BG95&BG77&BG600L Series
GNSS Application Note

LPWA Module Series

Rev. BG95&BG77&BG600L_Series_GNSS_Application_Note_V1.1

Date: 2020-04-10

Status: Preliminary

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About the Document

Revision History

Revision	Date	Author	Description
1.0	2019-11-29	Matt YE/ Alfred LI	Initial
1.1	2020-04-10	Matt YE	1. Added an applicable module BG600L-M3. 2. Updated the descriptions of GNSS and WWAN coexistence management (Chapter 1.1). 3. Added AT+QGPSCFG="qzssnmeatype" (Chapter 2.1.8). 4. Extended AT+QGPSCFG="priority" to support the feature of dynamic priority switch (Chapter 2.1.11) 5. Added AT commands to query and configure various extended settings and its example (Chapter 2.6 and Chapter 3.4).

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1 Introduction

Quectel BG95 series, BG77 and BG600L-M3 modules integrate a GNSS engine which supports GPS, BeiDou, Galileo, GLONASS and QZSS systems and gpsOneXTRA* Assistance technology. Only two constellations are supported simultaneously and must be GPS plus one other constellation. The GNSS engine is suitable for various applications where the lowest-cost and accurate positioning is needed, and it supports position tracking without network assistance.

Based on a new generation of Qualcomm LPWA platform with a cost-optimized architecture where WWAN (LTE Cat M1, LTE Cat NB2 and GSM) and GNSS Rx chains share some hardware blocks, the modules do not support concurrent operation of WWAN and GNSS.

The solution adopted in the modules is a form of coarse time-domain multiplexing between WWAN and GNSS Rx chains. Given the relaxed latency requirements of most LPWA applications, time-domain sharing of resources can be made largely transparent to applications.

NOTE

"*" means under development.

1.1. Applicable Modules

Table 1: Applicable Modules

Module Series	Model	Description
BG95	BG95-M1	Cat M1 only
	BG95-M2	Cat M1/Cat NB2
	BG95-M3	Cat M1/Cat NB2/EGPRS
	BG95-N1	Cat NB2 Only
	BG95-M4	Cat M1/Cat NB2, 450 MHz Supported

	BG95-M5	Cat M1/Cat NB2/EGPRS, Power Class 3
	BG95-MF	Cat M1/Cat NB2, Wi-Fi Positioning
BG77	BG77	Cat M1/Cat NB2
BG600L	BG600L-M3	Cat M1/Cat NB2/EGPRS

1.2. GNSS and WWAN Coexistence Management

As GNSS and WWAN cannot work simultaneously, either WWAN or GNSS can take priority during applications. By default, the modules are configured into GNSS priority mode which can be switched with **AT+QGPSCFG="priority"**. The command takes effect immediately, and more details are provided in ***Chapter 2.2.1.11***.

1.2.1. WWAN Priority Mode

In WWAN priority mode, GNSS positioning request will succeed only when WWAN is in idle sleep. Features of WWAN priority mode include:

- No WWAN page is missed
- RRC connection is not impacted by GNSS operation
- GNSS session is deferred to the time when the UE goes to eDRX state (eDRX cycle must be configured sufficiently long, and more details are provided in ***Chapter 1.2.4***)

For LPWA applications, the duration for WWAN in active status is fairly short. Therefore, GNSS will have an opportunity to get a fix.

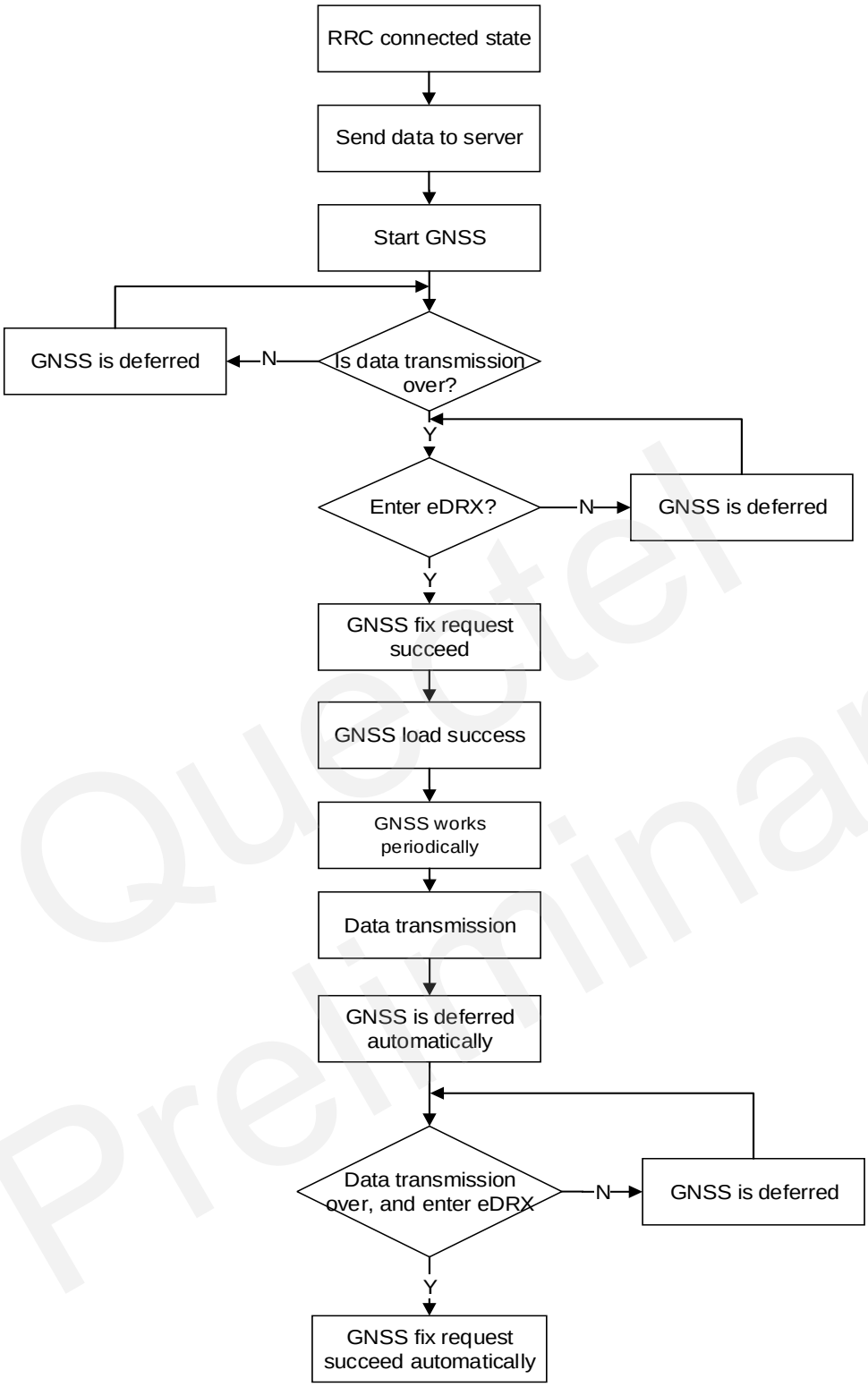

Figure 1: GNSS and WWAN Coexistence Management (WWAN Priority Mode)

NOTES

1. In WWAN priority mode, if the eDRX Sleep Cycle is shorter than the ***t*** + ***t1*** (refer to ***Chapter 1.2.4***), the GNSS will not be able to fix a position.
2. When the eDRX Sleep Cycle is less than ***t*** + ***t1*** (refer to ***Chapter 1.2.4***) or eDRX is not supported, it is recommended to set the modules into GNSS priority mode for location.
3. When switching from WWAN priority to GNSS priority mode, the module will take about 1 second (open sky, refer to ***Chapter 1.2.3***) for GNSS position fix if GNSS have got fixed before.

1.2.2. GNSS Priority Mode

In GNSS priority mode, GNSS positioning request will succeed in all WWAN states.

