

SHOUT ns/nsx User Guide

Version F

March 31, 2023



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REVISION HISTORY

Revision	Date	Description
A	02/05/2019	Initial version
B	07/12/2019	Editorial and format updates; added reference documents; and sections for Quick Start User Guide, SHOUT ns App; and NALVue Management Tool.
C	03/17/2022	Updated to new template Formal release
D	03/29/2022	Added SHOUT nsx device
E	08/11/2022	Updates to the Bluetooth pairing instructions, editorial and format updates
F	03/31/2023	Updated the following: <ul style="list-style-type: none"> • Section 2.6 Bluetooth • Section 3.6 Pair NS To Bluetooth Device • Section 5.2 Using SatTerm • Section 6 Shout ns App Overview • Section 7 Use NAL VUE with SHOUT ns

REFERENCE DOCUMENTS

The latest revisions of the NAL documents are available by request to

<https://www.nalresearch.com/>.

Reference	Title	Revision/Date
[1]	AT Commands for Model SHOUT ns	Revision A, October 2022
[2]	NAL GPS Report Version 6 Format	Revision 3, 26 September 2018
[3]	PECOS Message Definition Specification, 200907-001	Version 1.7 July 29, 2009
[4]	SHOUT ns-nsx App User Guide	Revision C, December 2022
[5]	NAL VUE User Guide	
[6]	SatTerm User Guide	Version A, March 29, 2022

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ACRONYM LIST

AES	Advanced Encryption Standard
API	Application programming interface
AT	Attention
BATT	Battery
BIS	Bureau of Industry and Security
BLE	Bluetooth Low Energy
BT	Bluetooth
CE	Conformité Européenne
CRUD	create, read, update, and delete
DAV	Data After Voice
DISA	Defense Information Systems Agency
DoD	Department of Defense
DSN	Defense Switch Network
EAR	Export Administration Regulations
EMSS	Enhanced Mobile Satellite Services
FCC	Federal Communications Commission
FDMA	Frequency-Division Multiple Access
GPS	Global Positioning System
GPX	GPS Exchange Format
GSM	Global System for Mobile Communication
GUI	Graphical User Interface
IMEI	International Mobile Equipment Identification
IRDM	Iridium
ISP	Internet Service Provider
ISU	Iridium Subscriber Unit
Kbps	kilobits per second
KML	Keyhole Markup Language
LED	Light Emitting Diode
LEO	Low-Earth Orbit

MMC.....	Mission Management Center
NIST	National Institute of Standards and Technology
NOAA.....	National Oceanic and Atmospheric Association
NOC	Network Operations Center
NORTHCOM	Northern Command
OFAC.....	Office of Foreign Asset Controls
PMS	PECOS Message Structure
PPP	Point-to-Point Protocol
PSTN	Public Switched Telephone Network
RUDICS	Router-based Unrestricted Digital Internetworking Connectivity Solution
SBD	Short Burst Data
SMA	SubMiniature version A
SMS	Short Message Service
SMSC	Short Message Service Center
STAT	Status
TDD.....	Time Division Duplex
TDMA	Time-Division Multiple Access
TTKT.....	Time To Keep Trying
TTL.....	Transistor–Transistor Logic
USA.....	United States of America
USB.....	Universal Serial Bus
UTC.....	Coordinated Universal Time
VAC.....	Volts (Alternating Current)
VDOP	Vertical Dilution of Precision

1 INTRODUCTION

In the SHOUT ns/nsx user guide, all references of the operational features, interface, and electrical specifications of the SHOUT ns device also apply to the SHOUT nsx device. Where the SHOUT nsx device differentiates from the SHOUT ns device, the user guide will note it in the applicable sections. In summary, the SHOUT nsx device is taller, heavier, and has a larger battery for longer mission life than the SHOUT ns device.

The SHOUT ns is a pocket-sized, low-cost, low-power, Iridium satellite network tracking device. It is designed to relay, via the Iridium satellite network, Global Positioning System (GPS) location data and other critical data, such as emergency messages, geofence data, and callouts from the device, and text messages from the NAL SHOUT smartphone app. It has a rugged plastic housing with embedded Iridium, GPS, and Bluetooth antennas. This device can easily be carried by a person or attached to high value, untethered or non-powered assets.

The SHOUT ns comprises an Iridium 9603 transceiver module, a built-in 72-channel u-blox GPS receiver, and low-power microcontrollers. The SHOUT ns can send Short Burst Data (SBD) messages over the Iridium satellite network. The SHOUT ns can transmit messages in NAL Research's defined report formats compatible with models 9602-LP, 9602-AB, the A3LA series modems, and SHOUT series tracking devices. The SHOUT ns can also transmit in PECOS Message Structure (PMS). The PMS complies with the Blue Force Tracking Data Format Specification as defined in the document [PECOS Message Definition Specification, 200907-001](#) Version 1.7 [3]. When requested by an authorized user, NAL Research can enable the SHOUT ns to utilize the DoD Defense Information Systems Agency (DISA) Enhanced Mobile Satellite Service (EMSS) Gateway when sending over the Iridium satellite network.

Important: EMSS-enabled SHOUT ns must first be provisioned (signed up for airtime) with EMSS SBD service before testing or field use. Accessing the DoD EMSS Gateway is not authorized until the SHOUT ns is provisioned. Unauthorized attempts to access the DoD EMSS Gateway result in immediate disabling of the offending device, which must then be returned to NAL Research for repair. See <https://emss.pac.disa.mil/home.shtml> for more information regarding EMSS service provisioning.

The SHOUT ns is designed with ultra-low power consumption electronics. It is capable of delivering uninterrupted service for up to 20 days at one report per hour. Power consumption can be further reduced by using the device's built-in motion sensor and/or Geofencing features to reduce reporting frequency when a platform is not in motion or is outside an area of interest. In addition to normal tracking, the SHOUT ns also has a real-time clock allowing power-up delay as well as scheduled daily Call Outs.

1.1 DEVICE DESCRIPTION

The SHOUT ns comprises a Power button/911, a Light Emitting Diode (LED) Status display, an Iridium antenna, a GPS antenna, Bluetooth antenna, Bluetooth button/911, and a micro Universal Serial Bus (USB) interface as shown in **Figure 1**. The USB Micro-B interface port is for charging, firmware updates, data collection, and setting parameters using the NAL Research SatTerm application. The six Light Emitting Diodes (LEDs) provide the status of power state, battery charging status, GPS fix, Bluetooth connection status, report transmission status, and Iridium connection status to the user. Using the *Power* and *Bluetooth* buttons activates the emergency/911 mode to send an emergency message with an increased reporting rate. For detailed information on the emergency/911 mode, refer to section **2.3 Emergency/911 Mode Activation**.



Figure 1: SHOUT ns/nsx Buttons and Indicators

Note: The buttons and indicators on the SHOUT nsx are the same as those noted on the SHOUT ns.

1.2 ACCESSORIES



AC Wall Adapter



USB-A to USB Micro-B Cable

Figure 2: SHOUT ns Accessories

2 USER INTERFACES

2.1 POWER BUTTON

The SHOUT ns has a single power ON/OFF button. The SHOUT ns can be turned off and on again by momentarily holding down the Power button for two seconds and releasing it. If the device is sleeping, briefly pressing the Power button turns the SHOUT ns on for 10 seconds. The ON/OFF button is also used with the Bluetooth button for emergency mode activation. See section **2.3 Emergency/911 Mode Activation** for details.


2.2 BLUETOOTH BUTTON

The SHOUT ns has a single Bluetooth (BT) button. Press this button for two (2) seconds to activate the Bluetooth link. Press the Bluetooth button again for two seconds to deactivate the Bluetooth link. If the device is sleeping, pressing the Bluetooth button turns the SHOUT ns on for two (2) minutes. This extended duration as compared to the power button is to give sufficient time to connect and pair with the Bluetooth interface. Refer to section **2.6 Bluetooth** for details on use of the Bluetooth interface. The Bluetooth button is also used with the power button for emergency mode activation. See section **2.3 Emergency/911 Mode Activation** for details.

2.3 EMERGENCY/911 MODE ACTIVATION

The SHOUT ns has an emergency/911 mode that immediately sends a location report with the Emergency bit set, and thereafter sends location reports at a rate configured in the Emergency Report Rate parameter until the emergency/911 mode is canceled. All text messages sent when the emergency/911 mode is active also have the Emergency flag set. In order to activate the emergency/911 mode feature on the SHOUT ns, initiate a four (4) button press sequence. This sequence involves alternating between the Power button (first) and Bluetooth button for a total of two (2) times each. This action results in all six (6) LEDs blinking at the same time once per second until the device is turned off. This sequence can be activated with the SHOUT ns turned on or off. Emergency is deactivated when the SHOUT ns is turned off and will not resume emergency operation until it is the emergency mode is activated again.

2.4 STATUS LEDs

The SHOUT ns has six (6) status LEDs, as shown in **Figure 3**, which include power , battery level (BATT), GPS fix (GPS), Bluetooth state (BT), transmission status (STAT), and Iridium signal (IRDM). They provide a quick visual check to ensure proper operations. Each LED can be enabled and disabled through a setting in the general configuration profile (^LEDS) (see section 5.2.2.1 **General Profile Settings**). **Table 1** below describes the function of each LED.

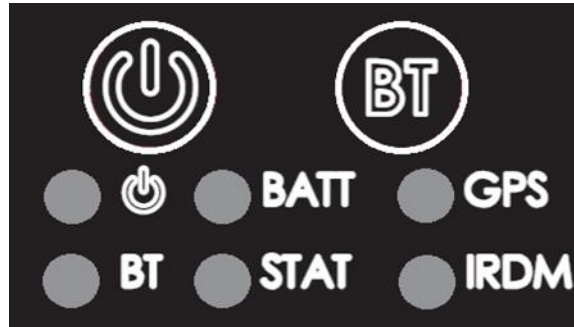


Figure 3: Control Buttons and Status LEDs on the SHOUT ns Front Face

Table 1: Description of LED States


Label	Name	LED Off	LED Blinking	LED Solid
	Power	Device is off	Once every 5 sec: Device is on and sleeping in normal mode Once every 2.5 sec: Device is on and sleeping in emergency mode	Device is on and awake
BATT	Battery	During operation: <ul style="list-style-type: none"> Charge required 	During operation: <ul style="list-style-type: none"> Charge under 80%; 1.25 sec on, 0.25 sec off Charge under 20%; 0.125 sec on, 1.00 sec off While charging: <ul style="list-style-type: none"> Charge in progress; 1.25 sec on, 0.25 off 	During operation: <ul style="list-style-type: none"> Charge over 80% While charging: <ul style="list-style-type: none"> Charge complete
GPS	GPS	GPS off or time only	2-D fix or dead reckoning	3-D fix

Table 1: Description of LED States

Label	Name	LED Off	LED Blinking	LED Solid
BT	Bluetooth	Bluetooth off	1 sec: Bluetooth on and not connected/pairing	Bluetooth on and connected
STAT	Status	No successful report transmission	1 sec: Last report transmission failed	Last report transmission succeeded
IRDM	Iridium	Off or has no signal	Has 1–2 bars of signal	Has 3–5 bars of signal

Special Functions: The SHOUT ns features two (2) special LED patterns that indicate the following:

- a. **Emergency Mode Active:** All six (6) LEDs blink simultaneously in a 0.5 sec on and 0.5 sec off pattern for as long as the emergency mode is active and the device is awake. When the device is asleep, the six (6) LED pattern stops but the power LED blink rate changes from once every 5 seconds for normal mode to once every 2.5 seconds for emergency mode.
- b. **Upon Charger Connection:** When power is on*, the battery, GPS, Iridium, and status LEDs blink in a clockwise sequence for three (3) seconds when power is applied.

After a special function has ended, the LEDs revert to their standard operating state. NOTE: There are no LED indicators while the SHOUT ns is turned off and while plugged in and charging. To verify charge status, the SHOUT ns must be turned on.

2.5 USB PORT



Figure 4: Position of USB Connector

The USB connector on the SHOUT ns is a USB Micro-B receptacle located on the right of the chassis, as shown in **Figure 4**. This connector has a rubber O-ring sealed cover required to achieve the IP67 rating of the device. The USB connector pin assignments are detailed below in **Table 2**.

Table 2: Pin Assignments for the SHOUT ns USB Connector

Pin #	Signal	Description	Interface	In/Out
1	VBUS	USB VBUS	USB	I
2	USBD-	USB data	USB	I/O
3	USBD+	USB data	USB	I/O
4	ID	USB OTG ID	USB	I/O
5	GND	Ground	USB	--

Important: Ensure the rubber O-ring sealing cover shown in **Figure 4** is fully seated before exposing the SHOUT ns to water.

2.5.1 USB DATA

The SHOUT ns communicates to computer equipment using the USB Micro-B port located on the right side of the chassis (see **Figure 4**). The USB connection allows configuration of and data collection from the SHOUT ns using NAL Research’s defined AT commands and NAL’s SatTerm console window. These AT commands can be found in the manual [AT Commands for Model SHOUT ns \[1\]](#); also see section **4.2 Modes of Operation**. NAL Research recommends using the SatTerm graphical user interface (GUI) software to configure the SHOUT ns instead of trying to memorize various AT commands. The latest version of this software can be downloaded from the NAL Research website (<https://www.nalresearch.com/support/documentation-downloads/>).

2.5.2 DC POWER INPUTS

The device can be powered from and recharge the internal battery through the USB Micro-B port. A USB 1.0 host (100 mA) can charge the battery within 8 hours and a USB 2.0 host (500 mA) can charge the battery within two (2) hours.

2.6 BLUETOOTH

The SHOUT ns utilizes a Bluetooth Low Energy (BLE) transceiver to provide a secondary command interface to the Micro-USB port. This interface can connect with SatTerm running on a Windows® PC. You can also establish a Bluetooth connection with a Bluetooth enabled Android device running the SHOUT ns App. For more details regarding the SHOUT app, refer to section **6 SHOUT ns App Overview** of this manual and in the [SHOUT ns-nsx App User Guide \[4\]](#) document.

See section 3.6 *Pair SHOUT ns to Bluetooth Device* for details on how to pair a Bluetooth enabled device with the SHOUT ns. By default, the Bluetooth interface has a 10-minute idle timer that turns off the Bluetooth interface when there is no data transfer or when the Bluetooth disconnection has been more than for 10 minutes. To keep the interface alive, periodically send an AT command such as just “AT” (the SHOUT ns will respond with “OK”).

3 QUICK START USER GUIDE



This Quick Start user guide provides an overview to transition the SHOUT ns to operational use.

3.1 PREPARE DEVICE

Prior to using the SHOUT ns, first purchase airtime from NAL Research or from any Iridium-certified airtime reseller. An airtime reseller must register the SHOUT ns IMEI number to “point” to a Network Operation Center (NOC) server. This section explains how to set up quickly the SHOUT ns as a tracking device.

Remove the SHOUT ns, the wall charger, and the USB cable from the packaging. Remove the SHOUT ns USB port cover (see **Figure 4**) and connect the USB cable’s USB micro port to the SHOUT ns. Connect the USB-A connector to the wall charger.

3.2 START DEVICE

Activate the SHOUT ns by pressing the power button  for two seconds until the power LED  illuminates. The power LED should remain steadily illuminated. The battery LED then starts blinking in a 1.25 sec on and 0.25 sec off pattern to indicate the battery requires charging. If the battery is blinking in a 0.125 sec on and 1.0 sec off pattern, the battery is less than 20% charged and will take longer to fully charge.

Note: If the device is not used for 10 minutes, the SHOUT ns enters sleep mode and the power LED changes to blinking once every five (5) seconds to indicate it is asleep. The SHOUT ns can be removed from the sleep mode by pressing the power button for two (2) seconds.

Before charging the unit, test the emergency/911 mode activation feature with the following button press combination: Power, Bluetooth, Power, and Bluetooth. The SHOUT ns should enter the emergency/911 activation mode and all six LEDs should start blinking once per second to indicate this mode is active. To cancel this mode, hold the Power button for two seconds to turn the device off. Hold the Power button again for two seconds to turn the device back on. Again, confirm the power LED remains steadily illuminated and the battery LED begins to blink as described above.

3.3 CHARGE DEVICE

The SHOUT ns ships with a partially charged battery. Before use, charge the SHOUT ns for one (1) hour. **Note:** Upon battery depletion, the SHOUT ns should reach full charge within two (2) hours of continuously plugged in.

Plug the wall charger into a 115 Volts (Alternating Current) (VAC) power source. After plugging in the wall charger, confirm that power applied to the SHOUT ns USB port, the battery, GPS, Iridium, and status LEDs blink in clockwise sequence for three (3) seconds. Let the SHOUT ns charge for several hours or until the BATT LED changes to steady illumination.

3.4 DEVICE GPS RECEPTION AND IRIDIUM REGISTRATION

After charging the SHOUT ns, the device is ready to use. Hold the power button for two (2) seconds. The power LED and battery LED light up and the device begins functioning. Ensure the top of the SHOUT ns has a clear view of the sky. The standard LED sequence during a successful report is as follows:

1. The GPS LED lights first after acquiring a signal.
2. The Iridium (IRDM) LED begins lighting after acquiring an Iridium, as either solid or blinking based on signal strength.
3. The status (STAT) LED begins lighting when a report transmitted.

After transmitting a report, all LEDs turn off and the power LED blinks intermittently, indicating the device is in sleep mode awaiting the next report transmission.

3.5 CONFIGURE THE SHOUT NS WITH SATTERM

The SHOUT ns ships with the default settings noted below:

- Report Rate: five (5) minutes
- Emergency Report Rate: five (5) minutes
- Transmit Report Without GPS Fix: Yes
- Message Format: NAL Message Format

If you want to change these default settings, the SHOUT ns supports a Micro-USB connection to a computer with SatTerm software (or any terminal emulator software) to configure its operating profile using NAL Research's defined AT commands. Find these AT commands in the manual [AT Commands for Model SHOUT ns](#) [1].

The required hardware and software for the configuration of the SHOUT ns include:

- A desktop or laptop computer (not provided).
- A USB-A to USB Micro-B cable (provided with the SHOUT ns).
- A USB AC adapter (provided with the SHOUT ns).
- SatTerm software or any terminal emulator software (SatTerm is available for download from NAL Research for use with the SHOUT ns).

To configure the operating profile using NAL Research's defined AT commands:

4. Install SatTerm software on a computer. Connect the provided USB to Micro-USB cable to the computer and to the SHOUT ns; hold the power button for two (2) seconds to turn on the device.
5. Run the SatTerm software after connecting the SHOUT ns to a computer. An NAL Research message appears along with the firmware version to indicate proper communications and power input.
6. Use SatTerm (or any terminal emulator) installed on the computer to set the SHOUT ns operating parameters. The SHOUT ns is now ready for use. Verify the antennas have a full view of the sky to ensure optimal tracking.

