

LTE-A(Q) Series

FILE Application Note

LTE-A Module Series

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About the Document

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1 Introduction

Quectel LTE-A(Q) series modules support AT commands to operate files on different physical storage mediums. This document is an application note to these commands.

The modules support the following storage mediums:

- **UFS:** User File Storage directory. It is a special directory on the flash file system.
- **RAM:** Random access memory directory

NOTE

The file name indicates the storage location. A file name beginning with a prefix “UFS:” or no prefix indicates that the file is stored in UFS, while a file name beginning with a prefix “RAM:” indicates that the file is stored in RAM.

1.1. Applicable Modules

Table 1: Applicable Modules

Module Series	
LTE-A(Q)	EG06 Series
	EG065K Series
	EG060K-EA
	EM06 Series
	EP06 Series
	EG12 Series
	EG18 Series
	EM12-G

EG512R-EA

EM160R-GL

EM120R-GL

EM121R-GL

1.2. The Process of Using FILE AT Commands

The following procedures can be followed to create, read and write a file in the storage:

1. Upload a file to the storage by **AT+QFUPL**, or output/download it through the serial interface by **AT+QFDWL**.
2. Open a file by **AT+QFOPEN**, and then the file can be written or read at any time and any location until the file is closed by **AT+QFCLOSE**.
 - When using **AT+QFOPEN** to open a file, you can set the file to overwrite mode, read-only mode or other modes by the parameter **<mode>** (For more information about **<mode>**, see **Chapter 2.3.6**). After the file is opened, a parameter **<filehandle>** is assigned to it. Then the file can be operated by **<filehandle>**.
 - After opening a file, write data into it by **AT+QFWRITE** or read the data by **AT+QFREAD** from the current file pointer position.
 - Set the file pointer position by **AT+QFSEEK** and query the current file pointer position by **AT+QFPOSITION**.
 - Close the file by **AT+QFCLOSE**, after which the **<filehandle>** turns invalid any more.

Use the following commands to manage files in the storage medium:

1. **AT+QFLDS**: Get the space information of the storage medium.
2. **AT+QFLST**: List the file information in the storage medium.
3. **AT+QFDEL**: Delete the file(s) in the storage medium.

NOTE

The file handle obtained after executing **AT+QFOPEN** must be closed with **AT+QFCLOSE** in time after the operation is completed, otherwise the file handle will be leaked.

1.3. Introduction of Data Mode

The COM port of the modules has two working modes: AT command mode and data mode. In AT command mode, the inputted data via the COM port will be treated as AT command, while in data mode, as data.

When a write command of **AT+QFUPL**, **AT+QFDWL**, **AT+QFREAD** or **AT+QFWRITE** is executed, the COM port will enter data mode. Inputting **+++** or pulling up DTR (**AT&D1** should be set first) can make the COM port exit data mode. To prevent the **+++** from being mistaken for data, the following standards should be followed:

1. Do not input any character within 1 s before inputting **+++**.
2. Finish the inputting of **+++** within 1 s, during which no other characters shall be inputted.
3. Do not input any character within 1 s after inputting **+++**.

If you are using **+++** or DTR to make the port exit data mode, the executing procedure of these commands will be interrupted before the response is returned.

2 Description of FILE AT Commands

2.1. AT Command Introduction

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

2.1.2. 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 2: Type 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.

2.2. 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.

2.3. AT Command Description

2.3.1. AT+QFLDS Get the Space Information of the Storage Medium

This command gets the space information of the specified storage medium.

AT+QFLDS Get the Space Information of the Storage Medium	
Test Command AT+QFLDS=?	Response OK
Write Command AT+QFLDS=<storage>	Response +QFLDS: <free_size>,<total_size> OK If there is any error: +CME ERROR: <err>
Execution Command AT+QFLDS	Response +QFLDS: <UFS_file_size>,<UFS_file_number> OK If there is any error: +CME ERROR: <err>
Maximum Response Time	300 ms
Characteristics	The command takes effect immediately; The configurations will not be saved.

Parameter

<storage>	String type. Storage medium type. "UFS" UFS
------------------------	--

	"RAM" RAM
<free_size>	Integer type. The free space size of <storage>.
<total_size>	Integer type. The total space size of <storage>.
<UFS_file_size>	Integer type. The size of all files in UFS. Unit: byte.
<UFS_file_number>	Integer type. The number of files in UFS.
<err>	Error code relating to ME. See Chapter 4 for details.