- **When UE in RRC connected state:**

  The UE locally releases the RRC connection and initiates the GNSS session. After the GNSS session is completed, if there is WWAN data to be sent, the RRC connection will be initiated again.

- **When UE in eDRX state:**

  The UE may miss pages that were sent on the paging channel while the GNSS session is still active.

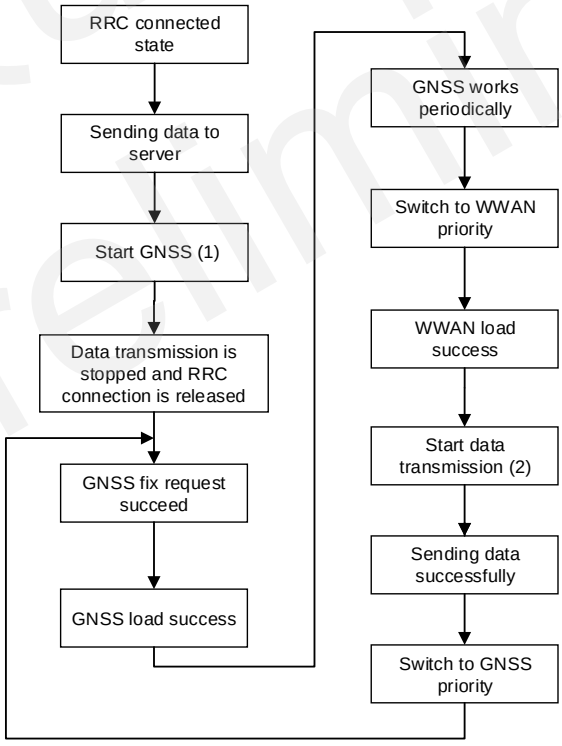

Figure 2: GNSS and WWAN Coexistence Management (GNSS Priority Mode)

NOTES

1. GNSS starts working immediately when GNSS is started.
2. It is recommended to delay 0.5 second to transmit as it will take about 0.5 second (refer to ***Chapter 1.1.4***) to switch from GNSS to WWAN.
3. The following procedures are the highest priority, which can ignore the priority of GNSS and WWAN.
   - Power off/PSM
   - MO call (to be tested)
   - PS Detach

1.2.3. WWAN and GNSS Switching Delays

The following table summarizes the average delays captured for different RATs.

- **Test Environment**

GNSS C/N_0 = 45 dB and in open sky
LTE-M RSRP = -71 dBm
SINR = 207 dB
NB-IoT RSRP = -87 dBm
SINR = 175 dB
GSM RSSI = -48 dBm

- **Test Steps**

Load WWAN → Unload WWAN → Load GNSS → Get fixed → Unload GNSS → Load WWAN → Transfer WWAN data (take 500 bytes data as an example here).

Table 2: Average Delays Captured for Different RATs (Unit: s)

Network Type	LTE-M	NB-IoT	GSM
Load WWAN	0.251	0.177	0.259
Unload WWAN	0.153	0.087	0.339
Load GNSS	0.208	0.216	0.197
Unload GNSS	0.116	0.112	0.105
Delay Between “Switching to WWAN Priority Mode” and “Start Sending Data” 1)	0.5	0.5	0.5
Time to Transfer WWAN Data (the delay for connection setup is not considered) 2)	1.0	4.5	3.6

Delay Between "Switching to GNSS Priority Mode" and "Getting GNSS Started"	0	0	0
GNSS Fix with XTRA/Without XTRA [3)]	1/1	1/1	1/1

NOTES

1. "Load" and "Load" mentioned above mean loading/unloading WWAN/GNSS protocol stack.
2. [1)] Based on the test result, it is recommended to delay 0.5 second before sending data after switching from GNSS priority to WWAN priority mode.
3. [2)] The time used to transfer WWAN data is varied depending on the coverage level and the data amount.
4. [3)] The TTFF is about 10/30 seconds (with/without XTRA in open sky) after a cold start. The data listed in the table above are the positioning time within 2 hours after a hot start.

1.2.4. Minimum eDRX Cycle Recommendation in WWAN Priority Mode

Assuming that a GNSS fix takes a maximum average of ***t*** seconds.

t1 = GNSS Unloading Time + WWAN Loading Time + Page Reception Wakeup Time

From test observations, ***t1*** ≈ 1.5 seconds.

The recommended minimum eDRX Sleep Cycle should be > (***t*** + ***t1***) seconds.

eDRX Sleep Cycle = eDRX Cycle - PTW

Table 3: Minimum eDRX Cycle Recommendation in WWAN Priority Mode (Unit: s)

Network Type	LTE-M	NB-IoT	GSM
Common eDRX Cycles	5.12 **10.24** 20.48 40.96 61.44 81.92 … 10485.76	**20.48** 40.96 61.44 163.84 …	eDRX not supported
Recommended Minimum eDRX Cycle (Cold start with XTRA)	10.24 (PTW = 1.28)	20.48 (PTW ≤ 10.24)	/
Recommended Minimum eDRX Cycle (Cold start without XTRA)	61.44 (PTW ≤ 20.48)	61.44 (PTW ≤ 20.48)	/

NOTES

1. The recommended minimum eDRX cycle is based on strong signal conditions. It is necessary to extend the eDRX Sleep Cycle under weak signal conditions.
2. The minimum eDRX Sleep Cycle must be greater than 8/40 seconds (cold start with/without XTRA).

1.2.5. GNSS/WWAN Priority and PSM

In GNSS priority mode, PSM cannot be configured when GNSS is active. However, it is allowed to configure PSM before starting GNSS. After configuring PSM successfully, it will be able to enter PSM even when GNSS is active.

In WWAN priority mode, the module is able to configure and enter PSM no matter whether GNSS is active or not.

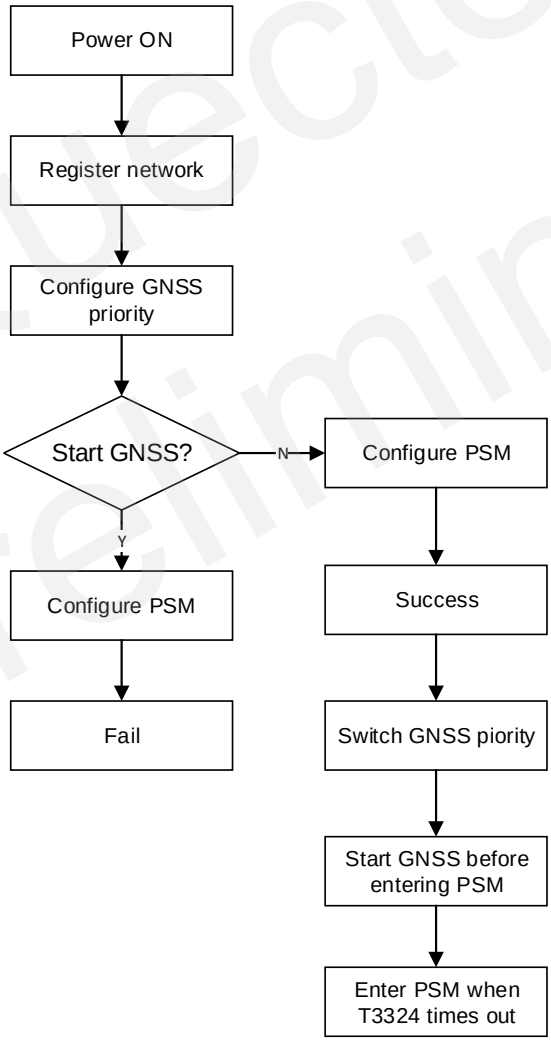

Figure 3: Configure PSM in GNSS Priority Mode

1.2.6. GNSS/WWAN Priority and eDRX

eDRX cannot be configured when GNSS is active under GNSS priority mode. Even if the Edrx was configured successfully before starting GNSS, the module still cannot enter into eDRX.

Under WWAN priority mode, the module is able to configure and enter into eDRX no matter whether GNSS is active or not.

