

AT Commands for 9602-LP

Version A

April 19, 2022



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REVISION HISTORY

Revision	Date	Description
1.4.5	05/29/2014	Initial Version
A	03/30/2022	Formal release

REFERENCE DOCUMENTS

The latest revisions of the NAL documents are available from the NAL Research website at <https://www.nalresearch.com/support/documentatio-downloads/>.

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ACRONYM LIST

DCE	Data Communications Equipment
DTE	Data Terminal Equipment
ESS	ETC SBD Subsystem
ETC	Earth Terminal Controller
FA	Field Application
GND	Ground
GSS	Gateway SBD Subsystem
IMEI	International Mobile Equipment Identity
IMEI	International Mobile Equipment Identity
LBT.....	L-Band Transceiver
MO	Mobile Originated
MOMSN	Mobile Originated Message Sequence Number
MT	Mobile Terminated
MTMSN	Mobile Terminated Message Sequence Number
NMEA	National Marine Electronics Association
Rx.....	Data line from DCE to DTE
SBD	Short Burst Data
Tx.....	Data line from DTE to DCE
UART	Universal Asynchronous Receiver Transmitter
UTC.....	Universal Time Coordinated

1 INTRODUCTION

This document is intended as a reference guide to the usage of AT command set for the 9602-LP Iridium satellite tracker. Note that AT commands may be periodically modified, removed or added; therefore users should always check for the latest revision by logging on to NAL Research's anonymous ftp site (under RESOURCE CENTER of website www.nalresearch.com).

For proper communications between the 9602-LP and the connected DTE (Data Terminal Equipment), the DTE must have the following settings:

1. Baud rate of 19.2 Kbits/sec
2. Flow control off
3. Three-wire serial interface with the 9602-LP (Tx, Rx and GND)

The 9602-LP has two modes of operation—Command mode and Tracking mode. When in Command mode, the 9602-LP operates as a standard modem with GPS. AT commands can be entered to configure the 9602-LP's operating profiles, send or receive SBD messages, or get GPS positions. When in Tracking mode, the 9602-LP automatically transmits GPS reports defined by parameters in the active operating profile. The 9602-LP is factory-set to power up in Command mode, which can be re-programmed with the AT^START command to power up in Tracking mode.

2 COMMAND OVERVIEW

An AT command is a string of characters sent by the DTE to the 9602-LP while the 9602-LP is in Command mode. During Tracking mode, the only AT command accepted by the 9602-LP is a sequence of three pluses (+++). All other commands are ignored. An AT command string has a prefix, a body, and a terminator. The prefix consists of the ASCII upper case characters AT or lower case characters at. The body is a string of commands restricted to printable ASCII characters. The terminator is the carriage return <CR> character.

2.1 COMMAND ENTRY

AT command syntax is critical and the following rules apply:

- All commands (apart from A/ and +++) begin with the prefix of AT or at.
- The commands in a command string (apart from A/ and +++) are executed only after the return or enter key is pressed.
- Use of upper or lower case letters are allowed, but not a combination of both.
- The maximum number of characters in a command string is 128.
- If the numeric parameter n is omitted from the basic command entry, a value of zero is assumed for n.
- If an optional parameter is omitted from an extended command, the current value is implied. Optional parameters are enclosed by square brackets ([...]) in this document.
- Multiple commands can be concatenated into a single command line by separating the additional non-prefixed commands with a space or a semicolon or with no separator.
- Spaces entered into a command string for clarity between the AT prefix and the body of the command are ignored. Likewise, spaces entered for clarity within the command body between alpha characters and decimal parameters are ignored.
- Backspace can be used to edit AT commands.

- The single quotes (') are used to enclose sensitive information such as passwords. When an entry is enclosed by the single quotes and the 9602-LP is set to echo, the entry is replaced with asterisks (*) instead of the actual value.
- For the commands requiring the Crypto Officer Password or the ^ID command, all character values may be entered. For passwords containing the single quote ('), a backslash must be entered in front of it. Similarly, for passwords containing a backslash (\), an additional backslash must be entered in front of it as well. For example, the password Qt3&\v'3 would be entered as 'Qt3&\\v\3'. If underscore (_) is used in the ID field, it will appear as spaces in NAL Research's provided PC software because of backwards compatibility issues with the A3LA-DGS and the A3LA-TSS.
- For the ^ID command with the static identifiers containing the double quote ("), they must be entered with a backslash (\) in front of it. For static identifiers containing a backslash (\), an additional backslash must be entered in front of it as well. For example, for static identifier The "fast" ship\boat would be entered as "The \"fast\" ship\\boat". All entries with \\, \' and \" are treated as single character in length.
- Characters that proceed the AT prefix are ignored.
- CTRL-X will abort a command line input.

2.2 COMMAND RESPONSES

A result code is sent to the DTE by the 9602-LP in response to the execution of an AT command. It may also occur unsolicited from other conditions such as an SBDRING alert. Responses returned as a result of a query are called information responses.

Result codes can be represented by text if the 9602-LP is in verbose mode or with numbers if in numeric mode. The command ATVn informs the 9602-LP whether to respond in verbose or numeric mode. Responses can be suppressed by setting the command ATQn to ATQ1. The table below shows the difference in format between these modes.

Table 1: Numeric and Verbose Response Formats

	Numeric Mode ATQ0 ATV0	Verbose Mode ATQ0 ATV1
Result codes	<NUMERIC_CODE><CR>	<CR><LF><VERBOSE_MODE><CR><LF>
Information Responses	<TEXT><CR><LF>	<CR><LF><TEXT><CR><LF>

Invalid input for certain types of commands will cause the 9602-LP to return a short description of failure before returning the information response and error message. Command entries to the 9602-LP with invalid syntax typically cause the 9602-LP to respond with an ERROR. Command entries of valid syntax with an out-of-range parameter can cause the 9602-LP to respond in one of the three ways:

- Disallow out-of-range entry and respond with ERROR,
- Disallow out-of-range entry and respond with OK,
- and disallow out-of-range entry, accept the closest in-range value, and respond with OK.

3 COMMAND DESCRIPTIONS

3.1 +++ – ESCAPE TRACKING MODE

Force the 9602-LP to leave Tracking mode and to enter Command mode. Before entering Command mode, the 9602-LP will display the information response of “COMMAND MODE”.

NOTE: The 9602-LP is factory-set to power up in Command mode. It can be reprogrammed to power up in either Command mode or Tracking mode with AT^STARTn. If the 9602-LP is powered up in Tracking mode and AT^CALn is set to “Sleep between reports”, then the 9602-LP will ONLY accept the +++ command when it is not sleeping. If the 9602-LP is in Tracking mode and AT^CALn is set to “Callable between reports”, then the 9602-LP will accept the +++ command at any time to transition from Tracking to Command mode. In addition, the 9602-LP tracking statuses are echoed back to the connected DTE in the form of AT commands.

3.2 AT – ATTENTION CODE

This is the prefix for all commands except A/ and +++. When entered by itself, the 9602-LP will respond with OK.

3.3 A/ – REPEAT LAST COMMAND

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

3.4 EN – ECHO

Echo command characters to DTE.

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

3.5 IN – IDENTIFICATION

Request the 9602-LP 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 of micro-controller/GPS) then on the next line "XXXXXXXX" (software revision level of 9602 RF board)
- 4 "NAL Research Corporation 9602-LP" (product description)
- 5 "8816" (for compatibility only)
- 6 "XXX" (9602 RF board factory identity)
- 7 "XXXXXXXX" (9602 RF board hardware specification)

3.6 QN – QUIET MODE

Control the 9602-LP responses to DTE.

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

3.7 VN – VERBOSE MODE

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

- 0 Numeric responses
- 1 Textual responses (default)

3.8 ZN – SOFT RESET

Soft reset the 9602-LP's active operating profile to a user-defined operating profile that has been previously stored using &Wn. The active operating profile will revert back to the user-defined operating profile designated under the &Yn command at power reset.

- 0 Restores user-defined operating profile 0
- 1 Restores user-defined operating profile 1

3.9 &FN – RESTORE FACTORY SETTINGS

Soft reset the 9602-LP's active operating profile to factory-default operating profile. The active operating profile will revert back to the user-defined operating profile designated under the &Yn command at power reset. This does not reset ^RUP, ^ID, encryption/decryption keys or the crypto officer password.

- 0 Recall factory-default operating profile

3.10 &V – VIEW ACTIVE AND STORED CONFIGURATIONS

View the current active operating profile and stored operating profiles.

3.11 &WN – STORE ACTIVE CONFIGURATION

Store the current active operating profile as user-defined operating profile in non-volatile memory for later use.

- 0 Store current (active) configuration profile as user-defined operating profile 0
- 1 Store current (active) configuration profile as user-defined operating profile 1

3.12 &YN – DESIGNATE DEFAULT RESET PROFILE

Select user-defined operating profile for use after power-up.

- 0 Select user-defined operating profile 0 (default)
- 1 Select user-defined operating profile 1

NOTE: The 9602-LP is factory-set to have the user-defined operating profile 0 as the factory-default operating profile.

3.13 *F – FLUSH TO EEPROM (FOR COMPATIBILITY ONLY)

On the standard 9602 this flushes all pending writes to EEPROM, shuts down the RF board or radio, and prepares the unit 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. On the 9602-LP this command does not do anything but only returns a success response.

3.14 *RN – RADIO ACTIVITY

Control radio activity.

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

While the radio is disabled:

- SBD sessions cannot be initiated; they will immediately return with an error
- 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-LP still accepts AT commands

This command allows the FA (field application, the “host” of the 9602-LP) 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 9602-LP.

3.15 *SN – L-BAND TRANSCEIVER ON/OFF

Control state of the LBT.

- 0 LBT power is off
- 1 LBT power is on

When the Iridium RF board is OFF, only AT*Sn command and AT GPS commands work on the 9602-LP.

Read Command: *S?

Query the current LBT setting. The response is in the form:

<setting>

3.16 *W – WAIT

Exec Command: *W=<w>,<m>,<s>

This turns the GPS receiver and rf board off for <m> minutes and <s> seconds. During this off time, the unit can only be awoken by a change to Test or Emergency modes or if enabled by <w>, motion detected on the motion sensor.

<w>:

Whether the motion sensor will wake the unit up from sleep mode. ‘1’ is wakes up and ‘0’ is let’s sleep.

<m>:

Number of minutes to wait. Valid values are between 0 and 99.

<s>:

Number of seconds to wait. Valid values are between 0 and 59.

NOTE: If <m> and <s> are both 0 an ERROR will be returned.

Command Response:

This will return OK, the unit will go into Sleep mode, and nothing else will be returned.

Test Command: *W=?

Returns a fixed message indicating the range of acceptable values.

NOTE: Since the active profile is not started over a sleep period the unit will revert back to the stored profile when it wakes up.

3.17 +CGMI – MANUFACTURER IDENTIFICATION

Exec Command: +CGMI

Query the 9602-LP manufacturer.

3.18 +CGMM – MODEL IDENTIFICATION

Exec Command: +CGMM

Query the 9602-LP model.

3.19 +CGMR – REVISION

Exec Command: +CGMR

Query the 9602-LP revision.

3.20 +CGSN – SERIAL NUMBER

Exec Command: +CGSN

Query the 9602-LP IMEI.

3.21 +CIER – INDICATOR EVENT REPORTING

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

The set command enables or disables sending of the +CIEV unsolicited result code from the 9602-LP 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-LP (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 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 9602-LP 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 9602-LP 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 <antinds>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 the 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-LP makes an immediate search for the network and, if successful, starts the SBD session, otherwise the SBD session fails.

3.22 +CRIS – RING INDICATION STATUS

Exec Command: +CRIS

Query the ring indication status, returning the cause for the latest assertion of the Ring Indicator. The response contains distinct 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.

