Hemisphere®

875-0435-10

S631 GNSS Smart Antenna

User Guide
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Device Compliance, License and Patents

Compliance

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 301489-17v2.2.1
- 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, SubpartB
- 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

Continued on next page

Device Compliance, License and Patents, Continued

Compliance, continued

Certifications

- S631 (752-0042-10)
- Model: S631
- FCC ID: LTE – XMR201903EG25G
- BT/Wi-Fi – 2ABNA-2455A
- UHF – 2ABNA-TRM121
- IC: LTE – 10224A-201903EG25G
- BT/Wi-Fi – 11648A-2455A
- UHF – 11648A-TRM121
- S631 (752-0043-10)
- Model: S631
- FCC ID: LTE – XMR201903EG25G
- BT/Wi-Fi – 2ABNA-2455A
- UHF – MRBSATEL-TA37
- IC: LTE – 10224A-201903EG25G
- BT/Wi-Fi – 11648A-2455A
- UHF – 2422A-SATELTA37

WARNING: Your S631 is equipped with a 400 MHz radio and you may be required to obtain a valid radio license for your jurisdiction. Set the radio only to the frequency and power you are licensed to use at your location.

Device Compliance

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

- This device may not cause harmful interference, and
- 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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Device Compliance, License and Patents, Continued

Patents

Hemisphere GNSS products may be covered by one or more of the following patents:

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

Australia Patents	
2002244539	2002325645
2004320401	

Notice to Customers

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

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WWW.HGNSS.COM

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Fax: (480) 270-5070
SUPPORT.HGNSS.COM

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Hemisphere GNSS is committed to the quality and continuous improvement of our products and services. We urge you to provide Hemisphere GNSS with any feedback regarding this guide by opening a support case at the following website: HGNSS.COM

Terms and Definitions

Introduction

The following table lists the terms and definitions used in this document.

S631 terms & definitions

Term	Definition
Activation	Activation refers to a feature added through a one-time purchase. For features that require recurring fees, see **Subscription**.
aRTK	aRTK is a Hemisphere GNSS exclusive service that uses Atlas to extrapolate the last RTK correction during an RTK outage so the length of time an RTK position can be used after an RTK outage is extended.
Atlas	Atlas is a subscription based service provided by Hemisphere.
Base Station	The base station is a receiver placed over a familiar point and provides real-time observations and sends these to nearby RTK rovers via UHF radio or the internet.
BeiDou	BeiDou is a global navigation satellite system deployed and maintained by China.
Cold Start	Position moved more than 100km during power-off, or power-off longer than 3 days.
Datalink	Datalink is the device used to send RTK or DGNSS corrections from a base station to one of more rovers. Common datalinks are UHF radio or NTRIP.
DGNSS	Differential GNSS
Elevation Mask	Elevation Mask is the minimum angle between a satellite and the horizon for the receiver to use that satellite in the solution.
Firmware	Firmware is the software loaded into the receiver that controls the functionality of the receiver and runs the GNSS engine.

Continued on next page

Terms and Definitions, Continued

S631 terms & definitions, continued

Term	Definition
GALILEO	Galileo is a global navigation satellite system implemented by the European Union and European Space Agency.
GLONASS	Global Orbiting Navigation Satellite System (GLONASS) is a Global Navigation Satellite System (GLONASS) deployed and maintained by Russia. It is comparable to the United States' GPS system.
GNSS	Global Navigation Satellite System (GNSS) is a system that provides autonomous 3D position (latitude, longitude, and altitude) along with very accurate timing globally by using satellites. Current GNSS providers are: GPS, GLONASS and Galileo.
GPS	Global Positioning System (GPS) is a global navigation satellite system implemented by the United States.
Hot Start	RF signal loss when power is on.
LED	Light Emitting Diode
Mountpoint	Mountpoints are the specified data streams in NTRIP. Multiple base stations may send data to a NTRIP caster.
NavIC (IRNSS)	Navigation with Indian Constellation and Indian Regional Navigational Satellite System (IRNSS) is a global navigation satellite system deployed and maintained by India.
NMEA	National Marine Electronics Association (NMEA) is a marine electronics organization that sets standards for communication between marine electronics.
NTRIP	Networked Transport of RTCM via Internet Protocol (NTRIP) is a protocol for streaming GNSS data over the internet. NTRIP is most often used to stream RTK or DGNSS corrections over the internet.
NTRIP Server	The NTRIP server sends data from the NTRIP source (base station) to the NTRIP caster.
QZSS	Quasi-Zenith Satellite System (QZSS) is a satellite navigation system currently under development in Japan.
RMS	Root mean square

Continued on next page

Terms and Definitions, Continued

S631 terms & definitions, continued

Term	Definition
RTK	Real-Time-Kinematic (RTK) is a real-time differential GPS method that provides better accuracy than differential corrections.
SBAS	Satellite Based Augmentation System (SBAS) is a system that provides differential corrections over satellite throughout a wide area or region.
Subscription	A subscription is a feature that is enabled for a limited time. Once the end-date of the subscription has been reached, the feature will turn off until the subscription is renewed.
Warm Start	Power loss is less than the cold start time or distance.

Chapter 1: Introduction

Overview

Introduction

This User Guide provides information to help you quickly set up your S631 GNSS Smart Antenna. You can download this manual from the Hemisphere GNSS website at WWW.HGNSS.COM.

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Product Overview

Product overview

The S631 is an all-new multi-frequency, multi-GNSS smart antenna. The S631 provides robust performance and high precision in a compact and rugged package. With multiple wireless communications ports and an open GNSS interface, the S631 can be used in a variety of operating modes.

Use the S631 as a precise base station for sending RTK to your existing rover network. Turn S631 into a lightweight and easy-to-use rover by connecting it to your base via UHF radio or cellular network. Use the built-in web user interface (WebUI) to control, manage, and upgrade the S631 with new firmware and activations. S631 is Athena®-enabled and Atlas®-capable.

Powered by the Phantom™ 40 OEM board, the S631 supports 800+ channels and can simultaneously track all satellite signals including GPS, GLONASS, BeiDou, Galileo, QZSS and NavIC (IRNSS), making them robust and reliable.

S631 comes standard with two long-life lithium batteries providing up to 12 hours of operation. The batteries are hot-swappable, and may be changed while working, maximizing your efficiency and Return on Investment (ROI).

The S631 combines Hemisphere's Athena GNSS engine and Atlas L-band correction technologies with a new WebUI, offering an unparalleled level of customer-friendly performance.

The ruggedized antenna is designed for the most challenging environments and meets IP67-standard requirements.

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Product overview
, continued

The S631 is the ideal positioning system to use in land or marine survey, GIS, mapping, and construction. Together with SureFix™, Hemisphere's advanced processor, the S631 delivers high-fidelity RTK quality information that results in guaranteed precision with virtually 100% reliability.

Figure 1-1: S631 GNSS Smart Antenna

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Athena RTK

The S631 receiver is powered by the Athena RTK technology. The S631 provides state-of-the-art RTK performance when receiving corrections from a static base station or network RTK correction system. With multiple connectivity options, the S631 allows for RTK corrections to be received over radio, cell modem, Wi-Fi, Bluetooth, or serial connection. S631 delivers centimeter-level accuracy with virtually instantaneously initialization times and cutting-edge robustness in challenging environments.

Athena RTK is Hemisphere's next-generation RTK engine designed to support all available constellations and takes advantage of available new signals. Athena was designed to seamlessly integrate into existing product portfolios and supports all major industry correction formats and standards.

Athena RTK can be added to the S631 as an activation.

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.

For more information about Athena RTK, see:
HTTPS://WWW.HEMISPHEREGNSS.COM/TECHNOLOGY/#ATHENA

Continued on next page

Atlas L-band

The Atlas system delivers world-wide centimeter-level correction data over L-band communication satellites. S631 users can experience sub-decimeter positioning performance anywhere on earth, without the need to be near a GNSS or communication infrastructure.

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 to the S631 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 4cm to 50cm range.
- **Convergence time -** Industry-leading convergence times of 10-40 minutes.
- **Global Ionospheric Model** - Real-time ionospheric activity and data is sent to the receiver and allows Atlas-capable devices to adjust accordingly, providing excellent convergence performance.

For more information about Atlas L-band, see: HTTP://HGNSS.COM/ATLAS

WARNING: Your S631 is equipped with a UHF radio. If you choose to use the radio, you may need to obtain a license.

Continued on next page

aRTK Position Aiding

aRTK is an innovative feature available in Hemisphere's S631 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.

S631 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 correction, creating one additional layer of correction redundancy as compared to typical RTK systems.

Once this process is established (a few seconds), the receiver can operate in the absence of either correction source. The receiver can continue generating RTK positions if the land-based RTK correction source becomes unavailable for a period of time.

SureFix™ RTK Position

SureFix is an additional processor that runs in combination with the RTK engine and provides high fidelity quality indicators to users.

The SureFix processor takes several inputs, such as GNSS data, data preprocessing results, and generated RTK solutions. Using all the available information and functional and stochastic analysis methods, SureFix determines the quality of the current RTK engine solution.

Shown as SureFix quality indicators, these indicators are combined with the RTK solution before being provided to the user. At the end of the process, the user has access to high fidelity information about the quality of the RTK solution.

