E103-RTL8711 Series Product User Manual

WiFi + BLE 5.0　2.4 GHz + 5.8 GHz　WiFi Serial Module



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Important Note:

- The following tests are for the LOG serial port; for normal use, simply use the AT command serial port. Although there are some differences, the method remains the same (the differences lie in the feedback information from the serial port, but the key information is still present).
- Before use, connect the AT command serial port first. The serial port pins are PB30 (RX) and PB31 (TX), with a baud rate of 115200, 8 data bits, 1 stop bit, and no parity. AT commands must be followed by a carriage return and line feed to be executed.

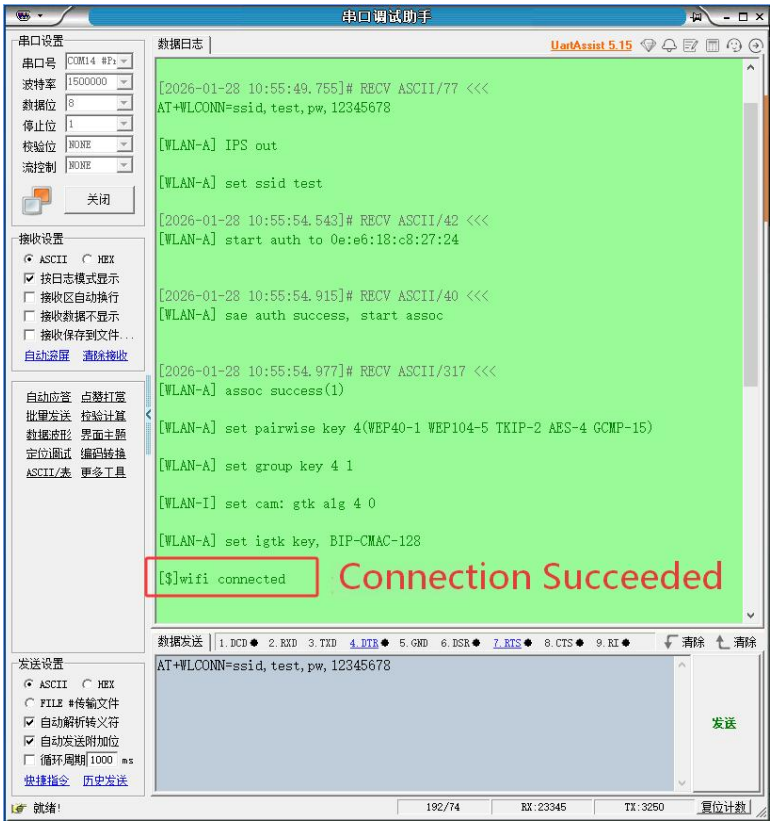
1 Wi-Fi Connection

1.1 STA Mode

• Use the AT+WLCONN command to connect to a Wi-Fi hotspot (router hotspot) on the 2.4 GHz or 5 GHz band. Power-on reconnection is supported by default, provided that Wi-Fi settings have already been configured.
• A large amount of log information will be printed during the connection process.

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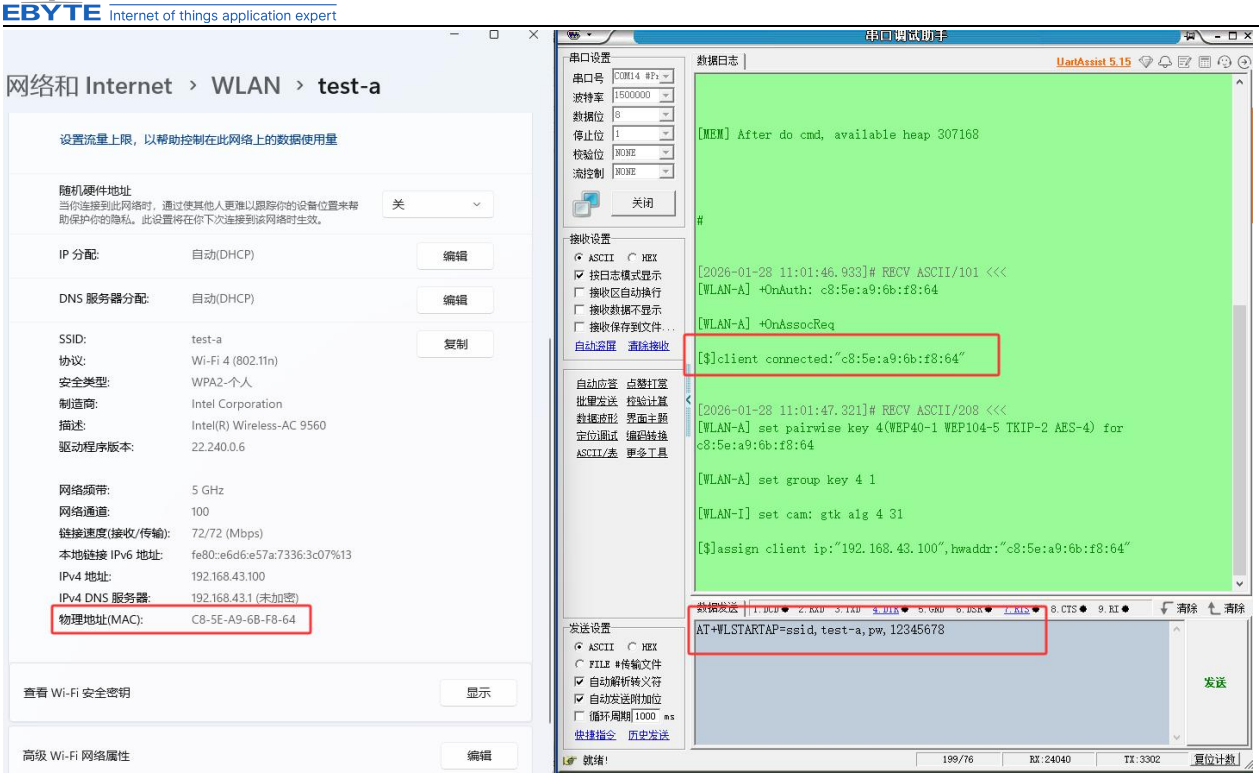


1.2 AP Mode

- Use the AT+WLSTARTAP command; the parameter rules are the same as for STA mode. The image below shows the Wi-Fi information on the left after connecting to the module’s hotspot; the default frequency band is 5 GHz.

