Wireless UART Transceiver Module

SPECIFICATION

Model No.: DL-P3028M

Version: V1.0

DL-P3028M (433Mhz)

Before using this module, please pay attention to the following important matters:

This Wireless Module is an electrostatic sensitive product. Please operate it on an anti-static workbench during installation and testing.

This DL-P3028M UART Wireless Module uses an external antenna by default, which is intended to be embedded in your product or application, and does equip with a metal shield itself for a better anti-interference ability. The antenna can be a wire antenna or a standard UHF antenna. You can choose a specific antenna according to the actual situation.

Metal objects and wires should be kept away from the antenna as much as possible. If the product uses a metal shell, be sure to install the antenna outside the metal shell. Otherwise, the RF signal will be seriously attenuated, which will affect the effective distance.

Disclaimer:

This specification is just for your information, all the charts and pictures used in this specification are for reference only. The actual test shall prevail for details. We do not assume any responsibility for personal injury or property loss caused by user's improper operation.

This specification is subject to change due to the continuous improvement and upgrading of the product version, and the latest version specification shall prevail. DREAMLNK reserves the right of final interpretation and modification of all contents in this specification.

Revision History

Date	Version	Formulation / Revision of Contents	Approved by
2022-11-5	V1.0	DL-P3028M Standard Version UART Module	Fagan Xu

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

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1. Module Overview

1.1 Brief Introduction

This DL-P3028M RF module is an UART Transceiver Module, which was designed base on high-performance PAN3028 RF chip and built-in HC32L130 low-power MCU. It is an UART Module with AT command, which supports a maximum power output of 22dBm and a sensitivity of -140dBm; it is an effective wireless module which can provide excellent RF performance and strong anti-interference performance in the 398-510MHz frequency band.

1.2 Features

- Support AT commands for configuration, easy to develop and debug;
- Support transparent transmission mode for data transmission;
- Support data flow control in transparent transmission mode (AUX);
- Typical serial baud rate (such as 9600/19200/38400/57600/115200bps) is supported;
- Multiple wireless baud rate is supported;
- Wake-on-Radio (WOR) function supported (intermittent receiving), which can be greatly increases the battery standby time;
- Support CAD (Automatic Radio Frequency Signal Detection) to reduce the probability of signal collision;
- Can achieve fixed point transmission, broadcasting and other transmission methods;

1.3 Typical Application

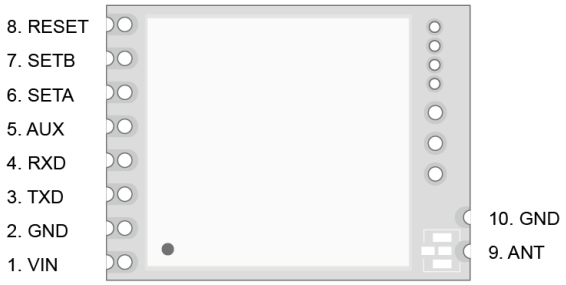
- Smart Grid and Automatic Meter Reading (water meter, electricity meter, gas meter)
- Long-Range Data Communication
- Smart Home Systems
- Wireless Sensor Networks
- Industrial Automation (Data Acquisition)
- Remote Control and Telemetry of Field Data
- Various Transmitter, Intelligent Flow Meter Instrument
- Building Automation and Security
- Monitoring and Control of Petroleum Equipment in Mines
- Environment, Energy Saving, Temperature Monitoring
- Intelligent Transportation, Smart City
- Home and Building Automation
- Wireless Alarm and Security Systems

2. Technical Parameter

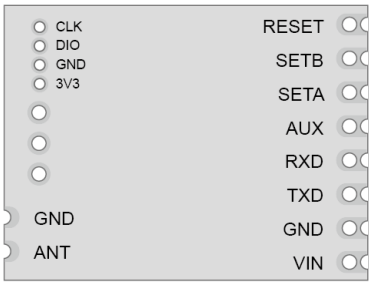
No.	Category	Parameter	Value
1	Radio Parameter	Working Frequency	398~510MHz
2	Radio Parameter	TX Power	22dBm (peak value)
3	Hardware Parameters	TX Current	165mA
4	Radio Parameter	RX Sensitivity	-140dBm @SF12 62.5KHz -133dBm @SF9 62.5KHz
5	Radio Parameter	Communication Range	(1) >300M@SF7, BW250khz, RF power:22dBm (2) >1500M@SF9, BW125khz, RF power: 22dBm
6	Radio Parameter	Antenna Type	External antenna (ANT pad or IPEX)
7	Hardware Parameters	Data Interface	Baud rate: 115200 (default)
8	Hardware Parameters	Working Voltage	1.8~3.6V
9	Hardware Parameters	Working Current	Receiving: 24mA Sleeping: 1.6uA
10	Hardware Parameters	Working Temperature	-40℃ ~ +85℃
11	Hardware Parameters	Storage Temperature	-45℃ ~ +90℃
12	Hardware Parameters	Encapsulation Interface	SMT (surface mount)

Table 1

3. Pin Definitions



Front Side



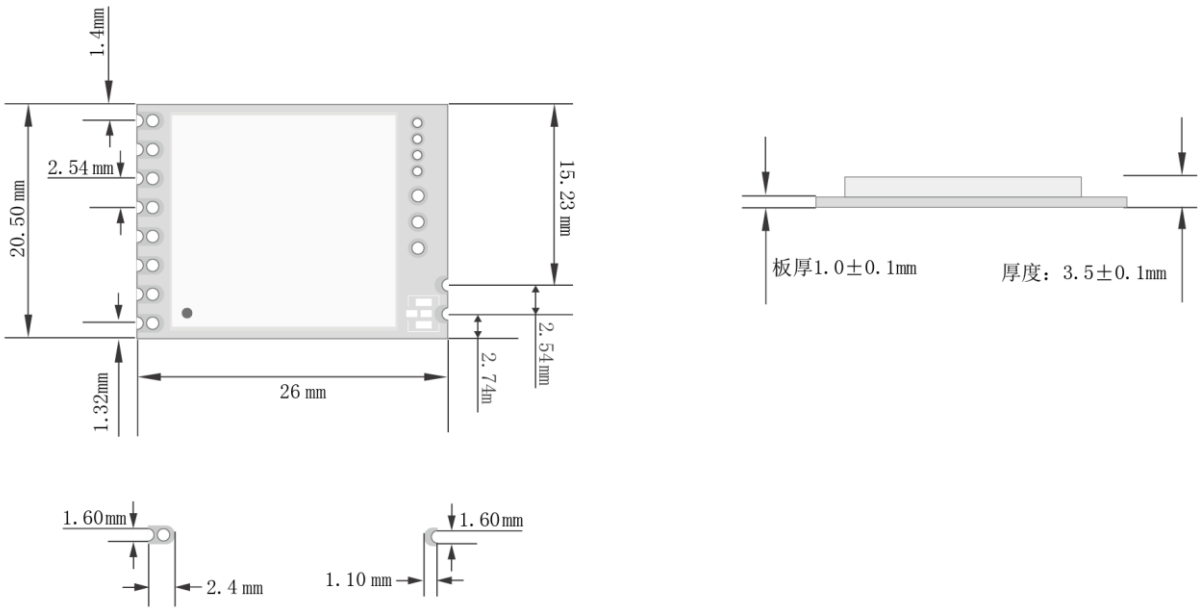
Back Side

No.	Pin Name	I/O Type	Pin Description
1	VIN	PWR	To maximize the chip function, ≥3V stable voltage is recommended
2	GND	PWR	Reference Ground
3	ANT	Analog I/O	RF signal input/output port, π-matching circuit must be reserved; Adopt 50Ω impedance matching for RF routing, route the ground and add via holes around it
4	AUX	Out	Indicate the working status of the module: 0: The buffer is empty 1: Buffer is not empty (Under Transmitting)
5	UART-RX	In	TTL serial port input, connected to external TXD output pin
6	UART-TX	Out	TTL serial port output, connected to external RXD input pin
7	SETA	In	Switching between AT Command and Transparent Transmission Mode, defaulted high level 0: P2P Transmission Mode 1: AT Command Mode
8	SETB	In	Control Module Sleep, defaulted high level 0: Sleep (or wake-on-radio) 1: Wake up
9	RESET	In	Hardware reset

