

# **EC2x&EG9x&EG25-G Series**

## **QuecOpen DFOTA**

### **Application Note**

**LTE Standard Module Series**

Ver. EC2x&EG9x&EG25-G\_Series\_QuecOpen\_DFOTA\_Application\_Note  
\_V1.0

Date: 2020-07-31

Status: Released

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# About the Document

## Revision History

| Version | Date       | Author                                     | Description |
|---------|------------|--|-------------|
| 1.0     | 2020-07-31 | Ramos ZHANG/<br>Thomas ZHANG/<br>Fate ZHAO | Initial     |

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# 1 Introduction

Quectel LTE Standard EC2x&EG9x&EG25-G Series modules support QuecOpen®. This document mainly describes how to upgrade the firmware of the above modules via DFOTA.

The firmware can be upgraded or degraded via DFOTA. Before firmware updating, a delta firmware package which contains only the differences between the source and the target firmware versions has to be obtained. In this way, the amount of data transmitted and the time taken can be reduced.

## 1.1. Applicable Modules

**Table 1: Applicable Modules**

| Module Series | Module      |
|---------------|-------------|
| EC2x series   | EC25 series |
|               | EC21 series |
|               | EC20 R2.1   |
| EG9x series   | EG95 series |
|               | EG91 series |
| EG25-G        | EG25-G      |

## 2 Generate Delta Firmware Package

### 2.1. Make Target Firmware Version

Provided for making delta firmware package, the *targetfiles.zip* file in the */upgrade* directory of the target firmware package is a compressed file of all the original files. If Openlinux users modify *boot.img* and *rootfs*, the files will be different from the original ones saved in *targetfiles.zip*. This results in the failure of DFOTA. Hence, before releasing the target firmware version, the *targetfiles.zip* file needs to be updated at the same time. The steps for making *targetfiles.zip* are as follows:

#### 1. Unzip *targetfiles.zip* to the */target* directory.

Copy the original *targetfiles.zip* to Ubuntu system and execute the following command to unzip *targetfiles.zip* to the */target* directory.

```
unzip -d ./target ./targetfiles.zip
```

#### 2. Replace the *boot.img* and *recovery.img* files in *targetfiles*.

Replace the files of *boot.img* and *recovery.img* in the */BOOTABLE\_IMAGES* directory which is in the unzipped *targetfiles.zip* with the generated *mdm9607-perf-boot.img*. Then change the file name to *boot.img*.

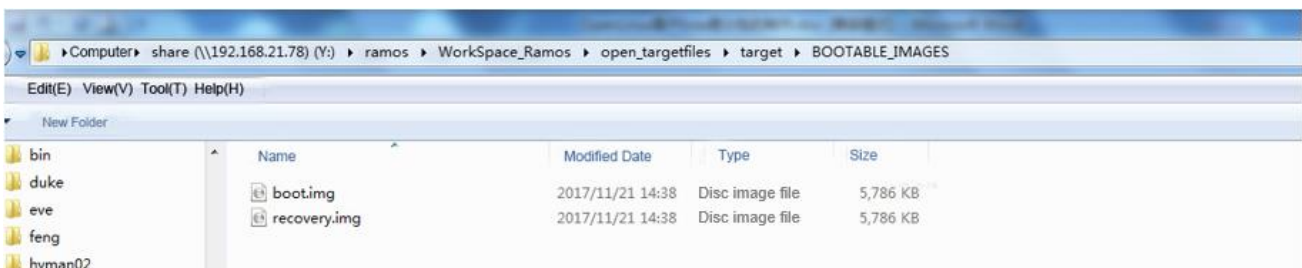


Figure 1: Replace *boot.img* and *recovery.img* files



### 3. Replace *rootfs* files.

After unzipping *targetfiles.zip* to the */target* directory, enter the */target* directory and delete all the files and directories in the */SYSTEM* directory except the */firmware* directory. Then copy all the files except the */firmware* directory in */ql-ol-rootfs* directory compiled in SDK to the */SYSTEM* directory.

