RF-AL42UH 433 MHz LoRa Module

Private Protocol

Version 1.0

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1 Device Overview

1.1 Description

RF-AL42UH is a LoRa wireless module based on ASR Microelectronics ASR6501 with a 32-bit ARM® Cortex®-M0+ processor at 48 MHz. It integrates LoRa Radio Transceiver, LoRa Modem. It features ultra-low power consumption, ultra-long transmission distance, high power density, high sensitivity, strong confidentiality, good anti-interference performance and rigid reliability. It supports a wide coverage frequency of LoRa Radio Transceiver from 410 MHz to 525 MHz, LPWAN and (G)FSK LoRa modulation, and LoRaWAN protocol. 1.27-mm pitch stamp stick package for easy assembling and cost-effective PCB design.

1.2 Key Features

- LoRa Radio and LoRa Modem
- Frequency Range: 410 MHz ~ 525 MHz
- Maximum Power +22 dBm constant RF output
- High sensitivity: down to -140 dBm
- Programmable bit rate up to 62.5 kbps in LoRa modulation mode
- Programmable bit rate up to 300 kbps in (G)FSK modulation mode
- Preamble detection
- Flash: 128 KB
- SRAM: 16 KB
- 6 x configurable GPIOs, 1 x I^2C, 1 x UART, 1 x SWD
- 48 MHz ARM® Cortex®-M0+ CPU
- 8 Channel DMA engine
- 12 bit 1 Msps SAR ADC
- Transmission distance: up to 3000 m
- Power supply: 2.8 V ~ 3.6 V

1.3 Applications

- Smart home
- Smart transportation
- Sensor network
- Automation industry
- Farming modernization
- Intelligent building
- Automatic collection system for water, electricity, gas and heating
- Street light control
- Grid monitoring
- Wind and solar complementary system
- Industrial equipment data wireless transmission

1.4 Functional Block Diagram

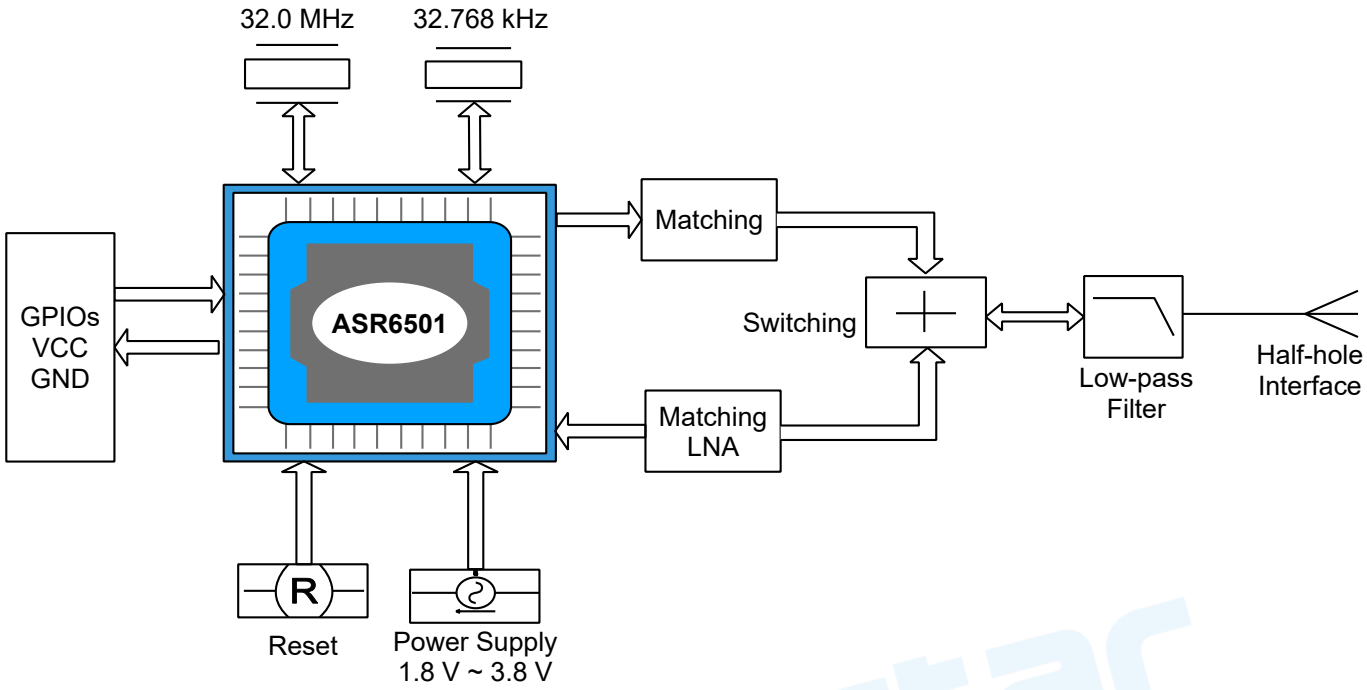

Figure 1. Functional Block Diagram of RF-AL42UH

1.5 Part Number Conventions

The part numbers are of the form of RF-AL42UH where the fields are defined as follows:

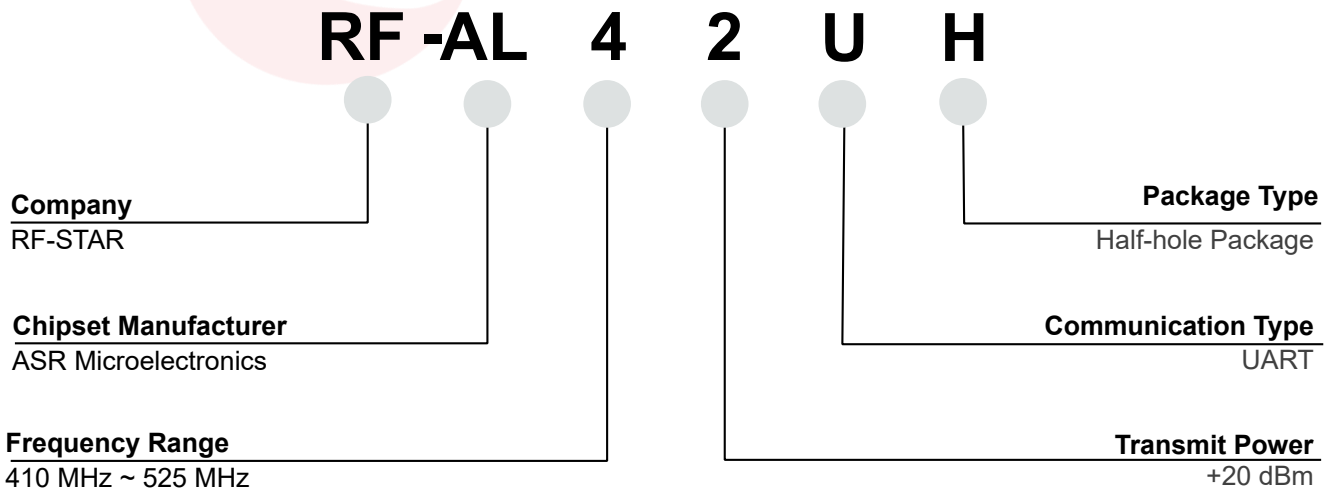

Figure 2. Part Number Conventions of RF-AL42UH

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2 Module Configuration and Functions

2.1 Module Parameters

Table 1. Parameters of RF-AL42UH

Item		Min.	Typ.	Max.	Unit
Frequency		410	433	525	MHz
TX power		10	21	22	dBm
Receiving Sensitivity		-134	-137	-140	dBm
Operating Voltage		2.8	3.3	3.6	V
Operating Current (3.3 V)	**TX Current**	136	137	139	mA
	RX Current	14.5	14.8	14.9	mA
	Sleep Current	2.9	2.93	3.15	μA
Air Rate		0.3	2.4	19.2	kbps
Operating Temperature		-40		+85	℃
Storage Temperature		-55		+125	℃
Operating Humidity		10% RH		90% RH	
Storage Humidity		10% RH		90% RH	
Data Interface Rate @ 3.3 V		TTL: 1200	TTL: 115200	TTL: 256000	bps
Default Channel		433			MHz
Bandwidth		125			kHz
Flash		128			KB
SRAM		16			KB
Capacity Per Packet @ SF7		250			Byte
Dimension		16 × 16			mm
Transmission Distance		3000 (Test condition: Sunny weather, open air, +22 dBm TX power, antenna gain 5 dBi, height greater than 2.5 m, air rate 2.4 kbps)			m
Packaging		SMT Packaging			
Antenna		Half hole			