Key Features

Key features

The key features of the S631 Smart Antenna include:

- Multi-frequency GPS, GLONASS, BeiDou, Galileo, QZSS, IRNSS, and Atlas L-band
- Long-range RTK baselines up to 50 km with fast acquisition times
- UHF (400 MHz & 900 MHz), cellular, Bluetooth, and Wi-Fi wireless communication
- Athena GNSS engine providing best-in-class RTK performance
- Internal sensor corrects collected point coordinates to within 2 cm

What's Included in Your Kit

What's included in your kit

As shown in Table 1-1 below, the S631 is available in a variety of kits, with supplementary products sold as "controller/option kits", "accessory kits" or simply as separate accessories. Contents can change without prior notice. Check the official price list to confirm contents.

Important: Charge your Li-Ion 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: S631 parts list

Main Kits	Part Number	Quantity
S631 Smart Antenna	752-0042-10 or 752-0043-10	1
S631 Serial Cable	051-0390-0	1
S321 Serial Cable (5-pin)	051-0392-0	1
S631 UHF 900MHz Antenna (TNC)	150-0058-10	1
S631 UHF 400MHz Antenna (TNC)	150-1026-0	1
Battery	427-0067-0	2
Battery Charger Adapter	427-0081-10	1
Battery Charger	427-0069-0	1
Cigarette Lighter Adapter	427-0064-0	1
Quick Release	699-0015-0	1
Tape Measure	699-0006-000	1
Carry Case	750-0248-10	1

Base Accessory Kit 940-5048-10	Part Number	Quantity
S631 Power Cable (Alligator Clips)	054-0171-0	1
S631 Power Cable	054-0180-0	1
External UHF Antenna Bracket Kit	710-0188-10	1

Chapter 2: Installation

Overview

Introduction

Chapter 2 provides instruction on how to install your S631 Smart Antenna.

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Ports and Connections

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: S631 ports and connectors

Table 2-1: S631 ports and connections

Port	What to connect
7-pin Diagnostic Port (LEMO)	Diagnostic cable for serial or USB
5-pin Power/Data Port (LEMO)	External Power, data, and radio devices
UHF Antenna Connector	External UHF antenna
Mounting hole	Pole or tripod mount

Installing/Connecting the S631

Installing batteries

The S631 comes standard with two long-life lithium batteries (see What's Included in Your Kit) providing up to 12 hours of operation. The batteries are hot-swappable and may be changed while your work.

To install the battery, slide each latch so that the lock is showing.

Figure 2-2: Battery latches

Continued on next page

Installing batteries, continued

Press the button on the side to open the battery compartment and remove the door as shown in Figure 2-3.

Figure 2-3: Battery compartment door removed

Continued on next page

Installing batteries, continued

Place the battery into the compartment. Take care to ensure the contacts on the battery are on the same side as the contacts on the receiver. The battery will fit down onto the notch. Slide the battery forward until it clicks and locks into place (Figure 2-4).

Figure 2-4: Installed battery

Continued on next page

Installing batteries, continued

To close the door cover, ensure the tab is unlocked. Slide the latch to cover the lock and lock the door (Figure 2-5).

Figure 2-5: Closed and locked battery compartment door

Installing UHF Antennas

Installing UHF antennas

To install the external UHF antenna of the S631, locate the UHF antenna (150-1026-0 for 400MHz or 150-0058-10 for 900MHz) from the kit list under What's Included in Your Kit.

Insert the connector end of the UHF antenna and rotate clockwise to secure the antenna to the S631.

Installing the S631 on a Tribrach

Installing S631 on a tribrach

The S631 mounts flush to the tribrach by securing the 5/8-11” female metal mounting portion of the S631 to the standard 5/8-11” male portion of the tribrach. Hand-tighten (35-40 in-lbs. of torque) to secure the S631 onto the mount in a clockwise rotation.

Figure 2-6: Installing S631 on a tribrach

Installing the S631 on a Range Pole

Installing the S631 on a range pole

Use the standard 5/8-11” mount on the bottom of the S631 to secure the unit to a field standard 5/8-11” range pole.

The S631 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 the unit.

Figure 2-7: Range pole installation

Connecting to a Power Source

Connecting to a power source

The S631 has two main power sources. The first power source is the internal removable battery described in the earlier portion of this chapter. The second power source is the external power cable (Part Number 054-0171-0).

The 5-pin (LEMO) connector allows 9 to 24V of power into the S631.

Figure 2-8: External power connector

Connecting to an External Device

Connecting to an external device

The 7-pin connector is available for diagnostics. You can also use this pin connector to download your data files.

Figure 2-9: 7-pin diagnostic connector

To download your data files, connect the 7-pin Lemo connector end of the cable to the S631. Plug the USB end into a computer. You can access the internal memory of the receiver via the filesystem.

The data files are kept in the “record” folder. Text files with a *.script* file extension that contain commands (see S631 Series Command Interface Integrator Guide) are placed into the “update” folder and sent upon startup of the receiver.

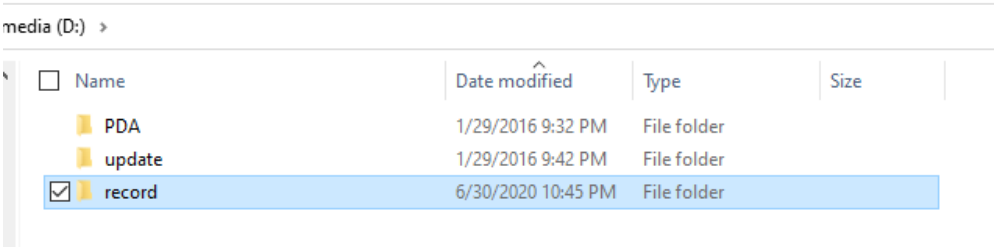

Figure 2-10: Record folder

Powering the S631 On/Off

Powering the S631 on/off

To power on the S631 receiver, press the **I** key for one second, and wait for the device to beep three times and power on.

To power off the S631 receiver, press the **I** key until the receiver beeps and the LED lights blink. Then press the power key again to power off.

Inserting and Removing the MicroSD Card/SIM Card

Inserting and removing the MicroSD card/SIM card

To remove the MicroSD card or SIM card:

– Open the battery compartment A.
– Remove the battery.
– Remove the cover for the SD or SIM card.
– Gently slide the tray backward until it clicks out of place.
– Gently lift the tray up and remove the card.

Note: When you insert either card make sure the contacts on the card are facing downward (toward the top of the unit).

Caution: Use electrostatic discharge (ESD) protection, such as wearing an ESD strap that is attached to an earth ground before inserting or removing the SIM card on the S631. If an ESD strap is not available, then touch a metal object prior to accessing the SIM card holder.

The MicroSD card and the SIM card are only accessible by first opening battery compartment **A**, where:

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

Warning! Ensure the unit is powered off when inserting or removing the SIM card.

Continued on next page

Inserting and Removing the MicroSD Card/SIM Card, Continued

Inserting and removing the MicroSD card/SIM card, continued

Figure 2-11 shows the Mirco/SIM card slot.

Figure 2-11: MicroSD/SIM card slot

Chapter 3: Setup and Configuration

Overview

Introduction

Chapter 3 contains the information you need to set up and configure your S631 GNSS Smart Antenna.

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Control Panel Overview

Control Panel overview

Refer to the table below for information on the control panel LED indicators.

Table 3-1: LED Indicators

Icon	Colors	Description	
Satellite LED	Red Green	Off	Not receiving satellites
		Flashing Red	Receiving satellites but no solution
		Flashing Green	Has a solution but is not fixed
		Green	Fixed
		Alternate Red and Green	GNSS receiver board abnormal
Data Link LED	Green Blue	Green	Datalink setup complete
		Flashing Green	Data transmitting normally
		Flashing Blue	In static mode, flashes according to the sampling intervals
Bluetooth LED	Blue	Off	No Bluetooth connection is established
		Blue	Bluetooth connection established
Power LED	Red Green	Green	Power is between 30% and 100%
		Flashing Green	Power is between 10% and 30%
		Flashing Red	Power is below 10%
Power Button	-	-	Used to turn on and off the receiver
		-	Short press to broadcast the current working mode and status

Setting up the S631

Setting up the S631

Figure 3-1 shows a typical setup for a base station (tripod is not included).

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

Figure 3-1: Base setup

Installing the base

To install the base, complete the following steps:

- Put a tripod on a location with known or unknown coordinates, attach the receiver to the tribrach.
- Attach the UHF radio antenna to the TNC connector (if using the internal UHF radio). We recommend using the 40cm pole extension to increase the height of the antenna.
- Switch on the receiver and select the base working mode.

Installing the rover

To install the rover, complete the following steps:

- Attach the hand-held bracket on the pole, fix the hand-held to the bracket, put the rover on the pole and attach the UHF antenna to the TNC connector (if using the internal UHF radio).
- Power on the receiver and select the rover working mode.
- Open the hand-held and start the software, then you can configure the instruments.

Bluetooth Communication

Bluetooth communication

If you have a Bluetooth-enabled device, such as a data collector, you can wirelessly communicate with the S631.

When you attempt to connect the S631 to a Bluetooth-enabled device, such as a hand-held data collector, the following S631 Bluetooth information appears on the device:

XXXXXX
where “XXXXXX” is the serial number

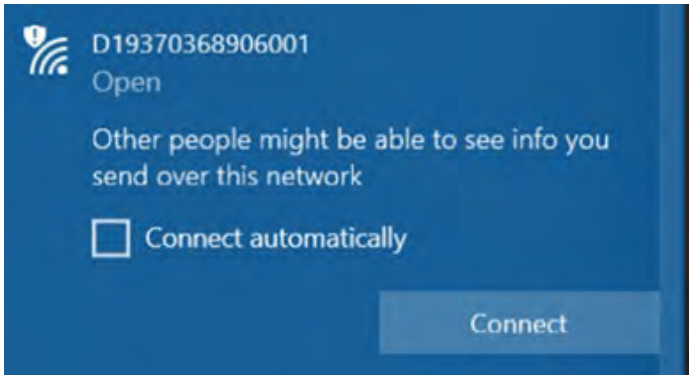
Hemisphere WebUI

Hemisphere WebUI

The WebUI 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 the same as the serial number of the device.



