GENERAL DESCRIPTION OF MODEL A3LA-I

TECHNICAL NOTE

December 6, 2004

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1.0 PURPOSE

This document describes the electrical and mechanical interfaces of the 9505 Iridium Modem model A3LA-I. Model A3LA-I is a satellite modem designed to operate with the Iridium network. Similar to a standard landline modem, the A3LA-I can be controlled by any DTE (data terminal equipment) capable of sending standard AT commands via a serial port. A DTE can be a desktop computer, a laptop computer, a PDA, or even a micro-controller. The A3LA-I has been both HERO and HERF certified by the Naval Surface Warfare Center of Dahlgren, Virginia.

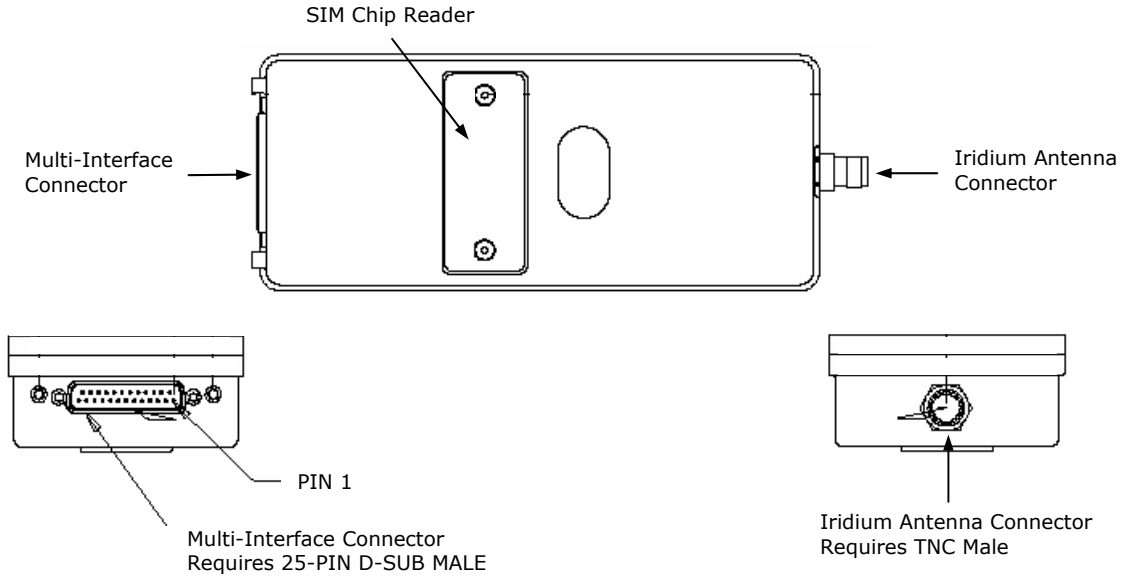
Services Supported:

1. Dial-Up Data
2. Direct Internet Connection
3. Short Message Service
4. Short-burst data (SBD)
5. Voice (when combined with the audio breakout box and handset)

2.0 SPECIFICATIONS

Mechanical Specifications

Dimensions:	7.73" L x 3.25" W x 1.54" D
Weight:	~1.3 pounds
Cooling:	Convection
Enclosure:	Aluminum/EMI shielding
Multi-Interface Connector:	25-Pin D-Sub located on the end of the A3LA-I
Iridium Antenna:	TNC female located on the opposite end of the multi-interface connector
SIM Chip Reader	Located beneath a cover plate atop the A3LA-I



RF Specifications

Operating Frequency:	1616 to 1626.5 MHz
Duplexing Method:	Time Division Duplex
Multiplexing Method:	TDMA/FDMA
Link Margin:	12.5 dB average

Electrical Specifications

Main Input Voltage Range:	+4.0VDC to +5.0VDC
Main Input Voltage Nominal:	+4.4VDC
Main Input Voltage Ripple:	40mV peak-to-peak
Power-up Current:	~2.2A @ 4.4VDC
Transmitting/Receiving Current:	~1A @ 4.4VDC average
Standby Current:	~120mA @ 4.4VDC average

Environmental Specifications

Operating Temperature Range:	–30°C to +60°C
Operating Humidity Range:	< 85% RH
Storage Temperature Range:	–40°C to +85°C
Storage Humidity Range:	< 85% RH

