PEB-916A Engine Board
Product Specification

Version 1.2

2009/9/15

Polstar Technologies Inc.
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1 OVERVIEW

The PEB-916A is a small form factor GPS module solution intended for a broad range of Original Equipment Manufacturer (OEM) products, where fast and easy system integration and minimal development risk is required. The PEB-916A GPS receiver's -160dBm tracking sensitivity allows continuous position coverage in nearly all application environments. Its high performance search engine is capable of testing 8,000,000 time-frequency hypotheses per second, offering industry-leading signal acquisition and TTFF speed.

The receiver is optimized for applications requiring high performance, low power, and low cost; suitable for a wide range of OEM configurations including mobile phone, PND, asset tracking, and vehicle navigation products. The very small 13mm x 16mm form factor and the SMT pads allow standard surface mount device pick-and-place process in fully automated assembly process; enabling high-volume, very cost-efficient production.

2 PRODUCT FEATURES

- 65 Channel GPS L1 C/A Code
- Perform 8 million time-frequency
- Open sky hot start 2 sec
- Open sky cold start 35 sec
- Signal detection better than -160dBm
- Multipath detection and suppression
- Accuracy 2.5m CEP
- Maximum update rate 10Hz
- Tracking current <30mA
- Supports active and passive antenna

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3 APPLICATIONS

- PND
- GPS Phone
- MID / UMPC
- Tracking Unit
- Automatic Vehicle Location

4 TECHNICAL SPECIFICATIONS

- Receiver Type
  - Frequency: L1, 1575.42MHz
  - C/A Code: 1.023MHz chip rate
  - Channel: 65-channel Venus 6 engine
- Accuracy
  - Position: 2.5m CEP
  - Velocity: 0.1m/sec
  - Time: 300ns
- A-GPS: Support PromptFix® AGPS
- Sensitivity
  - Tracking: -160 dBm
- Acquisition Rate
  - Hot start: 2 sec, average under open sky
  - Cold start: 35 sec, average under open sky
- Dynamic condition
  - Altitude: 18,000 meters max.
  - Velocity: 515 m/sec max.
  - Acceleration: 4g, max
- DC Power
  - Main Power: 3.3V DC
  - Tracking Mode: 30mA @3.3V DC
- Serial Interface
  - UART Port Level: 3.3V LVTTL
  - Protocol Message: NMEA-0183 V3.01
  - Update Rate: 1 / 2 / 4 / 5 / 8 / 10 Hz (1Hz default)
  - Baud Rate: 4800/9600/38400/115200 bps
- 1PPS Pulse
  - Level: CMOS
  - Pulse duration: 1ms
- Datum

