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Product name	Description	Version
RTK-4671-MH	Dual-frequency GNSS RTK receiver	0.3

1. Introduction

The dual-frequency RTK-4671-MH receiver is a compact, cost-effective and high-precision GNSS RTK board designed for applications requiring centimeter level positioning accuracy. It supports multiple constellations, including GPS, GLONASS, BeiDou, GALILEO, QZSS and SBAS to improve the continuity and reliability of RTK solution even in the harsh environment. This board can be setup either in rover mode or in base station mode.

Versatile, compact, smart, low power and high update rate, LOCOSYS RTK-4671-MH meets the requirement of most location-based applications.

2. Features

- Dual-frequency and multi-constellation RTK positioning solution
- Switchable modes between the rover and base station
- Built in short-circuit protection for antenna input
- Up to 5 Hz update rate
- Industrial operating temperature range -40 to +85°C
- Low-power consumption and compact size
- LOCOSYS IATF 16949 certified production sites.

3. Application

- Precision Agriculture
- AGV Robotics
- V2X / ETC / 5G Station
- Structural / Land Monitoring
- Offshore / Marine Application

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4. Product feature

GNSS feature	Description	
GNSS	Dual frequency and Multi-constellation	
DGPS, SBAS	WAAS, EGNOS, MSAS	
Channels	64 channels	
Update rate	1(default), 2, or 5 Hz	
Acquisition Time[1]	Cold start	32s (typical)
	Convergence time	< 10s (typical; after 3D fix)
Position Accuracy[1, 2]	Autonomous	< 1.5m CEP
	SBAS	< 1.5m (depends on accuracy of correction data)
	RTK[3]	0.01m + 1ppm
Limitations	Max. Altitude	< 18,000 m, up to 50,000m by request
	Max. Velocity	< 515 m/s
Navigation Outputs	NMEA 0183 ver. 4.0	115200 bps, 8 data bits, no parity, 1 stop bit (default) 1Hz: GGA, GSA, RMC, 0.2Hz: GSV
Correction Input[4]	RTCM-3.3	115200 bps, 8 data bits, no parity, 1 stop bits

Note 1: Acquisition time and position accuracy may be affected by atmospheric conditions, signal multipath, satellite geometry and corrections availability and quality.

Note 2: All position values are based on Horizontal position accuracy.

Note 3: RMS, 24hr static.

Note 4: See page 5 for the supported RTCM messages.

