Data Sheet / GE-5083 / GE-5084

Tiny, Easy to Use,

Ultra High Performance,

GPS + GLONASS (GE-5083) /

GPS + BEIDOU (GE-5084)

GNSS Engine Board

RoHS Compliant

With Digital & RF Connectors

Version 1.1

NaviSys Technology Corp.
Tel : +886-3-5632598
Sales contact: sales@navisys.com.tw
Address: 2F, No.56, Park Ave. II, Science-Based Industrial Park, Hsinchu 300, Taiwan (R.O.C.)
http://www.navisys.com.tw/
Fax: +886-3-5632597
Technical support: service@navisys.com.tw

Revision History

Ver.	Date	Description
1.0	Apr. 22nd, 2014	Initial draft
1.1	Oct. 3rd , 2016	Support web page update

Contents

1 Introduction

1.1 Overview

GE-5083/GE-5084 is a tiny, ultra-high performance, easy to use UART GNSS engine designed with MT3333 chipset, digital & RF connectors.

The tiny design allows the fast adoption of handheld applications or other dimension demanding devices and high yield production.

In addition, this low power engine supports multiple satellite positioning systems – GPS, GLONASS, BEIDOU, QZSS and SBAS.

Based on our experienced design, GE-5083/GE-5084 fully exhibits the excellent performance of MT3333. It provides not only fast acquisitions and excellent tracking performance but also quality and delivery assurance.

Feeding backup-power by the V_BAT pin allows faster position fix by keeping ephemeris in internal memory.

The high accuracy 1PPS (Pulse Per Second) w/ ±10ns jitter is useful in timing application.

For high speed application, it outputs 10Hz position data. It's especially useful in high speed racing applications.

1.2 Main Features

GE-5083/GE-5084 fixes positions using multiple satellite positioning systems. In addition, it supports self-generated ephemeris data and many other features.

- Full implementation of ultra-high performance MT3333 single chip architecture.
- Tiny: 8 (W) x 20 (L) x 2.7 (H) (mm)
- UART interface support
- High tracking sensitivity of -165 dBm[2]
- Low power consumption of 22 mA for average tracking
- Support multi-GNSS, SBAS ranging

- GNSS support: GPS/QZSS/GLONASS (GE-5083), GPS/QZS/BEIDOUS (GE-5084)
- SBAS support: WAAS/EGNOS/MSAS/GAGAN
- Time pulse support for timing application.
- Built-in RF connector, reduce RF tuning efforts, flexible antenna installation.
- Built-in digital connector: flexible module installation
- Screw hole for fixing & performance enhancement
- External active antenna **short circuit protection**
- External backup power by the V_BAT pin for faster position fix.
- 12 multi-tone active interference cancellers
- Indoor/outdoor multi-path detection & compensation
- Maximum update rate up to 10Hz.
- High accuracy 1PPS timing (10ns jitter)
- AGPS support with Self-Generated Orbit Prediction (EASY) [1] for fast position-fix
- Minimum RF and EMI efforts
- Industrial operating temperature range: -40 ~ 85℃

Notes

1. Some features may not coexist and need special firmware or command programmed by Customer.

1.3 Receiver Specifications

Features	Specifications[!]
GNSS Chipset	MT3333
Frequency	GPS, GALILEO,QZSS: L1 1575.42MHz, C/A code GLONASS: L1OF 1598.0625MHz ~1605.375 (GE-5083) BEIDOU: B1 1561.098 MHz (GE-5084)
Channels	Support 99 channels (33 tracking, 99 Acquisition)
Horizontal Position Accuracy	< 3.0m (Autonomous) < 2.5m (WAAS) (CEP, 50%, 24hr static, -130dBm)
Velocity Accuracy	<0.1 m/s (speed, Autonomous, w/o SBAS) <0.05 m/s (speed w/ SBAS) (50%@30m/s)
Accuracy of Time pulse Signal	±10ns RMS (1PPS output)
TTFF (Time to First Fix) (50%, -130dBm, autonomous)	Hot Start: < 1s, average Warm Start: <24s, average Cold Start: <28s, average
Sensitivity (Autonomous)	Tracking: –165dBm Acquisition: -148dBm(cold)/-163dBm(hot)

	(-142dBm 28dB-Hz with 4dB noise figure)
Update Rate	1 Hz (default), max. up to 10 Hz
Max. Altitude	< 18,000 m
Max. Velocity	< 1,852 km/hr
Datum	WGS-84 (default)
Protocol Support	NMEA 0183 output protocol: Ver. 4.1 (compatible to 3.0), MTK NMEA UART baud rate: 4800/9600(default)/38400/115200bps, No parity, 8-data bit, 1 stop bit (N-8-1) Default: GGA, GSA, RMC, VTG @ 1Hz, GSV @ 1/5 Hz, GLL, ZDA@0Hz
SBAS Support	WAAS, EGNOS, MSAS, GAGAN
Dynamics	< 4g
Power consumption	22 mA, continuous tracking mode
Power supply	3 ~ 4.3 V
Dimension	8 (W) x 20 (L) x 2.7 (H) (mm)
Operating temperature	-40°C ~ +85°C
Storage temperature	-40°C ~ +85°C

[!]Note: Data is from chip vendor.

1.4 Protocols

The NMEA protocol is supported via serial UART (RX/TX). The default supported protocol is NMEA protocol.

1. Serial communication channel – UART
    i. No parity, 8-data bit, 1-stop bit (N-8-1)
    ii. 9600 bps (default)
2. NMEA 0183 ASCII output - Version 4.1 and backward compliance
    i. Default GGA, GSA, RMC, VTG @ 1Hz, GSV @ 1/5 Hz

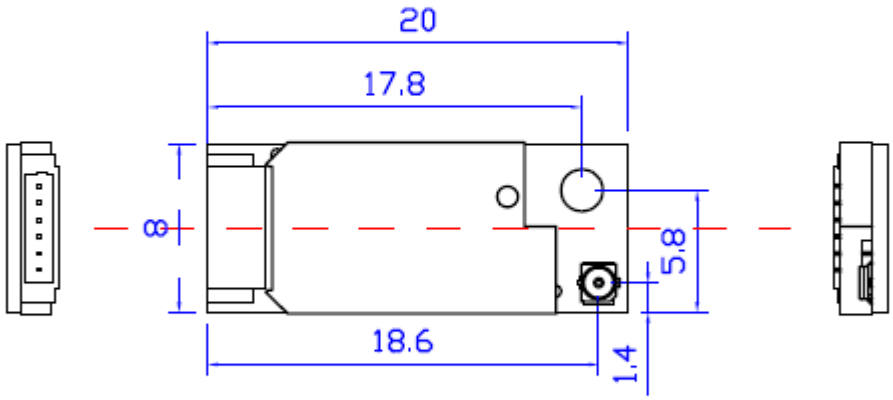
2 Hardware Interface

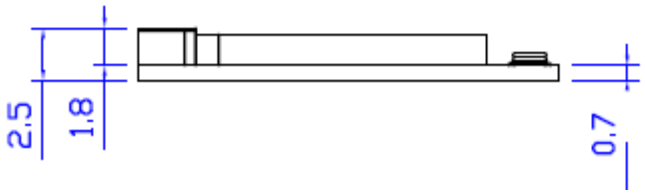
2.1 Module Dimension and LED

The dimension of GE-5083/GE-5084 is 8 mm (W) x 20 mm (L) x 2.7 mm (H).

