

Using a PC-Engines ALIX Board as a remote SDR server.

We are all familiar with low cost SDR USB adaptors. The RTL-SDR is ubiquitous and can be purchased from £15 and upwards. It represents a very cost-effective way of experimenting with software defined receivers and basic units tune from approximately 25MHz upwards of 1.5GHz. Some units have transverters taking coverage into HF and for under £40 you can get 150KHz to 1.7GHz coverage.



VHF-UHF example <http://www.nooelec.com/store/sdr/sdr-receivers/nesdr-smart-sdr.html>

HF Example <http://www.nooelec.com/store/sdr/sdr-addons/ham-it-up-plus-pcb.html>

Usage

One of the problems with these devices is noise. Given that you need to plug them into a USB port on a PC there is plenty of interference to be had. Close to monitors and other noise sources such as the CPU, HDD and motherboard the SDR novelty soon wears off.

Trying to extend the USB with a USB extension just picks up more noise, so many amateurs and SWLs look at using a small remote PC such as a Raspberry Pi and taking a network cable back to the router. The Raspberry Pi is inexpensive but does not handle network and USB performance particularly well. The implementations of remote SDR server software on Pi3s have given poor results when compared to the superior ALIX based board from PC Engines.

PC-Engines ALIX

The ALIX board in question has an AMD Geode CPU running at 500MHz, 256MB RAM, three 100Mb/s LAN ports and two USB ports. Best of all it is 12V powered. Its internal HDD is a Compact Flash card of either 1,2 or 4GB.

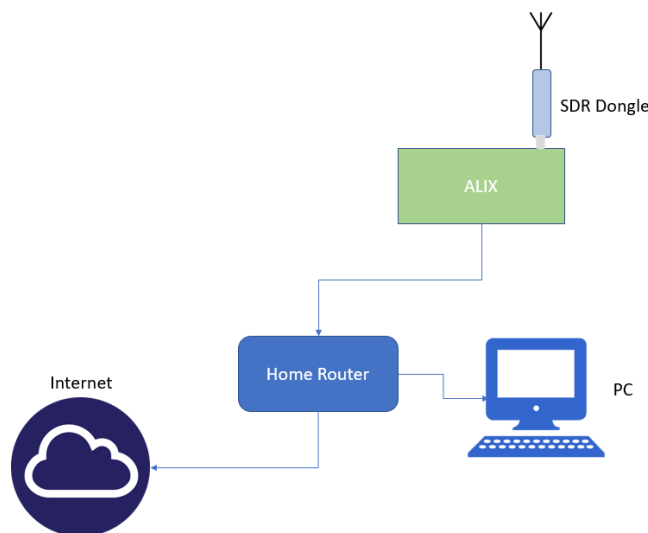


The ALIX has an RS232 Console port which is useful for diagnostics. It can run at up to 115,000 baud and down to 9600 with no parity, 8 bits and 1 stop bit. Getting Linux installed involves writing the chosen distribution to an .img file and imaging to the compact flash. OpenWRT is the OS which is well suited to this device and by installing the latest firmware we are left with a fully functional router/firewall. There is lots of documentation on OpenWRT at <https://openwrt.org/>

The firmware is configured and is ready to go. Just plug in an SDR, an antenna and turn it on. Either in dump1090 mode for viewing planes or sdr server mode as a general purpose SDR server. Details on how to switch modes are later in this document.

Accessing the ALIX

To make things as easy as possible the ALIX is plug and play. You do need to know its IP address though. The necessary libraries and code for dump1090 and the RTL-SDR server are installed and configured and the ALIX will boot up and look for an IP address on its WAN port shown above. Plug this port into a spare network port on your home router and log in to your router to check connectivity and to find out what IP address the ALIX has been given. Your network should look like this.



Logging onto your home router, look at the clients connected or DHCP table and you should find the ALIX board. It has the hostname "holly" or "hilly"

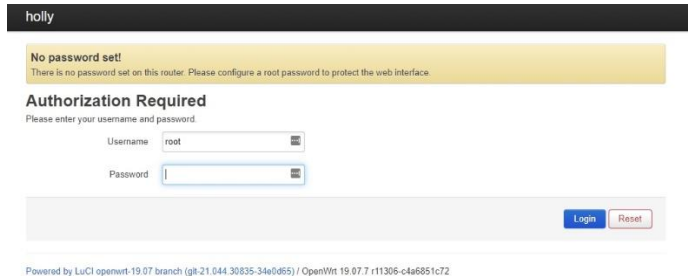
The screenshot shows the Netgear Genie web interface for an R6400 router in Access Point mode. The 'Attached Devices' section is active, displaying a table of wired devices. The table has columns for device number, IP address, MAC address, and device name.

