

OM5P-AN Quick AP Setup using OpenWRT

****If you are a FIRST Robotics Team visit AndyMark.com/FRCRadioSetup for configuration instructions.****

The OM5P-AN does not come with any firmware installed. In order to use the radio as an access point we need to flash the device with OpenWRT then do some simple setup steps. This install guide uses Windows OS for installation.

If you are using a variation of Linux, please see the OpenWRT install guide:

<http://wiki.openwrt.org/doc/howto/generic.flashing>

The default configuration for OpenWRT is to have 1 WAN port and 1 LAN port with both 2.4GHz and 5GHz WiFi disabled and the IP scheme does not match the FRC format, if you are not an FRC team you can skip changing the radio's IP address .

For general purposes, both ports on the same network allow use of 1 for the roboRIO, and the second for an IP camera, or connect tethered to your laptop. We will also configure both 2.4GHz and 5GHz WiFi bands to have broadcast the same SSID expected by the FRC format, if you are not an FRC team you can set the SSIDs to whatever you choose.

Overview:

1. Downloads
2. Installing OpenWRT firmware
3. Connecting to radio to edit settings
4. Changing default settings to connect ports on same network
5. Turn on WiFi
6. Change radio's IP address

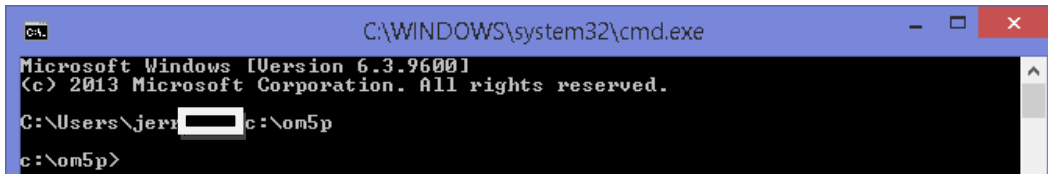
1. Downloads:

For install through Windows three downloads are required to program the radio:

1. WinPcap (<http://www.winpcap.org/install/default.htm>)
 - a. This allows network access to the radio through Ethernet, once installed continue to next download.
2. openwrt-15.05-ar71xx-generic-om5p-squashfs-factory.bin
(https://downloads.openwrt.org/chaos_calmer/15.05/ar71xx/generic/openwrt-15.05-ar71xx-generic-om5p-squashfs-factory.bin)
 - a. This is the latest firmware of OpenWRT as of 09/14/2015, save this to a location that is easy to use in a command prompt window, ie C:\om5p
3. ap51-flash.exe (<http://files.andymark.com/ap51-flash.exe>)
 - a. This is the flashing tool for the firmware (Thanks goes to Kevin O. at *FIRST* for compiling this version that works with the OM5P-AN), this can be saved to the same location as the firmware.

2. Install of OpenWRT Firmware:

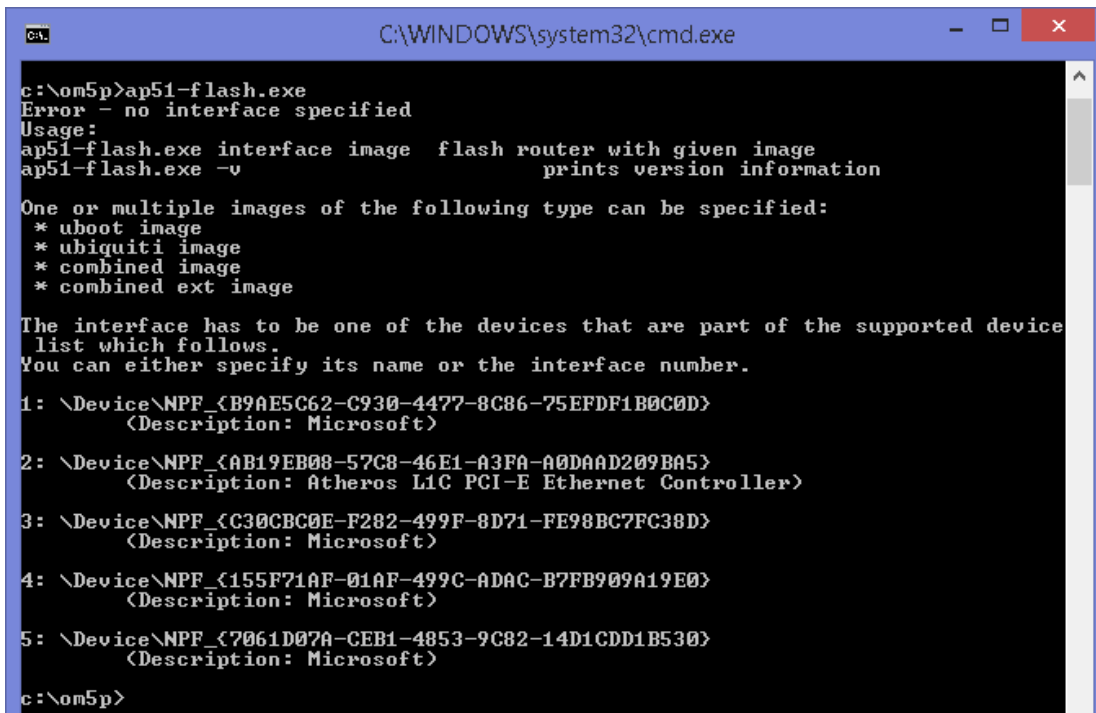
1. Once you have downloaded the three files and installed WinPcap open a command prompt window. This can be done by clicking on the start menu, then 'Run' and typing in 'cmd' and pressing 'OK' as well as many other methods. Once opened navigate to the folder you downloaded the firmware and flash tool to.
 - a. A simple command as "cd c:\om5p" would work if downloaded to this location.



```
C:\WINDOWS\system32\cmd.exe
Microsoft Windows [Version 6.3.9600]
(c) 2013 Microsoft Corporation. All rights reserved.

C:\Users\jerry>cd c:\om5p
c:\om5p>
```

