



GPS Module DataSheet

Name: Ultra High Sensitivity and Low Power GPS Receiver Module

Model NO.: SKG17AH

Revision: 001

Revision History:

Revision	Description	Approved	Date
001	Initial Release to 001	Neil	20100110

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General Description

The SkyNav SKG17AH is host-based solutions which is a highly cost-effective GPS solution since it eliminates the dedicated flash memory that is necessary in stand-alone configurations where all of the GPS software runs on the GPS baseband. For host-based solutions, SKYLAB offers *Install n Go*™ which is a full-featured Windows CE® host application program and compatible with ARM-based embedded processors. It initializes the GPS hardware, manages the fully ported Hosted Orion navigation software and provides a standard NMEA interface for Windows mapping software through an integrated virtual serial communication port.

This software allows for very easy installation of hosted Orion into the Windows CE environment, supporting a rapid product development cycle with a very attractive BOM. This version of the Orion software partitions the navigation and management functions onto the host, while real-time GPS signal processing remains fully embedded on the AR1511 single chip. This architecture is much easier to integrate with the host-based application software as it requires no real-time resources from the host. This hosted solution also eliminates any need for local/dedicated flash or fixed ROM. Features and performance can continue to be enhanced, and upgraded as opposed to an approach utilizing fixed ROM.

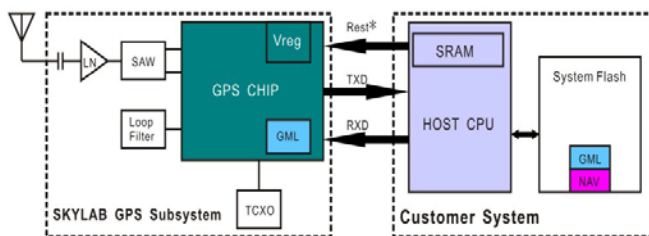


Figure 1-System Hardware Block Diagram

Figure 2 - System Hardware Block Diagram



Figure 1: SKG17AH Top View

Features

- Ultra high sensitivity: -160dBm
- Support SAGPS (Self- Assisted GPS)
- Built in high gain LNA
- Extremely fast TTFF at low signal level
- Low power consumption: Max 40mA@3.3V
- NMEA-0183 compliant protocol or custom protocol
- Operating voltage: 3.0V to 3.6V
- Operating temperature range: -40 to 85°C
- SMD type with stamp holes
- Small form factor: 22.9x17.0x2.8mm
- RoHS compliant (Lead-free)

Platform Support

- Windows XP/Vista, Windows Mobile
- Windows CE5.0/6.0, Linux 2.6,
- Others PND (Portable Navigation Device)

System Requirements

- 978K Flash memory
- 512K RAM memory

Applications

- PND (Portable Navigation Device)
- Vehicle navigation system
- Mobile phone

Pin Assignment



Figure 3: SKG17AH Pin Package

Performance Specification

Parameter	Specification
Receiver Type	L1 frequency band, C/A code, 20-channels
Sensitivity	Tracking -160dBm Acquisition -144dBm
Accuracy	Position(No SAGPS) 3.0m CEP50 without SA (Typical Open Sky) (With SAGPS) 20-30m CEP50~CEP70 Day1 35-50m CEP50~CEP70 Day2 45-60m CEP50~CEP70 Day3 Velocity 0.1m/s without SA Timing (PPS) 60ns RMS
Acquisition Time	Cold Start (No SAGPS) 36s (Typical Open Sky) (With SAGPS) 6s-10s (Typical Open Sky) Warm Start (No SAGPS) 30s 3.5s-8s Hot Start 1s Re-Acquisition <1s
Power Consumption	Tracking 35mA @3.3V Vcc(Typical) Acquisition 35mA
Navigation Data Update Rate	1Hz
Operational Limits	Altitude Max 18,000m Velocity Max 515m/s Acceleration Less than 4g

Interfaces Configuration

Power Supply: Regulated power for the SKG17AH is required. The input voltage V_{cc} should be $3.0V \pm 10\%$, maximum, current is no less than 100mA. Suitable decoupling must be provided by external decoupling circuitry.

Antenna: The SKG17AH GPS receiver is designed for supporting the active antenna or passive antenna connected with pin ANT. The gain of active antenna should be no less than 15dB. The maximum noise figure should be no more than 2.5dB and output impedance is at 50 Ohm.

