EC200U&EG915U Series

FOTA Application Note

LTE Standard Module Series

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About the Document

Revision History

Version	Date	Author	Description
-	2021-10-13	Fei XUE	Creation of the document
1.0	2021-11-08	Fei XUE	First official release

Contents

Table Index

1 Introduction

Quectel LTE Standard EC200U series and EG915U series modules support FOTA (Firmware Over-The-Air) function, and this function can realize the wireless upgrade or downgrade of module firmware.

2 Firmware Upgrade Procedure Through FOTA

The following chart illustrates the firmware upgrade procedure through FOTA.

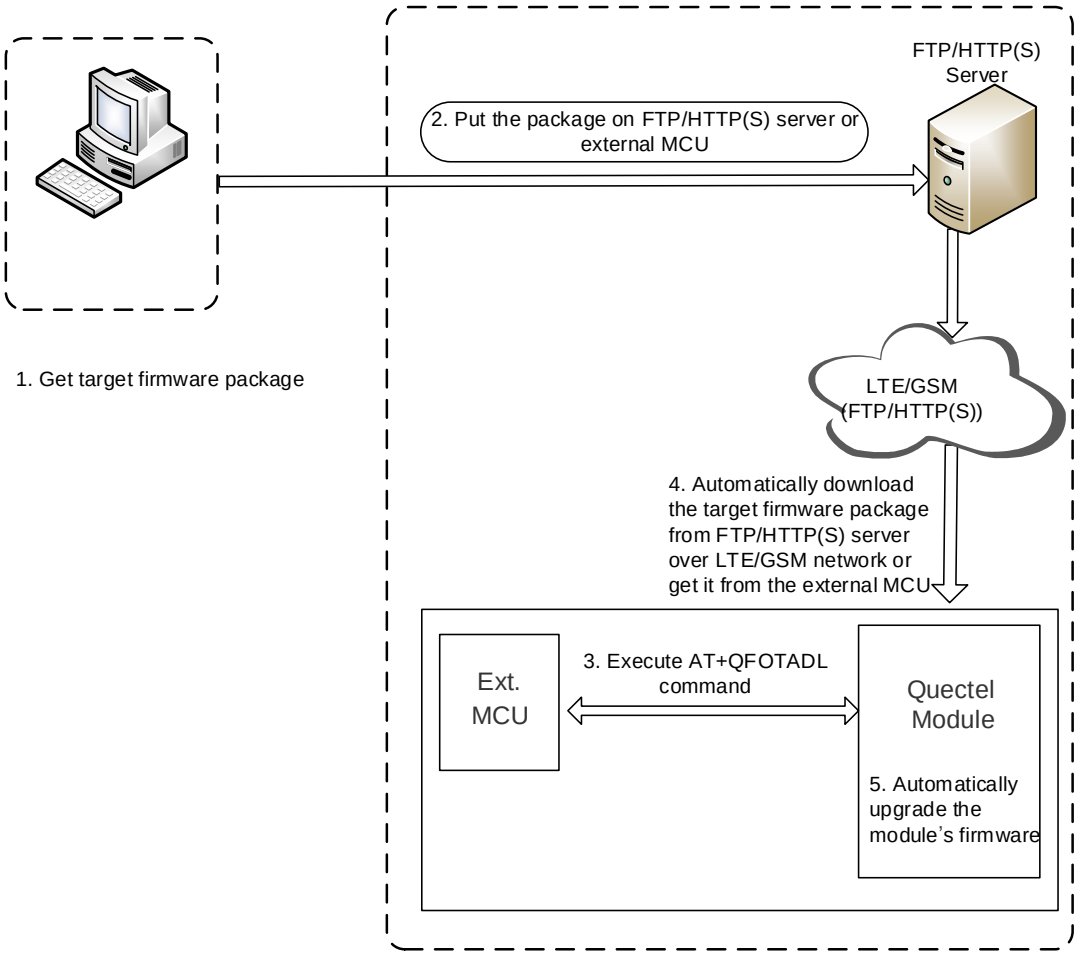

Figure 1: Firmware Upgrade Procedure through FOTA

Perform following steps to upgrade firmware through FOTA as shown in the figure above:

Step 1: Get the target firmware package from Quectel.
Step 2: Put the target firmware package on an FTP/HTTP(S) server or external MCU.

