HUAWEI MS2372h

AT Command Interface Specification

Issue   01

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About This Document

Change History

Version	Date	Chapter	Description
01	2017-08-08		Completed the draft.

Contents

Foreword

This document describes the specifications of the AT command interfaces between the client app and the terminal equipment.

More specifically, it includes the formats and values of the interface AT commands related to basic information query, SMS services, data services, and system settings, as well as how to use these commands.

1 Scope

This document describes the specifications of AT command interfaces used by HUAWEI MS2372h. These specifications provide the technical foundation for service and device development of manufacturers.

2 Reference Specifications

This document uses the following specifications:

[1]	AT command set for User Equipment (UE)	3GPP TS 27.007 V3.13.0
[2]	Alphabets and language-specific information	3GPP TS 23.038 V3.3.0
[3]	Technical realization of Short Message Service (SMS)	3GPP TS 23.040 V3.10.0
[4]	Recommandation V.25 ter V0025-TE.DOC	ITU-T

The specifications are valid at the time of publication and are subject to change. Use the latest versions from 3GPP and ITU-T.

3 Terms, Definitions, and Abbreviations

BER	Bit Error Rate
DCE	Data Circuit Equipment
DCS	Data Coding Scheme
DTE	Data Terminal Equipment
MS	Mobile Station
PCMCIA	Personal Computer Memory Card International Association
PDP	Packet Data Protocol
PLMN	Public Land Mobile Network
RSSI	Receive Signal Strength Indicator
RSCP	Receive Signal Code Power
RPLMN	Registered PLMN
SCA	Sevice Center Address
SM	Short Message
TE	Terminal Equipment
URC	Unsolicited Result Code

4 Interface Overview

All interfaces described in this document are between the TE and ME, which are used to perform the functions supported by the TE. These AT command interfaces are used to query and set basic information, receive and transmit SM services, process data services, process the phone book, and set the network system. The following figure shows the relationship between the radio interface layer (RIL) and ME.

Relationship between the RIL and ME
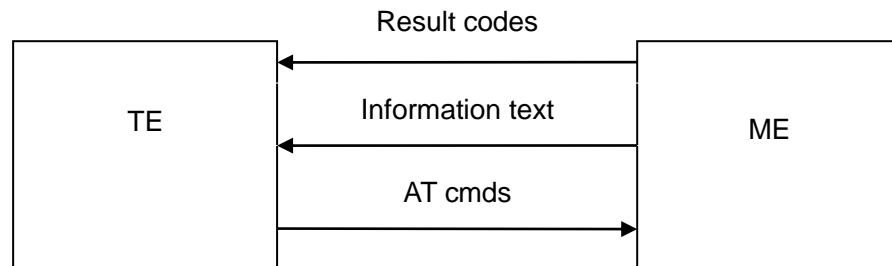
4.1 Principles for Designing Interfaces

- Each interface should be functionally convergent.
- As an AT command is a packet transmitted over communication ports, the length of a packet is limited. The maximum length of an AT command is 260 characters (including the spaces at the end, but excluding two characters "AT"). The maximum length of the response or unsolicited result code (URC) reported by a board is 668 characters.
- Each command line can only include one AT command. For the URC or response reported from the ME to the TE, only one AT command is allowed in a command line.
- To make the commands of new interfaces (excluding standard interfaces) and response formats more readable and standard, the commands such as AT^XXX:<arg0>,<arg1> must meet the following conditions:
  - There is no space after caret (^), colon (:), or comma (,).
  - No redundant space is allowed at the head or end.

- After delivering each AT command, the TE cannot deliver the second AT command until the ME has made response to the first AT command. Otherwise, the second AT command will not be executed.

- For the AT command to which the response is given only after a long period of time, it is recommended that the final execution result be reported asynchronously to prevent interference on other events.

- Unless otherwise specified, all default coding schemes between the TE and ME use the GSM 7 bit default alphabet. For details, see section 6 in 3GPP 23.038. The carriage return character (<CR>) and line feed character (<LF>) in the character string are uploaded in the form of space.

- The TE cannot send the character string including the combination of single quotation marks (") and comma (,). The current version of the ME does not support character escape. The codes of data that are coded by using UCS2 are reported in character string. If the code is 0x553a, 553a is reported.

- The possible response that the ME sends to the TE consists of the information text and result code. The information text is mandatory while the result code is optional. The format of the possible response is controlled by the ATV command. For details, see the ATV command. The format of the possible response listed in the tables in this document is ATV1.

5 Interfaces Used to Query and Set Basic Information

5.1 Setting Mode of Reporting ME Error (+CMEE)

5.1.1 Command Syntax

Command	Possible Response(s)
+CMEE=<n>	<CR><LF>OK<CR><LF>
+CMEE?	<CR><LF>+CMEE: <n><CR><LF><CR><LF>OK<CR><LF>
+CMEE=?	<CR><LF>+CMEE: (list of supported <n>s)<CR><LF><CR><LF>OK<CR><LF>

5.1.2 Description

This command is used to set whether the result code of +CME ERROR:<err> is used to indicate an ME error. If the parameter in this command is set to use the result code of +CME ERROR:<err>, the result code of +CME ERROR:<err> is generated to replace the result code of the common error when an ME error occurs. If the error is not caused by the ME, the common error is returned.

5.1.3 Defined Values

- <n>
  - 0: indicates that the result code of +CME ERROR:<err> is not used, and only errors are returned when the errors occur.
  - 1: indicates that the result code of +CME ERROR:<err> is used, and <err> uses the value of the error code.
  - 2: indicates that the result code of +CME ERROR:<err> is used, and <err> uses the value of the error character string.
- <err>

  For details about its values, see section C "CME Error List."

5.2 Echo Command (E)

5.2.1 Command Syntax

Command	Possible Response
E[<value>]	<CR><LF>OK<CR><LF>

5.2.2 Description

This command is used to set whether the ME returns the character received from the TE to the TE.

5.2.3 Defined Values

- 0: indicates that the ME does not return the character received from the TE to the TE.
- 1: indicates that the ME returns the character received from the TE to the TE.
- If there is no <value> in this command, the ME does not return the character received from the TE to the TE.

5.3 Setting Command Line End Character (S3)

5.3.1 Command Syntax

Command	Possible Response
S3=<value>	<CR><LF>OK<CR><LF>
S3?	<CR><LF><value><CR><LF><CR><LF>OK<CR><LF>

5.3.2 Description

This command is used to set the command line end character S3<CR>. The command line end character S3 is saved by using ASCII. This character is sent by the TE and identified and acknowledged by the ME. It indicates the end of a command line. This character is sent by the ME and is used as the header, tail, and end of the result code or information response.

When the **S3=<value>** command is used to set S3, the S3 character must be used as the end character of this command. In this case, the result code will immediately use the newly set S3 character in this command other than next commands.

5.3.3 Defined Values

- <value>
    - 0 to 127: indicate that the S3 character is set by using ASCII.

5.4 Setting Response Format Character (S4)

5.4.1 Command Syntax

Command	Possible Response(s)
S4=<value>	<CR><LF>OK<CR><LF>
S4?	<CR><LF><value><CR><LF><CR><LF>OK<CR><LF>

5.4.2 Description

This command is used to set the response format character S4<LF>. The response format character S4 is saved using ASCII. This character is sent by the ME and is used as the header, tail, and end of the result code or information response.

When the S4 character is changed in a command line, the result code will immediately use the newly set S4 character in this command other than next commands.

5.4.3 Defined Values

- <value>
    - 0 to 127: indicate that the S4 character is set by using ASCII.

5.5 Setting ME Response Format (V)

5.5.1 Command Syntax

Command	Possible Response(s)
V[<value>]	<CR><LF>OK<CR><LF>

5.5.2 Description

This command is used to set the ME response format of result codes or information responses. That is, this command is used to set the structures of the headers and tails for result codes or information responses, and the content formats of result codes. The content of the result code can be digits or character strings. The following table lists the formats of the result codes and information responses for V parameter values. <cr> indicates the S3 character while <lf> indicates the S4 character.

	V0	V1
Information responses	text cr lf	cr lf text cr lf

	V0	V1
Result codes	numeric code cr	cr lf verbose code cr lf

5.5.3 Defined Values

- <value>
  - 0: indicates that the ME sends a result code with the abbreviated header and tail in digital form.
  - 1: indicates that the ME sends a result code with the complete header and tail in a character string.
  - If there is no <value> in this command, the ME sends a result code with the abbreviated header and tail in digital form.

5.6 Setting Backspace Character (S5)

5.6.1 Command Syntax

Command	Possible Response(s)
S5=<value>	<CR><LF>OK<CR><LF>
S5?	<CR><LF><value><CR><LF><CR><LF>OK<CR><LF>

5.6.2 Description

This command is used to set the backspace character S5. The backspace character S5 is saved by using ASCII. The character is sent by the TE and acknowledged by the ME. It indicates that the previous character must be deleted.

5.6.3 Defined Values

- <value>
  - 0 to 127: indicate that the S5 character is set by using ASCII.

5.7 Querying RSSI (+CSQ)

5.7.1 Command Syntax

Command	Possible Response(s)
+CSQ	\<CR>\<LF>+CSQ: \<rssi>,\<ber>\<CR>\<LF>\<CR>\<LF>OK\<CR>\<LF> When ME-related errors occur: \<CR>\<LF>+CME ERROR: \<err>\<CR>\<LF>
+CSQ=?	\<CR>\<LF>+CSQ: (list of supported \<rssi>s),(list of supported \<ber>s) \<CR>\<LF>\<CR>\<LF>OK\<CR>\<LF>

5.7.2 Description

The execution command **+CSQ** is executed to return the received signal strength indicator (RSSI) and bit error rate (BER) of an ME.

The test command **+CSQ=?** is executed to return the RSSI and BER supported by the ME.

5.7.3 Defined Values

\<rssi> indicating the signal strength of GSM or UMTS cells

The following table lists mapping between the RSSI value and the signal strength.

RSSI Value	Signal Strength
0	≤ -113 dBm
1	-111 dBm
2 to 30	-109 dBm to -53 dBm
31	≥ -51 dBm
99	Unknown or unpredictable
100	≤ -116 dBm
101	-115 dBm
102 to 191	-114 dBm to -26 dBm
191	≥ -25 dBm
199	Unknown or unpredictable
100 to 199	The corresponding signal strength can be used for the received signal code power (RSCP) of a TD-SCDMA cell.

- \<ber> indicating the bit error rate

If the BER cannot be queried, 99 is returned when the execution command or test command is executed.

5.8 Setting Operation Mode (+CFUN)

5.8.1 Command Syntax

Command	Possible Response(s)
+CFUN=[<fun>[,<rst>]]	<CR><LF>OK<CR><LF> When ME-related errors occur: <CR><LF>+CME ERROR: <err><CR><LF>
+CFUN?	<CR><LF>+CFUN: <fun><CR><LF><CR><LF>OK<CR><LF> When ME-related errors occur: <CR><LF>+CME ERROR: <err><CR><LF>
+CFUN=?	<CR><LF>+CFUN: (list of supported <fun>s), (list of supported <rst>s)<CR><LF><CR><LF>OK<CR><LF> When ME-related errors occur: <CR><LF>+CME ERROR: <err><CR><LF>

5.8.2 Description

The execution command is executed to set the ME mode or restart the ME.

The read command is executed to return the current mode.

The test command is executed to return the parameter values supported by this command.

5.8.3 Defined Values

- <fun>
  - 0: indicates that the minimum mode is used.
  - 1: indicates that the complete function is used.
  - 4: indicates that the offline mode is used and the RF RX/TX channel is disabled.
  - 5: It is reserved.
  - 6: indicates that the function is reset (the offline mode must be used before reset).
  - 7: indicates customized minimum mode for Vodafone.
  - 8: indicates powered off status.
- <rst> indicates whether the ME is reset before restart.

5.9 Querying Information of Manufacturers (+CGMI)

5.9.1 Command Syntax

Command	Possible Response(s)
+CGMI	\<CR\>\<LF\>+CGMI: \<manufacturer\>\<CR\>\<LF\>\<CR\>\<LF\>OK\<CR\>\<LF\> When ME-related errors occur: \<CR\>\<LF\>+CME ERROR: \<err\>\<CR\>\<LF\>
+CGMI=?	\<CR\>\<LF\>OK\<CR\>\<LF\>

5.9.2 Description

This command is used to query information of manufacturers.

5.9.3 Defined Values

- \<manufacturer\> indicating information of manufacturers in character strings

5.10 Querying Software Version (+CGMR)

5.10.1 Command Syntax

Command	Possible Response(s)
+CGMR	\<CR\>\<LF\>+CGMR:\<softversion\>\<CR\>\<LF\>\<CR\>\<LF\>OK\<CR\>\<LF\> When ME-related errors occur: \<CR\>\<LF\>+CME ERROR: \<err\>\<CR\>\<LF\>
+CGMR=?	\<CR\>\<LF\>OK\<CR\>\<LF\>

5.10.2 Interface Description

The execution command is executed to return the software version of an ME.

5.10.3 Defined Values

- \<softversion\> indicating the software version whose length is less than or equal to 31 characters

5.11 Querying IMSI (+CIMI)

5.11.1 Command Syntax

Command	Possible Response(s)
+CIMI	<CR><LF>+CIMI: <IMSI><CR><LF><CR><LF>OK<CR><LF> When ME-related errors occur: <CR><LF>+CME ERROR: <err><CR><LF>
+CIMI=?	<CR><LF>OK<CR><LF>

5.11.2 Description

This command is used to query the international mobile subscriber identity (IMSI) of a UMTS subscriber identity module (USIM) or subscriber identity module (SIM).

5.11.3 Defined Values

<IMSI> indicating the IMSI consisting of 0 to 9 decimal digits returned to the SIM inside the phone

An IMSI follows these rules:

Maximum length: 15 characters
3 characters for MCC, 2 or 3 characters for MNC
Sequence*: MCCMNCMSIN

📖 NOTE
- where
- MCC is mobile country code. It has three characters.
- MNC is mobile network code. It has two or three characters.
- MSIN is mobile subscriber identification number. It has nine or ten characters.

If the MCC is 123, the MNC is 45, and the MSIN is 12345678, 1234512345678 is returned after the **CIMI** command is executed.

5.12 Querying IMEI (+CGSN)

5.12.1 Command Syntax

Command	Possible Response(s)
+CGSN	<CR><LF>+CGSN: <IMEI><CR><LF><CR><LF>OK<CR><LF> When ME-related errors occur: <CR><LF>+CME ERROR: <err><CR><LF>

Command	Possible Response(s)
+CGSN =?	<CR><LF>OK<CR><LF>

5.12.2 Description

This command is used to query the international mobile equipment identity (IMEI) of a board.

5.12.3 Defined Values

- <IMEI> indicating the IMEI of a board returned in a character string
- The composition of an IMEI is as follows:

8 characters	6 characters	1 character
TAC	SNR	Spare

NOTE

- TAC is short for tracking area code.
- SNR is short for serial number.
- Spare indicated that the character is reserved.

5.13 Querying Hardware Version (^HVER)

5.13.1 Command Syntax

Command	Possible Response(s)
^HVER	<CR><LF>^HVER:<hardversion><CR><LF><CR><LF>OK<CR><LF> When ME-related errors occur: <CR><LF>+CME ERROR: <err><CR><LF>

5.13.2 Description

The execution command is executed to return the hardware version of an ME.

5.13.3 Defined Values

- <hardversion> indicating the hardware version whose length is less than or equal to 31 characters

5.14 Querying Product Name (+CGMM)

5.14.1 Command Syntax

Command	Possible Response(s)
+CGMM	<CR><LF>< production_ name><CR><LF><CR><LF>OK<CR><LF> When MT-related errors occur: <CR><LF>+CME ERROR: <err><CR><LF>
+CGMM=?	<CR><LF>OK<CR><LF>

5.14.2 Description

This command is used to query product names. The **+CGMM** command is used to query the model ID of a product. The value of a model ID can be a line of characters or multiple lines of characters, including the product name and information provided by manufacturers. The value that varies depending on manufacturers indicates the model ID of a device. The maximum of length of the value is 2048 characters (including the end character). Note that 0<CR> or OK<CR> cannot be included in the value.

5.14.3 Defined Values

- < production_name > indicating the product name, such as CMCC-TD001

    For example,

    AT+CGMM

    CMCC-TD001

    OK

5.15 Board Restart Command^ RESET

5.15.1 Command Syntax

Command	Possible response(s)
^ RESET	<CR><LF>OK<CR><LF> When board-related errors occur: <CR><LF>ERROR<err><CR><LF>

5.15.2 Description

This command restarts the board.

5.15.3 Defined Values

NA

6 Interfaces for Processing SM Services

6.1 Setting Types of SM Services (+CSMS)

6.1.1 Command Syntax

Command	Possible Response(s)
+CSMS=<service>	<CR><LF>+CSMS: <mt>,<mo>,<bm><CR><LF><CR><LF>OK<CR><LF> When SM-related errors occur: <CR><LF>+CMS ERROR: <err><CR><LF>
+CSMS?	<CR><LF>+CSMS: <service>,<mt>,<mo>,<bm><CR><LF><CR><LF>OK<CR><LF>
+CSMS=?	<CR><LF>+CSMS: (list of supported <service>s)<CR><LF><CR><LF>OK<CR><LF>

6.1.2 Description

The set command is executed to set the type of an SM service. <mt> indicates the SM received by the ME. <mo> indicates the SM sent by the ME. <bm> indicates whether the broadcast message supports this type of the SM service.

6.1.3 Defined Values

- <service>: the type of service. Indicates whether the response contains <ackpdu> after the ME sends an SM.

  For example, when a TE responds with the **+CNMA** command after receiving the SM from the ME, the response contains <ackpdu>.

  The network also determines whether the response contains <ackpdu>.

  If the <service> value is:

  – 0, the response does not need to contain <ackpdu>.

– 1, the response contains <ackpdu> after the ME sends an SM. If the TE uses the **+CNMA** command to respond after receiving an SM from the ME, the response contains <ackpdu>. Whether the response contains <ackpdu> also depends on the network.

- <mt>, <mo>, and <bm>
    – 0: indicates that the network does not support the response containing <ackpdu>.
    – 1: indicates that the network supports the response containing <ackpdu>.

6.2 Setting SM Format (+CMGF)

6.2.1 Command Syntax

Command	Possible Response(s)
+CMGF[=<mode>]	<CR><LF>OK<CR><LF>
+CMGF?	<CR><LF>+CMGF: <mode><CR><LF><CR><LF>OK<CR><LF>
+CMGF=?	<CR><LF>+CMGF: (list of supported <mode>s)<CR><LF><CR><LF>OK<CR><LF>

6.2.2 Description

The set command is executed to set the format used by an SM. The SM has two types of formats: protocol data unit (PDU) and text, which are determined by the **<mode>** parameter.

The read command is executed to return the current mode.

The test command is executed to return the value of the **<mode>** parameter.

6.2.3 Defined Values

<mode>

- 0: indicates that the PDU is used.
- 1: indicates that the text is used. However, this mode is not supported at present.
- If there is no <mode> in this command, the PDU is used.

6.3 Indicating SM Arrival (+CMTI)

6.3.1 Command Syntax

Command	Possible Response(s)
-	<CR><LF>+CMTI: <mem>,<index><CR><LF>

6.3.2 Description

This command is used to indicate that a new SM or a new SM report has been received.

6.3.3 Defined Values

- \<mem\>
  - "ME" indicates that an ME is used to store SMs (which is not supported by MS2131 currently).
  - "SM" indicates that an SIM or USIM is used to store SMs.
- \<index\> indicating the SM position in a memory (integral value)

6.4 Indicating that New SMs Are Reported Directly (+CMT)

6.4.1 Command Syntax

Command	Possible Response(s)
-	\<CR\>\<LF\>+CMT: [\<reserved\>],\<length\>\<CR\>\<LF\>\<pdu\>\<CR\>\<LF\>

6.4.2 Description

The command is used to indicate that newly received SMs are reported to the TE, rather than storing the SMs.

6.4.3 Defined Values

- \<reserved\> (reserved parameter)
- \<length\> indicating the number of bytes of a PDU (integral value)
- \<pdu\> indicating the protocol data unit

  For detailed formats of the PDU, see section 6.14

6.5 Indicating that Status Reports of New SMs Were Received (+CDSI)

6.5.1 Command Syntax

Command	Possible Response(s)
-	\<CR\>\<LF\>+CDSI: \<mem\>,\<index\>\<CR\>\<LF\>

6.5.2 Description

This command is used to indicate that status reports of new SMs have been received and the positions for storing the reports have been reported.

