

# A810-L433M33 Product Manual

RS232/RS485 interface, 16km transmission, 410-441MHz LoRa spread spectrum

Star networking, Auto-relay, AES encryption, ModBus protocol



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# Catalog

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# RS232/RS485 interface, 16km transmission, 410-441MHz LoRa spread spectrum

## Star networking, auto-relay, AES encryption, ModBus protocol

### 1.Product Overview

A810-L433M33 is a 410-441MHz, 2W, high stability, industrial grade wireless digital radio. It adopts efficient cyclic error correction algorithm with high coding efficiency and strong error correction capability, which greatly improves the anti-jamming and high stability.

### 2.Product Features

- With data broadcast, data listening, fixed-point transmission, master-slave mode, automatic relay, fixed-point wake-up, automatic answer
- Auto-answer, the receiver automatically replies to the ACK to ensure transmission stability
- Receiving sensitivity up to -130dBm, transmission distance 16km <sup>[1]</sup>
- Automatic relay, continuous transmission
- AES encryption
- Readable module RSSI <sup>[2]</sup>
- Built-in multiple exception handling mechanisms to ensure long and stable operation of the module
- Maximum transmit power about 33dBm (about 2W)
- Multi-level baud rate <sup>[1]</sup>
  - Eight common baud rates, default baud rate is 9600bps
  - Baud rate range: 1200bps~115200bps
- Multi-level air rate <sup>[1]</sup>
  - Eight levels of adjustable air rate: 1.2~62.5kbps, default air rate 4.8kbps
- Frequency 410~441MHz, providing 81 channels with 1MHz interval for each channel <sup>[4]</sup>
  - $433\text{MHz} + \text{CHAN} * 1\text{MHz}$
  - CHAN: 0x00~0x1FH (corresponding to 410~441MHz)
  - Operates in the 433MHz application-free band by default
- Supply voltage range
  - 8.0V~28VDC
  - Built-in power management module to ensure stable power supply to the radio, able to meet a variety of system requirements
- 1K ring FIFO
  - 1K bytes of send FIFO
  - Internal automatic subcontracting of transfers

Some combinations of airspeed and baud rate can

send infinitely long packets <sup>[3]</sup>

## RS232/RS485 interface, 16km transmission, 410-441MHz LoRa spread spectrum

### Star networking, auto-relay, AES encryption, ModBus protocol

- Broadcast Data and Listening <sup>[5]</sup>

The station address is set to 0xFFFF, which allows listening to data transmissions from all stations on the same channel. The transmitted data can be received by any station with any address on the same channel

- Fixed-point transmission <sup>[5]</sup>

Data can be sent from any station and received from a specified station. When multiple receiving stations have the same address channel, data can be received.

Data can be transmitted point-to-point across channels

Can achieve a variety of applications such as networking and relaying

- Wake up in the air <sup>[5]</sup>

When the wireless wake-up time is not 0, the sender radio will automatically add a wake-up code to wake up the target module when sending data <sup>[6]</sup>

Same transmission method as fixed point transmission

Remark.

[ 1 ] test conditions: clear, open, maximum power, antenna gain 5dBi, height greater than 2m, 2.4k air rate

[ 2 ] Radio RSSI is internal intelligent processing, the user does not need to care, special needs can be read by command

[ 3 ] See the SPEED register in Chapter 7, Section 7.2 Radio Parameter Registers for details

[ 4 ] See the CHAN register in Chapter 7, Section 7.2 Radio Parameter Register for details

[ 5 ] See Chapter 8 for details on radio functions

[ 6 ] The wireless digital radio is compatible with our wireless serial module, and can wake up the wireless serial module over the air.

### 3.Series Products

| Radio Model  | Carrier frequency (Hz) | Core Chips | Interface   | Size (mm) | Maximum transmit power (dBm) | Communication distance (km) | Antenna Form            |
|--------------|------------------------|------------|-------------|-----------|------------------------------|-----------------------------|-------------------------|
| A810-L230M30 | 210M~241M              | ASR6505    | RS232/RS485 | 95*84*25  | 30                           | 30                          | Glue stick, suction cup |
| A810-L900M30 | 850M~931M              | ASR6505    | RS232/RS485 | 95*84*25  | 30                           | 10                          | Glue stick, suction cup |

### 4.Electrical parameters

Conditions: Tc = 25°C, VCC = 12VDC

| Radio Model  | Parameter Name           | Description                                                                                    | Minimum value | Typical values | Maximum value | Unit |
|--------------|--------------------------|------------------------------------------------------------------------------------------------|---------------|----------------|---------------|------|
| A810-L433M33 | Supply voltage           |                                                                                                | 8.0           |                | 28            | VDC  |
| A810-L433M33 | Emission current         |                                                                                                |               | 500            |               | mA   |
| A810-L433M33 | Receiving current        |                                                                                                |               | 12             |               | mA   |
| A810-L433M33 | Operating Frequency Band | 410~441MHz, 81 channels, 1MHz step, factory default 433MHz                                     | 410           | 433            | 441           | MHz  |
| A810-L433M33 | Transmitting power       |                                                                                                |               | 33             |               | dBm  |
| A810-L433M33 | airspeed                 | 8 levels adjustable (1.2kbps, 2.4kbps, 4.8kbps, 9.6kbps, 19.2kbps, 38.4kbps, 50kbps, 62.5kbps) | 1.2k          | 4.8k           | 62.5k         | bps  |
| A810-L433M33 | Reception sensitivity    | Receiving sensitivity is independent of serial port baud rate and delay time                   |               | -130           |               | dBm  |
| A810-L433M33 | Operating temperature    | Industrial Products                                                                            | -40           |                | +85           | °C   |
| A810-L433M33 | Working humidity         | Relative humidity, non-condensing                                                              | 10%           |                | 90%           |      |
| A810-L433M33 | Storage Temp             |                                                                                                | -40           |                | +125          | °C   |