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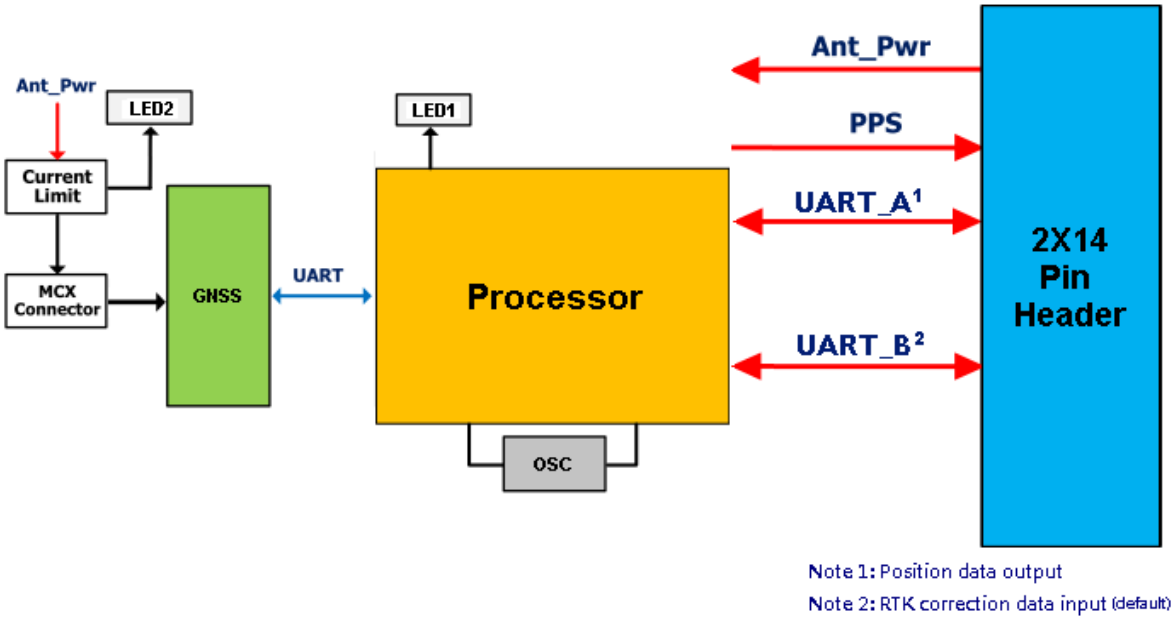
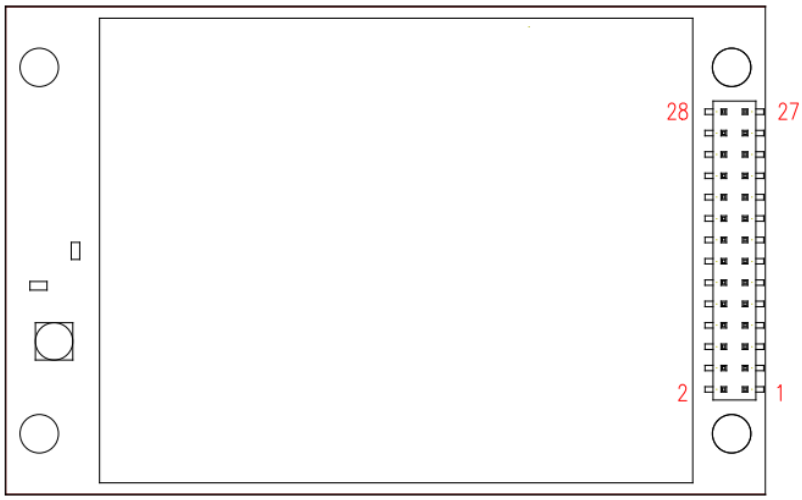
5. Block diagram



Note 1: Position data output
Note 2: RTK correction data input (default)

6. Pin definition

6.1. Pin assignment



28	NC	NC	27
26	NC	NC	25
24	NC	PPS	23
22	GND	Reserved	21
20	GND	RXD_B	19
18	TXD_B	GND	17
16	RXD_A	TXD_A	15
14	GND	Reserved	13
12	NC	Reserved	11
10	Reserved	/RESET_IN	9
8	Reserved	NC	7
6	VIN	Reserved	5
4	NC	NC	3
2	NC	NC	1

Top View

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6.2. Pin description

Pin No	Name	Description
1	NC	Not connected
2	NC	Not connected
3	NC	Not connected
4	NC	Not connected
5	Reserved	Microprocessor BOOT pin, this pin should be left floating
6	VIN	Device power supply
7	NC	Not connected
8	Reserved	Reserved, this pin should be left floating
9	RESET_IN	Device reset input, Low active
10	Reserved	Reserved, this pin should be left floating
11	Reserved	Reserved, this pin should be left floating
12	NC	Not connected
13	Reserved	Reserved, this pin should be left floating
14	GND	Ground
15	TXD_A	UART_A, transmitter output (Default NMEA)
16	RXD_A	UART_A, receiver input (Default NMEA)
17	GND	Ground
18	TXD_B	**UART_B transmitter output**
19	RXD_B	**UART_B receiver input, receive RTCM data streaming from base station to resolve RTK solutions.**
20	GND	Ground
21	Reserved	Reserved, this pin should be left floating
22	GND	Ground
23	PPS	Time pulse (1PPS, default 100 ms pulse/sec when 3D fix is available)
24	NC	Not connected
25	NC	Not connected
26	Reserved	Reserved, this pin should be left floating
27	NC	Not connected
28	NC	Not connected

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7. Data Interfaces and Protocols

7.1. Data Interface

The RTK-4671-MH receiver features 28 (2x14) pin 2.0mm pitch (male) header for connecting to host system. It has two UART interfaces with 115200 bps baud rate.

