

OpenWRT User Manual
(WLM113/WLM113H/WLM115)

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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: maximum up to 54Mbps 11n: maximum 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	Client/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°C to +40°C
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

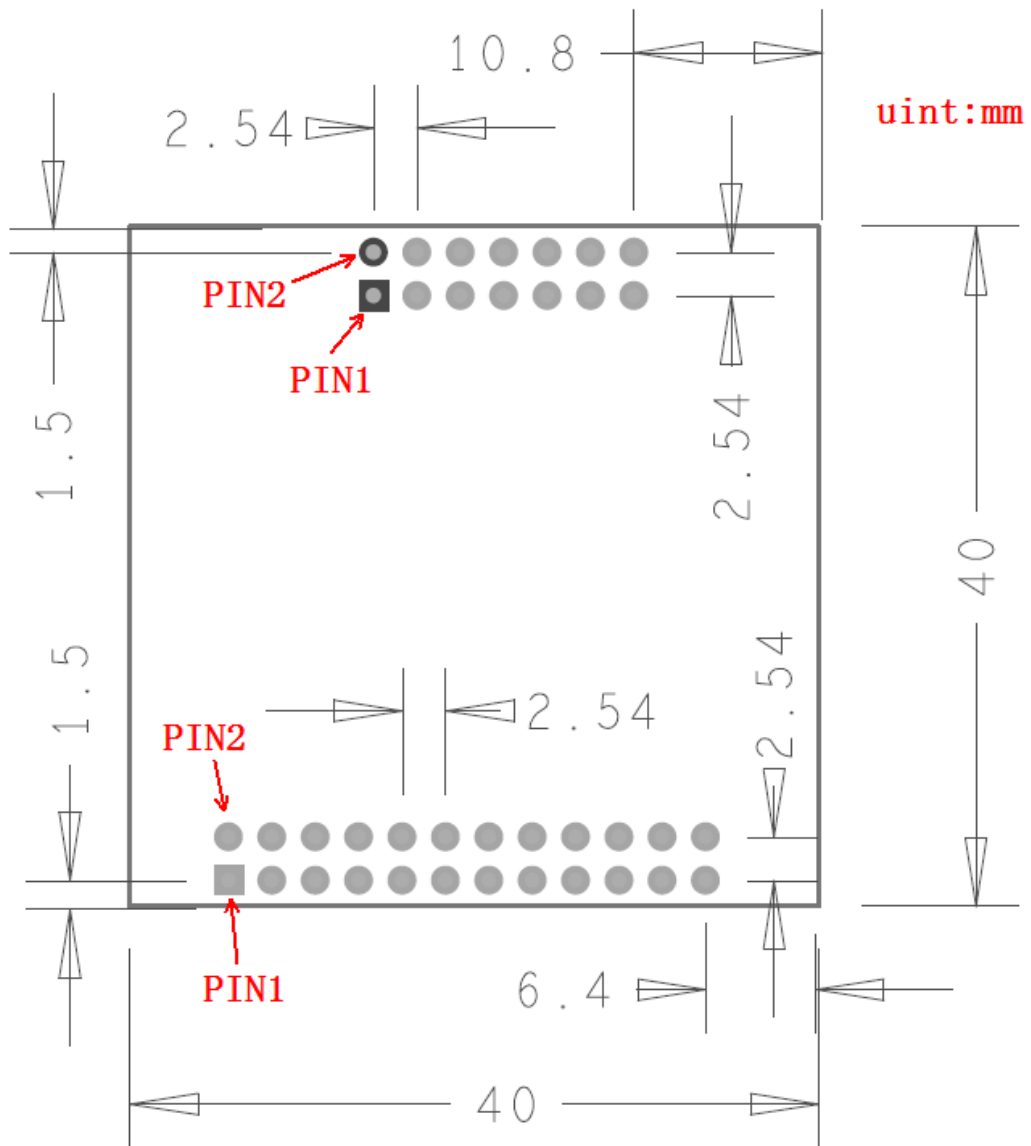


Chart 1.4 dimensions of WLM113 Unit:mm

1.4.1.3 Pins Interface

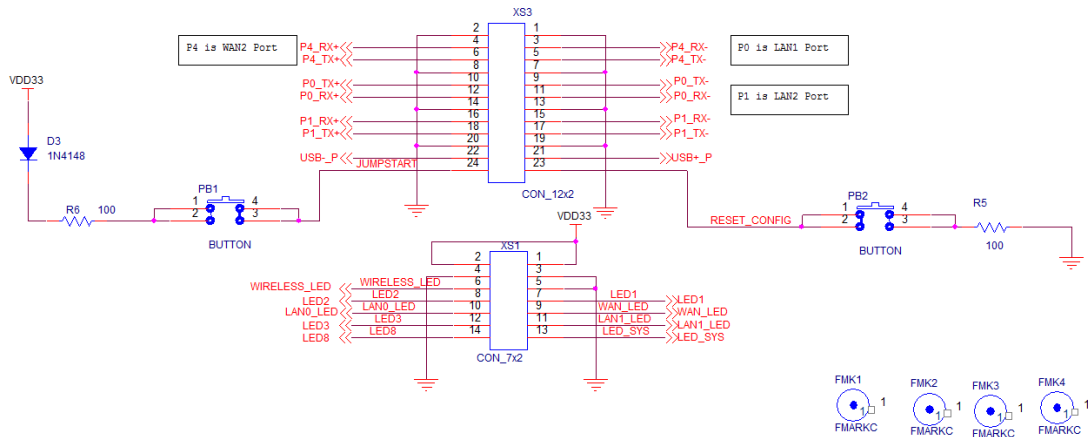


Chart 1.5 Pins of WLM113

1.4.2 WLM115

1.4.2.1 Diagram of the system application

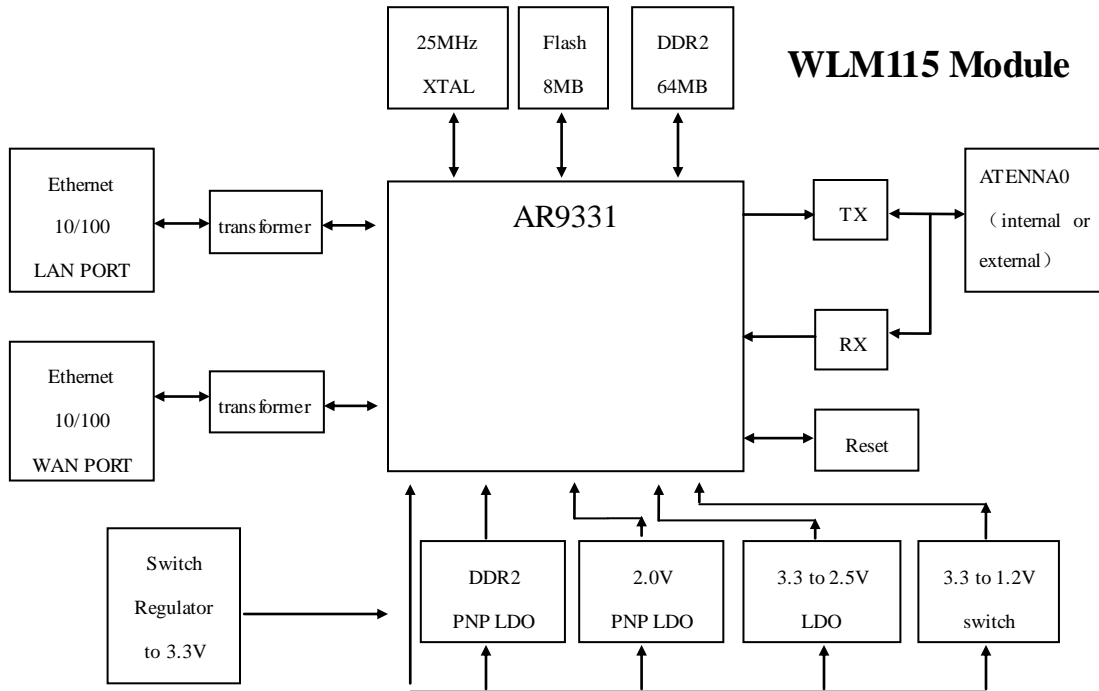


Chart 1.6 Diagram of the system application

1.4.2.2 Physical Map

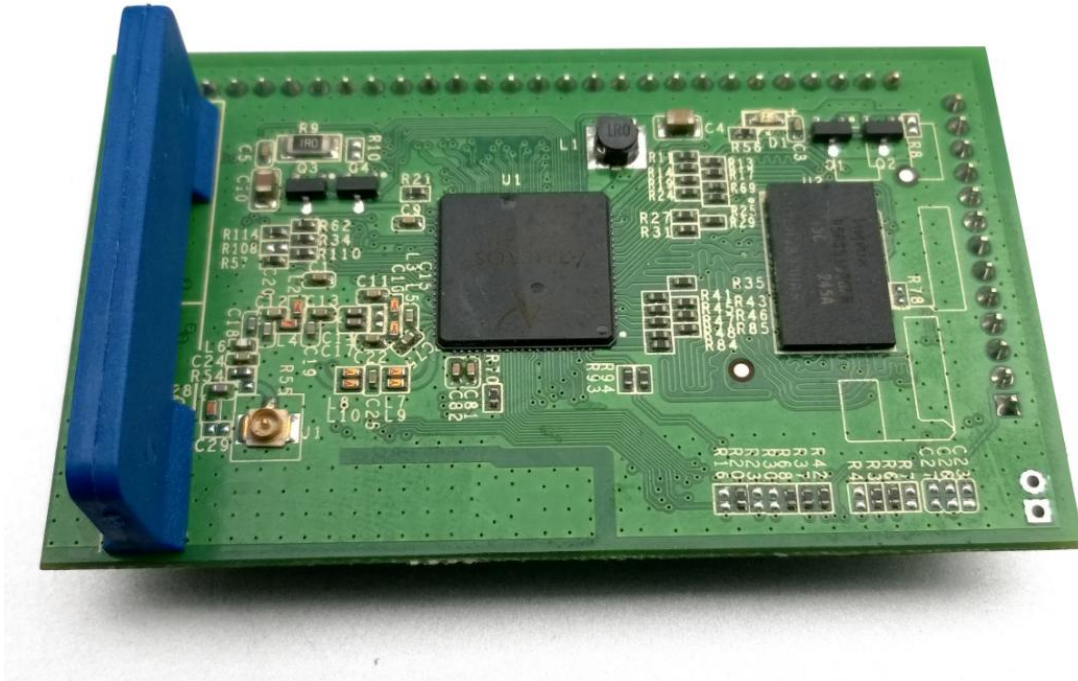


Chart 1.7 Top View of Physical Map

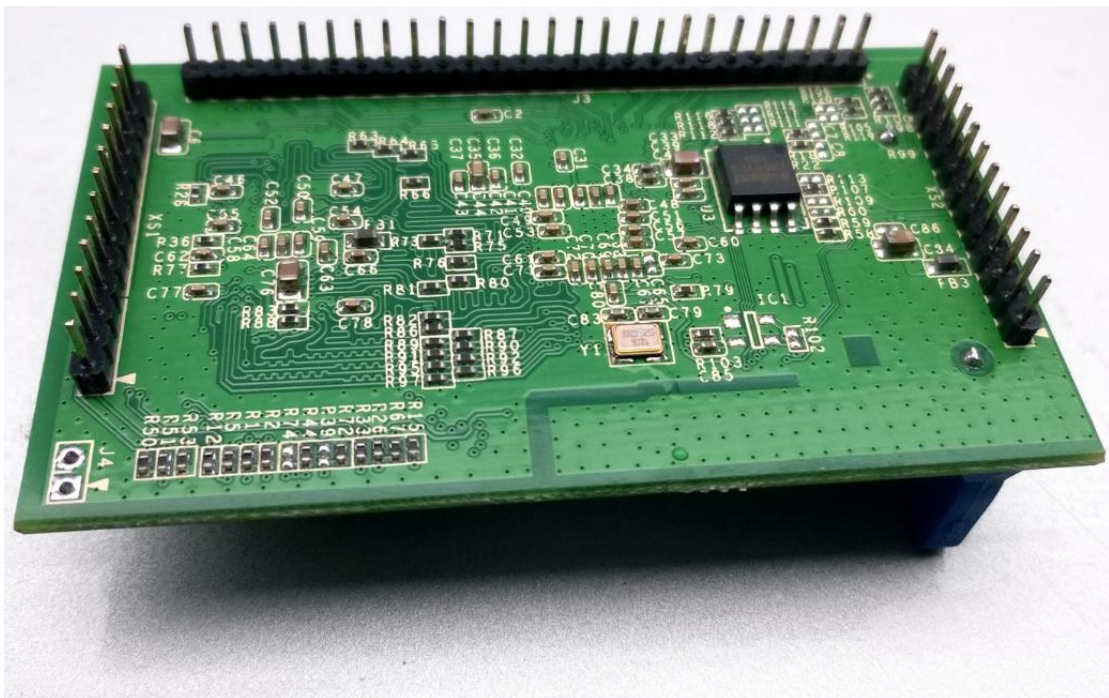


Chart 1.8 Bottom View of Physical Map



Chart 1.8 Physical Map of Main board

1.4.2.3 Mechanical Dimensions

WLM115 mechanical dimensions is shown in the following picture:

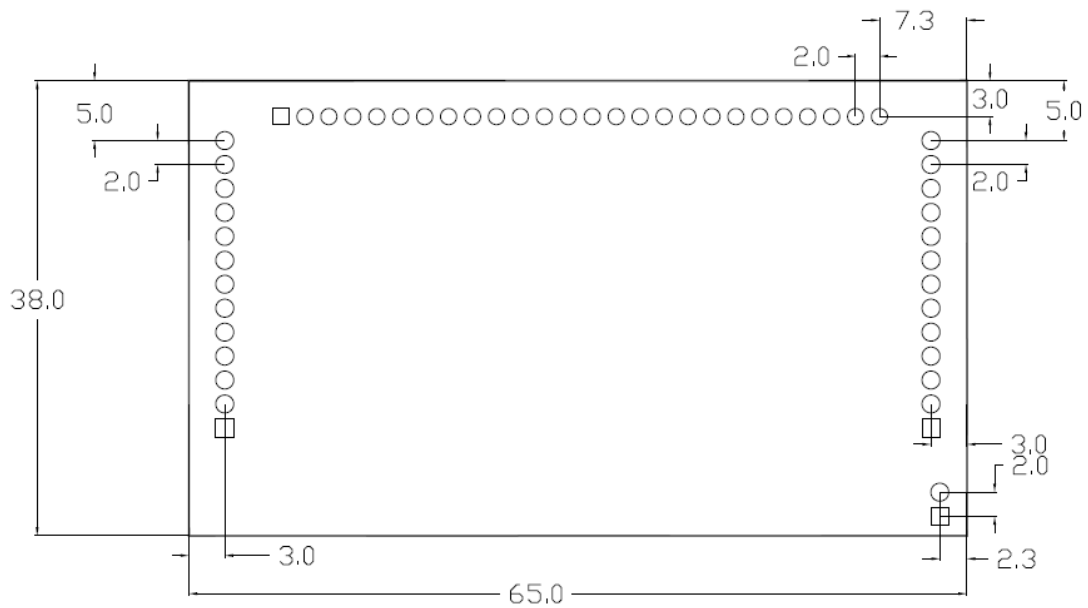


Chart 1.9 dimensions of WLM115(1) Unit:mm



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)		
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	XS 1	
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		
2	LAN1_TX-	OA	Ethernet port LAN1 transmit pair		J3
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

