



The Repeater

Next Club Meeting
 Thursday,
 February 7, 2013, 7:00 PM
 Red Cross Building,
 60 Hawthorne St., Medford, OR
 Across from Hawthorne Park

Program: HF Propagation

Volume 2013, Issue 2 February 2013

| | | | | |
|-----------------|--------|----------------|---|-------------------------|
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President's Letter

As we begin the 77th year of the Rogue Valley Amateur Radio Club, I was reflecting on what we accomplished last year. Certainly, Field Day 2012 was a success as we took first place in Oregon 3A and had many visitors in spite of the inclement weather. We also saw a nice increase in club membership including many newly licensed hams.

Looking forward to the new year it seemed apparent that we have need of a diversity of programs for our upcoming club meetings. On one hand we have a large core of veteran hams that have been active in the hobby for decades. But we also have a lot of new

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The Repeater is the official newsletter of the Rogue Valley Amateur Radio Club, Inc. It is published 10 times a year—once per month excluding July and August.

Secretary's Report

RVARC meeting of Jan. 3, 2013

Meeting brought to order 1900 by Jeff Statchwick, W7KNX, President.

Visitors introduced:

- Bill Bozarth, O'Brien, OR, working on relicensing
- Isaiah Bose age 17, no license yet. Home schooled, likes science.
- Barry Johnson, K6BAJ, recently moved to Rogue Valley

Other visitor(s):

- Rob Locher, W7GH, President of the SOARC (Grants Pass club).
- Ray Abbitt, KK6AM

Treasurer's report: \$4288.96 but insurance

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President's Report, Cont'd.

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hams who probably have some unanswered questions about how to get started. There are so many different areas of interest within the hobby that one could spend a lifetime exploring all of them.

With that in mind the executive committee has attempted to plan a variety of presentations that will benefit everyone. For example if you're a new ham and need some assistance getting started we will have a presentation in March that will allow you "hands on" experience in operating an HF station. Or maybe you have been curious about "LOTW", Log Book of The World, the ARRL's on line logging program that allows you to validate QSO's for awards you may be working on. Using the QSL bureau, operating 2m and 75cm repeaters and many other topics will be discussed this year. And of course everyone is encouraged to participate at some level for Field Day even if just to come by and socialize.

I'm looking forward to another fun and educational year with the club. I think there will be something to interest everyone.

In February, Tom McDermott, N5EG will present the topic "HF Propagation".

I hope to see you all there.

73,

Jeff W7KNX

Secretary's Report, Cont'd.

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payment soon to be made

Old Business: Thanks from the club to Tom, N5EG for providing his home and hospitality for the Holiday dinner/party.

New Business:

Dues are due. Badges for 2013 are BLUE font on white. Get yours after renewing.

Club needs a FD committee to consist of at least three members. Volunteers were solicited. To date volunteers are:

- Tom, N5EG
- Don, KG7BP
- With Joe, AF7GN a default member in his Publicity role.

Suggestion made to have a booth at the JC Fair. Other suggestions made to do similarly for the after-Thanksgiving Train Show at the Armory (Continental Morse demo), etc. Joe will obtain dates for such local shows and place in the newsletter in preparation for member comment.

Membership committee: nothing to report

Break at 1925 for coffee and cookies

Presentation after by Jeff, W7KNX on Compact and Stealth Antennas. Excellent presentation with pictures. The members especially enjoyed his removable access ladder to his apartment building's roof.

Submitted Jan. 4, 2013

Allan Taylor K7GT Secretary

Software Defined Radio

In previous issues of the *The Repeater*, a program called Gnuradio was discussed. It allows connecting a digital radio to a digital signal processing work surface and building DSP applications using drop and click wiring of the modules. While this is good for experimental use, it's not really intended for using a radio on-the-air in day-to-day mode.

