



# MT3337 Platform NMEA Message Specification\_V1.00



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## Version History

Date	Version	What is new	Author
2019-03-27	1.00	Original version	Zhao.wang

## Scope

This document presents details of the frequently used NMEA messages supported by SIMCom GNSS module which based on MT3337 Platform, such as SIM28ML/SIM39EAR etc. This document does not provide information about the complete NMEA-0183, user can refer to the related documents for more information.

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# 1 Introduction

At present, has been built and is planning the construction of a satellite navigation system apart from United States GPS system, and Russia's GLONASS system, the European Galileo system, Beidou satellite navigation system in China and Japan and Indian regional satellite navigation systems.

The integration of GPS with GLONASS may be considered a major milestone in satellite-based positioning, because it can dramatically improve location accuracy, reliability and speed.

## 2 NMEA Messages

### 2.1 General Format of NMEA Messages

NMEA messages use the ASCII character set and have a defined format. Each message begins with a \$ (hex 0x24) and end with a carriage return and line feed (hex 0x0D 0x0A, represented as <CR><LF>). Each message consists of one or more fields of ASCII letters and numbers, separated by commas. After the last field, and before the <CR><LF> is a checksum consisting of an asterisk (\*, hex 0x2A) followed by two ASCII characters representing the hexadecimal value of the checksum. The checksum is computed as the exclusive OR of all characters between the \$ and \* characters.

Table 2-1: NMEA output/input message parameters

Parameter	Example	Contents
Start	\$GPGGA	Message Identifier. Input messages begin at MID 100.
Payload	<Data>	Message specific data. Refer to a specific message section for <data>...<data> definition.
Checksum	*CKSUM	CKSUM is a two-hex ASCII character. Checksums is required in all input messages.
End	<CR> <LF>	Each message is terminated using Carriage Return (CR) Line Feed (LF) which are \r\n. Because \r\n are not printable ASCII characters, they are omitted from the example strings, but must be sent to terminate the message and cause the receiver to process that input message.



**Note:**

1. All fields in all proprietary NMEA messages are required, none are optional and are comma delimited.
2. In some numeric fields representing a single data element, leading zeros before a decimal are suppressed. A single "0" character preceding the decimal point is maintained. In compound numeric structures (such as LAT or LONG), leading zeros are suppressed only on the leftmost element. Trailing zeros are not suppressed.

## 2.2 Standard NMEA Output Messages

Table 2-2: GNSS module Frequently Used NMEA Output Messages

Message	Description	Possible Talker Identifiers
GGA	Time, position and fix type data	GP,GN,GL,BD,GA
GSA	GNSS receiver operating mode, satellites used in the position solution, and DOP values	GP, GL,BD,GA
GSV	Number of GNSS satellites in view satellite ID numbers, elevation, azimuth, & SNR values	GP,GL,BD,GA
RMC	Time, date, position, course and speed data	GP,GN,GL,BD,GA
VTG	Course and speed information relative to the ground	GP,GN,GL,BD,GA

**⚠ Note:**

1. The prefix "GP" refers to the GPS global navigation system;
2. The prefix "GN" refers to the GNSS global navigation system (All kinds of global navigation systems.);
3. The prefix "GL" refers to the GLONASS global navigation system;
4. The prefix "GA" refers to the GALILEO global navigation system;
5. The Prefix "BD" refers to the BEIDOU global navigation system.

A full description of the listed NMEA messages is provided in the following sections.

## 2.2.1 Message ID GGA: Global Positioning System Fixed Data

Table 2-3: GGA Data Format

<b>Example:</b> \$GPGGA,091926.000,3113.3166,N,12121.2682,E,1,09,0.9,36.9,M,7.9,M,,0000*56<CR><LF>			
Name	Example	Unit	Description
Message ID	\$GPGGA		GGA protocol header
UTC Time	091926.000		hhmmss.sss
Latitude	3113.3166		ddmm.mmmm
N/S Indicator	N		N=north or S=south
Longitude	12121.2682		dddmm.mmmm
E/W Indicator	E		E=east or W=west
Position Fix Indicator	1		See Table 2-4
Satellites Used	09		Range 0 to 12
HDOP	0.9		Horizontal Dilution of Precision
MSL Altitude	36.9	meters	
Units	M	meters	
Geoid Separation	7.9	meters	Geoid-to-ellipsoid separation. Ellipsoid altitude = MSL Altitude + Geoid Separation.
Units	M	meters	
Age of Diff. Corr.		sec	Null fields when DGPS is not used
Diff. Ref. Station ID	0000		
Checksum	*56		
<CR><LF>			End of message termination

Table 2-4: Position Fix Indicator

Value	Description
0	Fix not available or invalid
1	GPS SPS Mode, fix valid
2	Differential GPS, SPS Mode, fix valid
3-5	Not supported
6	Dead Reckoning Mode, fix valid

**Note :**

*A valid status is derived from all the parameters set in the software. This includes the minimum number of satellites required, any DOP mask setting, presence of DGPS corrections, etc. If the default or current software setting requires that a factor is met, then if that factor is not met, the solution will be marked as invalid.*

## 2.2.2 Message ID GSA: GNSS DOP and Active Satellites

Table 2-5: GSA Data Format

**Example:** \$GPGSA,A,3,07,02,26,27,09,04,15, , , , ,1.8,1.0,1.5\*33<CR><LF>

Name	Example	Unit	Description
Message ID	\$GPGSA		GSA protocol header
Mode 1	A		See Table 2-7
Mode 2	3		See Table 2-8
Satellite Used <sup>[1]</sup>	07		SV on Channel 1
Satellite Used <sup>[1]</sup>	02		SV on Channel 2
....			....
Satellite Used <sup>[1]</sup>			SV on Channel 12
PDOP <sup>[2]</sup>	1.8		Position Dilution of Precision
HDOP <sup>[2]</sup>	1.0		Horizontal Dilution of Precision
VDOP <sup>[2]</sup>	1.5		Vertical Dilution of Precision
Checksum	*33		
<CR><LF>			End of message termination

**Note:**

1. Satellite used in solution.
2. Maximum DOP value reported is 50. When value 50 is reported, the actual DOP may be much larger.

Table 2-6: Mode 1

Value	Description
M	Manual – Forced to operate in 2D or 3D mode
A	2D Automatic – Allowed to automatically switch 2D/3D

Table 2-7: Mode 2

Value	Description
1	Fix not available
2	2D (<4 SVs used)
3	3D (>3 SVs used)

### 2.2.3 Message ID GSV: GNSS Satellites in View

Table 2-8: GSV Data Format

**Example:**

```
$GPGSV,3,1,11,26,68,023,37,15,64,251,33,05,45,058,34,29,33,253,33*75<CR><LF>
$GPGSV,3,2,11,27,32,164,30,21,25,315,29,02,24,140,31,08,19,048,29*70<CR><LF>
$GPGSV,3,3,11,09,16,180,25,18,08,284,27,10,08,085,18*4E<CR><LF>
```

Name	Example	Unit	Description
Message ID	\$GPGSV		GSV protocol header
Number of Messages <sup>[1]</sup>	2		Total number of GSV messages to be sent in this group
Message Number <sup>[1]</sup>	1		Message number in this group of GSV messages
Satellites in View <sup>[1]</sup>	11		
Satellite ID	26		Channel 1 (Range 1 to 32)
Elevation	68	degrees	Channel 1 (Maximum 90)
Azimuth	023	degrees	Channel 1 (True, Range 0 to 359)
SNR (C/N0)	37	dBHz	Range 0 to 99, null when not tracking
....			....
Satellite ID	29		Channel 4 (Range 1 to 32)
Elevation	33	degrees	Channel 4 (Maximum 90)
Azimuth	253	degrees	Channel 4 (True, Range 0 to 359)
SNR (C/N0)	33	dBHz	Range 0 to 99, null when not tracking
Checksum	*75		
<CR><LF>			End of message termination

**Note:**

1. Depending on the number of satellites tracked, multiple messages of GSV data may be required. In some software versions, the maximum number of satellites reported as visible is limited to 12, even though more may be visible.

