ALX8XX WiFi Module

Product

User Manual

FCC STATEMENT

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

(1) This device may not cause harmful interference.

(2) This device must accept any interference received, including interference that may cause undesired operation.

2. Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation.

This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television

reception, which can be determined by turning the equipment off and on,

the user is encouraged to try to correct the interference by one or more

of the following measures:

Reorient or relocate the receiving antenna.

Increase the separation between the equipment and receiver.

Connect the equipment into an outlet on a circuit different from that to

which the receiver is connected.

Consult the dealer or an experienced radio/TV technician for help.

FCC Radiation Exposure Statement

This equipment complies with FCC radiation exposure limits set forth

for an uncontrolled environment. This equipment should be installed

and operated with minimum distance 20cm between the radiator &

your body.

Federal Communication Commission Statement (FCC, U.S.)

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- Consult the dealer or an experienced radio/TV technician for

help.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

FCC Caution:

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

IMPORTANT NOTES

FCC Radiation Exposure Statement:

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

Co-location warning:

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

Limited Channels fixed for use in the US:

IEEE 802.11b or 802.11g or 802.11n(HT20) operation of this product in the U.S. is firmware-limited to Channel 1 through 11. IEEE 802.11n(HT40) operation of this product in the U.S. is firmware-limited to Channel 3 through 9.

OEM integration instructions:

This device is intended only for OEM integrators under the following conditions:

The antenna must be installed such that 20 cm is maintained between the antenna and users, and the transmitter module may not be co-located with any other transmitter or antenna. The module shall be only used with the external antenna(s) that has been originally tested and certified with this module.

As long as 3 conditions above are met, further transmitter test will not be required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed (for example, digital device emissions, PC peripheral requirements, etc.).

Validity of using the module certification:

In the event that these conditions cannot be met (for example certain laptop configurations or co-location with another transmitter), then the FCC authorization for this module in combination with the host equipment is no longer considered valid and the FCC ID of the module cannot be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization.

End product labeling:

This transmitter module is authorized only for use in device where the antenna may be installed such that 20 cm may be

maintained between the antenna and users. The final end product must be labeled in a visible area with the following: "Contains Transmitter Module FCC ID: 2AELJ-ALX8XX".

Information that must be placed in the end user manual:

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user's manual of the end product which integrates this module. The end user manual shall include all required regulatory information/warning as show in this manual.

1 Revision History

Author	Version	Revision History
Alinket	V1.0	Initiation
Edwin Lin	V1.1	Added method to configure static IP address and 802.1x authentication

2 Product Brief

Alinket Technology Co. (Shanghai) Ltd. is a high-tech innovative company with full capability covering product design, engineering, manufacturing, selling and customer services. The funders and employees of the company are all senior experts with strong technical background and proven leadership and management skills, all of whom have worked in famous global companies like Qualcomm, Broadcom, Rosenberger, Intel and joined Alinket to pursuit innovations.

Alinket is focusing on designing IoT wireless communication modules and total solutions based on these products, through years the company has attained several patents and copyrights on wireless technologies.

Alinket works closely with top-class IC companies to provide total wireless solutions for IoT industry with series of low power consumption Wi-Fi, GPS, GSM communication modules, which products have been widely used in Intelligent Home Appliances, Medical Assistant Gadgets, Intelligent

Industry and Automation Instruments, etc.

Additionally, by providing connectivity to various Cloud IoT Platforms, Cloud-ready Middleware, APPs developing capabilities and total solution SDKs for production and testing, Alinket does its best to help our customers to quickly integrate their IoT innovations into Cloud arena.

ALX81X is the first Wi-Fi communication module developed by Alinket, this document describes its mechanical characteristics, module functionalities and testing setup. This is a brief description document, for the detailed electrical characteristics please refer to the document <ALX8XXC/IProduct Specification>.

2.1 Default Wi-Fi Configuration

The ALX8XX Wi-Fi communication module uses Wi-Fi STA mode by default, and the SSID is "alinket", and the password is "andersen", all in lowercase.

2.2 Functional Description

2.2.1 Software Functions Description

ALX82x series Wi-Fi Communication Module Software Functions	AP Mode	Endpoint Signal Strength Detection (RSSI)
		TCP Server
		TCP Client
		UDP Server
		UDP Client
	STA Mode	TCP Server
		TCP Client
		UDP Server
		UDP Client
		HTTP Server
		AP Scan
		Packet Filtering
		PING
		PING Webserver
		SNTP

		SMTP
		DNS
		XIVELY
	SECURITY	OPEN
		WEP PSK
		WEP SHARED
		WPA TKIP PSK
		WPA AES PSK
		WPA2 AES PSK
		WPA2 TKIP PSK
		WPA2 MIXED PSK
		WPA2 8021X AES
		WPA2 8021X TKIP

2.2.2 Hardware Interfaces

ALX82series Wi-Fi Communication Module	GPIO
	SPI
	I2C（Not supported by ALX8XX）
	UART

	WIFI
	USB

2.3 Product Features and Advantages

- Data Bridging between hardware interfaces: Serial and SPI ←→ Wi-Fi

- Integrated Broadcom BCM46332 Wi-Fi Chipset

- Supported IEEE802.11b/g/n

- Supported pre-installed RX Diversity Antenna

- Build-in Webserver, GUI configuration

- Supported TCP/IP stack

- Supported NTP, HTTP, DHCP protocols

- Serial baud rate: maximal 1382400bps, hardware flow control

- 11 GPIOs

- USB Interface Support

- Working State Indication: connecting and disconnect indication signals' output for controller MCU's monitoring

- Minimal factor design: 28mm*14.3mm LQFP 34 pins,

pitch 1.27mm

- Low power consumption, advanced power management to maintain long battery lifetime

- 3.3V power supply

2.4 Wi-Fi Features and Parameters

Feature	Description
WLAN Standards Conformance	IEEE 802 11b/g/n
Antenna Interface	Single Antenna
Spectrum	2.4000 GHz - 2.484 GHz
Channels	1~14 Channels
Modulation	DSSS, CCK, OFDM, BPSK, QPSK, 16QAM, 64QAM
Supported Speeds	1,2,5.5,11(Mbps) 6,9,12,18,24,36,48,54 (Mbps) HT20_MCS0(6.5Mbps) ~ HT20_MCS7(65Mbps)

