

# IRIDIUM

## 9522B L-Band Transceiver Product Information Guide



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## Contents

Revision History .....	3
1.0 Product Overview .....	4
2.0 Standards Compliance .....	5
2.1 FCC Compliance.....	5
2.2 CE Compliance .....	5
2.3 Industry Canada .....	5
3.0 Physical Specifications .....	6
3.1 Environmental.....	6
3.2 Dimensions .....	7
3.3 Interface Connectors .....	9
3.3.1 Multi-Interface Connector .....	10
3.3.2 Antenna Connector .....	11
3.3.3 GPS Feed Through Connector .....	12
3.3.4 SIM Chip Reader .....	12
3.4 Mounting.....	13
3.5 Mounting in Harsh Environments.....	13
4.0 Electrical Interfaces .....	14
4.1 DC Power Interface.....	14
4.1.1 DC Power Interface Signal Descriptions .....	14
4.1.2 DC Power Input Specifications.....	14
4.2 Control/Digital Audio Interface (DPL bus) .....	15
4.2.1 Control/Digital Audio Interface Signal Descriptions .....	15
4.3 RS232 Data Interface.....	15
4.3.1 RS232 Data Signal Descriptions.....	15
4.3.2 Autobaud.....	15
4.4 Analog Audio Interface.....	16
4.4.1 Analog Audio Interface Signal Descriptions .....	16
4.5 SIM Interface .....	16
4.6 RF Interface .....	17
4.6.1 RF Interface Specifications .....	17
4.6.2 GPS Feed Through Specification .....	17
4.6.3 Radio Characteristics .....	18
5.0 Instructions for the safe Installation and use of the 9522B LBT .....	19
5.1 Instructions for the Integrator .....	19
5.2 Instructions from the integrator to the user.....	19
6.0 Modem Commands and Configuration.....	19
7.0 Installation of the 9522B in place of a 9522A .....	20
7.1 Physical characteristics .....	21
7.2 Power Supply .....	22
7.3 Analog Audio.....	22

## **Revision History**

<b>Revision</b>	<b>Date</b>	<b>Comment</b>
V0.1		First revision based on 9522A product information guide
V0.2	17 April 2008	Updated mechanical drawings, mass and power.
V0.3	22 May 2008	Updated Header and DC Power Input Specification
V0.4	16 Jun 2008	Added 9522A adapter information. Updated DC Power Input Specification
V1.0	30 June 2008	Initial Release
V1.1	11 July 2008	Information regarding the DPL switch location and GPS added
V1.2	18 August 2008	Updated Standard Compliance, section 2.3 added
V1.3	18 Sept 2008	Clarified descriptions from internal review. Revised and clarified environmental and electrical requirements.
V1.4	13 Oct 2008	Power supply safety instructions for EN/UL60950; Instructions to reduce analog audio noise.
V1.5	14 Oct 2008	Added environmental tests table
V1.6	15 Oct 2008	Extended environmental tests table, updated drawings
V 1.7	9 April 2009	Updated mounting plate screw reference number

## **Export Compliance Information**

This product is controlled by the export laws and regulations of the United States of America. The U.S. Government may restrict the export or re-export of this product to certain individuals and/or destinations. For further information, contact the U.S. Department of Commerce, Bureau of Industry and Security or visit [www.bis.doc.gov](http://www.bis.doc.gov).

## **1.0 Product Overview**

The 9522B L-Band Transceiver (LBT) is designed to be integrated into a specific application with other hardware and software to produce a solution designed for a specific application or vertical market. Some examples of these solutions include a maritime voice telephony terminal or a vehicle tracking solution.

The LBT functionally supports all of Iridium's voice and data services. Applications can be built to use one or multiple services using the voice and data interfaces. The 9522B is a functional replacement to the 9522A LBT, although the mechanical design and the electrical connectors differ. Connection adaptors are available to enable the 9522B to be used in place of the 9522A.

A pass thru connector is provided to allow a GPS receiver to share the same antenna as the 9522B LBT.

The 9522B is regulatory approved for FCC, Canada, and CE assuming an antenna with a gain of ~3dBi. This allows the LBT to be integrated into a variety of subscriber products, or retrofitted into existing LBT-based products. These products, when integrated together will require regulatory testing to be conducted by the integrator.

The LBT is essentially provided as a 'black box' with all interfaces provided via a 26-way 0.1" pitch connector. The product provides the core transceiver module and SIM card reader. All other functions and hardware such as keypad, display, power supply, antenna etc. must be provided by the solution developer. The connector provides the following interfaces and connections:

- Analog Audio
- Control / Digital Audio
- RS232
- Power Input
- On / Off

## **2.0 Standards Compliance**

The 9522B is designed to comply with the standards for Radio Emissions Compliance, Electromagnetic Compatibility, and AC Safety in the United States, European Union and Canada.

### **2.1 FCC Compliance**

The 9522B is certified under 47 CFR Part 25 as FCC ID: Q639522B. It also complies with Part 15 of the FCC Regulations. 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.**

### **2.2 CE Compliance**

This product, when marked with the CE symbol, complies with the European Community Council Directive for R&TTE, 99/5/EC, provided that the integrator/user adheres to the instructions detailed in this LBT 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.

### **2.3 Industry Canada**

This product is compliant with Industry Canada RSS-102 for RF Exposure.

### 3.0 Physical Specifications

The 9522B is depicted in Figure 1 below.