Example

```

AT+QFLDS="UFS" //Query the space information of UFS.
+QFLDS: 578847,917503

OK
AT+QFLDS="RAM" //Query the space information of RAM.
+QFLDS: 1305600,1305600

OK
    
```

2.3.2. AT+QFLST List the File Information in the Storage Medium

This command lists the information of a single file or all files in the specified storage medium.

AT+QFLST List the File Information in the Storage Medium	
Test Command AT+QFLST=?	Response OK
Write Command AT+QFLST=<filename>	Response +QFLST: <filename>,<file_size> [+QFLST: <filename>,<file_size> [...]] OK If there is any error: +CME ERROR: <err>
Execution Command AT+QFLST	Response Return the information of all UFS files: +QFLST: <filename>,<file_size> [+QFLST: <filename>,<file_size> [...]] OK If there is any error:

	+CME ERROR: <err>
Maximum Response Time	300 ms
Characteristics	The command takes effect immediately; The configurations will not be saved.

Parameter

<filename>	String type. Name pattern of the file to be listed. "*" All the files in UFS "<file>" The specified <file> in UFS "UFS:*" All the files in UFS "UFS:<file>" The specified <file> in UFS "RAM:*" All the files in RAM "RAM:<file>" The specified <file> in RAM
<file>	String type. The exact name of the file.
<file_size>	Integer type. File size. Unit: byte.
<err>	Error code relating to ME. See Chapter 4 for details.

Example

```
AT+QFLST="*" //List all the files in UFS.
+QFLST: "UFS:1k.txt",1024
+QFLST: "UFS:2k.txt",2048
+QFLST: "UFS:3k.txt",3072

OK
```

NOTE

AT+QFLST queries the actual size of the file currently stored in the flash. After the data is written in with **AT+QFWRITE**, if you fail to query the file size by executing **AT+QFLST**, please close the file with **AT+QFCLOSE** first.

2.3.3. AT+QFDEL Delete the File(s) in the Storage Medium

This command deletes a single file or all the files in the specified storage medium.

AT+QFDEL Delete the File(s) in the Storage Medium

Test Command	Response
AT+QFDEL=?	+QFDEL: <filename>

	OK
Write Command AT+QFDEL=<filename>	Response OK If there is any error: +CME ERROR: <err>
Maximum Response Time	300 ms
Characteristics	The command takes effect immediately; The configurations will not be saved.

Parameter

<filename>	String type. Name pattern of the file to be deleted. The max length is 80 bytes. "*" Delete all the files in UFS (directory not included) "<file>" Delete the specified <file> in UFS "UFS:*" Delete all the files in UFS (directory not included) "UFS:<file>" Delete the specified <file> in UFS "RAM:*" Delete all the files in RAM (directory not included) "RAM:<file>" Delete the specified <file> in RAM
<file>	String type. The exact name of the file.
<err>	Error code relating to ME. See Chapter 4 for details.

Example

```
AT+QFDEL="" //Delete all the files in UFS (not delete the directory)
OK
AT+QFDEL="UFS:1.txt" //Delete the file 1.txt in UFS.
OK
```

2.3.4. AT+QFUPL Upload a File to the Storage Medium

This command uploads a file to storage medium. If there is an existing file in the storage having the same name as the file to be uploaded, an error will be reported.

After executing the Write Command and **CONNECT** returns, the module will switch to data mode. When the uploaded data reaches **<file_size>**, or a period without data input reaches **<timeout>**, it will exit data mode automatically. During data transmission, you can use **+++** or **DTR** to make the module exit data mode, and more details are provided in **Chapter 1.3**.

AT+QFUPL Upload a File to the Storage Medium

Test Command AT+QFUPL=?	Response +QFUPL: <filename>,(1-<free_size>),(range of supported
-----------------------------------	---

	<timeout>s),(list of supported <ackmode>s)
	OK
Write Command AT+QFUPL=<filename>[,<file_size>[,<timeout>[,<ackmode>]]]	Response CONNECT TA switches to data mode (transparent access mode), and the binary data of files can be inputted. When the total size of the inputted data reaches <file_size> or TA receives +++, TA will return to command mode and respond: +QFUPL: <upload_size>,<checksum> OK If there is any error: +CME ERROR: <err>
Maximum Response Time	300 ms
Characteristics	The command takes effect immediately; The configurations will not be saved.

