HUAWEI MU736 HSPA+ M.2 Module

Application Guide

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About This Document

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1 Introduction

1.1 Overview

This document is intended to provide references for customers to choose appropriate command sequences to start using the MU736 module in a faster manner. This document also contains examples and relevant description.

This document will be updated based on customers' requirements.

1.2 Conventions and Definitions

1.2.1 Conventions

Convention	Description
<…>	Value range of AT command parameters
XXXX	Personal identification number (PIN), Personal Unlock Key (PUK), or password

1.2.2 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 mobile network.
Module	HUAWEI HSPA+ module

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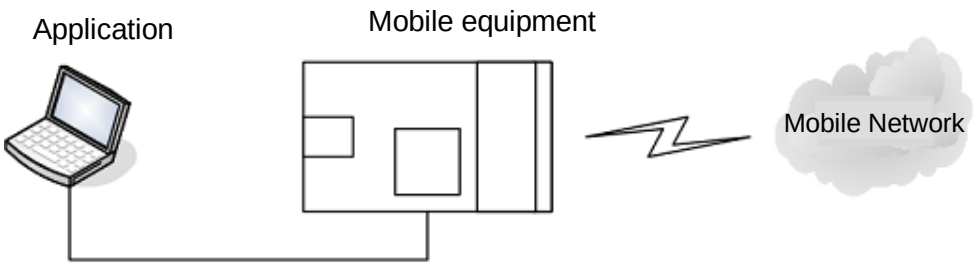
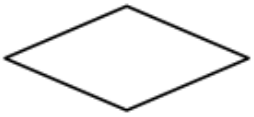
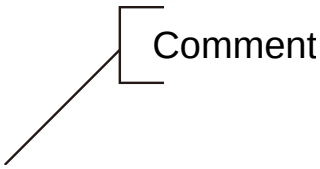
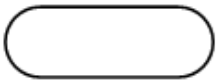
Term	Definition
	

1.2.3 Legends

Legend	Description
	Start.
	Action: includes user input, reports from the module, unsolicited indications from the module, and communication between the module and the host.
	Branch: determines the next step.
	Comment: clarifies the scenario.
	End.
	Dataflow: indicates the next step to which the service goes or the indication reported from an action.

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1.3 Basic AT Command Processing Principles

1.3.1 Ports

The MU736 provides three 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
- GPS port: simulated using USB, for AT command interaction and establishing data connection

  Port name: HUAWEI Mobile Connect – 3G GPS Interface.

The MU736 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.

1.3.2 AT Command Processing Mechanism

A module processes AT commands from the ports (MODEM, PCUI, and GPS) in series. The AT commands can parallel processing. It means that an AT command can be processed when the previous AT command processing hasn't been completed.

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.

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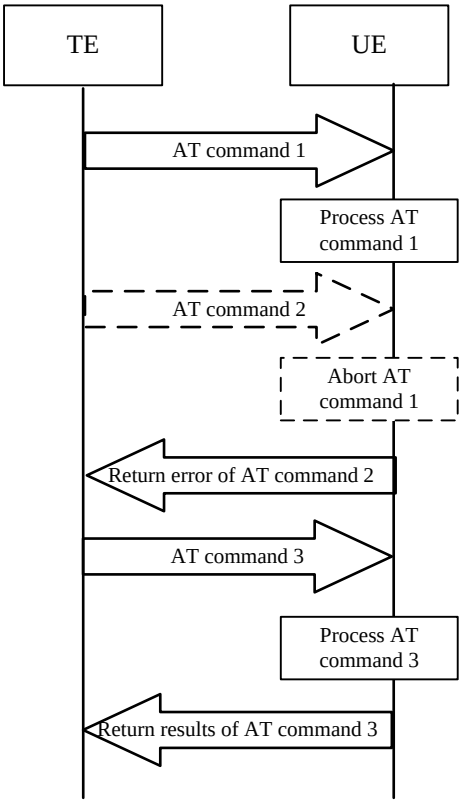
Figure 1-1 AT command processing sequence diagram



1.3.3 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 1-1 AT command timeout duration

AT Command	Timeout Duration
General AT commands	10s
AT+CMGS (used to send text messages)	60s
AT+COPS=? (used to search for networks)	180s

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 the AT command to the module.

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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.

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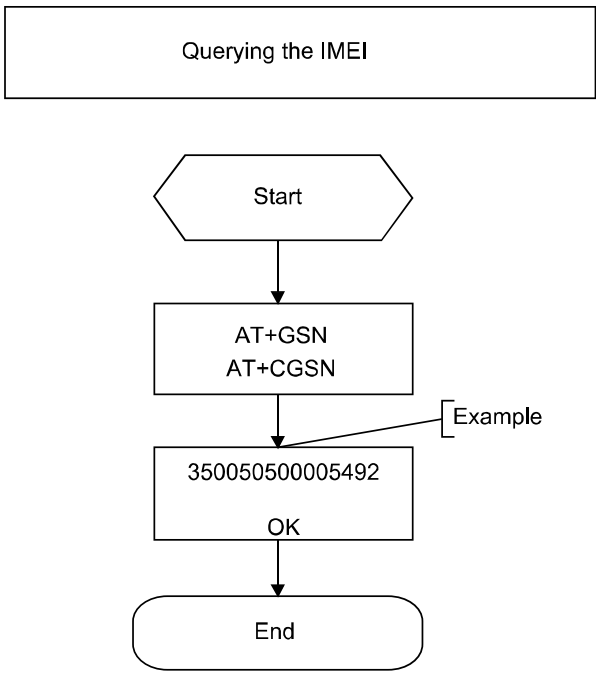
2 Basic Application Scenarios

2.1 Querying the IMEI

2.1.1 Reference Process

Command	Description
AT+GSN/AT+CGSN	Queries the IMEI
IMEI	For example: 350050500005492
OK	

Figure 2-1 Querying the IMEI



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2.1.2 Troubleshooting

Scenario	Possible Error Information	Solution
AT+GSN/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.

2.2 Querying Additional Information

2.2.1 Reference Process

Command	Description
ATI	Queries the product information
Product Information **OK**	For example: Manufacturer: Huawei Technologies Co., Ltd. Model: MU736 Revision: 11.103.12.00.00 IMEI: 492100022000114 +GCAP: +CGSM
AT+GMR/CGMR	Queries software version
Software version **OK**	Software version. e.g. 11.103.12.00.00
AT+GMI/CGMI	Queries manufacturer information
Manufacturer Identification **OK**	Huawei Technologies Co., Ltd.
AT+GMM/CGMM	Queries model name
Model identification **OK**	MU736

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2.2.2 Troubleshooting

None

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3 Power Management Application Scenarios

3.1 Overview

As a product embedded into a host, a module must be able to enter the low power consumption mode, be woken up by the host, wake up the host, and implement special configuration required by the host.

The module's power management supports the following two methods to wake up the host:

- When the USB has entered the suspend state and the module has data to be sent to the host, the module will request the host to start the resume operation. This method is called USB remote wake-up.
- For computers (Android-based computers) that do not support USB remote wake-up, the hosts can be woken up by using the modules' PINs connected to the hosts.

Reducing the number of times that the host is woken up by URCs can reduce the host's power consumption. For this purpose, the URC buffering mechanism is used in the module's power management. After the USB enters the suspend state, without losing URCs, this mechanism prevents the host from being frequently woken up. Relevant configuration can be made using the **^CURC** command.

3.2 Configuring the Remote Wake-up by URCs

3.2.1 Reference Process

Command	Description
AT^CURC=1	Enables the URCs defined by Huawei.
OK	
AT^CURC=2,2,2	Sets **^RSSI** as the wake-up source, and discards other URCs when the host is in the sleep mode.
OK	

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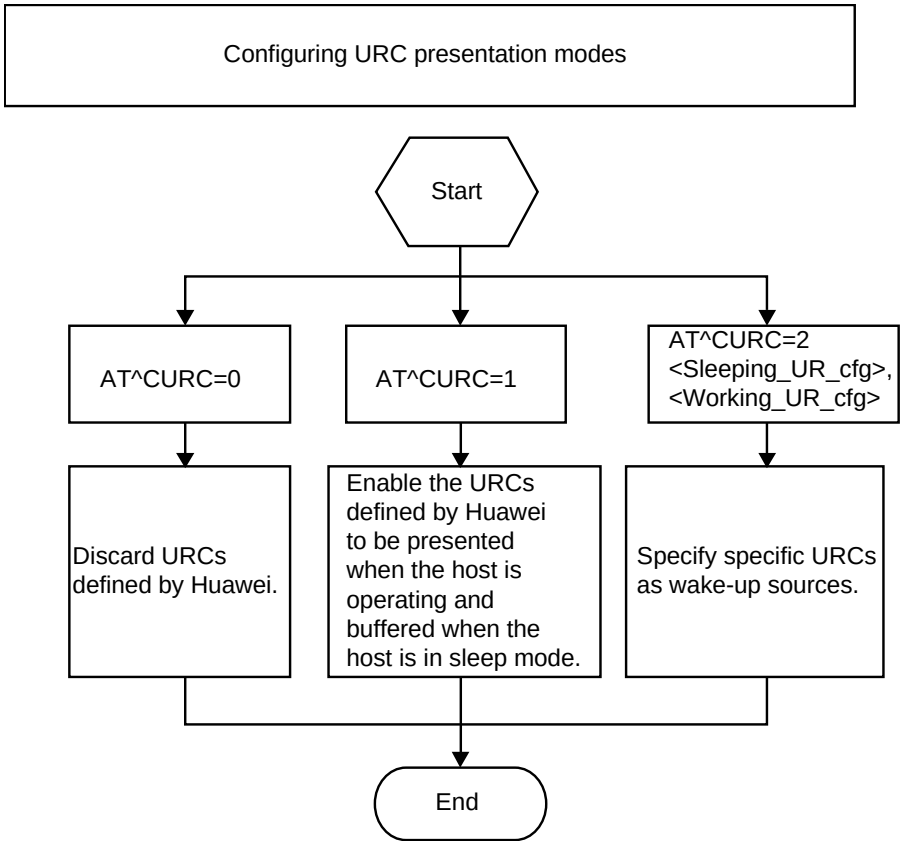
Command	Description
AT^CURC=2,1ffffffffffffff, 1ffffffffffffff	Sets all URCs as the wake-up sources when the host is in the sleep mode.
OK	

By default, the control mode set by **AT^CURC** is **1**. The control mode will be restored to the default value after the module restarts. If the control mode is **0** or **1**, **<Sleeping_UR_cfg>, <Working_UR_cfg>** cannot be contained in the command. If the control mode is **2**, **<Sleeping_UR_cfg>, <Working_UR_cfg>** must be contained in the command. The URC type settings configured by this command will be lost after the module is powered off.

Figure 3-1 Configuring URC presentation modes



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3.2.2 Troubleshooting

Scenario	Possible Error Information	Solution
Error information is returned in the set command of ^CURC.	+CME ERROR: operation not supported	Parameters not support, please check the input parameters and re-send the command

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4 Airplane Mode Application Scenarios

4.1 Overview

Modules are usually embedded into equipment such as personal computers. The airplane mode provided by the modules can be enabled or disabled as required. When a module is in airplane mode, its radio frequency (RF) unit is switched off, and other functions of the equipment into which the module is embedded are still available.

4.2 Setting the Flight Mode

4.2.1 Reference Process

Command	Description
AT^RFSWITCH=1	Sets the software-controlled RF switch for airplane mode.
OK	
AT^RFSWITCH?	Queries the states of the software and hardware controlled RF switches.
^RFSWITCH: 1,1 **OK**	Indicates the software switch is on, and the hardware switch is on.

AT^RFSWITCH=0: Sets the software-controlled RF switch to Off.

AT^RFSWITCH=1: Sets the software-controlled RF switch to On.

This command uses the software to switch on/off the module's RF unit, and, after successfully switching on/off the RF unit, saves the corresponding settings to the NV memory. The settings will be used as the initial settings of the software-controlled RF switch next time the module is powered on.

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NOTE

Airplane mode can be controlled by the software- and hardware-controlled RF switches. To check the states of the software- and hardware-controlled RF switches, run **AT^RFSWITCH?**.

The airplane mode is controlled in the following manner:

- The module will enter airplane mode when either the software- or hardware-controlled RF switch is on.
- The module will exit airplane mode only when both the software- and hardware-controlled RF switches are off.

4.2.2 Troubleshooting

None

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5 BODYSAR Application Scenarios

5.1 Overview

Specific absorption rate (SAR) is a measure of the rate at which energy is absorbed by the body when exposed to an RF electromagnetic field. It is commonly used to measure power absorbed from mobile phones. The greater the SAR value, the greater the radiation effect on humans.

For user equipment (UE) such as data cards and modules, their SAR value increases as their transmitted power increases.

At present, most vendors' tablets have passed SAR tests. Generally, these products have embedded proximity sensors. When the sensors detect that a human is in the proximity of or in contact with the UE, they will notify the UE so that the UE will reduce the transmitted power. When the human is no longer in the proximity of or in contact with the UE, the sensors also notify the UE so that the UE will restore the transmitted power.

