OpenWRT User Manual

(WLM113/WLM113H/WLM115)

Content

1 Product Introduction

1.1 Brief Introduction

WLM113/WLM113H/WLM115 is a low-cost embedded wireless module. WLM113 and WLM113H support 3 ethernet interfaces (1 wan + 2 lan) and WLM115 supports 5 ethernet interfaces (1 wan + 4 lan). The wireless module follows the standard of IEEE and 802.11b/g/n. The maximum transmission rate of wireless module can reach 150Mbps. Many encryption standard like WEP/WPA/WPA2 has been supported by the wireless module to guarantee the security of network data.

1.2 Technical Specifications

Table 1-1 Technical Specifications

network standard	wired: IEEE 802.3
	wireless: IEEE 802.11b、IEEE 802.11g、IEEE 802.11n
wireless transmission rate	11b: maximum up to 11Mbps 11g: maxmum up to 54Mbps 11n: maxmum up to 150Mbps
Frequency	2.412-2.462GHz
Emission power	0-20dbm
Interface	3 Ethernet(WLM113,WLM113H) or 5 Ethernet(WLM115), 1USB (host/slave), GPIO
WIFI Functional Parameters	
WIFI work mode	Clinent/AP/Repeater
WDS Function	Support WDS wireless bridge connection
Wireless security	Wireless MAC address filter
	WEP encryption(open system and shared key)
	WPA-PSK, WPA2-PSK, WPA-PSK/WPA2-PSK mixed mode
	hide ssid
Country Code	adjustment of country code
HT mode	20MHz, 40MHz 2^{nd} channel below, 40MHz 2^{nd} channel above
Network management	
Remote Web	configure the openwrt like network, wifi, software update, ntp and so on
	view system information like uptime, memory information, system log and so on
	software upgrade

management	import and export configuration file
telnet	support telnet to login in the shell of openwrt
ssh	support ssh to login in the shell of openwrt

1.3 Product Specification

Table 1-2 Product Specification

Features		**Specifications**
code size		4Mbyte or 8Mbyte flash
Data size		32Mbyte DDR1 or 64Mbyte DDR1 or 64Mbyte DDR2
Radio	Frequency	2.412~2.462 GHz
	Channel	11 channels, enable to choose different country code
	Modulation method	DSS, CCK and OFDM
	encoding scheme	BPSK, QPSK, 16QAM and 64QAM
	Antenna	Onboard antenna or External antenna
RF Rx sensitivity		802.11b: -82dbm @ 1 Mbps; -80dbm @ 2 Mbps -78dbm @ 5.5 Mbps -76dbm @ 11 Mbps 802.11g: -82dbm @ 6 Mbps -81dbm @ 9Mbps -79dbm @ 12 Mbps -77dbm @ 18 Mbps -74dbm @ 24 Mbps -70dbm @ 36 Mbps -66dbm @ 48 Mbps -65dbm @ 54 Mbps 802.11n: -65dbm @ 65 Mbps HT40 -62dbm @ 138 Mbps HT40

RF maximum output power		802.11b: 18 ±1dbm 802.11g: 13 ±1dbm @ 54 Mbps 14 ±1dbm @ 48 Mbps 16 ±1dbm @ 36 Mbps 17 ±1dbm @ 24 Mbps 802.11n: 12 ±1dbm @ MCS7 12 ±1dbm @ MCS6 13 ±1dbm @ MCS5 14 ±1dbm @ MCS4 14 ±1dbm @ MCS3 15 ±1dbm @ MCS2 15 ±1dbm @ MCS1 16 ±1dbm @ MCS0
Ethernet interface	WAN	one 100M 3thernet interface, 10/100 self-adaptive, support duplex and half-duplex work mode, support auto-MDI/MDIX. The Ethernet interface is connected to the main board through connector
	LAN	two or four 100M 3thernet interface, 10/100 self-adaptive, support duplex and half-duplex work mode, support auto-MDI/MDIX. The Ethernet interface is connected to the main board through connector
I/O	function interface	1xUART, 1xWAN, 4xLAN or 2xLAN
	GPIO	17 GPIO(some of them multiplex with other interface)
work voltage		3.3V
3.3V peak current		2A
Work temperature		0℃ to +40℃
Work humidity		10 ~ 90%(non-condensation)
Product size		65mm x 38 mm(WLM115)

1.4 Hardware Explanation

1.4.1 WLM113

1.4.1.1 Physical Map

Chart 1.1 Top View of Physical Map

Chart 1.2 Bottom View of Physical Map

Chart 1.3 Physical Map of Main board

1.4.1.2 Mechanical Dimensions

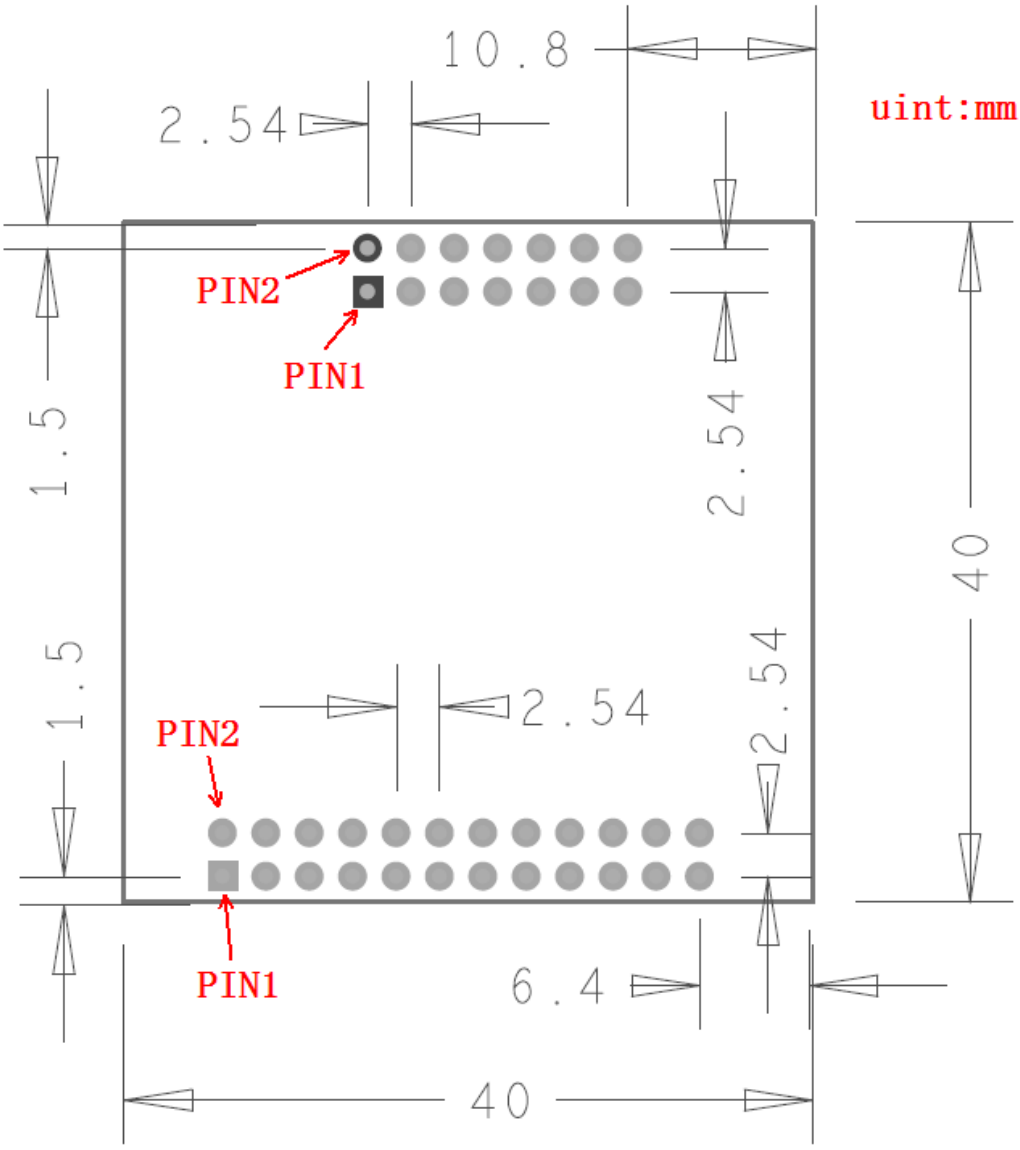

Chart 1.4 dimensions of WLM113 Unit:mm

1.4.1.3 Pins Interface

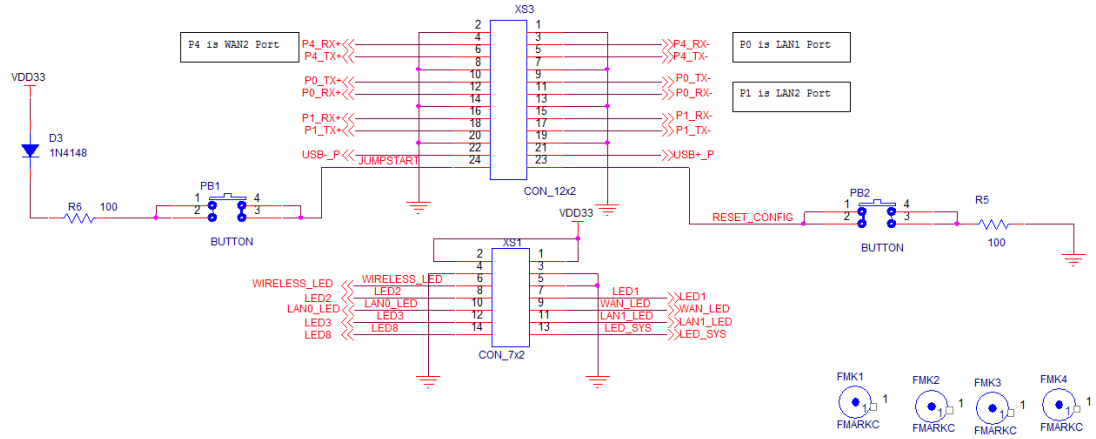

Chart 1.5 Pins of WLM113

1.4.2 WLM115

1.4.2.1 Diagram of the system application

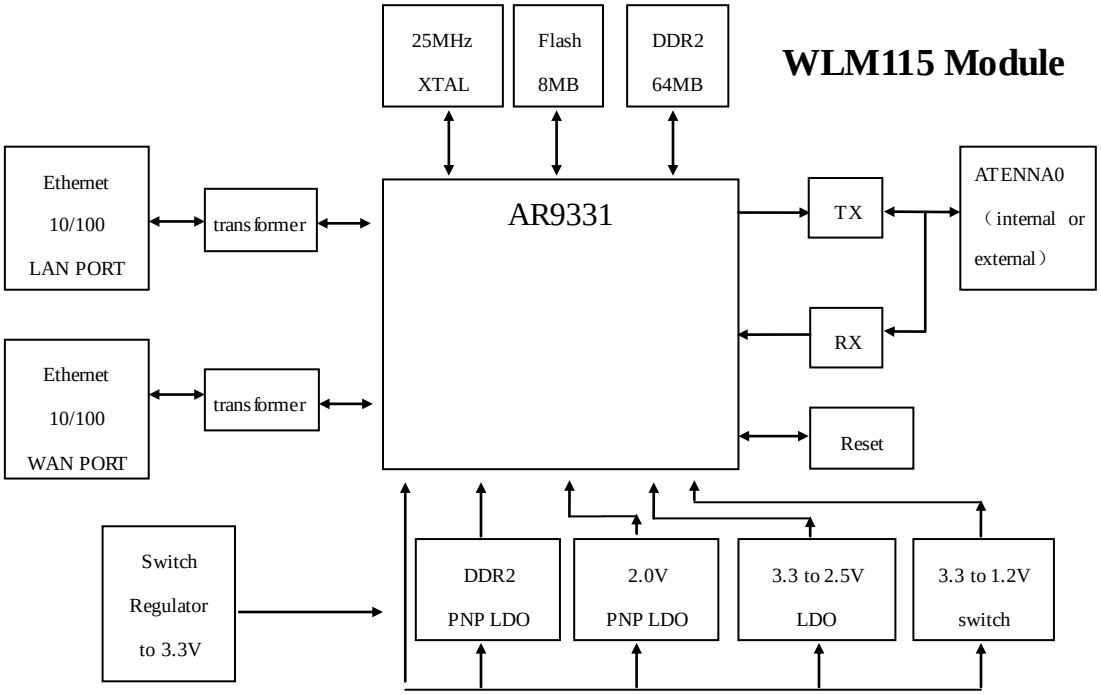

Chart 1.6 Diagram of the system application

1.4.2.2 Physical Map

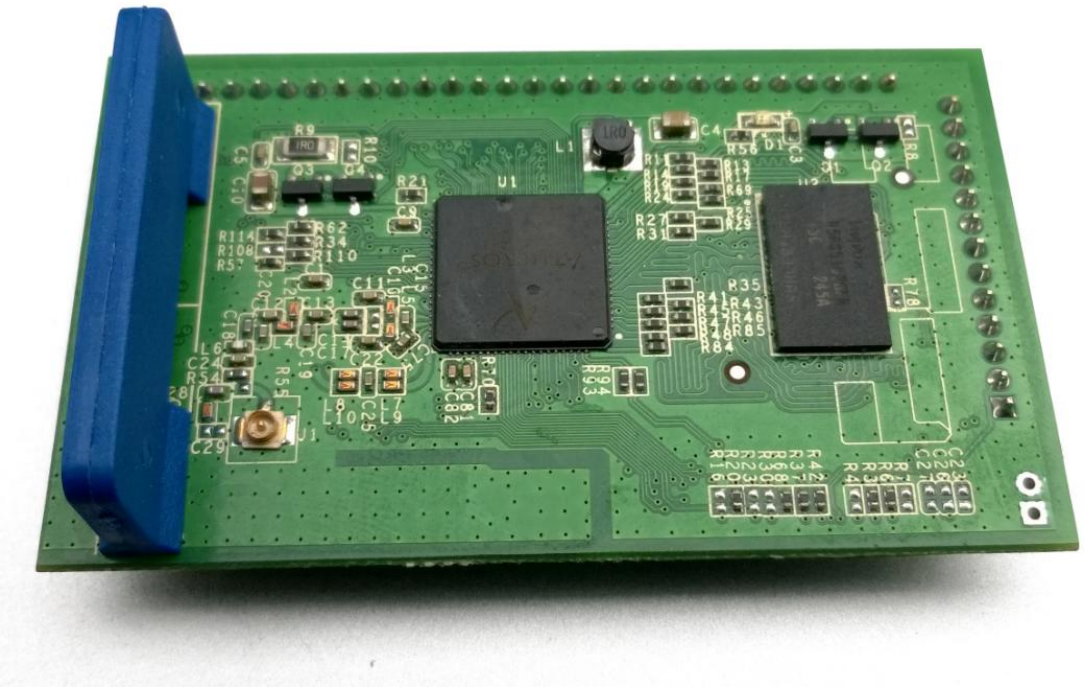

Chart 1.7 Top View of Physical Map

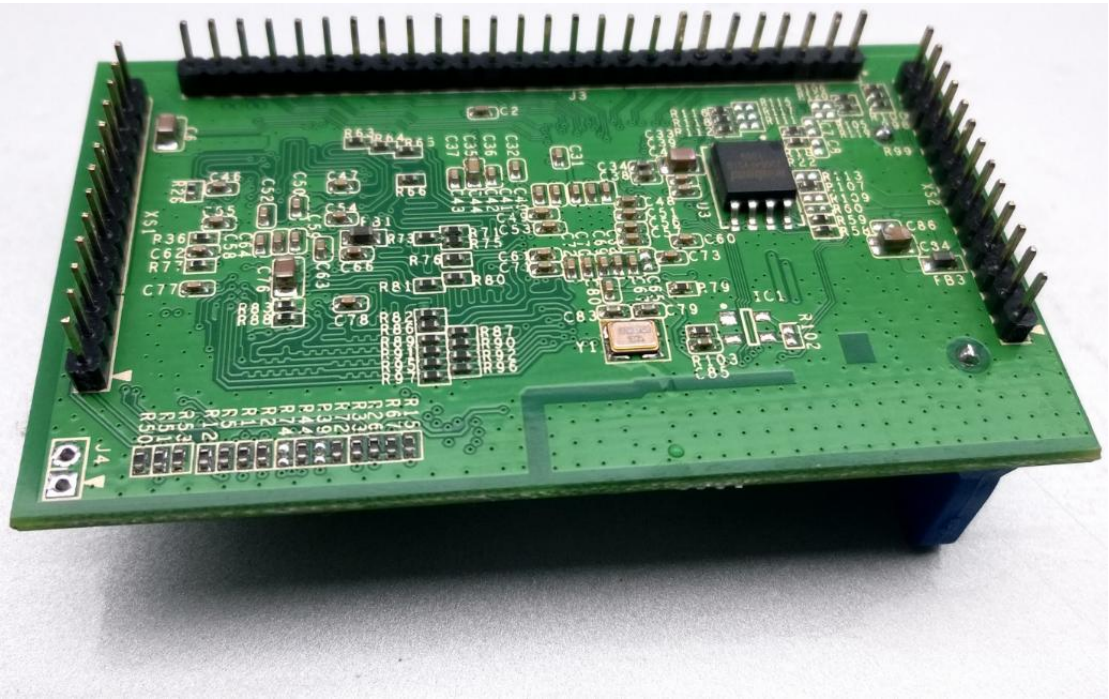

Chart 1.8 Bottom View of Physical Map

Chart 1.8 Physical Map of Main board

1.4.2.3 Mechanical Dimensions

WLM115 mechanical dimensions is shown in the following picture:

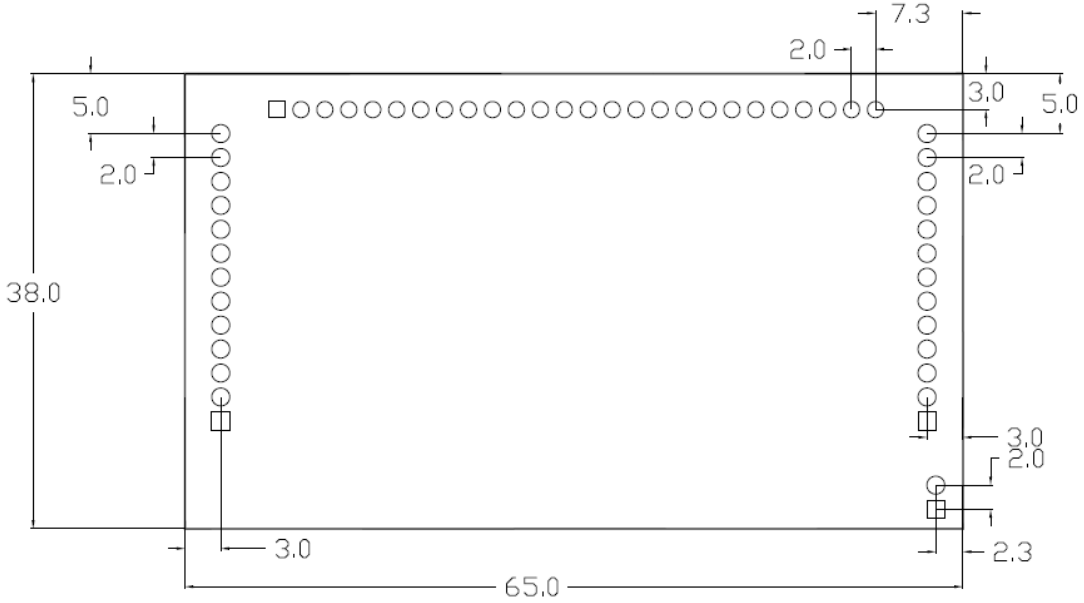

Chart 1.9 dimensions of WLM115(1) Unit:mm

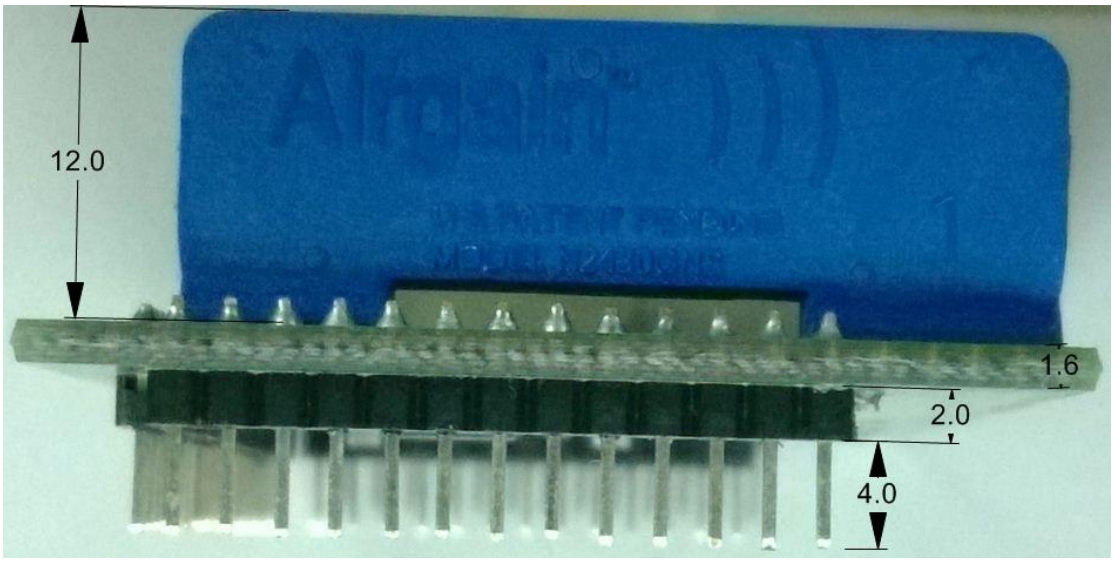

Chart 1.10 dimensions of WLM115(2) Unit:mm

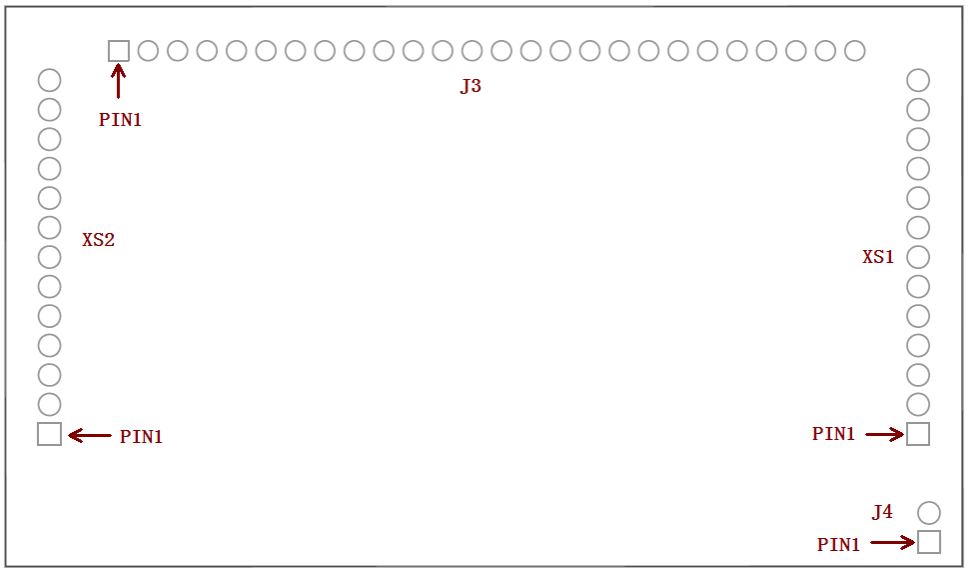

Chart 1.11 dimensions of WLM115(3) Unit:mm

1.4.2.4 Pins Interface

The Pin of WLM115 as shown above is defined as follows:

Table 1-3 pin interface of WLM115 module

PIN No.	name	director y	description	not e
1,2,3,8,11	GND	Power ground	Power ground	XS 2
4,5	VDD33	Power	Power supply for the	

		In	module(max 500mA)	
6	VDD25	Power Out	DC 2.5V	
7	2.0V	Power Out	DC 2.0V is power supply for external transformer tap	
9	USB+_P	IA/OA	USB D+ Signal	
10	USB-_P	IA/OA	USB D- Signal	
12	GPIO9/UART_RX_P	I/O/I	GPIO10/UART_RX	
13	GPIO10/UART_TX_P	I/O/O	GPIO9/UART_TX	
1	GPIO12/RESET_CONFIG	I/O/IH	GPIO12/System Reset (active high)	XS1
2	GPIO11/JUMP_START	I/O/IL	GPIO11/JUMP_START button input(active low)	
3	GPIO_22_P	I/O	GPIO22	
4	GPIO_23_P	I/O	GPIO23	
5	GPIO13/LAN1-LED	I/O/OH	GPIO13/LAN1-LED	
6	GPIO14/LAN2-LED	I/O/OH	GPIO14/LAN2-LED	
7	GPIO15/LAN3-LED	I/O/OH	GPIO15/LAN3-LED	
8	GPIO16/LAN4-LED	I/O/OH	GPIO16/LAN4-LED	
9	GPIO17/WAN-LED	I/O/OL	GPIO17/WAN-LED	
10	GPIO0/WIRELESS-LED	I/O/OH	GPIO0/WIRELESS-LED	
11	GPIO26/JumpStart_LED	I/O/OL	JumpStart indicator	
12	GPIO_27_P	I/O	GPIO27（with a 330 ohm resistor in series）	
13	GPIO_1_P	I/O	GPIO1（with a220 ohm resistor in series）	
1,6,11,16, 21,26	GND	Power ground	Power ground	J3
2	LAN1_TX-	OA	Ethernet port LAN1 transmit pair	
3	LAN1_TX+	OA		
4	LAN1_RX-	IA	Ethernet port LAN1 receive pair	
5	LAN1_RX+	IA		
7	LAN2_RX-	IA	Ethernet port LAN2 receive pair	
8	LAN2_RX+	IA		
9	LAN2_TX-	OA	Ethernet port LAN2 transmit pair	
10	LAN2_TX+	OA		

12	LAN3_TX-	OA	Ethernet port LAN3 transmit pair	
13	LAN3_TX+	OA		
14	LAN3_RX-	IA	Ethernet port LAN3receive pair	
15	LAN3_RX+	IA		
17	LAN4_RX-	IA	Ethernet port LAN4 receive pair	
18	LAN4_RX+	IA		
19	LAN4_TX-	OA	Ethernet port LAN4 transmit pair	
20	LAN4_TX+	OA		
22	WAN_TX-	OA	Ethernet portWANtransmit pair	
23	WAN_TX+	OA		
24	WAN_RX-	IA	Ethernet port WAN receive pair	
25	WAN_RX+	IA		
1,2	GND	Power ground	Power ground	J4

Notes:

1.I:input O:output L:low level effective H:high level effective A:analog signal

2.The supply voltage of WIFI module is 3.3V. When the WIFI module is plugged in main board, the supply voltage of main board is 5~12V.

1.4.3 WLM113H

1.4.3.1 Diagram of the system application

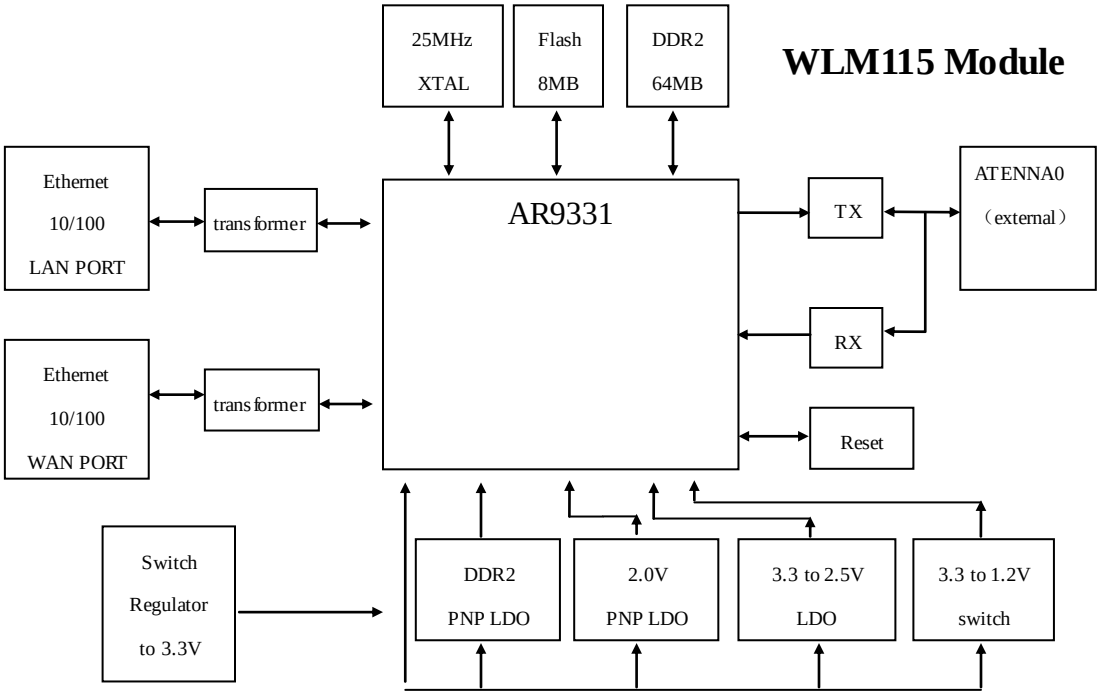

Chart 1.12 Diagram of the system application

1.4.3.2 Physical Map

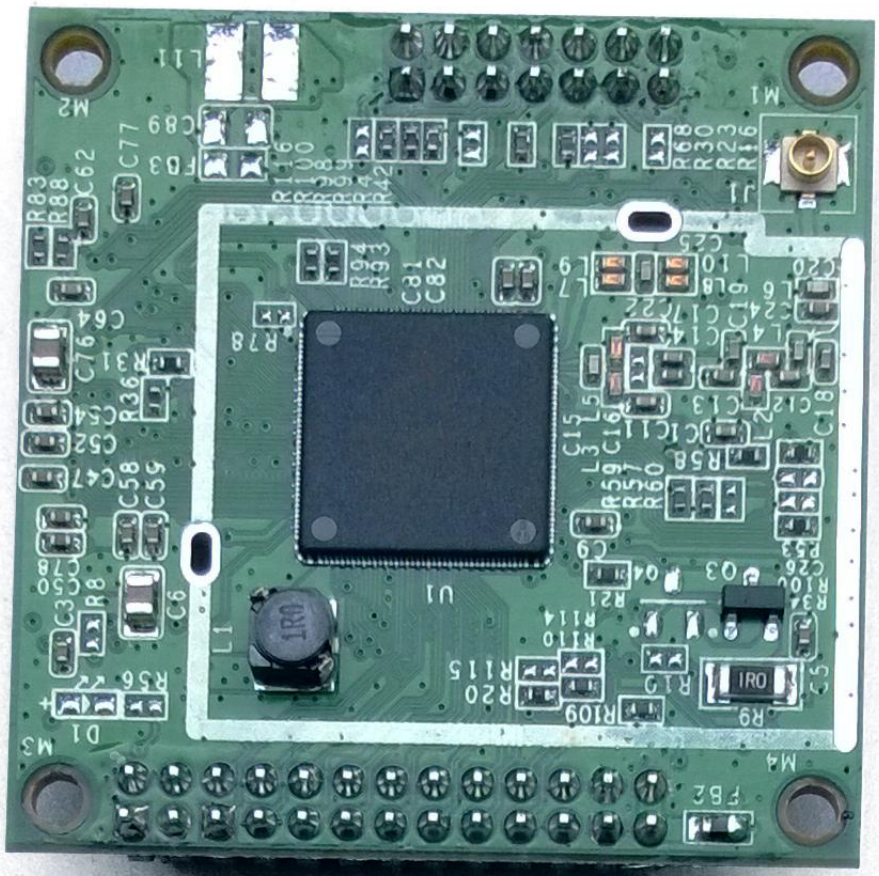

Chart 1.13 Top View of Physical Map

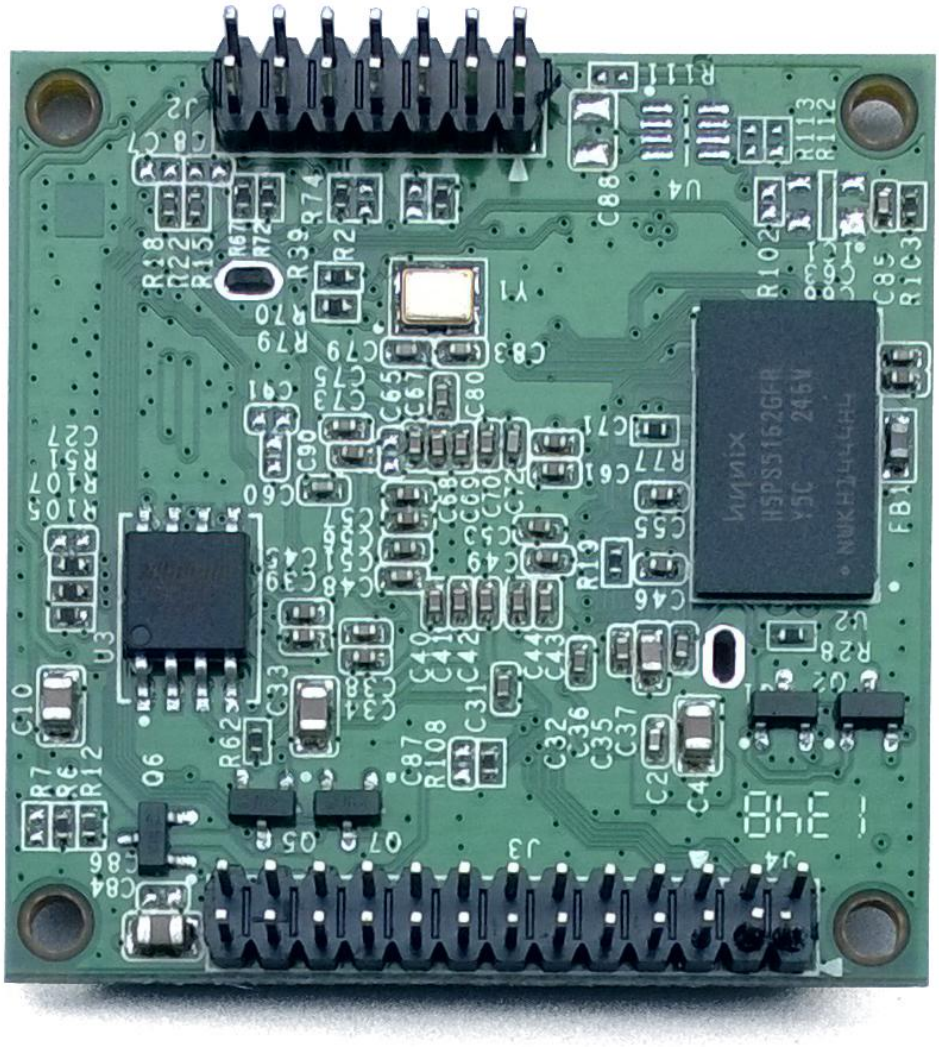

Chart 1.14 Bottom View of Physical Map

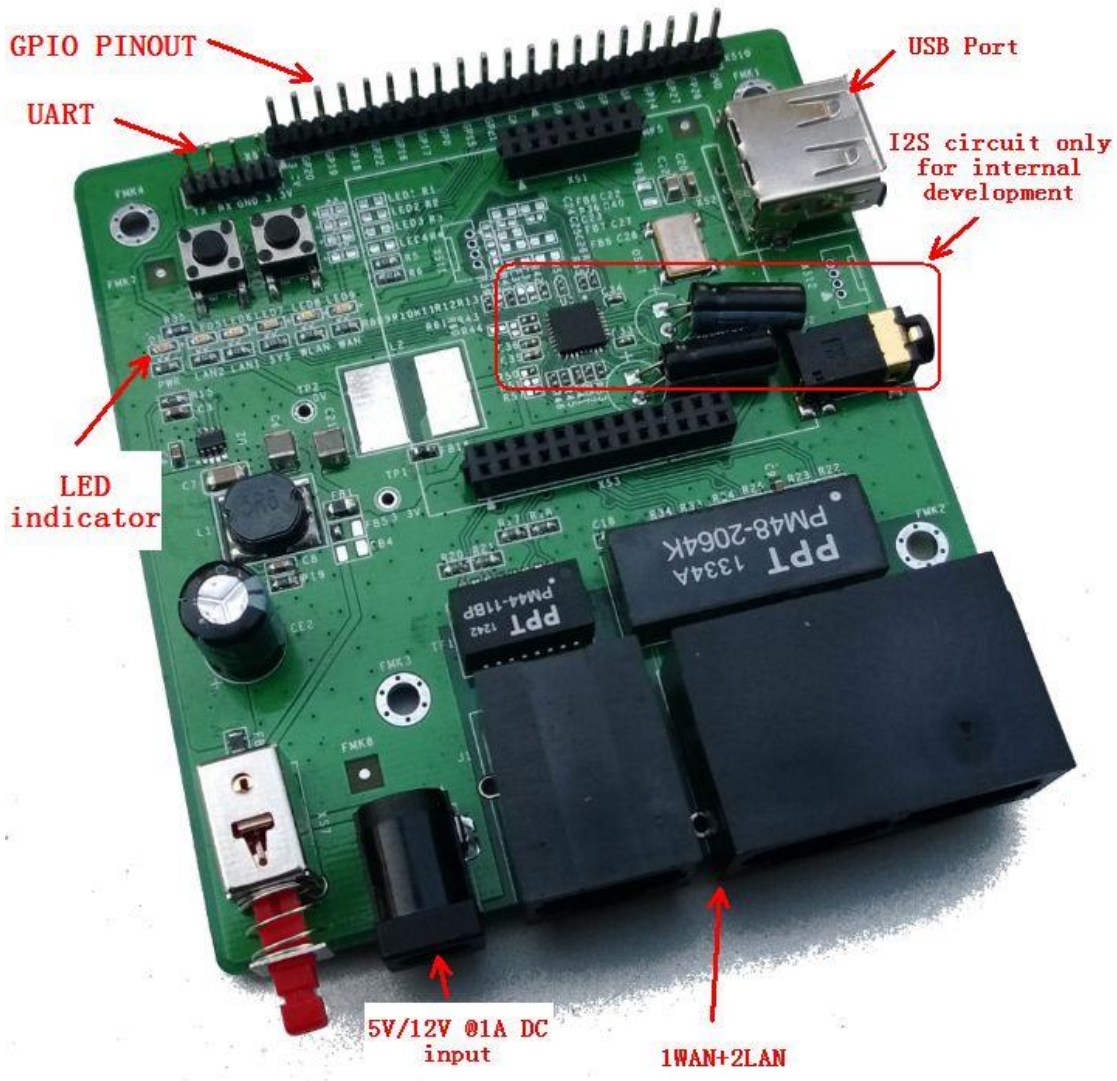

Chart 1.15 Physical Map of Main board

1.4.3.3 Mechanical Dimensions

WLM113H mechanical dimensions is shown in the following picture:

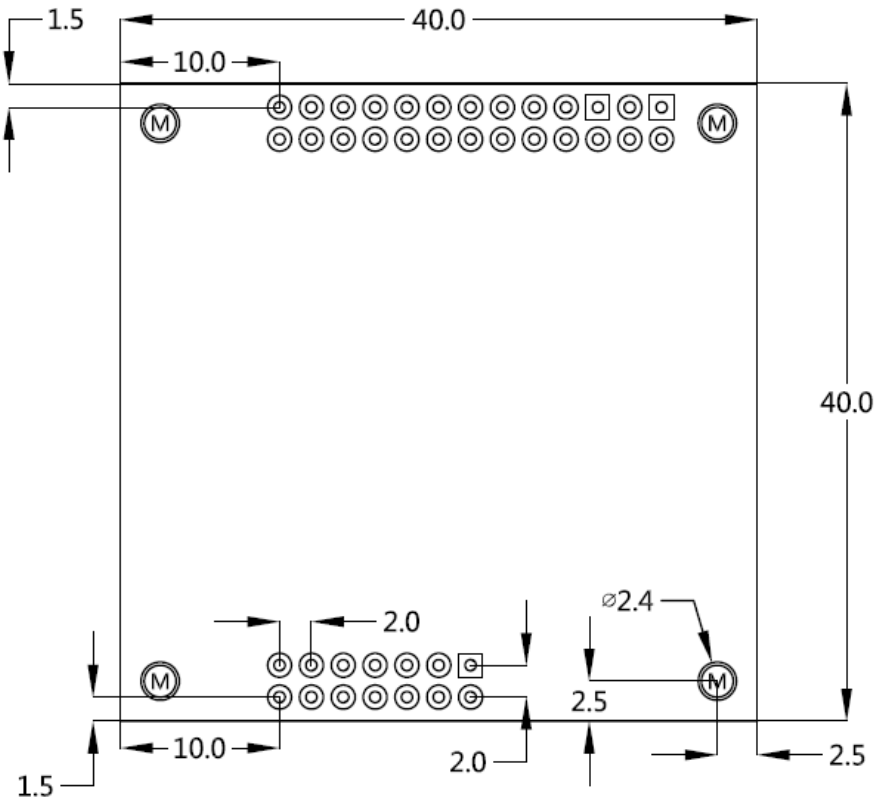

Chart 1.16 dimensions of WLM113H Unit:mm

1.4.2.4 Pins Interface

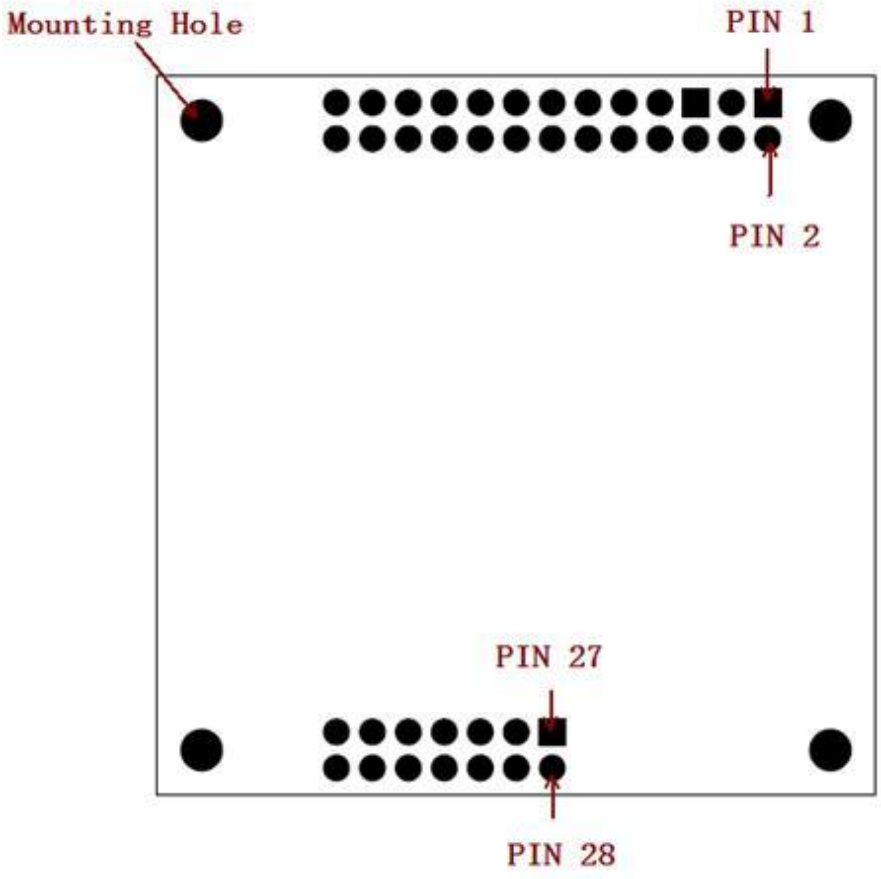

Chart 1.17 PIN of WLM113H

The Pin of WLM115 as shown above is defined as follows:

Table 1-4 pin interface of WLM113H module

PIN NO.	Signal Name	Direction	Description
1	GPIO19/I2S_WS	I/O	GPIO19/Word select for stereo
2	GPIO20/I2S_SD	I/O	GPIO20/Serial data input/output
3	GPIO22/I2S_MICIN	I/O	GPIO22/Data input
4	GPIO18/I2S_CK	I/O	GPIO18/Stereo clock
5	WAN_RX-	IA	Ethernet port WAN receive pair
6	WAN_RX+	IA	
7	WAN_TX-	OA	Ethernet port WAN transmit pair
8	WAN_TX+	OA	

9	LAN4_TX-	OA	Ethernet port LAN4 transmit pair
10	LAN4_TX+	OA	
11	LAN4_RX-	IA	Ethernet port LAN 4 receive pair
12	LAN4_RX+	IA	
13	LAN3_RX-	IA	Ethernet port LAN 3 receive pair
14	LAN3_RX+	IA	
15	LAN3_TX-	OA	Ethernet port LAN3 transmit pair
16	LAN3_TX+	OA	
17	GPIO17/WAN-LED	I/O	GPIO17/WAN-LED
18	GPIO16/LAN4-LED	OI/OL	GPIO16/LAN4-LED
19	GPIO15/LAN3-LED	OI/OL	GPIO15/LAN3-LED
20	GPIO0/WLAN-LED	OI/OL	GPIO0/WLAN-LED
21	GPIO21/I2S_MCK	I/O	GPIO21/Master clock
22	VDD2V	Power Out	DC 2.0V Voltage supply to external network transformer
23	GND	Power	Power Ground
24	GND	Power	Power Ground
25	VDD33	Power In	DC 3.3V max current(500mA),Voltage supply to module，choose one of VDD33 and VDD5V
26	VDD33	Power In	DC 3.3V max current (500mA) Voltage supply to module，choose one of VDD33 and VDD5V
27	GPIO7	I/O	GPIO7
28	VDD5V	Power In	DC 5V max current (500mA), Voltage supply to module，choose one of VDD33 and VDD5V
29	GND	Power	Power Ground
30	GND	Power	Power Ground
31	GPIO10/UART_TX	O	GPIO10/UART_TX
32	GPIO9/UART_RX	I	GPIO9/UART_RX
33	GPIO1/LED1	I/O	GPIO1/LED1
34	GPIO13/LED2	I/O	GPIO13/LED2
35	GPIO11/JUMP_START	I/O	GPIO11/JUMP_START button input
36	GPIO14/LED3	I/O	GPIO14/LED3
37	GPIO27/LED7	I/O	GPIO27/LED7
38	GPIO26/LED8	I/O	GPIO26/LED8
39	USB+	IA/OA	USB D+ Signal
40	USB-	IA/OA	USB D- Signal

Notes:

1.I:input O:output L:low level effective H:high level effective
A:analog signal

2.The supply voltage of WIFI module is 3.3V. When the WIFI module is plugged in main board, the supply voltage of main board is 5~12V.

2 Quik Start

2.1 Module Connection

1. Plug the WiFi module to the main board, and power on the module (the supply voltage of main board is 5~12 V);
2. Connect PC to the LAN port of WiFi module through cable, and set the PC to DHCP mode or static IP mode. When using static IP mode, the IP should be set to 192.168.1.X, netmask is 255.255.255.0, gateway is 192.168.1.1. The IP should not be set to 192.168.1.1, because the default IP of the module is 192.168.1.1;
3. Check out whether the IP of PC is right and then use ping command to check the connection;

2.2 Login in WiFi Module

Under the default mode, telnet and web services is available to login in the WiFi module. The user name of login is root, and the password is null at default mode. After setting password, telnet is not available, but SSH is available to login in the module. In this manual, we only introduce how to configure WiFi module through web.

2.2.1 Telnet Login

Use command “telnet 192.168.1.1” to login in the WiFi module and do not need user name and password at default configuration. After setting password through web, telnet service is not available. After that command, the shell is available like bellow.

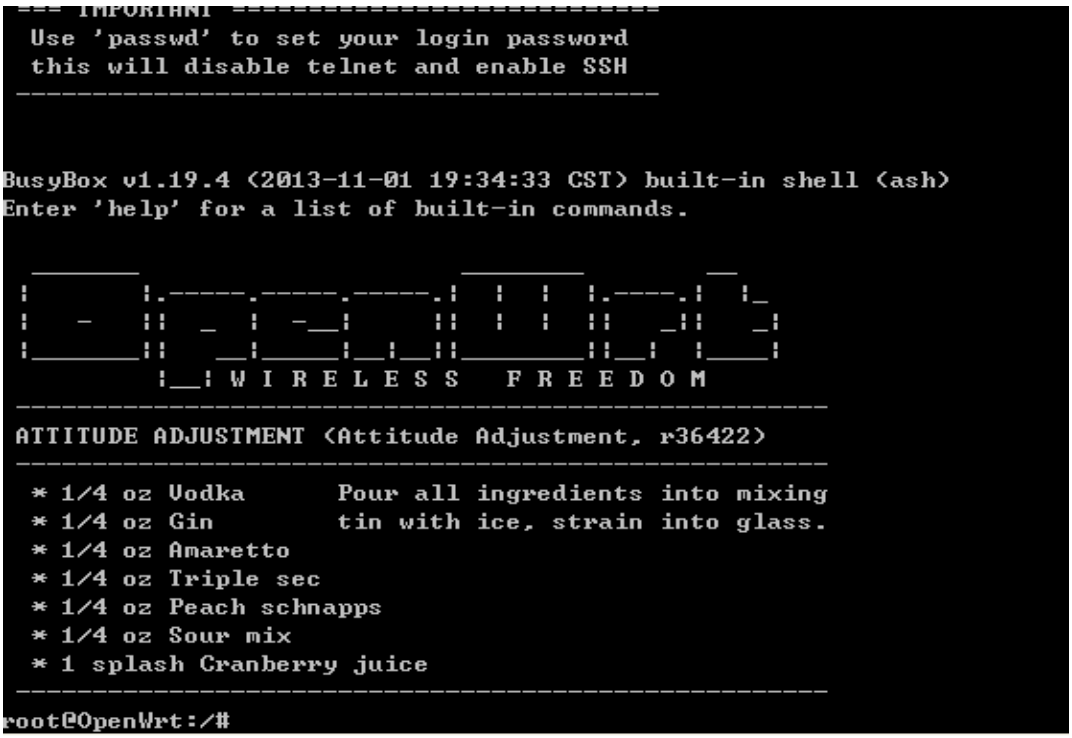

Chart 2.1 telnet login

2.2.2 Web Login

The default IP address of WiFi module is 192.168.1.1. Input the IP address 192.168.1.1 in browser address blank and then press enter, the login interface will be showed like bellow.

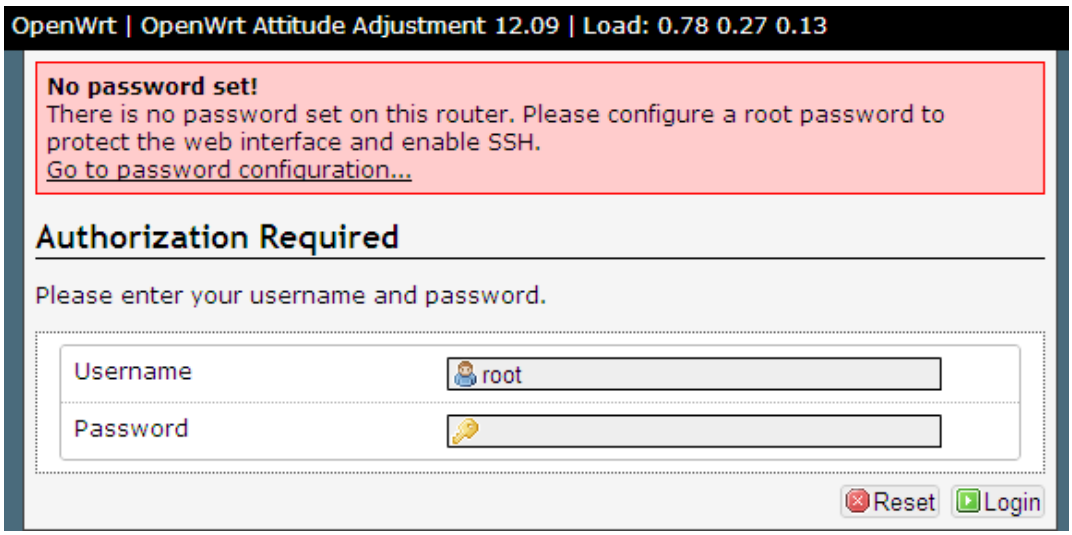

Chart 2.2 web login

The user name of login is root by default, and the password is NULL by default. After setting password, the SSH will be enabled.

2.2.3 SSH Login

After setting password, the SSH is enabled. Using tools like SecureCRT or Putty to login in the WiFi module through SSH protocol.

3 System Status View

This chapter introduces the status of overall system like system information, firewall status, system log and so on.

3.1 Overview

After login, bellow information will be shown.

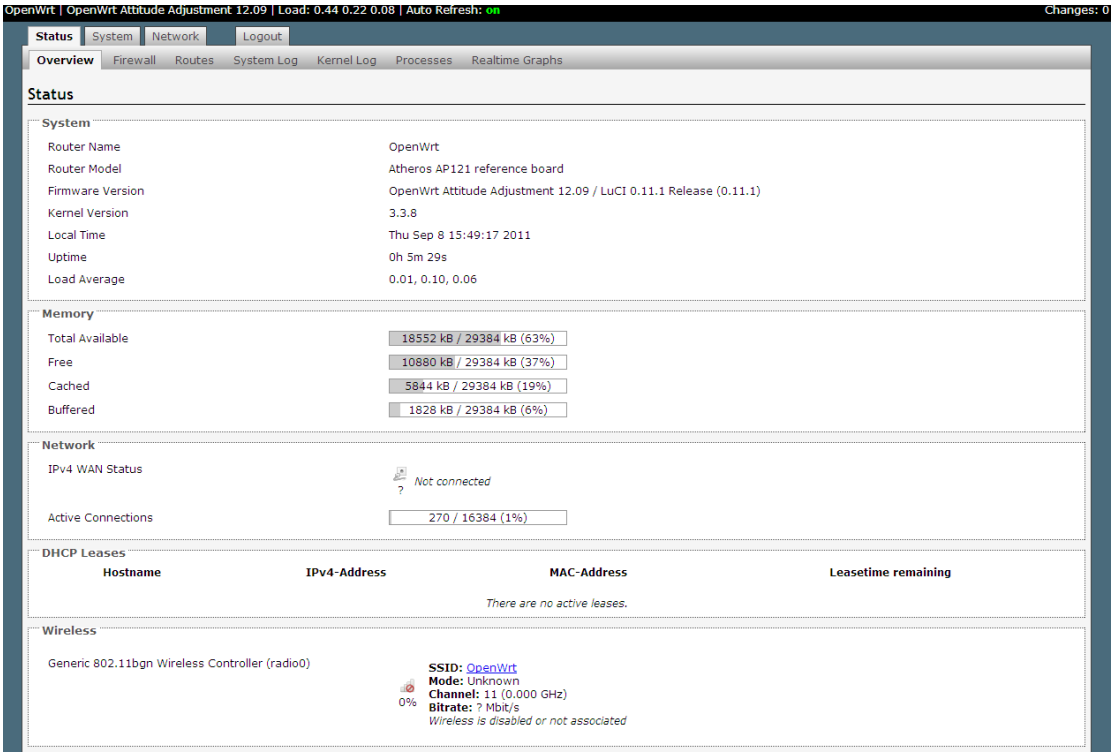

Chart 3.1 Overview

This page shows many information about OpenWrt, include router name, firmware version, kernel version, uptime, usage information of memory and network information.

3.2 Firewall view

This page shows all firewall rules namely iptables rules. All the tables and chains of iptables would be shown. The traffics on each rule is also counted.

There are two buttons to control the firewall. “reset counters” is used to clear all the counters of rules. “restart firewall” is used to restart the firewall.

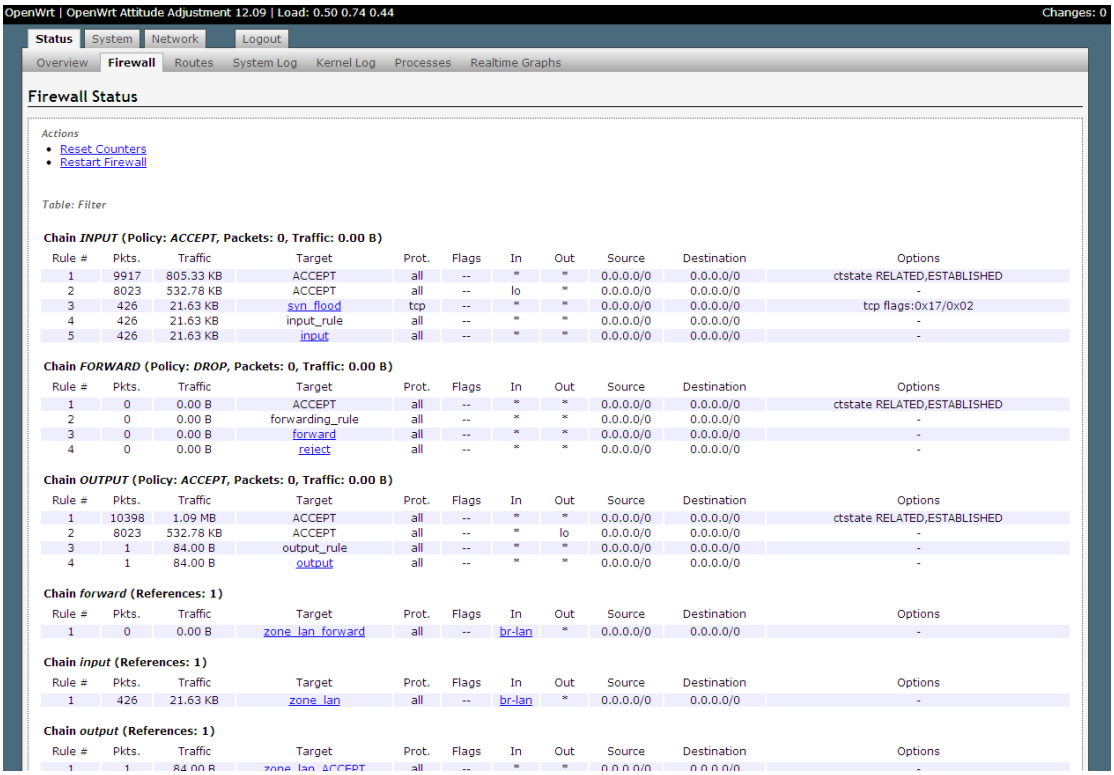

Chart 3.2 Firewall status

3.3 Routes

This page shows the ARP table and route table. There is only one item in ARP table and route table now.

