# EC2x&EG2x&EG9x&EM05 Series

# QuecLocator Application Note

**LTE Standard Module Series**

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# About the Document

## Revision History

| Version | Date | Author | Description |
|---|---|---|---|
| 1.0 | 2018-09-17 | Slark WANG | First official release |
| 2.0 | 2023-07-05 | Slark WANG/ Water WANG | 1. Updated the applicable modules:<br>● Added EG21-G, EG25-G, EG21-GL and EG25-GL.<br>● Updated EC20 R2.1 to EC20-CE.<br>● Deleted EC20 R2.0.<br>2. Deleted QuecLocator overview.<br>3. Deleted AT+QLOCCFG and AT+QCELLLOC.<br>4. Updated the introduction (Chapter 1).<br>5. Added QuecLocator authorization (Chapter 2).<br>6. Added AT+QLBSCFG, AT+QLBS and AT+QLBSEX (Chapters 3.3 & 3.4 & 3.5).<br>7. Updated the example (Chapter 4).<br>8. Updated summary of error codes (Chapter 6). |

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# 1 Introduction

This document is an application note for all AT commands related to QuecLocator® on Quectel LTE Standard EC2x, EG2x, EG9x family and EM05 series modules.

QuecLocator® is an efficient positioning technology developed by Quectel. By integrating the cellular network information, it boosts the stand-alone GNSS performance, especially in challenging environments, such as urban canyons, indoors, parking garages, areas under overpasses, or in case of a blocked or intermittent GNSS signal. For more information, visit https://iot.quectel.com/doc_getStart.html#QuecLocator.

## 1.1. Applicable Modules

**Table 1: Applicable Modules**

| Module Family | Module |
|---|---|
| EC2x | EC20-CE |
| | EC21 Series |
| | EC25 Series |
| EG2x | EG21-G |
| | EG25-G |
| | EG21-GL |
| | EG25-GL |
| EG9x | EG91 Series |
| | EG95 Series |
| - | EM05 Series |

# 2 QuecLocator® Authentication

To use the QuecLocator service, an authorization token is needed for identity authentication. The auth token remains valid after module rebooting or power-off. It is needed to execute **AT+QLBSCFG="token"** to confirm whether a token has already been configured when you use the service for the first time; if not, please input one. The concrete steps are illustrated in the figure below.