#	IP Address	MAC Address	Device Name
1	192.168.1.1	48:5D:36:7B:75:DC	--
2	192.168.1.3	80:7F:B9:80:16:8B	--
3	192.168.1.4	80:7F:B9:80:16:6D	--
4	192.168.1.5	00:56:2B:0F:4A:5A	--
5	192.168.1.7	78:2B:CB:57:0E:AA	--
6	192.168.1.30	18:16:C9:01:BF:05	--
7	192.168.1.55	00:0C:29:61:02:E9	--
8	192.168.1.57	00:0C:29:65:61:C5	WIN10VM
9	192.168.1.59	40:CB:C0:CF:69:DA	--
10	192.168.1.87	00:0C:29:C5:A6:4E	WIN7VM

Dual Functions – SDR Server and DUMP1090 Server

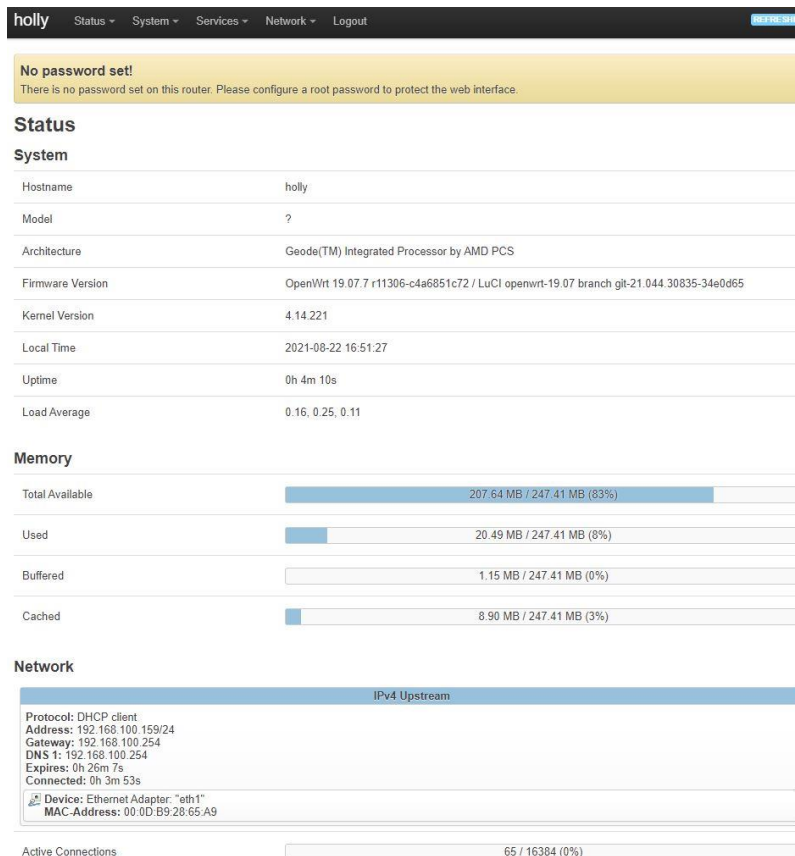
The ALIX board is set to run as either an SDR Server or as a dump1090 server for use as a flight radar detector. By default, the ALIX is set up as a dump1090 server but its configuration can easily be changed.

To change the config, log into your ALIX using the IP address you got from the router. You will be prompted with a login prompt. The password is blank so you may like to set it.

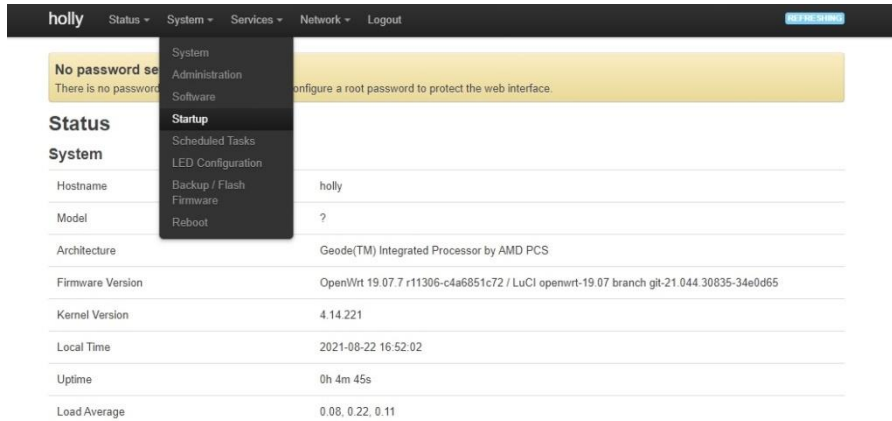


There is no password set by default so just press 'Login'

When you are in you will see the status page.



