

EC2x&EG9x&EG2x-G Series

LwM2M Application Note

LTE Standard Module Series

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1 Introduction

OMA Lightweight M2M (LwM2M) is a device management protocol designed for sensor networks and the demands of a machine-to-machine (M2M) environment. The LwM2M protocol, designed for remote management of M2M devices and related service enablement, features a modern architectural design based on REST, defines an extensible resource and data model and builds on an efficient secure data transfer standard called the Constrained Application Protocol (CoAP).

This document mainly introduces how to use the LwM2M feature with the following Quectel LTE standard modules through AT commands.

1.1. Applicable Modules

Table 1: Applicable Modules

Module Series	Module
EC2x series	EC21 series
	EC25 series
	EC20 R2.1
EG9x series	EG91 series
	EG95 series
EG2x-G	EG21-G
	EG25-G

2 Description of LwM2M AT Commands

2.1. AT Command Syntax

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

The **AT** or **at** prefix must be added at the beginning of each command line. Entering **<CR>** will terminate a command line. Commands are usually followed by a response that includes **<CR><LF><response><CR><LF>**. Throughout this document, only the response **<response>** will be presented, **<CR><LF>** are omitted intentionally.

Table 2: Type of AT Commands and Responses

Test Command	AT+<cmd>=?	This command returns the list of parameters and value ranges set by the corresponding Write Command or internal processes.
Read Command	AT+<cmd>?	This command returns the currently set value of the parameter or parameters.
Write Command	AT+<cmd>=<p1> [,<p2>[,<p3>[...]]]	This command sets the user-definable parameter values.
Execution Command	AT+<cmd>	This command reads non-variable parameters affected by internal processes in the module.

2.2. Description of AT Commands

2.2.1. AT+QLWCFG Configure Optional Parameters of LwM2M

This command configures optional parameters of LwM2M.

AT+QLWCFG Configure Optional Parameters of LwM2M	
<p>Test Command</p> <p>AT+QLWCFG=?</p>	<p>Response</p> <p>+QLWCFG: "security",(range of supported <serverID>s),(range of supported <SSID>s),<server_addr>,(list of supported <bootstrap>s),(list of supported <security_mode>s),<pskID>,<psk_key></p> <p>+QLWCFG: "server",(range of supported <serverID>s),(range of supported <life_time>s),(range of supported <pmin>s),(range of supported <pmax>s),(range of supported <disable_timeout>s),(list of supports <storing>s),(list of supported <binding_mode>s)</p> <p>+QLWCFG: "epname/mode",(list of supported <mode>s)</p> <p>+QLWCFG: "urc",(list of supported <URC_onoff>s)</p> <p>+QLWCFG: "startup",(list of supported <auto_startup>s)</p> <p>+QLWCFG: "fota",(list of supported <download>s),(list of supported <update>s)</p> <p>+QLWCFG: "hostdevice",(list of supported <hostID>s),<device ID>,<manufacturer>,<model>,<sw_version>,<fw_version>,<hw_version>,<upgrade_time></p> <p>+QLWCFG: "reset"</p> <p>+QLWCFG: "nettype",(range of supported <net_type>s)</p> <p>+QLWCFG: "maxreconntime",(range of supported <unitreconntime>s),(range of supported <multreconntime>s),(range of supported <maxdelaytime>s)</p> <p>+QLWCFG: "apnretry",(list of supported <APN_ID>s),(range of supported <retry_time>s),(range of supported <period>s)</p> <p>OK</p>
<p>Write Command</p> <p>Read/configure the LwM2M server property</p> <p>AT+QLWCFG="security" [,<serverID> [,<SSID> ,<server_addr> ,<bootstrap> ,<security_mode> [,<pskID> ,<psk_key>]]]]</p>	<p>Response</p> <p>If the optional parameters are omitted, query the current configuration:</p> <p>+QLWCFG: "security",<serverID>,<SSID>,<server_addr>,<bootstrap>,<security_mode></p> <p>...</p> <p>OK</p> <p>If only <serverID> is specified and other optional parameters are</p>

