GSM HTTPS Application Note

GSM/GPRS Module Series

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About the Document

History

Revision	Date	Author	Description
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1 Introduction

This document mainly introduces how to use the HTTPS function of Quectel standard module. HTTPS is used to secure the data transmission.

This document is applicable to Quectel M66, M95, M10 and M85 modules.

Hypertext Transfer Protocol Secure (HTTPS) is a combination of the Hypertext Transfer Protocol (HTTP) with SSL/TLS protocol to provide encrypted communication and secure identification of a network web server. HTTPS is the result of simply layering the Hypertext Transfer Protocol (HTTP) on the top of the SS/TLS protocol, thus adding the security capabilities of SS/TLS to standard HTTP communication.

In some cases, in order to ensure communication privacy, the communication between the server and the client should be in an encrypted way. So that it can prevent data from being eavesdropped, tampered, or forged during the communication process. The SSL function meets these demands.

1.1. SSL Version and CipherSuite

So far, several SSL versions have been released. They are SSL2.0, SSL3.0, TLS1.0, TLS1.1, and TLS1.2 The following versions are supported by Quectel modules.

Table 1: SSL Version

SSL Version
SSL3.0
TLS1.0
TLS1.1
TLS1.2

The following table shows the names of the CipherSuites that Quectel module supports. Please refer to RFC 2246-The TLS Protocol Version 1.0 on the CipherSuite definitions for details.

Table 2: SSL CipherSuite

CipherSuite Name	
0X0035	TLS_RSA_WITH_AES_256_CBC_SHA
0X0005	TLS_RSA_WITH_RC4_128_SHA
0X0004	TLS_RSA_WITH_RC4_128_MD5
0X000A	TLS_RSA_WITH_3DES_EDE_CBC_SHA
0X002F	TLS_RSA_WITH_AES_128_CBC_SHA
0X003D	TLS_RSA_WITH_AES_256_CBC_SHA256
0X0035	TLS_RSA_WITH_AES_256_CBC_SHA

1.2. The Procedure of Using SSL Function

Step 1: Install certificate and key to RAM or NVRAM by command AT+QSECWRITE. AT+QSECDEL is used to delete the certificate and key, and AT+QSECREAD is used to check the checksum of certificate and key. If you do not need server and client authentication, please skip this step.

Step 2: Configure the APN, username, password of the context by command AT+QICSGP. The command AT+QIREGAPP is used to register to TCP/IP stack.

Step 3: Activate GPRS PDP context by command AT+QIACT. After the PDP context is activated, query the local IP address by the command AT+QILOCIP.

Step 4: Configure SSL version, CipherSuit, server authentication, client authentication, CA certificate, client certificate and client key by command AT+QSSLCFG.

Step 5: Configure the URL by command AT+QHTTPURL. After “CONNECT” is returned, enter the URL, like “https:URL”.

Step 6: Send HTTP get request by command AT+QHTTPGET.

Step 7: Read HTTP server response by command AT+QHTTPREAD.

1.3. Error Handling

1.3.1. PDP Activation Fails

If you failed to activate PDP context by AT+QIACT command, please check the following aspects:

1. Query whether the PS domain is attached by AT+CGATT? command. If not, execute AT+CGATT=1 command to attach PS domain.
2. Query the CGREG status by AT+CGREG? command and make sure the PS domain has been registered.
3. Query the PDP context parameters by AT+QIREGAPP command and make sure the APN of specified PDP context has been set.
4. Make sure the specified PDP context ID is neither used by PPP nor activated by AT+CGACT command.
5 The module only supports three PDP contexts activated simultaneously, so you must make sure the amount of activated PDP context is less than 3.

If the result of above checking is OK, but the executing of AT+QIACT command still fails, please reboot the modem to resolve this issue. After rebooting the modem, please follow the above checking at least three times and each time at an interval of 10 minutes to avoid frequent rebooting of the module.

