RAK477 UART WiFi Module

Instruction Manual V1.1

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Content

1. Rapid usage

1.1 Introduction to the development board

RAK477 serial port transparent transmission module focuses on transparent transmission supported by AT Command; it has the advantages of simple operation and rich functions and can meet the requirements of various kinds of customers. First, let's see the usage of RAK477 evaluation suits.

Function	Name	Description
Module	U3	RAK477 transparent transmission WIFI module
External Interface	Micro USB	Input power supplied DC5V, communication interface of USB to serial port
Key	Reset	Module reset key
	WPS/MODE	WPS function is to instantly configured to the network (match with the router’ s WPS)
	Default	1. Press the “greater than 3 seconds” module to recover to the Factory Defaults parameters 2. Press the “less than 1 second”, instantly configure the easyconfig mode
Pin	P2	UART and 232 interface
	P6	Reset, Link and other pins
Power Consumption pin	J1	Power consumption measurement interface
LED Indicators	POWER	Power Lamp
	STATUS	Start Running Indicator Lamp
	LINK	Network Indicator Lamp

Table 1-1: Development board source

Table 1-2: LED Definition

	Status	Link	Status
Function	Instant configuration	Flash interval of 200ms	Normally on
	Upgrading of hard wares	Flash interval of 50ms	
STA Mode	Unconnected	Normally off	Normally on

	Connecting to the network	Flash interval of 1 second	
	Getting IP	Flash interval of 2 seconds	
	The network is connected	Normally on	
	Socket event	Flash for three times	
AP mode	AP is not established	Normally off	Normally on
	AP is established, and not connected	Periodically on and off in 1 second	
	STA is connected	Normally on	
Factory Defaults Mode	Recovering Factory Defaults takes effect	Periodically on and off in 500ms	Periodically on and off in 500ms

Note:

- "Status" light is a start light, which is in the normally on status after the module starts regularly.
- After pressing the instant configuration key for less than 1 second, "Link" light flashes until the configuration is successful or of timeout.
- After pressing the recovering Factory Defaults key for more than 3 seconds, "Link" and "Status" are on and off at the same time, and automatically reset after 3 seconds.
- Coexistence of AP and SAT mode, the indicator lamps indicate jointly

1.2 The method for the module to reset to Factory Defaults

There is a "Default" key on the development board, which is used to reset to Factory Defaults for the module when the configuration is made by mistakes or the current configuration parameters are forgotten:

Press the "Default" key for over 3 seconds, the indicator lamp "Link" and "Status" are on and off at the same time, at this time, loose the "Default" key for 3 seconds, the module will reset to the Factory Defaults mode (establish AP by default, and the customer can modify the defaults parameters).

1.3 Inspection prior to powering on

The evaluation suits mainly include: antenna of Micro USB line, development board, IPEX connector interface. If the module is external antenna module, please plug in the antenna. Connect the module’ s serial port and computer’ s serial port (the USB to serial port of the computer).

1.4 The status after powering on

Normal phenomenon

After the module is powering on, the power indicator lamp (power lamp) lights on, next, the “Status” light is on (the “Status” pins output the low level), it shows that the module starts regularly.

If the “status” light is not on after powering on, please try to press the “Reset” key. If the light is always off, please contact the After-Sale Service.

Under the Factory Defaults mode of the module, an open AP network will be established after powering on, with the name of RAK477_AP_XXXXXX (XXXXXX is the rear six digits of the module's MAC address), IP address of 192.168.7.1, default opening of DHCPSever (the Factory Defaults can be modified). After the “Status” light is on, open the computer's wireless network, RAK477_AP_XXXXXX will be found in the wireless list, as shown below:

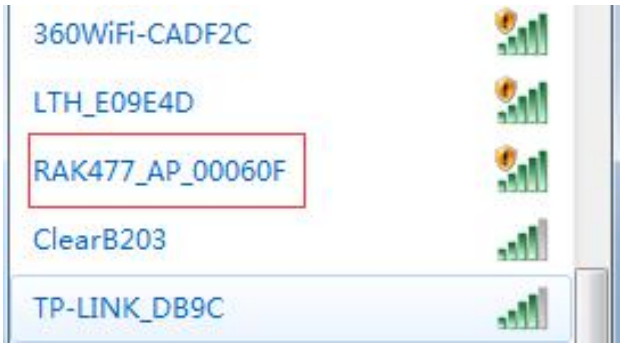


Figure 1-1: Factory Defaults AP scanning

1. Double click to join the network (at this time, “Link” will be normally on),

wait for well distributed IP address.

2. Through the mobile phone APP set the module serial port and socket parameters.

1.5 Transparent transmission data test

1. Open the serial port tools, select the COM port connected to the module. The default baud rate is 115200, data bit is 8, stop bit is 1, with no parity, no flow control. Open network debugging tools (TCP/UDP tool), establish TCP client to connect the IP and port of the other party (the default IP of the module is 192.168.7.1, the server port is 25000).

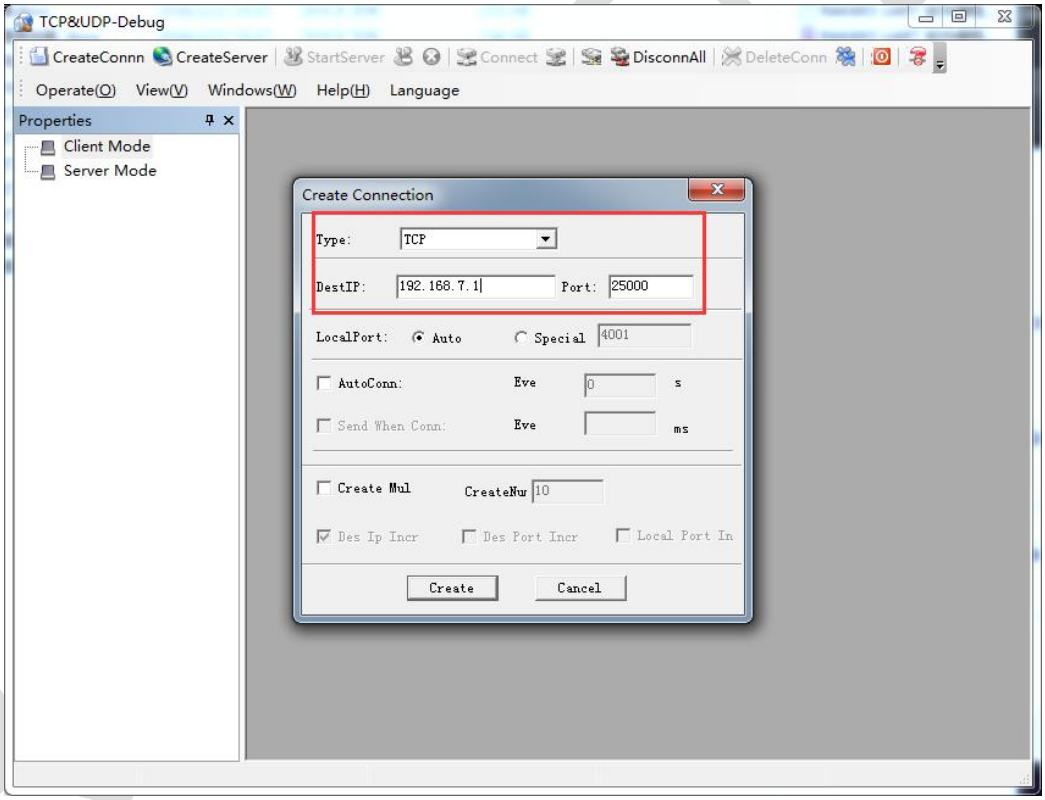


Figure 1-5: Establish TCP Client

2. After TCP is connected, the data can be sent to each other. At this time, the serial port of the module is changed into the virtual serial port of the network, and the serial port data and network data is interconnected.