Important: An EMSS-enabled SHOUT ns must first be provisioned (signed up for airtime) with EMSS SBD service before testing or field use. The device cannot access the DoD EMSS Gateway until it is provisioned. Unauthorized attempts to access the DoD EMSS Gateway will result in immediate disabling of the offending device, which must then be returned to NAL Research for repair. See <https://sbd.pac.disa.mil> for more information regarding EMSS service provisioning.

For more details regarding the SatTerm tool, see section **5.2 Using SatTerm**.

3.6 PAIR SHOUT NS TO BLUETOOTH DEVICE

Depending on your security requirements, pair the SHOUT ns to a BT device using one of two methods:

- Pairing without a PIN
- Pairing with a PIN

Pairing without a PIN is the default SHOUT ns Bluetooth pairing method of firmware versions V1.1.0 and higher, and is described in section **3.6.1 Pairing Without a PIN**. Pairing with a PIN is the default SHOUT ns Bluetooth pairing method of firmware versions prior to version V1.1.0 and is described in **Section 3.6.2 Pairing With a PIN**.

3.6.1 PAIRING WITHOUT A PIN

SHOUT ns firmware V1.1.0 and higher allows connection to a BT device, such as a BT enabled PC, without having to enter a PIN. The Pairing steps are show below running on a **Windows® PC** and are as follows:

1. Slide the **Bluetooth** switch to the **ON** position in the Windows Bluetooth – Settings (see **Figure 5**).

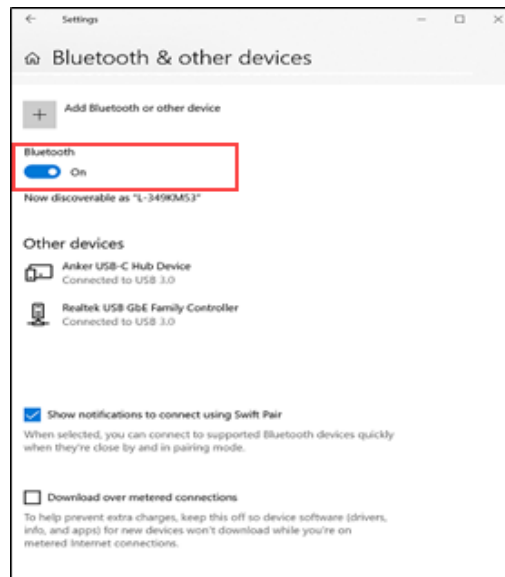



Figure 5: Win 10 Bluetooth Options

2. Press the **Power** button for at least two (2) seconds.

3. Press the **BT** button  for at least two (2) seconds.
4. Verify the BT LED is blinking. This indicates it is in Pairing mode.
5. Complete the pairing process by following your Bluetooth device's instructions (i.e.; your PC).

Steps for a Windows PC: Settings – Bluetooth

6. Select **Add Bluetooth or other device** in the Bluetooth & other devices window (see **Figure 6**).

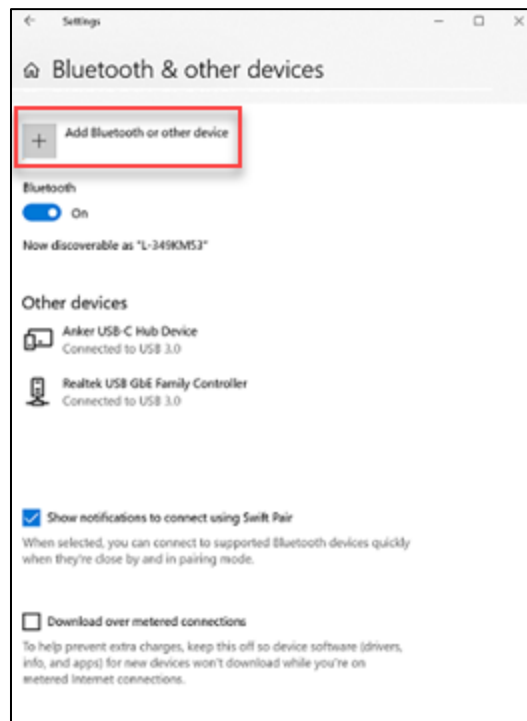


Figure 6: BT & other devices

The *Add a device* pop-up window displays (see **Figure 7**).

7. Select **Bluetooth** (see **Figure 7**).

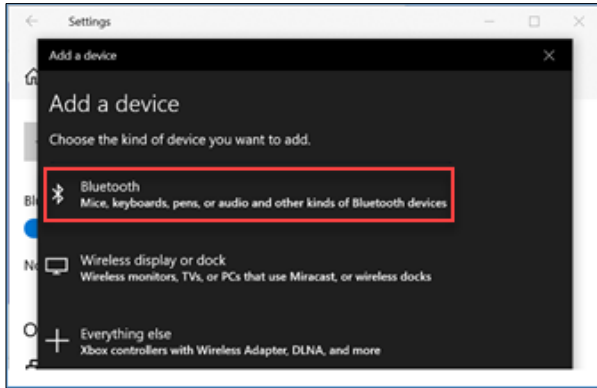


Figure 7: BT & other devices

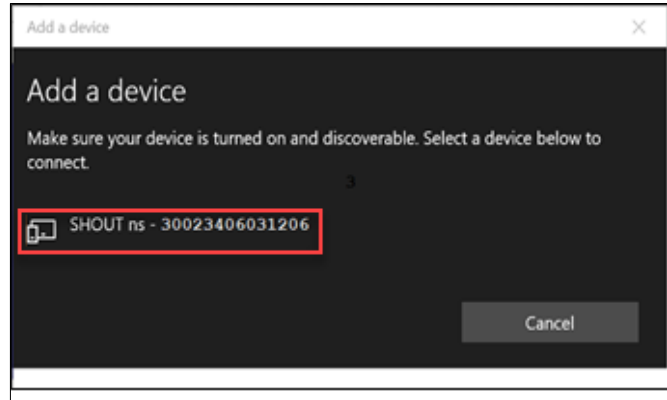


Figure 8: Select Device

8. Select **SHOUT ns** device (see **Figure 8**).

The *Your device is ready to go!* Pop-up window displays (see **Figure 9**).

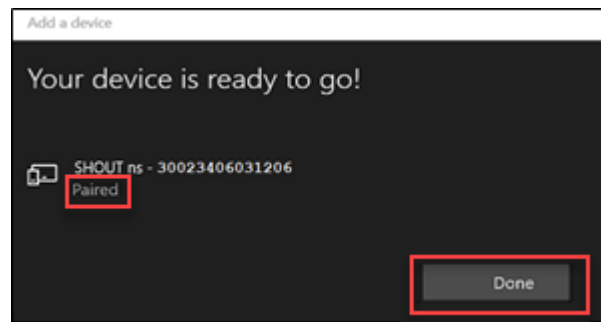



Figure 9: BT & other devices

9. Select **Done** (see **Figure 9**).

Verify BT connection with the PC: Run SatTerm to connect to the paired SHOUT ns

1. Verify the SHOUT ns **BT LED** is still blinking.

2. If not, press and hold the **BT** button  until the Bluetooth light starts blinking, signifying the pairing state.

3. Select **Port Properties**  at the top left corner of the *SatTerm* window (see **Figure 10**).

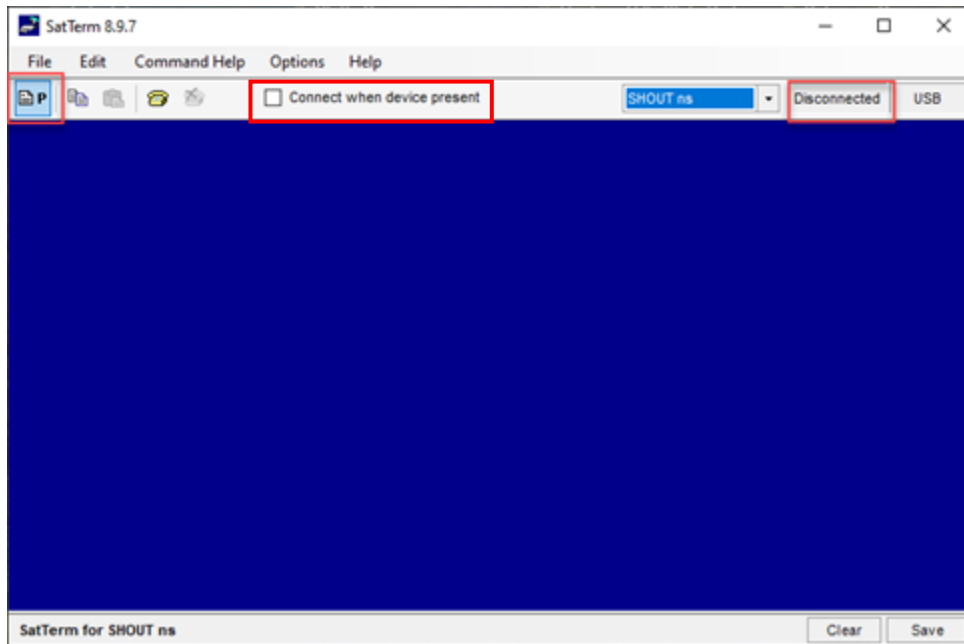


Figure 10: Select Port Properties in SatTerm

4. Select **BT** from the *Connect Using* drop down list (see **Figure 11**).

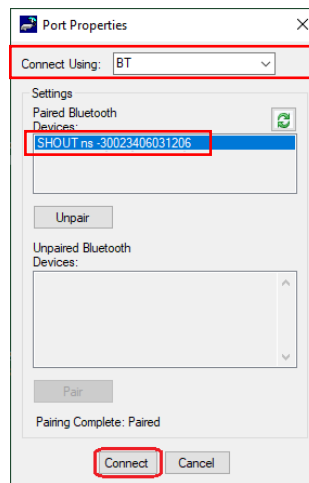


Figure 11: Port Properties

5. Select **SHOUT ns** from the *Settings Paired Bluetooth Devices* list (see **Figure 11**).
6. Select **Connect** (see **Figure 11**).
7. Verify the “*SHOUT ns - Connected – BT*” message displays at the top right side of the SatTerm screen.
8. Display SatTerm.

9. Enter **AT** and press **Enter**.

If SatTerm respond with **OK**, the device is connected via BT.

IMPORTANT: If configuring the SHOUT ns device **requires** a PIN for Bluetooth Pairing, follow these steps to change the device configuration to allow **pairing without a PIN**:

10. Run **SatTerm** on a PC and connect the SHOUT ns using a USB cable.
11. Enter **+++** (to enter Command Mode).
12. Enter **AT^BTPASSEN=0** (to Pair WITHOUT a PIN) and press **Enter**.
13. Enter **AT&w0** (to save to the Device Profile) and press **Enter**.
14. Unplug the USB cable and rerun section **3.6.1 Pairing Without a PIN**.

3.6.2 PAIRING WITH A PIN

The SHOUT ns allows connection to a BT device, such as a BT enabled PC, with the extra security of a requiring a PIN (**AT^BTPASSEN=1**). There are two (2) methods to Pair a SHOUT ns in Windows®.

Method 1: Following Windows pairing instructions in Windows® Bluetooth settings.

Method 2: The 'Just Works' method, using a BT Enabled Windows® PC running SatTerm.

3.6.2.1 MANUAL PAIRING IN WINDOWS BT SETTINGS (METHOD 1)

Pairing steps are show below running on a **Windows® PC** and are as follows:

1. Run **SatTerm** with the SHOUT ns connected via USB (to enter the PIN).
2. Slide the Bluetooth switch to the **ON** position in the Windows Bluetooth – Settings (see **Figure 12**).

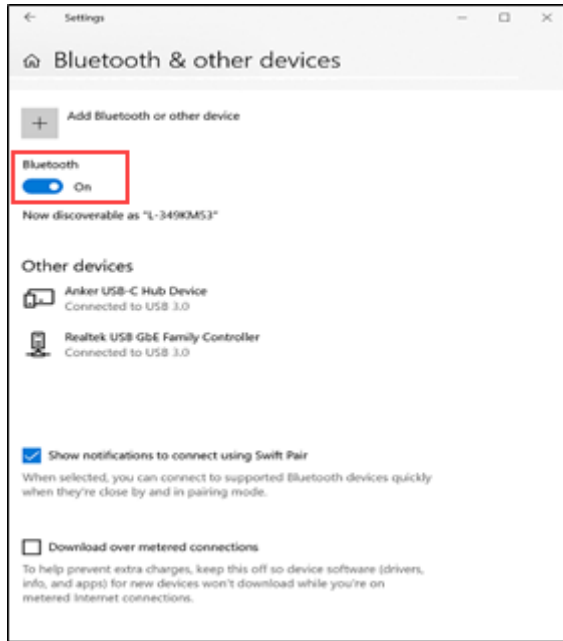


Figure 12: Win 10 Bluetooth – Settings

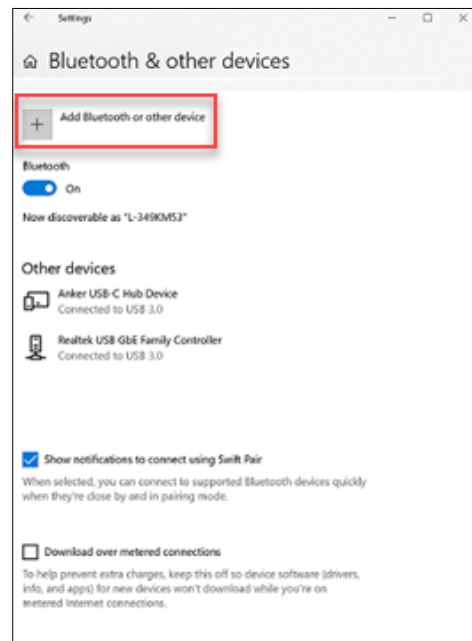




Figure 13: Add BT & other device

3. Press the **Power** button  for at least two (2) seconds.
4. Press the **BT** button  for at least two (2) seconds.
5. Verify the Bluetooth (**BT**) LED is blinking to indicate it is in Pairing mode.
6. Follow the remaining Bluetooth device’s pairing steps (i.e.; your PC) to complete the pairing process.

Steps for a Windows PC (Settings – Bluetooth)

7. Select **Add Bluetooth or other device** on the *Bluetooth & other devices* popup window (see **Figure 13**).
8. Select **Bluetooth** from the *Add a device* screen (see **Figure 14**).

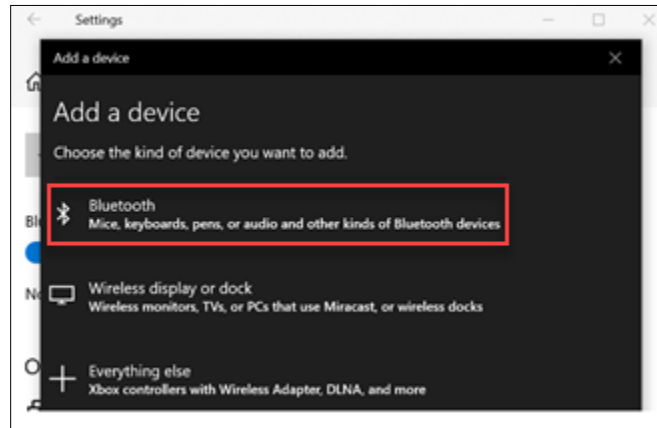


Figure 14: Select Bluetooth

9. Select the **SHOUT ns** device (see **Figure 15**).

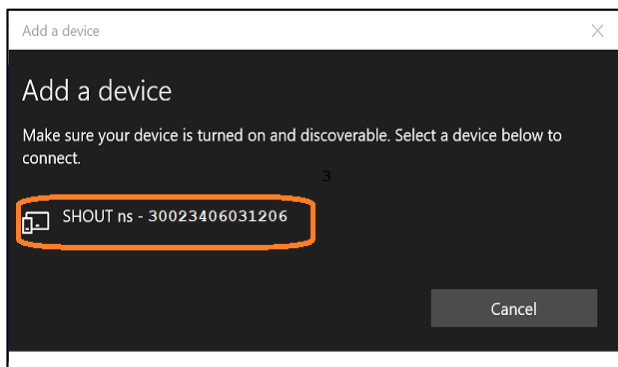


Figure 15: Add SHOUT ns

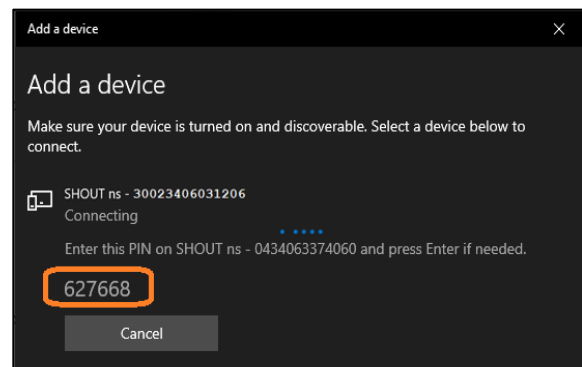


Figure 16: Paired SHOUT ns PIN

10. Verify PIN to enter displays (see **Figure 16**).

11. Switch to SatTerm window to enter the PIN from **Figure 16**.

12. Enter **+++** (to enter Command Mode).

13. Enter **AT^BTPASS=<Passkey>**, where **<Passkey>** is the PIN displayed on your Windows® PC's Bluetooth connection setting, and press **Enter** (see **Figure 17**).