3 Hardware Specification

3.1 Mechanical Factor
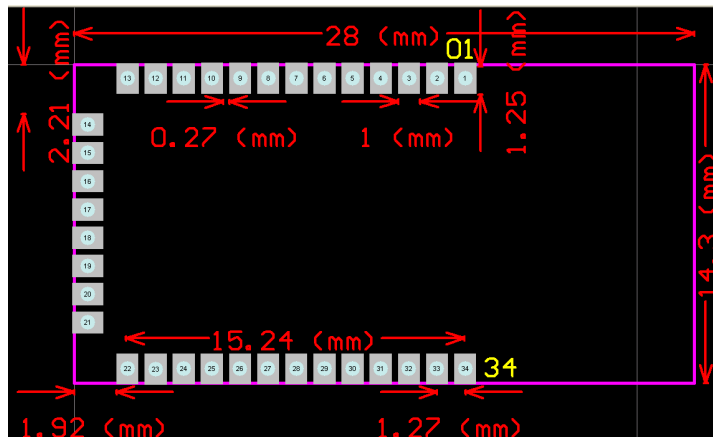
3.2 Pins Layout
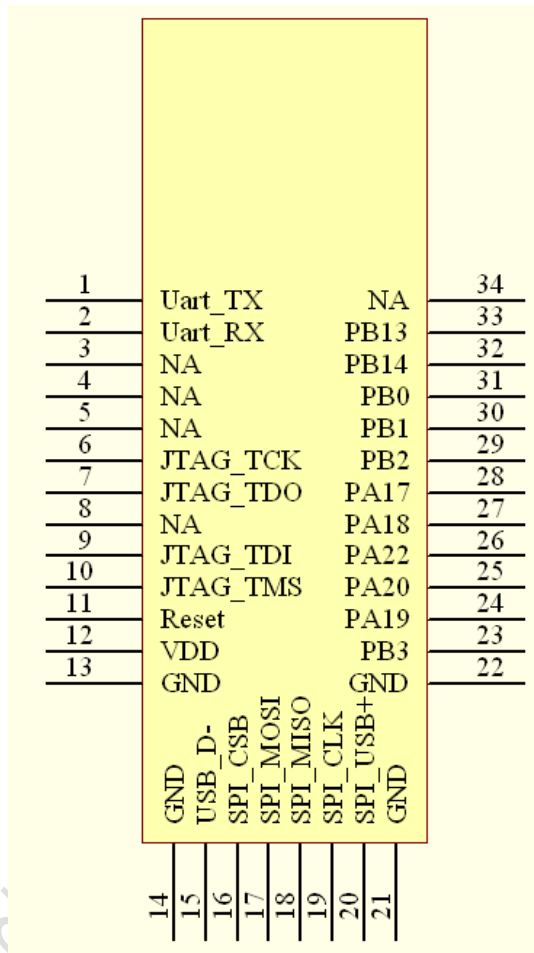
Notes: the pin mappings between IC and schematic are identical

3.3 Pins Description

Pins	Name	Type	Main function (after reset)	Alternate functions	Other functions
1	PA10	I/O	PA10	UTXD0 / SPI_NPCS2 / PWMFI1	

2	PA9	I/O	PA9	URXD0 / SPI_NPCS1 / PWMFIO / WKUP6	
3	NC				
4	NC				
5	NC				
6	PB7		JTAG_TCK		
7	PB5		JTAG_TDO	TWCK1	
8	NC				
9	PB4		JTAG_TDI	TWD1	
10	PB6		JTAG_TMS		
11	NRST				
12	VCC				
13	GND				
14	GND				
15	PB10	I/O	PB10	USB_DN	
16	PA11	I/O	PA11	SPI_NPCS0 / PWMH0 / WKUP7	
17	PA13	I/O	PA13	SPI_MOSI / PWMH2	
18	PA12	I/O	PA12	SPI_MISO / PWMH1	
19	PA14	I/O	PA14	SPI_SPCK / PWMH3	
20	PB11	I/O	PB11	USB_DP	

21	GND				
22	GND				
23	PB3	I/O	PB3	AD7 / UTXD1	
24	PA19	I/O	PA19	AD2 / PWML0 / WKUP9	
25	PA20	I/O	PA20	AD3 / PWML1 / WKUP10	
26	PA22	I/O	PA22	AD9 / TXD1 / SPI_NPCS3	
27	PA18	I/O	PA18	AD1	
28	PA17	I/O	PA17	AD0	
29	PB2	I/O	PB2	AD6 / URXD1 / WKUP12 / SPI_NPCS2	
30	PB1	I/O	PB1	AD5 / PWMH1 / RTCOUT1	
31	PB0	I/O	PB0	AD4 / PWMH0 / RTCOUT0	
32	PB14	I/O	PB14	DAC1 / SPI_NPCS1	
33	PB13	I/O	PB13	DAC0	
34	NC				

Note: TTL Level

When the Wi-Fi is connected, it returns hexadecimal 7e 01 55 aa

When the Wi-Fi is disconnected, it returns hexadecimal 7e 01 aa 55

Pin28 is used to implement the restore-to-factory-default function, when the button was pressed, the device will reboot, if the button was pressed more than 5 seconds, the device will restore the factory default settings. High level in normal operation and low level to trigger the button.

Pin27 is connected to the AP indicator LED (output low level signal while connected, and high level while disconnected)

Pin24 is connected to the server indicator LED (output low level signal while connected, and high level while disconnected)

3.4 Electrical Characteristics

3.4.1 Extreme Limitations

Power Supply	Max +3.6 Volt	
Non-work Temperature	-40 to 85 Celsius	
Voltage Drifting	+/-2%	Not exceeding maximal working

		voltage

3.4.2 Recommended Working Conditions

Working Temperature	-20 to 60 Celsius	
Humidity Range	Max 95%	Not condense, relative humidity

Note: maximal working temperature can reach 85 Celsius, but high temperature may downgrade the total performance and reliability.

3.4.3 Voltage

ALX8XX is powered by the main control logic.

Symbol	Min.	Typ.	Max.	Unit
VDD	3.0	3.3	3.6	V

4 User Operation Guide

4.1 Preparation

Hardware: Wi-Fi communication module, a PC, a WiFi AP/Router, USB-to-Serial converter (TTL interface)

Software: Serial Debugger Tool (we are using Procomm

Plus), TCP/IP Debugger, Alinket Intelligent Configuration Tool

4.2 Connect the Module to Serial Port

Serial cable (USB-to-Serial converter), Wi-Fi communication module is connected to the PC via a 4-pins connector (Tx, Rx, Vcc, Gnd):

Serial Port   Wi-Fi Communication Module

Tx ----------------------- Rx

Rx -----------------------Tx

Vcc (3.3v) -------------- Vcc (3.3v)

Gnd ------------------- Gnd
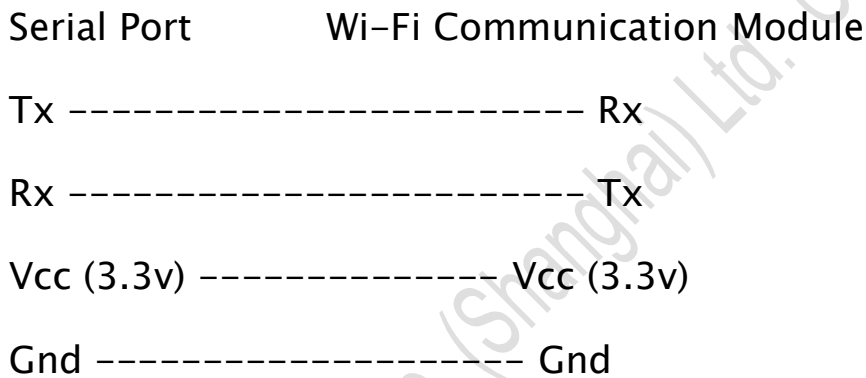
4.3 Connect to the Router