5.2 Enabling/Disabling BODYSAR

5.2.1 Reference Process

Command	Description
AT^BODYSARON=1	Enables the BODYSAR feature.
OK	
AT^BODYSARON=0	Disables the BODYSAR feature.
OK	

If the BODYSAR feature is enabled, the maximum transmitted power can be adjusted. If the BODYSAR feature is disabled, the system's default maximum transmitted power is used.

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5.2.2 Troubleshooting

Scenario	Possible Error Information	Solution
AT^BODYSARON=0 OK AT^BODYSARON?	^BODYSARON: 1 OK	Means HW pin enabled BODYSAR function

5.3 Adjusting the WCDMA Transmitted Power Using the BODYSAR Feature

5.3.1 Reference Process

Command	Description
AT^BODYSARWCDMA=20,00000001,18,0000000a	Sets the maximum WCDMA transmitted power threshold. Indicates that set the maximum WCDMA I Tx power limit to 20 and the maximum WCDMA II and WCDMA IV Tx power limit to 18.
OK	

The WCDMA transmitted power is controlled by setting the maximum transmitted power threshold. Affected by PDM and other factors, the test result may have an error of ±2 dBm.

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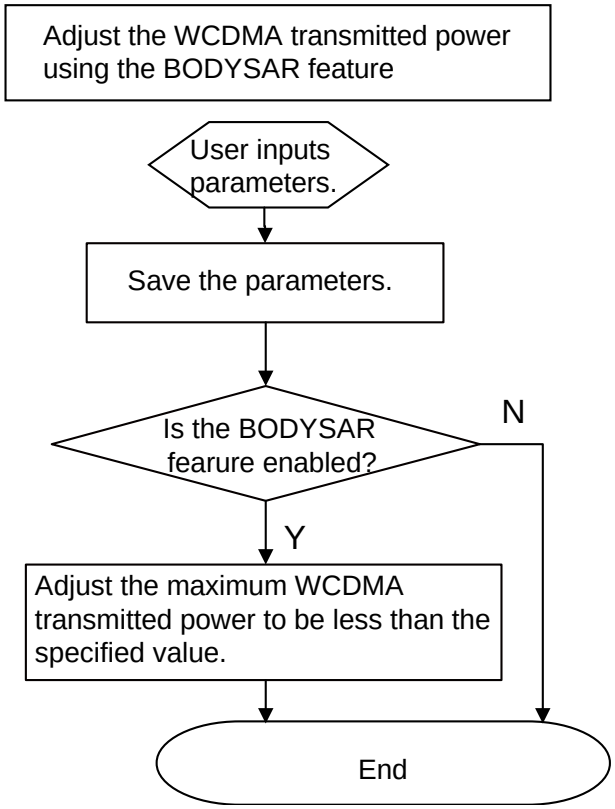
Figure 5-1 Adjusting the WCDMA transmitted power



5.3.2 Troubleshooting

None

5.4 Adjusting the GSM Transmitted Power Using the BODYSAR Feature

5.4.1 Reference Process

Command	Description
AT^BODYSARGSM=28,00000001,25,00000004	Sets the maximum GSM transmitted power thresholds. Indicates that set the maximum GSM850 GPRS Tx power limit to 28 and the maximum GSM1800 GPRS Tx power limit to 25.
OK	

- The **AT^BODYSARGSM** command has four parameters that specify the maximum transmitted power thresholds for the GSM bands (GSM-850, GSM-900, GSM-1800, and GSM-1900).

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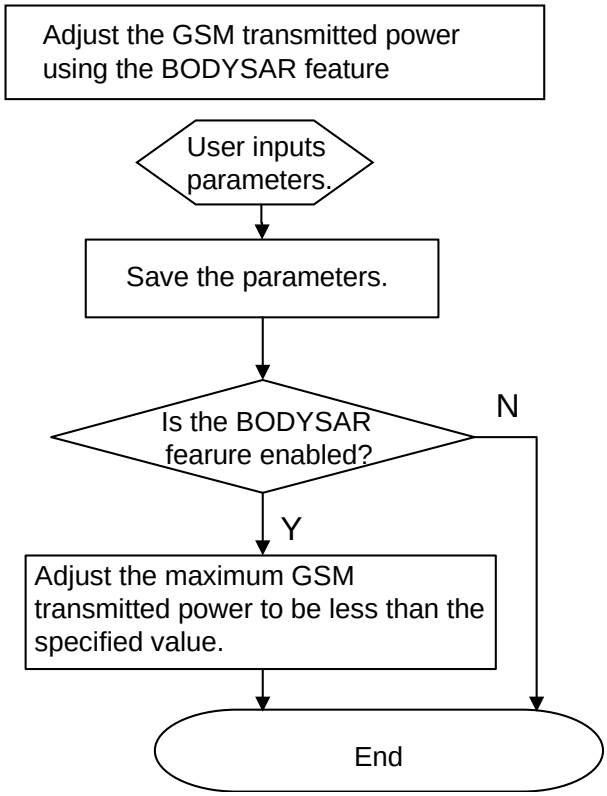
- The thresholds take effect only when the BODYSAR feature is enabled (**AT^BODYSARON=1**).
- The value range of the threshold is 15–33, which can be queried using **AT^BODYSARGSM=?**.

The transmitted power for each band of GSM GPRS and EGPRS (GSM-850, GSM-900, GSM-1800, and GSM-1900) is controlled by setting the maximum transmitted power thresholds. Affected by PDM and other factors, the test result may have an error of ±2 dBm.

Figure 5-2 Adjust the GSM transmitted power



5.4.2 Troubleshooting

None

5.5 Usage Description Of BODYSAR Feature

5.5.1 Reference Description

After a module is powered on, the default BodySAR function status is disabled, and the default power control function in the system is used.

The maximum transmitting power parameters take effect in real time only when the following requirements are met:

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- The **AT^BODYSARWCDMA** or **AT^BODYSARGSM** command is used to set the maximum transmitting power parameters successfully.
- The **AT^BODYSARON=1** command is used to enable the BodySAR function.

When the maximum transmitting power parameters are not set or the BodySAR function is disabled, the default power control function in the system is used.

After the maximum transmitting power parameters are set, the **AT^BODYSARON=0** command can be used to disable the BodySAR function. Then the default maximum transmitting power is resumed. If the **AT^BODYSARON=1** command is used to enable the BodySAR function again, the maximum transmitting power parameters that have been set take effect in real time.

The maximum transmitting power parameters are saved in flash. As a contrast, the current BodySAR function status is not saved. That means if the module restarts, the values of the maximum transmitting power parameters are the same with which before restarting, but the BodySAR function status is disable.

The **AT^BODYSARGSM** set command sets the maximum Tx power limit of GSM, GPRS and EGPRS for each band in single time-slot. When the module changes into multi-slot configuration, the maximum Tx power limit of each time-slot will be reduced. The power reduction in multi-slot configuration is as follow:

Number of timeslots in uplink assignment	Reduction of maximum Tx power (dB)
1	0
2	3
3	5
4	6
5	7
6	8
7	8.5
8	9

5.5.2 Troubleshooting

None

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6 Network Searching and Registration Application Scenarios

6.1 Searching and Registering Network

6.1.1 Reference Process

Command	Description
AT+COPS=0	Enables automatic search for networks.
OK	
AT+COPS=1,2,"46000"	Manual search for the appointed network.
OK	
AT+COPS=?	Seaches for all networks, and returns the networks.
OK	
AT+CREG=2	Enables the unsolicited indication when network registration state changes.
OK	
AT^SYSCFG=14,2, 3fffffff,1,0	Sets the band, keeps the domain unchanged, allows roaming, and allows connection to WCDMA 3G networks only.
OK	
AT^SYSCFG=13,1, 3ffffffff,1,0	Sets the band, keeps the domain unchanged, allows roaming, and allows connection to GSM 2G networks only.
OK	
AT^SYSINFO	Queries the system service state, domain, roaming status, and system mode.
^SYSINFO: 1,0,0,0,1,0,0,	

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Command	Description
OK	
AT+CSQ	Queries the signal quality.
+CSQ: 15,99 **OK**	

Figure 6-1 Automatic search for networks

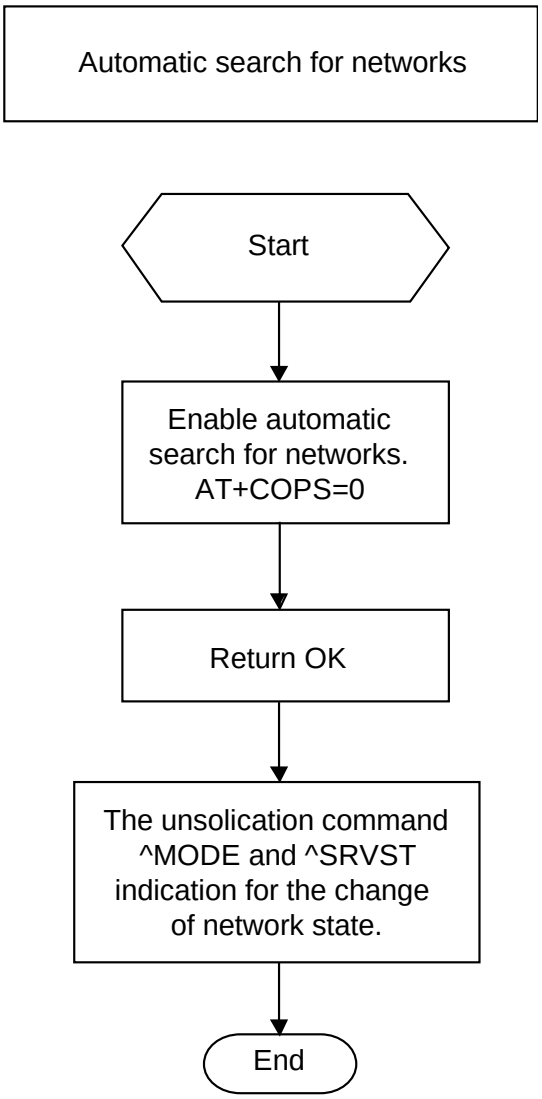

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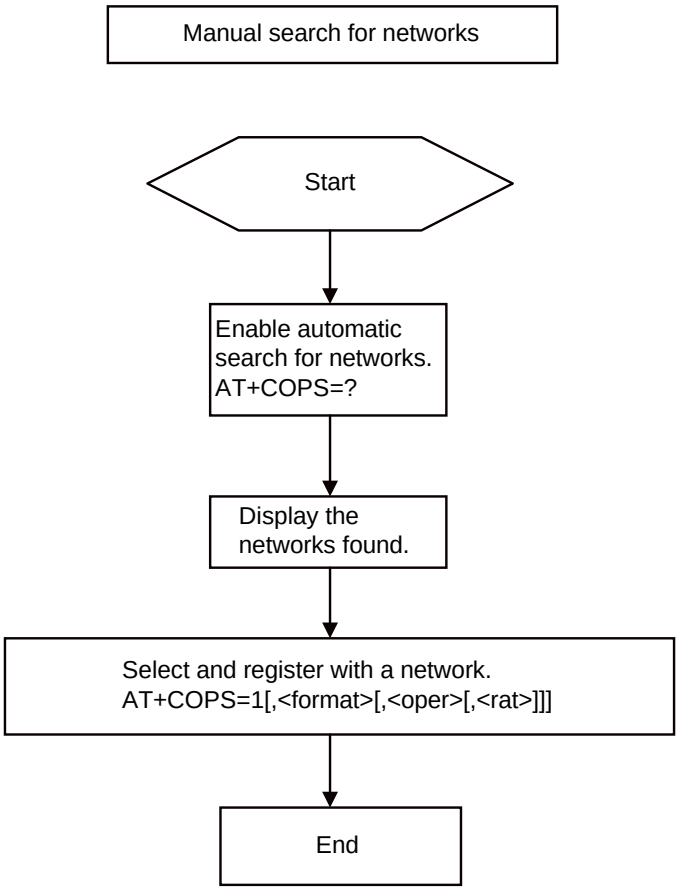
Figure 6-2 Manual search for networks



6.1.2 Troubleshooting

Scenario	Possible Error Information	Solution
AT+COPS?	+CME ERROR: SIM failure	No SIM card is detected. Insert a SIM card.
AT+CREG?	+CME ERROR: SIM failure	No SIM card is detected. Insert a SIM card.

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7 SMS Application Scenarios

7.1 Overview

Short Message Service (SMS) is a text messaging service using a service center(SC) to transfer short text messages between GSM MEs and Short Message Entities (SMEs). MU736 only supports protocol data unit (PDU) mode message.

A message must contain the following information before it is sent:

For a PDU mode message:

- Length of TPDU package
- Message content: To compose or send a PDU mode message, the message must contain all the message attributes and be encoded in PDU format. A PDU consists of the following:
  - Service Center Address (SCA): composed of the address length, SCA type and SCA reverse byte.
  - First octet: contains the message type indicator, TP-RP, TP-UDHI, TP-SRR, TP-VPF, TP-RD, and TP-MTI.
  - Short text message statement.
  - Destination address: consisting of the destination address, address length and destination address type.
  - Protocol identifier.
  - Data encoding scheme.
  - Validity duration.
  - Data length.
  - User data: consisting of the user data header and the data encoded in PDU format.

Figure 7-1 shows an example of data encoded in PDU format.

