



Shenzhen HI-Link Electronic Co.,Ltd

HLK-RM58S User Manual



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1. Product profile

1.1 Overview

HLK-RM58S is a new low-cost embedded UART-WIFI module (serial-Wireless network) developed by Shenzhen Hi-Link co., Ltd.

This product is an embedded module based on the serial interface in line with the network standard , built-in TCP/IP protocol stack, can realize the user serial port-wireless network (WIFI) conversion.

Through the HLK-RM58S module, the traditional serial device can transmit its own data through the Internet network without changing any configuration, which provides a complete and fast solution for the user's serial port device to transmit the data through the network.

1.2 Product Characteristics

- Compatible IEEE 802.11 a/b/g/n
- Dedicated high-performance 32-bit RISC CPU
- Support for 20 MHz and 40MHz bandwidth in the 2.4 GHz band
- Single frequency 1T1R mode, data rate up to 150Mbps
- Support for 2.4g/ 5 GHz band, dual frequency 1T1R
- Support two working modes of STA/AP
- Built-in TCP/IP protocol stack
- Support various AT instructions
- Support one-click configuration of intelligent networking features
- Support wireless upgrade (OTA)
- 5V single power supply, low power consumption
- Fast transmission speed of serial port

1.3 Product Packaging

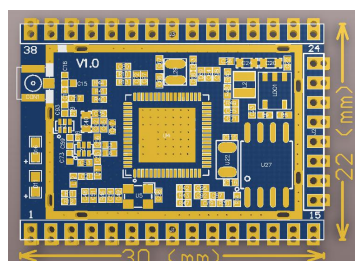


Figure 1 HLK-RM58S encapsulation size

1.4 Technical Specifications

Table 1 Product Technical specifications

Module	Model	HLK-RM58S
	Package	Plug-in
Wireless parameter	Wireless standard	IEEE 802.11 a/b/g/n
	Frequency range	2.412GHz-2.484GHz 5.180GHz-5.825GHz
	Transmitting power	802.11b: +16 +/-2dBm (@11Mbps)
		802.11g: +14 +/-2dBm (@54Mbps)
		802.11n: +13 +/-2dBm (@HT20,HT40- MCS7)
		802.11a: +15 +/-2dBm (@HT40,MCS7)
	Receiving sensitivity	802.11b: -88.4 dBm (@11Mbps ,CCK)
		802.11g: -75.7dBm (@54Mbps, OFDM)
		802.11n: -73.6dBm (@HT20, MCS7)
		802.11a: -75.0 dBm (@MCS7)
	Antenna form	Outside: patch pad
		External: I-PEX connector
		Built-in: no built-in antenna
Hardware parameters	Hardware interface	UART, IIC, PWM, GPIO, SPI
	Working voltage	5V
	GPIO drive capability	Max:16ma
	Working current	Continuous send=> Average value: ~100mA, peak value:120mA In normal mode => Average: ~100mA, Peak: 110mA
	Working temperature	-40℃~80℃
	Storage environment	Temperature: <40℃, The relative humidity: <90% R.H.
Serial transmission	Transmission speed	110-921600bps
	TCP Client	2
Software parameters	Wireless network type	STA/AP
	Security mechanism	WEP/WPA-PSK/WPA2-PSK
	Encryption type	WEP64/WEP128/TKIP/AES
	Firmware upgrade	Wireless, uart
	networking protocol	IPv4, TCP/UDP
	User configuration	AT+instruction, smart config

1.5 Pins introduction

Table 2 Module pin interface

Pin	Network Name	Type	Explanation
1	GND	Ground	Ground
2	GPIO0	I/O	ES0 pin, pull down 1 second, serial 0 into AT command mode ;Pull down ≥ 8 seconds, restore factory default parameter settings
3	NC		NC
4	UART_RXD1	I	Serial port 1 receiving
5	UART_TXD1	O	Serial port 1 sending
6	NC		NC
7	NC		NC
8	NC		NC
9	NC		NC
10	NC		NC
11	NC		NC
12	NC		NC
13	NC		NC
14	NC		NC
15	NC		NC
16	NC		
17	NC		NC
18	NC		NC
19	NC		NC
20	NC		NC
21	NC		NC
22	NC		NC
23	NC		NC
24	VCC_5V	P	External power supply pin 1: 5V @ 500mA
25	GND	GND	Ground
26	VDD_3V3	P	External power supply foot 2: 3.3V @ 500mA External power pin: 3.3V @ 200mA

27	NC		NC
28	NC		NC
29	NC		NC
30	SYS_RST_N	I	Module reset, low level effective, reset time $\geq 500\text{ms}$
31	NC		NC
32	UART_TXD0	O	Serial 0 output
33	UART_RXD0	I	Serial 0 input
34	NC		NC
35	NC		NC
36	GPIO33	I/O	Wifi indicator light
37	ANT	I/O	2.4G antenna, optional, default unavailable
38	GND	Ground	Ground