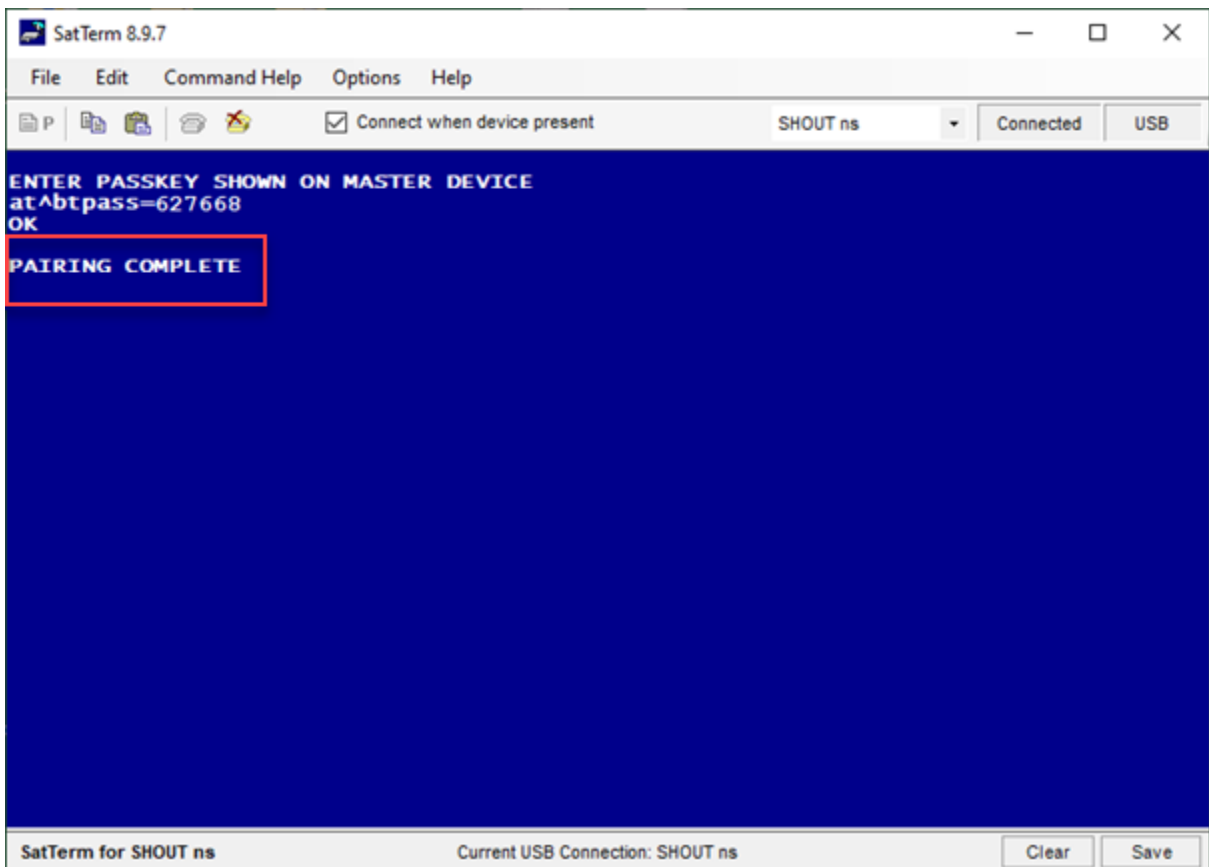


Figure 17: Enter the PIN in SatTerm

NOTE: Once the SHOUT ns has been paired to the BT Device with the correct PIN, there is no need to enter the PIN again, unless the SHOUT NS is removed from the BT device's list of 'Paired Devices'.

3.6.2.2 'JUST WORKS' METHOD RUNNING SATTERM (METHOD 2)

Pairing steps are show below running SatTerm on a Windows® PC and are as follows:

1. Run SatTerm with the SHOUT ns connected via USB. (to automatically enter the PIN)
2. In Windows Bluetooth - Settings, slide the Bluetooth switch to **On** (see **Figure 18**).

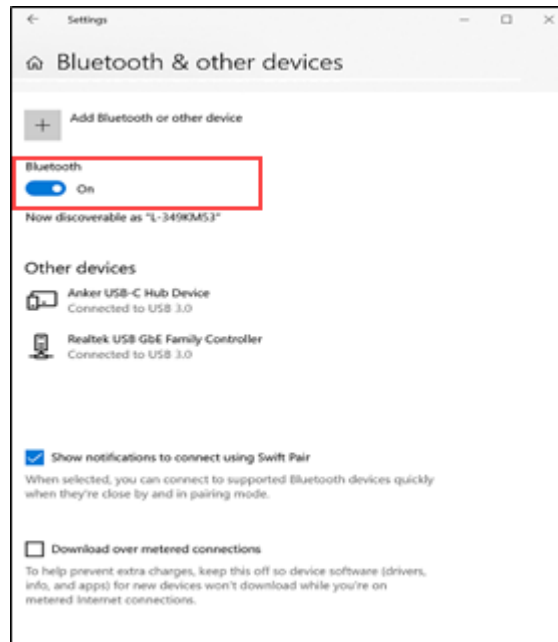






Figure 18: Win 10 Bluetooth - Settings

3. Press the **Power** button  on the device for at least two seconds.
4. Press the **BT** button  on the device for at least two seconds.
5. Verify the Bluetooth (**BT**) LED is blinking to indicate it is in 'Pairing' mode.
6. Press the **Disconnect** button  in SatTerm.
7. Click the **Port Properties** button  at the top left of the SatTerm window.

8. Select **BT** from the *Connect Using* drop down list (see **Figure 19**).
9. Select the **SHOUT ns** in the Unpaired Bluetooth Devices list.
10. Select **Pair**.
11. Select **Connect**.

NOTE: The 'Just Works' method will automatically fill in the required PIN and Pair the SHOUT ns to the BT Enable Windows PC. See the messages in SatTerm in **Figure 20**.

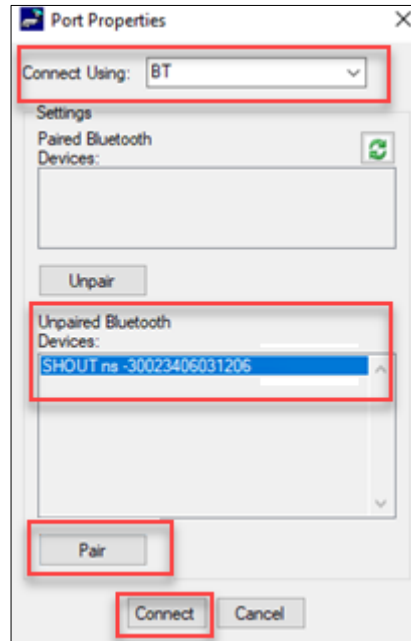


Figure 19: Port Properties

12. Disconnect the USB cable.

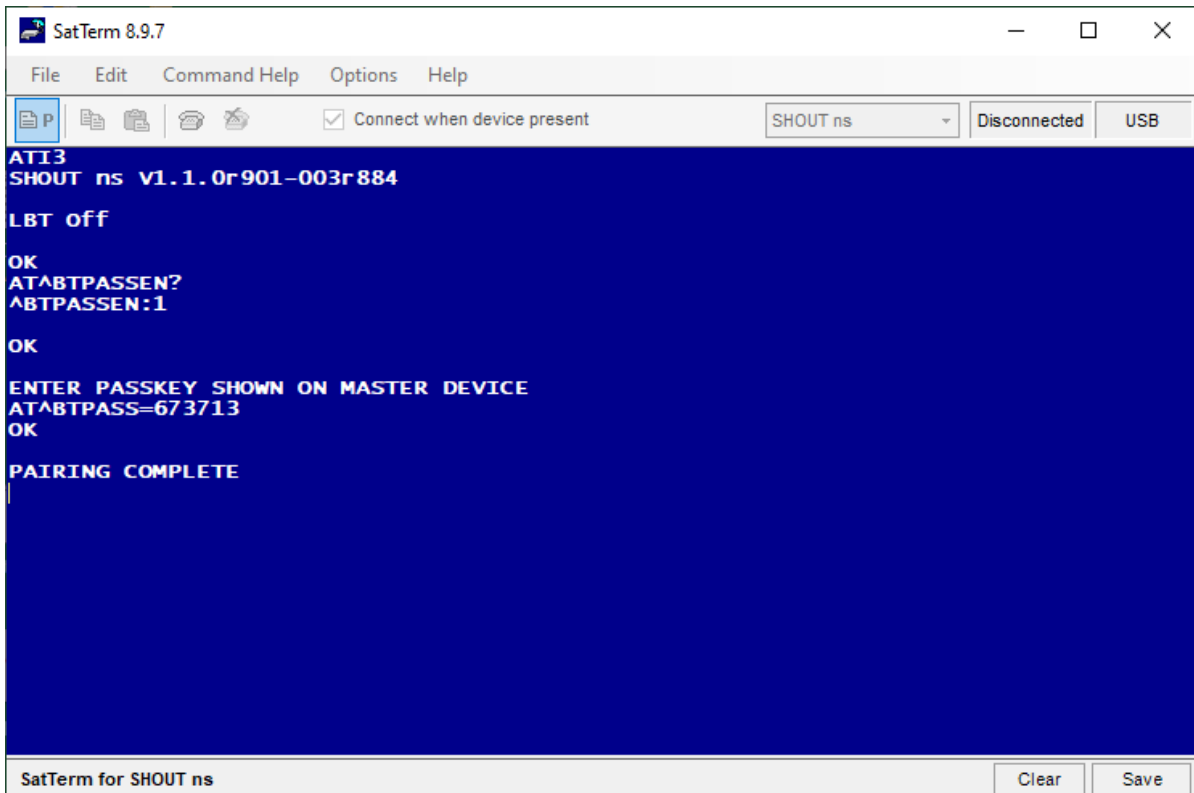


Figure 20: Pairing Complete

3.6.2.3 VERIFY BT CONNECTION FROM EITHER PAIRING METHOD

Verify the BT connection with the PC using SatTerm to connect to the BT paired SHOUT ns.

1. Verify the Shout ns **BT LED** is still blinking.
2. If not, press and hold the **BT** button until the Bluetooth light starts blinking, signifying the pairing state.

3. Select **Port Properties**  if not opened.

4. Select the **SHOUT ns** in the Paired Bluetooth Devices list (see **Figure 21**).

5. Select **Connect** (see **Figure 21**).

NOTE: The SHOUT ns - Connected – BT message displays at the top right side of the SatTerm screen.

6. In SatTerm, enter **AT** and press **Enter**.
7. If SatTerm respond with **OK**, then you are connected via BT

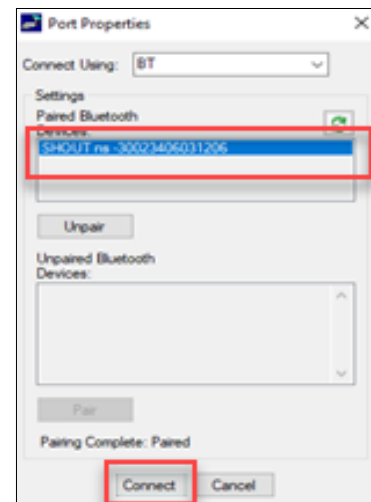


Figure 21: Port Properties

IMPORTANT: If the SHOUT ns firmware is configured to **not require** a PIN for Bluetooth Pairing, follow these steps to change the NS’s Configuration to allow pairing with a PIN:

1. Run SatTerm on a PC and connect the SHOUT ns using a USB cable.
2. In SatTerm, enter **+++** (to enter Command Mode).
3. Enter **AT^BTPASSEN=1** (to Pair WITH a PIN), and press **Enter**.
4. Enter **AT&w0** (to save to the Device Profile), and press **Enter**.
5. Rerun **3.6.2 Pairing With a PIN**.

3.7 AT COMMAND MODE

For scenarios where computer control of the SHOUT ns is desired, use a computer attached to the SHOUT ns USB interface through a USB cable. For example, the SHOUT ns can be turned off using the AT command **^SHUTDOWN**. If the device is sleeping or in low-power in between reporting cycles, pressing the power button turns the SHOUT ns on for 10 seconds. During this time, take the device out of tracking mode and put it into command mode by entering a sequence three pluses, “+++”. If “+++” is not entered within 10 seconds, the SHOUT ns goes back to sleep. See section **4.2 Modes of Operation** for a more detailed description of the command mode and see the NAL document [AT Commands for Model SHOUT ns \[1\]](#) for a full list of the AT command capabilities.

4 IMPORTANT FEATURES

4.1 COMMUNICATION LINKS

The SHOUT ns uses the Iridium network to send its location reports. To use Iridium service, the International Mobile Equipment Identification (IMEI) number must be activated with an SBD service plan through an authorized Iridium reseller. When an IMEI is provisioned for service, up to five SBD delivery destinations can be specified. These are delivery endpoints for the data transmitted by the SHOUT ns and can be any combination of three types: IP address, email, and IMEI.

4.2 MODES OF OPERATION

The SHOUT ns is always in one of two modes: (1) command mode or (2) tracking mode. It can be configured to turn on in one of these modes. The factory-set *Start-up Mode* is tracking mode, which can be changed using the **^START** command (see section **5.2.2.1 General Profile Settings**). For normal operational tracking scenarios, set the *Start-Up Mode* to tracking mode so that the unit continues tracking after waking up from sleep.

4.2.1 COMMAND MODE

When in command mode, the SHOUT ns accepts AT commands through the USB connection. The command set is detailed in the document [AT Commands for Model SHOUT ns \[1\]](#). Use the commands to configure the SHOUT ns operating parameters, to allow the SHOUT ns be operated as a modem, and to query the GPS receiver. Command mode can be switched to tracking mode by the AT command **^TRK**. To switch back, use the escape sequence **+++**.

4.2.2 TRACKING MODE

When in tracking mode, the SHOUT ns automatically transmits positional reports (GPS) using parameters contained in a tracking profile (see section **5.2.2.2 Tracking Profile Settings**). The SHOUT ns can transmit messages in NAL Research's defined report formats and can also transmit messages according to the PECOS Message Structure (PMS) compatible with the US Northern Command (NORTHCOM) Mission Management Center (MMC) server. The PMS complies with the Blue Force Tracking Data Format Specification as defined in the document [PECOS Message Definition Specification, 200907-001 Version 1.7 \[3\]](#).

The SHOUT ns tracking mode has configuration parameters that control the reporting capabilities and power consumption. The SHOUT ns can be configured to send reports at an interval ranging from continuous (as fast as the transmitter can handle) to once every seven (7) days. The SHOUT ns can operate in a low-power mode whereby the device turns off and sleeps between reports. When operating in low-power mode, the device consumes less than 110 μ A of current during sleep.

Tracking may enter the low-power mode while the USB and Bluetooth user interfaces are in use. Use the command **AT^PWRAO** (Power Always On) to keep the SHOUT ns turned on in this situation. This setting prevents the SHOUT ns device from sleeping and greatly increases power consumption; disable this command when finished using the USB or Bluetooth interface. Refer to the document [AT Commands for Model SHOUT ns \[1\]](#) for additional details.

The more commonly used tracking parameters are “Time Between Reports” (**^TBR**), “Time to Keep Trying” (**^TTKT**), and “Callable” (**^CAL**). The following features can also be utilized to further tailor tracking mode to a specific application: “GPS power” (**^GAO**), “communication link availability” (**^LNK**), “profile selection” (**^TPN**, **^TPT**, **^TPE**), motion detection, and geofencing.

“Time Between Reports” (**^TBR**) and “Time to Keep Trying” (**^TTKT**) adjust how often to send reports and how long the SHOUT ns tries to achieve a successful report transmission. Decreasing the “Time Between Reports” increases data points for more detailed situational awareness, and increasing the “Time to Keep Trying” improves the chances of transmission success. Both of these options also directly affect the SHOUT ns power consumption.

For supporting message-receiving scenarios, referred to as “Callable,” the SHOUT ns Iridium modem can be set to be on at all times by using the **^CAL** command. This configuration prevents the SHOUT ns device from sleeping and greatly increases power consumption.

To facilitate power management and time to acquire location, configure the SHOUT ns to control the power state of the GPS module. The module can be set to be on at all times using the command **^GAO**, which prevents the GPS from turning off after obtaining a valid fix.

While in tracking mode, the SHOUT ns can load tracking profiles dynamically. By default, there are two tracking profiles set aside for normal tracking and emergency tracking. Typically, when tracking mode starts, the tracking profile for normal tracking is loaded, specified by the "Tracking

Profile Normal" (^TPN) setting. When the emergency mode is triggered, tracking mode switches to using the tracking profile for emergency tracking, specified by the "Tracking Profile Emergency" (^TPE) setting. This allows the SHOUT ns to be configured to operate differently when there is an external stimulus.

Tracking mode also loads a different tracking profile if geofences are enabled and the SHOUT ns enters or exits a geofence. Priorities are assigned to the different stimuli and the SHOUT ns only switches to the associated tracking profile if it has a higher priority. Emergency tracking has the highest priority, Geofence is the second highest, and normal tracking is the default.

4.3 CALL-OUTS AND TURN-ON DELAY

Using an onboard real-time clock, the SHOUT ns can be configured to send daily call-out reports at specified UTC times. These call-out reports are in addition to tracking reports sent at a predefined tracking interval and they are indistinguishable from each other. Call-outs can be used as a heartbeat to determine if the device is still operational (see section **5.2.4 Call Out**).

In addition, using the onboard real-time clock, the SHOUT ns can be configured for a turn-on delay. A turn-on delay is set for a specific Coordinated Universal Time (UTC) time and date up to 45 days in the future. When a delay is set and tracking is started, the device remains in its low-power sleep mode until the configured date and time upon which the device will turn on automatically and enter the start-up mode. This is useful for conserving battery power while the tracker is in transit to a destination (see section **5.2.2.3 Additional Setup Parameters**).

4.4 GEOFENCING

The SHOUT ns can utilize location information from its GPS receiver to determine whether it has entered or exited the bounds of preconfigured geofences. A geofence is a set of connected latitude and longitude coordinates that defines a region or zone of interest (see section **5.2.3 Geofencing**). A geofence is defined by a minimum of three (3) coordinates and a maximum of 50. Multiple geofences can be configured, each with a unique set of tracking parameters that cause the SHOUT ns to change its tracking behavior while in a specific geofence. Each geofence can also be configured to send a report upon entering and exiting the defined geofence region. In addition, geofences can be configured to turn off the Iridium modem for regions that require radio silence.

4.5 MOTION DETECTION

The SHOUT ns has a built-in sensor that can reliably detect motion. It is an omnidirectional movement sensor and functions regardless of how the SHOUT ns is mounted or aligned. It is sensitive to both tilt (static acceleration) and vibration (dynamic acceleration). The signal level is fed directly into the SHOUT ns microcontroller to wake the SHOUT ns out of low-power mode when activity is sensed and to transmit a location report. The motion sensor has a variety of settings that impact its detection sensitivity. The motion sensor can be enabled or disabled (see section **5.2.2.1 General Profile Settings**).

4.6 ENCRYPTION

The SHOUT ns can be configured to encrypt/decrypt all transmitted and received data using 256-bit Advanced Encryption Standard (AES) encryption. To enable encryption, assign a cryptographic administrator for the device to be responsible for modifying the encryption and decryption keys and setting the device to use encryption (see section **5.2.2.3 Additional Setup Parameters**). The 256-bit AES encryption algorithms implemented here comply with NIST FIPS 140-2 (see the following documents (<https://csrc.nist.gov/publications/detail/fips/140/2/final>)):

1. Security Requirements for Cryptographic Modules, FIPS PUB 140-2, US Department of Commerce, National Institute of Standards and Technology (NIST), May 25, 2001
2. Security Requirements for Cryptographic Modules, Annex A: Approved Security Functions for FIPS PUB 140-2, US Department of Commerce, National Institute of Standards and Technology, February 19, 2003)

4.7 REMOTE UPDATES

Using the configurable, required remote update password, the SHOUT ns can be configured over the air through the remote update option. This allows remote, unattended trackers to be reconfigured without requiring direct access to the device. All of the tracking profile parameters and most of the general parameters can be configured via remote updates (see section **5.2.2.3 Additional Setup Parameters**). NAL Research provides two software applications that can be used to compose and transmit remote updates: Server for Trackers and Remote Configure. These programs can be downloaded from the NAL Research's website

(<https://www.nalresearch.com/support/documentation-downloads/>). Refer to the software applications for the list of remotely configurable parameters.