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Figure 7-1 Example of data encoded in PDU format

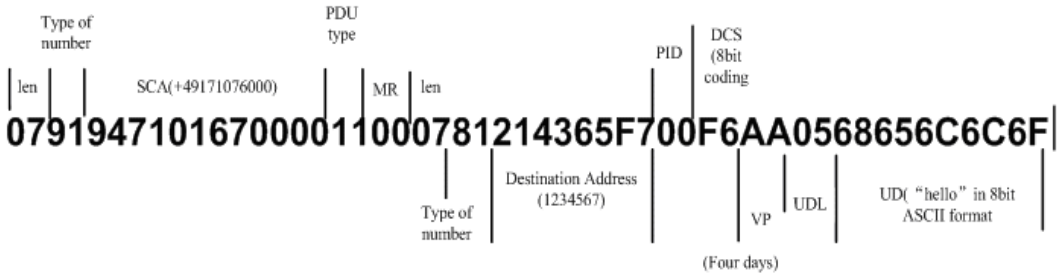
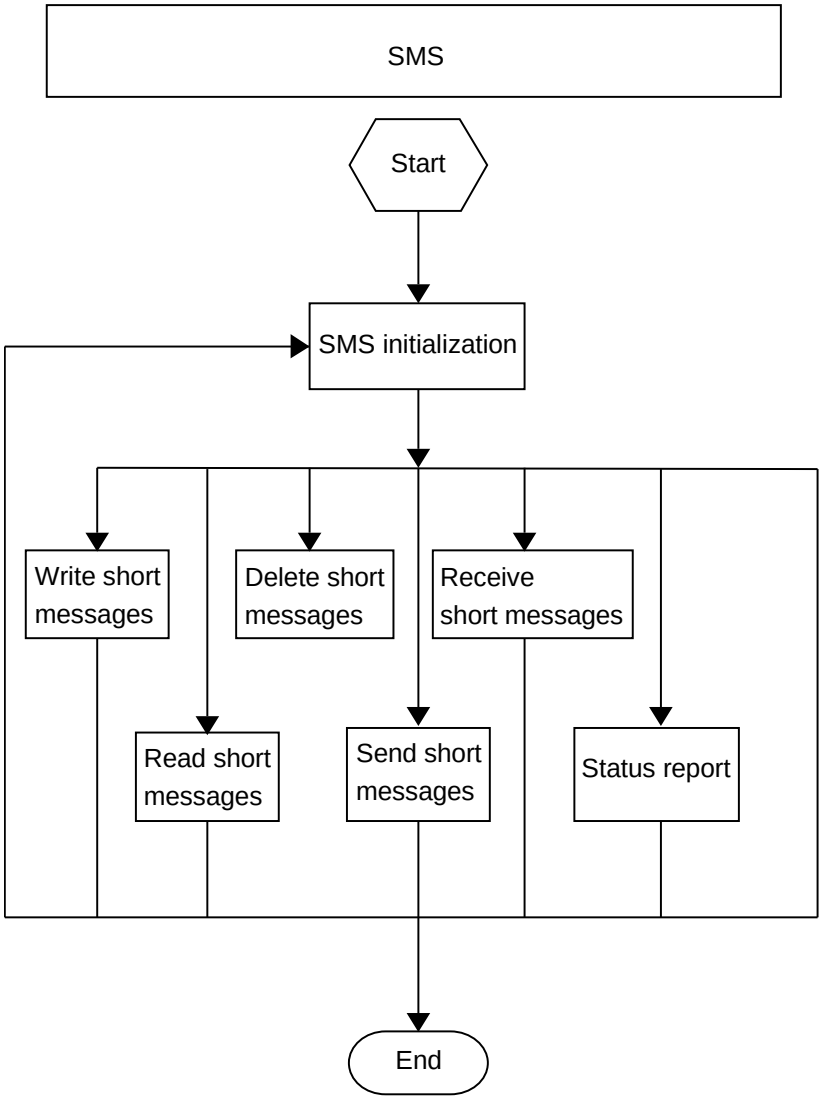


Figure 7-2 shows the general SMS process.

Figure 7-2 General SMS process



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7.2 Initializing SMS

7.2.1 Reference Process

Command	Description
AT+CSCA?	Queries the SMSC address.
+CSCA: "13800688509",129 **OK**	
AT+CSCA="+8613800755500"	Sets the SMSC address to the SMSC number of China Mobile's Shenzhen Branch.
OK	
AT+CSMS?	Queries the short message service type.
+CSMS: 0,1,1,1 **OK**	
AT+CNMI?	Queries the configuration of the new message indications to TE.
+CNMI: 0,0,0,0,1 **OK**	
AT+CNMI=2,1,0,0,1	Configures the new message indications to TE.
OK	
AT+CPMS?	Queries the preferred short message storage.
+CPMS: "SM",12,20," SM ",12,20," SM ",12,20 **OK**	
AT+CMPS="SM"	Sets SM as short message storage medium.
OK	
AT+CGSMS?	Queries the MO SMS bearer domain.
+CGSMS: 3 **OK**	
AT+CGSMS=2	Sets the PS domain as the preferred MO bearer domain (the CS domain is used only when the PS domain is unavailable).

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Command	Description
OK	
AT+CMGF?	Queries the short message format.
+CMGF: 0 **OK**	
AT+CMGF=0	Sets the short message format to PDU.
OK	

Use the **AT+CMGF** command to set short message format: **AT+CMGF=0** sets the short message format to PDU.

The SMSC address provided by the service provider must be specified. In PDU mode, the SMSC address is contained in the PDU packets. Therefore, in PDU mode, the **AT+CSCA** command is optional.

To use the SMS features specified in the GSM07.05 Phase 2+, the **AT+CSMS** command must be used to enable the features.

Use the **AT+CNMI** command to set the unsolicited indications.

Use the **AT+CPMS** command to select the preferred short message storage (SIM or ME). The MU736 supports only the SM (SIM card) storage.

Use the **AT+CGSMS** command to select the MO SMS bearer domain (PS or CS domain). For MU736, the CS domain is the preferred MO bearer domain.

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Figure 7-3 SMS initialization process – part 1

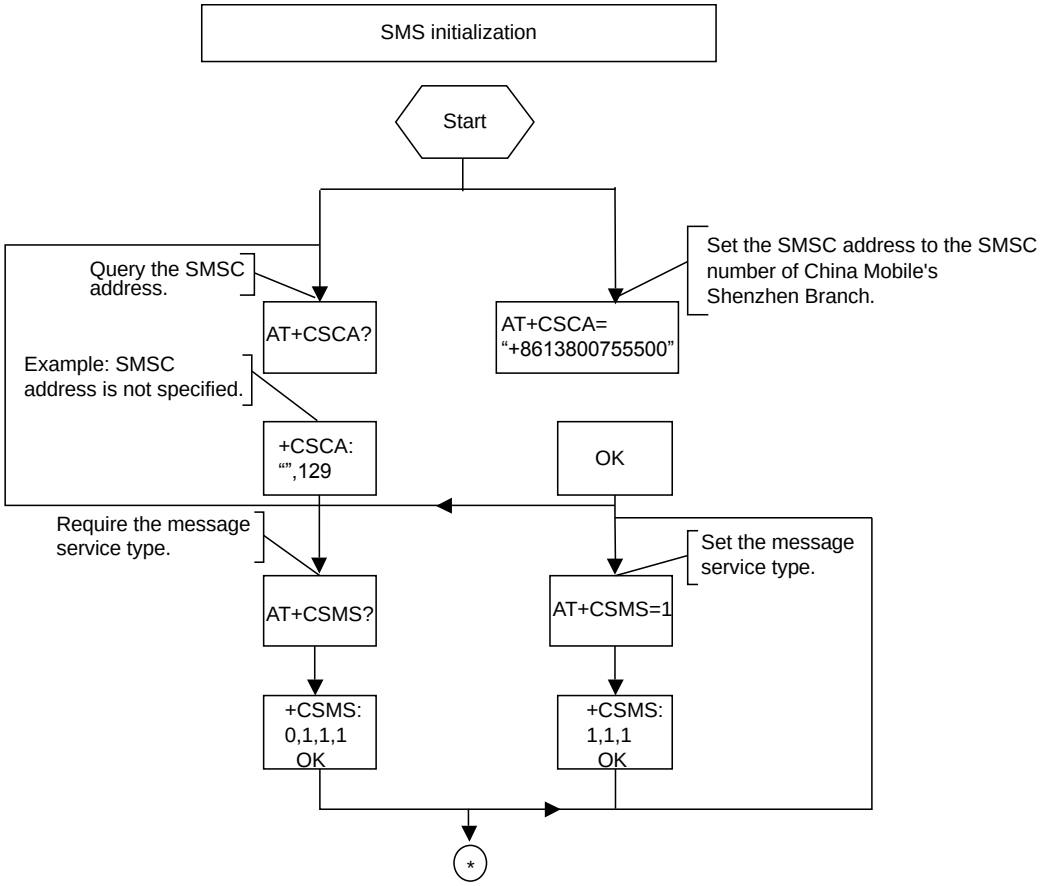

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Figure 7-4 SMS initialization process – part 2

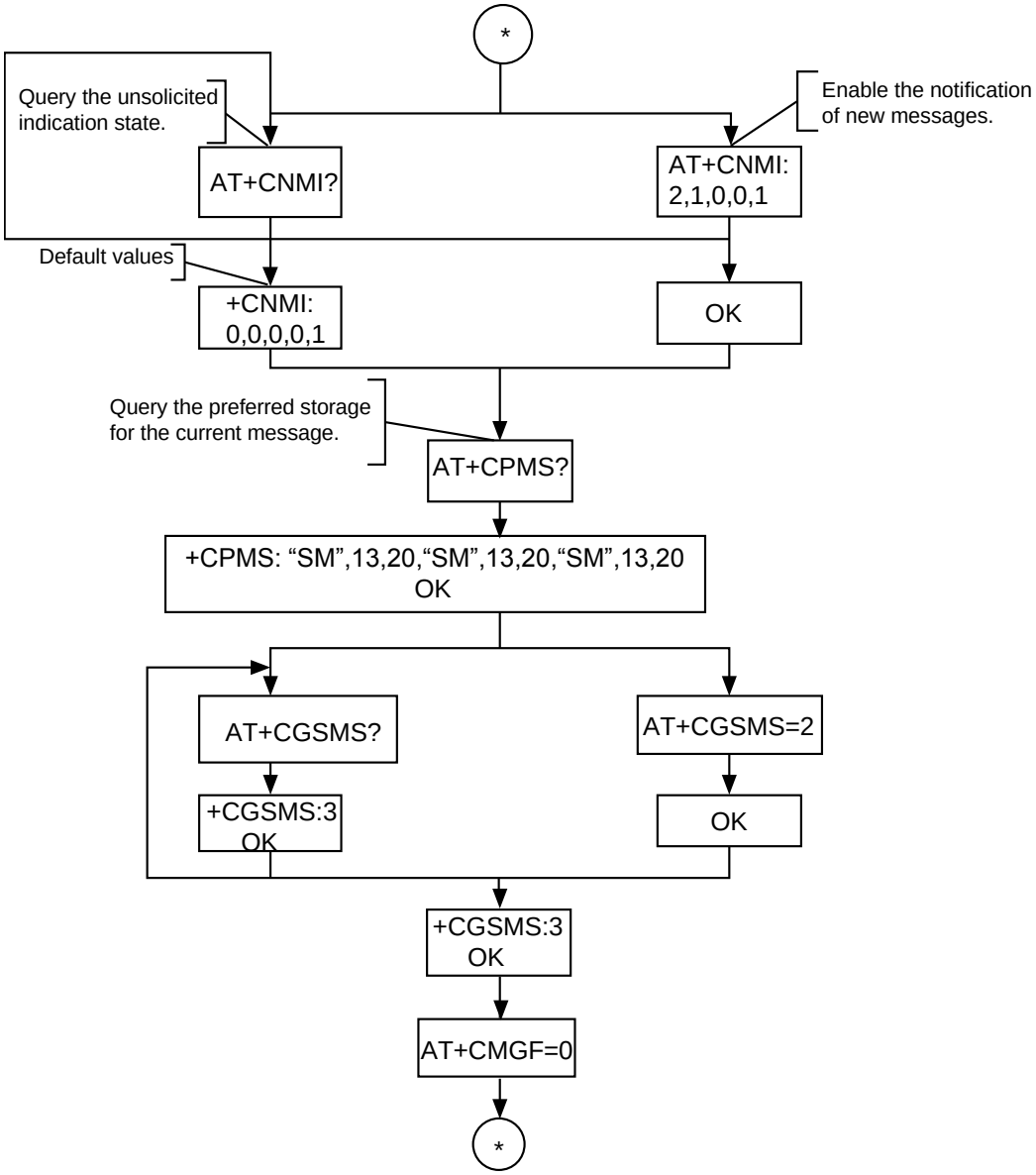

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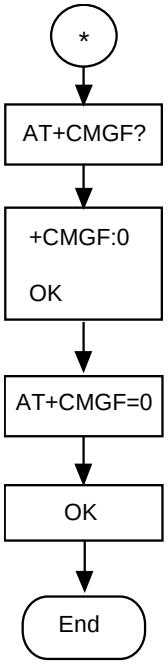
Figure 7-5 SMS initialization process – part 3



7.2.2 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: SIM busy	SIM card initialization has not completed. Try again later.

