BC660K-GL
DFOTA Application Note

NB-IoT Module Series

Version: 1.0

Date: 2020-12-23

Status: Released

Our aim is to provide customers with timely and comprehensive service. For any assistance, please contact our company headquarters:

Quectel Wireless Solutions Co., Ltd.
Building 5, Shanghai Business Park Phase III (Area B), No.1016 Tianlin Road, Minhang District, Shanghai 200233, China
Tel: +86 21 5108 6236
Email: info@quectel.com

Or our local office. For more information, please visit:
http://www.quectel.com/support/sales.htm.

For technical support, or to report documentation errors, please visit:
http://www.quectel.com/support/technical.htm
Or email to support@quectel.com.

General Notes

Quectel offers the information as a service to its customers. The information provided is based upon customers' requirements. Quectel makes every effort to ensure the quality of the information it makes available. Quectel does not make any warranty as to the information contained herein, and does not accept any liability for any injury, loss or damage of any kind incurred by use of or reliance upon the information. All information supplied herein is subject to change without prior notice.

Disclaimer

While Quectel has made efforts to ensure that the functions and features under development are free from errors, it is possible that these functions and features could contain errors, inaccuracies and omissions. Unless otherwise provided by valid agreement, Quectel makes no warranties of any kind, implied or express, with respect to the use of features and functions under development. To the maximum extent permitted by law, Quectel excludes all liability for any loss or damage suffered in connection with the use of the functions and features under development, regardless of whether such loss or damage may have been foreseeable.

Duty of Confidentiality

The Receiving Party shall keep confidential all documentation and information provided by Quectel, except when the specific permission has been granted by Quectel. The Receiving Party shall not access or use Quectel's documentation and information for any purpose except as expressly provided herein. Furthermore, the Receiving Party shall not disclose any of the Quectel's documentation and information to any third party without the prior written consent by Quectel. For any noncompliance to the above requirements, unauthorized use, or other illegal or malicious use of the documentation and information, Quectel will reserve the right to take legal action.

Copyright

The information contained here is proprietary technical information of Quectel. Transmitting, reproducing, disseminating and editing this document as well as using the content without permission are forbidden. Offenders will be held liable for payment of damages. All rights are reserved in the event of a patent grant or registration of a utility model or design.

About the Document

Revision History

Version	Date	Author	Description
-	2020-11-17	Randy LI	Creation of the document
1.0	2020-12-23	Randy LI	First Official Release

Contents

Table Index

1 Introduction

Quectel BC660K-GL module supports DFOTA function, which enables firmware upgrading over the air.

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

This document mainly describes how to upgrade the firmware of the BC660K-GL module via DFOTA over HTTP.