If you want this network to automatically connect, select the **Connect automatically** check box before pushing the **Connect** button. If not, click the **Connect** button. We suggest setting this to a private connection.

Once connected to your device, type or copy the following IP address into your URL bar:
http://192.168.10.1/

The WebUI will prompt you for a username and password. The default username and password are:

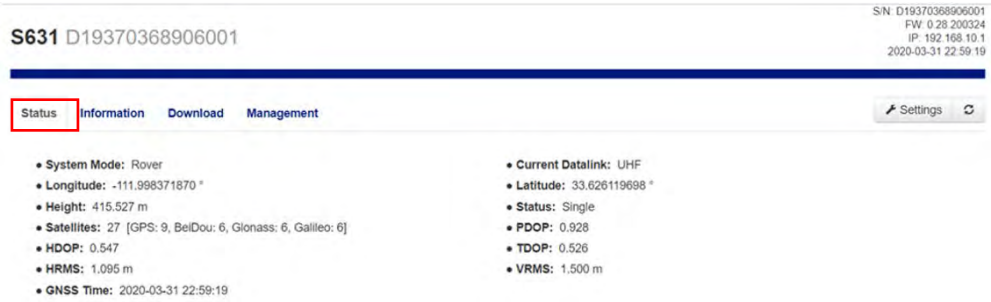
– Username: admin
– Password: s631

Continued on next page

Hemisphere WebUI, Continued

Status tab

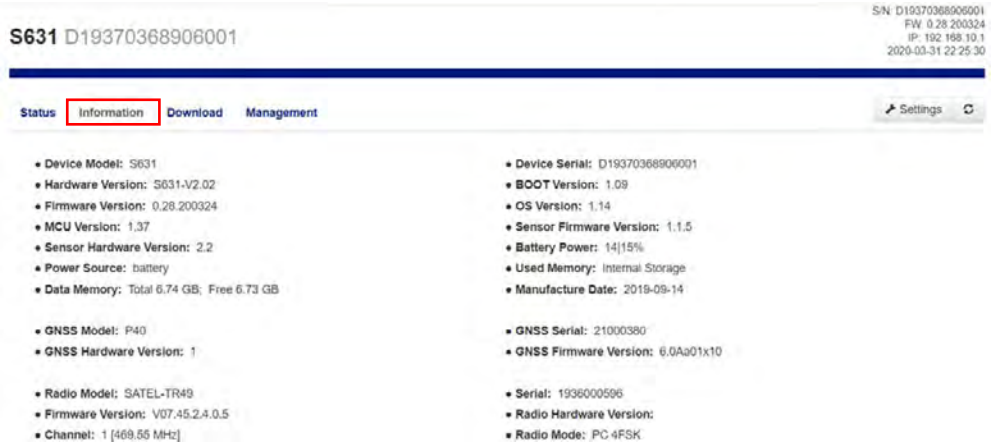
The **Status** tab provides general GNSS information including **System Mode**, **Latitude**, **Longitude**, and **Height**.



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 S631 device.

Information tab

The **Information** tab contains device and module information and current software and firmware versions.

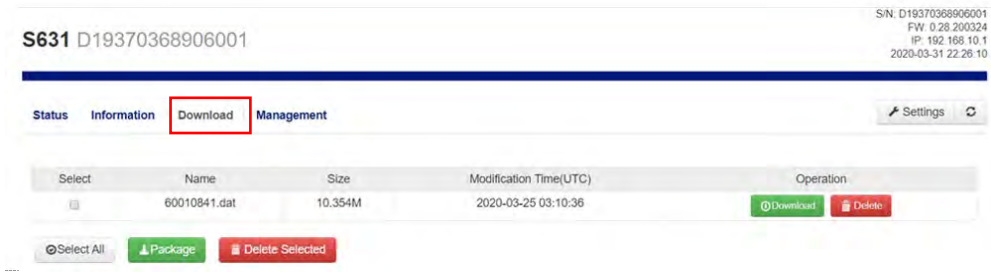


Continued on next page

Hemisphere WebUI, Continued

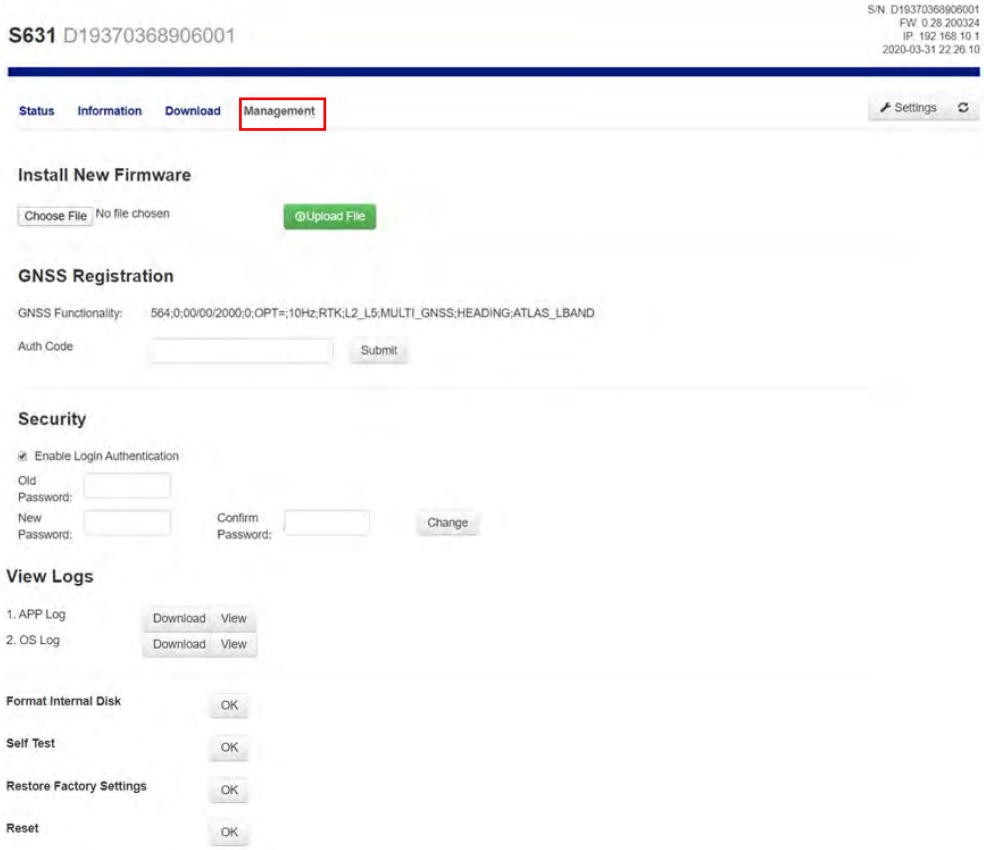
Download tab

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



Management tab

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



Continued on next page

Management tab, continued

GNSS Registration

GNSS Registration displays the expiration date of various subscription features on the S631.

The Atlas expiration date will be displayed under this field. In addition, the ability to update the S631 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 you can change, create and/or confirm your password.

View Logs

The **View Logs** field allows you to track any activity at the application and Operating System (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 S631.

Self-Test provides an application review to ensure the device functioning properly.

Restore Factory Settings returns the S631 to all default settings and performs a full power cycle.

Reset initiates a complete device shut down, creating a hard reset to the device and stopping any application activity.

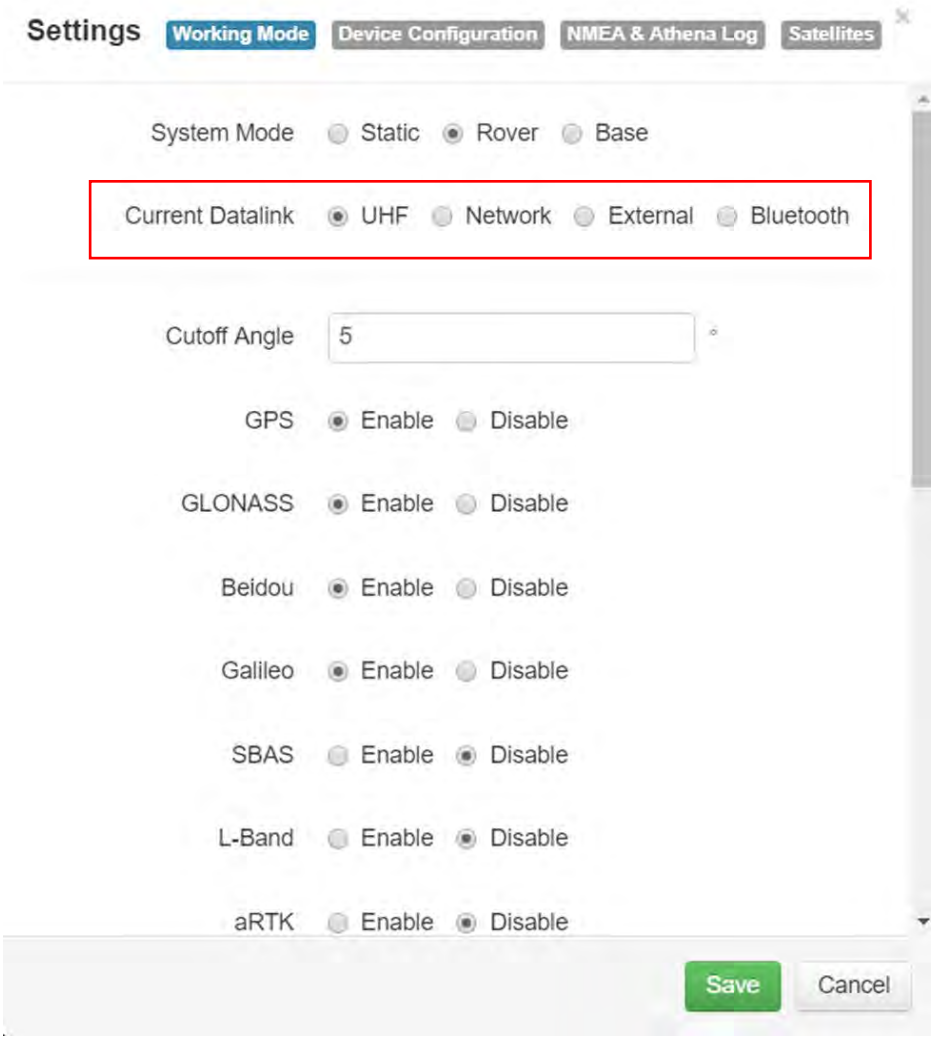
Continued on next page

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.