Application

The screw hole could be used for fixing or reducing potential ground noise if it is connected to main board via a shielded ground cable.



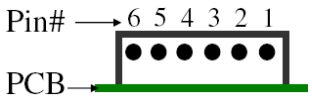


Unit : mm

Tolerance : ±0.25mm

2.2 Pin Assignment

6-pin Interface, pitch 0.8mm

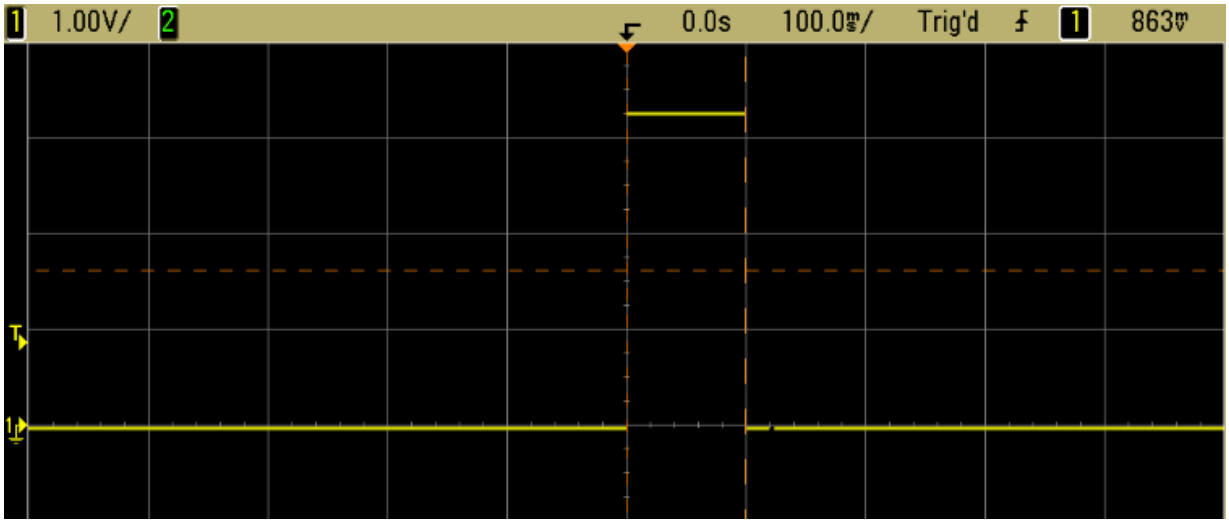


GE-5083A/GE-5084A

Pin	Name	Function	I/O
1	GND	Ground	Input
2	VCC	Power supply	Input
3	TXD	TTL level serial data output (from GPS)	Output
4	RXD	TTL level serial data input (to GPS)	Input
5	V_BAT	Backup Power	Input
6	1PPS	Time Pulse Per Second	Output

2.3 1PPS

The default pulse width of the 1PPS signal is 100ms. For customization of different width, please contact Navisys sales.



2.4 External Antenna Suggestion

An active antenna with following condition is suggested:

- Gain > 5 dB
- noise figure less than 1.5dB

3 Software Interface

3.1 NMEA Output Messages

GE-5083/GE-5084 follows the NMEA-0183 Version 4.10 interface specification standard of National Marine Electronics Association for input/output of ASCII messages. In addition to GPS, GE-5083/GE-5084 is also able to support GLONASS, BEIDOU (COMPASS), and GALILEO by software update. To distinguish pure GPS fix from GNSS (GPS + others) fix, new talker IDs are used.

For pure GPS fix, the talker ID “GP” is used. For GLONASS fix, talker IDs “GP”, “GN”, and “GL” are used as summarized below (GE-5083):

System\Sentence	GGA	GLL	GSA	GSV	RMC	VTG	ZDA
GPS	GPGGA	GPGLL	GPGSA	GPGSV	GPRMC	GPVTG	GPZDA
GNSS - GPS+GLONASS	GPGGA	GNGLL	GPGSA* or GNGSA	GPGSV GLGSV	GNRMC	GPVTG	GPZDA
Note*: "GP" if only GPS is used to fix. Otherwise, "GN"							

For BEIDOU fix, talker IDs “GP”, “GN”, and “BD” are used as summarized below (GE-5084):

System\Sentence	GGA	GLL	GSA	GSV	RMC	VTG	ZDA
GPS	GPGGA	GPGLL	GPGSA	GPGSV	GPRMC	GPVTG	GPZDA
GNSS - GPS+Beidou	GNGGA	GNGLL	GPGSA BDGSA	GPGSV BDGSV	GNRMC	GNVTG	GNZDA

GE-5083/GE-5084 supports 8 types of NMEA sentences (GGA, GLL, GSA, GSV, RMC, VTG, ZDA and PMTK).

The NMEA-0183 Output Messages are shown as below:

NMEA Record	Descriptions
GGA	Global positioning system fixed data: time, position, fixed type
GLL	Geographic position: latitude, longitude, UTC time of position fix and status
GSA	GNSS receiver operating mode, active satellites, and DOP values
GSV	GNSS satellites in view: ID number, elevation, azimuth, and SNR values
RMC	Recommended minimum specific GNSS data: time, date, position, course, speed
VTG	Course over ground and ground speed
ZDA	Time and date
PMTK	MTK proprietary message

The default output sentences are GGA, GSA, GSV, RMC and VTG. The default UART communication

parameters are 9600 bps, 8 data bits, 1 stop bit, and no parity. For support of baud rate, NMEA sentence and settings other than the default one, please contact our sales.