For more normal on-the-air use, there are programs that are better tailored to make the operation of the radio look like a traditional piece of equipment—emulating tuning, push to talk or VOX, muting the receiver during transmit, providing sidetone for CW, etc. In

Probably the best known of the SDR programs is PowerSDR. This is an open-source program that was initially designed to work with the FLEX series of radio produced by Flex Systems of Austin, Texas. Because it is open-source, the program has been adapted to many different radios for many different manufacturers. Flex has stopped releasing new features as open-source on PowerSDR, so there are now some differences in feature sets between the FLEX version and other versions (most notably the automatic tuned-notch-filter).

PowerSDR provides a user interface shown

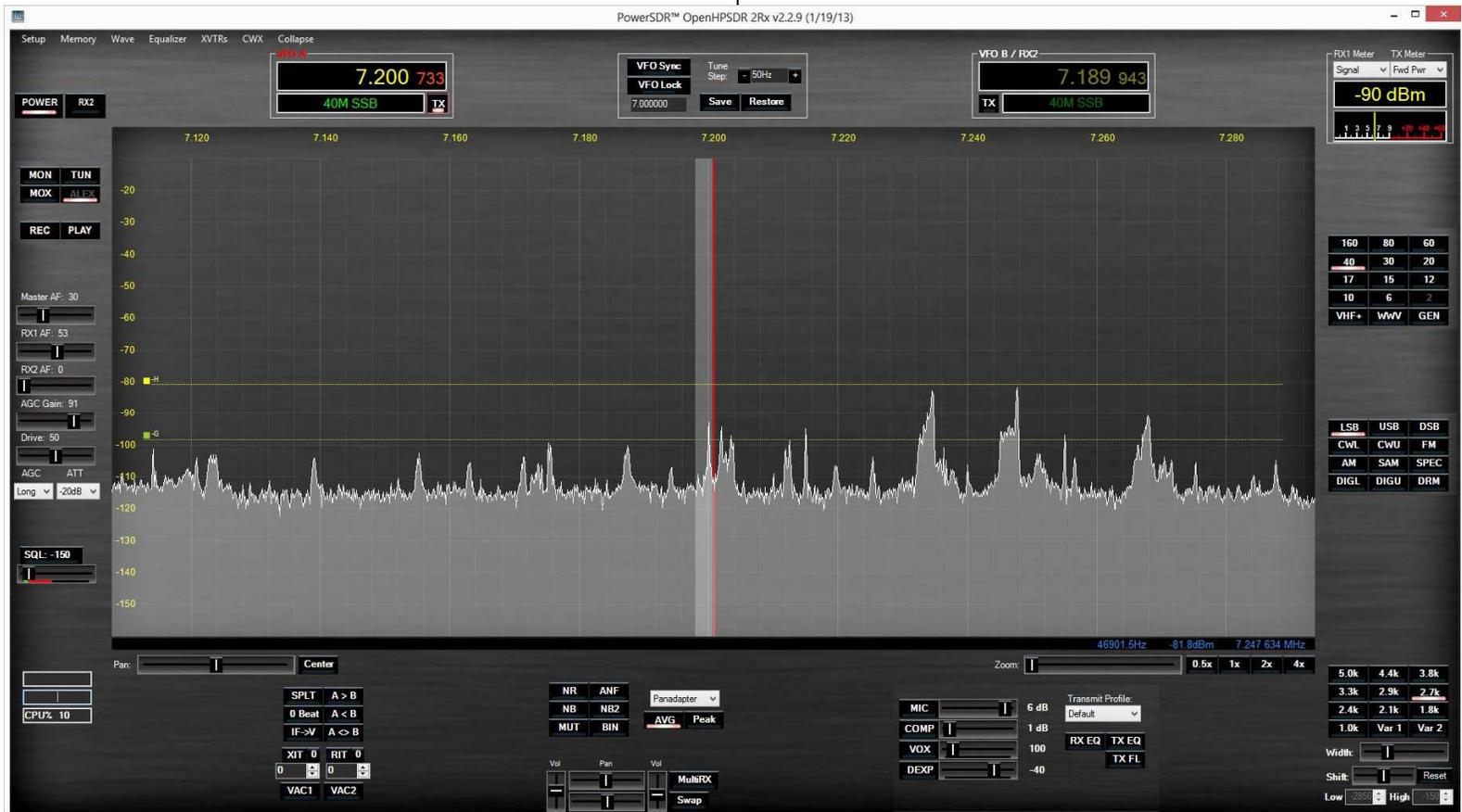


Figure 1—PowerSDR screenshot

this column, we'll look at a some reasonably complete SDR programs, and some that are still under construction.

in Figure 1. the main part of the display is the received spectrum from the SDR radio. The amount of spectrum shown is dependent on the SDR radio and the audio card used in

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the computer to capture the I and Q audio baseband signals from the radio. The spectrum is derived from a Fast Fourier Transform (FFT) of the audio.

