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>
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<td>Zhiyuan.tang</td>
<td>First Release</td>
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<td>V1.02</td>
<td>2020.2.26</td>
<td>Wenjie.Lai</td>
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<td>Ping.zhang</td>
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Scope

This document applies to the following products

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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+SMSSL</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>+SMDISC</td>
<td>Disconnection MQTT</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.

```plaintext
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
```
4.2 APN Manual Configuration

If not attached automatically, could configure correct APN setting.

//Example of APN Manual configuration.

```
AT+CFUN=0
+CPIN: NOT READY
OK
AT+CGDCONT=1,"IP","ctnb"
+CPIN: READY
OK
AT+CFUN=1
OK

+CPIN: READY
AT+CGATT?
+CGATT: 1
OK

AT+CGNAPN
+CGNAPN: 1,"ctnb"
OK

AT+CNCFG=0,1,"ctnb"
OK

AT+CNACT=0,1
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
5 MQTT(S) Examples

5.1 MQTT Function

//Example of MQTT Function.

AT+CNACT=0,1  //Open wireless connection parameter 0 is PDP Index, parameter 1 means active.
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
AT+SMCONF="URL",117.131.85.139,6000  //Set up server URL
OK
AT+SMCONF="KEEPTIME",60  //Set MQTT time to connect server
OK
AT+SMCONF="CLENASS",1  //Clear session
OK
AT+SMCONF="CLIENTID","simmqtt"  //Set client ID. need not set it after clear session
OK
AT+SMCONN
OK
AT+SMSUB="information",1  //Subscription packet
OK
AT+SMPUB="information",5,1,1  //Send packet, 5 is packet length.
>hello
OK

Get data on server

+SMSUB: "information","hello"
### 5.2 MQTTs Function

#### //Example of MQTTs Function.

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AT+SMUNSUB=&quot;information&quot;</td>
<td>//Unsubscription packet</td>
</tr>
<tr>
<td>OK</td>
<td></td>
</tr>
<tr>
<td>AT+SMDISC</td>
<td>//Disconnect MQTT</td>
</tr>
<tr>
<td>OK</td>
<td></td>
</tr>
<tr>
<td>AT+CNACT=0,0</td>
<td>//Disconnect wireless</td>
</tr>
<tr>
<td>OK</td>
<td></td>
</tr>
<tr>
<td>+APP PDP: 0,DEACTIVE</td>
<td></td>
</tr>
</tbody>
</table>

AT+CNACT=0,1  //Open wireless connection parameter 0 is PDP index, parameter 1 means active. and use AT+CLTS=1 reboot.

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

AT+CFSINIT  //Init FS AT command

OK

AT+CFSWFFILE=3,"ca.crt",0,2110,1000  //After download, sent certificate file through the serial port.

DOWNLOAD

OK

AT+CFSWFFILE=3,"myclient.crt",0,2110,1000  //Send cert file success

DOWNLOAD

OK

AT+CFSWFFILE=3,"myclient.key",0,2110,1000  //Send key file success

OK
### AT Command Examples

<table>
<thead>
<tr>
<th>AT Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<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;CLENASS&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.

<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;,&quot;a1kUAJknr0y.iot-as-mqtt.cn-shanghai.aliyuncs.com&quot;,1883</td>
<td>//The format of domain name is: productKey.iot-as-mqtt.cn-shanghai.aliyuncs.com Note: a1kUAJknr0y is product_key</td>
</tr>
<tr>
<td>OK</td>
<td></td>
</tr>
<tr>
<td>AT+SMCONF=&quot;USERNAME&quot;,&quot;7000C&amp;a1kUAJknr0y&quot;</td>
<td>//The format of username is: deviceName&amp;productKey Note: a1kUAJknr0y is product_key 7080 is device Name</td>
</tr>
<tr>
<td>OK</td>
<td></td>
</tr>
<tr>
<td>AT+SMCONF=&quot;PASSWORD&quot;,&quot;56bf1f37de9ce2591f5699eaa1117a43dae9bd11&quot;</td>
<td>//The password is generated by SHA1 algorithm</td>
</tr>
<tr>
<td>OK</td>
<td></td>
</tr>
<tr>
<td>AT+SMCONF=&quot;CLIENTID&quot;,&quot;a1kUAJknr0y.7080</td>
<td>securemode=3,timestamp=2524608000000,signdata=hmacsha1,gw=0</td>
</tr>
<tr>
<td>OK</td>
<td></td>
</tr>
<tr>
<td>AT+SMCONN</td>
<td></td>
</tr>
<tr>
<td>OK</td>
<td>//Connect ok</td>
</tr>
</tbody>
</table>
5.3.2 MQTTS Connecting Ali Cloud Function

//Example of MQTTS Connecting Ali Cloud Function.

```plaintext
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+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","56bf1f37de9ce2591f5699eea1117a43da9bd11"
The password is generated by SHA1 algorithm

OK

AT+SMCONF="CLIENTID","a1kUAJknr0y.7080|securemode=3,timestamp=2524608000000,signaturemethod=hmacsha1,gw=0"
The format of client id is: productKey.deviceName|securemode=3,signaturemethod=hmacsha1,gw=0
a1kUAJknr0y is product_key
7080 is deviceName

OK

AT+SMSSL=2,"aliiot_ca.pem","simcom.cert.pem"
//Configure SSL connect index
```
<table>
<thead>
<tr>
<th>Command</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>AT+SMCONN</td>
<td>//Connect ok</td>
</tr>
<tr>
<td>OK</td>
<td></td>
</tr>
<tr>
<td>OK</td>
<td></td>
</tr>
</tbody>
</table>