G-NiceRF®

Support Bluetooth BLE5.1 protocol
Support the coexistence of master and slave roles
Support over-the-air upgrade (OTA DFU)

Product Specifcation

CE FC

Catalogue

Note: Revision History

Revision	Date	Comment
V1.0	2021-07	First release
V1.1	2021-11	Modified some AT commands and their functions
V1.2	2023-03	Revised some copy; Replace the relevant picture Chapter 5: Typical application circuit

1. Overview

1.1 Product Introduction

BLE5101 is a Bluetooth-to-serial transceiver module based on Bluetooth protocol version 5.1, coexistence of master and slave roles, small size, low power consumption, and the working signal frequency band is 2.4GHz.

The BLE5101 module is developed by Shenzhen NiceRF Wireless Technology Co., Ltd. The module supports the coexistence of master and slave roles, can connect to the master and slave at the same time, and can flexibly set the number of master and slave connections, and can support up to 20 connections. Maximum support for data transmission at 115200bps baud rate. The module uses AT commands to set parameters, and the operation is simple and easy to use.Modules can be widely used in smart wear, smart home, automobiles, lighting, smart automation data collection, smart control, wireless sensing, electronic tags and other scenarios.

Module	CE	FCC	Shield
BLE5101	Yes	Yes	Yes

1.2 Features

- Support Bluetooth BLE5.1 protocol
- Support the coexistence of master and slave roles, and can connect multiple masters and slaves at the same time, up to 20 connections
- Support 2 working modes of configuration and transparent transmission
- Support over-the-air upgrade (OTA DFU)
- Support multiple serial port parameter configuration
- Support automatic advertising, scanning, connection
- Support manual connection and automatic connection 2 connection methods

- The maximum MTU is 247 bytes
- Support custom 16-bit UUID, including one Service uuid and two Characteristic uuid, which can be flexibly configured and compatible with similar BLE products
- Maximum communication distance 150m (10dBm, 1mbps)
- Support custom modification of the local mac address
- Support mac address binding, up to 8 devices (regardless of master and slave)
- Support low power sleep

1.3 Application

- Wireless meter reading wireless sensor
- Smart home
- Industrial remote control, telemetry
- Smart buildings, smart buildings
- Automated data collection

- Health sensor
- Smart wearable device
- Wireless sensing
- Electronic tags
- Intelligent control

2. Precautions for use

2.1 BLE description

2.1.1 MTU

Refers to the payload size of BLE air single packet data. The MTU of the BLE4.0/4.1 protocol is 27 bytes, which can be expanded to 251 bytes from the MTU of BLE4.2 and higher. In actual use, the single packet data is MTU-3, that is, the user can send a maximum of 24 bytes using BLE4.0/4.1 protocol single packet, and BLE4.2 and higher versions can be expanded to 247 bytes.

It should be noted that in actual applications, the MTU of different devices will be different. BLE5101 supports an MTU of 247 bytes

2.2 Precautions for module application

2.2.1 Judgment conditions for the role of master and slave

When the module actively scans and connects to other Bluetooth devices, the module assumes the role of the master in this connection; when the module is connected by other Bluetooth devices due to advertising itself, the module acts as the slave in this connection.

2.2.2 Response of distance to data transmission rate

The module uses PCB antenna. Compared with ceramic antennas, BLE wireless signals have stronger transmitting and receiving capabilities with external antennas. Nevertheless, the data transmission speed of the module will still be attenuated due to the increase in distance.

2.2.3 Module data transmission speed changes

The data transmission speed of the module will decrease as the distance increases. And because the module sends data in the form of polling connections, when there are multiple connections, the total data sending time will vary due to the distance and the number of connections. In the case of multiple connections, it is recommended to add a certain delay between each packet of data.

2.2.4 Module current may be too high in low power mode

When the module is connected, the connection may still be open in low power mode, so the current of the module may be slightly higher, but it is always less than 100uA.

3. Electrical Characteristics

Parameter	Min.	Typ.	Max.	Unit	Condition
Operation Conditions					
Working voltage range	1.71	3.3	4.3	V	
Operating temperature range	-40		60	℃	
Current Consumption					
Receive current		7.1		mA	
Emission current		7.4		mA	
Sleep current		< 7.5		uA	
Idle current		< 6.58		mA	Idle state: refers to no connection, no advertising/scanning of the module
RF Parameter					
Frequency Range	2400		2483.5	MHz	
Transmit power	-16		10	dBm	
Receiving sensitivity		-95		dBm	

4. Pin definition
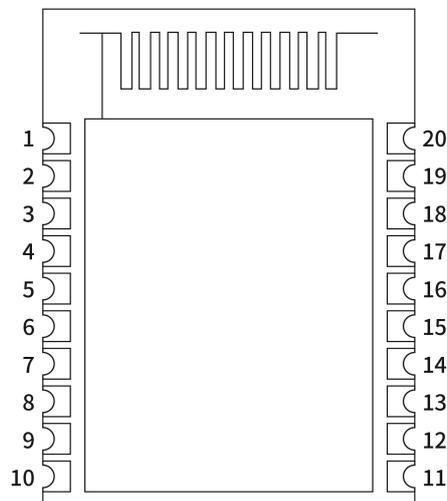
Pin NO.	Pin name	I/O	Pin function	Description
1, 9	GND		GND	Power ground
2	NC			Dangling feet

