EG060K&Ex120K&EM06xK Series

FOTA Upgrade Guide

LTE-A Module Series

Version: 1.5

Date: 2025-06-23

Status: Released

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About the Document

Revision History

Version	Date	Author	Description
-	2023-03-21	Monan TIAN	Creation of the document
1.0	2023-05-18	Monan TIAN	First official release
1.1	2023-12-27	Shengya HUANG	Added the note about AT+QFOTAPID to switch the channel (Chapter 3.3.3).
1.2	2024-06-12	Monan TIAN	1. Added the applicable module EM061K-GL. 2. Updated the note about AT+QFOTADL=<file_name>: added the note 2 and updated the note 3 (Chapter 3.3.3).
1.3	2024-09-03	Monan TIAN	1. Optimized the FOTA firmware upgrade flowchart to distinguish between the user side and the Quectel side (Figure 1). 2. Optimized the description of the FOTA firmware upgrade steps and added relevant notes to distinguish between the user side and the Quectel side (Chapter 2). 3. Updated the declaration of AT command examples (Chapter 3.2). 4. Optimized the explanation of the <serverURL> parameter and updated the URL address and related instructions in the command example (Chapter 3.3.1). 5. Optimized the explanation of the <HTTP_server_URL> parameter and updated the URL address and related instructions in the command example (Chapter 3.3.2).
1.4	2024-09-25	Monan TIAN	1. Updated the document name from "Application Note" to "Upgrade Guide". 2. Added the chapter of FOTA implementation and user responsibility (Chapter 1.1). 3. Updated the description of AT+QFOTADL=<file_name> (Chapter 3.3.3).
1.5	2025-06-23	Monan TIAN	1. Removed the applicable module EG065K series. 2. Added error code 513 and its description (Chapter 5).

Contents

Table Index

1 Introduction

Quectel LTE-A EG060K, Ex120K and EM06xK family modules support FOTA (Firmware Over-The-Air) function to upgrade the firmware of partitions such as modem, system, boot, sbl, tz and so on. With this function, you (the user) can upgrade the module firmware to a new version or revert the firmware to an old version.

1.1. FOTA Implementation and User Responsibility

Quectel follows industry best practices with regard to firmware updates for its modules by enabling users to offer FOTA updates. Please note that Quectel does not have the ability to unilaterally push updates to users' devices. Quectel hands full control over the FOTA process to users. In the process, Quectel solely provides the updated firmware but cannot initiate FOTA updates on users' devices.

Users can determine when to push the update to the Quectel modules using the FOTA mechanism by configuring corresponding parameters for the update that the users host on their own infrastructures.

1.2. Applicable Modules

Table 1: Applicable Modules

Module Family	Module
-	EG060K Series
Ex120K	EG120K Series
	EM120K-GL
EM06xK	EM060K Series
	EM061K-GL

2 Firmware Upgrade Procedure Over FOTA

The following chart illustrates the firmware upgrade procedure via FOTA when the firmware package is stored on an FTP/HTTP(S) server.

