BG96 SoftBank DFOTA Application Note

LPWA Module Series

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About the Document

Revision History

Version	Date	Author	Description
-	2020-11-02	Matt YE	Creation of the document
1.0	2020-11-02	Matt YE	First official release

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1 Introduction

This document describes the SoftBank DFOTA mechanism of Quectel BG96 module.

According to SoftBank requirements, the module must perform DFOTA update mechanism when the polling timer expires, and the mechanism cannot be disabled. In order to avoid unexpected interrupt of the running tasks resulted from DFOTA update, Quectel provides some AT commands to configure when to start the update and some URCs to report the update progress and results.

2 SoftBank DFOTA Mechanism

The polling timer is set randomly between 14 and 15 days. When the polling timer expires, the module queries whether there is a new firmware version on FOTA server.

- If a new version exists, the module automatically downloads the DFOTA package, begins update, and sets the next polling timer to 14 days plus 0–24 (random) hours. In such a case, URCs are outputted through the AT command port to report the update progress and results.
- If a new version does not exist, the next polling timer is set to 14 days plus 0–24 (random) hours directly.

When the polling timer expires, the module queries whether there is a new firmware version on FOTA server again and repeats the process.

NOTE

When a new firmware version is detected on the FOTA server, the module should not be powered off until it completes DFOTA update successfully, otherwise the update may fail.

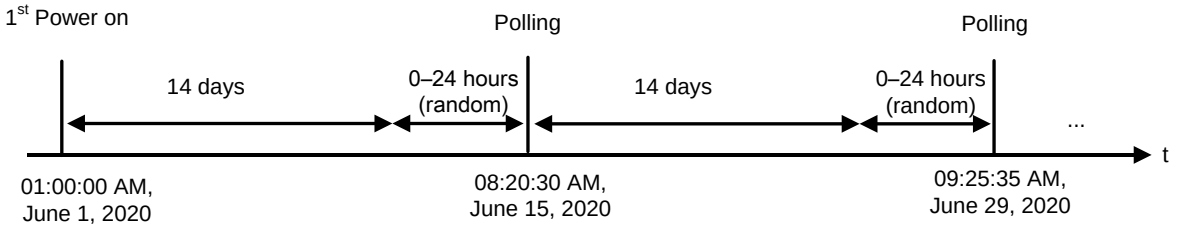

Figure 1: Polling Time (Module Always Active)

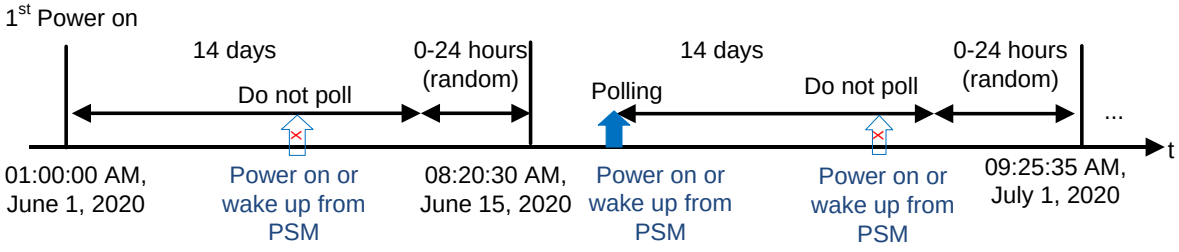

Figure 2: Polling Time (Module Powered on or Woken up from PSM Once Every 8 Days)