## 5. Radio connection method

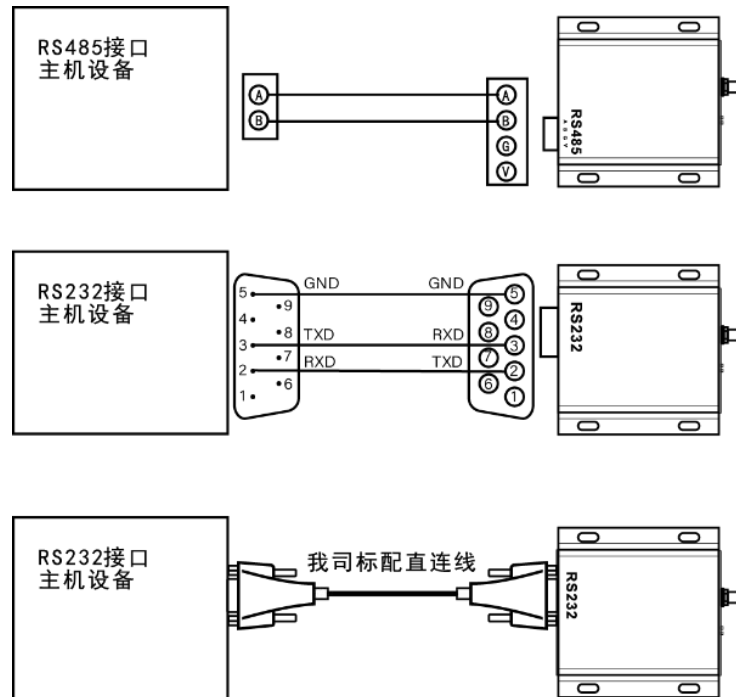


Figure 5-1 Recommended connection diagram

Note: [ 1 ] See DTU product manual for detailed connection methods and procedures

[ 2 ] Only one RS232 and RS485 can be used at the same time

## 6. Radio Reset

The default state of the radio RESET indicator is off. Press and hold the RESET button until the RESET indicator flashes, release the button, then the device will produce a reset and restore the factory settings.

## 7. Radio orders

### 7.1 Command Format

The parameters of our digital transmission radio can be configured to support read and write command operation, and the detailed commands are as follows.

#### ➤ Configuration Mode Command Overview Table

The parameter configuration command only supports parameter modification in the configuration mode, and is valid when the RESET lamp is lit, at which time the serial port parameters are 9600, 8N1.

The configuration command is implemented by adding the register address and register length to the command word, which can realize the configuration of multiple configuration items continuously at the same time.

The command format is as follows.

| Command word                                                           | Register start address                      | Number of configuration registers                                                                                                                                                                                                                           | Register Value                                                                                                                                            | Register Value | Register value n |
|------------------------------------------------------------------------|---------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|------------------|
| CMD                                                                    | REG                                         | LEN                                                                                                                                                                                                                                                         | DATA0                                                                                                                                                     | ...            | DATAn            |
| CMD [7]<br>0 for read, 1 for write                                     | The range of REG in this model is 0x00~0x21 | Indicates the number of registers to be operated.<br><br>When the number of registers to be operated exceeds the number of current operation rights, an error will be returned, for example, if a read-only register is written, an error will be returned. | When reading, you can leave it unfilled, when writing, make sure to correspond to the register length and total length, otherwise it will report an error |                |                  |
| CMD [6]<br>0 for local command, 1 for remote configuration             |                                             |                                                                                                                                                                                                                                                             |                                                                                                                                                           |                |                  |
| CMD [5].<br>0 is return operation success, 1 is return operation error |                                             |                                                                                                                                                                                                                                                             |                                                                                                                                                           |                |                  |
| CMD[4...0]<br>Reserved                                                 |                                             |                                                                                                                                                                                                                                                             |                                                                                                                                                           |                |                  |

Note: Register addresses are distinguished by function, not by occupied bytes

Command functions are detailed in the following table, using the default factory configuration as an example.

| Command Format                                                                                     | Module Answer  | Description                                                                  |
|----------------------------------------------------------------------------------------------------|----------------|------------------------------------------------------------------------------|
| 0x80 ADDR LEN VAL1 VAL2 ... VALn<br>(See parameter configuration register description for details) | 0x80 ADDR LEN  | Configuration success, configuration parameters power down and save          |
|                                                                                                    | 0xC0 ADDR LEN  | Configuration failed, the original configuration parameters were not changed |
| 0x80 0x0B 0x01 0x77 0x77 0x77 0x2E 0x61                                                            | 0x80 0x0B 0x01 | Data key success                                                             |

|                                                           |                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                           |
|-----------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0x73 0x68 0x69 0x6E 0x69 0x6E 0x67 0x2E<br>0x63 0x6F 0x6D | 0xC0 0x0B 0x01                                                                                                                                                                                                                                                                                                                                             | Data key failure                                                                                                                                                                                                                                                                                                          |
| 0x00 0x04 0x1B                                            | 0x00 0x00 0x25 0x80 0x00 0x02 0xBD<br>0x00 0x01 0x05 0x03 0xE8 0x00 0x77<br>0x77 0x77 0x77 0x2E 0x61 0x73 0x68<br>0x69 0x6E 0x69 0x6E 0x67 0x2E 0x63<br>0x6F 0x6D 0x7C 0x7C 0x7C 0x7C<br>0x7C 0x7C 0x05 0x40 0x00 0x23 0x00<br>0x00 0x00 0x00 0x3C 0x3C 0x00 0x0A<br>0x04 0x00 0x00 0x00 0x00 0x00 0x00<br>0x00 0x00 0x00 0x00 0x00 0x00 0x00<br>0x00 0x00 | The module returns the parameters of all currently writable registers in hexadecimal format                                                                                                                                                                                                                               |
| 0x00 0x00 0x01                                            | a810-l400m21-v1.0.10                                                                                                                                                                                                                                                                                                                                       | The module will return the current version number in ASCII format                                                                                                                                                                                                                                                         |
| 0x80 0x20 0x01                                            | OK                                                                                                                                                                                                                                                                                                                                                         | The module generates a reset, during which the module performs a self-test and the AUX goes low, after the reset the AUX goes high and the module starts to work normally. At this time, you can switch the status or initiate the next command                                                                           |
| 0x80 0x21 0x01                                            | OK                                                                                                                                                                                                                                                                                                                                                         | Restore default parameters configuration successfully                                                                                                                                                                                                                                                                     |
| 0x00 0x01 0x01                                            | XXXX                                                                                                                                                                                                                                                                                                                                                       | Read the current data signal RSSI and environment signal RSSI directly. e.g. the module returns XXXX, the first two XX represent the current environment RSSI, the last two XX represent the current data RSSI, convert them to decimal data, it means the current signal strength. This command can be used in all modes |

