The Latest

GNU Radio Revisited

Up

Posted by AG6QV Frank
Tags: GNU Radio | HAM | HackRF One

A long time ago I invested in a HackRF One device to play with Software Defined Radio (SDR). Over the years the available software has evolved and is evolving faster on a Linux platform compared to Windows. So when Microsoft introduced Windows Subsystem for Linux (WSL) I was exited to test it on my development system. Unfortunately the joy was short lived as there was no support for USB devices. Today I discovered that there was a way to make it all work. This post is a description of the steps needed to install WSL, a Linux distribution, the Gnu Radio software and how to make USB devices available to the Linux environment.

In order to use the WSL system there are a couple of Windows features that must be turned on. Change these will require the computer to be rebooted. As shown in the two screenshots below the Hyper-V feature and Windows Subsystem for Windows must be enabled.

When everything is installed and the system rebooted it's time to install the Linux distribution. There are several available to choose from. The list of distributions can be viewed by opening a Windows Terminal and executing the command 'wsl --list --online'. If you already have an older version of WSL installed it will be a good idea to run 'wsl --update' to insure the latest version is installed.

Use the command 'wsl --install -d Ubuntu-24.04' to install the latest version of Ubuntu. It is possible to install multiple distributions, and even to run them side by side. Using the wsl command will start a Linux terminal using the default distribution. I like to use a program called MobaXterm to interact with the Linux distributions on my system or with remote servers. The program comes with an X server that allows executing graphical applications and it know about all the WSL distributions that exists on the system.

Microsoft has contributed the the open source project 'usbipd' and created a special version called usbipd-win. Installing or updating this toll will allow the installed USB devices to be shared across to a linux distribution. Execute the following comman in a Windows terminal to install the tool:

```
winget install --interactive --exact dorssel.usbipd-win
```

When the tool is installed use the usbipd command to list the available USB devises. Note the BUSID for the device you would like to make available to the Linux distribution.

```
usbipd list
```

On my system the Hack RF One device has BUSID 2-2 and the following command will make the device available in the Ubunto environment.

```
usbipd attach --wsl --busid 2-2
```

The two images below shows MobaXterm with the list of available distributions and the terminal opened.

In order to view the available USB devices in the Linux Terminal it is necessary to install some tools called 'usbutils'. This package is installed by the following command:

```
sudo apt install usbutils
```

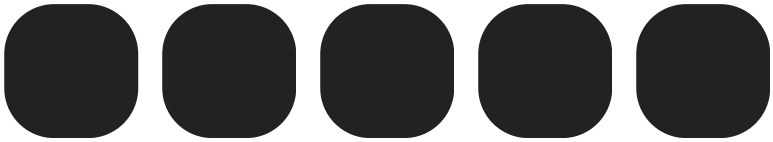
After installation the lsusb command can be used to list the available devices. The image below shows the list of devices before and after attaching the the HACK RF One device as one of the available devices in the Linux environment.

Installing the GNU Radio packages and the required GTK packages can be done with the command shown below.

```
sudo apt install gnuradio
sudo apt-get install libgtk-4-1 libgtk-4-dev
sudo apt install python3-gi gobject-introspection gir1.2-gtk-3.0
```

With everything installed the system is ready to use. I now have some work to do to update the projects I created when I first started to use GNU Radio. There has been many changes to the available objects. In the coming posts I'll share some of the projects I have created for signal generators, spectrum analyzers and other radio related items.

Link to this Post



Antenna Switch

Up

Posted by AG6QV Frank
Tags:

For 2m and 70 cm bands I have horizontally polarized antennas for each band and a dual band vertical for operating on repeaters. There is also an external amplifier for each band. In order to utilize the vertical antenna I created a box that houses 3 coax relays. There is a relay for each band to switch between horizontal and vertical polarization and one relay that switches between the bands. Since this switching is done directly on the output of

the radio, before the amplifiers and since the radio only transmits on one band at the time, the power handling for the relays can be limited to the power output of the radio (100W on 2m and 50W on 70cm). Standard coax relays can easily handle that amount of power.

With a 3D printed enclosure the box fits nicely on a shelf behind the radio. The image below shows the box and lid as they came out of the 3D printer.

The next image shows the components mounted inside the box. There are two RCA connectors used to control the switching of the relays (one for each band) and two LEDs to visually show which of the two bands are connected to the vertical antenna. When no LEDs are on both antennas will be connected to the horizontal beams.

The final image shows the box with the lid closed and ready to be connected to the radio, amplifiers and vertical antenna.

Controlling the relays is done through an Raspberry Pi application that also controls up to 6 HF/50MHz antennas. The logic ensures that only one HF antenna is selected at any given time and only 2m or 70cm can be connected to the vertical antenna at any given time.

Link to this Post

Tunig of 10 GHz bandpass filter

Up

Posted by AG6QV Frank
Tags:

I've been building multiple pipe cap filters for 10 GHz and found that precision is key to make something that is easy to tune. I'm using M3 screws and nuts but even with one nut soldered to the top of the 1/2" pipe cap the thread is not stable enough to keep the screw from moving from side to side. W7GLF, Ray found a waveguide filter on eBay and I jumped on the listing and paid the $85 plus tax. Today I received the filter to be used in my new 10 GHz rig.

The filter was listed as "Harris Farinon WG Filter 10 GHZ XMT 801-112556" but there was no frequency labeled on the filter and since there are 5 cavities I did not want to start moving them around without a system in place to avoid getting it completely out of tune.

10 GHz bandpass filter

When I inserted the filter in the 10GHz radio there was no viewable output on the spectrum analyzer and my HP spectrum analyzer, that covers 10 GHz, does not have a tracking generator. My Regol analyzer has a tracking generator but that only covers up to 1.5 GHz. I do not have a good signal generator that covers the microwave bands so that was not an option either. The solution is to use the 10 GHz transverter. It uses a LO Frequency of 10.224 GHz and would normally ise an IF of 144 MHz. Instead of using an IF radio I used the tracking generator from the Regol spectrum analyzer. I started out with a bandwidth of 500 MHz and used to HP spectrum analyzer to determine the center frequency of the filter to be around 10.580 GHz. I then narrowed the bandwidth to about 20 MHz and moved the center frequency down 5MHz. I could then tune the filter to max signal through, then I could move the center frequency another 5-10 MHz down as long as I able to see the signal I could tune the five cavities to maximum signal. By repeating these steps until the center frequency was close to the 10.368 GHz. Then I removed the tracking generator and replaced the IF signal with the 144 MHz radio and performed another tunig to maximum signal.

The image below shows the output of the mixer where the LO signal and the desired signal is shown.

Signal before filter

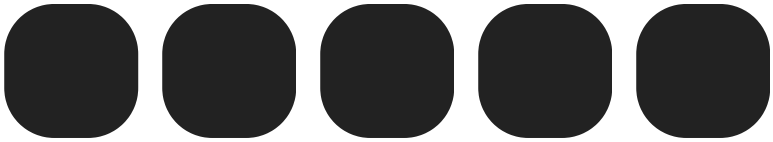
And the signal at the output of the filter looks like this:

Signal after filter

Note how the amplitude of the desired signal is the same level before and after the filter. This is an indication of a very small insertion loss. I'm quite happy about the performance. Tuning the filter to the correct frequency was much easier than anticipated. Having a VNA or an SA with tracking generator that covers the desired

frequencies would make it even easier, especially to get the pass band to be in the right position. Since we normally only use about 2 MHz of bandwidth it is easy to check the filter response by moving the frequency of the IF radio to the band edges.

Link to this Post



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