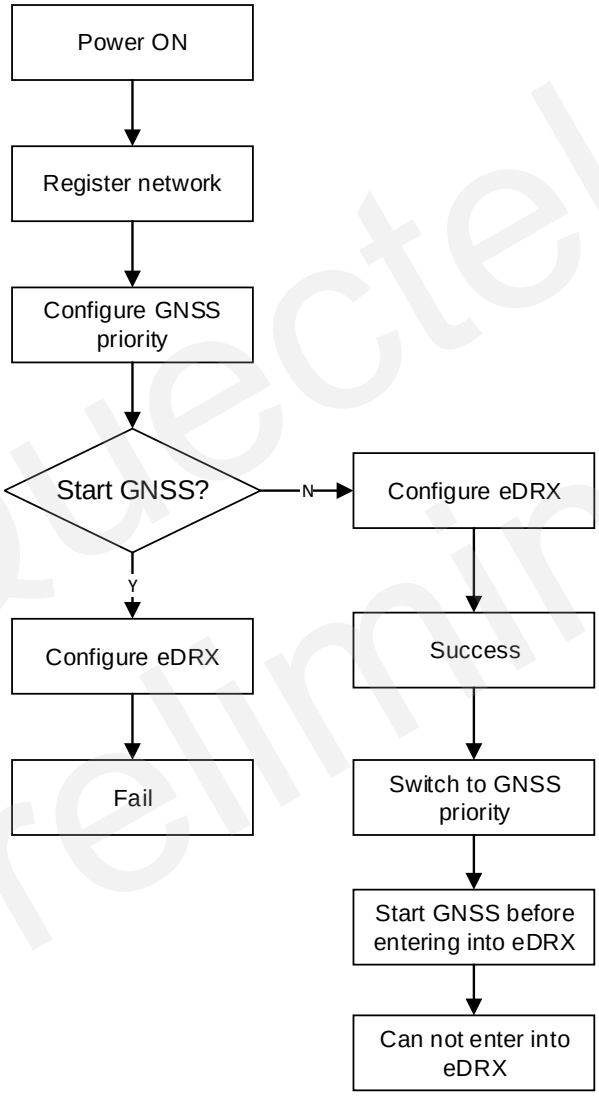

Figure 4: Configure eDRX under GNSS Priority Mode

1.2.7. Common Use Cases

- **Use Case 1:**

1. Configured a sufficient long eDRX cycle that is longer than TTFF (For details of TTFF values, please refer to the corresponding hardware design manuals)
2. Wake up from sleep mode
3. Turn on GNSS (GNSS session may be deferred to eDRX)
4. Obtain the GNSS positioning information
5. Turn off GNSS or switch to WWAN priority mode
6. Report position information to server
7. Return to sleep mode
8. Repeat 2-7

Recommendation: WWAN priority mode is recommended in this case. Step 5 is optional, it depends on the practical applications and the current consumption requirements.

- **Use Case 2:**

1. Wake up from sleep mode
2. Turn on GNSS (GNSS session started immediately)
3. Collect data from sensors and obtain the GNSS positioning information
4. Turn off GNSS or switch to WWAN priority mode
5. Report sensor data and positioning information to server
6. Return to sleep mode.
7. Repeat 1-6

Recommendation: GNSS priority mode is recommended in this case.
It will take at least 44.5 seconds one cycle. i.e. TCP connect time (8 s) + Time used to Send 500 bytes data (4.5 s) + TCP close time (10 s) + GNSS fix time (30 s) + delay time (2 s). If enable XTRA, this time can be reduced to 24.5 s.

- **Use case 3:**

1. Wake up from sleep mode
2. Turn on GNSS (GNSS session started immediately)
3. Collect data from sensors and obtain the GNSS positioning information
4. Turn off GNSS or switch to WWAN priority mode
5. Report sensor data and positioning information to server
6. Return to sleep mode
7. The sensor data and positioning information may be queried from the network side anytime during 2-5
8. Repeat 1-7

Recommendation: A success of the query on step 7 cannot be guaranteed every time, because the page may be lost when GNSS is in active status with GNSS priority. Additionally, it is unable to provide

guarantee to get position on time if WWAN is preferential. In such a case, it is recommended to select a solution where GNSS and WWAN could work simultaneously, either Quectel BG96 module, or Quectel BG95/BG77/BG600L module with an external GNSS module.

NOTE

Considering the complexity of GNSS feature of the modules and the fact that those use cases listed above cannot cover all tracking applications and extreme cases, we strongly suggest our customers to provide the specific application cases to Quectel Technical Support team for a review via support@quectel.com or http://e-service.quectel.com.

1.3. GNSS Turning on/off Procedures

The GNSS of the modules support location calculation without any assistance from the network. GNSS turning on/off procedures are shown below:

Step 1: Configure GNSS parameters via **AT+QGPSCFG**.

Step 2: Turn on GNSS via **AT+QGPS**.

Step 3: After GNSS is turned on and position is fixed successfully, the positioning information can be obtained in either of the following three ways:

1) NMEA sentences are output to "usbnmea" port by default. NMEA sentences can be obtained through reading the port.
2) **AT+QGPSLOC** can be used to obtain positioning information directly, such as latitude, longitude, height, GNSS positioning mode, time, number of satellites, and so on.
3) After enabling **<NMEA_src>** via **AT+QGPSCFG="nmeasrc",1**, the specified NMEA sentence can be acquired via **AT+QGPSGNMEA**. If **<NMEA_src>** is disabled, this command cannot be used.

Step 4: GNSS can be turned off in two ways:

1) If the parameter **<fix_count>** of **AT+QGPS** is set to 0 in ***Step 2***, GNSS will get the position continuously, and it can be turned off via **AT+QGPSEND**.
2) If **<fix_count>** reaches the specified value, the GNSS will stop automatically.

1.4. NMEA Sentence Types

The default NMEA sentences of the modules are compliant with NMEA 0183 version 4.10 standard except talker ID, and five kinds of prefixes are available to differentiate NMEA sentences of different satellite systems, as illustrated below.

For GPS sentences, the prefix is "GP", as below:

- GPGGA - Global positioning system fix data, such as time, position, etc.
- GPRMC - Recommended minimum specific GNSS data
- GPGSV - GNSS satellites in view, such as number of satellites in view, satellite ID numbers, etc.
- GPGSA - GNSS DOP, active satellites and system ID
- GPVTG - Course over ground and ground speed

For GLONASS sentences, the prefixes are "GL" and "GN", as below:

- GLGSV - GNSS satellites in view, such as number of satellites in view, satellite ID numbers, etc.
- GNGSA - GNSS DOP, active satellites and system ID

For Galileo sentences, the prefixes are "GA" and "GN", as below:

- GAGSV - GNSS satellites in view, such as number of satellites in view, satellite ID numbers, etc.
- GNGSA - GNSS DOP, active satellites and system ID

For BeiDou sentences, the prefix is "PQ", as below:

- PQGSV - GNSS satellites in view, such as number of satellites in view, satellite ID numbers, etc.
- PQGSA - GNSS DOP, active satellites and system ID

For QZSS sentences, the prefix is "PQ", as below:

- PQGSA - GNSS DOP, active satellites and system ID

2 Description of GNSS AT Commands

2.1. AT Command Syntax

2.1.1. Definitions

- **<CR>** Carriage return character.
- **<LF>** Line feed character.
- **<...>** Parameter name. Angle brackets do not appear on command line.
- **[...]** Optional parameter of a command or an optional part of TA information response. Square brackets do not appear on command line. When an optional parameter is not given, the new value equals to its previous value or its default setting, unless otherwise specified.
- **Underline** Default setting of a parameter.

2.1.2. AT Command Syntax

The **AT** or **at** prefix must be added at the beginning of each command line. Entering **<CR>** will terminate a command line. Commands are usually followed by a response that includes **<CR><LF><response><CR><LF>**. Throughout this document, only the response **<response>** will be presented, **<CR><LF>** are omitted intentionally.