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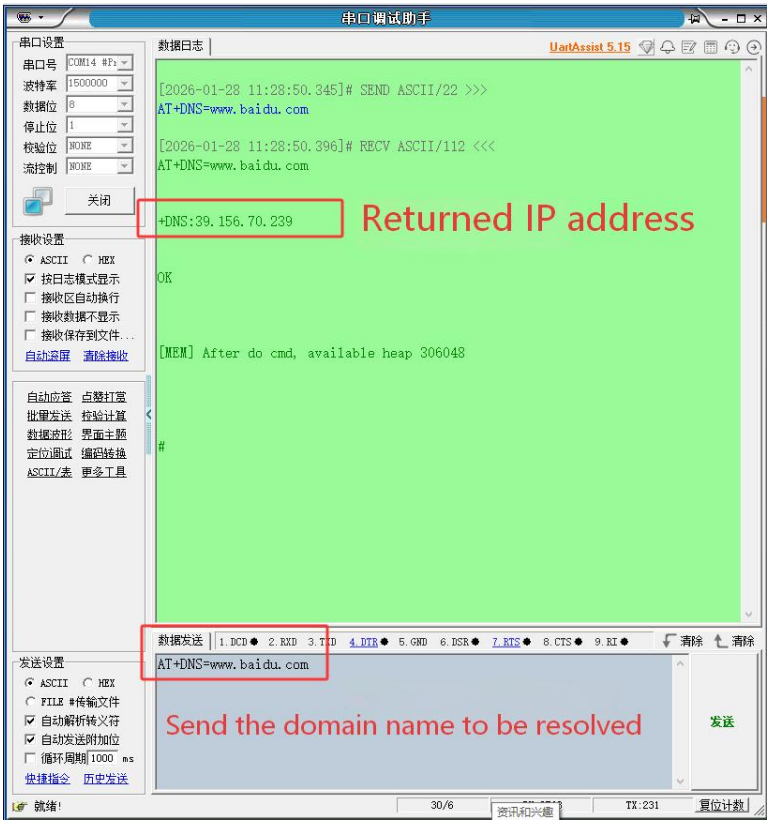
2 Network Testing

The NetWork command is used for network testing, including network connectivity testing, network bandwidth testing, and DNS service testing.

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2.1 DNS Test



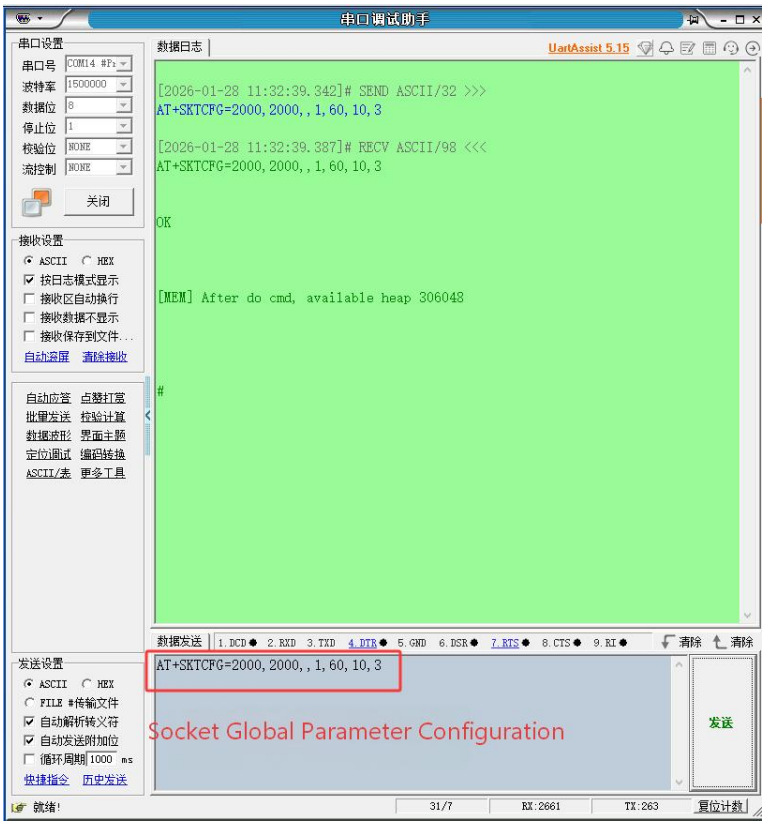
3 Socket Communication

The Socket command is used for network communication. You must connect to Wi-Fi before using it. Below, we will conduct TCP and UDP communication tests on a local area network. Connect the PC and the module to the same Wi-Fi network.

- First, configure the global parameters.
- These parameters are used for connection timeouts, keepalives, and other settings.

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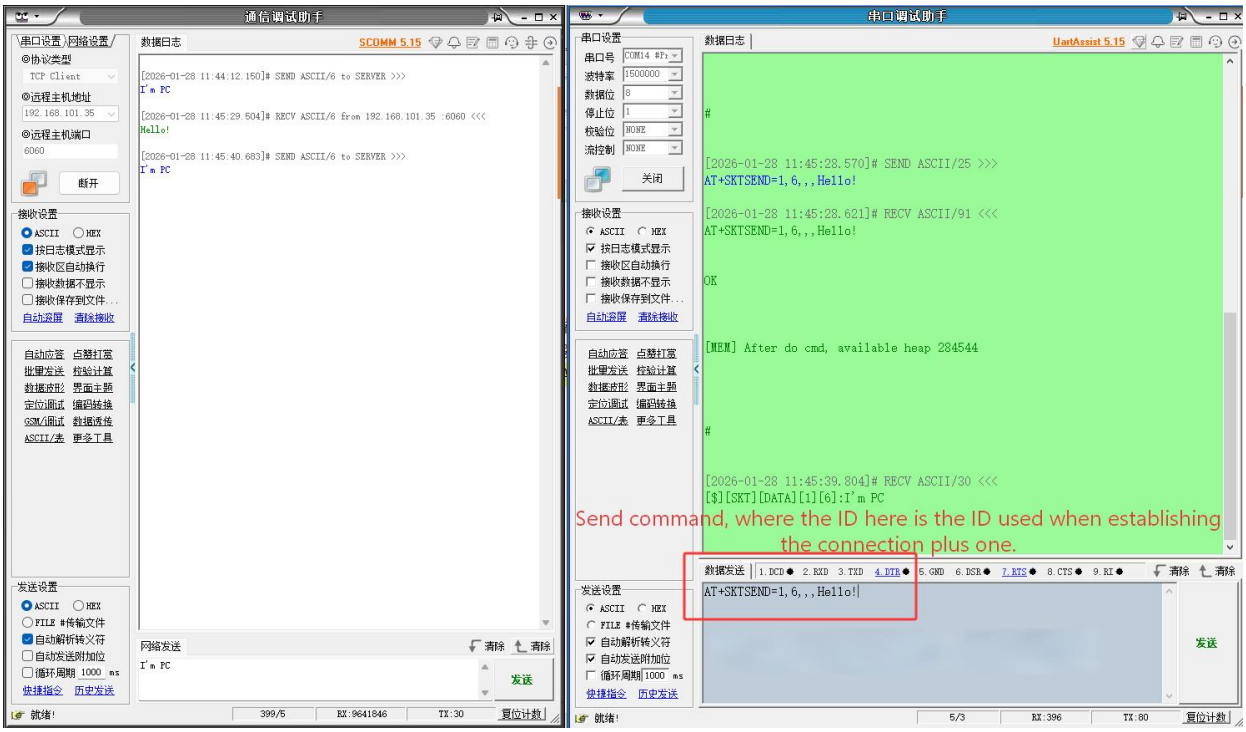


