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ASR6501/ASR6502 AT Command Introduction

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Aojie Technology (Shanghai) Co., Ltd.

ASR Microelectronics Co., Ltd

Revision History

Version Number	Modified Date	author	Modification Notes
V1.1	2018.06.21	Qipan Li	Initial Version
V2.0	2018.07.20	Qipan Li	Add AT commands
V3.0	2018.08.24	Ruilin Hao	Update
V3.1	2018.09.29	Ruilin Hao	Update
V4.0	2018.11.14	Ruilin Hao	Add some AT commands
V4.2	2019.03.05	Ruilin Hao	Modify some AT commands
V4.3	2019.07.01	Ao Ye	Modify some AT commands

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1scope

This standard specifies the AT command set for LoRa module communication in the field of Internet of Things. This standard is applicable to the configuration, operation, data transmission and reception of LoRa modules.

2 Terms, Definitions and Abbreviations

2.1Terms and Definitions

2.1.1LoRa

LoRayesLPWANOne of the communication technologies isSemtechThe company adopts and promotes an ultra-long-distance wireless transmission solution based on spread spectrum technology.LoRamainISM brandIt is in the global free frequency band:433MHz,470MHz,868MHz,915MHzwait.

Features: low power consumption, long distance, low cost.

2.1.2LoRaWAN

LoRaThe Alliance is2015Year3moonSemtechThe Alliance launched an open source, non-profit organization.MACLow-power wide area network standard based on layer protocol:LoRaWANProtocol standards.

Network topology: star structure

Network composition:LoRaModules, Gateways (Gatewayor base station),Server(includeNetwork Server,Network control,Application Server).

LoRaWANBundleLoRaModules are divided intoA/B/CThree categories.

2.2Abbreviations

The following abbreviations apply to this document.

Abbreviations	English full name	Chinese full name
MCU	Microcontroller Unit	Microcontroller unit
TA	Terminal Adaptor	Terminal adapter
TE	Terminal Equipment	Terminal equipment

3Overview

Terminal Equipment (TE) can control the functions of Mobile Terminal (MT) and related network services by sending AT commands described in this standard. Terminal Adaptor (TA) completes the command and message adaptation function between terminal equipment and mobile devices. The physical implementation of terminal equipment (TE), terminal adapter (TA) and mobile terminal (MT) can be as follows:

TE, TA and MT are three separate entities;

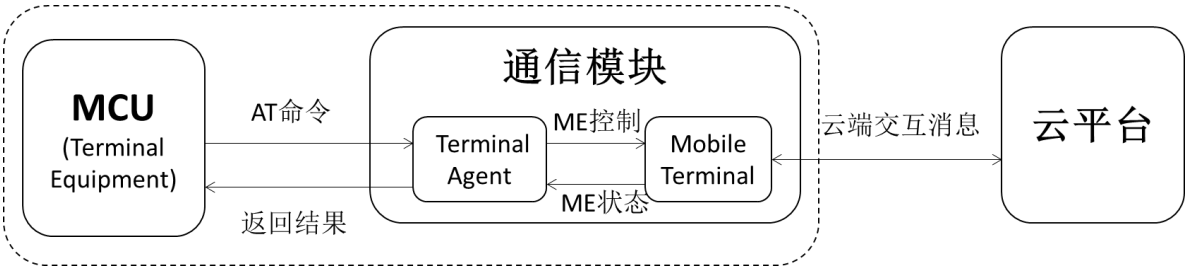
TE is an independent entity, and TA is integrated within MT;

MT is an independent entity, and TA is integrated within TE;

TE, TA and MT are integrated into one entity.

In this specification, TE is considered to be the MCU module of the IoT device, and TA is integrated inside MT and is considered to be the communication module. The communication module refers to the LoRa communication module.

The system structure of terminal equipment (TE), terminal adapter (TA) and mobile terminal (MT) and the basic process of establishing association between them are shown in Figure 1. The interface between the terminal equipment and the adapter can use serial cable, infrared and other methods.



picture1System structure diagram

As shown in FIG1 , the MCU module and the communication module are integrated into the IoT device. The MCU communicates with the TA through AT commands, thereby controlling the MT to realize the interaction between the IoT device and the cloud.

Since the interaction between IoT devices and the cloud is carried out through LoRa, in this specification, the standard AT commands are extended to support LoRa commands, etc., thereby realizing message interaction between IoT devices and the cloud.

4**ATCommand syntax**

AT commands use command lines based on ASCII code. The command format is as follows: Request message format: AT+<CMD>[OP][para-1,para-2,.....para-n]<\r>

sheet1 ATRequest message format

domain	illustrate
AT+	Command message prefix
CMD	Command string
Op	Instruction operator. It can be the following: ✓ "=": Indicates parameter settings. ✓ "?": Indicates the current value of the query parameter. ✓ "": Indicates execution of instructions. ✓ "=?": Indicates the parameters of the query setting instruction.
para-1,para-2,..... para-n	Indicates the parameter value to be set, or specifies the parameter to be queried
\r	Carriage return character, ASCII code is 0x0D

The response message format is: <\r\n>[+CMD:][para-1,para-2,.....para-n]<\r\n>
or: <\r\n><STATUS><\r\n>
Or both.

sheet2 ATResponse message format

domain	illustrate
\n	Newline character, ASCII code is 0x0A
+ CMD	The corresponding command string
para-1,para-2,..... para-n	The corresponding parameter string
STATUS	Instruction execution status. It can be the following: ✓ ""OK": indicates that the command was executed successfully. ✓ ""ERROR": indicates that the command execution failed.

	✓ "+"CME ERROR: <err>": indicates that the command execution failed and returns the corresponding error code.

Note:

- <>: Indicates content that must be included.
- [ ]: Indicates optional content.
- \r: carriage return character, ASCII code is 0x0D
- \n: line feed character, ASCII code is 0x0A.

For example, to query the connection mode of MQTT, send the command:

AT+IMQTTMODE?\r

The reply message is:

\r\n+IMQTTMODE:1\r\n

\r\nOK\r\n

In the following text, \r\n is hidden for ease of reading.