Table 4: Type of AT Commands and Responses

Test Command	**AT+<cmd>=?**	This command returns the list of parameters and value ranges set by the corresponding Write Command or internal processes.
Read Command	**AT+<cmd>?**	This command returns the currently set value of the parameter or parameters.
Write Command	**AT+<cmd>=<p1>[,<p2>[,<p3>[...]]]**	This command sets the user-definable parameter values.
Execution Command	**AT+<cmd>**	This command reads non-variable parameters affected by internal processes in the module.

2.2. AT Commands Description

2.2.1. AT+QGPSCFG Configure GNSS

This command queries and configures various GNSS settings, including NMEA sentences output port, output type of NMEA sentences, etc.

AT+QGPSCFG Configure GNSS	
Test Command **AT+QGPSCFG=?**	Response **+QGPSCFG: "outport",(**list of supported **<outport>s),(**list of supported **<baud_rate>s)** **+QGPSCFG: "gnssconfig",(**range of supported **<GNSS_config>**s**)** **+QGPSCFG: "nmeafmt",(**list of supported **<NMEA_fmt_config>s)** **+QGPSCFG: "gpsnmeatype",(**list of supported **<GPS_NMEA_type>**s**)** **+QGPSCFG: "glonassnmeatype",(**range of supported **<GLONASS_NMEA_type>**s**)** **+QGPSCFG: "galileonmeatype",(**list of supported **<Galileo_NMEA_type>**s**)** **+QGPSCFG: "beidounmeatype",(**range of supported **<BeiDou_NMEA_type>**s**)** **+QGPSCFG: "qzssnmeatype",(**range of supported **<QZSS_NMEA_type>**s**)** **+QGPSCFG: "nmeasrc",(**list of supported **<NMEA_src>**s**)** **+QGPSCFG: "autogps",(**list of supported **<autoGPS>**s**)** **+QGPSCFG: "priority",(**list of supported **<priority_type>**s**)** **OK**
Characteristics	/

2.2.1.1. AT+QGPSCFG="outport" Configure NMEA Sentences Output Port

This command configures the NMEA sentences output port.

AT+QGPSCFG="outport" Configure NMEA Sentences Output Port	
Write Command **AT+QGPSCFG="outport"[,<outport>[,<baud_rate>]]**	Response If **<outport>** and **<baud_rate>** are omitted, query the current configuration: If **<outport>** is configured as "uartnmea" or "auxnmea": **+QGPSCFG: "outport",<outport>,<baud_rate >** If **<outport>** is configured as "usbnmea" or "none":

	+QGPSCFG: "outport",<outport> **OK** If **<outport>** and **<baud_rate>** are specified, configure the NMEA sentences output port: **OK** If there is any error related to ME functionality: **+CME ERROR: <errcode>**
Maximum Response Time	300 ms
Characteristics	The command takes effect immediately. The configurations will be saved automatically.

Parameter

<outport>	String type. Configure the output port of NMEA sentences. "none" Close NMEA sentence output "usbnmea" Output via USB NMEA port "uartnmea" Output via GNSS UART port "auxnmea" Output via debug UART port
<baud_rate>	Integer type. Baud rate of GNSS UART and debug UART port. **<baud_rate>** is available only when **<outport>** is "uartnmea" or "auxnmea". Unit: bps. 4800 9600 19200 38400 57600 115200 230400 460800 921600
<errcode>	Integer type. Error code of operation. Please refer to ***Chapter 4*** for details.

NOTE

When **<baud_rate>** is 4800 or 9600, data loss may occur if a large amount of NMEA sentences are output.

2.2.1.2. AT+QGPSCFG="gnssconfig" Configure Supported GNSS Constellations

This command configures the supported GNSS constellations of the module.

AT+QGPSCFG="gnssconfig" Configure Supported GNSS Constellations	
Write Command **AT+QGPSCFG="gnssconfig"[,<GNSS_config>]**	Response When **<GNSS_config>** is omitted, query the current configuration: **+QGPSCFG: "gnssconfig",<GNSS_config>** **OK** When **<GNSS_config>** is specified, configure the supported GNSS constellations: **OK** If there is any error related to ME functionality: **+CME ERROR: <errcode>**
Maximum Response Time	300 ms
Characteristics	The command takes effect after rebooting. The configurations will be saved automatically.

Parameter

<GNSS_config>	Integer type. Supported GNSS constellation. 1 GPS ON/GLONASS ON/BeiDou OFF/Galileo OFF/QZSS OFF 2 GPS ON/GLONASS OFF/BeiDou ON/Galileo OFF/QZSS OFF 3 GPS ON/GLONASS OFF/BeiDou OFF/Galileo ON/QZSS OFF 4 GPS ON/GLONASS OFF/BeiDou OFF/Galileo OFF/QZSS ON 5 The constellation is selected based on MCC of camped network
<errcode>	Integer type. Error code of operation. Please refer to ***Chapter 4*** for details.

2.2.1.3. AT+QGPSCFG="nmeafmt" Configure NMEA Sentence Protocol Standard

This command configures the protocol standard of NMEA sentences.

AT+QGPSCFG="nmeafmt" Configure NMEA Sentence Protocol Standard	
Write Command **AT+QGPSCFG="nmeafmt"[,<NMEA_fmt_config>]**	Response If **<NMEA_fmt_config>** is omitted, query the current configuration: **+QGPSCFG: "nmeafmt",<NMEA_fmt_config>**

	OK If **<NMEA_fmt_config>** is specified, configure the NMEA sentence protocol standard: **OK** If there is any error related to ME functionality: **+CME ERROR: <errcode>**
Maximum Response Time	300 ms
Characteristics	The command takes effect immediately. The configurations will be saved automatically.

Parameter

<NMEA_fmt_config>	Integer type. NMEA sentences protocol standards. 0 The output NMEA sentences conforms to Qualcomm's standards 1 The output NMEA sentences conforms to NMEA 0183 version 4.10.
<errcode>	Integer type. Error code of operation. Please refer to ***Chapter 4*** for details.

NOTE

For details of NMEA sentences in Qualcomm standards, please refer to ***Chapter 1.4***. NMEA sentences in Qualcomm standards and that in NMEA 0183 version 4.10 standard differ from each other only in the talker ID of RMC, GGA and VTG sentences.

2.2.1.4. AT+QGPSCFG="gpsnmeatype" Configure Output Type of GPS NMEA Sentences

This command configures the output type of GPS NMEA sentences.

AT+QGPSCFG="gpsnmeatype"	**Configure Output Type of GPS NMEA Sentences**
Write Command **AT+QGPSCFG="gpsnmeatype"[,<GPS_NMEA_type>]**	Response If **<GPS_NMEA_type>** is omitted, query the current configuration: **+QGPSCFG: "gpsnmeatype",<GPS_NMEA_type>** **OK** If **<GPS_NMEA_type>** is specified, configure the output type of GPS NMEA sentences: **OK**

	If there is any error related to ME functionality: **+CME ERROR: <errcode>**
Maximum Response Time	300 ms
Characteristics	The command takes effect immediately. The configurations will be saved automatically.

Parameter

<GPS_NMEA_type>	Integer type. Output type of GPS NMEA sentences by ORed. 0 Disable 1 GGA 2 RMC 4 GSV 8 GSA 16 VTG 31 All the five types above
<errcode>	Integer type. Error code of operation. Please refer to ***Chapter 4*** for details.

2.2.1.5. AT+QGPSCFG="glonassnmeatype" Configure Output Type of GLONASS NMEA Sentences

This command configures the output type of GLONASS NMEA sentences.

AT+QGPSCFG="glonassnmeatype" Configure Output Type of GLONASS NMEA Sentences	
Write Command **AT+QGPSCFG="glonassnmeatype"[,<GLONASS_NMEA_type>]**	Response If **<GLONASS_NMEA_type>** is omitted, query the current configuration: **+QGPSCFG: "glonassnmeatype",<GLONASS_NMEA_type>** **OK** If **<GLONASS_NMEA_type>** is specified, configure the output type of GLONASS NMEA sentences: **OK** If there is any error related to ME functionality: **+CME ERROR: <errcode>**
Maximum Response Time	300 ms

Characteristics	The command takes effect immediately. The configurations will be saved automatically.