2 DFOTA over HTTP

2.1. Procedure Overview

The following chart illustrates the procedure of DFOTA over HTTP when the delta firmware package is stored on an HTTP server.
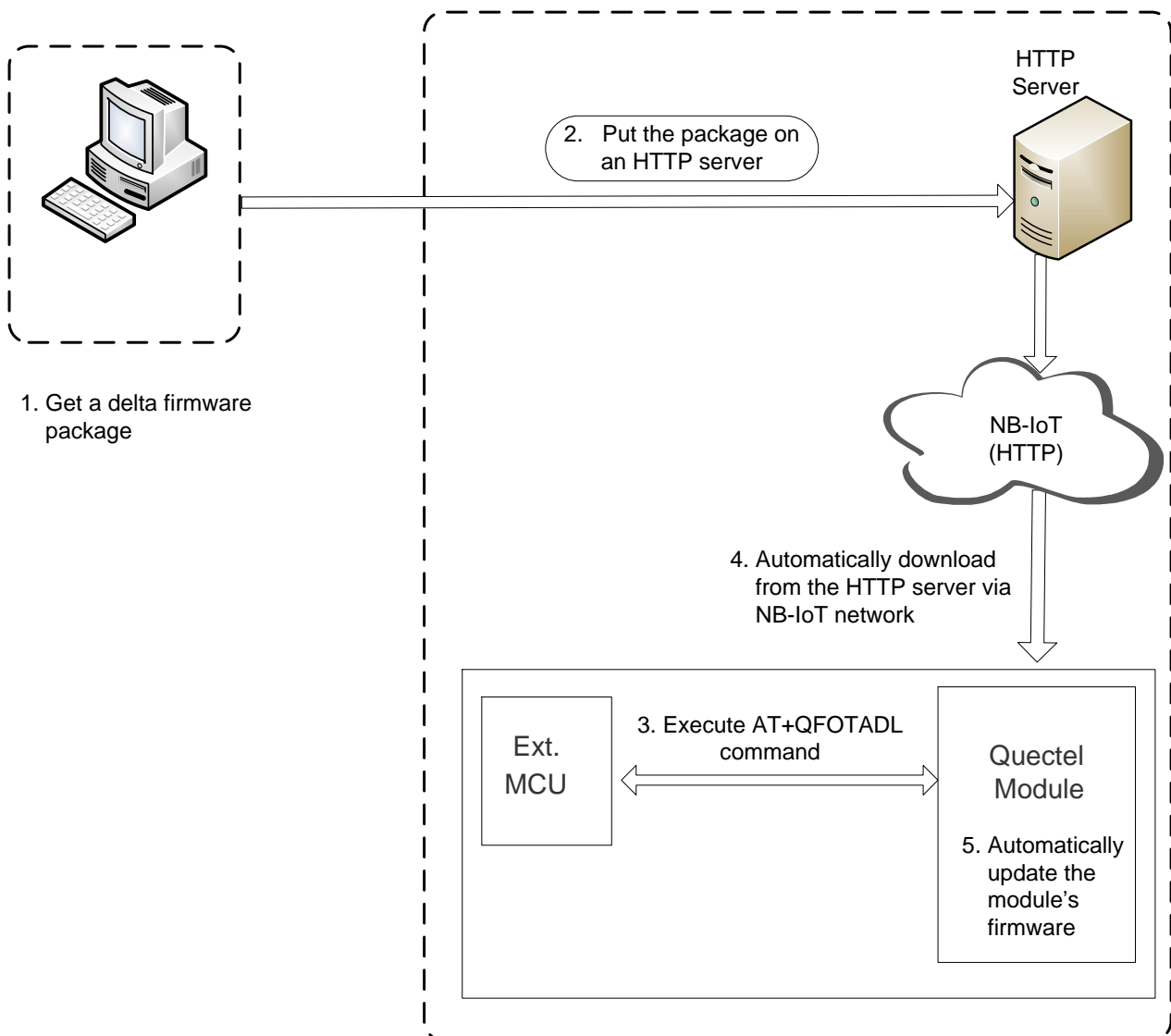

Figure 1: DFOTA Procedure over HTTP

2.2. Concrete Steps

The following steps need to be performed to upgrade the firmware when the firmware package is stored on an HTTP server:

Step 1: Get the delta firmware package from Quectel.
Step 2: Put the delta firmware package on an HTTP server.
Step 3: Check network status.
Step 4: Triger automatic DFOTA over HTTP with **AT+QFOTADL=<URL>**.

2.2.1. Get Delta Firmware Package

Before upgrading, please check the original firmware version with **ATI** command and confirm the target firmware version, and then send the two firmware versions to Quectel Technical Support (support@quectel.com) to get a delta firmware package.

2.2.2. Put Delta Firmware Package on HTTP Server

Step 1: Set up an HTTP server before using DFOTA function (Quectel does not provide such a server).
Step 2: Put the delta firmware package on the server, and record the storage path, which is to be included in **AT+QFOTADL=<URL>**.

2.2.3. Check Network Status

Check whether the module is registered on network or not with the following AT commands after it powers on and before the firmware upgrade.

- **AT+CESQ:** Query signal quality.
- **AT+CEREG?:** Query network registration status.
- **AT+CGPADDR?:** Query the allocated IP address for the default PDN.

For more details about the above commands, see ***document [1]***.