2.2 Module Pin Diagram

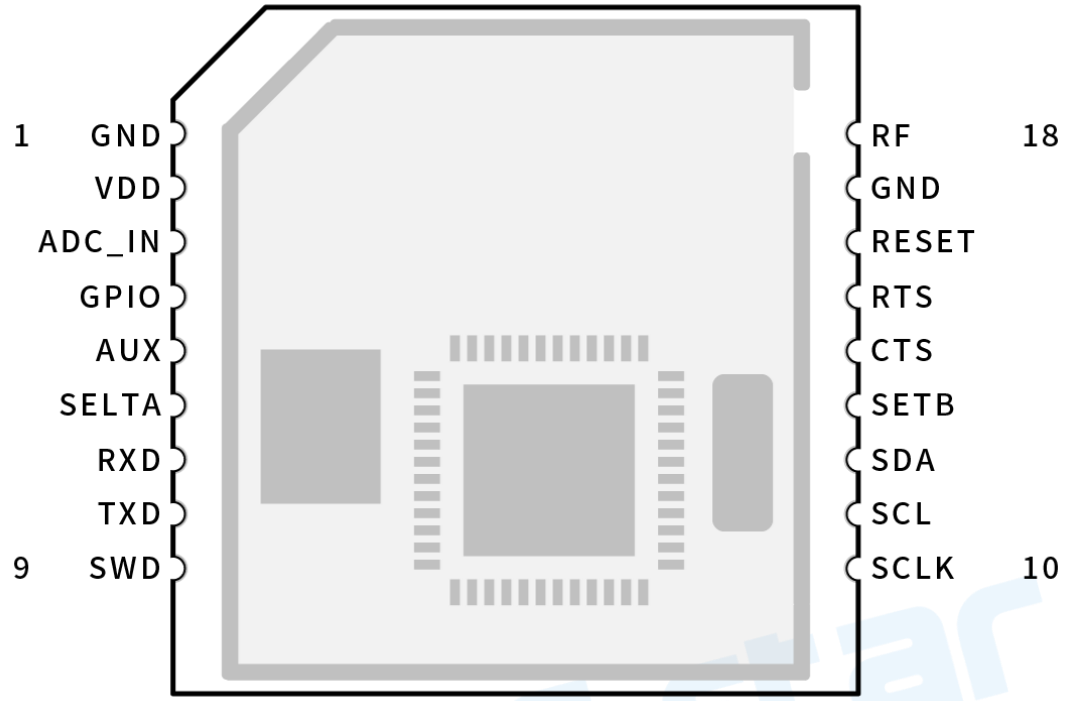

Figure 3. Pin Diagram of RF-AL42UH

3.3 Pin Functions

Table 2. Pin Functions of RF-AL42UH

Pin	Name	Pin Type	Description
1	GND	-	Ground
2	VDD	-	Power supply: 2.8 V ~ 3.6 V DC
3	ADC_IN	I	ADC input pin, programming is not enabled. NC
4	GPIO	I/O	MCU GPIO, NC
5	AUX	I/O	MCU GPIO, NC
6	SETA	I/O	MCU GPIO, NC
7	RXD	I/O	UART RX pin
8	TXD	I/O	UART TX pin
9	SWD	I/O	SWD DATA
10	SCLK	I/O	SWD CLK
11	SCL	I/O	I^2C, programming is not enabled. NC

12	SDA	I/O	I^2C, programming is not enabled. NC
13	SETB	I/O	MCU GPIO, NC
14	CTS	I/O	NC
15	RTS	I/O	NC
16	RESET	I/O	Reset
17	GND	-	Ground
18	RF	RF	Antenna interface

3 Application, Implementation and Layout

3.1 Module Photos

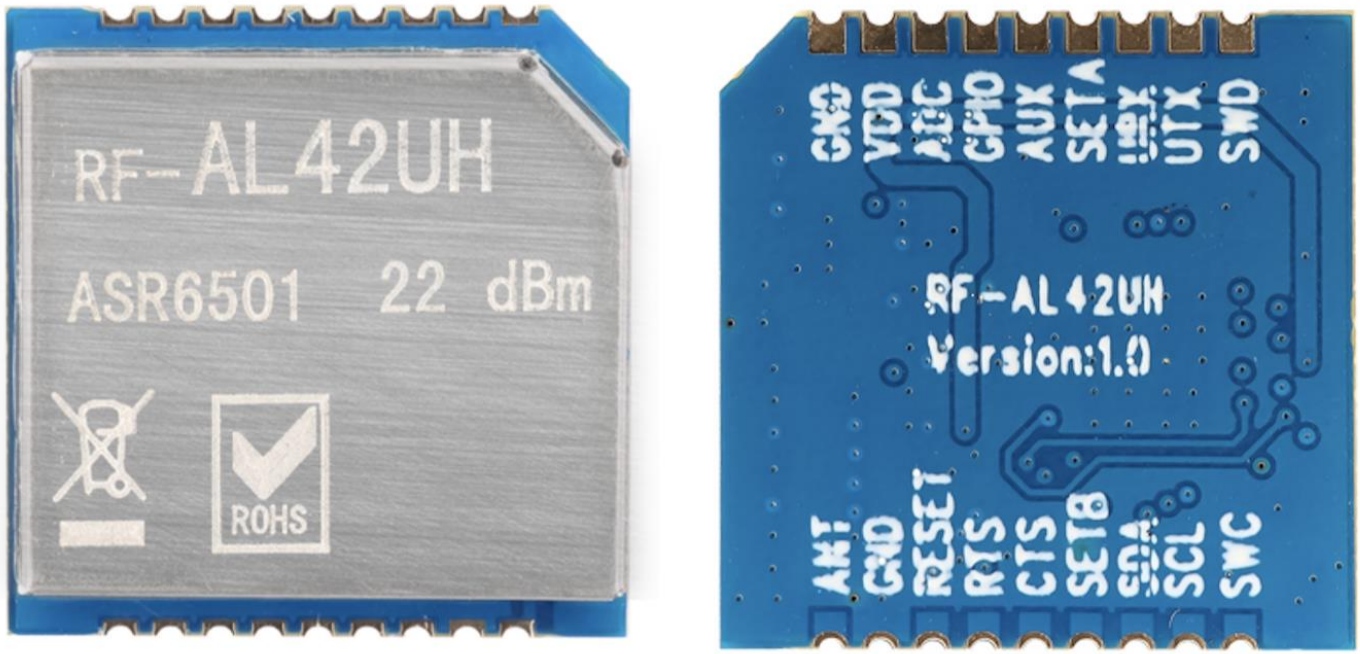

Figure 4. Photos of RF-AL42UH

3.2 Recommended PCB Footprint

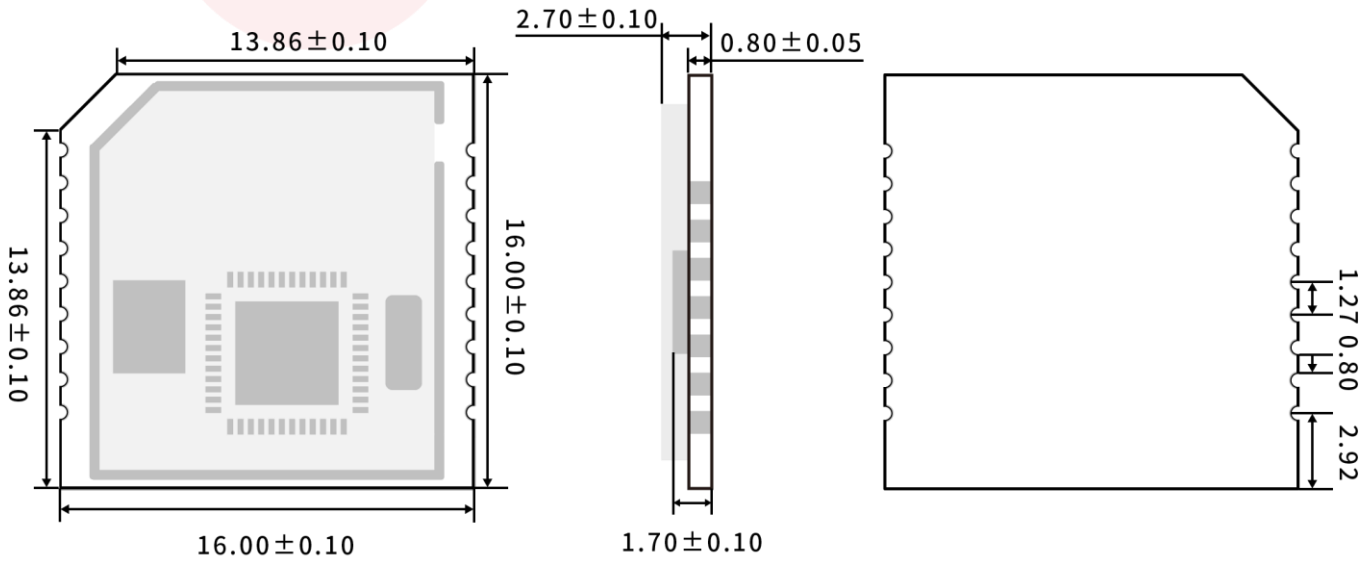

Figure 5. Recommended PCB Footprint of RF-AL42UH (mm)

