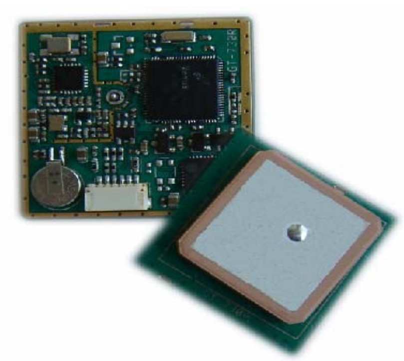
ME-1000RW

65 channels with ultra-high sensitive Smart GPS Antenna module

Technical Data Sheet

Version 1.2



Abstract
Technical data sheet describing the cost effective, high-performance ME-1000RW based series of ultra high sensitive GPS modules.

The smart GPS antenna ME-1000RW is a module that is sensitive to ***electrostatic dis- charge*** **(ESD)**. Please handle with appropriate care.

GPS Modules

Version History

Rev.	Date	Description
1.0	08-20-08	Initial Draft – preliminary information
1.1	10-12-08	Preliminary
1.2	01-20-09	Minor corrections

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1 Functional Description

1.1 Introduction

The SkyTrak ' smart GPS antenna ME-1000RW is a highly integrated GPS receiver module with and a ceramic GPS patch antenna. The antenna is connected to the module via an LNA. The module is with 51 channel acquisition engine and 14 channel track engine, which be capable of receiving signals from up to 65 GPS satellites and transferring them into the precise position and timing information that can be read over either UART port or RS232 serial port. Small size and high-end GPS functionality are at low power consumption, Both of the LVTTL-level and RS232 signal interface are provided on the interface connector, supply voltage of 3.3V~6.0V is supported.

The smart GPS antenna module is available as an off-the-shelf component, 100% tested. The smart GPS antenna module can be offered for OEM applications with the versatile adaptation in form and connection. Additionally, the antenna can be tuned to the final systems' circumstances.

1.2 Features

- 65 channel to acquire and track satellites simultaneously
- Industry-leading TTFF speed
- Signal detection better than -158 dBm
- 0.5 PPM TCXO for quick cold start
- Integral LNA with low power control
- SBAS (WAAS/EGNOS) capable
- Cold start < 35 sec
- Hot start < 10 sec
- Accuracy 5m CEP
- Operable at 3.3V-6V
- Both of RS232 and UART interface at CMOS level
- Small form factor of 33.9*33.9*9.2 mm
- Mountable without solder process

1.3 Applications

- Automotive and Marine Navigation
- Automotive Navigator Tracking
- Emergency Locator
- Geographic Surveying
- Personal Positioning
- Sporting and Recreation

1.4 Optional Accessories

ME-1000RW is with both of RS232 and UART interfaces, it is opened for the users to choose the versatile output cables assembly are as followings;

- PS2 output interface cable
- DB9 output interface cable
- RJ45 output interface cable
- RJ422 output interface cable

2 Characteristics

2.1 General Specification

The smart GPS antenna modules are characterized by the following parameters.

Parameter	Specification
Receiver Type	65 Channels GPS L1 frequency, C/A Code
Time-To-First-Fix	Cold Start (Autonomous) 32 s Warm Start (Autonomous) 32 s Hot Start (Autonomous) 10 s
Sensitivity	Tracking & Navigation -161 dBm Reacquisition -161 dBm Cold Start (Autonomous) -145 dBm
Accuracy	Autonomous 5 m CEP Velocity 0.1 m/sec (without aid)
Accuracy	RMS 30 ns 99% <60 ns Compensated[5] 15 ns[3]
Max Update Rate	1 Hz (default)
Velocity Accuracy	0.1m/s
Heading Accuracy	0.5 degrees
Dynamics	□ 4 g
Operational Limits	Velocity 515 m/s (1000 knots) Altitude <18000 meters

Table 1: ME-1000RW general specification

2.1 Serial Port Settings

The default configuration within the standard GPS firmware is:

- Standard configuration of serial port:
- Serial 0 (NMEA) 9600 baud, 8 data bits, no parity, 1 stop bit, no flow control Serial 0 (NMEA) 9600 baud, 8 data bits, no parity, 1 stop bit, no flow control

2.2 Improved TTFF

In order to improve the TTFF (Time To First Fix), ME-1000RW has been built with the back-up battery (SEIKO) to support the RTC with a back-up power when no system power is available.