5 CONFIGURE THE SHOUT NS

The SHOUT ns can be configured in one of three ways from a computer connected to the SHOUT ns USB port:

- 1) Manually through the SatTerm PC-based application (see section **5.2 Using SatTerm**),
- 2) Through a file download using SatTerm (see section **5.2.2.4 Configure Settings**), and
- 3) Via AT commands (see section **4.2.1 Command Mode**).

5.1 PROFILE DESCRIPTIONS

A profile is a group of user-modifiable settings saved to nonvolatile memory. There are three (3) types of profiles on the SHOUT ns: general profiles, tracking profiles, and additional setup parameters (*Other*).

1. **General Profiles:** General profiles contain settings that have a general impact on the operation of the SHOUT ns (see **General Profile Settings**). There are two (2) stored general profiles numbered 0 and 1. In addition to the stored general profiles, there is an “active” general profile, which is the set of general settings that are currently in effect.
 - At power-up, by default, general profile 0 is loaded into the “active” general profile. However, you can change the power-up profile using AT command **&Y**.
 - After power-up, you can load the “active” general profile with any stored general profile using the soft reset command **Z**.
 - Alternatively, you can use **&F** to load factory default settings back into the “active” general profile.
 - Any modifications made to general profile settings apply to the “active” general profile and are temporary. To save the modifications, write the “active” general profile to one of the stored general profiles using **&W**.
 - Settings that fall under general profiles can be displayed using **&V**.
2. **Tracking Profiles:** Tracking profiles contain settings that have an impact on the SHOUT ns during tracking mode (see **5.2.2.2 Tracking Profile Settings**). There are 12 stored tracking

profiles numbered from 0 to 11. In addition to the stored tracking profiles, there is an “active” tracking profile, which is a temporary tracking profile for the purpose of modifying a stored tracking profile. The “active” tracking profile is not used in tracking mode. Instead, tracking mode loads the stored tracking profiles directly based on the current state.

- At power-up, tracking profile 0 is always loaded into the “active” tracking profile. However, after power-up, you can load any of the stored tracking profiles using the soft reset AT command **ZT**.
 - Alternatively, you can use **&FT** to load factory default settings back into the “active” tracking profile.
 - Any modifications made to tracking profile settings apply to the “active” tracking profile and are temporary. To save the modifications, user must write the “active” tracking profile to one of the stored tracking profiles using **&WT**.
 - Settings that fall under tracking profiles can be displayed using **&VT**.
3. **Additional Setup Parameters:** Additional setup parameters affect the SHOUT ns globally and immediately. Unlike general profiles and tracking profiles, there is no “active” profile associated with these parameters to be saved or retrieved. Any modifications to these settings are saved to nonvolatile memory directly.

5.2 USING SATTERM

SatTerm, short for satellite terminal emulator, is terminal emulation software developed by NAL Research that runs on the Windows® operating system. It is used to communicate with the family of NAL Research devices through RS232 or USB interface. The following sections cover how to use SatTerm 8.9.0 (or higher) to configure the SHOUT ns-nsx. (Please reference the [SatTerm User Guide](#) [6] for SatTerm installation instructions.)

5.2.1 CONNECTING SATTERM TO THE SHOUT NS

The SHOUT ns can be connected to SatTerm via a USB port of a Windows® PC. The SHOUT can also be connected to SatTerm through a Bluetooth link. A USB connected is required during the Bluetooth Pairing Process. The steps for Bluetooth Pairing and Connection are described in detail in section **3.6 Pair SHOUT ns to Bluetooth Device**.

5.2.2 CONFIGURE WINDOW

The SatTerm *Configure Window* option allows you to set up the profiles described in section **5.1 Profile Descriptions**.

After the hardware setup is completed using the steps above, select **Options > Configure Windows** to configure the specific settings for the SHOUT ns (see **Figure 22**). Each part of the *Configuration* window is described below.

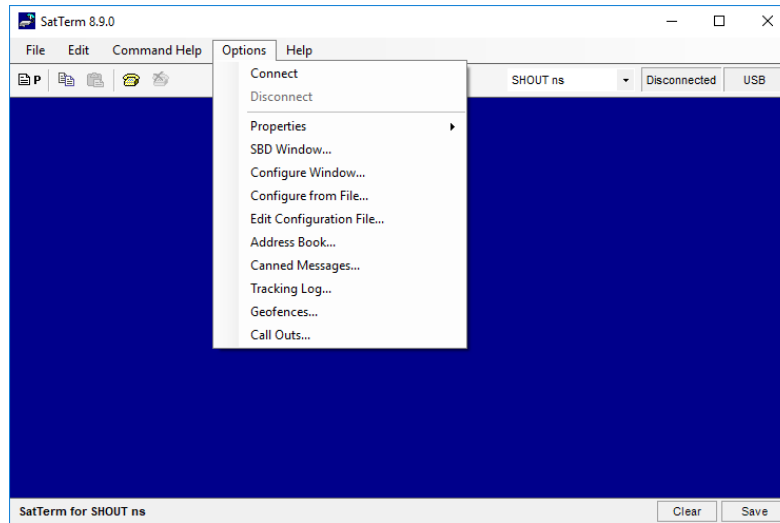


Figure 22: Options Menu and Configure Window Menu Item

5.2.2.1 GENERAL PROFILE SETTINGS

This section describes the general profile settings using SatTerm. After selecting the *Configure Window* menu item, the *Configuration* window appears. To access settings for a general profile, select **General Profile** as the profile type and then select **Store Profile** to select the profile number. The *Configuration* window organizes the general profile settings into five tabs: *Miscellaneous*, *Tracking*, *Motion*, *LED*, and *GPS*, as shown in **Figure 23**.

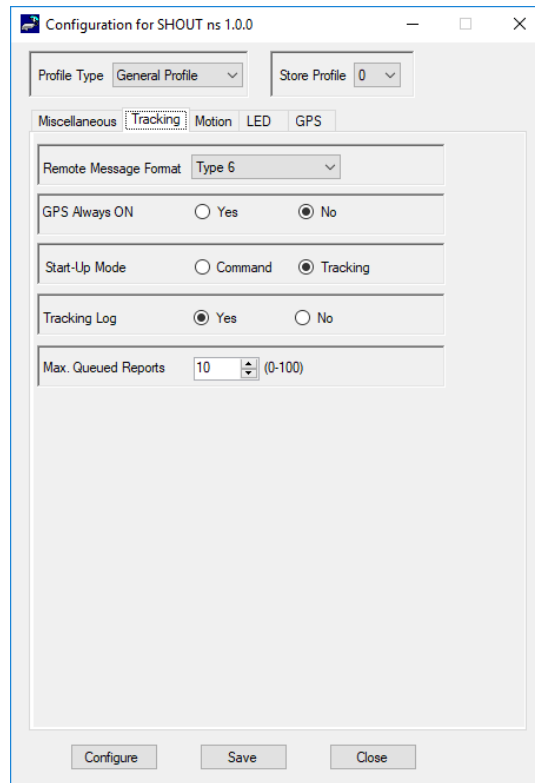


Figure 23: General Profile Window with Tracking Tab

5.2.2.1.1 TRACKING TAB

Tracking offers five settings, as shown in **Figure 23**: *Remote Message Format*, *GPS Always ON*, *Start-Up Mode*, *Tracking Log*, and *Max. Queued Reports*.

1. **Remote Message Format:** Sets the format of the messages that are sent from the SHOUT NS to the recipient.
 - a. Currently, available message formats include:
 - i. NAL Type 3: Same format as on the A3LA trackers
 - ii. NAL Type 4: Includes HDOP and Vertical Dilution of Precision (VDOP) GPS values, and motion
 - iii. NAL Type 5: Includes I/O pin states
 - iv. PECOS P3
 - v. PECOS P4
 - vi. NAL Type 6: Includes short codes and free text fields
 - vii. NAL 10 Byte Ver 0: A 10-byte message format to reduce data usage
 - b. The AT command associated with this setting is **^RMF**

2. **GPS Always On:** Forces the GPS receiver to remain on between reports, allowing the SHOUT ns to have immediate location information (GPS hot start, assuming the SHOUT ns always has full view of the sky) each time it is ready to transmit a tracking report.
 - a. When low-power consumption is not critical, enabling this option is recommended for faster GPS acquisition and more accurate location information. If the SHOUT ns turns off to sleep while idle, the GPS receiver also turns off.
 - b. The AT command associated with this setting is **^GAO**.

3. **Start-Up Mode:** Sets the operating mode for when the unit is powered on or wakes up from sleep. The default is to power up the unit in tracking mode to allow the unit to begin tracking after a power cycle and to automatically send reports at a predetermined interval. Alternatively, the SHOUT ns can also be configured to turn on in command mode, allowing users to enter AT commands via a connected computer.
 - a. The AT command associated with this setting is **^START**.

4. **Tracking Log:** Forces the SHOUT ns to save all tracking reports, whether successfully sent or attempted during tracking mode, to nonvolatile memory.
 - a. The device can save up to about 4,000 reports in a circular memory (oldest saved reports are overwritten when memory reaches maximum capacity).
 - b. SatTerm can be used to retrieve tracking reports at a later time using **Options > Tracking Log**.
 - c. The AT command associated with this setting is **^DLTRK**.

5. **Max. Queued Reports:** Sets the maximum number of reports that can be queued on the SHOUT ns for retransmit.
 - a. This setting applies only if *Queue Failed Reports*, *Queue Restricted Reports*, or both are set (see section **5.2.2.2 Tracking Profile Settings**).
 - i. A restricted report is a report that attempts to send while the Iridium link is configured to be disabled. For example, if Iridium were disabled in a certain geographic area by a geofence, any reports that attempt to send while in the geofence would be considered a restricted report. In this case, queuing

restricted reports would cause these reports to be queued to retransmit when outside that geographic area.

- ii. Failed reports are reports that are unable to send after the specified *Time to Keep Trying* value (see section **5.2.2.2 Tracking Profile Settings**).
- b. When the number of queued reports reaches its maximum number, the oldest queued reports are overwritten.
- c. The AT command associated with this setting is **^ERQM**.

5.2.2.1.2 MOTION TAB

The SHOUT ns has a built-in sensor that can reliably detect motion. The *Motion* tab, as shown in **Figure 24**, provides ways to detect different motion characteristics without having to interpret the raw motion sensor signals. Motion detection can be enabled or disabled through the *Motion Enabled* option in the tracking profile (see section **5.2.2.2 Tracking Profile Settings**).

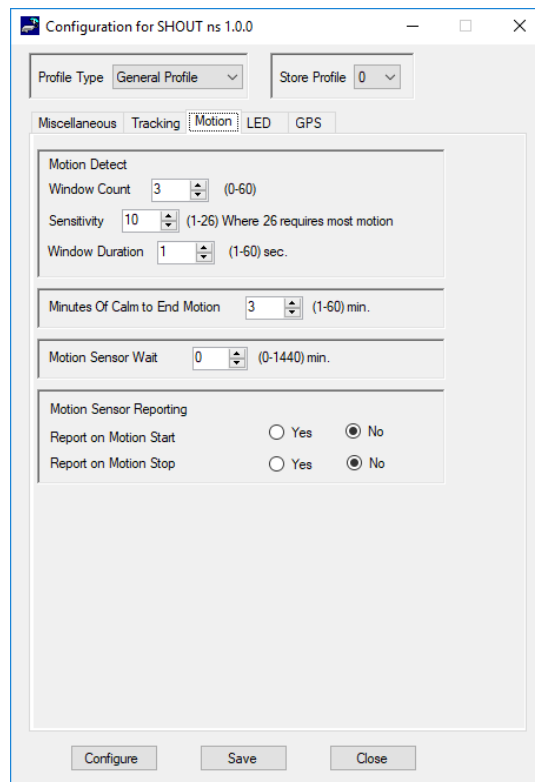


Figure 24: General Profile Window with Motion Tab

When motion detection is enabled, the device monitors the motion sensor to detect when the device is in motion. To detect the start of motion, an algorithm involving motion detection

windows is used. This algorithm succeeds to detect motion when a certain number of contiguous windows are each satisfied by a minimum number of Transistor–Transistor Logic

(TTL) pulses from the motion sensor. **Figure 25** illustrates the algorithm with a window count of 3, window duration of one (1) minute, and a sensitivity of two (2) TTL pulses.

Note: The motion detection algorithm starts over whenever the device receives a remote update. A remote update, in addition to restarting the motion detection algorithm, also resets the motion state of the device back to motionless.

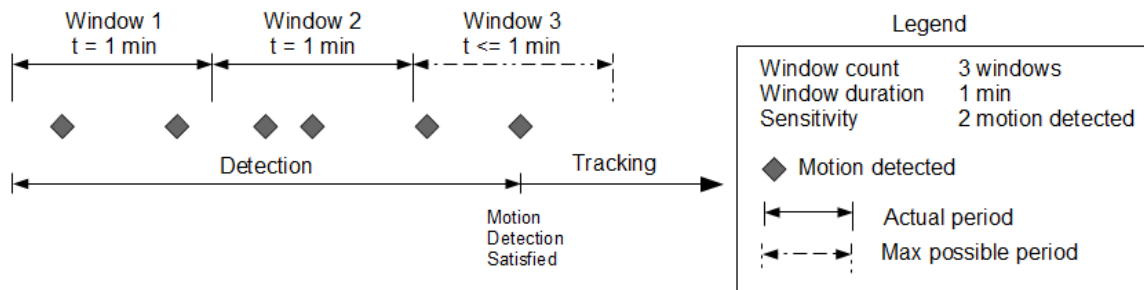


Figure 25: Motion Detection Example

Once motion has been detected using the motion detection algorithm, the device is considered in motion and report formats that support motion indication will have the motion indicator set. While in motion, the device switches to a different algorithm for detecting the end of motion. The device is considered motionless if there is a certain duration of calm. The definition of calm for this algorithm differs depending on whether the device is awake or sleeping. While awake, a single TTL pulse resets the calm timer; whereas while sleeping, the same algorithm used for detecting the start of motion is used to detect motion that will reset the calm timer. An example of this algorithm is shown in **Figure 26**.

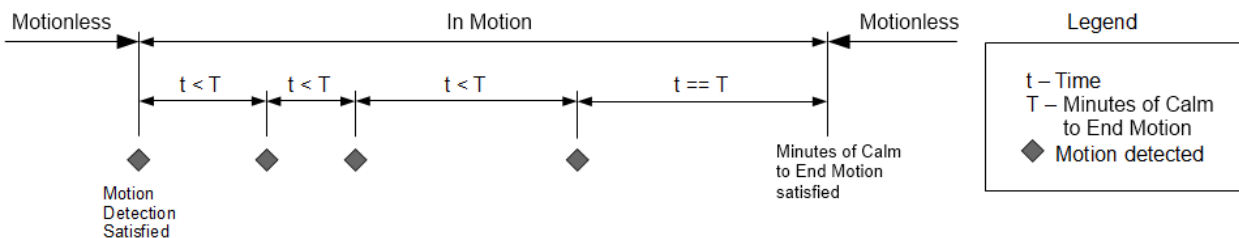


Figure 26: End of Motion Example

Algorithm settings:

1. **Window Count:** Specifies the number of contiguous windows for the motion detection algorithm. If set to 0, then a single TTL pulse from the motion sensor will satisfy the motion detection algorithm.
 - a. The AT command associated with this setting is **^MSB**.
2. **Sensitivity:** Specifies the minimum number of motion sensor TTL pulses that must be detected in order to satisfy a single motion detection window for the motion detection algorithm.
 - a. The AT command associated with this setting is **^MSB**.
3. **Window Duration:** Specifies the duration of each motion detection window for the motion detection algorithm. The AT command associated with this setting is **^MSB**.
4. **Minutes of Calm to End Motion:** Specifies the duration of calm needed in order for the device to return to the motionless state.
 - a. The AT command associated with this setting is **^MSE**.
5. **Motion Sensor Wait:** Specifies the duration of time to ignore the motion sensor whenever the SHOUT ns goes to sleep. Once this time has elapsed, motion detection begins again.
 - a. The AT command associated with this setting is **^MSW**.
6. **Motion Sensor Reporting:** Determines whether to send a report when motion starts and/or ends. For this setting to have an effect, it is required that the *Motion Enabled* option is enabled.
 - a. If the *Report on Motion Start* option is enabled, a NAL format GPS version 6 report with short code 20 will be transmitted when motion starts. See document [NAL GPS Report Version 6 Format \[2\]](#) for details.
 - b. If the *Report on Motion Stop* option is enabled, a version 6 report with short code 21 will be transmitted when motion ends.
 - c. The AT command associated with this setting is **^MSR**.

5.2.2.1.3 LED TAB

For applications where prolonging battery life is essential, the LEDs can be turned off using the **^LEDS AT** command or the SatTerm LED tab (see **Figure 27**). The SHOUT ns is shipped with all LEDs set to *ON*.

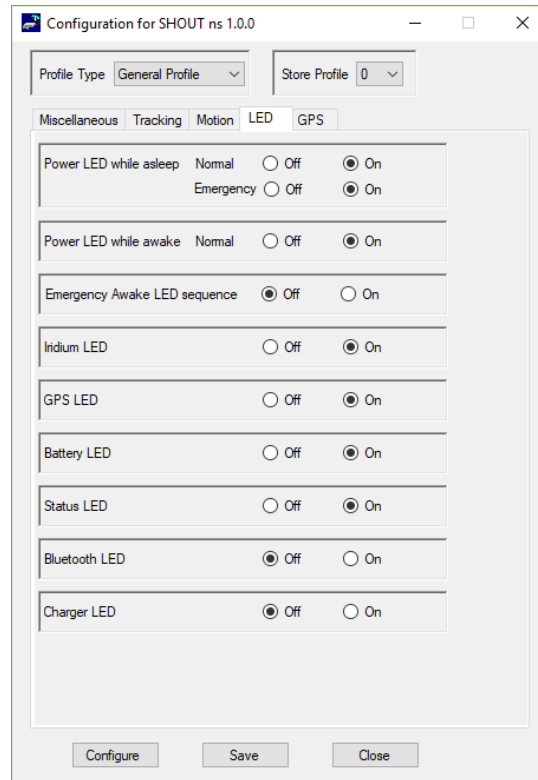




Figure 27: General Profile Window with LED Tab

1. **Power LED While Asleep (Normal and Emergency):** The power  LED has two (2) illumination modes when the device is asleep. While in tracking mode with emergency active, the LED blinks rapidly (once every 2.5 seconds); otherwise, the LED blinks slowly (once every five (5) seconds). Using these settings, the emergency and normal behavior can be turned on and off independently. If the emergency behavior is turned off, the device returns to using the normal behavior.
2. **Power LED While Awake (Normal):** While the power  LED is awake in normal mode, the LED remains solid. Using this setting turns on and off this functionality.
3. **Emergency Awake LED Sequence:** Sets whether to display the *Emergency LED Sequence*. In this state, all six (6) LEDs blink simultaneously, at a one (1) second interval, for as long as the

emergency mode is active and the device is awake. If the emergency behavior is turned off, the device returns to using the normal behavior.