📖 **NOTE**

When the **AT+CMGL** command is used to obtain the SM list, the stored status reports of SMs are not listed. Only the **AT+CMGR=\<index>** and **AT+CMGD=\<index>** commands can be used to obtain and delete the stored status reports of SMs, respectively.

6.5.3 Defined Values

- \<mem> whose settings are the same as those of \<mem> in the command of indicting SM arrival
- \<index> indicating the SM position in a memory (integral value)

6.6 Indicating that Status Reports of New SMs Are Reported Directly (+CDS)

6.6.1 Command Syntax

Command	Possible Response(s)
-	\<CR>\<LF>+CDS: \<length>\<CR>\<LF>\<pdu>\<CR>\<LF>

6.6.2 Description

The command is used to indicate that status reports of newly received SMs are directly reported to the TE without being stored.

6.6.3 Defined Values

- \<length> indicating the number of bytes of a PDU, which is an integral value
- \<pdu> indicating the protocol data unit

The structure of a PDU is as follows:

[\<SCA>]			(TPDU)
\<sc_len>	\<type_addr>	\<numbers>	

For details about the service center address \<SCA>, see section 6.12

The TPDU is structured as follows:

Abbreviation	Reference	P[1)]	R[2)]
TP-MTI	TP-Message-Type-Indicator	M	2b

Abbreviation	Reference	P[1)]	R[2)]
TP-UDHI	TP-User-Data-Header-Indication	O	b
TP-MMS	TP-More-Messages-to-Send	M	b
TP-SRQ	TP-Status-Report-Qualifier	M	b
TP-MR	TP-Message-Reference 3)	M	I
TP-RA	TP-Recipient-Address	M	2-12o
TP-SCTS	TP-Service-Centre-Time-Stamp	M	7o
TP-DT	TP-Discharge-Time	M	7o
TP-ST	TP-Status	M	o
TP-PI	TP-Parameter-Indicator	O	o
TP-PID	TP-Protocol-Identifier	O	o
TP-DCS	TP-Data-Coding-Scheme	O	o
TP-UDL	TP-User-Data-Length	O	o
TP-UD	TP-User-Data	O	

📖 NOTE

1) whether it is mandatory or optional: Mandatory (M) or Optional (O)

2) indicates: integer (I), bit (b), 2 bits (2b), octet (o), 7 octets (7o), 2 12 octets (2 12o).

6.7 Setting Notification of New SMs (+CNMI)

6.7.1 Command Syntax

Command	Possible Response(s)
+CNMI=[<mode>[,<mt>[,<bm>[,<ds>[,<bfr>]]]]]	<CR><LF>OK<CR><LF> When SM-related errors occur: <CR><LF>+CMS ERROR: <err><CR><LF>
+CNMI?	<CR><LF>+CNMI: <mode>,<mt>,<bm>,<ds>,<bfr><CR><LF><CR><LF>OK<CR><LF>
+CNMI=?	<CR><LF>+CNMI: (list of supported <mode>s),(list of supported <mt>s),(list of supported <bm>s),(list of supported <ds>s),(list of supported <bfr>s) <CR><LF><CR><LF>OK<CR><LF>

6.7.2 Interface Description

- The set command is executed to set the process for reporting new SMs to the TE.
    - <mode> and <bfr> are used to set the mode of reporting the notifications of new SMs to the TE. The modes include +CMT, +CMTI, and +CDSI3.
    - <mt> is used to set whether newly received SMs are reported to the TE or the SMs are stored on the ME and then the SM positions are reported.
    - <bm> is not used at present.
    - <ds> is used to set whether the **+CDSI** command or the **+CDS** command is used to report the status reports of SMs.
- The test command is executed to return the parameter values supported by this command.

6.7.3 Defined Values

- <mode> indicating the mode of reporting notifications of new SMs
    - 0: indicates that notifications of new SMs are stored on the ME. If all storage spaces on the ME are used, notifications of the earliest SMs are replaced by notifications of new SMs.
    - 1: indicates that notifications of new SMs are reported to the TE. If the notifications cannot be reported (for examples, the notifications are online data), they are discarded.
    - 2: indicates that notifications and status reports of new SMs are reported to the TE. If the notifications cannot be reported (for examples, the notifications are online data), they are stored on the ME, and then they are all reported to the TE later at one time.

> 📖 **NOTE**
>
> Notifications of SMs are stored in the volatile memory. If the ME is powered off before notifications of SMs are sent, they may be lost. Therefore, when **<mode>** is se to **0** or **2**, notifications of SMs must be stored and then reported (that is, **<mt>** is set to **2** or **3**.

- <mt> indicating the storage and notification rule of newly received SMs

    The newly received SMs can be stored and notified in any of the following ways:
    - Received SMs are sent to the TE in the following format, rather than being stored on the ME:

      +CMT: [<reserved>],<length><CR><LF><pdu>
    - Received SMs are stored on the ME, and the positions of the received SMs are sent to the TE in the following format:

      +CMTI: <mem>,<index>
    - Received SMs are stored on the ME, and the TE is not notified of the received SMs.

      The following figure shows the interaction between the TE and the ME when any of the preceding ways is used.
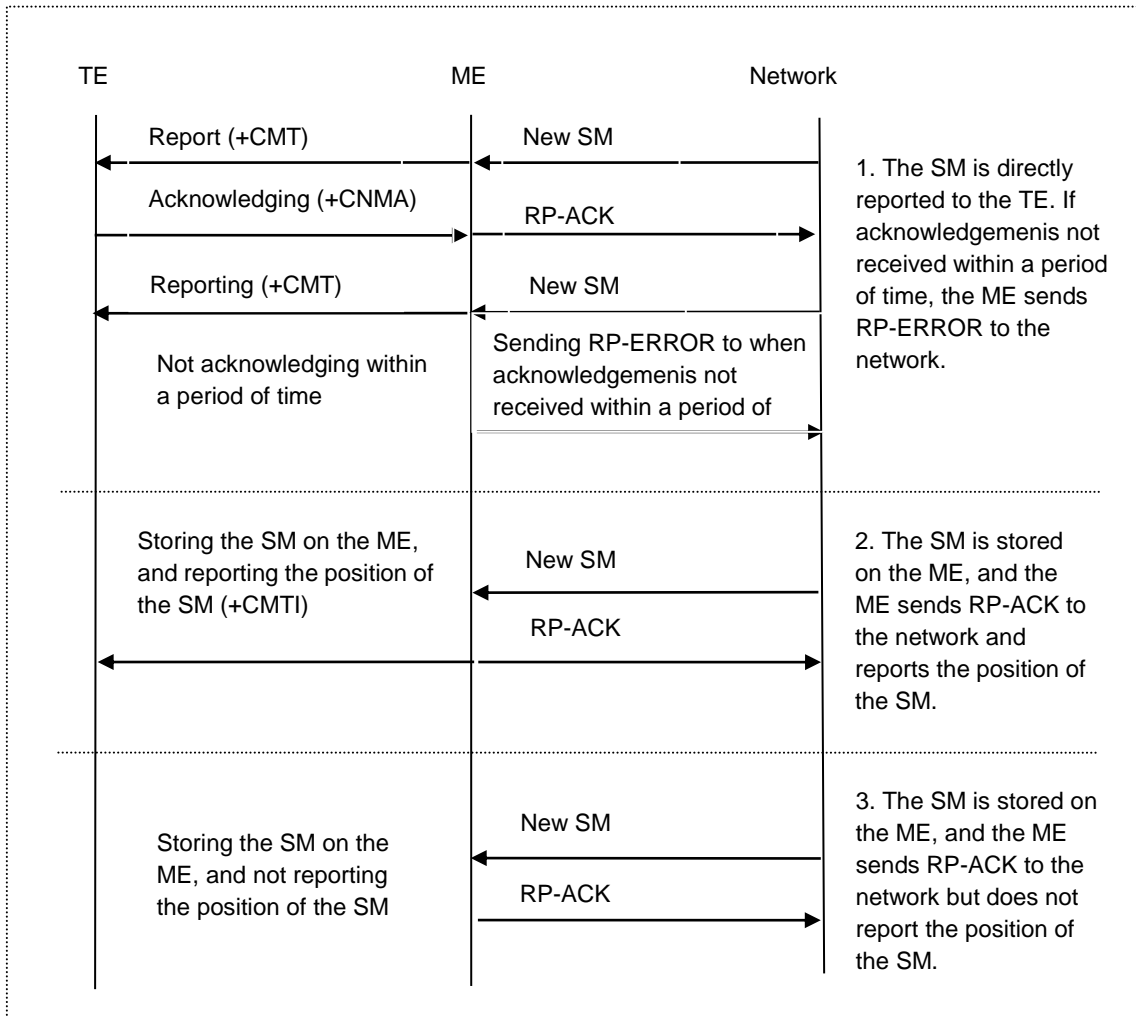
The following table lists mapping between the values of <mt> and the storage and notification rules of SMs.

<mt>	No Class or Class 1	Class 0 or Message Waiting Indication Group (Discard)	Class 2 or Message Waiting Indication Group (Stored)	Class 3
0	No	No	No	No
1	+CMTI	[+CMTI]	+CMTI	+CMTI
2	+CMT & +CNMA	+CMT [& +CNMA]	+CMTI	+CMT & +CNMA
3	+CMTI	[+CMTI]	+CMTI	+CMT & +CNMA

NOTE

- The SM class is defined by the TP-DCS field of the SM. For details, see the description of the **DCS** parameter in the +**CMGS** command.
- If the class is +CMT & +CNMA, the TE needs to send the +**CNMA** command to the ME.

- \<bm> used to set the cell broadcast message

  This parameter is not supported at present.

- \<ds> used to set the SM receipt

  - 0: indicates that the ME does not send the SM receipt message to the TE.
  - 1: indicates that the SM receipt message is sent to the TE in the following format, rather than being stored on the ME:

    +CDS: \<length>\<CR>\<LF>\<pdu>

  - 2: indicates that the SM receipt message is stored on the ME, and the position of the message is sent to the TE in the following format by using the +**CDSI** command:

    +CDSI: \<mem>,\<index>

- \<bfr> used to set the storage handling when **\<mode>** is changed from **0** to **1** or **2**

  - 0: indicates that all the stored unsolicited result codes are sent to the TE at one time.
  - 1: indicates that all the stored unsolicited result codes are cleared.

6.8 Deleting SMs (+CMGD)

6.8.1 Command Syntax

Command	Possible Response(s)
+CMGD=\<index>[,\<delflag>]	\<CR>\<LF>OK\<CR>\<LF> When SM-related errors occur: \<CR>\<LF>+CMS ERROR: \<err>\<CR>\<LF>
+CMGD=?	\<CR>\<LF>+CMGD: (list of supported \<index>s)[,(list of supported \<delflag>s)]\<CR>\<LF>\<CR>\<LF>OK\<CR>\<LF>

6.8.2 Description

The execution command is executed to delete the SM stored in the position specified by **\<index>** on the memory specified by **\<mem1>**. For details about the setting and description of **\<mem1>**, see the +**CPMS** command. If the **\<delflag>** parameter is set to other values than 0, the ME deletes the SM according to the **\<delflag>** parameter other than the **\<index>** parameter. For details about the settings of the **\<index>** parameter, see section 6.8.3 "Defined Values." If the SM cannot be deleted, the +CMS ERROR: \<err> message is returned.

The test command is executed to return the position for storing the SM and the value of the **\<delflag>** parameter supported by this command.

6.8.3 Defined Values

- <index> indicating the position for storing the SM
- <delflag>
  - 0 (default value): indicates that the SM stored in the position specified by **<index>** is deleted.
  - 1: indicates that all the read SMs are deleted and unread SMs, sent SMs, and unsent SMs are reserved in the preferred memory.
  - 2: indicates that all the read SMs and sent SMs are deleted and unread SMs and unsent SMs are reserved in the preferred memory.
  - 3: indicates that all the read SMs, sent SMs, and unsent SMs are deleted and unread SMs are reserved in the preferred memory.
  - 4: indicates that all SMs (including unread SMs) are deleted from the preferred memory.

6.9 Confirming New SMs (+CNMA)

6.9.1 Command Syntax

Command	Possible Response(s)
+CNMA[=<n>[,<length>[<CR> PDU is given<ctrl-Z/ESC>]]]	<CR><LF>OK<CR><LF> When SM-related errors occur: <CR><LF>+CMS ERROR: <err><CR><LF>
+CNMA=?	<CR><LF>+CNMA: (list of supported <n>s)<CR><LF><CR><LF>OK<CR><LF>

6.9.2 Description

The execution is executed to acknowledge a newly received SM directly sent by the ME to the TE. This command is used when the **<service>**parameter in the +**CSMS** command is set to 1.

For details about usage of the +**CNMA** command, see the description of the +**CNMI** command.

The ME using the PDU can send the acknowledge (RP-ACK) or error (RP-ERROR) to the network. <n> specifies whether the RP-ACK or RP-ERROR is sent.

The TPDU can be sent (SMS-DELIVER-REPORT for RP-ACK or RP-ERROR). The procedure for entering the PDU is similar to that for entering the +**CMGS** command. The differences are that **<ackpdu>** replaces **<pdu>**, and quotation marks (") do not need to be added before and after PDU.

Before an SM is acknowledged, the ME will not send the second +**CMT** command or +CDS result code to the TE.

If the ME does not receive acknowledgement within a period of time (that is, the network times out), the ME sends RP-ERROR to the network and set the **<mt>** and **<ds>** parameters

in the **+CNMI** command to **0** to prevent the ME from sending the notification of the SM to the TE. If the ME needs to report the notification of the SM again, the **<mt>** and **<ds>** parameters need to be set.

If this command is executed but there is no SM to be acknowledged, +CMS ERROR: <err> is returned.

The test command is executed to return the value of **<n>** supported by this command. If only **0** is supported, the **+CNMA** command does not support transmission by using the TPDU.

6.9.3 Defined Values

<n>

- – 0: indicates that the command operates similarly as defined for the text mode.
- – 1: indicates that RP-ACK is sent or the stored result code is successfully received.
- – 2: indicates that RP-ERROR is sent.

<ackpdu>

Basic elements:

Abbreviation	Reference	P[1]	P[2]	Indicates
TP-MTI	TP-Message Type Indicator	M	2b	*TP* Message Type
TP-UDHI	TP-User-Data-Header-Indication	O	b	that *TP-UD* has one header
TP-PI	TP-Parameter-Indicator	M	o	Optional parameters
TP-PID	TP-Protocol-Identifier	O	o	Protocol ID
TP-DCS	TP-Data-Coding-Scheme	O	o	Data coding scheme
TP-UDL	TP-User-Data-Length	O	o	User data length
TP-UD	TP-User-Data	O	[3]	User data

📖 **NOTE**

1) Mandatory (M) or Optional (O)

2) Integer (I), bit (b), 2 bits (2b), octet (o).

3) Varies by TP-DCS listed in the following table.

Number of Octets	7	6	5	4	3	2	1	0	
1									TP-MTI, TP-UDHI
1									TP-PI
0,1									TP-PID
0,1									TP-DCS

0,1									TP-UDL
0 to 159									TP-UD

The second to fifth bits and the seventh bit in the first byte are not used in the SMS deliver report, and the sender must set these bits to 0. If any of these bits is not set to 0, the receiver must ignore the bit.

The items in table above are described as follows:

<TP-MTI>: It is located in bits 0 and 1 in the first byte.

Bits 1 and 0	Message Type
00	SMS DELIVER (in the direction SMSC to ME)
00	DELIVER REPORT (in the direction ME to SMSC)
10	SMS STATUS REPORT (in the direction SMSC to ME)
10	SMS COMMAND (in the direction ME to SMSC)
01	SMS SUBMIT (in the direction ME to SMSC)
01	SMS SUBMIT REPORT (in the direction SMSC to ME)
11	Reserved

- <TP-UDHI>: It is located in bit 6 in the first byte.
  - 0 The TP-UD field contains only the short message.
  - 1 The beginning of the TP-UD field contains a Header in addition to the short message.
- <TP PI>: It indicates the optional parameters. If a bit is set to 1, the parameter corresponding to the bit exists.

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Extension bit	Reserved	Reserved	Reserved	Reserved	TP-UDL	TP-DCS	TP-PID

- <TP PID>: The TE set it to 00000000 (default value) when an SM is sent. If an e-mail is sent, this parameter is set to 00110010=0x32 by the TE.
- <TP-DCS>: It indicates that the TE uses the TP-DCS to send an SM.

Bits 4 to 7		Bits 0 to 5		
Bits 7 and 6 (The TE uses the TP-DCS to send an SM.)	00: The TE uses this value to send an SM.	Bit 5	0	Indicates that the SM is not compressed.
			1	Indicates that the sent SM is compressed. The TE does not use this value.

Bits 4 to 7			Bits 0 to 5		
		Bit 4	0	Indicates that bits 1 and 0 are reserved and they are set to 00.	
			1	Indicates that bits 1 and 0 indicate the SM type. The SM type depends on the user's settings. If the SM type is set by the user, the TE sets bit 4 to 1, such as class 1 or class 2.	
		Bits 3 and 2 indicating the SM coding scheme	00	Indicates the GSM 7 bit default alphabet.	
			01	Indicates 8 bit data.	
			10	Indicates the UCS2 coding scheme. This value is used when a Chinese character is entered.	
		Bits 1 and 0 indicating the SM type (They are set by the TE based on the user's options.)	00	Class 0: indicates that the SM is displayed on the TE and a message that the SM is received but not stored is returned to the SMSC.	
			01	Class 1 indicates that the SM is stored on the ME (that is, NV) or is stored on the SIM card when the ME is full. NV is short for non-volatile.	
			10	Class 2 (only for the SIM card): indicates that the storage status is reported to the SMSC when the SM is stored. If the SIM card is full, the status fails to be reported to the SMSC and the failure cause is reported to the SMSC.	
			11	Class 3: indicates that the SM is stored on the TE. However, the ME sends response to the SMSC after receiving the SM but before the TE receives the SM.	

Bits 4 to 7			Bits 0 to 5		
Bits 7 and 4 (The TE does not use the TP-DCS to send an SM.)	• 1100 and 1101 (The GSM 7 bit default alphabet is used.) • 1110 (The UCS2 coding scheme without compression is used.)	Bit 3	0	Indicates that the function of displaying information indicating that an SM is waiting is disabled. At present, the enhanced message, e-mail, and voice mail do not support this function.	
			1	Indicates that the function of displaying information indicating that an SM is waiting is activated.	
		Bit 2	0	Reserved and having no meaning.	
		Bits 1 and 0 indicating the type of a waiting SM	00	Indicates that a voice SM is waiting.	
			01	Indicates that a fax SM is waiting.	
			10	Indicates that an e-mail is waiting.	
			11	Indicates that unknown types of SMs are waiting.	
	1111 (The TE does not use this value.)	Bit 3	0	Reserved and having no meaning.	
		Bit 2	0	Indicates the GSM 7 bit default alphabet.	
			1	Indicates 8 bit data.	
		Bits 1 and 0	00	Class 0: indicates that the SM is displayed on the TE and a message that the SM is received but not stored is returned to the SMSC.	
			01	Class 1: indicates that the SM is stored on the ME (that is, NV) or the SIM card.	
			10	Class 2 (only for the SIM card): indicates that the storage status is reported to the SMSC when the SM is stored.	

Bits 4 to 7			Bits 0 to 5	
			11	Class 3: indicates that the SM is stored on the TE. However, the ME sends response to the SMSC after receiving the SM but before the TE receives the SM.

<TP-UDL> indicating the number of the bytes used by the user data

0: indicates that the user data does not exist.

- <TP-UD>

The user data may include the user data header. If bit 6 in byte 0 is set to 1, the user data includes the user data header, and the value of the TP-UDL is equal to the length of user data header plus the length of the user data. The TP-UDL value varies depending on the coding scheme. If the GSM 7 bit default alphabet is used, there are multiple septets. If 8 bit data or the UCS2 coding scheme is used, there are multiple octets. If the compressed GSM 7 bit default alphabet, compressed 8 bit data, or UCS2 coding scheme is used, there are multiple octets after compression. The following figures show the format of the user data.