### ➤ Operating mode command overview table

To configure parameters in operating mode, the configuration command needs to satisfy the following format. Sync header + ID code + header + command code inverse + command code + data (length is not fixed, refer to command overview table) + CS + sync header inverse + ID code inverse + header inverse + end code

| Number of data bits | Value     | Description                                                                                                                                      |
|---------------------|-----------|--------------------------------------------------------------------------------------------------------------------------------------------------|
| 0, 1                | 0xAF 0xAF | 2BYTE Sync Head                                                                                                                                  |
| 2, 3                | 0xFF 0xFF | 2BYTE ID code, can be a random number, default 0x55 0x55                                                                                         |
| 4                   | 0x5A      | 1BYTE header                                                                                                                                     |
| 5                   | 0xFF      | 1BYTE Command Code Inversion (Command Code Reference Command Overview Table)                                                                     |
| 6                   | 0xFF      | 1BYTE command code (command code reference command overview table)                                                                               |
| 7                   | 0xFF      | 1BYTE start address                                                                                                                              |
| 8                   | 0xFF      | 1BYTE command length                                                                                                                             |
| 8~n                 | 0xFF      | Command data, refer to the parameter register table                                                                                              |
| n+1, n+2            | 0xFF 0xFF | 2BYTE check code, the high eight bits are the sum of all data before CS to take the low 8 bits, the low eight bits are all data before CS iso-or |

|          |           |                                              |
|----------|-----------|----------------------------------------------|
| n+3, n+4 | 0x50 0x50 | 2BYTE synchronous header reversal            |
| n+5, n+6 | 0xXX 0xXX | 2BYTE ID code is inverted, default 0xAA 0xAA |
| n+7      | 0xA5      | 1BYTE header is reversed                     |
| n+8, n+9 | 0x0D 0x0A | 2BYTE end code                               |

The working mode command function is detailed in the following table, taking the default factory configuration as an example.

| Command Format                                                                                                                                                                                                                                                 | Module Answer                                                                                                                                                                                                           | Description                                                                                 |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|
| AF AF 55 55 5A FF 00 04 1C 81 BD 50 50 AA<br>AA A5 0D 0A                                                                                                                                                                                                       | 00 00 25 80 00 02 FA 00 01 05 03 E8 00<br>77 77 77 77 2E 61 73 68 69 6E 69 6E 67<br>2E 63 6F 6D 7C 7C 7C 7C 7C 05 40<br>00 23 00 00 00 00 3C 3C 00 0A 19 00<br>80 00 00 00 00 00 00 00 00 00 00 00<br>00 00 00 00 00 00 | The module returns the parameters of all currently writable registers in hexadecimal format |
| AF AF 55 55 5A 7F 80 04 1C 00 00 25 80 00 02<br>FA 00 01 05 03 E8 00 77 77 77 77 77 2E 61 73<br>68 69 6E 69 6E 67 2E 63 6F 6D 7C 7C 7C 7C<br>7C 7C 05 40 00 23 00 00 00 3C 3C 00 0A 19 00<br>80 00 00 00 00 00 00 00 00 00 00 00 53 8D<br>50 50 AA AA A5 0D 0A | 80 04 1C                                                                                                                                                                                                                | Write all parameters                                                                        |

## 7.2 Radio parameter register

Parameter registers (parameter registers cannot be used alone, they must be used in accordance with the command format of the configuration parameters)

| Serial number | Address | Register Permissions | Register Length | Register Description                                                                                                                                                                                                                                       |
|---------------|---------|----------------------|-----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1             | 0x00    | R                    | 20              | Module Version Number                                                                                                                                                                                                                                      |
| 2             | 0x01    | R                    | 4               | The first two bytes indicate the current environment RSSI, and the last two bytes indicate the current packet RSSI                                                                                                                                         |
| 3             | 0x02    | R                    | 2               | Value of ADC1                                                                                                                                                                                                                                              |
| 4             | 0x03    | R                    | 2               | Value of ADC2                                                                                                                                                                                                                                              |
| 5             | 0x04    | R/W                  | 4               | Serial port baud rate of the module, customizable in the range of 1200~115200bps                                                                                                                                                                           |
| 6             | 0x05    | R/W                  | 1               | Serial port parameters of the module<br>Bit4 is the frame length (data bits + parity bits)<br>0 for 8 bits 1 for 9 bits<br>Bit5 is the stop bit 0 is 1 bit 1 is 2 bits<br>Bit2   Bit1 is the parity bit 00 is no parity 10 is even parity 11 is odd parity |
| 7             | 0x06    | R/W                  | 2               | Bit10   Bit9   Bit8   Bit7   Bit6   Bit5 is the channel number, the default is 10111 (23) channels<br>Bit4   Bit3 for power 11 : 33dBm 10 : 30dBm                                                                                                          |

