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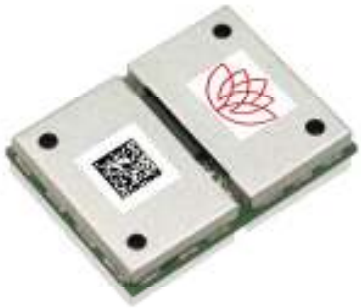
RX Oncore

Advanced GPS Module



NMEA Protocol Specifications

Abstract

This document serves to describe the NMEA Protocol Specifications of the cost effective, small size and high-performance i-Lotus RX Oncore GPS receiver module.

The Oncore series of GPS receivers feature easily integrated, high performance, and cost-effective solutions for an extensive variety of application environments.

What's Leading You

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1 NMEA Protocol Overview

The National Marine Electronics Association (NMEA) has developed a specification that defines the interface between various pieces of marine electronic equipment. The standard permits marine electronics to send information to computers and to other marine equipment. A full copy of this standard is available for purchase at their website (http://www.nmea.org).

GPS receiver communication is defined within this specification. Most computer programs that provide real time position information understand and expect data to be in NMEA format. This data includes the complete PVT (position, velocity, time) solution computed by the GPS receiver. The idea of NMEA is to send a line of data called a sentence that is totally self contained and independent from other sentences.

There are standard sentences for each device category and there is also the ability to define proprietary sentences for use by the individual company. All of the standard sentences have a two letter prefix that defines the device that uses that sentence type. (For gps receivers the prefix is GP) which is followed by a three letter sequence that defines the sentence contents. In addition NMEA permits hardware manufactures to define their own proprietary sentences for whatever purpose they see fit. All proprietary sentences begin with the letter P and are followed with 3 letters that identifies the manufacturer controlling that sentence. For example the ST and i-Lotus RX Oncore extended ones which have the format: $PSTM.

Each sentence begins with a '$' and ends with a carriage return/line feed sequence and can be no longer than 80 characters of visible text (plus the line terminators). The data is contained within this single line with data items separated by commas. The data itself is just ASCII text and may extend over multiple sentences in certain specialized instances but is normally fully contained in one variable length sentence. The data may vary in the amount of precision contained in the message. For example time might be indicated to decimal parts of a second or location may be show with 3 or even 4 digits after the decimal point. Programs that read the data should only use the commas to determine the field boundaries and not depend on column positions. There is a provision for a checksum at the end of each sentence which may or may not be checked by the unit that reads the data. The checksum field consists of a '*' and two hex digits representing an 8 bit exclusive OR of all characters between, but not including, the '$' and '*'. A checksum is required only on some sentences. The first word of a sentence, called a data type, defines the interpretation of the rest of the sentence. Each Data type would have its own unique interpretation and is defined in the NMEA standard.

1.1 Standard NMEA Protocol Structures

Standard NMEA adopts both structures with checksum and without checksum.

The following picture shows the structure of a NMEA protocol sentence with checksum -

Checksum Range

$	GP	<3 Characters>	{,<Parameter 1>{,<Parameter 2>{.....{,<Parameter N>}}}}	*	<Checksum>	<CR><LF>

Sentence Identifier	Date Type		Data	Data Terminator	Checksum	Sentence Terminator
	Prefix	Function Identifier				

Example -

$	GP	GGA	,123519,4807.038,N,01131.000,E,1,08,0.9,545.4,M,46.9,M, , ,	*	68	\n\r

The following picture shows the structure of a NMEA protocol sentence without checksum -

Checksum Range

$	GP	<3 Characters>	{,<Parameter 1>{,<Parameter 2>{.....{,<Parameter N>}}}}	<CR><LF>

Sentence Identifier	Date Type		Data	Sentence Terminator
	Prefix	Function Identifier		

Example -

$	GP	GGA	,123519,4807.038,N,01131.000,E,1,08,0.9,545.4,M,46.9,M, , ,	\n\r

1.2 Proprietary ST NMEA Protocol Structures

Proprietary ST NMEA adopts both structures with checksum and without checksum.

The following picture shows ST NMEA Protocol Structure with Checksum -

Checksum Range

$	PSTM	<n Characters>	{,<Parameter 1>{,<Parameter 2>{.....{,<Parameter N>}}}}	*	<Checksum>	<CR><LF>

Sentence Identifier	Date Type		Data	Data Terminator	Checksum	Sentence Terminator
	Prefix	Function Identifier				

Example -

$	PSTM	INITGPS	,3400.001,N,11800.000,W,0037,01,06,2005,09,34,42	*	04	\n\r

The following picture shows ST NMEA Protocol Structure without Checksum -

$	PSTM	<n Characters>	{,<Parameter 1>{,<Parameter 2>{……..{,<Parameter N>}}}}	<CR><LF>

Sentence Identifier	Date Type		Data	Sentence Terminator
	Prefix	Function Identifier		

Example -

$	PSTM	INITGPS	,3400.001,N,11800.000,W,0037,01,06,2005,09,34,42	\n\r

1.3 I-Lotus Extended STMicroelectronics proprietary NMEA Sentences Structures

i-Lotus extended ST proprietary NMEA adopts both structures with checksum and without checksum.

The following picture shows i-Lotus extended ST NMEA Protocol Structure with Checksum -

Checksum Range

$	PSTMiM	<n Characters>	{,<Parameter 1>{,<Parameter 2>{……..{,<Parameter N>}}}}	*	<Checksum>	<CR><LF>

Sentence Identifier	Date Type		Data	Data Terminator	Checksum	Sentence Terminator
	Prefix	Function Identifier				

Example -

$	PSTMiM			*		\n\r

The following picture shows i-Lotus extended ST NMEA Protocol Structure with Checksum-

$	PSTMiM	<n Characters>	{,<Parameter 1>{,<Parameter 2>{……..{,<Parameter N>}}}}	<CR><LF>

Sentence Identifier	Date Type		Data	Sentence Terminator
	Prefix	Function Identifier		

Example -

$	PSTMiM			\n\r

1.4 NMEA Checksum Algorithm

An NMEA checksum is calculated as the XOR of bytes between (but not including) the dollar sign and asterisk.

Code in C

```
// Calculates the checksum for a NMEA sentence
int GetNMEAChecksum (char * NMEASentence)
{
	int Checksum = 0;					// Initialize
	char *Ptr = NMEASentence + 1;				// Point to the char after $

	for (; *Ptr != '*' ; Ptr++)				// Loop through all chars to get a checksum
	{
		if (Checksum == 0) Checksum = (*Ptr);	// If first value, set the checksum to the value
		else Checksum ^=  *Ptr;			// Else XOR the checksum with this character's value
	}
	return (Checksum);				// Return the checksum
}
```

2 RX Oncore NMEA Sentences Summaries

RX Oncore supports the followings

- Standard NMEA Sentences
- STMicroelectronics proprietary NMEA Sentences
- iLotus Extended STMicroelectronics proprietary NMEA Sentences

2.1 Standard NMEA Sentences Summary

The following table shows RX Oncore's standard NMEA sentences support –

Data Type	Descriptions	Version		Remarks
		Navi	Time	
$GPGGA	Global Positioning System Fix Data	1.00	1.00	
$GPGLL	Geographic Position, Latitude and Longitude	1.00	1.00	
$GPGSA	GPS DOP and Active Satellites	1.00	1.00	
$GPGSV	GPS Satellites in View	1.00	1.00	
$GPRMC	Recommended Minimum Specific GPS/Transit Data	1.00	1.00	Checksum Required
$GPVTG	Track Made Good and Ground Speed	1.00	1.00	
$GPZDA	Time and Date	1.00	1.00	

2.2 STMicroelectronics proprietary NMEA Sentences Summary

The following table shows RX Oncore's STM proprietary NMEA sentences support –

Data Type	Descriptions	Version		Remarks
		Navi	Time	
$PSTMEPH	Ephemeris data/status	1.00	1.00	
$PSTMPRES	Position residual evaluated in the positioning algorithm for each channel	1.00	1.00	
$PSTMVRES	velocity residual evaluated in the positioning algorithm for each channel	1.00	1.00	
$PSTMTG	time of fix/ global parameters	1.00	1.00	
$PSTMTS	satellite related parameters	1.00	1.00	
$PSTMPA	positioning algorithm	1.00	1.00	
$PSTMSBAS	WAAS/SBAS information	1.00	1.00	

$PSTMTIM	Time validity information (RTC or GPS time)	1.00	1.00	

2.3 STMicroelectronics proprietary NMEA Commands Summary

The following table shows ST proprietary NMEA sentences support.

Data Type	Descriptions	Version		Remarks
		Navi	Time	
$PSTMINITGPS	Initialize GPS position and time	1.00	1.00	
$PSTMCLREPHS	Clear all ephemeris	1.00	1.00	
$PSTMDUMPEPHEMS	Dump Ephemeris data	1.00	1.00	
$PSTMEPHEM	Load Ephemeris data	1.00	1.00	
$PSTMCLRALMS	Clear all almanacs	1.00	1.00	
$PSTMDUMPALMANAC	Dump Almanacs data	1.00	1.00	
$PSTMALMANAC	Load Almanacs data	1.00	1.00	
$PSTMCOLD	Perform COLD start	1.00	1.00	
$PSTMWARM	Perform WARM start	1.00	1.00	
$PSTMHOT	Perform HOT start	1.00	1.00	
$PSTMNMEAONOFF	Toggle NMEA output	1.00	1.00	
$PSTMRMC	Toggle RMC message	1.00	1.00	
$PSTMGPSRESET	Reset the GPS receiver	1.00	1.00	
$PSTMGPSSUSPEND	Suspend GPS	1.00	1.00	
$PSTMGPSRESTART	Restart GPS	1.00	1.00	
$PSTMSRR	Execute a software reset of the system	1.00	1.00	
$PSTMTIMEINV	Invalidate the GPS time	1.00	1.00	
$PSTMGETSWVER	Provide the GPS library version string.	1.00	1.00	
$PSTMNMEACONFIG	Configure the NMEA baud rate and message list	1.00	1.00	
$PSTMSBASONOFF	Enable/Disable the SBAS activity	1.00	1.00	
$PSTMSBASSAT	Set the SBAS satellite's ID	1.00	1.00	

2.4 I-Lotus Extended STMicroelectronics proprietary NMEA Commands Summary

The following table shows i-Lotus extended ST proprietary NMEA sentences support.

Data Type	Descriptions	Version		Remarks
		Navi	Time	
$PSTMiMCD	PPS Cable Delay Correction	N.A.	1.00	Positive Value only
$PSTMiMCj	Show Receiver Information	1.00	1.00	
$PSTMiMER	Auto Error Event Response	1.00	1.00	
$PSTMiMPL	PPS Pulse Length	N.A.	1.02	Released in TV1.02
$PSTMiMPM	Power Saving Mode	1.00 1.00	1.03 1.03	LP-WFI Mode Standby Mode
$PSTMiMRR	NMEA message response rate	1.00	N.A.	
$PSTMiMIF	Communication Interface Select	TBD	TBD	For UART, SPI, USB selection

3 RX Oncore NMEA Sentences Details

3.1 Standard NMEA Sentences Details

3.1.1 $GPGGA – Global Positioning System Fix Data

This sentence provides the current Fix data, and is regarded as 1 of the most commonly used sentence in GPS NMEA. To configure this sentence, the “$PSTMNMEACONFIG” command needs to be sent to the GPS module.

Command1	$PSTMNMEACONFIG,115200,1,0<CR><LF>
Command1 Result	Set the UART baud-rate to 115200 bps for the NMEA $GPGGA sentences with 3 decimal points, and to transmit on UTC second
Command2	$PSTMNMEACONFIG,115200,2,0<CR><LF>
Command2 Result	Set the UART baud-rate to 115200 bps for the NMEA $GPGGA sentences with 5 decimal points, and to transmit on UTC second
Query	None
Response	$GPGGA ,<UTC Time> ,<Lat> ,<LatRef> <Lon> ,<LonRef> ,<Fix Quality> ,<Number of Satellites> ,<Horizontal Dilution> ,<Altitude> ,<UOM of Altitude>, <Height of GeoID> ,<UOM of Height> ,<DGPS Age> ,<DGPS station ID> <CR><LF>
Parameters	
$GPGGA	Data Type for Global Positioning System Fix Data
,<UTC Time>	Fix taken at UTC time Format : ,<%6d> Where <%6d> represents time format in hhmmss h = hours m = minutes s = seconds
,<Lat>	Latitude Format : ,<%8f.3> or <%10f.5> Where <%8f.3> represents latitude format in ddmm.mmm d = degrees m = minutes or <%10f.5> is latitude format in ddmm.mmmmm

<table>
<tr><td></td><td>d = degrees
m = minutes</td></tr>
<tr><td>,<LatRef></td><td>Direction of Latitude
Format : ,<%c>
Where
<%c> represents
‘N’ for North
‘S’ for South</td></tr>
<tr><td>,<Lon></td><td>Longitude with Direction
Format : ,<%9f.3> or <%11f.5>
Where
<%9f.3> represents longitude format in dddmm.mmm
d = degrees
m = minutes
or
<%11f.5> is latitude format in dddmm.mmmmm
d = degrees
m = minutes</td></tr>
<tr><td>,<LonRef></td><td>Direction of Longitude
Format : ,<%c>
Where
<%c> represents
‘E’ = East
‘W’ = West</td></tr>
<tr><td>,<Fix Quality></td><td>Quality of the position fix
Format : ,<%d>
Where
<%d> represents
‘0’ = Invalid
‘1’ = GPS fix (SPS)

‘2’ = DGPS fix (SBAS)</td></tr>
<tr><td>,<Number of Satellites></td><td>Number of satellites being tracked
Format : ,<%d>
Where
<%d> is in the range of 0 to 12</td></tr>
<tr><td>,<Horizontal Dilution of Position></td><td>Horizontal dilution of position
Format : ,<%f>
Where
<%f> is greater than 0
<table>
<tr><th>DOP Value</th><th>Rating</th><th>Description</th></tr>
<tr><td>0</td><td>Ideal</td><td>This is the highest possible confidence level to be used for applications demanding the highest possible precision at all times</td></tr>
<tr><td>1-3</td><td>Excellent</td><td>At this confidence level, positional measurements are considered accurate enough to meet all but the most sensitive applications</td></tr>
<tr><td>4-6</td><td>Good</td><td>Represents a level that marks the minimum appropriate for making business decisions. Positional measurements could be used to make reliable in-route navigation suggestions to the user</td></tr>
<tr><td>7-8</td><td>Moderate</td><td>Positional measurements could be used for calculations, but the fix quality could still be</td></tr>
</table>
</td></tr>
</table>

	<table><tr><td></td><td></td><td>improved. A more open view of the sky is recommended</td></tr><tr><td>9-20</td><td>Fair</td><td>Represents a low confidence level. Positional measurements should be discarded or used only to indicate a very rough estimate of the current location</td></tr><tr><td>21-50</td><td>Poor</td><td>At this level, measurements are inaccurate by as much as 300 metres with a 6 meter accurate device (50 dop * 6 meters) and should be discarded</td></tr></table>
,<Altitude>	Altitude above mean sea level Format : ,<%d>
,<UOM of Altitude>	Unit of Measure for Altitude Format : ,<%c> Where <%c> represents 'M' = Meters
,<Height of GeoID>	Height of GeoID (mean sea level) above WGS84 ellipsoid Format : ,<%d>
,<UOM of Height>	Unit of Measure for Altitude Format : ,<%c> Where <%c> represents 'M' = Meters
,<DGPS Age>	The time since the last DGPS update in seconds
,<DGPS Station ID>	The DGPS Station identification Format : , <%d> Where <%D> represents the range 0 to 1023
<CR><LF>	Sentence Terminator

Remarks

If the height of GeoID is missing then the altitude should be suspect. RX Oncore follows the standard of reporting GeoID altitude, unlike some nonstandard implementations which report altitude with respect to the ellipsoid. This is the only sentence that reports altitude.