2. Once in this correct location you can type the following command:
 - a. ap51-flash.exe
 - b. It should result in something similar



```
C:\WINDOWS\system32\cmd.exe
c:\om5p>ap51-flash.exe
Error - no interface specified
Usage:
ap51-flash.exe interface image flash router with given image
ap51-flash.exe -v prints version information

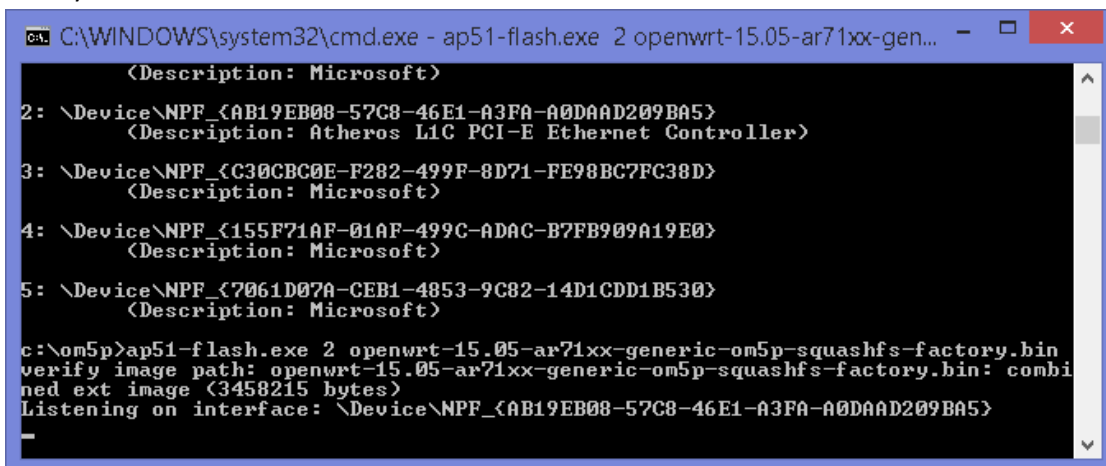
One or multiple images of the following type can be specified:
* uboot image
* ubiquiti image
* combined image
* combined ext image

The interface has to be one of the devices that are part of the supported device
list which follows.
You can either specify its name or the interface number.

1: \Device\NPF_{B9AE5C62-C930-4477-8C86-75EFD1B0C0D}
   (Description: Microsoft)
2: \Device\NPF_{AB19EB08-57C8-46E1-A3FA-A0DAAD209BA5}
   (Description: Atheros L1C PCI-E Ethernet Controller)
3: \Device\NPF_{C30CBC0E-F282-499F-8D71-FE98BC7FC38D}
   (Description: Microsoft)
4: \Device\NPF_{155F71AF-01AF-499C-ADAC-B7FB909A19E0}
   (Description: Microsoft)
5: \Device\NPF_{7061D07A-CEB1-4853-9C82-14D1CDD1B530}
   (Description: Microsoft)

c:\om5p>
```

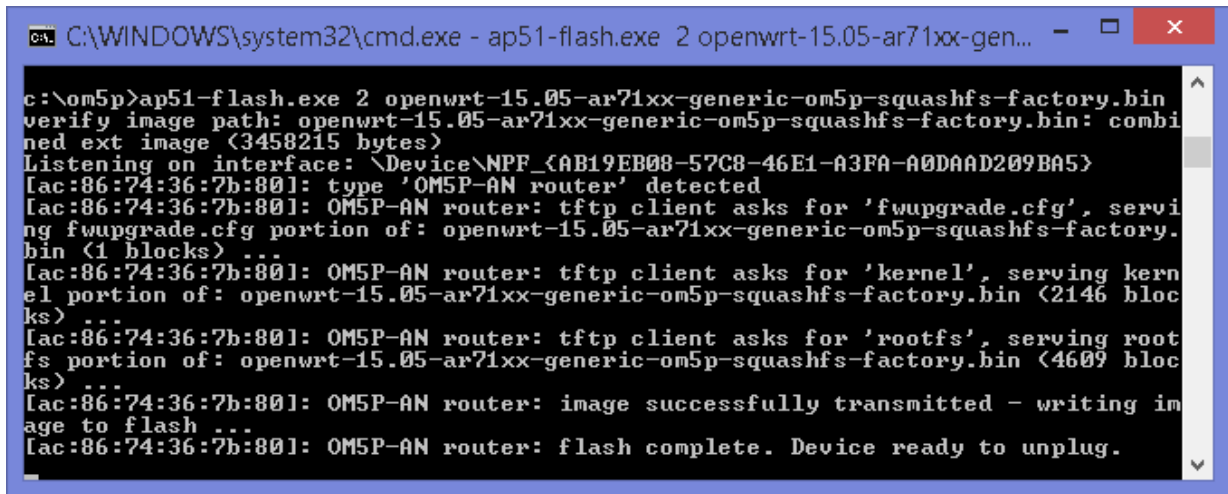
- c. The bottom is a list of interface numbers, you want the one that matches the Ethernet port you will be using. It might have the word 'Ethernet' in the description, the descriptions match what is listed in your network connections list in windows settings.
 - d. Next enter the command: ap51-flash.exe {INTERFACE#} openwrt-15.05-ar71xx-generic-om5p-squashfs-factory.bin



```
C:\WINDOWS\system32\cmd.exe - ap51-flash.exe 2 openwrt-15.05-ar71xx-gen...
   (Description: Microsoft)
2: \Device\NPF_{AB19EB08-57C8-46E1-A3FA-A0DAAD209BA5}
   (Description: Atheros L1C PCI-E Ethernet Controller)
3: \Device\NPF_{C30CBC0E-F282-499F-8D71-FE98BC7FC38D}
   (Description: Microsoft)
4: \Device\NPF_{155F71AF-01AF-499C-ADAC-B7FB909A19E0}
   (Description: Microsoft)
5: \Device\NPF_{7061D07A-CEB1-4853-9C82-14D1CDD1B530}
   (Description: Microsoft)

c:\om5p>ap51-flash.exe 2 openwrt-15.05-ar71xx-generic-om5p-squashfs-factory.bin
verify image path: openwrt-15.05-ar71xx-generic-om5p-squashfs-factory.bin: combi
ned ext image (3458215 bytes)
Listening on interface: \Device\NPF_{AB19EB08-57C8-46E1-A3FA-A0DAAD209BA5}
```

- e. The PC is now waiting for the radio to connect to the port specified.
- 3. The radio now needs to be connected.
 - a. Plug in an Ethernet cable to the port farthest to the Power Plug labeled: 802.3af POE'
 - b. Attach the other end to the port specified in step 3
 - c. After the Ethernet is plugged in, connect power to the radio
 - i. This must be done last as the firmware loading only works during the bootup sequence.
- 4. Wait for programming to finish
 - a. Once the radio begins it's bootup sequence you should see something similar to this:

