GEB-1722 Operational Manual

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Content

1 Introduction

RoyalTek GEB-1722 module provides simultaneous GPS, Galileo, Glonass, and QZSS reception capability. The module is powered by ST Microelectronic receiver engine, with 32 tracking channels and 2 fast acquisition channels for satellite signals tracking and the excellent -162dBm tracking sensitivity allows continuous position coverage in all application environments.

Product Feature

- ✧ Full GNSS support for best satellite coverage.
- ✧ 32 Tracking Channel and 2 fast acquisition channels.
- ✧ High indoor sensitivity of -162dBm in tracking mode.
- ✧ Power supply 3.3V voltage.
- ✧ Provide with 3-state-jammer barrier feature.
- ✧ SMT type with stamp hole

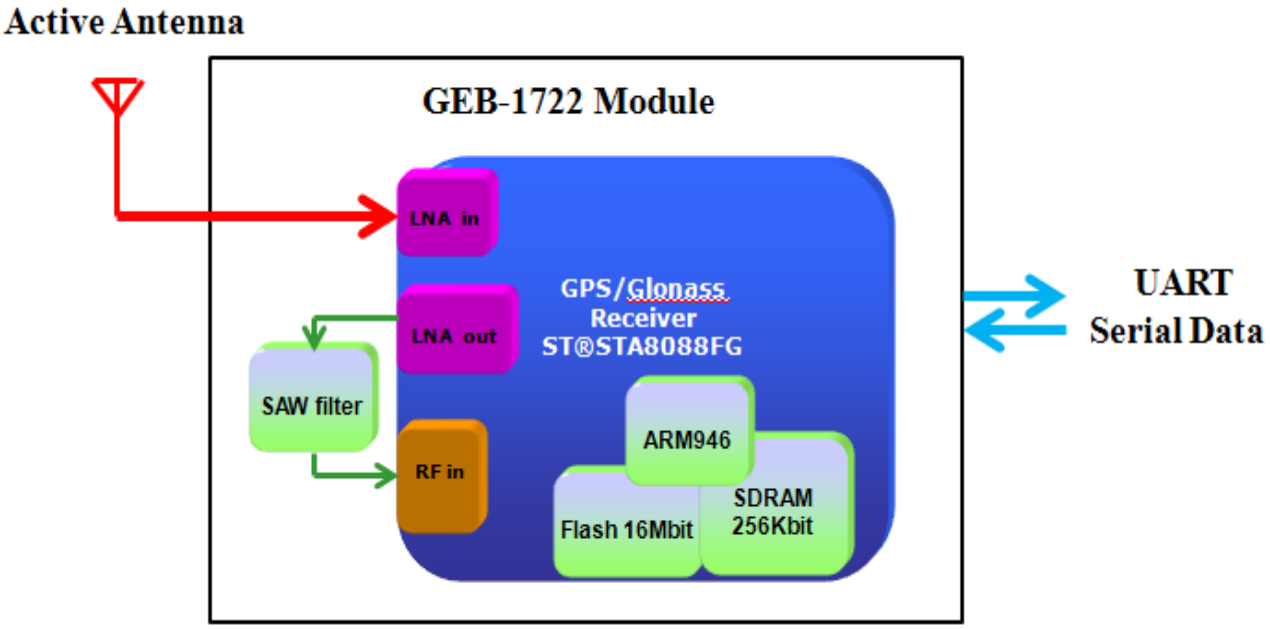
1.1 Product Applications

- ✧ Fleet management in Car
- ✧ Personal positioning and navigation
- ✧ Asset Tracking
- ✧ Others location-aware consumer devices

2 Product Pictures

3 GEB-1722 Block Diagram

System block diagram description:

