Iridium Short Burst Data Service
Developers Guide

Release 1.0

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Iridium Satellite LLC Confidential & Proprietary

Revision History

Version	Date	Reason
1.0	June 1, 2003	First Commercial Release

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1 Introduction

1.1 Purpose

The purpose of this document is to provide technical and operational information sufficient for an Iridium Value Added Reseller to be able to develop an integrated data application that utilizes Iridium's Short Burst Data Service (SBD).

An overview of the satellite network is provided as well as descriptions of the terminal equipment and the end to end communications protocol for SBD. This document is intended for use by technical personnel and assumes a reasonable level of technical skill and familiarity with satellite and/or wireless data applications.

1.2 Scope

This document defines:

- Specific SBD related AT commands and responses.
- How the SBD protocol works through an overview and command descriptions.
- Basic physical interface requirements.

Additional documents are referenced which provide more specific detail on certain topics and these are listed in Section 1.4 of this document.

1.3 Definitions, Acronyms, and Abbreviations

API	Application Programming Interface
ATC	AT Command
DTE	Data Terminal Equipment
ECS	ETC Communications Subsystem
ESS	ETC SBD Subsystem
ETC	Earth Terminal Controller
ETS	ETC Transmission Subsystem
FA	Field Application
IMEI	International Mobile Equipment Identity
ISU	Iridium Subscriber Unit
LBT	L-Band Transceiver
MIME	Multipurpose Internet Mail Extensions
MO	Mobile Originated
MOMSN	Mobile Originated Message Sequence Number
MSN	Message Sequence Number
MT	Mobile Terminated
MTMSN	Mobile Terminated Message Sequence Number
Mobile Terminated Buffer	This is the buffer in the ISU in which an SBD message sent from the ESS to the ISU will be stored.
SBD	Short Burst Data
Mobile Originated Buffer	This is the buffer in the ISU in which an SBD message to be sent from the ISU to the ESS will be stored.
SEP	SBD ETC Processor
SPP	SBD Post Processor
UTC	Coordinated Universal Time
VA	Vendor Application

1.4 References

1.4.1 Specifically Referenced Documents

[1] Motorola Satellite Series 9522 L-Band Transceiver Fact Sheets

[2] ISU AT Command Reference Version 2.0

[3] Motorola Satellite Series 9522 L-Band Transceiver Interface Specification

These documents are accessible from the http://vams.iridium.com, web site that is available only to authorized Value Added Manufacturers or Value Added Resellers.

1.4.2 Other Useful Documents

- Data Services Overview: The document includes Frequently Asked Questions (FAQs) for both Dial-up and Direct Internet Data Services. Both of these services are circuit switched.
- Dial-Up Data User's Guide: Provides detailed description of the set-up and use of dial-up data services
- Mobile Terminated Data User's Guide: Provides a detailed description of the set-up, operation, and constraints as it relates to terminating data calls.

These documents are accessible from the Iridium public web site: http://www.iridium.com.

2 Overview

Iridium's Short Burst Data Service (SBD) is a simple and efficient satellite network transport capability to transmit short data messages between field equipment and a centralized host computing system. A Mobile Originated (MO) SBD message can be between 0 and 1960 bytes. [Note that a zero (0) byte MO SBD message is referred to as a "Mailbox Check."] A Mobile Terminated (MT) SBD message can be between 1 and 1890 bytes.

The primary elements of the end to end SBD architecture are shown in Figure 1. Specifically, the elements consist of the Field Application (FA), the Iridium Subscriber Unit (ISU), the Iridium satellite constellation, the Earth Terminal Controller SBD Subsystem (ESS) located at the Iridium gateway, the Internet, and the Vendor Application (VA.) More details on the system architecture are shown in Figure 2.

The Field Application represents the hardware and software that is configured by the VAR for specific applications such as collecting and transmitting GPS data. The ISU is the Iridium 9522 L-Band Transceiver (LBT) with the SBD feature activated. The ESS is responsible for storing and forwarding messages from the ISU to the Vendor Application and storing messages from the Vendor Application to forward to the ISU. The ISU communicates with the ESS via the Iridium satellite network.