Continued on next page

Working Mode, continued

Reference the following table for **Working Mode** fields and descriptions:

Field	Description
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.
Atlas Frequency	If using Atlas, set to **Auto** to automatically tune to the correct frequency, or manually tune to the correct frequency.
Atlas Datum	If receiving Atlas corrections, you can use the ITRF08 datum, the GDA94 datum, or input custom X, Y, Z offsets. **Note:** This only affects Atlas positions.
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, set the L-band to **Enable** and **RTK Timeout** should be set to 2700.

Continued on next page

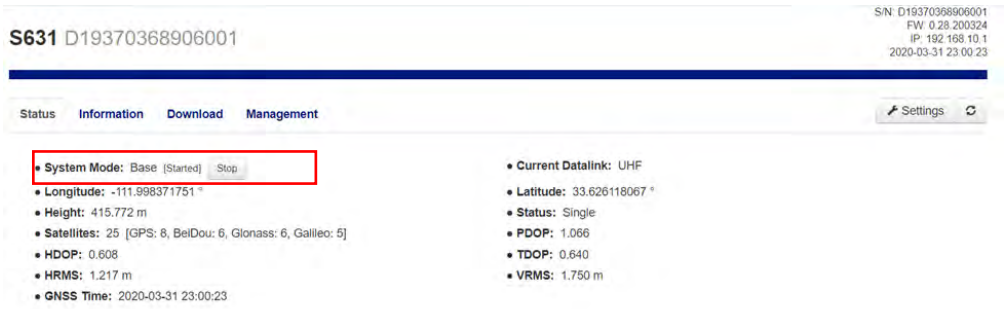
Working Mode, continued

System Mode

The S631 can be configured as a survey rover, base station, or run a static observation.

To set the base location select one of the following positions:

- **Single Position:** Upon startup, the S631 will average its position and use that position for the base position.
- **Repeat Position:** Used to input a permanent base station position into the S631. You may type in a latitude, longitude, and altitude, or click **Current Position** to automatically populate the field with the current GNSS position.
- **BaseLink Position:** (Requires an Atlas H10 (10-centimeter) subscription.) Used to input a **Target Accuracy**. Once the accuracy of the GNSS position of the receiver has reached the **Target Accuracy**, the receiver will begin to output RTK based on its calculated position. The accuracy of the GNSS position may continue to improve. If it does improve, a new target accuracy may be entered, and the base position will shift to reflect the new accuracy.



Continued on next page

Working Mode, continued

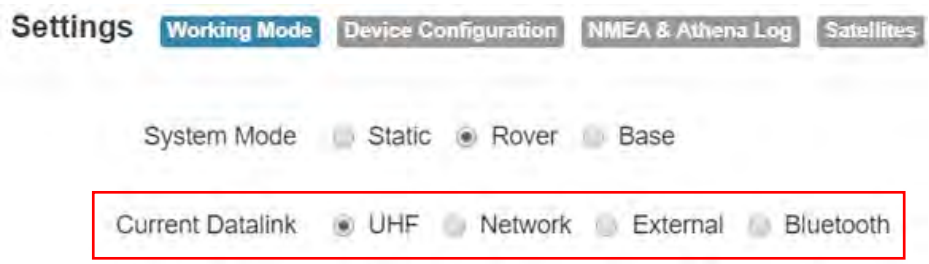
Data Link

The S631 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 S631 comes without a channel table loaded. Only Hemisphere GNSS or a Hemisphere GNSS certified dealer can create the file to upload a channel table.

Next to **Current DataLink** select **UHF.**



Note: The radio frequency should match the transmitting base.

Continued on next page

Working Mode, continued

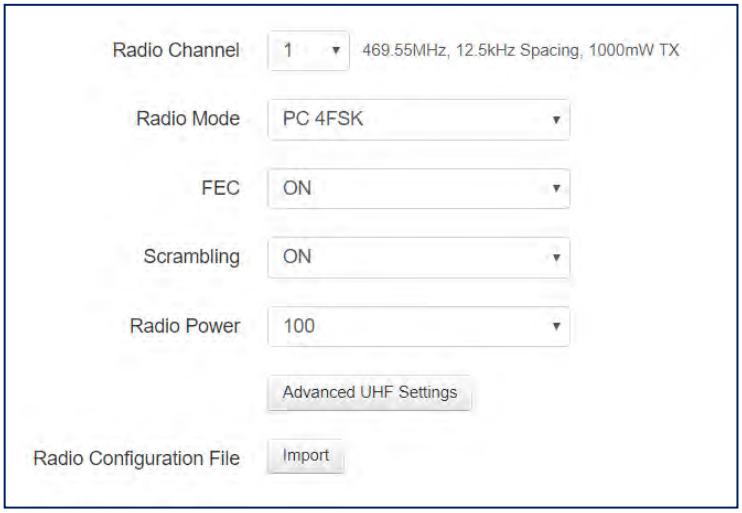
The following dialogue window appears:

You can also upload a file by clicking **Import** next to **Radio Configuration File** and uploading a channel table file (file extension .ucf) provided by your dealer.

Continued on next page

Working Mode, continued

The following dialogue window appears at the bottom of the page.



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 S631 supports PacCrest protocols (GMSK and 4FSK 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.

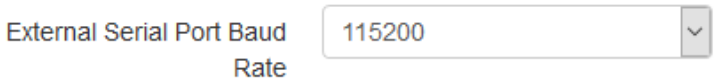
Continued on next page

Working Mode, continued

External

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

Use the drop-down arrow to select the **baud rate** of the external device and plug that device into the 5-pin serial port. (Baud rates range from 9600 bps – 115200 bps.)



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

Table 3-2: S631 5-pin cables

5-pin cable	Part Number	Description
S631 Power Cable (Alligator Clips)	054-0171-0	Alligator clip adapter for the 054-0180 serial cable and the 054-0178-0 power cable.
S631 Serial Cable	051-0392-0	Serial cable only Serial comes out to a DB9. To connect to an external UHF radio, you may need a null modem adapter.
S631 Power + Serial	054-0180-0	Power and serial cable
S631 Power Cable	054-0178-0	Power cable only

Continued on next page

Working Mode, continued

Network

The S631 supports TCP/IP connections for a direct connection between base and rovers via cellular as well as NTRIP.

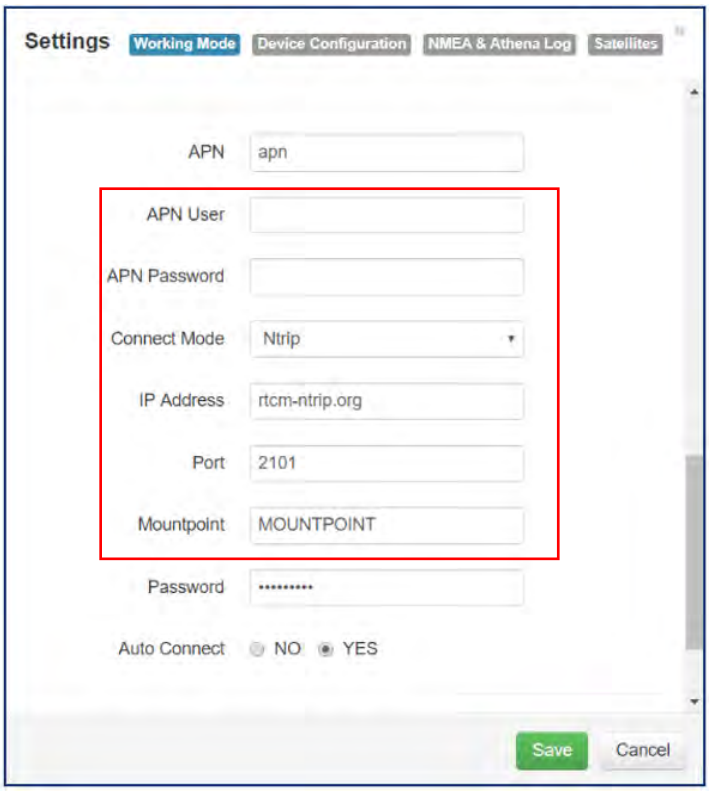
NTRIP

NTRIP requires a specific IP address, username, and password. When used as a base, the S631 is an NTRIP server.

Continued on next page

Working Mode, continued, continued

Type your **APN Username**, **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 mountpoints.