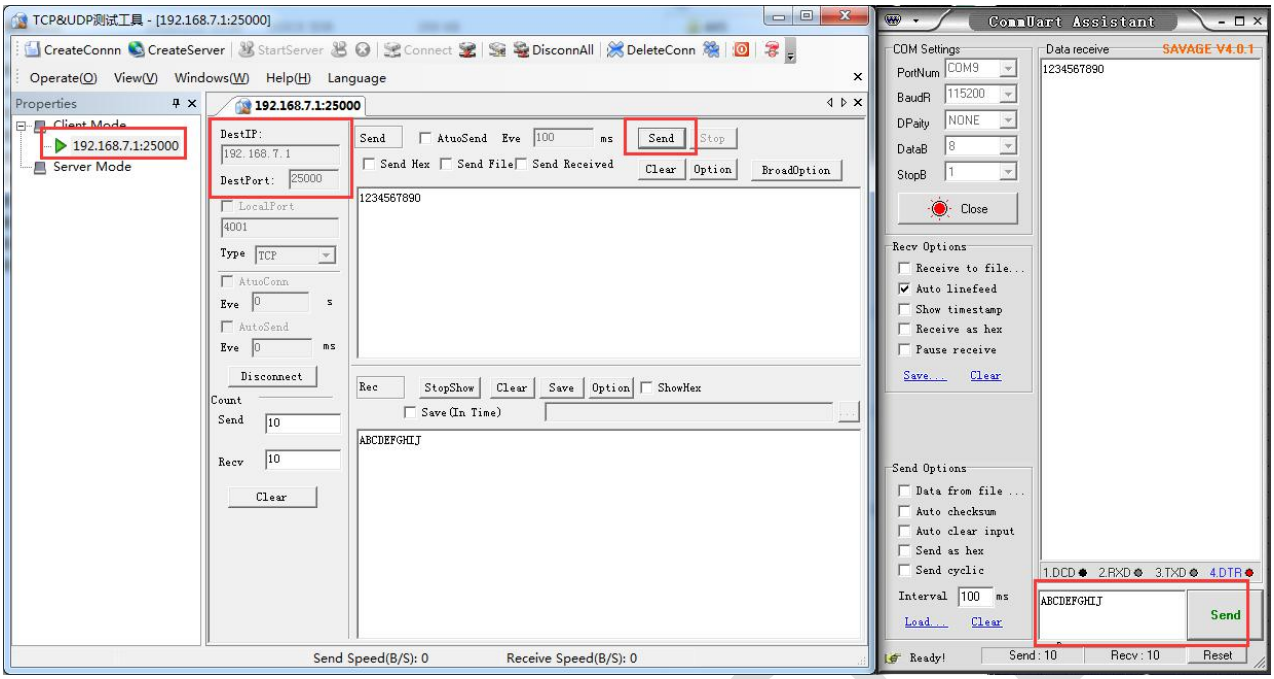


Figure 1-6: Factory Defaults mode transparent transmission test

2. Function features

2.1 Overview

RAK477 module is a Wi-Fi module that fully compliant with IEEE 802.11b/g/n wireless standards, It combines an ARM-CM3 MCU, WLAN MAC, a 1T1R capable WLAN baseband, and RF in the module. It have onboard antenna, and external antenna interface, RF output PIN also exist in the board. RAK477 internally integrated TCP / IP protocol stack, supporting numerous protocols such as ARP, IP, ICMP, TCP, UDP, DHCP CLIENT, DHCP SERVER, DNS and other etc. It supports AP mode, STA mode, AP+STA mode. It support rich AT command for all kinds of application, Users can easily and quickly use it to wifi networking and data transmission. It also support transparent transmission, easy to use by simply using the PC, APPs tool to work individually or in bulk for parameters configuration, and then module connects the serial ports and network for normal usage. The baud rate of module serial port is up to 921600bps, which can fully meet the low-rate applications.

In network part, RAK477 supports storing network parameters in the module, and reduce time connect to network. The module supports wireless network parameters configuration, supports wireless firmware upgrade. It also supports EasyConfig.

It also provides a bunch of configurable GPIOs which are configured as SPI ,UART, I2C, for different applications and control usage. RAK477 integrates internal 512K SRAM and 1MB flash for complete WIFI protocol functions.

2.2 Application fields

- Portable products
- Household appliance
- Industrial sensor
- POS terminal
- Building automation
- Logistics and freight management

- Household security and automation
- Medical field, for example, patients monitoring, medical diagnosis
- Measurement (parking meter, metering instrument, ammeter and the like)

2.3 Product features

- Application
  - Support at commands and transparent transmission mode
  - Support for multiple baud rate
  - Support wireless configuration and OTA upgrade firmware
  - Support the UART interface, OTW upgrade function
  - Support for fast networking, easyconfig, function
  - Support AP, STA, AP+STA Mode
  - Support proactively identifying devices in LAN

- Standards Supported
  - 802.11b/g/n compatible WLAN
  - 802.11e QoS Enhancement (WMM)
  - 802.11i (WPA, WPA2). Open, shared key, and pair-wise key authentication services
  - Light Weight TCP/IP protocol

- WLAN MAC Features
  - CMOS MAC, Baseband PHY, and RF in a single chip for 802.11b/g/n compatible WLAN
  - Complete 802.11n solution for 2.4GHz band
  - 72.2Mbps receive PHY rate and 72.2Mbps transmit PHY rate using 20MHz bandwidth
  - 150Mbps receive PHY rate and 150Mbps transmit PHY rate using 40MHz bandwidth
  - Backward compatible with 802.11b/g devices while operating in 802.11n mode
  - Compatible with 802.11n specification
  - Frame aggregation for increased MAC efficiency (A-MSDU, A-MPDU)

- Low latency immediate High-Throughput Block Acknowledgement (HT-BA)
- Long NAV for media reservation with CF-End for NAV release
- PHY-level spoofing to enhance legacy compatibility
- Power saving mechanism

- WLAN PHY Feature
  - 802.11n OFDM
  - One Transmit and one Receive path (1T1R)
  - 20MHz and 40MHz bandwidth transmission

- Short Guard Interval (400ns)
  - DSSS with DBPSK and DQPSK, CCK modulation with long and short preamble
  - OFDM with BPSK, QPSK, 16QAM, and 640QAM modulation. Convolutional Coding Rate: 1/2, 2/3,3/4, and 5/6
  - Maximum data rate 54Mbps in 802.11g and 150Mbps in 802.11n
  - Fast receiver Automatic Gain Control (AGC)

- Peripheral Interfaces
  - Maximum 1 SPI supported with baud rate up to 10.4MHz.
  - Support 4 External Timer Trigger Event (ETE function) with configurable period in low power mode
  - Maximum 17 GPIO pins
  - 2 high speed UART interface with baud rate up to 4MHz

3. Instruction encyclopedia

3.1 Network configuration method

The transparent transmission module aims at data communication in the end. WIFI communication is carried out under the preconditions of parameter configuration, and the network configuration (network name, PIN and IP address) and communication protocol socket setting (TCP, UDP) is rather important. The module defines the following two concepts for the parameters.

At first, the module defines two parts, namely, delivery parameters and user parameters.

- Delivery parameters: the module maintains the parameters of the initial status when it is not regularly used (generally acts as AP access point). At this time, the module has independent network name, fixed IP address, etc. The delivery mode ensures the recovery of the module, so as to avoid the problems caused by user's configuration mistakes. (Delivery parameters can be modified by customers)
- User parameters: when the module was regularly configured, the module will enable a new configuration to be user parameters as will be automatically loaded when the module resets. (Can write once)

In order to transfer from the delivery mode to the user mode easily, RAK477 transparent transmission module provides two kinds of flexible configuration methods to connect to the user's router:

- AP configuration
- EasyConfig instant configuration

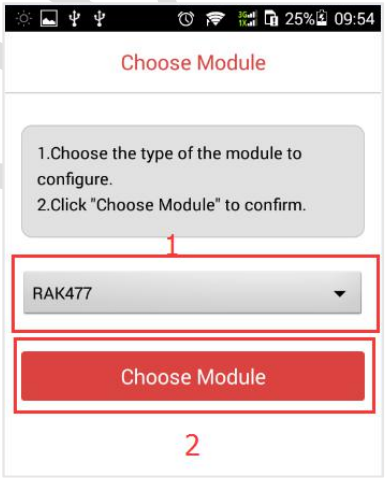
The module supports coexistence of AP and STA mode, i.e. users can not only connect the module to the router (Internet), but also access and look up the module and the like in the local net via the existing AP network, so as to be greatly convenient for users and enhance the user's experiences.