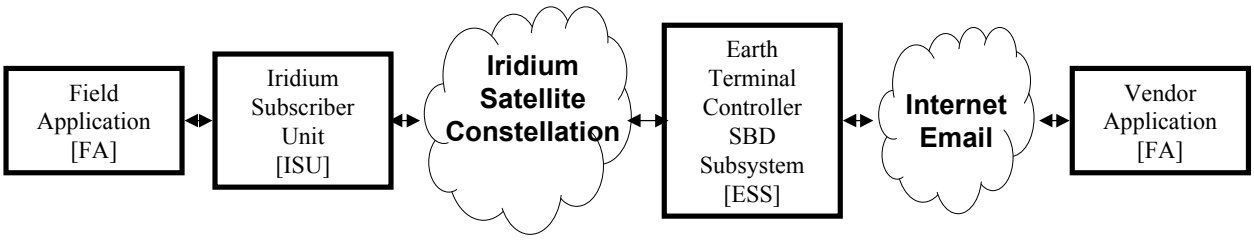
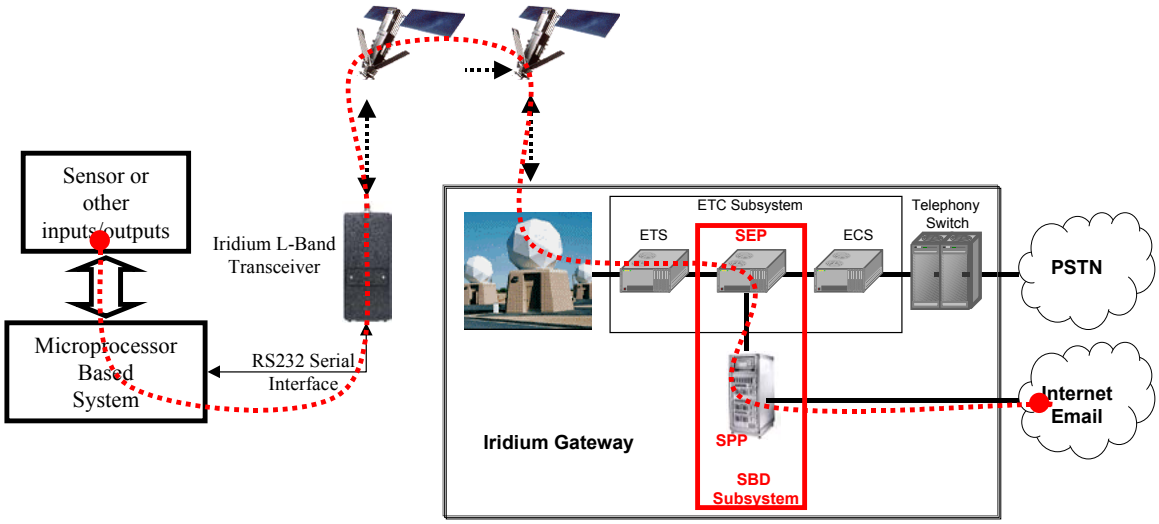


Figure 1 Short Burst Data Architecture.

Figure 2

SBD System Architecture showing the new SBD specific network elements "SBD Subsystem."



The interface between the Vendor Application and the ESS uses standard Internet mail protocols to send and receive messages. Messages are sent to the ESS using a common email address, identifying the specific ISU by encoding the unique ISU IMEI in the subject line of the email. The data message itself is transported as a binary attachment to the email. Messages sent to the Vendor Application are delivered to a specific email address that is configured when the IMEI is activated. The delivery address for each IMEI can be changed on-line by the VAR using the Iridium SPNet provisioning tool.

The interface between the FA and the ISU is a RS232 serial connection with extended proprietary AT commands. This interface is used to load and retrieve messages between the ISU and the Field Application.

For a Mobile Originated SBD Message (MO-SBD) the message is loaded into the MO buffer in the ISU using the +SBDWB or +SBDWT AT Commands, a message transfer session between the ISU and the ESS is initiated using the AT Command +SBDI. For a Mobile Terminated SBD Message (MT-SBD) the ISU initiates a Mailbox Check using the AT Command +SBDI and when the message is received from the ESS it can be retrieved from the MT buffer in the ISU by the Field Application using the +SBDRB or +SBDRT AT Commands.

Messages are transferred between the ISU and the ESS using a reliable transport mechanism that ensures the message is delivered error free. If the ISU was not able to send or receive messages, an indication is passed to the FA via the serial interface.

The MO and MT message buffers in the ISU will maintain messages as long as the ISU is powered on. Once a message is transferred from the FA to the MO buffer in the ISU, it will remain there even after it is successfully sent to the ESS. If a MT message is received at the ISU from the ESS, it will remain in the MT buffer even after the FA reads it. The buffers in the ISU will be cleared only when either given an explicit command (+SBDD) or when the ISU is power cycled or is overwritten with new data. The MT buffer will be cleared when a SBD session is initiated with the +SBDI command.

3 Vendor Application to ESS Interface Description

For each MO or MT message the VA will receive an email for each session that reaches the ESS regardless of any message transfer.

3.1 Mobile Terminated Messages

In order to send a MT message from the Vendor Application to the Field Application, the Vendor Application must send the message to the ESS where it will be queued for delivery awaiting contact from the ISU to retrieve it.

Figure 3 provides an example MT email message, the formatting rules are outlined below:

- Messages to all ISU units are sent to the email address: Data@SBD.Iridium.com
- Placing the ISU IMEI into the subject line of the email identifies the destination ISU unit.
- If the message does not contain a valid sender (From address), the message will be dropped.
- The message to the ISU will be carried in the attachment to the email.
- The attachment name must have a .sbd file name extension.
- The attachment must be from one to 1890 bytes in length.
- The attachment must use standard Multipurpose Internet Mail Extensions (MIME) Base64 encoding as defined in RFC 2045.
- The message body plays no role in the message transfer process; any information contained in the body will be discarded.

```
To: Data@SBD.Iridium.com
From: VA@VendorDomain.com
Subject: 304050607080903
<Message Attached>
```

Figure 3 Mobile Terminated Email Message

If the Vendor Application attempts to queue more than 50 messages for delivery at the ESS, a rejection notice email similar to will be sent to the message originator (From address).