Step 3: Execute **AT+QFOTADL**.

Step 4: The module automatically downloads the target firmware package from the FTP/HTTP(S) server over LTE/GSM network or gets target firmware package from external MCU.

Step 5: Automatically upgrade the module's firmware.

NOTE

During the firmware upgrade through FOTA, it is important to ensure the module is powered; otherwise, the upgrade will fail and cannot be restored.

2.1. Get Target Firmware Package

To get a target firmware package, you should:

- check the current firmware version by executing **ATI**;
- confirm the target firmware version;
- send the two versions to Quectel or agent.

2.2. Store Target Firmware Package

The steps to store the target firmware package on an FTP/HTTP(S) server are as follows:

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

Step 2: Put the target firmware package on the server, and record the storage path.

You can determine the storage path of target firmware package on external MCU.

2.3. Configure Storage Medium in Module

You can configure the storage medium of the module where the target firmware package is to be stored by executing **AT+QCFG="fota/path"**. The configuration is only available for the current FOTA upgrade and the storage medium will be restored to the default "UFS" once FOTA upgrade is completed or fails. See ***document [1]*** for details about this command.

When the storage medium is internal flash and external flash, a subdirectory is supported; when the storage medium is an SD card, only the root directory is supported. You can execute **AT+QCFG="fota/path"** to change the storage medium of the target firmware package before executing **AT+QFOTADL**.

NOTE

See ***document [2]*** for details on the storage medium supported on applicable modules.

2.4. Execute AT Command to Upgrade Firmware

Execute **AT+QFOTADL** to make the module download the target firmware package from FTP/HTTP(S) server or get the package from external MCU and upgrade the firmware automatically. See ***Chapter 3.3.1*** for details.

3 Description of FOTA AT Command

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 command line.
- **[...]** Optional parameter of a command or an optional part of TA information response. Square brackets do not appear on command line. When an optional parameter is not given, the new value equals to its previous value or its default setting, 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 1: 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. Description of FOTA AT Command

3.3.1. AT+QFOTADL Upgrade Firmware Through FOTA

This command enables automatic firmware upgrade for module through FOTA. The storage medium of target firmware package needs to be confirmed before executing this command and the default medium is UFS. You can also configure the storage medium. See ***Chapter 2.3*** for details.

The module automatically downloads the target firmware package from FTP/HTTP(S) server and upgrades firmware after executing this command. The module will reboot after successful upgrade.

If the target firmware package is stored on external MCU, the module receives the firmware package from external MCU via main UART or USB AT port and then upgrades the firmware automatically after executing the command.

AT+QFOTADL Upgrade Firmware Through FOTA	
Test Command **AT+QFOTADL=?**	Response **+QFOTADL: <url>,(**list of supported **<upgrade_mode>**s**),(**list of supported **<download_URC_max>**s**),(**list of supported **<update_URC_max>**s**)** **OK**
Maximum Response Time	40 ms
Characteristics	/

Parameter

<url>	String type. URL of the target firmware package on FTP/HTTP(S) server or external MCU. Maximum length: 255 bytes. See ***Chapter 3.3.1.1*** to ***Chapter 3.3.1.3*** for details.
<upgrade_mode>	Integer type. Upgrade mode after successfully downloading the target firmware package. 0 Reboot the module manually and then upgrade the firmware automatically. 1 Upgrade the firmware automatically.
<download_URC_max>	Integer type. URC indicating the progress of downloading target firmware package. The last URC indicates the completion of the downloading. For example, if 50 is specified, it reports 50 download progress URCs, among which the 25th URC means half of the downloading is completed, and the 50th URC indicates the completion of downloading. 0 Disable the reporting of download progress URC. 5–100 Maximum number of download progress URCs that can be reported.
<update_URC_max>	Integer type. URC indicating the progress of upgrading the firmware. The last URC indicates the completion of the upgrading. For example, if 50 is specified, it reports 50 upgrade progress URCs, among which the 25th URC means half of the upgrading is completed, and the 50th URC indicates the completion of upgrading. 0 Disable the reporting of upgrade progress URC. 5–100 Maximum number of upgrade progress URCs that can be reported.