1.6 Interface definitions

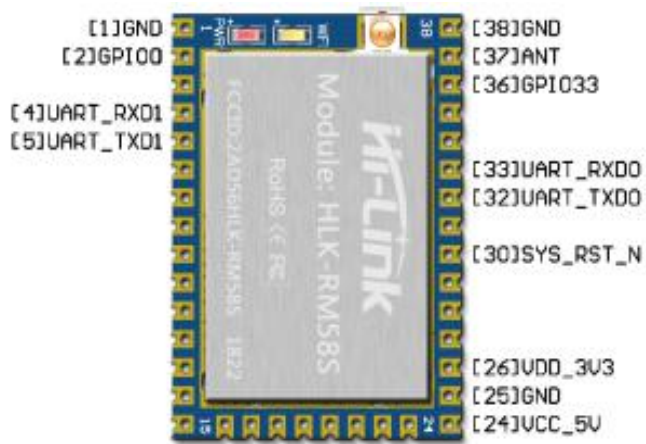
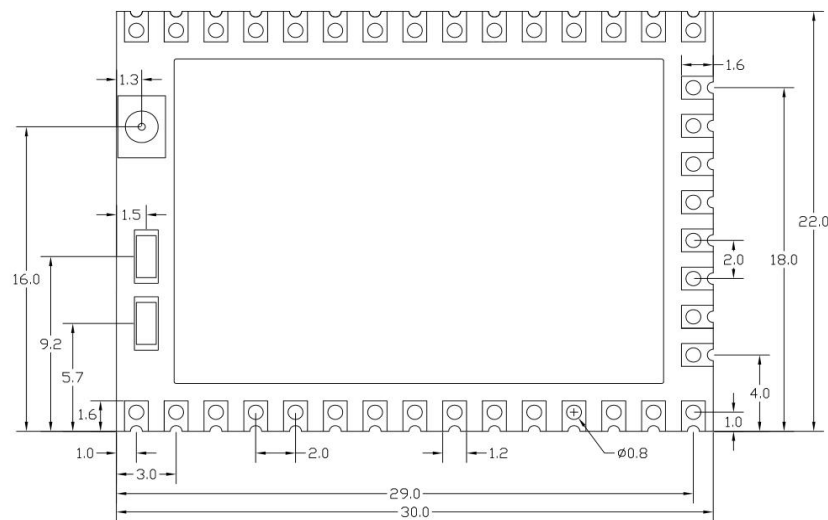


Figure 2 Module interface definition

1.7 Mechanical dimensions



Unit: mm (mm)

Figure 3 Module detail dimensions

2. Functional Description

HLK-RM58S supports serial port to WIFI STA, serial to WIFI AP mode.

2.1 WiFi indicator flashing description

The module is flashed by the LED indicator in different modes, so that the module running status can be quickly and easily known. The WiFi indicator of the module mainly has the following status:

- (1) The wifi indicator flashes twice periodically: indicates that the module is in the one-click distribution mode.
- (2) The wifi indicator flashes thirdly periodically: indicates that the module is in the sta mode and the target ap hotspot is not connected.
- (3) The wifi indicator flashes fourthly periodically: indicates that the module is in 2.4g ap mode, but it does not indicate whether there is a sta client device connected.
- (4) The wifi indicator flashes periodically: indicates that the module is in the 5.8g ap mode, but it does not indicate whether there is a sta client device connected.
- (5) The wifi indicator flashes quickly: indicates that the module is in the sta mode and is connected to the wifi hotspot. When there is data transmission, the module LED will flash quickly.

2.2 Wifi connection status indicator pin

GPIO58 pin is used as the indicator pin of the module's wifi connection status in sta mode. When the module's wifi is connected to the router, GPIO58 will output a high level, otherwise will output low level, and other modes will output low level.

2.3 Socket connection status indicator pin

The GPIO59 pin is used as the indicator pin of the module socket's connection status. When the socket connection is successful, the GPIO outputs a high level, otherwise outputs low level.

2.4 One-click distribution mode

For the IOT wifi module, based on cost and performance considerations, there is no touch screen interactive interface like a mobile phone. Users can see the ap list on the mobile phone and click the password to connect to the network. What should I do? One-click configuration is the wifi module in promiscuous mode (can capture all 802.11 frames in the air), APP sends the SSID and password to the wifi module through UDP broadcast or multicast through certain encoding rules, the module parses out, and then connects to the router. Install the Android app HLK-TCPdemo, then select Configure Networking, select the elian mode, then select V5, input the password, click to open the configuration and start the configuration. When the distribution network is successful, the module will change from double flash to quick flash, indicating network successful connected.



Figure 4 One-click distribution network

When the module is on the one-click distribution, you need to set the module to the one-click distribution mode. Serial configuration tool can be used to set the module to the one-click distribution mode.

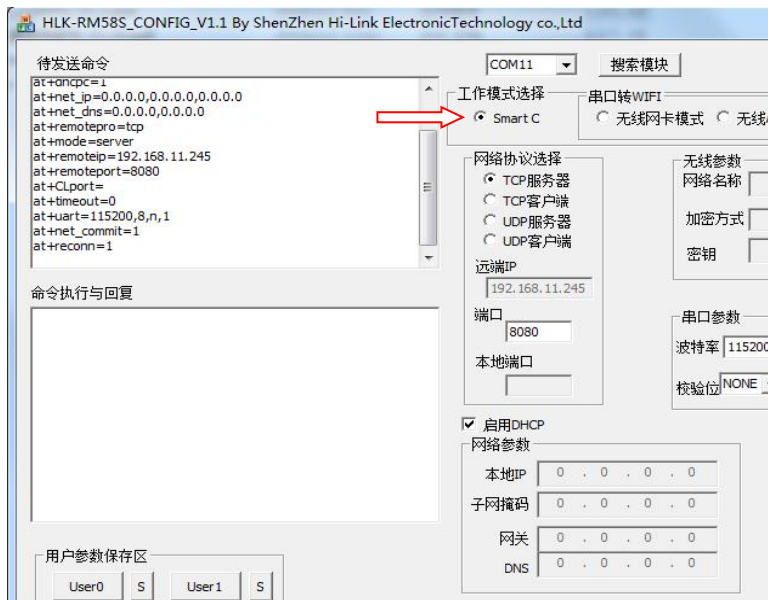


Figure 5 Set to one-click distribution mode

2.5 Web distribution function

When the module is in ap mode, input 192.168.16.254 in the browser, and then input the account and password admin, later enter the web page setting interface. (Default factory firmware is not supported)

