

BC65&BC92

DFOTA Application Note

NB-IoT Module Series

Rev. BC65&BC92_DFOTA_Application_Note_V1.0

Date: 2020-04-13

Status: Released



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About the Document

Revision History

Version	Date	Author	Description
1.0	2020-04-13	Fonda FANG	Initial

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1 Introduction

Quectel BC65 and BC92 modules support DFOTA (Delta Firmware Upgrade Over-The-Air) feature, which allows customers to upgrade or downgrade firmware wirelessly.

In DFOTA, a delta firmware package, which only contains the differences between the source and the target firmware version, is needed. In this way, the amount of data transmitted and time consumed can be reduced.

This document mainly describes how to upgrade the firmware of Quectel BC65 and BC92 modules via DFOTA.

2 DFOTA Procedure

The following chart illustrates the firmware upgrade procedure via DFOTA when the firmware package is stored on an HTTP server.

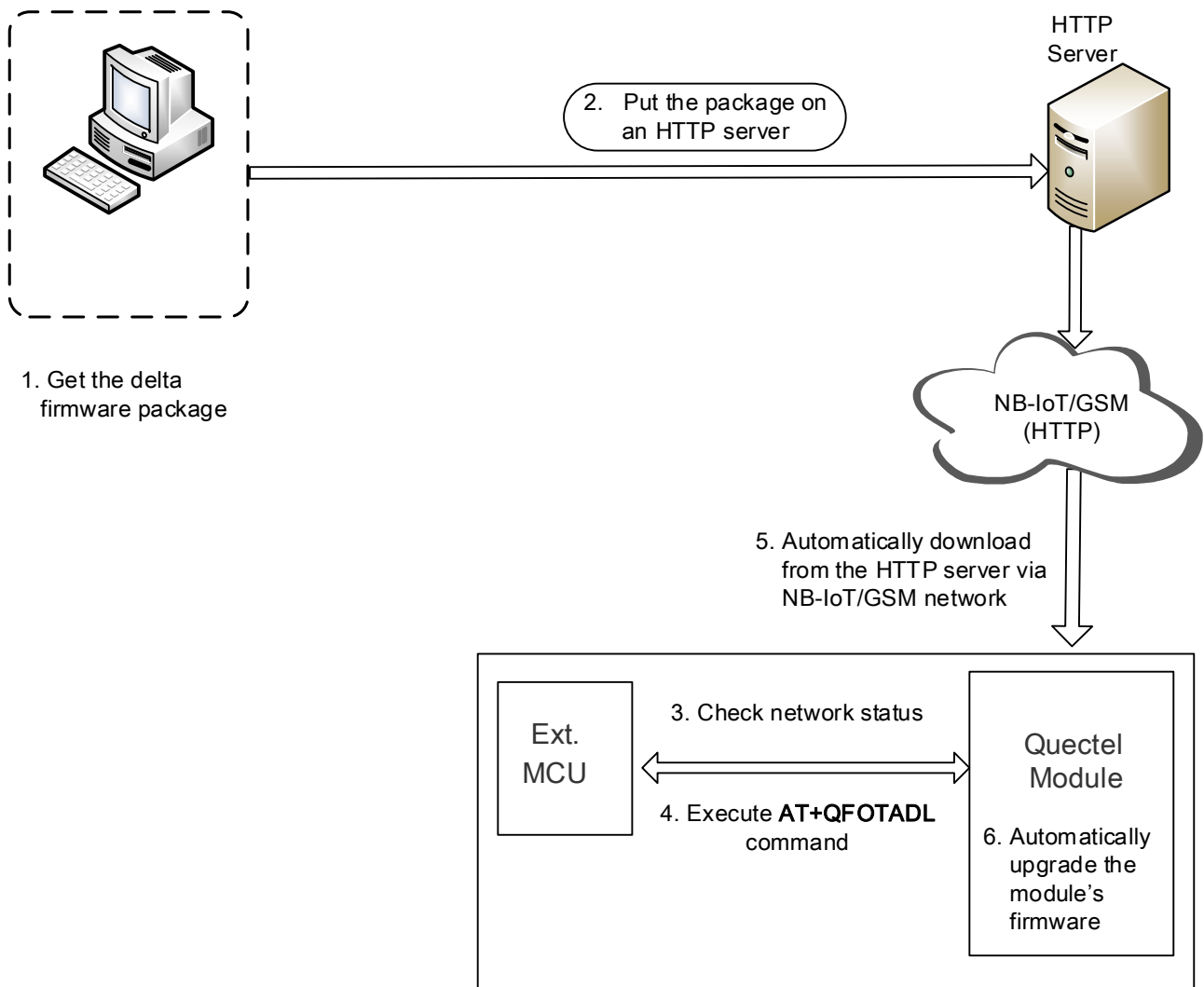


Figure 1: DFOTA Procedure

As shown in the above figure, customers only need to perform the following steps to upgrade the firmware when the firmware package is stored on an HTTP server:

- Step 1:** Acquire the delta firmware package from Quectel.
- Step 2:** Put the delta firmware package on an HTTP server.

Step 3: Check the status of network.

Step 4: Execute **AT+QFOTADL** command. Then the module will automatically download the package from the HTTP server via NB-IoT network or GSM network (**Step 5**) and finally automatically upgrade the module's firmware (**Step 6**).

NOTES

1. Since BC92 supports both NB-IoT and GSM networks, BC92 also supports to download upgrade files through GSM network.
2. When BC92 is under GSM network, it is needed to manually configure PDP and activate IP with the command **AT+CGDCONT** after **Step 3**.
3. Please refer to *Quectel_BC65_AT_Commands_Manual* or *Quectel_BC92_AT_Commands_Manual* for more details about the AT commands other than **AT+QFOTADL** in this chapter, .

2.1. Acquire Delta Firmware Package

Before upgrading, the source firmware version needs to be checked by executing **ATI** command and the target firmware version needs to be decided. Then, customers should send the two firmware versions to Quectel or the responsible agent to get a delta package.

2.2. Upload Delta Package to HTTP Server

Customers need to setup their own HTTP servers when applying DFOTA, since Quectel does not provide such a server. Then, after the delta firmware package is uploaded to the server and the HTTP path is recorded, the module will be able to acquire the delta firmware package through the HTTP path by executing the corresponding AT command.

NOTE

Please record the HTTP path (URL) to which the delta firmware package is uploaded for the **AT+QFOTADL** command in **Chapter 3**.

2.3. Check Network Status

After the module is powered on, please make sure it is registered on network before the firmware upgrading.

Relevant AT commands are listed below:

- **AT+CESQ** Query signal quality
- **AT+COPS?** Query the network type and registration status
- **AT+CGPADDR** Query allocated IP address

2.4. Execute AT Command to Upgrade the Firmware

After the network status is confirmed to be ready, **AT+QFOTADL** command can be executed to start the downloading process. Then the module will download the delta firmware package from the HTTP server wirelessly and upgrade the firmware automatically. For more details, please refer to **Chapter 3**.

3 DFOTA AT Commands

AT+QFOTADL command enables the automatic firmware upgrade for Quectel module via DFOTA. After the command is executed, the package will be automatically downloaded to the module from the HTTP server. After the package download completes, the module will start to upgrade its firmware automatically. If firmware is upgraded successfully, the module will reboot, otherwise it will return an error and exit from DFOTA.

3.1. AT+QFOTADL=<HTTP_URL> DFOTA via HTTP Server

If the delta firmware package is stored on an HTTP server, **AT+QFOTADL=<HTTP_URL>** command should be executed to enable the automatic firmware upgrade via DFOTA. Then the module will download the delta firmware package from the HTTP server wirelessly and upgrade the firmware automatically.

AT+QFOTADL=<HTTP_URL> DFOTA via HTTP Server

Test Command	Response
AT+QFOTADL=?	OK
Write Command AT+QFOTADL=<HTTP_URL>	Response OK +QIND: "FOTA", "HTTPSTART" +QIND: "FOTA", "DOWNLOADING", <percent> +QIND: "FOTA", "DOWNLOADING", <percent> ... +QIND: "FOTA", "HTTTPEND", <HTTP_err> +QIND: "FOTA", "START" +QIND: "FOTA", "UPDATING", <percent> +QIND: "FOTA", "UPDATING", <percent> ...

	<p>+QIND: "FOTA", "END", <FOTA_err></p> <p>If there is any error: ERROR</p> <p>Or +CME ERROR: <HTTP_err></p>
Characteristics	The command takes effect immediately.

