LG69T(AA,AD,AI,AJ,AK)
GNSS Protocol Specification

GNSS Module Series

Version: 1.0.0

Date: 2021-09-10

Status: Preliminary

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About the Document

Document Information	
Title	**LG69T(AA,AD,AI,AJ,AK) GNSS Protocol Specification**
Subtitle	GNSS Module Series
Document Type	GNSS Protocol Specification
Document Status	Preliminary

Revision History

Version	Date	Description
-	2021-06-17	Creation of the document
1.0.0	2021-09-10	Preliminary

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1 Introduction

Quectel LG69T GNSS module supports GPS, GLONASS, Galileo, BeiDou and QZSS constellations. Concurrent tracking of GPS L1 C/A, GLONASS G1, BeiDou B1I, Galileo E1, QZSS L1 C/A, GPS L2C, GLONASS G2, BeiDou B2I, Galileo E5a, GPS L5, BeiDou B2a, Galileo E5b, QZSS L2C, IRNSS L5[1)] and QZSS L5 frequency bands provides fast and accurate acquisition and makes this module an ideal solution for positioning and navigation in various vertical markets.

This document describes the software commands that are needed to control and modify the module configuration. The software commands are NMEA proprietary commands (PSTM Messages) defined by the chipset supplier. To report GNSS information, the module supports output messages in NMEA 0183 standard protocol or RTCM protocol format.

This document is applicable to the following Quectel modules:

- LG69T (AA)
- LG69T (AD)
- LG69T (AI)
- LG69T (AJ)
- LG69T (AK)

NOTES

1. [1)] Do not support IRNSS L5 now.
2. Only use the commands listed in this document. Quectel assumes no responsibility if other commands are used.

2 NMEA Protocol

2.1. Structure of NMEA Protocol Messages

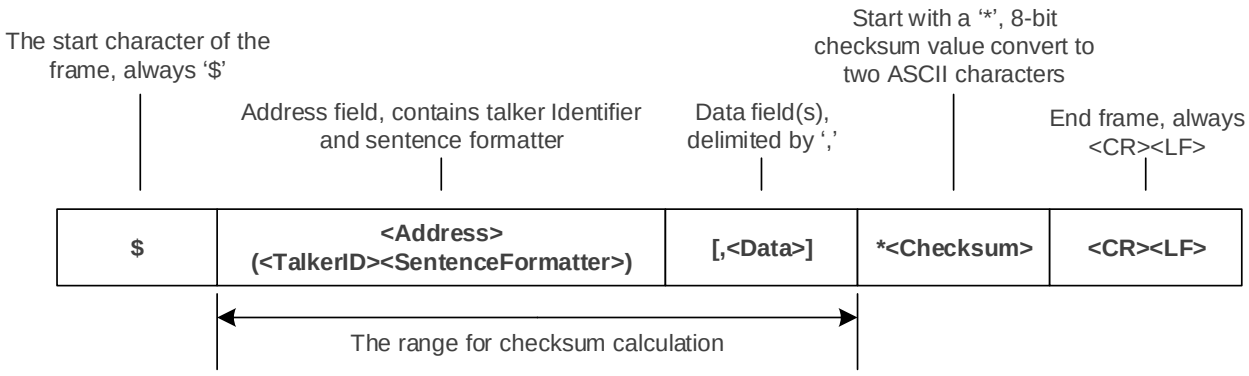

Figure 1: Structure of NMEA Protocol Message

Table 1: Structure of NMEA Protocol Message

Field	Description
$	Start of the sentence (Hex 0x24).
Address	**In Standard Messages:** In NMEA standard messages, this field consists of a two-character talker identifier (TalkerID) and a three-character sentence formatter (SentenceFormatter). The talker identifier serves to define the nature of the data being transmitted. For more information on the TalkerID, see *Table 2: NMEA Talker ID*. The sentence formatter is used to define data format and type. **In Proprietary Messages:** In NMEA proprietary messages, this field consists of the proprietary character **P** followed by a three-character Manufacturer's Mnemonic Code, used to identify the TALKER issuing a proprietary sentence, and any additional characters as required.
Data	Data fields, delimited by comma (,).

	Variable length (depends on the NMEA message type).
Checksum	The checksum field follows the checksum delimiter character *. The checksum is the 8-bit exclusive OR of all characters in the sentence, including the comma (,) delimiter, between but not including the $ and the * delimiters.
<CR><LF>	End of the sentence (Hex 0x0D 0x0A).

Table 2: NMEA Talker ID

GNSS Constellation Configuration	TalkerID (NMEA V4.11)
GPS	GP
GLONASS	GL
Galileo	GA
BeiDou	GB
QZSS	GQ
NavIC (IRNSS)*	GI
Combination of Multiple Satellite Systems	GN

2.2. Standard Messages

This chapter explains the NMEA 0183 V4.11 standard messages supported by the module.

2.2.1. RMC

Recommended Minimum Specific GNSS Data. Time, date, position, course, and speed data provided by a GNSS receiver.

Type:

Output.

Synopsis:

```
$<TalkerID>RMC,<UTC>,<Status>,<Lat>,<N/S>,<Lon>,<E/W>,<SOG>,<COG>,<Date>,<MagVar>,<MagVarDir>,<ModeInd>,<NavStatus>*<Checksum><CR><LF>
```

Parameter:

Field	Format	Unit	Example	Description
<TalkerID>	String, 2 characters	-	$GN	Always “GN” in NMEA 0183 V4.11.
RMC	String, 3 characters	-	RMC	Recommended Minimum Specific GNSS Data.
<UTC>	hhmmss.sss	-	082755.000	Position fix UTC: hh: Hours (00–23) mm: Minutes (00–59) ss: Seconds (00–59) sss: Decimal fraction of seconds
<Status>	Character	-	A	Positioning system status: A = Data valid V = Invalid D = Differential
<Lat>	ddmm.mmmmm	-	3149.33404	Latitude: dd: Degrees (00–90) mm: Minutes (00–59) mmmmm: Decimal fraction of minutes
<N/S>	Character	-	N	Latitude direction: N = North S = South
<Lon>	dddmm.mmmmm	-	11706.91207	Longitude: ddd: Degrees (000–180) mm: Minutes (00–59) mmmmm: Decimal fraction of minutes
<E/W>	Character	-	E	Longitude direction: E = East W = West
<SOG>	Numeric	Knot	0.0	Speed over ground. Variable length. Note that this field is empty in case of an invalid value.
<COG>	Numeric	Degree	0.0	Course over ground. Variable length. Maximum value is 359.9. Note that this field is empty in case of an invalid value.
<Date>	ddmmyy	-	090921	Date: dd: Day of month mm: Month yy: Year

<MagVar>	-	-	-	Magnetic variation. Not supported.
<MagVarDir>	-	-	-	The direction of magnetic variation. Not supported.
<ModeInd>	Character	-	D	Mode indicator: A = Autonomous mode. Satellite system used in non-differential mode in position fix D = Differential mode. Satellite system used in differential mode in position fix. Corrections from ground stations or Satellite Based Augmentation System (SBAS) E = Estimated (dead reckoning) mode F = Float RTK. Satellite system used in RTK mode with floating integers M = Manual input mode N = No fix. Satellite system not used in position fix, or fix not valid R = Real Time Kinematic (RTK). Satellite system used in RTK mode with fixed integers
<NavStatus>	Character	-	C	Navigational status. S = Safe C = Caution U = Unsafe V = Navigational status not valid, equipment is not providing navigational status indication.
<Checksum>	Hexadecimal	-	*17	Checksum.
<CR><LF>	Character	-	-	Carriage return and line feed.

Example:

```
$GNRMC,082755.000,A,3149.33404,N,11706.91207,E,0.0,0.0,090921,,,D,C*17
```

2.2.2. GGA

Global Positioning System Fix Data, Time, position and fix-related data for a GNSS receiver.

Type:

Output.

Synopsis:

```
$<TalkerID>GGA,<UTC>,<Lat>,<N/S>,<Lon>,<E/W>,<Quality>,<NumSatUsed>,<HDOP>,<Alt>,M,<Sep>,M,<DiffAge>,<DiffStation>*<Checksum><CR><LF>
```

Parameter:

Field	Format	Unit	Example	Description
<TalkerID>	String, 2 characters	-	$GN	Always “GN” in NMEA 0183 V4.11
GGA	String, 3 characters	-	GGA	Global Positioning System Fix Data.
<UTC>	hhmmss.sss	-	082755.000	Position fix UTC: hh: Hours (00–23) mm: Minutes (00–59) ss: Seconds (00–59) sss: Decimal fraction of seconds
<Lat>	ddmm.mmmmm	-	3149.33404	Latitude: dd: Degrees (00–90) mm: Minutes (00–59) mmmmm: Decimal fraction of minutes
<N/S>	Character	-	N	Latitude direction: N = North S = South
<Lon>	dddmm.mmmmm	-	11706.91207	Longitude: ddd: Degrees (000–180) mm: Minutes (00–59) mmmmm: Decimal fraction of minutes
<E/W>	Character	-	E	Longitude direction: E = East W = West
<Quality>	Numeric, 1 digit	-	2	GPS quality indicator: 0 = Fix not available or invalid 1 = GPS SPS Mode, fix valid 2 = Differential GPS, SPS Mode, or Satellite Based Augmentation System (SBAS), fix valid 3 = GPS PPS Mode, fix valid

				4 = Real Time Kinematic (RTK). System used in RTK mode with fixed integers 5 = Float RTK. Satellite system used in RTK mode, floating integers 6 = Estimated (dead reckoning) mode
<NumSatUsed>[1)]	Numeric, 2 digits	-	12	Number of satellites in use.
<HDOP>	Numeric	-	1.1	Horizontal dilution of precision.
<Alt>	Numeric	Meter	045.40	Altitude above mean-sea-level (geoid).
M	Character	-	M	-
<Sep>	Numeric	Meter	-0.3	Geoid separation (the difference between the earth ellipsoid surface and the mean-sea-level (geoid) surface defined by the reference datum used in the position solution).
M	Character	-	M	-
<DiffAge>	-	-	-	Differential GPS data age. Not supported.
<DiffStation>	-	-	-	Differential reference station ID. Not supported.
<Checksum>	Hexadecimal	-	*67	Checksum.
<CR><LF>	Character	-	-	Carriage return and line feed.

Example:

```
$GNGGA,082755.000,3149.33404,N,11706.91207,E,2,12,1.1,045.40,M,-0.3,M,,*67
```

NOTES

1. The NMEA 0183 specification indicates that the GGA message is GPS specific. However, when the receiver is configured for multi-constellations, the content of GGA message will be generated from the multi-constellation solution.
2. [1)] According to the NMEA 0183 specification, the number of satellites in use is between 00 and 12. However, in the multi-constellation solution, the number of satellites in use may exceed 12.

2.2.3. GNS

GNSS Fix Data. Fix data for single or combined satellite navigation systems (GNSS).

Type:

Output.

Synopsis:

```
$<TalkerID>GNS,<UTC>,<Lat>,<N/S>,<Lon>,<E/W>,<ModeInd>,<NumSatUsed>,<HDOP>,<Alt>,<Sep>
,<DiffAge>,<DiffStation>,<NavStatus>*<Checksum><CR><LF>
```

Parameter:

Field	Format	Unit	Example	Description
<TalkerID>	String, 2 characters	-	$GN	Always “GN” in NMEA 0183 V4.11.
GNS	String, 3 characters	-	GNS	GNSS Fix Data.
<UTC>	hhmmss.sss	-	112637.000	Position UTC: hh: Hours (00–23) mm: Minutes (00–59) ss: Seconds (00–59) sss: Decimal fraction of seconds
<Lat>	ddmm.mmmmm	-	3149.33338	Latitude. dd: Degrees (00–90) mm: Minutes (00–59) mmmmm: Decimal fraction of minutes
<N/S>	Character	-	N	Latitude direction: N = North S = South
<Lon>	dddmm.mmmmm	-	11706.91245	Longitude: ddd: Degrees (000–180) mm: Minutes (00–59) mmmmm: Decimal fraction of minutes
<E/W>	Character	-	E	Longitude direction: E = East W = West
<ModeInd>[1)]	Character	-	ANAAAN	Mode indicator: A = Autonomous mode. Satellite system used in non-differential mode in position fix

				D = Differential mode. Satellite system used in differential mode in position fix. Corrections from ground stations or Satellite Based Augmentation System (SBAS). E = Estimated (dead reckoning) mode. F = Float RTK. Satellite system used in RTK mode with floating integers. M = Manual input mode N = No fix. Satellite system not used in position fix, or fix not valid. R = Real Time Kinematic (RTK). Satellite system used in RTK mode with fixed integers.
<NumSatUsed>	Numeric	-	22	Total number of satellites in use. Range: 00–99.
<HDOP>	Numeric	-	0.6	Horizontal dilution of precision. Maximum value is 99.0.
<Alt>	Numeric	Meter	055.43	Antenna altitude above the mean sea level (geoid).
<Sep>	Numeric	Meter	-0.3	Geoid separation (the difference between the earth ellipsoid surface and the mean-sea-level (geoid) surface defined by the reference datum used in the position solution).
<DiffAge>	-	-	-	Differential GPS data age. Not supported.
<DiffStation>	-	-	-	Differential reference station ID. Not supported.
<NavStatus>	Character	-	C	Navigational status indicator. S = Safe C = Caution U = Unsafe V = Navigational status not valid, equipment is not providing navigational status indication.
<Checksum>	Hexadecimal	-	*25	Checksum
<CR><LF>	Character	-	-	Carriage return and line feed.