7.3 Sending Short Message

7.3.1 Reference Process

Command	Description
AT+CMGF=0	Sets the short message format to PDU.
OK	
AT+CSCA?	Queries the SMSC address.
+CSCA: "13800688509",129	

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Command	Description
OK	
AT+CMGS=18 **>0031000B813109731147F40000FF04F4F29C0E\x0A**	Sends a PDU message without the service center address. The value of SMSC address is the setting of +CSCA command.
+CMGS: 168 **OK**	The message is successfully sent.
AT+CMGS=18 **>0891683108608805F931000B813109731147F40000FF04F4F29C0E\x1A**	Sends a PDU message with the correct service center address.
+CMGS: 169 **OK**	The message is successfully sent.
AT+CMGS=18 **>0891683108608805F031000B813109731147F40011FF04F4F29C0E\x1A**	Sends a PDU message with the wrong service center address.
+CMS ERROR: Network out of order	The message is unsuccessfully sent.

Messages in PDU format must be converted using external tools or users' software. Tools for encoding and parsing messages in PDU format are available on the Internet.

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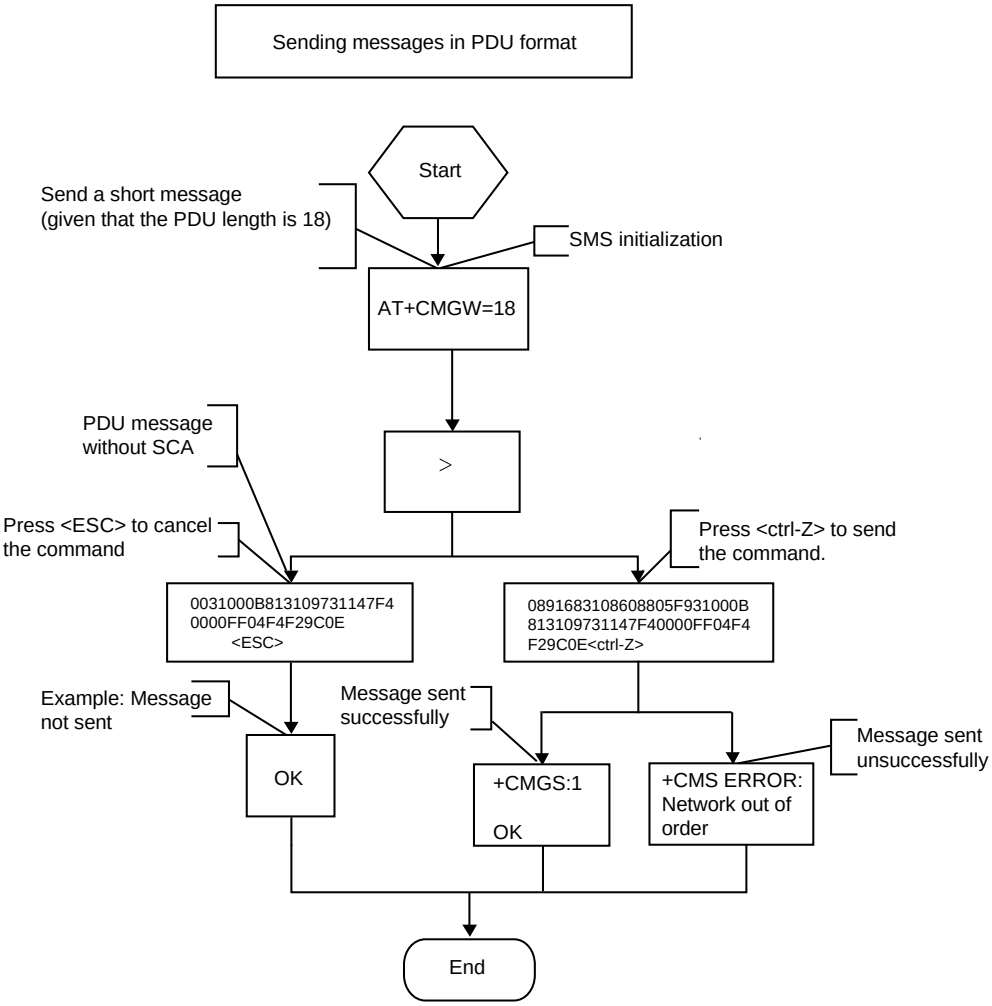
Figure 7-6 Sending short messages in PDU format



7.3.2 Troubleshooting

Scenario	Possible Error Information	Solution
Error information is returned in response to one of the previous commands.	+CMS ERROR: Network out of order	Check the validity of the service center address or the state of the current network.

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7.4 Reading Short Messages

7.4.1 Reference Process

Command	Description
AT+CMGL=0	Lists all received unread messages.
+CMGL: 2,0,,48 **0891683108608805F9040D91683109732097F2000001432619001001F506215744FD3D1A0E930C84296D9EC370BFDE86C2F23228FFAEFF00** **+CMGL: 4,0,,64** **0891683108608805F9040D91683109732097F20000014032613105003250621574 4FD3D1A0E930C84296D9EC370BFDBE83C2B0380F6A97416FF7B80C6AVFE5E510** **OK**	
AT+CMGR=4	Reads the message stored in the message storage location 4.
+CMGL: 1,,64 **0891683108608805F9040D91683109732097F20000014032613105003250621574 4FD3D1A0E930C84296D9EC370BFDBE83C2B0380F6A97416FF7B80C6AVFE5E510** **OK**	

There are two methods to read short messages:

- Method 1: Use the **AT+CMGL** command to list the messages that are in specified state and stored in the preferred message storage. The following table describes the message states. If the message sate is received unread messages, the REC UNREAD state will be changed to REC READ after the **AT+CMGL** command is executed.

Message State	PDU Mode
Received unread messages	0

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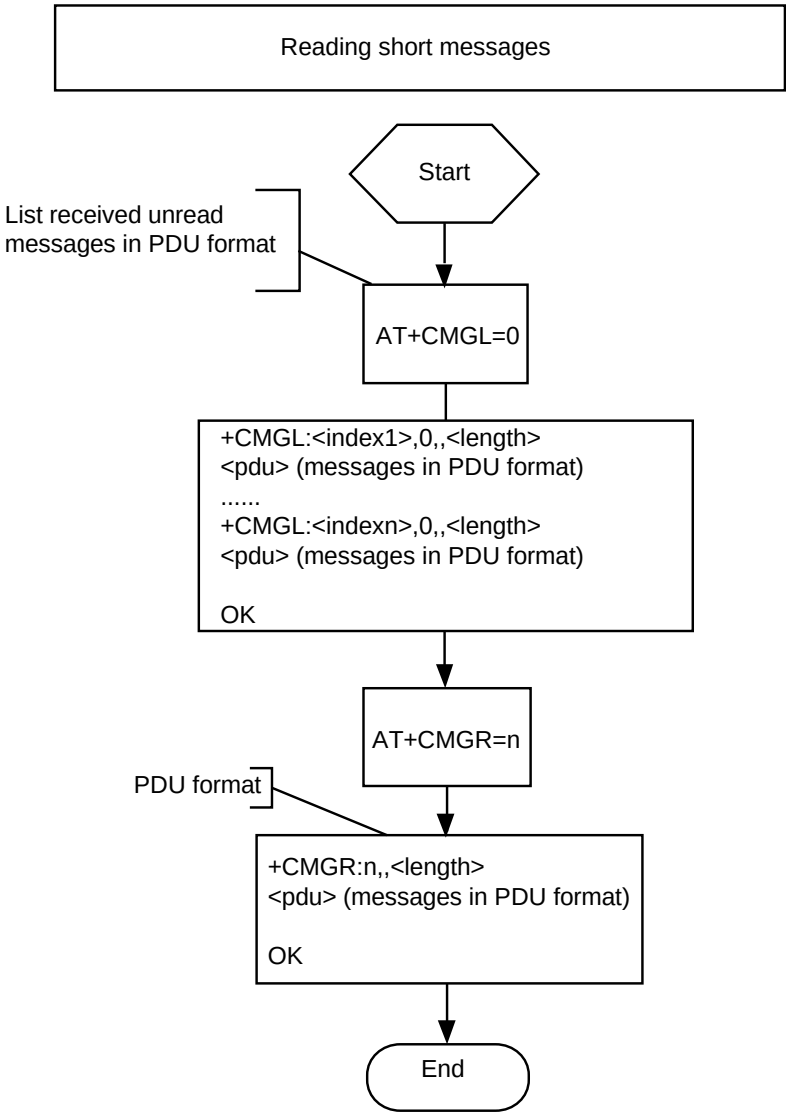
Message State	PDU Mode
Received read messages	1
Stored unsent messages	2
Stored sent messages	3
All messages	4

- Method 2: Use the **AT+CMGR** command to read a message from a specified storage location in the message storage. If the message is a received unread message, its state will be changed to REC READ after it is read using the **AT+CMGR** command.

You can use the **AT+CMGL** command to list all short messages so that you can view the messages' storage locations.

Figure 7-7 Reading short messages



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7.4.2 Troubleshooting

Scenario	Possible Error Information	Solution
Error information is returned in response to one of the previous commands.	+CMS ERROR: invalid memory index	Check the validity of the index.

7.5 Deleting Short Messages

7.5.1 Reference Process

Command	Description
AT+CMGF=0	Sets the message format to PDU mode.
OK	
AT+CMGL=4	Lists all short messages (PDU mode).
+CMGL: 6,2,,30 **0011000A91717987621300 00A713C8329BFD6681D0 EF3B282C2F83F2EFFA0F** **+CMGL: 11,1,,36** **0791947106004013240C91 9471598269900000308041 3115748013C8329BFD668 1D0EF3B282C2F83F2EFF A0F** **OK**	
AT+CMGD=1	Deletes the message stored in storage location 1.
OK	

- Either all messages stored in the preferred message storage or a message stored in the specified storage location in the preferred message storage can be deleted.
- All read or unread messages that have been received can be deleted.
- If no messages are stored in the preferred message storage, "OK" is returned when the action to delete messages is completed.
- Meanings of the DelFlag value:

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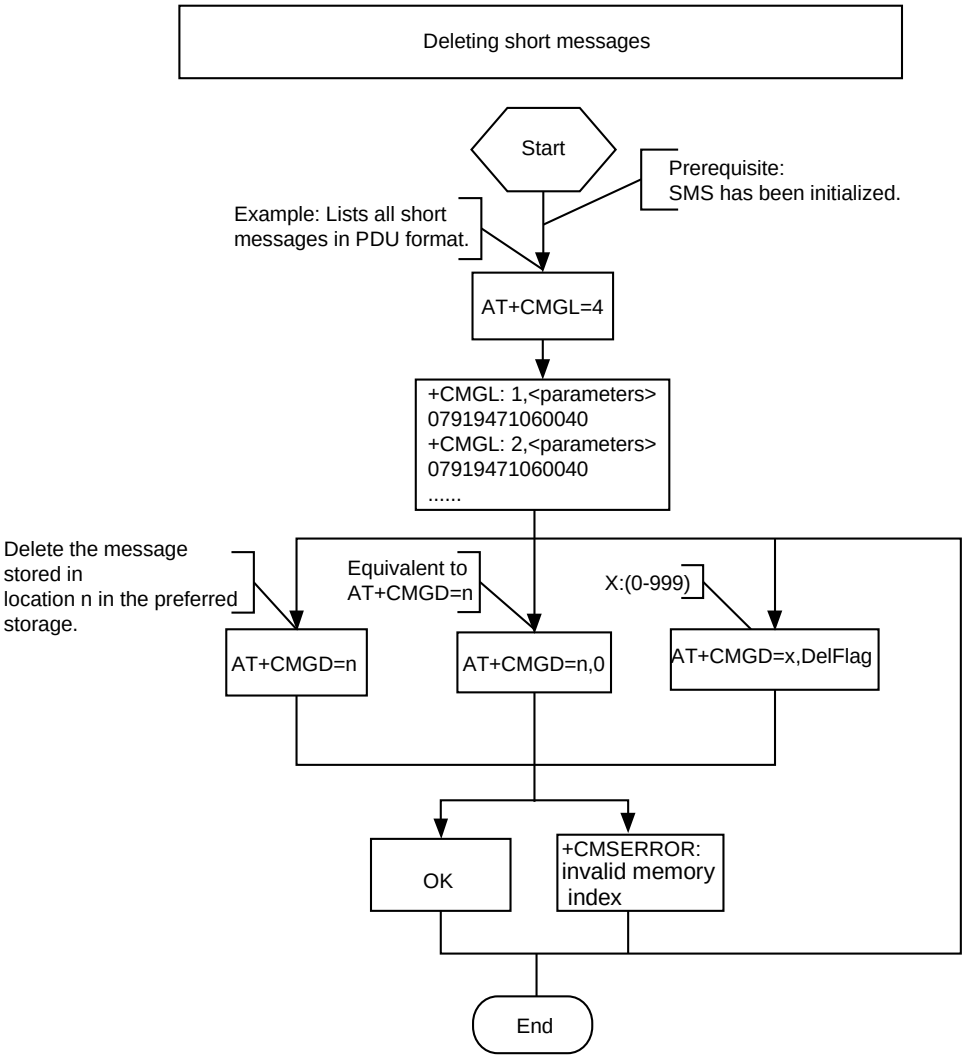
- 1: Delete all read messages in the preferred message storage, and keep the unread, sent and unsent messages.
- 2: Delete all read and sent messages in the preferred message storage, and keep the unread and unsent messages.
- 3: Delete all read, sent, and unsent messages in the preferred message storage, and keep the unread messages.
- 4: Delete all messages in the preferred message storage, including the unread messages.

