EG06xK&Ex120K&EM060K Series DFOTA Application Note

LTE-A Module Series

Version: 1.0.0

Date: 2021-12-16

Status: Preliminary

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About the Document

History

Revision	Date	Author	Description
-	2021-12-16	Monan TIAN	Creation of the document
1.0.0	2021-12-16	Monan TIAN	Preliminary

Content

Table Index

1 Introduction

Quectel EG06xK, Ex120K and EM060K series modules support DFOTA (Delta Firmware Upgrade Over the Air) function, which allows users to upgrade the firmware of the module over the air. It can upgrade the firmware to a target version, and upgrade back to the current version as well.

A delta firmware package, which only contains differences between the current and the target firmware version to be updated, must be obtained before DFOTA. In this way, the amount of data transmitted and the time taken can be reduced.

1.1. Applicable Modules

Table 1: Applicable Modules

Module Series	Module
EG06xK	EG065K-NA
	EG060K-EA
Ex120K	EM120K-GL
	EG120K-EA
EM060K	EM060K-GL

2 Firmware Upgrade Procedure via DFOTA

The following chart illustrates the firmware upgrade procedure via DFOTA.

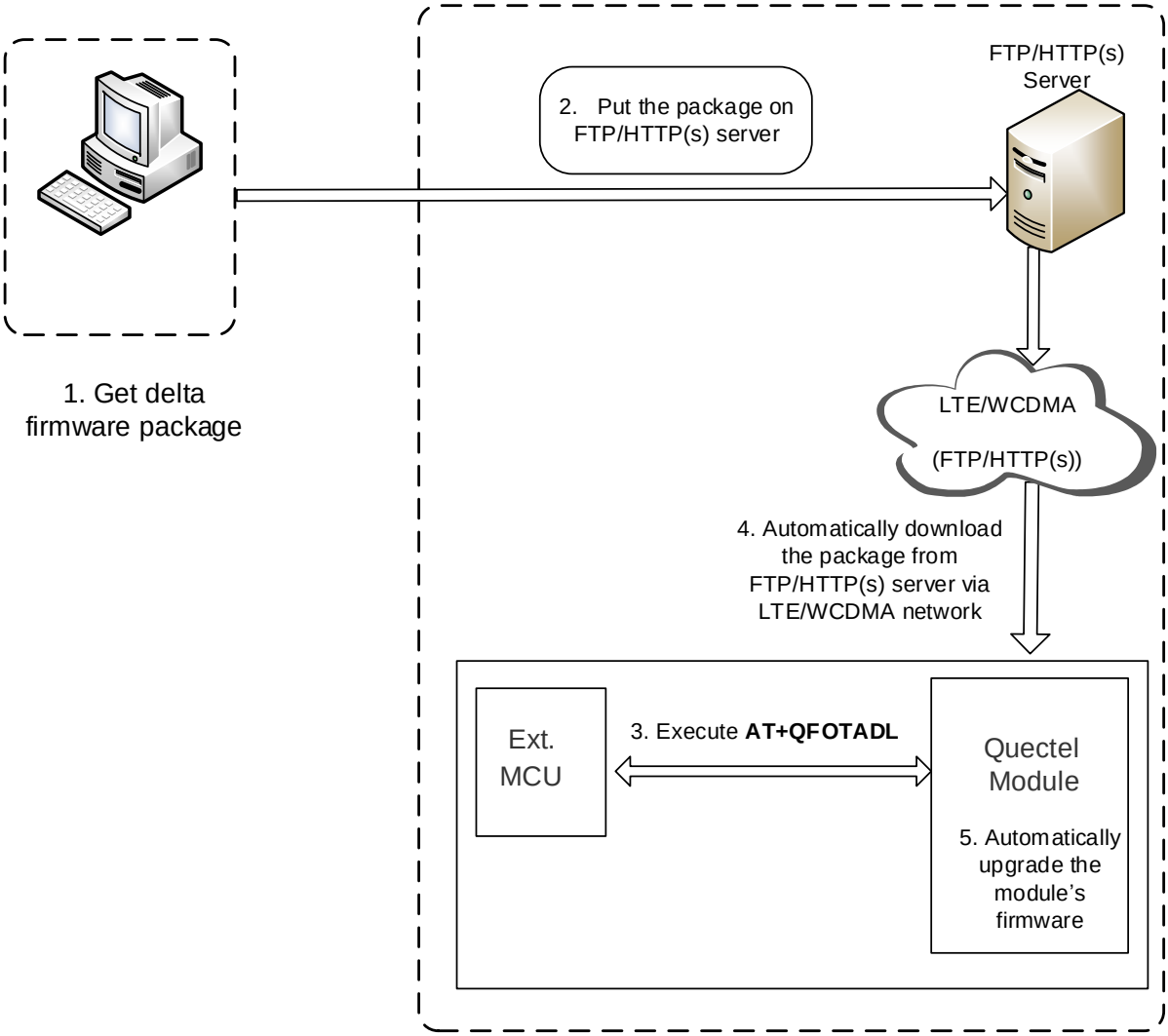

Figure 1: Firmware Upgrade Procedure via DFOTA

As shown in the figure above, you only need to perform the following steps to upgrade the firmware via DFOTA.