| 名称         | 压缩后大小 | 原始大小 | 类型      | 修改日期                |
|------------|-------|------|---------|---------------------|
| ..         |       |      |         | 2019/10/18 10:48:27 |
| bin        |       |      |         | 2019/10/18 10:48:27 |
| boot       |       |      |         | 2019/10/18 10:48:27 |
| cache      |       |      |         | 2019/10/18 10:48:26 |
| data       |       |      |         | 2019/10/18 10:48:27 |
| data_swap  |       |      |         | 2019/10/18 10:48:27 |
| dev        |       |      |         | 2019/10/18 10:48:27 |
| etc        |       |      |         | 2019/10/18 10:48:27 |
| firmware   |       |      |         | 2019/10/18 10:48:27 |
| home       |       |      |         | 2019/10/18 10:48:27 |
| lib        |       |      |         | 2019/10/18 10:48:26 |
| media      |       |      |         | 2019/10/18 10:48:27 |
| mnt        |       |      |         | 2019/10/18 10:48:27 |
| proc       |       |      |         | 2019/10/18 10:48:27 |
| run        |       |      |         | 2019/10/18 10:48:26 |
| sbin       |       |      |         | 2019/10/18 10:48:27 |
| share      |       |      |         | 2019/10/18 10:48:27 |
| sys        |       |      |         | 2019/10/18 10:48:27 |
| system     |       |      |         | 2019/10/18 10:48:27 |
| usr        |       |      |         | 2019/10/18 10:48:27 |
| usrdata    |       |      |         | 2019/10/18 10:48:27 |
| var        |       |      |         | 2019/10/18 10:48:26 |
| WEBSERVER  |       |      |         | 2019/10/18 10:48:27 |
| build.prop | 67    | 67   | PROP 文件 | 2019/10/18 10:48:26 |
| linuxrc    | 24    | 24   |         | 2019/10/18 10:48:26 |
| sdcard     | 13    | 13   |         | 2019/10/18 10:48:26 |
| target     | 8     | 8    |         | 2019/10/18 10:48:26 |
| tmp        | 8     | 8    |         | 2019/10/18 10:48:26 |

Figure 2: Replace rootfs Files

### 4. Repackage to generate *targetfiles.zip*.

Enter the */target* directory where *targetfiles.zip* is unzipped and execute the following command to repackage. The regenerated *targetfiles.zip* can be found in the upper directory of the */target* directory.

```
zip -qry0 ../targetfiles.zip ./*
```

**NOTE**

The package should be packaged by package command other than the packaging tool.

## 2.2. Generate Delta Firmware Package

Environment: Ubuntu 14.04 64 bit. The steps for generating delta firmware package are as follows, taking EC20 R2.1 as an example:

### 1. Unzip *EC20-delta-gentools*.

Execute the following command to unzip *EC20-delta-gentools*:

```
tar -xzf EC20-delta-gentools.tar.gz
```

### 2. Configure the environment.

**Step 1:** Configure the environment before the first execution. Execute the following command to configure the environment (Ignore this step if it is configured):

```
cd EC20-delta-gentools
```

**Step 2:** Execute the following command to install LZO library in case there is an error message of **No module named lzo**.

```
sudo apt-get install liblzo2-dev  
sudo pip install python-lzo
```

**Step 3:** Copy the library file in the current directory to */usr/lib* in case there is an error message of **bsdiff: error while loading shared libraries: libbz2.so.0: cannot open shared object file: No such file or directory**.

```
sudo cp libbz2.so.0* /usr/lib/
```

**Step 4:** In the */EC20-delta-gentools* directory, the executable permission should be given to the four files: *bsdiff*, *imgdiff*, *ota\_from\_target\_files*, *update\_gen.sh* via the following command:

```
chmod 777 bsdiff imgdiff ota_from_target_files update_gen.sh
```

### 3. Put the *targetFiles.zip* file into the corresponding directory

Enter the */EC20-delta-gentools* directory, then copy *targetfiles.zip* file in the */upgrade* directory of the running firmware package and the target firmware package to */v1* and */v2* directory respectively.

#### NOTE

ACDB files are loaded into memory in the process of *alsaucm\_test*. If the process is not enabled, online calibration mode cannot be used on QACT tool.

#### 4. Generate package and put it to the corresponding servers

Execute the following command and the *update.zip* generated in the */EC20-delta-gentools* directory is the expected delta firmware package. Put it to the corresponding HTTP and FTP servers.

```
./update_gen.sh a
```

#### NOTE

The optional parameters of the above command: <**m**: modem; **l**: linux; **o**: boot; **a**: all>. If you need to choose all, just input the parameter **a**.

### 2.3. Generate UBI Delta Firmware Package

Currently the delta firmware package generation tool supports direct delta upgrade of UBI files.