Figure 7-8 Deleting short message



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7.5.2 Troubleshooting

Scenario	Possible Error Information	Solution
Error information is returned in response to one of the previous commands.	+CMS ERROR: invalid memory index	Check the validity of the index.

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8 Phonebook Application Scenarios

8.1 Overview

As a product embedded into a host, the phonebook scenarios include that read, write, query and delete the phonebook entries in the SIM card.

Read Phonebook: use the **AT+CPBR** command to read phonebook entries.

Write phonebook: use the **AT+CPBW** command to save the phonebook entries into the SIM card.

Delete phonebook: use **AT+CPBW** command to delete the phonebook entries in the SIM card.

8.2 Initializing the Phonebook

8.2.1 Reference Process

Command	Description
AT+CPBS?	Queries the current phonebook storage.
+CPBS: "SM",0,0 **OK**	
AT+CPBS="SM"	Selects SM as the storage type.
OK	

Note that the AT commands for reading and writing phonebook entries can be used only after the phonebook storage is selected. To select a phonebook storage, use the **AT+CPBS** command.

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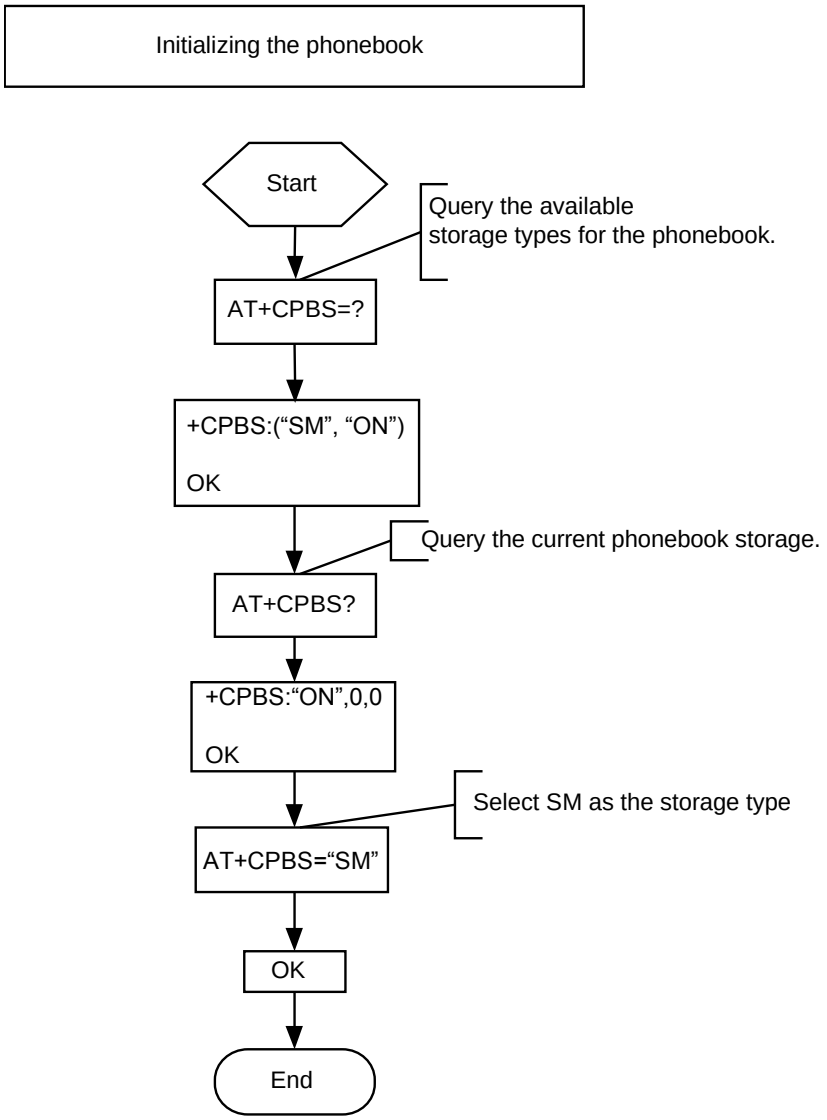
Figure 8-1 Initializing the phonebook



8.2.2 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.

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8.3 Reading Phonebook Entries

8.3.1 Reference Process

Command	Description
AT+CPBS?	Queries the phonebook storage selection and the maximum number of entries that can be stored.
+CPBS: "SM",9,20 **OK**	
AT+CPBR=1,20	Lists all phonebook entries by their indexes.
+CPBR: 1,"+491765864491",145,"John Smith",0 **+CPBR: 2,"+44545896638",145,"Paul Williams",0** **+CPBR: 3,"+44556565657",145,"Joe Anderson",0** **+CPBR: 4,"+445636934485",145," Oscar Thomso”,0** **+CPBR: 5,"+445565656899",145,"Hannah Adams",0** **+CPBR: 6,"+447982865563",145,"Samantha Young",0** **+CPBR: 7,"+449585315798",145,"Alexis Wright",0** **+CPBR: 8,"+445415454646",145,"Abigail Cox",0** **+CPBR: 12,"+446565689115",145," Kyla Clark",0** **OK**	

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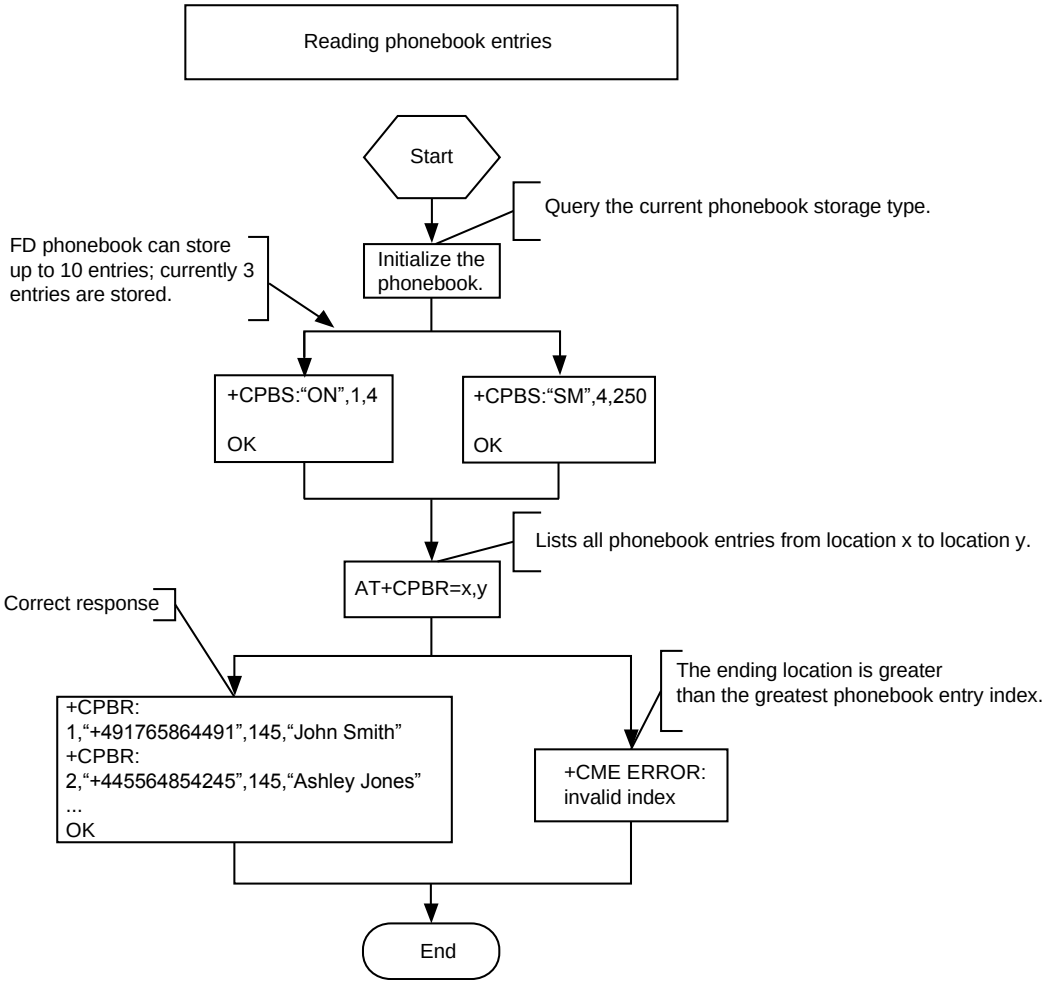
Figure 8-2 Reading phonebook entries



8.3.2 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.
AT+CPBR=<index1>	+CME ERROR: invalid index	The index is invalid. Check that index 1 is within the supported range.

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Scenario	Possible Error Information	Solution
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.
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.
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.

8.4 Writing Phonebook Entries

8.4.1 Reference Process

Command	Description
AT+CPBR=?	Queries the ranges of parameters related to the phonebook entries.
+CPBS: "SM",9,20 **OK**	
AT+CPBW="5","13903702805",,"test"	Writes a phonebook record.
OK	
AT+CPBW=1	Deletes the entry in index 1 in the phonebook.
OK	

There two methods to edit phonebook entries using the **AT+CPBW** command:

- Write an entry to a specified location. This method edits the location where a phonebook entry exists or writes a new entry to a vacant location.
- Write a new phonebook entry to the next location of a location that already has a phonebook entry. This method does not require a specified storage location. The

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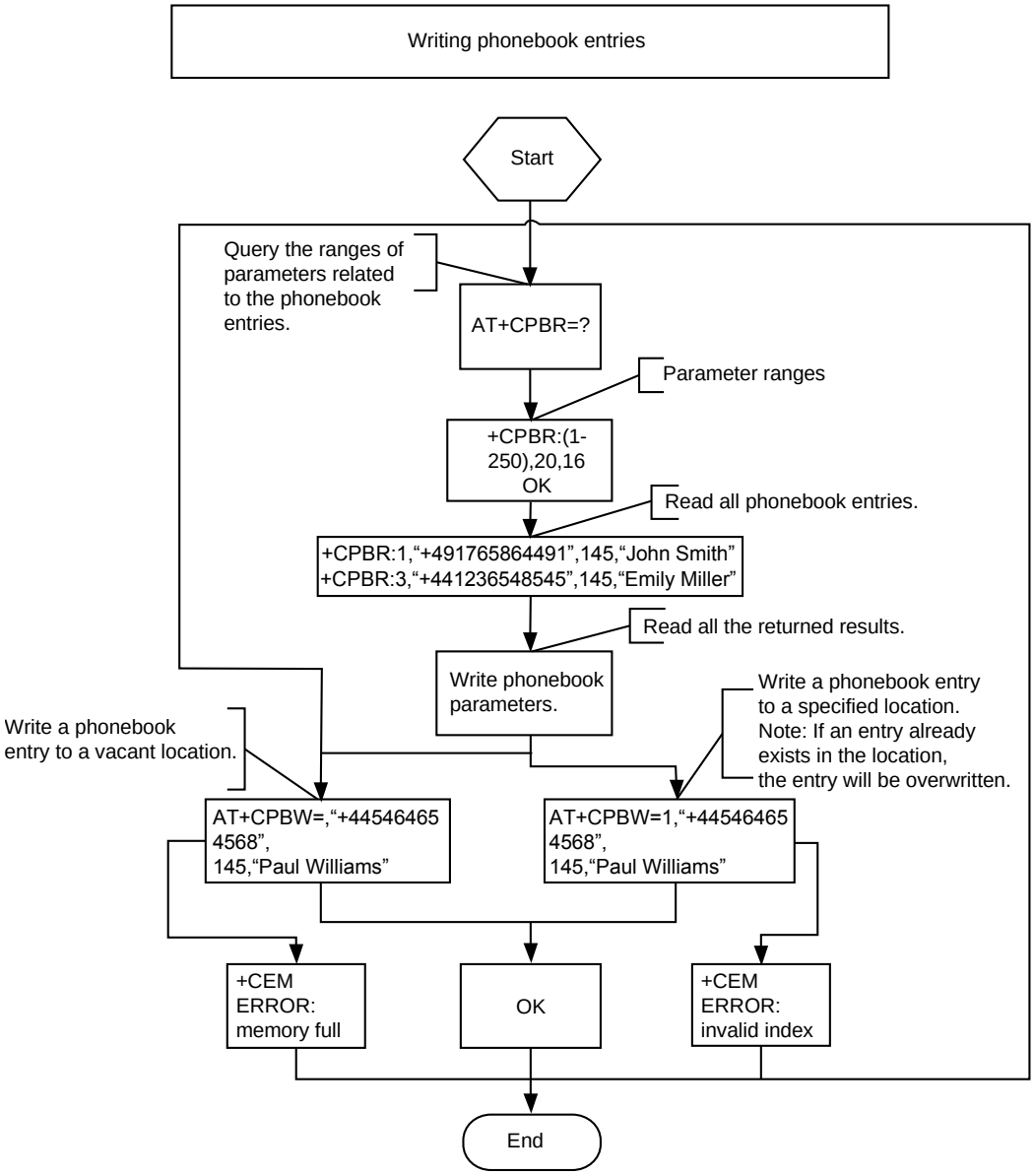
AT+CPBW command can be used to edit phonebook entries of the "SM" or "ON" type.