2.4 Assisted GPS (A-GPS)

Supply of aiding information like ephemeris, almanac, rough last position and time and satellite status and an optional time synchronization signal will decrease time to first fix significantly and improve the acquisition sensitivity.

2.5 Operating Conditions

Description	Min	Typical	Max
V_{cc}	3.3V		6V
Peak Acquisition Current Average Acquisition Current Tracking Current		70 mA 45mA 35mA	

Table 2: Operating Conditions

2.6 Absolute Maximum Ratings

Ite	Absolute maximum ratings	Uni
RX0 input voltage	0~3.3 (Max 4.0V)	V
FRX0 input voltage	0~3.3 (Max 5.0V)	V
VCC input voltage	0~3.3 (Max 6.0V)	V

Table 3: Absolute maximum ratings

2.7 DC Electrical Characteristics

Item			Min.	TYP	Max	Unit	Notes
TX0	H	Voltage	2	-	3.3	V	
(Output)	L	Voltage	0	-	0.4	V	
RX0	H	Voltage	2	-	3.3	V	
(Input)	L	Voltage	0	--	0.4	V	
VCC		Voltage	3	3.3	3.6	V	
		Current	-	62mA	76mA	m	@3.3V

Table 4: DC Electrical characteristics

Stresses beyond those listed under "Absolute Maximum Ratings" maybe bring the permanent damage to the device. Functional operation of the device at these or any other condition beyond those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

2.8 GPS Status Indicator

The **ME-1000RW** provides GPS status indicator. On board LED shows fix or non-fix. In fix mode, the LED will be lighting by 1 second and turn-off by 1second. In another mode, it will be lighting by 2 seconds and turn-off by 2 seconds.

2.9 Mechanical Characteristics

Mechanical dimensions	Length	33.90mm
	Width	33.90mm
Weight		30g (may vary)

Table 5: ME-1000RW dimensions and weight

3. Communication Specifications

Ite	Descriptio
Interface	Full duplex serial interface
Bit rate	4800/9600/38400/115200bps
Start bit	1bit
Stop bit	1bit
Data bit	8bit
Parity	None
Transmission data	SACII NMEA0183 Ver:3.01
Update rate	1Hz
Output sentence	GGA/GSA/GSV/RMC(typ)

Table 6: Communication specifications

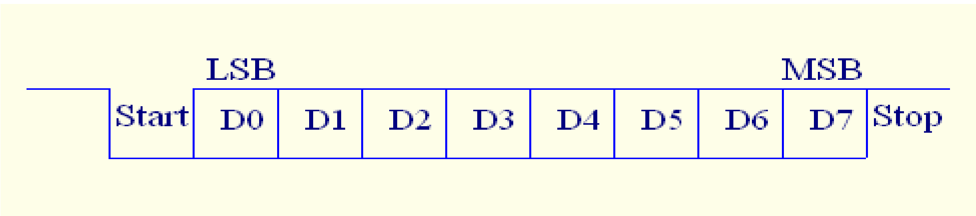


Fig. 1. Transmitting data stream

4. Connector

The connector mounted on the **ME-1000RW is** the ***Molex's*** connector type, the part number is 51021-0600. The mating plugs part number is 53261-0671.

5. Pin Assignments Information

Pin	Pin Name	Type	Function description
1	FTXD0	O	Serial Data output UART
2	FRXD0	I	Serial Data input UART
3	TXD0	O	Serial Data output RS-232
4	RXD0	I	Serial Data input RS-232
5	VIN	I	3.7~6 supply input
6	GND	O	GND