  WGS-84

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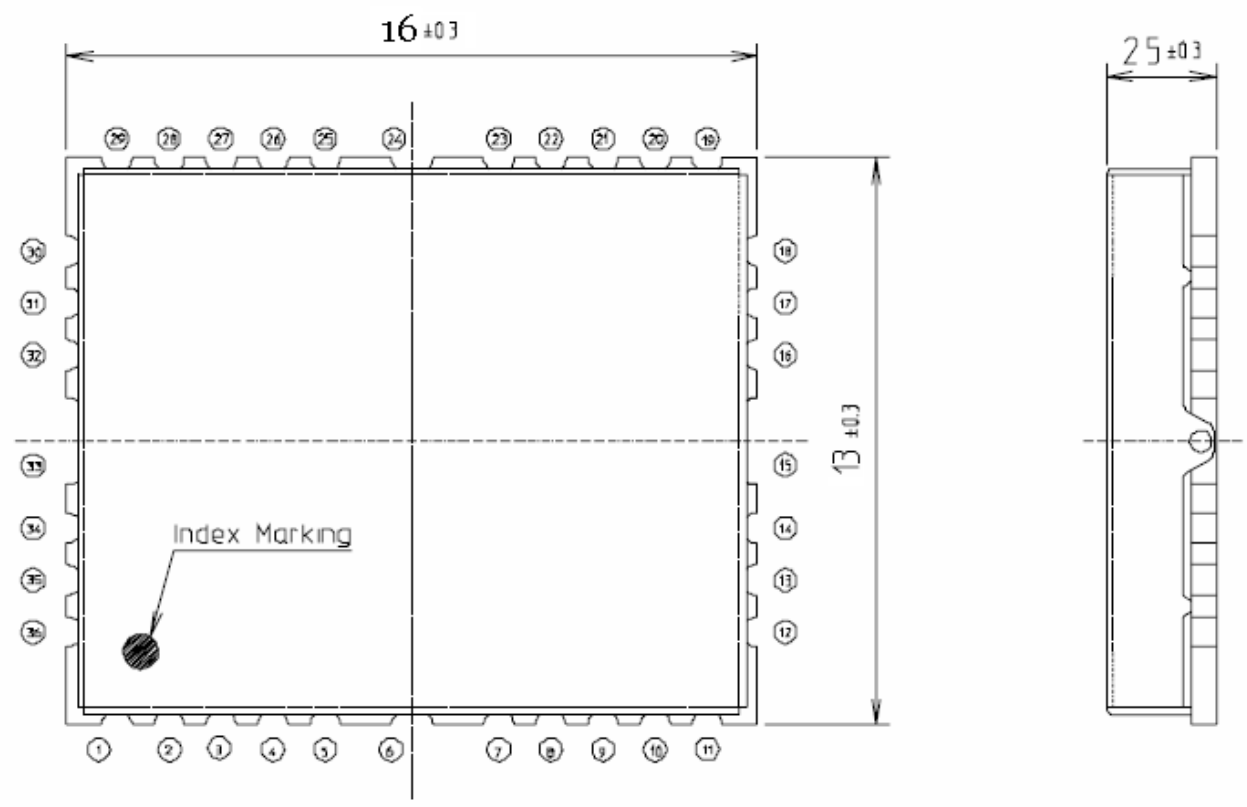
- Environment Condition

Operating Temperature	-30℃~+85℃
Storage Temperature	-40℃~+90℃
Operating Humidity	5%~95% RH, no condensing

5 MECHANICAL / PCB SPECIFICATION

5.1 Dimension (16x13x2.5, unit: mm)



Note: tolerance: ± 0.3 mm

5.2 Recommend PCB Layout Footprint

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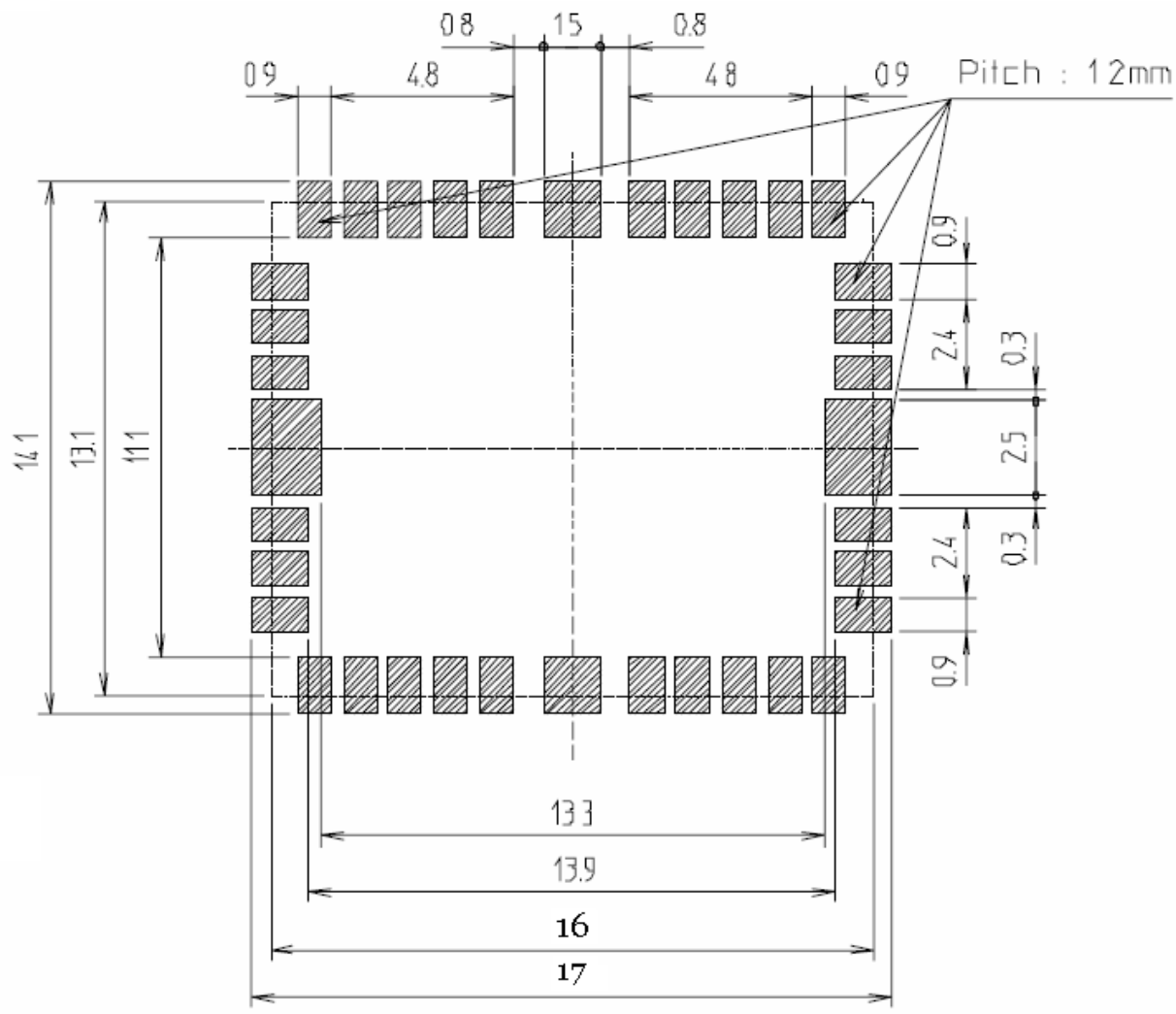