GPS Message examples

$GPGGA,031206.000,2446.4209,N,12100.4403,E,1,6,1.22,127.8,M,15.0,M,,*5F
$GPGLL,2446.4209,N,12100.4403,E,031206.000,A,A*55
$GPGSA,A,3,14,29,31,22,16,25,,,,,,,1.52,1.22,0.90*00
$GPGSV,2,1,07,14,64,099,27,31,49,349,31,29,32,081,26,16,31,226,22*78
$GPGSV,2,2,07,22,22,182,26,25,19,038,26,193,,,*4A
$GPRMC,031206.000,A,2446.4209,N,12100.4403,E,0.19,0.00,100613,,,A*6F
$GPVTG,0.00,T,,M,0.19,N,0.34,K,A*32

GPS+GLONASS Message examples (GE-5083)

$GPGGA,005255.000,2446.4218,N,12100.4412,E,1,16,0.70,103.5,M,15.0,M,,*62
$GNGLL,2446.4218,N,12100.4412,E,005255.000,A,A*4A
$GNGSA,A,3,26,05,17,04,12,10,02,25,13,193,,,1.22,0.70,1.00*26
$GNGSA,A,3,72,66,65,88,81,87,,,,,,,1.22,0.70,1.00*1B
$GPGSV,4,1,13,193,65,039,32,10,57,016,36,04,48,053,37,05,47,262,34*41
$GPGSV,4,2,13,02,46,334,36,17,38,144,36,13,26,052,37,12,24,277,33*77
$GPGSV,4,3,13,26,17,188,31,25,06,309,29,09,03,138,,07,01,103,*79
$GPGSV,4,4,13,23,01,036,*4E
$GLGSV,2,1,07,88,65,009,27,65,63,358,27,66,50,241,29,87,48,121,26*6F
$GLGSV,2,2,07,81,15,331,20,72,13,030,16,67,02,221,*5D
$GNRMC,005255.000,A,2446.4218,N,12100.4412,E,0.02,230.60,230114,,,A*7D
$GPVTG,230.60,T,,M,0.02,N,0.04,K,A*3C
$GPZDA,005255.000,23,01,2014,,*56

GPS+BEIDOU Message examples (GE-5084)

$GNGGA,101917.000,2446.4252,N,12100.4381,E,1,15,0.76,107.2,M,15.0,M,,*71
$GNGLL,2446.4252,N,12100.4381,E,101917.000,A,A*41
$GPGSA,A,3,25,14,31,22,18,193,12,32,29,,,,1.08,0.76,0.76*30
$BDGSA,A,3,07,14,06,09,10,12,,,,,,,1.08,0.76,0.76*15
$GPGSV,3,1,09,25,60,052,36,14,59,012,37,22,56,197,39,31,43,291,34*71
$GPGSV,3,2,09,18,27,166,32,193,26,176,31,12,22,039,35,29,18,120,31*4C
$GPGSV,3,3,09,32,15,319,30*4D
$BDGSV,3,1,12,09,65,240,26,14,63,193,25,07,58,341,23,03,58,204,*68
$BDGSV,3,2,12,01,55,139,28,06,50,188,24,10,46,296,24,04,38,117,*6E
$BDGSV,3,3,12,02,37,245,,05,17,257,,12,16,127,23,08,15,168,20*6D

$GNRMC,101917.000,A,2446.4252,N,12100.4381,E,0.07,202.88,220114,,,A*75
$GNVTG,202.88,T,,M,0.07,N,0.13,K,A*26
$GNZDA,101917.000,22,01,2014,,*41

3.2 GGA - Global Positioning System Fixed Data

3.2.1 GPS Satellites Only or GPS and GLONASS Satellites

- Example

  $GPGGA,052144.000,2446.4241,N,12100.4363,E,1,7,1.39,97.6,M,15.0,M,,*6D

- Explanation

Contents	Example	Unit	Explanation
Message ID	$GPGGA		GGA protocol header
UTC Time	052144.000		hhmmss.sss hh: hour, mm: minute, ss.sss: second
Latitude	2446.4241		ddmm.mmmm dd: degree, mm.mmmm: minute
North/South	N		N: North Latitude, S: South Latitude
Longitude	12100.4363		dddmm.mmmm dd: degree, mm.mmmm: minute
East/West	E		E: East Longitude, W: West Longitude
Position Fix Indicator	1		0: Fix not available or invalid, 1: GPS SPS Mode, fix valid, 2: Differential GPS SPS Mode, fix valid, 3~5: Not supported 6: Estimated (Dead Reckoning) Mode
Satellites Used	7		Number of satellites used in positioning calculation (0 to 33)
HDOP	1.39		Horizontal Dilution of Precision
MSL Altitude	97.6	meters	Mean-sea-level (geoid) altitude
Altitude Units	M		Meters
Geoid Separation	15.0	meters	The difference between the WGS-84 earth ellipsoid surface and mean-sea-level surface. “-“ means mean-sea-level surface below WGS-84 ellipsoid surface.
Separation Units	M		Meters
Age of DGPS data		second	Null, when DGPS is not used
DGPS Station ID			0000~1023; Null, when DGPS is not used
checksum	*6D		
<CR><LF>			End of sentence

3.2.2 GPS and BEIDOU Satellites

- Example

  $GNGGA,101917.000,2446.4252,N,12100.4381,E,1,15,0.76,107.2,M,15.0,M,,*71

- Explanation

Contents	Example	Unit	Explanation
Message ID	$GNGGA		GGA protocol header
UTC Time	101917.000		hhmmss.sss

			hh: hour, mm: minute, ss.sss: second
Latitude	2446.4252		ddmm.mmmm dd: degree, mm.mmmm: minute
North/South	N		N: North Latitude, S: South Latitude
Longitude	12100.4381		dddmm.mmmm dd: degree, mm.mmmm: minute
East/West	E		E: East Longitude, W: West Longitude
Position Fix Indicator	1		0: Fix not available or invalid, 1: GPS SPS Mode, fix valid, 2: Differential GPS SPS Mode, fix valid, 3~5: Not supported 6: Estimated (Dead Reckoning) Mode
Satellites Used	15		Number of satellites used in positioning calculation (0 to 33)
HDOP	0.76		Horizontal Dilution of Precision
MSL Altitude	107.2	meters	Mean-sea-level (geoid) altitude
Altitude Units	M		Meters
Geoid Separation	15.0	meters	The difference between the WGS-84 earth ellipsoid surface and mean-sea-level surface. "-" means mean-sea-level surface below WGS-84 ellipsoid surface.
Separation Units	M		Meters
Age of DGPS data		second	Null, when DGPS is not used
DGPS Station ID			0000~1023; Null, when DGPS is not used
checksum	*71		
<CR><LF>			End of sentence

3.3 GLL - Geographic Position - Latitude / Longitude

3.3.1 GPS Satellites Only

- Example

  $GPGLL,2446.4264,N,12100.4385,E,052631.000,A,A*52

- Explanation

Contents	Example	Unit	Explanation
Message ID	$GPGLL		GLL protocol header
Latitude	2446.4264		ddmm.mmmm dd: degree, mm.mmmm: minute
North/South	N		N: North Latitude, S: South Latitude
Longitude	12100.4385		dddmm.mmmm dd: degree, mm.mmmm: minute
East/West	E		E: East Longitude, W: West Longitude
UTC Time	052631.000		hhmmss.sss hh: hour, mm: minute, ss.sss: second
Status	A		A: Data valid, V: Data invalid
Mode Indicator	A		A: Autonomous mode, D: Differential mode, E: Estimated (dead reckoning) mode, M: Manual input mode, N: Data not valid, S: Simulator Mode
checksum	*52		
<CR><LF>			End of sentence