7.2. Device Configuration

The RTK-4671-MH interfaces support the following communication protocols:

UART_A	NMEA, 115200 bps. (GGA, GSA, RMC, GSV)	Position output
UART_B	TX: NMEA, 115200 bps. (GGA) RX: RTCM-3.3, 115200 bps. See “Supported Data Messages” table.	RTK correction data input

Supported Data Messages:

Message Type	Description
1005	Stationary RTK reference station ARP
1006	Stationary RTK reference station ARP with antenna height
1019	GPS ephemeris data
1042	BeiDou ephemeris data
1044	QZSS Ephemerides data
1074	Full GPS Pseudoranges and PhaseRanges plus CNR
1075	Full GPS Pseudoranges, PhaseRanges, PhaseRangeRate and CNR
1077	Full GPS Pseudoranges, PhaseRanges, PhaseRangeRate and CNR (high resolution)
1114	Full QZSS Pseudoranges and PhaseRanges plus CNR
1115	Full QZSS Pseudoranges, PhaseRanges, PhaseRangeRate and CNR
1124	Full BeiDou Pseudoranges and PhaseRanges plus CNR
1125	Full BeiDou Pseudoranges, PhaseRanges, PhaseRangeRate and CNR
1127	Full BeiDou Pseudoranges, PhaseRanges, PhaseRangeRate and CNR (high resolution)

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8. Electrical specifications

8.1. DC Electrical Characteristics

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units
Input voltage	VCC		3.2	3.3	4.5	V
External Active Antenna Output Voltage Current	ANT_PWR _OUT			 3.3 200		 V mA
Input current	Icc	VCC = 3.3V, w/o active antenna, Peak Tracking		 165	200	 mA mA
High Level Input Voltage	V_{IH}		2.1		3.6	V
Low Level Input Voltage	V_{IL}				0.8	V
High Level Output Voltage	V_{OH}		2.4			V
Low Level Output Voltage	V_{OL}				0.4	V

8.2. Temperature characteristics

Parameter	Symbol	Min.	Typ.	Max.	Units
Operating Temperature	Topr	-40	-	85	℃
Storage Temperature	Tstg	-40	-	85	℃