Format of the user data when the GSM 7 bit default alphabet is used
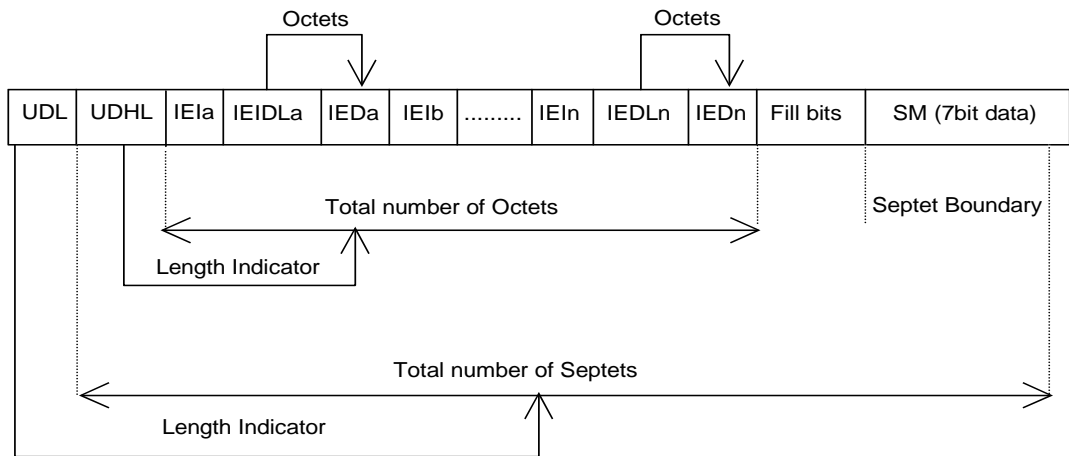
Format of the user data when the 8 bit data or the UCS2 coding scheme is used
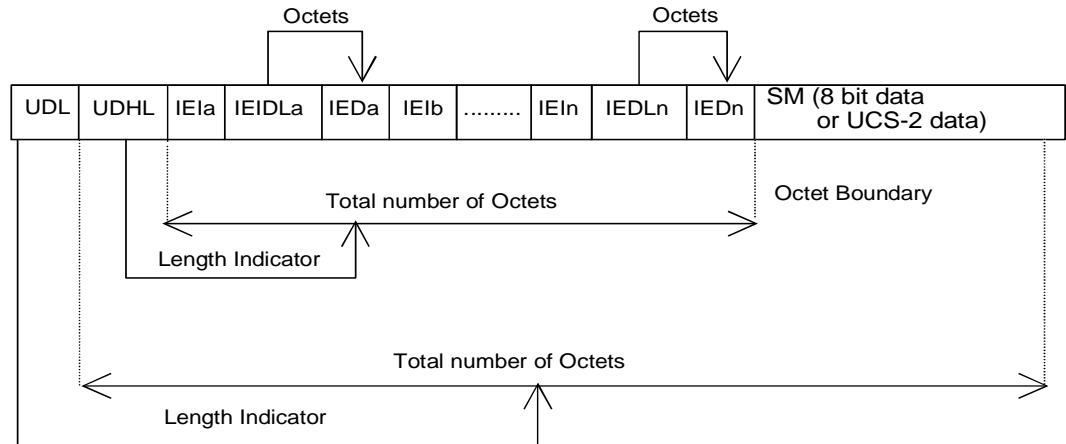
In the preceding figures, IEI is short for information element identifier.

6.10 Storing SMs (+CPMS)

6.10.1 Command Syntax

Command	Possible Response(s)
+CPMS=<mem1>[, <mem2>[,<mem3>]]	<CR><LF>+CPMS: <used1>,<total1>,<used2>,<total2>,<used3>,<total3><CR><LF> <CR><LF>OK<CR><LF>
+CPMS?	+CPMS: <mem1>,<used1>,<total1>,<mem2>,<used2>,<total2>, <mem3>,<used3>,<total3><CR><LF><CR><LF>OK<CR><LF >
+CPMS=?	+CPMS: (list of supported <mem1>s),(list of supported <mem2>s), (list of supported <mem3>s)<CR><LF><CR><LF>OK<CR><LF>

6.10.2 Description

The set command is executed to set the SM storage media corresponding to SM reading and writing, and to return the usage of the selected storage medium.

The read command is executed to return the name and usage of the selected storage medium.

The test command is executed to return all types of storage media supported by the ME.

6.10.3 Defined Values

- <mem1> indicating the medium used by the operation of reading or deleting an SM (character string)

  It can be set to "SM" or "ME".

  - "SM": indicates the SIM or USIM card.
  - "ME": indicates the NV.

- <mem2> indicating the medium used by the operation of writing or sending an SM (character string)

  Its values are the same as the values of **<mem1>**.

- <mem3> indicating the storage medium for a received SM (a character string)

  Its values are the same as the values of **<mem1>**.

- <total1> indicating the total number of SMs that can be stored in the memory specified by **<mem1>** (integral value)

- <total2> indicating the total number of SMs that can be stored in the memory specified by **<mem2>** (integral value)

- <total3> indicating the total number of SMs that can be stored in the memory specified by **<mem3>** (integral value)

- <used1> indicating the number of SMs stored in the memory specified by **<mem1>** (integral value)

- <used2> indicating the number of SMs stored in the memory specified by **<mem2>** (integral value)

- <used3> indicating the number of SMs stored in the memory specified by **<mem3>** (integral value)

6.11 Setting the SMSC Number (+CSCA)

6.11.1 Command Syntax

Command	Possible Response(s)
+CSCA=<sca>[,<tosca>]	<CR><LF>OK<CR><LF> When ME-related errors occur: <CR><LF>+CME ERROR: <err><CR><LF>
+CSCA?	<CR><LF>+CSCA: <sca>,<tosca><CR><LF><CR><LF>OK<CR><LF> When ME-related errors occur: <CR><LF>+CME ERROR: <err><CR><LF>
+CSCA=?	<CR><LF>OK<CR><LF>

6.11.2 Description

The set command is executed to set the SMSC number. This command can be executed for an SM sent in the PDU only when the **sc_len** parameter of the PDU is set to **0**. The **sc_len** parameter indicates the number of the SMSC. For the structure of a PDU, see section 6.12

6.11.3 Defined Values

- <sca> indicating the number of the SMSC (a character string)

  The number of the SMSC is composed of asterisk (*), number sign (#), plus sign (+), and digits (0 to 9). Its maximum length is 20 characters (excluding plus sign).

- <tosca> indicating the type of number (integral value)

  The international number is indicated by 145. For details, see defined values of the **type_ addr** parameter in the SMSC number in section 6.12

- If there is no <tosca>, the **<tosca>** parameter is not modified.

6.12 Sending SMs (+CMGS)

6.12.1 Command Syntax

Command	Possible Response(s)
+CMGS=<length><CR> PDU is given<ctrl-Z/ESC>	<CR><LF>+CMGS: <mr>[,<ackpdu>]<CR><LF><CR><LF>OK<CR><LF> When SM-related errors occur: <CR><LF>+CMS ERROR: <err><CR><LF>
+CMGS=?	<CR><LF>OK<CR><LF>

6.12.2 Description

The procedure for sending an SM to the network is as follows:

1. The TE delivers the **+CMGS=<length>** command ending with CR.

2. Upon receiving <CR><LF><greater_than><space>(IRA 13, 10, 62, 32), the TE delivers a PDU ending with <ctrl-Z> (IRA 26).

6.12.3 Defined Values

  It equals the actual number of sent TPDUs divided by 2. The value of this parameter is 0 to 9 decimal digits, and the maximum length of the value is 178.

- <mr> indicating the identifier of an SM

  Its value ranges from 0 to 255 and uses decimal numbers that range from 0 to 9.

- <ackpdu>

  When the **<service>** parameter in the **+CSMS** command is set to **1** that is supported by the network, this field is returned. The structure is similar to the structure of a PDU. The

only difference is that there is no SCA field in this structure. This field is not supported at present.

- <ctrl-Z> indicating the end of PDU data (The character is 0x1A.)
- <ESC> indicating that the SM sending is canceled (The character is 0x1B.)

The structure of a PDU is as follows:

[<SCA>]			TPDU
<sc_len>	<type_addr>	<numbers>	

NOTE

The character value in the packet can be any of the following: 0 to 9, A to F, and a to f. One octet is composed of two characters. For example, 23 equals 0x23, and 2a equals 0x2a. 23 and 2a are hexadecimal numbers.

The address structure of the SMSC specified by the <SCA> parameter is as follows:
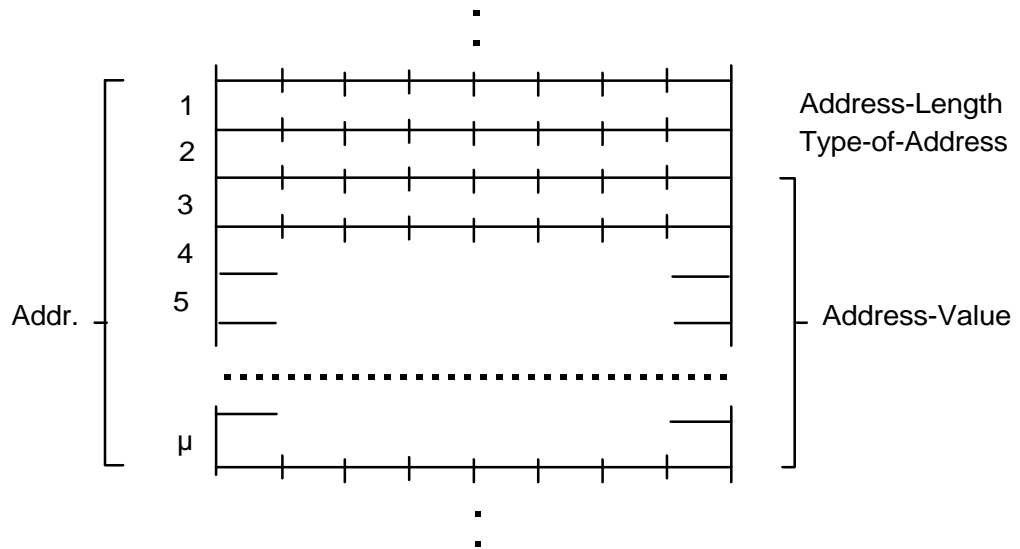
- <sc_len> indicating the length of the SCA

  It has two characters and equals the number of characters specifying <type_addr> and <numbers> parameters divided by 2.

- <type_addr> indicating the type of number address

  It has two characters and its structure is as follows:

1	Type-of-number	Numbering-plan-identification

  – Type-of-number (bits 6 to 4)

– Its values are as follows:

000 is used when the user does not know the prior information of the destination address that is organized by the network side.

001 is used when the user knows that it is an international number or believes that it falls in the national range.

010 is used for a national number. A prefix or suffix cannot be added. This value is used to initiate a national call.

011 is used for the management or service of the specific number in a network. Users cannot use this value.

101 is used for the number using the GSM 7 bit default coding scheme. It is not used at present.

110 is used for the short number. It is not used at present.

111 is reserved for extension. It is not used at present.

– Numbering plan identification (bits 3 to 0)

Bits 3 to 0 are valid when bits 6 to 4 are 000, 001, or 010. Its values are as follows:

0000 is used for the number determined by the number planning on the network side

0001 indicates the ISDN/telephone numbering plan.

0011 is used for the data numbering plan. It is not used at present.

0100 is used for the telex numbering plan. It is not used at present.

1000 is used for the national numbering plan. It is not used at present.

1001 is used for the private numbering plan. It is not used at present.

1010 is used for the ERMES numbering plan. It is not used at present.

- <numbers> indicating the address of a number

One byte stores two digits. Bits 3 to 0 store the first digit, and bits 7 to 4 store the second digit. The nibble coding sequence is as follows:
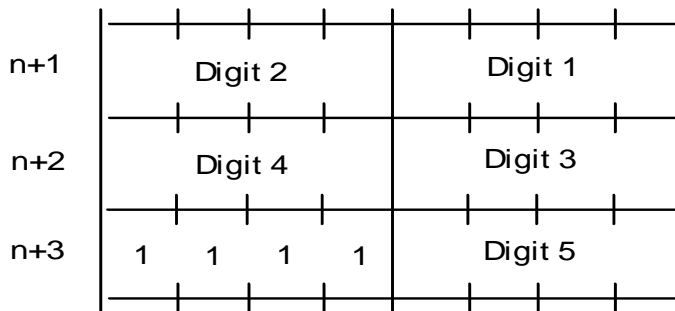
📖 NOTE

- If the length of a number is an odd number, the four high-order bits of octet are set to 1111.
- * represents 1010.
- # represents 1011.
- a represents 1100.
- b represents 1101.
- c represents 1110.

For example, if the number of the SCA is 13902900, the value of the **<numbers>** parameter is 31099200. If the number of the SCA is 139029001, the value of the **<numbers>** parameter is 31099200F1. If the type of number of is A1, the value of the **<SCA>** parameter is 05a131099200. If the type of number of is A1 (type of international number), but the number is 13902900 (national number), 86 must be added before the number and the value of the **<SCA>** parameter is 06a16831099200.

The TPDU structure is as follows:

1 Octet								1 Oct	2 Oct to 12 Oct	Oct 1	1 Oct	1 Oct	1 Oct	
RP	UD HI	SR R	VPF		RD	MTI		MR	DA	PID	DCS	VP	UDL	UD
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0							

- <MTI> indicating the type of SM

  Its values are as follows:

Bits 1 and 0	Message Type
00	SMS-DELIVER (in the direction SMSC to ME)
00	SMS-DELIVER REPORT (in the direction ME to SMSC)
10	SMS-STATUS-REPORT (in the direction SMSC to ME)
10	SMS-COMMAND (in the direction ME to SMSC)
01	SMS-SUBMIT (in the direction ME to SMSC)
01	SMS-SUBMIT-REPORT (in the direction SMSC to ME)
11	Reserved

- <RD> indicating whether the SMSC receives an SM that has the same measurement report (MR) and destination address (DA) with the SM from the same original address (OA)

  Its values are as follows:
    - 0: indicates that the SMSC receives the SM.
    - 1: indicates that the SMSC does not receive the SM.
- <VPF> indicating the validity format of a VP field

  Its values are as follows:

  Bits 4 and 3

  00: indicate that the VP field is valid.

  10: indicate that the VP field is valid and the format is relative. Only the format of relative is provided at present.

  01: indicate that the VP field is valid and the format is enhanced.

  11: indicate that the VP field is valid and the format is absolute.
- <RP> indicating whether the path of returning an SM is set

  Its values are as follows:
    - 0: indicates that the path is not set.
    - 1: indicates that the path is set. The SMSC numbers are same when an SM sent and when an SM is returned, and therefore the returning path is the same as the sending path.
- <UDHI> indicating the data header

  Its values are as follows:
    - 0: indicates that the user's data only includes the SM.
    - 1: indicates that the user's data includes the SM and data header.
- <SRR> indicating whether a status report is requested

  Its values are as follows:
    - 0: indicates that the status report indicating that an SM is successfully sent is not requested.
    - 1: indicates that the status report indicating that an SM is successfully sent is requested.
- <MR> indicating the identifier of an SM

  Its value ranges from 0 to 255.
- <DA> indicating the destination address

  The defined values are the same as those of the **<SCA>** parameter. A value includes 2 to 12 Otects. Therefore, the maximum length of an address in the DA field is 20.
- <PID> indicating a protocol

  Its values are as follows:

PID							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

  - Bits 7 and 6

    00: assigns bits 0 to 5 as defined below.

10: assigns bits 0 to 5 as defined below.

01: It is reserved.

11: assigns bits 0 to 5 for SMSC specific use.

- Bit 5

When bits 7 and 6 are set to 00, the values of bit 5 are as follows:

0: no interworking, but SME to SME protocol.

1: telematic interworking (In this case, the value of bits 4 to 0 is valid).

- Bits 4 to 0 indicating the types of telematic devices

10010 indicates that an e-mail is sent. Other values are not supported at present.

- <DCS> indicating the data coding scheme

The following table lists its values.

Bits 7 to 4			Bits 3 to 0
00xx	Bit 5	0: indicates that the SM is not compressed.	Bits 1 and 0 indicating the SM type • 00 (class 0): indicates that the SM is displayed on the TE and a message that the SM is received but not stored is returned to the SMSC. • 01 (class 1): indicates that the SM is stored in the NV or is stored in the SIM card when the NV is full. • 10 (class 2 only for the SIM card): indicates that the storage status is reported to the SMSC when the SM is stored. If the SIM card is full, the status fails to be reported to the SMSC and the failure cause is reported to the SMSC. • 00 (class 3): indicates that the SM is stored on the TE. However, the ME sends response to the SMSC after receiving the SM but before the TE receives the SM. Bits 3 and 2 indicating the SM type • 00: indicates the GSM 7 bit default alphabet. • 01: indicates 8 bit data. • 10: indicates the UCS2 coding scheme. This value is used when a Chinese character is entered. • 00: It is reserved.
		1: indicates that the SM is compressed. However, this value is not supported at present.	
	Bit 4	0; indicates that bits 1 and 0 are reserved.	
		1: indicates that bits 1 and 0 specify the SM type.	
0100 1011	Reserved		None

Bits 7 to 4		Bits 3 to 0
1100	Indicating that the SM is discarded, the information indicating that an SM is waiting is displayed, and the user's data uses the GSM 7 bit default alphabet	Meanings of the settings of bits 3 to 0 are the same as those of bits 3 to 0 when bits 7 to 4 are set to 1101.
1101	Indicating that the SM is stored, the information indicating that an SM is waiting is displayed, and the user's data uses the GSM 7 bit default alphabet	Bit 3 indicating whether warning information is displayed • 0: indicates that the function of displaying information indicating that an SM is waiting is disabled. • 1: indicates that the function of displaying information indicating that an SM is waiting is enabled. Bit 2 is reserved and its value is 0. Bits 1 and 0 indicating the SM type • 00: indicates that voice SMs are waiting. • 01: indicates that fax SMs are waiting. • 10: indicates that e-mail SMs are waiting. • 00: indicates that unknown types of SMs are waiting.
1110	Indicating that the SM is stored, the information indicating that an SM is waiting is displayed, and the user's data uses the UCS2 coding scheme without compression.	Meanings of the settings of bits 3 to 0 are the same as those of bits 3 to 0 when bits 7 to 4 are set to 1101.

Bits 7 to 4		Bits 3 to 0
1111	Data coding or message class	Bit 3 is reserved and its value is 0. Bit 2 indicating the SM coding scheme • 0: indicates the GSM 7 bit default alphabet. • 1: indicates data with 8 bits. Bits 1 and 0 indicating the SM type • 00 (class 0): indicates that the SM is displayed on the TE and a message that the SM is received but not stored is returned to the SMSC. • 01 (class 1): indicates that the SM is stored in the NV or is stored in the SIM card when the NV is full. • 10 (class 2 only for the SIM card): indicates that the storage status is reported to the SMSC when the SM is stored. If the SIM card is full, the status fails to be reported to the SMSC and the failure cause is reported to the SMSC. • 00 (class 3): indicates that the SM is stored on the TE. However, the ME sends response to the SMSC after receiving the SM but before the TE receives the SM.

• <VP> indicating the validity

The validity starts from the time the SMSC receives the SM. The following table lists the time list when the **VPF** parameter is set to **00**.

VP Value	Remarks
0 to 143	(VP + 1) x 5 minutes
144 to 167	12 hours + ((VP – 143) x 30 minutes)
168 to 196	(VP – 166) x 1 day
197 to 255	(VP – 192) x 1 week

• <UDL> indicating the length of user's data

Its values depend on the coding scheme.

– If the GSM 7 bit default alphabet is used, it indicates the number of septets.

– If the 8 bit data is used, it indicates the number of octets.

– If the UCS2 coding scheme is used, it indicates the number of octets in the UDL.

– If the GSM 7 bit default alphabet, 8 bit data, or the UCS2 coding scheme with compression is used, it indicates the number of octets in the compressed UDL.

– For the compressed SM code, the maximum length of the value of the **<UD>** parameter is 160 septets. For the uncompressed SM code, the maximum length is 140 octets.

- <UD> indicating the user's data

  Its values depend on the **UDL** parameter.

6.13 Storing an SM (+CMGW)

6.13.1 Command Syntax

Command	Possible Response(s)
+CMGW=<length>[,<stat>]<CR>PDU is given<ctrl-Z/ESC>	<CR><LF>+CMGW: <index><CR><LF><CR><LF>OK<CR><LF> When SM-related errors occur: <CR><LF>+CMS ERROR: <err><CR><LF>
+CMGW=?	<CR><LF>OK<CR><LF>

6.13.2 Description

This command is used to store an SM to the memory specified by the **<mem2>** parameter in the +**CPMS** command.

6.13.3 Defined Values

  Its value can be calculated by using the following formula:

  Number of actually sent TPDUs/2

- <mr> indicating the identifier of an SM

  Its value ranges from 0 to 255 and uses decimal numbers that range from 0 to 9.

- <ctrl-Z> indicating the end of PDU data (The character is 0x1A.)

- <ESC> indicating that the SM sending is canceled (The character is 0x1B.)

- <stat> indicating the storage status of an SM

  Its values are as follows (the value is set to **0** by default when the PDU is used):

  – 0 indicates the received SM that has not been read.

  – 1 indicates the received SM that has been read.

  – 2 indicates the stored SM that has not been sent.

  – 3 indicates the stored SM that has been sent.

