



# RAK410-EVB User Guide

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## Revision History

Version	Date	Description
V1.0.0	2013-4-27	Initial Creation
V1.0.1	2013-12-11	1.Modify RAK410 - EVB image 2.modify RAK410 - EVB hardware is introduced

## Catalog

1	Development Board Overview .....	4
1.1	Hardware Size .....	4
1.2	RAK410-EVB Pin Definitions .....	4
1.3	RAK410-EVB Profile .....	7
2	Tool.....	9
2.1	Hardware .....	9
2.2	Software .....	10
3	Establishing Working Environment .....	11
3.1	Creating AP .....	11
3.2	Hardware Connection.....	13
3.3	Software Tools .....	14
3.3.1	Windows Hyper Terminal Settings.....	14
3.3.2	WIFI SDK.....	15
4	AT Command.....	16
4.1	Format Description .....	16
4.2	Command Error Return Value (code) .....	16
4.3	Command Description .....	16
5	RAK410 Operating Mode .....	19
5.1	Hardware Connect of UART Operating Mode .....	19
5.1.1	Establishing a Station in the UART Mode.....	20
5.1.2	Creating AP in UART Mode .....	20
5.1.3	Establishing Ad-hoc in UART Mode.....	21
5.1.4	Establishing TCP/UDP Connection .....	23
5.2	Hardware Connection in SPI Operating Mode .....	33
6	WEB Sever Function.....	34
7	RAK410 and MCU Joint Debugging .....	38
7.1	RAK410 and MCU Joint Debugging via UART Interface.....	38
7.2	RAK410 and MCU Joint Debugging via SPI Interface.....	39
8	Upgrade.....	40
8.1	UART Upgrade to a Higher Version or SPI .....	40
8.2	SPI Upgrade to a Higher Version or UART .....	41
9	RAK410 Power Consumption Test.....	43
10	Contact.....	45

# 1 Development Board Overview

## 1.1 Hardware Size



Figure 1.1 Module Roof



Figure 1.2 Module Baseboard

The roof size: 28.06mm X 23.14mm; the baseboard size: 85 mm X 53 mm  
RAK410-EVB Roof Interface

## 1.2 RAK410-EVB Pin Definitions



Figure 1.3 Module Roof Pinout

As shown, in counterclockwise direction the module's pins is followed sequentially by 1 ~ 36 pins.

Table 1.1 Definitions of RAK410 Module Roof Pin

Pin No.	Pin Name		Function	Remark
	UART	SPI		
1	GND	GND	VCC	p
2	GND	GND	GND	p
3	NC	NC	Reserve	-
4	BIAS	BIAS	Bias, pins, the drop-down 10 k resistor to ground	I
5	GND	GND	GND	p
6	NC	NC	Reserve	-
7	NC	NC	Reserve	-
8	MCU_MODE		Choose transparent transmission pins, high level effectively	I
		MCU_WAKE	For wake up the modle, Rising along the effective	I
9	NC	NC	Reserve	-
10	NC	NC	Reserve	-
11	NC	NC	Reserve	-
12	GND	GND	GND	P
13	GND	GND	GND	P
14	NC	NC	Reserve	-
15	NC	NC	Reserve	-
16	NC	NC	Reserve	-
17	NC	NC	Reserve	-
18	MCU_ERROR	MCU_ERROR	Module a serious error indication, high effective	O
19	MCU_RESET	MCU_RESET	reset The module, active low	I
20	NC	NC	Reserve	-
21	NC	NC	Reserve	-
22	MCU_UART1_TX	MCU_UART1_TX	upgrade the firmware , UART output	O
23	MCU_UART1_RX	MCU_UART1_RX	upgrade the firmware , UART input	I
24	MCU_WPS	MCU_WPS	WPS function input, falling	I

			edge effective, if the boot on the pin input VDD / 2, the module will go into the WEB SERVER	
25	GND	GND	GND	-
26	NC	NC	Reserve	-
27	NC	MCU_SPI_INT	SPI INT signal, the rising edge effectively, set aside 100 kohm pull-down	O
28	MCU_BOOT	MCU_BOOT	Used to enter bootloader, high level effectively	I
29	NC	NC	Reserve	-
30	NC	NC	Reserve	-
31	MCU_US0_TX		UART data send	O
		MCU_US0_MOSI	SPI data receive	I
32	MCU_US0_RX		UART data receive	I
		MCU_US0_MISO	SPI data send	O
33	MCU_US0_RT S		Hardware flow control, UART request is sent	O
		MCU_US0_CLK	The SPI clock input	I
34	MCU_US0_CT S		Hardware flow control, UART clear to send	I
		MCU_US0_CS	SPI chip select input	I
35	VCC3V3		Power input pin	P
36	GND		GND	P

## 1.3 RAK410-EVB Profile

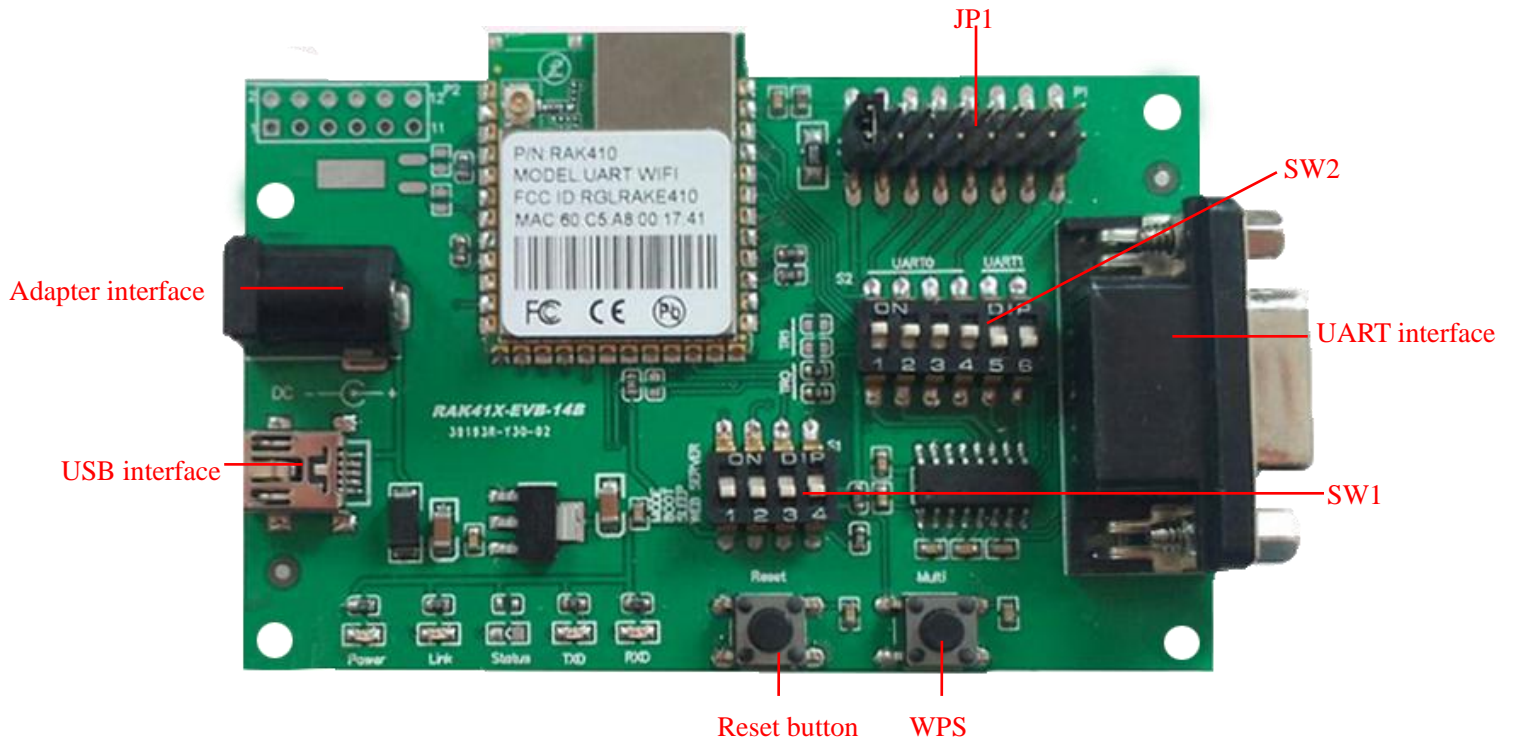


Figure 1.4 RAK410-EVB Blueprint

- 1) **power supply** : You can supply power to the board by USB or adapter interface.
- 2) **UART interface** : in UART mode, PC communicatt to the module through the serial port.
- 3) **JP1** : the all valid pin , As shown in the figure below:

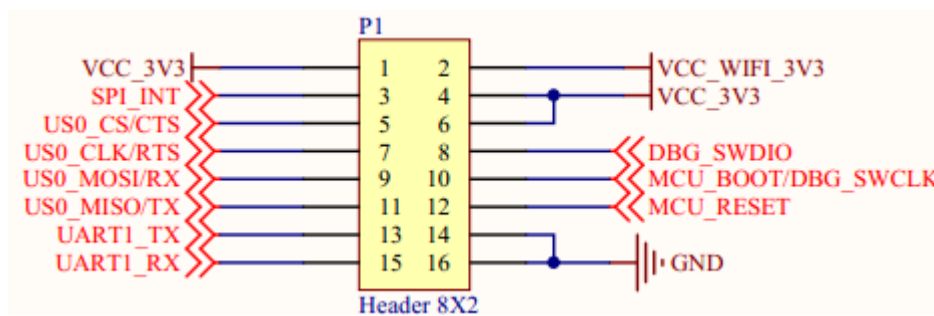


Figure 1.5 JP1 Blueprint

- 4) **JP2** : As shown in the figure below:

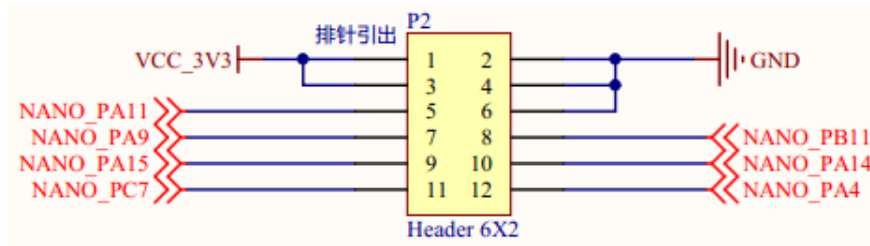


Figure 1.6 JP2 Blueprint

- 5) **SW1** : From left to right in the order

MODE : Dial to the bottom when normal use; After save the connection parameters, dial to the upper end,mcu\_mode pin is high level, after power on or reset, module will directly into the passthrough mode.

BOOT: Dial to the bottom when normal use;as the pin is low level.for high level when dial to the upper end, after power on or reset, module will directly into the upgrade module.

SLEEP : Dial to the bottom when normal use; When the dial to the upper end, 410 modules into sleep mode.

WEB\_SEVER : Dial to the bottom when normal use; dial to the upper end, after power on or reset, module will directly into WEBSEVER.