|    |      |     |    |                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|----|------|-----|----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|    |      |     |    | <p>01 : 27dBm</p> <p>00 : 24dBm</p> <p>Default is 11, power is 33 dBm</p> <p>Bit2   Bit1   Bit0 for null speed</p> <p>111 : 62.5K</p> <p>110 : 50K</p> <p>101 : 38.4K</p> <p>100 : 19.2K</p> <p>011 : 9.6K</p> <p>010 : 4.8K</p> <p>001 : 2.4K</p> <p>000 : 1.2K</p> <p>Default is 010 with an airspeed of 4.8K [2]</p>                                                                                                               |
| 8  | 0x07 | R/W | 2  | <p>Working mode</p> <p>0x0001, Pass-through</p> <p>0x0002, fixed point</p> <p>0x0004, Master-Slave</p> <p>0x0020, Relay</p> <p>0x0080, Polling mode</p> <p>0x0400, Timing up</p> <p>0x0100, Passing</p> <p>0xF001, Control IO output</p>                                                                                                                                                                                              |
| 9  | 0x08 | R/W | 1  | <p>Auto-answer settings</p> <p>Bit8 is 0 for off, 1 for enable</p> <p>Bit7~Bit0 indicates the number of re-transmissions</p>                                                                                                                                                                                                                                                                                                          |
| 10 | 0x09 | R/W | 2  | Auto-answer re-transmission interval, in ms                                                                                                                                                                                                                                                                                                                                                                                           |
| 11 | 0x0A | R/W | 1  | <p>Device as master or slave</p> <p>Bit2 Master (1) or slave (0) of the timed reporting mode</p> <p>Bit1 Master (1) or slave (0) in polling mode</p> <p>Bit0 Master (0) or slave (1) of master-slave mode</p>                                                                                                                                                                                                                         |
| 12 | 0x0B | R/W | 16 | AES Key                                                                                                                                                                                                                                                                                                                                                                                                                               |
| 13 | 0x0C | R/W | 5  | Package-to-package separator content                                                                                                                                                                                                                                                                                                                                                                                                  |
| 14 | 0x0D | R/W | 1  | Use the length of the separator in bytes                                                                                                                                                                                                                                                                                                                                                                                              |
| 15 | 0x0E | R/W | 1  | Serial packet length in bytes                                                                                                                                                                                                                                                                                                                                                                                                         |
| 16 | 0x0F | R/W | 2  | Serial port packing cycle in 0.1ms                                                                                                                                                                                                                                                                                                                                                                                                    |
| 17 | 0x10 | R/W | 2  | <p>The lowest digit of each three digits indicates whether the default is pull high or pull low</p> <p>1 is pull up 0 is pull down</p> <p>The middle bit of each three digits indicates whether the input or output</p> <p>1 is the input 0 is the output</p> <p>The highest bit of each three digits indicates When in output mode, latch or no latch 1 for flip 0 for press period, flip hold, release flip back to start state</p> |
| 18 | 0x11 | R/W | 1  | <p>ADC Parameters</p> <p>Bit0 is 1 Channel 1 enable 0 Channel 1 off</p> <p>Bit1 is Channel 1 enable Bit1 is 0 Channel 1 off</p>                                                                                                                                                                                                                                                                                                       |

|    |      |     |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|----|------|-----|---|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|    |      |     |   | Bit2 is whether or not to report regularly When 1 is reported regularly, when 0 is not reported regularly<br>Bit6~Bit5 ADC precision 00 is 12Bits 01 is 10Bits 10 is 8Bits 11 is 6Bits                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| 19 | 0x12 | R/W | 1 | ADC acquisition period in 0.5s                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| 20 | 0x13 | R/W | 1 | ADC data upload period via RF in 0.5s                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| 30 | 0x14 | R/W | 1 | Low power consumption level in 100ms units                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| 22 | 0x15 | R/W | 1 | IO control IO timeout time in 0.5s                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| 23 | 0x16 | R/W | 1 | Data window length in polling mode and active reporting mode, in 200ms                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| 24 | 0x17 | R/W | 2 | Job Options<br>Bit9 turns on data sending before scanning for new to idle<br>Bit8 opens data sending with random delay before sending<br>Bit6 opens the group number output to request lost packets after the reception is complete<br>Bit5 opens the function of group packet output<br>Bit4 turns remote configuration on or off<br>Bit3 When configured over the air, whether to reply to ACK, only available in one-to-one configuration<br>Bit2 When configured over the air, whether to output the result from the serial port<br>Whether to output packet and packet separator on Bit1 serial output<br>Bit0 output address |
| 25 | 0x18 | R/W | 1 | Local Group Number                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| 26 | 0x19 | R/W | 1 | Local Address                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| 27 | 0x1A | R/W | 1 | Target group number                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| 28 | 0x1B | R/W | 1 | Destination Address                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| 29 | 0x1C | R/W | 1 | In relay mode, the path A group number                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| 30 | 0x1D | R/W | 1 | Relay mode, path A address                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| 31 | 0x1E | R/W | 1 | In relay mode, the path B group number                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| 32 | 0x1F | R/W | 1 | Relay mode, path B address                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| 31 | 0x20 | X   | 1 | Module reboot                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| 32 | 0x30 | X   | 1 | Module restores factory settings                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |

### 7.3 Radio factory settings

Register factory configuration table.

| Serial number | Address | Register Permissions | Register Length | Default Parameters                                                                                           |
|---------------|---------|----------------------|-----------------|--------------------------------------------------------------------------------------------------------------|
| 1             | 0x00    | R                    | 20              | A810-L433M33-V1.0.10, module version number                                                                  |
| 2             | 0x01    | R                    | 4               | 0x0000 (default), which means that the current environment RSSI is 0x00 and the current package RSSI is 0x00 |
| 3             | 0x02    | R                    | 2               | 0x0000 (default), the value of ADC1, when the data changes after each data acquisition                       |
| 4             | 0x03    | R                    | 2               | 0x0000 (default), the value of ADC2, when the data changes after each data acquisition                       |
| 5             | 0x04    | R/W                  | 4               | 0x00002580 (9600bps, default) serial port baud rate of the module, customizable, range 1200~115200           |