This gives you an idea of how the system is running. Next navigate to 'System' and 'Startup'



From there choose 'Local Startup' and you will see the file that runs when the ALIX boots up. You can edit this file to run one or other of dump1090 OR sdr_server. When there is a # in front of the command it will be ignored.

Do not remove both #'s as you can only run one at a time.

Startup

Initscripts 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.
/root/dump.sh &
#/root/start_sdr_server.sh &
exit 0
```

The picture above shows the ALIX in dump1090 mode. Alternatively, if you want sdr_server mode the file will look like this.

Startup

Initscripts 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.

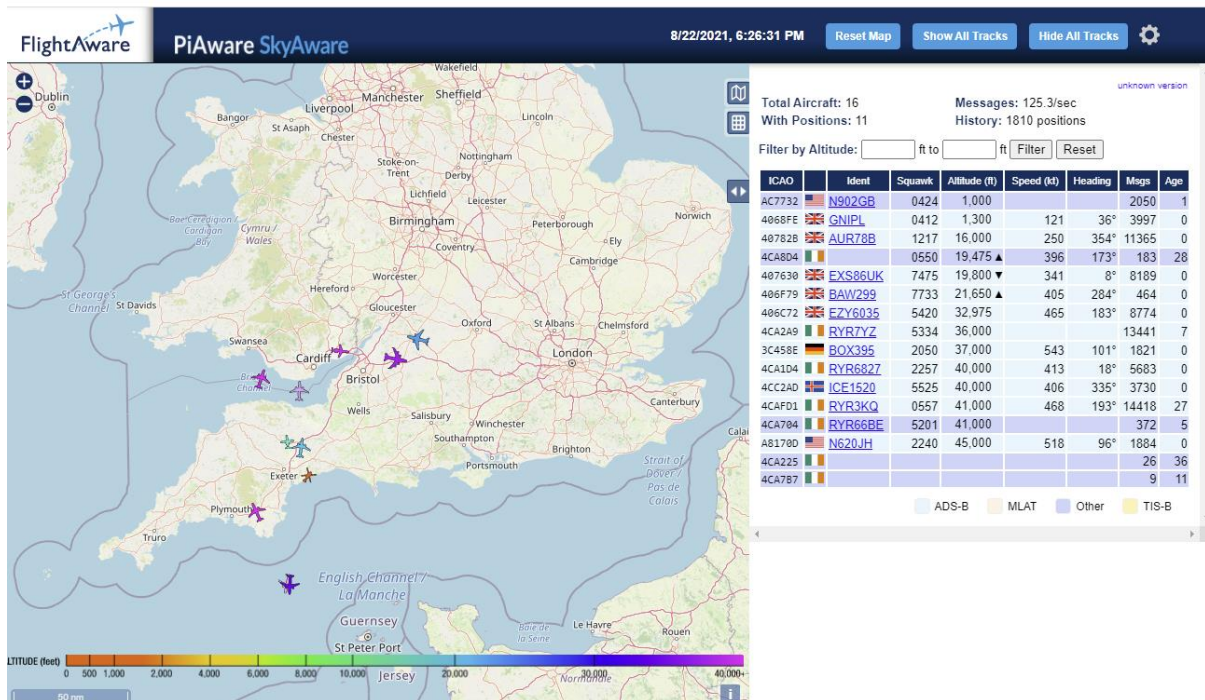
```
# Put your custom commands here that should be executed once
# the system init finished. By default this file does nothing.
#/root/dump.sh &
/root/start_sdr_server.sh &
exit 0
```

Don't forget to reboot after changing the file!

Accessing the server in dump1090 mode

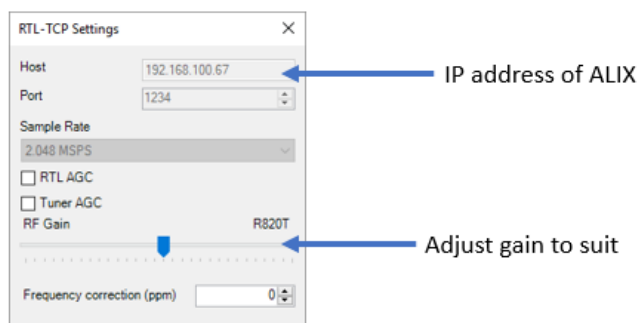
This is the easy bit. Once the ALIX is in dump1090 mode and has been rebooted, simply navigate to the IP address you logged into the ALIX with but add :8080 after the IP. Like this

