SIM7070_SIM7080_SIM7090 Series_MQTT(S) Application Note

LPWA Module
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About Document

Version History

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<tr>
<td>V1.00</td>
<td>2019.09.02</td>
<td>Zhiyuan.tang</td>
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<td>2020.02.26</td>
<td>Wenjie.Lai</td>
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<td>Add chapter 5.3.3 and 5.3.4 for One Device One Secret</td>
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Scope

This document applies to the following products

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<td>SIM7080G</td>
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<td>17.6<em>15.7</em>2.3</td>
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<td>NB/GPRS</td>
<td>24<em>24</em>2.4</td>
<td>N/A</td>
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<td>N/A</td>
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1 Introduction

1.1 Purpose of the document

Based on module AT command manual, this document will introduce MQTT(S) application process. Developers could understand and develop application quickly and efficiently based on this document.

1.2 Related documents

[2] SIM7070_SIM7080_SIM7090 Series_SSL_Application Note

1.3 Conventions and abbreviations

In this document, the GSM engines are referred to as following term:
- ME (Mobile Equipment);
- MS (Mobile Station);
- TA (Terminal Adapter);
- DCE (Data Communication Equipment) or facsimile DCE (FAX modem, FAX board);

In application, controlling device controls the GSM engine by sending AT Command via its serial interface. The controlling device at the other end of the serial line is referred to as following term:
- TE (Terminal Equipment);
- DTE (Data Terminal Equipment) or plainly “the application” which is running on an embedded system;
2 MQTT(S) Introduction

MQTT (Message Queue Telemetry Transport) is a messaging protocol based on the publish/subscribe paradigm under the ISO standard (ISO/IEC PRF 20922). It works on the TCP/IP protocol suite and is a publish/subscribe messaging protocol designed for remote devices with poor hardware performance and poor network conditions.

The MQTT protocol is a protocol designed for the communication of remote sensors and control devices with limited computing power and working on low-bandwidth, unreliable networks. It has the following main features:

- Use the publish/subscribe message mode to provide one-to-many message publishing and uncouple the application;
- Message transmission for shielding the payload content;
- Provide network connection using TCP/IP;
- There are three types of message publishing service quality:
  - "At most once," message publishing relies entirely on the underlying TCP/IP network. Message loss or duplication can occur. This level can be used in the following situations, environmental sensor data, loss of a read record does not matter, because there will be a second transmission in the near future.
  - "At least once" to ensure that the message arrives, but message duplication may occur.
  - "Only once" to ensure that the message arrives once. This level can be used in situations where repeated or missing messages can result in incorrect results.
- small transmission, low overhead (fixed length of the head is 2 bytes), protocol exchange is minimized to reduce network traffic;
- Use the Last Will and Testament features to notify the parties about the mechanism of client abort.
### 3 AT Commands for MQTT(S)

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AT+CSSLCFG</td>
<td>Configure SSL parameters of a context identifier</td>
</tr>
<tr>
<td>AT+SMCONF</td>
<td>Set MQTT Parameter</td>
</tr>
<tr>
<td>AT+SMS</td>
<td>Select SSL Configure</td>
</tr>
<tr>
<td>AT+SMCONN</td>
<td>MQTT Connection</td>
</tr>
<tr>
<td>AT+SMPUB</td>
<td>Send Packet</td>
</tr>
<tr>
<td>AT+SMSUB</td>
<td>Subscribe Packet</td>
</tr>
<tr>
<td>AT+SMUNSUB</td>
<td>Unsubscribe Packet</td>
</tr>
<tr>
<td>AT+SMSTATE</td>
<td>Inquire MQTT Connection Status</td>
</tr>
<tr>
<td>AT+SMPUBHEX</td>
<td>Set SMPUB Data Format to Hex</td>
</tr>
<tr>
<td>AT+SMDISC</td>
<td>Disconnection MQTT</td>
</tr>
<tr>
<td>AT+SMALIAUTH</td>
<td>Set Alibaba Cloud Parameter (One device One Secret)</td>
</tr>
<tr>
<td>AT+SMALIDYNA</td>
<td>Set Alibaba Cloud Dynamic Register Parameter (One Product One Secret)</td>
</tr>
<tr>
<td>+SMSUB</td>
<td>MQTT Receive Subscribe Data</td>
</tr>
</tbody>
</table>

For detail information, please refer to "SIM7070_SIM7080_SIM7090 Series_AT Command Manual".
4 Bearer Configuration

Usually module will register PS service automatically.