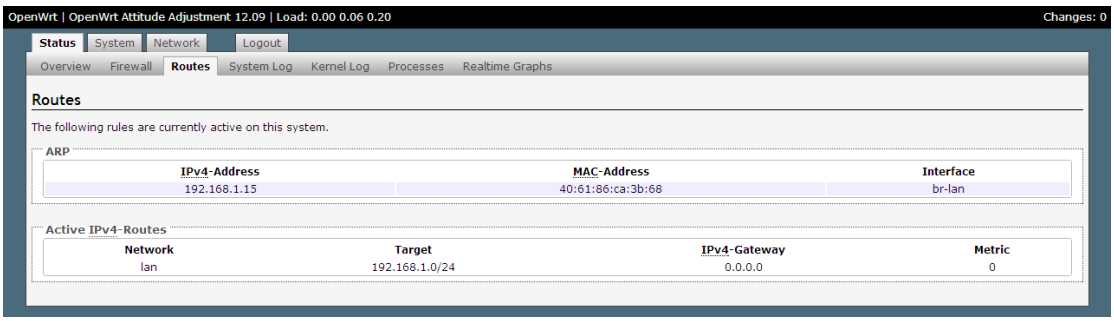

Chart 3.3 Routes view

3.4 System Log

This page shows the system log. If some errors occur, we can check the log to find the problem.

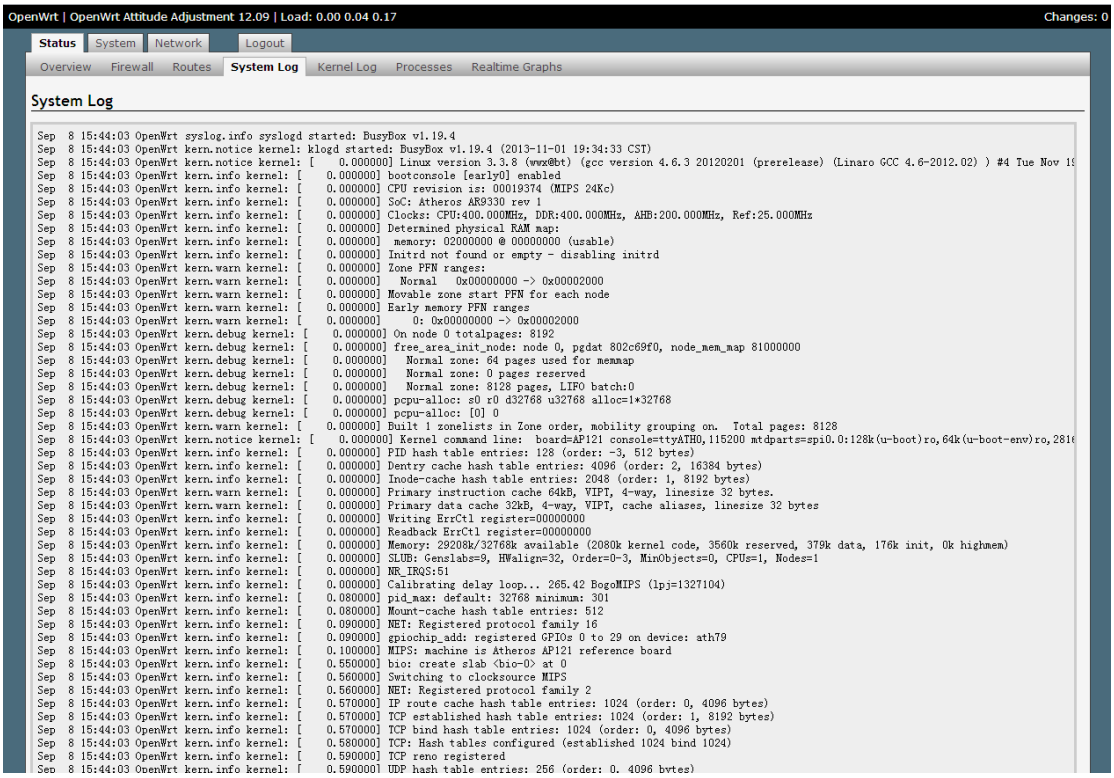

Chart 3.4 System log

3.5 Kernel Log

This page shows the system log. If some errors occur, we can check the log to find the problem.

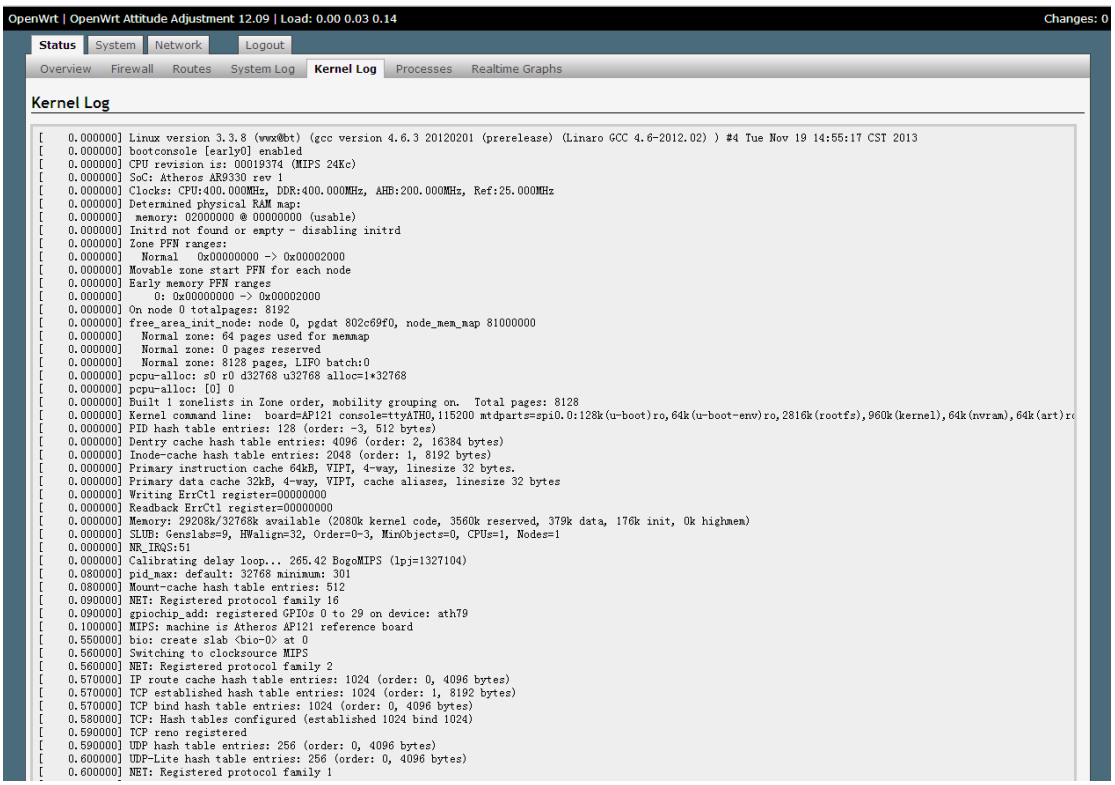

Chart 3.5 Kernel log

3.6 Processes

This page shows all processes run now in this module. You can hang up or terminate or kill any one of the processed. But don't it at discretion, or it may cause system exception.

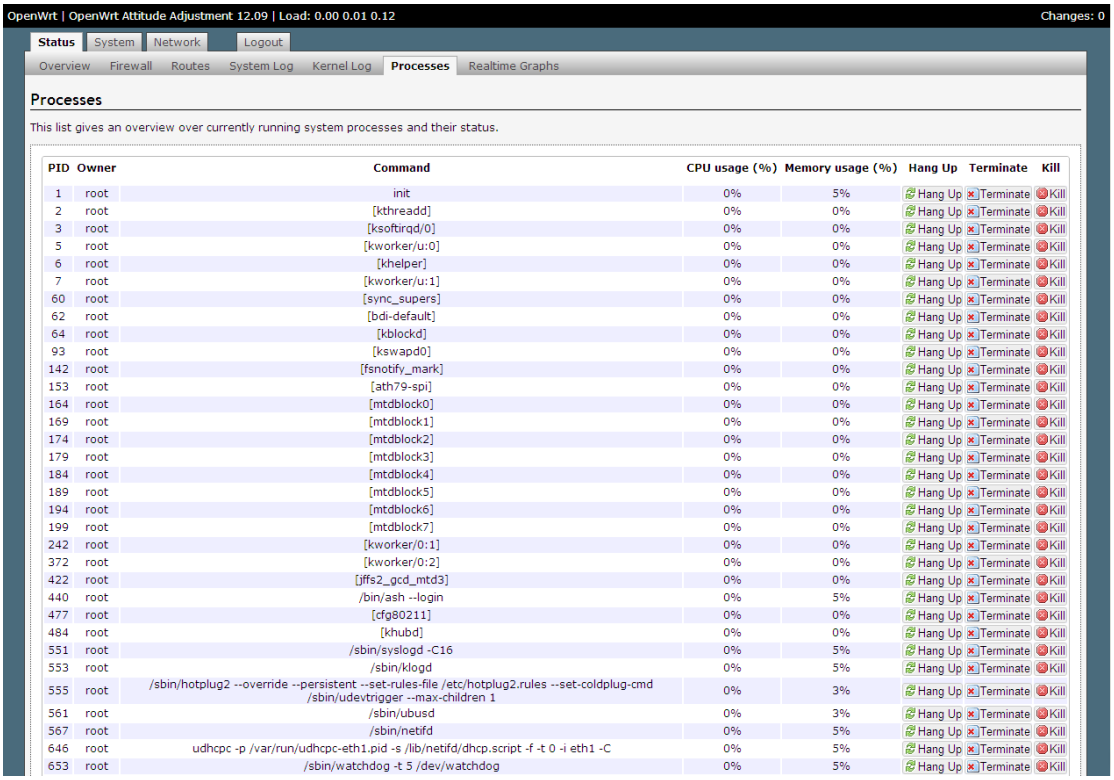

Chart 3.6 Proesses

3.7 Realtime Graphs

In this page, we can view the realtime load, traffic , wireless status and connection status.

3.7.1 Realtime Load

This page shows the realtime load of the system.

Chart 3.7 Reatime load

3.7.2 Realtime Traffic

This page shows the realtime traffic of all network interfaces. There are only three interfaces now.

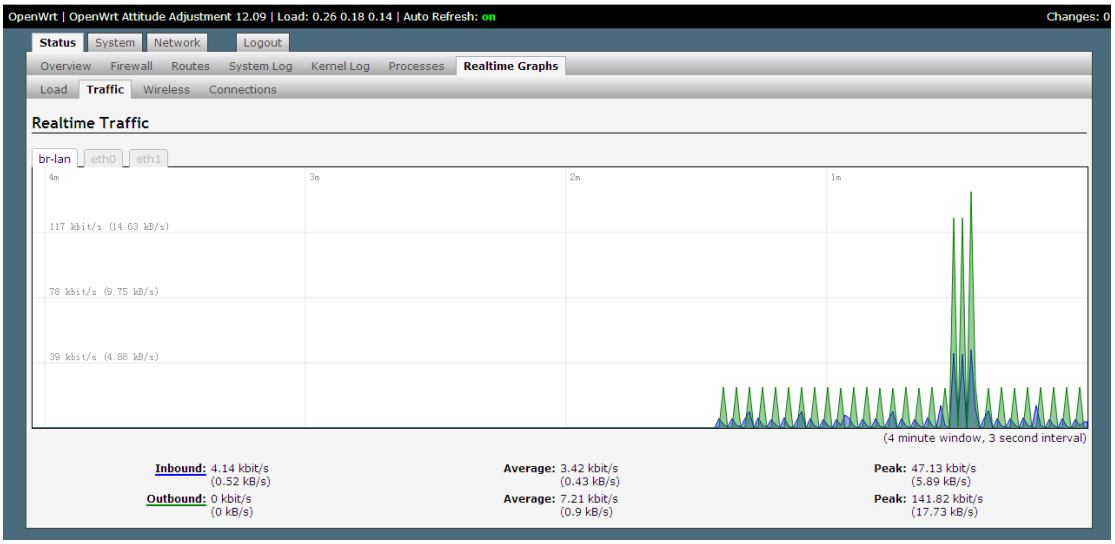

Chart 3.8 Realtime traffic

3.7.3 Realtime Wireless

This page shows the wireless information include signal intensity and phy rate. Because wireless is disabled by default, this page show nothing about wireless.

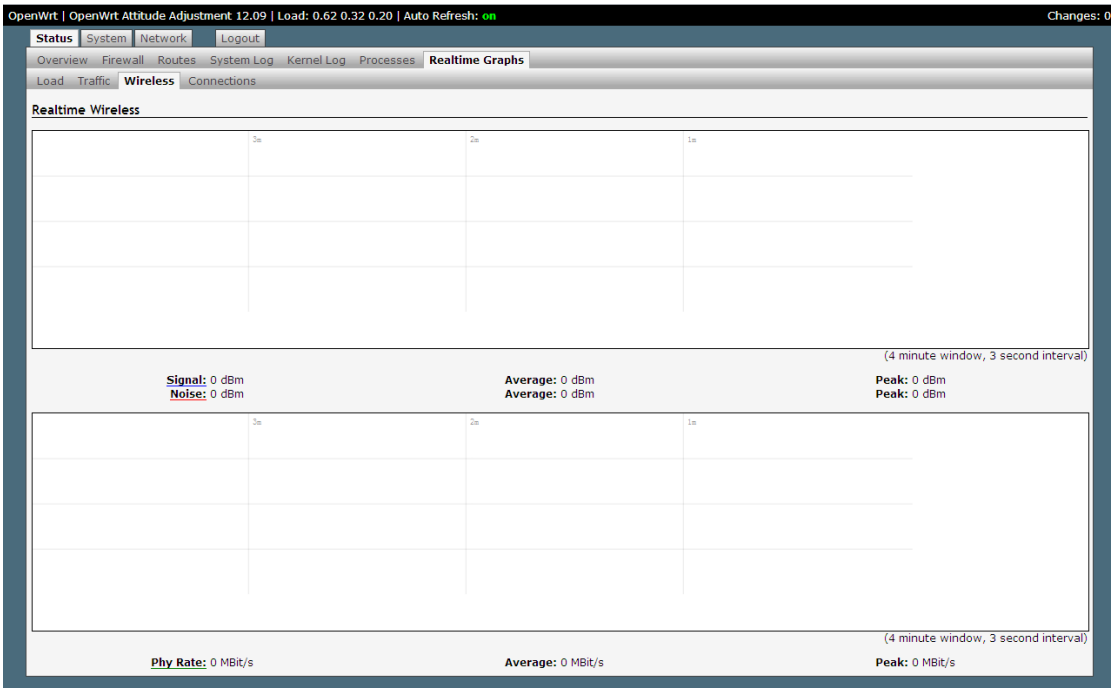

Chart 3.9 Realtime Wireless

3.7.4 Realtime Connections

This page shows all the connections. The information of the connection include source address, destination address, protocol, port can all be viewed.

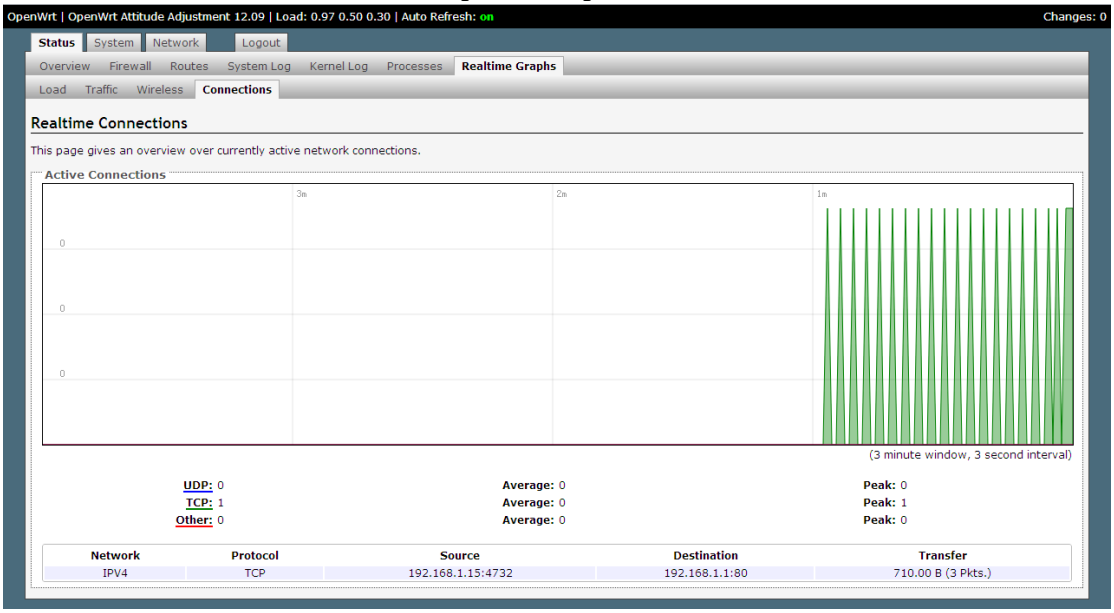

Chart 3.10 Realtime connections

4 System settings

4.1 System

4.1.1 System Properties

Here you can configure the basic aspects of your device like its hostname or the timezone:

You can set the hostname of the device. When you change the hostname, shell will take effect immediately.