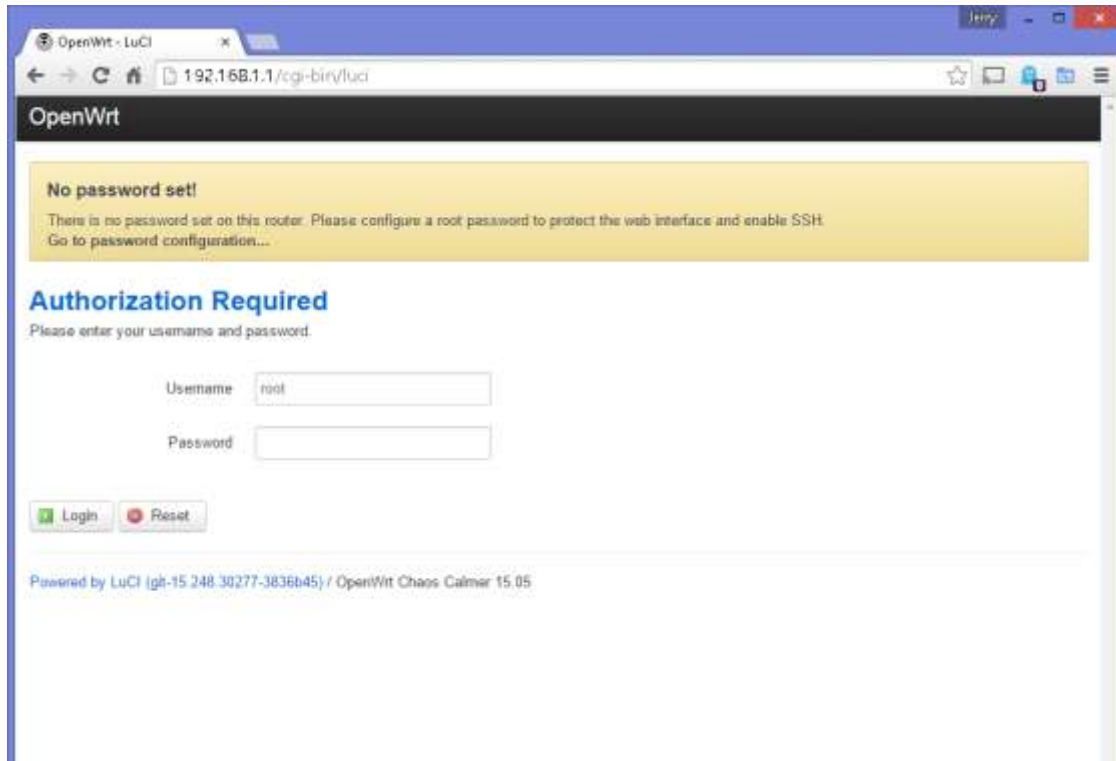


```
C:\WINDOWS\system32\cmd.exe - ap51-flash.exe 2 openwrt-15.05-ar71xx-gen...
c:\om5p>ap51-flash.exe 2 openwrt-15.05-ar71xx-generic-om5p-squashfs-factory.bin
verify image path: openwrt-15.05-ar71xx-generic-om5p-squashfs-factory.bin: combined ext image (3458215 bytes)
Listening on interface: \Device\NPF_{AB19EB08-57C8-46E1-A3FA-A0DAAD209BA5}
[ac:86:74:36:7b:80]: type 'OM5P-AN router' detected
[ac:86:74:36:7b:80]: OM5P-AN router: tftp client asks for 'fwupgrade.cfg', serving fwupgrade.cfg portion of: openwrt-15.05-ar71xx-generic-om5p-squashfs-factory.bin (1 blocks) ...
[ac:86:74:36:7b:80]: OM5P-AN router: tftp client asks for 'kernel', serving kernel portion of: openwrt-15.05-ar71xx-generic-om5p-squashfs-factory.bin (2146 blocks) ...
[ac:86:74:36:7b:80]: OM5P-AN router: tftp client asks for 'rootfs', serving rootfs portion of: openwrt-15.05-ar71xx-generic-om5p-squashfs-factory.bin (4609 blocks) ...
[ac:86:74:36:7b:80]: OM5P-AN router: image successfully transmitted - writing image to flash ...
[ac:86:74:36:7b:80]: OM5P-AN router: flash complete. Device ready to unplug.
```

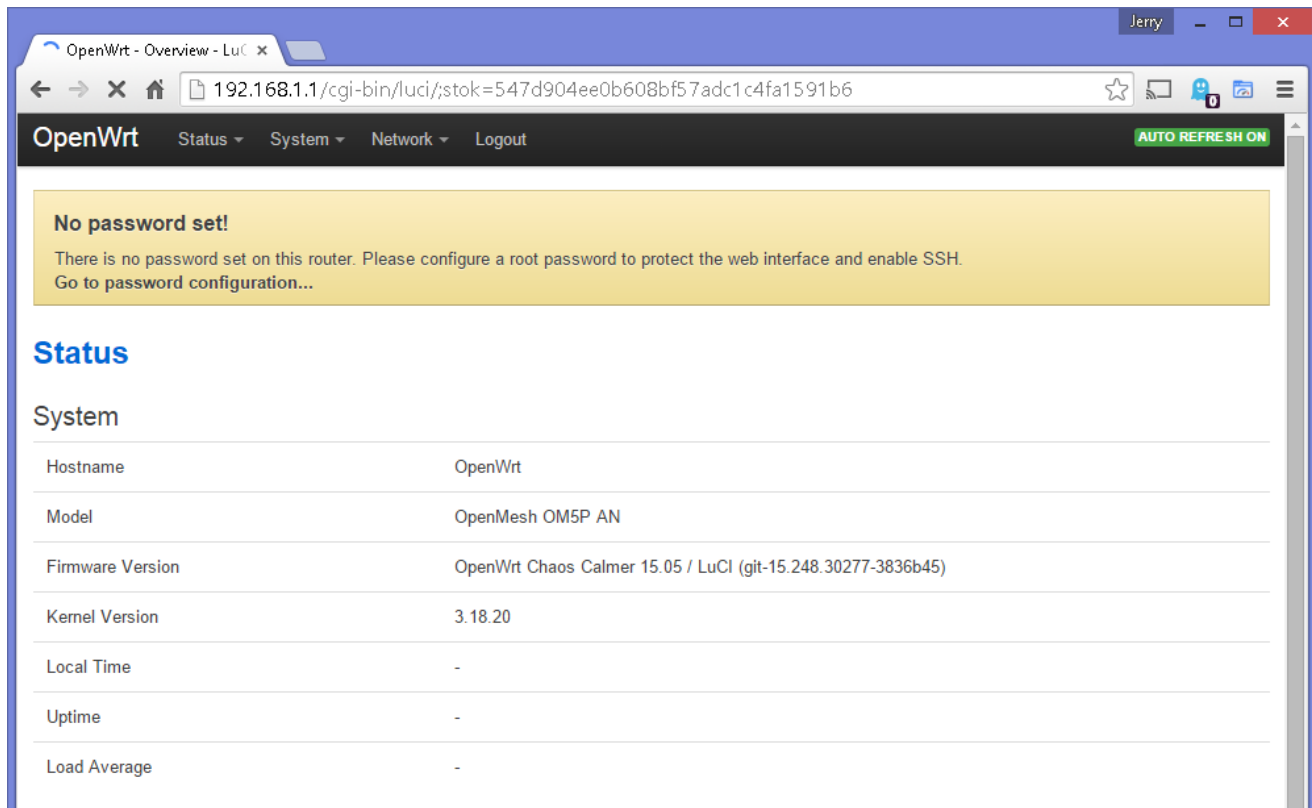
- b. Wait for it to show "Device ready to unplug"
- c. CLOSE the command prompt window
- d. Then power cycle the radio and wait for the Power LED indicator to be Solid and the Port indicator two away from the Power LED to be blinking randomly.

3. Connecting to the Radio to edit settings:

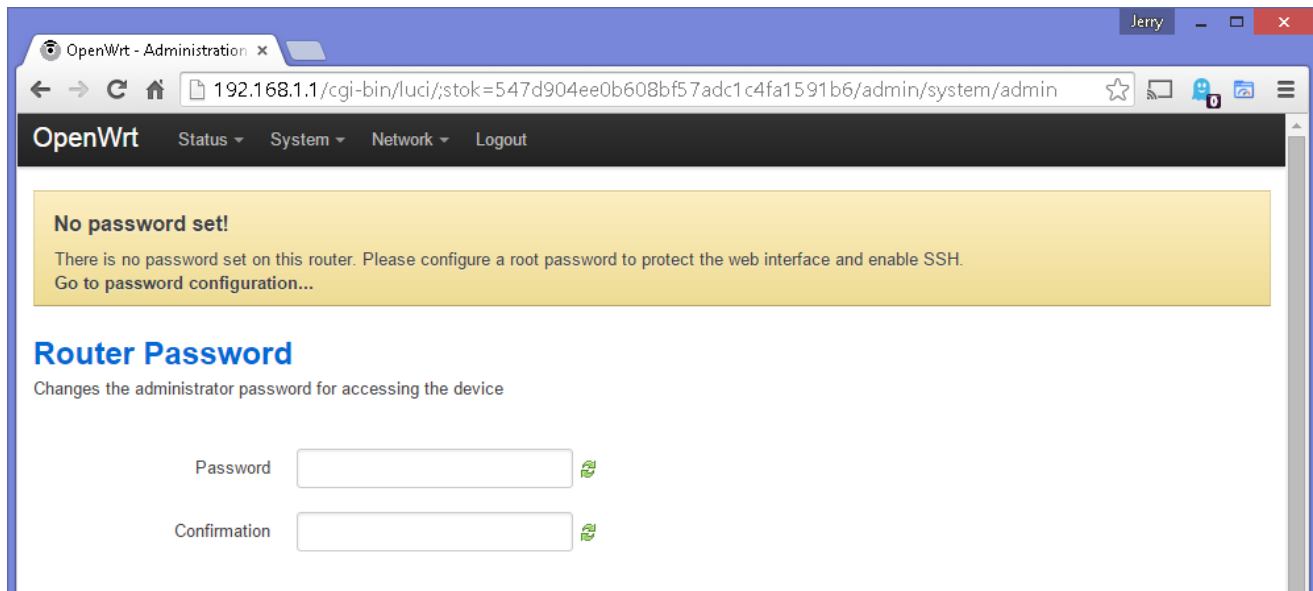
1. Open a browser (in this instance we use Chrome) and type in the URL bar 192.168.1.1