3	SWCLK		SWCLK/GPIO	Connect to internal IO, used to burn program, it can be used as normal IO when running
4	SWDIO		SWDIO/GPIO	Connect to internal IO, used to burn program, it can be used as normal IO when running
5	**PA0**	**I**	**CS**	**Module sleep pin CS (low level work, high level sleep, default high level)**
6	**PA1**	**I**	**SET**	**Module configuration pin SET (high level during normal communication, enter configuration mode when SET pin is pulled low, default high level)**
7	**PD5**	**O**	**USART1_TX**	**Module serial data transmission pin TXD (level voltage is up to 3.3V)**
8	**PD4**	**I**	**USART1_RX**	**Module serial data receiving pin RXD (level voltage up to 3.3V)**
10	VCC		VCC	Connect to the positive pole of the power supply (1.71-4.3V)
11	PD7	O	CS_DE	Sleep status indicator pin (low level when sleeping, high level when working)
12	RESET	I	RESET	Module reset pin, high level reset, there is a pull-down resistor inside.
13	PD6	O	MODE_DE	Working status indicator pin (high-level output is advertise state, low-level output is non-advertise state)
14	PC5	I/O	PC5	GPIO
15	PA3	I/O	PA3	Debug_TX
16	PA2	I/O	PA2	Debug_RX
17	**PA7**	**I**	**DISC**	**Bluetooth connection enable pin, pull down to disconnect Bluetooth connection, default high level**
18	PA6	I/O	PA6	GPIO
19	PA4	I/O	PA4	GPIO

20	PA5	O	SET_DE	High level = Transparent transmission mode
				Low level = AT configuration mode

5. Typical application circuit

A circuit diagram is recommended(Use most of the hardware features):
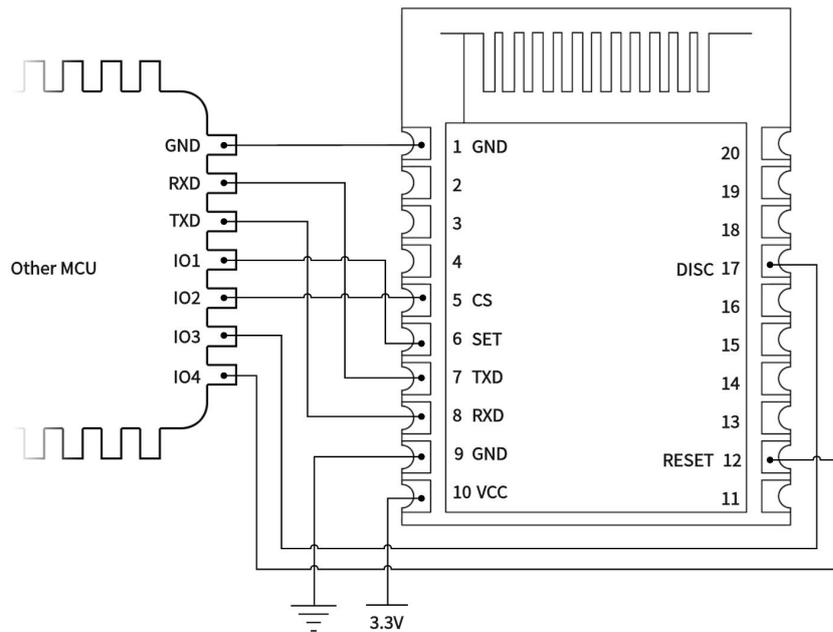
Minimum application circuit diagram (Only the serial port function is used):
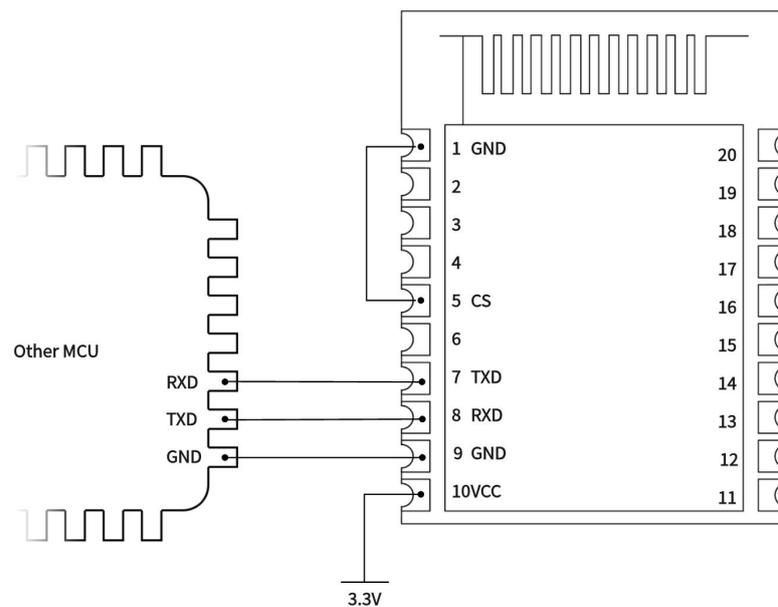
6. Mechanical size (unit：mm)
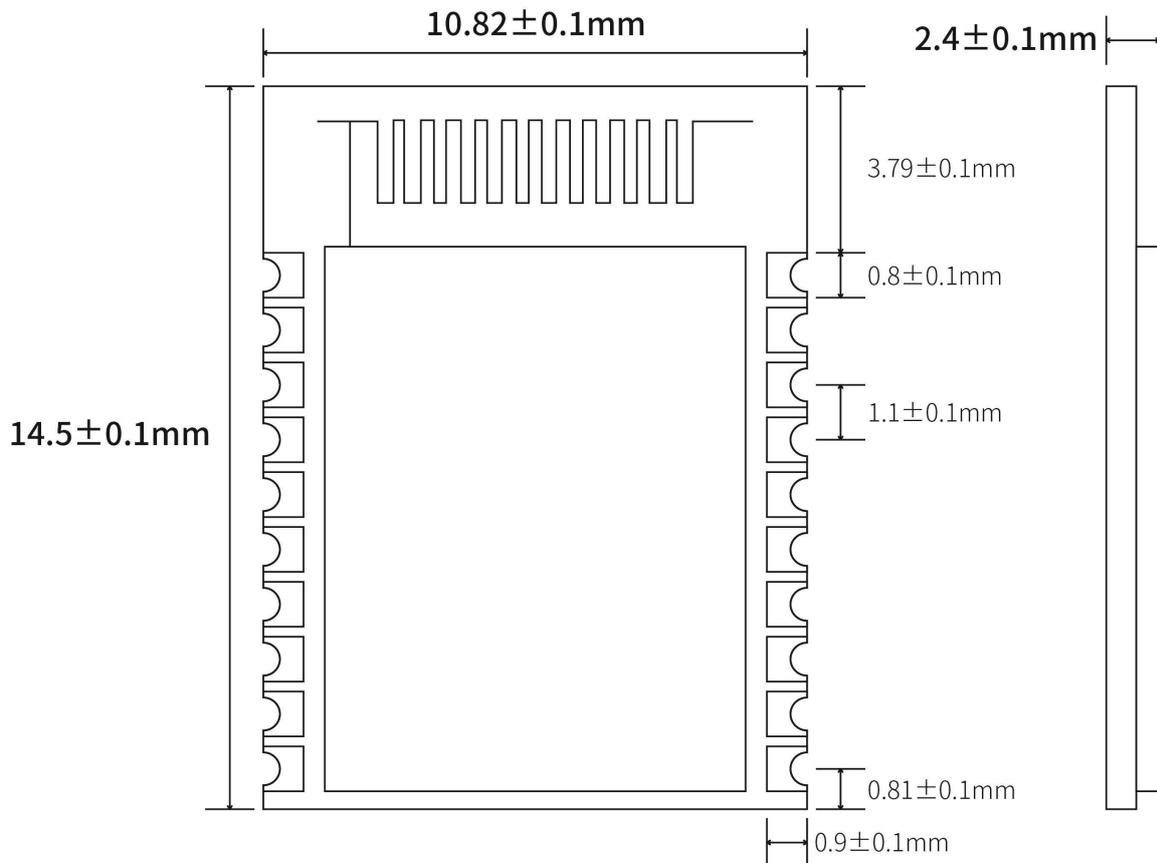
7. Function Description