Table 2: Pin Definitions

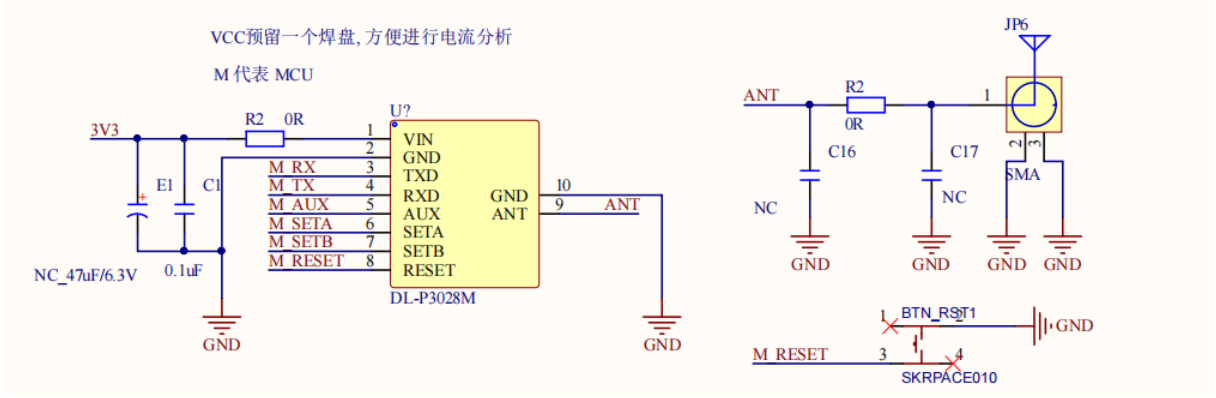
Note: if SETA and SETB are N/C (No Connection) during debugging, the RF module will be in AT command mode, which is convenient for testing;

4. Module Dimension



DL-P3028M Module Dimension

5. Application Connection Diagram



Notice for Pin Connection:

1. PIN9 & PIN10 of DL-P3028M and DL-P3028M are the same (ANT, GND), but the position of the pins on the module packaging is different

2. RX and TX are used for data transmission and should be inversely connected with the UART pins of external MCU.

3. AUX, SETA, SETB and RESET are used for the module control, which need to be connected with the GPIO port of the external MCU.

4. SETA and SETB are high level defaulted. When the Wireless Module enters sleep mode, these two Pins need to be connected to certain levels; otherwise, electric leakage will occur.

6. Circuit Design

6.1 Power Supply Design

● Please pay attention to the power supply voltage of the device, exceeding the recommended voltage range may cause function abnormally and permanently damage;

● Try to use a DC stabilized power supply, and the power ripple coefficient should be as small as possible; the power load when transmitting the maximum power needs to be also considered;

● The module needs to be grounded reliably, and a good grounding can achieve better performance output and reduce the impact of RF on other sensitive devices.

6.2 RF Routing Design

● The module should be far away from RF interference sources, such as high-frequency circuit transformer, and it is forbidden to route the wires directly under the module, otherwise it may affect the receiving sensitivity;

● When using the on-board antenna, the antenna needs to be clear on both sides, and the ground should not be too close to the antenna at the same time, otherwise it will absorb the radiated energy;

● Route 50Ω impedance line, lay the ground and drill more ground holes;

● The PCBA space allows to reserve a π-type matching network, first connect it through a 0R resistor, otherwise the antenna is open.

6.3 Antenna Design

● There are many types of antennas, choose the appropriate antenna according to your needs;

● Choose a suitable placement position, according to the Antenna polarity, and it is recommended to be vertically upward;

● There should be no metal objects in the antenna radiation path, otherwise the transmission distance will be affected (such as a closed metal casing).

7. AT Command Format & Error Code

7.1 AT Command Format

Send command format: End with carriage return<CR>, line feed<LF>, or carriage return line feed<CR><LF>, as shown in the following table.

Type	Command Format	Example
Query Command	AT+CMD? <CR><LF>	AT+VER? <CR><LF>
Query Command	AT+CMD <CR><LF>	AT+VER<CR><LF>
Set Command	AT+CMD=para <CR><LF>	AT+CH1=66<CR><LF>

Table 3: Command Format

Module Reply Format (with Echo Off):

Set parameters:<CR><LF>OK<CR><LF>

Query parameters:<CR><LF>+CMD=PARA<CR><LF>OK<CR><LF>

CMD: Command word PARA: Parameters

7.2 Return Code Description

Code Description	Return Code
Response Successful	OK
Invalid Command Format	ERR CHECK ARGS FORMAT FAILED!
Invalid Command	ERR CMD MATCH FAILED!
Invalid Parameter	ERR PARSE ARGS FAILED!
Other Errors	ERROR

Table 4

8. AT Command

8.1 AT Command List

★ Basic Command

Command	Description	Command Format	Savable (Y/N)
AT	AT test command, module receives AT and returns OK	AT\r\n OK	No
AT+ENTM	Enter the exit command and switch to the set working mode	AT+ENTM\r\n OK	No
AT+WMODE	Set the module working mode: Point to Point Mode: 0 (default) Network Mode: 1	AT+WMODE=<workmode>\r\n OK	Yes
AT+NID	Set/Query Module ID	AT+NID?\r\n	Yes
AT+E	AT command echo settings: Off: 0 (default) On: 1	AT+E=<0/1>\r\n OK	No
AT+Z	Restart the module, the built-in MCU (software) will perform a software reset, All peripherals	AT+Z\r\n OK	No
AT+SAVE	Save the current settings as the default settings; All settable parameters are saved.	AT+SAVE\r\n OK	No
AT+DEFAULT	Restore default settings: All settable parameters are restored to the initial factory settings	AT+DEFAULT\r\n	No
AT+VER	Query firmware version number, format: x.x.x	AT+VER?\r\n +VER=1.0.0 OK	No
AT+UART	Set/query serial port parameters: Baudrate: 9600/19200/38400/57600/115200 Databit: default to 8, cannot be set to other values temporarily Stopbits: default to 1, cannot be set to other values temporarily Parity: default to no comparison, temporarily cannot be set to other values	AT+UART=<baudrate>,<databits>, <stopbits>,<parity>\r\n OK	Yes

	Note: to avoid connection issues caused by forgetting the parameter, it is not recommended for users to set this parameter		
AT+UARTINT	Set/query serial port packaging interval: Range: 1-100, unit: ms Note: The packaging interval refers to a complete package being considered received if no new data is received within a certain period of time.	AT+UARTINT=<1~100>\r\n OK	Yes
AT+AUXT	Set/query AUX output time: When data is received, the time for AUX to be set “high in advance” and “low in delay” relative to the serial port TX; the default is 0ms. If the MCU may be in sleep, a reasonable value needs to be set to wait for the MCU to wake up. The PreTime and auxDelayTime ranges from 0 to 100, and the unit is ms	AT+RFADDR=<PreTime>,<auxDelayTime0>\r\n OK	Yes
AT+ENC	Set/query communication encryption switch: Encryption off: 0 (default) Encryption on: 1	AT+ENC=<0/1>\r\n OK	Yes
AT+RXGAS	Set/query the wake-up interval of the module: Range: 100-5000, unit: ms The RXGAS time of the receiving end should match the PREMABLE time of the transmitter, The PREAMABLE time should be slightly greater than the RXGAS time. Note: When WAKET=0 and SETB is 0, it enters sleep and wakes up irregularly.	AT+RXGAS=<wakeuptime>\r\n OK	Yes
AT+RFADDR	Set/query module address (as fixed-point transmission address): Addr0: 0-255 Addr1: 0-255	AT+RFADDR=<Addr0>,<Addr1>\r\n OK	Yes
AT+KEY	Set/query encryption key: KEY is a 16-byte HEX string (0-9, A-F), which actually takes up 32 bytes during transmission. e.g.: when setting the key to "0123456789abcdef", the following content will be sent AT+KEY=30313233343536373839414243444546 Note: to ensure data security, this encrypted word can only be set and cannot be queried	AT+KEY=<KeyHex>\r\n OK	Yes