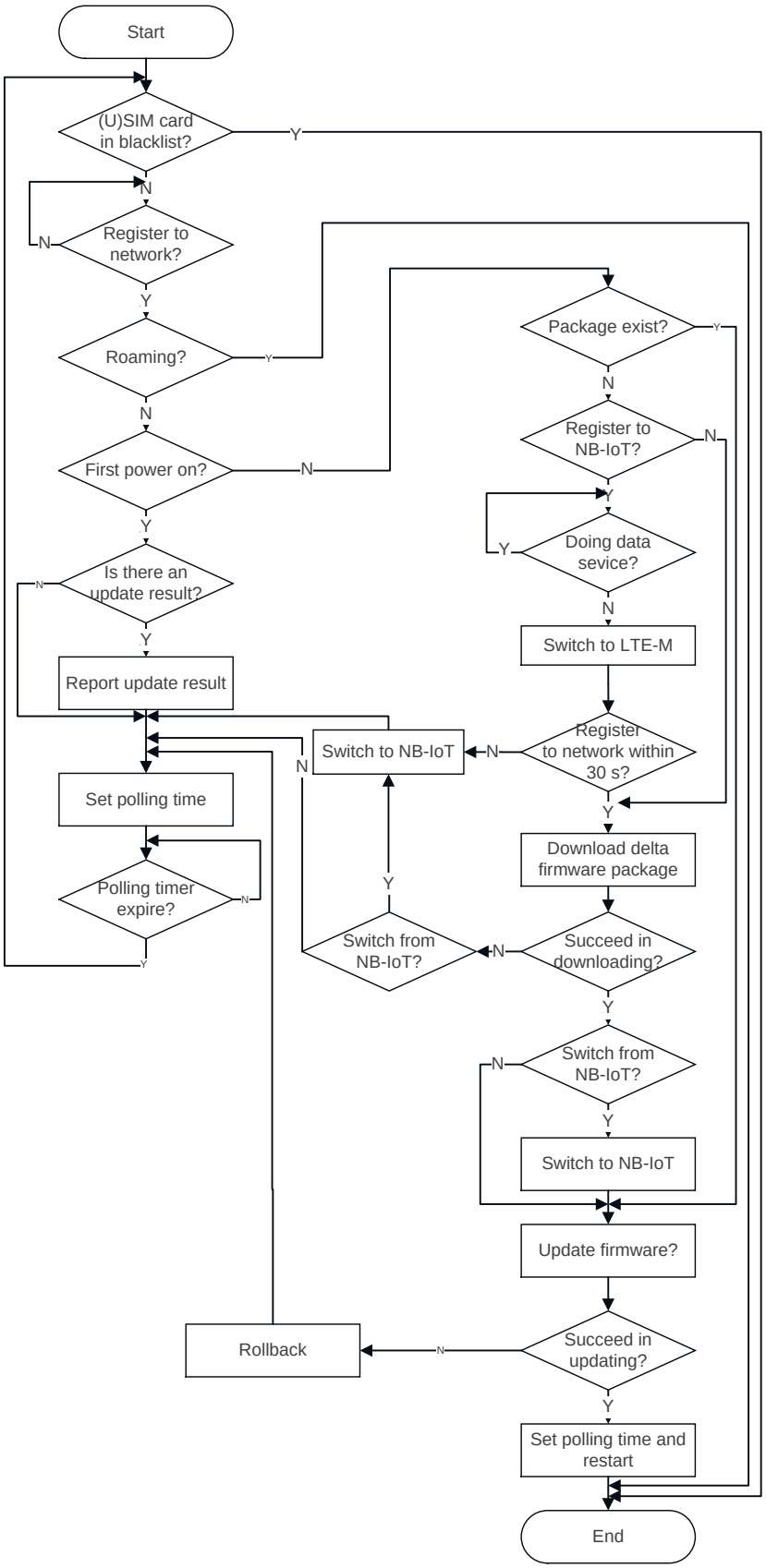

Figure 3: SoftBank DFOTA Flow Chart

3 SoftBank DFOTA Update Process

The following chart illustrates the SoftBank DFOTA update process when the delta firmware package is stored on the FOTA server.

Step 1: If there is a new version to update, Quectel makes the corresponding delta firmware package.
Step 2: Quectel puts the package to the FOTA server.
Step 3: When the polling timer expires, the module downloads the delta firmware package automatically.
Step 4: After downloading the firmware package successfully, the module starts DFOTA update automatically.
Step 5: The module sends the update result to the FOTA server.