Figure 4 Mobile Terminated Email Message Rejection Notice

```
To: VA@CustomerSite.com
From: sbdservice@sbd.iridium.com
Subject: Failure to send to unit 304050607080903
Original message is attached
<Message Attached>
```

3.2 Mobile Originated Messages

Messages sent from the ISU to the ESS are stored at the ESS then immediately forwarded to the destination email address that was designated when the ISU IMEI was provisioned. The message sent to the Vendor Application from the ISU will be carried as a binary attachment to an email from the ESS to the Vendor Application. The binary attachment is encoded using standard MIME Base64 encoding as defined in RFC 2045. Unlike Mobile Terminated messages sent to the ESS, Mobile Originated messages sent to the Vendor Application carry additional information in the email message body. This information includes the Mobile Originated Message Sequence Number (MOMSN), the time of the session, the session status, the message size, and the ISU unit location. The format of the email message is provided in Figure 5, details of the email message fields are provided in Table 1.

```
From: sbdservice@sbd.iridium.com
Sent: Tuesday, August 13, 2002 16:51 PM
Subject: SBD Msg From Unit: 304050607080903

MOMSN: 2
MTMSN: 239
Time of Session (UTC): Tue Aug 13 16:51:04 2002
Session Status: TRANSFER OK
Message Size (bytes): 1230

Unit Location: Lat = 59.372463 Long = 75.309806
CEPradius = 3

Message is Attached.
```

Figure 5 Mobile Originated Email Message

Table 1 Mobile Originated Message Email Message Field Description

<table>
<tr><th>Field Name</th><th colspan="2">Description</th></tr>
<tr><td>From</td><td colspan="2">This field identifies the sender of the email message as the SBD Service.</td></tr>
<tr><td>Sent</td><td colspan="2">This field provides the time at which the message was emailed from the ESS to the Vendor Application. The timestamp is in UTC.</td></tr>
<tr><td>Subject</td><td colspan="2">This field provides the ISU IMEI of the unit that sent the MO message.</td></tr>
<tr><td>MOMSN</td><td colspan="2">This field provides the MSN used by the ISU when the message was sent from the ISU to the ESS. This value is incremented each time an SBD session is successfully completed between the ISU to the ESS. This wrap around counter can range from 0 to 65535.</td></tr>
<tr><td>MTMSN</td><td colspan="2">This field provides the MSN used by the ESS when the message was forwarded from the ESS to the ISU. This field will have a value of zero (0) if no MT message was transferred during an associated SBD session. This value is incremented each time the ESS forwards a message to any ISU. This wrap around counter can range from 0 to 65535. [Note: This counter is not unique to each IMEI, but rather it increments every time the ESS sends a message to <u>any</u> ISU.]</td></tr>
<tr><td>Time of Session</td><td colspan="2">This field provides the UTC timestamp of the ISU session between the ISU and the ESS.</td></tr>
<tr><td>Session Status</td><td colspan="2">This field provides the result of SBD session between the ISU and the ESS and has four possible results shown below.
<table>
<tr><th>Session Status</th><th>Description</th></tr>
<tr><td>TRANSFER OK</td><td>The SBD session between the ISU and the ESS completed successfully.</td></tr>
<tr><td>INCOMPLETE CALL</td><td>The SBD session between the ISU and the ESS did not complete due to a protocol error. This would imply a problem with the Iridium network.</td></tr>
<tr><td>SBD DENIAL</td><td>The ISU is not allowed to access the system</td></tr>
<tr><td>SBD TIMEOUT</td><td>The SBD session between the ISU and the ESS did not complete for an unknown reason such as a RF fade.</td></tr>
</table></td></tr>
<tr><td>Message Size</td><td colspan="2">This field provides an indication of the size of the attached message in decoded form. This not the length of the MIME encoded data.</td></tr>
<tr><td>Unit Location</td><td colspan="2">This field provides the geographic location of the ISU. The latitude and longitude provide a center point and the CEPradius provides the radius of a circle around that center point. The reported position is accurate (within the reported circle) 80 percent of the time.</td></tr>
<tr><td>CEPradius</td><td colspan="2">This field provides an estimate of the accuracy of the unit location and is reported in Kilometers.</td></tr>
</table>

4 Field Application to ISU Interface

4.1 RS-232 Interface

The RS-232 interface on the 9522 is designed to auto-baud to the DTE device connected to it. The various port configuration options are outlined in Table 2.

Table 2 R232 Port Settings

Port Parameter	Acceptable Values	Default Value
Speed	1200, 2400, 4800, 9600, 19200, 38400	19200
Data Bits	7, 8	8
Stop Bits	1, None	1
Parity	Even, Odd, None	None

Note that it is not recommended to operate the serial port above 38400. See also the AT Command +IPR in the AT Command Set Reference.

4.2 AT Commands

This section describes only the subset of AT commands that are specifically used for SBD functions. Refer to [2] for all other AT commands that are supported by the Iridium Subscriber Units.

4.2.1 +SBDWB – Write binary data to the ISU

This command is used to transfer a binary SBD message from the FA to the Mobile Originated buffer in the ISU. The Mobile Originated buffer can contain only one message at any one time.

Exec Command: +SBDWB=[<SBD message length>]<CR>

- Once the command is entered, the ISU will indicate to the FA that it is prepared to receive the message by sending the ASCII encoded string "READY<CR><LF>" (hex 52 45 41 44 59 0D 0A) to the FA.
- The <SBD message length> parameter represents the length, in bytes, of the SBD message not including the mandatory two-byte checksum.
- The maximum MO-SBD message length is 1960 bytes. The minimum MO-SBD message length is 1 byte.
- Once the FA receives the READY indication from the ISU, the SBD message must be sent from the FA in the following format:

  {Binary SBD message} + {2-byte checksum}

  - The checksum is the least significant 2-bytes of the summation of the entire SBD message. The high order byte must be sent first. For example if the FA sends the word "hello" encoded in ASCII to the ISU the binary stream would be hex 68 65 6c 6c 6f 02 14.
  - The MO buffer will be empty upon power-up.
- If any data is currently in the MO buffer, it will be overwritten.

