RoyalTek
鼎天國際股份有限公司

RGM-3550LP User Manual

Version 1.3
2008/11/19

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0. Revision History

Rev	Release Date	Change Description	Editor
1.0	2007/3/26	Initial Draft	Amanda Lee
1.1	2007/4/30	Current-- Acquisition: 50mA (typical) Tracking: 45mA (typical)	Amanda Lee
1.2	2007/5/14	Chipset Sensitivity: -159dBm (tracking) Cold start: 35 sec@ open sky Warm start: 35 sec@ open sky Hot start:1 sec @ open sky	Amanda Lee
1.3	2008.11.19	Add 25x25x2mm patch antenna drawing	Amy Liu

Content

RoyalTek GPS Module: RGM-3550LP Operational Manual

1. Introduction

RoyalTek RGM-3550LP smart antenna GPS module (patch antenna embedded and external antenna supported) is inherited from RGM-3550, but lower power consumption than RGM-3550. The smart antenna GPS module is powered by SiRF Star III technology and RoyalTek proprietary navigation algorithm that providing you more stable navigation data.

The 6-pin connector design is the easiest and convenient solution to be embedded in a portable device and receiver like PND, GPS mouse, car holder, personal locator, speed camera detector and vehicle locator. The excellent sensitivity of RGM-3550LP gets the great performance when going though the urban canyon and foliage.

Product Features

✧ 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 and average Acquisition current is 50mA.

✧ 6 pin Wire-to-Board (WTB) connector type.

✧ GPS status light output.

✧ TCXO design.

✧ 0.1 second reacquisition time.

✧ Dimension is 35±0.3(L)x 31±0.3(W)x 8.55/6.55±0.5(H) mm.

✧ Weight ≦16.5g.

✧ NMEA-0183 compliant protocol/custom protocol.

✧ Enhanced algorithm for navigation stability

✧ SBAS (WAAS, EGNOS and MSAS) support and the default SBAS is enable

✧ Lead-Free

✧ Backup battery (installed)

Product Applications

✧ Personal Navigation Device including GPS PDA and GPS Handheld

✧ GPS receiver including GPS mouse and Bluetooth GPS receiver

✧ Personal positioning and navigation
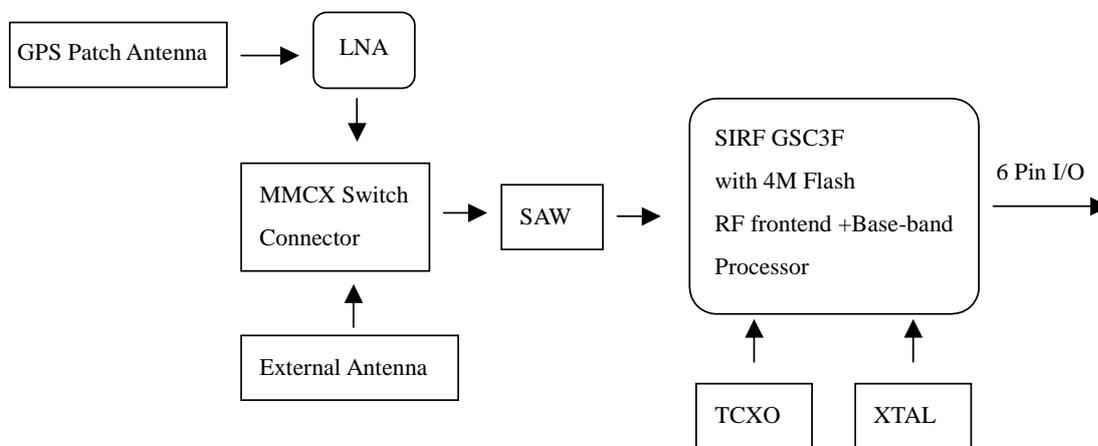
✧ Marine navigation