- Serial port parameter configuration: baud rate 115200, data bits 8, stop bit 1, parity bit 0.
- The current command supports echoing, but does not support BackSpace or scrolling back through history commands.

5 LoRa ATinstruction

5.1 Command Classification

LoRa's AT commands are classified as follows:

sheet3 LoRaofATInstruction classification

Classification	describe	Remark
General commands	Manufacturer ID, module ID, version ID, product ID Serial number identification;	General commands.
Network-related parameter configuration commands	Band mask, multicast address, same frequency/different frequency, device DevEUI;	Network related parameters config commands
Control and status commands	Initiate Join, working mode, Class, Battery capacity, module status;	Node control and status commands
MAC Configuration Commands	Related to MAC instructions in LoRaWAN protocol;	MAC config commands
Data sending and receiving commands	Data sending and receiving;	Data commands
Other commands	Log level, restart module, restore to factory settings;	
Manufacturer's private commands	LoRa manufacturer private instructions;	Manufacture private commands

5.1.1 General Commands Overview

sheet4 LoRaWANGeneral instruction set

Order	describe	Implementation
AT+CGMI	Read manufacturer identification	Optional
AT+CGMM	Reading model identification	Optional
AT+CGMR	Read the revision identification	Optional

AT+CGSN	Read product serial number identification)	Optional
AT+CGBR	Set the baud rate on UART interface	Optional

5.1.2**Overview of network-related parameter configuration commands**

sheet5 LoRaWANNetwork related parameter configuration instruction set

Order	describe	Implementation
AT+CJOINMODE	Set read Join mode (OTAA, ABP)	Required
AT+CDEVEUI	Set to read DevEUI (when OTAA accesses the network)	Required
AT+CAPPEUI	Set to read AppEUI (when OTAA accesses the network)	Required
AT+CAPPKEY	Set to read AppKey (when OTAA accesses the network)	Required
AT+CDEVADDR	Set to read DevAddr (when ABP is connected to the network)	Required
AT+CAPPSKEY	Set to read AppSkey (when ABP accesses the network)	Required
AT+CNWKSKEY	Set to read NwkSkey (when ABP joins the network)	Required
AT+CFREQBANDMASK	Set the frequency mask to read (FreqBandMask)	Required
AT+CULDLMODE	Set the reading UI/DI mode (same frequency or different frequency)	Required
AT+CADDMUTICAST	Add a multicast address	Optional
AT+CDELMUTICAST	Delete a multicast address	Optional
AT+CNUMMUTICAST	Query the number of multicast	Optional

5.1.3**Overview of Control and Status Commands**

sheet6 LoRaWANControl and status instruction set

Order	describe	Implementation
AT+CWORKMODE	Set the read working mode (normal working mode)	Required
AT+CCLASS	Set the read class type (Class A/B/C)	Required
AT+CBL	Reading the battery level	Optional
AT+CSTATUS	Reading node status	Required
AT+CJOIN	Initiate OTAA network access	Required
AT+CPINGSLOTINFOREQ	Initiate a pingslot info request	Optional

5.1.4**Data sending and receiving command overview**

sheet7 LoRaWANData transmission and reception instruction set

Order	describe	Implementation
AT+DTRX	Send and receive data frames	Required
AT+DRX	Get the latest received data from the Rx buffer and clear the Rx buffer	Required

5.1.5**MACConfiguration Command Overview**

sheet8 LoRaWANofMACConfiguration Instruction Set

Order	describe	Implementation
AT+CCONFIRM	Set the type of message sent (confirm or unconfirm)	Required
AT+CAPPPORT	Set the application layer port	Required
AT+CDATARATE	Set the read data rate	Required

AT+CRSSI	Get the RSSI value of the channel	Required
AT+CNBTRIALS	Set the parameters for reading NbTrans	Required
AT+CRM	Set the read report mode	Required
AT+CTXP	Set the read transmit power	Required
AT+CLINKCHECK	Enable Link Check	Required
AT+CADR	Enable or disable ADR	Required
AT+CRXP	Set the read receive window parameters	Required
AT+CRX1DELAY	Set the delay for reading TX and RX1	Required
AT+CSAVE	Save Configuration	Required
AT+CRESTORE	Restore default configuration	Required

5.1.6**Overview of other commands**

sheet9otherATInstruction Set

Order	describe	Implementation
AT+IREBOOT	Restart the communication module	Optional
AT+ILOGLVL	Set the log level	Optional

5.1.7**Private Commands Overview**

sheet10privateATInstruction Set

Order	describe	Implementation
AT+CLPM	Enable Low Power Command	
AT+CKEYSPROTECT	Device key encryption command	
AT+CSLEEP	Low power test command	
AT+CMCU	Low power test command	
AT+CSTDBY	Low power test command	
AT+CRXS	LORA test command	
AT+CRX	LORA test command	
AT+CTX	LORA test command	
AT+CTXCW	LORA test command	

5.2**ATFormat**

5.2.1**Read manufacturer identification +CGMI**

sheet11Read the manufacturer's logo

Command Type	Format	response
Query Command	AT+CGMI?	+ CGMI=<manufacturer> OK
Parameter Description Return value description	<manufacturer>: manufacturer's logo	

Example	AT+CGMI? + CGMI=ASR OK
Precautions	

5.2.2**Read module ID +CGMM**

sheet12Read module ID

Command Type	Format	response
Query Command	AT+CGMM?	+ CGMM=<model> OK
Parameter Description Return value description	<model>: module identifier	
Example	AT+CGMM? + CGMM=6501 OK	
Precautions		

5.2.3**Read version ID +CGMR**

sheet13Read the version identifier

Command Type	Format	response
Query Command	AT+CGMR?	+ CGMR=<revision> OK
Parameter Description Return value description	<revision>: version identifier	
Example	AT+CGMR? + CGMR=v4.2 OK	
Precautions		

5.2.4**Read product serial number identification +CGSN**

sheet14Read the version identifier

Command Type	Format	response
Query Command	AT+CGSN?	+ CGMR=<sn> OK
Parameter Description Return value description	<sn>: Product serial number identification	
Example	AT+CGSN? + CGSN=0539349E00032523 OK	