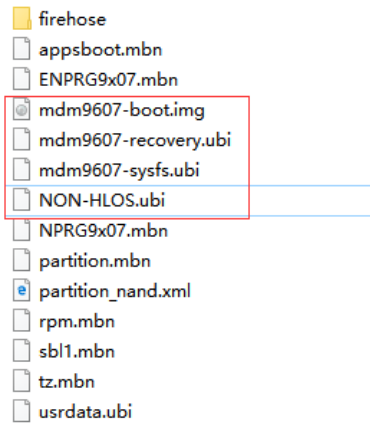
#### 2.3.1. Files Required

There are four files which are required to generate UBI delta firmware package in the */update* directory of the firmware package: *mdm9607-boot.img*, *mdm9607-sysfs.ubi*, *mdm9607-recovery.ubi*, and *NON-HLOS.ubi*. The four above files respectively correspond to Linux kernel image, main file system, backup file system and Modem file system. Although the file names may not remain exactly the same in different projects, you just need to find the file with the corresponding function.

The naming rules of files which need to be downloaded to each partition are as follows:

- System partition: *mdm.\*sysfs.ubi*
- modem partition: *NON-HLOS.ubi*
- boot partition: *mdm.\*boot.img*
- recovery partition: *mdm.\*recovery.\*.ubi*

Among them, \* can match any character or be void.



**Figure 3: Name of Required Files**

### 2.3.2. Files Path

Enter the directory of delta firmware package generation tool. There exist */v1* and */v2* directories that are supposed to store the above four files: the */v1* directory is used to store original version files, namely, the files are currently being downloaded and run by the module; the */v2* directory is used to store the files to be updated. If the Linux kernel image or the main file system has ever been updated, the files stored in the */v2* directory should be updated correspondingly.

```
v1:
mdm9607-perf-boot.img mdm9607-perf-sysfs.ubi mdm-perf-recovery-image-mdm9607-perf.ubi NON-HLOS.ubi readme.txt
v2:
mdm9607-perf-boot.img mdm9607-perf-sysfs.ubi mdm-perf-recovery-image-mdm9607-perf.ubi NON-HLOS.ubi readme.txt
```

**Figure 4: Files in v1 Directory and v2 Directory**

### 2.3.3. Execute Command

Compare the differences of the four files in */v2* directory with those in */v1* directory by executing the following command. Then generate the final delta firmware package *update.zip* based on the files in */v1* directory.

```
./update_gen.sh a.ubi
```

**NOTE**

The optional parameters of the above command: **<m.ubi**: modem; **l.ubi**: linux; **o.ubi**: boot; **a.ubi**: all>. If you need to choose all, just input the parameter **a.ubi**.

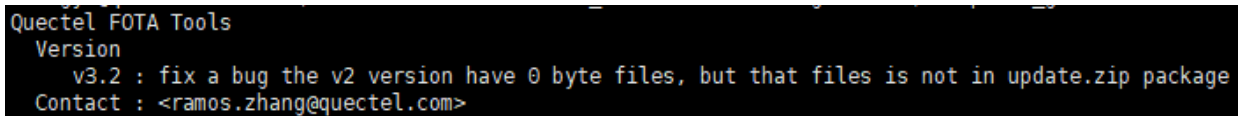
# 3 Check Delta Firmware Package

Acquire the version information of the delta firmware package generation tool used currently and the delta firmware package generation tool in the delta firmware package, and then check whether the delta firmware package is generated by the correct tool via comparing the version information of the delta firmware package generation tool used currently with the delta firmware package generation tool in the delta firmware package. The version information of the delta firmware package generation tool is acquired as follows.

## 1. Acquire the version information of the delta firmware package generation tool used currently

Acquire the version number of the current tool by executing the following command:

```
./update_gen.sh --version
```



```
Quectel FOTA Tools
Version
v3.2 : fix a bug the v2 version have 0 byte files, but that files is not in update.zip package
Contact : <ramos.zhang@quectel.com>
```

Figure 5: Version Information of Delta Firmware Package Generation Tool

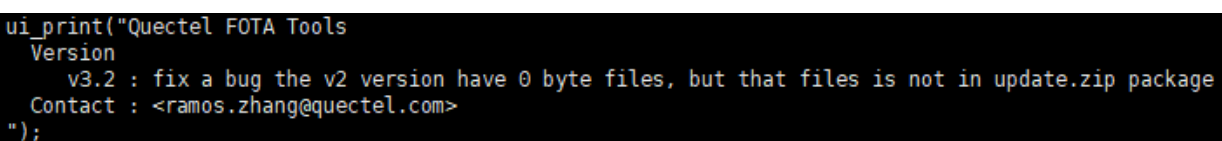
## 2. Acquire the delta firmware package generation tool version information in delta firmware package