Parameter

<GLONASS_NMEA_type>	Integer type. Output type of GLONASS NMEA sentences by ORed, default 3. 0 Disable 1 GSV 2 GSA
<errcode>	Integer type. Error code of operation. Please refer to ***Chapter 4*** for details.

2.2.1.6. AT+QGPSCFG="galileonmeatype" Configure Output Type of Galileo NMEA Sentences

This command configures the output type of Galileo NMEA sentences.

AT+QGPSCFG="galileonmeatype" Configure Output Type of Galileo NMEA Sentences	
Write Command **AT+QGPSCFG="galileonmeatype"[,<Galileo_NMEA_type>]**	Response If **<Galileo_NMEA_type>** is omitted, query the current configuration: **+QGPSCFG: "galileonmeatype",<Galileo_NMEA_type>** **OK** If **<Galileo_NMEA_type>** is specified, configure the output type of Galileo NMEA sentences: **OK** If there is any error related to ME functionality: **+CME ERROR: <errcode>**
Maximum Response Time	300 ms
Characteristics	The command takes effect immediately. The configurations will be saved automatically.

Parameter

<Galileo_NMEA_type>	Integer type. Output type of Galileo NMEA sentences by ORed.

	0 Disable 1 GSV 2 GSA
<errcode>	Integer type. Error code of operation. Please refer to ***Chapter 4*** for details.

2.2.1.7. AT+QGPSCFG="beidounmeatype" Configure Output Type of BeiDou NMEA Sentences

This command configures the output type of BeiDou NMEA sentences.

AT+QGPSCFG="beidounmeatype" Configure Output Type of BeiDou NMEA Sentences	
Write Command **AT+QGPSCFG="beidounmeatype"[,<BeiDou_NMEA_type>]**	Response If **<BeiDou_NMEA_type>** is omitted, query the current configuration: **+QGPSCFG: "beidounmeatype",<BeiDou_NMEA_type>** **OK** If **<BeiDou_NMEA_type>** is specified, configure output type of BeiDou NMEA sentences: **OK** If there is any error related to ME functionality: **+CME ERROR: <errcode>**
Maximum Response Time	300 ms
Characteristics	The command takes effect immediately. The configurations will be saved automatically.

Parameter

<BeiDou_NMEA_type>	Integer type. Output type of BeiDou NMEA sentences by ORed. 0 Disable 1 GSA 2 GSV
<errcode>	Integer type. Error code of operation. Please refer to ***Chapter 4*** for details.

2.2.1.8. AT+QGPSCFG="qzssnmeatype" Configure Output Type of QZSS NMEA Sentences

This command configures the output type of QZSS NMEA sentences.

AT+QGPSCFG="qzssnmeatype"	Configure Output Type of QZSS NMEA Sentences
Write Command **AT+QGPSCFG="qzssnmeatype"[,<QZSS_NMEA_type>]**	Response If **<QZSS_NMEA_type>** is omitted, query the current configuration: **+QGPSCFG: "qzssnmeatype",<QZSS_NMEA_type>** **OK** If **<QZSS_NMEA_type>** is specified, configure output type of QZSS NMEA sentences: **OK** If there is any error related to ME functionality: **+CME ERROR: <errcode>**
Maximum Response Time	300 ms
Characteristics	The command takes effect immediately. The configurations will be saved automatically.

Parameter

<QZSS_NMEA_type>	Integer type. Output type of QZSS NMEA sentences by ORed. 0 Disable 1 GSA
<errcode>	Integer type. Error code of operation. Please refer to ***Chapter 4*** for details.

2.2.1.9. AT+QGPSCFG="nmeasrc" Enable/Disable Acquisition of NMEA Sentences via AT+QGPSGNMEA

This command enables/disables acquisition of NMEA sentences via **AT+QGPSGNMEA**.

AT+QGPSCFG="nmeasrc" Enable/Disable Acquisition of NMEA Sentences via AT+QGPSGNMEA	
Write Command **AT+QGPSCFG="nmeasrc"[,<NMEA_src>]**	Response If **<NMEA_src>** is omitted, query the current setting: **+QGPSCFG: "nmeasrc",<NMEA_src>** **OK** If **<NMEA_src>** is specified, configure whether to enable

	acquisition of NMEA sentences via **AT+QGPSGNMEA**: **OK** If there is any error related to ME functionality: **+CME ERROR: <errcode>**
Maximum Response Time	300 ms
Characteristics	The command takes effect immediately. The configurations will be saved automatically.

Parameter

<NMEA_src>	Integer type. If enabled, original NMEA sentences can be acquired via **AT+QGPSGNMEA**. 0 Disable 1 Enable
<errcode>	Integer type. Error code of operation. Please refer to ***Chapter 4*** for details.

2.2.1.10. AT+QGPSCFG="autogps" Enable/Disable GNSS to Run Automatically

This command configures whether to enable automatic running of GNSS after the module is powered on.

AT+QGPSCFG="autogps" Enable/Disable GNSS to Run Automatically	
Write Command **AT+QGPSCFG="autogps"[,<autoGPS>]**	Response If **<autoGPS>** is omitted, query the current setting: **+QGPSCFG: "autogps",<autoGPS>** **OK** If **<autoGPS>** is specified, configure whether to enable automatic running of GNSS: **OK** If there is any error related to ME functionality: **+CME ERROR: <errcode>**
Maximum Response Time	300 ms
Characteristics	The command takes effect after rebooting. The configurations will be saved automatically.

Parameter

<autoGPS>	Integer type. Enable/disable GNSS to run automatically after the module is powered on. 0 Disable GNSS to run automatically 1 Enable GNSS to run automatically
<errcode>	Integer type. Error code of operation. Please refer to ***Chapter 4*** for details.

NOTES

1. GNSS runs automatically with high positioning accuracy and 1 Hz fix rate.
2. After enabling this function, the module may fail in network registration, since the module cannot search network when GNSS is active and when GNSS is in high priority.

2.2.1.11. AT+QGPSCFG="priority" Set GNSS or LTE Priority

This command configures GNSS or LTE priority.

AT+QGPSCFG="priority" Set GNSS or LTE Priority	
Write Command **AT+QGPSCFG="priority"[,<priority_type>[,<save>]]**	Response If **<priority_type>** and **<save>** are omitted, query the current setting: **+QGPSCFG: "priority",<priority_type>,<state>** **OK** If **<priority_type>** and **<save>** are specified, configure the GNSS or LTE priority: **OK** If there is any error related to ME functionality: **+CME ERROR: <errcode>**
Maximum Response Time	300 ms
Characteristics	The command take effect immediately. Whether to save the configuration is decided by **<save>**.

Parameter

<priority_type>	Integer type. Switch GNSS and LTE priority. 0 GNSS priority mode 1 LTE priority mode
<save>	Integer type. Whether to save the configuration to NVRAM. 0 Do not save to NVRAM

	1 Save to NVRAM
<state>	Integer type. GNSS/WWAN state. 0 WWAN/GNSS in unloaded state 1 WWAN in pending state 2 GNSS in pending state 3 WWAN in loaded state 4 GNSS in loaded state
<errcode>	Integer type. Error code of operation. Please refer to ***Chapter 4*** for details.

2.2.2. AT+QGPS Turn on GNSS

This command turns on GNSS function. When **<fix_count>** is non-zero, GNSS will be turned off automatically when **<fix_count>** reaches the value specified. When **<fix_count>** is 0, GNSS will fix position continuously, and it can be turned off via **AT+QGPSEND**.

