

AT COMMAND SET FOR MODEL 9601-D

TECHNICAL NOTE

November 15, 2005



Copyright © 2005 by NAL Research Corporation

The specifications in this document are subject to change at NAL Research's discretion. NAL Research assumes no responsibility for any claims or damages arising out of the use of this document or from the use of the 9601-D based on this document, including but not limited to claims or damages based on infringement of patents, copyrights or other intellectual property rights. NAL Research makes no warranties, either expressed or implied with respect to the information and specifications contained in this document. Performance characteristics listed in this document are estimates only and do not constitute a warranty or guarantee of product performance.

TABLE OF CONTENTS

TABLE OF CONTENTS	2
GLOSSARY	4
1.0 INTRODUCTION	5
2.0 AT COMMANDS	5
2.1 AT – Attention Code	5
2.2 A/ – Repeat Last Command	5
2.3 En – Echo	5
2.4 In – Identification	5
2.5 Qn – Quiet Mode	5
2.6 Vn – Verbose Mode	5
2.7 Zn – Soft Reset	5
2.8 &Dn – DTR Option (<i>modified</i>)	6
2.9 &Fn – Restore Factory Settings	6
2.10 &Kn – Flow Control (<i>modified</i>)	5
2.11 &V – View Active and Store Configuration	6
2.12 &Wn – Store Active Configuration	6
2.13 &Yn – Designate Default Reset Profile	6
2.14 %R – Display Registers	6
2.15 *F – Flush to EEPROM (<i>new</i>)	6
2.16 *Rn – Radio Activity (<i>new</i>)	7
2.17 +CGMI – Manufacturer Identification	7
2.18 +CGMM – Model Identification	7
2.19 +CGMR – Revision	7
2.20 +CGSN – Serial Number	7
2.21 +CIER – Indicator Event Reporting (<i>new</i>)	7
2.22 +CSQ – Signal Quality	9
2.23 +CULK – Unlock (<i>new</i>)	9
2.24 +GMI – Manufacturer Identification	10
2.25 +GMM – Model Identification	10
2.26 +GMR – Revision	10
2.27 +GSN – Serial Number	10
2.28 +IPR – Fixed DTE Rate	10
2.29 +SBDWB – Short Burst Data: Write Binary Data to the Module	11
2.30 +SBDRB – Short Burst Data: Read Binary Data from the Module	12
2.31 +SBDWT – Short Burst Data: Write a Text Message to the Module	12
2.32 +SBDRT – Short Burst Data: Read a Text Message from the Module	13
2.33 +SBDI – Short Burst Data: Initiate an SBD Session	13
2.34 +SBDDDET – Short Burst Data: Detach (<i>new</i>)	14
2.35 +SBDDSC – Short Burst Data: Delivery Short Code	15
2.36 +SBDIX – Short Burst Data: Initiate an SBD Session Extended (<i>new</i>)	16
2.37 +SBDMTA – Short Burst Data: Mobile-Terminated Alert (<i>new</i>)	18
2.38 +SBDREG – Short Burst Data: Network Registration (<i>new</i>)	18

2.39 +SBDAREG – Short Burst Data: Automatic Registration (<i>new</i>)	20
2.40 +SBDD – Short Burst Data: Clear SBD Message Buffer(s)	21
2.41 +SBDC – Short Burst Data: Clear SBD MOMSN	21
2.42 +SBDS – Short Burst Data: Status	21
2.43 +SBDTC – Short Burst Data: Transfer MO Buffer to MT Buffer	22
2.44 +MSSTM – Request System Time	22
3.0 S-REGISTER DEFINITIONS	23
3.1 S-Register Commands	23
3.1.1 Sr – Direct S-Register Reference	23
3.1.2 Sr? – Direct S-Register Read	23
3.1.3 Sr=n – Direct S-Register Write	23
3.1.4 ? – Referenced S-Register Read	23
3.1.5 =n – Referenced S-Register Write	23
3.2 S-Registers	24
4.0 SUMMARY OF RESULT CODES	28
5.0 INFORMATION EXAMPLES	29
5.1 Setting the Default Configuration	29
5.2 Power-on to Sending a Message	29
5.3 Automatic Notification Registration	30
5.4 Automatic Notification Message Reception	30
5.5 Automatic Notification Automatic Registration	31
5.6 Sending a Message with Minimal Radio Activity	31
5.7 Power Down	31
5.8 Sending an SBD Message to the 9601-D	32
5.9 Field Elements of an SBD Message (Commercial Gateway Only)	33
5.10 Calculate Checksum for SBDWB	34
6.0 TABLE OF AT COMMAND CHANGES	35