3.2 AP configuration

When the module is delivered, the default configuration is AP configuration with "status" light always on and "link" light slowly flashing.

The mobile phone is connected to the hot point of RAK477_AP_XXXXXX with "link" light always on.

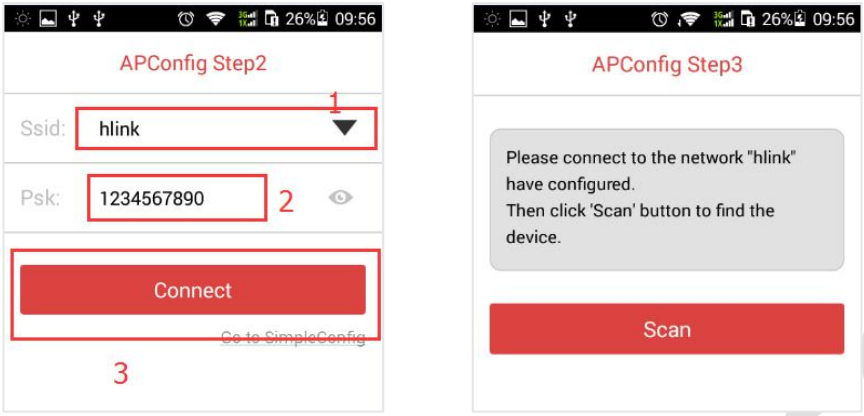
Use the mobile phone to open RAK47XConfigure software, and select the module type of RAK477.



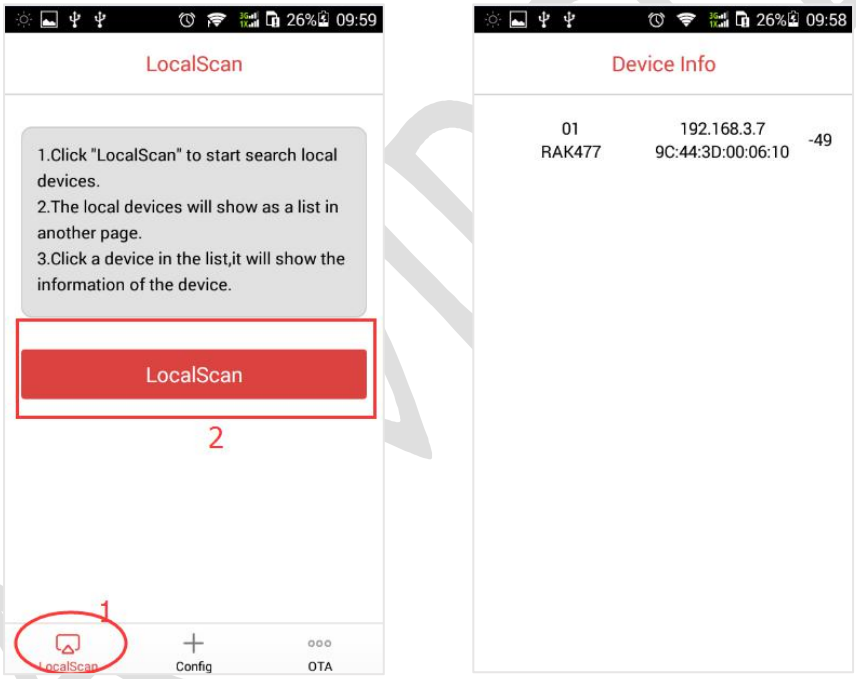
Enter into the Config option and select APConfig configuration:

Confirm that the mobile phone has been connected to the module hot spot, and then click NEXT:

Select the router to connect, input the password, click Connect, and the module will automatically save after receiving SSID and password.



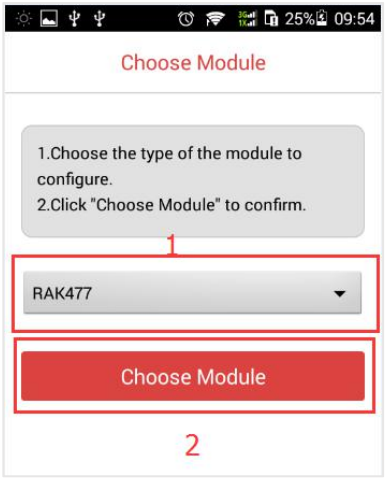
Connect mobile phone to the router saved on the module, select LocalScan option, and scan the module:



3.3 EasyConfig Configuration

First, the mobile phone is connected to the router which is to be connected by the module.

RAK477 Use the mobile phone to open RAK47XConfigure software, and select the module type of RAK477.

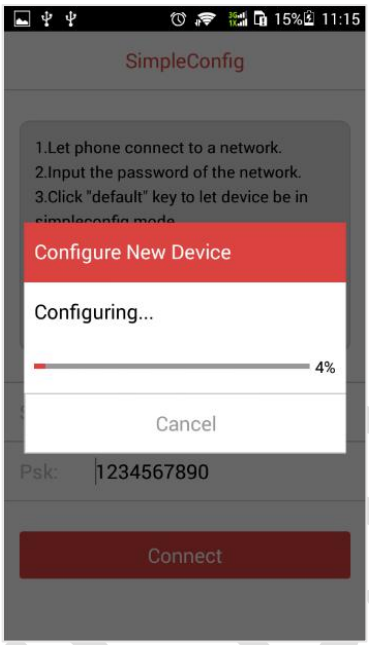


Enter into the Config option, and select SimpleConfig configuration:

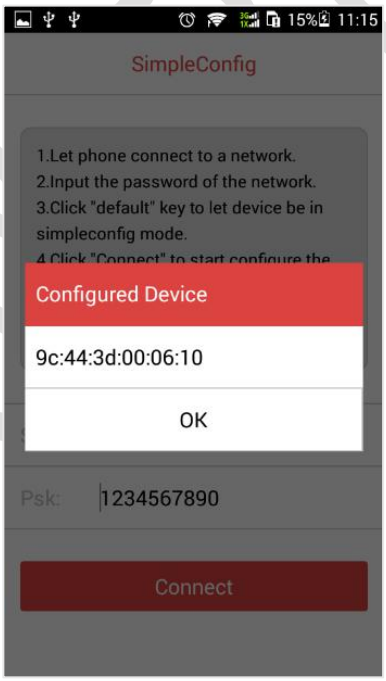
SSID is automatically filled in, input PSK

Press the development pad' s "default" key, the "link" light begins to slowly flash

Click Connect to start configuration.



Return to the module’s “mac” address after successful configuration:



3.4 Upgrading

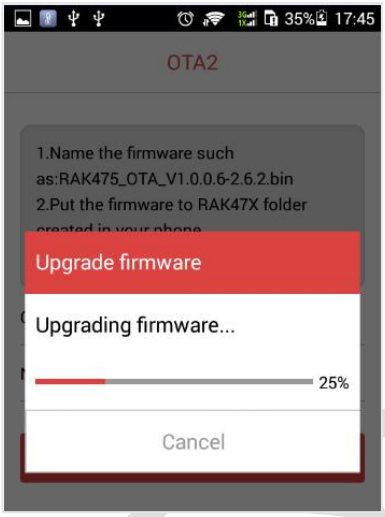
The module supports upgrading under the AP, STA and AP+STA mode.

The following mainly introduces the upgrading of the module under STA mode.