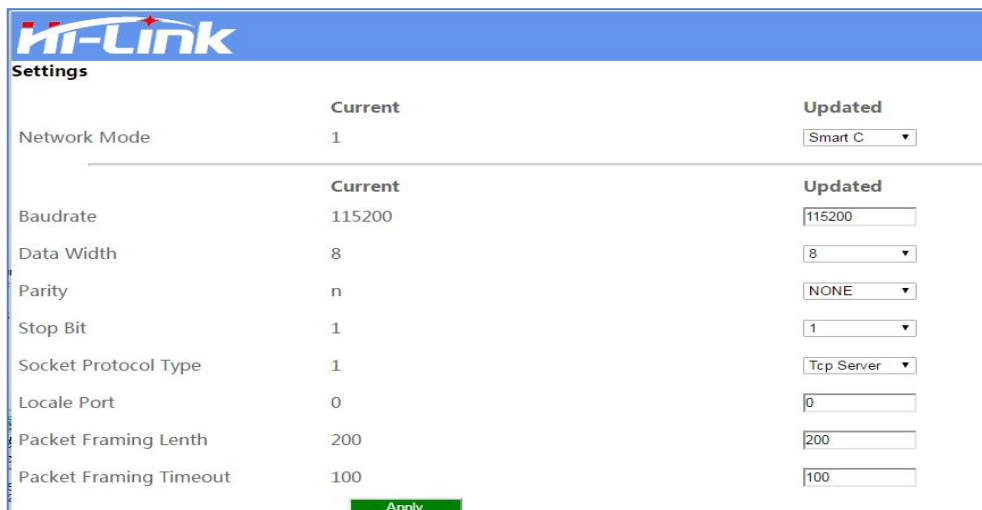


Figure 6 Module web page setting interface

When the module is in the sta mode, input the module's ip in the browser to access to the module's web page setup function.

2.6 Serial to WIFI STA

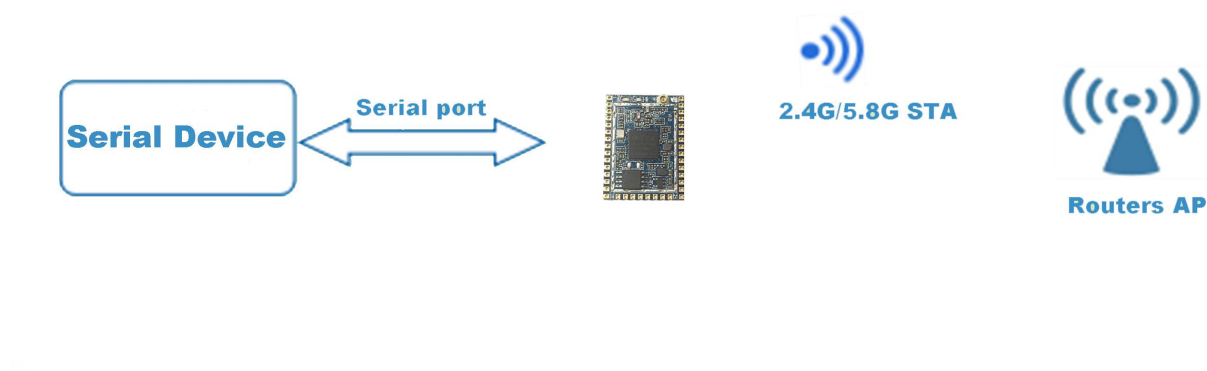


Figure 7 Module as STA

The module converts the serial port data into wifi data to achieve the purpose of networking.