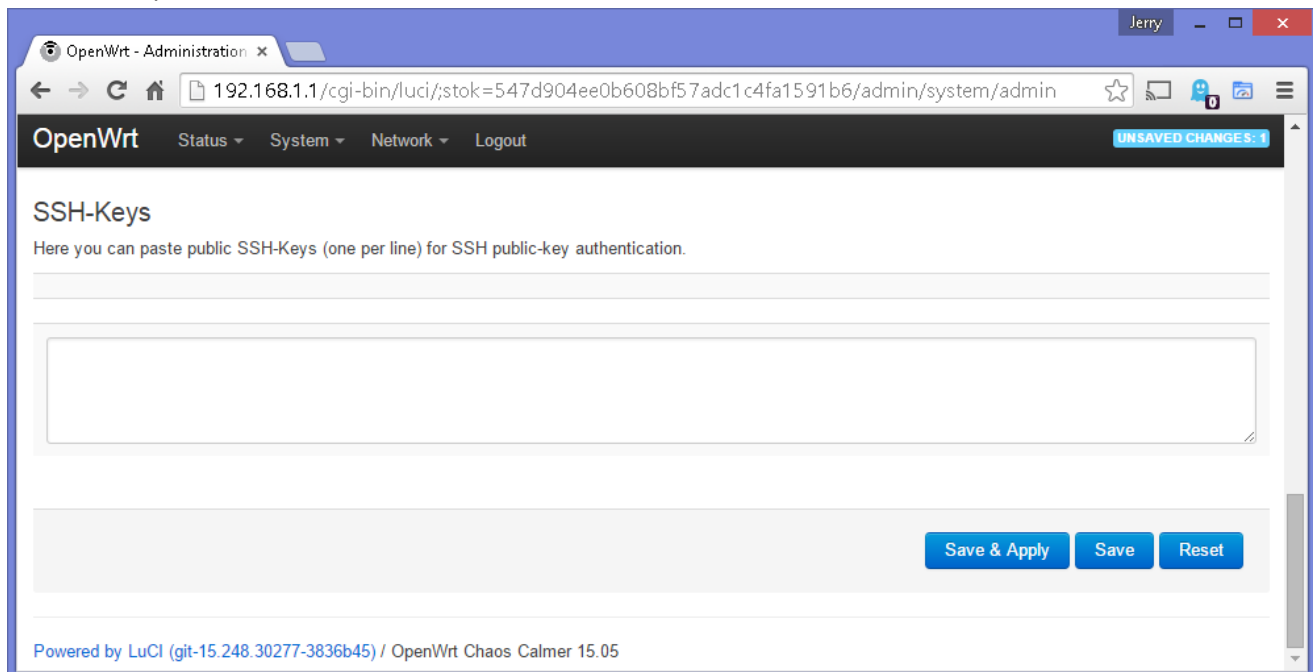
- a. Troubleshooting - if you are unable to get to this page, be sure that you are plugged into the radio's port labeled '802.3af POE' the furthest port from the power plug. You should have also power cycled the radio and have a blinking LED two away from the solid power LED. You can also check that the radio is giving your PC an IP address and it's not set to a static IP address.
2. Click Login to get to the main page



3. Click on the "Go to password configuration" at the top in the yellow box to set a password and remove the warning.

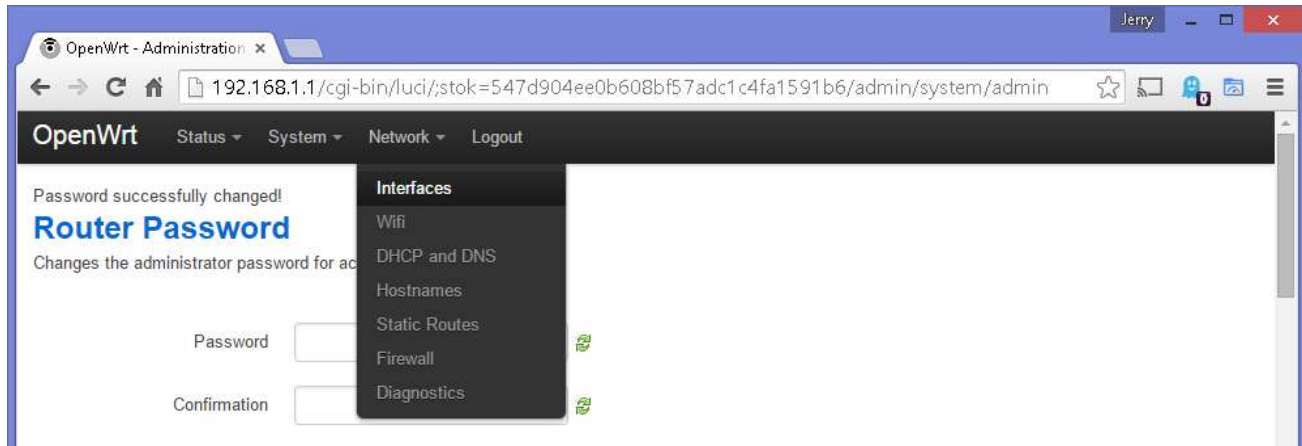


4. After entering the password twice, you must scroll to the bottom of the page to save this change. Remember this for other steps.