Table 5

8.2 RF Command

Command	Description	Command Format	Savable (Y/N)
AT+PWR	Set/query transmission power: PWR: Range 0-29	AT+PWR=<0~29>\r\n OK	Yes
AT+CH	Query/Set Communication Channel: CH range: 1-100 Note: 1-100 corresponds to the corresponding communication frequency	AT+CH=<1~100>\r\n OK	Yes
AT+RATE	Set/Query RF communication rate: Rate range: 4-10 Rate correspondence: 4 - 878bps; 5 - 977bps; 6 - 1758bps; 7 - 3125bps; 8 - 6250bps; 9 - 10937bps; 10 - 21875bps	AT+RATE=<4~10>\r\n OK	Yes
AT+SF	Set/Query SF: SF range: 7-12	AT+SF=<7~12>\r\n OK	Yes
AT+BW	Set/Query BW: BW range: 6-9 (6-62.5k, 7-125k, 8-250k, 9-500k)	AT+BW=<BW>\r\n OK	Yes
AT+CR	Set/Query CR: CR range: 1-4 (1- CR4/5, 2- CR4/6, 3- CR4/7, 4- CR4/8)	AT+CR=<CR>\r\n OK	Yes
AT+PREAMBLE	Set/query the sending preamble time of the module: PREMABLE range: 0100~5000ms Note: When PREAMABLE is 0, it means using the module's regular preamble; When PREAMBLE is between 100 and 5000ms, it represents the wake-up preamble	AT+PREAMBLE=<value>\r\n OK	Yes

Table 6

9. Working Modes

This chapter mainly introduce the AT Command mode and P2P transmission mode of the DL-P3028M UART module. The P2P transmission mode includes transparent transmission modes and fixed-point transmission modes. Both these 2 modes can be configured as High-Performance Mode (Non-low-power state), WOR Mode, and Pure Sleep Mode.

Name	Description	Condition
AT Command Mode	The parameters of the RF module can be configured via AT command	SETA=1 SETB=1

Transparent Transmission Mode	After entering the transparent transmission mode, the module will send out the data exactly as what the host send to it; The RF module is always in the receiving state under normal conditions. The received data will be sent out through the serial port; The RF module monitors both the serial port and RF simultaneously, and after receiving data packets, it forwards port data to each other;	SETA=0 SETB=1
WOR Mode (Stand-by Mode)	After entering the WOR mode, the module will activate RTC to periodically wake up and detect the RF preamble; It will automatically wake up based on the set time interval and detect wireless signals; When a valid wireless signal is detected, it will enter receiving mode until reception is complete	SETB=0 AT+RXGAS>0
Pure Sleep Mode	When in pure sleep mode, the module enters sleep mode and can only be awakened through SETA/SETB	SETB=0 AT+RXGAS=0

Table 7: Working Modes

Note: Mode switching needs to ensure that the module is idle, since the buffer will be emptied during mode switching

AT Command Mode:

The AT Command mode mainly enables users to send commands through the serial port to set module related parameters. In AT command mode, the module serial port is used to receive AT commands, and users can send AT commands to the module through the serial port for querying and setting the UART and other related parameters of the module. For a detailed introduction to AT Commands, please refer to the "AT Command List".

10. Data Transmission

● Fixed Point Transmission

The fixed-point transmission protocol uses the first 2 bytes of data as address 0 and address 1. During transmission, the module changes the target address and channel, and restores the original settings after transmission. The advantage of fixed-point transmission protocol is that it can flexibly change the target address and channel during data transmission, thereby achieving flexible changes in the target module.

Difference between Transparent Transmission Mode and Fixed-point Transmission Mode:

Fixed point transmission is based on transparent transmission, with two bytes of address information (ADDR0, ADDR1) added before the data packet.

When transmitting, the address information is the terminal device's ADDR0, ADDR1; When receiving, the terminal device needs to compare the ADDR0 and ADDR1 in the data packet to see if they match their own ADDR0 and ADDR1. If they match, the data is forwarded through the serial port. If not, the data is discarded.

Point to Point

For example:

1) Device A, B with MAC address 100,100 can communicate with each other **(same rate, same frequency)**

2) Device C with MAC address 101,100; then it cannot communicate

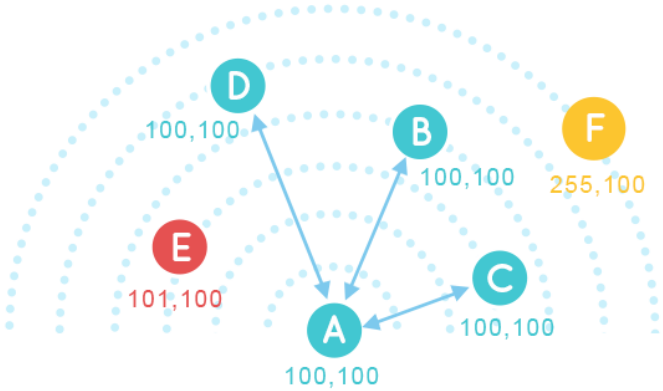
3) Device E with MAC address 255,100; then it cannot communicate

Note: one module triggers the TX, and the other receives

Characters

● Module A & Module B with **Same address, Same frequency and Same wireless baud rate** (not Serial Baud Rate)
● Point-to-point, RF modules with different addresses cannot receive data; for one-to-one communication applications

One to Many



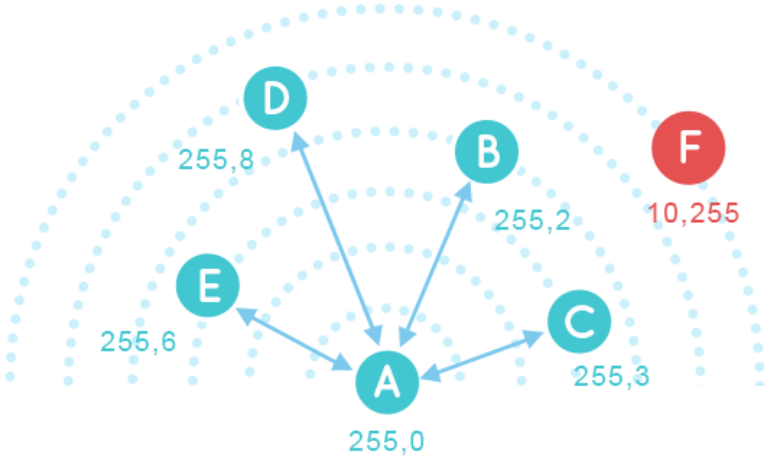
For example:

1) Device A/B/C/D with same MAC address 100,100; then they can communicate with each other
2) Device E with MAC address 101,100; then it cannot communicate
3) Device F with MAC address 255,100; then it cannot communicate

Characters

● Module A/B/C/D with **Same address, Same frequency and Same wireless baud rate** (not Serial Baud Rate)
● One to Many, one module act as a transmitter, and other modules act as receivers

● Broadcast Transmission/Monitoring



For example:

If MAC address of **Device A** is 255,0;

Addr0 for device **B/C/D/E** are all the same 255, Addr1 is arbitrary

MAC address of **Device F** is 10,255; then it cannot communicate

Broadcast:

Device A Broadcast: AA BB CC DD
Device B/C/D/E Receive: AA BB CC DD
Device F cannot receive anything

Monitoring:

