REA-1212 Operational Manual

Version 1.1
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0. Revision History

Rev	Release Date	Change Description	Editor
1.0	2007/03/23	Initial Draft	Van Wang
1.1	2008/01/23	Add application circuit	Linda Fan

Table of Content

RoyalTek GPS Module: REA-1212 Operational Manual

1. Introduction

RoyalTek REA-1212 low power and small form factor board is the newest generation of RoyalTek smart antenna GPS module. The smart antenna GPS module is powered by SiRF Star III technology and RoyalTek proprietary navigation algorithm that providing you more stable navigation data. T-type design is the major new feature of REA-1212.

The smallest form factor and T-type design is the best choice to be embedded in a portable device and receiver like PND, mobile phone, car holder, personal locator, digital camera and vehicle locator. The excellent sensitivity of REA-1212 gets the great performance when going though the urban canyon and foliage.

Product Features

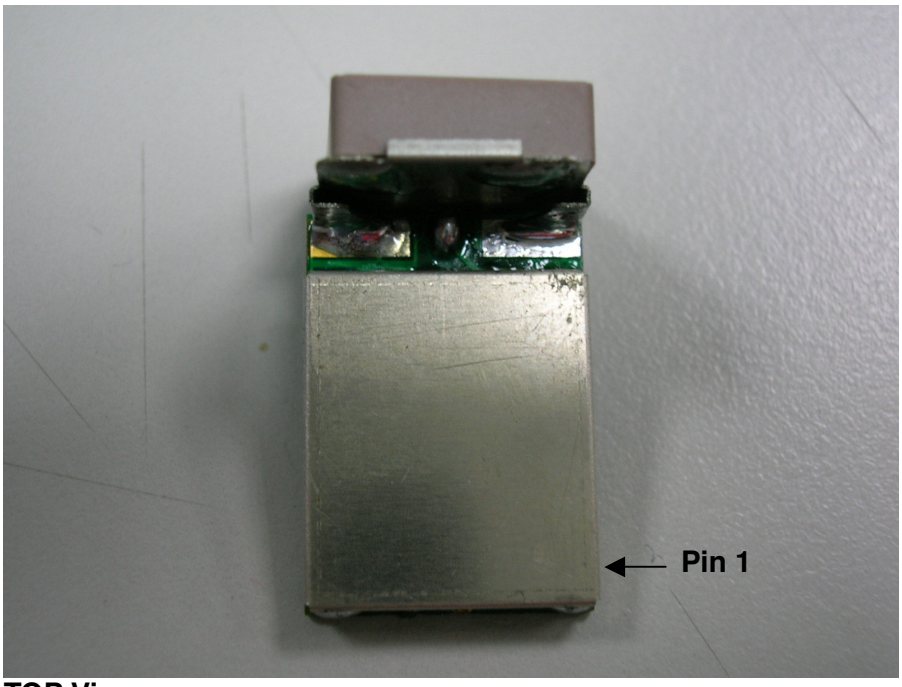
- ✧ Assemble in the form of T-type
- ✧ 20 parallel channels
- ✧ -159 dBm high GPS sensitivity
- ✧ Excellent sensitive for urban canyon and foliage environments
- ✧ Operable from 3.3V, average tracking current is 45mA@3.3V ; average acquisition current is 50mA@3.3V
- ✧ TCXO design
- ✧ NMEA-0183 compliant protocol/custom protocol
- ✧ SBAS (WAAS and EGNOS) support
- ✧ 4 Mbits Flash Memory
- ✧ SMT type with stamp holes
- ✧ Lead-Free
- ✧ Dimension is 24.6±0.4(L)x 14±0.1(W)x 13.4±0.2(T) mm