4. **Iridium LED:** Sets whether to display the Iridium (IRDM) LED. When enabled, the Iridium LED stays solid when the Iridium signal strength is between 3–5 bars, blinks when the Iridium signal strength is between 1–2 bars, and stays off when the Iridium signal strength is at 0 bars.
5. **GPS LED:** Sets whether to display the GPS LED. When enabled, the GPS LED stays solid when there is a valid GPS position fix, blinks when there is 2-D fix or using dead reckoning, and stays off when unable to obtain a position fix.
6. **Battery LED:** Sets whether to display the battery (BATT) LED. When enabled, the LED stays solid when the charge is over 80% or charge is complete. When under 80%, the LED blinks for 1.25 seconds while on, or 0.25 seconds while off. When under 20%, the LED blinks for 0.125 seconds while on, or 1.00 second while off. When the device is charging, the LED blinks for 1.25 seconds while on, or 0.25 seconds while off. The battery (BATT) LED only blinks when charging if the device is turned on and not in sleep mode. The battery still charges if the device is off or in sleep mode while plugged into a power source.
7. **Status LED:** Sets whether to display the status (STAT) LED. When enabled, the LED stays solid if the last transmission was successful, blinks if the last transmission was unsuccessful but an earlier transmission was successful, and stays off if transmission has not been successful since turning on. This LED is reset to be off when switching between tracking and command mode.
8. **Bluetooth LED:** Sets whether to display the BT LED. When enabled, the LED stays solid when the device is paired with another device, blinks if the device is in pairing mode but not yet paired, and stays off if the Bluetooth link is off.
9. **Charging Sequence LED:** Sets whether to display the charger LED sequence when power is first connected to USB. When power is applied, the battery, GPS, Iridium, and status LEDs blink in clockwise sequence for three (3) seconds, in that order.

5.2.2.1.4 GPS

The *GPS* tab, shown in **Figure 28**, provides the option to configure the GPS receiver and stream NMEA formatted GPS data from the SHOUT ns serial port while in command, tracking, or both modes.

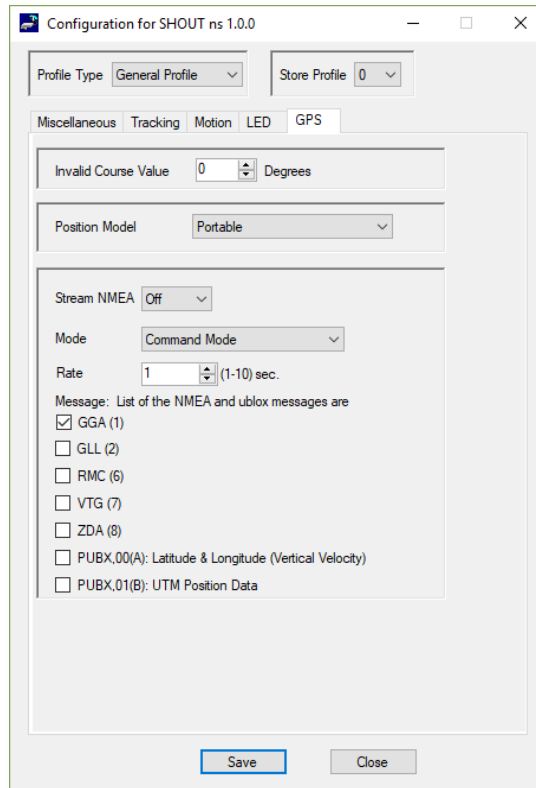


Figure 28: General Profile Window with GPS Tab

1. **Invalid Course Value:** This value is sent in GPS reports to indicate an invalid course when the GPS receiver is unable to determine the course.
 - a. The AT command associated with this setting is **^ICV**.
2. **Position Model:** Improves accuracy of the GPS receiver by telling the unit what its environment is like. For most applications operating below 12 km, the *Portable* setting is sufficient. If requiring operation above 12 km, refer to the [AT Commands for Model SHOUT ns \[1\]](#) document for details.
 - a. The AT command associated with this setting is **+PNAV**.
3. **Stream NMEA:** Sets NMEA streaming on or off.
 - a. The AT command associated with this setting is **+PG**.

4. **Mode:** Selects the mode (tracking, command, or both) in which GPS data streaming is active.
5. **Rate:** Sets the NMEA streaming update rate in seconds.
6. **Message:** The checkboxes determine which NMEA sentences are streamed through the SHOUT ns USB serial port.

5.2.2.1.5 MISCELLANEOUS TAB

The *Miscellaneous* tab provides seven settings as shown in **Figure 29: Successful Send Required for State Change, Startup Information, Bluetooth Power, Normal Tracking Profile, Emergency Tracking Profile, Power Up Time Refresh Frequency, and Remote Update Time Check.**

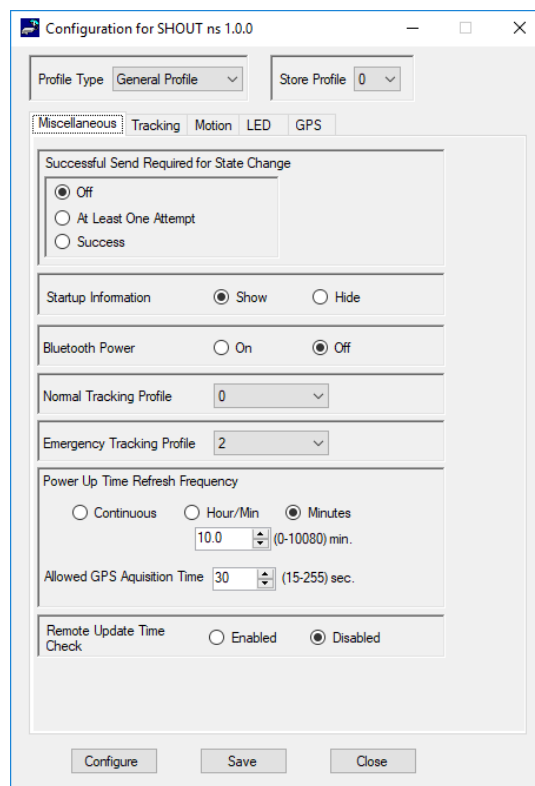


Figure 29: General Profile Window with Miscellaneous Tab

1. **Successful Send Required for State Change:** Restricts the SHOUT ns from changing to a lower priority tracking mode based on whether or not a tracking report has been transmitted. Among the three tracking modes, the order of priority is emergency, geofence, and then normal.

- a. When set to *Off*, a change to the tracking mode takes effect immediately (i.e., emergency to normal).
 - b. When set to *At Least One Attempt*, the mode change is delayed until at least one report transmission attempt has been made.
 - c. When set to *Success*, the mode change is blocked until a tracking report is transmitted successfully.
 - d. The AT command associated with this setting is **^SSR**.
2. **Startup Information:** Hides/shows the text displayed when the device is turned on (copyright, model number, etc.), which is echoed to the SHOUT ns device's USB serial port.
- a. The AT command associated with this setting is **^SSI**.
3. **Bluetooth Power:** Sets whether the Bluetooth transceiver is turned on when the device is turned on.
- a. The AT command associated with this setting is **^BTPWR**.
4. **Normal Tracking Profile:** Selects the stored tracking profile to be used in normal tracking mode.
- a. The AT command associated with this setting is **^TPN**.
5. **Emergency Tracking Profile:** Selects the stored tracking profile to be used in emergency tracking mode.
- a. The AT command associated with this setting is **^TPE**.
6. **Power Up Time Refresh Frequency:** When a power-up delay is set, the SHOUT ns periodically wakes up from sleep to adjust its internal clock against the GPS receiver timing signal. If the GPS receiver does not yet have a time fix, the SHOUT ns stays awake for a specified period of time (Allowed GPS Acquisition Time) waiting for a GPS time fix. After which, the SHOUT ns sleeps for another period of time (Power Up Time Refresh Frequency) before retrying to find a time fix.
- a. These values are configured through the AT command **^PUPT**.

7. **Remote Update Time Check:** Enables a time check for incoming remote updates. When enabled, remote updates with a timestamp less than or equal to the last remote update time are not applied.

- a. The associated AT command is **^RUTC**.

5.2.2.2 TRACKING PROFILE SETTINGS

This section covers the configuration tabs associated with the tracking profile settings.

1. Select **Options > Configure Window**.
2. Select **Tracking Profile** for the *Profile Type* at the top-left of the window.
3. Select the *Store Profile* number (see **Figure 30**).

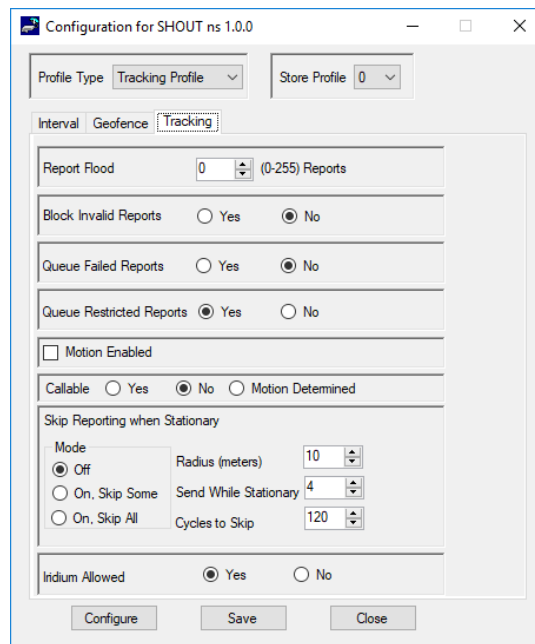


Figure 30: Tracking Profile Window with Tracking Tab

5.2.2.2.1 TRACKING TAB

The *Tracking* tab has eight settings: *Report Flood*, *Blocked Invalid Reports*, *Queue Failed Reports*, *Queue Restricted Reports*, *Motion Enabled*, *Callable*, and *Skip Reporting when Stationary*, and *Iridium Allowed*.

1. **Report Flood:** Sets the number of tracking reports that are to be transmitted continuously when first entering tracking mode and when the tracking mode changes (for example, from normal to emergency). After the specified tracking reports have been transmitted, the

preprogrammed reporting interval takes effect. If in the emergency tracking mode, the report flood is ended prematurely if an emergency acknowledgement is received.

- a. The AT command associated with this setting is **^RF**.
2. **Block Invalid Reports:** When this setting is enabled, only tracking reports with a valid GPS position fix are transmitted. This can be useful in filtering out possibly misleading GPS data points.
 - a. The AT command for this setting is **^BIGR**.
 3. **Queue Failed Reports:** When this setting is enabled, tracking reports that failed to transmit are queued for retransmission. A tracking report that cannot be sent before the specified Time-to-Keep-Trying value is considered a failed report.
 - a. The AT command associated with this setting is **^ERQ**.
 4. **Queue Restricted Reports:** When this setting is enabled, tracking reports that are restricted from transmitting are queued for later transmission. A report is considered restricted when the Iridium link has been disabled.
 - a. For example, if Iridium is disabled in a certain geographic area by a geofence, tracking reports collected while in the geofence would be considered restricted reports.
 - b. If configured for queuing, the restricted reports are later transmitted when outside that geographic area or in an area that allows transmitting.
 - c. The command related to this setting is **^ERQ**.
 5. **Motion Enabled:** Enables the motion sensor in tracking mode. This setting can vary between tracking profiles. For example, the motion sensor could be enabled for normal tracking but be disabled while operating inside in a geofence.
 - a. The AT command associated with this setting is **^MSA**.
 6. **Callable:** Sets the callable state of the SHOUT ns in tracking mode.
 - a. When *Callable* is set to *Yes*, the Iridium modem remains turned on between reports to listen for incoming messages. Any incoming messages or updates from a control

center occur immediately. However, the SHOUT ns consumes the most power because the device never goes into sleep mode.

- b. When *Callable* is set to *No*, the SHOUT ns puts all its internal circuitry in sleep mode while idle. Any incoming messages or updates from a control center have to wait until the next reporting cycle (when the RF module wakes up for sending). For this configuration, the SHOUT ns consumes the least power in between reports.
- c. When *Callable* is set to *Motion Determined*, the SHOUT ns is callable when the device is in motion and is in sleep mode when the device is stationary.
- d. The AT command associated with this setting is **^CAL**.

7. **Skip Reporting when Stationary:** Limits the SHOUT ns from sending tracking reports when it has not moved out of a specified radius.

- a. When enabled, the unit is bounded by a sphere with a specified radius. While the unit remains in the sphere, report sending skips a specified *Cycles to Skip* number of report cycles.
- b. When the *Cycles to Skip* value is reached, the SHOUT ns reports for a specified number of *Send While Stationary* cycles. The process is repeated until the unit leaves the sphere.
- c. Upon leaving the bounding sphere, a new boundary is created at the current location of the unit and the SHOUT ns reports for the specified *Send While Stationary* cycles.
- d. If *On, Skip All* is selected, the *Cycles to Skip* parameter is disregarded and the unit only sends the *Send While Stationary* cycles each time a new sphere is established.
- e. The AT command associated with this setting is **^SPSR**.

8. **Iridium Allowed:** Enables/disables the Iridium link. Refer to section **5.2.2.2.1 Queue Restricted Reports** option 4) for additional details.

- a. The AT command associated with this setting is **AT^LNK**.

5.2.2.2.2 GEOFENCE TAB

The *Geofence* tab provides two settings, as shown in **Figure 31**: *Geofence Check Frequency* and *Allowed GPS Acquisition Time*.

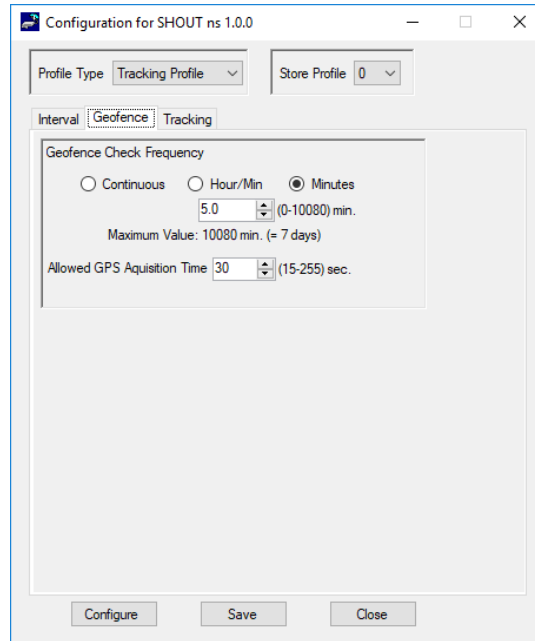


Figure 31: Tracking Profile Window with Geofence Frequency Tab

1. **Geofence Check Frequency:** Sets the maximum time between position updates to check if the device is in a geofence. If a valid GPS position is received before the next check, the countdown to the next check is restarted.
 - a. The AT command associated with this setting is **^GFCE**.
2. **Allowed GPS Acquisition Time:** Sets the amount of time the geofence check attempts to acquire a GPS position. If the SHOUT ns fails to acquire a position in the time allowed, the geofence check is aborted and occurs at the next scheduled check or the next time the GPS receiver has a valid position.
 - a. The AT command associated with this setting is **^GFCE**.

5.2.2.2.3 INTERVAL TAB

The *Interval* tab provides four settings: *Use Alternate Interval for Motion*, *Time Between Reports (Standard and Motion)*, *Time To Keep Trying (Standard and Motion)*, and *Delayed First Report (Standard and Motion)*, as shown in **Figure 32**.

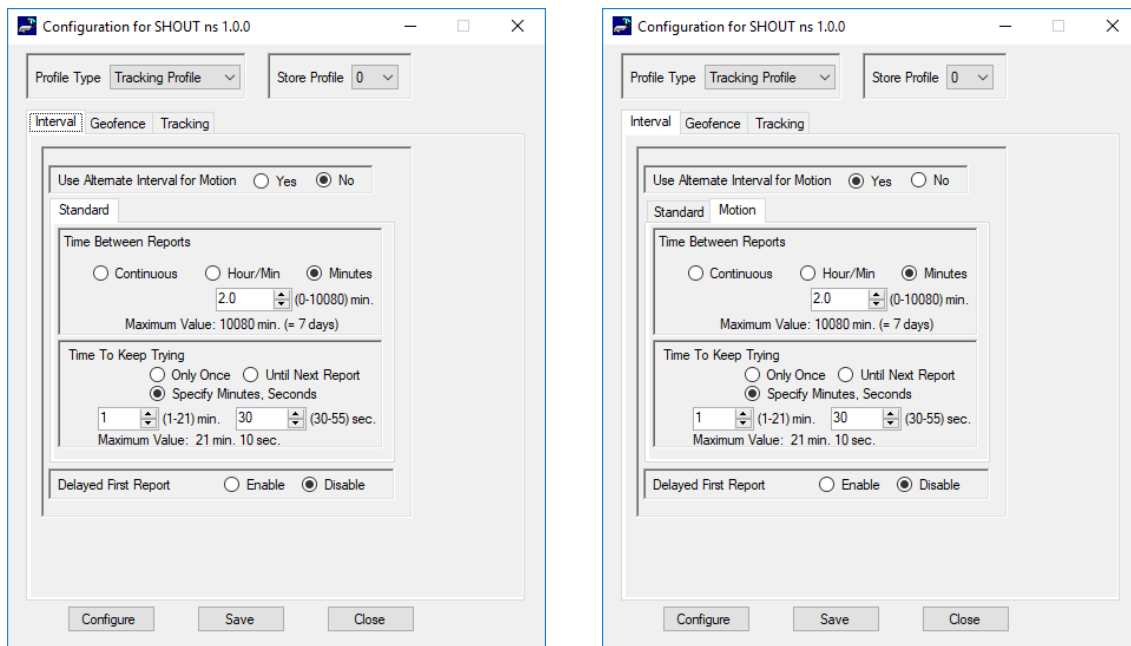


Figure 32: Interval Tab in Tracking Profile Window with Standard and Motion Tabs

1. **Use Alternate Interval for Motion:** When this setting is set to *Yes*, the SHOUT ns uses alternate *Time Between Reports*, *Time To Keep Trying*, and *Delayed First Report* settings while in motion. To set these alternate settings, use the *Motion* tab that appears when *Yes* is selected.
 - a. The AT command associated with this setting is **^UAMS**.
2. **Time Between Reports (Standard and Motion):** Sets the interval between tracking report cycles. The interval can range from 0 and 10080 minutes in increments of 0.5 minutes (i.e., 30 seconds).
 - a. The AT command associated with this setting is **^TBR** (Standard) and **^TBRA** (Motion).
3. **Time To Keep Trying (Standard and Motion):** Sets the duration in which the SHOUT ns attempts to retry sending a tracking report. During a report cycle, the SHOUT ns attempts to acquire a valid GPS fix and acceptable communication link signal strength. Once the GPS fix and signal strength requirements are met, the device sends a report. If the report fails to send, the SHOUT ns retries until the specified *Time To Keep Trying* window expires.
 - a. There are two (2) additional special values for *Time To Keep Trying*: *Only Once* and *Until Next Report*.

