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Used in the Beam 9602 SBD DataModem

EXTRACTED and EDITED by BEAM Communications from the

Iridium 9602 SBD Transceiver Developer's Guide

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Contents

1 Product Overview

The Iridium 9602 Short Burst Data Only Transceiver (9602) used in the Beam SBD DataMODEM is designed to be integrated into a wireless data application with other host system hardware and software to produce a full solution designed for a specific application or vertical market. Examples of these solutions include tracking a maritime vessel or automatic vehicle location.

The 9602 only supports Iridium's Short Burst Data (SBD) capability. It does not support voice, circuit switched data, or short message service (SMS).

The 9602 is designed to meet the regulatory requirements for approval for FCC, Canada, and CE assuming an antenna with a gain of ~3 dBi and adequate shielding. This allows the 9602 to be integrated into a variety of wireless data applications or retrofitted into existing SBD only applications that utilize SBD with the current Iridium 9601, 9522A, 9522B or 9522 L-Band transceiver-based products. Such finished products, when integrated together, require regulatory and safety testing to be conducted by the integrator.

The 9602 does not incorporate nor require a Subscriber Identity Module (also known as a SIM Card) to be inserted into the Transceiver. The 9602 is intended to be used as a transceiver module fitted within another host system. The 9602 module is designed to comply with the standards for Radio Emissions Compliance, Electromagnetic Compatibility, and AC Safety in the United States, European Union and Canada, for host systems that provide safe connections to power supply and external antenna or cable distribution system.

The 9602 is described within this document as "9602," "9602 SBD Transceiver," "Transceiver," and "ISU." All of these terms refer to the same product.

1.1 *Key Features*

- Small form factor
- No SIM card
- Designed to be incorporated into an OEM solution
- Maximum mobile originated message size 340 bytes
- Maximum mobile terminated message size 270 bytes
- Automatic Notification to the Transceiver that a mobile terminated message is queued at the Gateway
- Global operating capability

1.2 *Transceiver Packaging and Regulatory Certification*

The 9602 SBD Transceiver is a regulatory approved daughter module transceiver that can be fitted within an enclosed host system. With appropriate external connections, the host system can be designed to meet full transceiver regulatory tests and sold as a Regulatory Certified product that meets CE, FCC and IC requirements.

The 9602 is tested to the regulatory and technical certifications shown in Table 1 (See Note below).

Table 1: Regulatory and Technical Certifications.

Regulatory Approvals	Radio Tests	EMC Tests	Electrical/ Mechanical/ Operational Safety Tests
CE	ETSI EN 301 441 V1.1.1 (2000-05)	ETSI EN301 489-1 V1.8.1(2008-04) ETSI EN 301 489-20 V1.2.1(2002-11)	EN60950-1:2006 Part 1
FCC	FCC CFR47 parts 2, 15, and 25	EN61000-4-2 : 1995/A2 : 2001 Part 4.2 EN61000-4-3 : 2002 Part 4.3 EN61000-4-4 : 2004 EN61000-4-6 : 1996/A1 : 2001 Part 4.6 EN55022:2006	
Industry Canada	Industry Canada RSS170 Issue 1, Rev 1, November 6, 1999		

Note: The initial 9602 FP1 & FP2 prototype units are different from the commercially produced 9602 SBD Transceivers from a regulatory and certification perspective. Those initial units cannot and should not be used for any commercial purpose or for any regulatory certification or compliance purposes. Only the commercial 9602 units conform to the regulatory approved design and the regulatory and technical certifications listed in Table 1.

1.3 Software Revision

Product Developers should read this document in conjunction with the "Software Release Notes" relevant to the revision of the software that is loaded into their 9602 SBD Transceiver.

Product Developers should take into account in their software design that it is possible that a transceiver may have an earlier software release and may therefore have different capabilities to those listed in this document. Product Developers are advised to ensure that production procedures for finished goods confirm that the software used in the Product Developer application is designed for the Software Release loaded in the 9602 SBD Transceiver. This can be read out of the module using the AT command interface. A software upgrade utility is provided with each SW release. The utility runs on a Windows compatible OS and will automatically upgrade the modem with the latest version.

2 Physical Specification

2.1 *Environmental*

2.1.1 Environmental Specification

The environmental specifications of the 9602 are summarized in Table 2 below.

Table 2: Environmental Specifications

Parameter	Value
Operating Temperature Range[1]	-40ºC to + 85ºC
Operating Humidity Range	≤ 75% RH
Storage Temperature Range	-40ºC to + 85ºC
Storage Humidity Range	≤ 93% RH

2.1.2 Environmental Tests Performed

The 9602 has been tested to the specifications listed in Table 3.

Table 3: Environmental Tests

Test Name	Test Reference	Test Description
Thermal Shock	EN60068-2-14:2000	Change of Temperature, -25°C to +70°C, 5 cycles of 1 hour each
Humidity	IEC60068-2-78:2002	Damp heat steady state 40OC 93% RH for 4 days
Vibration	EN 60068-2-36:1996	0.96 m2/s3 from 5Hz to 20Hz 21Hz to 500Hz dropping -3dB per octave
Vibration	J1455 Society of Automotive Engineers	10-40Hz at 0.02g2/Hz 40-500Hz dropping 6dB per octave
Shock	EN60068-2-27:1993 (NF c20-727)	
Shock	J1455 Society of Automotive Engineers	Drop 1m onto concrete in 3 perpendicular orientations (3 drops) Also 10G shock over a period of 12ms

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1 Operating Temperature Range based on a duty-cycled usage model with 9602 sending one SBD message per hour and is otherwise turned off during the hour. Iridium has tested the 9602 per these temperature condition and partners venturing outside of these stated conditions need to ensure they have engineered a solution appropriate to the stated environmental conditions for the 9602.

3 Electrical Interface

3.1 *Serial Data Interface*

The Serial data interface is used to both command the 9602 and transfer user data to and from the Transceiver. The 9602 presents a 9-wire data port to the FA (Field Application), where the interface is at 3.3V digital signal levels. With respect to this interface, the 9602 behaves as a DCE (Data Communication Equipment), and the FA behaves as a DTE (Data Terminal Equipment).

The terms "FA" and "DTE" are used interchangeably throughout this document; similarly for the terms "9602" and "DCE". Autobaud is not supported in 9602 SBD Transceiver. The baud rate can be set via the AT+IPR command. The default rate is 19200 bps.

3.1.1 9-Wire and 3-Wire Operation

By default, the serial interface operates as a 9-wire connection. Table 4 describes each of the signals, where "input" means an input to the 9602, and "output" means an output from the 9602 SBD Transceiver.

Table 4: Serial Interface Signals

Signal	Description
RX	Active high data output [The DTE receives the data from the 9602]
TX	Active high data input [Data is transmitted from the DTE to the 9602]
GND	0V
RTS	Active low flow control input
CTS	Active low flow control output RTS and CTS are used together to implement hardware flow control when enabled with AT&K3
DTR	Active low handshaking input AT&Dn controls how the 9602 uses DTR: If set to AT&D0, DTR is always ignored. Otherwise DTR set to OFF places the data port into UART test mode after 10 seconds, or immediately on boot-up. A subsequent transition of DTR to ON returns the data port to DCE mode and resets it to its power-on state. The UART test mode is provided for factory testing of the data port UART. An FA should never activate test mode; if it does, the 9602 will stop responding to AT commands until the data port is returned to DCE mode.
DSR	Active low handshaking output The 9602 drives DSR ON when the data port is in DCE mode, and OFF when the data port is in test mode. The DTE may use this signal as an indication that the 9602 is powered up and ready to receive AT commands.
RI	Active low ring indicator output The 9602 drives RI ON when it receives a Automatic Notification from the network that a Mobile Terminated SBD Message is queued at the Gateway, and drives RI OFF after 5 seconds or when the DTE initiates an SBD session, whichever occurs first.
DCD	Active low handshaking output DCD is driven OFF at all times.