GLOSSARY

CTS (V.24 signal)	Clear To Send. This signal is used to control the flow of data to the 9601-D
DCD (V.24 signal)	Data Carrier Detect
DCE	Data Communications Equipment. In this product, DCE refers to the 9601-D
DSR (V.24 signal)	Data Set Ready. This signal, from the 9601-D, indicates readiness to accept communication over the data port
DTE	Data Terminal Equipment. In this product, DTE refers to the FA
DTR (V.24 signal)	Data Terminal Ready. This signal, from the FA, requests the 9601-D to accept communication over the data port
ESS	ETC SBD Subsystem (synonymous with GSS)
ETC	Earth Terminal Controller, part of the Iridium Gateway
FA	Field Application, the "host" of the 9601-D
GSS	Gateway SBD Subsystem (synonymous with ESS)
IMEI	International Mobile Equipment Identity
MO	Mobile Originated
MOMSN	Mobile Originated Message Sequence Number
MT	Mobile Terminated
MTMSN	Mobile Terminated Message Sequence Number
RI (V.24 signal)	Ring Indicate. This signal, from the 9601-D, indicates that an MT message is present at the ESS
RTS (V.24 signal)	Request To Send. This signal is used to control the flow of data from the 9601-D
SBD	Short Burst Data
UART	Universal Asynchronous Receiver Transmitter

1.0 INTRODUCTION

This document is intended as a reference guide to the usage of AT command set for the Iridium 9601-D modem. Only AT commands that are relevant to the 9601-D are included. Note that AT commands may be modified, removed or added and users should always check for the latest revision by logging on NAL Research's anonymous ftp site (under www.nalresearch.com).

2.0 AT COMMANDS

2.1 AT – ATtention Code

This is the prefix for all commands except A/. When entered by itself, the 9601-D will respond with OK.

2.2 A/ – Repeat Last Command

Repeat the last command issued to the 9601-D unless power was interrupted or the 9601-D is reset. A/ is not followed by <CR>.

2.3 En – Echo

Echo command characters.

- 0 Characters are not echoed to the DTE.
- 1 Characters are echoed to the DTE (default).

2.4 In – Identification

Requests the 9601-D 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 9601" (product description)
- 5 "8816" (for compatibility only)
- 6 "XXX" (factory identity)
- 7 "XXXXXXXX" (hardware specification)

2.5 Qn – Quiet Mode

Control 9601-D responses.

- 0 9601-D responses are sent to the DTE (default).
- 1 9601-D responses are NOT sent to the DTE.

2.6 Vn –Verbose Mode

Set the response format of the 9601-D, which may be either numeric or textual.

- 0 Numeric responses.
- 1 Textual responses (default).

2.7 Zn – Soft Reset

Reset the 9601-D'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.

2.8 &Dn – DTR Option (*modified*)

Set the 9601-D 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 (the default is 2).

2.9 &Fn – Restore Factory Settings

Recall factory default configuration without resetting the data port.

0 Recall factory default 0.

2.10 &Kn – Flow Control (*modified*)

Select the flow control method between the 9601-D 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).

2.11 &V – View Active and Stored Configuration

View the current active configuration and stored profiles.

2.12 &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.

2.13 &Yn – Designate Default Reset Profile

Select profile for use after power-up.

0 Select profile 0 (default).

1 Select profile 1.

2.14 %R – Display Registers

Display all the S-registers in the system.

2.15 *F – Flush to EEPROM (*new*)

Flush all pending writes to EEPROM, shut down the radio, and prepare the 9601-D 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 9601-D from responding to any more commands, but does not actually power it down. The only way to power down the 9601-D is for the DC power to be removed 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.

2.16 *Rn – Radio Activity (*new*)

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 9601-D still accepts AT commands.

This command allows the FA (field application, the “host” of the 9601-D) to reduce detectable emissions from the RF circuitry during the idle periods between SBD sessions, and also provides a degree of power saving in cases where it may be inconvenient for the FA to power down the 9601-D.

2.17 +CGMI – Manufacturer Identification

Exec Command: +CGMI

Query the 9601-D manufacturer.

2.18 +CGMM – Model Identification

Exec Command: +CGMM

Query the 9601-D model.

2.19 +CGMR – Revision

Exec Command: +CGMR

Query the 9601-D revision.

2.20 +CGSN – Serial Number

Exec Command: +CGSN

Query the 9601-D IMEI.

2.21 +CIER – Indicator Event Reporting (*new*)

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

The set command enables or disables sending of the +CIEV unsolicited result code from the 9601-D 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 9601-D (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,<rsssi>
where <rsssi> is:
 - 0 Equivalent to 0 bar on the signal strength indicator
 - 1 Equivalent to 1 bar 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 9601-D can start an SBD session without receiving continual notifications of changes in signal strength.

<antind>:

Control reporting of "antenna fault" indicator changes:

- 0 No "antenna fault" indicator reporting.
- 1 Enable "antenna fault" indicator reporting using result code
+CIEV:2,<value>
where <value> is:
 - 0 No antenna fault detected, or antenna fault cleared.
 - 1 Antenna fault detected, further transmission impossible.

An antenna fault indicates that the antenna is not correctly attached, and in order to protect the transmitter no more transmissions are permitted. On seeing an antenna fault, the user should check the antenna connection; the fault will be automatically cleared once the 9601-D detects network service availability again.

Read Command: +CIER?

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

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

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 9601-D makes an immediate search for the network and, if successful, starts the SBD session, otherwise the SBD session fails.