3.1 DNS Test

- The command sequence `AT+SKTSERVER=0,1,,6060,1` is used to create a TCP server on port 6060. Note that when connecting to the module’s TCP server from a PC, the IP address used for the connection is the one returned by the module after it successfully connects to Wi-Fi. You can also use the `AT+WLSTATE` command to query the device’s IP address.
- `AT+SKTSEND=1,6,,,Hello!`

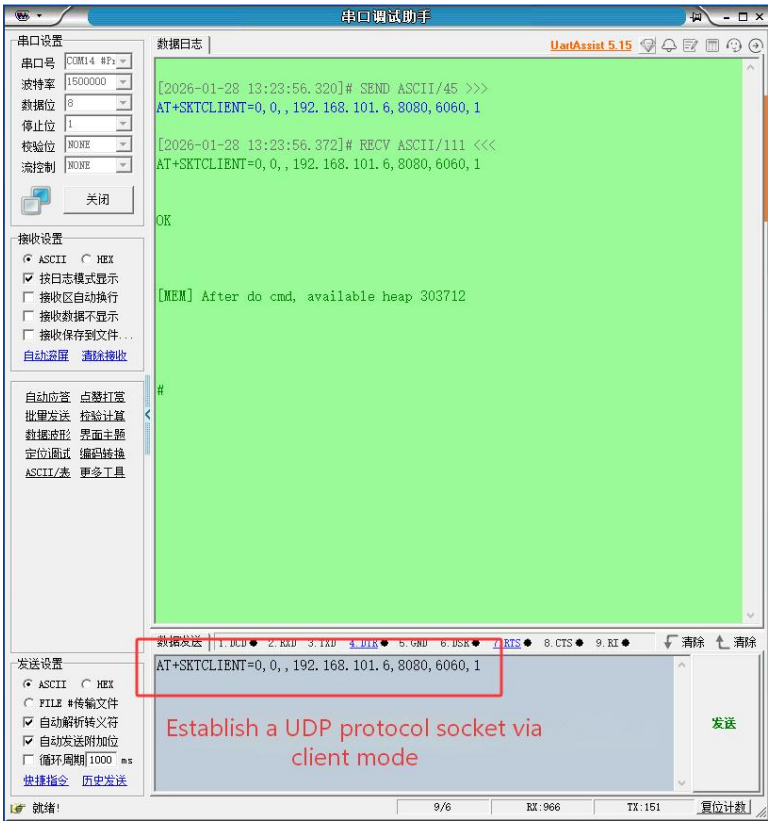
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3.2 UDP Communication Testing

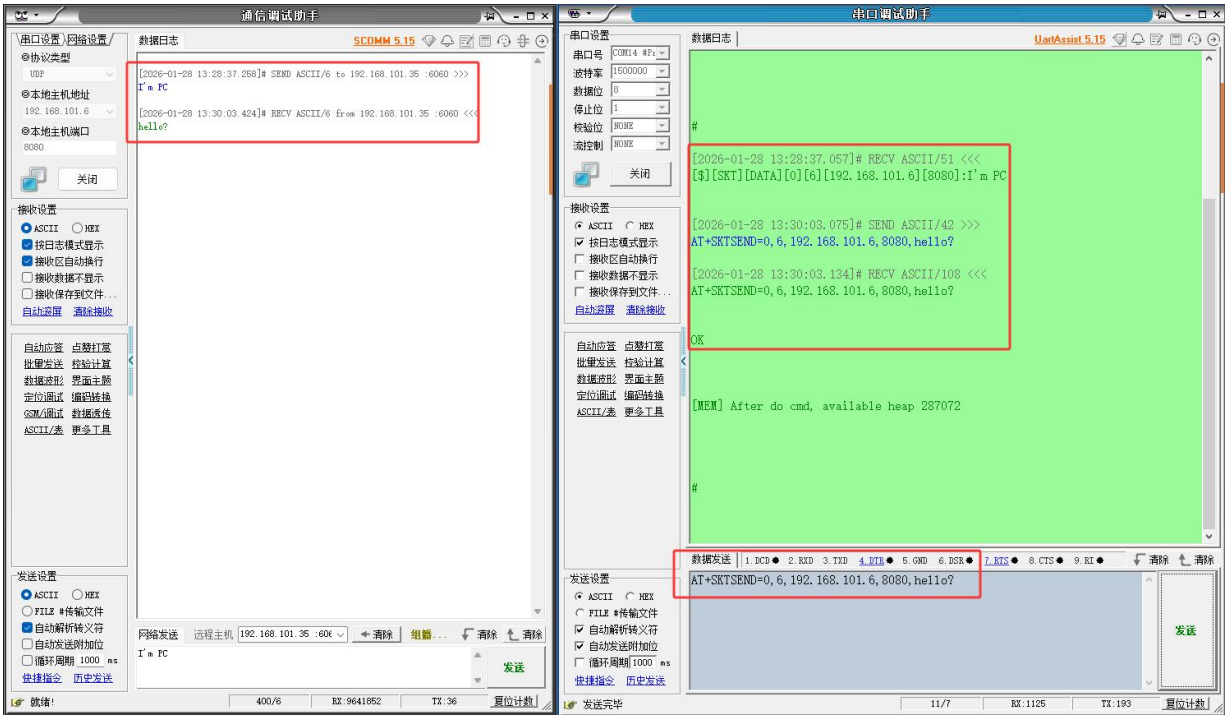
- AT+SKTCLIENT=0,0,,192.168.101.6,8080,6060,1 Note: If the last parameter is 0, you must use the AT+SKTREAD command to read data (the same applies to TCP).



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• AT+SKTSEND=0,6,192.168.101.6,8080,hello? Use this command to send data to the PC. Note that when using the UDP protocol, the ID used when creating the socket must match the ID used during transmission (parameter 1).