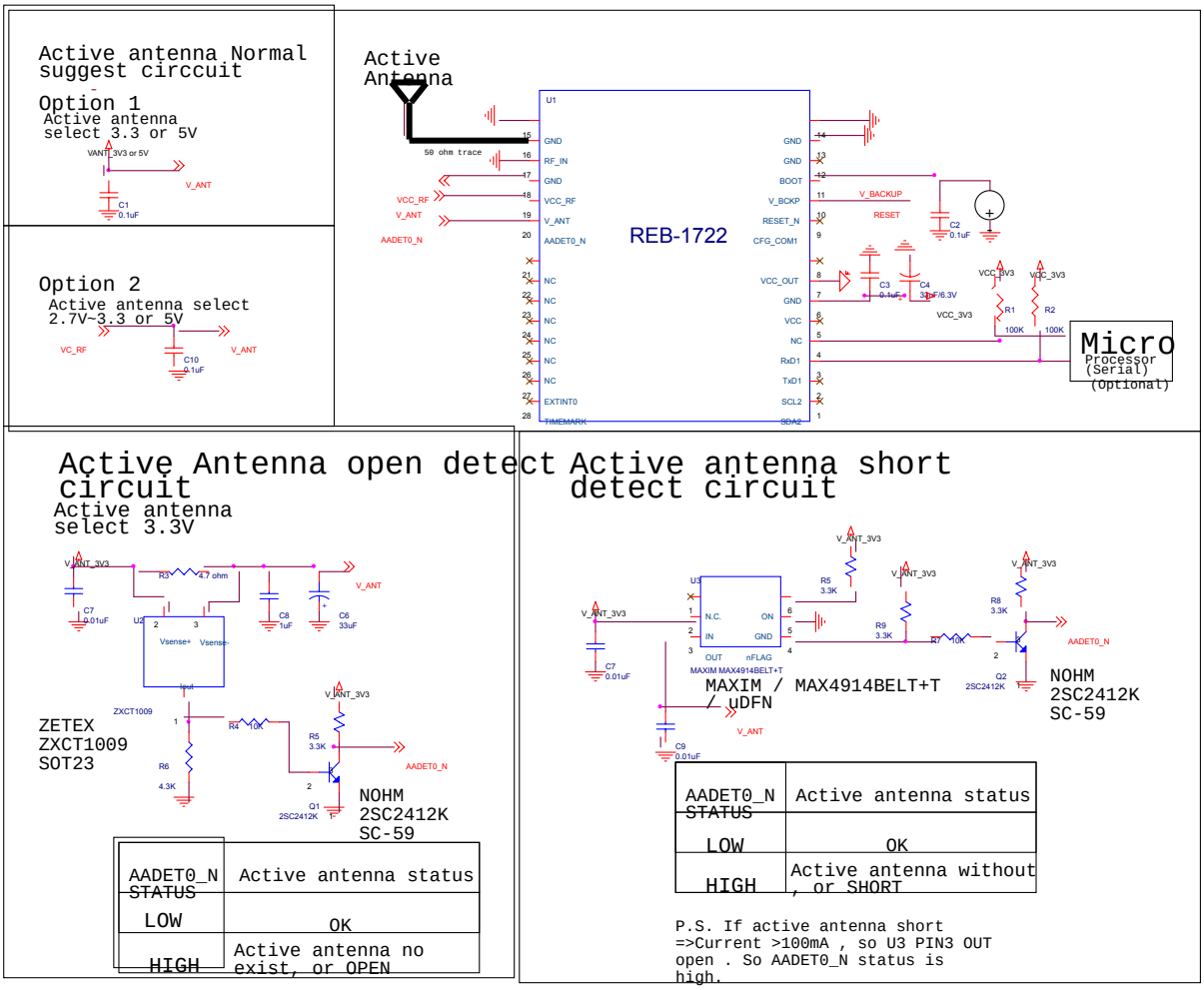


4 GEB-1722 Technical Specification

Impedance：50Ω

No	Function	Specification
GPS receiver		
1	Chipset	ST Microelectronic high sensitivity chipset
2	Frequency band, Mhz	GPS: 1575.42MHz. GLONASS: 1598~1606MHz
3	Code	C.A. Code.
4	Channels	Tracking:32 Channel Acquisition: 2 Channel
5	Chipset Sensitivity	Indoor sensitivity in tracking mode: -162dBm.
6	Chipset Cold start	35 sec (open sky)
7	Chipset Warm start	35 sec (open sky)
8	Hot start	1 sec (open sky)
9	Reacquisition	less than 1s
10	Position accuracy	Static 1.5m (CEP50 24hr static-130dBm)
11	Maximum altitude	18000 m
12	Maximum velocity	515 m/s
13	Update rate	Continuous operation: 1Hz
14	Protocol setup	It shall store the protocol setup in the SRAM memory.
15	DGPS	WAAS, EGNOS
Interface		
16	LNA	17dB Gain. (Typical)
17	I/O Pin	28pins
Power consumption		
18	VCC	DC +3.0~3.6V
19	V_BCKP	DC +1.4~3.6V
20	Current	Avg. 100mA@3.3V(without ext. antenna)
Environment		
21	Temperature	Operating : -40 ~ 85℃ Storage : -40 ~ 85℃
22	Humidity	≦95%

5 Reference schematic:



Note:

- **Ground Planes:**
  These pin (7,13, 14, 15, 17) should be connect to ground.
- **Serial Interface:**
  (I) The TxD1 pin is the serial output data (Default NMEA).
  (II) The RxD1 pin is the serial input data (Default NMEA).
- **Backup Battery:**
  When module is working, must to supply VCC (P6) and V_BCKP (P11) power at the same time.
  It's recommended to connect a backup battery to V_BCKP pin.
  In order to enable the warm start and hot start features of the GPS receiver.
  If you use backup battery, should be adding a bypassing capacitor (0.01~10uF) at V_BCKP pin. It can reduce noise and increase the stability.

■ **RF_IN:**

Connecting to the antenna has to be routed on the PCB. The transmission line must to controlled impedance to connect RF_IN to the antenna or antenna connector of your choice. (Impedance 50Ω)

(1) Power:

Connect VCC pin to DC+3.0~3.6V. The power supply must add bypassing capacitor (10uF and 0.1uF).It can reduce the Noise from power supply and increase power stability.

(2) Active antenna bias voltage:

The VCC_RF pin (pin 18) provide voltage 3.3V. If you use active antenna, you can connect this pin to V_ANT pin (pin 19) to provide bias voltage of active antenna. The bias voltage will be through GPS_RF_IN pin to provide active antenna bias voltage from VCC_RF pin.