AT+QGPS Turn on GNSS	
Test Command **AT+QGPS=?**	Response **+QGPS: (**list of supported **<GNSS_mode>)[,(**range of supported **<accuracy>**s**)[,(**range of supported **<fix_count>**s**)[,(**range of supported **<fix_rate>**s**)]]]** **OK**
Read Command **AT+QGPS?**	Response **+QGPS: <GNSS_state>** **OK**
Write Command **AT+QGPS=<GNSS_mode>[,<accuracy>[,<fix_count>[,<fix_rate>]]]**	Response **OK** If there is any error related to ME functionality: **+CME ERROR: <errcode>**
Maximum Response Time	300 ms
Characteristics	The command takes effect immediately. The configuration will not be saved.

Parameter

<GNSS_state>	Integer type. GNSS state. 0 GNSS OFF 1 GNSS ON
<GNSS_mode>	Integer type. GNSS working mode. 1 Stand-alone mode

<accuracy>	Integer type. Flags to indicate the desired level of accuracy for fix computation. 1 Low Accuracy for location is acceptable. 2 Medium Accuracy for location is acceptable. 3 Only High Accuracy for location is acceptable
<fix_count>	Integer type. Number of attempts for positioning. Range: 0–1000. 0 indicates continuous positioning. Other values indicate the number of attempts for positioning. When the value reaches, GNSS will be stopped.
<fix_rate>	The interval time between the first and second time positioning. Unit: second. If **<fix_rate>** < 1 0.1, 0.2, 0.5 If **<fix_rate>** ≥ 1 1–65535
<errcode>	Integer type. Error code of operation. Please refer to ***Chapter 4*** for details.

2.2.3. AT+QGPSEND Turn off GNSS

When GNSS is turned on and **<fix_count>** is 0, GNSS fixes position continuously. In such as case, GNSS can be turned off compulsorily via **AT+QGPSEND**. When **<fix_count>** is non-zero, GNSS will be turned off automatically when **<fix_count>** reaches the value specified, and thus this command can be ignored in such a case.

AT+QGPSEND Turn off GNSS	
Test Command **AT+QGPSEND=?**	Response **OK**
Execution Command **AT+QGPSEND**	Response **OK** If there is any error related to ME functionality: **+CME ERROR: <errcode>**
Maximum Response Time	300 ms
Characteristics	The command takes effect immediately.

Parameter

<errcode>	Integer type. Error code of operation. Please refer to ***Chapter 4*** for details.

2.2.4. AT+QGPSLOC Acquire Positioning Information

This command acquires positioning information. Before executing the command, GNSS must be turned on via **AT+QGPS**. If it fails in position fix, **+CME ERROR: <errcode>** will be returned to indicate the corresponding situation.

AT+QGPSLOC Acquire Positioning Information	
Test Command **AT+QGPSLOC=?**	Response **+QGPSLOC: (**range of supported **<mode>**s**)[,(**range of supported **<time>**s**)]** **OK**
Write Command **AT+QGPSLOC=<mode>[,<time>]**	Response **+QGPSLOC: <UTC>,<latitude>,<longitude>,<HDOP>,<altitude>,<fix>,<COG>,<spkm>,<spkn>,<date>,<nsat>** **OK** If there is any error related to ME functionality: **+CME ERROR: <errcode>**
Maximum Response Time	300 ms
Characteristics	The command takes effect immediately. The configurations will not be saved.

Parameter

<mode>	Integer type. Latitude and longitude display format. 0 **<latitude>,<longitude>** format: ddmm.mmmm N/S,dddmm.mmmm E/W 1 **<latitude>,<longitude>** format: ddmm.mmmmmm N/S,dddmm.mmmmmm E/W 2 **<latitude>,<longitude>** format: (-)dd.ddddd,(-)ddd.ddddd
<time>	Integer type. The time when the queried results are reported periodically. Range: 0–3600. Default value: 0. Unit: s. 0 indicates turn off this feature.
<UTC>	String type. UTC time. Format: hhmmss.sss (Quoted from GPGGA sentence).
<latitude>	Float type. Latitude. If **<mode>** is 0: Format: ddmm.mmmm N/S (Quoted from GPGGA sentence) dd 00–89 (Unit: degree) mm.mmmm 00.0000–59.9999 (Unit: minute) N/S North latitude/South latitude If **<mode>** is 1: Format: ddmm.mmmmmm N/S (Quoted from GPGGA sentence) dd 00–89 (Unit: degree) mm.mmmmmm 00.000000–59.999999 (Unit: minute) N/S North latitude/South latitude If **<mode>** is 2: Format: (-)dd.ddddd (Quoted from GPGGA sentence) dd.ddddd -89.99999–89.99999 (Unit: degree) - South latitude

<longitude>	Float type. Longitude. If **<mode>** is 0: Format: dddmm.mmmm E/W (Quoted from GPGGA sentence) ddd 000–179 (Unit: degree) mm.mmmm 00.0000–59.9999 (minute) E/W East longitude/West longitude If **<mode>** is 1: Format: dddmm.mmmmmm E/W (Quoted from GPGGA sentence) ddd 000–179 (Unit: degree) mm.mmmmmm 00.000000–59.999999 (Unit: minute) E/W East longitude/West longitude If **<mode>** is 2: Format: (-)dd.ddddd Quoted from GPGGA sentence) dd.ddddd -179.99999–179.99999 (Unit: degree) - West longitude
<HDOP>	Float type. Horizontal precision. Range: 0.5–99.9 (Quoted from GPGGA sentence).
<altitude>	Float type. The altitude of the antenna away from the sea level, accurate to one decimal place. Unit: meter. (Quoted from GPGGA sentence)
<fix>	Integer type. GNSS positioning mode (Quoted from GNGSA/GPGSA sentence). 2 2D positioning 3 3D positioning
<COG>	String type. Course Over Ground based on true north. Format: ddd.mm (Quoted from GPVTG sentence). ddd 000–359 (Unit: degree) mm 00–59 (Unit: minute)
<spkm>	Float type. Speed over ground. Format: xxxx.x. Unit: Km/h. Accurate to one decimal place (Quoted from GPVTG sentence).
<spkn>	Float type. Speed over ground. Format: xxxx.x. Unit: knots. Accurate to one decimal place (Quoted from GPVTG sentence).
<date>	String type. UTC time when fixing position. Format: ddmmyy (Quoted from GPRMC sentence).
<nsat>	Integer type. Number of satellites, from 00 (the first 0 should be retained) to 12 (Quoted from GPGGA sentence).
<errcode>	Integer type. Error code of operation. Please refer to ***Chapter 4*** for details.

2.2.5. AT+QGPSGNMEA Acquire NMEA Sentences

This command acquires NMEA sentences. Before using this command, GNSS must be turned on via **AT+QGPS**, and set **<NMEA_src>** into 1 to enable acquisition of NMEA sentences via **AT+QGPSGNMEA**.

The sentence output can be disabled via **AT+QGPSCFG="gpsnmeatype",0**, **AT+QGPSCFG="glonassnmeatype",0**, **AT+QGPSCFG="galileonmeatype",0** and **AT+QGPSCFG="beidounmeatype",0**. If sentence output is disabled, **AT+QGPSGNMEA** can still be used to acquire NMEA sentences on

condition that the GNSS has already acquired sentences via this command after its activation. And the sentences acquired via the command will be the last ones that have ever been acquired.

AT+QGPSGNMEA Acquire NMEA Sentences	
Test Command **AT+QGPSGNMEA=?**	Response **+QGPSGNMEA: ("GGA","RMC","GSV","GSA","VTG")** **OK**
Write Command Acquire GGA sentence **AT+QGPSGNMEA="GGA"**	Response **+QGPSGNMEA: <GGA_sentence>** **OK** If there is any error related to ME functionality: **+CME ERROR: <errcode>**
Write Command Acquire RMC sentence **AT+QGPSGNMEA="RMC"**	Response **+QGPSGNMEA: <RMC_sentence>** **OK** If there is any error related to ME functionality: **+CME ERROR: <errcode>**
Write Command Acquire GSV sentence **AT+QGPSGNMEA="GSV"**	Response **+QGPSGNMEA: <GSV_sentence>** **OK** If there is any error related to ME functionality: **+CME ERROR: <errcode>**
Write Command Acquire GSA sentence **AT+QGPSGNMEA="GSA"**	Response **+QGPSGNMEA: <GSA_sentence>** **OK** If there is any error related to ME functionality: **+CME ERROR: <errcode>**
Write Command Acquire VTG sentence **AT+QGPSGNMEA="VTG"**	Response **+QGPSGNMEA: <VTG_sentence>** **OK** If there is any error related to ME functionality: **+CME ERROR: <errcode>**

Maximum Response Time	300 ms
Characteristics	The command takes effect immediately.