  – 4 indicates all SMs. (This value can be used only for the +**CMGL** command)

- <index> indicating the number of the SM position in a memory

Its value ranges from 0 to the maximum capacity of the memory minus 1 and uses decimal numbers that range from 0 to 9.

- The structure of a PDU is the same as that in section 6.12

6.14 Querying SM List (+CMGL)

6.14.1 Command Syntax

Command	Possible Response(s)
+CMGL[=<stat>]	When the PDU is used and this command is successfully executed: [<CR><LF>+CMGL: <index>,<stat>,[<reserved>],<length><CR><LF><pdu> [<CR><LF>+CMGL: <index>,<stat>,[<reserved>],<length><CR><LF><pdu> [...]]<CR><LF>]<CR><LF>OK<CR><LF> Otherwise, <CR><LF>+CMS ERROR: <err><CR><LF>
+CMGL=?	<CR><LF>+CMGL: (list of supported <stat>s) <CR><LF><CR><LF>OK<CR><LF>

6.14.2 Description

The execution command is executed to return all the SMs whose status is specified by the **<stat>** parameter from the memory specified by the **<mem1>** parameter. After this command is executed, the status of a received SM in a memory is changed from unread to read.

The SM status report is processed as an ordinary SM.

When the **<stat>** parameter is set the default value, the result of running the execution command is the same as that of running the set command **+CMGL=0**.

The test command is executed to return all values of the **<stat>** parameter supported by this command.

6.14.3 Defined Values

- <stat> indicating the SM type (Its default value is 0.)
  - 0 indicates the received SM that has not been read.
  - 1 indicates the received SM that has been read.
  - 2 indicates the stored SM that has not been sent.
  - 3 indicates the stored SM that has been sent.
  - 4 indicates all SMs.
- <index> indicating the SM position in a memory (integral value)
- <reserved> (reserved parameter)
- <length> indicating the number of bytes of a TPDU (integral value)

- <pdu> indicating the PDU

The structure of a TPDU is as follows:

[<SCA>]			TPDU
<sc_len>	<type_addr>	<numbers>	

For defined values of the <SCA>, <sc_len>, <type_addr>, and <numbers> parameters, see the section 6.12

For the structure of a TPDU of a sent SM, see the PDU in section 6.12 The structure of a TPDU of a received SM is as follows:

1 Oct							2 Oct to 12 Oct	1 Oct	1 Oct	7 Oct	1 Oct	
TP-MTI	MMS	0	0	SRI	UDHI	RP	OA	PID	DCS	SCTS	UDL	UD
Bit 0	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7					

- <MTI>

  For its defined values, see the values of the **<MTI>** parameters in section 6.12

- <MMS> indicating whether there are SMs that need to be sent
  - 0: indicates that there is no SM that needs to be sent.
  - 1: indicates that there are SMs that need to be sent.

- <SRI> indicating whether a short message entity has requested a status report.
  - 0: indicates that a short message entity has not requested a status report.
  - 1: indicates that a short message entity has requested a status report.

- <UDHI>

  For its defined values, see the values of the **<UDHI>** parameters in section 6.12

- <RP>

  For its defined values, see the values of the **<RP>** parameters in section 6.12

- <OA> indicating the original address

  The defined values are the same as those of the **<SCA>** parameter. A value includes 2 to 12 otects. Therefore, the maximum length of an address in the OA field is 20.

- <PID> indicating a protocol

  For its defined values, see the values of the **<PID>** parameters in section 6.12

- <DCS> indicating the coding scheme of user's data

  For its defined values, see the values of the **<DCS>** parameters in section 6.12

- <SCTS> indicating the timestamp of the SMSC including year, month, date, hour, minute, second, and equation of time (The equation of time is the difference between the local time and the Greenwich Mean Time.)

- <UDL> indicating the length of user's data

  For its defined values, see the values of the **<UDL>** parameters in section 6.12

- <UD> indicating the user's data

The length of user's data depends on the UDL.

6.15 Reading One SM (+CMGR)

6.15.1 Command Syntax

Command	Possible Response(s)
+CMGR=<index>	When the PDU is used and this command is successfully executed: <CR><LF>+CMGR: <stat>,[<reserved>],<length><CR><LF><pdu><CR><LF><CR><LF>OK<CR><LF> Otherwise, <CR><LF>+CMS ERROR: <err><CR><LF>
+CMGR=?	<CR><LF>OK<CR><LF>

6.15.2 Description

The execution command is executed to return all the SMs whose positions are specified by the **<index>** parameter from the memory specified by the **<mem1>** parameter. After this command is executed, the status of a received SM in a memory is changed from unread to read.

The test command is executed to return OK.

6.15.3 Defined Values

- <index> indicating the SM position in a memory (integral value)
- <stat> indicating the SM type
  - 0 indicates the received SM that has not been read.
  - 1 indicates the received SM that has been read.
  - 2 indicates the stored SM that has not been sent.
  - 3 indicates the stored SM that has been sent.
- <reserved> (reserved parameter)
- <length> indicating the number of bytes of a PDU (integral value)
- <pdu> indicating the PDU

  For the structure of a PDU, see the PDU in section 6.14 "Querying SM List (+CMGL)."

6.16 Setting the Domain Carrying SMs (+CGSMS)

6.16.1 Command Syntax

Command	Possible Response(s)
+CGSMS=<service>	<CR><LF>OK<CR><LF> When SM-related errors occur: <CR><LF>+CMS ERROR: <err><CR><LF>
+CGSMS?	<CR><LF>+CGSMS:<service><CR><LF><CR><LF>OK<CR><LF>
+CGSMS=?	<CR><LF>+CGSMS: (list of supported <service>s)<CR><LF><CR><LF>OK<CR><LF>

6.16.2 Description

The set command is executed to set the domain carrying SMs. That is, this command is used to select the CS or PS domain.

The read command is executed to return the domain carrying the SMs.

The test command is executed to return the parameter values supported by this command.

6.16.3 Defined Values

- <service>
  - 0: indicates that only the PS domain is selected.
  - 1: indicates that only the CS domain is selected.
  - 2: indicates that the PS domain is preferentially selected.
  - 3: indicates that the CS domain is preferentially selected.

📖 NOTE

For more successful message sending in practice, use the following configurations:

0, 2: PS domain preferred

1, 3: CS domain preferred

6.17 Reporting Full Memory (^SMMEMFULL)

6.17.1 Command Syntax

Command	Possible Response(s)
-	^SMMEMFUL:[<mem>]

6.17.2 Description

If the memory is full, the **^SMMEFULL** command is reported and a message that the network fails to receive the SM is returned when a new SM is received. The failure cause is that there is no available space in the memory.

6.17.3 Defined Values

- <mem> indicating the memory of SM operations (character string)
  - SM indicates a SIM card.
  - ME indicates flash memory.

7 Interface for Setting Security

7.1 Modifying PIN Password (+CPWD)

7.1.1 Command Syntax

Command	Possible Response(s)
+CPWD=<fac>,<oldpwd>,<newpwd>	<CR><LF>OK<CR><LF> When ME-related errors occur: <CR><LF>+CME ERROR: <err><CR><LF>
+CPWD=?	<CR><LF>+CPWD: list of supported (<fac>,<pwdlength>)s<CR><LF><CR><LF>OK<CR><LF> When ME-related errors occur: <CR><LF>+CME ERROR: <err><CR><LF>

7.1.2 Description

The execution command is executed to modify the password of the Lock function for a device, such as personal identification number (PIN).

The test command is executed to return the types of devices supported by this command and the maximum lengths of passwords for these devices.

7.1.3 Defined Values

- <fac> indicates the object of the executed command (Only SIM card is supported, and the value is "SC".)
    - SC indicates the PIN of an SIM card.
    - P2 indicates the PIN2 of an SIM card (not supported currently)
    - AO: bar All Outgoing calls.
    - OI: bar Outgoing International calls.
    - OX: bar Outgoing international calls except to home country.
    - AI: bar All Incoming calls.

- IR: bar Incoming calls when Roaming outside home country.
  - AB: All Barring services (applicable only when *<mode> = 0*)
  - AG: All Outgoing barring services (applicable only when *<mode> = 0*)
  - AC: All Incoming barring services (applicable only when *<mode> = 0*)
- <oldpwd> and <newpwd> indicate the original password and the new password (character string), respectively

   The maximum length of these values is specified by the **<pwdlength>** parameter.
- <pwdlength> indicates the maximum length of the password of the Lock function for a device

7.2 Managing PIN (+CPIN)

7.2.1 Command Syntax

Command	Possible Response(s)
+CPIN=<pin>[,<newpin>]	<CR><LF>OK<CR><LF> When ME-related errors occur: <CR><LF>+CME ERROR: <err><CR><LF>
+CPIN?	<CR><LF>+CPIN: <code><CR><LF><CR><LF>OK<CR><LF> When ME-related errors occur: <CR><LF>+CME ERROR: <err><CR><LF>
+CPIN=?	<CR><LF>OK<CR><LF>

7.2.2 Description

The read command is executed to set a password enter request.

The set command is executed to verify and unlock the PIN or PIN2.

If the password enter request is PIN or PIN2, enter the **+CPIN=<pin>** command to verify the PIN or PIN2.

If the password enter request is PIN unblocking key (PUK) or PUK2, enter the **+CPIN=<pin>,<newpin>** command to unlock PIN or PIN2. The value of the **<pin>** parameter is the SIM PUK or SIM PUK2, and the value of the **<newpin>** parameter is the new PIN or PIN2.

When the set command is executed, +CME ERROR is returned if there is no PIN enter request.

7.2.3 Defined Values

- <pin> and <newpin> (Their values are character strings.)
- <code> (Its value is a character string without quotation marks.)
- READY indicating that there is no password enter request on the mobile terminal (MT)

- SIM PIN indicating the UICC/SIM PIN enter request
- SIM PUK indicating the UICC/SIM PUK enter request

7.3 Enabling and Querying PIN (+CLCK)

7.3.1 Command Syntax

Command	Possible Response(s)
+CLCK=<fac>,<mode>[,<passwd>[,<class>]]	When the **<mode>** parameter is set to **2** and this command is successfully executed: <CR><LF>+CLCK: <status><CR><LF><CR><LF>OK<CR><LF> When the **<mode>** parameter is not set to **2** and this command is successfully executed: <CR><LF>OK<CR><LF> When ME-related errors occur: <CR><LF>+CME ERROR: <err><CR><LF>
+CLCK=?	<CR><LF>+CLCK: (list of supported <fac>s)<CR><LF><CR><LF>OK<CR><LF> When ME-related errors occur: <CR><LF>+CME ERROR: <err><CR><LF>

7.3.2 Description

The execution command is executed to lock or unlock ME or network device, or query the **<fac>** parameter of the ME or network device. In most cases, this operation requires the password.

The test command is executed to return the types of devices supported by this command.

7.3.3 Defined Values

- <fac> indicating the object for which this command is executed (Only SIM card is supported, and the value is "SC".)
- SC indicates the SIM card. If this parameter needs to be set, the password needs to be entered before the ME is powered on.
  - AO: bar All Outgoing calls.
  - OI: bar Outgoing International calls.
  - OX: bar Outgoing international calls except to home country.
  - AI: bar All Incoming calls.
  - IR: bar Incoming calls when Roaming outside home country.
  - AB: All Barring services (applicable only when *<mode> = 0*)
  - AG: All Outgoing barring services (applicable only when *<mode> = 0*)

- AC: All Incoming barring services (applicable only when *<mode> = 0*)
- FD indicates the FDN.
- <mode>
  - 0: indicates that the ME or network device is unlocked.
  - 1: indicates that the ME or network device is locked.
  - 2: indicates that the status of the ME or network device is being queried.
- <status>
  - 0: indicates that the ME or network device is not activated.
  - 1: indicates that the ME or network device is activated.
- <passwd> (Its value is a character string.)

  Its value is the same as the password set by running the +**CPWD** command.
- <class> (It is set to 7 by default.)
  - 1: indicates a call.
  - 2: indicates data.
  - 4: indicates a fax.
  - 8: indicates an SM.

8 Interfaces for Processing Data Services

8.1 DHCP/IP Query Command^DHCP

8.1.1 Command Syntax

Command	Possible response(s)
^DHCP?	<CR><LF>^DHCP: <clip>,<netmask>,<gate>,<dhcp>,<pDNS>,<sDNS>,<max_rx_data>,<max_tx_data><CR><LF> When MT-related errors occur: <CR><LF>+CME ERROR: <err><CR><LF>
^DHCP =?	<CR><LF>OK<CR><LF>

8.1.2 Description

This command is used to query IP values of DHCP, including the host IP address, default gateway, subnet mask, and DHCP server address.

Once connected on dial-up, the PC issues the command to obtain the corresponding IP address.

📖 NOTE

You cannot query IPv6 address with this command.. See ^DHCPv6 for IPv6.

8.1.3 Defined Values

The following IP addresses are written in hexadecimal notation in descending order. For example: 192.168.50.32 is notated as 0x2032A8C0, where 0x20 indicates 32, 0x32 indicates 50, 0xA8 indicates 168, and 0xC0 indicates 192.

- <clip> indicates the host IP address.

  Range: 0x00000000-0xFFFFFFFF.

- <netmask> indicates the subnet mask.

  Range: 0x000000FF-0xFCFFFFFF.

- <gate> indicates the default gateway.

Range: 0x00000000-0xFFFFFFFF.

- <dhcp> indicates the address for the DHCP server.

  Range: 0x00000000-0xFFFFFFFF.

- <pDNS> indicates the address for the Primary DNS.

  Range: 0x00000000-0xFFFFFFFF.

- <sDNS> indicates the address for the Secondary DNS.

  Range: 0x00000000-0xFFFFFFFF.

- <max_rx_data> indicates the Maximum Receive Rate (bps).

- <max_tx_data> indicates the Maximum Sending Rate (bps).

8.2 NDIS Dialing Command ^NDISDUP

8.2.1 Command Syntax

Command	Possible response(s)
^NDISDUP=<cid>,<connect>[,<APN>[< username>[,<passwd> [,<auth_type>]]]]	<CR><LF>OK<CR><LF> If an error occurs: <CR><LF>+CME ERROR: <err><CR><LF>
^ NDISDUP?	<CR><LF>OK<CR><LF>
^ NDISDUP=?	<CR><LF>^NDISDUP: (list of supported <cid>s),(list of supported <connect>s)) <CR><LF><CR><LF>OK<CR><LF>

8.2.2 Description

The command is used for NDIS dial-up and is only available for NDIS port.

When AT^ NDISDUP =1,1, no other parameter is required for dial-up.

When AT^ NDISDUP =1,0, the network needs to be disconnected.

8.2.3 Defined values

The following IP addresses (hexadecimal notation) are all in descending order. For example: 192.168.50.32 is notated as 0x2032A8C0, 0x20 indicates 32, 0x32 indicates 50, 0xA8 indicates 168, and 0xC0 indicates 192.

- <pdpid> indicates call ID
  - The current value can only be 1 (expandable to 16 in the future);
- < connect >
  - 0: indicates that the server is disconnected;
  - 1: indicates that the connection is established;
- <APN> indicates the Access Point Name（0-99bytes）
- <username> indicates the username string（0-255bytes）
- <passwd> indicates the password string（0-255bytes）

- <authpref> indicates the authentication reference
    - 0: no authentication;
    - 1: uses PAP authentication.
    - 2: uses CHAP authentication.

8.3 NDIS Address Setting Command ^NDISADD

8.3.1 Command Systax

Command	Possible response(s)
^NDISADD =<IP_Type>, [<IP_Address>[,<Primary_DNS>[,<Secondary_DNS>[,<Primary_NBNS>[,<Secondary_NBNS>]]]]]	<CR><LF><CR><LF>OK<CR><LF> When MT-related errors occur: <CR><LF>ERROR<CR><LF>
+NDISADD?	<CR><LF>^NDISADD: < IP_Type >,[<IP_Address>[, <Primary_DNS>[,<Secondary_DNS>[, <Primary_NBNS>[,<Secondary_NBNS>]]]]]<CR><LF><C R><LF>OK<CR><LF> When MT-related errors occur: <CR><LF>ERROR<CR><LF>

8.3.2 Description

This command sets the fixed IP address, DNS address, and NBNS (WINS) address in NIDs dialing mode. Once these addresses are set through a PC client, it is necessary to set the parameters through this command before dialing with ^NDISCONN or ^NDISDUP. The <IP_Address> parameter activates PDP for a single board-initiated specified IP address. DNS addresses and NBNS (WINS) addresses are cached only on a single board, and after successful PDP activation, the parameters are returned to the system or drive via DHCP negotiation (on XP, Vista OSs), or ^DHCP command query (on Win7 OS).

Use the query command for the fixed IP address, DNS address, NBNS (WINS) address set previously. If the user has not set these addresses before, the query command returns the address assigned by the network.

At present, only IPV4 addresses are supported. IPv6 is not supported. If the IP_Type is not 0, the ERROR message is reported. The relevant parameters set by this command are not saved at power-off and are invalid at reboot.

8.3.3 Defined Values

- <IP_Type> indicates IP address type. The type of the parameter value is int, The board types defined are as follows:
    - 0: indicates IP V4 address type;

–   1: indicates IP V6 address type;

- <IP_Address> indicates persistent IP address. Its value is a character string, for example: "192.168.0.1".
- <Primary_DNS> indicates the preferred DNS server address. Its value is a character string, for example: "202.96.1.1".
- <Secondary_DNS> indicates the secondary DNS address. Its value is a character string, for example: "202.96.1.1".
- <Primary_NBNS> indicates the preferred NBNS (WINS) address. Its value is a character string, for example: "202.100.1.1".
- <Secondary_NBNS> indicates the secondary NBNS (WINS) address. Its value is a character string, for example: "202.100.1.2".

8.4 Connection Status Unsolicited Report Command ^NDISSTAT

8.4.1 Command Syntax

Command	Possible response(s)
^ NDISSTAT	<CR><LF>^NDISSTAT: <stat>[,<err_code>[,<wx_state>[,<PDP_type>]]]<CR><LF><CR><LF >OK<CR><LF>

8.4.2 Description

When the connection status changes, the MT reports the change to the TE.

8.4.3 Defined Values

- <stat> indicates the connection status. The values are as follows:
  –   0: disconnected;
  –   1: connected;
  –   2: connecting (automatic connection mode);
  –   3: disconnecting (automatic connection mode);
- <err_code> indicates the error code. The value range is 0 – 0x7FFFFFFF
  –   0: unknown error/ unspecified error
- <wx_state> indicates WiMAX data card substate. (used in WiMax data card only)
  –   1: indicates DL Synchronization.
  –   2: indicates Handover DL acquisition.
  –   3: indicates UL Acquisition.
  –   4: indicates Ranging.
  –   5: indicates Handover ranging.
  –   6: indicates Capabilities negotiation.
  –   7: indicates Authorization.

- 8: indicates Registration.
- <PDP_type> indicating the character string value.
    - "IPV4"
    - "IPV6"

8.5 Connection Status Query Command ^NDISSTATQRY

8.5.1 Command Systax

Command	Possible response(s)
^NDISSTATQRY?	<CR><LF>^NDISSTATQRY: <stat>[,<err_code>[,<wx_state>[,<PDP_type>]]][,<stat>,<err_code> ,<wx_state>,<PDP_type>]<CR><LF><CR><LF>OK<CR><LF> If an error occurs: <CR><LF> ERROR<CR><LF>
^NDISSTATQRY=<cid>	<CR><LF>^NDISSTATQRY: <stat>[,<err_code>[,<wx_state>[,<PDP_type>]]][,<stat>,<err_code> ,<wx_state>,<PDP_type>]<CR><LF><CR><LF>OK<CR><LF> If an error occurs: <CR><LF> ERROR<CR><LF>
^NDISSTATQRY=?	<CR><LF>^NDISSTATQRY: (list of <cid>s associated with active contexts)<CR><LF><CR><LF>OK<CR><LF>

8.5.2 Description

This command queries the dial-up connection status.

In single NDIS connection, the AT^ NDISSTATQRY? command checks whether the only NDIS link is connected.

In multiple NDIS connections, the AT^NDISSTATQRY=<cid> command checks the connection state of a specific NDIS link. The AT^NDISSTATQRY? Command checks the first NDIS link (i.e. AT^NDISSTATQRY=1).

See examples for specific use cases.

Here, the Test command queries all CID currently with dial-up connection status, except LTE default hosting.

8.5.3 Defined Values

- <cid> indicates the index of a PDP context, used when other PDP-related commands call the storage location. The current reference values are 1-16 (Qualcomm) and 1-11 (Balong).

  The value indicates the NDIS connection whose status is being queried.

