

SHOUT ns/nsx User Guide

Version E

August 11, 2022



LEGAL DISCLAIMER AND CONDITION OF USE

This document contains information for the SHOUT ns tracker and accompanying accessories (“Product”), which is provided “as is.” Reasonable effort has been made to make the information in this document reliable and consistent with specifications, test measurements and other information. However, NAL Research Corporation and its affiliated companies, directors, officers, employees, agents, trustees or consultants (“NAL Research”) assume no responsibility for any typographical, technical, content or other inaccuracies in this document. NAL Research reserves the right in its sole discretion and without notice to you to change Product specifications and materials and/or revise this document or withdraw it at any time. User assumes the full risk of using the Product specifications and any other information provided.

NAL Research makes no representations, guarantees, conditions or warranties, either express or implied, including without limitation, any implied representations, guarantees, conditions or warranties of merchantability and fitness for a particular purpose, non-infringement, satisfactory quality, non-interference, accuracy of informational content, or arising from a course of dealing, law, usage, or trade practice, use, or related to the performance or nonperformance of any products, accessories, facilities or services or information except as expressly stated in this guide and/or the Product and/or satellite service documentation. Any other standards of performance, guarantees, conditions and warranties are hereby expressly excluded and disclaimed to the fullest extent permitted by the law. This disclaimer and exclusion shall apply even if the express limited warranty contained in this guide or such documentation fails of its essential purpose.

In no event shall NAL Research be liable, whether in contract or tort or any other legal theory, including without limitation strict liability, gross negligence or negligence, for any damages in excess of the purchase price of the Product, including any direct, indirect, incidental, special or consequential damages of any kind, or loss of revenue or profits, loss of business, loss of privacy, loss of use, loss of time or inconvenience, loss of information or data, software or applications or other financial loss caused by the Product (including hardware, software and/or firmware) and/or the Iridium satellite, or arising out of or in connection with the ability or inability to use the Product (including hardware, software and/or firmware) and/or the Iridium satellite to the fullest extent these damages may be disclaimed by law and whether advised of the possibilities of such damages. NAL Research is not liable for any claim made by a third party or made by you for a third party.

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 Android 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

REFERENCE DOCUMENTS

The latest revisions of the NAL documents are available from the NAL Research website at <https://www.nalresearch.com/support/documentation-downloads/>.

Reference	Title	Revision/Date
[1]	AT Commands for Model SHOUT ns	Revision 1.0.5, 23 March 2018
[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 App User Guide	Revision C, March 17, 2022
[5]	NALVue User Guide	DD/MM/YYYY
[6]	SatTerm User Guide	Version A, March 29, 2022

TABLE OF CONTENTS

1	Introduction	11
1.1	Device Description	12
1.2	Accessories.....	13
2	User Interfaces	14
2.1	Power Button	14
2.2	Bluetooth Button	14
2.3	Emergency/911 Mode Activation	14
2.4	Status LEDs.....	15
2.5	USB Port	17
2.5.1	USB Data.....	17
2.5.2	DC Power Inputs	18
2.6	Bluetooth	18
3	Quick Start User Guide	19
3.1	Prepare Device	19
3.2	Start Device	19
3.3	Charge Device	20
3.4	Device GPS Reception and Iridium Registration	20
3.5	Configure the SHOUT ns with SatTerm.....	20
3.6	Pair Device Bluetooth with the SHOUT App	22
3.6.1	Pair Device Bluetooth without a PIN.....	22
3.6.2	Pair Device Bluetooth with the NAL SatTerm Application	23
3.7	AT Command Mode	24
4	Important Features	25
4.1	Communication Links.....	25
4.2	Modes of Operation.....	25
4.2.1	Command Mode.....	25
4.2.2	Tracking Mode.....	25
4.3	Call-Outs and Turn-On Delay	27
4.4	Geofencing.....	27
4.5	Motion Detection.....	28
4.6	Encryption	28

4.7	Remote Updates	28
5	Configure the SHOUT ns	30
5.1	Profile Descriptions	30
5.2	Using SatTerm	31
5.2.1	Connecting SatTerm to the SHOUT ns	31
5.2.2	Configure Window.....	35
5.2.3	Geofencing	55
5.2.4	Call Out	58
6	NAL SHOUT Android App Overview.....	60
6.1	Pairing the SHOUT ns with a Smartphone	60
6.2	SHOUT App Screen Overview	60
6.2.1	Title Bar	61
6.2.2	Status Bar.....	61
6.2.3	Menu Functional Area	63
6.2.4	Bottom Dock.....	63
6.3	Texting Menu	63
6.4	Tracking Menu	64
6.5	Utilities Menu.....	65
6.6	Settings Menu	65
7	Use NAL VUE with SHOUT ns	66
7.1	Overview	66
7.2	NAL Vue User Interface.....	66
7.2.1	Six Core Tabs.....	66
7.2.2	Asset Management Tools	67
7.2.3	Alerts	70
7.2.4	Reports	70
7.2.5	Settings and Preferences.....	71
7.2.6	Users	73
8	Technical Support.....	75
	Appendix A: Standards Compliance	76
	Appendix B: Export Compliance	77
	Appendix C: The Iridium Network	78

Iridium Network Data Capabilities.....	79
Dial-Up Data Service	80
Direct Internet Connection	81
RUDICS Data.....	82
Short Burst Data.....	82
Short Messaging Service	83
Iridium Geolocation	83
Appendix D: SHOUT ns Design Specifications	85
D.1: Mechanical Specifications	85
D.2 Iridium RF Specifications	85
D.3 GPS Specifications	85
D.4 Bluetooth RF Specifications.....	86
D.5 Electrical Specifications	86
D.6 Environmental Specifications	87
D.7 Data I/O Specifications	87
D.8 Related Hardware.....	87
Appendix E: Mechanical Drawings	88
E.1 SHOUT ns Mechanical Drawing.....	88
E.2 SHOUT nsx Mechanical Drawing.....	89

TABLE OF FIGURES

Figure 1: SHOUT ns/nsx Buttons and Indicators.....	13
Figure 2: SHOUT ns Accessories.....	13
Figure 3: Control Buttons and Status LEDs on the SHOUT ns Front Face.....	15
Figure 4: Position of USB Connector	17
Figure 5: Port Properties Window Option	32
Figure 6: Bluetooth Port Properties Window Unpaired	33
Figure 7: Bluetooth Port Properties Paired	34
Figure 8: Options Menu and Configure Window Menu Item	35
Figure 9: General Profile Window with Tracking Tab	36
Figure 10: General Profile Window with Motion Tab.....	38
Figure 11: Motion Detection Example	39

Figure 12: End of Motion Example	39
Figure 13: General Profile Window with LED Tab.....	41
Figure 14: General Profile Window with GPS Tab	43
Figure 15: General Profile Window with Miscellaneous Tab	44
Figure 16: Tracking Profile Window with Tracking Tab	46
Figure 17: Tracking Profile Window with Geofence Frequency Tab	49
Figure 18: Interval Tab in Tracking Profile Window with Standard and Motion Tabs	50
Figure 19: Other Profile Window with Miscellaneous Tab.....	52
Figure 20: Encryption Tab and Change Encryption Settings Window	53
Figure 21: Successful Update Made Window	55
Figure 22: Geofences Window.....	56
Figure 23: Create/Edit Geofence Window.....	57
Figure 24: Callout Form Window	59
Figure 25: SHOUT ns Android App Main Window	61
Figure 26: Texting Menu Screen	64
Figure 27: Tracking Menu Screen	64
Figure 28: Utilities Menu Screen.....	65
Figure 29: Settings Menu Screen	65
Figure 30: NAL Vue Home Map/Asset Window.....	67
Figure 31: NAL Vue Add Asset Window	68
Figure 32: NAL Vue Messaging Window	73
Figure 33: Iridium Network Major Components	78
Figure 34: Iridium Network Data Capabilities.....	80
Figure 35: Iridium Dial-Up Data Service.....	81
Figure 36: SHOUT ns Mechanical Drawing	88
Figure 37: SHOUT nsx Mechanical Drawing.....	89

TABLE OF TABLES

Table 1: Description of LED States	15
Table 2: Pin Assignments for the SHOUT ns USB Connector	17
Table 3: Status Icons	61

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.

The SHOUT ns also has an associated Android app for use with a Bluetooth-enabled smartphone or tablet to provide the same functionality as other NAL SHOUT devices with displays. Functionality provided includes text messaging; managing tracking parameters, such as reporting rate, reporting format, and Geofencing; diagnostic utilities; and configuring the SHOUT ns. This application is available from NAL Research via the Google Play App Store. More details are provided in section **6 NAL SHOUT Android App Overview**.

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**.



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



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 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 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 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.

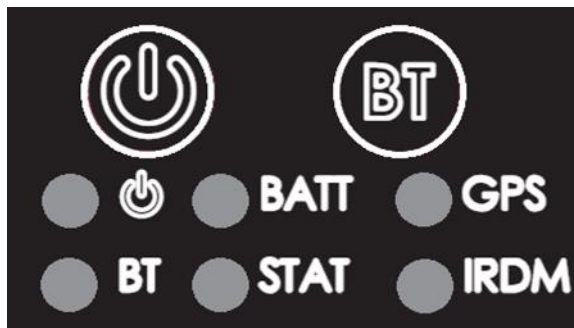


Figure 3: Control Buttons and Status LEDs on the SHOUT ns Front Face

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: • Charge required	During operation: • Charge under 80%; 1.25 sec on, 0.25 sec off • Charge under 20%; 0.125 sec on, 1.00 sec off While charging: • Charge in progress; 1.25 sec on, 0.25 off	During operation: • Charge over 80% While charging: • 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:

1. **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 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.
2. **Upon Charger Connection:** When power is on*, the battery, GPS, Iridium, and status LEDs blink in a clockwise sequence for 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 be used to interface with SatTerm and the NAL SHOUT Android app.

See section **3.6 Pair Device Bluetooth with the SHOUT App** for details on how to pair a Bluetooth enabled device with the NAL SHOUT Android app to the SHOUT ns. The NAL SHOUT Android app is described in more detail in section **6 NAL SHOUT Android App Overview**.

The Bluetooth interface has a 10-minute idle timer that turns off the Bluetooth interface when there is no data transfer or when it is disconnected 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 quickly set up 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 5 seconds to indicate it is asleep. The SHOUT ns can be removed from the sleep mode by pressing the power button for two 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 flashing 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 is shipped with a partially charged battery. Before use, charge the SHOUT ns for one hour.

Note: Upon battery depletion, the SHOUT ns should reach full charge within 2 hours of being continuously plugged in.

Plug the wall charger into a 115 Volts (Alternating Current) (VAC) power source. Confirm that when the wall charger is plugged in and power is applied to the SHOUT ns USB port, the battery, GPS, Iridium, and status LEDs blink in clockwise sequence for 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 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 when a signal has been acquired.
2. The Iridium (IRDM) LED begins lighting when an Iridium signal has been acquired, either solid or blinking based on signal strength.
3. The status (STAT) LED begins lighting when a report has been transmitted.

Once this has been accomplished, 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 is shipped with the default settings below:

- Report Rate: 5 minutes
- Emergency Report Rate: 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:

1. 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 2 seconds to turn on the device.
2. Run the SatTerm software while the SHOUT ns is connected to a computer. An NAL Research message appears along with the firmware version to indicate proper communications and power input.
3. 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. Accessing the DoD EMSS Gateway is not authorized until the SHOUT ns 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 DEVICE BLUETOOTH WITH THE SHOUT APP

The SHOUT ns is paired in one of two methods; 1) pairing without a PIN with just the SHOUT ns and an Android device, and 2) using the NAL SatTerm application to manage the pairing process of the SHOUT ns with a PIN. Method 1) is the default SHOUT ns Bluetooth pairing method (^BTPASSEN property of '0') for firmware versions V1.1.0 and later, and is described in section **3.6.1 Pair Device Bluetooth without a PIN**. Method 2) is the default SHOUT ns Bluetooth pairing method (^BTPASSEN property to '1') for firmware versions before V1.1.0 and is described in Section **3.6.2 Pair Device Bluetooth with the NAL SatTerm Application**.