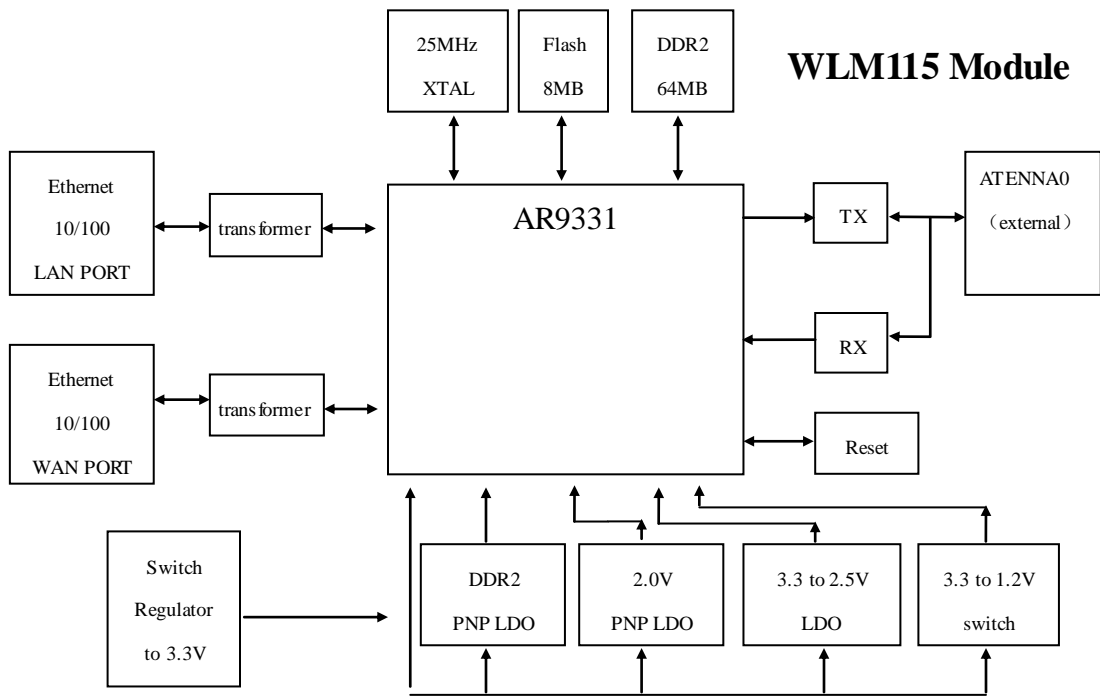


Chart 1.12 Diagram of the system application

1.4.3.2 Physical Map

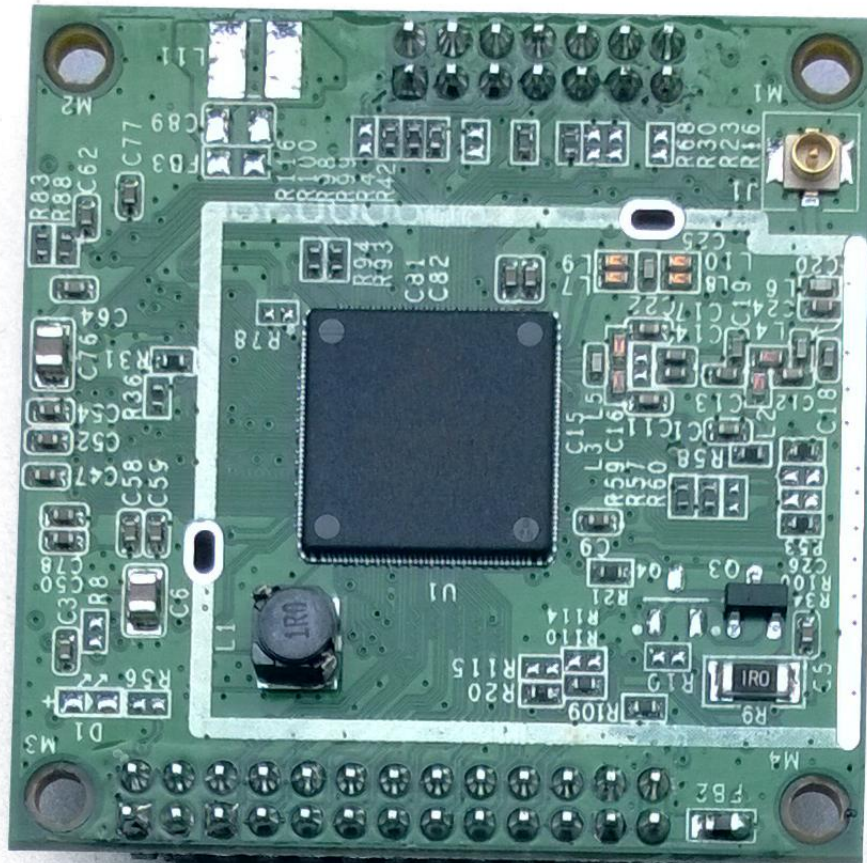


Chart 1.13 Top View of Physical Map

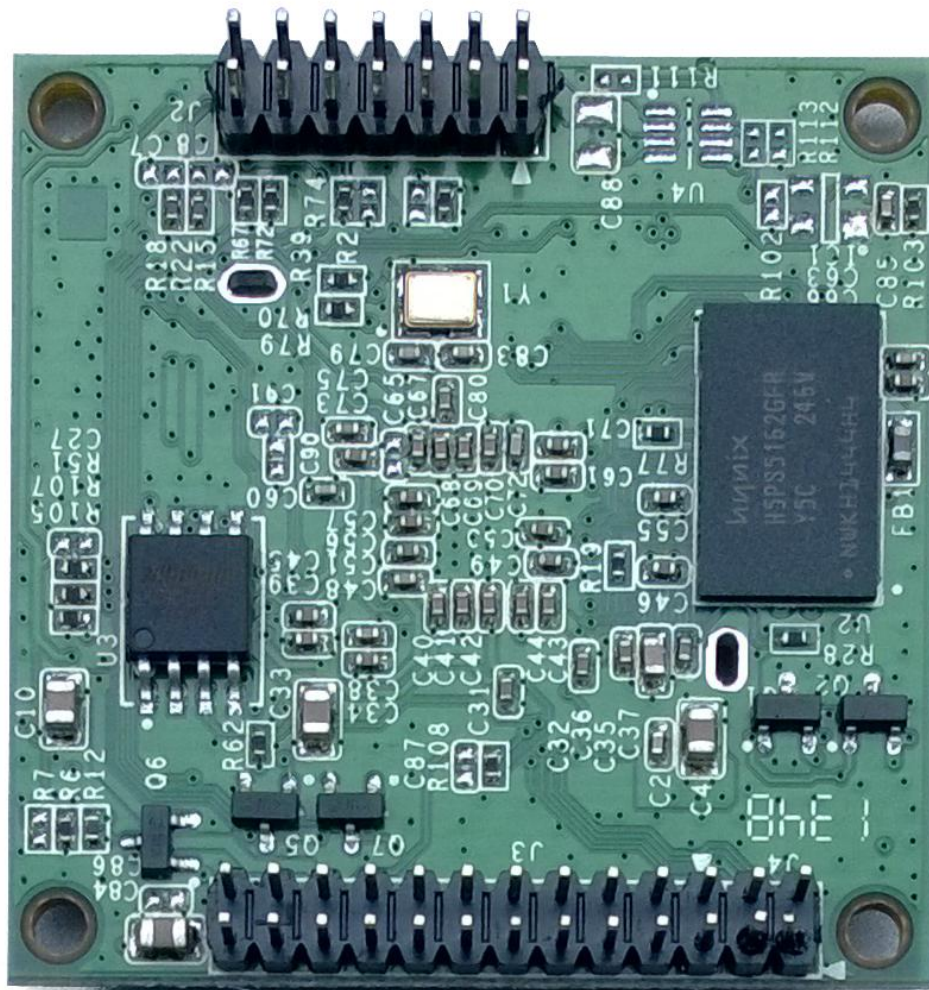


Chart 1.14 Bottom View of Physical Map

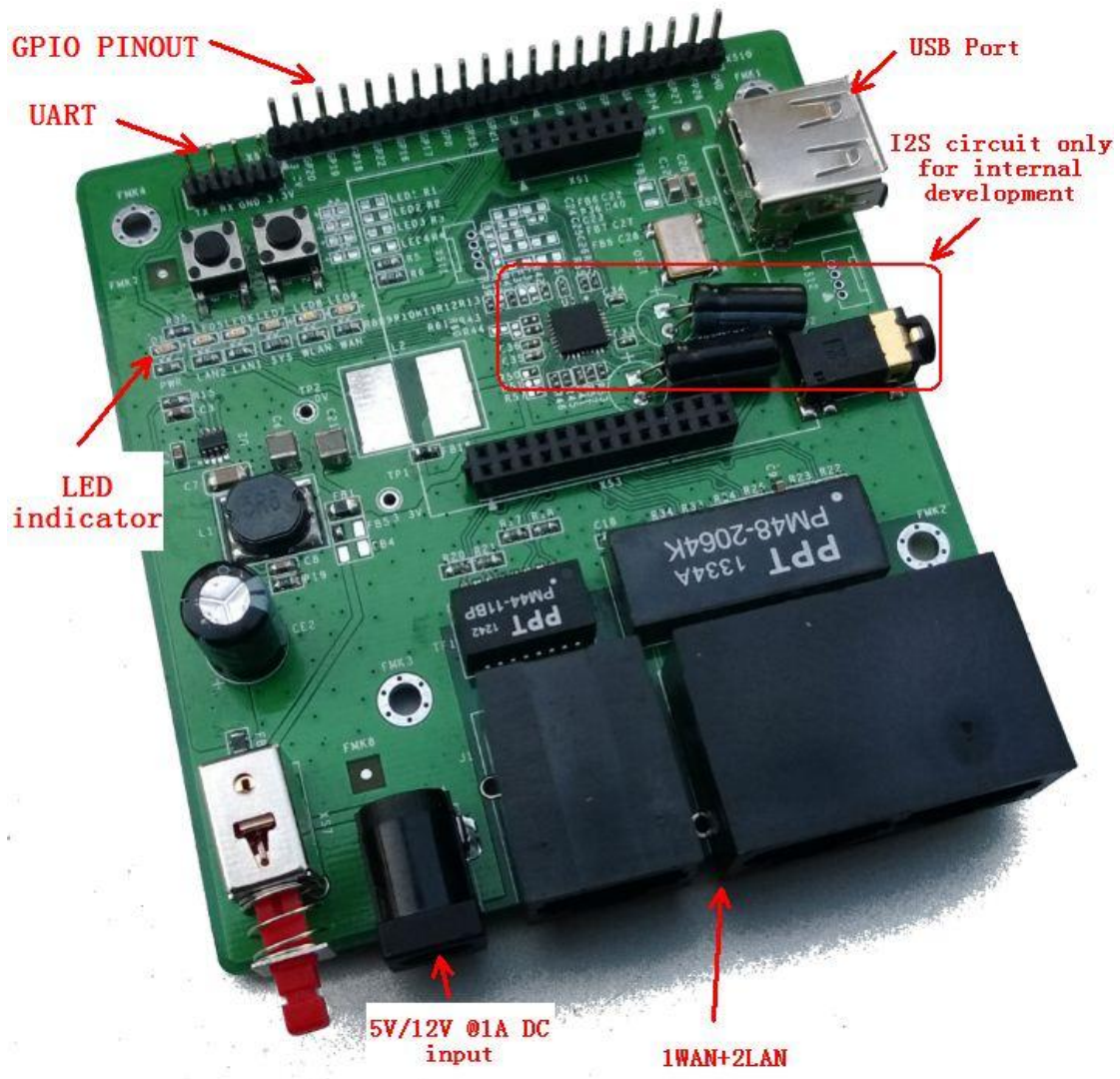


Chart 1.15 Physical Map of Main board

1.4.3.3 Mechanical Dimensions

WLM113H mechanical dimensions is shown in the following picture:

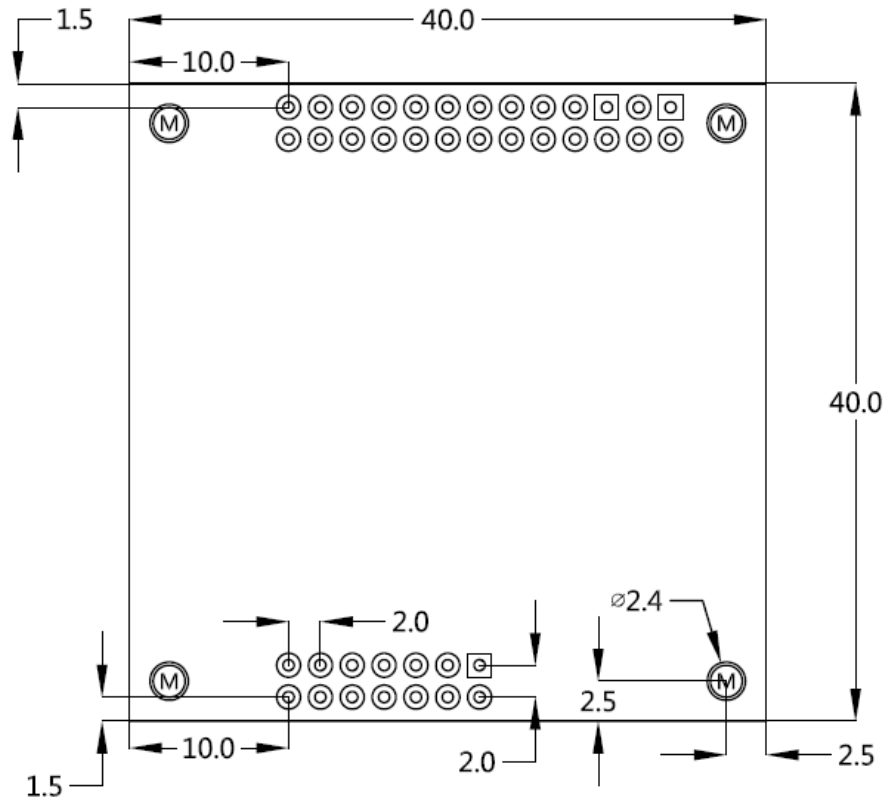


Chart 1.16 dimensions of WLM113H Unit:mm

1.4.2.4 Pins Interface

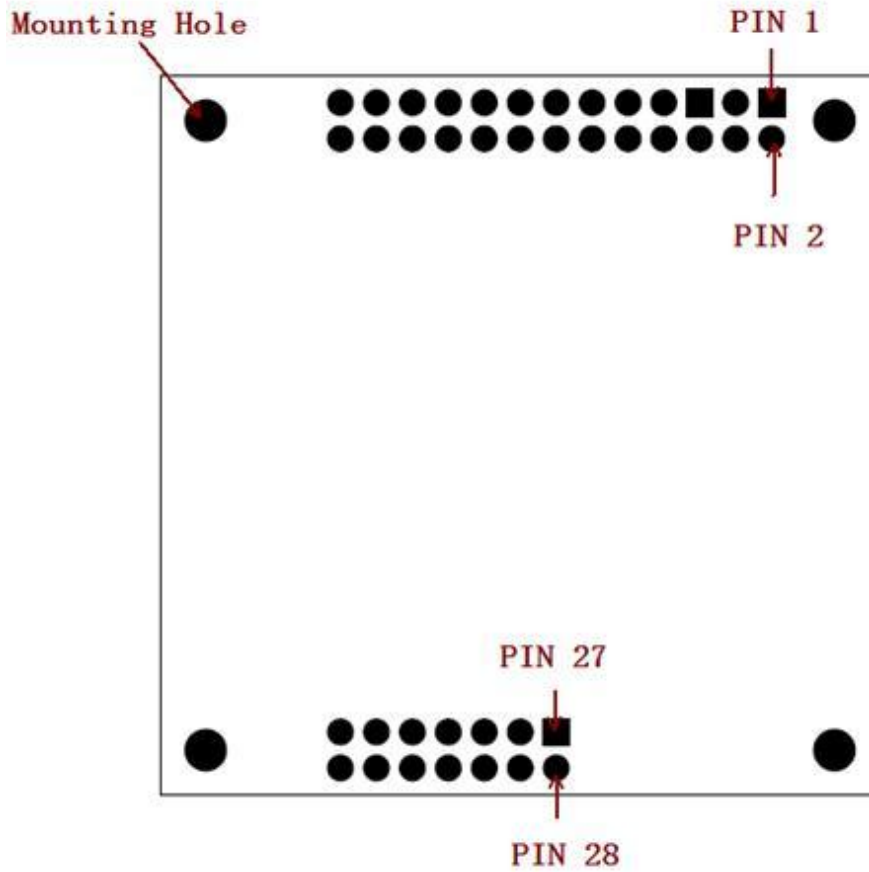


Chart 1.17 PIN of WLM113H

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.


```
==== IMPORTANT! ====
Use 'passwd' to set your login password
this will disable telnet and enable SSH
=====

BusyBox v1.19.4 (2013-11-01 19:34:33 CST) built-in shell (ash)
Enter 'help' for a list of built-in commands.

      _.._ _.._ _.._ _.._ _.._ _.._ _.._ _.._
      |   | |   | |   | |   | |   | |   | |   |
      |___| |___| |___| |___| |___| |___| |___|
      :_! W I R E L E S S   F R E E D O M

=====
ATTITUDE ADJUSTMENT (Attitude Adjustment, r36422)
=====
* 1/4 oz Vodka      Pour all ingredients into mixing
* 1/4 oz Gin        tin with ice, strain into glass.
* 1/4 oz Amaretto
* 1/4 oz Triple sec
* 1/4 oz Peach schnapps
* 1/4 oz Sour mix
* 1 splash Cranberry juice
=====
root@OpenWrt:~#
```

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.