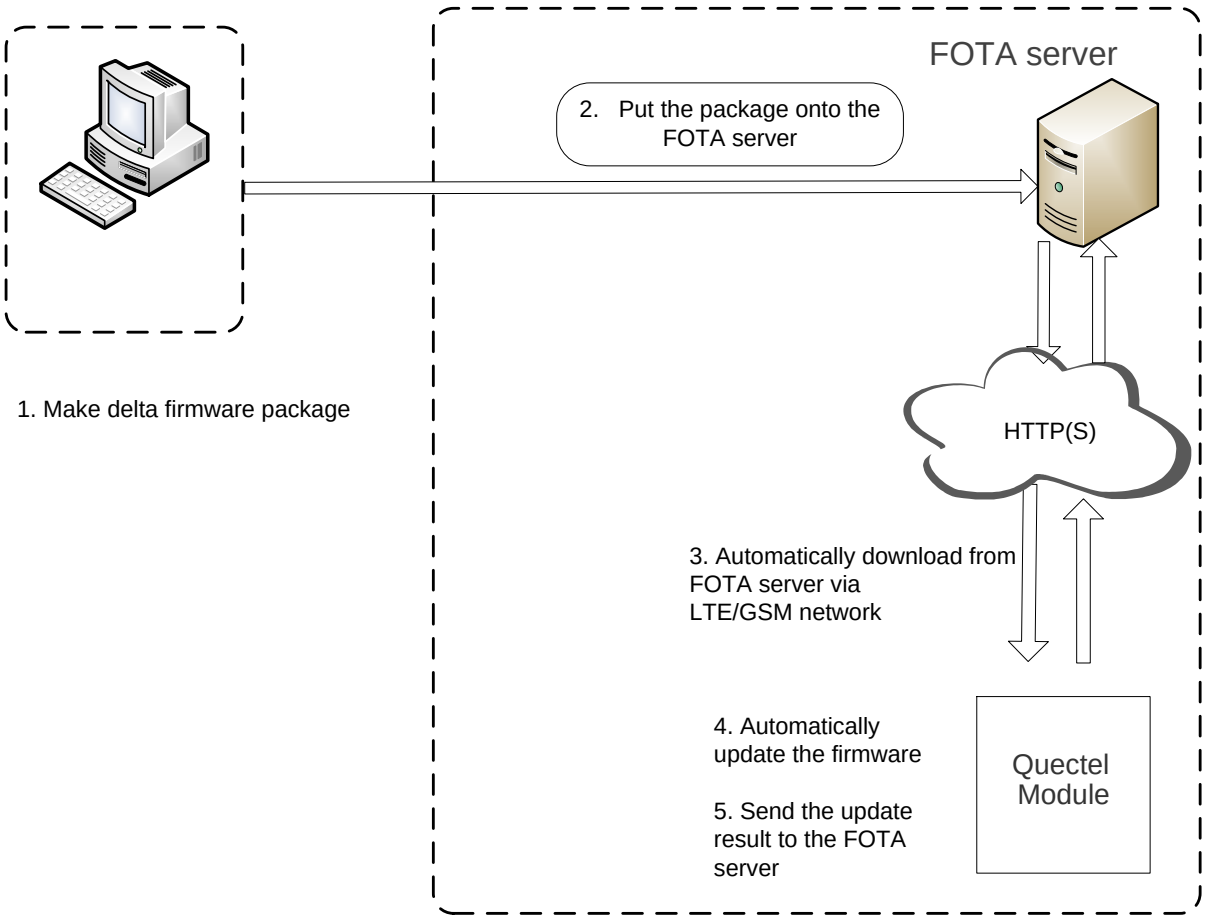

Figure 4: Firmware Update Procedure via DFOTA

4 SoftBank DFOTA AT Commands

4.1. AT Command Syntax

4.1.1. 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 omitted, the new value equals to the previous value or the default settings, unless otherwise specified.
- **Underline** Default setting of a parameter.

4.1.2. 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 and Responses

Command Type	Syntax	Description
Test Command	**AT+<cmd>=?**	Returns the list of parameters and value ranges set by the corresponding Write Command or internal processes.
Read Command	**AT+<cmd>?**	Returns the currently set value of a parameter or parameters.
Write Command	**AT+<cmd>=<p1>[,<p2>[,<p3>[...]]]**	Sets parameter values.
Execution Command	**AT+<cmd>**	Reads non-variable parameters affected by internal processes in the module.

4.2. Description of SoftBank DFOTA AT Commands

4.2.1. AT+QCFGEXT="sbfota_delay" Configure Update Delay Time

The command configures the delay time to start DFOTA update after the delta firmware package is downloaded successfully.

AT+QCFGEXT="sbfota_delay" Configure Update Delay Time	
Command **AT+QCFGEXT="sbfota_delay"[,<time>]**	Response If the optional parameter is omitted, the command queries the current setting. **+QCFGEXT: "sbfota_delay",<time>** **OK** If the optional parameter is specified, the command configures the update delay time. **OK** If there is any error: **ERROR**
Maximum Response Time	300 ms
Characteristics	The command takes effect immediately. The configuration is saved automatically.