## 2.2.4 Message ID RMC: Recommended Minimum Specific GNSS Data

Table 2-9: RMC Data Format

<b>Example:</b> \$GPRMC,094330.000,A,3113.3156,N,12121.2686,E,0.51,193.93,171210,,A*68<CR><LF>			
Name	Example	Unit	Description
Message ID	\$GPRMC		RMC protocol header
UTC Time	094330.000		hhmmss.sss
Status <sup>[1]</sup>	A		A=data valid or V=data not valid
Latitude	3113.3156		ddmm.mmmm
N/S Indicator	N		N=north or S=south
Longitude	12121.2686		dddmm.mmmm
E/W Indicator	E		E=east or W=west
Speed Over Ground	0.51	knots	
Course Over Ground	193.93	degrees	True
Date	171210		ddmmyy
Magnetic Variation <sup>[2]</sup>		degrees	E=east or W=west
East/West Indicator <sup>[2]</sup>			E=east
Mode	A		A=Autonomous, D=DGPS
Checksum	*68		
<CR><LF>			End of message termination

**Note:**

1. A valid status is derived from all the parameters set in the software. This includes the minimum number of satellites required, any DOP mask setting, presence of DGPS corrections, etc. If the default or current software setting requires that a factor is met, then if that factor is not met, the solution will be marked as invalid.
2. Does not support magnetic declination. All “course over ground” data are geodetic WGS84 directions relative to true North.

## 2.2.5 Message ID VTG: Course Over Ground and Ground Speed

Table 2-10: VTG Data Format

**Example:** \$GPVTG,83.37,T,,M,0.00,N,0.0,K,A\*32<CR><LF>

Name	Example	Unit	Description
Message ID	\$GPVTG		VTG protocol header
Course	83.37	degrees	Measured heading
Reference	T		True
Course		degrees	Measured heading
Reference	M		Magnetic1 <sup>[1]</sup>
Speed	0.00	knots	Measured horizontal speed
Units	N		Knots
Speed	0.0	km/hr	Measured horizontal speed
Units	K		Kilometers per hour
Mode	A		A=Autonomous, D=DGPS
Checksum	*32		
<CR><LF>			End of message termination

**Note:**

1. Does not support magnetic declination. All "course over ground" data are geodetic WGS84 directions.

## 2.2.6 Message ID GPACCURACY:ACCURACY OF THE LOCATION

This message is accuracy of the location; The smaller the number is, the be better the condition is;

Table 2-11: GPACCURACY Data Format

**Example:** \$GPACCURACY,961.2\*04 <CR><LF>

## 2.3 Proprietary NMEA Messages

### 2.3.1 Packet Type: 000 PMTK\_TEST

Test Packet.

Table 2-12: 000 PMTK\_TEST Data Format

<b>DataField:</b> PMTK000			
<b>Example:</b> \$PMTK000*32<CR><LF>			
Name	Unit	Default	Description
--	--	--	--

### 2.3.2 Packet Type: 001 PMTK\_ACK

Acknowledge of PMTK command.

Table 2-13: 001 PMTK\_ACK Data Format

<b>DataField:</b> PMTK001,Cmd,Flag			
<b>Example:</b> \$PMTK001,604,3*32<CR><LF>			
Name	Unit	Default	Description
Cmd	--	--	The command / packet type the acknowledge responds.
Flag	--	--	'0' = Invalid command / packet. '1' = Unsupported command / packet type '2' = Valid command / packet, but action failed '3' = Valid command / packet, and action succeeded

### 2.3.3 Packet Type: 010 PMTK\_SYS\_MSG

Output system message.

Table 2-14: 010 PMTK\_SYS\_MSG Data Format

<b>DataField:</b> PMTK010,Type			
<b>Example:</b> \$PMTK010,001*2E<CR><LF>			
Name	Unit	Default	Description
Type	--	--	The system message type. '0': UNKNOWN '1': STARTUP '2': Notification: Notification for the host aiding EPO '3': Notification: Notification for the transition to Normal mode is successfully done



### 2.3.4 Packet Type: 011 PMTK\_TXT\_MSG

Output system text message.

Table 2-15: 011 PMTK\_TXT\_MSG Format

<b>DataField:</b> PMTK011, msg			
<b>Example:</b> \$PMTK011,MTKGPS*08 <CR><LF>			
Name	Unit	Default	Description
msg	--	--	Message of this is MTK GPS

### 2.3.5 Packet Type: 101 PMTK\_CMD\_HOT\_START

Hot Restart: Use all available data in the NVRAM.

Table 2-16: 101 PMTK\_CMD\_HOT\_START Data Format

<b>DataField:</b> PMTK101			
<b>Example:</b> \$PMTK101*32<CR><LF>			
Name	Unit	Default	Description
--	--	--	--

### 2.3.6 Packet Type: 102 PMTK\_CMD\_WARM\_START

Warm Restart: Not using Ephemeris data at start.

Table 2-17: 102 PMTK\_CMD\_WARM\_START Data Format

<b>DataField:</b> PMTK102			
<b>Example:</b> \$PMTK102*31<CR><LF>			
Name	Unit	Default	Description
--	--	--	--

### 2.3.7 Packet Type: 103 PMTK\_CMD\_COLD\_START

Cold Restart: Not using the Position, Almanac and Ephemeris data at start.

Table 2-18: 103 PMTK\_CMD\_COLD\_START Data Format

<b>DataField:</b> PMTK103			
<b>Example:</b> \$PMTK103*30<CR><LF>			
Name	Unit	Default	Description
--	--	--	--

### 2.3.8 Packet Type: 104 PMTK\_CMD\_FULL\_COLD\_START

Full Cold Restart: In addition to Cold start, this command clears the system/user configurations at start. It resets the GNSS module to the factory default.

Table 2-19: 104 PMTK\_CMD\_FULL\_COLD\_START Data Format

<b>DataField:</b> PMTK104			
<b>Example:</b> \$PMTK104*37<CR><LF>			
Name	Unit	Default	Description
--	--	--	--

### 2.3.9 Packet Type: 120 PMTK\_CMD\_CLEAR\_FLASH\_AID

Erase aiding data stored in the flash memory.

Table 2-21: 120 PMTK\_CMD\_CLEAR\_FLASH\_AID Data Format

<b>DataField:</b> PMTK120			
<b>Example:</b> \$PMTK120*31<CR><LF>			
Name	Unit	Default	Description
--	--	--	--

### 2.3.10 Packet Type: 127 PMTK\_CMD\_CLEAR\_EPO

Erase EPO data stored in the flash memory.

Table 2-2220: 127 PMTK\_CMD\_CLEAR\_EPO Data Format

<b>DataField:</b> PMTK127			
<b>Example:</b> \$PMTK127*36<CR><LF>			
Name	Unit	Default	Description
--	--	--	--

### 2.3.11 Packet Type: 161 PMTK\_CMD\_STANDBY\_MODE (NOT supported in AXN3.0)

Enter standby mode (stop mode or sleep mode) for power saving.

Table 2-2321: 161 PMTK\_CMD\_STANDBY\_MODE Data Format

<b>DataField:</b> PMTK161,Type			
<b>Example:</b> \$PMTK161,0*28<CR><LF>			
Name	Unit	Default	Description
--	--	--	--

Type	--	--	Standby type: '0' = Stop mode, stop NMEA output, the receiver stays at ultra low power state '1' = Sleep mode, stop NMEA output, the receiver stays at full on power state
------	----	----	--

### 2.3.12 Packet Type: 220 PMTK\_SET\_POS\_FIX

Position Fix Interval

Keep status after reboot → Yes.

