

EC2x&EG9x&EM05 DFOTA

User Guide

LTE Module Series

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About the Document

History

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Contents

About the Document.....	2
Contents	3
Table Index.....	4
1 Introduction	5
2 Firmware Upgrade Procedure via DFOTA.....	6
2.1. Get Delta Firmware Package.....	7
2.2. Put Delta Package on FTP/HTTP(S) Server	7
2.3. Execute AT Command to Upgrade the Firmware	7
3 Description of DFOTA AT Commands.....	8
3.1. AT+QFOTADL=<ftpURL> Upgrade Firmware When Delta Package is Stored on FTP Server	8
3.2. AT+QFOTADL=<httpURL> Upgrade Firmware When Delta Package is Stored on HTTP(S) Server	10
3.3. AT+QFOTADL=<file_name> Upgrade Firmware When Delta Package is Stored on Local File System	11
4 Abnormalities and Important Note.....	13
4.1. Abnormalities	13
4.1.1. Wrong Delta Firmware Package	13
4.1.2. Failure of Firmware Upgrade	13
4.2. Important Note	14
5 Summary of error Codes.....	15
6 Appendix A References.....	16

Table Index

TABLE 1: SUMMARY OF <FTP_ERR>, <HTTP_ERR> AND <ERR> CODES	15
TABLE 2: RELATED DOCUMENTS	16
TABLE 3: TERMS AND ABBREVIATIONS	16

1 Introduction

Quectel EC2x&EG9x&EM05 modules support DFOTA (Delta Firmware Upgrade Over-the-air) function, which allows customers to upgrade the firmware over the air. It can upgrade the firmware to a new version, and revert to the old version as well.

Before firmware upgrading, customers only need to prepare the firmware package which contains the differences between the original and target firmware versions. This reduces the amount of data transmitted and accelerates the speed of firmware upgrade.

This document is applicable to following Quectel modules:

- EC2x (including EC25, EC21, EC20 R2.0 and EC20 R2.1)
- EG9x (including EG91 and EG95)
- EM05

2 Firmware Upgrade Procedure via DFOTA

The following chart illustrates the firmware upgrade procedure via DFOTA.

