

# **BG95&BG77&BG600L Series**

## **GTP Application Note**

**LPWA Module Series**

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# About the Document

## Revision History

Version	Date	Author	Description
-	2022-04-27	Matt YE	Creation of the document
1.0	2022-07-28	Matt YE	First official release

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# 1 Introduction

Quectel BG95 series, BG77 and BG600L-M3 modules integrate GTP feature with the GNSS engine to ensure better positioning performance. The modules support both GTP 1.0 and GTP 2.0 versions.

GTP feature is a cellular positioning technology that is disabled by default. If you want to use it, please confirm whether it is supported in the current area by GTP service provider.

**NOTE**

GTP feature is supported only on specified firmware versions of the modules. Please contact Quectel Technical Support ([support@quectel.com](mailto:support@quectel.com)) for more detailed information.

## 1.1. GTP Architecture

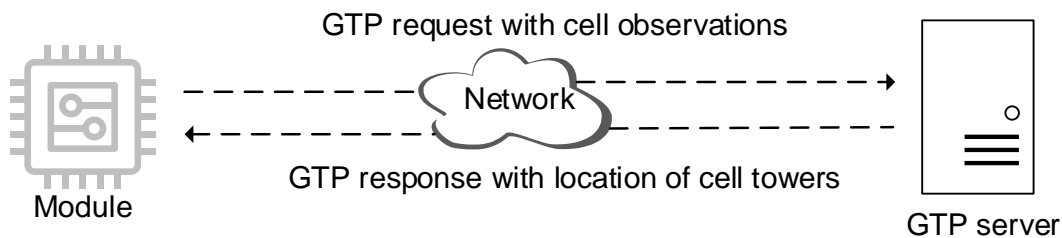


Figure 1: GTP Architecture

## 1.2. Supported GTP Versions

### GTP 1.0

- Supported RATs: GSM, LTE-M and NB-IoT
- Serving-cell only (a single registered cell ID)
- Performance varies across RATs and operators



**GTP 2.0**

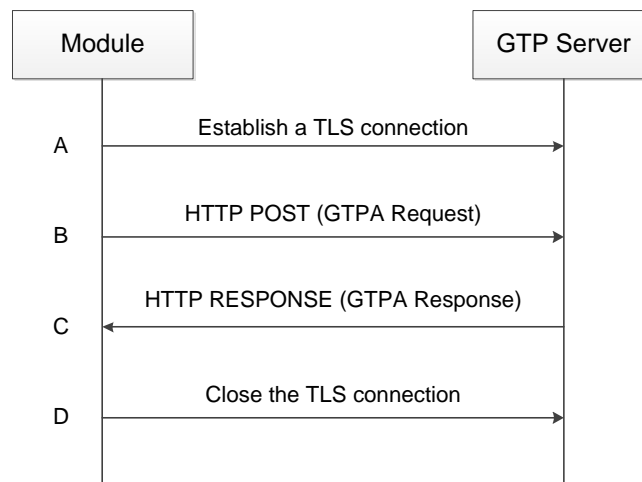
- Supported RATs: GSM, LTE-M and NB-IoT
- Multi-cell scan (across RATs and bands)
- Improved accuracy compared to GTP 1.0; uniform performance across RATs and operators

**1.3. GTP Operation**

GTP can be used alone or together with XTRA. XTRA provides predicted orbit data (GNSS assistance data) but does not provide reference position. GTP can provide an initial reference position for improved GNSS TTFF performance (similar to AGPS) compared to TTFF achieved using XTRA only. This improvement is prominent in challenging signal conditions, whereas it may be limited in a strong signal environment.

**1.3.1. GTP Operation Flow**

The following flow is triggered by **AT+QGPSONE=1,<accuracy\_level>** with XTRA disabled.