Command Response	Response Definition
0	SBD message successfully written to the ISU.
1	SBD message write timeout. An insufficient number of bytes were transferred to ISU during the transfer period of 60 seconds.
2	SBD message checksum sent from DTE does not match the checksum calculated at the ISU.
3	SBD message size is not correct. The maximum MO-SBD message length is 1960 bytes. The minimum MO-SBD message length is 1 byte.

4.2.2 +SBDRB – Read binary data from ISU

This command is used to transfer a binary SBD message from the Mobile Terminated buffer in the ISU to the FA. The Mobile Terminated buffer can contain only one message at any one time.

Exec Command: +SBDRB<CR>

- The SBD message is transferred formatted as follows:

  {2-byte message length} + {binary SBD message} + {2-byte checksum}

  - The {2-byte message length} field represents the length, in bytes, of the SBD message not including the length field or the mandatory two-byte checksum. The high order byte will be sent first.
  - The maximum MT-SBD message length is 1890 bytes.
  - The checksum is the least significant 2-bytes of the summation of the entire SBD message. The high order byte will be sent first. For example if the ISU sent the word "hello" encoded in ASCII to the FA the binary stream would be hex 00 05 68 65 6c 6c 6f 02 14 0d 0a 4f 4b 0d 0a reflecting a successful transfer with the standard AT Command response <CR><LF>OK<CR><LF> following the two-byte checksum.
  - If there is no MT-SBD message waiting to be retrieved from the ISU, the message length and checksum fields will be zero.
- The Mobile Terminated message buffer will be empty upon power-up.

Command Response:

There are no response codes generated by the ISU for this command.

4.2.3 +SBDWT – Write a text message to the ISU

This command is used to transfer a text SBD message from the FA to the Mobile Originated buffer in the ISU.

Exec Command: +SBDWT=[<text message>]<CR>

- The length of <text message> is limited to 120 bytes, this is due to the length limit on the AT command line interface.
- The message is terminated when a carriage return is entered.
- The MO buffer will be empty upon power-up.

Command Response	Response Definition
OK	SBD message stored in MO buffer successfully.
ERROR	An error occurred storing SBD message in MO buffer

4.2.4 +SBDRT – Read a text message from the ISU

This command is used to transfer a text SBD message from the Mobile Terminated buffer in the ISU to the FA. The intent of this command is to provide a human friendly interface to SBD for demonstrations and application development. It is expected that most usage of SBD will be with binary messages.

Exec Command: +SBDRT<CR>

- Once the command is entered, the SBD message in the MT buffer is sent out of the port.
- This command is similar to the +SBDRB except no length or checksum will be provided.
- The data read is followed with the standard AT Command response <CR><LF>OK<CR><LF> if successful.
- The maximum MT-SBD message length is 1890 bytes.
- The MT message buffer will be empty upon power-up.

Command Response:

+SBDRT: <CR> {receive buffer}

4.2.5 +SBDI – Initiate an SBD session

This command initiates an SBD session between the ISU and the ESS. If there is a message in the MO buffer it will be transferred to the ESS. Similarly if there is one or more messages queued at the ESS the oldest will be transferred to the ISU and placed into the MT buffer.

Exec Command: +SBDI<CR>

- The message, if any, in the MO buffer will be sent from the ISU to the ESS.
- If there is a message queued at the ESS it will be transferred to the ISU and placed into the MT buffer.

Command Response:

+SBDI: <MOStatus>,<MOMSN>,<MTStatus>,<MTMSN>,<MTLength>, MTQueued>

Command Response	Response Definition	
<MO Status>	Provides information the disposition of the Mobile Originated transmission. The field can take on the following values:	
	0	No MO-SBD message to transmit from the ISU.
	1	MO-SBD message successfully sent from the ISU to the ESS
	2	An error occurred while attempting to transmit the MO-SBD message from ISU to ESS.
<MOMSN>	The Mobile Originated Message Sequence Number (MOMSN) is a value assigned by the ISU when sending a message to the ESS. This value is incremented each time an SBD session is successfully completed between the ISU to the ESS. This wrap around counter can range from 0 to 65535.	
<MT Status>	Provides information the disposition of the Mobile Terminated transmission. The field can take on the following values:	
	0	No SBD message to receive from the ESS
	1	SBD message successfully received from the ESS.
	2	An error occurred while attempting to perform a mailbox check or receive a message from the ESS.
<MTMSN>:	The Mobile Terminated Message Sequence Number is assigned by the ESS when transmitting a message to the ISU. This value is incremented each time a message is sent from the ESS to any ISU. This wrap around counter can range from 0 to 65535. This value is indeterminate if the value is zero.	
<MT Length>	Length in bytes of the MT-SBD message transmitted from the ESS. If no message was received, this field will be zero.	
<MT Queued>	The number of MT-SBD waiting at the ESS to be transmitted to the ISU.	

4.2.6 +SBDD – Clear SBD Message Buffer(s)

This command is used to clear the Mobile Originated buffer, Mobile Terminated buffer or both.

Exec Command: +SBDD[<Delete type>]<CR>

- The <Delete type> parameter identifies which buffers are cleared.
  - 0: Clear the Mobile Originated buffer.
  - 1: Clear the Mobile Terminated buffer.
  - 2: Clear both the Mobile Originated and Mobile Terminated buffers.