（1） PC connects to the Router, and obtain the IP address

```
Wireless LAN adapter 无线网络连接:

   Connection-specific DNS Suffix  . :
   Link-local IPv6 Address . . . . . : fe80::cc92:80b4:d8b6:a9cc%15
   IPv4 Address. . . . . . . . . . . : 192.168.61.200
   Subnet Mask . . . . . . . . . . . : 255.255.255.0
   Default Gateway . . . . . . . . . : 192.168.61.1
```
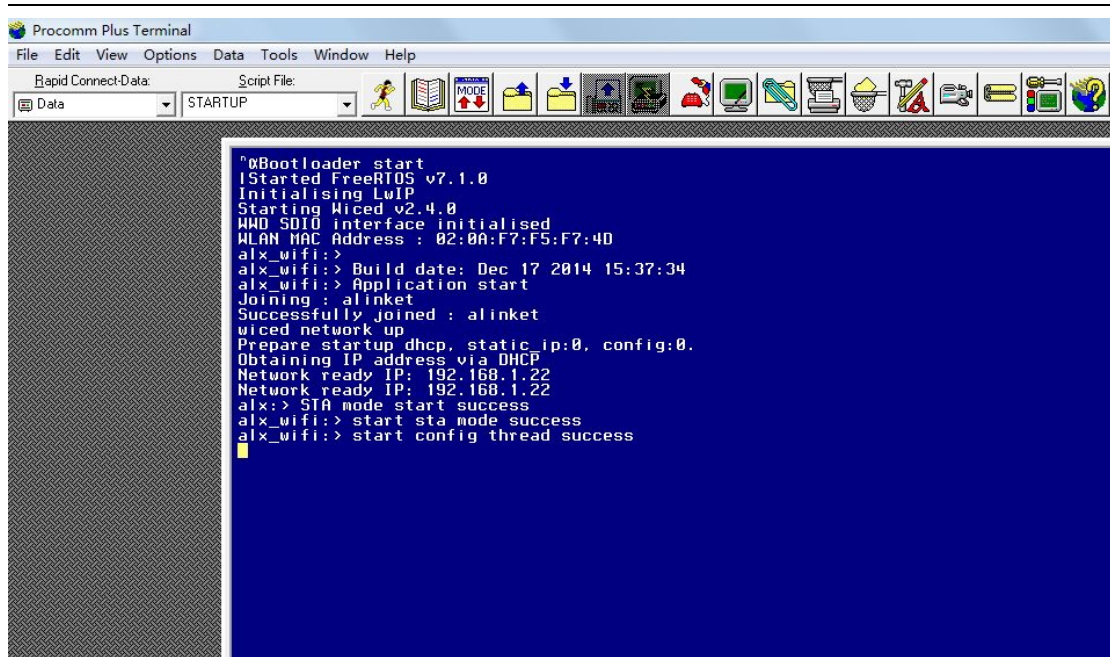
（2） Wi-Fi communication module connects to the

Router

Open the serial port debugger, choose the port, and set the baud rate to 115200, parity check NONE, 8N1 Data/Stop configuration, as below:

Alt:	Host	Chat	LogonWiz	WinLink
ANSI BBS	ASCII	direct connect-Com4	115200	N-8-1	rd ⚪ sd ⚪ cd 🔴 cts 🔴
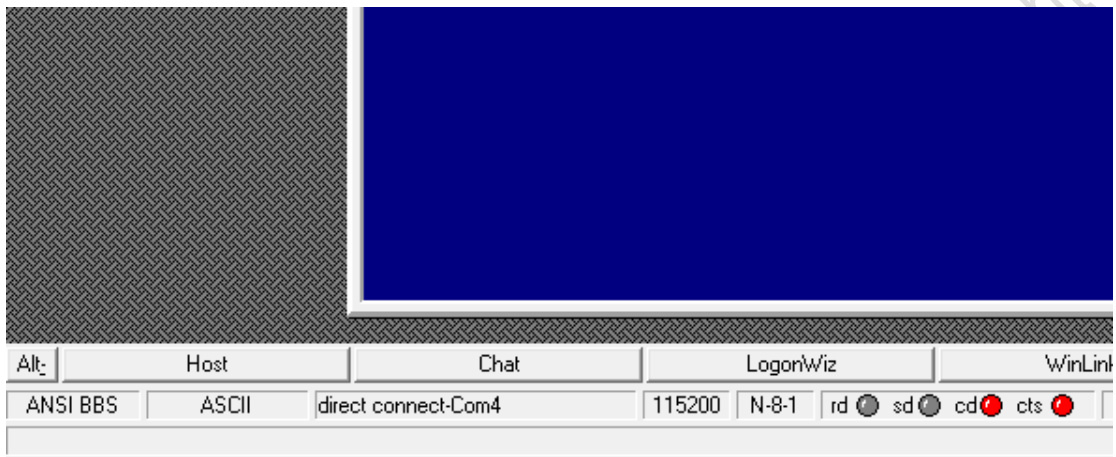
Power on the module, check the console and saw the module successfully joined the Wi-Fi network "alinket" and the IP address assignment may looks like:

4.4 Alinket Smart Configuration Software

4.4.1 Software Installation

Double click the installer ASCS.msi, until successfully completed.

4.4.2 Software Usage

After installation, 3 desktop shortcuts will be created:
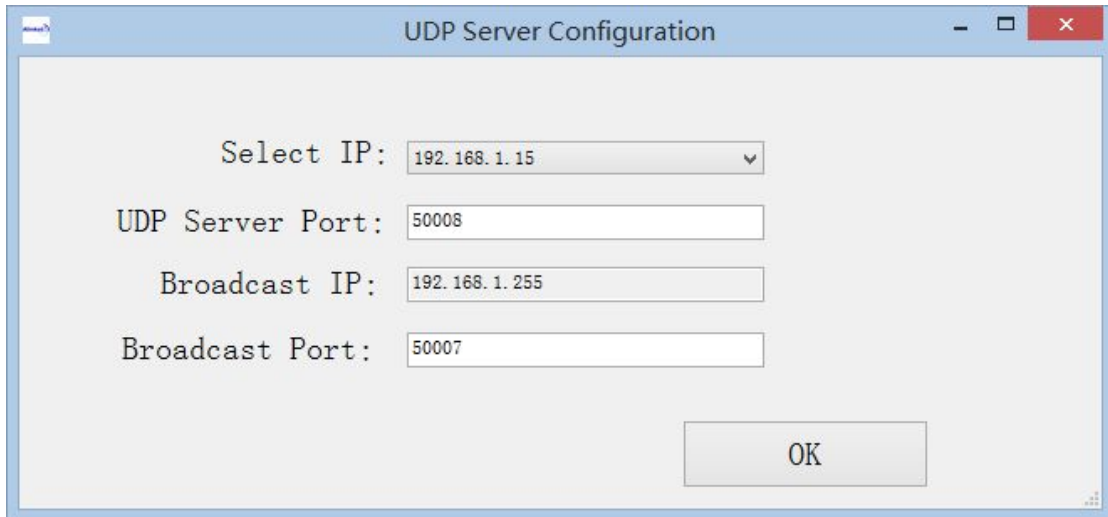
- "ASCS"

- "ASCS UartAssist"

- "ASCS TCPUDP"