5.3 Pad configuration

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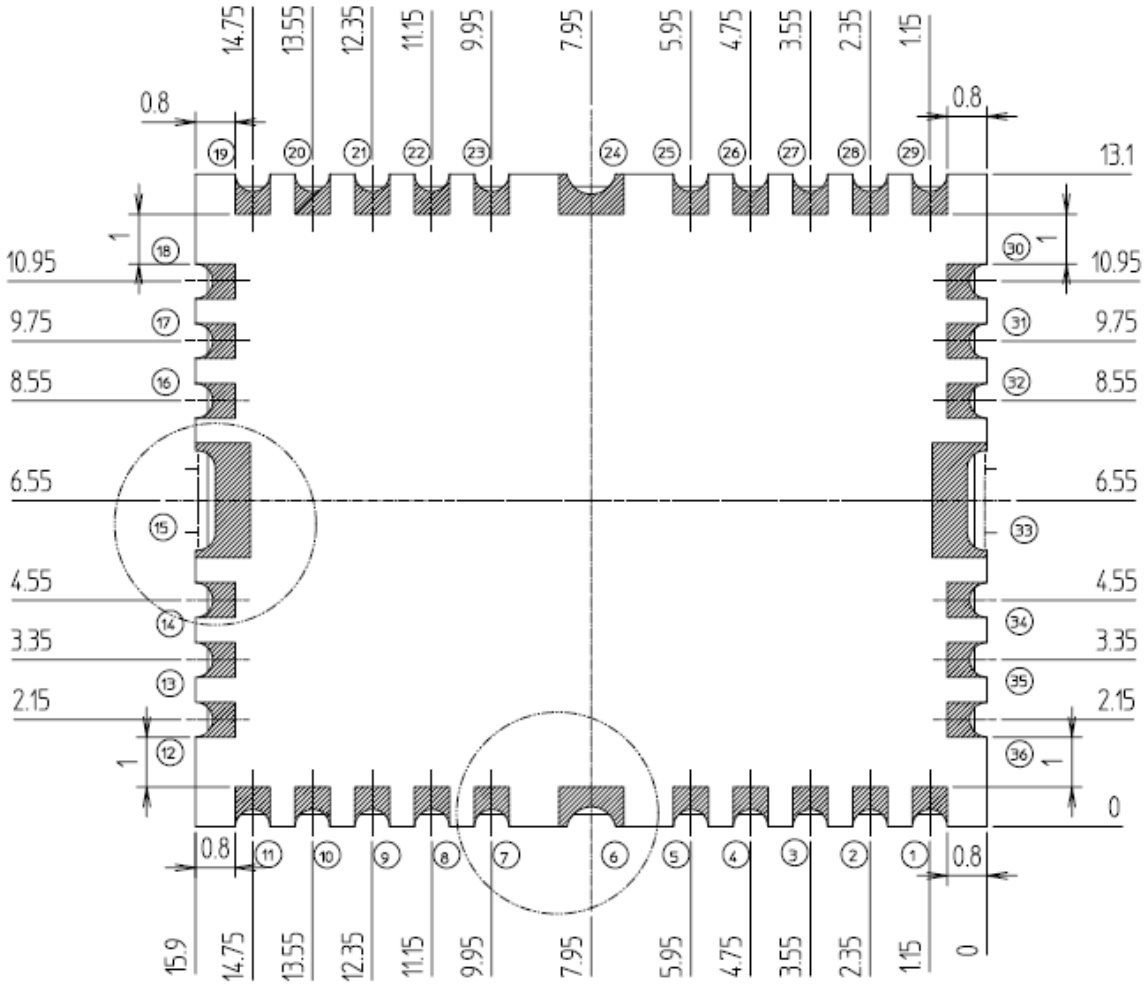