Command Response:

0: Buffer(s) cleared successfully.

1: An error occurred while clearing the buffer(s).

Notes:

- Using this command or power cycling the phone are the only means by which both buffers are cleared.
- The Mobile Terminated buffer will be cleared when an SBD session is initiated.
- Sending a message from the ISU to the ESS does not clear the Mobile Originated buffer.
- Similarly reading a message from the ISU to the FA does not clear the Mobile Terminated buffer.

4.2.7 +SBDC – Clear SBD MOMSN

This command will clear (set to 0) the MOMSN number stored in the ISU.

Exec Command: +SBDC

- The message sequence number is maintained even after power cycle.

Command Response	Response Definition
0	The Mobile Originated Message Sequence Number was cleared successfully.
1	An error occurred while clearing the Message Sequence Number.

4.2.8 +SBDS – SBD Status

This command returns current state of the Mobile Originated and Mobile Terminated buffers.

Exec Command: +SBDS

Command Response:

+SBDS: <MO Flag>, <MOMSN>, <MT Flag>, <MTMSN>

Where:

Command Response	Response Definition	
<MO Flag>	Indicates the existence of a message in the Mobile Originated buffer. The response from the ISU is one of the following numeric codes.	
	0	No message in Mobile Originated buffer
	1	Message in Mobile Originated buffer
<MOMSN>	The MOMSN identifies the sequence number that will be used during the next Mobile Originated message transmission without regard to actual message transfer during that transmission.	
<MT Flag>	Indicates the existence of a message in the Mobile Terminated buffer. The response from the ISU is one of the following numeric codes:	
	0	No message in Mobile Terminated buffer
	1	Message in Mobile Terminated buffer
<MTMSN>	Identifies the sequence number that was used in the most recent Mobile Terminated transmission. This value will be –1 if there is nothing in the receive buffer.	

4.2.9 +SBDTC – Transfer MO Buffer to MT Buffer

This command will transfer the contents of the Mobile Originated buffer to the Mobile Terminated buffer. Developers can use this command to test reading and writing to the ISU without actually initiating SBD transmissions to the ESS. There is no numeric response code to this command. A message response is supplied instead.

Exec Command: +SBDTC

Command Response:

+SBDT: Outbound SBD copied to Inbound SBD: Osize=<size>, Isize=<size>

OK

Where:

Command Response	Response Definition
Osize=<size>	This is the size of the message in the MOSBD buffer
Isize=<size>	This is the size of the message transferred to the MT buffer from the MO buffer

5 Examples of SBD Usage

This section outlines some generic examples of SBD usage scenarios. The scenarios are merely examples and developers may use the SBD AT Commands in other permutations and combinations.

5.1 Mobile Originated (MO) Message

The FA will load a Mobile Originated message into the ISU, initiate a SBD session, evaluate and act on the results of the SBD session (Table 3). Finally, the ESS will forward the MO message to the Vendor Application. (Figure 6).

Table 3 FA to ISU Interface, MO Message

To ISU (from DTE)	To DTE (from ISU)	Description
AT+SBDWB=351↵		The FA instructs the ISU that it will write a 351 byte message into the ISU.
	READY↵	The ISU informs the FA that it is ready to receive the message
Binary transfer		The FA sends the 351 byte message followed by the two byte checksum to the ISU. This transfer is not echoed.
	0↵	The ISU will send a zero result code to the FA indicating that the message was loaded without error.
AT+SBDI↵		The FA instructs the ISU to initiate an SBD transfer.
	+SBDI: 1, 23, 0, -1, 0, 0↵	The ISU informs the FA that the message was sent successfully using MOMSN 23. No MT message was received and no MT messages are queued.
AT+SBDD0↵		The FA instructs the ISU to clear the message from the Mobile Originated buffer.
	0↵	The ISU informs the FA that the message buffer was cleared successfully.

```
From: sbdservice@sbd.iridium.com
Sent: Tuesday, August 13, 2002 12:49 PM
Subject: SBD Msg From Unit: 304050607080903

MOMSN: 23
MTMSN: 0
Time of Session (UTC): Tue Aug 13 16:51:04 2002
Session Status: TRANSFER OK
Message Size (bytes): 351

Unit Location: Lat = 59.372463 Long = 75.309806
CEPradius = 3

Message is Attached.
```

Figure 6 VA to ESS Interface, MO Message

5.2 Mailbox Check / Mobile Terminated (MT) Message

The ESS does not have the ability to automatically notify the ISU that a Mobile Terminated message is waiting for it at the ESS. The FA is required to perform a Mailbox Check by initiating an SBD session with an empty MO buffer. If a MT message is waiting for the ISU at the ESS, the MT message is transmitted to the ISU.