Example:

```
$GNGNS,112637.000,3149.33338,N,11706.91245,E,ANAAAN,22,0.6,055.43,-0.3,,,C*25
```

NOTE

1) ModeInd is a field type of variable length. The first character indicates the use of GPS satellites, the second character indicates the use of GLONASS satellites, and the third character indicates the use of Galileo satellites, the fourth character indicates the use of BeiDou satellites, the fifth character indicates the use of QZSS satellites, and the sixth character indicates the use of NavIC (IRNSS) satellites.

2.2.4. GSV

GNSS Satellites in View. The GSV sentence provides the number of satellites in view (SV), satellite ID numbers, elevation, azimuth, and SNR value, and it contains maximum four satellites per transmission. Therefore, it may take several sentences to get complete information. The total number of sentences being transmitted and the sentence number are indicated in the first two data fields.

Type:

Output.

Synopsis:

```
$<TalkerID>GSV,<TotalNumSen>,<SenNum>,<TotalNumSat>,<SatID>,<SatElev>,<SatAz>,<SatSNR>[,…],<SignalID>*<Checksum><CR><LF>
```

Parameter:

Field	Format	Unit	Example	Description
<TalkerID>	String, 2 characters	-	$GB	Talker identifier. See *Table 2: NMEA Talker ID.*
GSV	String, 3 characters	-	GSV	GNSS Satellites in View.
<TotalNumSen>	Numeric	-	4	Total number of sentences. Range: 1–9.
<SenNum>	Numeric	-	1	Sentence number. Range: 1–TotalNumSen.
<TotalNumSat>	Numeric	-	14	Total number of satellites in view.
Start of repeat block. Repeat times: 1–4.				
<SatID>	Numeric	-	39	Satellite ID. See *Table 23: GNSS Numbering.*
<SatElev>	Numeric	Degree	70	Satellite elevation. Range: 00–90.

<SatAz>	Numeric	Degree	326	Satellite azimuth, with true north as the reference plane. Range: 000–359.
<SatSNR>	Numeric	dB-Hz	39	Satellite SNR (C/N_0). Range 00–99. Null when not tracking.
End of repeat block.				
<SignalID>	Numeric	-	1	GNSS signal ID. See *Table 23: GNSS Numbering.*
<Checksum>	Hexadecimal	-	*7E	Checksum.
<CR><LF>	Character	-	-	Carriage return and line feed.

Example:

```
$GPGSV,1,1,03,10,,,33,23,,,33,18,,,33,,,,,1*6E
$GBGSV,4,1,14,39,70,326,39,16,68,295,38,08,68,192,36,06,66,284,36,1*7E
$GBGSV,4,2,14,20,63,009,40,38,56,177,38,37,56,090,39,03,53,193,36,1*72
$GBGSV,4,3,14,09,52,262,34,01,43,135,34,32,32,088,36,04,31,119,31,1*75
$GBGSV,4,4,14,05,19,254,28,29,18,246,33,,,,,,,,1*75
$GPGSV,1,1,03,10,,,30,23,,,37,18,,,35,,,,,8*66
$GBGSV,2,1,05,38,,,33,20,,,34,37,,,35,39,,,33,5*72
$GBGSV,2,2,05,32,,,30,,,,,,,,,,,,5*75
```

NOTE

GN cannot be used for GSV sentences. If satellites of multiple constellations are in view, use separate GSV sentences with the corresponding talker ID for each constellation.

2.2.5. GSA

GNSS DOP and Active Satellites. GNSS receiver operating mode, satellites used in the navigation solution reported by the GGA or GNS sentence, and DOP values.

Type:

Output.

Synopsis:

```
$<TalkerID>GSA,<Mode>,<FixMode>,<SatID>,…,<SatID>,<PDOP>,<HDOP>,<VDOP><SystemID>*<Checksum><CR><LF>
```

Parameter:

Field	Format	Unit	Example	Description
<TalkerID>	String, 2 characters	-	$GN	Always “GN” in NMEA 0183 V4.11.
GSA	String, 3 characters	-	GSA	GNSS DOP and Active Satellites.
<Mode>	Character	-	A	M = Manual, forced to operate in 2D or 3D mode. A = Automatic, allowed to automatically switch to 2D/3D.
<FixMode>	Numeric	-	3	1 = Fix not available 2 = 2D 3 = 3D
Start of repeat block. Repeat times: 12.				
<SatID>	Numeric	-	-	ID numbers of satellites used in solution. See *Table 23: GNSS Numbering*. Note that this field is empty in case of an invalid value.
End of repeat block.				
<PDOP>	Numeric	-	2.0	Position dilution of precision. Maximum value: 99.0.
<HDOP>	Numeric	-	1.1	Horizontal dilution of precision. Maximum value is 99.0.
<VDOP>	Numeric	-	1.7	Vertical dilution of precision. Maximum value is 99.0.
<SystemID>	Numeric	-	1	GNSS system ID. See *Table 23: GNSS Numbering*
<Checksum>	Hexadecimal	-	*35	Checksum.
<CR><LF>	Character	-	-	Carriage return and line feed.

Example:

```
$GNGSA,A,3,,,,,,,,,,,,,2.0,1.1,1.7,1*35
$GNGSA,A,3,,,,,,,,,,,,,2.0,1.1,1.7,5*31
$GNGSA,A,3,,,,,,,,,,,,,2.0,1.1,1.7,3*37
$GNGSA,A,3,01,06,16,03,20,37,39,32,38,29,08,09,2.0,1.1,1.7,4*3F
```

NOTE

If less than 12 satellites are used for navigation, the remaining SatID fields are left empty. If more than 12 satellites are used for navigation, only the IDs of the first 12 are output.

2.2.6. VTG

Course Over Ground & Ground Speed. The actual course and speed relative to the ground.

Type:

Output.

Synopsis:

$<TalkerID>VTG,<COGT>,T,<COGM>,M,<SOGN>,N,<SOGK>,K,<ModeInd>*<Checksum><CR><LF>

Parameter:

Field	Format	Unit	Example	Description
<TalkerID>	String, 2 characters	-	$GN	Always “GN” in NMEA 0183 V4.11.
VTG	String, 3 characters	-	VTG	Course Over Ground & Ground Speed.
<COGT>	Numeric	Degrees	0.0	Course over ground, in true north course direction. Note that this field is empty in case of an invalid value.
T	Character	-	T	Course over ground (degrees true, fixed field).
<COGM>	Numeric	Degrees	-	Course over ground (magnetic). Not supported.
M	Character	-	M	Course over ground (degrees magnetic, fixed field).
<SOGN>	Numeric	Knots	0.0	Speed over ground in knots. Note that this field is empty in case of an invalid value.
N	Character	-	N	Speed over ground (knots, fixed field).
<SOGK>	Numeric	km/h	0.0	Speed over ground in kilometers per hour. Note that this field is empty in case of an invalid value.
K	Character	-	K	Speed over ground (kilometers per hour, fixed field).
<ModeInd>	Character	-	D	Mode indicator: A = Autonomous mode. Satellite system used in non-differential mode in position fix D = Differential mode. Satellite system

				used in differential mode in position fix. Corrections from ground stations or Satellite Based Augmentation System (SBAS) E = Estimated (dead reckoning) mode. M = Manual input mode N = No fix. Satellite system not used in position fix, or fix not valid
<Checksum>	Hexadecimal	-	*16	Checksum.
<CR><LF>	Character	-	-	Carriage return and line feed.

Example:

```
$GNVTG,0.0,T,,M,0.0,N,0.0,K,D*16
```

2.2.7. GLL

Geographic Position – Latitude/Longitude. Latitude and longitude of the GNSS receiver position, the time of position fix and status.

Type:

Output.

Synopsis:

```
$<TalkerID>GLL,<Lat>,<N/S>,<Lon>,<E/W>,<UTC>,<Status>,<ModeInd>*<Checksum><CR><LF>
```

Parameter:

Field	Format	Unit	Example	Description
<TalkerID>	String, 2 characters	-	$GP	Always “GN” in NMEA 0183 V4.11.
GLL	String, 3 characters	-	GLL	Geographic Position – Latitude/Longitude.
<Lat>	ddmm.mmmmm	-	3149.33404	Latitude: dd: Degrees (00–90) mm: Minutes (00–59) mmmmm: Decimal fraction of minutes
<N/S>	Character	-	N	Latitude direction: N = North S = South
<Lon>	dddmm.mmmmm	-	11706.91207	Longitude:

				ddd: Degrees (000–180) mm: Minutes (00–59) mmmmm: Decimal fraction of minutes
<E/W>	Character	-	E	Longitude direction: E = East W = West
<UTC>	hhmmss.sss	-	082755.000	The UTC of a position: hh: Hours (00–23) mm: Minutes (00–59) ss: Seconds (00–59) sss: Decimal fraction of seconds
<Status>	Character	-	D	The status of the positioning system: V = Invalid A = Autonomous D = Differential
<ModeInd>	Character	-	D	Mode indicator: A = Autonomous mode. Satellite system used in non-differential mode in position fix D = Differential mode. Satellite system used in differential mode in position fix. Corrections from ground stations or Satellite Based Augmentation System (SBAS) E = Estimated (dead reckoning) mode. M = Manual input mode N = No fix. Satellite system not used in position fix, or fix not valid
<Checksum>	Hexadecimal	-	*49	Checksum.
<CR><LF>	Character	-	-	Carriage return and line feed.

Example:

```
$GNGLL,3149.33404,N,11706.91207,E,082755.000,D,D*49
```

2.2.8. ZDA

Time & Time. UTC, day, month, year and local time zone.

Type:

Output.

Synopsis:

```
$<TalkerID>ZDA,<UTC>,<Day>,<Month>,<Year>,<LocalHour>,<LocalMin>*<Checksum><CR><LF>
```

Parameter:

Field	Format	Unit	Example	Description
<TalkerID>	String, 2 characters	-	$GN	Always “GN” in NMEA 0183 V4.11.
ZDA	String, 3 characters	-	ZDA	Time & Time. UTC, day, month, year and local time zone.
<UTC>	hhmmss.sss	-	112751.000	Position fix UTC: hh: Hours (00–23) mm: Minutes (00–59) ss: Seconds (00–59) sss: Decimal fraction of seconds
<Day>	Numeric	-	09	Day of month. Range: 01–31.
<Month>	Numeric	-	09	Month. Range: 01–12.
<Year>	Numeric	-	2021	Year.
<LocalHour>	Numeric	-	-	Local zone hours, 00 to ±13 hours.
<LocalMin>	Numeric	-	-	Local zone minutes, 00 to +59 minutes.
<Checksum>	Hexadecimal	-	*48	Checksum.
<CR><LF>	Character	-	-	Carriage return and line feed.

Example:

```
$GNZDA,112751.000,09,09,2021,,*48
```

2.3. PSTM Messages

This chapter explains the PSTM messages (proprietary NMEA messages defined by the chipset supplier) supported by LG69T (AA,AD,AI,AJ,AK). Please note that these messages are not available in RTCM mode.

2.3.1. PSTMCOLD

Performs a cold start.

Type:

Command.

Synopsis:

```
$PSTMCOLD*<Checksum><CR><LF>
```

Parameter:

None.

Result:

Cold start initialization and GNSS engine restart.

Example:

```
$PSTMCOLD*1E
```

2.3.2. PSTMWARM

Performs a warm start.

Type:

Command.

Synopsis:

```
$PSTMWARM*<Checksum><CR><LF>
```

Parameter:

None.

Result:

Warm start initialization and GNSS engine restart.

Example:

```
$PSTMWARM*13
```

2.3.3. PSTMHOT

Performs a hot start.

Type:

Command.

Synopsis:

```
$PSTMHOT*<Checksum><CR><LF>
```

Parameter:

None.

Result:

GNSS engine restart.

Example:

```
$PSTMHOT*49
```

2.3.4. PSTMSRR

Executes a system reset.

Type:

Command.

Synopsis:

```
$PSTMSRR*<Checksum><CR><LF>
```

Parameter:

None.

Result:

The module restarts.

Example:

```
$PSTMSRR*49
```

2.3.5. PSTMTG

Time and Satellites Information.

Type:

Output.