- I. *Only Once* forces the SHOUT ns to send only once per report cycle regardless of whether the tracking report was successfully transmitted or not.
 - II. *Until Next Report* forces the SHOUT ns to retry sending a tracking report up to the next reporting cycle if there is no successful transmission.
 - b. *Time To Keep Trying* is specified in 5-second increments. It has a minimum value of 1.5 minutes and a maximum value of 21 minutes and 10 seconds.
 - c. The AT command associated with this setting is **^TTKT** (Standard) and **^TTKTA** (Motion).
4. Delay First Report (Standard and Motion): When enabled, this setting prevents the transmission of the first tracking report. This applies when tracking is turned on from off or if there is a mode change. A mode change occurs when entering/leaving a geofence and when emergency is enabled/disabled.
- a. An example of how this parameter might be useful is to avoid unwanted transmissions that may accumulate airtime costs. If tracking mode is restarting repeatedly because of frequent power cycling, reports are transmitted each time. Enabling *Delay First Report* would delay that first report and reduce the airtime usage.
 - b. The AT command associated with this setting is **^DFR** (Standard) and **^DFRA** (Motion).

5.2.2.3 ADDITIONAL SETUP PARAMETERS

This section covers the configuration tabs associated with the *Other* profile settings.

1. Select **Options > Configure Window**.
2. Select **Other** for the *Profile Type* at the top-left of the window.
3. **Note:** The *Store Profile* number has no effect for this profile type.

5.2.2.3.1 MISCELLANEOUS TAB

The *Miscellaneous* tab shown in **Figure 33** provides three settings: *Remote Update Password*, *Identifier in Reports*, and *Power-up Delay*.

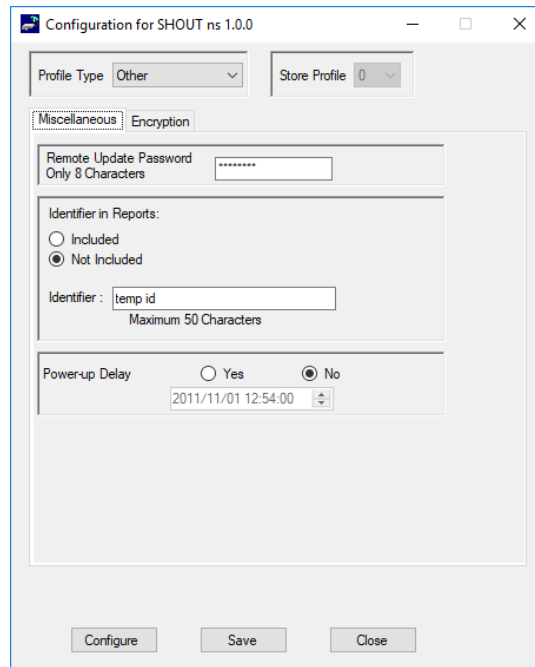


Figure 33: Other Profile Window with Miscellaneous Tab

1. **Remote Update Password:** An unattended SHOUT ns can be reconfigured without requiring direct access to the device. All of the tracking profile parameters and most of the general parameters can be configured via remote updates. This parameter sets the required remote update password. The password entered must be eight characters in length. All printable characters are allowed. The factory-set default password is 12345678 and there is no requirement to change this password.
 - a. The AT command for this setting is **^RUP**.
2. **Identifier in Reports:** Sets an additional identifier of up to 50 characters that is included in Type 3, Type 4, and Type 5 tracking reports. Keep the identifier short to reduce airtime cost, especially when on the Iridium link.
 - a. The AT command associated with this setting is **^ID**.
3. **Power-up Delay:** This parameter enables the power-up delay to a specified date and time. The date and time format is as follows: YYYY/MM/DD HH:MM:SS (i.e., 2012/11/30 12:54:23). When in tracking mode and immediately after power is applied to the SHOUT ns, the device remains in a power-saving sleep mode until the user-specified date and time. At that point, the device enters tracking mode.

- a. The AT command for this setting is **^PUPD**.

5.2.2.3.2 ENCRYPTION TAB

The SHOUT ns can send and receive data in AES 256-bit encrypted format. **Figure 34** displays the SatTerm encryption setting window that opens after selecting the *Change* button in the *Encryption* tab. Options include changing the *Crypto Officer Password*, enabling or disabling encryption, and setting the encryption and decryption keys.

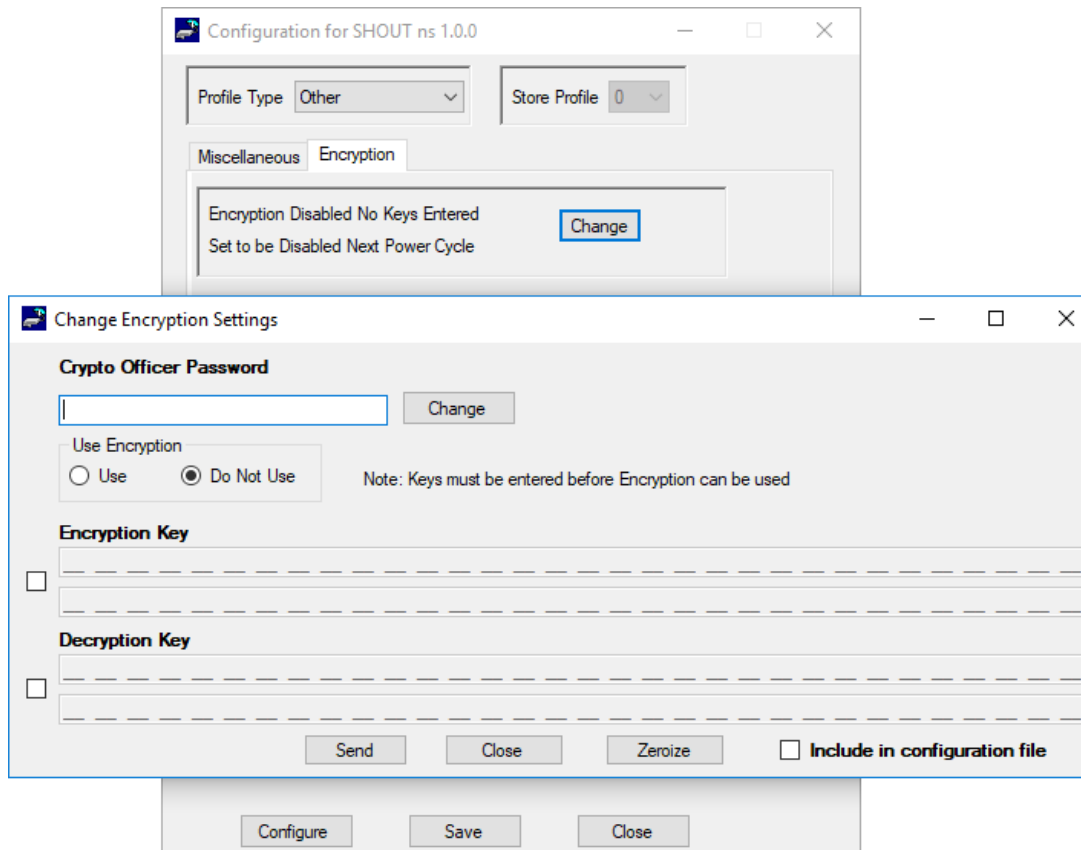


Figure 34: Encryption Tab and Change Encryption Settings Window

A factory-default *Crypto Officer Password* is initially set on the SHOUT ns. This default password must be changed before any encryption properties can be set. To change the default password:

1. Select **Change** to open the *Change Crypto Officer Password* window and complete the form.
2. Enter the default password, “temp password,” in the *Old Password* box.
3. Select **Send**. Encryption properties can now be modified via the *Change Encryption Settings* window using the new *Crypto Officer Password*.

After the default password has been changed, set the encryption and decryption keys in order to use encryption.

4. In the *Change Encryption Settings* window, select **Use** under *Use Encryption*.

5. Select the **Encryption Key** checkbox and enter the key twice.

6. Select the **Decryption Key** checkbox and enter the key twice.

NOTE: The *Decryption Key* is optional but required to receive encrypted data.

7. Select **Send**. The message *Update Made* is displayed to confirm successful configuration of the selected settings.

The encryption settings are included in the configuration file (see section **5.2.2.4 Configure Settings**) when the *Save to file* checkbox is selected. The *Zeroize* button erases the encryption/decryption keys on the SHOUT ns.

Configuration can also be accomplished by using AT commands. The following five AT commands are used to configure the SHOUT ns device's cryptographic options: Change Crypto Officer Password (**^CCOP**), Key for Decryption (**^KD**), Key for Encryption (**^KE**), Use Encryption (**^UE**), and Key Zeroization (**^KZ**).

5.2.2.4 CONFIGURE SETTINGS

To configure the SHOUT ns with the current *Configuration* window settings, click the **Configure** button at the bottom of the *Configuration* window (see **Figure 23**). When the settings have been programmed and saved into the SHOUT ns, SatTerm displays the confirmation message shown in **Figure 35**.

The current *Configuration* window settings can be saved to a file by clicking **Save** at the bottom of the *Configuration* window.

The SHOUT ns can also be configured from an existing *.ncf configuration file. To load an existing *.ncf configuration file into the SHOUT ns, select **Options > Configure from File** from the SatTerm main window. This opens a file browsing window prompting you to select a file. Locate the configuration file you wish to use and click **Open**. SatTerm proceeds to configure the SHOUT ns with the settings contained in the selected configuration file. When this has completed, the *Update Made* dialog window appears (See **Figure 35**).

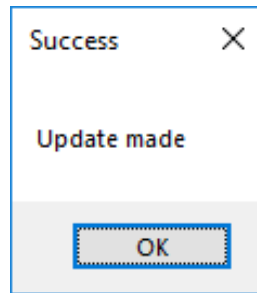


Figure 35: Successful Update Made Window

5.2.3 GEOFENCING

The SHOUT ns can utilize location information from its GPS receiver to determine whether it has entered or exited the bounds of preconfigured geofences. A geofence is a set of connected latitude and longitude coordinates that defines a region or zone. A SHOUT ns can be configured to send a report when entering or exiting a geofence, and to use a different tracking profile. This provides the ability to change the behavior of the SHOUT ns based on its location.

Geofences can be configured two (2) ways: using the AT commands and using SatTerm. If latitude and longitude coordinates are known, geofences configuration can be done using the following AT commands: Start Geofence (**^GFS**), Add Geofence Point (**^GFAP**), and Finish Adding Geofence Points (**^GFF**). Geofence maintenance and modification can be accomplished using the following AT commands: Geofence Check Frequency (**^GFCF**), Modify Geofence (**^GFM**), Delete Geofence (**^GFD**), Erase Geofence (**^GFE**), and Read Geofence Points (**^GFR**).

A Geofence forms-based GUI configuration tool is available using SatTerm. To configure Geofences with SatTerm, select **Options > Geofences** (see **Figure 22**); the *Geofences* window shown in **Figure 36** appears. Note that the visual map-based Geofence options *Create Geofence* and *Edit Geofence* utilize Google Maps, so an internet connection is required for a map to appear.

There are two (2) lists in the *Geofences* window. The one on the left shows a list of geofences, and the one on the right shows a list of coordinates corresponding to the selected geofence. To the far right are settings for the selected geofence. The list of Geofences contains three columns that reflect values set in the settings section on the right.

1. The *ID* column indicates the identifier assigned to the geofence. This identifier is used to reference the geofence when the SHOUT ns sends arrival and departure notices and when updating geofence parameters via AT commands or remote updates.

2. The *Options* column shows a combined bit field value of the options parameters (000 (0) – 111 (7), with each digit corresponding to *Enable*, *Arrive notice*, and *Depart notice*).
3. The *Profile* column indicates the tracking profile assigned to the geofence.

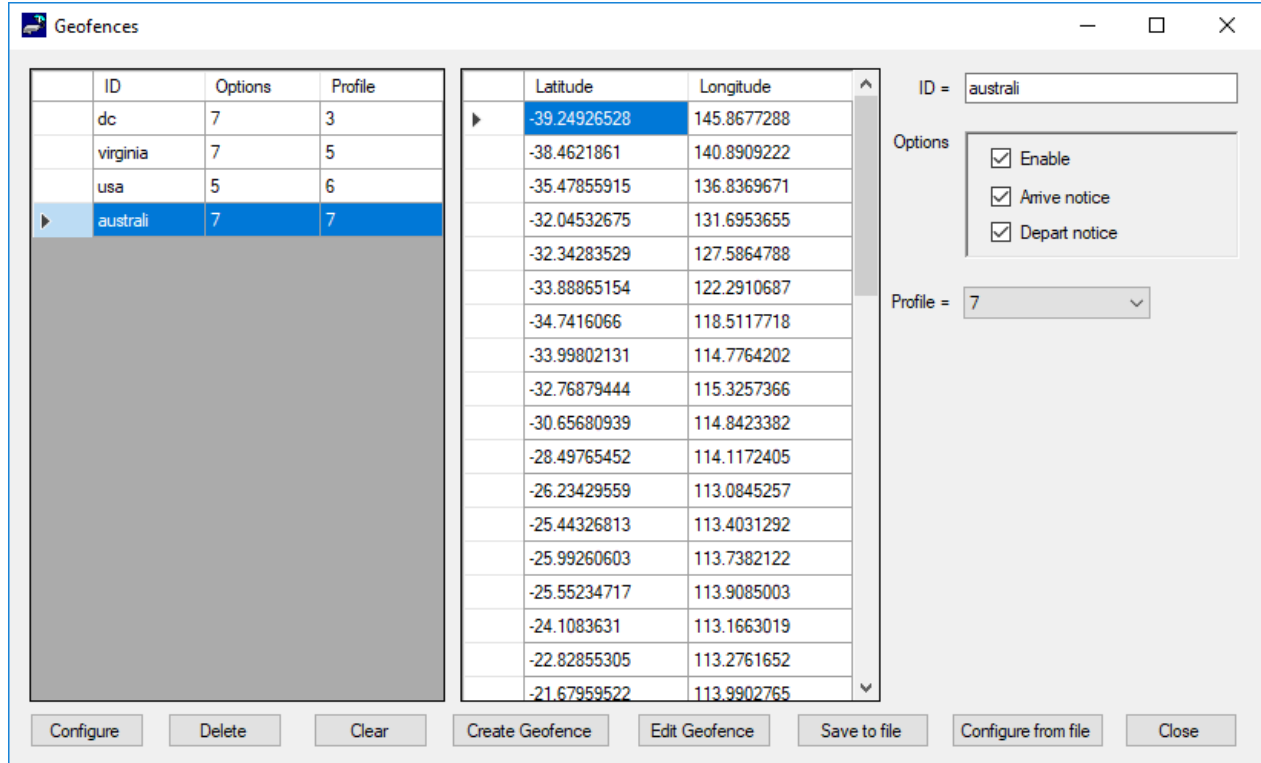


Figure 36: Geofences Window

Descriptions of the geofence settings listed on the right side of the window are as follows.

4. **ID:** Defaults to an incremented integer value. It can be set to any 8-character string to identify the geofence (e.g., "USA", "BASE", and "DANGERZN").
5. **Enable:** Enables this specific geofence.
6. **Arrive notice:** Sends a NAL format GPS version 6 tracking report with short code 18 when entering this specific geofence. See document [NAL GPS Report Version 6 Format \[2\]](#) for details.
7. **Depart notice:** Sends a GPS version 6 tracking report with short code 19 when exiting this specific geofence.
8. **Profile:** Sets a tracking profile to be used while inside this specific geofence.

At the bottom of the *Geofences* window is a set of buttons. Descriptions of the buttons are as follows:

9. **Configure:** Selecting the *Configure* button saves the list of Geofences on the SHOUT ns.
10. **Delete:** Deletes the selected geofence.
11. **Clear:** Deletes all configured Geofences.

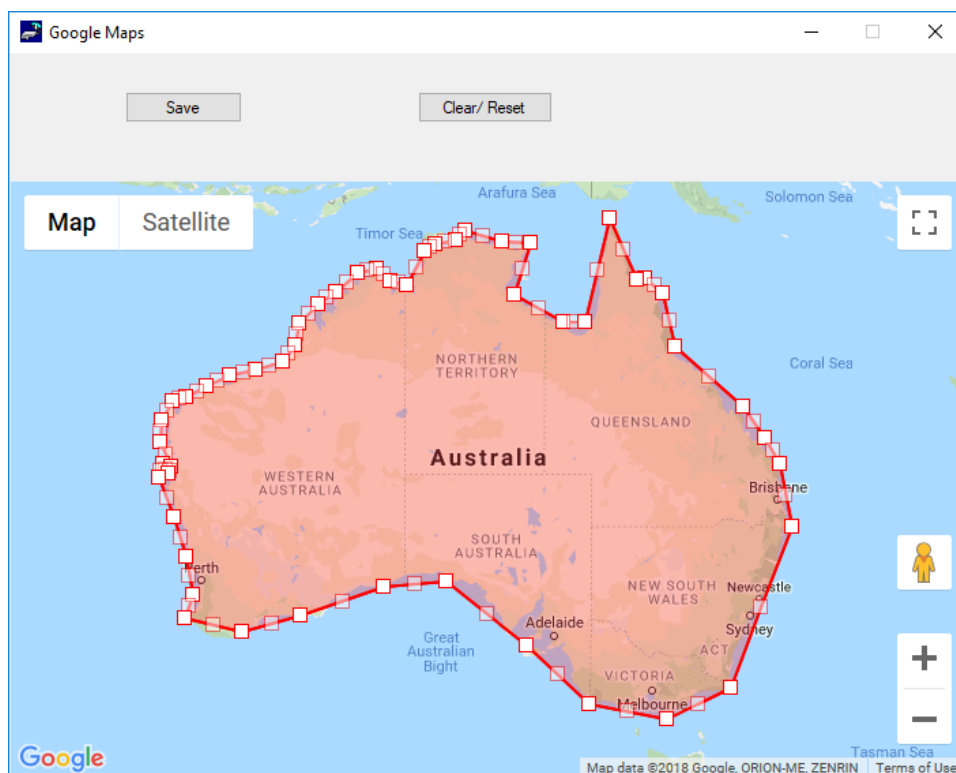


Figure 37: Create/Edit Geofence Window

12. **Create Geofence:** Opens a window to create a geofence by adding points on a map. The window is shown in **Figure 37**.
 - Clicking anywhere on the map adds a point to the geofence. Each point is connected to its previous point.
 - Clicking an existing point deletes it from the geofence.
 - Dragging an existing point moves that point to where it is dragged.
 - A geofence is complete when the start point is clicked.
 - The *Save Points* button transfers the marked points to the coordinates list and closes the map.
 - The *Clear/Reset* button clears all points on the map.