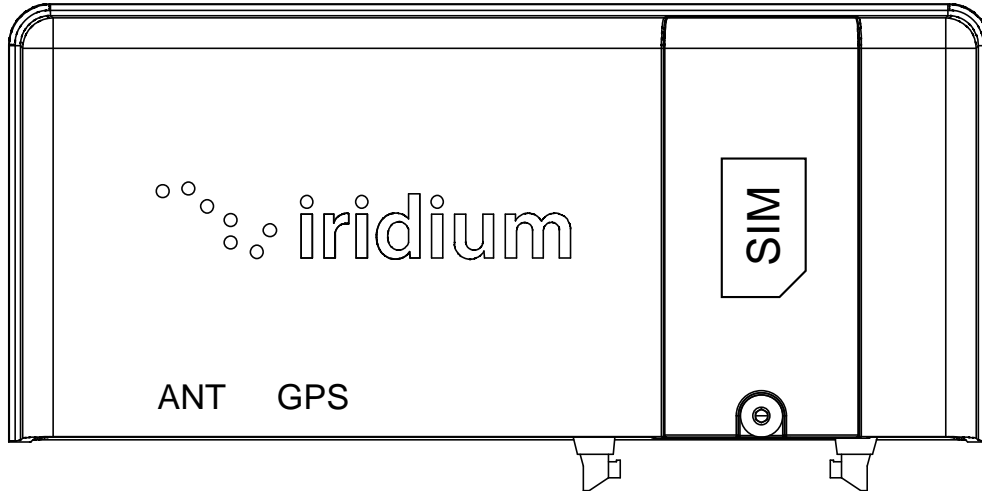


Figure 1: Front View of 9522B

### 3.1 Environmental

The environmental specifications of the 9522B LBT are summarized in Table 1 below.

Table 1: Environmental Specifications

Parameter	Value
Operating Temperature Range	-30°C to +60°C
Operating Humidity Range	25 to 75% RH
Storage Temperature Range	-40°C to +85°C
Storage Humidity Range	≤ 93% RH

The 9522B LBT may additionally be operated up to +70°C only if it is mounted in a location that is inaccessible to the user.

The unit must have adequate ventilation - if this is not done the surface of the unit may become hot enough to cause burns.

The 9522B LBT has been tested to the specifications listed in Table 2.

**Table 2: Environmental Tests**

Test Name	Test Reference	Test Description
Thermal Shock	EN60068-2-14:2000 Test Na	-25°C to +70°C, 5 cycles of 1 hour each
Humidity	IEC60068-2-78:2002	Damp heat steady state 40°C 93% RH for 4 days
Shock	SAE J1455:1994, §4.10.3.2.2	Packaged unit – shipping and handling, 10 falls
Shock	EN60068-2-32:1993	Packaged unit – shipping and handling, 10 falls
Shock	EN60068-2-27:1993 Test Ea	Shock test to 15g peak, 11ms
Vibration	EN 60068-2-6:1996 Test Fc	Sinusoidal Vibration 2g peak from 10Hz to 2kHz
Ingress	EN60529:1991/A1:2000	Water and solid ingress to IP33

### 3.2 Dimensions

The overall dimensions of the 9522B LBT and its weight are summarized in Table 3 below. Dimensioned views of the 9522B LBT are shown in Figures 2-5 which follow. All dimensions are in mm unless otherwise stated.

**Table 3: Mechanical Dimensions**

Parameter	Value
Length	162 mm (6.38")
Width	81 mm (3.16")
Depth	28 mm (1.10")
Weight (approximate)	420 g