7.1 Role description

The module supports three roles: master, slave, and master-slave coexist. These three types can be modified by sending AT command AT+CONS.

The module supports up to 20 connections, supports transparent transmission, and supports manual and automatic connections.

7.1.1 Master

➢ Command AT+CONS=x,y. When the value of y is greater than 0, the master role is enabled and the scanning function can be used.

➢ In configuration mode, send command AT+SCAN to start scanning, which is used to manually connect to the slave;

➢ In the transparent transmission mode, the module will automatically scan the connected

slaves.

➢ Supports one-master and multiple-slave connections. The maximum number of connections depends on the AT+CONS command, and the maximum number is not more than 20.

➢ When the number of connected slaves reaches the set maximum value, the module will stop scanning and all scanning functions will be invalid until any slave is disconnected.

7.1.1.1 Master connection strategy

The module filters advertising packets by service UUID.

UUID filtering is based on the content filtering configured by AT+UUID, and this condition cannot be closed.

The module will analyze the scanned advertising packet during scanning. If the advertising packet contains Service UUID and the UUID is the same as the Service UUID of the module itself, the module will automatically initiate a connection. After the connection is established, the module as the master role will try to read the Characteristic UUID under the Service UUID of the peer device. If the module does not read the Service UUID and the Characteristic UUID under it, or the UUID value read does not match the module itself, the module will automatically disconnect its connection. This filter condition applies to manual connection and automatic connection.

7.1.2 Slave

➢ Command AT+CONS=x,y. When the value of x is greater than 0, the slave role is enabled and the advertising function can be used.

➢ Send command AT+MODE=A in configuration mode to start advertising.

➢ In the transparent transmission mode, the module will automatically advertise itself.

➢ Support one-slave multi-master connection. The maximum number of connections depends on the AT+CONS command, and the maximum number is not more than 20.

➢ The advertising content includes the device name, mac address, and Service UUID required for transparent data transmission.

➢ When the number of connected masters reaches the set maximum value, the module will stop advertising itself, and all advertising functions will be invalid until any master connection is disconnected.

7.2 Power mode

The module supports 2 power modes: low power consumption mode and wake-up mode.

7.2.1 Low power mode

Low power mode means that when the module enters this mode, the BLE function will continue to run, turn off some peripherals, stop advertising and scanning, in order to minimize the power consumption of the module when it is running.

How to enter the low power mode: pull up the CS pin, when the indicator pin is pulled low, it means that it has entered the low power mode.

In low power mode, when there is an undisconnected connection, such as the module receives data from the opposite end, or when the connection status changes, the module will temporarily wake up and process related tasks. After the task is completed, the module will enter immediately when there is no task temporarily. Sleep.

7.2.2 Wake mode

Wake up mode refers to the state when the module is operating normally outside of the low-power mode, and all peripherals and functions are operating normally.

How to wake up: pull down the CS pin.

7.3 Data transparent transmission

Data transparent transmission means that the data received by the serial port is sent to the peer device via BLE without any processing, or the data received by BLE is output to the serial port without any processing.

All data is transmitted in ASCII format. The module sends the data to every connected Bluetooth device through polling connection when the data is transparently transmitted. Under extreme conditions, it cannot be guaranteed that every device will receive the data.

Do not only send the data "+++\r\n" within 20ms during data transparent transmission, otherwise the module will enter the configuration mode due to misoperation.

Service UUID	FFF0		
Characteristic UUID	UUID	Attributes	Description

	FFF1	Read/Notify	The slave sends, the master receives the data channel
	FFF2	Write/Write no response	The master sends and the slave receives the data channel

7.4 UUID description

The UUID values listed in the table can be modified by AT commands, except for UUID attributes.

7.5 Connection handle

1. Normally, the connection handle of the module is the number of the specified link (0-19). In principle, the handle of the module connection may not be the same each time.

2. In the case of a multi-master and multi-slave connection, each module on the connection handle may have a master role or a slave role, depending on the connection.

3. The designated link can be operated through AT commands.

7.6 Air upgrade（OTA DFU）

The module supports over-the-air upgrade of firmware, and the best functional experience can be obtained through over-the-air upgrade. Users can also customize the firmware they need.