(Bottom view)

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6 PADS DETAILS

Pin no	Name	Description
1	RF_IN	GPS RF input, 1575.42MHz, 50ohm External VANT needed 3.3VDC bias for external active antenna
2	GND	System ground
3	GND	System ground
4	GND	System ground
5	V_BAT	For Internal Battery Backup SRAM Power and RTC(1.7V~3.3V)
6	GND	System ground (Chassis GND)
7	NC	No connection
8	BaudSel1	Hardware baud rate selection input, used with BaudSel0. BaudSel[1:0] = 00 for 9600 baud, 01 for 4800 baud, 10 for 38400 baud, 11 for 115200 baud 3.3V LVTTL
9	GND	System ground
10	GND	System ground
11	VCC	Main power VCC (3.3V)
12	GND	System ground
13	NRESET	Low active reset inside
14	BaudSel0	Hardware baud rate selection input, used with BaudSel1 3.3V LVTTL
15	GND	System ground (Chassis GND)
16	NC	No connection
17	GND	System ground
18	GPIO1	Indication for GPS fixed as LED blinking
19	GND	System ground
20	Time Mark	1PPS One Pulse output Per Second
21	GND	System ground
22	GND	System ground
23	PSE_SEL	Search engine mode selection 1: low power acquisition mode 0: enhanced acquisition mode 3.3V LVTTL
24	GND	System ground (Chassis GND)
25	NC	No connection
26	GND	System ground

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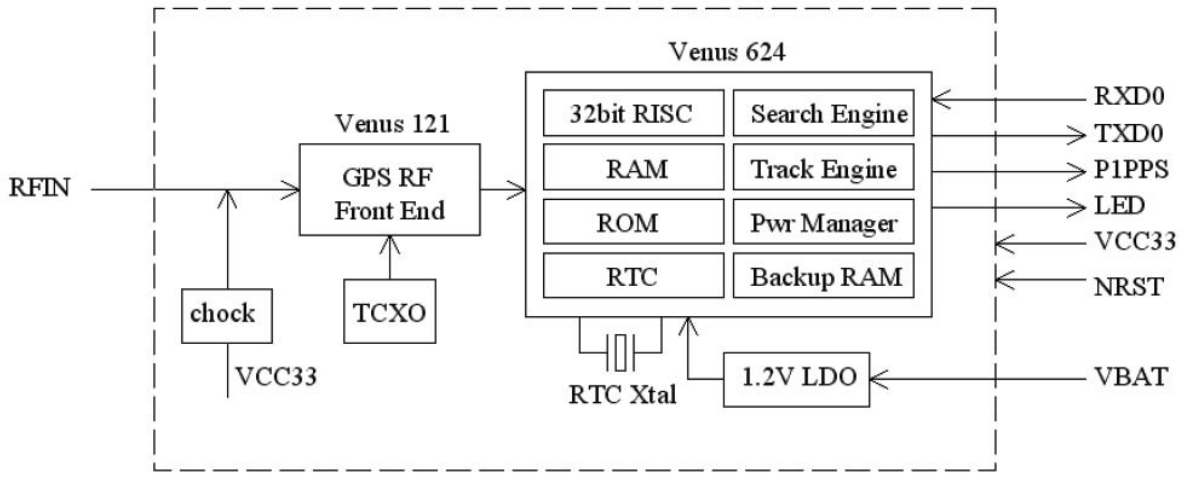
27	NC	No connection
28	GND	System ground
29	GND	System ground
30	TX0	Serial UART interface to processor, module output
31	RX0	Serial UART interface to processor, module input
32	NC	No connection
33	GND	System ground (Chassis GND)
34	NC	No connection
35	GND	System ground
36	GND	System ground

