# EXTENDED AT GPS COMMANDS FOR A3LA-DG

# TECHNICAL NOTE

February 20, 2007

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## 1.0 OVERVIEW

This document is a supplement to the AT Command Reference Version 2.7. It is intended as a reference guide to the usage of the extended AT GPS command set for the NAL Research's satellite data modem with global positioning system (GPS) model A3LA-DG. Users are also recommended to read the following documents all of which are shipped on the CD-ROM provided in the same shipping package of the satellite modem:

NAL2007-14-V3.4.0 (How to Use Model A3LA-DG)
NAL2007-15-V3.4.0 (General Description of Model A3LA-DG)
GPS.G3-MS3-02028 (TIM-LP Product Summary)
GPS.G3-MS3-02010-P9 (TIM-LP Data Sheet)

## 2.0 REQUIREMENTS

In order for the GPS features on the A3LA-DG modem to work, please do not change the following modem default values:

1. Echo (ATEn) must be set to 1 (ATE1) to access GPS during a data call.
2. Quiet (ATQn) must be set to 0 (ATQ0) to access GPS during a data call.
3. Serial port setting at 19200 bits/sec.
4. When the Iridium RF board is turned OFF by an AT command, communications with the A3LA-DG must be done with no flow control.

Furthermore, when switching from data to command mode during a call, the first AT command should be a non-GPS AT command such as AT. If the first command is an AT GPS command then the modem will switch back to data mode. These conditions apply only when in a call with a remote modem. NAL Research can also reconfigure the modem to operate at other baud rates.

## 3.0 EXTENDED AT COMMAND FOR POWER CONTROL

The following AT command can be used to toggle the Iridium RF board ON and OFF. A different AT command can be used to toggle the GPS receiver and active antenna ON and OFF as well (see next section).

AT*TP – Toggles power of the Iridium transceiver board from OFF to ON or ON to OFF

A carriage return or <Enter> key is needed after this command. This command performs the same function as toggling the A3LA-DG ON/OFF by shorting pin 1 to the ground for 270ms. This command may also be used to turn the Iridium RF board back ON after being turned OFF with AT*P command. Once the Iridium RF board is OFF, the A3LA-DG can only communicate with a data terminal equipment (DTE) with flow control OFF. When the Iridium RF board is OFF, only AT*TP command and extended AT GPS commands work on the A3LA-DG. During a data call with the GPS receiver having been toggled off with the AT+PP command and the +++ sequence has been executed, the AT*TP command will not turn the Iridium RF board OFF. However, the Iridium RF board can still be turned OFF with the AT*P command. There is no echo when the Iridium RF board is OFF.

The following example shows how the Iridium RF board is being turned OFF with the AT*TP command, then GPS location information being retrieved with the AT+PL command and finally the Iridium RF board

being turned back ON with AT*TP. An ATI3 command is then issued immediately after this sequence of commands.

**AT*TP**

OK

**AT+PL**
+PL:
Latitude=38:46.0145 North
Longitude=077:29.0971 West
Altitude=91.3 meters
Satellites Used=7

OK

**AT*TP**

OK

**ATI3**
IS05001

OK

## 4.0 EXTENDED AT GPS COMMANDS

The following AT commands are available specifically for the GPS receiver and GPS antenna:

| | |
|---|---|
| AT+PA=<n> | – Displays a standard NMEA message, where <n> is NMEA format type |
| AT+PM=<r>,<1, …,C> | – Displays multiple NMEA messages at a repeated interval, where <r> is the interval and <1, ..,C> is a list of NMEA format types |
| AT+PT | – Displays UTC time |
| AT+PD | – Displays UTC date |
| AT+PL | – Displays position (latitude, longitude, altitude) to the 4th decimal place |
| AT+PLOC | – Displays position (latitude, longitude, altitude) to the 5th decimal place |
| AT+PV | – Displays ground velocity (speed and direction) |
| AT+PVEL | – Displays velocity (ground speed, vertical speed and ground heading) |
| AT+PNAV=<n> | – Increase the accuracy of the GPS receiver by specifying the environment, where <n> is a list of 7 different environments |
| AT+PNAV? | – Displays the status of the current environment |
| AT+PP=<n> | – Toggles the GPS receiver ON/OFF. <n> is 0 for OFF and 1 for ON. |