4 MQTT Connection

4.1 Connecting MQTT to a Remote Server

• AT+MQTTCFG=0,60,60,0,test/aaa,I'm Module,0,0: This command configures the MQTT heartbeat interval, topic, message, and message quality, among other settings.

• AT+MQTTCONN=0,121.41.166.205,1883,Module,1,,Module,1234: This command connects to a remote MQTT server.

• Additionally, an MQTT client debugging tool on a PC was used to connect to the MQTT server to verify data exchange between the two devices; the figure below shows the information displayed after a successful connection.

客户端 ID	用户名	状态	IP 地址	心跳	干净起点	会话过期间隔	连接时间
PC	PC	已连接	183.220.26.196:12945	50	确实如此	0	2026-01-28 13:43:33
模块	模块	已连接	183.220.26.196:13015	60	错误	2 小时	2026-01-28 13:44:14

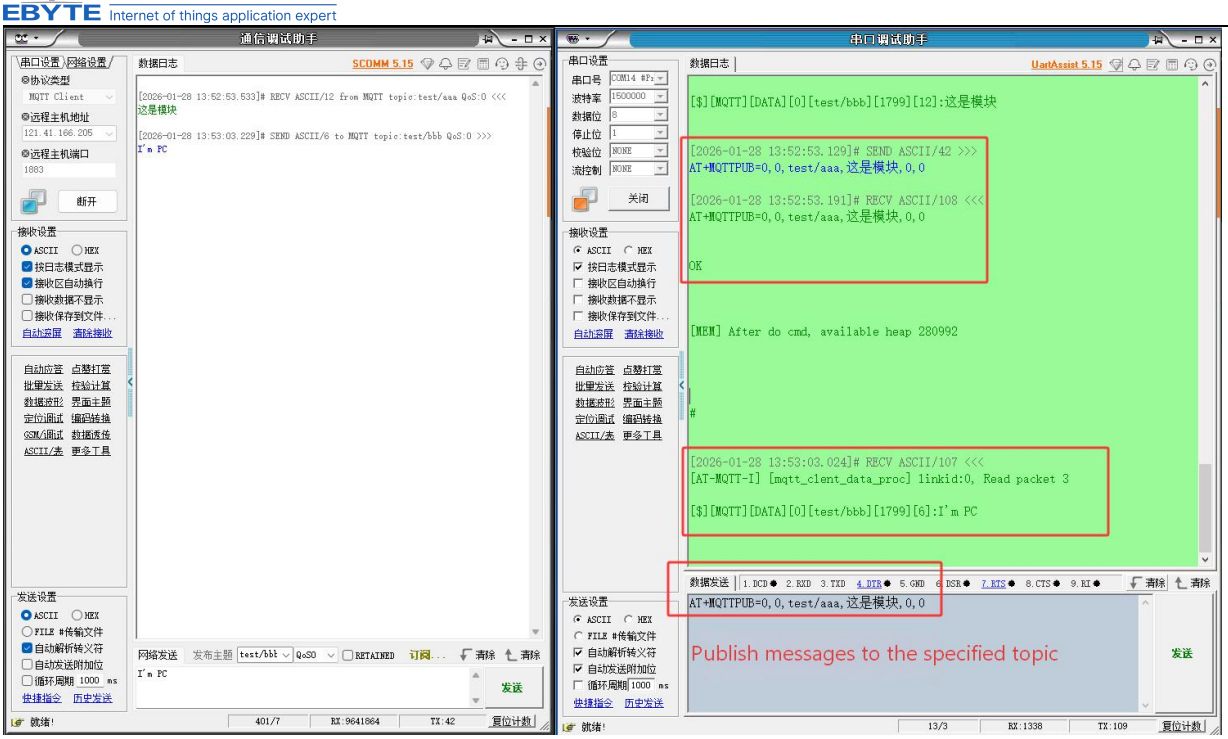
• AT+MQTTSUB=0,test/bbb,0 Subscribe to a topic.

• AT+MQTTPUB=0,0,test/aaa,This is the module,0,0 Publish a message to a specified topic.

• Testing confirmed that the two devices can communicate data normally with each other.

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5 HTTP Retrieval

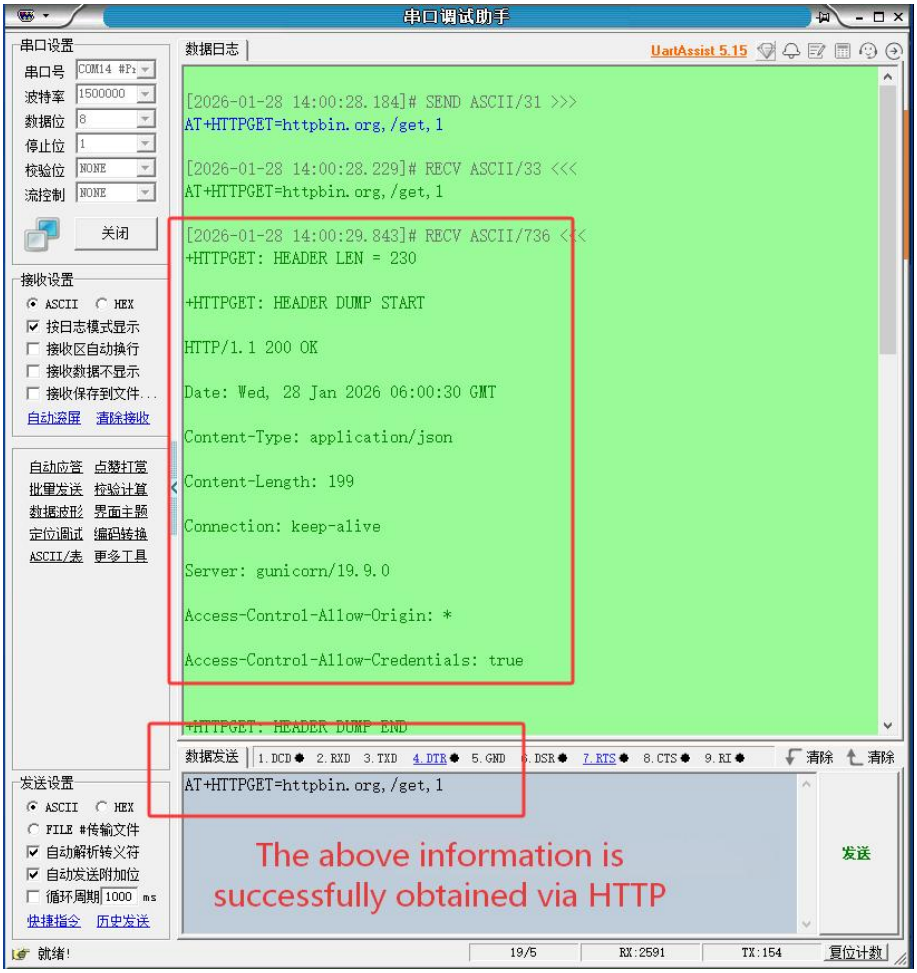
• When using HTTP features, please first connect to a Wi-Fi network with internet access.