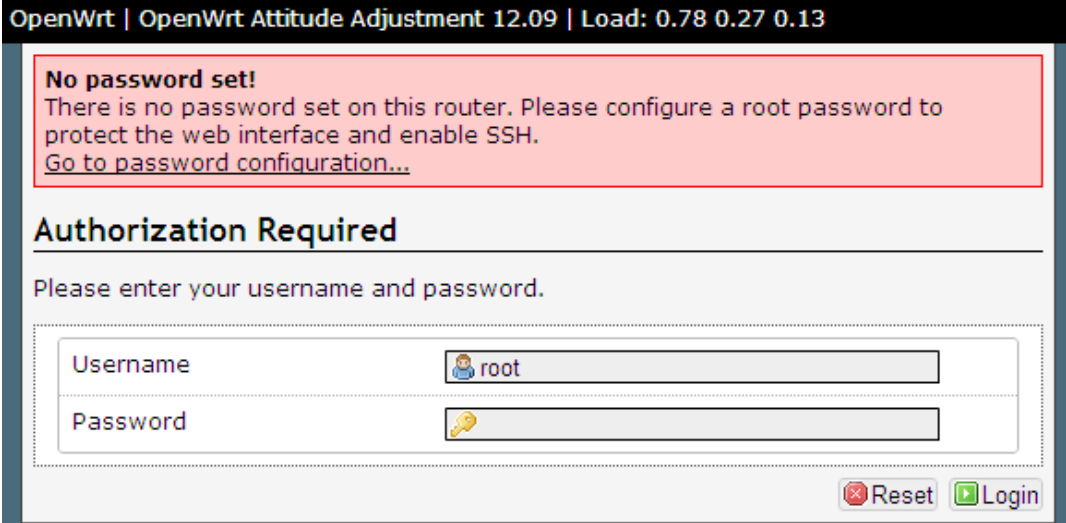


Chart 2.2 web login

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.

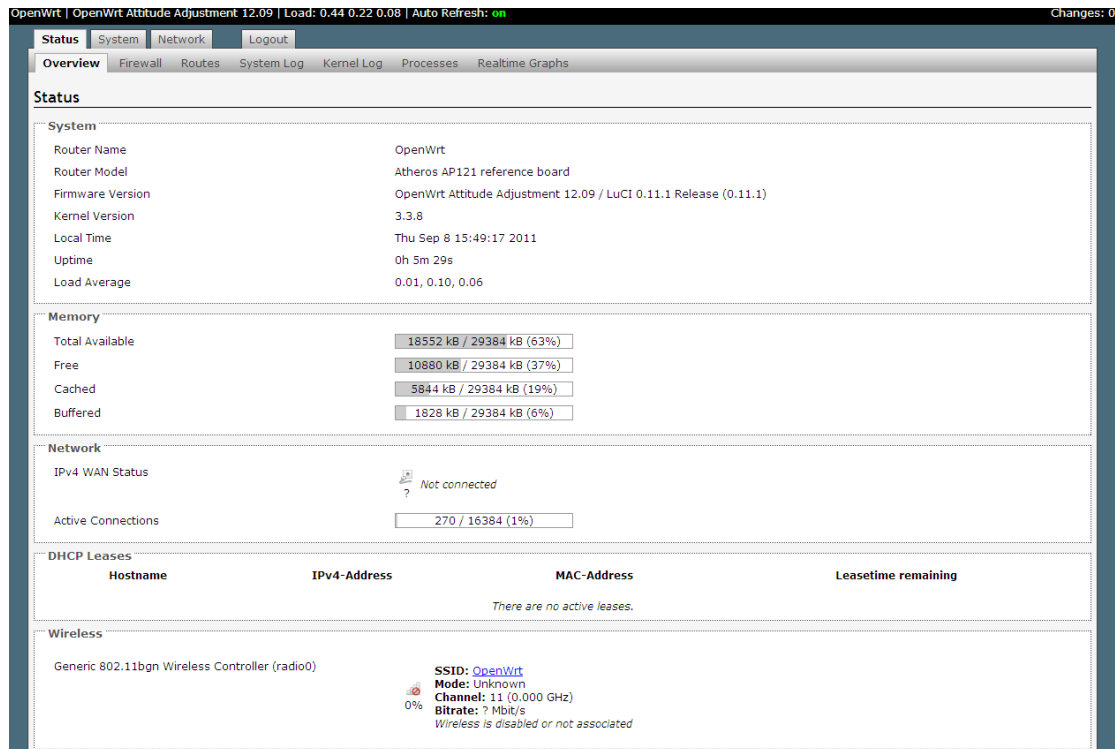


Chart 3.1 Overview

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.

OpenWrt | OpenWrt Attitude Adjustment 12.09 | Load: 0.50 0.74 0.44 Changes: 0

Status System Network Logout

Overview Firewall Routes System Log Kernel Log Processes Realtime Graphs

Firewall Status

Actions

- Reset Counters
- Restart Firewall

Table: Filter

Chain INPUT (Policy: ACCEPT, Packets: 0, Traffic: 0.00 B)

Rule #	Pkts.	Traffic	Target	Prot.	Flags	In	Out	Source	Destination	Options
1	9917	805.33 KB	ACCEPT	all	--	*	*	0.0.0.0/0	0.0.0.0/0	ctstate RELATED,ESTABLISHED
2	8023	532.78 KB	ACCEPT	all	--	lo	*	0.0.0.0/0	0.0.0.0/0	-
3	426	21.63 KB	syn_flood	tcp	--	*	*	0.0.0.0/0	0.0.0.0/0	tcp flags:0x17/0x02
4	426	21.63 KB	input_rule	all	--	*	*	0.0.0.0/0	0.0.0.0/0	-
5	426	21.63 KB	input	all	--	*	*	0.0.0.0/0	0.0.0.0/0	-

Chain FORWARD (Policy: DROP, Packets: 0, Traffic: 0.00 B)

Rule #	Pkts.	Traffic	Target	Prot.	Flags	In	Out	Source	Destination	Options
1	0	0.00 B	ACCEPT	all	--	*	*	0.0.0.0/0	0.0.0.0/0	ctstate RELATED,ESTABLISHED
2	0	0.00 B	forwarding_rule	all	--	*	*	0.0.0.0/0	0.0.0.0/0	-
3	0	0.00 B	forward	all	--	*	*	0.0.0.0/0	0.0.0.0/0	-
4	0	0.00 B	reject	all	--	*	*	0.0.0.0/0	0.0.0.0/0	-

Chain OUTPUT (Policy: ACCEPT, Packets: 0, Traffic: 0.00 B)

Rule #	Pkts.	Traffic	Target	Prot.	Flags	In	Out	Source	Destination	Options
1	10398	1.09 MB	ACCEPT	all	--	*	*	0.0.0.0/0	0.0.0.0/0	ctstate RELATED,ESTABLISHED
2	8023	532.78 KB	ACCEPT	all	--	lo	*	0.0.0.0/0	0.0.0.0/0	-
3	1	84.00 B	output_rule	all	--	*	*	0.0.0.0/0	0.0.0.0/0	-
4	1	84.00 B	output	all	--	*	*	0.0.0.0/0	0.0.0.0/0	-

Chain forward (References: 1)

Rule #	Pkts.	Traffic	Target	Prot.	Flags	In	Out	Source	Destination	Options
1	0	0.00 B	zone_lan_forward	all	--	br-lan	*	0.0.0.0/0	0.0.0.0/0	-

Chain input (References: 1)

Rule #	Pkts.	Traffic	Target	Prot.	Flags	In	Out	Source	Destination	Options
1	426	21.63 KB	zone_lan	all	--	br-lan	*	0.0.0.0/0	0.0.0.0/0	-

Chain output (References: 1)

Rule #	Pkts.	Traffic	Target	Prot.	Flags	In	Out	Source	Destination	Options
1	1	84.00 B	zone_lan ACCEPT	all	--	*	*	0.0.0.0/0	0.0.0.0/0	-

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.

OpenWrt | OpenWrt Attitude Adjustment 12.09 | Load: 0.00 0.06 0.20 Changes: 0

Status System Network Logout

Overview Firewall Routes System Log Kernel Log Processes Realtime Graphs

Routes

The following rules are currently active on this system.

ARP

IPv4-Address	MAC-Address	Interface
192.168.1.15	40:61:86:ca:3b:68	br-lan

Active IPv4-Routes

Network	Target	IPv4-Gateway	Metric
lan	192.168.1.0/24	0.0.0.0	0

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.

```

OpenWrt | OpenWrt Attitude Adjustment 12.09 | Load: 0.00 0.04 0.17
Changes: 0
Status System Network Logout
Overview Firewall Routes System Log Kernel Log Processes Realtime Graphs
System Log
Sep 8 15:44:03 OpenWrt syslog.info syslogd started: BusyBox v1.19.4
Sep 8 15:44:03 OpenWrt kern.notice kernel: klogd started: BusyBox v1.19.4 (2013-11-01 19:34:33 CST)
Sep 8 15:44:03 OpenWrt kern.notice kernel: [ 0.000000] Linux version 3.3.8 (wxx@bt) (gcc version 4.6.3 20120201 (prerelease) (Linaro GCC 4.6-2012.02) ) #4 Tue Nov 15
Sep 8 15:44:03 OpenWrt kern.info kernel: [ 0.000000] bootconsole [early0] enabled
Sep 8 15:44:03 OpenWrt kern.info kernel: [ 0.000000] CPU revision is: 00019374 (MIPS 24Kc)
Sep 8 15:44:03 OpenWrt kern.info kernel: [ 0.000000] SoC: Atheros AR9330 rev 1
Sep 8 15:44:03 OpenWrt kern.info kernel: [ 0.000000] Clocks: CPU:400.000MHz, DDR:400.000MHz, AHB:200.000MHz, Ref:25.000MHz
Sep 8 15:44:03 OpenWrt kern.info kernel: [ 0.000000] Determined physical RAM map:
Sep 8 15:44:03 OpenWrt kern.info kernel: [ 0.000000]   memory: 02000000 @ 00000000 (usable)
Sep 8 15:44:03 OpenWrt kern.info kernel: [ 0.000000]   initrd not found or empty - disabling initrd
Sep 8 15:44:03 OpenWrt kern.warn kernel: [ 0.000000] Zone PFN ranges:
Sep 8 15:44:03 OpenWrt kern.warn kernel: [ 0.000000]   Normal 0x00000000 -> 0x00002000
Sep 8 15:44:03 OpenWrt kern.warn kernel: [ 0.000000] Movable zone start PFN for each node
Sep 8 15:44:03 OpenWrt kern.warn kernel: [ 0.000000]   Early memory PFN ranges
Sep 8 15:44:03 OpenWrt kern.warn kernel: [ 0.000000]   0: 0x00000000 -> 0x00002000
Sep 8 15:44:03 OpenWrt kern.debug kernel: [ 0.000000]   On node 0 totalpages: 8192
Sep 8 15:44:03 OpenWrt kern.debug kernel: [ 0.000000]   free_area_init_node: node 0, pgdat 802c69f0, node_mem_map 81000000
Sep 8 15:44:03 OpenWrt kern.debug kernel: [ 0.000000]   Normal zone: 64 pages used for memmap
Sep 8 15:44:03 OpenWrt kern.debug kernel: [ 0.000000]   Normal zone: 0 pages reserved
Sep 8 15:44:03 OpenWrt kern.debug kernel: [ 0.000000]   Normal zone: 8128 pages, LIFO batch:0
Sep 8 15:44:03 OpenWrt kern.debug kernel: [ 0.000000]   popu-alloc: s0 r0 d32768 u32768 alloc=1*32768
Sep 8 15:44:03 OpenWrt kern.debug kernel: [ 0.000000]   popu-alloc: [0] 0
Sep 8 15:44:03 OpenWrt kern.warn kernel: [ 0.000000] Built 1 zonelists in Zone order, mobility grouping on. Total pages: 8128
Sep 8 15:44:03 OpenWrt kern.notice kernel: [ 0.000000] Kernel command line: board=AP121 console=ttyATH0,115200 mtdpart=spi0.0:128k(u-boot)ro,64k(u-boot-env)ro,281k
Sep 8 15:44:03 OpenWrt kern.info kernel: [ 0.000000] PID hash table entries: 128 (order: -3, 512 bytes)
Sep 8 15:44:03 OpenWrt kern.info kernel: [ 0.000000] Dentry cache hash table entries: 4096 (order: 2, 16384 bytes)
Sep 8 15:44:03 OpenWrt kern.info kernel: [ 0.000000] Inode-cache hash table entries: 2048 (order: 1, 8192 bytes)
Sep 8 15:44:03 OpenWrt kern.warn kernel: [ 0.000000] Primary instruction cache 64kB, VIPT, 4-way, linesize 32 bytes.
Sep 8 15:44:03 OpenWrt kern.warn kernel: [ 0.000000] Primary data cache 32kB, 4-way, VIPT, cache aliases, linesize 32 bytes
Sep 8 15:44:03 OpenWrt kern.info kernel: [ 0.000000] Writing ErrCtl register=00000000
Sep 8 15:44:03 OpenWrt kern.info kernel: [ 0.000000] Readback ErrCtl register=00000000
Sep 8 15:44:03 OpenWrt kern.info kernel: [ 0.000000] Memory: 29208k/32768k available (2080k kernel code, 3560k reserved, 379k data, 176k init, 0k highmem)
Sep 8 15:44:03 OpenWrt kern.info kernel: [ 0.000000] SLUB: Genslabs=9, HWalign=32, Order=0-3, MinObjects=0, CPUs=1, Nodes=1
Sep 8 15:44:03 OpenWrt kern.info kernel: [ 0.000000] NR_IRQS:51
Sep 8 15:44:03 OpenWrt kern.info kernel: [ 0.000000] Calibrating delay loop... 265.42 BogoMIPS (lpj=1327104)
Sep 8 15:44:03 OpenWrt kern.info kernel: [ 0.080000] pid_max: default: 32768 minimum: 301
Sep 8 15:44:03 OpenWrt kern.info kernel: [ 0.080000] Mount-cache hash table entries: 512
Sep 8 15:44:03 OpenWrt kern.info kernel: [ 0.090000] NET: Registered protocol family 16
Sep 8 15:44:03 OpenWrt kern.info kernel: [ 0.090000] gpiochip_add: registered GPIOs 0 to 29 on device: ath79
Sep 8 15:44:03 OpenWrt kern.info kernel: [ 0.100000] MIPS: machine is Atheros AP121 reference board
Sep 8 15:44:03 OpenWrt kern.info kernel: [ 0.550000] bio: create slab <bio-0> at 0
Sep 8 15:44:03 OpenWrt kern.info kernel: [ 0.560000] Switching to clocksource MIPS
Sep 8 15:44:03 OpenWrt kern.info kernel: [ 0.560000] NET: Registered protocol family 2
Sep 8 15:44:03 OpenWrt kern.info kernel: [ 0.570000] IP route cache hash table entries: 1024 (order: 0, 4096 bytes)
Sep 8 15:44:03 OpenWrt kern.info kernel: [ 0.570000] TCP established hash table entries: 1024 (order: 1, 8192 bytes)
Sep 8 15:44:03 OpenWrt kern.info kernel: [ 0.570000] TCP bind hash table entries: 1024 (order: 0, 4096 bytes)
Sep 8 15:44:03 OpenWrt kern.info kernel: [ 0.580000] TCP: Hash tables configured (established 1024 bind 1024)
Sep 8 15:44:03 OpenWrt kern.info kernel: [ 0.590000] TCP reno registered
Sep 8 15:44:03 OpenWrt kern.info kernel: [ 0.590000] UDP hash table entries: 256 (order: 0, 4096 bytes)