Precautions	

5.2.5**Set Baud Rate +CGBR**

sheet15Read the version identifier

Command Type	Format	response
Query Command	AT+CGBR?	+ CGBR=<baud> OK
Setting Commands	AT+CGBR=<baud>	OK
Parameter Description Return value description	<baud>: baud rate	
Example	AT+CGBR=9600 OK	
Precautions		

5.2.6**set upJoinMethod +CJOINMODE**

sheet16set upJoinWay

Command Type	Format	response
Test Command	AT+CJOINMODE=?	+ CJOINMODE:“mode” OK
Query Command	AT+CJOINMODE?	+ CJOINMODE:<mode> OK
Execute Command	AT+CJOINMODE=<mode>	OK or + CME ERROR:<err>
Parameter Description Return value description	<mode>: Node Join mode, as follows. 0: OTAA 1: ABP <err>: error code.	
Example	AT+CJOINMODE=0 OK	
Precautions	The default method is OTAA; If you need to use ABP network access, please use this command to set it before sending data.	

5.2.7**set upDevEUI + CDEVEUI**

sheet17QueryDevEUI

Command Type	Format	response
Test Command	AT+CDEVEUI=?	+ CDEVEUI=<DevEUI:length is 16>
Query Command	AT+CDEVEUI?	+ CDEVEUI:<value> OK
Execute Command	AT+CDEVEUI=<value>	OK or

		+ CME ERROR:<err>
Parameter Description	<value>: node DevEUI	
Return value description		
Example	AT+CDEVEUI? + CDEVEUI=AABBCCDD00112233 OK	
Precautions	Set or read DevEUI, return Y1Y2...Y8, hexadecimal format, 8 bytes.	

5.2.8**set upAppEUI +CAPPEUI**

sheet18set upAppEUI

Command Type	Format	response
Test Command	AT+CAPPEUI=?	+ CAPPEUI=<AppEUI:length is 16>
Query Command	AT+CAPPEUI?	+ CAPPEUI:<value> OK
Execute Command	AT+CAPPEUI=<value>	OK or + CME ERROR:<err>
Parameter Description	<value>: node AppEUI <err>: error code.	
Return value description		
Example	AT+CAPPEUI=AABBCCDD00112233 OK	
Precautions	Used for OTAA, set or read AppEUI, return Y1Y2...Y8, hexadecimal format, 8 bytes.	

5.2.9**set upAppKey +CAPPKEY**

sheet19set upAppKey

Command Type	Format	response
Test Command	AT+CAPPKEY=?	+ CAPPKEY=<AppKey:length is 32>
Query Command	AT+CAPPKEY?	+ CAPPKEY:<value> OK
Execute Command	AT+CAPPKEY=<value>	OK or + CME ERROR:<err>
Parameter Description	<value>: Node AppKey <err>: error code.	
Return value description		
Example	AT+CAPPKEY=AABBCCDD00112233AABBCCDD00112233 OK	
Precautions	Used for OTAA, set or read AppKey, return Y1Y2...Y16, hexadecimal format, 16 bytes.	

5.2.10**set upDevAddr +CDEVADDR**

sheet20set upDevAddr

Command Type	Format	response
Test Command	AT+CDEVADDR=?	+ CDEVADDR=<DevAddr:length is 8，Device address of ABP mode>

Query Command	AT+CDEVADDR?	+CDEVADDR:<value> OK
Execute Command	AT+CDEVADDR=<value>	OK or + CME ERROR:<err>
Parameter Description	<value>: Node DevAddr <err>: error code.	
Return value description		
Example	AT+CDEVADDR=00112233 OK	
Precautions	Used when ABP, set or read DevAddr, return Y1Y2...Y4, hexadecimal format, 4 bytes.	

5.2.11**set upAppSKey +CAPPSKEY**

sheettwenty oneset upAppSKey

Command Type	Format	response
Test Command	AT+CAPPSKEY=?	+ CAPPSKEY=<AppSKey:length is 32>
Query Command	AT+CAPPSKEY?	+ CAPPSKEY:<value> OK
Execute Command	AT+CAPPSKEY=<value>	OK or + CME ERROR:<err>
Parameter Description	<value>: Node AppSKey <err>: error code.	
Return value description		
Example	AT+CAPPSKEY=AABBCCDD00112233AABBCCDD00112233 OK	
Precautions	Used when using ABP, set or read AppSKey, return Y1Y2...Y16, hexadecimal format, 16 bytes.	

5.2.12**set upNwkSKey +CNWKSKEY**

sheettwenty twoset upNwkSKey

Command Type	Format	response
Test Command	AT+CNWKSKEY=?	+ CNWKSKEY =<NwkSKey:length is 32>
Query Command	AT+CNWKSKEY?	+ CNWKSKEY:<value> OK
Execute Command	AT+CNWKSKEY=<value>	OK or + CME ERROR:<err>
Parameter Description	<value>: Node NwkSKey <err>: error code.	
Return value description		
Example	AT+CNWKSKEY=AABBCCDD00112233AABBCCDD00112233 OK	
Precautions	Used in ABP, set or read NwkSKey, return Y1Y2...Y16, hexadecimal format, 16 bytes.	

5.2.13**Set Band Mask +CFREQBANDMASK**

sheettwenty threeSet the frequency band mask

Command Type	Format	response
Test Command	AT+CFREQBANDMASK=?	+ CFREQBANDMASK:“mask” OK
Query Command	AT+CFREQBANDMASK?	+ CFREQBANDMASK:<mask> OK
Execute Command	AT+CFREQBANDMASK=<mask>	OK or + CME ERROR:<err>
Parameter Description Return value description	<mask>: The frequency mask that the network may work on, 16 bits correspond to 16 frequency groups, see the LoRaWAN access specification for details. For example: 0-7 channels correspond to a mask of 0001, 8-15 channels correspond to a mask of 0002, and so on. The frequencies corresponding to specific channels need to be checked in the region protocol. For example, channels 0-7 in CN470 correspond to: 470.3MHz, 470.5MHz, 470.7MHz, 470.9MHz, 471.1MHz, 471.3MHz, 471.5MHz, 471.7MHz. <err>: error code.	
Example	AT+CFREQBANDMASK=0001 OK	
Precautions	Need to be set before Join.	