4.1 PDN Auto-activation

//Example of PDN Auto-activation.

```
AT+CPIN?  //Check SIM card status
+CPIN:READY
OK

AT+CSQ  //Check RF signal
+CSQ: 20,0
OK

AT+CGATT? //Check PS service. 1 indicates PS has attached.
+CGATT: 1
OK

AT+COPS? //Query Network information, operator and network.
+COPS: 0,0,"CHN-CT",9 //Mode 9 means NB-IOT network.
OK

AT+CGNAPN  //Query the APN delivered by the network after the CAT-M or NB-IOT network is successfully registered.
+CGNAPN: 1,"ctnb" //"ctnb" is APN delivered by the CAT-M or NB-IOT network. APN is empty under the GSM network.
OK

AT+CNCFG=0,1,"ctnb"  //Before activation please use AT+CNCFG to set APN\user name\password if needed.
OK

AT+CNACT=0,1 //Activate network, Activate 0th PDP.
OK

+APP PDP: 0,ACTIVE
```
AT+CNACT?              //Get local IP
+CNACT: 0,1,"10.94.36.44"
+CNACT: 1,0,"0.0.0.0"
+CNACT: 2,0,"0.0.0.0"
+CNACT: 3,0,"0.0.0.0"
OK

4.2 APN Manual Configuration

If not attached automatically, could configure correct APN setting.

//Example of APN Manual configuration.

AT+CFUN=0               //Disable RF
+CPIN: NOT READY
OK

AT+CGDCONT=1,"IP","ctnb"  //Set the APN manually. Some operators need to set APN first when registering the network.
OK

AT+CFUN=1               //Enable RF
OK

+CPIN: READY
AT+CGATT?               //Check PS service. 1 indicates PS has attached.
+CGATT: 1
OK

AT+CGNAPN               //Query the APN delivered by the network after the CAT-M or NB-IOT network is successfully registered.
+CGNAPN: 1,"ctnb"
//"ctnb" is APN delivered by the CAT-M or NB-IOT network. APN is empty under the GSM network.
OK

AT+CNCFG=0,1,"ctnb"    //Before activation please use AT+CNCFG to set APN\user name\password if needed.
OK

AT+CNACT=0,1           //Activate network, Activate 0th PDP.
OK
+APP PDP: 0,ACTIVE
AT+CNCT?  //Get local IP
+CNACT: 0,1,"10.94.36.44"
+CNACT: 1,0,"0.0.0.0"
+CNACT: 2,0,"0.0.0.0"
+CNACT: 3,0,"0.0.0.0"
OK
# 5 MQTT(S) Examples

## 5.1 MQTT Function

//Example of MQTT Function.