5.1 HTTP Retrieval

• The command `AT+HTTPCONF=10,80` configures the HTTP request timeout and the port numbers used; HTTP uses port 80, and HTTPS uses port 443.

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5.2 HTTPS Retrieval

- AT+HTTPCONF=10,443: Configure the port to 443 to use HTTPS
- AT+HTTPGET=www.baidu.com,/get,2: Send this command to test whether HTTPS is available; although it returns a 404 “Not Found” error, the data can still be retrieved

6 WebSocket Communication

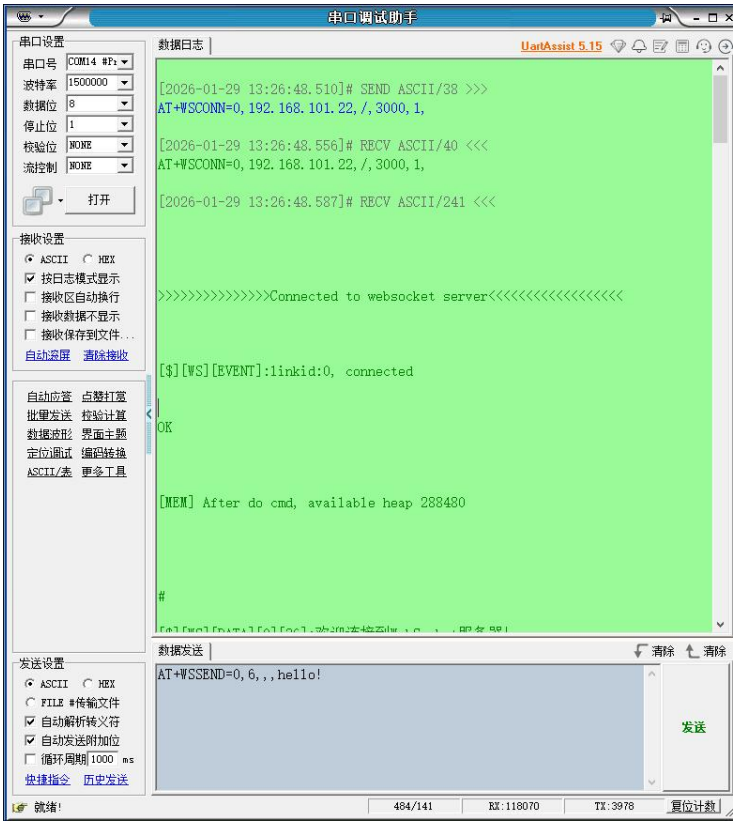
Before use, please connect to a working Wi-Fi network and ensure you are on the same local area network as the computer to test WebSocket communication.

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6.1 Module as Client

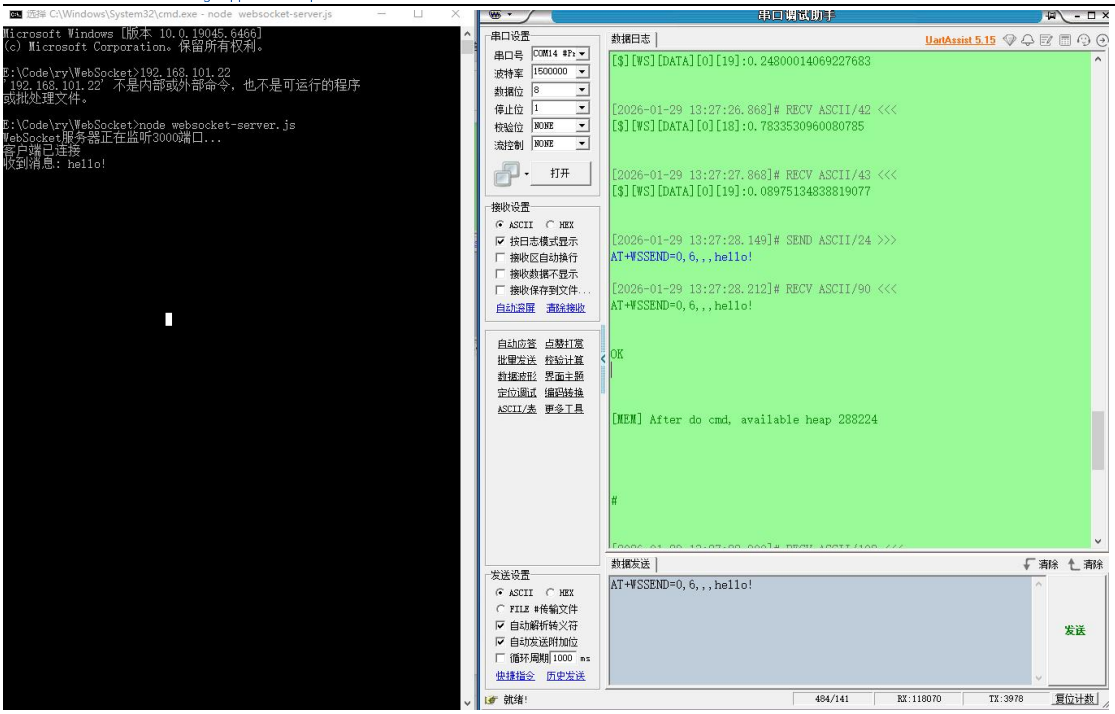
- Before you begin, set up a basic local WebSocket server for testing using the link below.
- Set up a simple WebSocket server in 2 minutes – Zhihu.
- AT+WSGLCFG=5,2000,2000,0,300,5,3: Configure the WebSocket client’s global parameters.
- AT+WSCFG=0,30,120,2048,1500,5,,13,3: Configure the client connection ID parameters.
- AT+WSCONN=0,192.168.101.22,/,3000,1: Start connecting to the Web server.
- Note that request headers do not need to be configured for this test; additionally, you may encounter an “ERROR:5” when attempting to connect. In this case, simply try connecting several times or change the port number.



- Communication test: The local web server randomly sends data to the client, and the client sends “hello!” back to the server, as shown in the figure below.