3.23 +CSQ[F] – SIGNAL QUALITY

Exec Command: +CSQ[F]

Execution command returns the received signal strength indication <rss> from the 9602-LP.

Response is in the form:

+CSQ:<rss>

where <rss> indicates:

- 0 Equivalent to 0 bars 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

NOTE: The +CSQ form of the command waits for an updated signal strength reading to become available. This will usually be within two seconds of issuing the command. If the 9602-LP is in the process of acquiring the system, or in a satellite handoff, a delay in response of up to 50 seconds may be experienced. If the 9602-LP has not proceeded to successful registration, the delay in response may exceed the 50 second timeout limit. Under such condition, an ERROR response will be received. To avoid a delayed response due to registration problems, issue the +CREG command to verify registration prior to entering the +CSQ command to obtain signal strength.

NOTE: The +CSQF form of the command returns immediately, reporting the last known signal strength.

Test Command: +CSQ=?

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

+CSQ:(supported <rss>s)

3.24 +CULK – UNLOCK

Exec Command: +CULK=<unlock key>

Unlock the 9602-LP 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 9602-LP is locked, it is unable to perform any SBD sessions. Any attempts to start a session will return an error code indicating that the 9602-LP is locked.

Command Response:

+CULK:<status>

where <status> indicates the lock status of the 9602-LP following the unlock attempt:

- 0 Unlocked – 9602-LP is not locked and is permitted to perform SBD sessions.
- 1 Locked – 9602-LP 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 – 9602-LP 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 9602-LP. The response is of the form:

+CULK:<status>

where <status> indicates:

- 0 Unlocked
- 1 Locked
- 2 Permanently locked

3.25 +GMI – MANUFACTURER IDENTIFICATION

Exec Command: +GMI

Query the 9602-LP manufacturer (same as command +CGMI).

3.26 +GMM – MODEL IDENTIFICATION

Exec Command: +GMM

Query the 9602-LP model (same as command +CGMM).

3.27 +GMR – REVISION

Exec Command: +GMR

Query the 9602-LP revision (same as command +CGMR).

3.28 +GSN – SERIAL NUMBER

Exec Command: +GSN

Query the 9602-LP IMEI (same as command +CGSN).

3.29 +IPR – FIXED DTE RATE

Set Command: +IPR=<rate>

Set the data rate at which the 9602-LP will accept commands. The 9602-LP supports a different range of baud rates than the standard 9602-N.

<rate> takes the following values:

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)

If this command was used and the configuration was not saved, then the original configuration can be restored by power cycling the modem. If this command has been saved to memory, then perform the following to save into the configuration:

1. Change the settings on the serial communications program to use the baud rate it has been set to
2. Issue the Command, "AT+IPR=6"
3. Change the settings on the serial communications program to use 19200 bps as the baud rate
4. Issue the Command "AT+GSN". If the IMEI number of the unit is not returned then repeat step 1 at a different baud rate. Otherwise continue to the next step

Issue the Command "AT&Wn&Yn" where n is the profile you are currently using. For example, "AT&W0&Y0"

3.30 +PA – GPS: LIST OF NMEA MESSAGE FORMATS

Exec Command: +PA=<n>

This command returns the complete NMEA message format, where <n> is an integer number ranging from 1 to C corresponding to the following NMEA and proprietary u-blox formats:

1	GGA
2	GLL
3	GSA
4	GSV
5	GRS
6	RMC
7	VTG
8	ZDA
9	GST
A	PUBX,00

B PUBX,01
C PUBX,04

3.31 +PD – GPS: UTC DATE

Exec Command: +PD

This command returns UTC date with the format shown below. The <Invalid Position Fix> message will appear only if the GPS receiver could not acquire a position fix.

Command Response:

+PD:
UTC Date = <mm>-<dd>-<yyyy>
<Invalid Position Fix>
Satellites Used = <zz>

where:

<mm> Month(01-12), 01 may appear for an <Invalid Position Fix>
<dd> Day(01-31), 06 may appear for an <Invalid Position Fix>
<yyyy> Year(0000-9999), 1980 may appear for an <Invalid Position Fix>
<zz> Number of satellites used to obtain information

3.32 +PG – GPS: GPS AUTOMATICALLY SENT

Exec Command: +PG=<Enable>[,<mode>[,<rate>[,<messages>]]]

This command automatically sets the unit to return GPS information at a set rate through the multi-interface connector.

<Enable> 0 is off, 1 is on
<mode> Determines whether to send in command mode or in tracking mode. 1 is in command mode only, 2 is in tracking mode only and 3 is in command or tracking mode.
<rate> Frequency that the GPS information is sent over in seconds.
<messages> Which messages are sent at the specified rate. Current list of NMEA and proprietary ublox messages are: 1 GGA, 2 GLL, 6 RMC, 7 VTG, 8 ZDA, A PUBX00 and B PUBX01.

Read Command: +PG?

Returns the current settings with the messages displayed as a hexadecimal number showing what messages are set to be sent. The bit correspondence is as follows:

Bit	Message
0	Not Used
1	GGA
2	GLL
3	Not Used
4	Not Used
5	Not Used
6	RMC
7	VTG
8	ZDA
9	Not Used
10 or 0x0A	PUBX,00
11 or 0x0B	PUBX,01
12 or 0x0C	Not Used
13 or 0x0D	Not Used
14 or 0x0E	Not Used
15 or 0x0F	Not Used

Test Command: +PG=?

Returns the current settings with the messages displayed as a hexadecimal number showing what messages are set to be sent. The bit correspondence is as follows

3.33 +PL – GPS: DISPLAY POSITION TO 4TH DECIMAL PLACE

Exec Command: +PL

This command returns position with the format shown below. The <Invalid Position Fix> message will appear only if the GPS receiver could not acquire a position fix. The latitude and longitude have been rounded to 4th place. The AT+PLOC command is recommended to obtain GPS information.

Command Response:

```
+PL:
Latitude:<||>:<mm>.<nnnn> <N/S>
Longitude=<ooo>:<pp>.<qqqq> <E/W>
Altitude=<#> meters
<Invalid Position Fix>
Satellites Used=<zz>
```

where:

< >	Latitude in degrees (00-90)
<mm>	Latitude in minutes (00-59)
<nnnn>	Fraction of minutes (0000-9999)
<N/S>	Either North or South depending on the direction
<ooo>	Longitude in degrees (000-180)
<pp>	Longitude in minutes (00-59)
<qqqq>	Fraction of minutes (0000-9999)
<E/W>	Either East or West depending on the direction
<#>	Altitude displayed with one decimal place
<zz>	Number of satellites used to obtain information

3.34 +PLOC – GPS: DISPLAY POSITION TO 5TH DECIMAL PLACE

Exec Command: +PLOC

This command returns position with the format shown below. The <Invalid Position Fix> message will appear only if the GPS receiver could not acquire a position fix.

Command Response:

+PLOC:

Latitude:<||>:<mm>.<nnnnn> <N/S>

Longitude=<ooo>:<pp>.<qqqqq> <E/W>

Altitude=<#> meters

<Position Fix> = Invalid Position Fix, Valid Position Fix, or Dead Reckoning

Satellites Used=<zz>

where:

- <||> Latitude in degrees (00-90)
- <mm> Latitude in minutes (00-59)
- <nnnnn> Fraction of minutes (00000-99999)
- <N/S> Either North or South depending on the direction
- <ooo> Longitude in degrees (000-180)
- <pp> Longitude in minutes (00-59)
- <qqqqq> Fraction of minutes (00000-99999)
- <E/W> Either East or West depending on the direction
- <#> Altitude displayed with one decimal place
- <zz> Number of satellites used to obtain information

3.35 +PNAV – GPS: NAVIGATION SETTINGS

Exec Command: +PNAV=<n>

This command increases the accuracy of the GPS receiver by specifying the environment, where <n> takes on one of the following values:

- 0 Portable. Suitable for most situations; for applications with low accelerations; maximum altitude of 12 km; maximum velocity of 310 m/sec; maximum vertical velocity of 50 m/sec; sanity check type: altitude and velocity; maximum position deviation: medium. (Default)
- 2 Stationary. Used in timing applications (antenna must be stationary) or other stationary applications; velocity is constrained to 0 m/s; zero

-
- dynamics assumed; maximum altitude of 9 km; maximum velocity of 10 m/sec; maximum vertical velocity of 6 m/sec; sanity check type: altitude and velocity; maximum position deviation: small.
- 3 Pedestrian. Applications with low acceleration and low speed, as a pedestrian would move; assuming low accelerations; maximum altitude of 9 km; maximum velocity of 30 m/sec; maximum vertical velocity of 20 m/sec; sanity check type: altitude and velocity; maximum position deviation: small.
 - 4 Automotive. Used for applications that can be compared with the dynamics of a passenger car; assuming low vertical acceleration; maximum altitude of 6 km; maximum velocity of 84 m/sec; maximum vertical velocity of 15 m/sec; sanity check type: altitude and velocity; maximum position deviation: medium.
 - 5 Sea. Recommended for applications at sea; assuming zero vertical velocity; maximum altitude of 500 m; maximum velocity of 25 m/sec; maximum vertical velocity of 5 m/sec; sanity check type: altitude and velocity; maximum position deviation: medium.
 - 6 Airborne low dynamics ($< 1g$). Used for applications that have to handle a higher dynamic range than a car and higher vertical accelerations; no 2D position fixes supported; maximum altitude of 50 km; maximum velocity of 100 m/sec; maximum vertical velocity of 100 m/sec; sanity check type: altitude; maximum position deviation: large.
 - 7 Airborne medium dynamics ($< 2g$). Recommended for typical airborne environment; no 2D position fixes supported; maximum altitude of 50 km; maximum velocity of 250 m/sec; maximum vertical velocity of 100 m/sec; sanity check type: altitude; maximum position deviation: large.
 - 8 Airborne high dynamics ($< 4g$). Only recommended for an extreme dynamic environment; no 2D position fixes supported; maximum altitude

of 50 km; maximum velocity of 500 m/sec; maximum vertical velocity 100 m/sec; sanity check type: altitude; maximum position deviation: large.

Read Command: +PNAV?

This command lists the current setting of the +PNAV command.

Test Command: +PNAV=?

This command lists the supported settings of the +PNAV command.

3.36 +PP – GPS: TOGGLE GPS RECEIVER ON/OFF

Exec Command: +PP=<n>

This command toggles the GPS receiver and GPS antenna between ON and OFF.

where:

- 0 Off
- 1 On

Read Command: +PP?

This command responds with the current status of the GPS receiver.

3.37 +PSIX[A] – GPS: INITIATE SBD SESSION UTILIZING GPS

Exec Command: +PSIX[A]

NOTE: The +PSIX[A] command has the same functionality as the +SBDIX[A] command. The only difference is the +PSIX[A] command sends GPS coordinates as the location argument. The command response is the same as that of the +SBDIX[A]; however, it is listed below for convenience.

NOTE: If there is an Invalid Position Fix the DTE will respond with “No GPS Fix” before issuing the response to the attempt to initiate an SBD session with the GSS. In this case no location is added.

NOTE: The +PSIX or the +SBDIX command must be used in place of the +SBDI command for FAs wishing to make use of SBD Ring Alert functionality.

NOTE: When encryption is enabled the +PSIX command will be disabled.

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

- The message, if any, in the mobile originated buffer will be sent from the 9602-LP to the GSS.
- If there is a message queued at the GSS it will be transferred to the 9602-LP 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 Ring Alert. If this is not desired, the +SBDI command should be used.
- The FA should append an 'A' to the command, i.e. +PSIXA, when the SBD session is in response to an SBD ring alert.