3.3 Schematic Diagram

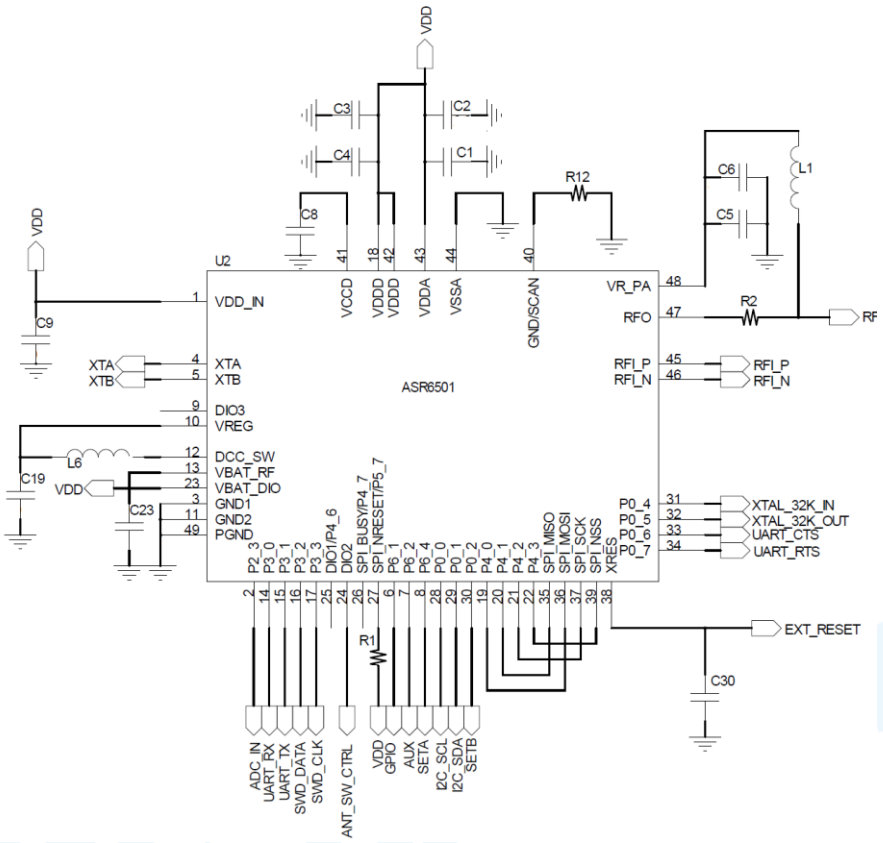

Figure 6. Schematic Diagram of RF-AL42UH

3.4 Reference Hardware Wiring Diagram

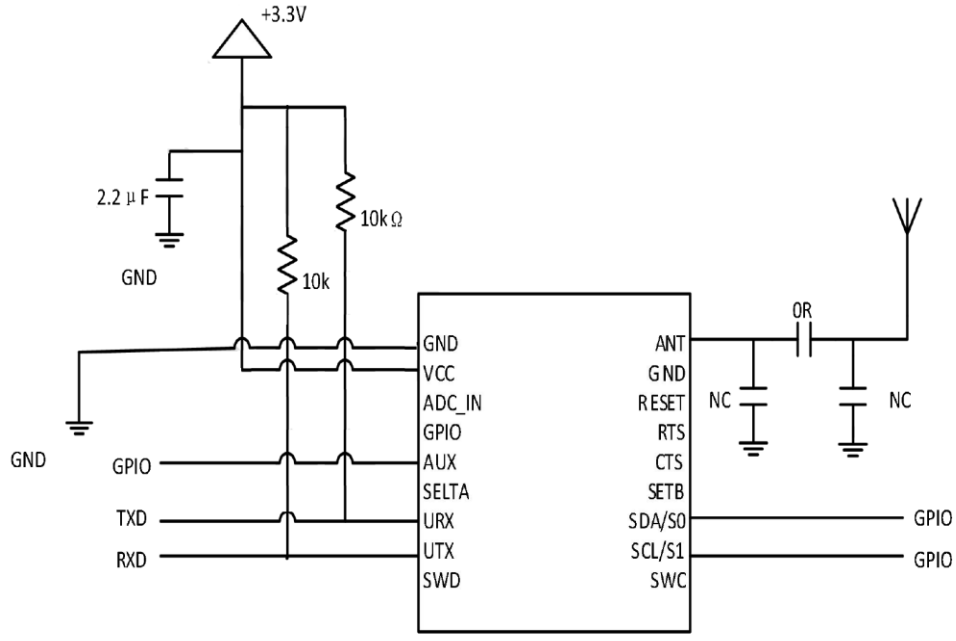

Figure 7. Reference Hardware Wiring Diagram

4 Working Principle

4.1 Transparent Transmission of Node Configuration

The transparent data transmission under the same channel, the same module address and the same airspeed is shown in the figure below.

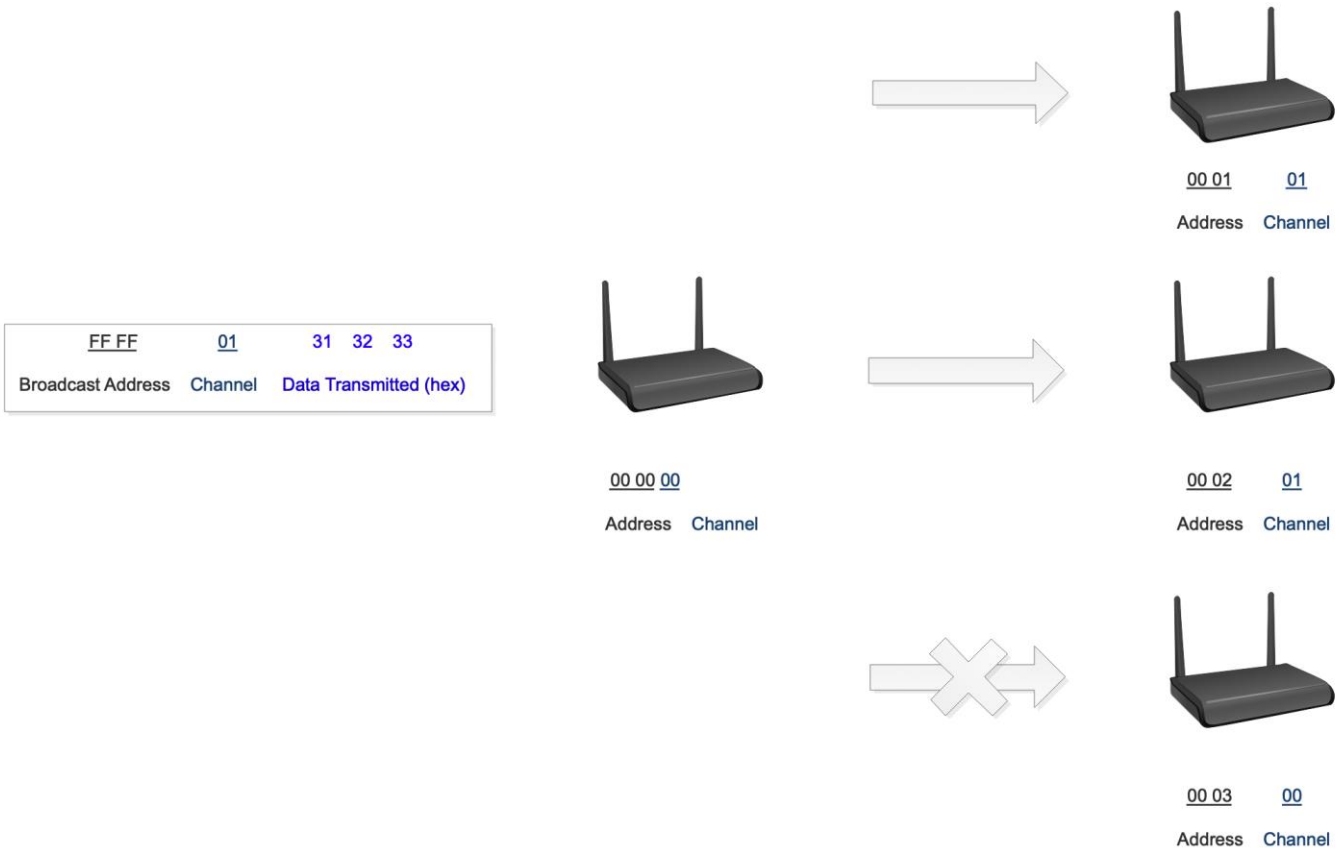

Figure 8. Transparent Transmission Function Diagram

6.2 Fixed Point Transmission of Node Configuration

The transparent data transmission under the different channel, the different module address and the different airspeed is shown in the figure below.

Figure 9. Point Transmission Function Diagram

5 Mode Description

5.1 Working Mode

The module supports 4 working modes.

Working Mode	S0	S1	Mode Description	Remark
Normal mode	Low level	Low level	Transparent transmission mode.	The receiver must work in normal mode or wake-up mode.
Wake-up mode	Low level	High level	Difference from the normal mode: Before data packet transmission, automatically add a wake-up code to wake up the receiver module working in low-power mode.	The receiver can be in normal mode, wake-up mode and low-power mode.
Low-power mode	High level	Low level	Serial port reception is off, and it is in the air waiting for wake-up mode. After receiving wireless data, open the serial port to send data.	The transmitter must work in the wake-up mode. Unable to transmit data in low-power mode.
Sleep mode	High level	High level	Unable to transmit data, only can modify and query parameters.	Modify and query settings and sleep.

Note: Parameters can be modified and queried in all modes. Modification of parameters requires a power-on reset of the module to take effect. Modifications in sleep mode can be used directly.

5.2 Mode Switching (0 for Low Level, 1 for High Level)

1. Combine high and low levels of S0 and S1 to determine the working mode of the module. Two GPIOs of MCU can be used to control mode switching. When the level of S0 and S1 are changed, the module is idle for 1 ms, that is, it starts to work according to the new mode. If the module has serial port data that has not been transmitted by wireless, it can enter the new working mode after the transmission is completed. If the module receives wireless data and sends out data through the serial port, it needs to finish sending before entering the new working mod. Therefore, the mode switching can only be effective when EN outputs 1, otherwise it will delay the switching. For example: in normal mode or wake-up mode, the user continuously inputs a large amount of data and switches the mode at the same time. At this time, the mode switching operation is invalid, and the module will process all user data before performing new mode detection. So, it is generally recommended to detect the output state of the EN pin and wait for 2 ms after the EN output is high before switching.

2. When the module is switched from other modes to sleep mode, if there is any data that has not been processed yet, the module will enter the sleep mode after processing these data (including receiving and sending). This feature can be used for fast sleep, thus saving power consumption. For example: the transmitter module works in normal mode, the user initiates serial data "ABC", and then does not have to wait for the EN pin to be idle (high level), and it can directly switch to sleep mode and the main MCU will immediately sleep. The module will automatically send all user data by wireless, and then automatically enter sleep within 1 ms, thus saving the working time of MCU and reducing power consumption.
3. This feature can be used for all mode switching. After processing the current mode event, the module will automatically enter the new mode within 1 ms, thus eliminating the user's work of querying EN and achieving the purpose of fast switching. For example: switching from transmit mode to receive mode, the user MCU can also go to sleep in advance before the mode switching, and use the external interrupt function to get the EN change for mode switching. This operation method is flexible and efficient, and is designed in accordance with the convenience of the user MCU, and can reduce the workload of the entire system as much as possible, improve system efficiency, and reduce power consumption.