For specific upgrade steps, please refer to Chapter 9 Quick Use.

8. AT command

The module must enter the configuration mode to send AT commands, otherwise the commands will not respond.

8.1 Instructions

- All AT commands are transmitted in ASCII format.
- The "\r\n" appearing in the AT command set are all carriage return and line feed characters.
- Command sending format: All commands begin with "AT" and end with "\r\n". Commands must be capitalized except for parameters.
- Command return format: return the relevant string corresponding to the sent command, all ending with "\r\n".
- The sending interval of each AT command should be more than 20ms.
- Entering the configuration mode will temporarily disable the low power consumption mode

(CS pin function is invalid).

➢ In the configuration mode, in order to prevent data interference, the data sent from other devices will not be displayed.

8.2 How to enter and exit configuration mode

1）How to enter：

1. In the transparent transmission mode, "+++\r\n" is sent separately within 50ms. In the configuration mode entered in this way, the serial port parameter configuration is the same as the transparent transmission mode.

2. The transparent transmission mode pulls down the SET pin. In the configuration mode entered in this way, the serial port parameters will be reconfigured (115200 bps, 8 databits, 1 stopbit, None parity).

2）How to log out:

1. Send the command "AT+EXIT\r\n" in configuration mode.

2. Pull high when the SET pin is low.

3. When exiting the configuration mode, the serial port parameters will be restored to the same configuration as the transparent transmission mode.

8.3 Error code

When the command sent does not meet certain conditions(Commands that do not exist or cannot be used in some cases), the module will return an error in the format "+ERROR\r\n".

8.4 Status printing

The serial port will output status during some operations.

Status		Print information
Connection succeeded	Establish a connection as a master	\r\n[SLAVE CONNECT]\r\n
	Establish a connection as a slave	\r\n[MASTER CONNECT]\r\n
Disconnect	The peer device as the master	\r\n[MASTER DISCONNECT]\r\n
	The peer device acts as a slave	\r\n[SLAVE DISCONNECT]\r\n

Enter configuration mode	\r\n[ENTER AT MODE]\r\n
Exit configuration mode	\r\n[EXIT AT MODE]\r\n
Enter low power mode	\r\n[ENTER SLEEP]\r\n
Exit low power mode	\r\n[EXIT SLEEP]\r\n

8.5 AT command set

8.5.1 Test instruction

instruction	response
AT	OK
Description: None	

8.5.2 AT+RESET Reset command

instruction	response
AT+RESET	OK
Description: Restart module	

8.5.3 AT+DEFAULT Reset

instruction	response
AT+DEFAULT	OK
Note: After sending this command, the module will restore the data to the default parameters and restart automatically. The default value of the parameter can be set: AT+NAME: BLE5101 AT+UART: 8,1,0,0 AT+TXPOWER: 0 AT+ADVINT:0 AT+UUID: FFF0, FFF1, FFF2 AT+CONS: 1,0 AT+ENATMODE: 1	

8.5.4 AT+VERSION Query the firmware version number

instruction	response
AT+VERSION?	+VERSION=\<param>
Description	\<param>: module firmware version number

8.5.5 AT+NAME Modify module name

instruction		response
Inquire	AT+NAME?	+NAME=\<param>
Set up	AT+NAME=\<param>	OK
Description	\<param>: device name string, no more than 16 characters Default value: BLE5101	

8.5.6 AT+MAC Modify the local MAC address of the module

instruction		response
Inquire	AT+MAC?	+MAC=\<param>
Set up	AT+MAC=\<param1>	OK
Description	\<param>: the mac address of the device \<param1>: The mac address to be modified, without a semicolon Note: If there is no connection to the module when the mac address is modified, the module will immediately change its mac address to apply to the next Bluetooth connection.	
Example	Send: AT+MAC=aabbcc112233\r\n Return: OK\r\n Description: Modify the local mac address to aa:bb:cc:11:22:33	

8.5.7 AT+UART Modify the serial port parameters of the module's transparent

transmission mode

instruction		response
Inquire	AT+UART?	+UART=<param>,<param1>,<param2>,<param3>
Set up	AT+UART=<param>, <param1>,<param2>, <param3>	OK
Description	Parameter	Description	Ranges

	Parameter	Description	Ranges
	<param>	Serial port baud rate	1: 2400bps 2: 4800bps 3: 9600bps 4: 14400bps 5: 19200bps 6: 38400bps 7: 57600bps 8: 115200bps (default value)
	<param1>	Data bit	0: 7bits 1: 8bits (default value)
	<param2>	Check Digit	0: NONE (default value) 1: EVEN 2: ODD
	<param3>	Stop bit	0：1bit (default value) 1：2bit

Note: Modifying the serial port parameters will take effect immediately in the transparent transmission mode.

8.5.8 AT+TXPOWER modify the transmit power of the module

instruction		response
Inquire	AT+TXPOWER?	+TXPOWER=<param>
Set up	AT+TXPOWER= <param>	OK
Description	<param>: 0：10 dbm（default value） 1：6dbm 2：3 dbm 3：0 dbm 4：-3 dbm 5：-7 dbm 6：-10 dbm	

	7：-16 dbm
	The maximum transmission distance of the module can be controlled by adjusting the transmitting power.