UART Ports: When the *Install n Go™* service is started the GML binary image is downloaded to GPS baseband's SRAM using the physical UART0 connection between the baseband and the host CPU. To

two virtual serial ports are made available through which NMEA data is provided to GPS mapping applications. For ease of application integration these virtual serial ports are fully compatible with the standard Windows CE serial port APIs.

Backup Battery Power: In case of a power failure on pin VDD, real-time clock and backup RAM are supplied through pin VBAT. This enables the SKG17AH GPS Receiver to recover from power failure with either a hot start or a warm start. Please be noted that module could not work if VBAT do not connect to backup battery or power supply, and still need to add a bypassing capacitor (10uF) to V_BAT pin, then can reduce noise and increase the stability

Pin Description

Pin No.	Pin name	I/O	Description	Remark
1	TXD1	O	UART Serial Data Output 1	Not open
2	RXD1	I	UART Serial Data Input 1	Not open
3	TXD0	O	UART Serial Data Output 0	Leave open if not used
4	RXD0	I	UART Serial Data Input 0	Leave open if not used
5	NC		Reserved for future use	Leave open
6	VCC	I	Module Power Supply	
7	GND	G	Ground	
8	NC		Reserved for future use	Leave open
9	NC		Reserved for future use	Leave open
10	RESET	I	Module Reset (Active Low)	Leave open if not used
11	V_BAT	I	RTC Battery Input	Leave open if not used
12	Boot	I	Boot Mode	Leave open if not used
13	GND	G	Ground	
14	GND	G	Ground	
15	GND	G	Ground	
16	RF_IN	I	Antenna Input	50Ω@1.57542GHz
17	GND	G	Ground	
18	VCC_RF	O	Voltage Output for Active Antenna	May be connected to V_ANT, Leave open if not used
19	V_ANT	I	Active Antenna External Voltage Supply	

20	AADET	I	Active Antenna Open-circuit detection	Leave open in not used
21	NC		Reserved for future use	Leave open
22	NC		Reserved for future use	Leave open
23	NC		Reserved for future use	Leave open
24	NC		Reserved for future use	Leave open
25	NC		Reserved for future use	Leave open
26	NC		Reserved for future use	Leave open
27	WAKE	I	Wake Control Input Pin	Not open
28	PPS	O	Time pulse Signal (100ms)	Leave open if not used

Electrical Characteristics

Absolute Maximum Rating

Parameter	Symbol	Min	Max	Units
Power Supply				
Power Supply Volt.	VCC	-0.3	3.6	V
Input Pins				
Input Pin Voltage I/O	Reset	-0.3	3.6	V
Input Pin Voltage I/O	RX	-0.3	3.6	V
Input Pin Voltage I/O	BOOT	-0.3	3.6	V
Antenna Bias DC Voltage	VANT	-0.3	3.6	V
Backup Battery	VBAT	2.0	3.6	V
Environment				
Storage Temperature	Tstg	-40	125	°C
Peak Reflow Soldering Temperature <10s	Tpeak		260	°C
Humidity			95	%

Note: Absolute maximum ratings are stress ratings only, and functional operation at the maxims is not guaranteed. Stress beyond the limits specified in this table may affect device reliability or cause permanent damage to the device. For functional operating conditions, refer to the operating conditions tables as follow.

Operating Condition

Parameter	Symbol	Condition	Min	Typ	Max	Units
Power supply voltage	Vcc		3.0	3.3	3.6	V
Power supply voltage ripple	Vcc_PP	Vcc=3.0V			30	mV
Consumption current	Icc	Vcc=3.0V		40	45	mA
Input high voltage	V _{IH}		0.7xVcc		Vcc	V
Input low voltage	V _{IL}		-0.3		0.3xVcc	V
Output high voltage	V _{OH}		0.8xVcc		Vcc	V
Output low voltage	V _{OL}		0		0.2xVcc	V
Operating temperature	Topr		-40		85	°C

