



HUAWEI MU709 Series HSPA+ Module
V100R002

Application Guide

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MU709s-2 (11.652.60.00.00 version or later)
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1 Overview

This document is intended to provide references for customers to choose appropriate command sequences to start using the MU709 series module (MU709 for short) in a faster manner. This document also contains examples and relevant description.

The MU709 is an industrial module that is designed for automobiles.

Table 1-1 MU709 series module

Product	Bands
MU709s-2	UMTS: WCDMA 900 MHz/2100 MHz GSM: GSM 850 MHz/900 MHz, DCS 1800 MHz, and PCS 1900 MHz
MU709s-6	UMTS: WCDMA 850 MHz/1900 MHz/2100 MHz GSM: GSM 850 MHz/900 MHz, DCS 1800 MHz, and PCS 1900 MHz

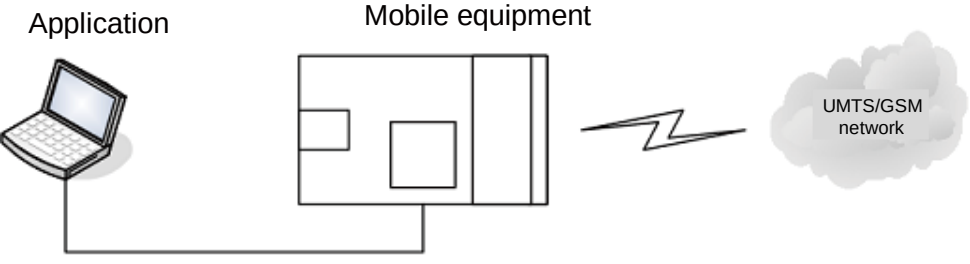
This document will be updated based on customers' requirements.

1.1 Conventions and Definitions

1.1.1 Conventions

Convention	Description
<...>	Value range of AT command parameters
xxxx	Personal Identification Number (PIN), Personal Unlock Key (PUK), or password

1.1.2 Definitions

Term	Definition
Connected	Indicates that a link has been set up between two modules or a module and a terminal.
Registered	Indicates that the module is registered with a UMTS/GSM network.
Module	HUAWEI UMTS/GSM/GPRS module
	

1.2 Basic AT Command Processing Principles

1.2.1 Ports

The MU709 provides four ports to interact with its host:

- MODEM port: simulated using USB, for AT command interaction and establishing data connection.
Port name: HUAWEI Mobile Connect-3G Modem
- PCUI port: simulated using USB, for AT command interaction only.
Port name: HUAWEI Mobile Connect-3G PCUI Interface
- UART port: physical serial port, for AT command interaction and establishing data connection.
- ECM port: simulated using USB, for establishing communication connection.
Port name: CDC Ethernet Control Model (ECM)

The MU709 also provides a port for debugging:

- DIAG port: simulated using USB, for DIAG (diagnostic) command interaction (mainly used to debug modules at present).
Port name: HUAWEI Mobile Connect-3G Application Interface.

A host controls a module using AT commands. If AT commands are unavailable, a module can be deemed as unavailable.

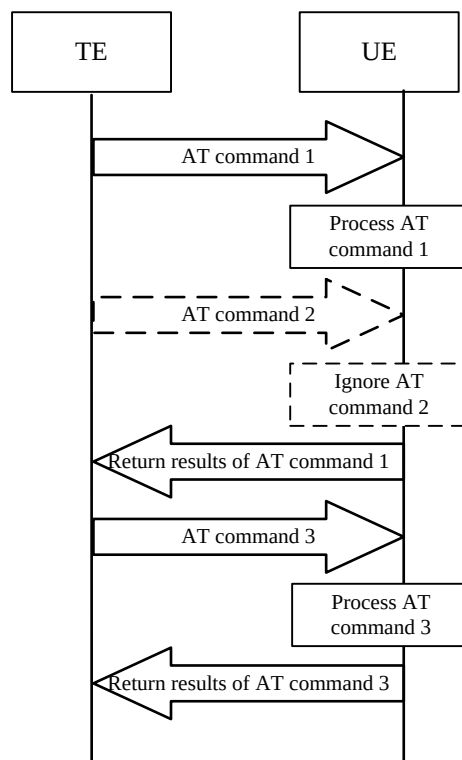
1.2.2 AT Command Processing Mechanism

A module processes AT commands from the ports (MODEM, PCUI, ECM and UART) in series. An AT command can be processed when and only when the previous AT command processing has been completed. If the module is processing an AT command, a new AT command from the same port will be buffered and other commands from other ports will be buffered until the current AT command is processed.

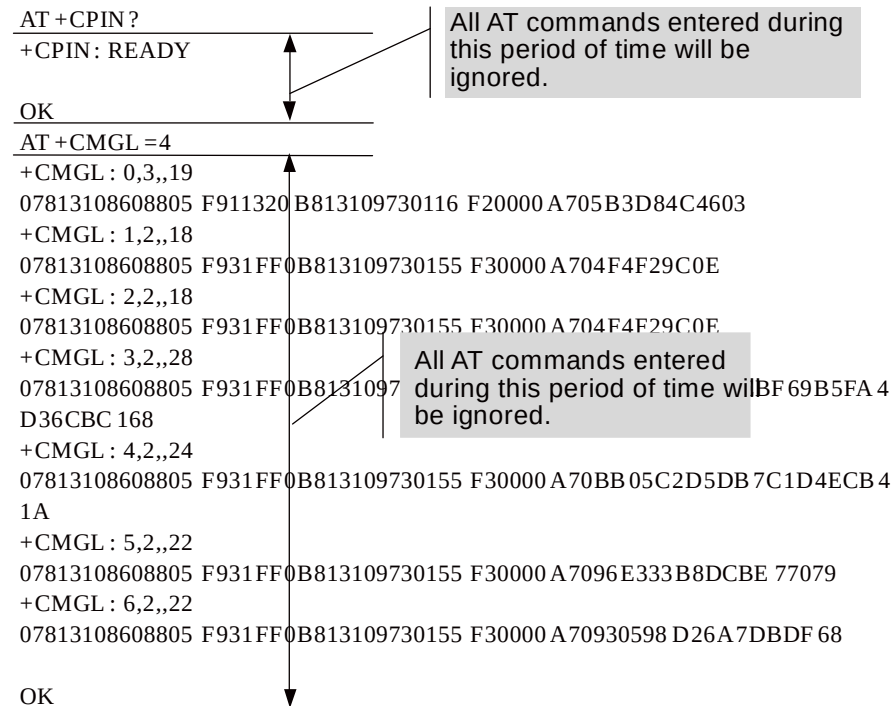
This rule also applies to COM ports converted from USB ports.

The processing of an AT command starts when the AT command is entered from the TE, and ends when the UE (the module) returns all the results in response the command.

Figure 1-2 AT command processing sequence diagram



Example:



Some special AT commands can be aborted by new AT commands. Such special commands are called abortive commands.

The MU709 supports the following abortive AT commands:

- ATD
- ATA
- AT+CLCK
- AT+COPS=?
- AT+CLCC
- AT+CLIP
- AT^IPINIT
- AT^IPOPEN
- AT^IPSEND
- AT^IPSENDEX
- AT^IPCLOSE
- AT^EMSEND
- AT^HTTPCMD
- AT^FTPCMD

- AT^SSLO
- AT^SSLTX
- AT^SSLRX

Example:

```
AT+COPS=1,2,23415
OK
```

Before the results of AT+COPS is returned, enter any characters (such as "AT"), the module will terminate the processing of AT+COPS and return **OK**. The entered characters are used to abort the command only.

Some commands can be executed when SIM card is inserted. It would return to SIM failure if SIM card is not inserted. For more information, see Property Description of related AT in [HUAWEI MU709 Series HSPA+ Module AT Command Interface Specification](#).

Example:

```
AT+CREG?
```

```
+CME ERROR: SIM failure          return to SIM failure if SIM card is not inserted
```

1.2.3 Recommended Timeout Mechanism for AT Commands Processed by a Host

A module processes AT commands in series. Do not send another AT command before the result for the current command is returned or the current command times out (except when the current command is an interruptible AT command). The following table lists AT command timeout durations (starting from the time when an AT command arrives at a port).

Table 1-2 AT command timeout duration

AT Command	Timeout Duration
General AT commands	30s
AT+CMSS/AT+CMGS (used to send text messages)	60s
AT+COPS=? (used to search for networks)	120s

After an AT command times out, it is recommended that the host check whether the module is functioning normally. The following procedure is provided for your reference:

1. The host sends AT to the module.



2. If the module returns failure information, go to step 5.
3. If the module returns success information, the module is functioning normally.
4. If the host times out (the host waits for a response for over 30 seconds) three times when waiting for the response from the module, go to step 5. Otherwise go to step 1.
5. The host deems that the current module does not exist or is unavailable. Close the port, stop sending all AT commands, exit the procedure to determine whether the module is normal, and re-search for modules.

2 Initialization Application Scenarios

2.1 Startup Indication ^SYSSTART

2.1.1 Reference Process

Command	Description
	This unsolicited indication is used to notify the TE when the ME is powered on or reset.
^SYSSTART	Indicates that a module is starting.

**NOTE**

^SYSSTART is presented only when a module is starting and will not be presented after a module has started.

2.1.2 Troubleshooting

Scenario	Possible Error Information	Solution
The module presents ^SYSSTART during startup. After that, the module presents ^SYSSTART again.	Indicates that the module has been reset.	If ^SYSSTART is presented repeatedly, send the module to the specified repair center.

2.2 Querying Basic Information

2.2.1 Reference Process

Command	Description
AT+GMR/AT+CGMR	Queries software version.
Software version	Software version. For example: 11.103.03.00.00
OK	
AT+GMI/AT+CGMI	Queries manufacturer identification.
Manufacturer Identification	For example: Huawei Technologies Co., Ltd.
OK	
AT+GMM/AT+CGMM	Queries model identification.
Model identification	For example: MU709s-2
OK	
AT+GSN/AT+CGSN	Queries product IMEI.
IMEI	For example: 865261010004010
OK	



NOTE

The previously listed commands are execution commands and cannot be used to configure settings.

2.2.2 Troubleshooting

Scenario	Possible Error Information	Solution
Query product IMEI: AT+GSN/AT+CGSN	+CME ERROR: memory failure	This error occurs when a module's IMEI is not specified. This problem is solved after the IMEI is written into the module.

2.3 Network Service Operations

2.3.1 Reference Process

Command	Description
AT+CFUN?	Queries a module's current mode.
+CFUN: 1	1 indicates online mode.
OK	
AT+CPIN?	Queries whether a module's SIM card is password protected.
+CPIN: READY	READY indicates that the SIM card is ready.
OK	
AT^HCSQ?	Queries the network's signal strength.
^HCSQ: "WCDMA",30,30,58	
OK	
AT+COPS?	Returns the current network selection mode, information about the operator with which the module is registered, and the wireless access standard.
+COPS: "Network status information"	For example: +COPS: 1,0,"China Mobile Com",0
OK	
AT+COPS=0	Automatically searches for networks.
OK	
AT+CREG?	Queries the state of the currently registered network.
+CREG: 0,1	
OK	
AT+CREG=1	Sets the +CREG unsolicited indication.
OK	



2.3.2 Troubleshooting

Scenario	Possible Error Information	Solution
Query the current registered network information about selection mode, operator info and the wireless access standard. AT+COPS?	+CME ERROR: SIM failure	No SIM card is detected. Insert a SIM card.
Query the current circuit mode network registered network state. AT+CREG?	+CME ERROR: SIM failure	No SIM card is detected. Insert a SIM card.

3

Serial Port Configuration Application Scenarios

3.1 Baud Rate Configuration

3.1.1 Reference Process

Command	Description
AT+IPR? +IPR: 115200 OK	Queries the baud rate currently used by a module.
AT+IPR=<baud rate> OK	Sets a module's baud rate. After a new baud rate is specified, the module communicates using the new baud rate.

**NOTE**

- If a module's baud rate is too low, its communication speed will be slow.
- At present, the MU709 supports the following baud rates: 9600 bit/s, 19200 bit/s, 38400 bit/s, 57600 bit/s, 115200 bit/s, 230400 bit/s, 460800 bit/s and 921600 bit/s.

3.1.2 Troubleshooting

Scenario	Possible Error Information	Solution
Specify a baud rate not supported by a module. AT+IPR=9800	ERROR	Check whether the specified baud rate is within the range of supported baud rates.

Scenario	Possible Error Information	Solution
If the specified value is a letter, ERROR will be returned. AT+IPR=ABCD	ERROR	Check whether the specified value is a digit.

3.2 Baud Rate Autonegotiation

3.2.1 Reference Process

Command	Description
AT+IPR=0	Switches to baud rate autonegotiation mode when the module is restarted.
OK	
AT/at	Sends the baud rate detection signal. After the module is restarted and switched to baud rate autonegotiation mode, only the "AT" or "at" characters are considered as the baud rate detection signal and can return OK.
OK	



NOTE

- If the parameter of the **AT+IPR** command is set to a value other than 0, the module is switched to fixed baud rate mode, and the host and module communicate with each other at the set baud rate. No baud rate autonegotiation is involved.
- In baud rate autonegotiation mode, only the 9600 bit/s, 19200 bit/s, 38400 bit/s, 57600 bit/s, and 115200 bit/s rates can be detected. If the host uses a rate other than the listed, the module cannot detect the rate. In this case, a user needs to manually check the host's baud rate and run the **AT+IPR** command to set the module to the same rate for normal communication.
- The baud rate autonegotiation mode is used by default. Before the host communicates with the module, the host sends "AT" or "at" to sync the baud rate.
- To ensure that baud rate autonegotiation is successful, the serial port frame format of the host and module must be 1 start bit+8 data bits+1 stop bit.

3.2.2 Troubleshooting

Scenario	Possible Error Information	Solution
After the module is switched to baud rate autonegotiation mode, "aT" or "At" is sent as the baud rate detection signal.	ERROR	Only the strings "AT" or "at" can be detected as detecting signal, neither "At" nor "aT".

3.3 DTR Hang Up Data Services

3.3.1 Reference Process

Command	Description
AT&D0	Establishes a dial-up connection through a serial port for data services. After this command is executed, data can be transferred properly regardless of any DTR pin voltage changes.
OK	
AT&D2	Terminates a dial-up connection through a serial port for data services. After this command is executed, data services will be ended if the DTR pin voltage settings are invalid.
OK	



NOTE

At present, only **AT&D0** and **AT&D2** are supported. **AT&D1** is not supported.

3.3.2 Troubleshooting

Scenario	Possible Error Information	Solution
The specified value of 1 is not supported by a module. AT&D1	ERROR	At present, only AT&D0 and AT&D2 are supported. AT&D1 is not supported.

3.4 DCD Pin Control

3.4.1 Reference Process

Command	Description
AT&C0	Sets the DCD pin to be always valid regardless of data services.
OK	
AT&C1	Sets the DCD pin to be valid when there are ongoing data services and invalid after data services are disconnected.
OK	

3.4.2 Troubleshooting

Scenario	Possible Error Information	Solution
The specified value of 2 is not supported by a module. AT&C2	ERROR	Unsupported parameter value.
The specified value of a letter is not supported by a module. AT&CA	ERROR	At present, only AT&C0 and AT&C1 are supported. Otherwise, ERROR will be returned.

3.5 Setting Hardware Flow Control

3.5.1 Reference Process

Command	Description
AT+IFC=0,0	Turns hardware flow control off. After hardware flow control is turned off, communication between the UE and the DTC is not restricted by flow control.
OK	
AT+IFC=2,2	Turns hardware flow control on. After hardware flow control is turned on, communication between the UE and the TE is restricted by flow control: Data transmission stops when UE's or TE's buffer level exceeds 80% and resumes when the buffer level is below 20%.

Command	Description
OK	



NOTE

- If hardware flow control is enabled, no AT commands can be executed.
- To support hardware flow control, RX, TX, CTS, and RTS pins are all required for the serial port.

3.5.2 Troubleshooting

Scenario	Possible Error Information	Solution
If the specified value exceeds the value range, ERROR will be returned. AT+IFC=4,0	ERROR	The specified value of 4 exceeds the value range. Specify the value as 0 or 2.
If the specified value exceeds the value range, ERROR will be returned. AT+IFC=0,4	ERROR	The specified value of 4 exceeds the value range. Specify the value as 0 or 2.

4 External Protocol Stack Application Scenarios

4.1 Prerequisites

4.1.1 Reference Process

Command	Description
AT+CGDCONT=1,"IP","1234"	Configures PDP contexts. In this example provided in the left column, the APN is 1234. In practice, the APN is provided by your network service provider.
OK	
AT+CGATT?	Obtains PS domain service status.
+CGATT: 1	If 1 is returned, attaching to the PS domain is succeeded.
OK	If OK is returned, the command has been executed successfully.



NOTE

External protocol stack supports UART or MODEM ports only. After the pre-configuration is complete, ensure that the desired port is not occupied by other processes.

4.1.2 Troubleshooting

Scenario	Possible Error Information	Solution
Query the current GPRS service state: AT+CGATT?	+CGATT: 0 OK	This value indicates the UE does not obtain any PS domain services. Run AT+CGATT=1 to manually attach to the PS domain. If attaching to the PS domain still fails, refer to section 2.3 .

4.2 Establishing Data Connections

- Reference process 1

Command	Description
ATD*99#	*99# is the GPRS password. This command is usually used in Windows. The UE switches from command mode to data mode. After the TE starts the PPP negotiation process, the UE automatically performs the actions (including PS domain attaching and PDP activation) required for establishing data connections.
CONNECT xxx	CONNECT indicates that the data service dial-up command is being processed by the module. xxx indicates the data rate, which depends on the network standard and capability level.

- Reference process 2

Command	Description
AT+CGDATA="PPP",1	This command is equivalent to ATD*99# . This command is usually used in the Android Radio Interface Layer (RIL).
CONNECT	


NOTE

- Using the previously configured profile, the PPP negotiation between the TE and the UE, and the PDP negotiation between the UE and the network, the TE obtains the IP and DNS addresses to establish the routing between the TE and the network.
- When establishing data service connections, the TE must start the PPP negotiation after the UE enters data mode. Otherwise the UE will only enter data mode but will not establish data connections with the network.
- The data mode means: After entering data mode, the UE only transfers data packets between the UE and the network, and will not respond to any AT commands.

4.2.1 Troubleshooting

Scenario	Possible Error Information	Solution
Failure to open ports or register with a network	Error xxx: The modem (or other connected device) is in use. Note: xxx is usually a number indicating an error. For example, 633 .	1. Check whether the Modem port is in use. Ensure that the Modem port is not being used by other connections. 2. Check whether the current network is operating normally. Data service connections can be established only when the network is operating normally.

4.3 Data Transmission

4.3.1 Data Transmission

1. Data can be transmitted after data service connections are established.
2. According to 3GPP TS 25.306, HSDPA (FDD) terminals are classified into 24 categories. Different categories have different peak data rates. The following table lists common categories and their key parameters.

Common Terminal Category	Maximum Number of Codewords	Soft Channel Size (Bits)	Minimum Transmission Time Interval (TTI)	Modulation Mode	Theoretical Peak Rate (Mbit/s)
Category 8	10	134400	1	QPSK 16QAM	7.2
Category 10	15	172800	1	QPSK 16QAM	14.4
Category 14	15	259200	1	QPSK 16QAM 64QAM	21.6

Common Terminal Category	Maximum Number of Codewords	Soft Channel Size (Bits)	Minimum Transmission Time Interval (TTI)	Modulation Mode	Theoretical Peak Rate (Mbit/s)
Category 16	15	345600	1	QPSK 16QAM MIMO+16QAM Note: 64QAM is not supported.	28.8
Category 18	15	345600	1	QPSK 16QAM 64QAM MIMO+16QAM	28.8
Category 20	15	518400	1	QPSK 16QAM 64QAM MIMO+16QAM MIMO+64QAM	43.2
Category 24	15	518400	1	QPSK 16QAM 64QAM DC	43.2

HSUPA (FDD) terminals are classified into seven categories. The following table lists common categories and their key parameters.

Common Terminal Category	Maximum Number of E-DCH	Minimum SF	Support 2 ms TTI	Modulation Mode	Theoretical Peak Rate (Mbit/s)
Category 5	2	SF2	No	QPSK	2
Category 6	4	SF2	Yes	QPSK	5.76

- According to the Radio Resource Control (RRC) version, the WCDMA/HSDPA/HSUPA/HSPA+/DC_HSPA rate in theory are as follows:

WCDMA RRC Version	Modulation Mode		Theoretical Peak Rate (Mbit/s)	
	Downlink	Uplink	Downlink	Uplink
3GPP Rel	Downlink	Uplink	Downlink	Uplink
R99/R4	QPSK	BPSK	0.384	0.384
Rel-5	16QAM+	QPSK	14.4	0.38
Rel-6	16QAM	QPSK	14.4	5.76
Rel-7	16QAM	16QAM	28.8	11.52
	64QAM	16QAM	21.6	11.52
Rel-8	64QAM	16QAM	43.2	11.52
	DC-SHDP+64QAM	16QAM	43.2	11.52
Rel-9	DC-SHDP+64QAM	DC-SHUPA	84	23

4.4 Switch Between Data Mode and Command Mode

4.4.1 Reference Process

Command	Description
ATD*99#	UE dials up.
CONNECT	
+++	Enters +++ (three plus signs) to switch the data service port from data mode to command mode. The UE can then respond to AT commands and perform corresponding actions.
ATO	Switches the data service port back to data mode so that the UE can continue to transmit data.
CONNECT	



NOTE

- If there are no data links available, the module will not switch back to data mode but remains in command mode.
- If the data link is connected, when the module switches from data mode to command mode, data transmission will be suspended.
- If the data link is connected, when the module switches from command mode to data mode, data transmission will be resumed.

4.4.2 Troubleshooting

Scenario	Possible Error Information	Solution
Switch the data service port from data mode to command mode : +++	Failed to switch to command mode.	+++ must be consecutively entered within 0.9s.

4.5 Disconnecting Data Service Connections

4.5.1 Reference Process

- Process 1

Command	Description
+++ ATH	Before this command is executed at the data service port, the +++ sequence must be sent from the data service port. This command is used to disconnect data service connections. This command is usually used in Windows.
OK	

- Process 2

Command	Description
AT+CGACT=0,1	In Android RIL, after a PPP connection is disconnected, this command is executed to deactivate the PDP context to release the data link and disconnect the data services. The use of this command is the same as that of ATH .
OK	

- Terminating a data service connection from the TE: the TE sends a PPP Terminate packet to the UE to pull down the DTR signal. The UE disconnects the PPP connection, releases the wireless link resource, pulls down the CD signal, and returns **NO CARRIER**. As a result, the data service connection is disconnected. This method of disconnecting data service connections is usually implemented by the disconnection function of the TE's application.
- Terminating a data service connection from the UE: The TE sends an AT command to the UE to pull down the DTR signal. After receiving the AT command, the UE releases the connection to the network, pulls down the CD



signal, and returns **NO CARRIER**. As a result, the data service connection is disconnected. This mode of disconnecting data service connections requires an AT command interaction tool.

3. When disconnecting data service connections in Android RIL, the module must kill pppd to disconnect PPP connections before using **AT+CGACT=0** to deactivate PDP contexts and release wireless link resources.

5 Internal Protocol Stack Application Scenarios

5.1 Initializing Internet Services

5.1.1 Reference Process

Command	Description
AT+IPINIT="1234","card","card",,2	In this example provided in the left column, the APN is 1234. , and the user name and password are both card . The authentication type is CHAP .
OK	
AT+IPINIT?	Queries the obtained IP and DNS addresses.
+IPINIT: 1,"192.168.70.59","1234","172.22.44.200","172.22.44.201"	
OK	

5.1.2 Troubleshooting

Scenario	Possible Error Information	Solution
Query the obtained IP and DNS addresses. AT+IPINIT?	+IPINIT: 0 OK	Initialization has not been performed. Initialize the internal protocol stack and query again.

Scenario	Possible Error Information	Solution
Initialize the internal protocol stack. AT^IPINIT="1234","card","card"	+CME ERROR: Normal error	Initialization failed. 1. Check that the current network signal strength is good and the parameters are set correctly. 2. Ensure that no IP stack termination command has been executed.
	+CME ERROR: The link has been established already	AT^IPINIT? queries whether the internal protocol stack has been initialized. If the internal protocol stack has been initialized, it does not need to be initialized again. If it has not been initialized, there are ongoing dial-up services. Hang up the dial-up services and re-send AT^IPINIT to start initialization.

5.2 Creating a Listen Server

5.2.1 Reference Process

Command	Description
AT^IPINIT="1234","card","card"	Initializes the internal protocol stack.
OK	
AT^IPLISTEN="TCP",5000	Creates a TCP server whose listen port number is 5000 (users can specify this number as required). For the method to create UDP servers, refer to the AT command document.
OK	
AT^IPLISTEN?	Queries the information about the server that has been created.
^IPLISTEN: "TCP",5000,5	
OK	


NOTE

- Only one server is supported by the internal protocol stack.
- The internal protocol stack must be initialized before you create a listen server.

5.2.2 Troubleshooting

Scenario	Possible Error Information	Solution
Create a listen server. AT^IPLISTEN="TCP",5000	+CME ERROR: The network has not been opened yet	Run AT^IPINIT to initialize the internal protocol stack, and then create the listen server.
	+CME ERROR: The server has been established already	A listen server already exists. Run AT^IPCLOSE=6 to close the existing listen server.
	+CME ERROR: Fail to bind the specified port with server	The local port is in use. Change the port and re-send the command.

5.3 Creating TCP/UDP Links

5.3.1 Reference Process

Command	Description
AT^IPINIT="1234","card","card" OK	Initializes the internal protocol stack.
AT^IPOPEN=1,"UDP","172.22.44.33",5000,5500 OK	Uses a specified IP address to connect to the remote server and establish a UDP link.
AT^IPOPEN? ^IPOPEN: 1,"UDP",5500,"172.22.44.33",5000,3,0 OK	Queries link information.
AT^IPOPEN=1,"TCP","www.huawei.com",80 OK	Uses a specified domain name to connect to the remote server and establish a TCP link.
AT^IPOPEN?	Queries link information.

Command	Description
^IPOPEN: 1,"TCP",5500,"www.huawei.com",80	
OK	


NOTE

- When creating a listen server, the local port number can be ignored. If the port number is ignored, the module will randomly assign a local port number.
- When creating a TCP link, ensure that the remote server has been started.
- The Maximum Segment Size (MSS) for creating TCP links is 1220 bytes. Data larger than the MSS will be segmented into several packets.

5.3.2 Troubleshooting

Scenario	Possible Error Information	Solution
Create a client link AT^IPOPEN=1,"TCP", "172.22.44.33",5000	+CME ERROR: The network has not been opened yet	Initialize the internal protocol stack before sending the command to create the link.
	+CME ERROR: The link has been established already	Run AT^IPCLOSE to close the corresponding link. Alternatively, change the link ID and send the command to create the link.
	+CME ERROR: Fail to bind the specified port	Change the local port number, or leave the local port number blank.
Query link information AT^IPOPEN?	OK	No link information is available. Create a link, or accept the link as a server, and then query the link information again.

5.4 Sending Data

5.4.1 Reference Process

Command	Description
AT^IPINIT="1234","card","card"	Initializes the internal protocol stack.
OK	

Command	Description
AT^IPOPEN=1,"TCP","172.22.44.33",5000,5500	Creates a link.
OK	
AT^IPSEND=1,"31323334"	Sends data. In this example, 31323334 is sent.
^IPSEND: 1	Data is successfully sent and received.
OK	
^IPDATA: 1,8,31323334	
AT^IPSENDEX=1,0,"31323334"	Sends data in mode 0. In this example, 31323334 is sent.
^IPSENDEX: 1	
OK	
^IPDATA: 1,8,31323334	
AT^IPSENDEX=1,1,"31323334"	Sends data in mode 1. In this example, 1234 is actually sent.
^IPSENDEX: 1	
OK	
^IPDATA: 1,4,1234	
AT^IPSENDEX=1,2,<datalen>	Sends data in mode 2.
OK	
(Wait for the user to enter user data with a length of <datalen>)	
^IPSENDEX: 1	
OK	


NOTE

- **AT^IPSEND** and mode 0 of **AT^IPSENDEX** can send displayable characters only. Mode 1 and mode 2 of **AT^IPSENDEX** can send all characters.
- In mode 2 of **AT^IPSENDEX** (length restriction mode), except the port that receives data entered by the user, all other ports are unavailable before the user finishes entering the user data.

5.4.2 Troubleshooting

Scenario	Possible Error Information	Solution
Send data using AT^IPSEND AT^IPSEND=1,"data"	+CME ERROR: The network has not been opened yet	Before sending data, initialize the protocol stack or accept the link as a server.
	+CME ERROR: Remain data is sending	The module is exiting transparent transmission mode and cannot send data. Wait until the module completely exits transparent transmission mode.
	+CME ERROR: The link has not been established yet	Before sending data, create a link or accept the link as a server.
	+CME ERROR: Normal error	The module failed to send the data. Ensure that the current network's signal strength is good.
Send data using mode 2 of AT^IPSENDEX AT^IPSENDEX=1,2,<datalen>	+CME ERROR: Too many data to be sent	The length of the data entered by the user exceeds the length specified by the command. Ensure that the length of the data is equal to the data length specified by mode 2 of AT^IPSENDEX .