# "ASCS" is the ALX82x series smart configuration software.
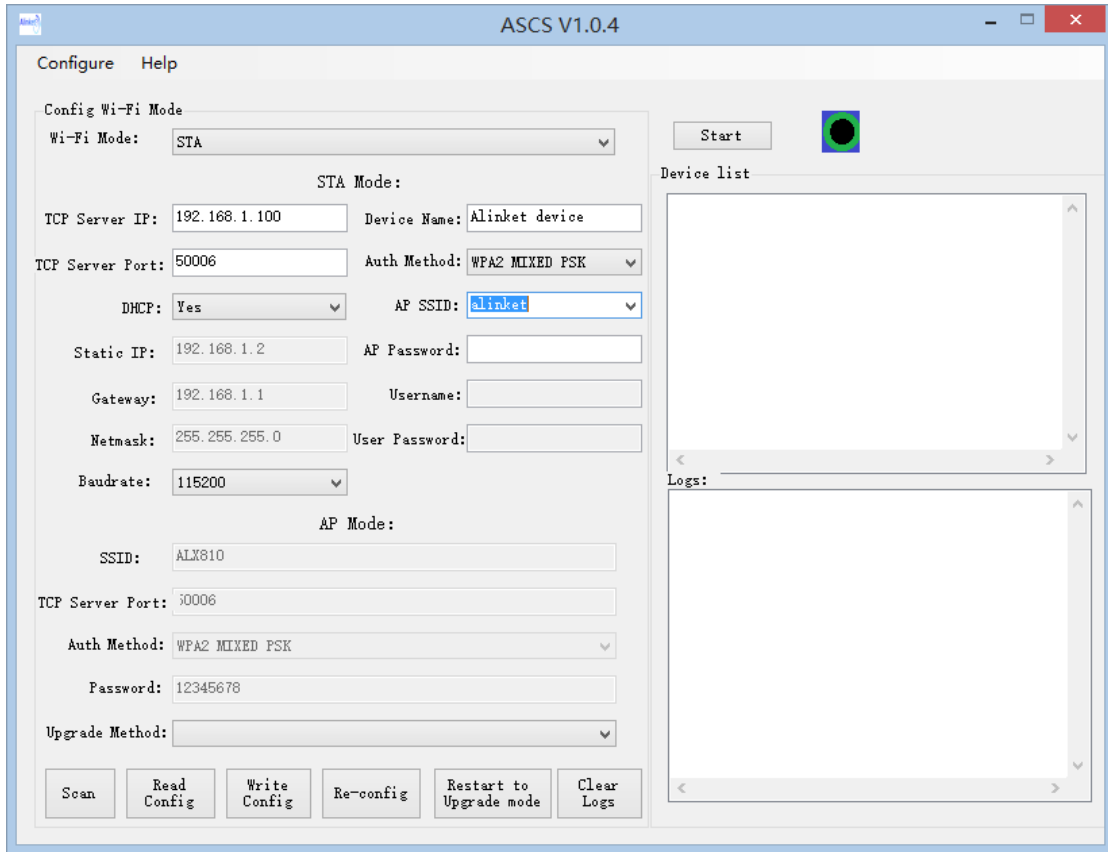
4.4.3 UDP Server Configuration Description

- Choose "Configure" in the menu → "Configure Server":

- Select the local network interface to communicate with ALX82x modules.

- Set the UDP server port used to communicate with ALX82x modules.

- Broadcast IP: used internally, use the default is OK.

- Broadcast port: must be 50007.

- Click "OK" to save UDP Server configuration.

4.4.4 Device Configuration Description
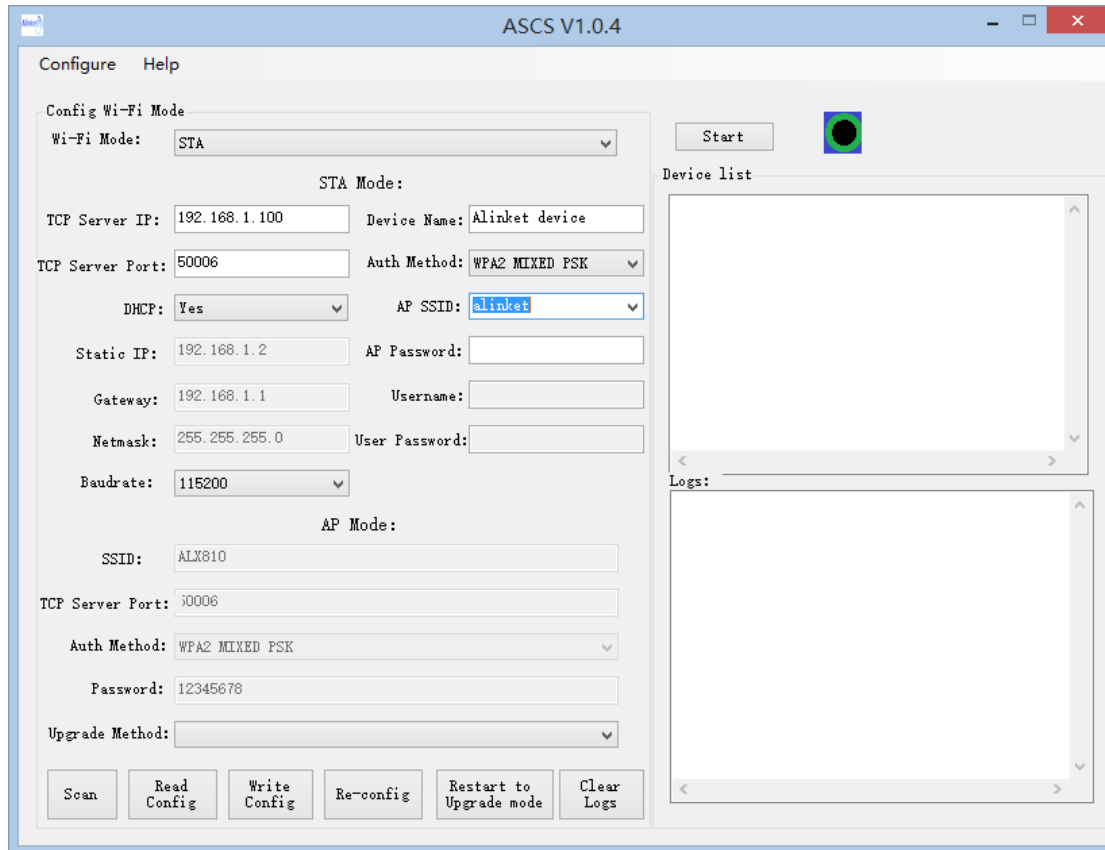
Wi-Fi mode select: STA, AP, STA+AP (will support later)

STA mode:

- TCP Server IP: the IP address of the running TCP server.

- TCP Server Port: the TCP port of the running TCP server.

- Serial Baud Rate

- Device Name: the module name identification.

- AP SSID: Router AP's SSID to be connected by the

  communication module.

- Auth Method: OPEN (no password), WPA2 MIXED PSK (pre-shared key), WPA TKIP PSK, WPA ASE PSK, WPA2 TKIP PSK, WPA2 AES PSK, WPA2 8021X AES PSK, WPA2 8021X TKIP PSK

- AP password: Router AP's password to be connected.

Note: while selecting security method as: WPA2 8021X AES PSK or WPA2 8021X TKIP PSK, need to configure below parameters:

- User name: radius username

- User password: radius password

AP Mode:

- SSID: Module's own SSID as AP.

- Auth method: OPEN (no password), WPA2 MIXED PSK (pre-shared key)

- Password: password as AP, at least 8 bytes and mostly 30 bytes.

- Upgrade Method: Upgrade Firmware method(UART USB OTA)

Menu Buttons Description:

- "Read Config": Read the configuration which device you selected

- "Write Config": Write the configuration which device you selected.

● "Scan": list all started devices and show them in the device list.

● "Re-configuration": restore to default settings.

● "Clear Logs": flush the logs in the console window.