5.3 Normal Mode

Type	When S0 = 0 and S1 = 0, the module works in normal mode.
Transmitting	The single packet length of wireless data transmitted by the module is 196 bytes. When the amount of data input by the user reaches 196 bytes, the module will start wireless transmission. At this time, the user can continue to input the data to be transmitted. When the byte to be transmitted by the user is less than 196 bytes, the module waits for 3 bytes. If no user data continues to be input, the data is considered to be terminated. At this time, the module will send all the data packets by wireless. When the module receives the first user data, it outputs the EN to the low level, when the module puts all the data into the RF chip and starts the transmission, the EN outputs to the high level. At this time, it indicates that the last packet of wireless data has started the transmission, and the user can continue to input up to 512 bytes of data. The packets sent out through the normal mode can only be received by the receiving module in normal mode and wake-up mode.
Receiving	The module always turns on the wireless receiving function, and can receive the data packets sent from the normal mode and wake-up mode. After receiving the data packets, the module EN outputs the low level and delays for 5 ms, and It starts to send the wireless data through the serial port TXD pin. After all the wireless data are output through the serial port, the module outputs the EN to the high level.

5.4 Wake-up Mode

Type	When S0 = 0 and S1 = 1, the module works in wake-up mode.
Transmitting	The conditions for the module to start packet transmission and the EN function are the same as the EN function. The only difference is that the module will automatically add a wake-up code before each packet. The length of the wake-up code depends on the wake-up time set in the user parameters. The purpose of the wake-up code is to wake up the receiving module working in the low power consumption mode. Therefore, the data transmitted in the wake-up mode can be used in the normal mode Module received in wake-up mode and low power consumption mode. The conditions under which the module initiates a packet transmission and the EN functions are equivalent to normal mode. The only difference is that the module automatically adds a wake-up code before each data packet, and the length of the wake-up code depends on the wake-up time set in the user parameters. The purpose of the wake-up code is to wake up the receiving module working in the low-power mode. Therefore, the data transmitted in the wake-up mode can be received by the module in the normal mode, wake-up mode, and low-power mode.
Receiving	Equivalent to normal mode.

5.5 Low-power Mode

Type	When S0 = 1 and S1 = 0, the module works in low-power mode
Transmitting	The module is in sleep state, the serial port is closed, and it cannot receive the serial port data from the external MCU, so this mode does not have the function of wireless transmission.
Receiving	In the low-power mode, the transmitter is required to work in the wake-up mode. When the wake-up code is monitored regularly, once the effective wake-up code is received, the module will continue to be in the receiving state and wait for the whole effective packet to be received. Then the EN outputs the low Level, after a delay of 5 ms, open the serial port to send the wireless data received through TXD, and the EN outputs the high when finished. The wireless module continues to enter the "sleep-monitor" working state, by setting different wake-up time, the module has different receive response delay (maximum 2 s) and average power consumption (minimum 30 μA).

5.6 Sleep Mode

Type	When S0 = 1 and S1 = 1, the module works in sleep mode
Transmitting	Unable to transmit.
Receiving	Unable to receive.

Configuration	The sleep mode can be used for module parameter setting. Use serial ports 9600 and 8N1 to set the module working parameters through a specific instruction format, as shown in the following instruction format details. When entering other modes from sleep mode, the module will re-configure the parameters. During the configuration, EN remains low. After completion, the module outputs high level, so it is recommended that users detect the rising edge of EN.

5.7 Data Security

The specific encryption algorithm is used to encrypt the module data. After receiving the data, the receiving module can get the actual transmission data according to the encryption factor to avoid receiving the wrong information.

6 Working Status

EN is used for wireless transceiver buffer indication and self-check indication. It indicates whether any data of the module has not been transmitted through the wireless, whether the wireless data has been received but has not been completely transmitted through the serial port, or the module is in the process of initial self-check.