✧ Timing application

2. RGM-3550LP Picture and Pin Definition

Pin 1
Pin 6

31 ±0.3 mm   35 ± 0.3mm
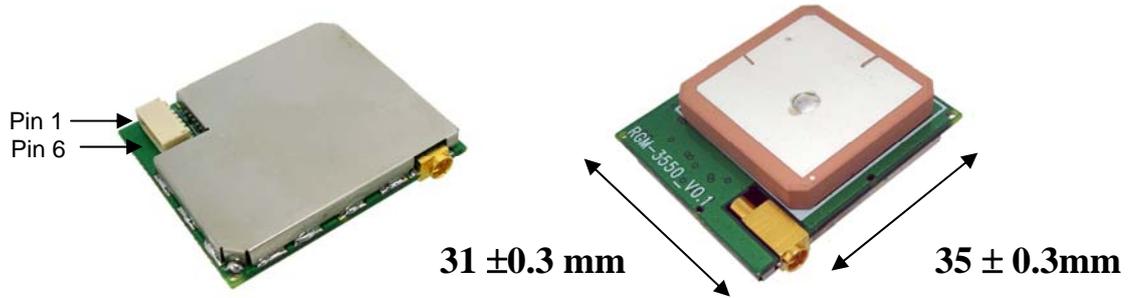
3. RGM-3550LP System Block Diagram

System block diagram description:

- Patch antenna with 1 Stage LNA
- 4Mega bits flash memory on chip
- MMCX External Antenna Supported
- 6 pin I/O pin (see page 7, Interface pin definition)

```
┌──────────────────┐      ┌─────────┐
│ GPS Patch Antenna │ ───► │   LNA   │
└──────────────────┘      └─────────┘
                               │
                               ▼
┌──────────────────┐      ┌─────────┐      ┌──────────────────────────┐
│   MMCX Switch    │ ───► │   SAW   │ ───► │   SIRF GSC3F             │
│   Connector      │      └─────────┘      │   with 4M Flash          │ ──► 6 Pin I/O
└──────────────────┘                       │   RF frontend +Base-band │
        ▲                                  │   Processor              │
        │                                  └──────────────────────────┘
┌──────────────────┐                            ▲           ▲
│ External Antenna │                        ┌────────┐  ┌────────┐
└──────────────────┘                        │  TCXO  │  │  XTAL  │
                                            └────────┘  └────────┘
```

4. RGM-3550LP Technique Specification

No	Function	Specification
GPS receiver		
1	Chipset	SiRF GSC3F/LP single chipset
2	Frequency	L1 1575.42MHz.
3	Code	C.A. Code.
4	Channels	20.
5	Chipset Sensitivity	-159dBm (tracking)
6	Cold start	35 sec@ open sky
7	Warm start	35 sec@ open sky
8	Hot start	1 sec @ open sky
9	Reacquisition	0.1sec typical
9	Position accuracy	10meters at 2D RMS.
10	Maximum altitude	18000 m
11	Maximum velocity	514 m/s
12	Trickle power mode	Duty cycle $\leqq$ 34%. (Variable)
13	Update rate	Continuous operation: 1Hz
14	Testability	It shall be able to be tested by SiRF test mode IV and single channel simulator.
15	Protocol setup	It shall store the protocol setup in the SRAM memory.
Interface		
16	I/O Pin	6 pin (see page 7 about pin definition)
Mechanical requirements		
17	Dimension	35±0.3(L)x 31±0.3(W)x 8.55±0.5(H) mm
18	Weight	$\leqq$16.5g
Power consumption		
19	Vcc	DC 3.3 ±5%
20	Current	Acquisition: 50mA (typical) Tracking: 45mA (typical)
21	Trickle power mode	Average current 37mA. (300ms on /700ms off)
22	SRAM backup battery	3.3mAhr Li-Ion rechargeable battery. Battery life at full charge is $\geq$ 7 days.
Environment		
23	Operating temperature	-40 ~ +85℃(except for SRAM battery backup -20 to +60 degree Celsius)