Table 2-2922: 220 PMTK\_SET\_POS\_FIX Data Format

<b>DataField:</b> PMTK220, Interval			
<b>Example:</b> \$PMTK220,1000*1F<CR><LF>			
Name	Unit	Default	Description
Interval	msec	--	Position fix interval. <b>Range: [100~10000]</b>

Note: If the instruction fails to execute successfully, the setting value is small, the data output is more, and the baud rate is too low to output, so the instruction fails. To execute successfully, you can use the PMTK314 instruction to reduce the output frequency of NMEA statements and execute successfully.

### 2.3.13 Packet Type: 250 PMTK\_SET\_DATA\_PORT

Set data port input/output data type and baudrate.

Keep status after reboot → Yes.

Table 2-3223: 250 PMTK\_SET\_DATA\_PORT Data Format

<b>DataField:</b> PMTK250, InType, OutType, Baudrate			
<b>Example:</b> \$PMTK250,1,3,9600*14<CR><LF>			
Name	Unit	Default	Description
InType			Data port input data type '0'= DPORT_IN_NONE (No data input) '1'=DPORT_IN_RTCM (RTCM input) '3'=DPORT_IN_NMEA (MTK NMEA)
OutType			Data port input data type '0'= DPORT_OUT_NONE (No data output) '3'=DPORT_OUT_NMEA (MTK NMEA)
Baudrate			Baudratesetting 4800 9600 14400

			19200
			38400
			57600
			115200
			460800
			921600

### 2.3.14 Packet Type: 251 PMTK\_SET\_NMEA\_BAUDRATE

Set NMEA port baudrate. Using PMTK251 command to setup baud rate setting, the setting will be back to default value in the two conditions:

1. Full cold start command is issued
2. Enter standby mode

Keep status after reboot → Yes.

Table 2-3324: 251 PMTK\_SET\_NMEA\_BAUDRATE Data Format

<b>DataField:</b> PMTK251,Baudrate			
<b>Example:</b> \$PMTK251,115200*1F<CR><LF>			
Name	Unit	Default	Description
Baudrate	--	--	Baudrate setting 0 – default setting 4800 9600 14400 19200 38400 57600 115200 230400 460800 921600

*Note: The option “Allow change of baudrate” at the “NMEA” page in the CoreBuilder should be checked before using this command.*

### 2.3.15 Packet Type: 253 PMTK\_SET\_OUTPUT\_FMT

Set data output format for current port.

Keep status after reboot → Yes.

Table 2-3425: 253 PMTK\_SET\_OUTPUT\_FMT Data Format

<b>DataField:</b> PMTK253, Flag			
<b>Example:</b> \$PMTK253,1*2B<CR><LF>//Change output format from NMEA mode to binary mode			
Name	Unit	Default	Description

Flag			Unsigned 1 byte: 0-NMEA mode 1-Binary mode
------	--	--	--

*Note: When you switch from binary mode to NMEA mode, you will receive a binary ACK after the command is processed. When you switch from NMEA mode to binary mode, NO ACK will be sent.*

### 2.3.16 Packet Type: 255 PMTK\_SET\_SYNC\_PPS\_NMEA

Enable or disable fix NMEA output time behind PPS function. (Default off). The latency range of the beginning of UART Tx is between 170 ms and 180ms at MT3339 platform (465 ms~485ms at MT3333 platform) and behind the rising edge of PPS.

Table 2-35: 255 PMTK\_SET\_SYNC\_PPS\_NMEA Data Format

<b>DataField:</b> PMTK255, Enabled			
<b>Example:</b> \$PMTK255,1*2D<CR><LF>			
Name	Unit	Default	Description
Enabled			Enable or disable '0'= Disable '1'=Enable

### 2.3.17 Packet Type: 285 PMTK\_SET\_PPS\_CONFIG\_CMD

Config PPS setting.

Keep status after reboot -> Yes.

Table 2-4026: 285 PMTK\_SET\_PPS\_CONFIG\_CMD Data Format

<b>DataField:</b> PMTK285,PPSType,PPSPulseWidth			
<b>Example:</b> \$PMTK285,2,100*3E<CR><LF>			
Name	Unit	Default	Description
PPSType	-	-	Availability '0'= Disable '1'=After the first fix '2'=3D fix only '3'=2D/3D fix only '4'= Always
PPSPulseWidth	ms	-	PPS Pulse Width

### 2.3.18 Packet Type: 286 PMTK\_SET\_AIC\_CMD

Enable or disable active interference cancellation function.

Table 2-4127: 286 PMTK\_SET\_AIC\_CMD Data Format

<b>DataField:</b> PMTK286,Enabled			
<b>Example:</b> \$PMTK286,1*23<CR><LF>			
Name	Unit	Default	Description
Enabled	--	--	Enable or disable '0' = Disable '1' = Enable

### 2.3.19 Packet Type: 299 PMTK\_SET\_OUTPUT\_DEBUG

Enable or disable the debug log output.

Keep status after reboot->Yes

Table 2-42: 299 PMTK\_SET\_OUTPUT\_DEBUG

<b>DataField:</b> PMTK299,Enabled			
<b>Example:</b> \$PMTK299,1*2D<CR><LF>			
Name	Unit	Default	Description
Enabled	--	--	Enable or disable '0' = Disable '1' = Enable

### 2.3.20 Packet Type: 300 PMTK\_API\_SET\_FIX\_CTL

Set Fix interval.

Table 2-4328: 300 PMTK\_API\_SET\_FIX\_CTL Data Format

<b>DataField:</b> PMTK300,Fixinterval,0,0,0,0			
<b>Example:</b> \$PMTK300,1000,0,0,0,0*1C<CR><LF>			
<b>Return:</b> \$PMTK001,300,3*33			
Name	Unit	Default	Description
Fixinterval	milliseconds	--	Range: [100 ~ 10000]

### 2.3.21 Packet Type: 301 PMTK\_API\_SET\_DGPS\_MODE

Set DGPS correction data source mode.

Keep status after reboot->Yes

Table 2-4429: 301 PMTK\_API\_SET\_DGPS\_MODE Data Format

<b>DataField:</b> PMTK301,Mode			
--------------------------------	--	--	--

**Example:** \$PMTK301,1\*2D<CR><LF>

Name	Unit	Default	Description
Mode	--	--	DGPS data source mode. '0': No DGPS source '1': RTCM '2': SBAS (Include WAAS/EGNOS/GAGAN/MSAS)

### 2.3.22 Packet Type: 314 PMTK\_API\_SET\_NMEA\_OUTPUT

Set NMEA sentence output frequencies.

Keep status after reboot->Yes

There are totally **19** data fields that present output frequencies for the **19** supported NMEA sentences individually.

Supported NMEA Sentences:

- 0 NMEA\_SEN\_GLL, // GPGLL interval - Geographic Position - Latitude longitude
- 1 NMEA\_SEN\_RMC, // GPRMC interval - Recommended Minimum Specific GNSS Sentence
- 2 NMEA\_SEN\_VTG, // GPVTG interval - Course Over Ground and Ground Speed
- 3 NMEA\_SEN\_GGA, // GPGGA interval - GPS Fix Data
- 4 NMEA\_SEN\_GSA, // GPGSA interval - GNSS DOPS and Active Satellites
- 5 NMEA\_SEN\_GSV, // GPGSV interval - GNSS Satellites in View
- 6 NMEA\_SEN\_GRS, //GPGRS interval – GNSS Range Residuals
- 7 NMEA\_SEN\_GST, //GPGST interval – GNSS Pseudorange Errors Statistics
- 17 NMEA\_SEN\_ZDA, // GPZDA interval – Time & Date
- 18 NMEA\_SEN\_MCHN, //PMTKCHN interval – GNSS channel status
- 19 NMEA\_SEN\_DTM, //GPDTM interval – Datum reference

Supported Frequency Setting

- 0 - Disabled or not supported sentence
- 1 - Output once every one position fix
- 2 - Output once every two position fixes
- 3 - Output once every three position fixes
- 4 - Output once every four position fixes
- 5 - Output once every five position fixes

**Example:**

\$PMTK314,1,1,1,1,1,5,0,0,0,0,0,0,0,0,0,0,0,1,1,0\*30<CR><LF>

This command set GLL output frequency to be outputting once every 1 position fix, and RMC to be outputting once every 1 position fix, and so on.