Note that the Ring Indicator (RI) pin is used by the 9602 SBD Transceiver to indicate that a Mobile Terminated SBD (MT-SBD) message is queued at the Gateway. The Field Application can monitor this pin and use appropriate AT Commands to command the Transceiver to retrieve the MT-SBD message.

The serial interface may be operated with a 3-wire connection, where only transmit, receive and ground signals are used. However the 9 wire interface offers better control and is the recommended implementation. Iridium is only able to provide limited 3-wire interface support. Due to the small code space and limited processing resources of the 9602 the flow control is limited.

When operating with a 3-wire connection, the following rules apply:
AT&Dn must be set to AT&D0 to ignore the DTR input AT&Kn must be set to AT&K0 to disable RTS/CTS flow control The other output signals may be connected, and operate as follows: CTS driven ON (low) DSR operates as normal RI operates as normal DCD driven ON (low)

Notes:
1. RTS/CTS flow control, when enabled, is only used when the data port is in SBD data mode. In AT command mode, RTS is ignored and CTS is driven ON (low).
2. If the DC input to the modem is to be disconnected, the developer will need to "tri-state" the serial interface to prevent a possible latch-up condition.

3.1.2 Configuration Settings

The 9602 allows the DTE to configure the data port communication parameters. The three configuration types are active, factory default, and stored. The active configuration is the set of parameters currently in use. They can be changed by the DTE individually via specific AT commands. The factory default configuration is stored in permanent memory. This configuration can be recalled at any time through use of the AT&Fn command.

Two groups of settings, or "profiles", can be stored as user-defined configurations. The DTE first creates desired active configurations and then writes them to memory using the AT&Wn command. These profiles can be designated to be loaded as the active configuration upon 9602 power-up through use of the AT&Yn command. The 9602 can be reset without loss of power to these profiles through use of the ATZn command.

The configuration settings are stored in "S-register" locations and are detailed further in section 6.

3.1.3 Modes of Operation

The serial interface is always in one of three modes: command mode, SBD data mode or SBD session mode. When the data port is in command mode, AT commands can be entered to control the 9602. In command mode, flow control has no effect, with the RTS input ignored and the CTS output driven ON (low). When in SBD data mode, the 9602 is transferring binary or text SBD message data to or from the DTE.

In SBD data mode:
- All characters from the DTE not forming part of the message data are ignored (i.e. no AT commands may be entered)
- No unsolicited result codes are issued.
- RTS/CTS flow control, if enabled, is active. When RTS is OFF (high), the 9602 suspends transfer of data to the DTE; when CTS is OFF (high), the 9602 expects the DTE to suspend transfer of data to the 9602.

When in SBD session mode, the 9602 is attempting to conduct an SBD session with the network. In SBD session mode:
- The DTE must wait for the +SBDI [X][A]session result code.
- All characters from the DTE are ignored.
- Unsolicited result codes are issued where those codes have been enabled.

Transitions between the modes of operation are performed automatically by the 9602 in response to the SBD AT Commands; the DTE has no other control over the mode.

3.2 *Hardware Failure Reporting*

If the 9602 detects a hardware problem during initialisation, the 9602 may be unable to function correctly. The 9602 notifies the DTE of this situation by issuing an unsolicited result code at the end of initialisation:

HARDWARE FAILURE: <subsys>,<error>

where <subsys> identifies the software subsystem that detected the error, and <error> is the subsystem-specific error code.

Any AT commands that cannot be handled in the failure condition will terminate with result code 4 ("ERROR").

4 RF Interface

4.1 *RF Interface Specifications*

The RF interface requirements for the 9602 are summarized in Table 5 below.

Table 5: General RF Parameters

Parameter	Value
Frequency Range	1616 MHz to 1626.5 MHz
Duplexing Method	TDD (Time Domain Duplex)
Input/Output Impedance	50Ω
Multiplexing Method	TDMA/FDMA

4.2 *Radio Characteristics*

Table 6 contains radio characteristics of the 9602 SBD Transceiver.

Table 6: Radio Characteristics

Parameter	Value
Average Power during a transmit slot (max)	1.6W
Receiver sensitivity (Typical level at module connector)	-117dBm
Max Cable loss permitted (Note 1)	2dB
Link Margin – Downlink (Note 2)	13dB
Link Margin – Uplink (Note 2)	7dB

Note 1: Cable losses should be minimized. The total implementation loss for an antenna, connectors, cable, lightening arrestor and any other RF component between the transceiver and the antenna should not exceed 3dB. The total cable loss between the antenna and the modem includes losses in the motherboard. Implementation loss higher than this will affect the Iridium link performance and quality of service. Solutions with a loss higher than 3dB will not meet the requirements of Iridium Solution Certification.

Note 2: Link Margins are given assuming a free-space propagation model.

4.3 *S-meter Performance*

The numbers "reported over the AT command interface indicate the signal strength of the ring channel. Care should be taken when using the S-meter readings for comparisons between devices. Of particular note are the following:
1. There is a 0.5 dB tolerance on calibrating the S-meter.
2. Each bar represents a 2 dB increment
3. Multiple ring channels can be present at the same time so units can lock to different signals.
4. The Test Interface Card (TIC board) implementation adds about 0.6 dB loss in the antenna path.
5. If the reading is near the decision threshold it would be easy to see a 1 bar difference

5 AT Command Set Description

This document specifies the AT Commands supported by the 9602 Transceiver. Informative examples are presented in Section 8. The 9602 is compatible with all previous 9601 with the exception of +CCLK. The +CCLK command is still supported but the value returned is now the Iridium system time while the 9601 returned its internal "real time clock" time. A new AT command has been added for the 9602, +SBDGW and it returns the default gateway on which the modem is programmed to operate.

The 9602 is configured and operated through the use of AT commands. Only AT Commands that are relevant to the 9602 are included. AT Commands related to functionality of the 9522 and 9522A LBTs are not included. Note that Commands may be modified, removed or added and that you should not rely on this document as a definitive statement of the functionality of the commercial 9602 Transceiver. This document will be periodically updated to reflect the addition, deletion or modification of AT Commands. Product Developers should also consult the software release notes for the version of software that is physically loaded on the 9602 used in applications under development. Such release notes are made available to authorized Iridium VARs and VAMs on the Iridium Developer Extranet. It is the responsibility of Product Developers to check compatibility of applications software with the AT Commands on all 9602s used for both development and commercial deployments.

Product Developers should also consult the "Iridium Short Burst Data Service Developers Guide" in addition to the Commands stated herein. That guide provides significant additional information that will aide in Product Developers understanding of the Iridium system.

5.1 *AT – ATtention Code*

This is the prefix for all commands except A/. When entered on its own, the 9602 will respond OK.

5.2 *A/ - Repeat Last Command*

Repeat the last command issued to the 9602 unless the power was interrupted or the unit is reset. A/ is not followed by <CR>.

5.3 *En – Echo*

Echo command characters.
>   0   Characters are not echoed to the DTE.
>   1   Characters are echoed to the DTE (default).

5.4 In – Identification

Requests the 9602 to display information about itself.

0	"2400" (for compatibility only)
1	"0000" (for compatibility only)
2	"OK" (for compatibility only)
3	"XXXXXXXX" (Software revision level)
4	"IRIDIUM 9600 Family" (Product description)
5	"8816" (for compatibility only)
6	"XXX" (Factory identity)
7	"XXXXXXXX" (Hardware specification)

5.5 Qn – Quiet Mode

Control 9602 responses.

0	9602 responses are sent to the DTE (default).
1	9602 responses are NOT sent to the DTE.

5.6 Vn – Verbose Mode

Set the response format of the 9602, which may be either numeric or textual.

0	Numeric responses.
1	Textual responses (default).

5.7 Zn – Soft Reset

Reset the 9602's data port to a user-stored configuration that has been previously stored using &Wn.

0	Restores user configuration 0.
1	Restores user configuration 1.

5.8 &Dn – DTR Option

Set the 9602 reaction to the DTR signal.

0	DTR is ignored. A DTR signal input is not needed when set to &D0.
1-3	DTR must be ON. If DTR transitions from ON to OFF, the data port will be locked after approximately 10 seconds to enter the UART test mode. The data port will resume when DTR is restored to ON. There is no distinction between settings 1-3. (Default is 2)

5.9 &Fn – Restore Factory Settings

Recall factory default configuration without resetting the data port.