2 Description of AT Command

2.1. AT Command Syntax

Test Command	**AT+<x>=?**	This command returns the list of parameters and value ranges Set by the corresponding Write Command or internal processes.
Read Command	**AT+<x>?**	This Command returns the currently set value of the parameter or parameters.
Write Command	**AT+<x>=<…>**	This command sets the user-definable parameter values.
Execution Command	**AT+<x>**	This command reads non-variable parameters affected by internal processes in the GSM engine.

2.2. Description of AT Command

2.2.1. AT+QSSLCFG SSL Configuration

This AT command is used to configure the SSL version, CipherSuite, secure level, CA certificate, client certificate, client key, RTC time ignorance, HTTP/HTTPS and SMTP/SMTPS. These parameters will be used in the handshake procedure.

CTX is the abbreviation of the SSL (Secure Socket Layer) context. <ctxindex> is the index of the SSL context. Quectel standard module supports 6 SSL contexts at most. On the basis of a SSL context, several SSL connections can be established. The settings such as the SSL version and the CipherSuite are stored in the SSL context, and the settings will be applied to the new SSL connection which is associated with the SSL context.

AT+QSSLCFG SSL Configuration	
Test Command **AT+QSSLCFG=?**	Response **+QSSLCFG: "type",(0-5),"value"** **OK**
Query the setting of the context **AT+QSSLCFG="ctxindex",<ctxindex>**	Response **+QSSLCFG: <ctxindex>,<sslversion>,<seclevel>,<ciphersuite>,<cacert>,<clientcertname>,<clientkeyname>**

	OK Otherwise response **ERROR**
Configure the SSL version **AT+QSSLCFG="sslversion",<ctxindex>[,<sslversion>]**	Response **OK** Otherwise response **ERROR** If the third parameter is omitted, query the "sslversion" value. **+QSSLCFG: "sslversion",<sslversion>** **OK**
Configure the CipherSuite **AT+QSSLCFG="ciphersuite",<ctxindex>[,<list of supported<ciphersuite>s>]**	Response **OK** Otherwise response **ERROR** If the third parameter is omitted, query the "ciphersuite" value. **+QSSLCFG: "ciphersuite",<ciphersuite>** **OK**
Configure the authentication mode **AT+QSSLCFG="seclevel",<ctxindex>[,<seclevel>]**	Response **OK** Otherwise response **ERROR** If the third parameter is omitted, query the "seclevel" value. **+QSSLCFG: "seclevel",< seclevel >** **OK**
Configure the path of root certificate **AT+QSSLCFG="cacert",<ctxindex>[,<cacertname>]**	Response **OK** Otherwise response **ERROR** If the third parameter is omitted, query the "cacertname" value. **+QSSLCFG: "cacert",<cacertname>** **OK**
Configure the path of client certificate **AT+QSSLCFG="clientcert",<ctxindex**	Response **OK**

>[,<clientcertname>]	Otherwise response **ERROR** If the third parameter is omitted, query the “clientcertname” value. **+QSSLCFG: “clientcert”,<clientcertname>** **OK**
Configure the path of client key **AT+QSSLCFG=“clientkey”,<ctxindex>[,<clientkeyname>]**	Response **OK** Otherwise response **ERROR** If the third parameter is omitted, query the “clientkeyname” value. **+QSSLCFG: “clientkey”,<clientkeyname>** **OK**
Configure whether to ignore the RTC time **AT+QSSLCFG=“ignorertctime”[,<ignorertctime>]**	Response **OK** Otherwise response **ERROR** If the second parameter is omitted, query the “ignorertctime” value. **+QSSLCFG: “ignorertctime”,<ignorertctime>** **OK**
Enable/Disable the HTTPS function **AT+QSSLCFG=“https”[,<httpsenable>]**	Response **OK** Otherwise response **ERROR** If the second parameter is omitted, query the “httpsenable” value. **+QSSLCFG: “https”,<httpsendable>** **OK**
Configure the SSL context index for HTTPS **AT+QSSLCFG=“httpsctxi”[,<httpsctxindex>]**	Response **OK** Otherwise response **ERROR** If the second parameter is omitted, query the “httpsctxindex” value.