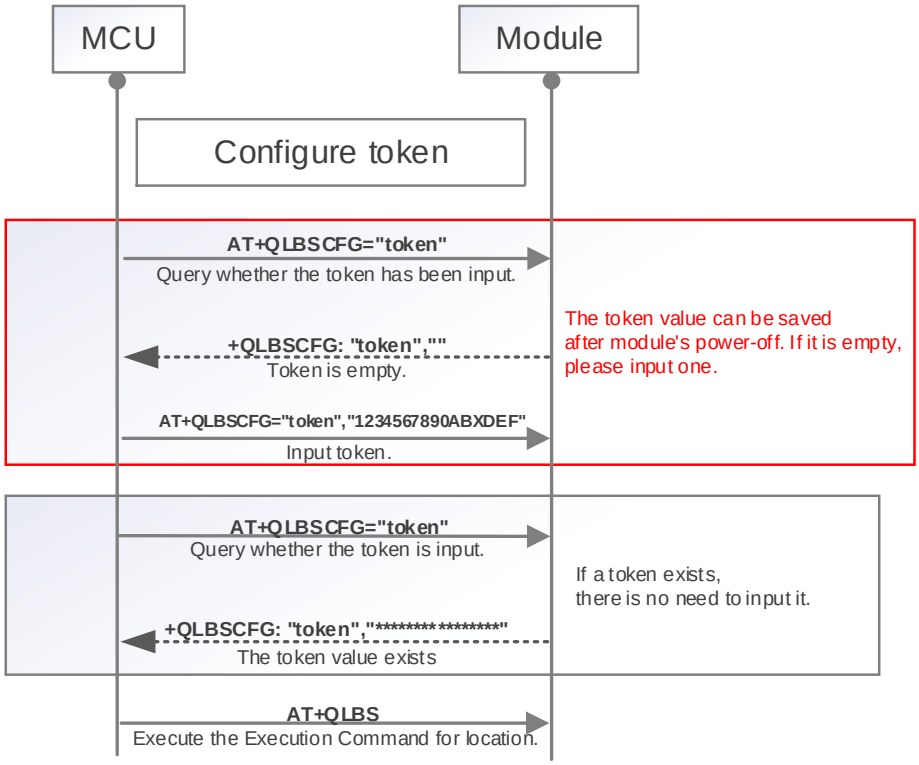


**Figure 1: QuecLocator® Auth Token Configuration**

**NOTE**

Please contact Quectel Technical Support to apply for the token value.

# 3 Description of AT Commands

## 3.1. AT Command Introduction

### 3.1.1. 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 to its previous value or the default settings, unless otherwise specified.
- **Underline** Default setting of a parameter.

### 3.1.2. 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 2: Types of AT Commands**

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

## 3.2. Declaration of AT Command Examples

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

## 3.3. AT+QLBSCFG Configure Parameters for QuecLocator

| AT+QLBSCFG Configure Parameters for QuecLocator | |
|---|---|
| Test Command<br>**AT+QLBSCFG=?** | Response<br>**+QLBSCFG: "asynch",(**list of supported **<asynch_mode>**s**)**<br>**+QLBSCFG: "timeout",(**range of supported **<response_time>**s**)**<br>**+QLBSCFG: "server",<server_name>**<br>**+QLBSCFG: "token",<token_value>**<br>**+QLBSCFG: "timeupdate",(**list of supported **<update_mode>**s**)**<br>**+QLBSCFG: "withtime",(**list of supported **<time_mode>**s**)**<br>**+QLBSCFG: "latorder",(**list of supported **<order_mode>**s**)**<br>**+QLBSCFG: "contextid",(**range of supported **<contextID>**s**)**<br><br>**OK** |
| Read Command<br>**AT+QLBSCFG?** | Response<br>**+QLBSCFG: "asynch",<asynch_mode>**<br>**+QLBSCFG: "timeout",<response_time>**<br>**+QLBSCFG: "server",<server_name>**<br>**+QLBSCFG: "token",<token_value>**<br>**+QLBSCFG: "timeupdate",<update_mode>**<br>**+QLBSCFG: "withtime",<time_mode>**<br>**+QLBSCFG: "latorder",<order_mode>**<br>**+QLBSCFG: "contextid",<contextID>**<br><br>**OK** |
| Write Command<br>**AT+QLBSCFG="asynch"[,<asynch_mode>]** | Response<br>If the optional parameter is omitted, query the current setting:<br>**+QLBSCFG: "asynch",<asynch_mode>**<br><br>**OK** |

| | |
|---|---|
| | If the optional parameter is specified, set the execution mode of **AT+QLBS**:<br>**OK**<br><br>If there is an error related to ME functionality:<br>**+CME ERROR: <err>** |
| Write Command<br>**AT+QLBSCFG="timeout"[,<response_time>]** | Response<br>If the optional parameter is omitted, query the current setting:<br>**+QLBSCFG: "timeout",<response_time>**<br><br>**OK**<br><br>If the optional parameter is specified, set the maximum response time of **AT+QLBS**:<br>**OK**<br><br>If there is an error related to ME functionality:<br>**+CME ERROR: <err>** |
| Write Command<br>**AT+QLBSCFG="server"[,<server_name>]** | Response<br>If the optional parameter is omitted, query the current setting:<br>**+QLBSCFG: "server",<server_name>**<br><br>**OK**<br><br>If the optional parameter is specified, set the domain name/IP address and port number of the server providing the positioning service:<br>**OK**<br><br>If there is an error related to ME functionality:<br>**+CME ERROR: <err>** |
| Write Command<br>**AT+QLBSCFG="token"[,<token_value>]** | Response<br>If the optional parameter is omitted, and **<token_value>** is set, query the current setting:<br>**+QLBSCFG: "token","****************"**<br><br>**OK**<br><br>If the optional parameter is omitted, and **<token_value>** is not set, query the current setting:<br>**+QLBSCFG: "token",""**<br><br>**OK** |