Data I/O Specifications

Dial-Up Data:	2.4 Kbits/sec (average)
Direct Internet:	~10.0 Kbits/sec (with data compression)
Short-Burst Data:	1960 Bytes/message (maximum)
Short Messaging:	160 Characters (maximum)
Hardware Interface:	RS232 or USB
Software Interface:	Standard AT Commands

Related Hardware

Antennas:	SYN7391 Series (A and B), SAF2040 Series (A–F), SAF5340 Series (A and B), SAF5350 Series (A–C)
Power Adapters:	LA-2098 (AC Adapter), LA-7021 (Cigarette Lighter Adapter)
Battery Pack:	SYN-LI-416AH
Audio Breakout Box:	SYN-AD-LBT
Audio Handset:	SCN4052A
External SIM Card Reader:	SYN7922B
RF Splitter:	SYN-SLC-ALBT

Reference Documents

Product Information Model A3LA-I

SSP-ISU-CPSW-USER-0005 V2.0 (AT Command Reference V2.0)

TN2004-39-V3.2 (How to Use Model A3LA-I)

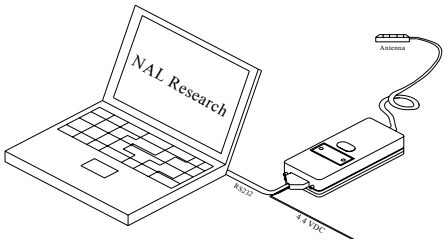
TN2002-53-V2.2 (Power Consumption of Models A3LA-I and A3LA-IG)

TN2004-69-V3.2 (SatTerm Software Manual)

3.0 MULTI-INTERFACE CONNECTOR (NOT APPLICABLE TO MODEL A3LA-I-NV)

The multi-interface connector is a male 25-pin miniature D-Sub type that includes four interfaces. The interface descriptions are listed below and the pin assignments are summarized in Table 1.

1. RS232 Data Interface
2. DC Power Interface
3. Control/Audio Interface
4. Analog Audio Interface



PIN #	SIGNAL	DESCRIPTION	INTERFACE
1	EXT_ON_OFF	Power on/off control input	DC Power
2	ISU_SENSE_11HZ	Reserved	Reserved
3	GND	External GND input	DC Power
4	EXT_B+	External 4.4 VDC input	DC Power
5	SPKR_AUD	Analog audio output	Analog Audio
6	ANALOG_AUD_EN	Analog audio enable input	Analog Audio
7	RI	RS232 Ring Indicate	RS232 Data
8	RTS	RS232 Request To Send	RS232 Data
9	S_TX	RS232 Transmit Data	RS232 Data
10	DCD	RS232 Data Carrier Detect	RS232 Data
11	DSC_EN	DSC bus enable output	Control/Audio
12	DOWNLINK	DSC bus downlink	Control/Audio
13	S_RX	RS232 Receive Data	RS232 Data
14	GND	Spare GND	Spare GND
15	MIC_AUD	Analog audio input	Analog Audio
16	EXT_B+	External 4.4 VDC input	DC Power
17	GND	External GND input	DC Power
18	UPLINK	DSC bus uplink	Control/Audio
19	DTR	RS232 Data Terminal Ready	RS232 Data
20	BATT_FDBK	Reserved	Reserved
21	DSR	RS232 Data Set Ready	RS232 Data
22	CTS	RS232 Clear To Send	RS232 Data
23	GND	RS232 ground level signal reference	RS232 Data
24	GND	DSC bus ground level signal reference	Control/Audio
25	ANALOG_GND	Analog audio ground level signal reference	Analog Audio

Table 1. Pin assignment for the multi-interface connector.

3.1 RS232 Data Interface (Standard 9-Wire Configuration)

The A3LA-I supports standard RS232 data interface to a DTE incorporating hardware handshaking and flow control. The RS232 data interface comprises of eight standard RS232 data, control and status signals plus a ground level signal reference as shown in Table 1 (pins 7-RI, 8-RTS, 9-TX, 10-DCD, 13-RX, 19-DTR, 21-DSR, 22-CTS and 23-GND). This interface allows a connected DTE to utilize the A3LA-I's modem

functionality through standard AT and extended sets of AT commands. These commands are defined in the document SSP-ISU-CPSW-USER-0005 V2.0. The A3LA-I will automatically adjust to the DTE baud rate.