Synopsis:

```
$PSTMTG,<WN>,<TOW>,<TotSat>,<CPU_Time>,<TimeValid>,<NCO>,<ConfigStatus>,<ConstellationMask>,<TimeBestSatType>,<TimeMasterSatType>,<TimeMasterWN>,<TimeMasterTOW>,<TimeMasterValidity>,<TG_AUX_Flags>,<ClockBias>,<MFREQ_ConstMask>,<LeapSec>,<PPS_Edge>,<MTB_MS>,<MTB_Timestamp>*<Checksum><CR><LF>
```

Parameter:

Field	Format	Unit	Description
<WN>	Numeric	-	Week Number.
<TOW>	Numeric	Second	Time of Week.
<TotSat>	Numeric	-	Total Number of satellites used for fix.
<CPU_Time>	Numeric	-	CPU Time.
<TimeValid>	Numeric	-	0 = No time 1 = Time read from flash 2 = Time set by user 3 = Time set user RTC 4 = RTC time 5 = RTC time, accurate 6 = Time approximate 7 = “not used” 8 = Time accurate 9 = Position time 10 = Ephemeris time
<NCO>	Numeric	Hz	Estimated receiver clock drift [Hz]. If clock steering is enabled this value shall be used in the Doppler calculation (instead of the nominal values).
<ConfigStatus>	Hexadecimal	-	● Byte 0: Kalman Filter Configuration: 0 means feature disabled 1 means feature enabled

Bit 0	Walking mode
Bit 1	Stop Detection
Bit 2	Frequency Ramp
Bit 3	Velocity estimator model: 1 means MULTIPLE MODEL 0 means SINGLE MODEL
Bit 4	Velocity estimator filter:

			<table><tr><td></td><td>1 means SLOW 0 means FAST</td></tr><tr><td>Bit 5</td><td>FDE Status</td></tr></table> ● Byte 1: Global Configuration: <table><tr><td>Bit 0-3</td><td>Front end frequency 1 means 48 MHz 0 means 26 MHz</td></tr><tr><td>Bit 4-6</td><td>$PSTMTG, $PSTMTS version</td></tr><tr><td>Bit 7</td><td>Clock steering indicator 1 = Steered 0 = No</td></tr></table>
<ConstellationMask>	Numeric	-	It is a bit mask where each bit enable/disable a specific constellation independently by the others: Bit 0: GPS L1 C/A constellation enabling/disabling Bit 1: GLONASS G1 constellation enabling/disabling Bit 2: QZSS L1 C/A constellation enabling/disabling Bit 3: Galileo E1 OS constellation enabling/disabling Bit 7: BeiDou B1I constellation enabling/disabling Bit 10: IRNSS L5 constellation enabling/disabling
<TimeBestSatType>	Numeric	-	Selected best time satellite type.
<TimeMasterSatType>	Numeric	-	Master time satellite type.
<TimeMasterWN>	Numeric	-	Master time week number.
<TimeMasterTOW>	Numeric	Second	Master time TOW.
<TimeMasterValidity>	Numeric		Master week number time validity.
<TG_AUX_Flags>	Numeric	-	Bit 0: TCXO jump detected Bit 1: Earth Rotation Corr. in sat pos ● 0 = Legacy ● 1 = w/o earth rotation Bit 2: Spectral inversion ● 0 = Legacy (BeiDou inverted) ● 1 = Spectral inversion internally compensated Bit 3: Clock bias validity ● 0 = Invalid (legacy) ● 1 = Valid Bit 4: Indicates presence of PPS_Edge field Bit 5–31: Reserved

<ClockBias>	Numeric	Meter	Estimated receiver clock bias.
<MFREQ_ConstMask>	Numeric	-	Multi-frequency configuration mask.
<LeapSec>	Numeric	Second	Leap seconds (0 = unknown).
<PPS_Edge>	Numeric	-	PPS edge counter @64F0 resolution.
<MTB_MS>	Numeric	ms	Master time-base. Number of ms (1e-3 s) since time reference.
<MTB_Timestamp>	Numeric	ps	Master time-base. Fixed-point fractional precision in ps (1e-12 s).

Example:

```
$PSTMTG,2138,309102.99999985,0,284085426,9,-47838.9973,a000,88207,0,0,2138,309102.99999985,9,126,-45.128,141,18,466314038,270259,896615656*6A
$PSTMTG,2138,309103.99999985,0,285108457,9,-47838.3969,a000,88207,0,0,2138,309103.99999985,9,126,-44.760,141,18,531852026,271259,961825862*6A
```

2.3.6. PSTMPPSDATA

Reports the Pulse Per Second data.

Type:

Output.

Synopsis:

```
$PSTMPPSDATA,<OnOff>,<PPSValid>,<SyncValid>,<OutMode>,<RefTime>,<RefConstellation>,<PulseDuration>,<PulseDelay>,<GpsDelay>,<GloDelay>,<BeiDelay>,<GalDelay>,<InvertedPolarity>,<FixCond>,<SatTh>,<ElevMask>,<ConstMask>,<RefSec>,<FixStatus>,<UsedSats>,<GpsUtcDeltaS>,<GpsUtcDeltaNs>,<GlonassUtcDeltaNs>,<GalileoUtcDeltaNs>,<QuantizationError>,<PPSClockFreq>,<TcxoClockFreq>*<Checksum><CR><LF>
```

Parameter:

Field	Format	Unit	Description
<OnOff>	Numeric	-	PPS signal ON/OFF status: 0 = OFF 1 = ON
<PPSValid>	Numeric	-	Global PPS validity flag: 0 = PPS not valid 1 = PPS valid

<SyncValid>	Numeric	-	PPS synchronization validity: 0 = Not Valid 1 = Valid
<OutMode>	Numeric	-	0 = PPS_OUT_MODE_ALWAYS 1 = PPS_OUT_MODE_ON_EVEN_SECONDS 2 = PPS_OUT_MODE_ON_ODD_SECONDS
<RefTime>	Numeric	-	0 = UTC 1 = GPS_UTC (GPS Time) 2 = GLONASS_UTC (GLONASS Time) 3 = UTC_SU 4 = GPS_UTC_FROM_GLONASS
<RefConstellation>	Numeric	-	0 = GPS 1 = GLONASS
<PulseDuration>	Numeric	Second	Pulse duration.
<PulseDelay>	Numeric	ns	Pulse delay.
<GpsDelay>	Numeric	ns	GPS path RF delay.
<GloDelay>	Numeric	ns	GLONASS path RF delay.
<BeiDelay>	Numeric	ns	BeiDou path RF delay.
<GalDelay>	Numeric	ns	Galileo path RF delay.
<InvertedPolarity>	Numeric	-	Pulse polarity inversion: 0 = not inverted 1 = inverted
<FixCond>	Numeric	-	Selected GNSS fix condition for PPS signal generation: 1 = NO_FIX 2 = 2D_FIX 3 = 3D_FIX
<SatTh>	Numeric	-	Selected minimum number of satellites for PPS signal generation.
<ElevMask>	Numeric	-	Selected minimum satellite elevation for time correction.
<ConstMask>	Numeric	-	Selected constellations for time correction.
<RefSec>	Numeric	-	Second at which the reported PPS data is applied. According to the reference time configuration, it could be a UTC, a GPS or a GLONASS time second.
<FixStatus>	Numeric	-	GNSS position fix status when the time has been corrected.
<UsedSats>	Numeric	-	Used satellites for time correction.

<GpsUtcDeltaS>	Numeric	Second	UTC leap seconds.
<GpsUtcDeltaNs>	Numeric	ns	UTC – GPS delta time.
<GlonassUtcDeltaNs>	Numeric	ns	UTC – GLONASS delta time.
<GalileoUtcDeltaNs>	Numeric	ns	UTC – Galileo delta time.
<QuantizationError>	Numeric	Second	Quantization error.
<PPSClockFreq>	Numeric	Hz	PPS clock frequency.
<TcxoClockFreq>	Numeric	Hz	TCXO clock frequency.

Example:

```
$PSTMPPSDATA,1,1,1,0,0,0,0.500000,0,633,420,420,633,0,0,0,0,0,29,3,7,18,0,0,0,9.426e-09,6547398
7.92,26000011.75,4*2F
$PSTMPPSDATA,1,1,1,0,0,0,0.500000,0,633,420,420,633,0,0,0,0,0,30,3,7,18,0,0,0,8.293e-09,6547398
7.92,26000011.75,4*2E
```

2.3.7. PSTMEPHEM

Reports the Ephemeris Data.

Type:

Output.

Synopsis:

```
$PSTMEPHEM,<SatID>,<DataSize>,<HexData>*<Checksum><CR><LF>
```

Parameter:

Field	Format	Unit	Description
<SatID>	Numeric	-	Satellite Number (PRN).
<DataSize>	Numeric	-	Number of bytes contained in the “Hex-Data” field.
<HexData>	Hexadecimal	-	Ephemeris Data in Hex-Format.

Example:

```
$PSTMEPHEM,308,68,5a085c175c97156b00bcdf3e44d41d27585b2200adea04aaf9ed565b73f8cc2afdc
bcd1d3d47f6221c01e713c611e400f8ff2000b8c4ff08809cffffe2ff360600000000*56
$PSTMEPHEM,327,68,5a085c175c97156b0028b000dfa7ec27a43d2800530305aad7d23a15329a60802
```

51c68ee4d7b481c8409390b88198f071300080065c8ff1b8073ffff9308100000000000*5E

Table 3: Ephemeris Data Format for GPS Constellation

Bits	Structure Member	Description
16	week	Week number of the issue of data.
16	toe	Time of week for ephemeris epoch.
16	toc	Time of week for clock epoch.
8	iode1	Issue of data 1.
8	iode2	Issue of data 2.
10	iodc	Issue of data clock.
14	i_dot	Rate of inclination angle.
8	spare1	-
24	omega_dot	Rate of inclination angle.
2	reserved1	Must be 0.
6	reserved2	Must be 0.
16	crs	Amplitude of the sine harmonic correction to the orbit radius.
16	crc	Amplitude of the cosine harmonic correction to the orbit radius.
16	cus	Amplitude of the sine harmonic correction to the argument of latitude.
16	cuc	Amplitude of the cosine harmonic correction to the argument of latitude.
16	cis	Amplitude of the sine harmonic correction to the angle of inclination.
16	cic	Amplitude of the cosine harmonic correction to the angle of inclination.
16	motion_difference	Mean motion difference from computed value.
10	age_h	Reserved
2	l2_codes	Reserved
4	spare3	-
32	inclination	Inclination angle at reference time.
32	eccentricity	Eccentricity

32	root_a	Square root of major axis.
32	mean_anomaly	Mean anomaly at reference time.
32	omega_zero	Longitude of ascending node of orbit plane at weekly epoch.
32	perigee	Argument of perigee.
8	time_group_delay	Estimated group delay differential.
8	af2	Second order clock correction.
16	af1	First order clock correction.
22	af0	Constant clock correction.
1	subframe1_available	-
1	subframe2_available	-
1	subframe3_available	-
1	available	Contain 1 if ephemeris is available, 0 if not.
1	health	Contain 1 if the satellite is unhealthy, 0 if healthy.
1	predicted	-
4	accuracy	Accuracy

Table 4: Ephemeris Data Format for GLONASS Constellation

Bits	Structure Member	Description
16	week	Week number of the issue of data.
16	toe	Time of week for ephemeris epoch.
4	toe_lsb	Time of week for ephemeris epoch (LSB).
11	NA	Calendar day number within the four-year period since the beginning of last leap year (almanac).
7	tb	Time of ephemeris index.
2	M	Type of satellite 00 = GLONASS 01 = GLONASS-M
2	P1	Time interval between two adjacent tb parameters.

1	P3	Number of satellites for which almanac is transmitted within this frame 0 = 4 1 = 5
1	P2	Flag of oddness (1) or evenness (0) of the value of tb.
1	P4	Flag to show that ephemeris parameters are present.
2	KP	Notification on forthcoming leap second correction of UTC.
1	spare0	-
27	xn	Satellite PZ-90 x coordinate at epoch tb.
5	xn_dot_dot	Satellite PZ-90 x velocity at epoch tb.
24	xn_dot	Satellite PZ-90 x acceleration component at epoch tb.
5	n	Slot number (1–24).
3	Bn	Healthy flags.
27	yn	Satellite PZ-90 y coordinate at epoch tb.
5	yn_dot_dot	Satellite PZ-90 y acceleration component at epoch tb.
24	yn_dot	Satellite PZ-90 y velocity at epoch tb.
5	delta_tau_n	-
3	spare4	-
27	zn	Satellite PZ-90 z coordinate at epoch tb.
5	zn_dot_dot	Satellite PZ-90 z acceleration component at epoch tb.
24	zn_dot	Satellite PZ-90 z velocity at epoch tb.
2	reserved1	Must be 0.
6	reserved2	Must be 0.
11	gamma_n	Satellite clock frequency drift at epoch tb.
5	E_n	Age of the ephemeris information.
4	freq_id	Frequency ID.
12	spare3	-
22	tau_n	Satellite clock correction at epoch tb.
10	age_h	-

32	tau_c	GLONASS to UTC(SU) time correction.
22	tau_GPS	GLONASS to GPS system time correction.
10	spare5	-
11	NT	Calendar day number of ephemeris within the four-year period since the beginning of last leap year.
5	N4	Four-year interval number starting from 1996.
12	tk	Satellite time referenced to the beginning of the frame.
4	FT	Predicted satellite user range accuracy at time tb.
32	spare7	-
5	m_available	Must be 0x1F.
1	nvm_reliable	Must be 1.
26	spare8	-
25	spare9	-
1	available	Contain 1 if ephemeris is available, 0 if not.
1	health	Contain 1 if the satellite is unhealthy, 0 if healthy.
1	predicated	-
4	spare10	-

Table 5: Ephemeris Data Format for BeiDou Constellation

Bits	Structure Member	Description
32	inclination	Inclination angle at reference time.
32	eccentricity	Eccentricity
32	root_a	Square root of major axis.
32	mean_anomaly	Mean anomaly at reference time.
32	omega_zero	Longitude of ascending node of orbit plane at weekly epoch.
32	perigee	Argument of perigee.
17	toe	Rate of inclination angle.