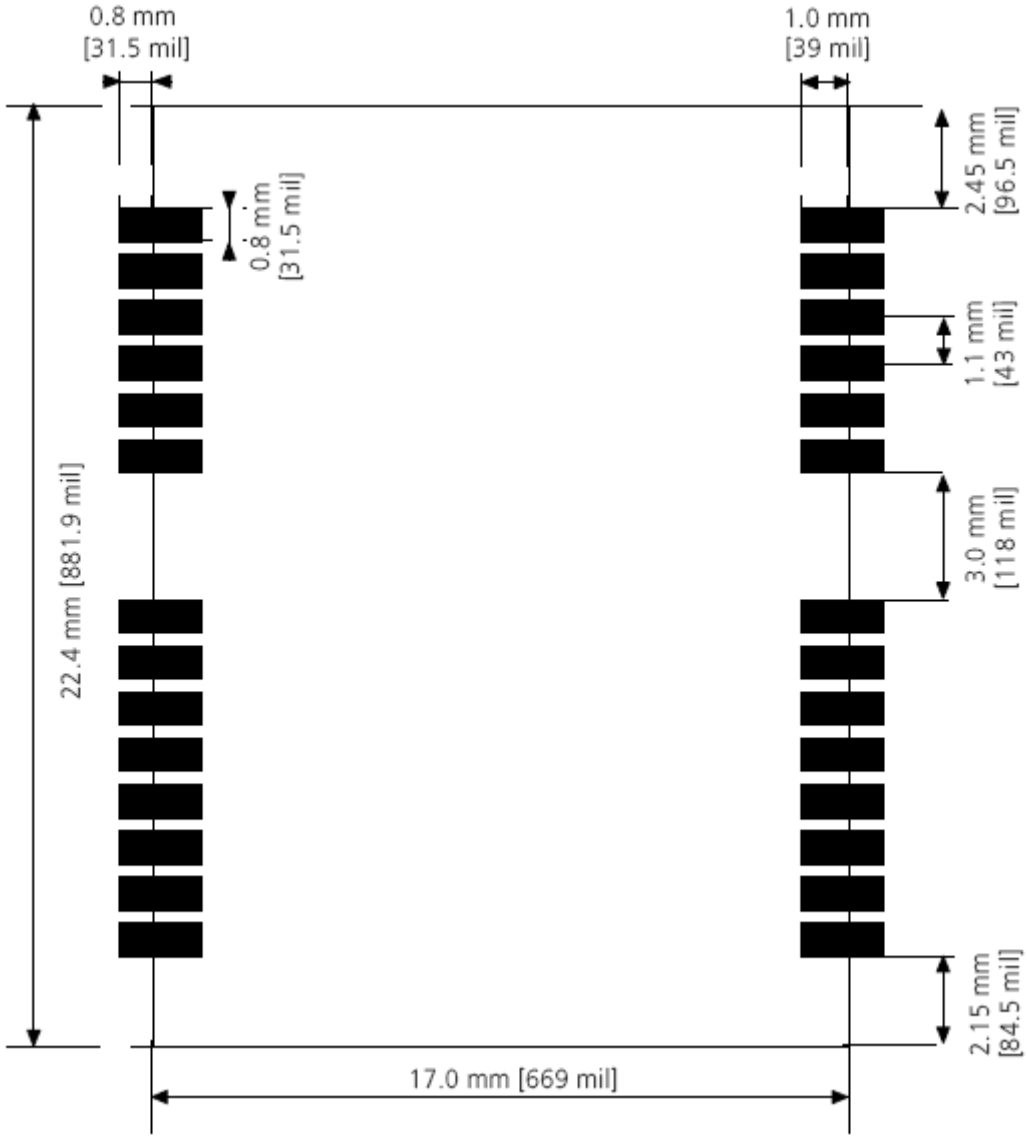
If your bias voltage of active antenna isn't 3.3V, you can input bias voltage to V_ANT pin (pin 19).And input bias voltage of you need. The input bias voltage will through GPS_RF_IN pin to provide active antenna bias voltage from V_ANT pin.

PS:

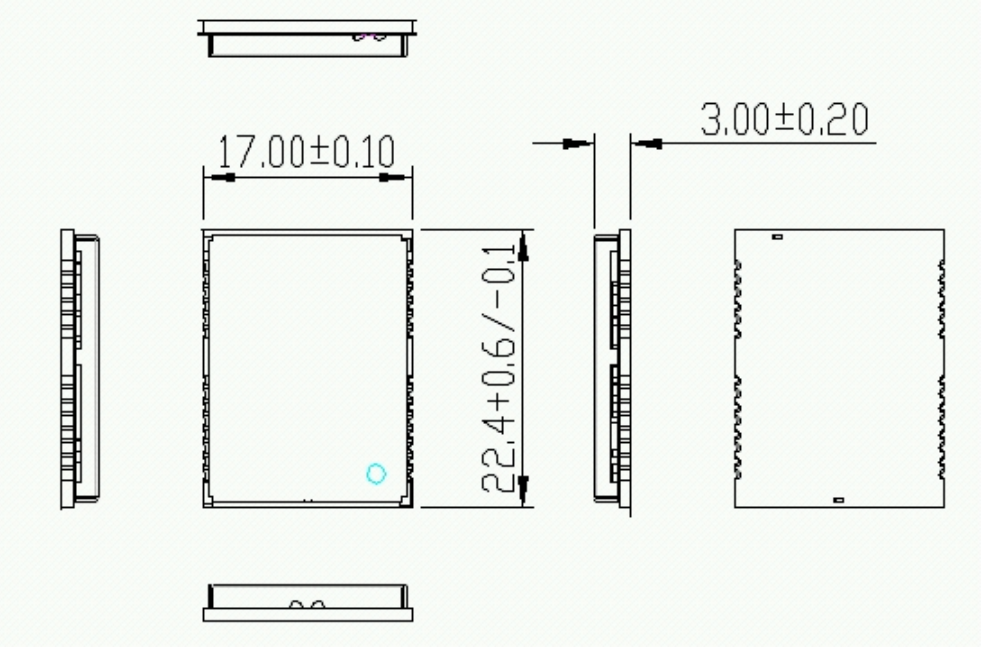
(1) The maximum power consumption of active antenna is about 85mW.