Mechanical Specification

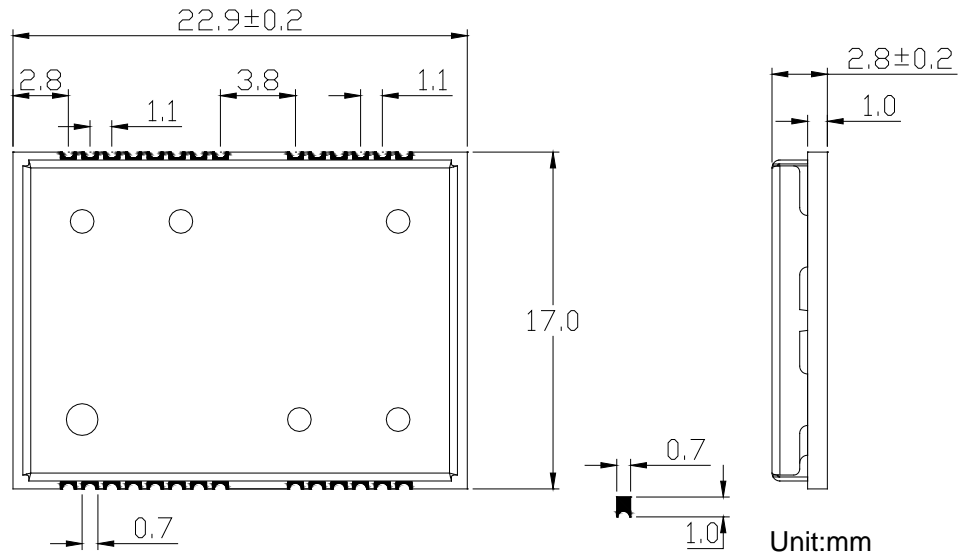


Figure 4: SKG17AH Dimensions

Recommend Layout

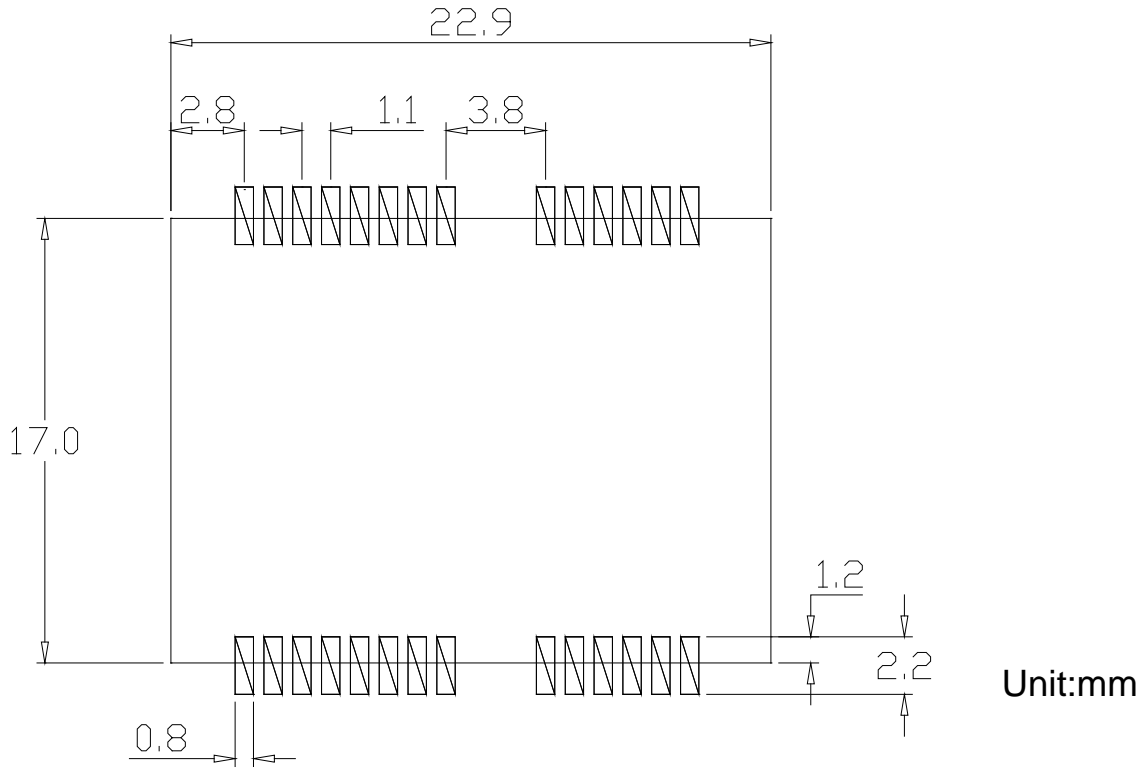


Figure 5: SKG17AH Footprint

Packaging Specification

SKG17AH Series modules are shipped in tray and with 90 units per tray. Each tray is 'dry' package