Example 1 – Enable $GPGGA with 3 decimals accuracy

Command	$PSTMNMEACONFIG,115200,1,0*<CR><LF>*
Command Remark	Set the UART baud-rate to 115200 bps for the NMEA $GPGGA sentences with 3 decimal points, and to transmit on UTC second
Command Reply	The selected configuration will be setup, and no message will be replied
Command Result	The unit will output $GPGGA sentence with 3 decimal points for Latitude and Longitude on UTC second via the UART at 115200 bps baud-rate
Periodic NMEA Reply	$GPGGA,123519,4807.038,N,01131.000,E,1,08,0.9,545.4,M,46.9,M,,,*68*<CR><LF>* Where UTC Time = 12:35:19 Latitude = 48° 7.038' North Longitude = 11° 31.000' East Fix Quality = GPS Fix Number of Satellites = 8 Horizontal dilution of Position = 0.9

	Altitude = 545.4 meters Height of GeoID = 46.9 meters DGPS Lag = Not Available DGPS Station ID = Not Available

Example 2 – Enable $GPGGA with 5 decimals accuracy

Command	$PSTMNMEACONFIG,115200,2,0<*CR*><*LF*>
Command Remark	Set the UART baud-rate to 115200 bps for the NMEA $GPGGA sentences with 5 decimal points, and to transmit on UTC second
Command Reply	The selected configuration will be setup, and no message will be replied
Command Result	The unit will output $GPGGA sentence with 5 decimal points for Latitude and Longitude on UTC second via the UART at 115200 bps baud-rate
Periodic NMEA Reply	$GPGGA,123519,4807.03844,N,01131.00032,E,1,08,0.9,545.4,M,46.9,M,,, *68<*CR*><*LF*> Where UTC Time = 12:35:19 Latitude = 48° 7.03844' North Longitude = 11° 31.00032' East Fix Quality = GPS Fix Number of Satellites = 8 Horizontal dilution of Position = 0.9 Altitude = 545.4 meters Height of GeoID = 46.9 meters DGPS Lag = Not Available DGPS Station ID = Not Available

Example 3 – Disable $GPGGA

<table>
<tr><td>Command</td><td>$PSTMNMEACONFIG,115200,5242972,0<CR><LF></td></tr>
<tr><td>Command Remark</td><td>Set the UART baud-rate to 115200 bps and to transmit on UTC second.
<table>
<tr><th>NMEA</th><th>ID</th><th>Output</th></tr>
<tr><td>GGA</td><td>1</td><td>Disabled</td></tr>
<tr><td>GGA5</td><td>2</td><td>Disabled</td></tr>
<tr><td>GSA</td><td>4</td><td>Enabled</td></tr>
<tr><td>GSV</td><td>8</td><td>Enabled</td></tr>
<tr><td>VTG</td><td>16</td><td>Enabled</td></tr>
<tr><td>RMC</td><td>64</td><td>Enabled</td></tr>
<tr><td>GLL</td><td>1048576</td><td>Enabled</td></tr>
<tr><td>ZDA</td><td>4194304</td><td>Enabled</td></tr>
</table></td></tr>
<tr><td>Command Reply</td><td>The selected configuration will be setup, and no message will be replied</td></tr>
<tr><td>Command Result</td><td>The unit will output $GPGSA,$GPGSV,$GPVTG,$GPRMC,$GPGLL,$GPZDA except $GPGGA sentences on UTC second via the UART at 115200 bps baud-rate</td></tr>
<tr><td>Periodic NMEA Reply</td><td>Only the following NMEA sentences are output
$GPGSA
$GPGSV
$GPVTG
$GPRMC
$GPGLL
$GPZDA</td></tr>
</table>

3.1.2 $GPGLL – Geographic position, Latitude and Longitude

Geographic Latitude and Longitude is a holdover from Loran data.

Command	$PSTMNMEACONFIG,115200,1048576,0<CR><LF>
Command Remark	Set the UART baud-rate to 115200 bps for the NMEA $GPGLL sentences, and to transmit on UTC second
Query	None
Response	$GPGLL ,<Lat> ,<LatRef> ,<Lon> ,<LonRef> ,<UTC Time> ,<Status Flag> *<CS><CR><LF>
Parameters	
$GPGLL	Data Type for Geographic Latitude and Longitude
,<Lat>	Latitude Format : ,<%7f.2> Where <%7f.2> represents latitude format in ddmm.mmm d = degrees m = minutes
,<LatRef>	Direction of Latitude Format : ,<%c> Where <%c> represents 'N' = North 'S' = South
,<Lon>	Longitude with Direction Format : ,<%8f.2> Where <%8f.2> represents longitude format in dddmm.mmm d = degrees m = minutes
,<LonRef>	Direction of Longitude Format : ,<%c> Where <%c> represents 'E' = East 'W' = West
,<UTC Time>	Fix taken at UTC time Format : ,<%6d> Where <%6d> represents time format in hhmmss h = hours m = minutes s = seconds
,<Status Flag>	Status of this data sentence Format : ,<%c> Where <%c> represents

	'A' = Active 'V' = Void
*<CS>	Checksum from the 2nd character to the character before '*' inclusively
<CR><LF>	Sentence Terminator

Example 1 – Enable $GPGLL

Command	$PSTMNMEACONFIG,115200,1048576,0*<CR><LF>*
Command Remark	Set the UART baud-rate to 115200 bps for the NMEA $GPGLL sentences, and to transmit on UTC second
Command Reply	The selected configuration will be setup, and no message will be replied
Command Result	The unit will output $GPGLL sentence on UTC second via the UART at 115200 bps baud-rate
Periodic NMEA Reply	$GPGLL,4916.45,N,12311.12,W,225444,A*31*<CR><LF>* Where Latitude = 49° 16.45' North Longitude = 123° 11.12' West UTC Time = 22:54:44 Status Flag = Active

Example 2 – Disable $GPGLL

Command	$PSTMNMEACONFIG,115200,4194398,0*<CR><LF>*
Command Remark	Set the UART baud-rate to 115200 bps and to transmit on UTC second.
Command Reply	The selected configuration will be setup, and no message will be replied
Command Result	The unit will output $GPGGA,$GPGSA,$GPGSV,$GPVTG,$GPRMC,$GPZDA except $GPGLL sentences on UTC second via the UART at 115200 bps baud-rate
Periodic NMEA Reply	Only the following NMEA sentences are output $GPGGA $GPGSA $GPGSV $GPVTG $GPRMC $GPZDA

NMEA	ID	Output
GGA	1	Disabled
GGA5	2	Enabled
GSA	4	Enabled
GSV	8	Enabled
VTG	16	Enabled
RMC	64	Enabled
GLL	1048576	Disabled
ZDA	4194304	Enabled

3.1.3 $GPGSA – GPS DOP and active satellites

This sentence provides details on the nature of the fix. It includes the numbers of the satellites being used in the current solution and the DOP. DOP (dilution of precision) is an indication of the effect of satellite geometry on the accuracy of the fix. It is a “unitless” number where smaller is better. For 3D fixes using 4 satellites a 1.0 would be considered to be a perfect number, however for over-determined solutions it is possible to see numbers below 1.0.

There are differences in the way the PRN's are presented which can affect the ability of some programs to display this data. For example, in the example shown below there are 5 satellites in the solution and the null fields are scattered indicating that the almanac would show satellites in the null positions that are not being used as part of this solution. Other receivers might output all of the satellites used at the beginning of the sentence with the null field all stacked up at the end. Due to this difference, some satellite display programs are not always being able to display the satellites being tracked. Some units may show all satellites that have ephemeris data without regard to their use as part of the solution but this is non-standard.

Command	$PSTMNMEACONFIG,115200,4,0*CR**LF*
Command Remark	Set the UART baud-rate to 115200 bps for the NMEA $GPGSA sentences, and to transmit on UTC second
Query	None
Response	$GPGSA ,<Satellite Acquisition Mode> ,<Fix Status> ,<PRN ID$_1$>,<PRN ID$_2$>,…,<PRN ID$_{12}$> ,<PDOP> ,<VDOP> *<CR><LF>*
Parameters	
$GPGSA	GPS DOP and active satellites
,<Satellite Acquisition Mode>	Display the Satellite Acquisition Mode Format : ,<%c> Where <%c> represents ‘M’ = Manual, forced to operate in 2D or 3D ‘A’ = Automatic, can operate in both modes
,<Fix Status>	Display the type of fix Format : ,<%d> Where <%d> represents 1 = Fix is not available 2 = 2D fix 3 = 3D fix
,<PRN ID>$_1$,<PRN ID>$_2$,…,<PRN ID>$_{12}$	PRN’s of Satellite Vehicles (SV’s) used in position fix (Null for unused fields) Format : ,<%d>$_1$,<%d>$_2$,…,<%d>$_{12}$
,<PDOP>	Horizontal Dilution of Precision Format : , <%f> Where <%f> is greater than 0

<table>
<tr>
<td></td>
<td>
<table>
<tr><th>DOP Value</th><th>Rating</th><th>Description</th></tr>
<tr><td>0</td><td>Ideal</td><td>This is the highest possible confidence level to be used for applications demanding the highest possible precision at all times</td></tr>
<tr><td>1-3</td><td>Excellent</td><td>At this confidence level, positional measurements are considered accurate enough to meet all but the most sensitive applications</td></tr>
<tr><td>4-6</td><td>Good</td><td>Represents a level that marks the minimum appropriate for making business decisions. Positional measurements could be used to make reliable in-route navigation suggestions to the user</td></tr>
<tr><td>7-8</td><td>Moderate</td><td>Positional measurements could be used for calculations, but the fix quality could still be improved. A more open view of the sky is recommended</td></tr>
<tr><td>9-20</td><td>Fair</td><td>Represents a low confidence level. Positional measurements should be discarded or used only to indicate a very rough estimate of the current location</td></tr>
<tr><td>21-50</td><td>Poor</td><td>At this level, measurements are inaccurate by as much as 300 metres with a 6 meter accurate device (50 dop * 6 meters) and should be discarded</td></tr>
</table>
</td>
</tr>
<tr>
<td>,<VDOP></td>
<td>Vertical Dilution of Precision
Format : , <%f>
Where
<%f> is greater than 0
<table>
<tr><th>DOP Value</th><th>Rating</th><th>Description</th></tr>
<tr><td>0</td><td>Ideal</td><td>This is the highest possible confidence level to be used for applications demanding the highest possible precision at all times</td></tr>
<tr><td>1-3</td><td>Excellent</td><td>At this confidence level, positional measurements are considered accurate enough to meet all but the most sensitive applications</td></tr>
<tr><td>4-6</td><td>Good</td><td>Represents a level that marks the minimum appropriate for making business decisions. Positional measurements could be used to make reliable in-route navigation suggestions to the user</td></tr>
<tr><td>7-8</td><td>Moderate</td><td>Positional measurements could be used for calculations, but the fix quality could still be improved. A more open view of the sky is recommended</td></tr>
<tr><td>9-20</td><td>Fair</td><td>Represents a low confidence level. Positional measurements should be discarded or used only to indicate a very rough estimate of the current location</td></tr>
<tr><td>21-50</td><td>Poor</td><td>At this level, measurements are inaccurate by as much as 300 metres with a 6 meter accurate device (50 dop * 6 meters) and should be discarded</td></tr>
</table>
</td>
</tr>
</table>

<CR><LF>	Sentence Terminator

Example 1 – Enable $GPGSA

Command	$PSTMNMEACONFIG,115200,4,0<CR><LF>
Command Remark	Set the UART baud-rate to 115200 bps for the NMEA $GPGSA sentences, and to transmit on UTC second
Command Reply	The selected configuration will be setup, and no message will be replied
Command Result	The unit will output $GPGSA sentence on UTC second via the UART at 115200 bps baud-rate
Periodic NMEA Reply	$GPGSA,A,3,04,05,,09,12,,,24,,,,,2.5,1.3,2.1*39<CR><LF> Where Satellite Acquisition Mode = Auto PRN IDs = 3,4,5,9,12,24 PDOP = 2.5 HDOP = 1.3 VDOP = 2.1

Example 2 – Disable $GPGSA

Command	$PSTMNMEACONFIG,115200,5242970,0<CR><LF>
Command Remark	Set the UART baud-rate to 115200 bps and to transmit on UTC second.
Command Reply	The selected configuration will be setup, and no message will be replied
Command Result	The unit will output $GPGGA,$GPGSV,$GPVTG,$GPRMC,$GPGLL,$GPZDA except $GPGSA sentences on UTC second via the UART at 115200 bps baud-rate
Periodic NMEA Reply	Only the following NMEA sentences are output $GPGGA $GPGSV $GPVTG $GPRMC $GPGLL $GPZDA

NMEA	ID	Output
GGA	1	Disabled
GGA5	2	Enabled
GSA	4	Disabled
GSV	8	Enabled
VTG	16	Enabled
RMC	64	Enabled
GLL	1048576	Enabled
ZDA	4194304	Enabled

3.1.4 $GPGSV – Satellites in view

Satellites in View shows data about the satellites that the unit might be able to find based on its viewing mask and almanac data. It also shows current ability to track this data. Note that one GSV sentence only can provide data for up to 4 satellites and thus there may need to be 3 sentences for the full information. It is reasonable for the GSV sentence to contain more satellites than GGA might indicate since GSV may include satellites that are not used as part of the solution. It is not a requirement that the GSV sentences all appear in sequence. To avoid

overloading the data bandwidth some receivers may place the various sentences in totally different samples since each sentence identifies which one it is.