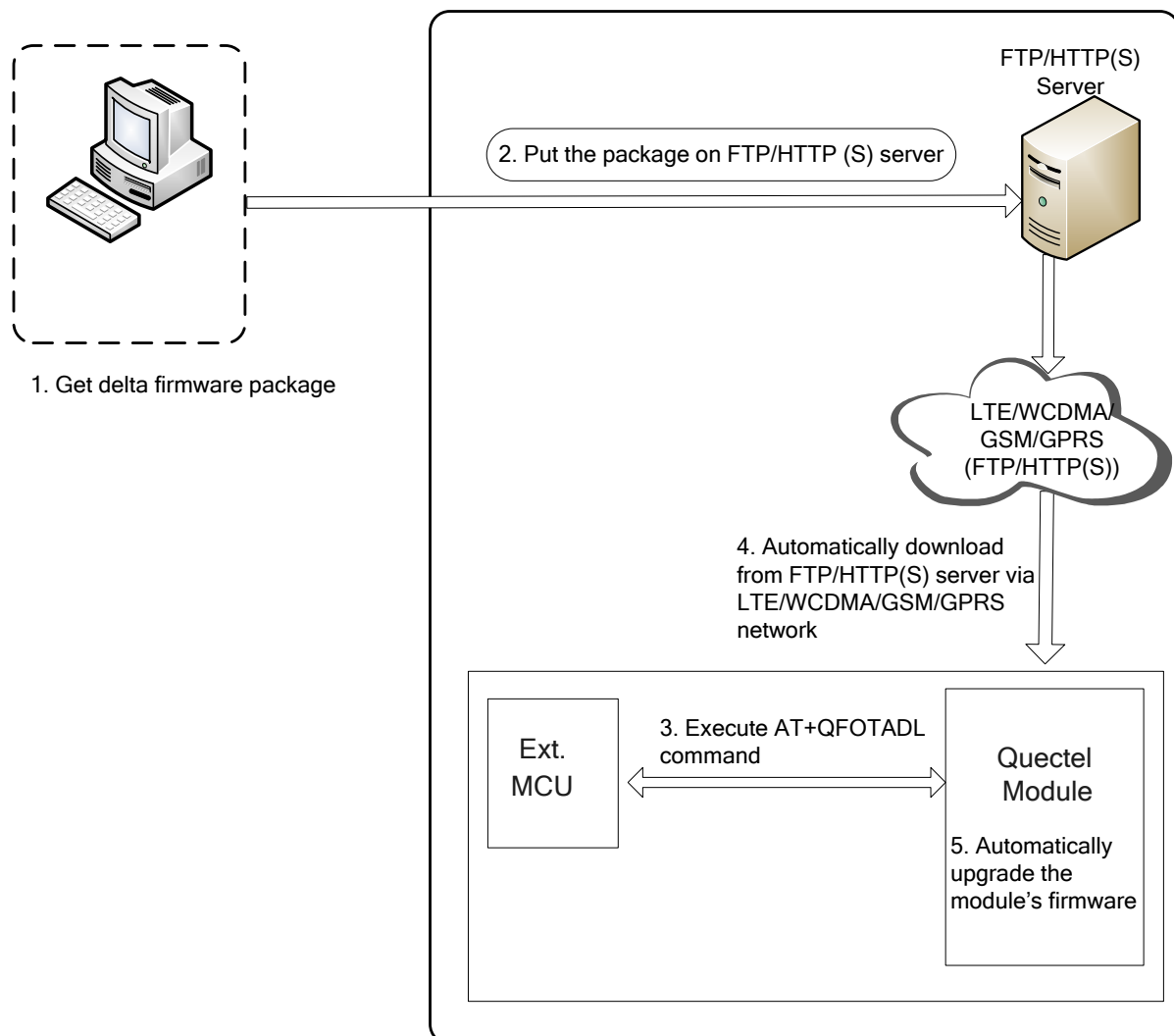


Figure 1: Firmware Upgrade Procedure via DFOTA

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

- 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 command. Then the module will automatically download the package from FTP/HTTP(S) server via LTE/WCDMA/GSM/GPRS network (**Step 4**) and finally automatically upgrade the module's firmware (**Step 5**).

2.1. Get Delta Firmware Package

Before upgrading, customers need to check the current firmware version (the original version) by executing ATI command, and also need to know the target firmware version. Then the two firmware versions should be provided for Quectel or the module supplier, to get the delta firmware package.

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

When using the DFOTA function, customers need to setup an FTP/HTTP(S) server by themselves, for Quectel does not provide such a server. Then please 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.

2.3. Execute AT Command to Upgrade the Firmware

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

3 Description of DFOTA AT Commands

AT+QFOTADL command enables automatic firmware upgrade for module via DFOTA. After executing the command, the module will automatically download the package from FTP/HTTP(S) server, reboot automatically and then enter into recovery mode. When the upgrade package is checked OK and the firmware upgrade is successful, the module will reboot and enter into normal mode.

AT+QFOTADL Upgrade Firmware via DFOTA

Test Command	Response
AT+QFOTADL=?	OK

3.1. AT+QFOTADL=<ftpURL> Upgrade Firmware When Delta Package is Stored on FTP Server

If the delta firmware package is stored on an FTP server, AT+QFOTADL=<ftpURL> should be executed 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 When Delta Package is Stored on FTP Server

Write Command	Response
AT+QFOTADL=<ftpURL>	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, response: ERROR

Parameter

<ftpURL>	String format. The max length is 255 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 size of the parameter is 50 bytes.
<password>	String type. The password for authentication. The maximum size of the parameter is 50 bytes.
<serverURL>	String type. The IP address or domain name of the FTP server. The maximum size of the parameter is 50 bytes.
<port>	Integer type. The port of the FTP server. The default value is 21. The range is 1-65535.
<file_path>	String type. The file name on FTP server. The maximum size of the parameter is 50 bytes.
<ftp_err>	Integer type. The FTP error code. 0 means upgraded successfully. Please refer to Chapter 5 for details.
<percent>	Integer type. The upgrade progress in percentage.
<err>	Integer type. 0 means upgraded successfully. Any other value means an error. Please refer to Chapter 5 for details.

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-v12-to-v13.zip".

//Execute AT+QFOTADL command 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-v12-to-v13.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 and the USB port will be re-initialized. If the current port is USB port, MCU should
close and reopen it.

+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.
```

3.2. AT+QFOTADL=<httpURL> Upgrade Firmware When Delta Package is Stored on HTTP(S) Server

If the delta firmware package is stored on an HTTP(S) server, AT+QFOTADL=<httpURL> command should be executed 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 When Delta Package is Stored on 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, response: ERROR
---------------------------------------	---

Parameter

<httpURL>	String format. The max length is 255 bytes. It should be started with "http://" or "https://". For example: "http://<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. The default value is 80. The range is 1-65535.
<http_file_path>	String type. The file name in HTTP(S) server.
<http_err>	Integer type. The HTTP(S) error code. 0 means upgraded successfully. Please refer to Chapter 5 for details.
<percent>	Integer type. The upgrade progress in percentage.
<err>	Integer type. 0 means upgraded successfully. Any other value means an error. Please refer to Chapter 5 for details.

Example

```
//Upgrade firmware when delta firmware package is stored on an HTTP server.
//The HTTP server address is "http://www.quectel.com:100/update.zip".
//Execute AT+QFOTADL command 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.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 be rebooted and the USB port will be re-initialized. If the current port is USB port, MCU should close and reopen it.