- The minimum number of points in a geofence is 3 and the maximum number of points is 50.

Note: The *Create Geofence* option utilizes Google Maps. An internet connection is required for the map to appear.

13. **Edit Geofence:** Opens a window to edit the coordinates of the selected geofence. The window is the same as *Create Geofence* with the same functionality, but it opens prepopulated with coordinates, as shown in **Figure 36**.

14. **Save to file:** Saves the list of geofences to a comma-separated values (CSV) file.

15. **Load from file:** Loads geofences from a CSV file.

16. **Close:** Closes the Geo Fencing Information window.

5.2.4 CALL OUT

In addition to normal tracking reports sent at a predefined interval, the SHOUT ns can also send daily tracking reports at specific UTC times. These daily reports are called Call Outs. Call Outs can be configured two ways: using AT commands and using SatTerm.

Call Outs configuration can be done using the following AT command: Add Call Out (**^COA**). Call Outs' maintenance and modification can be accomplished using the following AT commands: Delete Call Out (**^COD**), Erase Call Out (**^COE**), and Read Call Out (**^COR**).

To configure Call Outs with SatTerm, select **Options > Call Out** (see **Figure 22**); the *Callout Form* window shown in **Figure 38** appears. As long as there is at least one enabled entry in the list, the Call Out feature is enabled.

The main portion of the *Callout Form* window has a list of existing Call Outs. The list displays three columns: *Index* is the position of the Call Out in the list, *UTC Time* is the time a Call Out is to be made (in HH:MM:SS format), and *State* indicates whether the Call Out is enabled (1) or disabled (0). Below the Call Out list is a set of buttons. Descriptions of the buttons are as follows:

- **Add:** Adds a Call Out to the list
- **Delete:** Deletes the selected Call Out
- **Clear:** Deletes all configured Call Outs

- Close: Closes the Callout Form window.

	Index	UTC Time	State
▶	0	12:15:00	1
	1	12:50:00	0

UTC Time:

State: Enabled Disabled

Figure 38: Callout Form Window

6 SHOUT NS APP OVERVIEW

The SHOUT ns can communicate with an Android device by running the SHOUT ns App. The SHOUT ns App developed by NAL Research, is available for download from the Google Play Store. This Android application provides all the capabilities of the display screens seen on other NAL Research tracking devices such as the SHOUT nano and SHOUT ts. These capabilities include device status; text messaging; managing tracking parameters such as reporting rate, reporting format, and geofencing; diagnostic utilities; and configuring the SHOUT ns. More details regarding the SHOUT app can be found in the [SHOUT ns-nsx App User Guide \[4\]](#) document.

7 USE NAL VUE WITH SHOUT NS

7.1 OVERVIEW

NAL VUE is a web-based locating, tracking, and communication management system that provides your team with situational awareness and control to make timely and effective mission decisions. NAL VUE is an integrated system bringing satellite, Global System for Mobile Communication (GSM), and other data together into a single and simple-to-manage display and control platform. NAL VUE tracks your assets by location and movement (position, speed, altitude, and heading) in real-time via GPS updates from your NAL Research devices and other compatible tracking devices.

The flexibility of the NAL VUE Asset Management System offers awareness of position over your global inventory of trackable assets such as the SHOUT ns. Whether you are tracking personnel, vehicles, shipping containers, etc., your designated system administrator will maintain control and have the ability to communicate with any number of assets simultaneously. Conversely, NAL VUE does not allow others to see the location or movement of your assets unless you authorize it. For more details, see the NAL Research [NAL VUE User Guide \[5\]](#) document.

8 TECHNICAL SUPPORT

For technical support, please contact us

at: Phone: 703-392-1136

Fax: 703-392-6795

Email: Support@Nalresearch.com

Technical documents are also available to download on NAL Research's website
www.nalresearch.com.

APPENDIX A: STANDARDS COMPLIANCE

The 9603 transceiver inside the SHOUT ns is designed to meet the regulatory requirements for approval for the Federal Communications Commission (FCC), Canada, and Conformité Européenne (CE), assuming an antenna with a gain of approximately 3 dBiC and adequate shielding. The 9603 transceiver is tested to the regulatory and technical certifications shown in the table below.

Regulatory Approvals	Radio Tests	EMC Tests	Mechanical/ Electrical Tests
FCC	FCC CFR47 Parts 2, 15, and 25	EN61000-4-2: 1995/A2: 2001 Part 4.2 EN61000-4-3: 2002 Part 4.3 EN61000-4-4: 2004 EN61000-4-6: 1996/A1: 2001 Part 4.6	
Industry Canada	Industry Canada RSS170 Issue 1, Rev 1, November 6, 1999	EN55022: 2006	
CE	ETSI EN 301 441 V1.1.1 (2000-05)	ETSI EN 301 489-1 V1.8.1 (2008-04) ETSI EN 301 489-20 V1.2.1 (2002- 11)	EN60950-1:2006 Part 1

APPENDIX B: EXPORT COMPLIANCE

The SHOUT ns is controlled by the export laws and regulations of the United States of America (USA). It is the policy of NAL Research to fully comply with all U.S. export and economic sanction laws and regulations. The export of NAL Research products, services, hardware, software and technology must be made only in accordance with the laws, regulations and licensing requirements of the U.S. government. NAL Research customers must also comply with these laws and regulations. Failure to comply can result in the imposition of fines and penalties, the loss of export privileges, and termination of your contractual agreements with NAL Research.

The export and re-export of NAL Research products and services are subject to regulation by the Export Administration Regulations (15 CFR 730-744), as administered by the U.S. Department of Commerce, Bureau of Industry and Security (BIS).

See: <https://www.bis.doc.gov/index.php/regulations/export-administration-regulations-ear> for further information on BIS and the Export Administration Regulations (EAR). Additional export restrictions are administered by the U.S. Department of the Treasury's Office of Foreign Asset Controls (OFAC). See: <http://www.ustreas.gov/ofac> for further information on OFAC and its requirements.

APPENDIX C: THE IRIDIUM NETWORK

The Iridium satellite network is owned and operated by Iridium Communications Inc. It is constructed as a constellation of 66 satellites in low-earth orbit (LEO), terrestrial gateways, and Iridium subscriber units (ISUs). An ISU can either be an Iridium satellite phone or various types of modems. The satellites are placed in an approximate polar orbit at an altitude of 780 km. There are 6 polar planes populated with 11 satellites per orbit constituting the 66-satellite constellation. The near polar orbits of the Iridium constellation provide truly real-time and global coverage from pole-to-pole.

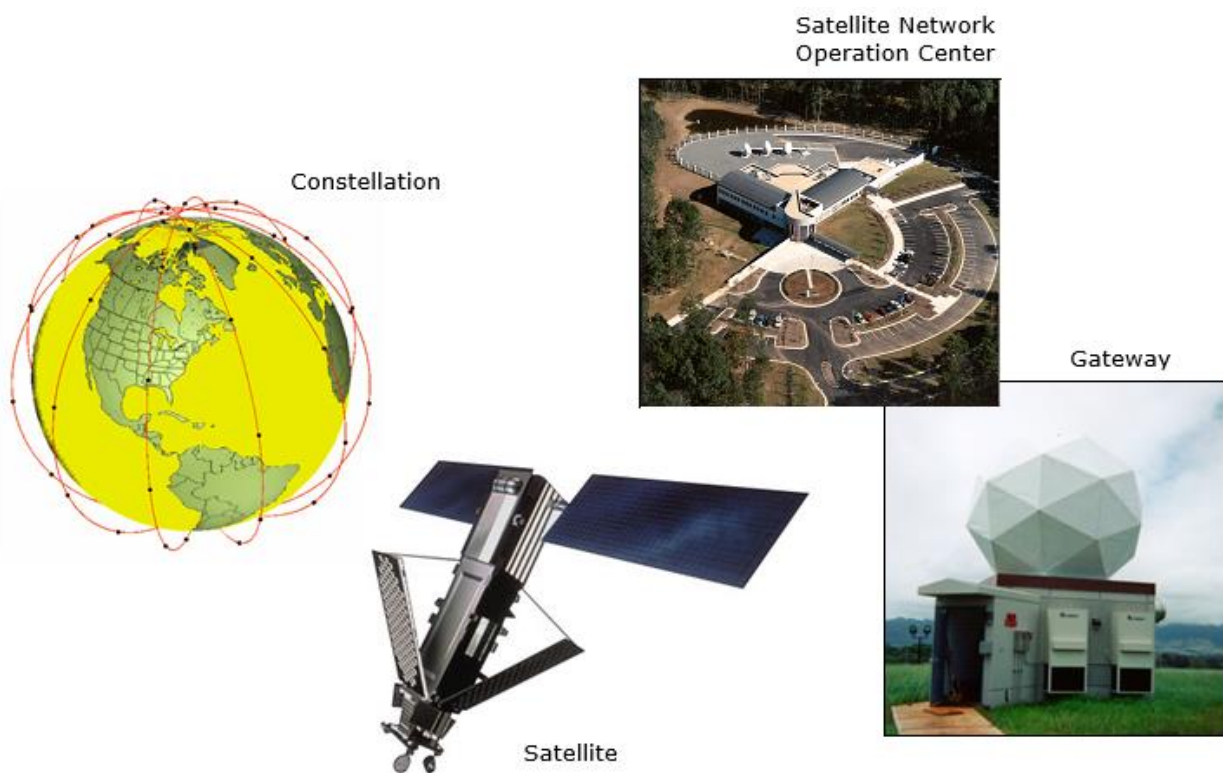


Figure 39: Iridium Network Major Components

The Iridium network is designed to operate in the band of 1616.0 to 1626.5 MHz, although the exact frequencies used depend on the local regulating authorities and issued licenses in any particular region. Each satellite projects 48 beams on the surface of earth, which may be viewed as providing coverage cells on the ground similar to terrestrial systems. Each beam is approximately 600 km in diameter. The 66-satellite constellation has the potential to support a total of 3,168 spot beams; however, as the satellite orbits converge at the poles, overlapping

beams are shut down. The satellite footprint is approximately 4,700 km in diameter. Under each footprint, a satellite is power-limited to approximately 1,100 simultaneous circuits.

The Iridium network uses a time division duplex (TDD) method and transmits and receives in an allotted time window within the frame structure. Since the system is TDD, the ISU transmit and receive in the same frequency band. The access technology is a frequency division multiple access/time division multiple access (FDMA/TDMA) method whereby an ISU is assigned a channel composed of a frequency and time slot in any particular beam. Channel assignments may be changed across cell/beam boundaries and are controlled by the satellite. The system provides an average link margin of 13.1 dB.

Although there are multiple gateways, a user is registered to a single gateway. The gateways perform call connection setup and administrative duties such as billing and resource management. The satellite constellation provides connectivity between users, from a user to the Iridium system gateway, and between gateways. Within the Iridium network architecture, the satellites are cross-linked, which allows ISU-to-ISU communication independent of gateway intervention once the call connection is established.

There are currently two commercial Iridium gateways located in Arizona, United States; and Fucino, Italy. The U.S. government owns and operates an Iridium gateway located in Hawaii, United States. Each gateway generates and controls all user information pertaining to its registered users, such as user identity, geolocation, and billing items. The gateway also provides connectivity from the Iridium system to the terrestrial-based networks such as the public switched telephone network (PSTN) or the internet.

C.1: IRIDIUM NETWORK DATA CAPABILITIES

For data communications, the Iridium network supports five different modes of operation as shown in **Figure 40**: dial-up data service, direct internet connection, SBD, short-messaging service (SMS), and router-based unrestricted digital internetworking connectivity solution (RUDICS).

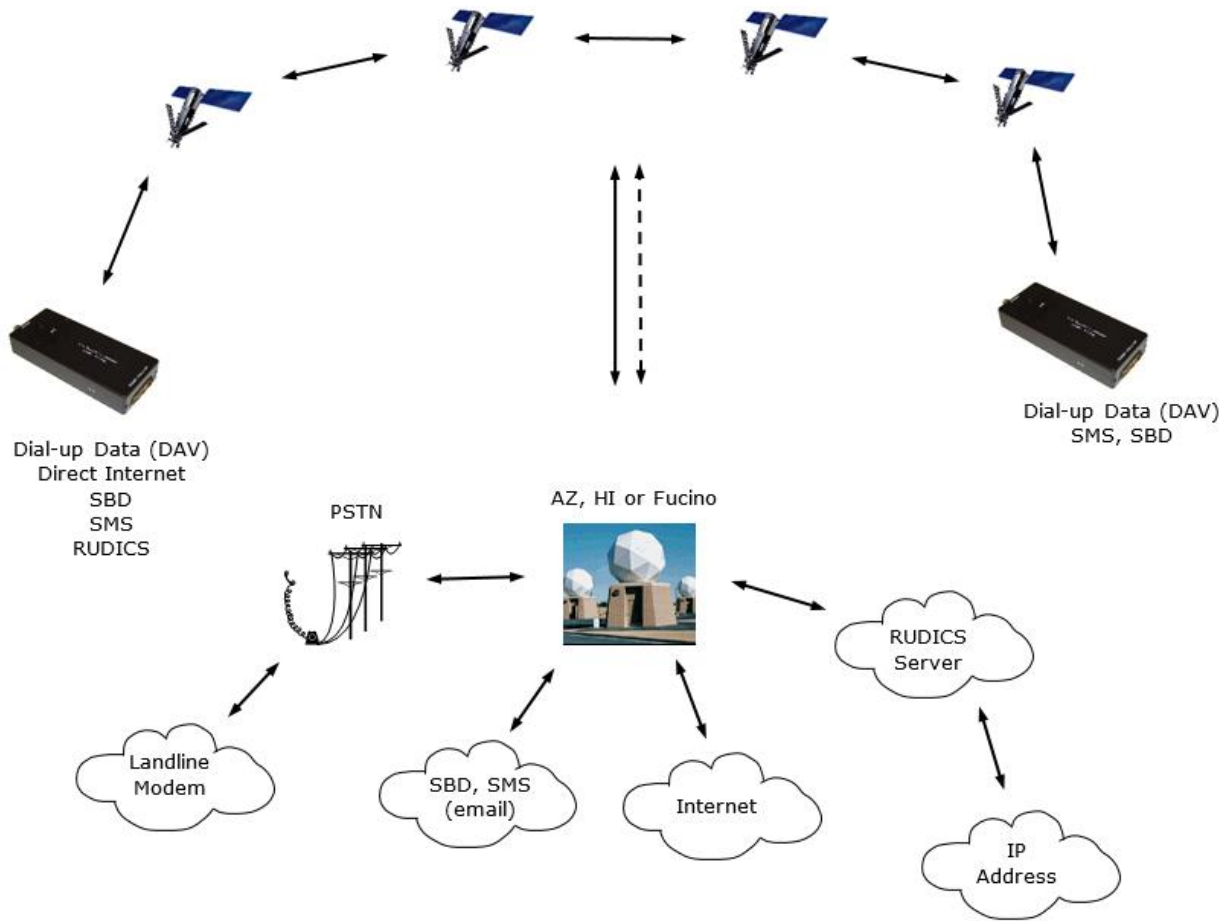


Figure 40: Iridium Network Data Capabilities

C.1.1: DIAL-UP DATA SERVICE

Dial-up data service provides connectivity through the Iridium satellite network to another Iridium modem, to the PSTN, to the Defense Switch Network (DSN), to a remote LAN (e.g., a corporate network), or to an internet service provider (ISP) at a nominal data rate of 2.4 kilobits per second (kbps). The connection time involving user authentication and handshaking (or modem training) can range from 15 to 30 seconds. For an Iridium-to-Iridium call, dial-up data service offers an additional option known as Data After Voice (DAV). Similar to a voice call, a DAV call is routed directly from one Iridium modem to another Iridium modem without going through the gateway.

The Iridium dial-up data service, as shown in **Figure 41**, functions in much the same way as the PSTN dial-up connectivity. From the perspective of a computer, the Iridium modem is just another external modem. The only difference is that the dialed telephone number must conform to the international dialing pattern used by Iridium. When a data call is placed, the Iridium

modem actually dials and initiates a connection with the Iridium gateway through the Iridium satellite constellation. Because the Iridium modem is requesting to establish a data connection, the switch at the gateway routes the call through another modem. The modem at the Iridium gateway then dials into and connects to another modem at the other end. **Figure 41** illustrates how an Iridium dial-up data service call is routed. The handshaking and protocols established between the modems are independent of the Iridium network.

For those ISU-to-ISU dial-up calls where data transmission delay is critical, such as the application of TCP/IP protocol, DAV should be considered in the design. This option eliminates the Iridium gateway once authentication and registration is completed, allowing ISU-to-ISU communication without the gateway in the loop.