- <stat> indicates the connection status. The values are as follows:
  - 0: indicates disconnected status;
  - 1: indicates connected status;
  - 2: indicates connecting status (reports only when automatically connecting boards) (not yet supported on the balong platform);
  - 3: indicates disconnecting status (reports only when automatically connecting boards) (not yet supported on the balong platform);

- <err_code> indicates the error code. The values are the same as those of ^NDISSTAT command.

- <wx_state> indicates WiMAX data card substate.

- <PDP_type> indicates the character string value.
  - "IPV4"
  - "IPV6"

8.6 Setting PDP Context (+CGDCONT)

8.6.1 Command Syntax

Command	Possible Response(s)
+CGDCONT=<cid>[,<PDP _type>[,<APN>[,<PDP_addr >[,<d_comp>[,<h_comp>]]]]]	<CR><LF>OK<CR><LF>
+CGDCONT?	<CR><LF>+CGDCONT: <cid>, <PDP_type>, <APN>,<PDP_addr>, <d_comp>, <h_comp>[<CR><LF>+CGDCONT: <cid>, <PDP_type>, <APN>,<PDP_addr>, <d_comp>, <h_comp>[...]]<CR><LF><CR><LF>OK<CR><LF>
+CGDCONT=?	<CR><LF>+CGDCONT: (range of supported <cid>s), <PDP_type>,,,(list of supported <d_comp>s),(list of supported <h_comp>s) [<CR><LF>+CGDCONT: (range of supported <cid>s), <PDP_type>,,,(list of supported <d_comp>s), (list of supported <h_comp>s)[...]]<CR><LF><CR><LF>OK<CR><LF>

8.6.2 Description

A group of PDP contexts whose indexes are specified by the **<cid>** parameter are saved on the ME. Each saved PDP context includes a group of PDP context parameters. The set command is executed to save the PDP parameter in a PDP context specified by the **<cid>** parameter. Each PDP context is not initially defined. After the set command is executed to save a group of parameters, the PDP context is defined. The number of defined PDP contexts that can be saved depends on the value range of the **<cid>** parameter.

The special set command +**CGDCONT= <cid>** is executed to all the parameters in a PDP context specified by the **<cid>** parameter. After this command is executed, the status of the PDP context is changed from defined to undefined.

The read command is executed to return all the parameter values of the defined PDP contexts. The PDP contexts are displayed by means of linefeed.

The test command is executed to return values supported by this command. In the response message, the values of <PDP_type> parameter supported by the ME are displayed as indexes in different lines. In each line, except a value of the **<PDP_type>** parameter, value ranges of other parameters when the **<PDP_type>** parameter is set to this value are displayed.

8.6.3 Defined Values

- <cid>

  1 to 16: indicates the index of the PDP context. The configurations of other commands related to the PDP context can be invoked by using this index.
- <PDP_type> indicating the type of the packet switching protocol (character string)
- "IP" indicating the IP protocol.
- "PPP" indicating Peer-to-Peer protocol.
- <APN> indicating the domain name of the access point connecting to the connected gateway GPRS support node (GGSN) or external network (character string)
- <PDP_addr> indicating the address of the ME (character string)
- <d_comp> indicating whether the PDP data is compressed (digits)
    - 0: indicates that the PDP data is not compressed.
    - 1: indicates that the PDP data is compressed.
    - If there is no <d_comp> in this command, the PDP data is not compressed.
- <h_comp> indicating whether the PDP header is compressed (digits)
    - 0: indicates that the PDP header is not compressed.
    - 1: indicates that the PDP header is compressed.
    - If there is no <h_comp> in this command, the PDP header is not compressed.

8.7 Setting Attachment to or Detachment from PS Domain (+CGATT)

8.7.1 Command Syntax

Command	Possible Response(s)
+CGATT=[<state>]	OK ERROR
+CGATT?	+CGATT: <state>
+CGATT=?	+CGATT: (list of supported <state>s)

8.7.2 Description

This command is used to set attachment to or detachment from the PS domain.

8.7.3 Defined Values

<state> indicates the PS service state (integral value)

- 0: indicates detachment from the PS domain.
- 1: indicates attachment to the PS domain.

8.8 Setting Attachment to or Detachment from the CS or PS Domain (+CGCATT)

8.8.1 Command Syntax

Command	Possible Response(s)
^CGCATT=<state>,<mode>	OK ERROR
^CGCATT?	^CGCATT: <PS state>,<CS state>
^CGCATT=?	^CGCATT: (list of supported <state>s), (list of supported <mode>s)

8.8.2 Description

This command is used to set attachment to or detachment from the CS or PS domain.

This command depends on the MT mode. If the MT mode is set to support one domain, this command only supports attachment to or detachment from this one domain. For example, if

the MT mode is set to CC, this command only supports attachment to or detachment from the CS domain.

8.8.3 Defined Values

- <state> indicating the CS and PS service state (integral value)
    - 0: indicates detachment from the CS or PS domain.
    - 1: indicates attachment to the CS or PS domain.
- <mode> indicating the operation mode (integral value)
    - 1: indicates that attachment to or detachment from the PS domain is changed.
    - 2: indicates that attachment to or detachment from the CS domain is changed.
    - 3: indicates that attachment to or detachment from the CS and PS domains is changed.
- <PS state> indicating the PS service state (integral value)

    For its values, see the <state> parameter.
- <CS state> indicating the CS service state (integral value)

    For its values, see the <state> parameter.

8.9 Setting Whether Change in Service State Is Reported (^SRVST)

8.9.1 Command Syntax

Command	Possible Response(s)
^ SRVST=<n>	<CR><LF>OK<CR><LF>
^SRVST=?	List of supported <n>s

8.9.2 Description

This command is used to set whether the ME reports the new state of the service to the TE when the service state changes.

8.9.3 Defined Values

<n> indicating whether the service state is automatically reported (integral value ranging from 0 to 1)

- 0: indicates that the service state is not reported automatically.
- 1: indicates that the service state is reported automatically.

8.10 Indicating Change in Service Status (^SRVST)

8.10.1 Command Syntax

Command	Possible Response(s)
-	<CR><LF>^SRVST: <srv_status><CR><LF>

8.10.2 Description

This command is used to allow the ME to report the new state of the service to the TE when the service state changes.

8.10.3 Defined Values

<srv_status> indicating the system service state (integral value ranging from 0 to 4)Its values are as follows:

- 0: indicates that there is no service.
- 1: indicates that there are restricted services.
- 2: indicates that services are valid.
- 3: indicates that there are restricted regional services.
- 4: indicates power-saving and deep sleep state. However, this value is not supported.

8.11 Reporting Change in RSSI (^RSSI)

8.11.1 Command Syntax

Command	Possible Response(s)
-	<CR><LF>^RSSI: <rssi><CR><LF>

8.11.2 Description

This command is used for the ME to report the change in the RSSI to the TE when the change is greater than 5 dBm.

8.11.3 Defined Values

<rssi> indicating the received signal strength indicator (integral value being 99 or ranging from 0 to 31)

- 0: indicates that the change is less than or equal to -113 dBm.
- 1: indicates that the change is equal to -111 dBm.
- 2 to 30: indicates that the change ranges from -109 dBm to -53 dBm.
- 31: indicates that the change is greater than or equal to -51 dBm.

- 99: indicates that the change is unpredictable.

8.12 Querying RSCP and Ec/Io (^CSNR)

8.12.1 Command Syntax

Command	Possible Response(s)
^CSNR	<CR><LF>ERROR<CR><LF>
^CSNR?	<CR><LF>^CSNR: <rscp>,<ecio><CR><LF><CR><LF>OK<CR><LF>
^CSNR=?	<CR><LF>^CSNR:(list of supported <rscp>s), (list of supported <ecio>s)<CR><LF><CR><LF>OK<CR><LF>

8.12.2 Description

This command is used to query the RSCP or Ec/Io. The value of the RSCP or Ec/Io depends on the change in the RSSI.

The RSCP, Ec/Io, and RSSI can be related by using the following formula:

RSCP = Ec/Io+ RSSI

In the preceding formula, the values of the RSCP, Ec/Io, and RSSI must be actual absolute values, not relative values.

8.12.3 Defined Values

- <rscp> indicating the received signal code power (integral value ranging from −145 to −60)

  The unit is dBm.
- <ecio> indicating the Ec/Io (integral value ranging from −32 to 0)

  The unit is dBm.

8.13 Activating PDP (+CGACT)

8.13.1 Command Syntax

Command	Possible Response(s)
+CGACT=[<state>,<cid>]	OK ERROR +CME ERROR: <err>
+CGACT?	+CGACT: <cid>,<state>[<CR><LF>+CGACT: <cid>,<state>[...]]
+CGACT=?	+CGACT: (list of supported <state>s)

8.13.2 Description

This command is used to activate or deactivate the PDP context specified by the **<cid>** parameter.

At present, Balong supports the function of activating only one PDP context at one time.

If the PDP context has been activated by using the PPP dialing, the AT command cannot be used to deactivate this PDP context.

8.13.3 Defined Values

<state> indicating the status of the PDP context (integral value)

- 0: indicates that the PDP context is not activated.
- 1: indicates that the PDP context is activated.

8.14 Indicating Status Change of SIM or USIM Card (^SIMST)

8.14.1 Command Syntax

Command	Possible Response(s)
-	<CR><LF>^SIMST:<sim_state>[,<lock_state>]<CR><LF>

8.14.2 Description

When the state of the SIM or USIM card changes, the current state and locking state of the SIM or USIM card are automatically reported.

8.14.3 Defined Values

- <sim_state> indicating the state of the SIM or USIM card (integral value)
  - 0: indicates that the SIM or USIM card is invalid.
  - 1: indicates that the SIM or USIM card is valid.
  - 2: indicates that the SIM or USIM card is invalid in the CS domain.
  - 3: indicates that the SIM or USIM card is invalid in the PS domain.
  - 4: indicates that the SIM or USIM card is invalid in both CS and PS domains.
  - 240: indicates the version of the read-only memory (ROM) SIM card.
  - 255: indicates that the SIM or USIM card does not exist. The SIM or USIM card is not in position or cannot be detected because it is locked by the CardLock function. In this case, you need to determine the state of the SIM or USIM card according to the value of the **<lock_state>** parameter.
- <sim_state> indicating the locking state of the SIM or USIM card (integral value)
  - 0: indicates that the SIM or USIM card is not locked by the CardLock function.

‒ 1: indicates that the SIM or USIM card is locked by the CardLock function.

8.15 Querying the Type of SIM or USIM Card (^CARDMODE)

8.15.1 Command Syntax

Command	Possible Response(s)
^CARDMODE	<CR><LF>^CARDMODE:<sim_type><CR><LF><CR><LF>OK<CR><LF> When ME-related errors occur: <CR><LF>+CME ERROR: <err><CR><LF>

8.15.2 Description

This command is used to query the type of the SIM card.

8.15.3 Defined Values

<sim_type> indicating the type of the SIM card (integral value)

- 0: indicates that there is no card.
- 1: indicates the SIM card.
- 2: indicates the USIM card.

8.16 ICCID Query Command ^ICCID

8.16.1 Command Syntax

Command	Possible response(s)
^ICCID?	<CR><LF>^ICCID: <iccid><CR><LF><CR><LF>OK<CR><LF> When MT-related errors occur: <CR><LF>+CME ERROR: <err><CR><LF>
^ICCID=?	<CR><LF>OK<CR><LF>

8.16.2 Description

This command is used to query the integrated circuit card identity (ICCID) of a SIM card regardless of whether the PIN is entered.

8.16.3 Defined Values

<iccid> indicating the ICCID value. Its value is a character string. The maximum length is 20 characters, excluding the double quotation marks.

📖 NOTE

The ICCID uniquely identifies an integrated circuit (IC) card. It is saved in the EFiccid file and EFiccid file (for details, see the GSM11.11 protocol).

Byte 1:
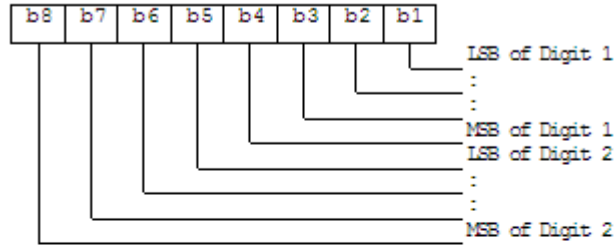
Byte 2:
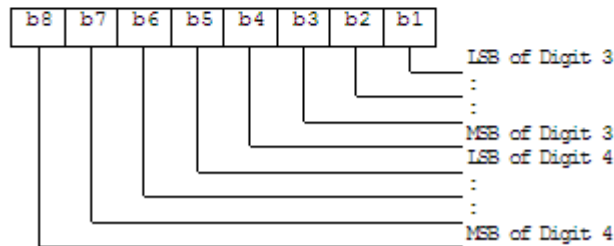
etc.

The figure shows the conversion of the bit sequence of the information obtained from the EFiccid file.

📖 NOTE(2013.02.18)

The EFiccid file may contain the placeholder 0Xf. Remove it when returning the ICCID.

8.17 Setting and Querying the Authentication Info(^AUTHDATA)

8.17.1 Command Syntax

Command	Possible response(s)
^AUTHDATA=<CID>[,<Auth_type>][<PLMN>[,<password>[,<username>]]]	<CR><LF>OK<CR><LF> When ME-related errors occur: <CR><LF>+CME ERROR:<err><CR><LF>

^AUTHDATA?	<CR><LF>^AUTHDATA: <CID>,<Auth_type>, <passwd>,<username>,<PLMN> [<CR><LF>^AUTHDATA: <CID>,<Auth_type>, <passwd>,<username>,<PLMN> […]] <CR><LF>OK<CR><LF>
^AUTHDATA=?	<CR><LF>^AUTHDATA:(list of suppoeted<CID>s),(list of supported <Auth_type>s),,<CR><LF><CR><LF>OK<CR><LF>
^AUTHDATA	<CR><LF>OK<CR><LF>

8.17.2 Description

A group of Authentication parameters whose indexes are specified by the **<cid>** parameter are saved on the ME. Each authentication parameter includes a group of parameters which are used in handshake protocol.

The set command is executed to save the handshake protocol parameters in UE specified by the **<cid>** parameter. Each handshake protocol parameter is not defined initially. After the set command is executed to save a group of parameters, the parameters of handshake protocol are defined. The number of parameters of handshake protocol that can be saved depends on the value range of the **<cid>** parameter.

The special set command **^AUTHDATA=<CID>** is executed to clear the parameters of handshake protocol specified by the **<cid>** parameter. After this command is executed, the status of the parameter group specified by <cid> is changed from defined to undefined

The read command is executed to return all the parameter values of the handshake parameters. The handshake protocol parameters are displayed by means of linefeed.

The test command is executed to return values supported by this command.

8.17.3 Defined Values

Parameter	Indicates
<CID>	1 to 11: index of the PDP context (integer).
<Auth-type>	Authentication protocol (integer) − 0: no authentication − 1: PAP − 2:CHAP
<PLMN>	PLMN of the operator (character string). Length:0~6 bytes.
<passwd>	Indicating the password of the handshake protocol (character string). Length: 0~127 bytes.
<username>	Indicating the username of the handshake protocol (character string). Length: 0~127 bytes

9 Interfaces for Setting the System

9.1 Indicating System Mode Change Event (^MODE)

9.1.1 Command Syntax

Command	Possible Response(s)
	\<CR>\<LF>^MODE:\<sys_mode>[,\<sys_submode>]\<CR>\<LF>

9.1.2 Description

When the system mode changes, the ME reports this change to the TE.

9.1.3 Defined Values

- \<sys_mode> indicating the system mode

   Its values are as follows:

   – 0: indicates that there is no service.

   – 1 (This value is reserved.)

   – 2 (This value is reserved.)

   – 4 (This value is reserved.)

   – 3: indicates the GSM/GPRS mode.

   – 5: indicates the WCDMA mode.

   – 15: indicates the TD-SCDMA mode.

- \<sys_submode> indicating system sub-mode

   Its values are as follows:

   – 0: indicates that there is no service.

   – 1: indicates the GSM mode.

   – 2: indicates the GPRS mode.

   – 3: indicates the EDGE mode.

   – 4: indicates the WCDMA mode.

   – 5: indicates the HSDPA mode.

- 6: indicates the HSUPA mode.
- 7: indicates the HSUPA and HSDPA modes.
- 8: indicates the TD-SCDMA mode.

9.2 Querying System Information (^SYSINFO)

9.2.1 Command Syntax

Command	Possible Response(s)
^SYSINFO	<CR><LF>^SYSINFO:< srv_status >,< srv_domain >,< roam_status >,< sys_mode >,< sim_state >[,[<reserve>],<sys_submode>]<CR><LF><CR><LF>OK<CR><LF>

9.2.2 Description

This command is used to query information of the current system, such as system service status, domain, and roaming.

9.2.3 Defined Values

- <srv_status> indicating system service status

  Its values are as follows:
  - 0: indicates that there is no service.
  - 1: indicates that there are restricted services.
  - 2: indicates that services are valid.
  - 3: indicates that there are restricted regional services.
  - 4: indicates the power-saving mode.
- <srv_domain> indicating system service domain

  Its values are as follows:
  - 0: indicates that there is no service.
  - 1: indicates that there are only CS service.
  - 2: indicates that there are only PS service.
  - 3: indicates that there are both PS and CS service.
- <roam_status> indicating the roaming status

  Its values are as follows:
  - 0: indicates that the ME is not roaming.
  - 1: indicates that the ME is roaming.
- <sim_state> indicates the SIM card status.
  - 0: invalid USIM card.
  - 1: valid USIM card.
  - 2: invalid USIM card in the CS domain.

- – 3: invalid USIM card in the PS domain.
- – 4: invalid USIM card in the CS and PS domains.
- – 240: ROMSIM version
- – 255: USIM card does not exist, or PIN is unverified or unlocked.
- <lock_state> indicates whether the SIM card is locked by CardLock.
  - – 0: unlocked.
  - – 1: locked.

☐ NOTE

This parameter is valid only for the E5 and lightning card.

- <sys_mode> indicating the system mode

  Its values are as follows:
  - – 0: indicates that there is no service.
  - – 1 (This value is reserved.)
  - – 2 (This value is reserved.)
  - – 3: indicates the GSM/GPRS mode.
  - – 4 (This value is reserved.)
  - – 5: indicates the WCDMA mode.
  - – 6: indicates the LTE mode.
- <sysmode_name> is a string-type value indicating the system mode name corresponding to <sysmode>. For example, if <sysmode> = 3, <sysmode_name> = "WCDMA".
-
- <submode> indicating system sub-mode

  Its values are as follows:
  - – 0: no service.
  - – 1: GSM mode.
  - – 2: GPRS mode.
  - – 3: EDGE mode.
  - – 21: IS95A mode.
  - – 22: IS95B mode.
  - – 23: CDMA2000 1X mode.
  - – 24: EVDO Re10 mode.
  - – 25: EVDO Re1A mode.
  - – 27: HYBRID(CDMA2000 1X) mode.
  - – 28: HYBRID(EVDO Re10) mode.
  - – 29: HYBRID(EVDO Re1A) mode.
  - – 30: HYBRID(EVDO Re1B) mode.
  - – 41: WCDMA mode.
  - – 42: HSDPA mode.
  - – 43: HSUPA mode.
  - – 44: HSPA mode.
  - – 45: HSPA+ mode.

- 46: DC-HSPA+ mode.
- 61: TD-SCDMA mode.
- 62: HSDPA mode.
- 63: HSUPA mode.
- 64: HSPA mode.
- 65: HSPA+ mode.
- 81: 802.16e mode.
- 101: LTE mode.

<submode_name> indicates the name of the current system submode as specified by <submode> to the background.. For example, if the value of <submode> is 45, the value of <submode_name> is "HSPA+".

9.3 Registering at a Network (+CREG)

9.3.1 Command Syntax

Command	Possible Response(s)
+CREG=[<n>]	<CR><LF>OK<CR><LF> When ME-related errors occur: <CR><LF>+CME ERROR: <err><CR><LF>
+CREG?	<CR><LF>+CREG:<n>,<stat>[,<lac>,<ci>]<CR><LF><CR><LF>OK<CR><LF> When ME-related errors occur: <CR><LF>+CME ERROR: <err><CR><LF>
+CREG=?	<CR><LF>+CREG: (list of supported <n>s)<CR><LF><CR><LF>OK<CR><LF>

9.3.2 Description

The set command is executed to set whether the **+CREG** command automatically reports an event.

When the **<n>** parameter is set to **1** and the network registration status changes, +CREG:< stat > is reported.

When **<n>** parameter is set to **2** and the cell information changes, +CREG: <stat>[,<lac>,<ci>] is reported.

