RAK415 UART-WIFI Module

User Guide V2.0

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1. Quick Start

1.1 Development Board introduction

Thank you for choosing RAK415 serial pass-through module, the pass-through module is extremely easy to use and feature-rich, to meet various needs of customers. First, we use RAK415 evaluation kit to have a feel of it.

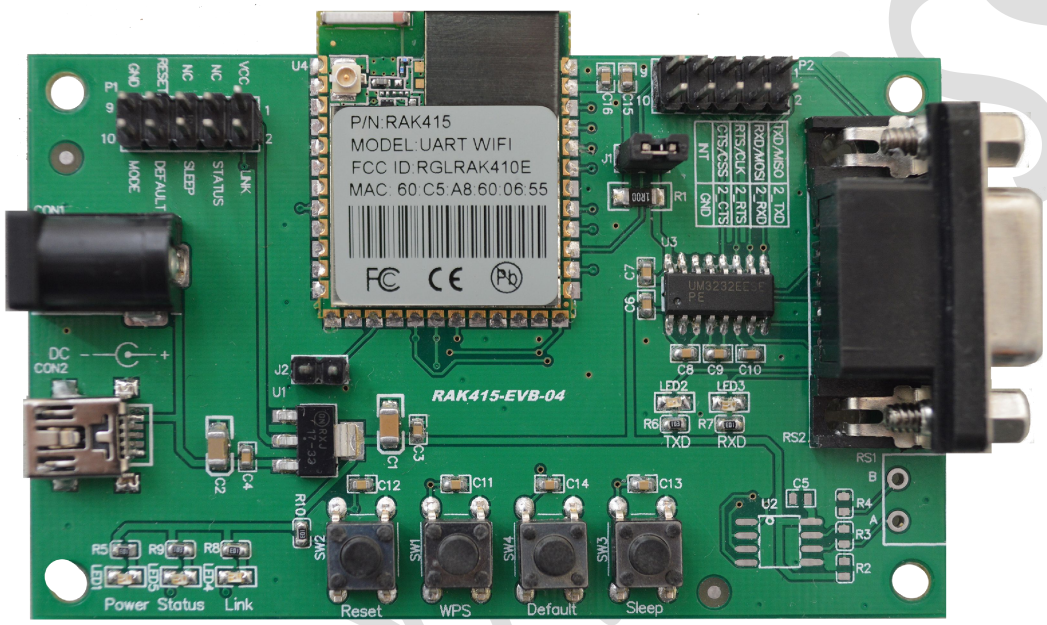

Figure 1-1： View of Development Board

Table 1-1 Main Peripherals

Function	Name	Description
External Interface	Mini USB/DC5V	Power Supply DC 5V input
	RS232	The main communication interface, standard serial port, female port
	RS485	Assistant communication interface, 485 industrial
Button	Reset	Module reset button
	WPS/MODE	WPS function,one-key configuration to network (with a router WPS)
	Config/Default	1. Press and hold 3 sec and longer, module will restore to factory parameters 2. Press and hold shorter than 3 sec,one-key configuration to network (with phone)
	Sleep	Into ultra-low power mode button. Press and hold longer than 5 sec and release, into the ultra-low power. Press, and then release to wake up module.
Pin out	P1	Pin Reset and Pin Link
	P2	UART and 232 interface

Power consumption Pin	J1	Power Consumption Interface
LED Indicator	POWER	Power Indicator
	STATUS	Status indicators: Module started properly —— on (output low) Module failed to start —— off Module firmware is in upgrade —— quick flashing Module is ready to enter factory mode —— quick flashing Module Upgrade Error —— slow flashing
	LINK	module is connected to router in STA mode， module builds STA connection in AP mode ——on(output low) Conversely off EasyConfig, WPS in one-key configuration —— quick flashing More LINK lights indicate status refer to RAK415 specification
	SLEEP	ultra-low power mode Indicator.

1.2 Methods for module to factory reset

There is a Default button on development board, it is used when configuring mistakes occur or forget the current configuration parameters for the module to restore factory reset:

Press the Default button, status indicator starts blinking rapidly, press and hold more than 3 seconds, the light stops flashing, and release the Default button, the module goes back to factory mode (by default AP is built,factory parameters can be modified).

1.3 Check before Power Up

Evaluation Kit contains a serial adapter cable, a USB cable, Development Board, and also provides antenna with IPEX connector interface. If the module has external antenna, plug in with the external antenna. Connect the module serial port with PC serial port (PC COM port or USB to serial port).

1.4 State after Power Up

Normal phenomenon

When module is plug with power supply, module LED (Power LED) lights up, followed by Status lights (Status pin output low), which means that the module start properly.

If the power-Status light is not on, try pressing the Reset button, if the light still remains off, please contact Sales.

1 . In the module factory mode,after power up, it creates an open AP network named

RAK415_AP_XXXXXX, "XXXXXX " is the last 6 digits of module MAC address, IP address is 192.168.7.1, by default DHCPServer is on (Factory parameters can be modified).When the Status light turns on, computer's wireless network list will find RAK415_AP_XXXXXX.

Figure 1-2: AP Scanning after Factory

2． Double click to join the network (the Link lights up), an IP address will be assigned.Open browser and enter the module gateway address 192.168.7.1, the default web authentication interface pops up, enter authentication user name: admin,password: admin.

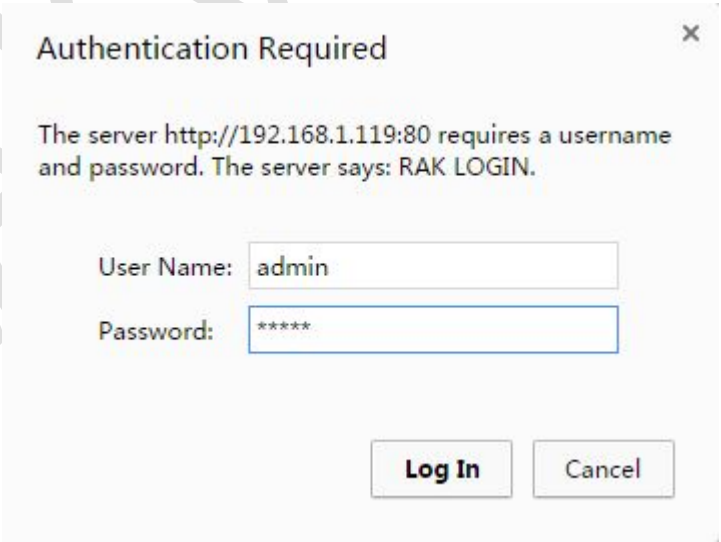

Figure 1-3: WEB Authentication

3．The built-in WEBServer interface is shown. AP settings and IO communication settings can be viewed (i.e.UART interface and socket communication settings).

Figure 1-4: Factory Webpages

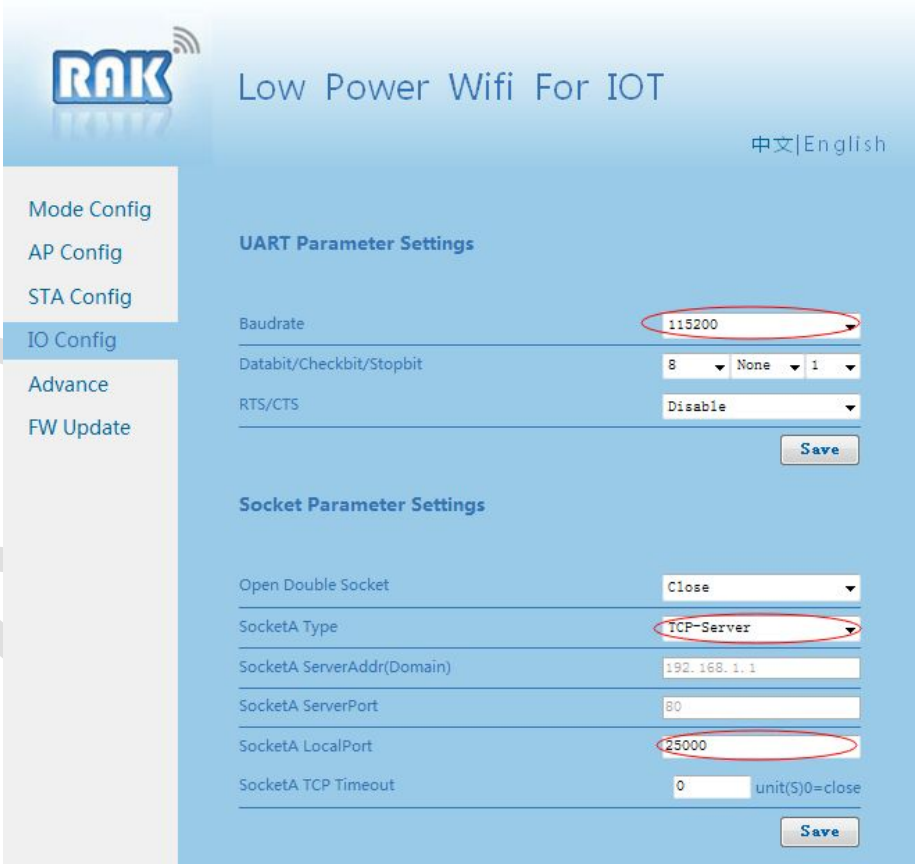

Figure 1-5: Factory IO Communication Test

1.5 Pass-through Data Test

4．Open serial port tool, select the COM port. The default baud rate is 115200, data bit is 8, and stop bit is 1, no parity check, no flow control. Then open network debugging tools (TCP / UDP Net Assistant) to establish TCP client connection, with target IP 192.168.7.1, server port 25000.

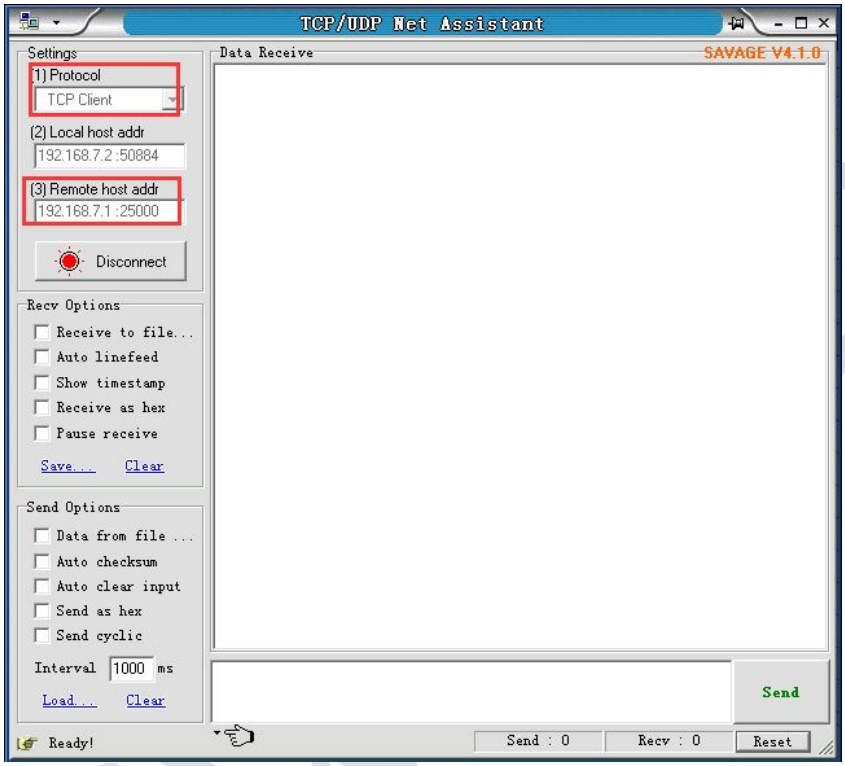

Figure 1-6: Establish a TCP Client

5．After the TCP is connected, data can be exchanged. At this point the module becomes a virtual serial port on the network, data from serial port and network can be exchanged.