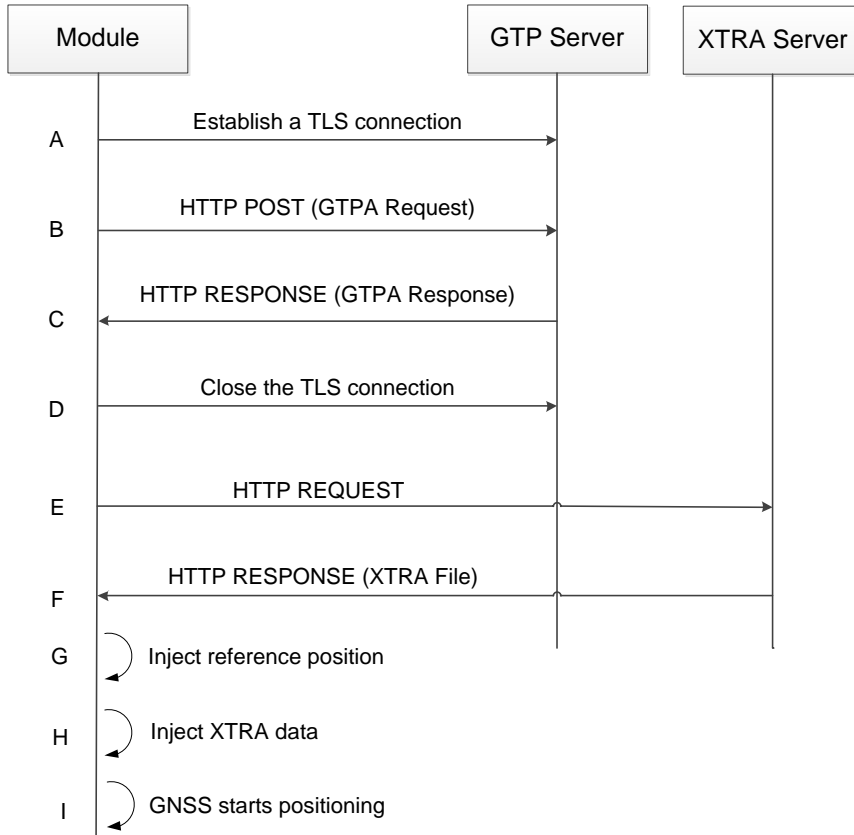


**Figure 2: GTP Operation Flow (XTRA Disabled)**

- A: The module will establish a TLS connection to the GTP server, if the currently observed cell information is not the one that is cached by the module in the last positioning.
- B: The module initiates a GTPA Request to upload the currently observed cell information, module status, etc. to the GTP server.
- C: The GTP server responds with a GTPA Response message with location information.
- D: The module closes the TLS connection.

### 1.3.2. GNSS Operation Flow with GTP and XTRA

The following flow is triggered by **AT+QGPS=1** (see *document [1]* for details) or **AT+QGPSONE=0**.



**Figure 3: GNSS Operation Flow with GTP and XTRA**

- A: The module will establish a TLS connection to the GTP server, if the currently observed cell information is not the one that is cached by the module in the last positioning.
- B: The module initiates a GTPA Request to upload the currently observed cell information, module status, etc. to the GTP server.
- C: The GTP server responds with a GTPA Response message with location information.
- D: The module closes the TLS connection.
- E: The module requests an XTRA file download.
- F: The XTRA server responds with XTRA file which includes the current GNSS assistance data.
- G: The module injects reference position to the GNSS engine.
- H: The module inject XTRA data to the GNSS engine.
- I: GNSS starts positioning.

**NOTE**

Make sure that XTRA time is synchronized from network or injected manually before executing **AT+QGPS=1** or **AT+QGPSONE=0**. See *document [1]* for more detailed information.

---

# 2 Description of GNSS AT Commands

## 2.1. AT Command Introduction

### 2.1.1. Definitions

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

### 2.1.2. AT Command Syntax

All command lines must start with **AT** or **at** and end with **<CR>**. Information responses and result codes always start and end with a carriage return character and a line feed character: **<CR><LF><response><CR><LF>**. In tables presenting commands and responses throughout this document, only the commands and responses are presented, and **<CR>** and **<LF>** are deliberately omitted.

**Table 1: Types of AT Commands**

Command Type	Syntax	Description
Test Command	<b>AT+&lt;cmd&gt;=?</b>	Test the existence of the corresponding command and return information about the type, value, or range of its parameter.
Read Command	<b>AT+&lt;cmd&gt;?</b>	Check the current parameter value of the corresponding command.
Write Command	<b>AT+&lt;cmd&gt;=&lt;p1&gt;[,&lt;p2&gt;[,&lt;p3&gt;[...]]]</b>	Set user-definable parameter value.
Execution Command	<b>AT+&lt;cmd&gt;</b>	Return a specific information parameter or perform a specific action.

## 2.2. Declaration of AT Command Examples

The AT command examples in this document are provided to help you learn about how to use the AT commands introduced herein. The examples, however, should not be taken as Quectel's recommendation or suggestions about how to design a program flow or what status to set the module into. Sometimes multiple examples may be provided for one AT command. However, this does not mean that there is a correlation among these examples and that they should be executed in a given sequence.