```

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.

```

OpenWrt | OpenWrt Attitude Adjustment 12.09 | Load: 0.00 0.03 0.14
Changes: 0
Status System Network Logout
Overview Firewall Routes System Log Kernel Log Processes Realtime Graphs
Kernel Log
[ 0.000000] Linux version 3.3.8 (vwx@bt) (gcc version 4.6.3 20120201 (prerelease) (Linaro GCC 4.6-2012.02) ) #4 Tue Nov 19 14:55:17 CST 2013
[ 0.000000] bootconsole [early0] enabled
[ 0.000000] CPU revision is: 00019374 (MIPS 24Kc)
[ 0.000000] SoC: Atheros AR9330 rev 1
[ 0.000000] Clocks: CPU:400.000MHz, DDR:400.000MHz, AHB:200.000MHz, Ref:25.000MHz
[ 0.000000] Determined physical RAM map:
[ 0.000000] memory: 02000000 @ 00000000 (usable)
[ 0.000000] Initrd not found or empty - disabling initrd
[ 0.000000] Zone PFN ranges:
[ 0.000000] Normal 0x00000000 -> 0x00002000
[ 0.000000] Movable zone start PFN for each node
[ 0.000000] Early memory PFN ranges
[ 0.000000] 0: 0x00000000 -> 0x00002000
[ 0.000000] On node 0 totalpages: 8192
[ 0.000000] free_area_init_node: node 0, pgdat 802c69f0, node_mem_map 81000000
[ 0.000000] Normal zone: 64 pages used for memmap
[ 0.000000] Normal zone: 0 pages reserved
[ 0.000000] Normal zone: 8128 pages, LIFO batch:0
[ 0.000000] popu-alloc: s0 r0 d32768 u32768 alloc=1*32768
[ 0.000000] popu-alloc: [0] 0
[ 0.000000] Built 1 zonelists in Zone order, mobility grouping on. Total pages: 8128
[ 0.000000] Kernel command line: board=AP121 console=ttyATH0,115200 mtdparts=spi0.0:128k(u-boot)ro,64k(u-boot-env)ro,2816k(rootfs),960k(kernel),64k(nvram),64k(art)ro
[ 0.000000] PID hash table entries: 128 (order: -3, 512 bytes)
[ 0.000000] Dentry cache hash table entries: 4096 (order: 2, 16384 bytes)
[ 0.000000] Inode-cache hash table entries: 2048 (order: 1, 8192 bytes)
[ 0.000000] Primary instruction cache 64kB, VIPT, 4-way, linesize 32 bytes.
[ 0.000000] Primary data cache 32kB, 4-way, VIPT, cache aliases, linesize 32 bytes
[ 0.000000] Writing ErrCtl register=00000000
[ 0.000000] Readback ErrCtl register=00000000
[ 0.000000] Memory: 29208k/32768k available (2080k kernel code, 3560k reserved, 379k data, 176k init, 0k highmem)
[ 0.000000] SLUB: GenSlabs=9, HwAlign=32, Order=0-3, MinObjects=0, CPUs=1, Nodes=1
[ 0.000000] NR_IRQS:51
[ 0.000000] Calibrating delay loop... 265.42 BogoMIPS (lpj=1327104)
[ 0.080000] pid_max: default: 32768 minimum: 301
[ 0.080000] Mount-cache hash table entries: 512
[ 0.090000] NET: Registered protocol family 16
[ 0.090000] gpiochip_add: registered GPIOs 0 to 29 on device: ath79
[ 0.100000] MIPS: machine is Atheros AP121 reference board
[ 0.550000] bio: create slab <bio-0> at 0
[ 0.560000] Switching to clocksource MIPS
[ 0.560000] NET: Registered protocol family 2
[ 0.570000] IP route cache hash table entries: 1024 (order: 0, 4096 bytes)
[ 0.570000] TCP established hash table entries: 1024 (order: 1, 8192 bytes)
[ 0.570000] TCP bind hash table entries: 1024 (order: 0, 4096 bytes)
[ 0.580000] TCP: Hash tables configured (established 1024 bind 1024)
[ 0.590000] TCP reno registered
[ 0.590000] UDP hash table entries: 256 (order: 0, 4096 bytes)
[ 0.600000] UDP-Lite hash table entries: 256 (order: 0, 4096 bytes)
[ 0.600000] NET: Registered protocol family 1

```

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.

OpenWrt | OpenWrt Attitude Adjustment 12.09 | Load: 0.00 0.01 0.12 Changes: 0

Status System Network Logout

Overview Firewall Routes System Log Kernel Log Processes Realtime Graphs

Processes

This list gives an overview over currently running system processes and their status.

PID	Owner	Command	CPU usage (%)	Memory usage (%)	Hang Up	Terminate	Kill
1	root	init	0%	5%	Hang Up	Terminate	Kill
2	root	[kthreadd]	0%	0%	Hang Up	Terminate	Kill
3	root	[ksoftirqd/0]	0%	0%	Hang Up	Terminate	Kill
5	root	[kworker/u:0]	0%	0%	Hang Up	Terminate	Kill
6	root	[khelper]	0%	0%	Hang Up	Terminate	Kill
7	root	[kworker/u:1]	0%	0%	Hang Up	Terminate	Kill
60	root	[sync_supers]	0%	0%	Hang Up	Terminate	Kill
62	root	[bdi-default]	0%	0%	Hang Up	Terminate	Kill
64	root	[kblockd]	0%	0%	Hang Up	Terminate	Kill
93	root	[kswapd0]	0%	0%	Hang Up	Terminate	Kill
142	root	[fsnotify_mark]	0%	0%	Hang Up	Terminate	Kill
153	root	[ath79-spi]	0%	0%	Hang Up	Terminate	Kill
164	root	[mtdblock0]	0%	0%	Hang Up	Terminate	Kill
169	root	[mtdblock1]	0%	0%	Hang Up	Terminate	Kill
174	root	[mtdblock2]	0%	0%	Hang Up	Terminate	Kill
179	root	[mtdblock3]	0%	0%	Hang Up	Terminate	Kill
184	root	[mtdblock4]	0%	0%	Hang Up	Terminate	Kill
189	root	[mtdblock5]	0%	0%	Hang Up	Terminate	Kill
194	root	[mtdblock6]	0%	0%	Hang Up	Terminate	Kill
199	root	[mtdblock7]	0%	0%	Hang Up	Terminate	Kill
242	root	[kworker/0:1]	0%	0%	Hang Up	Terminate	Kill
372	root	[kworker/0:2]	0%	0%	Hang Up	Terminate	Kill
422	root	[jffs2_gc_d_mtd3]	0%	0%	Hang Up	Terminate	Kill
440	root	/bin/ash --login	0%	5%	Hang Up	Terminate	Kill
477	root	[cfg80211]	0%	0%	Hang Up	Terminate	Kill
484	root	[khubd]	0%	0%	Hang Up	Terminate	Kill
551	root	/sbin/syslogd -C16	0%	5%	Hang Up	Terminate	Kill
553	root	/sbin/klogd	0%	5%	Hang Up	Terminate	Kill
555	root	/sbin/hotplug2 --override --persistent --set-rules-file /etc/hotplug2.rules --set-coldplug-cmd /sbin/udevtrigger --max-children 1	0%	3%	Hang Up	Terminate	Kill
561	root	/sbin/ubusd	0%	3%	Hang Up	Terminate	Kill
567	root	/sbin/netifd	0%	5%	Hang Up	Terminate	Kill
646	root	udhcpd -p /var/run/udhcpd-eth1.pid -s /lib/netifd/dhcp.script -f -t 0 -i eth1 -C	0%	5%	Hang Up	Terminate	Kill
653	root	/sbin/watchdog -t 5 /dev/watchdog	0%	5%	Hang Up	Terminate	Kill

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.

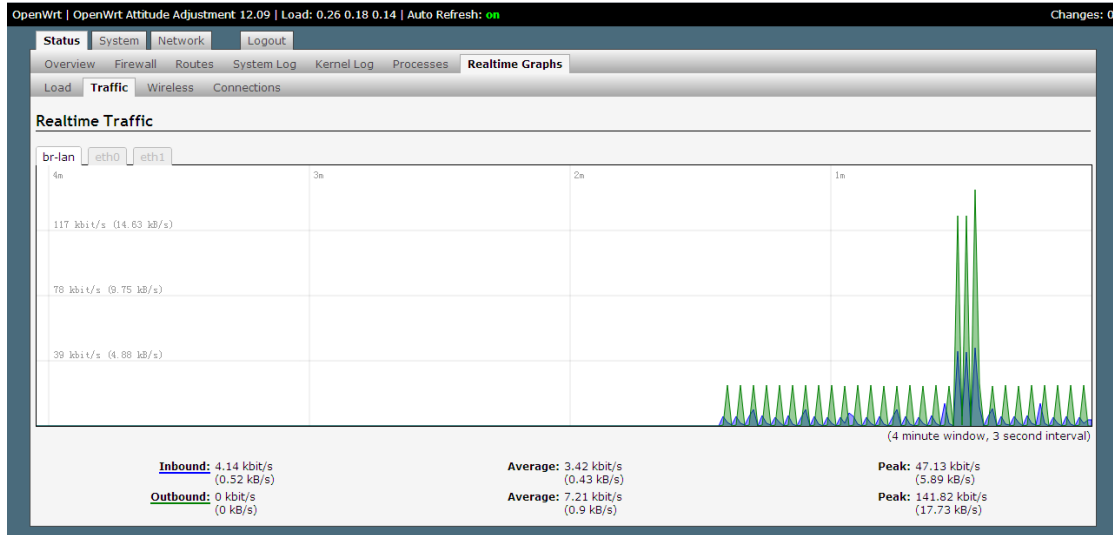


Chart 3.8 Realtime traffic

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.

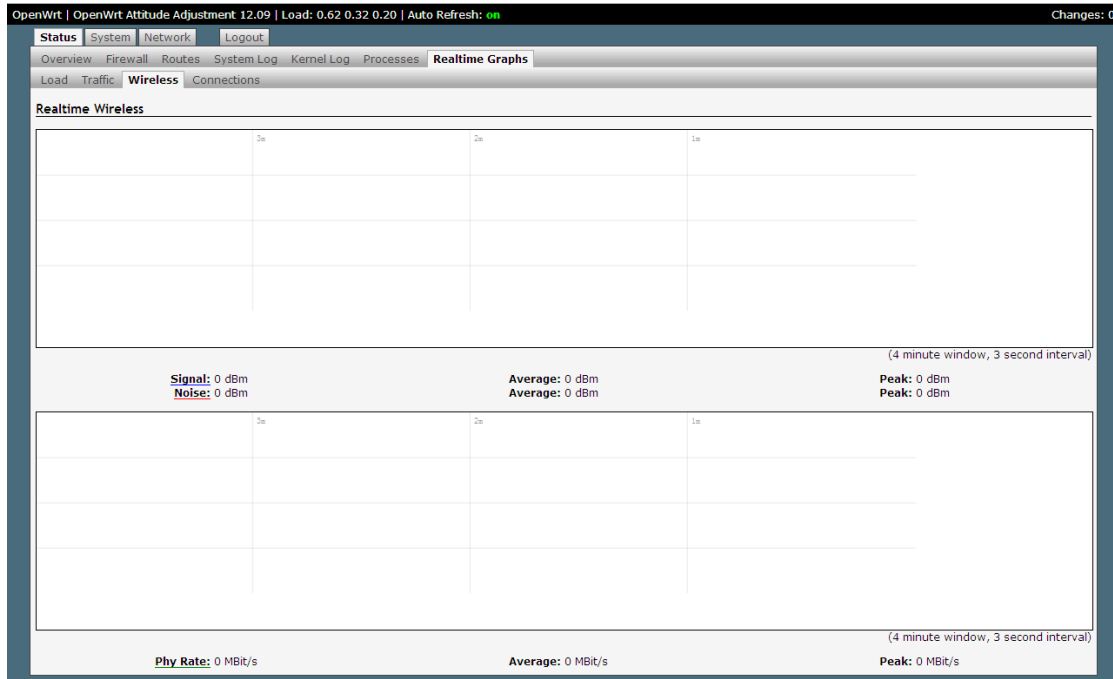


Chart 3.9 Realtime Wireless

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.

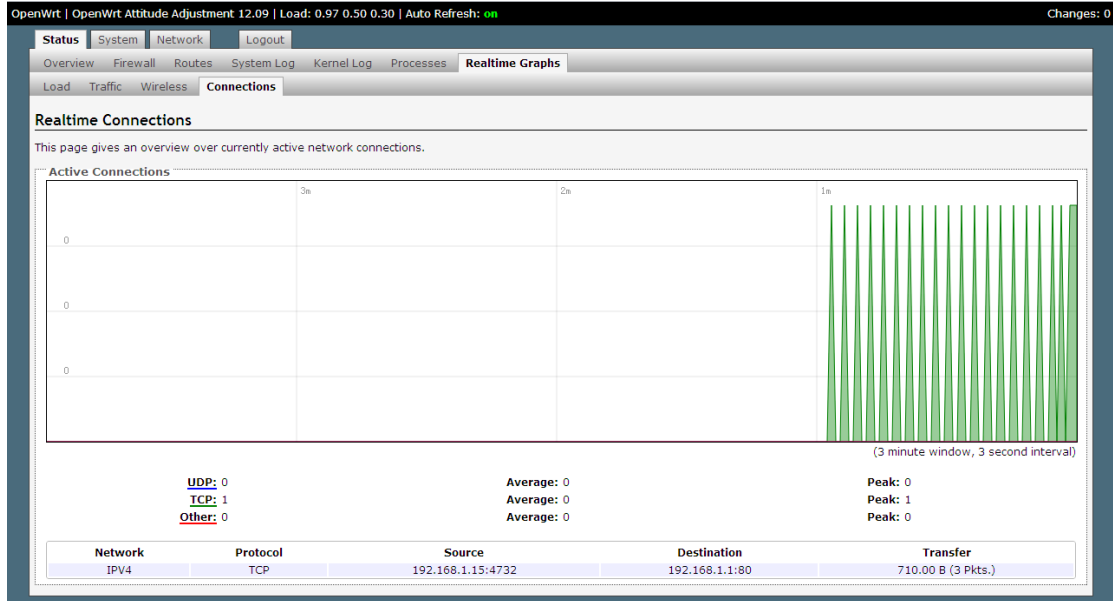


Chart 3.10 Realtime connections

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.