5.5 Closing TCP/UDP Links

5.5.1 Reference Process

Command	Description
AT^IPCLOSE=<link_id>	Closes the specified link, server, or network. For details about the parameters, refer to the related AT command document.
OK	
AT^IPCLOSE?	Queries the current link status.
^IPCLOSE: 1,0,0,0,0	1 indicates that the link is open, and 0 indicates that the link is closed.
OK	

5.5.2 Troubleshooting

Scenario	Possible Error Information	Solution
Close the specified link. AT^IPCLOSE=<link_id>	+CME ERROR: Normal error	The command is terminated. Run the AT^IPCLOSE command again.

5.6 Transparent Transmission Mode

5.6.1 Reference Process

Command	Description
AT^IPINIT="1234","card","card" OK	Initializes the internal protocol stack.
AT^IPOPEN=1,"UDP","172.22.44.33",5000,5500 OK	Creates a link.
AT^IPCFL=12,0 OK	Sets the transparent transmission mode to time- and length-based transmission mode.
AT^IPCFL=5,100 OK	Sets the timer for triggering transparent transmission to 10s (100 x 0.1s).
AT^IPCFL=10,1220 OK	Sets the TCP/UDP MSS to 1220 bytes.
AT^IPENTRANS=1 OK	Enables transparent transmission mode.

Command	Description
313233347D5D7D5E7E	Sends user data. User data is sent once the data length reaches the segment length specified by parameter 10 of AT^IPCFL. If the user data length is shorter than the specified length, the data will be sent when the timer set by parameter 5 of AT^IPCFL counts down to 0. For details about the transmission mechanism, refer to the description of AT^IPENTRANS in the AT command document. In this example, the data entered by the user is 313233347D5D7D5E7E in hexadecimal format. The data sent by the module is the original data entered by the user.
313233347D5D7D5E7E	Receives user data in time-based and length-based transmission mode. In this example, the data received by the module is 313233347D5D7D5E7E. The original data received by the module is presented.
+++	Exits transparent transmission mode. For the rules about the +++ sequence, refer to the AT command document.
OK	
AT^IPCFL=12,1	Sets the transparent transmission mode to 7E detection mode.
OK	
AT^IPENTRANS=1	Enables transparent transmission mode.
OK	
AT^IPENTRANS?	Queries the link ID for entering transparent transmission mode from a non-transparent port.
^IPENTRANS: 1	
313233347D5D7D5E7E	Sends data in 7E detection mode (applies to UDP only). In this example, the data that the user wants to send is 313233347D7E in hexadecimal format. Therefore, the user needs to transform 7D to 7D5D and 7E to 7D5E, and adds 7E as the ending characters to the end of the data. After the module recognizes the data packet, the data actually sent by the module is 313233347D7E.

Command	Description
313233347D5D7D5E7E	Receives data in 7E detection mode (applies to UDP only). The data received by the module is 313233347D7E in hexadecimal format. After receiving the data, the module transforms 7D to 7D5D and 7E to 7D5E, and adds 7E as the ending characters to the end of the data before presenting the data to the user.



NOTE

- The transparent transmission mode of the internal protocol stack supports UART only.
- The internal protocol stack allows only one link to enter transparent transmission mode. In addition, before entering transparent transmission mode, ensure that only one link exists at the current physical port. If the module functions as a server, the link can enter transparent transmission mode only when the link is requested by a remote client and accepted by the server.
- The settings (including the time- and length-based transmission mode and 7E detection mode) of transparent transmission mode must be configured using **AT^IPCF** before the transparent transmission mode is enabled. For details about how to configure the settings, refer to the AT command document.
- When in transparent transmission mode, the current port cannot be used for reporting.

5.6.2 Troubleshooting

Scenario	Possible Error Information	Solution
Enter transparent transmission mode. AT^IPENTRANS=1	+CME ERROR: Invalid port for transparent mode	This indicates that the link is not established at a UART port. To solve this problem, establish a link from a UART port and set the UART port to enter transparent transmission mode.
	+CME ERROR: More than one link in physical port	There are more than one link. Use AT^IPCLOSE to close other links before entering transparent transmission mode.
	+CME ERROR: The physical port is in listen state and has no client	The module functions as the server but does not accept the link requested by the client. Accept the link before entering transparent transmission mode.

Scenario	Possible Error Information	Solution
Specify the transparent transmission mode using AT^IPCFI . AT^IPCFI=5,10	+CME ERROR: Forbidden operation in transparent mode	AT^IPCFI cannot be used during transparent transmission. Exit transparent transmission mode before running AT^IPCFI .

5.7 Packet Statistics

5.7.1 Reference Process

Command	Description
AT^IPFLOWQ?	Queries packet statistics. In this example, the returned result indicates that 3 bytes of characters are successfully received by and sent from link 1. For details about the parameters, refer to the AT command document.
^IPFLOWQ: 1,3,3,3,3,3 ^IPFLOWQ: 2,0,0,0,0,0 ^IPFLOWQ: 3,0,0,0,0,0 ^IPFLOWQ: 4,0,0,0,0,0 ^IPFLOWQ: 5,0,0,0,0,0	
OK	
AT^IPFLOWQ=<linkid>	Clears the traffic statistics on the specified link (<linkid>: 1–5).
OK	
AT^IPFLOWQ=0	Clears the traffic statistics on all links.
OK	

5.8 TCP/UDP Link Change Indication

5.8.1 Reference Process

Command	Description
AT^IPINIT="1234","card","card"	Initializes the internal protocol stack.

Command	Description
OK	
AT+IPLISTEN="TCP",5000	Creates a server.
OK (The client requests to connect to the server.) ^IPSTATE: 1,1,1 (The other party of the link closest the link.) ^IPSTATE: 1,0,0 (Network connection is broken.) ^IPSTATE: 1,0,2 ^IPSTATE: 6,0,2 ^IPSTATE: 7,0,2 ^IPSTATE: 0,0,3 ^IPSTATE: 0,0,4	The server accepts the link requested by the client. Indications presented without solicitation for broken links, connection to the server, and network connections. The number of current links has reached the supported maximum. New link requests will be rejected. The module rejects new link requests because it functions as the server and is in transparent transmission mode.

5.9 FTP Application Scenarios

5.9.1 Creating an FTP Control Link

Reference Process

Command	Description
AT+IPOPEN=1,"FTP","192.166.63.41",2 1,,"username","password" OK ^IPSRVST:1,10,230	Creates a normal FTP control link ,an FTP user is successfully logged in FTP server.



NOTE

- Only one FTP service can be enabled at a time. Not concurrent operate with other built-in protocols, including TCP, UDP, etc.
- PDP must be activated.
- Use FTPS because FTP may impose security risks.

Troubleshooting

Scenario	Possible Error Information	Solution
Create the link. AT^IPOPEN=1,"FTP","192.166.63.41",21,,"username","password"	+CME ERROR: The network has not been opened yet	Initialize the internal protocol stack before sending the command to create the link.
	+CME ERROR: The link has been established already	Try to open an already established link.

5.9.2 Configuring Data Transmission Mode

In FTP, data can be transferred (PUT or GET) in three different modes.

- **Transparent transmission mode:**
For GET operation, files will be downloaded from the server and the content will be displayed to the user.
For PUT operation, users shall enter the data to be transferred to the server followed by "+++" to indicate the end of file.
During the data transfer process, we cannot execute other AT commands.
- **Command transmission mode:**
For GET operation, contents of downloaded file from server will be displayed to users through **AT^IPDATA** report.
For PUT operation, users shall enter the data to be transferred using **AT^IPSENDEX** command
During the data transfer process, we can execute any other AT commands than GET and PUT.
- **Buffer mode:**
For GET operation, contents of downloaded file from server will be stored in a buffer.
And an **^IPRCVST** report will be displayed which indicates whether there is data to be read. After that, users need to issue **"AT^IPRCV=<link_id>,<reqReceiveLength>"** to read the data from buffer. For more information on **AT^IPRCV**, please refer AT command document.
The size of the buffer is 65536 bytes.
PUT operation will be similar as in COMMAND TRANSMISSION MODE.
During the data transfer process, we can execute any other AT commands other than GET and PUT.

Reference Process

Command	Description
AT^IPCFL=14,0	Sets data transmission mode to transparent transmission mode.
OK	
AT^IPCFL=14,1	Sets data transmission mode to command transmission mode.
OK	
AT^IPCFL=14,2	Sets data transmission mode to buffer transmission mode.
OK	

The **AT^IPCFL** command is used to set the processing mode for FTP file data. By default, transparent transmission mode will be set. Users can change the data transmission mode as per the need specified in section 5.9.2 Configuring Data Transmission Mode.

5.9.3 Configuring FTP Data Channel Mode

Reference Process

Command	Description
AT^FTPCMD=1,PORT	Configures the connection mode in PORT mode for downloading and uploading data.
OK	
AT^FTPCMD=1,PASV	Configures the connection mode in PASV mode for downloading and uploading data. The default mode is PASV mode.
OK	

- In PORT mode, the client creates the control channel and provides the data port number which it will be listening on. The server then creates the data channel with the client provided port.
- In PASV mode, the client creates both control channel and data channel. PASV mode is generally used in scenarios where the server will not be able to setup the data channel; one of the major reasons for this would be the network firewall limitation.

5.9.4 Getting FTP File Size

Reference Process

Command	Description
AT^FTPCMD=1,FILESIZE,"ftp.txt"	Gets the size of the file.
^FTPCMD: "FILESIZE",25490	
OK	
AT^FTPCMD=1,FILESIZE,"/work/test.txt"	Gets the size of the file.
^FTPCMD: "FILESIZE",34570	
OK	

Troubleshooting

Scenario	Possible Error Information	Solution
File Size Command AT^FTPCMD=1,FILESIZE,"ftp.txt"	+CME ERROR: The link has not been established yet	Make sure that the file size operation link ID is established.
Get File Size for a big file (> 4GB) AT^FTPCMD=1,FILESIZE,"ftp.rar"	ERROR	The file size command will return ERROR if the file size is greater than 4 GB.

5.9.5 Downloading File Using "GET" Command in Transparent Mode

Reference Process

Command	Description
AT^IPINIT="mhahuawei1.com"	Initializes the internal protocol stack.
OK	
AT^IPCFL=14,0	Sets data transmission mode to transparent mode. By default it will be in transparent mode only.
OK	
AT^IPOPEN=1,"FTP","192.166.63.41",2	Creates the link.

Command	Description
1,,"username","password"	
OK	
^IPSRVST:1,10,230	
AT^FTPCMD=1,PORT	Sets the FTP data channel mode to PORT mode for downloading and uploading the data. By default it will be PASV mode.
OK	
AT^FTPCMD=1,GET,"ftp.txt"	Gives the FTP GET command for downloading data.
CONNECT	
Hello	
OK	
^IPSRVST: 1,11,1	

Troubleshooting

Scenario	Possible Error Information	Solution
AT^FTPCMD=1,GET,"ftp.txt"	+CME ERROR: The link has not been established yet	Make sure that the get operation link ID is established.

5.9.6 Downloading File Using "GET" Command in Command Mode

Reference Process

Command	Description
AT^IPINIT="mhahuawei1.com"	Initializes the internal protocol stack
OK	
AT^IPOPEN=1,"FTP","192.166.63.41",2 1,,"username","password"	Creates the link.
OK	
^IPSRVST:1,10,230	

Command	Description
AT^IPCFL=14,1	Sets data transmission mode to command mode.
OK	
AT^FTPCMD=1,PORT	Sets the FTP data channel mode to PORT mode for downloading and uploading the data. By default it will be PASV mode.
OK	
AT^FTPCMD=1,GET,"ftp.txt"	Gives the FTP GET command for downloading data.
OK	
^IPDATA: 1, 5, Hello	
^IPSRVST: 1,11,1	

5.9.7 Download File Using "GET" Command in Buffer Mode

Reference Process

Command	Description
AT^IPINIT="mhahuawei1.com"	Initializes the internal protocol stack.
OK	
AT^IPOPEN=1,"FTP","192.166.63.41",2 1,,"username","password"	Creates the link.
OK	
^IPSRVST:1,10,230	
AT^IPCFL=14,2	Sets data transmission mode to buffer mode.
OK	
AT^FTPCMD=1,PORT	Sets the FTP data channel mode PORT for downloading and uploading the data. By default it will be PASV mode. For more information on when to use PORT or PASV mode refer section 5.9.3 Configuring FTP Data Channel Mode.
OK	

Command	Description
AT^FTPCMD=1,GET,"ftp.txt"	Gives the FTP GET command for downloading data.
OK	
^IPRCVST: 1, 1	
^IPSRVST: 1,11,1	
AT^IPRCV=1,5	Receives the data stored in the buffer.
^IPRCV: 1,5 Hello	
OK	

5.9.8 Uploading File Using "PUT" Command in Transparent Mode

Reference Process

Command	Description
AT^IPINIT="mhahuawei1.com"	Initializes the internal protocol stack.
OK	
AT^IPOPEN=1,"FTP","192.166.63.41",2 1,"username","password"	Creates the link.
OK	
^IPSRVST:1,10,230	
AT^IPCFL=14,0	Sets data transmission mode to transparent mode.
OK	
AT^FTPCMD=1,PORT	Sets the FTP data channel mode PORT for downloading and uploading the data. By default it will be PASV mode. For more information on when to use PORT or PASV mode refer section 5.9.3 Configuring FTP Data Channel Mode.
OK	
AT^FTPCMD=1,PUT,"ftp.txt"	Upload the data using this command. After completion of uploading, send

Command	Description
	+++ to terminate from the server. Any character is forbidden in 900 ms before and after inputting "+++", and it must be less than 900 ms between two '+' input.
CONNECT	
<Enter the data>	
<Type "+++" to terminate from the server>	
OK	
^IPSRVST: 1,11,1	

5.9.9 Uploading File Using "PUT" Command in Command Mode and Buffer Mode

There is no difference in PUT operation of "Command and Buffer mode". In both the mode, **AT^IPSENDEX** is used to enter the data.

Reference Process

Command	Description
AT^IPINIT="mhahuawei1.com"	Initializes the internal protocol stack.
OK	
AT^IPOPEN=1,"FTP","192.166.63.41",2 1,,"username","password"	Creates the link.
OK	
^IPSRVST:1,10,230	
AT^IPCFL=14,2	Sets data transmission mode to buffer mode.
OK	
AT^FTPCMD=1,PORT	Sets the FTP data channel mode PORT for downloading and uploading the data. By default it will be PASV mode. For more information on when to use PORT or PASV mode refer section 5.9.3 Configuring FTP Data Channel Mode.

Command	Description
OK	
AT^FTPCMD=1,PUT,"ftp.txt"	Uploads the data using this command.
OK	
AT^IPSENDEX=1,2,1500,0	It can send maximum 1500 data at a time. The last parameter <eof> is 0 where 0 means user can send more data.
OK	
<Enter the data>	
^IPSENDEX:1	
OK	
AT^IPSENDEX=1,2,1500,1	It can send maximum 1500 data at a time. The last parameter <eof> is 1, where 1 means end of packet and the file upload will be completed.
OK	
<Enter the data>	
^IPSENDEX: 1	
OK	
^IPSRVST: 1,11,1	
AT^IPCLOSE=1	Closes the link.
OK	

5.9.10 FTP Error Codes

<state code>	<state code> representative's meaning
100	The server has not responded
110	Restarts the mark reply
120	Prepares in n minutes
125	The connection opens the preparation to transmit
150	Opens the data connection
200	Command Execution Success

<state code>	<state code> representative's meaning
202	Command Execution Failure
211	System Status
212	List Status
213	FILE SIZE
214	Help information
215	Name system type
220	The new client prepared
221	Service closure pilot connection, may withdraw registers
225	The data connection opens, does not have the transmission to be in progress
226	That the closure data connection, requested file operation successfully
227	Enters the passive pattern
230	Successful Login
250	File operation of request completes
257	Setup PATH NAME
331	A user correctness, needs the password
332	When registers needs the account information
350	Next order
421	Cannot provide the service, closes the pilot connection
425	Cannot open the data connection
426	The closure connection, stops transmitting

5.10 HTTP Application Scenarios

5.10.1 Creating an HTTP Server Link

Reference Process

Command	Description
AT+IPOPEN=1,"HTTP","m2m.huawei.com",9001	Opens a normal HTTP server link, an HTTP user is successfully logged in

HTTP.

OK



NOTE

- Only one HTTP service can be enabled at a time.
- Before an HTTP service is enabled, Internet configuration and HTTP configuration must be completed.
- Use HTTPS because HTTP may impose security risks.

Troubleshooting

Scenario	Possible Error Information	Solution
Create the link. AT+IPOPEN=1,"HTTP","m2m.huawei.com",9001	+CME ERROR: The network has not been opened yet	Initialize the internal protocol stack before sending the command to create the link.
	+CME ERROR: The link has been established already	Try to open an already established link.

5.10.2 Configuring Data Transmission Mode

Reference Process

Command	Description
AT+IPCFL=14,0	Sets data transmission mode to transparent transmission mode.
OK	
AT+IPCFL=14,1	Sets data transmission mode to command transmission mode.
OK	
AT+IPCFL=14,2	Sets data transmission mode to buffer transmission mode.
OK	

The **AT+IPCFL** command is used to set the data processing mode for HTTP, which is same as FTP. By default, transparent transmission mode will be set. Users can change the data transmission mode as per the need specified in section 5.9.2 Configuring Data Transmission Mode.



5.10.3 Downloading File Using "GET" Command in Transparent Mode

Reference Process

Command	Description
AT^IPINIT="mhahuawe1.com"	Initializes the internal protocol stack.
OK	
AT^IPOPEN=1,"HTTP","m2m.huawei.com192.166.63.41",9001	Creates the link.
OK	
AT^IPCFL=14,0	Sets data transmission mode to transparent mode. By default it will be in transparent mode only.
OK	
AT^HTTPCMD=1,GET,http://m2m.none xist.com:9001/n_index.txt	Downloads the file from the HTTP server n_index.txt (In the following example, <link_id>is 1).
CONNECT hello123	
OK	
^IPSRVST: 1,12,200	

Troubleshooting

Scenario	Possible Error Information	Solution
AT^HTTPCMD=1,GET,http://m2m.huawei.com:9001/n_index.html	+CME ERROR: The link has not been established yet	Make sure that the get operation link ID is established.

5.10.4 Downloading File Using "GET" Command in Command Mode

Reference Process

Command	Description
AT^IPINIT="mhahuawe1.com"	Initializes the internal protocol stack.
OK	
AT^IPCFL=14,1	Sets data transmission mode to command mode
OK	
AT^IPOPEN=1,"HTTP","www.m2m.huawei.com",9001	Creates the link.
OK	
AT^HTTPCMD=1,GET,http://m2m.huawei.com:9001/n_index.txt	Downloads the file from the HTTP server n_index.txt (In the following example, link ID is 1.
OK	
^IPDATA: 1,5,hello123	
^IPSRVST: 1,12,200	

5.10.5 Downloading File Using "GET" Command in Buffer Mode

Reference Process

Command	Description
AT^IPINIT="mhahuawe1.com"	Initializes the internal protocol stack.
OK	
AT^IPOPEN=1,"HTTP","m2m.huawei.com",9001	Creates the link.
OK	
AT^IPCFL=14,2	Sets data transmission mode to buffer transmission mode.
OK	
AT^HTTPCMD=1,GET,http://m2m.huawei.com:9001/n_index.txt	Downloads the file from the HTTP server n_index.txt (In the following example, link ID is 1)

Command	Description
OK	
^IPRCVST: 1,1	
AT^IPRCV=1,5	Receives the data stored in the buffer.
^IPRCV: 1, 5 Hello	
OK	

5.10.6 Uploading File Using "POST" Command in Transparent Mode

Reference Process

Command	Description
AT^IPINIT="mhahuawe1.com"	Initializes the internal protocol stack.
OK	
AT^IPOPEN=1,"HTTP","m2m.huawei.com",9001	Creates the link.
OK	
AT^IPCFL=14,0	Sets data transmission mode to online mode.
OK	
AT^HTTPCMD=1,POST,HTTP://m2m.huawei.com:448/cgi-bin/textarea.cgi,20,"text/plain"	Uploads the data using this command .If the upload has to be cancelled, then give +++ to terminate.
CONNECT textcontext=hello123 Enter 20 bytes of data <phtml><head><title>Text Area - Fifth CGI Program</title></phead><body> EnteredText Content is hello123 </body></html>	
OK	
^IPSRVST: 1, 12,200	

5.10.7 Uploading File"POST" Command in Command Mode and Buffer Mode

There is no difference in HTTP POST operation of "Command and Buffer mode". In both the mode, **AT^IPSENDEX** is used to enter the data.

Reference Process

Command	Description
AT^IPINIT="mhahuawe1.com" OK	Initializes the internal protocol stack.
AT^IPOPEN=1,"HTTP","m2m.huawei.com",9001 OK	Creates the link.
AT^IPCFL=14,1 OK	Sets data transmission mode to command mode.
AT^HTTPCMD=1,POST,HTTP://m2m.huawei.com:448/cgi-bin/textarea.cgi,20,"text/plain" OK	Uploads the data content to the post script textarea.cgi .
AT^IPSEND=1,"textcontext=hello123" ^IPSEND: 1 OK	Transmits the data through the link established (in this case, <link_id> is 1).
^IPSRVST: 1,12,200	
AT^IPSENDEX=1,0,"textcontent=hello123" ^IPSEND: 1 OK	Transmits the data through the link established in IPSENDEX Mode 0 (in this case, <link_id> is 1).
^IPSRVST: 1,12,200	
AT^IPSENDEX=1,2,20,1textcontext=hello123 ^IPSEND: 1	Transmits the data through the link established in IPSENDEX Mode 2 (in this case, <link_id> is 1).

Command	Description
OK	
^IPSRVST: 1,12,200	
AT^IPSENDEX=1,1,"74657874636F6E74656E743D68"	Transmits the data through the link established in IPSENDEX Mode 1(in this case, <link_id> is 1)
^IPSEND: 1	
OK	
^IPSRVST: 1,12,200	
AT^IPCLOSE=1	Closes the link.
OK	


NOTE

The <textcontent> specifies the corresponding field in the POST Script.

Troubleshooting

Scenario	Possible Error Information	Solution
Close the specified link. AT^IPCLOSE=<link_id>	+CME ERROR: Normal error	The command is terminated. Run the AT^IPCLOSE command again.
Create the link. AT^IPOPEN=1,"HTTP","m2m.huawei.com",9001	+CME ERROR: The network has not been opened yet	Initialize the internal protocol stack before sending the command to create the link.
	+CME ERROR: The link has been established already	Run AT^IPCLOSE to close the corresponding link. Alternatively, change the link ID and send the command to create the link.
	+CME ERROR: Fail to bind the specified port	Change the local port number, or leave the local port number blank.
Query link information. AT^IPOPEN?	OK	No link information is available. Create a link, or accept the link as a server, and then query the link information again.
AT^HTTPCMD=?	^HTTPCMD: (1-5),("GET","POST")	Get the current HTTP command

Scenario	Possible Error Information	Solution
AT^HTTPCMD=1,G ET,http://m2m.hua wei.com:9001/n_in dex.html	+CME ERROR: The link has not been established yet	Run AT^IOPEN to open the link and then perform the download operation.
AT^HTTPCMD=1,P OST,"http://m2m.h uawei.com:9001/cg i- bin/textarea.cgi",20 ,"text/index.html"	+CME ERROR: The link has not been established yet	Run AT^IOPEN to open the link and then perform the upload operation.

5.10.8 HTTP Error Codes

<state code>	<state code> representative's meaning
200	Operation successful
301	Moved permanently
302	Moved temporarily
401	Requested action requires authorization
403	Forbidden
404	Resource not found
405	Method not allowed on resource
406	Requested representation not accepted
408	Request timed out
410	Requested source is no longer available server
500	Internal server error
501	Requested HTTP operation not supported
505	HTTP version not supported

5.11 SMTP Application Scenarios

5.11.1 Creating an SMTP Server Link

Reference Process

Command	Description
AT+IPOPEN=1,"smtp","192.166.63.41",25,, "m2mtest@m2m.huawei.com","M2mhuawei"	An SMTP user is successfully logged in SMTP.
OK	
^IPSRVST: 1,13,235	



NOTE

- Only one SMTP service can be enabled at a time.
- Before an SMTP service is enabled, Internet configuration and SMTP configuration must be completed.
- Use SMTPS because SMTP may impose security risks.

Troubleshooting

Scenario	Possible Error Information	Solution
Create the link. AT+IPOPEN=1,"smtp","192.166.63.41",25,, "m2mtest@m2m.huawei.com","M2mhuawei"	+CME ERROR: The network has not been opened yet	Initialize the internal protocol stack before sending the command to create the link.
	+CME ERROR: The link has been established already	Try to open an already established link.

5.11.2 Sending Mail Through "emsend" Without Attachment

Reference Process

Command	Description
AT+IPOPEN=1,"smtp","192.166.63.41",25,, "m2mtest@m2m.huawei.com","M2mhuawei"	Creates the link.
OK	
^IPSRVST: 1,13,235	
AT+EMSEND=1,"m2mtest@m2m.huawei.com","test with attachment","utf-8",0	Sends mail without attachment.

Command	Description
> <ENTER THE BODY OF THE MAIL> <Press Ctrl+Z to end input> OK ^IPSRVST: 1,14,250	

5.11.3 Sending Mail Through "emsend" with Attachment Using 7 bit

Reference Process

Command	Description
AT^IPOPEN=1,"smtp","192.166.63.41",25,"m2mtest@m2m.huawei.com","M2m huawei"	Creates the link.
OK ^IPSRVST: 1,13,235	
AT^EMSEND=1,"m2mtest@m2m.huawei.com","test with attachment","utf-8",1,"test.txt"	Sends mail with attachment
> <ENTER THE BODY OF THE MAIL> <Press Ctrl+Z to end input> OK ^IPSRVST: 1,14,250	
AT^IPSENDEX=1,2,1500,0	It can send maximum 1500 data at a time. The last parameter i.e. <eof> can be 0 and 1, where 0 means user can send more data and 1 means the last data to be send. This is an example on how to send 3000 bytes of attachment.
^IPSENDEX: 1 OK	

Command	Description
AT^IPSENDEX=1,2,1000,0	Here user has to send 1000 bytes of data. The last parameter is 0, which means not end of file.
^IPSENDEX: 1	
OK	
AT^IPSENDEX=1,2,500,1	Here user has to send 500 bytes of data. The last parameter is 1, which means end of file.
^IPSENDEX: 1	
OK	
^IPSRVST: 1,14,250	

5.11.4 Sending Mail Through "emsend" with Attachment Using base 64

Reference Process

Command	Description
AT^IPOPEN=1,"smtp","192.166.63.41",25,, "m2m test@m2m.huawei.com","M2mhuawei"	Creates the link.
OK	
^IPSRVST: 1,13,235	
AT^EMSEND=1,"m2mtest@m2m.huawei.com","test with attachment", "utf-8",2,"jpgtest.jpg"	Sends mail with attachment using base 64 algorithm.
>	
<ENTER THE BODY OF THE MAIL>	
<Press Ctrl+Z to send>	
OK	
^IPSRVST: 1,14,250	
AT^IPSENDEX=1,2, 4,1	It can send maximum 1500 data at a time. The last parameter i.e. <eof> can be

Command	Description
	0 and 1, where 0 means user can send more data and 1 means the last data to be send.
^IPSENDEX: 1	
OK	
^IPSRVST: 1,14,250	
AT^IPCLOSE=1	Closes the link.
OK	

Troubleshooting

Scenario	Possible Error Information	Solution
Close the specified link. AT^IPCLOSE=<link_id>	+CME ERROR: Normal error	The command is terminated. Run the AT^IPCLOSE command again.
Create the link. AT^IPOPEN=1,"smtp","192.166.63.41",25,, "m2mtest@m2m.huawei.com", "M2mhuawei"	+CME ERROR: The network has not been opened yet	Initialize the internal protocol stack before sending the command to create the link.
	+CME ERROR: The link has been established already	Run AT^IPCLOSE to close the corresponding link. Alternatively, change the link ID and send the command to create the link.
	+CME ERROR: Fail to bind the specified port	Change the local port number, or leave the local port number blank.
Query link information. AT^IPOPEN?	OK	No link information is available. Create a link, or accept the link as a server, and then query the link information again.
AT^SMTPCMD=?	^HTTPCMD: (1-5),("GET","POS")	Get the current HTTP command.

Scenario	Possible Error Information	Solution
AT^EMSEND=1,"m2mtest@m2m.huawei.com", "test with attachment","ut f-8",2,"test.txt"	+CME ERROR: The link has not been established yet	Run AT^IPOPEN to open the link and then perform the download operation.