- 6) **SW2** : 1 ~ 4 is UART0 for communication and upgrade ; 5 ~ 6 is UART1 interface, is only used to upgrade.
- 7) **Reste button** : if you want reset the 410 module ,you can press the reset button.
- 8) **WPS** : Press the WPS button, then press the router WPS button in 2 minutes,WPS function can be realized.



## 2 Tool

### 2.1 Hardware

- PC (with wireless card)
- Wireless AP



Figure 2.1 Wireless AP

- RAK410 Development Board



Figure 2.2 RAK410-EVB

- Connections, communication cables (RS-232 serial cable, network cables , USB-based power line, etc.).

## 2.2 Software

### ➤ Hyper Terminal

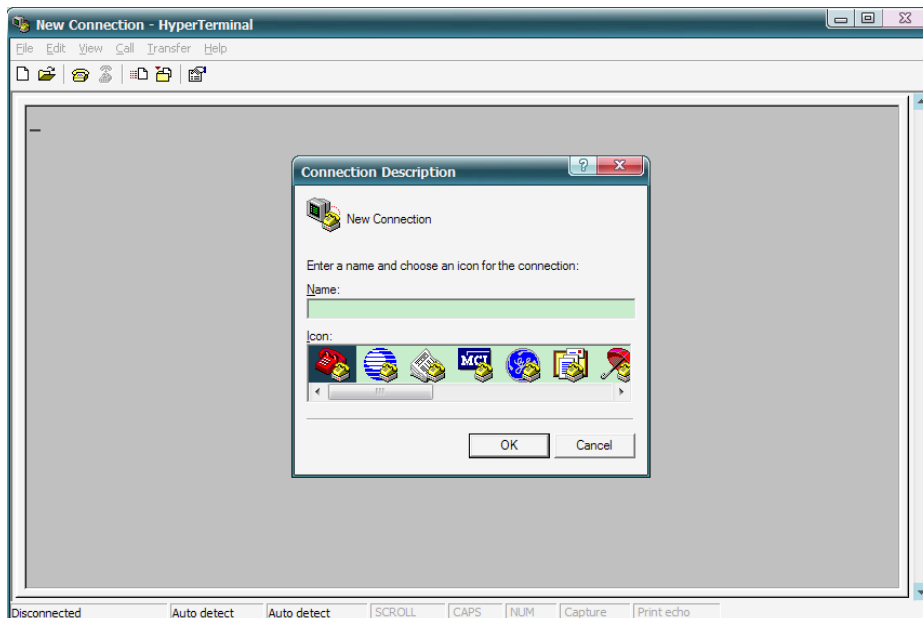


Figure 2.3 Hyper Terminal Interface

### ➤ WIFI SDK

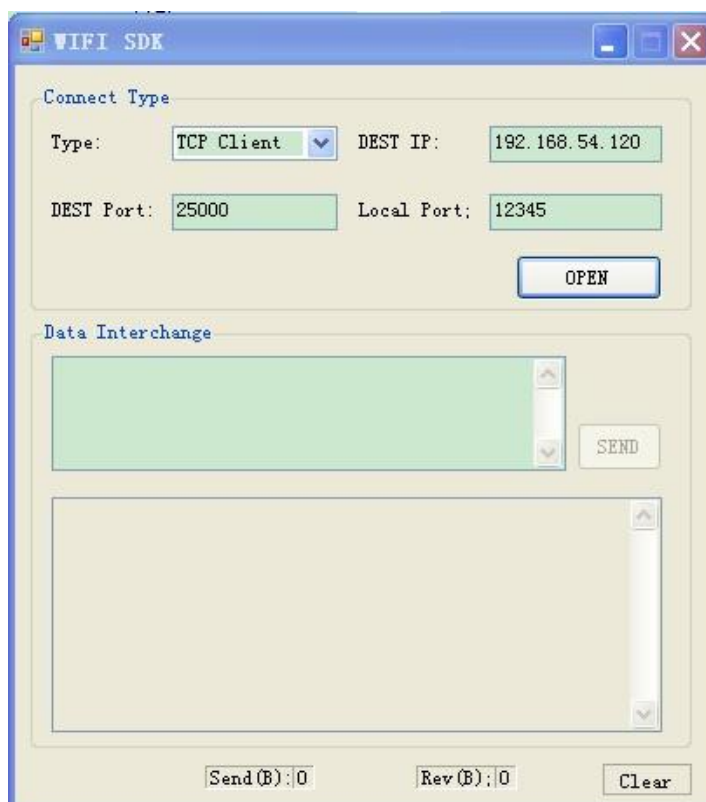


Figure 2.4 WIFI SDK

## 3 Establishing Working Environment

This is used to establish the working environment. Set the router to AP for RAK410 to connect and test.

### 3.1 Creating AP

To set up a wireless router, take TP-LINK TL-WR841N for an example:

1. Connect the computer and wireless LAN port via network cable, then configure the computer's IP address (e.g.: 192.168.1.101) and wireless AP management IP (e.g.: 192.168.1.1) for the same network segment.
2. Open a browser and enter the management address of the wireless router, then enter the user name and password, and enter the management page:

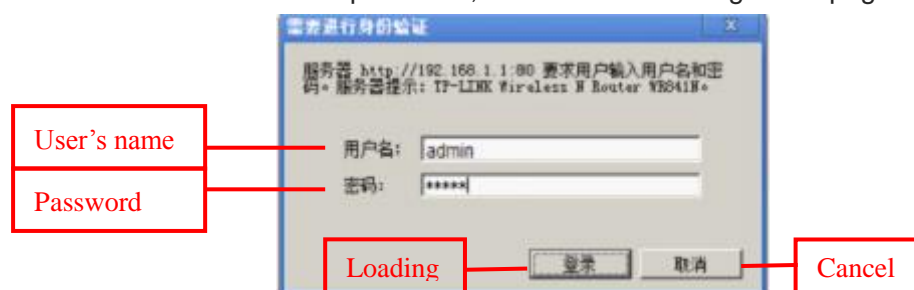


Figure 3.1 Login Window



Figure 3.2 Management Window

- Set the operating mode for AP

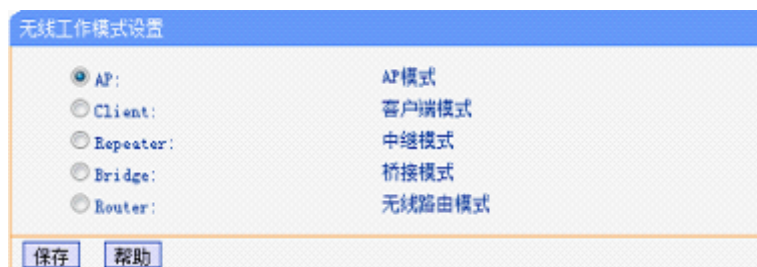


Figure 3.3 Selecting an Operating Mode

- Set SSID=LTHonway\_test in AP mode, channel = automatic, mode = 11bgn mixed, and the other parameters as defaults.



Figure 3.4 Setting SSID and Channel

- Set encryption method; RAK410 supports OPEN, WPA, WPA2 and WEP encryptions, and here WPA2-PSK is set, the encryption algorithm is automatic and the password is: lthonway



Figure 3.5 Setting Encryption

## 6. Open a DHCP Server



Figure 3.6 Setting DHCP SERVER

## 7. Restart Router

## 3.2 Hardware Connection

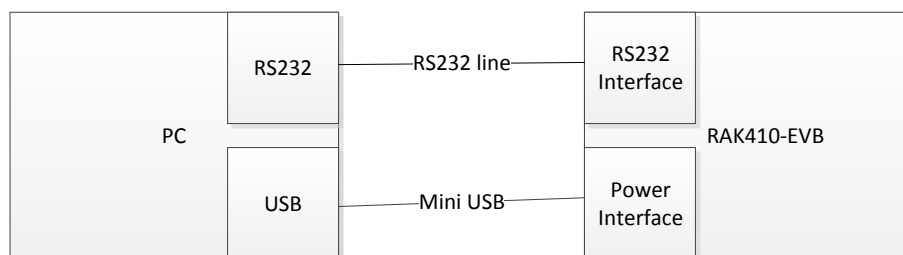


Figure 3.7 Hardware Connection Diagram

## 3.3 Software Tools

### 3.3.1 Windows Hyper Terminal Settings

1. For Windows 7 OS, open hypertrm.exe (For Windows XP OS – Accessories - Hyper Terminal), shown as below:



Figure 3.8 Type a name for the connection

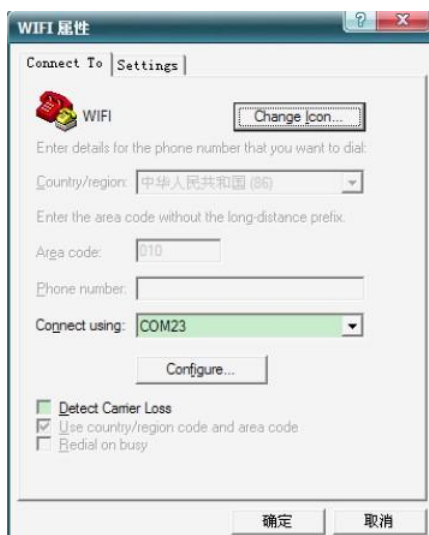


Figure 3.9 Select an available COM port

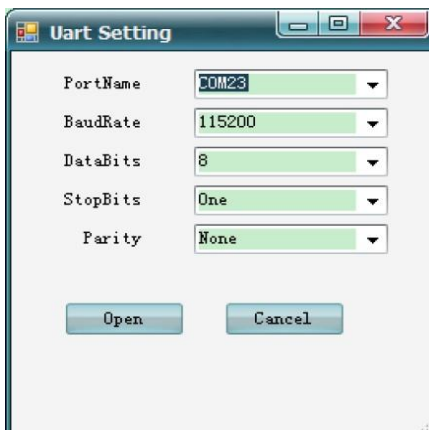


Figure 3.10 Set serial port parameters

2. Click “File – Properties –Settings - ASCII code configuration”, shown as the following figure:

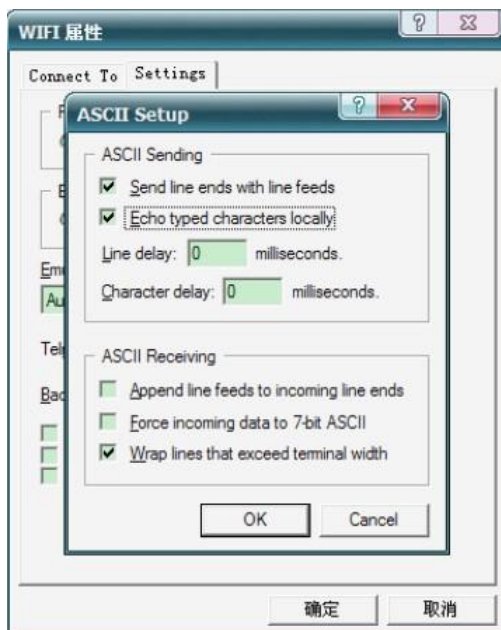


Figure 3.11 ASCII code configuration

### 3.3.2 WIFI SDK

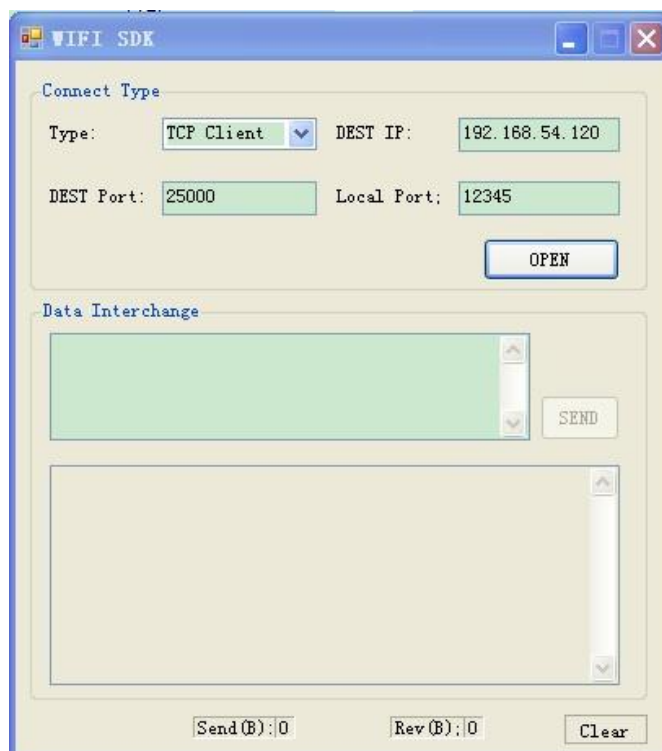


Figure 3.12 WIFI SDK



## 4 AT Command

The following is an introduction to AT command, for more details, refer to RAK410 Software Programming Reference Manual.