Note: the device name, AP SSID, AP password, SSID and password cannot exceed 30 bytes long.
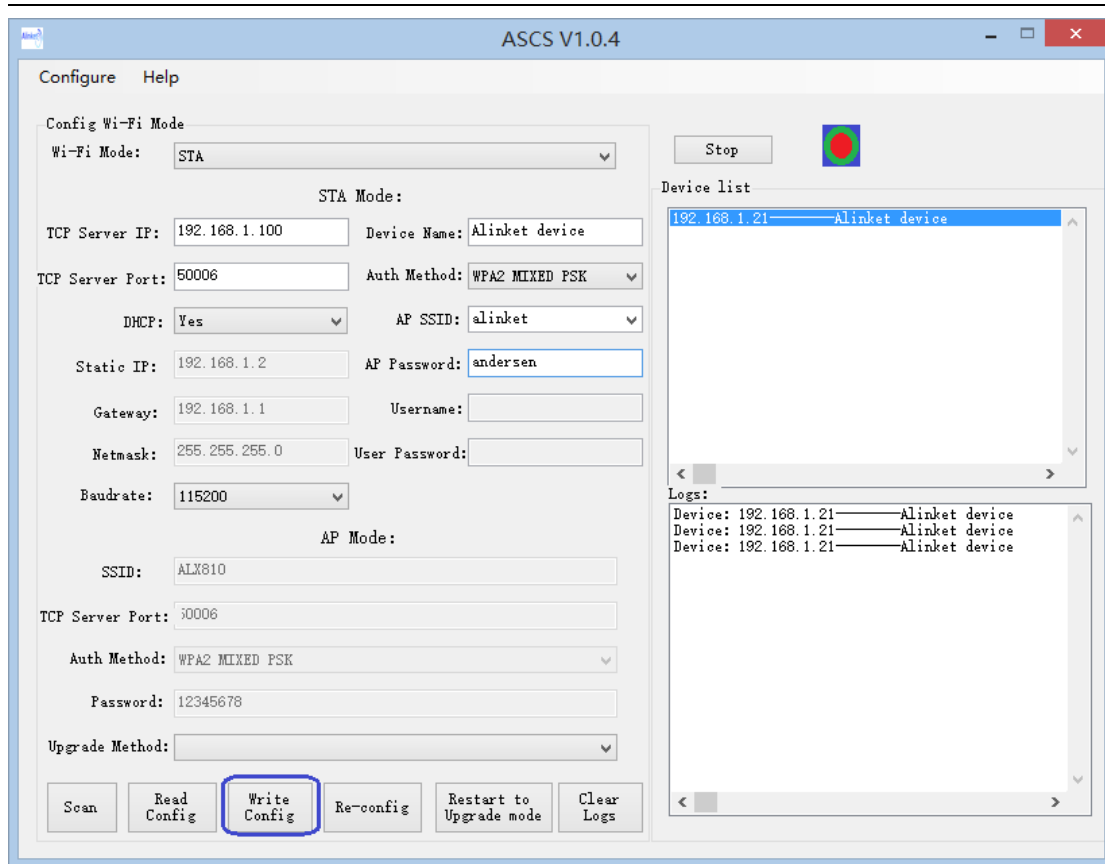
4.4.5 Device Scan

Click the "Scan" menu button to re-scan all the connected ALX82x Wi-Fi communication modules in local network region, as depicted in below diagram:
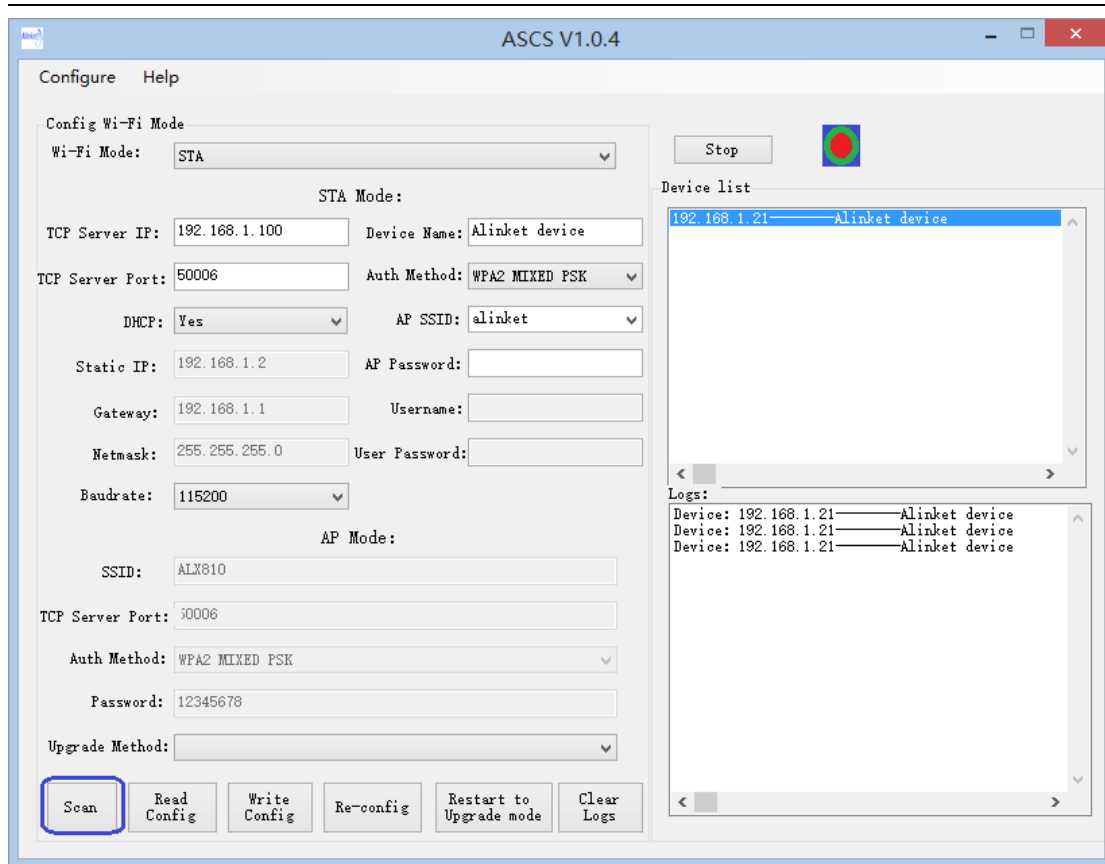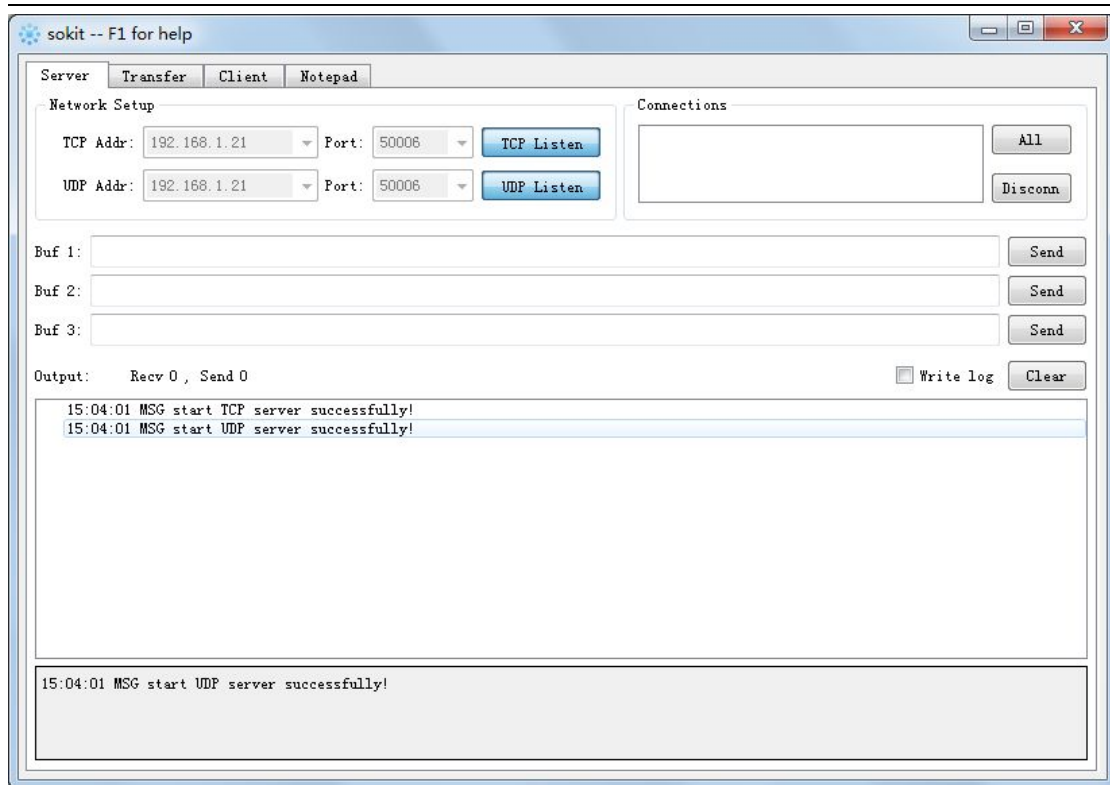
4.4.6 Configure Device