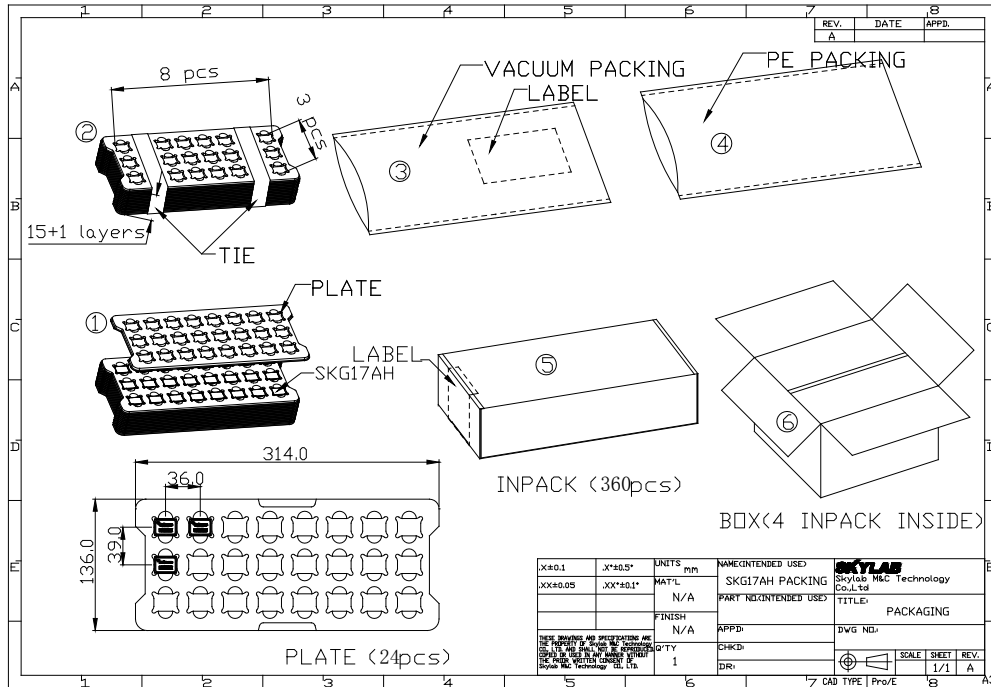


Figure 6: SKG17AH Packaging

Manufacturing Process Recommendations

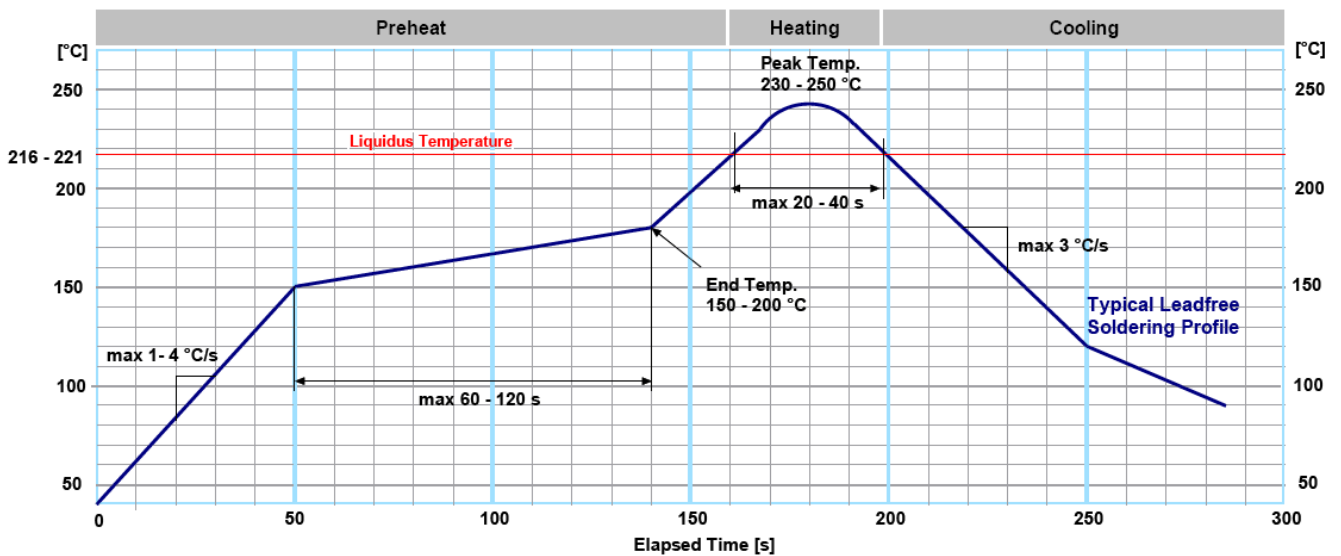


Figure 7: SKG17AH Typical Leadfree Soldering Profile

Note: The final soldering temperature chosen at the factory depends on additional external factors like choice of

soldering paste, size, thickness and properties of the baseboard, etc. Exceeding the maximum soldering temperature in the recommended soldering profile may permanently damage the module.

