BG96 GNSS
Application Note

LPWA Module Series

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About the Document

Revision History

Version	Date	Author	Description
1.0	2017-11-23	Matt YE/ Vita LV	Initial
1.1	2018-02-12	Matt YE/ Vita LV	1. Added geo-fence related AT commands in Chapter 2.10. 2. Modified an error in the example in Chapter 3.3. 3. Added the example for operation of geo-fence function in Chapter 3.4.
1.2	2020-06-23	Matt YE/ Mac ZHU/ Alfred LI	1. Added the URLs for gpsOneXTRA file downloading through MCUs/browsers in Chapter 1.3. 2. Updated AT+QGPSCFG="outport" in Chapter 2.2.1.1. 3. Added AT+QGPSCFG="speed_threshold" for speed and distance thresholds configuration in Chapter 2.2.1.10. 4. Added AT+QGPSCFG="estimation_error" for estimation error acquisition in Chapter 2.2.1.11. 5. Added AT+QGPSCFG="nmea_epe" to enable/disable the output of EPE NMEA sentences in Chapter 2.2.1.12 and the example in Chapter 3.5. 6. Updated AT+QGPSLOC in Chapter 2.2.5. 7. Updated the example for downloading gpsOneXTRA files in Chapter 3.3.

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1 Introduction

Quectel BG96 module integrates a GNSS engine which supports GPS, BeiDou, Galileo, GLONASS and QZSS systems, and also it supports gpsOneXTRA Assistance technology. The high performance GNSS engine is suitable for various applications where lowest-cost and accurate positioning is needed, and it supports position tracking without network assistance. BG96 GNSS can be applied in the following applications: turn-by-turn navigation, asset tracking, personnel tracking, location-aware games, as well as home and fleet management.

1.1. GNSS Turning on/off Procedures

BG96 GNSS supports 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, you can obtain the positioning information in three ways:
  1) NMEA sentences are output to "usbnmea" port by default. Read the port to obtain NMEA sentences.
  2) Use **AT+QGPSLOC** to obtain positioning information, such as latitude, longitude, height, GNSS positioning mode, time and number of satellites.
  3) After enabling **<NMEA_src>** via **AT+QGPSCFG="nmeasrc",1**, you can acquire the specified NMEA sentence via **AT+QGPSGNMEA**. If **<NMEA_src>** is disabled, the command **AT+QGPSGNMEA** cannot be used.

Step 4: GNSS can be turned off in two ways:
  1) If **<fix_count>** of **AT+QGPS** is set to 0 in *Step 2*, GNSS gets position continuously, and it can be turned off via **AT+QGPSEND**.
  2) If **<fix_count>** reaches the specified value, the GNSS is stopped automatically.

1.2. NMEA Sentences Type

The NMEA sentences are compliant with NMEA 0183 standard, and the standard NMEA sentences have five kinds of prefix, as illustrated below.

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

- GPGGA – Global positioning system fix data, such as time and position
- GPRMC – Recommended minimum specific GNSS data
- GPGSV – GNSS satellites in view, such as number of satellites in view and satellite ID numbers
- GPGSA – GNSS DOP and active satellites
- 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 and satellite ID numbers
- GNGSA – GNSS DOP and active satellites
- GNGNS – GNSS fix data

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

- GAGSV – GNSS satellites in view, such as number of satellites in view and satellite ID numbers
- GNGSA – GNSS DOP and active satellites
- GNGNS – GNSS fix data

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

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

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

- PQGSA – GNSS DOP and active satellites

1.3. Introduction of gpsOneXTRA Assistance

gpsOneXTRA Assistance technology enhances the performance of GNSS, and provides simplified GNSS assistance delivery, including ephemeris, almanac, ionosphere, UTC, health and coarse time assistance for GNSS engine. After activating gpsOneXTRA Assistance, the TTFF (Time to First Fix) can be reduced by 18–30 s (or more in harsh environments with weak signals). The assistance data which is obtained from one of the gpsOneXTRA Assistance web servers on the network needs to be updated once a day (or every couple of days).

Before using this function, ensure the valid gpsOneXTRA assistance data is available. The gpsOneXTRA binary file, which contains the assistance data, can be downloaded from the gpsOneXTRA Assistance web server through URLs listed below. The module supports the following two kinds of files.

- *xtra2.bin* files for GPS and GLONASS. The file size is about 60 KB.
- *xtra3grc.bin* files for GPS, GLONASS and BeiDou. The file size is about 25 KB.