Parameter

<free_size>	Integer type. The free space size of <storage>. See AT+QFLDS in <i>Chapter 2.3.1</i> for more details of <storage>.
<filename>	String type. Name pattern of the file to be uploaded. The maximum length is 80 bytes. " <file>" The specified <file> to be uploaded to UFS "UFS:<file>" The specified <file> to be uploaded to UFS "RAM:<file>" The specified <file> to be uploaded to RAM
<file>	String type. The exact name of the file.
<file_size>	Integer type. The file size expected to be uploaded. Default: 10240. Unit: byte.
<upload_size>	Integer type. The actual size of the uploaded data. Unit: byte.
<timeout>	Integer type. The time to wait for data to be inputted to USB/UART. Range: 1–65535. Default: 5. Unit: second.
<ackmode>	Integer type. Whether to use ACK mode. 0 Turn off the ACK mode 1 Turn on the ACK mode
<checksum>	Integer type. The checksum of the uploaded data.
<err>	Error code relating to ME. See <i>Chapter 4</i> for details.

NOTE

1. It is strongly recommended to use DOS 8.3 file name format for <filename>.
2. <checksum> is a 16-bit checksum based on bitwise XOR.
If the number of the characters is odd, the last character is set as the high 8 bit, and the low 8 bit as 0,

and then an XOR operator is used to calculate the checksum. **+++** sequence will cause TA to end the command and switch to command mode. However, the data previously uploaded will be preserved in the file.

3. When executing the command, the data must be inputted after **CONNECT** is returned.
4. The ACK mode is provided to avoid the loss of data when uploading large files, in case hardware flow control does not work. The ACK mode works as follows:
 - 1) Run **AT+QFUPL=<filename>,<file_size>,<timeout>,1** to enable the ACK mode.
 - 2) The module outputs **CONNECT**.
 - 3) The MCU sends 1 KB data, and then the module will respond with an **A**.
 - 4) The MCU receives the **A** and then sends the next 1 KB data.
 - 5) Repeat step 3) and 4) until the transfer is completed.

2.3.5. AT+QFDWL Download a File from the Storage Medium

This command downloads a specified file from the storage medium.

AT+QFDWL Download a File from the Storage Medium	
Test Command AT+QFDWL=?	Response +QFDWL: <filename> OK
Write Command AT+QFDWL=<filename>	Response CONNECT TA switches to data mode, and the binary data of the file will be outputted. When the file is read over or TA receives +++ , TA will return to command mode and respond: +QFDWL: <download_size>,<checksum> OK If there is any error: +CME ERROR: <err>
Maximum Response Time	300 ms
Characteristics	The command takes effect immediately; The configurations will not be saved.

Parameter

<filename>	String type. Name pattern of the file to be downloaded. The maximum length is 80 bytes.
"<file>"	The specified UFS <file> to be downloaded
"UFS:<file>"	The specified UFS <file> to be downloaded

<file>	"RAM:<file>" The specified RAM <file> to be downloaded
<download_size>	String type. The exact name of the file.
<checksum>	Integer type. The size of the downloaded data.
<err>	Integer type. The checksum of the downloaded data.
	Error code relating to ME. See Chapter 4 for details.

NOTE

1. +++ sequence will cause TA to end the data mode and switch to command mode.
2. <checksum> is a 16-bit checksum based on bitwise XOR.

2.3.6. AT+QFOPEN Open a File

This command opens a file and gets the file handle to be used in commands such as **AT+QFREAD**, **AT+QFWRITE**, **AT+QFSEEK**, **AT+QFPOSITION** and **AT+QFCLOSE**.

AT+QFOPEN Open a File	
Test Command AT+QFOPEN=?	Response +QFOPEN: <filename>,(range of supported <mode>s) OK
Read Command AT+QFOPEN?	Response +QFOPEN: <filename>,<filehandle>,<mode> [+QFOPEN: <filename>,<filehandle>,<mode> [...]] OK
Write Command AT+QFOPEN=<filename>[,<mode>]	Response +QFOPEN: <filehandle> OK If there is any error: +CME ERROR: <err>
Maximum Response Time	300 ms
Characteristics	The command takes effect immediately; The configurations will not be saved.