3.3.1.1. AT+QFOTADL=<FTP_URL> Upgrade Firmware When Target Firmware Package Is Stored on FTP Server

This command enables automatic firmware upgrade through FOTA when the target firmware package is stored on an FTP server. The module downloads package from FTP server and upgrades the firmware automatically after the command is executed successfully.

AT+QFOTADL=<FTP_URL> Upgrade Firmware When Target Firmware Package is Stored on FTP Server	
Write Command **AT+QFOTADL=<FTP_URL>[,<upgrade_mode>[,<download_URC_max>[,<update_URC_max>]]]**	Response **OK** **+QIND: "FOTA","FTPSTART"** **[+QIND: "FOTA","DOWNLOADING",<percent>** **+QIND: "FOTA","DOWNLOADING",<percent>** **…]**

	+QIND: "FOTA","FTPEND",<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	40 ms
Characteristics	/

Parameter

<FTP_URL>	String type. Maximum length: 255 bytes. It should be started with "FTP://". For example: "FTP://**<username>**:**<password>**@**<serverURL>**:**<port>/<file_path>**".
<username>	String type. User name for authentication. Maximum length: 50 bytes.
<password>	String type. Password for authentication. Maximum length: 50 bytes.
<serverURL>	String type. IP address or domain name of FTP server. Maximum length: 50 bytes.
<port>	Integer type. Port of FTP server. Range: 1–65535. Default: 21.
<file_path>	String type. Target firmware package name on FTP server. Maximum length: 50 bytes. Only root path is currently supported.
<upgrade_mode>	Integer type. Upgrade mode after successfully downloading the target firmware package. 0 Reboot the module manually and then upgrade the firmware automatically. 1 Upgrade the firmware automatically.
<download_URC_max>	Integer type. URC indicating the progress of downloading target firmware package. The last URC indicates the completion of the downloading. For example, if 50 is specified, it reports 50 download progress URCs, among which the 25th URC means half of the downloading is completed, and the 50th URC indicates the completion of downloading. 0 Disable the reporting of download progress URC. 5–100 Maximum number of download progress URCs that can be reported.
<update_URC_max>	Integer type. URC indicating the progress of upgrading the firmware. The last URC indicates the completion of the upgrading. For example, if 50 is specified, it reports 50 upgrade progress URCs, among which the 25th URC means half of the upgrading is completed, and the 50th URC indicates the completion of upgrading.

	0	Disable the reporting of upgrade progress URC.
	5–100	Maximum number of upgrade progress URCs that can be reported.
<percent>	Integer type. Download or upgrade progress.	
<err>	Integer type. 0 indicates successful upgrade and any other value indicates an error. See ***Chapter 4*** for details.	

Example

```
//Upgrade firmware when the target firmware package is stored on an FTP server.
//The FTP server address is "FTP://test:test@124.74.41.170:21/EC200UCNTCNMAR02A02M16.pack".
//Configure the PDP context, and PDP context 2 is used in this example. See document [1] and document [3] for details.
AT+QICSGP=2,1,"cmnet","","",1        //Configure PDP context ID to 2, the APN to "cmnet" (which means China Mobile), username and password to null, and the authentication type to PAP.
OK
AT+QCFG="fota/cid",2                 //Configure the PDP context ID to 2.
OK
//Execute AT+QFOTADL to enable automatic firmware upgrade through FOTA, and then the module starts to download the target firmware package and upgrade firmware automatically.
AT+QFOTADL="FTP://test:test@124.74.41.170:21/EC200UCNTCNMAR02A02M16.pack",1,50,100
OK

+QIND: "FOTA","FTPSTART"
+QIND: "FOTA","DOWNLOADING",2
+QIND: "FOTA","DOWNLOADING",4
...
+QIND: "FOTA"," DOWNLOADING",100
+QIND: "FOTA","FTPEND",0
//Download the package from FTP server successfully.
+QIND: "FOTA","START"
+QIND: "FOTA","UPDATING",1
+QIND: "FOTA","UPDATING",2
...
+QIND: "FOTA","UPDATING",100
+QIND: "FOTA","END",0                 //Upgrade the firmware successfully.
```

3.3.1.2. AT+QFOTADL=<HTTP_URL> Upgrade Firmware When Target Firmware Package Is Stored on HTTP(S) Server

This command enables automatic firmware upgrade through FOTA when the target firmware package is stored on an HTTP(S) server. The module downloads package from HTTP(S) server and upgrades the firmware automatically after the command is executed successfully.