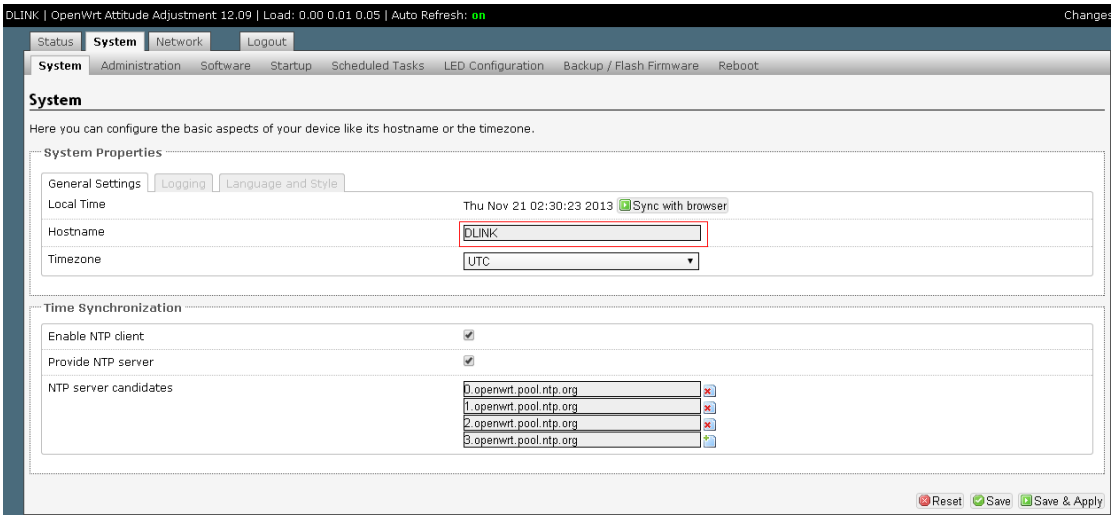

Chart 4.1 Hostname setting(1)

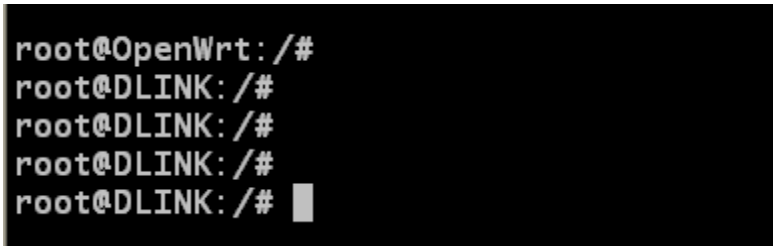

Chart 4.2 Hostname setting(2)

change time zones:

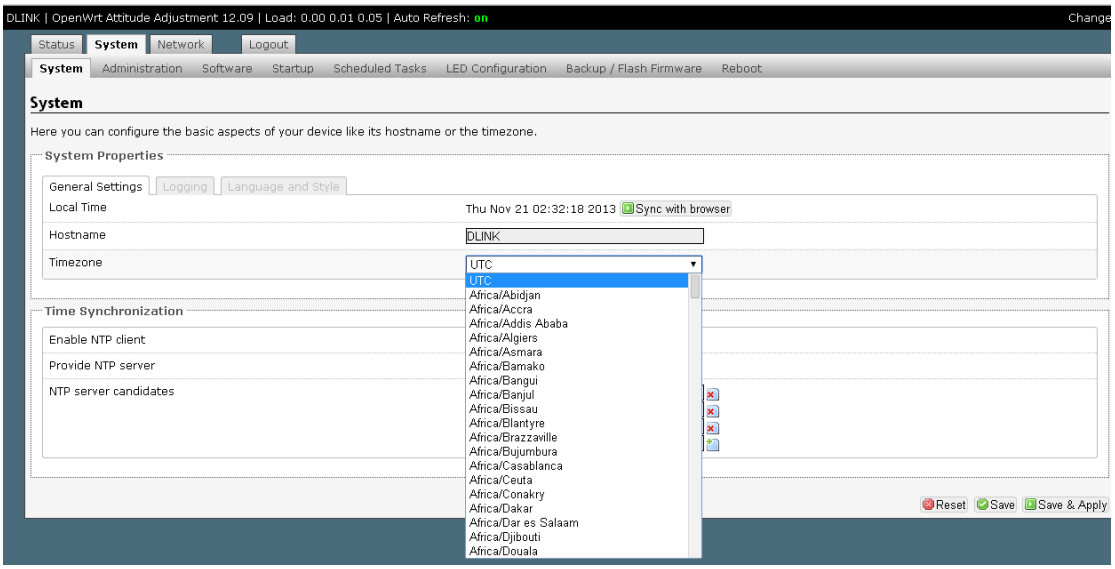

Chart 4.3 Timezone setting

Also, device can sync the time with the browser:

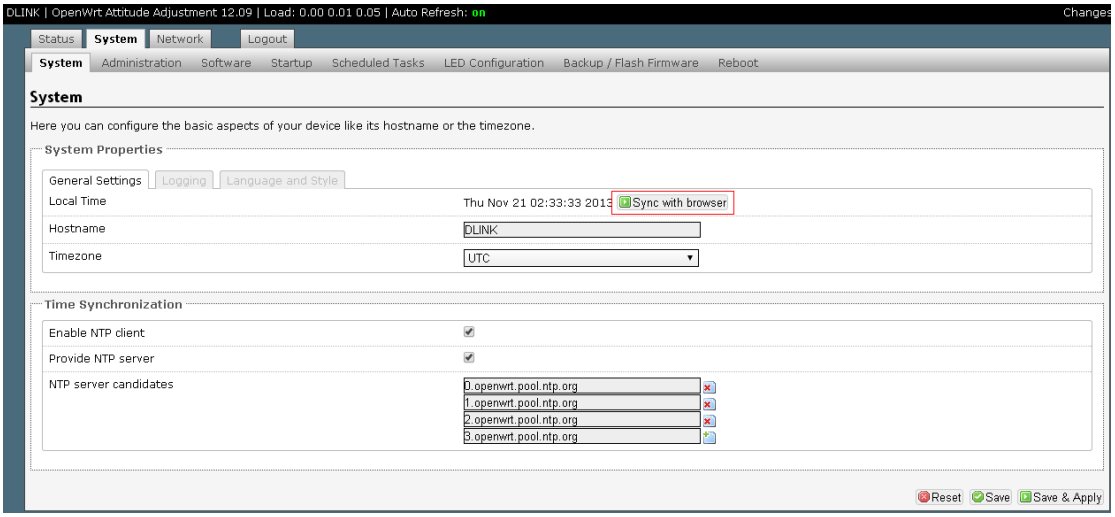

Chart 4.4 Time sync

If you want to log the device for diagnose, you can change the configure below:

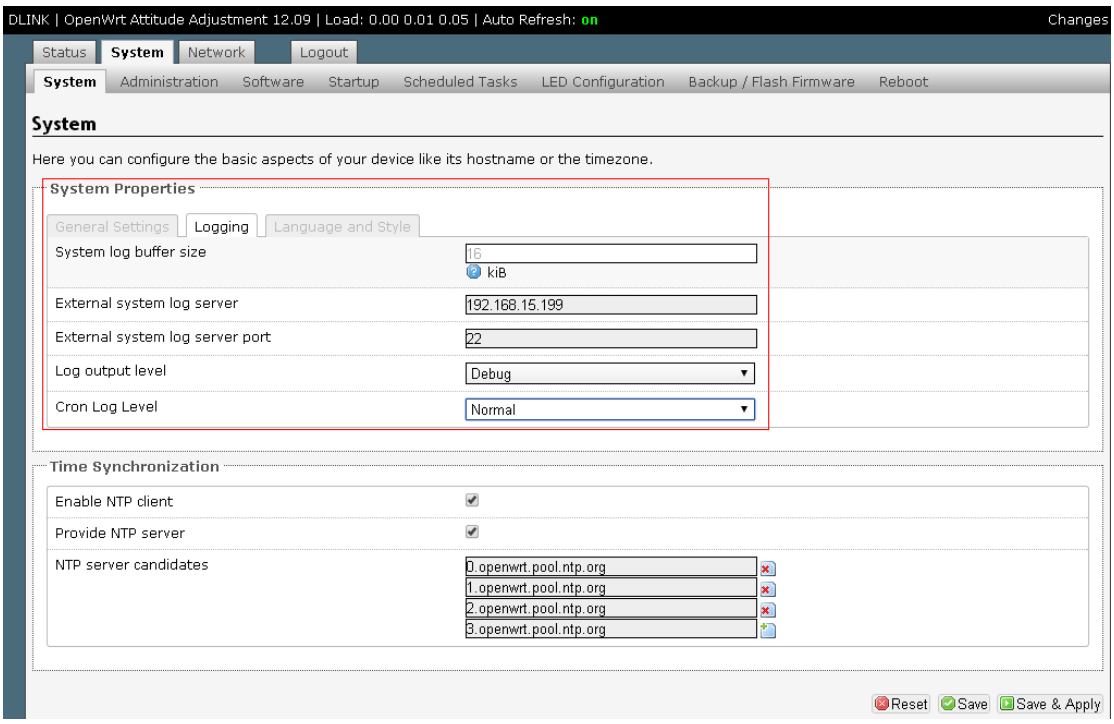

Chart 4.5 Logging setting

Language and style can also be change in this page:

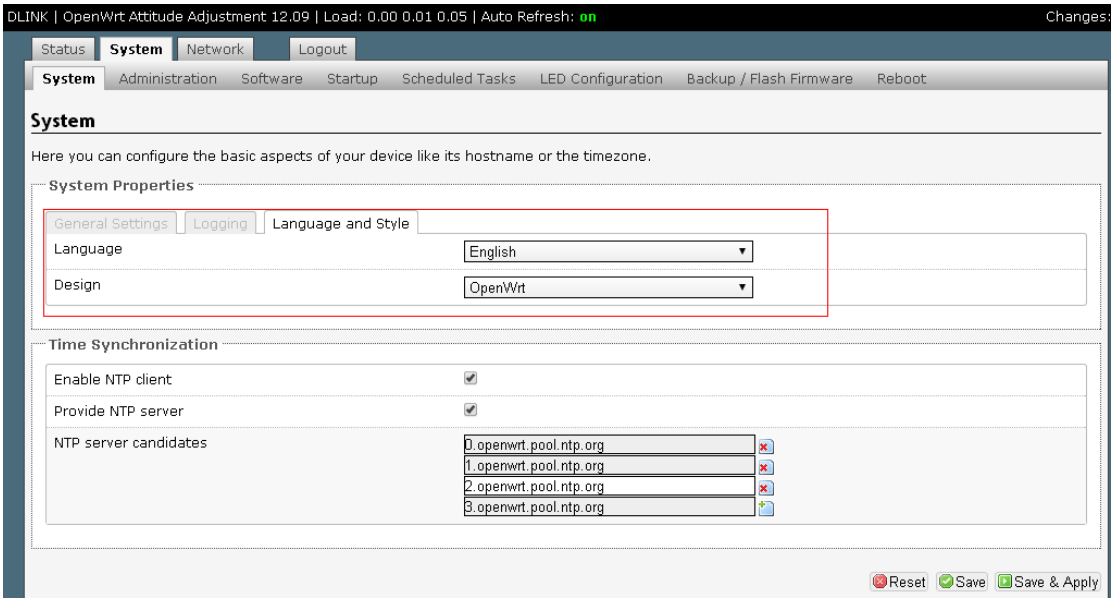

Chart 4.6 Language and style setting

4.1.2 Time Synchronization

In this part, if “Enable NTP client” is selected, the device time will automatic sync with the internal NTP server. And if “Provide NTP server ” is selected, the NTP server will change what you fill in:

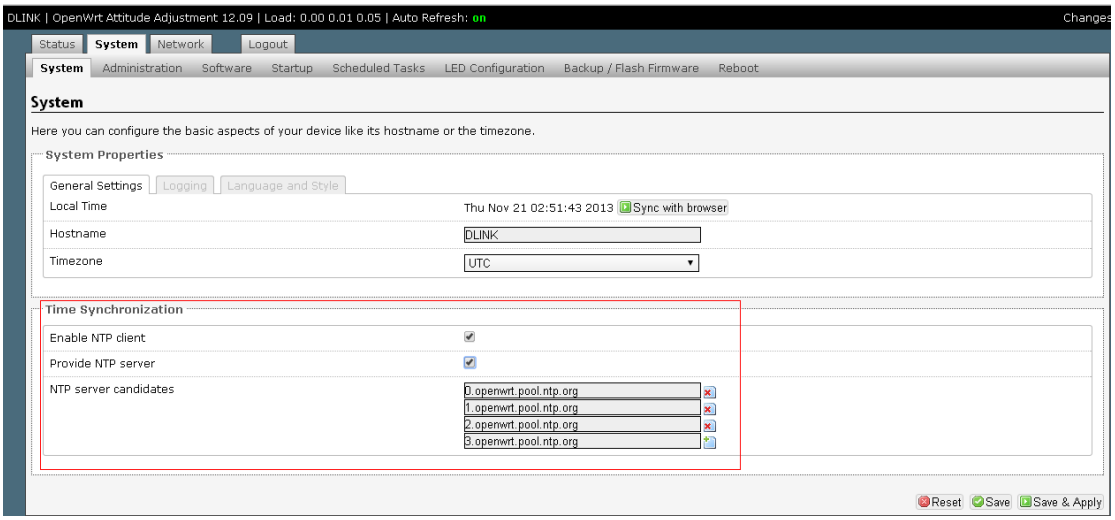

Chart 4.7 NTP setting

4.2 Administration

4.2.1 Route Password

Changes the administrator password for accessing the device:

You can change the route password. After save and apply, you should use new password to login SSH or web:

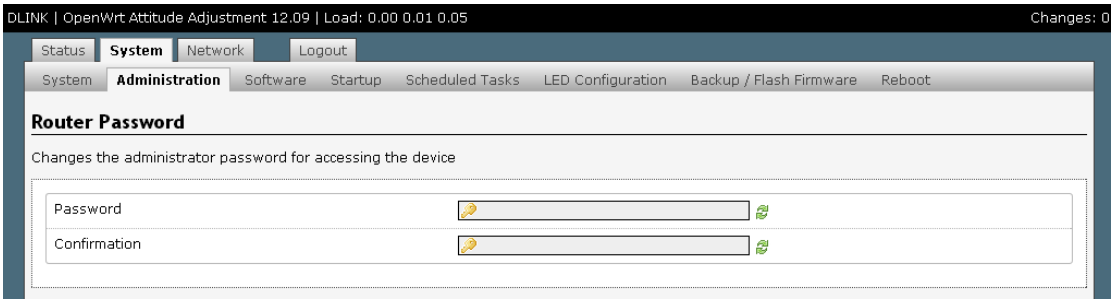

Chart 4.8 Route password setting

4.2.2 SSH access

Dropbear offers SSH network shell access and an integrated SCP server

Here can change something about SSH network shell access settings below:

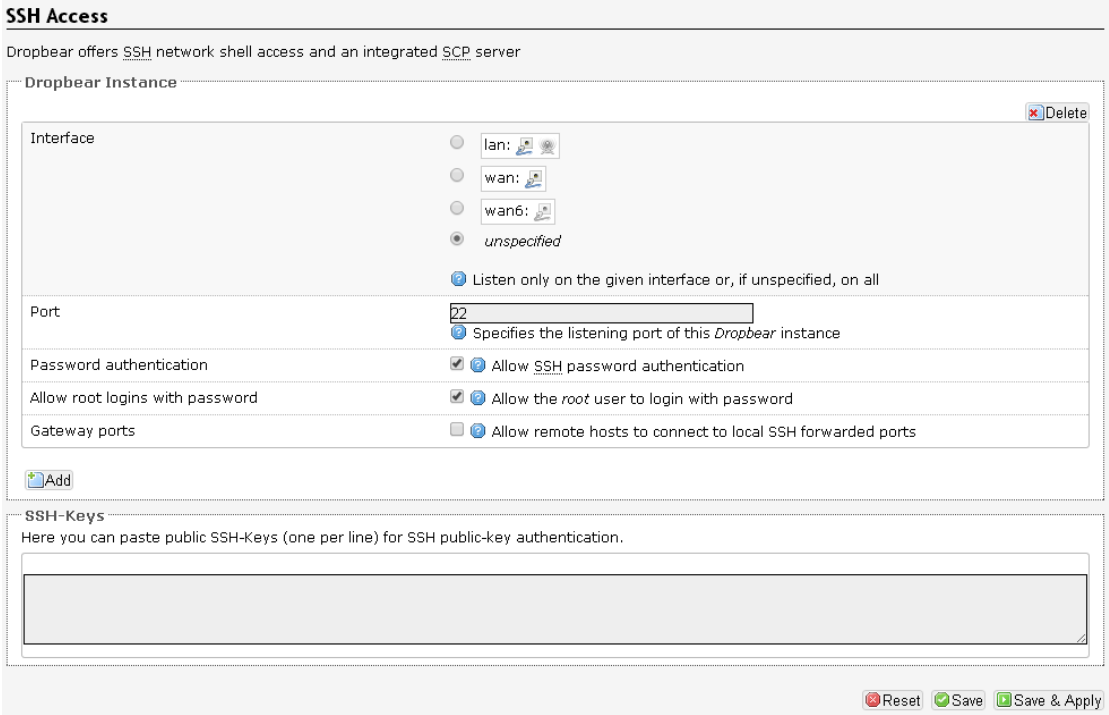

Chart 4.8 SSH access setting

4.3 Software

4.3.1 Actions

In this part, you can install some package for the route, the route become more powerful:

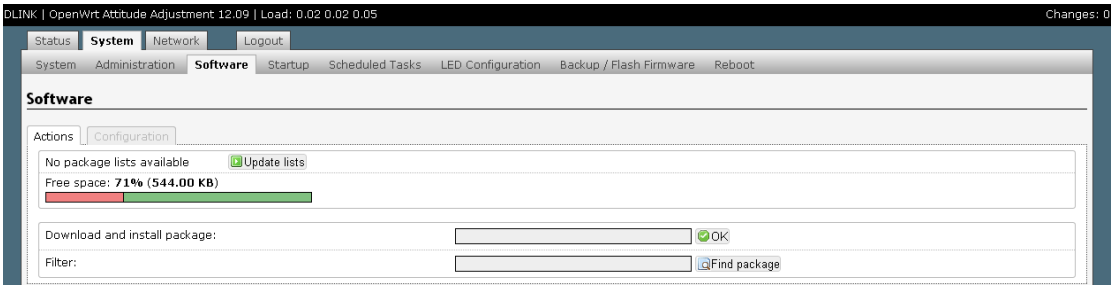

Chart 4.9 Software package management

Also you can remove some packages that you don’t need in order to free the flash space:

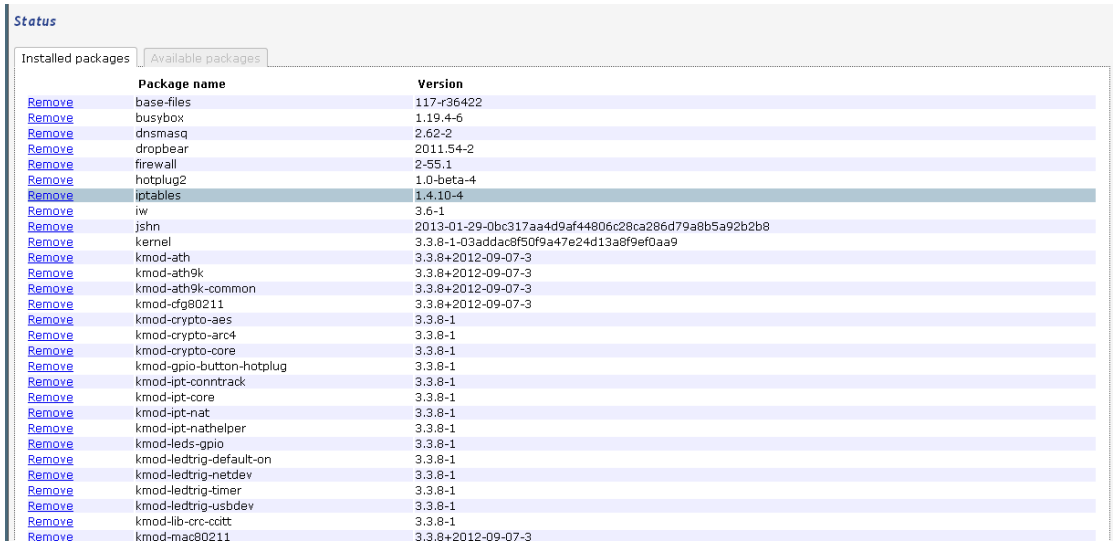

Chart 4.9 Software package remove

4.4 Startup

4.4.1 Initscripts

You can enable or disable installed init scripts here. Changes will applied after a device reboot:

Warning: If you disable essential init scripts like "network", your device might become inaccesable!