	+QSSLCFG: "httpsctxi",< httpsctxindex> **OK**
Configure the type of SMTP/SMTPS **AT+QSSLCFG="smtpstyle"[,<smtpstyle>]**	Response **OK** Otherwise response **ERROR** If the second parameter is omitted, query the "smtpstyle" value. **+QSSLCFG: "smtpstyle",< smtpstyle >** **OK**
Configure the SSL context index for SMTPS **AT+QSSLCFG="smtpsctxi"[,<smtpsctxindex>]**	Response **OK** Otherwise response **ERROR** If the second parameter is omitted, query the "smtpsctxindex" value. **+QSSLCFG: "smtpctxi",<smtpsctxindex>** **OK**
Reference	

Parameter

<ctxindex>	SSL context index
<sslversion>	Configuration the SSL version
	0 SSL3.0
	1 TLS1.0
	2 TLS1.1
	3 TLS1.2
	4 Support all
<ciphersuite>	Configuration the CipherSuite
	0X0035 TLS_RSA_WITH_AES_256_CBC_SHA
	0X002F TLS_RSA_WITH_AES_128_CBC_SHA
	0X0005 TLS_RSA_WITH_RC4_128_SHA
	0X0004 TLS_RSA_WITH_RC4_128_MD5
	0X000A TLS_RSA_WITH_3DES_EDE_CBC_SHA
	0X003D TLS_RSA_WITH_AES_256_CBC_SHA256
<seclevel>	Configure the authentication mode
	0 No authentication

	1	Manage server authentication
	2	Manage server and client authentication if requested by the remote server
<cacertname>	String format, configure the server CA certificate	
<clientcertname>	String format, configure the client certificate	
<clientkeyname>	String format, configure the client key	
<ignorertctime>	Configure whether to ignore the RTC time	
	0	Do not ignore the RTC time
	1	Ignore the RTC time
<httpsenable>	Enable/disable the HTTPS function	
	0	Disable HTTPS
	1	Enable HTTPS
<httpsctxindex>	Configure the SSL context for HTTPS <httpsctxindex> is the index of SSL context. If the host does not configure the <httpsctxindex>, the value of <httpsctxindex> is -1. Range: 0-5	
<smtpstyle>	Configure the type of SMTP/SMTPS	
	0	Without SSL
	1	SSL
	2	STARTTLS
<smtpsctxindex>	Configure the SSL context for SMTPS <smtpsctxindex> is the index of SSL context. If the host does not configure the <smtpsctxindex>, the value of <smtpsctxindex> is -1. Range: 0-5	

NOTES

1. The format of <cacertname>, <clientcertname> and <clientkeyname> can be as follows:
   “RAM:filename” File is uploaded to RAM
   “NVRAM:filename” File is upload to NVRAM. Support two CA certificates, one client certificate and one client private key. The filename of CA certificate must be CA0 or CA1, the filename of client certificate must be CC0, and the filename of client private key must be CK0.
   CA[0,1] Identify a CA certificate
   CC0 Identify a client certificate
   CK0 Identify a client key
2. If no authentication is set, security data will not be needed. If server authentication has been set, you need to configure server CA certificate. If server and client authentication has been set, you need to configure client certificate, server CA certificate and client private key.

2.2.2. AT+QSECWRITE Add a Certificate or Key

This command is used to add user certificate, user key and CA certificate to RAM or NVRAM. And the certificate and key will be stored in these storages in an encrypted way. After the certificate and key are stored in these storages, the host cannot read the data from these storages, instead, the host can only query the checksum of them. Please note that before adding a certificate or key to RAM or NVRAM, it

should not be existed in the corresponding storage, if it exists already, the host should delete it first, and then add it to the corresponding storage.