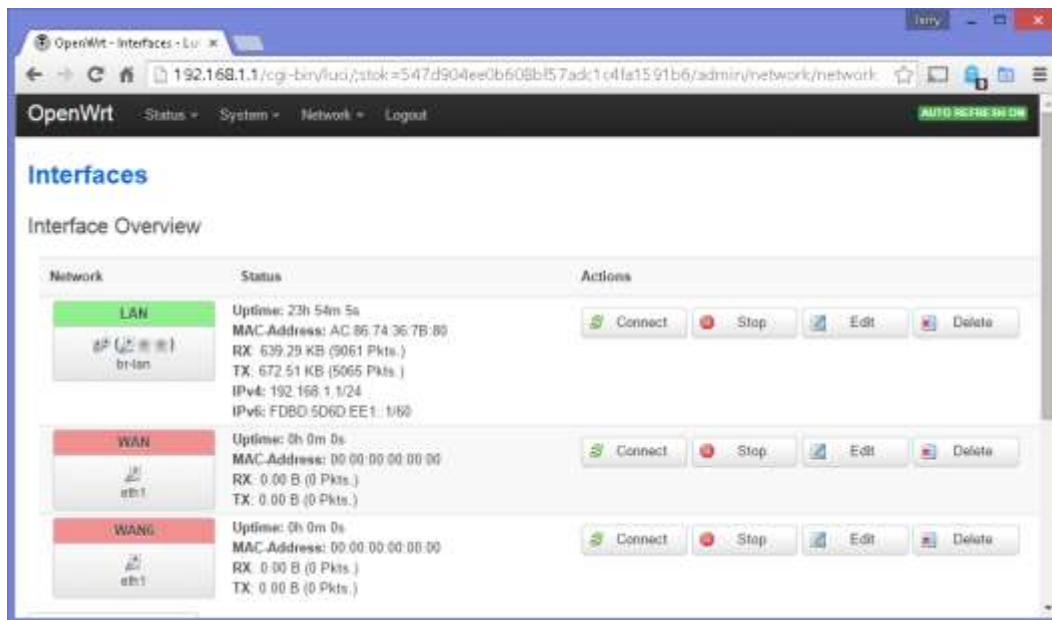


4. Programming the Radio to have both ports connected to the same network.

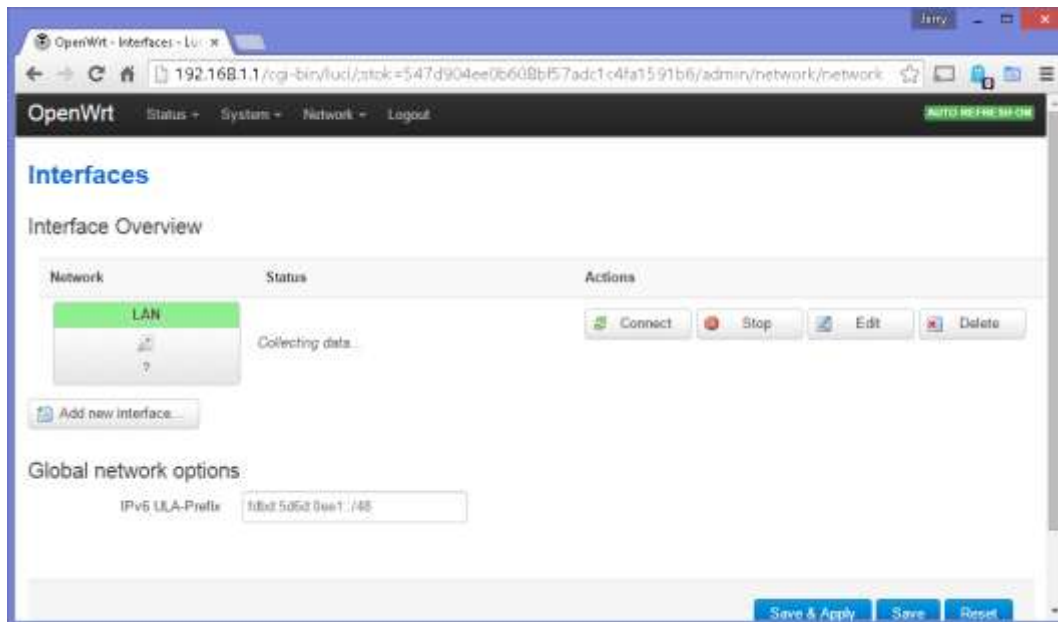
1. Select 'Interfaces' under the 'Network' Menu



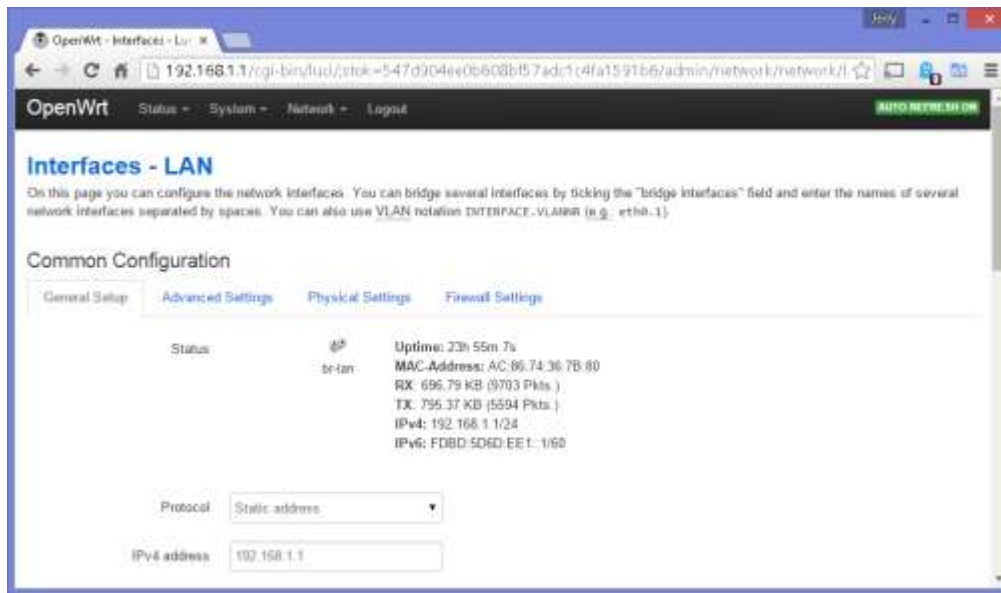
2. Delete the 'WAN' and 'WAN6' interfaces