Device B sends to **Device C**: AA BB CC DD
Device A monitoring: AA BB CC DD

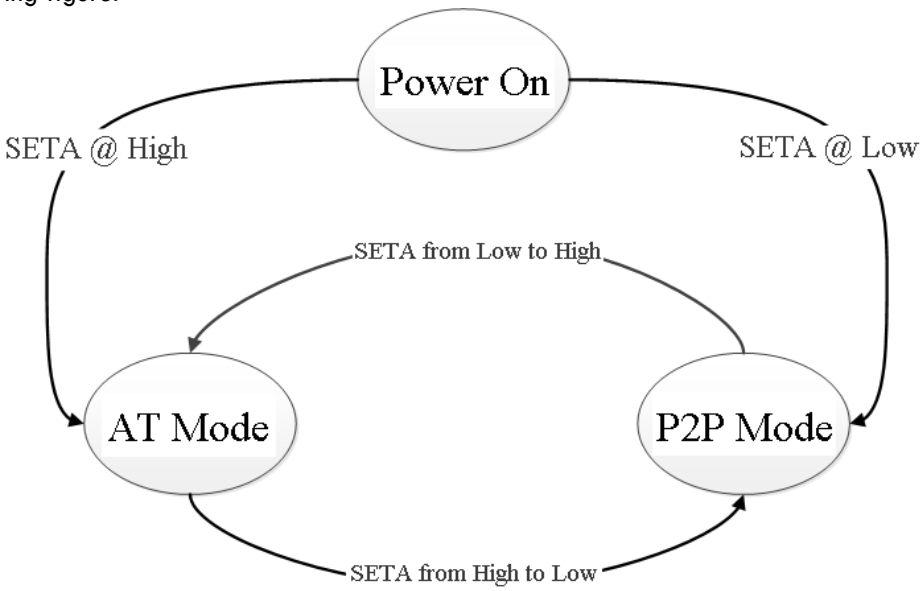
Device F send: AA BB CC DD
Device A cannot receive anything

Characters

● If the devices **Addr0=255** are at the Same rate and Same frequency, the modules will be in Broadcast/Monitoring mode. Addr1 of these Broadcast/Monitoring devices does not need to have the same address.
● If the Addr0 of the RF modules are 255, data sent between them can be received by all the other **Addr0=255** RF modules, regardless of whether Addr1 is the same. **(Broadcast)**
● It can receive data from any device with **Addr0=255**. (**Monitoring**)

● Switching between AT mode and P2P mode:

When SETA is set to high, it enters AT mode; and when SETA is set to low, it enters P2P working mode, as shown in the following figure:



SETA Pin Switching Timing Diagram

Note: command switching has the same priority as pin SETA switching

When using host computer tools to configure testing, it is recommended to use AT commands to switch working modes;

When connecting to RF modules using MCU, it is recommended to switch the working modes through pin switching.

11. Module Parameter Configuration

11.1 Two Parameter Configuration Methods

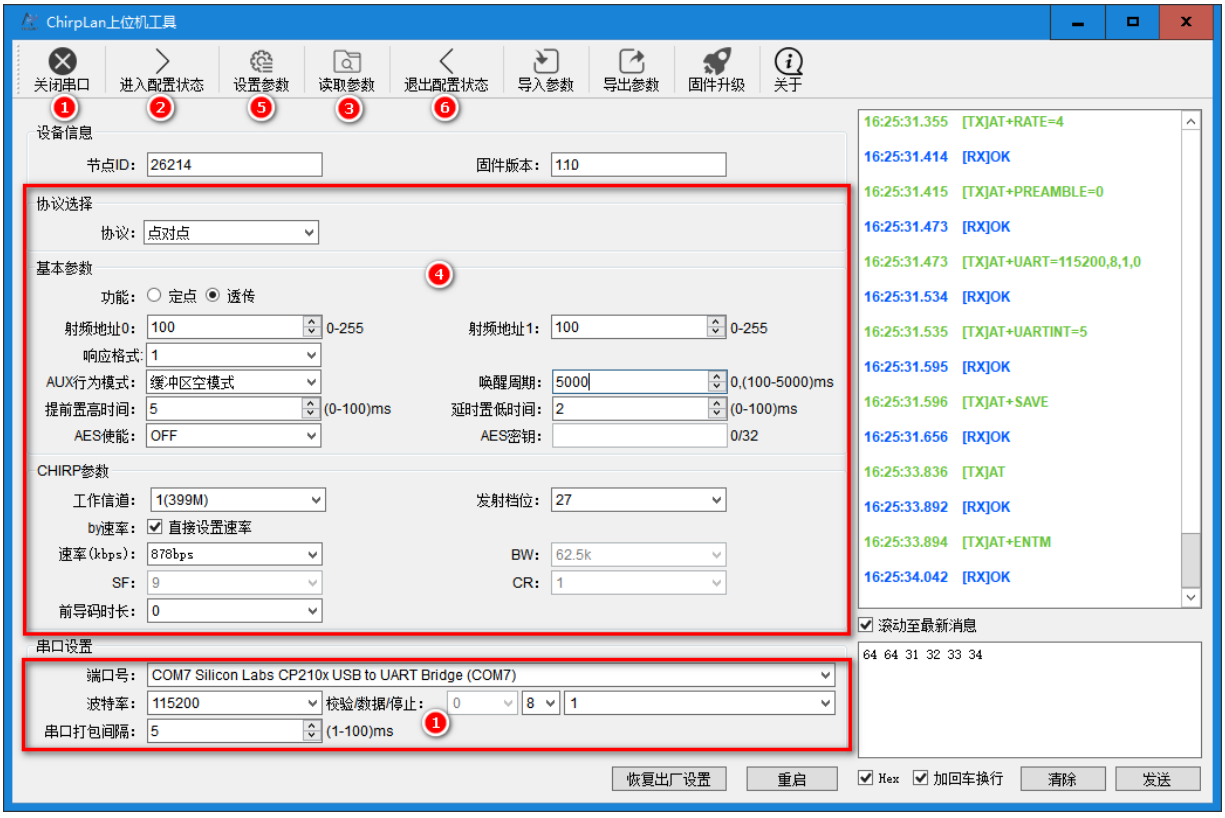
1. Host-computer Software Configuration: there is a Host-computer Software that supports parameter settings and simplifies your operations. It is recommended to use this software to configure parameters.

2. Configuration via AT Commands: The AT Commands refers to the instructions that users can use through UART and RF modules in AT Command mode. The detailed format for using AT Command is provided in previous chapter. If manually entering the AT Command mode, the following two steps are required:

① Enter "+++" via the UART, the RF module will return a confirmation code "a" after receiving "+++";

② Within 3 seconds, input the confirmation code "a" on the UART. After receiving the confirmation code, the RF module returns "+OK" to confirm and enter the AT Command mode.

Use the Host-computer Software to configure parameters, and the sequence numbers in the following figure correspond to the following steps in sequence:



Step Description:

1. In the serial port setting interface, set the baud rate, parity bit, data bit, and stop bit as the corresponding parameters for the node. The default parameters for the node serial port are 115200, NONE, 8, 1. Click the "打开串口(Open UART)" button;

2. Click to enter configuration status, and the RF module responds with "+OK", indicating that the RF module enters the AT Command mode;

3. Press the "读取参数(Read Parameter)" button to read the module parameter information;

4. Select the P2P (point-to-point) Protocol, and then select the P2P (point-to-point) or transparent function; Set other parameters (channel/rate/encryption, etc.);

5. After changing the parameters, click the "设置参数(Set Parameters)" button, and the software will automatically set the module parameters. After setting, the module will automatically save the parameters;