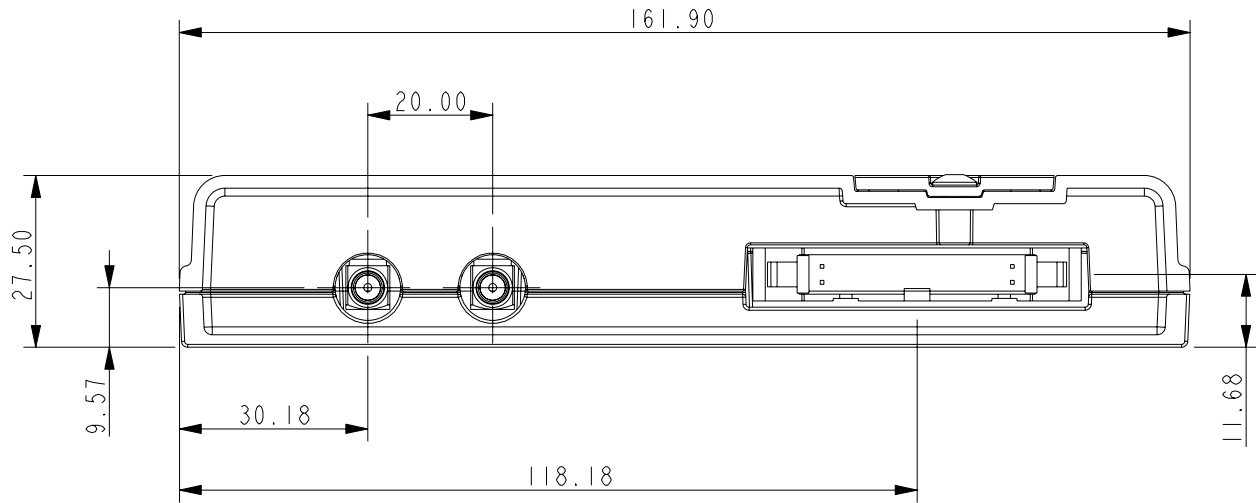


Figure 2: Bottom (connector) View

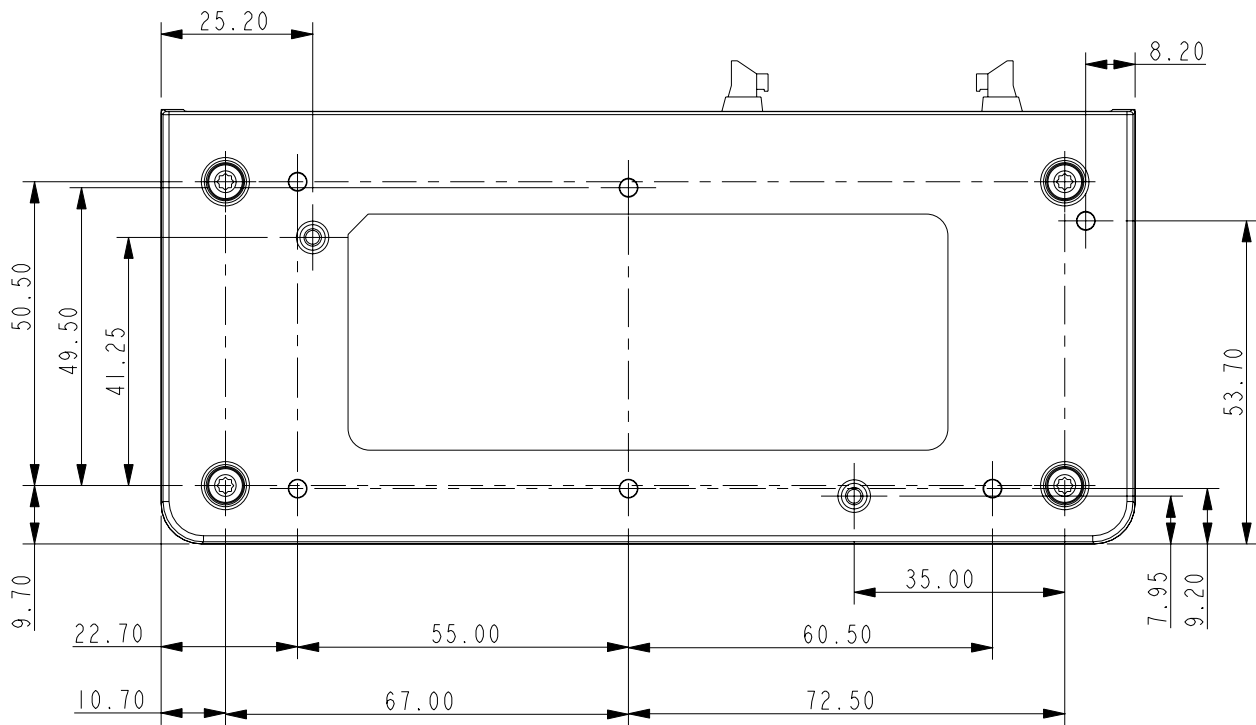
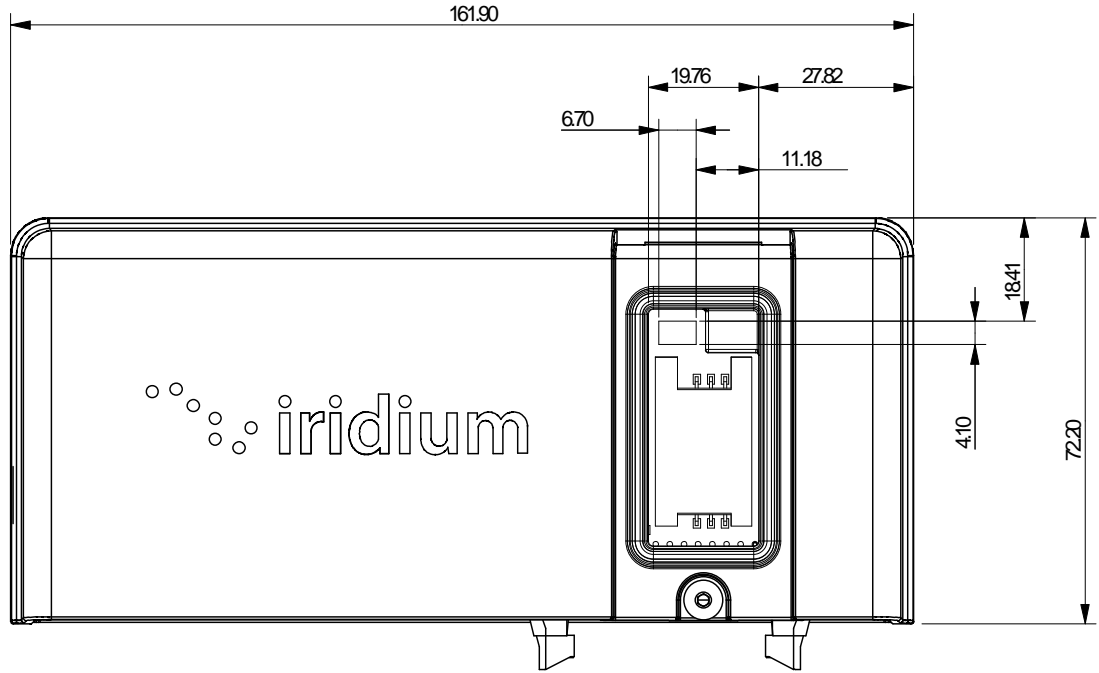
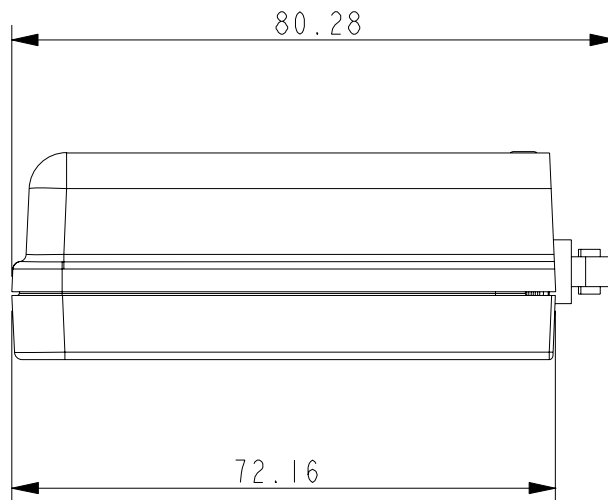


Figure 3: Back (mounting) View



**Figure 4: Front (SIM access) View**



**Figure 5: End View**

### 3.3 Interface Connectors

The 9522B LBT incorporates four interface connectors:

- Multi-Interface Connector (located at the right-hand end of the bottom of the 9522B LBT)
- Antenna Connector (located at the left-hand end of the bottom of the 9522B LBT)
- GPS Feed Through Connector (located in the middle of the bottom of the 9522B LBT)
- Subscriber Identity Module (SIM) Connector (located beneath a cover plate on the front of the 9522B)

LBT)

### 3.3.1 Multi-Interface Connector

The multi-interface connector is a standard 26-pin 0.1” pitch short latch IDC header with pins in two rows of 13. Connection to this is made using a 26-way IDC without strain relief (such as AVX/Kyocera 00 8290 026 000 0X 1 or Harting 09 18 526 7803). To support legacy applications, a cable is available that converts its pin-out to a DB25 connector with the same pin-out as the 9522A. The connector includes four interfaces:

- DC Power
- Control/Digital Audio (DPL bus)
- RS232 Data
- Analog Audio

The pin out information for this connector is given in Table 4 and Figure 6 below. The pin out from the DB25 adapter is given in Table 5 below.

**Table 4: 26-way connector pin-out**

Contact	Signal	Description
1	EXT_ON_OFF	External connection for On / Off key input to LBT
2	AUDIO_GND	Analog audio (speaker and microphone) ground reference
3	EXT_11HZ	90ms “frame sync” signal (used in testing)
4	MIC_AUD	Microphone audio input to LBT
5	EXT_GND	Power Ground input to LBT
6	EXT_PWR	Power input to LBT
7	EXT_PWR	Power input to LBT
8	EXT_GND	Power Ground input to LBT
9	SPKR_AUD	Speaker audio output from LBT
10	DPL_TX	Digital Peripheral Link (UART) data output from LBT
11	DA_TX	PCM digital audio output from LBT
12	DF_DTR	Data / Fax Data Terminal Ready input to LBT
13	DF_RI	Data / Fax Ring Indication output from LBT
14	DPL_RX	Digital Peripheral Link (UART) data input to LBT
15	DF_RTS	Data / Fax Request to Send input to LBT
16	DF_DSR	Data / Fax Data Set Ready output from LBT
17	DF_S_TX	Data / Fax (UART) data input to LBT
18	DF_CTS	Data / Fax Clear to Send output from LBT
19	DF_DCD	Data / Fax Data Carrier Detect output from LBT
20	0V	Signal ground, 0V signal reference and return
21	DA_FS	PCM digital audio frame sync output from LBT
22	DA_RX	PCM digital audio input to LBT
23	DA_CLK	PCM digital 2.048MHz audio clock output from LBT
24	0V	Signal ground, 0V signal reference and return
25	DF_S_RX	Data / Fax data (UART) output from LBT
26	NETWORK_AVAILABLE	Network available output from LBT

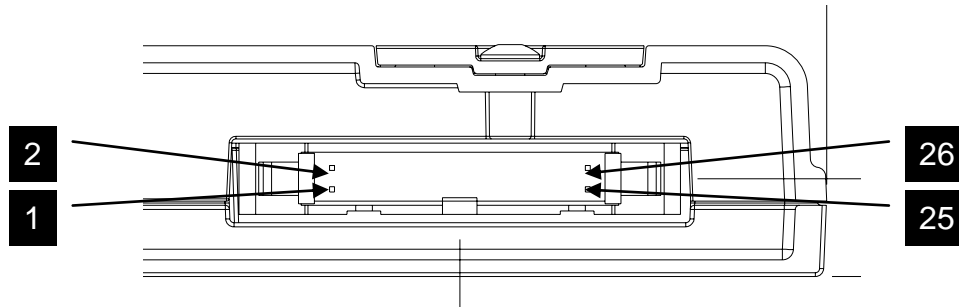


Figure 6: Pin identification on 26-way connector

Table 5: 25-way D connector pin-out

Contact	Signal	Description
1	EXT_ON_OFF	External connection for On / Off key input to LBT
2	EXT_11HZ	90ms "frame sync" signal (used in testing)
3	EXT_GND	Power Ground input to LBT
4	EXT_PWR	Power input to LBT
5	SPKR_AUD	Speaker audio output from LBT
6	DA_TX	PCM digital audio output from LBT
7	DF_RI	Data / Fax Ring Indication output from LBT
8	DF_RTS	Data / Fax Request to Send input to LBT
9	DF_S_TX	Data / Fax (UART) data input to LBT
10	DF_DCD	Data / Fax Data Carrier Detect output from LBT
11	DA_FS	PCM digital audio frame sync output from LBT
12	DA_CLK	PCM digital 2.048MHz audio clock output from LBT
13	DF_S_RX	Data / Fax data (UART) output from LBT
14	AUDIO_GND	Analog audio (speaker and microphone) ground reference
15	MIC_AUD	Microphone audio input to LBT
16	EXT_PWR	Power input to LBT
17	EXT_GND	Power Ground input to LBT
18	DPL_TX	Digital Peripheral Link (UART) data output from LBT
19	DF_DTR	Data / Fax Data Terminal Ready input to LBT
20	DPL_RX	Digital Peripheral Link (UART) data input to LBT
21	DF_DSR	Data / Fax Data Set Ready output from LBT
22	DF_CTS	Data / Fax Clear to Send output from LBT
23	0V	Signal ground, 0V signal reference and return
24	DA_RX	PCM digital audio input to LBT
25	0V	Signal ground, 0V signal reference and return

### 3.3.2 Antenna Connector

The 9522B LBT provides a single 50 Ω, SMA type antenna connector. This mates with a standard SMA plug, for example Radiall R125.072.000 (straight) or R125.172.000 (right-angle). An adaptor is available to convert this connector to TNC to enable the 9522B to be used as a replacement for a 9522A.