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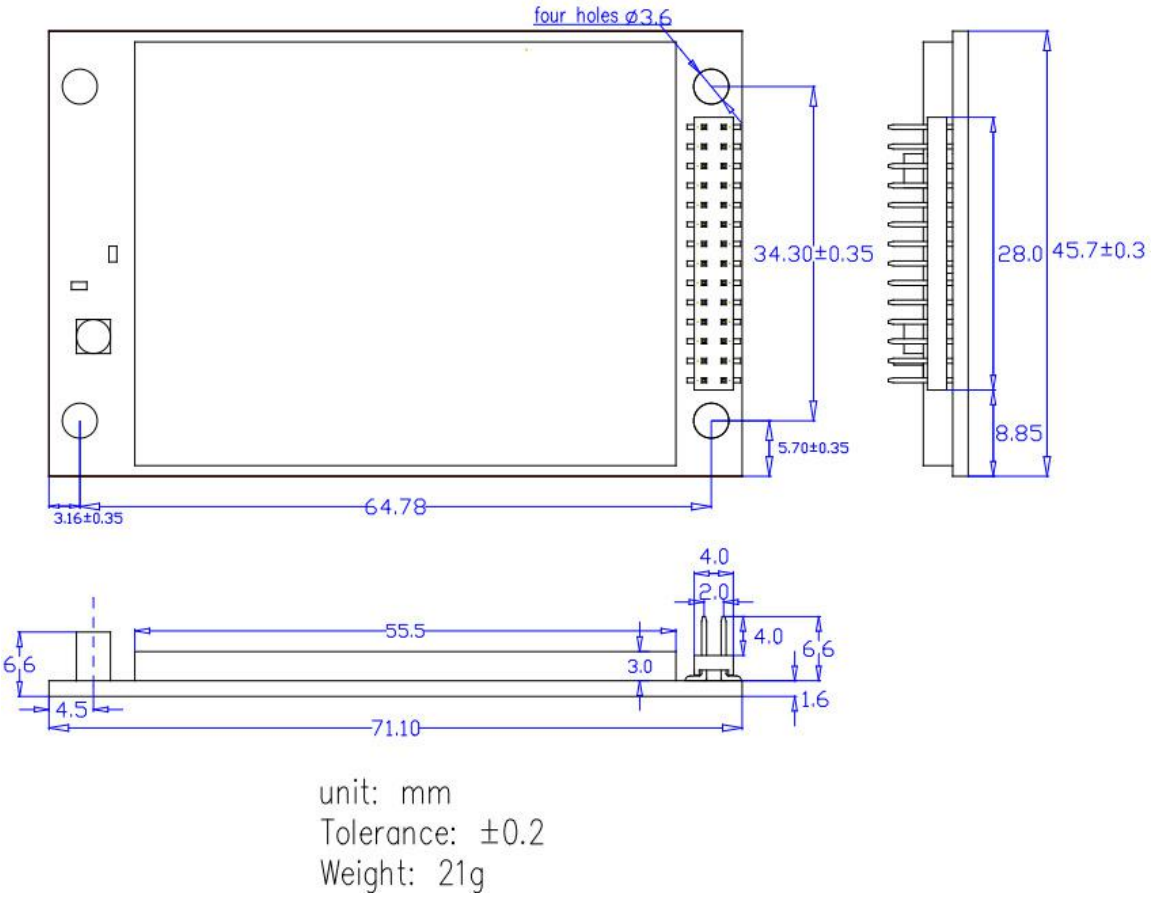
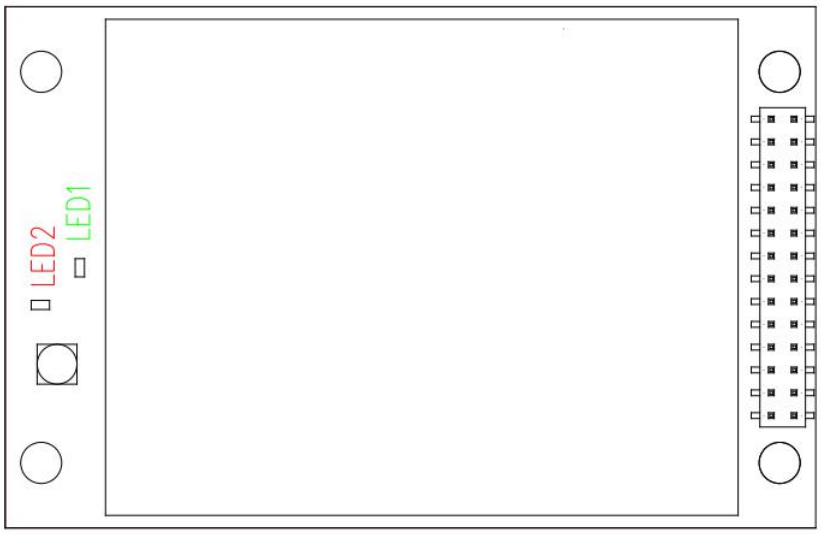
9. Board Layout and Dimensions



unit: mm
Tolerance: ±0.2
Weight: 21g

10. LED indicator



LED1 flashes (Green LED, 1Hz) when RTK FIX is available

LED2 flashes (Red LED) when short circuit on MMCX antenna connector.

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11. Software interface

11.1. NMEA output message

Table 11.1-1 NMEA output message

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

- **GGA--- Global Positioning System Fixed Data**

Table 11.1-2 contains the values for the following example:

$GNGGA,021027.000,2503.7125580,N,12138.7454063,E,4,18,0.65,121.422,M,15.3,M,1,*4D

Table 11.1- 2 GGA Data Format

Name	Example	Units	Description
Message ID	$GNGGA		GGA protocol header (GNGGA)
UTC Time	021027.000		hhmmss.sss
Latitude	2503.7125580		ddmm.mmmmmmm
N/S indicator	N		N=north or S=south
Longitude	12138.7454063		dddmm.mmmmmmm
E/W Indicator	E		E=east or W=west
Position Fix Indicator	4		See Table 11.1-3
Satellites Used	18		Range 0 to 33
HDOP	0.65		Horizontal Dilution of Precision
MSL Altitude	121.422	meters	
Units	M	meters	
Geoid Separation	15.3	meters	
Units	M	meters	
Age of Diff. Corr.	1	second	Null fields when DGPS is not used
Diff. Ref. Station ID			
Checksum	*4D		