The field called SNR (Signal to Noise Ratio) in the NMEA standard is often referred to as signal strength. SNR is an indirect but more useful value that raw signal strength. It can range from 0 to 99 and has units of dB according to the NMEA standard, but the various manufacturers send different ranges of numbers with different starting numbers so the values themselves cannot necessarily be used to evaluate different units. The range of working values in a given gps will usually show a difference of about 25 to 35 between the lowest and highest values, however 0 is a special case and may be shown on satellites that are in view but not being tracked.

Command	$PSTMNMEACONFIG,115200,8,0<*CR*><*LF*>
Command Remark	Set the UART baud-rate to 115200 bps for the NMEA $GPGSV sentences, and to transmit on UTC second
Query	None
Response	$GPGSV ,<Number of Sentences> ,<Sentence ID> ,<Satellite Total> ,<Satellite PRN ID> ,<Elevation> ,<Azimuth> ,<SNR> <*CR*><*LF*>
Parameters	
$GPGSV	Satellite in View
,<Number of Sentences>	Number of sentences for full data Format : ,<%d>
,<Sentence ID>	Indicates the sequence of the sentences of the full set of data Format : ,<%d>
,<Satellite Total>	Number of satellites in view Format : ,<%d>
,<Satellite PRN ID>	Satellite PRN number Format : ,<%d>
,<Elevation>	Elevation in degree Format : ,<%d> Where <%d> represents the range 0 to 90
,<Azimuth>	Azimuth in degree Format : ,<%d> Where <%d> represents the range 0 to 359
,<SNR>	Signal to Noise Ration, which is often referred as signal strength Format : ,<%d> Where <%d> can range from 0 to 99 dB
<*CR*><*LF*>	Sentence Terminator

Example 1 – Enable $GPGSV

Command	$PSTMNMEACONFIG,115200,8,0<*CR*><*LF*>
Command Remark	Set the UART baud-rate to 115200 bps for the NMEA $GPGSV sentences, and to transmit on UTC second
Command Reply	The selected configuration will be setup, and no message will be replied
Command	The unit will output $GPGSV sentence on UTC second via the UART at 115200 bps

Result	baud-rate
Periodic NMEA Reply	$GPGSV,2,1,08,01,40,083,46,02,17,308,41,12,07,344,39,14,22,228,45*75<CR><LF> Where Number of Sentences = 2 Sentence ID = 1 Satellite Total = 8 Satellite PRN ID = 01 Elevation = 40 Azimuth = 083 SNR = 45 Satellite PRN ID = 02 Elevation = 17 Azimuth = 308 SNR = 41 Satellite PRN ID = 12 Elevation = 07 Azimuth = 344 SNR = 39 Satellite PRN ID = 14 Elevation = 22 Azimuth = 228 SNR = 45

Example 2 – Disable $GPGSV

<table>
<tr><td>Command</td><td>$PSTMNMEACONFIG,115200,5242966,0<CR><LF></td></tr>
<tr><td>Command Remark</td><td>Set the UART baud-rate to 115200 bps and to transmit on UTC second.
<table>
<tr><th>NMEA</th><th>ID</th><th>Output</th></tr>
<tr><td>GGA</td><td>1</td><td>Disabled</td></tr>
<tr><td>GGA5</td><td>2</td><td>Enabled</td></tr>
<tr><td>GSA</td><td>4</td><td>Enabled</td></tr>
<tr><td>GSV</td><td>8</td><td>Disabled</td></tr>
<tr><td>VTG</td><td>16</td><td>Enabled</td></tr>
<tr><td>RMC</td><td>64</td><td>Enabled</td></tr>
<tr><td>GLL</td><td>1048576</td><td>Enabled</td></tr>
<tr><td>ZDA</td><td>4194304</td><td>Enabled</td></tr>
</table></td></tr>
<tr><td>Command Reply</td><td>The selected configuration will be setup, and no message will be replied</td></tr>
<tr><td>Command Result</td><td>The unit will output $GPGGA,$GPGSA,$GPVTG,$GPRMC,$GPGLL,$GPZDA except $GPGSV sentences on UTC second via the UART at 115200 bps baud-rate</td></tr>
<tr><td>Periodic NMEA Reply</td><td>Only the following NMEA sentences are output
$GPGGA
$GPGSA
$GPVTG
$GPRMC
$GPGLL
$GPZDA</td></tr>
</table>

3.1.5 $GPRMC – Recommended Minimum Sentence

NMEA own version of essential GPS PVT (Position, Velocity, Time) data.

Command	$PSTMNMEACONFIG,115200,64,0*CR*<*LF*>
Command Remark	Set the UART baud-rate to 115200 bps for the NMEA $GPRMC sentences, and to transmit on UTC second
Query	None
Response	$GPRMC ,<UTC Time> ,<Status Flag> ,<Lat> ,<LatRef> ,<Lon> ,<LonRef> ,<Speed> ,<Heading> ,<Date> ,<Magnetic Variation> ,<Magnetic Variation Reference> <*CR*><*LF*>
Parameters	
,<UTC Time>	Fix taken at UTC time Format : ,<%6d> Where <%6d> represents time format in hhmmss h = hours m = minutes s = seconds
,<Status Flag>	Status of this data sentence Format : ,<%c> Where <%c> represents 'A' = Active 'V' = Void
,<Lat>	Latitude Format : ,<%8f.3> Where <%8f.3> represents latitude format in ddmm.mmm d = degrees m = minutes
,<LatRef>	Direction of Latitude Format : ,<%c> Where <%c> represents 'N' for North 'S' for South
,<Lon>	Longitude with Direction Format : ,<%9f.3> Where <%9f.3> represents longitude format in dddmm.mmm d = degrees m = minutes

,<LonRef>	Direction of Longitude Format : ,<%c> Where <%c> represents 'E' = East 'W' = West
,<Speed>	Speed over the ground in knots Format : ,<%f>
,<Heading>	Track angle in degrees, 0° is North, 180° is South, Clockwise Format: ,<%f> Where <%f> range from 0° to 359.9°
,<Date>	Date of the fix Format : ,<%d> Where <%d> represents date format DDMMYY D is Date M is Month Y is Year
,<Magnetic Variation>	Magnetic Variation Format : ,<%f>
,<Magnetic Variation Reference>	Magnetic Variation Direction Format : ,<%c> Where <%c> represents 'E' = East 'W' = West
*<CS><CR><LF>	Checksum and Sentence Terminator

Example 1 – Enable $GPRMC

Command	$PSTMNMEACONFIG,115200,64,0<CR><LF>
Command Remark	Set the UART baud-rate to 115200 bps for the NMEA $GPRMC sentences, and to transmit on UTC second
Command Reply	The selected configuration will be setup, and no message will be replied
Command Result	The unit will output $GPRMC sentence on UTC second via the UART at 115200 bps baud-rate
Periodic NMEA Reply	$GPRMC,123519,A,4807.038,N,01131.000,E,022.4,084.4,230394,003.1,W *6A<CR><LF> WHERE UTC Time = 12:35:19 Status Flag = Active Latitude = 48° 7.038' Latitude Direction = North Longitude = 11° 31' Longitude Direction = East Speed = 22.4 Knots Heading = 84.4° True Date = 23 Mar 94 Magnetic Variation = 3.1 Magnetic Variation Direction = West

Example 2 – Disable $GPRMC

Command	$PSTMNMEACONFIG,115200,5242910,0<CR><LF>
Command Remark	Set the UART baud-rate to 115200 bps and to transmit on UTC second.

<table>
<tr><td></td><td>
<table>
<tr><th>NMEA</th><th>ID</th><th>Output</th></tr>
<tr><td>GGA</td><td>1</td><td>Disabled</td></tr>
<tr><td>GGA5</td><td>2</td><td>Enabled</td></tr>
<tr><td>GSA</td><td>4</td><td>Enabled</td></tr>
<tr><td>GSV</td><td>8</td><td>Enabled</td></tr>
<tr><td>VTG</td><td>16</td><td>Enabled</td></tr>
<tr><td>RMC</td><td>64</td><td>Disabled</td></tr>
<tr><td>GLL</td><td>1048576</td><td>Enabled</td></tr>
<tr><td>ZDA</td><td>4194304</td><td>Enabled</td></tr>
</table>
</td></tr>
<tr><td>Command Reply</td><td>The selected configuration will be setup, and no message will be replied</td></tr>
<tr><td>Command Result</td><td>The unit will output $GPGGA,$GPGSA,$GPGSV,$GPVTG,$GPGLL,$GPZDA except $GPRMC sentences on UTC second via the UART at 115200 bps baud-rate</td></tr>
<tr><td>Periodic NMEA Reply</td><td>Only the following NMEA sentences are output
$GPGGA
$GPGSA
$GPGSV
$GPVTG
$GPGLL
$GPZDA</td></tr>
</table>

3.1.6 $GPVTG – Track made Good and Ground Speed

Command	$PSTMNMEACONFIG,115200,16,0<CR><LF>
Command Remark	Set the UART baud-rate to 115200 bps for the NMEA $GPVTG sentences, and to transmit on UTC second
Query	None
Response	$GPVTG ,<Track1> ,<Track1 Format> ,<Track2> ,<Track2 Format> ,<Speed1> ,<Speed1 Format> ,<Speed2> ,<Speed2 Format> *<CS><CR><LF>
Parameters	
$GPVTG	Track made Good and Ground Speed
,<Track1>	Track1 made Good
,<Track1 Format>	Type of Track1
,<Track2>	Track2 made Good
,<Track2 Format>	Type of Track2
,<Speed1>	Ground Speed1
,<Speed1 Format>	Unit of Measure for Speed1
,<Speed2>	Ground Speed2
,<Speed2 Format>	Unit of Measure for Speed2
*<CS><CR><LF>	Checksum and Sentence Terminator

Example 1 – Enable $GPVTG

Command	$PSTMNMEACONFIG,115200,16,0<CR><LF>
Command Remark	Set the UART baud-rate to 115200 bps for the NMEA $GPVTG sentences, and to transmit on UTC second
Command Reply	The selected configuration will be setup, and no message will be replied
Command Result	The unit will output $GPVTG sentence on UTC second via the UART at 115200 bps baud-rate
Periodic NMEA Reply	$GPVTG,054.7,T,034.4,M,005.5,N,010.2,K*33<CR><LF> Where Track1 = 54.7° Track1 Format = True Track2 = 34.4° Track2 Format = Magnetic Speed1= 5.5 Speed1 Format = 'N' = Knots Speed2 = 10.2 Speed2 Format = 'K' = Kilometers per hour

Example 2 – Disable $GPVTG

<table>
<tr><td>Command</td><td>$PSTMNMEACONFIG,115200,5242958,0<CR><LF></td></tr>
<tr><td>Command Remark</td><td>Set the UART baud-rate to 115200 bps and to transmit on UTC second.
<table>
<tr><th>NMEA</th><th>ID</th><th>Output</th></tr>
<tr><td>GGA</td><td>1</td><td>Disabled</td></tr>
<tr><td>GGA5</td><td>2</td><td>Enabled</td></tr>
<tr><td>GSA</td><td>4</td><td>Enabled</td></tr>
<tr><td>GSV</td><td>8</td><td>Enabled</td></tr>
<tr><td>VTG</td><td>16</td><td>Disabled</td></tr>
<tr><td>RMC</td><td>64</td><td>Enabled</td></tr>
<tr><td>GLL</td><td>1048576</td><td>Enabled</td></tr>
<tr><td>ZDA</td><td>4194304</td><td>Enabled</td></tr>
</table></td></tr>
<tr><td>Command Reply</td><td>The selected configuration will be setup, and no message will be replied</td></tr>
<tr><td>Command Result</td><td>The unit will output $GPGGA,$GPGSA,$GPGSV,$GPRMC,$GPGLL,$GPZDA except $GPVTG sentences on UTC second via the UART at 115200 bps baud-rate</td></tr>
<tr><td>Periodic NMEA Reply</td><td>Only the following NMEA sentences are output
$GPGGA
$GPGSA
$GPGSV
$GPRMC
$GPGLL
$GPZDA</td></tr>
</table>

3.1.7 $GPZDA – Date and Time

Get the Date and Time from the GPS receiver

Command	$PSTMNMEACONFIG,115200,4194304,0*<CR><LF>*
Command Remark	Set the UART baud-rate to 115200 bps for the NMEA $GPZDA sentences, and to transmit on UTC second
Query	None
Response	$GPZDA ,<Time> ,<Date> ,<Month> ,<Year> ,<Local Zone Hour> ,<Local Zone Minutes> *<CS><R><LF>*
Parameters	
$PGZDA	Date and Time
,<Time>	Fix taken at UTC time Format : ,<%6d> Where <%6d> represents time format in hhmmss h = hours m = minutes s = seconds
,<Date>	Date of the fix Format : ,<%d> Where <%d> represents Date format DD D = Date from 1 to 31
,<Month>	Month of the fix Format : ,<%d> Where <%d> represents Month format MM M = Month from 1 to 12
,<Year>	Year of the fix Format : ,<%d> Where <%d> represents Year format YYYY Y = Year
,<Local Zone Hour>	Local Zone Hours Format :,<%d> Where <%d> represents the hours -13 to 13
,<Local Zone Minutes>	Local Zone Minutes Format :,<%d> Where <%d> represents the minutes 0 to 59
<CS><CR><LF>	Checksum and Sentence Terminator

Example 1 – Enable $GPZDA

NMEA Command	$PSTMNMEACONFIG,115200,4194304,0*<CR><LF>*

Command Remark	Set the UART baud-rate to 115200 bps for the NMEA $GPZDA sentences, and to transmit on UTC second
Command Reply	The selected configuration will be setup, and no message will be replied
Command Result	The unit will output $GPZDA sentence on UTC second via the UART at 115200 bps baud-rate
Periodic NMEA Reply	$GPZDA,201530.00,04,07,2002,00,00*6E<CR><LF> Where Time = 20:15:30.00 Date = 4 Month = July Year = 2002 Local Zone Hour = 0 Local Zone Minutes = 0

Example 2 – Disable $GPZDA

Command	$PSTMNMEACONFIG,115200,1048670,0<CR><LF>
Command Remark	Set the UART baud-rate to 115200 bps and to transmit on UTC second.
Command Reply	The selected configuration will be setup, and no message will be replied
Command Result	The unit will output $GPGGA,$GPGSA,$GPGSV,$GPVTG,$GPRMC,$GPGLL except $GPZDA sentences on UTC second via the UART at 115200 bps baud-rate
Periodic NMEA Reply	Only the following NMEA sentences are output $GPGGA $GPGSA $GPGSV $GPVTG $GPRMC $GPGLL

NMEA	ID	Output
GGA	1	Disabled
GGA5	2	Enabled
GSA	4	Enabled
GSV	8	Enabled
VTG	16	Enabled
RMC	64	Enabled
GLL	1048576	Enabled
ZDA	4194304	Disabled

3.2 STMicroelectronics proprietary NMEA Sentences Details

3.2.1 $PSTMEPH – Ephemeris Data and Status

This message reports for each satellite assigned to a HW receiver channel the IODE value evaluated from the received ephemeris. This receiver requires 2 sentences to complete for its 12 channels of information.