### 4.1 Format Description

at+<commad>=<parameter 1>,<parameter 2>.....<parameter n>\r\n

Note:

- 1) If performed successfully, returns "OK\r\n" or "OK<parameter 1>.....<parameter n>\r\n".
- 2) If failed, then returns ERROR<code>.

### 4.2 Command Error Return Value (code)

Table 2.2 Command Error Return Value

Code(HEX)	Description
-1	Parameter input error (parameter can't be recognized/missing parameter/command is too long/other illegal parameters)
-2	Command execution error (re-enter the command)
-10	System error (re-enter the command or reset the module)
-11	Fatal error (must reset the module)
Other	See the specific commands

### 4.3 Command Description

The following table shows a brief description of AT commands. For details, refer to RAK410 Software Programming Reference Manual.

Table 2.3 AT Commands Description

Command	Description
at+scan=<channel>,<ssid>\r\n	Scan wireless networks and get wireless information
at+get_scan=<scan_num>\r\n	Read the scanned information. This command must be called after the command <i>at+scan</i>
at+psk=<passphrase>\r\n	Used to enter the network password
at+connect=<ssid>\r\n	Connect to the specified network
at+wps=<mode>,<pin>\r\n	Connect to network via WPS
at+listen=<listen interval>\r\n	Set the beacon interval when module in station



	mode
at+rssil\r\n	Query the current network signal strength
at+ap=<ssid>,<hidden>\r\n	Create a wireless AP
at+apconfig=<contry code>,<inact time>,< beacon>,< dtim>\r\n	Set up a wireless AP parameter
at+adhoc=<ssid>\r\n	create/connect to a peer-to-peer network (Ad-hoc)
at+channel=< channel >\r\n	Set AP/Ad-hoc network channel
at+con_status\r\n	Query the current state of Wireless network
at+ipdhcp=<mode>\r\n	Set DHCP mode
at+ipstatic=<ip>,<mask>,<gatewa y>\r\n	Assign a static IP for module
at+ipconfig \r\n	Query current IP address
at+dns=<domain>\r\n	DNS
at+http_get=<ip/domain>:<port>/< url>\r\n	Request a web page by command <i>http get</i>
at+http_post=<ip/domain>:<port>/<url>,<data>\r\n	Submit web content by command <i>http post</i>
at+ascii=<mode>\r\n	Return value conversion
at+ping=<host>,<count>,<size>\r\n	Run command <i>ping</i>
at+udp=<dest_ip>,<dest_port>,<l ocal_port>\r\n	Create a UDP port on the module
at+ludp=<local port>\r\n	Create a UDP listening port locally
at+tcp=<dest_ip>,<dest_port>,<m odule_port>\r\n	Module creates a TCP client and connect to the remote TCP server
at+ltcp=<local_port>\r\n	Module creates a local TCP listening port
at+cls=<flag>\r\n	Closes the port by the corresponding identifier
at+send_data=< flag>,<data_length>,<data_strea m>\r\n	Send data to target connection (port identifier)
at+recv_data=<socket_flag><dest _port><dest_ip> <data_length><data_stream>\r\n	Module receives data
at+easy_txrx\r\n	Transparent transmission mode
at+disc\r\n	Disconnect the current wireless connection
at+pwrmode=<mode>\r\n	Set power operating mode

at+wake_up\r\n	Wake up the module
at+uartconfig=<baud rate>,<data bits>,<stop bits>,<parity>,<flow ctrl>\r\n	Configure and save UART parameters, becoming effective after reboot
at+storeenable=<mode>\r\n	Load parameters after boot
at+storeconfig\r\n	Save the configuration parameters
at+boot_mode=<mode>	The configuration module enters BOOT or WEB SERVER
at+del_data\r\n	Delete the saved data
at+reset =<mode>\r\n	Reset module
at+version\r\n	Query module version

## 5 RAK410 Operating Mode

RAK410 Module has two modes: UART mode and SPI mode. The following describes the applications of the two modes.

### 5.1 Hardware Connect of UART Operating Mode

When using the UART mode, the connections of the jumper, Dial switch on the development board are shown as below:

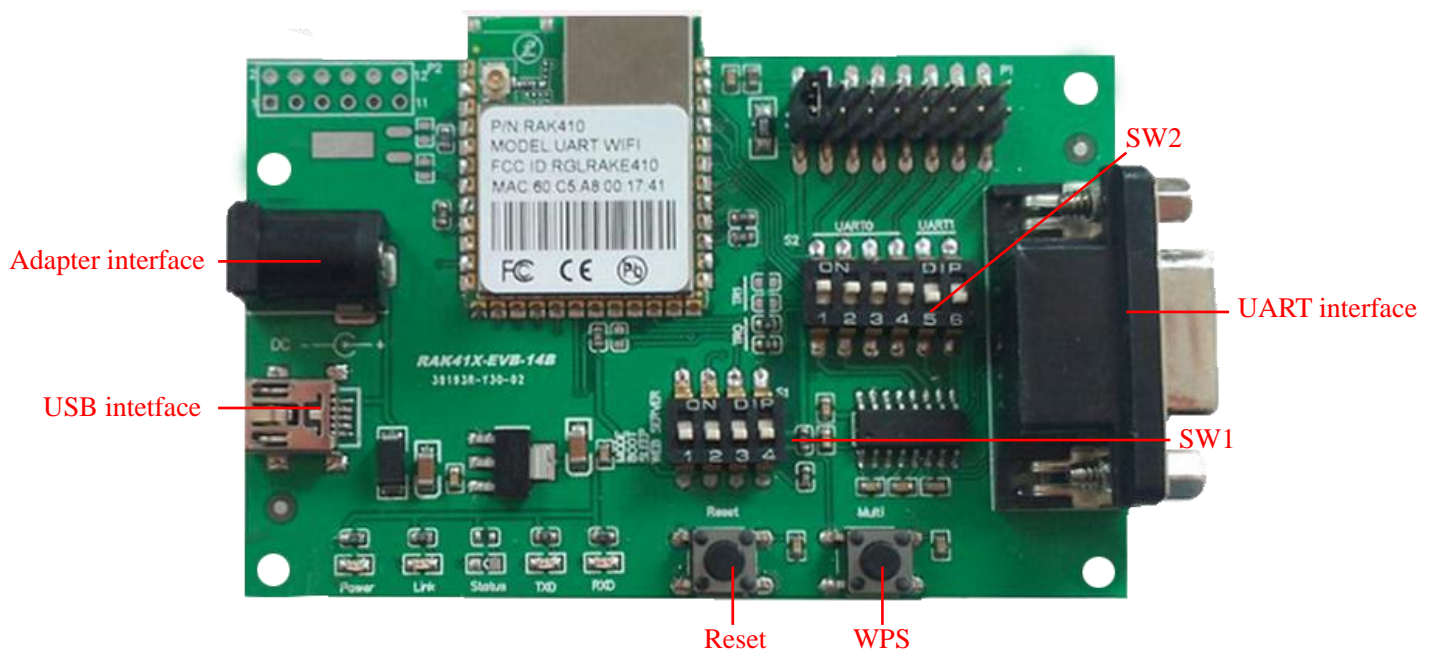


Figure 5.1 UART Operating Mode

Using UART mode as following:

- 1) SW1: dial all to the bottom.
- 2) SW2: 1 ~ 4 dial to the upper end, UART0 connected; Others dial to the bottom, not through UART1.
- 3) connected to the USB or ac adapter to supply power to the board, connected to a serial port line to let the PC communicate with the module.
- 4) Establish super terminal in PC, reference this document section 3.3.1.
- 5) Press the reset button, after the super terminal display "Welcome to RAK410", you can use AT commands to configure the operation mode of the module.

### 5.1.1 Establishing a Station in the UART Mode

- 1) Open the Hyper Terminal, set the serial port parameters, then press the reset button, the Hyper Terminal outputs start information.
- 2) The RAK410 return value by default are displayed as hexadecimal; Enter `at+ascii=1\r\n`, convert all the module return value parameters to ASCII; after command is entered, returned OK.
- 3) Enter `at+scan=0,ChinaNet-14f3\r\n`, the parameter 0 indicates scanning all channels, ChinaNet-14f3 is the name of the network to be scanned.
- 4) Enter `at+psk=lthonway303550\r\n`, then returns OK.
- 5) Enter `at+connect=ChinaNet-14f3\r\n`, and returned OK, which indicates a successful connection, as shown in the below figure:

```

Welcome to RAK410
at+ascii=1
OK
at+scan=0,ChinaNet-14f3
OK
SCAN NUM:1
SSID                      BSSID                      CH  RSSI  SECURITY
ChinaNet-14f3             00:26:ED:DD:B6:00        9   -57   WPA2-PSK-TKIP-CCMP
                              WPA -PSK-TKIP-CCMP
at+psk=lthonway303550
OK
at+connect=ChinaNet-14f3
OK

```

Figure 5.2 Setting up a Station

- 6) Configure IP address, and enter `at+ipdhcp=0\r\n`, then IP is returned, as shown:

```

at+ipdhcp=0
OK
IP=192.168.1.107
Mask=255.255.255.0
Gateway=192.168.1.1
DNS1=116.228.111.118
DNS2=180.168.255.18

```

Figure 5.3 DHCP automatically assigning IP address

In this case, user can configure the module connection mode: TCP Sever, TCP Client, UDP Sever and UDP Client. For details, refer to Chapter 5.1.4.

### 5.1.2 Creating AP in UART Mode

- 1) Open a Hyper Terminal and reset RAK410, the start information is returned.
- 2) Enter `at+ascii=1\r\n`, convert all return value parameters to ASCII.
- 3) Enter `at+psk=lthonway\r\n`, then enter password.
- 4) Enter `at+channel=8\r\n` and set channel to 8.

