A3LA-RM Quick Start Guide

Version A

April 28, 2022

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REVISION HISTORY

Revision	Date	Description
1.1	04/08/2013	Initial version
1.2	08/02/2021	Updated to new template
A	04/28/2022	Formal release

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]	AL3A-RM User Guide	Version B, 04/04/2022
[2]	SatTerm Software Manual	Version A, 06/01/2020

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TABLE OF FIGURES

ACRONYM LIST

AT ....Two-letter sequence starting a string of terminal commands. The AT is intended to get the terminal's attention prior to executing a command.

dB ....Decibel

DC..............................Direct Current

DPL ....Digital Peripheral Link

DTE ....Data Terminal Equipment

FCC ....Federal Communications Commission

GND...........................Ground

LCD ....Liquid Crystal Display

LED ....Light Emitting Diode

PIN.............................Personal Identification Number

PUK...........................Personal Unblocking Key

RF...............................Radio Frequency

RX ....Receiving

SatTerm.....................Satellite Terminal emulator software

SIM ....Subscriber Identification Module

TX ....Transmitting

V ....Volt

1   INTRODUCTION

The A3LA-RM is a satellite modem comprising a 9523 L-band transceiver (LBT) with an extended input voltage range. The A3LA-RM has an internal microcontroller programmed to monitor the modem's connectivity status to prevent hardware lockup. It is designed to transmit either AES 256-bit encrypted or unencrypted data via the Iridium satellite network. Similar to a standard landline modem, the A3LA-RM can be controlled by any data terminal equipment (DTE) capable of sending standard AT commands via an RS232 serial port. A DTE can be a desktop computer, a laptop computer, a smartphone, or even a microcontroller.

Services supported include:

- Dial-up data switch

- Direct Internet connection (or NIPRNet connection)

- Direct Internet connection using Apollo Emulator (only for DoD EMSS gateway)

- Short message service (SMS)

- Short burst data (SBD)

- Router-based unrestricted digital internetworking connectivity solution (RUDICS)

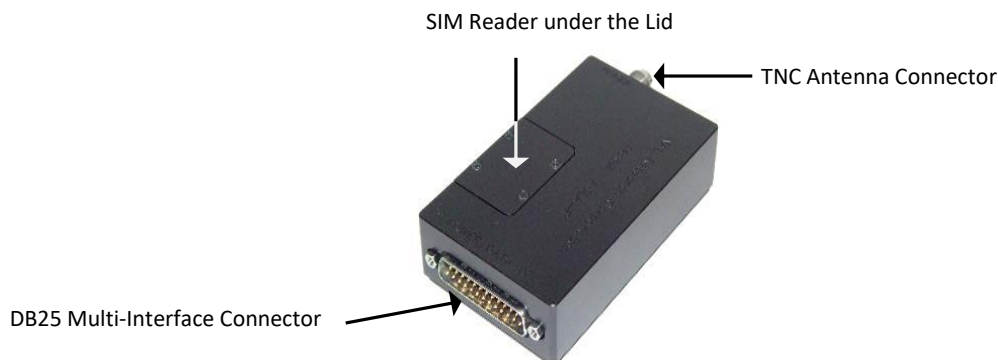- Voice when combined with the Digital Peripheral Link (DPL) audio handset

SIM Reader under the Lid

TNC Antenna Connector

DB25 Multi-Interface Connector

Figure 1: Iridium Satellite Modem A3LA-RM

The A3LA-RM is shipped with the following items in the package:

- A3LA-RM modem

- Installation CD with manuals and SatTerm software

Before using the A3LA-RM, the following additional hardware and software are required:

- Desktop or laptop computer

- 9-wire DB25-to-DB9 RS232 data cable

- DC power source

- SatTerm software or any terminal emulator software

Important: Do not disassemble the A3LA-RM for repair or services. The warranty is voided if the A3LA-RM is disassembled. Return it to NAL Research for any services.

The A3LA-RM is shipped with the following items in the package:

- A3LA-RM modem

- Installation CD with manuals and SatTerm software

2   DEVICE DESCRIPTION

2.1   MULTI-INTERFACE CONNECTOR

The multi-interface connector (see **Figure 1**) is a male 25-pin miniature D-sub type that includes five interfaces—RS232, DC input power, ON/OFF control line, analog audio, and DPL. The multi-interface connector pin assignments are summarized in **Table 1**, which is 'pin-to-pin' the same as model A3LA-R, A3LA-XM, and A3LA-X.