Product Applications

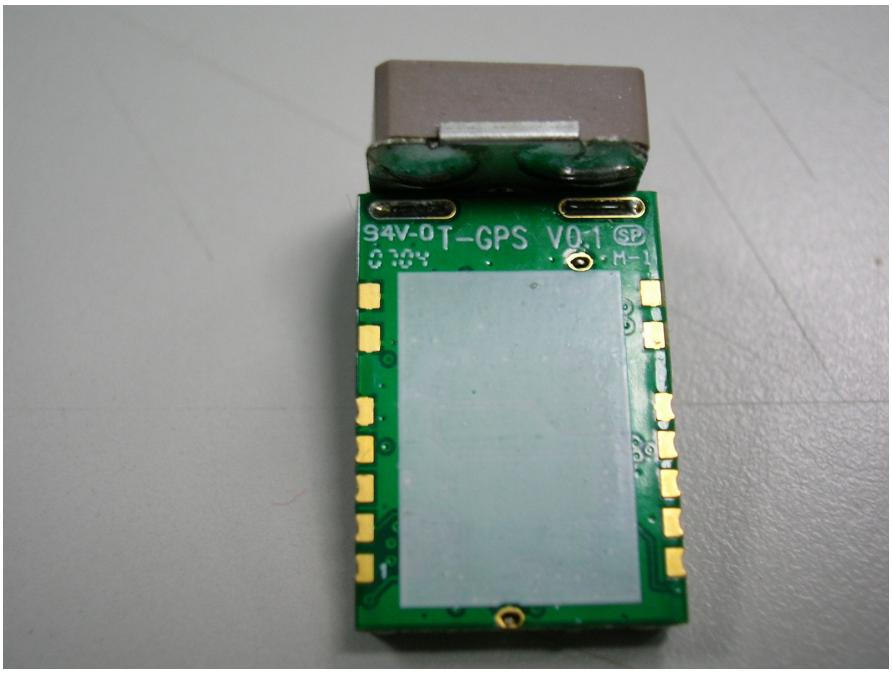
- ✧ Personal Navigation Device including GPS PDA and GPS Handheld
- ✧ Mobile phone including smart phone
- ✧ GPS receiver including GPS mouse
- ✧ Personal positioning and navigation
- ✧ Automotive/Marine navigation
- ✧ Timing application

2. Product Picture and Pin Definition

REA-1212



TOP View



BOTTOM View

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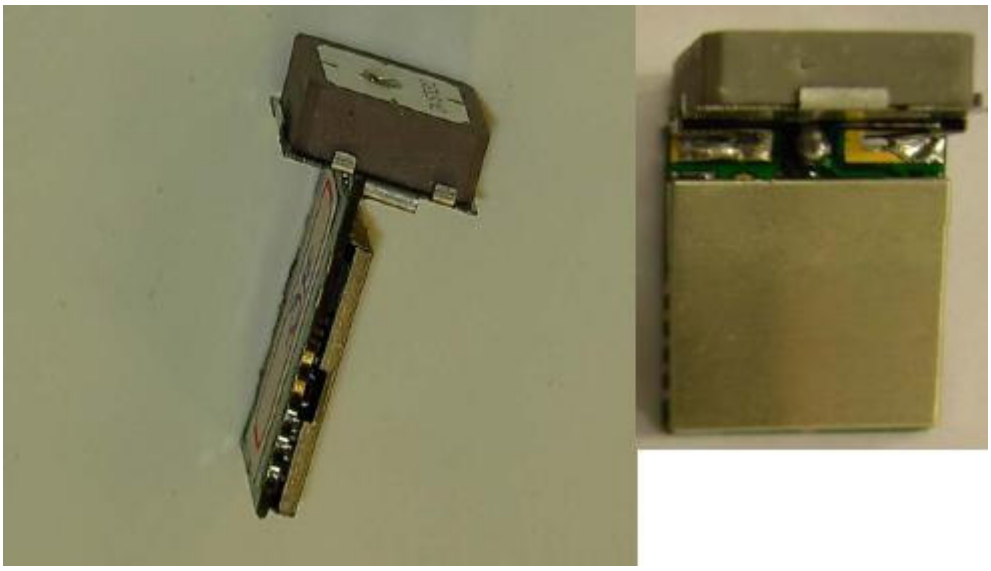
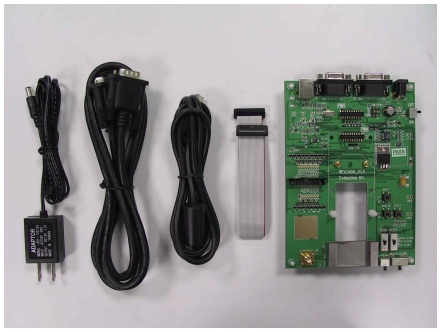
REA-1212 Operational Manual



