A76XX Series_MQTT(S)_Application Note

LTE Module
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About Document

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<td>V1.00</td>
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Scope

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. This document applies to A1803S Series, A1603 Series, A1601 Series and A1802 Series.
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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


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;

Other Conventions:
MQTT (Message Queuing Telemetry Transport);
SSL (Secure Sockets Layer);
PDP (Packet Data Protocol);
1.4 The process of Using MQTT(S) AT Command
1.5 Error Handling

For more details, please refer to A76XXSeries_AT Command Manual.
2 AT Commands for MQTT(S)

2.1 Overview of AT Commands for MQTT(S)

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<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AT+CMQTTSTART</td>
<td>Start MQTT service</td>
</tr>
<tr>
<td>AT+CMQTTSTOP</td>
<td>Stop MQTT service</td>
</tr>
<tr>
<td>AT+CMQTTACCQ</td>
<td>Acquire a client</td>
</tr>
<tr>
<td>AT+CMQTTREL</td>
<td>Release a client</td>
</tr>
<tr>
<td>AT+CMQTSSLCFG</td>
<td>Set the SSL context (only for SSL/TLS MQTT)</td>
</tr>
<tr>
<td>AT+CMQTWILLTOPIC</td>
<td>Input the topic of will message</td>
</tr>
<tr>
<td>AT+CMQTWILLMSG</td>
<td>Input the will message</td>
</tr>
<tr>
<td>AT+CMQTTCONNECT</td>
<td>Connect to MQTT server</td>
</tr>
<tr>
<td>AT+CMQTDDISC</td>
<td>Disconnect from server</td>
</tr>
<tr>
<td>AT+CMQTTTOPIC</td>
<td>Input the topic of publish message</td>
</tr>
<tr>
<td>AT+CMQTPAYLOAD</td>
<td>Input the publish message</td>
</tr>
<tr>
<td>AT+CMQTPUB</td>
<td>Publish a message to server</td>
</tr>
<tr>
<td>AT+CMQTTSUBTOPIC</td>
<td>Input the topic of subscribe message</td>
</tr>
<tr>
<td>AT+CMQTTSUB</td>
<td>Subscribe a message to server</td>
</tr>
<tr>
<td>AT+CMQTUNSUBTOPIC</td>
<td>Input the topic of unsubscribe message</td>
</tr>
<tr>
<td>AT+CMQTUNSUB</td>
<td>Unsubscribe a message to server</td>
</tr>
<tr>
<td>AT+CMQTTCFG</td>
<td>Configure the MQTT Context</td>
</tr>
</tbody>
</table>

For detail information, please refer to “A76XXSeries_AT Command Manual”. 
3 MQTT(S) Examples

Before all MQTT(S) related operations, we should ensure the following:

Ensure network is available:

```at
AT+CSQ
+CSQ: 23,0
OK
AT+CREG?
+CREG: 0,1
OK
AT+CGREG?
+CGREG: 0,1
OK
AT+CPSI?
+CPSI:
LTE,Online,460-00,0x333C,39589680,308,EUT
RAN-BAND3,1350,5,0,0,54,0,22
OK
```

In WCDMA/GSW, you need to continue to execute the following instructions:

```at
AT+CGDCONT=cid,"ip","APN"
OK
AT+CGACT=1,cid
OK
AT+CGACT?
+CGACT: 1,1
OK
```

3.1 Access to MQTT server not SSL/TLS

Following commands shows how to communicate with a MQTT server.
// start MQTT service, activate PDP context

AT+CMQTTSTART
OK

+CMQTTSTART: 0
// Acquire one client which will connect to a MQTT server not SSL/TLS