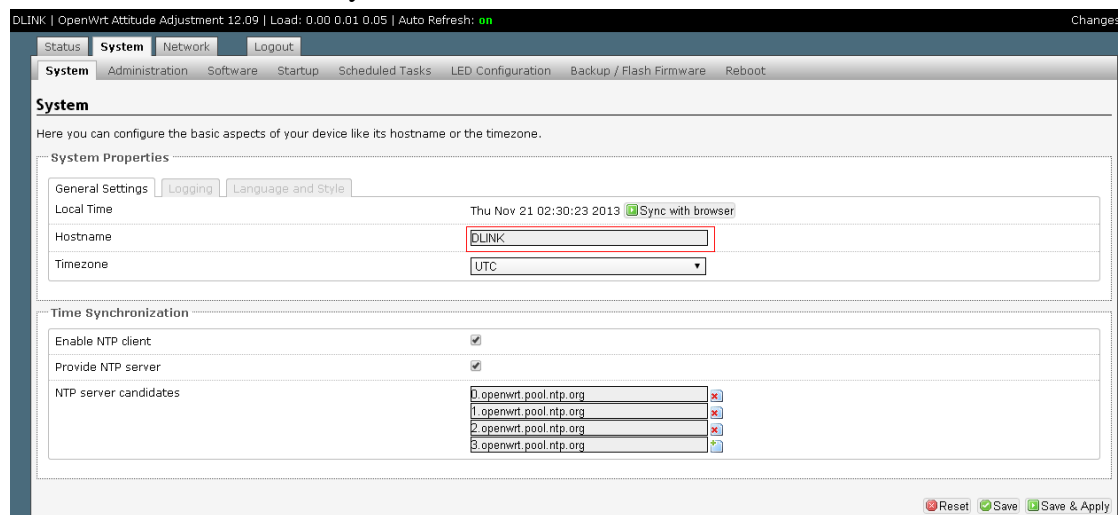


Chart 4.1 Hostname setting(1)

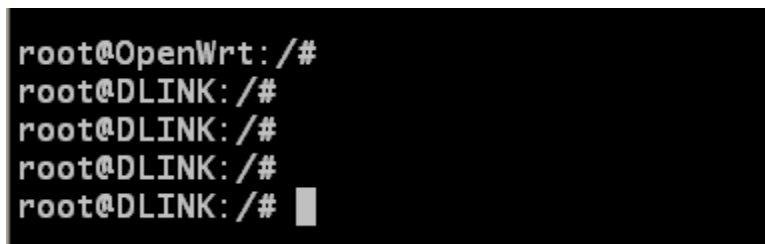


Chart 4.2 Hostname setting(2)

change time zones:

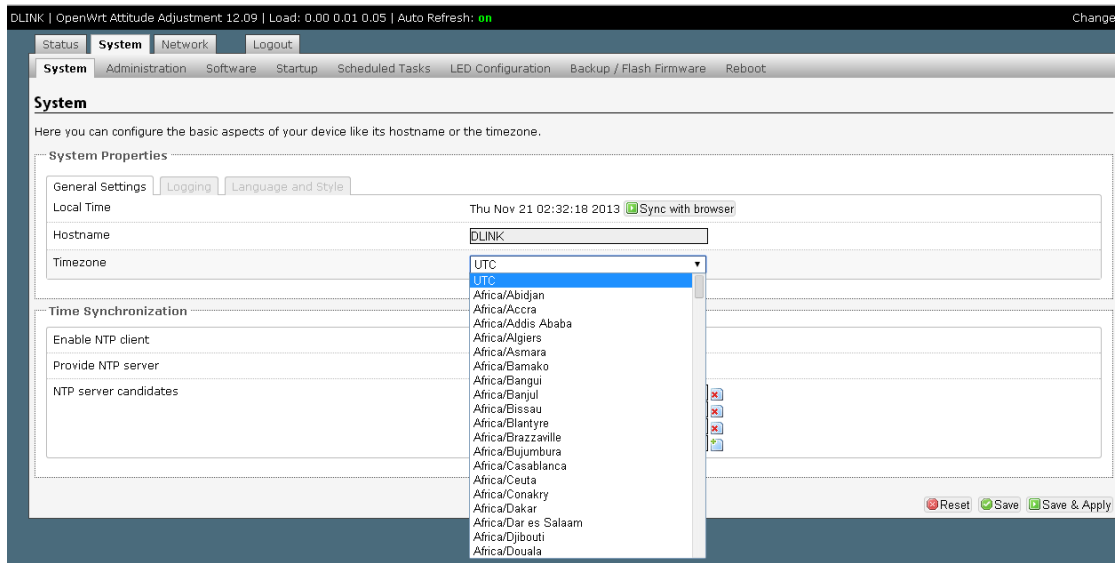


Chart 4.3 Timezone setting

Also, device can sync the time with the browser:

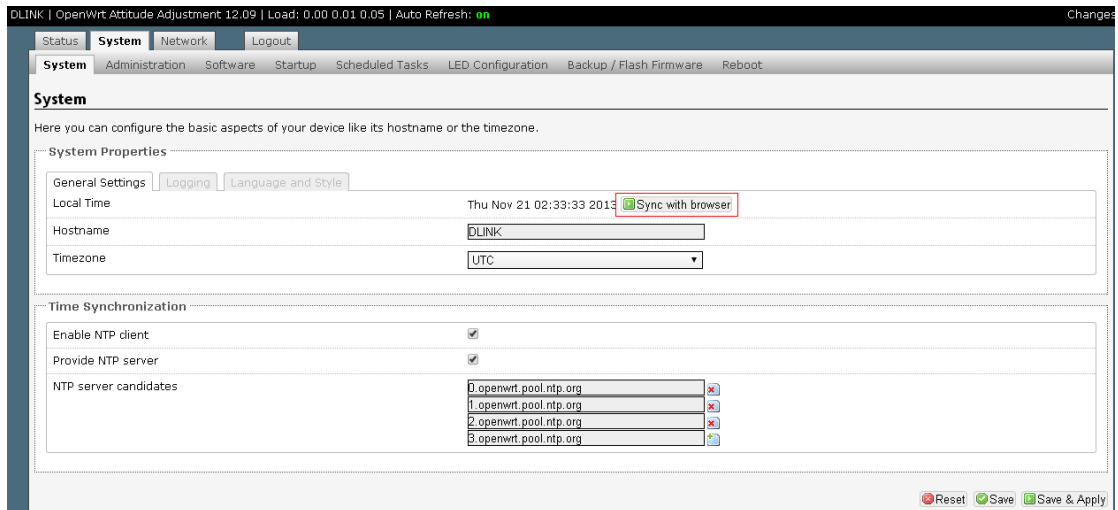


Chart 4.4 Time sync

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

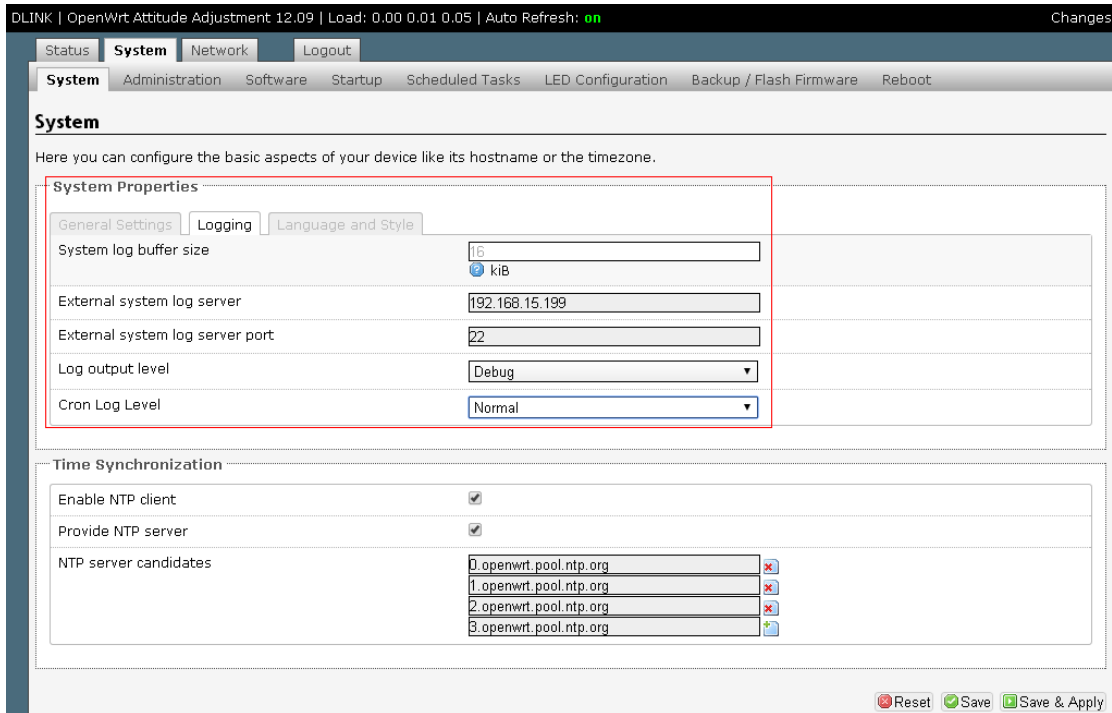


Chart 4.5 Logging setting

Language and style can also be change in this page:

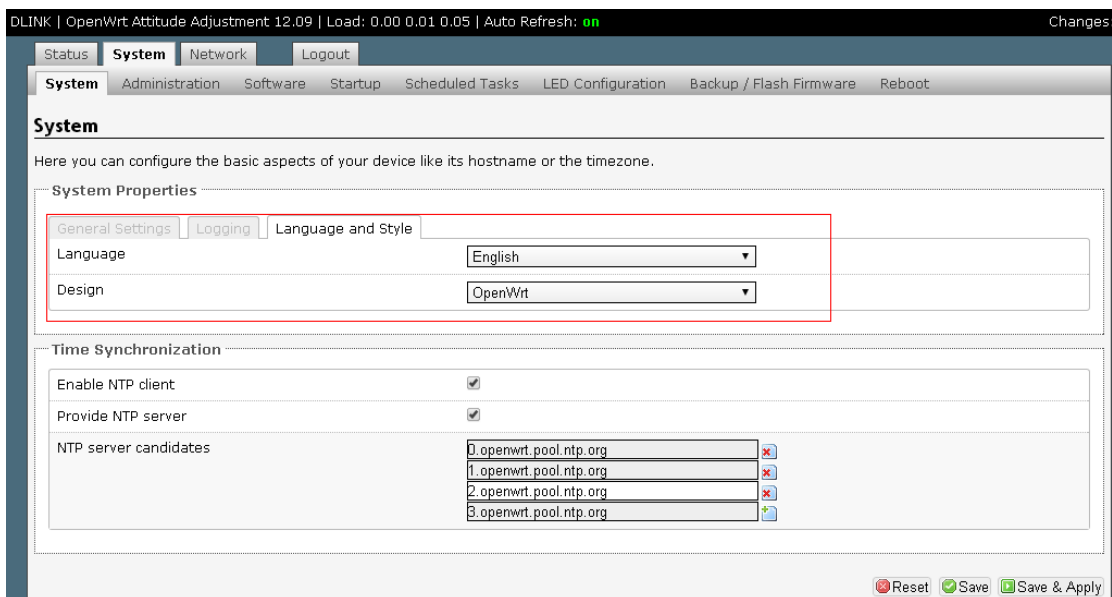


Chart 4.6 Language and style setting

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:

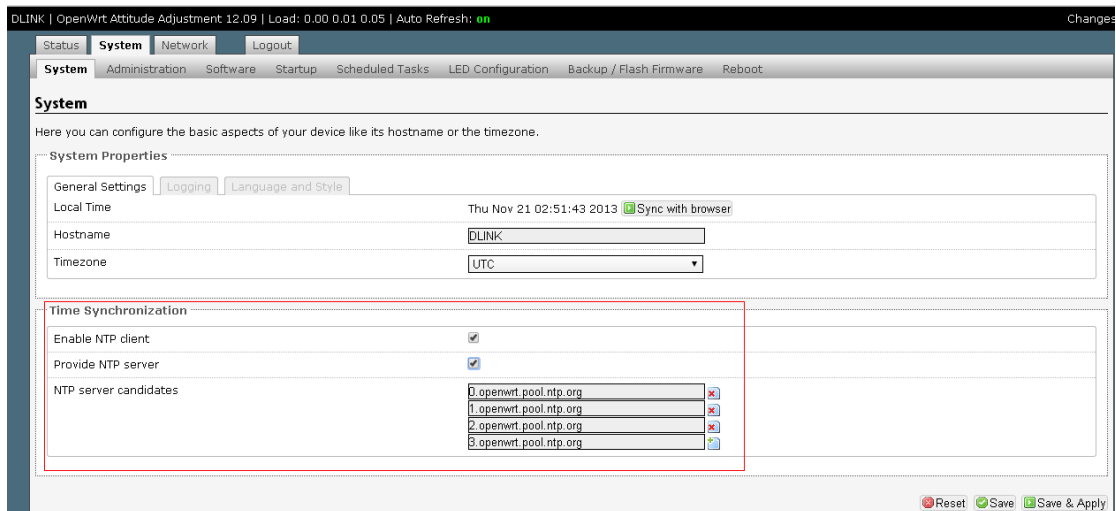


Chart 4.7 NTP setting

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:

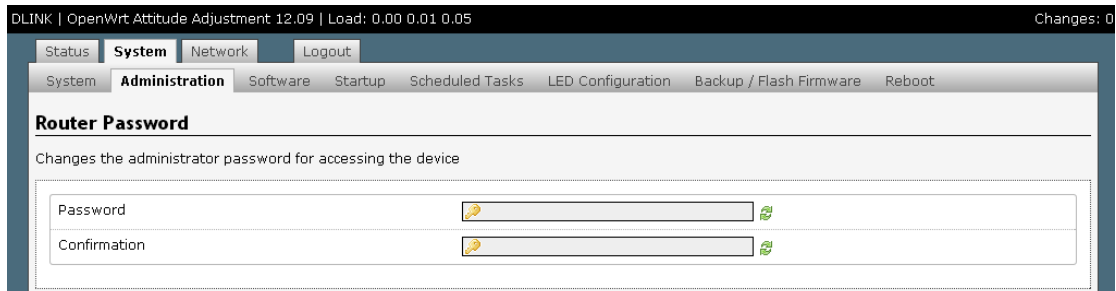


Chart 4.8 Route password setting

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:

SSH Access

Dropbear offers [SSH](#) network shell access and an integrated [SCP](#) server

Dropbear Instance Delete

Interface	<input type="radio"/> lan: <input type="radio"/> wan: <input type="radio"/> wan6: <input checked="" type="radio"/> unspecified
	<input checked="" type="checkbox"/> Listen only on the given interface or, if unspecified, on all
Port	<input type="text" value="22"/> <input checked="" type="checkbox"/> Specifies the listening port of this <i>Dropbear</i> instance
Password authentication	<input checked="" type="checkbox"/> Allow SSH password authentication
Allow root logins with password	<input checked="" type="checkbox"/> Allow the <i>root</i> user to login with password
Gateway ports	<input type="checkbox"/> Allow remote hosts to connect to local SSH forwarded ports

Add

SSH-Keys

Here you can paste public SSH-Keys (one per line) for SSH public-key authentication.