(2) The input gain ranges are 19~ 27dB.

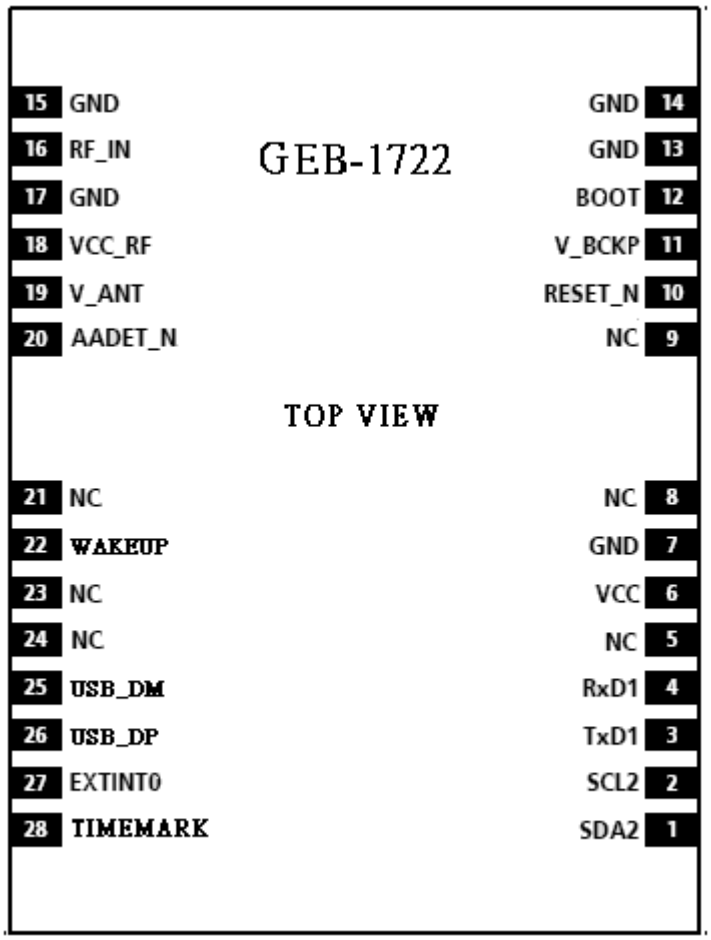
6 Recommend layout PAD:



7 Mechanical diagram



8 Interface pin definition



Pin defined:

Pin #	Signal Name	I/O	Description	Characteristics
1	SDA2	I/O	General purpose I/O	$3.6V \geq V_{IH} \geq 2.0V$ $-0.3V \leq V_{IL} \leq 0.8V$ $V_{OH} \geq 2.9V$ $V_{OL} \leq 0.4V$
2	SCL2	I/O	General purpose I/O	$3.6V \geq V_{IH} \geq 2.0V$ $-0.3V \leq V_{IL} \leq 0.8V$ $V_{OH} \geq 2.9V$ $V_{OL} \leq 0.4V$
3	TxD1	O	Serial port A	$V_{OH} \geq 2.9V$ $V_{OL} \leq 0.4V$
4	RxD1	I	Serial port B	$3.6V \geq V_{IH} \geq 2.0V$ $-0.3V \leq V_{IL} \leq 0.8V$
5	N.C.	~	N.C.	None connector
6	VCC	I	DC Supply Voltage input	DC +3.0~3.6V
7	GND	~	Ground	Reference Ground
8	N.C.	~	N.C.	None connector