This port must be connected to an approved antenna, located with a clear view of the sky. If the GPS feed-through is being used then this antenna must also have sufficient sensitivity at GPS frequencies.

### **3.3.3 GPS Feed Through Connector**

9522B LBT passes the received signal through to this 50  $\Omega$ , SMA type connector, which mates with a standard SMA plug, for example Radiall R125.072.000 (straight) or R125.172.000 (right-angle). It is intended that this be connected to a GPS receiver. Note that this signal will be de-graded during a call.

### **3.3.4 SIM Chip Reader**

An integrated SIM chip reader is provided on the 9522B LBT. This connector allows installation of the chip form of the SIM beneath a cover plate on the 9522B LBT housing.

### **3.4 *Mounting***

The 9522B LBT incorporates (6) mounting holes on its bottom surface that can aid in its mounting. See Figure 3 for locations of these features. It is recommended that a thread-forming screw be used to mount the 9522B LBT via these features. Particularly, a Textron Camcar® Taptite® II Thread-Rolling Fastener of M3.5x0.6 thread type is recommended. This fastener has a 15IP Torx Plus® pan head and is available in lengths of 6, 8, 12, 16, and 20 mm as part number 3BE-P802-00, 3BE-P803-00, 3BE-P8185-00, 3BE-P804-00, 3BEP8186-00, and 3BE-P8187-00 respectively. Length should be chosen to ensure that penetration into the 9522B LBT housing does not exceed 11 mm. If a 6-32 thread type is desired, a Textron Camcar® Taptite® II Thread-Rolling Fastener with a 15IP Torx Plus® pan head is available in lengths of 1/4, 5/16, 3/8, 1/2, 5/8, 3/4, and 1 inch as part number 3BE-P814-00, 3BE-P8123-00, 3BE-P815-00, 3BE-P816-00, 3BE-P8124-00, 3BE-P817-00, and 3BE-P818-00 respectively. A 10IP Torx Plus® flat head version is also available in a single length of 1/2 inch as part number 3BE-P801-00. Another 6-32 thread type option is to insert a helical coil insert with a 6-32 internal thread into these features thus accommodating 6-32 threaded fasteners as mounting hardware for the 9522B LBT. National Aerospace Standard NASM122238 serves as a technical reference for the recommended helical coil insert.

### **3.5 *Mounting in Harsh Environments***

If the 9522B LBT is to be used in a harsh environment with exposure to high humidity, water or dust, the LBT must be installed in the correct orientation, with all connectors facing downwards.

## 4.0 Electrical Interfaces

The subsections to follow contain interface information for the electrical interfaces of the 9522B LBT.

### 4.1 DC Power Interface

#### 4.1.1 DC Power Interface Signal Descriptions

The DC power interface is comprised of the DC power inputs and a control signal as summarized in Table 6 below. The EXT\_PWR and GND inputs are used to supply DC power to the 9522B LBT. The EXT\_ON\_OFF control input is pulled to a GND level to toggle the 9522B LBT on and off. Note that both pairs of pins should be connected for EXT PWR and EXT GND.

**Table 6: Control/Audio Interface Signal Descriptions**

Signal Name	Signal Description
EXT_PWR (pin 6 and 7)	External power input
EXT_GND (pin 5 and 8)	External power GND input
EXT_ON_OFF (pin 1)	Power on/off control input

#### 4.1.2 DC Power Input Specifications

The DC power requirements for the 9522B LBT are summarized in Table 7 below. Note that these requirements apply to DC power measured at the 9522B LBT multi-interface connector input.

**Table 7: DC Power Input Specifications**

Parameter	Value
Nominal Main Input Voltage	+4.4 VDC to +28 VDC
Main Input Voltage Limits	+4.0 VDC to +32 VDC
Main Input Voltage – Ripple	40 mV peak to peak
<i>Consumption at +5 VDC</i>	
	Value
Input Standby Current (average)	300mA
Max current during call	2.5A
Typical current during call (see note)	800mA
Power Average – Voice/Data Call (see note)	4W

Note: The average power consumption depends on the view of the satellite constellation from the antenna.

The 9522B is intended to be supplied from a limited power source with a fuse or equivalent protection device of no more than 3A. It is the responsibility of the installer to ensure that the complete system (of which the 9522B forms a part) complies with EN60950-1 or UL60950-1 as applicable. In particular the complete system must be capable of withstanding the 10kV surge test from clause 7 of this standard if its power source is derived from a mains adapter.

Damage may result if the LBT is operated outside of the main input voltage limits.

## 4.2 Control/Digital Audio Interface (DPL bus)

### 4.2.1 Control/Digital Audio Interface Signal Descriptions

The control/digital audio interface enables peripherals such as handsets and SIM card readers to be interfaced to the 9522B LBT. The interface utilizes an Iridium Proprietary communication bus not detailed in this fact sheet. Details can be made available after appropriate Non-Disclosure and/or License Agreements are executed.

The signal levels for the DPL bus (DPL\_RX and DPL\_TX signals) can be RS232 or logic level. The level can be selected using the switch that is accessible when the SIM cover plate is removed as shown in Figure 7 below. The switch should be moved to the right (when the unit is positioned with the connectors facing the user) towards the RS232 lettering in copper on the PCB.