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 GSS reported that the call did not complete in the allowed time
 - 11 MO message queue at the GSS is full
 - 12 MO message has too many segments
 - 13 GSS reported that the session did not complete
 - 14 Invalid segment size
 - 15 Access is denied

9602-LP-reported values:

- 16. 9602-LP has been locked and may not make SBD calls
- 17. Gateway not responding (local session timeout)
- 18. Connection lost (RF drop)
- 19. Link failure (A protocol error caused termination of the call)
- 20..31 Reserved, but indicate failure if used
- 32 No network service, unable to initiate call
- 33..34 Reserved, but indicate failure if used
- 35 9602-LP is busy, unable to initiate call
- 36.. Reserved, but indicate failure if used

<MOMSN>:

The Mobile Originated Message Sequence Number (MOMSN) is a value assigned by the 9602-LP when sending a mobile-originated message to the GSS. This value is incremented each time an SBD session is successfully completed between the 9602-LP 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 9602-LP. 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-LP.

3.38 +PSREG – GPS: NETWORK REGISTRATION UTILIZING GPS

Exec Command: +PSREG

This command initiates an SBD session to perform a manual SBD registration, consisting of an attach and location update. This session does not transfer an MO or MT messages.

NOTE: This command is the same as the +SBDREG command, only +PSREG sends GPS information as the location argument. The command response is the same; however, it is listed below for convenience. If there is an invalid position fix, the DTE will respond with “No GPS Fix” before giving the response to the network registration attempt.

NOTE: The 9602-LP 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 register at the same time by using the +PSIX command. The +PSIX command always performs a registration attempt and should be used for an application requiring SBD Ring Alert. The +SBDI command never includes an SBD registration and should be used for an application that does not require SBD Ring Alert.

NOTE: When encryption is enabled the +PSREG command will be disabled.

Command Response:

+SBDREG:<status> , <reg err>

where:

<status> indicates the resulting registration status of the 9602-LP:

- 0 Detached – 9602-LP is detached as a result of a successful +SBDDDET or +SBDI command.
- 1 Not registered – 9602-LP is attached but has not provided a good location since it was last detached.
- 2 Registered – 9602-LP 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 GSS is denying service to the 9602-LP.

<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

9602-reported values:

- 16 9602-LP has been locked and may not make SBD calls
- 17 Gateway not responding (local session timeout)
- 18 Connection lost (RF drop)
- 19 Link failure (A protocol error caused termination of the call)
- 20..31 Reserved, but indicate failure if used
- 32 No network service, unable to initiate call
- 33..34 Reserved, but indicate failure if used
- 35 9602-LP is busy, unable to initiate call
- 36 Try later, must wait 3 minutes since last registration
- 37 Reserved, but indicate failure if use

3.39 +PT – GPS: UTC TIME

Exec Command: +PT

This command returns UTC time with the format shown below. The <Invalid Position Fix> message will appear only if the GPS receiver could not acquire a position fix.

```
+PT:  
UTC Time=<hh>:<mm>:<ss>.<xxx>  
<Invalid Position Fix>  
Satellites Used=<zz>
```

where:

```
<hh>    Hours (01-23)  
<mm>    Minutes (00-59)  
<ss>    Seconds (00-59)  
<xxx>   Fraction of seconds (000-999)  
<zz>    Number of satellites used to obtain information
```

3.40 +PV – GPS: BASIC GPS VELOCITY

Exec Command: +PV

This command returns velocity (consisting of speed and direction) with the format shown below. The <Invalid Position Fix> message will appear only if the GPS receiver could not acquire a position fix. The AT+PVEL command is recommended to obtain velocity information because this command also lists the vertical velocity and will sometimes indicate dead reckoning instead of listing Invalid Position Fix.

```
+PV:  
Ground Velocity=<#s> km/h, <#h> degrees from true North  
<Invalid Position Fix>  
Satellites Used=<zz>
```

where:

```
<#s>    Speed displayed with one decimal place  
<#h>    Heading in degrees from true north ranging from 0 to 360
```

<zz> Number of satellites used to obtain information

3.41 +PVEL – GPS: GPS VELOCITY

Exec Command: +PVEL

This command returns velocity (consisting of speed and direction) with the format shown below. The <Invalid Position Fix> Message will appear only if the GPS receiver could not acquire a position fix.

+PVEL:

Ground Velocity=<#g> km/h, <#h> degrees from true North

Vertical Velocity=<#v> m/s

<Position Fix>

Satellites Used=<zz>

where:

<#g> Speed displayed

<#h> Heading in degrees from true north ranging from 0 to 360

<#v> Vertical component of velocity. Value may be negative.

<Position Fix> = Invalid Position Fix, Valid Position Fix, or Dead Reckoning

<zz> Number of satellites used to obtain information

3.42 +SBDAREG – SHORT BURST DATA: AUTOMATIC REGISTRATION

Exec Command: +SBDAREG=<mode>

Set the Auto-registration mode of the 9602-LP.

<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 9602-LP monitors its current location and triggers an SBD auto-registration when it determines that the 9602-LP has moved sufficiently far away from its last registered location. Note that auto-registration runs only

while the 9602-LP is attached to the GSS, 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 or +PSREG.

Upon triggering in mode 1, “Automatic”, the 9602-LP autonomously initiates an SBD session in order to perform a registration with the updated location of the 9602-LP. This session does not transfer any MO or MT messages.

Upon triggering in mode 2, “Ask”, the 9602-LP reports to the FA that it should register with the system because the 9602-LP 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 any MT message that is pending at the GSS. In tracking mode, if the decryption key is set to all 0s the auto-registration will be disabled.

When auto-registration is enabled, mode 1 or 2, the 9602-LP 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

9602-LP reported values:

- 16 9602-LP 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 Link failure (A protocol error caused termination of the call)
- 20..31 Reserved, but indicate failure if used
- 32 No network service, unable to initiate call
- 33..34 Reserved, but indicate failure if used
- 35 9602-LP is busy, unable to initiate call
- 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)

3.43 +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-LP. The MOMSN is maintained even after power cycle.

Command Response:

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

3.44 +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 phone are the only means by which both buffers are cleared.
- The mobile terminated buffer will be cleared when an SBD session is initiated.
- Sending a message from the 9602-LP to the GSS does not clear the mobile originated buffer.
- Reading a message from the 9602-LP does not clear the mobile terminated buffer.

Command Response:

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

3.45 +SBDDDET – SHORT BURST DATA: DETACH

Exec Command: +SBDDDET

Initiates an SBD session to detach the 9602-LP 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 Detach successfully performed
- 1..4 Reserved, but indicate success if used
- 5..14 Reserved, but indicate failure if used
- 15 Access is denied

9602-LP-reported values:

-
- | | |
|--------|--|
| 16 | 9602-LP has been locked and may not make SBD calls |
| 17 | Gateway not responding (local session timeout) |
| 18 | Connection lost (RF drop) |
| 19 | Link failure (A protocol error caused termination of the call) |
| 20..31 | Reserved, but indicate failure if used |
| 32 | No network service, unable to initiate call |
| 33..34 | Reserved, but indicate failure if used |
| 35 | 9602-LP is busy, unable to initiate call |
| 36.. | Reserved, but indicate failure if used |

This instructs the GSS to disable (detach) SBD ring alerts for the calling 9602-LP. Successful completion of the detach command implies that the GSS has performed the requested detach action and the 9602-LP is no longer registered for SBD ring alerts. 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.

3.46 +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 9602-LP 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) |
| 128 | Hold MT message delivery |
| 64 | Leave MT message in queue after delivery |

Read Command: +SBDDSC?

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

```
+SBDDSC:<dsc>
```

3.47 +SBDGW[N] – SHORT BURST DATA GATEWAY

These commands will read back the Iridium gateway that the Short Burst Data messages are configured to be sent to, giving either a textual or numeric result.

Exec Command: +SBDGW

The command produces a response of the form “+SBDGW: <Gateway_text>”

<Gateway_text>: ‘EMSS’ or ‘non-EMSS’.

Due to an inaccurate specification for this command, ‘EMSS’ is used here to indicate the default commercial gateway, although this is actually the name of a different gateway. The error will not be corrected, to maintain backward compatibility.

Exec Command: +SBDGWN

The command produces a response of the form “+SBDGWN: <Gateway_numeric>”

<Gateway_numeric>:

- 1 The default commercial gateway
- 2 EMSS gateway

In future software releases, other <Gateway_numeric> values may be output to indicate specific gateways, so for future compatibility the FA should treat any value other than 1 as meaning ‘not the default commercial gateway’.

3.48 +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 Ring Alert 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.
- An SBD Detach is performed as part of the call.
- No SBD location update is performed.

FAs requiring SBD Ring Alert functionality should use the extended +SBDIX command.

Exec Command: +SBDI

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

- The message, if any, in the mobile originated buffer will be sent from the 9602-LP to the GSS.
- If there is a message queued at the GSS it will be transferred to the 9602-LP 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-LP |
| 1 | SBD message successfully sent from the 9602-LP to the GSS |
| 2 | An error occurred while attempting to send SBD message from the 9602-LP to GSS |

<MOMSN>:

The Mobile Originated Message Sequence Number (MOMSN) is a value assigned by the 9602-LP when sending a mobile-originated message to the GSS. This value is incremented each time an SBD session is successfully completed between the ISU 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 9602-LP. 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 messages waiting at the GSS to be transferred to the 9602-LP.

3.49 +SBDIX[A] – 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 Ring Alert functionality.

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

This command initiates an SBD session between the 9602-LP 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 are one or more messages queued at the GSS the oldest will be transferred to the 9602-LP and placed into the mobile terminated buffer.

- The message, if any, in the mobile originated buffer will be sent from the 9602-LP to the GSS.
- If there is a message queued at the GSS it will be transferred to the 9602-LP 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 Ring Alert. If this is not desired, the +SBDI command should be used.
- For security reasons a location update will not be allowed when +SBDIX[A] is used with a 9602-LP tracker which has encryption enabled.
- The FA should append an 'A' to the command, i.e. +SBDIXA, when the SBD session is in response to an SBD ring alert.

<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)

This command initiates an SBD session between the 9602-LP and the GSS, setting the SBD Session.

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 GSS reported that the call did not complete in the allowed time
- 11 MO message queue at the GSS is full
- 12 MO message has too many segments
- 13 GSS reported that the session did not complete
- 14 Invalid segment size
- 15 Access is denied

9602-LP-reported values:

- 16 9602-LP has been locked and may not make SBD calls
- 17 Gateway not responding (local session timeout)
- 18 Connection lost (RF drop)
- 19 Link failure (A protocol error caused termination of the call)
- 20..31 Reserved, but indicate failure if used
- 32 No network service, unable to initiate call
- 33..34 Reserved, but indicate failure if used
- 35 9602-LP is busy, unable to initiate call

36.. Reserved, but indicate failure if used

<MOMSN>:

The Mobile Originated Message Sequence Number (MOMSN) is a value assigned by the 9602-LP when sending a mobile-originated message to the GSS. This value is incremented each time an SBD session is successfully completed between the 9602-LP 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 9602-LP. 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-LP.

3.50 +SBDLOE – SHORT BURST DATA TRAFFIC MANAGEMENT STATUS

Exec Command: +SBDLOE

This command returns the remaining time, in seconds, to the end of the current SBD traffic management period. The command may not return immediately, as it will wait if necessary up to 10 seconds to try to acquire the Iridium system time.

Exec Response: +SBDLOE:<status>,<time>

<status>: The status indicates whether the time to the end of the current SBD traffic management period could be determined. This requires the SSD to know the Iridium system time and hence may fail if the Iridium network is not currently visible.

0 <time> is valid

1 <time> could not be determined

<time>: This is the time, in seconds, to the end of the current SBD traffic management period. If no traffic management period is active this will be zero.