Choose the IP address of the device from the device list to be configured, click the configuration button, the device will reboot after submitting the configuration, like below:

4.5 TCP/UDP Debugger Server Usage

We are using a TCP/UDP debugger tool called sokit, it can be downloaded from: https://code.google.com/p/sokit/

Configure the TCP/UDP Server, select the host IP interface which will be used to communicate with the ALX82x modules, and set the TCP/UDP port to 50006, then click "TCP/UDP Listen", with the same configuration the ALX82x modules should automatically connect to our TCP/UDP server:
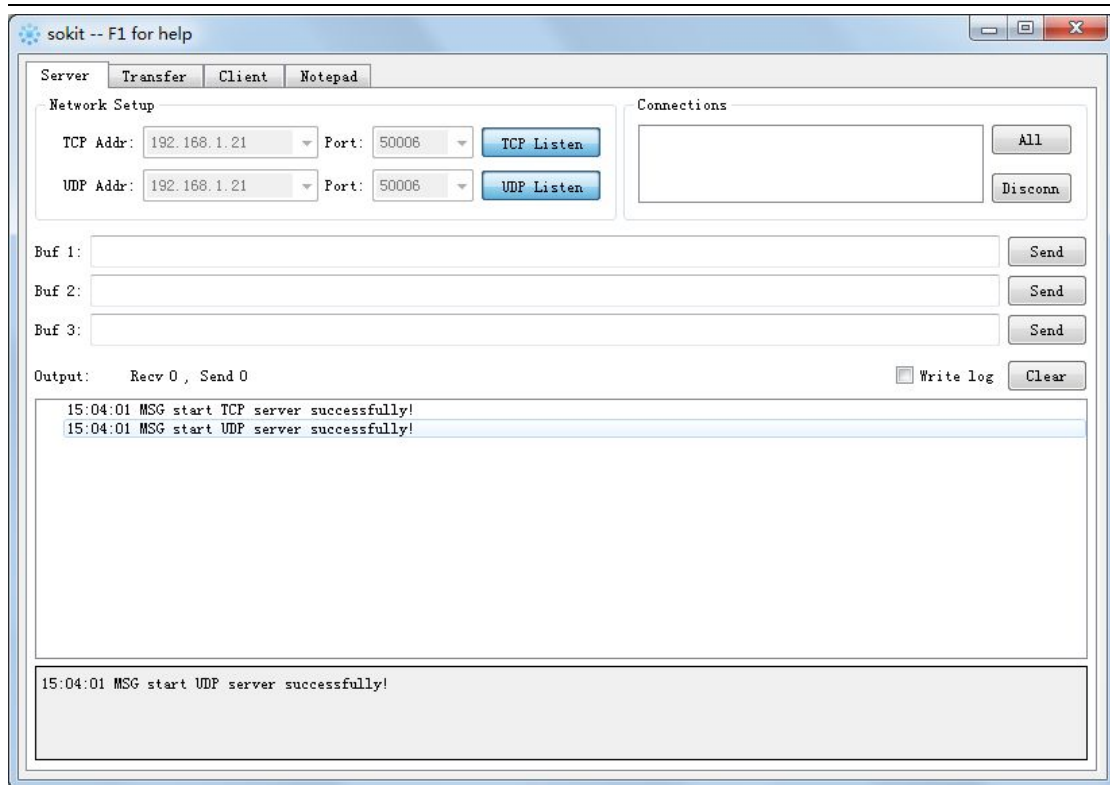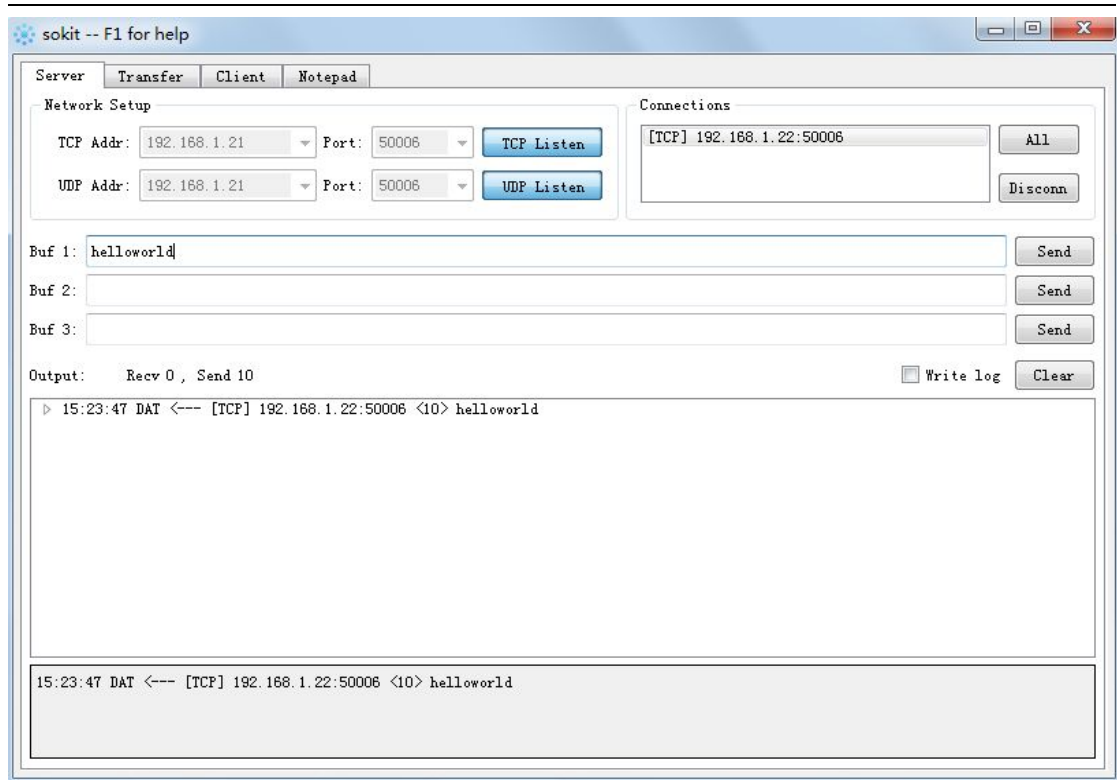
4.6 Data Transferring