1. Wake-up MCU

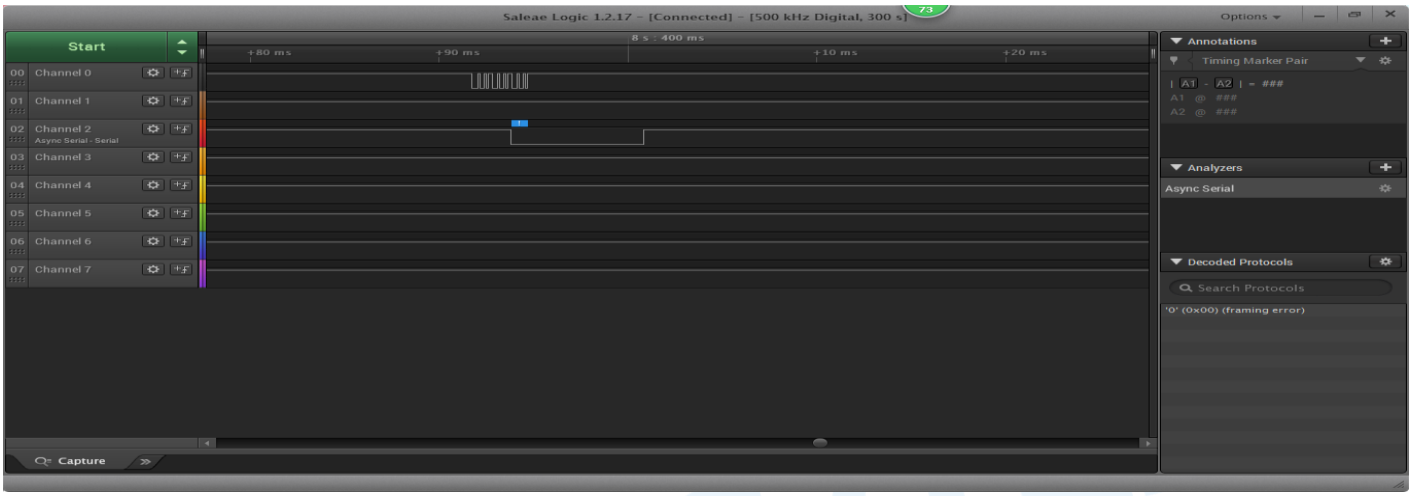

Figure 10. EN Timing Diagram of Wake-up Sleep MCU

2. Send indication

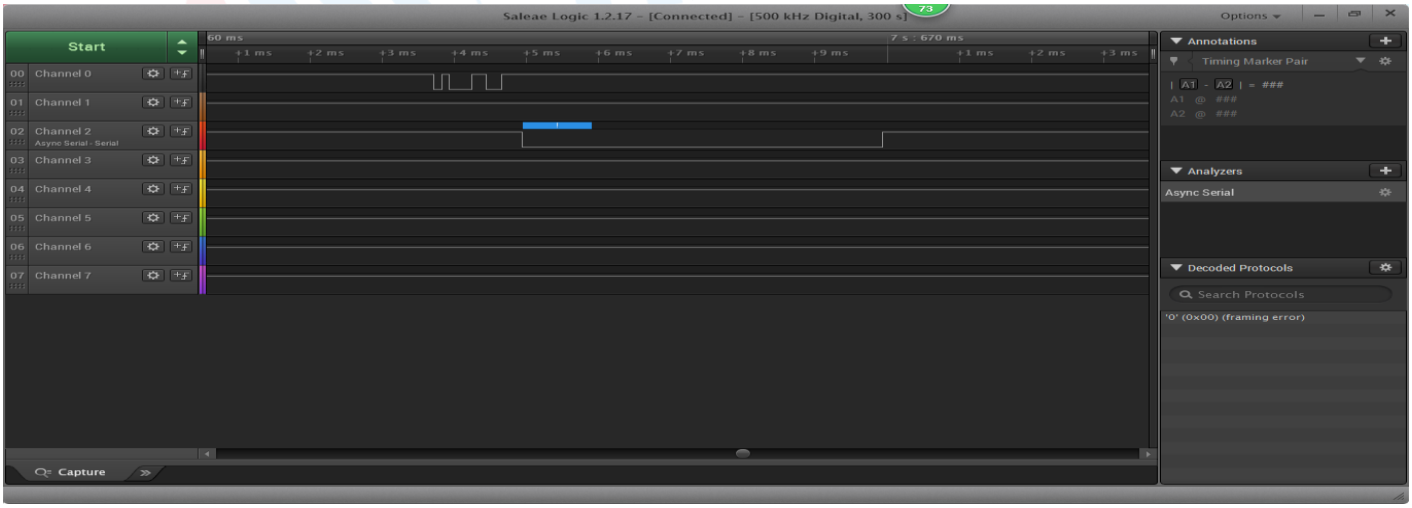

Figure 11. EN Timing Diagram during Sending Data

3. Receive indication

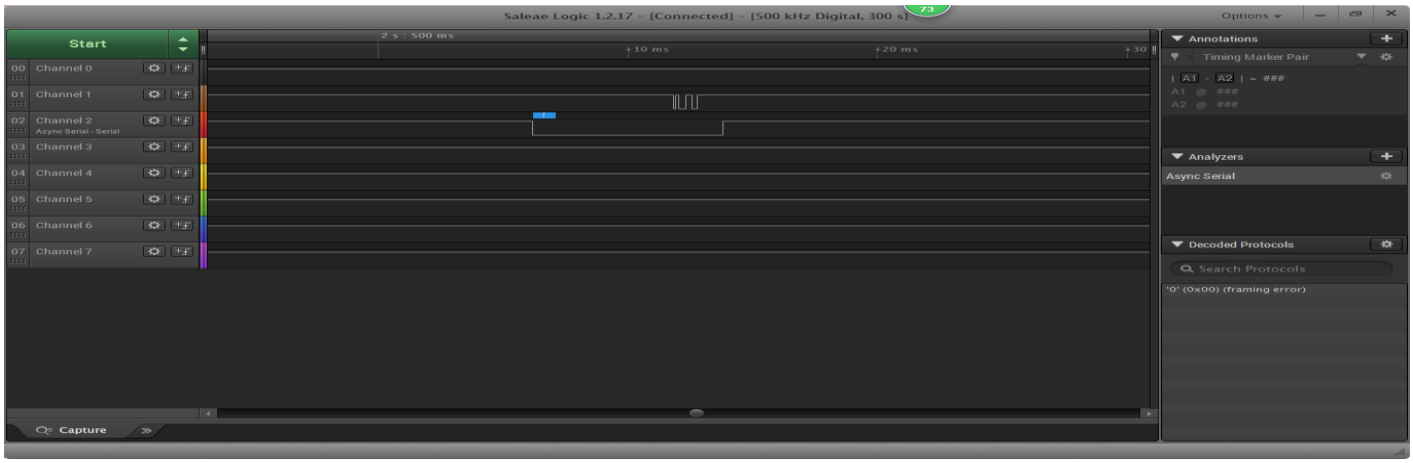

Figure 12. EN Timing Diagram during Receiving Data

4. Configuration process

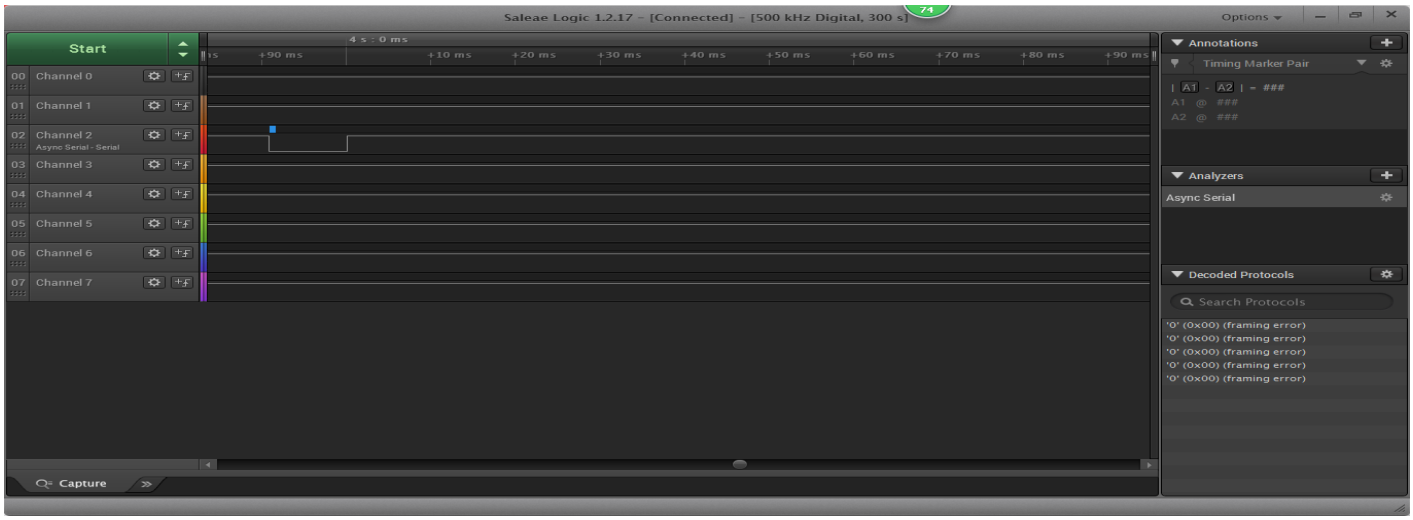

Figure 13. EN Timing Diagram during Setting Data

5. Cautions

- EN outputting low level takes priority. When any low-level output condition is met, EN outputs low level. When all low-level conditions are not met, EN outputs high level.
- When the EN output in at low level, it means that the module is busy, and the working mode detection will not be carried out at this time. When the module EN output is at high level, it means the mode switching will be completed within 1 ms.
- After switching to the new working mode, the module will enter the mode at least 2 ms after the rising edge of EN. When the EN output is always at high level, the mode switching will take effect immediately.
- When entering from sleep mode to other modes or during reset, the module will reset the parameters, during which EN output is low.

6 AT Commands

6.1 Read AT Commands [AT_READ]

Command	Command Format	Response
Query Command	AT_READ	AT_READ=XX,XX,XX,XX,XX
Parameter Description	AT_READ=XX,XX,XX,XX,XX	
Return Value Description	Refer to the module parameters, the returned data is consistent with the parameters set using the AT_SET command.	
Example		
Remark		

6.2 Read Protocol Version [AT_VER]

Command	Command Format	Response
Query Command	AT+CGMR?	+CGMR<revision> OK
Parameter Description	<revision>: Version identification	
Return Value Description		
Example	AT+CGMR? +CGMR=v4.2 OK	
Remark		
Remark		

6.3 Set Baud Rate [+CGBR]

Command	Command Format	Response
Query Command	AT+CGBR?	+CGBR<baud> OK
Set Command	AT+CGBR=<baud>	OK
Parameter Description	<baud>: Baud rate	
Return Value Description		

Example	AT+CGBR=9600 OK
Remark	

7.2.6 Set Join Mode [+CJOINMODE]

Command	Command Format	Response
Test Command	AT+CJOINMODE=?	+CJOINMODE: “mode” OK
Query Command	AT+CJOINMODE?	+CJOINMODE:<mode> OK
Set Command	AT+CJOINMODE=<mode>	OK or +CME ERROR:<err>
Parameter Description	<mode>: 0: OTAA 1: ABP <err>: error code.	
Return Value Description		
Example	AT+CJOINMODE=0 OK	
Remark	OTAA mode is adopted by default. If ABP network access mode is needed, please use this command before sending data.	

7.2.7 Set DevEUI [+CDEVEUI]

Command	Command Format	Response
Test Command	AT+CDEVEUI=?	+CDEVEUI=<DevEUI:length is 16>
Query Command	AT+CDEVEUI?	+CDEVEUI:<value> OK
Set Command	AT+CDEVEUI =<value>	OK or +CME ERROR:<err>
Parameter Description	<value>: Node DevEUI	

Return Value Description	
Example	AT+CDEVEUI? +CDEVEUI=AABBCCDD00112233 OK
Remark	Set / read DevEUI, and Y1Y2…Y8 will be returned in hex and takes 8 bytes.

7.2.8 Set AppEUI [+CAPPEUI]

Command	Command Format	Response
Test Command	AT+CAPPEUI=?	+CAPPEUI=<AppEUI:length is 16>
Query Command	AT+CAPPEUI?	+CAPPEUI:<value> OK
Set Command	AT+CAPPEUI =<value>	OK or +CME ERROR:<err>
Parameter Description	<value>: Node AppEUI	
Return Value Description	<err>: error code	
Example	AT+CAPPEUI=AABBCCDD00112233 OK	
Remark	When in OTAA network access mode, set or read AppEUI, and Y1Y2...Y8 will be returned in hex and takes 8 bytes.	

7.2.9 Set AppKey [+CAPPKEY]

Command	Command Format	Response
Test Command	AT+CAPPKEY=?	+CAPPKEY=<AppKey:length is 32>
Query Command	AT+CAPPKEY?	+CAPPKEY:<value> OK
Set Command	AT+CAPPKEY=<value>	OK or +CME ERROR:<err>
Parameter Description	<value>: Node AppKey	
Return Value Description		

	<err>: error code.
Example	AT+CAPPKEY=AABBCCDD00112233 OK
Remark	When in OTAA network access mode, set or read AppKey, and Y1Y2...Y16 will be returned in hex and takes 16 bytes.

7.2.10 Set DevAddr +CDEVADDR

Command	Command Format	Response
Test Command	AT+CDEVADDR=?	+CDEVADDR=<DevADDR:length is 8, Device address of ABP mode>
Query Command	AT+CDEVADDR?	+CDEVADDR:<value> OK
Set Command	AT+CDEVADDR=<value>	OK or +CME ERROR:<err>
Parameter Description	<value>: Node DevAddr	
Return Value Description	<err>: error code.	
Example	AT+CDEVADDR=00112233 OK	
Remark	When in ABP network access mode, set or read DevAddr, and Y1Y2...Y4 will be returned in hex and takes 4 bytes.	

7.2.11 Set AppSKEY [+CAPPSKEY]

Command	Command Format	Response
Test Command	AT+CAPPSKEY=?	+CAPPSKEY=<AppSKey:length is 32>
Query Command	AT+CAPPSKEY?	+CAPPSKEY:<value> OK
Set Command	AT+CAPPSKEY=<value>	OK or +CME ERROR:<err>
Parameter Description	<value>: Node AppSKey	

Return Value Description	<err>: error code.
Example	AT+CAPPSKEY=AABBCCDD00112233 AABBCCDD00112233 OK
Remark	When in ABP network access mode, set or read AppSKey, and Y1Y2...Y16 will be returned in hex and takes 16 bytes.

7.2.12 Set NwkSKEY [+CNWKSKEY]

Command	Command Format	Response
Test Command	AT+CNWKSKEY=?	+CNWkSKEY=<NwkSKey:length is 32>
Query Command	AT+CNWKSKEY?	+CNWKSKEY:<value> OK
Set Command	AT+CNWKSKEY=<value>	OK or +CME ERROR:<err>
Parameter Description	<value>: Node NwkSKey	
Return Value Description	<err>: error code.	
Example	AT+CNWKSKEY=AABBCCDD00112233 AABBCCDD00112233 OK	
Remark	When in ABPnetwork access mode, set or read NwkSKey, and Y1Y2...Y16 will be returned in hex and takes 16 bytes.	

7.2.13 Set Frequency Band Mask [+CFREQBANDMASK]

Command	Command Format	Response
Test Command	AT+CDREQBANDMASK=?	+CDREQBANDMASK: “mask”
Query Command	AT+CDREQBANDMASK?	+CDREQBANDMASK:<mask> OK
Set Command	AT+CDREQBANDMASK=<mask>	OK or +CME ERROR:<err>

Parameter Description	<mask>: The possible frequency band mask of the network may work. The 16 bits correspond to 16 frequency groups. For details, see the LoRaWAN access specification. For example, channel 0 ~ 7, the corresponding frequency band mask is 0001, the corresponding mask of channel 8 ~ 15 is 0002, and so on.
Return Value Description	The frequency corresponding to the specific channel needs to check the region protocol. For example, channel 0 ~ 7 corresponds to 868.3 MHz, 868.5 MHz, 868.7 MHz, 868.9 MHz, 471.1 MHz, 471.3 MHz, 471.5 MHz, 471.7 MHz in CN868. <err>: error code.
Example	AT+CDREQBANDMASK=0001 OK
Remark	Need to set before join.

