Natural Radio

News, Comments and Letters About Natural Radio

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As I mentioned a few months ago, I have been in the process of re-doing my workshop after some flooding this past summer. A new vinyl floor was installed and I upgraded the lighting so that I could actually see what I was working on. The lighting took way more time than anticipated because the original switches had been wired very strangely and I needed to trace back the circuitry through the conduit to figure it out. Also the color coding on the wires switched in midstream and certainly wasn't consistent. But I finally traced the circuitry and now I finally have bright and clear workbench surfaces. Now I can concentrate on equipment and software.

I am anticipating the long cold winter nights when I will have time to sit at the workbench and experiment with VLF and other projects. That seems a little farther away since the temperature here today is supposed to approach an unseasonable 70 degrees. Reality and highs in the mid 30s will return in the next couple of days, however, I will hopefully have some time at the bench over the Thanksgiving weekend.

As I was planning the workshop renovation, one of my goals was to have a computer based receiver for Natural Radio and VLF with recording and analysis capability. Previous attempts at a home-based Natural Radio receiver have been met with frustration due to my non-ideal environment and powerline noise and I am hoping that I can finally come up with a workable system this winter.

Spectrum Laboratory is free software written by Wolf, DL4HF, that accomplishes receiving and analysis functions superbly, so that is the package of choice. I know that some of you are already running this package and probably have a better command of using it than I do, but I'm going to chronicle the whole process her for those who don't and may be anticipating a computerized receiver installation.

THE COMPUTER

Spectrum Lab doesn't need massive amounts of computer power, at least by today's standards, so it's possible to re-purpose an older machine so that you can have a dedicated system. I had a 6 or 7 year old HP Pavillion a200n machine which was Pentium based and running at about 2 Gigahertz.

The first thing to do is to make sure the computer is in good working condition. I replaced the "C" drive as it was marginal and I wanted a larger drive for storage of audio recordings.

Make sure all the fans are clean and working and replace any other items that are suspect. The next thing was to re-install Windows. I needed to do this since I replaced the main drive, but it's a good idea to do in all cases, since the Registry can get

corrupted and bloated after several years of use and really slow down the machine. Starting with a clean hard drive and a new installation of Windows will insure optimum speed and performance.

You definitely want to get rid of all unnecessary software and re-install only what you need. I installed only the basic software that I need which was Firefox, my Internet browser of choice and a basic version of Microsoft Office.

THE SOUND CARD

Most computers already have a sound card either installed or present on the motherboard. I wanted an external soundcard for several reasons. Internal soundcards pick up noise from the internal workings of the computer. For browsing the internet and casual music listening this might be OK, but spurs and noise from the various internal clocks and power supplies of a computer are something you definitely don't want if you are trying to do weak signal VLF reception – especially since some of these spurs will be very near the frequencies that you are trying to listen to.

The other reason for a new sound card was that most standard cards sample at a maximum frequency of 48 kHz. That limits the maximum frequency you can receive or analyze to around 22 kHz. I wanted a faster card that would sample at 192 kHz. so that I could see the VLF and LF band all the way up to about 96 kHz.

After rummaging around on the Internet a bit, I found out that the device that most people were using for this application was the E-MU 0202 USB audio interface. I purchased one a few months back for a little under 100 dollars. A quick online search just indicated that they are still available at about the same price. For your information, E-MU is now a part of Creative labs.

The unit comes with high-quality 24-bit A/D and D/A converters that can sample at 44.1k, 48k, 88.2k, 96k, 176.4k and 192k. The dual microphone, Hi-Z and line preamps are ultra low-noise. There is a studio-grade Headphone amplifier with a level control. The unit is powered over the USB connection and thus it's simple to install it away from the computer, monitor and other noisy devices.

Installation was easily accomplished. Unlike some devices, the installation requires that the 0202/USB first be plugged in to the USB port. If the Add New Hardware Wizard appears, hit Cancel, put in the driver disk and follow the installation instructions. It was one of the simplest installs I have ever done.

SPECTRUM LABORATORY

The whole heart of a computerized receiving system is, of course, the software. Spectrum Laboratory has been around since about 2000 and is constantly being updated with new features. There is an active users group on Yahoo groups at http://groups.yahoo.com/group/SpectrumLab/

Both here and on the Spectrum Lab website there is lots of useful operating and application information. For example, for Lowfer listeners, there is an article by Lyle Koehler, K0LR, on how to build a Lowfer receiver using Spectrum laboratory. http://www.qsl.net/k0lr/SW-RX/sw-rx.htm

Spectrum Laboratory information and a download link for the software is available at http://www.qsl.net/dl4yhf/spectra1.html

I downloaded the software, unzipped the file and installed it without a hitch. The software saw the soundcard and started up a "waterfall display". Raising the preamp gain to max on the E-MU 0202 brought up broadband noise on the display which verified the software and sound device were working together correctly.

Spectrum laboratory is a very complex piece of software and I'll need to spend some time with the tutorials to really get an understanding of its features and to how to use it properly, but I couldn't resist hooking my long wire antenna to the input of the soundcard.

I set the display to display the full bandwidth between 0 and 96 kHz. and was able to see some constant signals. WWVB at 60 kHz. was visible as well as many other carrriers. Some were probably local interference, others likely some of the VLF and LF military transmitters. There was a weird signal that kept moving between 45 and 55 kHz. I assumed that this was some type of noise.

I selected the Sferics and Whistlers preset and engaged the built-in hum filter. I was able to detect a few sferics but there wasn't enough gain. The preamp was turned up to just below clipping and it appears that there is just too much hum for the preamp. The hum filter gets most of it out, but that's post-preamp.

Obviously, a longwire antenna, especially one that terminates about 20 feet from the power lines, is just not going to make it. But at least it did prove the concept.

My next step will be to work through the Spectrum Lab tutorials and articles and really get comfortable with the software. Then I'll try some different antenna systems that can hopefully get the hum and buzz to a reasonable enough level that the internal hum filter can deal with it.

I am guessing that I'll need a high-pass filter in the preamp to get rid of the 60 Hz. and the first couple of harmonics. Then I'll need a low-pass filter to avoid intermod problems from the three 50 kw. AM broadcasters that are about 15 miles to the south.

I'll try an active whip, but due to my low location and the large amount of mature trees, I think that at least for Natural Radio, a loop may be the best solution.
I'll continue to chronicle my progress the next time around.

In closing, a very Merry Christmas and Happy New Year to all. I wish you health, peace and good listening for the coming year.