24	Storage temperature	-40 ~ +85℃(except for SRAM battery backup -40 to +60 degree Celsius)
25	Humidity	≦95%
26	Lead Free	Yes
External Antenna RF Input		
27	Drive Output Voltage	2.85V ± 0.5%
28	Drive Output Current	30mA (max)
29	Connector Type	MMCX

Interface Pin definition (VDD=2.85V±2%)
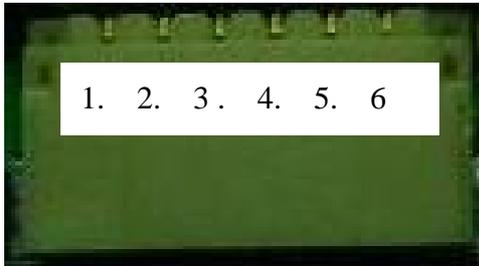
EXT Ant
RF IN

Pin #	Signal Name	I/O	Description	Characteristics
1	RX	I	Serial port A	$V_{IH} \geq 0.7 * VDD$ $\qquad V_{IL} \leq 0.3 * VDD$
2	TXA	O	Serial port A	$V_{OH} \geq 0.75 * VDD$ $\qquad V_{OL} \leq 0.25VDD$
3	GND	G	Ground	Reference Ground
4	VCC	I	DC Supply Voltage input	DC +3.3V±5%
5	GPS Status	O	GPS Status	$V_{OH} \geq 0.75 * VDD$ $\qquad V_{OL} \leq 0.25VDD$
6	Boot select	I	Boot mode	$V_{IH} \geq 0.7 * VDD$ $\qquad V_{IL} \leq 0.3 * VDD$
EXT Ant RFIN	External Antenna RF Input	RF IN	External Antenna RF Input	$V_{OUT} = 2.85V \pm 0.5\%$ $I_{Out} = 30mA(Max)$

■ VCC (+3.3V DC power Input)

this is the main DC power supply input pin. It provides voltage to module.

■ GND

Reference Ground Plane of RGM-3550.

■ Boot select

set this pin to high for programming flash.

■ RX

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

PS: Pull up if not used.

■ TX

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

■ GPS Status

GPS Status Pin can be connected to a LED to indicate the status of GPS signal

1. Solid: Power ON/ Tracking for Satellite
2. Blinking: 3D Fix Found

GPS status light indicating

Power off	LED off	VoL:0.71(Max)
Power on/search for satellite, voltage is high	LED solid	VoH: 2.13V(min)
3D fix found, voltage is high/low, remain 1 second each	LED blinking	VoH: 2.13V(min) & VoL:0.71(Max)

■ External Antenna RF Input

This is the MMCX RF Connector for External Active Antenna signal input

External Active Antenna Spec. Suggestion

1. Drive Output Voltage: $V_{OUT} = 2.85V \pm 0.5\%$
2. Drive Output Current: $I_{Out} = 30mA(Max)$
3. LNA Gain: 20~26dB
4. LNA Noise Figure: <1.5dB

How to use RGM-3550LP in 5V main board

The power supply of RGM-3550LP is 3V. If customer would like use RGM-3550LP in 5V system, RoyalTek suggest customer use linear regulator (from 5V to 3.3V) on customer main board. We could help check the circuit if providing regulator specification.