In Serial Debugger Console, type any characters at the serial console of the ALX8XX module, and you should be able to see the string received at the TCP server side terminal.

```
Bootloader start
IStarted FreeRTOS v7.1.0
Initialising LwIP
Starting Wiced v2.4.0
WWD SDIO interface initialised
WLAN MAC Address : 02:0A:F7:F5:F7:4D
alx_wifi:>
alx_wifi:> Build date: Dec 17 2014 15:37:34
alx_wifi:> Application start
Joining : alinket
Successfully joined : alinket
wiced network up
Prepare startup dhcp, static_ip:0, config:0.
Obtaining IP address via DHCP
Network ready IP: 192.168.1.22
Network ready IP: 192.168.1.22
alx:> STA mode start success
alx_wifi:> start sta mode success
alx_wifi:> start config thread success
alx_wifi_tcp:> uart to tcp thread start
~@U¬
```

Note that the characters you typed in will not be echoed back to the console, but you can see them at the TCP/UDP debugger side, as below:
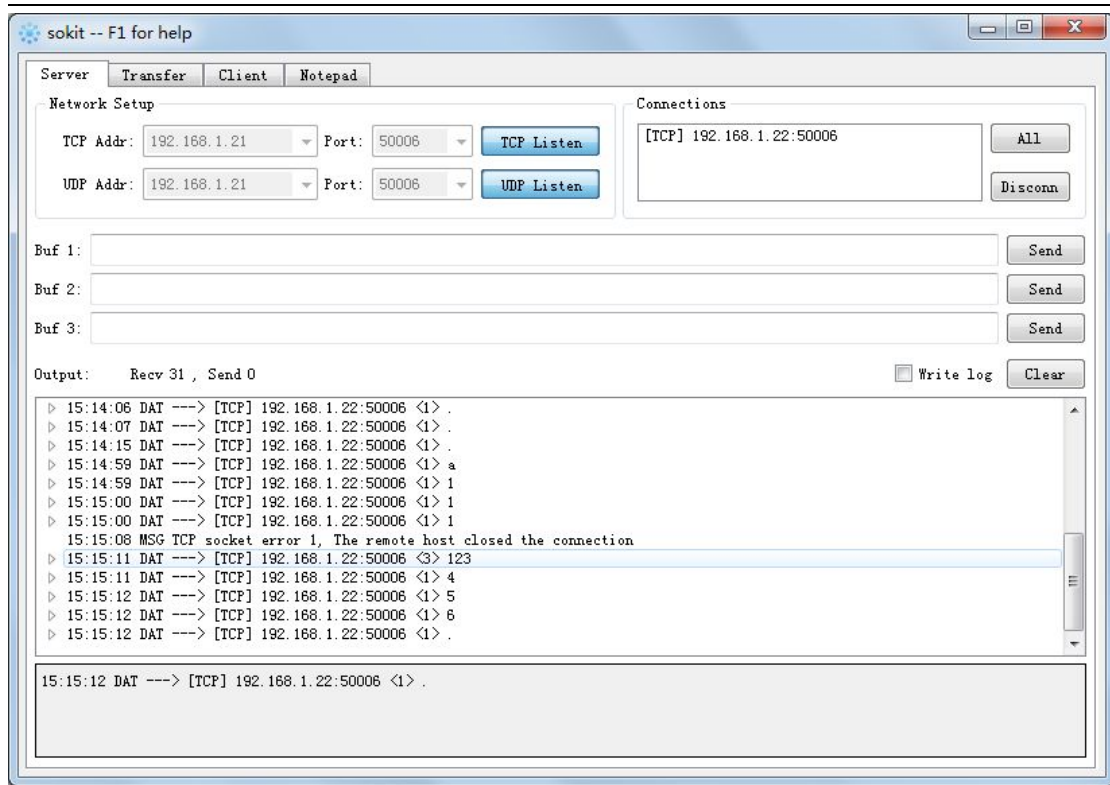
In the connected device list of the TCP server, select the IP address of the ALX82x Wi-Fi communication module, and send the "helloworld" string to the DAT:

And you will be able to see the "helloworld" string on the

serial console:

4.7 Disconnection and Re-connection

When the network signal gets awkward and unstable, which caused the ALX82x module disconnected from the network, the ALX82x module will automatically reconnect.

On the TCP/UDP debugger server select the ALX82x device IP address in the "Connections" list, click the "Disconn" button, you will see the ALX82x automatically detects this event and will try re-connect to the TCP/UDP debugger server.

On disconnection event, the module will print hexadecimal 7e 01 aa 55, and after successfully reconnection it prints hexadecimal 7e 01 55 aa.

```
Bootloader start
IStarted FreeRTOS v7.1.0
Initialising LwIP
Starting Wiced v2.4.0
WWD SDIO interface initialised
WLAN MAC Address : 02:0A:F7:F5:F7:4D
alx_wifi:>
alx_wifi:> Build date: Dec 17 2014 15:37:34
alx_wifi:> Application start
Joining : alinket
Successfully joined : alinket
wiced network up
Prepare startup dhcp, static_ip:0, config:0.
Obtaining IP address via DHCP
Network ready IP: 192.168.1.22
Network ready IP: 192.168.1.22
alx:> STA mode start success
alx_wifi:> start sta mode success
alx_wifi:> start config thread success
alx_wifi_tcp:> uart to tcp thread start
~@U¬helloworld~@¬UBootloader start
IStarted FreeRTOS v7.1.0
Initialising LwIP
Starting Wiced v2.4.0
WWD SDIO interface initialised
WLAN MAC Address : 02:0A:F7:F5:F7:4D
alx_wifi:>
alx_wifi:> Build date: Dec 17 2014 15:37:34
alx_wifi:> Application start
Joining : alinket
Successfully joined : alinket
wiced network up
Prepare startup dhcp, static_ip:0, config:0.
Obtaining IP address via DHCP
Network ready IP: 192.168.1.22
Network ready IP: 192.168.1.22
alx:> STA mode start success
alx_wifi:> start sta mode success
alx_wifi:> start config thread success
alx_wifi_tcp:> uart to tcp thread start
~@U¬
```

4.8 Configure Static IP Address

ASCS Alinket smart configuration tool supports static IP address setting after version 1.0.2:

- Set "Enable DHCP" to "No"

- Configure "Static IP address", "Netmask" and "Default Gateway"

- Wi-Fi security method and AP password are the same as before

- Use "Scan" to find the device in the device list, select the device to be configured, and click "Apply" to apply the configuration to

the device

- The ALX82x module will reboot and use the configured static IP address to re-connect to the ASCS as well as the AP router