8.5.9 AT+ADVINT Modify the advertising interval

instruction		response
Inquire	AT+ADVINT?	+ADVINT=<param>
Set up	AT+ADVINT=<param>	OK
Description	<param>: 0：50ms（default value） 1：100ms 2：200ms 3：500ms 4：1000ms 5：2000ms	

8.5.10 AT+UUID Modify service UUID

instruction		response
Inquire	AT+UUID?	+UUID=<param>,<param1>,<param2>
Set up	AT+UUID=<param>,<param1>,<param2>	OK
Description	<param>:Service UUID <param1>:Characteristic UUID (read,notify) <param2>:Characteristic UUID (write,write no response) Value range: 0000-FFFF Default value: FFF0, FFF1, FFF2	

8.5.11 AT+CONS Modify the number of connectable devices

instruction		response
Inquire	AT+CONS?	+CONS=<param>,<param1>
Set up	AT+CONS=<param>,<param1>	OK

Description	<param>: the number of masters that can be connected, and the module acts as a slave; <param1>: The number of slaves that can be connected, and the module serves as the master. The maximum number of modules that can be connected is 20, so <param> + <param1> <= 20. When <param>=0, the module will be disabled as a slave and cannot use any advertise function; when <param1>=0, the module will be disabled as a master and cannot use any scanning and active connection functions. Through this command, the number of connected devices of the module can be flexibly adjusted. (If you want to connect the master and the slave at the same time, control the number of devices to be connected (2 for the master and slave are recommended). Too many Bluetooth connections may cause module exceptions.)
Example	Command: AT+CONS=0,<x>\r\n Return: OK\r\n Description: Set the module as one master and multiple slaves. <x> can be any integer from 0 to 20.

8.5.12 AT+ENATMODE Modify the module power-on default mode

instruction		response
Inquire	AT+ENATMODE ?	+ENATMODE=<param>
Set up	AT+ENATMODE =<param>	OK
Description	<param>: 0: The configuration mode is not entered by default when powering on, and the module will automatically scan/advertise/ connection ; 1: Enter the configuration mode by default when powering on, the module does not initiate a scan/advertise/connection (default value)	

8.5.13 AT+MODE Modify the status in the module configuration mode

instruction		response
Inquire	AT+MODE?	+MODE=<param>
Set up	AT+MODE=<par am>	OK

Description	<param>: I: IDLE state, the module is not connected in this state, and no advertising or scanning operations are performed S: STATIC state, the module remains connected in this state, but does not do advertise and scan operations A: ADVERTISING state, the module continues to do advertise operations in this state C: CONNECTING state. In this state, the module will try to scan and connect to the device with the binding record. U: UPDATE status, used for air upgrade. Note: When entering the configuration mode, if the module is not connected, the default is IDLE state, if there is a connection, it is STATIC state. The IDLE status and STATIC status will dynamically change depending on the number of connections established by the module. After entering the UPDATE state, the module will only accept the two commands "AT+MODE?\r\n" and "AT+MODE=I\r\n".

8.5.14 AT+SCAN Module scan instruction

instruction	response
AT+SCAN	
Description	After sending this command, the module will enter the scanning state for 10 seconds, and print out all the scanned device information. Up to 10 device information can be printed. In this state, some AT commands cannot be used. Send this command again in this state to end the scan earlier.
Example	Command: AT+SCAN\r\n Return: OK\r\n 　　　　SCANS\r\n 　　　　+SCAN: address:11:22:33:44:55:66 type:0 rssi:77\r\n 　　　　+SCAN: address:aa:bb:cc:dd:ee:ff type:1 rssi:88\r\n 　　　　... 　　　　+SCANE\r\n Description: Scan example. address is the mac address of the scanned module; type is the type of the module mac address; rssi is the signal strength of the opposite module. Command: AT+SCAN\r\n Return: OK\r\n 　　　　SCANS\r\n 　　　　+SCAN: address:11:22:33:44:55:66 type:0 rssi:77\r\n Command 1: AT+SCAN\r\n --scan command to be sent again halfway 　　　　+SCANSTOP\r\n 　　　　+SCANE\r\n Note: An example of interrupt scanning, a +SCANSTOP response will be returned

	when the scanning ends early.

8.5.15 AT+CONA Connect Bluetooth device through mac address

instruction	response
AT+CONA=<param>,<param1>	OK
Description	<param>: the mac address of the Bluetooth device to be connected <param1>：The mac address type of the Bluetooth device to be connected Note: This command is to scan first and then connect. If the device is not scanned, the module will not connect. This command may fail to connect.
Example	Command: AT+CONA=112233445566,0\r\n Return: OK Description: As a master, try to establish a connection with a Bluetooth device with a Mac address of 11:22:33:44:55:66 and an address type of 0.

8.5.16 AT+LINK View information about connected devices

instruction	response
AT+LINK	OK
Description	After the command is sent, the module prints information about the connected device, including the link number, mac address, address type, and primary/secondary type. If the module does not have any connections, this directive returns NULL.
Example	Command：AT+LINK\r\n Return：+LINK=0, role:0, address:11:22:33:44:55:66, type:0\r\n 　　　　+LINK=1, role:1, address:aa:bb:cc:dd:ee:ff, type:1\r\n 　　　　... 　　　　OK\r\n Each connection returned contains four parameters: link number and role (0: master; 1: slave), mac address, mac address type.

8.5.17 AT+SEND Send data to a single device through the link number

instruction	response
AT+SEND=<param>,<param1>	OK

Description	<param>: link number ance<param1>: Numeric parameter: indicates the total number of bytes of data to be sent. The value cannot exceed 2048. Function: Enable unidirectional data transparent transmission to send data of a specified length After receiving this command, the module will return" >", and then start to receive serial port data. The data length is accumulated each time. When the accumulated data length reaches <param1>, +++\r\n is sent in a single packet, or the specified link is disconnected, unidirectional transparent data transmission ends. In this case, you can continue to configure the AT command
Example	For details, see 9.1.4 **Send Data to a Single Link**

8.5.18 AT+BOND Send a binding request to a single device through the link number

instruction	response
AT+BOND=<param>	OK
Description	<param>: link number Note: Each module can store up to 8 device binding data (regardless of master and slave). If there are more than 8, the binding request initiated will be invalid. After the binding is successful, more reliable data transmission can be obtained.