3.2 RS232 Data Interface (3-Wire Configuration)

Several steps must be taken to allow 3-wire configuration (i.e. only using S_TX, S_RX, and SIGNAL GND). These steps ensure the modem and DTE to work together without having hardware handshaking.

1. The modem's DTR line must be held high. Using the modem's input voltage is fine for this purpose. Looping back the modem's DSR line to DTR line will NOT work. The DSR line on the modem should be left unconnected.
2. Disconnect the CTS, DCD, DSR, DTR, RTS and RI lines between the DTE and modem.
3. AT&Dn must be set to AT&D0 to ignore the DTR input from the DTE.
4. AT&Kn must be set to AT&K0 for no flow control or AT&K4 for XON/XOFF software flow control.
5. The setting can be stored on the modem permanently (until another setting overwrites it) so that it remains after a power cycle. The modem allows two profiles in which settings are stored, and user can choose either as a default profile. The relevant commands are &Wn and &Yn. &Wn stores the present configuration in profile <n>, where <n> can be either 0 or 1. &Yn designates which profile is loaded after reset or power-up, again <n> is either 0 or 1.
6. Any needs of the DTE must be addressed separately.

NOTE THAT IRIDIUM'S DIRECT INTERNET SERVICE WHEN USING THE WINDOWS-BASED APOLLO CLIENT REQUIRES DCD TO BE PRESENT, HENCE IT IS INCOMPATIBLE WITH A 3-WIRE SERIAL APPLICATION.

3.3 DC Power Interface

The DC power input is through pins 4 & 16 (EXT_B+) and pins 3 & 17 (GND). Note that two pins (4 and 16) are provided for the external (EXT_B+) DC input. Two pins (3 and 17) are also provided for the associated external (GND) 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. The DC power requirements for the A3LA-I are summarized on page 2.

The A3LA-I will automatically turn on/off when external DC power is applied/removed via the EXT_B+ and GND inputs. The EXT_ON_OFF (pin 1) control input is used to turn a powered A3LA-I on and off in a toggle fashion. The EXT_ON_OFF control input is normally "floating" (i.e. high). When it is pulled to GND level (i.e. low) for at least 270 ms and released the A3LA-I will alternate from its current on/off state.

3.4 Control/Audio Interface

The control/audio interface enables peripherals such as an external SIM reader and audio handset to be interfaced to the A3LA-I. The interface utilizes a Motorola Proprietary full duplex communication bus comprised of the DSC uplink (pin 18), DSC downlink (pin 12), and DSC enable (pin 11) signals plus a ground level signal reference (pin 24) as summarized in Table 1. All data messages, primitives, and digital speech information are transferred on this bus. With the NAL Research's audio breakout box model SYN-AD-LBT and

audio handset model SCN4052A, the A3LA-I can be used both as data modem and a satellite phone (see picture below). This setup can be an extremely useful developmental tool since the modem status (modem power indicator, satellite signal strength, type of connection, etc.) can be seen on the handset LCD similar to a 9505 Iridium phone. Furthermore, the SYN-AD-LBT also allows the use of an external SIM reader model SYN7922B. A SIM card in the external SIM reader will take precedence over the SIM chip in the integrated connector when both are present.

3.5 Analog Audio Interface

The analog audio interface is comprised of the analog audio input (pin 15) and output (pin 5) signals, an enable input signal (pin 6), and a ground level signal reference (pin 25) as summarized in Table 1. The ANALOG_AUD_EN input is implemented with a resistor to pull to ground when the analog audio port is to be enabled, or an open circuit input when it is desired to retain the audio on the DSC bus.

4.0 ANTENNA CONNECTOR

The A3LA-I modem uses a single TNC female 50-ohm connector for both transmit and receive. Cable loss between the modem and the antenna is critical and must be kept less than 3dB at the operating frequency of 1616 to 1626.5 MHz. The minimum link margin of 12.5dB must also be maintained. General RF parameters are listed in the table below.