5.11.5 SMTP Error Codes

<state code>	<state code> representative's meaning
235	Authentication successful
250	Its typical side message is "Requested mail action okay completed": meaning that the server has transmitted a message.
354	The side message can be very cryptic ("Start mail input end <CRLF>.<CRLF>"). It's the typical response to the DATA command.
421	The service is unavailable due to a connection problem: it may refer to an exceeded limit of simultaneous connections, or a more general temporary problem.
450	"Requested action not taken – The user's mailbox is unavailable". The mailbox has been corrupted or placed on an offline server, or your email hasn't been accepted for IP problems or blacklisting.
451	"Requested action aborted – Local error in processing". Your ISP's server or the server that got a first relay from yours has encountered a connection problem.
452	Too many emails sent or too many recipients: more in general, a server storage limit exceeded.
500	A syntax error: the server couldn't recognize the command.
501	Another syntax error, not in the command but in its parameters or arguments.
502	The command is not implemented.
503	The server has encountered a bad sequence of commands, or it requires an authentication.
504	A command parameter is not implemented.
535	Authentication failure
550	It usually defines a non-existent email address on the remote side.

<state code>	<state code> representative's meaning
551	"User not local or invalid address – Relay denied". Meaning, if both your address and the recipient's are not locally hosted by the server, a relay can be interrupted.
552	"Requested mail actions aborted – Exceeded storage allocation": simply put, the recipient's mailbox has exceeded its limits.
553	"Requested action not taken – Mailbox name invalid". That is, there's an incorrect email address into the recipients line.
554	This means that the transaction has failed. It's a permanent error and the server will not try to send the message again.
555	Syntax error

5.12 FTPS, HTTPS and SMTPS in Secure Mode

5.12.1 Creating a Secure Control Link

Preliminary Operations

Before initializing a secure socket and transmitting data over the secure channel, certain preliminary operations need to be performed which are mentioned below.

IP Configuration

SSL requires IP configurations to be done to access the secure server over which data can be transmitted

- To Configure APN

Run: `AT+CGDCONT=1,"IP","mhahuawei1.com"`

Response: `OK`

- To check the APN settings

Run: `AT+CGDCONT?`

Response: `+CGDCONT: 1,"IP","mhahuawei1.com","",0,0`

`OK`

- To get the Signal Strength

Run: AT+CSQ

Response: +CSQ: 28,99

31 is the strongest, 0 is the weakest, and 99 for none.

OK

- To get the registered network

Run: AT+ COPS?

Response: +COPS: 0,0,"Terminal MHA Net",2

OK

SSL and TLS

SSL and TLS are cryptographic protocols used over the Internet to provide secure data communication in client server architecture.

Certificates

The SSL module allows the storage of a server certificate. It is assumed that licensed version of SSL contains certificates that will be unique for each device.

5.12.2 Configuring SSL

Reference Process

- FTPS:

Command	Description
AT^IPINIT="mhahuawei1.com"	Initializes the internal protocol stack.
OK	
AT^SLEN=1,1,1	Enables a secure socket.
OK	
AT^SSLCFG=1,30,0,1	Configures the properties of a secure socket.
OK	
AT^IPOPEN=2,"FTPS","192.166.63.41",990,"username","password"	Creates a secure FTP control link, an FTP user is successfully logged in FTP server.
OK	
^IPSRVST:1,10,230	



NOTE

GET and PUT operations are the same as in normal FTP.

- HTTPS:

Command	Description
AT^IPINIT="mhahuawei1.com"	Initializes the internal protocol stack.
OK	
AT^SLEN=1,1,1	Enables a secure socket.
OK	
AT^SSLCFG=1,30,0,1	Configures the properties of a secure socket.
OK	
AT^IOPEN=3,"HTTPS","m2m.huawei.com",448	Creates a secure HTTP server link, an HTTP user is successfully logged in HTTP server.
OK	



NOTE

GET and POST operations are the same as in normal HTTP

- SMTPS

Command	Description
AT^IPINIT="mhahuawei1.com"	Initializes the internal protocol stack.
OK	
AT^SLEN=1,1,1	Enables a secure socket.
OK	
AT^SSLCFG=1,30,0,1	Configures the properties of a secure socket.
OK	
AT^IOPEN=1,"smtps","192.166.63.41",25,,,"m2mtest@m2m.huawei.com","M2mhuawei"	Creates a secure SMTP server link, an SMTP user is successfully logged in SMTP server.
OK	
^IPSRVST:1,13,235	



NOTE

Sending emails (EMSEND) operation is the same as in normal SMTP.

6

SSL Application Scenarios

6.1 Initializing Secure Services

6.1.1 Reference Process

Command	Description
AT^IPINIT="1234","card","card"	In this example provided in the left column, the APN is 1234 , and the user name and password are both card .
OK	
AT^SSLEN=1,1,1	Enables SSL
OK	
AT^SSLEN?	Queries SSL enable status and obtained IP.
^SSLEN: 1,1,1,"192.167.200.1"	
OK	
AT^SLEN=1,0	Disables SSL
OK	
AT^SSLEN?	
^SSLEN: 1,0,1,"0.0.0.0"	
OK	

6.1.2 Troubleshooting

Scenario	Possible Error Information	Solution
Disabling SSL AT^SLEN=0,0	+CME ERROR: Invalid Operation	AT^SLEN? queries the SSL secure/normal socket enable status. If secure socket is enabled, it is invalid to disable normal socket and vice versa.
Enabling SSL AT^SLEN=1,1	+CME ERROR: Socket not enabled	Initialization has not been performed. Initialize the internal protocol stack and enable SSL.
	+CME ERROR: Socket already enabled	AT^SLEN? queries the SSL enable status. If SSL has been enabled, it does not need to be enabled again.

6.2 Configuring SSL

6.2.1 Reference Process

Command	Description
AT^IPINIT="1234","card","card" OK	Initializes the internal protocol stack.
AT^SLEN=1,1,1 OK	Enables SSL.
AT^SSLCFG=1,60,0,1 OK	Configures the timeout for TX and RX, cipher suites to be sent and authentication mode.
AT^SSLCFG? ^SSLCFG: 1,10,1,0 OK	Queries SSL configurations

6.2.2 Troubleshooting

Scenario	Possible Error Information	Solution
Create a client link AT^SSLCFG=1,60,0,1	+CME ERROR: Invalid Operation	Initialize the internal protocol stack and enable SSL in secure mode before configuring the secure socket link.
	+CME ERROR: Invalid Operation	It is not possible to configure the socket after opening.

6.3 Managing Certificate/Key

6.3.1 Reference Process

Command	Description
AT^IPINIT="1234","card","card" OK	Initializes the internal protocol stack.
AT^SSLEN=1,1,1 OK	Enables SSL
AT^SSLMNG=1,1,0,"ca-crt.pem",1,1,"LS0tLS1CRUdJTlBDRVJUSUZJQ0FURS0tLS0tDQotLS0tLUVORCBDRVJUSUZJQ0FURS0tLS0t" OK	Stores a certificate/key in the file system
AT^SSLMNG=1,1,2,"ca-crt.pem" OK	Loads a certificate/key in to library
AT^SSLMNG=1,1,1,"ca-crt.pem" OK	Deletes a certificate/key from the file system.
AT^SSLMNG? ^SSLMNG: 1,ca-crt.pem 0,client-crt.pem 2,client-key.pem	Queries the last SSLMNG operation performed and gives list of certificates present in the file system.

Command	Description
1,2,"ca-crt.pem",2,3	
OK	


NOTE

- If more than one client and key certificates are available in the file system, then users need to load the corresponding certificate by using **AT^SSLMNG** command with the <action> as 2 (read data) to succeed the hand shake during socket open.
- **AT^SSLMNG** for action 0 (store data) can store a maximum of 10 certificates (10 each for ca-cert, client cert and client key) in file system beyond which it would display error "Certificate maximum limit reached".
- **AT^SSLMNG** for action 2 (read data) can load a maximum of 10 certificates from buffer/file system during a particular session beyond which it would display error "Certificate maximum limit reached".
- **AT^SSLMNG** query command would display first 10 certificates stored in file system for each type (CA, Client, Private Key) of certificates.
- Usage of <password> parameter is applicable in case of "Load" of "Private Key" during client authentication and it is required to set the password if the private key is encrypted. So this password parameter is an optional parameter.
- If SSL is enabled in ASCII data mode then the buffer should be 1024 bytes of raw data.
- <password> is applicable only if <action> is 2 and when loading the private key with password
- It is not required to give the password in every package, but the last package must contain the correct password.

6.3.2 Troubleshooting

Scenario	Possible Error Information	Solution
Manage a certificate AT^SSLMNG=1,1,2,"ca-crt.pem"	+CME ERROR: Invalid Operation	Initialize the internal protocol stack and enable SSL in secure mode.
AT^SSLMNG?	^SSLMNG: OK	After device reset or before any SSLMNG operation is done, if no certificates are present in the file system.

6.4 Creating SSL Links

6.4.1 Reference Process

Command	Description
AT^IPINIT="1234","card","card"	Initializes the internal protocol stack.

Command	Description
OK	
AT^SSLEN=1,1,1	Enables SSL.
OK	
AT^SSLO=1,"192.166.63.41",9900,1,60	Uses a specified IP address to connect to the remote server and establish a SSL link. For the method to create normal link, refer to the AT command document.
OK	
AT^SSLO=1,"www.m2m.server.com",9900,0,60	Uses a specified domain name to connect to the remote server and establish a SSL link.
OK	
AT^SSLO?	Queries link information.
^SSLO: 1,"192.166.63.41",9900,1,60	
OK	

6.4.2 Troubleshooting

Scenario	Possible Error Information	Solution
Create a client link AT^SSLO=1,"192.166.63.41",9900,1,60	+CME ERROR: Socket not enabled	Initialize the internal protocol stack and enable SSL before sending the command to create the link.
	+CME ERROR: Socket already connected	Run AT^SSLC to close the current link.
	+CME ERROR: Invalid Operation	Open the connection with the same SSL id used in AT^SSLEN , or disable SSL and enable with the required SSL id.

6.5 Querying SSL Status

6.5.1 Reference Process

Command	Description
AT^IPINIT="1234","card","card"	Initializes the internal protocol stack.
OK	
AT^SSLEN=1,1,1	Enables SSL.
OK	
AT^SSLO=1,"192.166.63.41",9900,1,60	Creates a secure socket link
OK	
AT^SSLSTAT=1	Queries connections status of secure/normal socket
^SSLSTAT: Secure connection opened	
OK	

6.5.2 Troubleshooting

Scenario	Possible Error Information	Solution
Create a client link AT^SSLO=1,"192.166.63.41",9900,1,60	+CME ERROR: Invalid Operation	Initialize the internal protocol stack and enable SSL before sending the command to create the link.
	+CME ERROR: Invalid Operation	Query the connection status with the same SSL id used in SSLEN, or disable SSL and enable with the required SSL id.

6.6 Sending Data

6.6.1 Reference Process

Command	Description
AT^IPINIT="1234","card","card"	Initializes the internal protocol stack.

Command	Description
OK	
AT^SSLEN=1,1,1	Enables SSL in base64 encoded data mode.
OK	
AT^SSLO=1,"192.166.63.41",9900,1,60	Creates a secure socket link in asynchronous mode
OK	
AT^SSLTX=1,"aGVsbG8=",60	Sends data. In this example, base64 encode data of "hello" i.e. "aGVsbG8=" is sent.
OK	Data is successfully sent and received.
^SSLRX: 5 aGVsbG8=	
AT^SSLTX=1,"aGVsbG8=",60	Sends data in synchronous mode
OK	


NOTE

- If SSL is enabled in base64 encoded data mode then the buffer should be 768 bytes of raw data.
- If SSL is enabled in ASCII data mode then the buffer should be 1024 bytes of raw data.

6.6.2 Troubleshooting

Scenario	Possible Error Information	Solution
Send data AT^SSLTX=1,"aGVsbG8=",60	+CME ERROR: Invalid Operation	Before sending data, initialize the protocol stack and enable SSL.
	+CME ERROR: Socket not connected	Before sending data, create a secure/normal socket link.
	+CME ERROR: Invalid Operation	Send data with the same SSL id used in SSLEN, or disable SSL and enable with the required SSL id.

6.7 Receiving Data

6.7.1 Reference Process

Command	Description
AT^IPINIT="1234","card","card" OK	Initializes the internal protocol stack.
AT^SSLEN=1,1,1 OK	Enables SSL in base64 encoded data mode
AT^SSLO=1,"192.166.63.41",9900,1,60 OK	Creates a secure socket link in asynchronous mode
AT^SSLTX=1,"aGVsbG8=" OK	Sends data. In this example, base64 encode data of "hello" i.e. "aGVsbG8=" is sent.
^SSLRX: 5 aGVsbG8=	Data is successfully sent and received.
AT^SSLTX=1,"aGVsbG8=",60 OK	Sends data in synchronous mode
AT^SSLRX=1,10,60 ^SSLRX: 5 aGVsbG8= OK	Receives data in synchronous mode



NOTE

If SSL is enabled in base64 encoded data mode then the length of the received data will differ from displayed received data length, because the received data is in base64 encoded format.

6.7.2 Troubleshooting

Scenario	Possible Error Information	Solution
Send data AT^SSLRX=1,1024,60	+CME ERROR: Invalid Operation	Before receiving data, initialize the protocol stack and enable SSL.

Scenario	Possible Error Information	Solution
	+CME ERROR: Socket not connected	Before receiving data, create a secure/normal socket link.
	+CME ERROR: Invalid Operation	Receive data with the same SSL id used in SSLEN, or disable SSL and enable with the required SSL id.
	+CME ERROR: Invalid Operation	If socket has been opened in asynchronous mode, SSLRX command is not allowed. Open socket in synchronous mode and receive data.

6.8 Closing SSL

6.8.1 Reference Process

Command	Description
AT^IPINIT="1234","card","card"	Initializes the internal protocol stack.
OK	
AT^SSLEN=1,1,1	Enables SSL in base64 encoded data mode
OK	
AT^SSLO=1,"192.166.63.41",9900,1,60	Creates a secure socket link
OK	
AT^SSLC=1	Closes the link
OK	

6.8.2 Troubleshooting

Scenario	Possible Error Information	Solution
Closing socket AT^SSLC=1	+CME ERROR: Invalid Operation	Before closing the socket, initialize the protocol stack and enable SSL.



Scenario	Possible Error Information	Solution
	+CME ERROR: Socket not connected	Before closing the socket, create a secure/normal socket link.
	+CME ERROR: Invalid Operation	Close the socket with the same SSL id used in SSLO.

7

ECM Application Scenarios

7.1 Dialing ECM

7.1.1 Reference Process

Command	Description
AT^NDISDUP=?	Checks the parameter range supported by the command.
^NDISDUP: (1–11),(0–1)	
OK	
AT^NDISDUP=1,1,"1234"	Sets up a dial-up connection using the APN provided by the network server. "1234" is an example.
OK	The command is successfully executed.
^NDISSTAT: 1,,,IPV4	Reports the dial-up connection state.
AT^NDISDUP=1,1,"4321","huawei","huawei",1	Sets up a dial-up connection using the account, password, and authentication mode provided by the network server.
OK	The command is successfully executed.
^NDISSTAT: 1,,,IPV4	Reports the dial-up connection state.

The process of obtaining the IP address:

1. After the dial-up is successful, the module will establish the DHCP service automatically.
2. The PC driver will get the dial-up state and send <net_ready> state to the network manage.
3. The network manager sends the DHCP service discover.

4. The module responses the service discover, and then sends the IP and DNS address which is obtained from the PDP active process to the network managing device.

7.1.2 Troubleshooting

Scenario	Possible Error Information	Solution
AT^NDISDUP=1,1,"1234"	+CME ERROR: SIM failure	No SIM card is detected. Insert a SIM card.
AT^NDISDUP=1,1,"4321","huae","huawei",1	OK ^NDISSTAT: 0,33,,IPV4 ^NDISEND:1,29	NDISEND indicates the failure reason during the dial-up. 29 indicates that the authenticated information is not correct.
AT^NDISDUP=1,1,"abcd"	OK ^NDISSTAT: 0,33,,IPV4 ^NDISEND:1,33	NDISEND indicates the failure reason during the dial-up. 33 indicates that request service is not subscribed. In this case, the network don not support this APN "abcd".

7.2 Querying the Dial-up Connection State

7.2.1 Reference Process

Command	Description
AT^NDISSTATQRY?	Queries the dial-up connection state.
^NDISSTATQRY: 0,0,,IPV4	Reports the connection is not set up.
OK	
AT^NDISSTATQRY?	Queries the dial-up connection state.
^NDISSTATQRY: 1,,,IPV4	Reports the connection is set up.
OK	



7.2.2 Troubleshooting

None

7.3 Disconnecting the Dial-up Connection

7.3.1 Reference Process

Command	Description
AT^NDISDUP=1,0	Disconnects the dial-up connection.
OK	The command is successfully executed.
^NDISSTAT:0,0,,IPV4	IPv4 changes from the connected state to the disconnected state.

7.3.2 Troubleshooting

None

8 Voice and Supplementary Service Application Scenarios

8.1 Pre-configuration

8.1.1 Reference Process

Command	Description
AT^CPCM=0,0,0,0,0 or AT^CPCM=0,1,0,0,0	Sets the PCM voice channel as the master mode. The module generates 2.048 MHz clock signals and 8 KHz short synchronization signals. Data is in 16 bit Linear format. Indicates the data is in 8 bit μ -Law format.
OK	
AT^SMUT=0	Unmutes the receive channel.
OK	

8.2 Voice Call Handling

8.2.1 Reference Process

Command	Description
ATD13912345678;	User 1 makes a voice call to 13912345678.
OK	
^ORIG: 1,0	User 1 presents the ^ORIG indication.
^CONF: 1	User 2 receives the indication.

Command	Description
RING	
ATA	User 2 answers the call.
OK	
^CONN: 1,0	User 2 presents the ^CONN indication.
^CONN: 1,0	User 1 presents the ^CONN indication.
AT+CHUP	User 1 hangs up
OK	User 1 presents ^CEND to indicate that it has ended the call.
^CEND: 1,6,29,16	User 1 presents the ^CEND indication.
(User 2) ^CEND: 1,6,104,16	User 2 presents ^CEND to indicate that it has ended the call.

8.2.2 Troubleshooting

Scenario	Possible Error Information	Solution
Make a voice call when no network is found.	Presents ^CEND.	Make the call after the network is found.
The PIN is not authenticated.	+CME ERROR: SIM PIN required	Enter the correct PIN.

8.3 DTMF Application

8.3.1 Reference Process

Command	Description
ATD10086;	The user dials 10086.

Command	Description
OK	
^ORIG: 1,0	
^CONF: 1	
^CONN: 1,0	Indicates that the call is connected.
AT+VTS=1	Following the voice instructions, sends a DTMF tone to select option 1 to enter the sub-option of querying the local area to which the module belongs.
OK	
AT+VTS=3	Sends a DTMF tone to select option 3.
OK	
AT+CHUP	The user hangs up.
OK	
^CEND: 1,6,29,16	Indicates that user ends the call.

8.3.2 Troubleshooting

Scenario	Possible Error Information	Solution
Make a voice call when no network is found.	Presents ^CEND .	Make the call after the network is found.
The PIN is not authenticated.	+CME ERROR: SIM PIN required	Enter the correct PIN.

8.4 ID Presentation

8.4.1 Reference Process

- Caller ID presentation:

Command	Description
AT+CLIP=1	User 1 enables the calling line identification presentation (CLIP) indication.

Command	Description
OK	
AT+CLIP?	User 1 queries the CLIP indication.
+CLIP: 1,1	
OK	
ATD13903710616;	User 2 calls user 1 whose number is 13903710616.
OK	
^ORIG: 1,0	User 2 presents the ^ORIG indication.
^CONF: 1	User 2 presents the ^CONF indication.
(User 1) RING	User 1 presents the +CLIP indication.
+CLIP: "+8613903702766",145,,,,0	User 1 presents the +CLIP indication every 5 seconds. User 2's number is 13903702766.
.....	


NOTE

All the previous actions can be performed only when user 1 has subscribed to CLIP.

- Caller ID presentation restriction:

Command	Description
AT+CLIP=1	User 1 enables the CLIP indication.
OK	
AT+CLIR?	User 2 queries the calling line identification restriction (CLIR).
+CLIR: 0,1	User 2 subscribes to permanent CLIR.
OK	
ATD13903710616;	User 2 calls user 1 whose number is 13903710616.

Command	Description
OK	
^ORIG: 1,0	User 2 presents the ^ORIG indication.
^CONF: 1	User 2 presents the ^CONF indication.
(User 1)	User 1 presents the +CLIP indication.
RING	User 1 presents the +CLIP indication every 5 seconds.
+CLIP: "",128,,,,,1	


NOTE

All the previous actions can be performed only when user 1 has subscribed to CLIP and user 2 has subscribed to permanent CLIR.

Command	Description
AT+CLIP=1	User 1 enables the CLIP indication.
OK	
AT+CLIR=2	User 2 has subscribed to CLIR.
OK	
AT+CLIR?	User 2 queries the CLIR.
+CLIR: 2,4	
OK	
ATD13903710616;	User 2 calls user 1 whose number is 13903710616.
OK	
^ORIG: 1,0	User 2 presents the ^ORIG indication.
^CONF: 1	User 2 presents the ^CONF indication.
(User 1)	User 1 presents the +CLIP indication.
RING	User 1 presents the +CLIP indication every 5 seconds. User 2's number is 13903702766.
+CLIP: "+8613903702766",145,,,,,0	

8.4.2 Troubleshooting

Scenario	Possible Error Information	Solution
Make a voice call when no network is found.	Presents ^CEND.	Make the call after the network is found.
The PIN is not authenticated.	+CME ERROR: SIM PIN required	Enter the correct PIN.

8.5 Call Forwarding

8.5.1 Reference Process

Command	Description
AT+CCFC=0,3,"13903710453",129,1	User 1 subscribes to the service of forwarding all calls to user 3 whose number is 13903710453.
OK	
AT+CCFC=0,2	User 1 queries the CCFC status.
+CCFC: 1,1,"+8613903710453",145,,,	
OK	
ATD13903702766;	User 2 calls user 1 whose number is 13903702766.
OK	
(User 3) RING	Instead of user 1, user 3 presents the ring indication.



NOTE

The previous actions are based on call forwarding without any restrictions. Those actions can be performed only after the user has subscribed to the call forwarding service.

Command	Description
AT+CCFC=1,3,"13903710453",129,1	User 1 subscribes to the service of forwarding busy calls to user 3 whose number is 13903710453.
OK	

Command	Description
AT+CCFC=0,2	User 1 queries the CCFC status.
+CCFC: 1,1,"+8613903710453",145,,,	
OK	
(User 1) ATD13903711234;	User 1 calls user 4 (13903711234), and user 4 answers the call.
OK	
^ORIG: 1,0	
^CONF: 1	
^CONN: 1,0	
(User 2) ATD13903702766;	User 2 calls user 1
OK	
^ORIG: 1,0	
^CONF: 1	
(User 3) RING	Forwards the call when busy. User 3 presents the Ring indication, while user 1 presents no indications.


NOTE

The previous actions are based on call forwarding without any restrictions. Those actions can be performed only after the user has subscribed to the call forwarding service.

8.5.2 Troubleshooting

Scenario	Possible Error Information	Solution
Make a voice call when no network is found.	Presents ^CEND .	Make the call after the network is found.
The PIN is not authenticated.	+CME ERROR: SIM PIN required	Enter the correct PIN.
The user has not subscribed to the call forwarding service.	Network reject	Subscribe to the call forwarding service.

8.6 Call Waiting

8.6.1 Reference Process

Command	Description
AT+CCWA=1,1,1	The User 1 activates the call waiting function and enables the +CCWA indication.
OK	
(User 1) ATD13903702766;	The User 1 calls User 2.
OK	
(User 2) ATA	The User 2 answers the call.
OK	
^CONN: 1,0	The User 2 presents ^CONN: 1,0 .
(User 1) ^CONN: 1,0	Then User 1 presents ^CONN: 1,0 .
(User 1) AT+CHLD=2	The User 1 maintains the call between the convener and User 2.
OK	
(User 1) ATD13903710453;	The User 1 calls User 3.
OK	
(User 3) ATA	The User 3 answers the call.
OK	
^CONN: 1,0	The User 3 presents ^CONN: 1,0 .
(User 1) ^CONN: 2,0	Then User 1 presents ^CONN: 2,0 .
(User 1) AT+CLCC	The User 1 queries the call status.

Command	Description
+CLCC: 1,0,1,0,0,"13903702766",129	
+CLCC: 2,0,0,0,0,"13903710453",129	
OK	


NOTE

- The previous actions are based on call hold without any restrictions. Those actions can be performed only after the user has subscribed to the call hold service.
- User 1 number: 13903710616.
- User 2 number: 13903702766.
- User 3 number: 13903710453.

8.6.2 Troubleshooting

Scenario	Possible Error Information	Solution
Make a voice call when no network is found.	Presents ^CEND .	Make the call after the network is found.
The PIN is not authenticated.	+CME ERROR: SIM PIN required	Enter the correct PIN.
The user has not subscribed to the call waiting or call holding service.	+CME ERROR: network rejected request	Subscribe to the required service.

8.7 Call Restriction

8.7.1 Reference Process

Command	Description
AT+CPWD="AO","0000","1111"	Modifies the call restriction password.
OK	
(User 1) AT+CLCK="AO",1,"1111",1	User 1 activates the barring of all outgoing calls (BAOC) service.
OK	
(User 1) AT+CLCK="AO",2	User 1 queries the BAO service.

Command	Description
+CLCK: 1,1	The returned result indicates that the BAOC service has been activated.
OK	
(User 1) ATD13903710453;	User 1 calls user 2.
OK	User 1 returns OK .
^ORIG: 1,0	User 1 presents the ^ORIG indication.
^CONF: 1	User 2 presents no indication.
^CEND: 1,0,100,21	
(User 1) AT+CLCK="AO",0,"1111",1	User 1 deactivates the BAOC service.
OK	
(User 1) ATD13903710453;	User 1 calls user 2.
OK	User 1 returns OK .
^ORIG: 1,0	User 1 presents the ^ORIG indication.
^CONF: 1	User 1 presents the ^CONF indication.
(User 2) RING	User 2 presents the ring indication.
(User 1) AT+CLCK="AI",1,"1111",1	User 1 activates BAIC service.
OK	
(User 1) AT+CLCK="AI",2	User 1 queries the BAIC service.
+CLCK: 1,1	User 1 returns the response indicating that the BAIC service is deactivated.
OK	

Command	Description
(User 2) ATD13903710426;	User 2 calls user 1.
OK	User 2 returns OK
^ORIG: 1,0	User 2 presents the ^ ORIG indication.
^CONF: 1	User 2 presents the ^ CONF indication.
^CEND: 1,0,100,21	User 2 presents the ^ CEND indication. User 1 presents no indication.
(User 1) AT+CLCK="AI",0,"1111",1	User 1 deactivates the BAIC service.
OK	
(User 2) ATD13903710426;	User 2 calls user 1.
OK	User 2 returns OK
^ORIG: 1,0	User 2 presents the ^ ORIG indication.
^CONF: 1	User 2 presents the ^ CONF indication.
(User 1) RING	User 1 presents the ring indication.


NOTE

- The user must subscribe to the call restriction service provided by the network operator. The right to use the call restriction service can be guaranteed or canceled by the operator only.
- User 1 number: 13903710426.
- User 2 number: 13903710453.

8.7.2 Troubleshooting

Scenario	Possible Error Information	Solution
Make a voice call when no network is found.	Presents ^CEND.	Make the call after the network is found.
The PIN is not authenticated.	+CME ERROR: SIM PIN required	Enter the correct PIN.

8.8 Debug the Audio Quality

8.8.1 Reference Process

Command	Description
AT+CMIC=5 OK	Sets the microphone gain to 5.
AT+CLVL=5 OK	Sets the speaker gain to 5.
AT^NSSWITCH=1 OK	Enables noise suppression.
AT^STN=1 OK	Enables sidetone.
AT^ECHOEX=1,320,0,86,4096 OK	Enables echo suppression.
AT^PCMFR="010001000D004800C2FFF3FEC1 FFB6FF2DFEE9FC20F931FC3DFACBE8CE0F FF7F0000000000000000000000000000 00000000000000000000000000000000 00000000000000000000000000000000 00000000000000000000000000000000 00000000000000000000000000000000"	Sets frequency response.
OK	



NOTE

- Make sure the modem's microphone and speaker gains are appropriate. If the gain is too small, the volume will be low. If the gain is too large, saturated distortion will occur. To adjust the uplink and downlink gains, both the codec's and modem's gains must be set.



- It is recommended that noise suppression be enabled.
- Sidetone is the playback of what's input by the modem's microphone through the modem's speaker. It is recommended that sidetone be enabled in headset mode and disabled in handsfree mode.
- It is recommended that echo suppression be enabled. (By default, the modem provides better echo suppression in handsfree mode than in headset mode.)
- If the uplink or downlink voice tone is distorted, use input and output devices and codec to run **AT^PCMR** to adjust the modem's frequency response settings.

8.8.2 Troubleshooting

Scenario	Possible Error Information	Solution
NSSWITCH, STN, ECHOEX, and PCMR failed to be set.	Presents Error.	The setting is available only when the modem is not in a call.