+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. AT+QFOTADL=<file_name> Upgrade Firmware When Delta Package is Stored on Local File System

If the delta firmware package has already been stored in the module's file system, AT+QFOTADL=<file_name> command should be executed to enable automatic firmware upgrade via DFOTA. Then the module will download the delta package from the local file system over the air and upgrade the firmware automatically.

AT+QFOTADL=<file_name> Upgrade Firmware When Delta Package is Stored on 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, response:

ERROR

Parameter

<file_name> String type. The max length is 90 bytes. It should be started with "/data/ufs/" in

	UFS.
<percent>	Integer type. The upgrade progress in percentage.
<err>	Integer type. 0 means upgraded successfully. Any other value means an error. Please refer to Chapter 5 for details.

Example

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

```
AT+QFOTADL="/data/ufs/update-v13-to-v12.zip"
```

```
OK
```

```
+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 Abnormalities and Important Note

4.1. Abnormalities

4.1.1. Wrong Delta Firmware Package

After executing AT+QFOTADL command and delta firmware package is downloaded, the module will reboot automatically and then enter into recovery mode. The module checks the upgrade package first, if there is something wrong with the package, the URC (+QIND: "FOTA","END",<err>) of an error code (504, 505 or 510) will be reported, then the module will reboot automatically, enter into recovery mode and re-check the package for maximally five times. If the package is still wrong after five retries, the module will reboot and enter into normal mode. In such case, please confirm the delta firmware package and re-put it on FTP/HTTP(S) server.

4.1.2. Failure of Firmware Upgrade

After the upgrade package is checked OK, then it starts to upgrade firmware. If it is failed to upgrade the firmware, the URC (+QIND: "FOTA","END",<err>) of an error code (502, 511, 520-530 or 540-546) will be reported, then the module will reboot automatically, enter into recovery mode and retry to upgrade for maximally five times. If upgrade is still unsuccessful after five retries, the module will stop firmware upgrade and restore to the original version.

NOTE

During an upgrading process, once the delta firmware package is downloaded, the module can only retry for maximally five times in total, among which retry times for package checking and firmware upgrading are both included.

As mentioned in **Chapter 2**, it is a completely automatic process after executing AT+QFOTADL command. Therefore, any +QIND: "FOTA","END",<err> URCs sent from the module to the Ext. MCU can be ignored.

4.2. Important Note

The URC of +QIND: "FOTA", "START" indicates the firmware upgrade process really starts. If the Ext. MCU receives this URC after executing AT+QFOTADL command, please **do NOT power off the module** until the firmware is upgraded successfully and +QIND: "FOTA", "END", 0 is received. Then the module will reboot and enter into normal mode automatically.

During upgrading process, if the Ext. MCU does not receive any URC in four minutes after the last URC is returned, then the module can be rebooted.

Meanwhile, it is recommended to set a flag on Ext. MCU to mark the task of the firmware upgrading, and clean it after successful upgrading.

5 Summary of error Codes

The error code indicates an error related to mobile equipment or network. The details about <ftp_err>, <http_err> and <err> are described in the following table.

Table 1: Summary of <ftp_err>, <http_err> and <err> Codes

<ftp_err>	Meaning
0	FTP download operation successful
601	FTP unknown error
<http_err>	Meaning
0	HTTP(S) download operation successful
701	HTTP(S) unknown error
<err>	Meaning
0	DFOTA upgrade successful
502	The upgrade process exits for some unpredictable errors
504	Something wrong with the upgrade package file
505	Something wrong with the upgrade package file
510	The patch does not match the source file in the module, need to check whether the upgrade package is wrong.
511	The file system has no enough space for upgrading
520-530, 540-546	Firmware upgrading failed

6 Appendix A References

Table 2: Related Documents

SN	Document Name	Remark
[1]	Quectel_EC25&EC21_AT_Commands_Manual	EC25&EC21 AT commands manual
[2]	Quectel_EC20_R2.0_AT_Commands_Manual	EC20 R2.0 AT commands manual
[3]	Quectel_EC20_R2.1_AT_Commands_Manual	EC20 R2.1 AT commands manual
[4]	Quectel_EG9x_AT_Commands_Manual	EG91 and EG95 AT commands manual
[5]	Quectel_EM05_AT_Commands_Manual	EM05 AT commands manual

Table 3: Terms and Abbreviations

Abbreviation	Description
DFOTA	Delta Firmware Upgrade Over the Air
Ext. MCU	External Microprogrammed Control Unit
FTP	File Transfer Protocol
GPRS	General Packet Radio Service
HTTP	Hyper Text Transport Protocol
LTE	Long Term Evolution
SD	Secure Digital
UFS	User File System
WCDMA	Wideband Code Division Multiple Access