| | |
|---|---|
| | If the optional parameter is specified, configure the token value for server authentication:<br>**OK**<br><br>If there is an error related to ME functionality:<br>**+CME ERROR: <err>** |
| Write Command<br>**AT+QLBSCFG="timeupdate"[,<update_mode>]** | Response<br>If the optional parameter is omitted, query the current setting:<br>**+QLBSCFG: "timeupdate",<update_mode>**<br><br>**OK**<br><br>If the optional parameter is specified, set whether to update to the RTC:<br>**OK**<br><br>If there is an error related to ME functionality:<br>**+CME ERROR: <err>** |
| Write Command<br>**AT+QLBSCFG="withtime"[,<time_mode>]** | Response<br>If the optional parameter is omitted, query the current setting:<br>**+QLBSCFG: "withtime",<time_mode>**<br><br>**OK**<br><br>If the optional parameter is specified, set whether to output the time when calling **AT+QLBS**:<br>**OK**<br><br>If there is an error related to ME functionality:<br>**+CME ERROR: <err>** |
| Write Command<br>**AT+QLBSCFG="latorder"[,<order_mode>]** | Response<br>If the optional parameter is omitted, query the current setting:<br>**+QLBSCFG: "latorder",<order_mode>**<br><br>**OK**<br><br>If the optional parameter is specified, set the latitude and longitude output order of the location results:<br>**OK**<br><br>If there is an error related to ME functionality:<br>**+CME ERROR: <err>** |
| Write Command<br>**AT+QLBSCFG="contextid"[,<context** | Response<br>If the optional parameter is omitted, query the current setting: |

| | |
|---|---|
| **ID>]** | **+QLBSCFG: "contextid",<contextID>**<br><br>**OK**<br><br>If the optional parameter is specified, set the number of PDP context ID:<br>**OK**<br><br>If there is an error related to ME functionality:<br>**+CME ERROR: <err>** |
| Maximum Response Time | 300 ms |
| Characteristics | The commands take effect immediately.<br>The configurations are not saved except those of **<asynch_mode>**and **<token_value>**. |

## Parameter

| | |
|---|---|
| **<asynch_mode>** | Integer type. Execution mode of **AT+QLBS**. In different modes, the response of the command will be different.<br>0 Synchronous mode<br>1 Asynchronous mode |
| **<response_time>** | Integer type. The maximum response time of **AT+QLBS**. If there is no response from the server within **<response_time>**, the command will be timeout.<br>Range: 10–120. Default: 60. Unit: second. |
| **<server_name>** | String type. Domain/IP address and server port. Format: "domain/IP address:port" (e.g., "www.queclocator.com:80"). Server port range: 1–65535. Default server: "www.queclocator.com:80". |
| **<token_value>** | String type. Authentication token value. Length: 16 bytes. |
| **<update_mode>** | Integer type. Whether to update the system time, which is acquired when accessing the server of QuecLocator, to RTC.<br>0 Do not update the time to RTC<br>1 Update the time to RTC |
| **<time_mode>** | Integer type. Whether to output the time when calling **AT+QLBS**.<br>0 Do not output the time<br>1 Output the time |
| **<order_mode>** | Integer type. Configure the latitude and longitude output order of the location results.<br>0 Longitude output before latitude like this:<br>**+QLBS: <loc_result>,<longitude>,<latitude>[,<time>]**<br>1 Latitude output before longitude like this:<br>**+QLBS: <loc_result>,<latitude>,<longitude>[,<time>]**<br>See ***Chapter 3.4*** for details of the parameters. |
| **<contextID>** | Integer type. PDP context ID. Range: 1–16. Default value: 1. |