RoyalTek Evaluation Kit REV-2000
(Please refer to RoyalTek Evaluation Kit REV-2000 Operational Manual for more information)

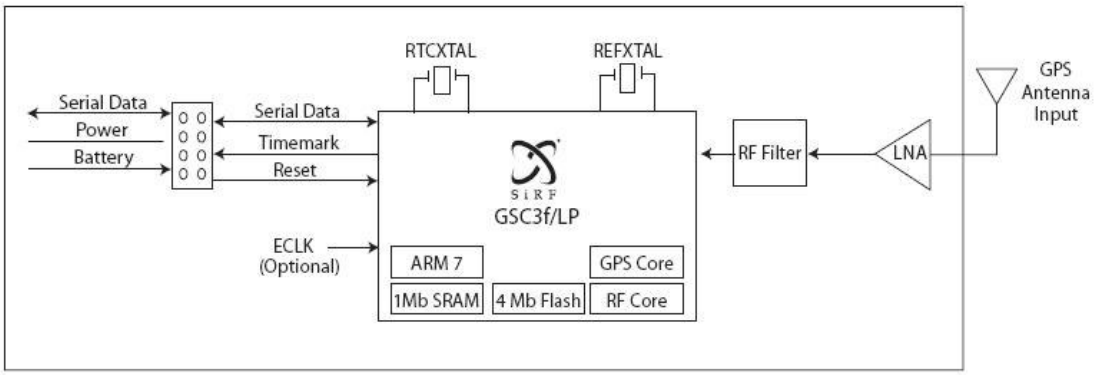
Evaluation Kit Front View



3. REA-1212 System Block Diagram

The system is described as follows:

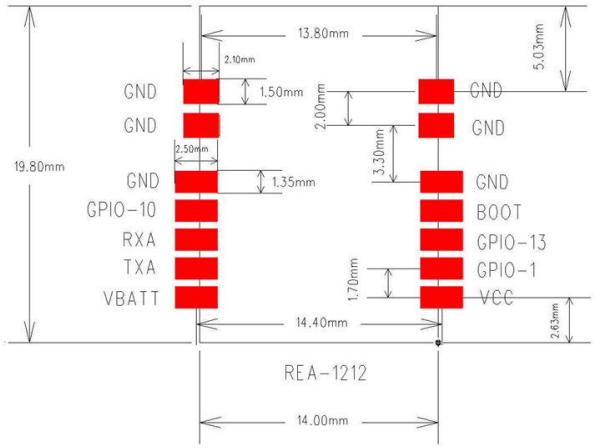
- ARM7 CPU and SDRAM to enable user tasks
- 4 Mega bits flash memory in a single package
- 14 I/O pins