5.2.14**Set the uplink and downlink frequencies to be the same or different.CULDLMODE**

sheettwenty fourSet the uplink and downlink frequencies to be the same or different

Command Type	Format	response
Test Command	AT+CULDLMODE=?	+ CULDLMODE: "mode" OK
Query Command	AT+CULDLMODE?	+ CULDLMODE:<mode> OK
Execute Command	AT+CULDLMODE=<mode>	OK or + CME ERROR:<err>
Parameter Description	<mode>: as follows.	
Return value description	1: Same frequency mode 2: Different frequency mode <err>: error code.	
Example	AT+CULDLMODE=2 OK	
Precautions	Need to be set before Join. (In SDK3.0 and earlier versions, because LinkWan has requirements for the DEVEUI of heterogeneous nodes, the problem of setting heterogeneous mode failure may occur. This limitation is lifted after SDK4.0)	

5.2.15**Set working mode +CWORKMODE**

sheet25Set the working mode

Command Type	Format	response
Test Command	AT+CWORKMODE=?	+ CWORKMODE:“mode”

Query Command	AT+CWORKMODE?	+ CWORKMODE:<mode> OK
Execute Command	AT+CWORKMODE=<mode>	OK or + CME ERROR:<err>
Parameter Description	<mode>: as follows.	
Return value description	2: Normal working mode <err>: error code.	
Example	AT+CWORKMODE=2 OK	
Precautions	Need to be set before Join, the default is normal working mode. Currently only supports normal working mode	

5.2.16**set upClass +CCLASS**

sheet26set upClass

Command Type	Format	response
Test Command	AT+CCLASS=?	+ CCLASS: "class", "branch", "para1", "para2", "para3", "para4" OK
Query Command	AT+CCLASS?	+ CCLASS:<class> OK
Execute Command	AT+CCLASS=<class> ,[branch], [para1], [para2], [para3], [para4]	OK or + CME ERROR:<err>
Parameter Description	<class>: as follows.	
Return value description	0: classA 1: classB 2: classC Depending on the device type, the following optional parameters are available: If class=1 and branch=0, only the para1 parameter is used to set the Ping slot periodicity, ranging from 0 to 7, and the corresponding actual cycle time is 0.96*2 periodicity seconds; If class=1, and branch=1, then: para1 sets the beacon frequency in Hz; para2 sets beacon DataRate, para3 sets ping frequency in Hz; para4 sets the ping DataRate. For the value range of each parameter, please refer to the LoRaWAN access specification. <err>: error code.	
Example	AT+CCLASS=2 OK	
Precautions	It needs to be set before Join, and the default value is ClassA.	

5.2.17**Query device power level +CBL**

sheet27Query the device power level

Command Type	Format	response
Test Command	AT+CBL=?	+ CBL: "value" OK
Query Command	AT+CBL?	+ CBL:<value> OK
Parameter Description Return value description	<value>: Node power level, the range is defined in the LoRaWAN protocol.	
Example	AT+CBL? + CBL=100 OK	
Precautions	Query the device power level.	

5.2.18**Query the current status of the device +CSTATUS**

sheet28Query the current status of the device

Command Type	Format	response
Test Command	AT+CSTATUS=?	+ CSTATUS:"status" OK
Query Command	AT+CSTATUS?	+ CSTATUS:<status> OK
Parameter Description	<status>: is defined as follows.	
Return value description	Current uplink results 00 – No data operation 01 – Data sending 02 – Data sending failed 03 – Data sent successfully 04 – JOIN success (only occurs during the first JOIN process) 05 – JOIN failure (only occurs during the first JOIN process) 06 – The network may be abnormal (Link Check result) 07 – Data is sent successfully, no downlink 08 – Data sent successfully, downlink	
Example	AT+CSTATUS? + CSTATUS=03 OK	
Precautions	Query the current status of the device.	

5.2.19**set upJoin + CJOIN**

sheet29set upJoin

Command Type	Format	response
Test Command	AT+CJOIN=?	+ CJOIN:<ParaTag1>,[ParaTag2],...[ParaTag4]

		OK
Query Command	AT+CJOIN?	+ CJOIN:<ParaValue1>,[ParaValue2],...[ParaValue4] OK
Execute Command	AT+CJOIN =<ParaValue1>,[ParaValue2],...[ParaValue4]	OK or + CME ERROR:<err> If the input is legal, it will first return OK and then start automatic authentication. The authentication result is returned. + CJOIN:OK Authentication successful + CJOIN:FAIL Authentication failed
Parameter Description Return value description	<ParaTag1>, [ParaTag2], ... [ParaTag4]: the names of authentication parameters 1, 2, ... 4; [ParaValue1], [ParaValue2], ... [ParaValue4]: the values of authentication parameters 1, 2, ... 4; ParaTag1 indicates the execution of a JOIN operation. The value range of ParaTag1 is: 0 – Stop JOIN 1 – Start JOIN, restart the JOIN process. For modules that enable hot start, executing this operation will clear the saved JOIN context parameters. ParaTag2 indicates whether the automatic JOIN function is enabled. The factory value is 1, and the value range of ParaTag2 is: 0 – Disable automatic JOIN 1 - Automatic JOIN. After the module enters transparent transmission mode, JOIN is automatically started. ParaTag3 represents the JOIN cycle, X3 value range: 7~255, unit is s. Factory default value: 8. ParaTag4 indicates the maximum number of JOIN attempts. The value range of ParaTag4 is 1 to 256. For details, see the access specification. <err>: error code.	
Example	AT+CJOIN=1,0,10,8 (Set JOIN parameters: turn off automatic JOIN, JOIN cycle is 10s, maximum number of attempts is 8 times) OK + CJOIN:OK	
Precautions		