A quick side note. Many are familiar with the Nyquist criteria—that is we must sample a waveform at least twice the highest frequency of interest, or else there will be aliasing of the spectrum. Thus a soundcard sampling at 48000 samples per second must internally low-pass-filter the audio to less than 24 KHz to prevent signals at 25 KHz from showing up at 23 KHz, signals at 30 KHz from showing up at 20 KHz, etc.

The SDR radio architectures are homodyne receivers (known as direct-conversion in analog radios). The local oscillator is the same frequency as the center of the passband. The SDR converts RF to audio, and the SDR radios use a half-complex mixer; that is a mix of the RF with an in-phase LO, and a mix of the RF with a quadrature-phase LO. This produces an I– signal at audio and a Q– signal at audio.

The actual spectrum from a 48000 samples per second soundcard from an SDR radio actually is from –24000 hertz to +24000 hertz. The mixers in the SDR radio produce sum and difference signals. It turns out that if we have both the I– and Q– samples, we can distinguish negative frequencies (those lower than the local oscillator) from the positive frequencies (those higher than the local oscillator) by looking at the phase relationship of the Q signal with the I signal. This is done automatically with what is called a complex FFT—one that takes complex samples in, and produces complex FFT samples out. Thus a 48000 sample per second soundcard with two audio channels is able to display the spectrum that is 48 KHz wide (from 24 KHz below the LO to 24 KHz above

the LO). The frequencies displayed are in reality just a bit narrower due to the fact that real low pass filters have a bit of roll off.

Similarly, a 96000 and a 192000 sample per second sound card is capable of producing 96 KHz of spectrum, and 192 KHz of spectrum respectively. Of course the soundcard needs to be able to capture audio up to one-half the sample rate, or 96 KHz for a 192000 samples per second card. Not all sound cards have frequency response this good, so for really wide spectra, a very high quality sound card is needed. The dynamic range of the receiver is set by the soundcard. A good 16-bit soundcard will provide about 84 dB of range, while a good 24 bit soundcard can provide over 100 dB of dynamic range (specific cards vary a lot in dynamic range).

Sometimes people will forget to plug in one of the two audio channels, or else the channels get shorted together, misconnected, or something else. In that case we do not have both I and Q samples. What happens is the spectrum display FFT cannot resolve positive from negative frequencies. Both positive and negative frequencies show up on both sides of the spectrum center, and the spectrum is completely symmetric about zero (the center). It's obvious when you see it, and the cause is due to one of the channels missing.

Some of the newer digital SDR radios don't produce down converted audio as an analog signal, but rather they produce that audio as a sequence of digital packets, which the computer needs to receive using either a USB or an Ethernet interface. This means that computer does not need a high-performance soundcard to provide the analog to digital conversion of the down converted baseband signal. It may need a lower performance soundcard however to drive the desired audio to a speaker or headphones.

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Software Defined Radio, Continued

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The audio right next to zero frequency is the channel that we are listening to. The computer need do nothing more than low-pass filter the ± 96 KHz signal down to something like 3 KHz to produce listenable audio. This yields a double-sideband suppressed carrier receiver.

An AM receiver requires computing the magnitude of the I and Q samples. This is done as $\text{Sqrt}(I^2 + Q^2)$. An FM receiver produces audio by computing the 4-quadrant arctangent of the I and Q signals, or by computing $(I \cdot dQ/dt + Q \cdot dI/dt)$.