Unzip the DFOTA package by executing the following command:

```
unzip -d ./update ./update.zip
```

Acquire the version information of the DFOTA package generation tool by executing the following command:

```
head -5 update/META-INF/com/google/android/updater-script
```



```
ui_print('Quectel FOTA Tools
Version
v3.2 : fix a bug the v2 version have 0 byte files, but that files is not in update.zip package
Contact : <ramos.zhang@quectel.com>
');
```

Figure 6: Version Information of Delta Firmware Package Generation Tool in Delta Firmware Package

# 4 Firmware Upgrading Procedure via DFOTA

## 4.1. Delta Firmware Package Importing Method

After checking *update.zip* package, import it to the module for DFOTA. There are two common methods to import DFOTA package, namely, ADB and RZ.

### 4.1.1. Imported by ADB

After the module is booted, plug in the USB cable to connect to the computer. Open the cmd window of the computer and use the **adb devices** command to check whether the device exists. If there is no ADB command currently, get the ADB command online. After the global variables are configured, the ADB command are ready to use. If the device is connected, the query results are as follows.

```
c:\>adb devices
List of devices attached
?      device
```

Figure 7: Device Queried with ADB Command

At this time, the generated *update.zip* can be transferred to the */usrdata* directory of the module with command **adb push "xxx\update.zip" "/usrdata/"**. Since the DFOTA package can be quickly imported through ADB, it is recommended to transfer files in this way.

### 4.1.2. Imported by RZ

After booting the module, enter */usrdata* directory, type **rz -E** command to pop up a selection box, then select *update.zip* file to import, or drag the file directly into the terminal command box to import it. However, the transmission rate of this method is very slow, hence it is not recommended to transfer files in this way.

## 4.2. Delta Firmware Upgrading Procedure

### 4.2.1. CMDLINE Upgrade

Since the final DFOTA package will be saved in the path `/usrdata/cache/fota/ipth_package.bin`, the CMDLINE upgrade needs to download DFOTA package first and then save it in the path `/usrdata/cache/fota/ipth_package.bin`. If you want to check the upgrade progress, configure AT port in `recoveryfs` of the module to report the progress. Besides, when downloading or saving DFOTA package, ensure that there is enough space in the `usrdata` partition. The available space for the `usrdata` partition should be greater than the size of the delta packet size, otherwise the DFOTA package will be downloaded or saved unsuccessfully. The specific CMDLINE upgrade process can be divided into 3 steps as shown in the **Chapter 4.2.1.1**, **Chapter 4.2.1.2** and **Chapter 4.2.1.3**.

#### 4.2.1.1. URC Port Configuration

The URC port is not configured by default. If the you want to view the upgrade progress during the upgrade, configure the corresponding URC port. The specific method is as follows.

##### 1. Mount `recoveryfs`

Mount `recoveryfs` with the following command:

```
mtddnum=`cat /proc/mtd | grep -w recoveryfs | awk -F["d"":"] '{print $2}`  
ubiattach -m $mtddnum -d 3 /dev/ubi_ctrl  
mkdir -p /tmp/mount_recovery  
mount -t ubifs /dev/ubi3_0 /tmp/mount_recovery -o bulk_read
```

##### 2. URC port configuration

Configure the URC port with the following command:

```
rm /tmp/mount_recovery/sbin/usb/boot_hsusb_composition  
ln -s /sbin/usb/compositions/recovery_9607 \  
/tmp/mount_recovery/sbin/usb/boot_hsusb_composition
```

#### 4.2.1.2. Move DFOTA Package

When moving the DFOTA package, make sure the original path has already existed and there is no old DFOTA package and log file in the original path, then finally make sure the file is written to flash. The process is as follows:

Move DFOTA package with the following command:

```
mkdir -p /usrdata/cache/fota
rm -rf /usrdata/cache/fota/*
mv local DFOTA package /usrdata/cache/fota/iphth_package.bin
sync "/sys/bus/msm_subsys/devices/subsys1/restart_level"
```

#### 4.2.1.3. Start Upgrade

In console, the DFOTA program can be started in two approaches as follows:

- **reboot-recovery**
- **sync && sys\_reboot recovery** (Add the sync operation before starting to prevent the file from not fully writing to flash.)