You can also restore the system default setting via issue:

\$PMTK314,-1\*04<CR><LF>

*Note: Settings of GST and GRS are valid only when firmware supports GST/GRS sentences.*

### 2.3.23 Packet Type: 326 PMTK\_API\_SET\_PPS

This packet contain the local millisecond and phase where the PPS should be placed.

Table 2-4730: 326 PMTK\_API\_SET\_PPS Data Format

<b>DataField:</b> PMTK326, PPS_BY_USER,Local_ms,phase			
<b>Example:</b> \$PMTK326,1,1345,555*1E <CR><LF>			
Name	Unit	Default	Description
PPS_BY_USER			1:PPS output by user 0:PPS output automatically
Local_ms			Local receiver time tick. Range: 0-4294967295(2 <sup>32</sup> -1)
Phase			Time phase 0-262143

### 2.3.24 Packet Type: 330 PMTK\_API\_SET\_DATUM

Set default datum.

Keep status after reboot → Yes.

Table 2-4931: 330 PMTK\_API\_SET\_DATUM Data Format

<b>DataField:</b> PMTK330,Datum			
<b>Example:</b> \$PMTK330,0*2E<CR><LF>			
Name	Unit	Default	Description
Datum	--	--	0: WGS84 1: TOKYO-M 2: TOKYO-A Support 219 different datums. The total datums list in the Appendix A.

### 2.3.25 Packet Type: 335 PMTK\_API\_SET\_RTC\_TIME

This command set RTC UTC time. To be noted, the command doesn't update the GPS time which maintained by GPS receiver. After setting, the RTC UTC time finally may be updated by GPS receiver with more accurate time after 60 seconds.

Table 2-5132: 335 PMTK\_API\_SET\_RTC\_TIME Data Format

<b>DataField:</b> PMTK335,Year,Month,Day,Hour,Min,Sec			
<b>Example:</b> \$PMTK335,2007,1,1,0,0,0*02<CR><LF>			
Name	Unit	Default	Description
Year	--	--	year
Month	--	--	1 ~ 12
Day	--	--	1 ~ 31



Hour	--	--	0 ~ 23
Min	--	--	0 ~ 59
Sec	--	--	0 ~ 59

### 2.3.26 Packet Type: 351 PMTK\_API\_SET\_SUPPORT\_QZSS\_NMEA

The receiver support new NMEA format for QZSS. The command allow user enable or disable QZSS NMEA format. Default is disable QZSS NMEA format. (use NMEA 0183 V3.01)

Keep status after reboot -> Yes.

Table 2-5233: 351 PMTK\_API\_SET\_SUPPORT\_QZSS\_NMEA Data Format

<b>DataField:</b> PMTK351,Enabled			
<b>Example:</b> \$PMTK351,0*29 : Disable QZSS NMEA format \$PMTK351,1*28 : Enable QZSS NMEA format			
Name	Unit	Default	Description
Enabled	--	--	'0': Disable QZSS NMEA format '1': Enable QZSS NMEA format

### 2.3.27 Packet Type: 352 PMTK\_API\_SET\_STOP\_QZSS

Since QZSS is regional positioning service. The command allow user enable or disable QZSS function. Default is enable QZSS function.

Keep status after reboot -> Yes.

Table 2-5334: 352 PMTK\_API\_SET\_STOP\_QZSS Data Format

<b>DataField:</b> PMTK352,Enabled			
<b>Example:</b> \$PMTK352,0*2A : Enable QZSS function \$PMTK352,1*2B : Disable QZSS function			
Name	Unit	Default	Description
Enabled	--	--	'0': Enable QZSS function '1': Disable QZSS function

### 2.3.28 Packet Type: 353 PMTK\_API\_SET\_GNSS\_SEARCH\_MODE (NOT supported in AXN3.0 and AXN2.3)

This command is used to configure the receive to start searching of which satellite system.

The setting will be kept available when NVRAM data is valid.

Keep status after reboot -> Yes.

Table 2-5435: 353 PMTK\_API\_SET\_GNSS\_SEARCH\_MODE Data Format

<b>DataField:</b> PMTK353,			
----------------------------	--	--	--

GPS\_Enable, GLONASS\_Enable, GALILEO\_Enable, GALILEO\_FULL\_Enable, BEIDOU\_Enable

**Example:**

```
$PMTK353,0,1,0,0,0*2A<CR><LF> //Search GLONASS satellites only
$PMTK353,1,0,0,0,0*2A<CR><LF> //Search GPS satellites only
$PMTK353,1,1,0,0,0*2B<CR><LF> //Search GPS and GLONASS satellites
$PMTK353,1,1,1,0,0*2A<CR><LF> //Search GPS, GLONASS, GALILEO satellites
$PMTK353,0,0,0,0,1*2A<CR><LF> //Search BEIDOU satellites only
$PMTK353,1,0,0,0,1*2B<CR><LF> //Search GPS and BEIDOU satellites
```

Name	Unit	Default	Description
GPS_Enabled			'0':disable(DO NOT search GPS satellites) '1' or non-ZERO: search GPS satellites
GLONASS_Enabled			'0':disable(DO NOT search GLONASS satellites) '1' or non-ZERO: search GLONASS satellites
GALILEO_Enabled			'0':disable(DO NOT search GALILEO satellites) '1' or non-ZERO: search GALILEO satellites
GALILEO_FULL_Enabled			'0':disable (DO NOT search GALILEO FULL mode satellites) '1' or non-ZERO: search GALILEO satellites
BEIDOU_Enabled			'0':disable(DO NOT search BEIDOU satellites) '1' or non-ZERO: search BEIDOU satellites

*Note: GLONASS only, BEIDOU only, and GALILEO only mode is only for testing purpose. Please use GPS + GLONASS or GPS + BEIDOU in the real application, GLONASS and BEIDOU cannot be enabled at the same time.*

### 2.3.29 Packet Type: 356 PMTK\_API\_SET\_HDOP\_THRESHOLD

This command is to set the HDOP threshold. If the HDOP value is larger than this threshold value, the position will not be fixed.

Table 2-5536: 356 PMTK\_API\_SET\_HDOP\_THRESHOLD Data Format

**DataField:** PMTK356,HDOPThreshold Set OK!

**Example:**

```
$PMTK356,0.8*38
Return $PMTK356,0.8 Set OK!*5F
```

Name	Unit	Default	Description
HDOPThreshold			'0':Disable this function Other value: Enable set the HDOP threshold

### 2.3.30 Packet Type: 357 PMTK\_API\_GET\_HDOP\_THRESHOLD

This command is to get the HDOP threshold.

Table 2-5637: 357 PMTK\_API\_GET\_HDOP\_THRESHOLD Data Format

<b>DataField:</b> PMTK357,HDOPThreshold			
<b>Example:</b> \$PMTK357,1*2E Return \$PMTK357,-1610612736.0*2D			
Name	Unit	Default	Description
HDOPThreshold			'0':Disable Other value: Enable

### 2.3.31 Packet Type: 386 PMTK\_API\_SET\_STATIC\_NAV\_THD

Set the speed threshold for static navigation. If the actual speed is below the threshold, output position will keep the same and output speed will be zero. If threshold value is set to 0, this function is disabled.