2.2.4. Triger Automatic DFOTA over HTTP

After the network status is ready, execute **AT+QFOTADL=<URL>**, and the module will download the delta firmware package from the HTTP server and upgrade the firmware automatically via DFOTA. For more details on the command, see ***Chapter 3.2***.

3 DFOTA Related AT Commands

3.1. AT Command Syntax

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>**. Throughout this document, only the commands and responses are presented, while carriage return and line feed characters 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 to give 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. AT+QFOTADL=<URL>　Trigger Automatic DFOTA over HTTP

The Write Command triggers the automatic firmware upgrade by the module via DFOTA.

After a delta firmware package has been stored on an HTTP server, **AT+QFOTADL=<URL>** triggers the automatic firmware download and upgrade process of DFOTA. When the firmware upgrade is complete, the module will return result code 0 and reboot automatically, otherwise it will return an error code, exit from DFOTA and continue to run on the original firmware.

AT+QFOTADL=<URL>　Trigger Automatic DFOTA over HTTP	
Test Command **AT+QFOTADL=?**	Response **+QFOTADL=<URL>** **OK**
Write Command **AT+QFOTADL=<URL>**	Response **OK** **+QIND: "FOTA","HTTPSTART"** **+QIND: "FOTA","DOWNLOADING",<percent>** **+QIND: "FOTA","DOWNLOADING",<percent>** **...** **+QIND: "FOTA","HTTPEND",<download_result>** **+QIND: "FOTA","START"** **+QIND: "FOTA","UPDATING",<percent>,<total_num>,<current_bin>** **+QIND: "FOTA","UPDATING",<percent>,<total_num>,<current_bin>** **...** **+QIND: "FOTA","END",<upgrade_result>** If there is any error: **ERROR**
Maximum Response Time	5 s

Characteristics	The command takes effect immediately. Remain invalid after deep-sleep wakeup. The configuration will not be saved to NVRAM.

Parameter

\<URL>	String type. The max length is 255 bytes. It should be started with "HTTP://". 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 server.
	\<HTTP_port>	Integer type. The port of the HTTP server. Range: 1–65535. Default value: 80.
	\<HTTP_file_path>	String type. The file path in HTTP server.
\<download_result>	Integer type.	The code of download result.
	0	Downloaded successfully.
	Other values	Download failed. See *Chapter 6* for more details.
\<percent>	Integer type.	The download or upgrade progress in percentage.
\<total_num>	Integer type.	The total number of programs to upgrade. Currently it is always 1.
\<current_bin>	Integer type.	The sequence number of the program being upgraded. Currently it is always 1.
\<upgrade_result>	Integer type.	The code of upgrade result.
	0	Upgraded successfully.
	Other values	Upgrade failed. See *Chapter 6* for more details.

NOTES

1. If the module is powered off during the "UPDATING" process, it enters the force upgrade mode automatically so that after it is powered on next time, the upgrade will continue. Below is an example of upgrade progress:
   +QIND: "FOTA","START"

   +QIND: "FOTA","UPDATING",0%,1,1

   +QIND: "FOTA","UPDATING",30%,1,1
   ...
   +QIND: "FOTA","END",0
2. Currently, the module does not support DFOTA over HTTPS.

4 DFOTA Related URCs

4.1. +QIND: "FOTA","HTTPSTART"   Notify the Start of HTTP Download

+QIND: "FOTA","HTTPSTART" Notify the Start of HTTP Download	
+QIND: "FOTA","HTTPSTART"	The URC notifies that the download over HTTP starts.

4.2. +QIND: "FOTA","DOWNLOADING"   Notify HTTP Download Progress

+QIND: "FOTA","DOWNLOADING" Notify HTTP Download Progress	
+QIND: "FOTA","DOWNLOADING",<percent>	The URC notifies the HTTP download progress.

Parameter

<percent>	Integer type. The download progress in percentage.

4.3. +QIND: "FOTA","HTTPEND"   Notify HTTP Download Result

+QIND: "FOTA","HTTPEND" Notify HTTP Download Result	
+QIND: "FOTA","HTTPEND",<download_result>	The URC notifies the HTTP download result.

Parameter

<download_result>	Integer type.	The code of download result.