Table 11.1-3 Position Fix Indicators

Value	Description
0	Fix not available or invalid
1	GNSS SPS Mode, fix valid
2	Differential GPS, SPS Mode, fix valid
4	Real-Time Kinematic, fixed integers
6	Dead Reckoning Mode, fix valid

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● GSA---GNSS DOP and Active Satellites

Table 11.1-4 contains the values for the following example:

$GPGSA,A,3,23,11,22,28,19,06,09,17,03,01,30,,0.94,0.62,0.71*06

$BDGSA,A,3,07,10,04,02,03,06,13,01,,,,,0.94,0.62,0.71*1A

Table 11.1-4 GSA Data Format

Name	**Example**	**Units**	**Description**
Message ID	$GPGSA		GSA protocol header
Mode 1	A		See Table 11.1-5
Mode 2	3		See Table 11.1-6
ID of satellite used	23		Sv on Channel 1
ID of satellite used	11		Sv on Channel 2
….			….
ID of satellite used			Sv on Channel 12
PDOP	0.94		Position Dilution of Precision
HDOP	0.62		Horizontal Dilution of Precision
VDOP	0.71		Vertical Dilution of Precision
Checksum	*06		
<CR> <LF>			End of message termination

Table 11.1-5 Mode 1

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

Table 11.1-6 Mode 2

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

● GSV---GNSS Satellites in View

Table 11.1-7 contains the values for the following example:

$GPGSV,4,1,14,03,12,310,35,10,12,177,35,14,77,028,40,16,36,227,39,1*61

$GPGSV,4,2,14,22,21,292,32,25,18,039,34,26,63,252,43,29,31,075,40,1*63

$GPGSV,4,3,14,31,51,358,43,32,62,120,44,193,45,173,38,194,65,031,41,1*63

$GPGSV,4,4,14,195,41,134,38,199,60,167,35,1*65

$GPGSV,4,1,14,03,12,310,,10,12,177,,14,77,028,,16,36,227,,6*68

$GPGSV,4,2,14,22,21,292,,25,18,039,,26,63,252,29,29,31,075,,6*6A

$GPGSV,4,3,14,31,51,358,,32,62,120,33,193,45,173,,194,65,031,32,6*6C

$GPGSV,4,4,14,195,41,134,31,199,60,167,31,6*6F

$GLGSV,2,1,06,65,30,324,36,71,41,174,38,72,70,276,36,73,16,038,36,1*7E

$GLGSV,2,2,06,75,33,282,34,84,13,099,28,1*77

$GLGSV,2,1,06,65,30,324,33,71,41,174,36,72,70,276,36,73,16,038,,3*72

$GLGSV,2,2,06,75,33,282,36,84,13,099,35,3*7B

$GBGSV,5,1,18,01,54,142,41,02,38,240,37,03,57,204,40,04,38,118,37,1*72

$GBGSV,5,2,18,05,15,257,30,06,82,087,42,07,74,278,41,09,65,333,41,1*7F

$GBGSV,5,3,18,10,51,246,38,11,22,084,35,16,83,027,44,20,12,318,36,1*7A

$GBGSV,5,4,18,23,54,348,45,25,26,050,38,28,14,163,34,32,52,276,43,1*73

$GBGSV,5,5,18,34,12,061,37,37,29,280,38,1*76

$GBGSV,5,1,18,01,54,142,40,02,38,240,39,03,57,204,40,04,38,118,36,3*7E

$GBGSV,5,2,18,05,15,257,,06,82,087,40,07,74,278,40,09,65,333,40,3*7C

$GBGSV,5,3,18,10,51,246,37,11,22,084,36,16,83,027,40,20,12,318,,3*75

$GBGSV,5,4,18,23,54,348,,25,26,050,,28,14,163,,32,52,276,,3*7B

$GBGSV,5,5,18,34,12,061,,37,29,280,,3*7B

Table 11.1-7 GSV Data Format

Name	Example	Units	Description
Message ID	$GPGSV		GSV protocol header
Total number of messages[1]	4		Range 1 to 4
Message number[1]	1		Range 1 to 4
Satellites in view	14		
Satellite ID	03		Channel 1 (Range 01 to 196)
Elevation	12	degrees	Channel 1 (Range 00 to 90)
Azimuth	310	degrees	Channel 1 (Range 000 to 359)
SNR (C/No)	35	dB-Hz	Channel 1 (Range 00 to 99, null when not tracking)
….			….
Satellite ID	16		Channel 4 (Range 01 to 196)
Elevation	36	degrees	Channel 4 (Range 00 to 90)
Azimuth	227	degrees	Channel 4 (Range 000 to 359)
SNR (C/No)	39	dB-Hz	Channel 4 (Range 00 to 99, null when not tracking)
SignalId	1		
Checksum	*61		
<CR> <LF>			End of message termination

