

**Iridium Short Burst Data Service**

**Best Practices Guide**

Draft

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**SBD Operational Overview**

Let’s start with a brief overview of the SBD service and how the Mobile Originated (MO) and Mobile Terminated (MT) messages are delivered.  The SBD service is a success based protocol, the response codes returned to the sender indicate if the message was successfully received by the next node or not.

The delivery of MO messages is very straightforward; the user frames the message and moves it to the transmit buffer of the 9602.  After the application receives the ‘OK’ response, it initiates the SBD session.  The session includes acquiring the satellite, authenticating the 9602, sending the MO messages, receiving a MT message if one is available, exchanging status information and performing the final ACK / NAK.

If the MO status response codes indicate a success, the MO message was delivered successfully to the GSS.  If the response codes indicate a failed transmission (RF link drop, inter-satellite handoff, etc), the message remains in the transmit buffer and the user must resend it.

The message is either successfully delivered to the GSS or remains in the transmit buffer, but it is not ‘lost’.

Once the MO message arrives at the GSS, it is passed to either the email or Direct IP servers for delivery.  Once the message is posted to the email, Iridium has no control over the delivery.  With the Direct IP, the connection to the destination server is opened, the message sent to the destination, and the connection is closed.  This is a very high reliability delivery method.

If the MO messages cannot be delivered, usually because the destination server is offline, the GSS will queue them until the server comes back on line.  The system is configured to hold 10,000 messages per application at the GSS.

MT messages are a little more involved.  The vendor application creates a message and sends it to the GSS; either via email or the Direct IP connection.  The GSS sends a receipt to the vendor application indicating the GSS received the MT message and queued for delivery to the 9602.

The GSS does not automatically attempt to deliver the MT messages.  Since the SBD is a success based protocol, the GSS will not send the MT message unless the destination is ready to receive it.  The destination 9602 must therefore request delivery of the queued MT message.  It does this by initiating a SBD session.  The session can be either a valid MO message or a ‘mailbox check’ (a ‘mailbox check’ is a MO message with a 0-byte message payload).

If the 9602 is configured to receive the automatic Ring Alerts, and there is a line of sight between the 9602 and the satellite, the GSS will send the RA to the 9602 notifying the device that a message is waiting to be retrieved.

If the 9602 is powered off or not in view of the satellite, the MT messages remains queued at the GSS.  The GSS can queue up to 50 MT messages for each IMEI.  A MT message can remain queued at the GSS for 5 days.  If a MT message is not retrieved by the application within this 5 day window, the daily maintenance program at the GSS purges the queue for this IMEI.   Again, the message is not ‘lost’ but remains queued at the GSS for up to 5 days.

**Power On / Off**

The ISUs should be powered on / off in a prescribed sequence. Both the 9601 and 9602 have an ON/OFF pin to control the power on off sequence. Assuming that power is supplied to the ISU when power is applied to the pin, the ISU boots up, and when power is removed it executes an orderly shutdown. For the 9601 this is pin 7 and the 9602 it is pin 5. The device is ON if 2.0 V or more is applied and is OFF if 0.5V or less.

Removing power from the ISU while effectively powering down of the ISU, is not a recommended practice since it does not guarantee the buffers are flushed and the variables are written to non-volatile memory. If the user wants to power down the ISU by removing power, they should first issue the AT\*F command. This command flushes all pending writes to non-volatile memory, shuts down the radio, and prepares the ISU to be powered down.

The ISU can then be powered down by removing power or de-asserting the ON/OFF line.

At power ON, the ISU executes a sequence of power on and memory tests. Interrupting this sequence can possibly cause problems with the ISU. Logic has been added to increase the robustness of operation and minimize the possibility of memory corruption, however it is recommended that the application wait at least 2 seconds between initiating a power ON sequence and powering OFF the unit.

**Automatic Ring Alert**

The Automatic Ring Alert feature notifies the ISU when a MT-SBD message is queued for this IMEI. When the ISU receives the RA, a number of unsolicited events occur; if the device is in verbose mode, the ISU sends the ASCII string SBDRING across the data port to the field application, if it is not in verbose mode, the ISU sends the string 126. Also the RI bit (9601 pin 24, 9602 pin 19) is asserted and the RA bit in the ISU is set.

These events notify the application that a MT-SBD message is waiting and the field application can then send a +SBDIXA ‘mailbox check’ to retrieve the message. If the application does not reply with a +SBDIXA ‘mailbox check’ within 20 seconds, the gateway sends a second RA to the ISU. If there is still no response, the RAs are cancelled and the ISU will not receive another RA until another MT-SBD is queued for this device or the Host ‘forces’ a RA using the Direct IP.

(There currently is no charge to the user for the ‘forced RA’ feature. However, this function does consume network resources. Consequently, unreasonable use of this feature will force Iridium to institute a charge for this.)

