

L76 Series

Protocol Specification

GNSS Module Series

Rev. L76_Series_Protocol_Specification_V2.0

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3.22. Packet Type: 313 PMTK_API_SET_SBAS_ENABLED

This message is used to enable or disable to search a SBAS satellite. SBAS (Satellite Based Augmentation Systems) is a system that supports wide-area or regional augmentation through geostationary satellite broadcast messages. The geostationary satellite broadcast GNSS integrity and correction data with the assistance of multiple ground stations which are located at accurately-surveyed points.

Data Field:
\$PMTK313,Enable
Example:
\$PMTK313,1*2E<CR><LF>
Response:
\$PMTK001,313,3*31<CR><LF>

Field	Description
\$	Each NMEA message starts with '\$'
PMTK	MTK proprietary message
Packet Type	313
Enable	'0'=Disable '1'=Enable
*	End character of data field
Checksum	Hexadecimal checksum
<CR><LF>	Each line message

3.23. Packet Type: 314 PMTK_API_SET_NMEA_OUTPUT

This message is used to set NMEA sentence output frequencies. There are totally 19 data fields that present output frequencies for the 19 supported NMEA sentences individually.

Supported Frequency Settings:

- 0 - Disabled or not supported sentence
- 1 - Output once every one position fix
- 2 - Output once every two position fixes
- 3 - Output once every three position fixes
- 4 - Output once every four position fixes

- 5 - Output once every five position fixes

Data Field:

None

Example:

The module only output RMC once every one position fix.

```
$PMTK314,0,1,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0*29<CR><LF>
```

Response:

```
$PMTK001,314,3*36<CR><LF>
```

Field	Description
\$	Each NMEA message starts with '\$'
PMTK	MTK proprietary message
Packet Type	314
0 GLL	GLL interval - Geographic Position - Latitude longitude
1 RMC	RMC interval - Recommended Minimum Specific GNSS Sentence
2 VTG	VTG interval - Course Over Ground and Ground Speed
3 GGA	GGA interval - GPS Fix Data
4 GSA	GSA interval - GNSS DOPS and Active Satellites
5 GSV	GSV interval - GNSS Satellites in View
6 GRS	GRS interval – GNSS Range Residuals
7 GST	GST interval – GNSS Pseudorange Error Statistics
8 Reserved	Always 0
9 Reserved	Always 0
10 Reserved	Always 0
11 Reserved	Always 0
12 Reserved	Always 0
13 Reserved	Always 0
14 Reserved	Always 0
15 Reserved	Always 0

16 Reserved	Always 0
17 ZDA	ZDA interval - Time and Date
18 MCHN	PMTKCHN interval - GNSS channel status
*	End character of data field
Checksum	Hexadecimal checksum
<CR><LF>	Each of message

To restore the system default setting, use below message:

Example:
\$PMTK314,-1*04<CR><LF>

Field	Description
\$	Each NMEA message starts with '\$'
PMTK	MTK proprietary message
Packet Type	314
Restore	Always -1
*	End character of data field
Checksum	Hexadecimal checksum
<CR><LF>	Each of message

3.24. Packet Type: 351 PMTK_API_SET_SUPPORT_QZSS_NMEA

The receiver support new NMEA format for QZSS. The command allow user enable or disable QZSS NMEA format. Default is disable QZSS NMEA format.

Data Field:
\$PMTK351,Enable
Example:
\$PMTK351,1*28<CR><LF>
Response:
\$PMTK001,351,3*37<CR><LF>

Field	Description
\$	Each NMEA message starts with '\$'
PMTK	MTK proprietary message
Packet Type	351
QZSS_Enable	'0'=Disable '1'=Enable
*	End character of data field
Checksum	Hexadecimal checksum

3.25. Packet Type: 352 PMTK_API_SET_STOP_QZSS

Since QZSS is regional positioning service. This command is used to enable or disable QZSS function. Default is enable QZSS function.

Data Field:
\$PMTK352,Enable
Example:
\$PMTK352,0*2A<CR><LF>
Response:
\$PMTK001,352,3*34<CR><LF>

Field	Description
\$	Each NMEA message starts with '\$'
PMTK	MTK proprietary message
Packet Type	352
QZSS_Enable	'0'=Enable '1'=Disable
*	End character of data field
Checksum	Hexadecimal checksum

3.26. Packet Type: 353 PMTK_API_SET_GNSS_SEARCH_MODE

This command is used to configure the receiver to start searching satellite system.