8.5.19 AT+DISC Disconnect Bluetooth connection by link number

instruction	response
AT+DISC=<param>	OK
Description	<param>: link number After successful disconnection, the serial port will output status. Note: If you do not enter the link number, it will be regarded as disconnecting all connections
Example	Command: AT+DISC=1\r\n Return: OK\r\n Note: Disconnect the Bluetooth connection with link number 1. Command: AT+DISC\r\n Return: OK\r\n Note: Disconnect all Bluetooth connections

8.5.20 AT+READBOND Read bound device information

instruction	response
AT+READBOND	
Description	After sending this command, the module will output all bound device information, up to 8 devices.
Example	Command：AT+READBOND\r\n Return：+REBOND=address:112233445566, type:0\r\n 　　　　　+REBOND=address:aabbccddeeff, type:0\r\n 　　　　　... 　　　　　OK\r\n

8.5.21 AT+CLRBOND Delete binding information

instruction	response
AT+CLRBOND=<param>,<param1>	OK
Description	<param>: The mac address of the binding information to be deleted <param1>: mac address type If you do not enter <param> and <param1>, all binding information will be regarded as deleted.
Example	Command: AT+CLRBOND=112233445566,0\r\n Return: OK\r\n Description: Delete the binding information of the device whose mac address is 11:22:33:44:55:66 Command: AT+CLRBOND\r\n Return: OK\r\n Description: Delete all binding information

9. Quick guide

9.1 Quick to use

9.1.1 Environmental preparation

Hardware: 2 BLE5101 modules

Software: SSCOM serial debugging assistant

Note: Since the CS pin of the module is high by default, and the low-power mode is active high, it is necessary to pull down the CS pin in advance to use all the functions of the module normally.

When the module is used for the first time, it enters the configuration mode by default. You need to use the AT+MAC command to modify the module's own mac address to ensure that the module's

mac address is unique. The module cannot actively connect to a Bluetooth device with the same mac address as its own.

9.1.2 Auto connect

When the module is powered on, it enters the configuration mode and sends the command "AT+EXIT\r\n" to exit the configuration mode. When both modules are in the transparent transmission mode, the Bluetooth connection will be automatically established. After the connection is established, data can be transmitted transparently.
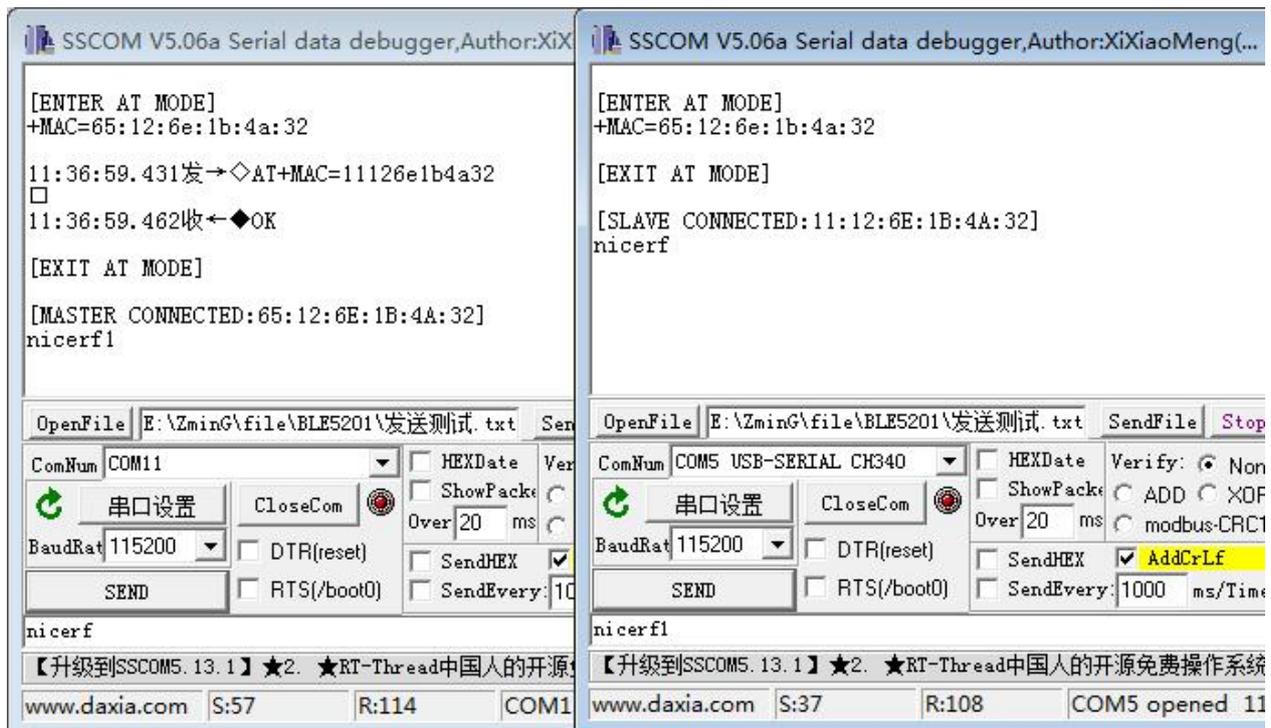

9.1.3 Manually connect

When the module is in the configuration mode, it is idle and does not perform advertising or scanning operations. At this time, manual connection can be used.

Send the command "AT+MODE=A" to module A to start advertising, and then send the command "AT+SCAN" to module B to start scanning. Module B will scan and print out the device information of Module A.