|    |      |     |    |                                                                                                                                                                                                                                                                                         |                                                                                                      |
|----|------|-----|----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|
| 6  | 0x05 | R/W | 1  | 0x00 (default)<br>Bit4 is 0.<br>Bit5 is 0.<br>Bit2   Bit1 is 00<br>Serial port parameters are 8-bit data bit 1-bit stop bit No parity bit                                                                                                                                               | Indicates that the data bits are 8 bits<br>Indicates that the stop bit is 1 bit<br>means no checksum |
| 7  | 0x06 | R/W | 2  | 0x02FC (default)<br>Bit10   Bit9   Bit8   Bit7   Bit6   Bit5 is the channel number, the default is 10111 (23) channels<br>Bit4   Bit3 is the power number, the default is 11, the power is 33dBm<br>Bit2   Bit1   Bit0 is the null speed number, default is 010, the null speed is 4.8K |                                                                                                      |
| 8  | 0x07 | R/W | 2  | 0x0001 (default)<br>Operating mode is transparent transmission                                                                                                                                                                                                                          |                                                                                                      |
| 9  | 0x08 | R/W | 1  | 0x05 (default)<br>Bit8 is 0 to turn off stable transmission by default<br>Bit7~Bit0 is 5, which means the default number of re-transmission is 5 times                                                                                                                                  |                                                                                                      |
| 10 | 0x09 | R/W | 2  | 1000 in ms, stable transmission re-transmission interval is 1S by default                                                                                                                                                                                                               |                                                                                                      |
| 11 | 0x0A | R/W | 1  | 0x00 (default)<br>Bit0=0 means that when in master-slave mode, as the host<br>Bit1=0 means that when in polling mode, as a slave<br>Bit2=0 means that when it is in the timed-up report, it acts as a slave                                                                             |                                                                                                      |
| 12 | 0x0B | R/W | 16 | 0x77 0x77 0x77 0x2E 0x61 0x73 0x68 0x69 0x6E 0x69 0x6E 0x67 0x2E 0x63 0x6F 0x6D<br>(default)<br>Indicates that the packet is encrypted using the above AES key                                                                                                                          |                                                                                                      |
| 13 | 0x0C | R/W | 5  | (default)<br>When the separator output is turned on, the above separator is output between packages                                                                                                                                                                                     |                                                                                                      |
| 14 | 0x0D | R/W | 1  | 0x05 (default)<br>Indicates that the maximum valid length for using separators is 5                                                                                                                                                                                                     |                                                                                                      |
| 15 | 0x0E | R/W | 1  | 64 (default)<br>When the serial input is more than 64 bytes, then every 64 bytes will be treated as 1 packet                                                                                                                                                                            |                                                                                                      |
| 16 | 0x0F | R/W | 2  | 35 (default)<br>When the serial port data idle time exceeds 3.5ms, then the currently received data is treated as a packet                                                                                                                                                              |                                                                                                      |
| 17 | 0x10 | R/W | 2  | 0x0000 (default)<br>Default each IO port is output, pull low, through other modules IO control output is not latching                                                                                                                                                                   |                                                                                                      |
| 18 | 0x11 | R/W | 1  | 0x00<br>Indicates that ADC channel 1 and channel 2 are off and not enabled to send the collected data through RF at regular intervals, with a collection accuracy of 12Bits                                                                                                             |                                                                                                      |
| 19 | 0x12 | R/W | 1  | 60 (default)<br>Data is collected via ADC channels every 30S                                                                                                                                                                                                                            |                                                                                                      |
| 20 | 0x13 | R/W | 1  | 60 (default)<br>If ADC data upload is turned on, then the data is sent out every 30S via wireless                                                                                                                                                                                       |                                                                                                      |
| 30 | 0x14 | R/W | 1  | 0 (default)<br>No wake-up code and no sleep will be sent by default                                                                                                                                                                                                                     |                                                                                                      |
| 22 | 0x15 | R/W | 1  | 10 (default)<br>When IO control time exceeds 5S, IO control is considered to be finished                                                                                                                                                                                                |                                                                                                      |

|    |      |     |   |                                                                                                                                                                                                                                                          |
|----|------|-----|---|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 23 | 0x16 | R/W | 1 | 25 (default)<br>Each window time is 5S                                                                                                                                                                                                                   |
| 24 | 0x17 | R/W | 1 | 0x04 (default)<br>Turn off wireless configuration function, turn off wireless reply to remote configuration result, turn on serial reply to wireless configuration result, turn off outputting separator between packets. Turn off outputting addresses. |
| 25 | 0x18 | R/W | 1 | 0x00, the local group number is 0x00                                                                                                                                                                                                                     |
| 26 | 0x19 | R/W | 1 | 0x00 with a local address of 0x00                                                                                                                                                                                                                        |
| 27 | 0x1A | R/W | 1 | 0x00, the target group number is 0x00                                                                                                                                                                                                                    |
| 28 | 0x1B | R/W | 1 | 0x00, the destination address is 0x00                                                                                                                                                                                                                    |
| 29 | 0x1C | R/W | 1 | 0x00, in relay mode, the path A group number is 0x00                                                                                                                                                                                                     |
| 30 | 0x1D | R/W | 1 | 0x00, in relay mode, the path A address is 0x00                                                                                                                                                                                                          |
| 31 | 0x1E | R/W | 1 | 0x00, in relay mode, the path B group number is 0x00                                                                                                                                                                                                     |
| 32 | 0x1F | R/W | 1 | 0x00, in relay mode, the path B address is 0x00                                                                                                                                                                                                          |

Remark.

1、 The configuration of the radio parameters can use the parameter configuration software ASDS provided by the company, the configuration process and steps are detailed in the DTU product manual

2、 Fast communication test of the radio and detailed procedures are described in the DTU product manual

## 8. Radio Function

### 8.1 Radio Features Overview

| Radio Menu                                                   |                                                                                                                                                                                                                                                    |                             |                                                                                                                                                                                                                                          |
|--------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Radio Function                                               | Data format of the sender                                                                                                                                                                                                                          | Data format of the receiver | Function Introduction                                                                                                                                                                                                                    |
| Transparent Broadcasting                                     | User Data                                                                                                                                                                                                                                          | User Data                   | Any station that sends data can be received by stations with the same address and the same channel. Sending data is transparent, and what you send is what you receive.                                                                  |
| Fixed-point transmission                                     | Receiver address + receiver channel + user data                                                                                                                                                                                                    | User Data                   | Data can be sent from any radio station and received by specified radio stations, and data can be received when multiple receiving radio stations have the same address channel. Data can be transmitted point-to-point across channels. |
| Broadcast and Monitoring<br>(under fixed-point transmission) | 0xFF+0xFF+receiver channel+user data                                                                                                                                                                                                               | User Data                   | Broadcast: any station sends data, and all stations under the same channel can receive data at the same time.<br>Listening: a radio with a 0xFFFF address can receive data sent by a radio with any address under the same channel.      |
| Wake Up in the Air                                           | 1. In transparent transmission mode.<br>(automatically adds wakeup code 010101010 -----) +<br>User Data<br>2. In fixed transmission mode.<br>(automatically adds wakeup code 010101010 -----) +<br>Receiver address + receiver channel + user data | User Data                   | 1、 The station will automatically add a wake-up code when sending data<br>2、 The length of the wake-up code can be set by setting the wireless wake-up time                                                                              |

### 8.2 Radio function detailed explanation

#### 8.2.1 Transparent Broadcasting

##### Function Description

Any station sends data, and any station with the same address and the same channel can receive data at the same time.