AT+QFOTADL=<HTTP_URL> Upgrade Firmware When Target Firmware Package is Stored on HTTP(S) Server	
Write Command **AT+QFOTADL=<HTTP_URL>[,<upgrade_mode>[,<download_URC_max>[,<update_URC_max>]]]**	Response **OK** **+QIND: "FOTA","HTTPSTART"** **[+QIND: "FOTA","DOWNLOADING",<percent>** **+QIND: "FOTA","DOWNLOADING",<percent>** **…]** **+QIND: "FOTA","HTTPEND",<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	40 ms
Characteristics	/

Parameter

<HTTP_URL>	String type. Maximum length: 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. IP address or domain name of HTTP(S) server. Maximum length: 50 bytes.
<HTTP_port>	Integer type. Port of HTTP(S) server. Range: 1–65535. Default: 80.
<HTTP_file_path>	String type. File name of target firmware package on HTTP(S) server. Maximum length: 50 bytes.
<upgrade_mode>	Integer type. Upgrade mode after successfully downloading the target firmware package. 0 Reboot the module manually and then upgrade the firmware

	automatically. 1 Upgrade the firmware automatically.
<download_URC_max>	Integer type. URC indicating the progress of downloading target firmware package. The last URC indicates the completion of the downloading. For example, if 50 is specified, it reports 50 download progress URCs, among which the 25th URC means half of the downloading is completed, and the 50th URC indicates the completion of downloading. 0 Disable the reporting of download progress URC. 5–100 Maximum number of download progress URCs that can be reported.
<update_URC_max>	Integer type. URC indicating the progress of upgrading the firmware. The last URC indicates the completion of the upgrading. For example, if 50 is specified, it reports 50 upgrade progress URCs, among which the 25th URC means half of the upgrading is completed, and the 50th URC indicates the completion of upgrading. 0 Disable the reporting of upgrade progress URC. 5–100 Maximum number of upgrade progress URCs that can be reported.
<percent>	Integer type. Download or upgrade progress.
<err>	Integer type. 0 indicates successful upgrade and any other value indicates an error. See ***Chapter 4*** for details.

Example

```
//Upgrade firmware when the target firmware package is stored on an HTTP(S) server.
//The HTTP(S) server address is "http://www.quectel.com:100/EC200UCNTCNMAR02A02M16.pack".
//Configure the PDP context, and PDP context 2 is used in this example. See document [1] and document [3] for details.
AT+QICSGP=2,1,"cmnet","","",1        //Configure PDP context ID to 2, the APN to "cmnet" (which means China Mobile), username and password to null, and the authentication type to PAP.
OK
AT+QCFG="fota/cid",2                 //Configure the PDP context ID to 2.
OK
//Execute AT+QFOTADL to enable automatic firmware upgrade through FOTA, and then the module will start to download the target firmware package and upgrade firmware automatically.
AT+QFOTADL="http://www.quectel.com:100/EC200UCNTCNMAR02A02M16.pack",1,50,100
OK

+QIND: "FOTA","HTTPSTART"
+QIND: "FOTA","DOWNLOADING",2
+QIND: "FOTA","DOWNLOADING",4
...
+QIND: "FOTA","DOWNLOADING",100
+QIND: "FOTA","HTTPEND",0
```

```
//Download the package from HTTP(S) server successfully.
+QIND: "FOTA","START"
+QIND: "FOTA","UPDATING",1
+QIND: "FOTA","UPDATING",2
...
+QIND: "FOTA","UPDATING",100
+QIND: "FOTA","END",0                    //Upgrade the firmware successfully.
```

3.3.1.3. AT+QFOTADL="FILE:<length>" Upgrade Firmware When Target Firmware Package Is Stored on External MCU

This command starts firmware upgrade when the target firmware package is stored on external MCU. The module receives firmware package from external MCU through serial port tool and then upgrades the firmware automatically after the command is executed successfully.