AT+CMQTTPCQ=0,"client test0"
OK
// Set the will topic for the CONNECT message

AT+CMQTTWILLTOPIC=0,10
>
OK
// Set the will message for the CONNECT message

AT+CMQTTWILLMSG=0,6,1
>
OK
// Connect to a MQTT server

AT+CMQTTCONNECT=0,"tcp://test.mosquitto.org:1883",60,1
OK

+CMQTTCONNECT: 0,0
// Subscribe one topic from the server

AT+CMQTTSUB=0,9,1
>
OK

+CMQTTSUB: 0,0
// Set the topic for the PUBLISH message

AT+CMQTTTOPIC=0,9
>
OK
// Set the payload for the PUBLISH message

AT+CMQTTTPAYLOAD=0,60
>
OK
// Publish a message
AT+CMQTT PUB=0,1,60
OK

+CMQTT PUB: 0,0
// receive publish message from server
+CMQTT RX START: 0,9,60
+CMQTT RX TOPIC: 0,9
simcommsg
+CMQTT RX PAYLOAD: 0,60
012345678901234567890123456789012345678
901234567890123456789
+CMQTT RX END: 0
// Set one topic for the SUBSCRIBE message
AT+CMQTT SUB TOPIC=0,9,1
>
OK
// Subscribe a message
AT+CMQTT SUB=0
OK

+CMQTT SUB: 0,0
// Unsubscribe one topic from the server
AT+CMQTT UNSUB=0,9,0
>
OK

+CMQTT UNSUB: 0,0
// Disconnect from server
AT+CMQTT DISC=0,120
OK

+CMQTT DISC: 0,0
// Release the client
AT+CMQTT REL=0
OK
// stop MQTT Service
AT+CMQTT STOP
OK
+CMQTT STOP: 0
3.2 Connect to SSL/TLS MQTT server (not verify server)

Following commands shows how to access to a MQTT server without verifying the server. It needs to configure the authentication mode to 0, and then it will connect to the server successfully.

```plaintext
// start MQTT service, activate PDP context
AT+CMQTTSTART
OK

+CMQTTSTART: 0
// Acquire one client which will connect to a SSL/TLS MQTT server
AT+CMQTTACCQ=0,"client test0",1
OK
// Set the will topic for the CONNECT message
AT+CMQTTWILLTOPIC=0,10
>
OK
// Set the will message for the CONNECT message
AT+CMQTTWILLMSG=0,6,1
>
OK
// Connect to a MQTT server
AT+CMQTTCONNECT=0,"tcp://test.mosquitto.org:8883",60,1
OK

+CMQTTCONNECT: 0,0
// Set the topic for the PUBLISH message
AT+CMQTTTOPIC=0,13
>
OK
// Set the payload for the PUBLISH message
AT+CMQTTTPAYLOAD=0,60
>
OK
// Publish a message
AT+CMQTTTPUB=0,1,60
OK
+CMQTTTPUB: 0,0
```
// Set one topic for the SUBSCRIBE message
AT+CMQTTSUBTOPIC=0,9,1
>

OK
// Subscribe a message
AT+CMQTTSUB=0
OK

+CMQTTSUB: 0,0
// Subscribe one topic from the server
AT+CMQTTSUB=0,9,1
>

OK

+CMQTTSUB: 0,0
// Unsubscribe one topic from the server
AT+CMQTTSUNSUB=0,9,0
>

OK

+CMQTTSUNSUB: 0,0
// Disconnect from server
AT+CMQTTDISC=0,120
OK

+CMQTTDISC: 0,0
// Release the client
AT+CMQTTREL=0
OK
// stop MQTT Service
AT+CMQTTSTOP
OK

+CMQTTSTOP: 0

3.3 Access to SSL/TLS MQTT server (only verify the server)

Following commands shows how to access to a SSL/TLS MQTT server with verifying the server. It needs to configure the authentication mode to 1 and the right server root CA, and then it will connect to the server
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successfully.

```
// Set the SSL version of the first SSL context
AT+CSSLCFG="sslversion",0,4
OK
// Set the authentication mode(verify server) of the first SSL context
AT+CSSLCFG="authmode",0,1
OK
// Set the server root CA of the first SSL context
AT+CSSLCFG="cacert",0,"server_ca.pem"
OK
// start MQTT service, activate PDP context
AT+CMQTTSTART
OK
+CMQTTSTART: 0

// Acquire one client which will connect to a SSL/TLS MQTT server
AT+CMQTTACCQ=0,"client test0",1
OK
// Set the first SSL context to be used in the SSL connection
AT+CMQTTSSLCFG=0,0
OK
// Set the will topic for the CONNECT message
AT+CMQTTWILLTOPIC=0,10
>
OK
// Set the will message for the CONNECT message
AT+CMQTTWILLMSG=0,6,1
>
OK
// Connect to a MQTT server, input the right server and port
AT+CMQTTCONNECT=0,"tcp://mqtts_server:port",60,1
OK
+CMQTTCONNECT: 0,0

// Set the topic for the PUBLISH message
AT+CMQTTTOPIC=0,13
>
OK
// Set the payload for the PUBLISH message
AT+CMQTTPAYLOAD=0,60
```
OK
// Publish a message
AT+CMQTTPUB=0,1,60
OK