- 5) Enter `at+ap=AP_TEST\r\n`, then create an AP, as shown:

```
Welcome to RAK410
at+ascii=1
OK
at+psk=1thonway
OK
at+channel=8
OK
at+ap=AP_TEST
OK
```

Figure 5.4 Creating an AP

- 6) `at+ipstatic=192.168.8.1,255.255.255.0,192.168.8.1,0,0` ,set the module's static IP.
- 7) `at+ipdhcp=1`, set DHCP SERVER parameter.
- 8) As shown, PC can connect to the network:

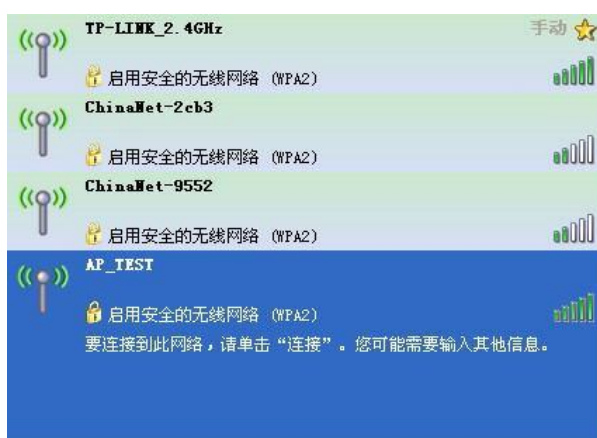


Figure 5.5 The AP\_TEST created via PC connection

- 9) In this case, user can configure the module connection mode: TCP Sever, TCP Client, UDP Sever and UDP Client. For details, refer to Chapter 5.1.4.

### 5.1.3 Establishing Ad-hoc in UART Mode

- 9) Open a Hyper Terminal, reset RAK410, and the start information is returned.
- 10) Enter `at+ascii=1\r\n`, convert all return value parameters to ASCII.
- 11) Enter `at+psk=0123456789\r\n`, then enter password.
- 12) Enter `at+channel=10\r\n`, and set channel to 10.
- 13) Enter `at+adhoc=test_adhoc\r\n`, as shown:

```
Welcome to RAK410
at+ascii=1
OK
at+psk=0123456789
OK
at+channel=10
OK
at+adhoc=test_adhoc
OK
```

Figure 5.6 Establishing Ad-hoc

- 14) Send `at+ipstatic=192.168.78.1,255.255.255.0,192.168.78.1,0,0`, as shown:

```
at+ipstatic=192.168.78.1,255.255.255.0,192.168.78.1,0,0
OK
```

Figure 5.7 Setting the static IP address

- 15) Connect PC to network, and set the static IP address (note that the module and the PC's IP must be in the same segment) as shown below:



Figure 5.8 connecting PC to the network established by module

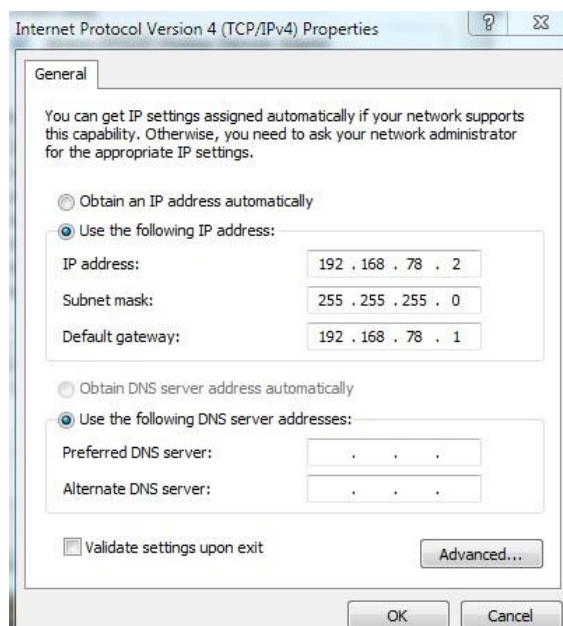


Figure 5.9 Setting static IP address

- 16) In this case, user can configure the module connection mode : TCP Sever, TCP Client, UDP Sever and UDP Client. For details, refer to Chapter 5.1.4.

## 5.1.4 Establishing TCP/UDP Connection

### 5.1.4.1 Establishing a TCP Sever

- 1) Open a Hyper Terminal, set the serial port parameters and press the reset button, then Hyper Terminal outputs start information.
- 2) Enter `at+ascii=1\r\n`, convert all return value parameters to ASCII; the RAK410 return value by default are displayed as hexadecimal; after command is entered, returned OK.
- 3) Enter `at+scan=0,ChinaNet-14f3\r\n`, and ChinaNet-14f3 is the name of the network to be scanned, parameter 0 indicates scanning all channels.
- 4) Enter `at+psk=lthonway303550\r\n`, then returned OK.
- 5) Enter `at+connect=ChinaNet-14f3\r\n`, if returned OK, it indicates a successful connection.
- 6) Configure IP address, and enter `at+ipdhcp=0\r\n`, then IP address information is returned.
- 7) Enter `at+ltp=25000\r\n`, then create local TCP port as 25000, OK and the port identifier will be returned.

```

Welcome to RAK410
at+ascii=1
OK
at+scan=0,ChinaNet-14f3
OK
SCAN NUM:1
SSID                                BSSID                                CH  RSSI  SECURITY
ChinaNet-14f3                      00:26:ED:DD:B6:00  9   -57   WPA2-PSK-TKIP-CCMP
                                     WPA -PSK-TKIP-CCMP
at+psk=lthonway303550
OK
at+connect=ChinaNet-14f3
OK
at+ipdhcp=0
OK
IP=192.168.1.107
Mask=255.255.255.0
Gateway=192.168.1.1
DNS1=116.228.111.118
DNS2=180.168.255.18
at+ltp=25000
OK8

```

Figure 5.10 Establishing a TCP Sever

- 8) Open the WIFI SDK, then select the type as TCP Client, the target IP is the module's IP, here is 192.168.1.107, the port is 25000, the local port is as default,as shown:



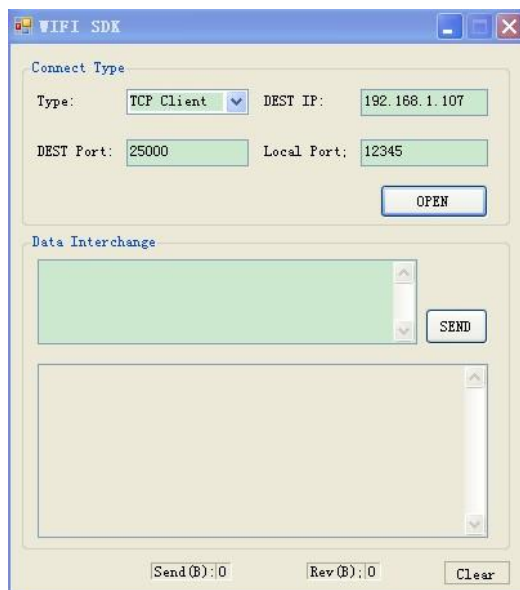


Figure 5.11 Enter TCP Connection Parameters

then click “OPEN” to Create a TCP Client:

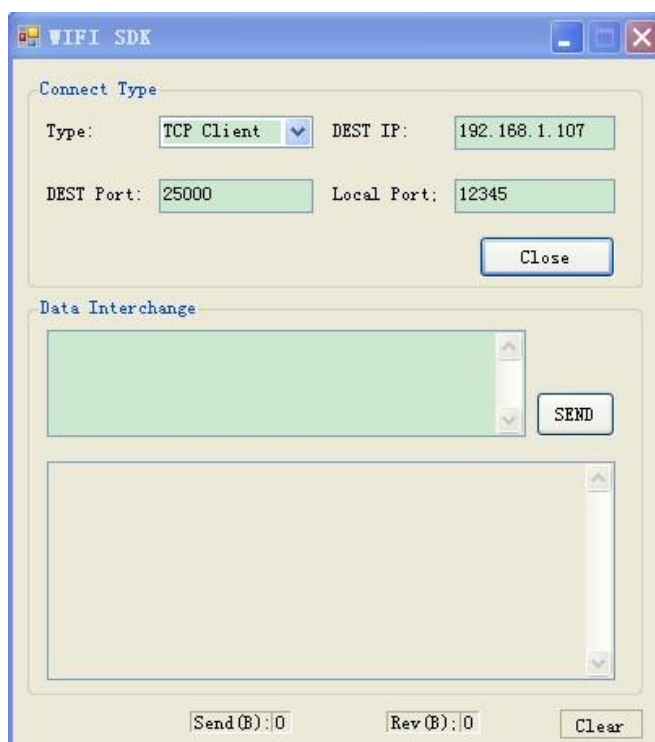


Figure 5.12 Creating a TCP Client by WIFI SDK

9) The Hyper Terminal displays the following connection information:

```
at+recv_data=open,0,2675,192,168,1,14
```

Figure 5.13 The Hyper Terminal displays the connection information



- 10) Enter 1234567890 in the send area, and click “Send”, the following content will be displayed on the Hyper Terminal.

```
at+recv_data=0,2675,192.168.1.14,10
1234567890
```

Figure 5.14 Hyper Terminal displays module receiving remote data

- 11) For module to send data, enter the command `at+send_data=0,10,1234567890\r\n`, and returns OK after successful implementation; the following data is displayed in the receiving column of the WIFI SDK, as shown:

```
at+send_data=0,10,1234567890
OK
```

Figure 5.15 Module sends data to remote end

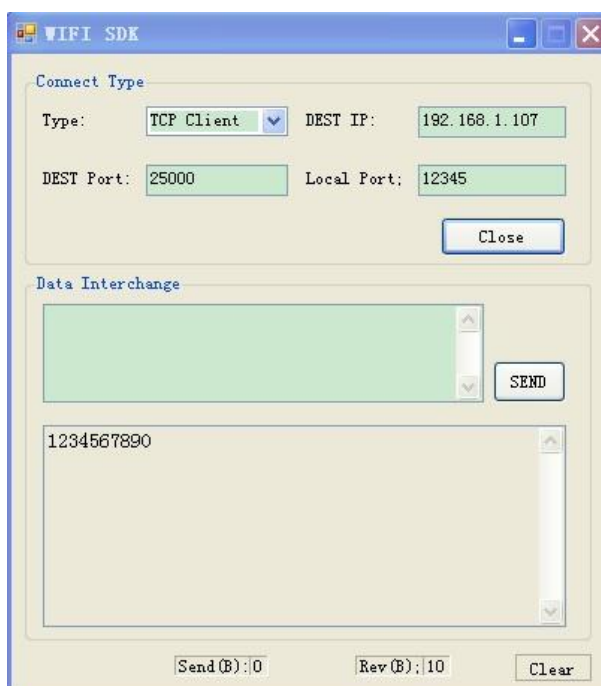


Figure 5.16 WIFI SDK receives data

- 12) To enter into the pass-through mode, firstly send `at+pwrmode=0\r\n`, set the power mode to 0 (1 is default), then enter the command `at+easy_txrx\r\n`, if the returned OK, then enter the pass-through mode; in this mode, data is free to be sent and received, as shown:

```
at+pwrmode=0
OK
at+easy_txrx
OK
```