3.6.1 PAIR DEVICE BLUETOOTH WITHOUT A PIN

The SHOUT ns firmware V1.1.0 and later, switches the default BT Pairing behavior to connect to a nearby BT Android device without needing a USB connection to SatTerm and without having to enter a PIN. After the NAL SHOUT Android app has been downloaded to the desired device, proceed to pair the device with the SHOUT ns.

1. Verify Bluetooth is 'On' in the Android Bluetooth menu.
2. Verify the SHOUT app is installed on the Android device.
3. Turn on the SHOUT ns device by pressing the **Power** button.
4. Activate the Bluetooth link on the SHOUT ns by pressing the **BT** button for at least two (2) seconds. Verify the Bluetooth (BT) LED starts blinking to indicate it is in pairing mode.
5. Run the SHOUT ns app on the Android device. The App will search for the nearby ns device.
6. Follow your Android device prompts to complete the pairing process.

After the SHOUT ns is successfully paired with a device, the SHOUT ns should automatically pair with the Android device in the future.

7. If the pairing is unsuccessful at first, follow the SHOUT ns Prompts. Retry steps 1 through 6 if pairing is unsuccessful after 2 or 3 repeated failed pairing cycles.

8. If the SHOUT ns firmware is configured to require a PIN for Bluetooth Pairing, use the following steps to modify the Configuration file to allow pairing without a PIN:
 - a. Connect the SHOUT ns using a USB cable to a PC running SatTerm
 - b. +++ (Enter Command Mode)
 - c. AT^BTPASSEN=0 (Pair WITHOUT a PIN)
 - d. AT&w0 (Save to Device Profile)
 - e. Turn on the Android device's BT and select the SHOUT ns from the device list
9. If the SHOUT ns firmware is configured to allow Bluetooth pairing without a PIN, use the following steps to modify the configuration file to require a PIN for Bluetooth pairing:
 - a. Connect the SHOUT ns using a USB cable to a PC running SatTerm
 - b. +++ (Enter Command Mode)
 - c. AT^BTPASSEN=1 (Pair USING a PIN)
 - d. AT&w0 (Save to Device Profile)
 - e. Turn on the Android device's BT and select the SHOUT ns from the device list
 - f. Within SatTerm, enter AT^BTPASS=##### (Numbers provided by the Android device).

3.6.2 PAIR DEVICE BLUETOOTH WITH THE NAL SATTERM APPLICATION

After the NAL SHOUT Android app is downloaded to the desired device, proceed to pair the device with the SHOUT ns. To pair a device such as a smartphone or tablet with the SHOUT ns for the first time, a connection to the USB interface of a PC is required to use the SatTerm PC-based terminal emulation application (see section **5.2 Using SatTerm**).

1. Verify Bluetooth is 'On' in the Android Bluetooth menu.
2. Verify the SHOUT app is installed on the Android device.
3. Power up the SHOUT ns by pressing the Power button, and connect the SHOUT ns to the PC with a USB cable.
4. Launch the SatTerm application and connect with the SHOUT ns device.

5. Put the SHOUT ns in command mode in SatTerm with the command **+++**.
6. Activate the Bluetooth link on the SHOUT ns by pressing the **BT** button for at least two seconds. Verify the Bluetooth (BT) LED starts blinking to indicate it is in pairing mode.
7. Launch the SHOUT ns App on the Android device.
8. The Android device will provide a passkey for pairing. Wait for the 'ENTER PASSKEY SHOWN ON MASTER DEVICE' PROMPT IN SatTerm.
9. Enter the Bluetooth Password command **AT^BTPASS=#####** replacing the 6 '#'s with the 6 digit code displayed in SHOUT ns App. After several seconds, the SHOUT ns BT LED changes from blinking to steady illumination to indicate it has paired successfully.
10. Remove the SHOUT ns from command mode by sending the **AT^TRK** command.
11. Unplug the SHOUT ns from the USB cable.

After the SHOUT ns is successfully paired with a device, the SHOUT ns should automatically pair with the Android device in the future.

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 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 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 for 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 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 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.
 - a. 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**.
 - b. After power-up, you can load the “active” general profile with any stored general profile using the soft reset command **Z**.
 - c. Alternatively, you can use **&F** to load factory default settings back into the “active” general profile.
 - d. 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**.
 - e. 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 **Tracking Profile Settings**). There are twelve 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.

- a. 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**.
 - b. Alternatively, you can use **&FT** to load factory default settings back into the “active” tracking profile.
 - c. 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**.
 - d. 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 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 later) to configure the SHOUT ns. (Please reference the SatTerm User Guide [6] for installation instructions.)

5.2.1 CONNECTING SATTERM TO THE SHOUT NS

SatTerm can connect to the SHOUT ns using the USB port or through the Bluetooth link. Each method is detailed in the following two sections.

5.2.1.1 CONNECTING WITH USB

Follow the steps below first to synchronize communication between the SHOUT ns and a connected USB device.

1. Launch SatTerm software from the Windows® *Start* tab. If SatTerm is not installed, the SatTerm installer can be downloaded from NAL Research's website (<https://www.nalresearch.com/support/documentation-downloads/>).
2. Use the **Options > Properties** menu to configure the modem type. Select **Options > Properties > Device Type > SHOUT ns**. This option selects the type of device connected to the computer. Only NAL Research devices appear on the list.
3. Clear the checkbox "Connect when device is present" in SatTerm's icon bar.
4. Attach one or more powered SHOUT ns devices to the computer's USB port.
5. Use the **Options > Properties** menu to configure the communications port settings (see **Figure 5**). The default should already be set to USB for the SHOUT ns. Select **Options > Properties > Set Port Properties**. This option sets the computer's communication parameters to communicate with a connected and powered SHOUT ns. If the USB port is not already selected, go to the **Connect Using** dropdown list and select USB. Select the desired SHOUT ns from the *USB Devices Connected* box. If multiple SHOUT ns devices are attached, they can be differentiated by the IMEI number of the internal Iridium modem.

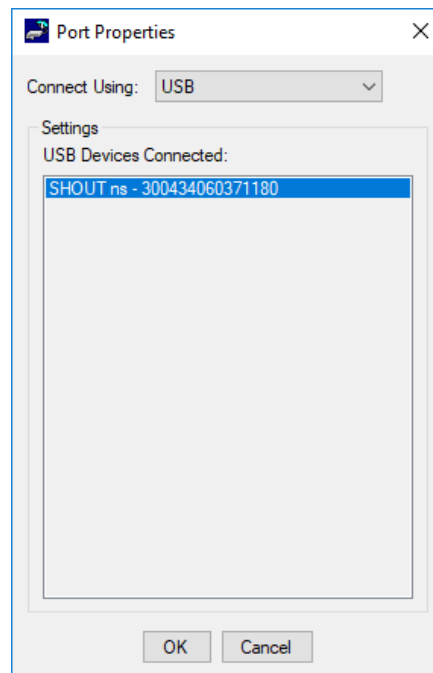


Figure 5: Port Properties Window Option

5.2.1.2 CONNECTING WITH BLUETOOTH

This section describes how to connect and pair the SHOUT ns to SatTerm via Bluetooth.

Connecting to Bluetooth is also done through the *Port Properties* window. The Bluetooth port properties window (see **Figure 6**) has several buttons, which function as follows:

1. Refresh icon: Refreshes the connections list and searches for a SHOUT ns device.
2. Pair: Pairs a selected device from the Unpaired Bluetooth list.
3. Unpair: Unpairs the selected from the Paired Bluetooth list.

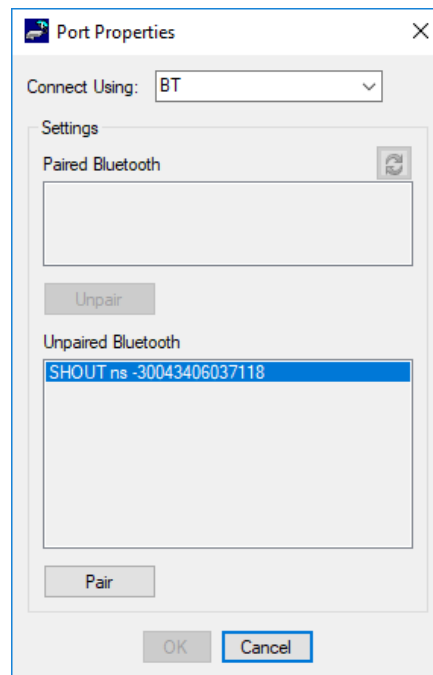


Figure 6: Bluetooth Port Properties Window Unpaired

The procedure is similar to connecting to USB, but requires Bluetooth capabilities on the PC.

Follow the steps below to connect the SHOUT ns to SatTerm using Bluetooth.

1. Use the **Options > Properties** menu to configure the modem type. Select **Options > Properties > Device Type > SHOUT ns**. This option selects the type of device connected to the computer. Only NAL Research's devices appear on the list.
2. Clear the checkbox "Connect when device is present" in SatTerm's icon bar.
3. Verify that the device's Bluetooth is turned on by pressing and holding the BT button for 2 seconds. The BT LED should blink, indicating that it is ready for pairing.

4. Attach the SHOUT ns to the computer's USB port. The SHOUT ns must be connected to USB for first-time pairing.
5. Use the **Options > Properties** menu to configure the communications port settings (see **Figure 5**). The default should be set to USB for the SHOUT ns. Select **Options > Properties > Set Port Properties**. This option sets the computer's communication parameters to communicate with a connected and powered SHOUT ns. If the Bluetooth port is not already selected, go to the **Connect Using** dropdown list and select **BT**.
6. On the Bluetooth *Port Properties* window, a list of any nearby SHOUT ns devices with Bluetooth activated is displayed (see **Figure 6**). Select the desired SHOUT ns device and click **Pair** to pair the device to SatTerm. When paired, SatTerm displays *PAIRING COMPLETE* to indicate it has successfully paired the device. If the SHOUT ns device is not displayed, verify that Bluetooth is on and click the refresh button to search for the device again.
7. Click your SHOUT ns device from the *Paired Bluetooth* list (see **Figure 7**) and click **OK** to connect. If the connection is a successful, the window closes and SatTerm is properly connected to the SHOUT ns.

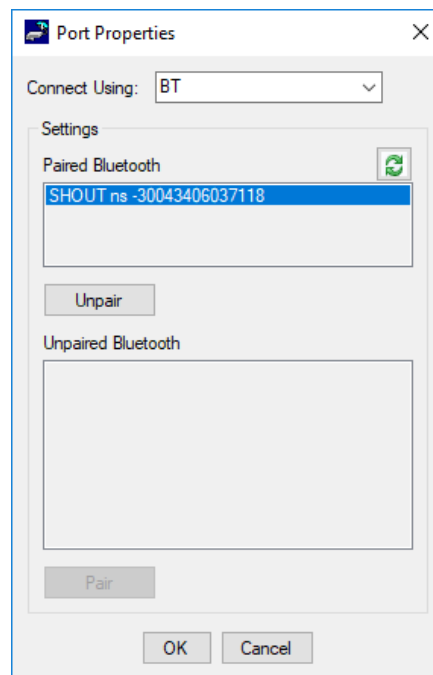


Figure 7: Bluetooth Port Properties Paired

5.2.2 CONFIGURE WINDOW

The SatTerm *Configure Window* option allows users 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 8**). Each part of the *Configuration* window is described below.