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AT+CNACT=0,1</td>
<td>Open wireless connection parameter 0 is PDP Index, parameter 1 means active.</td>
</tr>
<tr>
<td>OK</td>
<td></td>
</tr>
<tr>
<td>+APP PDP: 0,ACTIVE</td>
<td></td>
</tr>
<tr>
<td>AT+CNACT?</td>
<td>Get local IP</td>
</tr>
<tr>
<td>+CNACT: 0,1,&quot;10.94.36.44&quot;</td>
<td></td>
</tr>
<tr>
<td>+CNACT: 1,0,&quot;0.0.0.0&quot;</td>
<td></td>
</tr>
<tr>
<td>+CNACT: 2,0,&quot;0.0.0.0&quot;</td>
<td></td>
</tr>
<tr>
<td>+CNACT: 3,0,&quot;0.0.0.0&quot;</td>
<td></td>
</tr>
<tr>
<td>OK</td>
<td></td>
</tr>
<tr>
<td>AT+SMCONF=&quot;URL&quot;,117.131.85.139,6000</td>
<td>Set up server URL</td>
</tr>
<tr>
<td>OK</td>
<td></td>
</tr>
<tr>
<td>AT+SMCONF=&quot;KEEPTIME&quot;,60</td>
<td>Set MQTT time to connect server</td>
</tr>
<tr>
<td>OK</td>
<td></td>
</tr>
<tr>
<td>AT+SMCONF=&quot;CLEANSS&quot;,1</td>
<td>Clear session</td>
</tr>
<tr>
<td>OK</td>
<td></td>
</tr>
<tr>
<td>AT+SMCONF=&quot;CLIENTID&quot;,&quot;simmqtt&quot;</td>
<td>Set client ID, need not set it after clear session</td>
</tr>
<tr>
<td>OK</td>
<td></td>
</tr>
<tr>
<td>AT+SMCONN</td>
<td></td>
</tr>
<tr>
<td>OK</td>
<td></td>
</tr>
<tr>
<td>AT+SMSUB=&quot;information&quot;,1</td>
<td>Subscription packet</td>
</tr>
<tr>
<td>OK</td>
<td></td>
</tr>
<tr>
<td>AT+SMPUB=&quot;information&quot;,5,1,1</td>
<td>Send packet, 5 is packet length.</td>
</tr>
<tr>
<td>&gt;hello</td>
<td>Get data on server</td>
</tr>
<tr>
<td>OK</td>
<td></td>
</tr>
<tr>
<td>+SMSUB: &quot;information&quot;,&quot;hello&quot;</td>
<td></td>
</tr>
</tbody>
</table>
```
AT+SMUNSUB="information"
OK
AT+SMDISC
OK
AT+CNACT=0,0
OK
+APP PDP: 0,DEACTIVE

5.2 MQTTS Function

//Example of MQTTS Function.

AT+CNACT=0,1
OK
+APP PDP: 0,ACTIVE
AT+CCLK?
+CCLK: "21/05/26,13:37:37+32"
OK
AT+CNACT?
+CNACT: 0,1,"10.94.36.44"
+CNACT: 1,0,"0.0.0.0"
+CNACT: 2,0,"0.0.0.0"
+CNACT: 3,0,"0.0.0.0"
OK
AT+CFSINIT
OK
AT+CFSWFLE=3,"ca.crt",0,2110,1000
DOWNLOAD
OK
AT+CFSWFLE=3,"myclient.crt",0,2110,1000

//Unsubscription packet
//Disconnect MQTT
//Disconnect wireless
//Open wireless connection parameter 0 is PDP index, parameter 1 means active. and execute AT+CLTS=1 then reboot the device.
//Before connecting, you need to confirm that the time has been synchronized.
//Get local IP
//Init FS AT command
//After download, sent certificate file through the serial port. 2110 is certificate size. Send CA file success
//Send cert file success
```
### DOWNLOAD