Command	$PSTMNMEACONFIG,115200,2097152,0*<CR><LF>*
Command Remark	Set the UART baud-rate to 115200 bps for the NMEA $PSTMEPH sentences, and to transmit on UTC second
Query	None
Response	$PSTMEPH ,<Number of Sentences> ,<Sentence ID> ,<Time> ,<SatID>$_1$,<Lode>$_1$ … ,<SatID>$_n$,<Iode>$_n$ *<CS><CR><LF>*
Parameters	
$PSTMEPH	Ephemeris Data and Status
,<Number of Sentences>	Number of sentences for full data Format : ,<%d>
,<Sentence ID>	Indicates the sequence of the sentences of the full set of data Format : ,<%d>
,<Time>	Time Format : ,<%10.4f> Where <%10.4f> represent time format hhmmss.sss h = hour m = minute s = second
,<SatID>$_x$	Satellite ID Format : , <%d>
,<Iode>$_x$	Iode from ephemeris Format : ,<%d>
<CS><CR><LF>	Checksum and Sentence Terminator

Example – Enable $PSTMEPH

NMEA Command	$PSTMNMEACONFIG,115200,2097152,0<CR><LF>
Command Remark	Set the UART baud-rate to 115200 bps for the NMEA $PSTMEPH sentences, and to transmit on UTC second
Command Reply	The selected configuration will be setup, and no message will be replied
Command Result	The unit will output $PSTMEPH sentence on UTC second via the UART at 115200 bps baud-rate
Periodic NMEA Reply	$PSTMEPH,2,1,174446.000,19,085,32,N/A,03,062,14,076,01,031,11,060 *60<CR><LF> Where Number of Sentences = 2 Sentence ID = 1 Time = 17:44:46.000 $SatID_1$ = 19 $Iode_1$ = 85 $SatID_2$ = 32 $Iode_2$ = Not Available $SatID_3$ = 3 $Iode_3$ = 62 $SatID_4$ = 14 $Iode_4$ = 76 $SatID_5$ = 1 $Iode_5$ = 31 $SatID_1$ = 11 $Iode_1$ = 60

3.2.2 $PSTMPRES – Position Residual Information

This message contains information about position residual evaluated in the positioning algorithm for each channel (satellite) used for the fix. If a channel is not used an empty space or a simple comma is reported.

Command	$PSTMNMEACONFIG,115200,4096,0<CR><LF>
Command Remark	Set the UART baud-rate to 115200 bps for the NMEA $PSTMPRES sentences, and to transmit on UTC second
Query	None
Response	$PSTMPRES ,<RMS Position Residual> ,<Residual of Channel 1> ,<Residual of Channel 2> ,<Residual of Channel 3> ,<Residual of Channel 4> ,<Residual of Channel 5> ,<Residual of Channel 6> ,<Residual of Channel 7> ,<Residual of Channel 8> ,<Residual of Channel 9> ,<Residual of Channel 10> ,<Residual of Channel 11> ,<Residual of Channel 12> *<CS><CR><LF>
Parameters	
$PSTMPRES	Position Residual Information
,<RMS Position Residual>	RMS Position Residual for the fix Format : ,<%f>
,<Residual of Channel x>	Residual from channel x Format : ,<%f>
*<CS><CR><LF>	Checksum and Sentence Terminator

Example – Enable $PSTMPRES

NMEA Command	$PSTMNMEACONFIG,115200,4096,0<*CR*><*LF*>
Command Remark	Set the UART baud-rate to 115200 bps for the NMEA $PSTMPRES sentences, and to transmit on UTC second
Command Reply	The selected configuration will be setup, and no message will be replied
Command Result	The unit will output $PSTMPRES sentence on UTC second via the UART at 115200 bps baud-rate
Periodic NMEA Reply	$PSTMPRES,8.1,-0.2,-0.2,-0.1,-0.3,-2.0,-0.4,,,,,,,*2D<*CR*><*LF*> Where RMS Position Residual = 8.1 Residual from Channel 1 = -0.2 Residual from Channel 2 = -0.2 Residual from Channel 3 = -0.1 Residual from Channel 4 = -0.3 Residual from Channel 5 = -0.2 Residual from Channel 6 = -0.4 Residual from Channel 7 = Not Available Residual from Channel 8 = Not Available Residual from Channel 9 = Not Available Residual from Channel 10 = Not Available Residual from Channel 11 = Not Available Residual from Channel 12 = Not Available

3.2.3 $PSTMVRES – Velocity Residual

This message contains information about velocity residual evaluated in the positioning algorithm for each channel (satellite) used for the fix. If a channel is not used an empty space or a simple comma is reported.

Command	$PSTMNMEACONFIG,115200,4096,0*<CR><LF>*
Command Remark	Set the UART baud-rate to 115200 bps for the NMEA $PSTMVRES sentences, and to transmit on UTC second
Query	None
Response	$PSTMVRES ,<RMS Velocity Residual> ,<Residual of Channel 1> ,<Residual of Channel 2> ,<Residual of Channel 3> ,<Residual of Channel 4> ,<Residual of Channel 5> ,<Residual of Channel 6> ,<Residual of Channel 7> ,<Residual of Channel 8> ,<Residual of Channel 9> ,<Residual of Channel 10> ,<Residual of Channel 11> ,<Residual of Channel 12> *<CS><CR><LF>*
Parameters	
$PSTMVRES	Velocity Residual Information
,<RMS Position Residual>	RMS Velocity Residual for the fix Format : ,<%f>
,<Residual of Channel x>	Residual from channel x Format : ,<%f>
<CS><CR><LF>	Checksum and Sentence Terminator

Example – Enable $PSTMVRES

NMEA Command	$PSTMNMEACONFIG,115200,4096,0<CR><LF>
Command Remark	Set the UART baud-rate to 115200 bps for the NMEA $PSTMVRES sentences, and to transmit on UTC second
Command Reply	The selected configuration will be setup, and no message will be replied
Command Result	The unit will output $PSTMVRES sentence on UTC second via the UART at 115200 bps baud-rate
Periodic NMEA Reply	$PSTMVRES,0.0,-0.0,-0.0,-0.0,-0.0,-0.0,-0.0,,,,,,,*26<CR><LF> Where RMS Position Residual = 0.0 Residual from Channel 1 = -0.0 Residual from Channel 2 = -0.0 Residual from Channel 3 = -0.0 Residual from Channel 4 = -0.0 Residual from Channel 5 = -0.0 Residual from Channel 6 = -0.0 Residual from Channel 7 = Not Available Residual from Channel 8 = Not Available Residual from Channel 9 = Not Available Residual from Channel 10 = Not Available Residual from Channel 11 = Not Available Residual from Channel 12 = Not Available

3.2.4 $PSTMTG – Time of Fix and Global Parameters

This message contains information on the time of fix and other global (non satellite specific) parameters for a fix

Command	$PSTMNMEACONFIG,115200,256,0*<CR><LF>*
Command Remark	Set the UART baud-rate to 115200 bps for the NMEA $PSTMTG sentences, and to transmit on UTC second
Query	None
Response	$PSTMTG ,<Week Number> ,<TOW> ,<Satellites> ,<CPU Time> *<CS><CR><LF>*
Parameters	
$PSTMTG	Velocity Residual Information
,<Week Number>	Week Number since August 22, 1999 Format : ,<%d>
,<TOW>	The **TOW** represents the number of seconds into the week ranging from [0 . . . 604800] seconds and is counted from midnight Saturday/Sunday on the GPS time Format : ,<11.4f> Where <%11.4f> represents the range from 0 to 604799.9999
,<Satellites>	Number of satellites used for fix Format : , <%d>
,<CPU Time>	CPU Time used Format : , <%d>
<CS><CR><LF>	Checksum and Sentence Terminator

Example – Enable $PSTMTG

NMEA Command	$PSTMNMEACONFIG,115200,256,0*<CR><LF>*
Command Remark	Set the UART baud-rate to 115200 bps for the NMEA $PSTMTG sentences, and to transmit on UTC second
Command Reply	The selected configuration will be setup, and no message will be replied
Command Result	The unit will output $PSTMTG sentence on UTC second via the UART at 115200 bps baud-rate
Periodic NMEA Reply	$PSTMTG,1454,582300.9992,6,404636125 *<CR><LF>* Where Week Number = 1454 TOW = 582300.9992 Satellites = 6 CPU Time = 404636125

3.2.5 $PSTMTS – Satellite Parameters

This message contains information on satellite related parameters for a fix, such as satellite position, velocity, and pseudo-range

Command	$PSTMNMEACONFIG,115200,512,0<CR><LF>
Command Remark	Set the UART baud-rate to 115200 bps for the NMEA $PSTMTS sentences, and to transmit on UTC second
Query	None
Response	$PSTMTS ,<DSP Available> ,<SatID> ,<PseudoRange> ,<Freq> ,<Preamble Locked Flag> ,<CNO> ,<Tracked Time> ,<Sat Data Available> ,<Sat Position X> ,<Sat Position Y> ,<Sat Position Z> ,<Sat Velocity X> ,<Sat Velocity Y> ,<Sat Velocity Z> ,<Sat Range Correction> ,<Atmospheric Correction> ,<Diff Available> ,<Diff Range Correction> ,<Diff Range Rate Correction> <CR><LF>
Parameters	
$PSTMTS	Satellite Parameters
,<DSP Available>	DSP Availability Flag Format <%d> Where <%d> = 0 for No DSP Availability <%d> = 1 for DSP Availability
,<SatID>	Satellite ID Format <%d>
,<PseudoRange>	Pseudo Range Format <%f>
,<Freq>	Frequency Format <%f>
,<Preamble Locked Flag>	Preamble Locked Flag Format <%d> Where <%d> = 0 for Preamble Unlocked <%d> = 1 for Preamble Locked
,<CNO>	Estimated CNO in dB Format : ,<%d>
,<Tracked Time>	Tracked Time Format : ,<%d>
,<Sat Data Available>	Satellite Data Available Flag

	Format <%d> Where <%d> = 0 for Satellite Data Unavailable <%d> = 1 for Satellite Data Available
,<Sat Position X>	Satellite Position X Axis Format : ,<%f>
,<Sat Position Y>	Satellite Position Y Axis Format : ,<%f>
,<Sat Position Z>	Satellite Position Z Axis Format : ,<%f>
,<Sat Velocity X>	Satellite Velocity X Axis Format : ,<%f>
,<Sat Velocity Y>	Satellite Velocity Y Axis Format : ,<%f>
,<Sat Velocity Z>	Satellite Velocity Z Axis Format : ,<%f>
,<Sat Range Correction>	Satellite Range Correction Format : ,<%f>
,<Atmospheric Correction>	Atmospheric Correction Format : ,<%f>
,<Diff Available>	Differential Data Available Flag Format : ,<%d> Where <%d> = 0 for Differential Data Unavailable <%d> = 1 for Differential Data Available
,<Diff Range Correction>	Differential Range Correction Format : ,<%f>
,<Diff Range Rate Correction>	Differential Range Rate Correction Format : ,<%f>
<CR><LF>	Sentence Terminator

Example – Enable $PSTMTS

NMEA Command	$PSTMNMEACONFIG,115200,512,0<CR><LF>
Command Remark	Set the UART baud-rate to 115200 bps for the NMEA $PSTMTS sentences, and to transmit on UTC second
Command Reply	The selected configuration will be setup, and no message will be replied
Command Result	The unit will output $PSTMTS sentence on UTC second via the UART at 115200 bps baud-rate
Periodic NMEA Reply	$PSTMTS,1,19,86283939.12,-26781.88,1,47,460014,1,22706394.03,4757895.55 ,13155108.45,1218.90,1136.00,-2515.94,2610.67,4.27,0,0.00,0.00<CR><LF> Where DSP Available = 1 SatID = 19 PseudoRange = 86283939.12 Freq = -26781.88 Preamble Locked Flag = 1 CNO = 47 Tracked Time = 460014 Sat Data Available = 1 Sat Position X = 22706394.03 Sat Position Y = 4757895.55 Sat Position Z = 13155108.4 Sat Velocity X = 1218.90 Sat Velocity Y = 1136.00 Sat Velocity Z = -2515.94 Sat Range Correction = 2610.67 Atmospheric Correction = 4.27 Diff Available = 0 Diff Range Correction = 0.00 Diff Range Rate Correction = 0.00

3.2.6 $PSTMPA – Positioning Algorithm

This message contains information from the positioning algorithm

Command	$PSTMNMEACONFIG,115200,1024,0<CR><LF>
Command Remark	Set the UART baud-rate to 115200 bps for the NMEA $PSTMPA sentences, and to transmit on UTC second
Query	None
Response	$PSTMPA ,<Algorithm Type> ,<Stopped Duration> <CR><LF>
Parameters	
$PSTMPA	Positioning Algorithm
,<Algorithm Type>	Indicates the type of position algorithm Format : ,<%2c> Where <%2c> = <NULL> for None <%2c> = LS for LMS <%2c> = KF For Kalman Filter
,<Stopped Duration>	Counter Stopped Duration Format : ,<%d>
<CR><LF>	Sentence Terminator

Example – Enable $PSTMPA

NMEA Command	$PSTMNMEACONFIG,115200,1024,0<CR><LF>
Command Remark	Set the UART baud-rate to 115200 bps for the NMEA $PSTMPA sentences, and to transmit on UTC second
Command Reply	The selected configuration will be setup, and no message will be replied
Command Result	The unit will output $PSTMPA sentence on UTC second via the UART at 115200 bps baud-rate
Periodic NMEA Reply	$PSTMPA,KF,433 <CR><LF> Where Algorithm Type = Kalman Filter Counter Stopped Duration = 433

3.2.7 $PSTMSBAS – SBAS Information

Transmits WAAS/SBAS information about the status, the azimuth, the elevation and the power of SBAS satellite tracked.