Reference design schematic

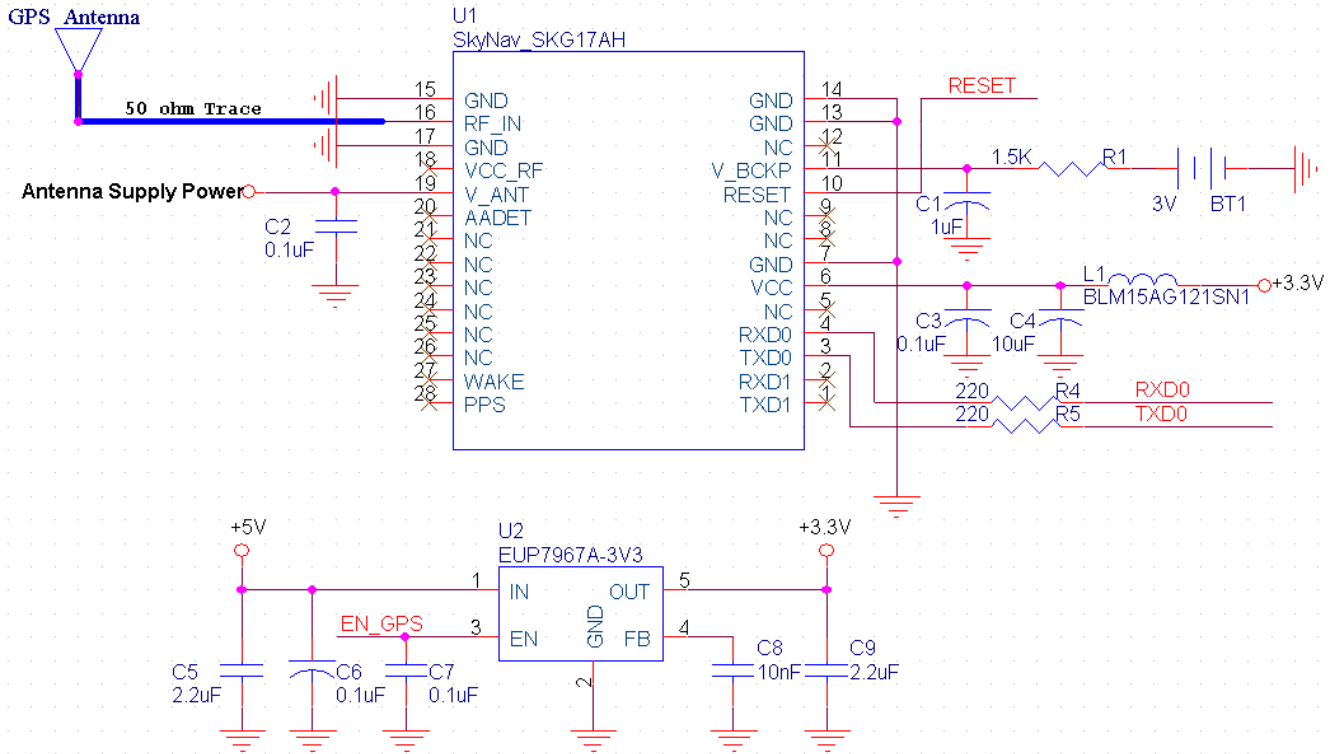


Figure 7: SKG17AH Reference design

Software Protocol

NMEA 0183 Protocol

The NMEA protocol is an ASCII-based protocol, Records start with a \$ and with carriage return/line feed. GPS specific messages all start with \$GPxxx where xxx is a three-letter identifier of the message data that follows. NMEA messages have a checksum, which allows detection of corrupted data transfers.