Figure 8-3 Writing phonebook entries



8.4.2 Troubleshooting

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

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Scenario	Possible Error Information	Solution
commands.	+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.
AT+CPBW=,"12345678901234567890123",128,"80534E4E3A"	+CME ERROR: memory full	The storage is full. Delete some entries and try again.

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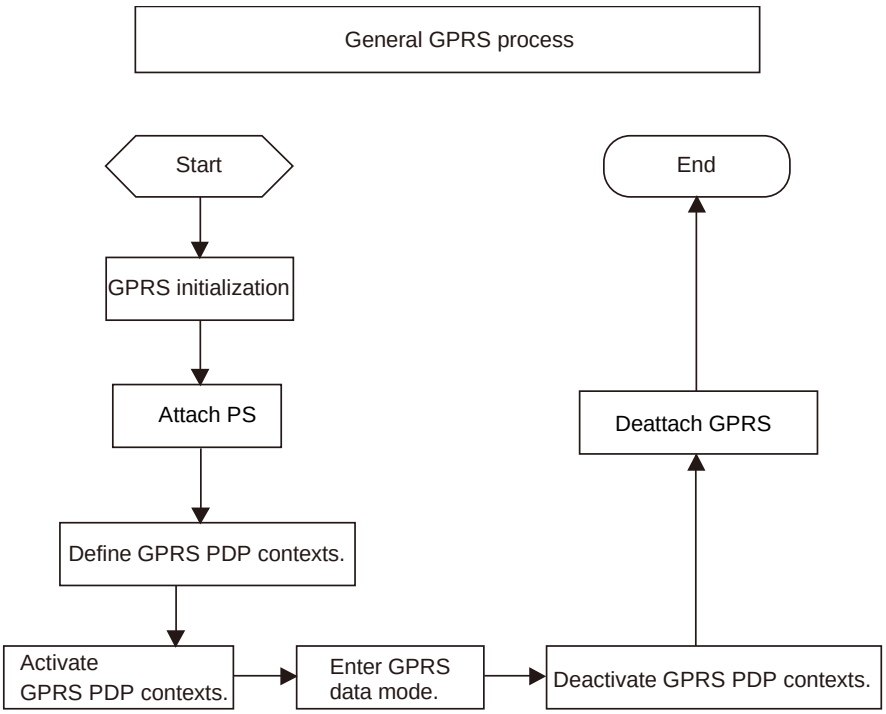
9 GPRS Application Scenarios

9.1 Overview

GPRS is a packet oriented mobile data service on the existing Global System for Mobile Communications (GSM). GPRS efficiently utilizes channel resources and is suitable for bursty data services.

Figure 9-1 General GPRS process



The procedure for starting GPRS is as follows:

1. Initialize GPRS settings.
2. Attach PS.
3. Define packet data protocol (PDP) contexts.
4. Activate PDP contexts.

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5. Enter GPRS data mode.

General GPRS process is shown as Figure 9-1 .To quit GPRS data mode, deactivate PDP contexts, and then detach GPRS. For details about the processes of the steps in the previous procedure, see the following sections.

9.2 Initializing GPRS Settings

9.2.1 Reference Process

Command	Description
AT+CGREG?	Queries the network registration state.
+CGREG: 0,0 **OK**	
AT+CGREG=1	Enables the network registration state URC.
OK	

9.2.2 Troubleshooting

Scenario	Possible Error Information	Solution
AT+CGREG?	+CGREG: 0,0 OK The PS domain has not attached.	Run **AT+CGATT=1** to manually attach to the PS domain.

9.3 Attaching/Detaching PS

9.3.1 Reference Process

Command	Description
AT+CGATT=1	Attaches PS
OK	
AT+CGATT?	Queries the attach state.

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Command	Description
+CGATT: 1 **OK**	
AT+CGATT=0	Detaches PS.
OK	

If PS has been attached or detached, the attached or detached command will be ignored, and "OK" will be returned.

If the ME detaches PS, all activated PDP contexts will be automatically deactivated.

9.3.2 Troubleshooting

Scenario	Possible Error Information	Solution
AT+CGATT?	+CGATT: 0 OK The PS domain has not attached.	Run **AT+CGATT=1** to manually attach to the PS domain.

9.4 Defining GPRS PDP Contexts

9.4.1 Reference Process

Command	Description
AT+CGDCONT?	Queries the defined PDP contexts.
+CGDCONT: **OK**	
AT+CGDCONT=1,"IP","1234"	Defines a new PDP context.
OK	
AT+CGDCONT?	Queries the defined PDP context.
+CGDCONT: 1,"IP","1234","",0,0	

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Command	Description
OK	
AT+CGDCONT=1	Deletes the PDP context with <cid>=1.
OK	
AT+CGDCONT?	Queries the defined PDP contexts.
OK	

The **AT+CGDCONT** command is used to define the context ID and specify the PDP type and access point name (APN). Each PDP context has a context ID (specified by the **<cid>** parameter of the **AT+CGDCONT** command), which is a sequence number starting from 1.

The PDP type describes the protocol between the ME and the network, and the APN specifies the gateway between the mobile network and the Internet.

The range of **<cid>** supported by MU736 module is the integer from 1 to 3.

Send **AT+CGDCONT=<cid>**, PDP context returns not defined status.

9.4.2 Troubleshooting

Scenario	Possible Error Information	Solution
AT+CGDCONT?	+CME ERROR: SIM PIN required The SIM PIN was not verified	Run AT+CPIN to verify the PIN

9.5 Activating/Deactivating GPRS PDP Contexts

9.5.1 Reference Process

Command	Description
AT+CGACT?	Queries the PDP contexts activation state.
OK	
AT+CGDCONT?	Queries the activated PDP contexts.
+CGDCONT: 1,"IP","1234","0.0.0.0",0,0	

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Command	Description
OK	
AT+CGACT=1,1	Activates the PDP context with <cid>=1.
OK	
AT+CGACT?	Queries the the defined PDP contexts activation state.
+CGACT: 1,1 **OK**	
AT+CGDCONT?	Queries the activated PDP contexts.
+CGDCONT: 1,"IP","1234","192.168.70.59",0,0 **OK**	
AT+CGACT=0	Deactivates all PDP contexts.
OK	
AT+CGACT=1	Activates all PDP contexts.
OK	

If the PDP context to be activated or deactivated is already activated or deactivated, it will not be activated or deactivated again. If the PDP context to be activated or deactivated is not defined, “ERROR” is returned.

If the ME does not attach to PS, PS attach will be performed before the PDP context is activated. If <cid> is not specified (for example, **AT+CGACT=1** or **AT+CGACT=0**), all the defined PDP contexts will be activated or deactivated.

The commands for activating GPRS PDP contexts may fail on many networks, because the networks require user names and passwords to activate PDP contexts, but AT commands cannot be used to obtain the user names and passwords. They can be obtained only during point-to-point protocol (PPP) negotiation. PPP negotiation can be started only in data mode. Therefore, use the **ATD*99#/AT^NDISDUP/AT^NDISCONN** command to switch the module to data mode before requesting the network to activate PDP contexts.

When the **AT+CGACT** or **AT+CGDATA** command is used to activate a PDP context, if the MT does not attach to GPRS, GPRS attach will be performed before the specified PDP context is activated.

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Figure 9-2 Activating GPRS PDP contexts

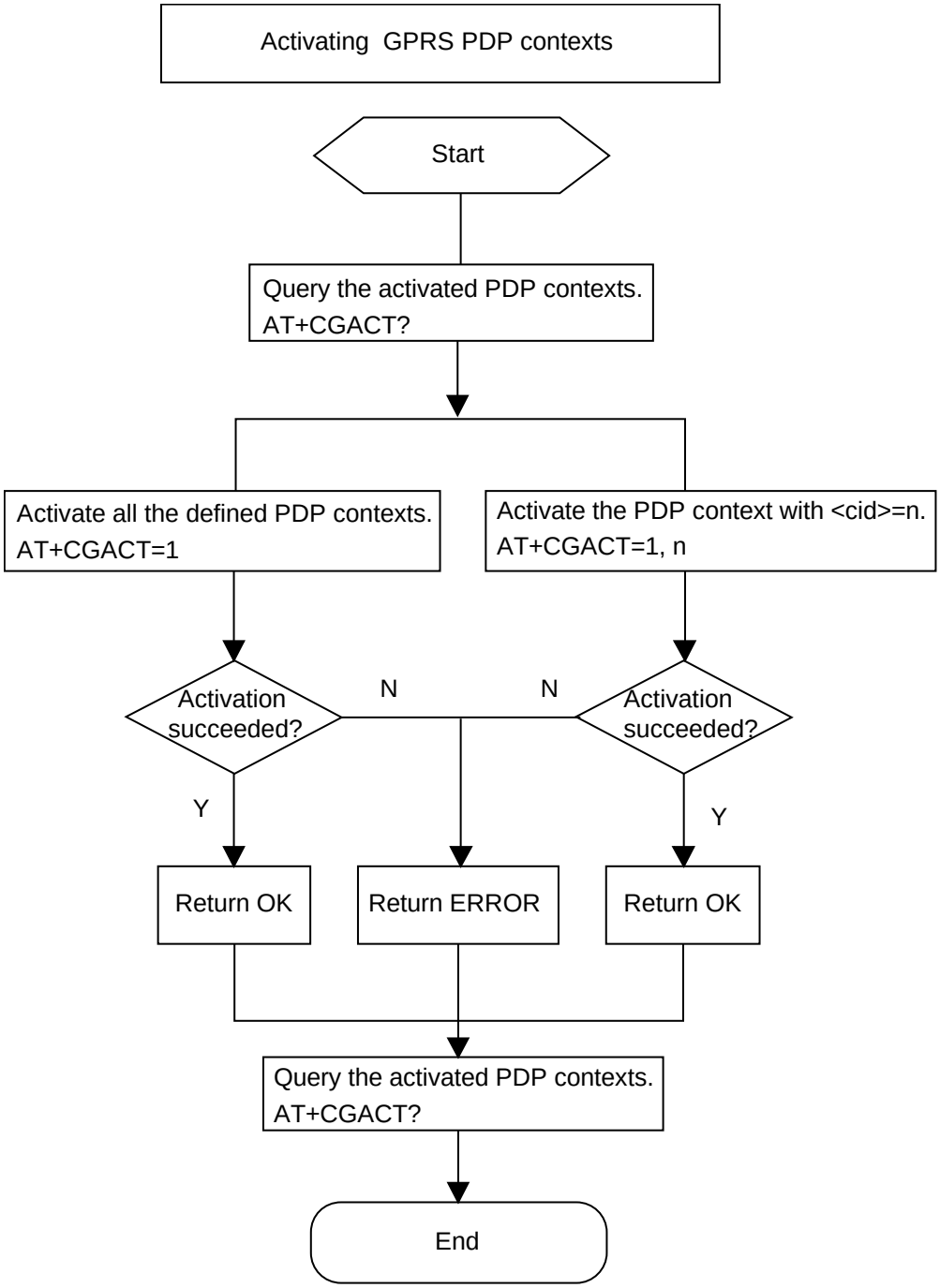

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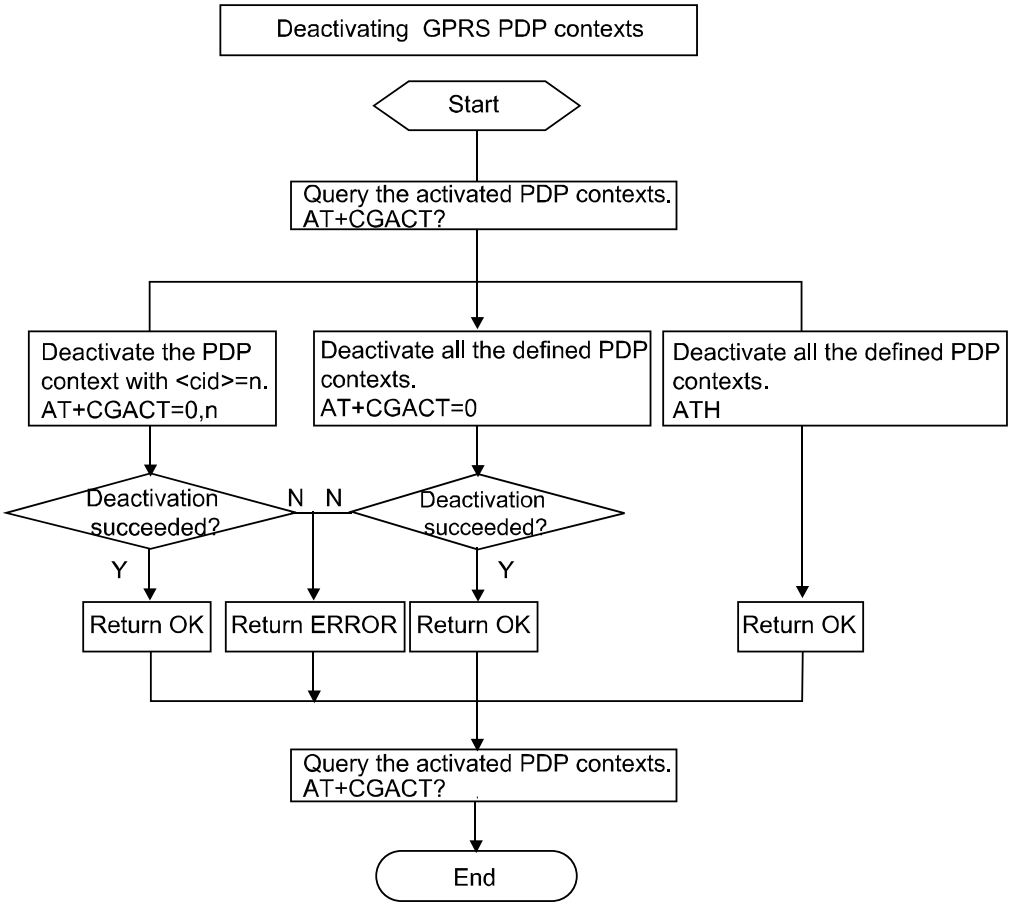
Figure 9-3 Deactivating GPRS PDP contexts