Command	$PSTMNMEACONFIG,115200,16384,0*<CR><LF>*
Command Remark	Set the UART baud-rate to 115200 bps for the NMEA $PSTMSBAS sentences, and to transmit on UTC second
Query	None
Response	$PSTMSBAS ,<WAAS/SBAS Status> ,<Satellite ID> ,<Satellite Elevation> ,<Satellite Azimuth> ,<Signal Strength> *<CS><CR><LF>*
Parameters	
$PSTMSBAS	Positioning Algorithm
,<WAAS/SBAS Status>	WAAS/SBAS Status Format : ,<%d> Where <%d> = 0 for No WAAS/SBAS Status <%d> = 1 for WAAS/SBAS Status
,<Satellite ID>	WAAS Satellite ID (PRN) Format : ,<%d>
,<Satellite Elevation>	WAAS Satellite Elevation Format : ,<%d>
,<Satellite Azimuth>	WAAS Satellite Azimuth Format : ,<%d>
,<Signal Strength>	WAAS Satellite Signal Strength Format : ,<%d>
<CS><CR><LF>	Checksum and Sentence Terminator

Example – Enable $PSTMSBAS

NMEA Command	$PSTMNMEACONFIG,115200,16384,0*<CR><LF>*
Command Remark	Set the UART baud-rate to 115200 bps for the NMEA $PSTMSBAS sentences, and to transmit on UTC second
Command Reply	The selected configuration will be setup, and no message will be replied
Command Result	The unit will output $PSTMSBAS sentence on UTC second via the UART at 115200 bps baud-rate
Periodic NMEA Reply	$PSTMSBAS,1,124,46,170,00*07<CR><LF> Where WAAS/SBAS Status = 1 Satellite ID = 124 Satellite Elevation = 46 Satellite Azimuth = 170 Signal Strength = 0

3.3 STMicroelectronics proprietary NMEA Commands Details

3.3.1 **$**PSTMINITGPS – Initialize GPS Position and Time

This command initializes the receiver with known position and time

Command	$PSTMINITGPS ,<Lat> ,<LatRef> ,<Lon> ,<LonRef> ,<Alt> ,<Day> ,<Month> ,<Year> ,<Hour> ,<Minute> ,<Second> *<CR><LF>*
Command Remark	Initialize the receiver with known position and time
Query	Not Applicable
Response	None
Parameters	
$PSTMINITGPS	Initialize GPS Position and Time
,<Lat>	Latitude Format : ,<%8f.3> Where <%8f.3> represents latitude format in ddmm.mmm d = degrees m = minutes
,<LatRef>	Direction of Latitude Format : ,<%c> Where <%c> represents 'N' for North 'S' for South
,<Lon>	Longitude with Direction Format : ,<%9f.3> Where <%9f.3> represents longitude format in dddmm.mmm d = degrees m = minutes
,<LonRef>	Direction of Longitude Format : ,<%c> Where <%c> represents 'E' = East 'W' = West
,<Alt>	Altitude in meters Format : ,<%4d> Where <%4D> represents the range 0000 to 9999

,<Day>	Day of the month Format : ,<%2d> Where <%2D> represents the range 01 to 31
,<Month>	Day of the month Format : ,<%2d> Where <%2D> represents the range 01 to 31
,<Year>	Year Format : ,<%4d> Where <%4D> represents the range 1996 to 9999
,<Hour>	Hour of the day Format : ,<%2d> Where <%2D> represents the range 00 to 23
,<Minute>	Minute of the hour Format : ,<%2d> Where <%2D> represents the range 00 to 59
,<Second>	Second of the minute Format : ,<%2d> Where <%2D> represents the range 00 to 59
<CR><LF>	Sentence Terminator

Example – Initialize GPS Position and Time

Command	$PSTMINITGPS,3400.001,N,11800.000,W,0037,01,06,2005,09,34,42<CR><LF>
Command Remark	Initialize the receiver with Latitude = 34° 0.001' North Longitude = 118° 0.000' West Altitude = 37 meters Date = 1 June 2005 Time = 09:34:42
Command Reply	None
Command Result	The receiver will be initialized with known latitude, longitude and time

3.3.2 $PSTMCLREPHS – Clear All Ephemeris Data

This command erases all the ephemeris stored in the non-volatile backup memory

Command	$PSTMCLREPHS<*CR*><*LF*>
Command Remark	Clear the ephemeris data in the non-volatile backup memory
Query	Not Applicable
Response	None
Parameters	
$PSTMCLREPHS	Clear All Ephemeris Data
<*CR*><*LF*>	Sentence Terminator

Example – Clear Ephemeris Data

Command	$PSTMCLREPHS<*CR*><*LF*>
Command Remark	Clear ephemeris data
Command Reply	None
Command Result	The ephemeris data in the non-volatile backup memory will be erased

3.3.3 $PSTMDUMPEPHEMS – Dump Ephemeris Data

This command dump the ephemeris data stored in the non-volatile backup memory

Command	$PSTMDUMPEPHEMS*<CR><LF>*
Command Remark	Dump the ephemeris data in the non-volatile backup memory
Query	Not Applicable
Response	$PSTMEPHEM,<sat_id>,<N>,<byte1>,…..,<byteN>**<CS><CR><LF>* Where <sat_id> = Satellite Number <N> = Ephemeris data Length in byte
Parameters	
$PSTMDUMPEPHEMS	Dump All Ephemeris Data
**<CS><CR><LF>*	Checksum and Sentence Terminator

Example – Dump Ephemeris Data

Command	$PSTMDUMPEPHEMS*<CR><LF>*
Command Remark	Dump ephemeris data
Command Reply	$PSTMEPHEM,2,64 ,2d05d449d449010101000000e0aaff0000000000000000000000000000000000006696ff2600d0d80400e10ca1e9bf1de6127832160090034700004000e178fe07 **02<CR><LF>*
Command Result	The ephemeris data in the non-volatile backup memory will be output

3.3.4 $PSTMEPHEM – Load Ephemeris Data

This command allows user to load the ephemeris data into the receiver's non-volatile backup memory

Command	$PSTMEPHEM ,<sat_id> ,<N> ,<byte1>,…..,<byteN> *<CS><CR><LF>
Command Remark	Store ephemeris data in the non-volatile backup memory
Query	Not Applicable
Response	None
Parameters	
$PSTMEPHEM	Store Ephemeris Data
,<sat_id>	Satellite Number Format : ,<%d>
,<N>	The length of the ephemeris data in bytes Format : ,<%d>
,<byte1>,…..,<byteN>	Ephemeris data Format : ,<%2x>,…,<%2x>
*<CS><CR><LF>	Checksum and Sentence Terminator

Example 1 – Store Ephemeris Data

Command	$PSTMEPHEM,3,64 ,d705da16da16444444140500dea7ff000efbfa0db11a1bfbbfff32004e360000 4202c0258ac7ac0577a50da15cb0f9a421f2e48200934522f7002e00cd16c903 *08<CR><LF>
Command Remark	Store ephemeris data
Command Reply	None
Command Result	This ephemeris data will be stored into the non-volatile backup memory

Example 2 – Invalid Command

Command	$PSTMEPHEM,3,64 ,d705da16da16444444140500dea7ff000efbfa0db11a1bfbbfff32004e360000 4202c0258ac7ac0577a50da15cb0f9a421f2e48200934522f7002e00cd16c903 *08*2A<CR><LF>
Command Remark	Store invalid ephemeris data
Command Reply	None
Command Result	This command will be ignored

3.3.5 $PSTMCLRALMS – Clear All Almanacs

This command erases all the almanacs data stored in the non-volatile backup memory

Command	$PSTMCLRALMS<*CR*><*LF*>
Command Remark	Clear the almanacs data in the non-volatile backup memory
Query	Not Applicable
Response	None
Parameters	
$PSTMCLRALMS	Clear All Almanacs Data
<*CR*><*LF*>	Sentence Terminator

Example – Clear Almanacs Data

Command	$PSTMCLREPHS<*CR*><*LF*>
Command Remark	Clear almanacs data
Command Reply	None
Command Result	The almanacs data in the non-volatile backup memory will be erased

3.3.6 $PSTMDUMPALMANAC – Dump Almanacs Data

This command dump the almanacs data stored in the non-volatile backup memory

Command	$PSTMDUMPALMANAC<*CR*><*LF*>
Command Remark	Dump the almanacs data in the non-volatile backup memory
Query	Not Applicable
Response	$PSTMALMANAC,<sat_id>,<N>,<byte1>,…..,<byteN>*<*CS*><*CR*><*LF*> Where <sat_id> = Satellite Number <N> = Almanacs data Length in byte
Parameters	
$PSTMDUMPALMANAC	Dump All Almanacs Data
*<*CS*><*CR*><*LF*>	Checksum and Sentence Terminator

Example – Dump Almanacs Data

Command	$PSTMDUMPALMANAC<*CR*><*LF*>
Command Remark	Dump almanacs data
Command Reply	$PSTMALMANAC,1,32 ,012d05834b31df195afd0020b30ca120c29c6c400140bc00d11c130090018041 *16<*CR*><*LF*>
Command Result	The almanacs data in the non-volatile backup memory will be output

3.3.7 $PSTMALMANAC – Load Almanacs Data

This command allows user to load the almanacs data into the receiver's non-volatile backup memory

Command	$PSTMALMANAC ,<sat_id> ,<N> ,<byte1>,…..,<byteN> *<CS><CR><LF>
Command Remark	Store almanacs data in the non-volatile backup memory
Query	Not Applicable
Response	None
Parameters	
$PSTMALMANAC	Store almanacs Data
,<sat_id>	Satellite Number Format : ,<%d>
,<N>	The length of the ephemeris data in bytes Format : ,<%d>
,<byte1>,…..,<byteN>	Ephemeris data Format : ,<%2x>,…,<%2x>
*<CS><CR><LF>	Checksum and Sentence Terminator

Example 1 – Store Almanacs Data

Command	$PSTMALMANAC,1,32 ,012d05834b31df195afd0020b30ca120c29c6c400140bc00d11c130090018041 *16<CR><LF>
Command Remark	Store almanacs data
Command Reply	None
Command Result	This almanacs data will be stored into the non-volatile backup memory

Example 2 – Invalid Command

Command	$PSTMALMANAC,1,32 ,012d05834b31df195afd0020b30ca120c29c6c400140bc00d11c130090018041 *16*3B<CR><LF>
Command Remark	Store invalid almanacs data
Command Reply	None
Command Result	This command will be ignored

3.3.8 $PSTMCOLD – Perform Cold Start

Instruct the receiver to clear ephemeris, positional and satellites in view information, and then perform a reboot

Command	$PSTMCOLD<*CR*><*LF*>
Command Remark	Erase ephemeris, positional and satellites information and reboot
Query	Not Applicable
Response	None
Parameters	
$PSTMCOLD	Perform cold start
<*CR*><*LF*>	Sentence Terminator

Remark

UTC Time and GPS Time and Week are retained in the non-volatile backup memory

Example – Perform a Cold Start

Command	$PSTMCOLD<*CR*><*LF*>
Command Remark	Perform a cold start
Command Reply	None
Command Result	The receiver will erase ephemeris, positional and satellites information and then perform a reboot

3.3.9 $PSTMWARM – Perform Warm Start

Instruct the receiver to clear ephemeris information, and then perform a reboot

Command	$PSTMWARM<*CR*><*LF*>
Command Remark	Erase ephemeris information and reboot
Query	Not Applicable
Response	None
Parameters	
$PSTMCOLD	Perform warm start
<*CR*><*LF*>	Sentence Terminator

Remark

Positional and Satellites information, UTC Time and GPS Time and Week are retained in the non-volatile backup memory

Example – Perform a Warm Start

Command	$PSTMWARM<*CR*><*LF*>
Command Remark	Perform a warm start
Command Reply	None
Command Result	The receiver will erase ephemeris information and then perform a reboot

3.3.10 $PSTMHOT – Perform Hot Start

Instruct the receiver to perform a reboot

Command	$PSTMHOT<*CR*><*LF*>
Command Remark	Reboot the receiver without erasing any information
Query	Not Applicable
Response	None
Parameters	
$PSTMCOLD	Perform hot start
<*CR*><*LF*>	Sentence Terminator

Remark

All ephemeris, positional and satellites information, UTC Time and GPS Time and Week are retained in the non-volatile backup memory

This command is equivalent to performing a Soft Reset $PSTMSRR

Example – Perform a Hot Start

Command	$PSTMHOT<*CR*><*LF*>
Command Remark	Perform a cold start
Command Reply	None
Command Result	The receiver will perform a reboot without erasing any information

3.3.11 $PSTMNMEAONOFF – Toggle NMEA output

This command enable or disable the NMEA sentences output

Command	$PSTMNMEAONOFF *<CR><LF>*
Command Remark	Enable or Disable the NMEA sentences output
Query	Not Applicable
Response	None
Parameters	
$PSTMNMEAONOFF	Enable or Disable the NMEA sentences output
<CR><LF>	Sentence Terminator

Remark

If the NMEA sentences output is enabled, issuing this command will disable the output

If the NMEA sentences output is disabled, issuing this command will enable the output

Example – Toggle NMEA output

Command	$PSTMNMEAONOFF*<CR><LF>*
Command Remark	Assuming that the receiver's NMEA sentences output is enabled, issuing this command will disable the output
Command Reply	None
Command Result	No NMEA sentences is output