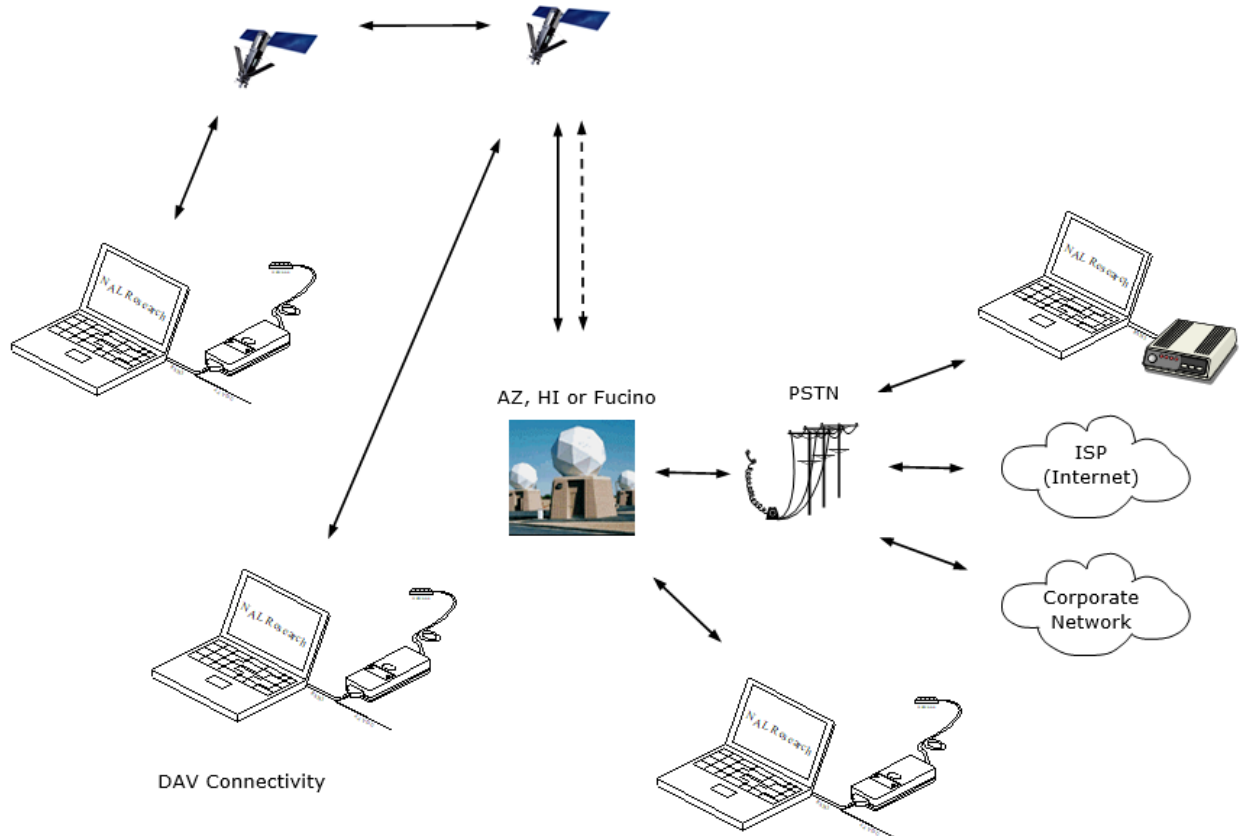


Figure 41: Iridium Dial-Up Data Service

C.1.2: DIRECT INTERNET CONNECTION

The Iridium Direct Internet service allows users to connect to the internet via the Iridium gateway without having to sign up with an internet service provider. This service utilizes a dedicated Apollo Server at the Iridium gateway, which provides high-speed connectivity to the

internet and optimizes server-to-Iridium modem communications. The dial-up networking setup is similar to the dial-up networking setup for a landline telephone. The only difference is that the dialed telephone number is an international number provided by Iridium. **Figure 41** illustrates how an Iridium internet call is routed.

Direct Internet service can be enhanced using Windows-based emulated point-to-point protocol (PPP) called the Apollo Emulator. With the use of the Apollo Emulator software instead of Microsoft Windows® dial-up networking, Direct Internet service can reduce connection time and improve data throughput. In addition, the Apollo Emulator offers a feature called Smart Connect™, which manages airtime by seamlessly connecting and disconnecting a user through the Iridium system. Airtime charges accumulate only while the call is connected. Improved effective data throughput is achieved through the use of user-transparent data compression. The channel rate is still 2.4 kbps. However, 10 kbps effective throughput can be achieved depending on content (graphics and images result in lower effective throughput).

C.1.3: RUDICS DATA

RUDICS is an enhanced gateway termination and origination capability for circuit-switched data calls across the Iridium satellite network. When an Iridium modem places a call to the RUDICS Server located at the Iridium gateway, the RUDICS server connects the call to a predefined IP address, allowing an end-to-end IP connection between the host application and the Iridium modem. There are three key benefits of using RUDICS over the conventional PSTN circuit-switched data connectivity or mobile-to-mobile data solutions: (1) elimination of analog modem training time, (2) increased call connection quality, reliability, and maximized throughput, and (3) protocol independence.

C.1.4: SHORT BURST DATA

SBD is a simple and efficient bidirectional transport capability used to transfer messages with sizes ranging from zero (a mailbox check) to 1960 bytes. SBD takes advantage of signals within the existing air interface but without using the dedicated traffic channels. As a result, small amounts of data can be transferred more efficiently than those associated with circuit-switched data calls. Messages that originate from an Iridium modem can be delivered to a variety of destinations. Commonly, data are delivered across terrestrial communications networks (NIPRNet

and internet) to servers and applications that process data from one or multiple fielded Iridium modems. SBD service also supports the transfer of messages to Iridium modems, where messages may originate from terrestrial sources. Delivery methods and options are initially configured when the Iridium modem is first purchased and may be easily modified via webpages at a later time.

C.1.5: SHORT MESSAGING SERVICE

SMS is a mechanism to deliver short data messages over the Iridium satellite network to the NIPRNet/internet. Iridium SMS incorporates a subset of the GSM SMS features. Each SMS message can be up to 160 text characters (7-bit coded) in length. The text characters are based on a 7-bit alphabet, which is encoded and transmitted as 8-bit data, hence the 140 octet (byte) maximum message size.

SMS is a store-and-forward method of transmitting messages to and from an Iridium modem. The short message from the modem is stored in a central Short Message Service Center (SMSC), which then forwards it to the destination. If the recipient is not available, the SMSC attempts to deliver the SMS message until it is delivered or the validity period expires. SMS supports a limited confirmation of message delivery. The sender of the short message can request to receive a return message notifying them whether or not the short message has been delivered. With this option, the originator gets a confirmation that the message was delivered to the SMSC. Unlike standard GSM, the Iridium SMS can only acknowledge that the message was delivered to the SMSC and not the end destination.

SMS messages can be sent and received simultaneously while a voice call is in progress. This is possible because SMS messages travel over and above the radio channel using the signaling path, whereas the voice call uses a dedicated “traffic” radio channel for the duration of the call.

C.2: IRIDIUM GEOLOCATION

The Iridium network makes calculations of the geographical location (geolocation) of an ISU each time a call is placed. The technique employed to determine the geolocation of an ISU is based on measurements of the ISU and satellite propagation delay and Doppler frequency shift. These measurements are used to estimate cosines of spherical angles that identify the ISU’s location relative to the satellite by the gateway.

The Iridium network can locate an ISU to within 10 km only about 78% of the time. The so-called error ellipse can have a large eccentricity with the major axis oriented in the azimuth dimension and the minor axis oriented in the radial dimension. The position of the ISU in the radial dimension relative to the satellite can almost always be determined to within 10 km with just one measurement. Errors in the azimuth dimension relative to the satellite are largest along the satellite's ground path and tend to increase with distance from the satellite. Geolocation errors in the east-west dimension, therefore, are sometimes more than 100 times greater than in the north-south dimension.

APPENDIX D: SHOUT NS DESIGN SPECIFICATIONS

D.1: MECHANICAL SPECIFICATIONS

Dimensions – SHOUT ns:	84 x 46 x 19 mm (3.30 x 1.80 x 0.74 inches) (see E.1 SHOUT ns Mechanical Drawing)
Weight – SHOUT ns:	85 g (3.0 oz.)
Dimensions – SHOUT nsx:	119 x 46 x 19 mm (4.7” x 1.8” x 0.7” inches) (see E.2 SHOUT nsx Mechanical Drawing)
Weight – SHOUT nsx:	~131 g (~4.6 ounces)
Enclosure Material:	Hard ABS plastic
Interface Connector:	USB Micro-B receptacle
Antennas:	Embedded Iridium, GPS, and Bluetooth
ON/OFF button:	Dome push button
Bluetooth Switch:	Dome push button
Status LED Displays:	Power, Battery, GPS, Bluetooth, message sent status, Iridium

D.2 IRIDIUM RF SPECIFICATIONS

Operating Frequency:	1616.0 to 1626.5 MHz
Duplexing Method:	TDD
Multiplexing Method:	TDMA/FDMA
RF TX output power (average):	1.6 W
Rx Sensitivity at 50Ω (typical):	-117 dBm
Link Margin–Downlink:	13 dB
Link Margin–Uplink:	7 dB

D.3 GPS SPECIFICATIONS

Type of GPS Receiver:	u-blox MAX-8MQ
Receiver Type:	72-Channel GPS L1 C/A, SBAS, QZSS, GLONASS
Update Rate:	4 Hz
Accuracy:	Position: 2.5 meters (8.2 feet) CEP

	Position SBAS: 2.0 meters (6.6 feet) CEP
Acquisition (typical):	Hot starts: 1 second
	Aided starts: 2 seconds
	Cold starts: 29 seconds
Sensitivity:	Tracking: -166 dBm
	Reacquisition: -160 dBm
	Cold starts: -148 dBm
Operational Limits:.....	Altitude: 50,000 meters (164,000 feet)
	Velocity: 500 m/s (1,640 feet/second)
	Dynamics: ≤ 4 g

As long as power is provided to the SHOUT ns, the GPS receiver provides real-time clock functionality and stores ephemeris data in its memory before turning off (sleeping between reports). The ephemeris data are valid up to two hours and can be used in future startup to improve time-to-first-fix.

D.4 BLUETOOTH RF SPECIFICATIONS

Operating Frequency:	2.4 GHz
Protocol:.....	Bluetooth Low Energy v4.0
Data Rate:	2.178 Mbps
Power Output:	+10 dBm
Sensitivity:	-93 dBm

D.5 ELECTRICAL SPECIFICATIONS

Battery Type – SHOUT ns:.....	Internal CR123 650 mAh rechargeable battery or external DC power via the USB port
Battery Type – SHOUT nsx:	Internal 2150 mAh rechargeable battery pack or external DC power via the USB port
USB Input Power:	+4.3 V to +5.5 VDC, up to 1 A
Current in Between Reports (sleep):	Less than 110 µA @ +3.7 V

Note: The average current drawn during transmission may vary depending on the field of view between the SHOUT ns antenna and the Iridium satellite.

D.6 ENVIRONMENTAL SPECIFICATIONS

Design Operating Temperature Range:-20°C to +60°C (-4°F to +140°F)

Charging Temperature Range:-0°C to +45°C (+32°F to +113°F)

Ingress Protection:IP67

Operating Humidity:≤ 75% RH

D.7 DATA I/O SPECIFICATIONS

Short-Burst Data Mobile-Originated:.....340 bytes per message (Iridium)

Short-Burst Data Mobile-Terminated:.....270 bytes per message (Iridium)

Multi-Interface Connector:USB

Software Interface:AT commands via USB

D.8 RELATED HARDWARE

AC Power Adapter:.....LA-3098 (100–240 VAC, 47–60 Hz input)

12 V Car Adapter:.....LA-7021 (12 VDC car battery input)

APPENDIX E: MECHANICAL DRAWINGS

E.1 SHOUT NS MECHANICAL DRAWING

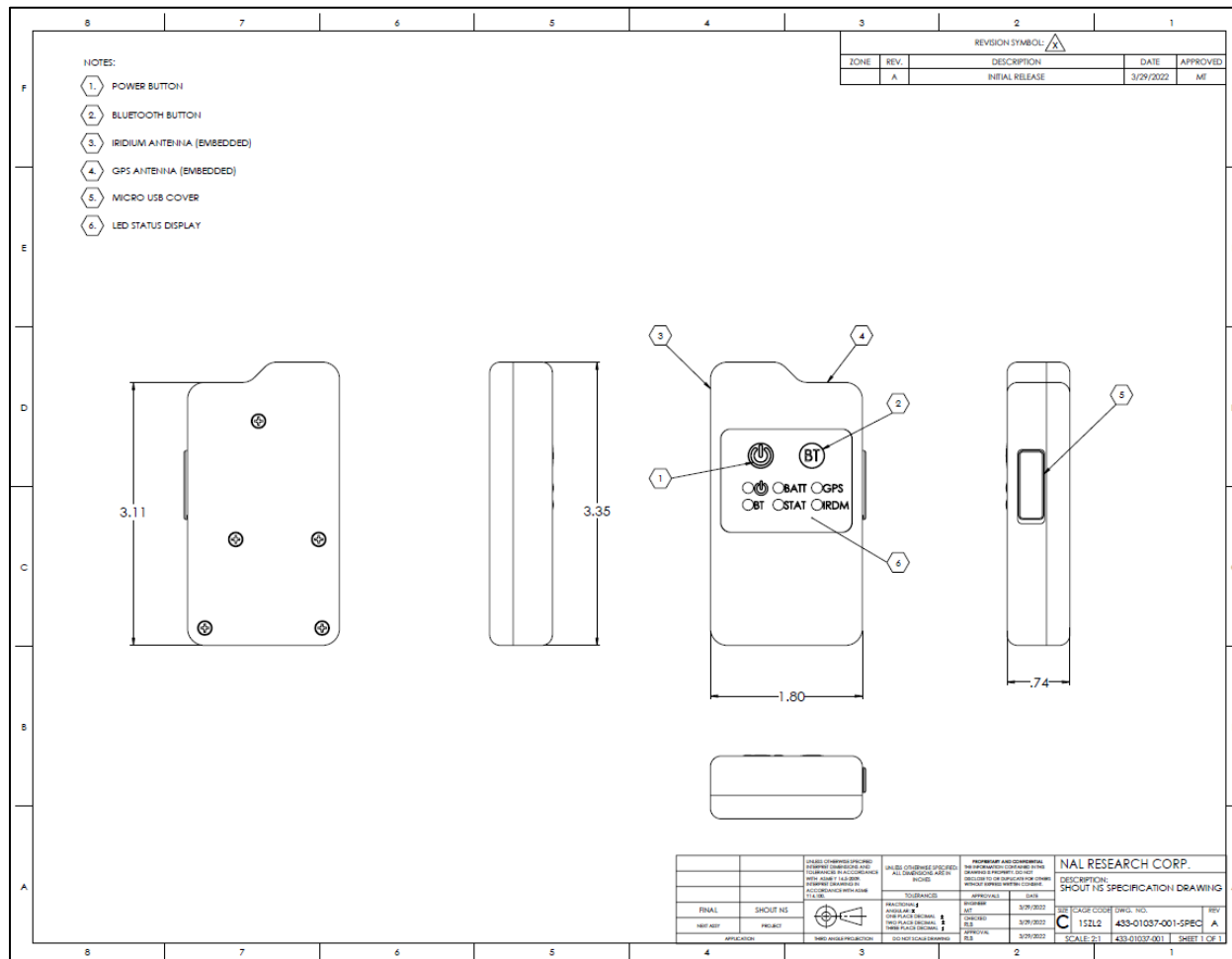


Figure 42: SHOUT ns Mechanical Drawing

E.2 SHOUT NSX MECHANICAL DRAWING

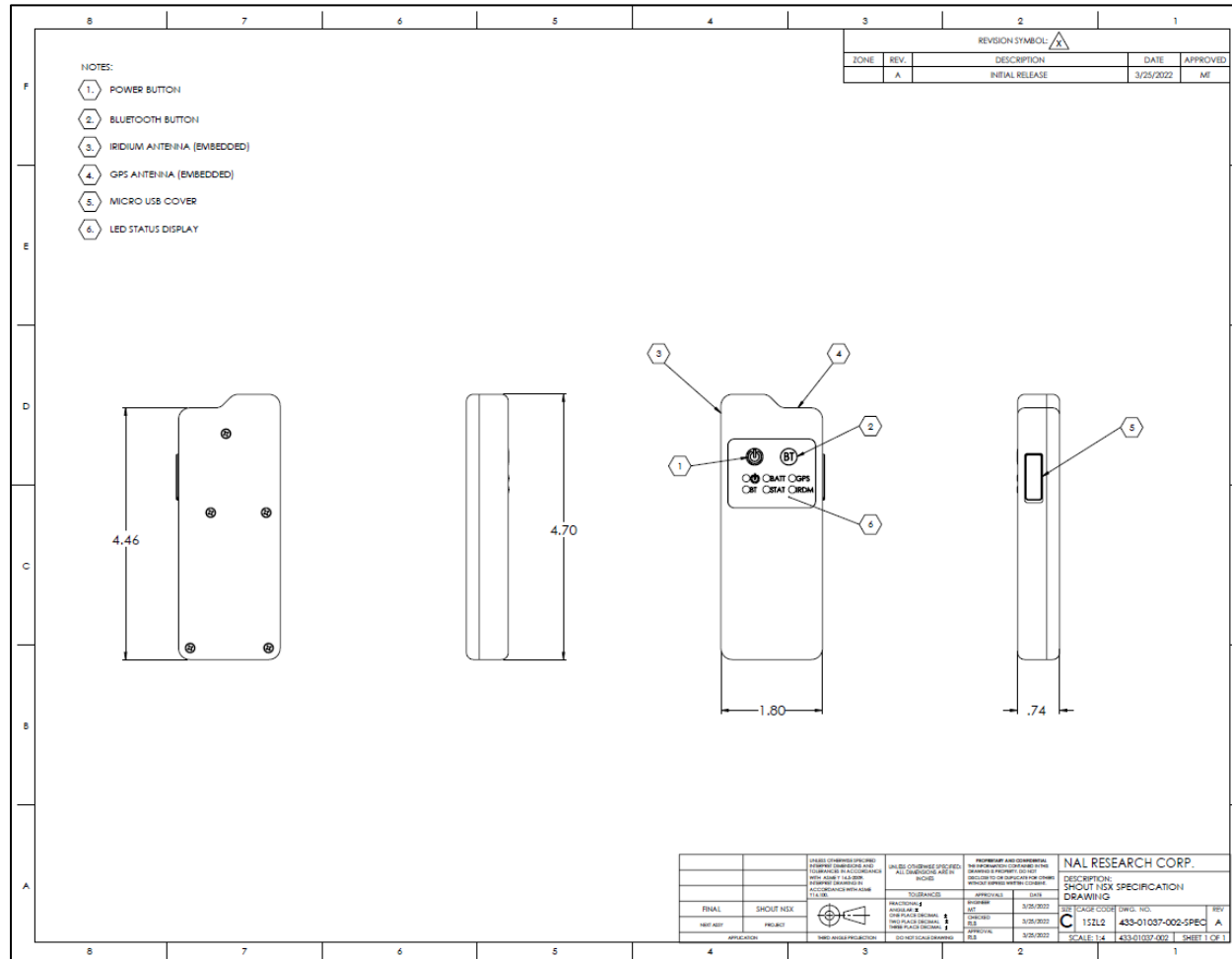


Figure 43: SHOUT nsx Mechanical Drawing