Step 1: Get the delta firmware package from Quectel.
Step 2: Put the delta firmware on FTP/HTTP(S) server.
Step 3: Execute **AT+QFOTADL**.
Step 4: the module will automatically download the package from FTP/HTTP(S) server via LTE/WCDMA network.
Step 5: The module's firmware will be automatically upgraded.

2.1. Get Delta Firmware Package

Before upgrading, get the original firmware version with **ATI** and confirm the target firmware version, and then send the two firmware versions to Quectel or the module supplier to get a delta firmware package.

2.2. Put Delta Package on FTP/HTTP(S) Server

Step 1: Set up an an FTP/HTTP(S) server before using DFOTA function. (Quectel does not provide such servers).
Step 2: Put the delta firmware package on the server, and record the FTP/HTTP(S) path. The module will get the delta package from the path after executing corresponding AT command. For more details, see ***Chapter 3***.

2.3. Execute AT Command to Upgrade the Firmware

After putting the delta firmware package on the FTP/HTTP(S) server, you need to execute **AT+QFOTADL**. Then the module will download the delta firmware package from the FTP/HTTP(S) server over the air and upgrade the firmware automatically. For more details, see ***Chapter 3***.

3 Description of DFOTA AT Commands

AT+QFOTADL enables automatic firmware upgrade for module via DFOTA. After executing the command, the module will automatically download the package from FTP/HTTP(S) server. After the package is downloaded successfully, the module will reboot automatically and then enter the recovery mode for firmware upgrade. Before entering the recovery mode, the module will check the upgrade package version first. If the version file in the package mismatches with the module, an error code (505) will be reported via URC. and the incorrect upgrade package will be deleted.

After the package is correct, and the firmware upgrade successfully, the module will reboot and work normally. If it fails to upgrade the firmware, the module will reboot automatically, and enter the recovery mode and retry to upgrade five times at most. If upgrade is still unsuccessful after five retries, the module will stop firmware upgrade and restore to the original version.

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 corresponding Write Command and return information about the type, value, or range of its parameter.
Read Command	**AT+<cmd>?**	Check the current parameter value of a corresponding Write 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 how to use the AT commands introduced herein. 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 Command Description

3.3.1. AT+QFOTADL Upgrade Firmware via DFOTA

AT+QFOTADL Upgrade Firmware via DOFTA	
Test Command **AT+QFOTADL=?**	Response **OK**
Maximum Response Time	/
Characteristics	/

3.3.1.1. AT+QFOTADL=<ftpURL> Upgrade Firmware over FTP Server

If the delta firmware package is stored on an FTP server, execute **AT+QFOTADL=<ftpURL>** to enable automatic firmware upgrade via DFOTA. Then the module will download the delta package from the FTP

server over the air and upgrade the firmware automatically.

AT+QFOTADL=<ftpURL> Upgrade Firmware over FTP Server	
Write Command **AT+QFOTADL=<ftpURL>**	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

<ftpURL>	String type. The URL that the delta firmware package stored on the FTP server. The maximum length is 100 bytes. It should be started with "FTP://", for example: "FTP://<user_name>:<password>@<serverURL>:<port>/<file_path>". <username> String type. The user name for authentication. The maximum length is 50 bytes. <password> String type. The password for authentication. The maximum length is 50 bytes. <serverURL> String type. The IP address or domain name of the FTP server. The maximum length is 50 bytes. <port> Integer type. The port of the FTP server. Default value: 21. Range: 1–65535. <file_path> String type. The file path name on FTP server. The maximum length is 50 bytes.
<ftp_err>	Integer type. The FTP error codes. 0 means upgraded successfully. For more details, see ***Chapter 4***.
<percent>	Integer type. The upgrade progress in percentage.
<err>	0 means upgraded successfully. Any other value means an error. For more details, see ***Chapter 4***.

Example

//Upgrade firmware when delta firmware package is stored on an FTP server.

//The FTP server address is "ftp://test:test@124.74.41.170:21/Jun/update-v01-to-v02.zip".

//Execute **AT+QFOTADL** to enable automatic firmware upgrade via DFOTA, and then the module will start to download the delta package and upgrade firmware automatically.

```
AT+QFOTADL="ftp://test:test@124.74.41.170:21/Jun/update-v01-to-v02.zip"
OK

+QIND: "FOTA","FTPSTART"          //Start to download the delta package from FTP server.
+QIND: "FOTA","FTPEND",0          //Finish downloading the delta package.
```

//The module will reboot automatically and the USB port will be re-initialized. If the current port is USB port, MCU should close and reopen it.