6. Click the "退出配置(Exit Configuration)" button to exit the configuration mode and enter P2P working mode for the module.

● High Performance Mode

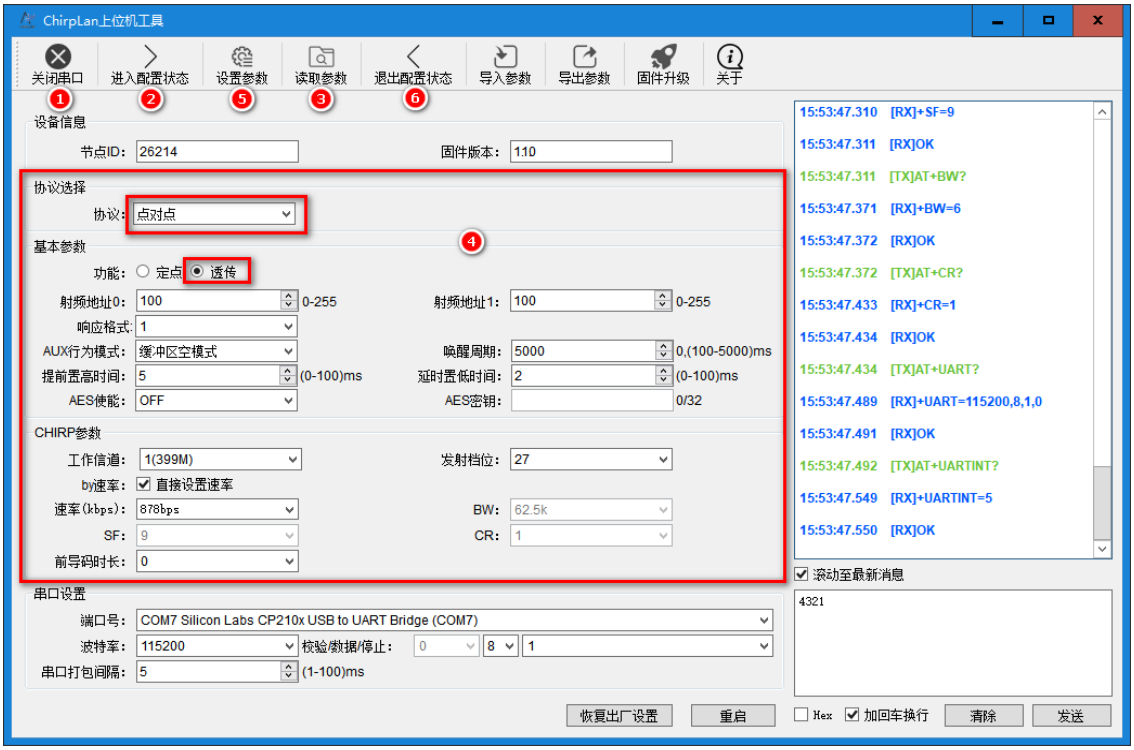
After the node (RF module) is configured as a P2P transmission protocol, each communication node must meet three conditions:

1. The RF module channel (freq) and rate parameters (rate, cr, sf, bw) are consistent
2. The RF module crc verification parameters are consistent
3. The RF Module encryption parameters are consistent

Command	Value
AT+CH	Set/Query Communication Channel
AT+RATE	Set/Query Communication Rate
AT+ENC	Set/Query Encryption Switch
AT+KEY	Set/Query Encryption Key

Table 8

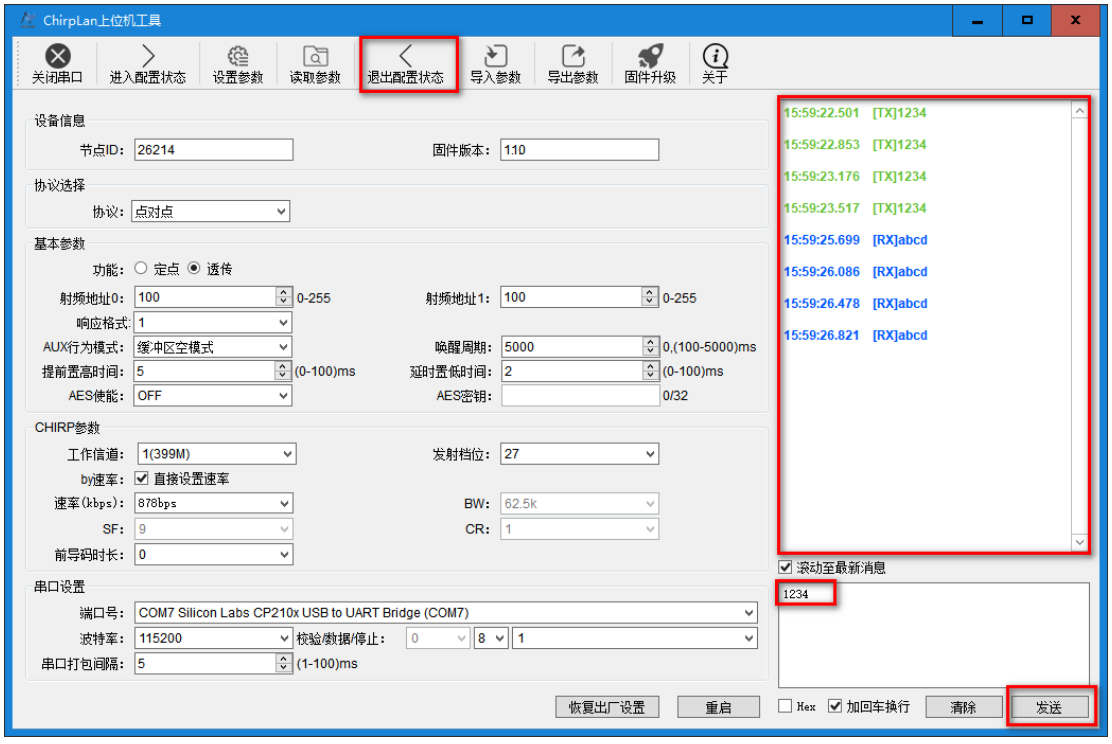
Host-computer Software Configuration method are as below:



Note: During the High-Performance Mode test, it is necessary to keep SETA and SETB at high levels, and the working mode is switched by the AT command.

● Transparent Transmission Test:

Open 2 Host-computer Software interfaces and connect them to 2 RF modules for transparent transmission testing. One Host-computer sends “1234” and the other sends “abcd”. The test results are as follows:



● Wake-on-Radio (WOR) Mode

After the node (RF module) is configured as a P2P transmission protocol, each communication node must meet three conditions:

1. The RF module channel (freq) and rate parameters (rate, cr, sf, bw) are consistent
2. The RF module crc verification parameters are consistent
3. The RF Module encryption parameters are consistent

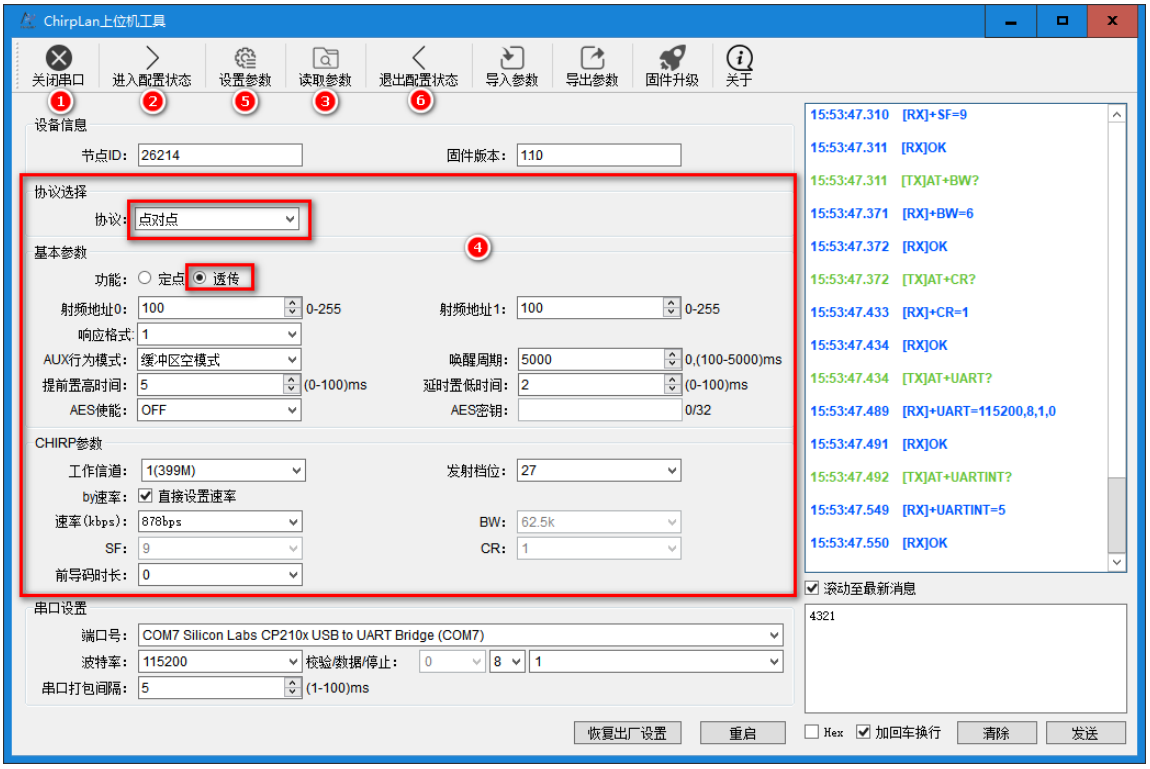
Command	Value
AT+CH	Set/Query Communication Channel
AT+RATE	Set/Query Communication Rate
AT+ENC	Set/Query Encryption Switch
AT+KEY	Set/Query Encryption Key
AT+RXGAS	Set/Query wake-up time interval. In this mode, RXGAS should be set to a non-zero value of 100-5000 (e.g.: AT+RXGAS=5000\r\n)