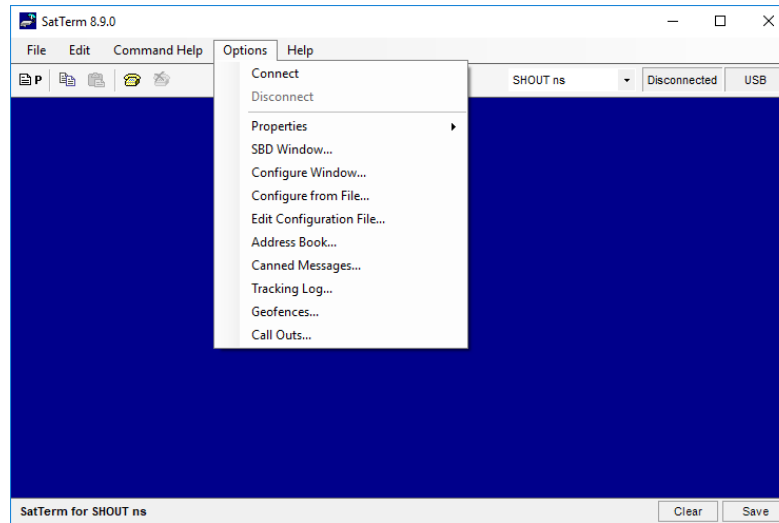


Figure 8: Options Menu and Configure Window Menu Item

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 9**.

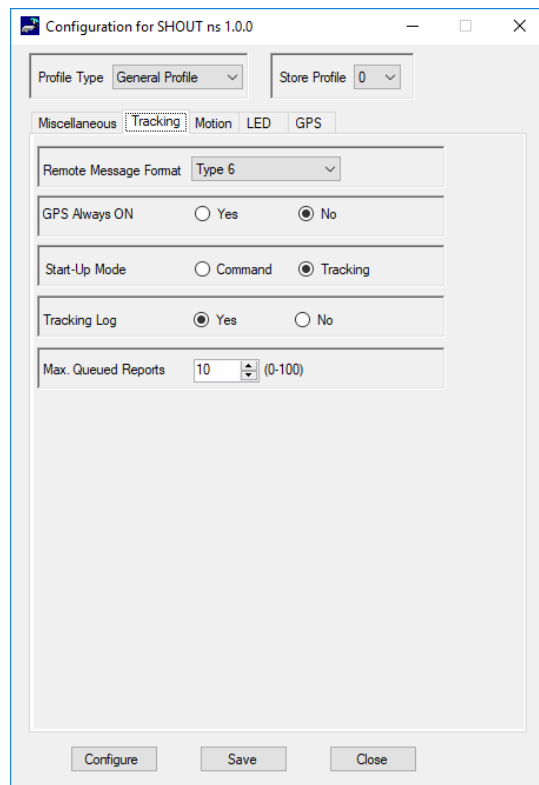


Figure 9: General Profile Window with Tracking Tab

5.2.2.1.1 TRACKING TAB

Tracking offers five settings, as shown in **Figure 9**: *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 are:
 - 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 **^RMP**.

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 is 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 10**, 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**).

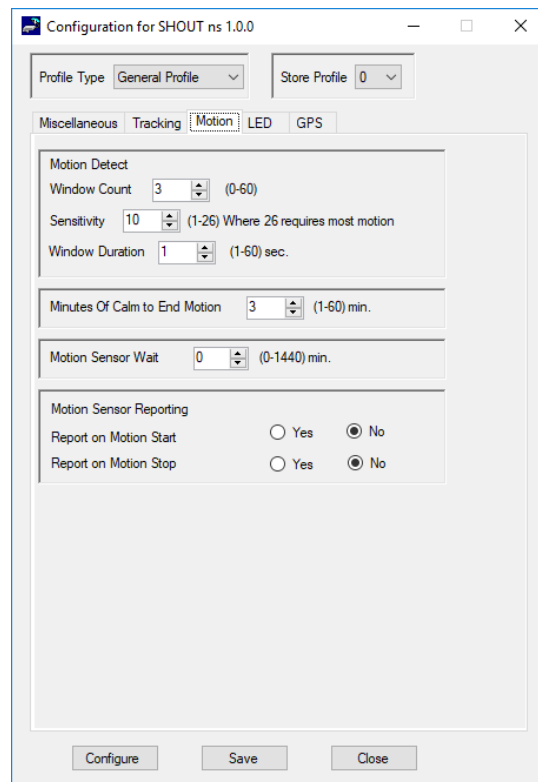


Figure 10: General Profile Window with Motion Tab

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 11** illustrates the algorithm with a window count of 3, window duration of 1 minute, and a sensitivity of 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.

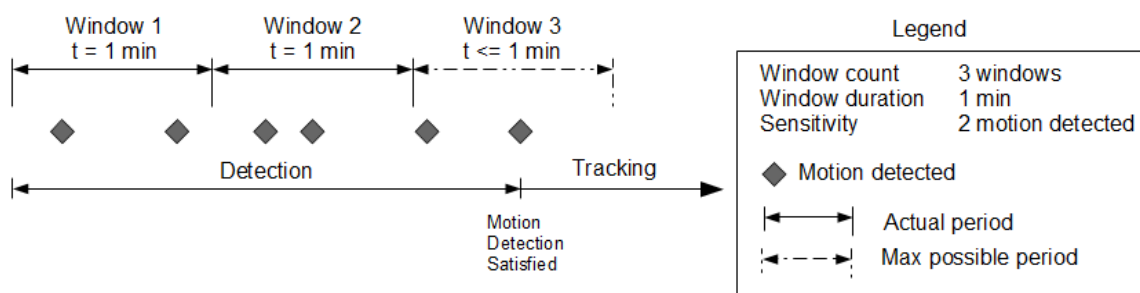


Figure 11: Motion Detection Example

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 12**.

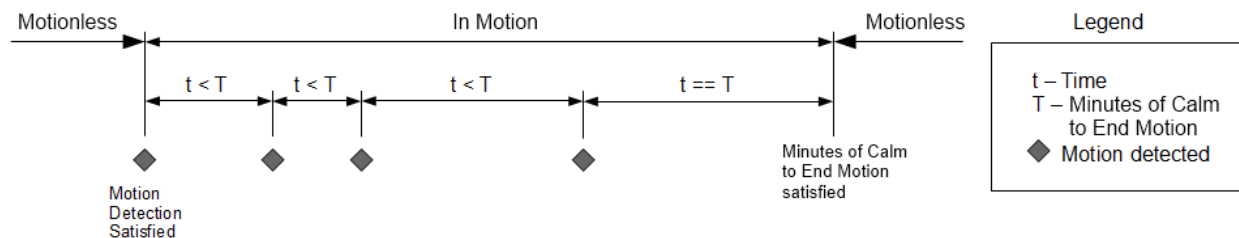


Figure 12: End of Motion Example

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 (GPS Report Version 6 Format [2]) will be transmitted when motion starts.
 - 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 13**). The SHOUT ns is shipped with all LEDs set to *ON*.

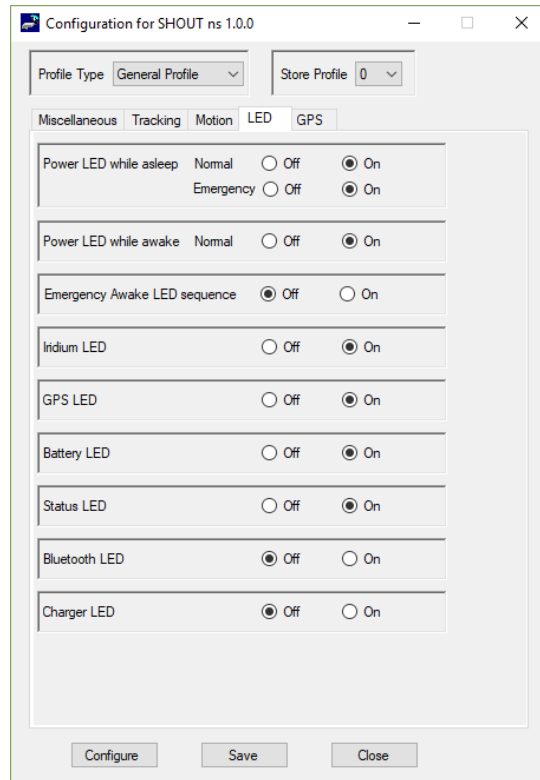




Figure 13: General Profile Window with LED Tab

3. **Power LED While Asleep (Normal and Emergency):** The power  LED has two 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 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.
4. **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.
5. **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.

6. **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.
7. **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.
8. **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 3 seconds, in that order.

5.2.2.1.4 GPS

The *GPS* tab, shown in **Figure 14**, 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.

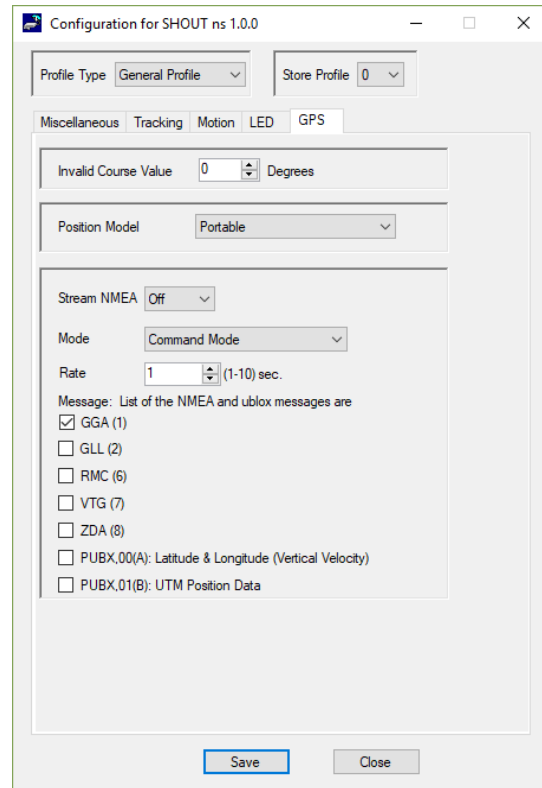


Figure 14: General Profile Window with GPS Tab

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 15: 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.**

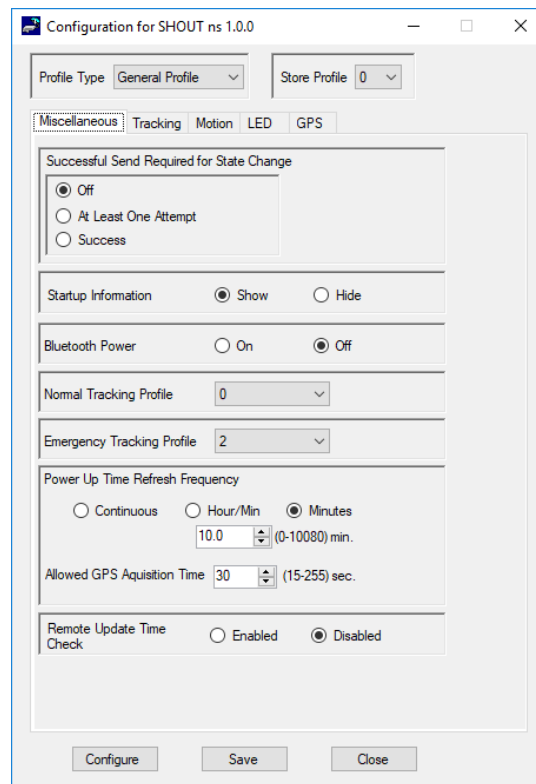


Figure 15: General Profile Window with Miscellaneous Tab

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 16**).