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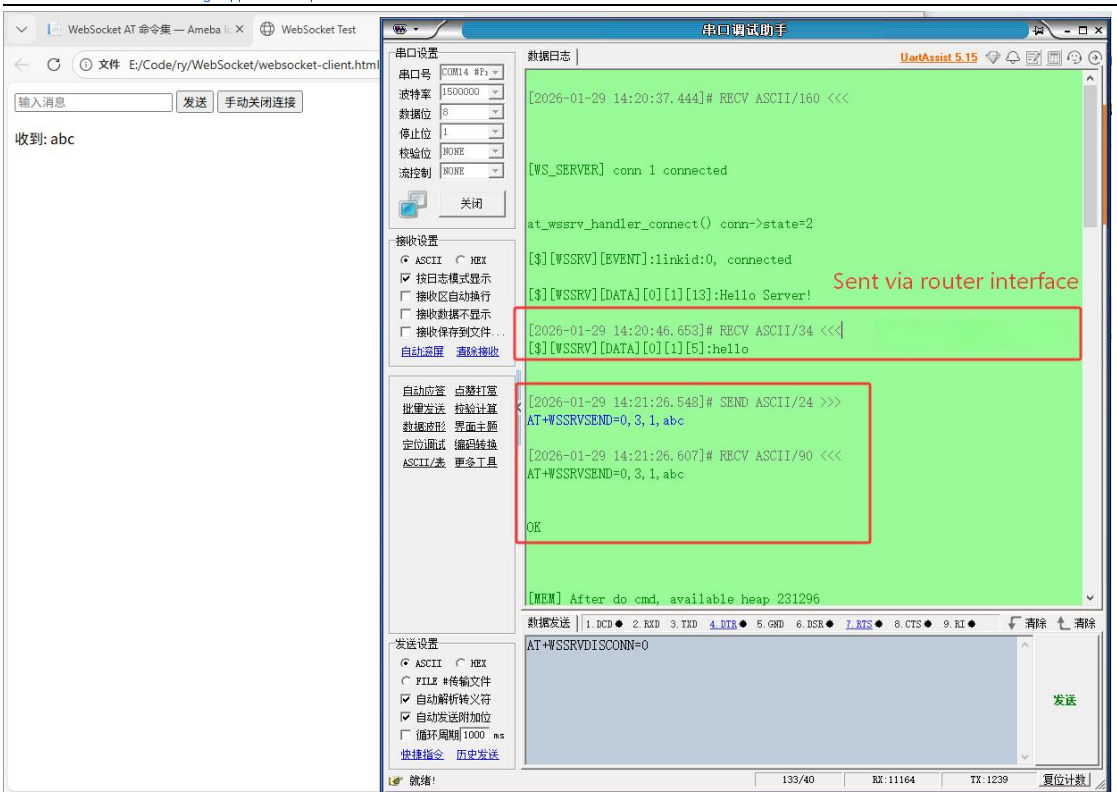
6.2 Module as a Server

- AT+WSSRVCFG=2,30,90,16384,16384 Configure the global parameters for the web server.
- AT+WSSRVSTART=3000,1 Start the server and set the port number to 3000.
- Note: If you are following the WebSocket setup tutorial provided earlier, you must replace the IP address in the HTML file with the module’s actual IP address.

```
// 创建WebSocket连接
const socket = new WebSocket("ws://192.168.101.15:3000");
```

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7 Bluetooth Transmission Test

Before the transmission module is initialized, only commands beginning with AT+BTDEMO are supported. To use other commands, you must first initialize the transmission module. Note: Bluetooth settings are not retained after a power cycle; you must restart broadcasting after the Bluetooth connection is disconnected.

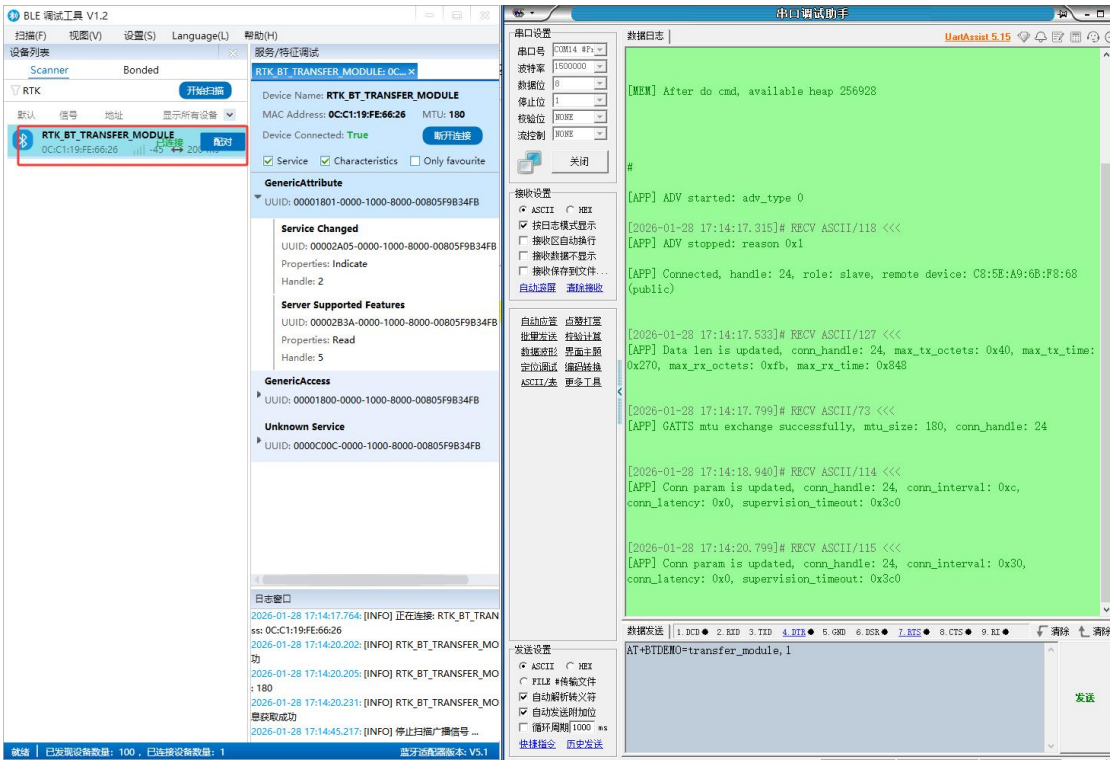
7.1 Bluetooth is enabled and broadcasting by default

• AT+BTDEMO=transfer_module,1 Initialize the Bluetooth module and use the default Bluetooth service to briefly verify that Bluetooth is available.