Table 9

Host-computer Software Configuration method are as below:

Set the wake-up cycle to 5000ms (AT+RXGAS=5000\r\n), and the module will wake up every 5000ms to detect CAD signals in P2P mode:

1. If no CAD signal is detected, the RF module will sleep for another 5000ms;
2. If a CAD signal is detected, the RF module will collect the entire RF data packet, send it out through the serial port, and then enter sleep state again.



After the host-computer configuration is set, pull down the SETA and SETB pins to enter the WOR mode. In this mode, the module intermittently enters a low-power sleep state, so it cannot communicate with the host-computer tool normally; If you want the RF module to communicate with the host-computer normally again, you need to set the SETA and SETB pins high, to wake up the RF module, and then recover normal communication.

● Pure Sleep Mode

After the node (RF module) is configured as a P2P transmission protocol, each communication node must meet three conditions:

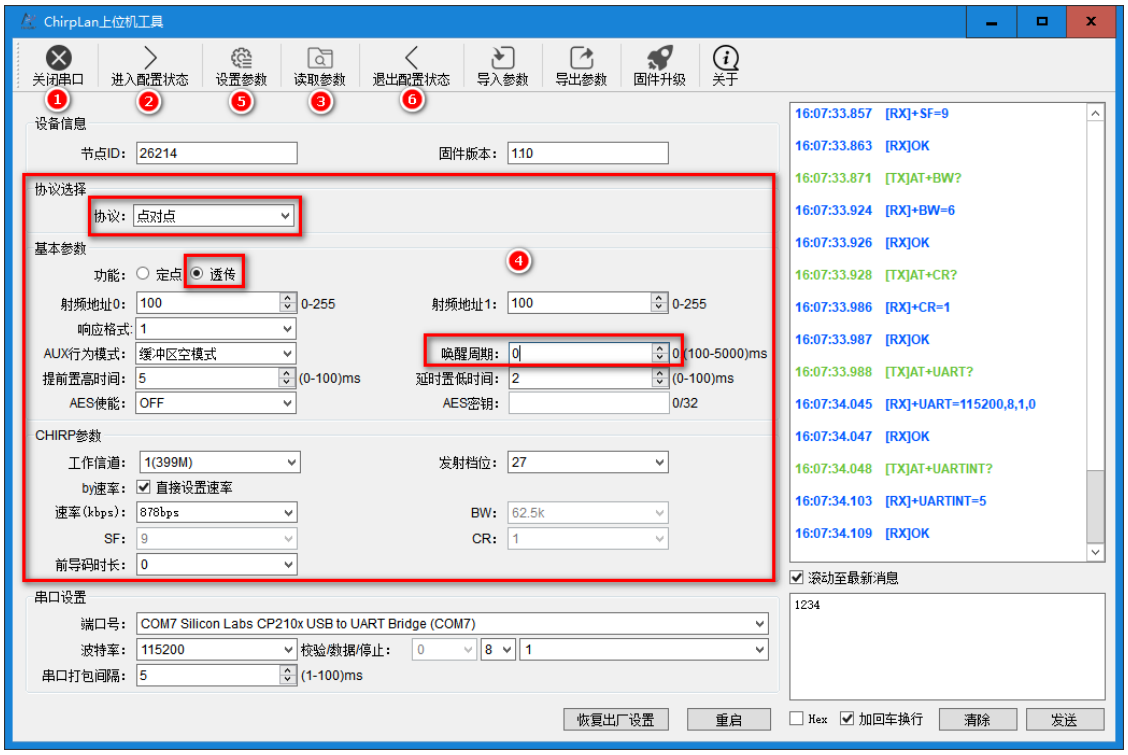
1. The RF module channel (freq) and rate parameters (rate, cr, sf, bw) are consistent
2. The RF module crc verification parameters are consistent
3. The RF Module encryption parameters are consistent

Command	Value
AT+CH	Set/Query Communication Channel
AT+RATE	Set/Query Communication Rate
AT+ENC	Set/Query Encryption Switch
AT+KEY	Set/Query Encryption Key
AT+RXGAS	Set/Query wake-up time interval. In this mode, RXGAS should be set to 0 (e.g.: AT+RXGAS=0\r\n)

Table 10

Host-computer Software Configuration method are as below:

Set the wake-up cycle to 0ms (AT+RXGAS=0\r\n), the RF module enters Pure Sleep Mode, until an IO port wakes it up:



After the host-computer configuration is set, pull down the SETA and SETB pins to enter the Pure Sleep Mode. In pure sleep mode, the module cannot communicate with the host-computer tool, since it enters a low-power sleep state; If you want the RF module to communicate with the host-computer normally again, you need to set the SETA and SETB pins high, to wake up the RF module, and then recover normal communication.

11.2 Fixed Point Transmission Mode Configuration

● High Performance Mode

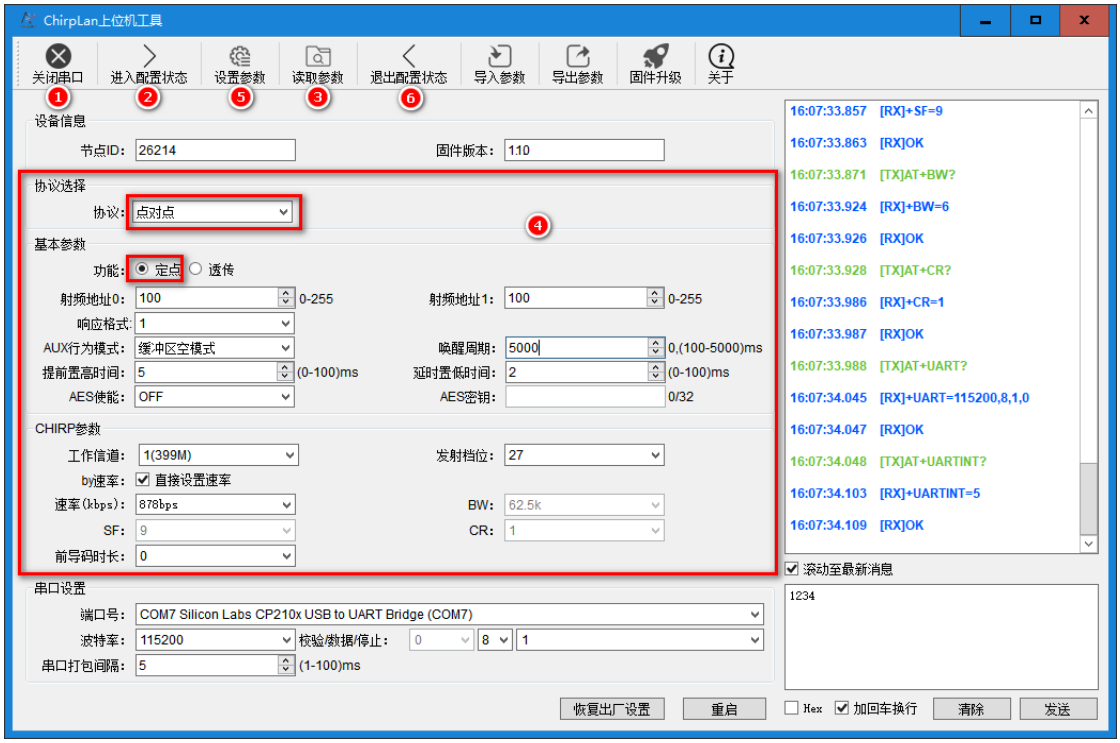
After the node (RF module) is configured as a P2P transmission protocol, each communication node must meet three conditions:

1. The RF module channel (freq) and rate parameters (rate, cr, sf, bw) are consistent
2. The RF module crc verification parameters are consistent
3. The RF Module encryption parameters are consistent

Command	Value
AT+WMODE	Set/Query Working Mode
AT+PTC	Set/Query Transparent Transmission Mode
AT+CH	Set/Query Communication Channel
AT+RATE	Set/Query Communication Rate
AT+ENC	Set/Query Encryption Switch
AT+KEY	Set/Query Encryption Key

Table 11

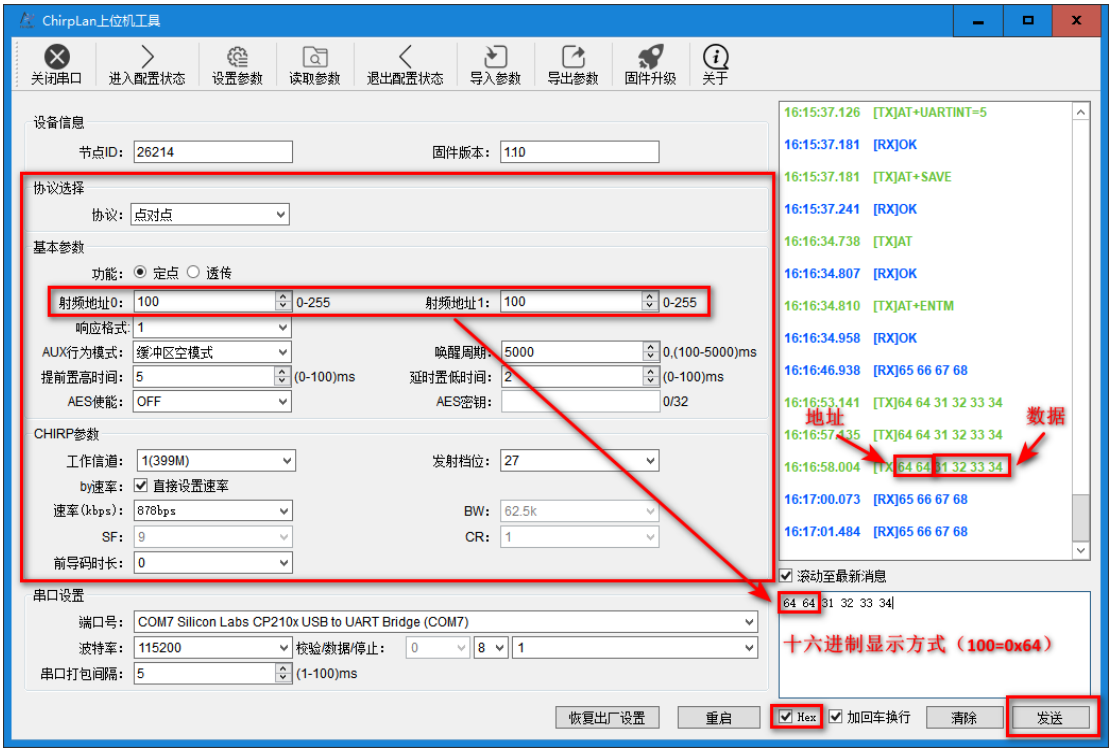
Host-computer Software Configuration method are as below:



Note: During the High-Performance Mode test, it is necessary to keep SETA and SETB at high levels, and the working mode is switched by the AT command.

● P2P (point-to-point) Transmission Testing:

Open 2 Host-computer Software interfaces and connect them to 2 RF modules for P2P (point-to-point) transmission testing. One Host-computer sends "1234" and the other sends "4321". The test results are as follows:



● Wake-on-Radio (WOR) Mode

After the node (RF module) is configured as a P2P transmission protocol, each communication node must meet three conditions:

1. The RF module channel (freq) and rate parameters (rate, cr, sf, bw) are consistent
2. The RF module crc verification parameters are consistent
3. The RF Module encryption parameters are consistent

Command	Value
AT+CH	Set/Query Communication Channel
AT+RATE	Set/Query Communication Rate
AT+ENC	Set/Query Encryption Switch
AT+KEY	Set/Query Encryption Key
AT+RXGAS	Set/Query wake-up time interval. In this mode, RXGAS should be set to a non-zero value of 100-5000

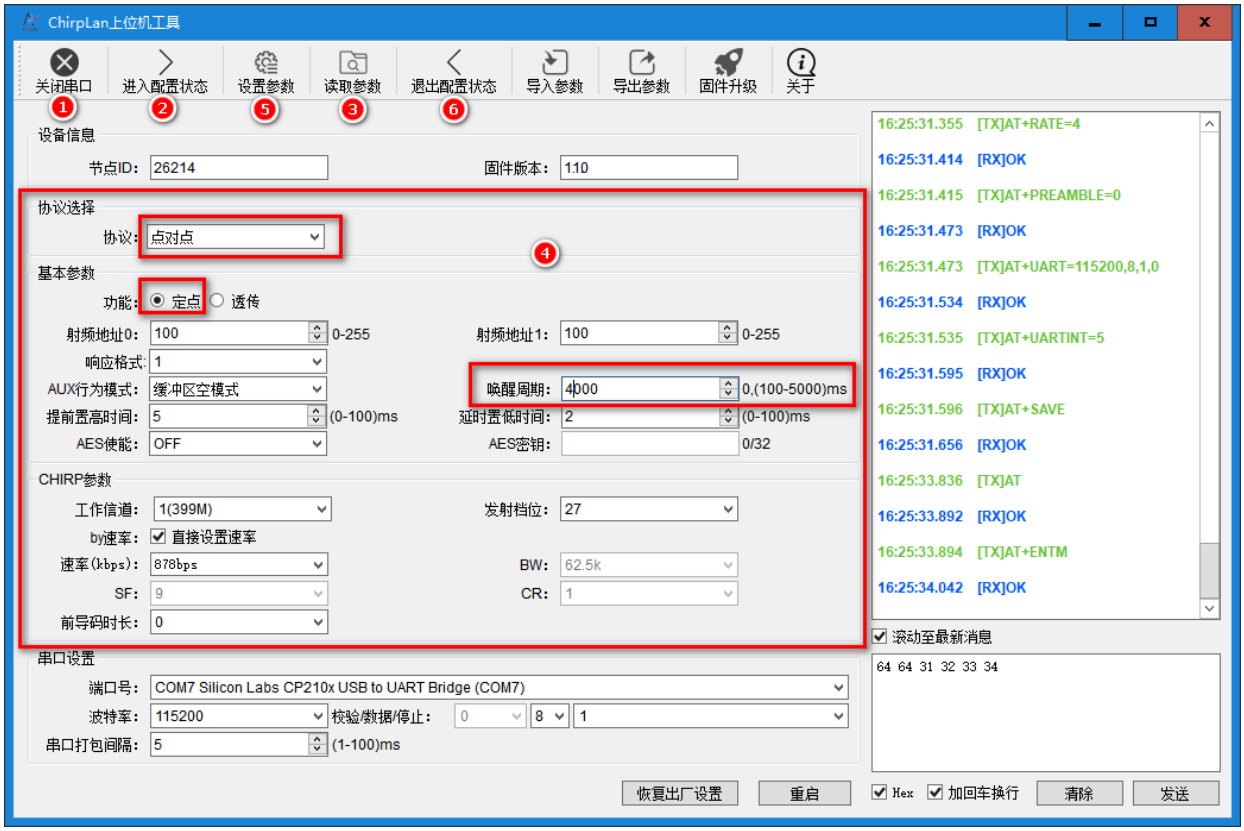
Table 12

Host-computer Software Configuration method are as below:

Set the wake-up cycle to 4000ms (AT+RXGAS=4000\r\n), and the module will wake up every 4000ms to detect CAD signals in P2P mode:

1. If no CAD signal is detected, the RF module will sleep for another 4000ms;

2. If a CAD signal is detected, the RF module will collect the entire RF data packet, send it out through the serial port, and then enter sleep state again.