3.3.2 GPS and GLONASS Satellites or GPS and BEIDOU Satellites

- Example

  $GNGLL,2446.4252,N,12100.4381,E,101917.000,A,A*41

- Explanation

Contents	Example	Unit	Explanation
Message ID	$GNGLL		GLL protocol header
Latitude	2446.4252		ddmm.mmmm dd: degree, mm.mmmm: minute
North/South	N		N: North Latitude, S: South Latitude
Longitude	12100.4381		dddmm.mmmm dd: degree, mm.mmmm: minute
East/West	E		E: East Longitude, W: West Longitude
UTC Time	101917.000		hhmmss.sss hh: hour, mm: minute, ss.sss: second
Status	A		A: Data valid, V: Data invalid
Mode Indicator	A		A: Autonomous mode, D: Differential mode, E: Estimated (dead reckoning) mode, M: Manual input mode, N: Data not valid, S: Simulator Mode
checksum	*41		
<CR><LF>			End of sentence

3.4 GSA - GNSS DOP and Active Satellites

3.4.1 GPS Satellites Only

- Example

  $GPGSA,A,3,19,03,23,06,27,13,16,31,,,,,1.55,1.28,0.88*06

- Explanation

Contents	Example	Explanation
Message ID	$GPGSA	GSA protocol header
Mode 1	A	M: Manual—forced to operate in 2D or 3D mode A: Automatic—allowed to automatically switch 2D/3D
Mode 2	3	1: Fix not available 2: 2D (<= 4 Satellites used) 3: 3D (>= 4 Satellites used)
Satellite used in solution	19	Satellite on Channel 1
Satellite used in solution	03	Satellite on Channel 2
…		Display of quantity used (12 max) If less than 12 SVs are used for navigation, the remaining fields are empty.
PDOP	1.55	Positional Dilution of Precision
HDOP	1.28	Horizontal Dilution of Precision
VDOP	0.88	Vertical Dilution of Precision
checksum	*06	
<CR><LF>		End of sentence

3.4.2 GPS and GLONASS Satellites

- Example

$GNGSA,A,3,11,19,08,01,07,03,193,09,20,32,17,16,0.93,0.66,0.65*20

$GNGSA,A,3,74,83,73,75,,,,,,,,0.93,0.66,0.65*1B

- Explanation

Contents	Example	Explanation
Message ID	$GNGSA	GSA protocol header
Mode 1	A	M: Manual—forced to operate in 2D or 3D mode A: Automatic—allowed to automatically switch 2D/3D
Mode 2	3	1: Fix not available 2: 2D (<= 4 Satellites used) 3: 3D (>= 4 Satellites used)
Satellite used in solution	11	Satellite on Channel 1
Satellite used in solution	19	Satellite on Channel 2
…		Display of quantity used (12 max) If less than 12 SVs are used for navigation, the remaining fields are empty.
PDOP	0.93	Positional Dilution of Precision
HDOP	0.66	Horizontal Dilution of Precision
VDOP	0.65	Vertical Dilution of Precision
checksum	*20	
<CR><LF>		End of sentence

3.4.3 GPS and BEIDOU Satellites

- Example

$GPGSA,A,3,25,14,31,22,18,193,12,32,29,,,,1.08,0.76,0.76*30

$BDGSA,A,3,07,14,06,09,10,12,,,,,,1.08,0.76,0.76*15

- Explanation

Contents	Example	Explanation
Message ID	$BDGSA	GSA protocol header
Mode 1	A	M: Manual—forced to operate in 2D or 3D mode A: Automatic—allowed to automatically switch 2D/3D
Mode 2	3	1: Fix not available 2: 2D (<= 4 Satellites used) 3: 3D (>= 4 Satellites used)
Satellite used in solution	07	Satellite on Channel 1
Satellite used in solution	14	Satellite on Channel 2
…		Display of quantity used (12 max) If less than 12 SVs are used for navigation, the remaining fields are empty.
PDOP	1.08	Positional Dilution of Precision
HDOP	0.76	Horizontal Dilution of Precision
VDOP	0.76	Vertical Dilution of Precision
checksum	*15	
<CR><LF>		End of sentence

3.5 GSV - GNSS Satellites in View

3.5.1 GPS Satellites Only

- Example

$GPGSV,3,1,12,03,78,330,48,19,69,224,47,06,62,028,49,42,54,140,44*7F

$GPGSV,3,2,12,23,46,255,49,16,43,030,48,13,39,293,47,193,28,147,42*4E

$GPGSV,3,3,12,11,19,193,44,31,19,126,45,21,09,049,25,07,08,318,37*76

- Explanation

Contents	Example	Unit	Explanation
Message ID	$GPGSV		GSV protocol header
Number of messages	3		Range 1 to 6
Message number	1		Range 1 to 6
Satellites in view	12		Number of satellites visible from receiver
Satellite ID number	03		Channel 1 (Range 01 to 196)
Elevation	78	degrees	Elevation angle of satellite as seen from receiver channel 1 (00 to 90)
Azimuth	330	degrees	Satellite azimuth as seen from receiver channel 1 (000 to 359)
SNR (C/No)	48	dBHz	Received signal level C/No from receiver channel 1 (00 to 99, null when not tracking)
…			
Satellite ID number	42		Channel 4 (Range 01 to 196)
Elevation	54	degrees	Elevation angle of satellite as seen from receiver channel 4 (00 to 90)
Azimuth	140	degrees	Satellite azimuth as seen from receiver channel 4 (000 to 359)
SNR (C/No)	44	dBHz	Received signal level C/No from receiver channel 4 (00 to 99, null when not tracking)
checksum	*7F		
<CR><LF>			End of sentence

3.5.2 GPS and GLONASS Satellites

- Example

$GPGSV,4,1,13,193,65,039,32,10,57,016,36,04,48,053,37,05,47,262,34*41

$GPGSV,4,2,13,02,46,334,36,17,38,144,36,13,26,052,37,12,24,277,33*77

$GPGSV,4,3,13,26,17,188,31,25,06,309,29,09,03,138,,07,01,103,*79

$GPGSV,4,4,13,23,01,036,*4E

$GLGSV,2,1,07,88,65,009,27,65,63,358,27,66,50,241,29,87,48,121,26*6F

$GLGSV,2,2,07,81,15,331,20,72,13,030,16,67,02,221,*5D

- Explanation

Contents	Example	Unit	Explanation
Message ID	$GLGSV		GSV protocol header
Number of messages	2		Range 1 to 6
Message number	1		Range 1 to 6
Satellites in view	07		Number of satellites visible from receiver
Satellite ID number	88		Channel 1 (Range 01 to 196)