5.2.20**Send and receive data +DTRX**

sheet30Sending and receiving data

Command Type	Format	response
Test Command	AT+DTRX=?	+ DTRX:[confirm],[nbtrials],<Length>,<Payload> OK
Execute Command	AT+DTRX=[confirm],[nbtrials],<Length>,<Payload>	OK+SEND:TX_LEN OK+SENT:TX_CNT OK+RECV:TYPE,PORT,LEN,DATA or ERR+SEND:ERR_NUM ERR+SENT:TX_CNT or + CME ERROR:<err>

Parameter Description	For confirm and nbtrials, please refer to the corresponding AT commands, which are only valid for this sending and are optional.
Return value description	Length: indicates the number of strings; see the access specification for the maximum value; the byte lengths allowed to be transmitted at different rates are different (see the LoRaWan protocol for details), and 0 means sending an empty data packet. Payload: Hexadecimal (2 characters represent 1 number); Return value: 1. How to determine whether data sending is successful? Confirm type data: Each time a frame of data is sent, there should be a corresponding response message. If the module times out and does not receive a response message, If the maximum number of times is reached, it will retry again. If the maximum number of times is reached and no downlink message is received, it will fail and output the ERR+SENT message. During this period, if a response message is received and the transmission ends, it will succeed and output the OK+SEND, OK+SENT and OK+RECV messages. Unconfirm type data: After sending data, no downlink response is requested. At the end of each transmission, an OK+SEND or OK+SENT message is returned. If downlink data is received, an OK+RECV message is sent. 2. Data sending status prompt OK+SEND: TX_LEN means data sending request is successful, TX_LEN: 1Byte, length of data sent OK+SENT: TX_CNT means data sending is successful, TX_CNT: 1Byte, number of data sending times. ERR+SEND:ERR_NUM indicates that the data sending request failed, and the reason is indicated by ERR_NUM. ERR_NUM: 1 Byte, 0- Not connected to the network 1- Communication is busy, and the request failed to be sent. 2- The data length exceeds the current sendable length, only send MAC command ERR+SENT:TX_CNT indicates data transmission failure, the number of transmissions reaches the maximum number, TX_CNT: 1Byte, the number of data transmissions. OK+RECV:TYPE,PORT,LEN,DATA Data received successfully (received response message or active downlink data) TYPE: 1Byte, downlink transmission type Bit0: 0-unconfirm, 1-confirm Bit1: 0-non-ACK, 1-ACK Bit2: 0- not carried, 1- carried, indicating whether the downlink data carries the LINK command response. Bit3: 0- not carried, 1- carried, indicating whether the downlink data carries the TIME command response. Only when this bit is 1 does it mean that the time synchronization is successful. Bit4~Bit7: Default 0, reserved PORT: 1 Byte, downstream transmission port LEN: 1 Byte, downlink data length DATA: nByte, downstream data. When LEN=0, this field does not exist. <err>: error code.
Example	AT+DTRX=1,2,5,0123456789 OK+SEND:05 OK+SENT:01

	OK+RECV:02,01,00 It indicates that the confirm data is sent successfully. The valid data received by the server should be "0x01 0x23 0x45 0x67 0x89", and the downlink confirmation is received.
Precautions	First access the network, then send data.

5.2.21**Receive Data +DRX**

sheet31Receiving Data

Command Type	Format	response
Test Command	AT+DRX=?	+ DRX:<Length>,<Payload> OK
Query Command	AT+DRX?	+ DRX:<Length>,<Payload> OK or + CME ERROR:<err>
Parameter Description Return value description	Return value: Length: 0 indicates an empty data packet; Payload: hexadecimal string data; OK: No abnormality in receiving data packets; <err>: error code.	
Example	AT+DRX? OK	
Precautions	Receive data packets from the receive buffer and clear the receive buffer;	

5.2.22**Set uplink transmission type +CCONFIRM**

sheet32Set the uplink transmission type

Command Type	Format	response
Test Command	AT+CCONFIRM=?	+ CCONFIRM:“value” OK
Query Command	AT+CCONFIRM?	+ CCONFIRM:<value> OK
Execute Command	AT+CCONFIRM =<value>	OK or + CME ERROR:<err>
Parameter Description Return value description	<value>: as follows. 0: UnConfirmed up message 1: Confirmed up message <err>: error code.	
Example	AT+CCONFIRM=1 OK	
Precautions	Need to be set before sending data.	

5.2.23**Set the uplink data port number +CAPPPORT**

sheet33Set the uplink data port number

Command Type	Format	response
Test Command	AT+CAPPPORT=?	+ CAPPPORT: "value" OK
Query Command	AT+CAPPPORT?	+ CAPPPORT:<value> OK
Execute Command	AT+CAPPPORT=<value>	OK or + CME ERROR:<err>
Parameter Description	<value>: as follows.	
Return value description	The port used, the data format is decimal, the factory value is 10. Value range: 1~223; Note 1: Port: 0x00 is the MAC command of LoRaWAN <err>: error code.	
Example	AT+CAPPPORT=10 OK	
Precautions	Need to be set before sending data.	

5.2.24**Set the communication rate +CDATARATE**

sheet34Set the communication rate

Command Type	Format	response
Test Command	AT+CDATARATE=?	+ CDATARATE:“value” OK
Query Command	AT+CDATARATE?	+ CDATARATE:<value> OK
Execute Command	AT+CDATARATE=<value>	OK or + CME ERROR:<err>
Parameter Description	<value>: as follows.	
Return value description	Rate value, factory value is 3, value range: 0 - SF12, BW125 1 - SF11, BW125 2 - SF10, BW125 3 - SF9, BW125 4 - SF8, BW125 5 - SF7, BW125 <err>: error code.	
Example	AT+CDATARATE=1 OK	
Precautions	Need to be set before sending data.	

	Because ADR is enabled by default, DATARATE cannot be changed. To change DATARATE, please execute AT+CADR=0 first.

