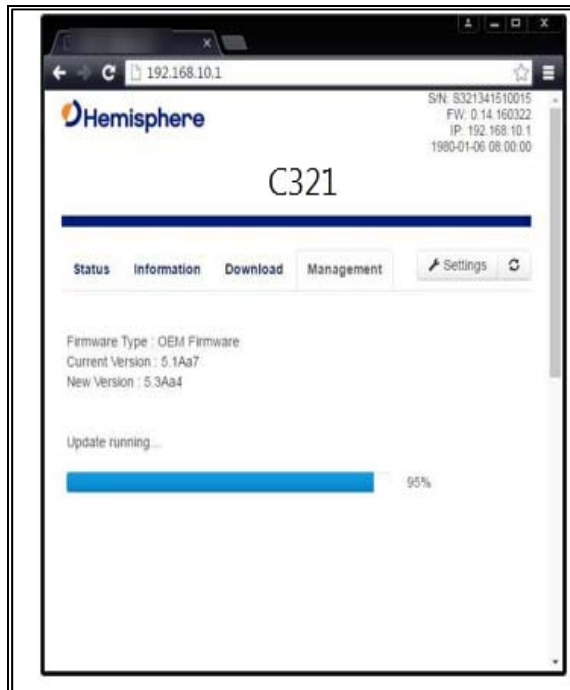
When the status bar reaches 100%, the upgrade is complete. The Web UI message displays "Update successful".

Updating Firmware via Micro SD Card

Using the Web UI, select "**Settings**" and "**Device Configuration**". Under "Device Configuration", locate the "First Storage" option, and select the "**SD Card**" radio button. Click the "**Save**" button at the bottom right of the screen.

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

Receiver firmware: C321_update_YYMMDD.bin YY: Year
MM: Month DD: Day
e.g. C321_update_160202.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

How to Download Static Data

You can download static data by Web UI "**Download**" tab and by USB. This allows the user to download internal logs via the USB port on the 7-pin connector. For a correct connection between receiver and PC, follow the procedure described below.

First, power-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. Power the C321 back on and the following task bar displays.

The PC considers the receiver as a "media disk", so open the "media disk", to retrieve the data files in the memory.
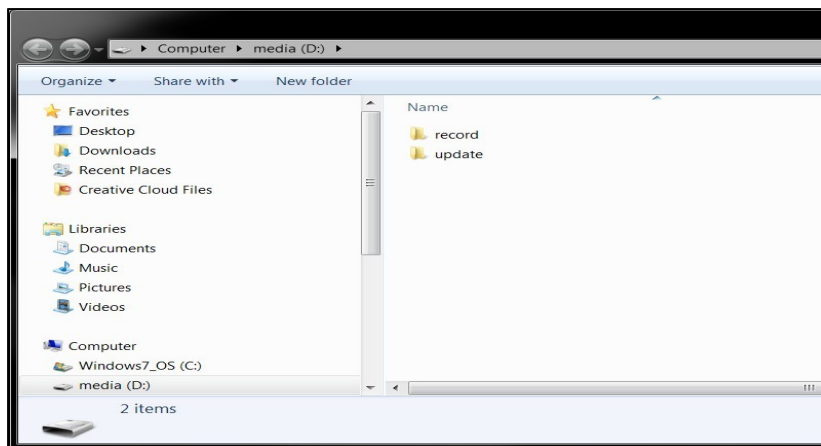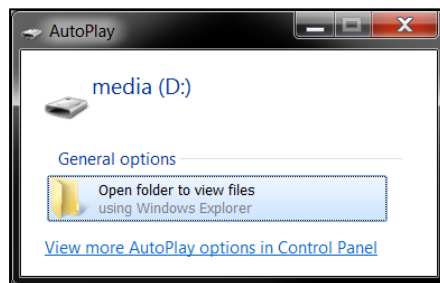
Appendix A: Troubleshooting

Appendix A: Troubleshooting

Table A-1 provides troubleshooting tips for the C321 Smart Antenna.