Parameter

<filename>	String type. Name pattern of the file to be opened. The maximum length is 80 bytes.
"<file>"	The specified UFS <file> to be opened

	"UFS:<file>"	The specified UFS <file> to be opened
	"RAM:<file>"	The specified RAM <file> to be opened
<file>	String type. The exact name of the file.	
<filehandle>	Integer type. The handle of the file.	
<mode>	Integer type. The open mode of the file.	
	0	If the file does not exist, it will be created. If the file exists, it will be directly opened. In both cases can the file be read and written.
	1	If the file does not exist, it will be created. If the file exists, it will be overwritten. In both cases can the file be read and written.
	2	If the file does not exist, an error will be responded. If the file exists, open it and it can be read only.
<err>	Error code relating to ME. See Chapter 4 for details.	

2.3.7. AT+QFREAD Read a File

This command reads the data of a file which is specified by the file handle. The data starts from the current position of the file pointer which belongs to the file handle.

AT+QFREAD Read a File	
Test Command AT+QFREAD=?	Response +QFREAD: <filehandle>,<length> OK
Write Command AT+QFREAD=<filehandle>[,<length>]	Response CONNECT <read_length> TA switches to data mode. When the total size of the data reaches <length> or TA receives +++ , TA will return to command mode and respond: OK If there is any error: +CME ERROR: <err>
Maximum Response Time	300 ms
Characteristics	The command takes effect immediately; The configurations will not be saved.

Parameter

<filehandle>	Integer type. The handle of the file to be operated.
<length>	Integer type. The expected length of the file to be read. The default length is 10 KB. If the file length is less than 10 KB, the actual length of the file will be read. Unit: byte.
<read_length>	Integer type. The actual read length. Unit: byte.

<err> Error code relating to ME. See **Chapter 4** for details.

2.3.8. AT+QFWRITE Write a File

This command writes data into a file. The data starts from the current position of the file pointer which belongs to the file handle.

AT+QFWRITE Write a File	
Test Command AT+QFWRITE=?	Response +QFWRITE: <filehandle>,<length>,<timeout> OK
Write Command AT+QFWRITE=<filehandle>[,<length>[,<timeout>]]	Response CONNECT TA switches to data mode. When the total size of the written data reaches <length> , TA receives +++ , or the time reaches <timeout> , TA will return to command mode and respond: +QFWRITE: <written_length>,<total_length> OK If there is any error: +CME ERROR: <err>
Maximum Response Time	300 ms
Characteristics	The command takes effect immediately; The configurations will not be saved.

Parameter

<filehandle>	Integer type. The handle of the file to be operated.
<length>	Integer type. The length of the file to be written, and the default length is 10 KB. The maximum value of this parameter is determined by <free_size> of AT+QFUPL . Unit: byte.
<timeout>	Integer type. The time waiting for data to be inputted via USB/UART. Default: 5. Unit: second.
<written_length>	Integer type. The actual written length. Unit: byte.
<total_length>	Integer type. The total length of the file. Unit: byte.
<err>	Error code relating to ME. See Chapter 4 for details.

2.3.9. AT+QFSEEK Set a File Pointer to the Specified Position

This command sets a file pointer to the specified position.

AT+QFSEEK Set a File Pointer to the Specified Position	
Test Command AT+QFSEEK=?	Response +QFSEEK: <filehandle>,<offset>,<position> OK
Write Command AT+QFSEEK=<filehandle>,<offset>[,<position>]	Response OK If there is any error: +CME ERROR: <err>
Maximum Response Time	300 ms
Characteristics	The command takes effect immediately; The configurations will not be saved.

Parameter

<filehandle>	Integer type. The handle of the file to be operated.
<offset>	Integer type. The number of bytes of the file pointer movement.
<position>	Integer type. Pointer movement mode. <ul style="list-style-type: none"> <u>0</u> Move forward from the beginning of the file 1 Move forward from the current position of the pointer 2 Move backward from the end of the file
<err>	Error code relating to ME. See Chapter 4 for details.

NOTE

If the set final pointer position exceeds the file range, executing this command will return **ERROR**.

2.3.10. AT+QFPOSITION Get the Offset of a File Pointer

This command gets the offset of a file pointer from the beginning of the file.

AT+QFPOSITION Get the Offset of a File Pointer	
Test Command AT+QFPOSITION=?	Response +QFPOSITION: <filehandle> OK

Write Command AT+QFPOSITION=<filehandle>	Response +QFPOSITION: <offset> OK If there is any error: +CME ERROR: <err>
Maximum Response Time	300 ms
Characteristics	The command takes effect immediately; The configurations will not be saved.

Parameter

<filehandle>	Integer type. The handle of the file to be operated.
<offset>	Integer type. The offset from the beginning of the file.
<err>	Error code relating to ME. See Chapter 4 for details.