9

Text Message Application Scenarios

9.1 Pre-configuration

9.1.1 Reference Process

Command	Description
AT+CPMS=? +CPMS: ("SM"),("SM"),("SM") OK	Queries the types of supported storage.
AT+CPMS="SM","SM","SM" +CPMS: 3,40,3,40,3,40 OK	For details about the parameters, refer to HUAWEI MU709 Series HSPA+ Module AT Command Interface Specification . It is recommended to keep the three types of storage consistent.
AT+CPMS? +CPMS: "SM",3,40,"SM",3,40,"SM",3,40 OK	Queries the current storage type, used storage space and maximum storage capacity.

9.1.2 Troubleshooting

Scenario	Possible Error Information	Solution
Error information is returned in response to one of the previous commands.	+CME ERROR: SIM PIN required	Enter the correct PIN.
	+CMS ERROR: 500	SIM card initialization has not completed. Try again later.
	ERROR	Unsupported storage.

9.2 Sending English Text Messages in PDU Format

9.2.1 Reference Process

Command	Description
AT+CMGF=0	Sets the message format to PDU format (see the note).
OK	
AT+CMGS=21 >0891683108608805F911000 B813109730137F10000FF07E DF27C1E3E9701 \0x1A	Sends a text message using PDU of 21 bytes in length (excluding the service center number 0891683108608805F9). The message content is "message". Presses ctrl+z (0x1A) to stop entering message content and send the message.
+CMGS: 4	The message is successfully sent. <TP-MR> is returned. For details about <TP-MR>, refer to the 3GPP TS 23040.
OK	
AT+CMGS=10 >0891683108608805F911000 B813109730137F10008FF067 7ED6D88606F \0x1A	Sends a text message using PDU of 20 bytes in length (excluding the service center number 0891683108608805F9). The message content is "短消息". Presses ctrl+z (0x1A) to stop entering message content and send the message.
+CMGS: 5	The message is successfully sent.
OK	



NOTE

For details about the structure of a PDU packet, refer to the 3GPP TS 23.040.

9.2.2 Troubleshooting

Scenario	Possible Error Information	Solution
Error information is returned in response to one of the previous commands.	+CMS ERROR: 500	The text message cannot be sent because of network errors, incorrect service center number, or other errors. Resend the message.
	+CMS ERROR: 304	Incorrect PDU packet content.

9.3 Sending Chinese Character Text Messages in Text Format

9.3.1 Reference Process

Command	Description
AT+CMGF=1 OK	Sets the message format to Text format.
AT+CSMP=,,0,8 OK	Sets the data coding scheme to UCS2.
AT+CSCA="8613800688509",145 OK	Sets the service center number.
AT+CSCS="UCS2" OK	Sets the TE's character set to UCS2 encoding.
AT+CMGS="00310033003300310032003300340035003600370038"> 534E4E3A \0x1A	Sends the message to the destination address "13312345678" that must be enclosed in double quotation marks. The message content is the UCS2 codes for the Chinese characters "华为". Presses ctrl+z (0x1A) to stop entering message content and send the message.
+CMGS: 6 OK	The message is successfully sent.
AT+CSMP=,,0,0	Sets the data coding scheme to GSM 7bit.

Command	Description
OK	
AT+CSCS="GSM"	Sets the TE's character set to GSM 7bit encoding.
OK	
AT+CMGS="13312345678" >huawei \0x1A	Sends the message to the destination address "13312345678" that must be enclosed in double quotation marks. The message content is the UCS2 codes for the Chinese characters "华为". Presses ctrl+z (0x1A) to stop entering message content and send the message.
+CMGS: 7	The message is successfully sent.
OK	

9.3.2 Troubleshooting

Scenario	Possible Error Information	Solution
Error information is returned in response to one of the previous commands.	+CMS ERROR: 305	The message content does not comply with the encoding scheme specified by AT+CSMP .
	+CMS ERROR: INVALID TXT Param	The message content specified by AT+CMGS is invalid.

9.4 Receiving Text Messages

9.4.1 Reference Process

Command	Description
AT+CNMI=2,1,0,0,0	Stores the message on the SIM card or ME, and presents the new message indication.
OK	Presents the storage and location without solicitation.
+CMTI: "SM",4	

Command	Description
AT+CNMI=1,2,0,0,0	Receives and directly presents the message instead of storing it.
OK +CMT: "+8613312345678",,"12/05/05,18:10:36+00" huawei	Directly presents the message instead of storing it. In this example, the message is in Text mode. In PDU mode, PDU packets are presented.
^SMEMFULL: "SM"	Presents an indication, without solicitation, when the message storage is full.
AT+CMGR=4	Reads the message stored in index 4.
+CMGR: "REC UNREAD","+8613312345678",,"12/05/17,16:13:08+00" huawei	
OK	
AT+CMGL="ALL"	In Text mode, lists all the messages in the current storage.
+CMGL: 2,"REC READ","+8613903710742",,"12/05/17,16:12:30+00" test1 +CMGL: 3,"REC READ","+8613903710742",,"12/05/17,16:13:08+00" test2	
OK	
AT+CMGL=0	In PDU mode, lists all the received unread messages.
+CMGL: 1,0,,25 0891683108608805F9040D91683109730147F200002150716172350005F4F29C4E03	
OK	
AT+CMGD=1	Deletes the messages stored in index 1.
OK	
AT+CMGD=1,4	Deletes all the messages in the current storage.
OK	

9.4.2 Troubleshooting

Scenario	Possible Error Information	Solution
Error information is returned in response to one of the previous commands.	ERROR	In Text mode, run AT+CMGL=4 (number), or in PDU mode, run AT+CMGL="ALL" (string), and ERROR is returned.
	+CMS ERROR: 500	During SIM card initialization, run AT+CMGL or AT+CMGD to read or delete a message, and an error is returned.

9.5 Segmenting and Reassembling Long Text Messages

9.5.1 Segmenting

In PDU mode, text messages can be encoded using GSM 7-bit, 8-bit or UCS2. The GSM 7-bit encoding scheme is used to encode common ASCII characters, compressing every 8 characters into 7 characters. The GSM 8-bit encoding scheme is usually used to encode data such as pictures and ringtones. The UCS2 encoding scheme is used to encode Unicode characters. According to the existing 3GPP protocols, the size of the user data contained a PDU is 140 bytes. Therefore, the maximum number of characters contained in a single message is 160, 140 and 70 for the GSM 7-bit, 8-bit, and UCS2 encoding schemes respectively. If the number of characters contained in a text message exceeds the maximum number, the message will be segmented into several messages. An English letter, a Chinese character, or a byte of data is considered as a character.

According to the existing 3GPP protocols, after a long text message is segmented, the number of characters that each message segment can contain is as follows:

- GSM 7-bit encoding: 153 characters
- GSM 8-bit encoding: 134 characters
- UCS2 encoding: 67 characters

The number of available characters per segment is lower, because each segment must contain segmentation information.

The storage space occupied by a character is as follows:

- GSM 7-bit encoding: 7 bits
- GSM 8-bit encoding: 8 bits
- UCS2 encoding: 16 bits

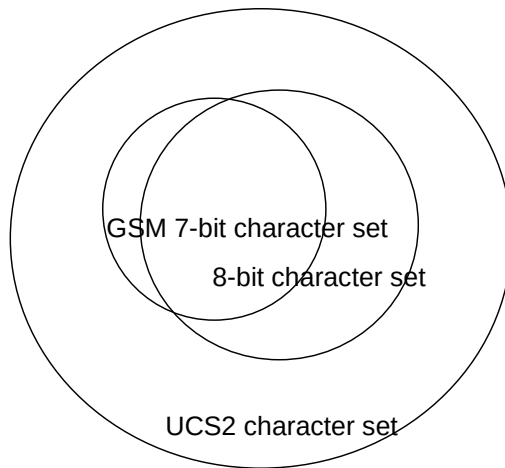
The storage space occupied by a segment of a long text message is as follows:

- GSM 7-bit encoding: 153 bits x 7 = 1071 bits

- GSM 8-bit encoding: $134 \text{ bits} \times 8 = 1072 \text{ bits}$
- UCS2 encoding: $67 \text{ bits} \times 16 = 1072 \text{ bits}$

For all the three encoding schemes, a short message occupies a maximum of 1120 bits (160×7 , 140×8 , or 70×16) in the storage. If a text message's size is larger than 1120 bits, the message is a long message.

Figure 9-1 Relationships between character sets



Relationships between character sets

9.5.2 Reassembling

The host applications can reassemble the segments of a long text based on the following:

- The protocol header in the user data (TP-UD) of a PDU (see the 3GPP TS 23.040 9.2.3.24.1)
- The sender's number contained in each segment
- The interval between the time when each segment is received. (The interval between the two neighboring segments' receiving time is less than 60 seconds, and the maximum interval between the first and the last segments' receiving time is 24 hours)

10 Phonebook Application Scenarios

10.1 Memory Operations

10.1.1 Reference Process

Command	Description
AT+CPBS=? +CPBS: ("SM","EN","ON") OK	Queries the current storage type.
AT+CPBS="SM" OK	Sets the current storage type to "SM".
AT+CPBS? +CPBS: "SM",241,250 OK	241 indicates that 241 entries have been stored in the storage. 250 indicates that the maximum storage capacity of the current storage ("SM") is 250 entries.

10.1.2 Troubleshooting

Scenario	Possible Error Information	Solution
Error information is returned in response to one of the previous commands.	+CME ERROR: SIM busy	Phonebook initialization has not completed. Try again later.
	+CME ERROR: SIM PIN required	Enter the correct PIN.
	+CME ERROR: SIM PUK required	Enter the correct PUK.

10.2 Setting the TE's Character Sets and Reading/Writing Phonebook Entries

10.2.1 Reference Process

Command	Description
AT+CSCS=?	Queries the character sets supported by the UE.
+CSCS: ("IRA","GSM","UCS2")	
OK	
AT+CSCS?	Queries the current character set.
+CSCS: "IRA"	
OK	
AT+CPBR=1	Reads the first phonebook entry. The TE character set is the International Reference Alphabet (IRA). The content of the first entry's name field is "HUAWEI".
+CPBR: 1,"0123456789",129,"HUAWEI"	
OK	
AT+CSCS="UCS2"	Sets the TE's character set to UCS2 alphabet.
OK	
AT+CPBW=1,"0123456789",129,"004800550041005700450049"	The character set is the UCS2 alphabet. The content of the phonebook entry's name field is 004800550041005700450049, which is "HUAWEI" in the IRA.
OK	
AT+CPBR=1	Reads the first phonebook entry. The TE character set is UCS2 alphabet. The content of the first entry's name field is 004800550041005700450049 ("HUAWEI" in the IRA).
+CPBR: 1,"0123456789",129,"004800550041005700450049"	
OK	
AT+CPBR=<index1>,<index2>	Reads all entries stored in locations between index 1 and index 2 (including index 1 and index 2).

Command	Description
+CPBR: <index1>,<number>,<type>,<text>	
+CPBR: <index>,<number>,<type>,<text>	
.....	
+CPBR: <index2>,<number>,<type>,<text>	
OK	

10.2.2 Troubleshooting

Scenario	Possible Error Information	Solution
Error information is returned in response to one of the previous commands.	+CME ERROR: SIM busy	Phonebook initialization has not completed. Try again later.
	+CME ERROR: SIM PIN required	Enter the correct PIN.
	+CME ERROR: SIM PUK required	Enter the correct PUK.
Error information is returned when writing an entry into the phonebook.	+CME ERROR: dial string too long	Check that the phone number is not too long.
Error information is returned in response to one of the previous commands.	+CME ERROR: invalid index	Check that the location index and phone number type are valid.
Error information is returned when writing an entry into the phonebook.	+CME ERROR: invalid characters in dial string	The phone number to be written into the phonebook contains invalid characters. Delete the invalid characters and try again.
Execute the following command after the storage is full. AT+CPBW=1,"0123456789",129,"004800550041005700450049"	+CME ERROR: memory full	The storage is full. Delete some entries and try again.

Scenario	Possible Error Information	Solution
Error information is returned in response to one of the previous commands.	+CME ERROR: SIM busy	Phonebook initialization has not completed. Try again later.
	+CME ERROR: SIM PIN required	Enter the correct PIN.
	+CME ERROR: SIM PUK required	Enter the correct PUK.
Read the specified phonebook entries in the current storage locations. AT+CPBR=<index1>	+CME ERROR: invalid index	The index is invalid. Check that index 1 is within the supported range
Read the phonebook entries within the specified range in the current storage locations. AT+CPBR=<index1>,<index2>	+CME ERROR: invalid index	The index is invalid. Check that index 1 and index 2 are within the supported range and that index 1 is not greater than index 2.
No phonebook entries are found in the current storage locations. AT+CPBR=<index1>	+CME ERROR: not found	No entries are found in the storage locations in index 1. Check that there have been entries successfully written into these locations.
No phonebook entries within the specified range are found in the current storage locations. AT+CPBR=<index1>,<index2>	+CME ERROR: not found	No entries are found in the storage locations between index 1 and index 2. Check that there have been entries successfully written into these locations.

10.3 Querying User Number

10.3.1 Reference Process

Command	Description
AT+CPBS="ON"	
OK	
AT+CPBW=1,"+8613987654321",145,"CC"	Sets the subscriber number step1.
OK	
AT+CPBW=2,"123",129,"USER"	Sets the subscriber number step2.
OK	
AT+CNUM	Queries the subscriber number.
+CNUM: "CC", "+8613987654321",145	
+CNUM: "USER", "123",129	
OK	

10.3.2 Troubleshooting

Scenario	Possible Error Information	Solution
Error information is returned in response to one of the previous commands.	+CME ERROR: SIM busy	Phonebook initialization has not completed. Try again later.
	+CME ERROR: SIM PIN required	Enter the correct PIN.
	+CME ERROR: SIM PUK required	Enter the correct PUK.

11 SIM Operation Application Scenarios

11.1 PIN Operations

11.1.1 Reference Process

Command	Description
AT+CLCK="SC",1,"<pwd>"	Enables PIN authentication. (<pwd> specifies the PIN. See notes.)
OK	
AT+CPIN="<pwd>"	Requests the PIN after the module restarts.
OK	
AT+CPWD="SC","<oldpwd>","<newpwd>"	Changes the PIN (<newpwd> will be the new PIN).
OK	



NOTE

- After PIN authentication is enabled using **AT+CLCK**, the module must be restarted for the change to take effect.
- Either **AT^CPIN** or **AT+CPIN** can be used to authenticate the PIN.
- In general cases, three incorrect PIN entry attempts in succession will lock the PIN, and 10 attempts will lock the PUK. If the PIN is locked, a PUK is required to unlock the PIN. If the PUK is locked, the SIM card will be unusable and cannot be recovered.

11.1.2 Troubleshooting

Scenario	Possible Error Information	Solution
Enable PIN authentication. AT+CLCK="SC",1,"<pwd>"	+CME ERROR: operation not allowed	If PIN authentication has been enabled, it cannot be enabled again. Check whether PIN authentication has been enabled.

Scenario	Possible Error Information	Solution
Enter the PIN. AT+CPIN="<pwd>"	+CME ERROR: incorrect password	Enter the correct PIN. The original PIN is provided by the operator.
	+CME ERROR: SIM PUK required	Incorrect PINs have been entered three times and the SIM card is blocked. Run AT+CPIN="<PUK>","<pwd>" to enter the PUK to unblock the SIM card. The PUK is provided by the operator and cannot be changed by users. If incorrect PUKs are entered 10 times, the SIM card will be permanently blocked.
Change the PIN. AT+CPWD="SC","<oldpwd>","<newpwd>"	+CME ERROR: incorrect password	<oldpwd> must be the current PIN. Like the PIN authentication, if incorrect PINs are entered three times, the PUK will be required. If incorrect PUKs are entered 10 times, the SIM card will be permanently blocked.

11.2 CRSM Command

11.2.1 Reference Process

Command	Description
AT+CRSM=176,12258,0,0,10	Reads the file EFiccid with a transparent structure. (12258 is 0X2FE2, the EF _{ICCID} file's FID).
+CRSM: 144,0,"<record>"	After the command is processed successfully, the EF _{ICCID} file's content (<record>) is returned.
OK	
AT+CRSM=178,28476,1,4,176,,7 F10"	Uses an absolute path to read the first entry from the EF _{SMS} file on the SIM card's DF _{TELECOM} folder.
+CRSM: 144,0,"<record>"	<record> is the content of the first entry. The length of <record> is 176 bytes.
OK	

Command	Description
AT+CRSM=192,12258	Gets response of EF _{ICCID} .
+CRSM: 144,0,"<response>"	<response> is the response data of EF _{ICCID} . For details about <response>, refer to the ETSI TS 102.221 protocol.
OK	
AT+CRSM=214,28421,0,0,2,"0012"	Updates the content of the transparent structure EF _{LI} file on the SIM card.
+CRSM: 144,0,""	Updates succeeded.
OK	
AT+CRSM=220,28476,1,4,176,"1111","7F10"	Updates the content of the linear fixed structure EF _{SMS} file on the SIM card.
+CRSM: 144,0,""	Updates succeeded.
OK	
AT+CRSM=242	Obtains the current directory information.
+CRSM: 144,0,"<status>"	<status> indicates the current directory status.
OK	



NOTE

- To read or update a file, appropriate commands must be used according to the file's structure type (for details, refer to the description of file properties in the 3GPP TS 31.102 protocol). For transparent structure files, use 176 (Read Binary) and 214 (Update Binary). For linear fixed structure files, use 178 (Read Record) and 220 (Update Record).
- If <pathid> is not contained in the command, the module will prefer to access the files with the same FID in the current directory.
- Files can be accessed only when the access criteria are met. Otherwise the SIM card will return PSWs indicating that the access authentication failed. If an EF file's read privilege is PIN protected and the module does not have the PIN authenticated, PSWs indicating that the access authentication failed will be returned after the **AT+CRSM** command is used to read the EF file.
- To use the **AT+CRSM** command to access the file content on the SIM card, the parameters contained in the command must strictly meet the requirements in the ETSI TS 102.221 and 3GPP TS 31.102 protocol. For detailed requirements, refer to the protocol.

11.2.2 Troubleshooting

Scenario	Possible Error Information	Solution
Update the content of the linear fixed structure EFsms file on the SIM card. AT+CRSM=178,12258,0,0,10	+CRSM: 105,129,"" OK	The status word (SW) indicates a Read command error occurred. Files with a transparent structure should be read using 176 (READ BINARY).
Update the content of the linear fixed structure EFsms file on the SIM card. AT+CRSM=220,28476,1,4,176,"1111","7F10"	+CRSM: 105,130,"" OK	The PSW indicates that the security conditions were not met. To update the EFsms file, the correct PIN is required.

12 Sleeping and Waking Up Application Scenarios

As an embedded component in the host, the module also consumes power, which increases the power consumption of the integrated product. Therefore, the most important task of power management is to reduce the power consumption of the integrated product by enabling the module's sleep mode when necessary.

The host and the module need to wake each other up from sleep if communication is required. Therefore, another task of power management is to provide a wake-up control mechanism for the host and module.

Power management involves three parts: the host system software (including the USB driver/GPIO driver/sleep mechanism functions), connection hardware between the host and module, and the module's software wake-up mechanism.

This chapter is mainly concerned with the module's software wakeup mechanism, including the wake-up principle, how USB related events impact on the waking up of the module and remotely waking up the module, and how the module remotely wakes up the host.

This chapter briefly describes the power management related connection hardware between the host and module.

This chapter does not describe the host system software. For example, if the host runs on a Windows or Mac system, Huawei will provide a USB driver program corresponding to the module. If the host runs on an Android system, Huawei will provide [Guide to Kernel Driver Integration in Linux for Huawei Modules](#) for users to configure the USB-based wakeup function of the module.

This document describes typical module application scenarios. A host can be designed based on the actual system features and the application scenarios of the module to reduce power consumption of both the module and integrated product.

After the host is designed as recommended by this document, the module's power consumption and the whole unit's power consumption can meet the performance requirements. For details, see related description in the product manual.

12.1 Hardware Interfaces

The module communicates with the host using mainly USB. For details about pins related to power management, see Table 12-1 .

For corresponding interface numbers, reference design, and sequence diagram for the pins, see [Hardware Guide](#) for each product.

Table 12-1 Power management related pins

Interface	Pin Name	Input/Output	Description
WAKEUP_OUT	Output	When a wake-up source (see section 12.3.5) arrives, these pins output a high-level-voltage pulse lasting for 1s during which if other wake-up sources arrive, the module will ignore the later wake-up requests. In other words, the module will not output a second pulse during this 1s.	Figure 12-1
WAKEUP_IN	Input	When the pin carries a high-level voltage, the states of the module are as follows: The module will be prohibited to enter sleep mode if the module is awake. The module will be woken up if the module is in sleep mode. When the pin carries a low-level voltage, the module is allowed to enter sleep mode. (By default, the pin is set to INPUT/PD, which is, the software detects a low-level voltage on the pin when the pin is not connected.)	Figure 12-2
SLEEP_STATUS	Output	Indicates the state of the module. When the pin carries a high-level voltage, the module is in working mode. When the pin carries a low-level voltage, the module is in sleep mode.	Figure 12-3

12.2 Sequence Diagram

Figure 12-1 WAKEUP_OUT output sequence

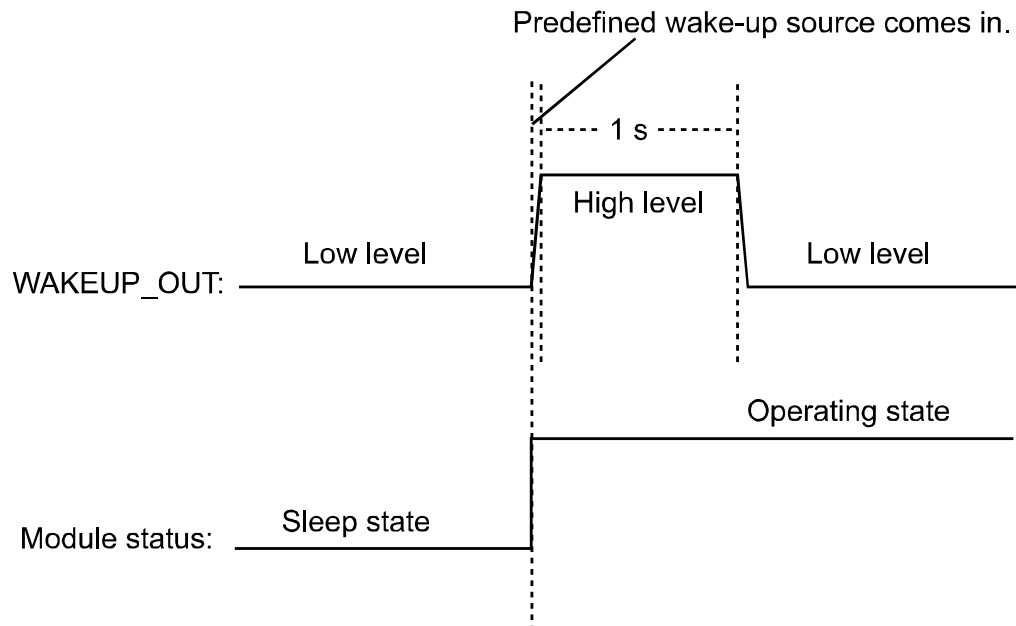
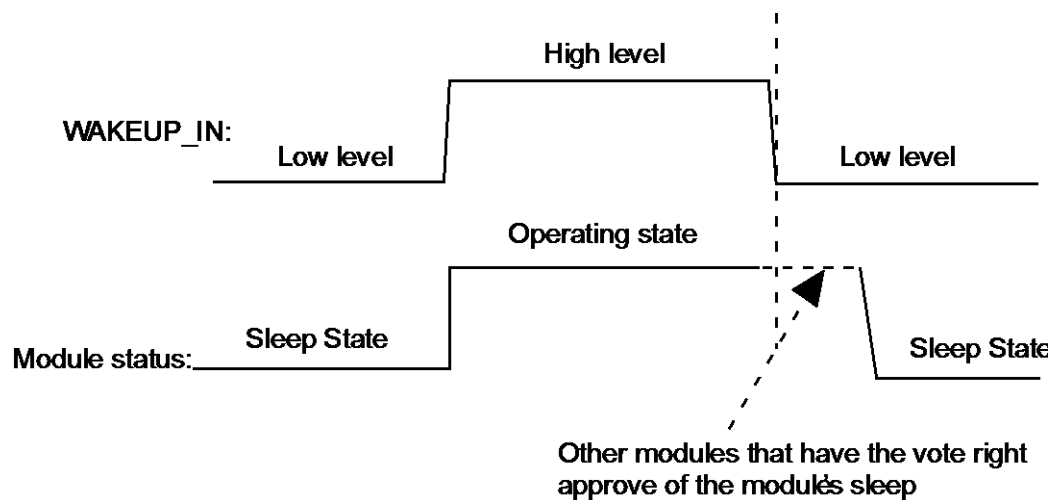
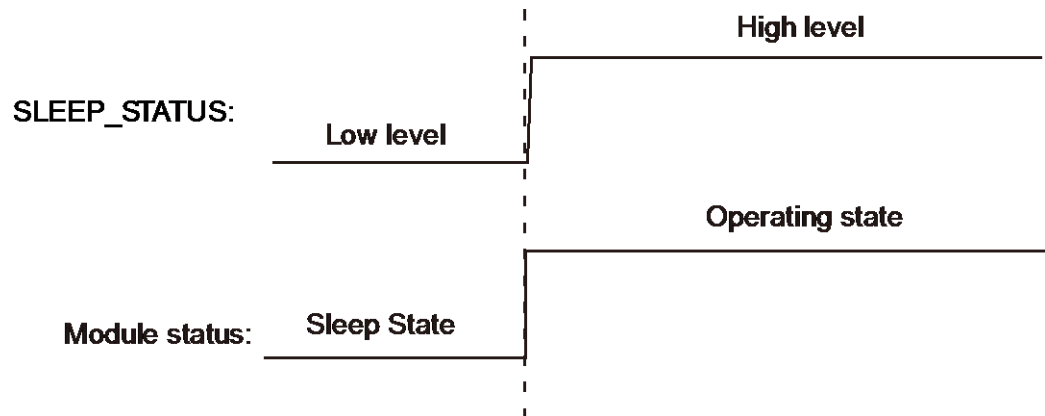


Figure 12-2 WAKEUP_IN input sequence



About the vote, see section 12.3.1.

Figure 12-3 SLEEP_STATUS output sequence

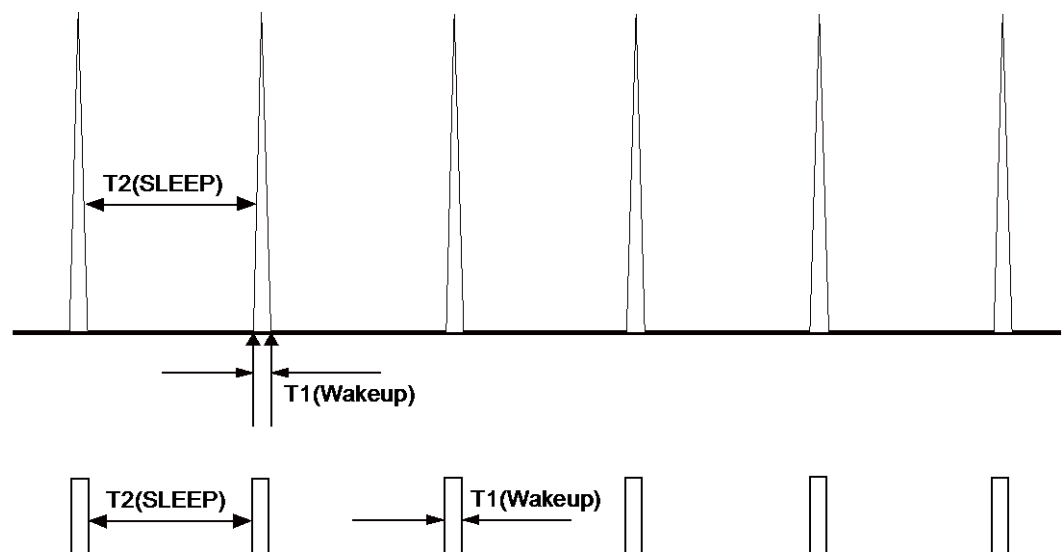


12.3 Software Interfaces

12.3.1 Principle

The module runs on a multi-task software system. The sleep task is granted with the lowest priority and assigned to detect whether the module can enter sleep mode. Other tasks (such as the RF, SIM card and USB) have voting rights. They vote to decide whether the module can enter sleep mode. When no other tasks are running, the sleep task is executed. If the sleep task detects that all other tasks agree on the module's sleep, the module enters sleep mode, as shown in Figure 12-4 . At this time, the baseband chip reduces the work frequency, and the RF enters the Discontinuous Reception (DRX) mode.