2.22 +CSQ – Signal Quality

Exec Command: +CSQ

Execution command returns the received signal strength indication <rss> from the 9601-D. Response is in the form:

+CSQ:<rss>

where <rss> indicates:

- 0 Equivalent to 0 bar displayed on the signal strength indicator.
- 1 Equivalent to 1 bar displayed on the signal strength indicator.
- 2 Equivalent to 2 bars displayed on the signal strength indicator.
- 3 Equivalent to 3 bars displayed on the signal strength indicator.
- 4 Equivalent to 4 bars displayed on the signal strength indicator.
- 5 Equivalent to 5 bars displayed on the signal strength indicator.

Test Command: +CSQ=?

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

+CSQ:(supported <rss>s)

Note: A signal strength response may not be immediately available, but will usually be received within two seconds of issuing the command. If the 9601-D is in the process of acquiring the system, a delay in response of up to 10 seconds may be experienced.

2.23 +CULK – Unlock (*new*)

Exec Command: +CULK=<unlock key>

Unlock the 9601-D 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 9601-D is locked, it is unable to perform any SBD sessions. Any attempts to start a session will return an error code indicating that the 9601-D is locked.

Command Response:

+CULK:<status>

where <status> indicates the lock status of the 9601-D following the unlock attempt:

- 0 Unlocked – 9601-D is not locked and is permitted to perform SBD sessions.
- 1 Locked – 9601-D 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 – 9601-D 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 9601-D. The response is of the form:

+CULK:<status>

where <status> indicates:

- 0 Unlocked
- 1 Locked
- 2 Permanently locked

2.24 +GMI – Manufacturer Identification

Exec Command: +CGMI

Query the 9601-D manufacturer.

2.25 +GMM – Model Identification

Exec Command: +CGMM

Query the 9601-D model.

2.26 +GMR – Revision

Exec Command: +CGMR

Query the 9601-D revision.

2.27 +GSN – Serial Number

Exec Command: +CGSN

Query the 9601-D IMEI.

2.28 +IPR – Fixed DTE Rate

Set Command: +IPR=<rate>

Set the data rate at which the 9601-D 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> indicates:

- 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)

2.29 +SBDWB – Short Burst Data: Write Binary Data to the Module

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 9601-D. 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 9601-D 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 205 bytes (and may be increased in the future). The minimum mobile originated SBD message length is 1 byte. If the <SBD message length> parameter is out of range, the 9601-D issues response 3 (see below).
- Once the DTE receives the READY indication from the 9601-D, 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 9601-D 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 9601-D.
- 1 SBD message write timeout. An insufficient number of bytes were transferred to 9601-D during the transfer period of 60 seconds.
- 2 SBD message checksum sent from DTE does not match the checksum calculated at the 9601-D.
- 3 SBD message size is not correct. The maximum mobile originated SBD message length is 205 bytes. The minimum mobile originated SBD message length is 1 byte.

2.30 +SBDDB – Short Burst Data: Read Binary Data from the Module

Exec Command: +SBDDB

This command is used to transfer a binary SBD message from the single mobile terminated buffer in the 9601-D 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}
 1. 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.
 2. The maximum mobile terminated SBD message length is specified at 135 bytes (and may be increased following actual performance testing).
 3. 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 9601-D 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.
 4. If there is no mobile terminated SBD message waiting to be retrieved from the 9601-D, 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 9601-D for this command.

2.31 +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 9601-D. 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 9601-D 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 205 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 9601-D.
- 1 SBD message write timeout. An insufficient number of bytes were transferred to 9601-D 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.

2.32 +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 9601-D to the DTE. This command is similar to +SBDRTB 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 +SBDRTB except no length or checksum will be provided.
- The maximum mobile terminated SBD message length is 135 bytes.
- The mobile terminated message buffer will be empty upon power-up.

Command Response:

+SBDRT:<CR> {mobile terminated buffer}

2.33 +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 9601-D and the GSS (Gateway SBD Subsystem). 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 9601-D and placed into the mobile terminated buffer.

- The message, if any, in the mobile originated buffer will be sent from the 9601-D to the GSS.
- If there is a message queued at the GSS it will be transferred to the 9601-D 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 9601-D.
- 1 SBD message successfully sent from the 9601-D to the GSS.
- 2 An error occurred while attempting to send SBD message from 9601-D to GSS.

<MOMSN>:

The Mobile Originated Message Sequence Number (MOMSN) is a value assigned by the 9601-D when sending a mobile-originated message to the GSS. This value is incremented each time an SBD session is successfully completed between the 9601-D 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 forwarding a message to the 9601-D. 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 9601-D.

2.34 +SBDDDET – Short Burst Data: Detach (new)**Exec Command: +SBDDDET**

Initiates an SBD session to detach the 9601-D from the Gateway.

Command Response:

+SBDDDET:<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.

9601-D-reported values

- 16 9601-D 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 9601-D is busy, unable to initiate call (typically performing auto-registration).
- 36 Reserved, but indicate failure if used.

This instructs the Gateway to disable (detach) SBD Automatic Notifications for the calling 9601-D. Successful completion of the detach command implies that the Gateway has performed the requested detach action and the 9601-D is no longer registered. 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.

2.35 +SBDDSC – Short Burst Data: Delivery Short Code

Set Command: +SBDDSC=<dsc>

Set the Delivery Short Code (DSC), which provides dynamic routing information for uploaded 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 9601-D is in a special mode (e.g. Auto-registration locks the flag values 0x80 and 0x40).