Figure 1: Firmware Upgrade Procedure via FOTA
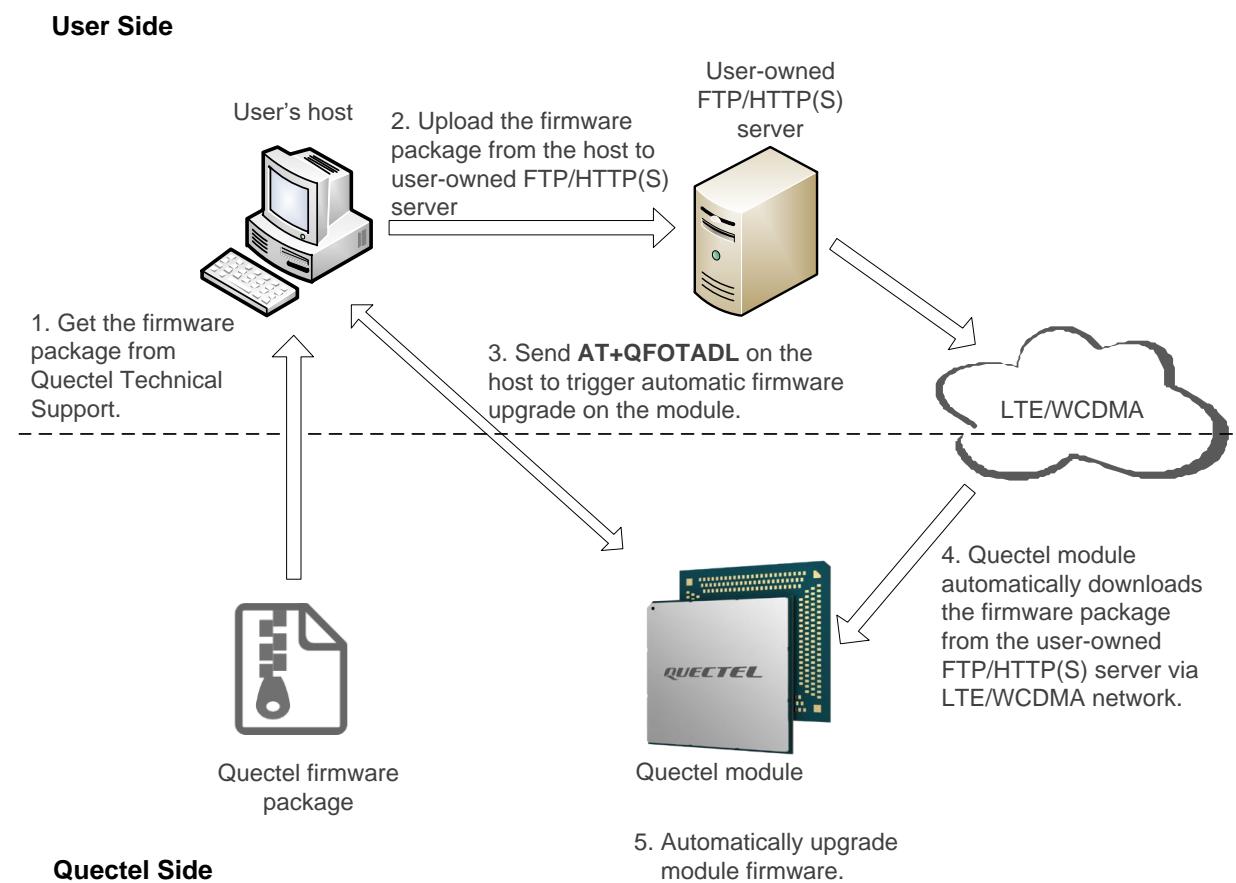
As shown in the above figure, the following steps need to be performed to upgrade the firmware when the firmware package is stored on an FTP/HTTP(S) server:

Step 1: Get the firmware package from Quectel Technical Support (see **Chapter 2.1** for details).

Step 2: Upload the firmware package from the host to your FTP/HTTP(S) server (see **Chapter 2.2** for details).

Step 3: Execute **AT+QFOTADL** on the host to trigger automatic firmware upgrade on the module (see *Chapter 2.3* for details).

Step 4: The module automatically downloads the firmware package from your FTP/HTTP(S) server via LTE/WCDMA network.

Step 5: The module internally runs the updating program to automatically upgrade the module firmware.

NOTE

You are responsible for providing and managing the FTP/HTTP(S) server for the firmware upgrade. Quectel does not supply the server or assist with its setup.

2.1. Get Firmware Package

Before firmware upgrading, check the original firmware version name with **ATI** and confirm the target firmware version, and then send the two firmware versions to Quectel Technical Support to obtain the corresponding firmware package.

2.2. Upload Firmware Package to FTP/HTTP(S) Server

Step 1: Please set up an FTP/HTTP(S) server before using the FOTA function. (Quectel does not provide such servers.)

Step 2: After completing the server setup, upload the firmware package to your server and save the storage path.

2.3. Execute AT Command to Upgrade the Firmware

After uploading the firmware package to the FTP/HTTP(S) server, execute **AT+QFOTADL** on the host to initiate the automatic over-the-air download and upgrade of module firmware package. For more details about the FOTA AT commands, see *Chapter 3.3*.

NOTE

The module supports firmware upgrades via both the FTP/HTTP(s) server and the local file system. For more information on the firmware upgrades via the local file system, see *Chapter 3.3.3*.

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3 Description of FOTA 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 its previous value or the default settings, unless otherwise specified.
- **<u>Underline</u>**   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 learn about the use of the AT commands introduced herein. The examples, however, should not be taken as Quectel's recommendations 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, or that they should be executed in a given sequence. The URLs, domain names, IP addresses, usernames/accounts, and passwords (if any) in the AT command examples are provided for illustrative and explanatory purposes only, and they should be modified to reflect your actual usage and specific needs.