3.3.12 $PSTMRMC – Toggle RMC Message

Use this command to enable or disable the RMC message in the NMEA sentences list

Command	$PSTMRMC<*CR*><*LF*>
Command Remark	Enable or Disable the RMC message in the NMEA sentences output
Query	Not Applicable
Response	None
Parameters	
$PSTMRMC	Enable or Disable the RMC message in the NMEA sentences output
<*CR*><*LF*>	Sentence Terminator

Remark

If the RMC message in the NMEA sentences output is enabled, issuing this command will disable the RMC output

If the RMC message in the NMEA sentences output is disabled, issuing this command will enable the RMC output

Example – Toggle RMC Message

Command	$PSTMRMC<*CR*><*LF*>
Command Remark	Assuming that the receiver's RMC message in the NMEA sentences output is enabled, issuing this command will disable the RMC output
Command Reply	None
Command Result	No RMC sentences is output

3.3.13 $PSTMGPSRESET – Reset GPS Receiver Engine

Reset the GPS Receiver

Command	$PSTMGPSRESET *<CR><LF>*
Command Remark	Reset the GPS receiver
Query	Not Applicable
Response	None
Parameters	
$PSTMGPSRESET	Reset the GPS receiver
<CR><LF>	Sentence Terminator

Remark

Equivalent to perform $PSTMGPSSUSPEND and $SPTMGPSRESTART

Example – Reset GPS Receiver Engine

Command	$PSTMGPSRESET*<CR><LF>*
Command Remark	Reset the GPS Receiver
Command Reply	None
Command Result	The GPS receiver will be reset

3.3.14 $PSTMGPSSUSPEND – Suspend GPS Receiver

Suspend the GPS Receiver

Command	$PSTMGPSSUSPEND<*CR*><*LF*>
Command Remark	Suspend the GPS Receiver
Query	Not Applicable
Response	None
Parameters	
$PSTMGPSSUSPEND	Suspend GPS Receiver
<*CR*><*LF*>	Sentence Terminator

Remark

To resume, send $PSTMGPRSRESTART

Example – Suspend GPS Receiver

Command	$PSTMGPSSUSPEND <*CR*><*LF*>
Command Remark	Suspend the GPS Receiver
Command Reply	None
Command Result	The GPS Receiver will be put on suspend mode

3.3.15 $PSTMGPSRESTART – Restart GPS Receiver

Restart the GPS Receiver

Command	$PSTMGPSRESTART<*CR*><*LF*>
Command Remark	Restart the GPS receiver
Query	Not Applicable
Response	None
Parameters	
$PSTMGPSRESTART	Restart GPS Receiver
<*CR*><*LF*>	Sentence Terminator

Example – Restart GPS Receiver

Command	$PSTMGPSRESTART<*CR*><*LF*>
Command Remark	Restart the GPS Receiver
Command Reply	None
Command Result	The GPS Receiver will be restart

3.3.16 $PSTMSRR – Perform Software Reset

Reset GPS Receiver

Command	$PSTMSRR<*CR*><*LF*>
Command Remark	Reset the GPS Receiver
Query	Not Applicable
Response	None
Parameters	
$PSTMSRR	Perform Software Reset
<*CR*><*LF*>	Sentence Terminator

Remark

Equivalent to perform a hardware pin reset, or a Hot Start $PSTMHOT

Example – Perform Software Reset

Command	$PSTMSRR<*CR*><*LF*>
Command Remark	Reset the GPS Receiver
Command Reply	None
Command Result	The GPS Receiver will be reset

3.3.17 $PSTMITIMEINV – Invalidate the GPS Time (Need to validate STM support)

The GPS time will be invalidated

Command	$PSTMITIMEINV<*CR*><*LF*>
Command Remark	Invalidate the receiver's GPS time
Query	Not Applicable
Response	None
Parameters	
$PSTMITIMEINV	Invalidate the receiver's GPS time
<*CR*><*LF*>	Sentence Terminator

Example – Invalidate the GPS Time

Command	$PSTMITIMEINV<*CR*><*LF*>
Command Remark	Invalidate the receiver's GPS time
Command Reply	None
Command Result	The receiver's GPS time will be invalidated

3.3.18 $PSTMGETSWVER - Query STM GPS Library Version

Get the version string of the GPS library embedded in the GPS receiver

Command	Not Applicable
Command Remark	Not Applicable
Query	$PSTMGETSWVER<*CR*><*LF*>
Response	$PSTMGETSWVER ,<Version String> <*CR*><*LF*>
Parameters	
$PSTMGETSWVER	Query STM GPS Library Version
,<Version String>	The GPS library version Format : ,<%s>
<*CR*><*LF*>	Sentence Terminator

Example – Query STM GPS Library Version

Query	$PSTMGETSWVER<*CR*><*LF*>
Query Remark	Query the Version of the STM GPS Library
Query Reply	$PSTMVER,GPSLIB_5.4.3.0 ARM - Jun 13 2008 11:38:47<*CR*><*LF*> Where Version String = GPSLIB_5.4.3.0 ARM - Jun 13 2008 11:38:47
Query Result	The STM GPS Library Version is output as a NMEA sentence

3.3.19 $PSTMNMEACONFIG – Configure NMEA

Configure the receiver baud rate, NMEA sentences list and transmission mode

<table>
<tr><td>Command</td><td>$PSTMNMEACONFIG
,<BaudRate>
,<MsgList>
,<TransmitMode>
<CR><LF></td></tr>
<tr><td>Command Remark</td><td>Set the UART baud rate, configure the NMEA sentences output list and specify the Transmission Mode</td></tr>
<tr><td>Query</td><td>Not Applicable</td></tr>
<tr><td>Response</td><td>None</td></tr>
<tr><td>Parameters</td><td></td></tr>
<tr><td>$PSTMNMEACONFIG</td><td>Configure NMEA</td></tr>
<tr><td>,<BaudRate></td><td>UART baud-rate
Format : ,<%7d>
Where
<%7d> = 4800 for 4.8 kbps
<%7d> = 9600 for 9.6 kbps
<%7d> = 19200 for 19.2 kbps
<%7d> = 38400 for 38.4 kbps
<%7d> = 57600 for 57.6 kbps
<%7d> = 115200 for 115.2 kbps (default)

Remark :

For serial port setting, only baud rate is configurable, other setting is default as below -
Parity bit: NONE
Stop bit: 1
Databits: 8</td></tr>
<tr><td>,<MsgList></td><td>NMEA sentences output list
Format : ,<%4d>
Where
<table>
<tr><th><MsgList></th><th>NMEA</th><th>Description</th></tr>
<tr><td>1</td><td>$GPGGA (3)</td><td>Global Positioning System Fix Data</td></tr>
<tr><td>2</td><td>$GPGGA (5)</td><td>Global Positioning System Fix Data</td></tr>
<tr><td>4</td><td>$GPGSA</td><td>GPS DOP and Active Satellites</td></tr>
<tr><td>8</td><td>$GPGSV</td><td>GPS Satellites in View</td></tr>
<tr><td>16</td><td>$GPVTG</td><td>Track Made Good and Ground Speed</td></tr>
<tr><td>64</td><td>$GPRMC</td><td>Recommended Minimum Specific GPS/Transit Data</td></tr>
<tr><td>128</td><td>$PSTMRF</td><td>tracked satellite information</td></tr>
<tr><td>256</td><td>$PSTMTG</td><td>Time of Fix and Global Parameters</td></tr>
<tr><td>512</td><td>$PSTMTS</td><td>Satellite Parameters</td></tr>
<tr><td>1024</td><td>$PSTMPA</td><td>Positioning Algorithm</td></tr>
<tr><td>2048</td><td>$PSTMSAT</td><td>Unknown Sentence</td></tr>
<tr><td>4096</td><td>$PSTMPRES And $PSTMVRES</td><td>Position Residual Information And Velocity Residual Information</td></tr>
<tr><td>8192</td><td>$PSTMTIM</td><td>Time Validity Information</td></tr>
</table>
</td></tr>
</table>

		16384	$PSTMSBAS	WAAS/SBAS information
		32768	$PSTMDIFF	Satellites in Differential Mode
		1048576	$GPGLL	Geographic Position, Latitude and Longitude
		2097152	$GPGLL	Ephemeris Data and Status
		1312072	$PSTMCORR	WAAS Correction information
		4194304	$GPZDA	Time and Date
,<TransmitMode>	Transmission Mode Format : ,<%1d> Where <%1d> = 0 to transmit on UTC second <%1d> = 1 to transmit after GPS fix			
<CR><LF>	Sentence Terminator			

Example 1 – Configure NMEA

Command	$PSTMNMEACONFIG,9600,5,1*<CR><LF>*
Command Remark	Set the UART baud-rate to 9.6 kbps Set the NMEA sentences output list to <MsgList> = 1; $GPGGA (3), <MsgList> = 4; $GPGSA Configure the transmission mode to transmit on UTC second Remark : User will need to change their PC tools to 9.6 kbps after sending this command
Command Reply	None
Command Result	The UART baud-rate will be set to 9.6 kbps and the transmission mode will be set to transmit on UTC second; the NMEA sentences output list is set to output only $GPGGA (3) and $GPGSA sentences only

Example 2 – Configure only the BAUD and Transmission Mode

Command	$PSTMNMEACONFIG,9600,0,1*<CR><LF>*
Command Remark	Set the UART baud-rate to 9.6 kbps without changing the NMEA sentences output list, and configure the transmission mode to transmit on UTC second Remark : User will need to change their PC tools to 9.6 kbps after sending this command
Command Reply	None
Command Result	The UART baud-rate will be set to 9.6 kbps and the transmission mode will be set to transmit on UTC second; the NMEA sentences output list is not affected

3.3.20 $PSTMSBASONOFF – Toggle the SBAS Feature

Suspend or Resume the SBAS feature of the receiver

Command	$PSTMSBASONOFF*<CR><LF>*
Command Remark	Toggle the SBAS function
Query	Not Applicable
Response	None
Parameters	
$PSTMSBASONOFF	
<CR><LF>	Sentence Terminator

Remark

If the SBAS function is enabled, issuing this command will suspend the function

If the SBAS function is disabled, issuing this command will resume the function

Example – Toggle SBAS Feature

Command	$PSTMSBASONOFF<*CR*><*LF*>
Command Remark	Assuming that the receiver's SBAS feature is running, issuing this command will suspend the feature
Command Reply	None
Command Result	The SBAS feature will be suspended

3.3.21 $PSTMSBASSAT – Change the SBAS Satellite PRN ID

Change the SBAS satellite PRN ID

Command	$PSTMSBASSAT,<PRN><*CR*><*LF*>
Command Remark	Change the SBAS PRN
Query	Not Applicable
Response	None
Parameters	
$PSTMSBASSAT	Change the SBAS Satellite PRN ID
,<PRN>	The SBAS Satellite PRN ID Format : ,<%d> Where <%d> = 0 for the receiver to auto search for the SBAS satellite **In WAAS system region, (USA, Canada and Mexico)** <%d> = 122 for Inmarsat 3F4 AOR-W 54.0° West http://www.lyngsat.com/tracker/inmar3f4.shtml <%d> = 134 for Inmarsat 3F3 POR 178.0° East http://www.lyngsat.com/tracker/inmar3f3.shtml **In EGNOS system region (Europe and Africa)** <%d> = 120 for Inmarsat 3F2 AOR-E 15.5° West http://www.lyngsat.com/tracker/inmar3f2.shtml <%d> = 124 for Artemis 21.5° East http://www.lyngsat.com/tracker/artemis.shtml <%d> = 126 for Inmarsat 3F5 IOR-W 25.0° East http://www.lyngsat.com/tracker/inmar3f5.shtml **In MSAS system region (Japan, Australia and Hawaii)** <%d> = 129 for MTSAT 1 <%d> = 137 for MTSAT 2
<CR><LF>	Sentence Terminator

Remarks

For a user located in US it is suggested to use the PRN satellite #122. The WAAS satellites (#122/134) broadcast the local ionospheric grid data, so if European user uses these satellites it is possible to get only satellite and tropospheric correction but not the ionospheric correction.

For a user located in Europe it is recommended from the ESA to use the EGNOS PRN satellite #124, for the time being. In fact, the signal broadcast by the EGNOS satellite (via PRN #120) is, for the time being, exclusively, used for EGNOS testing purpose (ESTB).

Additional information on EGNOS is available at ESA Website:
http://esamultimedia.esa.int/docs/egnos/estb/egnos_pro.htm

Example 1 – Set the receiver into auto SBAS Satellite Tracking

Command	$PSTMSBASSAT,0<*CR*><*LF*>
Command Remark	Get the receiver to automatically search for SBAS satellite
Command Reply	None
Command Result	The receiver will scan for SBAS satellite in the region

Example 2 – Change the SBAS Satellite PRN ID

Command	$PSTMSBASSAT,120<*CR*><*LF*>
Command Remark	Set the SBAS Satellite PRN ID to 120
Command Reply	None
Command Result	The receiver will scan for SBAS satellite PRN ID 120

Example 3 – Invalid Command

Command	$PSTMSBASSAT,333<*CR*><*LF*>
Command Remark	Set the SBAS Satellite PRN ID to 333
Command Reply	None
Command Result	The receiver will ignore this command

3.4 I-Lotus Extended STMicroelectronics proprietary NMEA Commands Details

3.4.1 $PSTMiMCD – PPS Cable Delay Correction

This parameter instructs the GPS receiver to output the 1PPS output pulse earlier in time to compensate for antenna cable delay. Up to one millisecond of equivalent cable delay can be removed. Zero cable delay is set for a zero-length antenna cable.