AT+BLEGAP=adv,1,0,0,0,1,010203040506,0x20,0x20,0x07 Set the Bluetooth broadcast parameters and enable broadcasting. As shown in the figure, the BLE Debug Assistant has already connected to this Bluetooth device and retrieved its services.

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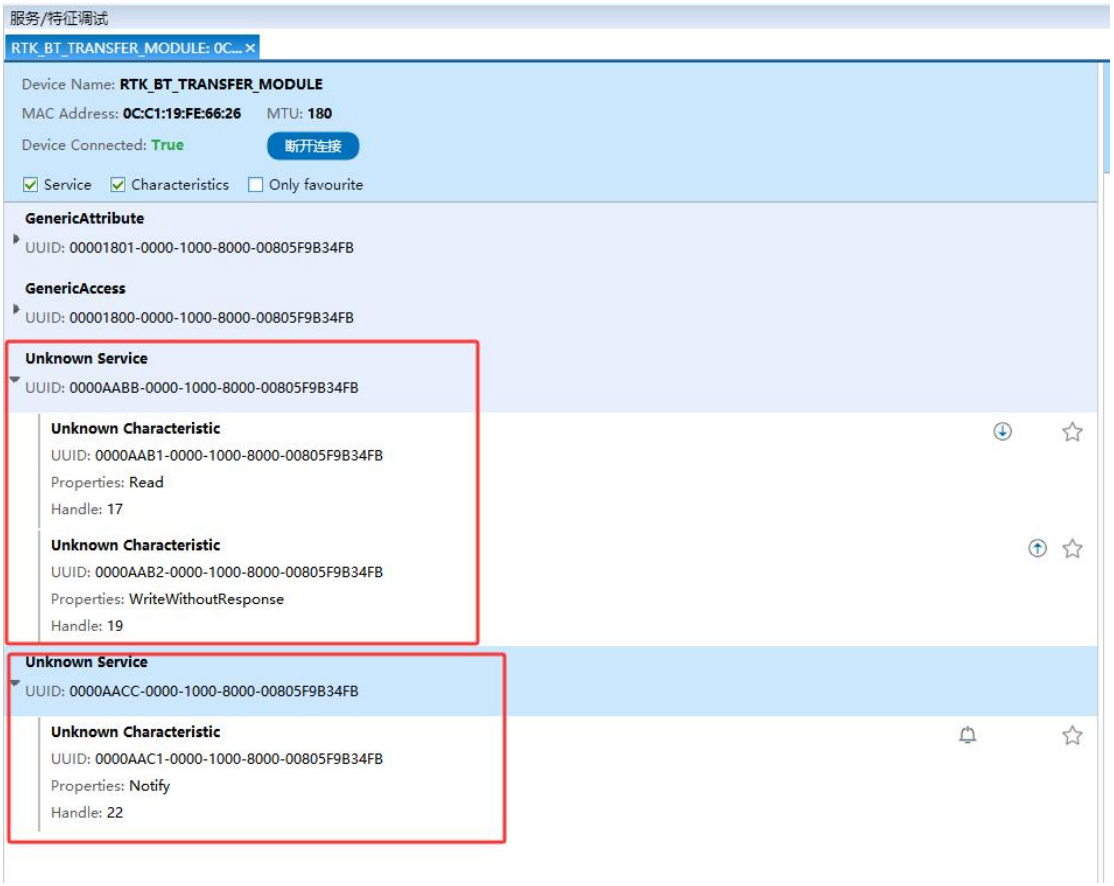


7.2 Add a Custom Service

- Note: Do not initialize the Bluetooth module yet; keep it in an uninitialized state.
- AT+BTDEMO=transfer_module,set_uuid,0,0xAABB: Send this command to add a primary service.
- AT+BTDEMO=transfer_module,set_uuid,1,0xAACC: Add a second service with read capabilities.
- AT+BTDEMO=transfer_module,srv_add,0xAABB: Begin adding features for the service with UUID 0xAABB until the current feature addition is complete.
- AT+BTDEMO=transfer_module,char_add,0xAAB1,0x02 Adds the first feature with UUID 0xAAB1 to the service with UUID 0xAABB; its attribute is “read.”
- AT+BTDEMO=transfer_module,char_add,0xAAB2,0x04 Adds the second feature with UUID 0xAAB2 to the service with UUID 0xAABB; its attribute is “write without reply.”
- AT+BTDEMO=transfer_module,srv_end Ends the current feature addition session.
- AT+BTDEMO=transfer_module,srv_add,0xAACC Begins adding features for the service with UUID 0xAABB until the current feature addition session ends.
- AT+BTDEMO=transfer_module,char_add,0xAAC1,0x10 Adds the first attribute with UUID 0xAAC1 to the service 0xAACC, with the attribute set to “Notification.”
- AT+BTDEMO=transfer_module,srv_end Ends the current attribute addition session.
- AT+BTDEMO=transfer_module,1 Initialize the Bluetooth module.
- AT+BLEGAP=adv,1 Enable Bluetooth broadcasting.
- As shown in the figure, the BLE Debug Assistant has successfully retrieved the module’s BLE services and attributes.

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7.3 Pair with a Cell Phone via Bluetooth

- Initialize the Bluetooth module before beginning.
- Use the command `AT+BLEGAP=sec_param` to set the pairing parameters.
- Use the command `AT+BLEGAP=adv,1` to enable broadcasting.
- At this point, turn on your phone’s Bluetooth and start searching for the device. Once found, tap to connect and pair. A pairing code will appear; note that the module’s feedback will prompt you to enter the pairing code.

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如果设备在配对过程中需要输入认证密钥，设备会有如下提示:

```
[$]+BLEGAP:passkey_input,<conn_handle>
```

- Simply send the command `AT+BLEGAP=auth_key,conn_handle,your key` to the module.
- If pairing is successful, the following message will be displayed (the `conn_handle` will be output during connection, and the `key` is the pairing code displayed on your phone).
- Pairing is now complete.

```
[2026-01-29 10:13:13.721]# SEND ASCII/30 >>>
AT+BLEGAP=auth_key,24,787071

[2026-01-29 10:13:13.779]# RECV ASCII/113 <<<
AT+BLEGAP=auth_key,24,787071

GAP input auth key OK!
```

7.4 Connect to other Bluetooth devices and communicate with them

- AT+BTDEMO=transfer_module,1.
- AT+BLEGAP=conn,1,010203040506 Connect to a slave device.
- AT+BLEGATTC=disc,16,5,0x01,0xFFFF Discover all characteristics and services of the connected slave device.