The SkyNav SKG17AH module supports the following NMEA-0183 messages: GGA, GLL, GSA, GSV, RMC VTG, ZDA and DTM. The module default NMEA-0183 output is set up GGA, GSA ,GSV, RMC and default baud rate is set up 9600bps.

Table 1: NMEA-0183 Output Messages

NMEA Record	Description	Default
GGA	Global positioning system fixed data	Y
GLL	Geographic position—latitude/longitude	N
GSA	GNSS DOP and active satellites	Y
GSV	GNSS satellites in view	Y

RMC	Recommended minimum specific GNSS data	Y
VTG	Course over ground and ground speed	N
ZDA	Date and Time	N
DTM	Datum reference	N

GGA-Global Positioning System Fixed Data

This sentence contains the position, time and quality of the navigation fix.

See RMC for Fix Status, Fix Mode, Fix Date, Speed, and True Course.

See GSA for Fix Type, PDOP, and VDOP.

\$GPGGA,033410.000,2232.1745,N,11401.1920,E,1,07,1.1,107.14,M,0.00,M,,*64

Table 2: GGA Data Format

Name	Example	Units	Description
Message ID	\$GPGGA		GGA protocol header
UTC Position	033410.000		hhmmss.sss
Latitude	2232.1745		ddmm.mmmm
N/S indicator	N		N=north or S=south
Longitude	11401.1920		dddmm.mmmm
E/W Indicator	E		E=east or W=west
Position Fix Indicator	1		See Table 2-1
Satellites Used	07		Range 0 to 12
HDOP	1.1		Horizontal Dilution of Precision
MSL Altitude	107.14	meters	Altitude (referenced to the Ellipsoid)
AltUnit	M	meters	Altitude Unit
GeoSep	0.00	meters	Geoidal Separation
GeoSepUnit	M	meters	Geoidal Separation Unit
Age of Diff.Corr.	<Null>	second	Null fields when it is not Used
Diff.Ref.Station ID	<Null>		Null fields when it is not Used
Checksum	*64		
EOL	<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	GPS PPS Mode, fix valid

GLL-Geographic Position – Latitude/Longitude

This sentence contains the fix latitude and longitude.

\$GPGLL,2232.1843,N,11401.1905,E,035059.000,A,A*54

Table 3: GLL Data Format

Name	Example	Units	Description
Message ID	\$GPGLL		GLL protocol header
Latitude	2232.1843		ddmm.mmmm
N/S Indicator	N		N=north or S=south
Longitude	11401.1905		dddmm.mmmm
E/W Indicator	E		E=east or W=west
UTC Position	035059.000		hhmmss.sss
Fix Status	A		A=data valid or V=data not valid
Fix Mode	A		A=autonomous, N = No fix, D=DGPS, E=DR
Checksum	*54		
EOL	<CR> <LF>		End of message termination

GSA-GNSS DOP and Active Satellites

This sentence contains the mode of operation, type of fix, PRNs of the satellites used in the solution as well as PDOP, HDOP and VDOP.

\$GPGSA,A,3,02,09,10,15,18,24,27,29,,,,,1.8,0.9,1.5*39

Table 4: GSA Data Format

Name	Example	Units	Description
Message	\$GPGSA		GSA protocol header
Mode 1	A		See Table 4-2
Mode 2	3		See Table 4-1
ID of satellite used	02		Sv on Channel 1
ID of satellite used	09		Sv on Channel 2
...
ID of satellite used	<Null>		Sv on Channel 12 (Null fields when it is not Used)
PDOP	1.8		Position Dilution of Precision
HDOP	0.9		Horizontal Dilution of Precision
VDOP	1.5		Vertical Dilution of Precision
Checksum	*39		
EOL	<CR> <LF>		End of message termination

Table 4-1: Mode 1

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

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

This sentence contains the PRNs, azimuth, elevation, and signal strength of all satellites in view.