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5. Mechanical Layout

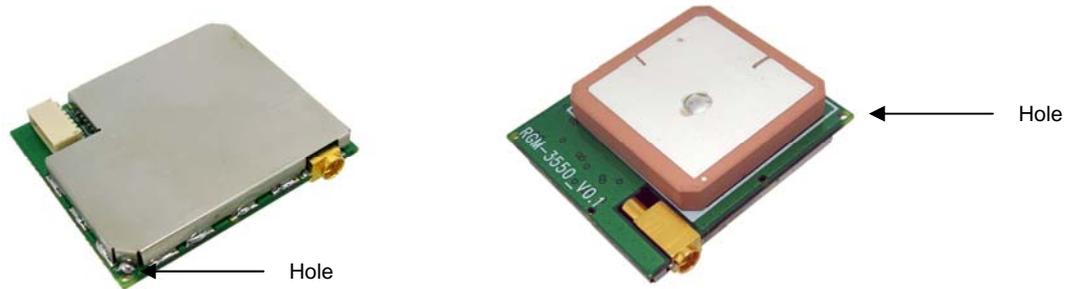**25x25x4mm patch antenna**
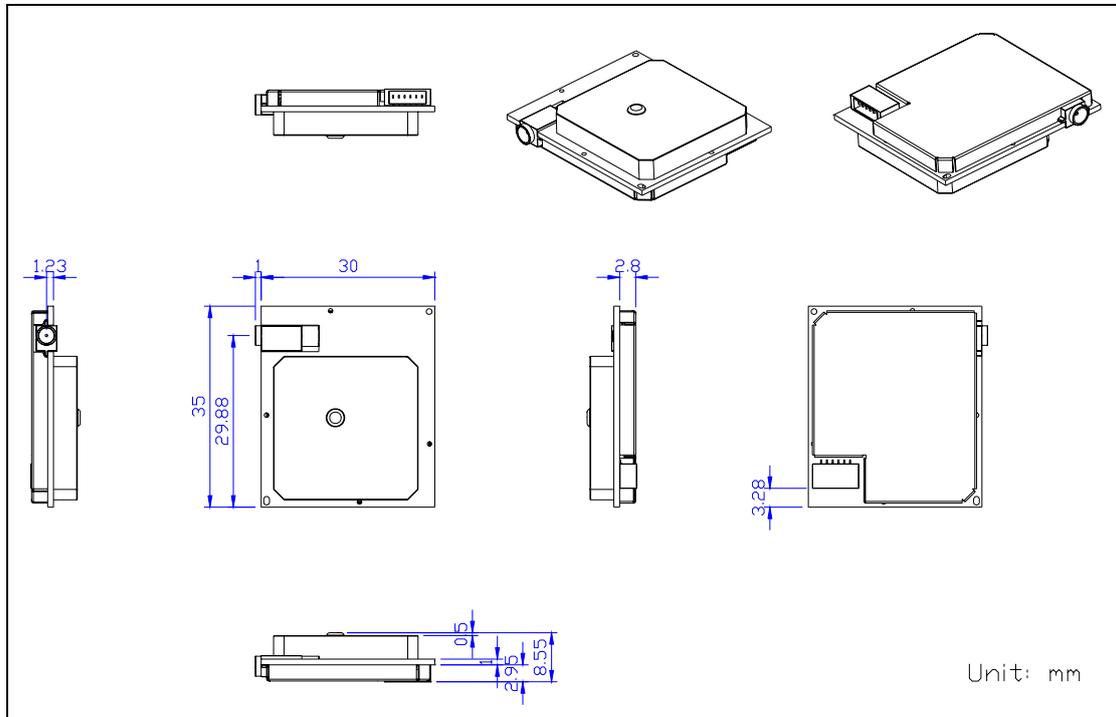
25x25x2mm patch antenna
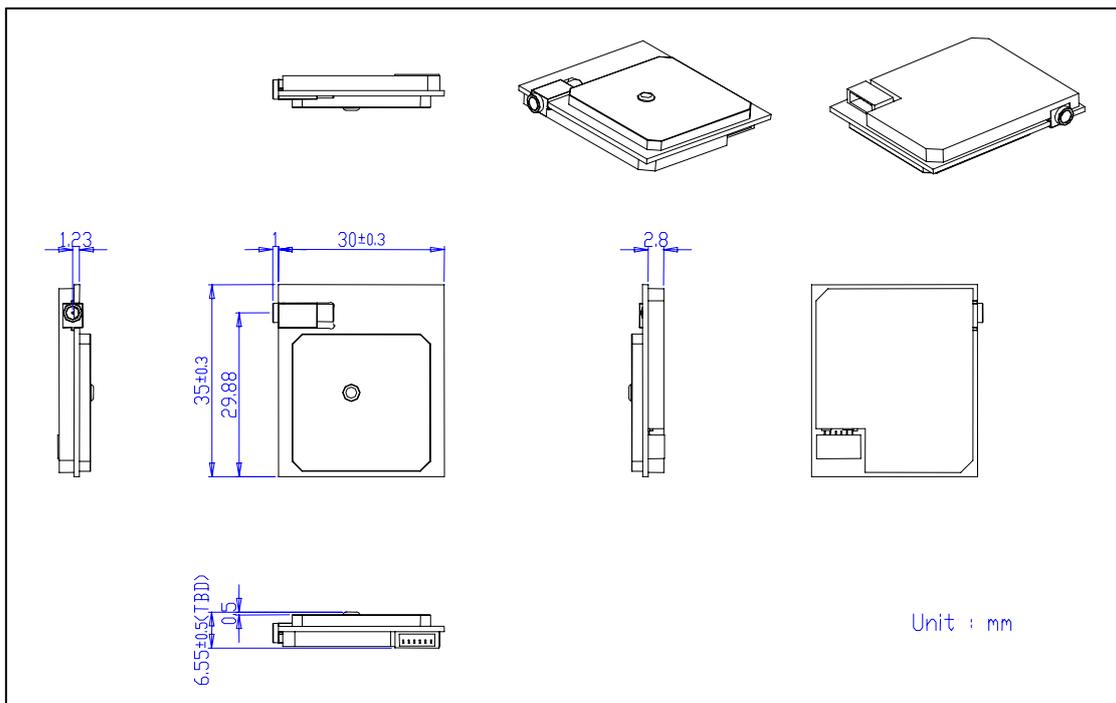
6. How to Assemble/Fix RGM-3550LP