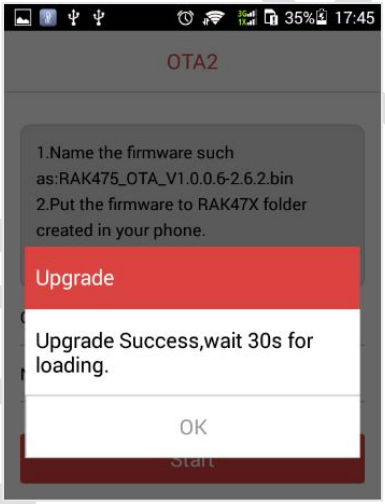
When upgrading the firm wares, the prior configuration information can be retained, thus being able to continue to connect the afore configured router after upgrading without configuration again.

First, confirm the mobile phone and the module is connected to the same router.
Open the mobile phone APP; select the module type of RAK477.
Select OTA option, click "CetInfo" to obtain the module's "mac" and "ip" address and other information;
Click the module information area, and enter into the upgrading interface.

The module's upgrading firm ware is saved under the RAK47X\RAK477 folder of the mobile phone, with file name format referring to "RAK477_OTA_V1.0.0.6-2.6.2.bin", "Cur version" is the current firm ware version of the module, "New version" is the mobile phone's firm ware to be upgraded, click "Start" to begin to upgrade.



After the completion of firm wares' upgrading, wait for 30 seconds (the module loads the firm ware and connects the router again)



3.5 Usage of scanning configuration tools

Mobile phone APP——RAK47XScanConfig

When the module works under AP mode, using the tool can scan the module after the mobile adds the module AP;

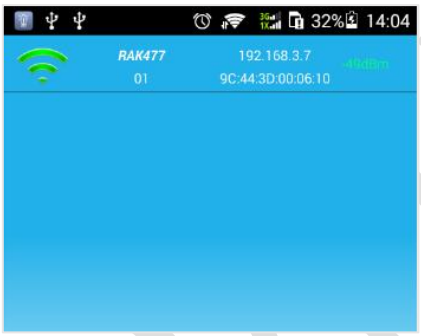
When the module works under STA mode and is successfully connected to the router, connect the mobile phone to the same router, and then the tool can scan the

module;

When the module works under AP+STA mode, the mobile phone is added to module AP or to the router connected to the module, the tool can scan the module.

Next, we will mainly introduce the usage of the module under STA mode.

1. Drop down the screen and scan the RAK47X module in the current network connected to the mobile, as shown below:



2. Click the module and input user's name and password for authentication, the default values are both "admin".

3. Configure the module

Caution: each configuration shall click "save" button to save the modified configuration parameters, and the modified parameters will not be effective until the module restarts.

- Mode configuration interface

The item mainly sets the mode and power consumption of the module, involving three modes, namely, AP, STA and AP+STA mode. The power consumption mode includes: full power consumption and automatic saving power consumption. After modifying the configuration, click "Save" button, as shown below:

- AP parameters configuration

Set basic parameters of AP mode, after modifying the configuration, click "Save" button, as shown below:

- Set the parameters of STA

Set basic parameters of STA mode. Clicking "Search" button can search out the nearby available wireless network. After modifying the configuration, click "Save" button, as shown below:

- The parameters setting of the serial port

Set basic parameters of the serial port, after modifying the configuration, click "Save" button, as shown below:

· Set the "socket" parameters

Set basic parameters of "socket", supporting single socket and double socket. After modifying the configuration, click "Save" button, as shown below:

- Advanced settings

Advance settings include: modifying the module' s user name and password (namely, authentication information), modifying the module' s name and group name, resetting the module and recover the ex-factory settings. Click "Reset" button, then all the configured parameters will be effective. As shown below:

4. Aided AT commands

4.1 Basic flow chart

Module' s work status gives priority to direct transparent transmission mode, but also provides an auxiliary command mode in order to manage and query the parameters for the module. Module interpret based on the MODE pin level, (high level by default) and enter into the transparent transmission mode. If the pin is low level, then open aided command mode. The aided command mode can be entered at any time. The following is the basic flow chart of the module:

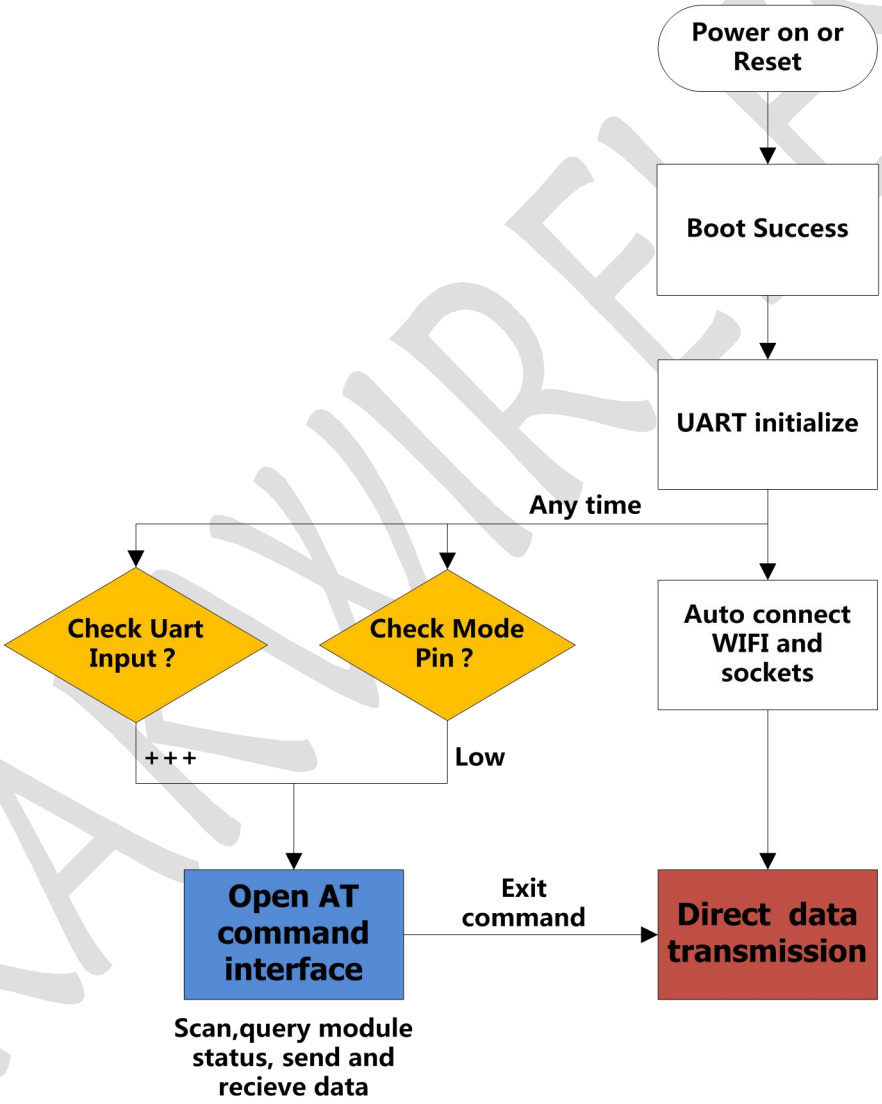


Figure 4-1 Basic flow chart of the module

4.2 AT command set

Table 4-1 AT command set

AT command	Description
Module management instruction	
at+ascii=<mode>\r\n	Open ASCII display
at+mac\r\n	Query the module’s MAC address
at+easy_txrx\r\n	Enter into the transparent transmission mode
at+version\r\n	Query the software version
at+reset \r\n	Reset the module
at+restore\r\n	Resect to Factory Defaults
Parameter configuration instruction	
at+write_config=Configure the parameter length and parameter of \r\n	Write user configuration
at+read_config\r\n	Read the user configuration
at+read_restoreconfig\r\n	Read Factory Defaults
at+write_restoreconfig=Configure the parameter length and parameter of \r\n	Modify the Factory Defaults
at+copy_cfg	Reproduce user configuration to be Factory Defaults configuration
AP SAT operating instruction	
at+con_status\r\n	Query the connection status of STA
at+ap_status\r\n	Query the connection status of AP
at+rssi\r\n	Query the wireless signal intensity of STA
at+scan=<channel>,<ssid>\r\n	Scan the wireless network
at+get_scan=<scan_num>\r\n	Get indicated number of network information
at+easy_config\r\n	The module enters into instant configuration mode
at+wps\r\n	The module starts WPS function, adds the indicated router
at+ipconfig\r\n	Query IP parameters of the module