Figure 5.17 Into the pass-through mode

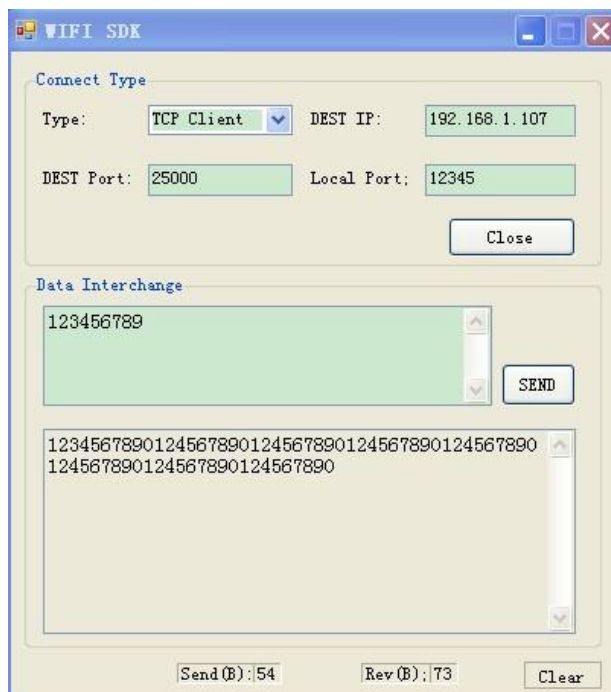


Figure 5.18 Pass-through test

#### 5.1.4.2 Creating a TCP Client

- 1) Open a Hyper Terminal, set the serial port parameters and press the reset button, then Hyper Terminal outputs start information.
- 2) Enter `at+ascii=1\r\n`, convert all return value parameters to ASCII; the RAK410 return value by default are displayed as hexadecimal; after command is entered, returned OK.
- 3) Enter `at+scan=0,ChinaNet-14f3\r\n`, ChinaNet-14f3 is the name of the network to be scanned, parameter 0 indicates scanning all channels.
- 4) Enter `at+psk=lthonway303550\r\n`, then returns OK.
- 5) Enter `at+connect=ChinaNet-14f3\r\n`, and returned OK, which indicates a successful connection.
- 6) Configure IP addresses, enter `at+ipdhcp=0\r\n`, then IP allocation information is returned.
- 7) Open WIFI SDK, choose TCP Sever and set local port to 25000, dest IP is 192.168.1.107, this is the module's IP address, as shown:

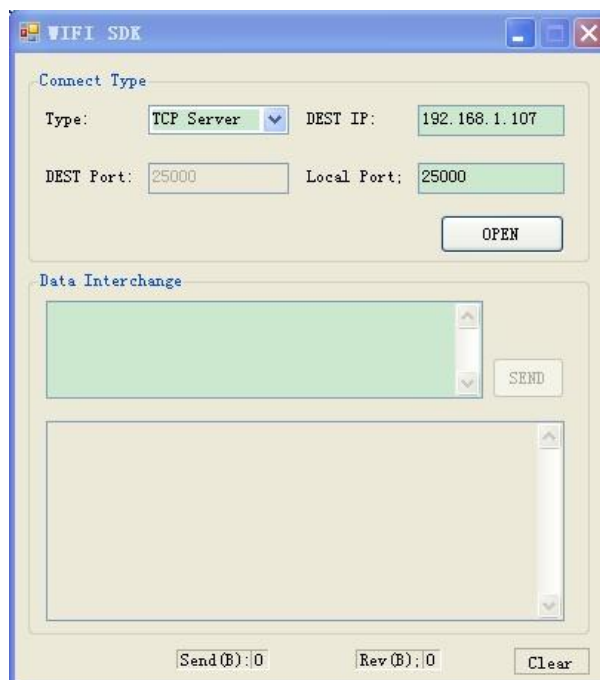


Figure 5.19 Creating a TCP Sever

Click "OPEN" and wait for client connections, as shown:

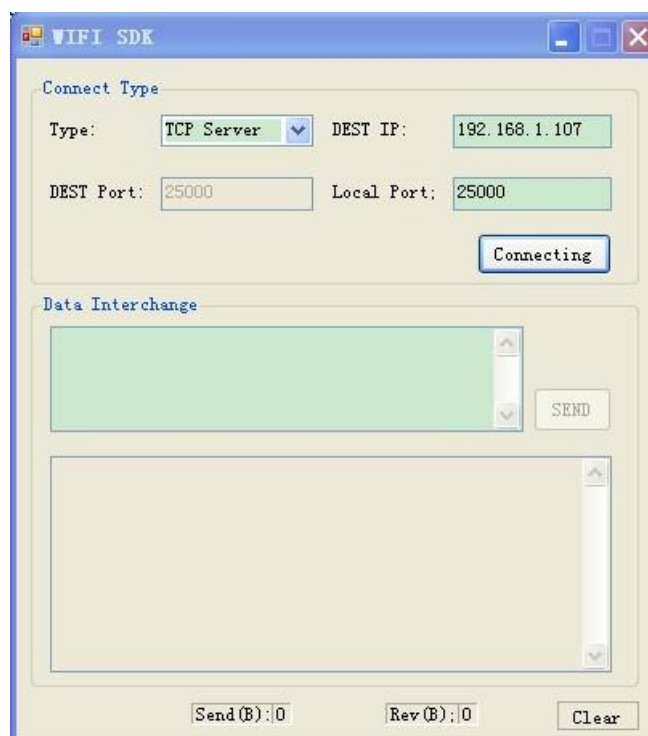


Figure 5.20 Open a TCP Sever

- 8) Enter `at+tcp=192.168.1.14,25000,1024\r\n`, set the remote IP as 192.168.1.14, then create a remote port as 25000, and the local port as 1024. If connected successfully, OK and the port identifier will be returned, as shown:

```

Welcome to RAK410
at+ascii=1
OK
at+scan=0,ChinaNet-14f3
OK
SCAN NUM:1
SSID                BSSID                CH  RSSI  SECURITY
ChinaNet-14f3        00:26:ED:DD:B6:00    9   -57   WPA2-PSK-TKIP-CCMP
                    WPA -PSK-TKIP-CCMP
at+psk=lthonway303550
OK
at+connect=ChinaNet-14f3
OK
at+tcp=192.168.1.14,25000,1024
OK0

```

Figure 5.21 Creating a TCP Client

- 9) Enter 1234567890 in the send area, and click “Send”, the content will be displayed on the Hyper Terminal.
- 10) To send data, enter the command `at+send_data=0,10,1234567890\r\n`, OK will be returned if run successfully; the received data will be displayed in the receiving column of the WIFI SDK.
- 11) To send data in pass-through mode, firstly send `at+pwrmode=0\r\n`, and set the power mode to 0 (1 is default), then enter the command `at+easy_txrx\r\n`; if the returns OK, then enter the pass-through mode; in this mode, data is free to be sent and received.

#### 5.1.4.3 Establishing a UDP Sever

- 1) Open a Hyper Terminal, set the serial port parameters and press the reset button, then Hyper Terminal outputs start information.
- 2) Enter `at+ascii=1\r\n`, convert all the module return value parameters to ASCII; the RAK410 return value by default are displayed as hexadecimal; after the command is entered, returned OK.
- 3) Enter `at+scan=0, ChinaNet-14f3\r\n`, ChinaNet-14f3 is the name of the network to be scanned, the parameter 0 indicates scanning all channels.
- 4) Enter `at+psk=lthonway303550\r\n`, then returns OK.
- 5) Enter `at+connect=ChinaNet-14f3\r\n`, and returned OK, which indicates a successful connection.
- 6) To configure IP addresses, enter `at+ipdhcp=0\r\n`, then IP addresses will be returned.
- 7) Enter `at+ludp=25000\r\n`, then create local TCP port as 25000, OK and the port identifier will be returned. As shown:

```

Welcome to RAK410
at+ascii=1
OK
at+scan=0,ChinaNet-14f3
OK
SCAN NUM:1
SSID                BSSID                CH  RSSI  SECURITY
ChinaNet-14f3       00:26:ED:DD:B6:00   9   -73   WPA2-PSK-TKIP-CCMP
                    WPA -PSK-TKIP-CCMP
at+psk=lthonway303550
OK
at+connect=ChinaNet-14f3
OK
at+ludp=25000
OK0

```

Figure 5.22 Establishing a UDP Sever

- 8) Open the WIFI SDK, then select the type as UDP, the target IP is the module's IP, here it is 192.168.1.107, the port is 25000, as shown:

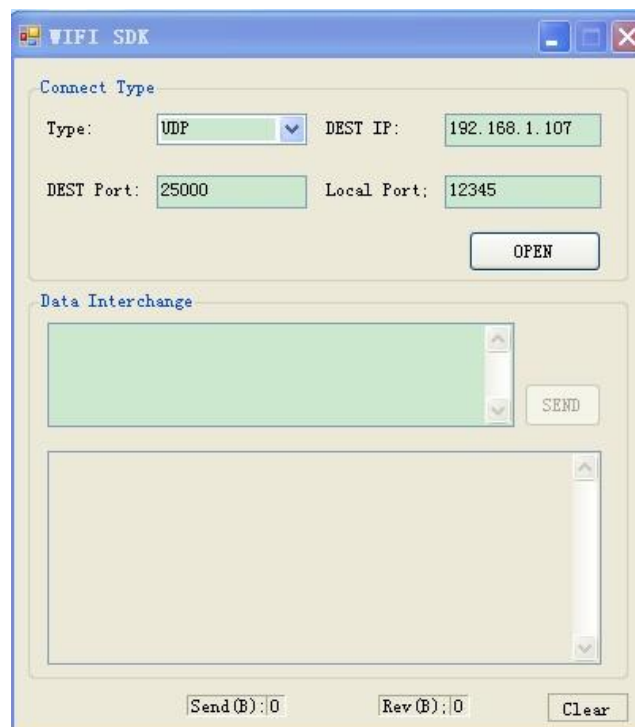


Figure 5.23 Input UDP parameters

- 9) Click “OPEN” to set PC as UDP Client :

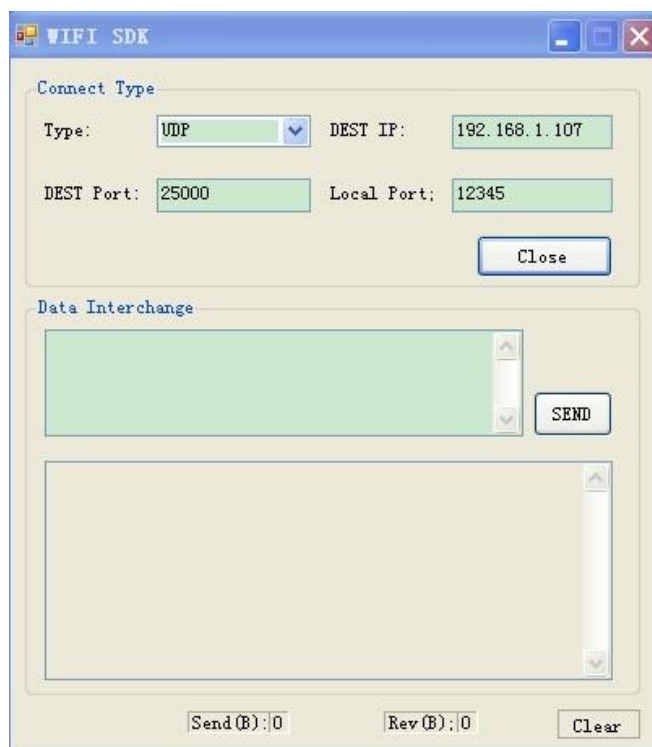


Figure 5.24 Establishing a UDP connection via WIFI SDK

- 10) Enter 1234567890 in the send area, and click “Send”, the content will be displayed on the Hyper Terminal.
- 11) For module to send data to Hyper Terminal, enter the command  
`at+send_data=0,10,1234567890\r\n` , and returns OK after successful implementation;  
the following data is displayed in the receiving column of the WIFI SDK.
- 12) To send data in the pass-through mode, firstly send `at+pwrmode=0\r\n`, set the power mode to 0 (1 is default), then enter the command `at+easy_txrx\r\n`, if the return is OK, then enter the pass-through mode; in this mode, data is free to be sent and received.