	<p>omitted, delete the property data of the specified <serverID>: OK Or ERROR</p> <p>If any of the other optional parameters are specified, configure the specified server property: OK Or ERROR</p>
<p>Write Command Read/configure the LwM2M server attribute AT+QLWCFG="server",<serverID>,<life_time>[,<pmin>,<pmax>[,<disable_timeout>[,<storing>[,<binding_mode>]]]]]</p>	<p>Response If the optional parameters are omitted, query the current configurations: +QLWCFG: "server",<serverID>,<life_time>,<pmin>,<pmax>,<disable_timeout>,<storing>,<binding_mode> ... OK</p> <p>If any of the optional parameters are specified, configure the server attribute: OK Or ERROR</p>
<p>Write Command Read/configure mode of end point name AT+QLWCFG="epname/mode"[,<mode>]</p>	<p>Response If the optional parameter is omitted, query the current configuration: +QLWCFG: "epname/mode",<mode> OK</p> <p>If the optional parameter is specified, configure the mode of end point name: OK Or ERROR</p>
<p>Write Command Read/configure LwM2M URC enablement AT+QLWCFG="urc"[,<URC_onoff>]</p>	<p>Response If the optional parameter is omitted, query the current configuration: +QLWCFG: "urc",<URC_onoff> OK</p> <p>If the optional parameter is specified, configure whether to enable URC report: OK</p>

	Or ERROR
Write Command Read/configure the startup mode of LwM2M client AT+QLWCFG="startup"[,<auto_startup>]	Response If the optional parameter is omitted, query the current configuration: +QLWCFG: "startup",<auto_startup> OK If the optional parameter is specified, configure the startup mode: OK Or ERROR
Write Command Read/configure FOTA mode AT+QLWCFG="fota"[,<download>,<update>]	Response If the optional parameters are omitted, query the current configuration: +QLWCFG: "fota",<download>,<update> OK If the optional parameters are specified, configure the FOTA mode: OK Or ERROR
Write Command Read/configure host device information if the network is not Verizon AT+QLWCFG="hostdevice"[,<hostID>,<deviceID>,<manufacturer>,<model>,<sw_version>]	Response If the optional parameters are omitted, query the current configurations: +QLWCFG: "hostdevice",<hostID>,<deviceID>,<manufacturer>,<model>,<sw_version> OK If the optional parameters are specified, configure host device information: OK Or ERROR
Write Command Read/configure host device information under Verizon network AT+QLWCFG="hostdevice"[,<hostID>,<deviceID>,<manufacturer>,<model>,<sw_version>,<fw_version>,<hw_version>,<upgrade_time>]	Response If the optional parameters are omitted, query the current configurations: +QLWCFG: "hostdevice",<hostID>,<deviceID>,<manufacturer>,<model>,<sw_version>,<fw_version>,<hw_version>,<upgrade_time> OK

<p><upgrade_time>]]]]]]]]]]</p>	<p>If the optional parameters are specified, configure host device information: OK Or ERROR</p>
<p>Execution Command Erase LwM2M client running record AT+QLWCFG="reset"</p>	<p>Response OK Or ERROR</p>
<p>Write Command Read/configure the net type of LwM2M client AT+QLWCFG="nettype"[,<net_type>]</p>	<p>Response If the optional parameter is omitted, query the current configuration: +QLWCFG: "nettype",<net_type> OK If the optional parameter is specified, configure the net type: OK Or ERROR</p>
<p>Write Command Read/configure the reconnection attribute AT+QLWCFG="maxreconntime"[,<unitreconntime>,<multreconntime>,<maxdelaytime>]</p>	<p>Response If the optional parameters are omitted, query the current configuration: +QLWCFG: "maxreconntime",<unitreconntime>,<multreconntime>,<maxdelaytime> OK If the optional parameters are specified, configure the specified reconnection: OK Or ERROR</p>
<p>Write Command Read/configure the APN retry attribute AT+QLWCFG="apnretry"[,<APN_ID>,<retry_time>,<period>]</p>	<p>Response If the optional parameters are omitted, query the current configuration: +QLWCFG: "apnretry",<APN_ID>,<retry_time>,<period> ... OK If the optional parameters are specified, configure the specified APN retry attribute: OK</p>

	Or ERROR
Maximum Response Time	/
Characteristics	The commands take effect immediately. The configurations will be saved automatically while the <net_type> will not be saved.