1.3.1. URLs for gpsOneXTRA File Downloading with AT+QHTTPGET

When downloading gpsOneXTRA files with **AT+QHTTPGET** (see *document [4]* for details), the files can be downloaded from the URLs listed below. It is recommended to use this method for gpsOneXTRA file downloading, and an example is provided in *Chapter 3.3.1*.

http://xtrapath1.izatcloud.net/xtra2.bin
http://xtrapath2.izatcloud.net/xtra2.bin
http://xtrapath3.izatcloud.net/xtra2.bin

http://xtrapath1.izatcloud.net/xtra3grc.bin
http://xtrapath2.izatcloud.net/xtra3grc.bin
http://xtrapath3.izatcloud.net/xtra3grc.bin

1.3.2. URLs for gpsOneXTRA File Downloading through MCU/Browser

When downloading gpsOneXTRA files through a browser or customer's own MCU, the files can be downloaded from the URLs listed below.

http://xtrapath4.izatcloud.net/xtra2.bin
http://xtrapath5.izatcloud.net/xtra2.bin
http://xtrapath6.izatcloud.net/xtra2.bin

http://xtrapath4.izatcloud.net/xtra3grc.bin
http://xtrapath5.izatcloud.net/xtra3grc.bin
http://xtrapath6.izatcloud.net/xtra3grc.bin

1.3.3. Procedure of Using gpsOneXTRA Assistance Function

gpsOneXTRA assistance data needs to be updated regularly. The status of gpsOneXTRA data file can be queried via **AT+QGPSXTRADATA?**.

The procedure of using gpsOneXTRA Assistance function is illustrated below:

Step 1: If gpsOneXTRA Assistance is disabled, enable it first via **AT+QGPSXTRA** and then restart the module to activate the function.

Step 2: Query and confirm the validity of gpsOneXTRA data file via **AT+QGPSXTRADATA?**. If the data is invalid, perform *Steps 3* to *6* then; if the data is valid, turn on GNSS engine according to the procedures described in *Chapter 1.1* directly.

Step 3: Download file *xtra2.bin* or xtra3grc*.bin* to the module via URLs listed above.

Step 4: Inject the correct gpsOneXTRA time to GNSS engine via **AT+QGPSXTRATIME**.

Step 5: Inject the valid gpsOneXTRA data file to GNSS engine via **AT+QGPSXTRADATA**.

Step 6: Turn on GNSS engine according to the procedures described in *Chapter 1.1*.

For more details of the AT commands mentioned above, see *Chapters 2.2.7*, *2.2.8* and *2.2.9*.

2 Description of GNSS AT Commands

This chapter mainly introduces the AT commands relating to GNSS function of BG96 module.

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.
- <u>**Underline**</u>   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 1: 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

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

AT+QGPSCFG Configure GNSS	
Test Command **AT+QGPSCFG=?**	Response **+QGPSCFG:"outport",(**list of supported **<outport>**s**),(**list of supported **<baud_rate>**s**)** **+QGPSCFG: "nmeasrc",(**list of supported **<NMEA_src>**s**)** **+QGPSCFG: "gpsnmeatype",(**range 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: "gsvextnmeatype",(**list of supported **<GSVEXT_NMEA_type>**s**)** **+QGPSCFG: "gnssconfig",(**range of supported **<GNSS_config>**s**)** **+QGPSCFG: "autogps",(**list of supported **<autoGPS>**s**)** **+QGPSCFG: "speed_threshold",(**range of supported **<speed_threshold>**s**)** **+QGPSCFG: "estimation_error"** **+QGPSCFG: "nmea_epe",(**list of supported **<NMEA_EPE>**s**)** **OK**
Maximum Response Time	300 ms
Characteristics	/
Reference	

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

The 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 the optional parameters are omitted, query the current setting: **+QGPSCFG: "outport",<outport>[,<baud_rate>]** **OK** If any of the optional parameters is specified, set the NMEA sentences output port and the port baud rate when **<outport>** is "uartnmea" or "auxnmea": **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 are saved automatically.
Reference	

Parameter

<outport>	String type. 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 port and debug port. **<baud_rate>** is available only when **<outport>** is "uartnmea" or "auxnmea". Unit: bps.	
	4800	
	9600	
	19200	
	38400	
	57600	
	115200	
<errcode>	Integer type. Error code of operation. See **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="nmeasrc" Enable/Disable Acquisition of NMEA Sentences via AT+QGPSGNMEA

The 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 the optional parameter is omitted, query the current setting: **+QGPSCFG: "nmeasrc",<NMEA_src>** **OK** If the optional parameter is specified, set whether to enable the 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 are saved automatically.
Reference	

Parameter

<NMEA_src>	Integer type. If enabled, original NMEA sentences can be acquired via **AT+QGPSGNMEA**, and the sentences are output via the same NMEA port as before. 0　Disable 1　Enable
<errcode>	Integer type. Error code of operation. See *Chapter 4* for details.

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

The command configures the output type of GPS NMEA sentences.