Parameter

<HTTP_URL>	String format. The maximum length is 511 bytes. It should start with " http:// " in a format as follows: "http://<HTTP_server_URL>:<HTTP_port>/<HTTP_file_path>"
<HTTP_server_URL>	String type. The IP address or domain of the HTTP server.
<HTTP_port>	Integer type. The port of the HTTP server. The default value is 80. The range is 1–65535.
<HTTP_file_path>	String type. The file name in the HTTP server.
<HTTP_err>	Integer type. The HTTP error code. 0 means downloaded successfully. Any other value means an error. Please refer to Chapter 5 for more details.
<percent>	Integer type. The download or upgrade progress in percentage.
<FOTA_err>	Integer type. 0 means upgraded successfully. Any other value means an error. Please refer to Chapter 5 for more details.

NOTE

If the module is powered off when it is reporting **+QIND: "FOTA", "UPDATING", <percent>**, the module will automatically enter force upgrade mode when powered on next time, and continue the upgrading progress. The URC of upgrade process is shown as below:

+QIND: "FOTA", "START"

+QIND: "FOTA", "UPDATING", 0%

+QIND: "FOTA", "UPDATING", 10%

...

+QIND: "FOTA", "END", 0

3.2. AT+QFOTADL=<para> Local Upgrade

If the delta firmware package already exists in the UFS directory of the module filesystem, and the name of this firmware package is “fota.pack”, the upgrade progress will be triggered by executing **AT+QFOTADL=1**. If the name of the firmware package is not “fota.pack”, please rename the firmware package with the filesystem-related AT command.

AT+QFOTADL=<para> Local Upgrade

Write Command AT+QFOTADL=<para>	Response OK +QIND: "FOTA","START" +QIND: "FOTA","UPDATING",<percent> +QIND: "FOTA","UPDATING",<percent> ... +QIND: "FOTA","END",<FOTA_err> If there is any error: ERROR Or +CME ERROR: <HTTP_err>
Characteristics	The command takes effect immediately.

Parameter

<para>	Integer type. 1 Local Upgrade
<percent>	Integer type. The download or upgrade progress in percentage.
<HTTP_err>	Integer type. The HTTP error code. 0 means downloaded successfully. Any other value means an error. Please refer to Chapter 5 for more details.
<FOTA_err>	Integer type. 0 means upgraded successfully. Any other value means an error. Please refer to Chapter 5 for more details.

NOTES

- Delta firmware package can be transferred to UFS directory in module with filesystem-related AT commands via AT UART port. The filename of this package must be named as “fota.pack”, otherwise

the upgrade process cannot be triggered correctly.

- If the module is powered off when it is reporting **+QIND: "FOTA","UPDATING",<percent>**, the module will automatically enter force upgrade mode when powered on next time, and continue the upgrading progress. The URC of upgrade process is shown as below:

+QIND: "FOTA","START"

+QIND: "FOTA","UPDATING",0%

+QIND: "FOTA","UPDATING",10%

...

+QIND: "FOTA","END",0

- Please refer to *Quectel_BC65&BC92_FileSystem_Application_Note* for the AT commands of filesystem.

3.3. AT+QFOTADL=<para>,<HTTP_URL>[,<filename>] Download MCU

File Via HTTP Server

If a file of external MCU is uploaded to the HTTP server, it can be downloaded by executing **AT+QFOTADL=<para>,<HTTP_URL>[,<filename>]**, and will be saved in UFS directory of the module filesystem. The file name can be specified by the parameter **<filename>**, or acquired from **<HTTP_URL>**.

AT+QFOTADL=<para>,<HTTP_URL>[,<filename>] Download MCU File Via HTTP Server

Write Command	Response
AT+QFOTADL=<para>,<HTTP_URL>[,<filename>]	OK
	+QIND: "FOTA","HTTPSTART"
	+QIND: "FOTA","DOWNLOADING",<percent>
	+QIND: "FOTA","DOWNLOADING",<percent>
	...
	+QIND: "FOTA","HTTPEND",<HTTP_err>
	If there is any error: ERROR
	Or

	+CME ERROR: <HTTP_err>
Characteristics	The command takes effect immediately.

Parameter

<para>	Integer type. 2 Download the file to module via HTTP server.
<filename>	String type. File name. Specify the saving name of file.
<HTTP_URL>	String type. The maximum length is 511 bytes. It should start with "http://" in a format as follows: "http://<HTTP_server_URL>:<HTTP_port>/<HTTP_file_path>"
<HTTP_server_URL>	String type. The IP address or domain name of HTTP server.
<HTTP_port>	Integer type. The port of the HTTP server. The default value is 80. The range is 1–65535.
<HTTP_file_path>	String type. The file name in HTTP server.
<HTTP_err>	Integer type. The HTTP error code. 0 means download successfully. Any other value means an error. Please refer to Chapter 5 for more details.
<percent>	Integer type. The download or upgrade progress in percentage.