Parameter

<serverID>	Integer type. Server type. 0 Bootstrap server 1 DM server 2 Diagnostics server 3 Repository server
<SSID>	Integer type. Short server ID. Custom parameter. Range: 1–65535. For Verizon network, the valid values are: 100 Bootstrap server 101 Diagnostics server 102 DM server 1000 Repository server
<server_addr>	String type. Server address. The format is "address:port".
<bootstrap>	Integer type. Bootstrap server flag. 0 Not bootstrap (Only valid when <serverID> is not 0) 1 Bootstrap (Only valid when <serverID> =0)
<security_mode>	Integer type. Encryption method. 0 Pre-share key mode 3 No security mode
<pskID>	String type. Pre-shared key identity. Only valid when <security_mode> =0.
<psk_key>	String type in hexadecimal. Pre-share key. Only valid when <security_mode> =0.
<life_time>	Integer type. The lifetime of receiving heartbeat package by server. Range: 1–86400. Default: 60. Unit: second.
<pmin>	Integer type. The minimum response period. Range: 1–86400. Default: 1. Unit: second.
<pmax>	Integer type. The maximum response period. Range: 1–86400. Default: 60. Unit: second.
<disable_timeout>	Integer type. The interval to the next connection after disconnecting from the LwM2M server. Range: 1–86400. Default: 86400. Unit: second.
<storing>	Integer type. Whether to save the server information. 0 Do not save 1 Save
<binding_mode>	String type. The binding mode used to connect the LwM2M server. "U" UDP

	"UQ"	UDP with Queue mode
	"S"	SMS
	"SQ"	SMS with Queue mode
	"US"	UDP and SMS
	"UQS"	UDP and SMS with Queue mode
<mode>		Integer type. The format of endpoint name.
	3	The endpoint name format: urn:imei:xxxxx
	6	The endpoint name format: urn:imei-msisdn:xxxxx-xxx
	7	The endpoint name format: urn:imei-imsi:xxxxx-xxx
	8	China Mobile DM endpoint name
<URC_onoff>		Integer type.
	0	Disable LwM2M URC report
	1	Enable LwM2M URC report
<auto_startup>		Integer type.
	0	LwM2M will not be started automatically when the module is powered on
	1	LwM2M will be started automatically when the module is powered on
<download>		Integer type. The mode of downloading delta firmware package.
	0	Download package manually
	1	Download package automatically
<update>		Integer type. The update mode of FOTA.
	0	Update manually
	1	Update automatically
<hostID>		Integer type. The identity of host device. Range: 0–1.
<deviceID>		String type. The device ID of host device.
<manufacturer>		String type. The manufacturer name of host device.
<model>		String type. The model of host device.
<sw_version>		String type. The software version number of host device.
<fw_version>		String type. The firmware version number of host device.
<hw_version>		String type. The hardware version number of host device.
<upgrade_time>		Integer type. The seconds from January 1,1970 00:00:00 to the last firmware or software update time. If no time stamp is available, 0 is returned.
<net_type>		Integer type. The network type.
	0	Others
	1	Verizon
	2	AT&T
<unitreconntime>		Integer type. The coefficient of the wait time before retrying. Range: 1–86400. Default: 1 (300 under AT&T network). Unit: second.
<multreconntime>		Integer type. Base number of the wait time before retrying. Range: 2–86400. Default: 2 (5 under AT&T network).
<maxdelaytime>		Integer type. The max delay time of the wait time before retrying. Range: 0–86400. Default: 0 (86400 under AT&T network). Unit: second. The module will retry to connect if <maxdelaytime> is greater than the delay time calculated by the following formula, otherwise, it will end reconnection.

	Delay time = $\langle \text{unitreconntime} \rangle \times \langle \text{multreconntime} \rangle ^{\wedge}$ reconnection times
<APN_ID>	Integer type. The ID of the APN to be reactivated. Range: 0–1.
<retry_time>	Integer type. The retry times to reactivate the APN. Range: 0–16. Default: 0 (2 under AT&T network).
<period>	Integer type. The retry period to reactivate the APN. Range: 0–86400. Default: 0 (86400 under AT&T network). Unit: second.

2.2.2. AT+QLWREG Send a Register Request to the LwM2M Server

This command sends a register request to the LwM2M Server.

AT+QLWREG Send a Register Request to the LwM2M Server	
Test Command AT+QLWREG=?	Response OK
Execution Command AT+QLWREG	Response OK Or ERROR

2.2.3. AT+QLWUPDATE Send an Update Request to the LwM2M Server

This command sends an update request to the LwM2M Server.