0	Recall factory default 0.

5.10 &Kn – Flow Control

Select the flow control method between the 9602 and DTE. Flow control is only applied to the transfer of SBD message data; it does not apply to AT commands and their responses.

0   Disables flow control.
3   Enables RTS/CTS flow control (default).

5.11 &V – View Active and Stored Configuration

View the current active configuration and stored profiles.

5.12 &Wn – Store Active Configuration

Store the active profile in non-volatile memory. This is used to store user configurations for later use.

0   Store current (active) configuration as profile 0.
1   Store current (active) configuration as profile 1.

5.13 &Yn – Designate Default Reset Profile

Select profile for use after power-up.

0   Select profile 0 (default).
1   Select profile 1.

5.14 %R – Display Registers

Display all the S-registers in the system.

5.15 *F – Flush to EEPROM

Flush all pending writes to EEPROM, shut down the radio, and prepare the 9602 to be powered down. The command returns OK upon completion, at which point it is safe to remove the power without losing non-volatile data.

Note: This command stops the 9602 from responding to any more commands, but does not actually power it down. The only way to power down the 9602 is for the FA to remove the power or to de-assert the on/off control line.

Note: After an SBD session, the new SBD MOMSN is always flushed to EEPROM before the +SBDI result is issued.

5.16 *Rn – Radio Activity

Control radio activity.

0	Disable radio activity.
1	Enable radio activity (default).

- While the radio is disabled:
- SBD sessions can not be initiated; they will fail immediately.
- No SBD Automatic Notifications will be issued for automatic-MT messages.
- No registration, i.e. location updates will be performed.
- The baseband circuitry is still active and the 9602 still accepts AT commands.

This command allows the FA to reduce detectable emissions from the RF circuitry during the idle periods between SBD sessions, and also provides some, limited, power saving in cases where it may be inconvenient for the FA to power down the 9602.

5.17 +CCLK – Real time clock

Exec Command: +CCLK
Query the 9602 for Iridium system time if available.

5.18 +CGMI – Manufacturer Identification

Exec Command: +CGMI
Query the 9602 manufacturer.

5.19 +CGMM – Model Identification

Exec Command: +CGMM
Query the 9602 model.

5.20 +CGMR – Revision

Exec Command: +CGMR
Query the 9602 revision.

5.21 +CGSN – Serial Number

Exec Command: +CGSN
Query the 9602 IMEI.

5.22 +CIER – Indicator Event Reporting

Set Command: +CIER=[<mode>[,<sigind>[,<svcind>]]]

The set command enables or disables sending of the +CIEV unsolicited result code from the 9602 to the DTE in case of indicator state changes. <mode> controls the processing of the +CIEV unsolicited result codes.

<mode>:

    0   Disable indicator event reporting; do not send +CIEV unsolicited result codes to the DTE; buffer the most recent indicator event for each indicator in the 9602 (default).

    1   Enable indicator event reporting; buffer the most recent +CIEV unsolicited result code for each indicator when the data port is reserved (e.g. in SBD data mode) and flush them to the DTE after reservation; otherwise forward them directly to the DTE.

<sigind>:

Control reporting of "signal quality" indicator changes:

    0   No "signal quality" indicator reporting.

    1   Enable "signal quality" indicator reporting using result code

          +CIEV:0,<rssi>

          where <rssi> is:

               0   Equivalent to 0 bars on the signal strength indicator

               1   Equivalent to 1 bars on the signal strength indicator

               2   Equivalent to 2 bars on the signal strength indicator

               3   Equivalent to 3 bars on the signal strength indicator

               4   Equivalent to 4 bars on the signal strength indicator

               5   Equivalent to 5 bars on the signal strength indicator

The reported signal strength is the same value that would be returned by the +CSQ command.

When enabled, the signal quality indicator is reported only when the signal strength changes.

<svcind>:

Control reporting of "service availability" indicator changes:

    0   No "service availability" indicator reporting.

    1   Enable "service availability" indicator reporting using result code

          +CIEV:1,<value>

          where <value> is:

               0   Network service is currently unavailable.

               1   Network service is available.

Network service availability is equivalent to a signal strength greater than 0. The service availability indicator provides a way for the FA to wait until the 9602 can start an SBD session without receiving continual notifications of changes in signal strength.

Read Command: +CIER?

Query the current indicator event reporting settings. The response is of the form:

> +CIER:<mode>,<sigind>,<svcind>,<antind>

Where <antind> is not used and is included for compatibility only.

Test Command: +CIER=?

List the supported settings. The response is in the form:

> +CIER:(supported <mode>s),(supported <sigind>s),(supported <svcind>s) ,(supported <antind>s)

Note: In <mode> 1, the DTE may miss some indicator state changes if they occur while the data port is reserved. However, the buffering mechanism ensures that the most recent change for each indicator during reservation will be flushed to the DTE after reservation; thus the DTE is always made aware of the latest state of each indicator.

Note: The DTE may initiate an SBD session even if service is unavailable; in this case, the 9602 makes an immediate search for the network and, if successful, starts the SBD session, otherwise the SBD session fails.

5.23 +CRIS – Ring Indication Status

Exec Command: +CRIS

Query the ring indication status, returning the reason for the most recent assertion of the Ring Indicator. The response contains separate indications for telephony and SBD ring indications.

The response is in the form:

+CRIS:<tri>,<sri>

where <tri> indicates the telephony ring indication status (for compatibility):

> 0   No telephony ring alert received.

and <sri> indicates the SBD ring indication status:

> 0   No SBD Ring Alert received.
> 1   SBD Ring Alert received.

Note: The <tri> response is included for compatibility with 9522A applications. The results in the <tri> response should be ignored for 9602 applications. For the 9602 only the <sri> response should be evaluated.

5.24 +CSQ – Signal Quality

Exec Command: +CSQ[F]

Execution command returns the received signal strength indication <rssi> from the 9602. Response is in the form:

+CSQ:<rssi>

where:

<rssi>:

0	Equivalent to 0 numbers displayed on the signal strength indicator.
1	Equivalent to 1 number displayed on the signal strength indicator.
2	Equivalent to 2 numbers displayed on the signal strength indicator.
3	Equivalent to 3 numbers displayed on the signal strength indicator.
4	Equivalent to 4 numbers displayed on the signal strength indicator.
5	Equivalent to 5 numbers displayed on the signal strength indicator.

Test Command: +CSQ=?

List the supported signal strength indications. The response is in the form:

+CSQ:(supported <rssi>s)

Each number represents about 2 dB improvement in link margin over the previous value. A reading of 0 is at or below the minimum receiver sensitivity level. A reading of 1 indicates about 2 db of link margin. A reading of 5 indicates 10 dB or more link margin. These are not calibrated output and provides relative information about the units receive signal, and not an absolute receiver level or even a calibrated signal to noise ratio.

Note: A signal strength response may not be immediately available, but will usually be received within two seconds of issuing the command. If the 9602 is in the process of acquiring the system, a delay in response of up to 50 seconds may be experienced.

Note: The +CSQF form of the command returns immediately, reporting the last known calculated signal strength. Note that the signal strength returned by this command could be different from the current actual signal strength if the +CSQ form is used. This form is included for Product Developer application compatibility as it provides a Fast response.

5.25 +CULK – Unlock

Exec Command: +CULK=<unlock key>

Unlock the Transceiver after it has been locked by the Gateway. The unlock key must be obtained by contacting Iridium's customer support.

<unlock key>:

0000000000000000 .. FFFFFFFFFFFFFFFF

A string of 16 hexadecimal digits.

While the Transceiver is locked, it is unable to perform any SBD sessions. Any attempts to start a session will return an error code indicating that the Transceiver is locked.

Command Response:

+CULK:<status>

where:

<status> indicates the lock status of the Transceiver following the unlock attempt:

0 Unlocked – Transceiver is not locked and is permitted to perform SBD sessions.

1 Locked – Transceiver is locked and unable to perform SBD sessions. It must be unlocked by supplying the correct unlock key to the +CULK command.