Figure 12-4 Currency state when the module is in sleep mode



For more information about the module's sleep procedure, see Figure 12-5

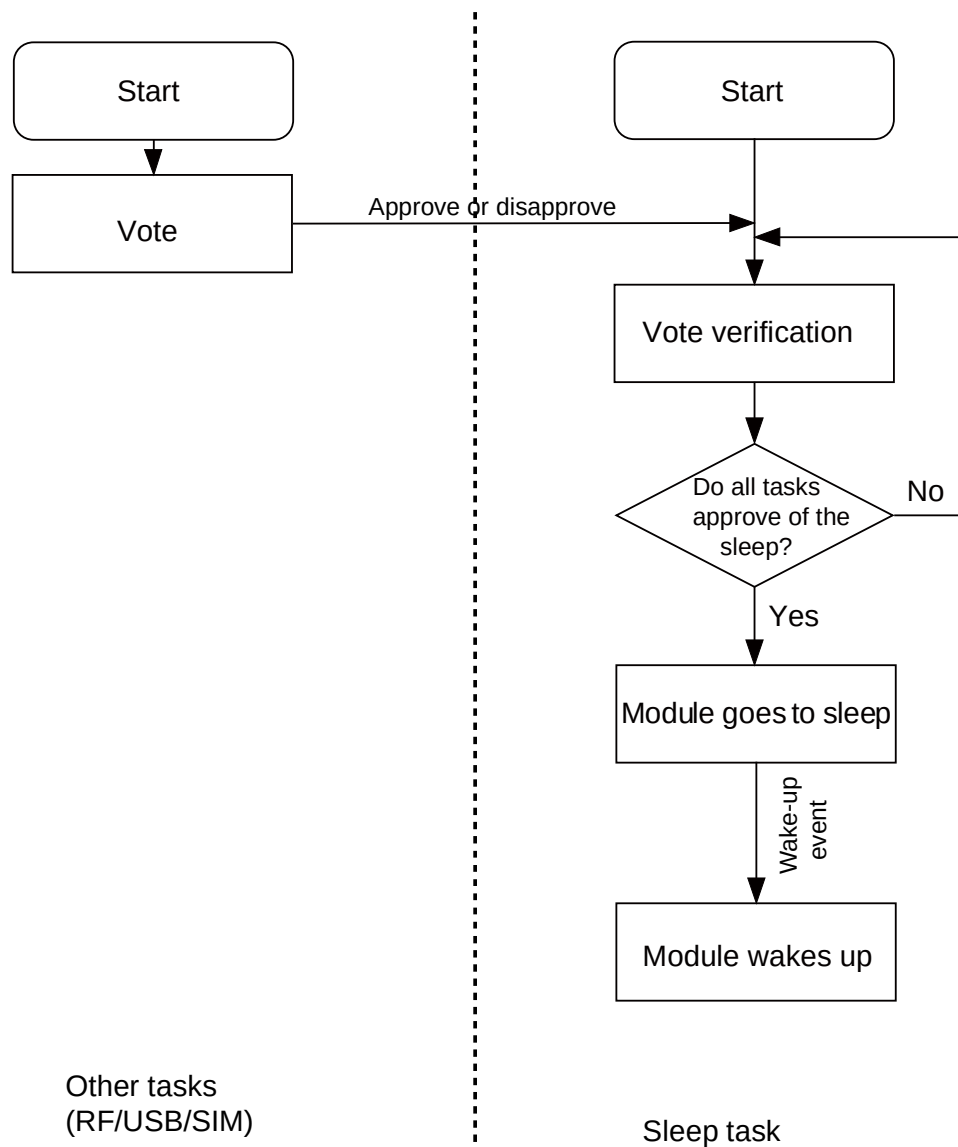


NOTE

The module's sleep mode is different from working mode or flight mode set using the **AT+CFUN** command. The RF will be turned off when the module enters LPM mode using the command **AT+CFUN=0** while the RF will enter DRX mode without being turned off when the module is in sleep mode. For more details, refer to [HUAWEI MU709 Series HSPA+ Module AT Command Interface Specification](#).

The module enters sleep mode automatically when the sleep task detects that all other tasks agree on the module's sleep. The sleep period of the module depends on the current working state and circumstance. The period may last for several seconds, or up to several minutes.

Figure 12-5 Sleep procedure



12.3.2 USB Interface

USB is an important communication channel between the module and the host. According to the USB protocol, normally a hub or a root hub periodically sends Start of Frame (SOF) data packages (one data package per ms using full-speed USB and one package per 125 μ s using high-speed USB). Through this mechanism, USB always votes to stop the module from entering sleep mode.

When the USB driver provided by Huawei detects that the module and the host have not exchanged data in 5 seconds, the USB driver will enable the port's suspend feature, stopping SOF data packages being sent and suspending the USB controller. This enables the USB to vote to agree the module's sleep.



NOTE

If the USB driver used is developed by users or is integrated with external application, ensure that the USB driver supports the USB suspend features (including selective suspend and global suspend, as defined in the USB standard.)

12.3.3 UART Interface

UART is an important communication channel between the module and the host. If the host uses UART (a TTL level interface), it can connect to the module's UART directly. If the host uses RS232, it can connect to the module's UART through a conversion chip such as MAX232.



NOTE

Regardless of the connection modes, when there is no data transmitted on the UART, the host should set the RX pin of the module's UART to low level so that the module can enter sleep mode.

12.3.4 Module Wake-up

RF periodically wakes up the module based on the DRX cycle (depending on the actual configuration of the network system), as shown in Figure 12-4 .

Other aperiodic events include:

1. The host sends data using USB or pulls WAKEUP_IN up.
2. Changes on the network, for example, an incoming call, an incoming text message, a signal change, a network working mode change, a network search, an IP data package (when a dial-up network connection is set up).
3. Software system events such as a timer
4. Abnormal events, for example, an antenna drops or a SIM card becomes loose.

12.3.5 Host Woken up by Module

Wake-up Source

A wake-up source is a module event that can wake up the host, for example, an incoming voice call, a text message, data (PPP data, TCP/UDP data from the network), and unsolicited messages.

Remotely Waking up the Host Using USB

When the host is in sleep mode and the USB controller is in suspended mode, if the module needs to send data to the host (for example, a wake-up source has arrived), the module sends a remote wake-up signal that lasts 3 ms to inform the host to start USB resume (as shown in Figure 12-6). To complete the procedure, the following conditions must be met:

1. The USB controller on the host supports USB remote wake-up and can wake up the host.
2. The USB driver enables or disables remote wake-up by executing SET_FEATURE and CLEAR_FEATURE commands. Therefore, remote wake-up must be enabled on the USB driver before USB enters suspended mode.
3. When the host receives the remote wake-up signal from the module, the host needs to send a full speed K signal that lasts at least 20 ms. When the USB controller resumes, the host must send the SOF token within 3 ms from the startup of the idle state. Otherwise, the module enters suspended mode again, as shown in Figure 12-6 .

Figure 12-6 USB resume time sequence

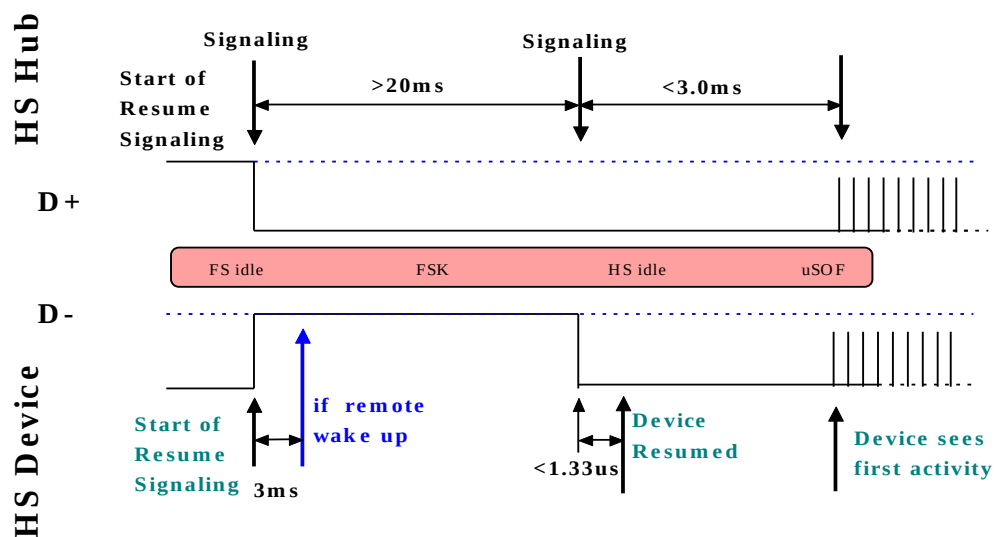


Figure 12-7 Successful procedure of remote wake-up

Transfer	F	Control	ADDR	ENDP	bRequest	wValue	wIndex	wLength	Time	Time Stamp
5	S	SET	3	0	SET_FEATURE	DEVICE_REMOTE_WAKEUP	0x0000	0	3.519 ms	8 . 897 431 766
Packet	H									
5356		Suspend							12.022 sec	8 . 900 949 650
Packet	H									
5357		Resume							21.000 ms	20 . 923 255 382
Packet	H									
5358		Resume EOP							1.333 μs	36.727 ms
6	S	GET	3	0	GET_STATUS	0x0000	USB 2.0 Standard Status	2	0x0002	1.162 ms
7	S	SET	3	0	CLEAR_FEATURE	0x0001	0x0000	0	12.352 ms	20 . 982 145 182

WAKEUP_OUT Waking up the Host

The module will output a 1s pulse using WAKEUP_OUT/WAKE# as shown in Figure 12-1 when a wake-up source arrives. The host wakes itself up after detecting the level change.

Remote Wake-up Configuration

The power consumption of the host increases if it is frequently woken up. The host can configure the module's wake-up sources using **AT^WAKEUPCFG** and **AT^CURC** command so as to reduce the power consumption.

The **AT^WAKEUPCFG** command can be used to choose wake-up sources and the wake-up channel (USB or WAKEUP_OUT). The **AT^CURC** command can choose unsolicited messages. For more details, refer to AT Command Interface Specification.

12.4 Application Scenarios: System with USB Connection only

A host runs in Android system, with support for USB suspend, USB remote resume, voice calling, and text messages.

12.4.1 Hardware Connection

The host connects to the module using USB.

12.4.2 Software Procedure

Command	Description
AT^WAKEUPCFG=?	Queries the parameter range of AT^WAKEUPCFG .
^WAKEUPCFG: (0–1),(0–3),(0–31)	
OK	
AT^WAKEUPCFG=1,2,15	Configures the module to make sure that incoming calls, text messages, data, and unsolicited messages can remotely wake up the host using USB.
OK	
AT^CURC=?	Queries the parameter range of AT^CURC .
^CURC: (0–1)	
OK	

12.4.3 Advantages

With software configuration, while the system requirements (calling and text messages) are met, the number of times the host is woken up by unsolicited messages, and consequently the power consumption, are reduced.

12.5 Application Scenarios: System with USB and WAKEUP_OUT

A host runs in Android system, with support for text messages, but not USB remote resume or voice calling.

12.5.1 Hardware Connection

The host must connect to the module using USB and WAKEUP_OUT pins

12.5.2 Software Procedure

Command	Description
AT^WAKEUPCFG=?	Queries the parameter range of AT^WAKEUPCFG .
^WAKEUPCFG: (0–1),(0–3),(0–31)	
OK	
AT^WAKEUPCFG=1,1,14	Configures the module to make sure that text messages, data, and unsolicited messages can remotely wake up the host using the WAKEUP_OUT pin.
OK	
AT^CURC=?	Queries the parameter range of AT^CURC .
^CURC: (0–1)	
OK	
AT^SLEEPCFG=?	Queries the parameter range of AT^SLEEPCFG .
^SLEEPCFG: (0–1)	
OK	
AT^SLEEPCFG=0,3000	Configures the delay time for module to report unsolicited indication to host since the 1s high-level-voltage wakeup pulse through WAKEUP_OUT pin.

Command	Description
OK	

12.5.3 Advantages

A solution is provided for systems not supporting USB remote resume.

With software configuration, while the system requirements (calling and text messages) are met, the number of times the host is woken up by unsolicited messages, and consequently the power consumption, are reduced.

12.6 Application Scenarios: System with UART and WAKEUP_OUT

A host is constructed based on a single-chip microcomputer. There is no user interface. The host supports UART and text messages. After receiving a text message, the host decodes it and takes corresponding actions.

12.6.1 Hardware Connection

The host must connect to the module using the UART and WAKEUP_OUT pins.

12.6.2 Software Procedure

Command	Description
AT^WAKEUPCFG=?	Queries the parameter range of AT^WAKEUPCFG .
^WAKEUPCFG: (0-1),(0-3),(0-31)	
OK	
AT^WAKEUPCFG=1,1,2	Configures the module to make sure that text messages can remotely wake up the host by WAKEUP_OUT.
OK	
AT^CURC=?	Queries the parameter range of AT^CURC .
^CURC: (0-1)	
OK	
AT^SLEEPCFG=?	Queries the parameter range of AT^SLEEPCFG .

Command	Description
^SLEEP_CFG: (0-1)	
OK	
AT^SLEEP_CFG=1,3000	Configures the delay time for module to enter sleep mode since no data are transmitted through UART.
OK	

12.6.3 Advantages

This solution enables module to enter sleep mode for saving energy when no data are transmitted through UART. With software configuration, the host can wake up the module using WAKEUP_IN PIN.

12.7 System with Other Connection Methods

If the host can be connected to the module only using UART, refer to the [Hardware Guide](#). If the host can connect to the module using USB WAKEUP_OUT, and can support USB remote. For details about the software procedure, refer to the earlier sections while considering the host system feature.



NOTE

The host should not be allowed to enter sleep mode when the host connects to the module using the UART RXD pin only. Because the module does not support UART remote wake-up, handshake is not implemented and consequently data on the UART will be lost when the host is in sleep mode.

13 Thermal Protection Application Scenarios

13.1 Pre-configuration

13.1.1 Reference Process

Command	Description
^THERM: 1	When the temperature is higher than the threshold, the module enables thermal protection: The module turns off its RF, and will automatically shut down if the temperature continues to rise.
^THERM: 0	When the temperature is lower than the threshold, the module turns on its RF and disables thermal protection.

13.1.2 Troubleshooting

Scenario	Possible Error Information	Solution
When the module temperature is higher than the threshold in running.	^THERM: 1 RF turns off. Automatically shut down.	Find the temperature rising factor, and solve or improve it.

13.2 Thermal Protection Process

- When the module's temperature is lower than 85°C, the module works normally.
- When the module's temperature reaches 85°C, the module enables thermal protection: turns off its RF and presents the **^THERM: 1** indication. When the module's temperature is lower than 85°C, the module disables thermal protection: turns on its RF transmission, and presents the **^THERM: 0** indication.
- When the module's temperature reaches 102°C, the module automatically shuts down.



NOTE

- During an emergency call, if thermal protection is enabled, the module will present an indication but will not take thermal protection actions such as turning off its RF or shutting down.
- After thermal protection is enabled, users cannot make emergency calls.
- Thermal protection is designed to protect the module from being damaged by excessively high temperatures. To work in high temperature environments, both the module and its peripheral components must be able to resist the same temperature.

14 Concurrent Service Application Scenarios

14.1 Voice Calls and Text Messaging

On a GSM or WCDMA network, the module uses the same wireless channel to establish voice calls and send text messages. Therefore, when the module provides voice call and text messaging services at the same time, it may fail to make the voice call or the message may be delayed.

14.1.1 Reference Process

Command	Description
ATD13912345;	Makes a voice call to 13912345 from the module.
OK	
^ORIG: 2,0	
AT+CMSS=0	Sends the text message before the voice call is connected.
OK	The voice call is hung up because the user is busy.
^CEND: 1,0,100,17	
+CMSS: 36	

**NOTE**

When a voice call has been connected, text messages can be sent without conflicting with the voice call.

14.2 Internal/External Protocol Stacks and Text Messaging

WCDMA networks support concurrent internal/external protocol stack services and text messaging.

When data is transmitted using the external protocol stack, text messages can be sent through only the ports on which no data is being transmitted.

When the internal protocol stack is in use, text messages can be sent through all ports in non-transparent transmission mode and through only the USB in transparent transmission mode.

Table 14-1 Ports available to text messaging during data services

	Service Port	Message Sending Port	Message Receiving Port
External protocol stack application	MODEM	PCUI, UART	PCUI, UART
	UART	PCUI, MODEM	PCUI, MODEM
Internal protocol stack application	UART (transparent transmission mode)	MODEM, PCUI	MODEM, PCUI
	MODEM (transparent transmission mode)	UART, PCUI	UART, PCUI

14.2.1 Reference Process

Command	Description
AT^IPOPEN=1,"TCP","172.22.44.33",7000,6000	Establishes a TCP link at the module's UART port.
OK	The module transmits data through the UART port.
^IPDATA: 1,1024,No.6:**... **	
AT+CMSS=0	The module sends text messages through the PCUI port.

Command	Description
+CMSS: 48	The module can send text messages without interrupting the data transmission through the UART.
OK	
(UART)	
^IPDATA: 1,1024,No.7:**... **	After receiving text messages, the module presents them through all ports (the format of the text messages is set by AT+CNMI).
^IPDATA: 1,1024,No.8:**... **	
+CMTI: "SM",4	
^IPDATA: 1,1024,No.9:**... **	



CAUTION

On GSM/GPRS networks, data transmission using the internal/external protocol stack services will be suspended when text messages are sent and will be resumed after the text messages are sent.

Command	Description
AT^IPOPEN=1,"TCP","172.22.44.33",7000,6000	Establishes a TCP link at the module's UART port.
OK	The module transmits data continuously.
^IPDATA: 1,1024,No.6:**... **	
AT+CMSS=0	The module sends text messages through the PCUI port.

Command	Description
+CMSS: 48	The data transmission through the UART port is suspended for the text messaging service through the PCUI port. The data transmission will be resumed after the messages are sent or received.
OK	
+CMT: "+8613912345", "12/01/01,12:00:00 +00"	
1234	
(UART) ^IPDATA: 1,1024,No.7:** ...** ^IPDATA: 1,1024,No.8:** ...**	

14.3 Internal/External Protocol Stacks and Voice Calls

WCDMA networks support concurrent internal/external protocol stack services and voice calls.

GSM/GPRS networks offer limited support for concurrent internal/external protocol stack services and voice calls.

First Service	Concurrent Service	Service State
Internal protocol stack	MO voice call	Suspend data transmission through the UART port until a voice call is hung up.
	MT voice call	Huawei's extended AT command AT^DVCFG can be used to configure the priorities of the internal protocol stack service and MT voice call.
External protocol stack	MO voice call	Suspend data transmission through the MODEM port until a voice call is hung up.
	MT voice call	
Voice calls	Internal protocol stack	Data connections through the UART port cannot be established (executing AT^IPINIT fails).
	External protocol stack	Data connections can be established through the MODEM port, but data cannot be transmitted until the voice call is hung up.


NOTE

Settings configured by **AT^DVCFG** take effect immediately and are effective only in transparent transmission mode of the internal protocol stack services.

14.3.1 Reference Process

Command	Description
(UART) AT^IPOPEN=1,"TCP","172.22.44.33",7000,6000	Establishes a TCP link at the module's UART port.
OK	The module transmits data in non-transparent transmission mode.
^IPDATA: 1,536,No.51:*****...	
	(Another party calls the module.)
(all ports) RING	Data transmission through the UART port is suspended, and all ports present the Ring indication.
RING	
(PCUI) AT+CHUP	
OK	After the call is hung up, data transmission through the UART port is resumed.
^CEND: 1,0,102,17	Packets received/transmitted when data transmission is suspended will not be lost.
(UART) ^IPDATA: 1,536,No.52:*****...	
(UART) AT^IPENTRANS=1	The module enters transparent transmission mode to transmit data continuously.
OK	
No.230:*****...	
	(An MT call comes in)
(PCUI) RING	By default, voice calls have priority over data transmission (which is set by AT^DVCFG=0). Data transmission through the UART port is suspended, and the USB (PCUI and MODEM) ports present Ring indications.
RING	
(PCUI) AT+CHUP	

Command	Description
OK	After the voice call is hung up, resumes data transmission through the UART port.
^CEND: 1,0,102,17	
(UART) No.231:***** ...	
(PCUI) AT^DVCFG=1	Sets data transmission to have priority over voice calls.
OK	The module transmits data in transparent transmission mode.
(UART) No.240:***** ...	
	(An MT call comes in)
(PCUI) ^CEND: 1,0,29,16	The module suspends data transmission through the UART port, hangs up the incoming call automatically, presents the ^CEND indications through the USB (PCUI and MODEM) ports, and resumes the data transmission through the UART port.
(UART) No.241:***** ...	
(UART) +++	The module exits transparent transmission mode to transmit data continuously.
OK	
^IPDATA: 1,536,No.61:***** ...	
	(An MT call comes in)
(all ports) RING	Data transmission through the UART port is suspended, and all ports present the Ring indication. AT^DVCFG=1 is invalid in non-transparent transmission mode.
RING	
(PCUI) AT+CHUP	
OK	After the call is hung up, data transmission through the UART port is resumed.
^CEND: 1,0,102,17	Packets received/transmitted when data transmission is suspended will not be lost.
(UART) ^IPDATA: 1,536,No.62:***** ...	

14.4 Other Services

Configuration operations (initialization and serial port configuration), phonebook operations, and PIN operations can be performed when the module is not in sleep mode, no matter the module is idle or processing services, because no interaction between the module and the network is required.

Especially, if the module is processing internal/external protocol stack services, operations such as configuration, phonebook and PIN operations must be performed at ports that are not used to provide data services.

Table 14-2 Ports available to configuration, phonebook and PIN operations when the module is processing data services

	Service Port	Ports Available to Configuration, Phonebook and PIN Operations
External protocol stack application	MODEM	PCUI, UART
	UART	PCUI, MODEM
Internal protocol stack application	UART	MODEM, PCUI

15

STK Application Scenarios

15.1 Unsolicited Report of STK Proactive Commands

15.1.1 Reference Process

Command	Description
AT^STSF=1,2	Activates the STK interface function, set the STK interface to 3GPP standard mode.
OK	
+CUSATP: "D081A2810301250082028182850F80005 500530049004D53615E9475288F0A1180 7CBE54C163A883508F0A318059296C14 988462A58F0A3280822A73ED67E58BE2 8F0A338051FA884C630753578F0A34804 F53575B5FEB8BAF8F0C518065B095FB 65E9665A62A58F0A5280624B673A97F3 4E508F0A5380624B673A96058BFB8F0A 5480624B673A90AE7BB18F0A558077E D4FE152A974068F0C5680624B673A842 54E1A5385"	Content of the SET UP MENU proactive command. The string should be interpreted according to the ETSI TS 102.223. The protocol states that the command type is determined by the 7th byte if the string length is greater than 127 bytes, and the 6th byte if the string length is 127 bytes or less. In the provided example, the 7th byte is 25, which indicates SET UP MENU.
AT+CUSATT="810301250082028281830 100"	The CAT client uses the AT command to respond to the proactive command. This string means "command performed successfully".
OK	


NOTE

- STK activation and deactivation still take effect after the device is restarted.
- **<proactive_command>** and **<terminal_response>** consist of the full BER-TLV data object as defined in 3GPP TS 31.111.
- For MU709, STK proactive commands can be divided into three categories:
Category 1: proactive commands that must be processed by the CAT client, including DISPLAY TEXT, GET INKEY, GET INPUT, PLAY TONE, SELECT ITEM, SET UP MENU, LANGUAGE NOTIFICATION, and LAUNCH BROWSER.
Category 2: proactive commands processed by the module (the CAT client is still notified), including **SEND SHORT MESSAGE**, **SEND SS**, **SEND USSD**, **SET UP EVENT LIST**, and **REFRESH**.
Category 3: other proactive commands that are processed by the module (the CAT client is not notified).
- Only commands of categories 1 and 2 are reported using the +CUSATP interface.
- Only terminal responses to commands of category 1 can be delivered using the AT interface.

15.1.2 Troubleshooting

Scenario	Possible Error Information	Solution
The SIM card has sent an STK proactive command, but the module does not unsolicited report it to the CAT client.	None	AT^STSF=1,2
Module reports proactive command and then the CAT client responds to the proactive command by delivering terminal response command. AT+CUSATT="<terminal_response>"	+CME ERROR: SIM PIN required	Unblock the PIN before delivering the terminal response.
	+CME ERROR: SIM busy	Wait until the SIM card initialization is complete before delivering the terminal response.
Module reports proactive command and then the CAT client responds to the proactive command by delivering terminal response command. AT+CUSATT="<terminal_response>"	ERROR	1. Use AT^STSF? to check whether STK has been activated and the interface has been set to 3GPP standard mode. If yes, proceed to the next step. 2. Check whether the proactive command reported needs to be processed by the CAT client. If yes, proceed to the next step. 3. Check whether <terminal_response> complies with the 3GPP TS 31.111 protocol. If yes, proceed to the next step.

Scenario	Possible Error Information	Solution
		4. Check whether the terminal response is delivered more than 2 minutes and 5 seconds after the proactive command is reported. If yes, the module does not receive terminal responses sent from the CAT client.

15.2 Querying the STK Main Menu

15.2.1 Reference Process

Command	Description
AT^CUSATM?	Checks the content of SET UP MENU .
^CUSATM: "D081A2810301250082028182850F80005500530049 004D53615E9475288F0A11807CBE54C163A883508 F0A318059296C14988462A58F0A3280822A73ED67 E58BE28F0A338051FA884C630753578F0A34804F5 3575B5FEB8BAF8F0C518065B095FB65E9665A62A 58F0A5280624B673A97F34E508F0A5380624B673A 96058BFB8F0A5480624B673A90AE7BB18F0A55807 7ED4FE152A974068F0C5680624B673A84254E1A53 85"	Content of SET UP MENU
OK	



NOTE

- This command is not specified in the standard interface protocol but is introduced to prevent the main menu information from being lost because **SET UP MENU** is sent too quickly.
- If the SIM card does not deliver **SET UP MENU**, then **^CUSATM: ""** will be returned after the main menu is queried.

15.2.2 Troubleshooting

Scenario	Possible Error Information	Solution
The CAT client queries Content of SET UP MENU. AT^CUSATM?	ERROR	AT^STSF=1,2
	+CME ERROR: SIM PIN required	Unblock the PIN before delivering the command.

15.3 STK Envelope Command

15.3.1 Reference Process

Command	Description
AT+CUSATE="D30782020181900156"	Delivers the envelope command MENU SELECTION .
+CUSATE: "",0	The SIM card's response to the envelope command. For details, see the below notes.
OK	



NOTE

- **<envelope_command>** and **<envelope_response>** consist of the full BER-TLV data object as defined in 3GPP TS 31.111.
- **<envelope_response>** is the SIM card's response to the envelope command. It may be empty.
- **<busy>** indicates the SIM card status. If **<busy>** is **0**, the SIM card is normal and the envelope command has been processed. If **<busy>** is **1**, the SIM card is busy. The envelope command can be resent when the SIM card is idle. If **<busy>** is **2**, the SIM card is faulty. Check the SIM card and do not resend the envelope command until the SIM card has been fixed.

15.3.2 Troubleshooting

Scenario	Possible Error Information	Solution
The CAT client delivers the envelope command. AT+CUSATE="<envelope_command>"	ERROR	AT^STSF=1,2
	+CME ERROR: SIM PIN required	Unblock the PIN before delivering the envelope command.



Scenario	Possible Error Information	Solution
	+CME ERROR: SIM busy	Wait until the SIM card initialization is complete before delivering the envelope command.
	ERROR	Check whether <envelope_command> complies with the 3GPP TS 31.111 protocol.

16 TTS Application Scenarios

16.1 TTS Playing

Parameters in text to speech (TTS) commands are restored to their default values every time the module is powered back on after a restart or power failure. The parameter settings are saved to the internal memory.

When enabled, TTS converts GBK character or Unicode strings into voice, which is played through the voice channel. If TTS is disabled or a voice call comes in, voice is not played.

During a voice call, TTS voice is played on the receiving end.

Concurrent TTS operations are not supported. The current TTS operation must stop before a new one is conducted.