AT+QGPSCFG="gpsnmeatype" Configure Output Type of GPS NMEA Sentences	
Write Command **AT+QGPSCFG="gpsnmeatype"[,<GP**	Response If the optional parameter is omitted, query the current setting:

S_NMEA_type>]	+QGPSCFG: "gpsnmeatype",<GPS_NMEA_type>
	OK
	If the optional parameter is specified, set 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 configuration is saved automatically.
Reference	

Parameter

<GPS_NMEA_type>	Integer type. Output type of GPS NMEA sentences by ORed. Range: 1–31.
	0 Disable
	1 GGA
	2 RMC
	4 GSV
	8 GSA
	16 VTG
	<u>31</u> All above sentences will be outputted
<errcode>	Integer type. Error code of operation. See ***Chapter 4*** for details.

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

The 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 the optional parameter is omitted, query the current setting: **+QGPSCFG: "glonassnmeatype",<GLONASS_NMEA_type>** **OK**

	If the optional parameter is specified, set 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 configuration is saved automatically.
Reference	

Parameter

<GLONASS_NMEA_type>	Integer type. Output type of GLONASS NMEA sentences by ORed. 0 Disable 1 GSV 2 GSA 4 GNS
<errcode>	Integer type. Error code of operation. See **Chapter 4** for details.

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

The 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 the optional parameter is omitted, query the current setting: **+QGPSCFG: "galileonmeatype",<Galileo_NMEA_type>** **OK** If the optional parameter is specified, set 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 configuration is saved automatically.
Reference	

Parameter

<Galileo_NMEA_type>	Integer type. Output type of Galileo NMEA sentences by ORed.
	<u>0</u> Disable
	1 GSV
<errcode>	Integer type. Error code of operation. See *Chapter 4* for details.

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

Sentences

The 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 the optional parameter is omitted, query the current setting: **+QGPSCFG: "beidounmeatype",<Beidou_NMEA_type>** **OK** If the optional parameter is specified, set the 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 configuration is saved automatically.
Reference	

Parameter

<Beidou_NMEA_type>	Integer type. Configure output type of BeiDou NMEA sentences via ORed.
	<u>0</u> Disable
	1 GSA

	2 GSV
\<errcode\>	Integer type. Error code of operation. See **Chapter 4** for details.

NOTE

When you enable GSA NMEA sentences of BeiDou, the module outputs QZSS NMEA sentences at the same time.

2.2.1.7.   AT+QGPSCFG="gsvextnmeatype"   Enable/Disable Output of GSVEXT NMEA

Sentences

The command enables/disables the output of GSVEXT NMEA sentences.

AT+QGPSCFG="gsvextnmeatype" Enable/Disable Output of GSVEXT NMEA Sentences	
Write Command **AT+QGPSCFG="gsvextnmeatype"[,\<GSVEXT_NMEA_type\>]**	Response If the optional parameter is omitted, query the current setting: **+QGPSCFG: "gsvextnmeatype",\<GSVEXT_NMEA_type\>** **OK** If the optional parameter is specified, set whether to enable the output of GSVEXT 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 configuration is saved automatically.
Reference	

Parameter

\<GSVEXT_NMEA_type\>	Integer type. Enables/disables output of extended GSV information. Elevation/Azimuth/SNR (C/No) are displayed as decimals when extended information is enabled, otherwise they are displayed as integers. 0 Disable 1 Enable
\<errcode\>	Integer type. Error code of operation. See **Chapter 4** for details.

2.2.1.8. AT+QGPSCFG="gnssconfig" Configure Supported GNSS Constellation

The command configures the supported GNSS constellations of the module.

AT+QGPSCFG="gnssconfig" Configure Supported GNSS Constellation	
Write Command **AT+QGPSCFG="gnssconfig"[,<GNSS _config>]**	Response If the optional parameter is omitted, query the current setting: **+QGPSCFG: "gnssconfig",<GNSS_config>** **OK** If the optional parameter is specified, set 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 configuration is saved automatically.
Reference	

Parameter

<GNSS_config>	Integer type. Supported GNSS constellation. GPS is always ON. 0 GLONASS OFF/BeiDou OFF/Galileo OFF 1 GLONASS ON/BeiDou ON/Galileo ON 2 GLONASS ON/BeiDou ON/Galileo OFF 3 GLONASS ON/BeiDou OFF/Galileo ON 4 GLONASS ON/BeiDou OFF/Galileo OFF 5 GLONASS OFF/BeiDou ON/Galileo ON 6 GLONASS OFF/BeiDou OFF/Galileo ON
<errcode>	Integer type. Error code of operation. See *Chapter 4* for details.

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

The 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 the optional parameter is omitted, query the current setting: **+QGPSCFG: "autogps",<autoGPS>** **OK** If the optional parameter is specified, set 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 configuration is saved automatically.
Reference	

Parameter

<autoGPS>	Integer type. Enables/disables 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. See *Chapter 4* for details.