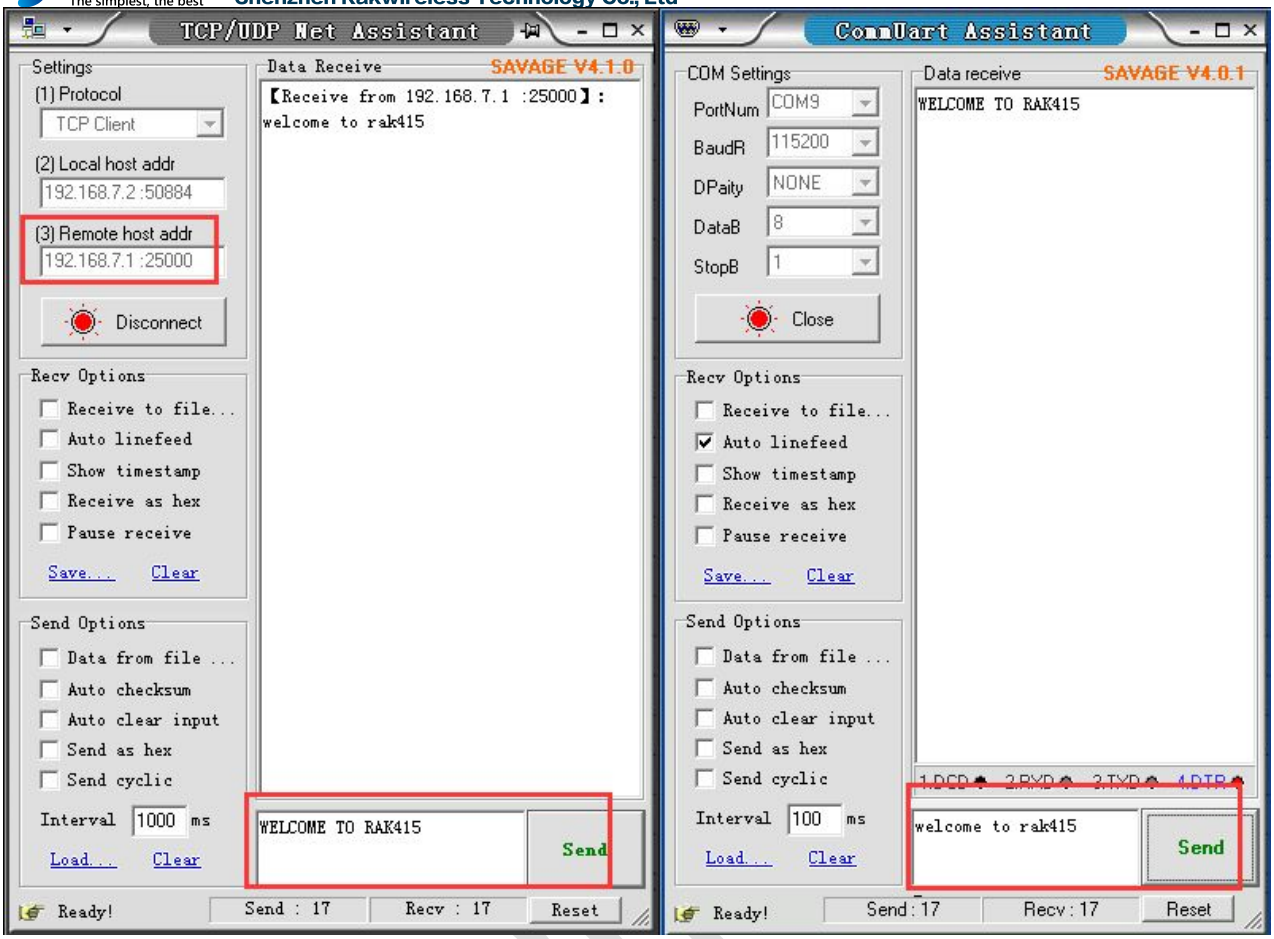

Figure 1-7：Factory Pass-through Test

2. Functional Description

2.1 Overview

RAK415 module is an ultra-low power WIFI module that fully supports IEEE 802.11b/g/n wireless standards, with a small package and easy-to-use features. The RAK415 is a complete serial pass-through module integrated with TCP / IP protocol stack and drivers, easy to use by simply using the PC, WEB Browser, APPs tool to work individually or in bulk for parameters configuration, and then module connects the serial ports and network for normal usage.

The RAK415 module is characterized by stable performance, low power consumption and flexibility to meet the various needs of customers. It can also provide test reports, allowing customers to get started quickly, shorten the development cycle.

The RAK415 module also provides various types of customized services, such as user webpages, production and configuration tools, mobile phone APPs, etc.

2.2 Key Applications

- Portable products
- Home appliances and electrical appliances
- Industrial sensors
- Sales terminals
- Buildings automation
- Logistics and freight management
- Home security and automation
- Medical applications, such as patient monitoring, medical diagnostics
- Metering (stop timing, measuring instruments, meters, etc.)

2.3 Device Features

- Support IEEE 802.11b/g/n wireless standards
- Integrated TCP / IP protocol stack
- Support OPEN, WEP, WPA/WPA2-PSK Encryption
- Support Soft AP, Station modes
- Support TCP, UDP protocols
- Support DHCP SERVER / DHCPCLIENT
- Support AT commands and transparent transmission mode
- Support UART communication with a data flow control, maximum rate of 921600bps

- Support multiple configuration tools for one-step configuration
- Support wireless upgrade firmware
- On-board ceramic antenna or U.FL antenna connector
- Operating voltage: 3.3V
- Support4kinds of power operating mode, with the lowest power consumption of 1-2uA
- FCC, RoHS and CE compliant

2.4 Feature Description

2.4.1 Hardware Interface

- Rate: 9600 - 921600bps
- Interface actual throughput up to 600kbps
- Support hardware flow control, ensuring the reliability of data transmission
- 485 function settings

2.4.2 Wireless Drivers

- Compliant with IEEE 802.11b/g/n standards
- Support AP and STA Mode
- Support WEP, WPA/WPA2-PSK encryption
- Fast networking, allowing module to be added to network within 2 sec after power up
- Support WPS and EasyConfig one-key to network connection
- Support network and socket automatic reconnection
- Support proactively identifying devices in LAN
- Support wireless configuration and firmware upgrade

2.4.3 TCP/IP

- DHCP Client and Server features
- DNS Client and Server functions
- TCP Client, TCP Server, UDP Client, UDP Server and UDP Multicast functions
- Dual socket transparent transmission of data (via uuid distinction)
- Support HTTP protocol
- TCPC / TCPS keep-alive time setting and TCPC reconnection

2.4.4 Power Consumption

The module supports three power consumption modes:

- Full speed working mode, with approx 80mA average power consumption, peak current less than 310mA

- Automatic power-saving mode, with approx 10mA average power consumption, peak current <310mA, DTIM = 100ms
- The stay connected mode,with approx ~ 3mA average power consumption, peak current <310mA, DTIM = 100ms (largest support to the 115200bps)
- External cable, ultra-low-power consumption mode, less than 1~2uA

3. Use Encyclopedia

3.1 Variety of Configurations

For pass-through module, it’ s aim for data communications. The precondition of WIFI communication is parameter configurations, among which the more important ones are network configuration (network name, password, IP address) and communication protocol socket settings (TCP, UDP). For parameters, the module defines the following two concepts.

First, the module defines two parts, factory parameters and user parameters.

Factory parameters: when the module is not in proper use, it maintains the parameters of the initial state (usually as access point), and it has an independent network name, a fixed IP address, etc. Factory mode ensures recoverability, to avoid user misconfiguration problems. (Factory parameters can be modified by the customer)

User parameters: When the module is in proper use and configured before, it will enable the new configuration as user parameters and these user parameters can be automatically loaded when module is reset, user parameters are the configuration for clients practical application scenarios. (Can be written at one time)

In order to facilitate entering from factory mode to user mode, pass-through mode provides four flexible ways to modify the configuration:

For Ad-hoc network customers(need to build their own networks)

1．parameter modification via the browser to access module built-in WEB server.

2．parameter modification via wireless discovery and configuration software provided.For the end customer scenarios by means of a router, it also provides a way for one-key networking.

3．Quick Connect with router using WPS function.

4．Connection with router using EasyConfig function.

3.2 WEB Configuration

After the module has established AP or joined a router, enter the IP address in the browser to access the module. When in AP mode, IP address is default recognized as gateway address(192.168.7.1). When in STA mode, if the IP address is automatically acquired, module IP address cannot be determined. However, with the help of “RAK415 Wireless Scan Config Tool” for local scanning, the IP address can be get, then user can get access to the WEB server.

Figure 3-1 Wireless Tool

When opening the address in the browser, message box will pop up that requires authentication, enter the default user name | password: admin | admin.

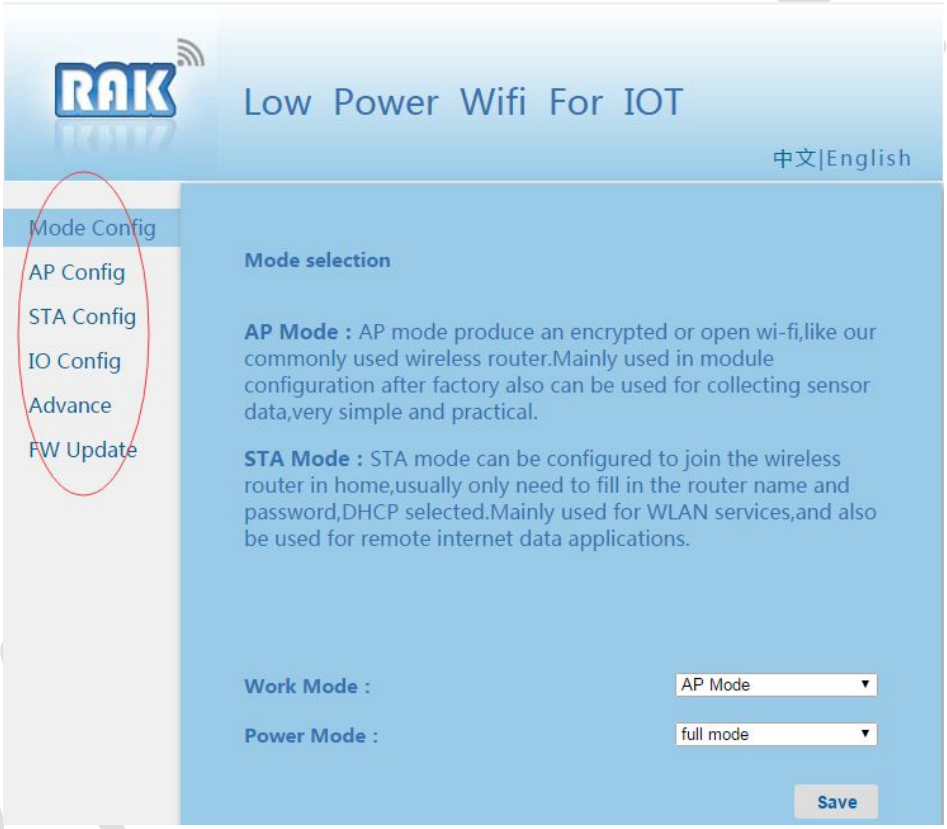

Figure 3-2 WEB Page

3.2.1 Mode Selection Page

Select the network mode which is divided into AP mode and STA mode.

AP Mode: AP mode is set to generate an encrypted WIFI wireless network, similar to our common wireless router. It is mainly applied for factory configuration, also for data collection point, simple and practical.

STA mode: STA mode can be configured to join home wireless router, usual configuration just with name and password of the router to select DHCP. It is mainly for LAN services, but also

for remote data applications.

Power consumption options: power consumption mode can be configured for full power mode to achieve maximum performance. The automatically power saving mode is set when module is before or after network connections. ensuring the module to reduce power consumption when idle.

3.2.2 AP Settings

Set an AP network name, with length limit of 32 bit. It is also configurable whether the network has broadcast (that can be scanned by other WIFI device), for security reasons,choose not to broadcast. Select a channel and whether or not the network is encrypted. Currently the module supports WPA2 encryption, which is more secure and reliable.

IP parameter settings, user can set IP address and subnet mask of AP gateway, by default DHCP is enabled.