There is no essential difference between the two approaches. After the command is executed, the DFOTA program will be started.

#### NOTES

1. The step described in **Chapter 4.2.1.1** can be omitted, because whether to configure URC port has no effect on the upgrade program. The URC port is configured just to view the progress of the upgrade.
2. The step described in **Chapter 4.2.1.2** can be omitted, if the `/usrdata/cache/fota/iphth_package.bin` file exists and the file is correct, you can execute DFOTA upgrade directly via **reboot-recovery** command.
3. The step described in **Chapter 4.2.1.3** cannot be omitted.

#### 4.2.2. APP Upgrade

Quectel added the APP command of one-key upgrade in the system, the specific command is **qlfotapp**. The usage is as follows.

##### 1. qlfotapp ./location\_file

The DFOTA procedure can be started via executing the command **qlfotapp ./location\_file**. The `location_file` is the parameter of local delta file.

##### 2. Start DFOTA upgrade

After executing above command, if the DFOTA package exists, system will start DFOTA procedure automatically, and the later upgrade process is the same as CMDLINE upgrade.



**NOTE**

This command **qlfotapp** is only supported by partial firmware versions, so before using this command, make sure whether this command is supported.

**4.3. DFOTA Flow Chart**

The following flow chart illustrates the DFOTA procedure

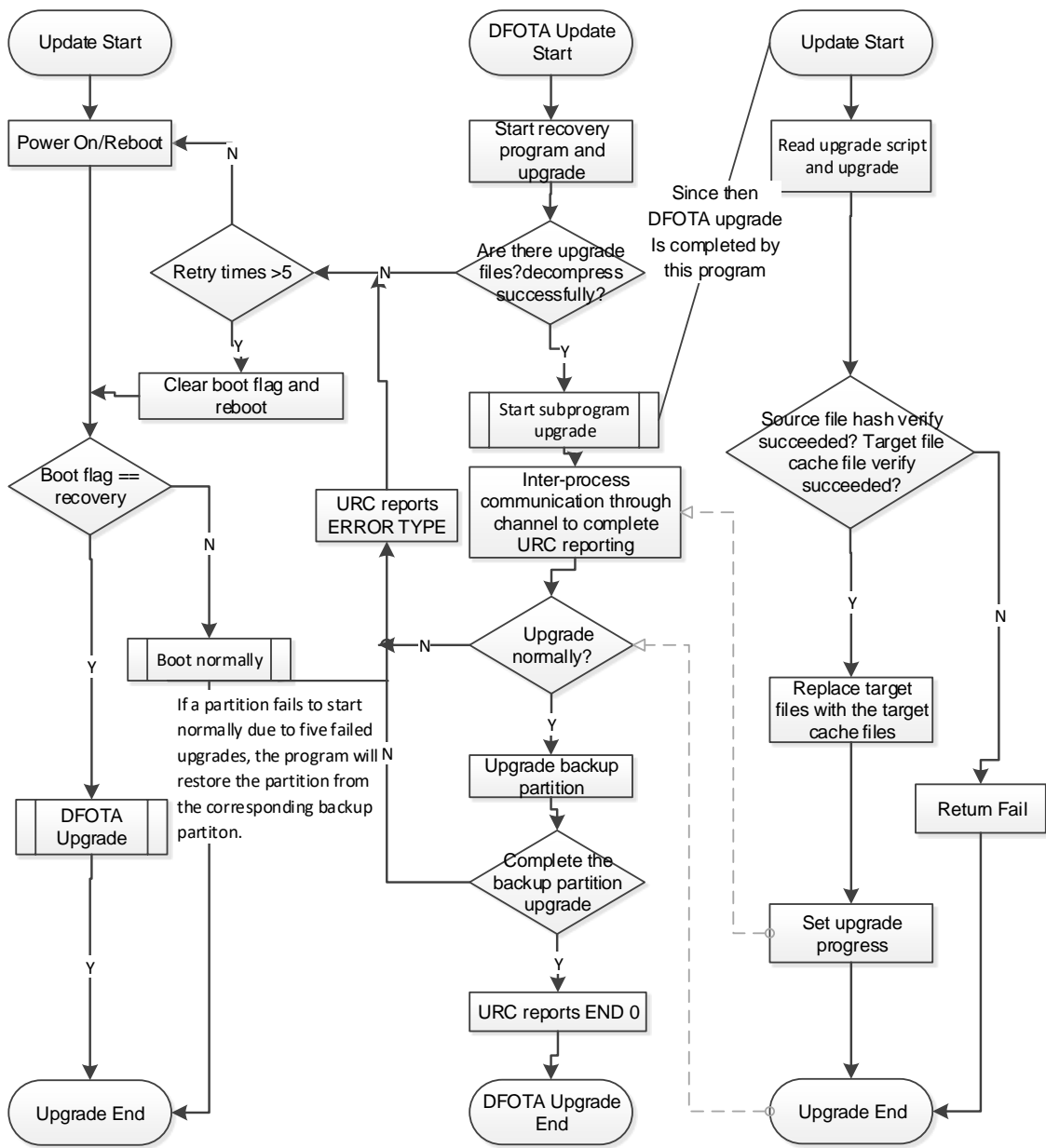


Figure 8: DFOTA Flow Chart

**NOTE**

The DFOTA procedure shown above is for 256 M + 256 M/512 M + 256 M modules (with backup area) only. While for 128 M + 128 M module which does not have backup area, if the upgrade is not successful, the upgrade will continue and will not exit the upgrade.

# 5 Troubleshoot

In general, the upgrade time is proportional to the size of the DFOTA package in the upgrade process. For DFOTA package downloaded via HTTP(S)/FTP, check the integrity of the package via the **md5sum** command before upgrading.

During the upgrade process, due to various reasons, such as flash stability, high and low temperature environments, random power off and other unpredictable situations, upgrade cannot success every time. Therefore, for modules that have backup areas, the software tries to upgrade for 5 times during the whole upgrade process. If the upgrade fails for five times, the entire upgrade process fails. At this time, the restoration is triggered and the version is restored to the version of the backup partition. No matter at which stage the upgrade fails, the module will eventually automatically restart and return to the normal state. While, for the modules without backup area (128 M + 128 M), If the upgrade fails, the upgrade will continue.