The read command is executed to return the current registration status indicated by the **<stat>** parameter and location information indicated by the <lac> parameter. The **<ci>** field is reported only when the **<n>** parameter is set to **2**.

9.3.3 Defined Values

- <n>

Its values are as follows:

- 0: indicates that the function of reporting +CREG is disabled.
- 1: indicates that the function of reporting +CREG: <stat> is enabled.
- 2: indicates that the function of reporting +CREG: <stat>[,<lac>,<ci>] is enabled. However, this value is not supported.

- <stat>

Its values are as follows:

- 0: indicates that the ME has not registered at any networks and is not searching for a new network for registration.
- 1: indicates that the ME has registered at a local network.
- 2: indicates that the ME has not registered at any networks but is searching for a new network for registration.
- 3: indicates that the registration request is rejected.
- 4: indicates that the network registration status is unknown.
- 5: indicates that the ME registers at a roaming network.

- <lac> indicating the location code (consisting of four characters represented by hexadecimal numbers) (For example, 00C3 equals 195.)

- <ci> indicating cell information (consisting of four characters represented by hexadecimal numbers)

9.4 Registering at a GPRS Network (+CGREG)

9.4.1 Command Syntax

Command	Possible Response(s)
+CGREG=[<n>]	<CR><LF>OK<CR><LF> When ME-related errors occur: <CR><LF>+CME ERROR: <err><CR><LF>
+CGREG?	<CR><LF>+CGREG:<n>,<stat>[,<lac>,<ci>]<CR><LF><CR><LF>OK<CR><LF> When ME-related errors occur: <CR><LF>+CME ERROR: <err><CR><LF>
+CGREG=?	<CR><LF>+CGREG: (list of supported <n>s)<CR><LF><CR><LF>OK<CR><LF>

9.4.2 Description

The set command is executed to set whether the **+CGREG** command automatically reports an event.

When the **<n>** parameter is set to **1** and the GPRS network registration status changes, +CGREG:< stat > is reported.

When **<n>** parameter is set to **2** and the cell information changes, +CGREG: <stat>[,<lac>,<ci>] is reported.

The read command is executed to return the current registration status indicated by the **<stat>** parameter and location information indicated by the <**lac**> parameter. The **<ci>** field is reported only when the **<n>** parameter is set to **2**.

9.4.3 Defined Values

- <n>

  Its values are as follows:

  – 0: indicates that the function of reporting +CGREG is disabled.

  – 1: indicates that the function of reporting +CGREG: <stat> is enabled.

  – 2: indicates that the function of reporting +CGREG: <stat>[,<lac>,<ci>] is enabled. However, this value is not supported at present.

- <stat>

  Its values are as follows:

  – 0: indicates that the ME has not registered at any networks and is not searching for a new network for registration.

  – 1: indicates that the ME has registered at a local network.

  – 2: indicates that the ME has not registered at any networks but is searching for a new network for registration.

  – 3: indicates that the registration request is rejected.

  – 4: indicates that the network registration status is unknown.

  – 5: indicates that the ME registers at a roaming network.

- <lac> indicating the location code (consisting of four characters represented by hexadecimal numbers) (For example, 00C3 equals 195.)

- <ci> indicating cell information (consisting of four characters represented by hexadecimal numbers)

9.5 Selecting an Operator (+COPS)

9.5.1 Command Syntax

Command	Possible Response(s)
+COPS=[<mode>[,<format> [,<oper>[,< AcT>]]]]	<CR><LF>OK<CR><LF> When ME-related errors occur: <CR><LF>+CME ERROR: <err><CR><LF>
+COPS?	<CR><LF>+COPS: <mode>[,<format>,<oper>[,<AcT>]] <CR><LF>OK<CR><LF> When ME-related errors occur: <CR><LF>+CME ERROR: <err><CR><LF>

+COPS=?	<CR><LF>+COPS: [list of supported (<stat>,long alphanumeric <oper>,short alphanumeric <oper>,numeric <oper>[,< AcT>])s][,,(list of supported <mode>s),(list of supported <format>s)]<CR><LF>OK<CR><LF>
	When ME-related errors occur:
	<CR><LF>+CME ERROR: <err><CR><LF>

9.5.2 Description

This command is used to query the status of the network at which the ME registers and network selection mode. The execution command is executed to allow a user to automatically or manually select the GSM or UMTS network. The read command is executed to return the network selection mode. If the registration succeeds, the read command is executed to return the information of the current operator. The test command is executed to return the operator information list, including no more than 20 operators in the live network.

9.5.3 Defined Values

- <mode> indicating the network selection mode

  Its values are as follows:

  - 0: indicates the automatic network selection mode. If **mode** is set to **0**, **format** and **oper** become invalid.
  - 1: indicates the manual network selection mode.
  - 2: indicates that the ME registers at a network(**not support**).
  - 3: indicates that the format is set only for returning the read command **+COPS?**.
  - 4: indicates both automatic and manual network selection modes. If the manual search fails, the automatic mode is enabled.

- <format> indicating the format of **<oper>** (operator information)

  Its values are as follows:

  - 0: indicates that the operator information uses the long character string.
  - 1: indicates that the operator information uses the short character string.
  - 2: indicates the operator information uses digits.

- <oper> indicating operator information
- <stat> indicating the network status identifier

  Its values are as follows:

  - 0: indicates that the network status is unknown.
  - 1: indicates that the network is available.
  - 2: indicates that the network accepts the ME registration.
  - 3: indicates that the network is unavailable.

- <Act> indicating the wireless access technology

  Its values are as follows:

  - 0: indicates the GSM/GPRS mode.
  - 2: indicates the UMTS mode.
  - 7: indicates the LTE mode.

9.6 Setting System Configurations (^SYSCFG)

9.6.1 Command Syntax

Command	Possible Response(s)
^ SYSCFG = <mode>,<acqorder>,<band>,<roam>,<srvdomain>	<CR><LF>OK<CR><LF>
^ SYSCFG?	<CR><LF>^SYSCFG:<mode>,<acqorder>,<band>,<roam>,<srvdomain><CR><LF><CR><LF>OK<CR><LF>

9.6.2 Description

This command is used to configure system features, such as the system mode, GSM/WCDMA access order, roaming support, and service domain.

9.6.3 Defined Values

- <acqorder> indicates the access priority of networks.

The value can be 00 or 99:
  - 00: automatic mode

    00 is not combined with other values. It indicates that the network access sequence is automatically changed by a board.
  - 99: status unchanged

    99 is not combined with other values. It indicates that the network access sequence for a board is unchanged.

The value can also be a combination of the following:
  - 01: GSM mode
  - 02: WCDMA mode
  - 03: LTE mode
  - 04: CDMA 1X mode
  - 05: TD-SCDMA mode
  - 06: Wimax mode
  - 07: CDMA EVDO mode

    For example, while 03 indicates LTE only, it can be combined as

    030201: LTE > WCDMA > GSM

    0302: LTE > WCDMA (GSM network search is not involved)

    030402: LTE > CDMA > WCDMA.

<band> indicates the frequency band in hexadecimal notation. This band is related to system mode selection and dependent on board performance. The values are one of the followings or their combination except 0x3FFFFFFF and 0x40000000:

- 00080000 (CM_BAND_PREF_GSM_850) GSM 850
- 00000080 (CM_BAND_PREF_GSM_DCS_1800) GSM DCS systems
- 00000100 (CM_BAND_PREF_GSM_EGSM_900) Extended GSM 900
- 00000200（CM_BAND_PREF_GSM_PGSM_900） Primary GSM 900
- 00100000（CM_BAND_PREF_GSM_RGSM_900） Railway GSM 900
- 00200000（CM_BAND_PREF_GSM_PCS_1900） GSM PCS
- 00400000（CM_BAND_PREF_WCDMA_I_IMT_2000） WCDMA IMT 2000
- 00800000 (CM_BAND_PREF_WCDMA_II_PCS_1900) WCDMA_II_PCS_1900
- 04000000 (CM_BAND_PREF_WCDMA_V_850) WCDMA_V_850
- 08000000(CM_BAND_PREF_WCDMA_VI_800) WCDMA_VI_800
- 3FFFFFFF（CM_BAND_PREF_ANY） any band
- 40000000（CM_BAND_PREF_NO_CHANGE） unchanged
- 0004000000000000 (CM_BAND_PREF_WCDMA_IX_1700) WCDMA_IX_1700
- 0000000000400000 (CM_BAND_PREF_WCDMA_IMT) WCDMA_IMT(2100)
- 0002000000000000 WCDMA 900
- 0002000000000000 (CM_BAND_PREF_WCDMA_VIII_900) WCDMA_VIII_900
- 2000000 (CM_BAND_PREF_WCDMA_IX_1700) AWS
- 00680380 Automatic

The following are the definitions of the CDMA frequency band.

00000001(CM_BAND_PREF_BC0_A) Band 0 A System

00000002(CM_BAND_PREF_BC0_B) Band 0 B System

00000004(CM_BAND_PREF_BC1) Band 1 1900

00000008(CM_BAND_PREF_BC2) Band 2

00000010(CM_BAND_PREF_BC3) Band 3

00000020(CM_BAND_PREF_BC4) Band 4

00000040 (CM_BAND_PREF_BC5) Band 5

00000400(CM_BAND_PREF_BC6) BAND 6

00000800(CM_BAND_PREF_BC7) BAND 7

00001000(CM_BAND_PREF_BC8) BAND 8

00002000(CM_BAND_PREF_BC9) BAND 9

00004000(CM_BAND_PREF_BC10) BAND 10

00008000(CM_BAND_PREF_BC11) BAND 11

10000000(CM_BAND_PREF_BC12) Band 12

20000000(CM_BAND_PREF_BC14) Band 14

80000000(CM_BAND_PREF_BC15) Band 15

<band_name> is a string type value indicating the frequency band name.

<roam> indicates whether the roaming function is supported

- – 0: not supported
- – 1: supported.
- – 2: no change.

- <srvdomain> indicates the service domain
  - – 0: only CS domain is used.
  - – 1: only PS domain is used.
  - – 2: both CS and PS domains are used.
  - – 3: either domain is used.
  - – 4: no change.

- <lteband>specifies the LTE frequency band in hexadecimal notation.

  The value of <lteband> can be one of the following or their combinations:
  - – 7FFFFFFFFFFFFFFF（CM_BAND_PREF_ANY） any band

    0x7FFFFFFFFFFFFFFFis not combined with other values
  - – 1 (CM_BAND_PREF_LTE_EUTRAN_BAND1) LTE BC1
  - – 2 (CM_BAND_PREF_LTE_EUTRAN_BAND2) LTE BC2
  - – 4 (CM_BAND_PREF_LTE_EUTRAN_BAND3) LTE BC3
  - – 8 (CM_BAND_PREF_LTE_EUTRAN_BAND4) LTE BC4
  - – 10 (CM_BAND_PREF_LTE_EUTRAN_BAND5) LTE BC5
  - – 20 (CM_BAND_PREF_LTE_EUTRAN_BAND6) LTE BC6
  - – 40 (CM_BAND_PREF_LTE_EUTRAN_BAND7) LTE BC7
  - – 80 (CM_BAND_PREF_LTE_EUTRAN_BAND8) LTE BC8
  - – 100 (CM_BAND_PREF_LTE_EUTRAN_BAND9) LTE BC9
  - – 200 (CM_BAND_PREF_LTE_EUTRAN_BAND10) LTE BC10
  - – 400 (CM_BAND_PREF_LTE_EUTRAN_BAND11) LTE BC11
  - – 800 (CM_BAND_PREF_LTE_EUTRAN_BAND12) LTE BC12
  - – 1000 (CM_BAND_PREF_LTE_EUTRAN_BAND13) LTE BC13
  - – 2000 (CM_BAND_PREF_LTE_EUTRAN_BAND14) LTE BC14
  - – 10000 (CM_BAND_PREF_LTE_EUTRAN_BAND17) LTE BC17
  - – 20000 (CM_BAND_PREF_LTE_EUTRAN_BAND18) LTE BC18
  - – 40000 (CM_BAND_PRE_LTE_EUTRAN_BAND19) LTE BC19
  - – 80000 (CM_BAND_PREF_LTE_EUTRAN_BAND20) LTE BC20
  - – 100000 (CM_BAND_PREF_LTE_EUTRAN_BAND21) LTE BC21
  - – 100000000 (CM_BAND_PREF_LTE_EUTRAN_BAND33) LTE BC33
  - – 200000000 (CM_BAND_PREF_LTE_EUTRAN_BAND34) LTE BC34
  - – 400000000 (CM_BAND_PREF_LTE_EUTRAN_BAND35) LTE BC35
  - – 800000000 (CM_BAND_PREF_LTE_EUTRAN_BAND36) LTE BC36
  - – 1000000000 (CM_BAND_PREF_LTE_EUTRAN_BAND37) LTE BC37

- 2000000000 (CM_BAND_PREF_LTE_EUTRAN_BAND38) LTE BC38
- 4000000000 (CM_BAND_PREF_LTE_EUTRAN_BAND39) LTE BC39
- 8000000000 (CM_BAND_PREF_LTE_EUTRAN_BAND40) LTE BC40
- 10000000000 (CM_BAND_PREF_LTE_EUTRAN_BAND41) LTE BC41
- 20000000000 (CM_BAND_PREF_LTE_EUTRAN_BAND42) LTE BC42
- 40000000000 (CM_BAND_PREF_LTE_EUTRAN_BAND43) LTE BC43
- 40000000 （CM_BAND_PREF_NO_CHANGE） unchanged

📖 NOTE

For data cards that do not support LTE, <lteband> and <lteband_name> are left out of the response. For example, in the response to AT^SYSCFGEX?, the value of <lteband> is left out.

^SYSCFGEX:(list of supported < acqorder >s),

(list of supported(<band >,<band_name>)s),

(list of supported < roam >s),

(list of supported < srvdomain >s) ,,

OK

in the response to AT^SYSCFGEX?, the value of <lteband> is left out：

^SYSCFGEX: <acqorder>,<band>,<roam>,<srvdomain>,,

OK

When AT^SYSCFGEX= is executed, <lteband> is null or unchanged.

^SYSCFGEX=<acqorder>,<band>,<roam>,<srvdomain>,,<reserve1>,<reserve2>

<lteband_name> is a string type value indicating the LTE frequency band name.

<reserve1> indicates reserved field 1

<reserve2> indicates reserved field 2

9.7 2G/3G/4G Query and Report Signal Strength ^HCSQ

9.7.1 Command Syntax

Command	Possible response(s)
^HCSQ?	<CR><LF>^HCSQ: <sysmode>[,<value1>[,<value2>[,<value3>[,<value4>[,<value5>]]]]]<CR><LF><CR><LF>OK<CR><LF> If an MT error occurs: <CR><LF>ERROR<CR><LF>
^HCSQ=?	<CR><LF>^HCSQ: (list of supported <sysmode>s)<CR><LF><CR><LF>OK<CR><LF>

	Report the current signal strength when the strength changes： <CR><LF>^HCSQ: <sysmode>[,<value1>[,<value2>[,<value3>[,<value4>[,<value5>]]]]]<CR><LF>

9.7.2 Description

This command queries and reports the signal strength of the current service network. If the MT is registered with multiple networks in different service modes, you can query the signal strength of networks in each mode.

This command queries the signal strength or allows the MT to automatically report the detected signal strength if the MT camps on the network, regardless of whether the MT is registered with the network. If the MT is not using any service network or the service mode is uncertain, the query will return a result of NOSERVICE.

The read command queries the current network signal strength detected by the MT.

The test command returns the list of service modes supported by the MT.

The URC command allows the MT to automatically report the current signal strength when the strength changes.

9.7.3 Defined Values

- <sysmode> is a string type value indicating the service mode in which the MT will automatically report the signal strength:

  NOSERVICE: no service is available.

  GSM: GSM/GRPS/EDGE mode.

  WCDMA: WCDMA/HSDPA/HSPA mode.

  TD-SCDMA: TD-SCDMA mode.

  LTE: LTE mode.

  CDMA: CDMA mode.

  EVDO: EVDO/EHRPD mode.

  CDMA-EVDO: CDMA/EVDO(EHRPD) hybrid mode.

  For <value1>, <value2>, <value3>, <value4>, <value5>, the following table lists the signal strength type corresponding to each service mode:

<sysmode>	<value1>	<value2>	<value3>	<value4>	<value5>
NOSERVICE					
GSM	gsm_rssi				
WCDMA	wcdma_rssi	wcdma_rscp	wcdma_ecio		
TD-SCDMA	tdscdma_rssi	tdscdma_rscp	tdscdma_ecio		
LTE	lte_rssi	lte_rsrp	lte_sinr	lte_rsrq	
CDMA	cdma_rssi	cdma_ecio			
EVDO	evdo_rssi	evdo_ecio	evdo_sinr		
CDMA-EVDO	cdma_rssi	cdma_ecio	evdo_rssi	evdo_ecio	evdo_sinr

<gsm_rssi>,<wcdma_rssi>,<tdscdma_rssi>,<lte_rssi>,<cdma_rssi>,<evdo_rssi> are integers indicating the received signal strength. These parameters are available for GSM, WCDMA, LTE, CDMA:

  0 rssi < -120 dBm

  1 -120 dBm ≤ rssi < -119 dBm

  2 -119 dBm ≤ rssi < -118 dBm

  : : : :

  94 -27 dBm ≤ rssi < -26 dBm

  95 -26 dBm ≤ rssi < -25 dBm

  96 -25 dBm ≤ rssi

  255 unknown or undetectable

<wcdma_rscp>、<tdscdma_rscp> an integer indicating the received signal code power. This parameter is available for WCDMA mode.

  0 rscp < -120 dBm

  1 -120 dBm ≤ rscp < -119 dBm

  2 -119 dBm ≤ rscp < -118 dBm

  : : : :

  94 -27 dBm ≤ rscp < -26 dBm

  95 -26 dBm ≤ rscp < -25 dBm

  96 -25 dBm ≤ rscp

  255 unknown or undetectable

<wcdma_ecio>, <tdscdma_ecio >,<cdma_ecio>,< evdo_ecio> an integer indicating the downlink carrier-to-interference ratio. These parameters are available for WCDMA, CDMA, and EV-DO mode.

  0 Ec/Io < -32 dB

  1 -32 dB ≤ Ec/Io < -31.5 dB

  2 -31.5 dB ≤ Ec/Io < -31 dB

  63 -1 dB ≤ Ec/Io < -0.5 dB

  64 -0.5 dB ≤ Ec/Io < 0 dB

  65 0 dB ≤ Ec/Io

  255 unknown or undetectable

<lte_rsrp> an integer indicating the reference signal received power (RSRP). This parameter is available for LTE mode.

0 rsrp < -140 dBm

1 -140 dBm ≤ rsrp < -139 dBm

2 -139 dBm ≤ rsrp < -138 dBm

: : : :

95 -46 dBm ≤ rsrp < -45 dBm

96 -45 dBm ≤ rsrp < -44 dBm

97 -44 dBm ≤ rsrp

255 unknown or undetectable

<lte_sinr> an integer indicating the signal to interference plus noise ratio (SINR). This parameter is available for LTE mode.

0 sinr < -20 dB

1 -20 dB ≤ sinr < -19.8 dB

2 -19.8 dB ≤ sinr < -19.6 dB

: : : :

249 29.6 dB ≤ sinr < 29.8 dB

250 29.8 dB ≤ sinr < 30 dB

251 30 dB ≤ sinr

255 unknown or undetectable

<lte_rsrq> an integer indicating the reference signal received quality (RSRQ) in dB.

0 rsrq < -19.5 dB

1 -19.5 dB ≤ rsrq < -19 dB

2 -19 dB ≤ rsrq < -18.5 dB

: : : :

32 -4 dB ≤ rsrq < -3.5 dB

33 -3.5 dB ≤ rsrq < -3 dB

34 -3 dB ≤ rsrq

255 unknown or undetectable

<evdo_sinr> an integer indicating the signal to interference plus noise ratio. This parameter is available for EV-DO mode.

0 sinr < -9 dB

1 -9 dB ≤ sinr < -6 dB

2 -6 dB ≤ sinr < -4.5 dB

3 -4.5 dB ≤ sinr < -3 dB

4 -3 dB ≤ sinr < -2 dB

5 -2 dB ≤ sinr < 1 dB

6 1 dB ≤ sinr < 3 dB

7 3 dB ≤ sinr < 6 dB

8 6 dB ≤ sinr

255 unknown or undetectable

9.8 Request Group Domain IP Service D

9.8.1 Command Systax

Command	Possible response(s)
ATD*99***<cid>#	<CR><LF>CONNECT<CR><LF> If an MT related error exists: <CR><LF>+CME ERROR: <err><CR><LF>
ATD*99#	<CR><LF>CONNECT<CR><LF> If an MT related error exists: <CR><LF>+CME ERROR: <err><CR><LF>

9.8.2 Description

This interface can be used in modem dialing.