#### 5.1.4.4 Establishing a UDP Client

- 1) Open a Hyper Terminal, set the serial port parameters and press the reset button, then Hyper Terminal outputs start information.
- 2) The RAK410 return value by default are displayed as hexadecimal; Enter `at+ascii=1\r\n`, convert all return value parameters to ASCII; after the command is entered, returned OK.
- 3) Enter `at+scan=0,ChinaNet-14f3\r\n` , ChinaNet-14f3 is the name of network to be scanned, parameter 0 indicates scanning all channels.

- 4) Enter `at+psk=lthonway303550\r\n`, then returned OK.
- 5) Enter `at+connect=ChinaNet-14f3\r\n`, if returned OK, it indicates a successful connection.
- 6) Configure IP address, and enter `at+ipdhcp=0\r\n`, then the IP address information is returned.
- 7) Enter `at+udp=192.168.1.14,25000,1024\r\n`, set the remote IP as 192.168.1.14, then create a remote port as 25000, and the local port as 1024. If connected successfully, both OK and the port identifier will be returned, as shown:

```

Welcome to RAK410
at+ascii=1
OK
at+scan=0,ChinaNet-14f3
OK
SCAN NUM:1
SSID                BSSID                CH  RSSI  SECURITY
ChinaNet-14f3        00:26:ED:DD:B6:00    9   -56   WPA2-PSK-TKIP-CCMP
                        WPA -PSK-TKIP-CCMP
at+psk=lthonway303550
OK
at+connect=ChinaNet-14f3
OK
at+udp=192.168.1.14,25000,1024
OK0

```

Figure 5.25 Creating a UDP Client

- 8) Open the WIFI SDK, select the type as UDP, the target IP is the module's IP, here is 192.168.1.107, the destination port is 1024, and the local port is the port is 25000, as shown :

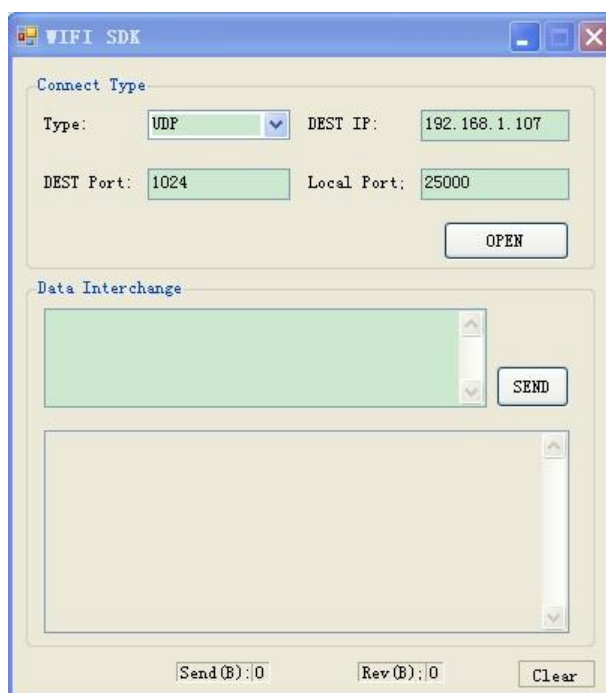


Figure 5.26 Enter UDP Parameters

- 9) Click “OPEN” to set PC as UDP Sever :



Figure 5.27 Establishing a UDP connection via WIFI SDK

- 10) Enter 1234567890 in the send area, and click “Send”, the content will be displayed on the Hyper Terminal
- 11) For module to send data, enter the command `at+send_data=0,10,1234567890\r\n`, and returns OK after successful implementation; the received data is displayed in the receiving column of the WIFI SDK.
- 12) To send data in the pass-through mode, firstly send `at+pwrmode=0\r\n`, set the power mode to 0 (1 is default), then enter the command `at+easy_txrx\r\n`, if the return is OK, then enter the pass-through mode; in this mode, data is free to be sent and received



## 5.2 Hardware Connection in SPI Operating Mode

In SPI mode, the connections of the jumpers, Dial switch on the development board are shown as below(SW2 dial all to the bottom):



Figure 5.28 SPI Operating Mode

SPI pins as shown in the back board, SPI's pins are CS\_CTS, MISO\_TX0, CLK\_RTS, MOSI\_RX0, SPI\_INT, the method into the SPI mode as following:

- 1) SW1:dial all to the bottom.
- 2) SW2:dial all to the bottom.
- 3) MCU SPI connect to the module's SPI pin. MISO and MOSI no exchange.
- 4) Connect USB or ac adapter to supply power to the board, reset the module. Program to configure the operation mode of the module.

## 6 WEB Sever Function

The RAK410 module supports WEBSever function in the UART mode and SPI mode. Only need to dial SW1 "4" switched to the upper, then reset the module. The following introduce the RAK410 module of the WEBSever function.

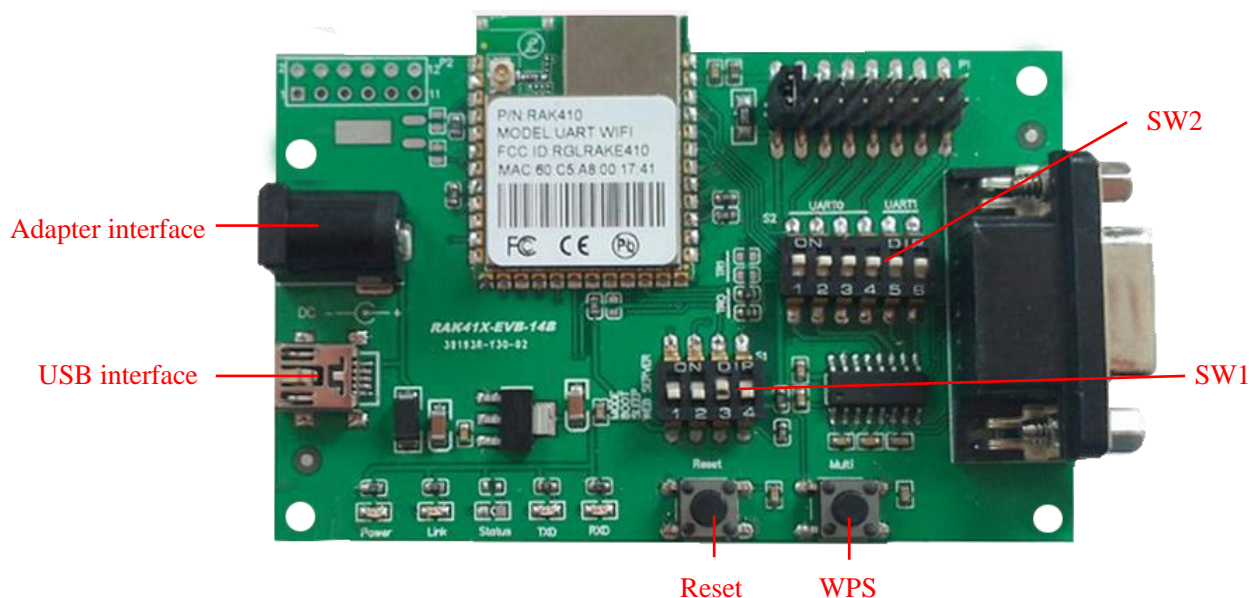


Figure 6.1 WEB Sever function introduction

- 1) Connect the serial cable and connect the USB interface to supply power, and turn on the power switch.
- 2) As shown below, when the Dial switch SW1 "4" is switched to the upper, prompting information can be displayed in the Hyper Terminal after reset; PC can joint the module's network, allow to configure operating mode via WEBSever, without the command "at+boot\_mode=1\r\n".

```

/***** WEB SERVER MODE *****/

```

Figure 6.2 Return message after entered WEB Sever

- 3) By default, the module creates connections with name beginning with "RAK\_" and with password as OPEN; if the module has saved AP data via at+storeconfig, then all the WEB SERVER information will be regarded as saved parameters (SSID, password, IP), as shown:



Figure 6.3 WEB Server Network Name: RAK\_05C3DF

- 4) If successfully connected to network, open a browser, find the gateway and input the gateway address (default is 192.168.78.1), as shown below:

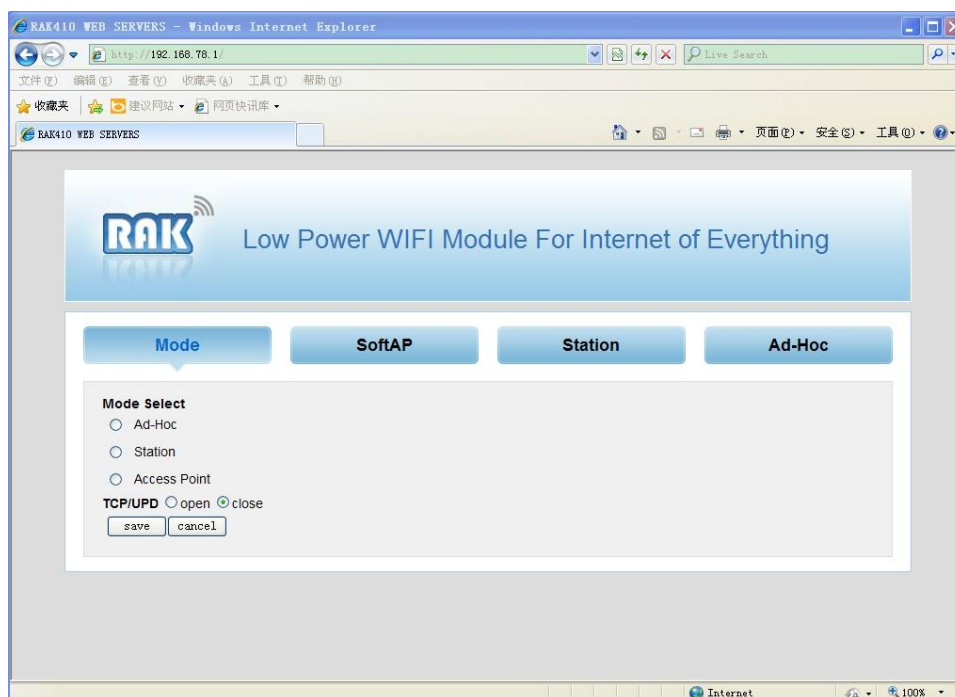
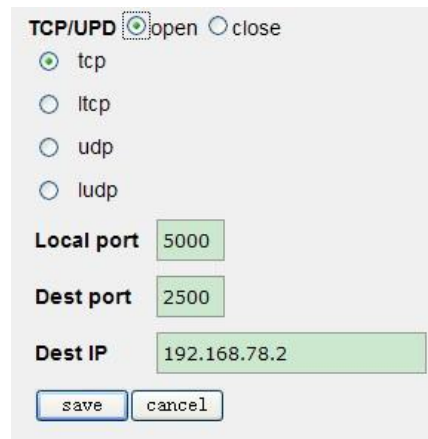


Figure 6.4 RAK410 Mode Select Page

- 5) From the “RAK410 Mode Select” window, select Station mode; if user wants to configure the connection information, click the “open” radio button and configure TCP/UDP parameters (if UART\_MODE is high, enter into pass-through mode) , then save the configuration.