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

● RMC---Recommended Minimum Specific GNSS Data

Table 11.1-8 contains the values for the following example:

$GNRMC,021027.000,A,2503.7125580,N,12138.7454063,E,0.01,171.63,030919,,,R*62

Table 11.1-8 RMC Data Format

Name	Example	Units	Description
Message ID	$GNRMC		RMC protocol header
UTC Time	021027.000		hhmmss.sss
Status	A		A=data valid or V=data not valid
Latitude	2503.7125580		ddmm.mmmmmmm
N/S Indicator	N		N=north or S=south
Longitude	12138.7454063		dddmm.mmmm
E/W Indicator	E		E=east or W=west
Speed over ground	0.01	knots	True
Course over ground	171.63	degrees	
Date	030919		ddmmyy
Magnetic variation		degrees	
Variation sense			E=east or W=west (Not shown)
Mode	R		A=autonomous, D=DGPS, E=DR, N=Data not valid, R=Coarse Position, S=Simulator
Checksum	*62		
<CR> <LF>			End of message termination

11.2. LOCOSYS proprietary commands

11.2.1. Query firmware version

Synopsis:

```
$PLSC,VER*CK<CR><LF>
```

Response:

```
$PLSR,<VER>*CK<CR><LF>
```

Examples:

```
$PLSC,VER*61<CR><LF>
```

11.2.2. Set update rate

Synopsis:

```
$PLSC,SETMXHZ,<RATE>*CK<CR><LF>
```

Response:

```
$PLSR,MXHZ,<RATE>*CK<CR><LF>
```

Parameter	Format	Description
RATE	Decimal	The output data update rate, in Hz.(included 1, 2, or 5

		Hz)

Examples:

$PLSC,SETMXHZ,1*78<CR><LF>

11.2.3. Serial port (for receive correction data) setting

Synopsis:

$PLSC,INJ,<PORT>*CK<CR><LF>

Response:

$PLSR,INJ,<PORT>*CK<CR><LF>

Parameter	Format	Description
PORT	Decimal	0: RXD_B (Pin-19) to receive correction data from base station (default) 1: RXD_A (Pin-16) to receive correction data from base station

Examples:

$PLSC,INJ,1*61<CR><LF>

11.2.4. Base setup

This section is provided configuration as a reference station to provide local RTCM corrections.

- Set up the board as a reference station or as a rover

Synopsis:

$PLSC,MXBASE,<MODE>*CK<CR><LF>

Response:

$PLSR,MXBASE,<MODE>*CK<CR><LF>

Parameter	Format	Description
MODE	Decimal	0: set up the board as a rover(default) 1: set up the board as a reference station (Output RTCM3 1005, 1074, 1114, 1124 messages)

Examples:

$PLSC,MXBASE,1*3D<CR><LF>

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- Set the base location (reference position)

Synopsis:

$CFGTPM,1,0,<LAT>,<LON>,<ALT>;CFGSAVE,*CK<CR><LF>

Response:

$ACKOK,*61

Parameter	Format	Description
LAT	DD.DDDDDDDDD	Latitude as degrees. -90 ~ 90 (+ for north, - for south)
LON	DDD.DDDDDDDDD	Longitude as degrees. -180 ~ 180 (+ for east, - for west)
ALT	DDD.DDDD	Altitude, ellipsoidal height, measure in meters. -426 ~ 82000

Examples:

$CFGTPM,1,0,25.061867950,121.645741950,136.2600<CR><LF>

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Document change list

Revision 0.1

- Draft release on Jan. 06, 2020.

Revision 0.2 (Feb.24.2020)

- Modify section 8.1 Input current on page 6.

Revision 0.3 (May.13.2020)

- Added Supported Data Messages in section 7.2.
- Added section 11.2.4 Base setup.