9	N.C.	~	N.C.	None connector
10	RESET_N	I	Reset (Active low)	$V_{IH} > 2.3V$ $V_{IL} < 0.8V$
11	V_BCKP	I	Backup voltage supply	DC +1.4 ~ +3.6V Current ≤ 10uA
12	BOOT	I	Boot mode	$3.6V \geq V_{IH} \geq 2.0V$ $-0.3V \leq V_{IL} \leq 0.8V$
13	GND	~	Ground	Reference Ground
14	GND	~	Ground	Reference Ground
15	GND	~	Ground	Reference Ground
16	RF_IN	I	GPS Signal input	GPS 50 Ω @1.57542GHz GNSS 50 Ω @1.601718GHz
17	GND	~	Ground	Reference Ground
18	VCC_RF	O	Supply Antenna Bias voltage	DC +3.3V ±2% Current < 20mA
19	V_ANT	I	Active Antenna Bias voltage	Receiving DC power supply for active antenna bias.
20	AADET0_N	I	Active Ant. Detect	Detect Active Antenna=>"low" $3.6V \geq V_{IH} \geq 2.0V$ $-0.3V \leq V_{IL} \leq 0.8V$
21	N.C.	~	N.C.	None connector
22	WAKEUP	I	WAKEUP from STANDBY mode	WAKEUP Active=>"High" $1.5V \geq V_{IH} \geq 0.84V$ $-0.3V \leq V_{IL} \leq 0.48V$
23	N.C.	~	N.C.	None connector
24	N.C.	~	N.C.	None connector
25	USB_DM	I/O	USB signal	USB D+ signal
26	USB_DP	I/O	USB signal	USB D+ signal
27	EXTINT0	I	Ext. Interrupt	External pull-up resistor to 3.3V $3.6V \geq V_{IH} \geq 2.0V$ $-0.3V \leq V_{IL} \leq 0.8V$
28	TIMEMARK	O	One pulse per second	$V_{OH} \geq 2.9V$ $V_{OL} \leq 0.4V$

■ **VCC_3V3 (DC 3.0~3.6V power Input)**

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

- **GND**
  GND provides the ground.
- **Boot**
  Set this pin to low for programming flash.
- **RxD1**
  This is the main receiver channel and is used to receive software commands to the board from SIRFdemo software or from user written software.
- **TXD1**
  This is the main transmitting channel and is used to output navigation and measurement data to SiRFdemo or user written software.
- **GPS_RF_IN**
  This pin receives GPS analog signal. The line on the PCB between the antenna (or antenna connector) has to be a controlled impedance line (Microstrip at 50Ω).
- **V_ANT_IN**
  This pin is reserved as external DC power supply input for active antenna.
  1. If using external supply DC+3.3V~5V to Active antenna
  2. If using connects to VCC_RF pin supply to Active antenna, pin 18 has to be connected to pin 19
  PS: The current must be ≦100mA and voltage ≦5.5V, if using external power supply.

- **VCC_RF_OUT**
  This pin can provide power 20mA@DC+2.85V for active antenna.

- **Reset_N**
  This pin provides an active-low reset input to the board. It causes the board to reset and start searching for satellites. If not utilized, it may be left open.

- **TIMEMARK**
  This pin provides one pulse-per-second output from the board, which is synchronized to GPS time.

- **V_RTC_3V3 (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 supply voltage should be between 1.4V and 3.6V.

- **GPIO Functions (SCL2, SDA2, USB_DP, USB_DM , AADET0_N, EXTINT0)**

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

  If don't used, can open.

- **AADET0_N**

  AADET_N is an input pin and is used to report whether an externa l circuit has detected a external antenna or not. Low means antenna has been detected. High means no external antenna has been detected.