Data Field:

\$PMTK353,GPS_Enable,GLONASS_Enable,GALILEO_Enable,GALILEO_FULL_Enable,BEIDOU_Ena
ble

Example:

\$PMTK353,1,1,0,0,0*2B<CR><LF>: Search GPS+GLONASS

Response:

\$PMTK001,353,3,1,1,0,0,0,3*36<CR><LF>

Field	Description
\$	Each NMEA message starts with '\$'
PMTK	MTK proprietary message
Packet Type	353
GPS_Enable	'0'=Disable (DO NOT search GPS satellites) '1'or non-ZERO: search GPS satellites
GLONASS_Enable	'0'=Disable (DO NOT search GLONASS satellites) '1'or non-ZERO: search GLONASS satellites
GALILEO_Enable	'0'=Disable (DO NOT search Galileo satellites) '1'or non-ZERO: search Galileo satellites
GALILEO_FULL_Enable	'0'=Disable (DO NOT search Galileo full mode satellites) '1'or non-ZERO: search Galileo satellites
BEIDOU_Enable	'0'=Disable '1'or non-ZERO: search BeiDou satellites
*	End character of data field
Checksum	Hexadecimal checksum

NOTES

Actually GLONASS only, BeiDou only, and Galileo only mode is only for testing purpose. Please use GPS+GLONASS or GPS+BeiDou in the real application, in Europe GPS+GLONASS+Galileo will be used too, GLONASS and BeiDou can not be enable at the same time.

- When the firmware supports GPS and GLONASS systems, the NMEA sentences output as below:
 - If the receiver is fixed by GPS only, it will print GPRMC, GPVTG, GPGGA, GPGSA, GPGSV and GPGLL.

- b) If the receiver is fixed by GPS only, and can also search QZSS satellite, it will print GPRMC, GPVTG, GPGGA, GPGSA, QZQSA, GPGSV, QZGSV and GPGLL.
 - c) If the receiver is fixed by GLONASS only, it will print GNRMC, GPVTG, GPGGA, GNGSA, GPGSV, GLGSV and GNGLL.
 - d) If the receiver is fixed by GPS and GLONASS, it will print GNRMC, GPVTG, GPGGA, GNGSA, GPGSV, GLGSV and GNGLL.
 - e) In the state of no satellite positioning, it will print initial state of NMEA, such as GPRMC, GPVTG, GPGGA, GPGSA, GPGSV and GPGLL. The time before satellite positioning after cold start, warm start or hot start belongs to this situation.
2. When the firmware supports GPS and BeiDou systems, the NMEA sentences output as below:
- a) If the receiver is fixed by GPS only, it will print GPRMC, GPVTG, GPGGA, GPGSA, GPGSV and GPGLL.
 - b) If the receiver is fixed by BeiDou only, it will print BDRMC, BDVTG, BDGGA, BDGSA, BDGSV and BDGLL.
 - c) If the receiver is fixed by GPS and BeiDou, it will print GNRMC, GNVTG, GNGGA, GPGSA, BDGSA, GPGSV, BDGSV and GNGLL.
 - d) In the state of no satellite positioning, it will print initial state of NMEA, such as GNRMC, GNVTG, GNGGA and GNGLL. The time before satellite positioning after cold start, warm start or hot start belongs to this situation.
3. When the firmware supports GPS, GLONASS and Galileo systems, the NMEA sentences output as below:
- a) If the receiver is fixed by GPS, GLONASS and Galileo, it will print GNGGA, GPGSA, GLGSA, GAGSA, GPGSV, GLGSV, GAGSV, GNRMC, GNVTG and GNGLL.

3.27. Packet Type: 386 PMTK_API_SET_STATIC_NAV_THD

This message is used to set the speed threshold for static navigation. If the actual speed is below the threshold, output position will keep the same and output speed will be zero. If threshold value is set to 0, this function is disabled.

Data Field:

\$PMTK386,Speed_threshold

Example:

\$PMTK386,0.3*3E<CR><LF>

Response:

\$PMTK001,386,3*3D<CR><LF>

Field	Description
\$	Each NMEA message starts with '\$'
PMTK	MTK proprietary message

Packet Type	386
Speed_threshold	0~2m/s
*	End character of data field
Checksum	Hexadecimal checksum
<CR><LF>	Each of message

3.28. Packet Type: 400 PMTK_API_Q_FIX_CTL

This message is used to query the rate of position fixing activity.