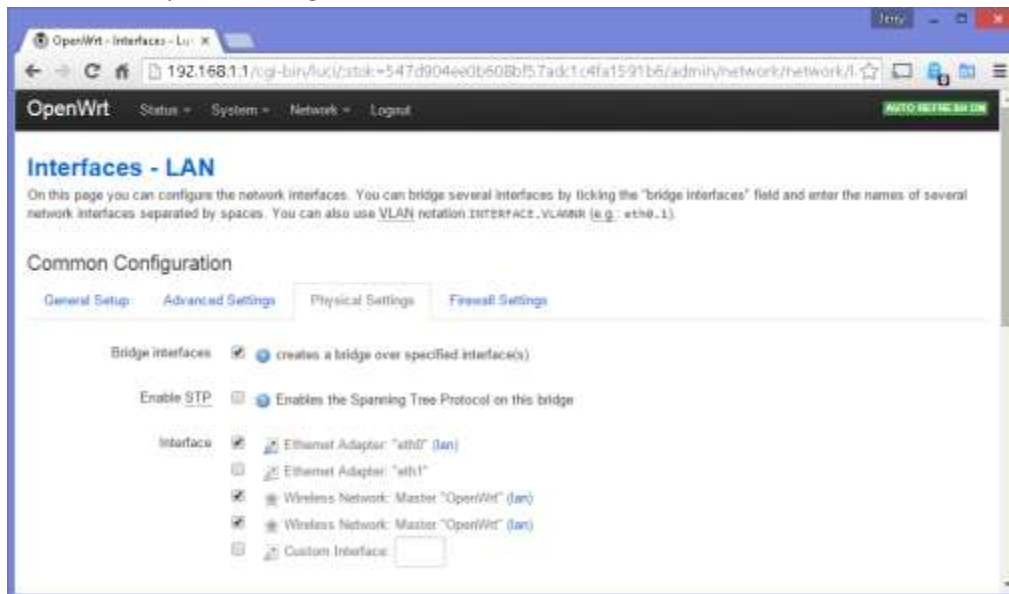
to



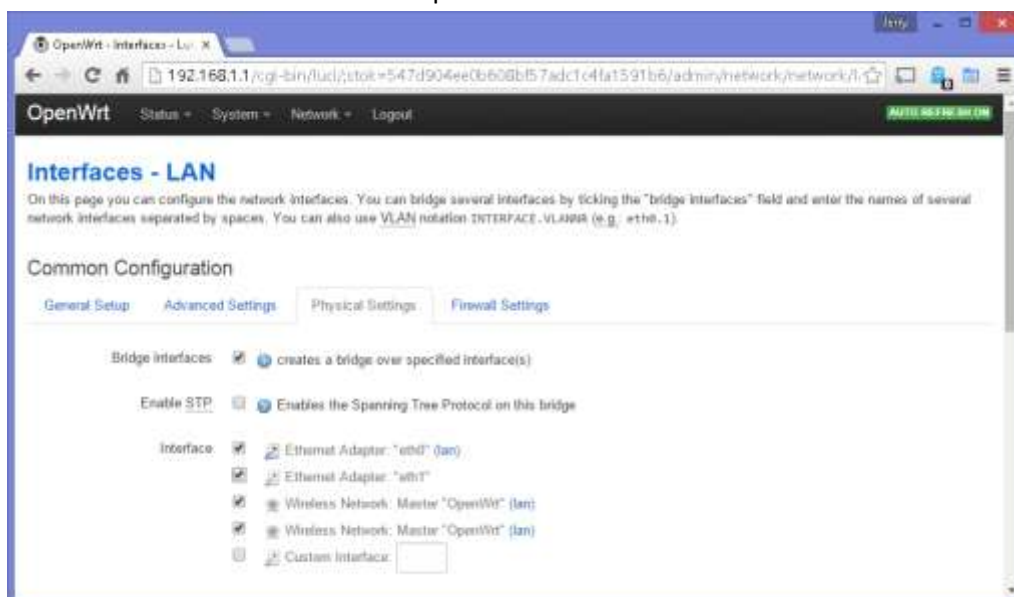
3. Click 'Edit' under Actions on the 'LAN' network



4. Select the 'Physical Settings' tab



5. Check the box next to 'Ethernet Adapter: "eth1"'



6. Scroll to bottom of page and click 'Save & Apply'

The screenshot shows the OpenWrt web interface for configuring DHCP. The browser address bar displays the URL `192.168.1.1/cgi-bin/luci/stok=547d904ee0b608b57adc1c4fa1591b6/admin/network/network/1`. The page header includes the OpenWrt logo and navigation links for Status, System, Network, and Logout. The main content area is titled "Ignore interface" and contains a checkbox labeled "Disable DHCP for this interface". Below this, there are three input fields: "Start" with the value 100, "Limit" with the value 150, and "Leasetime" with the value 12h. Each field has a tooltip explaining its function: "Lowest leased address as offset from the network address" for Start, "Maximum number of leased addresses" for Limit, and "Expiry time of leased addresses, minimum is 2 minutes (2h)" for Leasetime. At the bottom of the form, there is a "Back to Overview" button and three buttons: "Save & Apply", "Save", and "Reset". The footer of the page indicates it is powered by LuCI (git-15 248.30277-3836b45) / OpenWrt Chaos Calmer 15.05.

OpenWrt - interfaces - luci

192.168.1.1/cgi-bin/luci/stok=547d904ee0b608b57adc1c4fa1591b6/admin/network/network/1

OpenWrt Status System Network Logout

Ignore interface: ☐ Disable DHCP for this interface

Start: 100
Lowest leased address as offset from the network address

Limit: 150
Maximum number of leased addresses

Leasetime: 12h
Expiry time of leased addresses, minimum is 2 minutes (2h)

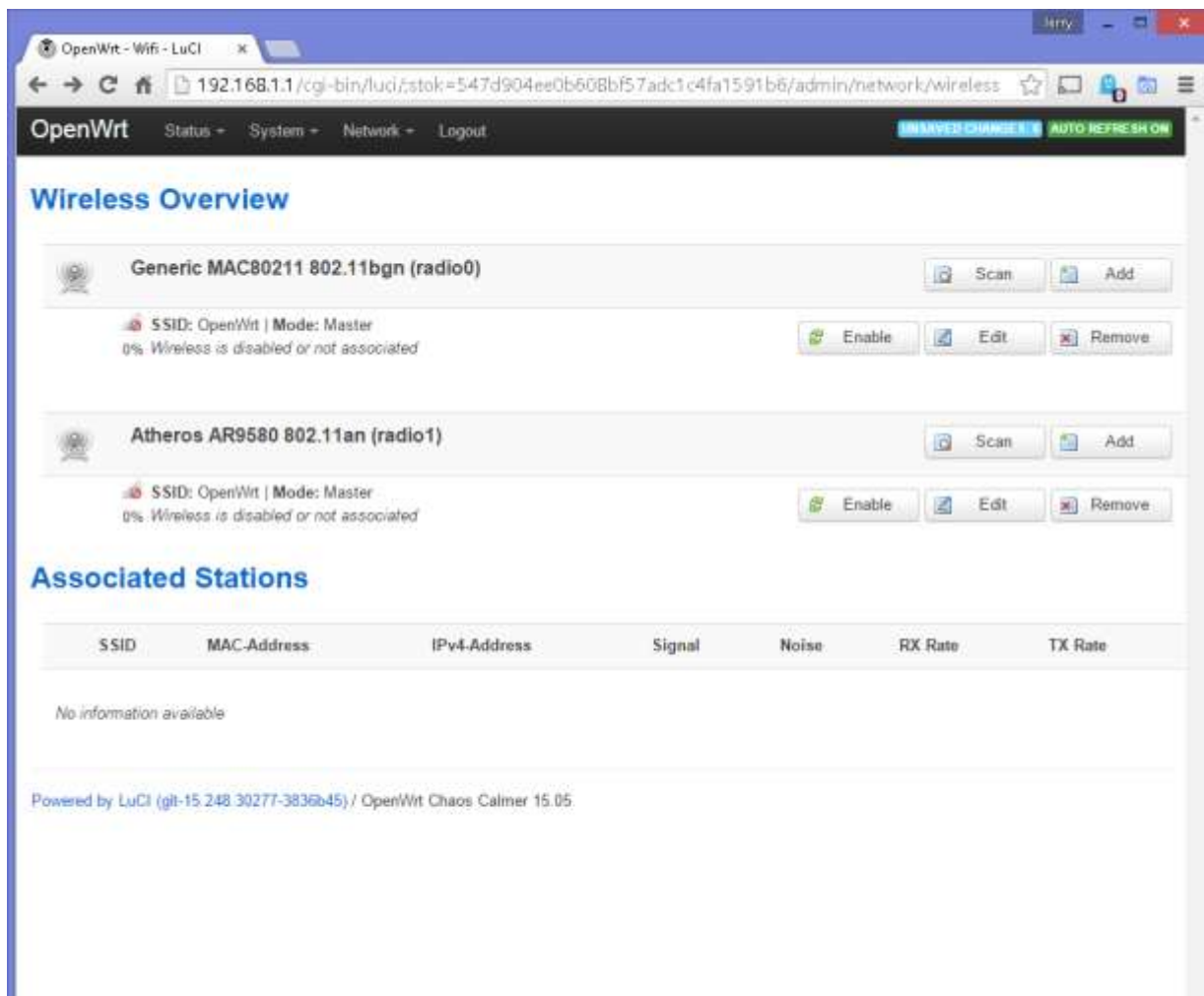
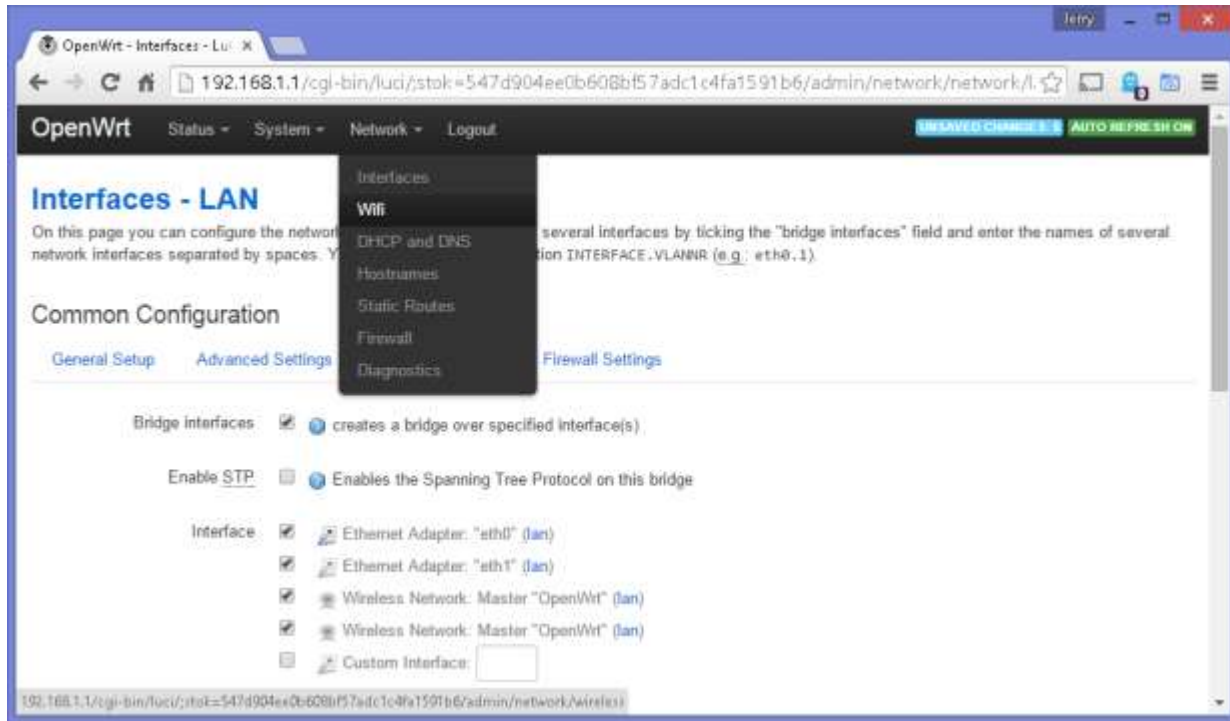
Back to Overview