3.51 +SBDMTA – SHORT BURST DATA: MOBILE-TERMINATED ALERT

Set Command: +SBDMTA=<mode>

Enable or disable ring indications for SBD Ring Alerts.

<status>:

0 Disable ring indication

1 Enable ring indication (default)

When SBD ring indication is enabled, the 9602-LP 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)

3.52 +SBDRB – SHORT BURST DATA: READ BINARY DATA FROM 9602-LP

Exec Command: +SBDRB

This command is used to transfer a binary SBD message from the single mobile terminated buffer in the 9602-LP to the FA. 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 270 bytes (256 when using encryption).
 - 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-LP were to send the word “hello” encoded in ASCII to the FA 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-LP, the message length and checksum fields will be zero.
- The mobile terminated message buffer will be empty upon power-up.
- When using a 9602-LP tracker with encryption enabled and the decryption key set to all 0s, the +SBDRB command will be disabled.

Command Response:

There are no response codes generated by the 9602-LP for this command.

3.53 +SBDREG – SHORT BURST DATA: NETWORK REGISTRATION

Exec Command: +SBDREG[=<location>]

This command initiates an SBD session to perform a manual SBD registration, consisting of an attach and location update. This session does not transfer an MO or MT messages.

NOTE: The 9602-LP 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 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 Ring Alert. The +SBDI command never includes an SBD registration and should be used for an application that does not require SBD Ring Alert.

NOTE: When using a 9602-LP tracker with encryption enabled, the location will not be allowed with the +SBDREG 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)

This command initiates an SBD session between the 9602-LP and the GSS, setting the SBD Session.

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 9602-LP:

- 0 Detached – 9602-LP is detached as a result of a successful +SBDDDET or +SBDI command.
- 1 Not registered – 9602-LP is attached but has not provided a good location since it was last detached.
- 2 Registered – 9602-LP 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 GSS is denying service to the 9602-LP.

<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

ISU-reported values:

- 16 9602-LP has been locked and may not make SBD calls
- 17 Gateway not responding (local session timeout)
- 18 Connection lost (RF drop)
- 19 Link failure (A protocol error caused termination of the call)
- 20..31 Reserved, but indicate failure if used
- 32 No network service, unable to initiate call

- 33..34 Reserved, but indicate failure if used
- 35 9602-LP is busy, unable to initiate call
- 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 9602-LP. The response is of the form:

+SBDREG:<status>

<status>:

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

The registration status is stored in 9602-LP non-volatile memory, and can therefore be queried by the FA after powering up.

3.54 +SBDRT – SHORT BURST DATA: READ A TEXT MESSAGE FROM THE 9602-LP

Exec Command: +SBDRT

This command is used to transfer a text SBD message from the single mobile terminated buffer in the 9602-LP to the FA. This command is similar to +SBDDB 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 +SBDDB except no length or checksum will be provided.
- The maximum mobile terminated SBD message length is 270 bytes (256 when using encryption).
- The mobile terminated message buffer will be empty upon power-up.

- When using the 9602-LP tracker with encryption enabled and the decryption key set to all 0s, the +SBDRT command will be disabled.

Command Response:

+SBDRT:<CR> {mobile terminated buffer}

3.55 +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-LP 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-LP 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.

3.56 +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 9602-LP 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-LP 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 9602-LP 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 9602-LP.

<msg waiting>:

The message waiting flag indicates how many SBD mobile terminated messages are currently queued at the gateway awaiting collection by the 9602-LP. This flag is updated after every SBD session, including +SBDI, +SBDIX, +SBDIXA, +SBDREG and +SBDDDET.

3.57 +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. FA can use this command to test reading and writing to the 9602-LP without actually initiating SBD sessions with the GSS.

NOTE: If encryption is enabled for sending and receiving messages to and from the 9602-LP then this command will return an error message.

Command Response:

- 0 Mobile originated buffer transferred successfully
- 1 An error occurred while transferring the mobile originated buffer.

3.58 +SBDWB – SHORT BURST DATA: WRITE BINARY DATA TO THE 9602-LP

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

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

- Once the command is entered, the 9602-LP will indicate to the FA that it is prepared to receive the message by sending the ASCII encoded string “READY<CR><LF>” (hex 52 45 41 44 59 0D 0A) to the FA.
- The <SBD message length> parameter represents the length, in bytes, of the SBD message not including the mandatory two-byte checksum.
- The maximum mobile originated SBD message length is 340 bytes (336 when using encryption). The minimum mobile originated SBD message length is 1 byte which will be expanded to 16 bytes if using encryption.
- Once the FA receives the READY indication from the 9602-LP, the SBD message must be sent from the FA 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 FA were to send the word “hello” encoded in ASCII to the 9602-LP 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-LP
- 1: SBD message write timeout. An insufficient number of bytes were transferred to 9602-LP during the transfer period of 60 seconds.

- 2: SBD message checksum sent from DTE does not match the checksum calculated at the 9602-LP
- 3: SBD message size is not correct. The maximum mobile originated SBD message length is 340 bytes (336 when using encryption). The minimum mobile originated SBD message length is 1 byte.

3.59 +SBDWT – SHORT BURST DATA: WRITE A TEXT MESSAGE TO THE 9602-LP

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

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

The text message may be entered on the command line:

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

Alternatively, the text message may be entered separately:

- Upon entering the command “AT+SBDWT”, the 9602-LP will indicate to the FA 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 FA.
- Once the FA 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 the maximum mobile originated message length of 340 bytes (336 when using encryption).
- 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-LP
- 1: SBD message write timeout. An insufficient number of bytes were transferred to 9602-LP during the transfer period of 60 seconds.
- 2: SBD message checksum sent from DTE does not match the checksum calculated at the 9602-LP
- 3 or ERROR: SBD message size is not correct. The maximum mobile originated SBD message length is 340 bytes (336 when using encryption). The minimum mobile originated SBD message length is 1 byte.

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

NOTE: Command responses 1, 2, and 3 are only likely to appear if there is an error with serial communications internal to the 9602-LP.

3.60 –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-LP has not yet received system time from the network.

XXXXXXXXX Where XXXXXXXXX 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: March 8, 2007, 03:50:21.00(GMT)

Previous Epoch: June 1, 1996, 00:00:13 (GMT)

Iridium system time source: The system time is available and valid only after the 9602-LP has registered with the network and has received the Iridium system time from the network. Once the time is received, the 9602-LP 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-LP 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-LP serial port should not exceed 4 frame ticks (.36 seconds) and in most cases will be one frame tick (.09 seconds) or less.

3.61 ^BIGR – BLOCK INVALID GPS REPORTS

Exec Command: ^BIGR=<n>,<t>,<e>

This determines in which modes sending of GPS reports with an invalid fix is blocked.

<n>:

- 0 Do not block any reports normal tracking mode (default)
- 1 Block invalid reports in normal tracking mode

<t>:

- 0 Do not block any reports test tracking mode (default)
- 1 Block invalid reports in test tracking mode

<e>:

- 0 Do not block any reports emergency tracking mode (default)
- 1 Block invalid reports in emergency tracking mode

Read Command: ^BIGR?

Indicates the current blocking mode.

Test Command: ^BIGR=?

Returns a fixed message indicating the range of acceptable values.

3.62 ^CALn – CALLABLE (REVISED)

Exec Command: ^CALn

In Tracking state, the 9602-LP automatically sends over GPS reports at a pre-defined frequency. In between GPS reports, the 9602-LP can put all internal electronic circuits in power-saving states known as “Sleep between reports.” The 9602-LP can also leave the 9602 RF board on in between GPS reports to listen for remote update requests known as the “Callable between reports”. A third option is that the unit runs Mode 0 when it is not in motion and Mode 1 when in motion. In Mode 1, the unit is also always awake to receive ping requests or remote updates. Mode 0 uses the least power. Mode 1 uses the most power.

- 0 Sleep between reports
- 1 Callable between reports (default)
- 2 Sleep while not in motion and callable while moving

Read Command: ^CAL?

Query the current Callable status.

Test Command: ^CAL=?

Returns the range this can be set to.

NOTE: If the 9602-LP is in Tracking mode and the ^CALn option is set for Sleep between reports, then the 9602-LP will accept the +++ command only when it is sending out a report. This will occur the first few seconds after startup. It will reject all AT commands while sleeping.

NOTE: If TBR is not set to a value greater than 1 minute the 9602-LP will not “sleep between reports” instead it will remain in “Callable between reports” mode.

3.63 ^CALEn – EMERGENCY CALLABLE (REVISED)

Exec Command: ^CALEn

Like ^CALn, but for Emergency mode.

- 0 Sleep between reports
- 1 Callable between reports (default)

2 Sleep while motionless callable while moving

Read Command: ^CALE?

Query the current Callable status.

Test Command: ^CALE=?

Returns the range this can be set to.

3.64 ^CALTN – TEST CALLABLE (REVISED)

Exec Command: ^CALTn

Like ^CALn, but for Test mode.

- 0 Sleep between reports
- 1 Callable between reports (default)
- 2 Sleep while motionless callable while moving

Read Command: ^CALT?

Query the current Callable status.

Test Command: ^CALT=?

Returns the range this can be set to.

3.65 ^CCOP – CHANGE CRYPTO OFFICER PASSWORD

Exec Command: ^CCOP=<old>,<new>

Change the Crypto Officer's password from factory-set/old value to new value. The password must include all printable keyboard characters. The password will not be reset by AT command &F. When the 9602-LP is set to echo, all entries are replaced with asterisks (*) instead of the actual typed value. All passwords must be between 8 and 16 characters in length. The factory-set password is 'temp password' and must be changed before encryption can be used.

<old>: Old password and must be enclosed by two single quotes ('old password')

<new>: New password and must be enclosed by two single quotes ('new password')

3.66 ^DLE – DATA LOG ERASE

Exec Command: ^DLE

This command erases the data log storage areas in memory.

3.67 ^DLR – DATA LOG READ

Exec Command: ^DLR[=<n>]

Reads the data log stored in memory.

<n>: number of logged reports to view

Read Command: ^DLR?

Query the number of logged reports. The response is in the form:

^DLR: <count>

Test Command: ^DLR=?

List the supported DLR values.

3.68 ^DLTRK: DATA LOG TRACKING

Exec Command: ^DLTRK=<n>

This command to initialize data log tracking to be enabled or disabled.

<n>:

- 0 Disable data log tracking functionality.
- 1 Enable data log tracking functionality.

Read Command: ^DLTRK?

Query the current data log tracking mode. The response is in the form:

^DLTRK: <mode>

Test Command: ^DLTRK=?

List the supported data log tracking modes.

3.69 ^ERF – EMERGENCY REPORT FLOOD

Exec Command: ^ERF=<n>

This determines how many reports will be sent out continuously when first entering Emergency mode. After n reports have been sent the interval value ^TBRE will take effect. If n is zero, the tracker will use ^TBRE to determine the rate at which reports are sent. The default value is 0.

Read Command: ^ERF?

Query the current value.

Test Command: ^ERF=?

Returns the allowable values for the ^ERF command.

3.70 ^GAO – GPS ALWAYS ON

Exec Command: ^GAOn

This command controls whether or not the GPS receiver “goes to sleep” between reports. If there is ample power supply it is recommended that this option is on to make the GPS location more accurate and give a faster response to ping requests. where n is:

- 0 GPS Receiver is off between reports
- 1 GPS Receiver is always on

Read Command: ^GAO?

This command responds with the current setting of the ^GAO command.

NOTE: This is forced off when callable is false.

NOTE: This is forced on when the interval is 30 seconds between reports.

3.71 ^ICV – INVALID COURSE VALUE

Exec Command: ^ICV=<v>

When the GPS receiver is unable to determine the course, this value is sent in GPS reports to indicate an invalid course. If the set value is too large for the GPS report, the value will be truncated to the maximum that the field in the report can hold.