## 3.4. AT+QLBS Get Location Information by QuecLocator

| AT+QLBS Get Location Information by QuecLocator | |
|---|---|
| Test Command<br>**AT+QLBS=?** | Response<br>**OK** |
| Execution Command<br>**AT+QLBS** | Response<br>If the module is in synchronous (**<asynch_mode>**=0) mode and the positioning succeeds:<br>**+QLBS: <loc_result>,<longitude>,<latitude>[,<time>]**<br>or<br>**+QLBS: <loc_result>,<latitude>,<longitude>[,<time>]**<br><br>**OK**<br><br>If the module is in synchronous mode and the positioning fails:<br>**+QLBS: <loc_result>**<br><br>**OK**<br><br>If the module is in asynchronous mode (**<asynch_mode>**=1) and the positioning succeeds:<br>**OK**<br><br>**+QLBS: <loc_result>,<longitude>,<latitude>[,<time>]**<br>or<br>**+QLBS: <loc_result>,<latitude>,<longitude>[,<time>]**<br><br>If the module is in asynchronous mode and the positioning fails:<br>**OK**<br><br>**+QLBS: <loc_result>**<br><br>If there is an error related to ME functionality:<br>**+CME ERROR: <err>** |
| Write Command<br>**AT+QLBS=<MAC_num>,<AP_MAC1>,<rssi1>,<AP_MAC2>,<rssi2>[,…]** | Response<br>If the module is in synchronous mode and the positioning succeeds:<br>**+QLBS: <loc_result>,<longitude>,<latitude>[,<time>]**<br>or<br>**+QLBS: <loc_result>,<latitude>,<longitude>[,<time>]** |

| | |
|---|---|
| | **OK**<br><br>If the module is in synchronous mode and the positioning fails:<br>**+QLBS: <loc_result>**<br><br>**OK**<br><br>If the module is in asynchronous mode and the positioning succeeds:<br>**OK**<br><br>**+QLBS: <loc_result>,<longitude>,<latitude>[,<time>]**<br>or<br>**+QLBS: <loc_result>,<latitude>,<longitude>[,<time>]**<br><br>If the module is in asynchronous mode and the positioning fails:<br>**OK**<br><br>**+QLBS: <loc_result>**<br><br>If there is an error related to ME functionality:<br>**+CME ERROR: <err>** |
| Maximum Response Time | Depends on **<response_time>** in **AT+QLBSCFG="timeout",<response_time>**. |
| Characteristics | The command takes effect immediately.<br>The configurations are not saved. |

## Parameter

| | |
|---|---|
| **<MAC_num>** | Integer type. The number of inputted Wi-Fi MAC addresses. Range: 2–6. |
| **<AP_MACX>** | String type. MAC addresses of nearby Wi-Fi hotspots. |
| **<rssiX>** | Integer type. Received signal strength indicator. The value should be less than zero. |
| **<latitude>** | Float type. The latitude of the location information. This value is accurate to six decimal places. Range: -90.000000–90.000000. |
| **<longitude>** | Float type. The longitude of the location information. This value is accurate to six decimal places, and the range is from -180.000000 to 180.000000. |
| **<time>** | String type. The date and time obtained from HTTP header. |
| **<loc_result>** | Integer type. Positioning result.<br>0 Positioning succeeded<br>Other values Positioning failed (See ***Chapter 6*** for more information.) |
| **<err>** | Error code. See ***Chapter 6*** for more information. |