2.7 Serial to WIFI AP

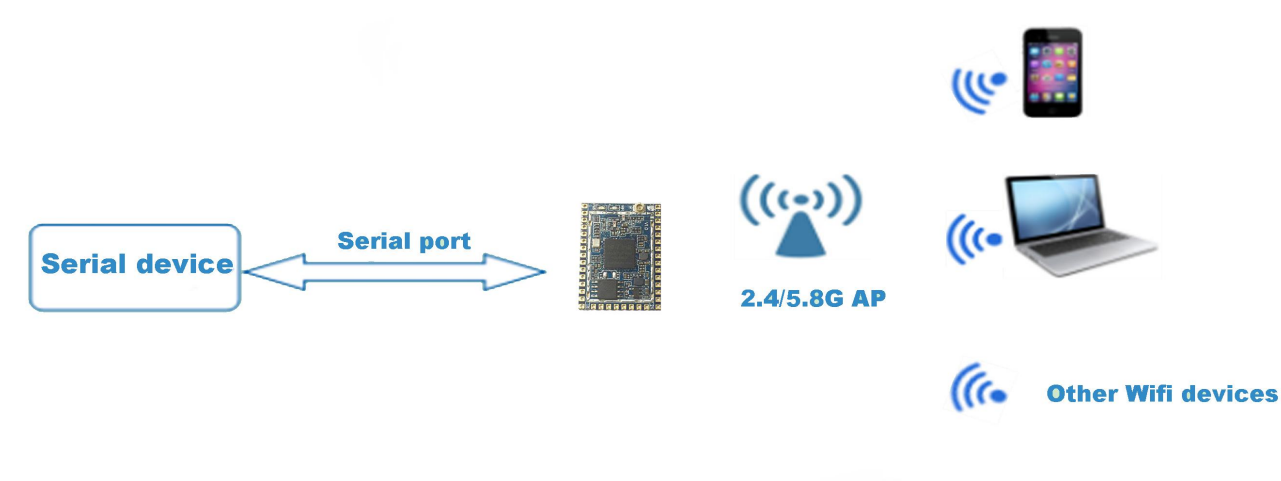


Figure 8 Module work as ap

In AP mode, mobile phone, PC or other wifi devices can be connected to RM58S module through wifi, and serial port devices can transmit data through RM58S module and other wifi devices.

2.8 Serial port working state conversion

After the HLK-RM58S is powered on, the default mode is transmission mode. By pulling down the pin ES0 (GPIO0) to enter at instruction mode longer than 50ms, the module will process the received data as at instructions, send at instructions to let the module into transparent mode, After the network connection, the data received by the serial port will be transmitted as transparent data.

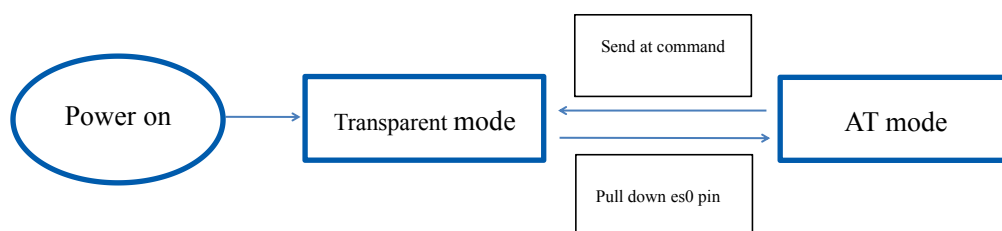


Figure 9 Serial port mode conversion

2.9 Serial port-network data conversion

2.9.1 Module as TCP Server

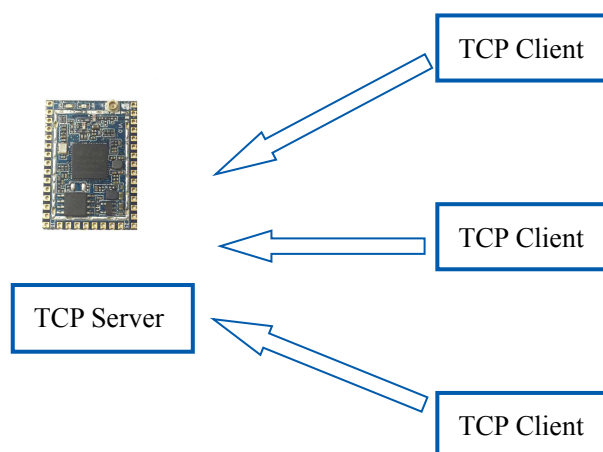


Figure 10 TCP Server

In this mode, the module listens to the specified port, waits for TCP Client connection, and after the connection, all TCP data is directly sent to the serial port end, and the data of the serial port end is sent to all TCP Client ends. When the module is used as the TCP server, the most supporting two TCP clients are connected to the TCP server.

2.9.2 Module as TCP Client

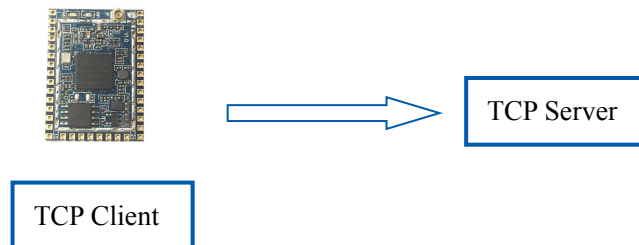


Figure 11 TCP Client

In this mode, the module will actively connect to the specified IP, port, all the data sent from the TCP Server end is sent directly to the serial port, and the data from the serial port to the TCP Server side. Abnormal network disconnection can result in active re-connection of the module.

2.9.3 Module as UDP Server

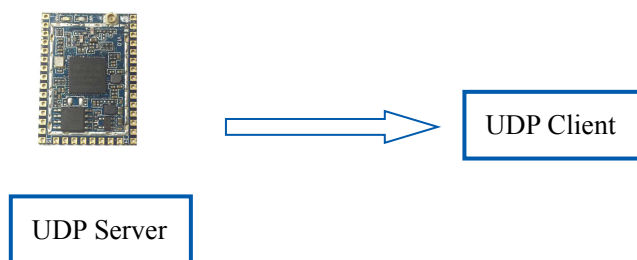


Figure 12. UDP Server

In this mode, the module opens the local designated port, once it receives the data sent to the port, the module sends the data to the serial port and records the remote ip, port. The module only records the remote information on the last connection, and the data sent by the serial port is sent directly to the recorded remote ip, port.

2.9.4 Module as UDP Client

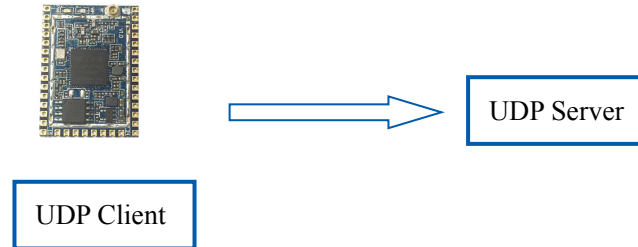


Figure 13. UDP Client

In this mode, the module sends the serial port data directly to the specified ip, port, and the data returned from the server will be sent to the serial port.