Elevation	65	degrees	Elevation angle of satellite as seen from receiver channel 1 (00 to 90)
Azimuth	009	degrees	Satellite azimuth as seen from receiver channel 1 (000 to 359)
SNR (C/No)	27	dBHz	Received signal level C/No from receiver channel 1 (00 to 99, null when not tracking)
…			
Satellite ID number	87		Channel 4 (Range 01 to 196)
Elevation	48	degrees	Elevation angle of satellite as seen from receiver channel 4 (00 to 90)
Azimuth	121	degrees	Satellite azimuth as seen from receiver channel 4 (000 to 359)
SNR (C/No)	26	dBHz	Received signal level C/No from receiver channel 4 (00 to 99, null when not tracking)
checksum	*6F		
<CR><LF>			End of sentence

3.5.3 GPS and BEIDOU Satellites

- Example

$GPGSV,3,1,09,25,60,052,36,14,59,012,37,22,56,197,39,31,43,291,34*71

$GPGSV,3,2,09,18,27,166,32,193,26,176,31,12,22,039,35,29,18,120,31*4C

$GPGSV,3,3,09,32,15,319,30*4D

$BDGSV,3,1,12,09,65,240,26,14,63,193,25,07,58,341,23,03,58,204,*68

$BDGSV,3,2,12,01,55,139,28,06,50,188,24,10,46,296,24,04,38,117,*6E

$BDGSV,3,3,12,02,37,245,,05,17,257,,12,16,127,23,08,15,168,20*6D

- Explanation

Contents	Example	Unit	Explanation
Message ID	$BDGSV		GSV protocol header
Number of messages	3		Range 1 to 6
Message number	1		Range 1 to 6
Satellites in view	12		Number of satellites visible from receiver
Satellite ID number	09		Channel 1 (Range 01 to 196)
Elevation	65	degrees	Elevation angle of satellite as seen from receiver channel 1 (00 to 90)
Azimuth	240	degrees	Satellite azimuth as seen from receiver channel 1 (000 to 359)
SNR (C/No)	26	dBHz	Received signal level C/No from receiver channel 1 (00 to 99, null when not tracking)
…			
Satellite ID number	03		Channel 4 (Range 01 to 196)
Elevation	58	degrees	Elevation angle of satellite as seen from receiver channel 4 (00 to 90)
Azimuth	204	degrees	Satellite azimuth as seen from receiver channel 4 (000 to 359)
SNR (C/No)		dBHz	Received signal level C/No from receiver channel 4 (00 to 99, null when not tracking)
checksum	*7F		
<CR><LF>			End of sentence

3.6 RMC - Recommended Minimum Specific GNSS Data

3.6.1 GPS Satellites Only

- Example

  $GPRMC,061141.000,A,2446.4235,N,12100.4391,E,0.61,294.52,240613,,,A*69

- Explanation

Contents	Example	Unit	Explanation
Message ID	$GPRMC		RMC protocol header
UTC Time	061141.000		hhmmss.sss hh: hour, mm: minute, ss.sss: second
Status	A		A: Data valid, V: Data invalid
Latitude	2446.4235		ddmm.mmm dd: degree, mm.mmm: minute
North/South	N		N: North Latitude, S: South Latitude
Longitude	12100.4391		dddmm.mmm dd: degree, mm.mmmmm: minute
East/West	E		E: East Longitude, W: West Longitude
Speed over ground	0.61	knots	Receiver's speed
Course over ground	294.52	degrees	Receiver's direction of travel Moving clockwise starting at due north
Date	240613		ddmmyy dd: Day, mm: Month, yy: Year
Magnetic variation		degrees	This receiver does not support magnetic declination. All "course over ground" data are geodetic WGS84 directions.
East/West magnetic variation			
Mode Indicator	A		A: Autonomous mode, D: Differential mode, E: Estimated (dead reckoning) mode, M: Manual input mode, N: Data not valid, S: Simulator Mode
checksum	*69		
<CR><LF>			End of sentence

3.6.2 GPS and GLONASS or GPS and BEIDOU Satellites

- Example

  $GNRMC,070558.000,A,2446.4231,N,12100.4384,E,0.01,68.79,030613,,,A*40

- Explanation

Contents	Example	Unit	Explanation
Message ID	$GNRMC		RMC protocol header
UTC Time	070558.000		hhmmss.sss hh: hour, mm: minute, ss.sss: second
Status	A		A: Data valid, V: Data invalid
Latitude	2446.4231		ddmm.mmm dd: degree, mm.mmm: minute
North/South	N		N: North Latitude, S: South Latitude
Longitude	12100.4384		dddmm.mmm dd: degree, mm.mmmmm: minute
East/West	E		E: East Longitude, W: West Longitude
Speed over ground	0.01	knots	Receiver's speed

Course over ground	68.79	degrees	Receiver's direction of travel Moving clockwise starting at due north
Date	030613		ddmmyy dd: Day, mm: Month, yy: Year
Magnetic variation		degrees	This receiver does not support magnetic declination. All "course over ground" data are geodetic WGS84 directions.
Mode Indicator	A		A: Autonomous mode, D: Differential mode, E: Estimated (dead reckoning) mode, M: Manual input mode, N: Data not valid, S: Simulator Mode
checksum	*40		
<CR><LF>			End of sentence

3.7 VTG - Course over Ground and Ground Speed

3.7.1 GPS Satellites Only or GPS and GLONASS Satellites

- Example

  $GPVTG,68.79,T,,M,0.00,N,0.01,K,D*09

Explanation

Contents	Example	Unit	Explanation
Message ID	$GPVTG		VTG protocol header
Course over ground	68.79	degrees	Receiver's direction of travel Moving clockwise starting at due north (geodetic WGS84 directions)
Reference	T		True heading
Course over ground		degrees	Receiver's direction of travel
Reference	M		Magnetic heading
Speed over ground	0.00	knots	Measured horizontal speed
Unit	N		Knots
Speed over ground	0.01	km/hr	Measured horizontal speed
Unit	K		km/hr
Mode Indicator	D		A: Autonomous mode, D: Differential mode, E: Estimated (dead reckoning) mode M: Manual input mode, N: Data valid, S: Simulator mode
checksum	*09		
<CR><LF>			End of sentence

3.7.2 GPS and BEIDOU Satellites

- Example

  $ GNVTG,202.88,T,,M,0.07,N,0.13,K,A*26

Explanation

Contents	Example	Unit	Explanation
Message ID	$GNVTG		VTG protocol header

Course over ground	202.88	degrees	Receiver's direction of travel Moving clockwise starting at due north (geodetic WGS84 directions)
Reference	T		True heading
Course over ground		degrees	Receiver's direction of travel
Reference	M		Magnetic heading
Speed over ground	0.07	knots	Measured horizontal speed
Unit	N		Knots
Speed over ground	0.13	km/hr	Measured horizontal speed
Unit	K		km/hr
Mode Indicator	A		A: Autonomous mode, D: Differential mode, E: Estimated (dead reckoning) mode M: Manual input mode, N: Data valid, S: Simulator mode
checksum	*26		
<CR><LF>			End of sentence