10	time_group_delay	Estimated group delay differential.
5	aode	Issue of data, ephemeris.
24	omega_dot	Rate of right ascension.
8	A0	Ionospheric delay model parameter α0.
24	af0	Constant clock correction.
8	A1	Ionospheric delay model parameter α1.
20	sow	Seconds of week.
11	af2	Second order clock correction.
1	is_geo	1 for geostationary satellites, otherwise 0.
22	af1	First order clock correction.
10	subframe_avail	-
16	motion_difference	Mean motion difference from computed value.
8	A2	Ionospheric delay model parameter α2.
8	A3	Ionospheric delay model parameter α3.
18	crs	Amplitude of the sine harmonic correction to the orbit radius.
8	B2	Ionospheric delay model parameter β2.
4	urai	User range accuracy index.
2	reserved1	-
18	crc	Amplitude of the cosine harmonic correction to the orbit radius.
8	B3	Ionospheric delay model parameter β3.
5	aodc	Issue of data, clock.
1	spare0	-
18	cus	Amplitude of the sine harmonic correction to the argument of latitude.
14	i_dot	Rate of inclination angle.
18	cuc	Amplitude of the cosine harmonic correction to the argument of latitude.
8	B0	Ionospheric delay model parameter β0.
6	spare1	-

18	cis	Amplitude of the sine harmonic correction to the angle of inclination.
8	B1	Ionospheric delay model parameter β1.
6	time_distance_h	Must be 0.
18	cic	Amplitude of the cosine harmonic correction to the angle of inclination.
1	nvm_reliable	Must be 1.
1	predicted	Must be 0.
10	tgd2	Must be 0.
2	spare4	-
17	toc	Time of week for clock epoch.
13	week	Week number of the issue of data.
1	available	Contain 1 if ephemeris is available, 0 if not.
1	health	Contain 1 if the satellite is unhealthy, 0 if healthy.

Table 6: Ephemeris Data Format for Galileo Constellation

Bits	Structure Member	Description
16	week	Week number of the issue of data.
14	toe	Time of week for ephemeris epoch.
2	ephems_n	Must be 0.
14	toc	Time of week for clock epoch.
10	iod_nav	Issue of data.
8	SISA	Signal in space accuracy.
10	age_h	Must be 0.
10	BGD_E1_E5a	E1-E5a broadcast group delay.
10	BGD_E1_E5b	E1-E5b broadcast group delay.
2	E1BHS	E1-B signal health status.
32	inclination	Inclination angle at reference time.

32	eccentricity	Eccentricity
32	root_a	Square root of major axis.
32	mean_anomaly	Mean anomaly at reference time.
32	omega_zero	Longitude of ascending node of orbit plane at weekly epoch.
32	perigee	Argument of perigee.
14	i_dot	Rate of inclination angle.
1	available	Contain 1 if ephemeris is available, 0 if not.
1	health	Contain 1 if the satellite is unhealthy, 0 if healthy.
16	motion_difference	Mean motion difference from computed value.
16	crs	Amplitude of the sine harmonic correction to the orbit radius.
16	crc	Amplitude of the cosine harmonic correction to the orbit radius.
16	cus	Amplitude of the sine harmonic correction to the argument of latitude.
16	cuc	Amplitude of the cosine harmonic correction to the argument of latitude.
16	cis	Amplitude of the sine harmonic correction to the angle of inclination.
16	cic	Amplitude of the cosine harmonic correction to the angle of inclination.
24	omega_dot	Rate of right ascension.
6	SVID	Satellite identification.
1	E1BDVS	E1-B data validity status.
1	predicted	Must be 0.
6	af2	Second order clock correction.
21	af1	First order clock correction.
5	word_available	Must be 0x1F.
31	af0	Constant clock correction.
1	spare0	-
6	time_distance_h	Must be 0.
26	spare1	-

2.3.8. PSTMALMANAC

Reports the Almanacs Data.

Type:

Output.

Synopsis:

```
$PSTMALMANAC,<SatID>,<DataSize>,<HexData>*<Checksum><CR><LF>
```

Parameter:

Field	Format	Unit	Description
<SatID>	Numeric	-	Satellite Number (PRN).
<DataSize>	Numeric	-	Number of bytes contained in the “Hex-Data” field.
<HexData>	Hexadecimal	-	Almanac Data in Hex-Format.

Example:

```
$PSTMALMANAC,1,40,015b084ed053491a5cfd0000330da10079fbd900e97621009cf3430037f3bf0000
00000000000000*4A
$PSTMALMANAC,2,40,025b084e88a6720c4cfd0000570ca10084afd600b23bc00044ba4d00b2fdbf0000
00000000000000*1A
$PSTMALMANAC,65,40,415b08008051a17211681b0097df0e00538b0600be22580119c0340039080200
0200000072390000*7B
$PSTMALMANAC,68,40,445b080080512178789e1c00fbd80f0066c414003927840003c0340078e00200
0200000072390000*72
$PSTMALMANAC,193,40,c15b0855297ec4dbe8fe0000ddebca00aff81a005a76c00067f09200a0068000
0000000000000000*16
$PSTMALMANAC,301,40,2d0101005b080000a30000000ae0010079f40e00837bf1077398ebfdfe1f6610
0000000000000000*41
```

Table 7: Almanac Data Format for GPS Constellation

Bits	Structure Member	Description
8	sat_id	The satellite number.
16	week	The week number for the epoch.
8	toa	Reference time almanac.

16	e	Eccentricity.
16	delta_t	Rate of inclination angle.
16	omega_dot	Rate of right ascension.
16	spare0	-
24	root_A	Square root of semi-major axis.
8	spare1	-
24	omega_zero	Longitude of ascending node of orbit plane at weekly epoch.
8	spare2	-
24	perigee	Argument of perigee.
8	spare3	-
24	mean_anomaly	Mean anomaly at reference time.
8	spare4	-
11	af0	Constant clock correction.
11	af1	First order clock correction.
1	health	Contains 1 if the satellite is unhealthy, 0 if healthy.
1	available	Contains 1 if almanac is available, 0 if not.
8	spare5	-

Table 8: Almanac Data Format for GLONASS Constellation

Bits	Structure Member	Description
8	sat_id	The satellite ID number.
16	week	The week number for the epoch.
8	spare0	-
20	toa	Reference time almanac.
5	n_A	Slot number (1…24).
5	H_n_A	Carrier frequency channel number.

2	M_n_A	Type of satellite 00=GLONASS 01=GLONASS-M.
10	tau_n_A	Satellite clock correction.
15	epsilon_n_A	Eccentricity.
7	spare1	-
21	t_lambda_n_A	Time of the first ascending node passage.
11	spare2	-
21	lambda_n_A	Longitude of ascending node of orbit plane at almanac epoch.
11	spare3	-
18	delta_i_n_A	Inclination angle correction to nominal value.
7	delta_T_n_dot_A	Draconian period rate of change.
7	spare4	-
22	delta_T_n_A	Draconian period correction.
10	spare5	-
16	omega_n_A	Argument of perigee.
1	health	Contains 1 if the satellite is unhealthy, 0 if healthy.
1	available	Contains 1 if almanac is available, 0 if not.
14	spare6	-
32	Tau_c	-
11	NA	-
5	N4	-
16	spare7	-

Table 9: Almanac Data Format for Galileo Constellation

Bits	Structure Member	Description
16	sat_id	The satellite ID number.
6	svid	Space Vehicle Identifier.

10	spare0	-
16	week	The week number for the epoch.
16	spare1	-
20	toa	Reference time almanac.
12	spare2	-
13	delta_a	Delta of semi-major axis.
11	e	Eccentricity.
8	spare3	-
16	perigee	Argument of perigee.
11	delta_i	Rate of inclination angle.
5	spare4	-
16	omega_zero	Longitude of ascending node of orbit plane at weekly epoch.
11	omega_dot	Rate of right ascension.
5	spare5	-
16	mean_anomaly	Mean anomaly at reference time.
16	af0	Constant clock correction.
13	af1	First order clock correction.
2	E5b_HS	E5 signal health status.
2	E1B_HS	E1-B signal health status.
4	ioda_1	Issue of data Almanac 1.
4	ioda_2	Issue of data Almanac 2.
2	reserved	Reserved for use by GNSS library.
1	health	Contains 1 if the satellite is unhealthy, 0 if healthy.
2	reserved	Reserved for use by GNSS library
1	spare6	-

Table 10: Almanac Data Format for BeiDou Constellation

Bits	Structure Member	Description
8	prn	PRN number of the corresponding almanac data.
16	week	Almanac reference week number.
8	toa	Almanac reference time.
17	eccentricity	Eccentricity.
11	af0	Satellite clock time bias correction coefficient.
1	is_geo	Satellite orbit type.
1	WNa_valid	-
2	spare0	-
17	omega_dot	Rate of right ascension.
11	af1	Satellite clock time drift correction coefficient.
4	spare1	-
24	root_a	Square root of semi-major axis.
8	spare2	-
24	omega_zero	Longitude of ascending node of orbital plane at weekly epoch.
8	spare3	-
24	perigee	Argument of perigee.
8	spare4	-
24	mean_anomaly	Mean anomaly at reference time.
8	spare5	-
16	delta_i	Correction of inclination angle at reference time.
1	health	Satellite health information.
1	available	Contains 1 if almanac is available, 0 if not.
8	last_received_toa	-
6	spare6	-

Table 11: Almanac Data Format for NavIC (IRNSS) Constellation*

Bits	Structure Member	Description
10	WNa	Week number for almanac.
16	toa	Reference time almanac.
6	prn_al	PRN ID for almanac.
16	eccentricity	Eccentricity
16	omega_dot	Rate of Right Ascension.
24	inclination	Inclination
8	ISC	Inter Signal Correction.
24	root_a	Square Root of the Semi-Major Axis.
8	spare0	-
24	omega_zero	Longitude of Ascending Node of Orbit Plane at Weekly Epoch.
6	spare	-
2	spare1	-
24	perigee	Argument of perigee.
6	prn	PRN ID
2	spare2	-
24	mean_anomaly	Mean Anomaly at Reference Time.
8	spare3	-
11	af0	Clock bias A0.
11	af1	Clock bias A1.
1	health	Contains 1 if the satellite is unhealthy, 0 if healthy.
1	available	Contains 1 if almanac is available, 0 if not.
8	spare4	-

2.3.9. PSTMCPU

This message contains the real time CPU usage and the CPU speed setting.

Type:

Output.

Synopsis:

```
$PSTMCPU,<CPU_Usage>,-1,<CPU_Speed>*<Checksum><CR><LF>
```

Parameter:

Field	Format	Unit	Description
<CPU_Usage>	ddd.dd	-	CPU usage %.
-1	Numeric	-	-
<CPU_Speed>	Hexadecimal	MHz	CPU clock frequency..

Example:

```
$PSTMCPU,36.17,-1,261*74
```

2.3.10. PSTMTS

This message is repeated for each satellite tracked and used for the calculation of a fix.

Type:

Output.