TYPE	DESCRIPTION
Frequency Range	1616 to 1626.5 MHz
Input/Output Impedance	50 Ohms

NAL Research offers several types of antennas for use with the A3LA-I modem. These antennas include the fixed mast, mobile magnetic/permanent mount and portable auxiliary. If the specific application requires a custom antenna, it must meet the specifications in the following table.

PARAMETER	VALUE
Operating Temperature Range	−40°C/+85°C without loss of function
Measurement Frequency Range	1616 to 1626.5 MHz
Return Loss (Minimum)	9.5 dB (<2:1 VSWR)
Gain	0.0 dBic (weighted average minimum)
Minimum 'Horizon' Gain	−2.0 dBic (82° conic average)
Nominal Impedance	50 Ohms
Polarization	Right Hand Circular (RHCP)
Basic Pattern	Omni directional and hemispherical

5.0 SIM CARD INTERFACE

The A3LA-I modem contains an integrated SIM reader. The modem uses and requires an Iridium SIM chip for operation. The SIM chip is detached from the full-size Iridium SIM card. The SIM chip is inserted into the opening located on top of the modem. A plastic locking mechanism (same as with GSM wireless phones) is used hold the SIM in-place.

6.0 MOUNTING RECOMMENDATIONS

The A3LA-I has six features on its bottom surface that can aid in its mounting (see Appendix B). It is recommended that a thread-forming screw be used to mount the A3LA-I via these features. Screw length should be chosen to ensure that penetration into the A3LA-I housing does not exceed 11mm.

If the A3LA-I is to be used in a harsh environment with exposure to high humidity or water, the mating of the multi-interface connector must be further sealed to protect from moisture infiltration. It is recommended that a bead of RTV silicone sealant be placed on the connector mating to the A3LA-I's multi-interface connector.

7.0 SHORT-BURST DATA (SBD) AND SHORT-MESSAGE SERVICE (SMS)

The A3LA-I flashed with firmware SAC0307 will support SMS. This provides the ability to send a text messages up to 160 characters via e-mail or the Internet to the modem. The message can be extracted over the serial port of the modem. Refer to the SSP-ISU-CPSW-USER-0005 V2.0 document for additional information on commands required to access SMS messages. The A3LA-I modem supports SBD as well when flashed with firmware SAC0307. Modems flashed with earlier version of the firmware do not support SBD.

WARNING: Due to certain restrictions at the U.S. DoD gateway (applied ONLY to the U.S. DoD gateway and NOT commercial gateways), users cannot send outgoing SMS messages by e-mail. Furthermore, incoming SMS messages are limited to 120 characters.

8.0 TECHNICAL SUPPORT

For technical support, please contact us at:

Phone: 703-392-1136 x200 or

E-mail: contact@nalresearch.com

APPENDIX A: STANDARDS COMPLIANCE

The A3LA-I has been designed to comply with the standards for Emissions Compliance, Electromagnetic Compatibility, Electromagnetic Safety, and AC Safety in the United States, Europe and Canada. Standards in other areas of the world are often the same.

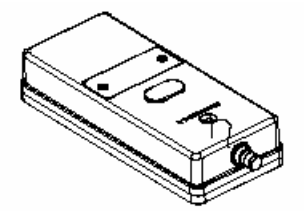
FCC Compliance

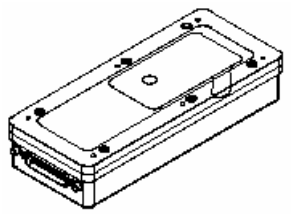
The A3LA-I has been certified under 47 CFR Part 25 as FCC ID: IHDT6NJ1 and also complies with Part 15 of the FCC Rules. Operation is subject to the condition that this device does not cause harmful interference. Any changes or modifications, including the use of a non-standard antenna, not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment. IMPORTANT: To comply with FCC RF exposure requirements, a minimum separation of 20 cm is required between the antenna and all persons.

CE Compliance

The A3LA-I complies with the European Community Council Directive for R&TTE, 99/5/EC, provided the installer/user adheres to the instructions detailed in the Interface specification. This product is in compliance with applicable ETSI standards. Compliance with the requirements of ETSI EN 301 489 requires the use of a shielded digital data interface cable.

APPENDIX B: MECHANICAL DRAWINGS





*NOTE: all dimensions are in millimeters (mm)