(If the application sends a ‘mailbox check’ and there is no message waiting for delivery, the user is charged a fee. If there is a message waiting, the user is only billed for the delivered message. The RA can mitigate the need for excessive ‘mailbox checks’.)

In order to use the Ring Alert feature, a few steps must be followed:

* First, the Ring Alert option must be selected in the provisioning for this IMEI. This is done by the user from the SPNet tool.
* Second, the application must configure the ISU to listen for the Ring Alert signal using the +SBDMTA command.
* Lastly, the ISU must be ‘attached’ to the gateway. This may be done with the +SBDREG command or initiating a SBD session with the +SBDIX command.

**Attaching an ISU to the Gateway**

The ‘attach’ process performs two functions; it indicates to the gateway that the ISU is configured to receive the RA and it updates the geo-location of the ISU on the gateway so the RA signal can be routed to the device. The ‘attach’ can be accomplished in two ways.

+SBDREG

The +SBDREG command ‘attaches’ the ISU to the gateway so it can receive the RA. When used, it notifies the gateway this IMEI is configured to receive the RA and updates the geo-location data. This command only needs to be executed one time. Once a device is attached, it remains attached until it is ‘detached’ by the field application. This is done by issuing the +SDBDET detach command or using the +SBDI command to initiate a SBD session.

+SBDIX

Every time the application issues the +SBDIX command the gateway attempts to ‘attach’ the device. For a fixed site or a device that operates in a limited geography, this will keep the device ‘attached’. This mitigates the need for using the +SBDREG command.

**Invalid geo-location Auto re-attach / SBDAREG**

The gateway relies on a current geo-location to determine which spot beams to route the RA to the device. If the field application is mobile, it may move outside of the ring alert radius without updating its geo-location by a +SBDIX command. When this occurs the mobile device will not receive the RA from the gateway. This can be addressed in two ways; periodically issue a +SBDIX command to re-attach or use the +SBDAREG command. NOTE: the +SBDIX is a billable event.

When run, the +SBDAREG performs a passive geo-location which estimates the distance the ISU has moved since the last attach. If this indicates the device may have moved beyond the RA radius, it automatically re-attaches the device. The application does not need to monitor the frequency of MO-SBD messages or issues periodic +SBDAREG commands.

The +SBDAREG works if the device is power cycled and moved. The caveat is that when the device is powered on, the calculation may take minutes to determine the geo-location and re-attach.

The +SBDAREG command is local to the ISU and must be issued after the ISU has been successfully attached to the gateway. It is NOT an alternative to the +SBDREG command, it is a complement.

To use the +SBDAREG

* Attach the ISU to the gateway. This may be done with the +SBDREG command or initiating a SBD session with the +SBDIX command.
* Check that the response code indicates as successful ‘attach’
* Issue AT+SBDAREG <mode>

**Recognizing and Responding to the RA**

Typically the field application is configured to look for the unsolicited ASCII string SBDRING or 126 to indicate that the RA was received by the ISU. The RI pin, 17 on the 9601 and pin 12 on the 9602, is also is also asserted on the ISU when the RA is received.

There are two additional commands available to the developer for checking the status of the RA pin. These are the +CRIS, Ring Indication Status and the +SBDSX, Status Extended commands.

+CRIS

The +CRIS returns the reason for the most recent assertion of the Ring Indicate signal. There are separate indications for telephony and SBD. For the 9601 / 9602 the SBD indicator, is the only valid response.

+SBDSX

The +SBDSX returns the status of the last successful SBD session and the RA flag. The RA flag indicates whether an SBD ring alert has been received and still needs to be answered. This flag is cleared by a successful SBD session, including ‘mailbox checks’.

If the designer does not wish to handle the unsolicited ASCII strings, the field application can periodically check the RA status with either of these commands instead to determine if a RA was received.

Once the field application has determined that the ISU received a RA, it can initiate a SBD session to retrieve the queued message. Typically this is accomplished with a ‘mailbox check’ which is a MO-SBD message with a 0-byte payload. The MT-SBD message waiting at the gateway is delivered as part of the SBD session. A MO-SBD message with a valid payload also retrieves the pending message.

The application should use the +SBDIXA command when responding to the RA.

**Network Satellite Availability**

Iridium, like all satellite networks, operates on the principle of line of sight communications and requires that the antenna maintain a clear view of the satellite. Since the Iridium satellites operate in low earth orbits, this view may at times be obstructed. The ISU contains features that indicate to the application that a satellite is within view of the antenna.

These are:

Network Available pin

+CSQ / +CSQF commands

+CIER / CIEV command

Network Available pin

The Network Available pin, 9601 / pin 24, 9602 / pin 19, is asserted when the satellite is within view of the device and the device is powered to receive a signal from the satellite. (The pin is not asserted if the device is powered off). The application board can be designed to make use of this input.