Synopsis:

```
$PSTMTS,<DspDat>,<SatID>,<PSR>,<Freq>,<CP>,<DSP_Flags>,<CN0>,<T_Tim>,<CodeNoise>,<PhaseNoise>,<CycleSlipCnt>,<GloSlot>,<Elev>*<Checksum><CR><LF>
```

Parameter:

Field	Format	Unit	Description
<DspDat>	Numeric	-	DSP data available: Bit 0 = 2nd band follows Bit 1 = Main band Bit 2 = 2rd band follows

<table>
<tr><td><SatID></td><td>Numeric</td><td>-</td><td>Satellite Identifier.</td></tr>
<tr><td><PSR></td><td>Numeric</td><td>Meter</td><td>Pseudo range.</td></tr>
<tr><td><Freq></td><td>Numeric</td><td>-</td><td>Satellite tracking frequency offset.</td></tr>
<tr><td><CP></td><td>Numeric</td><td>Cycle</td><td>Carrier phase measurement.</td></tr>
<tr><td><DSP_Flags></td><td>Numeric</td><td>-</td><td>
<table>
<tr><td>Bit 0</td><td>1 = Available</td></tr>
<tr><td>Bit 1</td><td>Preamble locked
1 = locked</td></tr>
<tr><td>Bit 3:2</td><td>Multi-path indicator
0 = No
3 = Strong</td></tr>
<tr><td>Bit 4</td><td>Loss of Lock Indicator</td></tr>
<tr><td>Bit 6:5</td><td>Reserved</td></tr>
<tr><td>Bit 7</td><td>Preamble polarity
0 = Normal
1 = Reserved</td></tr>
<tr><td>Bit 8</td><td>Half cycle ambiguity
0 = fixed
1 = not fixed</td></tr>
<tr><td>Bit 13:9</td><td>Reserved</td></tr>
<tr><td>Bit 14</td><td>1 = main freq (L1)
0 = dual freq. (L2, L5, etc.)</td></tr>
<tr><td>Bit 15</td><td>Cycle slip indicator (at current epoch vs. previous one)
1 = occurred</td></tr>
<tr><td>Bit 16</td><td>ddm_ext_validity</td></tr>
<tr><td>Bit 17</td><td>psr_int</td></tr>
<tr><td>Bit 18</td><td>cp_int</td></tr>
<tr><td>Bit 19</td><td>drop_detection_alarm</td></tr>
<tr><td>Bit 20</td><td>code_loop_alarm</td></tr>
<tr><td>Bit 21</td><td>preamble_propagated</td></tr>
</table>
</td></tr>
<tr><td><CN0></td><td>Numeric</td><td>dBHz</td><td>Satellite Carrier to Noise Ratio.</td></tr>
<tr><td><T_Tim></td><td>Numeric</td><td>Second</td><td>Track Time of Satellite.</td></tr>
<tr><td><CodeNoise></td><td>Numeric</td><td>-</td><td>Moving average of the code-loop discriminator error in arbitrary units. Typical abs <2000.</td></tr>
<tr><td><PhaseNoise></td><td>Numeric</td><td>-</td><td>Moving average of the error used to update the carrier loop in arbitrary units. Typical range 1–10k.</td></tr>
<tr><td><CycleSlipCnt></td><td>Numeric</td><td>-</td><td>Total Cycle Slip Counter.</td></tr>
<tr><td><GloSlot></td><td>Numeric</td><td>-</td><td>GLONASS satellite slot number (1–24), if available; otherwise 0.</td></tr>
</table>

<Elev>	Numeric	Degree	Elevation degree.

Example:

```
$PSTMTS,3,4,22300076.875,-45227.89,-117187620.363,87051,43,4810430,1151,1200,2,0,36*1A
$PSTMTS,3,26,20487080.438,-49062.72,-107660355.405,21507,45,13496275,261,1331,5,0,66*27
$PSTMTS,2,16,20392300.875,-47089.62,-107162325.957,21635,44,9045945,370,1245,3,0,65*16
$PSTMTS,2,22,24381933.562,-49905.73,-128127917.362,87043,39,12515315,282,1547,2,0,15*25
$PSTMTS,2,29,24142307.750,-50483.98,-126868703.795,21635,39,5390203,-246,1362,73,0,16*09
```

2.3.11. PSTMCHMON

This message reports the correlation for a given satellite.

Type:

Output.

Synopsis:

```
$PSTMCHMON,<Pool>,<SatID>,<CPU_Time1>,<CPU_Time2>,<P1_VL>,<P1_L>,<P1_P>,<P1_E>,<P1_VE>,<P2_VL>,<P2_L>,<P2_P>,<P2_E>,<P2_VE>*<Checksum><CR><LF>
```

Parameter:

Field	Format	Unit	Description
<Pool>	Numeric	-	Pool number being used.
<SatID>	Numeric	-	Satellite Identifier.
<CPU_Time1>	Numeric	-	The CPU tick count at the epoch when the correlation values have been collected from the baseband hardware (for debug purposes).
<CPU_Time2>	Numeric	-	The CPU tick count at the epoch when the correlation values have been collected from the baseband hardware (for debug purposes).
<P1_VL>…<P2_VE>	Numeric	-	The power (in arbitrary units) of the Very Late correlation point for the channel nr. 1 etc. for the Late, Prompt, Early, Very Early and for the remaining channels. Each channel can dump up to 5 points, so in this example 2 channels dump in total 10 correlation points.

Example:

```
$PSTMCHMON,0,27,-1389643691,-1389643691,286279,12007151,45989304,12515050,145361,32553
```

14,26953820,27461231,3158526,127079,-0.167310*7D
$PSTMCHMON,0,27,-1389439463,-1389439463,154534,12975043,52467171,16471905,296307,31925
29,30224984,33071855,5065653,165211,-0.016908*74
$PSTMCHMON,0,27,-1389234398,-1389234398,257647,13635328,52361514,15076408,290112,36904
34,30715550,31469373,4364229,279845,-0.159312*7F
$PSTMCHMON,0,27,-1389030170,-1389030170,420293,14314831,55862830,17383379,379867,36622
45,33064744,35445665,5104130,119868,-0.055406*7E
$PSTMCHMON,1,22,-1390006111,-1390006111,346120,5646286,27712202,7079567,276806,937789,1
4861318,16587779,1352804,349020,-0.010978*40
$PSTMCHMON,1,22,-1389801884,-1389801884,203812,6067700,27409985,7328124,280157,1266925,
14956885,17211323,1590192,334224,-0.126495*7E
$PSTMCHMON,1,22,-1389596819,-1389596819,661254,6693903,29197990,7378836,387548,1465871,
16280621,17174868,1678222,288058,-0.142812*7D
$PSTMCHMON,1,22,-1389392591,-1389392591,247553,6667459,28979462,7366498,329623,1089108,
16799499,17378033,1758215,300296,-0.051984*7E
$PSTMCHMON,1,22,-1389188363,-1389188363,231441,6362698,29434353,7323837,319156,1107325,
16643338,17930595,1267478,467739,-0.070006*71
$PSTMCHMON,2,4,-1389952543,-1389952543,94516,18102425,81257141,32116691,1081599,382130
2,45781608,61360210,11294711,257493,-0.563796*7C
$PSTMCHMON,2,4,-1389747479,-1389747479,128914,16945026,77116636,32201494,1113838,36198
02,42085124,59163748,11423663,169392,-0.468308*4E
$PSTMCHMON,2,4,-1389543251,-1389543251,90127,17429422,80607534,34191172,1339687,385167
0,43749746,62025691,12560850,348848,-0.533269*71
$PSTMCHMON,2,4,-1389338186,-1389338186,217790,16019265,71178739,30419500,1158678,38563
44,39285873,54509421,11170008,250690,-0.558216*48
$PSTMCHMON,2,4,-1389133958,-1389133958,210894,16836974,75451082,31624569,1312062,39282
16,40868266,56545527,11700640,315845,-0.532158*46
$PSTMCHMON,3,3,-1389905671,-1389905671,194397,5636078,26519973,9528058,169160,1447309,
14103483,17823414,2781187,192083,-0.253872*4C
$PSTMCHMON,3,3,-1389700607,-1389700607,251703,5914268,24188215,8100049,247755,1414637,
13887698,15523650,2506525,194629,-0.336371*44
$PSTMCHMON,3,3,-1389496379,-1389496379,61309,7963143,29988802,9855775,138062,1996794,1
7179818,19420215,2869765,101260,-0.202978*7E
$PSTMCHMON,3,3,-1389291314,-1389291314,174389,6325924,26902689,8643160,153906,1521374,
14995556,17221138,2374771,160551,-0.169488*42
$PSTMCHMON,3,3,-1389087086,-1389087086,161249,5648103,25438435,8721414,225230,1551393,
13792709,16421921,2708529,200414,-0.199821*4C

2.3.12. PSTMSBAS

SBAS satellite data.

Type:

Output.

Synopsis:

```
$PSTMSBAS,<Status>,<SatTrk>,<SatID>,<Elev>,<Azim>,<Sig>*<Checksum><CR><LF>
```

Parameter:

Field	Format	Unit	Description
<Status>	Decimal	-	SBAS Status: 0 = No SBAS used 1 = SBAS used
<SatTrk>	Decimal	-	SBAS Satellite tracked: 0 = SBAS Satellite not tracked 1 = SBAS Satellite tracked, decoding is ongoing 2 = SBAS Satellite tracked and decoded. Differential Mode ON
<SatID>	Decimal	-	SBAS Satellite ID.
<Elev>	Decimal	Degree	SBAS Satellite Elevation.
<Azim>	Decimal	Degree	SBAS Satellite Azimuth.
<Sig>	Decimal	dBHz	SBAS Satellite Signal Strength CN0.

Example:

```
$PSTMSBAS,1,2,129,45,141,19*1D
```

2.3.13. PSTMSETCONSTMASK

Sets the GNSS constellation mask and usage (optional). It allows switching the multi-frequency configuration at run-time. In case of reset, constellation mask is restored to default value.

Type:

Set.

Synopsis:

```
$PSTMSETCONSTMASK,<ConstellationMask>,<MultiFreqMask>*<Checksum><CR><LF>
```

Parameter:

Field	Format	Unit	Description
<ConstellationMask>	Decimal	-	It is a bit mask where each bit enable/disable a specific constellation independently by the others: bit 0: GPS constellation enabling/disabling bit 1: GLONASS constellation enabling/disabling bit 2: QZSS constellation enabling/disabling bit 3: Galileo constellation enabling/disabling bit 7: BeiDou constellation enabling/disabling bit 9: GPS L2C enabling/disabling bit 10: IRNSS L5 constellation enabling/disabling* bit 11: GPS L5 enabling/disabling bit 12: Galileo E5 enabling/disabling bit 14: BeiDou B2a enabling/disabling bit 15: QZSS L2C enabling/disabling bit 16: QZSS L5 enabling/disabling
<MultiFreqMask>	Decimal	-	It is a bit mask where each bit enable/disable multi frequency independently by the others: bit 0: GPS 0=OFF 1=L2C or L5 bit 1: GLONASS 0=OFF 1=G2 bit 2: QZSS 0=OFF 1= L2C or L5 bit 3: Galileo 0=OFF 1= E5a or E5b bit 7: BeiDou 0=OFF 1=B2I or B2a bit 11: 1= Single die mode (no ext. 5636) bit 12: Galileo 0=E5a 1=E5

Response:

- If successful, the module returns:

```
$PSTMSETCONSTMASKOK,<ConstellationMask>*<Checksum><CR><LF>
```

Parameter:

Field	Format	Unit	Description
<ConstellationMask>	Decimal	-	bit 0: GPS constellation enabling/disabling bit 1: GLONASS constellation enabling/disabling bit 2: QZSS constellation enabling/disabling bit 3: Galileo constellation enabling/disabling bit 7: BeiDou constellation enabling/disabling bit 9: GPS L2C enabling/disabling bit 10: IRNSS L5 constellation enabling/disabling* bit 11: GPS L5 enabling/disabling bit 12: Galileo E5 enabling/disabling

	bit 14: BeiDou B2a enabling/disabling bit 15: QZSS L2C enabling/disabling bit 16: QZSS L5 enabling/disabling

- If failed, the module returns :

```
$PSTMSETCONSTMASKERROR*<Checksum><CR><LF>
```

Example:

```
//Enabling GPS/QZSS L1+L2C, GLONASS G1+G2, GAL E1:
$PSTMSETCONSTMASK,527,3*0A
```

2.3.14. PSTMDRSENMSG

Outputs sensor message, which is specific to the message id for each specific sensor configuration.

Type:

Output.

Synopsis:

```
$PSTMDRSENMSG,<MessageID>,<DataFiled0>,[<DataFiled1>,……,<DataFiledn>]*<Checksum><CR>
<LF>
```

Parameter:

Field	Format	Unit	Description
<MessageID>	Decimal	-	Message ID, See *Table 12: Sensor Message ID*.
<DataFiled0>	Decimal	-	The First Parameter.
<DataFiledn>	Decimal	-	Nth parameters.

Table 12: Sensor Message ID

Message ID	Description
24	IMU Temperature
30	IMU Accelerometer
31	IMU Gyroscope

NOTE

Only LG69T (AA,AJ) supports this message.

2.3.14.1. When Message ID = 24

The performance and calibration of miniaturized MEMS motion sensors are dependent on device's temperature. For this reason, state of art MEMS IMUs embed a temperature sensor, to allow applications to compensate calibration for temperature changes. This message reports the value outputted by such MEMS thermal sensor at 1 Hz rate.

Type:

Output.

Synopsis:

```
$PSTMDRSENMSG,24,<CPU_Time>,<Temperature>,<Validity>*<Checksum><CR><LF>
```

Parameter:

Field	Format	Unit	Description
24	Decimal	-	Message ID.
<CPU_Time>	Decimal	-	CPU Ticks.
<Temperature>	Decimal	-	Gyro sensor temperature Fix Point value format 8.8. Floating point value can be recovered by dividing by 256.
<Validity>	Decimal	-	0 = temperature is not valid 1 = temperature is valid

Result:

None.

Example:

```
$PSTMDRSENMSG,24,109187663,1235,1*0A
```

2.3.14.2. When Message ID = 30

This message reports the value outputted by a 3 axis MEMS digital acceleration sensor at selected sampling rate [Default.50 Hz].

Type:

Output.