Data is sent and received transparently, and what is sent is what is received.

##### Radio settings

1. Bit 7 of the OPTION special function register needs to be configured to 0. Transparent transmission mode
2. Sending and receiving radio addresses are set to the same value
3. The channels of the transmitting and receiving radio are set to the same value

##### Examples

| Sender         |                          | Receiver       |                          |
|----------------|--------------------------|----------------|--------------------------|
| Radio Address  | 0x1234 (factory default) | Radio Address  | 0x1234 (factory default) |
| Radio Channels | 0x17 (factory default)   | Radio Channels | 0x17 (factory default)   |
| Sending data   | User Data                | Output Data    | User Data                |

0x11 0x22 0x33

0x11 0x22 0x33

### 8.2.2 Auto-Answer

#### Function Description

After the radio sends the data, it will wait for the answer packet from the receiver. When the packet is received, it means the current packet is sent successfully, if the timeout is not received, then the sender radio will automatically resend this packet data until the answer packet is received or until the maximum number of packets is sent.

#### Radio settings

1. Bit 7 of the 0x08 special function register needs to be configured to 1 to turn on the stable transfer function, which is off by default.
2. It is necessary to configure bits 6~0 of the 0x08 special function register to the number of times re-transmission is required, maximum 127 times, default 5 times
3. The 0x09 special function register needs to be configured to require a re-transmission interval in ms, the default is 1000ms

#### Examples

| Sender         |                           | Receiver       |                          |
|----------------|---------------------------|----------------|--------------------------|
| Radio Address  | 0x1234 (factory default)  | Radio Address  | 0x1234 (factory default) |
| Radio Channels | 0x17 (factory default)    | Radio Channels | 0x17 (factory default)   |
| Sending data   | User Data                 | Output Data    | User Data                |
|                | First send 0x11 0x22 0x33 |                |                          |
|                | No ACK received           |                |                          |
|                | nth send 0x11 0x22 0x33   |                | 0x11 0x22 0x33           |
|                | Receive ACK               |                |                          |

### 8.2.3 Master-Slave Mode

#### Function Description

The master can send data to the specified slaves, and all slaves can receive the data sent by the master.

#### Module Settings

1. MD0 = 0, MD1 = 0
2. Need to configure 0x07 special function register to 0x0004, master-slave mode
3. The addresses of the transmitter and receiver modules can be set differently
4. The channels of the transmitter and receiver modules are set to the same

#### Examples

| Sender                      |           | Receiver                   |                  |
|-----------------------------|-----------|----------------------------|------------------|
| Target group number address | 0xXXXX    | Local group number address | 0x5678           |
| Modular channels            | 0x18      | Modular channels           | 0x18             |
| Master-Slave                | Mainframe | Master-Slave               | From the machine |

|              |                                                   |             |                |
|--------------|---------------------------------------------------|-------------|----------------|
| Sending data | Receive address high + receive address low + data | Output Data | User Data      |
|              | 0x56 0x78 0x11 0x22 0x33                          |             | 0x11 0x22 0x33 |

## 8.2.4 Fixed-point transmission

### Function Description

Data can be sent from any station and received from a specified station. When multiple receiving stations have the same address channel, data can be received.

### Radio settings

- Bit 7 of the OPTION special function register needs to be configured to 1, fixed-point transmission mode
- The addresses of the transmitting and receiving stations can be set differently
- The channels of the transmitting and receiving radio can be set differently
- The first 3 bytes of the sender's data must be the receiver's address high + address low + channel

### Examples

| Sender         |                                                                     | Receiver       |                |
|----------------|---------------------------------------------------------------------|----------------|----------------|
| Radio Address  | 0XXXXX                                                              | Radio Address  | 0x5678         |
| Radio Channels | 0XXXXX                                                              | Radio Channels | 0x18           |
| Sending data   | Receive address high + receive address low + receive channel + data | Output Data    | User Data      |
|                | 0x56 0x78 0x18 0x11 0x22 0x33                                       |                | 0x11 0x22 0x33 |

## 8.2.5 Broadcast under fixed point transmission

### Function Description

Any station sends data, and all stations under the same channel can receive data.

### Radio settings

- Bit 7 of the OPTION special function register needs to be configured to 1, fixed-point transmission mode
- The addresses of the transmitting and receiving stations can be set differently
- The channels of the transmitting and receiving radio can be set differently
- The first 3 bytes of the sender's data must be 0xFF+0xFF+receiver channel

### Examples

| Sender         |                                     | Receiver       |                        |
|----------------|-------------------------------------|----------------|------------------------|
| Radio Address  | 0XXXXX                              | Radio Address  | 0XXXXX                 |
| Radio Channels | 0XXXXX                              | Radio Channels | 0x17 (factory default) |
| Sending data   | 0xFF+0xFF+receive channel+user data | Output Data    | User Data              |
|                | 0xFF 0xFF 0x17 0x11 0x22 0x33       |                | 0x11 0x22 0x33         |

## 8.2.6 Listening under fixed-point transmission

### Function Description

Any radio with a 0xFFFF address can receive data from a radio with any address on the same channel.

### Radio settings

1. Bit 7 of the OPTION special function register needs to be configured to 1, fixed-point transmission mode
2. The address of the listening radio must be set to 0xFFFF
3. The channels of the listening and transmitting stations must be set to the same
4. The first 3 bytes of the sender's data must be 0xXX+0xXX+listening channel

### Examples

| Sender         |                                                                                 | Receiver       |                        |
|----------------|---------------------------------------------------------------------------------|----------------|------------------------|
| Radio Address  | 0x1234 (factory default)                                                        | Radio Address  | 0xFFFF                 |
| Radio Channels | 0x17 (factory default)                                                          | Radio Channels | 0x17 (factory default) |
| Sending data   | arbitrary address high + arbitrary address low +<br>receive channel + user data | Output Data    | User Data              |
|                | 0xXX 0xXX 0xXX 0x17 0x11 0x22 0x33                                              |                | 0x11 0x22 0x33         |

## 8.2.7 Wake Up in the Air

### Function Description

The transmitter module in the wake-up state can wake up the receiver module in the power-saving state over the air. If a valid wake-up code is received during the "listening" process, the module will calculate the time of the arrival of the valid data. If the time of valid data arrival is longer than the time of three wake-up codes, the device will continue to enter the sleep state and wait until the data arrives to wake up and receive the data automatically. If it is less than the time of three wake-up codes, the module will keep waiting for the valid data packets. After receiving, the serial port will be opened and the received wireless data will be sent through TXD, after sending, the module will continue to enter the "sleep-listening" working state.