9 Software Interface

NMEA Protocol

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
GSA	GNSS DOP and active satellites
GSV	GNSS satellites in view
RMC	Recommended minimum specific GNSS data
GLL	Geographic position – latitude/longitude
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	12158.341		Dddmm.mmmm

	6		
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
3-5	Not Supported
6	Dead Reckoning Mode, fix valid

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 5
Mode 2	3		See Table 6
ID of Satellite Used	07		Sv on Channel 1
ID of Satellite Used	02		Sv on Channel 2

….			….
ID of 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 5 Mode 1

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

Table 6 Mode 2

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

GSV-GNSS Satellites in View

Table 7 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 7 GSV Data Format

Name	Example	Units	Description
Message ID	$GPGSV		GSV protocol header
Total 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(Range 00 to 90)

Azimuth	048	degrees	Channel 1(True, Range 000 to 359)
SNR (C/No)	42	dBHz	Channel 1(Range 0 to 99, null when not tracking)
Satellite ID	27		Channel 4(Range 01 to 32)
Elevation	27	degrees	Channel 4(Range 00 to 90)
Azimuth	138	degrees	Channel 4(True, Range 000 to 359)
SNR (C/No)	42	dB-Hz	Channel 4(Range 00 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 8 contains the values of the following example:

$GPRMC, 161229.487, A, 3723.2475, N, 12158.3416, W, 0.13, 309.62, 120598, ,*10

Table 8 RMC Data Format

Name	Example	Units	Description
Message ID	$GPRMC		RMC protocol header
UTC Time	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	True
Course Over Ground	309.62	degrees	
Date	120598		ddmmyy
Magnetic Variation		degrees	
Variation sense			E=east or W=west (Not shown)
Mode	A		A=Autonomous, D=DGPS, E=DR
Checksum	*10		
<CR><LF>			End of message termination

VTG-Course Over Ground and Ground Speed

Table 9 contains the values of the following example:

$GPVTG,79.65,T,,M,2.69,N,5.0,K,A*38

Table 9 VTG Data Format

Name	Example	Units	Description
Message ID	$GPVTG		VTG protocol header
Course over rgound	79.65	degrees	Measured heading
Reference	T		True
Course over ground		degrees	Measured heading
Reference	M		Magnetic
Speed over ground	2.69	Knots	Measured speed
Units	N		Knots
Speed over ground	5.0	Km/hr	Measured speed
Units	K		Kilometer per hour
Mode	A		A-autonomous, D=DGPS, E=DR
Checksum	*38		
<CR><LF>			End of message termination

GLL-Geographic Position – Latitude/Longitude

Table 10 contains the values of the following example:

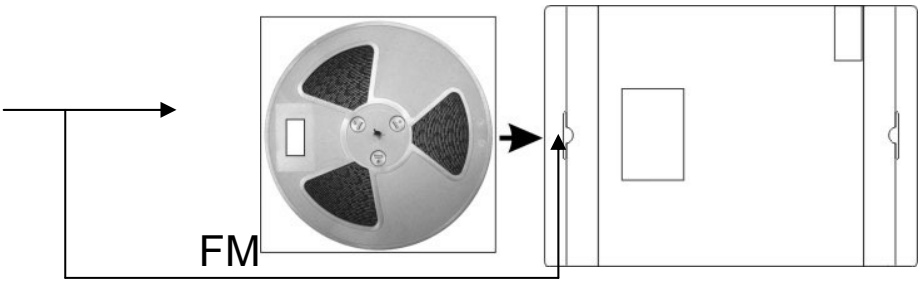
$GPGLL,2503.6319,N,12136.0099,E,053740.000,A,A*52

Table 10 GLL Data Format

Name	Example	Units	Description
Message ID	$GPGLL		GLL protocol header
Latitude	2503.6319		ddmm.mmmm
N/S indicator	N		N=north or S=south
Longitude	12136.0099		Dddmm.mmmm
E/W indicator	E		E=east or W=west
UTC Time	053740.000		hhmmss.sss
Status	A		A=data valid or V=data not valid
Mode	A		A=autonomous, D=DGPS, E=DR
Checksum	*52		
<CR><LF>			End of message termination

10 Package Specification and Order Information

Shipment Method: Tape and reel



11 Contact Royaltek

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Revision History

Title	GEB-1722 GPS Module		
Doc Type	Operational Manual		
Revision Number	Date	Author	Change notice
0.1	2012/05/09	May Chen	Initial Release