Synopsis:

```
$PSTMDRSENMSG,30,<CPUTimestamp>,<Rawx>,<Rawy>,<Rawz>*<Checksum><CR><LF>
```

Parameter:

Field	Format	Unit	Description
30	Decimal	-	Message ID.
<CPUTimestamp>	Decimal	-	CPU Ticks.
<Rawx>	Decimal	-	Raw X-axis acceleration. [signed, 16 bit].
<Rawy>	Decimal	-	Raw Y-axis acceleration. [signed, 16 bit].
<Rawz>	Decimal	-	Raw Z-axis acceleration. [signed, 16 bit].

Result:

None.

Example:

```
$PSTMDRSENMSG,30,109255904,111,23,16453*10
```

2.3.14.3. When Meassage ID = 31

This message reports the value outputted by a 3 axis MEMS digital angular rate sensor at selected sampling rate [Default.50 Hz].

Type:

Output.

Synopsis:

```
$PSTMDRSENMSG,31,<CpuTimestamp>,<Rawx>,<Rawy>,<Rawz>*<Checksum><CR><LF>
```

Parameter:

Field	Format	Unit	Description
31	Decimal	-	Message ID
<CpuTimestamp>	Decimal	-	CPU Ticks.
<Rawx>	Decimal	-	Raw signed 16 bit X-axis angular rate.
<Rawy>	Decimal	-	Raw signed 16 bit Y-axis angular rate.
<Rawz>	Decimal	-	Raw signed 16 bit Z-axis angular rate.

Result:

None.

Example:

```
$PSTMDRSENMSG,31,109255904,71,-74,-76*10
```

3 RTCM Protocol

This chapter introduces the RTCM proprietary protocol which is supported by LG69T(AA,AD,AI,AJ,AK).

3.1. Supported RTCM Messages

Message Type	Mode	Description
999	Input/Output	The chipset supplier proprietary RTCM messages.
1006	Output	Stationary RTK Reference Station ARP with Height.
1013	Output	System Parameters.
1019	Output	GPS Ephemerides.
1020	Output	GLONASS Ephemerides.
1042	Output	BeiDou Ephemeris Data.
1044	Output	QZSS Ephemerides.
1046	Output	Galileo I/NAV Satellite Ephemeris Data.
1077	Output	GPS MSM7.
1087	Output	GLONASS MSM7.
1097	Output	Galileo MSM7.
1117	Output	QZSS MSM7.
1127	Output	BeiDou MSM7.

3.2. RTCM Data Fields

The data fields used are shown in table below. Note that the Data Field ranges may be less than the

maximum possible range allowed by the Data Type.
The suffix '**P**' identifies Proprietary Data Fields.

Table 13: Data Field Table

DF	DF Name	DF Range	DF Resolution	Data Type	Data Field Notes
DF002	Message Number	0–4095	-	uint12	-
DF003	Reference Station ID	0–4095	-	uint12	-
DF004	GPS Epoch Time (TOW)	0–604799999ms	1ms	uint30	-
DF009	GPS Satellite ID	0–63	-	uint6	-
DF021	ITRF Realization Year	-	-	uint6	Reserved
DF025	Antenna Ref. Point ECEF-X	±13743895.3471m	0.0001m	int38	-
DF026	Antenna Ref. Point ECEF-Y	±13743895.3471m	0.0001m	int38	-
DF027	Antenna Ref. Point ECEF-Z	±13743895.3471m	0.0001m	int38	-
DF038	GLONASS Satellite ID (Satellite Slot Number)	0–63	-	uint6	-
DF054	Leap Seconds, GPS-UTC	0–254s	1s	uint8	-
DF252	Galileo Satellite ID	0–63	-	uint6	-
DF429	QZSS Satellite ID	1–10	-	uint4	A QZSS Satellite ID number from 1 to 10 refer to the PRN code of the QZSS satellite. The ID map to the PRN numbers as follows: 1: 193 2: 194 …

					10: 202
DF488	BDS Satellite ID	0–63	-	uint6	-
DF02P	Subtype ID	0–255	-	uint8	-
DF06P	GNSS ID	0–15	-	uint4	0 = GPS 1 = GLONASS 2 = QZSS 3 = Galileo 4 = SBAS 7 = BeiDou 10 = IRNSS*
DF16P	GNSS Epoch Time	0–604799999ms	1ms	uint30	TOW for any GNSS. 0x3FFFFFFF = Invalid
DF18P	Extended Week Number	-	1week	uint16	week number extended to 16-bit roll-over. 0xFFFF = Invalid
DF23P	Multiple Message Indicator	-	-	bit(1)	0 = last message of sequence 1 = multiple message
DF28P	GPS Quality Indicator	0–15	-	uint4	Same as field <Quality> in NMEA GGA 0 = Fix not available or invalid 1 = GPS, SPS Mode, fix valid 2 = Differential GPS, SPS Mode, fix valid 6 = Estimated (dead reckoning) mode
DF29P	Number of satellites in use	-	-	uint8	Same as field **<NumSatUsed>** in NMEA GGA.
DF30P	Dilution of precision (DOP)	0–25.4	0.1	uint8	0xFF = Invalid.
DF31P	Geoidal separation, meters	±163.83 m	0.01m	int15	Same as field **<Sep>** in NMEA GGA.
DF32P	Age of Differentials	-	1ms	int24	Same as field **<DiffAge>** in NMEA

					GGA.
DF33P	Differential Reference Station ID	0–4095	-	uint12	Same as DF003 format.
DF34P	Antenna Velocity ECEF-X	-	1E-6 m/s	int32	-
DF35P	Antenna Velocity ECEF-X	-	1E-6 m/s	int32	-
DF36P	Antenna Velocity ECEF-X	-	1E-6 m/s	int32	-
DF37P	Number of satellites in view	-	-	uint8	-
DF64P	CPU timestamp	0–4294967295	0.001s	uint32	Microseconds
DF65P	Acc raw X	-32768 to 32767	0.061mg/LSB	int16	Raw X-axis acceleration. Full scale = ±2g
DF66P	Acc raw Y	-32768 to 32767	0.061mg/LSB	int16	Raw Y-axis acceleration. Full scale = ±2g
DF67P	Acc raw Z	-32768 to 32767	0.061mg/LSB	int16	Raw Z-axis acceleration. Full scale = ±2g
DF68P	Gyro raw X	-32768 to 32767	4.37mdps/LSB	int16	Raw X-axis angular rate. In milli degree per second unit. Full scale = ±143dps.
DF69P	Gyro raw Y	-32768 to 32767	4.37mdps/LSB	int16	Raw Y-axis angular rate. In milli degree per second unit. Full scale = ±143dps.
DF70P	Gyro raw Z	-32768 to 32767	4.37mdps/LSB	int16	Raw Z-axis angular rate. In milli degree per second unit. Full scale = ±143dps.
DF71P	Sensor type	-	-	uint8	0x1E = accelerometer 0x1F = gyroscope
DF72P	Time ID	0–15	-	uint4	0 = GPS

					1 = GLONASS 2 = QZSS 3 = Galileo 4 = SBAS 7 = BeiDou 10 = IRNSS* 14 = UTC 15 = Invalid
DF73P	Latitude	-3.24*10^8 to 3.24*10^8	0.001arcsec	int32	0x80000000 = Invalid
DF74P	Longitude	-6.48*10^8 to 6.48*10^8	0.001arcsec	int32	0x80000000 = Invalid
DF75P	Height	-524287 to 524287	0.1m	int20	0x80000 = Invalid or not available (2D fix)
DF76P	Velocity Horizontal	-524287 to 524287	0.01m/s	int20	-
DF77P	Velocity Vertical	-524287 to 524287	0.01m/s	int20	-
DF78P	Course Angle	-32767 to 32767	1deg	int16	-
DF79P	Standard deviation of North position error	0–1048575	0.01m	uint20	0xFFFFF = Invalid
DF80P	Standard deviation of East position error	0–1048575	0.01m	uint20	0xFFFFF = Invalid
DF81P	Standard deviation of Up position error	0–1048575	0.01m	uint20	0xFFFFF = Invalid
DF82P	Signal Identifier	-	-	uint16	See *3.2.1 Signal Identifier and Tracking Mode (DF82P and DF86P)*
DF83P	Standard deviation of North velocity error	0–1048575	0.001m/s	uint20	0xFFFFF = Invalid
DF84P	Standard deviation of East velocity error	0–1048575	0.001m/s	uint20	0xFFFFF = Invalid
DF85P	Standard deviation of Up velocity error	0–1048575	0.001m/s	uint20	0xFFFFF = Invalid

DF86P	Tracking mode	-	-	uint8	See *3.2.1 Signal Identifier and Tracking Mode (DF82P and DF86P)*
DF87P	Time validity	0–15	-	uint4	0 = NO TIME 1 = FLASH TIME 2 = TOW TIME 3 = USER TIME 4 = USER RTC TIME 5 = RTC TIME 6 = RTC TIME ACCURATE 7 = APPROX TIME 8 = ACCURATE TIME 9 = POSITION TIME 10 = EPHEMERIS TIME
DF88P	Expected error in latitude	-524287 to 524287	0.01m	int20	0x80000 = Invalid
DF89P	Expected error in longitude	-524287 to 524287	0.01m	int20	0x80000 = Invalid
DF90P	Expected error in altitude	-524287 to 524287	0.01m	int20	0x80000 = Invalid
DF91P	RMS value of the standard deviation of the range inputs to the navigation process	0–1048575	0.01	uint20	0xFFFFF = Invalid
DF92P	Standard deviation of semi-major axis of error ellipse	0–1048575	0.01m	uint20	0xFFFFF = Invalid
DF93P	Standard deviation of semi-minor axis of error ellipse	0–1048575	0.01m	uint20	0xFFFFF = Invalid
DF94P	Orientation of semi-major axis of error ellipse	-32767 to 32767	0.1 degrees from true North	int16	0x8000 = Invalid
DF97P	STGRS Fields Value	-32767 to 32767	0.1	int16	Each field is the value of the residual in [dm]

	of the corresponding bit in the GNSS satellite mask

3.2.1. Signal Identifier and Tracking Mode (DF82P and DF86P)

Signal Identifier is an unsigned 16-bit number structured as showed below.

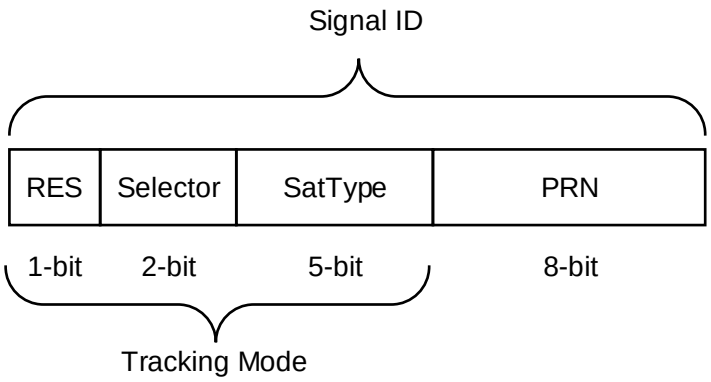

Figure 2: Signal ID (DF82P) Structure

PRN Field:

This field is set to the corresponding RTCM data field according to below table for each constellation (in case the RTCM data field length is lower than 8 bits, only the less significant bits will be used, and the remaining bits will be set to zero).

The "**PRN**" usually starts from '1', a "**PRN**" of value zero is not admitted and shall be used to identify special signal IDs (e.g. not valid IDs).

Table 14: The Chipset Supplier Proprietary RTCM Message List

Constellation	RTCM3 Data Field for PRN
GPS	DF009
GLONASS	DF038
Galileo	DF252

QZSS	DF429
BeiDou	DF488

SatType Field:

Table 15: Satellite Type and Selector

Sat Type			Selector
No.	**System**	**Signal**	
1	GPS	L1 C/A	00
2	GLONASS	G1	00
		G2	01
3	QZSS	L1 C/A	00
4	Galileo	E1B (data)	00
		E1C (pilot)	01
5	SBAS	L1	00
6	QZSS	L1 SAIF(*)	(*)
7	QZSS	L1C(*)	(*)
8	BeiDou	B1I	00
		B2I	01
9	BeiDou	B1C(*)	(*)
10	GPS	L2C CM	00
		L2C CL	01
11	IRNSS*	L5	00
12	GPS	L5-Q (pilot)	00
		L5-I (data)	01
13	Galileo	E5a-I	00
		E5a-Q	01

		E5b-I	10
		E5b-Q	11
14	Galileo	E6(*)	(*)
15	BeiDou	B2a	00
16	QZSS	L2C CM	00
		L2C CL	01
17	QZSS	L5-Q (pilot)	00
		L5-I (data)	01
18-32	Reserved	Reserved	-

NOTE

"*" means reserved for future use.

Selector Field:

The “selector” identifies specific tracking modes of the signal components, e.g. data vs. pilot, E5a vs. E5b, I vs. Q component etc. Refer to *Table 15: Satellite Type and Selector*.

RES Field:

Reserved for future use and kept to zero.

3.3. Proprietary RTCM Messages

The RTCM message type 999 is the chipset supplier proprietary RTCM message.