NOTE

This command is valid only when the GNSS works in **stand-alone** mode.

2.2.1.10. AT+QGPSCFG="speed_threshold" Configure Speed and Distance Thresholds

This command configures the speed and distance thresholds.

AT+QGPSCFG="speed_threshold" Configure Speed and Distance Thresholds	
Write Command **AT+QGPSCFG="speed_threshold"[,< speed_threshold>[,<distance_thresh old>]]**	Response If **<speed_threshold>** and **<distance_threshold>** are both omitted, query the current setting: **+QGPSCFG: "speed_threshold",<speed_threshold>,<di**

	stance_threshold>
	OK
	If **<distance_threshold>** is omitted, set the speed threshold only and the distance threshold is 0 by default: **OK**
	If **<speed_threshold>** and **<distance_threshold>** are specified, set the speed and distance thresholds: **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 is saved automatically.
Reference	

Parameter

<speed_threshold>	Float type. Speed threshold. If the speed is less than the threshold, the speed in the NMEA sentence is 0. Default value: 0.15 m/s. Range: 0.00–2.00. Unit: m/s.
<distance_threshold>	Integer type. Distance threshold. If the moved distance is less than the threshold, the position in the NMEA sentence will not be updated and the last position will be used. Default value: 0. 0 means the position is always updated. Range: 0–10000. Unit: m.
<errcode>	Integer type. Error code of operation. See *Chapter 4* for details.

2.2.1.11. AT+QGPSCFG="estimation_error"   Get Estimated Position Error

This command acquires the estimated position error.

AT+QGPSCFG="estimation_error" Get Estimated Position Error	
Execution Command **AT+QGPSCFG="estimation_error"**	Response **+QGPSCFG: "estimation_error",<hori_unc>,<vert_unc>, <speed_unc>,<head_unc>** **OK**

	If there is any error related to ME functionality:
	+CME ERROR: <errcode>
Maximum Response Time	300 ms
Characteristics	/
Reference	

Parameter

<hori_unc>	Float type. Horizontal estimated position error. Unit: meter
<vert_unc>	Float type. Vertical estimated position error. Unit: meter
<speed_unc>	Float type. Horizontal estimated velocity error. Unit: m/s
<head_unc>	Float type. Estimated heading error. Unit: degree,
<errcode>	Integer type. Error code of operation. See *Chapter 4* for details.

2.2.1.12. AT+QGPSCFG="nmea_epe" Enable/Disable EPE NMEA Sentences Output

The command enables/disables the output of EPE NMEA sentences.

AT+QGPSCFG="nmea_epe" Enable/Disable EPE NMEA Sentences Output	
Write Command **AT+QGPSCFG="nmea_epe"[,<NMEA_EPE>]**	Response If the optional parameter is omitted, query the current setting: **+QGPSCFG: "nmea_epe",<NMEA_EPE>** **OK** If the optional parameter is specified, set whether to enable the output of EPE 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 configuration is saved automatically.
Reference	

Parameter

<NMEA_EPE>	Integer type. Enables/disables the output of EPE NMEA sentences.
	<u>0</u> Disable
	1 Enable, and the sentence is in the format of:
	$PQEPE,<timestamp>,<status>,<HDOP>,<hori_unc>,<vert_unc>,<speed_unc>,<head_unc>*<checksum>
<timestamp>	String type. UTC time. Format: hhmmss.ss.
<status>	String type. Data valid indication.
	A Data valid
	V Data invalid
<HDOP>	Float type. Horizontal dilution of precision.
<hori_unc>	Float type. Horizontal estimated position error. Unit: meter.
<vert_unc>	Float type. Vertical estimation position error. Unit: meter.
<speed_unc>	Float type. Horizontal estimated velocity error. Unit: m/s.
<head_unc>	Float type. Estimated heading error. Unit: degree.
<checksum>	Hexadecimal type. The checksum is the XOR of all the bytes between the "$" and the "*" (not including the delimiters themselves).
<errcode>	Integer type. Error code of operation. See **Chapter 4** for details.

2.2.2. AT+QGPSDEL   Delete Assistance Data

The command deletes assistance data so as to operate cold start, hot start and warm start of GNSS. It can only be executed when GNSS is turned off. After deleting the assistance data via this command, cold start of GNSS can be enforced via **AT+QGPS**. Hot/warm start can also be performed if the corresponding conditions are satisfied.