In this scenario, a MT message is sent from the Vendor Application to the ESS (Figure 7.) The FA will initiate an SBD session, evaluate the results of the SBD session, and read the MT message from the ISU (Table 4). After the SBD session completes, the ESS sends an email message to the Vendor Application indicating the disposition of the SBD session (8).

```
To: Data@SBD.Iridium.com
From: VA@VendorDomain.com
Subject: 304050607080903
<561 byte message attached>
```

Figure 7 VA to ESS Interface, Mailbox Check / MT Message

Table 4 FA to ISU Interface, Mailbox Check / MT Message

To ISU (from DTE)	To DTE (from ISU)	Description
AT+SBDD0		The FA instructs the ISU to clear the send buffer.
AT+SBDI↵		The FA instructs the ISU to initiate an SBD transfer.
	+SBDI: 0, 498, 1, 237, 561, 2↵	The ISU informs the FA that no MO message was sent and a 561 byte MT message was successfully received with MTMSN 237. Two additional MT messages are queued.
AT+SBDRB↵		The FA instructs the ISU to transfer the MT message.
	Binary transfer	The ISU sends a two-byte length indicator followed by the 561 byte message followed by the two byte checksum to the FA.

```
From: <Iridium SBD Service (Tempe, AZ)>
Sent: Tuesday, August 13, 2002 12:49 PM
Subject: SBD Msg From Unit: 304050607080903

MOMSN: 498
MTMSN: 237
Time of Session (UTC): Tue Aug 13 16:51:04 2002
Session Status: TRANSFER OK
Message Size (bytes): 0

Unit Location: Lat = 59.372463 Long = 75.309806
CEPradius = 3

Message is Attached
```

Figure 8 ESS to VA Interface, Status Message.

5.3 Mobile Originated and Mobile Terminated Message

When the Field Application needs to send a Mobile Originated data message and the Vendor Application needs to send a Mobile Terminated Message, the following scenario assumes that the MT Message is waiting at the ESS before the MO message is sent.

In this scenario, the Vendor Application will send the MT message to the ESS (Figure 9); the FA will load the MO message into the ISU, initiate an SBD session, evaluate the results of the SBD session, and read the Mobile Terminated message from the ISU (Table 5). Finally the Vendor Application will receive the MO message (Figure 10).

Figure 9 Vendor Application to ESS Interface, MT Message

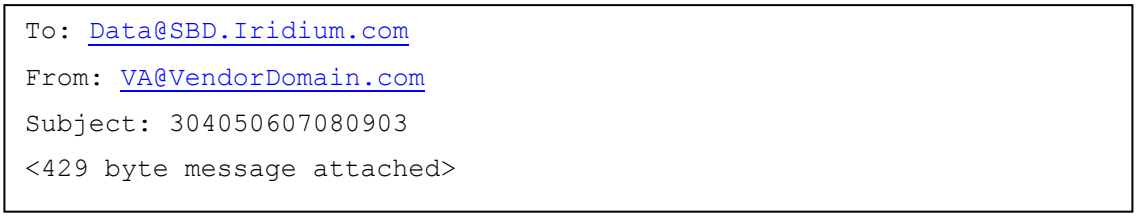


Table 5 FA to ISU Interface, Mobile Originated and Mobile Terminated

To ISU (from DTE)	To DTE (from ISU)	Description
AT+SBDWB=351↵		The FA instructs the ISU that it will write a 351 byte message into the ISU.
	READY↵	The ISU informs the FA that it is ready to receive the message
Binary transfer		The FA sends the 351-byte message followed by the two byte checksum to the ISU. This transfer is not echoed.
	0↵	The ISU will send a zero result code to the FA indicating that the message was loaded without error.
AT+SBDI↵		The FA instructs the ISU to initiate an SBD transfer.
	+SBDI: 1, 2173, 1, 87, 429, 0↵	The ISU informs the FA that the message was sent successfully using MOMSN 2173. A 429-byte message was received using MTMSN 87. No additional messages are queued.
AT+SBDD0↵		The FA instructs the ISU to clear the message from the send buffer.
	0↵	The ISU informs the FA that the message buffer was cleared successfully.
AT+SBDRB↵		The FA instructs the ISU to transfer the received message.
	Binary transfer	The ISU sends a two-byte length indicator followed by the 429byte message followed by the two byte checksum to the FA.

Figure 10 VA to ESS Interface, MO Message

```
From: <Iridium SBD Service (Tempe, AZ)>
Sent: Tuesday, August 13, 2002 12:49 PM
Subject: SBD Msg From Unit: 304050607080903

MOMSN: 2173
MTMSN: 87
Time of Session (UTC): Tue Aug 13 16:51:04 2002
Session Status: TRANSFER OK
Message Size (bytes): 351

Unit Location: Lat = 59.372463 Long = 75.309806
CEPradius = 3

Message is Attached.
```

5.4 Optimal Message Size Selection

There are two primary factors that affect optimal message size: Economic and technical.

5.4.1 Economic Message Size

The minimum billable message size is 30 bytes regardless of the actual number of bytes sent below 30. The developer should maximize the use of these bytes, and can do so in a number of ways. E.g. the business requirement is to report position every ten minutes. The position information in this case is fifteen bytes. The developer could therefore collect an intermediate position every five minutes and transmit both positions at the required ten-minute intervals to provide more detailed positioning information.

5.4.2 Technical Message Size

Each type of message whether MO or MT is broken into segments for actual transmission. The length of the segment relative to the absolute message length depends on whether it is a MO or MT message. Between each segment additional signaling and network overhead occurs. If optimizing for minimal latency then the minimal number of message segments should be used.

5.4.2.1 Mobile Originated Message Size

First user data segment size	70 bytes
Subsequent user data segment size	135 bytes

E.g. for a 1960 byte message there will be one segment of 70 bytes and 14 segments of 135 bytes

E.g. for a 71 byte message there will be one segment of 70 bytes and one segment of 1 byte.

5.4.2.2 Mobile Terminated Message Size

User data segment size	135 bytes

E.g. for a 1890 byte message there will be 14 segments of 135 bytes

E.g. for a 71 byte message there will be one segment used.

