

EC2x&EG2x&EG9x&EM05 Series

LwM2M Application Note

LTE Standard Module Series

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About the Document

Revision History

Version	Date	Author	Description
-	2020-09-02	Herry GENG	Creation of the document
1.0	2020-10-12	Herry GENG	First official release
1.1	2024-05-22	TT TAN/ Noah DENG	- Updated EC20 R2.1 to EC20-CE and added the applicable module: EG21-GL, EG25-GL and EM05 series. - Added the following AT+QLWCFG commands (Chapter 2.2.1): - AT+QLWCFG="lwm2m_enable" - AT+QLWCFG="testmode" - Deleted the following AT+QLWCFG commands: - AT+QLWCFG="startup" - AT+QLWCFG="fota" - AT+QLWCFG="maxreconntime" - AT+QLWCFG="apnrety" - Added the maximum response time to AT+QLWCFG and both the maximum response time and characteristics to the following commands (Chapters 2.2.1 to 2.2.4): - AT+QLWCFG - AT+QLWREG - AT+QLWUPDATE - AT+QLWDEREG - Delete AT+QLWSTAT. - Added +QLWURC: "dns" (Chapter 3.4) - Updated the example of login to the LwM2M server (Chapter 4.1). - Added the examples of login to the Verizon LwM2M test server and the Verizon LwM2M test server by test mode (Chapters 4.2 and 4.3).

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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 Family	Module
EC2x	EC20-CE
	EC21 Series
	EC25 Series
EG2x	EG21-G
	EG25-G
	EG21-GL
	EG25-GL
EG9x	EG91 Series
	EG95 Series
-	EM05 Series

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

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. 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	
Test Command AT+QLWCFG=?	Response +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> +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) +QLWCFG: "epname/mode", (list of supported <mode>s) +QLWCFG: "urc", (list of supported <URC_onoff>s) +QLWCFG: "lwm2m_enable", (range of supported <operatorID>s),(list of supported <auto_startup>s) +QLWCFG: "hostdevice", (list of supported <hostID>s),<deviceID>,<manufacturer>,<model>,<sw_version>,<fw_version>,<hw_version>,<upgrade_time> +QLWCFG: "reset" +QLWCFG: "nettype", (range of supported <net_type>s) +QLWCFG: "testmode",<bootstrap_serverURL> OK
Write Command Read/configure the LwM2M server property AT+QLWCFG="security"[,<serverID>[,<SSID>,<server_addr>,<bootstrap>,<security_mode>[,<pskID>,<psk_key>]]]	Response If the optional parameters are omitted, query the current configuration: +QLWCFG: "security",<serverID>,<SSID>,<server_addr>,<bootstrap>,<security_mode> ... OK If only <serverID> is specified and other optional parameters are omitted, delete the property data of the specified <serverID>: OK Or ERROR

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

LwM2M client for one or all operators. AT+QLWCFG="lwm2m_enable" [,<operatorID>[,<auto_startup>]]	that enable LwM2M client to start automatically after the module is booted: +QLWCFG: "lwm2m_enable",<operatorID> [+QLWCFG: "lwm2m_enable",<operatorID>] [...] OK If <auto_startup> is omitted, query whether the LwM2M client under the specified operator network will start automatically after the module is booted: +QLWCFG: "lwm2m_enable",<auto_startup> OK If the optional parameters are specified, set the startup mode of LwM2M client for one or all operators: OK If there is any error: 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 If the optional parameters are specified, configure host device

	information: OK Or ERROR
Execution Command Erase LwM2M client running record AT+QLWCFG="reset"	Response OK Or ERROR
Write Command Read/configure the net type of LwM2M client AT+QLWCFG="nettype",<net_type>]	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
Write Command Set the test mode AT+QLWCFG="testmode",<bootstrap_serverURL>]	Response If the optional parameter is omitted, query the current configurations: +QLWCFG: "testmode",<bootstrap_serverURL> OK If the optional parameter is specified, set the test mode: OK Or ERROR
Maximum Response Time	150 ms
Characteristics	The commands take effect immediately. The configurations are saved automatically while the <net_type> is not 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 a non-zero value.)
	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
	<u>1</u> 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
	<u>"UQS"</u> UDP and SMS with Queue mode
<mode>	Integer type. The format of endpoint name.
	<u>3</u> 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 (Only supported by the module supporting China Mobile DM auto-registration function)
<URC_onoff>	Integer type.
	0 Disable LwM2M URC report
	<u>1</u> Enable LwM2M URC report
<operatorID>	Integer type. Operator type.
	0 All operators

	1 Other operators or no (U)SIM card is inserted 2 Verizon 3 AT&T
<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
<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
<bootstrap_server URL>	String type. The bootstrap server URL. If <bootstrap_serverURL> is "0", it indicates to clear all the configured URLs and use the default commercial server URL.

NOTE

While the module returns **<operatorID>** with a range of 0 to 18 in **+QLWCFG: "lwm2m_enable"**, (range of supported **<operatorID>**s),(list of supported **<auto_startup>**s), a response to **AT+QLWCFG** test command, only the values within the range of 0 to 3 are supported by **<operatorID>**.