2 Permanently locked – Transceiver is locked and unable to perform SBD sessions. It cannot be unlocked and must be returned to the supplier.

Read Command: +CULK?

Query the current lock status of the Transceiver. The response is of the form:

+CULK:<status>

<status>:

0 Unlocked

1 Locked

2 Permanently locked

5.26 +GMI – Manufacturer Identification

Exec Command: +CGMI

Query the 9602 manufacturer.

5.27 +GMM – Model Identification

Exec Command: +CGMM

Query the 9602 model.

5.28 +GMR – Revision

Exec Command: +CGMR

Query the 9602 revision.

5.29 +GSN – Serial Number

Exec Command: +CGSN

Query the 9602 IMEI.

5.30 +IPR – Fixed DTE Rate

Set Command: +IPR=<rate>

Set the data rate at which the 9602 will accept commands. The change in data rate takes into effect after the result code (e.g., OK) is received by the DTE.

where:

<rate>:

1	600 bps
2	1200 bps
3	2400 bps
4	4800 bps
5	9600 bps
6	19200 bps (default)
7	38400 bps
8	57600 bps
9	115200 bps

Read Command: +IPR?

Query the current data rate. The response is in the form:

+IPR:<rate>

Test Command: +IPR=?

List the supported data rates. The response is in the form:

+IPR:(supported <rate> settings)

5.31 +*SBDWB – Short Burst Data: Write Binary Data to the ISU*

Exec Command: +SBDWB=<SBD message length>

This command is used to transfer a binary SBD message from the DTE to the single mobile originated buffer in the 9602. The mobile originated buffer can contain only one message at any one time.

- Once the command is entered, and the message length is acceptable, the 9602 will indicate to the DTE 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 DTE.

- The <SBD message length> parameter represents the length, in bytes, of the SBD message not including the mandatory two-byte checksum.

- The maximum mobile originated SBD message length is specified at 340 bytes. The minimum mobile originated SBD message length is 1 byte. If the <SBD message length> parameter is out of range, the 9602 issues response 3 (see below).

- Once the DTE receives the READY indication from the 9602, the SBD message must be sent from the DTE formatted as follows:
  {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 DTE were to send the word "hello" encoded in ASCII to the 9602 the binary stream would be hex 68 65 6c 6c 6f 02 14.

- The mobile originated buffer will be empty upon power-up.

- If any data is currently in the mobile originated buffer, it will be overwritten.

Command Response:

0   SBD message successfully written to the 9602.

1   SBD message write timeout. An insufficient number of bytes were transferred to 9602 during the transfer period of 60 seconds.

2   SBD message checksum sent from DTE does not match the checksum calculated by the 9602.

3   SBD message size is not correct. The maximum mobile originated SBD message length is 340 bytes. The minimum mobile originated SBD message length is 1 byte.

5.32 +SBDRB – Short Burst Data: Read Binary Data from the Module

Exec Command: +SBDRB

This command is used to transfer a binary SBD message from the single mobile terminated buffer in the 9602 to the DTE. The mobile terminated buffer can contain only one message at any one time.

- 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 mobile terminated SBD message length is length is specified at 270 bytes (and may be increased following actual performance testing).

  - 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 9602 were to send the word "hello" encoded in ASCII to the DTE the binary stream would be hex 00 05 68 65 6c 6c 6f 02 14.

  - If there is no mobile terminated SBD message waiting to be retrieved from the 9602, 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 9602 for this command.

5.33 +*SBDWT – Short Burst Data: Write a Text Message to the Module*

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

This command is used to transfer a text SBD message from the DTE to the single mobile originated buffer in the 9602.

The text message may be entered on the command line:

- For example, "AT+SBDWT=hello".
- The length of <text message> is limited to 120 characters. This is due to the length limit on the AT command line interface.
- The message is terminated when a carriage return is entered.

Alternatively, the text message may be entered separately:

- Upon entering the command "AT+SBDWT", the 9602 will indicate to the DTE that it is prepared to receive the message by sending the string "READY<CR><LF>" (hex 52 45 41 44 59 0D 0A) to the DTE.
- Once the DTE receives the READY indication, the text message must be sent, terminated by a carriage return.
- The length of the text message entered in this way is limited only by maximum mobile-originated SBD message length of 340 bytes.
- The mobile originated buffer will be empty upon power-up.
- If any data is currently in the mobile originated buffer, it will be overwritten.

Command Response:

For the "AT+SBDWT" form:

> 0   SBD message successfully written to the 9602.
>
> 1   SBD message write timeout. An insufficient number of bytes were transferred to 9602 during the transfer period of 60 seconds.

For the "AT+SBDWT=<text message>" form:

> OK: SBD message successfully stored in mobile originated buffer.
>
> ERROR: An error occurred storing SBD message in mobile originated buffer.

5.34 +*SBDRT – Short Burst Data: Read a Text Message from the Module*

Exec Command: +SBDRT

This command is used to transfer a text SBD message from the single mobile terminated buffer in the 9602 to the DTE. This command is similar to +SBDRB but does not provide a length indicator or checksum. 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.

- Once the command is entered, the SBD message in the mobile terminated buffer is sent out of the port.
- This command is similar to +SBDRB except no length or checksum will be provided.
- The maximum mobile terminated SBD message length is 270 bytes.
- The mobile terminated message buffer will be empty upon power-up.

Command Response:

> +SBDRT:<CR> {mobile terminated buffer}

5.35 +SBDI – Short Burst Data: Initiate an SBD Session

Note: The +SBDI command is provided for backwards compatibility with existing FAs which do not use SBD Automatic Notification functionality. For SBD calls invoked with this command: \

- The SBD Session Type is fixed at type 0 – MO call.

- The SBD Delivery Short Code will be the value specified by the +SBDDSC command.

- The Detach/Attach flag is fixed at the Detach setting.

- The Location Update flag is fixed at the No Update setting.

FAs requiring SBD Automatic Notification functionality should use the extended +SBDIX command.

Exec Command: +SBDI

This command initiates an SBD session between the 9602 and the GSS. If there is a message in the mobile originated buffer it will be transferred to the GSS. Similarly if there is one or more messages queued at the GSS the oldest will be transferred to the 9602 and placed into the mobile terminated buffer.

- The message, if any, in the mobile originated buffer will be sent from the 9602 to the GSS.

- If there is a MT-SBD message queued at the GSS it will be transferred to the 9602 and placed into the mobile terminated buffer.

Command Response:

+SBDI:<MO status>,<MOMSN>,<MT status>,<MTMSN>,<MT length>,<MT queued>

where:

<MO status>:

MO session status provides an indication of the disposition of the mobile originated transaction. The field can take on the following values:

0   No SBD message to send from the 9602.

1   SBD message successfully sent from the 9602 to the GSS.

2   An error occurred while attempting to send SBD message from 9602 to GSS.

<MOMSN>:

The Mobile Originated Message Sequence Number (MOMSN) is a value assigned by the 9602 when sending a mobile-originated message to the GSS. This value is incremented each time an SBD session is successfully completed between the 9602 to the GSS. This wrap around counter can range from 0 to 65535.

<MT status>:

The MT status provides an indication of the disposition of the mobile terminated transaction. The field can take on the following values:

0   No SBD message to receive from the GSS.

1   SBD message successfully received from the GSS.

2   An error occurred while attempting to perform a mailbox check or receive a message from the GSS.

<MTMSN>:

The Mobile Terminated Message Sequence Number (MTMSN) is assigned by the GSS when sending a message to the 9602. This value is indeterminate if the field <MT status> is zero. This wrap around counter can range from 0 to 65535.

<MT length>:

The MT length is the length in bytes of the mobile terminated SBD message received from the GSS. If no message was received, this field will be zero.

<MT queued>:

MT queued is a count of mobile terminated SBD messages waiting at the GSS to be transferred to the 9602.