5.2.25**Query channel signal strength +CRSSI**

sheet35Query channel signal strength

Command Type	Format	response
Test Command	AT+CRSSI=?	+ CRSSI OK
Query Command	AT+CRSSI FREQBANDIDX?	+ CRSSI: 0:<Channel 0 rssi> 1:<Channel 1 rssi> ... 15:<Channel 8 rssi> OK
Parameter Description	<FREQBANDIDX>: Indicates the frequency band number, starting from 0, and the 1A2 group is numbered 1.	
Return value description	Returns the RSSI of 8 channels in a frequency band.	
Example	AT+CRSSI 1? + CRSSI: 0:-157 1:-157 2:-157 3:-157 4:-157 5:-157 6:-157 7:-157 OK	
Precautions		

5.2.26**Set the number of times to send +CNBTRIALS**

sheet36Set the number of times to send

Command Type	Format	response
Test Command	AT+CNBTRIALS=?	+ CNBTRIALS: “MType”,“value” OK
Query Command	AT+CNBTRIALS?	+ CNBTRIALS:<MType>,<value> OK
Execute Command	AT+CNBTRIALS=<MType>,<value>	OK or + CME ERROR:<err>
Parameter Description	<MType>: 0: unconfirm package, 1: confirm package. <value>: the maximum	
Return value description	number of times to send, the value range is 1~15. For the default value, please refer to the access specification. <err>: error code.	

Example	AT+CNBTRIALS=1,2 OK
Precautions	Need to be set before sending data.

5.2.27**Set reporting mode +CRM**

sheet37Set the reporting mode

Command Type	Format	response
Test Command	AT+CRM=?	+ CRM:"reportMode","reportInterval" OK
Query Command	AT+CRM?	+ CTXP:<reportMode>,[reportInterval] OK
Execute Command	AT+CTXP=<reportMode>,[reportInterval]	OK or + CME ERROR:<err>
Parameter Description Return value description	This command is mainly used for testing purposes. <reportMode>: 0- Non-periodic reporting of data; 1- Periodic reporting of data; <reportInterval>: This parameter is only available when periodic data reporting is performed. The time interval for periodic data reporting, unit:sFor differentDRThe minimum period allowed is different and is defined by the period level, as shown in the following table. Rate\Period(s)\	
Example	AT+CRM=1,10 OK	
Precautions	Need to be set before sending data.	

grade	LV1	LV2
DR0	150	300
DR1	75	150
DR2	35	70
DR3	15	30
DR4	10	20
DR5	5	10

<err>: error code.

5.2.28**Set transmit power +CTXP**

sheet38Set the transmit power

Command Type	Format	response
Test Command	AT+CTXP=?	+ CTXP:“value” OK
Query Command	AT+CTXP?	+ CTXP:<value> OK
Execute Command	AT+CTXP=<value>	OK

		or + CME ERROR:<err>
Parameter Description	<value>: The sending power, the factory value is 0.	
Return value description	The actual value range depends on the specific product model. The value range of CN470A is: 0 - 17dBm 1 - 15dBm 2 - 13dBm 3 - 11dBm 4 - 9dBm 5 - 7dBm 6 - 5dBm 7 - 3dBm <err>: error code.	
Example	AT+CTXP=1 OK	
Precautions	Need to be set before sending data.	

5.2.29**Verify Network Connection +CLINKCHECK**

sheet39Verify network connectivity

Command Type	Format	response
Test Command	AT+CLINKCHECK=?	+ CLINKCHECK:“value” OK
Execute Command	AT+CLINKCHECK=<value>	OK or + CME ERROR:<err>
Parameter Description	<value>: Link Check enable control 0	
Return value description	– Disable Link Check 1 – Perform a Link Check 2 - The module automatically carries the linkcheck command in each uplink data packet. Return OK, the setting is successful. If X1=1, after a period of time, the second response message will be returned in the following format: + CLINKCHECK:Y0, Y1, Y2, Y3, Y4 YO indicates the Link Check result: ● 0 - Indicates that the Link Check was executed successfully ● Non-zero - indicates that the Link Check execution failed. Y1 is DemodMargin Y2 for NbGateways Y3 is the RSSI of this downlink Y4 is the SNR of this downlink <err>: error code.	
Example	AT+CLINKCHECK=1 OK +CLINKCHECK: 0, 0, 1, -68, 8	

Precautions	Need to be set before sending data.

5.2.30**EnableADR +CADR**

sheet40EnableADR

Command Type	Format	response
Test Command	AT+CADR=?	+ CADR: "value" OK
Query Command	AT+CADR?	+ CADR:<value> OK
Execute Command	AT+CADR=<value>	OK or + CME ERROR:<err>
Parameter Description	<value>: as follows.	
Return value description	ADR enable control, factory value is 1 0 - ADR is disabled 1 - ADR enabled <err>: error code.	
Example	AT+CADR=1 OK	
Precautions	Need to set before sending data. ADR is enabled by default.	

5.2.31**Set receive window parameters +CRXP**

sheet41Set receive window parameters

Command Type	Format	response
Test Command	AT+CRXP=?	+ CRXP: "RX1DRoffest", "RX2DataRate", "RX2Frequency" ” OK
Query Command	AT+CRXP?	+ CRXP:<RX1DRoffest>,<RX2DataRate>,<RX2Frequenc y> OK
Execute Command	AT+CRXP=<RX1DRoffest>,<RX2DataRat e>,<RX2Frequency>	OK or + CME ERROR:<err>
Parameter Description	For details about <RX1DRoffest>, <RX2DataRate>, and <RX2Frequency>, please refer to the LoRaWAN protocol.	
Return value description	<err>: error code.	
Example	AT+CRXP=1,1,471000000 OK	
Precautions	Need to be set before sending data. Do not set the default value.	

5.2.32**Set the sending and receiving delay +CRX1DELAY**

sheet42set upRx1Latency

Command Type	Format	response
Test Command	AT+CRX1DELAY=?	+ CRX1DELAY: "Delay"

		OK
Query Command	AT+CRX1DELAY?	+ CRX1DELAY:<Delay> OK
Execute Command	AT+CRX1DELAY=<Delay>	OK or + CME ERROR:<err>
Parameter Description	Delay: How long to open the RX1 window after sending,	
Return value description	unit: s; <err>: error code.	
Example	AT+CRX1DELAY=2 OK	
Precautions	Set how long to open the RX1 window after sending. Set it before sending data. If not set, it will be the default value of the protocol.	