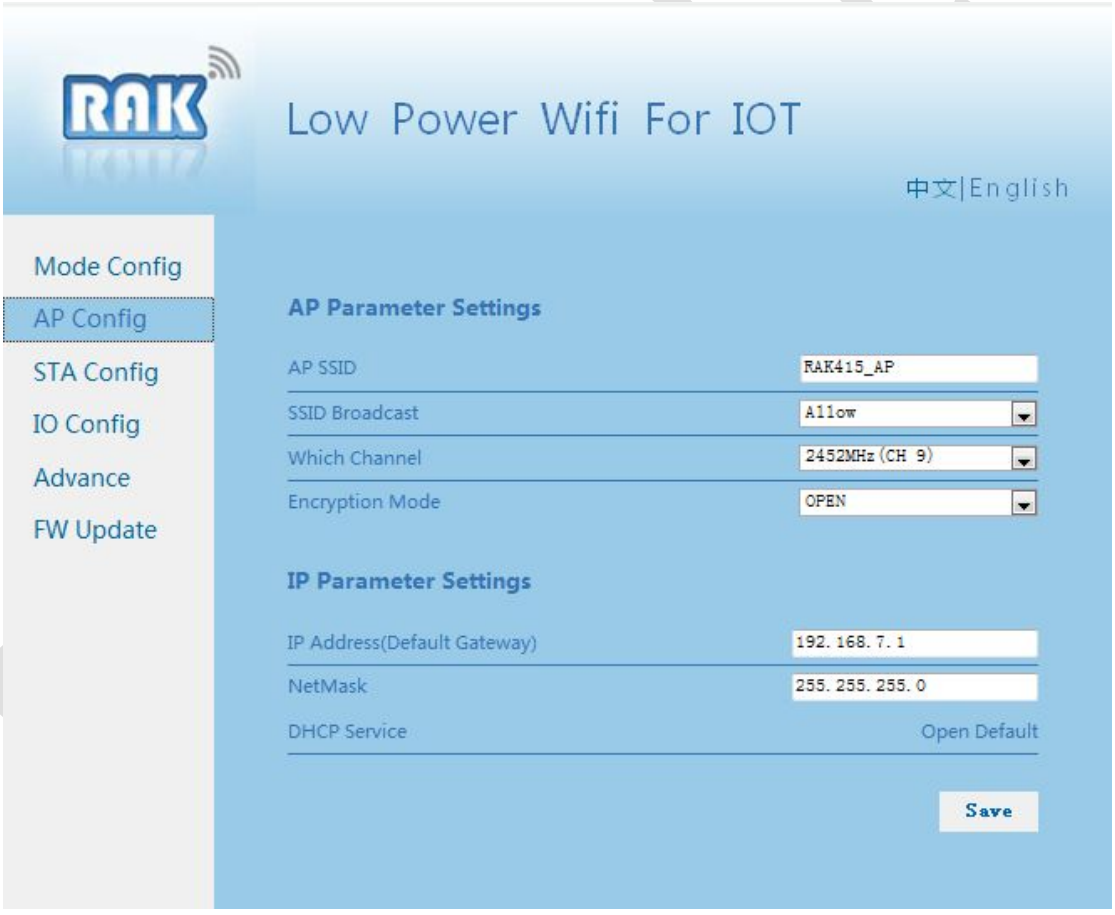

Figure 3-3 AP Settings Page

3.2.3 STA Node Parameter Settings

When module is used in STA mode, it adds its own routing equipment.

The network name can be manually filled in or by search a router nearby, click the router into

the searching page found to confirm. If the router is encrypted, pages will be prompted to enter password.

If the module cannot connect with the set route after reset, it will automatically revert to the factory parameters (AP) for one minute, and then try to connect the set route for another one minute, and so forth, until connection or reconfiguration(Enabled by default).

For IP parameter settings, user can choose a static setting. If static setting is chosen, note that the IP address is within gateway. It is recommended to select DHCP function is automatically assigned by router.

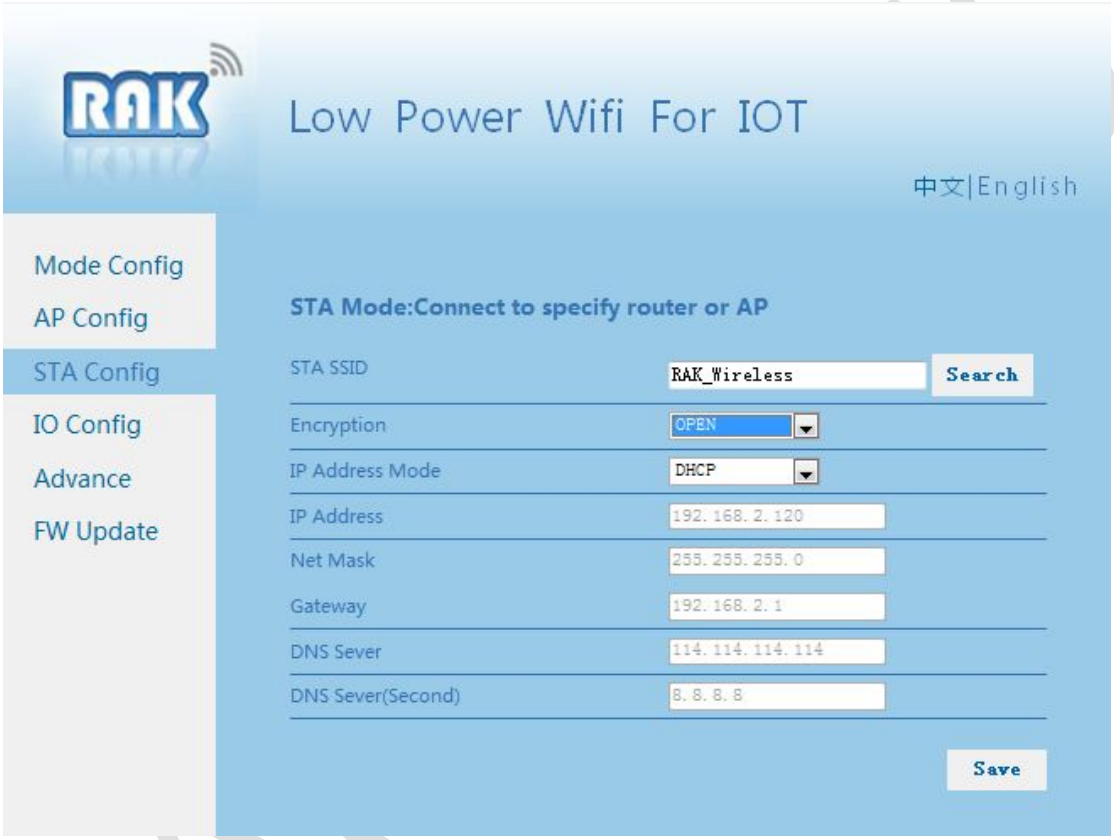

Figure 3-4 STA Settings Page

3.2.4 IO Communication Parameter Settings

IO communication includes serial ports parameter settings and network parameter settings.

Serial port parameters settings

Serial port parameters settings include serial port baud rate (autobaud is not supported), data bits, parity bits and stop bits. It supports hardware flow control, and 485 one-way communication function. The interval of Serial freedom sub-package is 5ms, that is, if a timeout is set for 5ms for serial port receiving bytes, when the interval is greater than 5ms, the serial data will be sent to networking sub-packages.

Network Parameter Settings

The network parameters are all about network communications settings, socket parameters settings includes three parameters, target server address, port number, and local port number.

The module supports two communication Sockets, SocketA and SocketB. They are all available for one of the TCP server, TCP client, UDP server and UDP client. When using the same serial port for communication, add a two-byte header before communication data, "S0"means the data sent and received by SocketA, and"S1"by SocketB.

TCP timeout parameter means that if the TCP connection is no data communication within the set time, the module will close the TCP connection initiatively. This parameter ensures that when the TCP connection is disconnected at any abnormal time, the module can be automatically restored. The time range of the parameter is 1 to 600s.

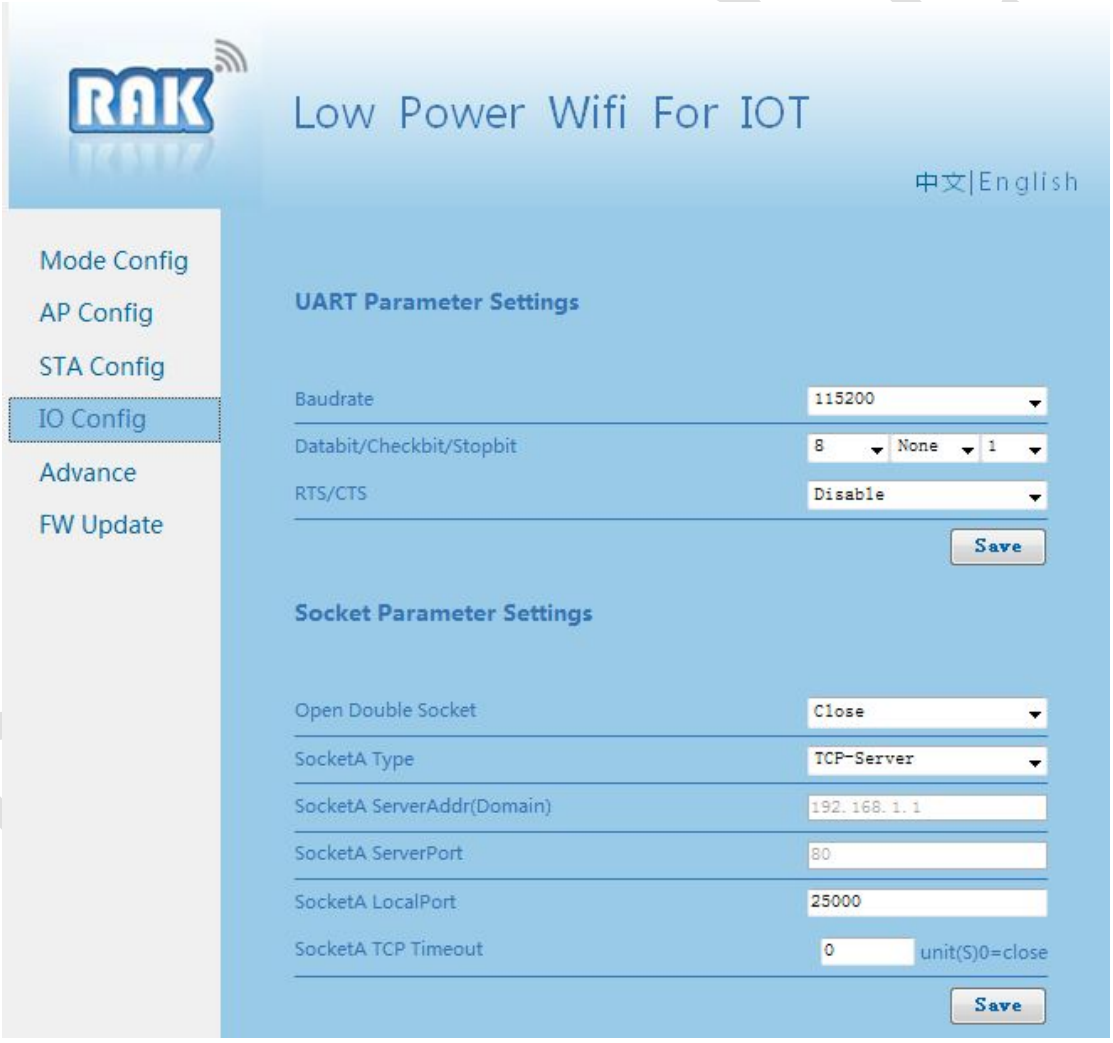

Figure 3-5 IO Communication Settings Page

3.2.5 Advanced Management

Modify user name and password on login page.

Modify module name and the group name, the module default name is the AP name of the

factory parameters.

Module Management provides function buttons to restart and restore factory settings.

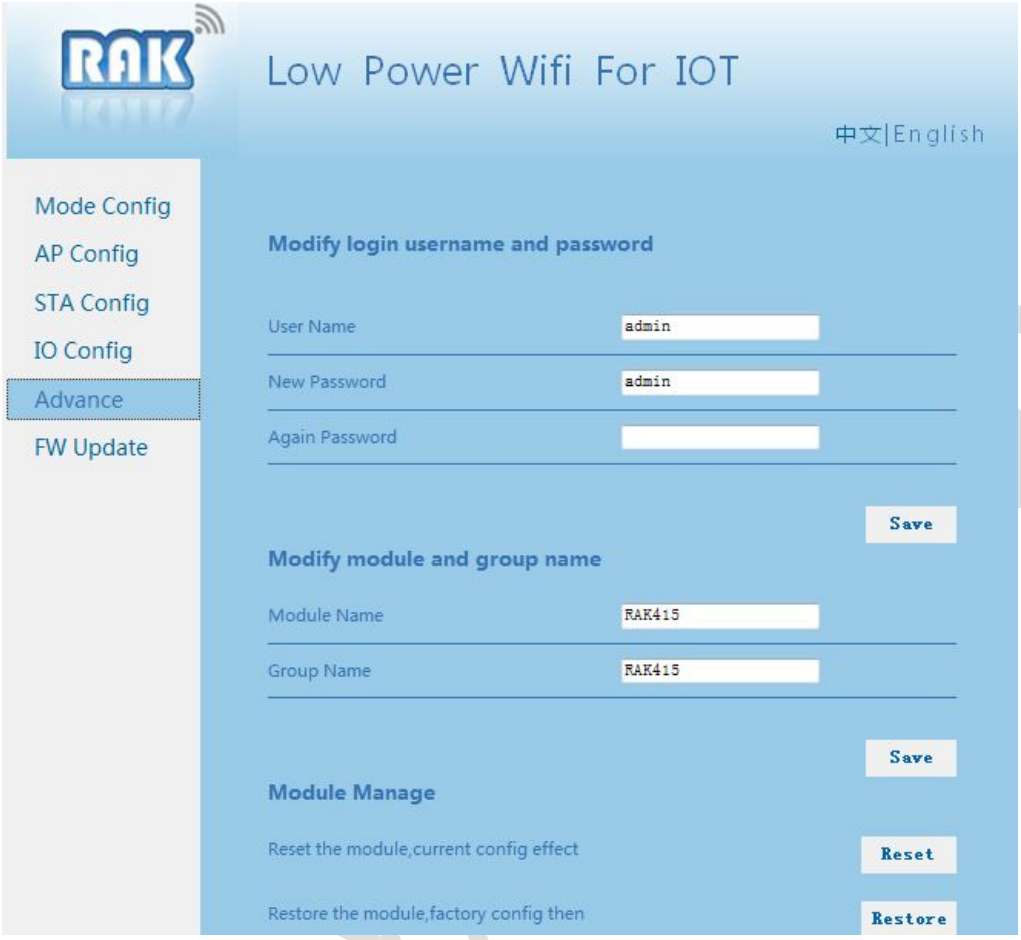

Figure 3-6 Advanced Management Page

3.2.6 Firmware Upgrade

The module provides wireless upgrade functionality to facilitate customer evaluation. Please upgrade carefully, for technical support please contact RAK.