A carriage return or <Enter> key is needed after each command. All AT GPS commands except AT+PA, AT+PM, AT+PNAV, and AT+PP will return the number of satellites used to generate the information. The GPS receiver will calculate UTC time based on its own internal clock if the GPS receiver can no longer acquire satellite signals. If the GPS receiver is turned OFF by AT+PP command and an extended AT GPS command besides AT+PP is issued, the A3LA-DG will respond with the message "GPS Off". All other AT commands will return the text "OK" and always be in verbose mode. If the A3LA-DG is in connection with another modem and is escaped out of the data mode, a regular AT command must be executed first before

using an extended AT GPS command. Otherwise, the A3LA-DG will return "ERROR". During a data call, the GPS receiver cannot be turned ON if it is OFF.

**WARNING:** When the AT+CNMI command is set to immediately route incoming messages to a DTE, SMS messages may be lost if an extended AT GPS command is simultaneously executed (very low probability that this will occur). If the AT+CNMI's default setting is not changed allowing all data to buffer, then SMS messages will not be lost.

### AT+PA=<n>

This command returns the complete NMEA message format (see Appendix C), 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

### AT+PM=<r>,<1,…,C)

This command returns multiple NMEA messages (see Appendix C) at a repeated interval, where <r> is the user-defined interval. NMEA message(s) will be displayed repeatedly until a character (any character) is received on the serial port. If the time it takes to display NMEA messages is greater than the time between the intervals then some NMEA messages will be discarded. Possible values for <r> are:

1 – 0.20 second
2 – 0.25 second
3 – 0.50 second
4 – 1.00 second
5 – 10.00 seconds

<1,..,C> is a list of characters whose elements range from 1 to C corresponding to the following NMEA and proprietary u-blox formats. Each element in the list corresponds to a message that will be repeated once every cycle. Each of the characters in the list must be separated by a comma and there must be no spaces between them.

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

**AT+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

**AT+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.

+PD:

UTC Date=<mm>–<dd>–<yyyy>

<Invalid Position Fix>

Satellites Used=<zz>

where,

<mm> – Month (01–12)

<dd> – Day (01–31)

<yyyy> – Year (0000–9999), 0000 may appear for an <Invalid Position Fix>

<zz> – Number of satellites used to obtain information

**AT+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 truncated to 4th decimal place for backwards compatibility with the TIM GPS receivers. The AT+PLOC command is recommended to obtain GPS information.

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

where,

<ll> – 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

**AT+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.

+PLOC:
Latitude=<ll>:<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,

<ll> – 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

**AT+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 recommend 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

**AT+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

**AT+PNAV=<n>**

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

1. Stationary
2. Pedestrian
3. Automotive
4. AT Sea

5. Airborne < 1g
6. Airborne < 2g
7. Airborne < 4g

**AT+PNAV?**

This command displays the status of the current environment, which will return the following:

+PNAV: <c>

where,

<c> – Is a value between 1 and 7 corresponding to <n> specified above.

**AT+PP=<n>**

This command turns the GPS receiver and GPS antenna ON and OFF, where <n> takes on a value of:

0 – OFF

1 – ON

The GPS receiver/antenna cannot be turned ON when the serial line CD is high. This means that during a data call if the GPS receiver is OFF it cannot be turned back ON. It is recommended that the GPS receiver be turned OFF before a data connection is made if there is no need to access the GPS during the data connection. For more information see Appendix F of document General Description of Model A3LA-DG (TN2005-15-V3.3.0).