I: Input O: Output

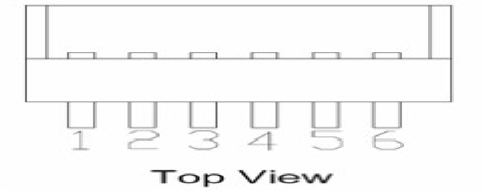
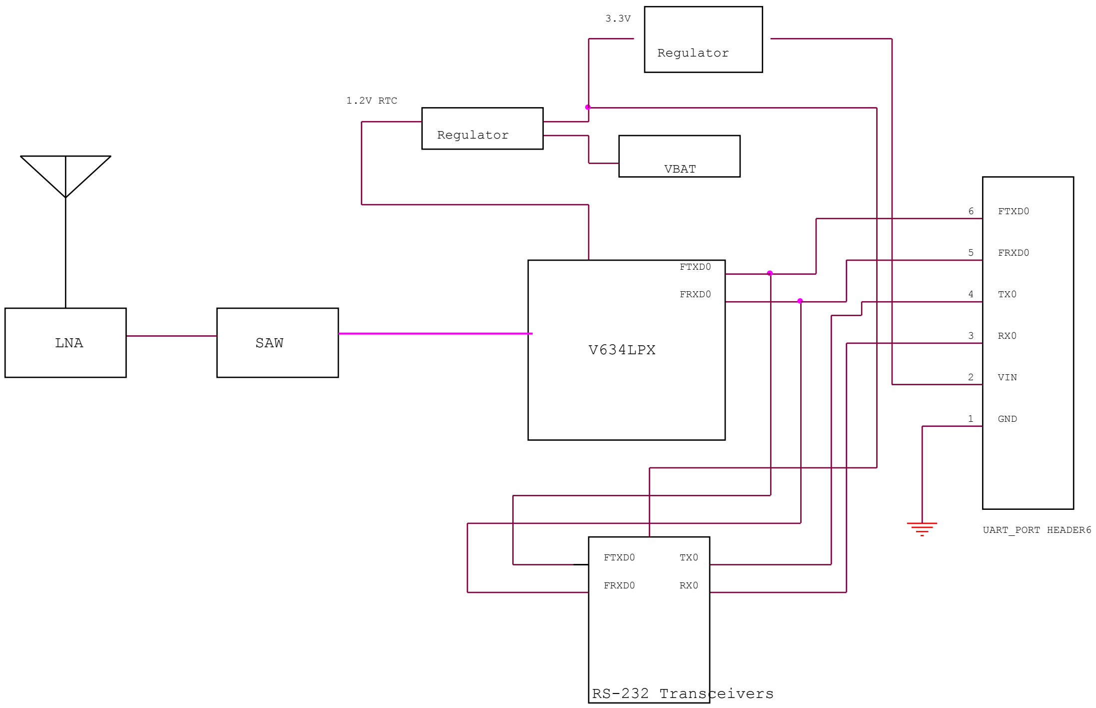