Table 1: Pin Assignment for the Multi-interface Connector

Pin #	Signal	Description	Interface
1	EXT_ON_OFF	Power on/off control input	DC Power
2	+12VDC	Output voltage to power the DPL handset	DC Power
3	EXT_GND	External GND input	DC Power
4	EXT_B+	External 4.0 V – 5.4 V or 5.0 V – 32.0 V	DC Power
5	SPKR_AUD	Speaker audio output	Analog Audio
6	DA_TX	PCM digital audio output	Digital Audio
7	RI	RS232 ring indicator	RS232 Data
8	RTS	RS232 request to send	RS232 Data
9	TX	RS232 transmit data (input)	RS232 Data
10	DCD	RS232 data carrier detect	RS232 Data
11	DA_FS	PCM digital audio frame sync output	Digital Audio
12	DA_CLK	PCM digital 2.048 MHz audio clock output	Digital Audio
13	RX	RS232 receive data (output)	RS232 Data
14	SIGNAL GND	Signal ground, 0 V signal reference and return	GND
15	MIC_AUD	Microphone audio input	Analog Audio
16	EXT_B+	External 4.0 V – 5.4V or 5.0 V – 32.0 V	DC Power
17	EXT_GND	External GND input	DC Power
18	DPL_TX	Digital Peripheral Link (DPL) data output	DPL UART
19	DTR	RS232 data terminal ready	RS232 Data
20	DPL_RX	Digital Peripheral Link (DPL) data input	DPL UART
21	DSR	RS232 data set ready	RS232 Data

Table 1: Pin Assignment for the Multi-interface Connector

Pin #	Signal	Description	Interface
22	CTS	RS232 clear to send	RS232 Data
23	SIGNAL GND	Signal ground, 0 V signal reference and return	GND
24	DA_RX	PCM digital audio input	Digital Audio
25	SIGNAL GND	Signal ground, 0 V signal reference and return	GND

2.1.1 RS232 DATA INTERFACE (STANDARD 9-WIRE CONFIGURATION)

The A3LA-RM supports a standard RS232 data interface to a DTE incorporating hardware handshaking and flow control. The RS232 data interface comprises eight standard RS232 data, control, and status signals, plus a ground-level signal reference, as shown in **Table 1**. This interface allows a connected DTE to utilize the A3LA-RM's modem functionality through a set of AT commands (see SatTerm Software Manual Version A).

2.1.2 DC POWER INPUT

The DC power input is through pin 4 & 16 (EXT_B+) and pins 3 & 17 (EXT_GND). Note that two pins are provided for the external DC input and two pins are also provided for the associated external ground input. This is done to distribute the current across two wires, and therefore all four pins should be utilized in the external power connection.

2.1.3 POWER ON/OFF CONTROL

With the EXT_ON_OFF pin left unconnected, the A3LA-RM automatically turns on or off when external DC power is applied or removed. Prior to turning the A3LA-RM off, issue command AT*P0 to ensure all memory write activity is completed.

2.2 AUDIO INTERFACE

The A3LA-RM supports both digital and analog audio Input/output (I/O). The digital audio is in PCM format. In such format, digital audio cannot travel far (less than one foot); this is why the analog is chosen for the A3LA-RM audio handset (see **Figure 2**).

A3LA-RM Modem →

HRC-24-8R Data Kit →

← DPL Handset

Figure 2: A3LA-RM Connected to a DPL Handset via the HRC-24-8R

2.3   ANTENNA CONNECTOR

The A3LA-RM modem uses a single Threaded Neill–Concelman (TNC) female 50-ohm connector for both transmit and receive.

NAL Research offers several types of antennas for use with the A3LA-RM modem. For low cost and applications where small form factor and light weight are required, NAL Research recommends model SYN7391-C (see **Figure 3** .