<dsc>:

- 0..255 DSC to be used for subsequent uploaded messages (0 default)
- 0x80 Hold MT message delivery
- 0x40 Leave MT message in queue after delivery
- 0x20 Destination in MO payload

Read Command: +SBDDSC?

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

+SBDDSC:<dsc>

2.36 +SBDIX – Short Burst Data: Initiate an SBD Session Extended (*new*)

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 9601-D 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 messages queued at the GSS the oldest will be transferred to the 9601-D and placed into the mobile terminated buffer.

- The message, if any, in the mobile originated buffer will be sent from the 9601-D to the GSS.
- If there is a message queued at the GSS it will be transferred to the 9601-D and placed into the mobile terminated buffer.
- This command will always attempt an SBD 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 an Automatic Notification.

<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.

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.
- 9601-D-reported values
- 16 9601-D 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 9601-D 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 9601-D when sending a mobile-originated message to the GSS. This value is incremented each time an SBD session is successfully completed between the 9601-D 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 9601-D. 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 9601-D.

2.37 +SBDMTA – Short Burst Data: Mobile-Terminated Alert (*new*)

Set Command: +SBDMTA=<mode>

Enable or disable ring indications for SBD Automatic Notifications.

<mode>:

- 0 Disable ring indication
- 1 Enable ring indication (default)

When ring indication is enabled, the 9601-D asserts the RI line and issues the unsolicited result code SBDRING when an SBD automatic notification 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)

2.38 +SBDREG – Short Burst Data: Network Registration (*new*)

Exec Command: +SBDREG[=<location>]

Triggers an SBD session to perform a manual SBD registration.

This command initiates an SBD session to perform a manual SBD 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 messages.

Note: The 9601-D restricts the number of manual and automatic registrations to once 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 register at the same time by using the +SBDIX command. The +SBDIX command always performs a registration attempt and should be used for an application requiring SBD Automatic Notification. The +SBDI command never includes an SBD registration and should be used for an application that does not require SBD Automatic Notification.

<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.

Command Response:

+SBDREG:<status>,<reg err>

where:

<status> indicates the resulting registration status of the 9601-D:

- 0 Detached –9601-D is detached as a result of a successful +SBDET or +SBDI command.
- 1 Not registered –9601-D is attached but has not provided a good location since it was last detached.
- 2 Registered –9601-D 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 9601-D.

<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.

9601-D-reported values

- 16 9601-D 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 9601-D 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 9601-D. The response is of the form:

+SBDREG:<status>

<status>:

- 0 Detached
- 1 Not registered
- 2 Registered
- 3 Registration denied
- 4 Unknown

The registration status is stored in 9601-D non-volatile memory, and can therefore be queried by the FA after powering up.

2.39 +SBDAREG – Short Burst Data: Automatic Registration (*new*)

Set Command: +SBDAREG=<mode>

Set the 9601-D's Auto-registration mode.

<mode>:

- 0 Disable automatic registration (default)
- 1 Set the Auto-registration mode to "Automatic"
- 2 Set the Auto-registration mode to "Ask"

When auto-registration is enabled, mode 1 or 2, the 9601-D monitors its current location and triggers an auto-registration when it determines that the 9601-D has moved sufficiently far away from its last registered location. Note that auto-registration runs only while the 9601-D is attached to the gateway, i.e. the registration status is "Not registered" or "Registered".

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

Upon triggering in mode 1, "Automatic", the 9601-D autonomously initiates an SBD session in order to perform a registration with the updated location of the 9601-D, 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 9601-D reports to the FA that it should register with the system because the 9601-D 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 9601-D 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.

9601-D-reported values

- 16 9601-D 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 9601-D 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)

2.40 +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 9601-D 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 9601-D to the ESS does not clear the mobile originated buffer.
- Reading a message from the 9601-D does not clear the mobile terminated buffer.

Command Response:

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

2.41 +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 9601-D. The MOMSN is maintained even after power cycle.

Command Response:

- 0 The MOMSN was cleared successfully.
- 1 An error occurred while clearing the MOMSN.

2.42 +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 9601-D 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 9601-D 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.

2.43 +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. Developers of DTE can use this command to test reading and writing to the 9601-D 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> is the length of the message in bytes.

2.44 -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 9601-D 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: June 1, 1996, 00:00:13 (GMT):

Iridium system time source: The system time is available and valid only after the 9601-D has registered with the network and has received the Iridium system time from the network. Once the time is received, the 9601-D 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 9601-D 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 9601-D serial port should not exceed 4 frame ticks (.36 seconds) and in most cases will be one frame tick (.09 seconds) or less.

3.0 S-REGISTER DEFINITIONS

S-registers allow control over specific 9601-D 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 1 defines the S-registers used for 9601-D. Many of the A3LA series S-registers are obsolete for 9601-D, and 9601-D 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 A3LA series and are marked as "new for 9601-D".

All S-registers, from S0 to S127, are readable. All write permissions remain unchanged from A3LA series, even where a writable register is not used in 9601-D. 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 9601-D can be reset to a stored profile using the Zn command.

3.1 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.

3.1.1 Sr – Direct S-Register Reference

Set a pointer to reference S-register r.