Command	$PSTMiMCD,<Cable Delay><*CR*><*LF*>
Command Remark	Set cable delay correction for PPS.
Query	$PSTMiMCD<*CR*><*LF*>
Response	$PSTMiMCD,<Cable Delay><*CR*><*LF*>
Parameters	
$PSTMiMCD	PPS cable delay correction
,<Cable Delay>	The cable delay correction in nanosecond: Format : ,<%d> Where <%d> represents the range 0 to 999,999 nanoseconds In <Software Version> = V1.01, <%d> will support -999,999 to 999,999
<*CR*><*LF*>	Sentence Terminator

Example – Setting the PPS Cable Delay Correction

Command	$PSTMiMCD,300000<*CR*><*LF*>
Command Remark	Correct PPS timing by 300,000 nanoseconds
Command Reply	$PSTMiMCD,300000<*CR*><*LF*>
Command Result	The PPS timing will be adjusted to 300,000 nanoseconds earlier
DEBUG Reply	None

3.4.2 $PSTMiMCj – Show Receiver Information

Display information of the unit, such as Software Version & Revision & Date, Model, Hardware Part-Number, Module Serial Number, and Manufactured Date

Command	Not Applicable
Command Remark	Not Applicable
Query	$PSTMiMCj<CR><LF>
Response	$PSTMiMCj ,<Software Version> ,<Software Revision> ,<Software Date> ,<Model ID> ,<Hardware PartNo> ,<Serial Number> ,<Manufactured Date> ,<GPS Version> <CR><LF>
Parameters	
$PSTMiMCj	Show Receiver Information
,<Software Version>	The receiver software version Format : ,<%20c>
,<Software Revision>	The receiver software revision Format : ,<%20c>
,<Software Date>	The receiver software date Format : ,<%6d> Where <%d> represents date format YYMMDD D is Date M is Month Y is Year
,<Model ID>	The receiver model number Format : ,<%20c>
,<Hardware PartNo>	The PCB part number Format : ,<%20c>
,<Serial Number>	The receiver serial number Format : ,<%20c>
,<Manufactured Date>	The date of receiver is manufactured Format : ,<%6d> Where <%d> represents date format YYMMDD D is Date M is Month Y is Year
,<GPS Version>	Available in <Software Version> = 1.1 The GPS Library Version Format : , <%s>
<CR><LF>	Sentence Terminator

Remark

This response is more than 80 characters

Example – Show Receiver Information

Query	$PSTMiMCj <CR><LF>
Query Remark	Query the receiver information
Query Reply	$PSTMiMCj,1.0,A,081116,IL-GPS-0080-UA,31-008000,NJ80X708440004J,081030 ,GPSLIB_5.4.3.0 ARM - Jun 13 2008 11:38:47<CR><LF> Where Software Version = 1.0 Software Revision = A Software Date = 081116 Model ID = IL-GPS-0080-UA Hardware PartNo = 31-008000 Serial Number = NJ80X708440004J Manufactured Date = 081030 GPS Version = GPSLIB_5.4.3.0 ARM - Jun 13 2008 11:38:47
Query Result	No configuration will be set.

3.4.3 $PSTMiMER – Auto Error Event Response

When the receiver encounters error or problem, it will self-generate this response

Command	Not Applicable
Command Remark	Not Applicable
Query	Not Applicable
Response	$PSTMiMER ,<ErrorCode> *<CR><LF>*
Parameters	
$PSTMiMER	Auto Error Event Response
,<ErrorCode>	The different error condition/s Format : ,<%d> Where <%d> = 1 is shorted antenna condition <%d> = 2 is ADC error <%d> = 4 is GPS No Fix
<CR><LF>	Sentence Terminator

Remarks

ErrorCodes can be combined and sent as a single response.

Example 1 – Shorted Antenna Event Response

Auto Response	$PSTMiMER,1*<CR><LF>*
Auto Response Remark	An shorted antenna is detected
Command Result	Not Applicable

Example 2 – Shorted Antenna and No GPS Fix Events' Response

Auto Response	$PSTMiMER,5*<CR><LF>*
Auto Response Remark	An shorted antenna is detected and there is no GPS Fix
Command Result	Not Applicable

3.4.4 $PSTMiMPM – Power Saving Mode

This command is to set the receiver into power-saving modes.

Command	$PSTMiMPM ,<Mode> <CR><LF>
Command Remark	This is to set the device into one of the several power saving modes. To wake the unit, send in any commands until the unit response.
Query	$PSTMiMPM<CR><LF>
Response	$PSTMiMPM ,<Mode> <CR><LF>
Parameters	
$PSTMiMPM	Power Saving Mode
,<Mode>	The different power saving mode of STA8058 Format : ,<%d> Where <%d> = 0 is the normal running mode <%d> = 2 is STM LP-WFI mode (Not implemented yet) <%d> = 4 is STM Stand-by mode
<CR><LF>	Sentence Terminator

Remarks

To wake unit up in Mode 1, 2 and 3, send any commands until the unit response.

For Mode 4, only the appropriate hardware pin can wake up the unit.

Example 1 – Set Power Mode to Stop

Command	$PSTMiMPM,3<CR><LF>
Command Remark	Set the receiver into Stop mode
Command Reply	$PSTMiMPM,3<CR><LF>
Command Result	The receiver will go into Stop mode. Send any command or query to wake the unit up.

Example 2 – Set Receiver to Run mode

Command	$PSTMiMPM,0<CR><LF>
Command Remark	Set the receiver into normal Run mode
Command Reply	$PSTMiMPM,0<CR><LF>
Command Result	The receiver will go into normal run mode

Example 3 – Invalid Command

Command	$PSTMiMPM,100<CR><LF>
Command Remark	Setting the mode to a non-supported value
Command Reply	$PSTMiMPM,ERROR<CR><LF>
Command Result	The unit will ignore the command

Example 4 – Query Power Mode

Query	$PSTMiMPM <CR><LF>
Query Remark	Query the mode
Query Reply	$PSTMiMPM,0<CR><LF>
Query Result	No configuration will be set.

3.4.5 $PSTMiMRR - NMEA Message Response Rate

The maximum response rate is 4 Hz; i.e. 4 NMEA sentences per second, and to as slow as once every 30 seconds. The default is 1 Hz, i.e. once every second.

Command	$PSTMiMRR ,<Response Rate> *<CR><LF>*
Command Remark	The unit will output the NMEA messages at the rate as specified by TableLookup (<Response Rate>)
Query	$PSTMiMRR*<CR><LF>*
Response	$PSTMiMRR ,<Response Rate> *<CR><LF>*
Parameters	
$PSTMiMRR	NMEA message response rate
,<Response Rate>	The response rate which RX Oncore will output the NMEA messages Format : ,<%d> Where <%d> = -3 for 1 response per 250 milliseconds (4 Hz) <%d> = -2 for 1 response per 333 milliseconds (3 Hz) <%d> = -1 for 1 response per 500 milliseconds (2 Hz) <%d> = 0 to poll the response on demand <%d> = 1 for 1 response per second (1 Hz, default) <%d> = 2 for 1 response per 2 seconds … <%d> = 30 for 1 response per 30 seconds Factory Default = 1 – 1 Hz Response Rate
<CR><LF>	Sentence Terminator

Remarks

When <Response Rate> = 0 is used, the unit will be on-demand mode, and will not repetitive send out NMEA sentences.

NMEA messages response rate less than 1Hz should be run with configuration below:

Baud rate: 115200kbps (115200)
NMEA messages list: $GPGGA, $GPRMC (65)
Transmit mode: transmit after fix (0)
DEBUG MODE: OFF

Example 1 – Set Response Rate

Command	$PSTMiMRR,-1<*CR*><*LF*>
Command Remark	Set the NMEA response rate to 2 Hz (1 response per 500 milliseconds)
Command Reply	$PSTMiMRR,-1<*CR*><*LF*>
Command Result	The unit will output NMEA sentences at a rate of once every 0.5 second

Example 2 – Poll NMEA Sentence

Command	$PSTMiMRR,0<*CR*><*LF*>
Command Remark	Poll the unit for NMEA sentences, no further NMEA sentences will be sent
Command Reply	$PSTMiMRR,0<*CR*><*LF*> NMEA sentences
Command Result	The unit will be set to no automatic NMEA sentence output

Example 3 – Invalid Command

Command	$PSTMiMRR,100<*CR*><*LF*>
Command Remark	Setting the response rate to a non-supported value
Command Reply	$PSTMiMRR,ERROR<*CR*><*LF*>
Command Result	The unit will ignore the command

Example 4 – Query Response Rate

Query	$PSTMiMRR<*CR*><*LF*>
Query Remark	Query the response rate
Query Reply	$PSTMiMRR,0<*CR*><*LF*>
Query Result	No configuration will be set.

3.4.6 $PSTMiMFT – Smart Start Algorithm

With this algorithm turned on, during cold start or warm start, the receiver will try to match its copy of almanacs and ephemeris data to the first few satellites it managed to sample. If it matches, then it will revert to a hot start.

Command	$PSTMiMFT,<Flag><*CR*><*LF*>
Command Remark	Enable or Disable the Smart Start Algorithm
Query	$PSTMiMFT<*CR*><*LF*>
Response	$PSTMiMFT,<Signal Type><*CR*><*LF*>
Parameters	
$PSTMiMFT	Enable or Disable the Smart Start Algorithm
,<Flag>	The Enable or Disable Flag: Format : ,<%d> Where <%d> = 0 to disable the algorithm <%d> = 1 to enable the algorithm Factory Default is 1 – Enabled Only supported in <Software Version> = V1.1
<*CR*><*LF*>	Sentence Terminator

Example 1 – Disable Smart Start Algorithm

Command	$PSTMiMFT,0<*CR*><*LF*>
Command Remark	Disable the Smart Start Algorithm
Command Reply	$PSTMiMFT,0<*CR*><*LF*>
Command Result	The Smart Start Algorithm will be disabled
DEBUG Reply	None

Example 2 – Enable Smart Start Algorithm

Command	$PSTMiMFT,1<*CR*><*LF*>
Command Remark	Enable the Smart Start Algorithm
Command Reply	$PSTMiMFT,1<*CR*><*LF*>
Command Result	The Smart Start Algorithm will be enabled
DEBUG Reply	None

Example 3 – Query the status of Smart Start Algorithm

Query	$PSTMiMFT<*CR*><*LF*>
Query Remark	Query the status of the Smart Start Algorithm
Query Reply	$PSTMiMFT,1<*CR*><*LF*>
Query Result	Give the status of the Smart Start Algorithm
DEBUG Reply	None

3.4.7 $PSTMiMIF - Communication Interface Select

To select the communication interface.

Command	$PSTMiMIF ,<Interface Type> *<CR><LF>*
Command Remark	The unit will communicate with the host with the selected communication interface
Query	$PSTMiMIF*<CR><LF>*
Response	$PSTMiMIF ,<Interface Type> *<CR><LF>*
Parameters	
$PSTMiMIF	Communication Interface Select
,<Interface Type>	The communicate interface that the unit will use for communicating with the host Format : ,<%s> Where <%s> = “UART” for UART Interface (Default) <%s> = “SPI” for SPI Interface <%s> = “USB” for USB Interface <%s> = “I2C” for I^2C Interface <%s> = “CAN” for CAN Interface
<CR><LF>	Sentence Terminator

Remarks

USB and CAN shares the same hardware pads

Table below shows the hardware pin setting for communication interface select:

Type of Interface	**<Param>**	**H/W Pin**	
		COM_SEL0 (Pin 39)	**COM_SEL1 (Pin 40)**
UART (default)	“UART”	Vcc / NC	Vcc / NC
SPI	“SPI”	Vcc / NC	Gnd
USB/CAN	“USB”	Gnd	Vcc / NC
I2C	“I2C”	Gnd	Gnd

Example – Select SPI interface

Command	$PSTMiMIF,SPI*<CR><LF>*
Command Remark	Change the communication interface to SPI
Command Reply	$PSTMiMIF,SPI*<CR><LF> via SPI interface*
Command Result	Communication with Host will be via SPI after this command
DEBUG Reply	None

4 Almanacs and Ephemeris Management

Please note that in order for new almanacs and ephemeris data to be stored correctly it is essential that the baud rate is at most 9600 baud. A higher baud rate will cause the stored data to be corrupted so, it is recommended to use the command to change the port baud rate before start the following procedures (an example is available in the appendix A).

4.1 Obtain Almanac and Ephemeris Data from a Reference GPS Receiver

The following steps may be used to obtain Ephemeris and Almanac data from the GPS receiver. In order for useful data to be obtained it is best that the GPS receiver has been running long enough to receive a full set of Ephemeris and Almanac data from the satellites.

Note that the Ephemeris data must be less than one hour old, while Almanac can tolerate some days/weeks delay between collection and use.

To ensure the validity of the ephemeris and almanac data it is advisable to clear the Ephemeris and Almanac data stored in the flash of the receiver. This may be done by sending the commands $PSTMCLREPHS and $PSTMCLRALMS.

Once this has been done it will be necessary wait for the reference receiver to receive up to date Ephemeris and Almanac data from the satellites, before issuing the dump commands. It is also useful that the commands have been saved in various text files that may be transmitted over the connection by the terminal emulator.

This example makes use of the following files:

- SUSPEND.RXt
- RESUME.RXt
- DUMPEPHEMS.RXt
- DUMPALMANAC.RXt

The content of these files has been reproduced in Appendix A.

Step 1

Ensure that the connection is working and that the user can see NMEA data displayed on their terminal emulator.

Step 2

Ensure that the terminal emulator is logging its input to a text file e.g. log.RXt.

Step 3

Before downloading the Almanac and Ephemeris data from the reference receiver, it is advisable to clear any existing Almanac and Ephemeris data from its memory and waiting until a

full set of Ephemeris and Almanac data has been received from the satellites. This will ensure the validity of the data downloaded from the reference GPS receiver. This can be achieved by sending the $PSTMCLREPHS and the $PSTMCLRALMS commands.

Step 4

Send the file SUSPEND.RXt to the target. The user will notice that the target appears to have stopped working. This is because the GPS library has been suspended.

NOTE:

Steps 5 and 6 are separate operations and may be carried out individually or together depending on the wishes of the user.

Step 5

Send the file DUMPEPHEMS.RXt to the target. The user will notice that the Ephemeris data is displayed on the terminal emulator (as shown below). Note that if no data is displayed then there is no Ephemeris data in the flash.