at+ping=<host>, <count>, <size>\r\n	Ping network host command
at+tcp_status=0\r\n	Query the connection status of TCP
at+net_info\r\n	Query the connected network information
Instruction for receiving and sending data	
at+send_data=0,dest_port,dest_ip,datalen,databuffer\r\n	Send data from Socket
at+recv_data=0,dest_port,dest_ip,datalen,databuffer\r\n	Receive data from Socket
Read and write NVM data	
at+nvm_write=<addr>,<len>,<data>\r\n	Write data to NVM
at+nvm_read=<addr>,<len>\r\n	Read NVM data
Set the certificate command	
at+set_cert=<cert_type>,<file_len>,<data_stream> \r\n	Set ssl security certificate
Information storage commands for the user networking list	
at+read_userlist_num\r\n	Read the information number of current list
at+read_userlist=<index>\r\n	Read the networking information in the indicated lists
at+write_userlist=<index>,<len>,<data>	Write the networking information to the indicated lists
at+delete_userlist=<index>\r\n	Delete the networking information in the indicated lists
Firm ware upgrading command	
at+upgrade\r\n	Enter into the upgrading mode

4.3 Command format

From the host to the module: at+<command>=<parameter 1>, <parameter 2>, <parameter n>\r\n

Parameters included in all the AT commands are all ASICII codes, for example:

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

After each piece of command is carried out, the module will send the returned value with the format as shown below:

1. If the command is successfully carried out, then the returned values shall be:
   OK\r\n or OK<parameter 1><parameter 2>.....<parameter n>\r\n
   Note: Besides OK, the other parameters are all hexadecimal system one, 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 is unsuccessfully carried out, then the returned values shall be:
   ERROR<code>
   Note:
   - Wherein, ERROR is ASCII code, <code> is hexadecimal system code
     ERROR ?\r\n HEX=45 52 52 4F 52 FE 0D 0A----------<code>=0XFE
   - AT command format instruction: AT command begins with "at+" (all are lowercase), and ends with "\r\n", the maximum command length of 80 bytes, and the beginning of any other formats are wrong orders.
   - The above AT command formats are not applicable to send and receive data commands of at+recv_data and at+send_data, for detailed instructions, please refer to at+recv_data, Instruction part of the at+send_data command.

   Error CODE

Code	Instruction
-1	Parameter input error (parameters are unable to identify / missing parameters / too long command / other illegal parameters
-12	Unknown errors (memories, system and the like)
Others	For details see specific commands

4.4 Enter into aided commands

Under the transparent transmission mode, open the aided command window, use the methods similar to shaking hands.

1. The host computer (host MCU) send "+ + +", request to enter the command mode.

2. Timing for 200ms, wait for the module to return "U" (0x55) , if the module did not return in the specified time, then the timing of 200ms will again send "+++" , and requests to enter the command mode until the module successfully return "U" (0x55) .It shows that the module is ready to enter into the command mode, waiting for final confirmation (waiting for 3 seconds).

3. Timing for 200ms, wait for the module to return "U" (0x55) , if the module did not return in the specified time, then the timing of 200ms will again send "+++" , and requests to enter the command mode until the module successfully return "U" (0x55) .It shows that the module is ready to enter into the command mode, waiting for final confirmation (waiting for 3 seconds).

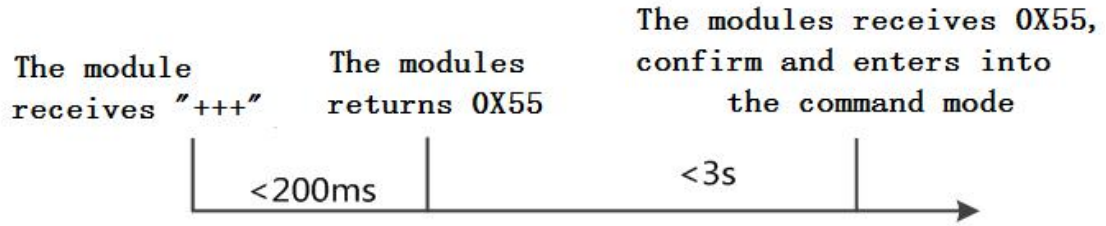


Figure 4-2 Enter into command time sequence
(the module receives "+++" ;
the module returns 0X55;
the module receives 0X55, confirms and enters into the command mode.)

4.5 Module management instruction

4.5.1 Open ASCII display

Command

at+ascii=<mode>\r\n

Description

Convert all the command returned value with ASCII display, facilitate the users to debug and be familiar with the AT command. There is no need to open while programming.

Parameter instruction

Parameter	Parameter value	Instruction
<mode>	0	Prohibit conversion
	1	Open conversion

Instruction for returned value

Parameter	Format	Length (byte)	Instruction
The command is successfully carried out			
OK	ASCII	2	Successfully open
\r\n	ASCII	2	End character
The command is unsuccessfully carried out			
ERROR	ASCII	5	Error
<CODE>	HEX	1	For details see ERROR list
\r\n	ASCII	2	End character
Remarks			

4.5.2 Query the module's MAC address

Command

at+mac\r\n

Description

Query MAC address information of the module, the coexistence of AP and STA is under STA mode, the MAC under the AP mode by default is MAC+1under the STA mode.

Parameter instruction

NULL

Instruction for returned value

Parameter	Format	Length (byte)	Instruction
The command is successfully carried out			
OK	ASCII	2	OK
MAC	HEX	6	MAC address
\r\n	ASCII	2	End character
The command is unsuccessfully carried out			
ERROR	ASCII	5	ERROR
<CODE>	HEX	1	For details see ERROR list
\r\n	ASCII	2	End character
Remarks			

4.5.3 Enter into the transparent transmission mode

Command

at+easy_txrx\r\n

Description

Send the command to exit the command mode, and enter into the transmission

mode.

Parameter instruction

NULL

Instruction for returned value

Parameter	Format	Length (byte)	Instruction
The command is successfully carried out			
OK	ASCII	2	OK
\r\n	ASCII	2	End character
The command is unsuccessfully carried out			
ERROR	ASCII	5	ERROR
<CODE>	HEX	1	For details see ERROR list
\r\n	ASCII	2	End character
Remarks			

4.5.4 Query the software version

Command

at+version\r\n

Description

Query the module version, including the software version and the WLAN version.

For example, 0.0.0.1-1.0.1， 0.0.0.1 indicates the software version number, and 1.0.1 indicates WLAN version number.

Parameter instruction

NULL

Instruction for returned value

Parameter	Format	Length(byte)	Instruction
The command is successfully carried out			
OK	ASCII	2	OK
	STRING		Character string
\r\n	ASCII	2	End character
The command is unsuccessfully carried out			
ERROR	ASCII	5	ERROR
<CODE>	HEX	1	For details see ERROR list
\r\n	ASCII	2	End character
Remarks			

4.5.5 Reset to restart the module

Command

at+reset \r\n

Description

The software reset module

Parameter instruction

NULL

Instruction for returned value

Parameter	Format	Length(byte)	Instruction

The command is successfully carried out			
OK	ASCII	2	The reset is successful
\r\n	ASCII	2	End character
The command is unsuccessfully carried out			
ERROR	ASCII	5	ERROR
<CODE>	HEX	1	For details see ERROR list
\r\n	ASCII	2	End character
Remarks			

4.5.6 Reset to Factory Defaults

Command

at+restore\r\n

Description

Recover the module parameters to the Factory Defaults parameters

Parameter instruction

NULL

Instruction for returned value

Parameter	Format	Length(byte)	Instruction
The command is successfully carried out			
OK	ASCII	2	The reset is successful
\r\n	ASCII	2	End character
The command is unsuccessfully carried out			

ERROR	ASCII	5	ERROR
<CODE>	HEX	1	For details see ERROR list
\r\n	ASCII	2	End character
Remarks			

4.6 Parameter configuration instruction

For the keywords and its parameters of the following configuration, please see the appendix - configuration parameters encyclopedia".

