

The Latest

HackRF One

Up

Posted by AG6QV Frank

Tags: [GNU Radio](#) | [HackRF One](#) | [PNW Microwave](#)

The November meeting in the PNW Microwave group was used to discuss Gnu Radio and HackRF One. We installed the Windows version of Gnu Radio (binaries can be found [here](#)). To verify the installations we used a flowgraph for a [narrow band FM receiver](#).

After the meeting John (W7FU) was inspired to install the latest version of GNU radio and he created 3 flowgraphs. I modified these to be used with HackRF One by adding the OsmoSDR versions of sink and source. I disabled the [UHD:USRP](#) versions but left them in the flowgraph for reference.

[SSB filter simulation](#)

This flow graph does not require any external hardware. This simulator visualize the USB, LSB or CW signal in the frequency domain. The first image below shows the flowgraph and the second is a screen shot of the output.

SSB filter simulation

SSB filter simulation output

[Wide spectrum receiver](#)

This flowgraph generates a very simple receiver and show the frequency spectrum. The HackRF One is limited to a 10 MHz bandwidth but with the use of the variables and GUI controls it can be used to show the spectrum anywhere from 10 MHz to 6GHz. A handy little spectrum analyzer although the sensitivity of the HackRF device is not that great and my version is installed in a plastic box allowing RF to get injected anywhere on the circuit board.

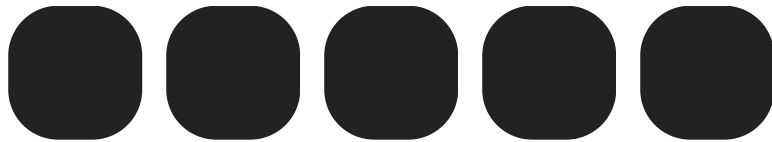
Wide spectrum receiver

[Signal Generator](#)

The signal generator is also very simple. It consists of a signal source and a sink (the component that communicate to the hardware. I tested this by tuning my handheld FM receiver to the same frequency and adjusting the drive until I was able to hear the signal. This can also be used on any frequency from 10 MHz to 6GHz with the HackRF One device.

Signal generator

Link to this Post



10 MHz Filter

Up

Posted by AG6QV Frank

Tags: [10 GHz](#) | [X-Band](#)

I have a couple of different GPS Locked reference oscillators that are used to lock PLL oscillators in microwave equipment. Some of these have a nice sine wave output at 10 MHz and others have a square wave output causing harmonics of the base frequency to be present in the signal. This is a factor that will increase the phase noise of the PLL oscillator. Getting rid of the harmonics is relatively simple with the help of a low pass filter. W1GHZ, Paul Wade has a nice [article](#) about the design of such a filter for a 10 MHz reference oscillator. The article is linked on the [small projects](#) page of his web site.

Today I decided to build a version of this low pass filter using SMD components. I did not have the exact values of all components, but was able to get close enough. I started out by creating a [NC](#) file for my CNC router and cut out a small PCB as seen on the image below. The PCB is about 8x19mm. This only a small amount wider than the SMA connectors I used.

20200126_152729

The at the end I added some heat shrink tube to finish the project.

20200126_161955

As you can see I ended up making two filters to check how accurate they were. It turned out that the first one gave the best performance. One of the inductors I used was in a 0402 package and way too small to work with. I'm going to order some in 0603 package and create a few more to see if this can be repeated with similar performance.

The output of the 10 MHz reference without the filter looks like this:

20200126_160751

The 3rd harmonic is only about 10dB down from the 10 MHz signal and there is a substantial amount of harmonics. After adding the filter the output looks like this:

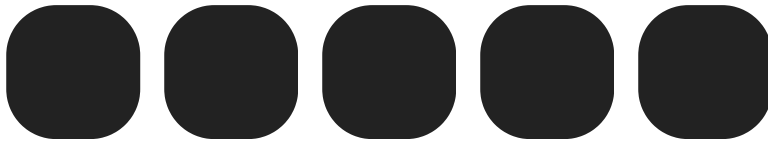
20200126_161039

Almost all of the harmonics are gone, indicating that the signal now is much closer to a sine wave. Using the spectrum analyzers tracking generator to show the filter response looks like this:

20200126_161021

This shows 40-45dB attenuation at the 3rd harmonic and almost no loss at the base frequency.

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