Table 6: Pin definition

6. Block Diagram



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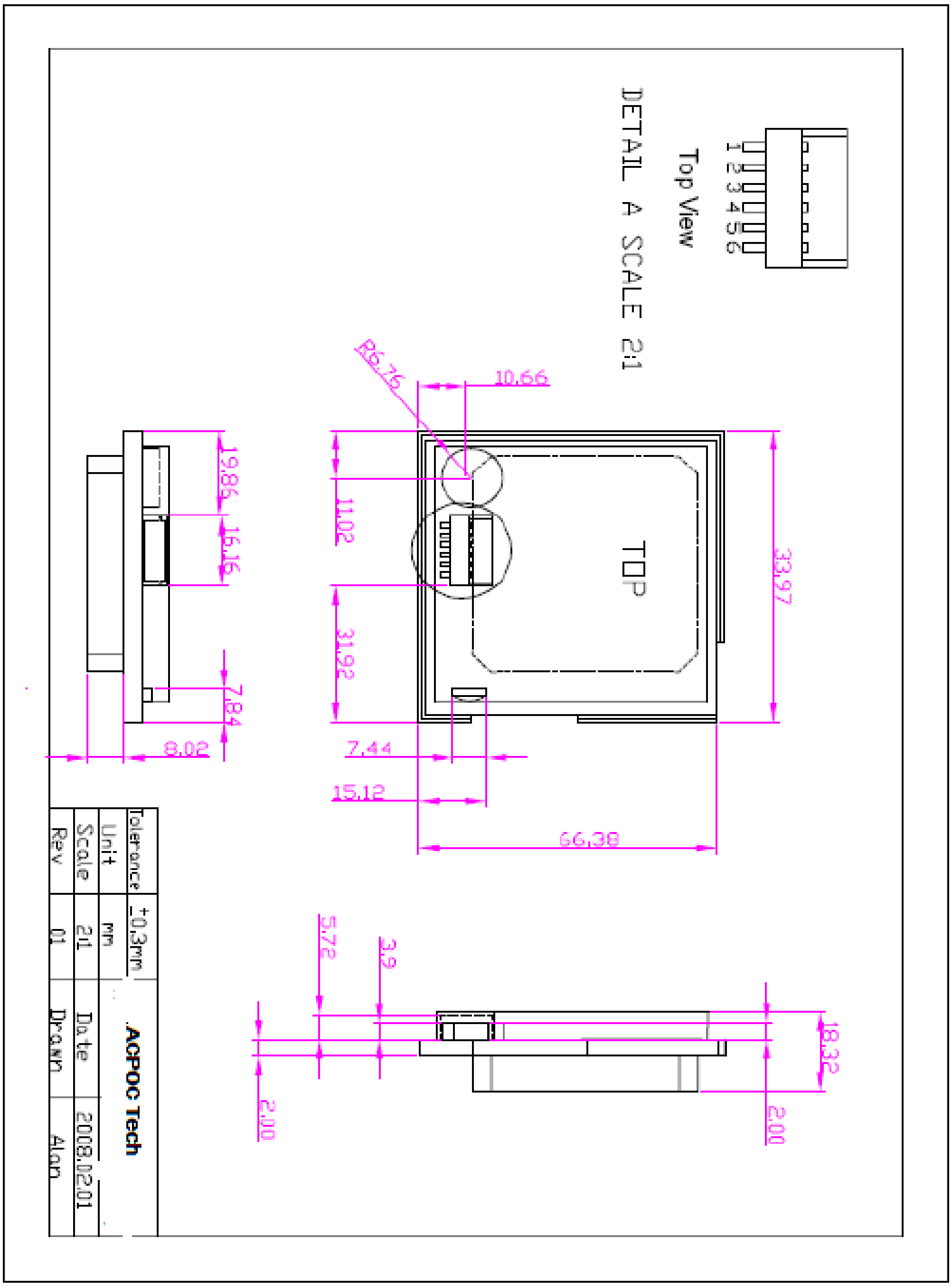
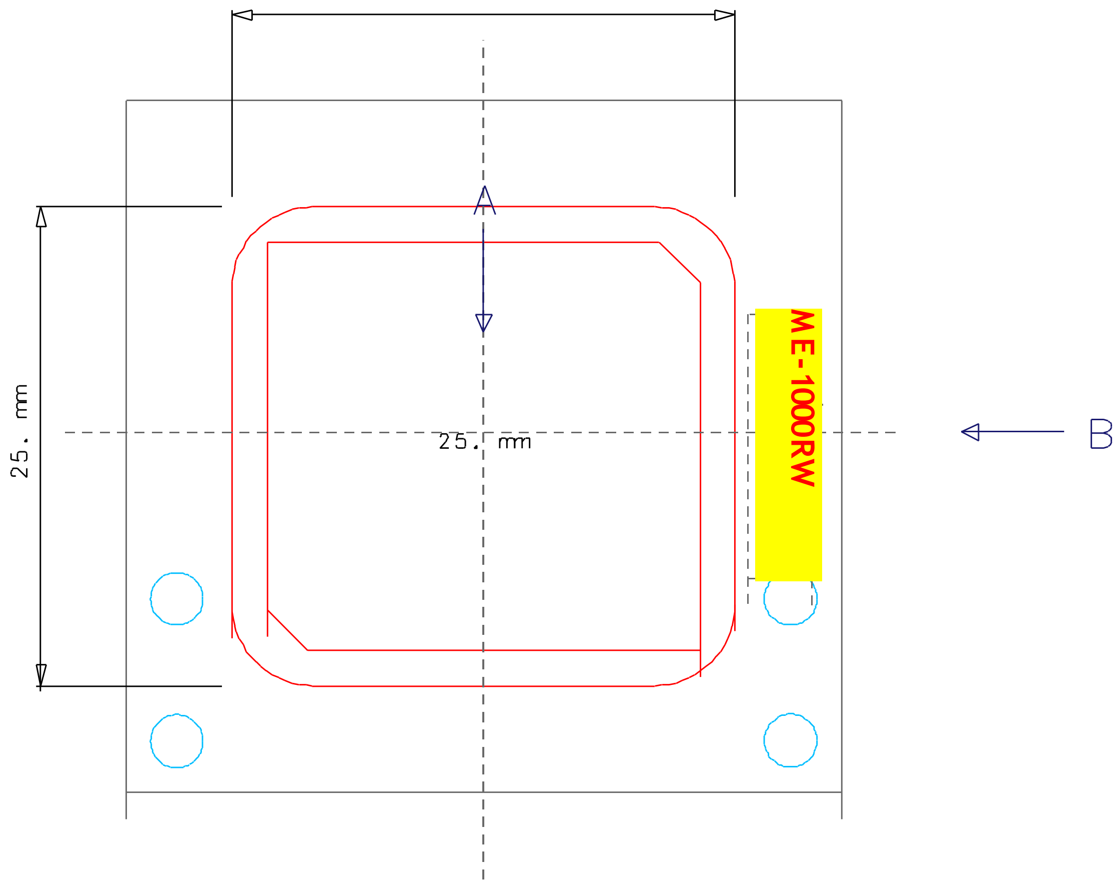
7. Mechanical Drawing Outline