Refer to PMTK_API_SET_FIX_CTL for setting the rate.

Refer to PMTK_DT_FIX_CTL for the result of the query.

Data Field:

None

Example:

\$PMTK400*36<CR><LF>

Field	Description
\$	Each NMEA message starts with '\$'
PMTK	MTK proprietary message
Packet Type	400
*	End character of data field
Checksum	Hexadecimal checksum
<CR><LF>	Each of message

3.29. Packet Type: 401 PMTK_API_Q_DGPS_MODE

This message is used to query the setting of DGPS mode.

Refer to PMTK_API_SET_DGPS_MODE for setting the DGPS mode.

Refer to PMTK_DT_DGPS_MODE for the result of the query.

Data Field: None Example: \$PMTK401*37<CR><LF>	
Field	Description
\$	Each NMEA message starts with '\$'
PMTK	MTK proprietary message
Packet Type	401
*	End character of data field
Checksum	Hexadecimal checksum
<CR><LF>	Each of message

3.30. Packet Type: 413 PMTK_API_Q_SBAS_ENABLED

This message is used to query the setting of SBAS.

Refer to PMTK_API_SET_SBAS_ENABLE for SBAS setting.

Refer to PMTK_DT_SBAS_ENABLED for the result of the query.

Data Field: None Example: \$PMTK413*34<CR><LF>	
Field	Description
\$	Each NMEA message starts with '\$'
PMTK	MTK proprietary message
Packet Type	413

*	End character of data field
Checksum	Hexadecimal checksum
<CR><LF>	Each of message

3.31. Packet Type: 414 PMTK_API_Q_NMEA_OUTPUT

This message is used to query the current NMEA sentence output frequencies.

Refer to PMTK_API_SET_NMEA_OUTPUT for the frequencies setting.

Refer to PMTK_DT_NMEA_OUTPUT for the result of the query.

Data Field: None Example: \$PMTK414*33<CR><LF>	
Field	Description
\$	Each NMEA message starts with '\$'
PMTK	MTK proprietary message
Packet Type	414
*	End character of data field
Checksum	Hexadecimal checksum
<CR><LF>	Each of message

3.32. Packet Type: 605 PMTK_Q_RELEASE

This message is used to query the firmware release information.

Refer to PMTK_DT_RELEASE for the result of the query.

Data Field: None

Example:
\$PMTK605*31<CR><LF>

Field	Description
\$	Each NMEA message starts with '\$'
PMTK	MTK proprietary message
Packet Type	605
*	End character of data field
Checksum	Hexadecimal checksum
<CR><LF>	Each of message

3.33. Packet Type: 500 PMTK_DT_FIX_CTL

This message is the response to PMTK_API_Q_FIX_CTL.

Data Field:
\$PMTK500,Fix interval
Example:
\$PMTK500,1000,0,0,0,0*1A<CR><LF>

Field	Description
\$	Each NMEA message starts with '\$'
PMTK	MTK proprietary message
Packet Type	500
Fix Interval	Position fix interval [msec]. Greater than 100
Reserved	Always 0
Reserved	Always 0
Reserved	Always 0
Reserved	Always 0
*	End character of data field

Checksum	Hexadecimal checksum
<CR><LF>	Each of message

3.34. Packet Type: 501 PMTK_DT_DGPS_MODE

This message is the response to PMTK_API_Q_DGPS_MODE.

Data Field: \$PMTK501,Mode Example: \$PMTK501,1*2B<CR><LF>	
Field	Description
\$	Each NMEA message starts with '\$'
PMTK	MTK proprietary message
Packet Type	501
Mode	DGPS data source mode '0'=No DGPS source '1'=RTCM '2'=SBAS
*	End character of data field
Checksum	Hexadecimal checksum
<CR><LF>	Each of message

3.35. Packet Type: 513 PMTK_DT_SBAS_ENABLED

This message is the response to PMTK_API_Q_SBAS_ENABLED.

Data Field: \$PMTK513,Enable Example: \$PMTK513,1*28<CR><LF>	
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Field	Description
\$	Each NMEA message starts with '\$'
PMTK	MTK proprietary message
Packet Type	513
Enable	'0'=Disable '1'=Enable
*	End character of data field
Checksum	Hexadecimal checksum
<CR><LF>	Each of message

3.36. Packet Type: 514 PMTK_DT_NMEA_OUTPUT

This message is the response to PMTK_API_Q_NMEA_OUTPUT.