0	Downloaded successfully.
Other values	Download failed. See *Chapter 6* for details.

4.4. +QIND: "FOTA","START" Notify the Start of Upgrade

+QIND: "FOTA","START" Notify the Start of Upgrade	
+QIND: "FOTA","START "	The URC notifies the start of upgrade.

4.5. +QIND: "FOTA","UPDATING" Notify Upgrade Progress

+QIND: "FOTA","UPDATING" Notify Upgrade Progress	
+QIND: "FOTA","UPDATING",\<percent>,\<total_num>,\<current_bin>	The URC notifies the upgrade progress.

Parameter

\<percent>	Integer type. The upgrade progress in percentage.
\<total_num>	Integer type. The total number of programs to upgrade. Currently it is always 1.
\<current_bin>	Integer type. The sequence number of the program being upgraded. Currently it is always 1.

4.6. +QIND: "FOTA","END" Notify Upgrade Result

+QIND: "FOTA","END" Notify Upgrade Result	
+QIND: "FOTA","END",\<upgrade_result>	The URC notifies the upgrade result.

Parameter

\<upgrade_result>	Integer type.	The code of upgrade result.
	0	Upgraded successfully.
	Other values	Failed to Upgrade. See *Chapter 6* for details.

5 Example

//Upgrade firmware when the delta firmware package is stored on an HTTP server.
//The HTTP server address is "http://www.quectel.com:100/update.zip".
AT+CESQ;+CEREG?;+CGPADDR?   //Query signal quality and network registration status.
+CESQ: 99,99,255,255,22,58
+CEREG: 0,1
+CGPADDR: 0,"11.102.241.134"

OK

//Execute **AT+QFOTADL** command to start automatic DFOTA over HTTP, and the module will download
the delta firmware package and upgrade firmware automatically.
AT+QFOTADL="http://www.quectel.com:100/update.zip"
OK

+QIND: "FOTA","HTTPSTART"   //Start download.

+QIND: "FOTA","DOWNLOADING", 1%   //Download progress.

+QIND: "FOTA","DOWNLOADING", 2%

…

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

+QIND: "FOTA","HTTPEND",0   //Downloaded successfully.

+QIND: "FOTA","START"   //Start upgrade.

+QIND: "FOTA","UPDATING",0%,1,1   //Upgrade progress.

+QIND: "FOTA","UPDATING",1%,1,1

…

+QIND: "FOTA","UPDATING",100%,1,1

RDY

```
+CFUN: 1

+QIND: "FOTA","END",0                    //Upgraded successfully.

+CPIN: READY

+IP: 100.75.72.128
```

6 Summary of Result Codes

This chapter introduces the result codes related to Quectel modules or the network. The details about **<download_result>** and **<upgrade_result>** are described in the following tables.

Table 2: Summary of <download_result> Codes

<download_result>	Description
0	Downloaded successfully
1	Unknown error
2	DNS resolution error
12	Download failed
13	Network deactivated
99	Network unavailable
100	Flash write error
101	Flash not enough

Table 3: Summary of <upgrade_result> Codes

<upgrade_result>	Description
0	Upgraded successfully
255	Delta firmware package invalid

7 Appendix A References

Table 4: Related Document

SN	Document Name	Remark
[1]	Quectel_BC660K-GL_AT_Commands_Manual	AT Commands Manual for BC660K-GL

Table 5: Terms and Abbreviations

Abbreviation	Description
DFOTA	Delta Firmware Upgrade Over-the-Air
DNS	Domain Name Server
HTTP	Hyper Text Transport Protocol
HTTPS	Hypertext Transfer Protocol (Secure/over Secure Socket Layer)
ID	Identification
IP	Internet Protocol
IMEI	International Mobile Equipment Identity
MCU	Microcontroller Unit
NB-IoT	Narrow Band Internet of Things
NVRAM	Non-Volatile Random Access Memory
PDN	Packet Data Network
TA	Terminal Adaptor
URC	Unsolicited Result Code
URI	Uniform Resource Identifier
URL	Uniform/Universal Resource Locator