9.5.2 Troubleshooting

Scenario	Possible Error Information	Solution
AT+CGACT?	+CME ERROR: SIM PIN required The SIM PIN was not verified	Run AT+CPIN to verify the PIN

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9.6 Entering GPRS Data Mode

9.6.1 Reference Process

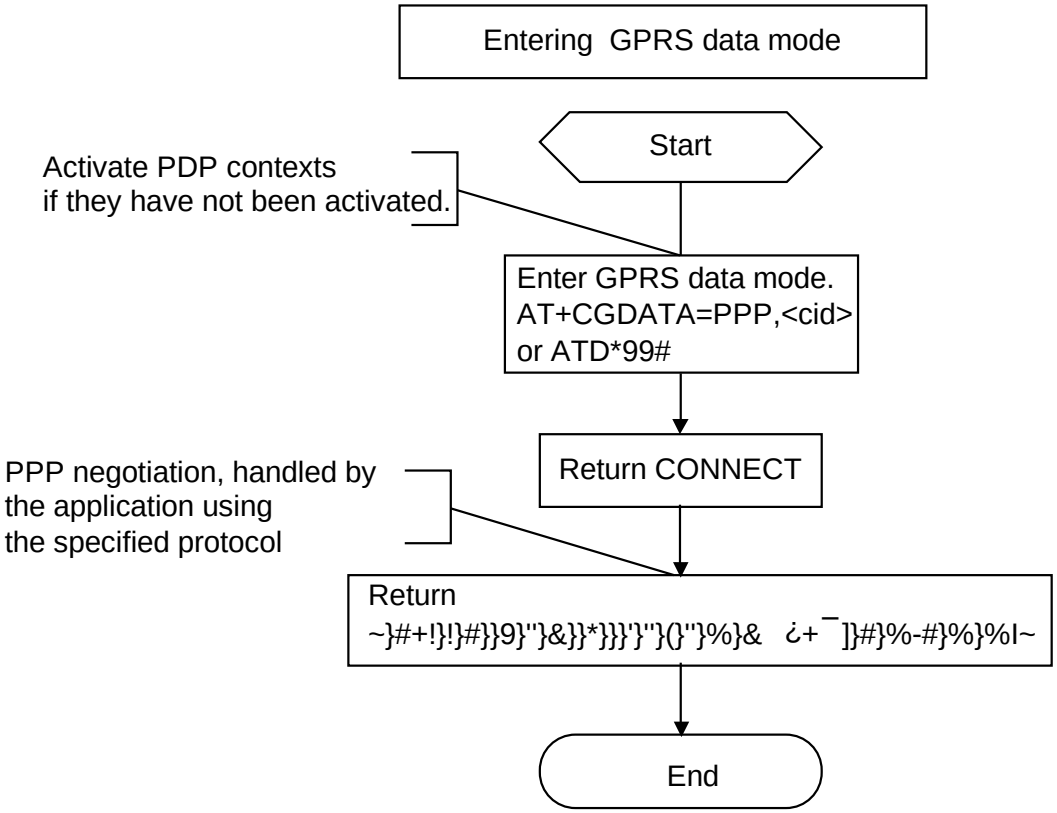
Command	Description
ATD*99#	Enters GPRS data mode.
CONNECT **~'255'}#'192'!}!}#} }9}"}&} }*} } }"}"}({}"}%}&9G}1}]}#}%'194'#}%Y'196'~**	Negotiates PPP.

There are several methods to switch the module to GPRS data mode, among which using the **ATD*99#** command is recommended.

Before switching the module to data mode, use the **AT+CGDCONT** command to define the PDP context ID.

Before entering GPRS data mode, the module negotiates PPP with the application. Therefore, the application must be able to support PPP. And the module must attach to PS and activate the specified PDP context.

Figure 9-4 Entering data mode



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9.6.2 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 that the current network is operating normally. Data service connections can be established only when the network is operating normally.

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10 Security Settings Application Scenarios

10.1 Changing the SIM PIN

10.1.1 Reference Process

Command	Description
AT+CPWD="SC","9999","1234"	Changes the PIN. Current PIN=9999; new PIN=1234.
OK	
AT+CPWD="SC","1113","1233"	Enters an incorrect PIN (first attempt).
+CME ERROR: incorrect password	
AT+CPWD="SC","3333","1255"	Enters an incorrect PIN (second attempt).
+CME ERROR: incorrect password	
AT+CPWD="SC","4711","1331"	Enters an incorrect PIN (third attempt).
+CME ERROR: SIM PUK required	
AT+CPIN?	Checks whether the password is requested.
+CPIN: SIM PUK **OK**	
AT+CPIN=“12345678”, “0000”	Enters the SIM PUK and specify the new SIM PIN (activate new "SC" lock).
OK	

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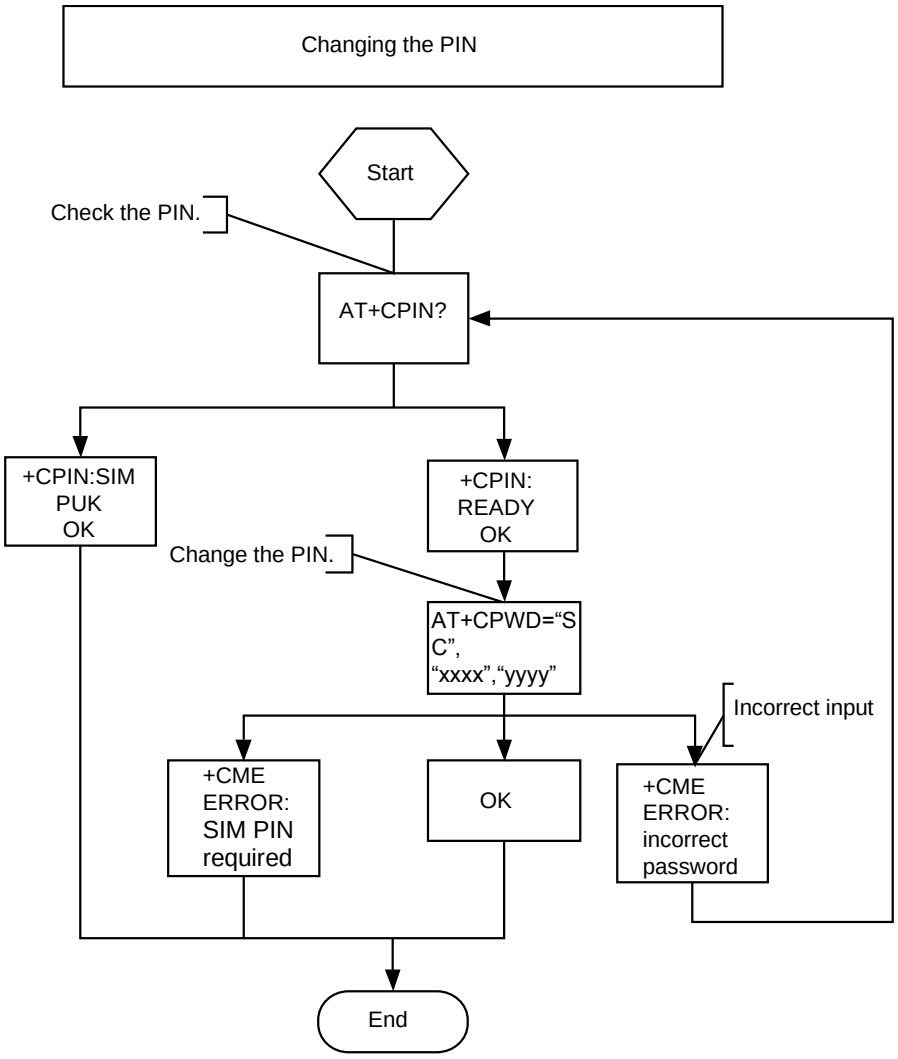
The **AT+CPWD** command can be used to change a SIM card's PIN. When the SIM card is PIN protected, the correct PIN must be entered to unblock SIM card. If incorrect PINs are entered three consecutive times, the PUK is required to unblock the SIM.

Figure 10-1 Changing the PIN



10.1.2 Troubleshooting

Scenario	Possible Error Information	Solution
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.

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10.2 Changing the SIM Card Configuration

10.2.1 Reference Process

Command	Description
AT+CPIN?	Requests the PIN state.
+CPIN: READY **OK**	
AT+CLCK="SC",2	Requests the SIM card state.
+CLCK: 0 **OK**	"+CLCK: 0" means that the SIM card is not blocked.
AT+CLCK="SC",1,"5555"	Uses an incorrect PIN to change the SIM card lock.
+CME ERROR: incorrect password	
AT+CLCK="SC",1,"0000"	Enables the SIM card lock.
OK	
AT+CLCK="SC",2	Requests the SIM card state.
+CLCK: 1 **OK**	"+CLCK: 1" means that the SIM card is blocked.
AT+CLCK="SC",0,"0000"	Disables the SIM card lock.
OK	
AT+CLCK="SC",2	Requests the SIM card state.
+CLCK: 0 **OK**	"+CLCK: 0" means that the SIM card is not blocked.
AT+CLCK="SC",1,"0000"	Enables the SIM card lock.
OK	

If the SIM card is blocked, the PIN code (that is, the PIN) is requested when the module is started. To enable the SIM card lock, the PIN is requested. A maximum of three attempts to enter the PIN is allowed. The **AT+CLCK="SC",<**mode**>,<**PIN**>** command can be used to block or unblock the SIM card. When <mode> = 1, the SIM card will be blocked. When <mode>=0, the SIM card will be unblocked. Before enabling the SIM card lock, it is recommended that the **AT+CPIN?** command be used to check the current state of the SIM card lock. If "+CPIN: SIM PUK" is returned, the correct PUK must be entered to change the SIM card settings.

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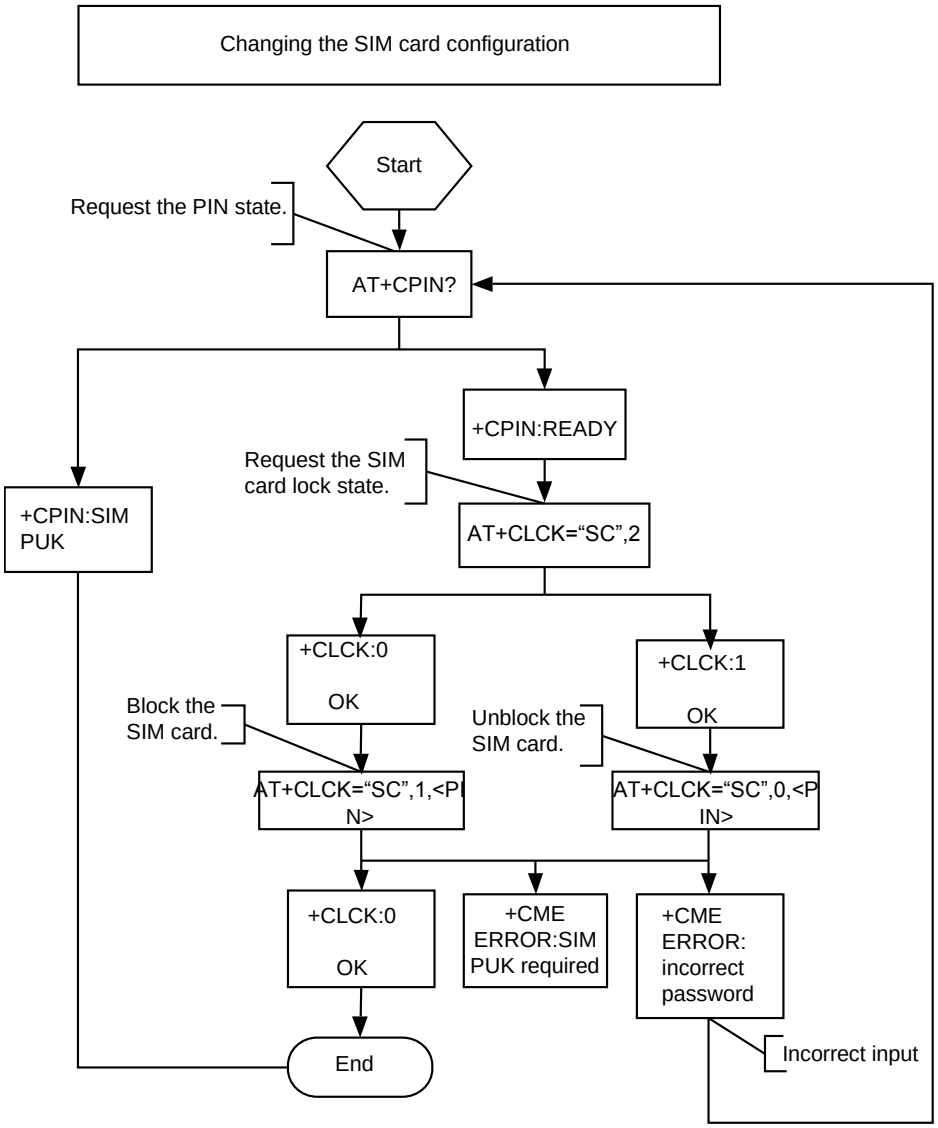
Figure 10-2 Changing the SIM card configuration



10.2.2 Troubleshooting

Scenario	Possible Error Information	Solution
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.