Table 16: The Chipset Supplier Proprietary RTCM Message List

Subtype ID	Mode	Description
4	Output	Receiver PVT (PVT)
21	Output	Extended PVT (EPVT)

25	Output	Firmware Version (FWVER)
28	Output	GNSS Satellites in view (STGSV)
29	Output	GNSS DOP and Active Satellites (STGSA)
30	Output	GNSS Pseudo-range Error Statistics (STGST)
31	Output	GNSS RAIM parameters (STGBS)
32	Output	GNSS Range Residuals (STGRS)
64	Output	Sensor message (SENS)

3.3.1. PVT (Subtype ID = 4)

This message reports the receiver PVT standard position in ECEF coordinates, plus additional fix information.

Data Field	DF Number	Data Type	Bits	Notes
Message Number	DF002	uint12	12	-
Subtype ID	DF02P	uint8	8	-
Reference Station ID	DF003	uint12	12	-
Reserved for ITRF Realization Year	DF021	uint6	6	-
GPS Quality Indicator (fix status)	DF28P	uint4	4	Same as field **<Quality>** in NMEA GGA
Number of satellites in use	DF29P	uint8	8	Same as field **<NumSatUsed>** in NMEA GGA
Number of satellites in view	DF37P	uint8	8	-
HDOP	DF30P	uint8	8	Same as field **<HDOP>** in NMEA GGA
VDOP	DF30P	uint8	8	-
PDOP	DF30P	uint8	8	-
Geoidal separation, meters	DF31P	int15	15	Same as field **<Sep>** in NMEA GGA
Age of Differentials	DF32P	int24	24	Same as field **<DiffAge>** in NMEA GGA

Differential Reference Station ID	DF33P	uint12	12	Same as field **<DiffStation>** in NMEA GGA
GNSS ID	DF06P	uint4	4	System Time GNSS ID
GNSS Epoch Time	DF16P	uint30	30	1ms resolution
Extended Week Number	DF18P	uint16	16	Include roll-over
Leap Seconds, GPS-UTC	DF054	uint8	8	-
Antenna Position ECEF-X	DF025	int38	38	-
Antenna Position ECEF-Y	DF026	int38	38	-
Antenna Position ECEF-Z	DF027	int38	38	-
Antenna Velocity ECEF-X	DF34P	int32	32	-
Antenna Velocity ECEF-Y	DF35P	int32	32	-
Antenna Velocity ECEF-Z	DF36P	int32	32	-

3.3.2. EPVT (Subtype ID = 21)

This message reports the receiver PVT standard position in LLH coordinates, plus extended fix information.

Data Field	DF Number	Data Type	Bits	Notes
Message Number	DF002	uint12	12	-
Subtype ID	DF02P	uint8	8	-
Reference Station ID	DF003	uint12	12	-
Reserved for ITRF Realization Year	DF021	uint6	6	-
GPS Quality Indicator (fix status)	DF28P	uint4	4	Same as field **<Quality>** in NMEA GGA
Data status	-	bit (1)	1	Same as field **<Status>** in NMEA RMC 0 = Data valid 1 = Navigation receiver warning
Fix frequency mode	-	bit (1)	1	0 = Single frequency fix 1 = Multi-frequency fix
Fix integrity (RAIM)	-	bit (1)	1	0 = Not checked 1 = Checked

Reserved	-	bit (1)	1	-
Number of satellites in use	DF29P	uint8	8	Same as field **<NumSatUsed>** in NMEA GGA
Number of satellites in view	DF37P	uint8	8	-
HDOP	DF30P	uint8	8	Same as field **<HDOP>** in NMEA GGA 0–25.4 0xFF = Invalid
VDOP	DF30P	uint8	8	0–25.4 0xFF = Invalid
PDOP	DF30P	uint8	8	0–25.4 0xFF = Invalid
Geoidal separation, meters	DF31P	int15	15	Same as field **<Sep>** in NMEA GGA 0x4000 = Invalid
Age of Differentials	DF32P	int24	24	Same as field **<DiffAge>** in NMEA GGA 0xFFFFFF = Invalid
Differential Reference Station ID	DF33P	uint12	12	Same as field **<DiffStation>** in NMEA GGA 0x3FF = Invalud
Time ID	DF72P	uint4	4	Time ID. 0xF = Invalid.
Time Validity	DF87P	uint4	4	-
GNSS Epoch Time	DF16P	uint30	30	1ms resolution. 0x3FFFFFFF = Invalid
Extended Week Number	DF18P	uint16	16	Include roll-over. The field is not valid if the GNSS Epoch Time is set 0x3FFFFFFF: in such case 0xFFFF will be reported.
Leap Seconds, GPS-UTC	DF054	uint8	8	0xFF = Invalid or not provided
Latitude	DF73P	int32	32	0x80000000 = Invalid
Longitude	DF74P	int32	32	0x80000000 = Invalid
Height	DF75P	int20	20	0x80000 = Invalid or not available (2D fix)
Velocity Horizontal	DF76P	int20	20	0x80000 = Invalid
Velocity Vertical	DF77P	int20	20	0x80000 = Invalid
Course Angle	DF78P	int16	16	0x8000 = Invalid
Protection Level Horizontal	-	uint16	16	Resolution: 0.01 meter. 0xFFFF = Invalid

Protection Level Vertical	-	uint16	16	Resolution: 0.01 meter 0xFFFF = Invalid
Protection Level Angle	-	uint16	16	Resolution: 0.01 degree 0xFFFF = Invalid
Receiver clock bias	-	int32	32	Unit: mm 0x80000000 = Invalid
Receiver Clock Drift	-	int32	32	Unit: cm/s 0x80000000 = Invalid

NOTES

1. In the case “GPS Quality Indicator (fix status)” is 0, then the following fields are not valid, regardless their reported values:
   - Geoidal separation, meters
   - Latitude
   - Longitude
   - Height
   - Velocity Horizontal
   - Velocity Vertical
   - Course Angle
   - Fix frequency mode
   - Fix constellation mode
   - Fix integrity
2. In the case of 2D fix, the Height field is set to Not Valid (0x80000).

3.3.3. FWVER (Subtype ID = 25)

The FWVER message reports the current firmware version.

Data Field	DF Number	Data Type	Bits	Notes
Message Number	DF002	uint12	12	-
Subtype ID	DF02P	uint8	8	-
Firmware version data length	-	uint8	8	N, number of bytes
Firmware version data string	-	char8	8*N	N depends on the firmware version data length

3.3.4. STGSV (Subtype ID = 28)

This message reports the number of satellites in view, satellite ID numbers, elevation, azimuth, and SNR

value.

Data Field	DF Number	Data Type	Bits	Notes
Message Number	DF002	uint12	12	-
Subtype ID	DF02P	uint8	8	-
GPS Epoch Time (TOW)	DF004	uint30	30	Best time converted to GPS system time.
GNSS ID	DF06P	uint4	4	-
GNSS Satellite Mask	DF07P	uint40	40	-
Field Mask	-	bit (8)	8	See *Table 17: STGSV Field Mask*
Multiple Message Indicator	DF23P	bit (1)	1	-
Field Value	-	-	-	See *Table 17: STGSV Field Mask*

Table 17: STGSV Field Mask

Bit	Description	Data Type	Bits	Resolution
0	Elevation 0x80 = Invalid	int8	8	1 Degree
1	Azimuth 0x1FF = Invalid	uint9	9	1 Degree
2	Signal Strength (C/No) - 1st band 0xFF = Invalid	uint8	8	1 dB-Hz
3	Signal Strength (C/No) - 2nd band 0xFF = Invalid	uint8	8	1 dB-Hz
4	Signal Strength (C/No) - 3rd band 0xFF = Invalid	uint8	8	1 dB-Hz
5–7	Reserved	-	-	-

NOTE

The Field Value corresponds to the number of bit sets in the GNSS Satellite Mask and the sub-field in each Field Value corresponds to the number of bits sets in the Field Mask.
For example:
The Field Value show as follows if Field Mask Bit0-3 set to 1.
Satellite 1: Elevation, Azimuth, 1st band C/No, 2nd band C/No

Satellite 2: Elevation, Azimuth, 1st band C/No, 2nd band C/No
Satellite 3: Elevation, Azimuth, 1st band C/No, 2nd band C/No
...

3.3.5. STGSA (Subtype ID = 29)

This message reports the GNSS receiver operating mode, satellites used in the navigation solution, and DOP values.

Data Field	DF Number	Data Type	Bits	Notes
Message Number	DF002	uint12	12	-
Subtype ID	DF02P	uint8	8	-
GPS Epoch Time (TOW)	DF004	uint30	30	Best time converted to GPS system time.
GNSS ID	DF06P	uint4	4	-
Mode	-	bit (1)	1	0 = Manual, forced to operate in 2D or 3D mode 1 = Automatic, allowed to automatically switch 2D/3D
Fix Mode	-	uint2	2	1 = Fix not available 2 = 2D 3 = 3D
Band Mask	-	bit (4)	4	Bit 0 = Band 1 available Bit 1 = Band 2 available Bit 2 = Band 3 available Bit 4 = Reserved M = The number of bits set in the mask.
HDOP	DF30P	uint8	8	0–25.4 0xFF = Invalid
VDOP	DF30P	uint8	8	0–25.4 0xFF = Invalid
PDOP	DF30P	uint8	8	0–25.4 0xFF = Invalid
Multiple Message Indicator	DF23P	bit (1)	1	-
Field Values	-	uint40(M)	40*M	See *Table 18: STGSA Field Values*

Table 18: STGSA Field Values

Data Field	DF Number	Data Type	Bits	Notes
GNSS satellite mask	DF07P	uint40	40	Each bit is set that if the corresponding satellites is used in the solution for the given band.

NOTE

Satellite ID 1 is the MSB.

3.3.6. STGST (Subtype ID = 30)

This message reports the current GNSS pseudo-range error statistics parameters.

Data Field	DF Number	Data Type	Bits	Notes
Message Number	DF002	uint12	12	-
Subtype ID	DF02P	uint8	8	-
GPS Epoch Time (TOW)	DF004	uint30	30	Best time converted to GPS system time.
RMS value of the standard deviation of the range inputs to the navigation process	DF91P	uint20	20	Resolution = 0.01 0xFFFFF = Invalid
Standard deviation of semi-major axis of error ellipse	DF92P	uint20	20	0.01 m 0xFFFFF = Invalid
Standard deviation of semi-minor axis of error ellipse	DF93P	uint20	20	0.01 m 0xFFFFF = Invalid
Orientation of semi-major axis of error ellipse	DF94P	int16	16	0.1 degrees from true North 0x8000 = Invalid
Standard deviation of North position error	DF79P	uint20	20	0.01 m 0xFFFFF = Invalid
Standard deviation of East position error	DF80P	uint20	20	0.01 m 0xFFFFF = Invalid
Standard deviation of Up position error	DF81P	uint20	20	0.01 m 0xFFFFF = Invalid
Standard deviation of North velocity error	DF83P	uint20	20	0.001 m/s 0xFFFFF = Invalid
Standard deviation of East velocity error	DF84P	uint20	20	0.001 m/s 0xFFFFF = Invalid

Standard deviation of Up velocity error	DF85P	uint20	20	0.001 m/s 0xFFFFF = Invalid

3.3.7. STGBS (Subtype ID = 31)

This message reports the current Receiver Autonomous Integrity Monitoring (RAIM) error parameters.

Data Field	DF Number	Data Type	Bits	Notes
Message Number	DF002	uint12	12	-
Subtype ID	DF02P	uint8	8	-
GPS Epoch Time (TOW)	DF004	uint30	30	Best time converted to GPS system time.
Expected error in latitude	DF88P	int20	20	0.01 meters 0x80000 = Invalid
Expected error in longitude	DF89P	int20	20	0.01 meters 0x80000 = Invalid
Expected error in altitude	DF90P	int20	20	0.01 meters 0x80000 = Invalid
ID number of most likely failed satellite.	DF82P	uint16	16	This satellite is excluded by RAIM or FDE algorithm. 0xFFFF = Invalid
Probability of missed detection for most likely failed satellite.	DF83P	uint20	20	Resolution = 10^{-6} 0xFFFFF = Invalid
Estimated range residual of most likely failed satellite.	-	int20	20	signed, 0.1 m 0x80000 = Invalid
Standard Deviation of bias estimate.	-	uint20	20	unsigned, 0.01 m 0xFFFFF = Invalid

3.3.8. STGRS (Subtype ID = 32)

This message reports the Receiver Autonomous Integrity Monitoring (RAIM) range residuals.

Data Field	DF Number	Data Type	Bits	Notes
Message Number	DF002	uint12	12	-
Subtype ID	DF02P	uint8	8	-
GPS Epoch Time (TOW)	DF004	uint30	30	Best time converted to GPS system time.