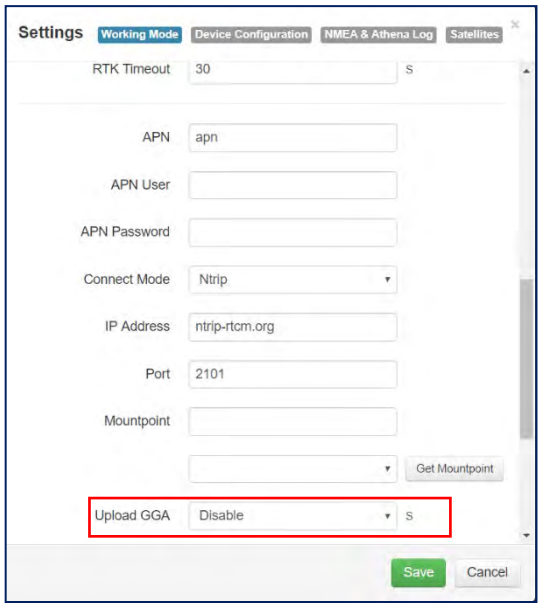
WARNING: If the S631 has not yet established an internet connection via the Internal GSM modem, the **Get Mountpoint** button will not operate. You can configure the APN settings while using TCP/IP so that an internet connection is established.

Continued on next page

Working Mode, continued

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

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



Continued on next page

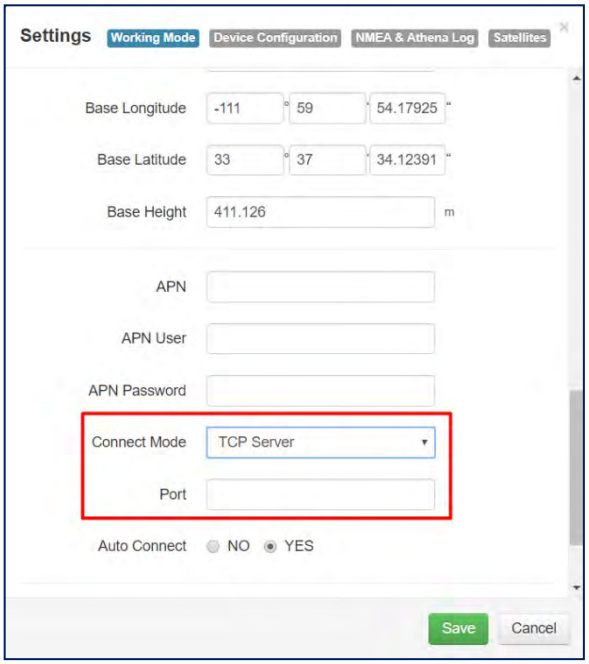
Working Mode, continued

TCP/IP

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

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 S631 WebUI.

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

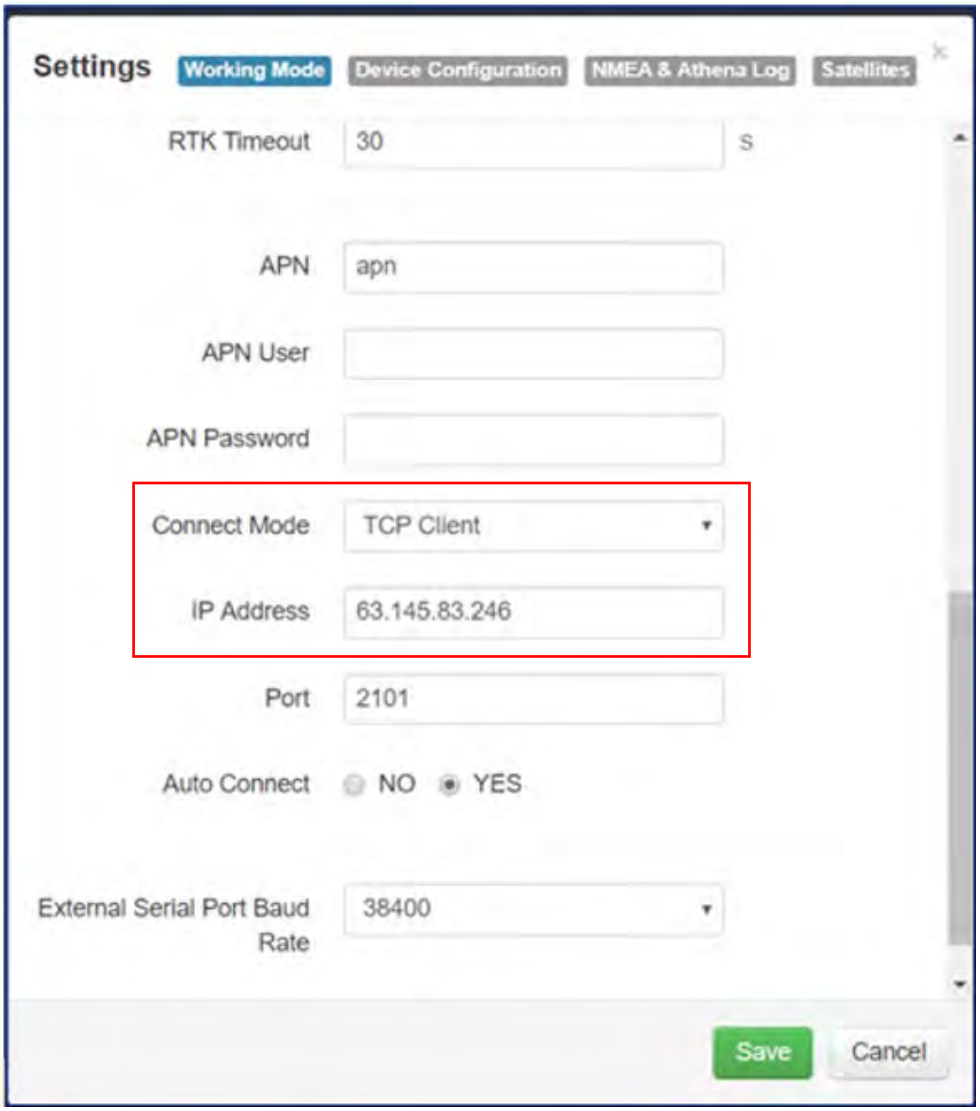


Continued on next page

Working Mode, continued

If the S631 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 is under the **Information** tab of the base station.



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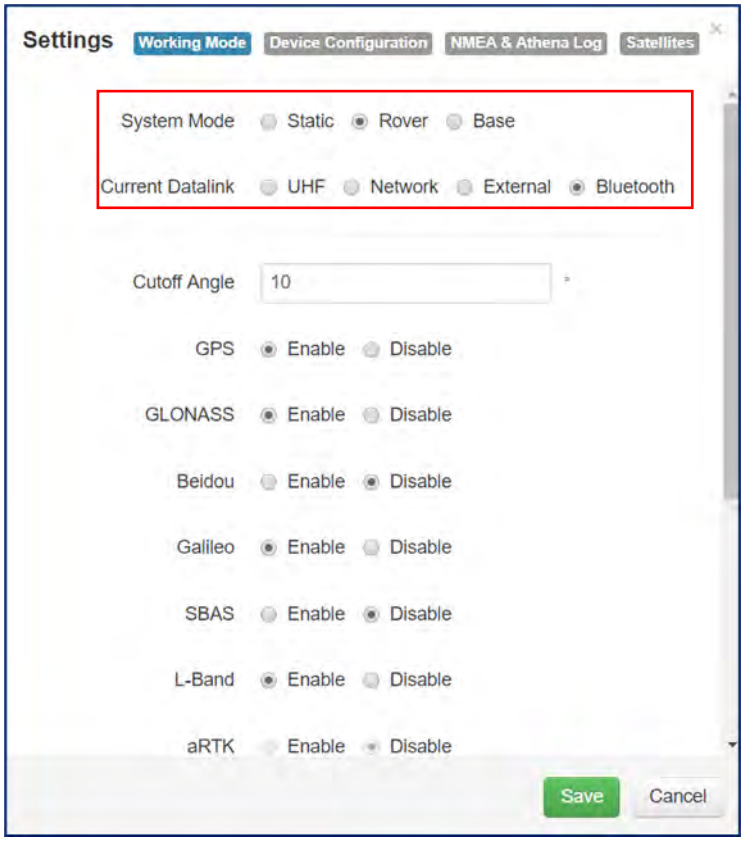
Working Mode, continued

Rover/Bluetooth

The Rover/Bluetooth is typically used with third-party software when streaming network corrections to the data collector internet and then sending them to the S631 via the Bluetooth communication port.