2.10 Application areas

- ◆ Smart home;
- ◆ Instruments and instruments;
- ◆ Wi-Fi remote monitoring / control;
- ◆ Toy field;
- ◆ Color LED control;
- ◆ Fire protection, security intelligent integrated management;
- ◆ Smart card terminals, wireless POS machines, handheld devices and so on.

3. AT Instructions

Instruction format: in AT instruction mode, the system can be configured through the AT instructions of the serial port. The command format is as follows:

at+[command]=[value],[value],[value].....

All commands begin with "at" and "\ r" end. If the command is not encapsulated in this format, it will not be processed and will return a different return value depending on the command module.

For example: "at+ver=?"

Module will return: HLK-RM58S (V1.00 (Nov 30 2017))

Query instruction format: at+[command]=?

3.1 Query current module version: at+ver

Grammatical rules:

Command type	Grammar	Return and description
EO	at+ver=?	at+ver=HLK-RM58S(V1.00(Nov 30 2017)): current version

3.2 Local port operation: at+CLport

Command type	Grammar	Return and description
EO	at+CLport=8080	at+CLport=8080 Ok Description: set the local port to port 8080
	at+CLport=?	at+CLport=? 8080 Description: Query local port

3.3 Set up serial Port: at+uart

Command Type	Grammar	Return and description
EO	at+uart=115200,8,n,1	at+uart=115200,8,n,1 Ok Description: Set up serial Port parameters
Query Command	at+uart=?	at+uart=? 115200,8,n,1 Description: query serial port parameters

3.4 Set up DHCP: at+dhcpc

Command Type	Grammar	Return and description
EO	at+dhcpc=1	at+dhcpc=1 ok
Query Command	at+dhcpc=?	at+dhcpc=? 1 Description: 1: dhcp mode, 0: static ip

3.5 Set up wifi connection mode: at+netmode

Command Type	Grammar	Return and description
EO	at+netmode=3	at+netmode=3 Ok Description: set the module to ap mode
Query Command	at+netmode=?	at+netmode=? 3 Description: 1: One-click distribution network 2: sta mode, 3: 2.4G ap mode, 4: 5.8G ap mode

3.6 Set up tcp connection mode: at+mode

Command Type	Grammar	Return and description
EO	at+mode=client	at+mode=client Ok Description: set the module to client mode
Query Command	at+mode=?	at+mode=? client Description: client: server:

3.7 Set up remote IP when modules work as client: at+remoteip

Command Type	Grammar	Return and description
EO	at+remoteip=192.168.11.102	at+remoteip=192.168.11.102 ok Description: set the remote ip of the mode
Query Command	at+remoteip=?	at+remoteip=? 192.168.11.102 Description: query remote ip

3.8 Set up remote port when module act as client: at+remoteport

Command Type	Grammar	Return and description
EO	at+remoteport=1234	at+remoteport=1234 ok Description: set the remote port of the mode
Query Command	at+remoteport=?	at+remoteport=? 1234 Description: query remote port

3.9 Set parameter submission: at+net_commit

Command Type	Grammar	Return and description
EO	at+net_commit=1	at+net_commit=1 Ok Description: submit setup parameters

3.10 System restart: at+reconn

Command Type	Grammar	Return and description
EO	at+reconn=1	at+reconn=1 Description: Quit at command mode
EO	at+net_commit=1 at+reconn=1	at+net_commit=1 ok at+reconn=1 ok Description: System restart

3.11 Set the module's ssid and password: at+wifi_conf

Command Type	Grammar	Return and description
EO	at+wifi_conf=HI-LINK_5FE8,none,12345678	at+wifi_conf=HI-LINK_5FE8,none,12345678 ok Description: set the ssid and password of the module
Query Command	at+wifi_conf=?	at+wifi_conf=? HI-LINK_5FE8,none,12345678 Description: Query the ssid and password of the module

3.12 Set up socket connection Protocol: at+remoteopro

Command Type	Grammar	Return and description
EO	at+remoteopro=tcp	at+remoteopro=tcp ok Description: set the module socket protocol to tcp
Query Command	at+remoteopro=?	at+remoteopro=? tcp Description: query module socket connection protocol

3.13 Set network connection parameters: at+net_ip

Command Type	Grammar	Return and description
EO	at+net_ip=192.168.16.254,255.255.0,192.168.16.254	at+net_ip=192.168.16.254,255.255.0,192.168.16.254 ok Description: set the ip, gateway, dns of the module
Query Command	at+net_ip=?	at+net_ip=? 192.168.16.254,255.255.0,192.168.16.254 Description: query module ip, gateway, dns

3.14 Query network connection status in STA mode: at+wifi_ConState

Command Type	Grammar	Return and description
Query Command	at+wifi_ConState=?	at+wifi_ConState=? Disconnected Description: in sta mode, the module wifi is not connected, and the Connected indicates that the network is connected

3.15 Query module MAC address: at+Get_MAC

Command Type	Grammar	Return and description
Query Command	at+Get_MAC=? 40:D6:3C:15:5F:E8	at+Get_MAC=? 40:D6:3C:15:5F:E8 Description: query module mac address

3.16 Set up frame length: at+uartpacklen

Command Type	Grammar	Return and description
EO	at+uartpacklen=64	at+uartpacklen=64 ok Description: Set the module's frame length to 64 bytes.
Query Command	at+uartpacklen=?	at+uartpacklen=? 64 Description: Query module's frame length as 64 bytes.