Data Field:

None

Example:

\$PMTK514,1,1,1,1,1,1,0,0,0,0,0,0,0,0,0,0*2E<CR><LF>

Field	Description
\$	Each NMEA message starts with '\$'
PMTK	MTK proprietary message
Packet Type	514
0 GLL	GLL interval - Geographic Position - Latitude longitude
1 RMC	RMC interval - Recommended Minimum Specific GNSS Sentence
2 VTG	VTG interval - Course Over Ground and Ground Speed
3 GGA	GGA interval - GPS Fix Data
4 GSA	GSA interval - GNSS DOPS and Active Satellites
5 GSV	GSV interval - GNSS Satellites in View

6 Reserved	GRS interval – GNSS Range Residuals
7 Reserved	GST interval – GNSS Pseudorange Error Statistics
8 Reserved	
9 Reserved	
10 Reserved	
11 Reserved	
12 Reserved	
13 Reserved	
14 Reserved	
15 Reserved	
16 Reserved	
17 ZDA	ZDA interval - Time and Date
18 Reserved	PMTKCHN interval - GNSS channel status
*	End character of data field
Checksum	Hexadecimal checksum
<CR><LF>	Each of message

3.37. Packet Type: 705 PMTK_DT_RELEASE

This message is the response to PMTK_Q_RELEASE.

Data Field:

\$PMTK705, Release string, Build ID, Product Model(,SDK Version)

Example:

\$PMTK705,AXN_3.10_3333_12102201,0000,QUECTEL-L76,*18<CR><LF>

Field	Description
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\$	Each NMEA message starts with '\$'
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PMTK	MTK proprietary message
Packet Type	705
Release String	Firmware release name and version 3318: Mcore_x.x 3329: AXN_x.x 3339: AXN_x.x 3333: AXN_x.x 3337: AXN_x.x
Build ID	Build ID set in CoreBuilder for firmware version control
Product Model	Product Model set in CoreBuilder for product identification
SDK Version (Optional)	Showing SDK version if the firmware is used for SDK
*	End character of data field
Checksum	Hexadecimal checksum
<CR><LF>	Each of message

3.38. Packet Type: 869 PMTK_EASY_ENABLE

This message is used to enable or disable EASY function, and it also can be used to query if EASY is enabled or disabled.

Data Field:
\$PMTK869,CmdType[, Enabled]
Example:
\$PMTK869,1,1*35<CR><LF>
Response:
\$PMTK001,869,3*37<CR><LF>

Field	Description
\$	Each NMEA message starts with '\$'
PMTK	MTK proprietary message
Packet Type	869
CmdType	'0'=Query '1'=Set

	'2'=Result for Query operation
Enabled	'0'=Disable '1'=Enable
*	End character of data field
Checksum	Hexadecimal checksum
<CR><LF>	Each of message

NOTES

1. If EASY is disabled, the receiver returns:
\$PMTK869,2,0,0*2B<CR><LF>
2. If EASY is enabled and not finished yet, the receiver may return:
\$PMTK869,2,1,0*2A<CR><LF>
3. If EASY is enabled and finished after 1 day, the receiver may return:
\$PMTK869,2,1,1*2B<CR><LF>
4. If EASY is enabled and finished after 2 days, the receiver may return:
\$PMTK869,2,1,2*28<CR><LF>
5. If EASY is enabled and finished after 3 days, the receiver may return:
\$PMTK869,2,1,3*29<CR><LF>

3.39. Packet Type: 875 PMTK_PMTKLSC_STN_OUTPUT

This message is used to enable or disable PMTKLSC Sentence output. Query if PMTKLSC Sentence output enabled or disabled.

Data Field:

\$PMTK875,CmdType[,Enabled]

Example:

\$PMTK875,1,1*38<CR><LF> : Enable PMTKLSC and PMTKLSCB Sentence output

Response:

\$PMTKLSC,Parameter1,Parameter2,Parameter3*CS

\$PMTKLSCB,Parameter1,Parameter2,Parameter3*CS

Where Parameter1 : current leap second

Parameter2 : leap indicator, 1 means updated from broadcast data

Parameter3 : next leap second

Field	Description
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\$	Each NMEA message starts with '\$'
PMTK	MTK proprietary message
Packet Type	875
CmdType	'0'=Query '1'=Set '2'=Result for Query operation
Enabled	'0'=Disable '1'=Enable
*	End character of data field
Checksum	Hexadecimal checksum
<CR><LF>	Each of message

3.40. Packet Type: 886 PMTK_FR_MODE

This message is used to set navigation mode.