3.3. AT+QFOTADL   Firmware Upgrade via FOTA

This command enables automatic firmware upgrade via FOTA. After executing the corresponding command, the module will automatically download or load the firmware package from FTP/HTTP(S) server or local file system. After the package is successfully downloaded or loaded, the module will automatically upgrade the firmware and then reboot.

AT+QFOTADL Firmware Upgrade via FOTA	
Test Command **AT+QFOTADL=?**	Response **OK**
Maximum Response Time	300 ms

3.3.1. AT+QFOTADL=<FTP_URL>   Upgrade Firmware over FTP Server

If the firmware package is stored on an FTP server, execute **AT+QFOTADL=<FTP_URL>** to initiate automatic firmware upgrade via FOTA. The module will download the package from the FTP server over the air, and then reboot and upgrade the firmware automatically.

AT+QFOTADL=<FTP_URL> Upgrade Firmware over FTP Server	
Write Command **AT+QFOTADL=<FTP_URL>**	Response **OK** **+QIND: "FOTA","FTPSTART"** **+QIND: "FOTA","FTPEND",<FTP_err>** **+QIND: "FOTA","START"** **+QIND: "FOTA","UPDATING",<percent>** **+QIND: "FOTA","UPDATING",<percent>** **...** **+QIND: "FOTA","END",<err>**

	If there is any error:
	ERROR
Maximum Response Time	300 ms
Characteristics	-

Parameter

<FTP_URL>	String type. The URL that the firmware package stored on the FTP server. The maximum length is 512; Unit: byte. It should be started with "ftp://". For example: "ftp://**<username>**:**<password>**@**<serverURL>**:**<port>**/**<file_path>**".
<username>	String type. The username for authentication.
<password>	String type. The password for authentication.
<serverURL>	String type. The address of the FTP server owned and operated by you.
<port>	Integer type. The port of the FTP server. Range: 1–65535. Default: 21.
<file_path>	String type. The file path on FTP server.
<FTP_err>	Integer type. The FTP error code.
	0 Downloaded the firmware package from the FTP server successfully.
	Others Failed to download the firmware package from the FTP server. See *Chapter 5* for details.
<percent>	Integer type. The upgrade progress in percentage. Range: 0–100.
<err>	Integer type. Error code of upgrading.
	0 Upgraded the firmware successfully
	Others Failed to upgrade the firmware. See *Chapter 5* for more details.

Example

//You can perform the firmware upgrade after storing the firmware package on your FTP server. "ftp://test:test@192.0.2.2:21/Jun/update-v12-to-v13.zip" is used as an example URL below. (The URL is provided for illustrative purpose only. Please replace it with a valid URL that corresponds to your FTP server and firmware package.) Execute the following command to initiate automatic firmware upgrade via FOTA. The module downloads the firmware package and upgrades the firmware automatically.
AT+QFOTADL="ftp://test:test@192.0.2.2:21/Jun/update-v12-to-v13.zip"
OK

+QIND: "FOTA","FTPSTART"
+QIND: "FOTA","FTPEND",0   //Finish downloading the firmware package from the FTP server.

//The module reboots automatically and the USB port is re-initialized. If the current port is USB port, MCU should close and reopen it. After the module is rebooted, the first URC should be reported within 90 seconds. Otherwise, it means an unknown error occurs.
+QIND: "FOTA","START"
+QIND: "FOTA","UPDATING",1

```
+QIND: "FOTA","UPDATING",2
...
+QIND: "FOTA","UPDATING",100
+QIND: "FOTA","END",0        //The module automatically restarts to complete the FOTA upgrade.
```

3.3.2. AT+QFOTADL=<HTTP_URL> Upgrade Firmware over HTTP(S) Server

If the firmware package is stored on an HTTP(S) server, execute **AT+QFOTADL=<HTTP_URL>** to initiate automatic firmware upgrade via FOTA. The module will download the package from the HTTP(S) server over the air, and then reboot and upgrade the firmware automatically.