Format one specifies the CID for modem dialing. Format two omits CID choice and uses CID1 for dialing as default. Ensure that the correct APN information has been saved in the corresponding CID before use.

9.8.3 Defined Values

<cid>: 1-11: is the index number that specifies a particular PDP context definition. Other PDP-related commands can refer to this index for the defined PDP context.

10   Interfaces for Processing Ordinary/Video Calls

10.1 Initiating Ordinary Calls (D)

10.1.1 Command Syntax

Command	Possible Response(s)
D[digits][I/i][;]	<CR><LF>OK<CR><LF>

10.1.2 Description

This command is used to initiate a voice or data service call.

The following flowcharts show the message exchange between the TE and ME when the TE serves as a calling party.

Successful call initiating process
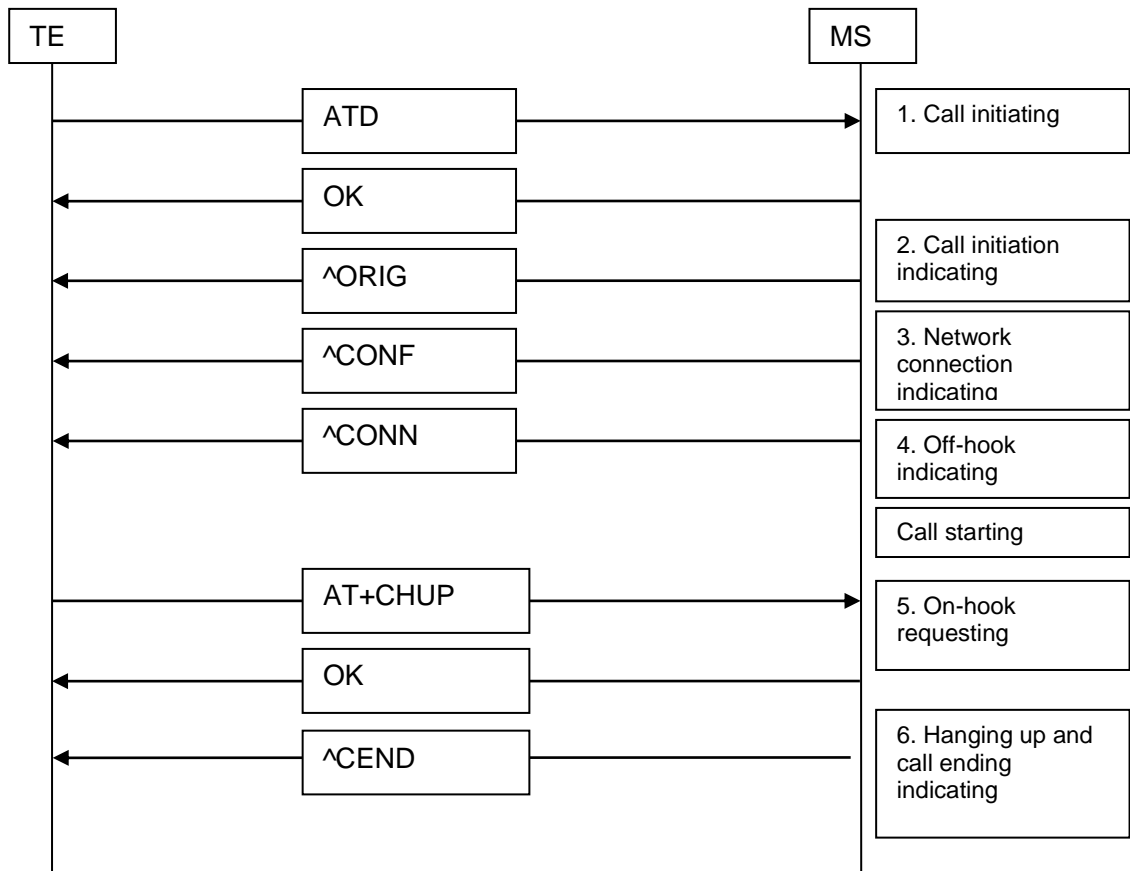
Failed call initiating process (1)
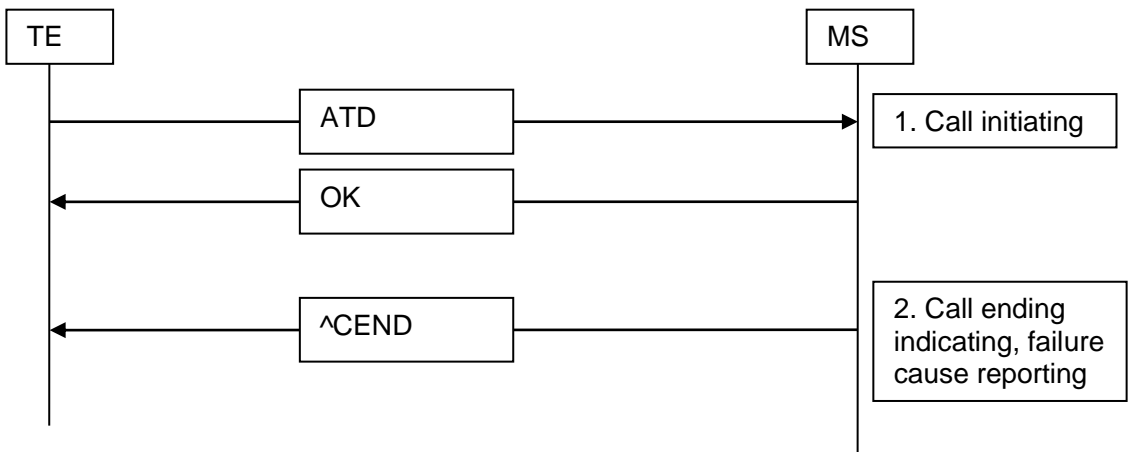
📖 **NOTE**

At present, the board state does not support call establishment, and the **^CEND** command is returned to report the failure cause.

Failed call initiating flowchart (2)
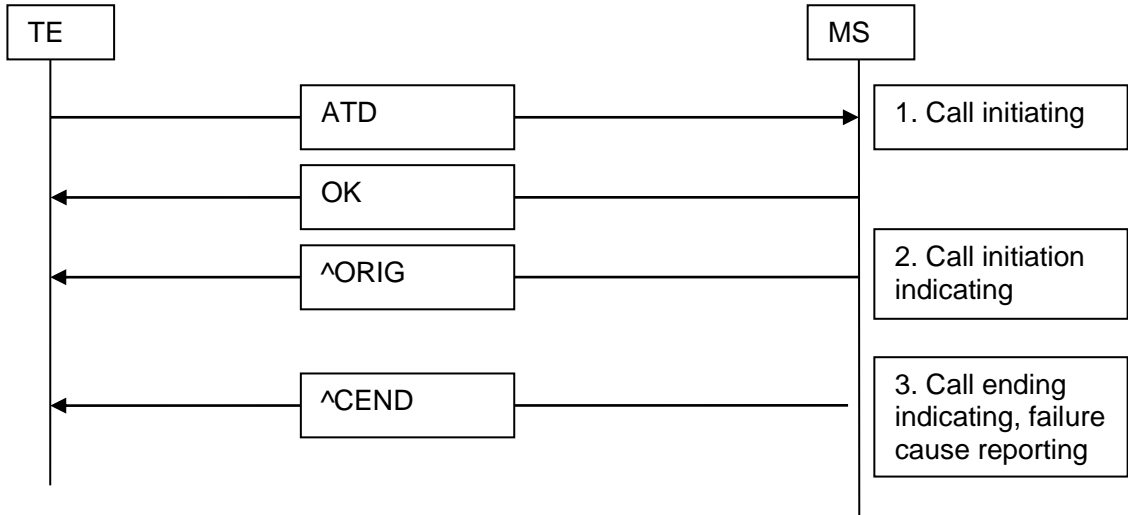
📖 **NOTE**

At present, the board state supports call establishment, and the **^ORIG** command of indicating call initiation is reported. After that, the network connection fails due to network reasons, and the failure cause is reported in the **^CEND** command.

Failed call initiating flowchart (3)
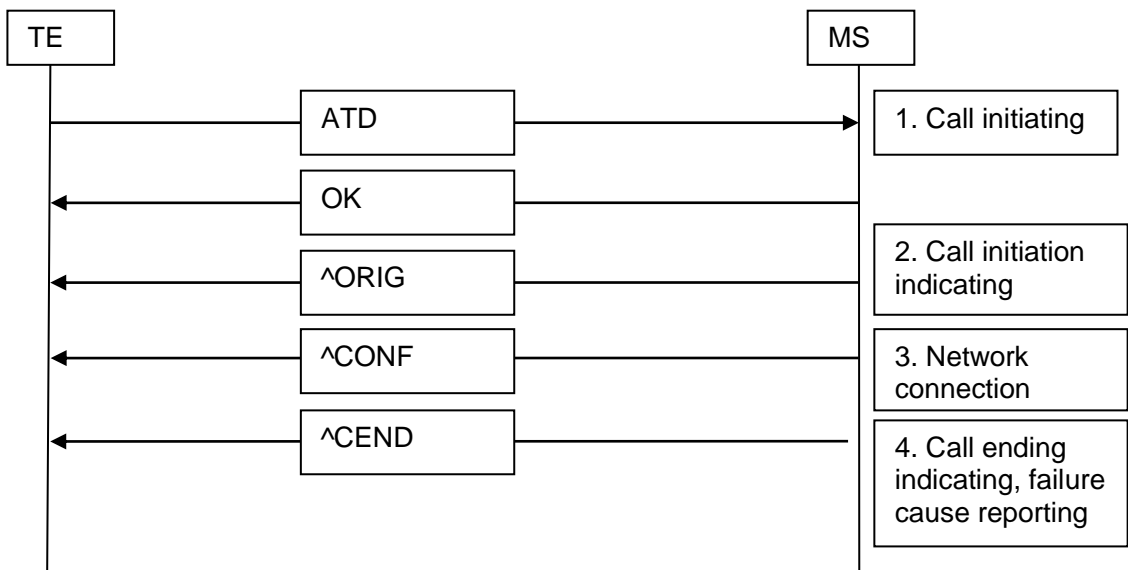
📖 **NOTE**

At present, the board state supports call establishment, and the **^ORIG** command of indicating call initiation is reported. When the network is connected, the **^CONF** command of indicating network connection is reported. After that, the call fails because the called party rejects or hangs up the call, and the failure cause is reported in the **^CEND** command.

Process of indicating an incoming call
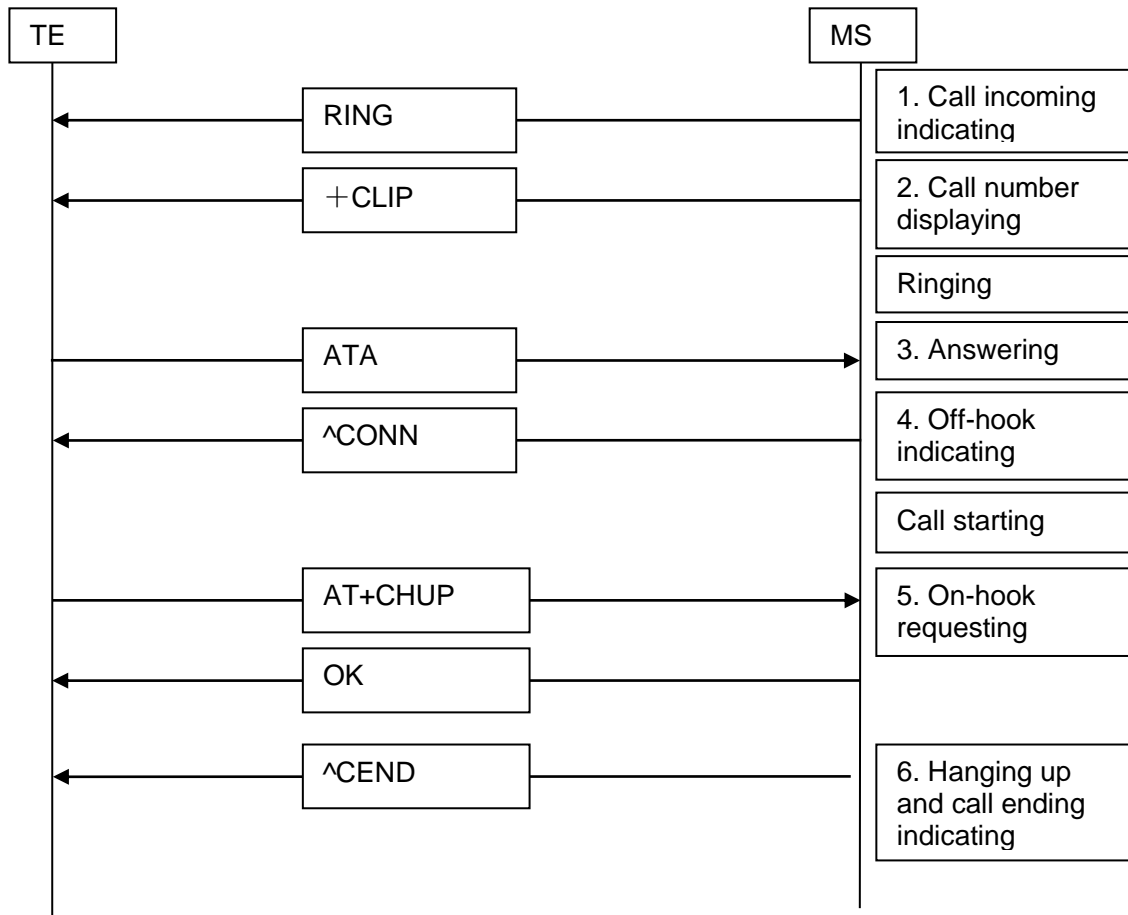
10.1.3 Defined Values

<digits> indicating the call number of the called party, using ASCII characters

The valid characters consist of 0 to 9 and the following characters: * # +.

The plus sign (+) can only be used at the start of the call number. The maximum length of a call number is shorter than or equal to 24 characters (excluding the plus sign (+)).

<I/i> indicating the identifier of calling line identification restriction (CLIR) services

If this parameter is not specified, the default identifier of the network is used, or the identifier is determined based on whether the network provisions CLIR services in permanent mode.)

Its values are as follows:

- I: indicates that CLIR is enabled.
- i: indicates that CLIR is disabled.

Two exceptions are as follows:

- If the network does not provision CLIR services and the user enables CLIR and initiates a call, the call establishment depends on the network side. If the call is rejected, the cause is reported in the **^CEND** command of indicating call ending.
- If the network provisions CLIR services in permanent mode but the user disables CLIR when initiating a call, the call can continue.

<;> indicating the type of call to be initiated. If a voice call is initiated, a semicolon (;) must be included.

10.2 Hanging Up Ordinary Calls (+CHUP)

10.2.1 Command Syntax

Command	Possible Response(s)
+CHUP	<CR><LF>OK<CR><LF> When ME-related errors occur: <CR><LF>+CME ERROR: <err><CR><LF>
+CHUP=?	<CR><LF>OK<CR><LF>

10.2.2 Description

This command is used to terminate a call when the user finishes the call and to reject an incoming call. For a conference call, this command is used to hang up all calls in the hold, active, and waiting states. However, new calls are not impacted.

10.3 Answering a Call (A)

10.3.1 Command Syntax

Command	Possible Response(s)
A	<CR><LF>OK<CR><LF>

10.3.2 Description

This command is used by the TE to inform the MT of answering an incoming call. At the same time, this command can be used to inform the MT of answering an incoming call from the third party.

10.4 Querying Call Status (+CLCC)

10.4.1 Command Syntax

Command	Possible Response(s)
+CLCC	[<CR><LF>+CLCC: <id1>,<dir>,<stat>,<mode>,<mpty>[, <number>,<type>[,<alpha>[,<priority>]]] [<CR><LF>+CLCC: <id2>,<dir>,<stat>,<mode>,<mpty>[, <number>,<type>[,<alpha>[,<priority>]]] [...]]<CR><LF>]<CR><LF>OK<CR><LF> When ME-related errors occur: <CR><LF>+CME ERROR: <err><CR><LF>
+CLCC=?	<CR><LF>OK<CR><LF>

10.4.2 Description

This command is used to query the number of ongoing calls and the status of each call.

10.4.3 Defined Values

<idx> indicating a call ID (integral value)

<dir> indicating the calling party

Its values are as follows:

- – 0: indicates an MO call.
- – 1: indicates an MT call.

<stat> indicating the call status

Its values are as follows:

- – 0: indicates that the call is in the active state.
- – 1: indicates that the call is in the held state.
- – 2: indicates that the call is in the dialing state.
- – 3: indicates that the call is in the alerting state.
- – 4: indicates that the call is in the incoming state.
- – 5: indicates that the call is in the waiting state.

<mode> indicating the call type

Its values are as follows:

- – 0: indicates a voice call.
- – 1: indicates a data service call.
- – 2: indicates that the call is a fax call.

<mpty> indicating whether the call is a conference call

Its values are as follows:

- – 0: indicates that the call is not a conference call.
- – 1: indicates that the call is a conference call.

<number> indicating the call number of the called party, using ASCII characters

The valid characters consist of 0 to 9 and the following characters: * # +. The plus sign (+) can only be used at the start of the call number.

<type> indicating the type of the call number

<alpha> indicating the text information corresponding to the call number in the phone book

This parameter is reserved and not supported at present.

<priority>

This parameter is reserved and not supported at present.

10.5 Selecting the Address Type (+CSTA)

10.5.1 Command Syntax

Command	Possible Response(s)
+CSTA=[<type>]	<CR><LF>OK<CR><LF> When ME-related errors occur: <CR><LF>+CME ERROR: <err><CR><LF>
+CSTA?	<CR><LF>+CSTA: <type><CR><LF> <CR><LF>OK<CR><LF>
+CSTA=?	<CR><LF>+CSTA: (list of supported <type>s)<CR><LF> <CR><LF>OK<CR><LF>

10.5.2 Description

The set command is used to select the type of the call number. This setting is used in the **D** command.

10.5.3 Defined Values

<type> indicating decimal value of the address type

When the call number includes the plus sign (+) (international access code), the value of **<type>** is **145** by default. Otherwise, the value is **129**.

10.6 Muting a Microphone (+CMUT)

10.6.1 Command Syntax

Command	Possible Response(s)
+CMUT=<n>	<CR><LF>OK<CR><LF>

| +CMUT? | <CR><LF>+CMUT: <n><CR><LF><CR><LF>OK<CR><LF> |
| +CMUT=? | <CR><LF>+CMUT: (list of supported <n>s)
<CR><LF><CR><LF>OK<CR><LF> |

10.6.2 Description

For this command, the set command is used to mute the microphone, the read command is used to query whether the microphone is muted, and the test command is used to return the value range for muting-related parameters. The set command is used only when the call is activated. **<n>** indicating volume takes effect for the first call and restores to **0** after the call ends or the board restarts.

10.6.3 Defined Values

<n>

Its values are as follows:

- 0: indicates that voice can be heard.
- 1: indicates that no voice can be heard.

10.7 Indicating Call Initiation (^ORIG)

10.7.1 Command Syntax

Command	Possible Response(s)
	<CR><LF>^ORIG:<call_x>,<call_type><CR><LF>

10.7.2 Description

This command is used to indicate that the MT is initiating a call.

10.7.3 Defined Values

<call_x> indicating the call ID (integral value)

This parameter is used to uniquely identify a call and involves the calling and called parties.

<call_type> indicating the call type

Its values are as follows:

- 0: indicates a voice call. 1: indicates a CS data call (GW).
- 2: indicates a PS data call (GW).
- 9: indicates an emergency call.

10.8 Indicating Network Connection (^CONF)

10.8.1 Command Syntax

Command	Possible Response(s)
	<CR><LF>^CONF:<call_x>[,<call_type>]<CR><LF>

10.8.2 Description

After initiating a call, the MT reports this initiation indication to the TE if the network is connected.

10.8.3 Defined Values

<call_x> indicating the call ID (integral value)

<call_type> indicating the call type

Its values are as follows:

- 0: indicates a voice call.
- 1: indicates a CS data call (GW).
- 2: indicates a PS data call (GW).
- 9: indicates an emergency call.

10.9 Indicating Call Connection (^CONN)

10.9.1 Command Syntax

Command	Possible Response(s)
	<CR><LF>^CONN:<call_x>,<call_type><CR><LF>

10.9.2 Description

After a call is connected, the MT reports this connection indication to inform the TE of the call start.

10.9.3 Defined Values

<call_x> indicating the call ID

This parameter is used to uniquely identify a call and involves the calling and called parties.

<call_type> indicating the call type

Its values are as follows:

- 0: indicates a voice call.