## EXAMPLES

**AT+PA=1**
+PA:
$GPGGA,173047.60,3846.01520,N,07729.09861,W,1,10,0.85,84.2,M,-33.4,M,,*57

**AT+PA=2**
+PA:
$GPGLL,3846.01496,N,07729.09773,W,173121.40,A,A*7A

**AT+PA=3**
+PA:
$GPGSA,A,3,25,30,11,09,18,14,05,22,35,15,,,1.62,0.85,1.38*06

**AT+PA=4**
+PA:
$GPGSV,3,1,11,21,04,175,,25,23,223,47,30,28,133,46,11,05,322,31*77
$GPGSV,3,2,11,09,24,046,48,18,43,127,47,14,60,312,48,05,33,091,40*76
$GPGSV,3,3,11,22,81,110,49,35,39,145,43,15,36,211,47*46

**AT+PA=5**
+PA:
$GPGRS,160944.40,1,-1.8,-0.8,-3.0,6.7,-2.7,3.1,0.9,-3.3,-2.5,,,*60

**AT+PA=6**
+PA:
$GPRMC,173221.60,A,3846.01492,N,07729.09772,W,0.020,103.73,300704,,,A*7D

**AT+PA=7**
+PA:
$GPVTG,125.55,T,,M,0.005,N,0.009,K,A*37

**AT+PA=8**
+PA:
$GPZDA,173254.60,30,07,2004,00,00*64

**AT+PA=9**
+PA:
$GPGST,161118.20,2.4,,,,1.6,1.1,2.1*77

**AT+PA=A**
+PA:
$PUBX,00,161135.80,3846.015871,N,07729.099067,W,42.863,G3,2.0,2.1,0.005,105.03,-0.014,,1.07,1.46,1.06,8,0,0*68$GPZDA,000800.33,15,02,2003,,*69

**AT+PA=B**
+PA:
$PUBX,01,161214.60,284102.185,W,4293845.657,N,75.286,G3,2.0,2.2,0.022,282.77,-0.007,,1.07,1.46,1.06,8,0,0*60

**AT+PA=C**
+PA:
$PUBX,04,161229.60,300704,490349.60,1281,490349.60,-3642995,-3950.460,43,*14

**AT+PM=1,1,7**

OK
$GPVTG,336.16,T,,M,0.014,N,0.026,K,A*3D
$GPGGA,172518.60,3846.01491,N,07729.09804,W,1,10,1.03,83.0,M,-33.4,M,,*5B
$GPVTG,336.16,T,,M,0.011,N,0.021,K,A*3F
$GPGGA,172518.80,3846.01492,N,07729.09805,W,1,10,1.03,83.0,M,-33.4,M,,*57
$GPVTG,336.16,T,,M,0.015,N,0.027,K,A*3D
$GPGGA,172519.00,3846.01492,N,07729.09805,W,1,10,1.03,83.0,M,-33.4,M,,*5E

OK

**AT+PT**
+PT:
UTC Time=00:08:14.335
Satellites Used=07

**AT+PD**
+PD:
UTC Date=02-15-2003
Satellites Used=07

**AT+PL**
+PL:
Latitude=38:46.0127 North
Longitude=077:29.0957 West
Altitude=55.6 meters
Satellites Used=07

**AT+PLOC**
+PLOC:
Latitude=38:46.01521 North
Longitude=077:29.09869 West
Altitude=82.2 meters
Valid Position Fix
Satellites Used=10

**AT+PV**
+PV:
Ground Velocity=0.1 km/h, 149.90 degrees from true North
Satellites Used=06

**AT+PVEL**
+PVEL:
Ground Velocity=0.049 km/h, 0.06 degrees from true North
Vertical Velocity=0.028 m/s
Valid Position Fix
Satellites Used=10

**AT+PNAV?**
+PNAV:2

OK

**AT+PNAV=4**
+PNAV:

OK

**AT+PNAV?**
+PNAV:4

OK

**AT+PLOC**
+PLOC:
Latitude=38:46.01767 North
Longitude=077:29.09746 West
Altitude=81.7 meters
Valid Position Fix
Satellites Used=8

OK

**AT+PP=0**

OK

**AT+PLOC**
GPS Off

OK

**AT+PP=1**

OK

**AT+PLOC**
+PLOC:
Latitude=38:46.01542 North
Longitude=077:29.09810 West
Altitude=80.3 meters
Valid Position Fix
Satellites Used=8

OK

## APPENDIX A: NMEA MESSAGE FORMAT

### GGA - 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.mmmm | 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 Altitude1 | 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. Referece 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 geodic corrections values are WGS-84 heights