## 3.5. AT+QLBSEX Input the Cell Information and Get Location Information by QuecLocator

| AT+QLBSEX Input the Cell information and Get Location Information by QuecLocator | |
|---|---|
| Test Command<br>**AT+QLBSEX=?** | Response<br>**OK** |
| Write Command<br>**AT+QLBSEX=<cell_num>,<radio_type>,<MCC>,<MNC>,<LAC>,<cellID>,<signal>,<timead>,<BCCH>,<BSIC>,<uarfcndl>,<PSC>,<TAC>,<RSRQ>,<PCI>,<EARFCN>,[,…]** | Response<br>If the module is in synchronous mode and the positioning succeeds:<br>**+QLBS: <loc_result>,<longitude>,<latitude>[,<time>]**<br>or<br>**+QLBS: <loc_result>,<latitude>,<longitude>[,<time>]**<br><br>**OK**<br><br>If the module is in synchronous mode and the positioning fails:<br>**+QLBS: <loc_result>**<br><br>**OK**<br><br>If the module is in asynchronous mode and the positioning succeeds:<br>**OK**<br><br>**+QLBS: <loc_result>,<longitude>,<latitude>[,<time>]**<br>or<br>**+QLBS: <loc_result>,<latitude>,<longitude>[,<time>]**<br><br>If the module is in asynchronous mode and the positioning fails:<br>**OK**<br><br>**+QLBS: <loc_result>**<br><br>If there is an error related to ME functionality:<br>**+CME ERROR: <err>** |
| Maximum Response Time | Depends on **<response_time>**. |
| Characteristics | The command takes effect immediately.<br>The configurations are not saved. |

## Parameter

| | |
|---|---|
| **<cell_num>** | Integer type. The number of inputted physical cell ID. Range: 1–5. |
| **<radio_type>** | Integer type. Radio access technology.<br>1 GSM<br>2 WCDMA<br>3 LTE |
| **<MCC>** | Integer type. Mobile country code (the first part of the PLMN code). |
| **<MNC>** | Integer type. Mobile network code (the second part of the PLMN code). |
| **<LAC>** | Integer type. Location area identification. |
| **<cellID>** | Integer type. The physical cell ID that has been locked. |
| **<signal>** | Integer type. Signal intensity. |
| **<BCCH>** | Integer type. Broadcast control channel. |
| **<BSIC>** | Integer type. Base station identity code, used for GSM. Range: 0–255. |
| **<uarfcndl>** | Integer type. UTRA absolute radio frequency channel number, used for WCDMA. Range: 0–65535. |
| **<PSC>** | Integer type. Primary scrambling code, used for WCDMA. Range: 0–65535. |
| **<TAC>** | Integer type. Tracking area code, used for LTE. Range: 0–65535. |
| **<RSRQ>** | Integer type. The reference signal received quality threshold, used for LTE. Range: 0–65535. |
| **<PCI>** | Integer type. Physical cell identifier, used for LTE. Range: 0–65535. |
| **<EARFCN>** | Integer type. E-UTRAN absolute radio frequency channel number, used for LTE. Range: 0–65535. |

# 4 Example

```
//Step 1: Configure and activate the PDP context.
AT+QICSGP=1,1,"UNIWAP","","",1          //Configure PDP context 1, APN is “UNIWAP” for
OK                                      China Unicom.
AT+QIACT=1                              //Activate PDP context 1.
OK                                      //Activated successfully.
AT+QIACT?                               //Query the state of PDP context.
+QIACT: 1,1,1,"10.7.157.1"

OK
AT+QLBSCFG="contextid",1                //Set the PDP context ID as 1. The PDP context
OK                                      must be activated first.
AT+QLBSCFG="contextid"                  //Query the PDP context ID.
+ QLBSCFG: "contextid",1

OK
AT+QLBCFG="timeout",10                  //Configure the timeout value.
OK
AT+QLBSCFG="timeout"                    //Query the current timeout value.
+ QLBSCFG: "timeout",10

OK
AT+QLBSCFG="token","1234567812345678"   //Configure the token value.
OK
AT+QLBSCFG="token"                      //Query the current token state.
+QLBSCFG: "token","****************"

OK
AT+QLBSCFG="server","47.74.213.211:80"  //Configure the server address and port
OK                                      information.
AT+QLBSCFG="server"                     //Query the current server address and port
+ QLBSCFG: "server","47.74.213.211:80"  information.

OK
//Step 2: Get the location information by QuecLocator.
AT+QLBS                                 //Get the serving cell location.
+QLBS: 0,117.115517,31.821774
OK
```

```
AT+QLBS=6,"44:6a:2e:11:d7:d1",-30,"44:6a:2e:11:d7:c2",-39,"44:6a:2e:11:d6:e1",-
59,"44:6a:2e:11:d6:e2",-76,"44:6a:2e:11:d6:e0",-81,"44:6a:2e:11:d7:d1",-30
+QLBS: 0,117.126633,31.800074
AT+QLBSEX=1,3,460,00,0,0,-95,0,0,0,0,0,0,0,121,1300
+QLBS: 0,117.115486,31.821793

OK
```