3.1.2 Sr? – Direct S-Register Read

Read the value of S-register r.

3.1.3 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.

3.1.4 ? –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.

3.1.5 =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.

3.2 S-Registers

Table 1: 9601-D Transceiver S-Registers

REGISTER	RANGE	DEFAULT	DESCRIPTION	Sr=n writable?	Profile Setting?
S0	0 – 255	0	Auto-answer. Assigning a value from 1 to 255 in register S0 tells the ISU to automatically answer incoming calls. The factory setting of 0 turns off the automatic answer feature.	✓	✓
S1	0 – 255	0	Ring count		✓
S2	0 – 255	43	Escape code character	✓	✓
S3	0 – 127	13	Carriage return character	✓	
S4	0 – 127	10	Line feed character	✓	
S5	0 – 32	8	Backspace character	✓	
S6	0 – 255	4	Wait for dial-tone	✓	✓
S7	0 – 255	50	Communication standard used by ISU	✓	✓
S8	0 – 255	4	Pause time for comma	✓	✓
S9	0 – 255	6	Carrier detect response time	✓	✓
S10	0 – 255	14	Carrier loss time	✓	✓
S11	0 – 255	0	DTMF tone duration		✓
S12	0 – 255	50	Escape guard time. Time, in 50 ^{ths} of a second, until OK displayed after entering command mode by escape sequence	✓	✓
S13	0 – 255	49	Bitmap register: Bits 0 – 1: DCE data bits Bits 2 – 3: DCE stop bits Bits 4 – 6: DCE parity setting		✓
S14	0 – 255	170	Bit register: Bit 1: En setting (echo) Bit 2: Qn setting (quiet) Bit 3: Vn setting (verbose) Bit 5: pulse/tone dial mode	✓	✓
S21	0 – 255	48	Bitmap register: Bit 0: telephone jack control Bit 2: RTS/CTS on/off Bits 3 – 4: &Dn setting (DTR operation) Bit 5: &Cn setting Bit 6: disconnecting long space		✓
S22	0 – 255	246	Bitmap register Bits 0 – 1: speaker volume setting Bits 2 – 3: speaker on/off setting Bits 4 – 6: Xn setting		✓

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: guard tone		✓
S25	0 – 255	5	Sets length of time in hundredths of a second that a change in the DTR status has to persist for before it is recognized	✓	✓
S27	0 – 255	9	Bitmap register: Bits 0 – 2: &Qn setting Bit 3: leased line operation setting Bits 4 – 5: synchronous clock setting		✓
S28	0 – 255	0	Bitmap register: Bits 3 – 4: &Pn setting (pulse dial make/break ratio)		
S30	0 – 255	0	Disconnect activity timer. Timer used to determined how long the call connection been inactive, in increments of 1/10000ms. A value of 0 disables this function	✓	✓
S31	0 – 255	0	Bitmap register: Bit 1: line modulation method setting Bits 2 – 3: Wn setting		✓
S34	0 – 255	0	Bitmap register: Bits 0 – 1: data compression type (PT) Bit 6: +DS compression negotiation setting Bit 7: +DR setting		✓
S35	0 – 255	7	Bearer service capabilities	✓	✓
S36	0 – 255	0	Bitmap register: Bits 0 – 2: link type setting		
S37	0 – 255	0	Bitmap register: Bits 0 – 4: Fn setting (line modulation standard)	✓	
S39	0 – 255	3	Bitmap register: Bits 0 – 2: &Kn setting (flow control)		✓
S40	0 – 255	104	Bitmap register: Bits 2 – 4: \K setting Bits 3 – 5: \Kn setting Bits 6 – 7: \An setting		✓
S41	0 – 255	0	Bitmap registers: Bits 2, 6: enable retrain on bad signal quality setting Bit 4: xon/xoff usage setting Bit 5: DTE auto rate adjustment setting		
S42	0 – 255	16	GSM Call clearing code as returned by the network. Refer to GSM 04.08 Table 10.86 Cause Information Element Values		✓

REGISTER	RANGE	DEFAULT	DESCRIPTION	Sr=n writable?	Profile Setting?
S43	0 – 255	32	Bitmap register: Bit 0: +CMGF setting Bit 1: +CBST parameter <name> setting Bit 2: +CMEE setting Bit 3: +CMEE setting Bit 5: +CBST parameter <ce> setting Bit 6: +CRC setting Bit 7: +CR setting		✓
S44	0 – 255	4	Bitmap register: Bits 0 – 2: +CPBS setting Bits 5 – 6: +CREG setting Bit 7: reserved		
S45	0 – 255	0	Bitmap register: Bits 0 – 1: +CNMI parameter <mode> setting Bits 2 – 3: +CNMI parameter <mt> setting Bits 4 – 5: +CNMI parameter <bm> setting Bits 6 – 7: +CNMI parameter <ds> setting		
S47	0 – 255	0	Bitmap register: Bits 4 – 6: TON settings for dial string	✓	✓
S49	0 – 255	1	Bitmap register: Bits 0 – 3: NPI settings for dial string	✓	✓
S51	0 – 255	2	V.42bis maximum codewords (P1), high byte		✓
S52	0 – 255	0	V.42bis maximum codewords (P1), low byte	✓	✓
S54	0 – 255	6	V.42bis maximum string size (P2)	✓	✓
S58	0 – 255	3	V.42bis compression direction (P0)	✓	✓
S95	0 – 255	0	Bitmap register for extended result codes (overrides Wn setting): Bit 0: CONNECT shows DCE speed Bit 2: Enable CARRIER XXXX Bit 3: Enable PROTOCOL XXXX Bit 5: Enable COMPRESSION XXXX	✓	✓
S96	0 – 255	0	IRLP version number (N0) parameter	✓	
S98	1 – 105	10 5	IRLP k iwf → ISU parameter	✓	
S99	1 – 105	10 5	IRLP k ISU → iwf parameter	✓	
S100	1 – 15	15	IRLP N2 parameter	✓	
S102	26 – 255	30	IRLP T1 parameter	✓	
S103	10 – 255	10	IRLP T2 parameter	✓	
S104	4 – 255	25	IRLP T4 parameter	✓	