3.8 ZDA – Time and Date

3.8.1 GPS Satellites Only or GPS and GLONASS Satellites

- Example

  $GPZDA,065644.000,14,11,2013,,*56

- Explanation

Contents	Example	Unit	Explanation
Message ID	$GPZDA		ZDA protocol header
UTC time	065644.000		HHMMSS.sss
Day	14		Day according to UTC time (01 to 31)
Month	11		Month according to UTC time (01 to 12)
Year	2013		Year according to UTC time (1980 to 2079)
Local zone hour			Offset from UTC
Local zone minutes			Offset from UTC
checksum	*56		
<CR><LF>			End of sentence

3.8.2 GPS and BEIDOU Satellites

- Example

  $GNZDA,101917.000,22,01,2014,,*41

- Explanation

Contents	Example	Unit	Explanation
Message ID	$GNZDA		ZDA protocol header
UTC time	101917.000		HHMMSS.sss
Day	22		Day according to UTC time (01 to 31)
Month	01		Month according to UTC time (01 to 12)
Year	2014		Year according to UTC time (1980 to 2079)
Local zone hour			Offset from UTC
Local zone minutes			Offset from UTC
checksum	*41		

<CR><LF>			End of sentence

3.9 PMTK – MTK Proprietary Messages[2]

Command Format:

$PMTK<command code>[,<parm>[,<parm>[,…]]]*<check sum><CR><LF>

Response Format:

$PMTK001,<command code>,<flag><CR><LF>

<flag>:

0: invalid command/packet

1: unsupported command/packet type

2: valid command/packet, but action failed

3: valid command/packet, action succeeded

- Example - TTFF

  $PMTK101*32<CR><LF> // hot start

  $PMTK102*31<CR><LF> // warm start

  $PMTK103*30<CR><LF> // cold start

  $PMTK104*37<CR><LF> // factory reset

- Example – NMEA Baud Rate[1]

  $PMTK251,4800*14<CR><LF> // 4800 bps

  $PMTK251,9600*17<CR><LF> // 9600 bps

  $PMTK251,19200*22<CR><LF> // 19200 bps

  $PMTK251,38400*27<CR><LF> // 38400 bps

  $PMTK251,115200*1F<CR><LF> // 115200 bps

- Example – NMEA Sentence Output Rate

  $PMTK314,1,1,1,1,1,5,0,0,0,0,0,0,0,0,0,0,0,0,0*2C<CR><LF>

  // GLL, RMC, VTG, GGA, GSA once every fix; GSV once every 5 fixes

  $PMTK314,0,1,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0*29<CR><LF> // RMC only

  $PMTK314,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,1,0*29<CR><LF> // ZDA only

  $PMTK314,0,1,0,1,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0*28<CR><LF> // GGA, RMC

  $PMTK314,0,1,0,0,1,0,0,0,0,0,0,0,0,0,0,0,0,0,0*28<CR><LF> // GSA, RMC

- Example – Fix Update Rate[1]

  $PMTK300,100,0,0,0,0*2C<CR><LF>// Output 10 fixes a second

  $PMTK300,200,0,0,0,0*2F<CR><LF> // Output 5 fixes a second

  $PMTK300,500,0,0,0,0*28<CR><LF> // Output 2 fixes a second

  $PMTK300,1000,0,0,0,0*1A<CR><LF> // Output 1 fix a second

  Return: $PMTK001,300,3*33<CR><LF> // response of successful command

- Example – Static Navigation Threshold
  $PMTK386,<speed threshold in m/s; 0~2>*<check sum><CR><LF>
  $PMTK386,0.4*19<CR><LF> // 0.4 m/s
  $PMTK386,2.0*3F<CR><LF> // 2.0 m/s
  $PMTK386,0*23<CR><LF> // disable static navigation
  Return: $PMTK001,386,3*3D<CR><LF> // response of successful command

- Example – DGPS Mode
  $PMTK301,2*2E<CR><LF> // DGPS source SBAS
  $PMTK301,1*2D<CR><LF> // DGPS source RTCM
  $PMTK301,0*2C<CR><LF> // No DGPS source
  Return: $PMTK001,301,3*32<CR><LF> // response of successful command

- Example – SBAS
  $PMTK313,1*2E<CR><LF> // SBAS enable
  $PMTK313,0*2F<CR><LF> // SBAS disable

- Notes

  1. Higher update rate requires higher NMEA baud rate. E.g. Baud rate higher than 38400 bps is suggested if output GGA, GSA, GSV, RMC at 5 Hz.

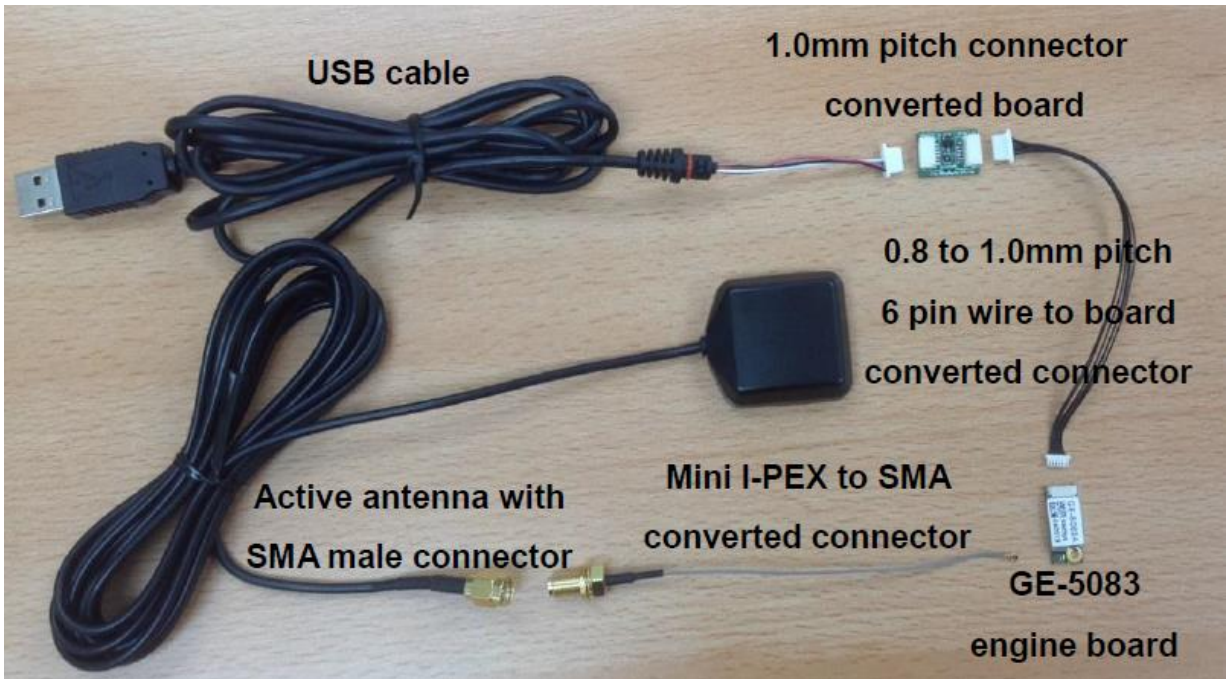
  2. All the command changes are valid only when the backup power is supplied. Settings will go back to their default one if the backup power disappears.