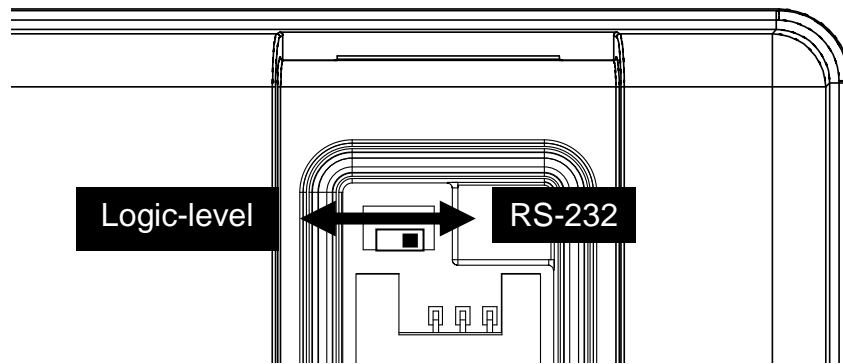


Figure 7: Location of DPL level switch

## 4.3 RS232 Data Interface

### 4.3.1 RS232 Data Signal Descriptions

The RS232 data interface is comprised of eight standard RS232 data, control, and status signals plus a ground level signal reference. This interface allows a connected Data Terminal Equipment (DTE) to utilize the 9522B LBT's modem functionality via AT command control. A 3-wire RS232 Data minimal interface may also be implemented however the 9 wire interface offers better control and is the recommended implementation.

### 4.3.2 Autobaud

Autobaud is enabled by default. Autobaud will occur on the following characters 'a', 'A', or CR (carriage return). Autobaud will also occur on the escape sequence character, provided this is an odd number character. Normally this is set to '+' in register S2. See the AT Command Reference for details.

## 4.4 Analog Audio Interface

### 4.4.1 Analog Audio Interface Signal Descriptions

The analog audio interface is comprised of the analog audio input and output signals referenced to the audio signal ground as summarized in Table 7 below. AUDIO\_GND is internally connected to 0V, but noise can be reduced by connecting audio signal returns directly to this pin, rather than to 0V.

**Table 7: Analog Audio Interface Signal Descriptions**

Signal Name	Signal Description
MIC_AUD (pin 4)	Analog audio input to LBT
SPKR_AUD (pin 9)	Analog audio output from LBT
AUDIO_GND (pin 2)	Analog audio ground reference

## 4.5 SIM Interface

An integrated SIM chip reader is provided on the 9522B LBT. An external SIM card reader may also be interfaced as a peripheral to the 9522B LBT via the DPL bus (control/audio interface). A SIM card in the external reader will take precedence over the SIM chip in the integrated connector when both are present.

## 4.6 RF Interface

### 4.6.1 RF Interface Specifications

The RF interface requirements for the 9522B LBT are summarized in Table 8 below.

**Table 8: General RF Parameters**

Parameter	Value
Frequency Range	1616 MHz to 1626.5 MHz
Duplexing Method	TDD (Time Domain Duplex)
Oscillator Stability	$\pm 1.5$ ppm
Input/Output Impedance	50 $\Omega$
Multiplexing Method	TDMA/FDMA

### 4.6.2 GPS Feed Through Specification

The GPS feed through connector is provided to allow an Iridium 9522B and a GPS module to share a single antenna. When used in this way, the antenna is connected to the antenna connector, described in 3.3.2 above. Then the GPS receiver module can be connected to the GPS feed through connector output on the 9522B. When the 9522B is powered but not transmitting, any GPS signal received on the antenna is passed through to the GPS output. Either a passive or an active GPS module can be connected to the 9522B GPS port.

The gain from the 9522B antenna input to the GPS connector is 0dB (+/- 2dB).  
The GPS output is available at all times when the 9522B is powered, except during the transmit cycle<sup>1</sup>.

The RF interface of the GPS feed through connector is summarized in Table 9 below.

**Table 9: General RF Parameters**

Parameter	Value
Frequency Range	1575 MHz
Output Impedance	50 $\Omega$
Insertion Loss	+/-2dB
Noise Figure	$\leq 7$ dB

This should provide adequate signal for most GPS receivers because the Iridium antenna will already be well sited. If the Iridium antenna is being shared with GPS then it is important to use an antenna with adequate gain at 1575MHz.

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<sup>1</sup> During the transmit cycle there will be some energy at the Iridium frequency which may adversely affect the AGC system of some GPS receivers.

### 4.6.3 Radio Characteristics

The tables within this section contain radio characteristics of the 9522B LBT.

**Table 10: In-Band Characteristics**

Parameter	Value
Average Power during a transmit slot (max)	7 W
Average Power during a frame (typical)	0.6 W
Receiver Sensitivity at 50Ω (typical)	-118.5 dBm
Receiver Spurious Rejection at offsets > 1 MHz (typical)	60 dB

**Table 11: Link Margin**

Configuration	Cable Loss	Link Margin
9522B LBT with accessory antennas (Note 1)	2 dB (Note 2)	13.1 dB (Note 3)

Note 1: Other antenna options are available

Note 2: Cable losses should be minimized

Note 3: Link Margin given for free space

## 5.0 Instructions for the safe Installation and use of the 9522B LBT

The 9522B LBT is intended for integration into a finished product. The integrator of the 9522B LBT is required to connect a power supply, antenna, and user interface to the 9522B LBT. To ensure that the 9522B LBT is correctly installed the following general instructions (sub-section 5.1) are provided for the installer.

The integrator will be required to supply the end user of the integrated product, incorporating the 9522B LBT, with operating instructions and any other information relating to the maintenance and safety of the equipment (sub-section 5.2).

### 5.1 *Instructions for the Integrator*

- The 9522B LBT must be installed by an appropriately qualified installer and mounted securely as described in section 3.4 of this document.
- The power supply used to power the 9522B LBT must be checked to ensure it meets the requirements of sub-section 4.1.2 of this document.
- Electrical connections to the 9522B LBT multi-interface connector shall be as designated in Table 4 of sub-section 3.3.1 of this document.
- The current and voltage rating of the multi-interface connector cable shall meet the requirements of the LBT DC power input.
- The electrical characteristics of the multi-interface connector cable shall not degrade the 9522B LBT digital communications and analog audio signals.
- The multi-interface connector cable will provide adequate screening from external electromagnetic interference.
- The 9522B LBT shall not be located in close proximity to sources of extreme temperature which will cause it to be operated outside of its temperature specification.
- The 9522B LBT shall not be operated without an appropriate antenna connected to its Antenna connector via a suitable 50 Ohm coaxial cable. This antenna shall be sited at least 20cm away from any person.