REGISTER	RANGE	DEFAULT	DESCRIPTION	Sr=n writable?	Profile Setting?
S106	1 – 10	10	IRLP riwf → ISU parameter	✓	
S107	1 – 10	10	IRLP risu → iwf parameter	✓	
S110	0 – 1	0	SBM max segment size (40 – 310) (high byte)		
S111	0 – 255	135	SBM max segment size (40 – 310) (low byte)		
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 9601-D Bitmap register: Bit 0: +SBDMTA setting (ring indication) Bits 1 – 2: +SBDAREG setting (automatic registration)		✓
S122	0 – 31	1	New for 9601-D Bitmap register: Bit 0: *R setting (radio activity) Bits 1 – 4: +CIER setting (indicator event reporting)		✓
S123	0 – 255	8	Bitmap register: Bit 1: +WTM Bit 2: +WDLDM<dldm> Bit 3: +WIRLP<mode> Bits 4 – 5: +WFRNG		
S124	0 – 255	15	Dynamic link measurement interval (+WDLDM <mi> setting). Value in 1000ms unit	✓	
S125	1 – 100	10	Dynamic link delay measurement delay tolerance (+WDLDM<dtl> setting). Value in % unit	✓	
S126	0 – 255	2	Bitmap register: Bit 0: ignore &Dn command specified reaction to DTR ON to OFF transitions. Disconnect as reaction to Hn command. OK response given Bit 1: ignore &Dn command specified reaction to DTR ON to OFF transitions. Ignore Hn command. OK response given Bit 2: comply with &Dn command specified reaction to DTR ON to OFF transitions. Disconnect as reaction to Hn command.		
S127	0 – 255	0	Bitmap register containing copies of MSVTR/MSVLS parameters: Bit 0: -MSVTR: 0=Disabled (default) 1=Enabled Bit 1: -MSVLS: 0=No Mute (default) 1=Mute Enabled		✓

4.0 SUMMARY OF RESULT CODES

NUMERIC (V0)	VERBOSE (V1)	DESCRIPTION
0	'OK'	Acknowledges execution of command
2	'SBDRING'	MT messages present at gateway (unsolicited if enabled). See section 2.34
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 2.39
as verbose	''+CIEV:<sig>,<value >'	Indicator event report (unsolicited if enabled). See section 2.21

5.0 INFORMATIVE EXAMPLES

5.1 Setting the Default Configuration

The FA sets the 9601-D's default configuration to no handshaking, no flow control, radio enabled, SBD Automatic Notifications enabled.

TO 9601-D (FROM FA)	TO FA (FROM 9601-D)	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		Store profile 0 as the power-up default
	OK	

5.2 Power-on to Sending a Message

The FA will power the 9601-D, wait for the 9601-D to acquire the network, and send a 70-byte message.

TO 9601-D (FROM FA)	TO FA (FROM 9601-D)	DESCRIPTION
		Apply power to the 9601-D
		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 9601-D to acquire the network
AT+SBDWB=70		Transfer message to 9601
	READY	
<binary transfer>		
	0	
AT+SBDIX		Perform SBD session
	+SBDIX:0,23,0,-1,0,0	
AT+SBD00		Clear the MO message buffer
	OK	

5.3 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 9601-D (FROM FA)	TO FA (FROM 9601-D)	DESCRIPTION
AT+SBDREG?		Query the 9601-D registration status
	+SBDREG:0	9601-D is detached, i.e. un-registered
AT+SBDREG		Tell the 9601-D to register for Automatic Notifications
	+SBDREG:2,0	9601-D is now registered
AT+SBDREG?		Query the 9601-D registration status
	+SBDREG:2	9601-D is registered
AT+SBDMTA=1		Enable SBD ring indications from 9601-D to FA
	OK	

5.4 Automatic Notification Message Reception

The FA verifies its registration state. Upon receiving an Automatic Notification the FA initiates an SBD session to receive an MT message.