Send the connection establishment command AT+CONA to module B and wait for the connection to be established. After the connection is successfully established, send the command "AT+EXIT" to both modules to exit the configuration mode, and then the data can be transparently transmitted.
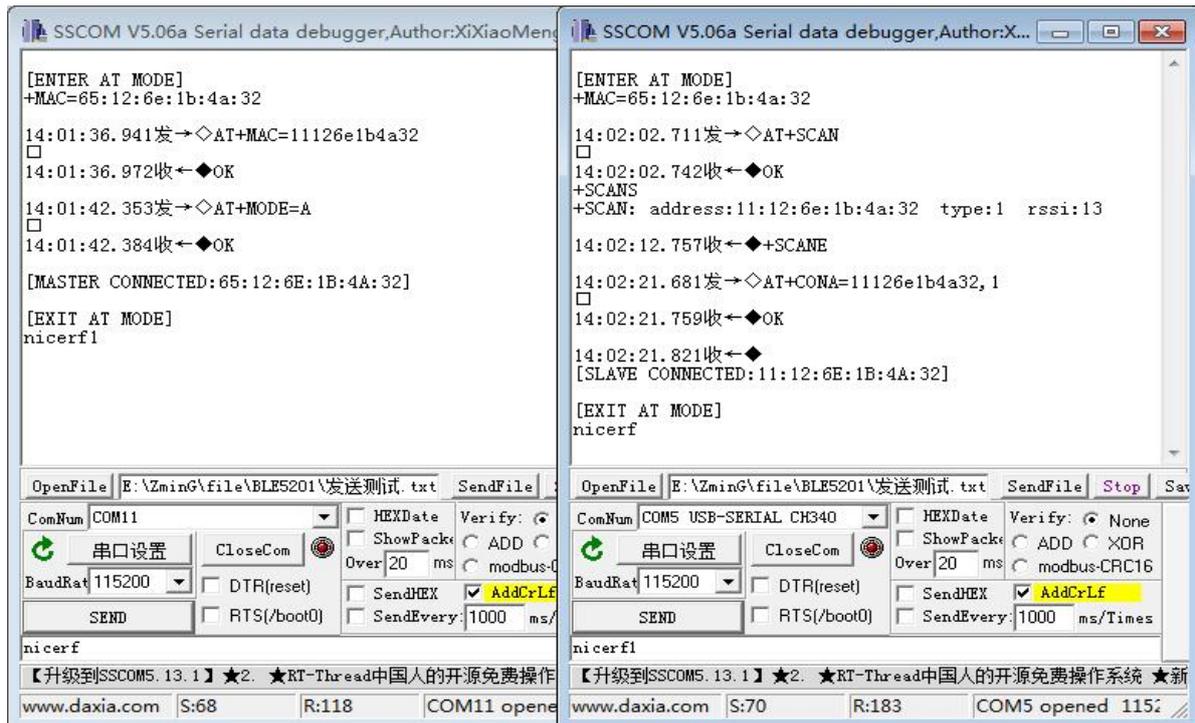
9.1.4 Send data to a single link

After confirming the link number, send AT+SEND command in configuration mode to start one-way transparent transmission.

Data volume will be accumulated when sending data
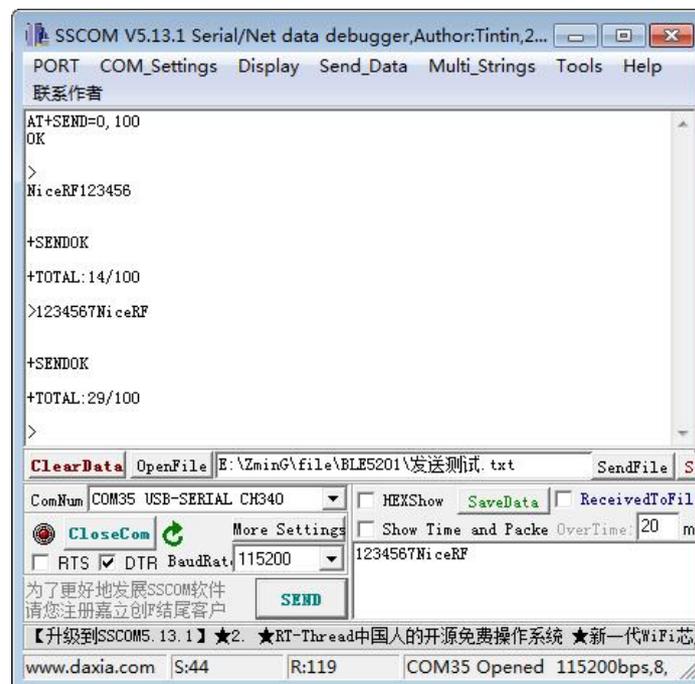
When the accumulated number of bytes sent reaches the preset maximum value, the one-way transparent transmission ends.
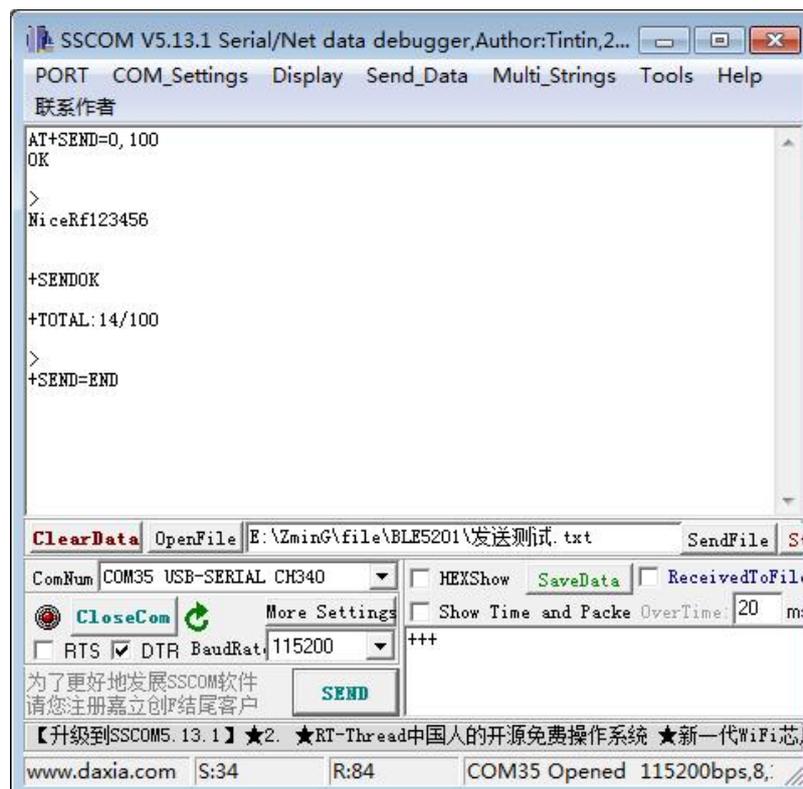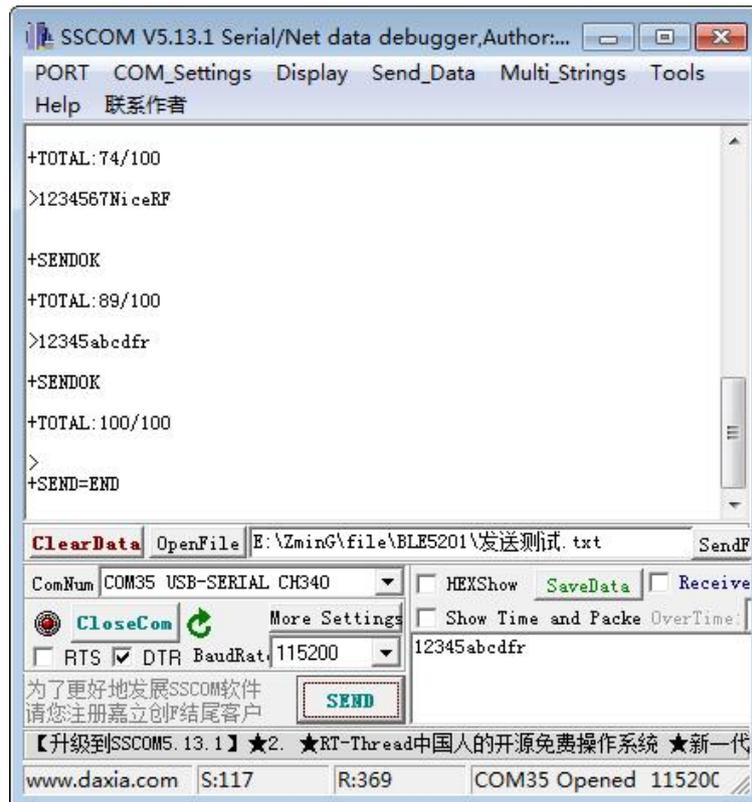
When a single packet sends a specific character string "+++\r\n", the one-way transparent transmission is ended early