4.6.1 Write user configuration

Command

at+write_config=<data_length> ,<data_stream>\r\n

Description

Write the user configuration parameters with one step, the user send all the configuration parameters to the module at one-time. Including network model, network parameters, serial port and communication parameters, etc.

The command can also enable or disable the module's advanced feature options, such as the MODE pin function, whether to enable the connection list function or not, etc.

Parameter instruction

Parameter	parameter values	Instruction
<data_length>	length	Length of written configuration parameter
<data_stream>	data	Written configuration parameter

Example

at+write_config=963,wlan_mode=1&ap_ssid=RAK477_AP&ap_channel=1&ap_sec_mode=1&ap_psk=123456789&……\r\n

Instruction for returned value

Parameter	Format	Length(byte)	Instruction
The command is successfully carried out			
OK	ASCII	2	The reset is successful
\r\n	ASCII	2	End character
The command is unsuccessfully carried out			
ERROR	ASCII	5	ERROR
<CODE>	HEX	1	For details see ERROR list
\r\n	ASCII	2	End character
Remarks			

4.6.2 Read the user configuration

Command

at+read_config\r\n

Description

Read the user configuration parameters, and read all the user configuration parameters at one time.

Parameter instruction

NULL

Example

at+read_config\r\n

OKwlan_mode=2&ap_ssid=RAK477_AP_38A55D&ap_channel=9&ap_sec_mode=0&ap_psk=123456789&ap_max_clts=0&ap_bdcast=1&ap_ip=192.168.7.1&sta_ssid=RAK_2.4GHz&sta_sec_mode=1&sta_psk=rakwireless205&sta_dhcp=1&sta_ip=0.0.0.0&sta_netmask=0.0.0.0&sta_gateway=0.0.0.0&sta_dns1=0.0.0.0&sta_dns2=0.0.0.0&...\r\n

Instruction for returned value

Parameter	Format	Length(byte)	Instruction
The command is successfully carried out			
OK	ASCII	2	OK
	STRING		Character string
\r\n	ASCII	2	End character
The command is unsuccessfully carried out			
ERROR	ASCII	5	ERROR
<CODE>	HEX	1	For details see ERROR list
\r\n	ASCII	2	End character
Remarks			

4.6.3 Reproduce the user configuration

Command

at+copy_cfg\r\n

Description

Reproduce the user parameters to be Factory Defaults parameters.

Parameter instruction

NULL

Instruction for returned value

Parameter	Format	Length(byte)	Instruction
The command is successfully carried out			
OK	ASCII	2	Open successfully
\r\n	ASCII	2	End character
The command is unsuccessfully carried out			
ERROR	ASCII	5	ERROR
<CODE>	HEX	1	For details see ERROR list
\r\n	ASCII	2	End character
Remarks			

4.6.4 Read Factory Defaults

Command

at+read_restoreconfig\r\n

Descripion

Read Factory Defaults parameters configuration of the module, returning structure is the same with reading user's configuration.

Parameter instruction

NULL

Instruction for returned value

Parameter	Format	Length(byte)	Instruction
The command is successfully carried out			
OK	ASCII	2	OK

	STRING		Character string
\r\n	ASCII	2	End character
The command is unsuccessfully carried out			
ERROR	ASCII	5	ERROR
<CODE>	HEX	1	For details see ERROR list
\r\n	ASCII	2	End character
Remarks			

4.6.5 Read Factory Defaults

Command

at+write_restoreconfig=<data_length>,<data_stream>\r\n

Description

Read Factory Defaults parameters configuration of the module, returning structure is the same with reading user's configuration.

Parameter instruction

Parameter	Parameter value	Instruction
<data_length>	length	Written length of written configuration parameter
<data_stream>	data	Written configuration parameter

Instruction for returned value

Parameter	Format	Length(byte)	Instruction
The command is successfully carried out			
OK	ASCII	2	OK

	STRING		Character string
\r\n	ASCII	2	End character
The command is unsuccessfully carried out			
ERROR	ASCII	5	ERROR
<CODE>	HEX	1	For details see ERROR list
\r\n	ASCII	2	End character
Remarks			

4.7 AP STA operating instruction

4.7.1 Query the connection status of STA

Command

at+con_status\r\n

Description

If the module works under the STA mode，the command will be used for the wireless network connection status of the module.

Parameter instruction

NULL

Instruction for returned value

Parameter	Format	Length(byte)	Instruction
The command is successfully carried out			
OK	ASCII	2	The command was executed successfully
1	HEX	1	0x01: Connected

			0x00: unconnected
\r\n	ASCII	2	End character
The command is unsuccessfully carried out			
ERROR	ASCII	5	ERROR
<CODE>	HEX	1	For details see ERROR list
\r\n	ASCII	2	End character
Remarks			

4.7.2 Query the connection status of AP

Command

at+ap_status\r\n

Description

If the module works under the AP mode, the command will be used for determining the connection status of the equipment.

Parameter instruction

NULL

Instruction for returned value

Parameter	Format	Length(byte)	Instruction
The command is successfully carried out			
OK	ASCII	2	The command was executed successfully
1	HEX	1	0x01: Connected 0x00: unconnected

\r\n	ASCII	2	End character
The command is unsuccessfully carried out			
ERROR	ASCII	5	ERROR
<CODE>	HEX	1	For details see ERROR list
\r\n	ASCII	2	End character
Remarks			

4.7.3 The wireless signal intensity of STA

Command

at+rssi\r\n

Description

Querying the wireless network intensity under STA mode will be effective.

Parameter instruction

NULL

Instruction for returned value

Parameter	Format	Length(byte)	Instruction
The command is successfully carried out			
OK	ASCII	2	OK
<RSSI>	HEX	1	Signal intensity (negative), for example: -50, the lower the signal intensity, the smaller the returned value.
\r\n	ASCII	2	End character

The command is unsuccessfully carried out				
ERROR	ASCII	5	ERROR	
<CODE>	HEX	1	0XFE=-2	When there is no network connection or the module works under AP mode.
\r\n	ASCII	2	End character	
Remarks				

4.7.4 Scan the wireless network

Command

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

Description

Scan the wireless network through this command, and access the wireless information, including encryption information, channel, signal strength, BSSID, etc.

Parameter instruction

The scan command includes two parameters, wherein <channel> is the specified channel scanning with the value range of 1 to13, if the value is set to 0, Then scan all the channels, <ssid> means scanning the indicated SSID, the parameter can be optional.

Note:

In case of indicating the channel to scan, you can reduce the scanning time.

Parameter	Parameter value	Instruction

<channel>	0-13	Indicating the channel (1-13) to scan means channel 0 refers to scan all the channels.
<ssid>	The network name	Indicate SSID (optional)

For example：

at+scan=0 \r\n---------- Scan all the channels

at+scan=0,RAKwireless\r\n---------- Scan the wireless network with the network name of "RAKwireless" in all the channels.

at+scan=8,RAKwireless\r\n---------- Scan the wireless network with the network name of "RAKwireless" in channel 8.

at+scan=6 \r\n---------- Scan all the SSID in channel 6.

Instruction for returned value

If the command is executed successfully, then it returns OK and the number of wireless networks that are scanned (with maximum of 20). If the user needs to use the network information, you can call the command "at+get_scan" to get.

Note:

When at+ascii=1, the module will return all the information without need to call get_scan to get. Just for looking up easily.