Configuration for SHOUT ns 1.0.0

Profile Type: Tracking Profile Store Profile: 0

Interval Geofence Tracking

Report Flood: 0 (0-255) Reports

Block Invalid Reports: ☐ Yes ☒ No

Queue Failed Reports: ☐ Yes ☒ No

Queue Restricted Reports: ☒ Yes ☐ No

☐ Motion Enabled

Callable: ☐ Yes ☒ No ☐ Motion Determined

Skip Reporting when Stationary

Mode: ☒ Off ☐ On, Skip Some ☐ On, Skip All

Radius (meters): 10

Send While Stationary: 4

Cycles to Skip: 120

Iridium Allowed: ☒ Yes ☐ No

Configure Save Close

Figure 16: 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 the **Queue Restricted Reports** option (section 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 17**: *Geofence Check Frequency* and *Allowed GPS Acquisition Time*.

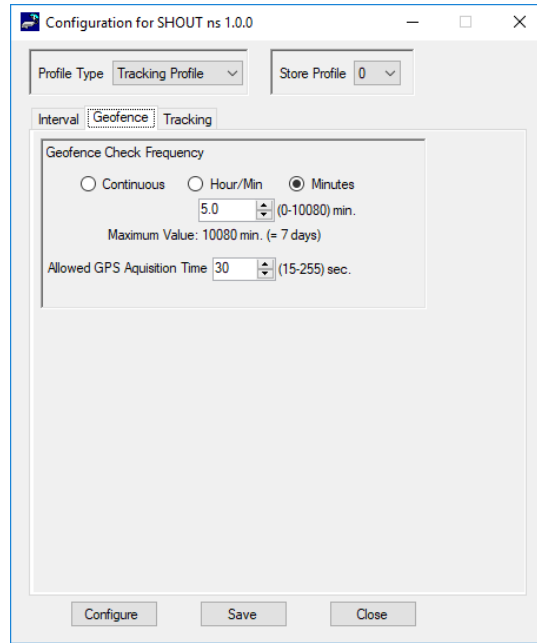


Figure 17: Tracking Profile Window with Geofence Frequency Tab

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 18**.

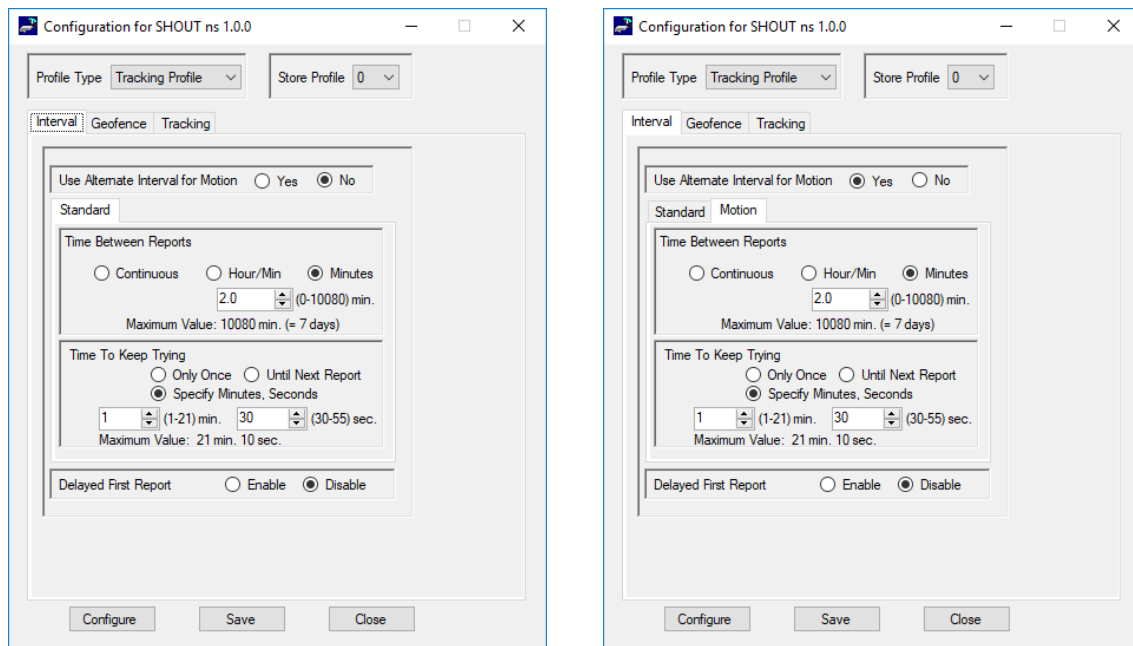


Figure 18: Interval Tab in Tracking Profile Window with Standard and Motion Tabs

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.
2. The AT command associated with this setting is **^UAMS**.
3. **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).
4. The AT command associated with this setting is **^TBR** (Standard) and **^TBRA** (Motion).
5. **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 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).
6. **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.

7. Select **Options > Configure Window**.
8. Select **Other** for the *Profile Type* at the top-left of the window.

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 19** provides three settings: *Remote Update Password*, *Identifier in Reports*, and *Power-up Delay*.

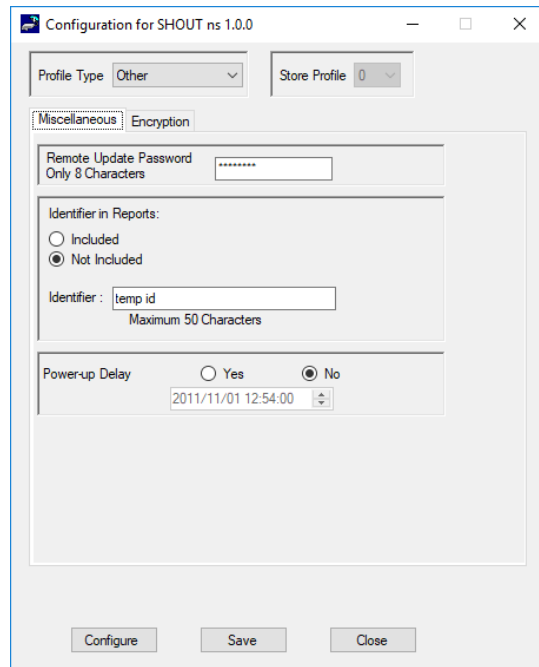


Figure 19: Other Profile Window with Miscellaneous Tab

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 which 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 20** 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.

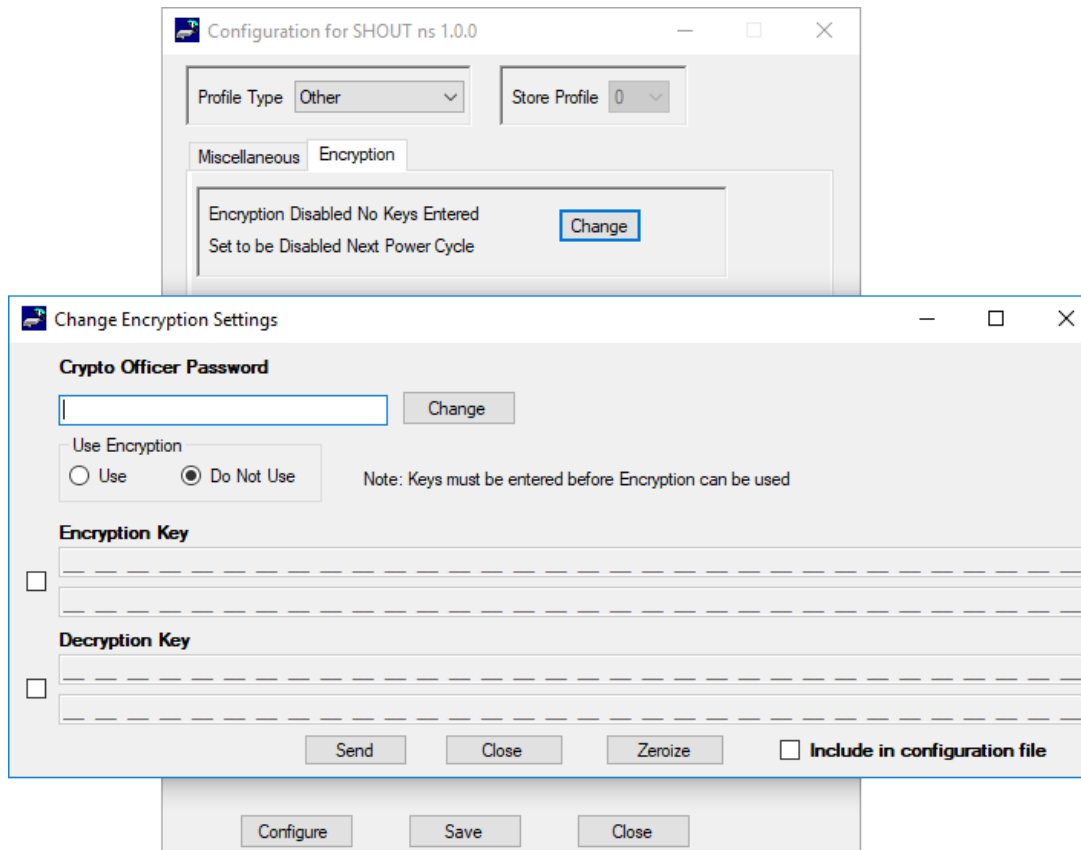


Figure 20: Encryption Tab and Change Encryption Settings Window

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. Click **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. Click **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. Click **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 9**). When the settings have been programmed and saved into the SHOUT ns, SatTerm displays the confirmation message shown in **Figure 21**.

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 21**).

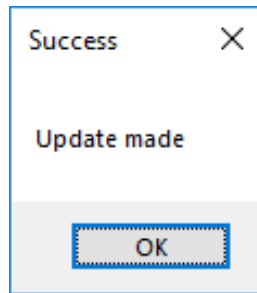


Figure 21: Successful Update Made Window

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 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 8**); the *Geofences* window shown in **Figure 22** 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 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.

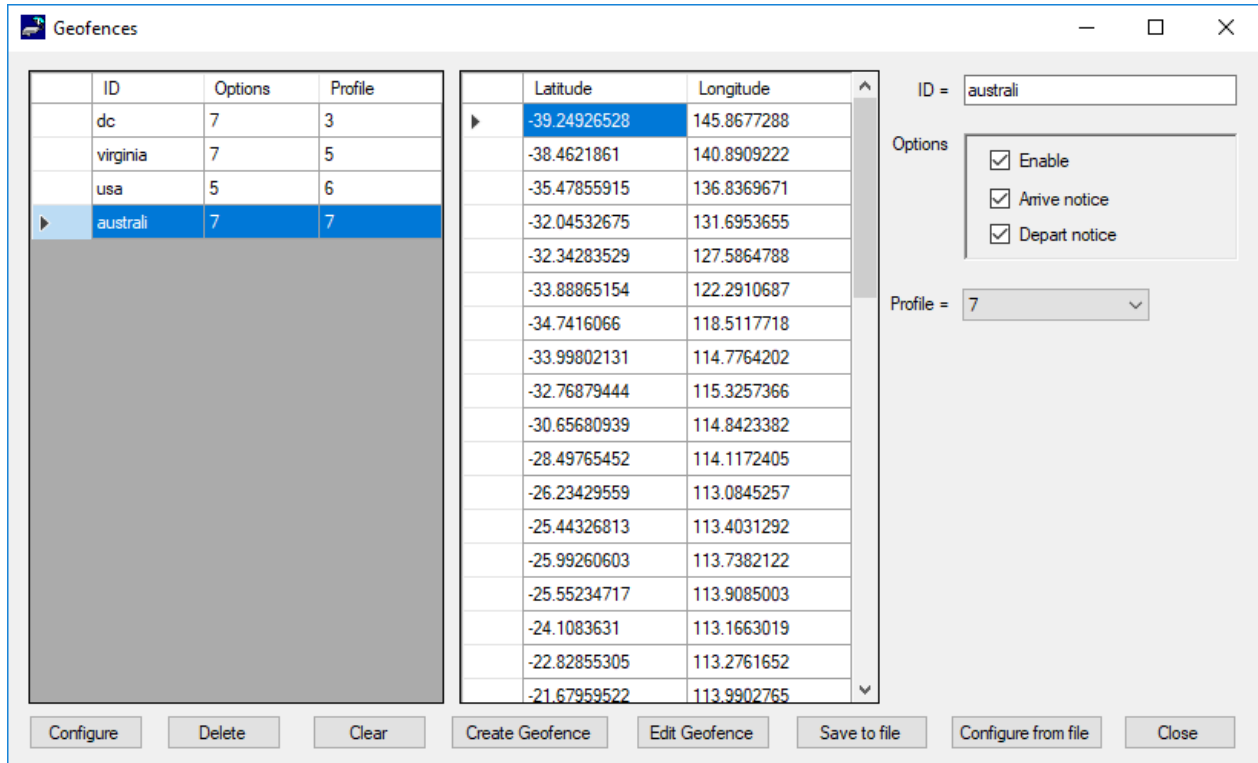


Figure 22: Geofences Window

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 (GPS Report Version 6 Format [2]) when entering this specific geofence.
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.