4. REA-1212 Technique Specification

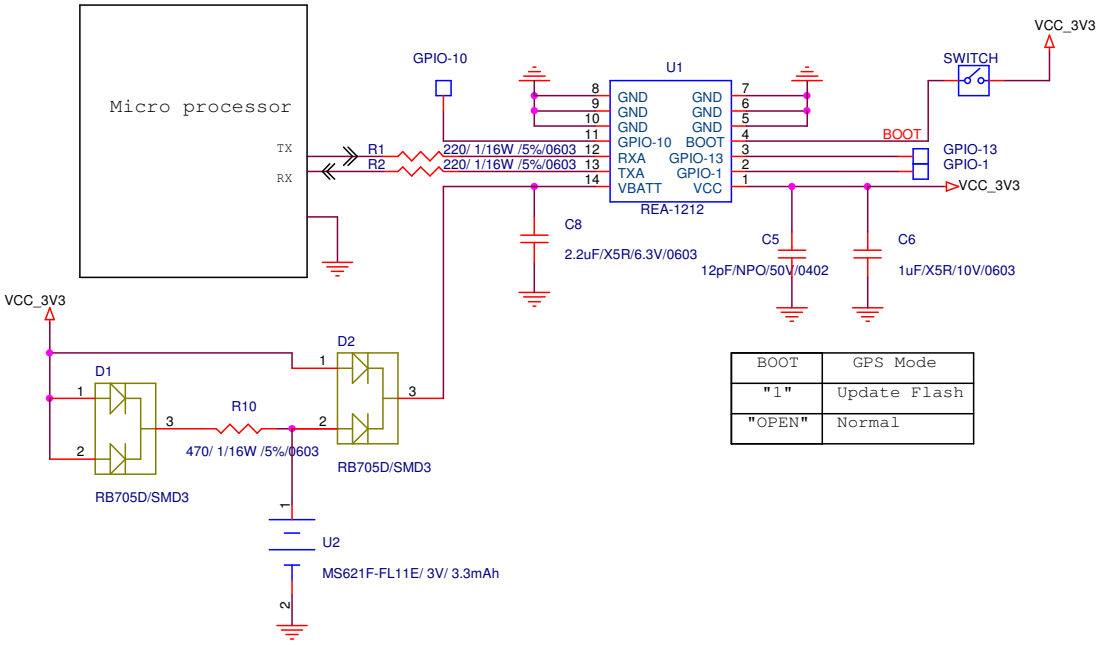
No	Function	Specification
GPS receiver		
1	Chipset	SiRF Star III GSC3f/LPSingle Chipset
2	Frequency	L1 1575.42MHz.
3	Code	C.A. Code.
4	Channels	20
5	Sensitivity (Tracking)	-159dBm.
6	Cold start	42 sec
7	Warm start	35 sec
8	Hot start	1 sec
9	Reacquisition	0.1sec typical
10	Position accuracy(95%)	10m 90%
11	Maximum altitude	18000 m
12	Maximum velocity	514 m/s
13	Trickle power mode	Duty cycle ≦ 34%. (Variable)
14	Update rate	Continuous operation: 1Hz
15	Testability	It shall be able to be tested by SiRF test mode 4 and single channel simulator.
16	Protocol setup	It shall store the protocol setup in the SRAM memory.
Interface		
17	I/O Pin	14-pin stamp holes
Mechanical requirements		
18	Weight	≦6g
Power consumption		
19	Vcc	DC 3.3 ±5%
20	Current	45mA typical @tracking situation 50mA typical @acquistion situation
Environment		
21	Operating temperature	-40 ~ 85℃
22	Storage temperature	-40 ~ 85℃
23	Humidity	≦95%
24	Lead Free	Yes