Table 2-5738: 386 PMTK\_API\_SET\_STATIC\_NAV\_THD Data Format

<b>DataField:</b> PMTK386, speed_threshold			
<b>Example:</b> \$PMTK386,0.4*39<CR><LF>			
Name	Unit	Default	Description
Speed_trhreshold	m/s	--	0~2 The minimum is 0.1 m/s, the max is 2.0 m/s

### 2.3.32 Packet Type: 399 PMTK\_API\_SET\_FLASH\_DATA

Write data to the flash.

Table 2-5839: 399 PMTK\_API\_SET\_FLASH\_DATA Data Format

<b>DataField:</b> PMTK399,Address,Length,Data0,Data1,Data2,.....			
<b>Example:</b> \$PMTK399,1c0,7,30,5c,22,1D,02,04,01*6F<CR><LF>			
Name	Unit	Default	Description
Address			The starting address in hex format(the address is fixed at 0x1C0)
Length			The number of bytes of incoming data fields in hex format(Mad length = 7 bytes)
DataN			Data type in hex format

### 2.3.33 Packet Type: 400 PMTK\_API\_Q\_FIX\_CTL

API\_Query\_Fix\_Ctl, Query Fix Control.

Table 2-5940: 400 PMTK\_API\_Q\_FIX\_CTL Data Format

<b>DataField:</b> PMTK400			
<b>Example:</b> \$PMTK400*36<CR><LF>			
<b>Return:</b> PMTK_DT_FIX_CTL (See Packet Type: 500)			
Name	Unit	Default	Description
--	--	--	--

### 2.3.34 Packet Type: 401 PMTK\_API\_Q\_DGPS\_MODE

Query DGPS mode.

Table 2-6041: 401 PMTK\_API\_Q\_DGPS\_MODE Data Format

<b>DataField:</b> PMTK401			
<b>Example:</b> \$PMTK401*37<CR><LF>			
<b>Return:</b> PMTK_DT_DGPS_MODE			
Name	Unit	Default	Description
--	--	--	--

### 2.3.35 Packet Type: 414 PMTK\_API\_Q\_NMEA\_OUTPUT

Query current NMEA sentence output frequencies.

Table 2-6542: 414 PMTK\_API\_Q\_NMEA\_OUTPUT Data Format

<b>DataField:</b> PMTK414			
<b>Example:</b> \$PMTK414*33<CR><LF>			
<b>Return:</b> PMTK_DT_NMEA_OUTPUT			
Name	Unit	Default	Description
--	--	--	--

**Note:**

*PMTK414 command for query, PMTK514 is response to PMTK414, and PMTK314 is set command.*

### 2.3.36 Packet Type: 435 PMTK\_API\_Q\_RTC\_TIME

Query current RTC UTC time.

Table 2-6843: 435 PMTK\_API\_Q\_RTC\_TIME Data Format

<b>DataField:</b> PMTK435			
<b>Example:</b> \$PMTK435*30<CR><LF>			
<b>Return:</b> PMTK_API_DT_RTC_TIME			

Name	Unit	Default	Description

### 2.3.37 Packet Type: 499 PMTK\_API\_GET\_FLASH\_DATA

Read the flash memory.

Table 2-7244: 499 PMTK\_API\_GET\_FLASH\_DATA Data Format

<b>DataField:</b> PMTK499,Address,Length			
<b>Example:</b> \$PMTK499,1C0,7*43<CR><LF>			
<b>Return:</b> PMTK_DT_FLASH_DATA			
Name	Unit	Default	Description
Address			the starting address in hex format.( The address is fixed at 0x1C0)
Length			The number of bytes requested in hex format(Max length is 7 bytes)

### 2.3.38 Packet Type: 514 PMTK\_DT\_NMEA\_OUTPUT

This is a response to PMTK414, which return current NMEA sentence output frequency setting.

Table 2-7445: 514 PMTK\_DT\_NMEA\_OUTPUT Data Format

<b>DataField:</b> PMTK514			
<b>Example:</b> \$PMTK514,1,1,1,1,1,5,1,1,1,1,1,0,1,1,1,1,1,1*37<CR><LF>			
Name	Unit	Default	Description
			There are totally <b>20</b> data fields that present output frequencies for the <b>20</b> supported NMEA sentences individually. Please refer to PMTK_API_SET_NMEA_OUTPUT for the Supported NMEA Sentences and Frequency Setting.

### 2.3.39 Packet Type: 602 PMTK\_Q\_DATA\_PORT

Read data port input/output data type and baudrate.

Table 2-7846: 602 PMTK\_Q\_DATA\_PORT Data Format

<b>DataField:</b> PMTK602			
<b>Example:</b> \$PMTK602*36<CR><LF>			

<b>Return:</b> PMTK_DT_DATA_PORT			
Name	Unit	Default	Description

### 2.3.40 Packet Type: 605 PMTK\_Q\_RELEASE

Query the firmware release information.

Table 2-7947: 605 PMTK\_Q\_RELEASE Data Format

<b>DataField:</b> PMTK605			
<b>Example:</b> \$PMTK605*31<CR><LF>			
<b>Return:</b> PMTK_DT_RELEASE			
Name	Unit	Default	Description
--	--	--	--

### 2.3.41 Packet Type: 607 PMTK\_Q\_EPO\_INFO

Query the EPO data status stored in the GPS chip.

Table 2-8048: 607 PMTK\_Q\_EPO\_INFO Data Format

<b>DataField:</b> PMTK607			
<b>Example:</b> \$PMTK607*33<CR><LF>			
<b>Return:</b> PMTK_DT_EPO_INFO			
Name	Unit	Default	Description
--	--	--	--

### 2.3.42 Packet Type: 660 PMTK\_Q\_AVAILABLE\_SV\_EPH

Support PMTK660 which report valid Ephemeris SV:

- (a) Host -> module: A PMTK660 command to request the EPH info, together with a time interval parameter (for example, 1800sec).
- (b) module -> Host: Reply 32-bit flags of 32SV to indicate which EPHs will be available after the specified time interval.

Table 2-8249: 660 PMTK\_Q\_AVAILABLE\_SV\_EPH Data Format

<b>DataField:</b> PMTK660, Time interval			
<b>Example:</b> Indicate which EPHs will be available after 1800 seconds \$PMTK660,1800*17<CR><LF>			

**Return:**

\$PMTK001,660,3,40449464\*17<CR><LF>

Note the Hex 40449464 means 0100 0000 0100 0100 1001 0100 0110 0100 and the Valid SV's numbers are 3, 6, 7, 11, 13, 16, 19, 23, 31.

Name	Unit	Default	Description
Time interval	sec	--	Set the time interval for MT3329 to reply 32-bit flags of 32SV. The Time interval > 0 and <= 7200 (2 hours).

### 2.3.43 Packet Type: 661 PMTK\_Q\_AVAILABLE\_SV\_ALM

Support PMTK661 which report valid Almanac SV

- (a) Host -> MT3329: A PMTK661 command to request the Almanac info, together with a time interval parameter (for example, 30 days).
- (b) MT3329 -> Host: Reply 32-bit flags of 32SV to indicate which Almanac will be available after the specified time interval.

Table 2-8350: 661 PMTK\_Q\_AVAILABLE\_SV\_ALM Data Format

<b>DataField:</b> PMTK661,Time interval			
<b>Example:</b> Indicate which Almanac will be available after 30 days \$PMTK661,30*1C<CR><LF>			
<b>Return:</b> \$PMTK001,661,3,fec0bfff*49<CR><LF> Note the Hex fec0bfff means 111111011000000101111111111111 and the Valid SV's numbers are 1,2,3,4,5,6,7,8,9,10,11,12,13,14,16,23,24,26,27,28,29,30,31,32.			
Name	Unit	Default	Description
Time interval	day	--	Set the time interval for MT3329 to reply 32-bit flags of 32SV. Note that the Time interval > 0 and <= 365 (1 year for maximum)

### 2.3.44 Packet Type: 705 PMTK\_DT\_RELEASE

Firmware release information.