## 2.3. AT Commands Description

### 2.3.1. AT+QGPSCFG="gtp\_fun" Enable/Disable GTP Feature

This command enables or disables GTP feature.

<b>AT+QGPSCFG="gtp_fun" Enable/Disable GTP Feature</b>	
Test Command <b>AT+QGPSCFG=?</b>	Response ... <b>+QGPSCFG: "gtp_fun",(list of supported &lt;mode&gt;s)</b> ... <b>OK</b>
Write Command <b>AT+QGPSCFG="gtp_fun"[,&lt;mode&gt;]</b>	Response If the optional parameter is omitted, query the current setting: <b>+QGPSCFG: "gtp_fun",&lt;mode&gt;</b>  <b>OK</b>  If the optional parameter is specified, enable/disable GTP feature: <b>OK</b>  If there is any error: <b>+CME ERROR: &lt;errcode&gt;</b>
Maximum Response Time	300 ms
Characteristics	The command takes effect after the module is rebooted. The configurations are saved automatically.

### Parameter

<b>&lt;mode&gt;</b>	Integer type. Enable/Disable GTP feature. 0 Disable 1 Enable
---------------------	--

**<errcode>** Integer type. Error code. See **Chapter 3** for details.

### 2.3.2. AT+QGPSONE Attempt a Single Position Fix

This command attempts a single position fix and obtains a single location information. Before executing the command, deactivate GNSS, if it is active.

AT+QGPSONE Attempt a Single Position Fix	
Test Command <b>AT+QGPSONE=?</b>	Response <b>+QGPSONE:</b> (list of supported<mode>s),(range of supported <accuracy_level>s),(range of supported <timeout>s)  <b>OK</b>
Write Command <b>AT+QGPSONE=&lt;mode&gt;,&lt;accuracy_level&gt;[,&lt;timeout&gt;]</b>	Response <b>OK</b>  If the location information is not successfully obtained: <b>+QGPSURC: "single_shot",,,,,,</b>  If the location information is successfully obtained: <b>+QGPSURC: "single_shot",&lt;UTC&gt;,&lt;latitude&gt;,&lt;longitude&gt;,&lt;altitude&gt;,&lt;accuracy&gt;</b>  If there is any error: <b>+CME ERROR: &lt;errcode&gt;</b>
Maximum Response Time	300 ms
Characteristics	The command takes effect immediately. The configurations are not saved.

#### Parameter

<b>&lt;mode&gt;</b>	Integer type. Requested location mode. URC will be reported once the location information is successfully obtained, or after <b>&lt;timeout&gt;</b> . 0 Use GNSS for positioning 1 Use GTP for positioning
<b>&lt;accuracy_level&gt;</b>	Integer type. Desired accuracy level acceptable for fix computation. URC <b>+QGPSURC: "single_shot",,,,,,</b> will be output when the accuracy of the acquired position is greater than the set threshold or the timeout for single position fix exceeds the value of <b>&lt;timeout&gt;</b> . When <b>&lt;mode&gt;=0</b> : 0 No accuracy threshold

	1 Low accuracy threshold: 1000 m
	2 Medium accuracy threshold: 500 m
	3 High accuracy threshold: 100 m
	When <b>&lt;mode&gt;</b> =1:
	0 No accuracy threshold (GTP 2.0)
	1 Low accuracy threshold (GTP 1.0): 1000 m
	2 Medium accuracy threshold (GTP 2.0): 500 m
	3 High accuracy threshold (GTP 2.0): 100 m
<b>&lt;timeout&gt;</b>	Integer type. Timeout of single position fix. Range: 20–600. Default value: 60. Unit: second.
<b>&lt;UTC&gt;</b>	String type. Current UTC time. Format: yyyy/mm/dd hh:mm:ss.
<b>&lt;latitude&gt;</b>	Float type. Latitude. Format: ±dd.dddddd. Range: -90.000000 – 90.000000
<b>&lt;longitude&gt;</b>	Float type. Longitude. Format: ±ddd.dddddd. Range: -180.000000 – 180.000000
<b>&lt;altitude&gt;</b>	Float type. Height above sea level, correct to one decimal place. Unit: meter.
<b>&lt;accuracy&gt;</b>	Float type. Positioning accuracy. Unit: meter.
<b>&lt;errcode&gt;</b>	Error code. See <b>Chapter 3</b> for details.