7.2.14 Set Co-Frequency and Inter-frequency of Upstream and Downstream [+CULDLMODE]

Command	Command Format	Response
Test Command	AT+CULDLMODE=?	+CULDLMODE: “mode”
Query Command	AT+CULDLMODE?	+CULDLMODE:<mode> OK
Set Command	AT+CULDLMODE=<mode>	OK or +CME ERROR:<err>
Parameter Description	<mode>:	
Return Value Description	1: Co-frequency mode 2: Inter-frequency mode <err>: error code.	
Example	AT+CULDLMODE=2 OK	

Remark	Need to set before join.

7.2.15 Set Working Mode [+CWORKMODE]

Command	Command Format	Response
Test Command	AT+CWORKMODE=?	+CWORKMODE: “mode”
Query Command	AT+CWORKMODE?	+CWORKMODE:<mode> OK
Set Command	AT+CWORKMODE=<mask>	OK +CME ERROR:<err>
Parameter Description	<mode>: 2: Normal mode <err>: error code.	
Return Value Description		
Example	AT+CWORKMODE=2 OK	
Remark	Need to set before join. Normal mode is adopted by default. Only support normal mode by now.	

7.2.16 Set Class [+CCLASS]

Command	Command Format	Response
Test Command	AT+CCLASS=?	+CCLASS: “class”, “branch”, “para1”, “para2”, “para3”, “para4” OK
Query Command	AT+CCLASS?	+CCLASS:<class> OK
Set Command	AT+CCLASS=<class>, [branch], [para1], [para2], [para3], [para4],	OK or +CME ERROR:<err>
Parameter Description	<class>: 0: Class A 1: Class B	
Return Value Description		

	2: Class C According to different device types, the following optional parameters are available: If class = 1 and branch = 0, only the para1 parameter is used to set the Ping slot periodicity, the range is 0 ~ 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 point in Hz; para2 sets the beacon DataRate, para3 sets the ping frequency point in Hz; para4 sets ping DataRate. The range of values for each parameter is detailed in the LoRaWAN Access Specification. <err>: error code.
Example	AT+CCLASS=2 OK
Remark	Need to set before join. Class A is adopted by default.

7.2.17 Query the Battery Level of Device [+CBL]

Command	Command Format	Response
Test Command	AT+CBL=?	+CBL: “value” OK
Query Command	AT+CBL?	+CBL:<value> OK
Parameter Description	<value>: Node power level, the range is defined by the LoRaWAN protocol.	
Return Value Description		
Example	AT+CBL? +CBL=100 OK	

Remark	Query the device battery level.

7.2.18 Query the Current Status of Device [+CSTATUS]

Command	Command Format	Response
Test Command	AT+CSTATUS=?	+CSTATUS: “status” OK
Query Command	AT+CSTATUS=?	+CSTATUS:<status> OK
Parameter Description	<status>:	
Return Value Description	Current upstream result 00: No data operating 01: Data transmitting 02: Data transmission failed 03: Data transmission successfully 04: JOIN is successful (appears only in the first JOIN process) 05: JOIN failed (appears only in the first JOIN process) 06: The network may be abnormal 07: Data transmission successfully, no downstream 08: Data transmission is successful, there is a downstream	
Example	AT+CSTATUS? +CSTATUS=03 OK	
Remark	Query the current status of the device.	

7.2.19 Set Join [+CJOIN]

Command	Command Format	Response
Test Command	AT+CJOIN=?	+CJOIN: <ParaTag1>, <ParaTag2>, …<ParaTag4> OK

Query Command	AT+CSTATUS=?	+CSTATUS: <ParaValue1>, <ParaValue2>, …< ParaValue4> OK
Set Command	AT+CSTATUS=<ParaValue1>,[ParaValue2],…[ParaValue4]	OK or +CME ERROR:<err> If the input is valid, first return OK, then start automatic authentication and return the authentication result. +CJOIN:OK: Authentication succeeded +CJOIN:FAIL: Authentication failed
Parameter Description	<ParaTag1>, [ParaTag2], ... [ParaTag4]: Names of authentication parameters 1, 2, ... 4. [ParaValue1], [ParaValue2], ... [ParaValue4]: Parameter values of authentication parameters 1, 2, ... 4. ParaTag1 indicates that a JOIN operation is performed, and ParaTag1 ranges from: 0: Stop JOIN 1: Start the JOIN and restart the JOIN process again. For modules with hot start enabled, performing this operation will clear the saved JOIN context parameters. ParaTag2 indicates whether to enable the automatic JOIN function. The factory value is 1, and the range of ParaTag2 is: 0: Turn off automatic JOIN 1: Automatic JOIN. After the module enters the transparent transmission mode, it automatically starts JOIN. ParaTag3 r indicates the JOIN cycle. X3 ranges from 7 to 255 in s.	
Return Value Description		

	Factory default: 8. ParaTag4 indicates the maximum number of JOIN attempts. ParaTag4 ranges from 1 to 256. <err>: Error code.
Example	AT+CJOIN=1,0,10,8 (Set JOIN parameters: turn off automatic JOIN, the JOIN cycle is 10 s, and the maximum number of attempts is 8 times) OK +CJOIN:OK
Remark	

7.2.20 Send Received Data [+DTRX]

Command	Command Format	Response
Test Command	AT+DTRX=?	+DTRX: [confirm],[nbtrials],<Length>,<Payload> OK
Set 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	Confirm and nbtrials refer to the corresponding AT command, which is valid only for this transmission, and it is optional. Length: Indicates the number of strings, and the maximum value is described in the access specification. The different length of the bytes is allowed to be transmitted at different rates (see LoRaWan protocol for details), and 0 indicates that null packets are sent.	
Return Value Description		

	Payload: in hex (2 characters for 1 number). Return value: 1. How to judge whether the data transmission is successful? **Confirm type data:** After each frame of data is sent, there should be a corresponding response message. When the module fails to receive the response message, or if it does not reach the maximum number of times, it will retry again. If the maximum number of times is not received, no downstream message is received, that is, it fails, and an ERR+SENT message is output. During this period, if the transmission of the received reply message is completed, it success, and the OK+SEND, OK+SENT and OK+RECV messages are output. **Unconfirm type data:** No downstream response is requested after the data is sent, and the OK+SEND, OK+SENT message is returned at the end of each transmission. If the downstream data is received, the OK+RECV message is sent. 2. Data transmission status prompt OK+SEND:TX_LEN indicates that the data transmission request was successful. TX_LEN: 1 Byte, the number of the transmitted data. OK+SENT:TX_CNT indicates that the data transmission was successfully. TX_CNT: 1 Byte, the number of the transmitted data. ERR+SEND:ERR_NUM indicates that the data transmission request failed for the reason indicated by ERR_NUM. ERR_NUM: 1 Byte 0: Not connected 1: Communication is busy, sending request failed 2: The data length exceeds the current transmittable length, only MAC command is sent. ERR+SENT:TX_CNT indicates the data transmission failed, the number of transmissions reaches the maximum number.

	TX_CNT: 1 Byte, the number of the transmitted data. OK+RECV:TYPE,PORT,LEN,DATA indicates that the data received was successfully (received a response message or active downstream data). TYPE: 1 Byte, downstream transmission type. Bit0: 0 - unconfirm, 1 - confirm Bit1: 0 - non-ACK, 1 - ACK Bit2: 0 - not carried, 1 - carried, indicating whether the downstream data carries the LINK command response. Bit3: 0 - not carried, 1 - carried, indicating whether the downstream data carries the TIME command response, only when the bit is 1 means time synchronization success. Bit4 ~ Bit7: Default 0, reserved. PORT: 1 Byte, downstream transmission port. LEN: 1 Byte, downstream data length. DATA: n Byte, downstream data, when LEN = 0, this string does not exist. <err>: error code.
Example	AT+DTRX=1,2,10,0123456789 OK+SEND:03 OK+SENT:01 OK+RECV:02,01,00 It means that the confirm data was sent successfully. The valid data received by the server should be "0x01 0x23 0x45 0x67 0x89", and a downlink confirmation was received.
Remark	First enter the network, then send data.

7.2.21 Receive Data [+DRX]

Command	Command 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:	
Return Value Description	Length: 0 means empty data packet. Payload: hexadecimal string data. OK: No abnormality of the receiving data packet. <err>: error code.	
Example	AT+DRX? OK	
Remark	Receiving a data packet from the receiving buffer and clearing the receiving buffer.	

7.2.22 Set Upstream Transmission Type [+CCONFIRM]

Command	Command Format	Response
Test Command	AT+CCONFIRM=?	+CCONFIRM:“value” OK
Query Command	AT+CCONFIRM?	+CCONFIRM:<value> OK
Set Command	AT+CCONFIRM=<value>	OK Or +CME ERROR:<err>
Parameter Description	<value>:	
Return Value Description	0: Unconfirmed up message 1: Confirmed up message <err>: error code.	
Example	AT+CCONFIRM=1 OK	
Remark	Need to be set before sending data.	

7.2.23 Set Upstream Data Port Number [+CAPPPORT]

Command	Command Format	Response
Test Command	AT+CAPPPORT=?	+CAPPPORT:“value” OK
Query Command	AT+CAPPPORT?	+CAPPPORT:<value> OK
Set Command	AT+CAPPPORT=<value>	OK or +CME ERROR:<err>
Parameter Description	<value>:	
Return Value Description	The port used is in decimal, and 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	
Remark	Need to be set before sending data.	