Below is our recommendation to assemble/fix up RGM-3550LP GPS module on the customer board or device case.

Hole

Hole

7. Software Specification and NMEA Protocol

Software Specification

GPS Firmware	- Standard SiRF firmware for SSIII (GSW3 & SiRFLoc 3)
	- Upload firmware
	- RGM-3550LP [GSW3][SBAS GGA(1), GSA(1), GSV(1), RMC(1) 9600 GPS Firmware, version 2.1.0.123 (default)
GPS Utility	- A GPS performance diagnostic utility is required
	- C/NO, TTFF
WAAS	- Enable
GPS status	- See GPS status light indicating specification

NMEA V3.0 Protocol

Its output signal level is TTL: 9600bps (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 3 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	GPS PPS 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　GGA 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 GGA 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	

Name	Example	Units	Description
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

GPS Receiver User's Tip

1. 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.

2. 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.

3. The following situation will affect the GPS receiving performance:
    a. Solar control filmed windows.
    b. Metal shielded, such as umbrella, or in vehicle.
    c. Among high buildings.
    d. Under bridges or tunnels.
    e. Under high voltage cables or near by radio wave sources, such as mobile phone base stations.
    f. Bad or heavy cloudy weather.

4. If the satellite signals can not be locked or encounter receiving problem (while in the urban area), the following steps are suggested:
    a. 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.
    b. Move to another open space or reposition GPS receiver toward the direction with less blockage.
    c. Move the GPS receiver away from the interferences resources.
    d. Wait until the weather condition is improved.

5. 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.

8. Package Specification and Order Information

外箱序號標籤置於外箱右上角.但避開封箱膠帶貼附

3L060N08N7

C/NO.:
Made in Taiwan

1   2   3