Parameter	Format	Length(byte)	Instruction
The command is successfully carried out			
OK	ASCII	2	Scan to the network
<SCAN NUM>	HEX	1	Number of wireless networks

\r\n	ASCII	2	End character	
The command is unsuccessfully carried out				
ERROR	ASCII	5	ERROR	
<CODE>	HEX	1	0XFE=-2	the indicated ssid is not found
\r\n	ASCII	2	End character	
Remark				

4.7.5 Get the wireless network

Command

at+get_scan=<scan_num>\r\n

Description

Read the scanned information from the command, this command must be called after the at+scan scan wireless network command.

Note:

If the wireless network information is not required, the command can be omitted.

Scanned information has been read completely, if reading again, the module will return the error -2, the at+scan command need to be called for scanning again.

Parameters instruction

<scan_num> is the amount of scanned information that are read , if the parameter is greater than the actual scanned amount, then the command will return the actual scanned amount.

Parameter	Parameter	Instruction

	value	
<scan_num>	＞0	Read the scanned information amount

For example：

at+get_scan=10\r\n---------- Read 10 pieces of wireless network information

Instruction for returned value

Parameter	Format	Length(byte)	Instruction							
The command is successfully carried out										
OK	ASCII	2	Get the information correctly							
<SSID>	HEX	33	SSID							
<BSSID>	HEX	6	BSSID							
<CHANNEL>	HEX	1	Channel							
<RSSI>	HEX	1	signal intensity (negative value)							
<Security Mode>	HEX	1	encryption method							
			b7	b6	b5	b4	b3	b2	b1	b0
			WPA2	WPA	WEP	802.1X	PSK	WEP	TKIP	CCMP
\r\n	ASCII	2	End character							
The command is unsuccessfully carried out										

ERROR	ASCII	5	ERROR	
<CODE>	HEX	1	0XFE=-2	canned information have fully been read
\r\n	ASCII	2	End character	
Remark	b7-b5: encryption method b4-b3：encryption type b2-b0：encryption algorithm			

4.7.6 EasyConfig networking

Command

at+easy_config\r\n

Description

Send the command, the module enters into an instant configuration mode, waiting for the phone to send configuration information. Customers can query whether the network is connected or not through querying network status command.

Instruction for returned value

Parameter	Format	Length(byte)	Instruction
The command is successfully carried out			
OK	ASCII	2	Connect to the network
\r\n	ASCII	2	End character
The command is unsuccessfully carried out			

ERROR	ASCII	5	ERROR
<CODE>	HEX	1	For details see ERROR list
\r\n	ASCII	2	End character
Remark			

4.7.7 Query IP information

Command

at+ipconfig\r\n

Description

Query the current module’s MAC address information, IP address, subnet mask, gateway, DNS server, etc., if the DHCP is not assigned while setting; check out the module address of 127.0.0.1.

Parameter instruction

NULL

Instruction for returned value

Parameter	Format	Length(byte)	Instruction
The command is successfully carried out			
OK	ASCII	2	success query
<MAC>	HEX	6	module’s MAC address
<IP>	HEX	4	module’s IP address
<NETMASK>	HEX	4	module’s subnet mask
<GATEWAY>	HEX	4	gateway

<DNS SERVER1>	HEX	4	DNS server 1
<DNS SERVER2>	HEX	4	DNS server 2
\r\n	ASCII	2	End character
The command is unsuccessfully carried out			
ERROR	ASCII	5	ERROR
<CODE>	HEX	1	0XFC=-2 query failed
\r\n	ASCII	2	End character
Remark			

4.7.8 Query the connected network information

Command

at+net_info\r\n

Description

Read the current network parameters, all the network parameters will be read at one time and returned back to the corresponding structure.

Example

OKwlan_mode=2&sta_ssid=RAK_2.4GHz&sta_bssid=8C:21:0A:D9:EB:7B&sta_sec_mode=1&sta_psk=rakwireless205&sta_dhcp=1&sta_ip=192.168.1.119&sta_netmask=255.255.255.0&sta_gateway=192.168.1.1&sta_dns1=192.168.1.1&sta_dns2=0.0.0.0ap_ssid=RAK477_AP_38A55D&ap_channel=9&ap_sec_mode=0&ap_psk=12345678 9&ap_max_clts=0&ap_bdcast=1&ap_ip=192.168.7.1

Parameter instruction

NULL

Instruction for returned value

Parameter	Format	Length(byte)	Instruction
The command is successfully carried out			
OK	ASCII	2	OK
	STRING		Character string
/r/n	ASCII	2	End character
The command is unsuccessfully carried out			
ERROR	ASCII	5	ERROR
<CODE>	HEX	1	For details see ERROR list
\r\n	ASCII	2	End character
Remark			

4.8 Instruction for receiving and sending the data

4.8.1 Send data

Command

at+send_data=<uuid>,<dest_port>,<dest_ip>,<data_length> ,<data_stream>\r\n

Description

Send data to the target connection (port identifier) through the command, with the maximum data length of 1024, wherein <data_stream> can be any format of the data, the module will keep the original data and send without carrying out any process. If the connection is a TCP connection, wherein the target IP and target port can be ignored, filling in 0 will be ok. When the connection is UDP, if not specified, you can fill in 0, if you need to send to the specified target as LUDP, fill in the target IP and destination port number.

Parameters instruction

Parameter	Parameter value	Instruction
< uuid>	0	Indicate socketA
	1	Indicate socketB
<dest port>	1-65535	Target port (ASCII)
<dest ip>	0.0.0.-255.255.255.255	Target IP address (ASCII)
<data_length>	1-1004	Data length (ASCII)
<data_stream>	data	Data to sent (HEX)

For example:

at+send_data=0,0,0,4,ABCD\ r\n---------- send 4bytes of data to the connection with the identifier of 0, the data content is "ABCD".

Instruction for returned value

Parameter	Format	Length(byte)	Instruction	
The command is successfully carried out				
OK	ASCII	2	The data was sent successfully	
\r\n	ASCII	2	End character	
The command is unsuccessfully carried out				
ERROR	ASCII	5	Data transmission failed	
<CODE>	HEX	1	0XFE=-2	Indicated socket is not existed
			0XFD=-3	the data is sent by mistakes

\r\n	ASCII	2	End character
Remark			

4.8.2 Receive data

Command

at+recv_data=<uuid>,<dest_port>,<dest_ip>,<data_length>,<data_stream>\r\n

Description

Receives the UUID data of the corresponding Socket (A, B), when the ASCII display is disabled, receive 16 Decimal system data. The sequence is the same. Suggest using ASCII to display disable mode when programming.

If socket is set to the UDP type, the UDP receives a packet of less than 1024B per packet. Most of them will be discarded. UDP sending end need to set the sending packet's maximum length.

Parameter instruction

NULL

Instruction for returned value

Parameter	Format	Length(byte)	Instruction
The command is successfully carried out			
<CMD>	ASCII	13	Command header
< uuid>	HEX	1	=0X00-0X01 Socket identifier

<dest_port>	HEX	2	destination port (low byte is in the front)
<dest_ip>	HEX	4	target IP
<data_length>	HEX	2	data length (low byte is in the front)
<data_stream>	HEX	<data_length>	Data
\r\n	ASCII	2	End character
The command is unsuccessfully carried out			
<CMD>	ASCII	13	Command header
<CODE>	HEX	1	For details see ERROR list
\r\n	ASCII	2	End character
Remark			

4.9 Information storage commands for the user networking list

4.9.1 Read the number of current list

Command

at+read_userlist_num\r\n

Description

Read the number of currently saved networking information list.