5. Recommended layout PAD



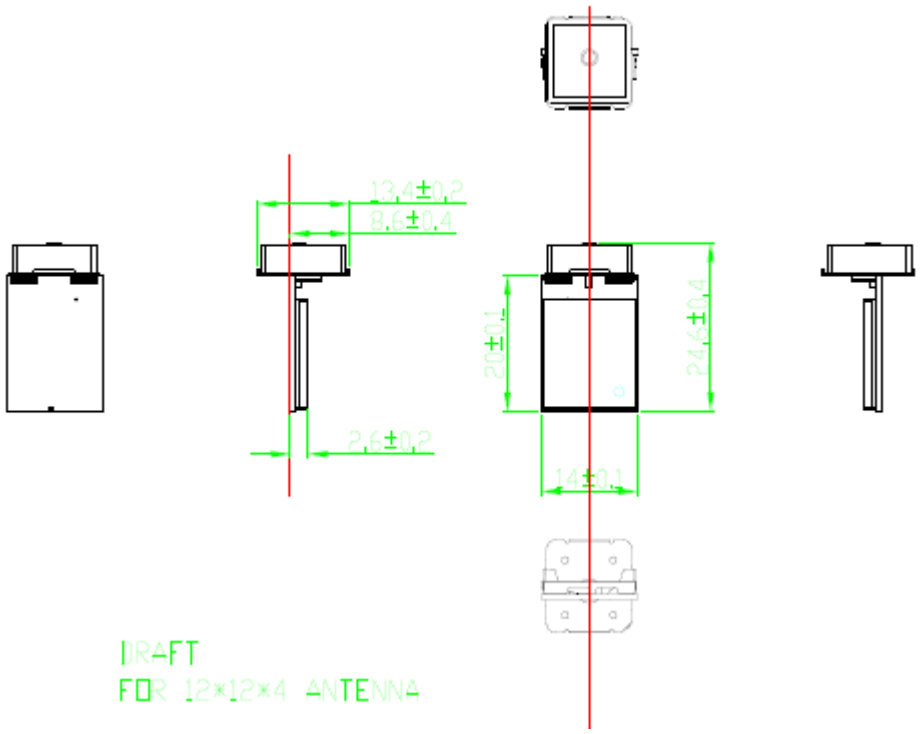
TOP VIEW

6. Application Circuit



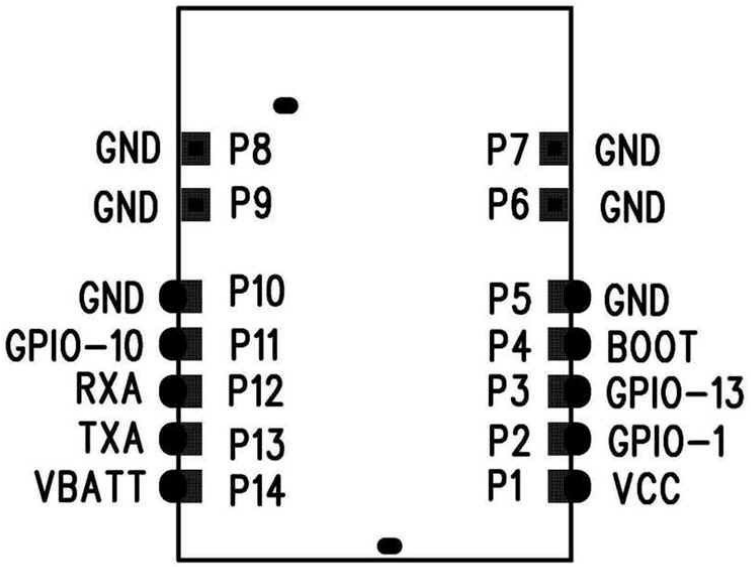
BOOT	GPS Mode
"1"	Update Flash
"OPEN"	Normal

7. Mechanical Layout



8. Hardware Interface

REA-1212



Top view

Definition of Pin assignment

Pin	Signal Name	I/O	Description	Characteristics
1	VCC	I	DC Supply Voltage input	DC +3.3V±5%
2	GPIO-1	I/O	General purpose I/O	$3.6 > V_{IH}$ 都$1.995V$ -0.3V V_{IL} $0.855V$ $2.85V \geq V_{OH} \geq 2.375V$ $V_{OL} \leq 0.715V$
3	GPIO-13	I/O	General purpose I/O	$3.6 > V_{IH}$ 都$1.995V$ -0.3V V_{IL} $0.855V$ $2.85V \geq V_{OH} \geq 2.375V$ $V_{OL} \leq 0.715V$
4	Boot	I	Boot mode	$3.6 > V_{IH}$ 都$1.995V$ -0.3V V_{IL} $0.855V$
5	GND	G	Ground	Reference Ground
6	GND	G	Ground	Reference Ground
7	GND	G	Ground	Reference Ground
8	GND	G	Ground	Reference Ground
9	GND	G	Ground	Reference Ground
10	GND	G	Ground	Reference Ground
11	GPIO-10	I/O	General purpose I/O	$3.6 > V_{IH}$ 都$1.995V$ -0.3V V_{IL} $0.855V$ $2.85V \geq V_{OH} \geq 2.375V$ $V_{OL} \leq 0.715V$
12	RXA	I	Serial port A	$3.6V > V_{IH}$ 都$1.995V$ -0.3V V_{IL} $0.855V$
13	TXA	O	Serial port A	$2.85V \geq V_{OH} \geq 2.375V$ $V_{OL} \leq 0.715V$

14	VBATT	I	Backup voltage supply	DC + 2.5 ~ +3.6V Current ≤ 10uA

VCC(+3.3V DC power Input)

This is the DC power supply input pin for GPS system. It provides voltage to module.