AT+QGPSDEL Delete Assistance Data	
Test Command **AT+QGPSDEL=?**	Response **+QGPSDEL: (**range of supported **<delete_type>)** **OK**
Write Command **AT+QGPSDEL=<delete_type>**	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.
Reference	

Parameter

<delete_type>	Integer type. The type of GNSS assistance data to be deleted.
	0 Delete all assistance data except gpsOneXTRA data. Enforce cold start after starting GNSS.
	1 Do not delete any data. Perform hot start if the conditions are permitted after starting GNSS.
	2 Delete some related data. Perform warm start if the conditions are permitted after starting GNSS.
	3 Delete the gpsOneXTRA assistance data injected into GNSS engine.
<errcode>	Integer type. Error code of operation. See ***Chapter 4*** for details.

2.2.3. AT+QGPS　Turn on GNSS

The command turns on GNSS function. Currently it only supports turning on GNSS in **Stand-alone** mode (that is, **<GNSS_mode>**=1). When **<fix_count>** is 0, GNSS will fix position continuously, and it can be turned off via **AT+QGPSEND**. When **<fix_count>** is non-zero and reaches the specified value, GNSS will be turned off automatically.

AT+QGPS　Turn on GNSS	
Test Command **AT+QGPS=?**	Response **+QGPS: (**range of supported **<GNSS_mode>**s**),(**range of supported **<fix_max_time>**s**),(**range of supported **<fix_max_dist>**s**),(**range of supported **<fix_count>**s**),(**range of supported **<fix_rate>**s)** **OK**
Read Command Read current GNSS state **AT+QGPS?**	Response **+QGPS: <GNSS_state>** **OK**
Write Command **AT+QGPS=<GNSS_mode>[,<fix_max _time>[,<fix_max_dist>[,<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.
Reference	

Parameter

<GNSS_state>	Integer type. GNSS state.
	<u>0</u> GNSS OFF
	1 GNSS ON
<GNSS_mode>	Integer type. GNSS working mode.
	<u>1</u> Stand-alone
	2 MS-based
	3 MS-assisted
	4 Speed-optimal
<fix_max_time>	Integer type. The maximum positioning time, which indicate the response time of GNSS receiver while measuring the GNSS pseudo range, and the upper time limit of GNSS satellite searching. It also includes the time for demodulating the ephemeris data and calculating the position. The default value will be used if the parameter is omitted. Range: 1–255. Default value: 30. Unit: second.
<fix_max_dist>	Integer type. Accuracy threshold of positioning. Unit: meter. Range: 1–1000. Default value: 50. Unit: meter.
<fix_count>	Integer type. Number of attempts for positioning. Range: 0–1000. Default value: 0. 0 indicates continuous positioning. Non-zero values indicate the actual number of attempts for positioning.
<fix_rate>	Integer type. The interval time between the first and second time positioning. Range: 1–65535. Default value: 1. Unit: second.
<errcode>	Integer type. Error code of operation. See *Chapter 4* for details.

2.2.4. AT+QGPSEND   Turn off GNSS

When GNSS is turned on and **<fix_count>** is 0, GNSS fixes position continuously. In such a 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 the 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.
Reference	

Parameter

\<errcode\>	Integer type. Error code of operation. See *Chapter 4* for details.

2.2.5. AT+QGPSLOC   Acquire Positioning Information

The 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**
Read Command **AT+QGPSLOC?**	Response Return the positioning information in **\<latitude\>,\<longitude\>** format of ddmm.mmmmN/S,dddmm.mmmmE/W: **+QGPSLOC: \<UTC\>,\<latitude\>,\<longitude\>,\<HDOP\>,\<altitude\>,\<fix\>,\<COG\>,\<spkm\>,\<spkn\>,\<date\>,\<nsat\>** **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 configuration will not be saved.
Reference	

Parameter

\<mode\>	Integer type. Latitude and longitude display format. 0 **\<latitude\>,\<longitude\>** format: ddmm.mmmmN/S,dddmm.mmmmE/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: second. 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.mmmmN/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 to 89.99999 (Unit: degree)
	- South latitude
<longitude>	Float type. Longitude.
	If **<mode>** is 0:
	Format: dddmm.mmmmE/W (Quoted from GPGGA sentence)
	ddd 000–179 (Unit: degree)
	mm.mmmm 00.0000–59.9999 (Unit: 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 to 179.99999 (Unit: degree)
	- West longitude
<HDOP>	Float type. Horizontal precision: 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>	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. See *Chapter 4* for details.