<v>: 0 – 999. Default is 0.

3.72 ^ID – CHANGE THE IDENTIFIER

Exec Command: ^ID=n[,<id>]

Allow a unique static identifier (platform identifier of the 9602-LP) to be entered and added to the GPS report. When n takes on a value of 1, an <id> of up to 50 characters long must appear immediately after and enclosed inside two double quotes (“ ”).

<id>: The static identifier to be included in every GPS report, enclosed by “ ”, and can be up to 50 characters long.

Read Command: ^ID?

Query the current ID status and displays the static identifier if available.

IMPORTANT: Iridium charges a minimum of 30 bytes for each SBD message. The 9602-LP compresses each GPS report to 30 bytes, not including the static identifier, to minimize airtime cost. Thus, keeping static ID short will reduce per message cost.

3.73 ^IPS – INITIAL POWER STATE

Exec Command: ^IPSn

Sets the power state of the 9602-LP after DC power is first applied through the user multi-interface connector. When set to zero and DC power is applied, the 9602-LP must be turned on via the power button on the front of the case. When set to one, the 9602-LP is powered up automatically when DC power is first applied.

- 0 Initial power state is off
- 1 Initial power state is on (default)

Read Command: ^IPS?

This command responds with the current setting of the ^IPS command.

3.74 ^KD – KEY FOR DECRYPTION

Exec Command: ^KD=<password>,<key>

Allow entering the 32 bytes for the AES decryption key. These bytes must be entered with mandatory leading 0s, where each byte is represented by 2 hexadecimal uppercase characters for a total of 64 digits. The password and key will not be reset by &F. The password and key will not be echoed. This command must be entered twice before an update is made.

NOTE: The Decryption key must match the Encryption key at the base station or network operation center (NOC).

<password>: The Crypto Officer Password which must be enclosed by two single quotes (' ').

The Crypto Officer Password must be changed from its factory-set value before this command will work.

<key>: The key that must be enclosed by two single quotes (' '). This can only have characters 0-9 or A-F and must be 64 bytes long. For example,

'0102030405060708090A0B0C0D0E0F101112131415161718191A1B1C1D1E1F20'.

3.75 ^KE – KEY FOR ENCRYPTION

Exec Command: ^KE=<password>,<key>

Allow entering the 32 bytes for the AES encryption key. These bytes must be entered with mandatory leading 0s, where each byte is represented by 2 hexadecimal uppercase characters for a total of 64 digits. The password and key will not be reset by &F. The password and key will not be echoed. This command must be entered twice before an update is made.

NOTE: The Encryption key must match the Decryption key at the base station or NOC.

<password>: The Crypto Officer Password which must be enclosed by two single quotes (' ').

The Crypto Officer Password must be changed from its factory-set value before this command will work.

<key>: The key that must be enclosed by two single quotes (' '). This can only have characters 0-9 or A-F and must be 64 bytes long. For example,
'0102030405060708090A0B0C0D0E0F101112131415161718191A1B1C1D1E1F20'.

3.76 ^KZ – KEY ZEROIZATION

Exec Command: ^KZ=<password>

Reset or zeroize the encryption and the decryption keys and stop encryption until the keys are re-entered with the AT^KD and AT^KE commands.

<password>: The Crypto Officer Password which must be enclosed by two single quotes (' ').
The Crypto Officer Password must be changed from its factory-set value before this command will work.

3.77 ^LEDS: LIGHT EMITTING DIODES.

Exec Command: ^LEDS=<s>,<a>,<i>,<g>,<e>,<t>

<s> : Power LED Enabled (1) or disabled (0) during sleep

<a> : Power LED Enabled (1) or disabled (0) while awake

<i> : Iridium LED Enabled (1) or disabled (0)

<g> : GPS LED Enabled (1) or disabled (0)

<e> : Emergency LED Enabled (1) or disabled (0)

<t> : Status LED Enabled (1) or disabled (0)

Read Command: ^LEDS?

Query the current LED modes. The response is in the form:

^LEDS: <s>,<a>,<i>,<g>,<t>

Test Command: ^LEDS=?

List the supported LED modes

3.78 ^MAME – MEMORY ALL MEMORY ERASE

Exec Command: ^MAME

Erases all of the memory on the device. This includes data logging, queued remote update responses, etc.

3.79 ^MSA - MOTION SENSOR AWAKES

Exec Command: ^MSA=<normal>,<test>,<emergency>

This determines which states awake from sleep by activity from the motion sensor. It also determines the parameters which define motion on the sensor.

<normal>: '1' if when the motion sensor detects movement it will send out a report when sleeping in normal state. '0' if it will not. Default is '0'.

<test>: '1' if when the motion sensor detects movement it will send out a report when sleeping in test state. '0' if it will not. Default is '0'.

<emergency>: '1' if when the motion sensor detects movement it will send out a report when sleeping in emergency state. '0' if it will not. Default is '0'.

Read Command: ^MSA?

Returns the current value for Motion Sensor awake in the 3 states: Normal, Test, and Emergency and timing values

Test Command: ^MSA=?

Returns a fixed message indicating that this can individually be set in the 3 states for Normal, Test, and Emergency and explains timing values.

3.80 ^MSB – MOTION SENSOR BEGIN

Exec Command: ^MSB=<m>,<s>

This determines the number of minutes to look for motion for before the unit wakes up.

<m>: Number of minutes to wait to determine movement. The range is from 0 to 60. The value of 0 means that the unit wakes up after sensing a single motion. Default value is 3.

<s>: Sensitivity – How vigorous and consistent the motion must be every minute for the unit to determine it is in motion. The range is 1 to 26 where 1 requires the least motion and 26 requires the most motion.

Read Command: ^MSB?

Returns the current state for this command.

Test Command: ^MSB=?

Returns a fixed message indicating the ranges this can be set to.

3.81 ^MSE – MOTION SENSOR END

Exec Command: ^MSE=<m>

This determines the number of minutes to need to see no motion for, before the unit goes back to sleep.

<m>: Number of minutes to wait to determine no movement. The range is from 1 to 60. Default value is 3.

Read Command: ^MSE?

Returns the current state for this command.

Test Command: ^MSE=?

Returns a fixed message indicating the ranges this can be set to.

3.82 ^MSW – MOTION SENSOR WAIT (REVISED)

Exec Command: ^MSW=<m>

This determines approximately how long to wait while sleeping between when the GPS wakes up from sleep with the motions sensor one time and when it wakes from sleep again with the motions sensor. This was put in to save battery power for cases where the unit is constantly in motion. The time will only be counted during sleep and it can range across multiple sleep intervals. Changing commands ^MSB and ^S will reset the count for the wait. If transitioning between 2 states that do not both have ^CAL set to 1 then the count will also be reset.

<m>: Number of minutes to wait during sleep from a motion sensor awake message. Default is 10 minutes.

Read Command: ^MSW?

Returns the current state of Motion Sensor Wait Command.

Test Command: ^MSW=?

Returns a fixed message indicating the range of minutes this can be set to.

3.83 ^OBE – OUTBOX ERASE

Exec Command: ^OBE

Erases the contents of the outbox. The outbox is primarily used to store outgoing remote update responses.

3.84 ^Pn – SET AND READ PIN STATE

Exec Command: ^Pn=<m>

This sets output pins on an I/O enabled 9602-LP tracker. The 9602-LP does not immediately process the pin changes, but rather waits until the end of the line and processes all of the pin changes simultaneously.

n: Can be 0-2 corresponding to three different output pins.

<m>: '1' to set the output pin n high. '0' to set it low.

Read Command: ^Pn?

Returns the current state of input and output pins in the form:

Out Pins=<out_pins>

In Pins=<in_pins>

where:

<out_pins> represents the output pins 0,1,2 where each number is a 0 or 1

<in_pins> represents the output pins 0,1,2,3 where each number is a 0 or 1

3.85 ^PR – PIN REPORTING

Exec Command: ^PR=<n>

This reports on the pin values when they change.

<n>:

- 0 Do not report pin values or battery level to the DTE.
- 1 Reports pin changes automatically

Pin reports are in the format of ^PR:0,<p> where <p> is in the format 0,1,2,3 where each number has the value of the corresponding pin level of 0 or 1.

Read Command: ^PR?

Returns the current value

Test Command: ^PR=?

Returns a fixed message indicating the range of values that can be entered

3.86 ^RMF – REMOTE MESSAGE FORMAT

Exec Command: ^RMF=<n>

This command sets the format of the messages that will be sent to the recipient.

where:

- 1 GPS version 3 (format used on A3LA series tracking units)
- 2 GPS version 4 (includes HDOP, VDOP, Motion, and Low Battery)
- 3 GPS version 5 (includes input and output pin states)
- 4 PECOS P3
- 5 PECOS P4
- 6 GPS version 6 (includes short codes and free text)
- 7 10 byte GPS version 0

Read Command: ^RMF?

This command reveals the current setting of the ^RMF command.

Test Command: ^RMF=?

This command responds with the supported settings of the ^RMF command.

3.87 ^RUP – REMOTE UPDATE PASSWORD

Exec Command: ^RUP=<password>

The 9602-LP operating parameters (in the current active operating profile) can be changed and saved from a remote site while the 9602-LP is deployed in the field. A Remote Update password is required each time a remote update is made and can be set with the ^RUP command. The <password> entered must be 8 characters in length and all printable characters are allowed. The factory-set password is 12345678 and there is no requirement to change this password. In order to initiate remote update on the 9602-LP, the password of an incoming message from a remote site must match with the Remote Update password. The Remote Update password also provides a way to identify field units when making mass remote updates.

The 9602-LP remote update format is the same for both standard and encrypted versions. The ^RUP command does not require the Crypto Officer role in order to make changes. Users are referred to the 9602-LP manuals associated with encryption for further details.

Read Command: ^RUP?

Display the current Remote Update Password. It is used to confirm a recently entered password.

The following parameter is required:

<password>: The Remote Update Password which must be enclosed by two single quotes (‘ ’) and must be 8 characters long.

3.88 ^SN – SETUP INPUT PINS

Exec Command: ^S<n>=<m>[,<f>[,<r>]][,<l>]]

This configures the input pins of the 9602-LP tracker. There are three pin modes: general input, emergency, and test. And there are two trigger types: rising and falling. When a trigger is enabled and the trigger stimulus is satisfied, the function of the pin mode is triggered. The general input trigger queues an input report (see Appendix C) to be queued for transmission. The emergency trigger enables the emergency tracking state. The test trigger enables the test tracking state. While any pin can be configured as any mode, input 0 is shared with the

emergency switch and defaults to emergency mode with a falling edge trigger. Input 1 default to test mode with a falling edge trigger. Inputs 2 and 3 default to general input with no triggers enabled. Each pin can be configured to be either latching or momentary. A latching input activates when the trigger is activated and deactivates once the trigger is inactive. A momentary configured input is enabled by activating the trigger momentarily and releasing and is disabled by activating the trigger for 3 seconds and releasing.

Changing these settings will force the emergency or test tracking state to return to normal and the latching pin state to be reevaluated.

<n>: 0 - 3 corresponding to the four different input pins.

<m>: Sets the pin mode.

0 – General input

1 – Emergency

2 – Test

<f>: Sets if the pin is triggered on a falling edge. 0 – disabled, 1 – enabled

<r>: Sets if the pin is triggered on a rising edge. 0 – disabled, 1 – enabled

<l>: Sets if the pin is latching or momentary. 0 – momentary, 1 – latching

Read Command: ^S<n>?

Returns the current setting for pin <n>

<n>: 0 - 3 corresponding to the four different input pins.