3.17 Set up frame time: at+uartpacktimeout

Command Type	Grammar	Return and description
EO	at+uartpacktimeout=200	at+uartpacktimeout=200 ok Description: Set the module's frame time is 200ms
Query Command	at+uartpacktimeout=?	at+uartpacktimeout=? 200 Description: Query the module's frame time as 200ms

4. AT command control code routine

4.1 Query configuration information

Code:

```
char *query="" // Defining a string pointer
at+netmode=?\r\n // Query WiFi connection mode
at+wifi_conf=?\r\n // Query the SSID and password of the module
at+dhcpc=?\r\n // Query dhcp
at+net_ip=?\r\n // Query module ip
at+remoteip=?\r\n // Query remote ip
at+remoteport=?\r\n // Query the port
at+remotepro=?\r\n // Query socket connection protocol
at+mode=?\r\n // Query tcp connection mode
at+uart=?\r\n // Query the serial port parameter
at+uartpacklen=?\r\n // Query serial port frame length
at+uartpacktimeout=?\r\n // Query serial port frame time
at+ver=?\r\n // Query firmware version number
";
Com_send(query); // Send these data out of the serial port
```

Run back:

```
at+netmode=? 0

at+wifi_conf=? Hi-Link,wpa2_aes,12345678 at+dhcpc=? 0

at+dhcpc=? 1

at+net_ip=? 192.168.15.254,255.255.254.0,192.168.11.1

at+remoteip=? 192.168.11.245

at+remoteport=? 8080

at+remotepro=? tcp

at+mode=? server

at+uart=? 115200,8,n,1

at+uartpacklen=? 64

at+uartpacktimeout=? 10

at+ver=? V1.39(Dec 6 2012)
```

4.2 Serial to Wifi client (static ip address)

Code:

```
char *commands_wifi_client_static=""\
at+netmode=2\r\n\           //Set to wireless network card sta mode
at+wifi_conf=HI-LINK,wpa2_aes,12345678\r\n\ //Set wifi, encryption and password
at+dhcpc=0\r\n\           //Use static ip mode
at+net_ip=192.168.11.254,255.255.255.0,192.168.11.1\r\n\ // Set mode ip 设置模块的 ip
at+remoteip=192.168.11.245\r\n\ // Set the remote ip to be connected
at+remoteport=8080\r\n\ // Set the remote port to be connected
at+remoteproto=tcp\r\n\ // Set socket's connection methods
at+mode=client\r\n\ //Use client mode to connect to the remote server
at+uart=115200,8,n,1\r\n\ // Set the serial port parameter
at+uartpacklen=64\r\n\ // Set the frame length
at+uartpacktimeout=10\r\n\ // Set the frame time
at+net_commit=1\r\n\ // Submit parameters
at+reconn=1\r\n\ // Restart the module
Com_send(commands_wifi_client_static); //Send parameters out of the serial port
```

Run back:

```
at+netmode=2 ok

at+wifi_conf=HI-LINK,wpa2_aes,12345678 ok

at+dhcpc=1 ok

at+remoteip=192.168.11.245 ok

at+remoteport=8080 ok

at+remoteproto=tcp

at+mode=server

at+uart=115200,8,n,1 ok

at+uartpacklen=64 ok

at+uartpacktimeout=10 ok

at+net_commit=1
```

4.3 Serial to wifi server(dynamic ip address)

Code:

```
char *commands_wifi_ap=""
at+netmode=2\r\n           // Set to wireless network card mode
at+wifi_conf=Hi-Link_,wpa2_aes,0000000000\r\n // Set the hotspot name and password for the wifi connection
at+dhcpc=1\r\n             // Use dynamic way to get ip
at+remoteport=8080\r\n      // Set the local monitor port
at+remotepro=tcp\r\n        // Set socket's connection methods
at+mode=server\r\n          // Socket as a server to connect
at+uart=115200,8,n,1\r\n    // Set serial port parameters
at+uartpacklen=64\r\n       // Set the frame length
at+uartpacktimeout=10\r\n   // Set the frame time
at+net_commit=1\r\n        // Submit parameters
at+reconn=1\r\n";          // Restart the module
Com_send(commands_wifi_ap);
```

Run back:

```
at+netmode=2 ok

at+wifi_conf=HI-LINK,wpa2_aes,12345678 ok

  at+dhcpc=1

at+remoteip=192.168.11.245 ok

at+remoteport=8080 ok

at+remotepro=tcp

at+mode=server

at+uart=115200,8,n,1 ok

at+uartpacklen=64 ok

at+uartpacktimeout=10 ok

at+net_commit=1
```


- 3: mode selection
- 4: wifi name and password
- 5: network protocol selection
- 6: serial port parameters
- 7: commit configuration
- 8: query configuration
- 9: enter transparent mode
- 10: restore factory setting
- 11: serial return command

5. Upgrade Introduction

The upgrade of HLK-RM58S module can be carried out through serial port or network, and the appropriate upgrade method can be selected according to the field environment.