9.2 Air upgrade

### 9.2.1 Environmental preparation

Hardware: 1 BLE5101 module

Software: SSCOM serial port debugging assistant, 1 firmware to be upgraded, mobile phone app "Fr8010 OTA"

9.2.2 Upgrade steps

➢ If the module is in transparent transmission mode, send the command "+++\r\n" to the module or pull down the SET pin to enter the configuration mode.

➢ Make sure that the module is not connected to other Bluetooth devices and the module is in IDLE state. If yes, send the command "AT+MODE=I\r\n" to disconnect all Bluetooth connections.

➢ Send the command "AT+MODE=U\r\n" to enter the upgrade mode.
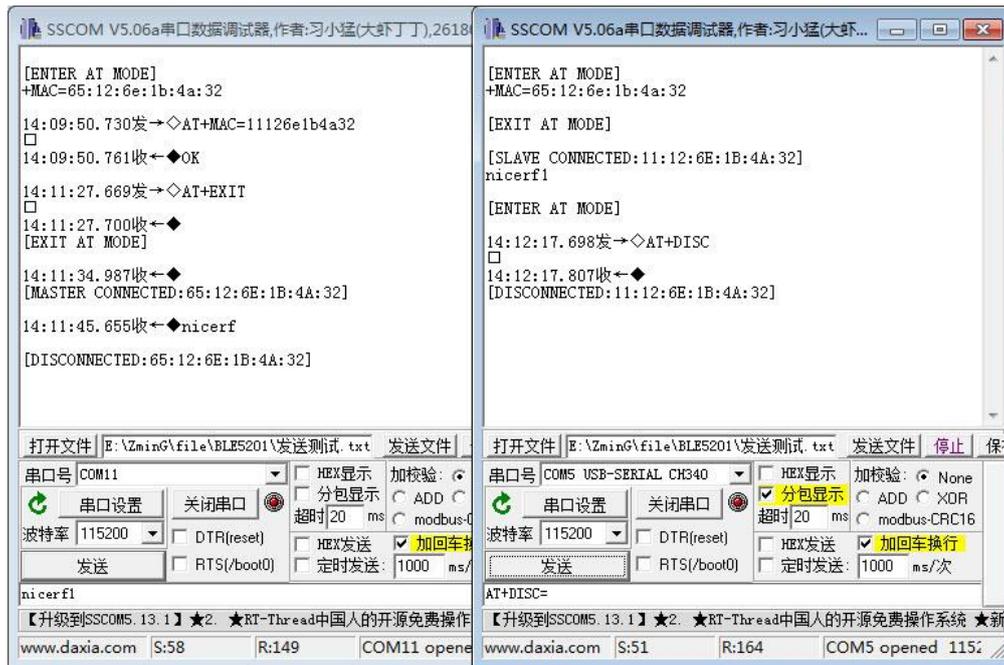
> Open the mobile phone app "Fr8010 OTA", you can see a device name "OTA-xxxxx" in the scan result, click connect.
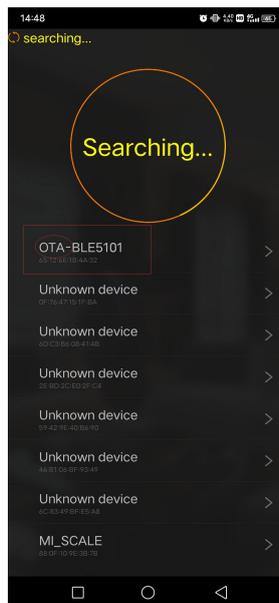
> After the connection is established, select the firmware file for upgrading, and then click Write.

➤ After the firmware file is transferred, the module will automatically restart, and the firmware upgrade is now complete.