Table 2-8951: 705 PMTK\_DT\_RELEASE Data Format

<b>DataField:</b> PMTK705,ReleaseStr,Build_ID,Product_Model,(SDK_Version,)			
<b>Example:</b> \$PMTK705,AXN_2.32_3337_15010801,0000,,*2D<CR><LF>			
Name	Unit	Default	Description
ReleaseStr	--	--	Firmware release name and version:

			3318 : Mcore_x.x 3329 : AXN_x.x
Build_ID	--	--	Build ID set in CoreBuilder for firmware version control
Product_Model	--	--	Product Model set in CoreBuilder for product identification
SDK_Version	--	--	Showing SDK version if the firmware is used for SDK

### 2.3.45 Packet Type: 740 PMTK\_DT\_UTC

The packet contains current UTC time. Please do not use local time, which has time-zone offset. To have faster TTFF, the accuracy of reference UTC shall be better less than 3 seconds.

Keep status after reboot -> Yes.

Table 2-9152: 740 PMTK\_DT\_UTC Data Format

<b>DataField:</b> PMTK740,YYYY,MM,DD,hh,mm,ss*CS<CR><LF>			
<b>Example:</b> The packet indicates that the current UTC time 2010/Feb/10 09:00:58. \$PMTK740,2010,2,10,9,0,58*05<CR><LF>			
Name	Unit	Range	Description
YYYY	year	> 1980	UTC time: year in 4 digits
MM	month	1 - 12	UTC time: month
DD	day	1 - 31	UTC time: day
hh	hour	0 - 23	UTC time: hour
mm	minute	0 - 59	UTC time: minute
ss	second	0 - 59	UTC time: second
cs			8-bit accumulative checksum of all bytes in-between the \$ and * characters in hexadecimal

### 2.3.46 Packet Type: 721 PMTK\_DT\_SV\_EPO

The packet contains GPS EPO data for a single satellite.

Table 2-9253: 721 PMTK\_DT\_SV\_EPO Data Format

<b>DataField:</b> \$PMTK721,SatID,W[0],...,W[17]*CS<CR><LF>			
<b>Example:</b> The packet contains EPO data of satellite PRN 17. \$PMTK721,11,6a043d2f,d52e00,0d2f1a3d,....,.....*CS<CR><LF>			
Name	Unit	Range	Description
SatID	---	1~32	Satellite PRN number [Represented in HEX characters] for the EPO data to follow
W[0] ~ W[17]	---	---	words [LSB first] of one EPO segment data (total 72 bytes)
cs			8-bit accumulative checksum of all bytes in-between the \$ and * characters in hexadecimal



### 2.3.47 Packet Type: 741 PMTK\_DT\_POS

According to the few hardware design that did not keep VBAT power to keep NVRAM data, it would cause GPS always get COLD Start when power on device and then get the long time fixed and poor accuracy. MTK designed the command to assist customer to resolve above issue. User could perform the command to inject the last fixed position information into this GPS device to have faster TTFF. The reference time information in this PMTK command represents when do you recorded this location from the GPS. Please send PMTK740 to inject time before sending PMTK741.

The packet contains reference location for the GPS receiver. To have faster TTFF, the accuracy of the location shall be better than 30km.

Keep status after reboot -> Yes.

Table 2-9354: 741 PMTK\_DT\_POS Data Format

**DataField:** \$PMTK741,Lat,Long,Alt,YYYY,MM,DD,hh,mm,ss \*CS<CR><LF>

**Example:** The packet indicates that GPS receiver is at latitude 24.772816 degrees, longitude 121.022636 degrees, and altitude 160m at UTC 2016/1/1 12:00:00. If GPS receiver was powered on at UTC 2016/1/2 12:00:00, you could send the following command to inject the location information to GPS receiver.

\$PMTK741,24.772816,121.022636,160,2016,01,01,12,00,00\*17

Name	Unit	Range	Description
Lat	degree	-90.0 ~ 90.0	WGS84 geodetic latitude. NOTE: suggest to express this value in floating-point with 6 decimal points Minus: south; Plus: north
Long	degree	-180.0 ~ 180.0	WGS84 geodetic longitude. NOTE: suggest to express this value in floating-point with 6 decimal points Minus: west; Plus: east
Alt	m	---	WGS84 ellipsoidal altitude.
YYYY	year	> 1980	Reference UTC time: year in 4 digits
MM	month	1 - 12	Reference UTC time: month
DD	day	1 - 31	Reference UTC time: day
hh	hour	0 - 23	Reference UTC time: hour
mm	minute	0 - 59	Reference UTC time: minute
ss	second	0 - 59	Reference UTC time: second
cs			8-bit accumulative checksum of all bytes in-between the \$ and * characters in hexadecimal

**Note:**

*GPS chip will check value range for the following parameters:*

*Lat: -90.0 ~ 90.0,*

*Long: -180.0 ~ 180.0*

### 2.3.48 Packet Type: 810 PMTK\_TEST\_ALL

Enter MP test mode and set test item and SV id.

Table 2-9455: 810 PMTK\_TEST\_ALL Data Format

<b>DataField:</b> \$PMTK810,Bitmap,SVID*CS<CR><LF>			
<b>Example:</b> \$PMTK810,0003,1D*4D<CR><LF>			
This command only tests TEST_INFO and TEST_ACQ test items.The specific SV id is PRN29.			
Name	Unit	Range	Description
Bitmap	--	--	The first data field means the test items. Each bit of test item field means one test item. List these test items below. Supported Test Items Bit0 TEST_INFO // Include f/w version, NMEA type and NMEA output rate Bit1 TEST_ACQ // the time of acquiring the specific SV Bit2 TEST_BITSYNC // the time of bit sync Bit3 TEST_SIGNAL // Include phase error, TCXO clock/drift and CNR mean/sigma Bit4 -15 (Reserved)
SVID	--	1~20	The second means the SV id. The value of SV id is between 1 and 20 in Hex format. The value of Glonass SVID is Frequency ID which is between C9 and D6 in Hex format.

Note. Glonass frequency id representation

- 7 = C9
- 6 = CA
- 5 = CB
- 4 = CC
- 3 = CD
- 2 = DE
- 1 = CF
- 0 = D0
- 1 = D1
- 2 = D2
- 3 = D3
- 4 = D4
- 5 = D5
- 6 = D6

### 2.3.49 Packet Type: 811 PMTK\_TEST\_STOP

Testing tool could send this command to GPS receiver to leave MP test mode.

Table 2-9556: 811 PMTK\_TEST\_STOP Data Format

<b>DataField:</b> PMTK811			
<b>Example:</b> \$PMTK811*3A<CR><LF>			
Name	Unit	Default	Description
--	--	--	--

### 2.3.50 Packet Type: 837 PMTK\_TEST\_JAMMING (NOT supported in AXN3.0)

Jamming scan test command.

Table 2-10057: 837 PMTK\_TEST\_JAMMING Data Format

<b>DataField:</b> PMTK837, JamScanType, JamScanNum			
<b>Example:</b> \$PMTK837,0,50*0B<CR><LF> GPS jamming scan test 50 times \$PMTK837,1,50*0A<CR><LF> GLONASS jamming scan test 50 times \$PMTK837,2,50*09<CR><LF> BEIDOU jamming scan test 50 times			
Name	Unit	Range	Description
JamScanType	--	--	'0' : Enable GPS jamming scan '1' : Enable GLONASS jamming scan '2' : Enable BEIDOU jamming scan
JamScanNum	--	--	Jamming scan test times.