6 9522 L-Band Transceiver

The 9522 L-Band Transceiver (LBT) is an Iridium network compliant communications device designed for integration by a Value Added Manufacturer (VAM) or Value Added Reseller (VAR) as part of a total wireless data solution. The 9522 LBT is also known as the "Sebring". The section provides information specifically related to using the 9522 LBT for SBD. The key features are:

- Multi-interface DB-25 connector
- AT Command Set for commanding, controlling, and configuring the LBT.
- TNC RF Connector - Compatible with existing Iridium antenna accessories.
- Integral SIM card reader.

The information on the 9522 is provided here as a convenience and should be read in conjunction with the Motorola Satellite Series 9522 L-Band Transceiver Interface Specification.

6.1 Requirements for Short Burst Data

The firmware revision of the 9522 must be at least Version SAC03xx where xx are integers. You can determine the version by issuing the AT command +CGMR to the 9522.

6.2 Multi-Interface Connector

The Multi-Interface connector, pictured in Figure 11, is a standard DB25 that is used to provide power and RS232 connectivity. The pin out of the Multi-Interface connector is provided in Table 6.

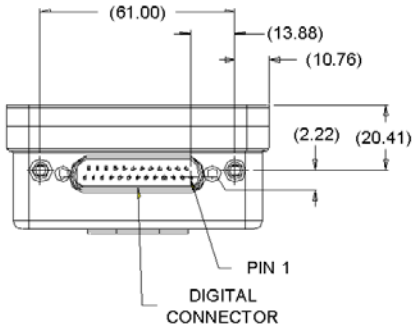


Figure 11 Multi-Interface Connector

Table 6: DC Power, and RS232 Data

Pin	Signal Name	Signal Description	Interface	RS232 DB9 Pin
1	EXT_ON_OFF	Power on/off control input. EXT_ON_OFF control input is pulled to a GND level to toggle the 9522 LBT on and off	DC Power	
2	Reserved	Reserved	Reserved	
3	GND	External GND input. Same as pin 17, both pins should be connected	DC Power	
4	EXT_B+	External 4.4 VDC input. Same as pin 16, both pins should be connected	DC Power	
5	Reserved	Reserved	Reserved	
6	Reserved	Reserved	Reserved	
7	RI	RS232 Ring Indicate	RS232 Data	9
8	RTS	RS232Request To Send	RS232 Data	7
9	S_TX	RS232 Transmit Data	RS232 Data	3
10	DCD	RS232 Data Carrier Detect	RS232 Data	1
11	Reserved	Reserved	Reserved	
12	Reserved	Reserved	Reserved	
13	S_RX	RS232 Receive Data	RS232 Data	2
14	GND	Spare GND	Spare GND	
15	Reserved	Reserved	Reserved	
16	EXT_B+	External 4.4 VDC input. Same as pin 4, both pins should be connected	DC Power	
17	GND	External GND input. Same as pin 3, both pins should be connected	DC Power	
18	Reserved	Reserved	Reserved	
19	DTR	RS232 Data Terminal Ready	RS232 Data	4
20	Reserved	Reserved	Reserved	
21	DSR	RS232 Data Set Ready	RS232 Data	6
22	CTS	RS232 Clear To Send	RS232 Data	8
23	GND	RS232 ground level signal reference	RS232 Data	5
24	Reserved	Reserved	Reserved	
25	Reserved	Reserved	Reserved	

6.2.1 DC Power Input Specifications

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

Table 7: DC Power Input Specifications

Parameter	Value
Main Input Voltage - Range	+4.0 VDC to +4.8 VDC
Main Input Voltage - Nominal	4.4 VDC
Main Input Voltage - Ripple	40 mVpp
Peak Input Current (maximum)	2.5 A @ 4.4 VDC
Main Input Active Power (average)	2500 mW
Main Input Standby Power (average)	210 mW

6.2.2 Remote Power ON/OFF

The 9522 LBT can be turned on and off using the EXT_ON_OFF pin. When EXT_ON_OFF transitions from high to low, the 9522 toggles between being on and off. The EXT_ON_OFF pin is pulled high internally in the 9522. If the pin is to be pulled to ground, it must be pulled down via a load that is less than 1KOhm.

The following algorithms can be used for powering up/down. Note that the timings mentioned were determined empirically and are on the conservative side.

6.2.2.1 Turning the LBT on:

A. Make sure the LBT is not already on by sending it AT. If there is no response after 50ms, assume that the LBT is off.

B. Pull EXT_ON_OFF to ground. Wait 800ms. This should turn LBT on. Release the EXT_ON_OFF pin.

C. Send AT to the LBT to verify that it is on. Allow 50ms for a response.

6.2.2.2 Turning the LBT off:

Removing power can turn off the LBT. However this does not give LBT an opportunity to perform an orderly system shutdown. It is preferable to use the EXT_ON_OFF pin as described here:

A. Make sure the LBT is not already off by sending an AT command to it. If there is no response after 50ms, assume that the LBT is off.

B. Pull EXT_ON_OFF to ground. Wait 500ms. This should start the shutdown process. Release the EXT_ON_OFF pin.

C. Even though the LBT should be shutting down, it can still respond to AT commands for several seconds until the shut down is complete. Therefore, if it is desired to verify that the LBT is off, wait 5 seconds to allow shut down to complete. Then send an AT to the LBT to verify that it is off. Wait 50ms before deciding if there was no response.

If desired, remove power from the LBT.