$PSTMEPHEM,1,64,42056a626a6281818170100009a9ff00cb05e920580e65052f00ecff212c00000ced2b287d1021031f5b0da1b0eabad3c9277301316763b9f90011009184c003*59
$PSTMEPHEM,2,64,4205706270629898941f60034a3ff0017014e23c90ad20095fffeff40360000e59fd126b3f39f04ddda0ca160ecc10ed28dacaa512bc74edb000300e21eff03*09
$PSTMEPHEM,5,64,4205706270626f6f6fd1f600fea6ff0076f8491883120ff9c5fff0ff5b36000089e92c26d3a6700364ca0da109f24862068422525c188929f700f201032bc703*5b
$PSTMEPHEM,6,64,4205706270627d7d7d800800a4a6ff007506cf18ee1178050a00200053370000a4b113261c5b240333740da1b1d91e956051cf7e3f6ed4b3f60004006fa5db03*00
$PSTMEPHEM,14,64,4205706270625c5c5c5e10e007ea9ff0064058520a30ea60416000200772c000024c01b28451e1f01c49f0ca10aeb5ff83bcf570002bc35acec000400a632ff03*6b
$PSTMEPHEM,21,64,42057062706221212188f9009da5ff00e7004622cd0aba00d9ff9efffd3500001a618a2634ba500506010ea1e9f9fa926c745cac2cc31f84e700200044a6c403*3c
$PSTMEPHEM,25,64,42056c626c62b2b2b20c04008ca5ff0007fc3b250b0820fd5b00290079370000ada6bd26d78f350664e90ca176ebc4a6c5e0fd26c93f03c6f00007004d12c003*3d
$PSTMEPHEM,30,64,4205706270625b0b0b091f800caa6ff00cff8e2179e1355f999ffc0ff553500003f077326f97e6c04c8140da10c14be42db05f853b7a66b34ef005e009ff7cd03*3e

Step 6

Send the file DUMPALMANAC.RXt to the target. As in the previous step the user will notice that the Almanac data is displayed on the terminal emulator (as shown below).

Note that if no data is displayed then there is no Almanac data in the flash.

$PSTMALMANAC,1,32,0142056314325b1c5efd0140020da14009730160ad61b900caffe12011088020*1d
$PSTMALMANAC,2,32,02420563034ab50634fd01406c0ca1402eacaa6047c64e005b741c20e4078020*15
$PSTMALMANAC,3,32,03420563483df0f537fd0140bb0ca140807d7c60237f19000a3ef92030088020*1c
$PSTMALMANAC,4,32,04420563f93a700633fd0140450da140447bab606fd202008ec97f201e208020*1a
$PSTMALMANAC,5,32,054205630d3765fc3ffd0140500da14033225260f08929006cf96f20e6808020*19
$PSTMALMANAC,6,32,064205634532d6fa3ffd0140fc0ca14018cf7e600cd4b30037d0a22075038020*49
$PSTMALMANAC,7,32,07420563f56cd9fb3ffd0140d20da1402eb77d6082d2b7003bdcfa2099218020*13
$PSTMALMANAC,8,32,08420563ee4e011242fd0140190da14072452c609b4a6900fbe2a620d0078020*1b
$PSTMALMANAC,9,32,09420563588ed00938fd0140cf0ca1406728296083eb3000c2729720f1078020*44
$PSTMALMANAC,10,32,0a420563ed35ee155ffd0140ac0da140f82cd6609c7a0e004eb22a204c008020*76
$PSTMALMANAC,11,32,0b420563fc2632e406fd0140fc0ca1403c39a56064700a00608bbe2023098020*7b
$PSTMALMANAC,13,32,0d4205632315171f64fd0140ca0ca140d1d4006012ed2d00d0a1242016088020*2c
$PSTMALMANAC,14,32,0e420563f711581b5efd0140480ca140b2570060bd35ac002a110620e6078020*20
$PSTMALMANAC,15,32,0f420563f14a070b3bfd0140780ba1400dc3ad60b14366000ce9a92017128020*2f
$PSTMALMANAC,16,32,10420563c917770c58fd0140550ca140199f55601c2bd800a2196b200d008020*24
$PSTMALMANAC,17,32,114205630c0d1a0c54fd0140430ca140aeef7f6043406d0008044920c427c020*79
$PSTMALMANAC,18,32,12420563c0367d0b50fd0140b30ca140c130d76094349100f755672031ffbf20*25
$PSTMALMANAC,19,32,13420563b01ad60a51fd01409a0da140d1628260fc19c500a7d23520e4078020*72
$PSTMALMANAC,20,32,14420563e0133f0b4efd0140830ca140db0ad560ed613a00a1365a20d3078020*7c

$PSTMALMANAC,21,32,154205630955410230fd0140880da1400d5cac60921f84007faca02095088020*29
$PSTMALMANAC,22,32,164205631029da094efd0140140da140808ad7608e4abf00dbfc212032088020*27
$PSTMALMANAC,23,32,174205630f23bf0f51fd0140a50ca140a0f0ff60905c6100172d0720aff8bf20*7d
$PSTMALMANAC,24,32,184205634b4a1f0d3ffd01404d0da1400ec6ac604db9d40006aac7203c088020*2c
$PSTMALMANAC,25,32,19420563596376052ffd0140760ca1408bfd26603c01c600e9d9b42002008020*28
$PSTMALMANAC,26,32,1a420563fd87eb1d61fd0140bc0ca140e5e2006013041e001389e320f7ffbf20*22
$PSTMALMANAC,27,32,1b4205630e9e660834fd0140720da140313f28606565ae002a2d772016008020*7b
$PSTMALMANAC,28,32,1c4205631756300b57fd0000dc0ca1402f06562082c6a12050f344002a008000*25
$PSTMALMANAC,29,32,1d4205638f49d21b60fd0140090da1407880ff60c018d50000953520952980 20*73
$PSTMALMANAC,30,32,1e420563ca46c70045fd0140a00ca140baf75360466c3400e26e5020bf198020*28

Step 7

To resume the GPS library operation send the file RESUME.RXt.

Step 8

The Almanac and Ephemeris data should now be saved the log file. These can be extracted for loading to a new target GPS receiver by copying the $PSTMALMANAC and $PSTMEPHEM lines into a new file, ensuring that there is no wrapping of lines introduced by the editor.

4.2 Load Almanacs and Ephemeris Data into a Target Receiver

The following steps may be used to load Ephemeris and Almanac data to the GPS receiver.

Note that the Ephemeris data must be less than one hour old, while Almanac can tolerate some days/weeks delay between collection and use.

In a production environment it should be the case that there is no Ephemeris and Almanac data in the flash. However if the Almanac and Ephemeris data is being loaded in the field it is important to clear any existing data using the $PSTMCLREPHS and $PSTMCLRALMS commands. It is useful that the commands have been saved in various text files that may be transmitted over the connection by the terminal emulator.

This example makes use of the following files:

- SETBAUDRATE.RXt
- SUSPEND.RXt
- RESUME.RXt
- LOADEPHEMS.RXt
- LOADALMANAC.RXt

The content of these files has been reproduced in Appendix A.

Step 1

Ensure that the connection is working and that the user can see NMEA data displayed on their terminal emulator.

Step 2

Before loading the receiver with new Almanac and Ephemeris data it is necessary to clear any existing Almanac and Ephemeris data from its memory. If this is not done the receiver will make a copy of the data already within its memory before loading the new data into memory. This will result in twice as many erase and write operations occurring on the flash memory of the receiver. This can be achieved by sending the $PSTMCLREPHS and the $PSTMCLRALMS commands.

Step 3

Send the file SUSPEND.RXt to the target. The user will notice that the target appears to have stopped working. This is because the GPS library has been suspended.

NOTE:

Steps 4 and 5 are separate operations and may be carried out individually or together depending on the wishes of the user.

Step 4

Send the file LOADEPHEMS.RXt to the target. This will load the ephemeris data into the target flash. If the user wishes to verify that the ephemeris data has been downloaded they can do so

by issuing a hot start command ($PSTMHOT). Note that it is important that they resume the operation of the GPS library before issuing the hot start command otherwise the hot start command will fail. This is possible via the $PSTMRESUME command.

Step 5

Send the file LOADALMANAC.RXt to the target. This will load the almanac data into the target flash.

Step 6

To resume the GPS library operation send the file RESUME.RXt. In order to use these commands to truly assist a GPS receiver in a cold start scenario, it is also necessary to issue position and time information using the $PSTMINITGPS command before loading the Almanac and Ephemeris data. It is important that the time in this case corresponds to the Ephemeris and Almanac data otherwise the receiver will reject the data as being invalid.

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- life support devices or systems
- Aviation devices or systems

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6 APPENDIX A: Summary of text files used in the examples

File: SETBAUDRATE.RXt

$PSTMNMEACONFIG,9600,0,0

File: SUSPEND.RXt

$PSTMSUSPEND

File: RESUME.RXt

$PSTMRESUME

File: DUMPEPHEMS.RXt

$PSTMNMEAONOFF
$PSTMDUMPALMANAC

File: DUMPALMANAC.RXt

$PSTMNMEAONOFF
$PSTMDUMPALMANAC

File: LOADALMANAC.RXt

$PSTMLOADALM
$PSTMALMANAC,1,32,0142056314325b1c5efd0140020da14009730160ad61b900caffe12011088020*1d
$PSTMALMANAC,2,32,02420563034ab50634fd01406c0ca1402eacaa6047c64e005b741c20e4078020*15
$PSTMALMANAC,3,32,03420563483df0f537fd0140bb0ca140807d7c60237f19000a3ef92030088020*1c
$PSTMALMANAC,4,32,04420563f93a700633fd0140450da140447bab606fd202008ec97f201e208020*1a
$PSTMALMANAC,5,32,054205630d3765fc3ffd0140500da14033225260f08929006cf96f20e6808020*19
$PSTMALMANAC,6,32,064205634532d6fa3ffd0140fc0ca14018cf7e600cd4b30037d0a22075038020*49
$PSTMALMANAC,7,32,07420563f56cd9fb3ffd0140d20da1402eb77d6082d2b7003bdcfa2099218020*13
$PSTMALMANAC,8,32,08420563ee4e011242fd0140190da14072452c609b4a6900fbe2a620d0078020*1b
$PSTMALMANAC,9,32,09420563588ed00938fd0140cf0ca1406728296083eb3000c2729720f1078020*44
$PSTMALMANAC,10,32,0a420563ed35ee155ffd0140ac0da140f82cd6609c7a0e004eb22a204c008020*76
$PSTMALMANAC,11,32,0b420563fc2632e406fd0140fc0ca1403c39a56064700a00608bbe2023098020*7b
$PSTMALMANAC,13,32,0d4205632315171f64fd0140ca0ca140d1d4006012ed2d00d0a1242016088020*2c
$PSTMALMANAC,14,32,0e420563f711581b5efd0140480ca140b2570060bd35ac002a110620e6078020*20
$PSTMALMANAC,15,32,0f420563f14a070b3bfd0140780ba1400dc3ad60b14366000ce9a92017128020*2f
$PSTMALMANAC,16,32,10420563c917770c58fd0140550ca140199f55601c2bd800a2196b200d008020*24
$PSTMALMANAC,17,32,114205630c0d1a0c54fd0140430ca140aeef7f6043406d0008044920c427c020*79
$PSTMALMANAC,18,32,12420563c0367d0b50fd0140b30ca140c130d76094349100f755672031ffbf20*25
$PSTMALMANAC,19,32,13420563b01ad60a51fd01409a0da140d1628260fc19c500a7d23520e4078020*72
$PSTMALMANAC,20,32,14420563e0133f0b4efd0140830ca140db0ad560ed613a00a1365a20d3078020*7c
$PSTMALMANAC,21,32,154205630955410230fd0140880da1400d5cac60921f84007faca02095088020*29
$PSTMALMANAC,22,32,164205631029da094efd0140140da140808ad7608e4abf00dbfc212032088020*27
$PSTMALMANAC,23,32,174205630f23bf0f51fd0140a50ca140a0f0ff60905c6100172d0720aff8bf20*7d
$PSTMALMANAC,24,32,184205634b4a1f0d3ffd01404d0da1400ec6ac604db9d40006aac7203c088020*2c
$PSTMALMANAC,25,32,19420563596376052ffd0140760ca1408bfd26603c01c600e9d9b42002008020*28
$PSTMALMANAC,26,32,1a420563fd87eb1d61fd0140bc0ca140e5e2006013041e001389e320f7ffbf20*22
$PSTMALMANAC,27,32,1b4205630e9e660834fd0140720da140313f28606565ae002a2d772016008020*7b
$PSTMALMANAC,28,32,1c4205631756300b57fd0000dc0ca1402f06562082c6a12050f344002a008000*25
$PSTMALMANAC,29,32,1d4205638f49d21b60fd0140090da1407880ff60c018d50000953520952980 20*73
$PSTMALMANAC,30,32,1e420563ca46c70045fd0140a00ca140baf75360466c3400e26e5020bf198020*28

File: LOADEPHEMS.RXt

$PSTMLOADEPHEMS
$PSTMEPHEM,1,64,42056a626a6281818170100009a9ff00cb05e920580e65052f00ecff212c00000ced2b287d1021031f5b0da1b0eabad3c9277301316763b9f90011009184c003*59
$PSTMEPHEM,2,64,42057062706298989841f60034a3ff0017014e23c90ad20095fffeff40360000e59fd126b3f39f04ddda0ca160ecc10ed28dacaa512bc74edb000300e21eff03*09
$PSTMEPHEM,5,64,4205706270626f6f6fd1f600fea6ff0076f8491883120ff9c5fff0ff5b36000089e92c26d3a6700364ca0da109f24862068422525c188929f700f201032bc703*5b
$PSTMEPHEM,6,64,4205706270627d7d7d800800a4a6ff007506cf18ee1178050a00200053370000a4b113261c5b240333740da1b1d91e956051cf7e3f6ed4b3f60004006fa5db03*00
$PSTMEPHEM,14,64,420570627062c5c5c5e10e007ea9ff0064058520a30ea60416000200772c000024c01b28451e1f01c49f0ca10aeb5ff83bcf570002bc35acec000400a632ff03*6b
$PSTMEPHEM,21,64,42057062706221212188f9009da5ff00e7004622cd0aba00d9ff9efffd3500001a618a2634ba500506010ea1e9f9fa926c745cac2cc31f84e700200044a6c403*3c
$PSTMEPHEM,25,64,42056c626c62b2b2b20c04008ca5ff0007fc3b250b0820fd5b00290079370000ada6bd26d78f350664e90ca176ebc4a6c5e0fd26c93f03c6f00007004d12c003*3d
$PSTMEPHEM,30,64,420570627062b0b0b091f800caa6ff00cff8e2179e1355f999ffc0ff553500003f077326f97e6c04c8140da10c14be42db05f853b7a66b34ef005e009ff7cd03*3e