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Standard Modules

MQTT Application Guide

Issue 1.2 Date 2021-02-25

Notice

This document provides guide for users to use Standard Modules.

This document is intended for system engineers (SEs), development engineers, and test engineers.

THIS GUIDE PROVIDES INSTRUCTIONS FOR CUSTOMERS TO DESIGN THEIR APPLICATIONS. PLEASE FOLLOW THE RULES AND PARAMETERS IN THIS GUIDE TO DESIGN AND COMMISSION. NEOWAY WILL NOT TAKE ANY RESPONSIBILITY OF BODILY HURT OR ASSET LOSS CAUSED BY IMPROPER OPERATIONS.

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Contents

About This Document

Scope

This document is applicable to the Standard Modules.

Audience

This document is intended for system engineers (SEs), development engineers, and test engineers.

Change History

Issue	Date	Change	Changed By
1.0	2018-12	Initial draft	Chen Canxin
1.1	2020-03	• Added Appendix A Troubleshooting Exceptions of the Module Initialization Process. • Added the Alibaba Process. • Added the standard MQTT commands.	Wang Lei
1.2	2020-09	• Optimized the application flowcharts. • Added the description of timeout settings on publishing messages.	Wang Lei

Conventions

Symbol	Indication
	Indicates danger or warning. This information must be followed. Otherwise, a catastrophic module or user device failure or bodily injury may occur.
	Indicates caution. This symbol alerts the user to important points about using the module. If these points are not followed, the module or user device may fail.
	Indicates instructions or tips. This symbol provides advices or suggestions that may be useful when using the module.

Related Documents

Neoway_Standard Modules_TCP_Application_Guide

Neoway_Standard Modules_FTP_Application_Guide

Neoway_Standard Modules_MQTT_Application_Guide

Neoway_Standard Modules_Power-on_off_Application_Guide

1 Overview

Message Queuing Telemetry Transport (MQTT) is a "lightweight" communication protocol based on the publish/subscribe model. The protocol is built on the TCP/IP protocol. The biggest advantage of MQTT is that it can provide the real-time and reliable message service for connecting remote devices with very few codes and limited bandwidth. As a low-overhead and low-bandwidth instant messaging protocol, MQTT is widely applied in the Internet of Things (IoT), compact devices, and mobile applications.

Multiple Neoway modules support MQTT.

This document describes the AT process where the MQTT function is used, and provides the corresponding command examples.

2 Initialization

Ensure that the module is initialized before setting up an FTP connection.