5.2.33**saveMACParameter Settings +CSAVE**

sheet43saveMACParameter settings

Command Type	Format	response
Test Command	AT+CSAVE=?	+ CSAVE OK
Execute Command	AT+CSAVE	OK or + CME ERROR:<err>
Parameter Description	This command saves the configuration parameters to EERPOM/FLASH. After restarting, the module will use the new MAC configuration parameters for network initialization and	
Return value description	operation. <err>: error code.	
Example	AT+CSAVE OK	
Precautions	The data needs to be saved before it is sent.	

5.2.34**recoverMACDefault Parameters +CRESTORE**

sheet44recoverMACDefault Parameters

Command Type	Format	response
Test Command	AT+CRESTORE=?	+ CRESTORE OK
Execute Command	AT+CRESTORE	OK or + CME ERROR:<err>
Parameter Description	This command restores the default MAC configuration parameters to EERPOM/	
Return value description	FLASH. <err>: error code.	
Example	AT+CRESTORE OK	
Precautions	The data needs to be saved before it is sent.	

5.2.35**PingSlotInfoRequest +CPINGSLOTINFOREQ**

sheet45 PingSlotInfoask

Command Type	Format	response
Test Command	AT+CPINGSLOTINFOREQ=?	+ CPINGSLOTINFOREQ:<periodicity> OK
Query Command	AT+CPINGSLOTINFOREQ?	+ CPINGSLOTINFOREQ:<periodicity> OK
Execute Command	AT+CPINGSLOTINFOREQ=<periodicity>	OK or + CME ERROR:<err>
Parameter Description	periodicity: ping slot period parameter <err>: error code.	
Return value description		
Example	AT+CPINGSLOTINFOREQ=3 OK	
Precautions	ClassB dedicated instructions	

5.2.36**Add multicast address +CADDMUTICAST**

sheet46Add multicast address

Command Type	Format	response
Test Command	AT+CADDMUTICAST=?	+ CADDMUTICAST:"DevAddr","AppSKey","NwkSKey","Periodicity", OK
Execute Command	AT+CADDMUTICAST=<DevAddr>,<AppSKey>,<NwkSKey>,[Periodicity],[Datarate]	OK or + CME ERROR:<err>
Parameter Description	DevAddr: multicast address AppSKey: Multicast application session key NwkSKey: Multicast network session key Periodicity: Ping slot period parameter Datarate: Data rate <err>: error code.	
Return value description		
Example	AT+CADDMUTICAST=67678d5e,5ac8eb2016f11f19ad19d7f530592c44, 59543069010279fa7317f85f47c46926, 2, 2 OK	
Precautions	Please set before JOIN	

5.2.37**Delete multicast address +CDELMUTICAST**

sheet47Deleting a multicast address

Command Type	Format	response
Test Command	AT+CDELMUTICAST=?	+ CDELMUTICAST:"DevAddr" OK
Execute Command	AT+CDELMUTICAST=<DevAddr>	OK or + CME ERROR:<err>

Parameter Description	DevAddr: multicast address
Return value description	<err>: error code.
Example	AT+CDELMUTICAST=67678d5e OK
Precautions	

5.2.38**Query the number of multicasts +CNUMMUTICAST**

sheet48Query the number of multicast

Command Type	Format	response
Test Command	AT+CNUMMUTICAST=?	+ CNUMMUTICAST:"number" OK
Query Command	AT+CNUMMUTICAST?	+ CNUMMUTICAST:<number> OK
Parameter Description		
Return value description		
Example	AT+CNUMMUTICAST? + CNUMMUTICAST:0 OK	
Precautions		

5.2.39**Restart Module +IREBOOT**

sheet49Restart module

Command Type	Format	response
Test Command	AT+IREBOOT=?	+ IREBOOT:"Mode" OK
Execute Command	AT+IREBOOT=<mode>	OK or + CME ERROR:<err>
Parameter Description	<mode>: restart mode; 0: Restart the communication module immediately. 1: Wait for the wireless frame currently being sent in the communication module to complete before 7: restarting. Restart to enter the bootloader <err>: error code.	
Return value description		
Example	AT+IREBOOT=1 OK	
Precautions	After receiving the command, the communication module replies OK and restarts the communication module. Before the restart is completed, no subsequent AT commands will be received.	

5.2.40**Set log level +ILOGLVL**

sheet50Set the log level

Command Type	Format	response
Test Command	AT+ILOGLVL=?	+ ILOGLVL: "level" OK
Query Command	AT+ILOGLVL?	+ ILOGLVL:<level> OK
Execute Command	AT+ILOGLVL=<level>	OK or + CME ERROR:<err>
Parameter Description	<level>: log level;	
Return value description	0: Disable logging information. 1~5: Enable log information. The larger the number, the more detailed the log information. <err>: error code.	
Example	AT+ILOGLVL=1 OK	
Precautions		

5.2.41**Encrypted Device Key +CKEYSPROTECT**

sheet51set upNwkSKey

Command Type	Format	response
Test Command	AT+CKEYSPROTECT=?	+ CKEYSPROTECT =<ProtectKey:length is 32> OK
Query Command	AT+CKEYSPROTECT?	+ CKEYSPROTECT:<protected> OK
Execute Command	AT+CKEYSPROTECT=<key>	OK or + CME ERROR:<err>
Parameter Description	<key>: node protection key	
Return value description	<err>: error code.	
Example	AT+CKEYSPROTECT=AABBCCDD00112233AABBCCDD00112233 OK	
Precautions	After using this command, the device triplet information will be encrypted and stored, and only the ciphertext can be read and cannot be modified.	

5.2.42**Enable Low Power +CLPM**

sheet52set upNwkSKey

Command Type	Format	response
Test Command	AT+CLPM=?	+ CLPM:"Mode" OK
Execute Command	AT+CLPM=<mode>	OK or + CME ERROR:<err>

Parameter Description	<mode>: low power consumption mode
Return value description	1: The device enters low power consumption <err>: error code.
Example	AT+CLPM=1 OK
Precautions	Because the UART initial bytes may be transmitted incorrectly when transmitting at a rate above 40kbps, AT+CLPM=0 may be recognized incorrectly and return "+CME ERROR". It is recommended to use "000000000D0A" (hexadecimal) for wake-up.