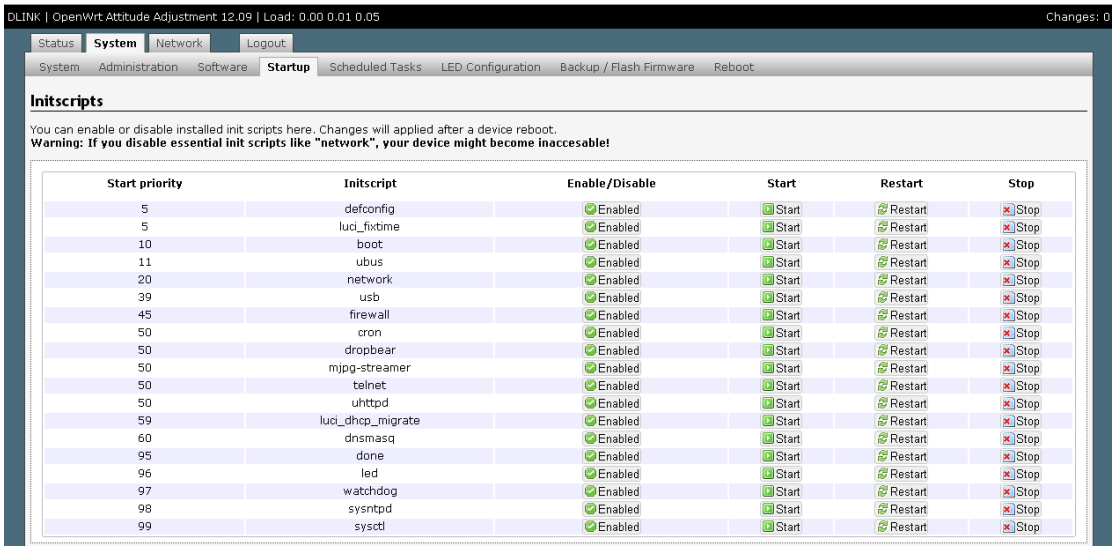

Chart 4.10 Startup setting

4.4.2 Local Startup

This is the content of /etc/rc.local. Insert your own commands here (in front of ‘exit 0’) to execute them at the end of the boot process.

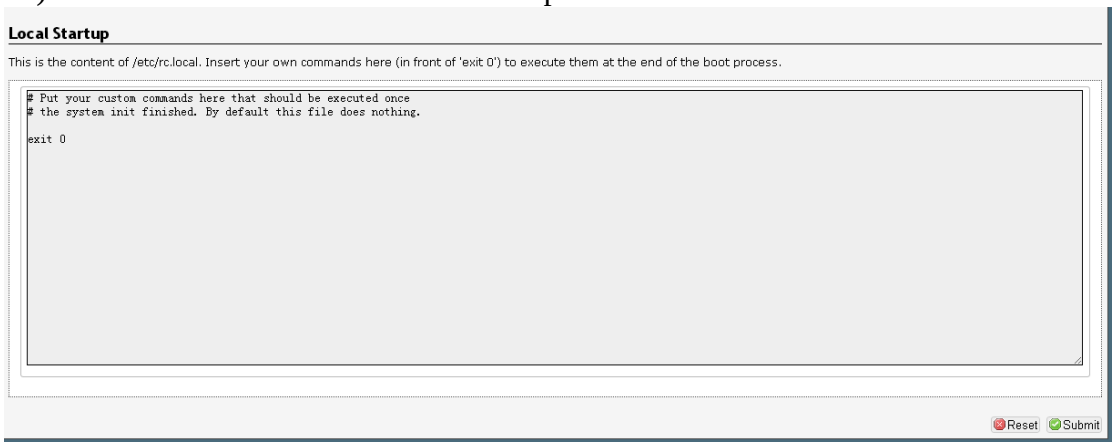

Chart 4.11 Local startup setting

4.5 Scheduled Tasks

4.5.1 Scheduled Tasks

This is the system crontab in which scheduled tasks can be defined.

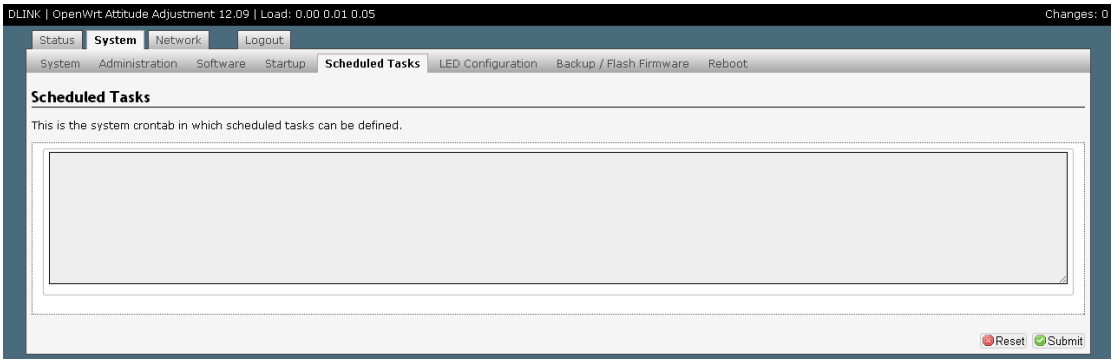

Chart 4.12 Scheduled task setting

4.6 LED Configuration

4.6.1 LED Configuration

Customizes the 37ehavior of the device LEDs if possible.

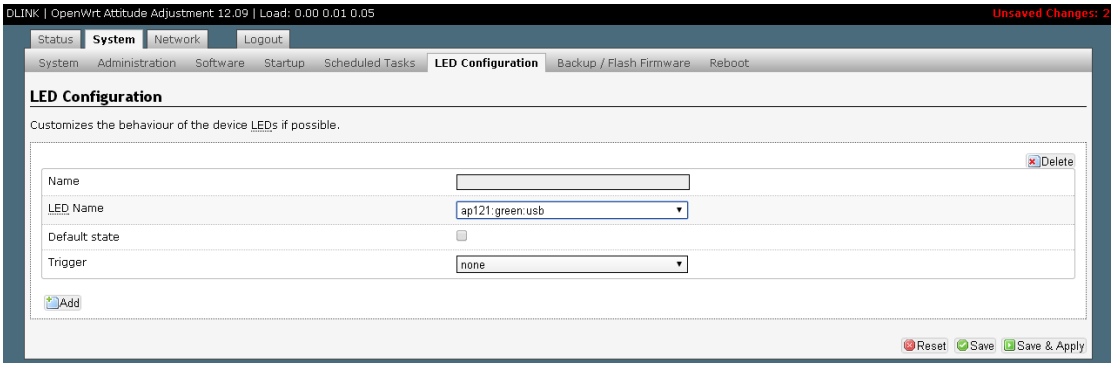

Chart 4.13 LED configuration

4.7 Backup /Flash Firmware

4.7.1 Backup / Restore

You can make a backup configure file by press “Gemerate archive”, and a new file will be download in your browser:

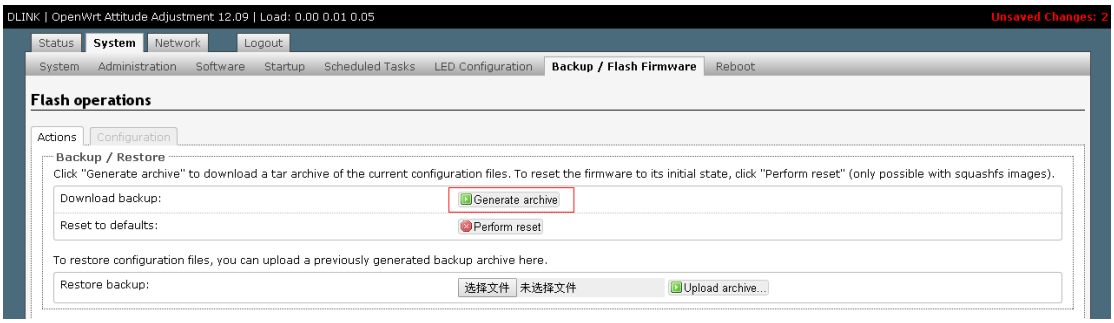

Chart 4.14 Configuration backup

And if you want to reset the configuration as the factory configure, you should press “Perform reset”:

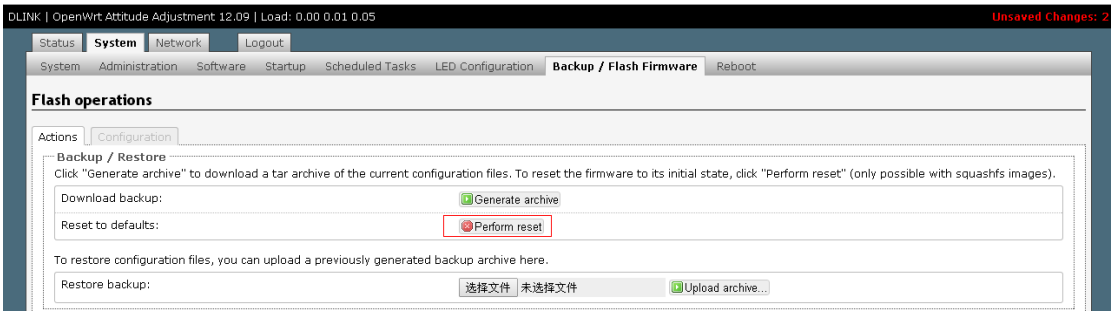

Chart 4.15 Factory reset

When you want to restore configuration files, you can upload a previously generated backup archive here:

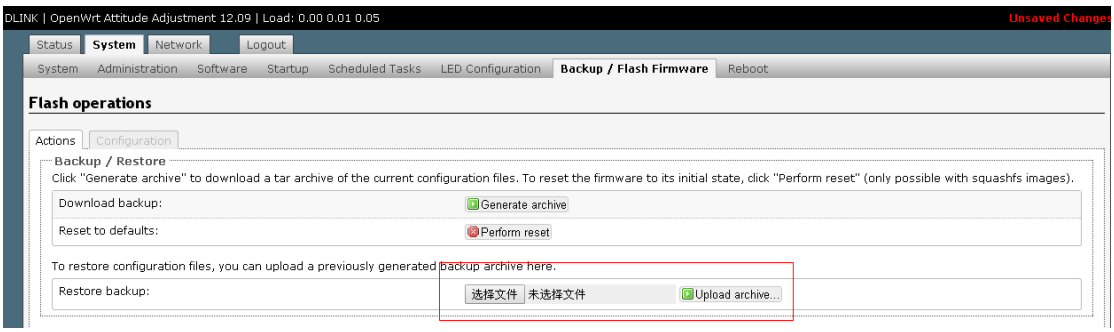

Chart 4.16 Configuration restore

4.7.2 Flash new firmware image

When you receive a new firmware from official release, you can Flash new firmware image like this:

Warning: If you want to keep the current settings, you should select the keep settings CheckBox!

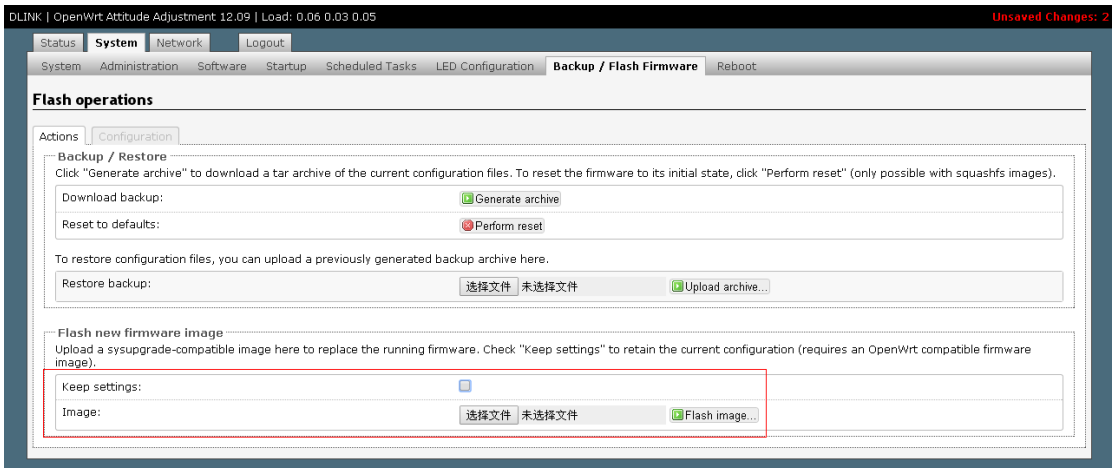

Chart 4.17 Firmware upgrade

4.8 Reboot

Reboots the operating system of your device:

5 Network Configuration

This chapter will introduce how to configure OpenWrt associated with network. There are many configuration items. We only introduce the basic settings, and throught that you can connect to the Internet successfully. The advanced setting will not be introduced. You can try it by yourself. If you really don't know what the setting is, just keep it default.

5.1 Network Interfaces Overview

This page show all the network interfaces. There are only two interfaces by default. One is LAN interface, and the other is WAN interface. By default, as long as the WAN interface is configured properly, you can surf internet through wired network.

In this page, you can also start, shutdown, edit or delete the interface. You can also add new interface.

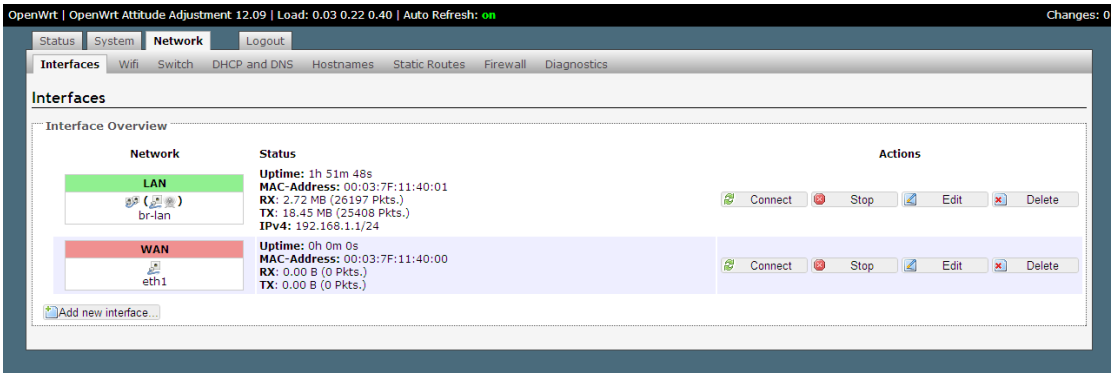

Chart 5.1 Interface overview

5.2 LAN Interface Configuration

Click edit of the LAN interface to enter LAN configuration page.

5.2.1 General Setup

In this page, the IP address and DHCP should be configured. Static address mode should be chosen for this interface. The IP address and netmask can be configured to what you want. The default IP address is 192.168.1.1, and default netmask is 255.255.255.0. DHCP Server is enabled by default for LAN interface. You can

configure the start address, end address of DHCP address pool, also the leasetime.

After configuration, you can press “Save & Apply” button in the lower right corner to save and apply your configuration immediately. Pressing “Save” button will only save the configuration, and take effect after you restart the module.

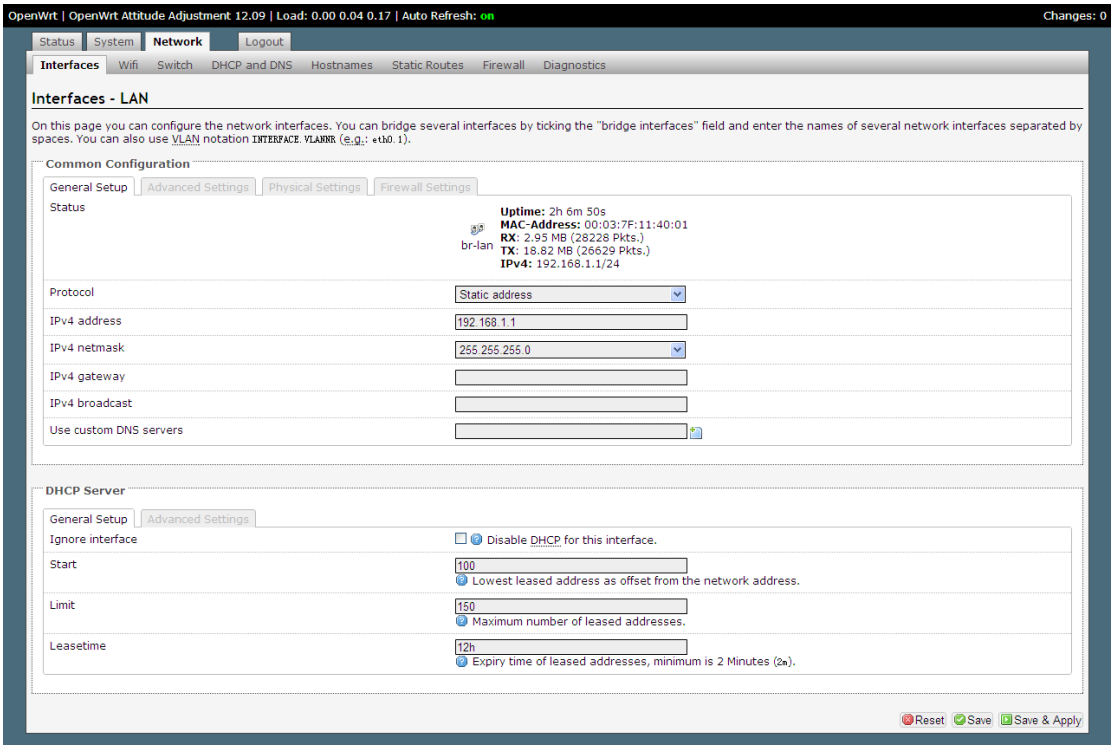

Chart 5.2 LAN Interface Configuration (general setup)

5.2.2 Advanced Settings

In advanced settings page, you can choose whether bring up this interface on boot. You can also set new MAC address and MTU to override the old.

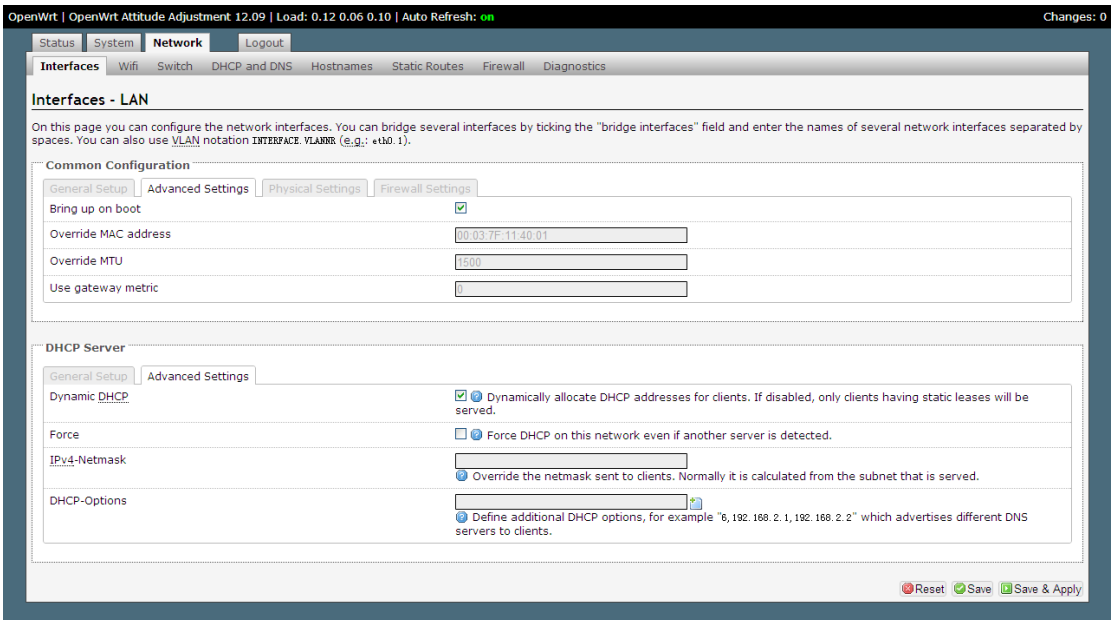

Chart 5.3 LAN Interface Configuration (advanced settings)

5.2.3 Physical Settings

For LAN interface, it is a bridge interface like bellow. It contains eth0 and wireless interface now.