Save & Apply Save Reset

Powered by LuCI (git-15 248.30277-3836b45) / OpenWrt Chaos Calmer 15.05

5. Turn on the 2.4GHz and 5GHz wifi

1. Under 'Network' menu select 'WiFi'



2. The 802.11bgn (radio0) is the 2.4GHz WiFi, 802.11an (radio1) is the 5GHz WiFi. Click on Edit next to the (radio0)

OpenWrt - Wifi - LuCI

192.168.1.1/cgi-bin/luci/stok=547d904ee0b608b57adc1c4fa1591b6/admin/network/Wireless/r

OpenWrt Status System Network Logout

Wireless Network: Master "OpenWrt" (radio0.network1)

The Device Configuration section covers physical settings of the radio hardware such as channel, transmit power or antenna selection which are shared among all defined wireless networks (if the radio hardware is multi-SSID capable). Per network settings like encryption or operation mode are grouped in the interface Configuration.

Device Configuration

General Setup Advanced Settings

Status Collecting data...

Wireless network is disabled ☒ Enable

Operating frequency Mode Channel Width

N 11 (2412 MHz) 20 MHz

Transmit Power 10 dBm (53 mW)

Interface Configuration

General Setup Wireless Security MAC-Filter

ESSID OpenWrt

Mode Access Point

Network lan

3. Under 'Interface Configuration' you can change your SSID to your team number (in this example we are using team 9999), if you wish to make this a secure connection, you can click on the 'Wireless Security' tab and use your desired encryption. Click on 'Save & Apply' at the bottom of the page.

OpenWrt - Wifi - LuCI

192.168.1.1/cgi-bin/luci/stok=547d904ee0b608b57adc1c4fa1591b6/admin/network/wireless/r

OpenWrt Status System Network Logout

Interface Configuration

General Setup Wireless Security MAC-Filter

ESSID 9999

Mode Access Point

Network lan

create:

Choose the network(s) you want to attach to this wireless interface or fill out the create field to define a new network.

Hide ESSID

WMM Mode

Back to Overview

Save & Apply Save Reset

Powered by LuCI (git-15 248 30277-3836b45) / OpenWrt Chaos Calmer 15.05

4. Next you can click on the 'Enable' button next to (radio0) to turn on the 2.4GHz.

The screenshot shows the OpenWrt LuCI 'Wireless Overview' page. The browser address bar shows the URL: 192.168.1.1/cgi-bin/luci/stok=547d904ee0b608bf57adc1c4fa1591b6/admin/network/wireless. The page has a navigation bar with 'OpenWrt', 'Status', 'System', 'Network', and 'Logout'. A green bar at the top right indicates 'UNSAVED CHANGES' and 'AUTO REFRESH ON'. The main content area is titled 'Wireless Overview' and contains two sections for wireless interfaces.

Generic MAC80211 802.11bgn (radio0)

SSID: 9999 | Mode: Master
0% Wireless is disabled or not associated

Buttons: Scan, Add, Enable, Edit, Remove, Activate this network

Atheros AR9580 802.11an (radio1)

SSID: OpenWrt | Mode: Master
0% Wireless is disabled or not associated

Buttons: Scan, Add, Enable, Edit, Remove

Associated Stations

SSID	MAC-Address	IPv4-Address	Signal	Noise	RX Rate	TX Rate
No information available						

Powered by LuCI (git-15.248.30277-3836b45) / OpenWrt Chaos Calmer 15.05

The screenshot shows the OpenWrt LuCI 'Wireless Overview' page after the 'Enable' button for radio0 has been clicked. The browser address bar and navigation bar are the same as in the previous screenshot. The 'Wireless Overview' section now shows radio0 as enabled.