Parameter

<time>	Integer type. The delay time for starting DFOTA update after the delta firmware package is downloaded successfully. Range: 0–60. Default: 0. Unit: second.

NOTES

1. If **<time>** is 0, it means that the module starts DFOTA update immediately after the delta firmware package is downloaded successfully. In such a case, no URC will be reported.
2. If **<time>** is not 0, after the delta firmware package is downloaded successfully, the URC **+QIND: "SBFOTA","UPDATE_TIMEOUT",<timeout>** is reported. **<timeout>** equals **<time>**.
3. You can configure the delay time so that there is enough time to stop or handle the ongoing tasks before the update starts.

4.2.2. AT+QCFGEXT="sbfota_accept" Start DFOTA Update Immediately

The command starts DFOTA update immediately.

AT+QCFGEXT="sbfota_accept" Start DFOTA Update Immediately	
Write Command **AT+QCFGEXT="sbfota_accept",<para>**	Response **OK** If there is any error related to ME functionality: **ERROR**
Maximum Response Time	300 ms
Characteristics	The command takes effect immediately. The configuration is not saved.

Parameter

<para>	Integer type. Whether to start DFOTA update immediately. 1 Start immediately, without the need to wait for the delay time to expire

NOTES

1. Execute this command between **+QIND: "SBFOTA","UPDATE_TIMEOUT",<timeout>** and **+QIND: "SBFOTA","START"**, otherwise an error is returned.
2. If the ongoing tasks have been stopped or handled before **<timeout>** reaches, execute this command to start DFOTA update immediately.

5 SoftBank DFOTA URCs

SoftBank DFOTA URCs begins with **+QIND: "SBFOTA"**.

5.1. URC to Report Polling Time

URC to Report Polling Time	
+QIND: "SBFOTA","polling_time",<time>	Report polling time.

Parameter

<time>	Integer type. The polling time. Range: 0–1296000. Unit: second.

NOTES

1. When the polling timer expires, the module queries whether there is a new version to update on the FOTA server. If a new version exists, the module automatically downloads the DFOTA package, begins update, and sets the next polling timer to 14 days plus 0–24 (random) hours. If a new version does not exist, the next polling timer is set to 14 days plus 0–24 (random) hours directly.
2. This URC is reported only when the module sets the polling time or after the module registers to the network successfully at startup.

5.2. URC to Report Polling Exceptions

URC to Report Polling Exceptions	
+QIND: "SBFOTA","POLLING",<err>	Report polling exceptions.

Parameter

<err>	Integer type. The polling exceptions (errors). -1 Unregistered to the network, set the next polling timer to 14 days plus 0–24 hours -2 No SoftBank (U)SIM card, stop polling -3 (U)SIM card not inserted, set the next polling timer to 14 days plus 0–24 hours -4 UE in roaming state, stop polling

NOTE

Only when a polling error occurs, this URC is reported.

5.3. URCs to Report DFOTA Progress

URCs to Report DFOTA Progress	
+QIND: "SBFOTA","HTTPSTART" **+QIND: "SBFOTA","DOWNLOADING",<percent>** **…** **+QIND: "SBFOTA","HTTPEND",<HTTP_err>** **+QIND: "SBFOTA","UPDATE_TIMEOUT",<timeout>** **+QIND: "SBFOTA","START"** **+QIND: "SBFOTA","UPDATING",<percent>** **...** **+QIND: "SBFOTA","RESTORE",<percent>** **...** **+QIND: "SBFOTA","END",<update_err>**	Report downloading and updating progress.

Parameter

<percent>	Integer type. The downloading, updating or restoring progress in percentage.
<HTTP_err>	Integer type. The HTTP(S) error code. See ***Chapter 7*** for the error code. 0 means a successful update. Any other value means an error during downloading.
<timeout>	Integer type. The delay time (set by **AT+QCFGEXT="sbfota_delay"**) for starting DFOTA update after the delta firmware package is downloaded successfully. Range: 0–60. Unit: second.
<update_err>	Integer type. The updating error code. See ***Chapter 7*** for the error code. 0 means a successful update. Any other value means an error during updating.