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```
[2026-01-29 11:08:30.821]# SEND ASCII/35 >>>
AT+BLEGATTC=disc,16,5,0x01,0xFFFF

[2026-01-29 11:08:30.895]# RECV ASCII/1684 <<<
AT+BLEGATTC=disc,16,5,0x01,0xFFFF

GATT Client based on common API

GATTC Discovering ...


[MEM] After do cmd, available heap 256576



#

[APP] GATTC discover descriptor all result: handle: 0x0002, UUID: 2803

[APP] GATTC discover descriptor all result: handle: 0x0003, UUID: 2a00

[APP] GATTC discover descriptor all result: handle: 0x0004, UUID: 2803

[APP] GATTC discover descriptor all result: handle: 0x0005, UUID: 2a27

[APP] GATTC discover descriptor all result: handle: 0x0006, UUID: 2803

[APP] GATTC discover descriptor all result: handle: 0x0007, UUID: 2a28
```

• AT+BLEGATTC=write,16,0,0xa,2,4154: Sends an AT test command to this handle using hexadecimal values. The notification event returns 2b 41 54 (corresponding to +AT) and 0a 2b 4f 4b 0d 0a (corresponding to +OK\r\n).

```
[2026-01-29 11:03:46.688]# RECV ASCII/436 <<<
AT+BLEGATTC=write,16,0,0xa,2,4154

GATTC Writing ...


[MEM] After do cmd, available heap 256512



#

[APP] GATTC write completed, profile_id: 0, conn_handle: 16, type: 0,
handle: 0xa

[APP] GATTC notify received, profile_id: 0, conn_handle: 16, handle: 0xa

[APP] GATTC notify event:

2b 41 54

[APP] GATTC notify received, profile_id: 0, conn_handle: 16, handle: 0xa

[APP] GATTC notify event:

0a 2b 4f 4b 0d 0a
```

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8 File System Usage

8.1 Flashing a Security Certificate to the File System

• Reference: Overview — Ameba IoT Docs: How to Pre-configure AT Security Certificates and Use the Flashing Software to Flash the Certificate File Directly to the Specified Location

9 Over-the-Air (OTA) Update

9.1 Example of an OTA Update

• This OTA update will be performed on the same local area network (LAN), using the HTTP protocol.

• Firmware Update Programming Guide — Ameba IoT Docs: According to the configuration instructions in this document, you must first change the IP address in your code to that of the HTTP server you intend to use; the port can be set to the default value of 8082.



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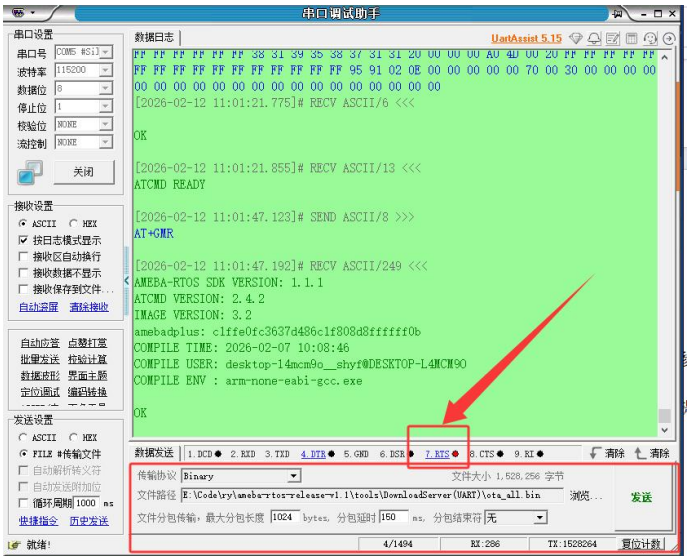
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9.2 UART Upgrade Example

• First, send the command `AT+OTAUSER=1,1528256`. Parameter 1 specifies whether to automatically reboot after the update, and parameter 2 specifies the size of the firmware to be updated.

• After sending the command, the host must control the RTS pin to send a signal to the module’s CTS pin to notify the module. A prompt will then appear: <<<. At this point, the module enters pass-through mode, and you can proceed to send the firmware directly.

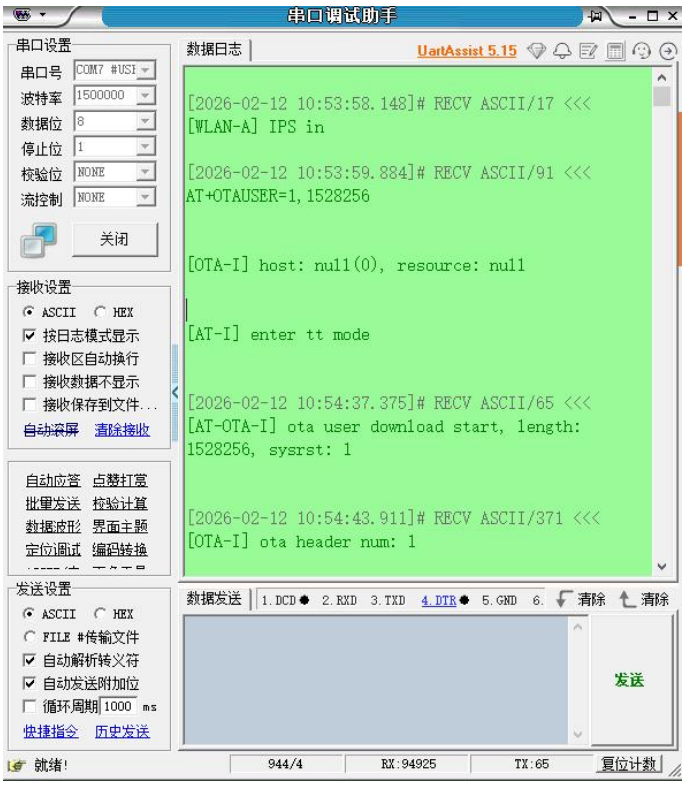
• You can use a USB-to-TTL module with hardware flow control. Cross-connect the USB-to-TTL module’s RTS and CTS pins to the module’s CTS and RTS pins, and enable the RTS function in the host computer’s serial debugging software.



The information output via the serial port is as follows:

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- The figure below shows the upgrade progress percentage as output to the log serial port.



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10 Secondary Development

• For detailed instructions on obtaining the SDK for secondary development, setting up the development environment, and flashing code, please refer to the link on the Realtek website:
FreeRTOS SDK and Development Resources — Ameba IoT Docs

Revision History

Version	Revision Date	Revision Notes	maintainer
1.0	2026-06-12	Initial version	ALL

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