Parameter instruction

NULL

Instruction for returned value

Parameter	Format	Length(byte)	Instruction
The command is successfully carried out			
OK	ASCII	2	OK
NUM	HEX	1	List number（0-4）
/r/n	ASCII	2	End character
The command is unsuccessfully carried out			
ERROR	ASCII	5	ERROR
<CODE>	HEX	1	For details see ERROR list
\r\n	ASCII	2	End character
Remark			

4.9.2 Read the networking information in the indicated lists

Command

at+read_userlist=<index>\r\n

Description

Read the networking information in the current list

Parameter instruction

Parameter	Parameter value	Instruction
<index>	0-4	Indicate the list to read the networking information

For example：

OKsta_ssid=RAK_2.4GHz&sta_sec_mode=1&sta_psk=rakwireless205&sta_bssid=8C:21:0A:D9:EB:7B\r\n

Instruction for returned value

Parameter	Format	Length(byte)	Instruction
Information read successfully			
OK	ASCII	2	OK
	STRING		Character string
\r\n	ASCII	2	End character
Information read failed			
<CMD>	ASCII	13	Command header
<CODE>	HEX	0XFE=-2	Invalid storage information
\r\n	ASCII	2	End character
Remark			

4.9.3 Write the networking information to the indicated lists

Command

at+write_userlist=<index>,<len>,<data>\r\n

Description

Write the networking information to the indicated lists

Parameter instruction

Parameter	Parameter value	Instruction

<index>	0-4	Indicate the list to read the networking information
<len>	Data length	The data length of the networking information
<data>	data	networking information

For example:

at+write_userlist=0,85,sta_ssid=RAK_2.4GHz&sta_sec_mode=1&sta_psk=rakwireless205&sta_bssid=8C:21:0A:D9:EB:7B\r\n

Instruction for returned value

Parameter	Format	Length(byte)	Instruction
The command is successfully carried out			
OK	ASCII	2	OK
\r\n	ASCII	2	End character
The command is unsuccessfully carried out			
ERROR	ASCII	5	ERROR
<CODE>	HEX	1	For details see ERROR list
\r\n	ASCII	2	End character
Remark			

4.9.4 Delete the networking information in the indicated lists

Command

at+delete_userlist =<index>\r\n

Description

Delete the networking information in the current list

Parameter instruction

Parameter	Parameter value	Instruction
<index>	0-4	Indicate the list to delete the networking information

Instruction for returned value

Parameter	Forma	Length(byte)	Instruction
The command is successfully carried out			
OK	ASCII	2	OK
/r/n	ASCII	2	End character
The command is unsuccessfully carried out			
ERROR	ASCII	5	ERROR
<CODE>	HEX	0XFE=-2	Invalid stored information
\r\n	ASCII	2	End character
Remark			

4.10 Upgrading of serial port firm ware

4.10.1 Enter into the upgrading mode

Command

at+upgrade\r\n

Description

The command is used to set the module to enter into the upgrading mode.

1. The host computer (host MCU) send at+upgrade\r\n to the module, and request to enter into the upgrading mode.
2. Until the command is executed successfully, the module returns “OK”, the host computer (host MCU) sends “u” to confirm entering into the upgrading mode. If the module executing the command did not return "OK", return to carry out step 1.
3. Until the module return “OKC”, utilize xmodem protocol to send firm ware to the module. If the module did not return "OKC", returned to carry out step 1 to 3

Parameter instruction

NULL

Instruction for returned value

Parameter	Format	Length(byte)	Instruction
The command is successfully carried out			
OK	ASCII	2	Open successfully
\r\n	ASCII	2	End character
The command is unsuccessfully carried out			
ERROR	ASCII	5	ERROR
<CODE>	HEX	1	Invalid stored information
\r\n	ASCII	2	End character
Remark			

5. Appendix-configuration parameter encyclopedia

Table 5-1 Configuration parameter table

Keywords	Parameter	Remarks
Mode selection		
wlan_mode	0: STA mode 1: AP mode 2: Coexistence AP and STA mode	
AP mode parameter		
ap_ssid	RAK477_AP_SSID	SSID name is less than 32B
ap_channel	6	Channel range (1-13)
ap_sec_mode	0: No encryption 1: Encryption	
ap_psk	1234567890	The PIN is between 8B and 32B
ap_ip	192.168.7.1	
ap_bdcast	0: No broadcast 1: Broadcast	
ap_max_clts	The maximum connection number of AP	The maximum is 3
STA mode parameter		
sta_ssid	RAK_AP_STA	SSID name is less than 32B
sta_bssid	8C:21:0A:D9:EB:7B	
sta_sec_mode	0: No encryption 1: Encryption	
sta_sec_type	0: OPEN 1: WEP-PSK 2: WEP-SHARED 3: WPA-TKIP-PSK 4: WPA-AES-PSK 5: WPA2-AES-PSK 6: WPA2-TKIP-PSK 7: WPA2-MIXED-PSK 8 UNKNOWN	
sta_psk	1234567890	The PIN is between 8B and 32B
sta_dhcp	0: Static setting 1: Dynamic acquisition	

sta_ip	192.168.1.100	
sta_netmask	255.255.255.0	
sta_gateway	192.168.1.1	
sta_dns1	192.68.1.1	
sta_dns2	0.0.0.0	
UART communication parameter		
uart_baudrate	9600,19200,38400,57600,115200,230400,460800,921600	
uart_datalen	8	(5-8)
uart_parity_en	0: No 1: Odd parity check 3: Even parity check	
uart_stoplen	1	(1-2)
uart_rtscts_en	0: disable 1: enable	
uart_timeout	5	Timeout time unit for the serial port to be frame: ms The serial port is recommended to send interval per 10ms, the minimum interval is 5ms.
uart_recvlenout	512	When the serial port receives the byte of no less than 512, the module carry out forwarding
FuncBitMap		
mode_pin	wps: wps function easy: Mode selection function	Multiple function pin
userlist_en	0: User list is not enabled 1: User list is enabled	
web_switch	0: Use the original factory's web page 1: Use the customer’s web page	unused
web_en	0: WEB (English by default) 1: WEB(Chinese by default)	

web_func_en	0: Disabled WEB configuration 1: Enable WEB configuration	unused
local_find_en	0: Local discovery is disabled 1: Local discovery is enabled	Mdns function is opened by default
first_user_switch	0: disable 1: enable	When the user is configured from the Factory Defaults parameter to the user parameter, the configured router is not able to connect, switch to the Factory Defaults parameter
last_user_switch	0: disable 1: enable	When the user is configured from the current user parameters to another parameter, the configured route is not able to connect, whether switch to the current user parameter or not.
Power consumption mode		
power_mode	0: Full power consumption 1: Automatically saving	
Socket communication		

parameter		
socket_multi_en	Socket communication parameter 1: Double socket	
SocketA parameter		
socketA_type	0: tcpc 1: ltcp 2: udpc 3: ludp 4: tls/ssl	
socketA_tls_v	0: auto 1: SSLV3 2:TLSV1 3:TLSV1_1 4:TLSV1_2	Tls version Auto is the mixture of TLS SSL
socketA_tls_ca	0: disable 1: enable	Tls ca certificate is enabled
socketA_tls_clt	0: disable 1: enable	Tls client certificate is enabled
socketA_max_clts	2	The maximum connecting number of Tcp server The maximum number is 4
socketA_localport	25000	(1-65535)
socketA_destip	192.168.1.101	IP or domain name
socketA_destport	25000	(1-65535)
socketA_tcp_timeout	0: disable 1-600 : valid	TCP idle timeout time unit: s
socketA_tcp_reconval	0: disable 1-600 : valid	Interval time unit of TCP reconnection: s
SocketB parameter		
socketB_type	0: tcpc 1: ltcp 2: udpc 3: ludp	
socketB_max_clts	2	The maximum connecting number of Tcp server The maximum

		connecting number of Tcp server
socketB_localport	25001	(1-65535)
socketB_destip	192.168.1.101	
socketB_destport	25001	(1-65535)
socketB_tcp_timeout	0: disable 1-600 : valid	TCP idle timeout time unit: s
socketB_tcp_reconval	0: disable 1-600 : valid	Interval time unit of TCP reconnection: s
Module name		
module_name	RAK477	(16B)
WEB setting		
user_name	admin	(16B)
user_password	admin	(16B)

6. Version

Version	Date	Modified records
V1.0	2016-3-1	Create a document
V1.1	2016-611	Add the related tools section