2.2.6. AT+QGPSGNMEA Acquire NMEA Sentences

The 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="glon assnmeatype",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: (**list of supported **<NMEA_sentence>**s**)** **OK**
Write Command Acquire GGA sentences **AT+QGPSGNMEA="GGA"**	Response **+QGPSGNMEA: <GGA_sentence>** **OK** If there is any error related to ME functionality: **+CME ERROR: <errcode>**
Write Command Acquire RMC sentences **AT+QGPSGNMEA="RMC"**	Response **+QGPSGNMEA: <RMC_sentence>** **OK** If there is any error related to ME functionality: **+CME ERROR: <errcode>**
Write Command	Response

Acquire GSV sentences **AT+QGPSGNMEA="GSV"**	**+QGPSGNMEA: <GSV_sentence>** **OK** If there is any error related to ME functionality: **+CME ERROR: <errcode>**
Write Command Acquire GSA sentences **AT+QGPSGNMEA="GSA"**	Response **+QGPSGNMEA: <GSA_sentence>** **OK** If there is any error related to ME functionality: **+CME ERROR: <errcode>**
Write Command Acquire VTG sentences **AT+QGPSGNMEA="VTG"**	Response **+QGPSGNMEA: <VTG_sentence>** **OK** If there is any error related to ME functionality: **+CME ERROR: <errcode>**
Write Command Acquire GNS sentences **AT+QGPSGNMEA="GNS"**	Response **+QGPSGNMEA: <GNS_sentence>** **OK** If there is any error related to ME functionality: **+CME ERROR: <errcode>**
Maximum Response Time	300 ms
Characteristics	/
Reference	

Parameter

<GGA_sentence>	String type. GGA sentences.
<RMC_sentence>	String type. RMC sentences.
<GSV_sentence>	String type. GSV sentences.
<GSA_sentence>	String type. GSA sentences.
<VTG_sentence>	String type. VTG sentences.
<GNS_sentence>	String type. GNS sentences.
<NMEA_sentence>	String type. The supported NMEA standard sentences. "GGA" "RMC" "GSV"

	"GSA"
	"VTG"
	"GNS"
<errcode>	Integer type. Error code of operation. See *Chapter 4* for details.

2.2.7. AT+QGPSXTRA   Enable/Disable gpsOneXTRA Assistance Function

The command enables/disables gpsOneXTRA Assistance function, and the function can be activated after restarting the module.

AT+QGPSXTRA Enable/Disable gpsOneXTRA Assistance Function	
Test Command **AT+QGPSXTRA=?**	Response **+QGPSXTRA: (**list of supported **<XTRA_enable>**s**)** **OK**
Read Command **AT+QGPSXTRA?**	Response **+QGPSXTRA: <XTRA_enable>** **OK**
Write Command **AT+QGPSXTRA=<XTRA_enable>**	Response **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 configuration is saved automatically.
Reference	

Parameter

<XTRA_enable>	Integer type. Enable/disable gpsOneXTRA Assistance function.
	0 Disable
	1 Enable
<errcode>	Integer type. Error code of operation. See *Chapter 4* for details.

2.2.8. AT+QGPSXTRATIME   Inject gpsOneXTRA Time

This command injects gpsOneXTRA time to GNSS engine. Before using it, you must enable gpsOneXTRA Assistance function via **AT+QGPSXTRA=1**. After activating the function, the GNSS engine will ask for gpsOneXTRA time and assistance data file. Before injecting gpsOneXTRA data file, gpsOneXTRA time

must be injected first via this command.

AT+QGPSXTRATIME Inject gpsOneXTRA Time	
Test Command **AT+QGPSXTRATIME=?**	Response **+QGPSXTRATIME: 0,<XTRA_time>,(**list of supported **<UTC>**s**),(**list of supported **<force>**s**),<uncrtn>** **OK**
Write Command Inject gpsOneXTRA time **AT+QGPSXTRATIME=<op>,<XTRA_ti me>[,<UTC>[,<force>,<uncrtn>]]**	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.
Reference	

Parameter

<op>	Integer type. Operation type.
	0 Inject gpsOneXTRA time
<XTRA_time>	String type. Current UTC/GPS time.
	Format: YYYY/MM/DD,hh:mm:ss. e.g. "2016/01/03,15:34:50".
<UTC>	Integer type. The type of time.
	0 GPS time
	<u>1</u> UTC time
<force>	Integer type. Allows or forces GPS subsystem to accept the time injected.
	<u>0</u> Allow acceptance
	1 Force acceptance
<uncrtn>	Integer type. Uncertainty of time. Default value: 3500. Unit: millisecond. It indicates the time difference between sending a request to the SNTP server and receiving a response from the SNTP server. If the set time is less than 3.5 s, it will be counted as 3.5 s.
<errcode>	Integer type. Error code of operation. See *Chapter 4* for details.

2.2.9.   AT+QGPSXTRADATA   Inject gpsOneXTRA Data File

This command injects gpsOneXTRA assistance data file to GNSS engine. Before operating this command, you must enable gpsOneXTRA, store the valid gpsOneXTRA data file into UFS of the mudule and inject gpsOneXTRA time to GNSS engine. After operating this command successfully, gpsOneXTRA data file can be deleted from UFS file, and you can query whether the gpsOneXTRA data is injected successfully

via **AT+QGPSXTRADATA?**.