5.1 Introduction of Serial Port Upgrade Method

In the upgrade folder there is a img file, upgrade software mainly read the files inside to upgrade; There are three files in the img folder, where HLK-RM58S.img and HLK-RM58S (b.1.00.120180611182552).img file contents are the same, only file names are different, HLK-RM58S (b.1.00.120180611182552).txt records the default parameter for this firmware; HLK-RM58S (b.1.00.120180611182) 552) "is the firmware version number, when the module runs this firmware query version number and this version number the same, each firmware has a unique version number, automatically generated by the compilation system; When there is a new firmware to upgrade, the three files can be overwritten.

名称	修改日期	类
 HLK-RM58S(b.1.00.120180611182552).img	2018/6/11 18:25	光
 HLK-RM58S(b.1.00.120180611182552).txt	2018/6/11 18:25	文
 HLK-RM58S.img	2018/6/11 18:25	光

Figure 15. Upgrade file list

5.1.1 Open Serial Port upgrade Software

Open serial port upgrade software HLK-RM58S_uart.exe, input lowercase string c, select serial port number, select the corresponding baud rate through digital key 1 / 2 / 3 / 4

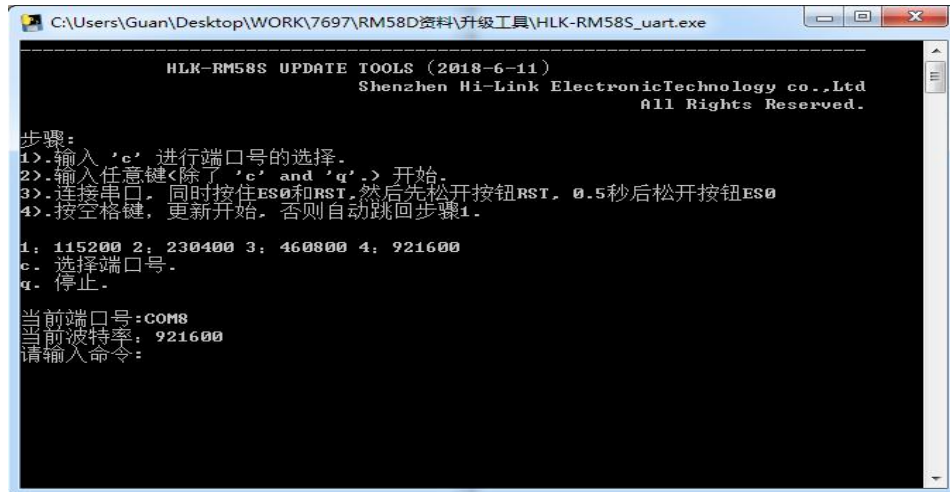


Figure 16. Serial upgrade interface

5.1.2 Start to upgrade

Enter the space bar, press and hold the ES0 (GPIO0) and RST (SYS_RST_N) buttons at the same time, then release the button RST, 0.5s then release the button ES0, computer side software will automatically upgrade the module.

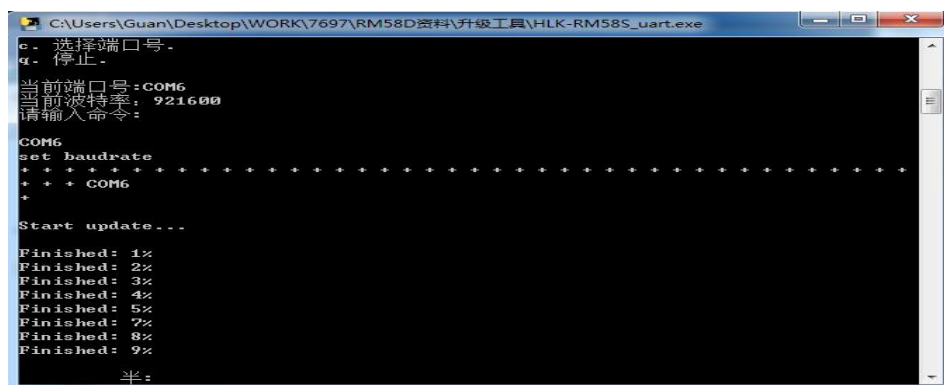


Figure 17. Serial port is upgrading

5.2 Introduction of Network upgrade methods

In order to realize the network upgrade of the module, it is necessary to connect the line module through wifi, and then to upgrade the data transmission according to the ip of the module.

5.2.1 Router Connection

Modules that need to be upgraded can be configured and connected to routers through serial port configuration tools, or ap mode can be used.

5.2.2 Lookup module ip

Because you need to input the ip, of the module when upgrading, you can go to the router to find the corresponding ip, of the module or use HLK-RM58S_Discover to search the corresponding ip. for the module in the local area network.



Figure 18. Lookup module ip

5.2.3 Program upgrades

Enter the module's ip address on the software HLK-RM58S_wifi.exe, and then enter:

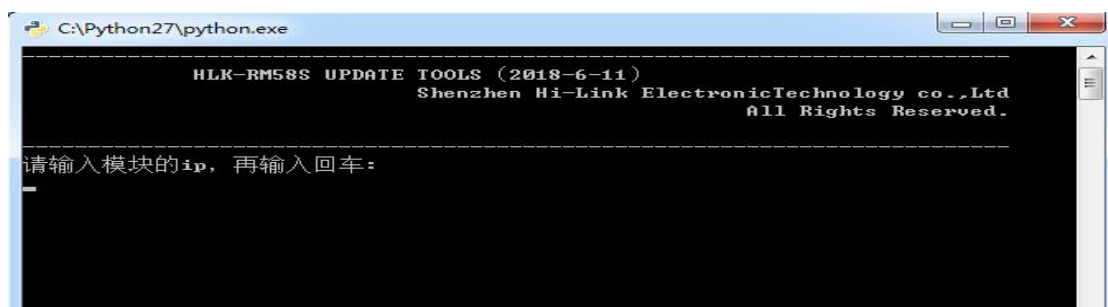


Figure 19. Open upgrade interface

Appears as shown in the figure to indicate that the upgrade is in progress

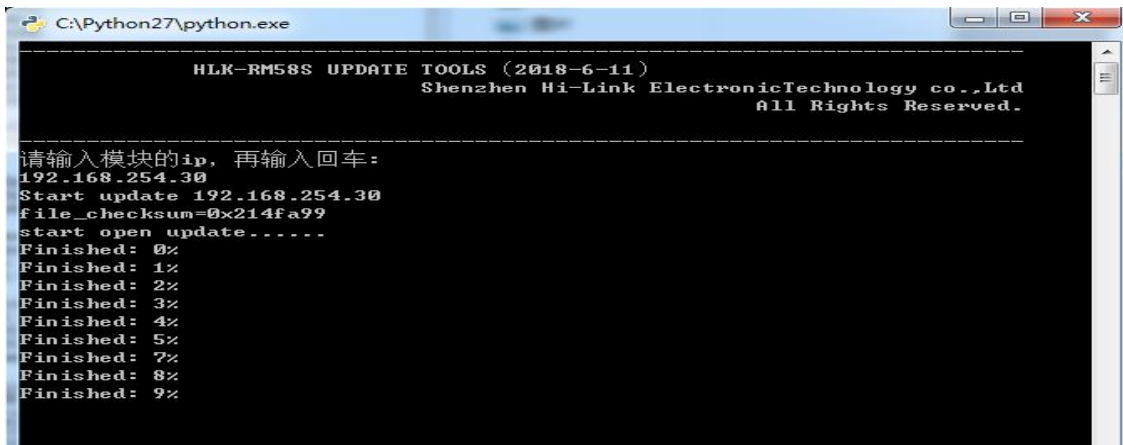


Figure 20. Upgrade in progress

Appears as Update finish!, indicates upgraded successfully.



Figure 21. Upgrade completed

(If your computer turns on a dual network card, you may not be able to upgrade and you will need to shut down a network card, if it is generated by the installation virtual machine.)

6. Restoration of factory setting method

Press the ES0 button on the base plate for 6 seconds to restore the factory setting.

7. Appendix A document revision

Version No.	Revised scope	Date
V1.21	Power supply changed from 3.3v to 5v	
V1.22	Add upgrade function description	
V1.23	Add the instruction of the at command netmode, update the picture of the serial port configuration tool Add wifi, socket indicated pin description Add one-click distribution description, web set description	
V1.25	Add AT command sample code	
V1.26	Add demo code description	

2.2 List of applicable FCC rules

FCC Part 15.247 and FCC Part 15.407

2.6 RF exposure considerations

This equipment complies with the FCC RF radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with a minimum distance of 20cm between the radiator and any part of your body.

2.8 Label and compliance information

Remind end customers to add "Contain FCC ID: 2AD56HLK-RM58S"

2.9 Information on test modes and additional testing requirements

Contact ShenZhen HaiLingKe Electronic co., Ltd. will provide stand-alone modular transmitter test mode. Additional testing and certification may be necessary when multiple modules are used in a host.

2.10 Additional testing, Part 15 Subpart B disclaimer

To ensure compliance with all non-transmitter functions the host manufacturer is responsible for ensuring compliance with the module(s) installed and fully operational. For example, if a host was previously authorized as an unintentional radiator under the Supplier's Declaration of Conformity procedure without a transmitter certified module and a module is added, the host manufacturer is responsible for ensuring that after the module is installed and operational the host continues to be compliant with the Part 15B unintentional radiator requirements. Since this may depend on the details of how the module is integrated with the host, ShenZhen HaiLingKe Electronic co., Ltd. shall provide guidance to the host manufacturer for compliance with the Part 15B requirements.

FCC Warning

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

(1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

NOTE 1: Any changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

FCC Radiation Exposure Statement:

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. End users must follow the specific operating instructions for satisfying RF exposure compliance.

This module certified that complies with RF exposure requirement under mobile or fixed condition, this module is to be installed only in mobile or fixed applications.

A mobile device is defined as a transmitting device designed to be used in other than fixed locations and to generally be used in such a way that a separation distance of at least 20 centimeters is normally maintained between the transmitter's radiating structure(s) and the body of the user or nearby persons. Transmitting devices designed to be used by consumers or workers that can be easily re-located, such as wireless devices associated with a personal computer, are considered to be mobile devices if they meet the 20 centimeter separation requirement.

A fixed device is defined as a device is physically secured at one location and is not able to be easily moved to another location.

Note 2: Any modifications made to the module will void the Grant of Certification, this module is limited to OEM installation only and must not be sold to end-users, end-user has no manual instructions to remove or install the device, only software or operating procedure shall be placed in the end-user operating manual of final products.

Note 3: Additional testing and certification may be necessary when multiple modules are used.

Note 4: The module may be operated only with the antenna with which it is authorized. Any antenna that is of the same type and of equal or less directional gain as an antenna that is authorized with the intentional radiator may be marketed with, and used with, that intentional radiator.

Antenna No.	Frequency Range	Antenna Type	Gain
1	2400-2483.5MHz	External uniqueness Antenna	3.13dBi
1	5150-5850MHz	External uniqueness Antenna	3.73dBi