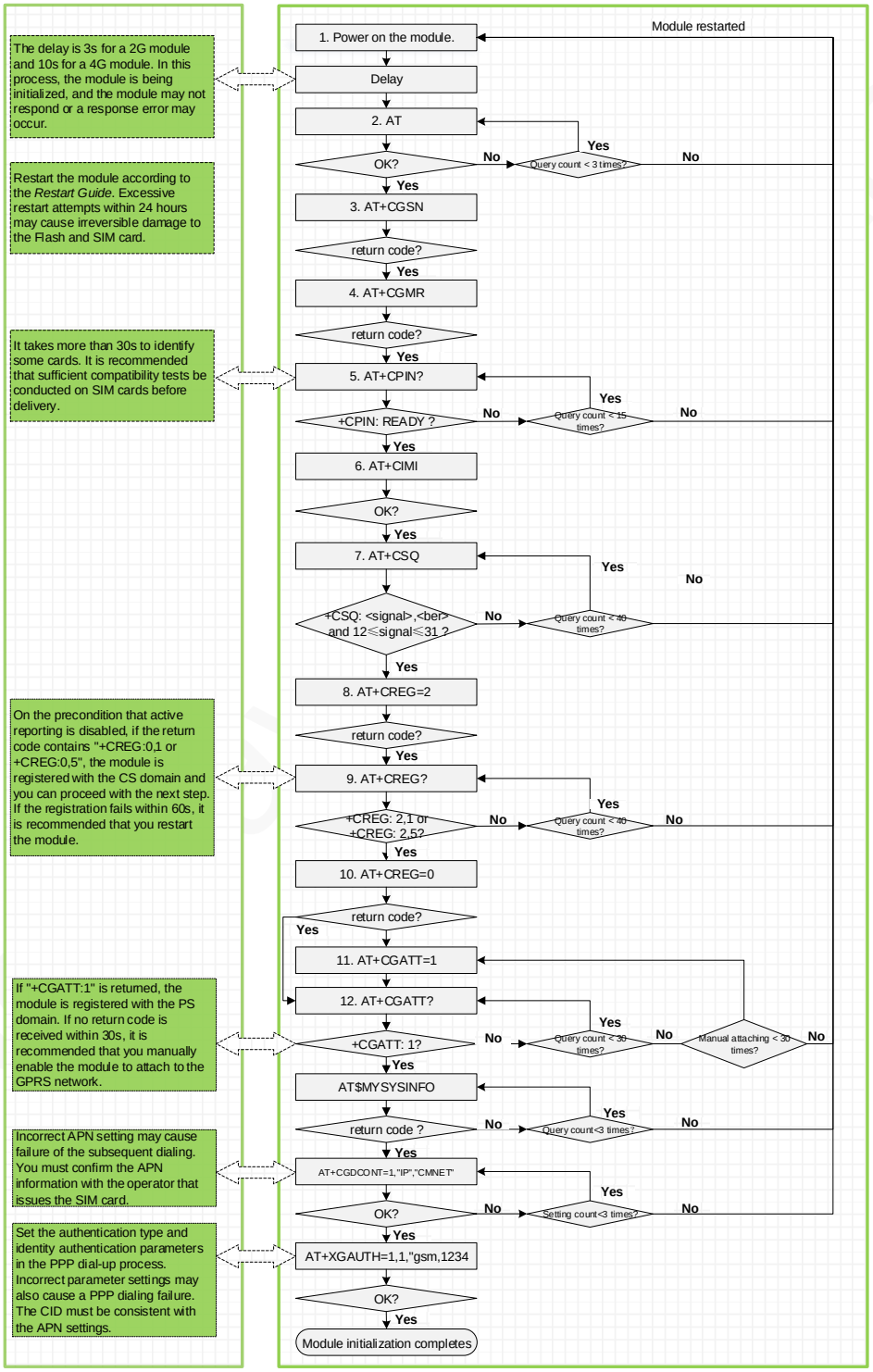


Figure 2-1 PPP dialing process

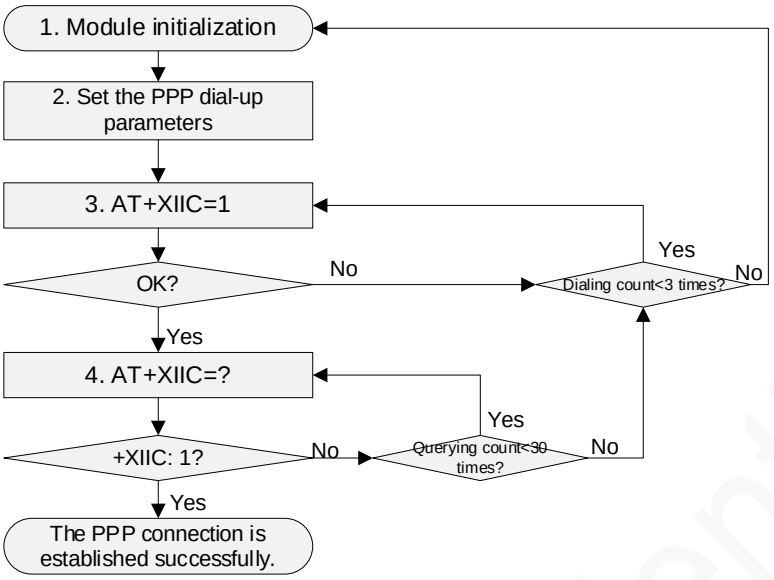
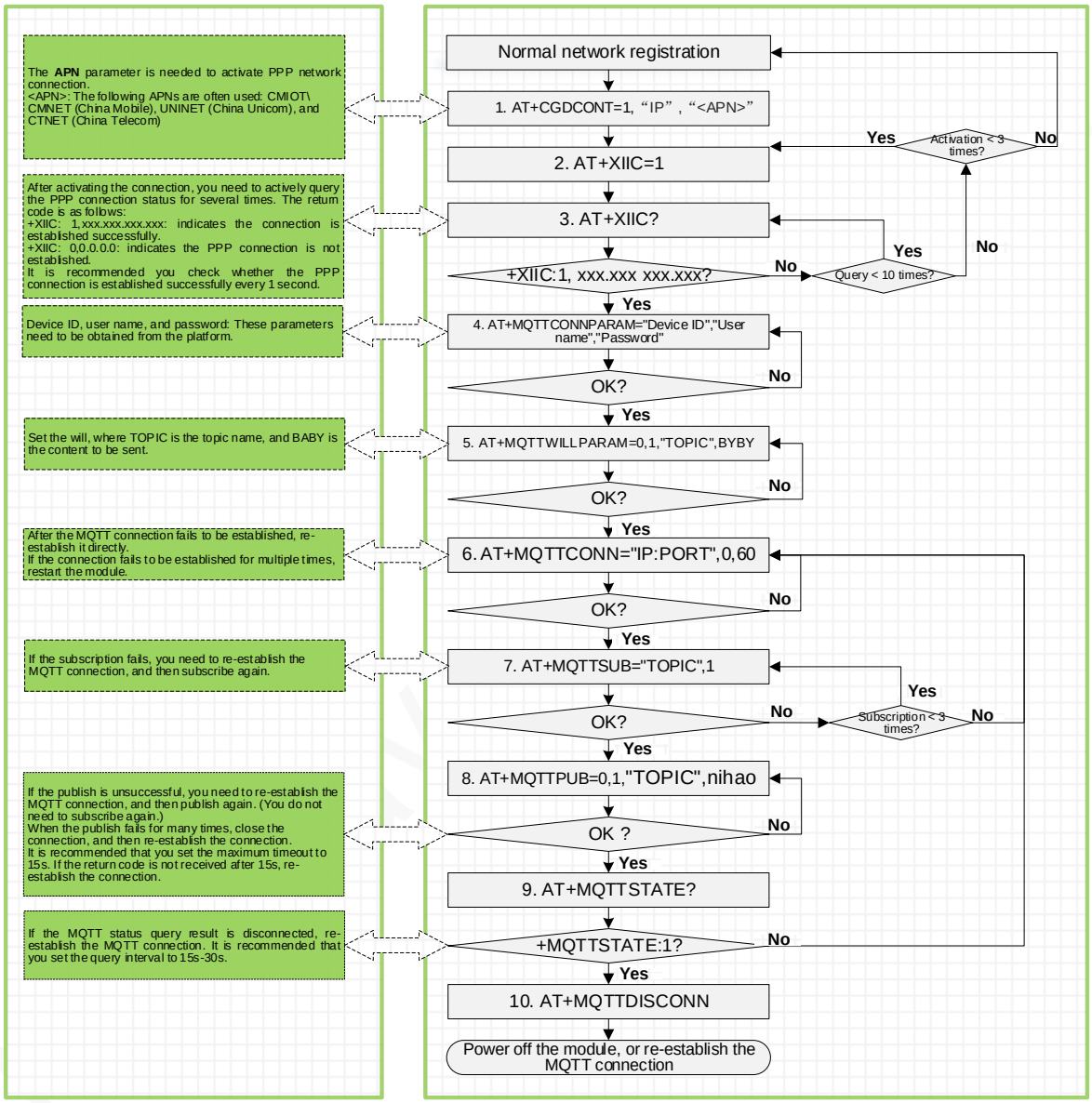