16.1.1 Reference Process

Command	Description
AT^TTSCFG=0,1	Enables TTS.
OK	
AT^TTS=1,"CED2C3C7CAC7C4A3BF E9D7E9A1A3"	Plays voice.
OK	
AT^TTS=0	Stops TTS playing forcibly.
OK	Reports the end of TTS playing.
^AUDEND:2,1	



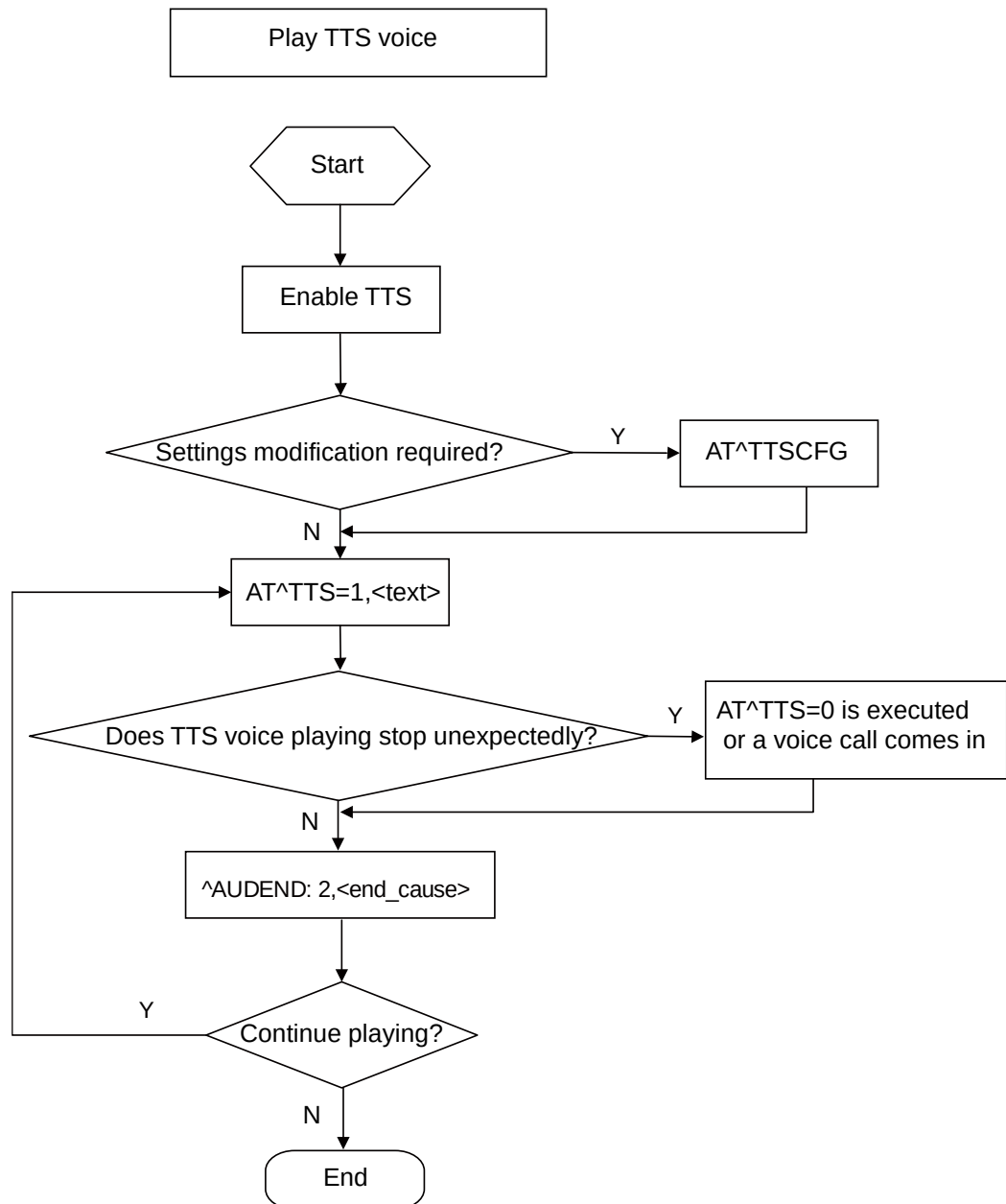
NOTE

- The character string to covert to speech must be hexadecimal and GBK encoded or Unicode encoded. The maximum length is 1200 (for Chinese) or 500 (for Italian) bytes and the number of bytes must be an integer multiple of 2 (for Chinese) or 4 (for Italian) (0 is excluded).

- Before **^AUDEND** is executed, **AT^TTS=1,<text>** is not available.
- TTS-related AT commands cannot be executed on modules that do not support TTS.
- When TTS voice is played, ERROR will be returned when **AT^TTSCFG** set command is executed.
- TTS maintains the lowest priority in the voice channel. If any audio function (such as recording, incoming call ringtone, and DTMF) requires the voice channel, TTS voice will not be played.
- "-" is pronounced "至" in Chinese, eg: "500-300=200" is pronounced "500 至 300=200".

16.1.2 Flowchart

Figure 16-1 Process for playing TTS voice





16.1.3 Troubleshooting

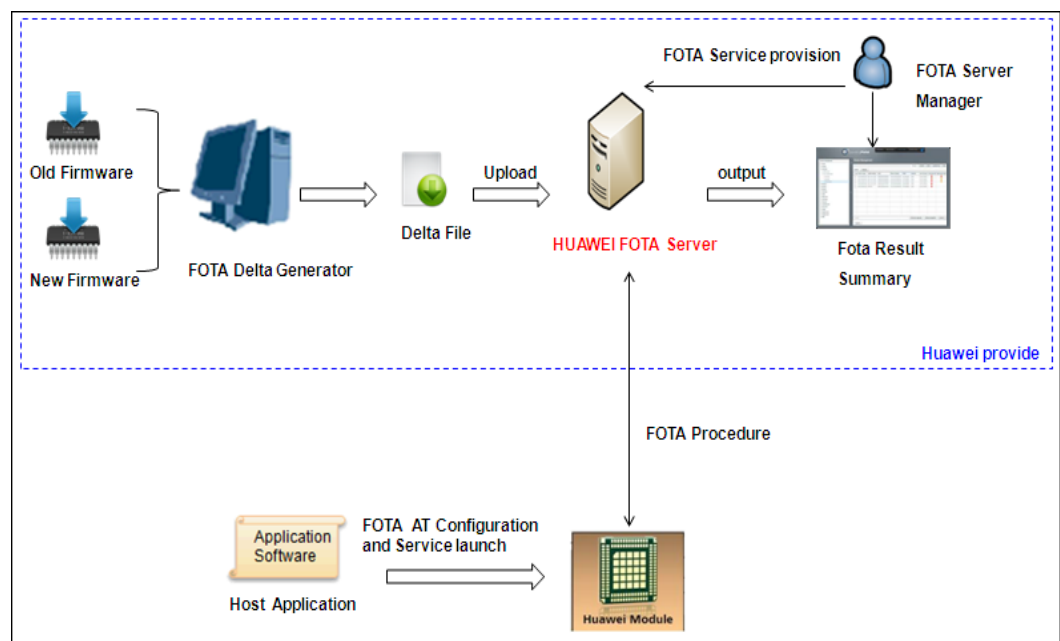
Scenario	Possible Error Information	Solution
AT^TTS=1,"C4E3BAC3"	+CME ERROR: operation not allowed	• Solution 1: Run AT^TTSCFG=0,1 to enable TTS. • Solution 2: End the current call, recording, and playback tasks.

17 FOTA Application Scenarios

17.1 FOTA Process

17.1.1 Upgrade Module Firmware Over Air Through Delta Package

Figure 17-1 Upgrade module firmware over air through delta package



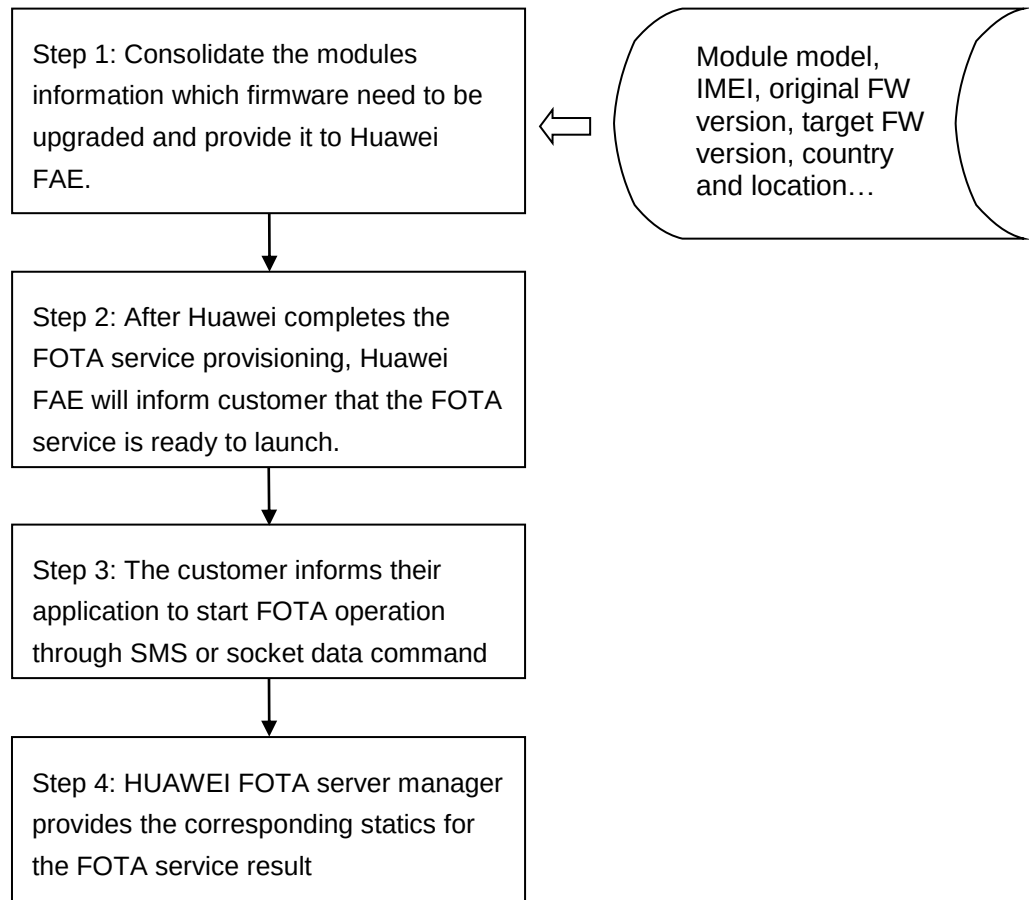
NOTE

Update file downloads may incur data usage fees charged by the operator.

17.1.2 Procedure for FOTA Implementation

This section describes the workflow of HUAWEI Module FOTA feature.

Figure 17-2 FOTA data flow



 NOTE

If the module is powered off during the firmware installing progress, after the module is restarted, the firmware will resume installing at the last point.

Reference Process

After customer application received SMS or socket command to perform FOTA upgrade.

Command	Description
AT+GMR	Queries the module's software version
12.815.01.03.00	
OK	
AT^FOTACFG="1234","", "",2	Configures APN
OK	
AT^FOTAMODE=0,0,1,1	Sets FOTA mode
OK	

Command	Description
AT^FOTASTATE?	
^FOTASTATE: 10	Indicates that the FOTA state is idle.
OK	
AT^FOTADET	Starts to detect
OK	
^FOTASTATE: 11	
^FOTASTATE: 12,12.815.01.04.00,79114,"Support send sms background"	Gets the module's new version "12.815.01.04.00"
AT^FOTADL=1	Starts to download the new version and upgrade.
OK	
^FOTASTATE: 30	The download progressing of the FW delta file.
AT^FOTADLQ	Queries file download.
^FOTADLQ: 1,"FIRMWARE1",0,17471680	
OK	
^FOTASTATE: 40	Indicates that FW delta file is completely downloaded.
^FOTASTATE: 50	Indicates that FW is ready to update.
^FOTASTATE: 90	After few minutes, FW is successfully upgraded.
AT+GMR	Queries the module's software version after the upgrade.
12.815.01.04.00	The software version has been changed.
OK	

17.2 Setting FOTA Mode

17.2.1 Reference Process

Command	Description
AT^FOTAMODE=?	Checks the parameter range supported by the command.
^FOTAMODE: (0–1),(0–1),(0–1),(0–1),(1–65535)	
OK	
AT^FOTAMODE?	Queries the current settings.
^FOTAMODE: 0,0,0,1,7	Returns the current FOTA mode: manual query, manual download, manual upgrade, and resumable data transfer enabled
OK	
	The value 7 indicates that the query cycle is seven days, which is meaningless when manual query is used.
AT^FOTAMODE=1,1,1,1,15	Configures FOTA mode as auto query, auto download, auto upgrade, and resumable data transfer enabled. And the auto query cycle is set to 15 days.
OK	



NOTE

- Parameter settings are all saved upon power-off.
- All parameters will be restored to their default values after the upgrade.

17.2.2 Troubleshooting

Scenario	Possible Error Information	Solution
An error message is returned.	+CME ERROR: Error command parameters	The parameter is incorrectly set.

17.3 Setting FOTA Connection Parameters

17.3.1 Reference Process

Command	Description
AT^FOTACFG="cmnet","", "",2	Sets the APN to cmnet and authentication

Command	Description
	mode to CHAP . Leaves the user name and password blank. These parameters should be set according to the contracted values.
OK	
AT^FOTACFG?	Queries the current settings.
^FOTACFG: "cmnet","", "",2	
OK	


NOTE

- Parameter settings are all saved upon power-off.
- This command does not provide a test command. For details, see [HUAWEI MU709 Series HSPA+ Module AT Command Interface Specification](#).

17.3.2 Troubleshooting

Scenario	Possible Error Information	Solution
An error message is returned.	+CME ERROR: Operation not supported	The operation is not supported.
An error message is returned.	+CME ERROR: Error command parameters	The parameter is incorrectly set.

17.4 Manually Querying for Upgrade Firmware Version

17.4.1 Reference Process

Command	Description
AT^FOTACFG="cmnet","", "",2	Configures the PDP context. For example, sets the APN to cmnet (the value of APN is provided by the network server) and authentication mode to CHAP.
OK	
AT^FOTAMODE=0,0,0,1	Configures FOTA mode as manual query, manual download, manual upgrade, and resumable data transfer enabled.
OK	
AT^FOTASTATE?	Queries the current FOTA state.

Command	Description
^FOTASTATE: 10	Indicates that the FOTA state is idle.
OK	
AT^FOTADET	Check for updates. Ensures that the module is registered with a valid network before you run this command.
OK	Returns OK (success) or return +CME ERROR (failure).
^FOTASTATE: 11	Reports that the query operation is in process.
^FOTASTATE: 12,12.815.01.04.00,79114,"Support send sms background"	Reports information about the new version, including the version number, size of the file to be downloaded, and change description.
AT^FOTASTATE?	Queries the current FOTA state.
^FOTASTATE: 12	Indicates that a new version is found.
OK	
AT^FOTADL=0	Deletes the detected new version.
OK	
AT^FOTASTATE?	Queries the current FOTA state.
^FOTASTATE: 10	Indicates that the FOTA state is idle.
OK	
AT^FOTADET	Checks for updates after deleting the new version on the server.
OK	
^FOTASTATE: 11	
^FOTASTATE: 14	Reports that no new version is found.


NOTE

- Version detection is allowed only if the FOTA state is idle.
- If the module is undergoing the PS data service or IPSTACK service, the FOTA service cannot be initiated, including version detection, download, and upgrade.
- The parameter <description> of the **^FOTASTATE** command is a string composed of ASCII characters. This parameter is used to describe the changed items (corresponding to the feature items in **changelog.xml** in the upgrade package) of the new version. The parameter contains a maximum of five records, each containing up to 255 characters. Records are separated by semicolon.

17.4.2 Troubleshooting

Scenario	Possible Error Information	Solution
An error message is returned.	+CME ERROR: FOTA is in collision state	Check whether the PS data service or IPSTACK service is going on, or use AT^FOTASTATE? command to check whether the FOTA state is idle.
An error message is returned.	+CME ERROR: Previous command is not complete	Wait for the previous command to be completely executed.
An error message is returned.	+CME ERROR: SIM PIN required	Use the PIN to unlock the SIM card.
The module reports a query failure.	^FOTASTATE: 13,<error_code>	Upon a query failure, the module restores the FOTA state to idle and deletes the downloaded files. For error codes, see HUAWEI MU709 Series HSPA+ Module AT Command Interface Specification .

17.5 Periodically Querying the Version

17.5.1 Reference Process

Command	Description
AT^FOTAMODE=1,0,0,1,7	Configures FOTA mode as auto query, auto download, auto upgrade, and resumable data transfer enabled and the query cycle to seven days.
OK	The command is successfully executed. The module automatically checks for updates when the query time arrives.

Command	Description
^FOTASTATE: 11	Reports that the query operation is in process.
^FOTASTATE: 12,12.815.01.04.00,79114,"Support send sms background"	Reports information about the new version.


NOTE

- Periodical query is based on either of the two timekeeping modes: network timekeeping or local timekeeping. If network timekeeping is unavailable, local timekeeping is used. Local timekeeping may not be accurate.
- Local timekeeping is affected by **AT+CCLK** command. Upon a power-off event, the CCLK value changes to "2000/01/06,08:00:00". After you choose to use local timekeeping and change the CCLK value, the query operation cannot be carried out at the correct time.
- It is recommended to detect the FOTA state when the host powers on. There are two options if the value is 12 (that is, there is a new version):
 - Download this new version. Note that this new version may not be the latest one. It may be the version that is queried previously.
 - Clear the previous versions. And then detect the new version again, which is the latest version in the server.

17.5.2 Troubleshooting

Scenario	Possible Error Information	Solution
Auto query is in use.	No query operation is initiated when the query time arrives.	- Check if the FOTA state is idle. If not, change the FOTA state to idle by using the AT^FOTADL=0 command. - Check whether the PS data service or IPSTACK service is going on. If yes, terminate the service.

17.6 Manually Downloading the Version

17.6.1 Reference Process

Command	Description
AT^FOTASTATE?	Queries the current FOTA state.
^FOTASTATE: 12	Indicates that a new version is found.
OK	

Command	Description
AT^FOTADL=1	Runs this command to manually download the version or to resume data transfer.
OK	The command is successfully executed. Report that the download is in process.
^FOTASTATE: 30	
AT^FOTADL=2	Runs this command to manually download Pause.
OK	The command is successfully executed. Reports that the download is pending. If the resumable data transfer mode is disabled, the command will return "+CME ERROR: Operation not supported".
^FOTASTATE: 31	
AT^FOTADL=1	Runs this command to manually download the version or to resume data transfer.
OK	The command is successfully executed. Reports that the download is in process.
^FOTASTATE: 30	
AT^FOTADLQ	Queries the download progress.
^FOTADLQ: 1,"IMAGE",1324,1324	Returns that the IMAGE file size is 1324 bytes, and 1324 bytes have been downloaded.
^FOTADLQ: 2,"XNV",47104,77778	The XNV file size is 77778 bytes, and 47104 bytes have been downloaded.
OK	
^FOTASTATE: 40	Reports that the version is completely downloaded and passes the MD5 verification.
AT^FOTADL=?	Queries the parameters supported by the command.
^FOTADL: (0-2)	Returns the supported parameters. 0: not to download.
OK	1: download. 2: download Pause



NOTE

- Version download is allowed only if the FOTA state is **12** (new version detected) and **31** (download pending).
- The prerequisites for version download and query are:
 - Module registered with a valid network.
 - No ongoing PS data service or IPSTACK service.

17.6.2 Troubleshooting

Scenario	Possible Error Information	Solution
An error message is returned.	+CME ERROR: Operation not supported	The command is incorrect.
An error message is returned.	+CME ERROR: SIM PIN required	Use the PIN to unlock the SIM card.
An error message is returned.	ERROR	The command is executed in incorrect FOTA state. Ensure that the FOTA state is 12 or 31 before you run the command.
The module reports a download failure.	^FOTASTATE: 20,<error_code>	Upon a download failure, the module restores the FOTA state to idle and deletes the downloaded file. For error codes, see HUAWEI MU709 Series HSPA+ Module AT Command Interface Specification .

17.7 Automatically Downloading the Firmware

17.7.1 Reference Process

Command	Description
AT^FOTAMODE=0,1,0,1	Configures auto download mode.
OK	
AT^FOTADET	Runs this command to manually check for upgrades.

Command	Description
OK	
^FOTASTATE: 11	Reports that the query operation is in process.
^FOTASTATE: 12,12.815.01.01.00,79102,"Support send sms background"	Reports that a new version is found and information about the new version. Automatically download the new version and reports that the download is in process.
^FOTASTATE: 30	Reports that the version is completely downloaded and passes the MD5 verification.
^FOTASTATE: 40	

17.7.2 Troubleshooting

None

17.8 Using the Resumable Data Transfer Function

17.8.1 Reference Process

Command	Description
AT^FOTAMODE=0,0,0,1	Enables resumable data transfer.
OK	
AT^FOTASTATE?	Queries the FOTA state.
^FOTASTATE: 31	Indicates that the download is pending.
OK	
AT^FOTADL=1	Resumes the transmission from the break point.
OK	
^FOTASTATE: 30	Reports that the download is in process.
^FOTASTATE: 40	Reports that the download is complete.



NOTE

If resumable data transfer is disabled, the download pending due to network disconnection or TCP link break-off will be regarded as a download error.

17.8.2 Troubleshooting

Scenario	Possible Error Information	Solution
The function of resumable data transfer is disabled, and the network or TCP link is disconnected.	^FOTASTATE: 20,18 Or other download error	The module deletes the downloaded file and restores the FOTA state to idle.
The function of resumable data transfer is enabled, and the module is powered off.	^FOTASTATE: 31	The module prompts that the download can be resumed.

17.9 Manually Canceling the Download

17.9.1 Reference Process

Command	Description
AT^FOTADL=1	Initiates the version download.
OK	
^FOTASTATE: 30	Reports that the download is in process.
AT^FOTADL=0	Cancels the download, deletes the downloaded file, and restores the FOTA state to idle.
OK	The command is successfully executed.
AT^FOTASTATE?	
^FOTASTATE: 10	Reports that the operation to cancel the download is complete. The FOTA state is idle.
OK	

17.9.2 Troubleshooting

None

17.10 Manually Upgrading the Version

17.10.1 Reference Process

Command	Description
AT^FOTASTATE?	
^FOTASTATE: 40	Reports that the download is complete.
OK	
AT^FWUP	Runs this command to manually start the upgrade.
OK	The command is successfully executed.
^FOTASTATE: 50	Reports that the upgrade starts. The module restarts, and then starts the upgrade.
^FOTASTATE: 90	Reports that the upgrade succeeds.



NOTE

- The module restarts several times during the upgrade. Ensure that during this process, the module is powered on. Do not send AT commands during the upgrade.
- If the upgrade fails, the module enters forcible loading mode, you can perform any of the following:
 - One-click upgrade from devices running Windows (full upgrade using the .exe file)
 - Upgrade from devices that run Android or Linux using **UpdateWizard** (full upgrade using the .bin file)
 - Local upgrade no matter the host having the operation system or not (for details, see section 19 Local Upgrade Application Scenarios).

17.10.2 Troubleshooting

Scenario	Possible Error Information	Solution
An error message is returned.	+CME ERROR: Previous command is not complete	Wait for the previous command to be completely executed.
An error message is returned.	+CME ERROR: FOTA is in collision state	- Check whether the PS data service or IPSTACK service is going on. - Check that the FOTA state is not 40 (download is complete).

Scenario	Possible Error Information	Solution
An error message is returned.	ERROR	The command format is incorrect. Please see HUAWEI MU709 Series HSPA+ Module AT Command Interface Specification .
The module reports an upgrade failure.	^FOTASTATE: 80,<error_code>	The module automatically changes the FOTA state to idle and deletes the downloaded file. You can use the AT^FOTADL=0 command to set the FOTA state to idle manually. For error codes, see HUAWEI MU709 Series HSPA+ Module AT Command Interface Specification .

17.11 Automatically Upgrading the Version

17.11.1 Reference Process

Command	Description
AT^FOTAMODE=0,1,1,1	Configures FOTA mode as auto download and auto upgrade.
OK	
AT^FOTADET	Checks for upgrades.

Command	Description
OK	
^FOTASTATE: 11	Returns information about the new version.
^FOTASTATE: 12,12.815.01.02.00,79114,"Support send sms background"	Automatically download the version.
^FOTASTATE: 30	
^FOTASTATE: 40	Reports that the version is completely downloaded and passes the MD5 verification.
^FOTASTATE: 50	Reports that the module is ready for the upgrade.
^FOTASTATE: 90	Reports that the upgrade succeeds.
AT^FOTASTATE?	Queries the FOTA state.
^FOTASTATE: 10	The FOTA state changes to idle after the upgrade.
OK	

17.11.2 Troubleshooting

None

17.12 Enable or Disable FOTA SMS Auto-Download

17.12.1 Reference Process

Command	Description
AT^FOTASMSCFG=1	Enables FOTA SMS auto-download.
OK	

Command	Description
^FOTASMS	
^FOTASTATE: 11	Returns information about the new version.
^FOTASTATE: 12,12.815.01.02.00,79114,"Support send sms background"	Automatically download the version.
^FOTASTATE: 30	
^FOTASTATE: 40	Reports that the version is completely downloaded and passes the MD5 verification.
^FOTASTATE: 50	Reports that the module is ready for the upgrade.
^FOTASTATE: 90	Reports that the upgrade succeeds.
AT^FOTASTATE?	Queries the FOTA state.
^FOTASTATE: 10	The FOTA state changes to idle after the upgrade.
OK	
AT^FOTASMSCFG=0	Disables FOTA SMS auto-download.
OK	
^FOTASMS	
AT^FOTAP=1	The host decides that an upgrade is required.
OK	
^FOTASTATE: 11	Returns information about the new version.
^FOTASTATE: 12,12.815.01.02.00,79114,"Support send sms background"	Automatically download the version.
^FOTASTATE: 30	
^FOTASTATE: 40	Reports that the version is completely downloaded and passes the MD5 verification.
^FOTASTATE: 50	Reports that the module is ready for the upgrade.
^FOTASTATE: 90	Reports that the upgrade succeeds.

Command	Description
AT^FOTASTATE?	Queries the FOTA state.
^FOTASTATE: 10	The FOTA state changes to idle after the upgrade.
OK	


NOTE

- If FOTA SMS auto-download is enabled and **AT^FOTAP** is not received within 10 seconds after **^FOTASMS** is reported, the module automatically downloads the new version.
- When FOTA SMS auto-download is disabled, after **^FOTASMS** is reported, the module downloads the new version only if it receives **AT^FOTAP=1**.

17.12.2 Troubleshooting

None

17.13 FOTA Notification Reception Application Scenarios

17.13.1 Reference Process

Command	Description
^FOTASMS	This command is used by the module to report to the host computer when receiving an update request so the host computer can decide whether to perform the update.


NOTE

- After receiving an update request, the module sends the **^FOTASMS** command three times (once every four seconds; this frequency may change) within 10 seconds to the host computer.
- If the module receives "OK" or does not receive any response from the host computer within 10 seconds, the module starts an FOTA process.
- If the host computer returns "REJ" within 10 seconds, the process ends.

17.13.2 Troubleshooting

None

17.14 FOTA Process Startup Application Scenarios

17.14.1 Reference Process

Command	Description
AT^FOTAP=1	The host computer needs to accept an FOTA update request.
OK	
^FOTAMODE?	Queries the mode settings.
^FOTAMODE: 0,1,1,1,7	Sets the download mode and update mode to automatic and enable resumable data transfer. The settings are not saved to the NV.
OK	
AT^FOTACFG?	Queries dial-up connection profile settings for FOTA.
^FOTACFG: "1234","hwtest","hwtest",2	
OK	
^FOTASTATE: 11	Reports that the query operation is in process.
^FOTASTATE: 12,25.635.65.00.01,19553132,1 add 1;2 del;3 mod;4 add 2;5 add 3	Reports information about the new version, including the version number, size of the file to be downloaded, and update description.
AT^FOTASTATE?	Queries the FOTA status.
^FOTASTATE: 12	A new version is detected.
OK	
^FOTASTATE: 30	Reports that the download is in process.
^FOTASTATE: 40	Reports that the download is complete.
^FOTASTATE: 50	Reports that the update starts.

NOTE

- Query the message-driven FOTA flag byte. If the flag byte is 0, a FOTA process is active. Stop the process to forcibly recover the FOTA state to idle. If the flag byte is 1, the last message-driven FOTA update is still in progress. In this case, query the FOTA state and wait for message to push the state machine to the next state.
- If no new version is detected (state 14), the process ends.

- If the attempt to check for or download updates fails, the module makes another attempt every half an hour within 24 hours until the attempt succeeds or the number of attempts reaches 48.
- If the module fails to check for updates within 24 hours, it saves the flag byte that indicates an detection failure.
- When implementing the FOTA service, the host computer sends the **AT^FOTADL=0** command, and the module performs the update as if it received a FOTA notification and removes the message-driven FOTA flag byte.
- If the module detects the flag byte next time it is powered back on, it attempts to check for updates again. If the attempt succeeds, it sets message-driven FOTA flag byte to **0**. If the attempt fails, it removes the message-driven FOTA flag byte, and the FOTA state recovers to idle.

17.14.2 Troubleshooting

Scenario	Possible Error Information	Solution
The command returns an error message.	+CME ERROR: FOTA is in collision state	Use the AT^FOTASTATE command to check whether the data service or IP stack service is used or whether FOTA state is idle.
The command returns an error message.	+CME ERROR: Previous command is not complete	Wait for the previous command to be completely executed.
The command returns an error message.	+CME ERROR: SIM PIN required	Use the PIN to unlock the module.
The module reports a query failure.	^FOTASTATE: 13,<error_code>	Upon a query failure, the module recovers the FOTA state to idle and deletes the downloaded files. See the AT command guide for error codes.

18 LED Indication Application Scenarios

18.1 Overview

LED indicates the MT's current state. Table 18-1 shows the Huawei default LED program, including LED mode to different states.