<http://192.168.0.121:8080> You should then see this screen.



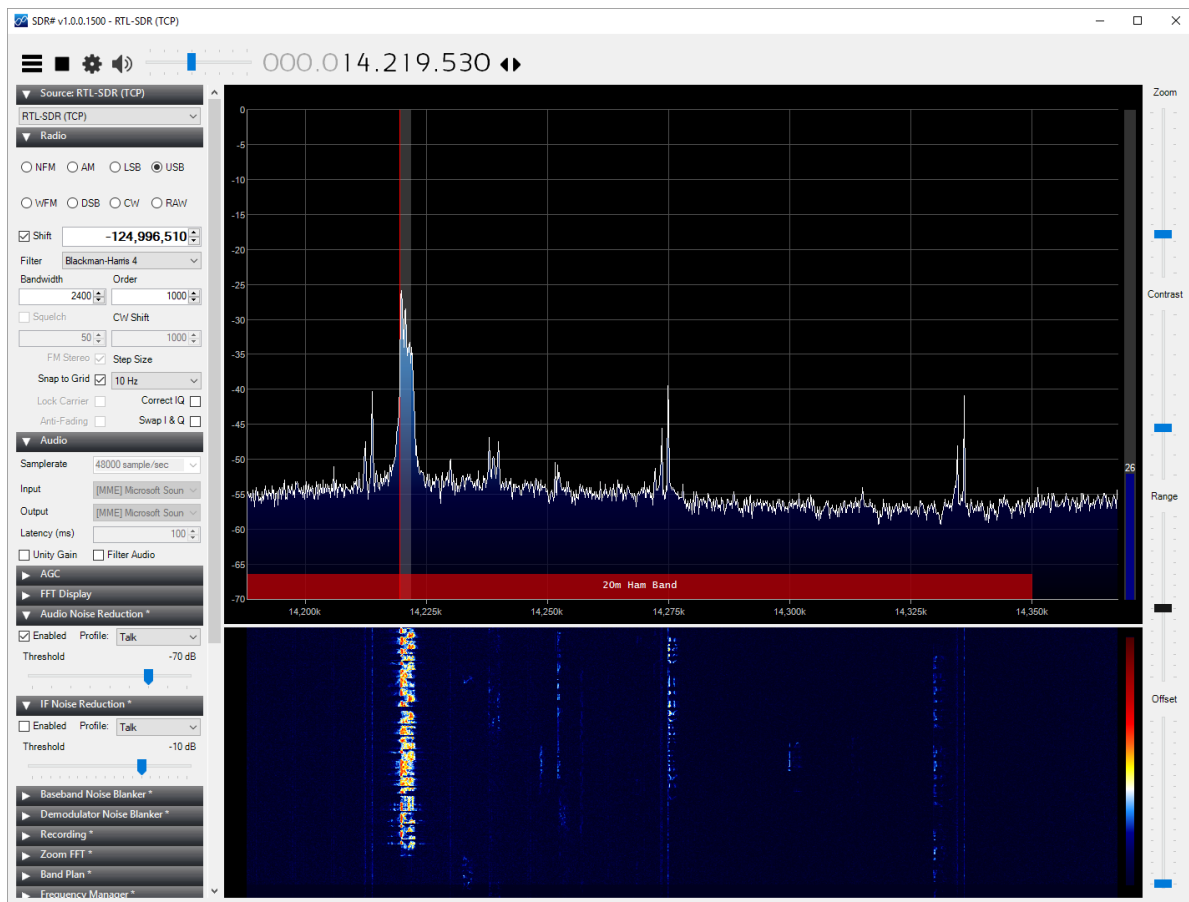
Accessing the SDR Server running on the ALIX

Once you know what this is (for example 192.168.0.121:1234) you simply need to start your SDR software (A great choice is SDR# from AirSpy <https://airspy.com/download/>) and tell it to use RTL-SDR(TCP) as the source.



SDR# Software

Using SDR can be a little daunting at first but there is lots of great reference guides online. Try this one for starters. <https://www.rtl-sdr.com/sdrsharp-users-guide/>



SDR# in action on a short wire antenna on 20M. Some of the noise cancelling is very effective!

OpenWRT

Installed on your ALIX is OpenWRT which is a great firewall and router. It has lots of features and is very well supported. If you feel adventurous you can replace the firewall / router function of your home router by putting it into bridge mode and letting the ALIX dial PPPoE/A. Again, lots of stuff online about this. To further explore OpenWRT on the ALIX, navigate to its WAN IP in your browser and login using a blank password.