If main UART is used, you need to set hardware flow control before executing **AT+QFOTADL="FILE:<length>"**. If it is not set, the speed at which the host can send the target firmware package should be limited. Therefore, it is recommended to control the length of the target firmware package sent each time within 32 bytes. The following steps should be taken to upgrade firmware:

Step 1: Open the serial port tool, choose main UART and set the hardware flow control.
Step 2: Send **AT+IFC=2,2** to open the hardware flow control.
Step 3: Select the target firmware package form external MCU.
Step 4: Send **AT+QFOTADL="FILE:<length>"[,<upgrade_mode>[,<download_URC_max>[,<update_URC_max>]]]**.
Step 5: Send the target firmware package to the module.

If an USB port for AT command communication is used, the following steps should be taken to upgrade firmware:

Step 1: Open the serial port tool and select the USB port for AT command communication.
Step 2: Select the target firmware package from external MCU.
Step 3: Send **AT+QFOTADL="FILE:<length>"[,<upgrade_mode>[,<download_URC_max>[,<update_URC_max>]]]**.
Step 4: Send the target firmware package to the module.

AT+QFOTADL="FILE:<length>" Upgrade Firmware When Target Firmware Package is Stored on External MCU	
Write Command **AT+QFOTADL="FILE:<length>"[,<upgrade_mode>[,<download_URC_max>[,<update_URC_max>]]]**	Response **OK** **+QIND: "FOTA","FILESTART"** **[+QIND: "FOTA","DOWNLOADING",<percent>**

	+QIND: "FOTA","DOWNLOADING",<percent> **…]** **+QIND: "FOTA","FILEEND",<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	40 ms
Characteristics	/

Parameter

<length>	Integer type. Length of the target firmware package. Unit: byte.
<upgrade_mode>	Integer type. Upgrade mode after successfully downloading the target firmware package. 0 Reboot the module manually and then upgrade the firmware automatically. 1 Upgrade the firmware immediately.
<download_URC_max>	Integer type. URC indicating the progress of downloading target firmware package. The last URC indicates the completion of the downloading. For example, if 50 is specified, it reports 50 download progress URCs, among which the 25th URC means half of the downloading is completed, and the 50th URC indicates the completion of the downloading. 0 Disable the reporting of download progress URC. 5–100 Maximum number of download progress URCs that can be reported.
<update_URC_max>	Integer type. URC indicating the progress of upgrading the firmware. The last URC indicates the completion of the upgrading. For example, if 50 is specified, it reports 50 upgrade progress URCs, among which the 25th URC means half of the upgrading is completed, and the 50th URC indicates the completion of upgrading. 0 Disable the reporting of upgrade progress URC. 5–100 Maximum number of upgrade progress URCs that can be reported.
<percent>	Integer type. Download or upgrade progress.
<err>	Integer type. 0 indicates successful upgrade and any other value indicates an error. See ***Chapter 4*** for details.

NOTE

Before sending target firmware package, you need to select the target firmware package to get its length (the value of **<length>**) and send it to the module by **AT+QFOTADL="FILE:<length>"** to determine whether there is enough storage in module.

Example

```
// When the target firmware package is stored on external MCU, use the File method to upgrade the firmware through the USB AT port.
AT+QFOTADL="FILE:1200",1,50,100   //The length of target firmware package is 1200 bytes.
OK

+QIND: "FOTA","FILESTART"
//Wait for external MCU to send target firmware package through the serial port tool to the module.
+QIND: "FOTA","DOWNLOADING",2
+QIND: "FOTA","DOWNLOADING",4
...
+QIND: "FOTA","DOWNLOADING",100
+QIND: "FOTA","FILEEND",0
// Immediately upgrade firmware through FOTA after successfully downloading target firmware package.
+QIND: "FOTA","START"
+QIND: "FOTA","UPDATING",1
+QIND: "FOTA","UPDATING",2
...
+QIND: "FOTA","UPDATING",100
+QIND: "FOTA","END",0              //Upgrade the firmware successfully.
```

4 Summary of Error Codes

This chapter introduces the error codes related to mobile equipment and network.