AT+QFOTADL=<HTTP_URL> Upgrade Firmware over HTTP(S) Server	
Write Command **AT+QFOTADL=<HTTP_URL>**	Response **OK** **+QIND: "FOTA","HTTPSTART"** **+QIND: "FOTA","HTTPEND",<HTTP_err>** **+QIND: "FOTA","START"** **+QIND: "FOTA","UPDATING",<percent>** **+QIND: "FOTA","UPDATING",<percent>** ... **+QIND: "FOTA","END",<err>** If there is any error: **ERROR**
Maximum Response Time	300 ms
Characteristics	-

Parameter

<HTTP_URL>	String type. The URL that the firmware package stored on the HTTP(S) server. Maximum length: 512. Unit: byte. It should be started with "http(s)://". For example: "http(s)://**<HTTP_server_URL>:<HTTP_port>/<HTTP_file_path>**".
<HTTP_server_URL>	String type. The IP address or domain name of the HTTP(S) server owned and operated by you.
<HTTP_port>	Integer type. The port of the HTTP(S) server. Range: 1–65535. Default: 80.
<HTTP_file_path>	String type. The file path on the HTTP(S) server.
<HTTP_err>	Integer type. The HTTP(S) error code.
	0 Downloaded the firmware package from the HTTP(S) server successfully

	Others	Failed to download the firmware package from the HTTP(S) server. See **Chapter 5** for details.
<percent>		Integer type. The upgrade progress in percentage. Range: 0–100.
<err>		Integer type. Error code of upgrading.
	0	Upgraded the firmware successfully
	Others	Failed to upgrade the firmware. See **Chapter 5** for more details.

Example

//You can perform the firmware upgrade after storing the firmware package on your HTTP(S) server. "http://www.example.com:100/update.zip" is used as an example URL below. (The URL is provided for illustrative purpose only. Please replace it with a valid URL that corresponds to your HTTP(S) server and firmware package.) Execute the following command to initiate automatic firmware upgrade via FOTA. The module downloads the firmware package and upgrades the firmware automatically.
AT+QFOTADL="http://www.example.com:100/update.zip"
OK

+QIND: "FOTA","HTTPSTART"
+QIND: "FOTA","HTTPEND",0   //Finish downloading the firmware package from the HTTP(S) server.

//The module reboots automatically and the USB port is re-initialized. If the current port is USB port, MCU should close and reopen it. After the module is rebooted, the first URC should be reported within 90 seconds. Otherwise, it means an unknown error occurs.
+QIND: "FOTA","START"
+QIND: "FOTA","UPDATING",1
+QIND: "FOTA","UPDATING",2
...
+QIND: "FOTA","UPDATING",100
+QIND: "FOTA","END",0   //The module automatically restarts to complete the FOTA upgrade.

3.3.3. AT+QFOTADL=<file_name>   Upgrade Firmware over Local File System

If the firmware package has already been stored in the module's file system, execute **AT+QFOTADL=<file_name>** to initiate automatic firmware upgrade via FOTA. Then the module will load the package from the local file system, and then reboot and upgrade the firmware automatically.

AT+QFOTADL=<file_name> Upgrade Firmware over Local File System	
Write Command **AT+QFOTADL=<file_name>**	Response **OK** **+QIND: "FOTA","START"** **+QIND: "FOTA","UPDATING",<percent>** **+QIND: "FOTA","UPDATING",<percent>**

	...
	+QIND: "FOTA","END",<err>
	If there is any error:
	ERROR
Maximum Response Time	300 ms
Characteristics	-

Parameter

<file_name>	String type. The path of firmware package on the local file system. The maximum length: 512; Unit: byte.
	It should be started with "/cache/ufs/" in UFS.
<percent>	Integer type. The upgrade progress in percentage. Range: 0–100.
<err>	Integer type. Error code of upgrading.
	0 Upgraded the firmware successfully
	Others Failed to upgrade the firmware. See *Chapter 5* for more details.

NOTE

1. Before using this command, make sure that the firmware package is stored in the module. You can upload the package to the module through **AT+QFUPL**. For details of **AT+QFUPL**, see *document [1]*.
2. Please disconnect the data call of the host first before proceeding with the FOTA upgrade, because when the host performs data call with the module, it causes the internal FOTA upgrade program of the module to be unable to perform data call.
3. The first APN is used for data call during FOTA upgrade by default. If the data call with the first APN is occupied by any program of the module, the module cannot use this APN to perform other data call at the same time. Therefore, the module should perform FOTA upgrade after the program disconnects the data call with this APN or after you execute **AT+QFOTAPID** to switch the channel.
4. If Verizon certification uses the first APN to perform data call, it is suggested to use **AT+QFOTAPID** to switch channels for FOTA upgrade.
5. For details of **AT+QFOTAPID**, please contact Quectel Technical Support.