7.2.24 Set Data Rate [+CDATARATE]

Command	Command Format	Response
Test Command	AT+CDATARATE=?	+CDATARATE:“value” OK
Query Command	AT+CDATARATE?	+CDATARATE:<value> OK
Set Command	AT+CDATARATE=<value>	OK or +CME ERROR:<err>
Parameter Description	<value>:	
Return Value Description	Data rate value, the factory value is 3, the 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
Remark	Need to be set before sending data. Because ADR is enabled by default, you cannot change the DATARATE. To change the DATARATE, first execute AT+CADR=0.

7.2.25 Query RSSI [+CRSSI]

Command	Command 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 number of the frequency band, starting from 0, and the 1A2 group number is 1. Returns the RSSI of 8 channels in a frequency band.	
Return Value Description		
Example	AT+CRSSI 1? +CRSSI: 0: -157	

	1: -157 2: -157 3: -157 4: -157 5: -157 6: -157 7: -157 OK
Remark	

7.2.26 Set Number of Transmissions [+CNBTRIALS]

Command	Command Format	Response
Test Command	AT+CNBTRIALS=?	+CNBTRIALS: “Type”,“value” OK
Query Command	AT+CNBTRIALS?	+CNBTRIALS:<MType>,<value> OK
Set Command	AT+CNBTRIALS=<MType>,<value>	OK or +CME ERROR:<err>
Parameter Description	<MType>:	
Return Value Description	0: unconfirm package. 1: confirm package. <value>: Indicates the maximum number of transmissions, ranging from 1 to 15. The default values are detailed in the access specification. <err>: error code.	
Example	AT+CNBTRIALS=1,2 OK	
Remark	Need to be set before sending data.	

7.2.27 Set Report Mode [+CRM]

Command	Command Format	Response

<table>
<tr><td>Test Command</td><td>AT+CRM=?</td><td>+CRM:“reportMode”,”reportInterval”
OK</td></tr>
<tr><td>Query Command</td><td>AT+CRM?</td><td>+CTXP:<reportMode>,[reportInterval]
OK</td></tr>
<tr><td>Set Command</td><td>AT+CTXP=<reportMode>,[reportInterval]</td><td>OK
or
+CME ERROR:<err></td></tr>
<tr><td>Parameter Description</td><td colspan="2">This command is primarily intended for testing purposes.</td></tr>
<tr><td>Return Value Description</td><td colspan="2"><reportMode>:
0: aperiodic reported data;
1: periodic reported data;
<reportInterval>:
This parameter is only available when the data is reported periodically. The unit of interval for periodic reported data is in second. For different DRs, the minimum allowed periods are different, defined by the period level, as shown in the following table.
<table>
<tr><th>Rate / Period (s) / Level</th><th>LV1</th><th>LV2</th></tr>
<tr><td>DR0</td><td>150</td><td>300</td></tr>
<tr><td>DR1</td><td>75</td><td>150</td></tr>
<tr><td>DR2</td><td>35</td><td>75</td></tr>
<tr><td>DR3</td><td>15</td><td>30</td></tr>
<tr><td>DR4</td><td>10</td><td>20</td></tr>
<tr><td>DR5</td><td>5</td><td>10</td></tr>
</table>
<err>: error code.</td></tr>
<tr><td>Example</td><td colspan="2">AT+CRM=1,10
OK</td></tr>
<tr><td>Remark</td><td colspan="2">Need to be set before sending data.</td></tr>
</table>

7.2.28 Set Transmit Power [+CTXP]

Command	Command Format	Response
Test Command	AT+CTXP=?	+CTXP:“value” OK
Query Command	AT+CTXP?	+CTXP:<value> OK
Set Command	AT+CTXP=<value>	OK or +CME ERROR:<err>
Parameter Description	<value>: Indicates the transmission power size, the factory default is 0, and the actual value range is related to the specific product model. The value range of RF-AL42UH: 0: 17 dBm 1: 15 dBm 2: 13 dBm 3: 11 dBm 4: 9 dBm 5: 7 dBm 6: 5 dBm 7: 3 dBm <err>: error code.	
Return Value Description		
Example	AT+CTXP=1 OK	
Remark	Need to be set before sending data.	

7.2.29 Verify Network Connection [+CLINKCHEK]

Command	Command Format	Response

Test Command	AT+CLINKCHECK=?	+CLINKCHECK:“value” OK
Set Command	AT+CLINKCHECK=<value>	OK or +CME ERROR:<err>
Parameter Description	<value>: link check enable control	
Return Value Description	0: Link check is not enabled 1: Link check is executed one time 2: The module automatically carries the link check command in each upstream packet. Return OK, the setting is successful. If X1 = 1, after waiting for a while, it will return the second response message, the format is as follows: +CLINKCHECK: Y0, Y1, Y2, Y3, Y4 Y0 indicates the link check result: 0: indicates that the link check execution succeeds. Non-zero: indicates that the link check execution failed. Y1 is DemodMargin Y2 is NbGateways Y3 is the downstream RSSI Y4 for this downstream SNR <err>: error code.	
Example	AT+CLINKCHECK=1 OK +CLINKCHECK: 0,0,1,-68,8	
Remark	Need to be set before sending data.	

7.2.30 Enable ADR [+CADR]

Command	Command Format	Response

Test Command	AT+CADR=?	+CADR:“value” OK
Query Command	AT+CADR?	+CADR:<value> OK
Set Command	AT+CADR=<value>	OK or +CME ERROR:<err>
Parameter Description	<value>: ADR enable control, factory default is 1 0: ADR disabled 1: ADR enabled	
Return Value Description	<err>: error code.	
Example	AT+CADR=1 OK	
Remark	Need to be set before sending data. ADR is enabled by default.	

7.2.31 Set Receiving Window Parameters [+CRXP]

Command	Command Format	Response
Test Command	AT+CRXP=?	+CRXP:“RX1DRoffest”, “RX2DataRate”, “RX2Frequency” OK
Query Command	AT+CRXP?	+CRXP=<RX1DRoffest>, <RX2DataRate>, <RX2Frequency> OK
Set Command	AT+CRXP=<RX1DRoffest>, <RX2DataRate>, <RX2Frequency>	OK or +CME ERROR:<err>
Parameter Description		

Return Value Description	<RX1DRoffest>, <RX2DataRate>, <RX2Frequency> can refer to the LoRaWAN protocol for details. <err>: error code.
Example	AT+CRXP=1,1,471000000 OK
Remark	Need to be set before sending data. Do not set the default value.

7.2.32 Set Frequency List [+CFREQLIST]

Command	Command Format	Response
Test Command	AT+CFREQLIST=?	+CFREQLIST:“ULDL”, “method”, “number”, “freqlist” OK
Query Command	AT+CFREQLIST?	+CFREQLIST:<ULDL>, <method>, <number>, <freqlist> OK
Set Command	AT+CFREQLIST:<ULDL>, <method>, <number>, <freqlist>	OK or +CME ERROR:<err>
Parameter Description	ULDL indicates whether to set the transmission or reception frequency 1: UL 2: DL For the inter-frequency, you need to set the downstream reception frequency. For the co-frequency, no need. Method to set the frequency mode 1: The frequency list is automatically generated according to the starting frequency, channel bandwidth, and the number of channels. 2: Set the specified frequency corresponding to the logical channel separately.	
Return Value Description		

	Number is the number of channels, and the valid range is 1 ~ 16. Need to cooperate with the base station. Freqlist is set according to the X1 parameter. Method = 1, then freqlist is the starting frequency in Hz. Method = 2, then freqlist may be multiple parameters, depending on number, in Hz. <err>: error code.
Example	AT+CFREQLIST=1,2,8,475300000,475500000,475900000,763000000,476500000, 476700000, 476900000
Remark	Optionally, set the frequency band mask according to AT commands of the frequency list. (This command is currently not supported.)

7.2.33 Set Transmitting-Receiving Delay [+CRX1DELAY]

Command	Command Format	Response
Test Command	AT+CRX1DELAY=?	+CRX1DELAY:“Delay” OK
Query Command	AT+CRX1DELAY?	+CRX1DELAY:<Delay> OK
Set Command	AT+CRX1DELAY=<Delay>	OK or +CME ERROR:<err>
Parameter Description	Delay: How long does it take to open the RX1 window after sending, unit: s.	
Return Value Description	<err>: error code.	
Example	AT+CRX1DELAY=2 OK	
Remark	Set how long to open the RX1 window after sending and set before sending data. When	

	not set, it is the protocol default value.

7.2.34 Save MAC Parameter Settings [+CSAVE]

Command	Command Format	Response
Test Command	AT+CSAVE=?	+CSAVE OK
Set Command	AT+CSAVE	OK or +CME ERROR:<err>
Parameter Description	This command saves the configuration parameters to EERPOM / FLASH. After executing the AT+RESET command, the module will use the new MAC configuration parameters for network initialization and operation.	
Return Value Description	<err>: error code.	
Example	AT+CSAVE OK	
Remark	Need to save before sending data.	

7.2.35 Restore MAC Default Parameters [+CRESRORE]

Command	Command Format	Response
Test Command	AT+CRESTORE=?	+CRESTORE OK
Set Command	AT+CRESTORE	OK or +CME ERROR:<err>
Parameter Description	This command saves the MAC default configuration parameters to EERPOM / FLASH.	
Return Value Description	<err>: error code.	

Example	AT+CRESTORE OK
Remark	Need to save before sending data.

7.2.36 PingSlotInfo Request [+CPINGSLOTINFOREQ]

Command	Command Format	Response
Test Command	AT+CPINGSLOTINFOREQ=?	+CPINGSLOTINFOREQ:<periodicity> OK
Query Command	AT+CPINGSLOTINFOREQ?	+CPINGSLOTINFOREQ:<periodicity> OK
Set Command	AT+CPINGSLOTINFOREQ	OK or +CME ERROR:<err>
Parameter Description	Periodicity: ping slot period parameter.	
Return Value Description	<err>: error code.	
Example	AT+CPINGSLOTINFOREQ=3 OK	
Remark	Class B dedicated command.	