7 APPLICATION NOTE

7.1 Function block and application circuit



Block Diagram

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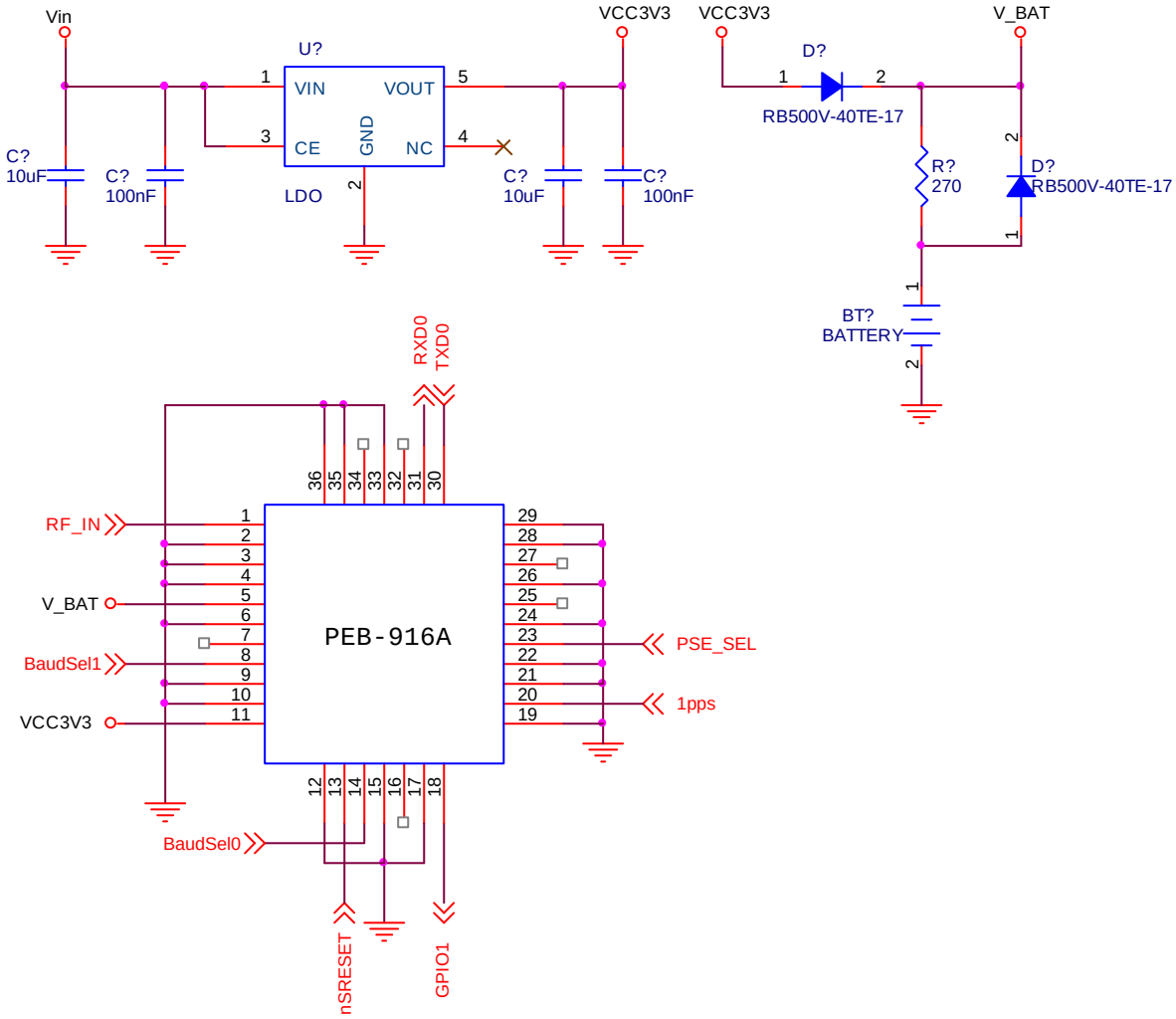