Figure 3: SYN7391-C Antenna

2.4   SIM CARD INTERFACE

The A3LA-RM modem contains an integrated Subscriber identification module (SIM) reader. The modem uses and requires an Iridium SIM chip for operation. The SIM chip is inserted into the opening located on top of the modem, as shown in **Figure 4**. A plastic locking mechanism is used hold the SIM in place. Place the SIM chip (facing down) into the SIM reader's bracket. Ensure that the cutoff on the SIM chip aligns with the SIM reader.
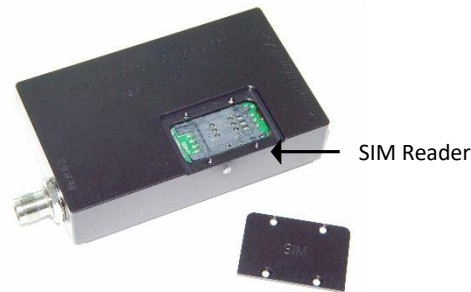
Figure 4: Location of the SIM Reader

2.5 LED DISPLAY

The A3LA-RM has three status LEDs depicted as *P* for power indicator, *I* for Iridium satellite signal strength, and *S* for status (see **Figure 5**). They provide a quick visual check to ensure proper modem operations and a way to optimize antenna locations during field installation. These LEDs provide the following information:

- P: LED lights up when power is provided to the A3LA-RM.

- I: LED stays solid when the signal strength is between 3–5, blinks when the signal strength is between 1 and 2, and is off when signal strength is 0. The Light-emitting diode (LED) also stays solid when the carrier detects (CD) line on the RS232 goes high during a data call.
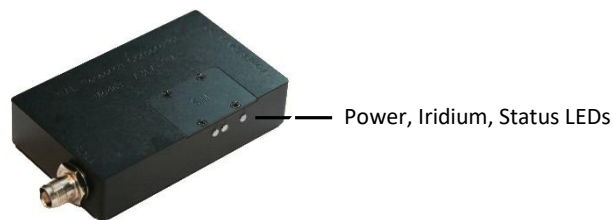
- S: LED lights up when the A3LA-RM is in data mode.

Figure 5: Iridium Satellite Modem A3LA-RM

3 CONFIGURING THE A3LA-RM

1. Remove the SIM cover located at the top of the A3LA-RM Iridium modem. Under the SIM cover is an integrated SIM chip reader.
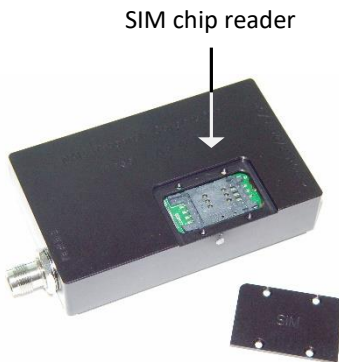
SIM chip reader

Figure 6: SIM Chip Reader

The A3LA-RM uses and requires an Iridium SIM chip for operation.

2. Detach the SIM chip from the full-size SIM card, as shown in **Figure 7**.

SIM chip

Full-size SIM card

Figure 7: Iridium SIM Chip

3. Place the SIM chip (facing down) into the SIM chip reader.

   There is a small cut-off on one of the corners of the SIM chip.

4. Ensure that the cut-off is pointing upward, which should align the SIM chip with the SIM chip reader.

5. Lower and lock the SIM chip reader's bracket.

6. Connect a data terminal equipment (DTE) such as a computer, laptop, microcontroller, etc. to the modem DB25 port using the RS232/data cable model HRC-24-7R or the DB25 data kit model HRC-24-8R.

Both of these models can be purchased separately from NAL Research. The HRC-24-7R cable consists of a full DB-9 serial connector and two terminal leads for DC power input. The HRC-24-8R data kit consists of a full DB-9 serial connector/cable, an RJ-45 for the DPL audio handset, and a DC power plug. A three-wire (TX, RX, and GND) serial cable can also be used (see document 451-93156-002B [1]) if flow control is not required. The A3LA-RM automatically adjusts to the DTE baud.

7. Connect an external Iridium antenna to the A3LA-RM.

    Any of the four types of antennas offered by NAL Research is appropriate (SYN7391 Series, SAF2040 Series, SAF5340 Series, and SAF5350 Series).

8. Ensure the antenna has a full view of the sky and the cable loss between the modem and antenna is less than 3 dB.
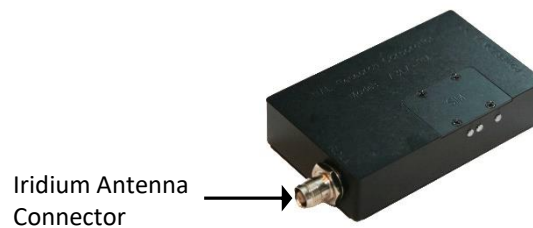

Iridium Antenna Connector

Figure 8: Iridium Antenna Connector

WARNING: To comply with FCC RF exposure requirements, a minimum separation of 20 cm is required between the antenna and all persons.