Figure 3-7 Firmware Upgrade Page

3.3 Wireless Scan Configuration Tool

Wireless Scan configuration tool of the module can conduct locally discovery, RAK module can be found in LAN after scanning. Click to select the module for authentication, enter the default authentication. When succeeded, configure the corresponding parameters, save and reset. For details, refer to "RAK415 Configuration Tool User Guide.pdf.

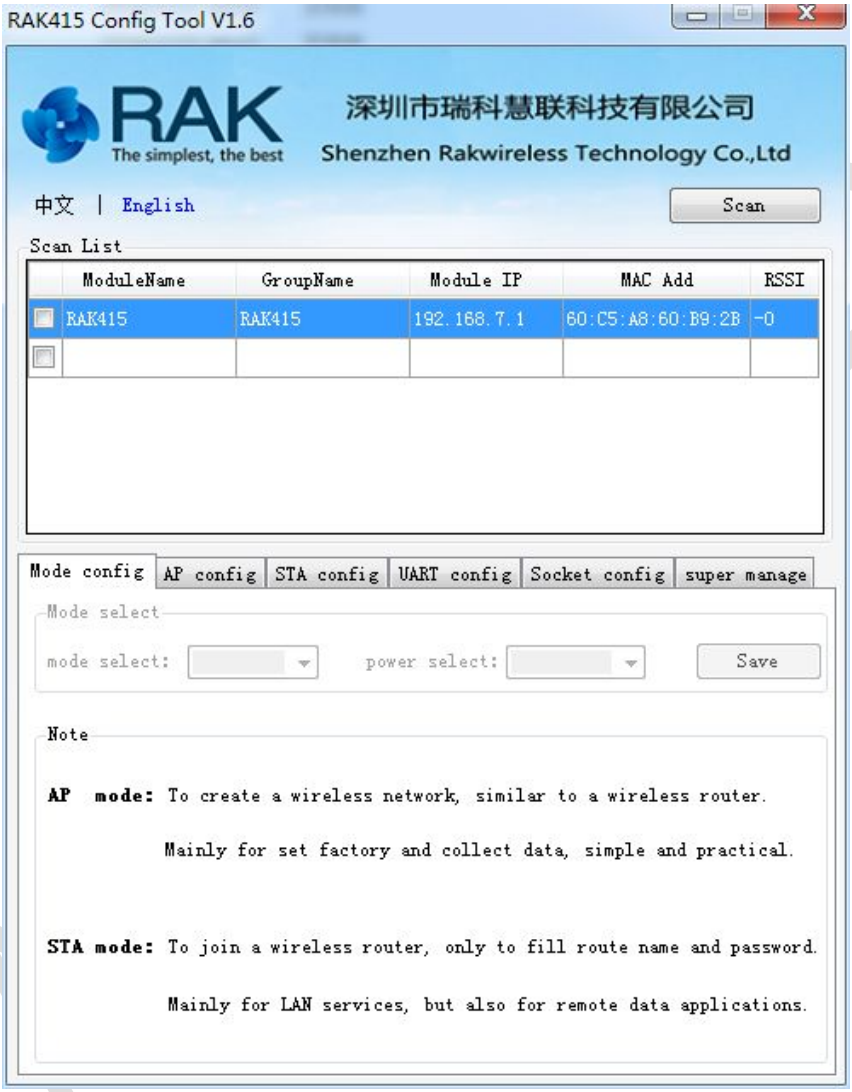

Figure 3-8 Wireless Scanning Configuration Page

3.4 Serial Interface Configuration Tool

The module provides AT command assessment under assistant command mode, the tool can also complete bulk editing on the factory parameters settings and user parameters settings. Software provides open source, customers can also independently design.

Select the module corresponding serial interface and click Open, the module enters an assistant command mode. After successfully entered, user can execute the corresponding

commands. The interface is shown as below: For details, refer to "RAK415 Configuration Tool User Guide.pdf.

Figure 3-9 AT Configuration Page

3.5 Dual Socket Applications

The module supports opening sockets for two-way communication to meet customer demand for multi-sockets. The following shows how to configure router and open dual sockets from the factory mode. One socket is to establish TCP server for local access. The other one is to create a TCP client for LAN server or Extranet/Internet server access.

1. create a TCP server in LAN, 192.168.1.104:12345.

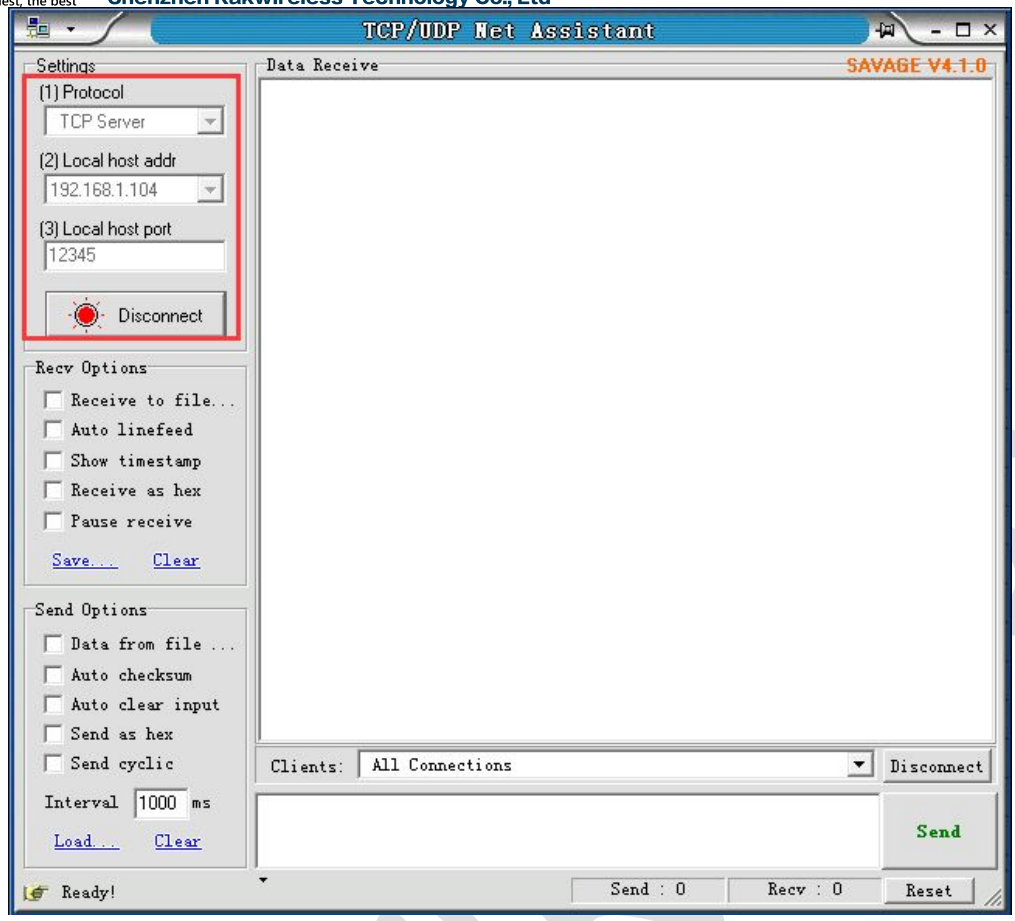

Figure 3-10 TCP Server in LAN

2 . Enter into the module factory AP, adding its WEB, at Home page select the operating mode: STA mode. Click “Save” butto.

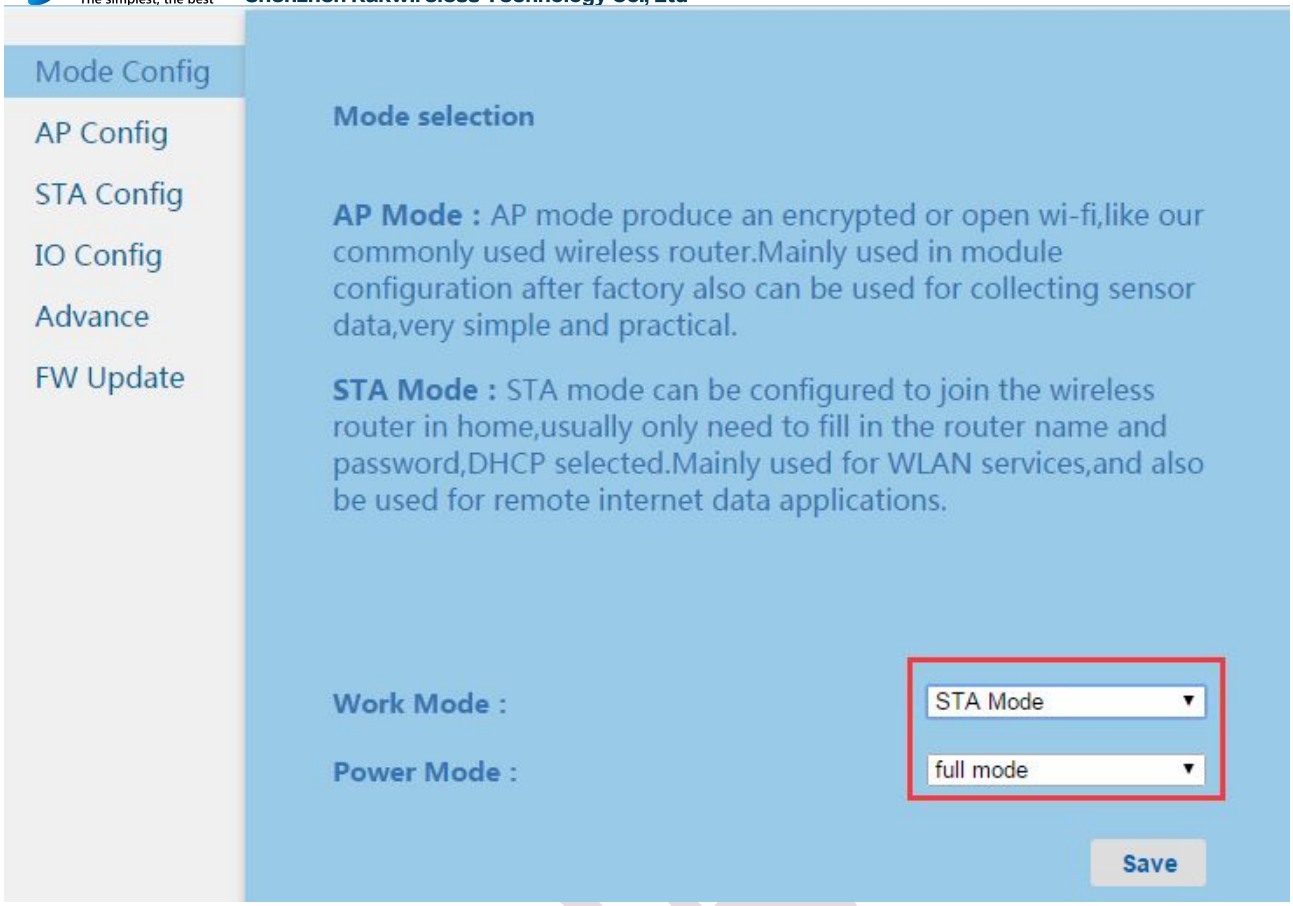

Figure 3-11 STA Mode

3．Then into the STA Settings page, click to scan, select the corresponding routing, confirm it and return, a password is prompted to fill in.