AT+QSECWRITE Add a Certificate or Key	
Test Command **AT+QSECWRITE=?**	Response **+QSECWRITE: <filename>,<filesize>[,(3,200)]** **OK**
Read Command **AT+QSECWRITE?**	Response **OK**
Write Command **AT+QCELLLOC=<filename>,<filezsize>[,<timeout>]**	Response If format is right, response: **Connect** After module switches to data mode, and the certificate or key data can be input. When the size of the input data reaches <filesize> (unit: byte) or module receives "+++" sequence from UART, module will return to command mode and reply the following codes: +QSECWRITE: <uploadsize>,<checksum> **OK** If some errors occur, response: **+CME ERROR: <err>**
Reference	

Parameter

<filename>	The name of the file to be stored. The format can be as follows: "RAM:filename" File is uploaded to RAM "NVRAM:filename" File is upload to NVRAM. Support two CA certificates, one client certificate and one client private key. The filename of CA certificate must be CA0 or CA1, the filename of client certificate must be CC0, and the filename of client private key must be CK0 CA[0,1] Identify a CA certificate CC0 Identify a client certificate CK0 Identify a client key
<filesize>	The size of the file to be uploaded. Unit: byte If the file is uploaded to the RAM, the maximum size is 32768. If the file is uploaded to NVRAM, the maximum size is 2025. The minimum size is 1
<timeout>	The time in seconds to wait for input data from UART. Unit: byte. Range: 3-200. The

	default value is 100.
<uploadsize>	The size of the actually uploaded data. Unit: byte
<checksum>	The checksum of the uploaded data

2.2.3. AT+QSECREAD Query the Checksum of a Certificate or Key

This command is used to query the checksum of a certificate or key, if the checksum is not same as the original one owned by the user, some mistakes will occur.

AT+QSECREAD Query the Checksum of a Certificate or Key	
Test Command **AT+QSECREAD=?**	Response **+QSECREAD: <filename>** **OK**
Read Command **AT+QCELLLOC=1[,<cellNum>]**	Response **OK**
Write Command. **AT+QSECREAD=<filename>**	Response **+QSECREAD: <good>,<checksum>** **OK** If some errors occur, response: **+CME ERROR: <err>**
Reference	

Parameter

<filename>	The name of the file to be stored. The format can be as follows: "RAM:filename" File is uploaded to RAM "NVRAM:filename" File is upload to NVRAM. Support two CA certificates, one client certificate and one client private key. The filename of CA certificate must be CA0 or CA1, the filename of client certificate must be CC0, and the filename of client private key must be CK0 CA[0,1] Identify a CA certificate CC0 Identify a client certificate CK0 Identify a client key
<good>	Indicate whether the certificate or key is correct or not. When uploading the certificate or key by QSECWRITE, the checksum of certificate or key will be stored at the same time. After executing QSECREAD, QSECREAD will calculate checksum of the certificate or key again, and then compare this checksum with the one stored by QSECWRITE, if they are the same, the certificate or key is correct, otherwise the certificate or key is wrong

	0	The certificate or key is wrong
	1	The certificate or key is correct
<checksum>	The checksum of the file	

2.2.4. AT+QSECDEL Delete a Certificate or Key

This command is used to delete a certificate or key.

AT+QSECDEL Delete a Certificate or Key	
Test Command **AT+QSECDEL=?**	Response **+QSECDEL: <filename>** **OK**
Read Command **AT+QSECDEL?**	Response **OK**
Write Command **AT+QSECDEL=<filename>**	Response **OK** If some errors occur, response: **+CME ERROR: <err>**
Reference	

Parameter

<filename>	The name of the file to be stored. The format can be as follows:	
	“RAM:filename”	File is uploaded to RAM
	“NVRAM:filename”	File is upload to NVRAM. Support two CA certificates, one client certificate and one client private key. The filename of CA certificate must be CA0 or CA1, the filename of client certificate must be CC0, and the filename of client private key must be CK0.
	CA[0,1]	Identify a CA certificate
	CC0	Identify a client certificate
	CK0	Identify a client key