TO 9601-D (FROM FA)	TO FA (FROM 9601-D)	DESCRIPTION
AT+SBDREG?		Query the 9601-D registration status
	+SBDREG:2	9601-D is registered
		User sending a MT message to the GSS
	+SBDRING	9601-D 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	9601-D 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+SBDARB		FA retrieves the received message from the 9601-D
	<binary transfer>	

5.5 Automatic Notification Automatic Registration

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

TO 9601-D (FROM FA)	TO FA (FROM 9601-D)	DESCRIPTION
AT+SBDREG?		Query the 9601-D registration status
	+SBDREG:2	9601-D is registered
AT+SBDAREG=2		FA sets the automatic registration to "Ask" mode
	OK	
	...	9601-D is moved
	+AREG:0,0	9601-D notifies FA that it needs to register
AT+SBDREG		FA instructs the 9601-D to register
	+SBDREG:2,0	Registration successful

5.6 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 9601-D (FROM FA)	TO FA (FROM 9601-D)	DESCRIPTION
AT+SBDWB=70		Transfer message to 9601-D
	READY	
<binary transfer>		
	0	
AT*R1		Activate the radio and wait for the 9601-D to acquire the network
	OK	
	+CIEV:1,1	9601-D 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	

5.7 Powering Down

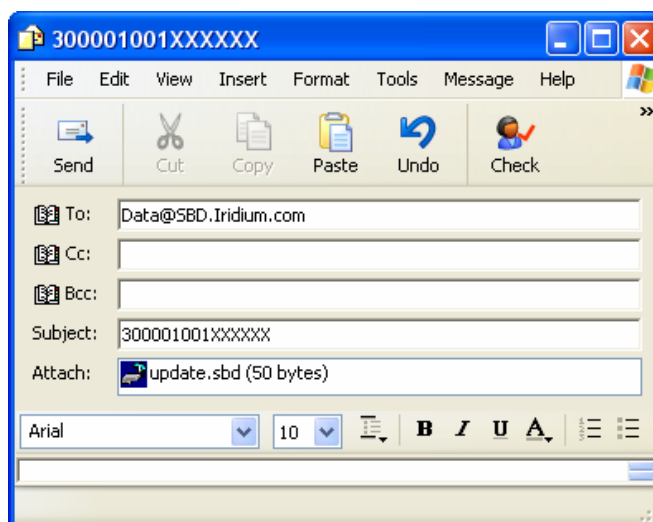
The FA flushes any pending EEPROM writes before powering down the 9601-D.

TO 9601-D (FROM FA)	TO FA (FROM 9601-D)	DESCRIPTION
AT*F		FA tells the 9601-D to flush pending writes to EEPROM and waits for completion
	OK	
<binary transfer>		FA may now safely disconnect the 9601-D power supply

5.8 Sending an SBD Message to the 9601-D

Messages can be sent to the 9601-D via SBD from almost any e-mail program (Outlook, Outlook Express, etc.).

1. In order to send e-mail messages to a 9601-D, the e-mail program must use the standard Multipurpose Internet Mail Extensions (MIME) Base64 encoding as defined in RFC 2045. The following instructions describe how to set this up for Microsoft Outlook Express:
 - a. Select "Tools/Options"
 - b. Click the "Send" Tab
 - c. Under "Mail Sending Format", click "HTML Settings..."
 - d. Click MIME
 - e. Select "Base 64" for Encode text using
 - f. Click OK
 - g. Under "Mail Sending Format", click "Plain Text Settings..."
 - h. Repeat steps d – f
2. Send all e-mail messages to Data@SBD.Iridium.com
3. Place the IMEI number of the modem in the subject line
4. The message should be carried in an attachment, which must have a ".sbd" extension



NOTE: Comparable information related to the DoD gateway is provided upon request.

5.9 Field Elements of an SBD Message (Commercial Gateway Only)

The table below displays the field descriptors of each SBD messages sent from the 9601-D. This format will appear in the body of every SBD e-mail message.

FIELD NAME	DESCRIPTION	
MOMSN	Mobile Originated Message Sequence Number (0 – 65535).	
MTMSN	Mobile Terminated Message Sequence Number (0 – 65535).	
Time of Session	The UTC Timestamp of the 9601-D session between the 9601-D and the controller subsystem.	
Session Status	Session Status	Description
	TRANSFER OK	The SBD session completed successfully.
	INCOMPLETE CALL	The SBD session did not complete successfully due to a protocol error.
	SBD DENIAL	The 9601-D is not allowed to access the system.
	SBD TIMEOUT	The SBD session did not complete for an unknown reason such as a RF fade.
Message Size	The size of the attached message in decoded format. This is not the length of the MIME encoded data.	
Unit Location	The latitude and longitude of the 9601-D. The latitude and the 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% of the time. This location is estimated using Iridium satellites.	
CEPradius	An estimate of the accuracy of the unit in kilometers.	

Example:

MOMSN: 1
MTMSN: 0
Time of Session (UTC): Tue Dec 7 13:09:43 2004
Session Status: TRANSFER OK
Message Size (bytes): 11

Unit Location: Lat = 38.766516 Long = -77.426262
CEPradius = 2

The actual message sent from the 9601-D is in an attachment of the e-mail and the subject line contains the IMEI number of the unit that sent the SBD message.