GNSS ID	DF06P	uint4	4	-
Mode	-	bit (1)	1	0 = residuals were used to calculate the position given in the matching EPVT message 1 = residuals were recomputed after the EPVT position was computed
Band mask	-	bit (4)	4	Bit 0 = band 1 available Bit 1 = band 2 available Bit 2 = band 3 available Bit 4 = Reserved M is the number of bits set in the mask
GNSS satellite mask	DF07P	uint40	40	Each bit is set that if the corresponding satellites is used in the solution. N is the number of bits set in the mask
Multiple message indicator	DF23P	bit (1)	1	-
Field value	DF97P	int16	16*M*N	Each field is the value of the residual in [dm] of the corresponding bit in the GNSS satellite mask for the given band. 0x8000 = not valid

NOTE

The Field Value corresponds to the number of bit sets in the Band mask. For example:
If two bands are available, the residual will be reported in the following order:
Satellite 1 band 1 residual,
Satellite 1 band 2 residual,
Satellite 2 band 1 residual,
Satellite 2 band 2 residual,
...
if three bands are available, the residual will be reported in the following order:
Satellite 1 band 1 residual,
Satellite 1 band 2 residual,
Satellite 1 band 3 residual,
Satellite 2 band 1 residual,
Satellite 2 band 2 residual,
Satellite 2 band 3 residual,
...

3.3.9. SENS (Subtype ID = 64)

Reports sensor message data, which is specific to the Message ID for each specific sensor configuration

for RTCM 3 output (Accelerometer and Gyroscope).

Data Field	DF Number	Data Type	Bits	Notes
Message Number	DF002	uint12	12	-
Subtype ID	DF02P	uint8	8	-
Total Count	-	uint8	8	Count of total sensor message frame.
Frame entry	-	-	variable	Frame data according to Subtype ID.

Table 19: Message Frame for Accelerometer (Sensor type = 0x1E)

Data Field	DF Number	Data Type	Bits	Notes
Sensor type	DF71P	uint8	8	Sensor type (0x1E for accelerometer)
CPU timestamp	DF64P	uint32	32	Microseconds
Acc raw X	DF65P	int16	8	Raw X-axis acceleration
Acc raw Y	DF66P	int16	16	Raw Y-axis acceleration
Acc raw Z	DF67P	int16	16	Raw Z-axis acceleration

Table 20: Message Frame for Gyroscope (Sensor type = 0x1F)

Data Field	DF Number	Data Type	Bits	Notes
Sensor type	DF71P	uint8	8	Sensor type (0x1F for gyroscope)
CPU timestamp	DF64P	uint32	32	Microseconds
Gyro raw X	DF68P	int16	8	Raw X-axis angular rate.
Gyro raw Y	DF69P	int16	16	Raw Y-axis angular rate.
Gyro raw Z	DF70P	int16	16	Raw Z-axis angular rate.

4 Appendix A References

Table 21: Related Documents

Document Name	
[1]	Quectel_LG69T(AA)_EVB_User_Guide
[2]	Quectel_LG69T(AD)_EVB_User_Guide
[3]	Quectel_LG69T(AA)&LG69T(AD)_Hardware_Design
[4]	Quectel_LG69T(AA)&LG69T(AD)_Reference_Design
[5]	Quectel_LG69T(AI)&LG69T(AJ)&LG69T(AK)_Hardware_Design
[6]	Quectel_LG69T(AI)&LG69T(AJ)&LG69T(AK)_Reference_Design

Table 22: Terms and Abbreviations

Abbreviation	Description
2D	2 Dimension
3D	3 Dimension
ARP	Antenna Reference Point
C/N_0	Carrier-to-Noise Ratio
COG	Course over Ground
COGM	Course over Ground (in Magnetic North Course Direction)
COGT	Course over Ground (in True North Course Direction)
CPU	Central Processing Unit
DOP	Dilution of Precision

ECEF	Earth-centered, Earth-fixed
FDE	False Detection Exclusion
GGA	Global Positioning System Fix Data
GLL	Geographic Position - Latitude and Longitude
GLONASS	Global Navigation Satellite System (Russia)
GNS	Global Network Service
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
GSA	GPS DOP and Active Satellites
GSV	GNSS Satellites in View
HDOP	Horizontal Dilution of Precision
IMU	Inertial Measurement Unit
IRNSS*	Indian Regional Navigation Satellite System
LSB	Least Significant Bit
MEMS	Micro-Electro-Mechanical System
MSB	Most Significant Bit
NavIC	Navigation with Indian Constellation
NMEA	NMEA (National Marine Electronics Association) 0183 Interface Standard
PDOP	Position Dilution of Precision
PPS	Pulse Per Second
PRN	Pseudo Random Noise
PVT	Process Verification Test
QZSS	Quasi-Zenith Satellite System
RAIM	Receiver Autonomous Integrity Monitoring
RF	Radio Frequency

RMC	Recommended Minimum Specific GNSS Data
RTC	Real-Time Clock
RTK	Real-Time Kinematic
SBAS	Satellite-Based Augmentation System
SNR	Signal to Noise Ratio
SOG	Speed over Ground
SPS	Standard Positioning Service
TCXO	Temperature Compensated Crystal Oscillato
TOW	Time of Week
UTC	Coordinated Universal Time
VDOP	Vertical Dilution of Precision
VTG	Course Over Ground & Ground Speed
WGS84	World Geodetic System 1984
ZDA	Time & Date

5 Appendix B GNSS Numbering

Table 23: GNSS Numbering

GNSS Type	System ID	Satellite ID	Signal ID
GPS	1	L1 C/A: 1–32 L2C: 401–432 L5-Q: 501–532	1 = L1 C/A 5 = L2C 8 = L5-Q
GLONASS	2	G1 C/A: 65–92 G2 C/A: 465–492	1 = G1 C/A 3 = G2 C/A
Galileo	3	E1: 301–336 E5a: 601–636 E5b: 651–685	1 = E5a 2 = E5b 6 = E1
BeiDou	4	B1I: 141–177 B2I: 541–577 B2a: 851–887	1 = B1I 5 = B2a B = B2I
QZSS	5	L1 C/A: 183–202 L2C: 203–212 L5-Q: 213–222	1 = L1 C/A 5 = L2C 8 = L5-Q
NavIC (IRNSS)*	6	L5: 801–814	1 = L5
SBAS	-	120–140	-

6 Appendix C Example

6.1. Conversion Between NMEA and RTCM

6.1.1. Switch from NMEA to RTCM

The following NMEA commands are used to switch from NMEA mode to RTCM mode:

```
$PSTMSETPAR,1,15,1,0,0x2*79
$PSTMSETPAR,21,0,0,2,0x20*4C
$PSTMSETPAR,21,0,0,1,0x800*75
$PSTMSETPAR,21,1,0,2,0x9*76
$PSTMSETPAR,21,1,0,1,0x20020*7C
$PSTMSAVEPAR*58
```

NOTE

Need to restart the module after issuing all commands.

6.1.2. Switch from RTCM to NMEA

The following RTCM commands are used to switch from RTCM mode to NMEA mode:

```
D3 00 0C 3E 70 20 04 01 50 00 00 80 00 03 00 0E A1 FB
D3 00 0C 3E 70 20 04 15 40 00 42 40 05 99 00 CE 8E 89
D3 00 0C 3E 70 20 04 15 40 00 80 00 00 03 40 A0 DC 2E
```

NOTE

Need to restart the module after issuing all commands.

6.2. Supported Frequency Plans

The following tables show the supported frequency plans:

Table 24: Supported Frequency Plans

Scenario	L1				L2				L5		
	GPS	GLO	BDS	GAL	GPS	GLO	BDS	GAL	GPS	BDS	GAL
	L1	G1	B1I	E1	L2C	G2	B2I	E5b	L5	B2a	E5a
0	●	●	●	●	●	●	●	–	–	–	–
1	●	●	●	●	●	–	●	–	–	–	–
2	●	●	●	●	–	–	–	–	●	●	●
3	●	●	●	●	●	–	–	●	–	–	–
5	●	●	●	●	●	–	●	●	–	–	–

● = Can be enabled.
– = Cannot be enabled.

NOTE

LG69T(AD) does not support change the scenario.

NMEA commands to switch the scenarios:

Scenario 0:

```
$PSTMSETPARLINE,21,4,0x0000828F*32
$PSTMSETPARLINE,21,5,0x00000087*48
$PSTMSETPARLINE,21,6,0x0000008D*38
$PSTMSETPARLINE,21,7,0x0000008F*3B
$PSTMSAVEPAR*58
```

Scenario 1:

```
$PSTMSETPARLINE,21,4,0x0000828F*32
$PSTMSETPARLINE,21,5,0x00000085*4A
$PSTMSETPARLINE,21,6,0x0000008D*38
$PSTMSETPARLINE,21,7,0x0000008F*3B
$PSTMSAVEPAR*58
```

Scenario 2:

```
$PSTMSETPARLINE,21,4,0x0001588F*34
$PSTMSETPARLINE,21,5,0x0000008D*3B
$PSTMSETPARLINE,21,6,0x0000008D*38
$PSTMSETPARLINE,21,7,0x0000008F*3B
```

```
$PSTMSAVEPAR*58
```

Scenario 3:

```
$PSTMSETPARLINE,21,4,0x0000928F*33
$PSTMSETPARLINE,21,5,0x0000100D*32
$PSTMSETPARLINE,21,6,0x0000008D*38
$PSTMSETPARLINE,21,7,0x0000008F*3B
$PSTMSAVEPAR*58
```

Scenario 5:

```
$PSTMSETPARLINE,21,4,0x0000928F*33
$PSTMSETPARLINE,21,5,0x0000108D*3A
$PSTMSETPARLINE,21,6,0x0000008D*38
$PSTMSETPARLINE,21,7,0x0000008F*3B
$PSTMSAVEPAR*58
```

RTCM commands to switch the scenarios:

Scenario 0:

```
D3 00 0C 3E 70 20 04 15 40 04 00 00 20 A3 C0 55 3C BA
D3 00 0C 3E 70 20 04 15 40 08 00 00 00 21 C0 54 4D 32
D3 00 0C 3E 70 20 04 15 40 10 00 00 00 23 40 F9 2B 33
D3 00 0C 3E 70 20 04 15 40 20 00 00 00 23 C0 6C 12 FD
```

Scenario 1:

```
D3 00 0C 3E 70 20 04 15 40 04 00 00 20 A3 C0 55 3C BA
D3 00 0C 3E 70 20 04 15 40 08 00 00 00 21 40 67 0A 96
D3 00 0C 3E 70 20 04 15 40 10 00 00 00 23 40 F9 2B 33
D3 00 0C 3E 70 20 04 15 40 20 00 00 00 23 C0 6C 12 FD
```

Scenario 2:

```
D3 00 0C 3E 70 20 04 15 40 04 00 00 56 23 C0 2A FF 21
D3 00 0C 3E 70 20 04 15 40 08 00 00 00 23 40 AA 14 06
D3 00 0C 3E 70 20 04 15 40 10 00 00 00 23 40 F9 2B 33
D3 00 0C 3E 70 20 04 15 40 20 00 00 00 23 C0 6C 12 FD
```

Scenario 3:

```
D3 00 0C 3E 70 20 04 15 40 04 00 00 24 A3 C0 D3 CE EB
D3 00 0C 3E 70 20 04 15 40 08 00 00 04 03 40 CF 68 8F
D3 00 0C 3E 70 20 04 15 40 10 00 00 00 23 40 F9 2B 33
D3 00 0C 3E 70 20 04 15 40 20 00 00 00 23 C0 6C 12 FD
```

Scenario 5:

```
D3 00 0C 3E 70 20 04 15 40 04 00 00 24 A3 C0 D3 CE EB
D3 00 0C 3E 70 20 04 15 40 08 00 00 04 23 40 2C E6 57
```

```
D3 00 0C 3E 70 20 04 15 40 10 00 00 00 23 40 F9 2B 33
D3 00 0C 3E 70 20 04 15 40 20 00 00 00 23 C0 6C 12 FD
```

NOTE

Need to restart the module after issuing these commands.

6.3. Change Baud Rate

6.3.1. Change Baud Rate in NMEA Mode

The following NMEA commands are used to change the baud rate in NMEA mode:

```
$PSTMSETPAR,1,15,0,0,<Baudrate>*<Checksum><CR><LF>
```

Parameter:

Field	Format	Unit	Description
<Baudrate>	Hexadecimal	-	0xA = 115200 bps 0xB = 230400 bps 0xC = 460800 bps

Example:

```
$PSTMSETPAR,1,15,0,0,0xA*0B
$PSTMSETPAROK,P01,L15,F00,0000000a*11
$PSTMSAVEPAR*58
```

NOTE

Need to restart the module after issuing all commands.

6.3.2. Change Baud Rate in RTCM Mode

The following RTCM commands are used to change the baud rate in RTCM mode:

Switch to 115200 bps:

```
D3 00 0C 3E 70 20 04 01 60 00 00 80 00 02 80 03 A6 B6
```

Switch to 230400 bps:

```
D3 00 0C 3E 70 20 04 01 60 00 00 80 00 02 C0 1A 05 64
```

Switch to 460800 bps:

```
D3 00 0C 3E 70 20 04 01 60 00 00 80 00 03 00 56 6E 5A
```

NOTE

Need to restart the module after issuing all commands.