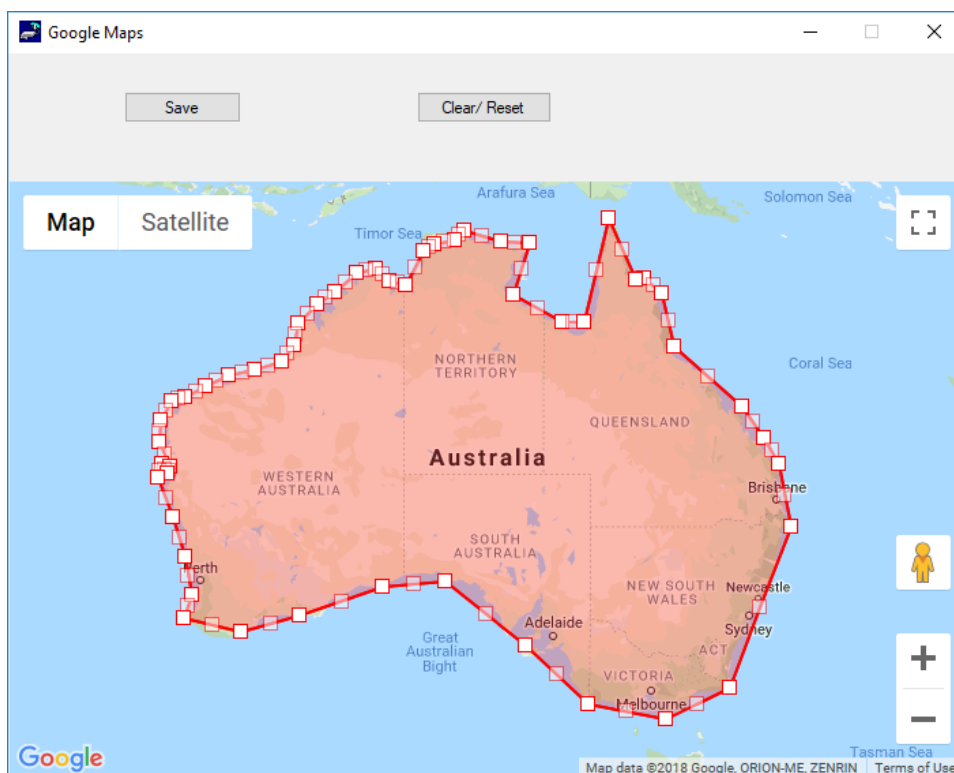


Figure 23: Create/Edit Geofence Window

12. **Create Geofence:** Opens a window to create a geofence by adding points on a map.

The window is shown in **Figure 23**.

- 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 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 22**.

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

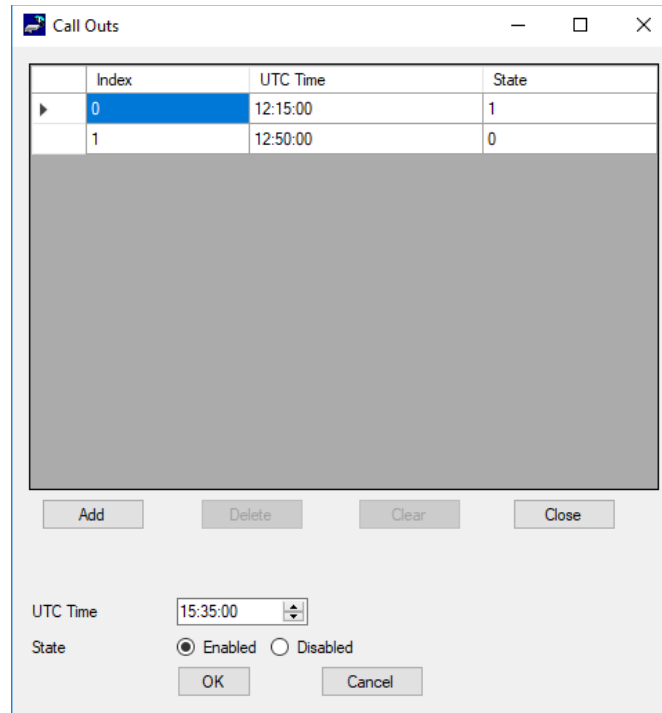
In addition to normal tracking reports sent at a predefined interval, the SHOUT ns can also send daily tracking reports at specific UTC times. These daily reports are called Call Outs. Call Outs can be configured two ways: using AT commands and using SatTerm.

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 8**); the *Callout Form* window shown in **Figure 24** 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.



The 'Call Outs' window displays a table with the following data:

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

Below the table are four buttons: Add, Delete, Clear, and Close. At the bottom, there is a UTC Time field set to 15:35:00, a State section with 'Enabled' selected (radio button) and 'Disabled' (radio button), and OK and Cancel buttons.

Figure 24: Callout Form Window

6 NAL SHOUT ANDROID APP OVERVIEW

The SHOUT ns can communicate with an Android smartphone running the SHOUT Android app, available from NAL Research via the Google Play App Store, using the SHOUT ns Bluetooth interface. This Android application provides all the capabilities of the display screens 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. This section provides a brief overview of the SHOUT app. More details regarding the SHOUT app can be found in the SHOUT App User Guide [4] document.

6.1 PAIRING THE SHOUT NS WITH A SMARTPHONE

After the Android app has been downloaded to the desired device, pair the device with the SHOUT ns. To pair a Bluetooth-enabled device such as a smartphone or tablet with the SHOUT ns, a PC must be connected to the USB interface to use the SatTerm PC-based terminal emulation application (see section 5.2 Using SatTerm). Section 3.6 Pair Device Bluetooth with the SHOUT App has detailed steps to pair the SHOUT ns with an Android device.

6.2 SHOUT APP SCREEN OVERVIEW

Once the devices have been paired, launch the SHOUT app on the smartphone or tablet. **Figure 25** depicts the SHOUT ns Android app display. This window has four segments, which provide status and menu selections.

1. The top segment is called the title bar and provides the name of the selected menu item displayed in the menu area, as well as forward/back icons to assist in navigating the app screens.
2. The next segment is the status bar, which provides an overview of the SHOUT ns status (Iridium network connection, GPS signal strength, battery life/charging status, text message status, etc.), as well as an array of icons for the various SHOUT app functions.
3. The third segment is the menu/function area, which provides the menu icons for the function selected in the bottom dock segment and various data entry windows.

4. The last segment is the bottom dock. Like an Android smartphone, this menu area is always present on every screen and allows a quick change to a new menu area when desired.



Figure 25: SHOUT ns Android App Main Window

6.2.1 TITLE BAR

The SHOUT app's title bar provides the name of the selected menu item displayed in the menu/function area as well as forward/back icons to assist in navigating the app screens. The top-level menus (*Texting*, *Tracking*, *Utilities*, and *Settings*) do not have forward/back icons; the bottom dock segment is used to switch between these menus.

6.2.2 STATUS BAR

The next segment of the SHOUT app display is the status bar located between the title bar and the menu/function area. Below is a list of status icons and their meanings:


Table 3: Status Icons	
	Denotes the Iridium transceiver is off. To preserve battery life, the Iridium transceiver is only turned on when transmitting a message or position report; thus, a diagonal line is drawn over the symbol when off.

Table 3: Status Icons














	Denotes either: (1) the Iridium transceiver is on with real-time signal strength represented by the number of vertical bars or (2) SBD message transmission is in progress. The signal strength can range from the lowest of zero to the highest of five bars. During transmission the antenna must have a clear view of the sky. Due to variable signal attenuation for different structures, the device cannot reliably send messages or reports from inside a building.
	Denotes the GPS receiver is off. The GPS receiver is always kept off to preserve battery life until time, date, or position information is needed.
	Denotes the GPS receiver is on with real-time satellite acquisition status represented by the number of vertical bars. One bar represents valid time and date fix, two bars represent 2-D fix or dead reckoning, three bars represent 3-D fix with HDOP higher than 2.0, and four bars represent 3-D fix with HDOP less than 2.0. Although the GPS receiver can often obtain a location fix when the antenna is partially blocked (near buildings, in a room next to a window, etc.), the antenna should have a clear view of the sky to minimize acquisition time and increase position accuracy.
	Battery charge indicator.
	Denotes the battery is being charged by an external power source.
	Denotes all audio is off.
	Denotes audio is on.
	Denotes one or more unread messages are in the Inbox.
	Denotes one or more messages are in the Outbox ready to be sent, or one or more messages in queue failed to send.
	Denotes geofences is on when the symbol is bright white. The symbol turns dimmed gray when geofence tracking is off. The geofence symbol does not appear when there are no fences saved into the device.
	Denotes Call Out is on when the symbol is bright white. The symbol turns dimmed gray when Call Out is off. The Call Out symbol does not appear when there are no Call Out times saved into the device.
	Denotes Mailbox Check is on when the symbol is bright white. The symbol turns dimmed gray when Mailbox Check is off.

Table 3: Status Icons

	<p>Denotes Tracking (standard tracking, geofence tracking, etc.) is on when the symbol is bright white. When standard tracking is on, a countdown timer to the next report appears beside the tracking symbol. The symbol turns dimmed gray when tracking is off.</p>
---	---

6.2.3 MENU FUNCTIONAL AREA

At the top menu level, the menu/functional area contains the functions' submenu icons and the functional screens for each of those menus, such as the Inbox for the Texting menu and the Reporting Rate selections for the Tracking menu.

6.2.4 BOTTOM DOCK

The bottom dock contains the menu icons for the four main menus: *Texting*, *Tracking*, *Utilities*, and *Settings*. This segment is always visible and enables switching between top-level menus quickly.