7.2 Reference design

Two kind of RF input can be designed, one is external activate antenna, the other is patch antenna.

7.2.1 External activate antenna

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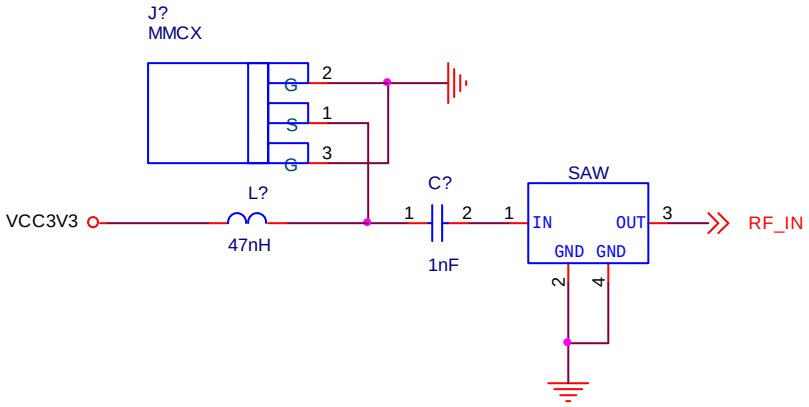
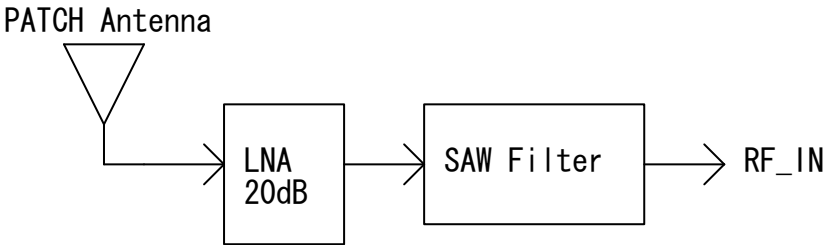


By way of MMCX connector, it can connect with external active antenna with external VANT power supply provided by user. The gain on external active antenna should be in range of 10~ 30dB and noise figure less than 2dB. The insertion loss for SAW is as small as possible.

7.2.2 Patch antenna



Some applications like GPS mouse receiver need patch antenna to receive GPS signal, it can add another LNA and SAW before PEB-916A to make it more reliable. The gain of LNA should be less than 30dB and the Noise Figure is as small as possible (Typical is 0.8dB). The insertion loss for SAW is as small as possible.

7.3 NMEA Message

- ***GGA - Global Positioning System Fix Data***

Structure:

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

Example:

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$GPGGA,111636.932,2447.0949,N,12100.5223,E,1,11,0.8,118.2,M,,,,0000*02<CR><LF>

Field	Name	Example	Description
1	UTC Time	111636.932	UTC of position in hhmmss.sss format, (000000.000 ~ 235959.999)
2	Latitude	2447.0949	Latitude in ddmm.mmmm format Leading zeros transmitted
3	N/S Indicator	N	Latitude hemisphere indicator, 'N' = North, 'S' = South
4	Longitude	12100.5223	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	11	Number of satellites in use, (00 ~ 12)
8	HDOP	0.8	Horizontal dilution of precision, (00.0 ~ 99.9)
9	Altitude	108.2	mean sea level (geoid), (-9999.9 ~ 17999.9)
10	DGPS Station ID	0000	Differential reference station ID, 0000 ~ 1023 NULL when DGPS not used
11	Checksum	02	