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:

Status

Installed packages Available packages

	Package name	Version
Remove	base-files	117-r36422
Remove	busybox	1.19.4-6
Remove	dnsmasq	2.62-2
Remove	dropbear	2011.54-2
Remove	firewall	2-55.1
Remove	hotplug2	1.0-beta-4
Remove	iptables	1.4.10-4
Remove	iw	3.6-1
Remove	jshn	2013-01-29-0bc317aa4d9af44806c28ca286d79a8b5a92b2b8
Remove	kernel	3.3.8-1-03addacc8f50f9a47e24d13a8f9ef0aa9
Remove	kmod-ath	3.3.8+2012-09-07-3
Remove	kmod-ath9k	3.3.8+2012-09-07-3
Remove	kmod-ath9k-common	3.3.8+2012-09-07-3
Remove	kmod-cfg80211	3.3.8+2012-09-07-3
Remove	kmod-crypto-aes	3.3.8-1
Remove	kmod-crypto-arc4	3.3.8-1
Remove	kmod-crypto-core	3.3.8-1
Remove	kmod-gpio-button-hotplug	3.3.8-1
Remove	kmod-ipt-contrack	3.3.8-1
Remove	kmod-ipt-core	3.3.8-1
Remove	kmod-ipt-nat	3.3.8-1
Remove	kmod-ipt-nathelper	3.3.8-1
Remove	kmod-leds-gpio	3.3.8-1
Remove	kmod-ledtrig-default-on	3.3.8-1
Remove	kmod-ledtrig-netdev	3.3.8-1
Remove	kmod-ledtrig-timer	3.3.8-1
Remove	kmod-ledtrig-usbdev	3.3.8-1
Remove	kmod-lib-crc-catt	3.3.8-1
Remove	kmod-mac80211	3.3.8+2012-09-07-3

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 inaccessible!

DLINK | OpenWrt Attitude Adjustment 12.09 | Load: 0.00 0.01 0.05 Changes: 0

Status System Network Logout

System Administration Software Startup Scheduled Tasks LED Configuration Backup / Flash Firmware Reboot

Initscripts

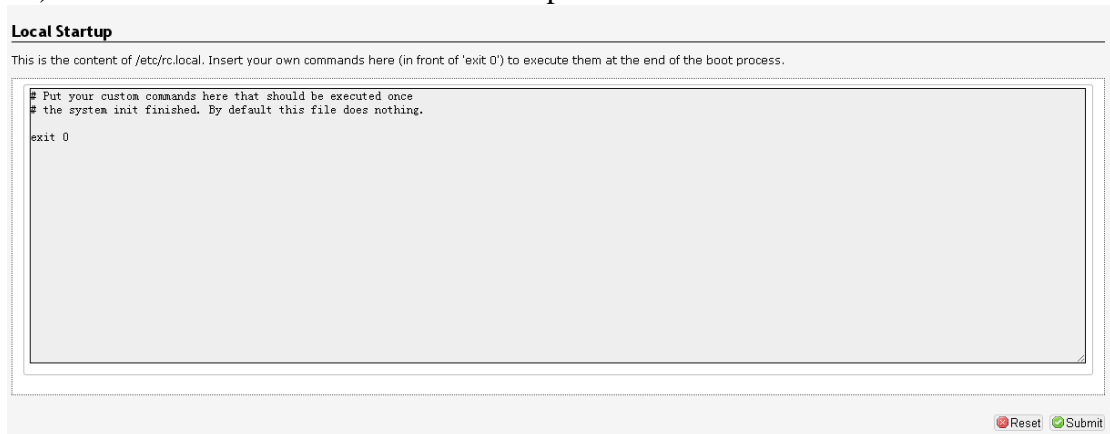
You can enable or disable installed init scripts here. Changes will applied after a device reboot.
Warning: If you disable essential init scripts like "network", your device might become inaccessible!

Start priority	Initscript	Enable/Disable	Start	Restart	Stop
5	defconfig	Enabled	Start	Restart	Stop
5	luci_fixtime	Enabled	Start	Restart	Stop
10	boot	Enabled	Start	Restart	Stop
11	ubus	Enabled	Start	Restart	Stop
20	network	Enabled	Start	Restart	Stop
39	usb	Enabled	Start	Restart	Stop
45	firewall	Enabled	Start	Restart	Stop
50	cron	Enabled	Start	Restart	Stop
50	dropbear	Enabled	Start	Restart	Stop
50	mjpg-streamer	Enabled	Start	Restart	Stop
50	telnet	Enabled	Start	Restart	Stop
50	uhttpd	Enabled	Start	Restart	Stop
59	luci_dhcp_migrate	Enabled	Start	Restart	Stop
60	dnsmasq	Enabled	Start	Restart	Stop
95	done	Enabled	Start	Restart	Stop
96	led	Enabled	Start	Restart	Stop
97	watchdog	Enabled	Start	Restart	Stop
98	sysnptd	Enabled	Start	Restart	Stop
99	sysctl	Enabled	Start	Restart	Stop

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.



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.

```
# Put your custom commands here that should be executed once
# the system init finished. By default this file does nothing.

exit 0
```

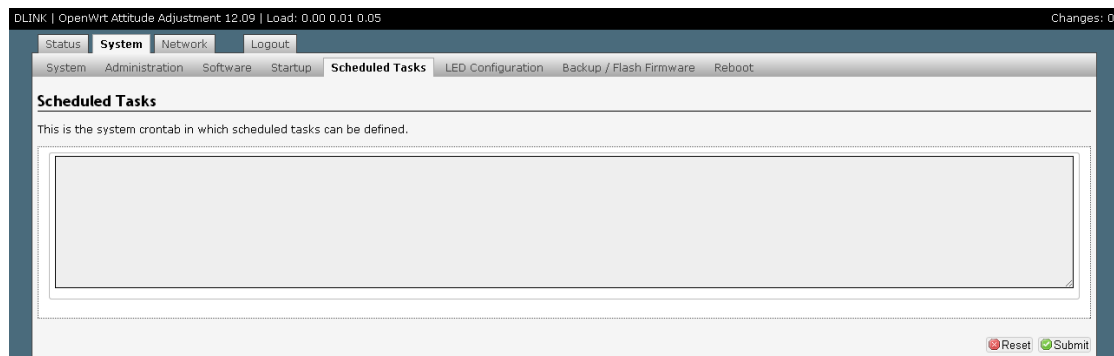
Reset Submit

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.



DLINK | OpenWrt Attitude Adjustment 12.09 | Load: 0.00 0.01 0.05 Changes: 0

Status System Network Logout

System Administration Software Startup Scheduled Tasks LED Configuration Backup / Flash Firmware Reboot

Scheduled Tasks

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

Reset Submit

Chart 4.12 Scheduled task setting

4.6 LED Configuration

4.6.1 LED Configuration

Customizes the behavior of the device LEDs if possible.

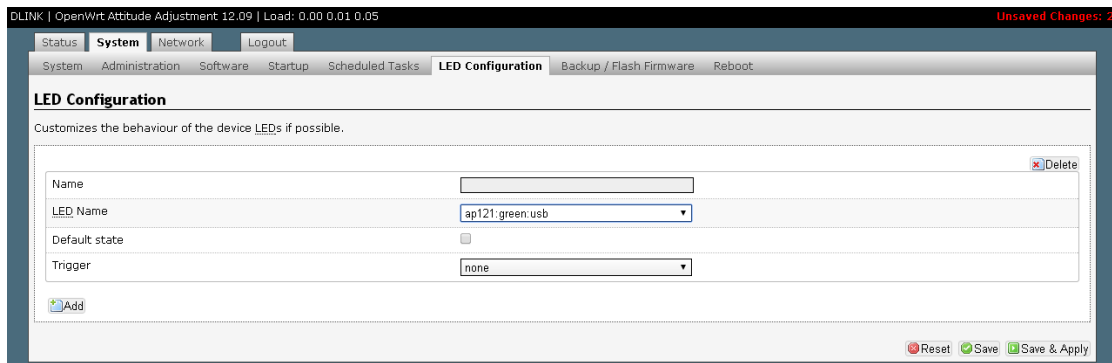


Chart 4.13 LED configuration

4.7 Backup /Flash Firmware

4.7.1 Backup / Restore

You can make a backup configure file by press “Generate 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:

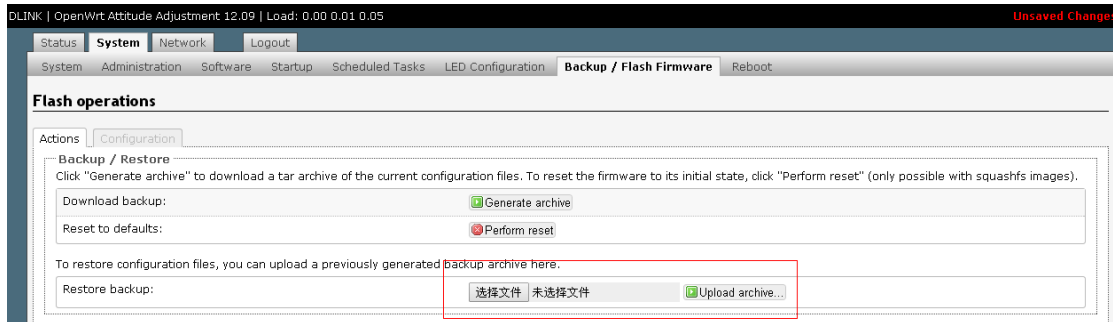


Chart 4.16 Configuration restore

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!

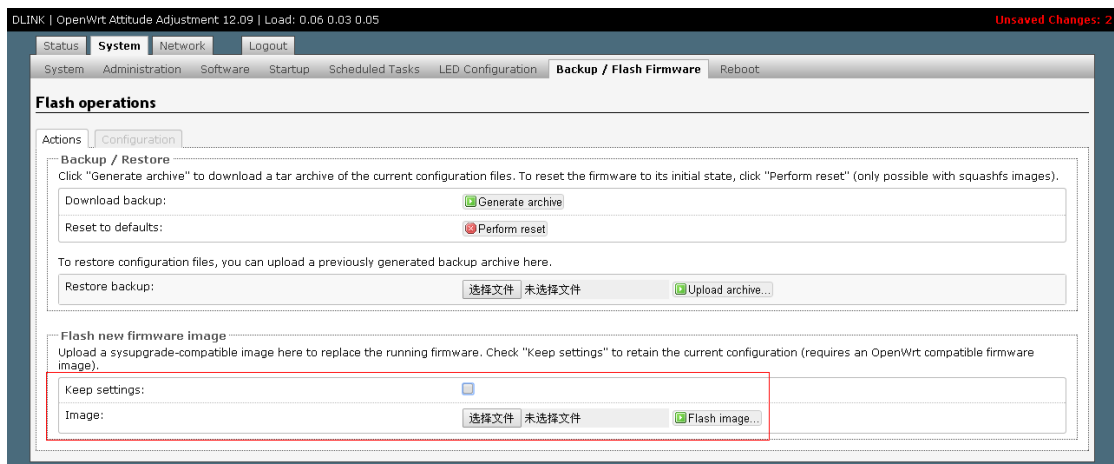


Chart 4.17 Firmware upgrade

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 thought 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.

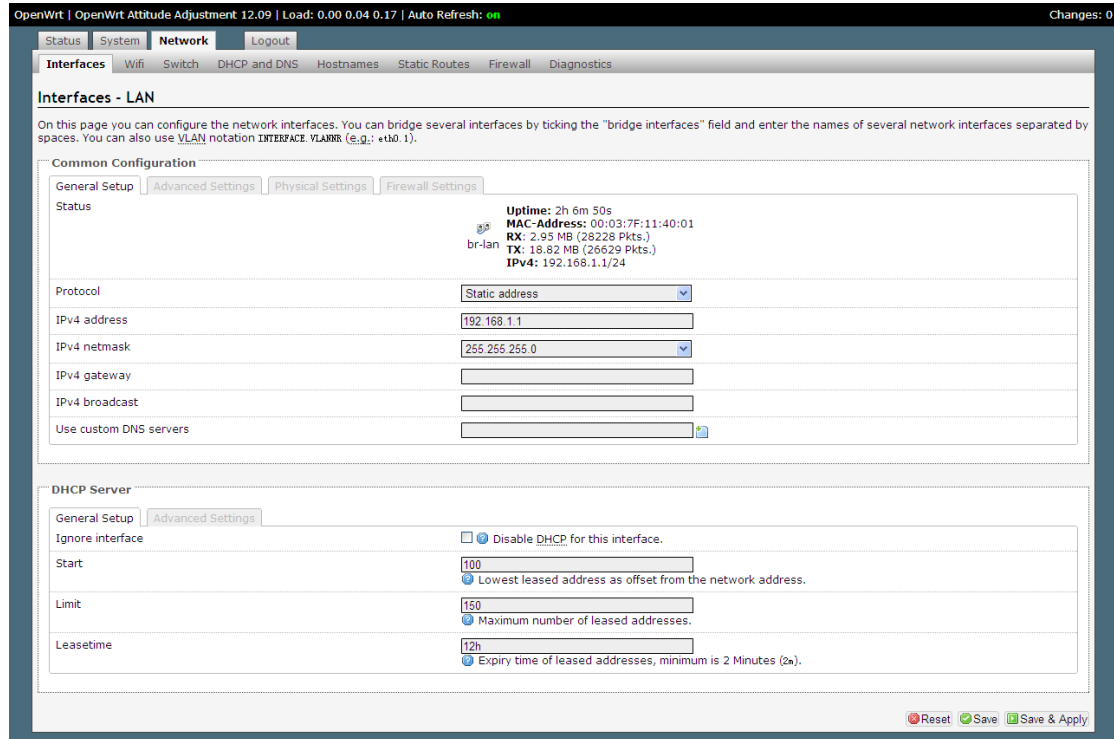


Chart 5.2 LAN Interface Configuration (general setup)

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.