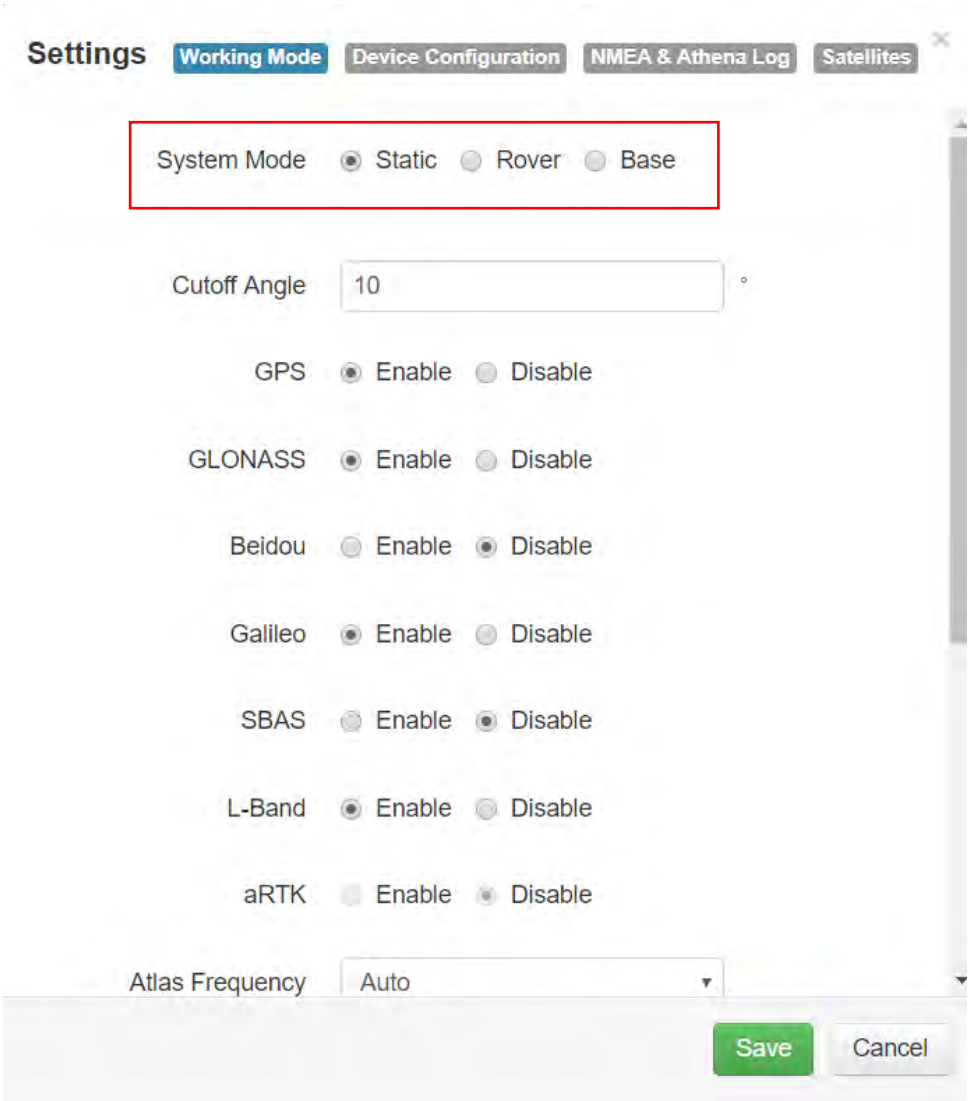
Continued on next page

Working Mode, continued

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.



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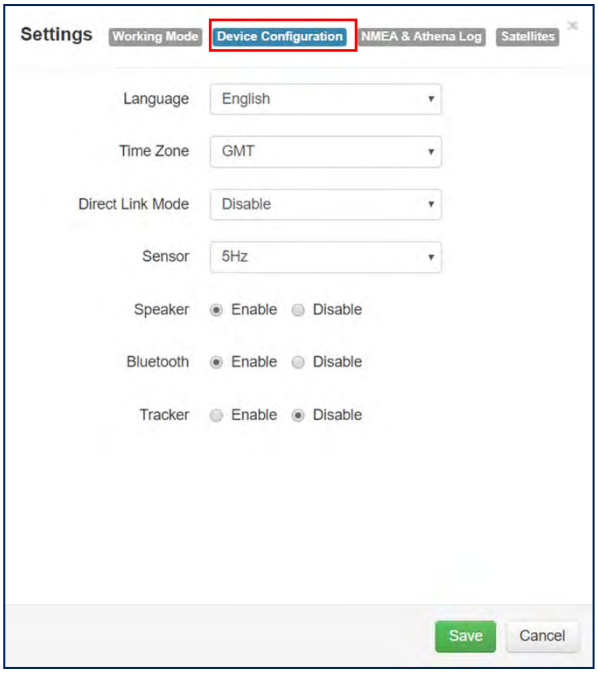
Device Configuration

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

When enabling the speaker, the S631 relays the status of the positioning via voice updates. The S631 will audibly indicate when the receiver is in **Base** or **Rover** mode. Voice indication covers logging data and declaring when the S631 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 disable or enable Bluetooth.

Note: Restore Factory Defaults re-enables Bluetooth.



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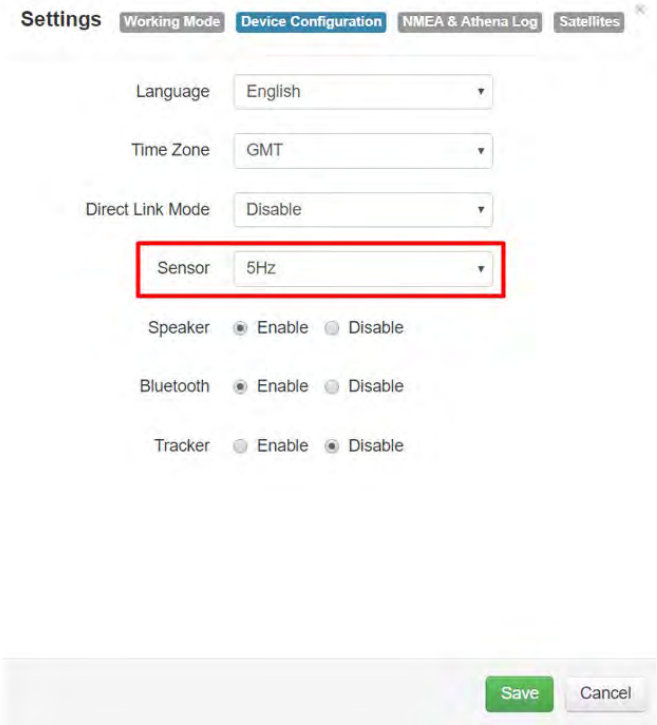
Device Configuration, continued

Sensor

Turn on the Sensor, using the drop-drown arrow to select the desired rate.



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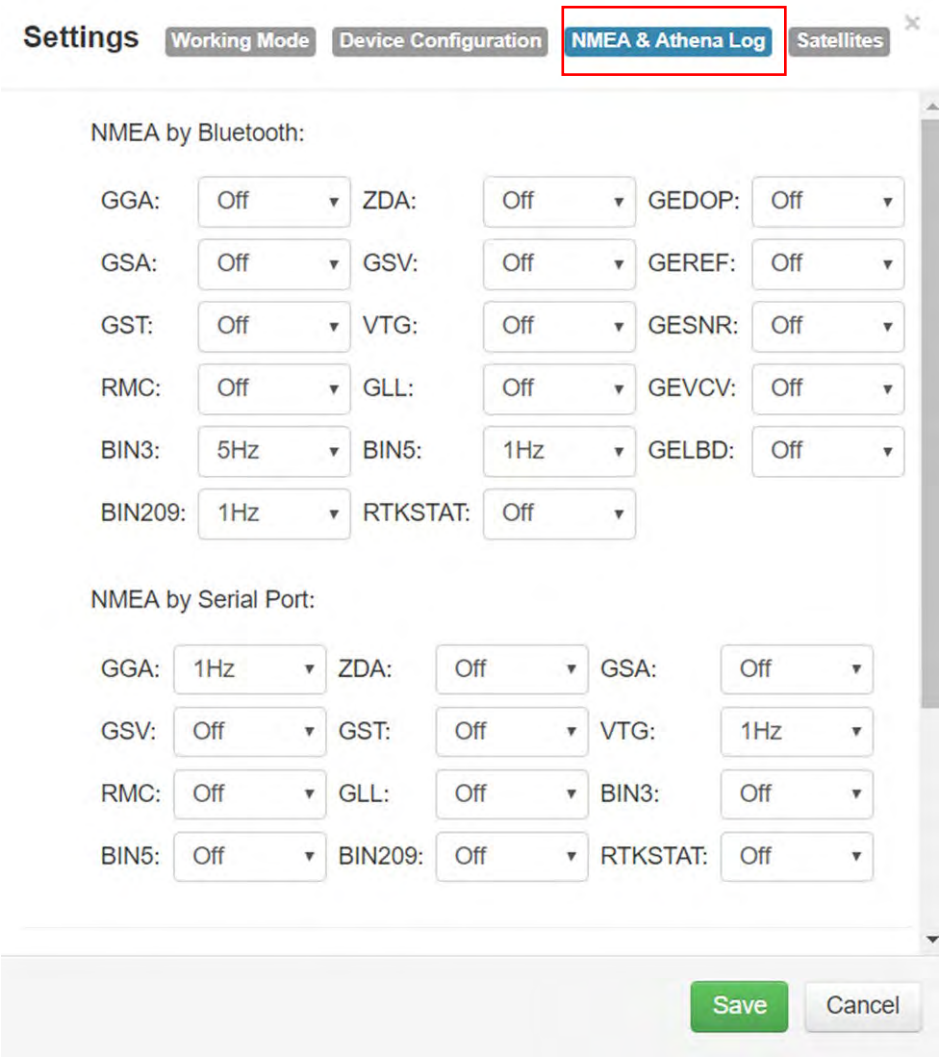
Hemisphere WebUI, Continued

NMEA Message

To enable NMEA messages, click the **NMEA & Athena Log** tab. Adjust the NMEA messages that are output over the 5-pin serial port and over Bluetooth.