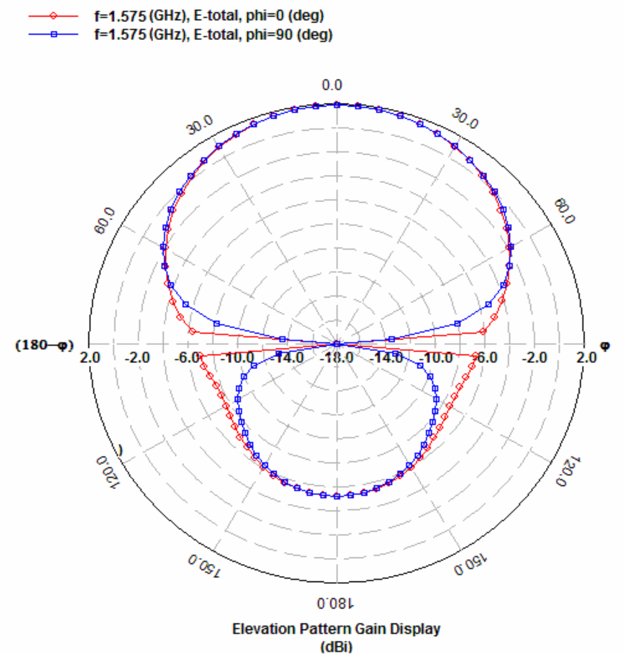




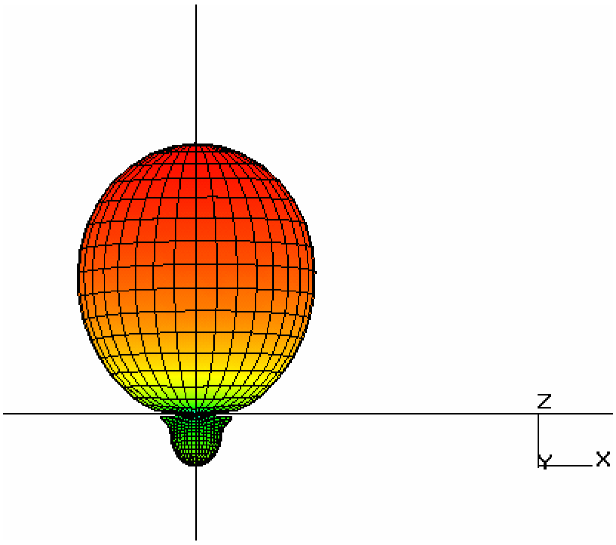
All dimensions in [mm]

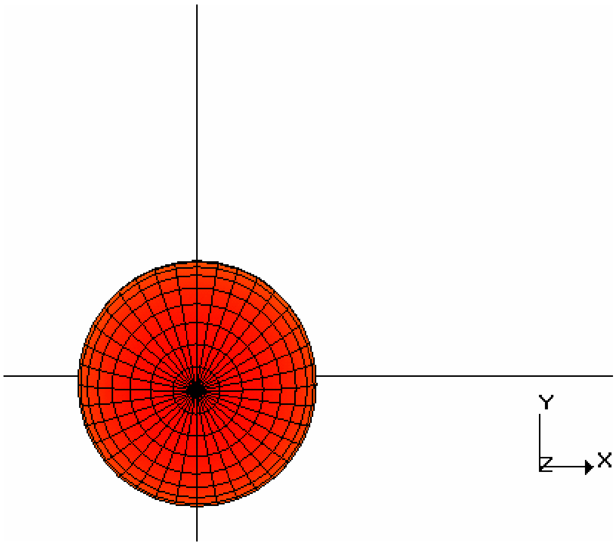
Figure 2: Mechanical outline overview ME-1000RW (top)