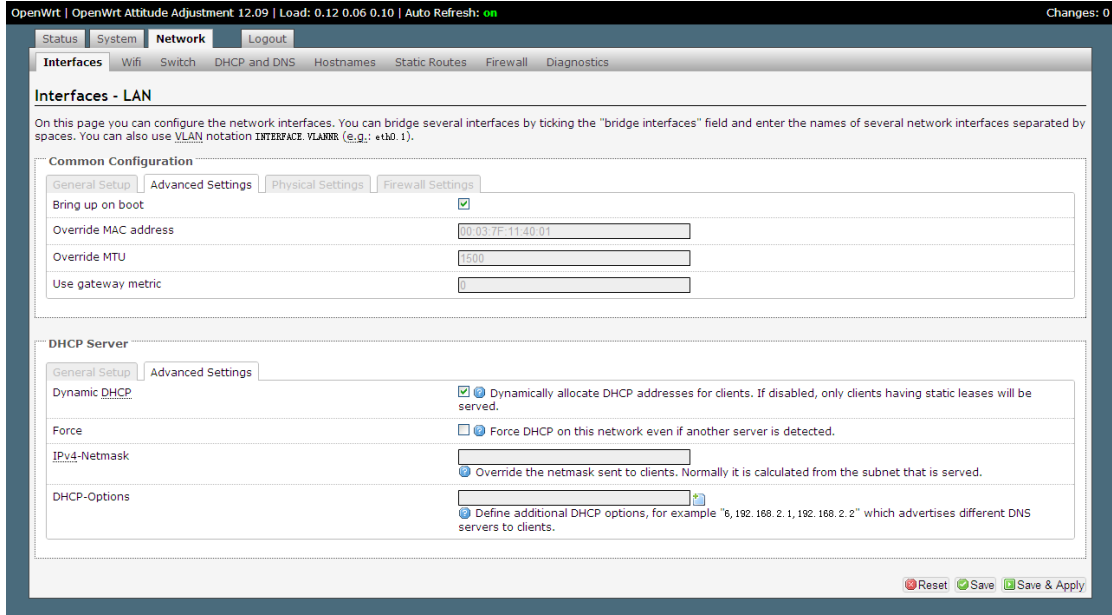


Chart 5.3 LAN Interface Configuration (advanced settings)

5.2.3 Physical Settings

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

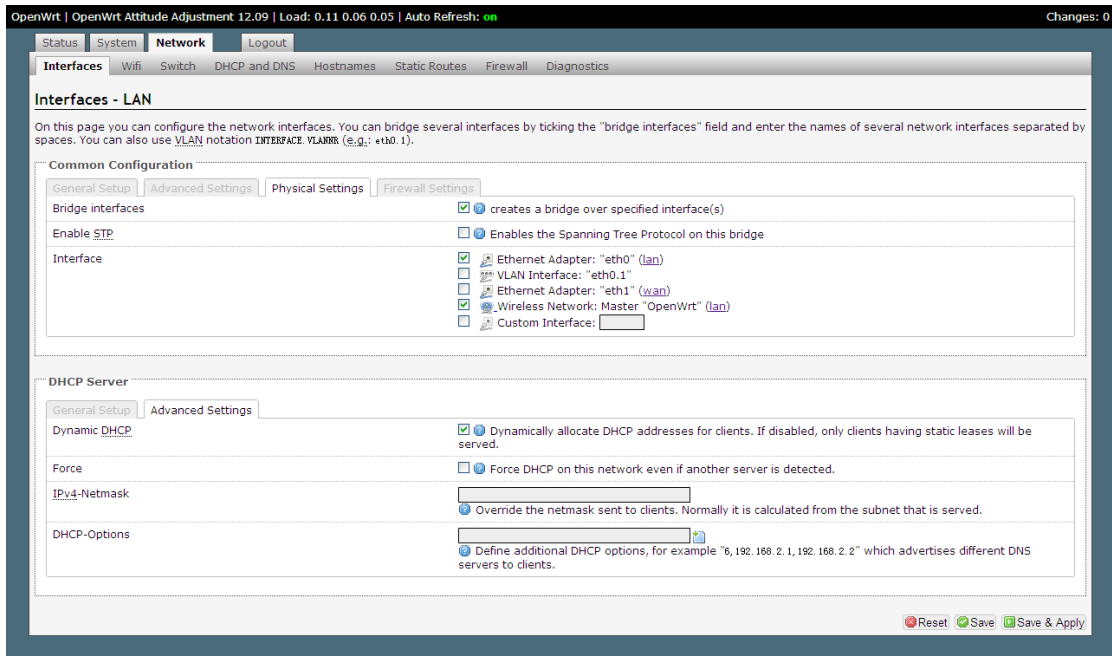


Chart 5.4 LAN Interface Configuration (physical settings)

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.

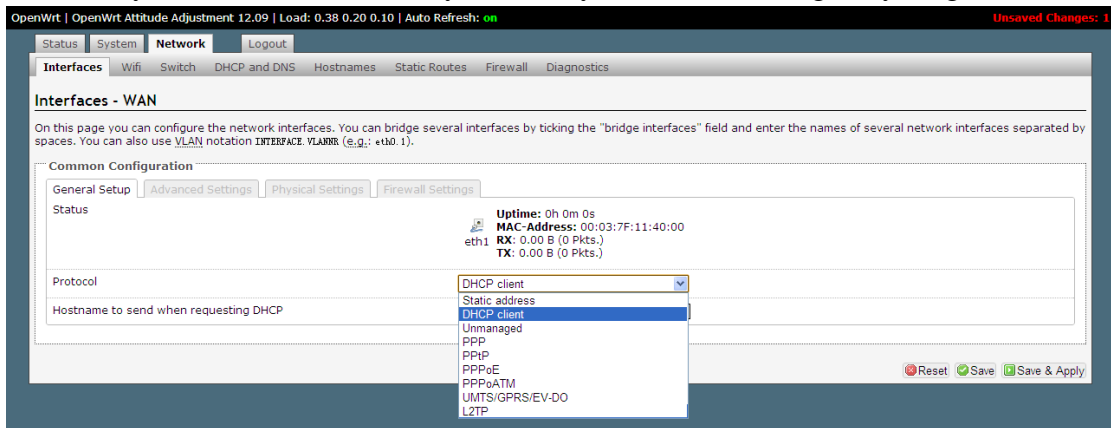


Chart 5.5 WAN Interface Configuration(DHCP general setup)

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.

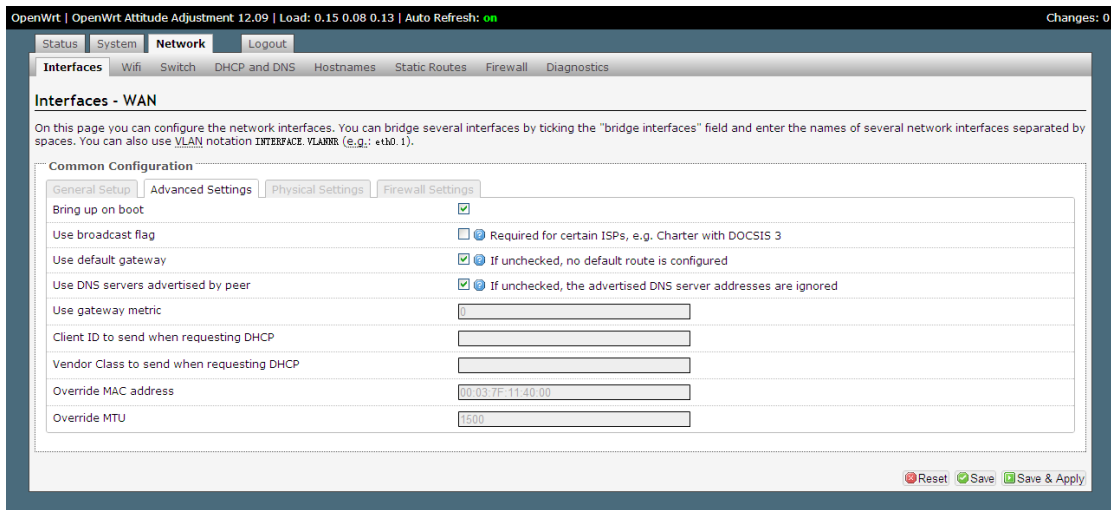


Chart 5.5 WAN Interface Configuration(DHCP advanced settings)

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.

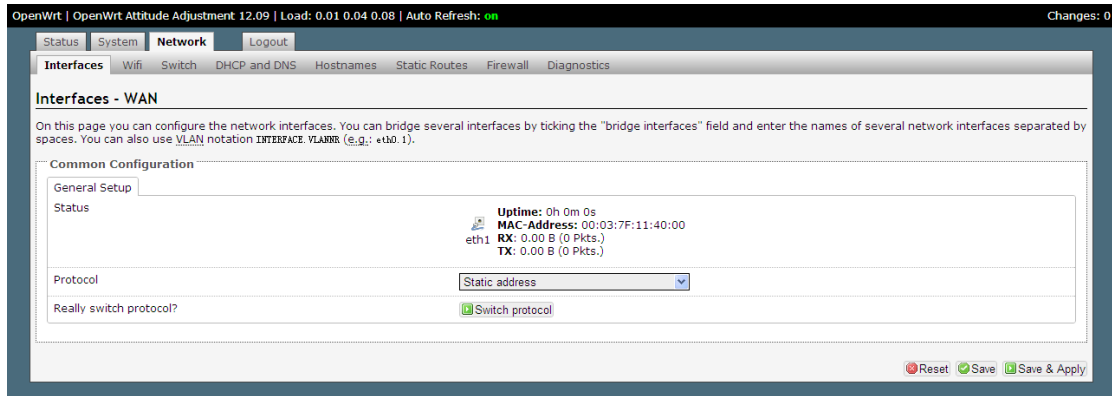


Chart 5.6 WAN Interface Configuration(change to static address)

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.

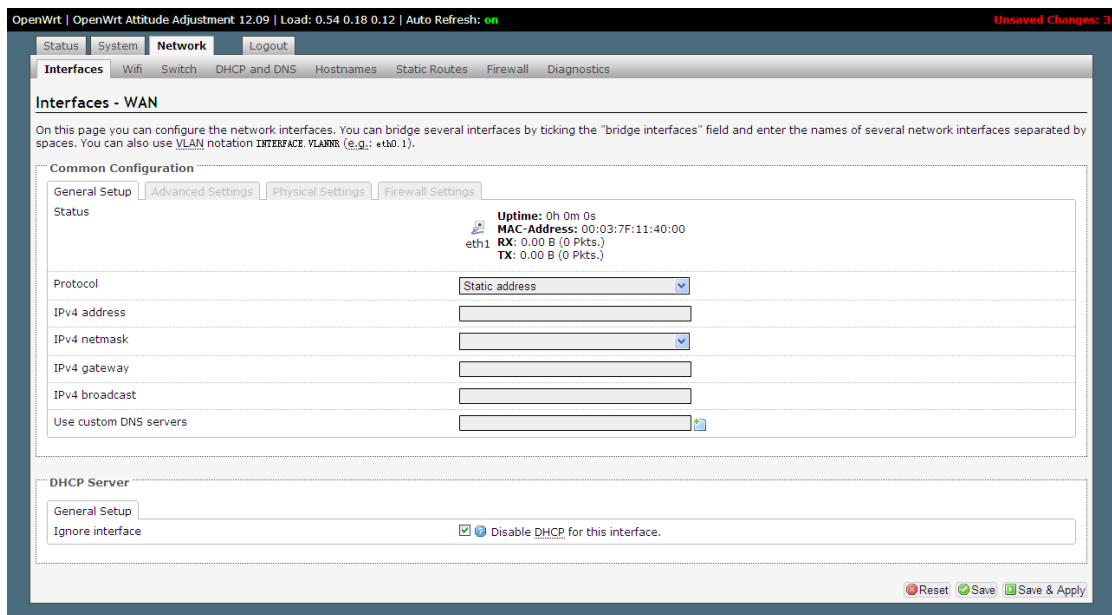


Chart 5.7 WAN Interface Configuration(static address general setup)

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.

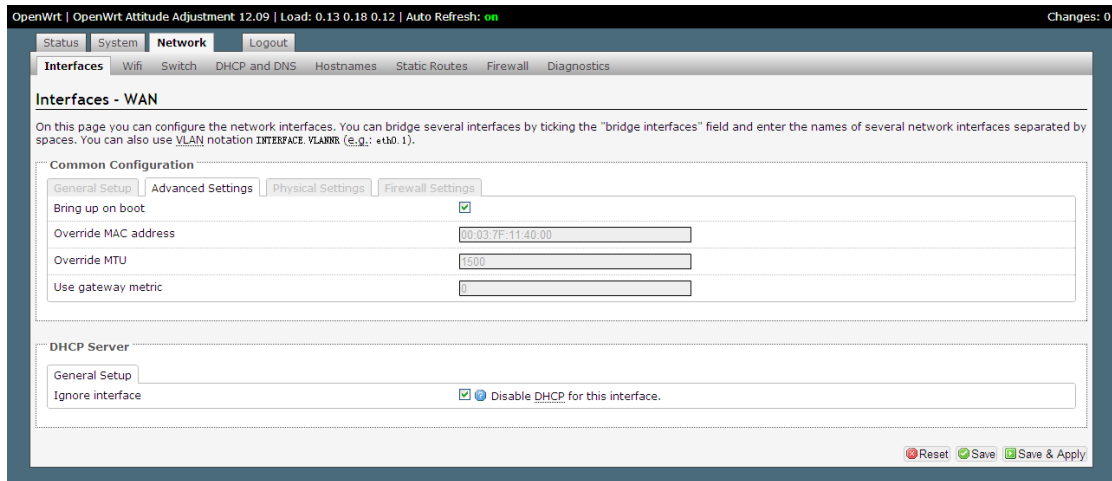


Chart 5.8 WAN Interface Configuration(static address advanced settings)

5.3.3 PPPoE

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

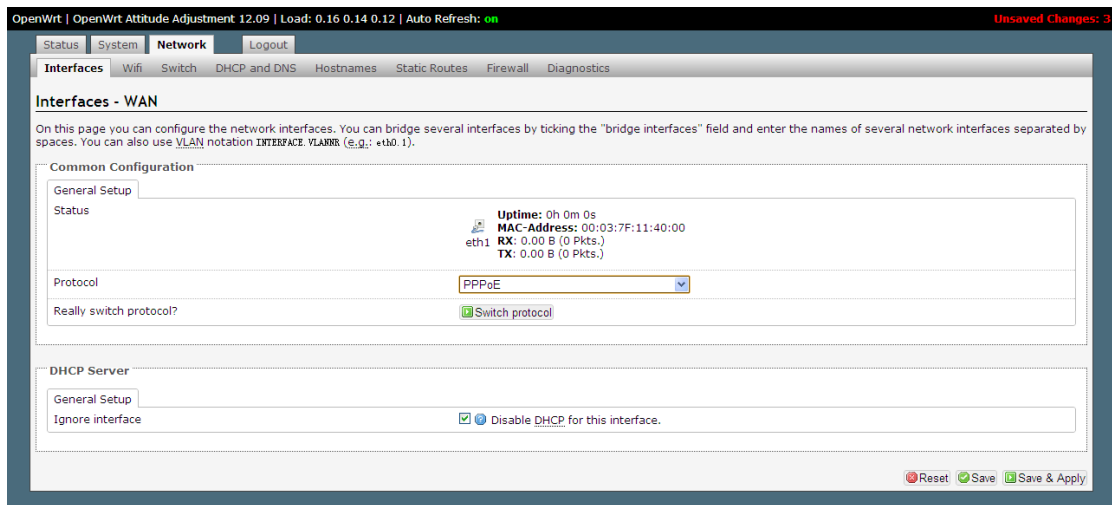


Chart 5.9 WAN Interface Configuration(change to PPPoE)

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

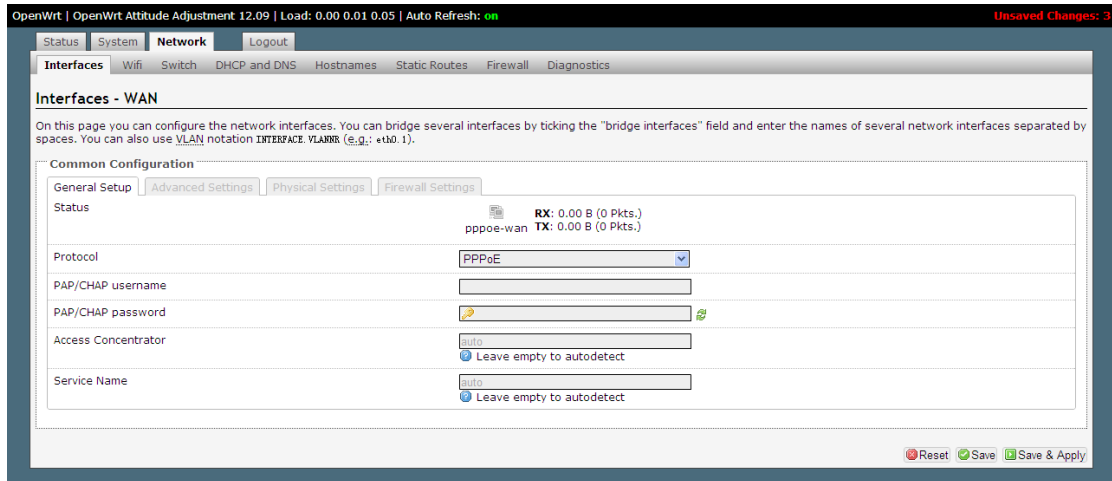


Chart 5.10 WAN Interface Configuration(PPPoE general setup)

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.