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
Maximum Response Time	150 ms

Characteristics	The command takes effect immediately after registration.
-----------------	--

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
Maximum Response Time	150 ms
Characteristics	The command takes effect immediately. The configuration is not saved.

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
Maximum Response Time	150 ms
Characteristics	/

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: "dns" DNS Resolution Result Indication

This URC is reported to indicate the DNS resolution result.

+QLWURC: "dns" DNS Resolution Result Indication

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

This URC is reported to indicate the DNS resolution result.

Parameter

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

3.5. +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.

3.6. +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

3.7. +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.

3.8. +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

3.9. +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

3.10. +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","UQS")
+QLWCFG: "epname/mode",(3,6,7)
+QLWCFG: "urc",(0,1)
+QLWCFG: "lwm2m_enable",(0-18),(0-1)
+QLWCFG:
"hostdevice",(0,1),<deviceId>,<manufacturer>,<model>,<sw_version>,<fw_version>,<hw_version>,<upgrade_time>
+QLWCFG: "reset"
+QLWCFG: "nettype",(0-2)
+QLWCFG: "testmode",(bootstrap_serverURL)

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="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+QLWREG
OK

+QLWURC: "pdp active","successfully","attm2mglobal"

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

+QLWURC: "dns","successfully",100

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

+QLWURC: "bootstrapping"

+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+QLWDEREG
OK

+QLWURC: "deregister",0
```

NOTE

While the module returns **<operatorID>** with a range of 0 to 18 in **+QLWCFG: "lwm2m_enable"**, (range of supported **<operatorID>**s),(list of supported **<auto_startup>**s), a response to **AT+QLWCFG** test command, only the values within the range of 0 to 3 are supported by **<operatorID>**.

4.2. Login to the Verizon LwM2M Test Server

```
AT+QLWDEREG //Send a deregister request to the LwM2M Server.
OK
AT+QLWCFG="reset" //Erase LwM2M client running record.
OK
AT+QLWCFG="security" //Query the resources of LwM2M security object.
+QLWCFG: "security",0,100,"coaps://boot.lwm2m.vzwdm.com:5684",1,0
+QLWCFG: "security",2,101,"coaps://diag.lwm2m.vzwdm.com:5684",0,0

OK
AT+QLWCFG="security",0 //Delete the property data of Bootstrap server.
OK
AT+QLWCFG="security" //Query the current setting.
+QLWCFG: "security",2,101,"coaps://diag.lwm2m.vzwdm.com:5684",0,0

OK
AT+GSN //Request International Mobile Equipment Identity.
865814040000216

OK
AT+CNUM //Query the subscribers' number from the (U)SIM.
+CNUM: "Line 1","+15404498889",145

OK
AT+QLWCFG="security",0,100,"coaps://xvzwcdpii.xdev.motive.com:5684",1,0,"urn:imei-msisdn:8
65814040000216-5404498889","d6160c2e7c90399ee7d207a22611e3d3a87241b0462976b935341d00
0a91e747" //Set the property data of Bootstrap server.
OK
```

```

AT+QLWCFG="security"           //Query the current setting.
+QLWCFG: "security",0,100,"coaps://xvzwcdpii.xdev.motive.com:5684",1,0
+QLWCFG: "security",2,101,"coaps://diag.lwm2m.vzwdm.com:5684",0,0

OK
AT+CFUN=1,1                     //Set the device to full functionality after it is reset.
OK

+QLWURC: "pdp active","successfully","VZWADMIN"

+QLWURC: "dns","successfully",100

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

+QLWURC: "bootstrapping"

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

+QLWURC: "dns","successfully",102

+QLWURC: "dns","successfully",101

+QLWURC: "dtls","successfully",102

+QLWURC: "ready","successfully",102

+QLWURC: "pdp active","successfully","VZWINTERNET"

+QLWURC: "dns","successfully",1000

+QLWURC: "update","successfully",102

+QLWURC: "dtls","successfully",101

+QLWURC: "dtls","successfully",1000

+QLWURC: "ready","successfully",101

+QLWURC: "ready","successfully",1000

OK

```

NOTE

For details about **AT+GSN**, **AT+CNUM** and **AT+CFUN**, see *document [1]*.

4.3. Login to the Verizon LwM2M Test Server by Test Mode

```

AT+QLWDEREG //Send a deregister request to the LwM2M Server.
OK
AT+QLWCFG="testmode","0" //Clear the existing configured URLs.
OK
AT+QLWCFG="testmode","coaps://xvzwcdpii.xdev.motive.com:5684" //Configure Bootstrap server
                                                                    URL which the module will
                                                                    connect to.
OK
AT+CFUN=1,1 //Set the device to full functionality after it is reset.
OK
    
```

NOTE

For details about **AT+CFUN**, see *document [1]*.

5 Appendix References

Table 3: Related Document

Document Name
[1] Quectel_EC2x&EG9x&EG2x-G&EM05_Series_AT_Commands_Manual

Table 4: 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