Thus the amount of audio DSP work occurring in the computer is actually quite small if

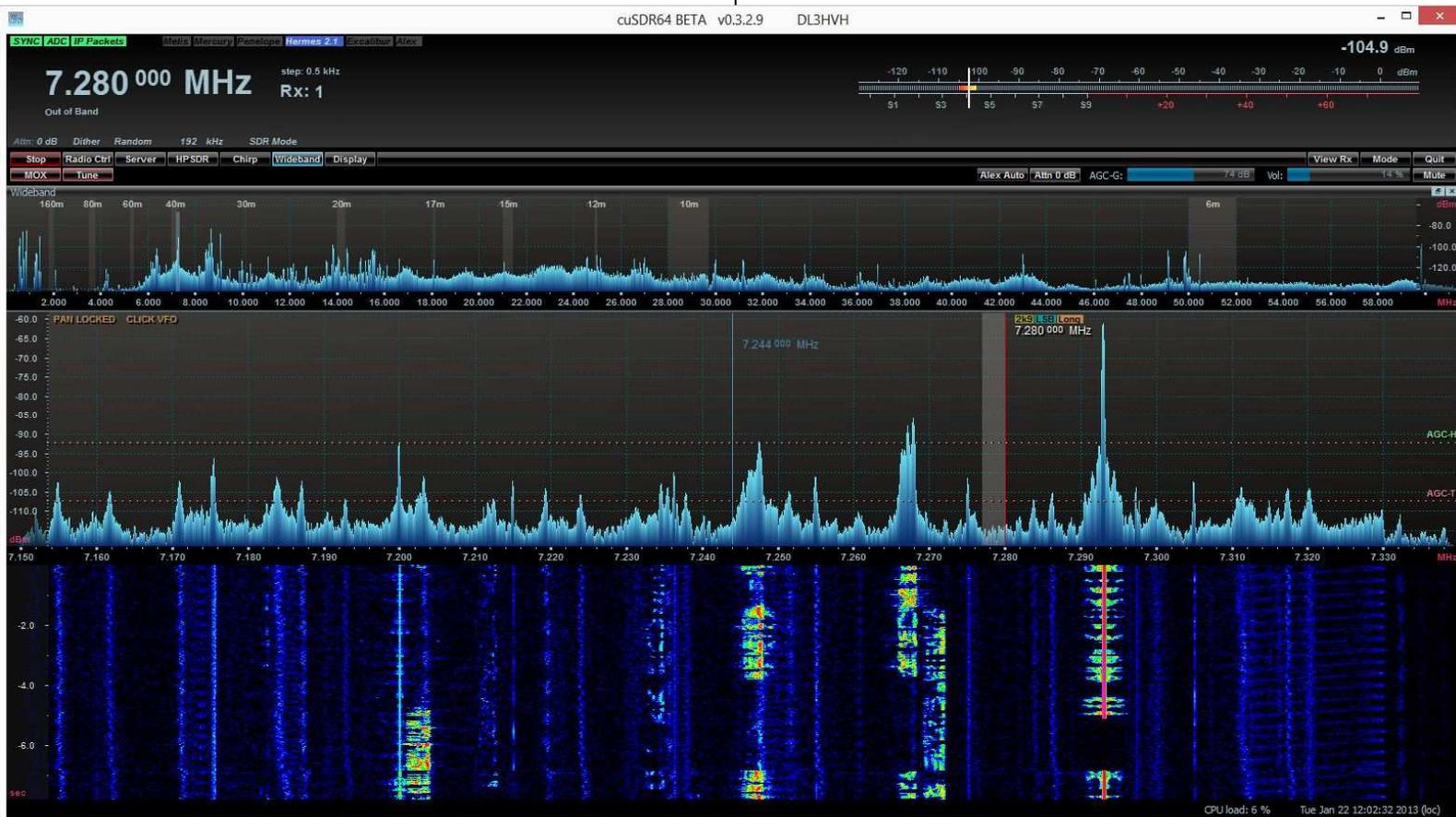


Figure 2—cuSDR screenshot. Top spectrum is DC—62 MHz. Bottom spectrum is 40 meters (192 KHz wide).