- ***GSA – GNSS DOP and Active Satellites***

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>

Example:

$GPGSA,A,3,05,12,21,22,30,09,18,06,14,01,31,,1.2,0.8,0.9*36<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

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3	Satellite used 1~12	05,12,21,22,30 ,09,18,06,14,0 1,31,,	Satellite ID number, 01 to 32, of satellite used in solution, up to 12 transmitted
4	PDOP	1.2	Position dilution of precision (00.0 to 99.9)
5	HDOP	0.8	Horizontal dilution of precision (00.0 to 99.9)
6	VDOP	0.9	Vertical dilution of precision (00.0 to 99.9)
7	Checksum	36	

- ***GSV – GNSS Satellites in View***

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

Example:

$GPGSV,3,1,12,05,54,069,45,12,44,061,44,21,07,184,46,22,78,289,47*72<CR><LF>

$GPGSV,3,2,12,30,65,118,45,09,12,047,37,18,62,157,47,06,08,144,45*7C<CR><LF>

$GPGSV,3,3,12,14,39,330,42,01,06,299,38,31,30,256,44,32,36,320,47*7B<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	12	Total number of satellites in view (00 ~ 12)
4	Satellite ID	05	Satellite ID number, GPS: 01 ~ 32, SBAS: 33 ~ 64 (33 = PRN120)
5	Elevation	54	Satellite elevation in degrees, (00 ~ 90)
6	Azimuth	069	Satellite azimuth angle in degrees, (000 ~ 359)
7	SNR	45	C/No in dB (00 ~ 99) Null when not tracking
8	Checksum	72	

- ***RMC – Recommended Minimum Specific GNSS Data***

Structure:

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$GPRMC,hhmmss.sss,A,dddmm.mmmm,a,dddmm.mmmm,a,x.x,x.x,ddmmyy,,,a*hh<CR><LF>
Example:
$GPRMC,111636.932,A,2447.0949,N,12100.5223,E,000.0,000.0,030407,,,A*61<CR><LF>

Field	Name	Example	Description
1	UTC time	0111636.932	UTC time in hhmmss.sss format (000000.00 ~ 235959.999)
2	Status	A	Status 'V' = Navigation receiver warning 'A' = Data Valid
3	Latitude	2447.0949	Latitude in dddmm.mmmm format Leading zeros transmitted
4	N/S indicator	N	Latitude hemisphere indicator 'N' = North 'S' = South
5	Longitude	12100.5223	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	030407	UTC date of position fix, ddmmyy format
10	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
11	checksum	61	

- *VTG – Course Over Ground and Ground Speed*

Structure: GPVTG,x.x,T,,M,x.x,N,x.x,K,a*hh<CR><LF>
Example: $GPVTG, 000.0,T,,M,000.0,N,0000.0,K,A*3D<CR><LF>

Field	Name	Example	Description

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1	Course	000.0	True course over ground in degrees (000.0 ~ 359.9)
2	Speed	000.0	Speed over ground in knots (000.0 ~ 999.9)
3	Speed	0000.0	Speed over ground in kilometers per hour (0000.0 ~ 1800.0)
4	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
5	Checksum	3D	

- *GLL – Latitude/Longitude*

Structure:
$GPGLL,ddmm.mmmm,a,dddmm.mmmm,a,hhmmss.sss,A,a*hh<CR><LF>
Example:
$GPGLL,2447.0944,N,12100.5213,E,112609.932,A,A*57<CR><LF>

Field	Name	Example	Description
1	Latitude	2447.0944	Latitude in ddmm.mmmm format Leading zeros transmitted
2	N/S Indicator	N	Latitude hemisphere indicator ‘N’ = North ‘S’ = South
3	Longitude	12100.5213	Longitude in dddmm.mmmm format Leading zeros transmitted
4	E/W Indicator	E	Longitude hemisphere indicator 'E' = East 'W' = West
5	UTC Time	112609.932	UTC time in hhmmss.sss format (000000.000 ~ 235959.999)
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	57	

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