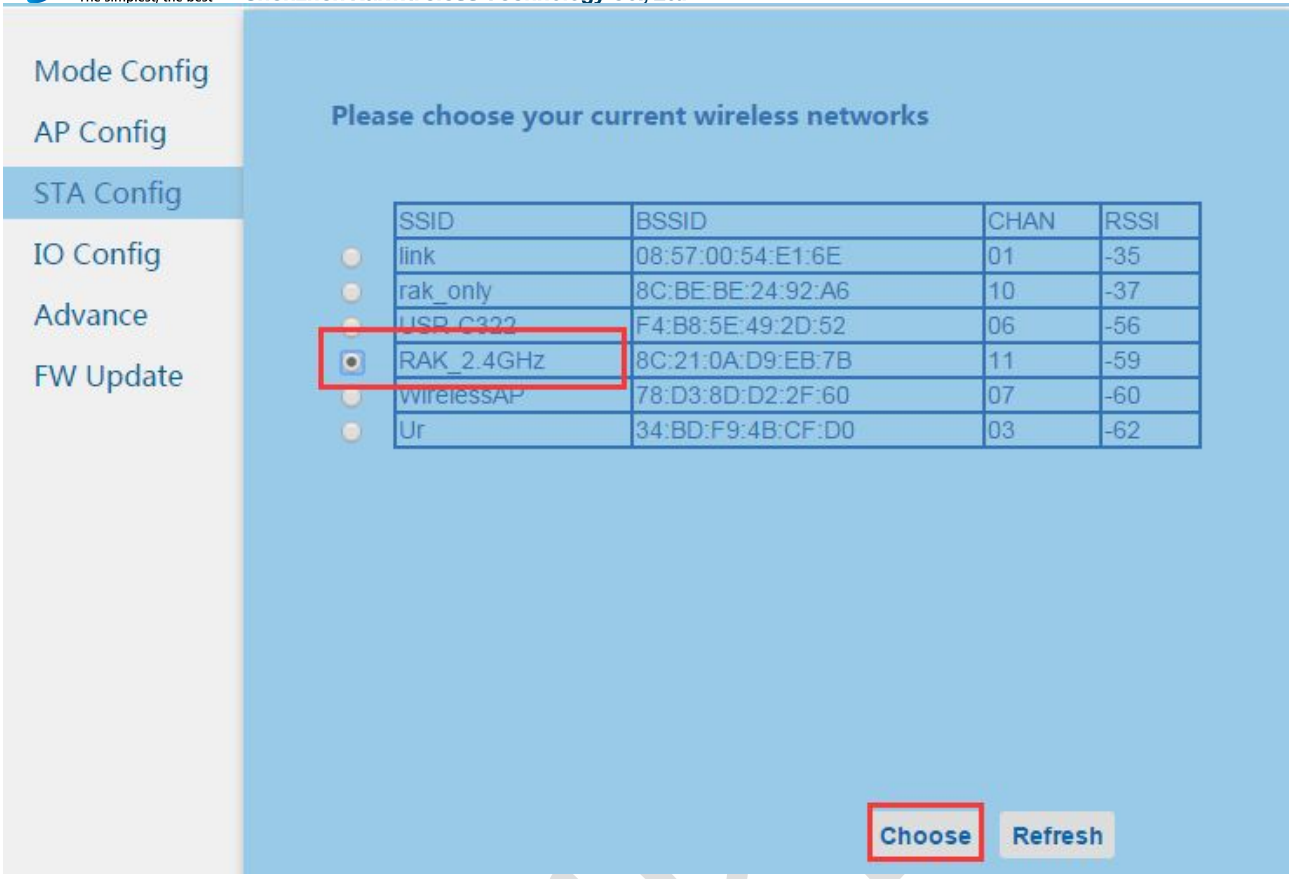

Figure 3-12 Select Specified Router

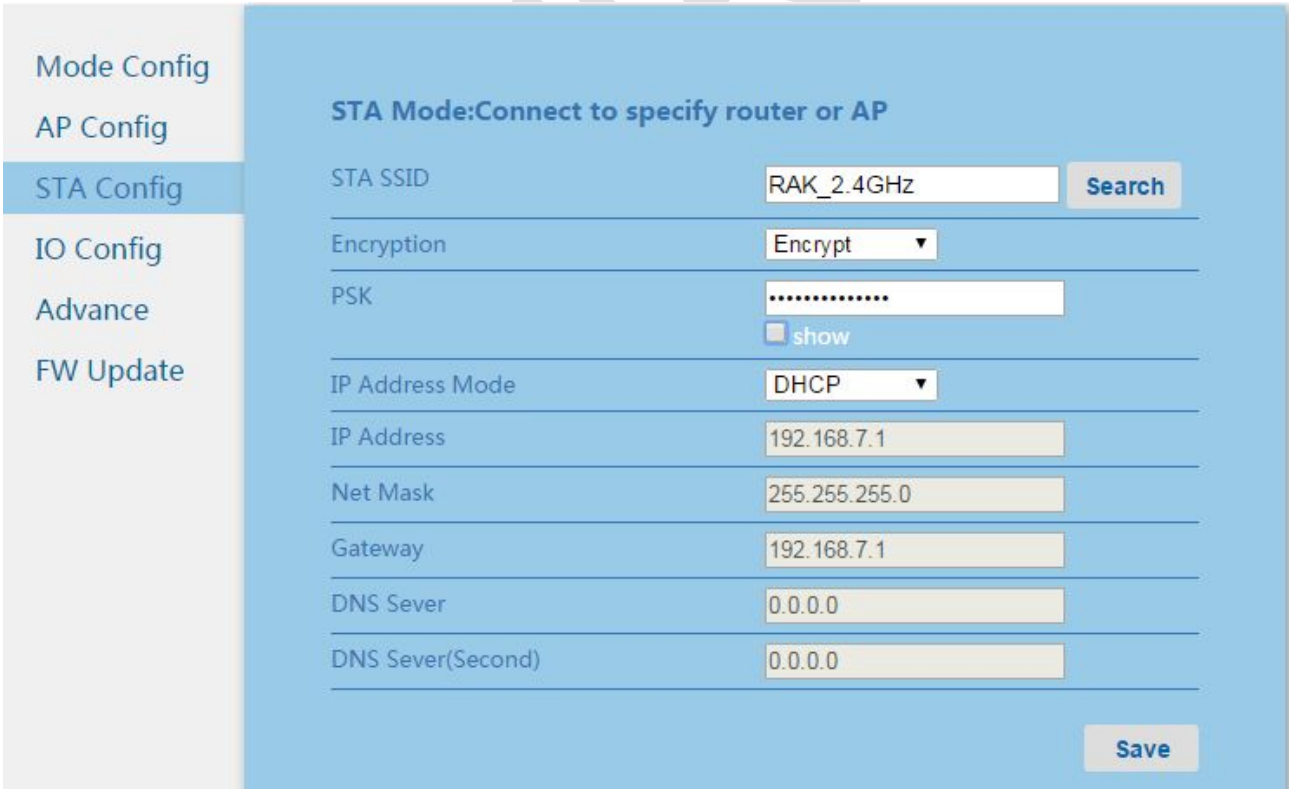

Figure 3-13 Fill in Password

4．Now, configure IO communication socket, open dual sockets, set socketA to TCP server, local port 25000, ignore the target server address and port number. set SocketB to TCP client,

with the server IP 192.168.1.104, server port number 12345. Save and restart.

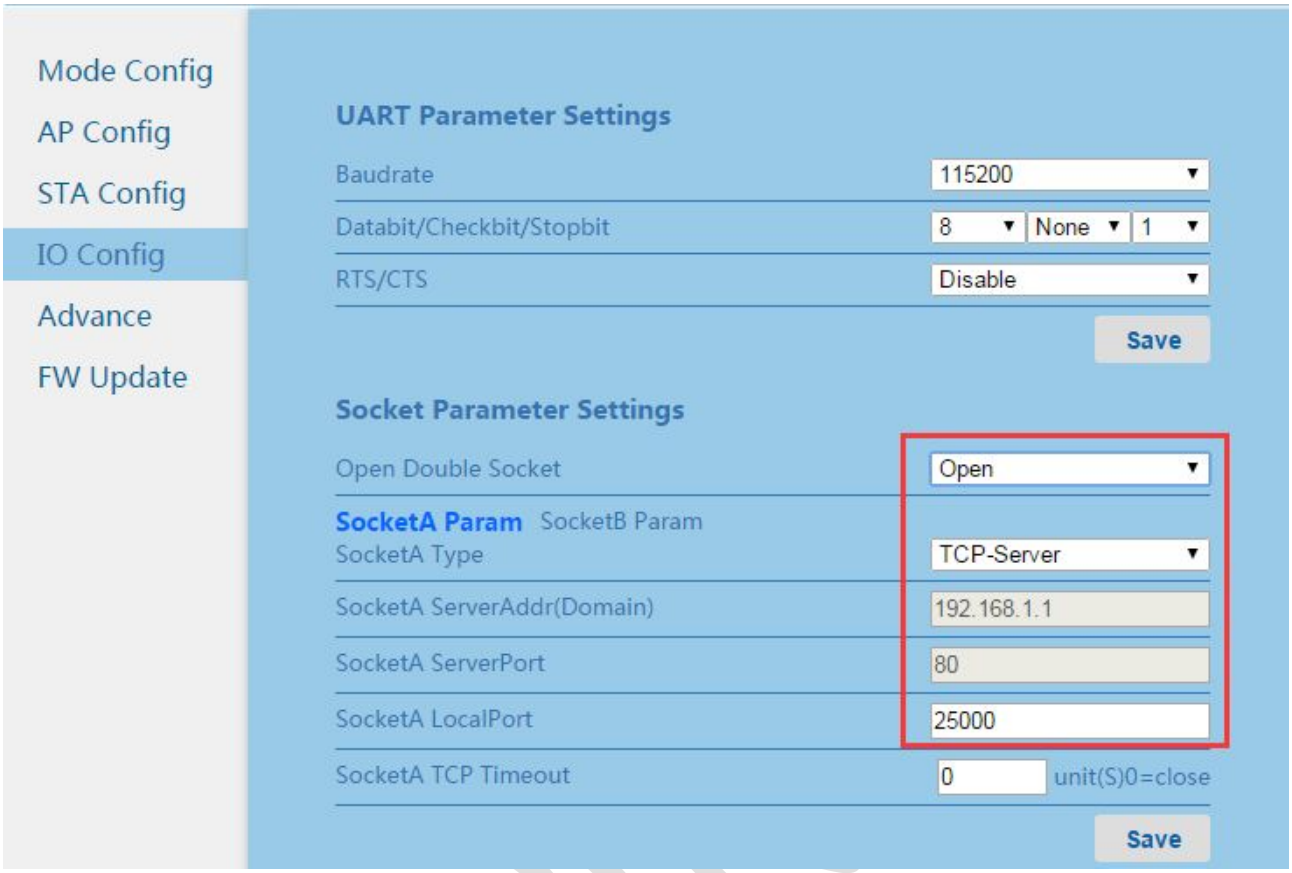

Figure 3-14 Socket A Settings

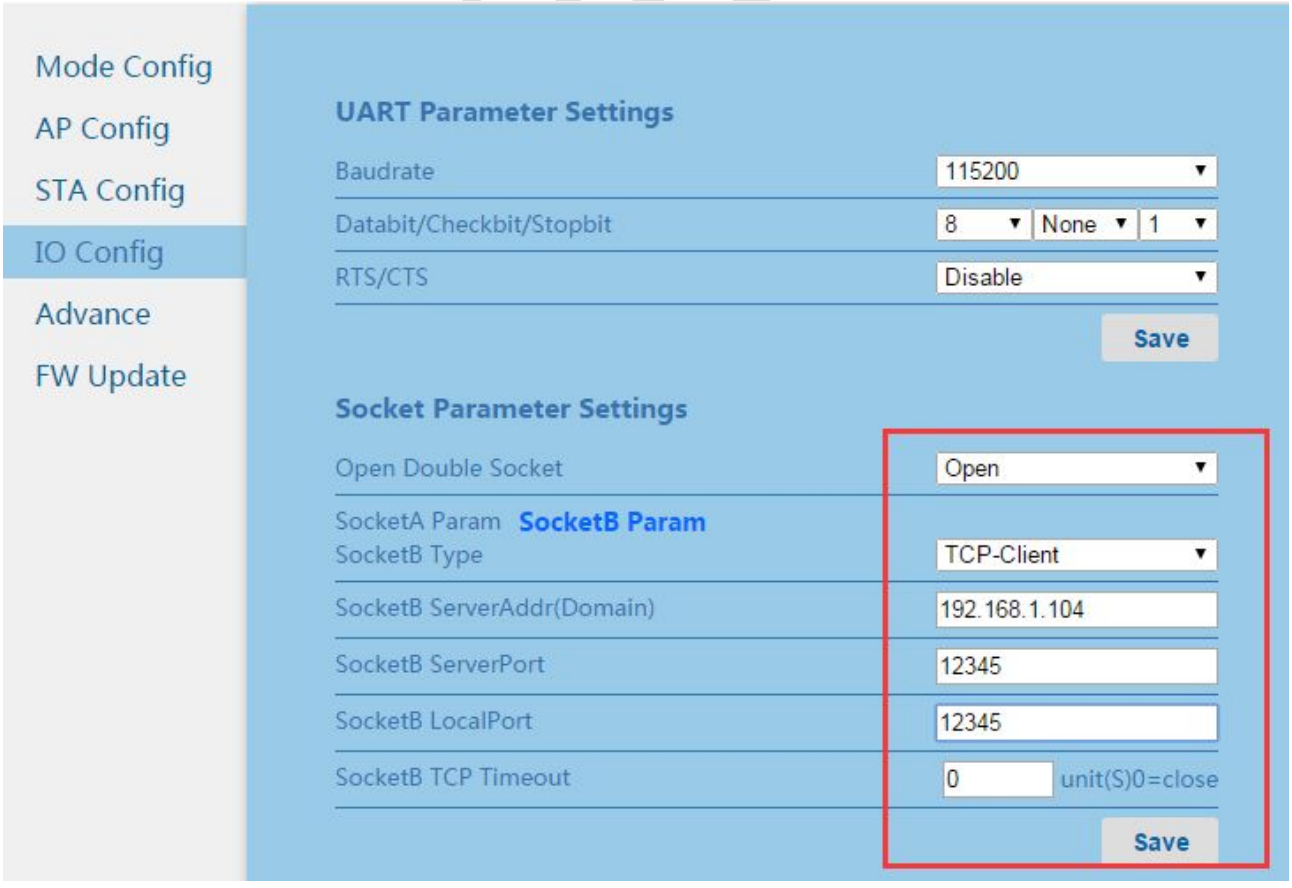

Figure 3-15 Socket B Settings

5．After the restart, until the link light on the development board starts flashing, the module is connected to the specified router, then there is a client connected to SocketB 192.168.1.130:12345 this is the module TCP connection. Verify it by opening module WEB page, from the browser enter 192.168.1.130(You can use “Wireless Scan Configuration Tool” to scan). Then open the STA section.