NOTES

1. **+QIND: "SBFOTA","RESTORE",<percent>** reports the progress of copying the updated firmware to the original partition from backup partition.
2. Do not power off the module during DFOTA update process.
   - When the module powers down or the network disconnects during "DOWNLOADING" process, the entire process ends.
   - When the module powers down during "UPDATING" process, it rolls back to the original version.
   - When the module powers down during "RESTORE" process, it automatically enters forced updating mode in which it continues to update upon reboot. In such a case, the URCs below are reported:

     +QIND: "SBFOTA","Last update was not finished,continue update"

     +QIND: "SBFOTA","RESTORE",1%

     +QIND: "SBFOTA","RESTORE",3%

     ...

     +QIND: "SBFOTA","RESTORE",100%

     +QIND: "SBFOTA","END",0

5.4. URC to Notify FOTA Server of the Update Result

URC to Notify FOTA Server of the Update Result	
+QIND: "SBFOTA","report_result","start" **+QIND: "SBFOTA","report_result","end",<HTTP_err>**	Notify FOTA server of the update result.

Parameter

<HTTP_err>	Integer type. The HTTP(S) error code. See ***Chapter 7*** for the error code. 0 means a successful update. Any other value means an error.

NOTE

The URC is reported only when the DFOTA update process starts.

6 Example

Here is a detailed example on the DFOTA update process.

```
RDY

APP RDY

AT+QCFGEXT="sbfota_delay",30          //Set the delay time to 30 seconds.
OK

+QIND: "SBFOTA","polling_time",407    //407 seconds later, it triggers the polling and starts to download the delta firmware package.
+QIND: "SBFOTA","HTTPSTART"           //Start to download.

+QIND: "SBFOTA","DOWNLOADING",10%
…

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

+QIND: "SBFOTA","HTTPEND",0           //Succeed in downloading.

+QIND: "SBFOTA","UPDATE_TIMEOUT",30   //It will delay 30 seconds to start DFOTA update after the delta firmware package is downloaded successfully.

//Execute AT+QCFGEXT="sbfota_accept",1 to start DFOTA update immediately.

+QIND: "SBFOTA","START"               //Start to update.

+QIND: "SBFOTA","UPDATING",6%

…

+QIND: "SBFOTA","UPDATING",100%

+QIND: "SBFOTA","RESTORE",4%

…
```

```
+QIND: "SBFOTA","RESTORE",100%

+QIND: "SBFOTA","END",0                    //Updated successfully.

RDY

APP RDY

+QIND: "SBFOTA","report_result","start"    //Start to notify FOTA server of the update result.

+QIND: "SBFOTA","report_result","end",0    //Successfully notified FOTA server of the update result.

+QIND: "SBFOTA","polling_time",1220654     //Report the polling time (1220654 seconds).
```

7 Summary of Error Codes

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

Table 1: Summary of <HTTP_err> Codes

<HTTP_err>	Description
0	Download successful
701	HTTP(S) unknown error
702	Server connection failed
703	Request failed
704	Download timeout
706	File not exist
707	Write data to file failed
708	Downloaded file is too large
800	Update status not matched
801	Protocol access type not matched
802	This module has no update plan
803	The update plan not exist
804	Battery power too low for update plan
805	Signal strength too low for update plan
806	Current time not match the plan
807	Concurrency out of limit for this plan
808	Plan has ended or forced to stop

809	Module not exist
810	Access token not exist
811	Access token invalid
812	Access token has been expired
813	Insufficient token permissions
814	Request parameter has no IMEI number
815	The request module does not match the current token
850	Authentication exception
851	Getting access token failed
852	Password incorrect
853	Invalid refresh token
854	Module info not exist
855	Module name or password empty
880	Service exception

Table 2: Summary of <update_err> Codes

<update_err>	Description
0	Updated successfully
504	Firmware update failed
505	Update package not exist
506	Update package check failed
510	Restore error
511	Package is mismatched with the current firmware
512	Unknown error

8 Appendix A References

Table 3: Terms and Abbreviations

Abbreviation	Description
DFOTA	Delta Firmware Update Over-the-Air
FOTA	Firmware Over-the-Air
GPRS	General Packet Radio Service
HTTP(S)	Hyper Text Transport Protocol (Secure)
IMEI	International Mobile Equipment Identity
LPWA	Low Power Wide Area
LTE	Long Term Evolution
ME	Mobile Equipment
URC	Unsolicited Result Code