5.36 +SBDDET – Short Burst Data: Detach

Exec Command: +SBDDET

Initiates an SBD session to stop sending SBD Ring Alerts to the Transceiver from the Gateway (detach).

Command Response:

> +SBDDET:<status>,<error>

where:

<status>:

0	Detach successfully performed
1	An error occurred while attempting the detach

<error>:

Gateway-reported values

0	No error.
1..4	Reserved, but indicate success if used.
5..14	Reserved, but indicate failure if used.
15	Access is denied.

Transceiver-reported values

16	Transceiver has been locked and may not make SBD calls (see +CULK command).
17	Gateway not responding (local session timeout).
18	Connection lost (RF drop).
19..31	Reserved, but indicate failure if used.
32	No network service, unable to initiate call.
33	Antenna fault, unable to initiate call.
34	Radio is disabled, unable to initiate call (see *Rn command).
35	Transceiver is busy, unable to initiate call (typically performing auto-registration).
36..	Reserved, but indicate failure if used.

This command instructs the GSS to stop sending SBD Ring Alerts (detach) for the calling Transceiver. Successful completion of the detach command implies that the GSS has performed the requested detach action and the Transceiver will no longer receive any notifications of queued MT Messages from the GSS. This session does not transfer any MO or MT messages.

Note: A user can send an MO-SBD message and request a detach at the same time by using the +SBDI command. The +SBDI command always requests a detach.

5.37 +SBDDSC – Short Burst Data: Delivery Short Code

Set Command: +SBDDSC=<dsc>

Set the Delivery Short Code (DSC), which provides some additional options for control of MT messages. This is an 8-bit value providing the ability to set individual fields. Value 0x80 (hexadecimal) sets the most significant bit. Value 0x01 sets the least significant bit. Flag values can be added together to achieve a combination of settings. Some fields may be "locked" when the Transceiver is in a special mode (e.g. Autoregistration locks the flag values 0x80 and 0x40).

<dsc>:

> 0x00 to 0xFF   DSC to be used for subsequent uploaded messages (0x00 is default)
>
> 0x80   Hold MT message delivery
>
> 0x40   Leave MT message in queue after delivery

Read Command: +SBDDSC?

Query the current Delivery Short Code. The response is of the form:

+SBDDSC:<dsc>

5.38 +*SBDIX – Short Burst Data: Initiate an SBD Session Extended*

Note: The +SBDIX command must be used in place of the +SBDI command for FAs wishing to make use of SBD Automatic Notification functionality.

Exec Command: **+SBDIX[A][=<location>]**

This command initiates an SBD session between the 9602 and the GSS, setting the SBD Session Type according to the type of command +SBDIX or +SBDIXA, Delivery Short Code according to the value specified by the +SBDDSC command, and the type of location according to whether the optional location value is provided. If there is a message in the mobile originated buffer it will be transferred to the GSS. Similarly if there is one or more MT messages queued at the GSS the oldest will be transferred to the 9602 and placed into the mobile terminated buffer.

- The message, if any, in the mobile originated buffer will be sent from the 9602 to the GSS.

- If there is a MT message queued at the GSS it will be transferred to the 9602 and placed into the mobile terminated buffer.

- This command will always attempt an SBD Network Registration, consisting of attach and location update, during the SBD session in order to support SBD Automatic Notification. If this is not desired, the +SBDI command should be used.

- The FA should append an 'A' to the command, i.e. +SBDIXA, when the SBD session is in response to SBD Ring Alert. If this option is not used, more than one SBD Ring Alert may be received.

<location> has format:

      [+|-]DDMM.MMM,[+|-]dddmm.mmm

where:

      DD   Degrees latitude (00-89)

      MM   Minutes latitude (00-59)

      MMM Thousandths of minutes latitude (000-999)

      ddd   Degrees longitude (000-179)

      mm   Minutes longitude (00-59)

      mmm Thousandths of minutes longitude (000-999)

The optional sign indicators specify latitude North (+) or South (-), and longitude East (+) or West (-). If omitted, the default is +.

For example,

      AT+SBDIX=5212.483,-00007.350

corresponds to 52 degrees 12.483 minutes North, 0 degrees 7.35 minutes West.

Note: The <location> feature is a future capability and has not been implemented.

Command Response:

      +SBDIX:<MO status>,<MOMSN>,<MT status>,<MTMSN>,<MT length>,<MT queued>

where:

<MO status>:

MO session status provides an indication of the disposition of the mobile originated transaction. The field can take on the following values:

Gateway-reported values

0	MO message, if any, transferred successfully.
1	MO message, if any, transferred successfully, but the MT message in the queue was too big to be transferred.
2	MO message, if any, transferred successfully, but the requested Location Update was not accepted.
3..4	Reserved, but indicate MO session success if used.
5..8	Reserved, but indicate MO session failure if used.
10	Gateway reported that the call did not complete in the allowed time.
11	MO message queue at the Gateway is full.
12	MO message has too many segments.
13	Gateway reported that the session did not complete.
14	Invalid segment size.
15	Access is denied.

Transceiver-reported values

16	Transceiver has been locked and may not make SBD calls (see +CULK command).
17	Gateway not responding (local session timeout).
18	Connection lost (RF drop).
19..31	Reserved, but indicate MO session failure if used.
32	No network service, unable to initiate call.
33	Antenna fault, unable to initiate call.
34	Radio is disabled, unable to initiate call (see *Rn command).
35	Transceiver is busy, unable to initiate call (typically performing auto-registration).
36..	Reserved, but indicate failure if used.

<MOMSN>:

The Mobile Originated Message Sequence Number (MOMSN) is a value assigned by the 9602 when sending a mobile-originated message to the GSS. This value is incremented each time an SBD session is successfully completed between the 9602 to the GSS. This wrap around counter can range from 0 to 65535.

<MT status>:

The MT status provides an indication of the disposition of the mobile terminated transaction. The field can take on the following values:

0	No MT SBD message to receive from the Gateway.
1	MT SBD message successfully received from the Gateway.
2	An error occurred while attempting to perform a mailbox check or receive a message from the Gateway.

<MTMSN>:

The Mobile Terminated Message Sequence Number (MTMSN) is assigned by the GSS when forwarding a message to the 9602. This value is indeterminate if the field <MT status> is zero. This wrap around counter can range from 0 to 65535.

<MT length>:

The MT length is the length in bytes of the mobile terminated SBD message received from the GSS. If no message was received, this field will be zero.

<MT queued>:

MT queued is a count of mobile terminated SBD messages waiting at the GSS to be transferred to the 9602.

5.39 +*SBDMTA – Short Burst Data: Mobile-Terminated Alert*

Set Command: +SBDMTA=<mode>

Enable or disable the ISU to listen for SBD Ring Alerts.

<mode>:

     0   Disable SBD Ring Alert indication

     1   Enable SBD Ring Alert ring indication (default)

When SBD Ring Alert indication is enabled, the 9602 asserts the RI line and issues the unsolicited result code SBDRING when an SBD Ring Alert is received.

Read Command: +SBDMTA?

Query the current ring indication mode. The response is of the form:

+SBDMTA:<mode>

Test Command: +SBDMTA=?

List the supported mode settings. The response is of the form:

+SBDMTA:(supported <mode> settings)

Note: There are a number of required steps in both the ISU and the GSS in order to successfully enable SBD Automatic Notifications. Consult the SBD Developers Guide section on Automatic Notifications for Mobile Terminated Messages.

5.40 +*SBDREG – Short Burst Data: Network Registration*

Exec Command: +SBDREG[=<location>]

Triggers an SBD session to perform a manual SBD Network Registration.

This command initiates an SBD session to perform a manual SBD Network Registration, consisting of an attach and location update. The session type will be set to 2 – registration. This session does not transfer any MO or MT message(s).

Note: The Transceiver restricts the number of manual and automatic registrations to one every 3 minutes. Successive attempts within 3 minutes will return an error code indicating that the FA should try later (see error 36 below).

Note: A user can send an MO SBD message and perform a SBD Network Registration at the same time by using the +SBDIX command. The +SBDIX command always performs a SBD Network Registration attempt and should be used for an application requiring SBD Automatic Notification. The +SBDI command never includes an SBD Network registration and should be used for an application that does not require SBD Automatic Notification.