- If configured wrongly and cannot re-connect the ALX82x module, restore to the factory default to solve the problem.
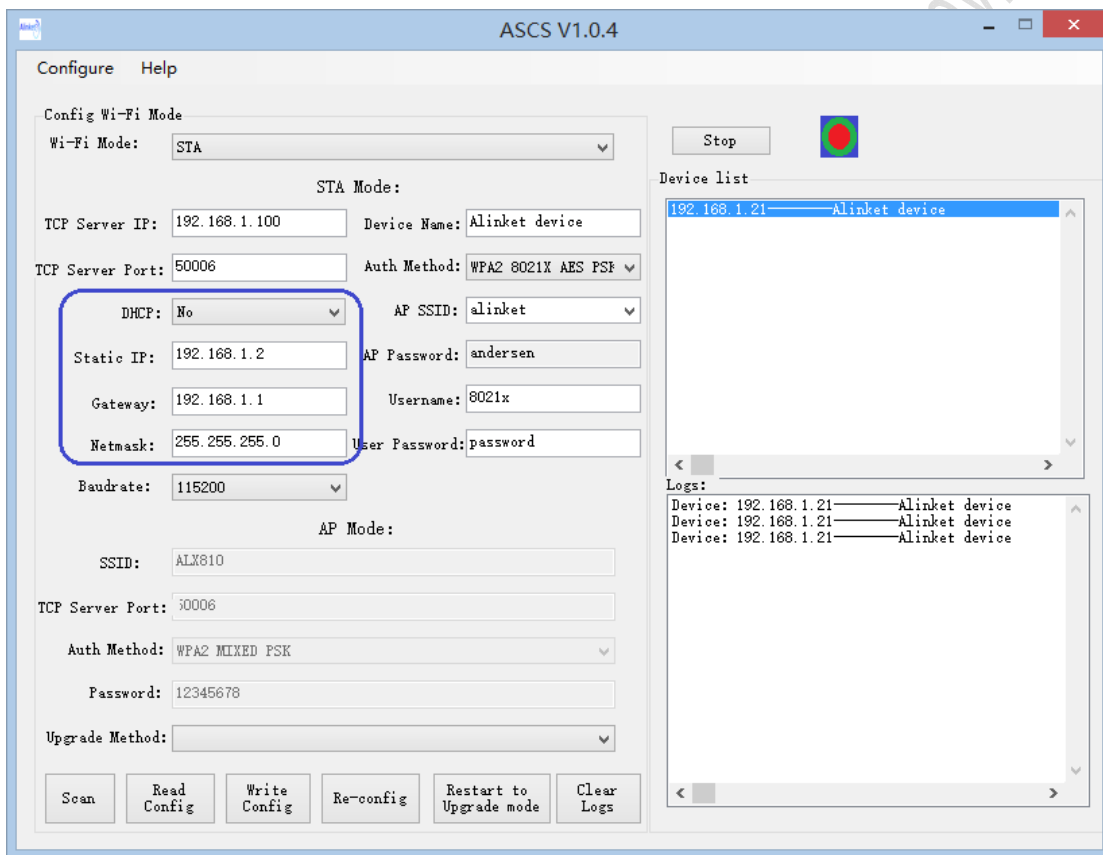
4.9 Configure 802.1x Authentication

ASCS Alinket smart configuration tool supports 802.1x authentication setting after version 1.0.2:

- Set "Enable DHCP" to "No"

- Choose "WPA2_8021X_AES_PSK" as the "Security Mode"

- Set "AP SSID" to the connecting AP SSID

- Set the 802.1x authentication user name and password in the "username" and "password"

- Use "Scan" to find the device in the device list, select the device to be configured, and click "Apply" to apply the configuration to the device

- The ALX82x module will reboot and use the configured authentication secrets to re-connect to the AP router
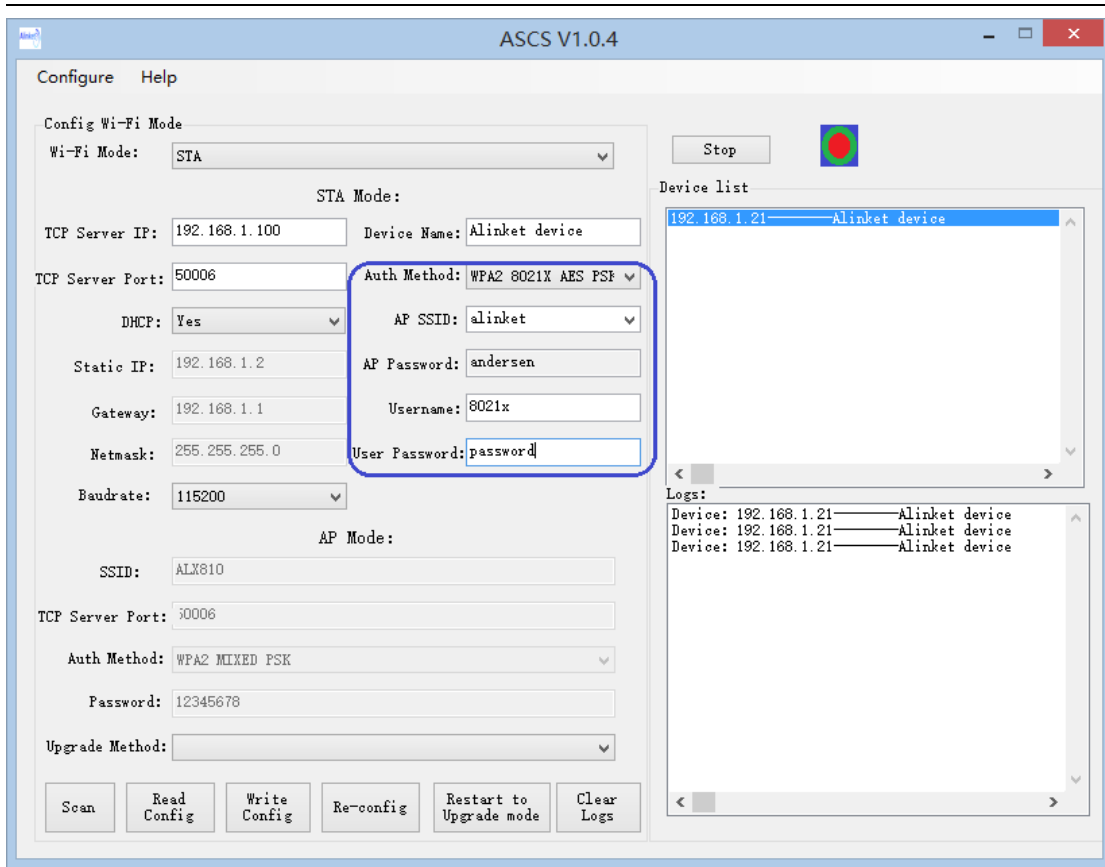
5 Testing Report

5.1 Power Consumption Testing (ALX8XX)

Test Case	MCU power save	Wi-Fi power save	Mode	Max current (ma)	Min current (ma)
Project 1	Normal	Normal	AP	100	82.7
			Station	108	83.3
Project 2	Normal	Low	AP	100	82.7

		Power	Station	34	22.4
Project 3	Low Power	Normal	AP	81	69
			Station	32.1	22.7
Project 4	Low Power	Low Power	AP	80	65
			Station	27	5

5.2 Reliability Testing

Test Case	Mode	Direction	Time (H)	Data (S)	Result
Project 1	Station	UART to TCP	48	10kB	No loss
Project 1	Station	TCP to UART	48	5kB	No loss
Project 1	Station	Bi-directional	48	15kB (simultaneously)	No loss