+CMQTTPUB: 0,0
// Set one topic for the SUBSCRIBE message
AT+CMQTTSUBTOPIC=0,9,1
>

OK
// Subscribe a message
AT+CMQTTSUB=0
OK

+CMQTTSUB: 0,0
// Subscribe one topic from the server
AT+CMQTTSUB=0,9,1
>

OK

+CMQTTSUB: 0,0
// Unsubscribe one topic from the server
AT+CMQTTUNSUB=0,9,0
>

OK

+CMQTTUNSUB: 0,0
// Disconnect from server
AT+CMQTTDISC=0,120
OK

+CMQTTDISC: 0,0
// Release the client
AT+CMQTTREL=0
OK
// stop MQTT Service
AT+CMQTTSTOP
OK

+CMQTTSTOP: 0
3.4 Access to SSL/TLS MQTT server (verify server and client)

Following commands shows how to access to a SSL/TLS MQTT server with verifying the server and client. It needs to configure the authentication mode to 2, the right server root CA, the right client certificate and key, and then it will connect to the server successfully.

```
// Set the SSL version of the first SSL context
AT+CSSLCFG="sslversion",0,4
OK

// Set the authentication mode(verify server and client) of the first SSL context
AT+CSSLCFG="authmode",0,2
OK

// Set the server root CA of the first SSL context
AT+CSSLCFG="cacert",0,"ca_cert.pem"
OK

// Set the client certificate of the first SSL context
AT+CSSLCFG="clientcert",0,"cert.pem"
OK

// Set the client key of the first SSL context
AT+CSSLCFG="clientkey",0,"key_cert.pem"
OK

// start MQTT service, activate PDP context
AT+CMQTSTART
OK

+CMQTSTART: 0

// Acquire one client which will connect to a SSL/TLS MQTT server
AT+CMQTTACCQ=0,"client_test0",1
OK

// Set the first SSL context to be used in the SSL connection
AT+CMQTTSSELCFG=0,0
OK

// Set the will topic for the CONNECT message
AT+CMQTTWILLTOPIC=0,10
>

OK

// Set the will message for the CONNECT message
AT+CMQTTWILLMSG=0,6,1
>

OK
```
// Connect to a MQTT server
AT+CMQTTCONNECT=0,"tcp://hooleeping.com:8883",60,1
OK

+CMQTTCONNECT: 0,0
// Set the topic for the PUBLISH message
AT+CMQTTTOPIC=0,13
>
OK
// Set the payload for the PUBLISH message
AT+CMQTTPAYLOAD=0,60
>
OK
// Publish a message
AT+CMQTTPUB=0,1,60
OK

+CMQTTPUB: 0,0
// Set one topic for the SUBSCRIBE message
AT+CMQTTSUBTOPIC=0,9,1
>
OK
// Subscribe a message
AT+CMQTTSUB=0
OK

+CMQTTSUB: 0,0
// Subscribe one topic from the server
AT+CMQTTSUB=0,9,1
>
OK

+CMQTTSUB: 0,0
// Unsubscribe one topic from the server
AT+CMQTTUNSUB=0,9,0
>
OK

+CMQTTUNSUB: 0,0
// Disconnect from server
3.5 Access to MQTT server without checking UTF8 coding

Following commands shows how to communicate with a MQTT server without checking UTF8 coding.