AT+QGPSXTRADATA Inject gpsOneXTRA Data File	
Test Command **AT+QGPSXTRADATA=?**	Response **+QGPSXTRADATA: <XTRA_data_filename>** **OK**
Read Command Query the status of gpsOneXTRA data file **AT+QGPSXTRADATA?**	Response **+QGPSXTRADATA: <XTRA_data_durtime>,<injected_datatime>** **OK** If there is any error related to ME functionality: **+CME ERROR: <errcode>**
Write Command Inject gpsOneXTRA data file **AT+QGPSXTRADATA=<XTRA_data_filename>**	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.
Reference	

Parameter

<XTRA_data_filename>	String type. Filename of the gpsOneXTRA data file, e.g. "UFS:xtra2.bin" or "USF:xtra3grc.bin".
<XTRA_data_durtime>	Integer type. Valid time of injected gpsOneXTRA data file. Unit: min. 0 No gpsOneXTRA file or the file is overdue 1–10080 Valid time of gpsOneXTRA file
<injected_datatime>	Starting time of the valid time of gpsOneXTRA data file. Format: YYYY/MM/DD,hh:mm:ss, e.g. 2016/01/03,15:34:50.
<errcode>	Integer type. Error code of operation. See *Chapter 4* for details.

2.2.10. AT+QCFGEXT Extended Configuration Settings

The 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	/

2.2.10.1. 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 optional 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.
Reference	

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 the module when entering or leaving the geo-fence. Unit: degree.
	Format: ±dd.dddddd. Range: -90.000000 to 90.000000.
	<longitude> The longitude of the module when entering or leaving the geo-fence. Unit: degree.
	Format: ±ddd.dddddd. Range: -180.000000 to 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 a radius. Unit: meter. Range: 0-6000000.
		When **\<shape\>** is other values, 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. See *Chapter 4* for details.

2.2.10.2. 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.
Reference	

Parameter

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

2.2.10.3. 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",<geoid>,<posWrtGeofence>** **OK** If there is any error related to ME functionality: **+CME ERROR: <errcode>**
Maximum Response Time	300 ms
Characteristics	/
Reference	

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. See *Chapter 4* for details.

3 Examples

3.1. Turn on and off the GNSS

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

```
AT+QGPS=1                          //Turn on GNSS.
OK
//After the GNSS is turned on, NMEA sentences will be output from "usbnmea" port by default.
AT+QGPSLOC?                        //Obtain positioning information.
+QGPSLOC: 061951.00,3150.7223N,11711.9293E,0.7,62.2,2,0.00,0.0,0.0,110513,09


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

3.2. Application of GNSS <NMEA_src>

When GNSS is turned on and **<NMEA_src>** is set to 1, NMEA sentences can be acquired directly via **AT+QGPSGNMEA**.

```
AT+QGPSCFG="nmeasrc",1             //Set <NMEA_src> to 1 to enable acquisition of NMEA
                                     sentences via AT+QGPSGNMEA.
OK
AT+QGPSGNMEA="GGA"                 //Acquire GGA sentences.
+QGPSGNMEA: $GPGGA,103647.0,3150.721154,N,11711.925873,E,1,02,4.7,59.8,M,-2.0,M,,*77


OK
AT+QGPSCFG="nmeasrc",0             //Set <NMEA_src> to 0 to disable acquisition of NMEA
                                     sentences via AT+QGPSGNMEA.
OK
AT+QGPSGNMEA="GGA"                 //Acquisition of NMEA sentences via AT+QGPSGNMEA
                                     is disabled, therefore GGA sentences cannot be acquired.
```

+CME ERROR: 507

3.3. Procedure of Using gpsOneXTRA Assistance Function

The examples show the procedures of using gpsOneXTRA Assistance function.

3.3.1.   Download gpsOneXTRA Files with AT+QHTTPGET

//If gpsOneXTRA Assistance is disabled, enable it via **AT+QGPSXTRA=1** and restart the mdoule, then perform the following procedures.

AT+QGPSXTRA=1   //Enable gpsOneXTRA Assistance.

OK

//The gpsOneXTRA Assistance function is activated after restarting the module.

//If gpsOneXTRA data file is valid (query via **AT+QGPSXTRADATA?**), turn on GNSS engine directly.

//If gpsOneXTRA data file is invalid (query via **AT+QGPSXTRADATA?**), then perform the following procedures.

//You can download the gpsOneXTRA data file through **AT+QHTTPGET** from URL *http://xtrapath1.izatcloud.net/xtra3grc.bin* or other URLs listed in *Chapter 1.3.1*. For more details about this command, see *document [4]*.

AT+QHTTPURL=43

CONNECT

<input_data>   //After **CONNECT** is reported, input the URLs listed in *Chapter 1.3.1*.

OK

AT+QHTTPURL?

+QHTTPURL: http://xtrapath1.izatcloud.net/xtra3grc.bin

OK

AT+QHTTPGET=60

OK

+QHTTPGET: 0,200,33298   //Requested successfully

AT+QHTTPREADFILE="UFS:xtra3grc.bin",80

OK

+QHTTPREADFILE: 0   //Downloaded successfully

AT+QGPSXTRATIME=0,"2017/11/08,15:30:30",1,1,5   //Inject gpsOneXTRA time to GNSS engine.

OK

AT+QGPSXTRADATA="UFS:xtra3grc.bin"   //Injected gpsOneXTRA data file to GNSS engine successfully.

OK