### Module Settings

1. The sender module must be operating in the wake-up working state (MD0 = 1, MD1 = 0)
2. The sender sets the length of the wake-up time by setting the wireless wake-up time register 0x14. The wireless wake-up time of the sender module is greater than or equal to the listening interval of the receiver module to ensure that the receiver module can listen to the wake-up code when it is in the power-saving working state. After receiving the wake-up code, the receiver module calculates whether it needs to enter the sleep state again. If the time of valid data arrival is greater than the time of three wake-up codes, the module will enter the sleep state again and wake up before the arrival of valid data to complete the data reception.
3. Receiver module must be in power-saving operation (MD0 = 1, MD1 = 1)
4. Set the listen interval time register 0x14 of the receiver module to ensure that the receiver module can receive a valid wake-up code within the listen interval time.
5. In general application cases, it is sufficient for both the sender and receiver modules to set the wake-up time register 0x14 to the same value.

### 8.2.8 Low power consumption

#### Function Description

The wake-up module is in the power-saving state, and the module will listen to the wake-up code or not at regular intervals. If no wake-up code is received, the module will always be in the "sleep-listening" state. If a wake-up code is received during the wake-up listening process, the receiving module calculates whether it needs to enter the sleep state again. If the time of valid data arrival is longer than the time of three wake-up codes, the module will enter the sleep state again and wake up before the arrival of valid data to complete the data reception.

By setting different listening interval times, the module has different receive response latency and average power consumption. Users need to strike a balance between the communication delay time and the average power consumption time.

#### Module Settings

1. Set the operating state of the module to power-saving operation (MD0 = 1, MD1 = 1)
2. Set the module's wireless wake-up time register 0x14

### 8.2.9 Relay

#### Function Description

The device in relay mode will forward the received data backward according to the set path until the target device for the purpose of extending the transmission distance.

#### Module Settings

1. MD0 = 0, MD1 = 0; MD0 = 1, MD1 = 0
2. Need to configure 0x07 special function register to 0x0020, relay mode
3. Set the previous group number address and the next group number address in relay mode (0x1B~0x1E registers)
4. The channels of the relay module and the transmitter module must be set to the same

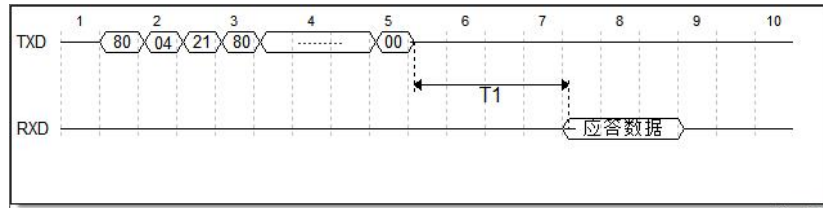
#### Remark.

The setting of [ 1 ] 0x14 is described in the OPTION register in Chapter 6.2 Module parameter configuration commands.

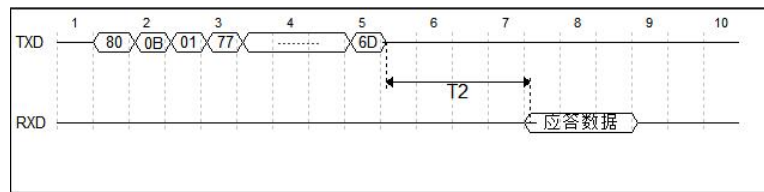
[ 2 ] The average power consumption is determined by the duty cycle of the highest power consumption and the lowest power consumption. The power consumption of the module is influenced by the airspeed, baud rate, wake-up time and the number of bytes sent.

## 9. Timing Chart

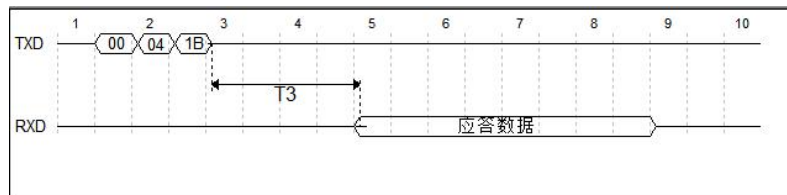
### 1. Module parameter configuration commands



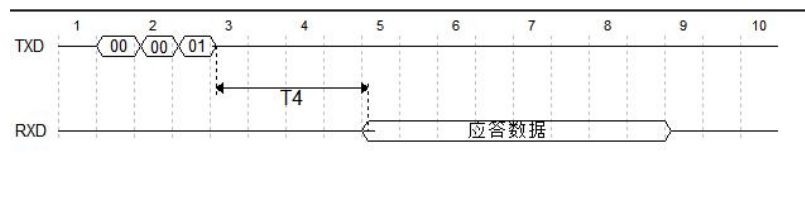
### 2. Module encryption key setting command



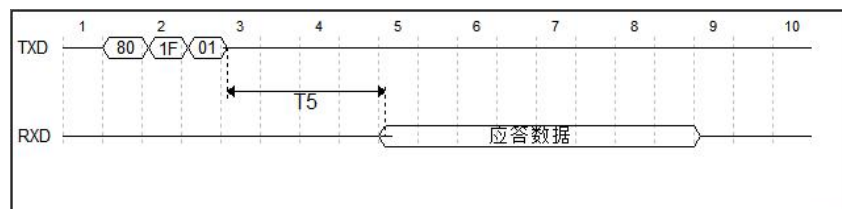
### 3. Read module configuration parameters command