6.3 TEXTING MENU

The Texting menu, depicted in **Figure 26**, allows the user to compose, save, view, send canned or free-text messages, check mailbox for incoming messages, and set up an automatic mailbox check frequency. This menu has the following submenu items:

Inbox	Drafts	Outbox	Sent
Compose	Contacts	Check Mailbox	Mailbox Check Rate
Include GPS	Memory		

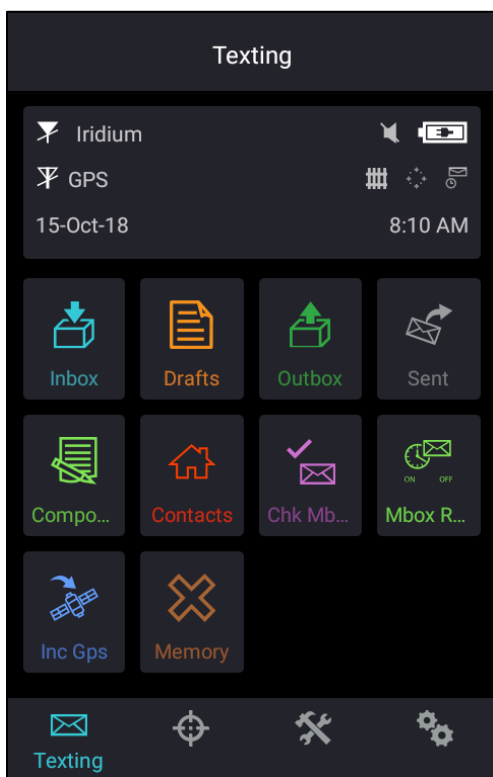


Figure 26: Texting Menu Screen

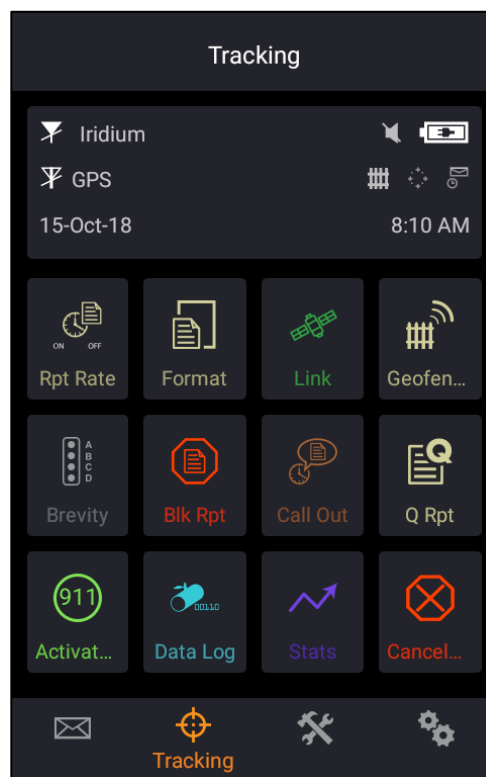


Figure 27: Tracking Menu Screen

6.4 TRACKING MENU

The Tracking menu for the SHOUT app is shown in **Figure 27**. There are a variety of different menus used to interact with the tracking function. Some menus, such as Geofences and Call Out, require using SatTerm to configure parameters beforehand. For these options, refer to section **5.2 Using SatTerm** for more details. This menu has the following submenu items:

Report Rate	Format	Link (Iridium)	Geofences
Brevity	Block Report	Call Out	Queue Report
911 Activate	Data Log	Stats	Cancel 911

6.5 UTILITIES MENU

The Utilities menu, shown in **Figure 28**, provides five options used mainly to check for proper hardware operation and network setup. These utilities can be useful when trying to troubleshoot certain problems with the device. This menu has the following submenu items:

Check GPS	Check Iridium	Test Report	Check-In
Waypoints			

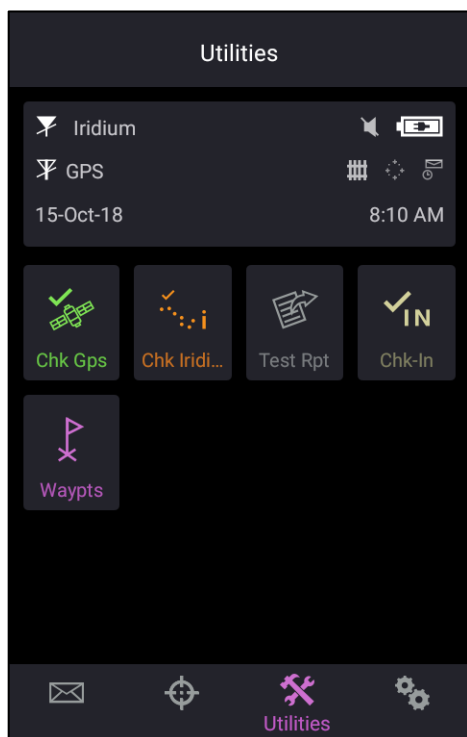


Figure 28: Utilities Menu Screen

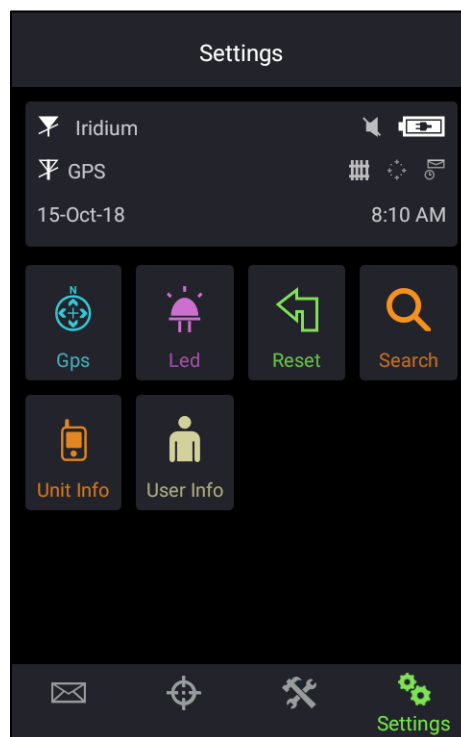


Figure 29: Settings Menu Screen

6.6 SETTINGS MENU

Use the Settings menu, shown in **Figure 29**, to view and customize the hardware settings or to reset the device to default tracking settings. The Settings menu also provides an easier way to view device information. This menu has the following submenu items:

GPS	LED	Reset	Search
Unit Info	User Info		

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.

7.2 NAL VUE USER INTERFACE

7.2.1 SIX CORE TABS

NAL Vue's features and capabilities all roll up into one of six main functional groups, making the navigation panel simple and direct for new users: *Assets*, *Alerts*, *Reports*, *Settings*, *Preferences*, and *Users*. This navigational hierarchy comes from an understanding that users entering the tracking portal have a very clear intent, and the six top-level categories make it very clear how to get directly to that interface.



Figure 30: NAL Vue Home Map/Asset Window

7.2.2 ASSET MANAGEMENT TOOLS

Full create, read, update, and delete (CRUD) functionality for assets allows administrators and users to gather data in near real time, and under most circumstances, act upon that data without needing to leave the portal. Views of the data can be customized to show both live and historic data transmission, and users can group assets in a number of ways within NAL Vue. Configuration of field triggers and geofencing capabilities further expand the management of assets in the field.

7.2.2.1 ASSETS PANEL

The Assets panel to the left of the interface allows users to interact with their assets directly from the home map page, which makes it easier to locate them, as well as perform any tasks like configuration, messaging, or status checks. The panel itself allows users to create and collapse groups of assets in order to maintain order of large ecosystems from a single interface. Each asset's details can be viewed from the left panel or by clicking/tapping the asset on the map.

7.2.2.2 MAP VIEW

The default tracking view for the system is a map, shown in **Figure 30**, which can be zoomed in or out to display the entire region, continent, or world. Assets, groups, geofences, location history, and travel paths appear on the map, which can be as much or as little as the user wants

to see. Additionally, the user can switch between enabling and disabling various map layers on the view.

Layers on the map are ways for specific organizations to get more value out of the interface, particularly maritime industries, which has its own map layer available by default. Other layers include weather radars, traffic maps, satellite network maps, oil, and other Application Programming Interface (API)-based maps that can be configured by the user.

7.2.2.3 ADDING ASSETS

Adding assets such as the SHOUT ns to NAL Vue is a simple process that also allows for very specific pieces of information to be included in an asset profile. Managers can color-code their assets, use provided iconography or their own iconography to differentiate them, and configure a number of different settings from the add/edit interface. For assets with operators (such as vehicles), those operators can be added as “drivers” who are able to sign in to the device when they are actively engaged with it for more accountability. See **Figure 31** for the *NAL Vue Add Asset* window.

Figure 31: NAL Vue Add Asset Window

While adding assets, managers can also associate the asset with any number of groups or users so that the asset is visible and sorted within those groups immediately after it has been added to the system. There are a number of complex settings that can also be configured by the asset manager, including how to display it on the map. For advanced users, there is even an option to change the spatial reference system to a regionally supported or mandated standard system.

7.2.2.4 ASSET CONFIGURATION

Once added to the system, asset managers can configure and update asset details at any time using the same intuitive interface that was used to create the asset. Managers can also use this functionality to sort assets into groups, modify drivers, and change permissions for which users can and cannot interact with that asset through NAL Vue.

7.2.2.5 GROUPING ASSETS

Grouping allows users greater ability to manage their assets when there is a large number of different types of devices loaded into a single portal. This can also be used to set up local, regional, or team-based grouping so that asset and personnel management access can be delegated directly to the leaders of that corresponding group more efficiently.

This feature can be geared toward helping fleet managers with a thousand or more active assets or can be scaled down to smaller organizations that simply need to perform batch actions on a given set of assets.

7.2.2.6 TRACK AND MONITOR ASSETS

Each asset viewable on the left panel is also viewable on the map. Users can access the portal and immediately view any asset's last-reported position data, and they can open the asset menu to access interactive functionality. These functions include following an asset, routing the asset remotely from the NAL Vue system, and setting or sending waypoints along an intended route, which can be used to trigger alerts and estimate arrival times for more complex tracking operations.

While it is connected to NAL Vue, each asset creates a log of all its interaction with the system, including position reports, messages sent or received, waypoint and geofence activity, and any other information reported by hardware connected to the tracking device. Managers can access these logs at any time on NAL Vue, and they don't require a special server pull.

7.2.3 ALERTS

NAL Vue can help asset managers keep track of everything including service reminders and maintenance requirements for each of the assets in the system, whether the alerts are set to occur by intervals (i.e., a certain amount of time or usage) or by specific milestones. NAL Vue can use any of its collected data points to alert managers if one of its assets is in need of attention. Triggered alerts can be tied to intervals as mentioned above, but are also more often tied to events, activity, or geofence criteria. Alerts related to geofences can help managers keep assets out of dangerous situations or locations, and can also help managers identify potential theft if their assets deviate too far from the intended path. Because of the potential for hardware to be able to track and monitor personnel and their vital signs, NAL Vue can alert the system when a given unit is under siege, or if a particular field agent, operative, or member of a team is under duress or worse. This kind of real-time monitoring and alerting system allows managers to respond more quickly and with better information.

Alerts encompass a wide range of mostly trigger-based activity and behavioral monitoring. NAL Vue can also be used to automate certain “checking” and “reminder” activities and processes associated with hardware assets. Beyond that, manual alerts can be transmitted between NAL Vue and any device in the primary user portal that is part of the connected ecosystem. Alerts can be triggered by a number of events and data points within the NAL Vue ecosystem, but are most commonly associated with motion activity, geofence activity, and meter readings. The asset’s hardware and sensory devices are the primary means of determining the extent of the alert activity a manager is capable of establishing. Some alerts require the contact to acknowledge receipt of the notification, and these alerts are resent from the portal until the contact acknowledges it. The interval and number of retries can be configured when setting up the alert, and the course of action for unanswered alerts can include sending an alert to a secondary contact.

7.2.4 REPORTS

Reports from the NAL Vue system range from generic and high-level activity reports to fully customized and specifically detailed reports. Visual reports from the NAL Vue dashboard are also readily available and can be customized in order to help aggregate the data users need to make decisions and act upon insights produced within their data ecosystem. NAL Vue offers a

host of report types ranging from activity reports, which are detailed lists of all information gained from an asset, to more specific reports like geofence dwell reports, which identify how long an asset has been within a specific area. In addition to asset-related reports, administrators can also generate reports for NAL Vue users so that they can track the IP address, activity log, and session data for all activity in the system within a given time frame. For the majority of reporting needs, the reports that are already part of NAL Vue are those that are preconfigured to display the most pertinent information with regard to telematics. These reports can be customized.