With additional processing, a true single signal (single sideband) receiver can be constructed. This type of receiver uses phasing techniques to cancel out either the negative frequencies (cancelling the lower sideband when in USB mode) or canceling out the positive frequencies (cancelling the upper sideband when in LSB mode).

you ignore the FFT that it computes in order to provide the pretty spectrum display.

If the signal that you want to listen to is off frequency, you must retune the local oscillator. This is done in almost programs by dragging the spectrum with the mouse until the

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Software Defined Radio, Continued

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signal of interest lies at the center of the screen (or just off to the + or—of the center in the case of single sideband or CW signals). One drawback of retuning the LO is that the spectrum and any associate waterfall displays also get dragged across the screen. This makes it difficult to remember where stations are on the dial as they move each time you retune the receiver.

A new SDR program that is still under construction is cuSDR, written by Hermann, DL3HVH. It has the normal spectrum mode, but it also has a mode when the local oscillator on the radio is fixed. To retune, the

computer actually does another frequency conversion—from the offset of the LO to the position on the screen. Thus the result is a dual-conversion receiver—one by the radio and one by the computer. For example if the signal that you want to listen to is 35 KHz higher than the center of the display, the computer will mix a -35 KHz LO with the signal in a full-complex mixer essentially shifting the audio downwards by 35 KHz down to zero (plus or minus the modulation). At that point the signal then goes back into the normal processing chain—filtering, single-signal conversion, etc. this gives the effect that the

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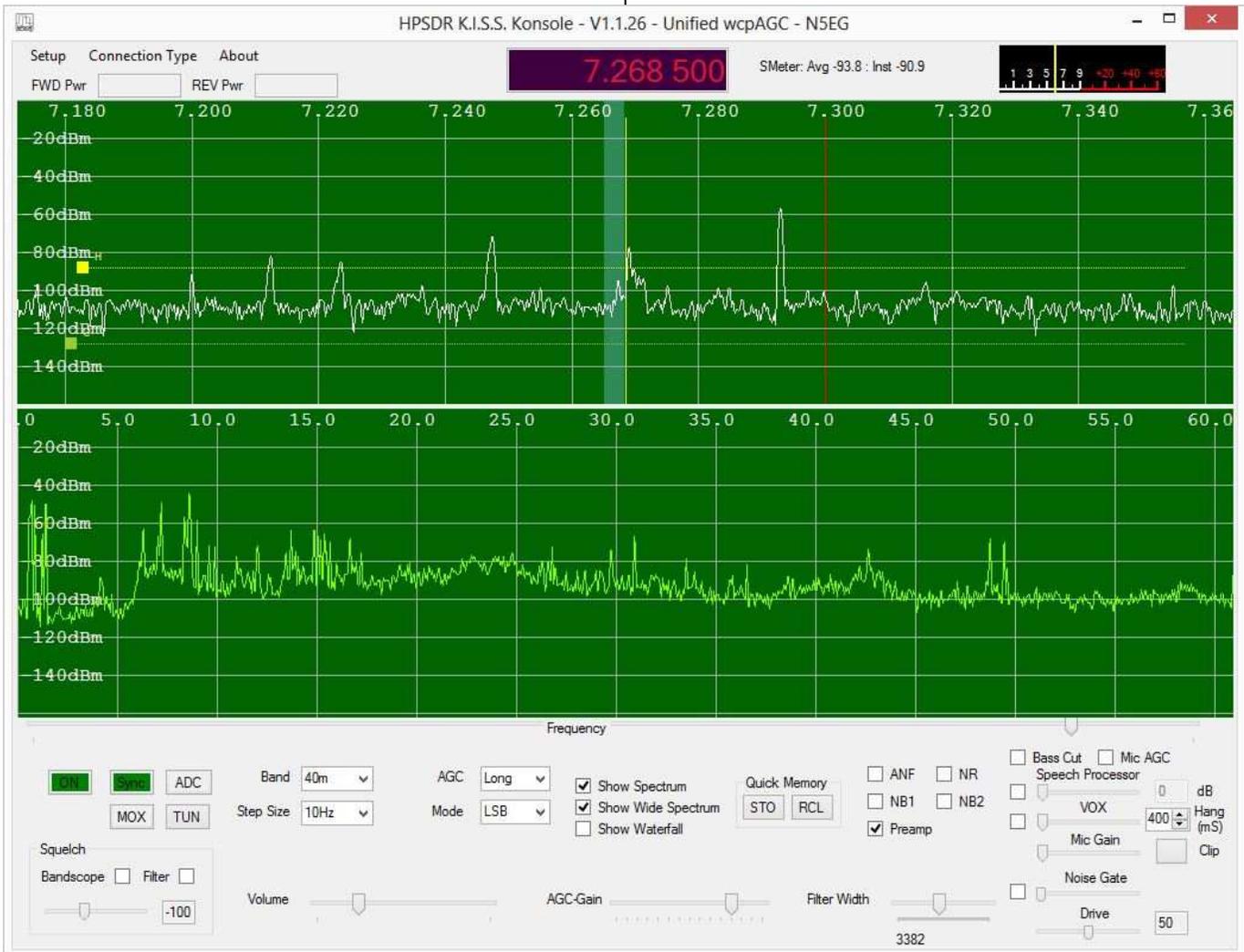