Figure 3-16 Module IP

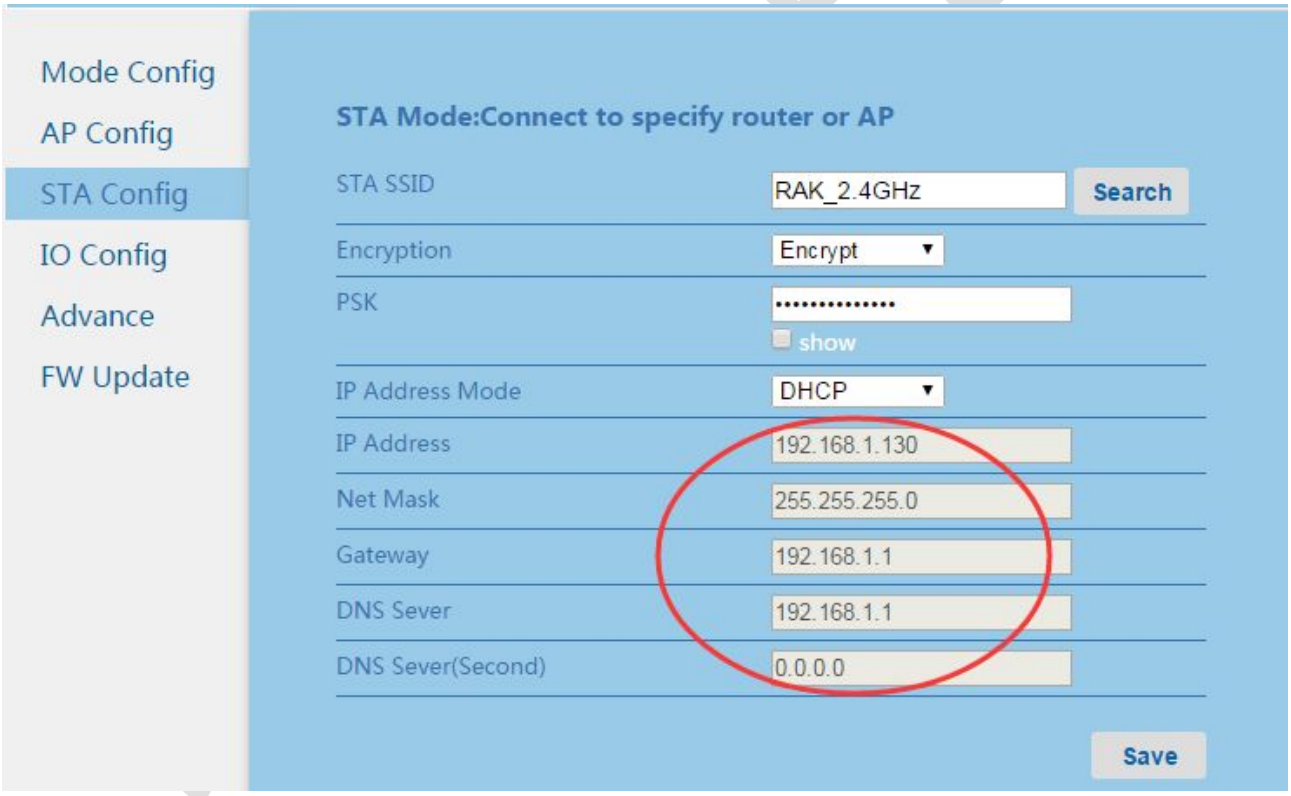

Figure 3-17 Assigning IP

6．Create another TCP client on the “TCP / UDP Net Assistant” connecting to module TCP server, build SocketA, 192.168.1.130:25000.

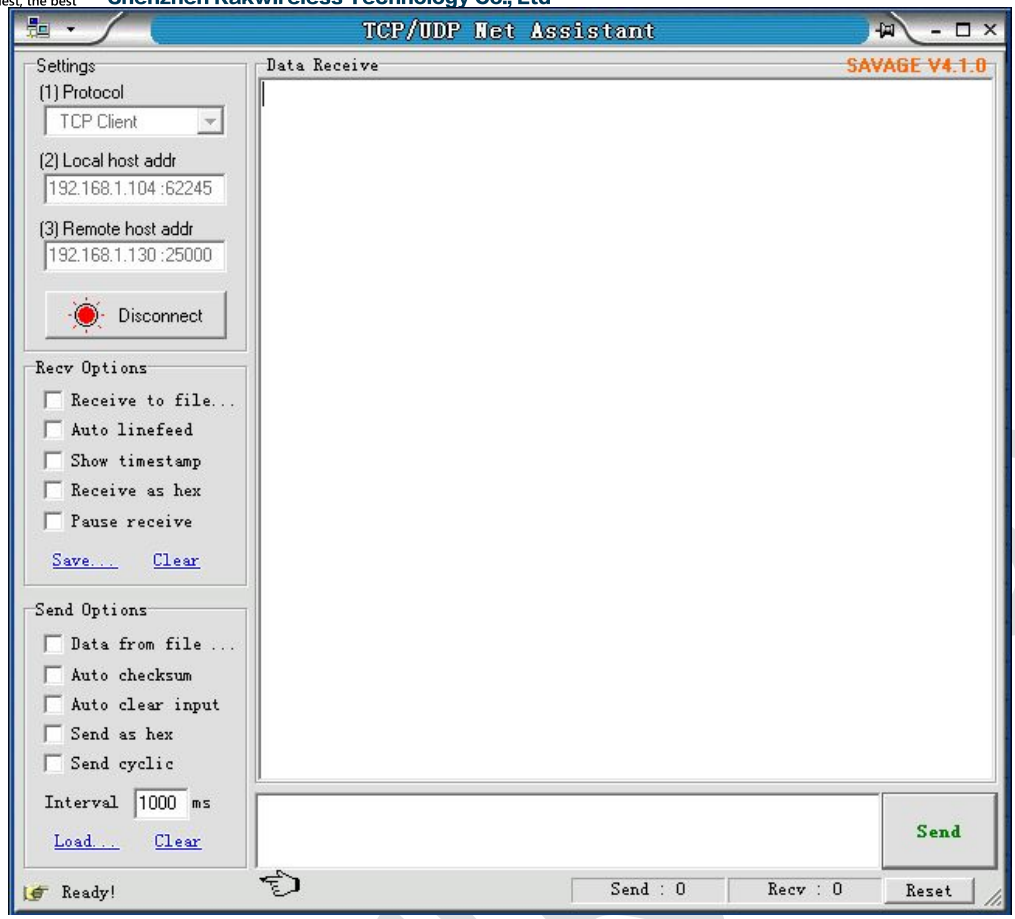

Figure 3-18 Create SocketA Established

7 . Now, conduct a dual socket pass-through demonstration, SocketA sends"WELCOME TO RAK", the serial port received "S0WELCOME TO RAK", the serial replied with adding S0 "S0welcome to rak", the tool received"welcome to rak"that means the serial and network completed a pass-through. Similarly repeat the above process by socketB,the serial replied with adding S1.