2.3.11. AT+QFCLOSE Close a File

This command closes a file and ends the operation to the file. After that, the file handle is released and should not be used again, unless the file is opened again by **AT+QFOPEN**.

AT+QFCLOSE Close a File	
Test Command AT+QFCLOSE=?	Response +QFCLOSE: <filehandle> OK
Write Command AT+QFCLOSE=<filehandle>	Response OK If there is any error: +CME ERROR: <err>
Maximum Response Time	300 ms
Characteristics	The command takes effect immediately; The configurations will not be saved.

Parameter

<filehandle>	Integer type. The handle of the file to be operated.
<err>	Error code relating to ME. See Chapter 4 for details.

3 Examples

3.1. Upload and Download a File

3.1.1. Upload a File

3.1.1.1. Non ACK Mode

```

AT+QFUPL="test1.txt",10 //Upload the text file test1.txt to UFS.
CONNECT
<File data> //Input the binary data of the file.
+QFUPL: 10,3938
OK
    
```

3.1.1.2. ACK Mode

The ACK mode can make the data transmission more reliable. When transmitting a large file without hardware flow control, the ACK mode is recommended to be used to prevent the data from being lost. For more details about ACK mode, see **AT+QFUPL**.

```

AT+QFUPL="test.txt",3000,5,1 //Upload the text file test.txt to UFS.
CONNECT
<1024-byte file data> //Input 1024-byte binary data of the file.
A //After MCU sends 1024-byte data, the module will respond
an A. And then the next 1024-byte data can be sent.
<1024-byte file data> //Input 1024-byte binary data of the file.
A
<Rest file data> //Input the rest binary data of the file.
+QFUPL: 3000,B34A
OK
    
```

3.1.2. Download a File

```

AT+QFDWL="test.txt"           //Download the text file test.txt from UFS.
CONNECT
<File data>                   //Binary data of the file is outputted
+QFDWL: 10,613e               //Size and checksum value of the downloaded data are responded.

OK
    
```

3.2. Write and Read a File

3.2.1. Write and Read a UFS File

```

AT+QFOPEN="test.txt",1       //Open the file to get the file handle.
+QFOPEN: 1

OK
AT+QFWRITE=1,10              //Write 10 bytes to the file.
CONNECT
<Write Data>                 //Write in the file data
+QFWRITE: 10,10              //The actual bytes written and the size of the file are returned.

OK
AT+QFSEEK=1,0,0              //Set the file pointer to the beginning of the file.
OK
AT+QFREAD=1,10               //Read the data.
CONNECT 10
<Read Data>                  //Read data output
OK
AT+QFCLOSE=1                  //Close the file.
OK
    
```

3.2.2. Write and Read a RAM File

```

AT+QFOPEN="RAM:1.sh",1       //Open the file to get the file handle.
+QFOPEN: 3000

OK
AT+QFWRITE=3000,1024         //Write 1024 bytes to the file.
CONNECT
<Write Data>                 //Write in the file data
+QFWRITE: 1024,1024         //The actual bytes written and the size of the file are returned.
    
```

```
OK
AT+QFSEEK=3000,0,0           //Set the file pointer to the beginning of the file.
OK
AT+QFREAD=3000,1024         //Read the data.
CONNECT 1024
<Read Data>                 //Read data output
OK
AT+QFCLOSE=3000             //Close the file.
OK
```


4 Summary of Error Codes

The error code **<err>** indicates an error related to mobile equipment. The details about **<err>** are described in the following table.

Table 3: Summary of Error Codes

<err>	Meaning
400	Invalid input value
401	Larger than the size of the file
402	Read zero byte
403	Drive full
405	File not found
406	Invalid file name
407	File already exists
409	Fail to write the file
410	Fail to open the file
411	Fail to read the file
413	Reach the max number of files allowed to be opened
414	The file read-only
416	Invalid file descriptor
417	Fail to list the file
418	Fail to delete the file
419	Fail to get disk info
420	No space

421	Time out
423	File too large
425	Invalid parameter
426	File already opened

5 Appendix Reference

Table 4: Terms and Abbreviations

Abbreviation	Description
ACK	Acknowledgement
COM	Communication Port
DOS	Disk Operating System
DTR	Data Terminal Ready
ME	Mobile Equipment
RAM	Random Access Memory
TA	Terminal Adapter
UART	Universal Asynchronous Receiver-Transmitter
UFS	User File Storage
USB	Universal Serial Bus
XOR	Exclusive OR