Table 2-1 Description of related commands

Command	Description
AT+CCID	Query whether the SIM card is detected.
AT+CPIN	Check the SIM card status.
AT+CSQ	Check the signal strength.
AT+CREG?	Query the network registration.
AT+CGATT?	Query the network attachment situation.
AT+XIIC=1	Establish a PPP connection.
AT+XIIC=?	Query whether the PPP connection has been established successfully.

3 Standard MQTT Process

Figure 3-1 Standard MQTT flowchart



Command description:

(Module initialization finishes)

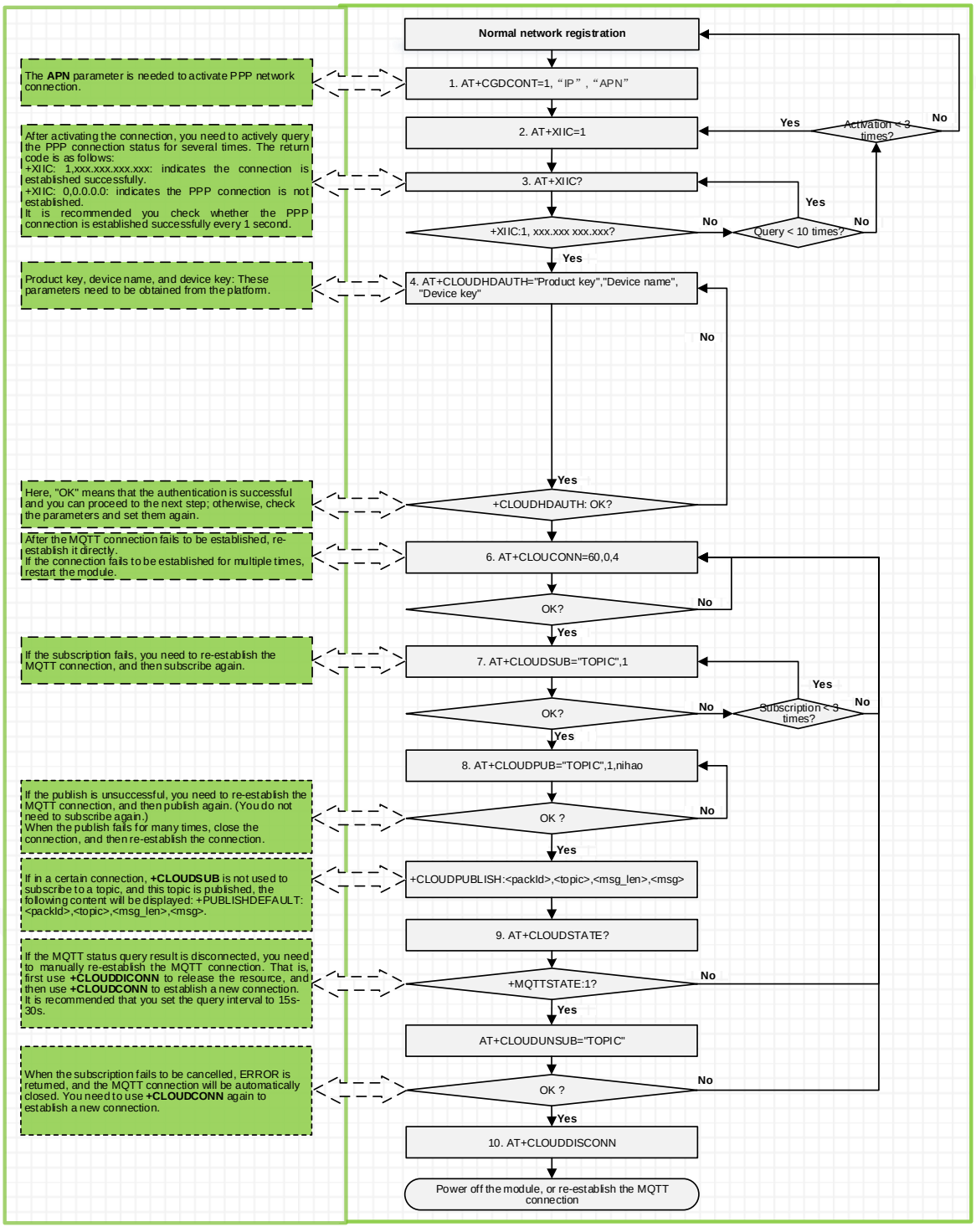
```
AT+CGDCONT=1,"IP","APN"                    // Set the network initialization parameters.
AT+XIIC=1                                 // Activate the network connection.
AT+MQTTCONNPARAM="device ID",”user name","Password"     //Set the MQTT connection parameters.
AT+MQTTWILLPARAM=0,1,"TOPIC",BYBY          //Set will parameters.
AT+MQTTCONN="IP:PORT",0,60                  //Connect to the server.
AT+MQTTSUB="TOPIC",1                       //Subscribe to the topic.
AT+MQTTPUB=0,1,"TOPIC",nihao                 //Publish the topic.
AT+MQTTSTATE?                              //Query the status of the MQTT connection.
AT+MQTTDISCONN                             //Disconnect to the server.
```