Example

//Upgrade firmware when the firmware package is stored on the local file system.
AT+QFOTADL="/cache/ufs/update-v12-to-v13.zip"
OK

//The module reboots automatically and the USB port is re-initialized. If the current port is USB port, MCU should close and reopen it. After the module is rebooted, the first URC should be reported within 90

seconds. Otherwise, it means an unknown error occurs.

```
+QIND: "FOTA","START"
+QIND: "FOTA","UPDATING",1
+QIND: "FOTA","UPDATING",2
...
+QIND: "FOTA","UPDATING",100
+QIND: "FOTA","END",0          //The module automatically restart to complete the FOTA upgrade.
```

4 Exception Handling and Precautions

4.1. Exception Handling

To improve the upgrade success rate, the module will set the upgrade flag before starting the upgrade. When an error is reported during the upgrade, the module will automatically restart. After the upgrade flag is found, the module will continue to upgrade. If the upgrade fails for five consecutive times, the upgrade is a complete failure, and the module will delete the flag, exit and try to start the module normally. The upgrade interface is as follows:

```
+QIND: "FOTA","START"
+QIND: "FOTA","UPDATING",20
+QIND: "FOTA","END",<err>
...
//The module restarts automatically
...
+QIND: "FOTA","START"
+QIND: "FOTA","UPDATING",20
+QIND: "FOTA","UPDATING",30
...
+QIND: "FOTA","END",0
```

NOTE

The consecutive upgrade times is only valid when an upgrade error is reported, while there is no limit to the number of upgrades in the event of an abnormal power failure. If an abnormal power failure occurs during module upgrade process, the upgrade can also continue after the module is restarted. After the upgrade is successful, the upgrade flag will also be deleted.

4.2. Precautions

1. After **AT+QFOTADL** is executed, the host receives URC **+QIND: "FOTA","START"** which means that the upgrade begins, and URC **+QIND: "FOTA","END",0** means the upgrade is completed. After the upgrade, the module automatically restarts and enters normal mode. Do not power off the module during the upgrade.
2. If the host does not receive any URC within 4 minutes during the upgrade process, you can restart the module.
3. It is recommended to set up a flag to mark the firmware upgrade task and remove it after the upgrade is completed successfully.

NOTE

It is recommended not to power off the module during the FOTA upgrade process.

5 Summary of Error Codes

This chapter introduces the error codes related to Quectel modules or network. The details about **<FTP_err>**, **<HTTP_err>** and **<err>** are described in the following tables.

Table 3: Summary of <FTP_err> Codes

Numerical <FTP_err>	Character <FTP_err>
0	Downloaded the firmware package from the FTP server successfully
601	FTP Unknown error

Table 4: Summary of <HTTP_err> Codes

Numerical <HTTP_err>	Character <HTTP_err>
0	Downloaded the firmware package from the HTTP(S) server successfully
701	Failed to download the firmware package from the HTTP(S) server

Table 5: Summary of <err> Codes

Numerical <err>	Character <err>
0	Upgraded the firmware successfully
502	The upgrade process exits due to some unknown errors or exceptions. The system will retry five times.
504	Incorrect zip format
505	The project or the version of the package does not match
510	The firmware package file does not match the source package file of the module, and needs to be checked if it is wrong.
511	The file system has no enough space for upgrade.

513	Signature verification failed
520–530 540–546	Firmware upgrading failed. The module will reboot and retry to upgrade the firmware until the upgrade is successful.
550	The firmware package is too large

6 Appendix References

Table 6: Related Document

Document Name
[1] Quectel_EG06xK&Ex120K&EM06xK_Series_FILE_Application_Note

Table 7: Terms and Abbreviations

Abbreviation	Description
FOTA	Firmware Over-The-Air
FTP	File Transfer Protocol
GPRS	General Packet Radio Service
GSM	Global System for Mobile Communications
HTTP(S)	Hypertext Transfer Protocol (Secure/over Secure Socket Layer)
IP	Internet Protocol
LTE	(Long-Term Evolution) a 4G mobile communications standard
MCU	Microcontroller Unit
TA	Terminal Adapter
UFS	User File System
URC	Unsolicited Result Code
URL	Uniform/Universal Resource Locator
USB	Universal Serial Bus
WCDMA	Wideband Code Division Multiple Access