If an error occurs when performing the FOTA function, the error codes are shown in the following table:

Table 2: Meaning of FOTA <err>

<err>	Meaning
0	Successful FOTA operation
500	General FOTA error
502	Abnormal FOTA error
510	FOTA upgrade package verification or flag bit setting error
547	FOTA upgrade package verification error
549	Busy FOTA
550	Null FOTA pointer
551	Invalid parameter
552	Invalid FOTA pack file path
553	FOTA NV fails to reset FOTA update package path information
554	FOTA NV fails to save FOTA update package path information
555	FOTA NV fails to delete FOTA update package path information
556	FOTA NV fails to read FOTA update package path information
557	FOTA package name length error
558	FOTA task creation error
559	FOTA runs repeatedly

560	FOTA download mode is not supported
561	FOTA URL input error
562	Fail to create FOTA FTP handle
563	Fail to initialize FOTA FTP Curl
564	The download file exceeds the set size in FOTA file download mode
565	Fail to create timer in FOTA file download mode
566	Fail to start timer in FOTA file download mode
567	Download timeout in FOTA file download mode
568	Fail to create FOTA HTTP semaphore
569	FOTA HTTP request package setting error
570	Abnormal FOTA HTTP socket
571	Abnormal FOTA HTTP operation

If an error occurs when downloading the target firmware package from FTP server, the error codes are shown in the following table:

Table 3: Meaning of FTP <err>

<err>	Meaning
0	Successful downloading and verification
601	Unknown FTP error
602	Blocked FTP service
603	Busy FTP service
604	Fail to parse DNS
605	Network error
606	Control connection is closed
607	Data connection is closed

608	Socket is closed by peer
609	Timeout error
610	Invalid parameter
611	Fail to open file
612	Invalid file position
613	File error
614	Service is not available and control connection is closing
615	Fail to open data connection
616	Connection is closed and transfer is aborted
617	Fail to request the file operation
618	Requested action is aborted: local error in processing
619	Requested action is not taken: insufficient system storage
620	Syntax error, command is unrecognized
621	Syntax error in parameters or arguments
622	Command is not implemented
623	Bad sequence of commands
624	Command parameter is not implemented
625	Fail to login FTP
626	Need account for storing files
627	Requested action is not taken
628	Requested action is aborted: unknown page type
629	Requested file action is aborted
630	Invalid requested file name
631	SSL authentication failure

If an error occurs when downloading the target firmware package from HTTP(S) server, the error codes are shown in the following table:

Table 4: Meaning of HTTP(S) <err>

<err>	Meaning
0	Successful downloading and verification
701	Unknown HTTP(S) error
702	HTTP(S) timeout
703	Busy HTTP(S)
714	Fail to parse DNS
716	HTTP(S) socket connection error
729	HTTP(S) memory allocation failure
730	Invalid parameter
731	HTTP(S) operation has not been processed

If a data call related error occurs when upgrading firmware through FOTA, the error codes are shown in the following table:

Table 5: Meaning of Datacall <err>

<err>	Meaning
1	Datacall abnormal
2	Null memory address
3	Invalid parameters
4	Network register timeout error
5	CFW active state getting error
6	Repeated activation
7	Repeated release

8	CFW PDP context setting error
9	CFW PDP context getting error
10	CS call error
11	CFW CFUN getting error
12	CFUN disable error
13	Network status getting error
14	Datacall cannot be registered
15	Datacall has no memory
16	CFW attach status getting error
17	Semaphore creation failure
18	Semaphore timeout error
19	CFW attach request error
20	CFW activation request error
21	Datacall activation failure
22	CFW release request failure

5 Appendix References

Table 6: Related Documents

Document Name
[1] Quectel_EC200U&EG915_Series_AT_Commands_Manual
[2] Quectel_EC200U&EG915U_Series_FILE_Application_Note
[3] Quectel_EC200U&EG915U_Series_TCP(IP)_Application_Note

Table 7: Terms and Abbreviations

Abbreviation	Description
CFW	Communication Framework
CS	Circuit Switch
DNS	Domain Name Server
FOTA	Firmware Upgrade Over-The-Air
FTP	File Transfer Protocol
GSM	Global System for Mobile Communications
HTTP	Hyper Text Transfer Protocol
HTTPS	Hyper Text Transfer Protocol Secure
LTE	Long Term Evolution
NV	Non-Volatile
MCU	Microcontroller Unit
PDP	Packet Data Protocol
SD	Secure Digital

UART	Universal Asynchronous Receiver/Transmitter
UFS	User File System
URL	Uniform Resource Locator
USB	Universal Serial Bus