3.89 ^SPSR – SAME PLACE, SKIP REPORTS

Exec Command: ^SPSR=<n>[,<d>[,[,<c>]]]

If the unit is not moving this will limit the number of GPS reports that are sent out. When enabled, ^SPSR causes the unit to be bounded by a sphere with radius <d>. Report sending is halted when the unit remains in the sphere for a time specified by . Report sending will resume once the unit has left the sphere. Upon leaving the bounding sphere, a new boundary will be created at the current location of the unit. If the unit remains in the boundary for an extended period of time a report may be sent depending on the mode <m> and the number of cycles specified by <c>. An example of how ^SPSR may be useful is if used on a truck the number of reports sent when the truck is parked would be limited.

<n>:

- 0 Turn off the feature.
- 1 Enable this feature for a set number of reports
- 2 Never send another report until it moves

<d>: The radius of a 3D sphere to not send reports in meters. Range is 10 to 65535.

: Number of reports to send while stationary before skipping takes effect. Range is 0 to 65535.

<c>: The number of cycles to skip sending out GPS reports if the unit has not moved.
Range is 1 to 65535.

NOTE: and <c> are measured in report cycles. In general, report cycles last ^TBR seconds. For example, if the unit is to be configured to wait 10 minutes before report skipping begins and ^TBR is set to 2 minutes, should be set to 5 cycles. (Desired time / ^TBR =)

NOTE: If SPSR is enabled and the 9602-LP attempts to send a report without a valid GPS fix, SPSR will not process its report skipping logic. The command ^BGR must be used to block reports with an invalid GPS fix from being sent.

Read Command: ^SPSR?

Returns the current settings for this command.

Test Command: ^SPSR=?

Returns a fixed message indicating the range of acceptable values and an explanation of what they mean.

3.90 ^SPSRE – SAME PLACE, SKIP REPORTS FOR EMERGENCY STATE

Exec Command: ^SPSRE=<n>[,<d>[,[,<c>]]]

The same as ^SPSR, but for Emergency state.

Read Command: ^SPSRE?

Returns the current settings for this command.

Test Command: ^SPSRE=?

Returns a fixed message indicating the range of acceptable values and an explanation of what they mean.

3.91 ^SPSRT – SAME PLACE, SKIP REPORTS FOR TEST STATE

Exec Command: ^SPSRT=<n>[,<d>[,[,<c>]]]

The same as ^SPSR, but for Test state.

Read Command: ^SPSRT?

Returns the current settings for this command.

Test Command: ^SPSRT=?

Returns a fixed message indicating the range of acceptable values and an explanation of what they mean.

3.92 ^STARTn – START UP MODE

Exec Command: ^STARTn

Set the 9602-LP mode of operation at power up. This will be reset by &F.

- 0 Start in command mode (default)
- 1 Start in tracking mode

Read Command: ^START?

Return the current start up mode.

3.93 ^STR – SELF TEST RUN

Exec Command: ^STR

Causes the 9602-LP to run self-tests and to report the status of all encryption setting parameters. This is the same test performs by the 9602-LP at each power up.

3.94 ^TBR – TIME BETWEEN REPORTS

Exec Command: ^TBR=<n>

Time between reporting cycles in minutes for tracking mode. <n>, also known as Time Between Reports (TBR), can take on a value between 0 to 10080 in increments of 0.5 (or 30 seconds).

When TBR is set to a value between 0.5 minute and 10080 minutes, an additional parameter called Time To Keep Trying or TTKT dictates how long the 9602-LP tries to send in a single reporting cycle. The value of TTKT can be changed using ^TTKT command. The 9602-LP will attempt to acquire a valid GPS fix and an acceptable Iridium signal strength for SBD transmission within the TTKT-time window. If both a valid GPS fix and an acceptable Iridium signal strength are obtained within the TTKT-time window, then the 9602-LP will transmit the GPS report. The 9602-LP will then immediately go into “Sleep between reports” mode for the remaining of the time until the next reporting cycle. If the 9602-LP is unable to acquire a valid GPS fix and/or unable to obtain an acceptable Iridium signal strength 30 seconds before the TTKT-time window expires, the 9602-LP will be forced to transmit a valid/invalid GPS report anyway. It is possible, but unlikely, that a GPS report with an invalid position fix will be sent and just before the end of the TTKT a GPS fix will be acquired and a valid one will be sent. If a report is missed one of three possible outcomes as shown below will occur in tracking mode:

1. Iridium gateway receives a valid GPS report (SBD Status LED stays solid)
2. Iridium gateway receives an invalid GPS report (SBD Status LED flashes)
3. Iridium gateway does not receive a GPS report (SBD Status LED flashes)

When TBR is set to 0, the 9602-LP will send GPS reports at the fastest possible rate ignoring the TTKT setting (approximately 4 seconds between reports depending on the Iridium and GPS satellites field-of-view with respect to the 9602-LP antennas). The 9602-LP will never go into power-saving mode with all its electronic circuits on at all-time allowing the fastest possible transmission rate.

The default value is 5.

Read Command: ^TBR?

Return the current Time Between Reports value.

Test Command: ^TBR=?

Returns a fixed message indicating the range of acceptable values.

3.95 ^TBRA – AWAKE TIME BETWEEN REPORTS

Exec Command: ^TBRA=<n>

Time between reporting cycles in minutes for normal state when ^CAL is 2 and the unit is moving. The command functions the same as ^TBR above, but determines the timing for motion and the ^TBR command is used when it is not in motion.

The default value is 0.

Read Command: ^TBRA?

Returns the current time between reports value.

Test Command: ^TBRA=?

Returns a fixed message indicating the range of acceptable values.

3.96 ^TBRE – EMERGENCY TIME BETWEEN REPORTS

Exec Command: ^TBRE=<n>

Time between reporting cycles in minutes for Emergency state. The command functions the same as ^TBR above, but determines the timing for Emergency mode instead of the normal tracking mode.

The default value is 0.

Read Command: ^TBRE?

Returns the current time between reports value.

Test Command: ^TBRE=?

Returns a fixed message indicating the range of acceptable values.

3.97 ^TBREA – AWAKE EMERGENCY TIME BETWEEN REPORTS

Exec Command: ^TBREA=<n>

Time between reporting cycles in minutes for Emergency state when ^CALE is 2 and the unit is moving. The command functions the same as ^TBRE above, but determines the timing for motion and the ^TBRE command is used when it is not in motion. The default value is 0.

Read Command: ^TBREA?

Returns the current time between reports value.

Test Command: ^TBREA=?

Returns a fixed message indicating the range of acceptable values.

3.98 ^TBRT – TEST TIME BETWEEN REPORTS

Exec Command: ^TBRT=<n>

Time between reporting cycles in minutes for Test state. The command functions the same as ^TBR above, but determines the timing for Test state instead of the normal tracking state. The default value is 0.

Read Command: ^TBRT?

Returns the current time between reports value.

Test Command: ^TBRT=?

Returns a fixed message indicating the range of acceptable values.

3.99 ^TBRTA – AWAKE TEST TIME BETWEEN REPORTS

Exec Command: ^TBRTA=<n>

Time between reporting cycles in minutes for Test state when ^CALT is 2 and the unit is moving. The command functions the same as ^TBRT above, but determines the timing for motion and the ^TBRT command is used when it is not in motion.

The default value is 1.

Read Command: ^TBRTA?

Returns the current time between reports value.

Test Command: ^TBRTA=?

Returns a fixed message indicating the range of acceptable values.

3.100 ^TRF – TEST REPORT FLOOD

Exec Command: ^TRF=<n>

This determines how many reports will be sent out continuously when first entering Test mode. After n reports have been sent the interval value ^TBRT will take effect. If n is zero, the tracker will use ^TBRT to determine the rate at which reports are sent. The default value is 0.

Read Command: ^TRF?

Query the current value.

Test Command: ^TRF=?

Returns the allowable values for the ^TRF command.

3.101 ^TRK – ENTER TRACKING MODE

Exec Command: ^TRK

Cause the 9602-LP to leave Command mode and enter Tracking mode. Must be the last command in an AT command string.

3.102 ^TTKT – TIME TO KEEP TRYING

Exec Command: ^TTKT=<n>,<v>[,<s>]

This allows different ways to modify the Time To Keep Trying or TTKT parameter.

If <n> has a value of 0 and <v> is between 12 and 254 then TTKT is set to (5*v) seconds. The value of <s> is omitted when n=0.

If <n> has a value of 1, then <v> must be between 1 and 21, <s> must be between 0 and 55 and TTKT is set to (<v> minutes + <s> seconds).

If <n> has a value of 0 and <v> has a value of 0, then TTKT is set to be the same as TBR except it will not try to send once 30 seconds before the ^TBR window is over. It will try to send once and if it fails it will not attempt to send another report. A GPS report is sent only when the

9602-LP is able to obtain both a valid GPS fix and an acceptable Iridium signal strength within the TTKT-time window. Otherwise, no GPS report is sent to the Iridium gateway. When callable is false, the RF board will turn on if it is not on already when 30 seconds are remaining. If <n> has a value of 0 and <v> has a value of 255, then TTKT is again set to be the same as TBR. The reporting procedure is the same as described in ^TBR.

The default TTKT value is n=0 and v=255.

Read Command: ^TTKT?

Return value of <v> assuming that <n> is 0.

Test Command: ^TTKT=?

Returns descriptions of allowable inputs for the TTKT command.

3.103 ^TTKTA – AWAKE TIME TO KEEP TRYING

Exec Command: ^TTKTA=<n>,<v>[,<s>]

Time To Keep Trying for normal state for when ^CAL2 and the unit is in motion. The command functions the same as ^TTKT above, but determines the timing for normal state when in motion and the ^TTKT determines the timing for normal state when not in motion.

The default value is 255.

Read Command: ^TTKTA?

Returns the current time to keep trying settings <v> assuming that <n> is 0.

Test Command: ^TTKTA=?

Returns a fixed message describing what can be entered for the TTKTA command.

3.104 ^TTKTE – EMERGENCY TIME TO KEEP TRYING

Exec Command: ^TTKTE=<n>,<v>[,<s>]

Time To Keep Trying for Emergency state. The command functions the same as ^TTKT above, but determines the timing for Emergency state instead of the normal tracking state.

The default value is 255.

Read Command: ^TTKTE?

Returns the current time to keep trying settings <v> assuming that <n> is 0.

Test Command: ^TTKTE=?

Returns a fixed message describing what can be entered for the TTKTE command.

3.105 ^TTKTEA – AWAKE EMERGENCY TIME TO KEEP TRYING

Exec Command: ^TTKTEA=<n>,<v>[,<s>]

Time To Keep Trying for Emergency state for when ^CALE2 and the unit is in motion. The command functions the same as ^TTKTE above, but determines the timing for Emergency state when in motion and the ^TTKTE determines the timing for Emergency state when not in motion.

The default value is 255.

Read Command: ^TTKTEA?

Returns the current time to keep trying settings <v> assuming that <n> is 0.

Test Command: ^TTKTEA=?

Returns a fixed message describing what can be entered for the TTKTEA command.

3.106 ^TTKTT – TEST TIME TO KEEP TRYING

Exec Command: ^TTKTT=<n>,<v>[,<s>]

Time To Keep Trying for Test state. The command functions the same as ^TTKT above, but determines the timing for Test state instead of the normal tracking state.

The default value is 255.

Read Command: ^TTKTT?

Returns the current time to keep trying settings <v> assuming that <n> is 0.

Test Command: ^TTKTT=?

Returns a fixed message describing what can be entered for the TTKTT command.

3.107 ^TTKTTA – AWAKE TEST TIME TO KEEP TRYING

Exec Command: ^TTKTTA=<n>,<v>[,<s>]

Time To Keep Trying for Test state for when ^CALT2 and the unit is in motion. The command functions the same as ^TTKTT above, but determines the timing for Test state when in motion and the ^TTKTT determines the timing for Test state when not in motion.