Parameter

<GGA_sentence>	String type. GGA sentence
<RMC_sentence>	String type. RMC sentence.
<GSV_sentence>	String type. GSV sentence.
<GSA_sentence>	String type. GSA sentence.
<VTG_sentence>	String type. VTG sentence.
<errcode>	Integer type. Error code of operation. Please refer to ***Chapter 4*** for details.

2.2.6. AT+QCFGEXT Extended Configuration Settings

This command queries and configures various extended settings of the module.

AT+QCFGEXT Extended Configuration Settings	
Test Command **AT+QCFGEXT=?**	Response **+QCFGEXT: "addgeo",<geoID>,<mode>,<shape>,<lat1>,<lon1>,<lat2>[,<lon2>[,<lat3>,<lon3>[,<lat4>,<lon4>]]]** **+QCFGEXT: "deletegeo",<geoID>** **+QCFGEXT: "querygeo",<geoID>** **OK**
Maximum Response Time	300 ms
Characteristics	/
Reference	/

2.2.6.1. AT+QCFGEXT="addgeo" Add a Geo-fence

The Write Command adds a geo-fence.

AT+QCFGEXT="addgeo" Add a Geo-fence	
Write Command **AT+QCFGEXT="addgeo",[<geoID>,[<mode>,<shape>,<lat1>,<lon1>,<lat2>,[<lon2>,[<lat3>,<lon3>[,<lat4>,<lon4>]]]]]**	Response If all parameters after **"addgeo"** are omitted, query the current setting of all geo-fences that have been added: **+QCFGEXT: "addgeo",<geoID>,<mode>,<shape>,<lat1>,<lon1>,<lat2>,[<lon2>,[<lat3>,<lon3>[,<lat4>,<lon4>]]]** **…**

	+QCFGEXT: "addgeo",<geoid>,<mode>,<shape>,<lat1>,<lon1>,<lat2>,[<lon2>,[<lat3>,<lon3>[,<lat4>,<lon4>]]] **OK** If the parameters after **<geoID>** are omitted, query the current setting of the specified geo-fence: **+QCFGEXT: "addgeo",<geoid>,<mode>,<shape>,<lat1>,<lon1>,<lat2>,[<lon2>,[<lat3>,<lon3>[,<lat4>,<lon4>]]]** **OK** If **<shape>**=0, add a circular geo-fence and the parameters after **<lat2>** must be omitted: **OK** If **<shape>**=1, add a circular geo-fence and the parameters after **<lon2>** must be omitted: **OK** If **<shape>**=2, add a triangle geo-fence and the parameters after **<lon3>** must be omitted: **OK** If **<shape>**=3, add a quadrangle geo-fence and all parameters must be specified: **OK** If there is any error related to ME functionality: **+CME ERROR: <errcode>**
Maximum Response Time	300 ms
Characteristics	The command takes effect immediately. The configurations will not be saved.

Parameter

<geoID>	Integer type. Geo-fence ID. Range: 0–9.
<mode>	Integer type. URC report mode. 0 Disable URC to be reported when entering or leaving the geo-fence 1 Enable URC to be reported when entering the geo-fence 2 Enable URC to be reported when leaving the geo-fence 3 Enable URC to be reported when entering or leaving the geo-fence The URC is shown as below:

	+QIND: "GEOFENCE",<ID>,<action>,<time>,<latitude>,<longitude>,<altitude>,<course>,<speed>,<PDOP>,<HDOP>,<VDOP> The parameters of the URC are described as below: **<ID>** The ID of geo-fence which is to be entered or left. **<action>** The current action of the module. 1 Entering the geo-fence 2 Leaving the geo-fence **<time>** The UTC time when entering or leaving the geo-fence. Format: yyyy-MM-dd hh:mm:ss **<latitude>** The latitude of module when entering or leaving the geo-fence. Unit: degree **<longitude>** The longitude of module when entering or leaving the geo-fence. Unit: degree Format: ±ddd.dddddd. Range: -180.000000–180.000000 **<altitude>** Mean sea level altitude. Unit: meter **<course>** Course over ground, relative to true north. Unit: degree **<speed>** Speed over ground. Unit: m/s **<PDOP>** Position dilution of precision. **<HDOP>** Horizontal dilution of precision. **<VDOP>** Vertical dilution of precision.
<shape>	Integer type. Geo-fence shape. 0 Circularity with center and radius 1 Circularity with center and one point on the circle 2 Triangle 3 Quadrangle
<lat1>	The latitude of a point which is defined as the center of the geo-fence circular region or the first point, Unit: degree Format: ±dd.dddddd. Range: -90.000000 to 90.000000
<lon1>	The longitude of a point which is defined as the center of the geo-fence circular region or the first point. Unit: degree Format: ±ddd.dddddd. Range: -180.000000 to 180.000000
<lat2>	When **<shape>** is 0, this parameter is radius. Range: 0–6000000. Unit: meter. When **<shape>** is other value, this parameter is a latitude. Unit: degree Format: ±dd.dddddd. Range: -90.000000 to 90.000000 If **<shape>** is 0, the parameters after **<lat2>** must be omitted.
<lon2>	The longitude of the second point. Unit: degree Format: ±ddd.dddddd. Range: -180.000000 to 180.000000 If **<shape>** is 1, the parameters after **<lon2>** must be omitted.
<lat3>	The latitude of the third point. Unit: degree Format: ±dd.dddddd. Range: -90.000000 to 90.000000
<lon3>	The longitude of the third point. Unit: degree Format: ±ddd.dddddd. Range: -180.000000 to 180.000000 If **<shape>** is 2, the parameters after **<lon3>** must be omitted.
<lat4>	The latitude of the fourth point. Unit: degree

	Format: ±dd.dddddd. Range: -90.000000 to 90.000000
<lon4>	The longitude of the fourth point. Unit: degree Format: ±ddd.dddddd. Range: -180.000000 to 180.000000
<errcode>	Integer type. Error code of operation. Please refer to ***Chapter 4*** for details.

2.2.6.2. AT+QCFGEXT="deletegeo" Delete a Geo-fence

The Write Command deletes a geo-fence.

AT+QCFGEXT="deletegeo" Delete a Geo-fence	
Write Command **AT+QCFGEXT="deletegeo",<geoID>**	Response **OK** If there is any error related to ME functionality: **+CME ERROR: <errcode>**
Maximum Response Time	300 ms
Characteristics	The command takes effect immediately. The configuration will not be saved.

Parameter

<geoID>	Integer type. Geo-fence ID. Range: 0–10. 10 means deleting all geo-fences.
<errcode>	Integer type. Error code of operation. Please refer to ***Chapter 4*** for details.

2.2.6.3. AT+QCFGEXT="querygeo" Query the Position with Respect to Geo-fence

The Write Command queries the position with respect to the geo-fence.

AT+QCFGEXT="querygeo" Query the Position with Respect to Geo-fence	
Write Command **AT+QCFGEXT="querygeo",<geoID>**	Response **+QCFGEXT: "querygeo",<posWrtGeofence>** **OK** If there is any error related to ME functionality: **+CME ERROR: <errcode>**
Maximum Response Time	300 ms
Characteristics	/

Parameter

<geoID>	Integer type. Geo-fence ID. Range: 0–9.
<posWrtGeofence>	Integer type. Position with respect to the geo-fence. 0 Position unknown 1 Position is inside the geo-fence 2 Position is outside the geo-fence
<errcode>	Integer type. Error code of operation. Please refer to ***Chapter 4*** for details.