Standard MQTT process:

```
AT                   //After the module starts, send “AT” to the module.
OK

AT+CPIN?
+CPIN: READY               //The module can identify the SIM card.
OK

AT+CSQ
+CSQ: 31, 99             //The signal strength is good.
OK

AT+CREG?
+CEREG: 0,1                //The module is successfully registered with the network.
OK

AT+CGATT?
+CGATT: 1                   //The module is successfully attached to the data service.
OK

AT+XIIC=1                                  //Activate the network connection.
OK

AT+XIIC?
+XIIC:    1,100.79.207.128              //Obtain the IP address.
OK

AT+MQTTCONNPARAM="owen","admin","public"   //Set the user parameters.
OK

AT+MQTTWILLPARAM=0,1,"lixytopic","byby"    //Set the will message according actual requirements.
OK

AT+MQTTCONN="121.43.166.63:1883",0,60     //Set up an MQTT connection.
OK

AT+MQTTSUB="lixytopic",1             //Subscribe to a topic. It is recommended to set QoS to 1.
OK

AT+MQTTPUB=0,1,"lixytopic","this is for testing!"   //Publish a message.
OK

+MQTTSUB:4,"lixytopic",20,this is for testing!    //Receive a message from lixytopic.

AT+MQTTSTATE?                        //Query the socket status.

+MQTTSTATE:1
OK

AT+MQTTDISCONN                      //Disconnect to the server.
OK
```


4 Alibaba MQTT Process

Figure 4-1 Alibaba MQTT flowchart



Command description:

(Module initialization finishes)

```
AT+CGDCONT=1,"IP","APN"                    // Set the network initialization parameters.
AT+XIIC=1                                  //Activate the network connection.
AT+CLOUDHDAUTH=”product key",”device name",”device key"     //Set the device authentication
information.
AT+CLOUDCONN=60,0,4                        //Set the MQTT connection parameters.
AT+CLOUDSUB="TOPIC",1                      //Subscribe to a topic.
AT+CLOUDPUB="TOPIC",1,nihao                //Publish a topic.
+CLOUDPUBLISH:<packId>,<topic>,<msg_len>,<msg>       //Receive the publish message.
AT+CLOUDSTATE?                            //Query the MQTT connection state.
AT+CLOUDUNSUB="TOPIC"    //Cancel the subscription.
AT+ CLOUDDISCONN                          //Disconnect to the server.
```

Alibaba MQTT process:

```
AT                        //After the module starts, send “AT” to the module.
OK

AT+CPIN?
+CPIN: READY               //The module can identify the SIM card.
OK

AT+CSQ
+CSQ: 31, 99              //The signal strength is good.
OK

AT+CREG?
+CEREG: 0,1                //The module is successfully registered with the network.
OK

AT+CGATT?
+CGATT: 1                  //The module is successfully attach to the data service.
OK

AT+XIIC=1                                  // Activate the network connection.
OK

AT+XIIC?
+XIIC:   1,10.157.164.183          //Obtain the IP address.
OK

AT+CLOUDHDAUTH=a1J5shuYgXN,J1L5D2itSsqNLMZ9wTyx,vdkeNCKWirhZsU9pKeyAUvvCnLOgpNzI
OK
+CLOUDHDAUTH: OK                       //Set the device authentication information.

AT+CLOUDCONN=60,0,4
OK                                 //Configure the MQTT connection parameters.

AT+CLOUDSUB=/a1J5shuYgXN/J1L5D2itSsqNLMZ9wTyx/user/get,1
OK
+CLOUDSUBACK: <OK>                     //Subscribe to a topic. It is recommended to set QoS.

AT+CLOUDPUB=/sys/a1J5shuYgXN/J1L5D2itSsqNLMZ9wTyx/thing/event/property/post,1,1234567890
OK
+CLOUDPUBACK: <OK>                         //Publish a message.
```


5 MQTT Commands

5.1 AT+MQTTCONNPARAM – Setting the User Parameter

To set the ID, user name, password parameters.

The user name and password can be null.

Format

Type	Command	Response
Set	AT+MQTTCONNPARAM=<”clientdID”>,<”username”>,<”password”><CR>	<CR><LF>OK<CR><LF> Or <CR><LF>ERROR<CR><LF>
Query	AT+MQTTCONNPARAM?<CR>	<CR><LF>+MQTTCONNPARAM:<"clientID">,<"username">,<"password"> <CR><LF>OK<CR><LF>
Test	AT+MQTTCONNPARAM=?<CR>	<CR><LF>+MQTTCONNPARAM: <cliendid>,<username>,<password> <CR><LF>OK<CR><LF>

Timeout

The command times out if the module does not respond in 300 ms.