### 5.2 *Instructions from the integrator to the user*

To comply with the requirements of sub-clause 1.7.2 (Safety instructions) of the European Information technology equipment safety standard EN60950-1:2002 the integrator must ensure that:

*'Sufficient information shall be provided to the USER concerning any condition necessary to ensure that, when used as prescribed by the manufacturer, the equipment is unlikely to present a hazard within the meaning of this standard. If it is necessary to take special precautions to avoid the introduction of hazards when operating, installing, servicing, transporting or storing equipment, the necessary instructions shall be made available.'*

As part of these instructions the installer should inform the user that they should not service the 9522B LBT.

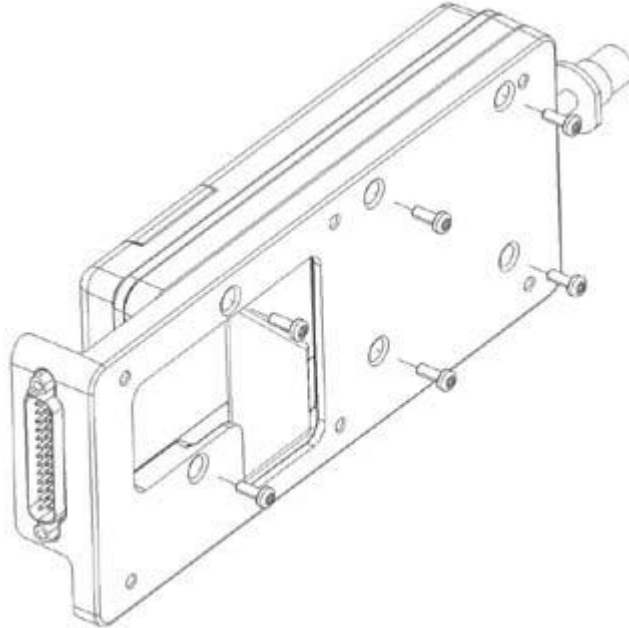
## 6.0 Modem Commands and Configuration

The 9522B is configured through the use of AT commands. A full listing of the supported AT commands can be found in the AT Command Reference document.

## 7.0 Installation of the 9522B in place of a 9522A

The 9522B is designed to replace the 9522A with the assistance of an optional adapter plate and cables. An adapter plate is mounted onto the 9522B and provides mounting points similar to those of the 9522A. The antenna cable adapter provides a cable-mounted TNC connector similar to the 9522A. The Multi-interface adapter cable provides a mechanical and electrical interface similar to the 9522A (although please see the note in section 7.2 below)

The 9522B LBT incorporates (6) mounting holes on its bottom surface that can aid in its mounting. It is recommended that a thread-forming screw be used to mount the 9522B LBT via these features.



**Figure 8: Mounting holes**

Particularly, a Textron Camcar® Taptite® II Thread-Rolling Fastener of M3x8 thread type is recommended. The adaptor bracket now provides the same footprint as the 9522A which can be mounted using six M3.5 thread forming screws of appropriate length to accommodate the mounting bracket thickness and still provide 3 to 7 mm of thread engagement with the adaptor. The screws must NOT protrude more than 8 mm into the adaptor bracket or the 9522B could be damaged. An Acument™ Taptite II ® or equivalent with a Torx plus pan head is recommended.

## 7.1 Physical characteristics

The physical design of the 9522B adapter is given in Figures 7-10 which follow. All dimensions are in mm unless otherwise stated. The TNC adapter is cable-mounted to allow flexibility in the routing of the antenna cable.