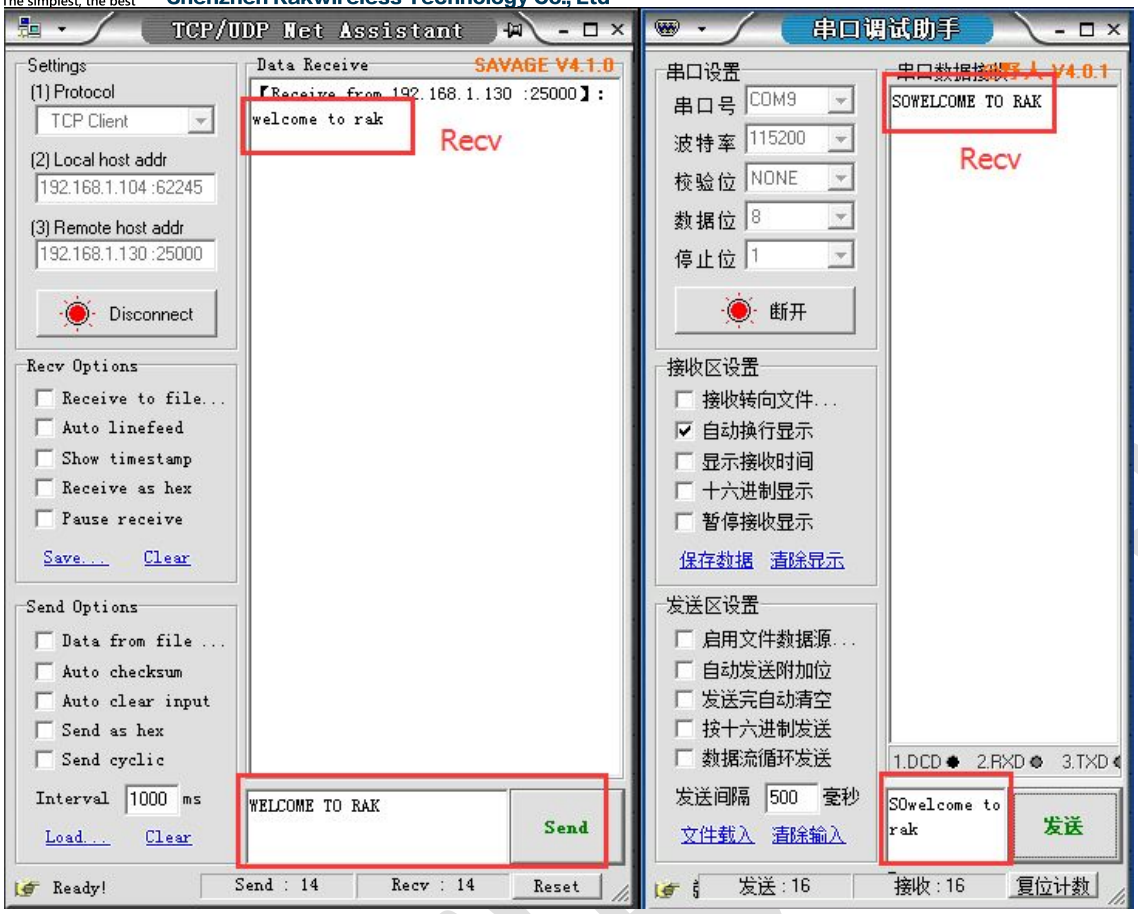

Figure 3-19 Socket ADemonstration

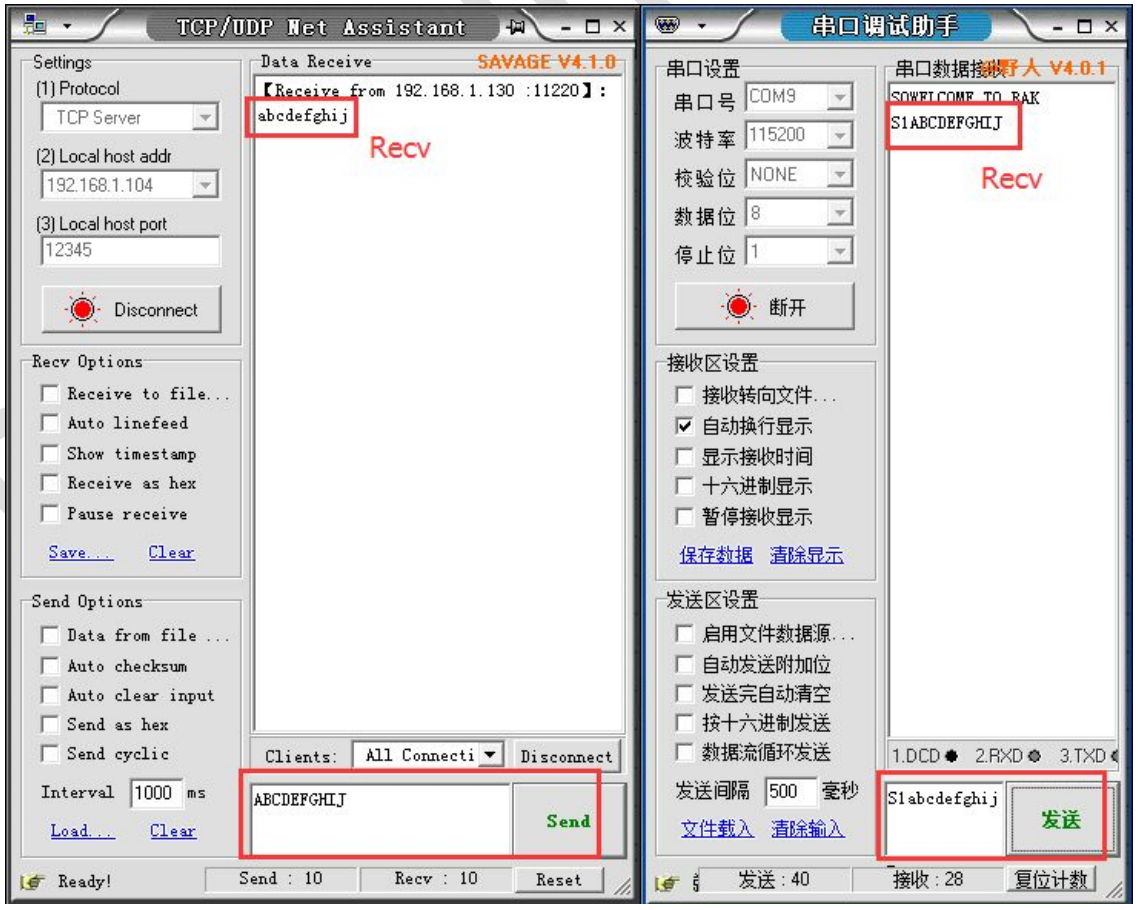

Figure 3-20 SocketB Demonstration

3.6 EasyConfig Functional Demonstration

Module supports Easyconfig connection, simply press the button on the module, the module will connect user’ s phone to the network specified, open the configuration software provided, wait a few seconds, the module will automatically connect to a specific network.

1 . Phone connect to the router, open a easyconfigdemo APP, if the router encryption, enter the router password.

2 . Click Default / Easyconfig button,the module (Link) networking light starts flashing, meaning it entered the configuration mode.

3 . In APP screen, click "Start" button to start a key configuration. wait a few seconds, Link light stops flashing, and light again. MAC address of the module pops up on the phone.

Note: when user confirms the choice of EasyConfig functionality, it is recommended connect the module Link pin with LED indicator.

If the module Link light is on, but there is no return with the MAC address of the phone, it is primarily because the module is already networked, but DHCP IP is not assigned. Check signal value of the router, and whether the DHCPServer is turned on or the route is busy(Too many clients added).

RAK provides Android and IOS client development libraries, and also provides customized services.

Figure 3-21 Android Configuration Page

4. AT command

4.1 Basic Flow Chart

The main working state of the module is pass-through mode, as well as assistant command mode, allowing parameters management and query. The module chooses mode according to the MODE pin level, which is high(default), it enters into the pass-through mode. If low, then turns into the assistant command mode. The module can enter into assistant command mode at all times.

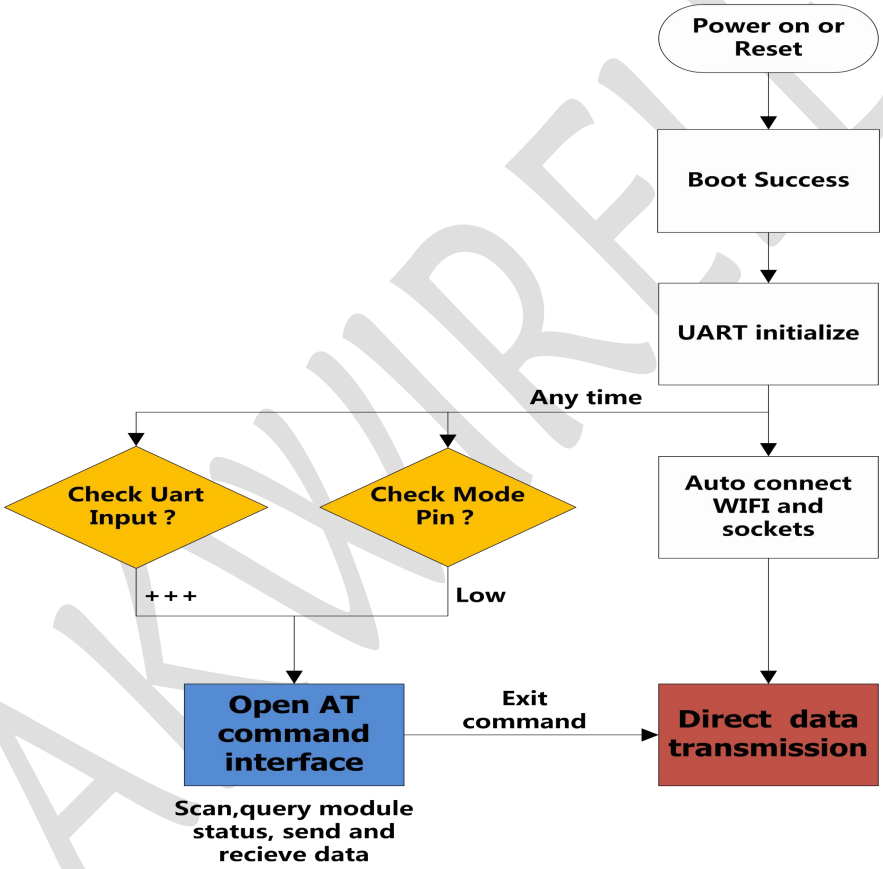

Figure 4-1 Basic Flow Chart

4.2 AT Command Set

Table 4-1 AT Command Set

AT Command	Description
Module Management Commands	
at+ascii=<mode>\r\n	Open ASCII display
at+mac\r\n	Query Module MAC address
at+easy_txrx\r\n	Enter pass-through mode

at+version\r\n	Check software version
at+reset \r\n	Reset module
at+restore\r\n	Restore factory settings
at+m_status\r\n	Query module's status
Parameter Configuration Commands	
at+write_config=configuration parameter length,configuration parameter length \r\n	Write user configuration
at+read_config\r\n	Read user configuration
at+read_setting\r\n	Read user advanced configuration
at+read_restoreconfig\r\n	Read factory configuration
at+read_restoresetting\r\n	Read factory advanced configuration
at+write_restoreconfig= configuration parameter length , configuration parameter\r\n	Modify factory configuration
at+copy_cfg	Copy user profile configuration to factory
AP SAT Operating Commands	
at+con_status\r\n	Query AP connection status
at+rssi\r\n	Query STA wireless signal strength
at+scan=<channel>,<ssid>\r\n	Scan wireless networks
at+get_scan=<scan_num>\r\n	Obtain specified number of network information
at+easy_config\r\n	Module enters one-key configuration mode
at+wps\r\n	WPS functionis enabled, joined specified router
at+ipconfig\r\n	Query the current IP information of module
at+ping=<host>, <count>, <size>\r\n	Ping network host command
at+tcp_status=0\r\n	Query TCP connection status
at+apconfig=<contry code>\r\n	AP Advanced Settings
Send and Receive Data Commands	
at+send_data=0,dest_port,dest_ip,datalen,databuffer\r\n	Send data from SocketA
at+recv_data=0,dest_port，dest_ip，datalen,databuffer\r\n	Receive data from SocketA

4.3 AT command format

Host to module :

at+<command>=<para 1>, <para 2>,.....<para n>\r\n

All AT commands, including parameters are ASICII code,

e.g. at+scan=0,TP-LINK_2.4GHz\r\n

After each command has been executed, the module will send a return value in the following

format

1) If the command is executed successful, the return value

OK\r\n or OK<para 1><para 2>.....<para n>\r\n

Note:

In addition to OK, the other parameters are in hexadecimal, for example,

OK\r\n HEX=4F 4B 0D 0A----------No parameter

OK@\r\n HEX=4F 4B 64 0D 0A----------parameter=0x64

2) If the command failed, the return value

ERROR<code>

Note:

1. ERROR is ASCII code, <code> hexadecimal, for example,

ERROR ?\r\n HEX=45 52 52 4F 52 FE 0D 0A----------<code>=oxFE

AT command format introduction：AT command begins with"at +" (lowercase), ends with "\ r \ n", the maximum length is 80 bytes, all commands beginning with any other format are wrong.

2. All AT Syntax above does not apply to the Receive data commands "at + recv_data" and"at + send_data", for details, please refer to "at + recv_data", "at + send_data".

4.4 Open Assistant Command

Open Assistant Command Mode

Open the assistant command interface in pass-through mode, similar to handshake way.

1．PC (master MCU) sends"+++", the request goes to the command mode。

2．Set timer 200ms, and wait for module returning"U" (0x55). If the module is not returned within the specified time, the timer of 200ms is sent again

Send "+++" for request to enter the command mode, till the module successful is returned with"U" (0x55). This indicates that the module is ready to enter the command mode, waiting for the final confirmation (wait for 3S).

3．PC (master MCU) receives a "U" (0x55), and sends within 3S the module the final confirmation, with"U" (0x55). Module receives this confirmation and return "OK" entering the command mode. If module did not receive the confirmation within 3S, module will exit standby mode, waiting for re-request command, then repeat steps 1~3.

Figure 4-2 Enter command timing

4.5 Module Management Commands

4.5.1 Open ASCII Display

Command:

at+ascii=<mode>\r\n

Parameter:

mode = 0 close ASCII display (The default setting)

mode = 1 open ASCII display

ASCII display is turned on or off,the module sends a command format has no effect.

Return:

OK\r\n

ERROR<code>\r\n

4.5.2 Query Module MAC address

Command:

at+mac\r\n

Description:

Check MAC address of the module

Return:

OK<Mac>\r\n

ERROR<code>\r\n

4.5.3 Enter pass-through mode

Command:

at+easy_txrx\r\n

Description:

Send the command to enter pass-through mode

Return:

OK\r\n

ERROR<code>\r\n

4.5.4 Query software version

Command:

at+version\r\n

Description:

Check the current version of the firmware, including the host version and WLAN version

Return:

OK<2.0.5>\r\n

ERROR<code>\r\n

4.5.5 Reset module

Command:

at+reset \r\n

Description:

Reset module

Return:

OK\r\n

ERROR<code>\r\n

4.5.6 Restore factory settings

Command:

at+restore\r\n

Description:

Restore factory parameter mode of module

Return:

OK\r\n

ERROR<code>\r\n

4.5.7 Query module's status

Command:

at+m_status\r\n

Description:

Query the status of each period module.

Note: It returns the data length is 32 bits, HEX display, low data bit first.

Return:

OK<code>\r\n

ERROR<code>\r\n

Note:

STATUS_MASK(0) //Successful initialization, start scanning

STATUS_MASK(1) //Scan success, begin to connect

STATUS_MASK(2) //ap created successfully

STATUS_MASK(3) //Start DHCP

STATUS_MASK(4) //Network connection is successful

STATUS_MASK(5) // SOCKET0 Connection Status

STATUS_MASK(6) // SOCKET1 Connection Status

STATUS_MASK(7) // Device is connected

STATUS_MASK(8) // AP = 1 STA = 0

STATUS_MASK(9) //Start easyconfig

STATUS_MASK(10) //Start WPS

STATUS_MASK(11) // Start the upgrade

STATUS_MASK(12) // Reserve

STATUS_MASK(13) // Reserve

STATUS_MASK(14) // Reserve

STATUS_MASK(15) // Reserve

For example:

Return to "OK0401", the high data bit is "01", a low data bits are "04", the binary number is "0000 0001 0000 0100", the corresponding status is: AP mode, AP created.

4.6 Parameter Configuration Commands

The following configuration and its parameters of keywords Please see theappendix 1

4.6.1 Write user configuration

Command:

at+write_config=configuration parameter length, configuration parameter\r\n

Description:

Write the user configuration parameters at one time, user sends all of the configuration

parameters to the module including network mode, power consumption mode, network parameters, serial port and communication parameters. User can also enable and disable the factory advanced features, such as LAN discovery, WEBServer and AP / STA switching mechanism.