```
AT+QFDEL="UFS:xtra3grc.bin"                    //Delete gpsOneXTRA data file from UFS file.
OK
AT+QGPS=1                                       //Turn on GNSS engine.
OK
```

3.3.2. Download gpsOneXTRA Files through MCU or Browser

//If gpsOneXTRA Assistance is disabled, enable it via **AT+QGPSXTRA=1** and restart the mdoule, then perform the following procedures.

```
AT+QGPSXTRA=1                                   //Enable gpsOneXTRA Assistance.
OK
```

//The gpsOneXTRA Assistance function is activated after restarting the module.

//If gpsOneXTRA data file is valid (query via **AT+QGPSXTRADATA?**), turn on GNSS engine directly.

//If gpsOneXTRA data file is invalid (query via **AT+QGPSXTRADATA?**), then perform the following procedures.

//You can download the gpsOneXTRA data file to PC (or MCU) from URL *http://xtrapath4.izatcloud.net/xtra3grc.bin* or other URLs listed in *Chapter 1.3.2*.

```
AT+QFUPL="UFS:xtra2.bin",60831,60              //Select the gpsOneXTRA file and upload it to
                                                  the module via QCOM. For more details about this
                                                  command, see document [2]. And for more
                                                  details about QCOM tool usage and
                                                  configuration, see document [3].

OK
AT+QGPSXTRATIME=0,"2017/11/08,15:30:30",1,1,5  //Inject gpsOneXTRA time to GNSS engine.
OK
AT+QGPSXTRADATA="UFS:xtra2.bin"                //Injected gpsOneXTRA data file to GNSS engine.
OK
AT+QFDEL="UFS:xtra2.bin"                        //Delete gpsOneXTRA data file from UFS file.
OK
AT+QGPS=1                                       //Turn on GNSS engine.
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="deletegeo",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

3.5. Application of EPE NMEA Sentences Function

AT+QCFGEXT="nmea_epe",1   //Enable output of EPE NMEA sentences
OK
AT+QGPS=1   //Turn on GNSS
OK

//Outputs NMEA sentence through USB NMEA port
$PQEPE,,V,,,,,*2B   //Invalid data

//Waiting for successful GNSS positioning
$PQEPE,032707.000,A,0.7,3.00,3.58,0.1,*18   //Valid data

AT+QGPSEND   //Turn off GNSS
OK

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 2: 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	gpsOneXTRA not enabled
510	gpsOneXTRA file open failed
511	Bad CRC for XTRA data file
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 3: Related Documents

SN	Document Name	Remark
[1]	Quectel_BG96_AT_Commands_Manual	BG96 AT Commands Manual
[2]	Quectel_BG96_FILE_AT_Commands_Manual	BG96 FILE AT Commands Manual
[3]	Quectel_QCOM_User_Guide	QCOM User Guide
[4]	Quectel_BG96_HTTP(S)_AT_Commands_Manual	BG96 HTTP AT Commands Manual

Table 4: Terms and Abbreviations

Abbreviation	Description
BeiDou	BeiDou Navigation Satellite System
DOP	Dilution of Precision
Galileo	Galileo Satellite Navigation System
GGA	Global Positioning System Fix Data
GLONASS	Global Navigation Satellite System
GNS	Global Network Service
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
MCU	Micro Control Unit
ME	Mobile Equipment
MS	Mobile Station
NMEA	National Marine Electronics Association
NVRAM	Non-Volatile Random Access Memory
PC	Private Computer
PDOP	Position Dilution of Precision
RMC	Recommended Minimum Specific GNSS Data
SNR	Signal Noise Ratio
SNTP	Simple Network Time Protocol
TTFF	Time to First Fix
UART	Universal Asynchronous Receiver & Transmitter
UFS	User File Storage
URC	Unsolicited Result Code
URL	Uniform Resource Locator
USB	Universal Serial Bus
UTC	Universal Time Code
VDOP	Vertical Dilution of Precision
VTG	Course over Ground and Ground Speed