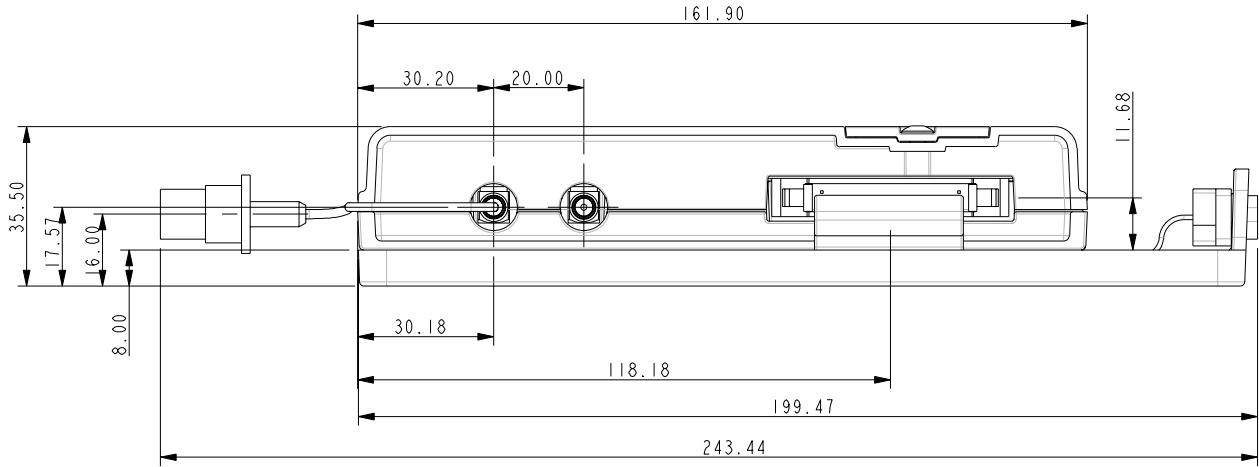


Figure 9: Bottom (connector) View

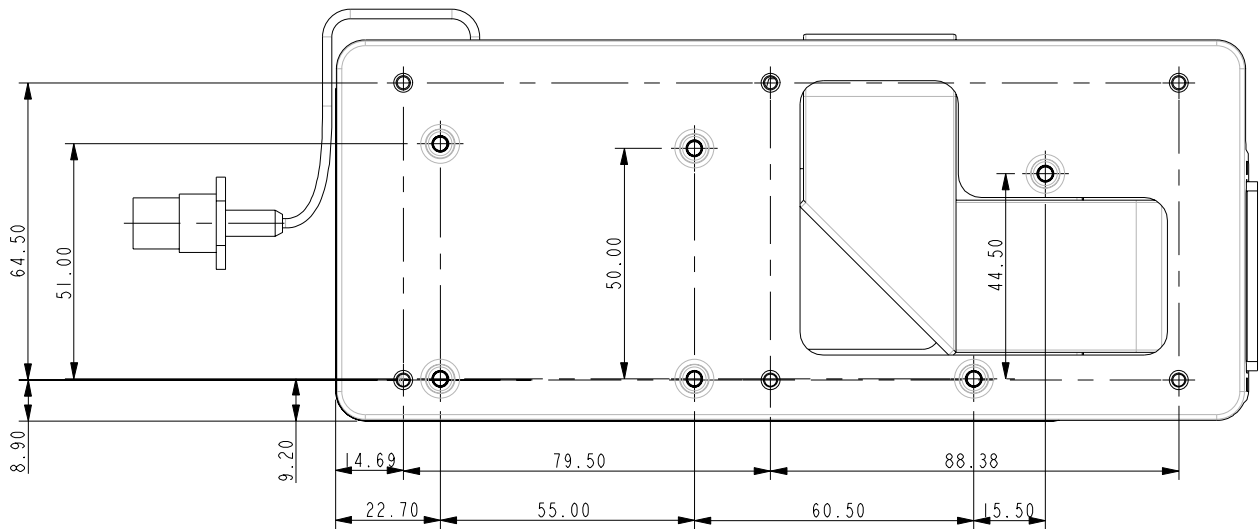
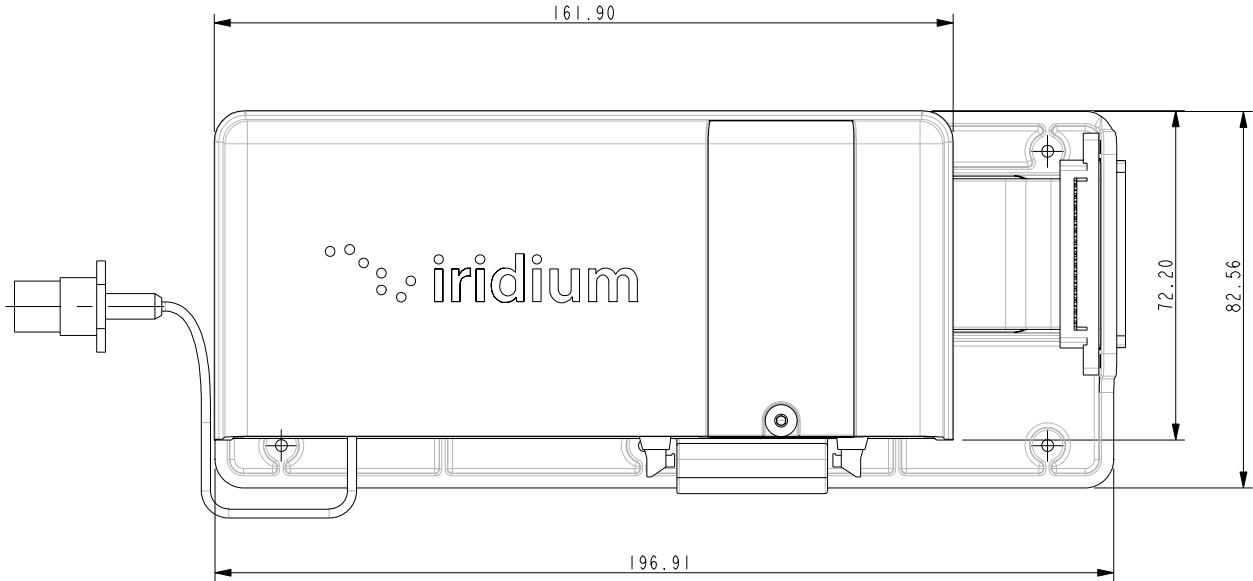
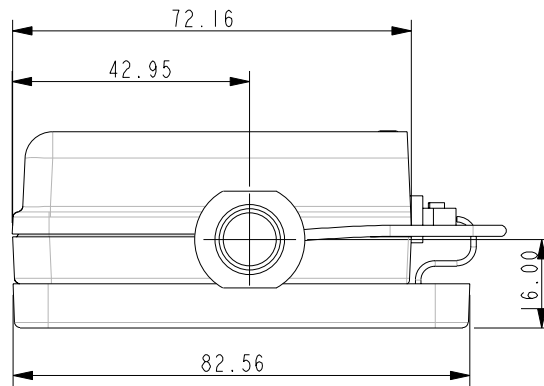


Figure 108: Back (mounting) View



**Figure 11: Front (SIM access) View**



**Figure 12: End View**

## **7.2 Power Supply**

With the adapter cables in use, the requirements for the signals to and from the 9522B are as given in section 3.3. Note that it is important to ensure that the power supply voltage measured at the 9522B multi-way connector does not fall below 4.0v. In order to allow for the voltage drop due to the resistance of the adapter cable and connectors, it is recommended that the voltage at the 25-way D-type connector should be 4.2v minimum. If it is possible to change the supply voltage in the application, it is recommended that 5v, 12v or 24v is used, as the effect of voltage drop will be reduced and the 9522B operates more efficiently.

## **7.3 Analog Audio**

The 9522B analog audio connections are compatible with those of 9522A. However analog noise can be reduced by referencing both analog audio signals back to AUDIO\_GND rather than to 0V.