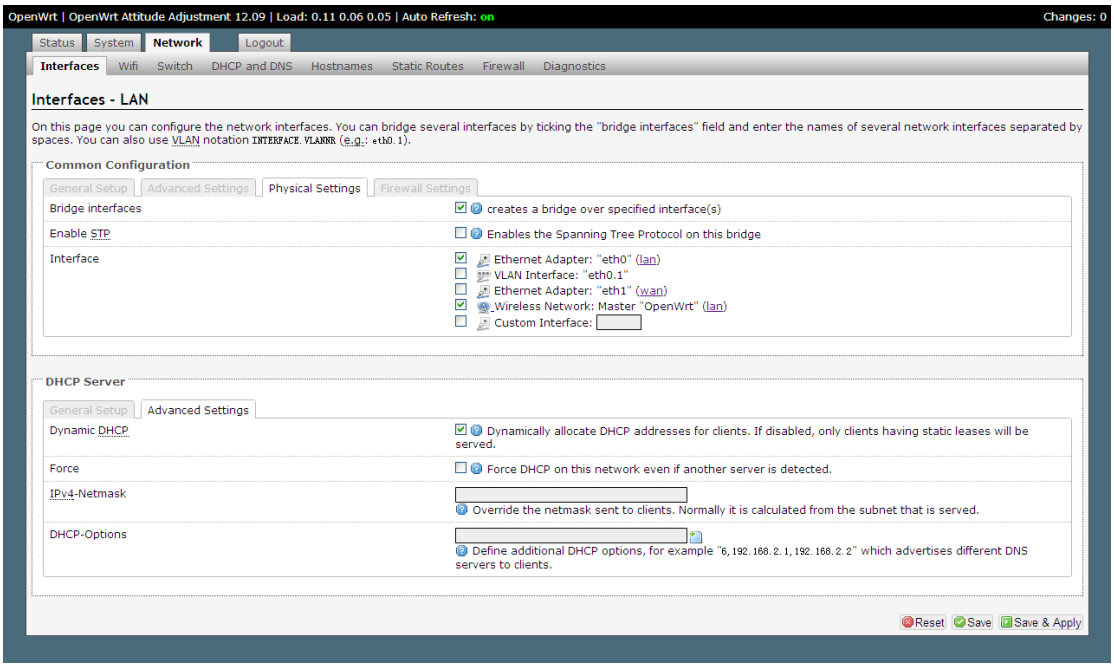

Chart 5.4 LAN Interface Configuration (physical settings)

5.3 WAN Interface Configuration

For WAN interface, we have choose proper protocol to get public IP address which we use to connect to the Internet. We only introduce three frequently used protocols here.

Click edit of the WAN interface to enter WAN interface configuration page.

5.3.1 DHCP client

The default protocol for WAN interface is DHCP client and DHCP server is disabled by default. If this is what you want, you have not change anything.

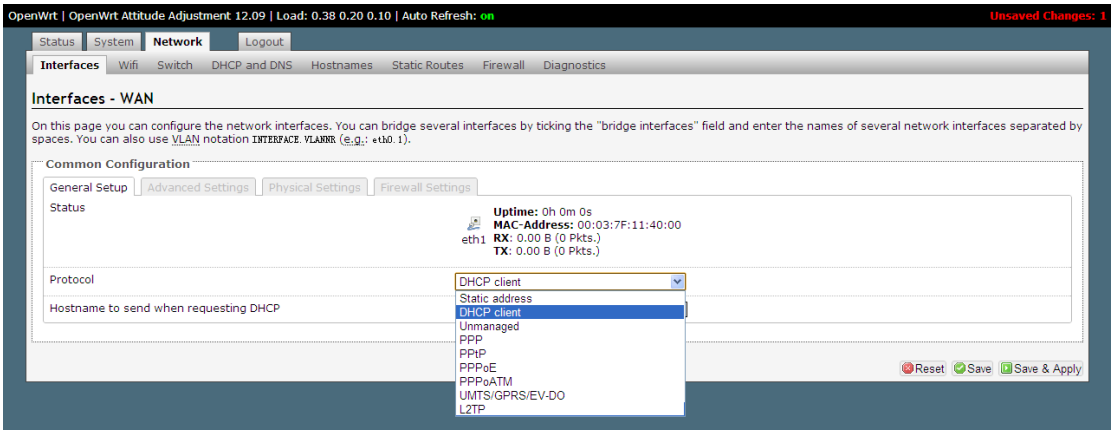

Chart 5.5 WAN Interface Configration(DHCP general setup)

In advanced settings of DHCP, you can choose whether bring up this interface on boot or not. You can also set MAC address and MTU to this interface. Some items associated DHCP can be configured by yourself.

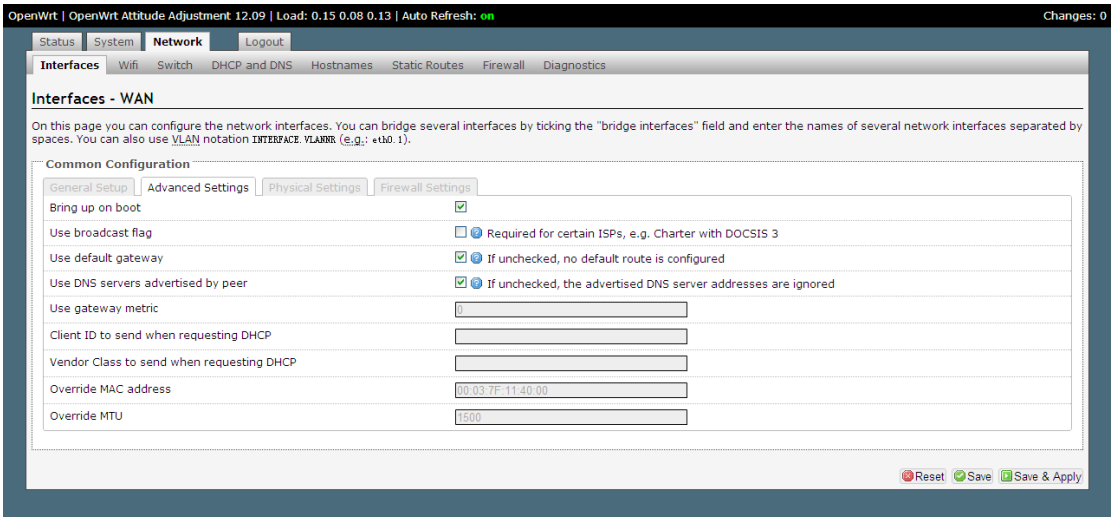

Chart 5.5 WAN Interface Configration(DHCP advanced settings)

5.3.2 Static address

If you use static address to connect to the internet, you should choose static address in protocol and then press switch protocol button like bellow.

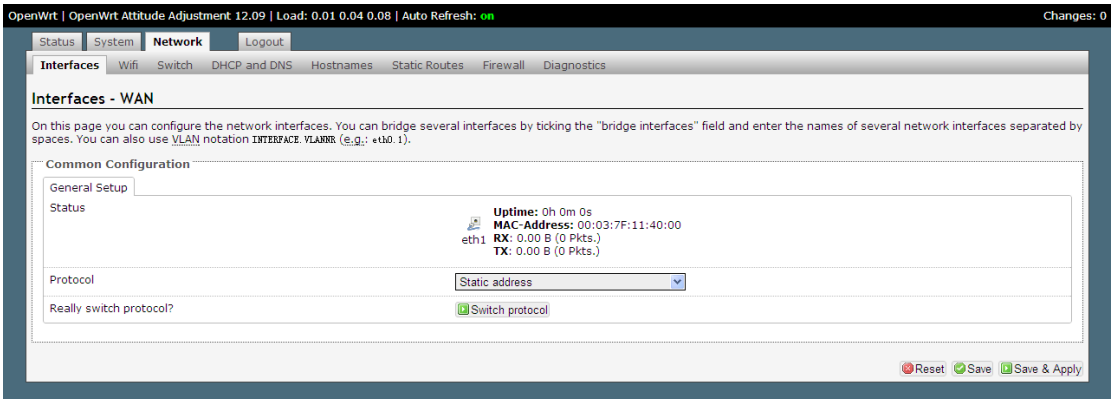

Chart 5.6 WAN Interface Configration(change to static address)

After pressing switch protocol, the configuration interface of static address will be showed like bellow. You have to input proper IP address, netmask, gateway, broadcast address and dns. After configuration, press “Save & Apply”, and then it will work.

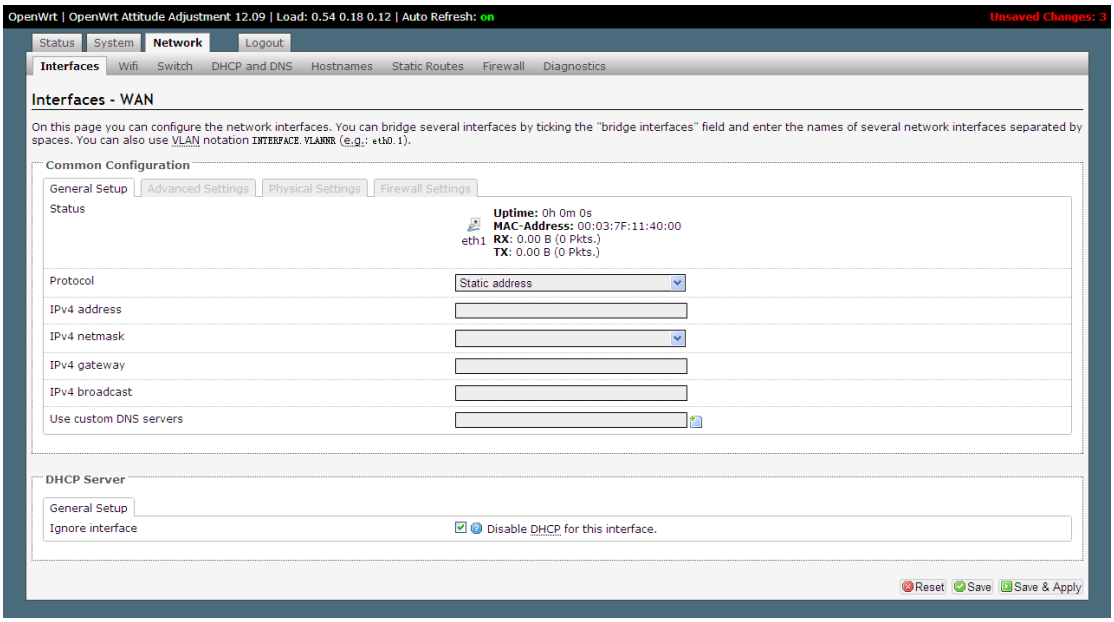

Chart 5.7 WAN Interface Configration(static address general setup)

In advanced settings of static address, you can choose whether bring up this interface on boot or not. You can also set MAC address and MTU to this interface.

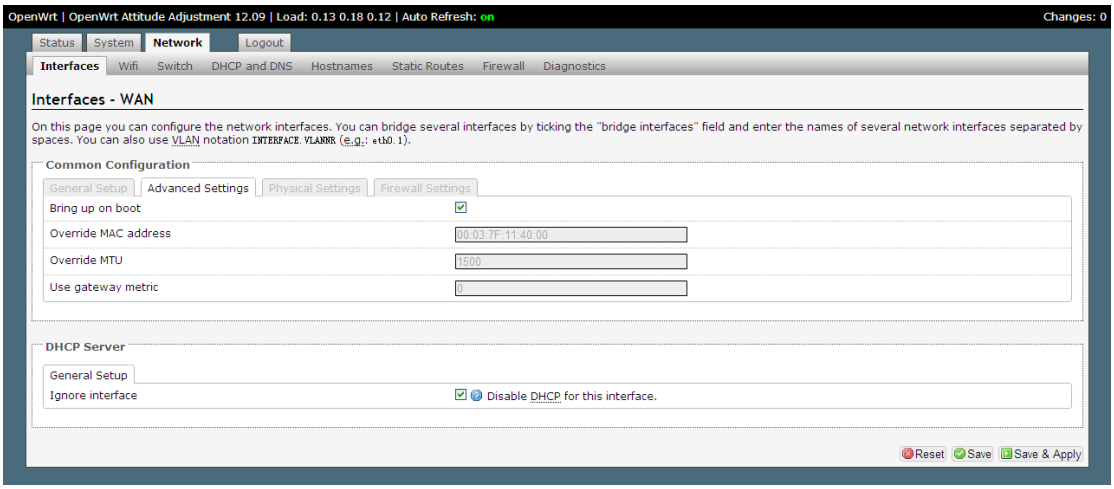

Chart 5.8 WAN Interface Configration(static address advanced settings)

5.3.3 PPPoE

If you use PPPoE to connet to the internet, you should choose PPPoE in protocol and then press switch protocol button like bellow.

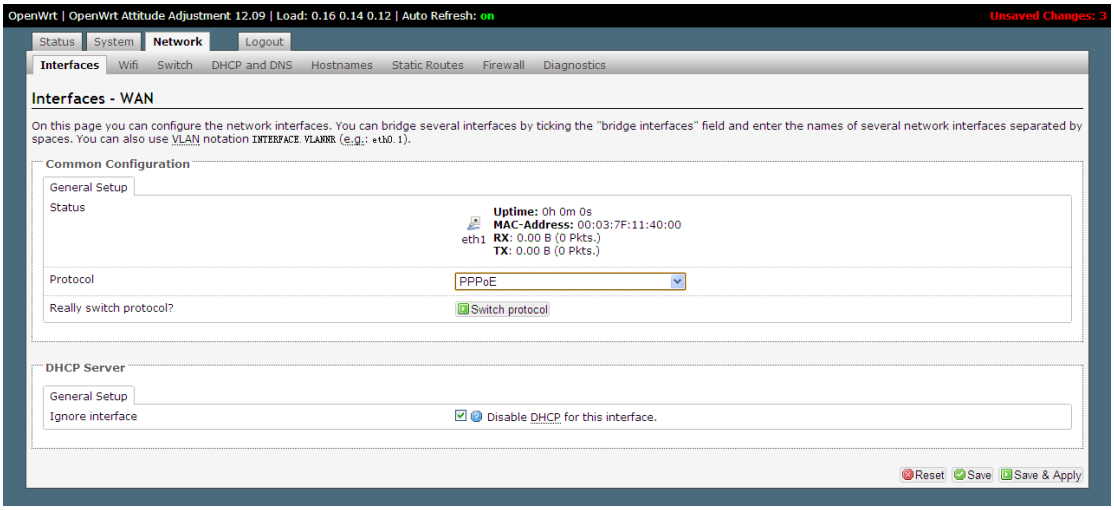

Chart 5.9 WAN Interface Configration(change to PPPoE)

After pressing switch protocol, the configuration interface of PPPoE will be showed like bellow. You have to input proper username and passwrod. After configuration, press “Save & Apply”, and then it will work.

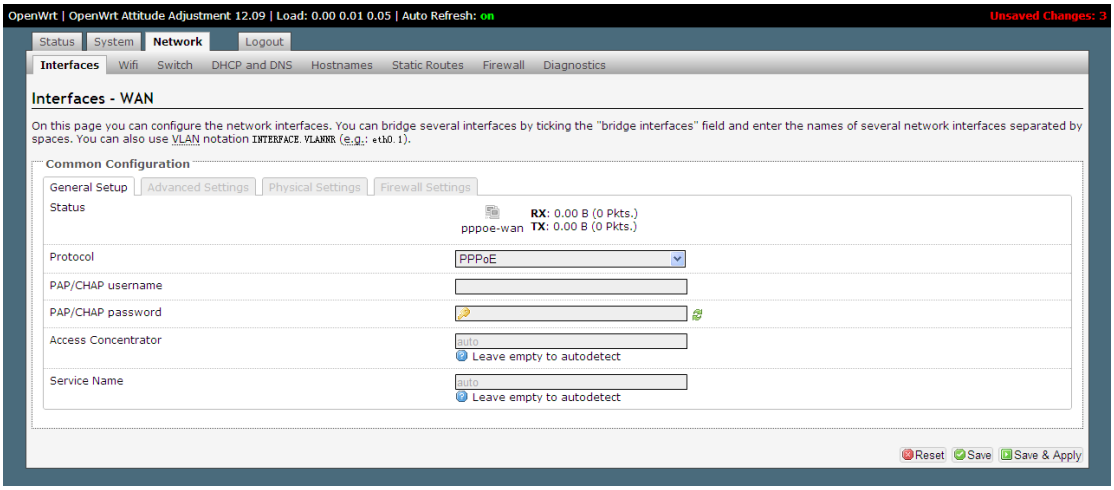

Chart 5.10 WAN Interface Configration(PPPoE general setup)

In advanced settings of PPPoe, you can choose whether bring up this interface on boot or not. You can also set MTU to this interface. Some items associated PPPoE can be configured by yourself.

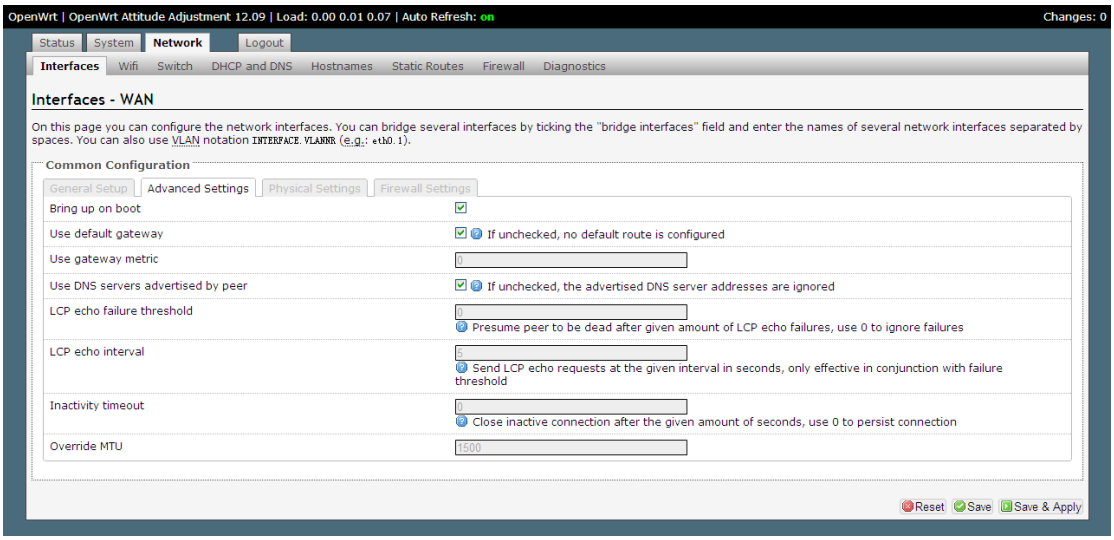

Chart 5.11 WAN Interface Configration(PPPoE advanced settings)

5.4 WiFi Configuration

5.4.1 Wireless Overview

WiFi is disabled by default. You can enable WiFi in bellow page or in WiFi configuration page after pressing edit button.