### 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<br>V = data invalid |
| Mode | character | A | 1 | | N=No Fix, A=Autonomous GNSS Fix,<br>D=Differential GNSS Fix,<br>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

### 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<br>A – 2D Automatic – allowed to automatically switch 2D/3D |
| Fix Status | 1 digit | 3 | 1 | | 1 – Fix not available<br>2 – 2D position fix<br>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 |
| 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

### 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 |

Example:
$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

### GRS - GNSS Range Residuals – AT+PA=5

| Name | ASCII String | | Length | Units | Description |
|---|---|---|---|---|---|
| | Format | Example | | | |
| Message ID | string | $GPGRS | 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:
$GPGRS,183431.80,1,1.2,-1.9,-0.8,-0.5,0.5,-2.3,2.5,-3.5,,,,*64

### 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<br>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

### 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

### 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<br>minutes<br>seconds | 00…23<br>00…59<br>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

### 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<br>minutes<br>seconds | 00…23<br>00…59<br>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 Latititude | 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

### 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<br>minutes<br>seconds | 00…23<br>00…59<br>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 | |
| 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 |
| 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

### 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<br>minutes<br>seconds | 00…23<br>00…59<br>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,G3,2.0,3.6,0.023,173.18,0.0
05,,1.05,2.02,1.28,8,0,0*45

### 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<br>minutes<br>seconds | 00…23<br>00…59<br>00.00…59.99 |
| UTC date | ddmmyy | 020804 | 6 | days<br>months<br>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

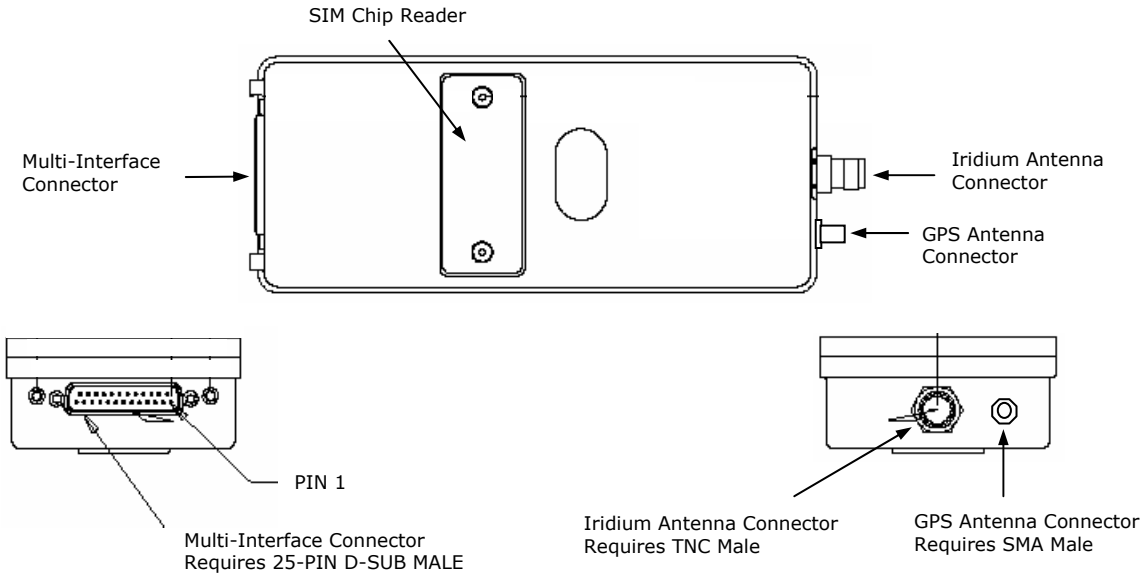
## APPENDIX B: MODEM SPECIFICATIONS

### Mechanical Specifications

| | |
|---|---|
| Dimensions: | 7.73″ L x 3.25″ W x 1.54″ D (196.4 mm x 82.6 mm x 39 mm) |
| Weight: | ~1.5 pounds (689 g) |
| Cooling: | Convection |
| Enclosure: | Aluminum/EMI shielding |
| Multi-Interface Connector: | 25-Pin D-Sub located on the end of the A3LA-DG |
| Iridium Antenna: | TNC female for Iridium and SMA female for GPS |
| SIM Chip Reader: | Located beneath a cover plate atop the A3LA-DG |