//After rebooting the module, it is recommended to wait 90 seconds for the first URC reporting. If there is no URC reported, which means it is an unknown error.

```
+QIND: "FOTA","START"             //Start to upgrade the firmware.
+QIND: "FOTA","UPDATING",1
+QIND: "FOTA","UPDATING",2
...
+QIND: "FOTA","UPDATING",100
+QIND: "FOTA","END",0             //Finish upgrading the firmware.
```

3.3.1.2. AT+QFOTADL=<httpURL> Upgrade Firmware over HTTP(S) Server

If the delta firmware package is stored on an HTTP(S) server, execute **AT+QFOTADL=<httpRUL>** to enable automatic firmware upgrade via DFOTA. Then the module will download the delta package from the HTTP(S) server over the air and upgrade the firmware automatically.

AT+QFOTADL=<httpURL> Upgrade Firmware over HTTP(S) Server	
Write Command **AT+QFOTADL=<httpURL>**	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

<httpURL>	String format. The URL that the delta firmware package stored on the HTTP(S) server. The max length is 100 bytes. 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. <http_port> Integer type. The port of the HTTP(S) server. Default value: 80. Range: 1–65535. <http_file_path> String type. The file name in HTTP server.
<http_err>	Integer type. The HTTP(S) error codes. 0 means upgraded successfully. For more details, see ***Chapter 4***.
<percent>	Integer type. The upgrade progress in percentage.
<err>	0 means upgraded successfully. Any other value means an error. For more details, see ***Chapter 4***.

Example

//Upgrade firmware when delta firmware package is stored on an HTTP server.

//The HTTP server address is "http://www.quectel.com:100/update-v01-to-v02.zip".

//Execute **AT+QFOTADL** to enable automatic firmware upgrade via DFOTA, and then the module will start to download the delta package and upgrade firmware automatically.

```
AT+QFOTADL="http://www.quectel.com:100/update-v01-to-v02.zip"
OK

+QIND: "FOTA","HTTPSTART"      //Start to download the delta package from the HTTP server.
+QIND: "FOTA","HTTPEND",0      //Finish downloading the delta package.
```

//The module will reboot automatically and the USB port will be re-initialized. If the current port is USB port, MCU should close and reopen it.

//After rebooting the module, it is recommended to wait 90 seconds for the first URC reporting. If there is no URC reported, which means it is an unknown error.

```
+QIND: "FOTA","START"          //Start to upgrade the firmware.
+QIND: "FOTA","UPDATING",1
+QIND: "FOTA","UPDATING",2
```

```
...
+QIND: "FOTA","UPDATING",100
+QIND: "FOTA","END",0                //Finish upgrading the firmware.
```

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

If the delta firmware package has already been stored in the module's file system, execute **AT+QFOTADL=<file_name>** to enable automatic firmware upgrade via DFOTA.

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>** Or **ERROR**
Maximum Response Time	
Characteristics	

Parameter

<file_name>	String type. The path that the delta firmware package stores in the local file system. The maximum length is 100 bytes. It should be started with "/usrdata/cache/ufs/" in UFS.
<percent>	Integer type. The upgrade progress in percentage.
<err>	0 means upgraded successfully. Any other value means an error. For more details, see ***Chapter 4***.

Example

```
//Upgrade firmware when delta firmware package is stored on local file system.

AT+QFOTADL="/usrdata/cache/ufs/update-v01-to-v02.zip"
OK

//The module will reboot automatically and the USB port will be re-initialized. If the current port is USB port,
MCU should close and reopen it.
```

```
//After rebooting the module, it is recommended to wait 90 seconds for the first URC reporting. If there is no URC reported, which means it is an unknown error.
+QIND: "FOTA","START"                //Start to upgrade the firmware.
+QIND: "FOTA","UPDATING",1
+QIND: "FOTA","UPDATING",2
...
+QIND: "FOTA","UPDATING",100
+QIND: "FOTA","END",0                //Finish upgrading the firmware.
```

4 Summary of Error Codes

This chapter introduces the error code related to mobile equipment or network. The details about **<ftp_err>, <http_err>** and **<err>** are described in the following tables.

Table 3: Summary of <ftp_err> Codes

<ftp_err>	Meaning
0	Successful FTP download operation
601	FTP Unknown error

Table 4: Summary of <http_err> Codes

<http_err>	Meaning
0	HTTP(S) download operation successful
701	HTTP(S) unknown error

Table 5: Summary of <err> Codes

<err>	Meaning
0	Successful DFOTA upgrade
502	The upgrade process exits with some unpredictable errors, the module will retry five times at most
504	Something wrong with the upgrade package format
505	Something wrong with the upgrade package file. The version file in the upgrade package mismatches with the module
510	The patch does not match the source file in the module, need to check whether the delta firmware package is wrong
511	The file system has no enough space for upgrading
520~530 540~546	Firmware upgrading failed.

5 Appendix References

Table 6: Related Documents

Document Name
[1] Quectel_EG06xK&Ex120K&EM060K_Series_AT_Commands_Manual

Table 7: Terms and Abbreviations

Abbreviation	Description
DFOTA	Delta Firmware Upgrade Over the Air
FTP	File Transfer Protocol
HTTP	Hyper Text Transport Protocol
HTTP(S)	Hyper Text Transport Protocol Secure
LTE	Long Term Evolution
MCU	Microcontroller Unit
UFS	User File System
URL	Uniform Resource Locator
WCDMA	Wideband Code Division Multiple Access