### 2.3.51 Packet Type: 869 PMTK\_EASY\_ENABLE

Enable or disable EASY function. Query if EASY is enabled or disabled.

Keep statue after reboot -> Yes.

Table 2-10158: 869 PMTK\_EASY\_ENABLE Format

<b>DataField:</b> PMTK869, CmdType, [Enable], [Extension Day]			
<b>Example:</b> To enable EASY, use \$PMTK869,1,1*35<CR><LF> To disable EASY, use \$PMTK869,1,0*36<CR><LF> To query if EASY is enabled or disabled, use \$PMTK869,0*29<CR><LF>			

If EASY is disabled, the receiver returns  
\$PMTK869,2,0,0\*37<CR><LF>

If EASY is enabled and is not finished yet, the receiver may returns  
\$PMTK869,2,1,0\*2A<CR><LF>

If EASY is enabled and is finished 1-day extension, the receiver may returns  
\$PMTK869,2,1,1\*2B<CR><LF>

If EASY is enabled and is finished 2-day extension, the receiver may returns  
\$PMTK869,2,1,2\*28<CR><LF>

If EASY is enabled and is finished 3-day extension, the receiver may returns  
\$PMTK869,2,1,3\*29<CR><LF>

Name	Unit	Range	Description
CmdType	--	--	Set or query 0: Query 1: Set 2: Result for query operation
Enabled	--	--	Enable or disable 0: Disable 1: Enable
Extension Day			Finished extension day

### 2.3.52 Packet Type: 886 PMTK\_FR\_MODE

Set navigation mode

Table 2-10359: 886 PMTK\_FR\_MODE Data Format

<b>DataField:</b> \$PMTK886,CmdType			
<b>Example:</b> \$PMTK886,0*28<CR><LF> :Enter normal mode. \$PMTK886,1*29<CR><LF> :Enter fitness mode. \$PMTK886,2*2A<CR><LF> :Enter aviation mode. \$PMTK886,3*2B<CR><LF> :Enter balloon mode. \$PMTK886,4*2C<CR><LF> :Enter stationary mode.			
<b>Return:</b> \$PMTK001,886,3*36<CR><LF>			
Name	Unit	Range	Description
CmdType	--	--	'0': Normal mode: For general purpose '1': Fitness mode: For running and walking purpose that the low-speed (< 5m/s) movement will have more effect on the position calculation. '2': Aviation mode: For high-dynamic purpose that the large-acceleration movement will have more effect on the

			<p>position calculation.</p> <p>'3': Balloon mode: For high-altitude balloon purpose that the vertical movement will have more effect on the position calculation.</p> <p>'4': Stationary mode: For stationary applications that zero dynamics is assumed.</p>
--	--	--	--

*Note: Each mode has its altitude limitation. Please base on below table to choose the appropriate mode. If your test scenario exceeds the limitation, the position calculation will be incorrect.*

Mode	Altitude Limitation
Normal mode	10000 m
Fitness mode	10000 m
Aviation mode	10000 m
Balloon mode	80000 m

## Appendix A: Datum List

No	Datum	Region
0	WGS1984	International
1	Tokyo	Japan
2	Tokyo	Mean For Japan, South Korea, Okinawa
3	User Setting	User Setting
4	Adindan	Burkina Faso
5	Adindan	Cameroon
6	Adindan	Ethiopia
7	Adindan	Mali
8	Adindan	Mean For Ethiopia, Sudan
9	Adindan	Senegal
10	Adindan	Sudan
11	Afgooye	Somalia
12	Ain El Abd1970	Bahrain
13	Ain El Abd1970	Saudi Arabia
14	American Samoa1962	American Samoa Islands
15	Anna 1 Astro1965	Cocos Island
16	Antigua Island Astro1943	Antigua(Leeward Islands)
17	Arc1950	Botswana
18	Arc1950	Burundi
19	Arc1950	Lesotho
20	Arc1950	Malawi
21	Arc1950	Mean For Botswana, Lesotho, Malawi, Swaziland, Zaire, Zambia, Zimbabwe
22	Arc1950	Swaziland
23	Arc1950	Zaire
24	Arc1950	Zambia
25	Arc1950	Zimbabwe
26	Arc1960	Mean For Kenya Tanzania
27	Arc1960	Kenya
28	Arc1960	Tanzania
29	Ascension Island1958	Ascension Island

30	Astro Beacon E 1945	Iwo Jima
31	Astro Dos 71/4	St Helena Island
32	Astro Tern Island (FRIG) 1961	Tern Island
33	Astronomical Station 1952	Marcus Island
34	Australian Geodetic 1966	Australia, Tasmania
35	Australian Geodetic 1984	Australia, Tasmania
36	Ayabelle Lighthouse	Djibouti
37	Bellevue (IGN)	Efate and Erromango Islands
38	Bermuda 1957	Bermuda
39	Bissau	Guinea-Bissau
40	Bogota Observatory	Colombia
41	Bukit Rimpah	Indonesia(Bangka and Belitung Ids)
42	Camp Area Astro	Antarctica(McMurdi Camp Area)
43	Campo Inchauspe	Argentina
44	Canton Astro1966	Phoenix Island
45	Cape	South Africa
46	Cape Canaveral	Bahamas, Florida
47	Carthage	Tunisia
48	Chatham Island Astro1971	New Zealand(Chatham Island)
49	Chua Astro	Paraguay
50	Corrego Alegre	Brazil
51	Dabola	Guinea
52	Deception Island	Deception Island, Antarctica
53	Djakarta (Batavia)	Indonesia(Sumatra)
54	Dos 1968	New Georgia Islands (Gizo Island)
55	Easter Island 1967	Easter Island
56	Estonia Coordinate System1937	Estonia
57	European 1950	Cyprus
58	European 1950	Egypt
59	European 1950	England, Channel Islands, Scotland, Shetland Islands
60	European 1950	England, Ireland, Scotland, Shetland Islands
61	European 1950	Finland, Norway
62	European 1950	Greece
63	European 1950	Iran
64	European 1950	Italy (Sardinia)
65	European 1950	Italy (Sicily)

66	European 1950	Malta
67	European 1950	Mean For Austria, Belgium,Denmark, Finland, France, W Germany, Gibraltar, Greece, Italy, Luxembourg, Netherlands, Norway, Portuga,l Spain, Sweden, Switzerland
68	European 1950	Mean For Austria, Debnmark,France, W Germany, Netherland , Switzerland
69	European 1950	Mean For Irag, Israel, Jordan, Lebanon, Kuwait, Saudi Arabia, Syria
70	European 1950	Portugal, Spain
71	European 1950	Tunisia,
72	European 1979	Mean For Austria, Finland ,Netherlands ,Norway, Spain, Sweden, Switzerland
73	Fort Thomas 1955	Nevis St Kitts (Leeward Islands)
74	Gan 1970	Republic Of Maldives
75	Geodetic Dataum 1970	New Zealand
76	Graciosa Base SW1948	Azores (Faial, Graciosa, Pico, Sao, Jorge, Terceria)
77	Guam1963	Guam
78	Gunung Segara	Indonesia (Kalimantan)
79	Gux I Astro	Guadalcanal Island
80	Herat North	Afghanistan
81	Hermannskogel Datum	Croatia-Serbia, Bosnia-Herzegovina
82	Hjorsey 1955	Iceland
83	Hongkong 1963	Hongkong
84	Hu Tzu Shan	Taiwan
85	Indian	Bangladesh
86	Indian	India,Nepal
87	Indian	Pakistan
88	Indian 1954	Thailand
89	Indian 1960	Vietnam (Con Son Island)
90	Indian 1960	Vietnam (Near 16 deg N)
91	Indian 1975	Thailand
92	Indonesian 1974	Indonesian
93	Ireland 1965	Ireland
94	ISTS 061 Astro 1968	South Georgia Islands
95	ISTS 073 Astro 1969	Diego Garcia
96	Johnston Island 1961	Johnston Island