Table 18-1 HUAWEI default LED program

LED MODE	SERVICE STATE
Permanently off	Off line
100 ms on/100ms off/100 ms on/1700ms off	Power on Initialization
100 ms on/100ms off/100 ms on/1700ms off	Register fail and no service
100 ms on/100ms off/100 ms on/1700ms off	Connect to no service area
100 ms on/1900 ms off	Register on WCDMA
Permanently on	Connect on WCDMA
Permanently on	Transmit data on WCDMA
Permanently on	Connect on HSPA
Permanently on	Transmit on HSPA



NOTE

LED ON indicates LED GPIO high and LED OFF indicates LED GPIO low.

18.2 LED Setting Operations

18.2.1 Reference Process

Command	Description
AT^LEDCTRL=?	Checks the parameter range supported by the command.
^LEDCTRL: (0-2),00000FFF,(0-1),(1-100),(1-100),(1-100),(1-100)	
OK	
AT^LEDCTRL?	Queries the current LED program, 1 indicates adapting Huawei default program.
^LEDCTRL: 1	
OK	
AT^LEDCTRL=0	Turns off LED function.
OK	
AT^LEDCTRL=1	Configures Huawei default program.
OK	
AT^LEDCTRL=2,00000001,0	Configures that offline state LED mode is Permanently off.
OK	
AT^LEDCTRL=2,00000001,1,10,10	Configures that offline state LED mode is single flash and cycle time is 2s (1s on/1s off).
OK	
AT^LEDCTRL=2,00000001,1,1,1,1,1,7	Configures that offline state LED mode is double flash and cycle time is 2s (0.1s on/0.1s off/0.1s on/1.7s off).
OK	
AT^LEDCTRL=2,0000000F,1,1,1,1,1,7	Configures that offline, power on initialization, register fail no service and connect to no service state LED mode are double flash. Cycle time is 2s (0.1s on/0.1s off/0.1s on/1.7s off).
OK	
AT^LEDCTRL=2,00000400,1	Configures that register successful on WCDMA, connect and transmit state LED mode are Permanently on.

Command	Description
OK	
AT^LEDCTRL=2,3FFFFFFF,1	Configures that all service state LED mod are Permanently on.
OK	

**NOTE**

- After LED mode is configured, it will take effective immediately. We suggest to configure all the LED modes corresponding to its service states. If one LED mode does not configure, the corresponding service state will adapt LED MODE to Permanently OFF.
- By default, the blinking function of modules is disabled.

18.2.2 Troubleshooting

None

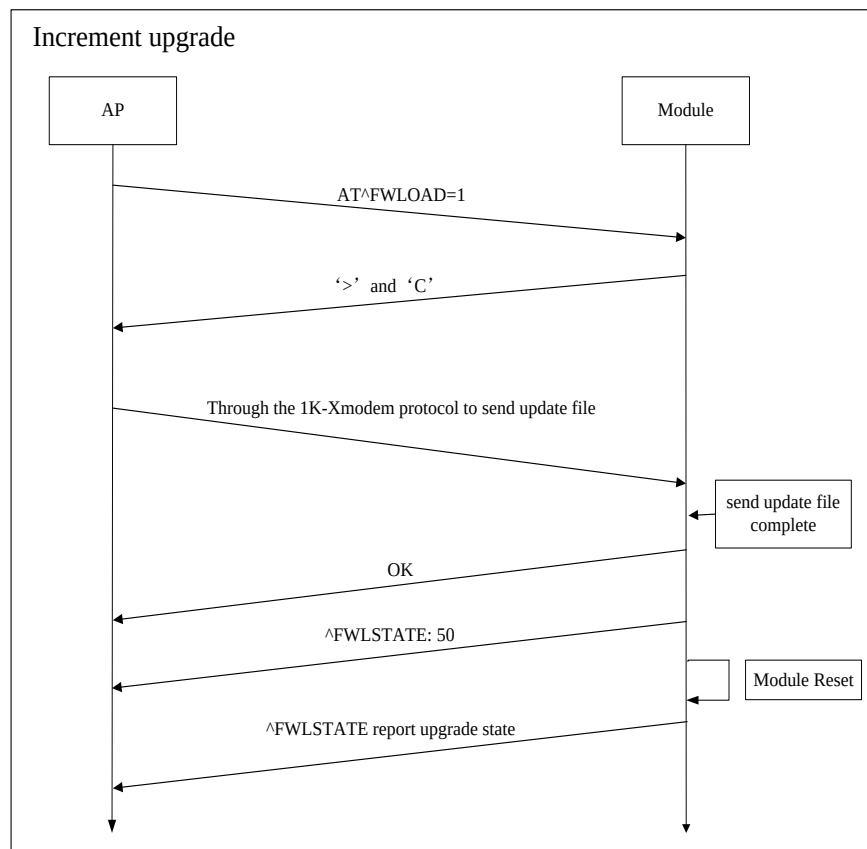
19 Local Upgrade Application Scenarios

19.1 Starting the Local Upgrade

19.1.1 Local Upgrade Flow Chart

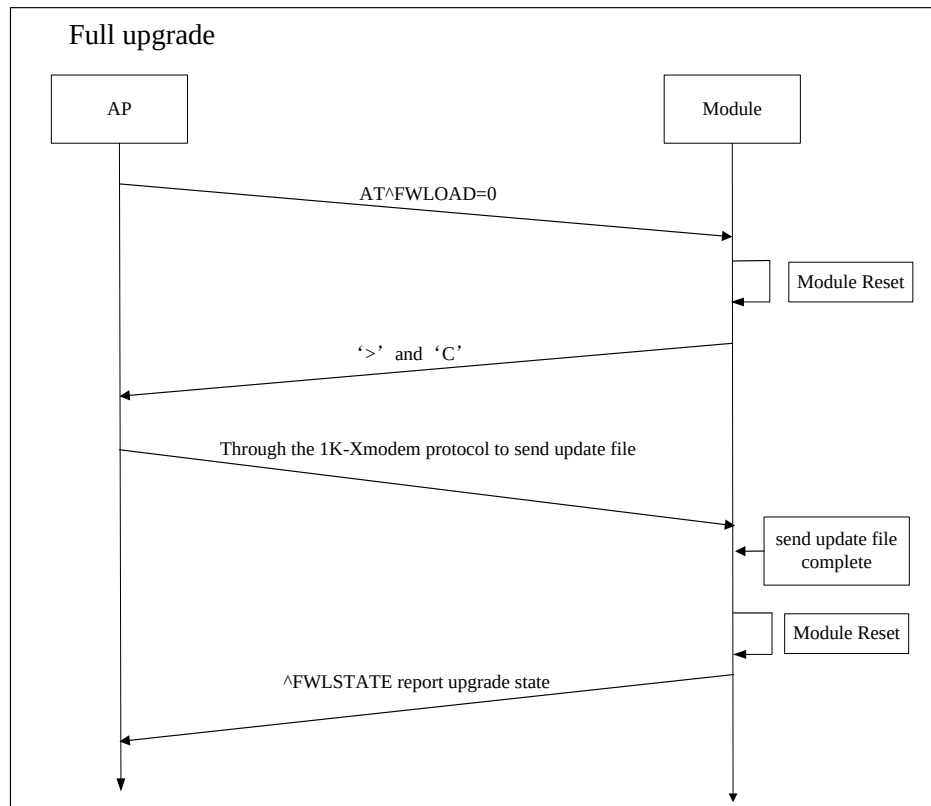
Increment Upgrade Flow

Figure 19-1 Increment upgrade flow



Full Upgrade Flow

Figure 19-2 Full upgrade flow



19.1.2 Test Steps

Tools and Test Steps

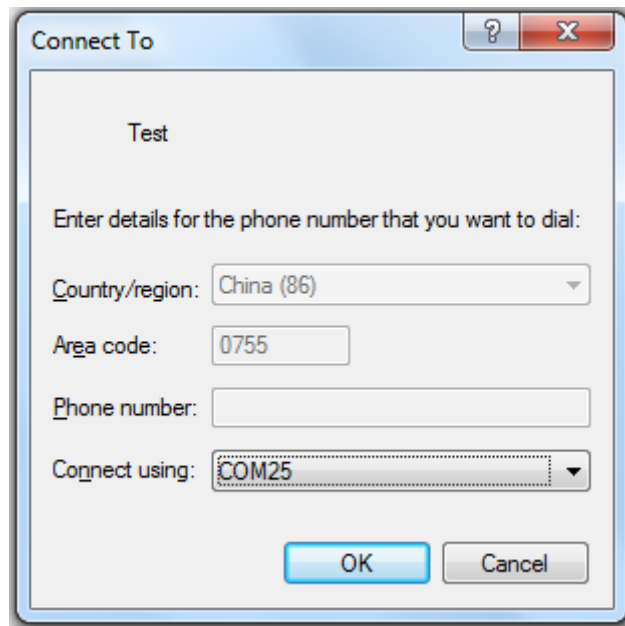
This section takes the increment upgrade flow for an example, and the test is taken on Windows system with Hyper Terminal tool.



NOTE

- The Hyper Terminal tool supports 1K-Xmodem protocol transfer files.
- Use Minicom instead of Hyper Terminal on a Linux system.

Step 1 Open the Hyper Terminal tool and choose the modem port number. (In this document, the modem port is **COM25**.)

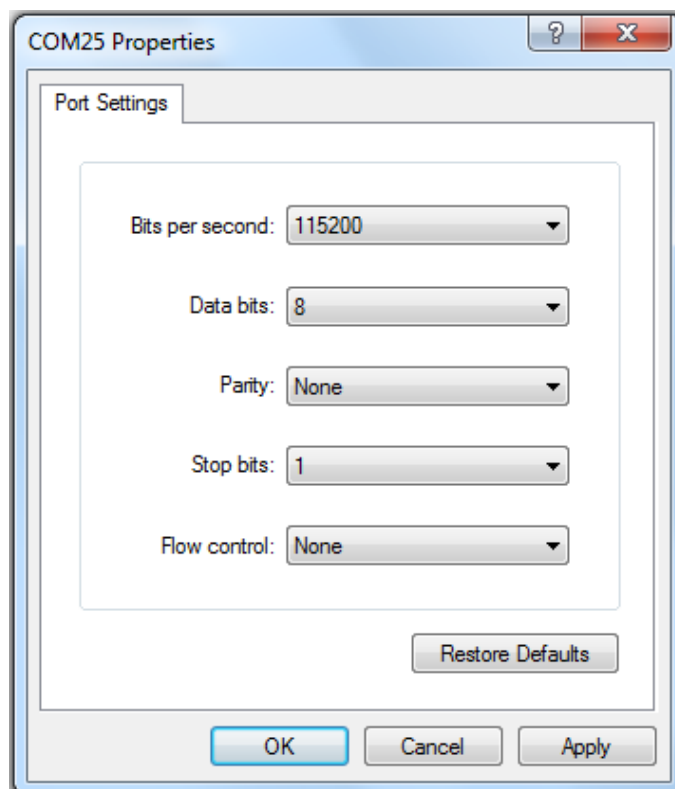


Step 2 Set the parameters of the COM25 port.

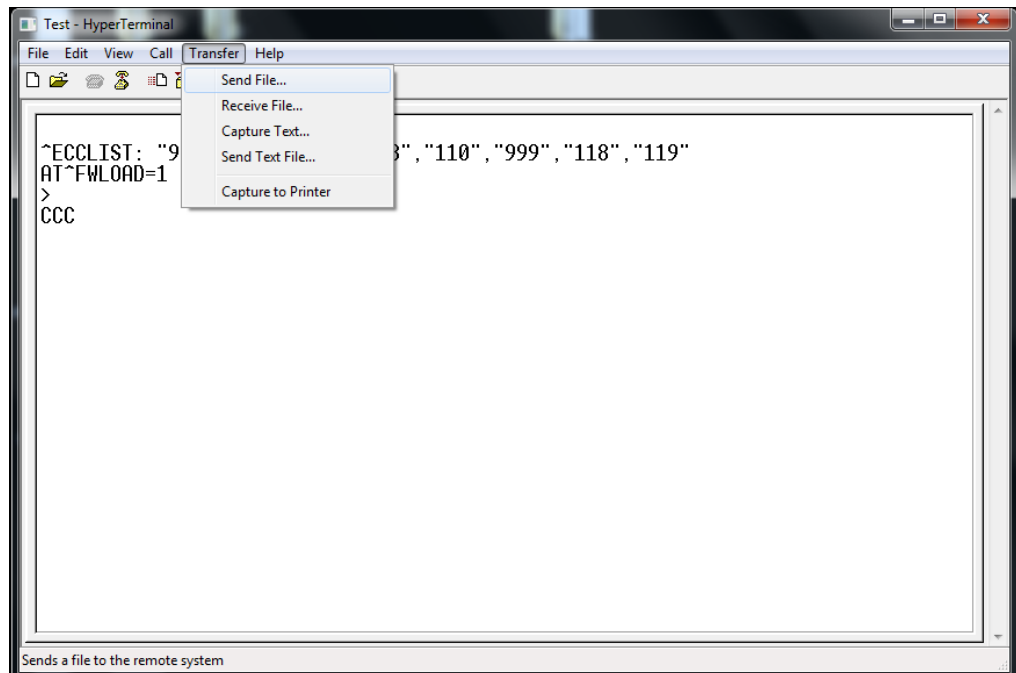


NOTE

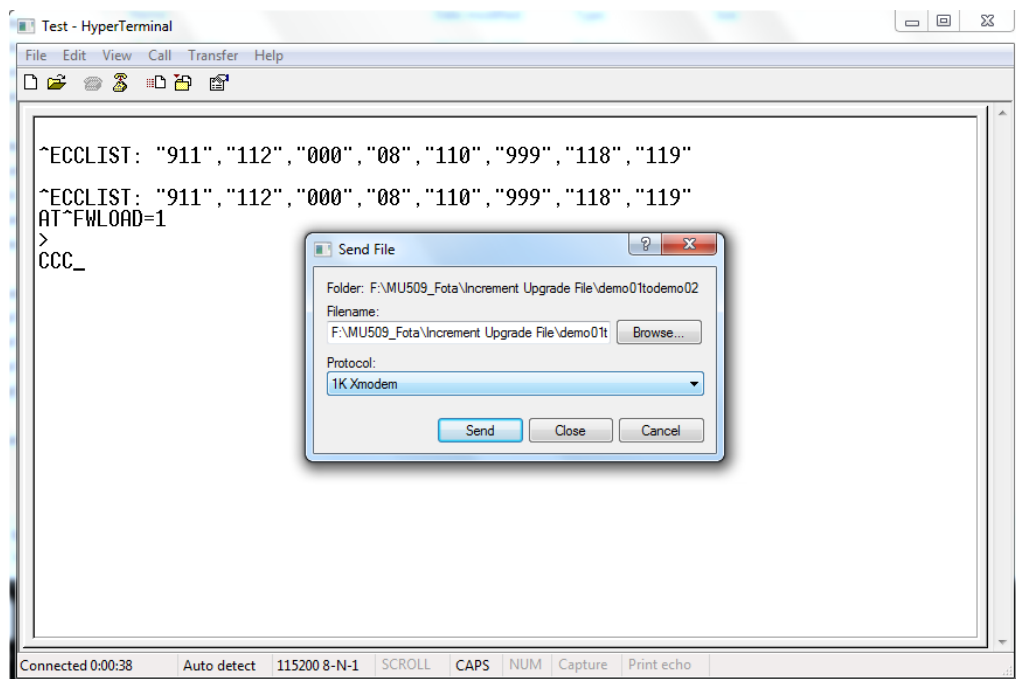
Run the **AT+IPR?** command, get the return value and use this value to set the **Bits per second**.



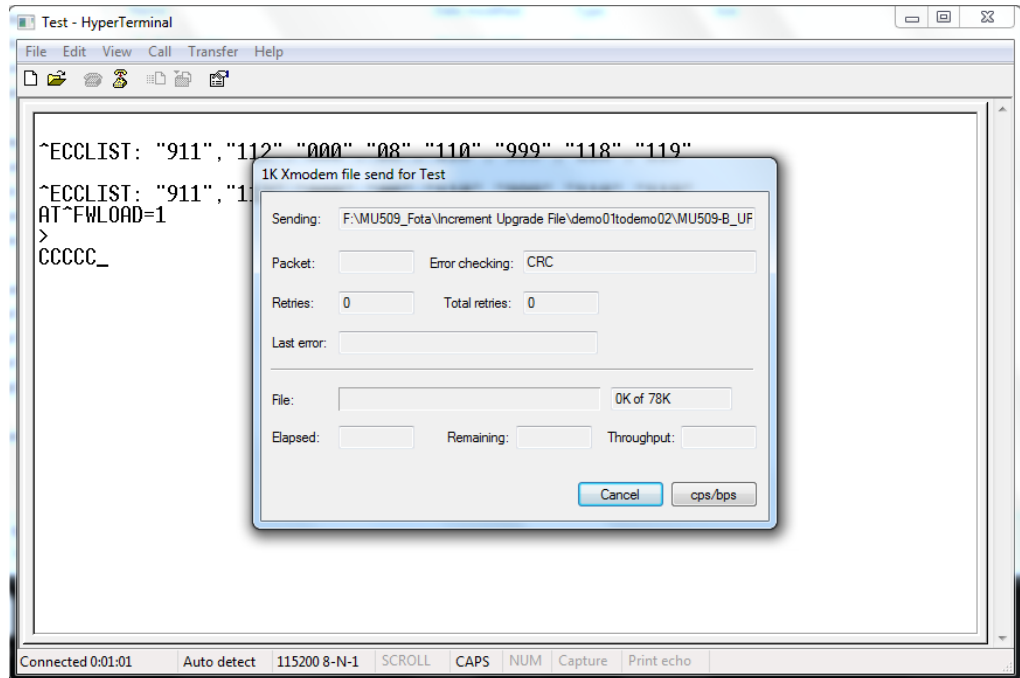
Step 3 Run the **AT^FWLOAD=1** command, and launch an increment upgrade.



Step 4 Choose the file which will be sent to the module and choose the **1K Xmodem** protocol.



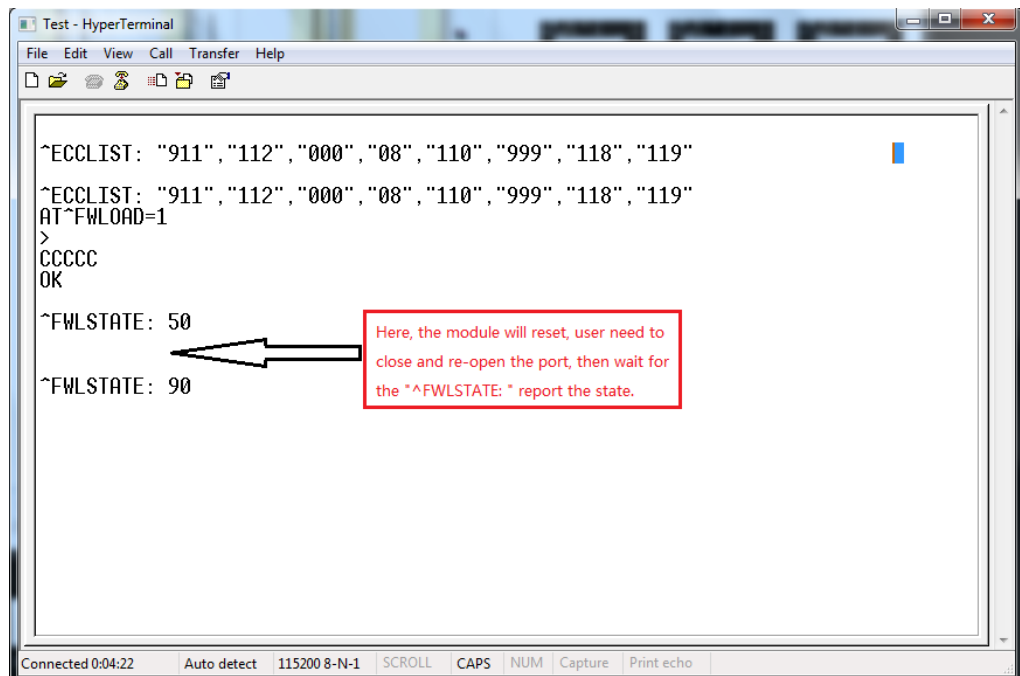
Step 5 Begin to transfer the local file to the module flash.



Step 6 After finishing the file transmission, start the upgrade. And the module will reset automatically to finish the upgrade.

If the upgrade is successful, the module will return **^FWLSTATE: 90**.

If the upgrade comes across some errors, the **^FWLSTATE** will give an error code.



Requirement of the AP

The AP is required to have 4KB RAM at least (used to store the cache data). If AP only needs to support the increment upgrade, AP FLASH memory must be larger than 1 MB. If AP needs to support the full upgrade, or both the increment upgrade and the full upgrade, AP FLASH memory must be larger than 22 MB. (The full size of MU709 firmware upgrade files is 22 MB.)

1. AP should be able to access and load the upgrade files.
2. AP should have a file transmission tool, this tool need to support 1K-Xmodem protocol.

Finding the PCUI port on Android and Linux System

Step 1 Enter `/sys/bus/usb/drivers/option`, and look out the following types of folders.

```
2-1.1:1.0
2-1.1:1.1
2-1.1:1.2
2-1.1:1.3
2-1.1:1.4
```

Step 2 Enter these folders, and view the **bInterfaceProtocol** value.

```
# cd 2-1.1:1.1
cd 2-1.1:1.1
# ls
ls
uevent
bInterfaceNumber
bAlternateSetting
bNumEndpoints
bInterfaceClass
bInterfaceSubClass
bInterfaceProtocol
modalias
supports_autosuspend
subsystem
power
driver
ttyUSB1
ep_83
ep_02
```

If the **bInterfaceProtocol** value is **02**, the port is PCUI.

```
# cat bInterfaceNumber
cat bInterfaceNumber
02
```

19.1.3 Reference Process

Command	Description
AT^FWLOAD=0	Starts the full upgrade.
>	
C	
AT^FWLOAD=1	Starts the increment upgrade.
>	
C	

NOTE

- After the module reports 'C', the host transmits the upgrade package to the module using the xmodem or 1k_xmodem protocol.
- Interfaces supported by the module:
- Full upgrade: serial ports and PCUI port (baud rate: 115200 bit/s)
- Increment upgrade: serial ports and modem ports (baud rate: current baud rate of the module)
- The full upgrade takes for long time, so the increment upgrade is recommended.

19.1.4 Troubleshooting

If using the full upgrade by the PCUI port, after the module is restarted, the PCUI port number may be changed. So you need to find the corresponding port, and then send the local upgrade package.

19.2 Reporting the Local Upgrade State

19.2.1 Reference Process

Command	Description
AT^FWLOAD=0	
>	
C	
The board restarts, and the upgrade starts.	

Command	Description
^FWLSTATE: 90	Reports that the local upgrade succeeds.

**NOTE**

After the data have been transmitted completely and successfully, the MT will not send **OK** to the TE.

19.2.2 Troubleshooting

If a power failure occurs during the upgrade, the upgrade process must be repeated.

20 eCall Application Scenarios

20.1 Performance Specifications for MSD Transmission

20.1.1 Prerequisites

To measure the time required for an eCall to transmit the minimum set of data (MSD), ensure that the following prerequisites are met:

- Network: Huawei laboratory network
- Network conditions: optimal conditions (error-free radio channel, GSM FR codec, and FR AMR 12.2 kbit/s mode)
- Call type: emergency calls
- In-vehicle system (IVS)'s modulation mode: fast modulator
- Module: The IVS and Public Safety Answering Point (PSAP) modules, which use the V3R3 chip by Hisilicon.

According to the 3GPP TS 26.267 protocol, the IVS can modulate the MSD using a fast or robust modulator. The MSD's frame duration is 1320 ms when using a fast modulator and 2320 ms when using a robust modulator. The MSD transmission duration varies depending on the MSD's data frame duration.

The MSD transmission performance specifications described in this document apply to fast modulators only. When tested on a Huawei laboratory network and the signals are strong, the IVS does not switch to a robust modulator. If the IVS uses a robust modulator, further analysis must be performed.

20.1.2 Timing Methods

There are two methods to measure the time required to transmit the MSD using eCall:

- When an eCall is initiated, the IVS transmits the SEND frame to the PSAP. Timing starts when the IVS begins to send the first SEND frame and ends when the IVS receives the second HLACK frame from the PSAP.
- When an eCall is in progress, the IVS does not send the SEND frame if the PSAP requires the IVS to resend the MSD. Timing starts when the IVS receives the first START frame and ends when the IVS receives the second HLACK frame from the PSAP.

The MSD transmission time required for both timing methods is the same.

20.1.3 Performance Specifications

Perform the eCall session in the test environment described in section 20.1.1 Prerequisites, and use the timing method described in section 20.1.2 Timing Methods. The time required for the MSD transmission is between 4 and 40 seconds under the following situations:

- The PSAP is set to PUSH mode.
- The PSAP is set to PULL mode.
- The PSAP requires the IVS to resend the MSD. This includes scenarios as follows:
 - The MSD is transmitted, and the voice call is in progress.
 - The PSAP hangs up the eCall voice call and calls back the IVS within 12 hour.
 - The eCall voice call is ended unexpectedly due to a network fault, and the PSAP calls back the IVS within 12 hour.

20.2 AT Command Initiating Port

It is recommended that AT commands for initiating an eCall, monitoring the eCall's unsolicited report of the voice call and MSD transmission status, and ending the eCall are executed using the UART port.

20.3 Precautions for Using ECLPUSH

The **AT+ECLPUSH** command can be executed only in non MSD transmission state. (It cannot be executed when ALACK transmission is not complete.)

20.4 Method for Improving the eCall Setup Success Rate

To improve the eCall setup success rate and make sure eCalls have the highest priority, use the dedicated eCall port to initiate eCalls. For example, if you initiate an eCall through this port during network search, the search will be terminated and the eCall will be set up.

20.5 Handling Conflicts Between eCall and Other Voice Calls

eCalls have the highest priority. When an eCall is initiated, the module disconnects other voice calls automatically. During an eCall, no other voice calls (including an eCall) can be initiated or answered, ensuring the correct transmission of MSD data.

20.6 Manual Initiation of eCall Emergency Calls

Users can manually initiate eCall emergency calls. As emergency calls do not send the number to the network side, **AT^ECLSTART** does not require a third parameter to specify the called number in this case. Even if a third parameter is provided, it will not be used.

20.6.1 Reference Process

Command	Description
AT^ECLCFG=0,0,1	Sets the MSD retrieving mode to transparent, unmutes the speaker on the IVS side, and enables the eCall redial function.
OK	
AT^ECLMSD="0101344141414141414141414141313131313131a8000000e100000c100000d1020002000300020004053030303030303030303030303030303030000000000000000000000000000000000000000000000000000000000000000000000000000000000000000"	Sets the MSD to be transmitted in the eCall session before the eCall is initiated. The vehicle encapsulates and encodes the MSD, and delivers the MSD to the module using AT^ECLMSD .
OK	
AT^ECLSTART=0,1	This is an asynchronous AT command. After this command is executed, OK is returned, but this does not mean that the eCall voice call has been connected. The eCall voice call is connected when ^CONN is reported.

Command	Description
OK	The eCall initiation request is sent to the eCall module.
^ORIG: 1,9	The eCall module initiates a voice call to the PSAP.
^CONF: 1	The ringback tone is played.
^CONN: 1,9	The voice call is answered.
^ECLSTAT: 0	The IVS starts transmitting data frames to the PSAP.
^ECLSTAT: 1	The PSAP confirms that the MSD was received. The IVS and PSAP switch to a normal voice call.
^ECLREC: "2014/10/17,01:51:05+32",0	
^ECLREC: "2014/10/17,01:51:05+32",0	
^ECLREC: "2014/10/17,01:51:06+32",0	The IVS receives the ALACK message from the PSAP
^ECLREC: "2014/10/17,01:51:06+32",0	
^ECLREC: "2014/10/17,01:51:07+32",0	
AT^ECLSTOP	The user must send AT^ECLSTOP to end the eCall. This is an asynchronous AT command. Returning OK does not mean the eCall is ended. The eCall is ended when ^CEND is unsolicitedly reported.
OK	The eCall ending request is sent to the eCall module.
^CEND: 1, 28, 29, 16	The IVS hangs up the voice call.

20.6.2 Troubleshooting

Scenario	Possible Error Information	Solution
The MSD is updated when an eCall is initiated and the MSD transmission is in progress.	ERROR	Set the MSD after ^ECLSTAT:3,4000 is reported or the eCall ends.
An eCall is initiated while another one is already in progress.	ERROR	Wait until the ongoing eCall ends. Only one eCall can be processed at a time.

20.7 Automatic Initiation of eCall Emergency Calls by the Vehicle

eCall emergency calls can be initiated when the vehicle sensor detects a collision. As emergency calls do not send the number to the network side, **AT^ECLSTART** does not require a third parameter to specify the called number in this case. Even if a third parameter is provided, it will not be used.

20.7.1 Reference Process

Command	Description
AT+ECLCFG=0,0,1	Sets the MSD retrieving mode to transparent, unmutes the speaker on the IVS side, and enables the eCall redial function.
OK	
AT+ECLMSD="0101344141414141414 141414141313131313131a8000000e10 00000c100000d102000200030002000 405303030303030303030303030303 030000000000000000000000000000 000000000000000000000000000000 000000000000000000000000000000 000000000000000000000000000000 000000000000000000000000000000 000000000000000000000000000000 00000"	Sets the MSD to be transmitted in the eCall session before the eCall is initiated. The vehicle encapsulates and encodes the MSD, and delivers the MSD to the module using AT+ECLMSD .
OK	
AT+ECLSTART=1,1	Automatic initiation of eCall emergency calls by the vehicle. This is an asynchronous AT command. For more information, see section 20.6 Manual Initiation of eCall Emergency Calls.