Generic MAC80211 802.11bgn (radio0)

Channel: 11 (2.462 GHz) | Bitrate: ? Mbit/s

SSID: 9999 | Mode: Master
0% BSSID: AC:86:74:36:7B:82 | Encryption: None

Buttons: Scan, Add, Disable, Edit, Remove

Atheros AR9580 802.11an (radio1)

SSID: OpenWrt | Mode: Master
0% Wireless is disabled or not associated

Buttons: Scan, Add, Enable, Edit, Remove

Associated Stations

SSID	MAC-Address	IPv4-Address	Signal	Noise	RX Rate	TX Rate
No information available						

Powered by LuCI (git-15.248.30277-3836b45) / OpenWrt Chaos Calmer 15.05

5. To setup the 5GHz band, you can do the same procedures on the (radio1) section.

The screenshot shows the OpenWrt LuCI web interface. The browser address bar displays the URL: `192.168.1.1/cgi-bin/luci/stok=547d904ee0b608b57adc1c4fa1591b6/admin/network/wireless`. The page title is "OpenWrt" with navigation links for Status, System, Network, and Logout. A green "AUTO REFRESH ON" button is in the top right.

Wireless Overview

Generic MAC80211 802.11bgn (radio0)
Channel: 11 (2.462 GHz) | Bitrate: 72.2 Mbit/s

SSID: 9999 | Mode: Master
100% BSSID: AC:86:74:36:7B:82 | Encryption: None

Buttons: Scan, Add, Disable, Edit, Remove

Atheros AR9580 802.11an (radio1)
Channel: 36 (5.180 GHz) | Bitrate: ? Mbit/s

SSID: 9999 | Mode: Master
0% BSSID: AC:86:74:36:7B:90 | Encryption: None

Buttons: Scan, Add, Disable, Edit, Remove

Associated Stations

SSID	MAC Address	IPv4 Address	Signal	Noise	RX Rate	TX Rate
9999	74:E5:0B:DF:AB:E6	192.168.1.180	-29 dBm	-64 dBm	72.2 Mbit/s, MCS 7, 20MHz	72.2 Mbit/s, MCS 7, 20MHz

Powered by LuCI (git-15.248.30277-3836b45) / OpenWrt Chaos Calmer 15.05

6. Change radio IP address to match FRC team number scheme

1. Click on 'Interfaces' under the 'Network' menu

OpenWrt - Wifi - LuCI

192.168.1.1/cgi-bin/luci/stok=547d904ee0b608bf57adc1c4fa1591b6/admin/network/wireless

OpenWrt Status System Network Logout

Wireless Overview

Generic MAC80211 802.11n
Channel: 11 (2.462 GHz) | Bitrate: 72.2 Mbit/s
SSID: 9999 | Mode: Master
100% BSSID: AC:86:74:36:7B:80

Atheros AR9580 802.11n (radio1)
Channel: 36 (5.180 GHz) | Bitrate: 72.2 Mbit/s
SSID: 9999 | Mode: Master
0% BSSID: AC:86:74:36:7B:80 | Encryption: None

Associated Stations

SSID	MAC-Address	IPv4-Address	Signal	Noise	RX Rate	TX Rate
9999	74:E5:0B:DF:AB:E6	192.168.1.100	-2 dBm	-83 dBm	72.2 Mbit/s, MCS 7, 20MHz	56.5 Mbit/s, MCS 6, 20MHz

2. Click on Edit next to the LAN interface

OpenWrt - Interfaces - LuCI

192.168.1.1/cgi-bin/luci/stok=547d904ee0b608bf57adc1c4fa1591b6/admin/network/network

OpenWrt Status System Network Logout

Interfaces

Interface Overview

Network	Status	Actions
LAN br-lan	Uptime: 24h 17m 22s MAC Address: AC:86:74:36:7B:80 RX: 1.39 MB (18432 Pkts.) TX: 2.13 MB (11508 Pkts.) IPv4: 192.168.1.1/24 IPv6: FDBD:5D6D:EE1::1/60	Connect Stop Edit Delete

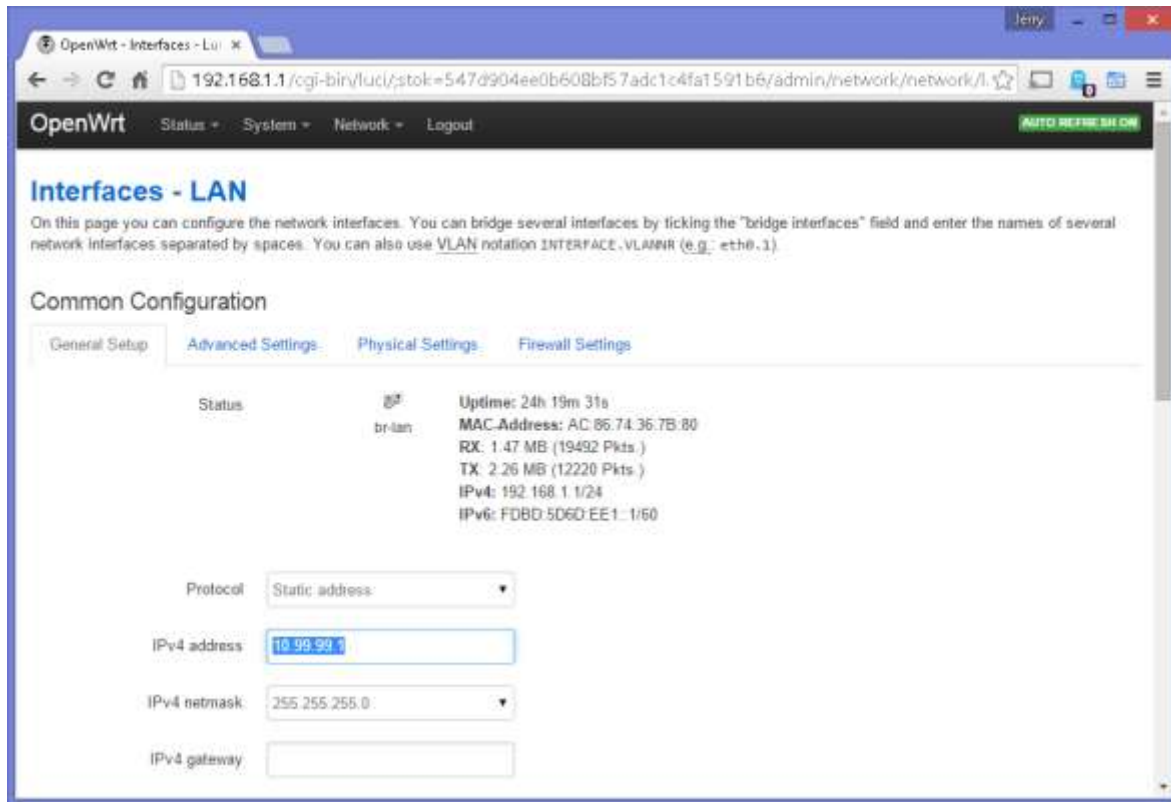
Add new interface

Global network options

IPv6 ULA-Prefix: fdbd:5d6d:0ee1::/48

Save & Apply Save Reset

3. Change the IP address to 10.xx.yy.1 (xx = first two digits of team number, yy = last two digits of team number)
 - a. Use 4 digits total, so leading zeros for teams under 1000, Example: Team 23 = 0023



4. Click 'Save & Apply' at the bottom of the page.
5. The web interface will no longer connect to the radio at this point as it's now at a different IP address. And the PC needs to be assigned a new IP address to match. Unplug the Ethernet cable and plug it back in.
6. After the LED is in the blinking state, in the URL bar, enter the IP address you just changed the radio to, in our example 10.99.99.1
7. Enter the password you setup earlier to get back into the settings.