Note: If you are not using MT-SBD messages there is no requirement or benefit to using this command.

<location> has format:

> [+|-]DDMM.MMM,[+|-]dddmm.mmm

where:

DD	Degrees latitude (00-89)
MM	Minutes latitude (00-59)
MMM	Thousandths of minutes latitude (000-999)
ddd	Degrees longitude (000-179)
mm	Minutes longitude (00-59)
mmm	Thousandths of minutes longitude (000-999)

The optional sign indicators specify latitude North (+) or South (-), and longitude East (+) or West (-). If omitted, the default is +.

For example,

> AT+SBDIX=5212.483,-00007.350

corresponds to 52 degrees 12.483 minutes North, 0 degrees 7.35 minutes West.

Note: The <location> feature is a future capability and has not been implemented.

Command Response:

> +SBDREG:<status>,<reg err>

where:

<status> indicates the resulting registration status of the Transceiver:

0	Detached – Transceiver is detached as a result of a successful +SBDDET or +SBDI command.
1	Not registered – Transceiver is attached but has not provided a good location since it was last detached.
2	Registered – Transceiver is attached with a good location. Note that this may be the case even when the most recent attempt did not provide a good location.
3	Registration denied – The gateway is denying service to the Transceiver.

<reg err>:

Gateway-reported values

0	No error.
2	Session completed but the requested Location Update was not accepted.
3..14	Reserved, but indicate Location Update failure if used.
15	Access is denied.

Transceiver-reported values

16	Transceiver has been locked and may not make SBD calls (see +CULK command).
17	Gateway not responding (local session timeout).

18   Connection lost (RF drop).

19..31 Reserved, but indicate failure if used.

32   No network service, unable to initiate call.

33   Antenna fault, unable to initiate call.

34   Radio is disabled, unable to initiate call (see *Rn command).

35   Transceiver is busy, unable to initiate call (typically performing auto-registration).

36   Try later, must wait 3 minutes since last registration.

37..   Reserved, but indicate failure if used.

Read Command: **+SBDREG?**

Query the current SBD registration status of the Transceiver. The response is of the form:

> +SBDREG:<status>

<status>:

0   Detached

1   Not registered

2   Registered

3   Registration denied

4   Unknown

The SBD Network Registration status is stored in Transceiver non-volatile memory, and can therefore be queried by the FA after powering up. Note that if the Transceiver is powered off and then moved any significant distance (> 150Kilometers) that the location information will be incorrect when the Transceiver is subsequently powered on. It is recommended that Product Developers initiate a SBD Network Registration following power on if the application is using Mobile Terminated Messages in conjunction with SBD Ring Alerts.

Note: There are a number of required steps in both the ISU and the GSS in order to successfully enable SBD Automatic Notifications. Consult the SBD Developers Guide section on Automatic Notifications for Mobile Terminated Messages.

5.41 +SBDAREG – Short Burst Data: Automatic Registration

Set Command: **+SBDAREG=<mode>**

Set the Transceiver's automatic SBD Network Registration mode.

<mode>:

0	Disable Automatic SBD Network Registration (default)
1	Set the Automatic SBD Network Registration mode to "Automatic"
2	Set the Automatic SBD Network Registration mode to "Ask"

When Automatic SBD Network Registration is enabled, mode 1 or 2, the Transceiver monitors its current location and triggers an Automatic SBD Network Registration when it determines that the Transceiver has moved sufficiently far away from its last registered location. Note that Automatic SBD Network Registration runs only while the Transceiver is attached to the gateway, i.e. the registration status is "Not registered" or "Registered".

A registration status is "Not registered" when the modem has not yet attempted communications with the gateway. The registration status is "Registered" when (1) the device has been provisioned and (2) is ready to communicate and (3) if the Ring Alert has been configured then the application will get notification of messages waiting for subscriber terminated delivery. If a registration is denied the device is prohibited from communications on the network (most likely a provisioning issue.) If in a detached state the unit will not receive ring alerts. This may be due to unknown location at the gateway or because the unit has been reconfigured to not receive alerts.

Automatic SBD Network Registration may only be used with system-provided location. If the FA is providing its own location (e.g. GPS) and the FA should use the manual SBD Network Registration command, +SBDREG.

Upon triggering in mode 1, "Automatic", the Transceiver autonomously initiates an SBD session in order to perform a SBD Network Registration with the updated location of the Transceiver, with the session type set to 3 – auto-registration. This session does not transfer any MO or MT messages.

Upon triggering in mode 2, "Ask", the Transceiver reports to the FA that it should register with the system because the Transceiver location has changed (see <event> below); it is then the responsibility of the FA to register via +SBDREG or +SBDIX. +SBDIX allows the FA to register while including an MO message and/or retrieving an MT message that is pending at the Gateway.

When auto-registration is enabled, mode 1 or 2, the Transceiver reports relevant events to the FA by issuing an unsolicited result code +AREG:<event>,<reg error>.

<event>:

0	Suggest FA makes a registration attempt (mode 2 only)
1	Auto-registration has been performed successfully (mode 1 only)
2	Auto-registration has failed and will be retried after a delay (mode 1 only)

<reg error>:

Gateway-reported values

0	No error.
2	Session completed but the requested Location Update was not accepted.
3..14	Reserved, but indicate Location Update failure if used.
15	Access is denied.

Transceiver-reported values

16	Transceiver has been locked and may not make SBD calls (see +CULK command).
17	Gateway not responding (local session timeout).
18	Connection lost (RF drop).
19..31	Reserved, but indicate failure if used.
32	No network service, unable to initiate call.
33	Antenna fault, unable to initiate call.
34	Radio is disabled, unable to initiate call (see *Rn command).
35	Transceiver is busy, unable to initiate call (typically performing auto-registration).
36	Try later, must wait 3 minutes since last registration.
37..	Reserved, but indicate failure if used.

Read Command: +SBDAREG?

Query the current automatic MT registration mode. The response is of the form:

+SBDAREG:<mode>

Test Command: +SBDAREG=?

List the supported mode settings. The response is of the form:

+SBDAREG:(supported <mode> settings)

Note: There are a number of required steps in both the ISU and the GSS in order to successfully enable SBD Automatic Notifications. Consult the SBD Developers Guide section on Automatic Notifications for Mobile Terminated Messages.

5.42 +SBDD – Short Burst Data: Clear SBD Message Buffer(s)

Exec Command: +SBDD<Delete type>

This command is used to clear the mobile originated buffer, mobile terminated buffer or both.

- 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.

- Using this command or power cycling the 9602 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 9602 to the ESS does not clear the mobile originated buffer.
- Reading a message from the 9602 does not clear the mobile terminated buffer.

Command Response:

0	Buffer(s) cleared successfully.
1	An error occurred while clearing the buffer(s).

5.43 +*SBDC – Short Burst Data: Clear SBD MOMSN*

Exec Command: +SBDC

This command will clear (set to 0) the mobile originated message sequence number (MOMSN) stored in the 9602.

- The MOMSN is maintained even after power cycle.

Command Response:

      0   The MOMSN was cleared successfully.

      1   An error occurred while clearing the MOMSN.

5.44 +*SBDS – Short Burst Data: Status*

Exec Command: +SBDS

This command returns current state of the mobile originated and mobile terminated buffers.

Command Response:

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

where:

<MO flag>:

The MO flag indicates the existence of a message in the mobile originated buffer. The response from the 9602 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 SBD session.

<MT Flag>:

The MT flag indicates the existence of a message in the mobile terminated buffer. The response from the 9602 is one of the following numeric codes:

      0   No message in mobile terminated buffer

      1   Message in mobile terminated buffer

<MTMSN>:

The MTMSN identifies the sequence number that was used in the most recent mobile terminated SBD session. This value will be –1 if there is nothing in the mobile terminated buffer.

5.45 +SBDSX - Short Burst Data: Status Extended

Exec Command: +SBDSX

This command returns current state of the mobile originated and mobile terminated buffers, and the SBD ring alert status.