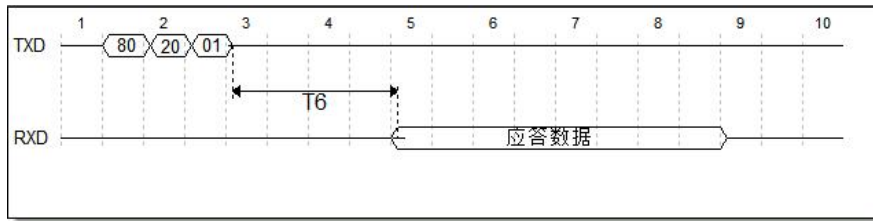
### 4. Read module hardware version number command



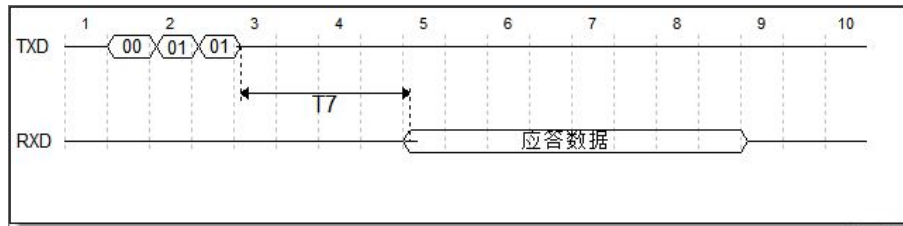
### 5. Module reset command



### 6. Restore module default parameter command



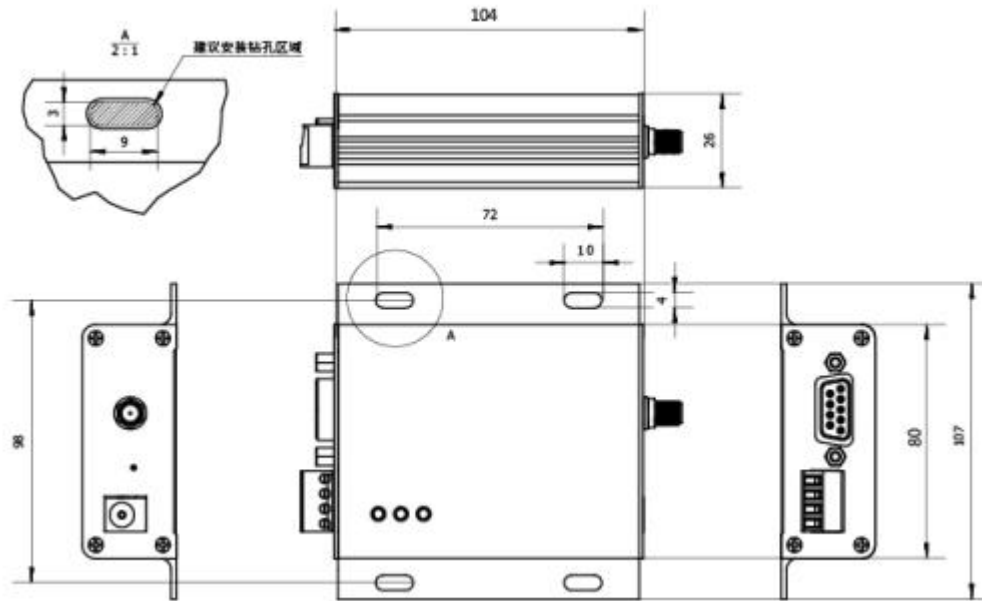
7. Read current data signal RSSI and environment RSSI commands directly



| Parameter Name                                 | T_answer | Description                                            | Minimum value | Typical values | Maximum value | Unit |
|------------------------------------------------|----------|--------------------------------------------------------|---------------|----------------|---------------|------|
| Module Command Answer Delay                    | T1       | Parameter configuration delay                          |               | 140            |               | ms   |
|                                                | T2       | Read module configuration parameters delay             |               | 3              |               | ms   |
|                                                | T3       | Read module hardware version number delay              |               | 3              |               | ms   |
|                                                | T4       | Waiting for module reset delay                         |               | 3              |               | ms   |
|                                                | T5       | Read module voltage delay                              |               | 3              |               | ms   |
|                                                | T6       | Configure module encryption key delay                  |               | 140            |               | ms   |
|                                                | T7       | Recovery module default parameter delay                |               | 50             |               | ms   |
| Waiting for data transmission completion delay | T_Packet | Delay time required to finish sending a packet of data |               |                |               | ms   |

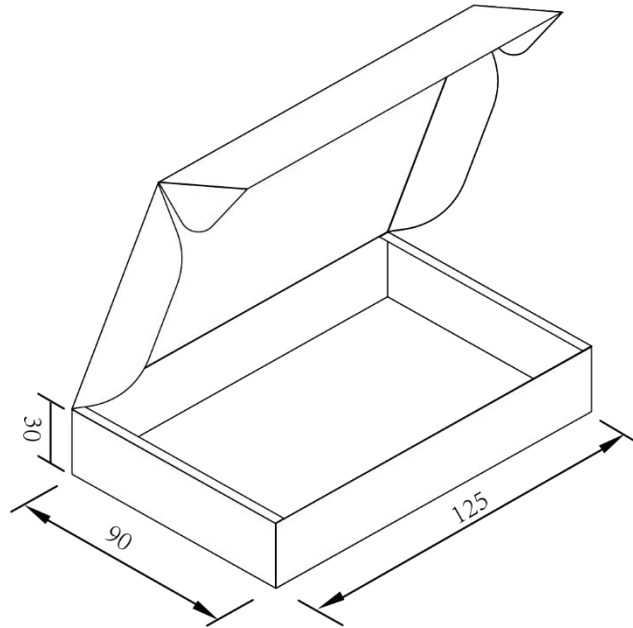
## 10.Package Information

### 10.1 Mechanical size



## 11. Packaging method

### 11.1 DTU tooling(unit:mm)



## Important Notes and Disclaimers

Due to the continuous improvement of hardware and software of the product, this specification is subject to change, and the latest version of the specification shall prevail in the end.

Users who use this product need to pay attention to the product dynamics at the official website so that users can get the latest information of this product in time.

The pictures and diagrams used in this specification are for illustrating the functions of this product and are for reference only.

The measurement data in this specification are measured by our company at room temperature for reference only, please refer to the actual measurement.

Chengdu Ashining Technology Co., Ltd. reserves the right of final interpretation and modification of all contents in this specification.