Reports can be pulled on demand or configured to automatically send on a given date or time schedule. The NAL Vue reporting feature is very similar to almost any other data-driven platform's reporting system in that it allows the user to configure a report from a set of preexisting criteria driven by the types of data available in the system, to define parameters and limitations on that information, and to generate reports once or at regular intervals.

All reports can be viewed directly in the NAL Vue system and can be pulled on demand or scheduled to be sent at predefined intervals. Regardless of whether they are recurring or single pulls, all reports can also be exported from the system in the form of a PDF, CSV, or XLS file that the user can download and/or send from the system to any recipient.

7.2.5 SETTINGS AND PREFERENCES

As with any account and user-based software system, NAL Vue affords its administrators and users the ability to configure their own settings and preferences while they are using the application using two tabs: the *Settings* tab and the *Preferences* tab. Within the Settings tab, users can configure address books, canned messages, driver settings and updates, custom map layers, and a number of other behavioral considerations. The Preferences tab manages the more standard account-level settings like regional considerations (i.e., time zone, metric or imperial measurements) and default views for each panel. More complex customization of the interface and functionality is available in the Settings tab.

7.2.5.1 MAP LAYERS

NAL Vue offers users the ability to control how a viewer sees the information presented from assets. The clearest visual example of this is the ability to switch between the various map

layers and map views on the Assets tab. Most of the map layers are provided by the National Oceanic and Atmospheric Association (NOAA), but clients also have the capability to add their own. The map views are provided by a third-party service called Mapbox®. It is important to note that in some cases the tile images by Mapbox can be improved, and more detailed visuals or more recent visuals of a given area can be obtained for a fee. Users may also import their own map layers in the Settings tab under *Map Layers* by clicking **Add Map Layer**. Keyhole Markup Language (KML), GeoJSON, GPS Exchange Format (GPX), and image overlay are the supported formats for custom map layers. From the Map Layers page, users can select or clear which map layers are enabled for viewing in the Assets tab.

7.2.5.2 MESSAGING CAPABILITIES

Users in the field with devices that have a graphical user interface can use their device to communicate with a system manager anywhere in the world by sending messages from the device to the NAL Vue system. This same functionality also permits devices to communicate with one another, regardless of manufacturer. Those devices also allow the same operator to receive important messages from a command hub or instructions related to performing certain tasks or field work. This feature set can be critically important in emergency scenarios as well as everyday operational needs for certain types of organizations.

Messages can be routed between devices, including those that do not normally have the means to communicate with one another. NAL Vue accomplishes this by assigning a message routing ID to each device. For example, Device Alpha (ID 13) can send a message to Device Bravo (ID 44) by sending a text message such as “44:Hello, Device Bravo.” The ID at the front of the text message tells the network to route the message to Device Bravo. This limits the need for additional address books to be developed, for as long as two operators are utilizing devices connected to NAL Vue, they can communicate with one another using this switchboard ability.

For managers or standard users of NAL Vue, this process is even easier, as they can push the messages to the devices directly from the system’s user interface (UI). This can be taken a step further when engaging the messaging functionality utilizing geofences. Instead of communicating to only one device, dispatchers can quickly draw a geofence around an area and begin messaging everyone in the designated zone. This process allows managers to quickly and efficiently direct personnel in the field on how to deal with situations.

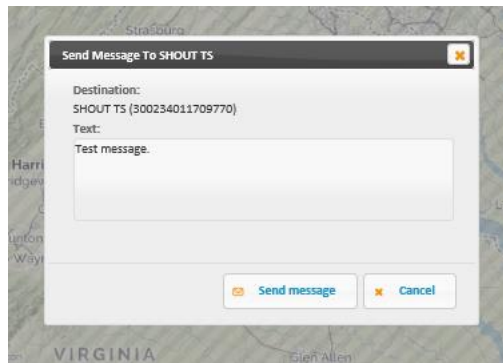


Figure 32: NAL Vue Messaging Window

For emergency services, this can be employed to make persons aware of how to respond to threats or natural disasters; for fleet managers, messages could include important information about expected delays, route guidance, modifications to the existing plan, or additional waypoints. The ability to communicate with any device across any network in a simple fashion allows users of NAL Vue to do more than simply observe telemetry and logistics data, but also be able to react to it in a meaningful and productive way.

7.2.6 USERS

As a web-based interface, NAL Vue has three (3) user profiles tailored to fit different user needs: *administrator*, *standard*, and *anonymous*.

- The administrator user profile has the ability to change all configurable aspects of the platform as well as the ability to change anything at the other user levels, including permissions, assets, or settings/preferences. This user profile type is typically assigned to a dispatcher for a fleet management operation, a high-level engineer for asset management, or a central command officer for remote ground personnel operations.
- The standard user profile will be the most common profile within an organization, and is perhaps the most flexible type, allowing for full control of each individual's permissions, capabilities, and usage as permitted by the administrator. Access to the assets, places, geofences, alerts, and other aspects of NAL Vue can be configured by the administrator to be as open or restricted as desired with this user type based on their roles and responsibilities.

- The anonymous user is not technically a user on NAL Vue. This user profile gives organizations the ability to make NAL Vue data (i.e., the location and behavior of an asset or asset group) available to people outside of the organization through a URL link.

For more details regarding NAL Vue, see the NAL document “NAL Vue User Guide” [5].

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 in the **Support > Documentation & Downloads** section.

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 IRIIDIUM 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.

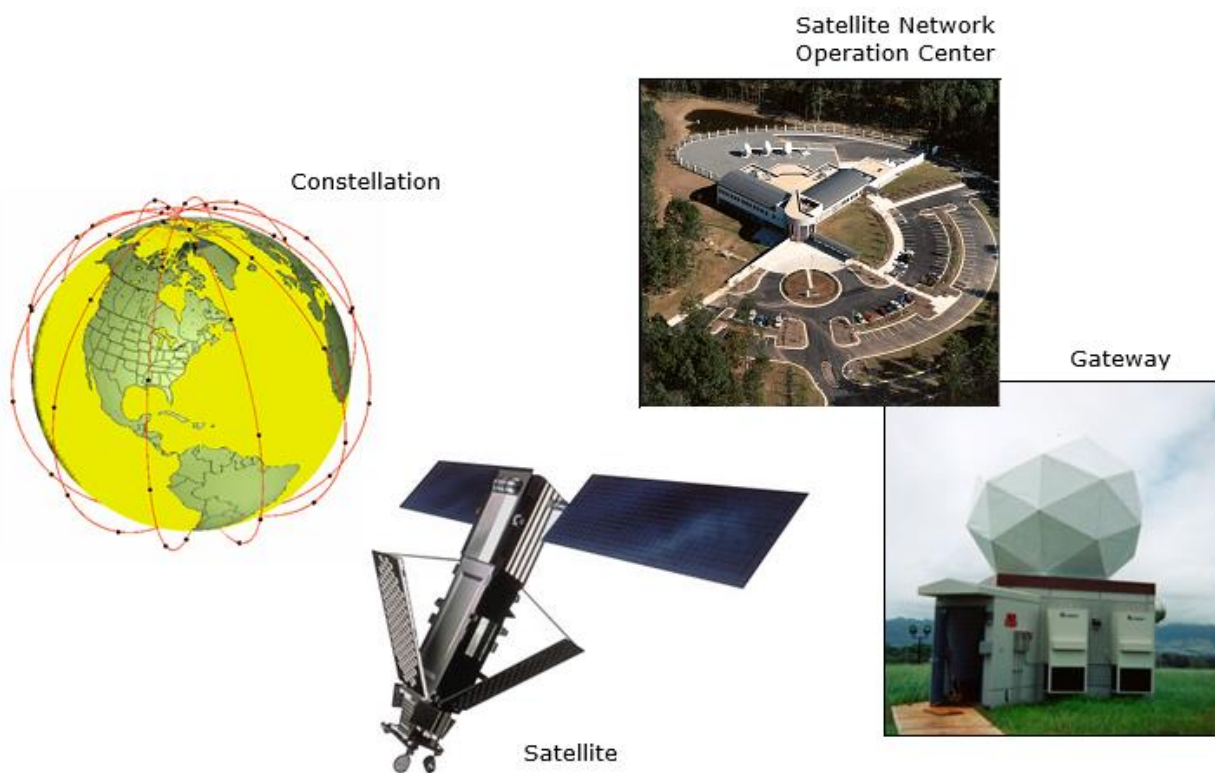


Figure 33: Iridium Network Major Components

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.

IRIDIUM NETWORK DATA CAPABILITIES

For data communications, the Iridium network supports five different modes of operation as shown in **Figure 34**: dial-up data service, direct internet connection, SBD, short-messaging service (SMS), and router-based unrestricted digital internetworking connectivity solution (RUDICS).

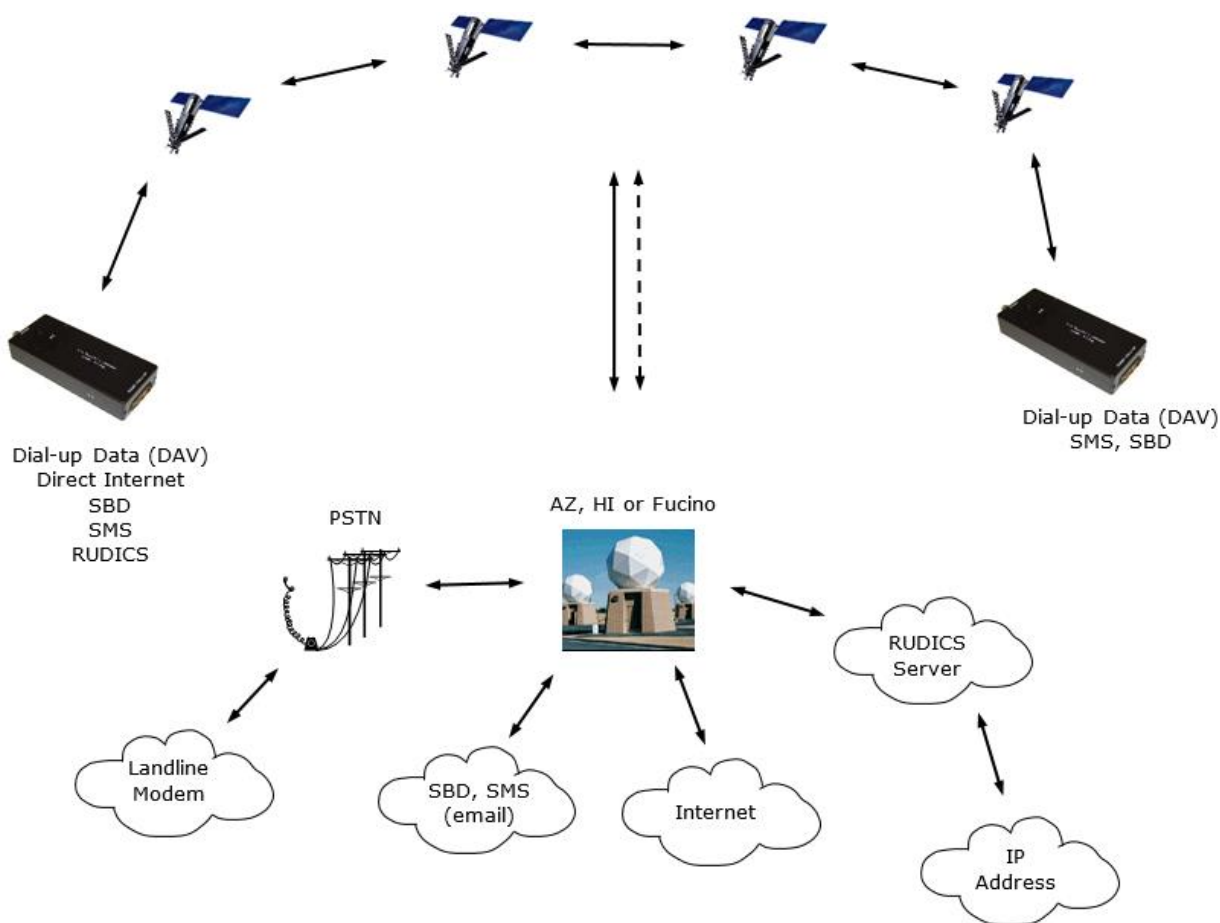


Figure 34: Iridium Network Data Capabilities

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 35**, 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 35** 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.