4 Evaluation Information

4.1 Evaluation Kit

The EVK (Evaluation Kit) of GE-5083/GE-5084 includes following major parts and a USB cable.

- the EVK includes following major parts
  - an active antenna module with SMA male connector, typically with 25x25x4 (mm) antenna
  - Mini I-PEX to SMA converted connector
  - a GE-5083/GE-5084
  - 1.0mm pitch connector converted board
  - a 0.8 to 1.0mm pitch 6-pin wire to board converted connector from GE-5083/GE-5084 to converted board
- USB cable
  - Type A USB male connector to PC/NB USB port
  - 6-pin wire to board male connector to converted board



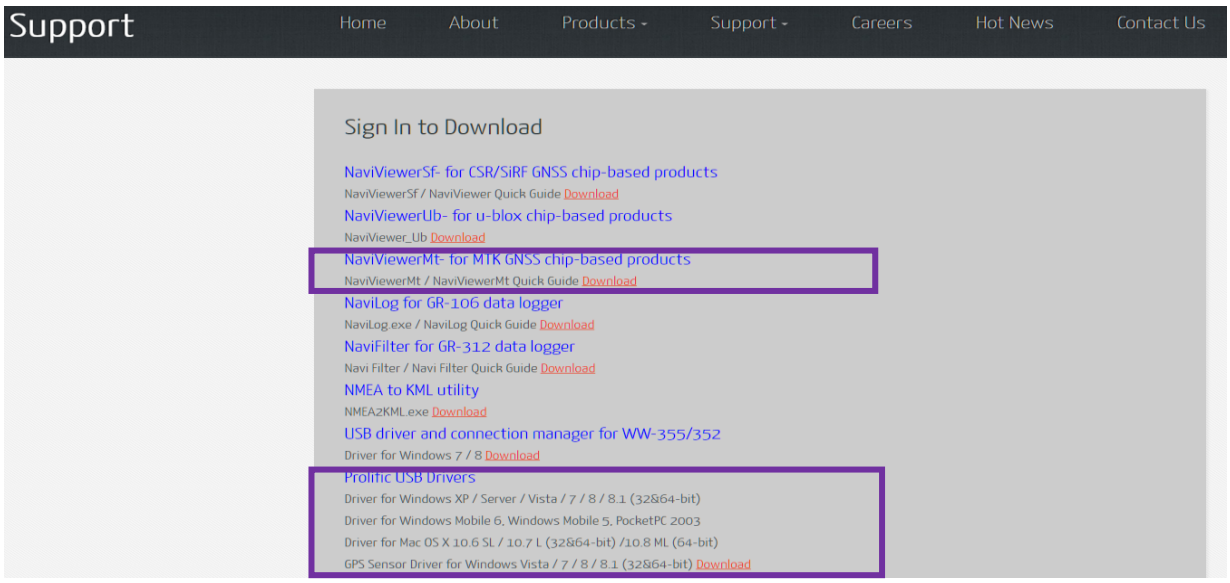
Picture of EVK parts

Picture of EVK parts connected

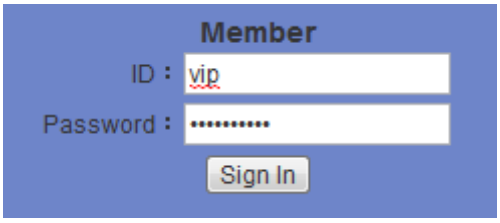
4.2 USB Driver and GNSS Viewer Tool

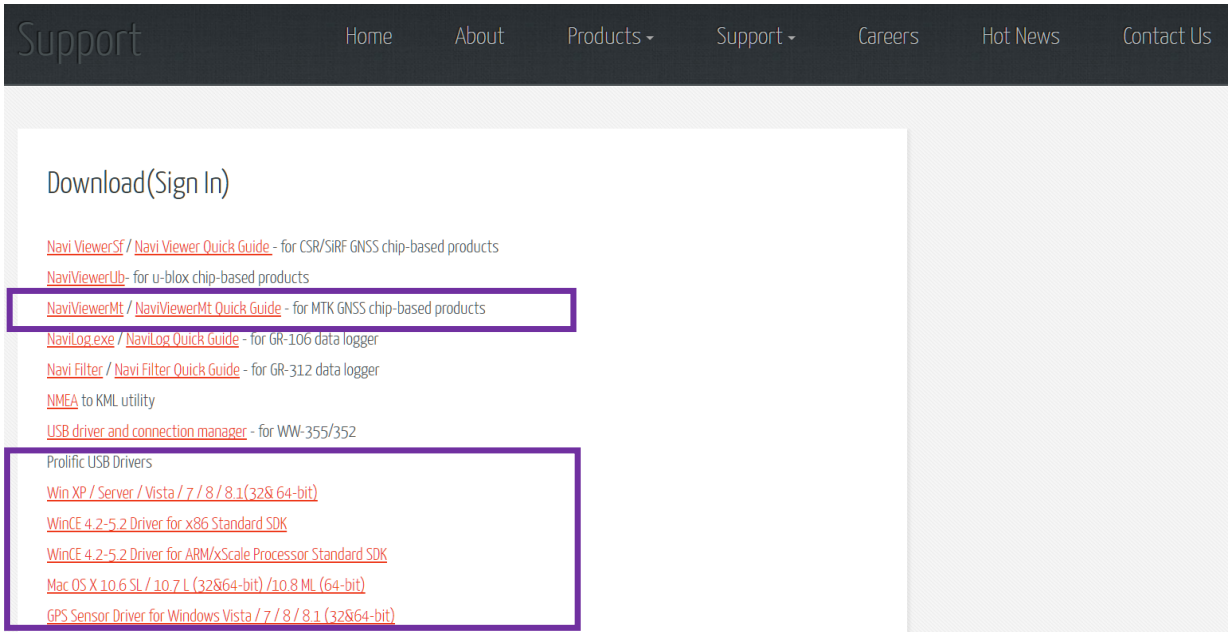
USB drivers and GNSS Viewer Tool (NaviViewerMt) are available from Navisys download link as shown below: http://www.navisys.com.tw/support.html

For GE-5083/GE-5084, please select the following purple mark **Prolific USB Drivers and NaviViewerMt- for MTK GNSS chip-based products**.