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11 SIM Card Application Scenarios

11.1 SIM Card Access

11.1.1 Reference Process

Command	Description
AT+CRSM=192,28483	Obtains response from the EF.
+CRSM: 144,0,000000026F43040011F05501020000 **OK**	
AT+CRSM=176,12258,0,0,10	Reads binary data from the EF.
+CRSM: 144,0,98000000000000000F3 **OK**	
AT+CRSM=178,28484,1,4,255	Reads records from the EF (incorrect input).
+CRSM: 103,28 **OK**	The first parameter <sw1>='103'. '103' is a decimal number corresponding to hexadecimal number '67', which indicates "illegal parameter <P3>". The second parameter <sw2>='xx', which indicates the correct length (28 in the example) or indicates that no information is provided.
AT+CRSM=178,28484,1,4,28	Reads the record of the last dialed number from the EF.
+CRSM: 144,0, **FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF0581420010F6F**	

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Command	Description
FFFFFFFFFFFFFFF **OK**	

The operations to access the SIM card depend on the value of **<command>**, a s described in Table 11-1 .

Table 11-1 Values of <command>

Value	Read Binary Command	Function
176	READ BINARY	Read binary strings from the current data domain.
178	READ RECORD	Read complete linear fixed or cyclic data domain consisting of CURRENT, ABSOLUTE, NEXT, and PREVIOUS.
192	GET RESPONSE	Return the basic information about the current data domain, including the file type and size.
214	UPDATE BINARY	Update the current data domain.
220	UPDATE RECORD	Update all the records in the linear fixed or cyclic data domain. There are four update modes: CURRENT, ABSOLUTE, NEXT, and PREVIOUS, of which only the PREVIOUS mode can be used for cyclic files.
242	STATUS	Return the status information about the current data domain.

The following table describes the components of the data returned in response to the READ RECORD command.

Byte	Description	Length
1 to X	Alpha identifier	X byte(s)
X+1	BCD code length; number/SSC content	1 byte
X+2	TON and NPI	1 byte
X+3 to X+12	Dialed number/SSC string	10 bytes
X+13	Capacity/configuration identifier	1 byte
X+14	Extension1 record identifier	1 byte

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Figure 11-1 Reading record response values

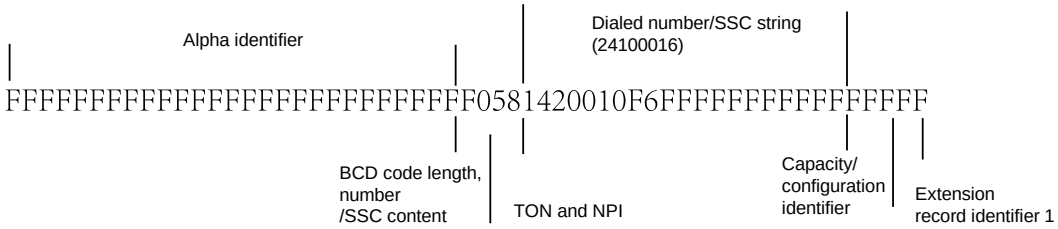

Figure 11-2 Obtaining response

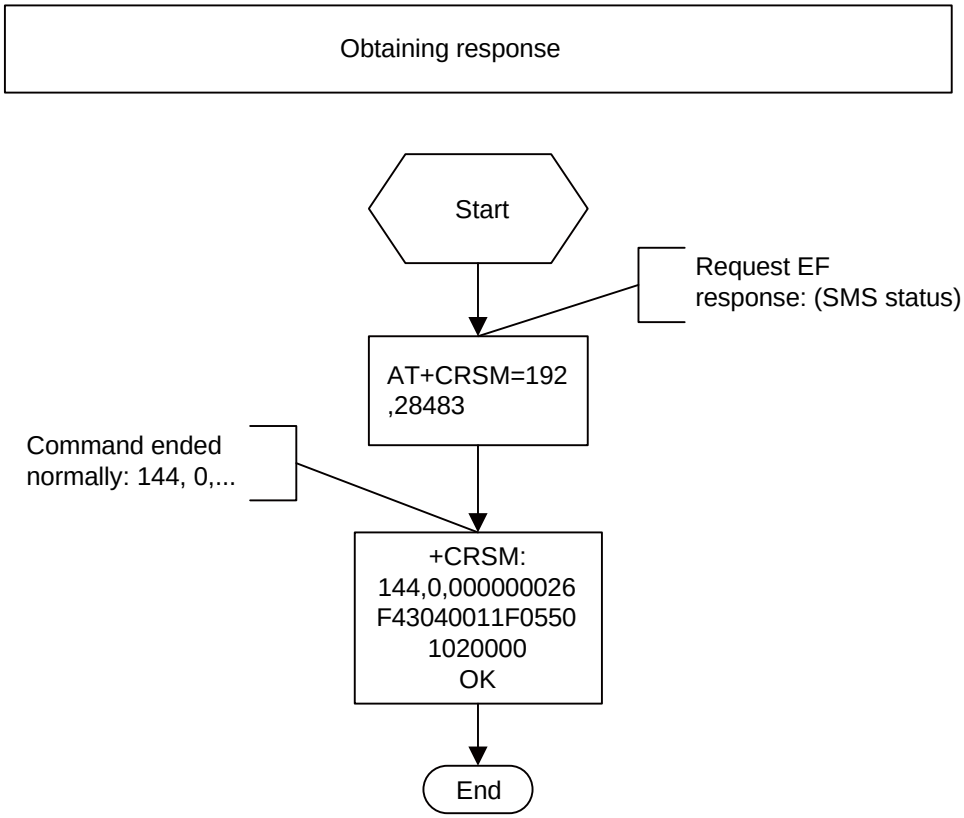

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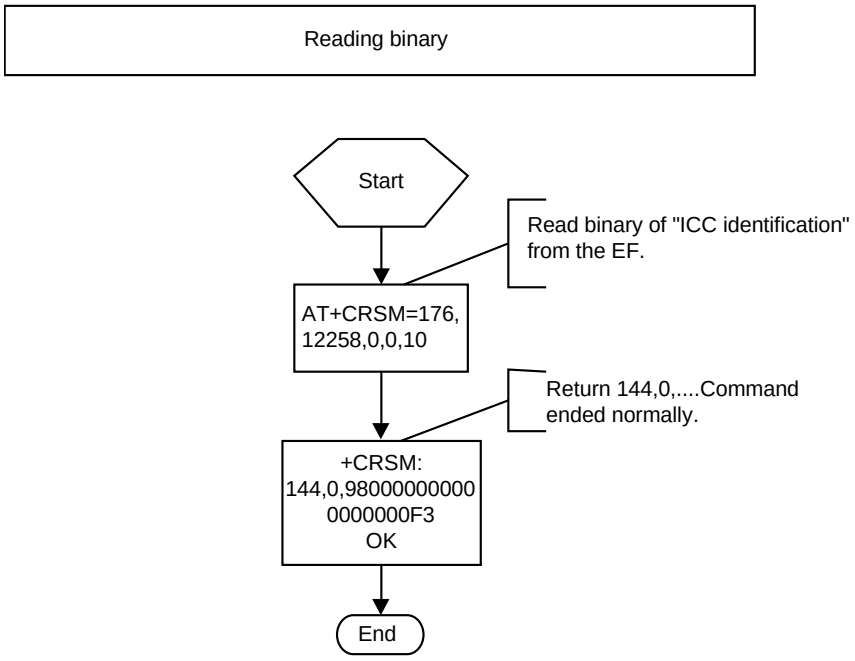
Figure 11-3 Reading binary



11.1.2 Troubleshooting

Scenario	Possible Error Information	Solution
Error information is returned in response to one of the previous commands.	+CME ERROR: SIM not inserted	Insert a SIM card.

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12 Module Powering Off and Resetting Application Scenarios

12.1 Restarting the ME

12.1.1 Reference Process

Command	Description
AT+CFUN=16	Restarts the module.
OK	

The ME can be reset or restarted using the **AT+CFUN** command. After the restart, the module must register with the network and authenticate its SIM card's PIN.

12.1.2 Troubleshooting

None

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13 DPTF Application Scenarios

13.1 Setting Thermal Sensor with the Threshold

13.1.1 Reference Process

Command	Description
AT+XTSM=0,1,80000,3000,1000	Sets thermal sensor with the threshold. Indicates that set the RF sensor 0 (only support 0) Alarm ID 1,threshold is 80000-20000=50000 MilliDegC, Hysteresis is 3000 MilliDegC, and the Sampling Period is 1000 ms.
OK	

The DPTF feature is used for host to monitor module temperature environment by Thermal Sensor. Host can set several groups threshold to module, and module will unsolicited response to host when module temperature exceed the threshold that host configures.

13.1.2 Troubleshooting

None

13.2 Querying the Current Temperature of a Thermal Sensor

13.2.1 Reference Process

Command	Description
AT+XTAMR=0	Queries the temperature of thermal sensor.
+XTAMR: 0,40000	Indicates that the current temperature of RF sensor

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Command	Description
	is 40°C.
OK	

13.2.2 Troubleshooting

None

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14 ACT Application Scenarios

14.1 Adaptive Clocking

14.1.1 Reference Process

Command	Description
AT+XADPCLKFREQINFO=1	Enables ACT feature.
OK	
AT+XADPCLKFREQINFO?	Queries the status of enabling/disabling the ACT feature.
+XADPCLKFREQINFO: 1 **OK**	
AT+XADPCLKFREQINFO=?	Queries Frequency information.
+XADPCLKFREQINFO: 2147600000,5000000,0 **OK**	

The ACT feature is disabled when powered on. It can be enabled by using "**AT+XADPCLKFREQINFO=1**".

After enabling the ACT feature, the AT command "**AT+XADPCLKFREQINFO=?**" can be used to query the frequency information. If the ACT feature is not enabled, this command will return ERROR.

When the frequency information has been changed, the unsolicited command "**+XADPCLKFREQINFO**" will unsolicitedly present the frequency information.

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14.1.2 Troubleshooting

Scenario	Possible Error Information	Solution
AT+XADPCLKFREQINFO=?	ERROR Query current frequency information returns error.	Run **AT+XADPCLKFREQINFO=1** to enable ACT feature.

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15 Appendix

15.1 Relative Documents

[1] HUAWEI MU736 HSPA+ M.2 Module AT Command Interface Specification

15.2 Acronyms and Abbreviations

Table 15-1 List of Abbreviations

Abbreviation	Expansion
ACT	Adaptive Clocking Technology
APN	Access Point Name
CDMA	Code Division Multiple Access
CS	Circuit Switched (CS) domain
DPTF	Dynamic Power and Temperature Framework
GPRS	General Packet Radio Service
GSM	Global System for Mobile Communications
IMEI	International Mobile Equipment Identity
IMSI	International Mobile Subscriber Identity
IP	Internet Protocol
ME	Mobile Equipment
MT	Mobile Terminal
PDP	Packet Data Protocol
PDU	Protocol Data Unit
PIN	Personal Identity Number

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Abbreviation	Expansion
PLMN	Public Land Mobile Network
PPP	Point-to-Point Protocol
PUK	PIN Unblocking Key
PS	Packet Switched (PS) domain
QoS	Quality of Service
RSSI	Receive Signal Strength Indicator
SCA	Service Center Address
SIM	GSM Subscriber Identity Module
SM	Short Message
SMS	Short Message Service
SMSC	Short Message Service Center
TE	Terminal Equipment
TPDU	Transfer Protocol Data Unit
UIM	User Identity Module
URC	Unsolicited Result Code
USIM	Universal Subscriber Identity Module
USSD	Unstructured Supplementary Service Data
VP	Validity Period
WCDMA	Wideband CDMA

Table 15-2 Phonebook-related abbreviations

Abbreviation	Full Name
SM	SIM phonebook
LD	MT last dialed number
EN	SIM emergency number
FD	SIM fixed dialing number
ON	SIM own numbers
RC	Recent call list on the MT

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Abbreviation	Full Name
MC	MT missed call list

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