Continued on next page

NMEA Message, continued

Refer to Table 3-3 for NMEA Message fields and descriptions:

Table 3-3: NMEA Message Fields and Descriptions

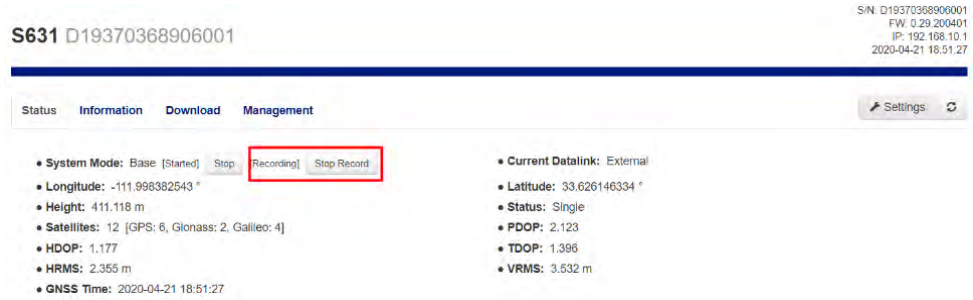
Field	Description
NMEA Log	Store the NMEA or binary messages that are turned on to the internal memory of the receiver or to an SD Card.
First Storage	Select if NMEA, binary, or Athena logs should be stored to the internal memory of the receiver or to an SD card.
Athena Log	Record raw data for converting 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 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 and can be changed).
Interval	Log data at intervals of 30s, 15s, 5s, 1Hz, 2Hz, 5Hz, or 10Hz.

Continued on next page

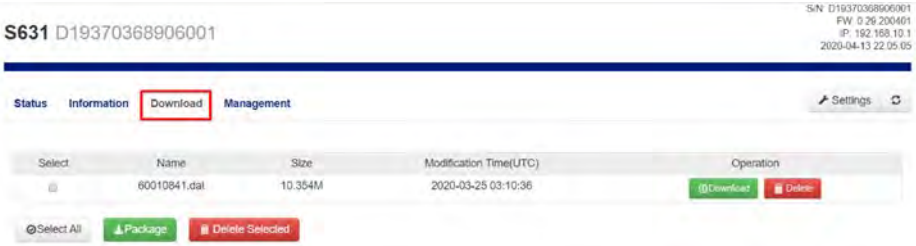
Hemisphere WebUI, Continued

NMEA Message, continued

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.

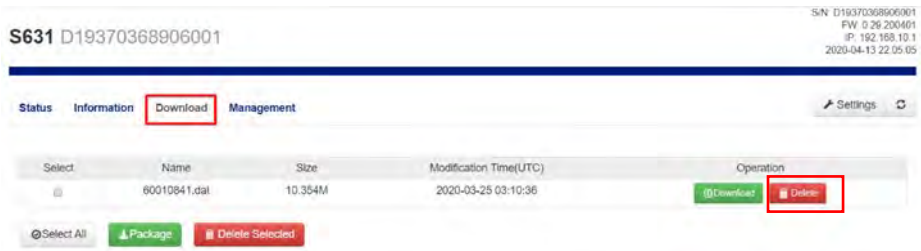


All logs stored on the S631 internal hard drive will display.

Continued on next page

NMEA Message, continued

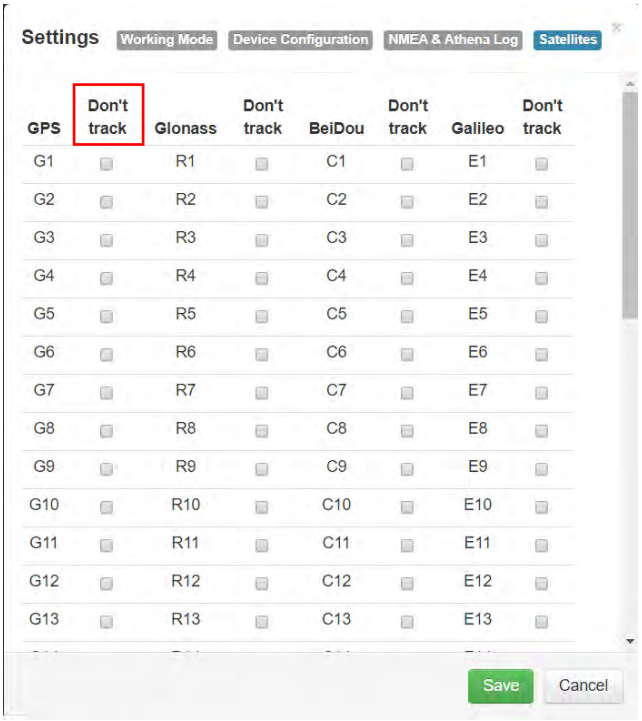
Click **Delete** to delete the log.



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**.

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 WebUI

Updating Firmware via WebUI

Using the **Management** tab under the WebUI, select the **Choose File** button to find the appropriate firmware of application software for the S631 device.

After selecting the correct firmware/software file, click the green **Upload File** button.

When the file is uploaded, be sure to compare the current firmware version with the new firmware version. When you have verified the correct files are in place, click the **OK** button.

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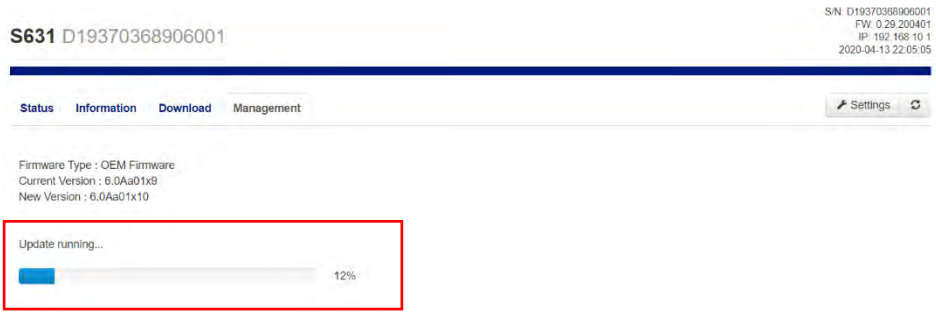
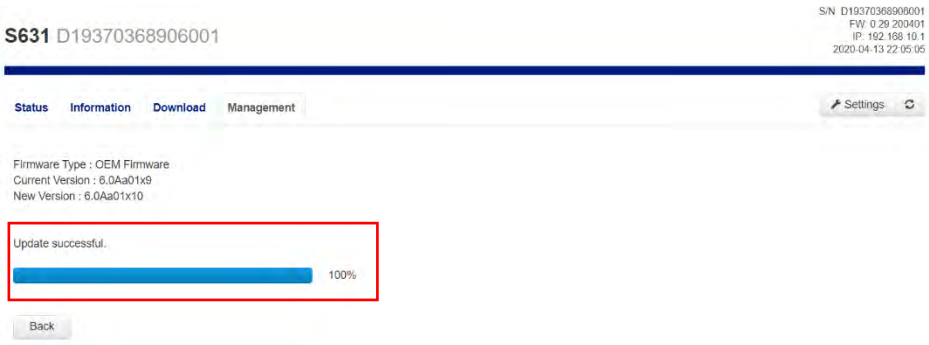
Firmware Update, Continued

Updating firmware via WebUI, continued

A status bar indicates the level of progress for the updating firmware / software.



When the status bar reaches 100%, the upgrade is complete. The WebUI will indicate **Update successful**.



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Updating firmware via WebUI, continued

Updating Firmware via MicroSD Card

Using the WebUI, 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 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: S631_update_YYMMDD.bin YY: Year
MM: Month DD: Day
e.g. S631_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

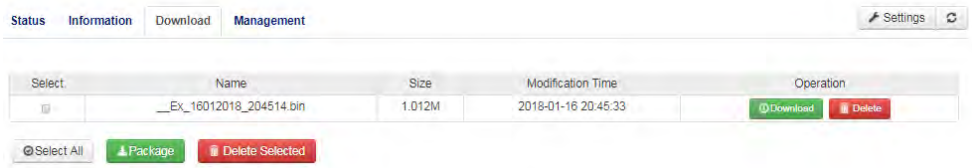
How to Download Static Data

How to download static data

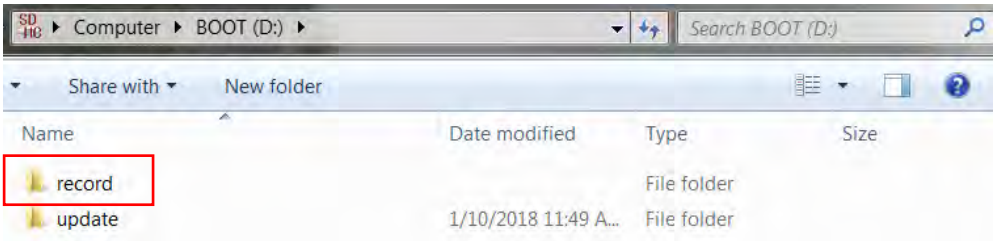
Static data can be logged to the S631 internal memory or to a MicroSD card.

If **First Storage** is set to **Internal Storage** (see Device Configuration), the log files save to the internal memory of the S631.

To download the logs, log into the WebUI and click **Download**.



If **First Storage** is set to **SD Card**, the files save to the MicroSD card in the S631. If the MicroSD card is full, or the S631 does not have a MicroSD card placed inside, the files will save to the S631 in the **record** folder.



Appendix A: Troubleshooting

Overview

Introduction

Appendix A provides troubleshooting and solutions for common questions.

Contents

Topic	See Page
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Troubleshooting

Troubleshooting

Table A-1 provides troubleshooting tips for the S631.

Table A-1: 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 the battery is installed with contacts pointed in the correct direction.
Random data from WebUI or S631 Direct Link mode	• Verify the messages selected in the output messages in the WebUI 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.