AT+QLWUPDATE Send an Update Request to the LwM2M Server	
Test Command AT+QLWUPDATE=?	Response OK
Write Command AT+QLWUPDATE=<SSID>	Response OK Or ERROR

Parameter

<SSID>	Integer type. Short server ID. 0 All servers Others Other specified server
---------------------	--

2.2.4. AT+QLWDEREG Send a Deregister Request to the LwM2M Server

This command launches a deregister request to the LwM2M Server.

AT+QLWDEREG Send a Deregister Request to the LwM2M Server	
Test Command AT+QLWDEREG=?	Response OK
Execution Command AT+QLWDEREG	Response OK Or ERROR

2.2.5. AT+QLWSTAT Get the State of LwM2M Client

This command queries the state of the specified LwM2M client.

AT+QLWSTAT Get the State of LwM2M Client	
Test Command AT+QLWSTAT=?	Response OK
Read Command AT+QLWSTAT?	Response +QLWSTAT: <stat> OK Or ERROR

Parameter

<stat>	Integer type. Indicates the state of LwM2M client. 0 Not registered 1 Registering 2 Registered 3 Deregistering
---------------------	--

3 LwM2M Related URCs

This chapter gives LwM2M related URCs and descriptions.

3.1. +QLWURC: "pdp active" The PDP Activation Indication

The activation result of PDP. The PDP should be activated before sending register request to the LwM2M server.

+QLWURC: "pdp active" The PDP Activation Indication

+QLWURC: "pdp active",<result>,<APN>

This URC is reported to indicate the PDP activation result.

Parameter

<result>	String type. The result of PDP activation. "successfully" "failed"
<APN>	String type. APN name.

3.2. +QLWURC: "initial" The Initialization Indication

The initialization result of connection between client and the LwM2M server.

+QLWURC: "initial" The Initialization Indication

+QLWURC: "initial",<result>,<SSID>

This URC is reported to indicate the connection initialization result.

Parameter

<result>	String type. The initialization result. "successfully" "failed"
----------	---

<SSID>	Integer type. Short server ID.
	0 All servers
	Others Specified servers

3.3. +QLWURC: "dtls" The DTLS Handshake Indication

This URC is reported to indicate the DTLS handshake result if the encryption method is used.

+QLWURC: "dtls" The DTLS Handshake Indication

+QLWURC: "dtls",<result>,<SSID>

This URC is reported to indicate the DTLS handshake result.

Parameter

<result>	String type. DTLS handshake result. "successfully" "failed"
<SSID>	Integer type. Short server ID. 0 All servers Others Specified servers

3.4. +QLWURC: "bootstrapping" The Bootstrap Working Indication

This URC will be reported when Bootstrap is working.

+QLWURC: "bootstrapping" The Bootstrap Working Indication

+QLWURC: "bootstrapping"

This URC is reported to indicate that the Bootstrap is working.

3.5. +QLWURC: "bootstrap" The Bootstrap Indication

The working result of Bootstrap.

+QLWURC: "bootstrap" The Bootstrap Indication

+QLWURC: "bootstrap",<result>,<SSID>

This URC is reported to indicate the Bootstrap working result.

Parameter

<result>	String type. The working result of Bootstrap. "successfully" "failed"
<SSID>	Integer type. Short server ID. 0 All servers Others Specified servers

3.6. +QLWURC: "registering" Start Registration Indication

This URC will be reported when the client is registering on the LwM2M server.

+QLWURC: "registering" Start Registration Indication

+QLWURC: "registering"

This URC is reported to indicate that the client is registering.

3.7. +QLWURC: "ready" The Registration Indication

This URC is reported to indicate the registration result after sending the register request to the LwM2M server.

+QLWURC: "ready" The Registration Indication

+QLWURC: "ready",<result>,<SSID>

This URC is reported to indicate the registration result.

Parameter

<result>	String type. The registration result.
----------	---------------------------------------

	"successfully"
	"failed"
<SSID>	Integer type. Short server ID.
	0 All servers
	Others Specified servers

3.8. +QLWURC: "update" The Update Indication

This URC is reported to indicate the update result after sending the update request to the LwM2M server.

+QLWURC: "update" The Update Indication

+QLWURC: "update",<result>,<SSID> This URC is reported to indicate the update result.

Parameter

<result>	String type. Update result. "successfully" "failed"
<SSID>	Integer type. Short server ID. 0 All servers Others Specified servers

3.9. +QLWURC: "deregister" The Deregistration Indication

This URC is reported to indicate the deregistration result after sending deregister request to the LwM2M server.