5.2.43**Low Power Test Commands +CSLEEP**

sheet53 +CSLEEP

Command Type	Format	response
Test Command	AT+CSLEEP=?	+ CSLEEP = <0, 1, 2 > OK
Execute Command	AT+CSLEEP=<sleep_mode>	OK or + CME ERROR:<err>
Parameter Description	This command executes to enter DeepSleep operation	
Return value description	There are three types of Sleep_mode 0 – Enter DeepSleep mode and wake up by Timer after 10s 1 – Enter DeepSleep mode and wake up by set_b pin being pulled high 2 – Enter DeepSleep mode and wake up by UART, user types any key <err>: error code.	
Example	AT+CSLEEP=0 deep sleep 10000 ms!=0 + CSLEEP OK	
Precautions		

5.2.44**Low Power Test Commands +CMCU**

sheet54 +CMCU

Command Type	Format	response
Test Command	AT+CMCU=?	+ CMCU = <0, 1, 2, 3 > OK
Execute Command	AT+CMCU=<mcu_mode>	OK or + CME ERROR:<err>
Parameter Description	This command executes the MCU test operation.	
Return value description	There are three types of mcu_mode 0 – Turn off SX1262 only 1 – MCU, watchdog, timer work	

	2 – MCU, watchdog, Timer work, system enters DeepSleep mode and wakes up by set_b 3 – Enter DeepSleep mode every 15s <err>: error code.
Example	AT+CMCU=0 OK
Precautions	

5.2.45**Low Power Test Commands +CSTDBY**

sheet55 +CSTDBY

Command Type	Format	response
Test Command	AT+CSTDBY=?	+ CRXC = <0, 1> OK
Execute Command	AT+CSTDBY=<standby_mode>	OK or + CME ERROR:<err>
Parameter Description Return value description	This command execution makes SX1262 enter standby mode, MCU enters DeepSleep state, and is awakened by UART 0 - represents STDBY_RC mode 1 – represents STDBY_XOSC mode <err>: error code.	
Example	AT+CSTDBY=0 deep sleep wait for uart...	
Precautions		

5.2.46**Test Commands +CRXS**

sheet56 +CRXS

Command Type	Format	response
Test Command	AT+CRXS=?	+ CRXS:"Frequency","DataRate","CodeRate","ldo" OK
Execute Command	AT+CRXS=<freq>,<data_rate>,<code_rate>,<ldo>	OK or + CME ERROR:<err>
Parameter Description Return value description	This command is mainly used for sensitivity testing. Freq: 150000000-960000000 Data_rate has 6 levels, DR0~DR5, corresponding to spread factor SF12~SF7. Code_rate: 1-4, 1 corresponds to 4/5, 2 corresponds to 4/6, 3 corresponds to 4/7, 4 corresponds to 4/8 ldo: 1: turn on low rate optimization, 0: turn off low rate optimization <err>: error code.	
Example	AT+CRXS=470000000,0,1,0 start to recv package (freq: 470000000, dr:0, cr:1, ldo:0)	

5.2.47**Test Commands +CRX**

sheet57 +CRX

Command Type	Format	response
Test Command	AT+CRX=?	+ CRX:"Frequency","DataRate" OK
Execute Command	AT+CRX=<freq>,<data_rate>	OK or + CME ERROR:<err>
Parameter Description	This command executes the operation to enter the RX continuous receiving mode	
Return value description	Freq: 150000000-960000000 Data_rate has 6 levels, DR0~DR5, corresponding to spread spectrum factors SF12~SF7. <err>: error code.	
Example	AT+CRX=470000000,0 start to recv package (freq: 470000000, dr:0)	
Precautions	Type the CRX test command. To maintain the test, the system enters an infinite loop and restarts to start the next test.	

5.2.48**Test Commands +CTX**

sheet58 +CTX

Command Type	Format	response
Test Command	AT+CTX=?	+ CTX:"Frequency","DataRate","TxPower","TxLen" OK
Execute Command	AT+CTX=<freq>,<data_rate>,<pwr>,<len>	OK or + CME ERROR:<err>
Parameter Description	This command is executed to enter the timed 1S cycle sending mode.	
Return value description	Freq: 150000000-960000000 Data_rate has 6 levels, DR0~DR5, corresponding to spread factor SF12~SF7. pwr is the transmit power of SX1262, which is 0 ~ 22. Len is the length of the message to be sent. <err>: error code.	
Example	AT+CTX=470000000,0,22,5 start to tx data(freq: 470000000, dr: 0, power: 22): 1	
Precautions	Type the CTX test command. To maintain the test, the system enters an infinite loop and restarts to start the next test.	

5.2.49**Test Commands +CTXCW**

sheet59 +CTXCW

Command Type	Format	response
Test Command	AT+CTXCW=?	+ CTXCW:"Frequency","TxPower","PaOpt" OK
Execute Command	AT+CTXCW=<freq>,<pwr>,<opt>	OK or

		+ CME ERROR:<err>
Parameter Description	This command executes the operation to enter the TX continuous transmission mode	
Return value description	Freq: 150000000-960000000 pwr is the transmit power of SX1262, which is 0 ~ 22. opt is the PA Optimal setting of SX1262, ranging from 0 to 3, with a default value of 0. The corresponding relationships are as follows: 0: [0x04, 0x07, 0x00, 0x01], 1: [0x03, 0x05, 0x00, 0x01], 2: [0x02, 0x03, 0x00, 0x01], 3: [0x02, 0x02, 0x00, 0x01]. For details, please refer to the "PA Optimal Settings" section of the SX1262 data sheet <err>: error code.	
Example	AT+CTXCW=470000000,22 Start to txcw (freq: 470000000, power: 22db, opt: 0) AT+CTXCW=470000000,22,2 Start to txcw (freq: 470000000, power: 22db, opt: 2)	
Precautions	Type the CTXCW test command. To maintain the test, the system enters an infinite loop and restarts to start the next test.	