+CSQ / +CSQF commands

These commands return the Relative Signal Strength Indicator value to the application. The commands return a value between 0 and 5. The value indicates strength of the signal relative to the noise floor. A value of 0 indicates no discernable signal and the communications will not work. A value of 1 is the minimum signal strength required to transmit. Every incremental value is an additional 2 dB of margin. For example; 2 is + 2 dB, 3 +4 dB, 5 +8 dB.

The +CSQ results are not ‘instantaneous’ and the calculation may takes seconds. The +CSQF command immediately returns the results of the last RSSI calculation to the user. The user must keep in mind this value may be ‘old’, perhaps 15 seconds.

+CIER / CIEV command

This command enables ‘Indicator Event Reporting’ which sends the unsolicited +CIEV result codes to the application. The command affects two parameters; the RSSI value and the Network Availability. When the parameter is enabled, the ISU sends the new value to the field application. This is an unsolicited response and is delivered as long as the data port to the ISU is available.

For the signal quality, it returns the latest RSSI value; 0 to 5. For the network, ‘service availability’ the ISU returns a 0 or 1.

The +CIEV, is the unsolicited text string returned with the +CIER value.

**Initiating SBD Session**

There are three commands available for initiating a SBD session:

+SBDI

+SBDIX

+SBDIXA

+SBDI

The +SBDI is the legacy command from the initial release of the SBD service. It can be used for sending SBD messages but in the current system design, there are a couple drawbacks to using this command. The +SBDI will detach the ISU from the gateway. If the application uses, or intends to use, automatic Ring Alert feature, the +SBDI command cannot be used. Also, the status response codes from the +SBDI command are limited and not very useful in diagnosing possible connectivity problems. Iridium recommends using the +SBDIX command rather than the +SBDI.

+SBDIX

The +SBDIX command is the recommended command for initiating a SBD session. It ensures the ISU won’t become detached inadvertently; it maintains the current geo-location for the RA and provides a more extensive set of response codes.

+SBDIXA

If the ISU is configured to receive the automatic Ring Alert, and the device is attached to the gateway, when the Host sends a MT-SBD message a RA is sent as the message is queued. If the field application does not respond to the RA within 20 seconds, a second RA is sent to the ISU. If the application is initiating a SBD session in response to the RA, it should use the +SBDIXA command. The +SBDIXA command functions the same, but it cancels the second RA. This prevents a possible race where the gateway would send a RA after the message has been retrieved.

**Interpreting Command Response Codes**

Each AT command returns to the application a result code that indicates the disposition of the command. Depending on the command, the codes may indicate status, condition or other related information. It is important to program the application to interpret these commands and properly execute logic based on these results.

Occasionally, a new command is introduced which provide additional features and may be used in place of exiting commands, such as +SBDIX and +SBDI. The +SBDIX can be used in place of the +SBDI, and is recommended, however, the response codes for the commands are different. Just replacing the one command with the other and not modifying how the codes are interpreted can introduce a major bug.

When a command is used, check the possible response codes and how to interpret them.

**Adaptive Retry**

There are a variety of reasons why a SBD message may not get through from the ISU to the satellite. Since this is a line of sight system, the most obvious cause of a link failure is an obstruction. However, it can be due to inter-satellite handoff or contention for satellite resources. The response codes indicate that the message failed, but do not always give a precise reason.

When a SBD session fails, the exception logic in the application should determine what action to take. Typically if a session fails once or twice, the application immediately initiates another session. If the resends fail beyond this, and a satellite is in view, there may be an issue with contention for satellite resources. In this case, it is better to incrementally adjust the time interval between the resend attempts.

A suggested retry scheme might be:

Initiate SBD session

If that fails attempt resend immediately (2 x)

If still unsuccessful wait 30 seconds before attempting a resend (2X)

If these attempts fail, increment the delay to 5 minutes.

This logic should cover almost any anomaly with the network.

**Frequently Asked Questions**

1. What is the Iridium source IP address that Mobile Originated deliveries will come from

* 12.47.179.11

1. What is the Iridium domain name for DirectIP Mobile Terminated messages:

* directip.sbd.iridium.com / port 10800

1. What is the current policy regarding DirectIP Mobile Originated TimeToLive setting:

* TimeToLive is 12 hours

What happens if the host server is not available to receive messages?

MO-SBD messages are queued at the GSS. The GSS can store 10,000 messages per server application. If the number of MO-SBD messages exceeds the 10,000 limit, the oldest message is discarded and the newest added to the queue. The expiry for the queued message is 12 hours. (ties in with #3)

1. What is the Iridium Mobile Terminated queue policy, before MT messages are purged;

* MobileTerminated messages that are ‘queued’ for 5 days – ( all messages for the destination will be purged at this time )

1. Maximum # of Mobile Terminated messages for a single IMEI:

* Max. of 50 msgs per IMEI

1. For SBD DirectIP Mobile Terminated, does the customer need to inform Iridium of the source IP address that will be utilized?

* Yes, the source IP address that will be utilized to connect to the Iridium gateway needs to be included within the Iridium network firewalls, to allow for successful connection