During the upgrade process, in addition to the normal URC reports, such as the percentage of upgrades, FOTA START, and FOTA END 0, if an exception occurs and the upgrade fails, the URC will report the corresponding value. The report format is as follows:

```
+QIND: "FOTA", "START"
+QIND: "FOTA", "UPDATING", <percent>
+QIND: "FOTA", "UPDATING", <percent>
...
+QIND: "FOTA", "END", <err>
```

Here are some common meanings of URC report values.

**Table 2: URC Descriptions**

| URC Value | Description  |
|-----------|--|
| 0         | Upgrade successfully   |
| 1         | Failed to upgrade the backup partition, such as insufficient flash space resulting in the corresponding ubi file generation failure. |
| 501       | Start upgrade, the URC reports DFOTA package exception decompression or insufficient space required by decompression.                |
| 502       | Upgrading, this URC generally reports an abnormal exit from the upgrade program.   |

---

|       |   |
|-------|---|
| 510   | Upgrading, file verification failed.                          |
| 511   | Upgrading, insufficient space for upgrade.                    |
| OK    | Command executed successfully (only applicable to AT upgrade) |
| ERROR | Command format error (only applicable to AT upgrade)          |

---

## 6 Attentions

Before DFOTA upgrade, download and save the corresponding DFOTA package locally, then ensure the correctness of the DFOTA.

After DFOTA upgrade, there is the possibility that the permissions may be changed for the added files. The permission configuration list will be added in the DFOTA tool to facilitate the configuration.

# 7 Appendix A References

**Table 3: Related Documents**

| SN  | Document Name                           | Remark                          |
|-----|---|---------------------------------|
| [1] | Quectel_EC2x&EG9x&EM05_DFOTA_User_Guide | EC2x&EG9x&EM05 DFOTA User Guide |

**Table 4: Terms and Abbreviations**

| Abbreviation | Description                  |
|--------------|------------------------------|
| ADB          | Android Debug Bridge         |
| APP          | Application                  |
| DFOTA        | Delta Firmware Over-The-Air  |
| FOTA         | Firmware Over-The-Air        |
| FTP          | File Transfer Protocol       |
| HTTP         | Hyper Text Transfer Protocol |
| LZO          | Lempel-Ziv-Oberhumer         |
| SDK          | Software Development Kit     |
| UBI          | Unsorted Block Images        |
| URC          | Unsolicited Result Code      |