9. Supply DC power (can be at any voltage between 4.0 V–5.4 V or 5.0 V–32 V) to the power input of the HRC-24-7R or of the HRC-24-8R data kit. The A3LA-RM is configured to accept 5.0 V–32.0 V as factory-setting default. To operate at voltages below 5 V, the device must be reconfigured with an internal jumper (see document: 451-93156-002B A3LA-RM User Guide Rev A), section 2.3 [1]). The modem will automatically be ON/OFF when DC power is applied/removed if the EXT_ON_OFF pin is left unconnected (pin 1). If power to the modem is cycled, ensure the elapsed time between each power cycle is at least 2 seconds. NAL Research's AC adapter model LA-3098 (purchase separately) can be used to power the A3LA-RM.

10. Wait for about 15 seconds for the modem to register with the Iridium satellite network.

Note: The A3LA-RM is basically a "black box" with four LED status indicators. This can pose great difficulties for first-time users who are not familiar with satellite modems. For application developers, NAL Research recommends using a DPL handset DPLS0401-X and a data kit HRC-24-8R in combination with the A3LA-RM. This setup can be a useful diagnostic tool, allowing the modem status to be displayed on the LCD of the handset as well as using the handset to place a voice call. The red power button on the DPL handset can be used to power reset the A3LA-RM.

Figure 9: A3LA-RM with Data Kit and Handset

11. Use any terminal emulator software and AT commands to communicate with the modem.

However, the A3LA-RM is shipped with a CD with a terminal emulator software package called SatTerm. NAL Research recommends using SatTerm with the A3LA-RM because it provides a complete reference manual for all AT commands through user-selected buttons for quick and easy access.

12. Verify the following if a data connection cannot be made with the Iridium network:

a. Antenna has a full view of the sky.

b. The PIN has been removed from the SIM chip.

c. Power source provides enough current.

13. Verify the following if using the DPL handset:

a. The Liquid Crystal Display (LCD) screen on the DPL handset is ON with the word "Iridium" written across the LCD screen. If not, check for appropriate power input.

b. The <Enter PIN> message should not be displayed on the LCD. If the <Enter PIN> message appears on the LCD, enter the appropriate PIN (the default PIN is 1111). The handset can be used to remove the PIN permanently.

c. Displayed satellite signal strength on the LCD must be at least 3 bars. Rearrange/relocate the Iridium antenna if the signal strength remains at 3 bars or below.

14. If the DPL handset is not available, use the following steps to check if the SIM or the Phone Control is locked:

a. If using the SatTerm software, open the AT Command Table for the AT+CPIN command and click the Read button. If NOT using the SatTerm software, enter the command AT+CPIN?.

b. If the response from the A3LA-RM is *SIM PIN*, then the SIM is currently locked (or activated). To remove the SIM, do the following:

    i. <u>If using the SatTerm software</u>:

        1. Enter the SIM PIN code (each SIM is shipped with the default code of 1111) in the *p* box, and then click the Send button. If the PIN code is correct, the response from the A3LA-RM is *OK*.

        2. Open the AT Command Table for the AT+CLCK command, and then select SC from the *f* box, select 0 from the *m* box, and enter the PIN code (again the default code is 1111) in the *p* box. Click the Send button. If the PIN code is correct, the response is *OK*.

        3. The SIM is now removed and ready for use.

    ii. <u>If NOT using the SatTerm software</u>:

        1. Enter the following command AT+CPIN="PIN code" (where the default PIN code is 1111). If the PIN code is correct, the response is *OK*.

   2. Enter the following command: AT+CLCK="SC",0,"PIN code". If the PIN code is correct, the response is *OK*.

   3. The SIM is now removed and ready for use.

c. If the response is *PH PIN*, then the surface control for the A3LA-RM is locked and the phone PIN code needs to be entered in order to use the commands that operate the A3LA-RM. To unlock the A3LA-RM surface control, do the same procedure in part **14.b** above except select CS instead of *SC* in step **14.b.i.2**.

d. If the response is *READY* or *SIM PIN2*, then the SIM is not locked and the A3LA-RM is ready for use. No PIN code needs to be entered.

e. If the response is *SIM PUK* or *SIM PUK2*, contact your service provider.

4   TECHNICAL SUPPORT

For technical support, please contact us at:

Phone: 703-392-1136, x203

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.