NOTES

- The length of file name cannot exceed 58 bytes when **<para>=2**, otherwise an error will be returned. In the case that **<filename>** is omitted, the module will first obtain the file name from the HTTP URL. If the file name is illegal, the default "mcu_update.bin" will be used to name the downloaded file. Then, please use the filesystem-related AT commands to operate it after downloading.
- Please refer to *Quectel_BC65&BC92_FileSystem_Application_Note* for the AT commands of filesystem.

4 Examples

4.1. DFOTA via HTTP Server Under NB-IoT Network

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

//The URL of the firmware on the HTTP server is "http://224.168.203.812:3029/update.pack".
AT+COPS? //Query network status
+COPS: 0,2,"46011",9 //The fourth parameter 9 indicates a NB-IoT network

OK
//Under NB-IoT network, the module will use the parameter configured by AT+QCGDEFCONT and
automatically activate IP
AT+CGDCONT?
+CGDCONT: 1,"IP","cmnbiot","100.68.194.234",0,0

OK
//Execute AT+QFOTADL command to enable automatic firmware upgrade via DFOTA, and then the
module will start to download the delta firmware package and upgrade firmware automatically.
AT+QFOTADL="http://224.168.203.812:3029/update.pack"
OK

+QIND: "FOTA","HTTPSTART" //Download starts

+QIND: "FOTA","DOWNLOADING",0%

+QIND: "FOTA","DOWNLOADING",10%

...

+QIND: "FOTA","DOWNLOADING",100%

+QIND: "FOTA","HTTPPEND",0 //The package from HTTP server is successfully downloaded

+QIND: "FOTA","START" //Upgrade starts

+QIND: "FOTA","UPDATING",0%
```

```
+QIND: "FOTA", "UPDATING", 10%
...
+QIND: "FOTA", "UPDATING", 100%
+QIND: "FOTA", "END", 0 //The firmware is successfully upgraded
```

4.2. DFOTA via HTTP Server Under GSM Network (for BC92 Only)

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

//The URL of the firmware on the HTTP server is "http://224.168.203.812:3029/update.pack".
AT+COPS? //Query network status
+COPS: 0,2,"46000",0 //The fourth parameter 0 indicates a GSM network

OK

//When BC92 is under GSM network, it is needed to configure PDP and activate IP manually before
downloading
AT+CGDCONT=1,"IP" //Configure PDP type to "IP"
OK
AT+CGACT=1,1 //Activate the PDP context
OK
AT+CGDCONT?
+CGDCONT: 1,"IP",,"100.68.194.234",0,0

OK
//Execute AT+QFOTADL command to enable automatic firmware upgrade via DFOTA, and then the
module will start to download the delta firmware package and upgrade firmware automatically.
AT+QFOTADL="http://224.168.203.812:3029/update.pack"
OK
+QIND: "FOTA", "HTTPSTART" //Download starts

+QIND: "FOTA", "DOWNLOADING", 0%

+QIND: "FOTA", "DOWNLOADING", 10%

...

+QIND: "FOTA", "DOWNLOADING", 100%
```



```
+QIND: "FOTA","HTTPEND",0           //The package from HTTP server is successfully downloaded
+QIND: "FOTA","START"                //Upgrade starts
+QIND: "FOTA","UPDATING",0%
+QIND: "FOTA","UPDATING",10%
...
+QIND: "FOTA","UPDATING",100%
+QIND: "FOTA","END",0                //The firmware is successfully upgraded
```

4.3. Local Upgrade Process

//The local upgrade process can be triggered by executing **AT+QFOTADL=1**. First, please make sure that the file already exists in module filesystem and its name must be "fota.pack", otherwise the module will return an error.

```
AT+QFLST                               //Check whether the file exists or not
+QFLST: "fota.pack",20135

OK
AT+QFOTADL=1                           //Trigger the local upgrade process
OK

+QIND: "FOTA","START"                  //Local upgrade starts
+QIND: "FOTA","UPDATING",0%
+QIND: "FOTA","UPDATING",10%
...
+QIND: "FOTA","UPDATING",100%
+QIND: "FOTA","END",0                  //Upgraded successful
```