Parameter

<clientID>	Client ID, 256 bytes at most.
<username>	User name, 512 bytes at most.
<password>	Password, 256 bytes at most.

Example

```
AT+MQTTCONNPARAM="C_201801021127","lixytest/thing01","0   Parameters are set successfully.
lSoY/eYnlSqUeAsbAKKQ/ACmipZwEw9H7Ff0h1kOps="
OK
```

5.2 AT+MQTTWILLPARAM – Setting Will

To set will parameters.

These parameters cannot be set when the MQTT connection is established. The parameters set by this command is not saved, you need to reset them after the module is powered off.

Format

Type	Command	Response
Set	AT+MQTTWILLPARAM=<retained>,<qos>,<”topicname”>,<”message”><CR>	<CR><LF>+GNSSSTATE: <status><CR><LF> Or <CR><LF>OK<CR><LF>
Query	AT+MQTTWILLPARAM?<CR>	<CR><LF>+MQTTWILLPARAM:<retained>,<qos>,<"topicname">,<"message"> <CR><LF>OK<CR><LF>
Test	AT+MQTTWILLPARAM=?<CR>	<CR><LF>+MQTTWILLPARAM: <retained>,<qos>,<topicname>,<message> <CR><LF>OK<CR><LF>

Timeout

The command times out if the module does not respond in 300 ms.

Parameter

<retained>	Retain mark, digit type.
<qos>	quality of service, 0 to 1.
<”topicname”>	Will topic name, 128 at most.
<”message”>	Will Message, 1024 at most.

Example

```
AT+MQTTWILLPARAM=0,1,"neoway02",”byby”          The will is set successfully.
OK
```

5.3 AT+MQTTCONN – Setting up a Connection

To connect to the MQTT server.

Wait for the return value when the module is connecting to the server. You cannot perform the connection operation again until receiving a return value.

When the connection is established successfully if you do not send the connection close command the module reports **+MQTTDISCONNED: Link Closed**, set up the connection manually.

Format

Type	Command	Response
Execute	AT+MQTTCONN=<"host">,<clean>,<keep_alive><CR>	<CR><LF>OK<CR><LF> Or <CR><LF>ERROR<CR><LF>
Query	**AT+MQTTCONN?<CR>**	<CR><LF>+MQTTCONN:<"ip:port">,<clean>,<keep_alive> <CR><LF>OK<CR><LF>
Test	AT+MQTTCONN=?<CR>	<CR><LF>OK<CR><LF>

Timeout

The command times out if the module does not respond in 60s.

Parameter

<"host">	Server address (url:port)
<clean>	Whether to clean session, digit type. 0: Not clean (default) 1: Clean
<keep_alive>	timeout period, ranging from 20 to 180, unit: ms

Example

```
AT+MQTTCONN="121.43.166.63:1883",0,60                    The connection is set up successfully.
OK
```

5.4 AT+MQTTSUB –Subscribing to a Topic

To subscribe to a topic.

When you fail to cancel the subscription, query the network status. When the network is poor, the return

value is slow.

The query command is valid only when the connection is set up. You can only query the latest subscribed QoS and topic.

Format

Type	Command	Response
Execute	AT+MQTTSUB=<"topicname">,<qos> <CR>	<CR><LF>OK<CR><LF> Or <CR><LF>ERROR<CR><LF>
Query	AT+MQTTSUB?<CR>	<CR><LF>+MQTTSUB:<"topicname">,<qos> <CR><LF>OK<CR><LF>
Test	AT+MQTTSUB=?<CR>	<CR><LF>OK<CR><LF>

Timeout

The command times out if the module does not respond in 30s.

Parameter

<"topicname">	Topic name, 128 at most.
<qos>	Quality of service, 0,1 to 2

Example

```
AT+MQTTSUB="neoway02",1
OK                                          Subscribe to the topic successfully. The server
                                            issues the topic retained last time.

+MQTTSUB:9,"neoway02",11,neoway mqtt
AT+MQTTSUB= neoway02,1
OK                                          Subscribed to the topic successfully.
```

5.5 AT+MQTTUNSUB – Canceling a Subscription

To cancel a subscription to the specified topic.

When you fail to cancel the subscription, query the network status. When the network is poor, the return value is slow.

Format

Type	Command	Response
Execute	AT+MQTTUNSUB=<"topicname"><CR>	<CR><LF>OK<CR><LF> Or <CR><LF>ERROR<CR><LF>

Timeout

The command times out if the module does not respond in 30s.

Parameter

<"topicname"> Name of the topic to be unsubscribed to, 128 at most.

Example

```
AT+MQTTUNSUB="neoway02"                                    Cancel a subscription.
OK
```

5.6 AT+MQTTPUB – Publishing a Topic

To publish a topic with long messages.

When the network is poor, the return value is slow.

Format

Type	Command	Response
Execute	AT+MQTTPUB=<retained>,<qos>,<"topicname">,<"message"><CR>	<CR><LF>OK<CR><LF> Or <CR><LF>ERROR<CR><LF>

Timeout

The command times out if the module does not respond in 30s.