5.10 Calculate Checksum for SBDWB

Since the calculation of the checksum for SBDWB may be confusing, a C code example is given below. Please see Section 2.29 (+SBDWB) for additional information.

```
unsigned int16 checksum = 0; /*Unsigned 16 bit integer*/
int i;
unsigned char c;
char* data = "Test SBD message";
int length = 16; /* Number of characters in data */

for (i=0;i<length;i++) {
    c = data[i];
    putchar(c);
    checksum += c;
}

//Print out the 2 byte checksum
putchar(checksum/256);
putchar(checksum%256);
```

6.0 TABLE OF AT COMMAND CHANGES

Table below shows which A3LA series AT commands are modified or removed, and which AT commands are new for 9601-D. Removed commands are shaded.

COMMAND	DESCRIPTION	MODIFIED	NEW
AT	Attention code		
A/	Repeat last command		
+++	Escape sequence		
A	Answer		
Bn	Communication standards		
Cn	Carrier control		
D	Dial		
En	Echo		
Fn	Line modulation		
Hn	Hangup		
In	Identification		
Ln	Loudspeaker Volume		
Mn	Speaker control		
Nn	Auto-Mode enable		
On	Online		
P	Pulse dial		
Qn	Quiet mode		
T	Tone dial		
Vn	Verbose mode		
Wn	Error correction message control		
Xn	Extended result codes		
Yn	Long space disconnect		
Zn	Soft reset		
&Cn	DCD option		
&Dn	DTR option	✓	
&Fn	Restore factory settings		
&Gn	Guard tone		
&Jn	Jack control		
&Kn	Flow control	✓	
&Ln	Lease line operation		
&Mn	Asynchronous/synchronous mode		
&Pn	Pulse dial make/break ratio		
&Qn	Sync/async mode		

COMMAND	DESCRIPTION	MODIFIED	NEW
&Rn	RTS/CTS option		
&Sn	DSR override		
&V	View active and stored configuration		
&Wn	Store active configuration		
&Xn	Select asynchronous clock		
&Yn	Designate default reset profile		
\An	MNP block size		
\Bn	Transmit break		
\Gn	XON/XOFF flow control		
\Jn	DTE auto rate		
\Kn	Control break		
\Nn	Line type		
%Cn	Compression control		
%En	Auto retrain		
%R	Display registers		
*F	Flush to EEPROM		✓
*Pn	Power phone		
*Rn	Radio activity		✓
+CBC	Battery charge		
+CBST	Select bearer service type		
+CCFC	Call forward service		
+CCLK	Real-time clock		
+CEER	Extended error report		
+CGMI	Manufacturer identification		
+CGMM	Model identification		
+CGMR	Revision		
+CGSN	Serial number		
+CHUP	Hangup call		
+CIER	Indicator event reporting		✓
+CLCC	Request current call status		
+CLCK	Facility lock		
+CLVL	Loudspeaker volume level control		
+CMEE	Report mobile equipment error		
+CMGD	Delete SMS message		
+CMGF	SMS message format		

COMMAND	DESCRIPTION	MODIFIED	NEW
+CMGL	List SMS messages		
+CMGR	Read SMS message		
+CMGS	Send SMS message		
+CMGW	Write SMS message to memory		
+CMOD	Call mode		
+CMUT	Mute control		
+CNMI	New SMS message indications to DTE		
+CNUM	Read MSISDN number		
+COPS	Operator select		
+CPAS	Phone activity status		
+CPBF	Find phonebook entries		
+CPBR	Read phonebook entries		
+CPBS	Select phonebook storage		
+CPBW	Write phonebook entry		
+CPIN	Enter PIN		
+CPMS	Select preferred SMS message storage		
+CPWD	Change password		
+CR	Service reporting control		
+CRC	Cellular result codes		
+CREG	Network registration		
+CSCA	SMS service center address		
+CSCB	Select cell broadcast message types		
+CSCS	Select TE character set		
+CSMS	Select SMS message service		
+CSQ	Signal quality		
+CSTA	Select type of address		
+CULK	Unlock		✓
+CVHU	Voice hangup control		
+DR	Data compression report level		
+DS	Set data compression function		
+GCAP	General capability		
+GMI	Manufacture 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		

COMMAND	DESCRIPTION	MODIFIED	NEW
+SBDD	Short burst data: Clear SBD message buffers		
+SBDDDET	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		✓
+SBDMTA	Short burst data: Mobile-terminated alert		✓
+SBDRB	Short burst data: Read binary data from 9601-D		
+SBDREG	Short burst data: Automatic registration		✓
+SBDRT	Short burst data: Read a text message from 9601-D		
+SBDS	Short burst data: Status		
+SBDTC	Short burst data: Transfer MO buffer to MT buffer		
+SBDWB	Short burst data: Write binary data to the 9601-D		
+SBDWT	Short burst data: Write a text message to 9601-D		
+SBDZ	Short burst data; Segment size		
+WDAV	Register or deregister an RS232 DAV data peripheral		
+WDLDM	IRLP dynamic link delay measurement		
+WFRNG	Force IRLP renegotiation		
+WIRLP	Iridium radio link protocol		
+WTM	IRLP test mode		
-MSGEO	Request geolocation		
-MSSTM	Request system time		
-MSVLS	Local DTMF feedback selection		
-MSVTR	DTMF received in voice call		
-MSVTS	DTMF generation in voice call		