\$GPGSV,3,1,12,02,35,123,25,24,22,321,48,15,78,335,53,29,45,261,45*77

\$GPGSV,3,2,12,26,22,223,28,05,34,046,30,10,16,064,39,18,14,284,48*75

\$GPGSV,3,3,12,27,32,161,31,33,,30,09,25,170,34,21,15,318,*4B

Table 5: GGA Data Format

Name	Example	Units	Description
Message ID	\$GPGSV		GSV protocol header
Number of Message	3		Total number of GSV sentences (Range 1 to 3)
Message Number	1		Sentence number of the total (Range 1 to 3)
Satellites in View	12		Number of satellites in view
Satellite ID	02		Channel 1(Range 01 to 32)
Elevation	35	degrees	Channel 1(Range 00 to 90)
Azinmuth	123	degrees	Channel 1(Range 000 to 359)
SNR(C/NO)	25	dB-Hz	Channel 1(Range 00 to 99, null when not tracking)
...			...
Satellite ID	29		Channel 4(Range 01 to 32)
Elevation	45	degrees	Channel 4(Range 00 to 90)
Azinmuth	261	degrees	Channel 4(Range 000 to 359)
SNR(C/NO)	45	dB-Hz	Channel 4(Range 00 to 99, null when not tracking)
Checksum	*77		
EOL	<CR> <LF>		End of message termination

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

RMC-Recommended Minimum Specific GNSS Data

This sentence contains the recommended minimum fix information.

See GGA for Fix Quality, Sats Used, HDOP, Altitude, Geoidal Separation, and DGPS data.

See GSA for Fix Type, PDOP and VDOP.

\$GPRMC,075747.000,A,2232.8990,N,11405.3368,E,3.9,357.8,260210,,A*6A

Table 6: RMC Data Format

Name	Example	Units	Description
Message ID	\$GPRMC		RMC protocol header
UTS Position	075747.000		hhmmss.sss
Status	A		A=data valid or V=data not valid
Latitude	2232.8990		ddmm.mmmm
N/S Indicator	N		N=north or S=south
Longitude	11405.3368		dddmm.mmmm
E/W Indicator	E		E=east or W=west
Speed Over Ground	3.9	Knots	
Course Over Ground	357.8	Degrees	True Course

Date(UTC)	260210		ddmmyy
Magnetic variation	<Null>	Degrees	Null fields when it is not Used
Magnetic Variation Direction	<Null>		E=east or W=west (Null fields when it is not Used)
Fix Mode	A		A=autonomous, N = No fix, D=DGPS, E=DR
Checksum	*6A		
EOL	<CR> <LF>		End of message termination

VTG-Course Over Ground and Ground Speed

This sentence contains the course and speed of the navigation solution.

\$GPVTG,303.8,T,,0.0,N,0.0,K,A*48

Table 7: VTG Data Format

Name	Example	Units	Description
Message ID	\$GPVTG		VTG protocol header
Tcourse	303.8	Degrees	True Course
Reference	T		T = True
Mcourse	<Null>	Degrees	Magnetic Course (Null fields when it is not Used)
Reference	<Null>		M = Magnetic (Null fields when it is not Used)
Speed over ground	0.0	Knots	Nautical Miles per Hour
Units	N		Knots
Speed over ground	0.0	Km/hr	in Kilometers per Hour
Units	K		Kilometer per hour
Mode	A		A=Autonomous, N=No fix, D=DGPS, E=DR
Checksum	*48		
EOL	<CR> <LF>		End of message termination

ZDA-Date and Time

This sentence contains UTC date & time, and local time zone offset information.

\$GPZDA,060819.000,22,03,2010,*,*50

Table 8: ZDA Data Format

Name	Example	Units	Description
Message ID	\$GPZDA		ZDA protocol header
UTC Time	060819.000		hhmmss.sss
Day	22		UTC time: day (01 ... 31) dd
Month	03		UTC time: month (01 ... 12) mm
Year	2010		UTC time: year (4 digit year) yyyy
local zone hours	<null>		Local Time Zone Offset Hours (Null fields when it is not Used)
local zone minutes	<null>		Local Time Zone Offset Minutes (Null fields when it is not Used)
Checksum	*50		

EOL	<CR> <LF>		End of message termination
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DTM - Datum reference

This sentence contains the ID of the datum selected, along with configured offsets.

\$GPDTM,W84,,0.000000,S,0.000000,W,0.00,W84*50

Table 9: DTM Data Format

Name	Example	Units	Description
Message ID	\$GPDTM		DTM protocol header
DatumID	W84		Local Datum ID
DatumSubD	<null>		Datum Subdivision Code (Null fields when it is not Used)
LatOfs	0.000000		Latitude Offset (in minutes)
LatDirection	S		N = North S = South
LonOfs	0.000000		Longitude Offset (in minutes)
LonDirection	W		E = East W = West
AltOfs	0.00		Altitude Offset (in meters)
RefDatum	W84		Reference Datum ID
Checksum	*50		
EOL	<CR> <LF>		End of message termination