Data Field:
\$PMTK886,CmdType
Example:
\$PMTK886,3*2B<CR><LF>
Response:
\$PMTK001,886,3*36

Field	Description
\$	Each NMEA message starts with '\$'
PMTK	MTK proprietary message
Packet Type	886
CmdType	'0'=Normal mode: For general purpose '1'=Fitness mode: For running and walking purpose that the low-speed (<5m/s) movement will have more effect on the position calculation. '2'=Aviation mode: For high-dynamic purpose that the large-acceleration movement will have more effect on the position calculation. '3'=Balloon mode: For high-altitude balloon purpose that the vertical movement will have more effect on the position calculation.

*	End character of data field
Checksum	Hexadecimal checksum
<CR><LF>	Each of message

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4 Appendix A Reference

Table 1: Related Documents

SN	Document Name	Remark
[1]	Quectel_L76_Hardware_Design	L76 Hardware Design
[2]	Quectel_L76_EVB_User Guide	L76 EVB User Guide
[3]	Quectel_L76_Reference_Design	L76 Reference Design

Table 2: Terms and Abbreviations

Abbreviation	Description
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
GLONASS	Global Navigation Satellite System(The Russian GNSS)
BeiDOu	BeiDou Navigation Satellite System
Galileo	Galileo satellite navigation system
NMEA	National Marine Electronics Association
PMTK	Private protocol of MTK
GGA	NMEA: Global Positioning System Fix Data
RMC	NMEA: Recommended Minimum Position Data
GSA	NMEA: GNSS DOP and Active Satellites
GSV	NMEA: GNSS Satellites in View
GLL	NMEA: Geographic Position – Latitude/Longitude
VTG	NMEA: Track Made Good and Ground Speed

GBS	NMEA: GPS Satellite Fault Detection
SBAS	Satellite-Based Augmentation System
AGPS	Assisted Global Positioning System
DGPS	Differential Global Positioning System
EASY	Embedded Assist System
AIC	Active Interference Cancellation
PDOP	Position Dilution of Precision
VDOP	Vertical Dilution of Precision
HDOP	Horizontal Dilution of Precision
WAAS	Wide Area Augmentation System
PPS	Pulse Per Second
UTC	Universal Time Coordinated

Table 3: Structure of NMEA Message

Filed	Length (Bytes)	Description
\$	1	Each NMEA message starts with '\$'
Talker ID	1~2	Talker IDs can be 'GP', 'GN' and 'BD' when the message ID is RMC, VTG, GLL or GGA, Talker IDs can be 'GP', 'GN', 'BD' and 'GA' when the message ID is GSA, Talker IDs can be 'GP', 'GL', 'BD' and 'GA' when the message ID is GSV, and Talker IDs can be 'GN' when the message ID is GBS.
NMEA Message ID	3	NMEA message ID
Data Field	Variable, depend on the NMEA message type	Data fields, delimited by comma ','
*	1	End character of data field
Checksum	2	A hexadecimal number calculated by exclusive OR of all characters between '\$' and '**'
<CR><LF>	2	Each NMEA message ends with 'CR' and 'LF'

NOTE

The default output message of L76 has the following six sentences: RMC, VTG, GGA, GSA, GSV and GLL. But if the receiver is fixed by GPS, GLONASS and Galileo, the default output message of L76 has the following six sentences: RMC, VTG, GGA, GSA, GSV and GBS.

Table 4: Structure of MTK NMEA Packet

Filed		Length (Bytes)	Description
\$		1	Each NMEA message starts with '\$'
Talker ID		1	'P' for proprietary message
NMEA	Data Type	3	Always 'MTK' to indicate MTK proprietary message
Data Filed	Packet Type	3	Packet type, from '000' to '999'
	Packet Data	Variable, depend on the packet type	Data fields, delimited by comma ','
*		1	End character of data field
Checksum		2	A hexadecimal number calculated by exclusive OR of all characters between '\$' and '**'
<CR><LF>		2	Each NMEA message ends with 'CR' and 'LF'

5 Default Configurations

Table 5: Default Configurations

Item	Default
NMEA Port Baud Rate	9600bps
Datum	WGS84
Rate of Position Fixing	1HZ
DGPS Mode	SBAS
SBAS Enable	Enable
NMEA Output Messages	GGA, RMC, GSA, GSV, VTG and GLL
AIC	On
EASY	On