TCP/UDP ☒ open ☐ close

☒ tcp

☐ ltcp

☐ udp

☐ ludp

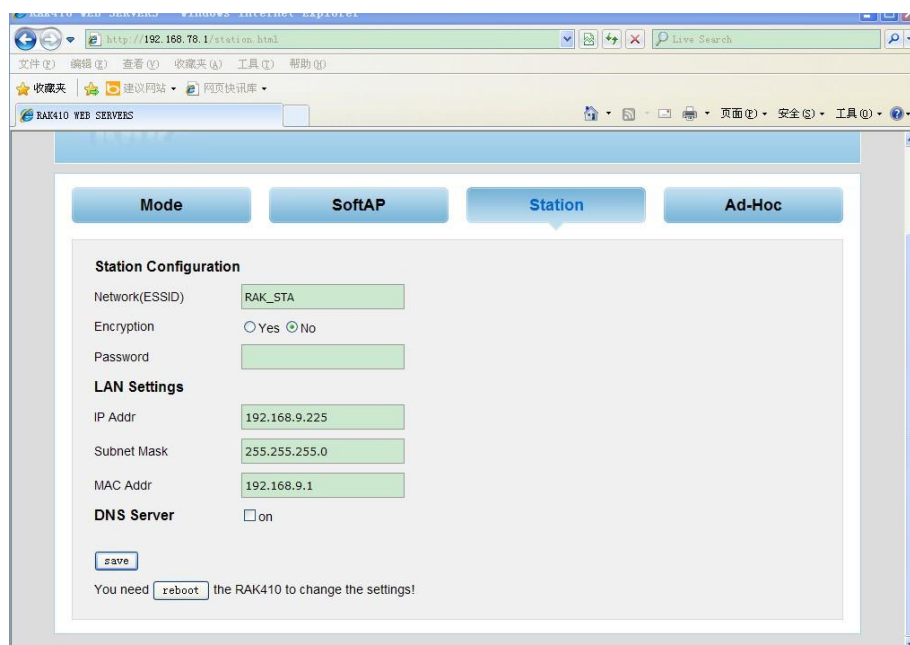
Local port

Dest port

Dest IP

Figure 6.5 RAK410 Configuring Connection Options

- 6) Click the “Station Configuration” tab, as shown below:



Mode SoftAP Station Ad-Hoc

Station Configuration

Network(ESSID)

Encryption ☐ Yes ☒ No

Password

LAN Settings

IP Addr

Subnet Mask

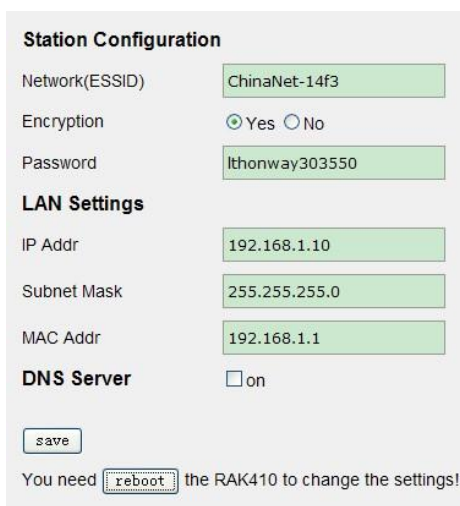
MAC Addr

DNS Server ☐ on

You need  the RAK410 to change the settings!

Figure 6.6 Station Configuration Window

- 7) Input the parameters for connecting to AP:



The image shows a web-based configuration interface for the RAK410 module. It is titled 'Station Configuration'. Under this title, there are three sections: 'Network(ESSID)' with a text input field containing 'ChinaNet-14f3'; 'Encryption' with radio buttons for 'Yes' (selected) and 'No'; and 'Password' with a text input field containing 'lthonway303550'. Below these is the 'LAN Settings' section, which includes 'IP Addr' (192.168.1.10), 'Subnet Mask' (255.255.255.0), and 'MAC Addr' (192.168.1.1). The 'DNS Server' section has a checkbox labeled 'on' which is currently unchecked. At the bottom of the configuration area is a 'save' button. Below the 'save' button, a message states: 'You need **reboot** the RAK410 to change the settings!'. The 'reboot' text is enclosed in a box with a circular arrow icon.

Figure 6.7 Inputting Parameters for Station Configuration

- 8) Click "Save", then reboot.
- 9) The module returns the boot information, then enter `at+con_status`; If returned OK, it indicates a successful connection.
- 10) Create a TCP/UDP connection; the module communicates with WIFI SDK after the connection.

## 7 RAK410 and MCU Joint Debugging

RAK410 can communicate with MCU via UART interface or SPI interface, as long as the corresponding pin of MCU is jumper-connected to the corresponding pin of the RAK410 development board, then joint debugging can be conducted.

By connecting SPI interface to the corresponding SPI interface on the RAK410 development board, we use M0 development board(Nuvoton) to joint debugging with RAK410 module.

### 7.1 RAK410 and MCU Joint Debugging via UART Interface

RAK410 can through the UART interface with MCU alignment wiring diagram, the dialing code method as shown in figure:

The red line---+3.3V      The black line---GND  
The white line---Reset      The yellow line---TX0  
The orange line---RX0

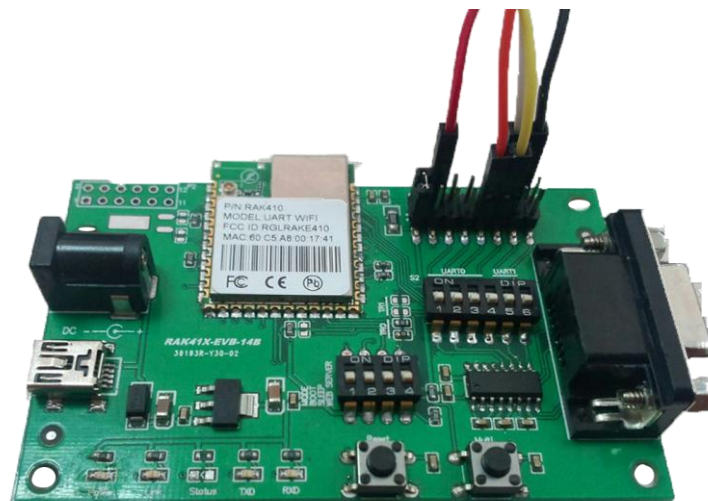


Figure 7.1 Hardware Connection for RAK410 and MCU joint debugging

If need RAK410 through UART and MCU alignment, can use M0 development board, we will provide sample source code.



## 7.2 RAK410 and MCU Joint Debugging via SPI Interface

RAK410 can communicate with MCU through the SPI interface alignment, the dialing code method as shown in figure:

The red line ---- 3.3 V	The black line --- GND
The blue line --- CLK	The white line --- RESET
The green line - CS	The orange line --- MOSI
The yellow line --- MISO	

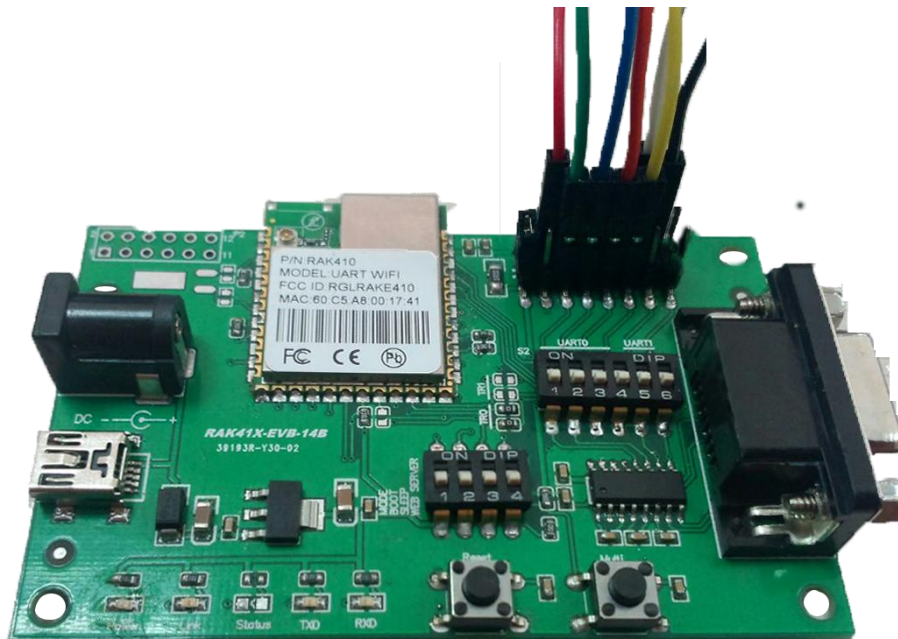


Figure 7.2 Hardware Connection for RAK410 and MCU joint debugging via SPI

If need to SPI evaluation function, can use M0 development board, provide sample source code.

## 8 Upgrade

RAK410-EVB development board supports switch between UART mode and SPI mode. UART mode can upgrade to a higher version or SPI mode, and SPI mode can upgrade to a higher version or UART mode. The following describes the method for switching between UART mode and SPI mode.