After the host-computer configuration is set, pull down the SETA and SETB pins to enter the WOR mode. In this mode, the module intermittently enters a low-power sleep state, so it cannot communicate with the host-computer tool normally; If you want the RF module to communicate with the host-computer normally again, you need to set the SETA and SETB pins high, to wake up the RF module, and then recover normal communication.

● Pure Sleep Mode

After the node (RF module) is configured as a P2P transmission protocol, each communication node must meet three conditions:

1. The RF module channel (freq) and rate parameters (rate, cr, sf, bw) are consistent

2. The RF module crc verification parameters are consistent

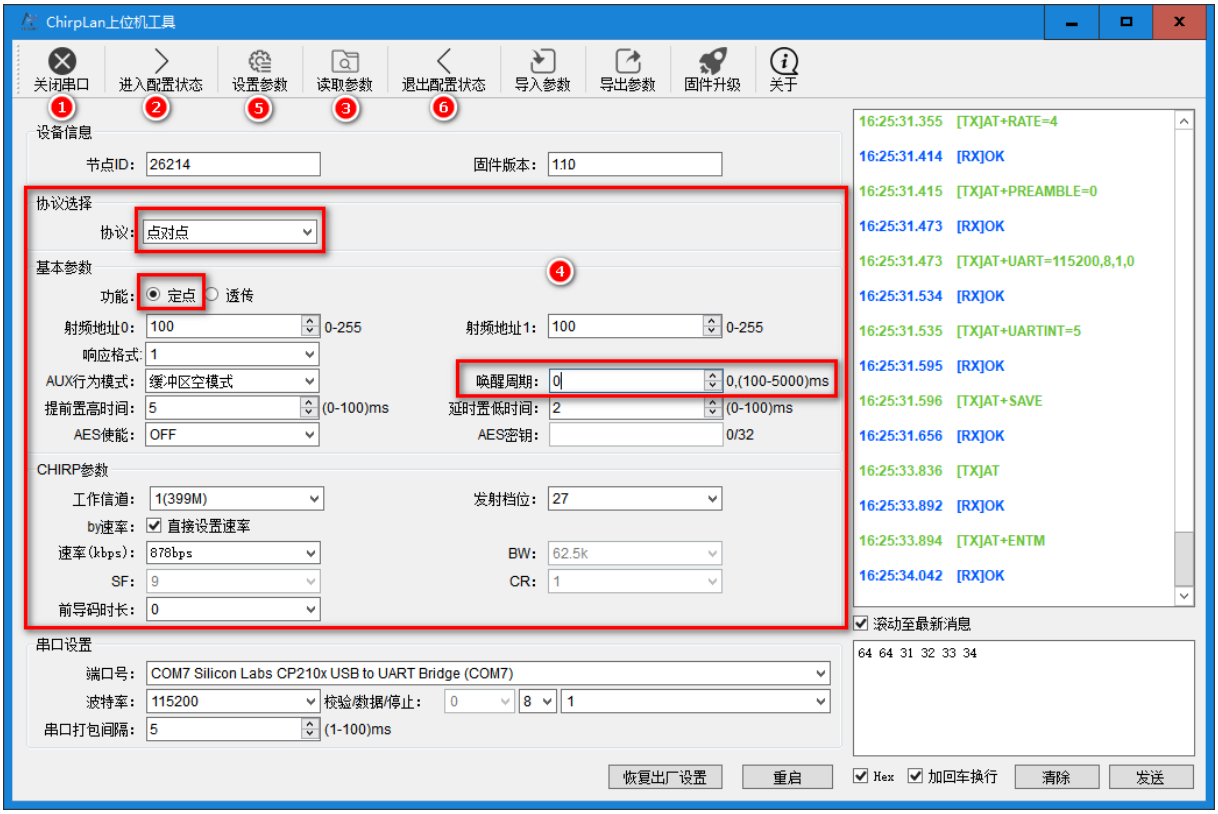
3. The RF Module encryption parameters are consistent

Command	Value
AT+CH	Set/Query Communication Channel
AT+RATE	Set/Query Communication Rate
AT+ENC	Set/Query Encryption Switch
AT+KEY	Set/Query Encryption Key
AT+RXGAS	Set/Query wake-up time interval. In this mode, RXGAS should be set to 0 (e.g.: AT+RXGAS=0\r\n)

Table 13

Host-computer Software Configuration method are as below:

Set the wake-up cycle to 0ms (AT+RXGAS=0\r\n), the RF module enters Pure Sleep Mode, until an IO port wakes it up:

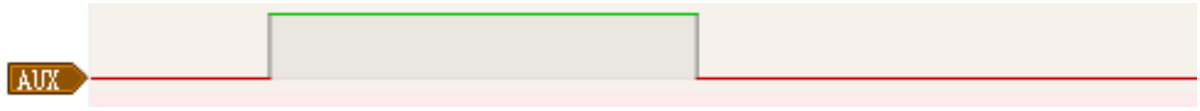


After the host-computer configuration is set, pull down the SETA and SETB pins to enter the Pure Sleep Mode. In pure sleep mode, the module cannot communicate with the host-computer tool, since it enters a low-power sleep state; If you want the RF module to communicate with the host-computer normally again, you need to set the SETA and SETB pins high, to wake up the RF module, and then recover normal communication.

12. AUX Timing Description

- **Module initialization AUX logic:**

After the mode is powered on, AUX is at a high level, indicating that the module is initializing for approximately 30ms. After initialization is completed, AUX becomes at a low level, indicating that the mode can communicate normally.

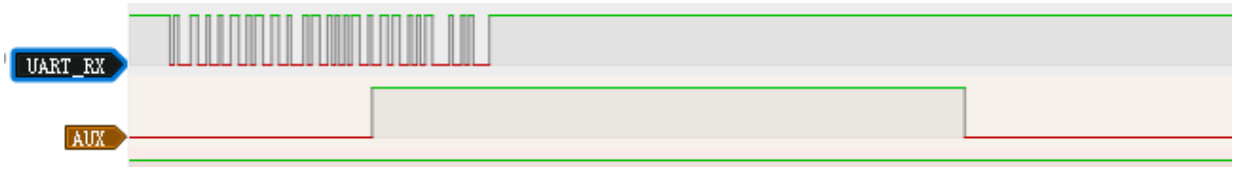


- **Module sleep and wake up AUX logic:**

During the module sleep period, AUX is at a high level. After being awakened by RTC, SETA, SETB, etc., AUX will not immediately decrease. AUX will only decrease after the module's working state is restored, indicating that the mode has entered a normal working state and can transmit and receive data normally.

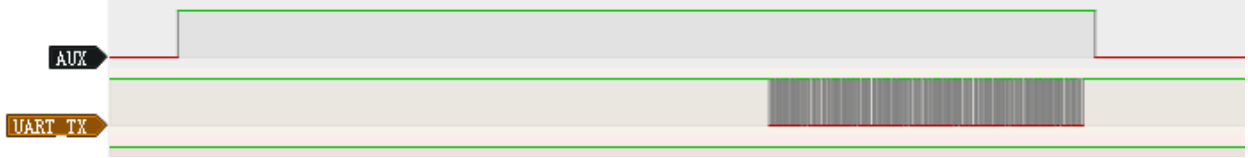
- **The logic for receiving transparent data from external MCU under transparent transmission:**

When the serial port receives the first byte, AUX becomes high, indicating that the FIFO is not empty and enters the TX state. After RF sends all the serial port data, AUX becomes low, indicating that the next packet of serial port data can be received again.



- **Serial port data output indication (used to wake up external MCU for sleep)**

AT+AUXT=10,0



13. Instructions for Software Development and Configuration

1. When programming, please use the AT Command to config, while for the data transmission, please use the Transparent Transmission Mode, because "\r\n" cannot be transmitted under the AT Command transmission, and it will block the command parsing. While the Transparent Transmission does not have these disadvantages.
2. Please transplant according to the provided SDK and refer to programming.

14. Contact us

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