6.3 RF Interface

The 9522 LBT provides a single, 50-Ohm, TNC Female type antenna connector for both transmit and receive as shown in Figure 12. The antenna cable must ensure a loss of <3 dB. The minimum link margin of 12.5 dB must be maintained. General RF parameters are listed in the Table 9.

Table 8 General RF Parameters

Parameter	Value
Operating Temperature Range	-40 - +85 degrees 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 dB (weighted average minimum)
Minimum ‘Horizon’ Gain	-2.0 dB (82 degree conic average)
Nominal Impedance	50 Ohms
Polarization	RHCP
Basic Pattern	Omni directional & Hemispherical
Multiplex Method	TDMA/FDMA
Duplexing	Time Domain Duplex (TDD)

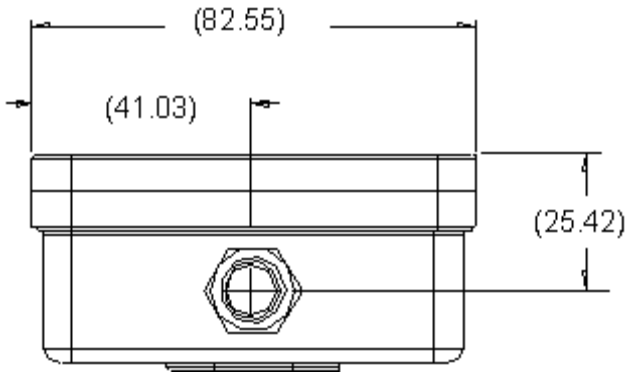


Figure 12 Antenna Connector

6.4 SIM Card Connector

An integrated SIM card connector is provided on the 9522 LBT. The SIM chip is detached from the full-size Iridium SIM card and inserted beneath a cover plate on the 9522 LBT housing, as pictured on the top of the LBT in Figure 13. A plastic locking mechanism (same as with GSM wireless phones) is used hold the SIM in-place. The black cover plate should be fastened down following installation of the SIM.

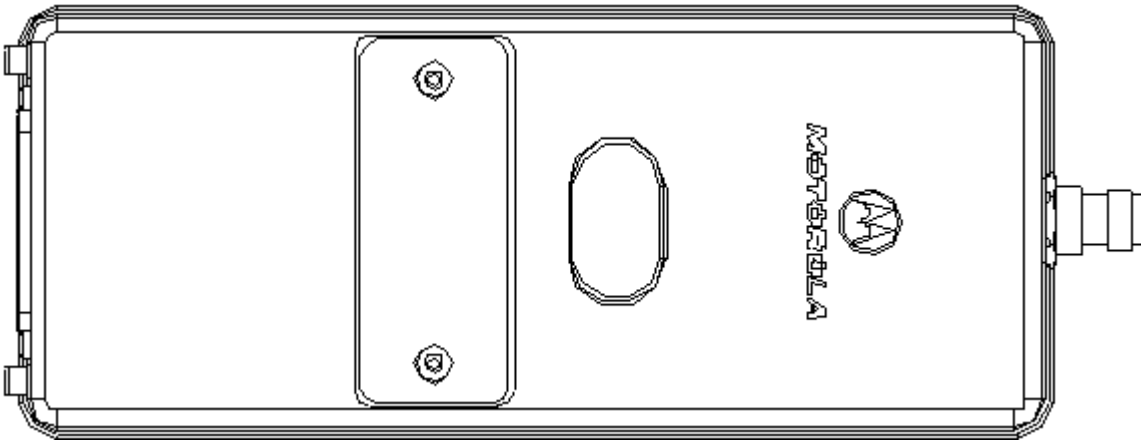


Figure 13 SIM Access Panel

6.5 Provisioning Requirements

In order to use a 9522 LBT for Short Burst Data, the following steps must be performed:

- The 9522 LBT must be provisioned on the Iridium SBD system by the VAR using the SPNet provisioning system.
- A SIM Card must be provisioned by the VAR using the SPNet provisioning system, and then installed in the 9522 LBT. The SIM Card must *not* have a PIN enabled, otherwise the 9522 LBT cannot register with the Iridium system and can therefore not place any type of call, including SBD calls.
    - If the 9522 LBT is to be used only for SBD, then the SIM Card should be provisioned with an SBD-only service package. Such a SIM card will not allow any type of call other than an SBD call.
    - If the 9522 LBT is to be used for other Iridium voice and data services in addition to SBD, then the SIM card should be provisioned with a service package that allows those services.

6.6 Operational Status via Serial Port

There are two levels of operational status that can be obtained from the 9522 LBT over the serial interface. The first level is simply determining whether or not the LBT is powered "ON". The second level is determining the LBT's readiness to place or receive a call.

A. Determining if the LBT is "ON" or "OFF" is accomplished by issuing the command AT over the serial port to the phone. If an "OK" response is received, the LBT is "ON". In the event that no response is received, at least one of the following conditions exists:

    a) The LBT is "OFF"
    b) DTR is not high
    c) there is a problem with wiring between the microprocessor based device and the LBT

B. In order to determine whether the LBT is ready to be used for data transmission the AT Command +CREG should be executed to check the registration status of the LBT. Additionally the AT Command +CSQ can be used to check the received signal strength. Further information is given in the full AT Command Set Reference Document as described in Section 1.4.1 of this document.

    If power has just been applied to the 9522 or it has been just place in an "ON" state, it will take a short period of time for the 9522 to register on the network (10-20 seconds). After the 9522 has registered, and assuming the antenna has a clear view of the sky, a data call can be attempted.