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AT+CFSWFILE=3,&quot;myclient.key&quot;,0,2110,1000</td>
<td>//Send key file success</td>
</tr>
<tr>
<td>AT+CFSTERM</td>
<td>//Free data buffer</td>
</tr>
<tr>
<td>AT+SMCONF=&quot;URL&quot;,117.131.85.139,6001</td>
<td>//Set up server URL</td>
</tr>
<tr>
<td>AT+SMCONF=&quot;KEEPTIME&quot;,60</td>
<td>//Set MQTT time to connect server</td>
</tr>
<tr>
<td>AT+SMCONF=&quot;CLEANSS&quot;,1</td>
<td>//Clear session</td>
</tr>
<tr>
<td>AT+SMCONF=&quot;CLIENTID&quot;,&quot;simmqtt&quot;</td>
<td>//Set client ID, need not set it after clear session</td>
</tr>
<tr>
<td>AT+CSSLCFG=&quot;CONVERT&quot;,2,&quot;ca.crt&quot;</td>
<td>//rootCA.pem is CA certificate</td>
</tr>
<tr>
<td>AT+CSSLCFG=&quot;CONVERT&quot;,1,&quot;myclient.crt&quot;,&quot;myclient.key&quot;</td>
<td>//cert.pem is certificate, key.pem is key of cert.pem</td>
</tr>
<tr>
<td>AT+SMSSL=1,&quot;ca.crt&quot;,&quot;myclient.crt&quot;</td>
<td>//Set CA certificate and cert certificate name</td>
</tr>
<tr>
<td>AT+SMCONN</td>
<td>OK</td>
</tr>
<tr>
<td>AT+SMSUB=&quot;information&quot;,1</td>
<td>//Subscription packet</td>
</tr>
<tr>
<td>AT+SMPUB=&quot;information&quot;,5,1,1</td>
<td>//Send packet, 5 is packet length. Get data on server</td>
</tr>
<tr>
<td>&gt;hello</td>
<td>OK</td>
</tr>
<tr>
<td>+SMSUB: &quot;information&quot;,&quot;hello&quot;</td>
<td>//Unsubscription packet</td>
</tr>
<tr>
<td>AT+SMUNSUB=&quot;information&quot;</td>
<td>OK</td>
</tr>
<tr>
<td>AT+SMDISC</td>
<td>//Disconnect MQTT</td>
</tr>
<tr>
<td>AT+CNACT=0,0</td>
<td>//Disconnect wireless</td>
</tr>
<tr>
<td>+APP PDP: 0,DEACTIVE</td>
<td></td>
</tr>
</tbody>
</table>
5.3 Connecting Ali Cloud Function

5.3.1 MQTT Connecting Ali Cloud Function

//Example of MQTT Connecting Ali Cloud Function.

\[\text{AT+CNACT}=0,1\] //Open wireless connection. Parameter 0 is PDP index, parameter 1 means active.

OK

+APP PDP: 0,ACTIVE
\[\text{AT+CNACT}\]
+CNACT: 0,1,"10.94.36.44"
+CNACT: 1,0,"0.0.0.0"
+CNACT: 2,0,"0.0.0.0"
+CNACT: 3,0,"0.0.0.0"

OK

\[\text{AT+SMCONF}="URL","a1kUAJknr0y.iot-as-mqtt.cn-shanghai.aliyuncs.com",1883\] //The format of domain name is: productKey.iot-as-mqtt.cn-shanghai.aliyuncs.com Note: a1kUAJknr0y is product_key

OK

\[\text{AT+SMCONF}="USERNAME","7000C&a1kUAJknr0y"\] //The format of username is: deviceName&productKey Note: a1kUAJknr0y is product_key 7080 is deviceName

OK

\[\text{AT+SMCONF}="PASSWORD","56bf1f37de9ce259ff5699ea1117a43dae9bd11"\] //The password is generated by SHA1 algorithm

OK

\[\text{AT+SMCONF}="CLIENTID","a1kUAJknr0y.7080|securemode=3,timestamp=2524608000000,signmethod=hmacsha1,gw=0|"\] //The format of client id is: productKey.deviceName|securemode=3,signmethod=hmacsha1,gw=0|

Note: a1kUAJknr0y is product_key 7080 is deviceName

OK

\[\text{AT+SMCONN}\] //Connect ok
5.3.2 MQTTs Connecting Ali Cloud Function

//Example of MQTTs Connecting Ali Cloud Function.

AT+CNACT=0,1
OK

+APP PDP: 0,ACTIVE
AT+CCLK?
+CCLK: "21/05/26,13:37:37+32"
OK

AT+CNACT?
+CNACT: 0,1,"10.94.36.44"
+CNACT: 1,0,"0.0.0.0"
+CNACT: 2,0,"0.0.0.0"
+CNACT: 3,0,"0.0.0.0"
OK

AT+CSSLCFG="CONVERT",2,"aliiot_ca.pem"
OK

AT+CSSLCFG="CONVERT",1,"simcom.cert.pem","simcom.private.key"
OK

AT+SMCONF="URL","a1kUAJknr0y.iot-as-mqtt.cn-shanghai.aliyuncs.com",1883
//The format of domain name is: productKey.iot-as-mqtt.cn-shanghai.aliyuncs.com
Note: a1kUAJknr0y is product_key
OK