GND

GND provides the reference ground

Boot

Set this pin to high for programming flash

RXA

This is the main receiver channel and is used to receive software commands to the board from SIRFdemo software or from user written software

TXA

This is the main transmitting channel and is used to output navigation and measurement data to SiRFdemo or user written software

VBATT (Backup battery)

This is the battery backup input that powers the SRAM and RTC when main power is removed. Typical current draw is 10uA.
The su pply voltage should be between 2.5V and 3.6V.

GPIO Functions

Several I/Os are connected to the digital interface connector for custom applications.

9. Software Specification and NMEA Protocol

NMEA V3.0 Protocol

Its output signal level is TTL: 4800 bps (default), 8 bit data, 1 stop bit and no parity. It supports the following NMEA-0183
Messages: GGA, GLL, GSA, GSV, RMC and VTG.
NMEA Output Messages: the Engine board outputs the following messages as shown in Table 1:

Table 1 NMEA-0183 Output Messages

NMEA Record	Description
GGA	Global positioning system fixed data
GLL	Geographic position – latitude / longitude
GSA	GNSS DOP and active satellites
GSV	GNSS satellites in view
RMC	Recommended minimum specific GNSS data
VTG	Course over ground and ground speed

GGA-Global Positioning System Fixed Data

Table 2 contains the values of the following example:
$GPGGA, 161229.487, 3723.2475, N, 12158.3416, W, 1, 07, 1.0, 9.0, M, , , ,0000*18

Table 2 GGA Data Format

Name	Example	Units	Description
Message ID	$GPGGA		GGA protocol header
UTC Position	161229.487		hhmmss.sss
Latitude	3723.2475		ddmm.mmmm
N/S Indicator	N		N=north or S=south
Longitude	12158.3416		Dddmm.mmmm
E/W Indicator	W		E=east or W=west
Position Fix Indicator	1		See Table 2-1
Satellites Used	07		Range 0 to 12
HDOP	1.0		Horizontal Dilution of Precision
MSL Altitude	9.0	meters	
Units	M	meters	
Geoid Separation		meters	
Units	M	meters	
Age of Diff. Corr.		second	Null fields when DGPS is not used
Diff. Ref. Station ID	0000		
Checksum	*18		
<CR><LF>			End of message termination

Table 2-1 Position Fix Indicators

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 GPS PPS Mode, fix valid
6	Dead Reckoning Mode, fix valid

GLL-Geographic Position –Latitude/Longitude
Table 3 contains the values of the following
Example: $GPGLL, 3723.2475, N, 12158.3416, W, 161229.487, A*2C

Table 3 GLL Data Format

Name	Example	Units	Description
Message ID	$GPGLL		GLL protocol header
Latitude	3723.2475		ddmm.mmmm
N/S Indicator	N		N=north or S=south
Longitude	12158.3416		Dddmm.mmmm
E/W Indicator	W		E=east or W=west
UTC Position	161229.487		hhmmss.ss
Status	A		A=data valid or V=data not valid
Checksum	*2C		
<CR><LF>			End of message termination

GSA-GNSS DOP and Active Satellites
Table 4 contains the values of the following example:
$GPGSA, A, 3, 07, 02, 26, 27, 09, 04, 15, , , , , , 1.8,1.0,1.5*33

Table 4 GSA Data Format

Name	Example	Units	Description
Message ID	$GPGSA		GSA protocol header
Mode 1	A		See Table 4-2
Mode 2	3		See Table 4-1
Satellite Used	07		Sv on Channel 1
Satellite Used	02		Sv on Channel 2
….			….
Satellite Used			Sv on Channel 12
PDOP	1.8		Position Dilution of Precision
HDOP	1.0		Horizontal Dilution of Precision
VDOP	1.5		Vertical Dilution of Precision
Checksum	*33		
<CR><LF>			End of message termination

Table 4-1 Mode 1

Value	Description
1	Fix not available
2	2D
3	3D

Table 4-2 Mode 2

Value	Description

M	Manual-forced to operate in 2D or 3D mode
A	Automatic-allowed to automatically switch 2D/3D