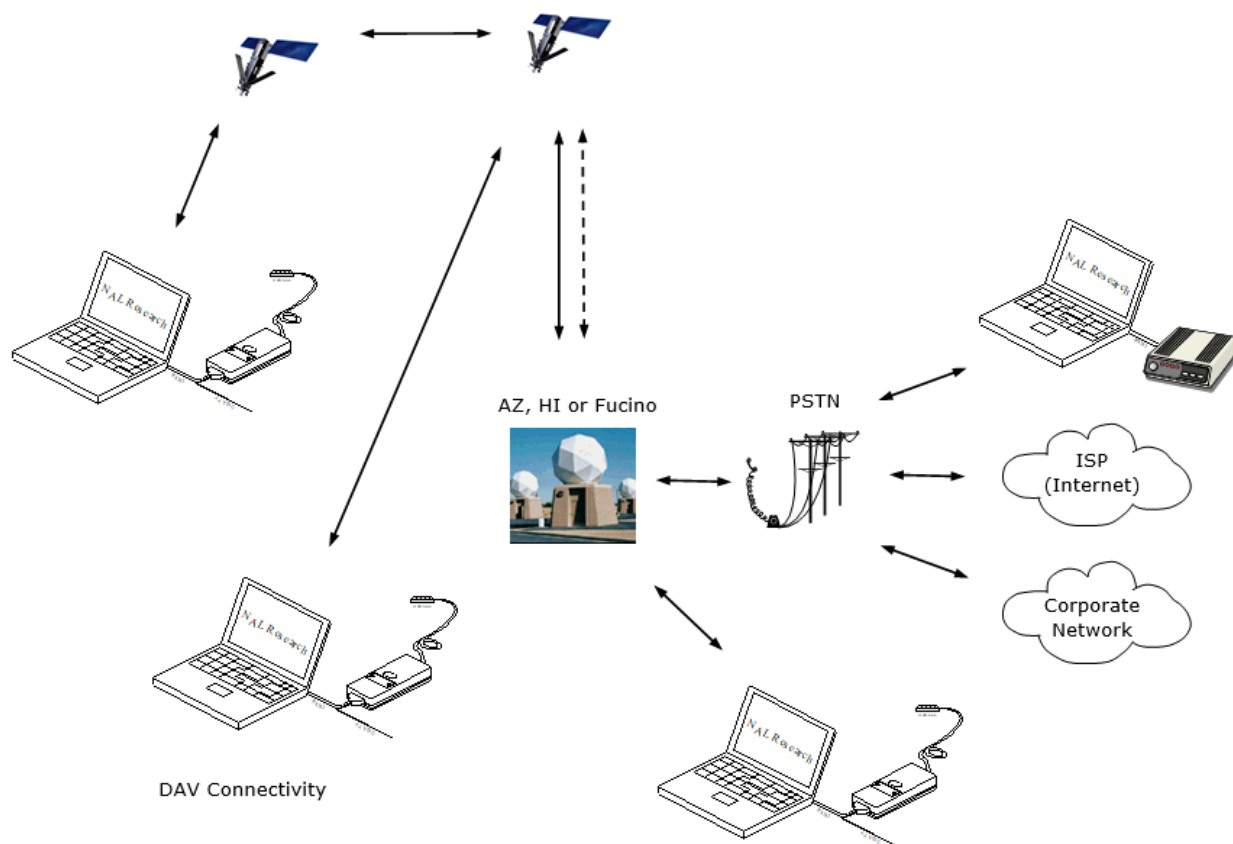


Figure 35: Iridium Dial-Up Data Service

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 35** 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).

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.

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.

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.

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 μ A @ +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

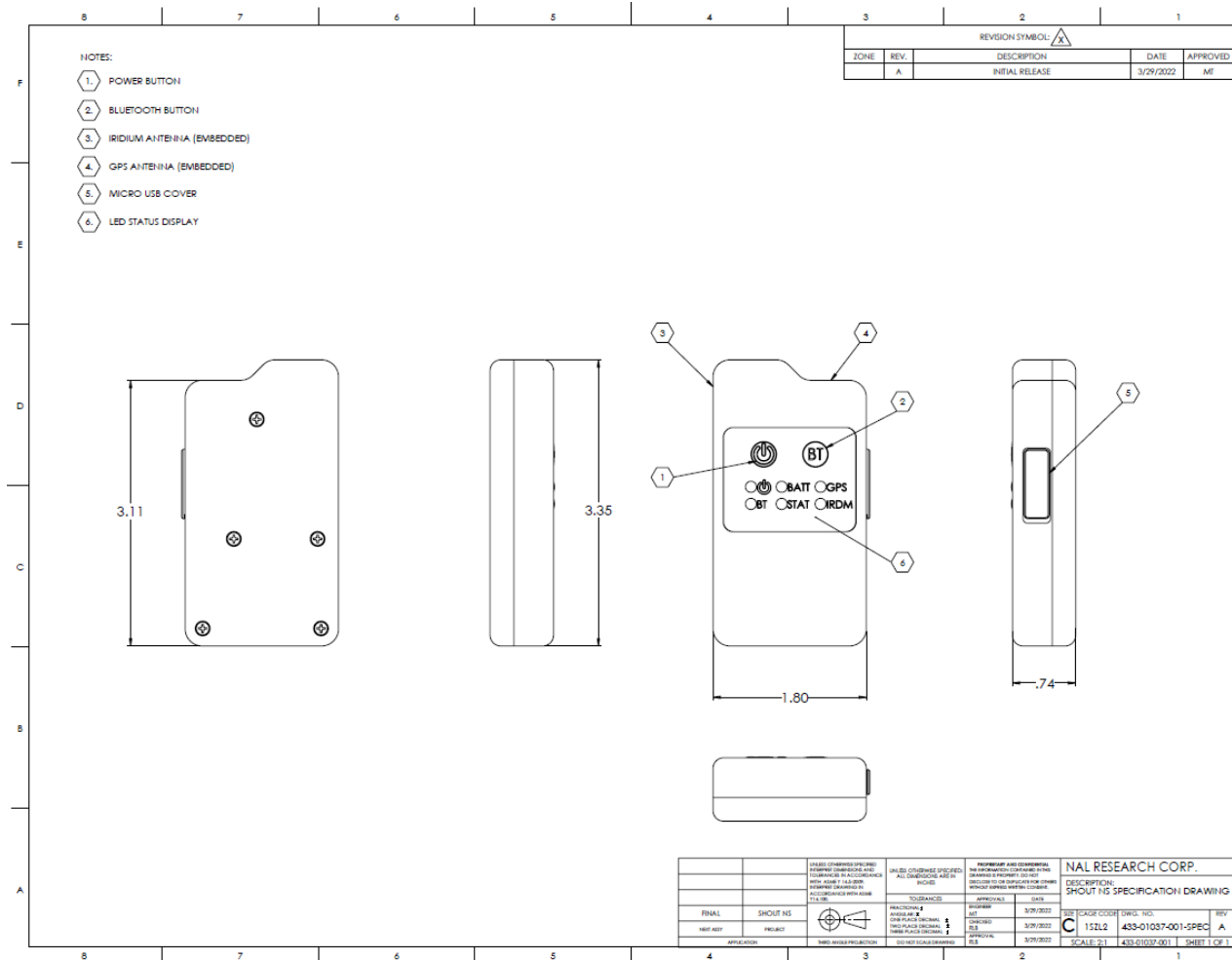


Figure 36: SHOUT ns Mechanical Drawing

E.2 SHOUT NSX MECHANICAL DRAWING

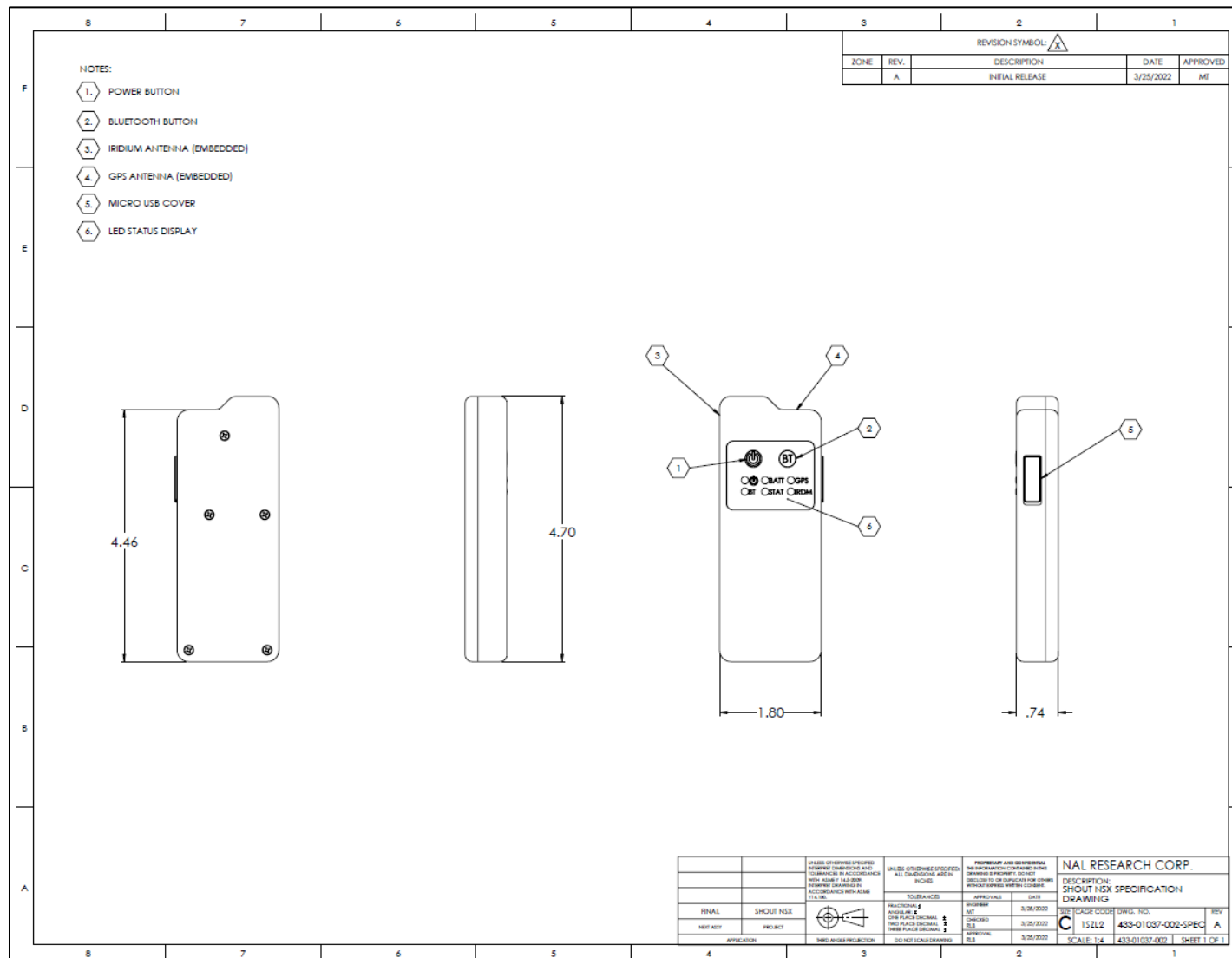


Figure 37: SHOUT nsx Mechanical Drawing