Command Response:

+SBDSX: <MO flag>, <MOMSN>, <MT flag>, <MTMSN>, <RA flag>, <msg waiting>

where:

<MO flag>:

The 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 SBD session.

<MT Flag>:

The 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>:

The MTMSN identifies the sequence number that was used in the most recent mobile terminated SBD session. This value will be −1 if there is nothing in the mobile terminated buffer.

<RA flag>:

The RA flag indicates whether an SBD Ring Alert has been received and still needs to be answered.

    0   No SBD ring alert.

    1   SBD ring alert has been received and needs to be answered.

Note: The RA flag is set whenever the ISU receives an SBD Ring Alert; this happens even if the +SBDMTA setting specifies that SBD ring indications are disabled.

The RA flag is cleared only on successful completion of an SBD mailbox check, i.e. an SBD session invoked with +SBDI[X[A]] in which the returned MT status indicates that no error occurred.

The value of the RA flag is stored in non-volatile memory so it is preserved across power cycling of the ISU.

<msg waiting>:

The message waiting flag indicates how many SBD Mobile Terminated messages are currently queued at the gateway awaiting collection by the ISU. This flag is updated after every SBD session, including +SBDI, +SBDIX, +SBDIXA, and +SBDREG.

5.46 +SBDTC – Short Burst Data: Transfer MO Buffer to MT Buffer

Exec Command: +SBDTC

This command will transfer the contents of the mobile originated buffer to the mobile terminated buffer. Product Developers of DTE can use this command to test reading and writing to the 9602 without actually initiating SBD sessions with the ESS.

Command Response:

The command produces a response of the form "SBDTC: Outbound SBD copied to Inbound SBD: size = <size>" followed by "OK", where:

<size>: The length of the message in bytes.

5.47 +SBDGW – Short Burst Data: Gateway

Exec Command: +SBDGW

This command will read back the Iridium gateway that the Short Burst Data messages are being sent to.

Command Response:

The command produces a response of the form "SBDGW: <Gateway>"

Where <Gateway> is either EMSS or non-EMSS.

5.48 -MSSTM – Request System Time

Exec Command: -MSSTM

Query the latest system time received from the network. The response is the form:

    -MSSTM:<system_time>

<system_time> can take one of the following forms:

no network service	The 9602 has not yet received system time from the network.
XXXXXXX	Where XXXXXXXX is the current Iridium system time available from the network. The system time as received through the Iridium Air Interface, is a 32 bit integer count of the number of 90 millisecond intervals that have elapsed since the epoch. The return value is formatted as an ASCII hexadecimal number. The counter will rollover approximately every 12 years.

Iridium system time epoch: Mar 8, 2007, 03:50:35 (GMT):

Iridium system time source: The system time is available and valid only after the 9602 has found the network and has received the Iridium system time from the network. Once the time is received, the 9602 uses its internal clock to increment the counter. In addition, at least every 8 hours, or on location update or other event that requires re-registration, the 9602 will obtain a new system time from the network.

Time localization: None. The system time value is always expressed in GMT time.

Resolution and accuracy: The resolution of the system time is one Iridium frame tick, or 90 ms. Accuracy as measured by the difference between the time reported and the actual time it is sent out the 9602 serial port should not exceed 4 frame ticks (.36 seconds) and in most cases will be one frame tick (.09 seconds) or less.

6 S-Register Definitions

S-registers allow control over specific 9602 operations. Some S-registers contain a single numeric value, other S-registers are bit-mapped where individual bits, or set of bits, control specific functions.

Table 6-1 defines the S-registers used for 9602 Transceiver. Some legacy S-registers from the 9522A are obsolete for 9602 Transceiver, and 9602 Transceiver requires some new S-registers. To prevent reallocation of obsolete S-registers, they are reserved and shaded out in the table, and the new S-registers are registers that are unused in 9522A Transceiver and are marked as "new for 9602 Transceiver."

All S-registers, from S0 to S127, are readable. All write permissions remain unchanged from 9522A Transceiver, even where a writable register is not used in 9602 Transceiver. Writable registers are highlighted in the "Sr=n writable?" column. An FA could use the unused writable S-registers to store application-specific data.

The final column in the table indicates which S-registers are stored in non-volatile memory as part of a user profile; the 9602 can be reset to a stored profile using the Zn command.

6.1 *S-Register Commands*

Commands allow S-registers to be read, written, or simply referenced (i.e. set a pointer to designate the current, referenced S-register). S-register commands are described in the following subsections.

6.1.4 Sr – Direct S-Register Reference

Set a pointer to reference S-register r.

6.1.5 Sr? – Direct S-Register Read

Read the value of S-register r.

6.1.6 Sr=n – Direct S-Register Write

Set the value of S-register r to n, where n is a decimal value in the range 0 to 255.

6.1.7 ? – Referenced S-Register Read

Read the value of the current referenced S-register. The current referenced S-register is that which was last acted upon by a direct reference (ATSr), read (ATSr?), or write (ATSr=n) command.

6.1.8 =n – Referenced S-Register Write

Set the value of the current referenced S-register to n. The current referenced S-register is that which was last acted upon by a direct reference (ATSr), read (ATSr?), or write (ATSr=n) command.

6.2 S-Registers

Table 6-1: 9602 Transceiver S-Registers

[Note: To prevent reallocation of obsolete S-registers, they are reserved and shaded out in the table, and the new S-registers are registers that are unused in 9522A Transceiver and are marked as "new for 9602 Transceiver."]

Register	Range	Default	Description	Sr=n writable?	Profile Setting?
S0			Not applicable to 9602		
S1			Not applicable to 9602		
S2	0-255	43	Not applicable to 9602 Escape code character	Y	Y
S3	0-127	13	Carriage return character	Y	
S4	0-127	10	Line feed character	Y	
S5	0-32	8	Backspace character	Y	
S6			Not applicable to 9602		
S7			Not applicable to 9602		
S8			Not applicable to 9602		
S9			Not applicable to 9602		
S10			Not applicable to 9602		
S11			Not applicable to 9602		
S12			Not applicable to 9602		
S13	0-255	49	Bitmap register: bits 0-1: DCE data bits bits 2-3: DCE stop bits bits 4-6: DCE parity setting		Y
S14	0-255	170	Bitmap register: bit 1: En setting (echo) bit 2: Qn setting (quiet) bit 3: Vn setting (verbose) bit 5: Not applicable to 9602	Y	Y
S21	0-255	48	Bitmap register: bit 0: Not applicable to 9602 bit 2: Not applicable to 9602 bits 3-4: &Dn setting (DTR operation) bit 5: Not applicable to 9602 bit 6: Not applicable to 9602		Y
S22			Not applicable to 9602		

Register	Range	Default	Description	Sr=n writable?	Profile Setting?
S23	0-255	61	Bitmap register: bits 1-4: +IPR setting (DTE baud rate) bits 6-7: Not applicable to 9602		Y
S25			Not applicable to 9602		
S27			Not applicable to 9602		
S28			Not applicable to 9602		
S30			Not applicable to 9602		
S31			Not applicable to 9602		
S34			Not applicable to 9602		
S35			Not applicable to 9602		
S36			Not applicable to 9602		
S37			Not applicable to 9602		
S39	0-255	3	Bitmap register: bits 0-2: &Kn setting (flow control)		Y
S40			Not applicable to 9602		
S41			Not applicable to 9602		
S42			Not applicable to 9602		
S43			Not applicable to 9602		
S44			Not applicable to 9602		
S45			Not applicable to 9602		
S47			Not applicable to 9602		
S49			Not applicable to 9602		
S51			Not applicable to 9602		
S52			Not applicable to 9602		
S54			Not applicable to 9602		
S58			Not applicable to 9602		
S95			Not applicable to 9602		
S96			Not applicable to 9602		
S98			Not applicable to 9602		
S99			Not applicable to 9602		
S100			Not applicable to 9602		
S102			Not applicable to 9602		
S103			Not applicable to 9602		