1. Click on Download and it prompts for ID and password. Enter ID and Password and then click on Sign In to download the drivers. The default password is “navi-utility”. Please note that the ID and password is subject to change without notification.





4.3 Tips in Designing

The GNSS signal is pretty low, less than -130 dBm, which is easily interfered by the EMI of application circuit. Its working frequency might be shifted from the central frequency due to the housing material of host.

Interference checking

1. Check the signal reception status of GNSS module (engine board with external antenna) standalone with GNSS viewer tool.
2. Compare it when it is placed at the planned location on the application board.
3. Please find better location or adjust the application to reduce the interference if it affects the GNSS receiving sensitivity.

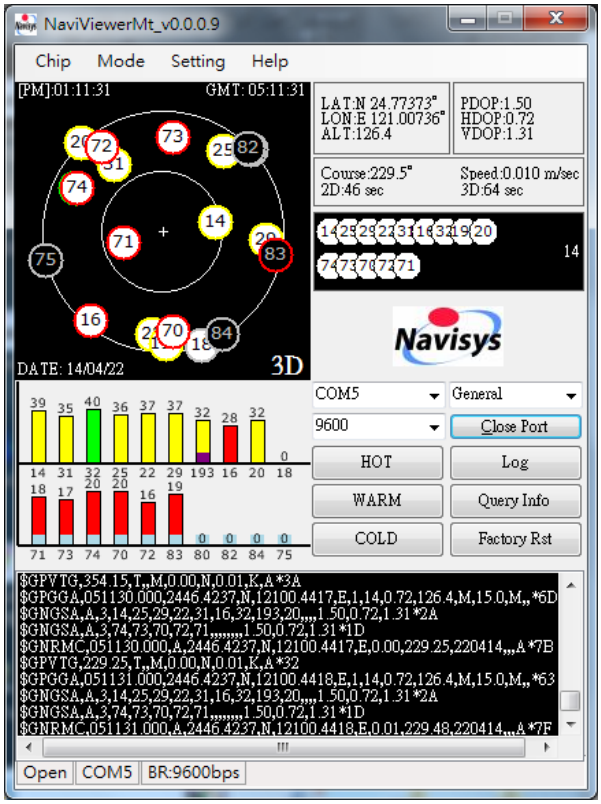
Antenna working frequency checking

1. Compare the GNSS sensitivity with and without host’s housing.

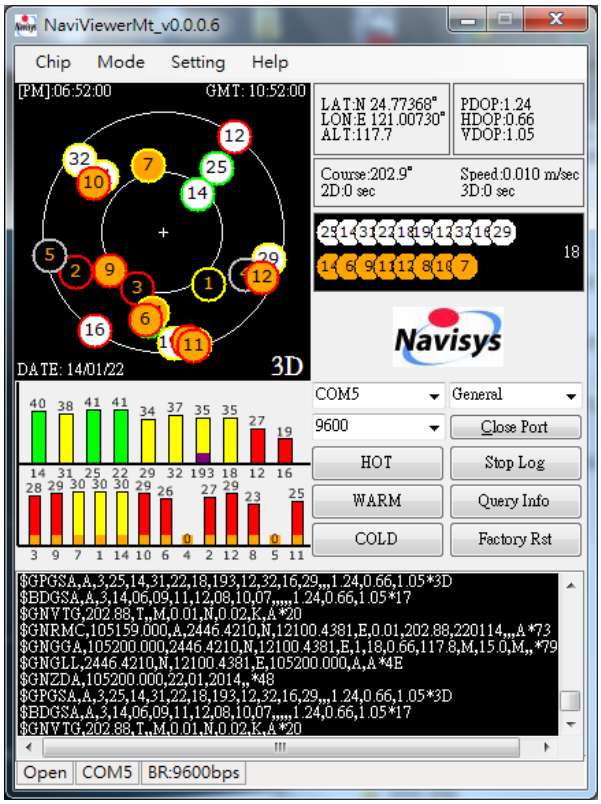
2. If the GNSS signal is degraded significantly, the GNSS antenna needs to fine tuning to achieve the optimum central frequency and field pattern.

3. Please note that there is MOQ request for antenna customization.

NaviViewerMt GNSS Viewer Tool



Snapshot of GE-5083



Snapshot of GE-5084

Notes on signal bars:

1. Signal strength is represented by the bar length and color
   - Blue: ≧ 50, green: ≧ 40, yellow: ≧ 30, red: < 30
2. Satellites of different systems are displayed by different bar colors:
   - GPS: one color
   - QZSS: purple rectangle at the bottom
   - GLONASS: cyan rectangle at the bottom
   - BEIDOU(Compass): brown rectangle at the bottom

4.4 Ordering Information

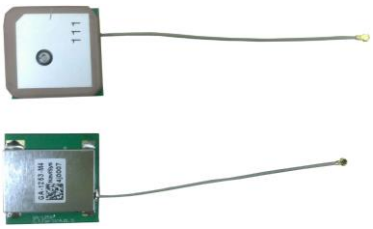
GE-5083X, GE-5084X

X=A	9600bps, GGA, GSA, RMC, VTG@1Hz, GSV@1/5Hz

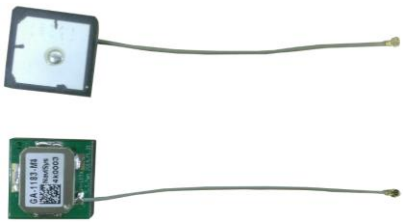
Software options of different baud rates, NMEA sentence output rate, position fix update rate, datum, and many others are available.

Please contact Navisys sales window directly or email to sales@navisys.com.tw if any customization is needed.

Reference **active antenna modules** - GPS/GLONASS, I-PEX MHF4 connector, 80 mm long



GA-1253M4



GA-1183M4

5 Electrical and Environmental Data

Electrical Data

Power Supply (VDC)	3 ~ 4.3
Power Consumption	22mA/average tracking
Backup power	2 ~ 4.3 V
Digital I/O (V)	V_{IH} : 2.1~3.1 V V_{IL} : 0 ~ 0.7 V V_{OH} ≧ 2.38 V V_{OL} ≦0.42 V
Protocols	NMEA (default), MTK NMEA

Environmental Data

Operating temperature	-40 ~ 85℃
Storage temperature	-40 ~ 85℃
Vibration	5Hz to 500Hz, 5g
Shock	Half sine 30g/11ms
RoHS compliant	Yes