Figure 3—Kiss Konsole receive-only program

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spectrum on screen is fixed and you tune the radio by moving the passband on top of the signal that you want to listen to.

It's more difficult to describe than to visualize. Figure 2 shows what this look like on cuSDR. One of the other advantages of cuSDR is that it listens to the wideband ADC sample set produced by the Open HPSDR series of radios (Metis, Hermes). This means that it can display the wideband DC-to-62 MHz spectrum. This is convenient as you can click on that wideband spectrum and it will instantly retune the SDR receiver LO to that frequency. Thus it shows both the wideband and the 192 KHz narrowband receivers at the same time. I personally find this very interesting as a way to look for large spikes in the HF spectrum and then zero in on the details. Figure 2 also shows the wideband spectrum at the top. Note that this does not work with most SDR radios, especially the ones that produce analog signals to the computer, as they do not provide the raw wideband ADC samples to the computer.

cuSDR is receive-only at this point but the author is working on transmit capabilities.

Another program, KISS Konsole, a receive-only program which works only with the Open HPSDR receiver can show both the wideband and narrowband spectrum as well. The wideband spectrum is essentially a DC to 60 MHz spectrum analyzer, see Figure 3.

RVARC Dues are Due

RVARC membership dues run from January 1 through December 31. Please bring cash or a check payable to RVARC to a club meeting, or mail (checks only) to:

RVARC Membership
c/o 102 McDonough Rd.
Gold Hill, OR 97525-9626

| | |
|------------------------------|---------|
| Regular Member: | \$20.00 |
| Senior Member (62 and over): | \$15.00 |
| Family Member: | \$20.00 |
| Student Member: | \$10.00 |

Amateur Radio Examinations

In the Rogue Valley, amateur radio exams are provided by the RVARC and the SOARC. New exam participants need to provide identification, while upgrading amateurs need to **provide a copy of their current license** as well as show identification. The exam fee for 2013 remains \$15.00. All license candidates must provide a picture ID. Upgrading amateurs must also provide a photocopy of their current license to send in with their application. To search for other exam locations, see:

<http://www.arrl.org/arrlvec/examsearch.phtml>

Medford—Phoenix, OR

Time: Saturdays, 8:00 AM. Walk-ins welcome.

Location: Fire District 5 HQ. 5811 South Pacific Highway, Phoenix, Oregon 97535

Dates 2013: Feb 23 June 22 Oct 26

Contact: Don Bennett, Email: kg7bp@rfwarrior.com Phone: (541) 973-3625

Grants Pass

Time: Arrive 6:00 PM. Exam session starts at 6:30 PM. Walk-ins welcome.

Location: Fruitdale Grange. 1440 Parkdale Dr., Grants Pass OR 97527-5288

Dates 2013: Feb 22 May 17 Aug 23 Nov 15

Contact: John Stubbe, K7VSU, email: K7VSU@arrl.net, Phone: (541) 218-2244

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Across from Hawthorne Park

Program: HF Propagation