97	Kandawala	Sri Lanka
98	Kerguelen Island 1949	Kerguelen Island
99	Kertau 1948	West Malaysia and Singapore
100	Kusaie Astro 1951	Caroline Islands
101	Korean Geodetic System	South Korea
102	LC5 Astro 1961	Cayman Brac Island
103	Leigon	Ghana
104	Liberia 1964	Liberia
105	Luzon	Philippines (Excluding Mindanao)
106	Luzon	Philippines (Mindanao)
107	M'Poraloko	Gabon
108	Mahe 1971	Mahe Island
109	Massawa	Ethiopia (Eritrea)
110	Merchich	Morocco
111	Midway Astro 1961	Midway Islands
112	Minna	Cameroon
113	Minna	Nigeria
114	Montserrat Island Astro 1958	Montserrat (Leeward Island)
115	Nahrwan	Oman (Masirah Island)
116	Nahrwan	Saudi Arabia
117	Nahrwan	United Arab Emirates
118	Naparima BWI	Trinidad and Tobago
119	North American 1927	Alaska (Excluding Aleutian Ids)
120	North American 1927	Alaska (Aleutian Ids East of 180 degW)
121	North American 1927	Alaska (Aleutian Ids West of 180 degW)
122	North American 1927	Bahamas (Except San Salvador Islands)
123	North American 1927	Bahamas (San Salvador Islands)
124	North American 1927	Canada (Alberta, British Columbia)
125	North American 1927	Canada (Manitoba, Ontario)
126	North American 1927	Canada (New Brunswick, Newfoundland, Nova Scotia, Qubec)
127	North American 1927	Canada (Northwest Territories, Saskatchewan)
128	North American 1927	Canada (Yukon)
129	North American 1927	Canal Zone
130	North American 1927	Cuba
131	North American 1927	Greenland (Hayes Peninsula)

132	North American 1927	Mean For Antigua, Barbados, Barbuda, Caicos Islands, Cuba, Dominican, Grand Cayman, Jamaica, Turks Islands
133	North American 1927	Mean For Belize, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua
134	North American 1927	Mean For Canada
135	North American 1927	Mean For Conus
136	North American 1927	Mean For Conus (East of Mississippi, River Including Louisiana, Missouri, Minnesota)
137	North American 1927	Mean For Conus (West of Mississippi, Rive Excluding Louisiana, Minnesota, Missouri)
138	North American 1927	Mexico
139	North American 1983	Alaska (Excluding Aleutian Ids)
140	North American 1983	Aleutian Ids
141	North American 1983	Canada
142	North American 1983	Conus
143	North American 1983	Hahawii
144	North American 1983	Mexico, Central America
145	North Sahara 1959	Algeria
146	Observatorio Meteorologico 1939	Azores (Corvo and Flores Islands)
147	Old Egyptian 1907	Egypt
148	Old Hawaiian	Hawaii
149	Old Hawaiian	Kauai
150	Old Hawaiian	Maui
151	Old Hawaiian	Mean For Hawaii, Kauai, Maui, Oahu
152	Old Hawaiian	Oahu
153	Oman	Oman
154	Ordnance Survey Great Britian 1936	England
155	Ordnance Survey Great Britian 1936	England, Isle of Man, Wales
156	Ordnance Survey Great Britian 1936	Mean For England ,Isle of Man, Scotland, Shetland Island, Wales
157	Ordnance Survey Great Britian 1936	Scotland, Shetland Islands
158	Ordnance Survey Great Britian 1936	Wales
159	Pico de las Nieves	Canary Islands

160	Pitcairn Astro 1967	Pitcairn Island
161	Point 58	Mean For Burkina Faso and Niger
162	Pointe Noire 1948	Congo
163	Porto Santo 1936	Porto Santo, Maderia Islands
164	Provisional South American 1956	Bolovia
165	Provisional South American 1956	Chile (Northern Near 19 deg S)
166	Provisional South American 1956	Chile (Southern Near 43 deg S)
167	Provisional South American 1956	Colombia
168	Provisional South American 1956	Ecuador
169	Provisional South American 1956	Guyana
170	Provisional South American 1956	Mean For Bolivia Chile, Colombia, Ecuador, Guyana, Peru, Venezuela
171	Provisional South American 1956	Peru
172	Provisional South American 1956	Venezuela
173	Provisional South Chilean 1963	Chile (Near 53 deg S) (Hito XVIII)
174	Puerto Rico	Puerto Rico, Virgin Islands
175	Pulkovo 1942	Russia
176	Qatar National	Qatar
177	Qornoq	Greenland (South)
178	Reunion	Mascarene Island
179	Rome 1940	Italy (Sardinia)
180	S-42 (Pulkovo 1942)	Hungary
181	S-42 (Pulkovo 1942)	Poland
182	S-42 (Pulkovo 1942)	Czechoslovakia
183	S-42 (Pulkovo 1942)	Lativa
184	S-42 (Pulkovo 1942)	Kazakhstan
185	S-42 (Pulkovo 1942)	Albania
186	S-42 (Pulkovo 1942)	Romania
187	S-JTSK	Czechoslovakia (Prior 1 Jan1993)
188	Santo (Dos) 1965	Espirito Santo Island
189	Sao Braz	Azores (Sao Miguel, Santa Maria Ids)

190	Sapper Hill 1943	East Falkland Island
191	Schwarzeck	Namibia
192	Selvagem Grande 1938	Salvage Islands
193	Sierra Leone 1960	Sierra Leone
194	South American 1969	Argentina
195	South American 1969	Bolivia
196	South American 1969	Brazil
197	South American 1969	Chile
198	South American 1969	Colombia
199	South American 1969	Ecuador
200	South American 1969	Ecuador (Baltra, Galapagos)
201	South American 1969	Guyana
202	South American 1969	Mean For Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Guyana, Paraguay, Peru, Trinidad and Tobago, Venezuela
203	South American 1969	Paraguay
204	South American 1969	Peru
205	South American 1969	Trinidad and Tobago
206	South American 1969	Venezuela
207	South Asia	Singapore
208	Tananarive Observatory 1925	Madagascar
209	Timbalai 1948	Brunei, E Malaysia (Sabah Sarawak)
210	Tokyo	Japan
211	Tokyo	Mean For Japan, South Korea, Okinawa
212	Tokyo	Okinawa
213	Tokyo	South Korea
214	Tristan Astro 1968	Tristan Da Cunha
215	Viti Levu 1916	Fiji (Viti Levu Island)
216	Voirol 1960	Algeria
217	Wake Island Astro 1952	Wake Atoll
218	Wake-Eniwetok 1960	Marshall Islands
219	WGS 1972	Global Definition
220	WGS 1984	Global Definition
221	Yacare	Uruguay
222	Zanderij	Suriname

## Appendix B: Related documents

- (1). NMEA-0183 Standard For Interfacing Marine Electronic Devices
- (2). MTK NMEA Packet User Manual(**Revision: 2.03**)
- (3). MTK\_NMEA\_Packet\_3

## Appendix C: Term abbreviation

Table 1-1: Term abbreviation

Term	Definition
1PPS	1 pulse per second
ABP	Almanac Based Position
ACK	Acknowledge
DGPS	Differential Global Positioning System
NMEA	National Marine Electronics Association
OSP	One Socket Protocol
SBAS	Satellite Based Augmentation System
SDK	Software Development Kit
SRAM	Static Random Access Memory
SW	Software
SVs	Satellites
PDOP	Position Dilution of Precision
HDOP	Horizontal Dilution of Precision
VDOP	Vertical Dilution of Precision

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