The default value is 255.

Read Command: ^TTKTTA?

Returns the current time to keep trying settings <v> assuming that <n> is 0.

Test Command: ^TTKTTA=?

Returns a fixed message describing what can be entered for the TTKTTA command.

3.108 ^UE – USE ENCRYPTION

Exec Command: ^UE=<password>,<n>

Set the 9602-LP on whether to use encryption or not at power up. The factory-default setting is not to use encryption at power up. Setting the ^UE command will take effect only after power has been cycled. This command will return an error if the encryption password has not been set.

<password>: The Crypto Officer Password which must be enclosed by two single quotes (' ')

<n>: 0 is not to use encryption and 1 is to use encryption at power up

Read Command: ^UE?

Returns whether <n> is set to 0 or 1 and then one of the following messages will appear:

- "Encryption Disabled No Keys Entered"
- ("Encryption Currently Enabled" OR "Encryption Currently Disabled") AND ("Set to be Enabled Next Power Cycle" OR "Set to be Disabled Next Power Cycle")
- "Encryption Feature Not Included"

3.109 ^WMF – WRITE MESSAGE FORMAT

Exec Command: ^WMF=<n>

This writes to the SBD buffer a GPS report in the format determined by n. Note: The command must be executed in its own AT command string. After this is done a message similar to a GPS report can be sent by sending the +SBDI or the +SBDIX command.

<n>:

- 1 GPS version 3 (format used on A3LA series tracking units)
- 2 GPS version 4 (includes HDOP, VDOP, Motion, and Low Battery)
- 3 GPS version 5 (includes input and output pin states)

Command Response:

<GPS Status>:

where:

“GPS Off” - indicates the GPS receiver is turned off, but the report is still written to the SBD buffer

“Invalid Position Fix” – indicates the GPS receiver is on, but was unable to get a valid position fix. A report is still written to the SBD buffer.

If no <GPS Status> is displayed, it can be assumed that the GPS receiver is on and a report with a valid position fix was written to the SBD buffer.

Test Command: ^WMF=?

Returns a fixed message indicating the range of acceptable values.

4 SUMMARY OF RESULT CODES

Table 2: Summary of Result Codes

NUMERIC (V0)	VERBOSE (V1)	DESCRIPTIONS
0	'OK'	Acknowledges execution of an AT command
126	'SBDRING'	MT messages present at the Iridium gateway (unsolicited if enabled). See section 2.34
4	'ERROR'	AT command is not accepted by the 9602-LP
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 4.42
As verbose	'+CIEV:<sig>,<value>'	Indicator event report (unsolicited if enabled). See section 4.21
As verbose	'^PR:<type>,<p>'	Pin value level changes. Other events may be included in future. The <type> is currently always 0. See section 4.74. ^PR command.

5 INFORMATIVE EXAMPLES

5.1 SENDING AN SBD MESSAGE TO THE 9602-LP

Messages can be sent to the 9602-LP via SBD from almost any e-mail program (Outlook, Outlook Express, etc.).

1. In order to send e-mail messages to a 9602-LP, 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 9602-LP in the subject line.
 4. The message should be carried in an attachment, which must have a “.sbd” extension, as shown in.

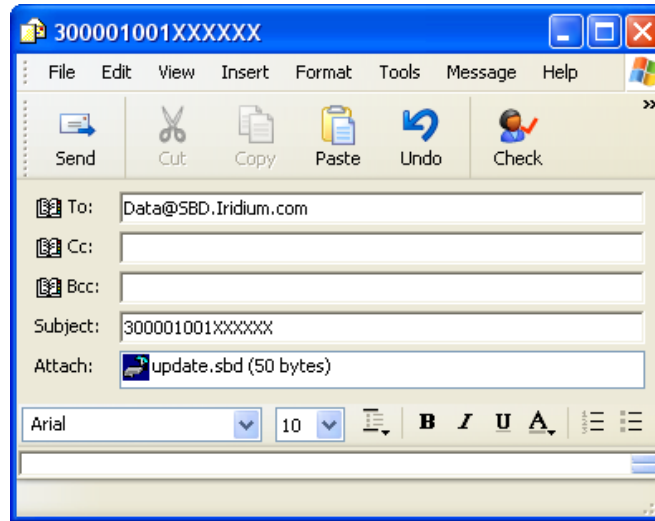


Figure 1: Send SBD Message

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

5.2 FIELD ELEMENTS OF AN SBD MESSAGE (FOR COMMERCIAL GATEWAY ONLY)

Table 3 below displays the field descriptors of each SBD messages sent from the 9602-LP. This format will appear in the body of every SBD e-mail message.

Table 3: Summary of Result Codes

FIELD NAME	DESCRIPTIONS	
MOMSN	Mobile Originated Message Sequence Number (0 – 65535)	
MTMSN	Mobile Terminated Message Sequence Number (0 – 65535)	
Time of Session	The UTC Timestamp of the 9602-LP session between the 9602-LP 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 9602-LP 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 9602-LP. The latitude and the longitude provide a center point and the CEPradius provides the radius of a circle around that center point. The reported	

FIELD NAME	DESCRIPTIONS
	position is accurate within 10km at 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 9602-LP is in an attachment of the e-mail and the subject line contains the IMEI number of the unit that sent the SBD message.

NOTE: The unit location message in the body of the email may be enabled or disabled by the SBD airtime service provider. If using encryption for the .sbd attachments then this should be disabled for greater security.

APPENDIX A – ENCRYPTED SENDING WITH NO RECEIVING

The 9602-LP has the ability to ignore all incoming messages when encryption is selected. This is done by setting the decryption key to all 0s or by never setting it since its default value is all 0s. The only AT command that is affected is the ^KD – Key for Decryption command. The ^KE – Key for encryption command works the same way as before and rejects all 0s as an unsafe key and thus forces another key to be entered before encryption can be used. The ^KZ command will reset both the encryption and decryption keys to 0. If only the encryption key is entered after the keys are zeroized with the ^KZ command, then all incoming messages will be blocked. If encryption is not selected with the ^UE command, then all incoming messages are allowed. In tracking mode, since there are no incoming messages and the +SBDRING alerts are not needed the +SBDI command is used to send GPS reports rather than the +SBDIX command. For this block no change is required in the Encryption Module or any software that uses it. Users just need to be created with IMEI records that have a decryption key but no encryption key.

Examples of AT Commands to Set-Up blocking all Incoming

Initial Setup Blocking all incoming:

```
at^ccop='temp password','password'
at^ke='password','000102030405060708090A0B0C0D0E0F101112131415161718191A1B1C1D1E1F'
at^ke='password','000102030405060708090A0B0C0D0E0F101112131415161718191A1B1C1D1E1F'
at^ue='password',1
at&w&y
```

With Responses

```
at^ccop='*****', '*****'
OK
at^ke='*****', '*****'
**'
```

Enter Encryption Key again to set.

```
OK
at^ke='*****', '*****'
**'
```

Encryption Key Set

```
OK
at^ue='*****',1
```


APPENDIX B – NMEA MESSAGE FORMAT

Table 4: GPS Fix Data – AT+PA=1

Name	ASCII String		Length	Units	Description
	Format	Example			
Message ID	String	\$GPGGA	6		GGA protocol header
UTC Time	hhmmss.ss	175837.40	9		Current Time
Latitude	ddmm.mmmmm	3846.01498	10		Degrees, minutes, and fraction of minutes
N/S Indicator	Character	N	1		N = north or S = south
Longitude	dddmm.mmmmm	07729.09940	11		Degrees, minutes, and fraction of minutes
E/W Indicator	Character	W	1		E = east or W = west
Position Fix Indicator	Digit	1	1		0 = Invalid Fix, 1 or 2 = Valid Fix, 3 = Estimated Dead Reckoning
Satellites Used	Ss	10	1 or 2		Range 0 to 12
HDOP	Numeric	0.85	varies		Horizontal Dilution of Precision
MSL Altitude ¹	Numeric	81.2	varies	meters	Altitude
Units	Character	M	1		Stands for meters
Altref	Numeric	-33.4	varies	meters	Geoid Separation
Units	Character	M	1		Stands for meters
Age of Differential Corrections	Numeric				Blank
Diff. Reference Station ID	Numeric				Blank
Checksum	hexadecimal characters	*59			
<CR><LF>					End of Message

Example:

\$GPGGA,175837.40,3846.01498,N,07729.09940,W,1,10,0.85,81.2,M,-33.4,M,,*59

¹ Does not support geoid corrections values are WGS-84 heights

Table 5: GGA - GLL - Latitude and Longitude with Time Position Fix and Status – AT+PA=2

Name	ASCII String		Length	Units	Description
	Format	Example			
Message ID	string	\$GPGLL	6		GLL Protocol header
Latitude	ddmm.mmmmm	3846.01505	10		Degrees, minutes, and fraction of minutes
N/S Indicator	character	N	1		N = north or S = south
Longitude	dddmm.mmmmm	07729.09766	11		Degrees, minutes, and fraction of minutes
E/W Indicator	character	W	1		E = east or W = west
UTC Time	hhmmss.xxx	181015.00	9		Current Time
Status	character	A	1		A = data valid or V = data invalid
Mode	character	A	1		N=No Fix, A=Autonomous GNSS Fix, D=Differential GNSS Fix, E=Estimated/Dead Reckoning Fix
Checksum	hexadecimal characters	*7A			
<CR><LF>					End of Message

Example:

\$GPGLL,3846.01505,N,07729.09766,W,181015.00,A,A*7A

Table 6: GSA - GPS Dilution of Precision and Active Satellites – AT+PA=3

Name	ASCII String		Length	Units	Description
	Format	Example			
Message ID	string	\$GPGSA	6		GSA Protocol header
SMode	character	A	1		M – Manual – forced to operate in 2D or 3D mode A – 2D Automatic – allowed to automatically switch 2D/3D
Fix Status	1 digit	3	1		1 – Fix not available 2 – 2D position fix 3 – 3D position fix
Satellites Used	numeric	11	variable		SV on Channel 1
Satellites Used	numeric	25	variable		SV on Channel 2
Satellites Used	numeric	30	variable		SV on Channel 3
Satellites Used	numeric	09	variable		SV on Channel 4
Satellites Used	numeric	18	variable		SV on Channel 5
Satellites Used	numeric	14	variable		SV on Channel 6
Satellites Used	numeric	05	variable		SV on Channel 7
Satellites Used	numeric	22	variable		SV on Channel 8
Satellites Used	numeric	35	variable		SV on Channel 9
Satellites Used	numeric	15	variable		SV on Channel 10
Satellites Used	numeric		variable		SV on Channel 11
Satellites Used	numeric		variable		SV on Channel 12
PDOP	numeric	1.53	variable		Position Dilution of Precision
HDOP	numeric	0.83	variable		Horizontal Dilution of Precision
VDOP	numeric	1.29	variable		Vertical Dilution of Precision

Name	ASCII String		Length	Units	Description
	Format	Example			
Message ID	string	\$GPGSA	6		GSA Protocol header
Checksum	hexadecimal characters	*02			
<CR><LF>					End of Message

Example:

\$GPGSA,A,3,11,25,30,09,18,14,05,22,35,15,,,1.53,0.83,1.29*02

Table 7: GSV - Satellites in View – AT+PA=4

Name	ASCII String		Length	Units	Description
	Format	Example			
Message ID	string	\$GPGSV	6		GSV protocol header
Number of Messages	1 digit	3	1		Range 1 to 3
Message Number	1 digit	1	1		Range 1 to 3
Satellites in View	numeric	10	2		
Satellite ID	ss	11	2		Channel 1 (Range 1 to 32)
Elevation	dd	12	2	degree	Channel 1 (Range 00 to 90)
Azimuth	aaa	304	3	degree	Channel1 (True, Range 000 to 359)
SNR	numeric	36	varies	dBHz	Range 0 to 99, null when not tracking
...					
Satellite ID	ss	15	2		Channel _ (Range 1 to 32)
Elevation	dd	15	2	degree	Channel _ (Range 00 to 90)
Azimuth	aaa	199	3	degree	Channel _ (True, Range 000 to 359)
SNR	numeric	40	varies	dBHz	Range 0 to 99, null when not tracking
Checksum	hexadecimal characters	*76			
<CR><LF>					End of Message

Examples:

\$GPGSV,3,1,10,11,12,304,36,25,43,237,50,30,43,110,46,09,04,050,37*72

\$GPGSV,3,2,10,18,22,141,46,14,68,003,49,05,32,064,49,22,58,147,49*7A

\$GPGSV,3,3,10,35,39,145,43,15,15,199,40*76

Table 8: GRS - GNSS Range Residuals – AT+PA=5

Name	ASCII String		Length	Units	Description
	Format	Example			
Message ID	string	\$GPRGS	6		GRS protocol header
UTC Time	hhmmss.ss	183431.80	9		Current Time
Mode	character	1	1		This will always be 1
residual	numeric	1.2	varies	meters	Range residuals for SVs used in navigation. The SV order matches the order from the GSA sentence.
...					
residual	numeric		varies	meters	
Checksum	hexadecimal characters	*64			
<CR><LF>					End of Message

Example:

\$GPRGS,183431.80,1,1.2,-1.9,-0.8,-0.5,0.5,-2.3,2.5,-3.5,,,,*64

Table 9: RMC - Recommended Minimum Data – AT+PA=6

Name	ASCII String		Length	Units	Description
	Format	Example			
Message ID	string	\$GPRMC	6		RMC protocol header
UTC Time	hhmmss.ss	184232.60	9		Current Time
Status	character	A	1		A=data valid or V=data invalid
Latitude	ddmm.mmmmm	3846.01437	9		Degrees, minutes, and fraction of minutes
N/S Indicator	character	N	1		N = north or S = south
Longitude	dddmm.mmmmm	07729.09861	10		Degrees, minutes, and fraction of minutes
E/W Indicator	character	W	1		E = east or W = west
Speed Over Ground	numeric	0.027	varies	knots	
Course Over Ground	numeric	331.95	varies	degrees	True
UTC Date	ddmmyy	300704	6	days, months, years	Current Date
Magnetic Variation	blank			degrees	Not Supported
Magnetic Variation E/W	blank				Not Supported
Mode	character	A	1		N=No Fix, A=Autonomous GNSS Fix, D=Differential GNSS Fix, E=Estimated/Dead Reckoning Fix
Checksum	hexadecimal characters	*79			
<CR><LF>					End of Message

Example:

\$GPRMC,184232.60,A,3846.01437,N,07729.09861,W,0.027,331.95,300704,,,A*79

Table 10: VTG - Course Over Ground and Ground Speed – AT+PA=7

Name	ASCII String		Length	Units	Description
	Format	Example			
Message ID	string	\$GPVTG	6		VTG protocol header
Course (True)	numeric	19.38	varies	degrees	Measured heading
Reference	character	T	1		True
Course (Magnetic)	blank				Measured Heading
Reference	character	M	1		Magnetic
Speed	numeric	0.032	varies	knots	
Units	character	N	1		Knots
Speed	numeric	0.059	varies	km/h	
Units	character	K	1		Kilometers per hour
Mode	character	A	1		N=No Fix, A=Autonomous GNSS Fix, D=Differential GNSS Fix, E=Estimated/Dead Reckoning Fix
Checksum	hexadecimal characters	*03			
<CR><LF>					End of Message

Example:

\$GPVTG,19.38,T,,M,0.032,N,0.059,K,A*03

Table 11: ZDA - Time and Date – AT+PA=8

Name	ASCII String		Length	Units	Description
	Format	Example			
Message ID	string	\$GPZDA	6		ZDA protocol header
UTC time	hhmmss.ss	185741.80	9	hours minutes seconds	00...23 00...59 00.00...59.99
UTC time: day	dd	30	2	days	01...31
UTC time: month	mm	07	2	months	01...12
UTC time: year	yyyy	2004	4	years	4 digit year
Local zone hours	xx or -xx	00	2		Not used (= 00)
Local zone minutes	zz	00	2		Not used (= 00)
Checksum	hexadecimal characters	*62			
<CR><LF>					End of Message

Example:

\$GPZDA,185741.80,30,07,2004,00,00*62

Table 12: GST - GNSS Pseudo Range Error Statistics – AT+PA=9

Name	ASCII String		Length	Units	Description
	Format	Example			
Message ID	string	\$GPST	6		GST protocol header
UTC time	hhmmss.ss	190009.60	9	hours minutes seconds	00...23 00...59 00.00...59.99
Range rms	numeric	2.4	varies	meters	RMS value of the standard deviation of the ranges
Std Major	numeric				Standard deviation (semi-major axis) Not supported empty.
Std Minor	numeric				Standard deviation of semi-minor axis Not supported empty.
Heading	numeric				Orientation of semi-major axis Not supported empty.
Std Latitude	numeric	1.4	varies	meters	Standard deviation of latitude
Std Longitude	numeric	1.3	varies	meters	Standard deviation of longitude
Std Altitude	numeric	2.4	varies	meters	Standard deviation of altitude
Checksum	hexadecimal characters	*79			
<CR><LF>					End of Message

Example:

\$GPGST,190009.60,2.4,,,,1.4,1.3,2.4*79

Table 13: VTG - PUBX0 - Lat/Long Position Data – AT+PA=A

Name	ASCII String		Length	Units	Description
	Format	Example			
Message Start	string	\$PUBX	5		Message Header Navstar Proprietary sentences
Message ID	character	00	2		Proprietary Message ID
UTC time	hhmmss.ss	191944.20	9	hours minutes seconds	00...23 00...59 00.00...59.99
Latitude	ddmm.mmmmm	3846.012485	10		Degrees, minutes, and fraction of minutes
N/S Indicator	character	N	1		N = north or S = south
Longitude	dddmm.mmmmm	07729.097149	11		Degrees, minutes, and fraction of minutes
E/W Indicator	character	W	1		E = east or W = west
AltRef	numeric	40.793			Altitude above user data ellipsoid.
NavStat	nn	G3	2	meters	

Name	ASCII String		Length	Units	Description
	Format	Example			
Message Start	string	\$PUBX	5		Message Header Navstar Proprietary sentences
Message ID	character	00	2		Proprietary Message ID
Hacc	numeric	1.7	varies		Horizontal Accuracy
Vacc	numeric	2.6	varies		Vertical Accuracy
SOG	numeric	0.032	varies		Speed Over Ground
COG	numeric	73.26	varies		Course Over Ground
Vvel	numeric	0.009	varies		Vertical Velocity, Ascending is negative and descending is positive
ageC	numeric		varies	seconds	Age of most recent DGPS Corrections. 00.0 to 999.9 Empty = none available
HDOP	numeric	0.84	varies		2-D Horizontal Dilution of Precision
VDOP	numeric	1.28	varies		Vertical Dilution of Precision
TDOP	numeric	0.68	varies		4-D Geometric Dilution of Precision
Number of Satellites	numeric	9	varies		Number of GPS Satellites Used
RU	numeric	0	1		Number of GLONASS satellites used in the navigation solution. Always set to 0.
DR	numeric	0	varies		Dead Reckoning used (0 or 1)
Checksum	hexadecimal characters	*79			
<CR><LF>					End of Message

Example:

\$PUBX,00,191944.20,3846.012485,N,07729.097149,W,40.793,G3,1.7,2.6,0.032,73.26,0.009,,0.84,1.28,0.68,9,0,0*79

Table 14: PUBX1 - Lat/Long Position Data – AT+PA=B

Name	ASCII String		Length	Units	Description
	Format	Example			
Message Start	string	\$PUBX	5		Message Header Navstar Proprietary sentences
Message ID	character	01	2		Proprietary Message ID
UTC time	hhmmss.ss	205838.60	9	hours minutes seconds	00...23 00...59 00.00...59.99
Easting	numeric	284099.823	varies	meters	UTM Easting
E/W Indicator	character	W	1		E = east or W = west
Northing	numeric	4293841.170	varies	meters	Degrees, minutes, and fraction of minutes
N/S Indicator	character	N	1		N = north or S = south
AltMSL	numeric	69.267	varies		Altitude above user datum ellipsoid.
NavStat	nn	G3	2	meters	
Hacc	numeric	2.0	varies		Horizontal Accuracy
Vacc	numeric	3.6	varies		Vertical Accuracy
SOG	numeric	0.023	varies		Speed Over Ground
COG	numeric	173.18	varies		Course Over Ground
Vvel	numeric	0.005	varies		Vertical Velocity
ageC	numeric		varies	seconds	Age of most recent DGPS Corrections. 00.0 to 999.9 Empty = none available
HDOP	numeric	1.05	varies		2-D Horizontal Dilution of Precision
VDOP	numeric	2.02	varies		Vertical Dilution of Precision
TDOP	numeric	1.28	varies		4-D Geometric Dilution of Precision
Number of Satellites	numeric	8	varies		Number of GPS Satellites Used
RU	numeric	0	1		Number of GLONASS satellites used in the navigation solution. Always set to 0.
DR	numeric	0	varies		Dead Reckoning used (0 or 1)
Checksum	hexadecimal characters	*45			
<CR><LF>					End of Message

Example:

```
$PUBX,01,205838.60,284099.823,W,4293841.170,N,69.267,G3,2.0,3.6,0.023,173.18,0.005,,1.05,2.02,1.28,8,0,0*45
```

Table 15: PUBX4 – Time of Day and Clock Information – AT+PA=C

Name	ASCII String		Length	Units	Description
	Format	Example			
Message Start	string	\$PUBX	5		Message Header Navstar Proprietary sentences
Message ID	character	04	2		Proprietary Message ID
UTC time	hhmmss.ss	155727.00	9	hours minutes seconds	00...23 00...59 00.00...59.99
UTC date	ddmmyy	020804	6	days months years	UTC Day, Month and Year
UTC TOW	numeric	143847.00	varies	seconds	UTC Time of Week
Week	numeric	1282	varies		GPS week number continues beyond 1023
Reserved	numeric	143847.00	varies		Reserved for future use
Clk_B	numeric	3448979	varies	ns	Receiver Clock Bias
Clk_D	numeric	-2894.038	varies	ns/s	Receiver Clock Drift
PG	numeric	43	varies	ns	Time Pulse Granularity
Checksum	hexadecimal characters	*45			
<CR><LF>					End of Message

Example:

\$PUBX,04,155727.00,020804,143847.00,1282,143847.00,3448979,-2894.038,43,*35

APPENDIX C – INPUT REPORT FORMAT

The 9602-LP will send an input report when input pins are triggered. The report is sent as a GPS version 6 report (refer to ^RMF for report versions) with UTC timestamp and pin information included as free text. The free text portion of the report uses the following text format:

YYYYMMDDHHMMSSPP, where

YYYY - Year

MM - Month

DD - Day

HH - Hour

MM - Minute

SS - Second

PP - Pin value in hexadecimal representation.

00 - No pins set

01 - Pin 0 set

02 - Pins 1 set

03 - Pins 0, 1 set

04 - Pins 2 set

05 - Pins 0, 2 set

...

FF - All pins set

CC - Bitmask indicating the position of the pin that changed

01 - Pin 0 changed

02 - Pin 1 changed

04 - Pin 2 changed

08 - Pin 3 changed