8. On-Board Patch Antenna



The **ME-1000RW** mounted a patch antenna which radiates normally to its patch surface the elevation for φ at 90 degrees would be important. Left figure shows the gain of the antenna at 1575MHz for φ = 90 degrees in the free space. The maximum gain is obtained in the broadside direction and this is Measured to be 2 dBi for φ at 90 degrees. The backlobe radiation is sufficiently small and is Measured to be -5.3 dBi for the left plot. The 3D plots for the antenna are shown in above Figure at different angles; it is easier to understand the radiation from the antenna.





(1) (2)

(1) 3D view of radiation pattern looking along the Y axis in the XZ plane

(2) 3D view of radiation pattern looking along the Z axis in the XY plane

When the ME-1000RW be placed into a device, its patch antenna flat surface orientation shall be toward the sky. Also do not put the metal material on the antenna, sometimes chooses the suitable material for converge the ME-1000RW if is required.

9 Quality and Reliability

9.1 Environmental Conditions

Parameter		Specification
Temperature	Operating	-20℃~+65℃
	Storage	-40℃~+80℃
Humidity		5%~95%
Storage		6 months in original vacuum package.

Table 7: Environmental conditions

9.2 Production Test

Each module is electrically tested prior to packing and shipping to ensure the GPS receiver performance and accuracy.

10 Brief application note

ME-1000RW can be applied to the versatile products, ex. PND (Portable Navigator Device), AVL (Automatic Vehicle Locator), Personal tracker or MPT (Mini Portable Tracker), Notebook/Netbook, marine, positioning/timing devices and so on.

Since ME-1000RW built in the internal patch antenna, we would like to submit the brief suggestions when users are in the designing stage. These suggestions will be helpful to avoid the RF (radio frequency) interference and noisy, and also furthermore improve the reception of GPS signals (S/N value).

10.1 Notes for the whole system:

- Radiation interference from the displaying panel
- Circuit layout between digital grand and analog ground
- Harmonic interference reduction (CPU, Crystal generator and VCO (voltage controller oscillator)
- The placement of the antenna

10.2 Notes for the mutual-interference between GSM antenna and GPS antenna

- Separate the two antenna as far as possible
- Add saw filter to reduce the GSM radiation interference
- Reduce the coupling from the ground or the signal line

If need the further assistance or the related information, please contact us

11. NMEA protocol

The serial interface protocol is based on the National Marine Electronics Association's NMEA 0183 ASCII interface specification. This standard is fully define in "NMEA 0183, Version 3.01" The standard may be obtained from NMEA, www.nmea.org

11.1 GGA-GLOBAL POSITIONING SYSTEM FIX DATA

Time, position and fix related data for a GPS receiver.

Structure:

$GPGGA,hhmmss.sss,ddmm.mmmm,a,dddmm.mmmm,a,x,xx,x.x,x.x,M,x.x,M,x.x,xxxx*hh<CR><LF>

1 2 3 4 5 6 7 8 9 10 11 12 13

Example:

$GPGGA,060932.448,2447.0959,N,12100.5204,E,1,08,1.1,108.7,M,,,,0000*0E<CR><LF>

Field	Name	Example	Description
1	UTC Time	060932.448	UTC of position in hhmmss.sss format, (000000.00 ~ 235959.99)
2	Latitude	2447.0959	Latitude in ddmm.mmmm format Leading zeros transmitted
3	N/S Indicator	N	Latitude hemisphere indicator, 'N' = North, 'S' = South
4	Longitude	12100.5204	Longitude in dddmm.mmmm format Leading zeros transmitted
5	E/W Indicator	E	Longitude hemisphere indicator, 'E' = East, 'W' = West
6	GPS quality indicator	1	GPS quality indicator 0: position fix unavailable 1: valid position fix, SPS mode 2: valid position fix, differential GPS mode 3: GPS PPS Mode, fix valid 4: Real Time Kinematic. System used in RTK mode with fixed integers 5: Float RTK. Satellite system used in RTK mode. Floating integers 6: Estimated (dead reckoning) Mode