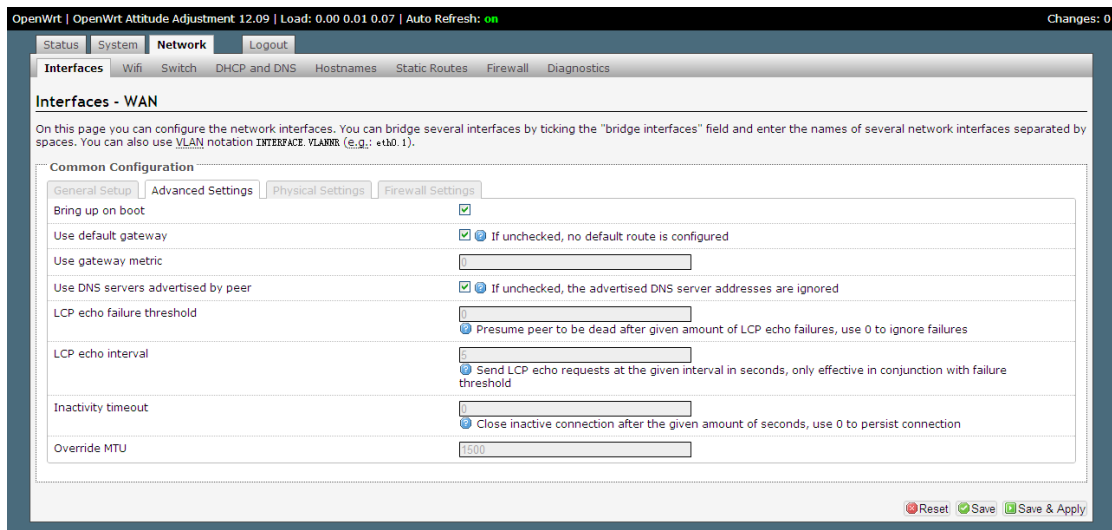


Chart 5.11 WAN Interface Configuration(PPPoE advanced settings)

5.4 WiFi Configuration

5.4.1 Wireless Overview

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

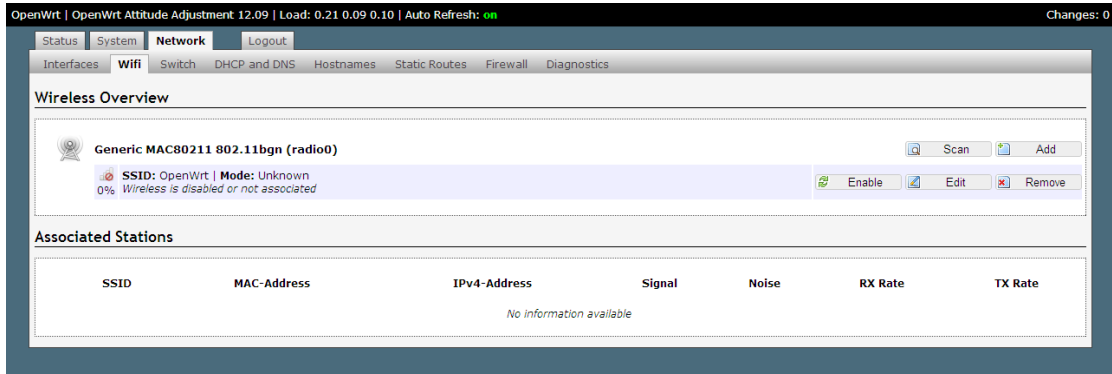


Chart 5.13 WiFi configuration (overview)

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.

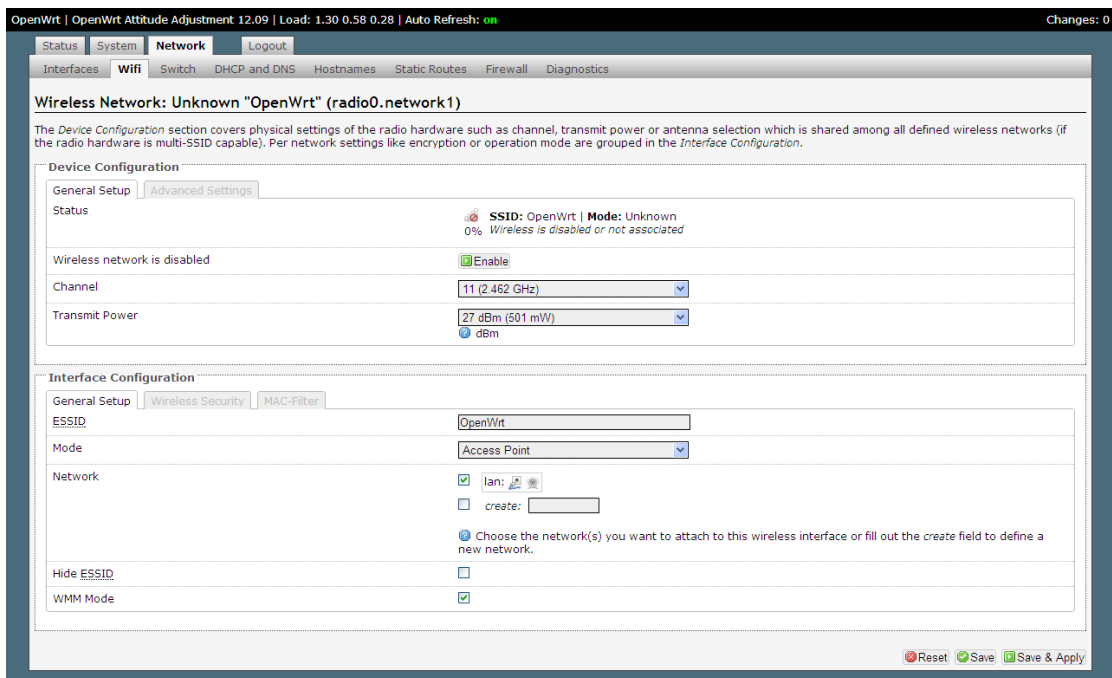


Chart 5.14 WiFi configuration (general setup)

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.

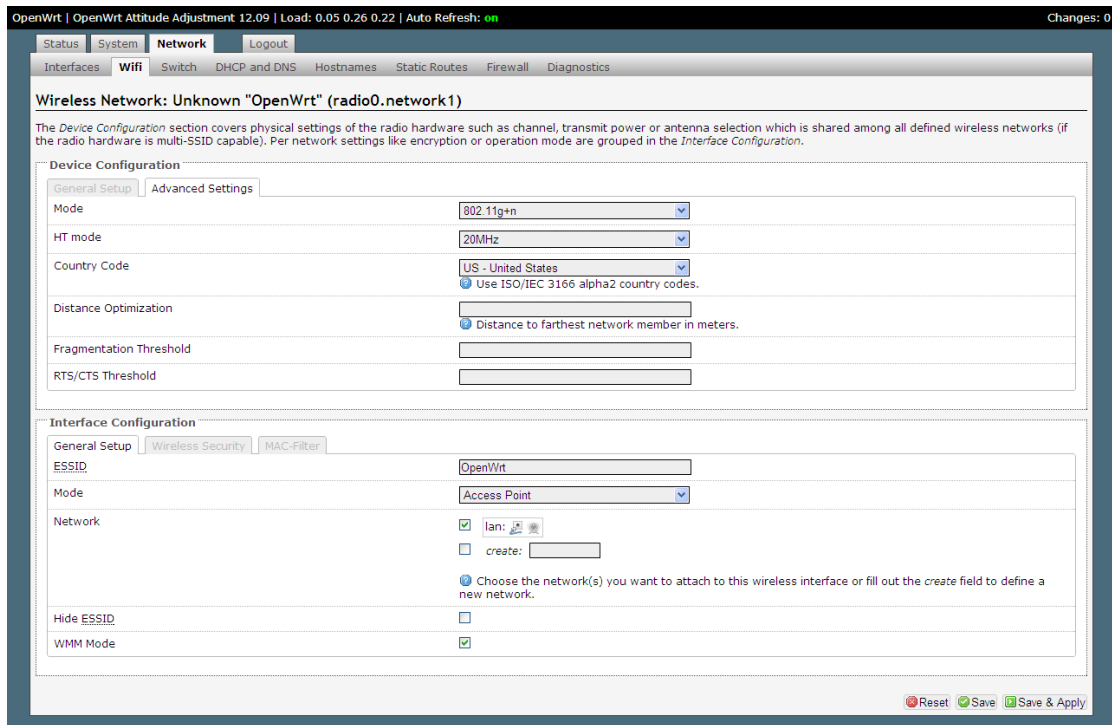


Chart 5.15 WiFi configuration (advanced settings)

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.

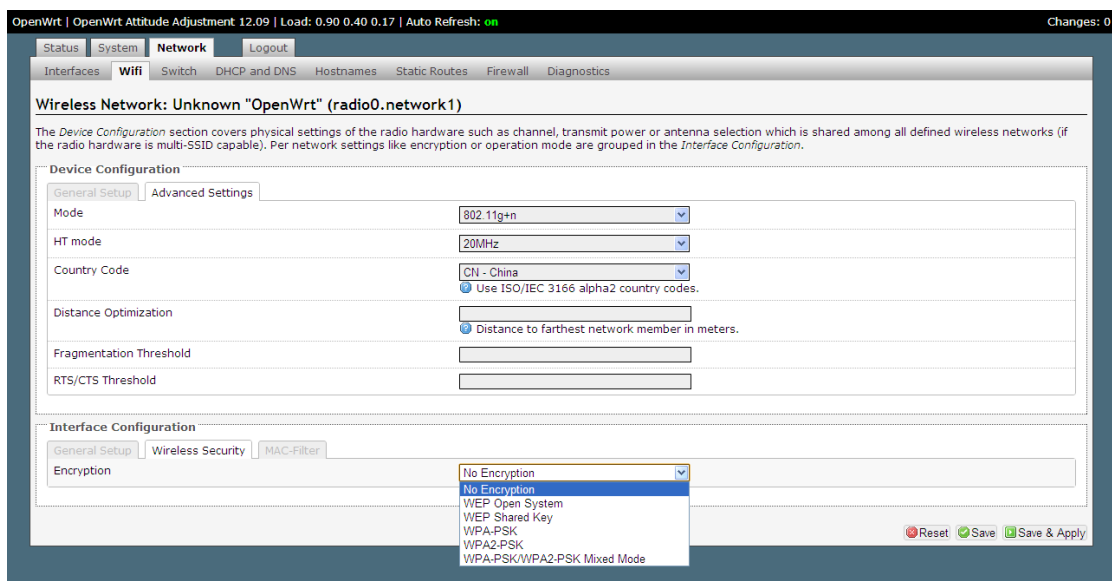


Chart 5.16 WiFi configuration (encryption)

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.

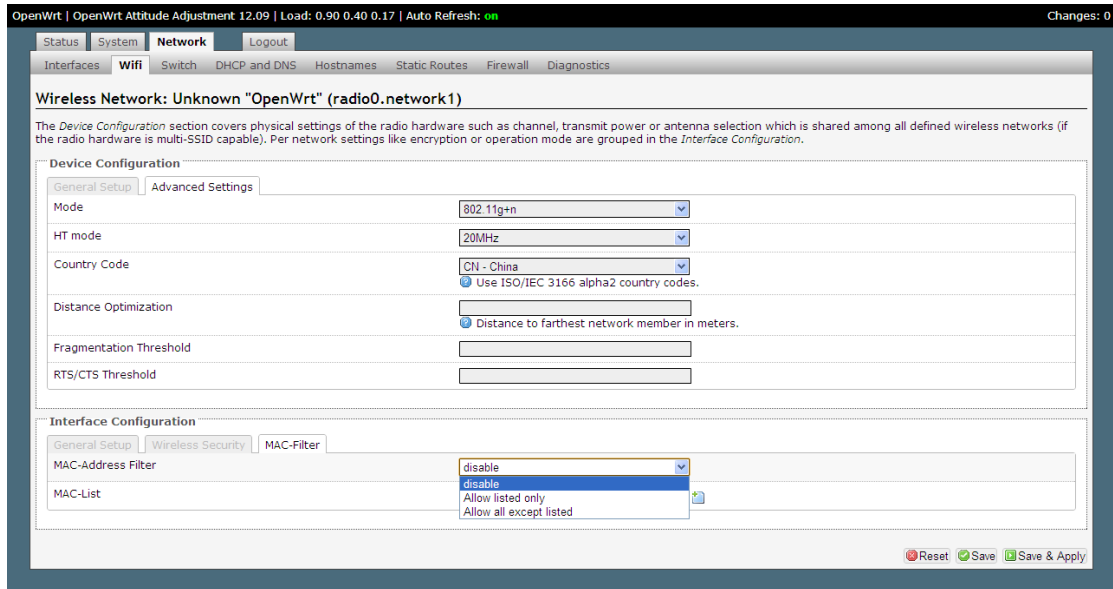


Chart 5.16 WiFi configuration (MAC filter)

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
0x00050000-0x002ffff : "rootfs"	2752k	0x2b0000
0x00300000-0x003dffff : "kernel"	896k	0xe0000
0x003e0000-0x003effff : "nvram"	64k	0x10000
0x003f0000-0x003ffff : "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
0x003f0000-0x003ffff : "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,RKUIImage))
```

to

```
$(eval $(call SingleProfile,AthLzma,64k,AP121_4M,ap121-4M,AP121,TTYATH0,115200,$(ap121_mtdlayout_4M),983040,2883584,RKUIImage))
```

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.

	0	1	2	3	4	5	6	7	8	9	a	b	c	d	e	f
00000000h:	00	13	7F	11	40	00	00	13	7F	11	40	01	FF	FF	FF	FF
00000010h:	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF
00000020h:	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF
00000030h:	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF
00000040h:	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF
00000050h:	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF
00000060h:	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF
00000070h:	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF
00000080h:	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF
00000090h:	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF
000000a0h:	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF
000000b0h:	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF

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

00001000h:	02	02	00	13	7F	BE	00	55	00	00	00	00	00	00	00	00
00001010h:	00	00	00	00	00	00	00	00	00	00	00	00	00	00	1F	00
00001020h:	11	02	00	00	00	04	00	10	00	7D	00	03	00	08	FF	
00001030h:	11	00	00	00	10	01	00	00	22	22	02	00	50	01	50	
00001040h:	01	50	01	00	00	00	00	00	28	00	A4	00	00	00	00	
00001050h:	FF	00	00	00	00	00	00	00	00	00	00	00	00	00	00	
00001060h:	0E	0E	03	00	2C	E2	00	02	0E	1C	E0	00	00	08	E0	
00001070h:	00	08	00	00	00	00	00	00	00	00	00	00	09	00	00	
00001080h:	00	00	00	00	00	00	00	00	00	70	89	AC	EB	00	87	
00001090h:	89	CE	00	EC	00	8B	89	CE	00	EB	00	8B	8A	CE	00	
000010a0h:	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	

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