4.4. Download MCU File from HTTP Server Under NB-IoT Network

```
AT+COPS? //Query network status
+COPS: 0,2,"46011",9 //The fourth parameter 9 indicates a NB-IoT network

OK
//The module will automatically active the default PDN, which set by AT+QCGDEFCONT command in
NB-IoT network
AT+CGDCONT?
+CGDCONT: 1,"IP","cmnbiot","100.68.194.234",0,0

OK
//Execute the AT+QFOTADL=2,<HTTP_URL> command to download the MCU upgrade file from the
HTTP server and store it in the module. After the download is complete, the corresponding filesystem AT
command can be used to operate this MCU upgrade file.
//The URL of the MCU file on the HTTP server is "http://224.168.203.812:3029/test.bin"
AT+QFOTADL=2,"http://224.168.203.812:3029/test.bin" //Trigger the process
OK

+QIND: "FOTA","HTTPSTART" //Download starts

+QIND: "FOTA","DOWNLOADING",0%

+QIND: "FOTA","DOWNLOADING",10%
...

+QIND: "FOTA","DOWNLOADING",100%

+QIND: "FOTA","HTTPPEND",0 //The MCU file is successfully downloaded.
AT+QFLST //List the files in the module filesystem.
+QFLST: "test.bin",93368

OK
```

4.5. Download MCU File from HTTP Server Under GSM Network (for BC92 Only)

```
AT+COPS? //Query network status
+COPS: 0,2,"46000",0 //The fourth parameter 0 indicates a GSM network.
```

OK

//When the BC92 is under a GSM network, please manually configure the PDP and activate the IP before downloading.

AT+CGDCONT=1,"IP" //Configure PDP type to "IP"

OK

AT+CGACT=1,1 //Active the PDP context

OK

AT+CGDCONT?

+CGDCONT: 1,"IP",,"100.68.194.234",0,0

OK

//Execute the **AT+QFOTADL=2,<HTTP_URL>** command to download the MCU upgrade file from the HTTP server and store it in the module. After the download is complete, the corresponding filesystem AT command can be used to operate this MCU upgrade file.

//The URL of the MCU file on the HTTP server is "http://224.168.203.812:3029/test.bin"

AT+QFOTADL=2,"http://224.168.203.812:3029/test.bin"

OK

+QIND: "FOTA", "HTTPSTART" //Download starts

+QIND: "FOTA", "DOWNLOADING", 0%

+QIND: "FOTA", "DOWNLOADING", 10%

...

+QIND: "FOTA", "DOWNLOADING", 100%

+QIND: "FOTA", "HTTPPEND", 0 //The MCU file is successfully downloaded

AT+QFLST //List the files in the module filesystem

+QFLST: "test.bin", 93368

OK

5 Summary of Error Codes

The error code indicates an error related to mobile equipment or network. The details about <FOTA_err> and <HTTP_err> are described in the following tables.

Table 1: Summary of <HTTP_err> Codes

<HTTP_err>	Description
0	Downloaded successfully
6500	Unknown mistake
6501	Illegal parameter
6502	Upgrade package is too large
6503	Download failed
6504	Upgrade package not found
6505	Upgrade package failed to write flash
6506	There are no differential packages in the module file system
6507	Differential packet verification error
6509	Allocate memory failed

Table 2: Summary of <FOTA_err> Codes

<FOTA_err>	Description
0	Upgraded successfully
6508	Upgrade failed

6 Appendix A References

Table 3: Related Documents

SN	Document Name	Remark
[1]	Quectel_BC65_AT_Commands_Manual	The AT commands manual of BC65
[2]	Quectel_BC92_AT_Commands_Manual	The AT commands manual of BC92
[3]	Quectel_BC65&BC92_FileSystem_Application_Note	The application note of the filesystem of BC65 and BC92 modules.

Table 4: Terms and Abbreviations

Abbreviation	Description
DFOTA	Delta Firmware Upgrade Over-The-Air
GSM	Global System for Mobile Communication
HTTP(S)	Hyper Text Transport Protocol (Secure)
IP	Internet Protocol
MCU	Microcontroller Unit
NB-IoT	Narrowband Internet of Things
PDP	Packet Data Protocol
UFS	User File Storage
URL	Uniform Resource Locator