# 5 Error Handling

## 5.1. Executing QuecLocator AT Command Fails

If an "**+CME ERROR: <err>**" response is received from the module, after executing QuecLocator AT commands, check the following:

- Ensure that the SIM/USIM card is inserted,
- Verify if "**+CPIN: READY**" was returned after executing **AT+CPIN?**.

## 5.2. PDP Activation Fails

If PDP context activation with **AT+QIACT** fails, check the following:

1. Query whether the PS domain is attached or not with **AT+CGATT?**. If not, execute **AT+CGATT=1** to attach PS domain.

2. Query the network registration status with **AT+CGREG?** and make sure the PS domain is registered.

3. Query the PDP context parameters with **AT+QICSGP** and make sure the APN of the specified PDP context is set correctly.

4. Make sure the specified PDP context ID is neither used by PPP nor activated by **AT+CGACT**.

If all above configurations are correct, but activating PDP context by **AT+QIACT** still fails, please reboot the module to resolve this issue. After booting the module, please check the configurations mentioned above at least three times and each time at an interval of 10 minutes to avoid frequently rebooting the module.

## 5.3. Error Response of AT+QLBS

If "**+CME ERROR: <err>**" is returned after executing **AT+QLBS**, retry the command. If it fails again, deactivate the PDP context with **AT+QIDEACT** command, and then try again.

# 6 Summary of Error Codes

**<err>** indicates an error related to mobile equipment or network. The details about **<err>** are described in the following table.

**Table 3: Summary of Error Codes**

| Code of <err> | Description of Error Codes |
|---|---|
| 10000 | Location failed. |
| 10001 | Illegal IMEI number. |
| 10002 | Token does not exist. |
| 10003 | The number of devices using the same token exceeds the limit. |
| 10004 | Times of positioning initiated by the same device in one day exceeds the limit. |
| 10005 | Total times of positioning using the same token exceeds the limit. |
| 10006 | Token expired. |
| 10007 | IMEI number is not accepted by the server. |
| 10008 | Times of positioning using the same token within one day exceeds the limit. |
| 10009 | Times of positioning using the same token within a cycle exceeds the limit. |

**NOTE**

If QuecLocator returns any HTTP error code, please refer to ***document [4]*** for detailed descriptions of the error codes.

# 7 Appendix References

**Table 4: Related Documents**

| Document Name |
|---|
| [1] Quectel_EC2x&EG9x&EG2x-G&EM05_Series_AT_Commands_Manual |
| [2] Quectel_EC2x&EG2x&EG9x&EM05_Series_QCFG_AT_Commands_Manual |
| [3] Quectel_EC2x&EG2x&EG9x&EM05_Series_TCP(IP)_Application_Note |
| [4] Quectel_EC2x&EG2x&EG9x&EM05_Series _HTTP(S)_Application_Note |

**Table 5: Terms and Abbreviations**

| Abbreviation | Description |
|---|---|
| AP | Access Point |
| APN | Access Point Name |
| E-UTRAN | Evolved Universal Terrestrial Radio Access |
| GNSS | Global Navigation Satellite System |
| GSM | Global System for Mobile Communications |
| HTTP | Hyper Text Transfer Protocol |
| ID | Identification |
| IMEI | International Mobile Equipment Identity |
| IP | Internet Protocol |
| LTE | Long Term Evolution |
| MAC | Media Access Control |
| PDP | Packet Data Protocol |

| | |
|---|---|
| PPP | Point-to-Point Protocol |
| QoS | Quality of Service |
| RTC | Real-Time Clock |
| UTRA | Universal Terrestrial Radio Access |
| WCDMA | Wideband Code Division Multiple Access |