Table A-1: C321 Troubleshooting

Issue	Possible Resolution
Receiver fails to power	- Verify polarity of power leads - Check integrity of power cable connections - Check power input voltage (8 - 32 VDC) - Check current restrictions imposed by power source (maximum is 300 mA at 12 VDC)
No data logged **No communication** **No valid data**	- Check receiver power status - Check integrity and connectivity of power and data cable connections - Verify the baud rate settings match - Verify receiver responds to valid $J Command ($JI) - Verify it is locked to a valid DGNSS signal - Verify it is locked to 4 or more GNSS satellites
Random data from Web UI or C321 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
C321 Will Not Go RTK Fixed	- If the C321 is "RTK Float", then it is receiving RTK or Atlas corrections. - If the RTK latency is between 10-15 seconds, these are most likely Atlas corrections - If the RTK latency is less than 10-15 seconds, the C321 is receiving RTK, but probably will not Fix because of the environment - If the C321 will not go RTK Float or RTK Fixed, check to ensure the base station is operating - Verify the settings of the UHF radio at the base and at the rover are the same - If using a network, check the Cellular Signal Quality (CSQ) under the **Information** tab for cellular reception. CSQ can also be viewed on the C321 display screen by pressing the **FN** button - If using the internal UHF radio, ensure a valid 400MHz UHF antenna is plugged into the SMA connector labeled **UHF** - If using the Internal GSM modem, ensure that the cellular antenna is screwed into the SMA connector labeled **UMTS** **WARNING:** The connectors are identical, always check to ensure the correct antenna is screwed into the correct slot - If using Bluetooth, ensure RTK is reaching the data collector (check the data collector internet or data collector radio)

Appendix B: Technical Specifications

Appendix B: Technical Specifications

Table B-1 through B-11 provide information on the technical specifications of the C321 Smart Antenna.

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	RTCM2.3, RTCM3.0, RTCM3.x, CMR, CMR+, ROX
L-band formats	Atlas H100, Atlas H30, and Atlas H10
Update rate / recording interval	Selectable from 1, 2, 4, 5, 10, 20 Hz (optional)

Table B-2: Performance Specifications

Mode	Specification	
	RMS (67%)	2DRMS (95%)
RTK Performance	8mm + 1 ppm	15mm + 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]	0.04 m	0.08m
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
QZSS	With future firmware upgrade
Galileo	E1BC, E5B
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 another electronic device
TTS	Smart voice broadcast system. "Speaking" receiver
Reference Outputs	RTCM3.0, RTCM3.2, CMR, CMR+, and ROX (Hemisphere proprietary messaging format)

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	Specification
Type	UMTS/HSPA+ (WCDMA/FDD), GSM/GPRS/EDGE
Supported Frequencies	•UMTS/HSPA+ (WCDMA/FDD) (850, 900, 1900 and 2100 MHz) •GSM (850/900/1800/1900 MHz)

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

Appendix C: Radio Mode

Appendix C: Radio Mode

Table C-1: Radio Mode

Radio Mode	Link Rate	Spacing	Modulation	Scrambling	FEC
Trimtalk 1	4800 bps	12.5 kHz	GMSK	On	Off
Trimtalk 2	9600 bps	25 kHz			
PC1	9600 bps	25 kHz	GMSK	On	On
PC5	4800 bps	12.5 kHz			
PC-4FSK	9600 bps	12.5 kHz	4FSK	On	On
	19200 bps	25 kHz			
Satel 3AS	9600 bps	12.5 kHz	4FSK	On	Off
					On
	19200 bps	25 kHz			Off
					On

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21. **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.

22. **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.

23. **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.

24. **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.

25. **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.

26. **CISG.** The United Nations Convention on Contracts for the International Sale of Goods will not apply to this Agreement or any transaction hereunder.

27. **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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COVERED PRODUCTS: This warranty covers all products manufactured by Hemisphere GNSS and purchased by the end purchaser (the "Products"), unless otherwise specifically and expressly agreed in writing by Hemisphere GNSS.

LIMITED WARRANTY: Hemisphere GNSS warrants solely to the end purchaser of the Products, subject to the exclusions and procedures set forth below, that the Products sold to such end purchaser and its internal components shall be free, under normal use and maintenance, from defects in materials, and workmanship and will substantially conform to Hemisphere GNSS's applicable specifications for the Product, for a period of 12 months from delivery of such Product to such end purchaser (the "Warranty Period"). Repairs and replacement components for the Products are warranted, subject to the exclusions and procedures set forth below, to be free, under normal use and maintenance, from defects in material and workmanship, and will substantially conform to Hemisphere GNSS's applicable specifications for the Product, for 90 days from performance or delivery, or for the balance of the original Warranty Period, whichever is greater.

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GOVERNING LAW. This agreement and any disputes relating to, concerning or based upon the Product shall be governed by and interpreted in accordance with the laws of the State of Arizona.

OBTAINING WARRANTY SERVICE. In order to obtain warranty service, the end purchaser must bring the Product to a Hemisphere GNSS approved service center along with the end purchaser's proof of purchase. Hemisphere GNSS does not warrant claims asserted after the end of the warranty period. For any questions regarding warranty service or to obtain information regarding the location of any of Hemisphere GNSS approved service center, contact Hemisphere GNSS at the following address:

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