For example:

at+write_config=622,wifi_mode=AP&power_mode=full&ap_channel=1&ap_ssid=RAK415_000001&ap_secu_en=0.....\r\n

return：

OK\r\n

ERROR<code>\r\n

4.6.2 Read user configuration

Command:

at+read_config\r\n

Description:

Read all user configuration parameters at one time and locate into the corresponding structure.

return：

OKwifi_mode=AP&power_mode=full&ap_channel=1&ap_ssid=RAK415_000001&ap_secu_en=0.....\r\n

ERROR<code>\r\n

4.6.3 Read user advanced configuration

Command:

at+read_setting\r\n

Description:

Read user advanced configuration parameters at one time and locate into the corresponding structure.

return：

OKcountry_code=US&ap_bdcast_en=1&web_func_en=1&udp_func_en=1&link_multi=1&web_switch=0&web_en=1&mode_pin=wps&net_switch=0&sta_beacon=100\r\n

ERROR<code>\r\n

4.6.4 Copy user parameters

Command:

at+copy_cfg\r\n

Description:

Copy the user parameters to the factory parameters.

return：

OK\r\n

ERROR<code>\r\n

4.6.5 Read factory configuration

Command:

at+read_restoreconfig\r\n

Description:

Read all the factory configuration parameters at one time and put these factory configuration parameters into the corresponding structure.

The AP established during factory configurationis the name of module,as default RAK415_XXXXXX .which can also be configured by the factory modification.

return：

OKwifi_mode=AP&power_mode=full&ap_channel=1&ap_ssid=RAK415_000001&ap_secu_en=0.....\r\n

ERROR<code>\r\n

4.6.6 Read factory Advanced Configuration

Command:

at+read_restoresetting\r\n

Description:

Read the factory advanced configuration parameters at one time and put these factory configuration parameters into the corresponding structure.

return：

OKcountry_code=US&ap_bdcast_en=1&web_func_en=1&udp_func_en=1&link_multi=1&web_switch=0&web_en=1&mode_pin=wps&net_switch=0&sta_beacon=100\r\n

ERROR<code>\r\n

4.6.7 Modify factory configuration

Command:

at+write_restoreconfig=configuration parameter length, configuration parameter\r\n

Description:

Modify the default configuration parameters, also customers can modify the default configuration parameters as required.

For example:

at+write_restoreconfig=602,wifi_mode=AP&power_mode=full&ap_channel=1&ap_ssid=RAK415_000001&ap_secu_en=0.....\r\n

return：

OK\r\n

ERROR<code>\r\n

4.7 AP & SAT Operating Commands

4.7.1 Query AP connection status

Command:

at+con_status\r\n

Description:

Check the connection status under AP or STA mode.

Return:

OK<code>\r\n

code=0 Not connected

code=1 Connected

ERROR<code>\r\n

4.7.2 Query STA wireless signal strength

Command:

at+rssi\r\n

Description:

Check wireless signal strength under STA.

Return:

OK<RSSI>\r\n

ERROR<code>\r\n

Note:

When there is no network connection, the command is invalid.

When module is as the AP, the default is-0db.

4.7.3 Scan for wireless networks

Command:

at+scan=<channel>,<ssid>\r\n

Description:

Scan the surrounding wireless networks.

For example:

at+scan=0 \r\n-------------------------Scanning all channels

at+scan=0,RAKwireless\r\n------------ Scanning a wireless networkcalled "RAKwireless" in all channels in the network

at+scan=8,RAKwireless\r\n------------ Scanning a wireless networkcalled "RAKwireless" in channel 8 in the network

at+scan=6 \r\n------------------------- Scanning all SSID in channel 6

Return:

OK<Num>\r\n

ERROR<code>\r\n

4.7.4 Get wireless network

Command:

at+get_scan=<scan_num>\r\n

Description:

Read the scanned information via command, the command must be usedafter"at + scan".

Note:

1．If user does not need to get the wireless network information, this command can be omitted!

2．All information scanned has been read. If read again, the module will return error -2, at this point, command "at + scan"is needed to rescan!

3．This command is invalid in the mode where at + ascii = 1 !

Table 4-2 Command Returns

参数	格式	长度(byte)	说明							
命令执行成功										
OK	ASCII	2	获取信息正确							
<SSID>	HEX	33	SSID							
<BSSID>	HEX	6	BSSID							
<CHANNEL>	HEX	1	信道							
<RSSI>	HEX	1	信号强度(负值)							
<Security Mode>	HEX	1	加密方式							
			bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
			WPA2	WPA	WEP	802.1X	PSK	WEP	TKIP	CCMP
\r\n	ASCII	2	结束符							
命令执行失败										
ERROR	ASCII	5	错误							
<CODE>	HEX	1	0XFE=-2				1、扫描信息已经全部读取			
\r\n	ASCII	2	结束符							
备注	*<Security Mode>中 bit=1 时加密方式有效，bit=0 时加密方式无效，如果多位同时为 1，则为混合加密方式*									

4.7.5 EasyConfig net-connection

Command:

at+easy_config\r\n

Description:

If this command is sent, module enters into EasyConfig configuration mode, waiting for the phone to send configuration information. Customers can check whether the connection is on via Query network status command.

Return

OK\r\n //enter configuration mode

ERROR<code>\r\n

4.7.6 WPS configuration commands

Command:

at+wps\r\n

Description:

If this command is sent, module enters into WPS configuration mode, meanwhile press the WPS button on the router. Customers can check whether the connection is on via Query network status command.

Return

OK\r\n //enter the WPS configuration mode

ERROR<code>\r\n

4.7.7 Query IP status

Command:

at+ipconfig\r\n

Description:

Query the current IP information of module, including MAC address, IP address, subnet mask, gateway, DNS server.If the DHCP is set, but IP is not assigned yet, check out the module address is 127.0.0.1.

Return:

Table 4-3 IP command returns

Parameter	Format	Length	Description
The command is completed successfully			
OK	ASCII	2	Query successfully
<MAC>	HEX	6	Module MAC address
<IP>	HEX	4	IP address
<NETMASK>	HEX	4	subnet mask
<GATEWAY>	HEX	4	Gateway
<DNS SERVER1>	HEX	4	DNS server 1
<DNS SERVER2>	HEX	4	DNS server 2
\r\n	ASCII	2	Terminator
Command execution error			
ERROR	ASCII	5	error
<CODE>	HEX	1	0XFE=-2 Query Failed
\r\n	ASCII	2	Terminator
Remark			

4.7.8 Ping command

Command:

at+ping=<host>, <count>, <size>\r\n

Description:

Run the ping command to test network connectivity.

Return:

OK\r\n

ERROR<code>\r\n

Table 4-4 ping command returns

<HOST>	Specified host
<COUNT>	The number of packets, the default value is 1. (optional)

<SIZE>	Packet size, maximum packet is 1000bytes, default is 64bytes. (Optional)

4.7.9 Query TCP connection status

Command:

at+tcp_status=uuid\r\n

Description:

Check TCPClient connection status for the corresponding uuid. uuid = 0 indicates socketA; uuid = 1 means that socketB

Return:

OK\r\n

code=0Not connected

code=1 Connected

ERROR<code>\r\n

4.7.10 AP Advanced Settings

Command:

at+apconfig=<contry code>\r\n

Description:

This command is used to set wireless AP parameters, including country code, inactive time, beacon frames interval, DTIM threshold.

Table 4-5 Parameter Description:

Parameter	Value	Description
<contry code >	Country code	Country code, i.e., China (CN) (US)

Return:

OK\r\n

ERROR<code>\r\n

4.8 Send and Receive Data Commands

4.8.1 Send data

Command:

at+send_data=uuid,dest_port,dest_ip,datalen,databuffer\r\n

Description: Send data uuid of the corresponding Socket (A, B).

Parameter Description:

uuid=0 Indicates socket A ; uuid=1 Indicates socket B

dest_port Indicates the target port (UDP server module as the initiative to send data to

the target host)

dest_ip Indicates the target IP (When other types,you can fill 0)

datalen Indicates the received data length

databuffer Indicates the received data content

Example：

at+send_data=0,12345,192.168.1.100,10,1234567890\r\n

or at+send_data=0,0,0,10,1234567890 \r\n

Return:

OK\r\n

ERROR<code>\r\n

4.8.2 Receiving Data

Command:

at+recv_data=uuid,dest_port,dest_ip,datalen,databuffer \r\n

Description:

Received the uuid data of corresponding Socket (A, B) , when ASCII display is not opened, the received data is in hexadecimal and arranged in the same order.When programming is recommended to use ASCII display disabled mode.

Parameter Description:

uuid=0 Indicates socket A ; uuid=1 Indicates socket B

dest_port Indicates the target port

dest_ip Indicates the target IP

datalen Indicates the received data length

databuffer Indicates the received data content

4.9 Appendix-1 Module configuration parameter table

Table 4-6 Read/write module configuration of keywords and parameters

keywords	parameters
Mode select	
wifi_mode	AP mode : AP STA mode : STA
power_mode	Full power : full Auto save : save Deep sleep : deep
AP mode parameters	

ap_ssid	RAK415_AP_SSID (32B ASCII)
ap_channel	6 (1-13)
ap_secu_en	open: 0 security: 1
ap_psk	1234567890
ap_ipaddr	192.168.7.1
ap_netmask	255.255.255.0
ap_bdcast_en	Not broadcast: 0 (hide) broadcast: 1
country_code	CN (China) Support 1 to 13 channels JP (Japan) Support 1 to 14 channels US (USA) Support 1 to 11 channels AUTO: Scan the country code of routers around automatically,then module will set the appropriate country code
STA mode parameters	
sta_ssid	RAK_AP_STA
sta_secu_en	open: 0 security: 1
sta_psk	1234567890
sta_dhcp_en	static: 0 dhcp: 1
sta_ipaddr	192.168.1.100
sta_netmask	255.255.255.0
sta_gateway	192.168.1.1
sta_dnssever1	192.68.1.1
sta_dnssever2	0.0.0.0
sta_beacon	Employer beacon frame interval
UART parameters	
uart_baudrate	9600,19200,38400,57600,115200,230400,460800,921600
uart_datalen	8 (5-8)
uart_parity_en	none: 0 odd: 1 Even: 3
uart_stoplen	1 (1-2)
uart_rtscts_en	forbidden: 0 enable: 1 RS485/RTS: 2 (RTS as a transceiver pin, switch High level to send）
Socket parameters	
socket_multi_en	One Socket: 0 Two Socket: 1
SocketA parameters	
socketA_type	tcp,ltcp,udp,ludp (TCPclient，TCPsever，UDPclient，UDPsever)
socketA_localport	25000 (1-65535)
socketA_destip	192.168.1.101
socketA_destport	25000 (1-65535)
socketA_tcp_timeout	disable: 0

	enable: 1-600 (S)
SocketB parameters	
socketB_type	tcp,ltcp,udp,ludp (TCPclient，TCPsever，UDPclient，UDPsever)
socketB_localport	25001 (1-65535)
socketB_destip	192.168.1.101
socketB_destport	25001 (1-65535)
socketB_tcp_timeout	disable: 0 enable: 1-600 (S)
Module name	
module_name	RAK415 (16B)
module_group	RAK415 (16B)
WEB Setting	
user_name	admin (16B)
user_password	admin (16B)
web_en	0: english default 1: Chinese default
Additional features (optional)	
mode_pin	Wps function: wps Cmd function: easy
net_switch	disable: 0 enable: 1 (when the net connection is loss ,module switching network on the factory and user parameters, Once a minute)
web_switch	Use rak web: 0 Use customer web: 1
web_func_en	Disable WEB config: 0 Enable WEB config: 1
udp_func_en	Disable UDP discover: 0 Enable UDP discover: 1
link_multi	After DHCP successful,LINK lights: 0 Enable multi-state LINK lights indicate: 1

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6. Revision History

Version	Author	Modification	Date
V1.0		Initial Draft	2014-01-11
V1.1		Finished modification and release	2014-01-20
V1.2		Modified partial text editing	2014-02-17
V1.3		Added WPS function Added workaround to cannot connecting to router Added open and close action to additional features	2014-02-25
V1.4		Replace the 415 development board photos	2014-03-01
V1.5		Modify the AT command to at+apconfig=<contry code>\r\n at+send_data=0,dest_port,dest_ip,datalen,databuffer \r\n optimize the minimum power consumption to 1-2uA	2014-03-28
V1.6		Increase to maintain the lowest power interconnection deleting PCB size chart Modify Pull into the sleep time is 2S	2014-6-09
V1.7		Add user parameters appendix factory	2014-07-01
V1.8		Update the contact way,Update the document format	2014-08-22
V1.9	Lampo	Update the chematics	2014-09-03
V1.10	Lampo	Deletes chematics and package diagram, add notes ASCII display, updated tools image Modify transmit and receive data descriptions	2014-09-12
V1.11	Lampo	Modifications back to the original pin number	2014-11-13
V2.0	Lampo	1.Added three commands,at + read_restoresetting, at + read_setting and at + m_status 2.Added link_multi, country_code and sta_beacon parameters 3.Update table describe the development board, hardware description delete, modify some other description. 4.Update the contact way,Update the document format 5.Adjust the position of a flow chart 6. Updated pictures.	2016-02-29