Command	Description
OK	The eCall initiation request is sent to the eCall module.
^ORIG: 1,9	
^CONF: 1	The eCall module initiates a voice call to the PSAP.
^CONN: 1,9	
^ECLSTAT: 0	The ringback tone is played.
	The voice call is answered.
^ECLSTAT: 1	The IVS starts transmitting data frames to the PSAP.
^ECLREC: "2014/10/17,01:51:05+32",0	The PSAP confirms that the MSD is received. The IVS and PSAP switch to a normal voice call.
^ECLREC: "2014/10/17,01:51:05+32",0	
^ECLREC: "2014/10/17,01:51:06+32",0	The IVS receives the ALACK message from the PSAP.
^ECLREC: "2014/10/17,01:51:06+32",0	
^ECLREC: "2014/10/17,01:51:07+32",0	
AT^ECLSTOP	The user must send AT^ECLSTOP to end the eCall. This is an asynchronous AT command. For more information, see section 20.6 Manual Initiation of eCall Emergency Calls.
OK	The eCall ending request is sent to the eCall module.
^CEND: 1, 28, 29, 16	The IVS hangs up the voice call.

20.7.2 Troubleshooting

Scenario	Possible Error Information	Solution
The MSD is reset when an eCall is initiated and the MSD transmission is in progress.	ERROR	Set the MSD after ^ECLSTAT:3,4000 is reported or the eCall ends.
An eCall is initiated while another one is already in progress.	ERROR	Wait until the ongoing eCall ends. Only one eCall can be processed at a time.

20.8 Manual Initiation of eCall Test Calls

Users can manually initiate eCall test calls. The tested number is specified by the third parameter of **AT^ECLSTART**. In this case, a third parameter of **AT^ECLSTART** must be provided.

20.8.1 Reference Process

Command	Description
AT^ECLCFG=0,0,1	Sets the MSD retrieving mode to transparent, unmutes the speaker on the IVS side, and enables the eCall redial function.
OK	
AT^ECLMSD="0101344141414141414141414141313131313131a8000000e100000c100000d102000200030002000405303030303030303030303030303030303000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000"	Sets the MSD to be transmitted in the eCall session before the eCall is initiated. The vehicle encapsulates and encodes the MSD, and delivers the MSD to the module using AT^ECLMSD .
OK	
AT^ECLSTART=0,0,"13903710429"	The user manually initiates an eCall test call to 13903710429. This is an asynchronous AT command. For more information, see section 20.6 Manual Initiation of eCall Emergency Calls..

Command	Description
OK	The eCall initiation request is sent to the eCall module.
^ORIG: 1,0	
^CONF: 1	The eCall module initiates a voice call to the PSAP.
^CONN: 1,0	
^ECLSTAT: 0	The ringback tone is played.
	The voice call is answered.
^ECLSTAT: 1	The IVS starts transmitting data frames to the PSAP.
^ECLREC: "2014/10/17,01:51:05+32",0	The PSAP confirms that the MSD is received. The IVS and PSAP switch to a normal voice call.
^ECLREC: "2014/10/17,01:51:05+32",0	The IVS receives the ALACK message from the PSAP.
^ECLREC: "2014/10/17,01:51:06+32",0	
^ECLREC: "2014/10/17,01:51:06+32",0	
^ECLREC: "2014/10/17,01:51:07+32",0	
AT^ECLSTOP	The user must send AT^ECLSTOP to end the eCall. This is an asynchronous AT command. For more information, see section 20.6 Manual Initiation of eCall Emergency Calls..
OK	The eCall ending request is sent to the eCall module.
^CEND: 1, 28, 29, 16	The IVS hangs up the voice call.

20.9 Automatic Initiation of eCall Test Calls by the Vehicle

The vehicle can automatically initiate a test call using eCall. The tested number is specified by the third parameter of **AT^ECLSTART**. In this case, a third parameter of **AT^ECLSTART** must be provided.

20.9.1 Reference Process

Command	Description
AT^ECLCFG=0,0	Sets the MSD retrieving mode to transparent, and unmute the speaker on the IVS side.

[illegible]

Command	Description
OK	The eCall ending request is sent to the eCall module.
^CEND: 1, 28, 29, 16	The IVS hangs up the voice call.

20.10 MSD Update Request to the User

During the eCall session, the PSAP may request the IVS to resend the MSD. In the case, the module unsolicitedly reports **^ECLSTAT: 3,4000**.

The user then needs to update and resend the MSD as soon as possible. If the user does not resend the updated MSD within 4 seconds, the module retransmits the MSD which was set in the previous attempt.

20.10.1 Reference Process

[illegible]

20.10.2 Troubleshooting

Scenario	Possible Error Information	Solution
The MSD is set after the 4 seconds timeout.	ERROR	Update the MSD within 4 seconds.

20.11 Unsolicited MSD Transmission by the IVS

20.11.1 Reference Process

Command	Description
AT^ECLSTART=0,0,"13903702987",0	After the call is set up, the IVS remains in PULL mode, and does not send MSD data to the PSAP actively.
OK	
^ORIG: 1,0	
^CONF: 1	
^CONN: 1,0	After the command is executed, the IVS enters voice call state.
AT^ECLPUSH	The IVS triggers an MSD transmission request in unsolicited mode.
OK	
^ECLSTAT: 0	After receiving the transmission request from the PSAP, the IVS transmits MSD data to the PSAP.

20.12 Unsolicited Report of eCall Redial Information

20.12.1 Reference Process

Command	Description
AT^ECLSTART=0,0	
ERROR	
^ECLREDIAL:0	ECall redial starts.
^ECLREDIAL:1	ECall redial fails.

20.13 Hanging Up eCall Voice Calls

To properly hang up eCall voice calls, use **AT^ECLSTOP**, which hangs up eCall voice calls (including the call initiated by the IVS and the callback by the PSAP) and deactivates eCall, so that the eCall session is terminated.

When the IVS deems that an eCall session needs to be terminated, the IVS must send **AT^ECLSTOP** to stop the eCall, even when the eCall voice call is hung up by the PSAP, so that to deactivate eCall from MT call waiting mode.



NOTE

IVS must not use **AT+CHLD** and **AT+CHUP** to hang up voice calls initiated by eCall. Although **AT+CHLD** and **AT+CHUP** can be used to hang up the call when eCall initiates a voice call, this method is incorrect. The call is hung up by the PSAP or the abnormal network, then the eCall module will enter MT call waiting mode. Therefore, all answered incoming calls within the next 12 hour will be deemed as eCall voice calls, and users will be requested to update the MSD.

21 Jamming Detection Application Scenarios

21.1 Pre-configuration

21.1.1 Reference Process

Command	Description
AT^JDETEX=?	Queries the supported range of parameters.
^JDETEX: (0,1),(2),(0-70),(0-255)	
OK	
AT^JDETEX=1,2,10,30	Enables the Jamming Detection function, set method and the threshold of noise power and useless channel number.
OK	
AT^JDETEX?	Queries the current jamming detection mode, current threshold of noise power and useless channel number.
^JDETEX: 1,2,10,30	
OK	



NOTE

- Currently, the interruption that can be detected by MU709 module is the strong one which can disconnect MU709 from network or which makes MU709 module re-search and re-register to network. Meanwhile, MU709 module cannot detect the interruption which is caused by intelligent Jammer.
- The parameter settings are still effective after restart the MT.
- If Jammer is not detected, nothing will be reported. (The voltage level at the pin RI will not change.)

- If Jammer is detected, **^JDET: "JAMMED"** will be unsolicitedly reported at once, and the voltage of pin RI is pulled low for 500 ms.
- If Jammer can no longer be detected, **^JDET: "DETECTING"** will be unsolicitedly reported, and the voltage of pin RI is pulled low for 200 ms. This scenario occurs only after a jammed condition has occurred.

21.1.2 Troubleshooting

Scenario	Possible Error Information	Solution
The parameter is out of the correct range.	ERROR	Refer to the AT command document.

21.2 Jamming Detection

When the jamming detection is enabled, the module will report an unsolicited result code: **^JDETEX: "status"**.

The following describes the status:

JAMMED: Jammed condition is detected.

DETECTING: Jammer disappeared. This code will be shown only after a jammed condition has occurred.

Pin RI is also changed to notify the application that jammed conditions are detected.

JAMMED: pin RI Low for 500 ms.

DETECTING: pin RI Low for 200 ms.

22 Netscan Application Scenarios

22.1 Reference Process

Command	Description
AT^NETSCAN=2,-110	Sends the command with two parameters, get the information about the two strong frequencies of the current network in GSM (default). The information includes frequency, cell reselection coefficient, location area code, MCC, MNC, base station code, and signal strength.
^NETSCAN: 15,,,4,460,09,5,-64 ^NETSCAN: 31,,,6,460,09,2,-100	
OK	
AT^NETSCAN=2,-110,1	Sends the command with three parameters to scan for 3G frequencies and return the information about the two cells with the strongest signal.
^NETSCAN: 9675,,,2513,234,15,0,-64,100190,800000 ^NETSCAN: 10688,,,a530,460,01,0,-77,1614a4e,400000	
OK	
AT^NETSCAN=?	Returns the range of parameters.
^NETSCAN: (1-20),(-110-47),(0,1)	
OK	

**NOTE**

- This command can be interrupted. For voice calling, packet data service, frequency point locking, TCP, and UDP services, this command will not find anything, and "operation not allowed" will be returned.
- To avoid a potential conflict with normal module operations, it is strongly recommended that you not use this command such as "incoming call", "periodic location update", "periodic routing area update".
- The command is executed within a maximum of 2 minutes.
- After the lock function is enabled using **AT^FREQLOCK**, the module will only scan the locked frequency points. Therefore, if the frequency lock function has been enabled and then **AT^NETSCAN** is sent, **ERROR** will be returned.

22.2 Troubleshooting

Scenario	Possible Error Information	Solution
AT^NETSCAN=2,-110	+CME ERROR: operation not allowed	Disable the current data service, or wait a few seconds when the SIM card is busy.
AT^NETSCAN=2,-110	+CME ERROR: operation not allowed	Wait a moment or move to a place with good reception.

23

Network Monitoring Application Scenarios

23.1 Application Background

If the network signal reception does not meet service requirements, use network monitoring to obtain information about the serving cell and neighboring cells. You can then use related functions to switch to an available neighboring cell to have a better service experience.

23.2 Reference Process

Command	Description
AT^MONSC	Obtains the information about the serving cell. For details, see the AT command document. Currently, only the information about GSM and WCDMA cells can be obtained.
^MONSC: GSM,001,01,2,522,63,0,1,-66,99,0	
OK	
AT^MONNC	
^MONNC: GSM,1,124,0,0,1,-79	
OK	

The **AT^MONSC** command queries the parameters of the serving cell. If the module is using a WCDMA network, the command returns the following information depending on the state:

- In non-Dedicated state, the command returns the parameters of the resident cell.
- In Dedicated state, the command returns the parameters of the cell whose signal is the strongest among the active set.

The **AT^MONNC** command queries the parameters of the neighboring cells. If the module is using a WCDMA network, the command returns the following information depending on the state:

- In non-Dedicated state, the command returns the parameters of neighboring WCDMA cells.
- In Dedicated state, the command returns the parameters of all the cells, including the cells in the active set, cells in the monitored set, and neighboring cells.

After the module receives a system message from the serving cell, it measures the parameters of the neighboring cells based on the neighboring cell information contained in the message and the network status.

The number of measured neighboring cells depends on the serving cell. The maximum number of measured neighboring cells vary by standard. For details, see the AT command document.

23.3 Troubleshooting

Scenario	Possible Error Information	Solution
AT^MONSC	ERROR	The module has not camped on any cells. Run this command after the module camps on a cell.
AT^MONNC	ERROR	The module has not camped on any cells. Run this command after the module camps on a cell.
AT^MONNC	^MONNC: NONE OK	No neighboring cell is configured for the module's serving cell, or neighboring cell measurement is not available in the current network condition. Run this command a few comments later.

24 Cell Lock Application Scenarios

24.1 Application Background

The cell lock function restricts the region where services can be used. Currently, the services are the data service, voice service, and short message service (SMS).

24.2 Reference Process

Command	Description
AT^CELLLOCK=?	Obtains the value range.
^CELLLOCK: (0-1),(0-1),("0000"- "FFFF"),("00000000"- "FFFFFFFF"),("00000000"- "FFFFFFFF"),("00000000"- "FFFFFFFF")	
OK	
AT^CELLLOCK?	Queries the activation status of cell lock.
^CELLLOCK: 0	Cell lock is disabled.
OK	
AT^CELLLOCK=1,0,"00C3","0000001"	Locks the module to cell 00000001 in the location area 00C3 in GSM mode.
OK	
AT^CELLLOCK=1,1,"00B3","0000001"	Locks the module to cell 00000001 in the location area 00B3 in WCDMA mode.
OK	
AT^CELLLOCK?	Queries the activation status of cell lock.

Command	Description
^CELLLOCK: 1,0,"00C3","00000001" ^CELLLOCK: 1,1,"00B3","00000001"	The module is locked to cell 00000001 in the location area 00C3 in GSM mode, and cell 00000001 in the location area 00B3 in WCDMA mode.
OK	

**NOTE**

- The cell lock settings take effect immediately. When the module is not in the region specified in the LAC+CI list, the module cannot initiate data, voice, and SMS services. Still, the module can receive voice calls initiated and short messages sent by the network.
- When cell lock is enabled and the module leaves or is outside the locked region, the module automatically disconnects the active dial-up connection.

24.3 Troubleshooting

None

25

FREQLock Application Scenarios

25.1 Application Background

The FREQLock function restricts the frequency of the cell from which the module receives services. When this function is enabled, the module cannot perform inter-frequency reselection or handover, reducing the module's power consumption.

 NOTE

- When FREQLock is enabled and the module leaves the locked serving cell, the module cannot use any service network.
- In GSM mode, FREQLock can be used to lock the module to a specific frequency. In WCDMA mode, FREQLock can be used to lock the module to a specific frequency and primary scrambling code. When the module is only locked to a specific frequency, it can reselect and switch to a cell with the same frequency.

25.2 Reference Process

Command	Description
AT^FREQLock?	Queries the activation status of FREQLock.
^FREQLock: 0,"01" ^FREQLock: 0,"02"	FREQLock is disabled in GSM and WCDMA modes.
OK	
AT^SYSCFG=13,0,3FFFFFFF,1,2	Sets the system mode to GSM only.
OK	
AT^FREQLock=1,"01",54,"01",	Locks the module to frequency 54 at GSM 900 MHz.
OK	The command is executed successfully. If the specified frequency is not available in the current network environment, the module enters no service state.

Command	Description
AT^SYSCFG=14,0,3FFFFFFF,1,2	Sets the system mode to WCDMA only.
OK	
AT^FREQLock=1,"02",10738,,	Locks the module to frequency 10738 in WCDMA mode.
OK	
AT^FREQLock=1,"02",10738,,30	Locks the module to frequency 10738 in WCDMA mode, with the scrambling code of 30.
OK	
AT^FREQLock?	Queries the FREQLock settings.
^FREQLock: 1,"01",54,"01", ^FREQLock: 1,"02",10738,,30	The module is locked to frequency 54 at GSM 900 MHz and frequency 10738 in WCDMA mode, with the scrambling code of 30.
OK	


NOTE

- If you use FREQLock to restrict the module to a frequency that is in a network mode different from the current network mode, the module does not automatically switch to that frequency. In this case, run **^SYSCFG** to set the system mode before running **^FREQLock**.
- In GSM mode, FREQLock does not affect list search or execution of the **AT^NETSCAN** command. In WCDMA mode, when FREQLock is enabled, list search only returns the cell information of the locked frequency, while execution of the **AT^NETSCAN** command returns **ERROR**.
- When the module is being used for voice or data service, it will switch to the locked cell once it is locked to a cell other than the current serving cell. If the switch fails, manually switch the module to the locked cell when the module is idle.

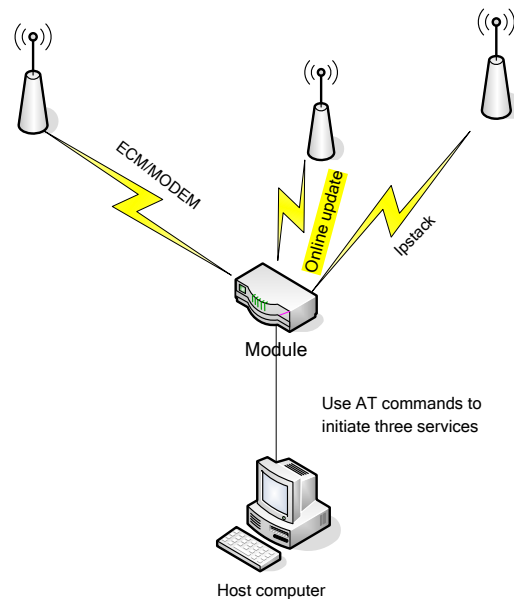
25.3 Troubleshooting

Scenario	Possible Error Information	Solution
The number of input parameters or the parameter value is invalid.	ERROR	Refer to the AT command document.
The specified frequency and frequency band in GSM mode do not match, or the specified frequency in WCDMA is invalid.	ERROR	Set the frequency and scrambling code again.

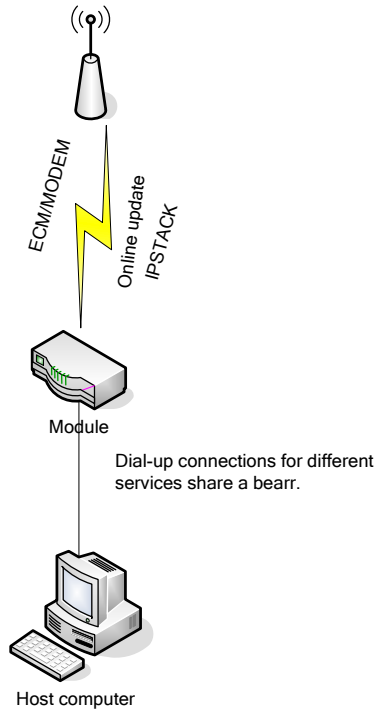
26 MultiPDP Application Scenarios

26.1 Solution Overview

The module provides the MultiPDP function to allow multiple concurrent dial-up connections. With this function, the host computer can set up an ECM or modem dial-up connection while using the IPSTACK and FOTA services. In addition, when the IPSTACK, FOTA, and ECM or modem dial-up connections use the same APN, they can share a bearer. The host computer uses AT commands to initiate dial-up connections for different services.



When multiple host computers run AT commands to use the same APN to initiate dial-up connections for different services, the connections share a bearer.



26.2 Restrictions

- Only one PPP dial-up connection is supported.
- Only one IPSTACK connection is supported.
- If the number of concurrent PDP connections exceeds 3, the connection performance may be affected.
- You can use any values except 3 and 5 in the 1–11 range as the CIDs of ECM and modem dial-up connections.

The following table lists the restrictions when a bearer is shared.

	FOTA	IPSTACK	MODEM	ECM
FOTA	NA ^[3]	Y ^[1]	Y	Y
IPSTACK	Y	NA	Y	Y
MODEM	Y	Y	NA	N ^[2]
ECM	Y	Y	N	NA

[1]:Y: Yes

[2]:N: No

[3]:NA: Not Applicable

When a bearer is shared, the protocol, local IP address, local IP port, remote IP address, and remote IP port used for the ECM or modem dial-up connection service

is the same as those for the FOTA or IPSTACK service. As a result, the service to which the ports are allocated cannot be determined.

When a bearer is shared, services cannot be used at the same time. To use multiple services at the same time, customers' development is required.

26.3 Example

1. Power on the module.
2. After the host computer uses APN 1 for the IPSTACK service, the module establishes a PDP bearer and reports **OK** to the host.
3. After the host uses APN 2 to set up an ECM dial-up connection, the module establishes a PDP bearer, and the dial-up connection is set up.
4. After the host uses APN 3 to perform FOTA download and query, the module establishes a PDP bearer, and the download and query are performed.
5. The host computer attempts to disconnect the FOTA service. After the module initiates PDP context deactivation, the service is disconnected successfully without affecting the IPSTACK and ECM services.
6. The host computer attempts to disconnect the IPSTACK service. After the module initiates PDP context deactivation, the service is disconnected successfully without affecting the ECM service.
7. The host computer uses APN 1 for the IPSTACK service. The module reports OK to the host computer and does not initiate PDP context deactivation. The IPSTACK and ECM services share a bearer and both can work properly.
8. The host computer disconnects the IPSTACK service. The module reports OK to the host computer and does not initiate PDP context deactivation. The ECM service is not affected.

27 Recorder Application Scenarios

27.1 Setting Recording Options

27.1.1 Reference Process

Command	Description
AT^RECCFG=0,3	Sets the DSP sampling and compression format to 3 (AMR).
OK	
AT^RECCFG?	Obtains the current settings.
^RECCFG: 0,3	
^RECCFG: 1,5	
OK	



NOTE

- The settings configured using this command are not saved after the module is powered off.
- For details, please refer to [HUAWEI MU709 Series HSPA+ Module AT Command Interface Specification](#).

27.1.2 Troubleshooting

Scenario	Possible Error Information	Solution
An error message is returned.	+CME ERROR: Operation not supported	The operation is not supported.

27.2 Starting Recording

27.2.1 Reference Process

Command	Description
AT^AUDREC=1,"REC1.AMR"	Starts recording and save the recordings to the REC1.AMR file in the flash memory.
OK	
AT^AUDREC=0	Suspends the recording.
OK	
^AUDEND: 0,0,412	The recording ends, and ^AUDEND is reported.
AT^AUDREC=1,"RAM"	Starts recording and save the recordings to the RAM file in the RAM.
OK	
^AUDEND: 0,1,61440	The recording ends because the storage is full, and ^AUDEND is reported.



NOTE

- If recording files are stored in the RAM, the value of <file_name> is "RAM" by default. If recording files are stored in the flash memory, the value of <file_name> can be "REC1.AMR", "REC2.AMR", "REC3.AMR", "REC4.AMR", or "REC5.AMR", which are all capital letters.
- The flash memory can store 5 files whose total size must not exceed 300 KB (The actual recording time may vary with sampling rates). The recording stops when the size of recordings reaches 300 KB.
- The RAM memory cannot exceed 60 KB (The actual recording time may vary with sampling rates). The recording stops when the size of recordings reaches 60 KB.
- If <op> is set to 1 or 2, <file_name> cannot be left blank. If <op> is set to 0 or 3, <file_name> is not configurable.

27.2.2 Troubleshooting

Scenario	Possible Error Information	Solution
An error message is returned.	+CME ERROR: Error command parameters	The parameter is incorrectly set.
An error message is returned.	+CME ERROR: memory full	There is no free space for recording data storage.

27.3 Playing Recordings

27.3.1 Reference Process

Command	Description
AT^AUDREC=1,"REC1.AMR"	Starts playing data in the REC1.AMR file.
OK	
^AUDEND: 1,1	The recording ends, and ^AUDEND is reported.
AT^AUDREC=1,"REC1.AMR"	Starts playing data in the REC1.AMR file.
OK	



NOTE

- If the recording you want to play is saved in RAM, make sure it is not read before you play it. Once read, the recording is automatically deleted.
- For more details, see the [HUAWEI MU709 Series HSPA+ Module AT Command Interface Specification](#).

27.3.2 Troubleshooting

Scenario	Possible Error Information	Solution
An error message is returned.	+CME ERROR: Operation not supported	The operation is not supported.

27.4 Writing Recording Data on Other Devices to the Module

27.4.1 Reference Process

Command	Description
AT^FILEIO=2,"REC1.AMR",1,1,3,"AD2A3AB12BAD2A3AB12BAD2A3AB12B"	Writes the first packet to the module. (The file name indicates the file storage location, and the file type field is neglected here. There are three packets in total, and the first packet is written here.)
^FILEIO: 1,15	The first packet is written.
OK	
AT^FILEIO=2,"REC1.AMR",1,2,3,"AD2A3AB12BAD2A3AB12BAD2A3AB12B"	Writes the second packet.

Command	Description
^FILEIO: 2,15	The second packet is written.
OK	
AT^FILEIO=2,"REC1.AMR",1,,3,3,"AD2A3AB12BAD2A3AB12BAD2A3AB12B"	Writes the third packet.
^FILEIO: 3,15	The third packet is written.
OK	
AT^FILEIO=1,"REC1.AMR",1,,0,100	Reads the 100-byte content in the REC1.AMR file in the flash memory.
^FILEIO: 15,15 "AD2A3AB12BAD2A3AB12BAD2A3AB12B"	The content in the REC1.AMR file is returned.
OK	


NOTE

- If the file to be read does not exist, an error is returned.
- If data is stored in the RAM, after a segment of data is read, it will be automatically deleted.
- If data is stored in RAM, the offset value must be set to 0. Otherwise, ERROR is returned.
- If the file to be deleted does not exist, **OK** is returned.
- The host sends 0x32 to the module, the module will just save 0x32. But **AT^FILEIO** needs to display the data, all characters will be encoded to ASCII. The ASCII codes of '3' and '2' are respectively "33" and "32", so the content of **AT^FILEIO** is 0x33 0x32. And the maximum length of each packet is 512 byte, if you need to write 300 KB data to the module, the host should totally send 600 packets.
- When **AT^FILEIO** is used to write data, the data must have AMR file header. If not, the module will consider the data is illegal and response **+CME ERROR: 65290** (amr file header lost).
- For details, please refer to [HUAWEI MU709 Series HSPA+ Module AT Command Interface Specification](#).

27.4.2 Troubleshooting

Scenario	Possible Error Information	Solution
An error message is returned.	+CME ERROR: Operation not supported	The operation is not supported.
An error message is returned.	+CME ERROR: memory full	There is no free space for recording data storage.
An error message is returned.	+CME ERROR: Error command parameters	The parameter is incorrectly set.

27.5 Deleting Recording Data of Other Devices from the Module

27.5.1 Reference Process

Command	Description
AT^FILEIO=3,"REC1.AMR"	Deletes the content from the REC1.AMR file in the flash memory.
OK	

**NOTE**

- The recording data written to the module has the same file name as the module's recordings. Therefore, this command will also delete the recordings with the same name on the module.
- For more details, see the [HUAWEI MU709 Series HSPA+ Module AT Command Interface Specification](#).

27.5.2 Troubleshooting

Scenario	Possible Error Information	Solution
An error message is returned.	+CME ERROR: Operation not supported	The operation is not supported.

28 Appendix

28.1 Relative Documents

1. HUAWEI MU709 Series HSPA+ Module AT Command Interface Specification
2. 3GPP TS 22.004 General on supplementary services
3. 3GPP TS 23.040 Technical realization of the Short Message Service (SMS)
4. 3GPP TS 24.008 Mobile radio interface Layer 3 specification; Core network protocols; Stage 3
5. 3GPP TS 27.005 Equipment (DTE – DCE) interface for Short Message Service (SMS) and Cell Broadcast Service (CBS)
6. 3GPP TS 27.007 AT command set for User Equipment (UE)
7. 3GPP TS 29.002 Mobile Application Part (MAP) specification
8. 3GPP TS 31.102 Universal Subscriber Identity Module (USIM) application
9. ETSI TS 102.221 Smart Cards; UICC-Terminal interface; Physical and logical characteristics

28.2 Acronyms and Abbreviations

Table 28-1 List of Abbreviations

Acronym or Abbreviation	Expansion
3GPP	Third Generation Partnership Project
APN	Access Point Name
AT	Attention
CS	Circuit Switched (CS) domain
DCE	Data Circuit Equipment
DTE	Data Terminal Equipment
FTP	File Transfer Protocol
GPRS	General Packet Radio Service

Acronym or Abbreviation	Expansion
GSM	Global System for Mobile Communications
HTTP	Hyper Text Transfer Protocol
IMEI	International Mobile Equipment Identity
IP	Internet Protocol
IVS	In-Vehicle System
ME	Mobile Equipment
MS	Mobile Station
MSD	Minimum Set of Data
PDP	Packet Data Protocol
PDU	Protocol Data Unit
PIN	Personal Identity Number
PPP	Point-to-Point Protocol
PUK	PIN Unblocking Key
PS	Packet Switched (PS) domain
PSAP	Public Safety Answering Point
QoS	Quality of Service
RSSI	Receive Signal Strength Indicator
SCA	Service Center Address
SIM	Subscriber Identity Module
SMS	Short Message Service
SMTP	Simple Mail Transfer Protocol
SSL	Secure Socket Layer
TE	Terminal Equipment
TLS	Transport Layer Security
UE	User Equipment
UMTS	Universal Mobile Telecommunications System
URC	Unsolicited Result Code
USIM	Universal Subscriber Identity Module
WCDMA	Wideband CDMA

Table 28-2 Phonebook-related abbreviations

Abbreviation	Full Name
SM	SIM phonebook
EN	SIM emergency number
ON	SIM own numbers