**NOTE**

1. **AT+QGPSONE=0,<accuracy\_level>** also triggers XTRA file downloading. To use XTRA, make sure that XTRA time is injected first. See **document [1]** for more information of XTRA.
2. To get location information via GTP, enable GTP feature with **AT+QGPSCFG="gtp\_fun",1** first.
3. To get location information via GNSS **ONLY**, disable GTP feature with **AT+QGPSCFG="gtp\_fun",0**.
4. One module only can access to the GTP server up to 255 times per day.
5. If the currently observed cell information is the same one with that cached by the module in the last positioning, the module starts positioning with the cached location information directly, without accessing to GTP server. Deleting the cached information with **AT+QGPSDEL=0** can make the module access GTP server, but this will cause GTP failure. In this case, execute **AT+CFUN=0** and then **AT+CFUN=1** to avoid GTP failure issue. This is usually used for testing.

**Example**

```

AT+QGPSCFG="gtp_fun",1 //Enable GTP feature. The command takes effect after the module is
                        rebooted.
OK
AT+QGPSONE=1,0,60      //Use GTP 2.0 for positioning and no accuracy threshold, and set
                        <timeout> to 60 seconds.
OK
+QGPSURC: "single_shot",,49.183300,-123.104631,0.0,434.7
AT+QGPSONE=0,3        //Use GNSS for positioning and high accuracy threshold, and default
    
```

<timeout> is 60 seconds.

OK

+QGPSURC: "single\_shot",2022/02/24 05:50:49,49.187322,-123.108171,1.5,8.0



# 3 Examples

## 3.1. GTP Operation

```

AT+QGPSCFG="gtp_fun",1 //Enable GTP feature. The command takes effect after the module is
                        rebooted.
OK
AT+QGPSONE=1,1,60 //Use GTP 1.0 for positioning, set a low accuracy threshold of 1000
                  meters, and set <timeout> to 60 seconds.
OK
+QGPSURC: "single_shot",,25.076315,121.574840,170.0,513.2
    
```

## 3.2. GNSS Operation with GTP and XTRA

```

AT+QGPSCFG="gtp_fun",1 //Enable GTP feature. The command takes effect after the module is
                        rebooted.
OK
AT+QGPSXTRA=1 //Enable XTRA feature. The command takes effect after the module is
              rebooted.
OK
//Reboot the module.
AT+QGPSXTRATIME?
+QGPSXTRATIME: "2022/07/22,08:07:59" //If XTRA time is not returned, inject the time manually.
OK
AT+QGPSONE=0,3,60 //Use GNSS for positioning, set a high accuracy threshold of 100 meters,
                  and set <timeout> to 60 seconds.
OK
+QGPSURC: "XTRA_DL",0 //The XTRA file is downloaded successfully.
+QGPSURC: "single_shot",2022/07/22 08:07:12,25.075385,121.575904,13.8,26.9
    
```

# 4 Summary of Error Codes

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

**Table 2: Summary of Error Codes**

<b>&lt;errcode&gt;</b>	<b>Description</b>
501	Invalid parameter
502	Operation is not supported
503	GNSS subsystem is busy
504	Session is ongoing
505	Session is inactive
506	Operation timeout
507	Functionality is disabled
508	Time information error
509	XTRA is disabled
510	XTRA 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 does not exist

---

518	Sync time failed
519	XTRA file does not exist
520	XTRA file is being downloaded
521	XTRA file is valid
522	GNSS is working
523	Time injection error
524	XTRA file is invalid
525	GTP is disabled
549	Unknown error

---

# 5 Appendix References

**Table 3: Related Document**

Document Name
[1] Quectel_BG95&BG77&BG600L_Series_GNSS_Application_Note

**Table 4: Terms and Abbreviations**

Abbreviation	Description
AGPS	Assisted Global Positioning System
CRC	Cyclic Redundancy Check
GNSS	Global Navigation Satellite System
GSM	Global System for Mobile Communications
GTP	Global Terrestrial Positioning
GTPA	GTP Assistance
HTTP	Hyper Text Transfer Protocol
IoT	Internet of Things
NB-IoT	Narrowband IoT (Internet of Things)
RAT	Radio Access Technology
TLS	Transport Layer Security
TTFF	Time to First Fix
URC	Unsolicited Result Code
UTC	Universal Time Coordinated
XTRA	Auxiliary Positioning Technology Provided by Qualcomm