3 Examples

3.1. Turn on/off the GNSS

Default arguments are used in this example to turn on GNSS. After turning on GNSS, NMEA sentences will be output from "usbnmea" port by default, and GNSS can be turned off via **AT+QGPSEND**.

```
AT+QGPS=1                    //Turn on GNSS.
OK

//After turning on GNSS, NMEA sentences will be output from "usbnmea" port by default.
AT+QGPSLOC?                  //Obtain positioning information.
+QGPSLOC: 130618.0,3150.8076N,11711.9039E,0.8,89.5,2,0.00,0.0,0.0,110919,12

OK
AT+QGPSEND                   //Turn off GNSS.
OK
```

3.2. Acquire Positioning Information

When GNSS is turned on and after it is fixed, the positioning information can be acquired via **AT+QGPSLOC**.

```
AT+QGPSLOC?                  //Obtain positioning information.
+QGPSLOC: 130618.0,3150.8076N,11711.9039E,0.8,89.5,2,0.00,0.0,0.0,110919,12

OK
AT+QGPSLOC=0
+QGPSLOC: 131050.0,3150.8069N,11711.9032E,1.2,90.7,3,0.00,0.0,0.0,110919,08

OK
AT+QGPSLOC=1
+QGPSLOC: 131117.0,3150.806972,N,11711.903278,E,1.3,90.6,3,0.00,0.0,0.0,110919,07
```

```
OK
AT+QGPSLOC=2
+QGPSLOC: 131140.0,31.84678,117.19838,1.3,90.5,3,0.00,0.0,0.0,110919,07

OK
AT+QGPSLOC=2,1                  //Obtain positioning information and enable periodical location report.
+QGPSLOC: 131305.0,31.84678,117.19838,1.8,89.9,3,0.00,0.0,0.0,110919,07

OK

+QGPSLOC: 131306.0,31.84678,117.19838,1.0,89.9,3,0.00,0.0,0.0,110919,08

+QGPSLOC: 131307.0,31.84678,117.19838,1.0,89.9,3,0.00,0.0,0.0,110919,08

+QGPSLOC: 131308.0,31.84678,117.19838,0.9,89.9,3,0.00,0.0,0.0,110919,08
AT+QGPSLOC=2,0                  //Obtain positioning information and disable periodical location report.
+QGPSLOC: 131431.0,31.84678,117.19838,0.9,89.7,3,0.00,0.0,0.0,110919,09

OK
```

3.3. Query Satellite System

```
AT+QGPSCFG="gnssconfig"      //Query enabled satellite systems
+QGPSCFG: "gnssconfig",1     //GPS and GLONASS are enabled.

OK
AT+QGPS=1                    //Turn on GNSS.
OK
AT+QGPSGNMEA="GSV"
$GPGSV,4,1,14,02,68,055,16,04,00,000,31,05,64,314,26,07,08,070,18,1*6D     //GPS GSV sentence.
$GPGSV,4,2,14,09,04,037,30,12,11,228,36,15,16,207,20,19,11,155,14,1*6B
$GPGSV,4,3,14,25,09,269,20,29,27,316,32,06,26,101,,13,41,177,,1*68
$GPGSV,4,4,14,17,00,000,,30,10,091,,1*6D
$GLGSV,2,1,05,22,32,332,26,20,25,136,13,21,78,073,18,07,57,243,21,1*78     //GLONASS GSV
                                                                            sentence
$GLGSV,2,2,05,08,10,224,,1*40

OK
AT+QGPSCFG="gnssconfig",2    //Enable GPS and BeiDou.
OK
/*Restart module*/
RDY
```

```
APP RDY
AT+QGPSCFG="gnssconfig"          //Query enabled satellite systems.
+QGPSCFG: "gnssconfig",2         //GPS and BeiDou are enabled.

OK
AT+QGPS=1
OK
AT+QGPSGNMEA="GSV"
$GPGSV,3,1,11,02,64,089,36,04,00,000,39,05,63,346,45,06,21,113,27,1*6F    //GPS GSV sentence
$GPGSV,3,2,11,07,09,059,45,12,02,218,33,15,29,211,30,25,04,257,27,1*64
$GPGSV,3,3,11,29,37,307,41,30,16,090,29,13,57,173,,1*59
$PQGSV,1,1,03,13,65,343,34,14,72,329,26,21,08,052,42,1*45                  //BeiDou GSV sentence

OK
```

3.4. Application of Geo-fence Function

```
AT+QCFGEXT="addgeo",0,3,0,31.826,117.2168,100      //Add a circular geo-fence 0.
OK
AT+QCFGEXT="addgeo",0                              //Query the setting of geo-fence 0.
+QCFGEXT: "addgeo",0,3,0,31.826000,117.216800,100.0

OK
AT+QCFGEXT="addgeo",7,1,3,31.833348,117.212909,31.826453,117.213248,31.82873,117.222093,
31.833502,117.2208623                              //Add a quadrangle geo-fence 7.
OK
AT+QCFGEXT="addgeo",7                              //Query the setting of geo-fence 7.
+QCFGEXT:
"addgeo",7,1,3,31.833348,117.212909,31.826453,117.213248,31.828730,117.222093,31.833502,117.
220862

OK
AT+QCFGEXT="deleltegeo",7                          //Delete geo-fence 7.
OK

AT+QGPS=1                                          //Turn on GNSS engine.
OK
AT+QCFGEXT="querygeo",0                  //Query the position with respect to geo-fence 0.
+QCFGEXT: "querygeo",0,1                 //The current position is inside the geo-fence 0.
```

OK

//When entering the geo-fence 0, this URC will be reported.
+QIND: "GEOFENCE",0,1,2017/08/25 08:35:53,31.825179,117.217127,34.0,0.2,13.8,1.1,0.7,0.8
//When leaving the geo-fence 0, this URC will be reported.
+QIND: "GEOFENCE",0,2,2017/08/25 08:36:07,31.826951,117.217071,38.0,359.0,13.4,0.9,0.6,0.6

4 Summary of Error Codes

The **<errcode>** indicates an error related to GNSS operation. The details about **<errcode>** are described in the following table.

Table 5: Summary of Error Codes

<errcode>	Meaning
501	Invalid parameter
502	Operation not supported
503	GNSS subsystem busy
504	Session is ongoing
505	Session not active
506	Operation timeout
507	Function not enabled
508	Time information error
509	XTRA not enabled
512	Validity time is out of range
513	Internal resource error
514	GNSS locked
515	End by E911
516	Not fixed now
517	Geo-fence ID is not existed
549	Unknown error

5 Appendix A References

Table 6: Related Documents

SN	Document Name	Remark
[1]	Quectel_BG95&BG77_AT_Commands_Manual	BG95&BG77 AT Commands Manual
[2]	Quectel_BG95&BG77_FILE_Application_Note	BG95&BG77 FILE Application Note
[3]	Quectel_BG95_Hardware_Design	BG95 Hardware Design

Table 7: Terms and Abbreviations

Abbreviation	Description
BeiDou	BeiDou Navigation Satellite System
DOP	Dilution of Precision
eDRX	Extended Discontinuous Reception
Galileo	Galileo Satellite Navigation System (EU)
GGA	Global Positioning System Fix Data
GLONASS	Global Navigation Satellite System (Russian)
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
gpsOneXTRA	An Auxiliary Positioning Technology Provided by Qualcomm
GSA	GNSS DOP and Active Satellites
GSV	GNSS Satellites in View
HDOP	Horizontal Dilution of Precision
LPWA	Low-Power Wide-Area

LTE	Long Term Evolution
MCC	Mobile Country Code
ME	Mobile Equipment
NMEA	National Marine Electronics Association
PTW	Paging Time Window
QZSS	Quasi-Zenith Satellite System
RMC	Recommended Minimum Specific GNSS Data
UART	Universal Asynchronous Receiver/Transmitter
USB	Universal Serial Bus
UTC	Universal Time Coordinated
VTG	Course over Ground and Ground Speed
WWAN	Wireless Wide Area Network