### Iridium RF Specifications

| | |
|---|---|
| Operating Frequency: | 1616 to 1626.5 MHz |
| Duplexing Method: | Time Division Duplex |
| Multiplexing Method: | TDMA/FDMA |
| Link Margin: | 13.1 dB average |
| Average Power during a transmit slot (max.): | 7W |
| Average Power during a frame (typical): | 0.6W |
| Receiver Sensitivity at 50W (typical): | –118.5 dBm |
| Receiver Spurious Rejection at offsets > 1MHz: | 60 dB |




### Electrical Specifications

| | |
|---|---|
| Main Input Voltage Range: | +4.0VDC to +4.8VDC |
| Main Input Voltage Nominal: | +4.4VDC |
| Main Input Voltage Ripple: | 40mV peak-to-peak |
| Peak Power-up Current: | ~2.5A @ 4.4VDC |
| Main Input Active Power: | 2050 mW (average) |

Main Input Standby Power: 600 mW (average)

**NOTE:** The power requirements apply to DC power measured at the A3LA-DG multi-interface connector input.

**Environmental Specifications**

Operating Temperature Range: 14°F to +131°F (–10°C to +55°C)
Operating Humidity Range: < 75% RH
Storage Temperature Range: –40°F to +185°F (–40°C to +85°C)
Storage Humidity Range: < 93% RH

**Data I/O Specifications**

Dial-Up Data/RUDICS: 2.4 Kbits/sec (average)
Direct Internet: 2.4 Kbits/sec (average)
Short-Burst Data: 1960 bytes for Mobile-Originated and 1890 bytes for Mobile-Terminated
Short Messaging: 160 Characters (maximum)
Hardware Interface: RS232
Software Interface: Standard AT commands, extended AT commands and AT GPS commands

**Related Hardware**

Iridium Antennas: SYN7391 Series, SAF2040 Series, SAF5340 Series, SAF5350 Series
GPS Antenna: SAF5270-G, SAF4070-IG, SAF5370-IG, SAF7352-IG
Power Adapters: LA-2098 (AC Adapter), LA-7021 (Cigarette Lighter Adapter)
Battery Pack: SYN-LI-416AH (16 A-Hr LiIon Battery)
DPL Audio Handset: DPLS0401-412
RF Splitter: SYN-SLC-ALBT

**Reference Documents**

Product Information Model A3LA-DG
ISU AT Command Reference V2.1
TN2007-14-V3.4.0 (How to Use Model A3LA-DG)
TN2007-16-V3.4.0 (Extended AT GPS Commands for Model A3LA-DG)
TN2007-69-V4.1.0 (SatTerm Software Manual)

## APPENDIX C: GPS RECEIVER SPECIFICATIONS

| | |
|---|---|
| Type of GPS Receiver: | TIM-LP GPS Receiver from u-Blox AG |
| Receiver Type: | L1 frequency (1575.42 MHz carrier frequency)<br>C/A code<br>16-channel |
| Maximum update rate: | 4Hz |
| Accuracy: | 2.5m CEP |
| Acquisition (typical): | Cold start < 36 seconds<br>Warm start < 33 seconds<br>Hot start < 3.5 seconds |
| Signal Reacquisition: | < 1 second |
| Operational Limits: | COCOM restrictions apply (can be lifted upon request) |
| I/O Protocols: | NMEA 0183 (RTCM input and SiRF* binary are also available) |
| WAAS: | WAAS (Wide Area Augmentation System) for North America is enabled on the receiver for 1 of the 16 channels. If requested when ordering other settings can be configured. |
| Related Documents: | GPS.G3-MS3-02028 (TIM-LP Product Summary)<br>GPS.G3-MS3-02010 (TIM-LP GPS Receiver Macro Component Data Sheet)<br>GPS.G3-MS3-01001-A (TIM-LC-LF-LP System Integration Manual) |