### 8.1 UART Upgrade to a Higher Version or SPI

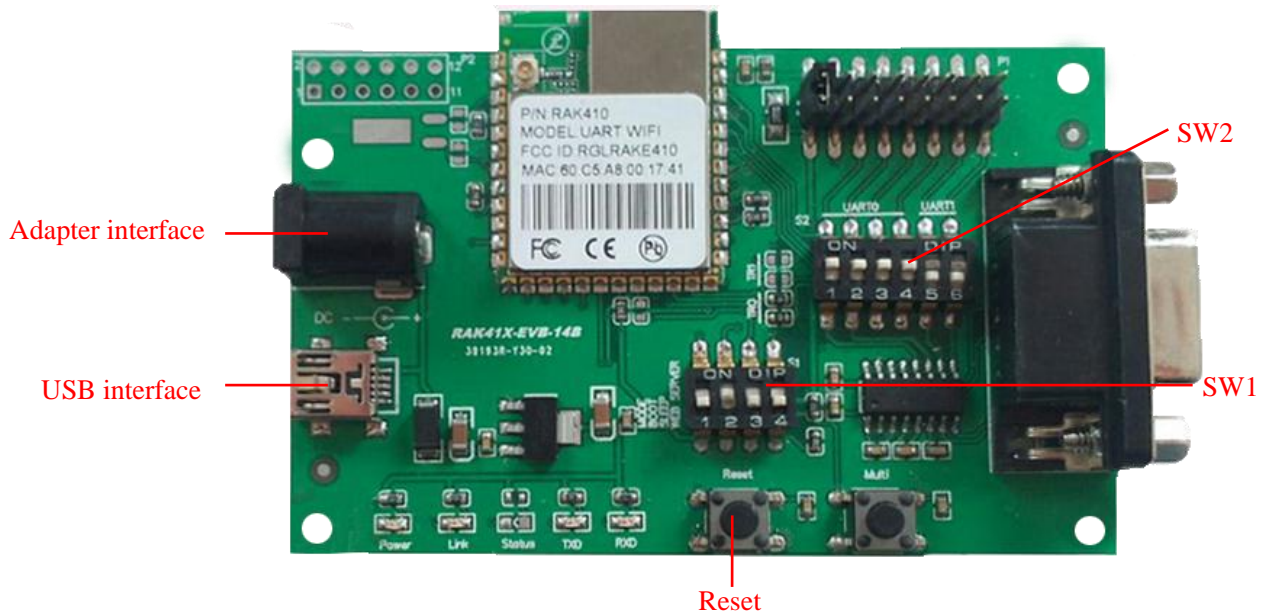



Figure 8.1 UART Upgrade Introduction

- 1) SW1 "2" dial to the top, make the BOOT pins for high level.
- 2) SW2, "5" and "6" dial to the bottom, the other to the top, to upgrade through UART0;
- 3) connected to a serial port, connected to the USB or ac adapter to supply power to the board.
- 4) set up the super terminal, press the reset button, as shown in figure.

```
Please chioce update interface(1/2)!
*1.UART0*
*2.UART1*
1
Upgrade firmware(y/n)?y
*Command:*
*u : Upgrade MCU FW      *
*f : Upgrade WIFI FW    *
*b : Boot APP            *
*d : Delete saved data*
*r : Reset RAK410       *
u
Ready
```

Figure 8.2 UART Upgrade Process



- 1) Click  button to select the upgrade file path and select Xmodem , protocol, and click "Send", as shown below:

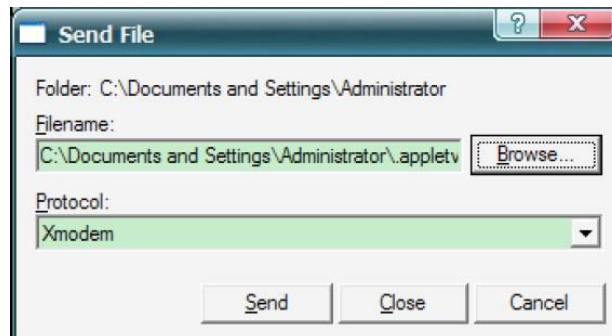


Figure 8.3 Sending File

- 2) After the upgrade, put the BOOT jumper on and reset, the Hyper Terminal displays "Welcome to RAK410", meaning a successful upgrade.

## 8.2 SPI Upgrade to a Higher Version or UART

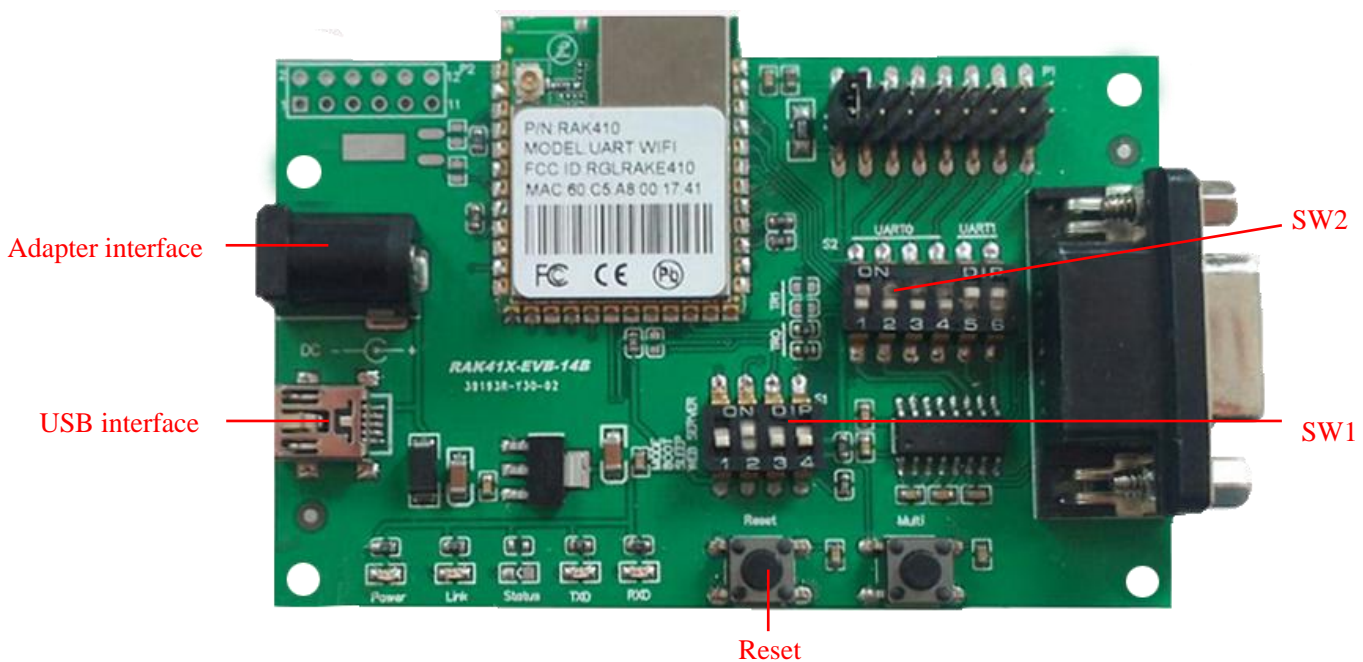


Figure 8.4 SPI Operating Mode

- 1) SW1 "2" to the top, make the BOOT pins for high level.
- 2) SW2, "5" and "6" dial to the upper end, others to the bottom, to upgrade through UART1
- 3) connected to a serial port, connected to the USB or ac adapter to supply power to the board.
- 4) press the reset button, input "2", select UART1 to upgrade. As shown in figure:

```
Please chioce update interface(1/2)!
*1.UART0*
*2.UART1*

Upgrade firmware(y/n)?
*Command:*
*u : Upgrade MCU FW      *
*f : Upgrade WIFI FW     *
*b : Boot   APP          *
*d : Delete saved data*
*r : Reset   RAK410      *

Ready
```

Figure 8.5 SPI Upgrade Process

Repeat the steps 4-6 in the UART Upgrade process to a Higher Version.

## 9 RAK410 Power Consumption Test

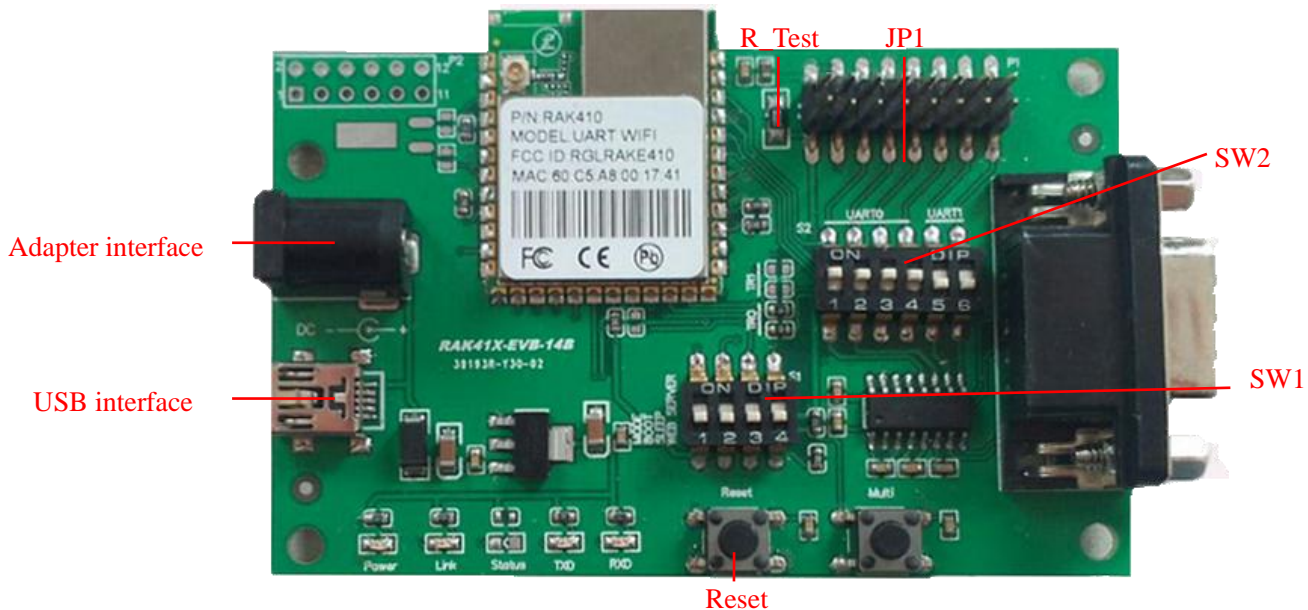


Figure 9.1 Power Consumption Test on RAK410 Roof

As shown in figure, R\_Test for power test resistance, resistance to 1  $\Omega$ , test power, remove the JP1 jump in risk, the multimeter measuring R\_Test on both ends of the voltage value, can be measured power consumption:  $U/R\_Test$ . Or remove the resistance, the multimeter to the current file list in direct current measurement. Specific test method is as follows:

- 1) SW1 dial all to bottom.
- 2) SW2, 1~4 dial to the top, others dial to the bottom
- 3) connected to a serial port line, connected to the USB or ac adapter to supply power to the board.
- 4) configuration RAK410 mode power consumption mode, on both ends of powermode 0 ~ 3 can R\_Test multimeter test voltage value, powermode4 due to the low consumption, need to remove the resistance, the multimeter to the current file list in direct measuring current. Test power consumption of various kinds of working mode. Test reference results in the following table:

Table 10.1 Station mode

mode	AT command	Wireless Status	stand-by power
STA	at+pwrmode=0	Max_Perf	80.35mA
	at+pwrmode=1	Power_Save	5.98mA
	at+pwrmode=2	Shut_down	4.97mA

	at+pwrmode=3	Power_Save	3.72mA
	at+pwrmode=4	Shut_down	0.6uA

Table 10.2 AP mode

mode	AT command	Wireless Status	stand-by power
AP	at+pwrmode=0	Max_Perf	80.85mA

## 10 Contact

If you have any questions , please contact us by the following ways:

Contacts:

- Website: [www.rakwireless.com](http://www.rakwireless.com)
- Contact Person: [kevin.lee](#)
- E-mail: [kevin.lee@rakwireless.com](mailto:kevin.lee@rakwireless.com)