AT+SMCONF="USERNAME","7080&a1kUAJknr0y"
//The format of username is: deviceName&productKey
Note: a1kUAJknr0y is product_key
7080 is deviceName
OK
AT+SMCONF="PASSWORD","56bf1f37de9ce2591f5699eea1117a43dae9bd11"
OK
AT+SMCONF="CLIENTID","a1kUAJknr0y.7080|securemode=2,timestamp=2524608000000,signmethod=hmacsha1,gw=01"
OK
AT+SMSSL=2,"aliiot_ca.pem","simcom.cert.pem"
OK
AT+SMCONN
OK

5.3.3 MQTT Quick Connecting Ali Cloud Function(One Device One Secret)

//Example of MQTT Quick Connecting Ali Cloud Function(One Device One Secret).

AT+CNACT=0,1
OK
+APP PDP: 0,ACTIVE
AT+CNACT?
+CNACT: 0,1,"10.94.36.44"
+CNACT: 1,0,"0.0.0.0"
+CNACT: 2,0,"0.0.0.0"
+CNACT: 3,0,"0.0.0.0"
OK
AT+SMCONF="URL","a1mgfEydceDb.iot-as-mqtt.cn-shanghai.aliyuncs.com",1883
OK
AT+SMALIAUTH="a1mgfEydceDb","SIM7080_test","1cea33667e1bec1ce074c63762168e99"
OK

//The password is generated by SHA1 algorithm
//The format of client id is:
//productKey.deviceName|securemode=2,timestamp=2524608000000,signmethod=hmacsha1,gw=01
//a1kUAJknr0y is product_key
//7080 is deviceName
//Configure SSL connect index
//Connect ok

//The format of domain name is :
//productKey.iot-as-mqtt.cn-shanghai.aliyuncs.com
Note:
a1kUAJknr0y is product_key
//Open wireless connection. Parameter 0 is PDP index, parameter 1 means active.
//Get local IP
//Set the Alibaba Cloud device parameters:
Note:
a1mgfEydceDb is product_key
SIM7080_test is device Name
1cea33667e1bec1ce074c63762168e99 is device Secret
5.3.4 MQTTs Ali Cloud Dynamic Register Function (One Product One Secret)

//Example of MQTTs Ali Cloud Dynamic Register Function (One Product One Secret)

AT+CNACT=0,1 //Open wireless connection parameter 0 is PDP index, parameter 1 means active, and execute AT+CLTS=1 then reboot the device.
OK

+APP PDP: 0,ACTIVE
AT+CCLK?
OK

AT+CCLK: "21/05/26,13:37:37+32" //Before connecting, you need to confirm that the time has been synchronized.

OK
AT+CNACT?
+CNACT: 0,1,"10.94.36.44"
+CNACT: 1,0,"0.0.0.0"
+CNACT: 2,0,"0.0.0.0"
+CNACT: 3,0,"0.0.0.0"

OK
AT+SMCONF="URL","a1mgfeydcdb.iot-as-mqtt.cn-shanghai.aliyuncs.com",1883 //The format of domain name is: productKey.iot-as-mqtt.cn-shanghai.aliyuncs.com
Note: a1mgfeydcdb is product_key
OK

AT+SMALIDYNA="a1mgfeydcdb","device1","UK2iuVb8yBUjQ286" //Set the Alibaba Cloud Dynamic Register parameters:
Note: a1mgfeydcdb is product_key,
device1 is device Name, user can define it by themselves.
UK2iuVb8yBUjQ286 is Product Secret.

OK
AT+SMCONN //Connect ok
OK
+SMSUB: /ext/regnwI,"clientId":"xF6cnBFV7GnoFKulQtEn000100","productKey":"a1mGfEydcDb","deviceName":"device3","deviceToken":"^1^1608097095451^6d7eb3914f7ed15"

//After the dynamic registration is successful, the Alibaba Cloud will return “clientId” & "deviceToken" which needed by future connection.