Continued on next page

Troubleshooting, Continued

Troubleshooting, continued

Issue	Possible Resolution
S631 will not go RTK Fixed	• If the S631 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 S631 is receiving RTK, but probably will not Fix because of the environment. • If the S631 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 I**nformation** tab for cellular reception. • If using the internal UHF radio, ensure a valid 400 MHz or 900 MHz UHF antenna is plugged into the TNC connector. If using Bluetooth, ensure RTK is reaching the data collector (check the data collector internet or data collector radio).

Appendix B: Technical Specifications

Overview

Introduction

The S631 GNSS Smart Antenna technical specifications are contained in Appendix B.

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Topic	See Page
Technical Specifications	68

Technical Specifications

S631 Technical specifications

Table B-1: GNSS Receiver

Item	Specification
Receiver type	Multi-Frequency GPS, GLONASS, BeiDou, Galileo, QZSS, IRNSS, and Atlas L-band
Signals Received	GPS L1CA/L1P/L1C/L2P/L2C/L5 GLONASS G1/G2/G3, P1/P2 BeiDou B1i/B2i/B3i/B10C/B2A/B2B/ ACEBOC GALILEO E1BC/E5a/E5b/E6BC/ALTBOC QZSS L1CA/L2C/L5/L1C/LEX IRNSS L5 Atlas
Channels	800+
RTK Formats	RTCM2.1, RTCM2.3, RTCM3.0, RTCM3.1, RTCM3.2 including MSM
Recording Intervals	Selectable from 1, 2, 4, 5, 10 Hz (20 Hz optional)

Table B-2: Accuracy

Positioning (RMS)	Horizontal	Vertical
Autonomous, no SA: [1]	1.2m	2.4m
SBAS: [1]	0.3m	0.6m
Atlas H10: [1, 3]	0.04m	0.08m
RTK [1,2]	8 mm + 1 ppm	15 mm + 2 ppm
Static Performance[1]	2.5 mm + 1 ppm	5 mm + 1 ppm
Tilt Compensation (within 30°)	2cm (with 1.8 m pole)	
Initialization Time	<10 s	

Continued on next page

S631 Technical specifications, continued

Table B-3: L-band Receiver

Item	Specification
Receiver Type	Single Channel
Frequency Range	1525 to 1560 MHz
Sensitivity	-130 dBm
Channel Spacing	5.0 kHz
Satellite Selection	Manual and Automatic
Reacquisition Time	15 seconds (typical)

Table B-4: Communications

Item	Specification
Bluetooth	Bluetooth 2.1+EDR / 4.0 LE
Wi-Fi	802.11 b/g
Network	LTE FDD: B1/B2/B3/B4/B5/B7/B8/B12/B13/ B18/B19/B20/B25/B26/B28 LTE TDD: B38/B39/B40/B41 UMTS: B1/B2/B4/B5/B6/B8/B19 GSM: B2/B3/B5/B8
Radio	Frequency range: 410MHz ~ 470MHz and 902.4MHz ~ 928MHz Channel Spacing: 12.5 KHz / 25 KHz Protocol: TrimTalk 450S, PCC EOT, TrimMark III(19200)
WebUI	To upgrade software, manage status and settings, data download, via smartphone, tablet or other electronic device, configure advanced radio settings.

Continued on next page

S631 Technical specifications, continued

Table B-5: Connector Ports

Item	Description
TNC	For connecting to UHF radio antenna
LEMO 5-pin	For connecting to external power supply, external radio
LEMO 7-pin	For serial port, USB
Card Slots	For Micro SIM card and Micro SD card

Table B-6: Data Storage

Item	Description
Storage Type	8 GB internal, SD card up to 32 GB

Table B-7: Physical

Item	Specification
Weight	1.3 kg (with battery)
Dimensions	Diameter: 152mm Height: 76mm

Continued on next page

S631 Technical specifications, continued

Table B-8: Environmental

Item	Specification
Operating Temperature	-30°C to 65°C
Storage Temperature	-40°C to 80°C
Temperature Protection	IP67, Protect from temporary immersion to a depth of 1 meter
Shock Resistance	MIL-STD-810G, method 516.6 Designed to survive a 2m pole drop on concrete floor with no damage; designed to survive a 1m free drop on hardwood floor with no damage
Vibration	MIL-STD-810G, method 514.6E-I
Humidity	Up to 100%
Flammability	UL recognized, 94HB Flame Class Rating (3). 1.49mm
Chemical Resistance	Cleaning agents, soapy water, industrial alcohol, water vapor, solar radiation (UV)

Table B-9: Electrical

Item	Specification
Input Voltage	9 to 28 VDC
Battery	With removable dual battery, for single battery parameter: 7.2 V, 3400 mAh, 24.48 Wh
Working Time	More than 9 hours in Rover UHF mode

Continued on next page

S631 Technical specifications, continued

Table B-10: User Interface

Item	Specification
Button	Switch receiver on/off, broadcast current operation mode and status.
LEDs	Power, Satellite, Data Link, Bluetooth
WebUI	Supports software updates, receiver status and settings, and data downloads via smartphones, tablets, or other Wi-Fi capable devices.

[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/QR Code

Overview

Introduction

The S631 Radio Mode information and the QR code is provided in Appendix C.

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Radio Mode

Radio Mode

The following tables show the available S631 radio modes. Table C-1 displays the information for the S631 model part number 752-0042-10, and Table C-2 displays the information for the S631 model part number 752-0043-10.

Table C-1: Radio Mode G.E. Protocols
S631 part number 752-0042-10

Radio Mode	Link Rate	Spacing	Modulation	Scrambling	FEC
Trimtalk 1	4800 bps	12.5 kHz	GMSK	OFF	OFF
Trimtalk 2	9600 bps	25.0 kHz			
Trimmark III	19200 bps	25.0 kHz	GMSK	OFF	OFF
PC5	4800 bps	12.5 kHz	GMSK	ON	ON
PC1	9600 bps	25.0 kHz	GMSK	ON	ON
Satel	9600 bps	12.5 kHz	4FSK	On	OFF
					ON
	19200 bps	25.0 kHz			OFF
					ON
PacCrest 4-FSK	9600 bps	12.5 kHz	4FSK	On	OFF
					ON
	19200 bps	25.0 kHz			OFF
					ON
900MHz	--	--	--	--	--

Continued on next page

Radio Mode, continued

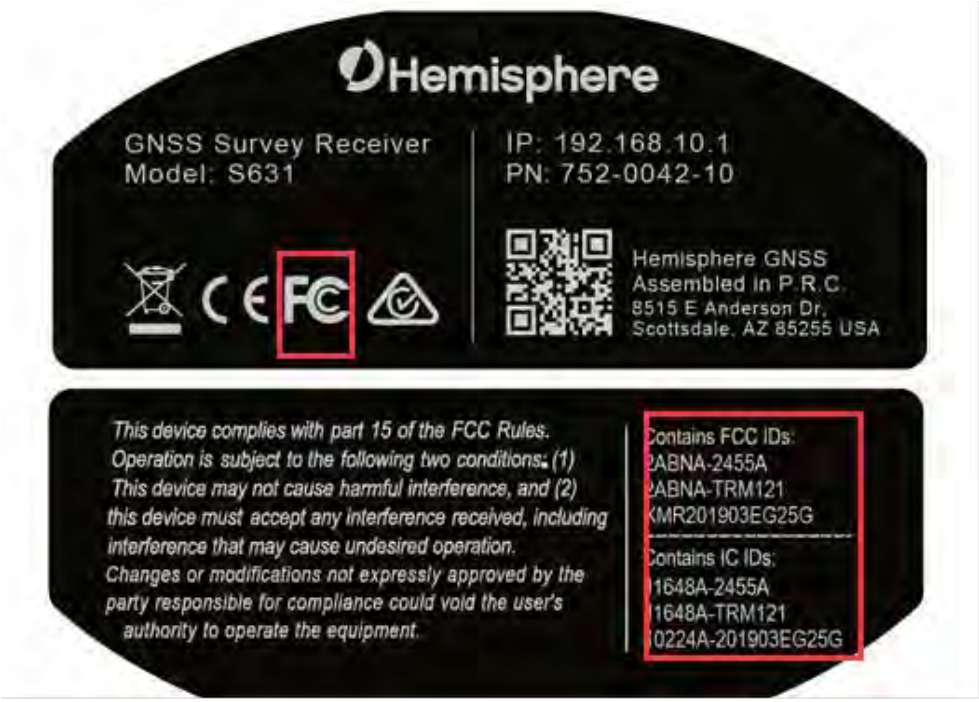
Table C-2: Radio Mode Satel Protocols
S631 part number 752-0043-10

Radio Mode	Link Rate	Spacing	Modulation	Scrambling	FEC
Trimtalk 1	4800 bps	12.5 kHz	GMSK	OFF	OFF
Trimtalk 2	9600 bps	25.0 kHz			
PacCrest GMSK	4800 bps	12.5 kHz	GMSK	OFF	OFF
					ON
				ON	OFF
					ON
	9600 bps	25.0 kHz		OFF	OFF
					ON
				ON	OFF
					ON
PacCrest 4FSK	9600 bps	12.5 kHz	4FSK	OFF	OFF
					ON
				ON	OFF
					ON
	19200 bps	25.0 kHz		OFF	OFF
					ON
				ON	OFF
					ON
Satel	9600 bps	12.5 kHz	4FSK	On	OFF
					ON
	19200 bps	25.0 kHz			OFF
					ON
900 MHz	--	--	--	--	--

QR Code

QR code

The below image shows the S631 QR code.



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