GSV-GNSS Satellites in View

Table 5 contains the values of the following example:
$GPGSV, 2, 1, 07, 07, 79, 048, 42, 02, 51, 062, 43, 26, 36, 256, 42, 27, 27, 138, 42*71$GPGSV, 2, 2, 07, 09, 23, 313, 42, 04, 19, 159, 41, 15, 12, 041, 42*41

Table 5 GSV Data Format

Name	Example	Units	Description
Message ID	$GPGSV		GSV protocol header
Number of Messages[1]	2		Range 1 to 3
Messages Number[1]	1		Range 1 to 3
Satellites in View	07		
Satellite ID	07		Channel 1(Range 1 to 32)
Elevation	79	degrees	Channel 1(Maximum 90)
Azimuth	048	degrees	Channel 1(True, Range 0 to 359)
SNR (C/No)	42	dBHz	Range 0 to 99, null when not tracking
….			….
Satellite ID	27		Channel 4(Range 1 to 32)
Elevation	27	degrees	Channel 4(Maximum 90)
Azimuth	138	degrees	Channel 4(True, Range 0 to 359)
SNR (C/No)	42	dBHz	Range 0 to 99, null when not tracking
Checksum	*71		
<CR><LF>			End of message termination

[1]Depending on the number of satellites tracked multiple messages of GSV data may be required.

RMC-Recommended Minimum Specific GNSS Data

Table 6 contains the values of the following example:
$GPRMC, 161229.487, A, 3723.2475, N, 12158.3416, W, 0.13, 309.62, 120598, ,*10

Table 6 RMC Data Format

Name	Example	Units	Description
Message ID	$GPRMC		RMC protocol header
UTC Position	161229.487		hhmmss.sss
Status	A		A=data valid or V=data not valid
Latitude	3723.2475		ddmm.mmmm
N/S Indicator	N		N=north or S=south
Longitude	12158.3416		dddmm.mmmm
E/W Indicator	W		E=east or W=west
Speed Over Ground	0.13	knots	
Course Over Ground	309.62	degrees	True
Date	120598		ddmmyy
Magnetic Variation		degrees	E=east or W=west

Checksum	*10		
<CR><LF>			End of message termination

VTG-Course Over Ground and Ground Speed

Table 7 contains the values of the following example:
$GPVTG, 309.62, T, , M, 0.13, N, 0.2, K*6E

Table 7 VTG Data Format

Name	Example	Units	Description
Message ID	$GPVTG		VTG protocol header
Course	309.62	degrees	Measured heading
Reference	T		True
Course		degrees	Measured heading
Reference	M		Magnetic
Speed	0.13	knots	Measured horizontal speed
Units	N		Knots
Speed	0.2	km/hr	Measured horizontal speed
Units	K		Kilometer per hour
Checksum	*6E		
<CR><LF>			End of message termination

10. GPS Receiver User's Tip

A. GPS signal will be affected by weather and environment conditions, thus suggest to use the GPS receiver under less shielding environments to ensure GPS receiver has better receiving performance.

B. When GPS receiver is moving, it will prolong the time to fix the position, so suggest to wait for the satellite signals to be locked at a fixed point when first power-on the GPS receiver to ensure to lock the GPS signal at the shortest time.

C. The following situation will affect the GPS receiving performance:
   i. Solar control filmed windows.
   ii. Metal shielded, such as umbrella, or in vehicle.
   iii. Among high buildings.
   iv. Under bridges or tunnels.
   v. Under high voltage cables or near by radio wave sources, such as mobile phone base stations.
   vi. Bad or heavy cloudy weather.

D. If the satellite signals can not be locked or encounter receiving problem (while in the urban area), the following steps are suggested:
   i. Please plug the external active antenna into GPS receiver and put the antenna on outdoor or the roof of the vehicle for better receiving performance.
   ii. Move to another open space or reposition GPS receiver toward the direction with less blockage.
   iii. Move the GPS receiver away from the interferences resources.
   iv. Wait until the weather condition is improved.

E. While a GPS with a backup battery, the GPS receiver can fix a position immediately at next power-on if the build-in backup battery is full-recharged.

11. Package Specification and Order Information

Please contact sales for further information.

12. Contact Information Section

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