			7: Manual Input Mode 8: Simulator Mode
7	Satellites Used	08	Number of satellites in use, (00 ~ 12)
8	HDOP	1.1	Horizontal dilution of precision, (00.0 ~ 99.9)
9	Altitude	108.7	mean sea level (geoid), (-9999.9 ~ 17999.9)
10	Geoid Separation		Geoid separation in meters according to WGS-84 ellipsoid (-999.9 ~ 9999.9)
11	DGPS Age		Age of DGPS data since last valid RTCM transmission in xxx format (seconds) NULL when DGPS not used
12	DGPS Station ID	0000	Differential reference station ID, 0000 ~ 1023 NULL when DGPS not used
13	Checksum	0E	

Note: The checksum field starts with a '*' and consists of 2 characters representing a hex number. The checksum is the exclusive OR of all characters between '$' and '*'.

11.2 GLL - LATITUDE AND LONGITUDE, WITH TIME OF POSITION FIX AND STATUS

Latitude and longitude of current position, time, and status.

Structure:

$GPGLL,ddmm.mmmm,a,dddmm.mmmm,a,hhmmss.sss,A,a*hh<CR><LF>

1 2 3 4 5 6 7 8

Example:

$GPGLL,4250.5589,S,14718.5084,E,092204.999,A,A*2D<CR><LF>

Field	Name	Example	Description
1	Latitude	4250.5589	Latitude in ddmm.mmmm format Leading zeros transmitted
2	N/S Indicator	S	Latitude hemisphere indicator 'N' = North 'S' = South
3	Longitude	14718.5084	Longitude in dddmm.mmmm format Leading zeros transmitted
4	E/W Indicator	E	Longitude hemisphere indicator 'E' = East 'W' = West
5	UTC Time	092204.999	UTC time in hhmmss.sss format (000000.00 ~ 235959.99)
6	Status	A	Status, 'A' = Data valid, 'V' = Data not valid
7	Mode Indicator	A	Mode indicator 'N' = Data not valid 'A' = Autonomous mode 'D' = Differential mode 'E' = Estimated (dead reckoning) mode 'M' = Manual input mode 'S' = Simulator mode
8	Checksum	2D	

11.3 GSA - GPS DOP AND ACTIVE SATELLITES

GPS receiver operating mode, satellites used in the navigation solution reported by the GGA or GNS sentence and DOP values.

Structure:

$GPGSA,A,x,xx,xx,xx,xx,xx,xx,xx,xx,xx,xx,xx,xx,x.x,x.x,x.x*hh<CR><LF>

1 2 3 3 3 3 3 3 3 3 3 3 3 3 4 5 6 7

Example:

$GPGSA,A,3,01,20,19,13,,,,,,,,,40.4,24.4,32.2*0A<CR><LF>

Field	Name	Example	Description
1	Mode	A	Mode 'M' = Manual, forced to operate in 2D or 3D mode 'A' = Automatic, allowed to automatically switch 2D/3D
2	Mode	3	Fix type 1 = Fix not available 2 = 2D 3 = 3D
3	Satellite used 1~12	01,20,19,13,,,,,,,,,	Satellite ID number, 01 to 32, of satellite used in solution, up to 12 transmitted
4	PDOP	40.4	Position dilution of precision (00.0 to 99.9)
5	HDOP	24.4	Horizontal dilution of precision (00.0 to 99.9)
6	VDOP	32.2	Vertical dilution of precision (00.0 to 99.9)
7	Checksum	0A	

11.4 GSV - GPS SATELLITE IN VIEW

Numbers of satellites in view, PRN number, elevation angle, azimuth angle, and C/No. Four satellites details are transmitted per message. Additional satellite in view information is send in subsequent GSV messages.