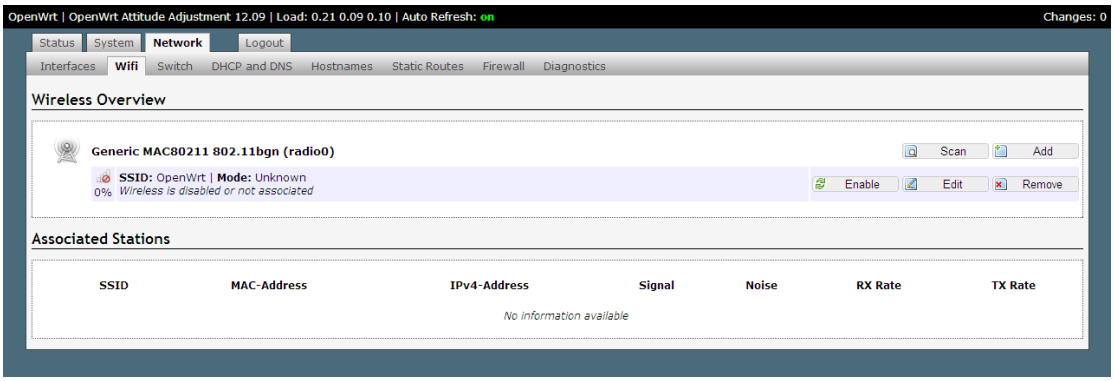

Chart 5.13 WIFi configuration (overview)

5.4.2 General Setup

Firstly, press enable button to enable WiFi. The default SSID of WiFi is OpenWrt. You can change the channel , transmit power, SSID of WiFi in this page. The default mode of WiFi is access point, and you can connect to this SSID using wireless device.

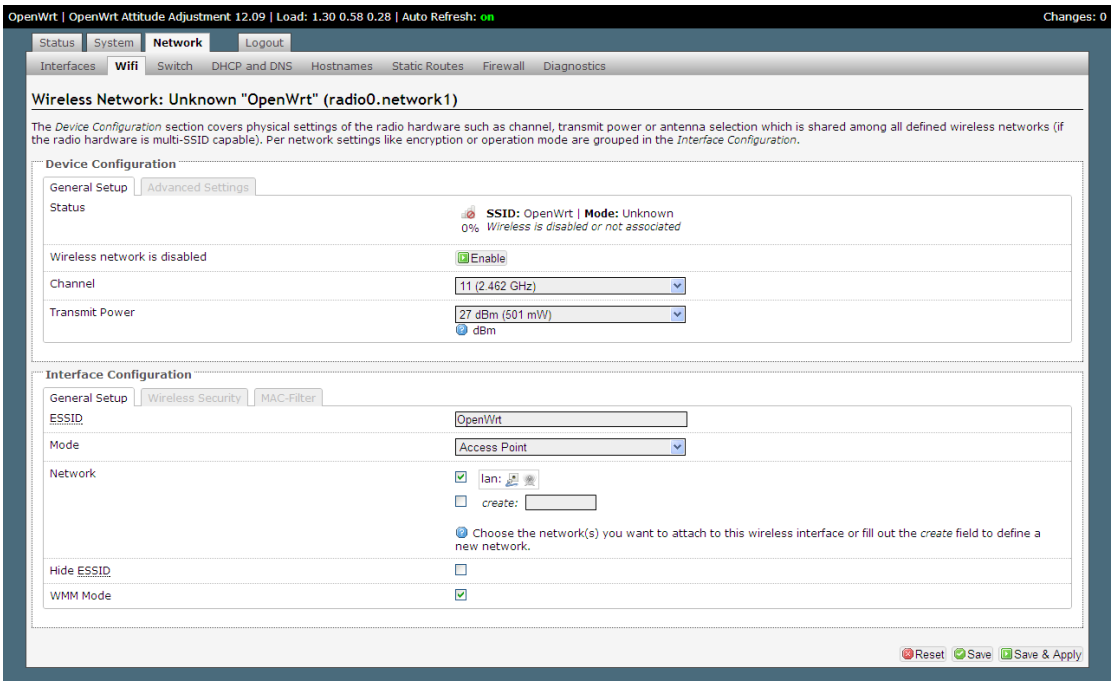

Chart 5.14 WIFi configuration (general setup)

5.4.3 Advanced Settings

In advanced settings page, country code must be set correctly according to your position. The default country code is United States.

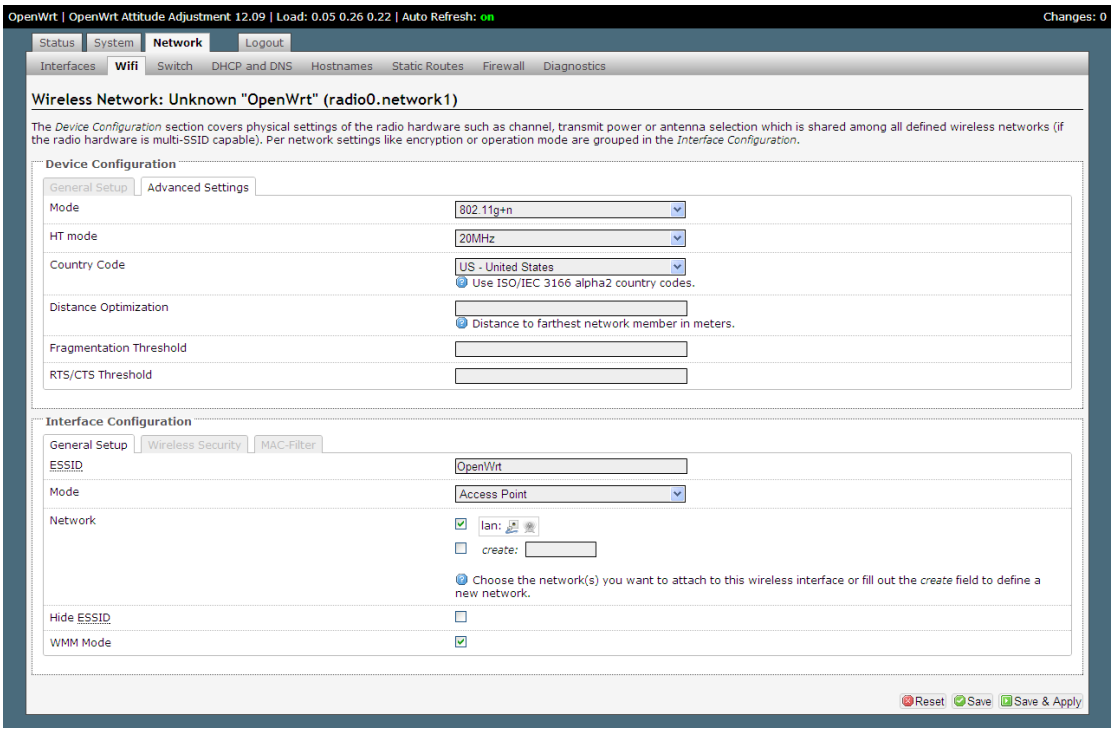

Chart 5.15 WIFi configuration (advanced settings)

5.4.4 Wireless Security

There is no encryption by default. In wireless security page, you can choose one encryption method to encrypt the data traffic. WEP, WPA-PSK, WPA2-PSK can be used in this system. For WEP, you can choose open system or shared key method. For WPA or WPA2, you can choose AES or TKIP to be default cipher.

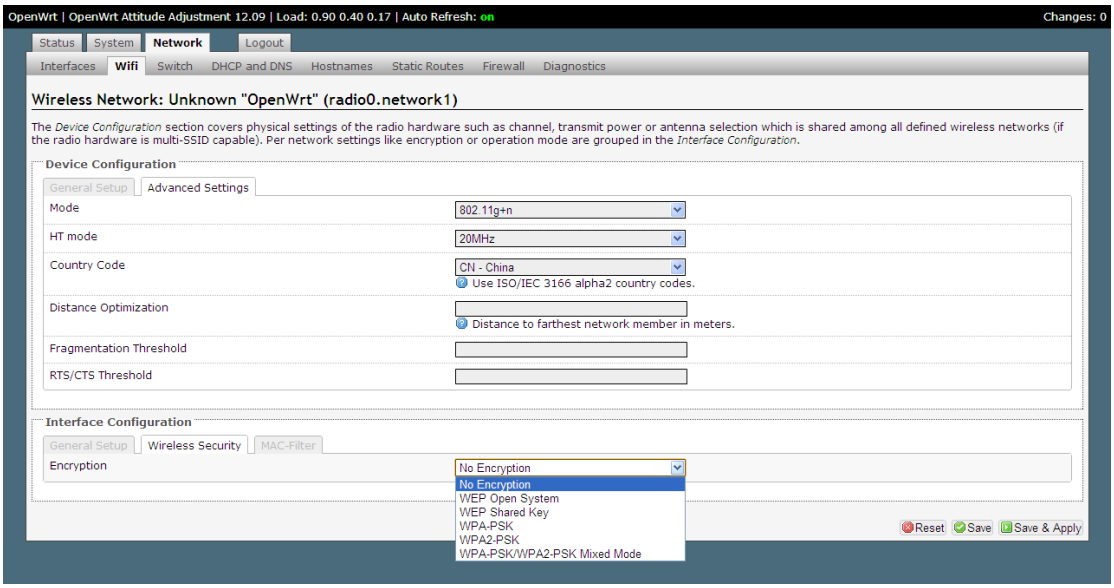

Chart 5.16 WIFi configuration (encrytption)

After configuration, press “Save & Apply” button to save and take effect the

configuration.

5.4.5 MAC Filter

In this page, you can determine which MAC can or can't connect to this access point. Only the mode of wireless is access point, this page can access.

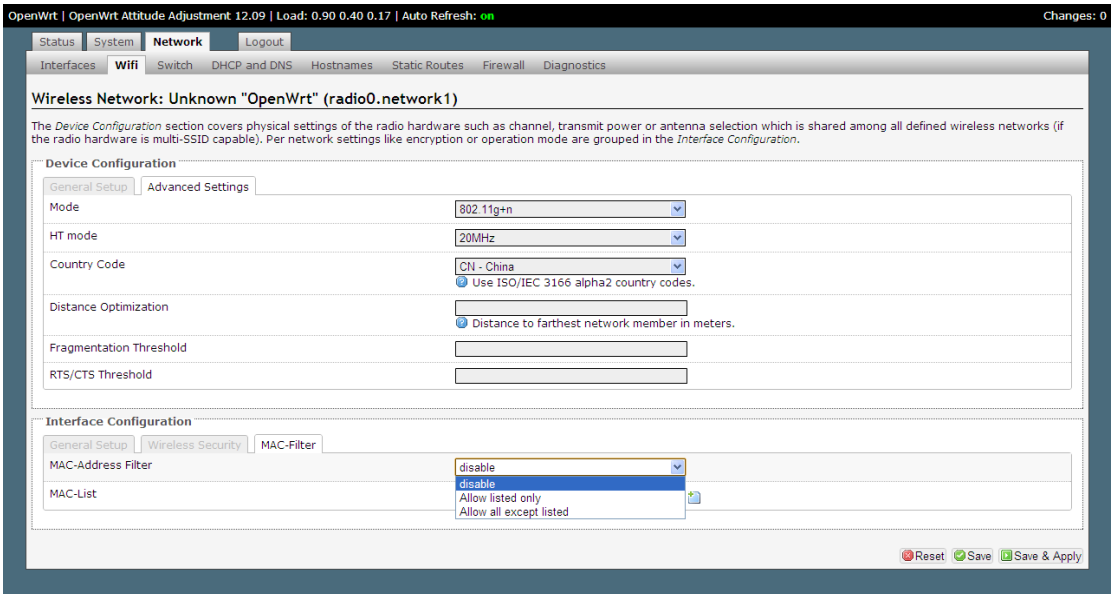

Chart 5.16 WIFi configuration (MAC filter)

6 Instruction of Source code modification

6.1 Brief Introduction

Openwrt supports many devices like TP-link, D-link and so on. For our WLM113 or WLM115 module, we just need to configure the openwrt to ap121. The image compiled from Openwrt can run on the WLM115 and WLM113 at the same time. But the uboot is different between the two module. The WLM113 uses DDR1, and the WLM115 uses DDR2. So we need first configure the uboot source code, and get a right uboot image to different module.

6.2 Reset Pin

For WLM113 , WLM113H and WLM115, the reset pin is all GPIO12. The uboot source code will check the GPIO12 value when it boot. For WLM113, low level of this pin is effective. For WLM113H and WLM115, high level of this pin is effective. If this pin is effective when boot, it will enter upgrade mode in uboot, and start httpd server for update. You can delete this function and don't check the value of GPIO12. For Openwrt, the reset of the system seems to be triggered by edge level. So it doesn't matter for Openwrt what the default value of GPIO12 is.

6.3 Partition Table

The default configuration for ap121 use 4MB flash. The default partition table for ap121 like bellow:

0x00000000-0x0003ffff : "u-boot"	256k	0x20000
0x00040000-0x0004ffff : "u-boot-env"	64k	0x10000
0x00050000-0x002fffff : "rootfs"	2752k	0x2b0000
0x00300000-0x003dffff : "kernel"	896k	0xe0000
0x003e0000-0x003effff : "nvram"	64k	0x10000
0x003f0000-0x003fffff : "art"	64k	0x10000
0x00050000-0x003dffff : "firmware"	3648k	0x390000

But if we use the default configuration to compile image, the kernel will be bigger than 896kB, and it will not generate sysupgrade image. And it is also very hard to cut down the size of kernel. So we changed the partition table and expand the kernel partition like bellow:

0x00000000-0x0001ffff : "u-boot"	128k	0x20000
0x00020000-0x0002ffff : "u-boot-env"	64k	0x10000
0x00030000-0x002effff : "rootfs"	2816k	0x2c0000

0x002f0000-0x003dffff : "kernel" 960k 0xe0000
0x003e0000-0x003effff : "nvram" 64k 0x10000
0x003f0000-0x003fffff : "art" 64k 0x10000
0x00050000-0x003dffff : "firmware" 3776k 0x3b0000

The partition table is defined in “trunk/target/linux/ar71xx/image/Makefile”, and do bellow changes:

1. change from

p121_mtdlayout_4M=mtdparts=spi0.0:256k(u-boot)ro,64k(u-boot-env)ro,2752k(rootfs),896k(kernel),64k(nvram),64k(art)ro,3648k@0x50000(firmware)

to

ap121_mtdlayout_4M=mtdparts=spi0.0:128k(u-boot)ro,64k(u-boot-env)ro,2816k(rootfs),960k(kernel),64k(nvram),64k(art)ro,3776k@0x30000(firmware)

2. change from

$(eval $(call SingleProfile,AthLzma,64k,AP121_4M,ap121-4M,AP121,ttyATH0,115200,$$(ap121_mtdlayout_4M),917504,2818048,RKuImage))

to

$(eval $(call SingleProfile,AthLzma,64k,AP121_4M,ap121-4M,AP121,ttyATH0,115200,$$(ap121_mtdlayout_4M),983040,2883584,RKuImage))

Because the partition table is changed. The address of kernel is also changed. So we should modify the uboot source code to change the boot address from 0x9f300000 to 0x9f2f0000(the base address of spi flash is 0x9f000000).

If the flash is not 4MB, we can also change this partition table to use 8MB or 16MB flash. But the we also need to modify the source code of uboot to boot system successfully.

6.4 Upgrade Script

When system booted, we can use web or shell to upgrade the image. No matter which method we use, the “sysupgrade” script will be called. But the default script can upgrade successfully. We modify the file “trunk/target/linux/ar71xx/base-files/lib/ar71xx.sh” to make upgrade successfully. At the function ar71xx_board_detect(), we do bellow modification:

```
        *AP121)
            name="ap121"
            ;;
        *"AP121 reference board")
            name="ap121"
            ;;
```

We add the red part.

6.5 Default enable WiFi

We change the file "/trunk/package/kernel/mac80211/files/lib/wifi/mac80211.sh" to enable WiFi by default. Delete the line "option disabled 1", and it will enable WiFi by default.

6.6 Upgrade under uboot

We use bellow method to upgrade uboot, system image and art file (for 4MB flash and modified partition table):

1. set module IP address and TFTP server IP address:
   set ipaddr 192.168.10.12
   set serverip 192.168.10.15
2. upgrade uboot:
   set update_uboot tftp 80060000 tuboot.bin\;erase 9f000000 +0x20000\;cp.b 80060000 9f000000 \${filesize}
   run update_uboot
3. upgrade firmware
   set update_fireware tftp 80060000 openwrt-ar71xx-generic-ap121-4M-squashfs-sysupgrade.bin\;erase 9f030000 +0x3b0000\;cp.b 80060000 9f030000 \${filesize}
   run update_fireware
4. upgrade art
   set update_art tftp 80060000 art\;erase 9f3f0000 +0x10000\;cp.b 80060000 9f3f0000 0x10000
   run update_art

6.7 ART file

The file art contains MAC address and WiFi parameters. The WiFi parameters is generate by calibration equipment like IQView. After calibration, the performance of WiFi can be optimum.

The size of art file is 64KB, and it must be flash to the last sector of the flash.

The position of MAC address is showed bellow. The MAC address in art file can be modified by tools.

If the image of OpenWrt has command 'macset', you can use this command to change MAC address. In fact, this command is shell script, it can modify the art partition.

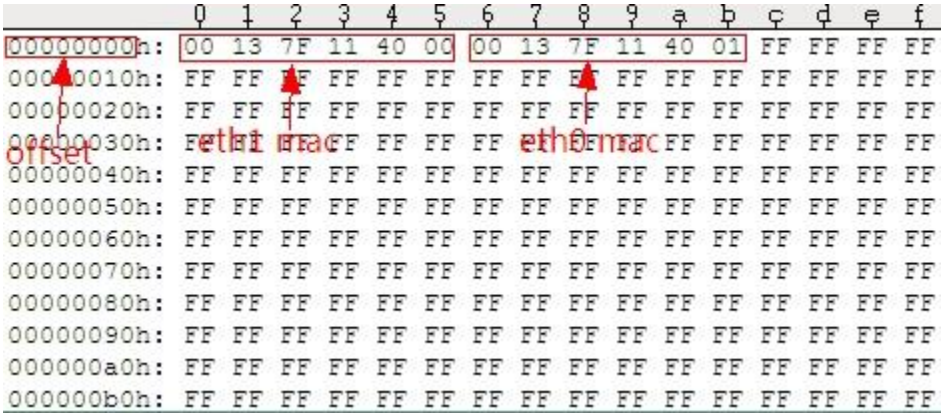

Chart 6.1 the position of MAC address in art file(1)

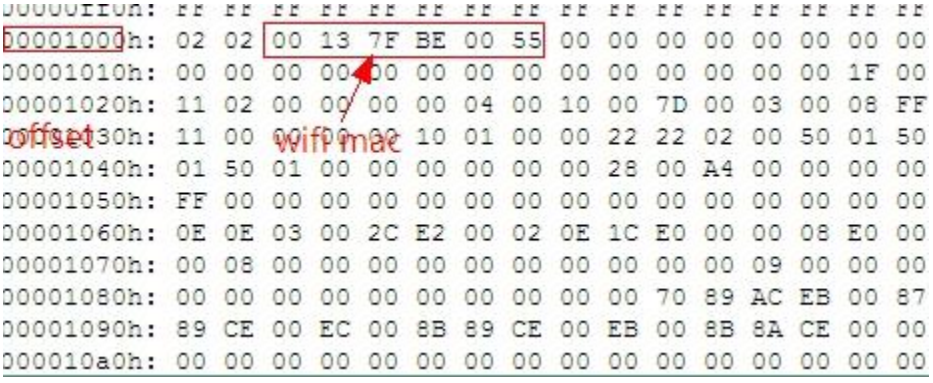

Chart 6.2 the position of MAC address in art file(2)