Register	Range	Default	Description	Sr=n writable?	Profile Setting?
S104			Not applicable to 9602		
S106			Not applicable to 9602		
S107			Not applicable to 9602		
S110			Not applicable to 9602		
S111			Not applicable to 9602		
S112	0-255	0	SBD upload message sequence number (high byte)		
S113	0-255	0	SBD upload message sequence number (low byte)		
S121	0-15	1	New for 9602 Transceiver Bitmap register: bit 0: +SBDMTA setting (ring indication) bit 1-2: +SBDAREG setting (automatic registration)		Y
S122	0-31	1	New for 9602 Transceiver Bitmap register: bit 0: *R setting (radio activity) bits 1-4: +CIER setting (indicator event reporting)		Y
S123			Not applicable to 9602		
S124			Not applicable to 9602		
S125			Not applicable to 9602		
S126			Not applicable to 9602		
S127			Not applicable to 9602		

7 Summary of Result Codes

Table 7- 2: Result codes

Numeric (V0)	Verbose (V1)	Description
0	'OK'	Acknowledges execution of command
126	'SBDRING'	MT-SBD message(s) present at gateway (unsolicited if enabled). See section 5.39
4	'ERROR'	Command not accepted
127	'HARDWARE FAILURE: <subsys>,<error>'	Issued at initialization in case of a hardware failure.
as verbose	'READY'	Ready to receive binary message data from DTE
as verbose	'+AREG:<event>,<reg error>'	Auto-registration event report. See section 5.41
as verbose	'+CIEV: <sig>,<value>'	Indicator event report (unsolicited if enabled). See section 5.22

8 Informative Examples

8.1 Setting the Default Configuration

The FA sets the Transceiver's default configuration to no handshaking, no flow control, radio enabled, SBD automatic notifications enabled.

To Transceiver (from FA)	To FA (from Transceiver)	Description
AT&K0		Disable RTS/CTS flow control
	OK	
AT*R1		Enable the radio
	OK	
AT+SBDMTA=1		Enable SBD ring indications
	OK	
AT&W0		Store the configuration as profile 0
	OK	
AT&Y0		Select profile 0 as the power-up default
	OK	

8.2 Power-on to Sending a Message

The FA will power up the Transceiver, wait for the Transceiver to acquire the network, and send a 70-byte message.

To Transceiver (from FA)	To FA (from Transceiver)	Description
		Apply power to the 9602
		Wait for DSR to become asserted
AT+CIER=1,0,1,0		Enable service indication reporting (note that this can be stored in the default configuration)
	OK	
	+CIEV: 1,1	Wait for the 9602 to acquire the network
AT+SBDWB=70		Transfer message to 9602
	READY	
<binary transfer>		
	0	
AT+SBDIX		Perform SBD session
	+SBDIX: 0,23,0,-1,0,0	
AT+SBDD0		Clear the MO message buffer
	OK	

8.3 *Automatic Notification Registration*

The FA verifies its registration state, performs a registration in order to be able to receive automatic notifications, and enables automatic notification indications.

To Transceiver (from FA)	To FA (from Transceiver)	Description
AT+SBDREG?		Query the Transceiver registration status
	+SBDREG:0	Transceiver is detached, i.e. un-registered
AT+SBDREG		Tell the Transceiver to register for automatic notifications
	+SBDREG:2,0	Transceiver is now registered
AT+SBDREG?		Query the Transceiver registration status
	+SBDREG:2	Transceiver is registered
AT+SBDMTA=1		Enable SBD ring indications from Transceiver to FA
	OK	

8.4 *Automatic Notification Message Reception*

The FA verifies its registration state. Upon receiving a automatic notification the FA initiates an SBD session to receive an MT message.

To Transceiver (from FA)	To FA (from Transceiver)	Description
AT+SBDREG?		Query the Transceiver registration status
	+SBDREG:2	Transceiver is registered
	…	Vendor application sends an MT message to the GSS
	+SBDRING	Transceiver indicates an incoming message. The RI line also toggles.
AT+SBDIXA		FA initiates an SBD session in answer to the automatic notification
	+SBDIXA:0,23,1,237,90,2	Transceiver informs FA that a 90-byte message was successfully received with MTMSN 237, and that two further MT messages are queued at the GSS
AT+SBDRB		FA retrieves the received message from the Transceiver
	<binary transfer>	

8.5 *Automatic Notification Automatic Registration*

The FA verifies its registration state and enables automatic registration using the "Ask" mode.

To Transceiver (from FA)	To FA (from Transceiver)	Description
AT+SBDREG?		Query the Transceiver registration status
	+SBDREG:2	Transceiver is registered
AT+SBDAREG=2		FA sets the automatic registration to "Ask" mode
	OK	
	…	Transceiver is moved
	+AREG:0,0	Transceiver notifies FA that it needs to register
AT+SBDREG		FA instructs the Transceiver to register
	+SBDREG:2,0	Registration is successful

8.6 *Sending a Message with Minimal Radio Activity*

Assuming that service indication events have been turned on with AT+CIER=1,0,1, and the radio has been disabled with AT*R0.

To Transceiver (from FA)	To FA (from Transceiver)	Description
AT+SBDWB=70		Transfer message to 9602
	READY	
<binary transfer>		
	0	
AT*R1		Activate the radio and wait for the Transceiver to acquire the network
	OK	
	+CIEV:1,1	Transceiver has acquired the network
AT+SBDI		Perform SBD session
	+SBDI: 0,23,0,-1,0,0	
AT*R0		Deactivate the radio
	OK	
AT+SBDD0		Clear the MO message buffer
	OK	

8.7 *Powering down*

The FA flushes any pending Eeprom writes before powering down the Transceiver.

To Transceiver (from FA)	To FA (from Transceiver)	Description
AT*F		FA tells Transceiver to flush pending writes to Eeprom and waits for completion
	OK	
<binary transfer>		FA may now safely disconnect the Transceiver power supply.

9 Supported AT Commands

Table 9-3, lists the AT commands supported by the 9602 module. This list of supported commands is a subset of commands taken from Iridium's AT Command Specification.

Table 9-3: Supported AT Commands

Command	Description	Note
AT	Attention code	
A/	Repeat last command	
En	Echo	
In	Identification	
Qn	Quiet mode	
Vn	Verbose mode	
Zn	Soft reset	
&Dn	DTR option	
&Fn	Restore factory settings	
&Kn	Flow Control	
&V	View active and stored configuration	
&Wn	Store active configuration	
&Yn	Designate default reset profile	
%R	Display registers	
*F	Flush to EEPROM	
*Rn	Radio activity	
+CCLK	Real-time clock	Reads Iridium Network time if available
+CGMI	Manufacturer identification	
+CGMM	Model identification	
+CGMR	Revision	
+CGSN	Serial number	
+CIER	Indicator event reporting	
+CIER	Ring Indicator Status	
+CSQ	Signal quality	
+CULK	Unlock	
+GMI	Manufacturer identification	
+GMM	Model identification	
+GMR	Revision	
+GSN	Serial number	
+IPR	Fixed DTE rate	
+SBDAREG	Short burst data: Automatic Registration	
+SBDC	Short burst data: Clear SBD MOMSN	
+SBDD	Short burst data: Clear SBD message buffers	
+SBDDET	Short burst data: Detach	
+SBDDSC	Short burst data: Delivery Short code	
+SBDI	Short burst data: Initiate an SBD session	
+SBDIX	Short burst data: Initiate an SBD session extended	
+SBDIXA	Short burst data: Initiate an SBD session extended	

Command	Description	Note
+SBDMTA	Short burst data: Mobile-terminated alert	Manual
+SBDRB	Short burst data: Read binary data from ISU	
+SBDREG	Short burst data: Automatic registration	
+SBDRT	Short burst data: Read a text message from the ISU	
+SBDS	Short burst data: Status	
+SBDSX	Short Burst data Status Extended	
+SBDTC	Short burst data: Transfer MO buffer to MT buffer	
+SBDWB	Short burst data: Write binary data to the ISU	Manual
+SBDWT	Short burst data: Write a text message to the ISU	
-MSSTM	Request system time	