Parameter

<retained>	Retain mark, digit type, 0 and 1.
<qos>	quality of service, 0, 1, 2.
<"topicname">	Name of the topic that is published, 128 at most.
<"message">	Message that is published, 1024 at most.

Example

```
AT+MQTTPUB=1,1,"neoway02",”neoway mqtt”                    The topic is published successfully.
OK
AT+MQTTPUB=1,1,"neoway02",”neoway mqtt”
OK                                                         The topic is published successfully. The server
                                                           issues the topic.
+MQTTSUB:5,"neoway02",11, neowaymqtt
```

5.7 AT+MQTTPUBS – Publishing a Topic with a Long Message

To publish a topic with a long message.

Format

Type	Command	Response
Execute	AT+MQTTPUBS=<retained>,<qos>,<”topic”>,<msg_length><CR>	<CR><LF>> <CR><LF>OK<CR><LF> Or <CR><LF>> <CR><LF>+MQTTPUBS: Timeout!<CR><LF> Or <CR><LF>ERROR<CR><LF>

Timeout

The command times out if the topic is not written within 30s.

Parameter

<retained>	Retain mark, digit type, 0 and 1.
<qos>	QoS of the published message.

<"topic">	Topic that is published.
<msg_length>	Length of the message body, 10240 bytes at most. Enter the message content of the length specified by after >.

Example

```
AT+MQTTPUBS=1,1,"lixytopic",10                    The message is published successfully.
>
OK
AT+MQTTPUBS=0,1,"lixytopic",12                    Failed to publish the message, the
>                                                 writing operation times out.
+MQTTPUBS: Timeout!
```

5.8 AT+MQTTDISCONN – Disconnecting to the MQTT Server

To close the MQTT connection.

The device disconnects to the MQTT server proactively and releases the MQTT resources. Then the MQTT resources are released. If you need to publish messages, reset the MQTT connection parameters and set up the connection again.

Format

Type	Command	Response
Execute	AT+MQTTDISCONN<CR>	<CR><LF>OK<CR><LF>

Timeout

The command times out if the module does not respond in 30s.

Parameter

N/A.

Example

```
AT+MQTTDISCONN
OK                                          To close the MQTT connection.
```


5.9 AT+MQTTSTATE – Query the MQTT Connection Status

To query the MQTT connection status.

The setting by this command is not saved after the module is powered off.

Every time you set up an MQTT connection, enable the unsolicited report of MQTT connection status.

Format

Type	Command	Response
Query	AT+MQTTSTATE?<CR>	<CR><LF>+MQTTSTATE: <state><CR><LF> <CR><LF>OK<CR><LF>

Timeout

The command times out if the module does not respond in 300 ms.

Parameter

<state>	Reconnection status 0: the connection has been closed 1: the connection is established.

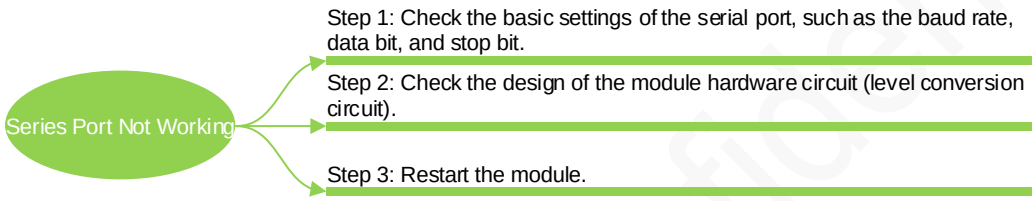
Example

```
AT+MQTTSTATE?                          Query the MQTT connection state.
+MQTTSTATE: 1                          1 indicates the MQTT connection is established successfully.
OK
AT+MQTTSTATE?                          Query the MQTT connection state.
+MQTTSTATE: 0                          0 indicates the MQTT connection is closed.
OK
```

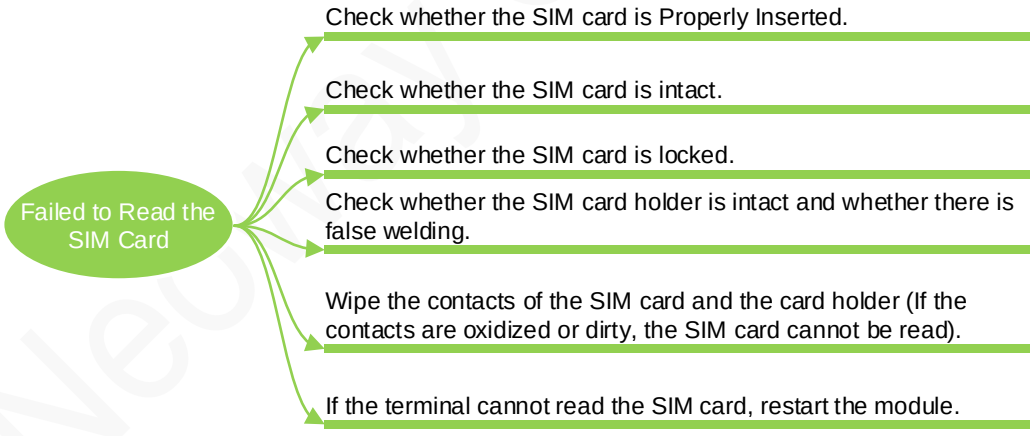

A Troubleshooting Exceptions of the Module Initialization Process

A.1 Series Port Not Working

If the serial port does not work after the AT command is sent for 15 times, troubleshoot the fault as follows:

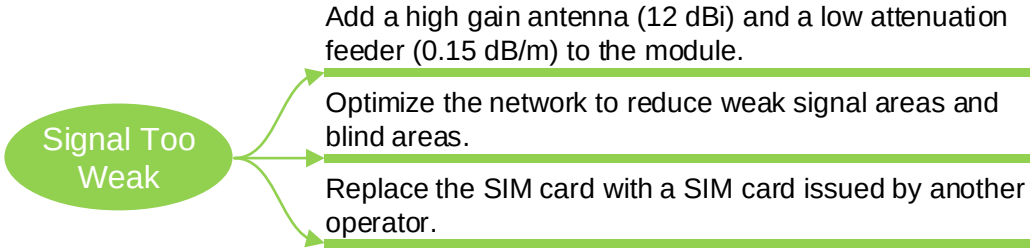


A.2 Failed to Read the SIM Card

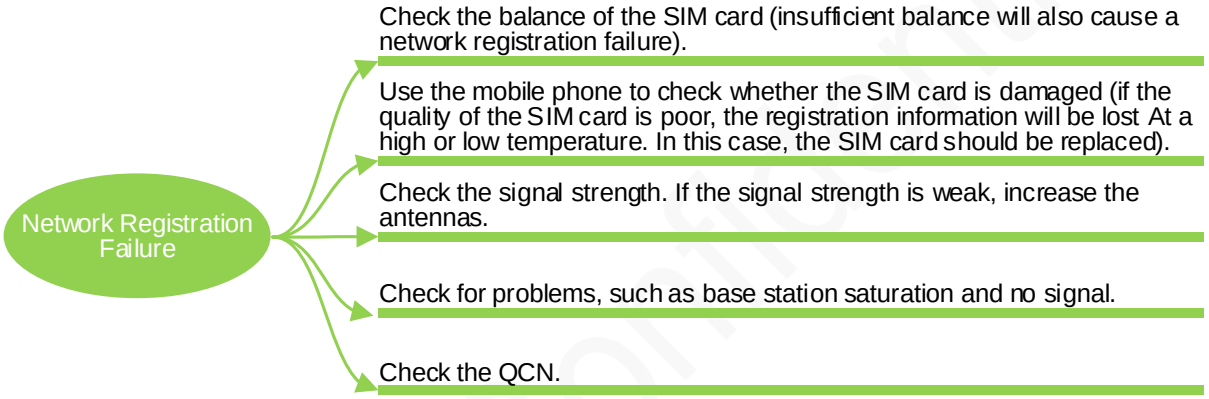


A.3 Signal Too Weak

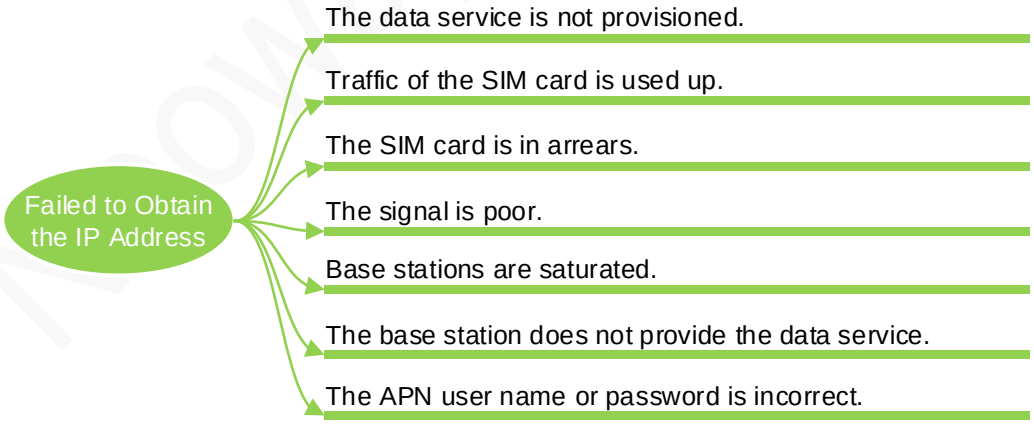
Input signal strength of the module (I) = Wireless signal field strength (R) + Antenna gain (G) - Feeder attenuation (D) When the signal strength of the module is 0, troubleshoot the fault as follows:



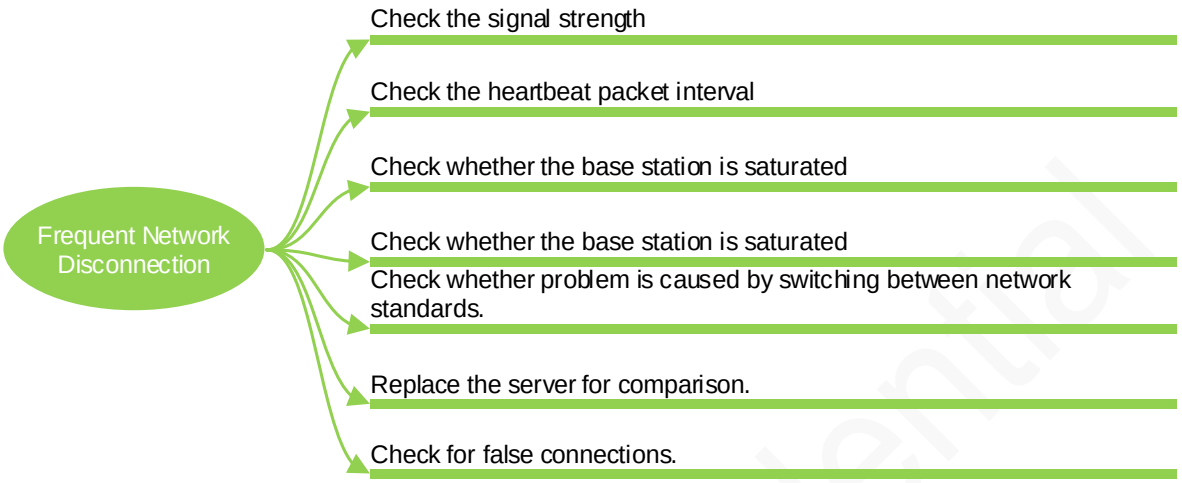
A.4 Network Registration Failure



A.5 Failed to Obtain the IP Address



A.6 Frequent Network Disconnection



B Troubleshooting MQTT Connection Exceptions

B.1 MQTT Connection

Run **AT+MQTTSTATE?** (standard) or **AT+CLOUDSTATE?** (Alibaba) to query the MQTT connection status. If "1" is returned, the MQTT connection is established. If "0" is returned, the MQTT connection is closed.

```
AT+CLOUDSTATE?
+CLOUDSTATE: 1
OK
```

When the PUB and SUB messages fail and "+CMD ERROR: <Code> is returned, the MQTT connection is automatically closed. In this case, **+CLOUDCONN** must be used again to establish a new connection.

B.2 Command Timeout

When you manually specify the byte length parameter for **AT+MQTTWILLMSG** or **AT+MQTTPUBS**, and the ">" sign is detected, the input needs to be completed within a fixed time (30s); otherwise a timeout message is displayed.

```
[2020-02-26 17:28:21]AT
+CLOUDPUBMSG=/sys/a1J5shuYgXN/J1L5D2itSsqNLMZ9wTyx/thing/event/pro
perty/post,1,10
[2020-02-26 17:28:21]>
[2020-02-26 17:28:51]
[2020-02-26 17:28:51]+CLOUDPUBMSG: Timeout!
```

B.3 Receiving ERROR:

When the return code ERROR is received after the command is input, check whether the command format is correct, check whether the MQTT connection is normal (**AT+MQTTSTATE?**), and finally check whether the network connection is normal (**AT+XIIC?**).

B.4 MQTT Authentication Failure

Check whether the authentication parameters are correct. Then, check whether the PDP connection is normal (whether the IP address exists). Meanwhile, you can replace the SIM card for testing (restart and reconnect the module after multiple authentication failures). If encryption is needed, you need to load the corresponding certificate.

If encryption is needed, you need to load and configure the corresponding certificate as follows:

```
AT+XIIC?
+XIIC:    1,10.84.227.62                //Obtain the IP address.
OK
AT+CERTADD=rootca.pem,1758
CONNECT

+CERTADD: 1758,OK                        //import the CA certificate.

AT+CERTADD=certificate.pem.crt,1220
CONNECT

+CERTADD: 1220,OK                        //Import the client certificate.

AT+CERTADD=private.pem.key,1675
CONNECT

+CERTADD: 1675,OK                        //Import the client key.

AT+AWSTLSCFG=authmode,1          //Security authentication mode, 1: Authorization Required, 0:
optional
OK

AT+AWSTLSCFG=rootca,rootca.pem                       //Deploy the CA certificate.
OK

AT+AWSTLSCFG=clientcert,certificate.pem.crt          //Configure the client certificate.
OK

AT+AWSTLSCFG=clientkey,private.pem.key               //Configure the client key.
OK

AT+AWSAUTHPARAM=nwy_test                             //Set the user parameters.

AT+AWSCONNPARAM=a1epg1vh6w7hlk.iot.us-east-2.amazonaws.com:443,1
OK                                                    //Set the AWS connection parameters.

AT+AWSCONN=60,1,4
OK
```

B.5 MQTT Subscription Failure

Check whether you have the permission to subscribe to the topic, and whether the MQTT connection is in normal state. If multiple subscription failures occur, re-establish the MQTT connection ("+CMD ERROR: <code>" will be returned upon a subscription failure). You can view different failure cause values based on the command set.

B.6 MQTT Publish Failure

If using **AT+MQTTPUB** (standard) or **AT+CLOUDPUB** (Alibaba) to publish a short message, you need to pay attention to the JSON format and special characters that need to be escaped. If you use a long message publish command, check whether the message length is consistent with the **< msg_length>** parameter in the command.

B.7 Failed to Receive Subscribed Messages

Check the connection status first. Then check whether the topic is subscribed successfully and whether

the **clean session** parameter of **AT+MQTTCONN** is set to **1**. If **clean session** is set to **0**, the session will be cleared due to abnormal disconnection. As a result, the subscribed topic will be lost, and messages cannot be received.

B.8 Disconnection

Check whether the connection is closed at the application layer or the IP layer. Then, check whether the auto reconnection mechanism is available (check whether the subscribed topic is lost when the connection is re-established).