- 1: indicates a CS data call (GW).

- 2: indicates a PS data call (GW).

- 9: indicates an emergency call.

10.10 Indicating Call Ending (^CEND)

10.10.1 Command Syntax

Command	Possible Response(s)
	<CR><LF>^CEND:<call_x>,[<reserve>],<end_status>[,<cc_cause>][,<call_type>]<CR><LF>

10.10.2 Description

After the call ends, the MT reports this indication to the TE, indicating the cause of the call ending and call duration.

10.10.3 Defined Values

<call_x> indicating the call ID (integral value)

<reserved> (It is a reserved parameter.)

<end_status> indicating the cause of the call ending

Its values are as follows:

- 0: indicates CM_CALL_END_OFFLINE.

- 21: indicates CM_CALL_END_NO_SRV.

- 29: indicates CM_CALL_END_CLIENT_END.

- 101: indicates CM_CALL_END_CONF_FAILED.

- 104: indicates CM_CALL_END_NETWORK_END (**<cc_cause>** needs to be further queried).

<cc_cause> indicating call control information (For details, see section 10.5.4.11 in 3GPP TS 24.008. Other causes of the call ending are optional.)

Its values are as follows:

- 16: indicates NORMAL_CALL_CLEARING

- 17: indicates USER_BUSY

- 18: indicates NO_USER_RESPONDING

- 19: indicates USER_ALERTING_NO_ANSWER

- 21: indicates CALL_REJECTED

- 22: indicates NUMBER_CHANGED

- 27: indicates DESTINATION_OUT_OF_ORDER

- 28: indicates NVALID_NUMBER_FORMAT

- 38: indicates NETWORK_OUT_OF_ORDER

- 102: indicates RECOVERY_ON_TIMER_EXPIRY

🕮 **NOTE**

<cc_cause> is reported only when the call ends due to network reasons, and is not reported when a locally initiated call ends before a response is received from the network side. The following table lists some common cases of **<cc_cause>** reported when a call ends.

Event	Command Reported by the Called Party	Command Reported by the Calling Party
The called party hangs up the call after connection.	^CEND:1,8,29,16	^CEND:1,8,104,16
The called party rejects the call.	^CEND:1,0,29,17	^CEND:1,0,104,21
The called party has not answered the call.	^CEND:1,0,104,102	^CEND:1,0,104,38
The calling party hangs up the call.	^CEND:1,0,104,16	^CEND:1,0,29,16

<call_type> indicating the call type

Its values are as follows:

- 0: indicates a voice call.
- 1: indicates a CS data call (GW).
- 2: indicates a PS data call (GW).
- 9: indicates an emergency call.

10.11 Displaying the Calling Party (+CLIP)

10.11.1 Command Syntax

Command	Possible Response(s)
+CLIP=[<n>]	<CR><LF>OK<CR><LF>
+CLIP?	<CR><LF>+CLIP:<n>[,<m>]<CR><LF><CR><LF>OK<CR><LF>
+CLIP=?	<CR><LF>+CLIP:(0,1)<CR><LF><CR><LF>OK<CR><LF>

10.11.2 Description

This command is used to enable or disable the calling line identification (CLI) function. If calling line identification presentation (CLIP) is enabled, the **+CLIP** command of indicating the number of the calling party is reported after the **RING** command of indicating an incoming call indication or the **+CRING** command is reported.

10.11.3 Defined Values

<n> indicating whether to report CLIP information

Its values are as follows:

- – 0: indicates that the function is disabled.
- – 1: indicates that the function is enabled.

<m> indicating the service status of CLIP (This parameter is not supported at present.)

Its values are as follows:

- – 0: indicates that CLIP is unavailable.
- – 1: indicates that CLIP is available.
- – 2: indicates that the CLIP service status is unknown (network reasons)

10.12 Indicating the Caller's Number Displaying (+CLIP)

10.12.1 Command Syntax

Command	Possible Response(s)
	<CR><LF>+CLIP:<number>,<type>[,<subaddr>,<satype>[,[<alpha>][,<CLI validity>]]]<CR><LF>

10.12.2 Description

This command is used to enable the call's number displaying function. When URC is reported, this indication is periodically (every 5s) reported to the TE following the **RING** command when a new call comes.

10.12.3 Defined Values

<number> indicating the number of the calling party (using ASCII characters)

The valid characters consist of 0 to 9 and the following characters: * #.

<type> indicating the number type

The international number is indicated by 145. For details, see the definition of the **type_ addr** parameter in the SC number in section 6.12

<subaddr> indicating the extension number (character string)

Its format depends on the **<satype>** parameter.

<satype> indicating the type of the extension number (integral value, using 8 bit data)

<alpha> indicating the name recorded in the phone book corresponding to the number of the calling party

<CLI validity>

Its values are as follows:

- – 0: indicates that CLI is available.
- – 1: indicates that CLI is rejected by the calling party.
- – 2: indicates that CLI is unavailable due to restrictions or problems of the network where the call is initiated.

10.12.4 Examples

"+CLIP:82882690,129,,,,0" is reported if the number of the calling party is displayed.

"+CLIP:,129,,,,1" is reported if the number cannot be displayed because the called party enables CLIR.

"+CLIP:,129,,,,2" is reported if the number cannot be displayed due to network reasons.

10.13 Restricting the Calling Party (+CLIR)

10.13.1 Command Syntax

Command	Possible Response(s)
+CLIR=[<n>]	
+CLIR?	+CLIR: <n>,<m>
+CLIR=?	+CLIR: (list of supported <n>s)

10.13.2 Description

This command is used for the calling party to enable or disable the function of displaying CLI of the called party. If CLIR is enabled, CLI of the calling party is not displayed for the called party when the calling party initiates a call.

10.13.3 Defined Values

<n> indicating that the function of automatically reporting CLI is enabled or disabled

Its values are as follows:

- 0: indicates that the function of displaying the CLI is based on CLIR subscription.
- 1: indicates that CLIR is used.
- 2: indicates that CLIR is suspended.

<m>

Its values are as follows:

- 0: indicates that CLIR is unavailable.
- 1: indicates that CLIR is in permanent mode.
- 2: indicates that CLIR state is unknown.
- 3: indicates that the function of temporarily displaying CLIR is restricted.
- 4: indicates that temporarily displaying CLIR is allowed.

10.14 Setting Auto-Answer Function (S0)

10.14.1 Command Syntax

Command	Possible Response(s)
S0=<n>	<CR><LF>OK<CR><LF> When ME-related errors occur: <CR><LF>+CME ERROR: <err><CR><LF>
S0?	<CR><LF><n><CR><LF>OK<CR><LF>
S0=?	S0:(list of supported<n>s)

10.14.2 Description

This command is used to set the auto-answer function.

10.14.3 Defined Values

< n> (integral value)

Its values are as follows:

0 (default value): indicates that the auto-answer function is disabled.

1 to 255: indicates the time the auto-answer function is enabled. The unit is second.

10.15 Setting Earphone Volume (+CLVL)

10.15.1 Command Syntax

Command	Possible response(s)
+CLVL=<level>	<CR><LF>OK<CR><LF> When MT-related errors occur: <CR><LF>+CME ERROR: <err><CR><LF>
^CLVL?	<CR><LF><level><CR><LF><CR><LF><n><CR><LF>OK<CR><LF>

10.15.2 Description

This command is used to set the earphone or speaker volume during a call.

10.15.3 Defined Values

<level> integer, indicating the volume level

Value range: 0 to 5. 0 indicates the minimum volume while 5 indicates the maximum volume.

11 Interfaces for Online Update

11.1 Setting Online Update Mode(^UPDATEMODE)

11.1.1 Command Syntax

Command	Possible response(s)
^UPDATEMODE =<automode>,<forcedmode>	Setting update mode successful: <CR><LF>OK<CR><LF> Setting update mode failed: <CR><LF>+ CME ERROR<CR><LF>
^UPDATEMODE?	<CR><LF>^UPDATEMODE: <automode>, <forcedmode><CR><LF><CR><LF>OK<CR><LF>
^UPDATEMODE=?	<CR><LF>^UPDATEMODE:(list of supported <service>s)<CR><LF><CR><LF>OK<CR><LF>

11.1.2 Description

The set command toggles automode or forcedmode to enabled or disabled.

The read command returns to the current mode.

The test command returns the possible value of <service>.

11.1.3 Defined Values

<automode> : automatic online update function switch.

– 0:　　　disabled.

– 1:　　　enabled.

<forcedmode> : force online update function switch.

– 0:　　　disabled.

– 1:　　　enabled.

11.2 Checking Update Version (^UPDATECHECK)

11.2.1 Command Syntax

Command	Possible response(s)
-	<CR><LF>^UPDATECHECK:<Value><CR><LF>
^UPDATECHECK	If the operation is successful: <CR><LF>OK<CR><LF> If there is an MT-related error: <CR><LF>+CME ERROR:<err><CR><LF>
^UPDATECHECK ?	If the operation is successful: <CR><LF>^ UPDATECHECK:<value><CR><LF><CR><LF>OK <CR><LF>
^UPDATECHECK =?	<CR><LF>^ UPDATECHECK:(list of supported <value>s)<CR><LF><CR><LF>OK<CR><LF>

11.2.2 Description

Once detected, new update information is reported every 10 seconds by default. Report frequency can be customized.

^UPDATECHECK: This command triggers the check for new updates;

^UPDATECHECK?: This command queries the check result;

^UPDATECHECK=?：This command returns possible values.

11.2.3 Defined Values

<Value>: (0,1,2,3,4,5,6,7,8)

- 0: no new update is found.
- 1: there is a new update but it will not be downloaded automatically. (reported at intervals)
- 2: the board is checking for new updates.
- 3: there is a new update and the board is downloading it from the server. (reported at intervals)

    – 4: the board failed to check update information.

    – 5: there is a new update and it has been downloaded. (reported at intervals)

    – 6: Dialing failed.

    – 7: Failed to download the update.(reported at intervals)

    – 8: Failed to install the update. (reported at intervals)

11.3 Manual Update Request (^UPDATEREQ)

11.3.1 Command Syntax

Command	Possible response(s)
^UPDATEREQ	If the operation is successful: <CR><LF>^UPDATEREQ<CR><LF><CR><LF>OK<CR><LF> If the operation failed: <CR><LF>+CME ERROR<CR><LF>

11.3.2 Description

This command triggers the board to download and install new updates. If there is a new update, it will be downloaded and installed, and the OK value is returned. Otherwise, the ERROR value is returned.

11.3.3 Defined Values

● Return value: OK, ERROR

● OK: The board downloads and installs the new update.

● ERROR: The board fails to download and install the new update.

A AT Commands

A.1 Basic Commands

The format of a basic command is <command>[<number>].

Specifically, <command> can be a single letter (A to Z), or the ampersand sign (&) plus a single letter. <number> is a decimal number composed of one or more digits. The number 0 in the first place of <number> will be omitted. If a basic command that can carry <number> does not carry <number>, the <number> value is set to 0 by default. If a basic command that cannot carry <number> carries <number>, the TOO MANY PARAMETERS message will be returned.

A.2 S Register Command

All commands that begin with capital letter S are called S register command. The command format is as follows:

S<parameter number>?

S<parameter number>=<value>

The S register command name is composed of the capital letter S combined with a decimal number. This decimal number is called the register sequence number (that is, parameter number). If the parameter number is not identified, this command does not exist, and the COMMAND NOT SUPPORT message will be returned. Each S register saves a character. If the S resister command name is followed by the question mark (?), the command is a read command. If this command is executed, the ASCII value of the character currently saved in this S register will be returned. The ASCII values are presented by a 3-digit decimal number. If there are less than 3 digits, add 0s before the digits. If the command name is followed by the equal sign (=), the command is a set command. The character stored in this S register is replaced by the character corresponding to the value of **<value>**.

A.3 Extended Commands and Manufacturer-Defined Commands

A.3.1 Action Commands

The extended commands begin with the plus sign (+). The commands defined by manufacturers also begin with a special character, such as the dollar sign ($) and the percent (%). In this document, all commands defined by manufacturers begin with the caret (^). All

extended commands and manufacturer-defined commands are divided into two categories: action commands and parameter commands.

Action commands are the commands that are used to perform a specific action rather than only dealing with local parameters of the ME, such as **=AT+CMGS**. An action command may carry parameters or not. Action commands include execution and test commands.

A.3.1.1 Execution Command

The command format is as follows:

No parameter: <name>
With one parameter: <name>[=<value>]
With multiple parameters: <name>[=<compound_value>]

<compound_value> indicates multiple parameters which are separated by the comma (,). For the parameters that have default values, they can be omitted and their default values are used. If all the parameters are omitted, the equal sign (=) following **<name>** should be also omitted. If **<name>** is not identified, this command does not exist, and the COMMAND NOT SUPPORT message will be returned. If <**name**> is identifiable, and the command that cannot carry parameters carries parameters, or the number of parameters goes beyond the defined range, the TOO MANY PARAMETERS message will be returned.

A.3.1.2 Test Command

The command format is as follows:

<name>=?

If the ME cannot identify **<name>**, the COMMAND NOT SUPPORT message will be returned. If the ME can identify **<name>**, and the command does not carry any parameters, "OK" will be returned. If the command carries parameters, the value range of each parameter will be returned first, and then "OK" will be returned.

A.3.2 Parameter Commands

Parameter commands are the commands that can only be used to deal with the local parameters of the ME. These parameters may affect the execution of the action commands. Parameter commands include set, read and test commands.

- Set command

  The command format is as follows:
  - With one parameter: <name>[=<value>]
  - With multiple parameters: <name>[=<compound_value>]

  The set command is used to set the parameters.

- <**compound_value**> indicates multiple parameters which are separated by the comma (,). For the parameters that have default values, they can be omitted and their default values are used. If all the parameters are omitted, the equal sign (=) following **<name>** should be also omitted. If **<name>** is not identified, this command does not exist, and the COMMAND NOT SUPPORT message will be returned. If <**name**> is identifiable, and the command that cannot carry parameters carries parameters, or the number of parameters goes beyond the defined range, the TOO MANY PARAMETERS message will be returned. Read command

  The command format is as follows:

  <name>?

The read command is used to read the current value of a parameter.

- Test command

The command format is as follows:

<name>=?

If the ME cannot identify **<name>**, the COMMAND NOT SUPPORT message will be returned. If the ME can identify **<name>**, and the command does not carry any parameters, "OK" will be returned. If the command carries parameters, the value range of each parameter will be returned first, and then "OK" will be returned.

A.3.3 Abort Attribute

The abort attribute means that the TE sends an instruction to interrupt a command execution. The abort message must be delivered before the command execution is complete, and therefore only the commands that require a certain period of time to execute can be aborted. However, not all commands that require a certain period of time to execute can be aborted, depending on the abort attribute of the command. Each AT command has the abort attribute. This attribute is a two-option choice. Namely, some commands can be aborted and some cannot. The commands that can be aborted include some basic commands and the execution command of the action command. These commands do not accept any abort request within 125 ms after being delivered. After the command has been delivered for 125 ms but the execution has not been finished, any character received from the TE will interrupt the execution of the command immediately.

The commands that can be aborted are as follows:

AT+CLCK: can be aborted.

AT+COPS: can be aborted except at+**COPS=?**.

B Result Codes

This section describes the result codes of AT commands.

Result Code	Code	Remarks
OK	0	A command line is correctly executed.
CONNECT	1	The connection has been set up.
RING	2	There is an incoming call.
NO CARRIER	3	Connection is terminated.
ERROR	4	It is an ordinary error.
NO DIALTONE	6	There is no dial tone.
BUSY	7	The called party is busy.
NO ANSWER	8	Connection completion times out, and there is no answer.
+CME ERROR: <err>	-	The error type is specified by the **<err>** parameter.
+CMS ERROR: <err>	-	It is an SM-related error.
COMMAND NOT SUPPORT	No code is supported.	The delivered command is not supported.

Result Code	Code	Remarks
TOO MANY PARAMETERS	No code is supported.	There are too many parameters in the delivered command.

C CME Error List

This section describes the CME errors of AT commands.

Error Code	Error Type	Error Description
0	phone failure	The phone is faulty.
1	no connection to phone	There is no connection to the phone.
2	phone-adaptor link reserved	The adaptation link of the phone is occupied.
3	operation not allowed	The operation is not allowed.
4	operation not supported	The operation is not supported.
5	PH-SIM PIN required	The Phone to SIM/UICC card (PH-SIM) PIN needs to be entered.
6	PH-FSIM PIN required	The Phone to the very First inserted SIM/UICC card (PH-FSIM) PIN needs to be entered.
7	PH-FSIM PUK required	The PH-FSIM PUK needs to be entered.
10	SIM not inserted (Note)	There is no SIM card.
11	SIM PIN required	The SIM PIN needs to be entered.
12	SIM PUK required	The SIM PUK needs to be entered.
13	SIM failure	The SIM card is faulty.
14	SIM busy	The SIM card is busy.
15	SIM wrong	The SIM card is incorrect.
16	incorrect password	The password is incorrect.
17	SIM PIN2 required	The SIM PIN2 needs to be entered.

Error Code	Error Type	Error Description
18	SIM PUK2 required	The SIM PUK2 needs to be entered.
20	memory full	The memory is full.
21	invalid index	The index is invalid.
22	not found	It is not found.
23	memory failure	The memory fails to store items.
24	text string too long	The text is too long.
25	invalid characters in text string	There are invalid characters in the text.
26	dial string too long	The phone number is too long.
27	invalid characters in dial string	There are invalid characters in the number.
30	no network service	There is no network service.
31	network timeout	The network times out.
32	network not allowed - emergency calls only	The network only supports emergency calls.
40	network personalization PIN required	The network PIN needs to be entered.
41	network personalization PUK required	The network PUK needs to be entered.
42	network subset personalization PIN required	The network sub-PIN needs to be entered.
43	network subset personalization PUK required	The network sub-PUK needs to be entered.
44	service provider personalization PIN required	The service provider's PIN needs to be entered.
45	service provider personalization PUK required	The service provider's PUK needs to be entered.
46	corporate personalization PIN required	The card manufacturer's PIN needs to be entered.
47	corporate personalization PUK required	The card manufacturer's PUK needs to be entered.
48	hidden key required	This key is required when you access hidden phonebook entries.

Error Code	Error Type	Error Description
49	EAP method not supported	The Extensible Authentication Protocol (EAP) is not supported.
50	Incorrect parameters	The parameter is incorrect.
100	unknown	There is an unknown error.
103	Illegal MS	The MS is illegal.
106	Illegal ME	The ME is illegal.
107	GPRS services not allowed	The GPRS services are not allowed.
111	PLMN not allowed	The public land mobile network (PLMN) is not allowed.
112	Location area not allowed	This location area is not allowed.
113	Roaming not allowed in this location area	Roaming is not allowed in this location area.
132	service option not supported	The service type is not supported.
133	requested service option not subscribed	The requested service is not subscribed.
134	service option temporarily out of order	The service type is not available at present.
149	PDP authentication failure	The PDP context authentication fails.

D CMS Error List

This section describes the CMS errors of AT commands.

Error Code	Error Type	Error Description
0 to 127	3GPP TS 24.011 [6] clause E.2 values	For details, see section 6 in 3GPP TS 24.011.
128 to 255	3GPP TS 23.040 [3] clause 9.2.3.22 values	For details, see section 3 in 3GPP TS 24.011.
300	ME failure	The ME is faulty.
301	SMS service of ME reserved	The SM services of the ME are reserved.
302	operation not allowed	The operation is not allowed.
303	operation not supported	The operation is not supported.
304	invalid PDU mode parameter	The parameter in scenarios in which the PDU is used is invalid.
305	invalid text mode parameter	The parameter in scenarios in which the text is used is invalid.
310	(U)SIM not inserted	The SIM card is not inserted.
311	(U)SIM PIN required	The SIM PIN needs to be entered.
312	PH-(U)SIM PIN required	The PH-SIM PIN needs to be entered.
313	(U)SIM failure	The SIM card is faulty.
314	(U)SIM busy	The SIM card is busy.
315	(U)SIM wrong	The SIM card is incorrect.
316	(U)SIM PUK required	The SIM PUK needs to be entered.
317	(U)SIM PIN2 required	The SIM PIN2 needs to be entered.
318	U)SIM PUK2 required	The SIM PUK2 needs to be entered.

Error Code	Error Type	Error Description
320	memory failure	The memory is faulty.
321	invalid memory index	The memory index is invalid.
322	memory full	The memory is full.
330	SMSC address unknown	The address of the SMSC is unknown.
331	no network service	There is no network service.
332	network timeout	The network times out.
340	no +CNMA acknowledgement	There is no +CNMA acknowledgement.
500	unknown error	There is an unknown error.