+QLWURC: "deregister" The Deregistration Indication

+QLWURC: "deregister",<SSID> This URC is reported to indicate the deregistration result.

Parameter

<SSID>	Integer type. Short server ID. 0 All servers Others Specified servers
--------	---

4 Examples

This chapter gives the examples to explain how to use LwM2M related AT commands.

4.1. Login to the LwM2M Server

```
AT+QLWCFG=?
```

```
+QLWCFG: "security",(0-3),(1-65535),<server_addr>,(0,1),(0,3),<pskID>,<psk_key>  
+QLWCFG: "server",(0-3),(1-86400),(1-86400),(1-86400),(1-86400),(0,1),("U","UQ","S","SQ","US""U  
QS")  
+QLWCFG: "epname/mode",(3,6,7,8)  
+QLWCFG: "urc",(0,1)  
+QLWCFG: "startup",(0,1)  
+QLWCFG: "fota",(0,1),(0,1)  
+QLWCFG: "hostdevice",(0,1),<deviceID>,<manufacturer>,<model>,<sw_version>,<fw_version>,  
<hw_version>,<upgrade_time>  
+QLWCFG: "reset"  
+QLWCFG: "nettype",(0-2)  
+QLWCFG: "maxreconntime",(1-86400),(2-86400),(0-86400)  
+QLWCFG: "apnretry",(0,1),(0-16),(0-86400)
```

```
OK
```

```
AT+QLWCFG="security",0,100,"coaps://InteropBootstrap.dm.iot.att.com:5694",1,0,"urn:imei:8644  
30010001095","313233343536"
```

```
OK
```

```
AT+QLWCFG="security"
```

```
+QLWCFG: "security",0,100,"coaps://InteropBootstrap.dm.iot.att.com:5694",1,0
```

```
OK
```

```
AT+QLWCFG="epname/mode",3
```

```
OK
```

```
AT+QLWCFG="epname/mode"
```

```
+QLWCFG: "epname/mode",3
```

```
OK
```

```
AT+QLWCFG="urc",1
```

```
OK
AT+QLWCFG="urc"
+QLWCFG: "urc",1

OK
AT+QLWCFG="startup",1
OK
AT+QLWCFG="startup"
+QLWCFG: "startup",1

OK
AT+QLWCFG="fota",1,1
OK
AT+QLWCFG="fota"
+QLWCFG: "fota",1,1

OK
AT+QLWCFG="hostdevice",0,"HUID0","HMAN0","HMOD0","HSW0" //Configure host device
                                                                    information if the network is not
                                                                    Verizon.

OK
AT+QLWCFG="hostdevice" //Read host device information if the network is not Verizon.
+QLWCFG: "hostdevice",0,"HUID0","HMAN0","HMOD0","HSW0"
+QLWCFG: "hostdevice",1,"HUID1","HMAN1","HMOD1","HSW1"

OK
AT+QLWCFG="reset"
OK
AT+QLWCFG="nettype",2
OK
AT+QLWCFG="nettype"
+QLWCFG: "nettype",2

OK
AT+QLWSTAT?
+QLWSTAT: 0

OK
AT+QLWREG
OK
+QLWURC: "pdp active","successfully","atm2mglobal"

+QLWURC: "initial","successfully",100
```

```
+QLWURC: "dtls","successfully",100

+QLWURC: "bootstraping"

+QLWURC: "bootstrap","successfully",100

+QLWURC: "initial","successfully",1

+QLWURC: "dtls","successfully",1

+QLWURC: "registering"

+QLWURC: "ready","successfully",1
AT+QLWUPDATE=0
OK

+QLWURC: "update","successfully",1
AT+QLWSTAT?
+QLWSTAT: 2

OK
AT+QLWDEREG
OK

+QLWURC: "deregister",0
AT+QLWSTAT?
+QLWSTAT: 0

OK
```

5 Appendix A References

Table 3: Terms and Abbreviations

Abbreviation	Description
APN	Access Point Name
CoAP	Constrained Application Protocol
DM	Device Management
DTLS	Datagram Transport Layer Security
ID	Mostly refers to Identifier in terms of software
LTE	Long Term Evolution
LwM2M	Lightweight Machine to Machine
PDP	Packet Data Protocol
REST	Representational State Transfer
SMS	Short Message Service
SSID	Service Set Identifier
UDP	User Datagram Protocol
URC	Unsolicited Result Code