Structure:

$GPGSV,x,x,xx,xx,xx,xxx,xx,…,xx,xx,xxx,xx *hh<CR><LF>

1 2 3 4 5 6 7 4 5 6 7 8

Example:

$GPGSV,3,1,09,28,81,225,41,24,66,323,44,20,48,066,43,17,45,336,41*78<CR><LF>

$GPGSV,3,2,09,07,36,321,45,04,36,257,39,11,20,050,41,08,18,208,43*77<CR><LF>

Field	NaME	Example	Description
1	Number of message	3	Total number of GSV messages to be transmitted (1-3)
2	Sequence number	1	Sequence number of current GSV message
3	Satellites in view	09	Total number of satellites in view (00 ~ 12)
4	Satellite ID	28	Satellite ID number, GPS: 01 ~ 32, SBAS: 33 ~ 64 (33 = PRN120)
5	Elevation	81	Satellite elevation in degrees, (00 ~ 90)
6	Azimuth	225	Satellite azimuth angle in degrees, (000 ~ 359)
7	SNR	41	C/No in dB (00 ~ 99) Null when not tracking
8	Checksum	78	

11.5 RMC - RECOMMANDED MINIMUM SPECIFIC GPS/TRANSIT DATA

Time, date, position, course and speed data provided by a GNSS navigation receiver.

Structure:

$GPRMC,hhmmss.sss,A,dddmm.mmmm,a,dddmm.mmmm,a,x.x,x.x,ddmmyy,x.x,a,a*hh<CR><LF>

1 2 3 4 5 6 7 8 9 10 11 12 13

Example:

$GPRMC,092204.999,A,4250.5589,S,14718.5084,E,0.00,89.68,211200,,A*25<CR><LF>

Field	NaME	Example	Description
1	UTC time	092204.999	UTC time in hhmmss.sss format (000000.00 ~ 235959.999)
2	Status	A	Status ‘V’ = Navigation receiver warning ‘A’ = Data Valid
3	Latitude	4250.5589	Latitude in dddmm.mmmm format Leading zeros transmitted
4	N/S indicator	S	Latitude hemisphere indicator ‘N’ = North ‘S’ = South
5	Longitude	14718.5084	Longitude in dddmm.mmmm format Leading zeros transmitted
6	E/W Indicator	E	Longitude hemisphere indicator 'E' = East 'W' = West
7	Speed over ground	000.0	Speed over ground in knots (000.0 ~ 999.9)
8	Course over ground	000.0	Course over ground in degrees (000.0 ~ 359.9)
9	UTC Date	211200	UTC date of position fix, ddmmyy format
10	Magnetic variation		Magnetic variation in degrees (000.0 ~ 180.0)
11	Magnetic Variation		Magnetic variation direction ‘E’ = East ‘W’ = West
12	Mode indicator	A	Mode indicator ‘N’ = Data not valid ‘A’ = Autonomous mode ‘D’ = Differential mode ‘E’ = Estimated (dead reckoning) mode ‘M’ = Manual input mode ‘S’ = Simulator mode
13	checksum	25	

11.6 VTG - COURSE OVER GROUND AND GROUND SPEED

The Actual course and speed relative to the ground.

Structure:

GPVTG,x.x,T,x.x,M,x.x,N,x.x,K,a*hh<CR><LF>

1 2 3 4 5 6

Example:

$GPVTG,89.68,T,,M,0.00,N,0.0,K,A*5F<CR><LF>

Field	Name	Example	Description
1	Course	89.68	True course over ground in degrees (000.0 ~ 359.9)
2	Course		Magnetic course over ground in degrees (000.0 ~ 359.9)
3	Speed	0.00	Speed over ground in knots (000.0 ~ 999.9)
4	Speed	0.00	Speed over ground in kilometers per hour (0000.0 ~ 1800.0)
5	Mode	A	Mode indicator 'N' = not valid 'A' = Autonomous mode 'D' = Differential mode 'E' = Estimated (dead reckoning) mode 'M' = Manual input mode 'S' = Simulator mode
6	Checksum	5F	

11.7 ZDA- TIME AND DATE

Structure:

$GPRMC,hhmmss.sss,dd,mm.yyyy, , ,xxx<CR><LF>

1 2 3 4 5 6 7

Example:

$GPZDA,104548.04,25,03,2004,,*6C<CR><LF>

Field	Name	Example	Description
1	UTC time	104548.04	UTC time in hhmmss.ss format, 000000.00 ~ 235959.99
2	UTC time: day	25	UTC time day (01 ... 31)
3	UTC time: month	03	UTC time: month (01 ... 12)
4	UTC time: year	2004	UTC time: year (4 digit year)
5			Local zone hour Not being output by the receiver (NULL)

6			Local zone minutes Not being output by the receiver (NULL)
7	6C	6C	Checksum