3 Example

3.1. SSL Function with Certificate and key in RAM

This is an example about server authentication and client authentication, and the certificate and key are stored in RAM. If you do not need server and client authentication, please skip this step.

```
//Step: Upload certificate and key to RAM.
AT+QSECWRITE="RAM:ca_cert.pem",1614,100        //Upload the CA certificate to RAM.
CONNECT

<Input the ca_cert.pem data, the size is 1614 bytes>

+QSECWRITE: 1614,4039

OK
AT+QSECWRITE="RAM:client_cert.pem",1419,100    //Upload the client certificate to RAM.
CONNECT

<Input the client_cert.pem data, the size is 1419 bytes>

+QSECWRITE: 1419,618

OK
AT+QSECWRITE="RAM:client_key.pem",1679,100     //Upload the client private key to RAM.
CONNECT

<Input the client_key.pem data, the size is 1679 bytes>

+QSECWRITE: 1679,83a7

OK
```

3.2. SSL Function with Certificate and key in NVRAM

This is an example about server authentication and client authentication, and the certificate and key are stored in NVRAM. If you do not need server and client authentication, please skip this step.

```
//Step: Upload the certificate and key to NVRAM.
AT+QSECWRITE=”NVRAM:CA0”,1614,100        //Upload the CA certificate to NVRAM.
CONNECT

<Input the CA0 data, the size is 1614 bytes>

+QSECWRITE: 1614,4039

OK
AT+QSECWRITE=“NVRAM:CC0”,1419,100       //Upload the client certificate to NVRAM.
CONNECT

<Input the CC0 data, the size is 1419 bytes>

+QSECWRITE: 1419,618

OK

AT+QSECWRITE=“NVRAM:CK0”,1679,100       //Upload the client private key to NVRAM.
CONNECT

<Input the CK0 data, the size is 1679 bytes>

+QSECWRITE: 1679,83a7

OK
```

3.3. Example about SSL Function with HTTPS

```
//Step 1: Configure and activate the PDP context.

AT+ QIFGCNT=0                          //Set context 0 as foreground context.
OK
AT+ QICSGP=1,“CMNET”                   //Set bearer type as GPRS and the APN is “CMNET”,
OK                                       no username and password for the APN.
AT+QIREGAPP                            //Register to TCP/IP stack.
OK
```

```
AT+QIACT                                    //Activate GPRS PDP context.
OK
AT+QILOCIP                                  //Query the local IP address.
10.1.83.188

//Step 2: Configure SSL version, ciphersuite, no authentication.

AT+QSSLCFG="sslversion",0,2                 //Configure SSL version.
OK
AT+QSSLCFG="seclevel",0,0                   //Configure Server authentication and client authentication.

OK
AT+QSSLCFG="ciphersuite",0,"0XFFFF"         //Configure ciphersuite.
OK
AT+QSSLCFG="https",1                        //Enable HTTPS function.
OK
AT+QHTTPURL=57,60                           //Set the URL.
CONNECT
……
//For example input 57 bytes: https://220.180.239.201:8417/test/testfiles/test2000.html.

OK
AT+QHTTPGET=60                              //Send HTTP get request.
OK
AT+QHTTPREAD=30                             //Read the response of HTTP server.
CONNECT
……..                                       //Output the response data of HTTP server to UART.
OK
AT+QIDEACT
DEACT OK
```

4 Appendix A Reference

Table 3: Related Documents

SN	Document Name	Remark
[1]	GSM 07.07	Digital cellular telecommunications (Phase 2+); AT command set for GSM Mobile Equipment (ME)
[2]	GSM 07.10	Support GSM 07.10 multiplexing protocol
[3]	Quectel_GSM_HTTP_AT_Commands_Manual	HTTP application note

Table 4: Terms and Abbreviations

Abbreviation	Description
SSL	Security Socket Layer
HTTPS	Hypertext Transfer Protocol Secure
URL	Uniform Resource Locator