7.2.37 Add A Multicast Address [+CADDMULTICAST]

Command	Command Format	Response
Test Command	AT+CADDMUTICAST=?	+CADDMULTICAST:“DevAddr”,“AppSKey”, “NwkSKey”, “Periodicity”, “DataRate” OK
Set Command	AT+CADDMUTICAST=?	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	
Remark	Set before JOIN.	

7.2.38 Delete A Multicast Address [+CDELMULTICAST]

Command	Command Format	Response
Test Command	AT+CDELMUTICAST=?	+CDELMULTICAST:“DevAddr” OK
Set Command	AT+CDELMUTICAST=?	OK or +CME ERROR:<err>
Parameter Description	DevAddr: Multicast address <err>: error code.	
Return Value Description		
Example	AT+CDELMUTICAST=67678d5e OK	
Remark		

7.2.39 Query the Number of Multicast [+CNUMMULTICAST]

Command	Command Format	Response
Test Command	AT+CNUMMUTICAST=?	+CNUMMULTICAST:“DevAddr” OK
Set Command	AT+CNUMMUTICAST=?	OK or +CME ERROR:<err>
Parameter Description		
Return Value Description		
Example	AT+CNUMMUTICAST? +CNUMMULTICAST:0 OK	
Remark		

7.2.40 Restart Module [+IREBOOT]

Command	Command Format	Response
Test Command	AT+IREBOOT=?	+IREBOOT:“Mode” OK
Set Command	AT+IREBOOT =<mode>	OK or +CME ERROR:<err>
Parameter Description	<mode>: restart mode.	
Return Value Description	0: Restart the communication module immediately. 1: Wait for the wireless frame currently being transmitted in the communication module to complete before restart. 7: Restart into bootloader. <err>: error code.	

Example	AT+IREBOOT=1 OK
Remark	After receiving the command, the communication module returns OK and restarts the communication module. No further AT commands will be received until the restart is complete.

7.2.41 Set Log Level [+ILOGLVL]

Command	Command Format	Response
Test Command	AT+ILOGLVL=?	+ILOGLVL:“level” OK
Query Command	AT+ILOGLVL?	+ILOGLVL:<level> OK
Set Command	AT+ILOGLVL=<level>	OK or +CME ERROR:<err>
Parameter Description	<level>: log level	
Return Value Description	0: Disable log information. 1 ~ 5: Enable log information. The larger the number, the more detailed the log information. <err>: error code.	
Example	AT+ILOGLVL=1 OK	
Remark		

7.2.42 Encryption Device Key [+CKEYSPROTECT]

Command	Command Format	Response
Test Command	AT+CKEYSPROTECT=?	+CKEYSPROTECT= <ProtectKey: length

		is 32> OK
Query Command	AT+CKEYSPROTECT?	+CKEYSPROTECT:<protected> OK
Set Command	AT+CKEYSPROTECT=<key>	OK or +CME ERROR:<err>
Parameter Description	<key>: Node protection key <err>: error code.	
Return Value Description		
Example	AT+CKEYSPROTECT=AABBCCDD00112233AABBCCDD00112233 OK	
Remark	After using this command, the device triples information will be encrypted and stored, and only the cipher text can be read, and it can no longer be modified.	

7.2.43 Enable Low-Power [+CLPM]

Command	Command Format	Response
Test Command	AT+CLPM=?	+CCLPM= “Mode” OK
Set Command	AT+CLPMT=<mode>	OK or +CME ERROR:<err>
Parameter Description	<mode>: low-power mode 1: The device enters low-power mode. <err>: error code.	
Return Value Description		
Example	AT+CLPM=1 OK	

Remark	Because when transmitting above 40 kbps, the beginning of the UART byte may be transmitted incorrectly, and AT+CLPM=0 may be recognized as an error and return "+CME ERROR". It is recommended to use "000000000D0A" (hexadecimal) to wake up.

7.2.44 Low-Power Test Command [+CSLEEP]

Command	Command Format	Response
Test Command	AT+CSLEEP=?	+CSLEEP=<0, 1, 2> OK
Set Command	AT+CLPMT=<mode>	OK or +CME ERROR:<err>
Parameter Description	This command is executed to enter the DeepSleep operation. There are three types of Sleep_mode: 0: Enters DeepSleep mode and wakes up by Timer after 10 s. 1: Enters DeepSleep mode and wakes up by set_b pin pulled up. 2: Enters DeepSleep mode and wakes up by UART, the user types any key. <err >: error code.	
Return Value Description		
Example	AT+CSLEEP=0 deep sleep 10000 ms!=0 +CSLEEP OK	
Remark		

7.2.45 Low Power Test Command [+CMCU]

Command	Command Format	Response
Test Command	AT+CMCU=?	+CMCU=<0, 1, 2>

		OK
Set Command	AT+CMCU=<mode>	OK or +CME ERROR:<err>
Parameter Description	This command performs MCU test operation. There are three types of mcu_mode: 0: Only shut down SX1262. 1: MCU, watchdog and Timer work 2: MCU, watchdog and Timer work. System enters DeepSleep mode and wakes up by set_b pin. 3: Enters DeepSleep mode every 15 s	
Return Value Description	< err>: error code.	
Example	AT+CMCU=0 OK	
Remark		

7.2.46 Low Power Test Command [+CSTDBY]

Command	Command Format	Response
Test Command	AT+CSTDBY=?	+CSTDBY=<0, 1> OK
Set Command	AT+CSTDBY=<standby mode>	OK or +CME ERROR:<err>
Parameter Description	The command execution causes the SX1262 into the standby mode, the MCU enters the DeepSleep state and is woken up by the UART.	
Return Value Description	0: Represents the STDBY_RC mode.	

	1: Represents for STDBY_XOSC mode. <err>: error code.
Example	AT+CSTDBY=0 deep sleep wait for uart.
Remark	

7.2.47 Sensitivity Test Command +[CRXS]

Command	Command Format	Response
Test Command	AT+CRXS=?	+CRXS:“Frequency”, “DataRate”,”CodeRate”,”Ido” OK
Set Command	AT+CRXS=<freq>, <data rate>,<CodeRate>,<Ido>	OK or +CME ERROR:<err>
Parameter Description	This command is mainly used for sensitivity test. Freq: 150000000 ~ 960000000 Data_rate has 6 levels, which are DR0 ~ DR5, corresponding to the spreading factors SF12 ~ SF7. Code_rate: 1 ~ 4, where 1 corresponds to 4 / 5, 2 corresponds to 4 / 6, 3 corresponds to 4 / 7, and 4 corresponds to 4 / 8. Ido: 1: enable low-rate optimization, 0: disable low-rate optimization. <err>: error code.	
Return Value Description		
Example	AT+CRXS=868000000,0,1,0 start to recv package (freq: 868000000, dr:0, cr:1, ldo:0)	
Remark		

7.2.48 Receive Test Command +[CRX]

Command	Command Format	Response
Test Command	AT+CRX=?	+CRX:“Frequency”, “DataRate” OK
Set Command	AT+CRX=<freq>, <data rate>	OK Or +CME ERROR:<err>
Parameter Description	This command executes the operation of entering RX continuous receiving mode Freq: 150000000 ~ 960000000 Data_rate has 6 levels, which are DR0 ~ DR5, corresponding to the spreading factor SF12 ~ SF7. <err>: error code.	
Return Value Description		
Example	AT+CRX=868000000,0 start to recv package (freq: 868000000, dr:0)	
Remark	Type the CRX test command. In order to keep the test, the system enters an endless loop and restarts to start the next test.	

7.2.49 Transmitting Test Command [+CTX]

Command	Command Format	Response
Test Command	AT+CTX=?	+CTX:“Frequency”, “DataRate”,”TxPower” OK
Set Command	AT+CTX=<freq>, <data rate>,<pwr>	OK or +CME ERROR:<err>
Parameter Description	This command is executed to enter the timing 1S loop transmission mode Freq: 150000000 ~ 960000000	
Return Value Description		

	Data_rate has 6 levels, which are DR0 ~ DR5, corresponding to the spreading factors SF12 ~ SF7. pwr is the transmit power of SX1262, which is 0 ~ 22. <err>: error code.
Example	AT+CTX=868000000,0,22 start to tx data(freq: 868000000, dr: 0, power: 22): 1
Remark	Type the CTX test command. In order to keep the test, the system enters an endless loop and restarts to start the next test.

7.2.50 Continuous Transmitting Test Command +CTXCW

Command	Command Format	Response
Test Command	AT+CTCW=?	+CTXCW:“Frequency”, “TxPower”, “PaOpt” OK
Set Command	AT+CTXCW=<freq>, <pwr>,<opt>	OK Or +CME ERROR:<err>
Parameter Description	This command executes the operation of entering TX continuous transmission mode. Freq: 150000000 ~ 960000000 pwr is the transmit power of SX1262, which is 0 ~ 22. opt is the PA Optimal setting of SX1262. The value is 0 ~ 3, and the default value is 0. The corresponding relationship is as follows: 0: [0x04,0x07,0x00, 0x01], 1: [0x03,0x05,0x00,0x01], 2: [0x02,0x03,0x00,0x01], 3: [0x02,0x02,0x00,0x01]. For details, refer to the "PA Optimal Settings" section of the sx1262 data sheet.	
Return Value Description		

	<err>: error code.
Example	AT+CTXCW=868000000,22 Start to txcw (freq: 868000000, power: 22db, opt: 0) AT+CTXCW=868000000,22,2 Start to txcw (freq: 868000000, power: 22db, opt: 2)
Remark	Type the CTXCW test command. In order to keep the test, the system enters an endless loop and restarts to start the next test.

9 Revision History

Date	Version No.	Description	Author
2019.06.21	V1.0	The Initial version is released.	Aroo Wang
2019.07.02	V1.1	Update the parameters of module	Aroo Wang
2019.07.12	V1.2	Update home page.	Aroo Wang

Note:

1. The document will be optimized and updated from time to time. Before using this document, please make sure it is the latest version.
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