// start MQTT service, activate PDP context

AT+CMQTTSTART
OK

+CMQTTSTART: 0
// Acquire one client which will connect to a MQTT server not SSL/TLS

AT+CMQTTACCQ=0,"client test0"
OK

// Configure not checking UTF8 coding

AT+CMQTTCFG="checkUTF8",0,0
OK
// Connect to a MQTT server

AT+CMQTTCONNECT=0,"tcp://198.41.30.241:1883",60,1
OK

+CMQTTCONNECT: 0,0
// Subscribe one topic which is not UTF8 coding string.
// The data can input by hexadecimal format.

AT+CMQTTSUB=0,9,1>

OK
+CMQTT SUB: 0, 0
// Set the topic for the PUBLISH message
AT+CMQTT TOPIC=0, 9
>
OK
// Publish a message
AT+CMQTT PUB=0, 1, 60
OK
+CMQTT PUB: 0, 0
// receive publish message from server
+CMQTT RX START: 0, 9, 0
+CMQTT RX TOPIC: 0, 9

+CMQTT RX END: 0
// Disconnect from server
AT+CMQTT DISC=0, 120
OK
+CMQTT DISC: 0, 0
// Release the client
AT+CMQTT REL=0
OK
// stop MQTT Service
AT+CMQTT STOP
OK
+CMQTT STOP: 0
# Appendix

## 4.1 Summary of Error Codes

<table>
<thead>
<tr>
<th>Code of &lt;err&gt;</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>operation succeeded</td>
</tr>
<tr>
<td>1</td>
<td>failed</td>
</tr>
<tr>
<td>2</td>
<td>bad UTF-8 string</td>
</tr>
<tr>
<td>3</td>
<td>sock connect fail</td>
</tr>
<tr>
<td>4</td>
<td>sock create fail</td>
</tr>
<tr>
<td>5</td>
<td>sock close fail</td>
</tr>
<tr>
<td>6</td>
<td>message receive fail</td>
</tr>
<tr>
<td>7</td>
<td>network open fail</td>
</tr>
<tr>
<td>8</td>
<td>network close fail</td>
</tr>
<tr>
<td>9</td>
<td>network not opened</td>
</tr>
<tr>
<td>10</td>
<td>client index error</td>
</tr>
<tr>
<td>11</td>
<td>no connection</td>
</tr>
<tr>
<td>12</td>
<td>invalid parameter</td>
</tr>
<tr>
<td>13</td>
<td>not supported operation</td>
</tr>
<tr>
<td>14</td>
<td>client is busy</td>
</tr>
<tr>
<td>15</td>
<td>require connection fail</td>
</tr>
<tr>
<td>16</td>
<td>sock sending fail</td>
</tr>
<tr>
<td>17</td>
<td>timeout</td>
</tr>
<tr>
<td>18</td>
<td>topic is empty</td>
</tr>
<tr>
<td>19</td>
<td>client is used</td>
</tr>
<tr>
<td>20</td>
<td>client not acquired</td>
</tr>
<tr>
<td>21</td>
<td>client not released</td>
</tr>
<tr>
<td>22</td>
<td>length out of range</td>
</tr>
<tr>
<td>23</td>
<td>network is opened</td>
</tr>
<tr>
<td>24</td>
<td>packet fail</td>
</tr>
<tr>
<td>25</td>
<td>DNS error</td>
</tr>
<tr>
<td>26</td>
<td>socket is closed by server</td>
</tr>
<tr>
<td>27</td>
<td>connection refused: unaccepted protocol version</td>
</tr>
<tr>
<td>28</td>
<td>connection refused: identifier rejected</td>
</tr>
<tr>
<td>No</td>
<td>Error Description</td>
</tr>
<tr>
<td>----</td>
<td>--------------------------------------------------------</td>
</tr>
<tr>
<td>29</td>
<td>connection refused: server unavailable</td>
</tr>
<tr>
<td>30</td>
<td>connection refused: bad user name or password</td>
</tr>
<tr>
<td>31</td>
<td>connection refused: not authorized</td>
</tr>
<tr>
<td>32</td>
<td>handshake fail</td>
</tr>
<tr>
<td>33</td>
<td>not set certificate</td>
</tr>
<tr>
<td>34</td>
<td>Open session failed</td>
</tr>
<tr>
<td>35</td>
<td>Disconnect from server failed</td>
</tr>
</tbody>
</table>